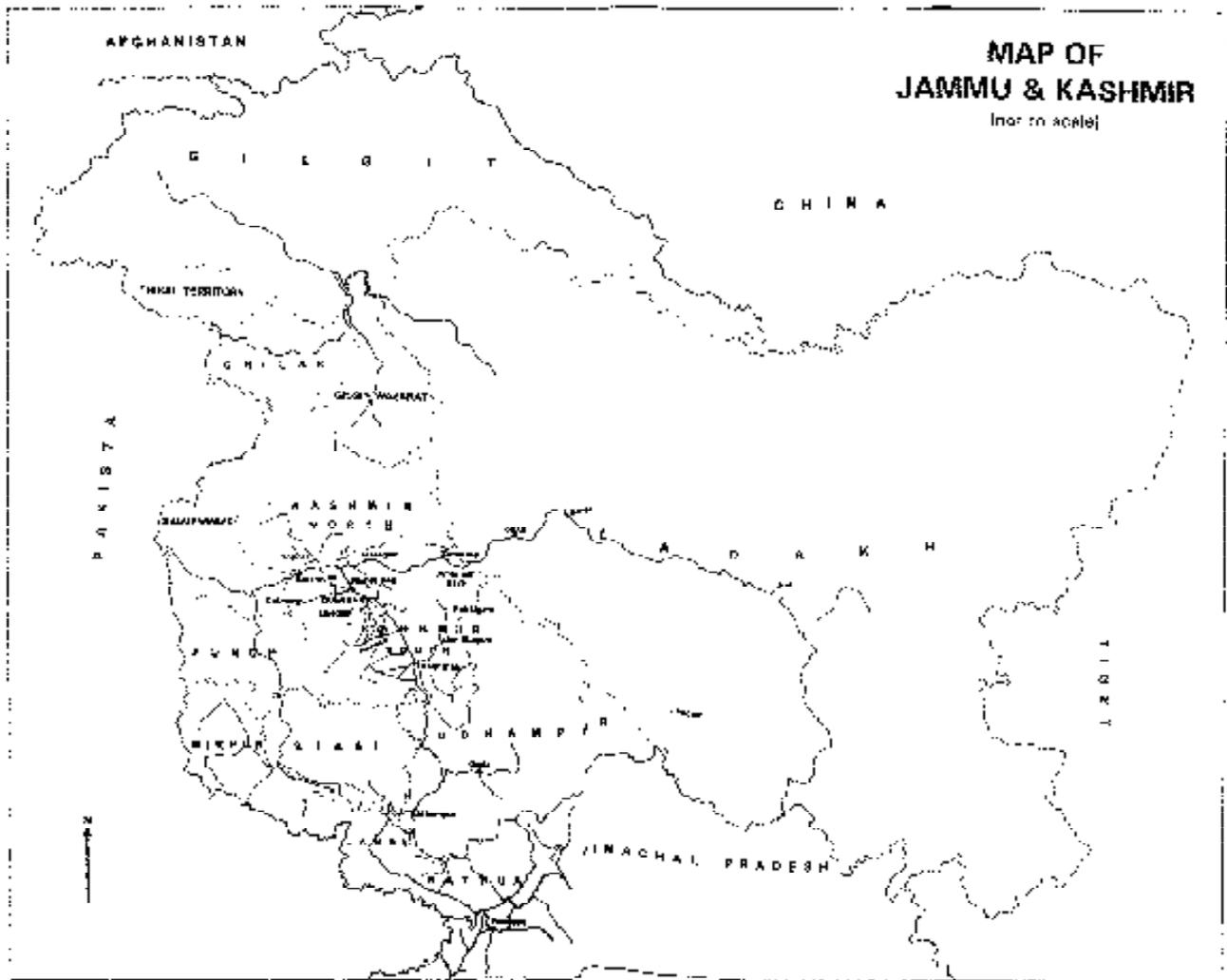
The cover of the book features a vibrant landscape photograph. In the background, there are rugged, grey mountains under a bright blue sky with scattered white clouds. Below the mountains, a lush green valley contains a small village with several white-walled houses and a dense line of tall, thin evergreen trees. In the foreground, a calm body of water reflects the surrounding scenery, with tall green reeds or grasses growing along the shoreline.

Flora of Jammu & Kashmir

Volume 1

BOTANICAL SURVEY OF INDIA
Ministry of Environment and Forests

**MAP OF
JAMMU & KASHMIR**
(Not to scale)



FLORA OF JAMMU & KASHMIR

Volume I
Pteridophytes, Gymnosperms and Angiosperms
(Ranunculaceae - Moringaceae)

Editors

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भारतीय वनस्पति सर्वेक्षण
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FOREWORD

Biodiversity is the biological wealth of the planet earth, which is absolutely essential for environmental safety and economic security of the world. According to estimates of some biologists there are over five, or perhaps as many as ten million species of plants, animals and microorganisms in the world. It has taken millions of years of evolution to bring about this enormous diversity of life on earth. However, in recent years man has not been careful enough in handling this biological wealth and merrily continues with his incompatible activities that have impoverished this 'gene bank'

India as one of the twelve mega-biodiversity countries in the world is committed to implementing the basic tenets of the Convention on Biological Diversity it signed a decade ago at Rio de Janero. These are conservation, sustainable use, and fair and equitable sharing of benefits arising out of the utilisation of the components of biodiversity. Flowering plants form a sizeable part of this biodiversity. They play an important role in sustainable economic development and form a major part of the habitat for other elements of biodiversity. Identification of the plant resources of a country and development of a sound database on them are prerequisites for effective conservation, management and sustainable utilisation of these resources.

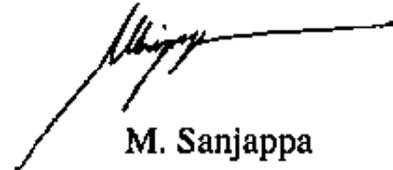
The Botanical Survey of India has been documenting the plant diversity in the country in the form of district, state, regional and national Floras. This first volume of the Flora of Jammu & Kashmir, one of the

richest states in terms of plant diversity, endemism and uniqueness of certain species and ecosystems, is another important contribution by the department which is singularly significant since it is published at a time when the country joins the rest of the world in celebrating the "International Year of Mountains". It presents an exhaustive taxonomic account of pteridophytes, gymnosperms and angiosperms comprising 195,20 and 664 species respectively. I am sure that this volume will be useful to various stakeholders of the biodiversity in the country in general and the state of Jammu & Kashmir in particular.

I congratulate the contributors and editors of this comprehensive work for the commendable job.

Date: 13. 12. 2002

Place: Kolkata



M. Sanjappa

PREFACE

Biodiversity is one of the most defining features of the nature, vital for the ecological security of a region and livelihood security of millions of those who critically depend upon it for their daily sustenance. Floristic component of the biodiversity is the major provider of ecosystem services and is basic to meet livelihood needs of not only the human beings but all other animals at large. The judicious management of floristic resources is, therefore, paramount to ensure the conservation of biodiversity, its sustainable utilization and equitability in benefit sharing as ordained in the Convention on Biological Diversity. In this context the floristic inventories play a significant role in increasing our understanding and information level on the availability of resources and its relationship with the mankind.

The biogeographically strategic location of Jammu & Kashmir, coupled with varied phyto-climatic conditions met in its different physiographic divisions, makes it one of the hyper-biodiversity states of the Indian Union. The rich biodiversity of the state and its scenic grandeur have attracted the botanists, naturalists and the travellers, who all have contributed to our knowledge about its flora, since early nineteenth century. Yet, Sir J.D. Hooker's monumental *Flora of the British India*, published between 1872 and 1897, is the only comprehensive treatise available on the flora of the state. Despite significant contributions made on the plant resources of the state during the twentieth century, the information on its flora is not only widely scattered but incomplete as well.

To fill this gap as well as to prepare an up to date inventory of the plants at district, state, regional and national level, the work on the Flora of Jammu & Kashmir was undertaken by the scientists of the Botanical Survey of India, Dehradun. It is largely based on over 35000 specimens collected by the scientists of the department from different parts of the state since 1956 and deposited in the herbarium of the Northern Circle, BSI, Dehradun (BSD) and the Central National Herbarium, Calcutta (CAL). Besides, the specimens collected by others since early nineteenth century and deposited in various Indian herbaria as well as all the published

information on the State's floristic diversity were also taken into account for preparation of this flora.

It is proposed to bring out the *Flora of Jammu & Kashmir* in five volumes. The present volume, dealing with general chapters, like introduction, physiography, drainage, climate, geology and soil, people, forests, forest types, floristic diversity, etc., includes detailed taxonomic account of 195 species in 57 genera and 31 families of Pteridophytes, 20 species in 7 genera and 4 families of Gymnosperms and 664 species in 225 genera and 51 families of Angiosperms from Ranunculaceae to Moringaceae along with keys to the family within each group, and to the genus, species and the infraspecific categories, where ever needed. It is supported by two maps, 123 line-drawings and 28 coloured plates.

The contributors thank the Principal Chief Conservator of Forests, Jammu & Kashmir and the Army Commanders in the border areas of the state for their generous help during the plant explorations. We are also thankful to the Director General, Indian Council of Forestry Research & Education, Dehradun and the Director, Regional Research Laboratory, Jammu for facilitating the study of specimens deposited in their respective herbaria. Thanks are also due to Dr. Rajendra Sarkar, Superintending Anthropologist, Anthropological Survey of India, Dehradun for some valuable information on the ethnic communities of Jammu & Kashmir state.

We also express our deep sense of gratitude to Dr. M. Sanjappa, Director, Botanical Survey of India and all the former Directors of the department for the facilities and constant encouragement during the progress of this work, and to Dr. R.R.Rao, ex-Joint Director and Dr. J.N. Vohra, Dr. U.C. Bhattacharyya, Dr. A.S. Rao and Dr. M.A. Rau, former Deputy Directors, Northern Circle, BSI, Dehraun for the keen interest evinced by them in this study. Thanks are also due to Prof. B.N. Kaul (Retd.) of Amar Singh College, Srinagar, Kashmir and Dr. R.D. Dixit, Additional Director, Central Circle, BSI, Allahabad for critically going through the portion on economic plants and the manuscript of Pteridophytes respectively.

We are thankful to Shri Dev Raj Agarwal, Photographer and Shri Sanjay Uniyal, Data Entry Operator, for most of the photographs and

computer type-setting and formatting of the manuscript respectively. The contributors also express their thanks to all the past and present staff members of the Northern Circle, Botanical Survey of India, Dehradun but for whose sincere efforts and cooperation this work would not have been possible. The help and assistance rendered by the staff of the Publication Section, Botanical Survey of India, Kolkata in arranging the publication of this volume is also acknowledged.

Finally we thank M/s Shiva Offset Press, Dehradun for its quick printing in present form.

Botanical Survey of India
Northern Circle, Dehradun

D.K. SINGH
Joint Director

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A view of Shivalik ranges near Jammu



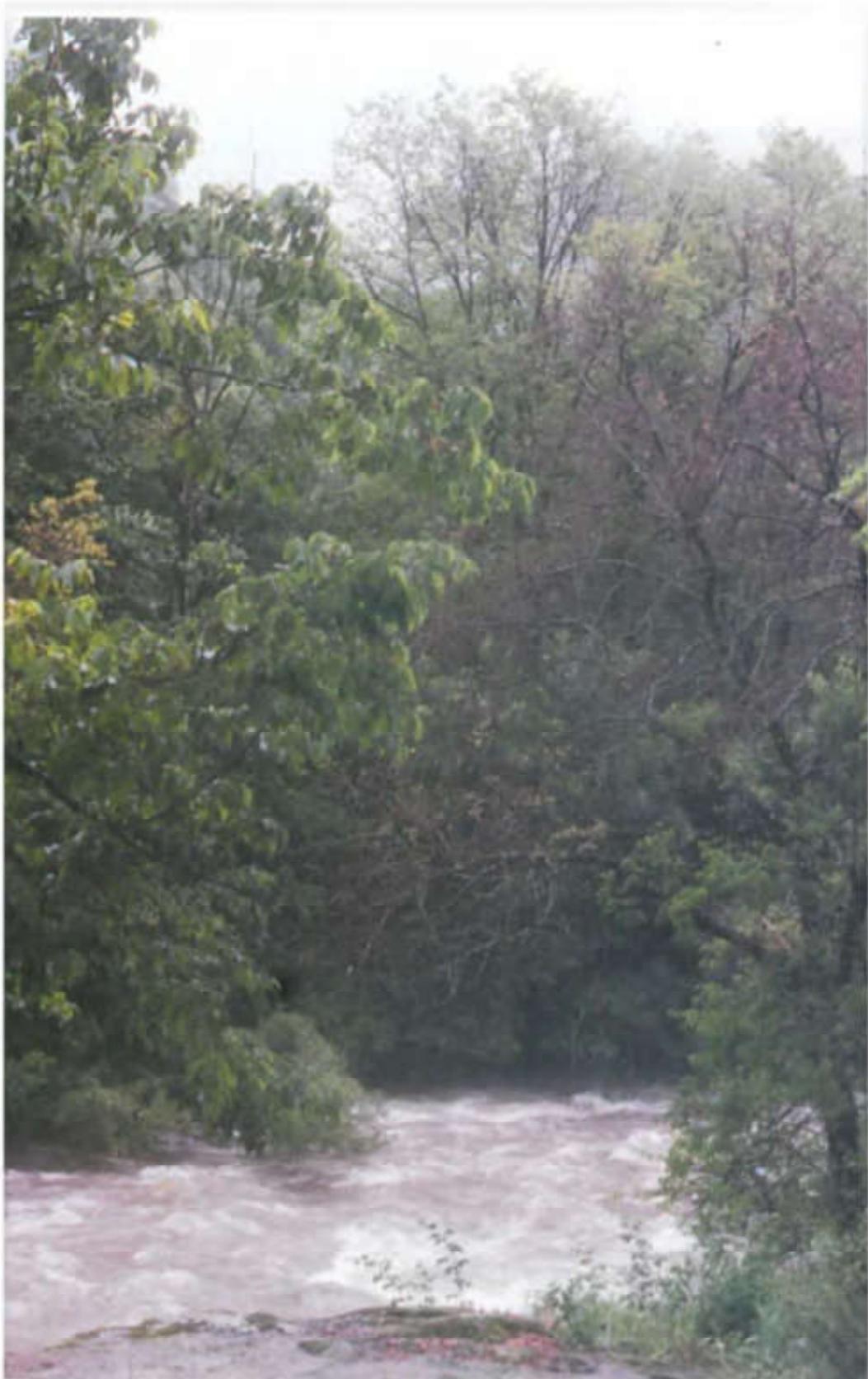
A view of Mansar lake in Jammu region



A view of mixed temperate forest in Dachigam National Park



A view of Dachigam National Park



A view of Dachigam National Park



Deodar forest in Pir Panjal



Cultivated fields near Anantnag



Confluence of rivers Indus and Zaskar near Nimu in Ladakh



Mixed, alpine vegetation in Suru valley, Ladakh



A typical cold desert landscape with *Myrtama* bushes



Caragana versicolor Benth. and *Geranium pratense* L. in
Hemis National Park, Ladakh



Freshwater swamp near Shey, Ladakh



A wetland near Spituk showing *Hippuris vulgaris* L.



Osmunda claytoniana L.



Dryopteris xanthomeles (Christ) C. Chr.



Ephedra gerardiana Wallich ex Stapf



Ephedra regeliana Florin



Pinus roxburghii Sargent



D.K. Singh

Cedrus deodara (Roxb. ex D. Don) G. Don



Aconitum heterophyllum Wallich ex Royle



Aquilegia fragrans Benth.



Clematis gouriana Roxb. ex DC.



Delphinium brunonianum Royle



Caltha palustris L.



Caltha palustris L. var. *alba* (Cambess.) Hook.f. & Thomson



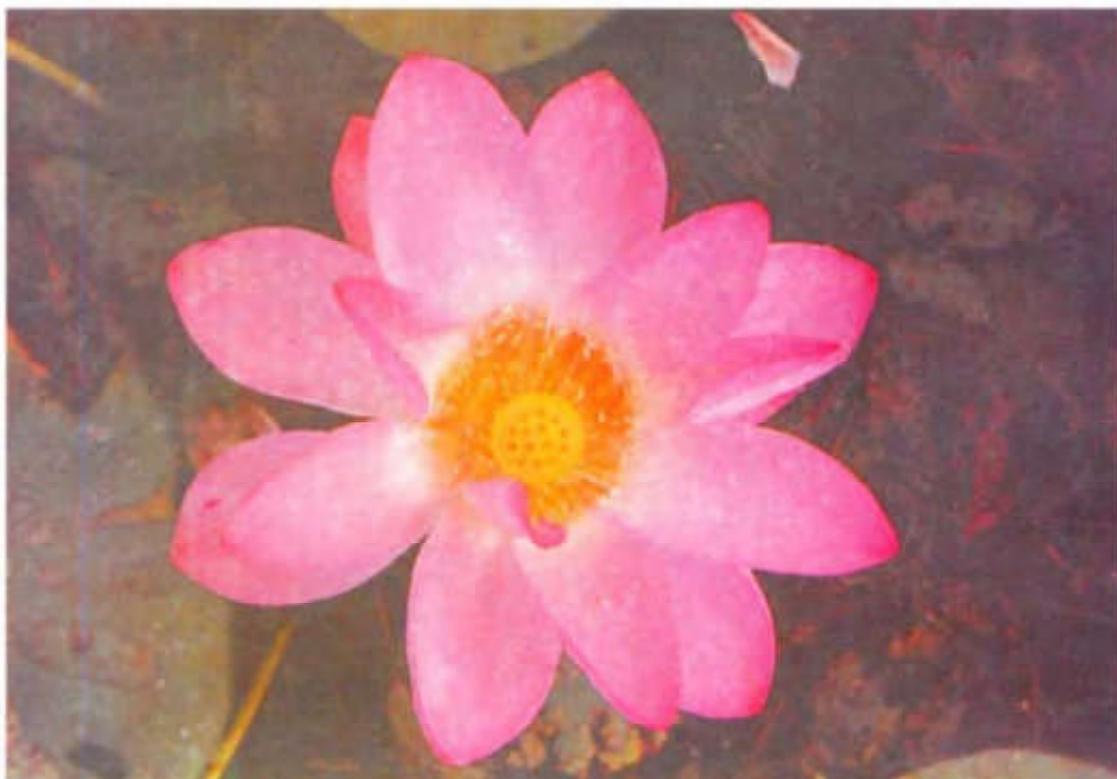
D.K. Singh

Anemone polyanthes D. Don

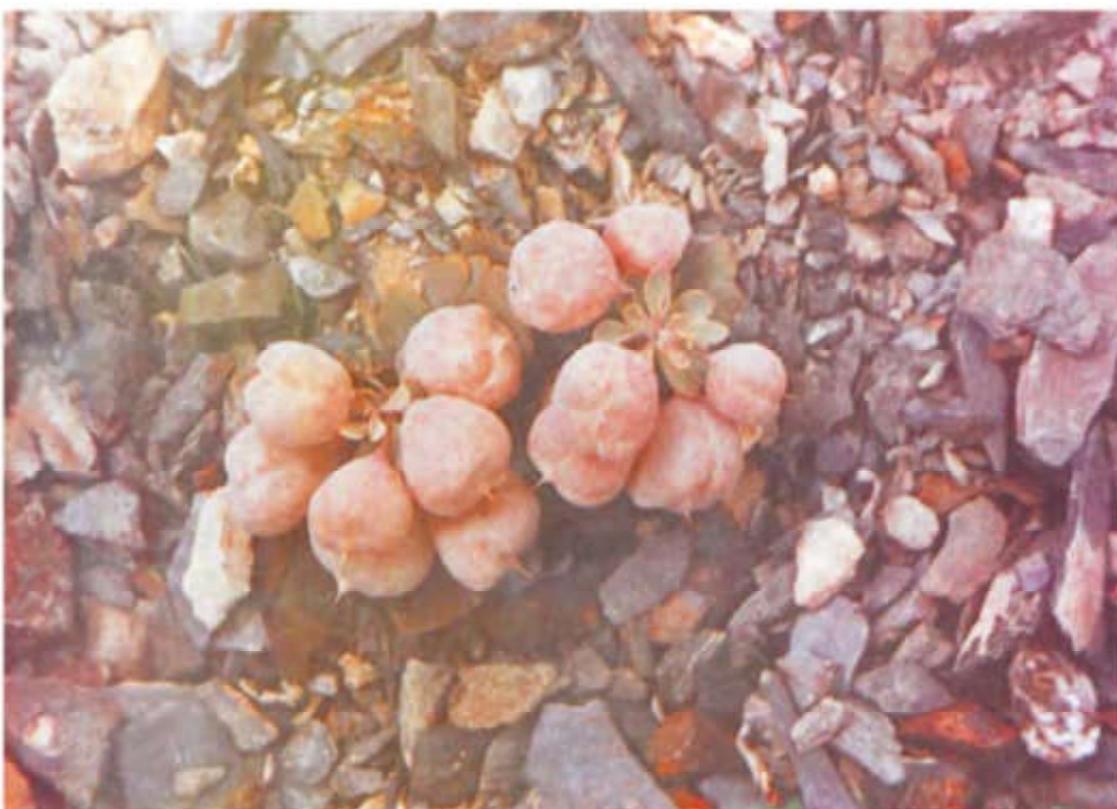


Bipin Balodi

Podophyllum hexandrum Royle



Nelumbo nucifera Gaertn.



Corydalis crassifolia Royle



Corydalis govaniana Wallich



Pycnolinthus uniflorus (Hook.f. & Thomson) O. Schulz



Capparis spinosa L.



Viola biflora L.



Arenaria festucoides Royle



D.K. Singh

Dianthus orientalis Adams var. *angulatus* (Royle ex Benth.) Majumdar



Gypsophila cerastioides D. Don



Silene moorcroftiana Wallich ex Benth.



Silene rechingeri Bocq.



Thylacospermum caespitosum (Cambess.) Schischk.



Myrtama elegans (Royle) Ovcz. & Kinz



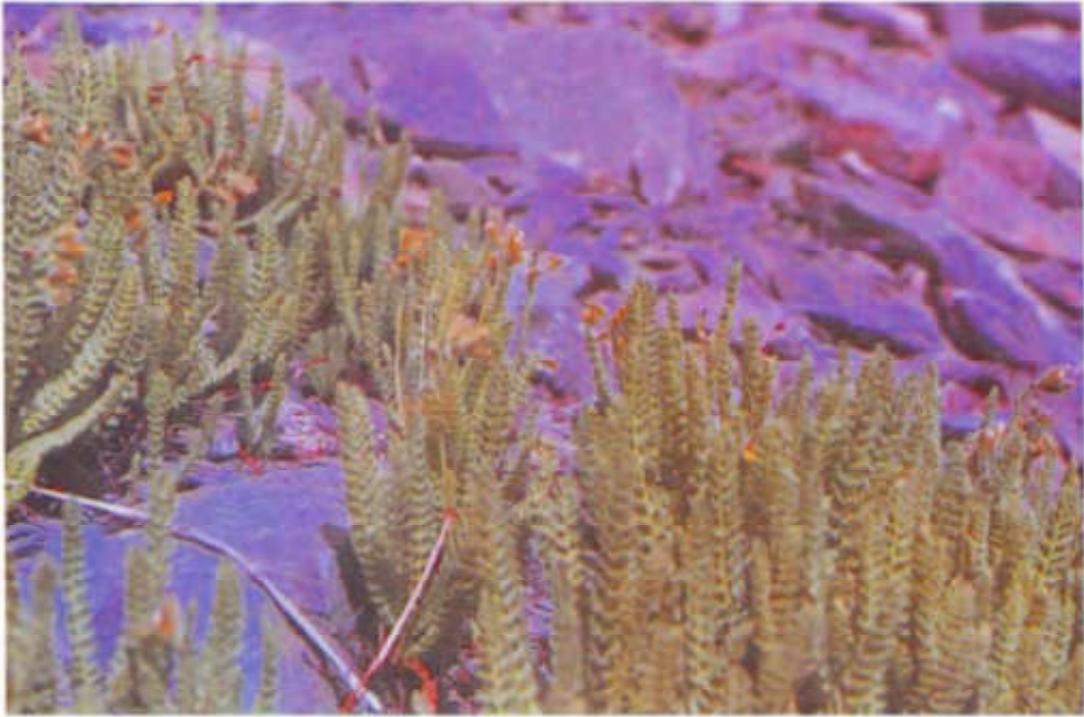
Hypericum perforatum L.



Hiptage benghalensis (L.) Kurz



Peganum harmala L.



Amit Chauhan

Biebersteinia odora Steph. ex Fischer



Geranium collinum Steph. ex Willd.



Geranium pratense L.



Murraya koenigii (L.) Spreng.

INTRODUCTION

(D.K. Singh & B.P. Uniyal)

Perched like a majestic crown in the extreme north of the Indian Union, the state of Jammu & Kashmir lies between the coordinates 32°17' to 37°20' north latitude and 73°25' to 80°30' east longitude. The entire territory extends to over 640 km from north to south and 480 km from east to west, covering a total area of about 2,22,236 sq. km in the north western Himalaya. The state comprising 14 districts largely covers rugged mountainous terrain, except for the small tracks adjoining the Punjab plains and the valley of Kashmir. Leh, with an area of ca 82,665 sq. km is the largest district of the state. The total population of the state, as per the 2001 census, is 10,069,917 with an average population density of about 99 persons per sq. km. Wedged between Afghanistan and North West Frontier Province of Pakistan on the west and the north-west, Turkmenistan and China on the north and Tibet in the east, as it is, the state is strategically located from the phytogeographical point of view representing the floristic gateway to the west Asian, Mediterranean and Central Asian elements in the Flora of India. On the south it is bordered by Punjab and Himachal Pradesh.

The entire state is broadly divided into three main structural groups resulting from the stratified rock formations. These are the Panjal, the Zaskar and the Tertiary groups. The Panjal comprises the outer hills, outer plains and the middle mountains of the Lesser Himalaya, the Zaskar, the entire tract from Lahaul and Spiti in the east to Karakoram in the north, and the Tertiary group is represented by the valley of Kashmir and other river valleys. The three geological constituents have resulted into considerable physiographic as well as climatic variations with direct bearing on the seasons, soil and vegetation in the state. In fact the state forms a transitional region of diverse physical and phyto-climatic features.

Physiography

Biogeographically the state falls under Boreal zone with two subzones, viz. Sino-Siberian or the Trans-Himalaya, and Sino-Himalayan

or the North Western Himalaya, and four Biomes, viz. Tundra zone, Alpine zone, Temperate zone and Subtropical zone (Rodgers 1985; Khoshoo, 1993). The relief features of the state are comparable with a three storeyed structure, each representing a distinct geomorphological and climatological regime.

The province of Jammu with the Shivaliks, the undulating ravinous plains and the outer hills on the south of Pir Panjal represents the first storey. The Shivalik hills in the region are largely anticlinal and on an average rise to an elevation of 600-1200 m overlooking a series of 'Duns'. The area receives an average annual precipitation of about 170 cm through south-west monsoon. The tectonic valley of Kashmir, originally a synclinal valley, with its lacustrine deposits called 'Karewas' covering more than half the area and some 'duns' between the Pir Panjal range on the south and south-east, and the Great Himalayan range in the north and the north-east represents the second storey. The valley of Kashmir, with an average height of about 1600 m, experiences a submediterranean climate with average annual precipitation of about 105 cm, which is mostly in the form of snow during winter months. And the Trans-Himalayan region comprising the territories of Gilgit, Baltistan and Ladakh, north of the Great Himalayan ranges, forms the third storey with some of the loftiest inhabited tracts of the world. Ladakh, including the territories of Rupshu, Nubra and Zaskar is the largest tract of the state, covering almost half its area. The region presents a Holarctic climate with extreme cold arid condition and receives average annual precipitation of less than 10 cm at Leh.

The Pir Panjal and the great Himalayan ranges almost divide the state into three distinct physiographic divisions, which are isolated from one and other by lofty mountain barriers. The passage from one region to another is usually facilitated through high altitude passes.

The outer plains : Approaching from the Punjab district of Gurdaspur, a stretch of level land, averaging between 300 to 360 m altitude, continue with the Punjab plain. This is bordered by a low, sparsely vegetated and irregularly broken low hilly terrain. The subaerial denudation

in this region has resulted into depressions out of anticlinal tops, leaving more rigid and compressed synclinal systems of strata to stand out as elevated ground. The succession of escarpments and deep slopes with broad longitudinal valleys is a conspicuous feature of this region of Shivaliks of Jammu division. The erosion and depositions from the sediments of the Himalayan rivers have resulted into finer soil characteristic of the region. This area lying between the rivers Ravi in the east and Jhelum in the west is known as *Kandi*. This division, comprising parts of Jammu, Kathua and Mirpur districts, is full of ravines which carry off the flood waters of the monsoon rains with soil exposing the sandy beds of seasonal streams which are full of pebbles and boulders.

The outer hills : This region shows a diverse and complex physiography. The region rises gradually from the north-western limits of the outer plains in the form of low-lying hills and broken mounds with average height between 700 to 1500 m. It ends in an abrupt, steep escarpment. These young tertiary hills, known as the Shivaliks, separate the middle Himalaya from the plains. The region is conspicuous by the sight of bare grey sandstone with uncovered soil. The narrow hills open into small valleys, called *duns*, longitudinally extending up to Devsal in the west. To the north of the Devsal Dun a longitudinal valley runs on the opposite side of Ramkot and is enclosed by Karai Thar hills which is above 1500 m.

The physiography of this region shows an unusual rate of deposition with undulating topography having abrupt steepness in the north. In outer hill region, the orthoclinal structures appear with steep escarpments on the southern face and a gentle inclination on the north. The southern limbs of the folds of this part are faulted in their anticlines. Whereas, towards the interior there is a compression of synclinal folds with an autochthonous position. The river Chenab divides this region into two flanks which covers the upper reaches of Jammu and Kathua districts and lower reaches of Poonch, Rajouri and Udhampur districts. The numerous streams forming tributaries of Chenab, Ravi and Tawi rivers have special significance in collecting water to irrigate the outer plains and beyond in the south.

The middle Himalaya : The middle Himalayan region of the state consists of the Panjal-trap. The southern aspect of these mountains faces the outer plains and occupy the middle and upper reaches of Doda, Poonch and Rajouri districts, while its northern aspect comprise the valley of Kashmir and other Himalayan valleys, like Sind, Lidder, Kishenganga, Lolab, etc. The average height of this region varies from *ca* 1500 to more than 4,700 m above the mean sea level. The region, famous for its scenic beauty and grandeur, is criss-crossed with deep cut ravines with precipitous cliffs. More or less converging ranges in this division are intersected by deep gorges through which rivers flow. The middle Himalayas have a very rich drainage system with upper courses of river Chenab (Chandrabhāgā) and its tributaries. The orthoclinal mountains help preserve moisture in the region and support rich vegetation.

To the north of these parallel ranges lies the Pir Panjal. The Panjal trap is largely composed of Permo-Carboniferous volcanic rocks. Beyond Reasi and Basoli, this physiographic division is not very distinct except towards Muzaffarabad beyond Hazara where the river Kishenganga joins Jhelum at Domel.

In the higher reaches in this division, there are a number of small valleys, comparable with mountain glades, which dot the mountains at Ramnagar, Bhaderwah, Ramban, Kishtwar, Padar, Reasi, Rajouri and Basoli. There are a number of high altitude passes in the Pir Panjal range, like Pir Panjal (3505 m), Bundil (4200 m), Banihal (2832 m), Haji Pir (2490 m), etc. which facilitate the movement across this range.

North of the Pir Panjal, lies the famous valley of Kashmir with an average altitude of *ca* 1600 m. Surrounded on all sides by high mountain ranges, except for the passes and a narrow gorge at Baramulla, the valley is the drainage basin of river Jhelum and its tributaries. With the lacustrine *Karewas* protruding throughout the valley from Shopian to Baramulla, it presents an interesting geomorphology with no physical monotony.

Geologically the valley of Kashmir has undergone many changes. Having been part of the geosynclinal Tethys even up to the Permian, when it was a region of calm and quite sedimentation, it suffered many violent changes. The mountain walls abruptly rising on sides exhibit massive quartzites and Silurian to the west of Wullar lake. Glacial boulders, conglomerates and *dogra* slates appear beyond the Baramulla gorge towards Hazara.

The inner Himalaya : The valley of Kashmir narrows towards the north with the massive structure of Kazi Nag range. The Great Himalaya or the innermost mountains rise above the limits of perpetual snow with an average height ranging from over 3000 m to above 8000 m, with Peaks like Nanga Parbat or Diyamir (8128 m). The central Himalayan axis bifurcates near Kullu in Himachal Pradesh, with its north-western branch known as Zaskar Range reaching the twin peaks of Nun Kun (7055 m). The other, Dhauladhar Range extends further to the north west. This physiographic division covers nearly 70 per cent of the total area of the state and includes the territories of Ladakh, Gilgit and Baltistan. It is a high plateau with cold-arid conditions. The Karakoram Range to the north of this plateau culminates into the second highest peak of the world the Godwin-Austin or the Mt. K₂ (8615 m). The glaciers on this mountain are the source of river Hunza which drains into river Gilgit.

The valley beds in the north-west part of this physiographic division descend on the mountains till Gilgit is reached at about 1524 m. On its north and north-east, this river valley has vast flat plains, like Deosai (3962 m) and Lingzhitang (4877 m). Some of the major passes in Great Himalayan and Karakoram mountain ranges are : Khardung la (5666 m), Sarsank la (5716 m), Poat la (5716 m), Tanglang la (5328 m), Chang la (5267 m), Singo la (5034 m), Lachulang la (5034 m), Baralacha la (4891 m), Chilung la (4401 m), Zoji la (3529 m), Karakoram pass (5352 m), Muztagh pass (5706 m), Sia la (5432 m), Marpo la (5611 m), Sasar la (5300 m).

Drainage

The Hindukush and the Karakoram ranges in the north-west and

the north, with perpetual snow cover and a large number of world renowned glaciers, like Siachen, Baltoro, etc. form the watershed of the central Asian drainage flowing into the Indian ocean. An important feature of the river system in the state is its antiquity as compared to the mountains they traverse through. The major rivers in the three divisions of the state are Ravi, Ujh, Tawi and Chenab in Jammu; Jhelum, Liddar, Vishav, Rambhara, Sukhnag, Dudganga, Indus, etc. in Kashmir; and the Indus, Shyok, Zaskar, etc. in Ladakh (Map-1).

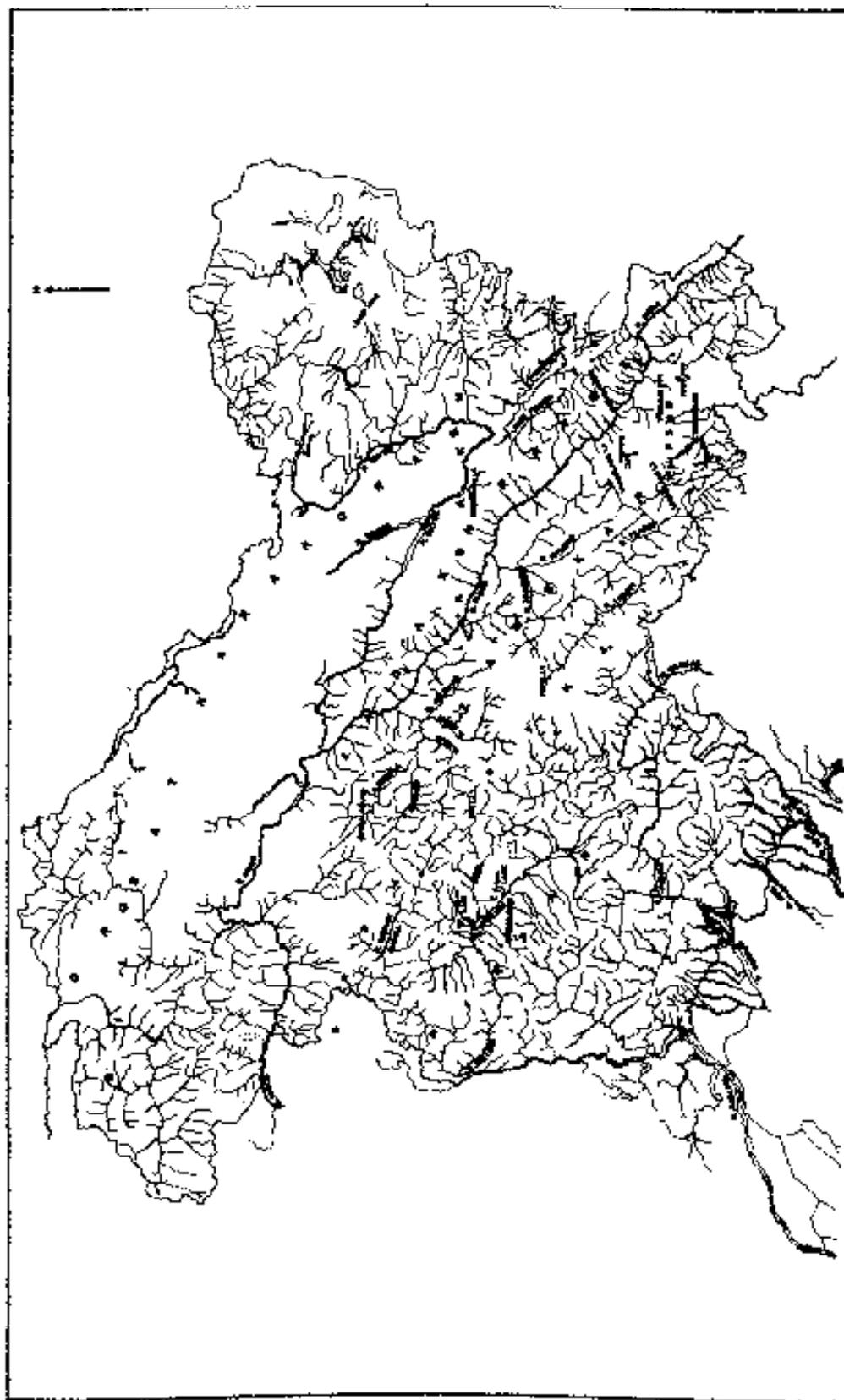
The Ravi : The Ravi, known as Iravati in Sanskrit and Hydotes in Greek, is the smallest river of Punjab and drains the southern slopes of Pir Panjal range and northern slopes of Dhauladhar range. It leaves the Himalaya at Basoli and passes close to Kathua, near Madhopur, where it enters the plains of Punjab.

The Ujh : It is the typical Shivalik stream draining the Shivalik hills in the summer months, when the monsoon rains flood these small valleys.

The Tawi : The Tawi drains the outer hill region. It flows round the city of Jammu after draining the interior mountains to the north-east of the city.

The Chenab : Chenab originates in the Himalayan contours of Lahaul-Spiti in Himachal Pradesh as two streams, Chandra and Bhaga. The Chandra issues from Chandra tal in the south-eastern lap of Baralacha la, while Bhaga originates from the north-western slopes of the same range. The two streams meet at Tandi and form Chandrabhaga which is called Chenab once it enters the state near Kishtwar. At Kishtwar it is joined by the river Wadvan, which is fed by snow at Nun Kun. The Chenab is a typical middle Himalayan river with rapids in its upper course and deep gorges cut through the rocks at the lower reaches.

The Jhelum : Known as 'Vyeth' in Kashmiri, 'Vitasta' in Sanskrit and Hydaspes in Greek, the river Jhelum originates from a spring near Anantnag at the bottom of a spur of Pir Panjal range. With its canals and lakes, Jhelum forms the main arterial system of the valley of



Map 1 : Major rivers and lakes of Jammu & Kashmir

Kashmir. The basin of Jhelum in the valley is like a oval trough between the Great Himalayan and Pir Panjal ranges. The alluvium, that filled the valley, has a depth of over 1800 m and has resulted into an unique geomorphological feature of the valley of Kashmir the lacustrine and fluvial *Karewas*.

The river flows north-west through the middle of the valley and after a winding course it forms the Wular lake. It leaves the lake at south-western side near Sopore and flows slowly south-west to the gorge at Baramulla. From this point the river is more rapid and flows westward to Muzaffarabad, where it sharply turns southward and is joined by the river Kishenganga.

The Vishav : It is an important tributary of river Jhelum which it joins below Bijbehara. Originating from the Kaunsarnag lake, it drains the Kulgam area which is known as the rice-bowl of southern Kashmir.

The Lidder : It is again an important tributary of the river Jhelum with its source in the Sheshnag lake.

The Rambhara : It is another tributary of the river Jhelum originating from the northern slopes of Pir Panjal.

The Sukhnag : It drains the Gulmarg area of the Kashmir valley.

The Dudganga : It flows from Ludurmarg in the central Pir Panjal, and near Tarakuti mountains it divides into two streams, the Sang-Safed and the Yachera. It flows to the south of Srinagar and in the western mountain of Baramulla-Gulmarg area with a number of springs below the Apharwat, Khilanmarg, Alapather, Gagrimarg, Banilanag and Kantarnag.

The Sind : It is an important tributary of Jhelum. Its traditional source is the sacred lake of Gangabal in the Harmukh mountains. The headwater emerges at Zoji la and the Amarnath peak in a limestone

cave. In its about 96 km course, the Sind drains the loftiest mountains till it joins the Jhelum at Shadipur. Sind feeds the Anchar lake near Ganderbal.

The Kishenganga : The river Kishenganga originates in the valley of Tilel and Gurez in the mountains of Dras. It passes through Keran, Karnah, Teetwal, Ghori, etc. and empties into Jhelum at Domel near Muzaffarabad.

The Indus : The river Indus drains the largest tract of the state comprising the territories of Ladakh, Baltistan and Gilgit. It enters Ladakh from south-east and flows in north-westerly direction through a barren land of granites, granulites, gneisses, phyllites and schists. It is joined by the river Zaskar below Leh and others, like Shyok, Shigar, etc. before it enters the North West Frontier Province of Pakistan after circling the Nanga Parbat at the western-most end of the Great Himalayan range.

Besides, there are about 18 natural lakes in the state covering a total area of over 700 sq km, the prominent among them being the Mansar, Surinsar, Sanasar (Jammu); Dal, Anchar, Hokarsar, Manasbal, Wular, Kaunsarnag, Gangabal, Tarsar Marsar, Sheshnag, Anantnag, etc. (Kashmir); and Pangong, Tso Morari, etc. (Ladakh).

Climate

Like its extremely diverse physiography, the state of Jammu & Kashmir shows an equally remarkable diversity in climate in its different regions (Table-1).

Temperature : In the outer plains and the outer hill regions of Jammu division the average annual temperature ranges around 30.1° celsius with the maximum of 40.6° C and minimum of 26.8° C during summer months (April - October) and 22°C and 11.5°C respectively during the winter months (November - March). The mean annual temperature in the interior of middle Himalayan region and its adjoining regions averages 13.3°C. The mean maximum and minimum temperatures between

Table - 1 : Mean average temperature and rainfall data at selected places in Jammu & Kashmir (source: Climatological Tables of India Meteorological Department, 1951 -1980).

	Jammu (367m)			Baramulla (1630m)			Qazigund (1739m)			Srinagar (1587m)			Gulabarg (2655m)			Lalit (3514m)		
	Temperature (°C)		Rain-fall (mm)	Temperature (°C)		Rain-fall (mm)	Temperature (°C)		Rain-fall (mm)	Temperature (°C)		Rain-fall (mm)	Temperature (°C)		Rain-fall (mm)	Temperature (°C)		Rain-fall (mm)
	Max.	Min.		Max.	Min.		Max.	Min.		Max.	Min.		Max.	Min.		Max.	Min.	
January	18.8	7.4	50.0	9.0	0.5	154.4	4.4	4.0	146.4	1.7	-2.3	56.5	0.6	-8.5	161.2	2.0	11.4	0.5
February	21.9	9.6	46.4	10.9	1.0	206.0	7.3	-1.8	180.4	7.8	-0.6	69.9	1.1	-7.6	274.6	1.5	-14.0	7.1
March	26.6	13.6	53.4	15.7	4.4	217.3	13.6	2.8	202.2	13.6	3.8	98.5	5.7	-2.9	231.8	6.5	-5.9	11.0
April	32.9	19.0	26.3	21.2	8.7	130.5	19.0	7.1	142.3	19.4	7.7	87.5	11.2	1.6	166.8	12.3	-1.1	9.1
May	38.3	24.4	16.0	24.9	11.3	83.0	22.8	10.0	113.0	23.8	10.7	71.8	15.2	4.5	138.8	16.2	1.2	9.0
June	40.6	26.8	51.8	28.9	15.1	51.0	27.7	14.3	64.4	29.2	14.7	37.2	20.2	7.7	76.3	21.8	7.4	3.5
July	35.3	24.5	283.4	28.2	17.6	104.5	28.0	17.2	95.8	30.0	18.2	48.7	21.2	10.3	100.3	25.0	10.5	15.2
August	33.7	24.5	344.5	27.6	17.1	100.0	27.8	16.4	74.3	29.7	17.5	69.7	20.2	10.1	95.3	25.4	10.0	15.4
September	33.6	23.0	123.9	26.4	12.4	59.3	25.8	11.3	61.9	27.8	12.9	33.3	18.4	6.3	54.1	21.7	4.8	9.0
October	31.2	18.4	38.1	23.4	7.1	24.8	21.3	6.0	41.3	21.9	6.1	36.1	14.5	2.7	68.1	14.6	1.0	7.5
November	26.8	12.6	11.9	17.9	3.2	57.1	14.9	1.1	49.8	14.7	0.9	27.0	9.1	-2.0	19.2	5.9	-0.7	1.0
December	21.1	8.5	42.2	12.3	0.5	107.1	7.6	-2.3	96.1	8.2	-1.8	43.3	4.2	-5.5	67.3	2.3	-11.8	4.6

June - September average 30°C and 14.7°C respectively, whereas during December - February it is 6.9°C and -2.1°C respectively. In between there are two transitional temperature regimes between October - November and March-May with mean maximum and minimum temperature averaging 20°C and 2.5°C respectively.

The inner Himalayan territories of the state are the coldest with mean annual temperature of about 5.8°C . In this region a mild temperature lasts during June to September when the mean maximum and minimum temperatures average 23°C and 8°C respectively, whereas during November-March it averages 3.2°C to -9.7°C respectively. The lowest recorded temperature in the region, however, has been -75°C at Dras, -45°C at Diskit (Nubra), -35°C at Nyoma (Changthang), -28.3°C at Leh and 15°C at Kargil. The months of October and April-May are the transitional periods with mean maximum and minimum temperature averaging $14.6-5.3^{\circ}\text{C}$ and $0.7-0.95^{\circ}\text{C}$ respectively.

Rainfall : The outer plains and the lower reaches of outer hills receive an average annual rainfall of about 1100 mm, mostly during the monsoon season between July-September which accounts for almost 66 per cent of mean annual rainfall. The regions on the outer aspect of middle Himalaya receive an average of about 1500 mm rains annually. The overall hydric regime is, however, modified by winter precipitation which comes partly as snow at higher elevations.

The inner aspects of the middle Himalaya, comprising the valley of Kashmir, receive an average of about 650 mm rains annually largely as winter and spring precipitation. The valley is often regarded as forming a separate climatic region because of its peculiarities in the variations of temperature, precipitation and humidity as compared to other parts of the Jammu & Kashmir. During winters, the cyclonic disturbances from the mediterranean cross over the Iran and Afghanistan and bring heavy precipitation into the valley and the surrounding mountains in the form of snow. The spring period, which lasts from March-May, is the rainiest season here. Summer rains are generally absent as the south-west monsoon is prevented by the Pir Panjal range in its south.

The inner Himalayan regions of Ladakh, Gilgit and Baltistan receive a very meagre rainfall averaging about 100 mm annually. July-August and December-March are the two rainiest seasons in these territories.

Geology and Soil

The general strike of the beds and the folds in the state is from north-west to south-east parallel to the mountain ranges. Along its south-west border lies the zone of tertiary beds which forms the sub-Himalayan zone. Next is the belt of Palaeozoic rocks, through which rise the granite, gneiss and schist of the Zaskar and Dhauladhar ranges and of the Pir Panjal. In the midst of the Palaeozoic zone lie the alluvium and Pleistocene deposits of the Srinagar valley and the Mesozoic and Carboniferous basin of upper part of Sind Valley. Beyond the Palaeozoic belt is a zone of Mesozoic and Tertiary beds which extend from Kargil in the north-west to Spiti region of Himachal Pradesh on the south-east. In the Trans Himalayan regions of Ladakh and Baltistan, there is a broad zone chiefly comprising old gneiss and schist.

The pioneering studies on the geology of Jammu & Kashmir has been done by Lydekker (1883), according to whom the entire territory is divisible into three structural zones : (i) the Panjal, (ii) the Zaskar, and (iii) the Tertiary groups. The Panjal includes the outer plains, outer hills and the middle mountains. The Zaskar includes the whole of the north eastern region extending from Lahaul-Spiti to the Karakoram range in the north. Whereas the Tertiary groups include the valley of Kashmir and other river valleys. Thus the geological zones of the state more or less correspond to its three well known physiographic divisions.

The Pre-Cambrian rocks are developed in Gilgit, Baltistan, Kashmir, Zaskar and Ladakh. In Kashmir and Hazara these are known as Saikhala series and are composed of slates, phyllites, quartzites, mica-schists, carbonaceous and graphite schists, crystalline limestones, dolomite and biotite-gneisses. They are highly folded and compressed and have been involved in the continental movements which brought the Himalayan

mountains into being. The Salkhalas are well seen in the Nangu Parbat, the mountains north of Kishenganga and in the Pir Panjal.

The gneissic rocks are well displayed in Zanskar range and to its north as also in the Dhauladhar range, Pir Panjal and other areas.

The Salkhalas and the gneisses are succeeded by Dogra Slates which are mainly argillaceous with minor layers of quartzite, quartzitic slates and flags. These are generally unfossiliferous, but are overlain by the fossiliferous Cambrians of Kashmir. The Dogra slates are also found in Pir Panjal and some parts of Kishenganga valley.

Palaeozoic rocks are exposed on the northern anticlines in the Sind and Lidder valleys and Abari synclines on the border of Kashmir valley. Here the Dogra slates are succeeded by slates, greywackes and quartzites. A formation composed of phyllites, quartzites, quartz-schists and conglomerates is found in number of places in western Kashmir and Hazara. The rocks in these formations are more or less metamorphosed and folded up with Dogra slate series.

The geomorphological revolutions during the Upper Carboniferous transformed a large part of Kashmir into volcanic land. The volcanic activity initially contributed volcanic-agglomerates and pyroclastics. The volcanic series is extensively developed in the Pir Panjal, west of the Zanskar range up to Hazara, Ladakh and Baltistan, as also in many areas in Jhelum river basin. The agglomeratic slates are generally unfossiliferous, yet well preserved fossils have been found in them in a number of localities. Some of the localities well known for yielding typical flora are : Gulabgarh pass (Pir Panjal), Gulmarg, Khunmu, Nagmarg, Bren and Narahom. The slaty plant beds contain *Gangamopteris kashmirensis*, *Glossopteris indica*, etc. The Agharwat ridge near Gulmarg has yielded *Gangamopteris*, *Glossopteris*, *Alethopteris*, *Cordaites* and *Psymphyllum* from beds underlying the lava flows and overlying the Tanwal series.

The Triassic belt in Kashmir is encountered in Lidder and Sind valleys, Wardwan, Gurez, central Ladakh, north-west Kashmir and

Pir Panjal. It largely comprises grey to dark massive limestones, red and grey limestones, sandy shales, nodular limestones and *Hungarites* shales.

The Tertiary rocks are well developed in Jammu region as well as in Kashmir, Ladakh and Gilgit. Eocene rocks similar to those of Hazara, comprising the limestones, are developed on the southern aspects of Pir Panjal. South of the Pir Panjal, there is a series of outcrops of Eocene rocks near Reasi and Jammu. These are composed of a basal zone of laterite, succeeded by grey and green pyritous and carboniferous shales and Nummulitic limestones.

Glaciation : Four to five distinct periods of glaciation, alternating with longer inter-glacial periods, have been identified in Kashmir. The first and third glaciation periods are considered to have been marked by the uplift of the Pir Panjal. The upper Karewas are thought to represent the second inter-glacial deposits, whereas the end of the fourth glaciation marked the final phase of terrace deposits of Kashmir.

The Karewas : The Karewas are fresh-water fluvial and lacustrine deposits. The lower Karewa beds are extensively developed over a length of ca 130 km and are up to 15 km wide. They lie on folded pre-Triassic and Triassic rocks and are about 1400 m thick. These are formed in a sinking lake between two slowly rising mountain ranges on either side which contributed the sediments. The big lake must have been formed by a mountainous barrier between Baramulla and Rampur, and which the ancestral Jhelum cut through to drain the lake. The lower part of the lower Karewa beds are fluvio-glacial and lacustrine, and are mainly preglacial in age. They are overlain by some glacial deposits, comprising dark grey shales belonging to the first inter-glacial and second glacial periods. The upper part of the lower Karewas contains well preserved plant leaves which existed in those times. The topmost part of the lower Karewas again comprise sand and gravel.

The plant fossils of the Karewas have been studied at Liddermarg, Laredura and Ningal nullah, and about 70 genera of flowering plants have been identified. A few Gymnosperms have also been found. The

fossil flora shows tropical, subtropical and temperate species. Interestingly some of the plant, which presently grow below an altitude of 1500 m, have been found as fossils above 3000 m. These include species of *Acer*, *Berberis*, *Indigofera*, *Rhamnus*, *Prunus*, *Pyrus*, *Rosa*, *Viburnum*, *Betula*, *Quercus*, *Juglans*, *Salix*, *Populus*, *Pinus*, *Picea*, *Juniperus*, *Nelumbium*, etc. The lignite beds show several genera of diatoms. Some of the species are still found in the Himalaya, while the others have become extinct. While the Liddermarg fossil flora is mostly tropical, the one of Ningal nullah is exclusively temperate.

Soil : The Jammu & Kashmir state has following different types of soil distributed in its different regions.

The recent and old alluvium : The largest expanse of alluvial soils occur in the outer plains of Jammu region and the plains of the valley of Kashmir. While the soils of outer plain are light to heavy with poor to moderate fertility, those from the Kashmir region are medium to heavy in texture and moderate to high in fertility. Besides, the alluvial soil in Jammu areas suffer from dryness, whereas the ones in the Kashmir have the problem of salinity.

The brown hill soil : Such type of soil is found in the outer hills and on the outer aspects of Pir Panjal, and also in the northern valleys of Kashmir. These soils are derived from a number of parent materials, but major components comprise sandstones, grey micaceous sandstones and shells.

The Podsollic soils : This is the most extensive soil type in the middle Himalayan region of the state. These are also found in vast areas in intermediate zones of Jammu region and temperate regions of Kashmir. This type of soil is largely derived from soft and hard sandstones and shells, and are medium to heavy in texture with poor moisture retention capability.

The mountain meadow soils : This type of soil is encountered in the Ladakh and Kargil regions and in the temperate zone of some inner Himalayan valleys. These are of moderate or shallow depth and

vary in texture from light to simple mixed weathered rock fragments, gravels and pebbles with sandstone and shells being the chief parent materials.

Skeletal and terai soils : These are also found in Ladakh region and are characterised by heavy texture, low depth and high aridity.

The people

The history of population building in Jammu & Kashmir is a record of constant impulses of immigration from different regions, especially the central Asia. The region had a special socio-cultural relations with people of countries in central Asia. Even in the protohistoric times, as recorded in *Nilamata Puran* and *Rajatarangini*, Kashmir was inhabited by tribes, like Nagas, Pisacas and Yakasas who used to migrate between Tibet and Central Asia in summer and the valley in winters (Stein, 1961; Buth *et al.*, 1987). As such, the alien races, ethnic groups and various religions have influenced the mode of life and cultural ethos of the people of the state.

The mosaic of ethnic groups in the state is very complex and to explain the race structure here prehistoric movement of the people has to be understood. The Dards in the north-west, the Ladakhis in the east, the Gujjars and the Rajputs in the south and Paharis in the south-east have closely influenced the existing ethnicity of the people. The racial composition of the state was also influenced by the immigrants from Tajkistan, Turkmenistan, Uzbekistan, Kazakistan, Georgia, Azerbaijan, Turkey, Iraq, Iran and Afghanistan. Though various ethnic groups in the state are intermingled, they have their respective areas of concentration. For example, Kashmiris are mostly concentrated in the valley bottom, Dards occupy the Gurej valley, Hanjis are confined to areas around the water bodies, the Gujjars and Bakarwals are living and oscillating in the Kandi area, Dogras occupy the outskirts of the Punjab plain, while Chibhalis and Paharis live between Chenab and Jhelum rivers. Besides, a number of other small ethnic groups, like Rhotas, Gaddis, Sikhs, etc. have significant concentration in isolated pockets of the state.

Kashmiris : Though the Kashmiris are well spread throughout the state, they are mostly concentrated in the valley of Kashmir, Kishtwar, Bhandarwah, Doda and Ramban areas. Kashmiri is an umbrella term which has been loosely applied for several streams of immigrants from Turkey, Iran, central Asia and Afghanistan. There is a close bearing of the Indo-Aryans on the racial composition of Kashmiris. The influence of Sanskrit on Kashmiri language is strong and cogent even today. The racial impulses from Indo-Greeks, Dards, Ladakhis and Punjabis have also influenced the race structure and cultural ethos of Kashmiris.

Dards : Dards are concentrated in the areas north of the Kashmir valley, especially in catchment of Kishenganga river north of Sardi, Gurej and Tifei. According to some opinion, Dards belong to the Aryan stock and separated from the main Aryan mass soon after their entrance into India. They initially inhabited the Pamir region from where they migrated to Chitral and Gilgit.

Ladakhis : Ladakhis have been named as the people of snow-living in an arid plateau. They are a mixture of Mongoloid and Aryan races, and the present day population of Ladakh is the result of the blending together of Dards and Mongolians.

Dogras : Dogras are a distinct ethnic group of Jammu division of the state living in the outskirts of Shivaliks facing Punjab plains. The major concentration of the Dogras is, however, found between the two holy lakes, Surinsar and Mansar. According to some social anthropologists 'Dogra' is the corruption of Rajasthani word 'Dungra' meaning hill. When the Rajasthani people migrated to the region under drought conditions, the Rajputs gave this name to the people of the hilly country.

Hanjis : Hanjis the dwellers of water, constitute a significant ethnic group in the valley of Kashmir. They are mainly confined to the Dal, Wular, Anchar lakes and the river Jhelum between Khanabal and Chattabal. Some of them claim themselves as the descendents of Prophet Noah.

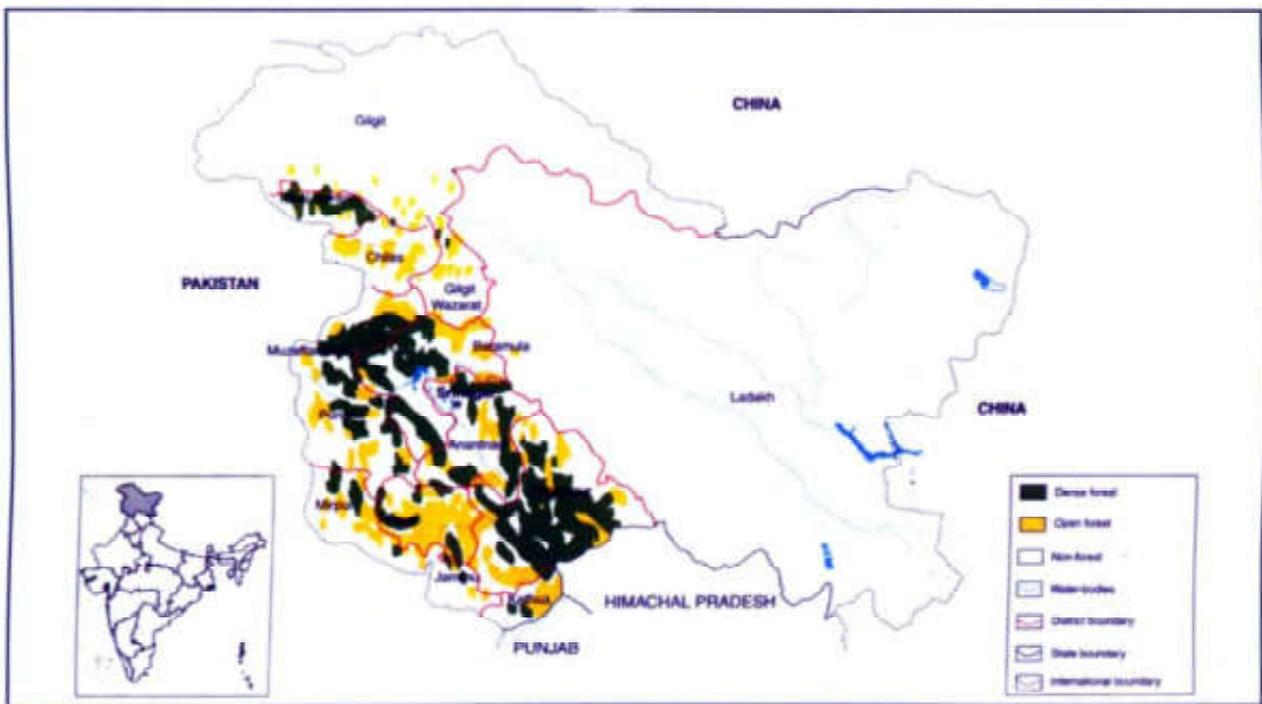
Gujjars and Bakarwals : They constitute a significant proportion of the population in the state. They lead a nomadic way of life, largely dependant on cattle rearing. Their major concentration in the state is in Jammu, Rajouri, Udhampur, Poonch, Uri, Ganderbal, Anantnag, Daksum, Narang and the Kandi areas. Although some of them have started a settled life, they are essentially cattle rearers and keep oscilating between the southern slopes of the Shivaliks to the margs the alpine pastures, of the middle Himalaya.

The other ethnic groups, which are encountered in the state, are Baltis (Kargil and Leh); Beda (Leh); Bot (Leh and Zanskar); Brokpa, Drokpa (Ladakh, Kargil and Dras); Changpa (Changthan valley, Ladakh); Garra (Leh and Kargil); Mor (Leh and Kargil); Purigpa (Purig area between Namik la and Zoji la), etc.

Forests

The recorded forest area in the state is about 20,441 sq. km which constitutes about 9.2 per cent of the total geographical area of Jammu & Kashmir (Anon., 1999). Forests are generally disturbed in Kashmir valley and Jammu region, whereas the cold desert areas of Ladakh and Kargil are devoid of forest vegetation. Of these dense forests and open forests account for 11,019 and 9,422 sq. km. respectively (Map-2). According to the *State of Forest Report 1999*, published by the Forest Survey of India, while there has been a loss of one squere kilometer of forest cover in Kathua district as compared to the preivous assessment made in 1997, there has been an increase of one square kilometer each in the districts of Mirpur and Riasi. Thus there has been a net gain of one square kilometer of forest in the state over the period of two years.

There are four National Parks and 15 Wildlife Sanctuaries in the state covering an area of ca 14,870.22 sq. km which represent ca 6.67 per cent of the total geographical area of the state. The Dachigam National Park is of special significance because of the Project Hangul initiated in 1970.



Map 2 : Forest cover map of Jammu & Kashmir (source : FSI, Dehradun)

In 1992, the state Government notified the scheme of Joint Forest Management (JFM) involving local communities in the management and rehabilitation of degraded forest. At present about 1895 JFM committees are involved in managing about 79546 ha of forest land. The scheme covers the degraded forest and waste *Khalsa* land in the state and the committee members get a share of 25 per cent of the proceeds from the harvests and are also entitled to collect minor forest produce, like grass, fodder, dry and fallen wood, etc.

From the period of first five year plan itself the State Forest Department has launched afforestation programme under Forestry and Conservation scheme. At present there is about 3,82,430 ha land under plantation. Some of the species used in afforestation programme are *Dalbergia sissoo*, *Juglans regia*, *Acacia nilotica*, *Populus ciliata*, *Salix* spp. and number of fruit trees.

Forest types

The wide range of physiography and phytoclimatic conditions met within the state of Jammu & Kashmir have adequately expressed itself by supporting a vast and luxuriant vegetation ranging from tropical dry deciduous in the south-west to alpine scrubs of cold desert in the north-east, with rich gene-pool of both wild and agri-horticultural plant species. About 20,443 sq. km, or 9.2 per cent of its total geographical area is under forest cover, of which 10,953 sq km of forest have crown density above 40 percent and the remaining with crown density ranging from 10-40 per cent. Besides, about 3,108 sq. km area is under scrub forest. Phytogeographically, the state is divisible into three distinct provinces, viz. the Jammu with more of tropical, subtropical and temperate elements; the Kashmir with its characteristic temperate and alpine flora; and the cold arid region of Ladakh showing predominance of alpine mesophytes, cold-desertic and oasisic elements, characteristic of Tibetan plateau and Siberia.

The vegetation of Jammu & Kashmir is fairly well known through the contributions of Duthie (1893, 1894), Troll (1967), Rao (1960), Champion and Seth (1968), Rau (1974), Singh, J.B. and Kachroo

(1983, 1983a), etc. Accordingly, the vegetation of the state is broadly grouped under following categories, each with numerous subtypes, based largely on the altitude, rainfall, humidity and species composition.

Tropical dry deciduous forests :

These forests occur in the Shivaliks of Jammu region in the foothills between the Ravi and Chenab rivers. As the summer temperature reaches as high as 40°C, the vegetation mainly comprises thorny, deciduous and xerophytic elements. Here the tree species are represented by *Acacia catechu*, *A. modesta*, *Bauhinia variegata*, *Phyllanthus emblica*, *Trena politoria*, *Bombax ceiba*, *Ougeinia oojienenses*, *Dalbergia sissoo*, *Cassia fistula*, *Albizia lebbeck*, *Mitragyna parvifolia*, *Moringa oleifera*, *Miliusa velutina*, *Butea monosperma*, *Aegle marmelos*, *Ehretia aspera*, *Terminalia bellirica*, *Ficus* spp., *Lannea coromandelica*, *Anogeissus latifolia*, *Kydia calycina*, *Flacourtia indica*, *Nyctanthes arbor-tristis*, *Holarrhena pubescens*, etc. *Naringi crenulata*, *Engelhardtia colebrookeana*, and *Oroxylum indicum* are also seen occasionally. Pure stands of *Butea monosperma* can be seen at few places in district Kathua. This species is common around Pallanwala also.

The shrubby vegetation in these forests includes *Mimosa rubicaulis*, *Adhatoda zeylanica*, *Murraya koenigii*, *Aechmanthera tomentosa*, *Indigofera cassioides*, *Colebrookea oppositifolia*, *Capparis septaria*, *Maytenus royleanus*, *Ziziphus mauritiana*, *Callicarpa macrophylla*, *Casearia elliptica*, *Vitex negundo*, *Helicteres isora*, *Euphorbia royleana*, *Lantana camara*, etc. Association of *Carissa opaca*, *Dodonaea viscosa*, *Adhatoda zeylanica* and *Woodfordia fruticosa* is a common feature in this region. *Berberis lycium*, *Rubus ellipticus*, *Pogostemon benghalense* and *Zanthoxylum armatum* are also met with at certain places.

Among the herbaceous elements *Argemone mexicana*, *Breua arvensis*, *Silybum marianum*, *Coronopus didymus*, *Oxalis corniculata*, *Tephrosia hamiltonii*, *Anisomeles indica*, *Tribulus terrestris*, *Indigofera linifolia*, *Gomphrena celosioides*, *Tridax procumbens*, *Zornia gibbosa*, *Heliotropium strigosum*, *Alternanthera pungens*, *Achyranthes aspera*, *Pupalia lappacea*, *Malvastrum coromandelianum*, *Leucas* spp., *Sida* spp., *Solanum* spp.,

etc. are commonly met with. *Gloriosa superba*, *Withania somnifera*, *Eclipta alba*, *Soliva anthemifolia*, etc. are frequently seen. *Zeuxine strateumatica*, a ground orchid, grows amidst grasses by the riverside.

On the dry river beds species of *Saccharum* grow in abundance. Other common species of grasses are *Dichanthium annulatum*, *Chrysopogon serrulatus*, *Hackelochloa granularis*, *Heteropogon contortus*, *Apluda mutica*, *Pogonatherum paniceum*, *Themeda anathera*, *Phragmites karka*, *Brachiaria ramosa*, *Arthraxon lancifolius*, *Hemarthria compressa*, *Setaria glauca*, *Oplismenus compositus*, *Panicum antidotale*, *Desmostachya bipinnata*, *Imperata cylindrica*, *Aristida adscensionis*, etc.

The climbers, twiners and creepers in this zone are represented by *Abrus precatorius*, *Bauhinia vahlii*, *Hiptage benghalensis*, *Clematis gouriana*, *Cardiospermum halicacabum*, *Cryptolepis buchanani*, *Cayratia trifolia*, *Helinus lanceolatus*, *Rhynchosia minima*, *R. capitata*, *Vallisneria spiralis*, *Cajanus crassus*, *Diptocyclos palmatus*, *Trichosanthes* spp., *Ipomoea* spp., *Porana paniculata*, *Cissampelos parirea*, *Tinospora cordifolia*, etc.

In the low lying areas, irrigated fields, ponds, puddles and marshy habitats *Hydrilla verticillata*, *Ceratophyllum demersum*, *Nymphaea hydrophyllum*, *Juncus bufonius*, *Ranunculus sceleratus*, *Rotala mexicana*, *Ammannia multiflora*, *Bacopa monnieri*, *Limnophila indica*, *Ludwigia adscendens*, *Typha angustata*, *Veronica anagallis-aquatica*, *Cyperus* spp., *Fimbristylis* spp., *Scirpus* spp., etc. are of common occurrence.

Calotis hispidula, *Eremostachys superba*, *Soliva anthemifolia*, *Taverniera nummularia*, *Vicia bithynica*, etc. are some of the interesting plant species growing within this height.

Himalayan subtropical pine forests :

This type of forests usually occur between 1000-1500 m altitude where *Pinus roxburghii* or the 'Chir pine' dominates over all other species. Other tree species growing in association of the Chir-pine are *Mallotus philippensis*, *Glochidion velutinum*, *Terminalia chebula*, *Pyrus*

pashia, *Nyzygium cumini*, *Albizia chinensis*, *Acacia catechu*, etc. *Carissa opaca*, *Dodonaea viscosa*, *Rubus ellipticus*, *Pyracantha crenulata*, *Flacourtia* sp., *Myrsine africana*, *Woodfordia fruticosa*, *Wendlandia heynei*, *Nyctanthes arbor-tristis*, *Myrraya koenigii*, *Colebrookia oppositifolia*, *Berberis* sp., *Flemingia strobilifera*, *Myriactis wallichii*, etc. and grasses, like *Chrysopogon fulvus*, *Cymbopogon* spp., *Dichanthium annulatum*, *Heteropogon contortus*, etc. are the common elements found as undergrowth in these forests.

Subtropical dry evergreen forests :

These type of forests occupy a larger area in the state in comparatively less disturbed areas. These are considerably interesting in the occurrence of a number of temperate elements, like *Alnus nepulensis*, *Rhododendron arboreum*, etc. the subtropical broad-leaved forests exhibit a high degree of species diversity with numerous shrubby and herbaceous elements. though there is no clear stratification of the vegetation. *Quercus leucotrichophora-Rhododendron arboreum*, *Lyonia ovalifolia* form a dominant association in these forests. *Persea odoratissima*, *P. duhtei*, *Lindera pulcherrima*, *Cinnamomum tamala*, *Rhus punjabensis*, *Fraxinus floribunda*, *F. xanthoxyloides*, *Olea ferruginea*, *Engelhardtia colebrookeana*, *Morus serrata*, etc. are some of the trees commonly seen in these forests. *Dodonaea viscosa*, *Punica granatum*, *Hypericum* spp., etc. are some of the common shrubs.

Dry temperate forests :

These type of forests are found on both northern as well as southern aspects of Pir Panjal and in the Kashmir valley. Conifers, like *Cedrus deodara*, *Pinus wallichiana*, *Picea smithiana*, and broad-leaved trees *Juglans regia*, *Acer pentapomicum*, *Celtis australis*, *Aesculus indica*, *Fraxinus excelsior*, etc. dominate these forests. On relatively drier slopes *Pinus gerardiana* forms gregarious strands. At certain places it is also seen in association with *Quercus ilex*, *Betula utilis* and *Rhododendron campanulatum*.

Other trees found in association of these are *Fraxinus xanthoxyloides*, *Rhus succedanea*, *Olea cuspidata*, *Pistacia integerrima*, etc. The common

shrubs in these forests are *Artemisia maritima*, *A. vulgaris*, *Daphne oleoides*, *Rosa webbiana*, *Berberis* spp., *Roylea calycina*, *Lonicera angustifolia*, *Sophora mollis*, *Abelia triflora*, etc.

On the south facing slopes of Sind and Liddor valleys shrubs, like *Parrotiopsis jacquemontiana*, *Rosa webbiana*, *Indigofera gerardiana*, species of *Berberis*, *Cotoneaster*, *Viburnum*, etc. form prominent association. *Parrotiopsis jacquemontiana* is also abundant in some degraded *Pinus wallichiana* forests which have suffered the parasitic attack of *Arceuthobium minutissimum*.

The common grasses in these forests are *Agropyron longearistatum*, *Agrostis alba*, *Eragrostis nigra*, *Phleum arenarium*, *Setaria viridis*, etc.

Moist temperate forests :

In these forests temperate species, like *Rhododendron arboreum*, *Lyonia ovalifolia*, *Quercus leucotrichophora*, *Ilex dipyrrena*, *Litsea umbrosa* var. *consimilis*, etc. are very common. This association is more common in the erstwhile Jammu province particularly the Trikuta hills and higher reaches of Kathua District. At other places *Alnus nitida*, *Diospyros lotus*, *Aesculus indica*, *Platanus orientalis*, *Acer caesium*, *A. cappadocicum*, *Robinia pseudoacacia*, *Juglans regia*, *Picrasma quassioides*, *Randia tetrasperma*, *Ulmus wallichiana*, *Buxus wallichiana*, *Quercus dilatata*, *Symplocos paniculata*, *Prunus* spp., *Corylus jacquemontii*, *Populus ciliata*, etc. are frequently met with. The coniferous species appearing at this altitude are *Pinus wallichiana* and *Cedrus deodara*.

The shrubby vegetation in this zone mainly consists of *Coriaria nepalensis*, *Indigofera heterantha*, *Inula cuppa*, *Viburnum cotinifolium*, *Sarcococca pruniformis*, *Syringa emodi*, *Daphne oleoides*, *Skimmia anquitilla*, *Pyracantha crenulata*, *Buddleja paniculata*, *Ribes orientale*, *Philadelphus tomentosus*, *Spiraea* spp., *Cotoneaster* spp., etc.

The ground floor in this region is adorned by species of *Anemone*, *Aconitum*, *Polygonum*, *Impatiens*, *Delphinium*, *Geranium*, *Potentilla*,

Primula, *Valeriana*, *Pedicularis*, *Galium*, *Silene*, *Iris*, *Lloydia serotina*, *Notholirion thomsonianum*, *Erodium cicutarium*, *Dipsacus inermis*, *Morina longifolia*, *Rostraria cristata*, etc.

Among the more common climbers and twiners mention may be made of *Galium verum*, *Codonopsis rotundifolia*, *Hedera nepalensis*, *Polygonum dumetorum*, *Rosa* spp., *Clematis* spp., *Cuscuta* spp., *Dioscorea* spp., etc.

The aquatic and marshy vegetation includes *Nymphaea alba*, *Nelumbo nucifera*, *Euryale ferox*, *Ranunculus trichophyllus*, *Caltha palustris*, *Myriophyllum spicatum*, *M. verticillatum*, *Menyanthes trifoliata*, *Spirodela polyrhiza*, *Butomus umbellatus*, *Potamogeton* spp., etc.

Berberis huegeliana, *B. royleana*, *Cotoneaster lambertii*, *Delphinium uncinatum*, *Onopordum acanthium*, *Tricholepis karenium*, *Senecio vulgaris*, *Cousinia minuta*, *Xanthium spinosum*, *Lavatera kashmiriana*, *Polygonum pacificum*, *Potamogeton filifolius*, *Listera ovata*, *Galium parsiense* subsp. *anglicum*, etc. are some of the interesting or rare species found within this altitude.

Subalpine forests :

These forests are usually found between 3000-3500 m altitudes. In valleys and slopes, where conditions are favourable, the typical west Himalayan coniferous forests comprising *Abies pindrow*, *A. spectabilis*, *Cedrus deodara*, *Pinus wallichiana*, *Taxus wallichiana* and occasionally species of *Juniperus* are a common sight. In drier places, however, an association of *Pinus gerardiana* and *Juniperus* is more gregarious. Intermixed with these conifers, the common broad-leaved species in these forests are *Quercus semecarpifolia*, *Betula utilis*, *Acer sterculiaceum*, etc. Other species commonly seen in these forests include *Rhododendron campanulatum*, *Viburnum cotinifolium*, *V. nervosum*, *Ribes emodense*, *R. glaciale*, *Rosa macrophylla*, *R. sericea*, *R. webbiana*, *Cotoneaster acuminatus*, *C. cashmirensis*, *C. brandtstii*, *C. duthieanus*, *C. falconeri*, *Piptanthus nepalensis*, *Salix pycnostachya*, *S. denticulata*, *S. disperma*,

Berberis jaeschkeana, *B. kashmiriana*, *Senecio laetus*, etc. *Osmunda claytoniana* is most common fern in these forests.

Alpine forests :

Such vegetation is generally found above 3300 m. The most commonly encountered plants in these forests are *Juniperus indica*, *Rhododendron anthopogon*, *R. lepidotum*, *Salix* spp., etc. The characteristic herbaceous plants in alpine zone include *Allium stracheyi*, *A. wallichii*, *Anaphalis contorta*, *A. nepalensis*, *A. royleana*, *Aster asteroides*, *A. altaicus*, *A. diplostephoides*, *A. falconeri*, *A. flaccidus*, *A. himalaicus*, *Bergenia stracheyi*, *Caltha palustris*, *Callianthemum pimpinelloides*, *Clematis orientalis*, *Corydalis cashmeriana*, *C. crassifolia*, *C. govaniana*, *C. stricta*, *Cyananthus lobatus*, *Dactylis glomerata*, *Danthonia cachemyriana*, *Epilobium angustifolium*, *E. laxum*, *Juncus bracteatus*, *J. lampocarpus*, *J. sphacelatus*, *J. triglumis*, *Poa alpina*, *P. angustifolia*, *P. calliopsis*, *Morina longifolia*, *Trollius acaulis*, *Sibbaldia cuneata*, *Lyoydia serotina*, *Leontopodium alpinum* and many species of *Aconitum*, *Astragalus*, *Draba*, *Carex*, *Delphinium*, *Saussurea*, *Primula*, *Saxifraga*, *Potentilla*, *Sibbaldia*, *Polygonum*, *Taraxacum*, *Sedum*, etc.

As this zone experiences severe climatic variations and stresses, the plants growing here mostly remain bushy and stunted. A number of them are also ephemerals adapted to ecological stress conditions of this zone. Such conditions make these ecosystems very-very fragile.

In and along the stream beds, marshes and similar habitat one usually comes across species like *Juncus leucomelas*, *J. membranaceous*, *Caltha palustris*, *Sparganium ramosum*, *Potamogeton natans*, *P. lucens*, *P. crispus*, *P. pectinatus*, *Triglochin maritima*, *Pedicularis* spp., *Polygonum* spp., etc.

The alpine and subalpine meadows in the inner valleys of Kashmir are locally known as 'margs' and are characteristically similar to 'charande' of Himachal Pradesh and 'bugyals' of Uttaranchal state. Lying between the tree line and the snow line, some of the famous 'margs' in the state are Gulmarg, Sonamarg, Tangmarg and Khillanmarg.

The tree species in these margs include *Acer caesium*, *Prunus cornuta*, *Pinus wallichiana*, *Cedrus deodara*, etc. in the lower heights, *Abies pindrow* and *Picea smithiana* in the upper reaches that ultimately culminate in to *Betula utilis* forming the tree limit. *Taxus wallichiana* is also seen growing here. *Indigofera heterantha*, *Plectranthus rugosus*, *Berberis lycium*, *Parrotiopsis jacquemontiana*, *Syringa emodi*, etc. are some of the shrubby species here. *Anemone obtusiloba*, *Gentiana carinata*, *Adonis chrysocyathus*, *Ranunculus laetus*, *Caltha palustris*, *Corydalis falconeri*, *Cardamine macrophylla*, *Draba glacialis*, *Dianthus crinitus*, *Geranium wallichianum*, *Dicliamnus albus*, *Lavatera kashmiriana*, *Phlomis bracteosa*, *Salvia hians*, *Polygonum viviparum*, etc. constitute the ground floor vegetation in these "margs".

Like Garhwal and Kumaon Himalaya, *Betula utilis* forms the tree limit in Kashmir Himalaya also. Singh and Kachroo (1976) have reported a solitary tree of *Sorbus* growing above the *Betula* line. Interestingly similar observations have also been made in Uttar Pradesh in the Nanda Devi Biosphere Reserve (Balodi, *pers. com.*) but the species in the latter case happens to be *Pinus wallichiana*.

Dry alpine scrubs :

In the trans Himalayan regions of Ladakh, Gilgit and Baltistan, better known as the 'cold desert', the vegetation is conspicuous by the absence of naturally occurring tree species. Whatsoever trees are seen in these areas are introduced along the river banks and nullahs near the settlements. These include *Salix elegans*, *S. alba*, *S. sclerophylla*, *S. fragilis*, *Populus caspica*, *P. euphratica*, *P. nigra*, *P. ciliata*, *P. angustifolia*, *P. balsamifera*, etc., which are important source of fodder, fuel and timber for the local inhabitants. Other species found are *Myrtama elegans*, *Hippophae rhamnoides*, *Rosa webbiana*, *Tamarix gallica*, *Elaeagnus hortensis*, *Caragana pygmaea*, *Ephedra gerardiana*, *Artiplex crassifolia*, etc.

The natural vegetation occurring here mostly conform to subtropical semi-desert type or the '*Artemisia* steppe' type, and comprise typical cold-desert elements. To ward off extreme climatic conditions these

plants variously modify themselves. As part of their survival strategy, they usually acquire bushy and diminutive cushion, clump or mat forming habit and invariably develop thick hairs and deep penetrating rootstocks. The most common plants met with are *Nepeta floccosa*, *Physochlaina praealta*, *Biebersteinia odora*, *Hyoscyamus niger*, *Cicer microphyllum*, *Acantholimon lycopodioides*, *Thylacospermum caespitosum*, *Inula rhizocephala*, *Saussurea gnaphalodes*, *Corydalis flabellata*, *Papaver nudicaule*, *Gentiana algida*, *Arenaria bryophylla*, *Chesneya cuneata*, *Dracocephalum* spp., *Draba* spp., *Chorispora* sp., *Stipa* spp., *Astragalus* spp., etc. The large sandy stretch of Pang that extends to miles together and dominated by *Caragana pygmaea* is also a peculiarity of this region.

Tricholepis tibetica, *Lancea tibetica*, *Stachys tibetica*, *Stracheya tibetica*, *Euphorbia tibetica*, *Nepeta tibetica*, *Hedinia tibetica*, *Rheum tibeticum*, *Tanacetum tibeticum*, *Actinocarya tibetica*, etc. perhaps point out towards the affinity of the flora with Tibet. Plants like *Capsella bursa-pastoris*, *Stellaria media*, *Capparis spinosa*, *Peganum harmala*, *Tribulus terrestris*, *Verbascum thapsus*, *Ceratophyllum demersum*, *Zannichellia palustris*, etc. are common with the lower regions. Some of the species, like *Macrotomia benthami*, *Aconitum heterophyllum*, *Oxyria digyna*, *Hippophae tibetana*, *Caltha palustris*, *Podophyllum hexandrum*, etc. are common with the temperate regions.

In the Deosai plains towards the Karakoram, where the mean altitude is above 4000 m, an *Artemisia-Tanacetum* dominated vegetation is encountered. North-east and south-east of Leh, around the brackish water lakes of Pangong Tso and Tso Morari the vegetation again comprises alpine steppe species belonging to *Caragana*, *Artemisia*, *Krascheninnikovia*, *Oxytropis*, *Potentilla*, *Stipa*, *Myricaria*, etc. During comparatively wet period, the common alpine herbs in these areas belong to the species of *Aster*, *Delphinium*, *Gentiana*, *Leontopodium*, *Primula*, *Sedum*, *Thymus*, etc.

The aquatic and marshy vegetation is represented by *Ranunculus trichophyllus*, *Hippuris vulgaris*, *Limosella aquatica*, *Ranunculus hyperboreus*, *Ceratophyllum demersum*, etc. *Glaux maritima*, a plant

generally found in salt water lakes elsewhere, has interestingly been reported from the fresh water lakes of Ladakh.

Astragalus zanskerensis, *Trachometum venetum*, *Poa suruana*, *P. markgrafii*, *Thermopsis inflata*, *Saussurea bracteata*, *Kengia mutica*, *Mitula spicata*, etc., are some of the other interesting species found in cold deserts.

The gymnosperms in this region are represented by 6 species of bushy *Juniperus* and medicinally important *Ephedra gerardiana*.

Botanical explorations

The history of botanical explorations in Jammu & Kashmir has been excellently reviewed by Rau (1959), Burkill (1965), Javeid (1971), Stewart (1979, 1982) and Nair *et al.* (1996). Dr. William Moorcroft, a British veterinary surgeon made the first botanical foray in the state during 1820-22. He collected 23 botanical specimens from the Ladakh region and sent them to Nathaniel Wallich at the then Royal Botanic Garden, Calcutta for identification. Victor Jacquemont, representing the National Museum of France, was the first botanist to visit the valley through Poonch in 1831. But he did not survive long to see through the publication of his excellent collections, which was later executed by Cambessedes and Decaisne in 1844 (see Stewart, 1982). Jacquemont was followed by G.T. Vigne (1834), Carl von Huegel (1835), H. Falconer (1837). Vigne returned to Kashmir valley again in 1836 and made extensive collections in Deosai plains near Drass and in Astore valley till 1839. J.F. Royle got his specimens from Kashmir through his collectors during 1835-39 and published the first account on the flora of Kashmir in 1839. J.E. Winterbottom made collections from Astore, Skardo, Gurez, and Gilgit area in north-western Kashmir in 1846, while Thomas Thomson (1847) made collections from Leh, Dras, Kashmir valley, Jammu, Kishtwar, Bhaderwah, the valleys of Nubra, Shyok and Zaskar, and Karakoram and beyond. Henry Strachey also made collections from Ladakh and upper Indus valley. William Munro mostly collected grasses in the state in 1848. J.H. Lance, of Bengal Civil Service, collected in Dras, Ladakh and

Kashmir in 1849. Sir J.D. Hooker and T. Thomson instituted genus *Lancea* in his honour.

Prominent among those, who explored the flora of Kashmir in the later half of the nineteenth century, are Schlagintweit (1855-57), J.L. Stewart (1868), Henderson and Hume (1873). Henderson and Hume recorded 276 plants from Ladakh in Their book *Lahore to Yarkand* published in 1873 (Nair *et al.*, 1996). C.B. Clarke made extensive explorations across Kashmir from east to west up to Gilgit during 1876, and also made collections from Jammu region. J.E.T. Aitchison, a Civil Surgeon, made collection from Astor and Ladakh in 1873. D. Brandis of Indian Forest Service collected in Kashmir in 1874. Maj. John Biddulph of the Indian Army collected from Gilgit area between 1879-81, while Col. H.C.B. Tanner explored Astor and Gilgit in 1880. Maj. G.M. Giles also collected in Gilgit during 1885-87.

J.F. Duthie from the Botanical Survey of India made extensive collections in Gilgit and Baltistan during 1892-93 and published his observations in detail in the *Records of the Botanical Survey of India* (Duthie, 1893-94). Other notable plant collectors in Jammu & Kashmir, towards the close of nineteenth and early twentieth century, had been Col. McLeod, E.W. Trotter (who mostly collected the Pteridophytes), McDonel, Ward, Osmaston, Inayat Khan (Duthie's collector), Prof. P.J. Bruehl, R.B. Keshvanand, Alfred Meebold, Filippo de Filippi, Duke of Abruzzi, Lacoste, Kashyap (who mostly collected liverworts), Mrs. Visser-Hoof, Prof. Wim Lillie and Rev. John Garret, W.N. Koelz, Dr. Arnold Scheibe and Gerhard Kerston, Carl Troll (a member of German-Austrian expedition to Nanga Parbat in 1937), R. Scott Russell, etc. The most prominent explorer and plant collector in Jammu & Kashmir during this period, however, had been R.R. Stewart of Gordon College, Rawalpindi. Between 1912 and 1947, Stewart extensively collected in several parts of Jammu, Kashmir valley, Ladakh, Gilgit and Baltistan. During some of these visits, even Mrs. Stewart also accompanied him.

In the post independence era, among others, the mention may be made of Col. R.N. Chopra, R.L. Badhwar, L.D. Kapur, M.L. Dhar,

Y.K. Sarin, B.K. Kapahi, T.N. Srivastava from RRI, Jammu; Prof. A.K. Kaul, B.M. Sharma from Jammu University; Prof. P. Kachroo, Uppeandra Dhar, B.L. Sapru, A. Navchoo, A.R. Naqshi, G.H. Dar, G.N. Javeid, A.M. Kak from Kashmir University, Srinagar; Oleg Polunin (an English school teacher), K.M. van Joest (a Dutch expert on *Taraxacum*), M.K. Wali, S.N. Tiku, etc. who collected from different parts of the state and significantly contributed to our knowledge of the flora of Jammu & Kashmir.

With the reorganisation of the Botanical Survey of India and the establishment of its Northern Regional Circle at Dehra Dun in 1956, the exploration activities in Jammu & Kashmir have gained appreciable momentum. Among the major collectors from this premier organisation, mention may be made of T.A. Rao, M.A. Rau, A.S. Rao, N.C. Nair, U.C. Bhattacharyya, M.V. Viswanathan, J.N. Vohra, B.D. Naithani, P.C. Pant, B.P. Uniyal, B.M. Wadhwa, P.K. Hajra, S.K. Murti, R.R. Rao, S. Kumar, B. Balodi, Surendra Singh, D.K. Singh, S.K. Srivastava, Amit Chauhan, etc. In recent years scientists from Field Research Laboratory, Leh and Himalayan Forest Research Institute, Shimla have also been undertaking plant exploration and collection in different valleys of Ladakh region and have significantly contributed to Indian herbaria.

Botanical studies

The first floristic account of the state of Jammu and Kashmir comes through John Forbes Royle's (1833-39) publication *Illustrations of the Botany and other branches of the Natural History of the Himalayan Mountains and of the Flora of Cashmere*. Subsequently, Duthie (1893-94), Meebold (1909), Stewart (1916-17), Bamber (1916), Coventry (1923-30), Blatter (1927-29), Lambert (1933), Mukherjee (1940), Pennell (1943), Rao (1960, 1961), Singh (1970), Rau (1975), Kachroo (1993) and many others made notable contribution to our knowledge about floristic diversity of Kashmir. Besides, a number of regional floras covering different physiographic, administrative or ecological units of the state (Singh & Kachroo, 1976; Kachroo, Sapru & Dhar 1977; Sharma & Kachroo, 1981; Dhar & Kachroo, 1983; Kaul, 1986; Sharma

& Jamwal, 1988; Kapur & Sarin, 1990; Singh & Kachroo 1992; Singh, J.B. & Kachroo, 1994; Khullar, 1994, 2000; Navchoo & Kachroo, 1995; Swami & Gupta, 1998; Murti, 2000); check-lists (Karthikeyan *et al.*, 1989; Ara & Naqshi, 1993; Ara *et al.*, 1995; Dar & Kachroo, 1982; Dar *et al.*, 1983; Gupta & Kachroo, 1985; Javeid, 1968, 1979; Kapoor *et al.*, 1964; Kapoor, 1968; Kaul, 1972; Naqshi *et al.*, 1984; Kapur, 1985; Singh & Wafai, 1973; Stewart 1967, 1967a, 1972; Sanjappa, 1992) and the revisions and monographs (Raven, 1962; van Soest, 1961, 1963; Grierson, 1964; Kazmi, 1970-71; Deb & Das Gupta, 1981; Chakravarty, 1982; Munshi & Javeid, 1986; Naqshi & Javeid, 1987; Naqshi *et al.*, 1988; Nayar *et al.* 1988, 1990; Chakrabarty & Balakrishnan, 1990, 1992; Purohit & Panigrahi, 1991; Mathur, 1994; Ghora & Panigrahi, 1995; Kumar & Panigrahi, 1995; Hajra *et al.*, 1995; Dikshit & Panigrahi, 1998; Jagtap & Singh, 1999), etc. have significantly contributed to our knowledge of the floristics of Jammu & Kashmir.

Interestingly *Flora of Pakistan*, currently being edited by E. Nasir and S.I. Ali, also provides significant insight into the flora of the state. Besides, the new *Flora of India*, being published by the Botanical Survey of India (Sharma & Sanjappa, 1993; Sharma & Balakrishnan, 1993; Sharma *et al.*, 1993; Hajra *et al.*, 1995a, 1995b, 1997; Singh *et al.*, 2000), provides up to date nomenclature, taxonomic description, phenology, distribution, etc. of flowering plant species from the state belonging to families Ranunculaceae to Moringaceae and Asteraceae.

The contributions include several new species and a number of new records, both for the state of Jammu & Kashmir and for the country from the state (Ghildyal & Bhattacharyya, 1986; Wadhwa, 1986; Chowdhery *et al.*, 1990, 1992; Pant *et al.*, 1994; Dar *et al.*, 1995; Dhar & Naqshi, 1976; Kumar & Balodi, 1987; Kak & Javeid, 1976).

Apart from the above, a number of contributions have also been made on vegetation and ecology (Rau, 1974; Bhat, 1982; Kaul & Sarin, 1982; Kaul, 1983; Dar & Kachroo, 1983; Dar *et al.*, 1983a; Kapur & Sarin, 1986; Bhat & Kaul, 1989), endemism (Dhar & Kachroo, 1983a; Dhar *et al.*, 1987; Nayar, 1996), aquatic plants (Kak, 1985, 1985a, 1986, 1990), medicinal, ethnobotanical and other economic

plants (Sarin, 1965; Kapur & Sarin, 1977, 1982, 1984; Kapoor, 1990, 1990a; Kaul *et al.*, 1991; Srivastava & Kupahi, 1995; Chaurasia & Singh, 1996-2001; Chaurasia *et al.*, 1988, 1999, 1999a, 2001; Kaul 1997; Balodi & Singh, 1997; Vishwanathan, 1999; Naqshi & Aman 2001) and rare and threatened plants (Jain & Sastry, 1980, 1984; Dar & Naqshi, 1984, 2001; Nayar & Sastry, 1987-1990; Chaudhury & Rao, 2002).

Apart from the macrophytes, other group of plants, viz. algae (Kant & Vohra, 1999), fungi (Qasba & Shah, 1991), bryophytes (Dixon, 1926; Brotherus, 1928; Kashyap, 1929, 1932; Robinson, 1965; Kaul & Dhar, 1968; Srivastava, 1979; Chopra & Kumar, 1981; Vohra, 1983), pteridophytes (Beddome, 1883, 1892; Hope, 1903; Stewart, 1945, 1951, 1957; Javeid, 1965; Kapur, 1985; Khullar, 1994, 2000) and gymnosperms (Dhar, 1966, 1968; Sahni, 1990. See also Dar *et al.*, 2002) have also received considerable attention in the state of Jammu & Kashmir.

Floristic diversity

The topographical divisions of Jammu & Kashmir, each with distinct phytoclimatic conditions together with the confluence of floristic elements from not only neighbouring central Asian mountains of Pamir, Hindukush and Karakoram, but also the Mediterranean regions and far off countries as well have together contributed to the richness of floristic diversity in the state. Sharma and Kachroo (1981), Vir Jee *et al.* (1989) and Kachroo (1993) recorded 506 species from Jammu, 3054 species from Kashmir and 800 species from Ladakh respectively (*see also* Awasthi, 1997). Besides, Dar *et al.* (2002) recorded 12 species of Gymnosperms (excluding 14 cultivated taxa) and 90 species of Pteridophytes from the state. He also recorded 221 taxa of Bryophytes, 423 fungi and 636 algae. In a recent review of the floristic diversity and conservation strategies in Jammu & Kashmir, Singh *et al.* (1999) recorded 4439 taxa comprising 4252 in 1220 genera and 189 families of Angiosperms, 19 species in 8 genera and 4 families of Gymnosperms and 168 species in 54 genera and 31 families of Pteridophytes. This amounts to about 24 per cent of the total species in these groups recorded from the country (Karthikeyan, 2000; Sharma & Singh, 2001).

Floristically, therefore, Jammu and Kashmir represents a megadiversity state comparable only with the east Himalayan states of Arunachal Pradesh and Sikkim (Singh & Hajra, 1996; Chowdhery, 1999; Singh & Chauhan 1999).

As per the data presented by Singh *et al.* (1999), the proportion of Dicotyledons to Monocotyledons in the state is approximately 5:1 at family level, 3.7:1 at generic level and 4:1 at species level which compares well with that in India, viz. 4.6:1, 3.3:1 and 3:1 respectively. The over all genus to species ratio in the flowering plants of the state is 1:3.5 as against 1:5.6 in India.

It was deduced from the above data that 12 families of the flowering plants in Jammu & Kashmir have 100 or more species, whereas 133 families are represented by up to 10 species only. Similarly only 2 families in the state were reported to have 100 or above genera while 164 of them are represented by up to 10 genera only.

An interesting aspect of the floristic diversity of Jammu & Kashmir, is that, apart from the families represented by just a single species in India as well as the Jammu & Kashmir, a number of families are represented in the state by 40 per cent or more of their total species hitherto recorded from India, viz. Alismataceae (57%), Apiaceae (43%), Asteraceae (53%), Basellaceae (100%), Boraginaceae (50.7%), Brassicaceae (85.5%), Callitrichaceae (67%), Caprifoliaceae (50%), Casuarinaceae (50%), Caryophyllaceae (92.6%), Chenopodiaceae (70%), Coriariaceae (50%), Crassulaceae (50%), Datisceae (50%), Fumariaceae (52%), Gentianaceae (40%), Geraniaceae (70%), Illecebraceae (75%), Iridaceae (81%), Juglandaceae (100%), Malvaceae (45%), Menyanthaceae (100%), Nymphaeaceae (100%), Onagraceae (71%), Orobanchaceae (50%), Papaveraceae (59%), Plantaginaceae (92%), Polygonaceae (67%), Pontederiaceae (100%), Potamogetonaceae (83%) Ranunculaceae (55%), Salicaceae (64%), Tamaricaceae (50%), Valerianaceae (67%), etc.

Similarly, apart from the monotypic genera or the ones represented in India and the Jammu & Kashmir by just a single species, a number of genera, such as *Allium* (34 species), *Potentilla* (50 species), *Waldheimia*

(5 species). *Tragopogon* (5 species), etc. have their cent per cent representation in the state (see also Singh & Hajra, 1996).

Apart from the above, the state of Jammu & Kashmir also abounds in rich genetic diversity of agri-horticultural crops like *Pyrus*, *Prunus*, *Sorbus*, *Rubus*, *Ribes*, *Hordeum*, *Elymus*, *Eremopyrum*, *Avena*, *Aegilops*, *Allium*, *Lepidium*, *Carum*, *Linum*, *Cicer*, *Cucumis*, etc. The strong linkages and contiguity of Indian gene centre with other rich locii of crop diversity, such as central and western Asia, coupled with the influx of germplasm in the past from the Mediterranean region has enormously augmented the crop genetic diversity in the state including the locally selected variabilities (Arora, 1994). Some of the wild relatives of the crop plants occurring in Jammu & Kashmir are shown in Table 2.

Table 2 : Some crop genetic resources of Jammu & Kashmir
(source : Arora, 1994).

Crops	Species
Cereals and millets	<i>Leersia oryzoides</i> , <i>Avena fatua</i> , <i>A. sterilis</i> subsp. <i>ludoviciana</i> , <i>Aegilops tauschii</i> , <i>Digitaria sanguinalis</i> , <i>D. ciliaris</i> , <i>Hordeum murinum</i> , <i>H. bogdanii</i> , <i>Elymus nutans</i> , <i>E. semicostatus</i> , <i>E. longearistatus</i> subsp. <i>canaliculatus</i> , <i>E. jacquemontii</i> , <i>E. cognatus</i> , <i>Pennisetum orientale</i> , <i>P. lanatum</i> , <i>P. flaccidum</i> , <i>Secale cereale</i> , etc.
Pulses	<i>Lathyrus aphaca</i> , <i>L. humilis</i> , <i>L. emodi</i> , <i>L. hirsutus</i> , <i>L. pratensis</i> , <i>L. sphaericus</i> , <i>Cajanus crassus</i> , <i>C. scarabaeoides</i> , <i>Vicia monantha</i> , <i>V. sativa</i> , <i>V. sepium</i> , <i>V. tenuifolia</i> , <i>V. bakeri</i> , <i>V. rigidula</i> , <i>Cicer microphyllum</i> , <i>Vigna radiata</i> var. <i>sublobata</i> , etc.
Fruits	<i>Malus baccata</i> , <i>Pyrus pashia</i> , <i>Prunus cerasifera</i> , <i>P. prostrata</i> , <i>P. tomentosa</i> , <i>P. cornuta</i> , <i>Fragaria nubicola</i> , <i>Duchesnea indica</i> , <i>Rubus antennifer</i> , <i>R.</i>

Crops	Species
	<i>ulmifolius</i> , <i>R. biflorus</i> , <i>R. ellipticus</i> , <i>R. niveus</i> var. <i>pauciflorus</i> , <i>R. pungens</i> , <i>R. pedunculatus</i> , <i>R. irritans</i> , <i>R. saxatilis</i> , <i>Elaeagnus parvifolia</i> , <i>Ficus</i> spp., <i>Morus</i> spp., <i>Ribes glaciale</i> , <i>R. nigrum</i> , <i>R. alpestre</i> , <i>R. himalense</i> , <i>Ziziphus</i> spp., etc.
Vegetables	<i>Cucumis hardwickii</i> , <i>C. callosus</i> , <i>Luffa echinata</i> , <i>L. graveolens</i> , <i>Abelmoschus manihot</i> , <i>Solanum incanum</i> , <i>Trichosanthes himalensis</i> , <i>Malva neglecta</i> , <i>Chenopodium</i> spp., <i>Amaranthus</i> spp., <i>Eremurus himalaicus</i> ; <i>Dipsacus inermis</i> , <i>Allium</i> spp., <i>Trigonella gracilis</i> , <i>T. pubescens</i> , <i>T. emodi</i> , <i>T. cachemiriana</i> , <i>T. corniculata</i> , <i>Mucuna</i> spp., etc.
Oil seeds	<i>Lepidium apetalum</i> , <i>L. latifolium</i> , <i>L. virginicum</i> , <i>L. capitatum</i> , <i>Brassica napus</i> , <i>B. nigra</i> , <i>Linum strictum</i> subsp. <i>corymbulosum</i> , <i>L. perenne</i> , etc.
Fibres	<i>Bauhinia vahlii</i> , <i>Cannabis sativa</i> , <i>Hibiscus cannabinus</i> , <i>Linum perenne</i> , <i>L. strictum</i> subsp. <i>corymbulosum</i> , etc.
Spices and condiments	<i>Allium carolinianum</i> , <i>A. humile</i> , <i>A. fedtschenkianum</i> , <i>Bunium persicum</i> , <i>Scaligeria stewartiana</i> , <i>Foeniculum vulgare</i> , etc.
Others	<i>Saccharum filifolium</i> , <i>Miscanthus nepalensis</i> , etc.

Asteraceae with 109 genera and 481 species (excluding the infraspecific taxa) is the largest flowering plant family in the state (Singh *et al.*, 1999; Singh & Mathur, 2001), whereas 50 families, including monotypics like Adoxaceae, Hippuridaceae, Sphenocleaceae, Butomaceae, are represented by just a single genus and species. Similarly, while Poaceae with 129 genera is the largest family by virtue of number of genera, 83 families

including monogenerics, like Aponogetonaceae, Biebersteiniaceae, Callitrichaceae, Casuarinaceae, Coriariaceae, Ceratophyllaceae, Cuscutaceae, Moringaceae, Najadaceae, Nelumbonaceae, Platanaceae, Leeaceae, Paeoniaceae, Typhaceae, Scheuchzeriaceae, Sparganiaceae, etc., are represented in the state by a single genus only. At a lower taxonomic level, *Taraxacum* with 72 species is the largest genus in Jammu and Kashmir, whereas ca 653 genera, including ca 27 monotypics, viz. *Apluda nutica*, *Boeninghausenia albiflora*, *Butomus umbellatus*, *Caesulia axillaris*, *Colebrookea oppositifolia*, *Craniotome versicolor*, *Cydonia vulgaris*, *Desmostachya bipinnata*, *Gontscharovia popovii*, *Hemiphragma heterophyllum*, *Hygroszja aristata*, *Lawsonia inermis*, *Lygeum spartum*, *Milula spicata*, *Naringi crenulata*, *Nicandra physalodes*, *Ochthochloa compressa*, *Parochetus communis*, *Pseuduechmanthera tomentosa*, *Pycnolanthus uniflorus*, *Roylea elegans*, *Stracheya tibetica*, *Thylacospermum caespitosum*, *Thysanolaena maxima*, *Zataria multiflora* (Uniyal & Mathur, 1994) have their representation in the state by a single species only.

Phytogeographical affinities

The territorial contiguity of Jammu & Kashmir with central and west Asia, having identical geoclimatic past, has resulted into its closer floristic affinity with that of several countries of the region. While the flora of Jammu & Kashmir shows greater affinity with that of central and west Asia and Mediterranean region. Indo-Malayan and Indo-Chinese elements are also present here in good proportion. Apart from that, the flora of the state is also characterised by the presence of a number of disjunct species representing floristic elements of New Zealand, Australia, Africa and America, a phenomenon indicative of different events in geological and climatological history that might have influenced the migration and even survival of floras.

According to Meher-Homji (1971) five principal floristic elements are discernible in north-western part of the Indian subcontinent, which together with its phytogeographic position accounts for diverse floristic composition of the region. These are Mediterranean; Mediterranean and Temperate; Tropical; Arid and General. While discussing the affinities of Alpine and subalpine flora of Kashmir, Dhar and Kachroo (1983)

concluded"... it appears that our flora (alpine-subalpine) leans heavily towards Afghanistan and Central Asia, South China and Europe. But considering the area in the West together, the affinities are surely to Afghanistan - Central Asia-South China-Axis. Amongst the other adjacent areas Siberia, Caucasus, Eastern Himalaya are more closer"

The floristic affinities with adjoining phytochoria, as exhibited by Kashmir flora in terms of percentage is: Pakistan (80.22 per cent), Afghanistan (44), Iran (21.42), Europe (33.68), USSR (44.15), Tibet (26.45), China (38.17), western Himalaya (62.22) and eastern Himalaya (36.69) (Vir Jee, Dhar & Kachroo, 1989). Kachroo (1992), however, provided the data for floristic affinities with respect to Kashmir flora as follows: Afghanistan (56.37), Central Asia (43.20), south-west China (38.69), Siberia (31), Caucasus (21.69), Iran (32.81), Europe (32.81), eastern Himalaya (22.12). Similarly, of the 895 species of flowering plants known to be occurring in Ladakh region, 449 are common with Kashmir, 153 with Siberia, 230 with Tadjikistan, 98 with Afghanistan, 78 with Baluchistan and 48 with Rajasthan (Kachroo, 1993). Some of the floristic elements of Jammu & Kashmir, which are common with other biogeographic regions within the country as well as other countries or the biogeographic regions of the world, are enumerated below.

Species common with eastern Himalaya :

Gypsophila cerastioides, *Oxygraphis endlicheri*, *Ranunculus diffusus*, *Thalictrum reniforme*, *Rubus niveus*, *Hypericum elodeoides*, *Rhododendron arboreum*, *Verbascum thapsus*, *Lonicera angustifolia*, *Eupatorium adenophorum*, *Sonchus asper*, *Poa annua*, *Artemisia biennis*, *Saussurea obvallata*, *Saussurea simpsoniana*, *Aster diplostephioides*, etc.

Species common with central India :

Ranunculus sceleratus, *Berberis lycium*, *Capparis sepriaria*, *Shorea robusta*, *Sida cordifolia*, *Helicteres isora*, *Crotalaria albida*, *Indigofera cassioides*, *Butea monosperma*, *Dalbergia sissoo*, *Cassia fistula*, *Rotala mexicana*, *Woodfordia fruticosa*, *Wendlandia heynei*, *Plumbago zeylanica*, etc.

Species common with peninsular India :

Barbarea intermedia, *Potentilla leschenaultiana*, *Cissampelos pariera* var. *hirsuta*, *Clematis gouriana*, *Ranunculus muricatus*, *Cocculus laurifolius*, *malvastrum coromandelianum*, *Bombax ceiba*, *Aegle marmelos*, *Murraya koenigii*, *Rhynchosia capitata*, *Crotalaria medicaginea*, *Desmodium triflorum*, *Withania somnifera*, *Bacopa monnieri*, *Alternanthera pungens*, etc.

Species common with Indo-Malayan region :

Callicarpa arborea, *Vitex negundo*, *Ficus hispida*, *Oroxylum indicum*, *Phyllanthus emblica*, *Ziziphus mauritiana*, *Cordia dichotoma*, *Dodonaea viscosa*, *Debregeasia longifolia*, *Alangium salvifolium*, *Terminalia bellirica*, *Youngia japonica*, *Cocculus laurifolius*, etc.

Species common with China :

Asplenium pekinense, *Dennstaedtia wilfordii*, *Lygodium japonicum*, *Fimbristylis podocarpa*, *Scirpus maritimus*, *Saccharum spontaneum*, *Ischaemum rugosum*, *Phragmites karka*, *Plantago major*, *Boerhavia repens*, *Mallotus philippensis*, *Solanum nigrum*, *Androsace aizoon*, *Plumbago zeylanica*, *Primula denticulata*, *Thalictrum alpinum*, *Anemone obtusiloba*, *Dianthus chinensis*, *Bauhinia variegata*, *Pimpinella diversifolia*, etc.

Species common with Europe :

Morus alba, *M. nigra*, *Ficus carica*, *Cannabis sativa*, *Urtica urens*, *Viscum album*, *Portulaca oleracea*, *Stellaria media*, *Nymphaea alba*, *Ceratophyllum demersum*, *Acorus calamus*, *Actaea spicata*, *Adoxa moschatellina*, *Cuscuta europea*, *Arctium lappa*, *Convolvulus arvensis*, *Cynodon dactylon*, *Scandix iberica*, *Lisaea heterocarpa*, *Bupleurum rotundifolium*, *Siderites romana*, etc.

Species common with Central Asia :

Physalis peruviana, *Phryma leptostachya*, *Plantago asiatica*, *Euphorbia antiquorum*, *Melia azedarach*, *Berchemia lineata*, *Hovenia*

dulcis, *Ammannia baccifera*, *Epilobium palustre*, *Punica granatum*, etc.

Species common with Australia :

Blainvillea acmella, *Picris hieracioides*, *Vittadinia australis*, *Erigeron karvinskianus*, *Arenaria serpyllifolia*, *Capparis sepiaria*, *Lepidium latifolium*, *Calotis hispidula*, etc.

Species common with Africa :

Sida acuta, *Dalbergia sissoo*, *Cassytha filiformis*, *Centella asiatica*, *Celosia argentea*, *Rotala mexicana*, *Rhynchosia minima*, *Ricinus communis*, *Pupalia lappacea*, *Phyllanthus urinaria*, *Indigofera cordifolia*, *Oxalis corniculata*, *Moringa oleifera*, *Polycarpaea corymbosa*, *Mucuna pruriens*, *Corchorus olitorius*, etc.

Species common with America :

Bromus catharticus, *Polypogon monspeliensis*, *Phleum alpinum*, *Phalaris minor*, *Echinochloa colona*, *Chenopodium botrys*, *Amaranthus viridis*, *Mirabilis jalapa*, *Ranunculus aquatilis*, *Argemone mexicana*, *Medicago lupulina*, *Lotus corniculatus*, *Melilotus officinalis*, etc.

Endemism

The occurrence of endemics, which is generally determined by biogeographic provinces, unique ecosystems, and topographical as well as climatological interfaces, is suggestive of the biogeography, locii of speciation, vicariance, extinction and adaptive evolution of the biota of a particular region. The geographical position, physiography and the geological history of Jammu & Kashmir have together contributed to considerably higher endemism in relatively younger mountain system (Kachroo, 1993). Conforming to the general pattern of endemism in India (Chatterjee, 1939; Ahmedullah & Nayar, 1987), the state of Jammu & Kashmir also shows higher endemism in dicotyledons as compared to monocotyledons (Dhar & Kachroo, 1983; Kachroo, 1993).

Some of the families, which show high endemism in Kashmir are: Saxifragaceae (53%), Fumariaceae (52%), Violaceae (50%), Rutaceae (50%), Valerianaceae (50%), Dipsacaceae (50%), Campanulaceae (50%), Gentianaceae (49%), Apiaceae (45%), Scrophulariaceae (44%), Balsaminaceae (43%), Asteraceae (39%), Primulaceae (39%), Fabaceae (39%), Berberidaceae (38%), Aceraceae (33%), Parnassiaceae (31%), etc. However, most of these endemics are either schizoendemics or Pan-Himalayan spreading across the entire length of the mountain ranges from Afghanistan to north Myanmar. Some of the genera, which show very high percentage of endemism in the state are *Alchemilla* (above 85%), *Taraxacum* (55%), etc. Nayar (1996) puts the figure of total endemics in the state at 224.

According to Nayar (1980; see also Ahmedullah, 2000) there are about 141 genera of Angiosperms endemic to India. Of these, while 15 genera are spread throughout the country, 67 are confined to Himalayas. The state of Jammu & Kashmir has about 13 endemic genera, out of which *Caesulia*, *Colebrookea* and *Ougeinia* are distributed across the country, *Arcyosperma*, *Kashmiria* and *Parrotoipsis* are confined to the western Himalaya, whereas the rest (*Aechmanthera*, *Craniotome*, *Jaeschkea*, *Milula*, *Picrorhiza*, *Pycnophilanthus* and *Roylea*) are spread across the Himalaya from east to west. Some of the endemic taxa, either exclusively confined to the state or found elsewhere as well within the political boundary of the country are listed in Table 3.

Table 3 : Some endemic Angiosperms of Jammu & Kashmir

Name of the taxa	Distribution	Remarks
APIACEAE		
<i>Eriocycla stewartii</i>	J&K	
ARISTOLOCHIACEAE		
<i>Aristolochia punjabensis</i>	J&K	
ASTERACEAE		
<i>Anaphalis kashmiriana</i>	J&K	
<i>Bidens tetraspinosa</i>	J&K	

Name of the taxa	Distribution	Remarks
<i>Chondrilla setulosa</i>	J&K	
<i>Crepis naniforma</i>	J&K, H.P.	Rare
<i>Lactuca benthamii</i>	J&K	Known through type only
<i>Lactuca kashmiriana</i>	J&K	
<i>Olgaea thomsonii</i>	J&K	
<i>Saussurea clarkei</i>	J&K	
<i>Tragopogon kashmirianus</i>	J&K	
<i>Ligularia jacquemontiana</i>	J&K, H.P.	
<i>Scorzonera alba</i>	J&K	
ATHYRIACEAE		
<i>Deparia acuta</i>	J&K, H.P.	
BALSAMINACEAE		
<i>Impatiens meeboldii</i>	J&K	
<i>Impatiens pahalgamensis</i>	J&K	
BERBERIDACEAE		
<i>Berberis glaucocarpa</i>	J&K, H.P., Uttaranchal	
<i>Berberis huegeliana</i>	J&K	Rare; known through type only
<i>Berberis kashmiriana</i>	J&K	
<i>Berberis parkeriana</i>	J&K, H.P.	
<i>Berberis pseudumbellata</i>	J&K	
subsp. <i>gilgitica</i>		
<i>Berberis stewartiana</i>	J&K	
BORAGINACEAE		
<i>Actinocarya acaulis</i>	J&K, Sikkim	
<i>Actinocarya tibetica</i>	J&K	
<i>Anoplocaryum brandisii</i>	J&K, N.W. India	
<i>Cynoglossum flexuosum</i>	J&K	

Name of the taxa	Distribution	Remarks
<i>Eritrichium spathulatum</i>	J&K	
var. <i>spathulatum</i>		
<i>Eritrichium spathulatum</i>	J&K	
var. <i>thomsonii</i>		
<i>Hackelia meeboldii</i>	J&K	
<i>Hackelia stewartii</i>	J&K	
<i>Heliotropium dasycarpum</i>	J&K	
var. <i>gymnostomum</i>		
<i>Lasiocaryum munroi</i>	J&K, Sikkim	
<i>Pseudomertensia drummondii</i>	J&K	
BRASSICACEAE		
<i>Arabis tenuirostris</i>	J&K	
<i>Draba nubrietoides</i>	J&K	
<i>Draba ludlowiana</i>	J&K	
<i>Erophila tenerrima</i>	J&K	
<i>Lignariella duthiei</i>	J&K	
CALLITRICHACEAE		
<i>Callitriche fehmedianii</i>	J&K	
CAMPANULACEAE		
<i>Campanula tenuissima</i>	J&K	
CARYOPHYLLACEAE		
<i>Minuartia ebracteolata</i>	J&K, H.P	
FUMARIACEAE		
<i>Corydalis stewartii</i>	J&K	
GENTIANACEAE		
<i>Gentiana harwanensis</i>	J&K	
<i>Gentiana marginata</i>	J&K	
var. <i>hugetii</i>		
LAMIACEAE		
<i>Chelonopsis albiflora</i>	J&K	
var. <i>cashmeriana</i>		

Name of the taxa	Distribution	Remarks
LEGUMINOSAE		
<i>Alysicarpus heyneanus</i>	J&K, M.P.,	
var. <i>meeboldii</i>	U.P.	
<i>Astragalus bakeri</i>	J&K	
<i>Astragalus cashmirensis</i>	J&K	
var. <i>cashmirensis</i>		
<i>Astragalus cashmirensis</i>	J&K	
var. <i>falconeri</i>		
<i>Astragalus gilgitensis</i>	J&K	
<i>Astragalus hoffmeisteri</i>	J&K	
var. <i>pilosa</i>		
<i>Astragalus kashmirensis</i>	J&K, H.P., Uttaranchal	
<i>Astragalus maxwellii</i>	J&K, H.P.	
<i>Hedysarum astragaloides</i>	J&K, H.P.	
<i>Hedysarum cachemirianum</i>	J&K	
<i>Hedysarum falconeri</i>	J&K	
var. <i>cachemirianum</i>		
<i>Hedysarum microcalyx</i>	J&K, H.P. Uttaranchal	
<i>Hedysarum pseudomicrocalyx</i>	J&K, H.P., Uttaranchal	
<i>Indigofera himalayensis</i>	J&K, H.P. Punjab	
<i>Oxytropis shivai</i>	J&K	
<i>Trigonella podperae</i>	J&K	
LILIACEAE		
<i>Allium gilgiticum</i>	J&K	Rare; known through type only
<i>Eremurus himalaicus</i>	J&K, H.P.	
ORCHIDACEAE		
<i>Neottia kashmiriana</i>	J&K	
POACEAE		
<i>Bromus barobalianus</i>	J&K	

Name of the taxa	Distribution	Remarks
<i>Calamagrostis decora</i>	J&K	
<i>Digitaria stewartiana</i>	J&K	
<i>Festuca levingei</i>	J&K	Rare; known through type only
<i>Festuca simlensis</i>	J&K, H.P.	
<i>Poa jaunsarensis</i>	J&K, H.P.	
<i>Poa koelzii</i>	J&K, H.P., U.P.	
<i>Poa ladakhensis</i>	J&K	
<i>Poa markgrafii</i>	J&K	
<i>Poa suruana</i>	J&K	
<i>Puccinellia thomsonii</i>	J&K	Rare
<i>Puccinellia himalaica</i>	J&K, H.P.	
<i>Rostraria clarkeana</i>	J&K	Rare; known through type only
<i>Schizachyrium impressum</i>	J&K	Rare; known through type only
POLYPODIACEAE		
<i>Lepisorus intermedius</i>	J&K, Uttaranchal	
<i>Lepisorus stewartii</i>	J&K	
PRIMULACEAE		
<i>Androsace duthieana</i>	J&K	
<i>Androsace studiosorum</i>	J&K	
<i>Primula clarkei</i>	J&K	
<i>Primula duthiei</i>	J&K	
<i>Primula inayatii</i>	J&K	
<i>Primula obtusifolia</i>	H.P., J&K E.H.	
<i>Primula reidii</i>	J&K, Uttaranchal	
PTERIDACEAE		
<i>Pteris pseudo-quadriaurita</i>	J&K, H.P. Uttaranchal	

Name of the taxa	Distribution	Remarks
RANUNCULACEAE		
<i>Aconitum moschatum</i>	J&K	
<i>Consolida schlagintweitii</i>	J&K	
<i>Ranunculus stewartii</i>	J&K	
<i>Ranunculus palmatifidus</i>	J&K, Uttaranchal	
<i>Ranunculus glacialiformis</i>	J&K	
<i>Isopyrum ludlowii</i>	J&K	
RHAMNACEAE		
<i>Rhamnella gilgitica</i>	J&K	
<i>Sageretia kashmirensis</i>	J&K	
<i>Sageretia kishwarensis</i>	J&K	
ROSACEAE		
<i>Alchemilla aksharmae</i>	J&K	
<i>Alchemilla brummittii</i>	J&K	
<i>Alchemilla cecillii</i>	J&K	
<i>Alchemilla chthamalea</i>	J&K, U.P.	
<i>Alchemilla duthieana</i>	J&K	Rare; known through type only
<i>Alchemilla gilgitensis</i>	J&K	
<i>Alchemilla kishengangensis</i>	J&K	
<i>Alchemilla kungwatenensis</i>	J&K	
<i>Alchemilla mantonii</i>	J&K	
<i>Alchemilla nicolsonii</i>	J&K	
<i>Alchemilla niltarensis</i>	J&K	
<i>Alchemilla plocekii</i>	J&K	
<i>Alchemilla rothmaleri</i>	J&K	
<i>Alchemilla samantraii</i>	J&K	
<i>Alchemilla sarojinii</i>	J&K	
<i>Alchemilla sojakii</i>	J&K	
<i>Alchemilla waltersii</i>	J&K	
<i>Alchemilla ypsilotoma</i>	J&K	
<i>Cotoneaster gilgitensis</i>	J&K, H.P., Uttaranchal	

Name of the taxa	Distribution	Remarks
<i>Cotoneaster lambertii</i>	J&K	
<i>Spiraea rhamniphylla</i>	J&K, H.P., Uttaranchal	
<i>Spiraea affinis</i>	J&K	
<i>Prunus bokhariensis</i>	J&K	
<i>Potentilla sericophylla</i>	J&K	
RUBIACEAE		
<i>Galium harwanensis</i>	J&K	
<i>Galium mahadivensis</i>	J&K	
SAXIFRAGACEAE		
<i>Saxifraga asarifolia</i>	J&K	
<i>Saxifraga duthiei</i>	J&K, W. Himal.	
<i>Saxifraga flagellaris</i> subsp. <i>mucronulata</i>	J&K	
<i>Saxifraga lilacina</i>	J&K	
SCROPHULARIACEAE		
<i>Euphrasia alba</i>	J&K	
<i>Euphrasia densiflora</i>	J&K, Uttaranchal	
<i>Euphrasia flabellata</i>	J&K, H.P.	
<i>Euphrasia foliosa</i>	J&K	
<i>Euphrasia himalayica</i>	J&K, H.P., Uttaranchal, Sikkim, Arunachal Pradesh	
<i>Euphrasia incisa</i>	J&K	
<i>Euphrasia jaeschkei</i>	J&K, H.P.	
<i>Euphrasia kashmiriana</i>	J&K	
<i>Euphrasia laxa</i>	J&K, H.P.	
<i>Euphrasia pauciflora</i>	J&K, H.P.	
<i>Euphrasia platyphylla</i>	J&K, H.P.	
<i>Euphrasia remota</i>	J&K, H.P.	
<i>Euphrasia secundiflora</i>	J&K	Rare; known through type only
<i>Legotis kunawarensis</i>	J&K, H.P., Uttaranchal	

Name of the taxa	Distribution	Remarks
<i>Pedicularis bicornuta</i>	J&K, H.P., Uttaranchal	
<i>Pedicularis brevirostris</i>	J&K	
<i>Pedicularis canescens</i>	J&K	
<i>Pedicularis punctata</i>	J&K	
<i>Scrophularia dentata</i>	J&K, H.P.	
<i>Scrophularia nudata</i>	J&K	
<i>Veronica cachemirica</i>	J&K	
<i>Veronica koeltzii</i>	J&K	
<i>Veronica nana</i>	J&K	Rare; known through type only
<i>Veronica uncinata</i>	J&K	Rare; known through type only
SELAGINELLACEAE		
<i>Selaginella pallidissima</i>	J&K, H.P., Uttaranchal, Arunachal Pradesh	
VIOLACEAE		
<i>Viola fedtschenkoana</i>	J&K	
subsp. <i>muzaffarabadensis</i>		
<i>Viola jordani</i> var. <i>falconeri</i>	J&K	
<i>Viola rupestris</i>	J&K	
var. <i>himalayensis</i>		

Economic plants

The Himalayas are an acknowledged treasure-house of enormous physical and biological resources, and the Kashmir Himalaya is no exception. The long historical and geographical isolation of the state coupled with the diverse social and cultural traditions and practices of its people have also helped in the evolution of rich ethnobotanical heritage in Jammu and Kashmir over a period of time. The early Kashmiris used plants like *Desmostachya bipinnata*, *Hordeum*, *Crocus*

sativus, *Sesamum*, *Betula*, *Amaranthus tricolor*, *Acorus calamus*, *Morus*, etc., in various, social and religious rites; *Skimmia anquittia*, *Morina* spp., *Jurinea macrocephala*, *Peganum harmala*, etc., as incense; *Typha angustata*, *Parrotiopsis jacquemontiana*, *Euonymus*, *Cotoneaster*, *Aesculus indica*, *Abies pindrow*, *Prunus cornuta*, *Carissa spinarum*, *Buxus wallichiana*, etc., for making crafts including kitchenwares and musical instruments. Besides, a large number of plants were used for variety of purposes such as toiletries (*Juglans regia*, *Corydalis falconeri*, *Cyperus rotundus*, *Origanum vulgare*, etc.), medicines (*Urtica* spp., *Linum usitatissimum*, *Ulmus wallichiana*, *Dolichos biflorus*, *Mallotus philippensis*, *Artemisia* spp., *Limnanthemum nymphaeoides*, *Polygonum* spp., *Euphorbia thomsoniana*, *Podophyllum hexandrum*, etc.), food (*Paspalum scrobiculatum*, *Codonopsis ovata*, *Marsilea quadrifolia*, *Nymphaea alba*, etc.), building materials (*Cedrus deodara*, *Pinus wallichiana*, etc.), culinary preparations (*Onosma hispidum*, *Crocus sativus*, *Origanum vulgare*, *Cymbopogon citratus*), etc.

Apart from that, a number of plants brought and introduced by various invaders and immigrants, that have now become permanent denizens of the state, also add to its economic plant diversity. Saffron or the *Crocus sativus*, an Iranian element most likely introduced by the Mughuls, is one of the many such examples. As such, a considerably large proportion of huge plant diversity met in the state are economically important, yielding both timber as well as a vast array of other products such as medicine, food, fodder, oil, gum, tannins, etc., collectively known as non timber forest products (NTFP) or minor forest products (MFP). Table 4 shows some of the important economic plants of the state, majority of which are in active use even today.

In addition, the state abounds in large number of wild ornamental plants of considerable horticultural significance, such as *Fritillaria imperialis*, *Asparagus filicinus*, *Rosa webbiana*, *R. moschata*, *Lavatera kashmiriana*, *Geranium pratense*, *Bergenia ligulata*, *Lychnis coronaria*, *Sorbaria tomentosa*, *Ferula jaeschkeana*, *Aquilegia fragrans*, *Delphinium* spp., *Corydalis* spp., *Rhododendron campanulatum*, *Platanus orientalis*, *Iris* spp., *Pedicularis* spp., *Primula* spp., *Saussurea* spp., *Gentiana algida*, *Aster flaccidus*, *A. thomsonii*, *Caltha palustris*, *Erigeron multiradiatus*, *Inula* spp., etc.

Table 4 : Some economic plants of Jammu & Kashmir and their uses

Name of the species	Agricultural implements	Dye	Fibre	Fodder	Fuel	Gum	Medicinal	Timber	Wild edible	Other uses	Remarks
	1	2	3	4	5	6	7	8	9	10	11
<i>Abies pindrow</i>					+	+	-	+		+	Packing cases
<i>Abrus precatorius</i>								+		+	
<i>Abutilon indicum</i>					-			+			
<i>Abutilon theophrasti</i>								+			
<i>Acacia nilotica</i>								+			
<i>Acacia modesta</i>								+			
<i>Acantholimon tycopodioides</i>					+			+			
<i>Acer pentapomicum</i>								+			
<i>Achillea millefolium</i>								+			Oil used in soap industry
<i>Achyranthes aspera</i>								+			
<i>Achyranthes bidentata</i>								+			
<i>Acronium heterophyllum</i>								+			

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Aconitum deinorrhizum</i>							+				
<i>Aconitum chasmanthum</i>							+				
<i>Aconitum violaceum</i> var. <i>robustum</i>							+				
<i>Aconitum kashmiricum</i>							+				
<i>Acorus calamus</i>							+		+		Insecticide in perfumery
<i>Actaea spicata</i>							+				
<i>Adiantum zeylanica</i>							+				
<i>Adiantum capillus-veneris</i>							+				
<i>Adiantum venustum</i>							+				
<i>Adonis chrysocyathus</i>							+				
<i>Aegle marmelos</i>							+			+	
<i>Aerva lanata</i>							+				
<i>Aesculus indica</i>							+				
<i>Agave americana</i>							+				
<i>Agrimonia eupatoria</i>							+				
<i>Agrostis gigantea</i>					+						
<i>Agrostis stolonifera</i>					+						
<i>Ainsliaea latifolia</i>							+				
<i>Ajuga bracteosa</i>							+				

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Ajuga parviflora</i>							+				
<i>Albizia lebbekii</i>				+							
<i>Alisma plantago</i>				+			+				
<i>Allium carolinianum</i>									+		
<i>Allium rubellum</i>							+		-		Spices
<i>Allium sativum</i>							+				
<i>Allium consanguineum</i>							+		+	+	Flavouring agent
<i>Allium wallichii</i>							+				Condiment
<i>Allium atropurpureum</i>							+		+		
<i>Allium stoliczkae</i>							+		+		
<i>Allium tuberosum</i>							+				
<i>Alnus nitida</i>							+				Tannin
<i>Alternanthera sessilis</i>									+		
<i>Althea rosea</i>							+				
<i>Amaranthus gangeticus</i>							+				
<i>Amaranthus hybridus</i>							+		+		
<i>Amaranthus spinosus</i>				+			+		+		
<i>Amaranthus tricolor</i>				+			+	-	+		
<i>Amaranthus viridis</i>							+				

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Anagallis arvensis</i>							+				
<i>Anaphalis cinnamomea</i>							+				
<i>Anaphalis cuneifolia</i>							+				
<i>Andrographis echinides</i>							+				
<i>Androsace rotundifolia</i>							+				
<i>Androsace serpentionalis</i>							+				
<i>Anemone obtusiloba</i>							+				
<i>Anemone rupicola</i>							+				
<i>Anemone tetrasepala</i>							+				
<i>Anemone vitifolia</i>							+				
<i>Angelica archangelica</i>										+	Condiments, in perfumes
<i>Angelica glauca</i>							+	-			Spices
<i>Anthriscus nemorosa</i>							+				
<i>Apium graveolens</i>											Condiments
<i>Aponogeton natans</i>				+							
<i>Aquilegia vulgaris</i>							+				
<i>Arabisopsis wullichii</i>							+			+	Condiments, in perfumes
<i>Archangelica himalaica</i>										+	Petals used in confectionary

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Arctium lappa</i>							+		+		
<i>Arenaria foliosa</i>				+							
<i>Argemone mexicana</i>							+				
<i>Arisaema jacquemontii</i>							+				Insecticide
<i>Arnebia tibetana</i>							+				
<i>Arnebia guttata</i>							+				
<i>Artemisia parviflora</i>							+				
<i>Artemisia absinthium</i>							+				
<i>Artemisia brevifolia</i>							+			+	
<i>Artemisia capillaris</i>							+				
<i>Artemisia dracunculoides</i>							+				
<i>Artemisia maritima</i>							+				
<i>Artemisia roxburghiana</i>							+				
<i>Artemisia scoparia</i>							+				
<i>Artemisia sieversiana</i>				+			+				
<i>Artemisia vestita</i>					+		+				
<i>Arun jacquemontiana</i>							+				
<i>Arundo donax</i>				+							
<i>Asparagus officinalis</i>							+				
<i>Asplenium adianthum-nigrum</i>							+				

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Aster diplostephoides</i>							+				
<i>Aster falconeri</i>							+				
<i>Astragalus psilocentros</i>							+				
<i>Astragalus nivalis</i>							+				
<i>Astragalus polyacanthus</i>							+				
<i>Astragalus rhizanthus</i>				+							
<i>Astragalus tibetanus</i>							+				
<i>Astragalus zanskarensis</i>				+			+				
<i>Atropa acuminata</i>							+				
<i>Avena sativa</i>				+					+		
<i>Azadirachta indica</i>							+				
<i>Bacopa monnieri</i>							+				
<i>Baliospermum montanum</i>							+				
<i>Barbarea vulgaris</i>							+				
<i>Barleria prionitis</i>							+				
<i>Bauhinia variegata</i>							+				
<i>Bauhinia racemosa</i>											Fish poison. Insecticide
<i>Berberis aristata</i>							+			+	
<i>Berberis asiatica</i>							+				

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Berberis lycium</i>							+			+	
<i>Berberis pachyacantha</i>							+				
<i>Berberis pachyacantha</i> ssp. <i>zabeliana</i>				l	+		+		+		
<i>Berberis pseudumbellata</i>							+				
<i>Berberis ulicina</i>					-		+				
<i>Berberis umbellata</i>							+				
<i>Bergenia ciliata</i>							+				
<i>Bergenia ligulata</i>							+				
<i>Bergenia stracheyi</i>				l			+				
<i>Riebersteinia odora</i>							+				Insect repellent
<i>Doeringhausenia albiflora</i>							+				Insect repellent
<i>Boerhavia diffusa</i>							+				
<i>Bothriochloa ischaemum</i>				l							
<i>Brunella vulgaris</i>							l				
<i>Bunium persicum</i>									+		Spices
<i>Bupleurum falcatum</i>							.				
<i>Bupleurum lanceolatum</i>							+				
<i>Butea monosperma</i>							+				
<i>Betula utilis</i>										+	Other uses
<i>Brachyactis pubescens</i>							+				

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Brassica campestris</i>							+			+	Oil
<i>Brassica oleracea</i> var. <i>acephala</i>							+				
<i>Brassica rapa</i>							+			+	Oil
<i>Caesalpinia decapetala</i>							+				
<i>Caesulia axillaris</i>							+				
<i>Calamagrostis pseudophragmites</i>				+							
<i>Calamintha umbrosa</i>							+				
<i>Calotropis procera</i>							+				
<i>Callitha palustris</i>							+				
<i>Cannabis sativa</i>							+				
<i>Capparis spinosa</i>				+			+		+		
<i>Capsella bursa-pastoris</i>							+		+		
<i>Caragana moorcroftiana</i>							+				
<i>Cardiospermum halicacabum</i>							+				
<i>Carduus edelbergii</i>							+				
<i>Carduus nutans</i>							+				
<i>Carex moorcroftii</i>				+							
<i>Carex nivalis</i>							+				
<i>Carissa spinarum</i>					-		+		+		
<i>Carthamus tinctorius</i>		+					+				Oil

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Carum carvi</i>							+		+	+	Condiments
<i>Cassia fistula</i>							+				
<i>Cassytha filiformis</i>							+				
<i>Cedrela serrata</i>							+				
<i>Cedrus deodara</i>					+		+	+			
<i>Celastrus paniculatus</i>							+				
<i>Celtis australis</i>	+			+			+		+		Oil
<i>Centaurea depressa</i>							+				
<i>Centaurea iberica</i>							+				
<i>Centella asiatica</i>							+				
<i>Chaerophyllum reflexum</i> var. <i>acuminatum</i>							+				
<i>Chaerophyllum reflexum</i>							+		+		
<i>Chenopodium album</i>							+		+		
<i>Chenopodium blitum</i>									+		
<i>Chenopodium botrys</i>							+				
<i>Chenopodium murale</i>							+		+	+	
<i>Chesneya cuneata</i>							+				
<i>Christolea crassifolia</i>									+		
<i>Chrysanthemum pyrethoides</i>							+				
<i>Cicer microphyllum</i>				+					+		

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Cicer soongaricum</i>				+					+		
<i>Cichorium inybus</i>							+		+		
<i>Cimicifuga foetida</i>							+				
<i>Cirsium wallichii</i>							+				
<i>Cissampelos pareira</i>							+				
<i>Clematis connata</i>							+				
<i>Clematis orientalis</i>							+				
<i>Clematis gouriana</i>							+				
<i>Clematis tibetana</i>				+			+				
<i>Colchicum luteum</i>							+				
<i>Colebrookea appositifolia</i>							+				
<i>Conium maculatum</i>							+				
<i>Convolvulus arvensis</i>				+			+				
<i>Coriaria nepalensis</i>									+		
<i>Corydalis flabellata</i>							+				
<i>Corydalis govaniiana</i>							+				
<i>Corylus colurna</i>							+				
<i>Costus speciosus</i>							+				
<i>Cotinus coggygria</i>									+		

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Cotoneaster bacillaris</i>					+					+	
<i>Cotoneaster nummularius</i>										+	Branches used to make baskets
<i>Cotula anthemoides</i>							+			+	Edible
<i>Crambe cordifolia</i>									+		
<i>Crataegus oxycantha</i>							+				
<i>Crataegus soongarica</i>							+				
<i>Cremanthodium decaisnei</i>									+		
<i>Cremanthodium ellisii</i>							+				
<i>Crisium arvense</i>				+							
<i>Cristolia crassifolia</i>									+		
<i>Crotalaria cytisoides</i>				+							
<i>Crotalaria juncea</i>			+								
<i>Crotalaria medicaginea</i>							+				
<i>Cucurbita pepo</i>							+			+	Edible
<i>Cucumis melo</i>							+			+	Edible
<i>Cuscuta reflexa</i>							+				
<i>Cydonia oblonga</i>									+		
<i>Cymbopogon jwarancusa</i>							+				
<i>Cynodon dactylon</i>				+							

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Cynoglossum wallichii</i>							+				
<i>Cyperus rotundus</i>							+				
<i>Dactyloctenium aegyptium</i>							+				
<i>Dalbergia latifolia</i>							+				
<i>Daphne genkwa</i>							+				
<i>Datisca cannabina</i>							+				
<i>Datura Stramonium</i>							+				
<i>Daucus carota</i>							+		+		
<i>Deeringia amarantoides</i>							+				
<i>Delphinium brunonianum</i>							+				
<i>Delphinium denudatum</i>							+				
<i>Delphinium viscosum</i>							+				
<i>Delphinium cashmerianum</i>							+				Magico religious
<i>Descurainia sophia</i>							+		+		
<i>Desmodium illiaefolium</i>							+				
<i>Desmodium trifolium</i>				+			+				
<i>Desmostachya bipinnata</i>							+				Sacred
<i>Dianthus anatolicus</i>							+				
<i>Dicliptera roxburghiana</i>							+				
<i>Dioscorea bulbifera</i>							+				
<i>Dioscorea deltoidea</i>							+			+	Decoration

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Dipsacus inermis</i> var. <i>mitis</i>							+		+		
<i>Dictamnus albus</i>							+				
<i>Digitalis lanata</i>							+				
<i>Digitalis purpurea</i>							+				
<i>Dipsacus inermis</i>							+		+		
<i>Dodonaea viscosa</i>							+				
<i>Draba setosa</i>											Incense
<i>Fchinaps cortigerus</i>							+				
<i>Eclipta alba</i>							+				
<i>Elaeagnus parvifolia</i>									+		
<i>Elaeagnus umbellata</i>							+				
<i>Elsholtzia densa</i>							+		+		
<i>Elsholtzia ciliostachya</i>							+				
<i>Elymus daturicus</i>				+							
<i>Emblica officinalis</i>							+				
<i>Ephedra gerardiana</i>							+				
<i>Ephedra regeliana</i>							+				
<i>Epipactis gigantea</i>							+				
<i>Epipactis royleana</i>							+				
<i>Epimedium elatum</i>										+	To expel and kill mosquitoes

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Equisetum debile</i>							+				
<i>Eremurus himalaicus</i>									+		
<i>Erigeron canadensis</i>							+				
<i>Erodium sisymbroides</i>							+				
<i>Erodium tibetanum</i>				+							
<i>Erysimum sisymbroides</i>							+				
<i>Euonymus hamiltonianus</i>				+							
<i>Euphorbia helioscopia</i>							+				
<i>Euphorbia hispida</i>							+				
<i>Euphorbia nerifolia</i>							+				
<i>Euphorbia royleana</i>							+				
<i>Euphorbia wallichii</i>							+				
<i>Euryale ferox</i>									+		
<i>Evolvulus alsinoides</i>							+				
<i>Fagopyrum esculentum</i>							+		+		
<i>Ferula jaeschkeana</i>				+		+	+			+	Od
<i>Festuca kashmiriana</i>				+							
<i>Ficus auriculata</i>				+			+			+	
<i>Ficus carica</i>							+				
<i>Ficus religiosa</i>							+				

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Foeniculum vulgare</i>							+			+	
<i>Fragaria vesca</i>							+		+		
<i>Fragaria nubicola</i>							+		+		Edible
<i>Fritillaria imperialis</i>							+				
<i>Fritillaria roylei</i>							+				
<i>Fumaria indica</i>							+				
<i>Fumaria parviflora</i>							+				
<i>Galium parviflorum</i>				+							
<i>Galium rotundifolium</i>							+				
<i>Galium verum</i>							+				
<i>Gentiana algida</i>							+				
<i>Gentiana argentea</i>							+				
<i>Gentiana curinata</i>							+				
<i>Gentiana kurroo</i>							+				
<i>Gentiana stipitata</i>							+				
<i>Gentiana tianshanica</i>							+				
<i>Gentianella tenella</i>							+				
<i>Geranium pratense</i>							+				
<i>Geranium nepalense</i>							+			+	Oil
<i>Geranium walliichianum</i>							+				

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Gerbera nepalensis</i>							+				
<i>Geum elatum</i>							+				
<i>Glaux maritima</i>				+							
<i>Glycyrrhiza glabra</i>							+				
<i>Gnaphalium luteo-album</i>							+				
<i>Goldfussia dathousiana</i>							+	-			
<i>Grewia optiva</i>				+							
<i>Gymnosporia montana</i>											Religious belief
<i>Hedera nepalensis</i>							+				
<i>Helicteres isora</i>							+				
<i>Heliotropium ellipticum</i>							+				
<i>Heracleum cundlicans</i>						1	+				
<i>Heracleum pinnatum</i>							-				
<i>Heracleum thomsonii</i>				-				-			
<i>Hippophae rhamnoides</i>					+		+		+	+	
<i>Holarrhena antidysenterica</i>							+				
<i>Hordeum vulgare</i>							+				
<i>Humulus lupulus</i>			+				+				
<i>Hyoscyamus niger</i>							+				
<i>Hypericum perforatum</i>							+				
<i>Ilex dipyrrena</i>							+				

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Impatiens glanduligera</i>				+							
<i>Impatiens roylei</i>							+		+		
<i>Imperata cylindrica</i>											Religious belief
<i>Indigofera gerardiana</i>										+	Misc (branches used to make baskets)
<i>Indigofera hebeperala</i>				+							
<i>Indigofera heterantha</i>							+				
<i>Inula cuspidata</i>							+				
<i>Inula obtusifolia</i>							+				
<i>Inula racemosa</i>							+				
<i>Inula rhizocephala</i>							+				
<i>Inula royleana</i>							+				
<i>Iris ensata</i>				+			+				
<i>Iris hookeriana</i>										+	Mats and foot-wear from leaves
<i>Iris kashmiriana</i>							+				
<i>Iris nepalensis</i>							+				
<i>Jaeschkea oligosperma</i>							+				

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Jasminum officinale</i>							+				
<i>Jasminum humile</i>										+	Ink
<i>Jasminum pubescens</i>							+				
<i>Jasminum multiflorum</i>							+				
<i>Jatropha curcas</i>							+				
<i>Juglans regia</i>							+	+	+	+	
<i>Juncus articulatus</i>							+				
<i>Juniperus communis</i>							+				
<i>Juniperus macropoda</i>							+				
<i>Juniperus recurva</i>										+	
<i>Juniperus wallichiana</i>							+				
<i>Jurinea ceratocarpa</i>							+				
<i>Jurinea macrocephala</i>							+				Tocense
<i>Jurinea himalaica</i>							+	-			
<i>Kydia calycina</i>							+				
<i>Lactuca tibetica</i>									+		
<i>Lactuca sativa</i>									+		
<i>Lamium album</i>							+				
<i>Lancea tibetica</i>							+				
<i>Lavatera kashmiriana</i>							+				

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Lawsonia inermis</i>											Religious belief
<i>Lactuca orientalis</i>							+		+		
<i>Lactuca tartarica</i>							+				
<i>Leonurus cardiaca</i>							+				
<i>Lepidium capitatum</i>							+				
<i>Lepidium latifolium</i>							+		+		
<i>Lens esculenta</i>							+				
<i>Leontopodium leontopodium</i>							+				
<i>Lespedeza sericea</i>											Oil
<i>Leucas cephalotes</i>							+				
<i>Limnium macrorrhizos</i>									+		
<i>Linum usitatissimum</i>							+				
<i>Lolium perenne</i>				+							
<i>Lonicera spinosa</i>					+		+				
<i>Lotus corniculata</i>				+							
<i>Lychnis apetala</i>							+				
<i>Lychnis coronaria</i>							+				
<i>Macrotomia benthamii</i>							+				
<i>Mallotus philippensis</i>			+	+			+				
<i>Malva sylvestris</i>							+		+		

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Mulva rotundifolia</i>				+			+				
<i>Mulva neglecta</i>							+		+		
<i>Mulva verticillata</i>										+	Seeds added to scharbat
<i>Marrubium vulgare</i>							+				
<i>Martynia annua</i>							+				
<i>Mathiola revoluta</i>							+				
<i>Mathiola flavida</i>							+				
<i>Meconopsis aculeata</i>									+		
<i>Medicago falcata</i>				+							
<i>Medicago polymorpha</i>				+							
<i>Medicago sativa</i>				+			+				
<i>Megacarpaea polyandra</i>								-	+		
<i>Melia azedarach</i>							+				
<i>Melilotus alba</i>									+		
<i>Melilotus officinalis</i>				+			+				
<i>Melothria heterophylla</i>							+				
<i>Mentha arvensis</i>							+				
<i>Mentha longifolia</i>							+		+		
<i>Mentha piperita</i>							+				

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Morina longifolia</i>							+		+		Religious belief
<i>Morus alba</i>					+				+	+	
<i>Morus nigra</i>							+		+	+	
<i>Mucuna prurita</i>							+				
<i>Murraya koenigii</i>							+				
<i>Musa paradisiaca</i>							+				
<i>Myosotis sylvatica</i>							+				
<i>Myricaria elegans</i>				+	+		+				
<i>Myricaria germanica</i>							+				
<i>Myrsine africana</i>							+				
<i>Nardostachys jatamansi</i>							+				
<i>Narcissus tazetta</i>							+				
<i>Nasturtium officinale</i>									+		
<i>Nelumbo nucifera</i>									+	+	
<i>Nepeta brachypetala</i>							+		+		
<i>Nepeta cataria</i>							+				
<i>Nepeta floccosa</i>							+		-		
<i>Nepeta leucophylla</i>							+				
<i>Nepeta longibracteata</i>							+				
<i>Nerium indicum</i>							+				
<i>Nyctanthes arbor-tristis</i>							+				

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Nymphaea alba</i>				+			+		+		
<i>Nymphoides peltatum</i>				+					+		
<i>Ocimum sanctum</i>							+				
<i>Olea cuspidata</i>							+				
<i>Onosma hispidum</i>							+			+	
<i>Ophioglossum vulgare</i>									+		
<i>Origanum vulgare</i>							+			+	Oil in soap industry
<i>Orobanche cernua</i>									+		
<i>Orthosiphon rubicundus</i>									+		
<i>Oxalis acetosella</i>							+			+	
<i>Oxalis corniculata</i>							+			+	
<i>Oxyria digyna</i>							+				
<i>Oxytropis lapponica</i>							+				
<i>Oxytropis mollis</i>							+				
<i>Oxytropis tartarica</i>							+				
<i>Paeonia emodi</i>							+				
<i>Panicum antidotale</i>				+			+		+		
<i>Panicum miliaceum</i>									+		
<i>Papaver nudicaule</i>							+		+		

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Parrotiopsis jacquemontiana</i>				+	+			+		+	
<i>Pedicularis albida</i>							+				
<i>Pedicularis bicornum</i>							+			+	
<i>Pedicularis oederi</i>							-				
<i>Pedicularis pectinata</i>							+				
<i>Peganum harmala</i>		+					+			+	
<i>Pennisetum flaccidum</i>				+							
<i>Pentanema indicum</i>							+				
<i>Perovskia abrotanoides</i>		+								-	
<i>Phlomis bracteosa</i>				+			+				
<i>Phragmites communis</i>							+		+		
<i>Phyllanthus niruri</i>							+				
<i>Physochlaina praealta</i>							+				
<i>Phytolacca acinosa</i>							+		+		Roots used to adulterate Belladonna
<i>Picrorhiza kurroa</i>							+			+	
<i>Pinus wallichiana</i>					+			-			Making charcoal from wood and manure from leaves Resin yields turpentine

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Piptatherum gracilis</i>										+	Baskets and nets
<i>Pisum sativum</i>				+					+		
<i>Plantago asiatica</i>							+				
<i>Plantago gentianoides</i>							+				
<i>Plantago himaliaca</i>							+				
<i>Plantago lanceolata</i>							+				
<i>Plantago major</i>				+			+				
<i>Platanus orientalis</i>					+					+	Light charcoal from leaves
<i>Plectranthus rugosus</i>					+		+			+	
<i>Pleurospermum hookeri</i>							+				
<i>Plumbago zeylanica</i>							+				
<i>Poa annua</i>				+							
<i>Podophyllum hexandrum</i>							+		+		
<i>Polygonatum multiflorum</i>							+				
<i>Polygonatum verticillatum</i>							+				
<i>Polygonum affine</i>							+				
<i>Polygonum alpinum</i>							+		+		
<i>Polygonum amplexicaule</i>							+		+		Substitute for tea

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Polygonum aviculare</i>							+				
<i>Polygonum convolvulus</i>										+	Misc. (Used in making bread)
<i>Polygonum hydropiper</i>							+				
<i>Polygonum nepulense</i>							+				
<i>Polygonum paronychioides</i>									-		
<i>Polygonum plebejum</i>							+				
<i>Polygonum rumicifolium</i>									+		
<i>Polygonum sibiricum</i>									+		
<i>Polygonum viviparum</i>							+				
<i>Pongamia pinnata</i>							+				
<i>Populus caspica</i>					-					+	
<i>Polygonum ciliata</i>					+						
<i>Polygonum nigra</i>				-	+		+	+			Match boxes and fruitcases
<i>Portulaca oleracea</i>							+		+		
<i>Potamogeton crispus</i>									+		
<i>Potamogeton indicus</i>									+		
<i>Potamogeton natans</i>				+							
<i>Potentilla anserina</i>				+			+				

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Potentilla argentea</i>							+				
<i>Potentilla argyrophylla</i>											Oil
<i>Potentilla sericea</i>							+				
<i>Potentilla supina</i>							+				
<i>Prangos pabularia</i>				+			+				
<i>Primula denticulata</i>							+				
<i>Primula obtusifolia</i>							+				
<i>Primula septentrionalis</i>							+				
<i>Prinsepia utilis</i>							+				Oil
<i>Prunella vulgare</i>							+				
<i>Prunella vulgares</i>							+				
<i>Prunus armeniaca</i>							+		+		
<i>Psychrogeton andryaloides</i>					+						
<i>Pteris cretica</i>							+		+		
<i>Punica granatum</i>							+			+	
<i>Pyrus foliolosa</i>									+		
<i>Pyrus pashia</i>									+		
<i>Quercus ilex</i>									+		
<i>Ranunculus arvensis</i>							+				
<i>Ranunculus hirsellus</i>							+				

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Ranunculus laetis</i>							+				
<i>Ranunculus muricatus</i>							+				
<i>Ranunculus pulchellus</i>							+				
<i>Ranunculus trichophyllus</i>							+				
<i>Rhamnus prostrata</i>							+				
<i>Rheum emodi</i>							+		+		
<i>Rheum tibeticum</i>							+				
<i>Rheum webbianum</i>							+				
<i>Rhodiola imbricata</i>				+			+				
<i>Rhodiola quadrifida</i>							+				
<i>Rhododendron campanulatum</i>							+				
<i>Rhus succedanea</i>							+				
<i>Ribes rubrum</i>									+		
<i>Ricinus communis</i>							+				Seed cakes used as manure
<i>Robinia pseudoacacia</i>					1		1		1		
<i>Rorippa aquaticum</i>									1		
<i>Rorippa nasturtium-aquaticum</i>							1				
<i>Rosa damascena</i>							1			+	
<i>Rosa macrophylla</i>							1		+		

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Rosa webbiana</i>					+		+		+		
<i>Rosularia alpestris</i>							+				
<i>Rubia cordifolia</i>							+		-		
<i>Rubia fruticosus</i>									+		
<i>Rubia niveus</i>									+		
<i>Rubus saxatilis</i>									-		
<i>Rubus ulmifolius</i>									+		
<i>Rumex dentatus</i>								+			
<i>Rumex hastatus</i>							+		+		
<i>Rumex nepalensis</i>							-		+		
<i>Rumex orientalis</i>							+		-		
<i>Rumex paulsenianus</i>							+				
<i>Rumex vesicarius</i>								+			
<i>Saccharum spontaneum</i>				+			+				
<i>Salix alba</i>				+	+					+	Sports items
<i>Salix babylonica</i>				+	+		+			+	Sports items
<i>Salix elagans</i>										-	
<i>Salix myrtilloidea</i>				+	+		+			+	
<i>Salweenia malabarica</i>				+							

Name of the species	1	2	3	4	5	6	7	8	9	10	11	
<i>Salsola collina</i>							+					
<i>Salvia hians</i>							+					
<i>Salvia moorecroftiana</i>							+					
<i>Sambucus wightiana</i>							+					
<i>Sarcococca pruniformis</i>										-		Making baskets
<i>Saussurea albescens</i>									+			
<i>Saussurea atkinsonii</i>							+					
<i>Saussurea costus</i>							+			+		Insect repellent
<i>Saussurea obvallata</i>												Sacred
<i>Saussurea sacra</i>							+					
<i>Saussurea taraxicifolia</i>							+					
<i>Saussurea thomsoni</i>							+					
<i>Scirpus articulatus</i>							+					
<i>Sedum ewersii</i>							+		-			
<i>Sedum quadrifidum</i>							+					
<i>Sedum rhodiola</i>									+			
<i>Sedum tibeticum</i>							+		+			
<i>Saxifraga ciliata</i>							+					
<i>Saxifraga flagellaris</i>							+					

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Saxifraga jacquemontiana</i>							+				
<i>Scandix veneris-pectin</i>							+				
<i>Scrophularia decomposita</i>							+				
<i>Scrophularia koetzi</i>							+				
<i>Scrophularia heydei</i>							+				
<i>Scutellaria heydei</i>							+				
<i>Selinum tenuifolium</i>							+				
<i>Sempervivella acuminata</i>							-				
<i>Sempervivella vaginatum</i>							+				
<i>Senecio chrysanthemoides</i>							+				
<i>Senecio kraschenninkovii</i>							-				
<i>Senecio jacquemontianus</i>							+				
<i>Sesbania sesban</i>							+				
<i>Seseli libanotis</i>							+				
<i>Silene moorcroftiana</i>							+				
<i>Sisymbrium orientale</i>							+				
<i>Skimmia laureola</i>										+	Essential oil
<i>Solanum erianthum</i>							+				
<i>Solanum nigrum</i>							+				
<i>Solanum surattense</i>							+				

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Solanum tuberosum</i>				-			+				
<i>Sonchus asper</i>							+				
<i>Sonchus oleraceus</i>							+				
<i>Sophora moorcroftiana</i>							+				
<i>Sorghum helipense</i>				+			+				Poisonous to cattle
<i>Stachys floccosa</i>							+				
<i>Stachys sericea</i>							+				
<i>Stellaria media</i>				+							
<i>Stipa sibirica</i>							+				Poisonous to cattle
<i>Swertia petiolata</i>							+				
<i>Swertia chirayita</i>							+				
<i>Tagetes minuta</i>							+				
<i>Tamarix indica</i>					+		+				
<i>Tanacetum fruticosum</i>										+	
<i>Taraxacum officinale</i>							+				
<i>Terminalia arjuna</i>							+				
<i>Terminalia bellirica</i>							+				
<i>Terminalia chebula</i>							+				

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Thalictrum foliolosum</i>							+				
<i>Thalictrum minus</i>							+				
<i>Thalictrum platycarpum</i>				+							
<i>Thalictrum vaginatum</i>							+				
<i>Thlaspi kotschyantum</i>							+				
<i>Thymus serpyllum</i>							+				
<i>Tinospora cordifolia</i>							+				
<i>Torularia humilis</i>							+				
<i>Tragopogon dubius</i>							+				
<i>Tragopogon pratense</i>							+				
<i>Trapa natans</i>				+					+		
<i>Tribulus terrestris</i>							+				
<i>Trichodesma indicum</i>							+				
<i>Trichosanthes palmata</i>							+				
<i>Tridax procumbens</i>							+				Dog bite
<i>Trifolium pratense</i>							+				
<i>Trifolium sp.</i>				+							
<i>Triglochin maritimum</i>				+					+		
<i>Triglochin palustre</i>							+				
<i>Trigonella foenum-graecum</i>							+		+		

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Tulipa stellata</i>							+				
<i>Tylophora indica</i>							+				
<i>Typha angustata</i>									+	+	Mat making
<i>Ulmus laevigata</i>				+							
<i>Ulmus pumilla</i>							+				
<i>Ulmus wallichiana</i>							+				
<i>Urena lobata</i>							+				
<i>Urginea indica</i>							+				
<i>Urtica dioica</i>							+		+	-	
<i>Urtica hyperborea</i>							+		+		
<i>Utricularia minor</i>										+	Fish baits
<i>Valeriana hardwickii</i>							+				
<i>Valeriana jatamansi</i>							+				
<i>Valeriana officinalis</i>							+				
<i>Verbascum thapsus</i>							+				
<i>Vernonia anthelmintica</i>							+				
<i>Viburnum foetens</i>				+			+		+		
<i>Viburnum nervosum</i>							+				
<i>Viburnum stellulatum</i>							+		+		

Name of the species	1	2	3	4	5	6	7	8	9	10	11
<i>Viola odorata</i>							+				
<i>Viscum album</i>							+				
<i>Vitis vinifera</i>							+				
<i>Vitex negundo</i>							+				
<i>Waldheimia nivea</i>							+				
<i>Waldheimia stoliczkae</i>							+				
<i>Waldheimia tomentosa</i>							+				
<i>Withania somnifera</i>							+				
<i>Woodfordia fruticosa</i>				+			+				
<i>Xanthium strumarium</i>							+				
<i>Youngia tenuifolia</i>							+				
<i>Zanthoxylum armatum</i>							+				
<i>Lea mays</i>							+		9		
<i>Ziziphus jujuba</i>				+	+		+			+	Sharbat
<i>Ziziphus mauritiana</i>				+			+		+		
<i>Ziziphus vulgaris</i>									+		

On the other hand certain plants, like *Rhus succedanea*, *Urtica dioica*, *Euphorbia helioscopia*, *E. prolifera*, *E. pilosa*, etc., are harmful and cause miseries to human beings. Besides, a number of parasites such as *Hedera nepalensis*, *Cuscuta reflexa*, *Arceuthobium minutissimum*, etc., cause severe damage to the vegetation.

Threatened species and conservation

The rich floristic diversity met in Jammu & Kashmir notwithstanding, a number of species in the state are getting depleted and their populations considerably depauperised either because of over exploitation or loss of habitat. The economically important species, including the ornamental ones, in particular are facing the brunt of widespread biotic activities in the state. Certain plants, like *Aconitum* spp., *Podophyllum hexandrum*, *Colchicum luteum*, *Atropa acuminata*, *Saussurea costus*, etc. have now come under different kinds of threat due to over exploitation. Dhar and Kachroo (1983a) reported about 40 endemic species of Kashmir Himalaya, such as *Aconitum kashmiricum*, *Aquilegia nivalis*, *Trollius acaulis*, *Meconopsis aculeata*, *Corydalis cashmeriana*, *Megacarpaea bifida*, *Saxifraga javanemontiana*, *Cremanthodium arnicoides*, *Saussurea sacra*, *Primula minutissima*, *Gentiana cachtmerica*, etc., as endangered, majority of which are highly exploited for their medicinal or ornamental virtues. Similarly Hajra (1983) listed a number of endemic and threatened taxa from the state, viz. *Berberis kashmiriana*, *Draba dasyastra*, *Erophila tenerrima*, *Viola himalayensis*, *Dianthus minimus*, *Impatiens meeboldii*, *I. pahalgamensis*, *Rhunnella gilgitica*, *Amphicarpaea anomalus*, *Astragalus anomalus*, *A. bakeri*, *Alysicarpus meeboldii*, *Indigofera cedrorum*, *Thermopsis inflata*, *Vicia benthamiana*, *Alchemilla cashmiriana*, *Cotoneaster cashmirensis*, *Potentilla kashmirica*, *Saussurea bracteata*, *S. clarkei*, *Androsace alzoom*, *A. moorcroftiana*, *Primula clarkei*, *Gastrodia orobanchoides*, *Neottia kashmiriana*, *Allium loratum*, *Calamagrostis stoliczkai*, *Lophochloa clarkeana*, etc. The recent surveys by the scientists of Botanical Survey of India have further identified the species like *Kengia mutica*, *Milula spicata* and *Taverniera numularia* as rare in Jammu & Kashmir. Once commonly occurring plants, like *Dioscorea deltoidea* and *Ulmus wallichiana* are now vulnerable. Some of the plants, like *Berberis huegeliana*, *Festuca levingei*, *Euphrasia secundiflora*, *Rostraria*

clarkeana, *Schizachyrium impressum*, *Veronica uncinata*, *Lactuca benthamii*, *L. undulata*, etc. are known through their types only. Even species like *Pedicularis brevirostris*, *P. stewartii*, etc. have not been collected for over six decades now since their last collection from wild.

Proper identification and documentation of species belonging to different categories of threat, is therefore, imperative for evolving any effective conservation strategy. A determined effort is required to complete the explorations in the state and inventorise the flora including the threatened taxa. The surveys should be especially intensified for locating the species which could not be collected since long, both in their known places of occurrence as well as in other locations with more or less similar eco-climatic conditions. The rediscovery of *Allium auriculatum*, *Carex borii*, *C. pamirensis*, *Delphinium uncinatum*, *Cotoneaster lambertii*, etc. after a long interval, either from their known localities or other areas clearly underlines the necessity of such exploratory surveys. The Botanical Survey of India, through critical evaluation of various taxa, reported to be threatened, has already compiled Red Data Sheets on 24 taxa (Jain & Sastry, 1984; Nayar & Sastry, 1987, 1988, 1990), from Jammu & Kashmir (Table 5). The effort needs to be further intensified.

Table 5 : Taxa included in Red Data Book of Indian plants

Name of the taxa	Status	Distribution	Remarks
ALLIACEAE			
<i>Allium stracheyi</i>	V	Kashmir, H.P., Garhwal, Kumaon and Nepal	Endemic to Himalaya
ASTERACEAE			
<i>Chondrilla setulosa</i>	R	J&K	Endemic
<i>Inula racemosa</i>	V	J& K	Endemic
<i>Lactuca undulata</i>	E	Kashmir	Endemic
<i>Saussurea bracteata</i>	R	J& K, H.P., Garhwal, Kumaon, Pakistan, C. Asia	

Name of the taxa	Status	Distribution	Remarks
<i>Saussurea clarkei</i>	R	Kashmir	Endemic
<i>Saussurea costus</i>	E	J&K, H.P., Pakistan	
BERBERIDACEAE			
<i>Berberis huegeliana</i>	I	Kashmir	Endemic
<i>Berberis kashmiriana</i>	R	J&K (Mantar valley)	Endemic
CARYOPHYLLACEAE			
<i>Silene kunawarensis</i>	R	Kashmir, H.P., Pakistan	
DIOSCOREACEE			
<i>Dioscorea deltoidea</i>	V	Himalaya, Pakistan, Afghanistan, Indo- China, W. China	
FABACEAE			
<i>Hedysarum astragaloides</i>	R	Kishtwar, Chenab valley, J&K, Lahul, H.P., Pakistan (?)	
<i>Hedysarum cachemirianum</i>	R	Kashmir, Pakistan (?)	
<i>Hedysarum microcalyx</i>	V	Chenab valley, J&K, Lahul, Simla, Kulu, H.P., Garhwal, Pakistan(?)	
LILIACEAE			
<i>Eremurus himalaicus</i>	R	J&K, H.P.	Endemic
<i>Lloydia himalayensis</i>	R	J&K, H.P., Sikkim, Bhutan, Nepal	
ORCHIDACEAE			
<i>Cypripedium cordigerum</i>	R	J&K, H.P., Garhwal, Nepal, Bhutan, Pakistan	

Name of the taxa	Status	Distribution	Remarks
<i>Neottia inayutii</i>	R	Kashmir, Pakistan	
PAPAVERACEAE			
<i>Meconopsis latifolia</i>	V	Kashmir	
POACEAE			
<i>Puccinellea kashmiriana</i>	R	Kamiri Valley, J&K, Lahul, H.P.	
RANUNCULACEAE			
<i>Aconitum deinorhizum</i>	V	J&K, H.P., Nepal, Bhutan	Endemic to Himalays
<i>Delphinium uncinatum</i>	V	Kashmir, H.P. Pakistan, Afghanis- lan	Presently known only from Kishtwar in Jammu region and Chamba in H.P.
RUBIACEAE			
<i>Rubia himalayensis</i>	V	Kashmir, Pakistan, Afghanistan	
SCROPHULARIACEAE			
<i>Picrorhiza kurrooa</i>	V	J&K, Sikkim, H.P., Uttaranchal	

E = Endangered; I = Indeterminate; R = Rare; V = Vulnerable

It may be recalled that conservation of plants was well in the minds of people of the state. Maharaja of Kashmir is said to have not only passed an ordinance to check the export of kuth (*Saussurea costus*) to save it from extinction but also facilitated its large scale introduction in adjoining Himachal Pradesh as a measure of safety against war and aggression (Sarin, *pers. comm.*).

A large number of species, including those belonging to different Red Data category, are already getting *in situ* protection in the four

National Parks and 15 Wildlife Sanctuaries in Jammu & Kashmir (Table 6) covering a total area of about 14,870.22 sq. km (Singh & Singh, 2002) or about 6% of the total geographical area of the state. This should be further complemented by creating *ex situ* conservation facilities in three different physiographic regions of the state and augmenting the existing ones. Special attention may be given to the protection of unique ecosystems of cold desert of Ladakh and the floral diversity it contain. As the region is known for having a large number of endemic and other species characteristic of this area alone in Indian flora, setting up of a Biosphere reserve may be considered for effective long term conservation and perpetuation of its biological resources.

Table 6 : Protected areas in Jammu & Kashmir

Name of NP/WS	Biogeographic province	Area (sq. km)
City Forest NP	02A	9.07
Dachigam NP	02A	141.00
Hemis NP	01A	4100.00
Kistwar NP	02A	400.00
Baltal-Thajwas WS	02A	210.50
Changthang WS	01A	4000.00
Gulmarg WS	02A	180.00
Hirapora WS	02A	114.50
Hokersar WS	02A	13.75
Jasrota WS	04A	10.04
Karakoram WS	01A	5000.00
Lachipora WS	02A	93.50
Limber WS	02A	43.75
Nandini WS	04A	13.50
Overa WS	02A	32.00
Overa-Aru WS	02A	425.00

Name of NP/WS	Biogeographic province	Area (sq. km)
Ramnagar Rakha WS	04A	12.75
Surinsar Mansar WS	04A	39.13
Trikuta WS	04A	31.73
Total Area		14870.22

NP = National Park; WS = Wildlife Sanctuary

Apart from that, the National Committee on Wetlands, Mangrooves and Coral Reefs, under the National Wetlands Programme of the Ministry of Environment and Forests, has already identified the Wular lake of the state for formulation and implementation of the management action plans for intensive conservation and management. The lake, covering an area of about 18,900 ha, represents one of the six Ramsar Sites under Ramsar Convention. As the proper assessment, documentation and the conservation of biota of wetlands in the state is a major gap, other major lakes in different regions of Jammu & Kashmir, like Mansar, Dal, Anchar, Hokarsar, Pangong, Tso Morari, etc., could also be brought under the purview of the above programme.

Expansion of Protected Area Network (PAN) in the state and augmentation of monitoring mechanism and management; banning of commercial trade of economic plants of wild origin and domestication of highly exploited NTFP or MFP component of plant diversity to ward off stress on their natural populations in the state; and appropriate incentive for local biodiversity conservation efforts, like joint management practices and benefit sharing are some of the strategies for ensuring sustainable utilisation of plant resources of Jammu & Kashmir and its conservation for posterity.

Materials and presentation of flora

The present flora is based on the collections made by the Scientists

of the Botanical Survey of India, Northern Circle, Dehradun from different parts of the state during 1956-95 and deposited in the herbarium of the circle (BSD), as well as those made by others and located in different herbaria, viz. the Forest Research Institute, Dehradun (DD), Regional Research Laboratory, Jammu (RRL), Punjab University, Chandigarh (PAN), Punjabi University, Patiala (PUN) and others. Besides, the species mentioned in literature have also been taken into account.

It is proposed to bring out the flora of Jammu & Kashmir in 5 volumes. The volume 1 includes Introductory chapters; like introduction, physiography, drainage, climate, geology and soil, people, forests, forest types, the history of botanical explorations, earlier botanical studies, floristic diversity, phytogeographical affinities of the flora, endemism, economic plants, threatened species and their conservation; references; systematic account of 195 species of Pteridophytes in 57 genera and 31 families; 20 species of Gymnosperms in 7 genera and 4 families and 664 species of Angiosperms in 225 genera and 51 families from Ranunculaceae to Moringaceae. While the families of Pteridophytes are arranged as per the system of classification of Pichi Sermolli (1977), those of Gymnosperms and Angiosperms are arranged after the Bentham and Hooker's system of classification (Bentham & Hooker, 1862-1883) with little modifications as proposed by Hutchinson (1959) regarding splitting of the families.. Within each family the genera, and within each genus species are arranged alphabetically. Detailed indented keys are provided to the families within different taxonomic groups and for genera and species within each family and genus respectively, wherever applicable, for easy delimitation of various taxa.

The currently accepted name of the species is followed by up to date nomenclature, including basionyms and synonyms included in *Flora of British India* and other relevant regional floras. Local names wherever available are provided immediately after the nomenclatural citations. This is followed by brief taxonomic account, flowering and fruiting time and distribution within the state. Selected specimens, on which the descriptions have been based, along with herbarium reference, has also been given. Wherever the specimens could not be located the source for their inclusion has been mentioned. A general index to both, the botanical and the local names, has also been provided at the end.

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P T E R I D O P H Y T E S

(Surendra Singh & H.C. Pande)

KEY TO THE FAMILIES

- 1a. Leaves represented by narrow and simple microphylls :
 - 2a. Sporangia borne on the axils or on the adaxial surface of sporophylls; stems not jointed :
 - 3a. Homosporous; leaves without ligules; sporangia in strobili or dispersed on the stem ... **Lycopodiaceae**
 - 3b. Heterosporous; leaves with ligules; sporangia in strobili ... **Selaginellaceae**
 - 2b. Sporangia borne on the undersurface of stalked, peltate sporophylls; stem jointed and have distinct nodes and internodes ... **Equisetaceae**
- 1b. Leaves represented by megaphylls or distinct lamina :
 - 4a. Aquatic or marshy plants :
 - 5a. Plants free floating :
 - 6a. Sporangia in a pairs; floating lamina small, light or light brown to reddish ... **Azollaceae**
 - 6b. Sporocarps in branches; floating leaves light green ... **Salviniaceae**
 - 5b. Plants rooted in mud :
 - 7a. Fronds dimorphic; sori marginal ... **Parkeriaceae**
 - 7b. Fronds not dimorphic; leaves distinctly 4-lobed; sori produced in sporocarp ... **Marsileaceae**
 - 4b. Terrestrial or epiphytic plants :
 - 8a. Sporangia borne in spikes or in paniculate clusters, arising from the spike or lamina :
 - 9a. Sterile segments simple; veins anastomosing; sporangia half embeded in two lateral rows ... **Ophioglossaceae**
 - 9b. Sterile segment decomound :
 - 10a. Rhizomes without persistent leaf bases; fronds herbaceous in texture; Stipes fleshy ... **Botrychiaceae**

- 10b. Rhizomes with persistent leaf bases; fronds
thick subcoriaceous in texture; Stipes
thick not fleshy ... **Osmundaceae**
- 8b. Sporangia borne on lamina :
- 11a. Fertile ultimate segments like a
"pod" ... **Cryptogrammaceae**
- 11b. Fertile segments never like a
"pod" :
- 12a. Rhizomes producing long stolons ... **Nephrolepidaceae**
- 12b. Rhizomes without stolons :
- 13a. Undersurface of lamina usually
farinose ... **Sinopteridaceae**
- 13a. Undersurface not farinose :
- 14a. Fronds wiry, much twining
or climbing ... **Lygodiaceae**
- 14b. Fronds not wiry, not climbing :
- 15a. Sori marginal or apical in
position :
- 16a. Sori continuous :
- 17a. Indusia single,
formed by reflexed
indusial margin
... **Pteridaceae**
- 17b. Indusia double,
outer false, the
inner true ... **Pteridiaceae**
- 16b. Sori discontinuous :
- 18a. Sori cup-shaped
... **Dennstaedtiaceae**
- 18b. Sori not cup-shaped :
- 19a. Pinnules dimidiate;
Stipes dark and
polished ... **Adiantaceae**
- 19b. Pinnules not
dimidiate; Stipes
light brown,
hairy ... **Hypolepidaceae**

- 15b. Sori not marginal :
- 20a. Sori non indusiate :
- 21a. Sori round, oval rarely linear; sporangial
paraphyses present ... **Polypodiaceae**
- 21b. Sori linear-elongate; sporangial paraphyses
absent :
- 22a. Lamina simple, leathery in texture;
sori never along veins ... **Loxogramnaceae**
- 22b. Lamina pinnate, never leathery;
sori along veins ... **Hemionitidaceae**
- 20b. Sori indusiate :
- 23a. Sori usually sunk, parallel to midrib ... **Blechnaceae**
- 23b. Sori not sunk :
- 24a. Indusia hairy ... **Hypodematiaceae**
- 24b. Indusia never hairy :
- 25a. Unicellular hairs or setae
present on rachis and costae;
lamina usually narrowed at
both ends ... **Thelypteridaceae**
- 25b. Unicellular hairs or setae absent :
- 26a. Indusia half cup-shaped;
ultimate segments always
unequal at base ... **Davalliaceae**
- 26b. Indusia linear, round to
reniform :
- 27a. Indusia round to reniform :
- 28a. Indusia round with
articulated hairs ... **Woodsiaceae**
- 28b. Indusia reniform,
without articulate hairs :
- 29a. Indusia round;
veins forming
narrow areolae
along costae
... **Tectariaceae**
- 29b. Indusia reniform;
veins free
... **Dryopteridaceae**

27b. Indusia linear :

30a. Scales clathrate; indusium linear ... **Aspleniaceae**

30b. Scales never clathrate; indusium curved ... **Athyriaceae**

LYCOPODIACEAE

HUPERZIA Bernh.

Huperzia selago (L.) Bernh. ex Schrank *et* Mart., Hort. 3. 1829; Dixit, Lycop. India 42. 1988. *Lycopodium selago* L., Sp. Pl. 2: 1102. 1753; Baker, Handb. Fern Allies 9. 1887; Stewart in Bull. Torrey Bot. Club 72: 426. 1945; Mehra & Bir in Res. Bull. (N.S.) Punjab Univ. 15: 101. 1969.

Terrestrials or lithophytes, up to 5-8 cm. Rhizophore short, erect. Stems erect, dichotomously forked, branchlets erect, often short, 0.5-1 cm in diam. including the leaves. Leaves crowded, ca 0.6 cm long, lanceolate, green, glossy, entire or denticulate; axillary buds conspicuous. Sporophylls similar to vegetative leaves, bearing reniform sporangia in the axils of unaltered leaves, all down the stems. Spores 30-40 μ m, dull brown, pitted.

Fertile : August September.

Rare, on shady, moist and moss covered rocks of subalpine to alpine meadows, 4000-4500 m.

Selected specimens : Kashmir-Sonamarg, R.R. Stewart 7336 (DD); also reported by Stewart (1945) from Gulmarg and Nanga Parwat.

SELAGINELLACEAE

SELAGINELLA P. Beauv.

1a. Stems red to pink :

2a. Leaves isomorphic, distichous, smooth on the margins ...1. *S. aitchisonii*

2b. Leaves slightly dimorphic, not distichous; margins dentate ...3. *S. kashmiriana*

- 1b. Stems not red or pink :
- 3a. Sporophylls of spikes uniform :
- 4a. Arista of median leaves more than half
as long as the lamina ...4. *S. nepalensis*
- 4b. Arista of median leaves less than half
as long as lamina ...6. *S. vaginata*
- 3b. Sporophylls of spikes not uniform, dimorphic :
- 5a. Smaller sporophylls in the same plane as
median leaves. Lateral leaves ovate ...5. *S. pallidissima*
- 5b. Smaller sporophylls in the same plane as
lateral leaves. Lateral leaves ovate-oblong;
stem rooting at base only ...2. *S. chrysocaulos*

1. *Selaginella aitchisonii* Hieron. in Engl. & Prantl., Nat. Pfl. 1(4): 674. 1902; Stewart in Bull. Torrey Bot. Club, 72: 426. 1945; Dixit, Selagin. India 35: 1992. *Selaginella sanguinolenta* (L.) Spring f. *aitchisonii* (Hieron.) Alston. Proc. Nat. Inst. Sci. India 11: 215. 1945.

Stems 10-25 cm, erect, densely matted, often forked at the base, very slender, dark pink in the basal part, branched from the base; branches dichotomously compound. Rhizophores confined to the base. Leaves isomorphic, green, distichous, ovate-lanceolate, uniauriculate, peltate at base, thick in texture, margins hyaline and denticulate. Strobili quadrangular, 7-10 mm, single at the apex of branchlets. Sporophylls uniform, ovate, truncate at base. Megaspores yellow, irregularly verrucose.

Strobili : July - October.

Frequent, grows on rocky and shady hill slopes of subalpine to alpine regions between 2200-3400 m.

Reported by Stewart (1945) from Kashmir: Baltal, Pahalgum and Sonamarg.

2. *Selaginella chrysocaulos* (Hook. et Grev.) Spring, Bull. Acad. Brux. 10: 232. 1843; Baker, Fern Allies 117. 1887; Alston in Proc. Nat. Inst. Sci. India 11: 225. 1945; Mehra & Bir. in Res. Bull. (N.S.) Panjab

Univ. 15(1 & 2): 100. 1964; Panigr. & Dixit, Proc. Nat. Acad. Sci. 46(1): 103. t. 1. f. 2. 1966; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 1972; Dixit, Selagin. India 95. 1992.

Terrestrials. Stems 10-25 cm, densely tufted, slender, stoloniferous at base, erect above, pale-brown, copiously branched from the base; branches short, copiously compound. Rhizophores brownish, confined to the basal one fourth. Leaves heteromorphic, bright-green, distant on the stem; lateral leaves ovate, spreading at right angles, oblique, subcordate, acute, dentate to denticulate; inner half ovate, acute, outer half-leaf semi-ovate; axillary leaves similar to the lateral leaves; median leaves ovate, oblique, acuminate. Strobili short, 3-5 x 1-2 mm, single at apex of the branchlets. Sporophylls dimorphic, dentate, larger sporophylls oblong, oblique; smaller ovate, acuminate. Megaspores dark-brown, verrucoid.

Strobili : July - September.

Common, in open shady places, 1000-2000 m.

Selected specimens : Udhampur, Katra, *Uniyal* 77352 (BSD).

3. *Selaginella kashmiriana* Dixit, Cens. Indian Pterid. 14. 1984. *S. borealis* f. *indica* Milde, Fl. Europe 267. 1867. *S. sanguinolenta* f. *indica* (Milde) Alston, Proc. Nat. Inst. Sci. India 11 : 215. 1945; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 1. 1972. **Fig. 1**

Stems 10-20 cm, slender, terete, erect, bright-pinkish-red, except apical one-third, stramineous-green, branched from the base; branches lax, pinnately compound, ascending. Rhizophores wiry, confined to base, rarely seen above. Leaves slightly heteromorphic, distant on the main stem, pale green, short median nerve present in the middle; lateral leaves obovate, ascending, oblique at base, mucronate at apex, inner half-margin obovate, ciliolate-dentate, outer-half semi-obovate; axillary leaves more or less similar to lateral leaves; median leaves slightly smaller, obovate. Strobili 5-7 x 1-2 mm, single at the apex of branchlets. Sporophylls uniform, adpressed, ovate, acute dentate. Megaspores red-brown, granular.

Strobili : July - October.

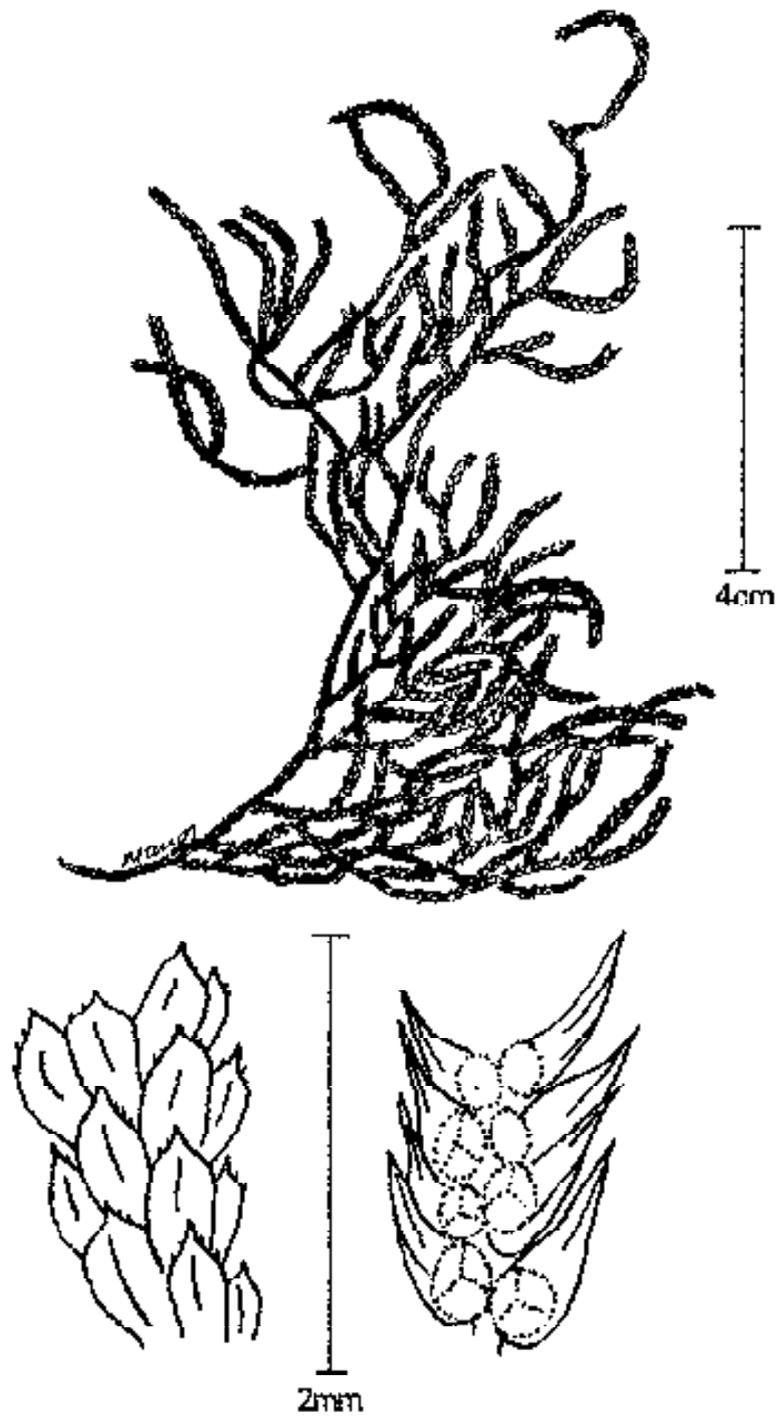


Fig. 1. *Selaginella kashmiriana* Dixit

Abundant and gregarious on cliffs and rocks, 1000-2000 m.

Selected specimens : Kashmir : *Falconer* 1231 (CAL); Sind valley, *Falconer* 11466 (DD).

4. *Selaginella nepalensis* Spring in Bull. Acad. Brux 10: 234. 1843; Panigr. in Bull Bot. Surv. India 17: 170. 1975; Dixit, Selagin. India 58. 1992.

Stems 20-40 cm. decumbent, flaccid, tetragonous, bisulcate, stramineous, pinnately branched from the base; branches erect, patent, elongated-pyramidus. Rooting or rhizophores throughout on the prostrate stems. Leaves heteromorphic, rigid; lateral leaves ovate, sub-erect; inner half-leaf ovate, dilated at base, dentate-serrulate; outer half-leaf semi-ovate entire; axillary leaves similar to the lateral leaves; median leaves ovate, cordate. Strobili quadrangular, 5-10 x 1-2 mm, single at the apex of branchlets. Sporophylls uniform, ovate, acuminate. Megaspores verrucoid.

Strobili : July - October.

Scattered, in shady moist situations, 1000-2000 m.

Selected specimens : Poonch, *H.S. Kiran s.n.* (Jammu Univ. Herb.).

5. *Selaginella pallidissima* Spring in Bull. Acad. Brux. 10: 231. 1843; Baker, Handb. Fern Allies 106. 1887; Alston, Proc. Nat. Inst. Sci. India 11: 216. 1945. *S. integerrima sensu* Strachey in Gaz. North-West Prov. 66. 1882, *non* Spring. 1850.

Stems glabrous, 20-28 cm, decumbent, pale-brown, branched; branches pinnate. Rhizophores long, thick, confined to the basal one third. Leaves heteromorphic, pale to dark-green in colour, pellucid, membranous, distant on the main stem and branches; lateral leaves ovate, oblique, cordate, acute; inner half-leaf ovate, imbricate; outer half-leaf semi-ovate; axillary leaves similar to lateral leaves, median leaves ovate, cordate, acute to acuminate. Strobili single to rarely paired at the apex of the branchlets, 6-10 x 1-2 mm. Sporophylls heteromorphic; larger sporophylls ovate, oblique

and smaller erecto-patent, ovate, cordate. Megaspores deep yellow, warty.

Strobili : August-October.

Frequent, growing along the road cutting in shady moist situations, 1000-2200 m.

Selected specimens : Jammu : Basoli & Kathua, *Dhir s.n.*, (PAN).

6. *Selaginella vaginata* Spring, Mem. Acad. Belg. 24(2): 87. 1850; Baker, Handb. Fern-Allies 36. 1887; Alston, Proc. Nat. Inst. Sci. India 11 : 217. 1945; Mehra & Bir in Res. Bull. (N.S.) Panjab Univ. 15 (1-2): 100. 1964; Dixit, Selagin. India 60. 1992.

Stems 3-10 cm, prostrate, slender, quadrangular, branched from the base; branches copious, lax ascending. Rhizophores many, wiry, shorts almost throughout the stems. Leaves heteromorphic thin but firm in texture; lateral leaves ovate-lanceolate, spreading, obliquely cordate at base; inner half-leaf ovate-lanceolate, much dilated at base; outer half-leaf ovate-lanceolate, dentate; median leaves imbricate, ovate-lanceolate, dentate; ciliate at base. Strobili single at the apex of each branchlets, 3-5 x 1-2 mm. Sporophylls resupinate, oblong-rhomboid to obtuse; smaller sporophylls ovate, acuminate. Megaspores dark brown, verrucoid.

Strobili : August - November.

Rare, growing in shady places.

Selected specimens : Kathua, Painal, *Hajra* 82383 (BSD).

EQUISETACEAE

EQUISETUM L.

- 1a. Spikes obtuse. Stomata with their aperture on the level of the epidermis:

- 2a. Sterile and fertile stems very different; the latter vernal fugacious. ...1. *E. arvense*
- 2b. Sterile and fertile stems alike; the latter subsistent and developing small branches in whorls :
- 3a. Branches copious and regularly whorled. Spikes dense, oblong. ...5. *E. palustre*
- 3b. Branches in typical form copious and densely whorled. Spikes cylindrical-oblong. ...3. *E. diffusum*
- 1b. Spikes apiculate. Stomata with their aperture immersed beneath the epidermis :
- 4a. Branches few, irregular :
- 5a. Ribs more than 20, prominent, narrow. Spikes dense, oblong, apiculate. ...6. *E. ramosissimum*
- 5b. Ribs less than 20, less prominent. Spikes oblong, cuspidate. ...2. *E. debile*
- 4b. Branches none. ...4. *E. hyemale*

1. *Equisetum arvense* L., Sp. Pl. 2: 1050. 1753; Baker, Handb. Fern Allies 2. 1887; Dixit, Cens. Indian Pterid. 19. 1984; Stewart in Bull. Torrey Bot. Club, 72: 425. 1945. Fig. 2

Sterile and fertile stems entirely different. Barren stems aestival, 3-4 mm in diam., 20-40 cm long with 6-12 ribs and a small, central hollow; sheaths loose; ribs distinctly grooved; teeth lanceolate, black with a white membranous edge; branches regular, densely whorled, solid, tetragonous, usually simple. Fertile stems vernal, larger than sterile, not branched, appearing before the sterile, light brown, fugacious; sheaths distant, 2-3 cm long, brown, membranous. Sporophylls peduncled, obtuse, up to 4 cm long.

Sporophylls : May - September.

Common in marshy places or along the streams, 2000-4000 m.

Selected specimens : Srinagar, Kungwatan T.A. Rao 9320 (BSD); Sonamarg, M.A. Rau 50219 (BSD); Yarikah, Rao 2187; Desurakh, Rao 9803; Thajwas mountains, Rao 9562 (BSD); Tilele Valley, Stewart 18584; Kishanganga valley, Stewart 18525 (DD); Gilgit, Giles 123 (CAL).

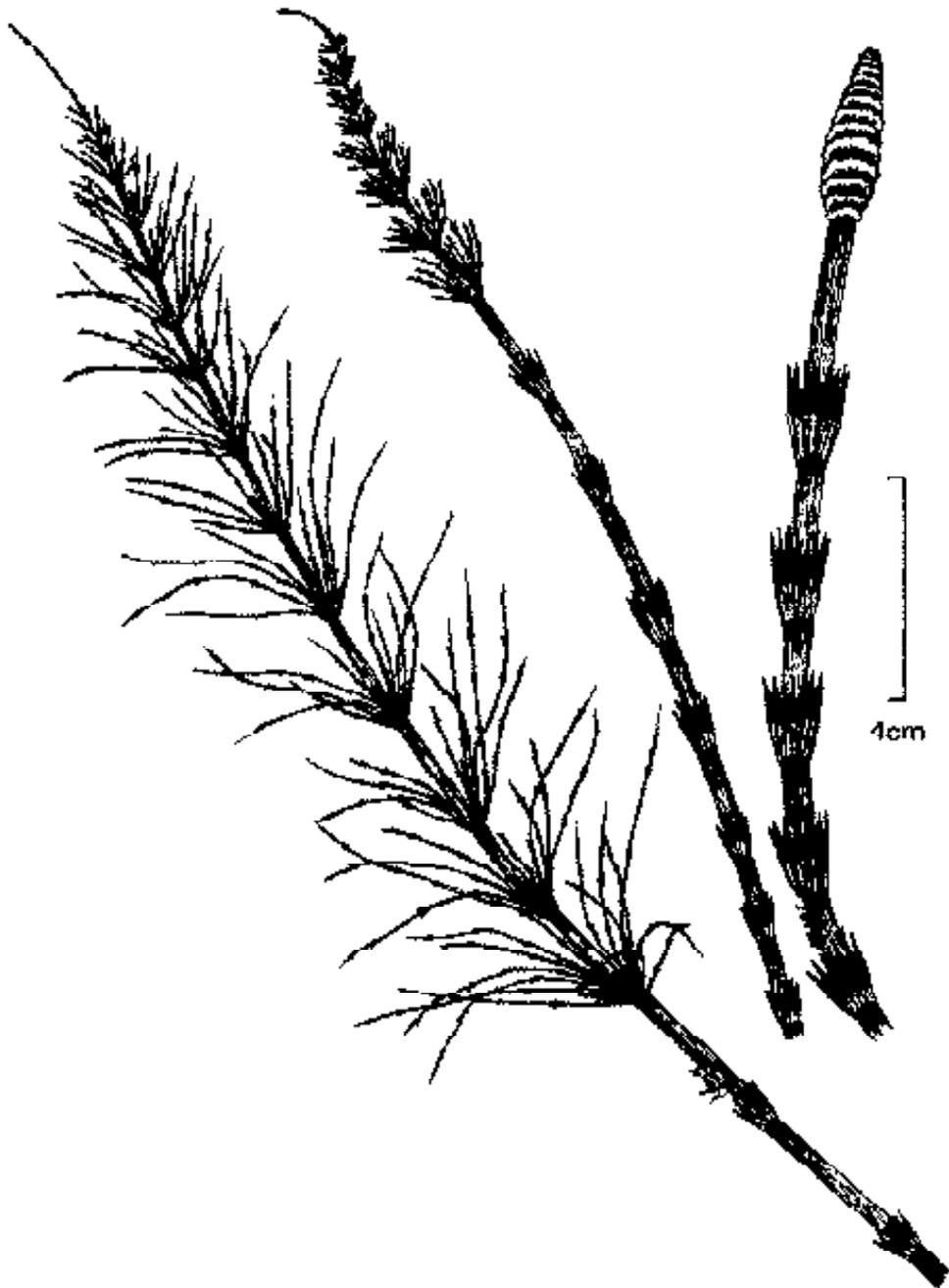


Fig. 2. *Equisetum arvense* L.

2. *Equisetum debile* Roxb. ex Vauch. in mem. Soc. Phys. Nat. Geneva 1: 387. 1821; Baker, Handb. Fern Allies 5. 1887; Stewart in Bull. Torrey Bot. Club 72: 425. 1945 *et in* J. Indian Bot. Soc. 30: 141. 1951; Singh & Kachroo, For. Fl. Srinagar 231. 1976. *Equisetum ramosissimum* Desf. subsp. *debile* (Roxb. ex Vauch.) Hauke in Amer. Fern J. 52: 33. 1962; Dixit, Cens. Indian Pterid. 20. 1984. *Zetsemanpo* (Ladakhi).

Sterile and fertile stems alike, up to 1.2 m tall, with a large central lumina, lax, simple or irregularly branched; branches long, slender, 1-3 in a whorl; ribs 8-20, less prominent and not scabrous toothed. Sheaths tight, 0.5 cm long, including lanceolate-acuminate, dark-brown margined deciduous teeth. Sporophylls terminal, oblong, apiculate, shortly stalked or sessile, up to 2 cm long. Sporangia oblong, yellowish.

Sporophylls : August - October.

Frequent or scattered, growing along the streams on sandy soils. Often scrambling among bushes.

Selected specimens : Ladakh, Sabunaja, *Bhattacharya* 71500; Dras, *Bhattacharya* 31345 (BSD); Leh, *Viswanathan* 54719 (BSD); Nubra Valley, *Hajra* 74133 (BSD). Kishanganga valley, *Stewart* 18884 (DD); Indus Valley, *Duthie s.n.* (CAL).

3. *Equisetum diffusum* D. Don, Prodr. Fl. Nepal. 19. 1825; Baker, Handb. Fern Allies 3. 1887; Stewart in Nasir & Ali, Annot. Cat. Vas. Pl. W. Pak. & Kashmir 2. 1972, Dixit, Cens. Indian Pterid. 19. 1984. Fig. 3

Tufted, up to 40 cm high, erect. Sterile and fertile stems alike, 30-60 cm long with a small central hollow and 6-12 square grooved ribs. Sheaths loose, 6-9 mm long; ribs very distinctly grooved; teeth linear or lanceolate, greenish brown, distinctly keeled. Branches in the typical form copious and densely whorled, ascending, solid. Sporophylls oblong-cylindrical, obtuse, 3-5 cm long, shortly peduncled. Spores reddish brown, round.

Sporophylls : August - November.

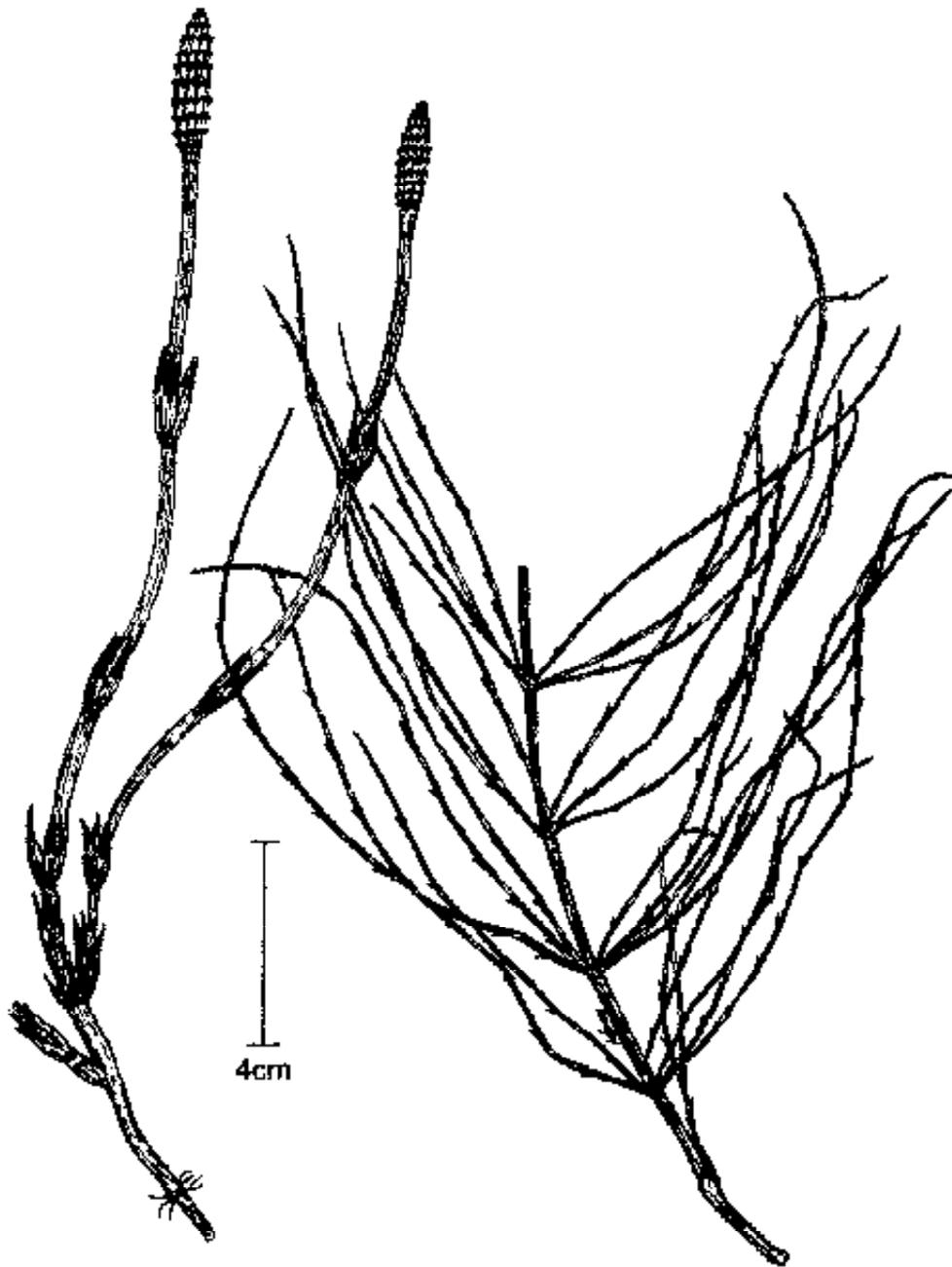


Fig. 3. *Equisetum diffusum* D. Don

Common, in open or shady, water logged sandy places, 500-3000 m.

Selected specimens : Ladakh : Sankee. *Wadhwa* 59855 (BSD); Kathua: Kot-Banjah, 1800 m. *Uniyal & Singh* 90328 (BSD). Kashmir, Jhelum Valley, Kalarus forests, *Keshavanand* 572 (DD); Desu Rakh. *T.A. Rao* 9303 (CAL).

4. *Equisetum hyemale* L., Sp. Pl. 2: 1061. 1753; Baker, Handb. Fern Allies 5. 1887; Dixit, Cens. Indian Pterid. 20. 1984.

Sterile and fertile stems alike, erect, persistent, branched at the base only, 60-90 cm long, up to 1 cm in diam., central hollow large. Ribs 20-30, flat on the top, very scabrous; sheaths tight, pale green, with a distinct zone of black at the top and bottom; teeth brown, deciduous, small, cuneate, with a membranous cusp. Spikes very dense, oblong, apiculate, sessile, ca 1.2 cm long.

Sporophylls : August - September.

Selected specimens : Hazratbal University campus, *A. Dutta* 58101, 58219 (CAL).

5. *Equisetum palustre* L., Sp. Pl. 2: 1061. 1753; Baker, Handb. Fern Allies 3. 1887; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 2. 1972; Dixit, Cens. Indian Pterid. 19. 1984.

Perennials, creeping, sterile and fertile stems alike, 30-40 cm long with a small central hollow and 6-12 square grooved ribs. Sheaths loose, up to 1 cm long; teeth brownish-green, linear or lanceolate, distinctly keeled. Branches in the typical form copious and densely whorled, ascending, solid. Sporophylls light greenish, dense, oblong, obtuse, 1-2 cm long, distinctly peduncled.

Sporophylls : September - November.

Rare or occasionally growing on stony moist soils, near the streams, 1800-3000 m.

Selected specimens : Srinagar : Dachigam, Wadhwa 66874 (BSD).

6. *Equisetum ramosissimum* Desf., Fl. Atlant. 2: 398. 1800; Baker, Handb. Fern Allies 4. 1887; Stewart in Bull. Torrey Bot. Club 72: 426. 1945; Singh & Kachroo, For. Fl. Srinagar 231. 1976.

Rhizomes creeping. Stems erect, up to 130 cm high with irregularly whorled branches, branched again, very scabrous. Sterile and fertile stems alike. Ribs 20-25, prominent. Sheaths 5-8 mm long; teeth 5-20, black pointed, lanceolate, acuminate. Terminal branch and often many of the others fertile. Sporophylls black, dense, oblong, apiculate, sessile, 1.5-2.5 cm long. Sporangia yellow. Spores yellow, simple, globose.

Sporophylls : August - November.

Common, in marshy situations or along the cultivated fields in shandy soils, 1000-3400 m.

Selected specimens : Ladakh : Dras, Duthie 13698 (CAL); Gilgit, Giles 106 (CAL); Karu-Indus valley, Bhattacharya 41154 (BSD); Shey-leh, Hajra 74095; Kathua : Hajra, 82559 (BSD); Dras, Wadhwa, 58580 (BSD); Srinagar, Dachigam, Wadhwa 66874 (BSD); Pahalgam, Rao 526 (BSD).

BOTRYCHIACEAE

- | | |
|--|-------------------------|
| 1a. Sterile branches oblong, smooth or glabrous,
pinnate-pinnatifid | ...1. <i>Botrychium</i> |
| 1b. Sterile branches deltoid, hairy, quadripinnatifid | ...2. <i>Botrypus</i> |

1. BOTRYCHUM Swartz.

- | | |
|---|---|
| 1a. Sterile blades coriaceous, with flabellate division often
imbricate and slightly crenate or undulate | ...1. <i>B. lunaria</i> var. <i>lunaria</i> |
| 1b. Sterile blades membranous with the flabellate or oblong
division rather remote and more deeply incised | ...2. <i>B. lunaria</i> var. <i>onondaganse</i> |

1. *Botrychium lunaria* (L.) Sw. in Schrad. J. Bot. 1800(2): 110. 1801; Bedd., Handb. Ferns Brit. India 469.f. 293. 1883; Suppl. 110. 1892; Stewart in Bull. Torrey Bot. Club 72: 425. 1945. var. *lunaria* Dixit. Cens. Indian Pterid. 21. 1984. *Osmunda lunaria* L., Sp. Pl. 2: 1064. 1753.

Fig. 4

Perennial or biennials ferns, up to 15 cm high. Rhizomes small, enclosed by brown sheaths and bearing branched roots, which are fleshy when fresh, brittle when dry. Common stalk 3-8 cm long, erect, smooth, cylindrical, hollow and succulent. Fronds solitary, firm, fleshy; sterile branches 6 x 2 cm; pinnae oblong, sessile, flabellate and often overlapping. Veins flabellately forked. Fertile branches clasped by the sterile one before unfolding, fertile spikes racemose or paniculate. Sporangia sessile, circular, brown, arranged in two rows on the dorsal face of spikes. Spores trilete, exine reticulate.

Sporangia : June - August.

Occasional, growing on grassy slopes of subalpine to alpine meadows. 3000-3500 m.

Reported by Stewart (1945, 1972) from Gilgit, Aparwat and Khullar (1994) from Gulmarg and Sonamarg.

2. *Botrychium lunaria* (L.) Sw. var. *onondagense* (Underw.) House in Bull. N.Y. State Mus. 243-244: 47. 1923; Clausen, Mem. Torrey Bot. Club. 19(2): 66-67. 1938; Panig. & Dixit in Proc. Natn. Inst. Sci. India 35: 240. 1969; *Botrychium onondagense* Underw. in Bull. Torrey Bot. Club 30: 47. 1903; Chandra, Ferns India 5. 2000.

Fronds approx. 15 cm high, resemble var. *lunaria* in all respect, except that the fertile blade is membranous and shortly stalked, deeply incised pinnae, arranged remotely on the rachis. Spores trilete with circular and reticulate exine.

Sporangia : May - July.

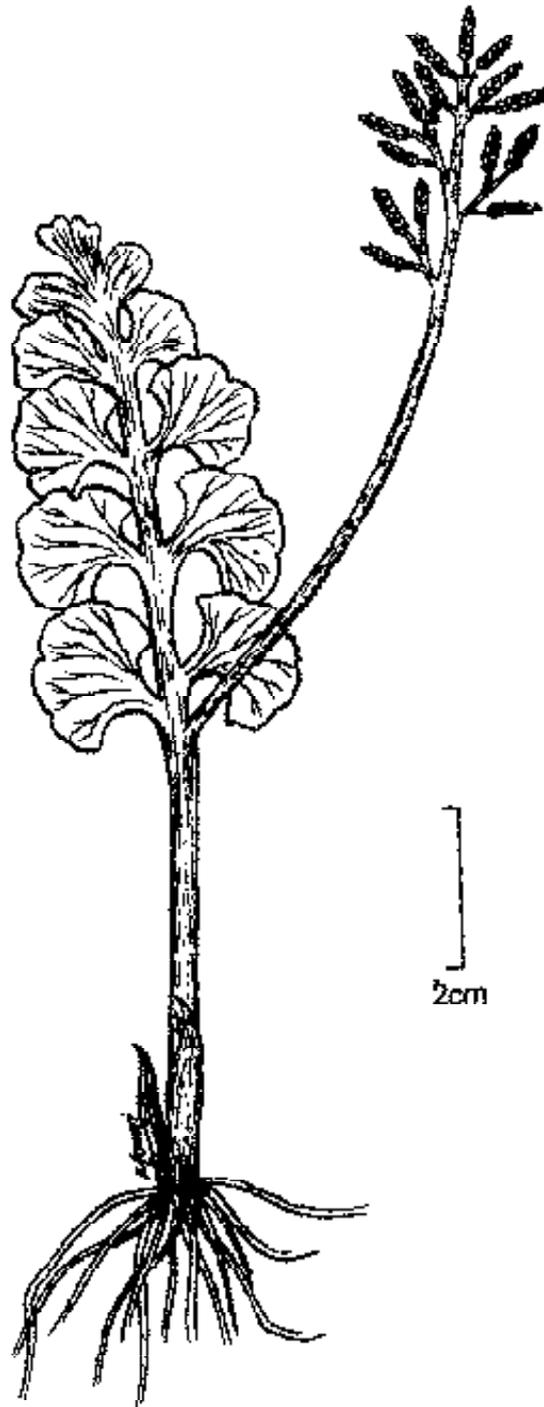


Fig. 4. *Botrychium lunaria* (L.) Sw. var. *lunaria*

Rare. growing among grasses in moist shady situations, 2800-3300 m.

Reported by Clausen (*loc. cit.*) from Phelgam.

2. BOTRYPUS Michaux

Botrypus virginianus (L.) Holub in Preslia 45: 276. 1973; Khullar, Illus. Fern. Fl. W. Himal. 1: 14. 1994. *Osmunda virginiana* L., Sp. Pl. 2: 1064. 1753. *Botrychium virginianum* (L.) Sw. Schrad. in J. Bot. 1800 (2): 111. 1801; Bedd., Handb. Fern Brit. India 471. 1883; Stewart in Bull. Torrey Bot. Club 72: 425. 1945; Dixit, Cens. Indian Pterid. 22. 1984.

Terrestrials, perennial. Rhizomes short with long, stout, branched roots. Stipes erect, fleshy, 10-45 cm long; sterile portion not prolonged beyond the fertile branches; sterile lamina deltoid, quadripinnatifid, lower pinnae much largest; pinnules ovate-oblong, closely cut down to a broadly winged rachis into finely cut linear, oblong segments, both sides naked or slightly hairy. Fertile branches of the rachis springing from the base of sterile portion. Sporangia in two closely-set rows on linear ultimate segment, globose. Spores hyaline, tetrahedrate.

Sporangia : August - September.

Frequent, growing on humus rich shaded grassy slopes, 1700-2500 m.

Reported by Stewart (1945, 1951, 1972) from Lolab valley, Phelgam and Poonch; Khullar (1994) from Kishtwar.

OPHIOGLOSSACEAE

OPHIOGLOSSUM L.

- 1a. Rhizomes long, surrounded by brown sheaths ...3. *O. polyphyllum*
 1b. Rhizomes short, erect, cylindrical, not surrounded
 by brown sheaths :

- 2a. Trophophylls fleshy, isodiametric ...1. *O. nudicaule*
 2b. Trophophylls broad, not isodiametric :
 3a. Common Stipes as long as the fertile Stipes;
 trophophylls cordate, broadly ovate, obtuse
 or subreniform. ...4. *O. reticulatum*
 3b. Common Stipes short, up to 4 cm long; fertile
 Stipes much longer than the common Stipes;
 trophophylls usually ovate-lanceolate or
 ovate. ...2. *O. petiolatum*

1. *Ophioglossum nudicaule* L.f., *Suppl. Syst.* t. 443. 1781; Bedd., *Handb. Fern. Brit. India* 464.t. 288. 1983; *Suppl.* 109. 1892; Clausen in *Mem. Torrey Bot. Club* 19: 144. 1938; Pangr. & Dixit in *Proc. Natn. Inst. Sci. India* 35(B): 262. 1969; Dixit, *Cens. Indian Pterid.* 21. 1984.

Rhizomes erect, small, slightly tuberous, 2-3 mm thick. Roots fibrous. Fronds 3-5 cm long, erect, slender. Sterile segments leafy, shortly stalked linear to ovate, apex acute or acuminate; texture thick, fleshy. Veins not distinct. Fertile spikes 1.5 cm long. Spores oval, light yellow.

Sporangia : April - August.

Scattered, in swampy, grassy, open situations, 900-1500m.

Selected specimens : Kathua dist., Hajra 82384 (BSD).

2. *Ophioglossum petiolatum* Hook., *Exotic Fl.* 1: t. 56. 1823; Clausen in *Mem. Torrey Bot. Club* 19: 134. 1938; Mehra & Bir in *Res. Bull. Panjab Univ. (N.S.)* 15: 103. 1964; Stewart in Nasir & Ali, *Annot. Cat. Vasc. Pl. W. Pak. & Kashmir* 3. 1972; Dhir in *J. Cramer, Biblioth. Pterid.* 1: 26. 1980; Nair & Dixit in *J. Bombay Nat. Hist. Soc.* 78: 458. 1981; Dixit, *Cens. Indian Pterid.* 23. 1984; Chandra, *Ferns India* 10. 2000. Fig. 5

Rhizomes 1-1.5 cm long, short, erect, usually with 2-3 fronds. Stipes 3-8 cm long. Sterile blade sessile, shortly petiolate, slightly cuneate or gradually tapering towards base; venation reticulate, midrib not distinct, often with included veinlets. Fertile portion stalked, 2-7 cm long. Spikes

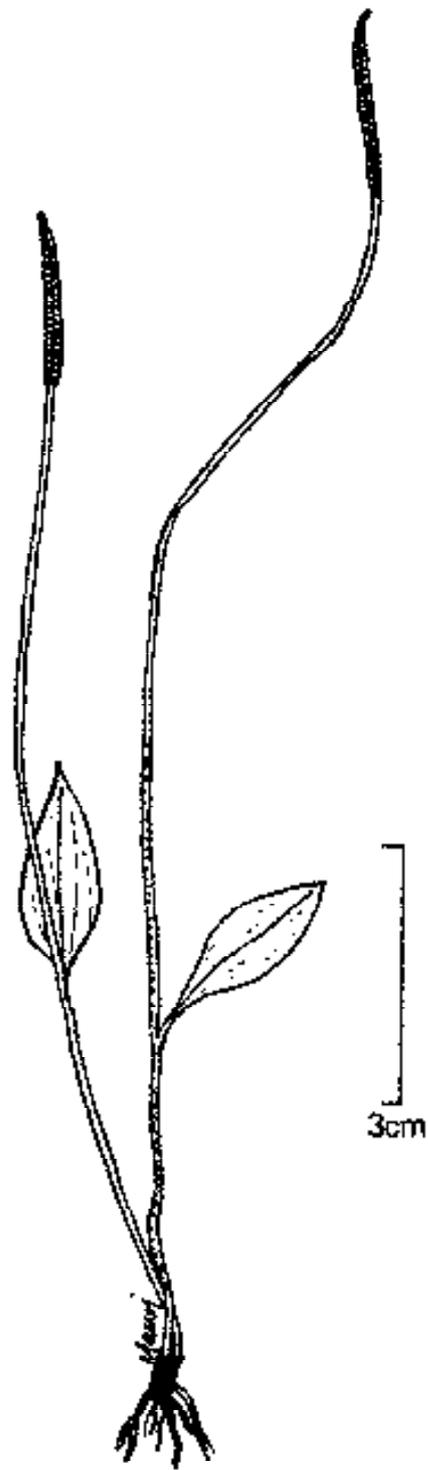


Fig. 5. *Ophioglossum petiolatum* Hook.

simple, 2-5 cm. Sporangia embedded in two rows on either side of the spikes. Spore exine finely reticulate.

Sporangia : June - September.

Rare, in moist grassy places between 700-1200 m.

Reported by Stewart (1972) and Dhir (1980) from Poonch and Dhulibagh.

3. *Ophioglossum polyphyllum* A. Braun ex Seubert., Fl. Azor. 17. 1844; Pichi-Serm. in *Webbia* 9: 632. 1954; Panigr. & Dixit, Proc. Nat. Inst. Sci. India 35: 255. 1969; Dixit, Cens. Indian Pterid. 23. 1984; Khullar, Illus. Fern. Fl. W. Himal. 1: 26. 1994.

Rhizomes long, tuberous, surrounded by brown, persistent sheaths around the frond base. Fronds usually more than one, produced in each season. Common Stipes up to 4 cm long, glabrous. Tropophylls 3.5-6 cm long, 0.5-2.0 cm broad, linear-lanceolate or ovate-lanceolate, margin entire, texture thin, firm; veins reticulate, forming large areolae with free included veinlets; midrib not distinct. Fertile stipes 2-4 cm long, arising a little above the base of the tropophyll; strobilus up to 3 cm long. Spores light yellow to brown.

Sporangia : July - October.

Occasional, growing on open grassy hill slopes, 1000-2400 m.

Reported by Khullar (1994) from Poonch and Jammu.

4. *Ophioglossum reticulatum* L., Sp. Pl. 2: 1063. 1753; Bedd., Handb. Fern. Brit. India 465 f. 291. 1883; Clausen in Mem. Torrey Bot. Club. 19: 130. 1938; Panigr. & Dixit in Proc. Natn. Inst. Sci. India 35(B): 257. 1969; Dixit, Cens. Indian Pterid. 24. 1984.

Rhizomes erect, cylindrical. Roots fleshy, numerous. Stipes up to 10 cm long. Sterile segment ovate-acute, spatulate-cordate, 2.5-3.5 x 1.5

cm, submembranous to coriaceous. Veins reticulate; midrib not well differentiated. Fertile segment arising from the base of sterile ones, erect, bearing 3-5 cm long spike; peduncle 6-10 cm long, slender. Sporangia 15-40 in each row, globose. Spores oval to round; light yellow, exine finely muricate.

Sporangia : July - November.

Occasionally, on shady grassy slopes, 400-1800 m.

Selected specimens : Kathua district, Pappala, *Hajra* 82378 (BSD).

Note : Dar *et al.* (2002) reported *O. vulgatum* L. from Dachigam forest floor, but Fraser-Jenkins (vide Khullar 1994) states that all records of the said taxa from Western Himalaya appear to be belonging to *O. reticulatum*.

OSMUNDACEAE

OSMUNDA L.

- 1a. Lamina 1-pinnate; white mucilage oozes out from the Rhizomes when injured; fertile pinnae intercalary in position ...1. *O. claytoniana*
 1b. Lamina 2-pinnate; no white mucilage; fertile pinnae on a separate frond ...2. *O. japonica*

1. *Osmunda claytoniana* L., Sp. Pl. 2: 1066. 1753; C.B. Clarke, Trans. Linn. Soc. London 2(Bot): 582, 1880; Bedd., Handb. Fern. Brit. India 449. t. 275. 1883; Stewart in Bull. Torrey Bot. Club 72: 424, 1945; Pangr. & Dixit in J. Bot. Soc. 48: 90. 1969; Singh & Kachroo, For. Fl. Srinagar 231. 1976. Fig. 6

Rhizomes deeply buried in soils with many hard and fibrous rhizoides. Stipes covered with long and hard persistent leaf bases. Fertile and sterile fronds 40-80 cm tall, bipinnatifid, erect; pinnae opposite, 10-12 x 3-4 cm, clefted to the costa; segment 2 cm long, obtuse, entire; rachis

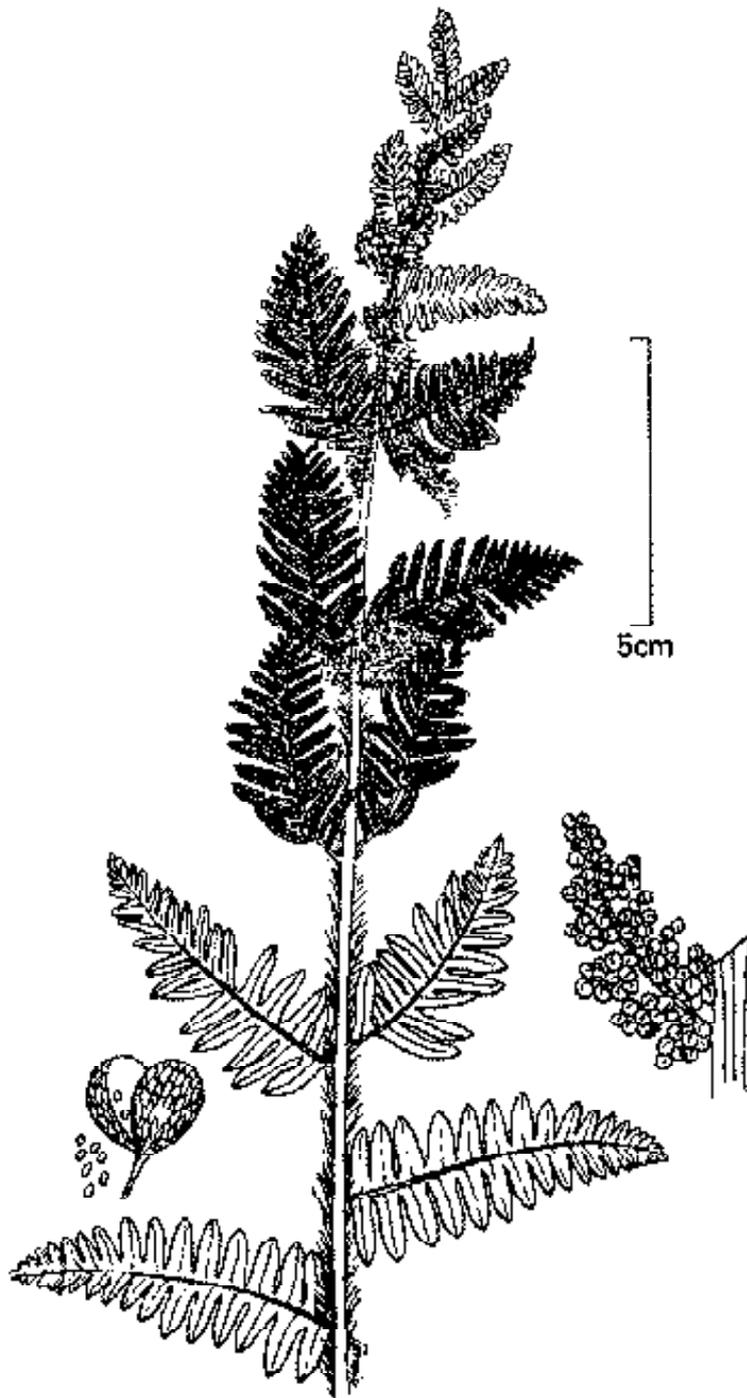


Fig. 6. *Osmunda claytoniana* L.

finely covered by deciduous hairs. Veins forked once. Sporangia attached to the surface of veins on both margins of segments. Spores trilete, round, exine finely spinulose.

Sporangia : May - August.

Common, growing in patches on open slopes of alpine meadows, 3000-4200 m.

Selected specimens : Baramula, *Rao* 9550; Bhadarwah, *Rao* 9068; Gulmarg, *Rao* 249 (BSD); Bagtore (Burzil Nalah), *Wadhwa* 84033; Dugwan, *Wadhwa* 66994 (BSD); Gulmarg, *Duthie* 11425 (CAL).

2. *Osmunda japonica* Thunb., Fl. Jap. 330. 1784; Tagawa, Jap. Pterid. 34. t. 9. f. 51. 1959. *Osmunda biformis* Mak. in J. Jap. Bot. 4: 4. 1959; Dixit, Cens. Indian Pterid. 27. 1984; Khullar, Illus. Fern Fl. W. Himal. 1: 39. 1994.

Rhizomes erect or suberect, thick. Fronds dimorphic. Stipes of sterile fronds 40-60 cm long, stramineous to light-brown, glabrous; rachis similar to Stipes, grooved. Lamina 2-pinnate, 40-60 cm long, 30 cm broad, broadly triangular-lanceolate, glabrous; texture thick, sub-coriaceous; sterile pinnae 5-7 pairs, approx. 20 x 8-10 cm, alternate, petiolate, lanceolate, base auricled, apex acute, margin nearly entire; veins free, forked once or twice near base. Fertile fronds, stipes and rachis as in the sterile fronds. Lamina 2-pinnate, 45-60 x 20 cm, hairy; pinnae 7-10 pairs, 15 x 1 cm or more, opposite, petiolate; pinnules 10-12 pairs, cylindrical, bearing dense cluster of sporangia. Spores light-brown.

Sporangia : April - May.

Rare, growing on shady moist rocks or near the water falls, 1400-2200 m.

Reported by Khullar (1994) from Kadol in Kathua district of Jammu division.

LOXOGRAMMACEAE**LOXOGRAMME (Blume) Presl**

- 1a. Rhizome scales broad and pale in colour ...2. *L. porcata*
 1b. Rhizome scales comparatively narrow and dark
 brown in colour ...1. *L. involuta*

1. *Loxogramme involuta* (D. Don) Presl, Tent. Pterid. 215. 1836; Bodd., Handb. Ferns Brit. India 393. 1883; Chandra, Ferns India 361. 2000. *Grammitis involuta* D. Don, Prod. Fl. Nepal. 14. 1825.

Rhizomes creeping, stout, woody, clothed with peltate, concolorous, clathrate scales. Stipes up to 5 cm long. Lamina about 15-50 x 2-6 cm. lanceolate, apex acuminate, margin entire, gradually narrowed at base to a short, broad, compressed Stipes. Sori more or less round, brown, scattered irregularly on either side of the midrib or in two regular rows. Sporangia stalked. Spores spherical, exine smooth.

Epiphytes or lithophytes between 1700-2300 m altitude.

Reported by Chandra (2000) from Jammu (Kathua).

2. *Loxogramme porcata* Price in Amer. Fern J. 80: 6. 1990; Khullar, Illus. Fern. Fl. W. Himal. 1: 60. 1994; Chandra, Ferns India 362. 2000.

Rhizomes short-creeping, scaly; scales broad, linear-lanceolate, dark-greyish-brown. Lamina simple, large 10.5-60 cm long, 0.8-6 cm broad, narrowly elliptic to oblanceolate, narrowed to base, but remaining broader shortly above the base, apex gradually acuminate, light olive-brown to deeply brown, surface slightly to deep wrinkled; rachis adaxially prominent. Sori up to 6 cm long, 2-5 mm apart, up to 4 on each side of the rachis, overlapping from rachis.

Sori : September - November.

Epiphytic on tree trunks or lithophytic in shady moss covered rocks, 600-2600 m altitude.

Reported by Price (1990) from Kathua district (Kadof).

POLYPODIACEAE

- 1a. Fronds simple :
- 2a. Sori borne in a single row on either side of the costa ...1. *Lepisorus*
- 2b. Sori borne in more than one row :
- 3a. Fronds herbaceous; stellate hairs absent ...2. *Microsorium*
- 3b. Fronds leathery, covered with stellate hairs ...6. *Pyrrhosia*
- 1b. Fronds deeply lobed or pinnatifid :
- 4a. Fronds simple pinnate, forming a costal series of large, oblong areolae ...4. *Polypodiastrium*
- 4b. Fronds deeply lobed, forming one or more series of areolae :
- 5a. Frond's length and width ratio 2: 3; veins forming 2-5 rows of areolae ...3. *Phymatopteris*
- 5b. Frond's length and width ratio 1: 5; single row of costal areolae present ...5. *Polypodiodes*

1. LEPISORUS (J. Smith) Ching

- 1a. Lamina less than 2.5 cm in width :
- 2a. Lamina herbaceous in texture :
- 3a. Rhizomes long creeping, thin, 0.2-0.6 cm in diam., middle part of the fronds fertile ...1. *L. clathratus*
- 3b. Rhizomes short creeping, 1.5-2.5 cm in diam., about whole of the frond fertile ...3. *L. loriformis*
- 2b. Lamina subcoriaceous to coriaceous in texture :
- 4a. Rhizomes scales concolorous, more than half portion of lamina fertile ...5. *L. nudus*
- 4b. Rhizomes scales bicolorous :

- 5a. Margin of Rhizomes scales entire or slightly eroded ...7. *L. stewartii*
 5b. Margins of Rhizomes scales toothed ...2. *L. intermedius*
 1b. Lamina more than 2.5 cm in width :
 6a. Rhizomes scales concolorous, margin eroded ...6. *L. sesquipedalis*
 6b. Rhizomes scales bicolorous, margin toothed ...4. *L. morrisonensis*

1. *Lepisorus clathratus* (C.B. Clarke) Ching in Bull. Fan Mem. Inst. Biol. 4: 71. 1933; Khullar, Illus. Fern Fl. W. Himal. 1: 90. 1994. *Polypodium clathratum* C.B. Clarke in Trans Linn. Soc. London 1: 559. 1880. *Pleopeltis clathrata* (C.B. Clarke) Bedd., Handb. Ferns Brit. India : 348. 1883.

Rhizomes long creeping, thin, 0.2-0.5 cm in diam., scaly; scales blackish concolorous, margin toothed. Stipes up to 2-5 cm long, often as long or half as long as the lamina, stramineous, thin, not winged, glabrous; rachis prominent. Lamina apex acute or obtuse, margin entire, texture thin, herbaceous; veins visible on both surfaces. Sori round, large, medial, middle part of the frond fertile. Spores yellowish.

Sori : August - October.

Occasional, growing on the humus rich crevices of rock and tree trunks, 2500-3600 m.

Selected specimens : Kashmir : Sonamarg. G.A. Gammie s.n. (DD); Inayat, 23208 (DD).

2. *Lepisorus intermedius* Ching et Khullar, Illus. Fern Fl. W. Himal. 1: 93. 1994.

Rhizomes short-creeping, thin, 1-1.5 mm in diam., densely scaly; scales brown, bicolorous, ovate-acuminate with a very broad base, margin distinctly-toothed. Stipes 3-6 cm long, stramineous, sparsely scaly, scales few; rachis prominent on under surface. Lamina simple, 20-30 cm long, 1-1.7 cm broad, lanceolate, base decurrent on Stipes, apex acuminate, margin entire, texture thin, chartaceous green, turning brown on drying:

veins indistinct, anastomosing to form areolae with or without simple forked included veinlets. Sori round, medium sized, only upper half of the lamina fertile. Spores yellowish.

Sori : August - January.

Frequent or occasional, as an epiphyte on tree trunks or lithophytic on shady moist rocks, 1500-2000 m.

Reported by Khullar (1994) from Kathua (Kadol).

3. *Lepisorus loriformis* (Wallich ex Mett.) Ching in Bull. Fan. Mem. Inst. Biol. 4: 81. 1933; Khullar, Illus. Fern Fl. West Himal. 99. 1994; Chandra, Ferns India 379. 2000. *Polypodium loriforme* Wallich ex Mett., Polyp. 92. 1875.

Rhizomes short-creeping, densely scaly. Stipes short, 1-3 cm long. Lamina simple, linear-elongate, gradually attenuate to a short Stipes, usually brown in colour, texture sub-coriaceous. Sori rounded or oblong, medium sized, submarginal.

Sori : August - November.

Reported by Chandra (2000) without definite locality.

4. *Lepisorus morrisonensis* (Hayata) H. Ito in J. Jap. Bot. 11: 92. 1935; Khullar, Illus. Fern Fl. W. Himal. 1: 99. 1994. *Polypodium morrisonensis* Hayata in Bot. Mag. Tokyo 23: 77. 1909.

Rhizomes long creeping, thin, densely scaly. Scales dark-brown, bicolorous with a light coloured margin, ovate, margin toothed or highly crosed, apex acuminate, Stipes 0.5-1 cm distant on Rhizomes, short, 2-4 cm long, stramineous, sparsely scaly; rachis prominent, sparsely scaly. Lamina simple 25-35 cm long, narrow, 2-2.5 cm broad, lanceolate, base decurrent on Stipes, apex acute, margin entire or slightly convoluted; texture herbaceous, membranaceous on drying, lower surface sparsely scaly; veins

obscure, anastomosing to form 3-4 areolae between margin and rachis; areole with free simple or forked included veinlets. Sori slightly immersed, round, sub-medial. Spores yellowish, exine verrucose.

Sori : July - October.

Occasional, epiphytic or lithophytes, 2000-3000 m.

Reported by Khullar (1994) from Pahelgam and Mt. Kolahoi.

5. *Lepisorus nudus* (Hook.) Ching in Bull. Fan Mem. Inst. Biol. 4: 83. 1933; Khullar, Illus. Fern Fl. W. Himal. 1: 101. 1994. *Pleopeltis nuda* Hooker, Exot. Fl. Pl. 63. 1823. Fig. 7

Rhizomes long-creeping, thin, scaly; scales dark-brown, concolorous, base broad, margin toothed, almost entire below, apex acuminate or acute. Stipes 0.5-1.5 cm, distant on Rhizomes, short, 0.5-3 cm long, sparsely scaly; rachis prominent, sparsely scaly. Lamina simple, 6-25 cm long, 0.5-1.5 cm broad, narrowly linear-lanceolate, base gradually attenuated and decurrent on Stipes, apex long acuminate, texture thick, fleshy, glabrous; veins obscure, anastomosing to form 2-3 areolae with free, simple or forked included veinlets. Sori round, large, medial, close to the rachis, often confluent, covering the entire lamina between margin and rachis, more than half of the lamina fertile. Spores hyaline to yellowish, exine smooth.

Sori : June - November.

Uncommon, epiphytic or lithophytes in shady places 700 - 2000 m.

Reported by Khullar (1994) from Poonch (Nakial near Kotli).

6. *Lepisorus sesquipedalis* (J. Smith) Fras.-Jenkins in Bot. Helv. 102(2): 153. 1992; Khullar, Illus. Fern Fl. W. Himal. 1: 109. 1994. *Drynaria sesquipedalis* J. Smith in Bot. Mag. 72 Comped. 13. 1846. *Polypodium sesquipedalis* (J. Smith) Mett., Mem. Fam. Foug. 1: 162. 1856.

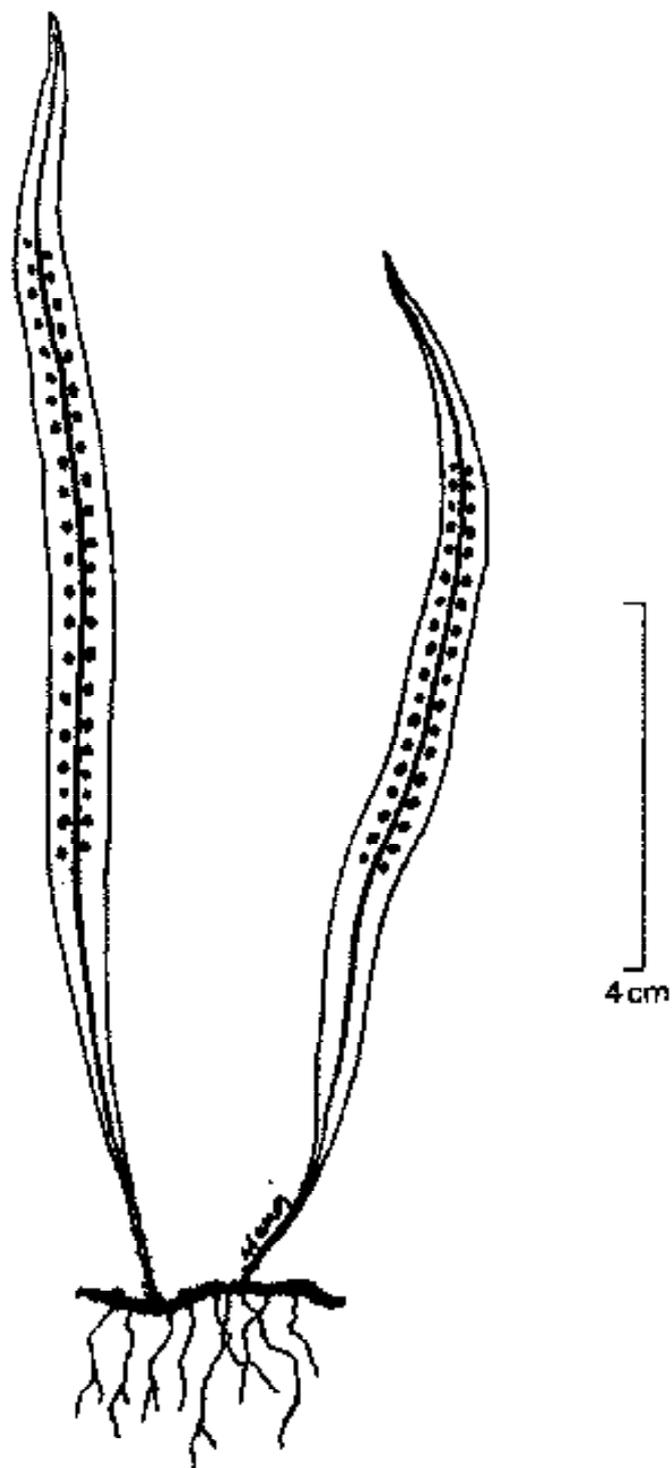


Fig. 7. *Lepisorus nudus* (Hook.) Ching

Rhizomes long-creeping, thick, up to 1 cm in diam., woody, scaly; scales dark brown, concolorous, margin entire or slightly eroded, apex acuminate. Stipes approximate, 0.5-2 cm, distant on Rhizomes, 0.5-4 cm long, stramineous, sparsely scaly; rachis prominent. Lamina simple, 15-40 cm long, 1.5-4 cm broad, linear to broad lanceolate, base decurrent on Stipes, apex acute, margin entire or slightly convoluted, texture herbaceous, membranous when dry, lower surface scaly; veins distinct, anastomosing to form 4-5 areolae between margin and rachis; areolae with free simple or forked included veinlets. Sori immersed, forming pustules on the surface, round, sub-medial, one between each main lateral vein. Spores yellowish-brown, tuberculate.

Sori : July - October.

Frequent, on moist rocks or on tree trunks in shady places, 1500-2500 m.

Batkat-Purfuzal, *T.A. Rao* 9777 (BSD).

7. *Lepisorus stewartii* Ching in Act. Bot. Austro Sinica 1: 23. 1983; Khullar, Illus. Fern Fl. W. Himal. 1: 112. 1994.

Rhizomes long-creeping, thin, densely scaly; scales dark-brown, bicolorous. Stipes 4-5 cm long. Lamina 15-20 cm long, 0.4-0.5 cm broad, narrowly linear, apex acute or obtuse, base gradually narrowed and decurrent on Stipes, margin slightly revolute, texture sub-coriaceous, pale-green; veins obscure. Sori large, medial, round contiguous, filling up the space between margin and costa.

Sori : July - October.

Occasional, from 1500-2000 m altitude, epiphytic or lithophytic on rocks.

Reported by Khullar (1994) from Tangmarg, Ferozpur nallah, Mt. Kolahoi and Lidderwat.

2. MICROSORUM Link

1. **Microsorium membranaceum** (D. Don) Ching in Bull. Fan Mem. Inst. Biol. 4: 309. 1933; Bir & Trikha in Bull. Bot. Surv. India 10: 139. 1968. *Polypodium membranaceum* D. Don, Prodr. Fl. Nepal. 2: 1825; Stewart in Bull. Torrey Bot. Club. 72: 423. 1945. *Pleopeltis membranacea* Moore, Index. Fil. 191. 1857; Bedd., Handb. Ferns Brit. India 335. 1883.

Fig. 8

Rhizomes thick, stout, widely creeping, branched and densely scaly. Scales broadly lanceolate, acuminate, clathrate. Stipes sub-caespitose or approximate 1-4 cm long, yellowish green. Fronds simple, broadly lanceolate to oblong-lanceolate, 20-50 cm long, 3-10 cm broad, apex acuminate, attenuate or carinate at base, margin entire or wavy, texture thin, herbaceous, light-green on both sides; rachis sharply ridged on lower side, naked. Veins parallel, with included veinlets, forming numerous areolae. Sori small globose, irregularly scattered along the veinlets, yellowish-brown. Spores oval to elliptic bright brown.

Sori : August - October.

Occasional, Epiphytes or rarely lithophytes in shady localities. 1400-2300 m.

Reported by Stewart (1945) from Jammu (Tawi Valley).

3. PHYMATOPTERIS Pichi-Sermolli

- | | |
|--------------------------------------|------------------------------|
| 1a. Lobes oblong, apex round. | ...1. <i>P. erythrocarpa</i> |
| 1b. Lobes triangular, apex acuminate | ...2. <i>P. stracheyi</i> |

1. **Phymatopteris erythrocarpa** (Mett. ex Kuhn) Pic.-Ser. in Webbia 28: 462. 1973; Dixit, Cens. Indian Pterid. 49. 1984; Khullar, Illus. Fern Fl. W. Himal. 1: 130. 1994, *Polypodium erythrocarpum* Mett. ex Kuhn in Linnaea 36: 135. 1869. *Goniophlebium erythrocarpum* Bedd., Fern Brit. India Suppl. 21, t. 382. 1876 & Handb. Fern Brit. India : 319. t. 171. 1883.

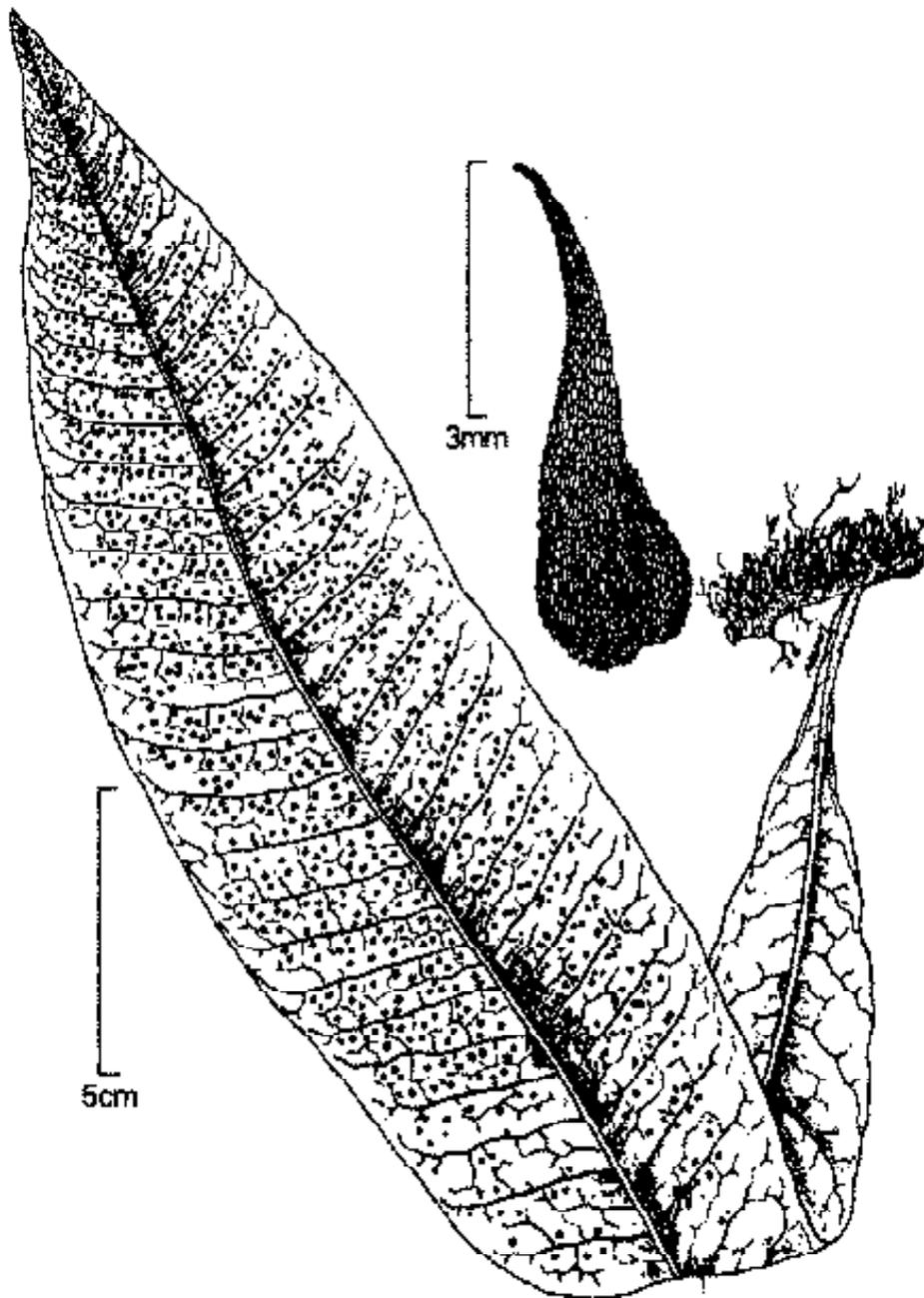


Fig. 8. *Microsorium membranaceum* (D. Don) Ching

Rhizomes long creeping, thin, 0.1 cm in diam., scaly; scales bicolorous, linear-lanceolate. Stipes 4-6 cm, distant on Rhizomes, 4-6 cm long, stramineous, sparsely hairy; rachis hairy. Lamina simple, pinnatifid, 10-15 cm long, 4-5 cm broad, triangular lanceolate, deltoid, texture sub-coriaceous; lower surface densely hairy, upper glabrous, lobes oblong, apex round; terminal lobe the largest, 4.5-5.5 cm long, lateral lobes 5-10 pairs, lowest pair downwards deflexed; veins prominent, hairy. Sori oval or round, closed to the main vein. Spores brown.

Sori : July - September.

Very rare, high altitude fern (3000 m), lithophytic.

Reported by Beddome (1883) from Kashmir.

2. *Phymatopteris stracheyi* (Ching) Pic. Ser. in *Webbia* 28: 468, 1973; Khullar, illus. Fern Fl. W. Himal. 1: 141, 1994. *Phymatodes stracheyi* Ching in *Contr. Inst. Bot. Nat. Acad. Peiping* 2: 83, 1933. *Crypsinus stracheyi* (Ching) Panigr. & Patnaik in *Proc. Nation. Acad. Sci. India* 34: 482, 1964. *Polypodium stracheyi* (Ching) C. Chr., *Index Fil. Suppl.* 3: 159, 1934; Stewart in *Bull. Torrey Bot. Club* 72: 423, 1945.

Rhizomes long creeping, thin, 0.3-0.4 cm in diam., scaly; scales bicolorous, lanceolate, soft. Stipes 1-2 cm, distant on Rhizomes, 8-10 cm long, stramineous, glabrous but base scaly; rachis glabrous. Lamina simple pinnatifid, 10-15 cm long, 10-15 cm broad, deltoid, deeply lobed; texture sub-coriaceous, glabrous, lobes triangular lanceolate, base broad, as long as the lateral ones; lateral lobes 3-4 pairs. Veins anastomosing. Sori round, close to the main vein, in one row on either sides of it. Spores dark brown.

Sori : August - October.

Rare, epiphyte or lithophyte in rock crevices, between 2000-3200 m.

Reported by Stewart (1945) from Pahalgam.

4. POLYPODIASTRUM Ching

1. Polypodiastrium argutum (Wallich ex Hook.) Ching in Acta Phytotax. Sin. 16: 28. 1978; Dixit, Cens. Indian Pterid. 51. 1984; Khullar & Sharma in Pangtey & Joshi, West Himal. Env. Probl. Devel. 1: 315. 1987. *Polypodium argutum* Wallich ex Hook., Sp. Fil. 5: 32. 1863; Stewart in Bull. Torrey Bot. Club. 72: 423. 1945. *Goniophlebium argutum* (Wallich) J. Smith in Hook. Gen. Fil. t. 51. 1840; Bedd., Handb. Ferns Brit. India 323. t. 174. 1883.

Rhizomes wide-creeping, densely scaly; scales blackish-brown, glossy, ovate-lanceolate, hairy, pointed at tip. Stipes slender, erect, glabrous. Fronds unipinnate, 25-40 cm long, 15-80 cm broad, oblong, pinnate with a terminal pinnae; pinnae 7-12-jugate, distant, sessile, more or less adnate, decurrent, elongate-oblong, acuminate, form a broader base having an obtusely serrated margin; texture firm, herbaceous, hairy; rachis covered with peltate, stellate scales. Venation distinct; veins forming a costal series of large oblong areolae, marginal veinlets free. Sori orbicular, exindusiate, paraphyses peltate, clathrate. Sporangia with 13-celled annulus. Spores light-yellow.

Sori : July - September

Occasionally, growing as lithophytes or epiphytic in shady mixed forests, 1600-2300 m.

Reported by Beddome (1883) from Kashmir without giving any definite locality.

5. POLYPODIODES Ching

- | | |
|---|-------------------------------|
| 1a. Rachis naked; pinna margin distantly incise-serrate | ... 3. <i>P. microrhizoma</i> |
| 1b. Rachis scaly underneath : | |
| 2a. Stipes scale margin fibrillose | ...2. <i>P. lachnopus</i> |
| 2b. Stipes scale margin dentate | ...1. <i>P. amoena</i> |

1. Polypodiodes amoena (Wallich ex Mett.) Ching in Acta Phytotax. Sin. 16: 27. 1978; Khullar, Illus. Fern Fl. W. Himal. 1: 148. 1994.

Polypodium amoenum Wallich ex Mett., Polyp. 80, 131, 1857; C.B. Clarke in Trans Linn. Soc. London 1: 550, 1880. *Goniophlebium amoenum* J. Smith in Hook.f., Gen. Fil. t. 51, 1840; Bedd., Handb. Ferns Brit. India 317, 1883.

Rhizomes wide creeping, thick, stout, densely scaly. Scales fusco-brown, ovate-acuminate with wavy margin. Stipes 15-30 cm long, firm erect, stout, stramineous with few ovate-acuminate scales at the base. Fronds far apart. Lamina 24-50 x 9-15 cm, lanceolate, acuminate, deeply cut down to the rachis under a terminal segment in to 25-36 pairs of horizontal segments, margin serrate, texture membranaceous, hairy, under surface of rachis scaly. Venation distinct, areolae uniseriate along the costa, basal areolae having free veinlets, marginal veinlet free. Sori subglobose, sunk, nearer to the costa. Sporangia with 13 annulus cell. Spores yellowish, granulated.

Sari : July September.

Epiphytes or lithophytes, in humus rich moist shaded localities, 1600-2200 m.

Reported by Khullar (1994) from Natha top and Sanasar.

2. *Polypodiodes lachnopus* (Wallich ex Hook.) Ching in Acta Phytotax Sin. 16: 27, 1978; Dixit, Cens. Indian Pterid. 52, 1984; Khullar, Illus. Fern Fl. W. Himal. 1: 151, 1994. *Polypodium lachnopus* Wallich ex Hook., Ic. Pl. t. 952, 1854; Stewart in Bull. Torrey Bot. Club, 72: 423, 1945. *Goniophlebium lachnopus* (Wallich ex Hook.) J. Smith in Hook., Gen. Fil. t. 52, 1840; Bedd., Handb. Ferns Brit. India 319, 1883.

Fig. 9

Rhizomes long, wide-creeping, 4-5 mm thick, densely scaly; scales blackish, fibrillose, shining, hair pointed, linear lanceolate. Stipes articulated on Rhizomes, covered with dark-brown scales. Fronds approximate, simple, lamina narrowly lanceolate, 16-30 x 3-5 cm, pinnatifid, cut down to the rachis, up to 18-36 cm, closely arranged, serrate, subacuminate pinnae; texture membranaceous, yellowish-green, rachis scaly beneath. Venation

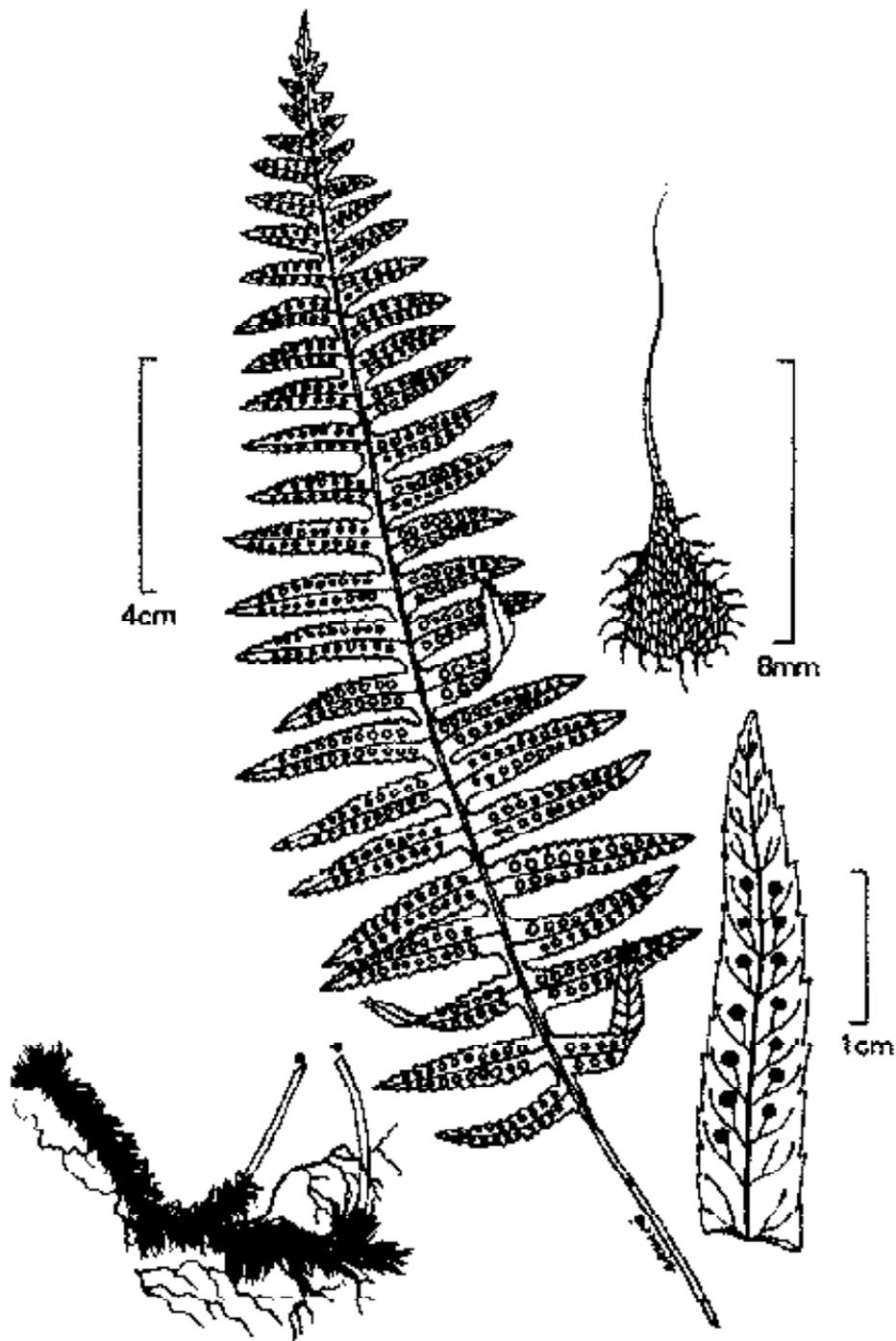


Fig. 9. *Polypodiodes lachnopus* (Wallich ex Hook.) Ching

distinct, uniseriate, marginal veinlets free. Sori rounded, present in single row on either side of the costae, exindusiate. Sporangia with 12-13-celled annulus. Spores hyaline, perisporiate.

Sori : August – October.

Occasional, growing as an epiphytes or lithophytes on tree trunk or on exposed rocks, 1700-2200 m.

Reported by Khullar (1994) from Sanasar.

3. *Polypodiodes microrhizoma* (C.B. Clarke) Ching in Acta Phytotax. Sin. 16: 27. 1978; Dixit, Cens. Indian Pterid. 52. 1984; Khullar, Illus. Fern Fl. W. Himal. 1: 152. 1994. *Polypodium microrhizoma* C.B. Clarke in Hook. & Bak., Syn. Fil. ed 2: 511. 1874; Stewart in Bull. Torrey Bot. Club. 72: 422. 1945. *Goniophlebium microrhizoma* (C.B. Clarke) Bedd., Ferns Brit. India Suppl. 21. t. 384. 1878 & Handb. Ferns Brit. India 322. 1883.

Rhizomes 4 mm thick, wide creeping, clothed with grey-brown ovate-acuminate scales. Stipes 10-22 cm long, naked, shining. Fronds distant, erect; lamina lanceolate, 20-30 cm long, 6-10 cm broad, deeply pinnatifid to the rachis, pinnae 20-25 pairs, lower pair often distant and free, margin serrate; rachis glabrous with smaller and similar scales; texture herbaceous, green. Venation distinct, areolae uniseriate, with a single free veinlet in each areole subtending a sorus, marginal veins free. Sori small, oblong, medial, in 2-rows, one on either side of costa. Sporangia with 13-celled annulus. Spores kidney shaped, perisporiate, light yellow in colour.

Sori : July – September.

Frequent, growing on tree trunks as an epiphytes or lithophyte in shady moist localities, 1600-2200 m.

Reported by Khullar (1994) Natha top – Sanasar and Vaishno Devi area.

6. **PYRROSIA** Mirbel

- 1a. Lamina base unequal, one half ending before another ...1. *P. flocculosa*
 1a. Lamina base equal :
 2a. Sporangial paraphyses dimorphous with
 crisped arms ...3. *P. stictica*
 2b. Sporangial paraphyses without crisped arms ...2. *P. mollis*

1. *Pyrrrosia flocculosa* (D. Don) Ching in Bull. Chinese Bot. Soc. 1: 66. 1935; Nayar & Chandra in Bull. Natn. Bot. Gard. Lucknow 117: 51-54. 1965; Satija & Bir in Bull. Bot. Surv. India 25: 84-85. 1983. *Polypodium flocculosum* D. Don, Prodr. Fl. Nepal. 1: 1825. *Niphobolus flocculosus* (D. Don) Bedd., Ferns Brit. India t. 162. 1867 & Handb. Ferns Brit. India 331. t. 180. 1883.

Rhizomes short-creeping, paleaceous, covered with numerous wiry roots. Scales yellow to golden-brown, linear-lanceolate or subulate. Stipes thick, aggregate, stout with prominent adaxial groove, 3-10 cm long. Fronds approximate in two closely placed rows; lamina lanceolate to oblong-lanceolate, apex acute, acuminate; texture coriaceous, lower surface covered with the thick tomentum of stellate hairs; venation immersed. Veins generally free, simple or forked. Sori small, circular, elevated above the tomentum, arranged in many regular rows. Sporangial paraphyses dimorphic, dark brown. Spores pale-yellow to light brown, bean shaped or elliptical.

Sori : Throughout the year.

Occasional, growing on tree trunks in shady forests. 400-1800 m.

Reported by Nayar and Chandra (1965) from Kashmir Valley (Verinag).

2. *Pyrrrosia mollis* (Kunze) Ching in Bull. Chin. Bot. Soc. 1: 53. 1935; Satija *et al.* in Bull. Bot. Surv. India 25: 76. 1983; Dixit, Cens. Indian Pterid. 55. 1984. *Niphobolus mollis* Kunze in Bot. Zeit. 6: 121. 1848.

Lithophytes or epiphytes. Rhizomes short-creeping, thin, covered with dark brown scales and wiry roots. Stipes subcaespitose. Fronds

oblanceolate, narrowed at base, 8-20 x 0.5-1.5 cm, dorsal surface glabrous, light green, dotted, ventral surface densely tomentose with ferruginous stellate hairs. Veins not prominent. Sori scattered in regular rows on half the length of the frond. Sporangial paraphyses dimorphous. Spores light yellow, oval to elliptical.

Sori : September - June.

Few on shaded rocks or on tree trunks, 700-1500 m.

Reported by Satija *et al.* (1983) from Poonch area.

3. *Pyrrosia stictica* (Kunze) Holtt., Novit. Bot. Inst. Bot. Univ. Carol. Prag. 31. 1968; Khullar, Illus. Ferns. Fl. W. Himal. 1: 169. 1994. *Niphobolus sticticus* Kunze in Linnaea 24: 257. 1851. *Polypodium sticticus* Mett. Poly. 128. No. 260. 1857.

Rhizomes short or short-creeping, thin, covered with dark brown wiry roots and light dark brown scales. Scales, ovate to ovate-lanceolate, fimbriate, apex acute. Fronds aggregate; Stipes 2-7 cm, densely covered by stellate hairs. Lamina lanceolate with acute or acuminate apex, margin entire, gradually attenuate at base, wholly tomentose with ferruginous woolly stellate hairs; texture coriaceous; venation obscure, lateral veins indusiate, more than 10 areolae on each side of midrib, areolae generally free or forked. Sori scattered, in irregular rows. Sporangial paraphyses dimorphous with crisped arms. Spores pale-yellow, oval to elliptical, exine slightly verrucose.

Sori : July - October.

Occasional, Epiphytes or lithophytes on trees or rocks, between 1500-2000 m.

Reported by Khullar (1994) from Poonch, Merimang, Kathua, Kodal.

LYGODIACEAE**LYGODIUM Sw.**

- 1a. Pinnules 1-2 x 3.5 cm, deeply cleft at base;
sterile pinnules not lobed ...1. *L. flexuosum*
- 1b. Pinnules 4 x 0.5 cm, auricle at base; sterile
pinnules 3-5-lobed, central lobe much elongated. ...2. *L. japonicum*

1. *Lygodium flexuosum* (L.) Sw. in Schrad., J. Bot. 1800(2): 106. 1801; Bedd., Handb. Fern. Brit. India 457. f. 283. 1883; C.B. Clarke in Trans. Linn. Soc. London 1: 584. 1880; Dhir, Fern. N. W. Himal. 28. 1980; Dixit, Cens. Indian Pterid. 60. 1984; *Ophioglossum flexuosum* L., Sp. Pl. 1063. 1753.

Rhizomes creeping, glabrous, rooting deeply in soils. Fronds glabrous; fertile fronds unipinnate, pinnae often lobed or variously clefted at the base, terminal lobes elongate, linear-oblong, barren fronds like fertile ones, occupy the terminal portion, margin of the pinnae serrulate, often clefted at the apex, very variable in size, 4-12 x 2-3.5 cm, texture subcoriaceous. Veins prominent, twice forked, free. Sori protruding from the margin of the pinnules, up to 1 cm long.

Sori : September - February.

Rare, in shady forests or ravines, 800 -1200 m.

Reported by Dhir (1980) from Doda (Ramban).

2. *Lygodium japonicum* (Thunb.) Sw. in Schrard., J. Bot. 1800 (2): 106. 1801; C.B. Clarke in Trans. Linn. Soc. London 1: 584. 1880; Bedd., Handb. Ferns Brit. India 452. 1883; Stewart in Bull. Torrey Bot. Club. 72: 424. 1945; Dixit, Cens. Indian Pterid. 60. 1984; Khullar, Illus. Fern. Fl. W. Himal. 1: 177. 1994. *Ophioglossum japonicum* Thunb., Fl. Japan 328. 1784.

Rhizomes creeping, covered with black hairs. Stipes and rachis

scabrous. Fronds pubescent when young, stipitate-pinnate; pinnae ending in a linear, elongated pinnule auricled at base, linear with deltoid base, 1.5-3.5 x 0.5 cm, margin crenate; barren pinnae often bipinnate. Secondary rachis ridged. Fertile pinnae much contracted giving an appearance of dissected lamina. Sporangia conical, green when young, up to 0.4 cm long.

Sori : June - October.

Rare, in open as well as shady forest slopes, 1000-1600 m.

Selected specimens : Jammu : Tawi valley, 1000 m. *Gammie s.n.* (DD).

SINOPTERIDACEAE

- 1a. Sori along the veins from the margin inwards. ...2. *Notholaena*
- 1b. Sori aggregated towards the vein endings :
 - 2a. Indusia usually continuous. ...3. *Pellaea*
 - 2b. Indusia discrete, rarely more or less confluent, but not quite continuous ...1. *Cheilanthes*

1. CHEILANTHES Swartz

- 1a. Farina visibly present on lower surface of lamina :
 - 2a. Costa and costules glabrous :
 - 3a. Scales restricted to the Stipes only, rachis glabrous :
 - 4a. Grows at low altitudes (up to 1500 m); Rhizomes scales bicolorous, farina only on lower surface of lamina ...4. *C. bicolor*
 - 4b. Grows at high altitudes (3500 m); Rhizomes scales concolorous; upper surface of lamina also sprinkled with white farina ...8. *C. grisea*
 - 3b. Scales running to the top of the Stipes or running on to the rachis as well :
 - 5a. Fronds large, 35 cm and above long; stipes thick; few scales on rachis; indusial margin toothed or fimbriate ...3. *C. anceps*

- 5b. Fronds small up to 20 cm long; Stipes thin, fragile; rachis scaly; indusial margin highly lacerate with long projections ...5. *C. brevifrons*
- 2b. Costa and costules scaly :
- 6a. Hairs absent on Stipes, rachis, costa and costules ...2. *C. albomarginata*
- 6b. Hairs present on Stipes, rachis and costa :
- 7a. Stipes, rachis, costa and costules densely hairy forming a woolly rusty-brown surface ...10. *C. rufa*
- 7b. Stipes, rachis, costa and costules very scantily hairy ...7. *C. dubia*
- 1b. Farina absent :
- 8a. Stipes glabrous except for a few broad scales at Stipes base; sori confluent ...6. *C. dathousiae*
- 8b. Stipes and rachis hairy :
- 9a. Ultimate lobes larger, 0.7-1.5 cm long, indusial margin crenulate, never fimbriate ...11. *C. subvillosa*
- 9b. Ultimate lobes small, less than 0.7 cm long; indusial margin highly fimbriate or with long hairs :
- 10a. Indusial margin with long hairs, resulting in a hairy lower surface of pinnules ...9. *C. persica*
- 10b. Indusial margin without hairs, lower surface of pinnules (lobes), glabrous ...1. *C. acrostica*

1. *Cheilanthes acrostica* (Balbis) Tod., Giom. Sci. Nat. Econ. Palermo 1: 215. 1866; Khullar, Illus. Fern Fl. W. Himal. 1: 183. 1994. *Pteris acrostica* Balbis, Elenco 98. 1801. *Cheilanthes pteridioides* (L.) C. Chr., Index Fil. 178. 1905; Stewart in Bull. Torrey Bot. Club. 72: 420. 1945. *Polypodium pteridioides* L., Mart. 307. 1771. **Fig. 10**

Rhizomes short, erect with light brown, concolorous, lanceolate scales. Stipes 1-13 cm long, dark-brown; rachis brown, hairy and scaly. Lamina 2-3 pinnate, 2-15 cm long, 1.5-3 cm broad; farina absent, glabrous; pinnae up to 12 pairs, deltate or lanceolate, alternate, shortly petiolate, ultimate lobes small, less than 0.7 cm long; veins pinnate, 1-2 pairs in a pinnule; costa and costules with light-brown scales. Sori indusiate.

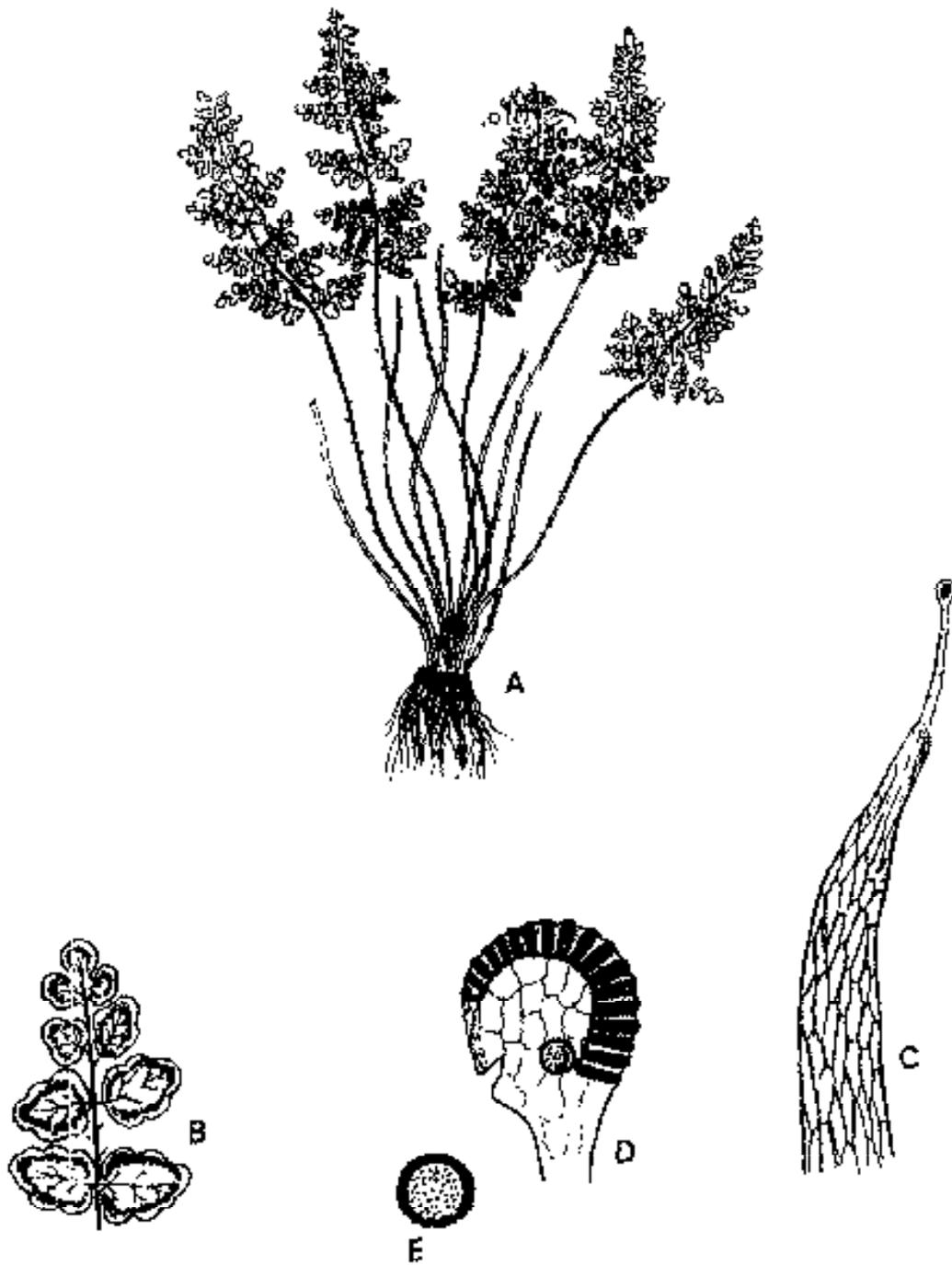


Fig. 10. *Cheilanthes acrostica* (Balbis) Tod.

marginal; indusia without hairs, light-brown, margin hairy, fimbriate. Spores light-brown, tetrahedral to globose.

Sori : March - September.

Frequent, growing in shady dry slopes, 1000-1800 m.

Selected specimens : Doda; Kistwar, Archi-Chenab, *Uniyal*, 80379 (BSD).

2. *Chellanthes albomarginata* C.B. Clarke in Trans. Linn. Soc. London 1: 456. 1880; Khullar, *Illus. Fern Fl. W. Himal.* 1: 185. 1994. *C. farinosa* Kaulf. var. *albomarginata* (C.B. Clarke) Bedd., *Handb. Ferns Brit. India Suppl.* 22. 1892. *Aleuritopteris albomarginata* (C.B. Clarke) Ching in *Hong Kong Nat.* 10: 199. 1941.

Rhizomes short, erect, thick with dark-brown, bicolorous, lanceolate, scales at apex. Stipes 3-16 cm long, equal or shorter than the lamina, densely scaly; rachis scaly. Lamina bipinnate, up to 18 cm long, 5-15 cm broad. Lower surface of young fronds generally thinly farinose; farina yellowish white, turning pale on maturity, upper surface dark green, glabrous; pinnae 8-12 pairs, margin deeply lobed to the costa; veins pinnate, 3-4 pairs in a pinnae; lobes scaly, costa and costules scaly. Sori indusiate, marginal; indusia light-brown, triangular. Spores dark-brown, tetrahedral to globose, exine smooth.

Sori : July - December.

Common on moist humus rich exposed slopes or walls, 1500-2500 m on the outer ranges.

Selected specimens : Udhampur : Sangihat-Bhairon temple, *Uniyal* 86696; Vaishno Devi, *Uniyal* 77458 (BSD).

3. *Chellanthes anceps* Blanford in J. Simla Nat. Hist. Soc. 25: 6. 1886; Khullar, *Illus. Fern Fl. W. Himal.* 1: 188. 1994. *C. farinosa* var. *anceps* (Blanford) Blanford in J. Asiat. Soc. Bengal 57: 301. 1888.

Aleuritopteris farinosa var. *anceps* Ching in Hong Kong Nat. 10: 201. 1941. *A. anceps* (Blanford) Panigrahi in Bull. Bot. Surv. India 2: 321. 1961.

Sori : July - January.

Rare, or occasional, on exposed rocks along the road sides, near the cultivated fields, 800-1800 m.

Reported by Khullar (1994) from Poonch, Patnitop, Kathua, Basohli.

4. *Cheilanthes bicolor* (Roxb.) Fraser-Jenkins in Pak. Syst. 5(1-2): 94. 1991-92; Khullar, Illus. Fern Fl. W. Himal. 1: 192. 1994. *Pteris bicolor* Roxb. in Griffith, Calcutta J. Nat. Hist. 4: 507. 1844. **Fig. 11**

Rhizomes short, erect, apex scaly, scales dark-brown, bicolorous. Stipes generally longer than the lamina, 15-25 cm long, brownish black, glossy thick; scales generally restricted to Stipes base, bicolorous or concolorous. Lamina 1-2 pinnate, 9-20 cm long, 5-10 cm broad, pinnatifid at apex, lanceolate, pentagonal or narrowly lanceolate, lower surface farinose; farina whitish or greenish-white, upper surface glabrous; pinnae 8-10 pairs, 2-5 cm long, 2-3.5 cm broad, alternate or subopposite, sessile, margin lobed to the costa; lobes obtuse or acute, margin deeply lobed to the costa, basiscopis lobes longer than the acroscopic ones; veins pinnate, 3-4 pairs in each lobe, simple or forked; costa and costules glabrous. Sori indusiate, marginal; indusia light brown. Spores dark-brown, globose to tetrahedral.

Sori : Throughout the year.

Common, growing on walls, road cutting slopes or forest floors in shady situations, (600-1500 m).

Selected specimens : Jammu : Tawi Valley, G.A. Gammie s.n. (DD); Kathua; Manser lake, Hajra 82461 (BSD); Jammu-Udhampur Road, Rao 63702 (BSD); Udhampur, B.P. Uniyal 77345 (BSD).

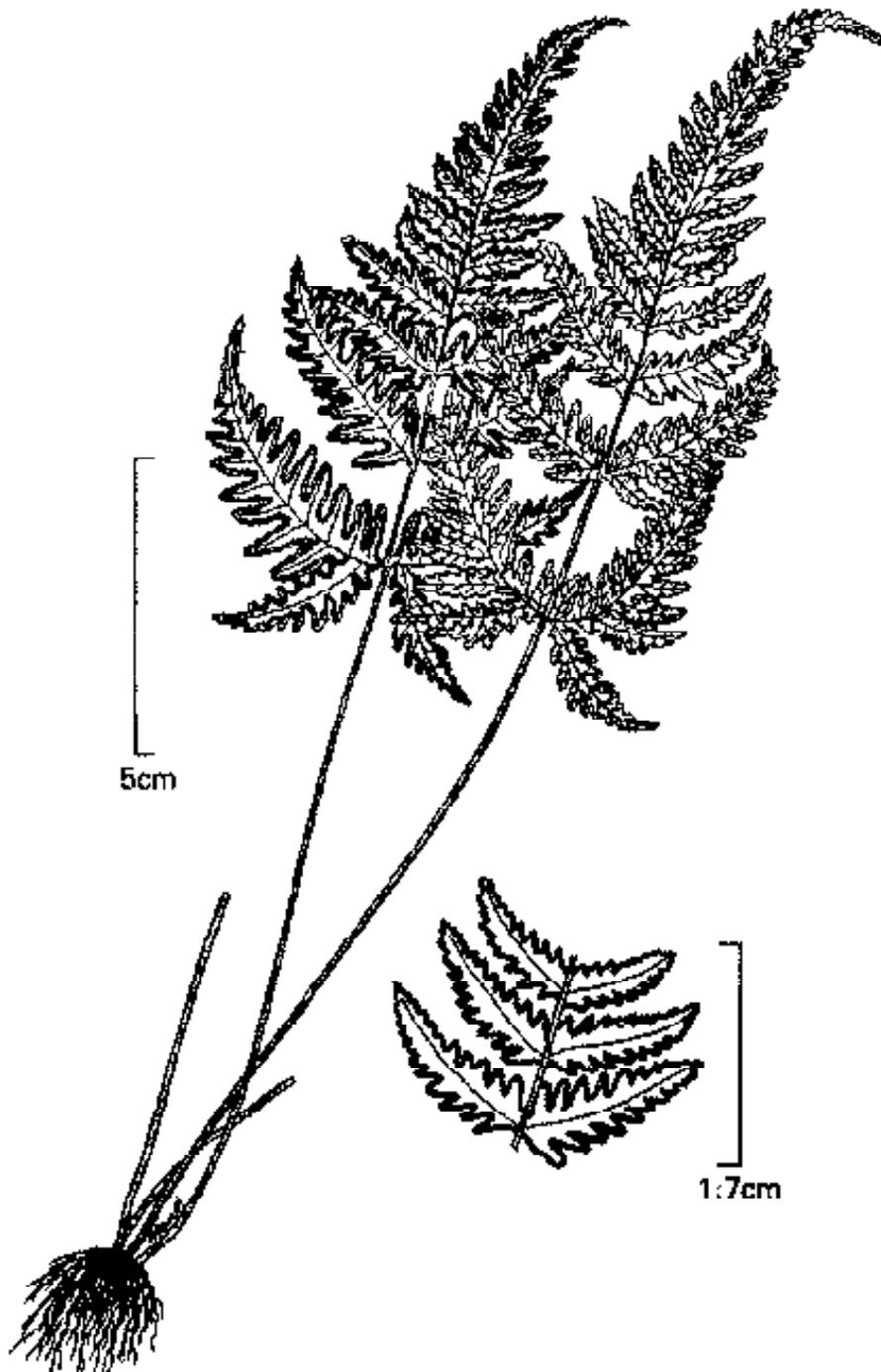


Fig. 11. *Cheilanthes bicolor* (Roxb.) Preser-Jenkins

5. *Chellanthes brevifrons* (Khullar) Khullar in Indian Fern J. 1: 90. 1984 & Illus. Fern Fl. W. Himal. 1: 193. 1994. *C. anceps* Blanford var. *brevifrons* Khullar in Amer. Fern J. 66: 24. 1976. *Aleuritopteris pseudofarinosa* Ching & S.K. Wu in Acta Phytotax. Sin. 19: 72. 1985.

Rhizomes short, erect, apex scaly; scales brown, bicolorous, linear lanceolate. Stipes 3.5-5.5 cm long, generally shorter or equal to the lamina, dark brown, glossy, scaly; scales distinctly bicolorous; rachis with concolorous scales. Lamina pinnate or bipinnate, 5.5-8 cm long, 3-3.5 cm broad, more or less oblong-lanceolate, apex acuminate; texture thick, compact, lower surface farinose; farina bright white, upper surface dark green, glabrous; pinnae 6-9 pairs, 2.5-3 cm long, 1.5-2.5 cm broad, broadest above the middle, subopposite to alternate, sessile, lowest pinnae distant, margin deeply lobed, to the costa; veins pinnate, 2-3 pairs in each pinna lobe, simple, rarely forked; costa and costules glabrous. Sori indusiate, marginal; indusia light-brown. Spores brown, globose, perinate, reticulate.

Sori : July - November.

Fairly common, on exposed rocky hill slopes or in shady places, 1500-1800 m.

Reported by Khullar (1984) from Poonch, Patnitop-kud. Sodh Mahadev.

6. *Cheilanthes dalhousiae* Hook., Sp. Fil. 2: 80. t. 78. 1852; Dixit, Cens. Indian Pterid. 64. 1984; Khullar, Illus. Fern Fl. W. Himal. 1: 199. 1994. *C. farinosa* var. *dalhousiae* (Hook.) C.B. Clarke in Trans. Linn. Soc. London 1: 457. 1880; Bedd., Handb. Ferns Brit. India : 93. 1883. *Aleuritopteris dalhousiae* (Hook.) Ching in Hongkong Nat. 10: 203. 1941. *Leptolepidium dalhousiae* (Hook.) Hsing & S.K. Wu, Fl. Yunannica 1: 116. 1979; Ching & S.K. Wu, Fl. Xiziangica 1: 85-86. 1983; Panigrahi *et al.* in Indian J. For. 14: 67. 1991.

Rhizomes short, thick, erect, ascending, scaly; scales dark brown, concolorous or bicolorous, linear-lanceolate. Stipes 10-20 cm long, shorter than the lamina, dark brown, sparsely scaly at base, scales brown; rachis

glossy, glabrous. Lamina 1-2-pinnate, 8-20 cm long, 4-7 cm broad, deltate, oblong or sub-deltate, lanceolate. texture herbaceous or sub-membranaceous; farina absent, glabrous; pinnae 10-15 pairs, 2-3 cm long and up to 2.5 cm broad at base, sub-opposite to alternate, margin deeply lobed, lowest pair of pinnae the largest. Veins 3-4 pairs in each pinnule, generally simple; costa and costule glabrous. Sori indusiate, almost confluent except at sinus, marginal; indusia light brown. Spores dark brown, globose, tetrahedral.

Sori : March - September.

Occasional, in damp, moist and shady places in forests, 1600-2500 m.

Selected specimens : Udhampur : Ghordi village, *Swamy & Gupta* 585 (BSD).

7. *Cheilanthes dubia* Hope in J. Bombay Nat. Hist. Soc. 12: 528, 1899; Khullar, *Illus. Fern Fl. W. Himal.* 1: 201, 1994. *Aleuritopteris dubia* (Hope) Ching in Hongkong Nat. 10: 200, 1941.

Rhizomes erect, apex densely scaly; scales dark-brown, bicolorous, linear-lanceolate. Fronds of 2 types; sterile generally with a broad herbaceous lamina without farina but with broad pinnae and lobes, secondary rachis and costae not hairy, sparsely with brown scales; the second type having lamina narrow, coriaceous, pinnae and segments shorter and narrow. Stipes 6-15 cm long, chestnut brown, thick, with light brown hairs, light-brown or dark-brown scales; rachis with pale brown scales and hairs. Lamina bipinnate, 15-25 cm long, 7-10 cm broad, lanceolate, hairy, lower surface farinose; farina white, or may be absent in the broad herbaceous type; pinnae 9-12 pairs, 6-7 cm long, 5 cm broad, lanceolate, alternate, lobed 2/3rd to the costa, but in lower 1 or 2 pairs deeply lobed to the costa. Veins pinnate in pinnae lobes, simple or forked. Costa and costules scantily hairy or without hairs; scales light brown. Sori indusiate, marginal; indusia pale brown. Spores brown, globose, perinate.

Sori : June - September.

Occasional, in shady places, around 1200 m altitude.

Selected specimens : Poonch : Kolai, 2000-1500 m. Vohra & Naithani 78214 (BSD).

8. *Cheilanthes grisea* Blanford in Simla Nat. Hist. Soc. 25/6. 1886; Hope in J. Bombay Nat. Hist. Soc. 13: 250. 1900; Khullar, Illus. Fern Fl. W. Himal. 1: 205. 1994. *Aleuritopteris farinosa* var. *grisea* (Blanford) Ching in Hongkong Nat. 10: 202. 1941.

Rhizomes ascending, apex scaly; scales light-brown, linear-lanceolate. Stipes 12 cm long, reddish glabrous. Lamina 1-2 pinnate, 9-10 cm long, 5-6 cm broad, lanceolate to ovate-lanceolate, texture herbaceous, lower surface farinose; farina thick, greyish-white, upper surface sparsely farinose; pinnae 5-6 pairs, up to 2 cm long and 1.5 cm broad, triangular, alternate, deeply lobed to the costa or almost becoming pinnate. Veins pinnate, 4-5 pairs in a pinna lobe or pinnule, simple or forked; costa and costules glabrous. Sori indusiate; indusia light-brown. Spores dark-brown, globose, perinate, verrucose to spinulose.

Sori : July - September.

A high altitude fern, between 2600-3000 m, on shaded rocks.

Reported by Khullar (1994) from Ladakh.

9. *Cheilanthes persica* (Bory) Mett. ex Kuhn, Fil. Afr. 73. 1868; Stewart in Bull. Torrey Bot. Club 72: 420. 1945; Dixit, Cens. Indian terid. 65. 1984; Khullar, Illus. Fern Fl. W. Himal. 1: 209. 1994. *C. szovitsii* Fisher Meyer in Bull. Soc. Mossc. 6: 260. 1833; Bedd., Handb. Ferns Brit. India 89. 1883. *Notholaena persica* Bory, Bel. Voy. Bot. 2: 23. 1833.

Fig. 12

Rhizomes short, erect, apex with brown, concolorous, linear-lanceolate scales. Stipes 5-10 cm long with woolly hairs and brown scales; rachis with yellowish brown scales. Lamina 2-3 pinnate, 8-15 cm long and up to 3.5 cm broad, oblong-lanceolate; texture sub-coriaceous, lower surface hairy, hairs white; upper surface slightly tomentose; farina absent; pinnae 12 pairs, deltate, pinnules or lobes linear-oblong. Ultimate lobes



Fig. 12. *Cheilanthes persica* (Bory) Mett. ex Kuhn

small, rounded. Veins free: costa and costules glabrous. Sori indusiate. Spores dark-brown, crenulate to granulate.

Sori : August - October.

Rare, on dry rock hill slopes, 1500-2500 m.

Selected specimens : Kashmir : Jhelum valley 1700-2000 m. *Duthie* 10919 (DD).

10. *Cheilanthes rufa* D. Don, Prodr. Fl. Nepal. 16. 1825; Bedd., Ferns Brit. India t. 144. 1867 & Handb. Ferns Brit. India Sppl. 94. 1892; Khullar, Illus. Fern Fl. W. Himal. 1: 211, 1994. *Aleuritopteris rufa* (D. Don) Ching in Hongkong Nat. 10: 247. 1941.

Rhizomes short, erect, apex scaly; scales brown, bicolorous, lanceolate. Stipes 3-8 cm long, shorter than the lamina, densely hairy and scaly, hairs rusty brown; rachis woolly and scaly, hairs and scales as on Stipes. Lamina 1-pinnate, 4-25 cm long, 2.5-6 cm broad, lanceolate or ovate or oblong-lanceolate; texture herbaceous, lower surface densely farinose and hairy; farina white to pale yellow, upper surface glabrous or with a few hairs; pinnae 10-12 pairs, 2-2.5 cm long and up to 1 cm broad, lanceolate, alternate, middle pinnae generally largest, up to 3.5 cm long; margin deeply lobed to the costa; lobes never free, apex rounded. Veins free, simple, 2-3 pairs in a pinna lobe; costa and costules hairy. Sori indusiate, marginal, indusia light-brown. Spores dark brown, globose, perinate.

Sori : September - March.

Frequent, growing on limestones rock crevices, 1000-1500 m.

Reported by Khullar (1994) from Jammu division (Vaishnodevi, Ardhkumari).

11. *Cheilanthes subvillosa* Hook., Sp. Fil. 2: 87. t. 98. B. 1852; Bedd., Handb. Ferns Brit. India 93. 1883; Hope in J. Bombay Nat. Hist.

Soc. 13: 242, 1900; Khullar, Illus. Fern Fl. W. Himal. 1: 212, 1994. *Ateuritopteris subvillosa* (Hook.) Ching in Hongkong Nat. 10: 204, 1941. *Leptolepidium subvillosum* (Hook.) Hsing et S.K. Wu, Fl. Xizangica 1: 85, 1983; Panigrahi et al. in Indian J. For. 14: 68, 1991. Fig. 13

Rhizomes short, ascending, apex scaly; scale pale-brown, concolorous. Stipes densely tufted, 6-10 cm long, shorter than the lamina, with lanceolate, acuminate scales below; main rachis glabrous beneath. Lamina 1-2 pinnate, 9-18 cm long, 4-5 cm broad, lanceolate; texture herbaceous, green; farina absent, lower surface hairy, upper surface glabrous; pinnae 8-10 pairs, 3 cm long, 2 cm broad, lanceolate, alternate, sessile, margin deeply lobed to the costa or becoming pinnate in the lower pinnae, lobes oblong or round or obtuse; middle pinnae of the frond the largest and lower usually shorter. Veins free, 4-5 pairs in a pinnule, simple or forked; costae and costules hairy. Sori indusiate, marginal; indusia light-brown. Spores light brown, tetrahedral.

Sori : August - October.

Generally growing at higher altitude, 2100-3000 m, on rocks or walls.

Reported by Hope (1900) from Kashmir without giving definite locality.

2. NOTHOLAENA R. Br.

- | | |
|--|----------------------------|
| 1a. Lamina scaly on lower surface, upper surface glabrous. | ...1. <i>N. lanuginosa</i> |
| 1b. Lamina scaly on both surfaces | ...2. <i>N. marantae</i> |

1. *Notholaena lanuginosa* (Desv.) Desv. ex Poiret, Enc. Bot. Suppl. 4: 110, 1816; Khullar, Illus. Fern Fl. W. Himal. 1: 219, 1994. *Acrostichum lanuginosum* Desv., Fl. Atlant. 2: 400, 1800. *Notholaena vellea* (Ait.) Desv. in J. de Bot. Appl. 1: 93, 1883; C.B. Clarke in Trans. Linn. Soc. London 1: 567, 1880; Bedd., Handb. Ferns Brit. India 375, 1883. *Cosentinia vellea* ssp. *vellea* (Ait.) Tod., Giorn. Sc. nat. Econ. Palermo 1: 219, 1866.

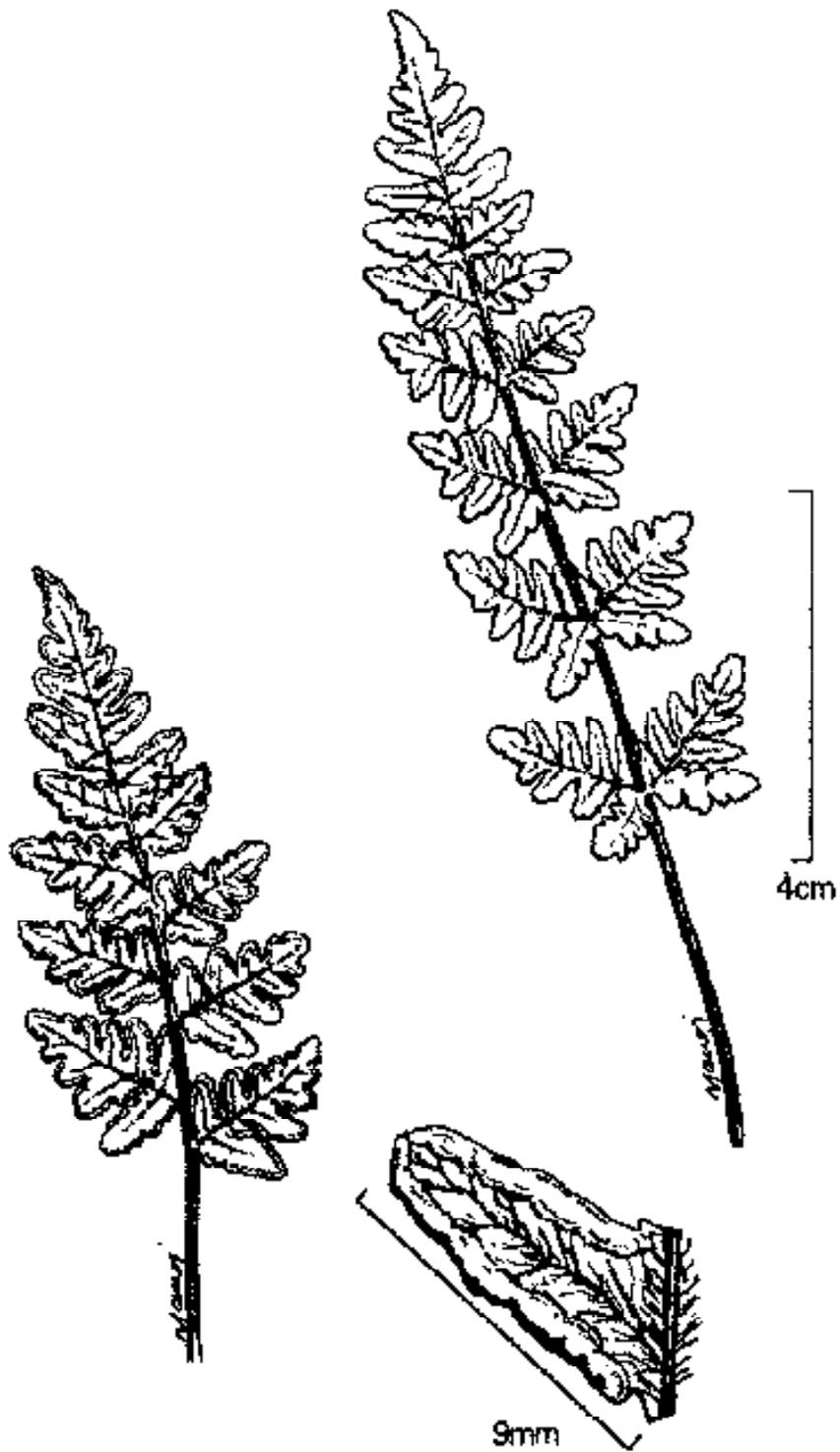


Fig. 13. *Cheilanthes subvillosa* Hook.

Rhizomes short, erect, scaly. Stipes short, up to 3 cm long, brown with light brown hairs and few scales; rachis similar to Stipes, densely hairy. Lamina pinnate, 15-25 cm long 1.5-3.5 cm broad, lanceolate, texture thick, herbaceous; lower surface densely hairy, hairs woolly; pinnae 20 pairs or more, 1-2 cm long, 0.5 cm broad, alternate, sessile, oblong- deeply lobed to the costa. Veins free. Sori exindusiate, present along the veins, completely hidden by hairs. Spores dark brown, tetrahedral.

A rather rare fern in the West Himalaya, 900-3600 m.

Reported by Beddome (1833) from Kashmir.

2. *Notholaena marantae* (L.) Desv. in J. de Bot. Appl. 1: 92. 1813. *non* R. Br.; C.B. Clarke in Trans. Linn. Soc. London 1: 567. 1880; Bedd., Handb. Ferns Brit. India : 373. 1883; Khullar, Illus. Fern Fl. W. Himal. 1: 220. 1994. *Acrostichum marantae* L., Sp. Pl. 2: 1071. 1753. **Fig. 14**

Rhizomes short-creeping, ascending with densely light-brown scales. Stipes 4-8 cm long, dark-brown or blackish with light-brown scales; rachis similar to the Stipes with light-brown scales and fibrillose. Lamina pinnate to bipinnate, 8-10 cm long, 2-3 cm broad, triangular lanceolate, texture coriaceous, lower densely scaly, upper surface glabrous, pinnae 7-10 pairs; 1.5-2 cm long, up to 1 cm broad, pinnae margin deeply lobed to the costa; veins pinnate in pinnules or lobe, simple or dichotomously forked. Sori exindusiate along the veins. Spores dark-brown.

Sori : August - October.

Rare, at 3000 m and above, on the exposed rocks.

Reported by C.B. Clarke (1980) and Beddome (1883) from Kashmir area.

3. *PELLAEA* Link.

***Pellaea nitidula* (Wallich ex Hook.) Hook. & Baker**, Syn. Fil. 149. 1867; C.B. Clarke in Trans. Linn. Soc. London 1: 460. 1880; Bedd.,

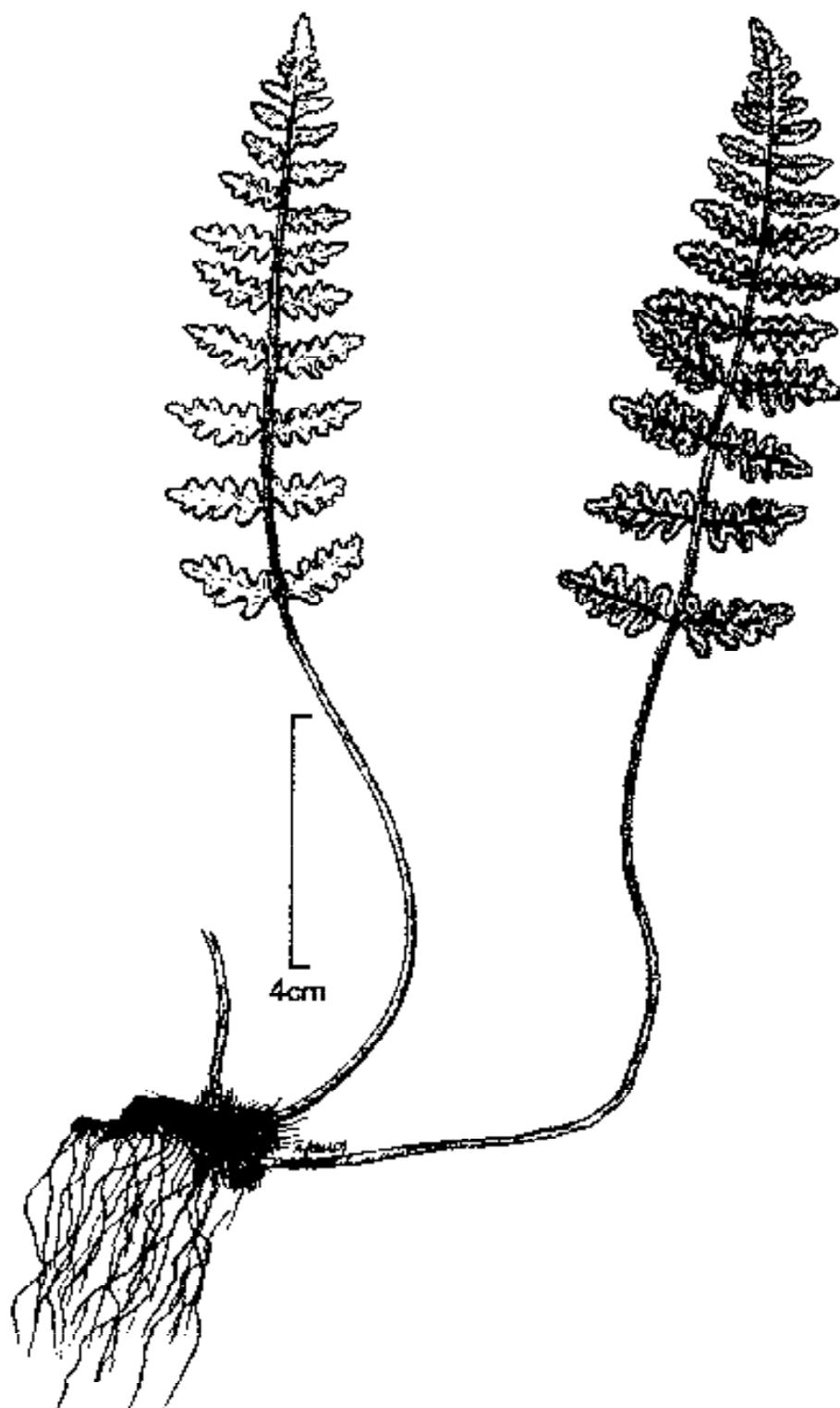


Fig. 14. *Notholaena marantae* (L.) Desv.

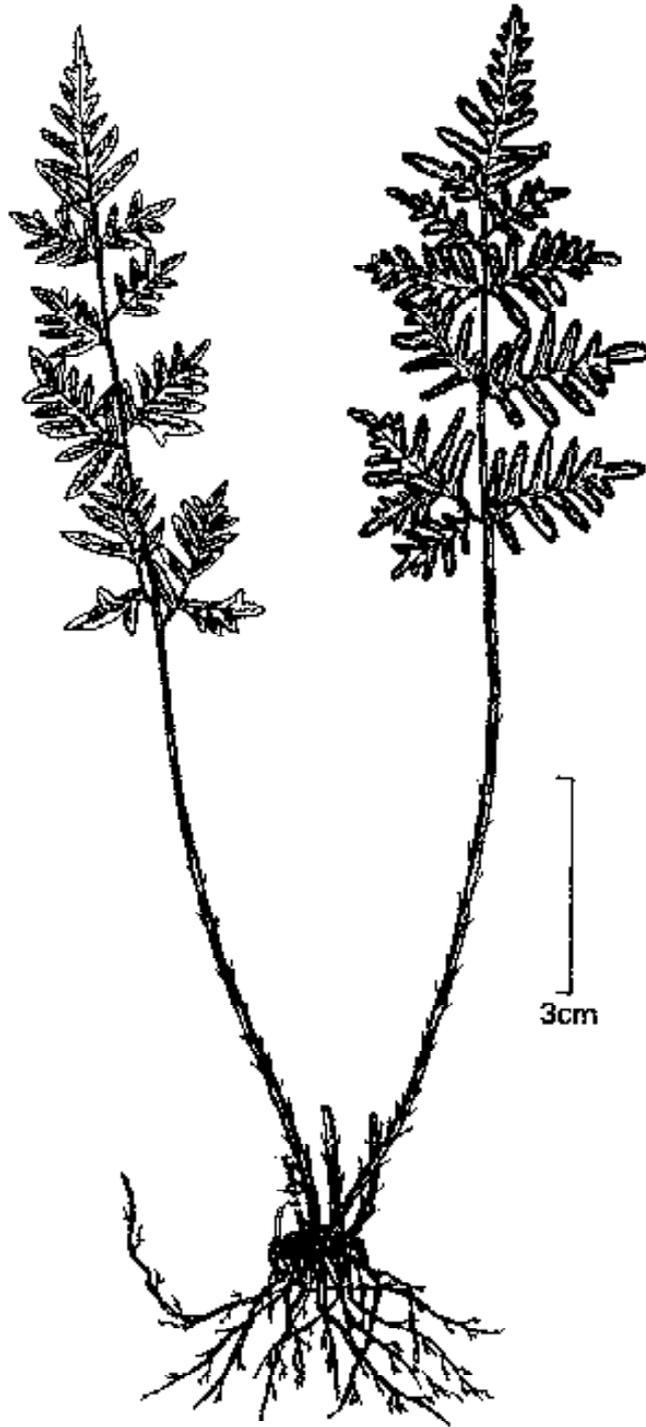


Fig. 15. *Pellaea nitidula* (Wallich ex Hook.) Hook. & Baker

Handb. Ferns Brit. India 101. 1883; Khullar, Illus. Fern Fl. W. Himal. 1: 225. 1994. *Cheilanthes nitidula* Wallich ex Hook., Sp. Fil. 2: 112. 1852. *Mildella nitidula* (Wallich ex Hook.) Hall & Lelling, in Amer. Fern J. 57: 113. 1967. Fig. 15

Rhizomes short-creeping or ascending with dark-brown, bicolorous scales. Stipes 5-15 cm long, brown, glossy, upper surface hairy; scales light-brown. Lamina 2-3 pinnate, 4-10 cm long, 4-6 cm broad, deltate or ovate-lanceolate or lanceolate; texture subcoriaceous, glabrous; pinnae 4-5 pairs, 3 cm long, up to 1.5 cm broad, alternate, petiolate, sessile; terminal lobes longer than the lateral lobes; pinnules simple, linear; veins pinnate in pinnules, up to 8 pairs in a pinnule, costae and costules glabrous. Sori indusiate, marginal; indusia light-brown. Sproes dark brown, globose.

Sori : July - October.

Frequent, between 1500-2400 m, in rock crevices.

Selected specimens : Udampur : Jekher forest, S. Kumar 81382 (BSD); Poonch; Rattan pir, 2000 m, G.A. Gammie s.n., Pirpanjal, 2600 m. G.A. Gammie s.n. (DD). Kistwar, C.B. Clarke 31337 (CAL).

CRYPTOGRAMMACEAE

- 1a. Fronds small, dimorphic. Sori rounded or oblong ...1. *Cryptogramma*
 1b. Fronds medium size, tripinnate or more compound.
 Sori not rounded ...2. *Onychium*

1. CRYPTOGRAMMA R. Br.

- 1a. Rhizomes short, ascending; Stipes fascicular ...1. *C. brunoniana*
 1b. Rhizomes thin, long-creeping; Stipes remote ...2. *C. stelleri*

1. *Cryptogramma brunoniana* Wallich ex Hook. & Grev., Icon. Fil. t. 158. 1829; Bedd., Ferns Brit. India t. 164. 1866; Dixit, Cens. Indian Pterid, 66. 1984. *C. crispa sensu* Hook. & Bak., Syn. Fil. 144. 1868 p.p. C.B. Clarke in Trans. Linn. Soc. London 1: 459. 1880; Bedd., Handb.

Ferns Brit. India 98. t. 50. 1883. *C. crispa* f. *indica* Hook., Sp. Fil. 2, 129. 1858. Fig. 16

Terrestrials or lithophytes, 8-13 cm high. Rhizomes short or creeping, ascending, scaly. Stipes tufted, stipes of fertile fronds larger than sterile one. Fertile fronds 5-10 cm long, pod-shaped, 3-4 pinnatifid. Sterile fronds smaller, ultimate pinnules elliptic, dentate. Veins free. Sori submarginal, brown, on distal ends of veins. Spores tetrahedral.

Sori : June - September.

Frequent in alpine regions, grows in rock crevices or at the base of huge boulders, around 3000 m and above.

Selected specimens : Baramula : Mitchal area, Wadhwa 84185 (BSD); Doda : Seoj-Kailash on way, Vohra & Naithani 82983 (BSD); Gulmarg, 2700-3000 Duthie 11387 (CAL).

2. *Cryptogramma stelleri* (Gmel.) Prantl in Engl. Jahrb. 3: 413. 1882; Stewart in Bull. Torrey Bot. Club. 72: 448. 1945; Dixit, Cens. Indian Pterid. 67. 1984. *Pteris stelleri* Gmel. in Nov. Comm. Pter. 12: 515 t. 12.f.1. 1768. *Pellaea gracilis* Hook., Sp. Fil. 2: 138. t. 133 B. 1858; Bedd., Handb. Ferns Brit. India 100. f. 51. 1883. *P. stelleri* Baker, Syn. Fil. ed. 1, 453. 1868.

Lithophytes, up to 15 cm high. Rhizomes wiry, creeping. Stipes scattered, slender up to 8 cm long, naked, pale brown, with few linear pale-brown scales. Fronds 5-10 x 2-4 cm, lanceolate-ovate, tripinnatifid. Fertile pinnules linear oblong, yellowish-green, sterile pinnules ovate-crenate. Veins free or visible. Sori submarginal, on distal ends of veins. Spores tetrahedral, tuberculate.

Sori : August - September.

Occasional, growing in moist shady rock crevices of the alpine regions, 3100-4300 m.

Selected specimens : Ladakh : Kargil-Panikhar, Chowdhery & Uniyal 85922 (BSD); Baramula; Barnai, Wadhwa 85068 (BSD); Amarnath

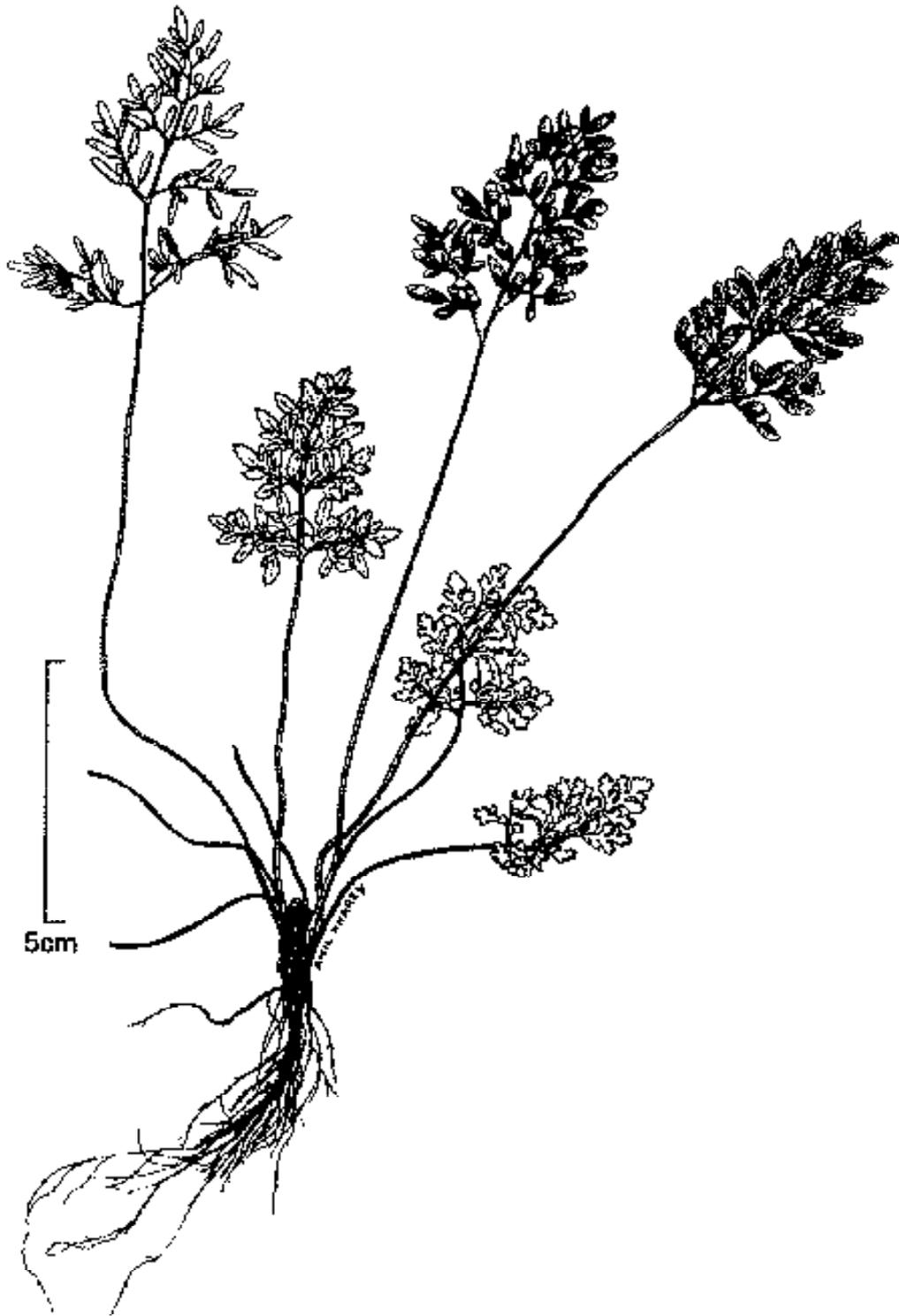


Fig. 16. *Cryptogramma brunoniana* Wallich ex Hook. & Grev.

(on way) *N.C. Nair* 37043 (BSD); Sheshnag, 4000 m, *Dahie* 13330 (DD); Sonamarg, 2800-3300 m, *G.A. Gammie* Acc. No. 7622 (CAL).

2. ONYCHIUM Kaulf.

- 1a. Rhizomes short, ascending; Stipes base straw coloured Sori up to 1.5 cm long ...4. *O. siliculosum*
- 1b. Rhizomes creeping; Stipes base dark-brown or black. Sori smaller:
- 2a. Stipes base dark reddish brown; lamina coriaceous; pinnules lanceolate, tip acute ...3. *O. lucidum*
- 2b. Stipes base black in colour, lamina herbaceous, pinnules tip bifid:
- 3a. Plants turned pale yellow when dry; pinnules tip fragile ...2. *O. fragile*
- 3b. Plants remain pale-green, when dry; pinnules tip bifid ...1. *O. contiguum*

1. *Onychium contiguum* Wallich ex Hope in J. Bombay Nat. Hist. Soc. 13: 444. 1901; Khullar & Sharma in Aspect Pl. Sci. 3: 81. 1980; Dixit, Cens. Indian Pterid. 67. 1984. *Cheilanthes contiguum* Wallich, List No. 72. 1828 (*nom. nud.*). *Onychium japonicum* var. *multisectum* Bedd., Handb. Ferns Brit. India Suppl. 23. 1892.

Terrestrials. Rhizomes long, creeping, thick, dictyostelic with sclerotic patches in the ground tissues. Fronds large, lax or compact, 40-50 cm long, stipes as long as lamina, stramineous, blackish and scaly at base. Lamina pentagonal or spreading, 5 or more pinnate. Infertile apex of the fertile pinnules apiculate. Sori linear; indusia contiguous, overlapping on the costule, greyish, do not out open at maturity. Spores brown, tuberculate or rugose, sparsely reticulate.

Sori : August - October.

Common, on forest floor in shady moist places, 1200-2700 m.

Selected specimens : Jammu : Vaishno Devi, *Uniyal* 77346 (BSD); Poonch : Loran, 2000 m, *Vohra & Naithani* 78322 (BSD), Kathua :

Masaditop, Hajra 82387 (BSD); Chenab Valley : Batote, T.A. Rao 7454 (BSD); Pir Panjal *Gammie* Acc. No. 7470 (CAL); *s. loc.*, Vohra & Wadhwa 469 (CAL).

2. *Onychium fragile* Verma & Khullar in *Nova Hedw.* 9(1-4): 85, 1965; Khullar & Sharma in Pangtey & Joshi, *West. Himal. Env. Probl. Devel.* 1: 320, 1987.

Terrestrials or lithophytes, up to 30 cm high. Rhizomes short, creeping, apex clothed with brown, lanceolate scales. Fronds small, more or less compact. Stipes thin, fragile, pale straw-coloured, invariably black at base. Lamina up to 10 cm long (nearly as long as the Stipes), 4-pinnate at the base, 3-pinnate above; primary pinnae 5-8-jugate, attenuate, basal pair the largest, secondary pinnae deltoid. Veins fine, one to each segment. Sori linear, 5-11. Sporangia on each side. Indusium partially open out at maturity. Spores large, tetrahedral.

Sori : August - October.

Occasional, 1700-2200 m, growing on rocky moist hill slopes.

Reported by Khullar and Sharma (1980) from Patnitop area.

Note : This species belong to *Onychium contiguum* complex and differs from typical *O. contiguum* in its very small size, delicate in texture and never forms colonies, nature of indusium, infertile segments and spores. The typical *O. contiguum* is diploid sexual while *O. fragile* is triploid apogamous.

3. *Onychium lucidum* (D. Don) Spring, *Syst. Veg.* 4: 66, 1827; Khullar & Sharma in *Asp. Pl. Sci.* 3: 85, 1980; Mehra & Bir in *Res. Bull. Panjab Univ. (N.S.)* 15: 108, 1964; Dixit, *Cens. Indian Pterid.* 67, 1984. *Leptostegia lucida* D. Don, *Prodr. Fl. Nepal.* 14, 1825. **Fig. 17**

Terrestrials, 40-50 cm high. Rhizomes long-creeping, thick, solenostelic, densely scaly. Scales light-brown, lanceolate, margin entire. Fronds subcoriaceous, 20-30 cm long, ovate. Stipes thick, tufted 10-15 cm long, stout and erect, rufo-brown, few small scales at base. Lamina

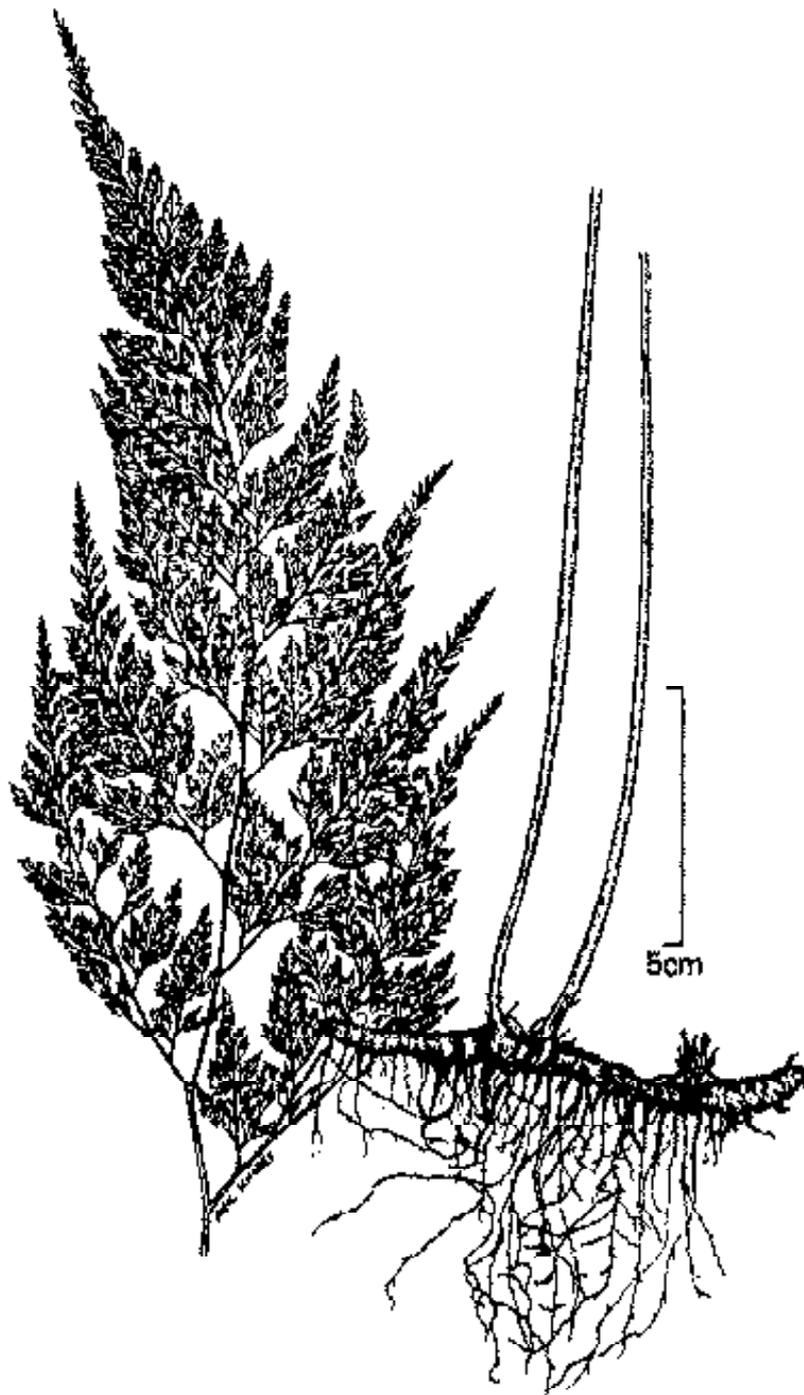


Fig. 17. *Onychium lucidum* (D. Don) Spring

4-pinnate, lower pinnae lanceolate deltoid. Vein ends clavate; infertile apex of the fertile segment mucronate; sterile segment with acute teeth on the lobes. Indusia brown. Spores brown to dark brown, tetrahedral, broadly reticulate.

Sori : September - March.

Frequent, in rocky and shady hill slopes, 1200-1800 m.

Selected specimens : Doda : Bhaderwah, Vohra & Naithani 82773 (BSD).

4. *Onychium siliculosum* (Desv.) C. Chr., Index Fil. 469. 1906; Ito in Hara, Fl. E. Himal. 464. 1966; 2: 206, 1971; Khullar, Illus. Fern Fl. West Himal. 243. 1994; Chandra, Ferns India, 31. 2000. *Pteris siliculosum* Desv., Ges. Freunde Berlin Mag. 5: 324. 1811. *Onychium auratum* Kaulf., Enum. 144. 1824.

Rhizomes long, always surface creeping, less than 8 mm in circumference, scaly; scales smooth margined, lanceolate. Stipes glabrous, double grooved, pale yellow in colour, about 25 cm long. Lamina deltoid, 3-4-pinnate, slightly dimorphic; fertile lamina larger in size; pinna arranged alternately, deeply dissected into lobes, lobe tip bifid, each lobe get a single vein. Sori up to 1.5 cm long, pale yellow in colour, indusiate, indusium margins entire. Spore round, yellowish brown in colour.

Reported by Chandra (2000).

HYPOLEPIDACEAE

HYPOLEPIS Bernh.

Hypolepis punctata (Thunb.) Mett. ex Kuhn, Fil. Afr. 120. 1868; Khullar, Illus. Fern Fl. W. Himal. 1: 250. 1994; Stewart in Bull. Torrey Bot. Club 72: 411. 1945. *Polypodium punctatum* Thunb., Fl. Japan 337. 1784. *Polypodium rugulosum sensu* Bedd., Ferns South. India t. 170. 1883; C.B. Clarke, Trans. Linn. Soc. London 1: 546. 1880. *Phegopteris punctata*

Mett., Ann. Lugd. Bot. 1: 222. 1864; Bedd., Handb. Ferns Brit. India 295. 1883.

Rhizomes long-creeping, slender, short-hairy without scales. Fronds distant, erect, pale-green, up to 125 cm long. Stipes hairy, 20-50 cm long. Rachis and costa bearing short, crisp hairs on both surfaces. Lamina deltoid, deeply quadripinnatifid; lower pinnae the largest; opposite and upper pinnae are smaller, alternate; ultimate pinnules oblong, apex rounded. Sori intermarginal; sporangia with 16, celled annuli. Spores oblong, spinulose.

Sori : Throughout the year.

Common, along the stream beds or in swampy forests, 1200-2000 m.

Reported by Stewart (1945) from Kistwar, Ramsu and Patnitop, and Khullar (1994) from Kathua (Bani).

PTERIDIACEAE

PTERIDIUM Gleditsch ex Scop.

Pteridium aquilinum (L.) Kuhn, Deck Reisen 3 Bot. 1. 1879 var. *wightianum* (Ag.) Tryon in Rhodora 43: 22. 1941; Khullar, Illus. Ferns Fl. W. Himal. 1: 254. 1994. *Pteris aquilina* L., Sp. Pl. 2: 1075. 1753; Bedd., Handb. Ferns Brit. India Suppl. 115. 1892.

Rhizomes wide creeping with whitish brown hairs. Stipes up to 95 cm long, solid, hairy at base, glabrous above. Fronds large with stout rachis; pinnae 10-15 pairs, alternate, distal pinnae opposite, lower pinnae the largest, up to 30 cm long and 10 cm broad; pinnules lanceolate, margin lobed to the costule; pinnules up to 6 cm long, 1 cm broad. Veins free, simple or forked. Sori marginal, continuous along the margin of segments; indusia double, membranaceous. Spores brown.

Sori : May - October.

Common, forming patches in open forest or in grassy hill slopes, 1800-2500 m.

Selected specimens : Benihal, T.A. Rao 7621; Pahelgam-Chandanwari, T.A. Rao 9658 (BSD); Sonamarg, Wadhwa 85248 (BSD); Gulmarg, 2300 m, G.A. Gammie s.n. (DD).

PTERIDACEAE

PTERIS L.

- 1a. Fronds once pinnate :
- 2a. Lowest pinnae forked at least once ...1. *P. cretica*
 - 2b. Lowest pinnae never forked :
 - 3a. Pinnae not clustered at apex, basal pinnae reduced to auricle ...5. *P. vittata*
 - 3b. Pinnae clustered at apex, basal pinnae not reduced to auricle ...4. *P. stenophylla*
- 1b. Fronds bipinnate or bipinnatifid :
- 4a. Lowest pair of pinnae forked; rachis red coloured ...3. *P. pseudoquadriaurita*
 - 4b. Lowest pair never forked; rachis otherwise
 - 5a. Lamina not tripartite, ultimate lobes long ...2. *P. excelsa*
 - 5b. Lamina tripartite, ultimate lobes small ...6. *P. wallichiana*

1. *Pteris cretica* L., Mant. Pl. 130. 1767; Bedd., Handb. Ferns Brit. India 106. 1883; Hope in J. Bombay Nat. Hist. Soc. 13. 449. 1901; Stewart in Bull. Torrey Bot. Club 72: 422. 1945; Dhir, Ferns N.W. Himal. & in Biblio. Pteridologica 1: 47. 1980; Dixit, Cens. Indian Pterid. 69. 1984.

Rhizomes short-creeping. Stipes erect, 15-30 cm long, naked or with lanceolate brown scales near the base. Fronds dimorphic, sterile fronds smaller than the fertile ones, 25-30 cm long, fertile fronds erect. Lamina sub-unipinnate, basioscopic, 2-3 pairs of pinnae unequally forked to the costa on posterior base; pinnae few, 4-6 pairs, sessile; fertile pinnae linear, entire; sterile pinnae broader, margins sharply serrate; rachis naked; veins forked once, simple. Sori confluent along the margin except at base and

apex. indusiate, marginal; indusia membranaceous. Spores brown, perisporiate, trilet.

Sori : Throughout the year.

Common, in open dry or shady forests, 1400-2300 m.

Selected specimens : Baramula : Chandigam, Rao 9448 (BSD); Dachigam : Wadhwa 66883 (BSD); Doda : Batot, Chenab valley, Rao 7368 (BSD); Bhadarwah, Vohra & Naithani 82787; Poonch : Mandi-Loran, Vohra & Naithani 78280 (BSD); Kathua : Machhedi, Hajra 82535 (BSD); Banjal, Uniyal & S. Singh 90343 (BSD).

2. *Pteris excelsa* Gaud., Freyc. Voy. Bot. 388. 1827; C.B. Clarke in Trans. Linn. Soc. London 1: 467. 1880; Khullar, Illus. Fern Fl. W. Himal. 1: 265. 1994.

Rhizomes short-creeping, thick, with brown, concolorous, lanceolate scales. Stipes 40-100 cm long, generally shorter than lamina, dark brown to violet, base very dark, thick, with linear-lanceolate dark brown scales, grooved; rachis light brown, glabrous, glossy. Lamina 2-pinnate, 50-150 cm long, 20-30 cm broad, sub-deltate, texture herbaceous, glabrous; pinnae 4-8 pairs or more, 15-30 cm long, up to 1.5 cm broad, alternate, margin deeply lobed to the base; the lowest pinnae largest, not forked; veins free, forked. Sori indusiate, marginal, continuous; indusia somewhat broad, membranaceous. Spores brown, with triradiate ridge.

Sori : June - September.

Occasional, growing in deep stream valley and shady damp places at 1600-2000 m altitude.

Selected specimens : Kathua : Banjal, Uniyal & Singh 90334 (BSD).

3. *Pteris pseudo-quadrifurcata* Khullar, Illus. Fern Fl. W. Himal. 1: 272. 1994.

Rhizomes short, erect with dark brown, concolorous, linear-lanceolate scales. Stipes 25-45 cm long, stramineous or pink, scaly at base; rachis variable in colour, glabrous. Lamina pinnate, 25-45 cm long, 10-20 cm broad, lanceolate or ovate-lanceolate; texture sub coriaceous, glabrous, pinnae many, 4-15 pairs, 10-20 cm long, 1.5-3 cm broad, lower pinnae shortly stalked, upper sessile, margin deeply lobed to the costa; lobes many, 0.5-2 cm long, linear or oblong-obtuse; lowest pair of pinnae always the largest and forked at least ones; veins free, forked or simple. Sori indusiate, extent of fertility variable, generally present little above the sinus and not reaching the lobe apex; indusia membranaceous, whitish-green. Spores dark brown, perisporiate.

Sori : Throughout the year.

Frequent, growing in humus rich forest edges, 1500-2400 m altitude.

Selected specimens : Kashmir, 1000 m, *Gamble* 8291(CAL).

4. *Pteris stenophylla* Wallich ex Hook. & Grev., Icon. Fil. t. 130, 1829; Dhir, Ferns N.W. Himal. in Biblio. Pterido. 1: 46. 1980; Dixit, Cens Indian Pterid. 72. 1984; Khullar, Illus. Fern Fl. W. Himal. 1: 275. 1994. *Pteris pellucida* Presl. var. *stenophylla* Wallich ex C.B. Clarke in Trans. Linn. Soc. London 1: 463. 1880; Bedd., Handb. Ferns Brit. India 107. t. 56. 1883.

Fig. 18

Rhizomes short, erect. Stipes more than 25-30 cm long, erect, naked. Fronds 30-45 cm long, ovate lanceolate, pinnate; pinnae acute, 3-4 or sometimes 2-3 subdigitate. Fertile pinnae narrow, longer than steriles. Rachis naked; texture coriaceous, surface bright-green, often glossy. Veins fine closed, simple or forked at right angles from the midrib. Sori indusiate, marginal. Spores brown, tetrahedral.

Sori : September - May.

Occasionally, growing in shady humid situations, 1000-1600 m.

Reported by Khullar (1994) from Jammu division (Kishtwar and Chatru).

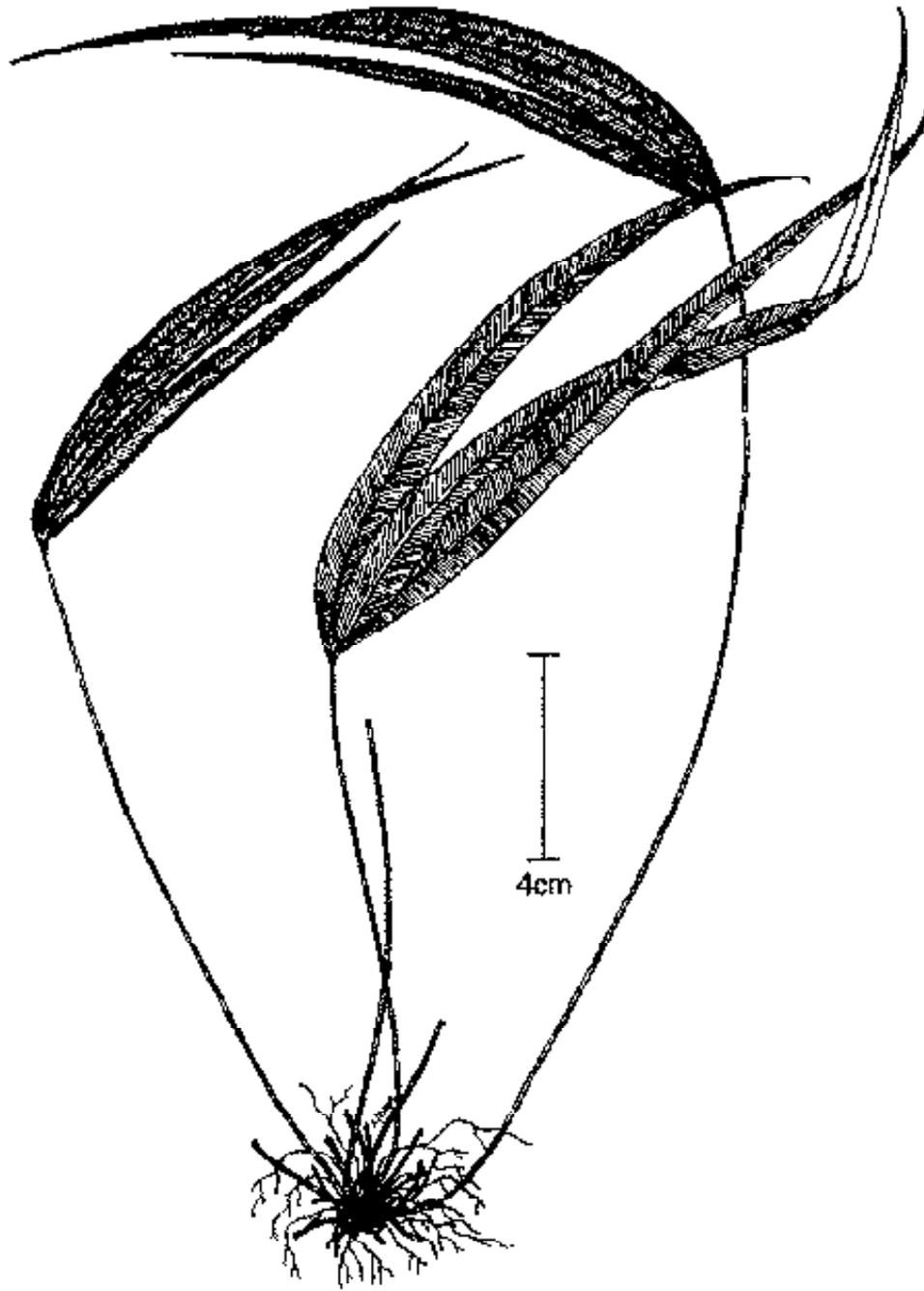


Fig. 18. *Pteris stenophylla* Wallich ex Hook. & Grev.

5. *Pteris vittata* L., Sp. Pl. 2: 1074. 1753; Mehra & Bir in Res. Bull. Punjab Univ. (N.S.) 15: 112. 1964; Dhir, Ferns N.W. Himal. in Biblio. Pteridologica 1: 46. 1980; Dixit, Cens. Indian Pterid. 73. 1984. *Pteris longifolia* auct. Quoad. Pl. Asiat; Bedd., Handb. Ferns Brit. India 106. t. 55. 1883; C.B. Clarke in Trans. Linn. Soc. London 1: 461. 1880; Hope in J. Bombay Nat. Hist. Soc. 13: 448. 1901.

Rhizomes thick, short, suberect, densely covered with silky brown, linear scales. Fronds sub-caespitose, oblong-lanceolate, covered with whitish hairs. Pinnae undivided, linear, deltoid-cordate at base. Rachis distinct and scaly. Veins free. Sori marginal, continuous from base of pinnae. Spores round, yellowish-brown, non-perisporiate, reticulate.

Sori : Throughout the year.

Common, grow usually on dry and exposed slopes or moist and densely shaded places, 600-1500 m.

Selected specimens : Kishatwar: Thathri, Rao 7771(BSD); Udhampur Vaishnodevi area, Uniyal 86655 (BSD); Kathua: Basoli-Thein dam, Hajra 82555 (BSD).

6. *Pteris wallichiana* Ag., Rec. Sp. Gen. Pterid. 69. 1839; C.B. Clarke in Trans. Linn. Soc. Lond. 1: 469. 1880; Hope in J. Bombay Nat. Hist. Soc. 134: 456. 1901; Chandra, Ferns India 47. 2000. *Campteria wallichiana* Moore, Ind. Fil. 221. 1861.

Rhizomes short, suberect, scaly; scales small, dark-brown coloured. Stipes up to 45 cm long, glabrous or sometimes covered with black hairs. Lamina large, up to 60 x 45 cm, tripartite; pinnae dissected into pinnules, not distinctly cut down to the costae; veins free, forked. Sori marginal, indusiate; indusium margin entire, sori confined to the basal region of segment. Spore trilete, golden coloured.

Sori : July - November.

Reported by Chandra (2000).

ADIANTACEAE

ADIANTUM L.

- 1a. Lamina 1-pinnate; rachis usually extended at the tip and then with a proliferous terminal vegetative bud and small sized lateral pinnae :
- 2a. Lamina hairy ...3. *A. incisum*
- 2b. Lamina glabrous :
- 3a. Pinnae large, few, 5-15 pairs, lunate or semi-orbicular, petiolate; petioles up to 1 cm long; outer margin entire or shallowly lobed. Sori entire or interrupted to the outer margin ...4. *A. lunulatum*
- 3b. Pinnae small, many, 15-20 pairs, triangular dimidiate, shortly petiolate or nearly sessile, outer margin straight or lobed. Sori on each lobe, never entire. ...2. *A. edgeworthii*
- 1b. Lamina more than 1-pinnate; rachis not extended at the tip; proliferous vegetative buds absent :
- 4a. Rhizomes erect; rachis dichotomously forked. ...5. *A. pedatum*
- 4b. Rhizomes creeping; rachis not dichotomously forked :
- 5a. Pinnules large; upper outer margin usually 3-6 lobed. Sori one to each pinnule lobe ...1. *A. capillus-veneris*
- 5b. Pinnules small; usually 1 or 2 rarely 3 sori to a pinnule ...6. *A. venustum*

1. *Adiantum capillus-veneris* L., Sp. Pl. 2: 1096. 1753; C.B. Clarke in Trans Linn. Soc. London 1: 453. 1880; Bedd., Handb. Ferns Brit. India 84. 1883; Stewart in Bull. Torrey Bot. Club 72: 421. 1945; Dixit, Cens. Indian Pterid. 74. 1984. *Dade*; *Hansraj* (Hindi); *Parioshan* (Urdu); *Gaoutheer* (Kashmiri).

Rhizomes creeping, densely clothed at apex with dark brown linear, entire scales. Fronds caespitose. Stipes 3-18 cm long, glossy. Lamina deltoid-ovate, usually bipinnate. Pinnae 1-5-jugate, alternate, with zigzag rachis, petiolate; lobes entire with deeply incurvate outer edge; veins fine, flabellately forked. Sori one to each lobe. Indusium curved, brown, persistent. Sporangia 15-celled annuls. Spores trilete, perisporiate smooth.

Sori : Throughout the year.

Extensively common, generally growing in moist and humus rich rocks or along the water channels, 700-2000 m.

Selected specimens : Dachigam, A.S. Rao 63578 (BSD); Srinagar: Nisatbagh, Vishwanathan 55700 (BSD); Poonch, Vohra & Naithani 78291 (BSD); Kathua : Basoli. Hajra 52556 (BSD); Udhampur : Katra. Uniyal 77342 (BSD); Samba-Mansar lake, Uniyal and Singh 91327 (BSD).

2. *Adiantum edgeworthii* Hook., Sp. Fil. 2: 14. t. 8113. 1851; Bedd., Handb. Ferns Brit. India Suppl. : 17. 1892. *A. caudatum* L. var. *edgeworthii* (Hook.) Bedd., Handb. Ferns Brit. India 84. 1883; Khullar, Illus. Fern Fl. W. Himal. 1: 290. 1994. Fig. 19

Rhizomes short, erect, apex with light-brown or black scales. Stipes black, 3-6 cm long, black, thin, sparsely scaly or glabrous; rachis with a terminal vegetative bud on an extended rachis. Lamina 1-pinnate, 10-15 cm long, up to 2.5 cm broad, linear-lanceolate, glabrous; pinnae many, 15-25 pairs, alternate, very shortly petiolate or sessile, demidiate, triangular base cuneate; veins fine, not prominent, free. Sori indusiate, oblong, elongated. Spores dark-brown.

Sori : August - September

Occasional, on humid shaded situations or in rock crevices, 1200-1800 m.

Reported by Khullar (1994) from Rajori and Bani in Kathua district.

3. *Adiantum incisum* Forssk., Pl. Aeg. Ar. 187. 1775; Pic.-Ser. in Webbia 12: 669. f. 6. 1957; Dhir & Dutta in J. Bombay Nat. Hist Soc. 74: 462. 1978; Dixit, Cens. Indian Pterid. 75. 1984. *A. caudatum* auct. Bedd., Ferns South. India t. 2. 1863; Handb. Ferns Brit. India 83. t. 44. 1883; Stewart in Bull. Torrey Bot. Club. 72: 421. 1945.

Rhizomes short, erect, densely scaly. Scales brown, linear, hairy. Fronds fasciculated together, elongated and rooting at the apex. Stipes

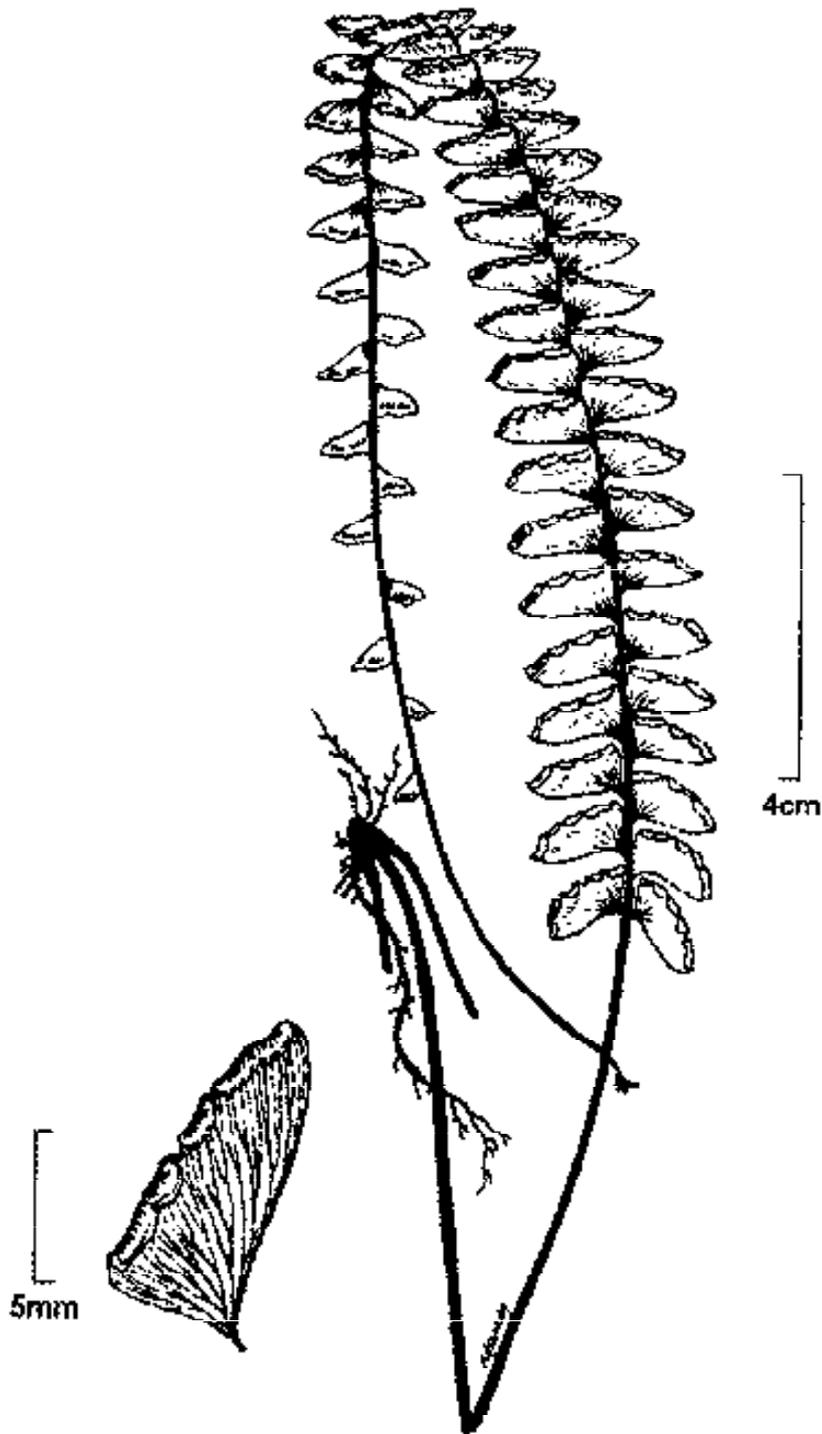


Fig. 19. *Adiantum edgeworthii* Hook.

pubescent and scaly; scales smaller than rhizome scales. Lamina linear-lanceolate, 20-37 cm long and 1-2 cm wide. Pinnae 10-35-jugate, basal ones smaller, deflexed downward and upper ones gradually diminished towards the apex; pinnules hairy, margin deeply incised into 3-5 lobes; veins free, flabellately forked. Sori 3-5 in each pinnae, at the margin of each lobe. Indusium oblong or sub reniform, brown. Sporangia stalked, with 15-celled annulus. Spores tetrahedral.

Sori : Throughout the year.

One of the commonest low altitude fern, growing on north shady slopes, road cuttings or shady walls, 700-1500 m.

Selected specimens : Udhampur : Sula, *Uniyal* 86639 (BSD); Udhampur-Jammu Road, *Rao* 63700 (BSD); Kathua : Padunala, *Hajra* 82359 (BSD); Jasorta forests, *Uniyal & Singh* 91231 (BSD).

4. *Adiantum lunulatum* Burm., Fl. Ind. 235. 1768; C.B. Clarke in Trans. Linn. Soc. London 1: 452. 1880; Bedd., Handb. Ferns Brit. India 82. 1883; Khullar, Illus. Fern Fl. W. Himal 1: 296. 1994. *Adiantum philippense* L., Sp. Pl. 2: 1094. 1753; Dixit, Cens. Indian Pterid. 75. 1984.

Fig. 20

Rhizomes short, ascending, densely clothed with stiff roots. Stipes and rachis purplish-black, glabrous. Fronds unipinnate, 30-50 cm long with 10-15 cm stipes; apical pinnae lamina like; pinnae suborbicular to oblong-ovate with linear margin, upper margin lobed. Sori linear, along the margin of the pinnae lobes. Indusia reddish-brown; spores tetrahedral with a tri-radiate mark, light brown in colour.

Sori : July - September.

Common, grows as a lithophyte on shaded walls in humid situation, 800-1500 m.

Reported by Khullar (1994) from Jammu-Udhampur Road and Kathua.

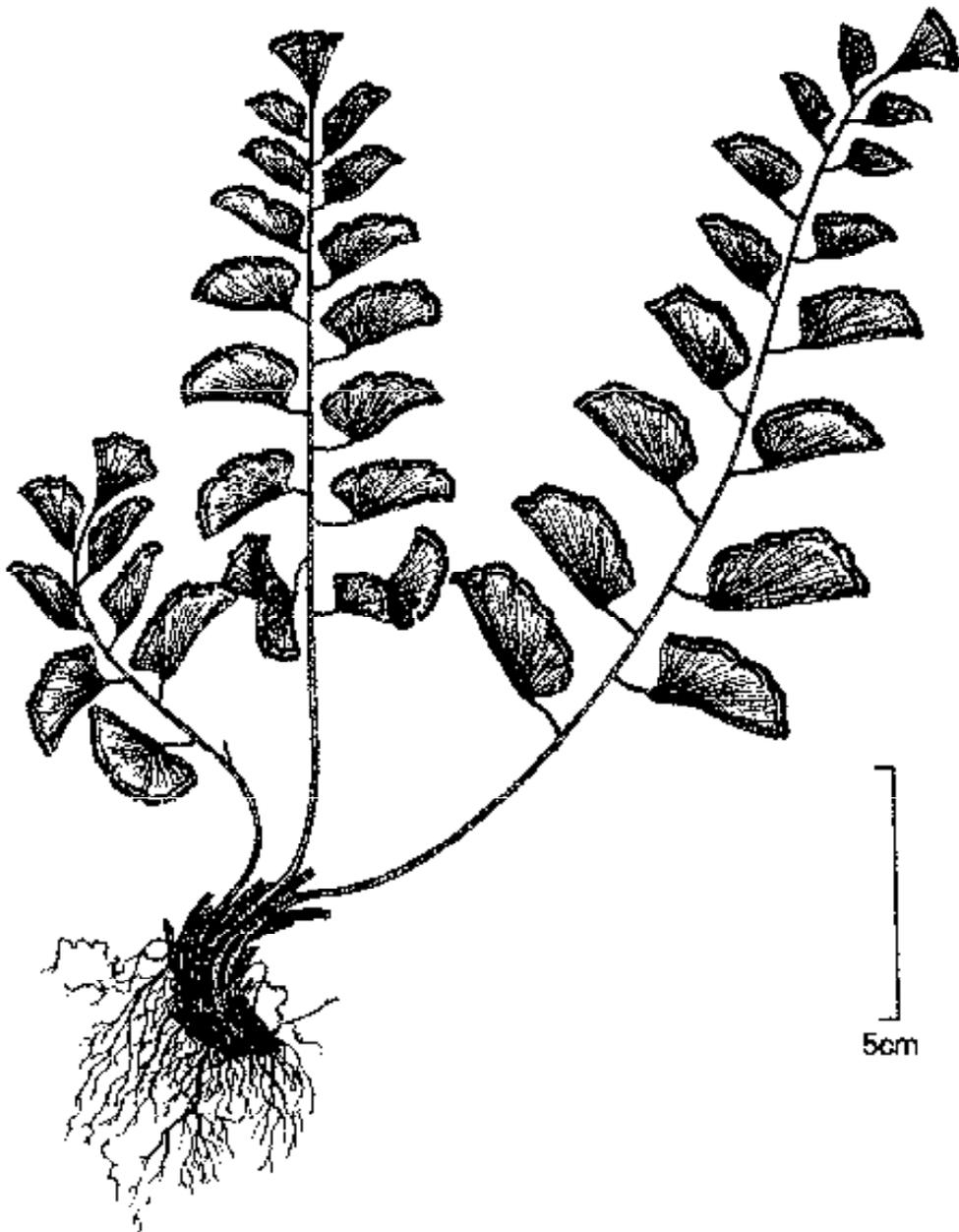


Fig. 20. *Adiantum lunulatum* Burm.

5. *Adiantum pedatum* L., Sp. Pl. 2: 1095. 1753; C.B. Clarke in Trans. Linn. Soc. London 1: 453. 1880; Bedd., Handb. Fern. Brit. India 86. 1883; Hope in J. Bombay Nat. Hist. Soc. 13: 241. 1900; Stewart in Bull. Torrey Bot. Club 72: 421. 1945; Dixit, Cens. Indian Pterid. 75. 1984.

Rhizomes creeping, stout. Stipes 15-30 cm long, polished, dark-brown, glabrous. Fronds dichotomous, flabellately branched; central pinnae 15-45 cm long, 2-4 cm broad; pinnules 1-2 cm long, 0.5 cm deep, dimidiate, the upper and outer margin lobed; texture pellucid-herbaceous. Rachis naked. Sori roundish or transversely-oblong.

Sori : July - September.

Rare, growing as lithophyte on the shaded walls or slopes in sub-alpine area, 2500-3300 m.

Selected specimens : Baramula : Bagtore-Burzil nalah, Wadhwa 84036 (BSD); Khishanganga valley, Duthie 14111 (DD); Kajiliban, Duthie 12619 (CAL).

6. *Adiantum venustum* D. Don, Prodr. Fl. Nepal. 17. 1825; C.B. Clarke in Trans. Linn. Soc. London 1: 453. 1880; Bedd., Handb. Ferns Brit. India 86.t. 45. 1883; Stewart in Bull. Torrey Bot. Club 72: 421. 1945; Dixit, Cens. Indian Pterid. 76. 1984. *Geu Theer*.

Rhizomes creeping, wiry, with scales; scales light-brown, ovate-lanceolate. Fronds caespitose. Stipes castaneous, slender, firm, terete, glossy, 11-20 cm long. Lamina deltoid-ovate, shorter than stipes, tripinnate; pinnae 2-5-jugate, petiolate; fertile lobes with 1-3 notches, each notch bearing a large sorus at the bottom. Sori indusiate; indusium light brown, reniform-cordate. Sporangia 14-16-celled annulus. Spores trilete, non perisporiolate, exine smooth.

Frequently observed, in densely shaded and humus rich soils, up to alpine regions, 2000-4000 m.

Selected specimens : Baramula : Gurez area, Wadhwa 83883 (BSD); Dachigam: Bhampura area, Rao 63610 (BSD); Yarikhal, Rao 154 (BSD);

Kishtwar : Nagin-siru. Rao 7833 (BSD); Poonch : Loran area, Vohra & Naithani 78312 (BSD); Lolab valley, 2600 m. Keshvanand. 483 (DD); Gulmarg, G.A. Gammie s.n. (CAL); Kathua : Barjal, Uniyal & Singh 90336 (BSD).

HEMIONITIDACEAE

- 1a. Fronds glabrous, bipinnate to tripinnate. ...1. *Coniogramme*
 1b. Fronds hairy, pinnate. ...2. *Gymnopteris*

1. CONIOGRAMME Fée

- 1a. Hydathodes at base reaching deep into marginal serrations. ...1. *C. affinis*
 1b. Hydathodes entering by tip into marginal serrations :
 2a. Stipes and rachis shining stramineous, sometimes with reddish tinge or dark purple in colour; pinnae not gradually narrowed at both ends, margins serrate ...3. *C. intermedia*
 2b. Stipes and rachis dull brown in colour; pinnae gradually narrowed at both ends, margins sharply serrate to spinose ...2. *C. caudata*

1. *Coniogramme affinis* Wallich ex Hieron., Hedw. 57: 297, 1916; Dixit & Das in Proc. Indian Acad. Sci. 18B: 262, 1979; Khullar, Illus. Fern. Fl. W. Himal. 1: 311, 1994. *Grammitis affinis* Wallich, List. No. 11, 1828 (*nom. nud.*). *Gymnogramma affinis* Wallich ex Presl, Tent. Pterid. 218, 1836 (*nom. nud.*).

Terrestrials, 90-120 cm tall. Rhizomes slender, wide creeping. Fronds bipinnate except the anterior one-third portion which is pinnate. Stipes 35-65 cm, yellowish-brown. Basal pinnae stalked, pinnate with 3-5 pairs of lateral pinnules which are 8-13 x 1.3-2.2 cm, linear-lanceolate, subcuneate at base, caudate at apex; veins forked at the base and usually again forked towards the apex, ending in hydathodes which clearly extend deep into the marginal serrations; lower surface of mature pinnae yellowish to brownish-green; upper surface dark, olive-green. Sori exindusiate extending from the costa. Spores yellow, triangular.

Sori : August - October.

Occasional, in shady, moist forest slopes or rock crevices, 2200-3000 m.

Selected specimens : Kashmir : Batkote-Furfazal, T.A. Rao 9774 (BSD).

2. *Coniogramme caudata* (Wallich ex Ettingsch.) Ching in Christ, Ind. Fil. Suppl. III, 56. 1934; Dixit & Das in Proc. Indian Acad. Sci. 88 B (Pt. II): 265. 1979; Khullar, Illus. Fern Fl. W. Himal. 1: 315. 1994. *Grammitis caudata* Wallich (List No. 4, 1828 *nom. nud.*) ex Ettingsch., Farnkr. 57: 38. 1865. **Fig. 21**

Terrestrials, 80-150 cm tall. Rhizomes thick, wide-creeping, clothed with many dark-brown scales and thick brown roots. Fronds simple pinnate throughout or bifid to bipinnate at basal region. Stipes 45-65 cm, dull-brown; basal pinnae stalked, upper ones sub-sessile. Pinnae cuneate at base, long caudate at apex, with sharply serrate to spinulose margins, lowers surface pubescent and upper surface glabrous; veins fine, forked at base, ending in hydathodes, the anterior ends of which extend into marginal serrations. Sori linear, extending from the costa to the margins. Spores yellowish-brown, triangular with a triradiate ridge.

Sori : July - September.

Occasional, it grows in moist and shady humus floor or slopes, 1500-3000 m.

Selected specimens : Kashmir : Kishanganga Valley along the road to Nanga Parbat, Stewart 17492 (CAL).

3. *Coniogramme intermedia* Hieron., Hedw. 57: 310. 1916; Dixit & A. Das in Proc. Indian Acad. Sci. 88 B (Pt. 2): 263-264. 1979.

Terrestrials, 80-130 cm tall. Rhizomes wide creeping, clothed with dark-brown scales. Fronds bipinnate at the base but pinnate upwards. Stipes 35-65 cm long, shining stramineous, sometimes with a reddish tint. Lamina



Fig. 21. *Coniogramme caudata* (Wallich ex Ettingsch.) Ching

thick, hairy, herbaceous. Basal pinnae pinnate with 2-3 pairs of lateral pinnules. Pinnae 15-20 x 2.5-3.5 cm, oblong-lanceolate, roundly cuneate at base, caudate at apex, pale-green in colour, and with serrate margins. Midrib stramineous, raised but feeble towards the apex on the lower surface. Veins forked near the base and again forked towards apex, ending in hydathodes. Sori exindusiate along the veins. Spores yellow.

- 1a. Lamina thick, hairy ...3.2. var. *intermedia*
 1b. Lamina thin, completely glabrous ...3.1. var. *glabra*

3.1. var. *glabra* Ching, Ic. Fil. Sin. 3: t. 143. 1935; Dixit & Das in Proc. Indian Acad. Sci. 88B (Pt. 2): 264. 1979.

Reported by Khullar (1994) from Jammu Division (Patnitop).

3.2. var. *intermedia* Khullar, Illus. Fern Fl. W. Himal. 1: 320. 1994. *Gymnogramme javanica sensu* Hook., Sp. Fil. 5: 145. 1863 (*pro parte*). *Syngramma fraxinea* (D. Don) Bedd., Handb. Ferns Brit. India 386. 1883 (*pro parte*).

Sori : August - November.

Frequent, growing in shady forests or moist rock crevices, 2000-3000 m.

Selected specimens : Kashmir : Moragnala, *Meebold* 2584 (CAL).

2. GYMNOPTERIS Bernh.

Gymnopteris vestita Wallich ex Underw. in Bull. Torrey Bot. Club 29: 627. 1902; Stewart in Bull. Torrey Bot. Club 72: 418. 1945; Khullar, Illus. Fern Fl. W. Himal. 1: 324. 1994. *Syngramma vestita* Wallich ex Bedd., Ferns Brit. India t. 154. 1867 & Handb. Ferns Brit. India 386. t. 223. 1883. *Grammitis vestita* Wallich, List No. 12. 1828 (*nom. nud.*).

Lithophytes. Rhizomes short creeping, densely clothed with silky yellow scales. Stipes 10-14 cm long, dark-brown, furfuraceous. Lamina

15-30 cm long, simply pinnate, with a terminal pinnae and 5-8 pairs of lateral pinnae. Pinnae ovate or oblong, entire, densely coated with fine ferruginous hairs. Sori along the veins, almost completely hidden in hairs. Spores tetrahedral-globose, exine thick.

Sori : August - October.

Rare, mainly growing on exposed rocks, 1500-2300 m.

Reported by Stewart (1945).

PARKERIACEAE

CERATOPTERIS Brongn.

Ceratopteris thalictroides (L.) Brongn. in Bull. Sci. Soc. Philom. Paris Ser. 38: 186. 1821; Dixit, Cens. Indian Pterid. 83. 1984; Khullar, Illus. Fern. Fl. W. Himal. 1: 332-334. 1994. *Acrostichum thalictroides* L., Sp. Pl. 1770. 1753.

Rhizomes short, erect, fronds dimorphic; fertile fronds erect, the sterile ones short and spreading. *Sterile fronds* : stipes 10-30 cm long, stramineous to yellowish-brown, succulent, inflated, glabrous; rachis glabrous; lamina pinnate to tripinnate, 10-30 cm long, 5-10 cm broad, narrowly triangular lanceolate, succulent; pinnae 3-5 pairs, 2-15 cm long, 2-5 cm broad, alternate, petiolate, upper ones sessile, margin lobed or incised, reticulate. Fertile fronds 3-4 pinnate, larger than the sterile ones, 10-60 cm long, 3-10 cm broad, lanceolate; pinnae 5-10 pairs, 3-10 cm long, alternate, petiolate, apex acute. Sori in 1-3 rows. Spores brown, tetrahedral with some rounded projections.

Sori : August - December.

This polymorphic species growing in ponds, ditches, or marshy places, sometimes in rice fields, up to 1000 m altitude.

Note : Plant seen during the month of March 1996 by S. Singh in

very poor condition due to late season, at Haria check, south of Kathua district, along the cultivated fields in swampy places.

MARSILEACEAE

1. MARSILEA L.

- 1a. Attachment of the pedicels adnate and connate.
Sporocarps 2-3 in a group; soral numbers
16-20 ...2. *M. quadrifolia*
- 1b. Attachment of the pedicels basal, slightly connate
or free. Sporocarps more than 3 in a group; soral
numbers less than 16 ...1. *M. minuta*

1. *Marsilea minuta* L., Mant. 308. 1771; Gupta, *Marsilea* Mon. 23. 1962; Mehra & Dhir in Bull. Bot. Surv. India 10: 303. 1968; Dixit, Cens. Indian Pterid. 85. 1984; Stewart in Bull. Torrey Bot. Club. 72: 425. *M. erosa* Willd., Sp. Pl. 5: 540. 1810.

Aquatic or submerged. Rhizomes slender, creeping, hairy, rooting at base throughout the Rhizome. Petioles glabrous, 4-5 cm long. Leaflets four, arranged symmetrically crosswise at the apex of the Stipes, obovate with entire rounded apex and cuneate base. Pedicels adnate-connate, stiffly erect. Sporocarps 2-3 in group, horizontal, glabrescent, about as broad as long, truncate at base, rounded at the apex. Sori approximately less than sixteen.

Sporocarps : September - March.

A common hydrophyte, growing in the rice fields or swampy situations, 800-2000 m.

Selected specimens : Kathua : Jastorta, Uniyal & Singh s.n. (BSD).

2. *Marsilea quadrifolia* L., Sp. Pl. 2: 1099. 1753; Gupta, *Marsilea* Mon. 26. 1962; G. Singh & Kachroo, For. Fl. Srinagar 232. 1976; Dixit, Cens. Indian Pterid. 85. 1984.

Small aquatics. Rhizomes wide creeping. Petioles 8-15 cm long. Leaflets deltoid, glabrous, outer edge rounded, entire. Pedicels 1-2.5 cm long, erect, adnate to the base of petiole. Sporocarps rounded-oblong, almost horizontal or little upwardly directed, usually glabrescent when mature. Sori approximately twenty.

Frequent, growing in ponds at the temperate regions, 1500-2000 m.

Sporocarps : September - November.

Selected specimens : Srinagar : Dal-lake, 1525 m, *Wudhwa & Vohra* 118 (CAL).

DENNSTAEDTIACEAE

DENNSTAEDTIA Bernh.

Dennstaedtia wilfordii (Moore) Christ, *Geogr. d. Farnen*: 192, 195, 1910; *C. Chr., Ind. Fil. Suppl.* 1: 24, 1913. *Davallia wilfordii* Baker, *Syn. Fil.* 98, 1867; Hope in *J. Bombay Nat. Hist. Soc.* 13: 33, 1900. *Davallia rhomboidea* Hook.f., *2nd. Cent. Ferns t.* 48, 1860. *Microlepia wilfordii* Moore, *Ind. Fil.* 299, 1861; Stewart in *Bull. Torrey Bot. Club* 72: 413, 1945; Dhir, *Ferns N.W. Himal.* 53, 1980.

Rhizomes wide creeping. Stipes 8-15 cm long, slender, naked, flexuous. Fronds 15-25 cm long and 5-8 cm broad, lanceolate, tripinnatifid, firm, herbaceous. Lower pinnae deltoid, stalked, cut down to the rachis, sharply toothed margin. Sori 2-6 in each lobe, intermarginal. Indusia half cup shaped.

Sori : July - September.

Rare in moist shaded situations near the streams or irrigation channel, 1350-1800 m.

Selected specimens : Jhelum valley : Rampur, 1400 m, *R.R. Stewart* 15521 (DD).

ASPLENIACEAE

ASPLENIUM L.

- 1a. Lamina simple, margin entire or deeply pinnatifid :
- 2a. Lamina margin entire, stains herbarium sheets deep pink ...7. *A. ensiforme*
- 2b. Lamina margin lobed or forked, never stains sheets :
- 3a. Lamina lower surface densely scaly; indusia vestigial :
- 4a. Stipes short, 2-3 cm long, stipes scales pale; lamina densely scaly on the under surface; scales thick, short, fringing the edges of the lamina. ...4. *A. ceteruch*
- 4b. Stipes longer, 3-5 cm long; Stipes scales dark; lamina sparsely scaly on the under surface; scales thinner, long, do not fringe the edges of the lamina. ...15. *A. punjabense*
- 3b. Lamina lower surface glabrous; indusia well developed :
- 5a. Lamina texture thin, flaccid with broad lobes; indusia broad, short ...13. *A. paucivenosum*
- 5b. Lamina texture thick, sub-coriaceous; indusia linear, long ...6. *A. dalhousiae*
- 1b. Lamina variously compound :
- 6a. Lamina simple pinnate :
- 7a. Rhizomes long creeping ... 5. *A. cheilosorum*
- 7b. Rhizomes erect or suberect :
- 8a. Lamina small, 3-5 cm long, with a few lateral pinnae :
- 9a. Lamina dichotomously 2-3 partite into linear, narrow, alternate segments or pinnae. ...18. *A. septentrionale*
- 9b. Lamina with 3-5 pairs of small cuneiform pinnae which are often 2-3-lobed with a narrow cuneate base and apex sharply and deeply toothed ...3. *A. x alternifolium*

- 8b. Lamina longer, 5-15 (-30) cm long with many lateral pinnae :
- 10a. Stipes short, 1-5 cm long, whole Stipes and rachis dark-purple to almost black, glossy; rachis with narrow brown lateral wings, but wing absent on abaxial surface ...20. *A. trichomanes*
- 10b. Stipes long, 10-15 cm long, dark brown only at base, rest green; rachis green, not winged ...16. *A. ramosum*
- 6b. Lamina bipinnatifid or bipinnate or more :
- 11a. Plants robust; lamina large, not finely dissected ...1. *A. adiantum-nigrum*
- 11b. Plants delicate; lamina small, finely dissected :
- 12a. Pinnae few, 1-4 pairs ...17. *A. ruta-muraria*
- 12b. Pinnae many :
- 13a. Pinnae subtripinnate or more ...8. *A. fontanum* ssp. *pseudofontanum*
- 13b. Lamina bipinnate :
- 14a. Fronds stiff; ultimate segments contracted ...14. *A. pekinense*
- 14b. Fronds soft and delicate; ultimate segments not contracted :
- 15a. Lamina deltate or elongate-triangular-lanceolate; stipes base black coloured :
- 16a. Rhizomes scale, with some marginal outgrowth ...2. *A. aitchisonii*
- 16b. Rhizomes scale smooth margined ...12. *A. nesii*

- 15b. Lamina lanceolate or oblong lanceolate; Stipes base straw or light brown in colour :
- 17a. Stipes as long as or longer than the lamina which is midgreen. ...9. *A. khullarii*
- 17b. Stipes not as long, or almost as long as the lamina; lamina mid to dark-green, or pale-green :
- 18a. Lamina mid to dark-green, not very finely dissected; pinnae apex a large fused segment; pinnules sessile or if stipitate then the stalk short and not very fine ...11. *A. laciniatum*
- 18b. Lamina pale-green, finely dissected, segments well separated; pinnae apex not a large fused segment; pinnules borne on relatively long, thin delicate stalks :
- 19a. Fronds long, narrow with small rounded segments with acute teeth and a long narrow frond apex with few segments ...10. *A. kukkonenii*
- 19b. Fronds broader than above, with larger ovate segments; pinnae apex shorter and more dissected. ...19. *A. tenuicaule*

1. *Asplenium adiantum-nigrum* L., Sp. Pl. 2: 1081. 1753; C.B. Clarke in Trans. Linn. Soc. London 1: 486. 1880; Bedd., Handb. Fern Brit. India 153. 1883; Hope in J. Bombay Nat. Hist. Soc. 13: 661. 1901; Khullar, Illus. Fern Fl. W. Himal. 1: 385. 1994. *Sheengassa*.

Rhizomes short, creeping or decumbent, with dark brown scales. Stipes many, 12-16 cm long, dark purple to blackish, thin, glossy, extreme base scaly; rachis firm, stramineous or dark-brown, upper half green, winged. Lamina 2-3-pinnate or 3-pinnatifid at base, apex pinnate, 10-20 cm long, 4-10 cm broad, triangular-lanceolate, or ovate-lanceolate; texture thick, coriaceous, grey-green, glabrous, pinnae few, 5-9 pairs, 3-5 cm long, 2-4 cm broad, alternate, petiolate, deltate-ovate; acroscopic basal pinules

the largest, deeply lobed to the costa; veins forked. Sori indusiate, nearer the costa; indusia whitish, membranaceous. Spores dark brown.

Sori : September - October.

Growing on rocks in forests or steep banks, between 1800-3200 m altitude.

Selected specimens : Sind valley, 2000 m. *G.A. Gammie* 9126 (DD). Lolab Valley, *Champion* 50807 (DD); Bhadarwah, *Uniyal* 80147; Kistwar, *Uniyal* 80362 (BSD); Baramulla, Thyan, *Wadhwa* 66751 (BSD); *Meebold* 2588 (CAL).

2. *Asplenium atchisonii* Fraser-Jenkins & Reich. in *Candollea* 37: 341. 1982; Khullar, *Illus. Fern Fl. W. Himal* 1: 388. 1994.

Rhizomes short, erect, apex scaly; scales dark-brown. Stipes 2-3 cm long, usually as long as or longer than lamina, thin, green, base dark-brown, very sparsely scaly or fimbriose higher up and becoming glabrous above; rachis thin, green, glabrous. Lamina 2-pinnate at base, bipinnate in distal part, 2-5 cm long, 1.5 cm broad, broadest at base, elongate, deltate or triangular lanceolate, dark green; texture herbaceous, glabrous; pinnae 3-8 pairs, up to 1.2 cm long, confluent towards lamina apex, the lowest pair of pinnae largest, veins free, simple or forked. Sori indusiate, covering the lower half of the ultimate lobes; indusia light brown, linear. Spores brown.

Sori : July - September.

Very few, growing in shaded rock crevices, often on the north side of open rocks and cliffs between 2500-4200 m.

Reported by Fraser-Jenkins & Reichstein (1982) and Khullar (1994) from Liddar Valley, North-East of Pahalgam, Upper Charpotsal Nallah near Bajipath.

3. *Asplenium x alternifolium* Wulfen, Jacq. *Misc. Austr. Bot.* 2: 51. t. 5. f.2. 1781. *A. x germanicum* auct. Crabbe, Jermy & Lovis in *Fl.*

Europ. 1: 16. 1964; Dutta & Ghosh in Bull. Bot. Surv. India 27. 158. 160. 1985.

Rhizomes short, erect, covered by numerous Stipes bases with dark-brown, linear-lanceolate scales. Stipes 4-6 cm long, longer than lamina, thin, fragile, green, but at base dark-brown; rachis green, glabrous. Lamina pinnate, small, 3-5 cm long and up to 1 cm broad, linear-lanceolate or deltate-lanceolate; texture herbaceous, glabrous; pinnae few, 3-5 pairs, distant, alternate, petiolate, often 2-3-lobed, base brown, apex sharply and deeply toothed, the lower pair of pinnae deeply lobed; veins simple, forked. Sori indusiate, linear, 1-2 on a pinnule; indusia light brown. Spores dark-brown.

Sori : July - October.

Rare, occurring between 2100-2500 m in shady rock crevices or on large boulders.

Selected specimens : Pahlgam, T.A. Rao 548 (BSD); Tulin-Lake (N.E. Pahlgam), 2500 m, Dutta & Ghosh 581594 (CAL); K.M. Vaid 118097 (DD); *s. loc.*, Stewart 7883 (DD).

4. *Asplenium ceterach* L., Sp. Pl. 2: 1080. 1753; Hope in J. Bombay Nat. Hist. Soc. 14: 256. 1902; C.B. Clarke in Trans. Linn. Soc. London 2 Bot. 1: 504. 1880. *Ceterach officinarum* (L.) Willd., Anleit. Selsbst. Bot. 578. 1804. *Hemidictyum ceterach* (L.) Bedd., Handb. Ferns Brit. India : 194. 1883.

Rhizomes short, erect, with dark-brown, bicolorous scales. Stipes short, 2-3 cm long, brown, densely covered by concolorous brown scales. Lamina simple, but deeply pinnatifid, 12-15 cm long, 1.5-2 cm broad, linear, thick, lower surface densely scaly, upper surface glabrous, lamina margin deeply lobed, lobes 10-15 pairs, up to 1.5 cm long, 0.5-0.7 cm broad; triangular-oblong to ovate, alternate, apex obtuse, gradually reduced and distant towards the base; veins 4-5 pairs per lobe, simple or forked, anastomosing towards the margin. Sori usually exindusiate, linear; indusia rudimentary, fugaceous or absent. Spores brown.

Sori : June – October.

Frequent, growing on shady dry walls or in rock crevices, 900-2500 m.

Selected specimens : Sonamarg, 2500 m, *Gammie s.n.* (DD); Srinagar hills, 2100 m, *T.A. Rao 789* (BSD); Dachigam: Vanpora, *A.S. Rao 63537* (BSD); Bhadarwah, *Uniyal 80105*; Kistwar, *Uniyal 80363* (BSD).

5. *Asplenium cheilosorum* Kunze ex Mett., *Abhandl. Sanckenb. Naturforsch. Ges.* 3: 177. t. 5. f. 12, 13. 1859; Khullar, *Illus. Fern Fl. W. Himal.* 401. 1994; Chandra, *Ferns India*, 260. 2000. *Hymenasplenium cheilosorum* (Kunze ex Mett.) Tagawa in *Acta. Phytotax. Geobot.* 7: 84. 1938.

Rhizomes long creeping, scaly; scales dark-brown, linear. Stipes dark-purple, thin, glabrous, glossy. Lamina pinnate; texture thin, membranaceous, glabrous, pinnae numerous, arranged alternately, petiolate, upper pinnae sessile; veins forked with two branches, one going to each tooth. Sori indusiate, borne along the apical part of the veins, invariably on the distal part of each lobe; indusia brown, thin, margins entire. Spores dark-brown, perinate, perine broad.

Reported by Chandra (2000).

6. *Asplenium dalhousiae* Hook., *lc. Pl.* t. 105. 1837; Khullar, *Illus. Fern Fl. W. Himal.* 401. 1994. *Ceterach dalhousiae* (Hook.) C. Chr., *Index Fil.* 1: 170. 1905. *Asplenium alternans* Wallich ex Hook.f. *Sp. Fil.* 3: 82. 1860; Bedd., *Handb. Ferns Brit. India* : 142. 1883. *Ceterachopsis dalhousiae* (Hook.) Ching in *Bull. Fan. Mem. Inst. Biol.* 10: 9. 1940.

Rhizomes short, erect, with brown, linear-lanceolate scales. Stipes short, 0.5-3 cm long, brown, thin with linear-lanceolate, brown scales; rachis brown, straight or wavy and scaly. Lamina simple but deeply pinnatifid, 8-30 cm long, 2-3 cm broad, narrow towards the base; texture thick, subcoriaceous, apex acuminate, margin variously lobed; lobes or

pinnae up to 20 pairs, triangular-oblong or ovate, alternate from one side to the other, apex obtuse, margin almost entire or crenately lobed; veins forked, free, glabrous. Sori indusiate, up to 0.5 cm long, linear; indusia brown, margin slightly wavy. Spores brown.

Sori : Major part of the year.

Common, growing in shady moist situations or forest floor, throughout the lower hills from 500-2500 m altitude.

Selected specimens : Pir-panjal, 2300 m, G.A. Ganumie s.n. (DD); Dachigam: Vanpora, A.S. Rao 63548 (BSD); Poonch, Mandi-Ioran, 1500-2000 m, Vohra & Naithani 78282 (BSD); Bhadarwah, Uniyal 30148; Katra, Uniyal 77343 (BSD).

7. *Asplenium ensiforme* Wallich ex Hook. et Grev., Ic. Fil., t. 71. 1829; Bedd., Ferns South India, t. 125. 1863 & Handb. Ferns Brit. India 141. 1883; C.B. Clarke in Trans. Linn. Soc. London 1: 476. 1880; Chandra, Ferns India 264. 2000.

Rhizomes erect or suberect, densely scaly; scales long, reddish-brown, lanceolate, acuminate, hairy tipped. Stipe up to 12 cm long, scaly; scales similar to rhizomes scales but smaller in size. Lamina simple, glabrous, lower portion bears scales along the mid vein; veins once forked. Sori in two rows along mid veins, obliquely placed, brown coloured, indusiate; indusium opens toward midrib, deciduous, fall down on maturity. Spore perisporiate, yellowish brown with fold surface.

Reported by Chandra (2000).

8. *Asplenium fontanum* (L.) Bernh. subsp. *pseudofontanum* (Kossinsky) Reich. et Schnell in Candollea 37: 123. 1982; Khullar, Illus. Fern Fl. W. Himal. 1: 408. 1994. *A. pseudofontanum* Kossinsky, Notulae System. Herb. Bot. Petro. 3: 122. 1922.

Rhizomes short, ascending, apex with brown, broad, lanceolate scales. Stipes short, 4-8 cm long, thin, fragile, blackish at base, rest green, scaly; rachis scanty fibrillose or almost glabrous. Lamina finely dissected, 2-

pinnate, sub-tripinnate or 3-pinnate or more, the longer middle pinnae sub-tripinnate, 8-20 cm long, 1.5-5 cm broad, oblong-lanceolate, narrowed towards both ends, broadest above middle, light green to greyish-green, texture herbaceous, glabrous; pinnae many, 10-25 pairs, up to 2.6 cm long, 1 cm broad, alternate, basal pinnae gradually becoming distant, reduced, sessile and less dissected, the longer central pinnae with more pinnules and the largest somewhat overlapping, pinnules with both margins lobed; veins free, forked, glabrous. Sori indusiate, 1-2 per lobe at maturity, covering the entire segments; indusia small, elongated, open out at maturity. Spores dark brown.

Sori : August - November.

Frequent, in shady rock crevices, 1000-3200 m.

Selected specimens : Liddar valley: Kintmala-nala, *Inayat* 25786 (DD); Sind valley: Sonamarg, 3000 m, *Gammie s.n.* (DD); Kishanganga valley, 3000 m, *Keshvanand* 639 (DD); Aharbal-Kungwatan, *T.A. Rao* 9275 (BSD); Sonamarg, 2100 m, *Bhattacharyya* 41254 (BSD); Baramulla-Guraij, *Duthie* 14084 (CAL).

9. *Asplenium khullarii* Viane, Rasbach and Reichstein in Khullar, *Illus. Fern Fl. W. Himal* 1: 414, 1994.

Rhizomes short, erect, apex with dark-brown, lanceolate scales. Stipes 6-10 cm, almost twice as long as the lamina, dark-brown becoming greenish in the distal region just below the lamina, scaly at extreme base, rest glabrous; rachis brownish-green, glabrous, without any vegetative buds. Lamina 2-3-pinnate, 2.5-6.5 cm long, 0.5-1.2 cm broad; broadest at base, narrowly triangular lanceolate; texture subcoriaceous, glabrous, upper surface dark-green; pinnae up to 7 pairs, first and second pair of pinnae longest, alternate, short-petiolate, ovate, margin deeply pinnate, pinnules 3-4 in well developed basal pinnae; veins free, simple or forked, one per lobe, glabrous. Sori indusiate; indusia membranaceous, entire. Spores dark-brown, perinate.

Sori : July - October.

Occasional, grows in crevices in shaded, humid, moss covered rocks and cliffs, between 2500-3500 m.

Reported by Khullar (1994) from Jammu Division (Sanasar and Patinitop).

10. *Asplenium kukkonenii* Viane, Rasbach & Reichst. in Khullar, *Illus. Fern Fl. W. Himal.* 1: 416. 1994.

Rhizomes short, erect, apex with dark-brown linear-lanceolate scales. Stipes short 2-3 cm, green but blackish at its extreme base, thin, with narrow, linear-lanceolate scales; rachis thin, green, glabrous. Lamina 2-pinnate, 8-10 cm long, 1-1.5 cm broad, broadest about the middle, narrowly lanceolate, apex long narrow; texture herbaceous, glabrous; pinnae many, 8-10 pairs, 1-1.5 cm long, 0.5 cm broad, alternate, ovate or broadly-lanceolate, margins deeply pinnate, fourth pair of pinnae usually the largest; pinnules (segments) small, rounded with acute teeth; lowest acroscopic segment the largest, always free; veins free, simple or forked. Sori indusiate, 1-2 on each segment; indusia membranaceous. Spores dark-brown.

Sori : May - November.

Occasional, between 1600-2500 m, in forest and on moist, shaded rocks.

Reported by Khullar (1994) from Poonch, Rattanpir, Gulmarg, Sonamarg and Kathua.

11. *Asplenium laciniatum* D. Don, *Prodr. Fl. Nepal.* 8. 1825; Khullar, *Illus. Fern Fl. W. Himal* 1: 418. 1994.

Rhizomes short, erect, apex with dark-brown, linear to oblong-lanceolate scales. Stipes 5-10 cm long, green, but base usually dark-brown to blackish, thin, with brown linear-lanceolate scales, rachis thin, green, glabrous. Lamina 2-pinnate, 5-15 (-20) cm long, 1.5-4.5 cm broad, broadest below the middle; texture herbaceous to subcoriaceous, glabrous; pinnae 8-14 pairs, 1.5-3.5 cm long, 0.5-1.5 cm broad, alternate, petiolate, margin

deeply pinnate; veins free, simple or forked. Sori indusiate, elongated, 1-4 in each pinnule; indusia membranaceous, almost entire. Spores dark brown.

Sori : September - November.

Fairly abundant, between 1600-2500 m in moist shaded rocks or old tree trunks.

Reported by Khullar (1994) from Jhelum, Liddar valley; Patnitop, Vaishnodevi, Batote, Sanasar and Poonch.

12. *Asplenium nesii* Christ, Nuov. Giorn. Bot. It. n.s. 4: 90. 1897; Ching *et* Reichstein in Candollea 36: 196. 1981; Chandra, Ferns India, 269. 2000.

Rhizomes erect or suberect, clothed with scales; scales brown coloured, smooth margined, tip hair pointed, ovate-lanceolate. Stipes up to 6 cm long, black at lower half, greenish upwards, scaly at base, above poorly scaly or glabrous. Lamina lanceolate, widest at middle, tapering to base; pinnae arranged alternately, petiolated; petioles make an angle of 60° with main rachis, dissected into pinnules; pinnules deeply incised; texture subcoriaceous; veins obscure, not reaching the margins. Sori obliquely placed, close to costa, indusiate; sporangia 19-23-celled annulus. Spores bilateral, dark brown, perinate, perine irregular.

Reported by Chandra (2000).

13. *Asplenium paucivenosum* (Ching) Bir in Bull. Bot. Surv. India 4: 3. 1962; Chandra, Ferns India 271. 2000. *Ceterach paucivenosum* Ching in Bull. Fan Mem. Inst. Biol. 2: 210 t. 28. 1931. *Ceterachopsis paucivenosa* Ching in Bull. Fan Mem. Inst. Biol. Bot. 10: 9. 1940.

Rhizomes short, scaly; scales brown. Stipes short, scaly; rachis wavy, scaly; scales similar to Stipes. Lamina simple, deeply pinnatifid, texture thin, fleshy, apex acuminate, lobes 6-8 pairs, alternate; veins almost always

free. Sori large, with a thick prominent indusium: indusia short, broad membranaceous, persistent. Spores perinate, perine broad.

Reported by Chandra (2000).

14. *Asplenium pekinense* Hanse in J. Bot, 262. 1867; C.B. Clarke in Trans. Linn. Soc. London 1: 156. 1880; Khullar Illus. Fern Fl. W. Himal. 1: 427. 1994.

Rhizomes erect, apex with blackish-brown, lanceolate scales. Stipes 3-8 cm long, flattened, green, sparsely numerous, narrow dark scales towards Stipes base. Lamina 2-3-pinnate, finely dissected, stiff narrow, 6-15 cm long, 1.5-4 cm broad, base attenuate, apex acuminate, glabrous; pinnae 8-12 pairs, 1-2.5 cm long, lower 1-2 pairs of pinnae shorter than those above, alternate or subopposite; pinnules 2-4 pairs; lobes contracted, narrow, acute with 2 acute teeth; veins 1 per ultimate lobe, ventrally raised. Sori linear, short; indusia thick, greyish-white.

Sori : August - October.

Rare, growing as lithophyte on walls or rocks from 600-2500 m altitude.

Reported by Khullar (1994) from Jhelum valley, Uri and Rampur.

15. *Asplenium punjabense* Bir, Fraser-Jenkins & Lovis in Fern Gaz. 13: 55. 1985; Khullar, Illus. Fern Fl. W. Himal. 1: 429. 1994. **Fig. 22**

Rhizomes short, erect, scaly; scales dark-brown, bicolorous, dark in middle, lanceolate. Stipes 2-4 cm, brownish, scaly; rachis scaly; scales as on Stipes. Lamina simple, 10-20 cm long, up to 2 cm broad, linear, thick, subcoriaceous, lower surface scaly; upper glabrous; lamina margin deeply pinnatifid; lobes sometimes reaching the rachis 10-15 pairs, 1 cm long, triangular to oblong, ovate, alternate, lower lobes gradually reduced and distant towards base; veins 4-5 pairs per lobe, simple, forked, anastomosing towards margin. Sori indusiate, linear; indusia rudimentary fugaceous. Spores brown.

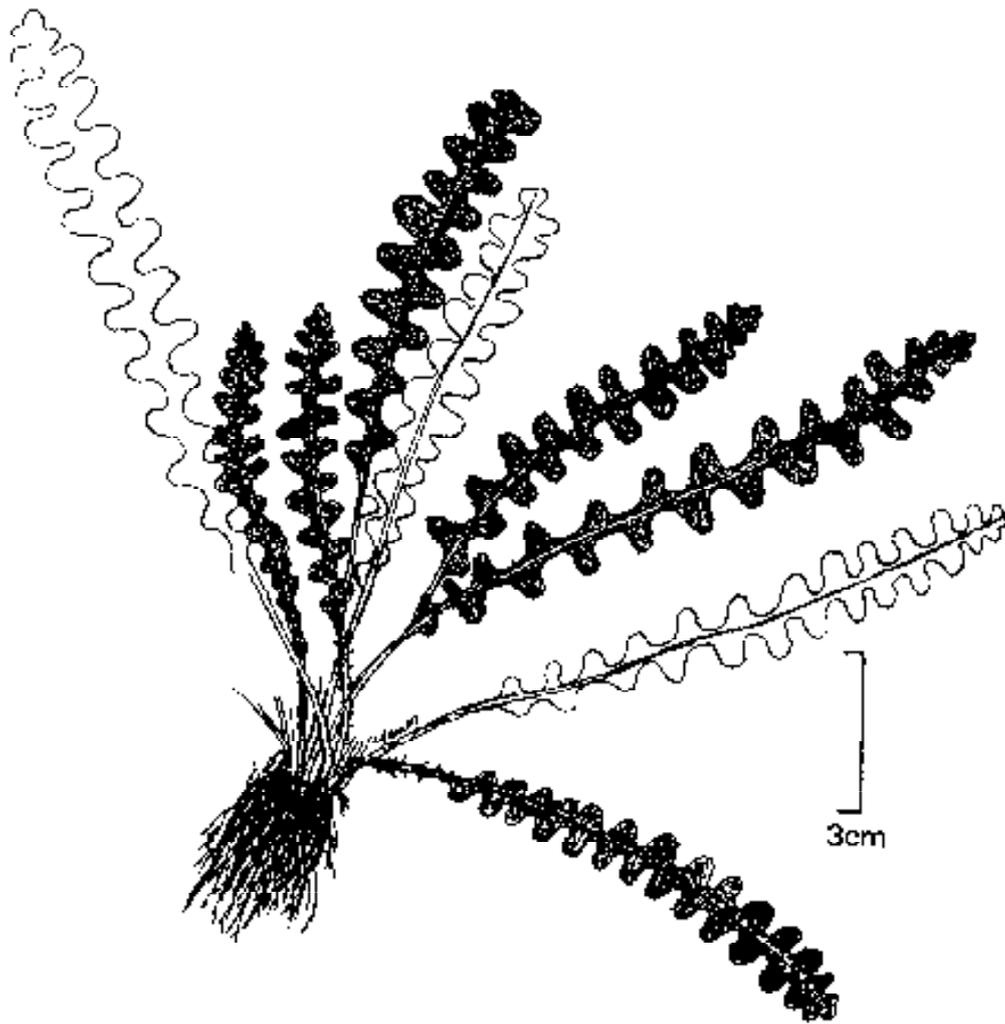


Fig. 22. *Asplenium punjabense* Bir. Fraser-Jenkins & Lovis

Occasional, occurs on banks, walls and steep rocky slopes. 900-2000 m altitude.

Sori : July - October.

Selected specimens : Bhaderwah-jai, 2000 m, *T.A. Rao* 9036; Kistwar hills, 1800-2000 m, *T.A. Rao* 7806 (BSD); Srinagar : Sankracharya temple, 1800 m, *N.C. Nair* 37886 (BSD).

16. *Asplenium ramosum* L., Sp. Pl. : 1082. 1753; Fras.-Jenkins, New Sp. Syndr. Indian Pterid. 52. 1997; Chandra, Ferns India 275, 2000.

Fig. 23

Rhizomes short, erect, apex scaly. Scales dark-brown, lanceolate, margin entire. Stipes up to 15 cm long, green, base dark-brown, glabrous; rachis green, grooved on upper surface, not winged, glabrous. Lamina pinnate, 5-15 cm long, up to 1.2 cm broad, linear-lanceolate; texture herbaceous, glabrous; pinnae 15-20 pairs, up to 1 cm long, alternate, petiolate, very short or sessile, ovate or orbicular, margin crenate; veins forked. Sori indusiate, linear, few, nearer the costa than the margin; indusia brown, margin crenate. Spores dark brown.

Sori : August - October.

Occasionally growing at an altitudes from 2300-4000 m on moss covered boulders.

Selected specimens : Ladakh : Kargil, Panikhar, *Chowdhery & Uniyal* 85925 (BSD); Kashmir : Baltal-Amarnath (on way), *Hajra* 74296 (BSD); Baramula, Barnai, *Wadhwa & Pant* 85074 (BSD); Tilail range, 3300 m, *C.B. Clarke s.n.* Acc. No. 10281 (CAL).

17. *Asplenium ruta-muraria* L., Sp. Pl. 2: 108. 1753; C.B. Clarke in Trans. Lin. Soc. London 1: 482. 1880; Bedd., Handb. Ferns Brit. India 156. 1883; Hope in J. Bombay Nat. Hist. Soc. 13: 660. 1901; Khullar, Illus. Fern Fl. W. Himal. 1: 433. 1994. *A. subtenuifolium* (Christ) Ching & Wu in Acta Phytotax. Sin. 23: 3. 1985.

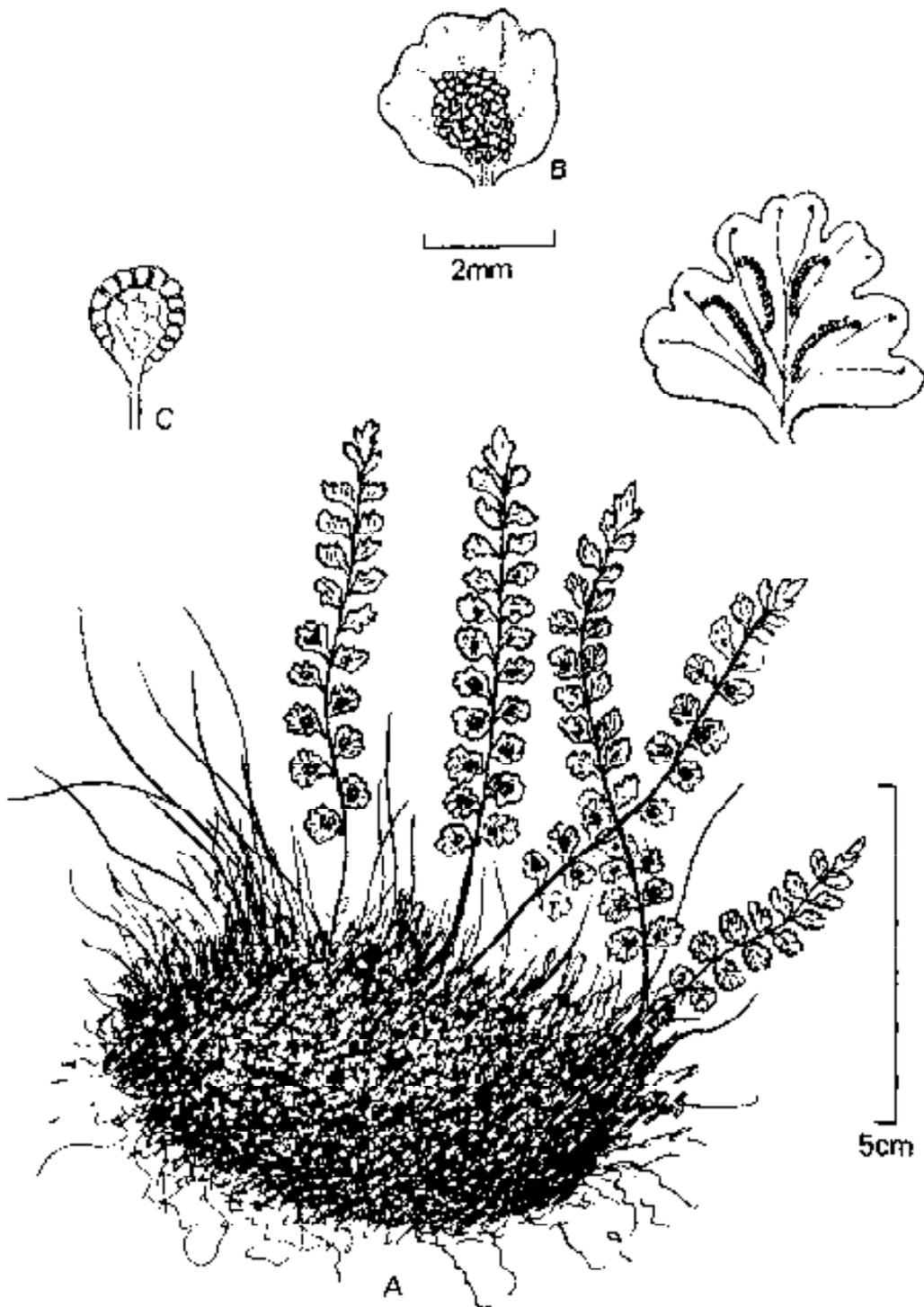


Fig. 23. *Asplenium ramosum* L.

Rhizomes short, erect, ascending, scaly; scales dark-brown, linear-lanceolate, glandular. Stipes longer than lamina, 2-7 cm long, green, base blackish, scaly at base; rachis firm, green, glabrous. Lamina 2-3 pinnate, small, 3-6 cm long, up to 2 cm broad, linear or deltate-lanceolate; texture delicately subcoriaceous, glabrous; pinnae few, 2-3 pairs, alternate, petiolate, lowest the largest; pinnules 3-5, obovate or rhomboid, wedge-shaped, terminal pinnules rhomboid; veins forked, obscure. Sori indusiate, short, linear, indusial margin fimbriate, crenulate. Spores brown, perinate.

Sori : July - September.

Occasional, growing on rock crevices at high altitudes between 2100-3600 m.

Selected specimens : Baramulla : Guraij, 2200-2600 m. *Duthie* 115 (CAL); *s. loc.* *Wadhwa* 87916 (BSD); Maszid valley 4000-4500 m. *Duthie* 13276 (CAL).

18. *Asplenium septentrionale* (L.) Hoffm., *Deutschl. Fl.* 2: 12. 1795; C.B. Clarke in *Trans. Linn. Soc. London* 1: 478. 1880; *Bedd.*, *Handb. Ferns Brit. India* : 145. 1883; Hope in *J. Bombay Nat. Hist. Soc.* 13: 658. 1901; *Khullar*, *Illus. Fern Fl. W. Himal.* 1: 435. 1994. *Acrostichum septentrionale* L., *Sp. Pl.* 2: 1068. 1753.

Rhizomes short, creeping, covered by many persistent Stipes bases, scaly; rachis green, glabrous. Lamina pinnate or simple in young plants, 2-5 cm long, shorter than the Stipes, very narrow, elongated, linear-lanceolate, dichotomously 2-3 partite into long linear, narrow alternate segments or pinnate; texture firm herbaceous or subcoriaceous, glabrous; pinnae 2-3, up to 1 cm long, alternate, petiolate; petioles up to 1 cm long; veins 2-3 per lobe, forked. Sori indusiate; indusia narrow, linear, elongate, confluent at maturity covering the entire surface; indusia brown or white. Spores brown, perinate.

Sori : July - October.

Common, growing on dry rocks or hill slopes in open situations, 2300-4200 m.

Selected specimens : Sonamarg, *Bhattacharyya* 41250 (BSD); Thujwas mountain, *T.A. Rao* 9569; Banihal mountain, *T.A. Rao* 9194 (BSD).

19. *Asplenium tenuicaule* Hayata, *Icon. Pl. Formos.* 4: 228. 1914; Khullar, *Illus. Fern Fl. W. Himal* 1: 437. 1994. *A. subvarians* Ching, in *Christ. Index. Fil.* 3: 38. 1934. *A. shiobarensse* Koidz in *Acta Phytotax. Geobot.* 5: 50. 1935.

Rhizomes short, erect, scaly. Scales dark-brown, oblong-lanceolate, acute. Stipes 2-4 cm long, green, base dark-brown to blackish, thin, scaly, becoming sparsely fibrillose. Lamina bipinnate, 3-10 cm long, up to 1.5 cm broad, oblong-lanceolate, herbaceous, glabrous; pinnae up to 5 pairs, besides the pinnatifid lamina, alternate, petiolate; lobes rounded, ovate, lowest pair of pinnae usually smaller; veins free, simple, or forked. Sori indusiate, small; indusia whitish, membranaceous. Spores dark brown, perinate.

Sori : July - October.

Occasionally, growing in shady rock crevices, between 1000-1800 m altitudes.

Selected specimens : Udhampur : Bhairon-temple, near Vaishno Devi, *Uniyal* 77451 (BSD).

20. *Asplenium trichomanes* L., *Sp. Pl.* 2: 1080. 1753; C.B. Clarke in *Trans. Linn. Soc. London* 1: 477. 1880; *Bedd., Handb. Ferns Brit. India* : 143. 1883; Khullar, *Illus. Fern Fl. W. Himal.* 1: 444. 1994.

Rhizomes short, erect, covered by persistent Stipes bases, apex scaly. Scales dark-brown, linear-lanceolate, margin fimbriate. Stipes short, 1-5 cm or more long, dark-brown or dark-purple, glabrous, glossy; rachis similar to Stipes, dark-purple, glabrous, glossy with narrow brown marginal wings glabrous, glossy; wings on abaxial side absent. Lamina pinnate, 4-15 cm long, 0.5-2 cm broad, linear-lanceolate; texture herbaceous to coriaceous, glabrous. Pinnae 10-13 pairs, alternate, petiolate, 0.3-0.4 cm long, 0.2-0.3 cm broad, orbicular or sub-oblong, the upper and basal pinnae smaller than the central pinnae; veins simple or once forked, glabrous.

Sori indusiate, linear, obliquely pointed towards pinnae apex. indusial margin entire. Spores dark-brown, perisporiate, margin irregular.

Sori : Throughout the year.

Fairly common, between 1800-3000 m in crevices of shaded rocks or on banks and cliffs.

Selected specimens : Kashmir : Dachigam, Pohlipora, *A.S. Rao* 63581 (BSD); Verinag, 2000 m, *T.A. Rao* 8959 (BSD); Sonamarg, 2100 m, *Bhattacharyya* 41252 (BSD); Baramula: Sabal, *Wadhwa & Murty* 84643 (BSD); Doda : Banihal ridge, 2500 m, *T.A. Rao* 7690 (BSD); Bhadarwah, *Uniyal* 80149 (BSD); Poonch; Sauzica-Gageria, 2000-2500 m, *Vohra & Naithani* 78371 (BSD); Gulmarg, 2000 m, *Gammie s.n.* Acc. No. 10212 (CAL).

WOODSIACEAE

WOODSIA R. Br.

- 1a. Fronds pinnatifid; pinnae and rachis bearing
atleast few scales, tips of the pinnae obtuse;
hairs on lamina present ...1. *W. alpina*
- 1b. Fronds pinnate; pinnae and rachis lacking scales.
tips of the pinnae acute; hairs on lamina
absent ...2. *W. hancockii*

1. *Woodsia alpina* (Bolton) Gray in Nat. Arr. Brit. Pl. 2: 17. 1821; Stewart in Bull. Torrey Bot. Club 72: 404. 1945; Dixit, Cens. Indian Pterid. 124. 1984; Brown in Nova Hedw. 16: 44. 1964. *Acrostichum alpinum* Bolton, Fil. Brit. II. 76. t. 42. 1790. *Woodsia hyperborea* R. Br., Prodr. Fl. Nov. Holl. 1: 158. 1810; Bedd., Handb. Ferns Brit. India 20. 1883. **Fig. 24**

Rhizomes short, erect, covered with many old Stipes bases and scales; scales light-brown, broad near the base. Fronds linear-lanceolate to oblong-lanceolate, rarely lanceolate, 10-20 x 2.5 cm. Stipes and rachis glabrous with few scales, stramineous or reddish-brown, bearing subopposite to alternate pinnae; pinnae cordate, ovate, lower and middle pinnae petiolate to sessile, pinnatifid with few broadly obovate entire lobes; veins free. Sori

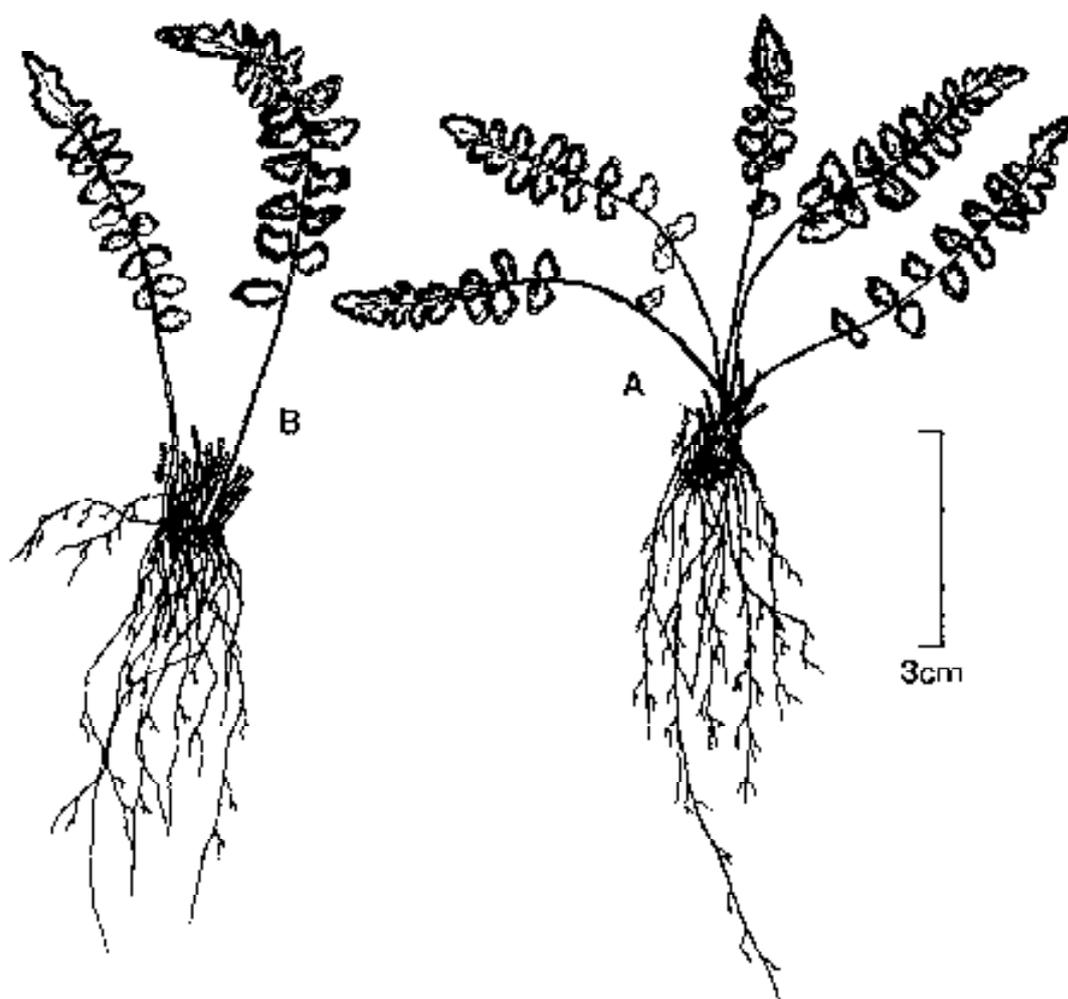


Fig. 24. *Woodsia alpina* (Bolton) Gray

medial with laminar hairs; indusium small, composed of ciliated plate-like lobes. Spores bilateral.

Sori : July - September.

Frequent, growing in dry rock crevices, sub alpine to alpine zones, 3200-4500.

Selected specimens : Kashmir : Liddar Valley, *Duthie* 13148 (CAL); Kolahoi Glacier, *Stewart* 9446 (DD); Sonamarg, 3300 m, *Inayat* 13644 (DD); Muszid Valley, *Duthie* 14126 (DD).

2. *Woodsia hancockii* Baker, Ann. Bot. 5: 196. 1891; D.F. M. Brown in Nova Hadw. 16: 72. 1964; Dixit, Cens. Indian Pterid. 124. 1984. Fig. 25

Rhizomes very short, erect, covered with 20-40 dark-brown old stipe bases and few light brown small scales. Fronds linear to oblong-lanceolate, up to 12 x 2 cm. Stipes up to 3 cm long, stipe and rachis dull-brown or stramineous, bearing ovate to lanceolate, 6-10 pairs of pinnae; pinnae generally alternate, lower and middle pinnae petiololate, remote, pinnate; tips of pinnae acute; veins free. Sori medial, without laminar hairs; indusia composed of ciliated plate-like lobes. Spores bilateral.

Sori : July - September.

Rare, growing on dry rocky hill slopes, above the alpine zones, 4000-4500 m.

Selected specimens : Kashmir : Maszid Valley, 4000 m, *Inayat s.n.* 1885 (DD); Maj. *Sedgewick, s.n.* Acc. No. 7271 (CAL).

ATHYRIACEAE

1a. Stipes and rachis more or less pubescent :

2a. Fronds bipinnatifid to decomposed; sori linear ...3. *Deparia*

2b. Fronds tripinnate to quadripinnate; sori round ...2. *Cystopteris*

1b. Stipes and rachis glabrous :

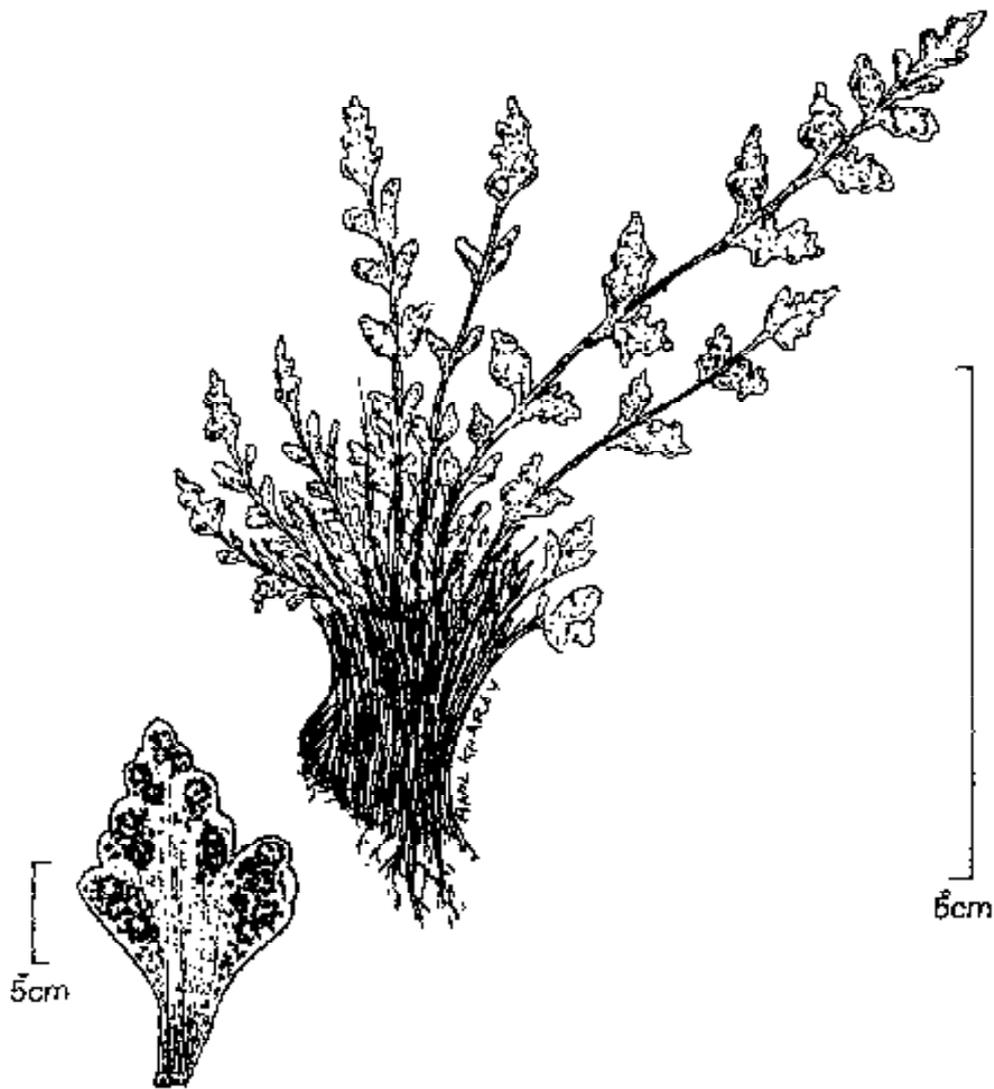


Fig. 25. *Woodsia hancockii* Baker

- 3a. Base of lamina and lower pinnae articulated to rachis ...5. *Gymnocarpium*
- 3b. Not as above :
- 4a. Sori crossing over the veinlets; basal Stipes scales thin, ovate-lanceolate, usually pale-brown. ...1. *Athyrium*
- 4b. Sori not crossing over veinlets; basal Stipes scales firm, usually very narrow, linear-lanceolate, dark-brown or black ...4. *Diplazium*

1. ATHYRIUM Roth

- 1a. Rhizomes long creeping :
- 2a. Lower pinnae generally much reduced and distant ...14. *A. wallichianum*
- 2b. Lower pinnae largest or of the same size as the pairs above or only slightly reduced :
- 3a. Lamina very finely dissected, with narrow ultimate lobes; stipes stramineous throughout ...8. *A. pectinatum*
- 3b. Lamina not finely dissected, but with broad ultimate lobes; stipes dark purplish or brown. ...11. *A. schimperii*
- 1b. Rhizomes erect, suberect or short-creeping :
- 4a. Setae present on the upper adaxial surface of costules :
- 5a. Stipes stramineous; pinnules small, 0.5-1.0 cm long, 0.3-0.4 cm broad, elliptic or oblong, margin shallowly lobed with a few, short teeth towards the rounded apex. ...12. *A. setiferum*
- 5b. Stipes generally pink or purplish; pinnules long, 1-2 cm long, 0.6-0.7 cm broad, lanceolate, margin lobed 1/2 way to the costa; pinnule lobes narrow, sharply serrate-dentate ...13. *A. strigillosum*
- 4b. Setae absent on the upper adaxial surface of costule :
- 6a. Lamina 3 or 4-pinnate :

- 7a. Rhizomes thin, without persistent leaf bases;
fronds arise singly from the Rhizomes; Stipes
less scaly; pinnules symmetrical and not stopping
...1. *A. atkinsonii*
- 7b. Rhizomes thick, covered with persistent leaf
bases; fronds clustered towards Rhizomes apex;
Stipes much scaly; pinnules asymmetrical and
stopping .. 4. *A. fimbriatum*
- 6b. Lamina 1 or 2-pinnate :
 - 8a. Lowermost pair of pinnae not reduced :
 - 9a. Lowest pair of pinnae largest in size
...6. *A. mackinnoniorum*
 - 9b. Lowerst pair of pinnae equal to
the 2-3 pairs above ...5. *A. foliolosum*
 - 8b. Lowerst pair of pinnae reduced :
 - 10a. Lamina 2-3-pinnate, thinly herbaceous ...3. *A. distans*
 - 10b. Lamina generally 1 or 2-pinnate :
 - 11a. Lower few pair of pinnae gradually
much shortened and reduced to
auricles; pinnae tips curved upwards
...10. *A. rupicola*
 - 11b. Lowest few pairs of pinnae only slightly
smaller than the rest; pinnae tip not
curved upwards ;
 - 12a. Lower pinnae much attenuated
...2. *A. attenuatum*
 - 12b. Lower few pinnae shortened,
never attenuated :
 - 13a. Lamina 2-pinnate; stipes
more than 20 cm long, base
densely scaly ...9. *A. rubricaule*
 - 13b. Lamina 1-pinnate; stipes
up to 15 cm long, base less
scaly ...7. *A. nigripes*

1. *Athyrium atkinsonii* Bedd., Ferns Brit. India Suppl. 11.f. 359, 1876; Dixit, Cens. Indian Pterid. 125. 1984. *Asplenium atkinsonii* (Bedd.)

C.B. Clarke in Trans. Linn. Soc. London 1: 487. 1880. *Pseudocystopteris atkinsonii* (Bedd.) Ching in Acta Phytotax. Sin. 9, 78. 1964.

Rhizomes widely creeping with ovate-lanceolate, attenuate, thin, light-brown scales. Stipes 15-40 cm long, pale brown with few light brown scales. Lamina broadly ovate, 4-pinnate; pinnules and segment petiolate; rachis slender; texture thin, with small clavate or linear, glandular hairs beneath, dorsal rachis grooved; veins free, forking. Sori rounded; indusia oval or reniform.

Sori : June - September.

Rare, growing in moist shady and humus rich forests between 3000-3700 m, up to the alpine slopes.

Reported by Stewart (1972) from Gulmarg and Khalinmarg areas.

2. *Athyrium attenuatum* (C.B. Clarke) Tagawa in Acta Phytotax. 16: 117. 1956. Fig. 26

Rhizome widely creeping with ovate-lanceolate, attenuate, thin, light brown scales. Stipe 10-40 cm long, covered with pale brown scales. Lamina 15-40 cm long, broadly ovate, 1-2 pinnate, consists of up to 22 pairs of pinnae; pinnae arranged subopposite to alternate, lowermost 3-4 pairs slightly reduced in size; texture herbaceous. Sori in 2 rows, indusiate; indusium hyaline, margin wavy, sporangia stalked.

- 1a. Fronds 1-pinnate, lower pinnae much reduced
pinnules undissected ...2.1. f. *attenuatum*
- 1b. Fronds 2-pinnate or bipinnate :
 - 2a. Lower pinnae smaller, never gradually reduced
pinnae & pinnules dentate. ...2.2. f. *dentigerum*
 - 2b. Lower pinnae shorted, gradually reduced pinnae
& pinnules crenate-serrate. ...2.3. f. *intermedium*

2.1. forma *attenuatum*

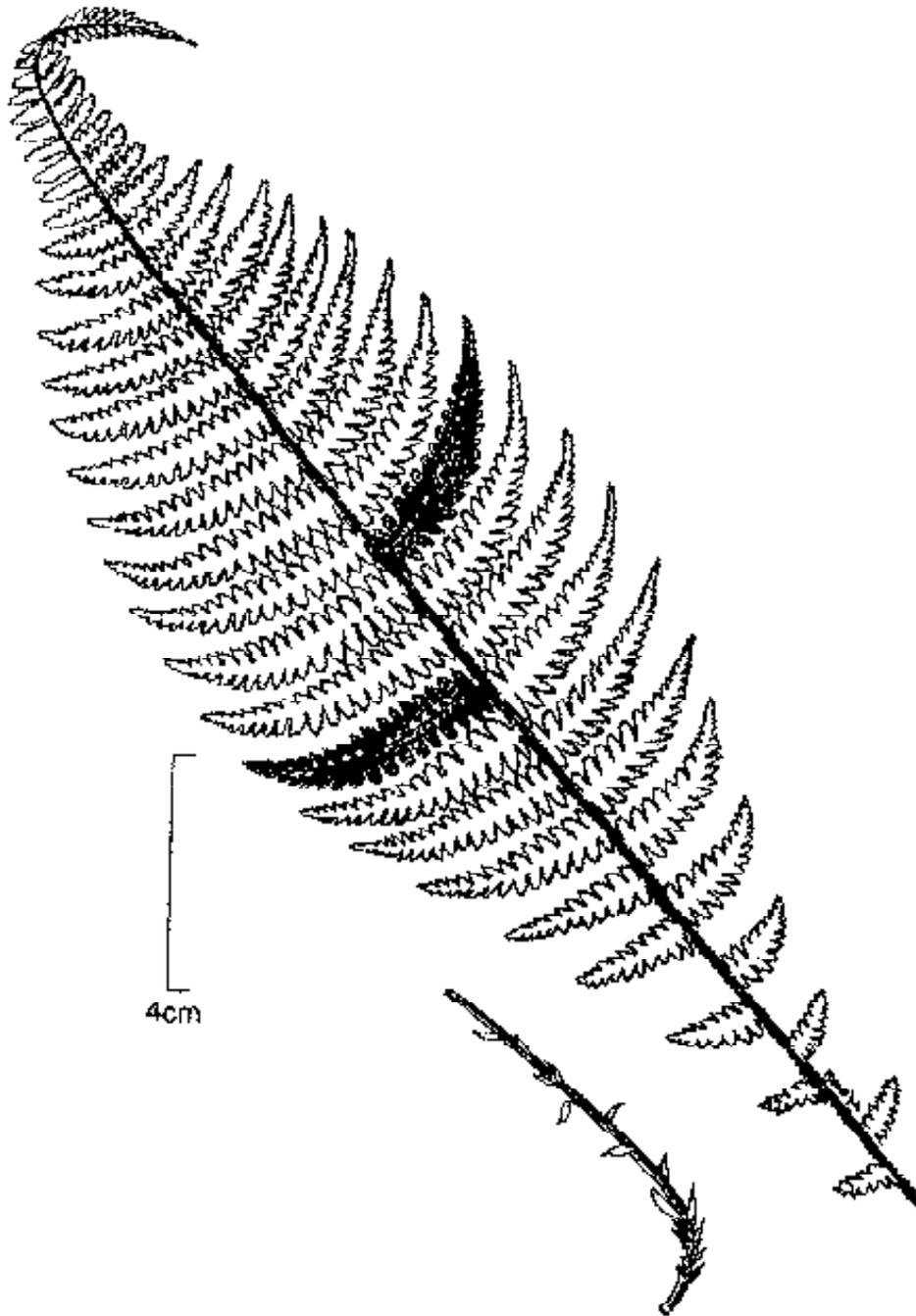


Fig. 26. *Athyrium attenuatum* (C.B. Clarke) Tagawa

Sori : July - October.

Usually growing on an open alpine meadows, above 3000 m.

Kashmir : Pahlgam, 3200 m, *T.A. Rao* 660; Gulmarg, 2700 m, *T.A. Rao* 255 (BSD); Dagwan, *Wadhwa*, 66983 (BSD); Liddar Valley, 3300-4000 m, *Duthie*, 13182 (CAL); *Duthie* 13436 (DD).

2.2. forma *dentigerum* (Wallich ex C.B. Clarke) Khullar *et* Fraser-Jenkins in *Bir in Aspect of Pl. Sci.* 6: 95-103. 1982. *A. dentigerum* (Wallich ex C.B. Clarke) Mehra & Bir in *American Fern J.* 50: 279. 1960. *A. filix-femina* (L.) Roth var. *dentigera* (Wallich ex C.B. Clarke) Bedd., *Handb. Ferns Brit. India* : 169. 1883. *A. filix-femina* (L.) Roth var. *dentigera* Wallich ex C.B. Clarke in *Trans. Linn. Soc. London* 1: 1491. 1880. *Polypodium dentigerum* Wallich, List no. 334. 1828, *nom. nud.*

Sori : July - October.

Growing in the forests below the alpine regions, 1800-3200 m generally along the streams.

Selected specimens : Kashmir near Guraige, 2300-2800 m, *Duthie* 12605 (DD); Pir-Panjal, 2200 m, *G.A. Gammie s.n.* Acc. No. 11340 (CAL).

2.3. forma *intermedium* (Mehra & Khullar) Fraser-Jenkins & Khullar in *Bir, Aspect Pl. Sci.* 6: 99-103. 1982. *A. filix-femina* (L.) Roth var. *intermedia* Mehra & Khullar in *Res. Bull. Panjab Univ.* 25: 156. 1974.

Sori : July - October.

Rare, growing between 2700-3300 m. on exposed slopes.

Selected specimens : Kashmir : Gulmarg, 2700 m, *Khullar*, 111 (PAN).

3. *Athyrium distans* (D. Don) Moore, *Index Fil.* 125. 1859; Khullar, *Illus. Fern. Fl. W. Himal.* 2: 39, 2000. *Asplenium distans* D. Don, *Prodr. Fl. Nepal.* 9. 1825.

Rhizomes erect, thick. Stipes long, thin, stramineous, scaly; scales brown to dark-brown; rachis stramineous. Lamina 2-3-pinnate, ovate lanceolate to triangular-lanceolate, proliferous, buds absent; pinnae many pairs, long, narrowly triangular-lanceolate, margin pinnate-pinnatifid, lowest pinnae shorter than next pair above; pinnules petiolate, triangular-lanceolate. Sori indusiate, stright, short, close to the costules; indusia small.

Sori : August to November.

Occasionally found between 1500-2500 m in forest on banks of streams.

Reported by Khullar (2000) from Sind Valley in Kashmir.

4. *Athyrium fimbriatum* (Wallich) Moore, Index Fil. 185. 1860; Bedd., Ferns Brit. India t. 295. 1868 & Handb. Ferns Brit. India 172. t. 83. 1883 (*p.p.*); Stewart in Bull. Torrey Bot. club. 72: 415. 1945. *Athyrium fimbriatum* Wallich, List no. 339, *nom. nud.* 1829. *Asplenium atkinsonii* var. *andersonii* (C.B. Clarke) C.B. Clarke in Trans. Linn. Soc. London 1: 494. 1880. *A. andersonii* C.B. Clarke in J. Linn. Soc. 15: 154. 1876.

Rhizomes widely creeping, apex clothed with lanceolate scales. Stipes solitary, distant, stout, brownish, up to 25 cm long. Lamina up to 38 cm long, up to 35 cm broad, subdeltoid, tripinnate or quadripinnate; pinnae stalked, acuminate, up to 15 x 5 cm; veins forked; rachis pale-brown, flexuous. Sori small, reniform, indusiate; indusia fimbriate. Spores brown.

Sori : July - October.

Frequent, under forest slopes or in shady places above 2200 m.

Reported by Stewart (1945) from Jhelum and Kishan ganga valley, Gulmarg, Sonamarg and Pahlgam.

5. *Athyrium foliolosum* (Wallich) Moore ex Sim, Priced Cat. Hort. no. 6: 22. 1859; Moore, Index Fil. 185. 1860; Khullar et Sharma in Pangtey & Joshi, West. Himal., 1: 332. 1987; *A. fimbriatum* var. *foliolosa* C.B.

Clarke in Trans. Linn. Soc. London 1: 495. 1880. *Asplenium foliolosum*
Hope in J. Bombay Nat. Hist. Soc. 14: 255. 1902.

Rhizomes ascending or suberect, with lanceolate, brown scales. Stipes and rachis scaly throughout, deep pink in colour when fresh, firm: Stipes up to 30 cm long; rachis with gland at the base of pinnae. Lamina large, 40-60 x 20-30 cm, often drooping, tripinnatifid or quadripinnate, ovate-lanceolate. Pinnae up to 20 x 4 cm; pinnules bearing large secondary pinnules, cut down into minute segments; veins forked. Sori J-shaped or reniform with conspicuous indusium. Spores dark or light-brown.

Sori : July - September.

Generally grows in abundance on forest floor between 2400-3000 m, below the alpine regions.

Reported by Khullar & Sharma (1987) from Gulmarg, Khallinmarg, Sonamarg and Pahalgam.

6. *Athyrium mackinnoniorum* (Hope) C. Chr., Index Fil. 143. 1905; Stewart in Bull. Torrey Bot. Club 72: 414. 1945; Dixit, Cens. Indian Pterid. 127. 1984. *Asplenium mackinnoni* Hope in J. Bot. 34: 124. 1896 & in J. Bombay Nat. Hist. Soc. 14: 112. 1903.

Rhizomes thick, ascending or suberect, clothed with bright brown castaneous, filiform-linear scales. Stipes densely tufted, firm, up to 35 cm long, scaly below, pale or straw-coloured above. Lamina bipinnate, broadly lanceolate, up to 50 x 30 cm; pinnae stalked, up to 17 x 4 cm, sub-basal the largest; veins forked, pinnate. Sori mostly on superior veinlet of each lobe, linear curved, with thin, large, athyroid indusia. Spores yellowish-brown.

Sori : June - October.

Common, between 2200-3000 m, in shady moist, humus rich places.

Selected specimens : Kashmir : Gulmarg, 2200 m, *E.M. Trotter* 117 (CAL); Gulmarg, 2500 m. *A.S. Rao* 63686 (BSD); *s. loc.*, *Duthie* 21060 (CAL).

7. *Athyrium nigripes* (Blume) T. Moore, Index Fil. 49. 1857; Hope in J. Bombay Nat. Hist. Soc. 14: 119. 1902; Khullar *et* Sharma in Pangtey *et* Joshi, West. Himal., 1: 332. 1987; *A. solenopteris sensu* Bedd., Handb. Ferns Brit. India : 166. 1883. *pp.*, *non* T. Moore.

Rhizomes erect, up to 5 cm high, with ovate-lanceolate, deltoid scales. Stipes short, up to 13 cm long, scaly at base, glabrous upwards, grooved above, greenish. Lamina bipinnatifid, lanceolate, acuminate, up to 22 cm long, 3-7 cm wide; pinnae up to 14 pairs, petiolate, basal pinnae slightly smaller, truncate at base; pinnules up to 12 pairs, 4 mm apart, lobed, 1/3-1/2 way to the costa; veins up to 2 pairs per lobe; texture herbaceous. Sori seated on veinlets, slightly linear.

Sori : August - October.

Rare, between 2500-3000 m, on open grassy hill slopes.

Reported by Khullar & Shamra (1987) from Gulmarg.

8. *Athyrium pectinatum* (Wallich ex Mett.) T. Moore, Index Fil. 152. 1959; Khullar, Illus. Fern Fl. W. Himal. 2: 63-65. 2000. *A. pectinatum* Wallich ex Mett., Tent. Pterid; 98. 1836 *nom. nud.* *A. filix-femina* (L.) Roth subsp. *pectinatum* (Wallich ex Mett.) Love *et* Love in Taxon 26: 326. 1977. *Asplenium pectinatum* Wallich, List No. 231. 1828 *nom. nud.*

Rhizomes creeping, thin and scaly. Stipes distant on rhizomes, up to 35 cm long, as long as the lamina, stramineous, scaly at base; scales brown; rachis stramineous, grooved, sometimes scaly or glabrous. Lamina 2-3-pinnate, finely dissected, 20-60 cm long, 10-30 cm broad, lanceolate, texture thin, herbaceous; pinnae 9-18 pairs, 3.5-13.5 cm long, 2.5-3 cm broad, alternate, petiolate; pinnules 8-10 pairs up to 1.5 cm long, 0.6 cm broad, margin deeply lobed to the costule; costae and costules glabrous. Sori indusiate, small; indusia light brown, straight or J-shaped.

Sori : August - October.

Common, between 1500-2000 m on grassy hill slopes.

Reported by Khullar (2000) recorded from Kathua district.

9. *Athyrium rubricaulis* (Edgew. ex C.B. Clarke) Bir in Nova Hedw. 4: 169. f. 12-13. 1862; Dixit, Cens. Indian Pterid. 128. 1984. *Asplenium filix-femina* Bernh. var. *retusa* subvar. *rubricaulis* Edgew. ex C.B. Clarke in Trans. Linn. Soc. London 1: 49. 7. 59. f. 2. 1880.

Rhizomes short, erect or suberect, thick, scaly, covered with few persistent leaf bases. Stipes very long, 25-40 cm, stramineous or light-brown; base with linear-lanceolate scales, higher up Stipes sparsely scaly or becoming glabrous; rachis not grooved when dry, glabrous. Lamina 2-pinnate, 25-40 cm long, 10-20 cm broad, widest just above the base, ovate-lanceolate; texture herbaceous, glabrous; pinnae 15-25 pairs, 7-15 cm long, 2-5 cm broad, distant, higher up on rachis close together, narrowly triangular-lanceolate, subopposite or alternate, shortly petiolate, lower 2-3 pinnae gradually shortened, but not attenuated; pinnules 6-10 pairs or more, 1-2.5 cm long, up to 0.7 cm broad, basal pinnules opposite, shallowly or deeply lobed. Sori indusiate often on the acroscopic side of veinlet of each lobe, "J" shaped. Spores yellowish brown.

Sori : August - October.

Occasionally growing between 2000-2800 m, under shady forest slopes.

Selected specimens : Gulmarg, S.P. Khullar s.n. (PAN); Bhaderwah, 2600 m. C.B. Clarke 31476 (CAL).

10. *Athyrium rupicola* (Hope) C. Chr., Index Fil. 145. 1905; Stewart in Bull. Torrey Bot. Club 72: 414. 1945; Khullar & Sharma in Pangtey & Joshi, West Himal. Env. Probl. Dev. 1: 333. 1987. *Asplenium rupicola* Hope in J. Bombay Nat. Hist. Soc. 12: 531. f. 5. 1899. *A. filix-femina* Bernh. var. *retusa* C.B. Clarke in Trans. Linn. Soc. London 1: 492.

1880. *Athyrium filix-femina* var. *retusa* (C.B. Clarke) Bedd., Handb. Fern Brit. India 170. 1883 p.p.

Rhizomes suberect or procumbent, clothed with brown, linear scales. Stipes short densely tufted, bases persistent, straw-coloured, clothed below with dark-brown hair-pointed, linear scales. Lamina pinnate to pinnatifid, up to 40 x 10 cm, narrow, lanceolate, acuminate at apex, the lower pinnae becoming distant towards base of frond, broadest at base; texture herbaceous or sub-coriaceous; veins usually 1-forked or simple, pinnate in the segment, one veinlet to each tooth. Sori linear, curved or J-shaped; indusium curls back at maturity. Spores dark brown.

Sori : July September.

Common throughout the sub-alpine to alpine regions, 2400-3500 m.

Reported by Khullar and Sharma (1987) from Pir panjal, Seshnag, Patinitop, Nathatop and Sansar forests.

11. *Athyrium schimperii* Moug. ex Fée, Mem. Fougères, 5 (Gen. Fil.): 187. 1850-52; Bedd., Handb. Ferns Brit. India Suppl. 36. 1892; Stewart in Bull. Torrey Bot. Club 72: 415. 1945. *Asplenium schimperii* A. Br., Schweinf. Beitr. 1: 224. 1867; Hopc in J. Bombay Nat. Hist. Soc. 14: 252. 1902.

Rhizomes widely creeping, densely clothed with bright brown, narrowly lanceolate-acuminate scales. Stipes firm, erect, scaly below, 15-25 cm long, stramineous. Lamina oblong-lanceolate, gradually reduced below, up to 45 cm long, 25 cm broad at middle, bipinnate to tripinnatifid; rachis stramineous, sometimes broadly winged; pinnae lanceolate-acuminate, up to 15 x 4 cm with sessile, up to 2 x 1 cm pinnules; texture herbaceous; veins simple or forked. Sori typically athyroid with broad indusium. Spores dark brown.

Sori : July September.

Uncommon, between 1800-3000 m, in damp shady places.

Selected specimens : Kashmir : Patinitop Sanasar, 2300-2500 m, T.A. Rao 7455 (BSD).

12. *Athyrium setiferum* C. Chr., Index Fil. 146, 1905 & Supplm. 3: 44, 1934; Mehra & Bir in Res. Bull. Panjab Univ. (N.S.) 15: 142, 1964; Stewart in Bull. Torrey Bot. Club 72: 414, 1945. *Athyrium nigripes* Bedd., Handb. Ferns Brit. India: 166, 1883 (pp.). *Asplenium nigripes* Mett. var. *dissecta* Moore, C.B. Clarke in Trans. Linn. Soc. London 1: 491, 1880. *Asplenium tenellum* Hope in J. Bombay Nat. Hist. Soc. 12: 529, 1899.

Rhizomes erect, small, thick. Stipes up to 35 cm long tufted with a few lanceolate-acuminate brown scales at the base. Lamina bipinnate, up to 50 x 25 cm, 10-18 pairs, stalked, ovate, acuminate, 4-8 cm long, broadest in the middle; secondary rachis flat above, keeled below; pinnules 6-12 pairs; texture herbaceous; veins pinnate in the pinnules, forking in the ultimate segments. Sori in double row, closed to the costa along the veins of each lobe; indusium fugacious at maturity. Spores light brown.

Sori : August - October.

Rare, on moist rocks or near the water-falls, between 1200-1800 m.

Selected specimens : Kistwar, 1400-1600 m, T. Thomson s.n. (DD).

13. *Athyrium strigillosum* (T. Moore ex E.J. Lowe) T. Moore ex Salom., Nomenc. Gefasskrypt. 112, 1883. *Asplenium strigillosum* T. Moore ex E.J. Lowe, Ferns Brit. Exot. 5: t. 36, 1858; Dixit, Cens. Indian Pterid. 129, 1984. *Athyrium tenuifrons* Wallich ex Sim, Priced Cat. Ferns 6: 17 no. 204, 1859. *Asplenium tenuifrons* Wallich ex Hope in J. Bombay Nat. Hist. Soc. 14: 120, t. 22, 1902.

Rhizomes ascending or short-creeping, apex clothed with dark-brown scales. Stipes tufted, firm, round, glabrous, scaly below, up to 20 cm long. Lamina 20-50 x 10-20 cm, ovate-lanceolate, gradually narrowed at both ends, generally rooting from a bud on the upper side of the rachis. Pinnae deltoid-lanceolate, up to 10 x 3 cm; pinnules shortly stalked; conspicuous

setae present along costa and costules on upper surface; veins forked. Primary rachis stramineous, secondary winged. Sori linear-oblong, curved, in two rows towards the midrib of the pinnae; indusium fugacious at maturity. Spores light-yellow to brown.

Sori : July - October.

Rare, growing on the banks and beds of streams or on moist rocks in well shaded ravines, 1500-2100 m.

Selected specimens : Bhaderwah Agoli, Vohra & Naithani 82891 (BSD).

14. *Athyrium wallichianum* Ching in Bull. Fan Mem. Inst. Biol. Bot. 8: 497, 1938; Dhir in Biblioth. Pterid. 1: 92, 1980; Dixit, Cens. Indian Pterid. 130, 1984. *Nephrodium brunonianum* Hook., Sp. Fil. 4: 291, t. 113, 1862. *Lastrea brunoniana* Presl, Tent. Pterid. 76, 1836 *nomen nud.*; Bedd., Handb. Ferns Brit. India 246, 1883. *Dryopteris brunoniana* (Wallich ex Mett.) O. Kuntze, Rev. Gen. Pl. 2: 812, 1891; Stewart in Bull. Torrey Bot. Club 72: 407, 1945. **Fig. 27**

Rhizomes slender or short creeping, densely clothed with large, dark-brown, lanceolate scales. Stipes tufted, 10-15 cm long, black or dark-brown coloured, densely clothed with large dark-brown, lanceolate scales. Lamina 30-45 cm long, 5-10 cm broad, 1-pinnate with numerous close subequal oblong-lanceolate blunt pinnae, the lower ones reduced, the largest 4-5 cm long, 1-2 cm broad, narrowly cut down to the rachis into sharply toothed, rounded lobes; texture herbaceous; rachis ebeneous and more or less clothed with long fibrillose scales, undersurfaces naked; veins forked. Sori round.

Sori : July - October.

Common, grows in alpine hill slopes, between 3200-4000 m elevation.

Selected specimens : Kashmir : Lidderwart above, 4000 m, Duthie 13563 (CAL); Pahlgam, 3500 m, C.B. Clarke 31054 (CAL); Gulmarg, 3300-

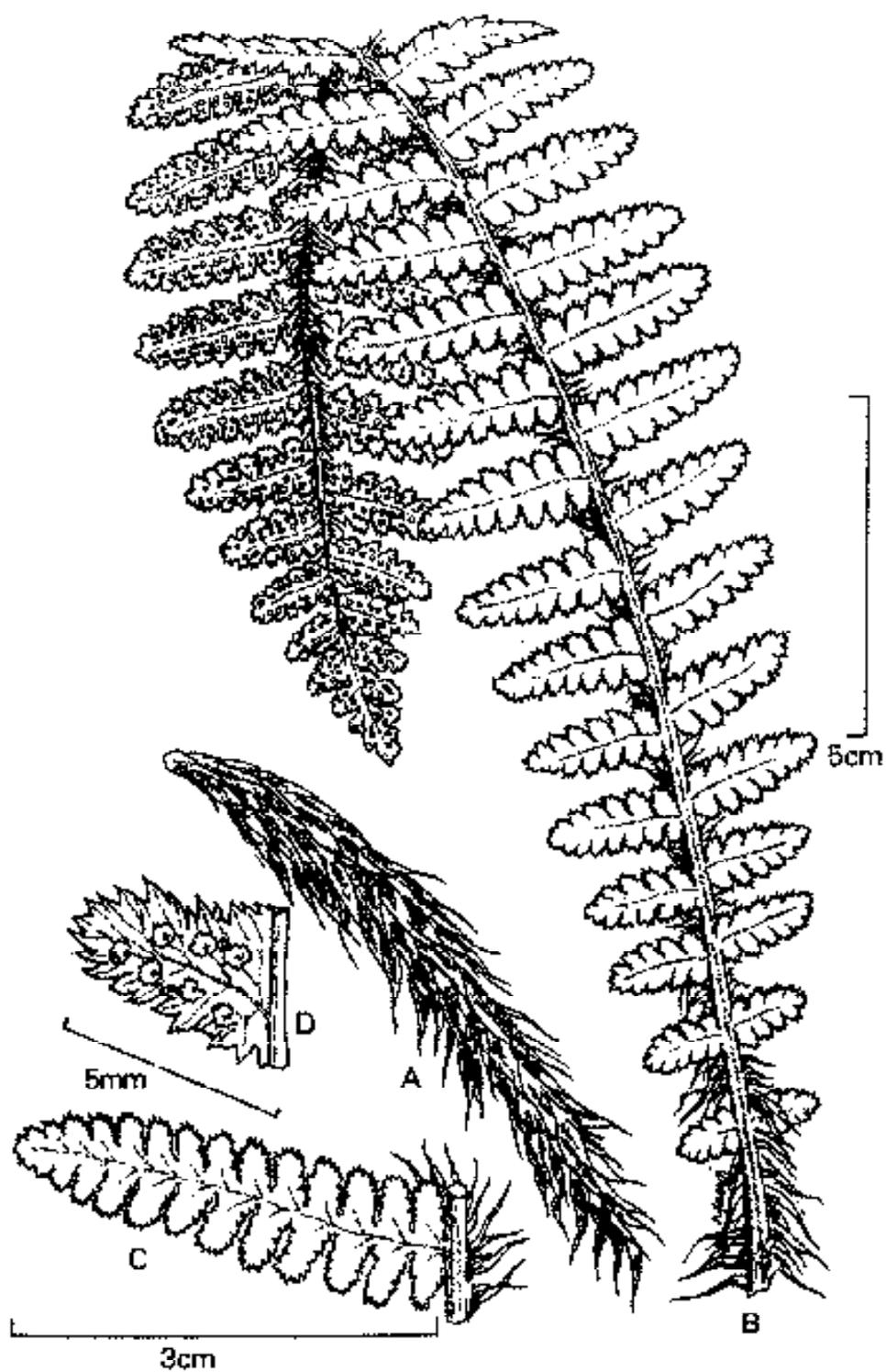


Fig. 27. *Athyrium wallichianum* Ching

3700 m, *Duthie* 11278 (DD); Baramula : Rajdhan, Alpine meadows, *Wadhwa* 83823 (BSD).

2. CYSTOPTERIS Bernh.

- 1a. Veins directed into the depression at the pinnule margin; indusia cupshaped, with free margin, relatively entire; rhizomes thin with long internodes. ...4. *C. montana*
- 1b. Veins extending directly into teeth; indusium large, conspicuous with free margin, frequently lacerate; rhizomes short with approximate nodes :
- 2a. Lamina broadly ovate-lanceolate; stipes elongated; pinnae large, 3-8 cm, never overlapping :
- 3a. Spores abortive and non spiny ...3. *C. fragilis* nothosubsp. *x montserratii*
- 3b. Spores not abortive, echinate ...2. *C. fragilis* f. *fragilis*
- 2b. Lamina sub-deltoid to ovate-lanceolate; Stipes short, thin; pinnae closed, overlapping each other, often deflexed; pinnules obtuse, oblong-ovate; spores rugos verrucose. ...1. *C. dickieana*

1. *Cystopteris dickieana* R. Sim in *Gardn. et Fern. J.* 308. 1848; Alston in *Amer. Fern J.* 41: 76. 1951; Bir & Trikha in *Nova Hedw.* 24: 22. 1974. *C. fragilis* subsp. *dickieana* (R. Sim) Nylender, *Uppsala Univ. Arsskr.* 7: 59. 1945. Fig. 28

Rhizomes small, thin, shortly creeping, apex clothed with pale yellow, ovate-lanceolate scales. Stipes closely aggregated, thin, yellowish-brown, naked, poorly scaly at base, 4-6 cm long. Lamina hairy throughout, up to 18 cm long and 5 cm broad, fragile, bi-pinnate, subdeltoid to ovate-lanceolate; pinnae opposite to subopposite, closely placed, overlapping each other, deltoid-ovate with obtuse apex; pinnules obtuse, oblong-ovate, markedly overlapping, pinnatifid; rachis winged; veins simple or forked. Sori near the margin of the pinnule, conspicuous; indusia prominent. Spores dark-brown, rugose-verrucose.

Sori : July September.

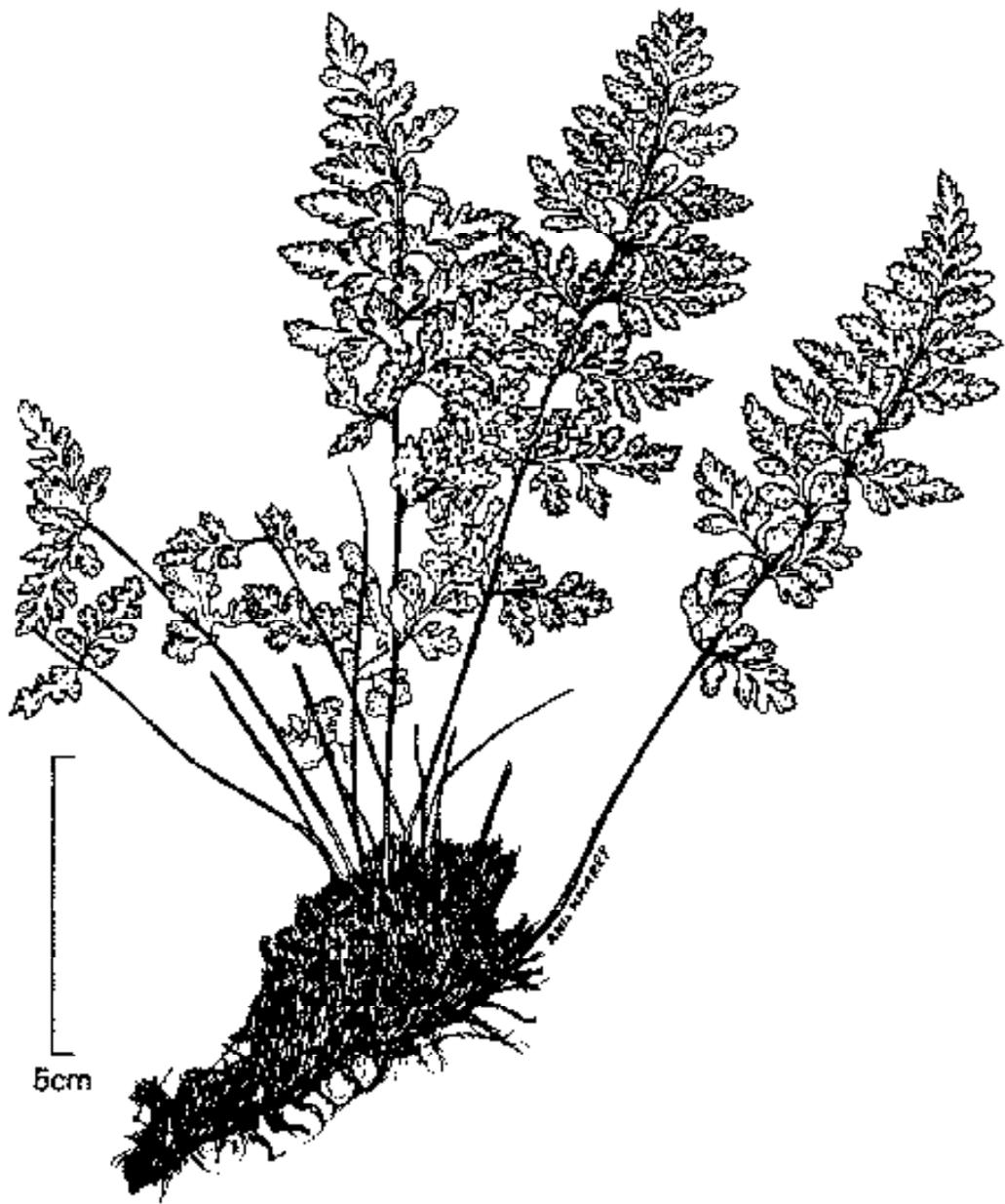


Fig. 28. *Cystopteris dickiana* R. Sim

Frequently growing on rocky slopes or crevices in subalpine to alpine regions, 2300-4000 m.

Selected specimens : Ladakh : Kargil-Suru Road, *Vishwanathan* 55657 (BSD); Daras-Kargil Road, *Wadhwa* 58750 (BSD); Khardungla, *Hajra* 74190 (BSD); Hemis National Park, *S.K. Srivastava & A. Chauhan* 100999 (BSD). Kashmir : Lidderwart hill top, 3700 m, *T.A. Rao* 6914; Aherbal, *T.A. Rao* 9246 (BSD).

2. *Cystopteris fragilis* (L.) Bernh. f. *fragilis* Bir & Trikha in *American Fern J.* 66: 109. l. 1. 1976; Dixit, *Cens. Indian Pterid.* 130. 1984. *Polypodium fragilis* L., *Sp. Pl.* 1091. 1753. *Cystopteris fragilis* (L.) Bernh. in *Schrad. J. Bot.* 1: 27. 1806; Stewart in *Bull. Torrey Bot. Club* 72: 404. 1945.

Rhizomes short, creeping, scaly; scales ovate-lanceolate, yellowish-brown scales. Stipes usually shorter than lamina, stramineous to light brown or dark brown with lanceolate scales at base. Lamina 15-30 cm long, 10-12 cm wide, fragile, bipinnate-tripinnatifid, linear-lanceolate to broadly ovate-lanceolate; main rachis in the upper region and secondary rachis slightly winged, both the rachises covered with multicellular glandular hairs; primary pinnae broadly lanceolate to ovate-lanceolate with acuminate apex; middle pinnae 3-8 cm long, 1-3 cm wide, acuminate; basal pinnules shortly stalked; texture thin, membranaceous; veins divided, 6-7 to a segment, each vein entering a tooth. Sori round, discrete; indusium large, conspicuous with free margin. Spores dark brown, echinate.

Sori : July - October.

Common, growing on open rocky hill slopes, sub-alpine to alpine regions, 2000-4500 m.

Selected specimens : Ladakh : Thanglang La, 4500 m, *Bhattacharyya*, 41027 (BSD); Ganglas, *Chowdhery & Uniyal* 86059 (BSD); Khardungla (on way), *D.K. Singh & party* 101090 (BSD); Kashmir : Jasker-Dagwan, *Wadhwa*, 66903 (BSD); Baramula, Barnai, *Wadhwa & Pant* 85069 (BSD); Tilail Range, 4000 m, *J.F. Duthie* 13913 (CAL).

Note : This is a polymorphic species exhibiting great variation in the size and degree of cutting of pinnae, outline of pinnae and lamina and consequently ultimate segments and spore structure. On the basis of morphological variations, Bir and Trikha (1976) has separated it into different forms.

3. *Cystopteris fragilis* (L.) Bernh. nothosubsp. *x montserratii* (Prado *et* Salvo) Fraser-Jenkins, *New Species Syndrome Indian Pteridology & Fern Nepal*. 100. 1997; Khullar, *Illus. Fern, Fl. West. Himal.* 2: 102. 2000; *C. x montserratii* Prado & Salvo in *Anal. Jard. Bot. Madrid* 41(2): 466. 1985.

Spores fully abortive, non spiny.

Reported by Khullar (2000).

4. *Cystopteris montana* (Lam.) Bernh. in Schrad. *Neues J. Bot.* 1: 26. 1806; Bedd., *Handb. Ferns Brit. India Suppl.* 15-16. 1892; Stewart in *Bull. Torrey Bot. Club* 72: 404. 1945; Bir & Trikha in *Nova Hedw.* 47: 7. 1973. *Polypodium montanum* Lam., *Fl. France* 1: 23. 1778.

Rhizomes cord-like, thin, widely creeping, 2-3 mm in diam with elongated nodes, apex clothed; scales with acuminate apex and glandular margin. Stipes longer than the lamina, 20-30 cm, stramineous. Lamina 10-15 cm, hairy throughout, tri-quadripinatid, broadly deltoid-ovate with the basal pinnae the largest and curved upwards towards the apex, upper pinnae becoming smaller, deltoid-lanceolate, triangular towards base. Pinnules lanceolate to oblong, apex acute. Sori round, discrete, rarely confluent; indusia persistent at maturity, cup shaped. Spores dark brown, spinose, tuberculate.

Sori : August - October.

Occasional, growing in rock crevices in Birch forests, 3000-4000 m.

Reported by Stewart (1945) from Gulmarg and Sonamarg.

3. *DEPARIA* Hook. & Grev.

- 1a. Fronds large to huge, bipinnate to deeply tripinnatifid; sori round ...3. *D. boryana*
- 1b. Fronds smaller, pinnate to bipinnate; sori linear or J-shaped :
- 2a. Rhizomes; suberect or erect; lower pinnae gradually reduced :
- 3a. Fronds up to 60 cm long; lowest acroscopic pinnule in each pinna markedly elongated and deflexed; spores large ...1. *D. acuta*
- 3b. Fronds more than 7 cm long; lowest acroscopic pinnule on each pinnae of the same size and hardly more lobed; spores small ...2. *D. allantodioides*
- 2b. Rhizomes creeping; lower pinnae not reduced :
- 4a. Lamina lanceolate, 20-40 cm long ...5. *D. macdonelli*
- 4b. Lamina triangular-lanceolate, 20-25 cm long :
- 5a. Pinnules more rectangular and less sloping; a tetraploid sexual ...6. *D. petersenii*
- 5b. Pinnules less rectangular but sloping; a diploid sexual ...4. *D. japonicum*

1. *Deparia acuta* (Ching) Fraser-Jenkins, New species Syndrome, Indian Pteridology & Ferns Nepal. 102. 1997; Khullar, Illus. Fern Fl. W. Himal. 2: 107. 2000. *Lunathyrium acutum* Ching in Acta Phytotax. Sinica 9: 73. 1964.

Rhizomes suberect with dark brown scales. Stipes 25-35 cm long, thick, densely scaly at base; scales dark brown, up to 1 cm long, lanceolate. Laminas 2-pinnatifid, 50-70 cm long, 10-13 cm broad, lanceolate; firm chartaceous, glabrous; pinnae 20-25 pairs, 5-8 cm long, 1-1.5 cm broad, middle pinnae longest; lower 3-4 pairs gradually much reduced; basal pinnae reduced, margin deeply lobed; pinnules 10-15 pairs, narrow, lanceolate, apex acute, margin entire, lowest acroscopic pinnae enlarged and deflexed. Sori small, 2-4 pairs per lobe; indusia of the same shape as sori, reddish-brown.

Sori : August - October.

Grows on the hill slopes in open rocky places near the streams, between 2300-3800 m altitude.

Reported by Khullar (2000) from Kashmir valley, Gulmarg, Tangmang nallah, Pahlgam, Chandanwari and Kolahio Glacier.

2. *Deparia allantodioides* (Bedd.) Kato, *Annals Carnegie Mus.* 49: 177. 1980; Khullar, *Illus. Fern Fl. W. Himal.* 2: 109. 2000. *Lunathyrium allantodioides* (Bedd.) Ching in *Acta Phytotax. Sin.* 9: 72. 1964; Dixit, *Cens. Indian Pterid* 136. 1984. *Athyrium allantodioides* Bedd., *Ferns Brit. India* t. 221. 1867. *A. acrostichoides* (Sw.) Diels in *Engl. & Prantl, Nat. Pfl.* 1: 223. 1899; Stewart in *Bull. Torrey Bot. Club* 72: 414. 1945. *A. rhylopteroides* (Michx.) Desv., *Prodr.* 226. 1827; Bedd., *Handb. Ferns Brit. India* 164. 1883.

Rhizomes creeping, black with narrowly-linear, black, denticulate scales. Stipes 30-50 cm long, stramineous, scaly at base and articulated hairs on upper parts. Lamina 35-90 cm long, 15-20 cm broad, hairy, lanceolate, gradually narrowed towards the base; pinnae numerous, 18-25 cm long, 2-3 cm broad, erect-patent, cut down to the rachis; petiolate; pinnules with very short petioles, lanceolate, acuminate, 5-8 cm long, 1.5 cm broad, truncate at base, margins crenately lobed, cut less than half way to costa. Sori linear or short, medial on veinlet.

Sori : July - October.

Common, between 2300-3000 m, elevation, on hill slopes.

Selected specimens : Kistwar, T.A. Rao 7849 (BSD); Baramulla Barnai, Wadhwa 85070 (BSD); Pir-panjal: Haripur, G.A. Gammie s.n. (DD); Sind Valley; C.B. Clarke 30983 (CAL); Liddar Valley, Duthie 13181 (CAL).

3. *Deparia boryana* (Willd.) Kato in *Bot. Mag. Tokyo* 90: 36. 1977; Khullar, *Illus. Fern Fl. W. Himal.* 2: 110-112. 2000. *Aspidium boryanum* Willd., *Sp. Pl.* 5: 285. 1810.

Rhizomes short, thick, ascending, apex scaly. Stipes 60-95 cm long or more, stramineous or brown, sparsely scaly and fibrillose; scales brown, bicolourous, 1.5 cm long, lanceolate; rachis brown, grooved on the upper surface; secondary rachis not grooved, sparsely fibrillose or hairy. Lamina 2-3-pinnate, large, 0.5-1 m long, 30-60 cm broad; triangular-lanceolate; texture herbaceous, sparsely hairy; pinnae many pairs, up to 45 cm long, 17 cm broad, alternate, petiolate, lanceolate, lowest pinnae not much reduced; pinnules 10-20 pairs, 4-8 cm long, 1-3 cm broad, alternate, petiolate, lanceolate, margin deeply lobed to the costa or pinnate in larger fronds; ultimate lobes 5-10 pairs; costae and costules stramineous, hairy; hairs brown. Sori indusiate, round, fimbriate.

Sori : July - October.

Grow along the streams or in moist places, around 1800-2400 m altitude.

Reported by Khullar (2000) from Silodi mandir and from Bhund to Bani, North of Basohli in Kathura district.

4. *Deparia japonica* (Thunb. ex Murray) Kato in Bot. Mag. Tokyo 90: 37. 1977; Khullar, Illus. Fern Fl. W. Himal. 2: 115. 2000. *Lunathyrium japonicum* (Thunb.) Kurata in J. Geobot. 9: 99. 1961; Dixit, Cens. Indian Pterid. 136. 1984. *Asplenium japonicum* Thunb., Fl. Japan 334. 1784. *Athyrium japonica* (Thunb.) Copel. in Philp. J. Sci. 3C: 290. 1908. *Diplazium japonica* (Thunb.) Bedd., Ferns Brit. India Suppl. 12. 1876 & Handb. Ferns Brit. India : 180. 1883; Stewart in Bull. Torrey Bot. Club. 72: 415. 1945. Fig. 29

Rhizomes short with thin, dark-brown, lanceolate scales. Stipes 10-30 cm long, stramineous, hairy, scaly at base. Lamina 15-40 cm long, hairy, gradually tapering to the apex. Basal pinnae somewhat shortened or little reflexed; lateral pinnae lanceolate or falcate, 3-10 cm long, 2-3 cm broad, cut about half to costa; lobes rounded with few teeth on apex; veins free, pinnate in the lobes; veinlets simple or forked, hairy or with minute crisped scales. Sori linear, single or double near the midrib, not reaching up to the margin; indusia brown.



Fig. 29. *Deparia japonica* (Thunb. ex Murray) Kato

Sori : June - September.

Frequent, between 1200-2200 m, growing along the streams or moist shady places.

Reported by Stewart (1945) from Kishanganga Valley.

5. *Deparia macdonellii* (Bedd.) Kato in J. Fac. Sci. Univ. Tokyo 13(4): 391. 1984; Khullar, *Illus. Fern Fl. W. Himal.* 2: 117. 2000. *Lunathyrium macdonellii* (Bedd.) Ching in *Acta Bot. Austro. Sinica* 1: 21. 1983; Khullar & Sharma in *Pangtey & Joshi, West. Himal. Env. Dev.* 1: 336. 1987. *Asplenium macdonellii* Bedd. in *J. Bot.* 73. 1889. *Athyrium macdonellii* (Bedd.) Bedd., *Handb. Ferns Brit. India Suppl.* 34. 1892; Stewart in *Bull. Torrey Bot. Club* 72: 414. 1945. **Fig. 30**

Rhizomes erect, or procumbent with dark brown, large lanceolate scales. Stipes up to 30 cm long, much thickened, at the base with densely deciduous, lanceolate scales and rachis, white, hairy. Lamina 25-35 cm long, 25-35 cm broad at the base, rarely hairy, ovate to deltoid-lanceolate; pinnae 18-20 pairs, lanceolate, alternate or subopposite, 10-12 cm long, up to 5 cm broad, pinnatifid nearly to the midrib, leaving only a winged margin to the villous partial rachis; pinnules ligulate-oblong, 0.5 cm broad, cut down 1/3 into small oblong lobes; texture herbaceous; surfaces naked or nearly so; veins one to each lobe, forked or pinnate or simple. Sori elongate to each lobe, not reaching the margin; involucre athyroid or asplenoid, never diplazioid.

Sori : July - October.

One of the rare ferns, mainly found between 1200-1800 m elevation, in very wet situations or along streamlets.

Selected specimens : Kajiliban, *Duthie* 12622 (DD); Kishanganga Valley, 1939, *R.R. & I.D. Stewart* 17623 (CAL).

6. *Deparia petersenii* (Kunze) Kato in *Bot. Mey. Tokyo* 90. 37. 1977; Khullar, *Illus. Fern Fl. W. Himal.* 2: 119. 2000. *Lunathyrium petersenii*

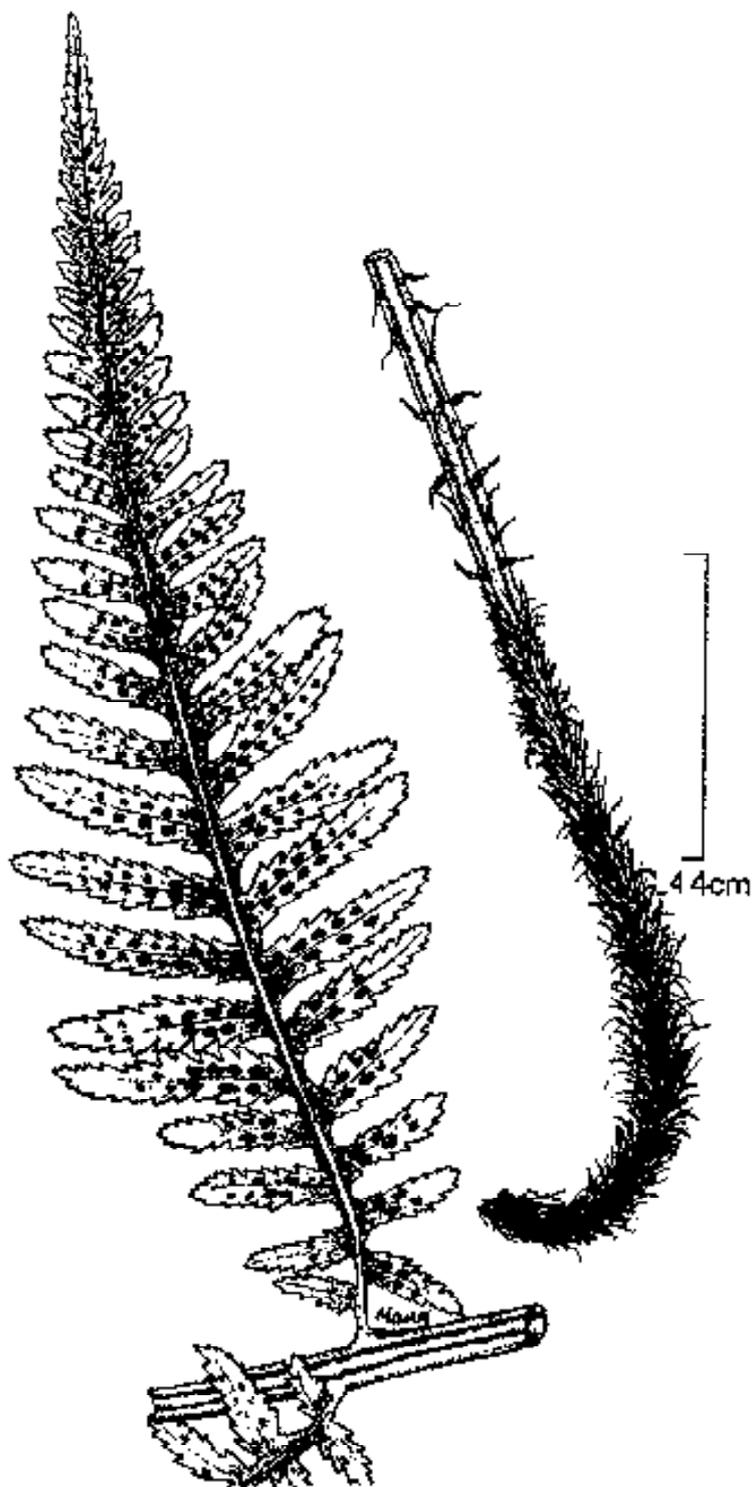


Fig. 30. *Deparia macdonellii* (Bedd.) Kato

(Kunze) H. Ohba in Sci. Rep. Yokosuka City Mus. 11: 53. 1965. *Asplenium petersenii* Kunze. Anal. Pterid. 24. 1837.

Rhizomes creeping, scaly. Stipes 30-50 cm long, as long as the lamina, stramineous, but dark brown at base; rachis sparsely scaly-fibrillose and hairy. Lamina pinnate, 25-40 cm long, 10-15 cm broad, triangular-lanceolate or deltate; texture herbaceous, sparsely hairy; pinnae 10-12 pairs, 7-10 cm long, 1.5-2 cm broad, distant alternate, margin deeply lobed to the costa; lobes 10 pairs, up to 1.5 cm long, 0.5 cm broad, regular, characteristically more rectangular with broad apex; lower pinnae generally the largest. Sori indusiate; indusium flat, fimbriate.

Sori : June - September.

Occuring between 1500-2000 m, shady and damp locality in forest floor.

Reported by Khullar (2000) from Neelam valley, Banjosa, Rawalkot of Poonch district, Patnitop of Jammu Division and Bani of the Kathua district.

4. DIPLAZIUM Swartz

- 1a. Lamina pinnate or bipinnate ...4. *D. lobulosum*
- 1b. Lamina 2-pinnate or more :
 - 2a. Fronds of moderate size (up to 50 cm) with black scales scattered above and on rachis :
 - 3a. Rhizomes long creeping, thin; pinnae lobes small (0.5-1 cm) ...6. *D. sibiricum*
 - 3b. Rhizomes creeping-ascending, thick; pinnae lobes longer (2-3 cm) ...8. *D. squamigerum*
 - 2b. Fronds large to huge (60-100 cm) with brown scales confined to lower part of the stipes :
 - 4a. Basal 2-3 pairs of veinlets of adjacent lobes anastomosing and forming an excurrent veinlet to sinus; spores non perinate ...2. *D. esculentum*

- 4b. Veinlets not as above, all free :
- 5a. Rhizomes thin and long creeping;
pinnule lobes elongate-ovate with
some what narrow bases, round lobes
and rounded apices ...7. *D. spectabile*
- 5b. Rhizomes thick, short, escended or
upright; pinnule lobes rectangular, with
wide bases, apices pointed or unlobed
and truncate :
- 6a. Spores highly abortive ...3. *D. x kashmirianum*
- 6b. Spores not abortive :
- 7a. Stipes base and costae pale to
brown, bearing brown scales;
sori large and long ...5. *D. maximum*
- 7b. Stipes base and costae dark,
without scales; sori small and
short ...1. *D. bellum*

1. *Diplazium bellum* (C.B. Clarke) Bir in Res. Bull. Punjab Univ. (N.S.) 15: 148. 1964 & J. Indian Bot. Soc. 43: 571. 1964; Khullar, Illus. Fern Fl. W. Himal. 2: 128-129. 2000. *Asplenium bellum* C.B. Clarke in Trans. Linn. Soc. London 1: 496. 1880.

Rhizomes erect, large. Stipes blackish at base; rachis glabrous. Lamina deeply tripinnatifid or subtrippinate, large; texture herbaceous, glabrous; pinnae 30-60 cm long, 20-25 cm broad, alternate, petiolate; margin deeply lobed to the costa; lobes up to 10 pairs, up to 2 cm long 1 cm broad, narrow based. Sori small, short, oblong, rarely extended to the margin.

Sori : May to October.

Grows between 300-1500 m altitude in moist places.

Reported by Khullar (2000) from Buffliaz of Poonch district and Kodal of Kathna district.

2. *Diplazium esculentum* (Retz.) Sw. in Schrad. J. Bot. 1801: 312. 1803. *Hemionitis esculenta* Retz., Obs. Bot. 6: 38. 1791. *Anisogonium*

esculentum (Retz.) Presl, Tent. Pterid. 116. 1836; Bedd., Handb. Ferns Brit. India: 192. 1883.

Rhizomes ascending, becoming erect, with few black or brown, lanceolate, attenuate scales. Stipes stout, blackish at base, 30-60 cm long, strong, erect, tufted. Lamina up to 1.5 m long, occasionally simple pinnate, generally bipinnate; young fronds pinnate with broad pinnac; older fronds bipinnate with narrower pinnules; large fronds sometime tripinnatifid. Lower pinnac 30-40 cm long, 15-20 cm broad; pinnules 7-12 cm long, up to 3-4 cm broad, apex acuminate, the edge more or less deeply lobed; texture subcoriaceous; rachis often pubescent; veins fine, copiously pinnated, anastomosing. Sori linear, single or double; indusia thin, narrow.

Sori : Throughout the year.

Common, growing along the ditches or streams up to 1600 m in hilly regions.

Selected specimens : Kathua : Perol, *Hajra* 82415 (BSD); Kathua city area *Uniyal & Singh* 91211 (BSD).

3. *Diplazium* × *kashmirianum* Fraser-Jenkins, Bot. Helvetica 102/2: 154. 1993; Khullar, illus. Fern Fl. West. Himal. 2 : 152. 2000.

Stipe scales dark-brown, narrow, lanceolate, somewhat stiff. Ultimate segments larger than in *D. maximum*, ± without lobes, ± rectangular, apex acute, segments at base of pinnules lobes; lobes narrowed at base. Sori small in size, near to costules. Spores abortive.

Reported by Khullar (2000) from Jammu, Kathua, N.W. of Kadal, North of Basohli, on way to Bheaderwah.

4. *Diplazium lobulosum* (Wallich ex Mett.) Presl ex C. Chr., Index Fil. 1: 234. 1905. *Asplenium lobulosum* Wallich, List No. 210. 1828 *nom. nud.*, Wallich ex Mett., Farngett. Aspl. 114 n. 170. 1859. *Diplazium longifolium* T. Moore, Ind. Fil. 141. 332. 1859. Bedd., Handb. Ferns Brit. India 179. t. 87. 1883; Khullar, illus. Fern Fl. W. Himal. 2: 133. 2000.

Rhizomes short, erect or ascending, covered with dark brown scales. Stipes 5-15 cm long, light brown; rachis scaly towards base, rest glabrous. Lamina pinnate, up to 50 cm long 6-10 cm broad, ovate or lanceolate broadest at the middle; texture subcoriaceous, glabrous; pinnae up to 20 pairs, 3-7 cm long, 1-1.5 cm broad, alternate, petiolate, falcate, auricled at base on upper side, pinnae apex acuminate, margin subentire or shallowly lobed; lobes spinulose-serrate. Sori indusiate, elongated, never reaching the margin; indusia light brown.

Sori : Major part of the year.

Grows between 1200-2400 m altitude along ravines, waterfalls and wet rocks.

Reported by Khullar (2000) from Kadal of Kathua district.

5. *Diplazium maximum* (D. Don) C. Chr., Index Fil. 1: 235. 1905. *Asplenium maximum* D. Don, Prodr. Fl. Nepal. 8. 1825. *Diplazium frondosum* (C.B. Clarke) Christ in Not. Syst. Lecomte 1: 46. 1909; Khullar & Sharma in Pangtey & Joshi, West. Himal. Environ. Dev. 1: 334. 1987. *Asplenium latifolium* D. Don var. *frondosum* C.B. Clarke in Trans Linn. Soc. London 1: 503. 1880.

Rhizomes erect, sub-arborescent, densely clothed at the crown with dark brown, fibrillose scales; scales up to 2 cm long. Stipes densely tufted, stout, green, 30-35 cm long, sometimes muricated, not scaly, but slightly furfuraceous. Lamina up to 85 cm long, 35-50 cm broad, with 8-9 pinnae on each side, below the simple ones at the apex; the lower ones 10-12 cm apart, 20-30 cm long, 12-15 cm broad; pinnules numerous, spreading 5-7 cm long, 1-2 cm wide, cut down nearly to the rachis; texture herbaceous; both surfaces naked, bright green; veinlets about 6 on each side in the lobes. Sori diplazoid, linear, falling distinctly short of the edge.

Sori : August - October.

Extremely common, between 1200-2500 m, in shady moist places or along the river beds.

Selected specimens : Batot, 1958. T.A. Rao 1371 (BSD); Kishanganga Valley, T.A. Rao 1700 m, s.n. (DD).

6. *Diplazium sibiricum* (Turez. ex Kunze) Kurata, Enum. Japan Pterid. 292-340. 1961; Jermy in Brit. Fern Gaz. 9: 160. 1964; Khullar & Sharma in Pangtey & Joshi, West. Himal. Env. Dev. 1: 335. 1987. *Asplenium sibiricum* Turez. ex Kunze, Annal. 25. t. 15. 1837. *Athyrium crenatum* (Sommerf.) Rupr., Nyland. Spicil. Pl. Fenn. 2: 14. 1844. *Aspidium crenatum* Sommerf., Vet. Ak. Handl. 1834. 104. 1835; Stewart in Bull. Torrey Bot. Club 72: 413. 1945.

Rhizomes short, with dark brown, ovate-lanceolate scales. Stipes 15-30 cm long, scattered, firm erect, naked, stramineous, with large, dark-brown or black ovate scales at base. Lamina 22-35 cm each, deltoid, tripinnatifid or quadripinnate; pinnae 9-12 pairs on each side; the lowest pinnae largest, 15-20 cm long, 4-6 cm broad; pinnules lanceolate, cut down to the rachis (except towards the point on each side) into 4-6 blunt, oblong segments which are bluntly toothed; texture herbaceous; rachis stramineous, both surfaces hairy or nearly naked. Sori 2-6 to a segment, oblong, often double, diplazoid.

Sori : July September.

A very rare fern between 2400-2700 m in shady forest slopes.

Reported by Khullar and Sharma (1987) from Gulmarg, and Stewart (1945) from Kishanganga valley below Guraj.

7. *Diplazium spectabile* (Wallich ex Mett.) Ching in Lingnan Sci. J. 15: 278. 1936; Dixit, Cens. Indian Pterid. : 134. 1984; Khullar & Sharma, in Pangtey & Joshi, West. Himal. Env. Dev. 1: 335. 1987. *Asplenium spectabile* Wallich ex Mett., Aspl. 196. no. 240. 1859. *Diplazium umbrosum* var. *multicaudatum* (Wallich ex C.B. Clarke) Bedd., Handb. Ferns Brit. India : 190. t. 91. 1883.

Rhizomes wide, creeping, apex clothed with brown, linear-lanceolate scales. Stipes 20-30 cm long, black scaly at base, stramineous. Lamina

30-60 cm long, 20-30 cm broad, tripinnate, broadest at the base with an acute apex. Pinnae 22 cm long, 8 cm broad, stalked, ascending with acute apex; pinnules 20-25 pairs, stalked, deeply pinnatifid, oblong, 5 cm long and 1.5 cm wide; texture herbaceous, dark green; veins simple, forked, almost reaching the margin of the segment. Sori linear-oblong, near the midrib, indusiate; indusia short, thin. Spores yellow, reniform.

Sori : June September.

Occasional, between 900-2000 m elevation, growing in wet places.

Reported by Khullar and Sharma (1987) from Patinitop and Sanasar.

8. *Diplazium squamigerum* (Mett.) Matsum., Ind. Pl. Jap. 1: 304, 1904; Christ in Bull. Soc. Bot. 12: 538, 1936; Stewart in Bull. Torrey Bot. Club. 72: 416, 1945. *Asplenium squamigerum* Mett. in Miq. Ann. Mus. Bot. Lugd. Bot. 2: 239, 1866; Hook. et Baker, Syn. Fil. 237, 1874. *Athyrium squamigerum* (Mett.) Ohwi, Fl. Japan : 87, 1965.

Rhizomes short, creeping, black with lanceolate, denticulate, dark brown to black scales. Stipes 15-40 cm long, stramineous, scaly throughout, densely black scaly at base. Lamina bipinnate to tripinnatifid, 30-40 cm long, and 25-35 cm broad. Pinnae petiolate, subopposite; lower pinnae 15-20 cm long, 5-7 cm broad; pinnules 3-4 cm long, 2-2.5 cm wide, sessile, ovate-oblong, margin cut into rounded lobes. Sori linear, curved, borne on medial veinlets near costa, single, the lowest double; indusia thin, brown.

Sori : July September.

Rare, around 2300-3000 m, growing in deep shaded moist places or along the streams.

Selected specimens : Kishanganga Valley, 1893, *Duthie* 14100 (DD); North of Denoni, *Macdonell s.n.* (DD); Kishanganga Valley; Sarda-Kel, *R.R. & I.D. Stewart* 17808 (CAL).

5. GYMNOCARPIUM Newman

Gymnocarpium fedtschenkoanum Pojark, Soobsch. Tadzhik. Fil. Akad. Nauk S.S.S.R. 22: 9. 1950; Khullar, Illus. Fern. Fl. W. Himal. 2: 155. 2000. *Gymnocarpium dryopteris* (L.) Newman in Phytol. 4: 371. 1851; Dixit, Cens. Indian Pterid. 135-136. 1984. *Polypodium dryopteris* L., Sp. Pl. 2: 1053. 1753; Bedd., Ferns Brit. India t. 74. 1865; Hook. et Baker, Syn. Fil. 308. 1874. *Phegopteris dryopteris* (L.) Bedd., Handb. Fern Brit. India : 293. 1883; C.N. Page, Ferns Brit. Island 224. 1982. Fig. 31

Rhizomes thin, slender, long creeping, branched. Stipes 12-18 cm long, sometimes longer than the lamina, erect, with few pale-brown scales at base. Lamina triangular-deltoid, 10-15 cm long, 10-20 cm broad, slightly broader than long, 2-or 3-pinnate, green, delicate, almost membranaceous in texture, edge of the segments usually bend downwards; pinnules 1-2 cm long, up to 1 cm broad, lanceolate, crenate; rachis glabrous. Sori in row near the margin of each segment, exindusiate. Spores dark-brown.

Sori : August - October.

Grows, between 2000-3000 m in deep moist and sheltered ravines, along the mountain streamsides.

Selected specimens : Kishanganga Valley : Sarda, R.R. & I.D. Stewart 1775 (CAL); Pir Panjal Range, 2300 m, Eoniqu s.n. Acc. No. 20104 (CAL); Gilgit, G.M. Giles s.n. Acc. No. 20105 (CAL).

HYPODEMATIACEAE

HYPODEMATIUM Kunze

Hypodematum crenatum (Forssk.) Kuhn subsp. ***crenatum*** Khullar, Illus. Fern Fl. West. Himal. 2: 161. 2000. *Hypodematum crenatum* (Forssk.) Kuhn in Deck. Reis. Bot. 3: 37. 1879; Dixit, Cens. Indian Pterid. 137. 1984; Chandra, Ferns India, 160. 2000. *Polypodium crenata* Forssk., Fl. Aegypt. Arab. 185. 1775. *Dryopteris crenata* (Forssk.) O. Kuntze, Rev. Gen. 811. Pl. 2. 1891; Stewart in Bull. Torrey Bot. Club 72: 407.

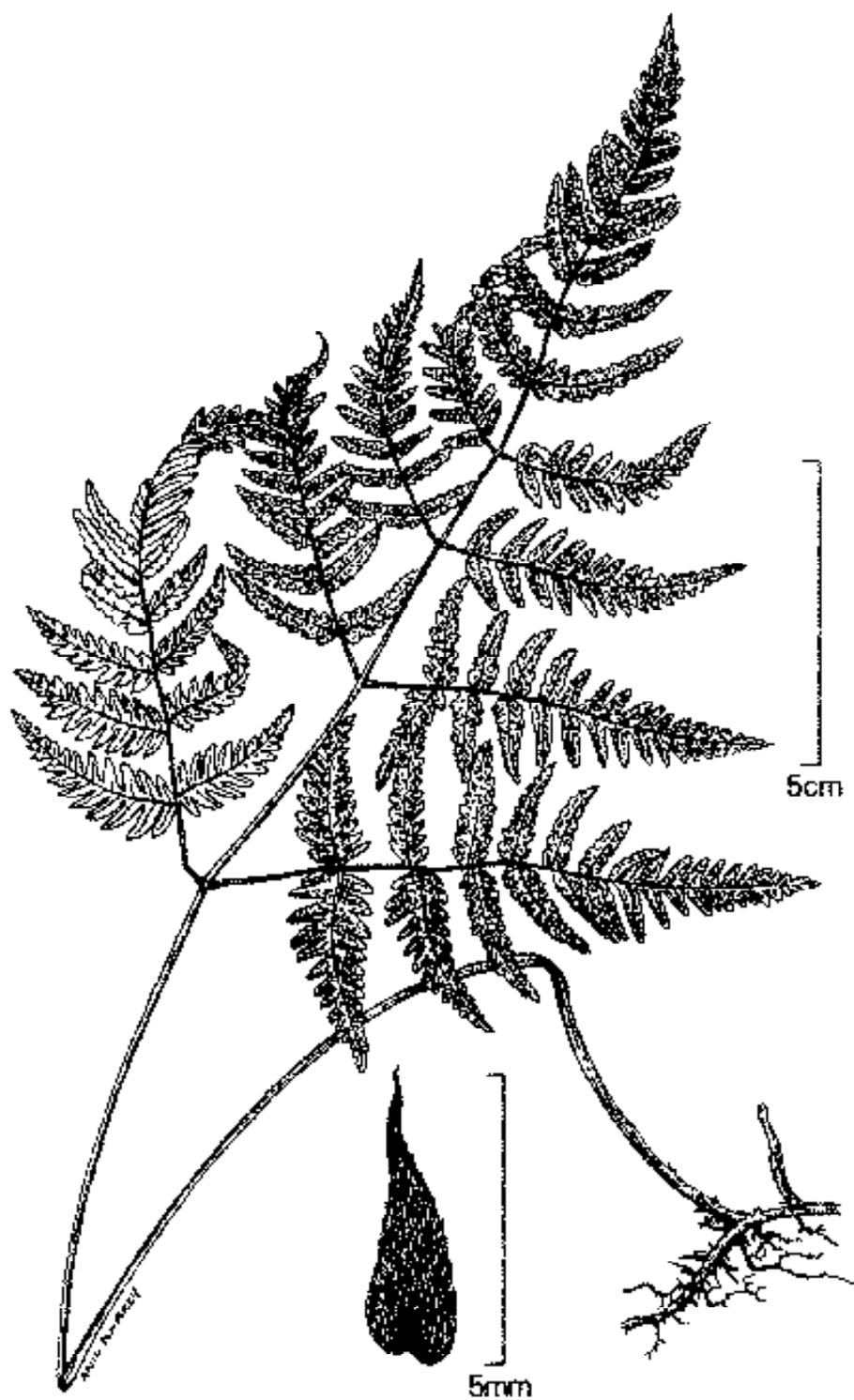


Fig. 31. *Gymnocarpium fedtschenkoanum* Pojark

1945. *Lastrea crenata* Bedd., Ferns Brit. India Suppl. 18. 1876 & Handb. Ferns Brit. India t. 95. 1883.

Rhizomes including scales *ca* 3 cm thick, covered with thin large golden brown scales. Scales narrowly linear, attached by their bases. Stipes stramineous, up to 30 cm long, base covered with reddish-brown scales. Fronds ovate-deltoid, 4-pinnatifid; both surface densely setose; venation free. Sori rounded, dorsal on veins; indusia reniform, pubescent, attached by sinus; sporangia stalked. Spores reddish brown, perisporiate, exine eroded.

Sori : August - December.

Common, growing in crevices of limestone rock and brick walls, 800-1800 m.

Selected specimens : Udhampur : Katra, Bhairon Temple, *Uniyal* 77344, 87702 (BSD); Poonch : Kolai, *Vohra & Naithani* 78213 (BSD); Kathua : Kot-Banjul, *Uniyal & Singh* 90331 (BSD).

THELYPTERIDACEAE

- 1a. Sori elongated :
- 2a. Sporangia with numerous eglandular setae; proliferating buds absent ...9. *Stegnogramme*
- 2b. Sporangia with glandular hairs; proliferating buds present ...1. *Ampelopteris*
- 1b. Sori more or less round :
- 3a. Veins anastomosing ...6. *Pronephrium*
- 3b. Veins not anastomosing :
- 4a. Sporangial wall with numerous hooked hairs ...3. *Cyclogramma*
- 4b. Hooked hairs absent :
- 5a. Indusium generally persistent :
- 6a. Spores generally tetra-hedral, trilete ...11. *Trigonospora*
- 6b. Spores generally bilateral, monolete ...10. *Thelypteris*

- 5b. Indusium absent or fugaceous:
- 7a. Sori near to the costule ...4. *Glaphyopteridopsis*
- 7b. Sori medial or near to the margin :
- 8a. Stipes scale margin with glandular hairs ...7. *Pseudocyclosorus*
- 8b. Stipes scale margin hairy or smooth :
- 9a. Aerophores at the base of reduced pinna present ...2. *Christella*
- 9b. Aerophores absent :
- 10a. Stipes base stramineous in colour; scales deciduous ...8. *Pseudophegopteris*
- 10b. Stipes base dark-brown; scales persistent ...5. *Phegopteris*

1. AMPELOPTERIS Kunze

Ampelopteris prolifera (Retz.) Copel., Gen. Fil. 144. 1947; Khullar *et al.* in Nova Hedw. 38: 621. 1983. *Goniopteris prolifera* (Retz.) C. Presl., Tent. Pterid. 183, 1836; Bedd., Handb. Ferns Brit. India 296. 1883. *Cyclosorus prolifera* Retz. in Tard. ex Tad. *et* C. Chr., Notul. Syst. Paris 7: 76. 1938. *Dryopteris prolifera* (Retz.) C. Chr., Index Fil. 1: 286. 1905; Stewart in Bull. Torrey Bot. Club 72: 409. 1945. **Fig. 32**

Rhizomes creeping, apex scaly; scales dark-brown, ovate, dentate. Stipes close together, distant on Rhizomes, 15-20 cm long, stramineous, base dark coloured, scaly throughout; scales dark brown, ovate-lanceolate. Lamina 1-pinnate, 60-90 cm long, axillary vegetative buds present; pinnae numerous, 6-10 pairs, alternate, sessile, oblong-lanceolate, base truncate, apex acute, margin subentire or dentate-serrate; veins up to 10 pairs, lower surface of veins hairy; lower surface of costae scaly; scales small, ovate. Sori exindusiate, oblong or round. Spores brown.

Sori : Major part of the year.

Fairly common, found in plains and the foot-hills, up to 1500 m along the river banks or near the water sources.

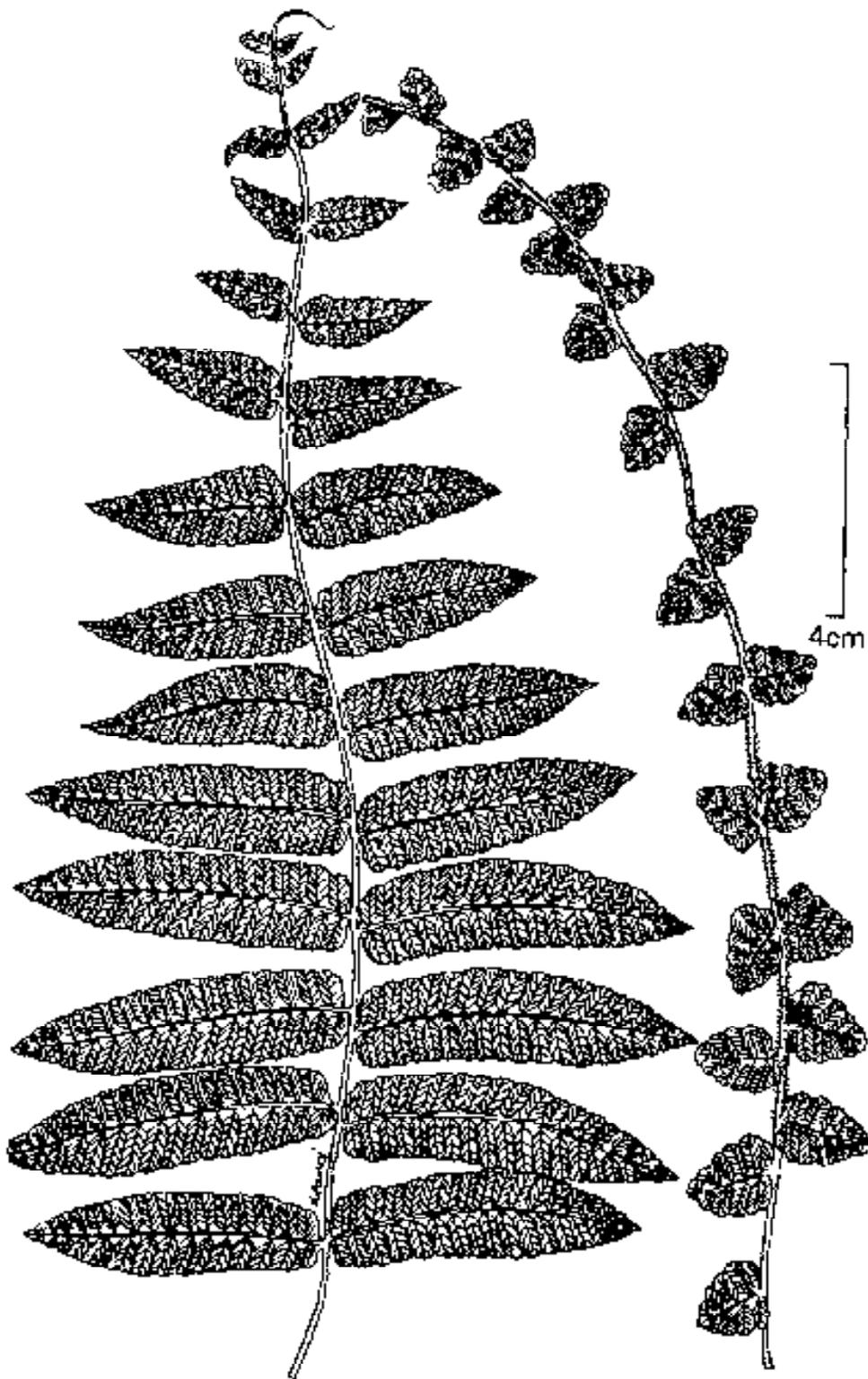


Fig. 32. *Ampelopteris prolifera* (Retz.) Copel.

Selected specimens : Kathua : Jasorta, S. Singh 91236 (BSID).

2. CHRISTELLA H. Lev.

- 1a. Rhizomes long creeping; pinnae margin shallowly lobed ...1. *C. arida*
- 1b. Rhizomes erect or short creeping :
- 2a. Lamina subcoriaceous; lower-2-4 pair of pinnae reduced ...2. *C. dentata*
- 2b. Lamina papyraceous; lower 10-12 pair of pinnae reduced ...3. *C. papilio*

1. *Christella arida* (D. Don) Holttum in Nayar & Kaur, Comp. Bedd., Handb. Ferns Brit. India : 206, 1974; Holttum in Kew Bull. 31: 320, 1976; Khullar, Illus. Fern Fl. W. Himal. 2: 178, 2000. *Aspidium aridum* D. Don, Prodr. Fl. Nepal. 4, 1825.

Rhizomes long creeping, apex scaly; scales light brown. linear-lanceolate. Stipes 15-30 cm long, thick, brownish or stramineous, base dark hairy when young, base sparsely scaly; rachis hairy; hairs white, long, unicellular. Lamina pinnate, 30-150 cm long, 30-40 cm broad, apex of lamina almost pinnae like; pinnae 30 pairs or more, up to 16 cm long, 1.5-2.0 cm broad, lanceolate, alternate, base cuneate, apex acuminate, margin shallowly lobed less than half to the costae; lowest 3-5 pairs of pinnae abruptly reduced, lowest pinnae much reduced; veins and costules hairy. Sori induciate, round, medial; indusia reniform.

Sori : Major part of the year.

Uncommon, between 1000-1600 m altitude, along the streams and wet places.

Reported by Khullar (2000) from Kashmir valley, Wular lake area and Kathua (West of Dhar).

2. *Christella dentata* (Forssk.) Brown. & Jermy in Brit. Fern Gaz. 10: 338, 1973; Khullar *et al.* in Nova Hedw. 38: 626, 1983. *Polypodium*

dentatum Forssk., Fl. Aegypt. Arab. 185. 1775. *Nephrodium molle* (Sw.) R. Br., Prodr. Fl. N. Holl. 149. 1810, pp. ; Bedd., Handb. Ferns Brit. India 277. 1883, pp.

Rhizomes, short ascending or short-creeping, apex scaly; scales brown, linear-lanceolate. Stipes 5-25 cm long, short, stramineous or light brown, hairy; rachis hairy; hairs unicellular. Lamina 1-pinnate, large, 20-35 cm long, 7-15 cm broad, oblong-lanceolate, apex pinnatifid, hairy on both surfaces (fertile with distant pinnae, sterile with closer pinnae); pinnae 15-25 pairs, 6-12 cm long, 1-2.5 cm broad, subopposite or alternate, sessile, lanceolate, base truncate, apex acuminate; lobes regular, slightly oblique; lower 2-4 pairs of pinnae distant and much reduced; veins 6-9 pairs, corresponding to lobes, pinnate, free. Sori indusiate, medial. Spores dark brown.

Sori : April - October.

Abundant, along ravines, irrigation channels and moist places, 600-1500 m.

Selected specimens : Kathua : Jasorta, S. Singh 91237 (BSD).

3. *Christella papilio* (Hope) Holttum in Nayar & Kaur, Comp. Bedd. Handb. Ferns Brit. India 208. 1974; Khullar, Illus. Fern Fl. W. Himal. 2: 184. 2000. *Nephrodium papillie* Hope in J. Bombay Nat. Hist. Soc. 12: 625. 1899.

Rhizomes short, erect. Stipes short, up to 30 cm long, stramineous, base scaly, higher up Stipes glabrous; scales brown, ovate or lanceolate; rachis stramineous, hairy. Lamina pinnate, up to 95 cm long, 30-45 cm broad, apex with a pinnatifid terminal pinna; texture thin papyraceous, glabrous, margin of pinnae lobes hairy; pinnae 15-45 pairs, 20-25 cm long, 2 cm broad, lanceolate, alternate or sub-opposite; pinnae gradually distant and much shortened, broadly triangular, auricled, auricles on acroscopic base much developed, free almost to the base; lower 5-10 pairs of pinnae distant, much reduced, triangular in shape due to both acroscopic and

basiscopic lower lobes being well developed and assuming a different shape from the pinnae in the middle of the frond: veins 7-9 pairs per pinnae lobe; costae and costules surface minutely hairy. Sori indusiate: indusia brown, reniform.

Sori : October - April.

Uncommon, up to 1600 m altitude, in moist places, often along banks of streamlets.

Reported by Khullar (2000) reported from Bhund in Kathua district.

3. CYCLOGRAMMA Tagawa

Cyclogranina auriculata (J. Smith) Ching in Acta Phytotax. Sinica 8: 317. 1963; Khullar, *et al.*, in Nova Hedw. 38: 632. 1983. *Phegopteris auriculata* J. Smith, Hist. Fil. 233. 1875; Bedd., Handb. Ferns Brit. India 290. 1883. *Thelypteris subvillosa* (Moore) Ching in Bull. Fan. Mem. Inst. Biol. 6: 279. 1936. *Phegopteris subvillosa* Moore, Index Fil. 308. 1961 (*nom. nud.*).

Rhizomes short, creeping. Stipes up to 15 cm long, short, thick, brown, hairy; hairs white, straight or hooked, base scaly; rachis with acicular hairs. Lamina 1-pinnate, 60-80 cm long, 20-30 cm broad. oblanceolate, herbaceous hairy, hairs white, hooked; pinnae 30-40 pairs, 10-13 cm long, 1-2 cm broad, alternate, deeply lobed, nearly to costa; lobes numerous, rounded, entire, subfalcate; lower pinnae gradually reduced to more auricles; veins 8-10 pairs on a lobe, pinnate, simple, free, never anastomosing. Sori exindusiate, round, near the costule. Spores brown.

Sori : Throughout the year.

Occasional, growing in swampy or near the water falls between 1000-2000 m.

Selected specimens : Kathua district : on way to Basoli from the Dam area, *Uniyal & Singh* 91392 (BSD).

4. GLAPHYROPTERIDOPSIS Ching

Glaphyopteridopsis erubescens (Wallich ex Hook.) Ching in Acta Phytotax. Sinica 8: 320. 1963; Khullar *et al.* in Nova Hedw. 38: 634. 1983. *Polypodium erubescens* Wallich ex Hook., Sp. Fil. 6: 236. 1862; C.B. Clarke in Trans. Linn. Soc. London 1: 543. 1880; Hope in J. Bombay Nat. Hist. Soc. 15: 78. 1903. *Phegopteris erubescens* Bedd., Handb. Ferns Brit. India 289. 1883. Fig. 33

Rhizomes short, erect, with a rosette of fronds equally round it, apex scaly; scales brown, linear-lanceolate, entire. Stipes 30-60 cm long, as long as lamina, grooved, pink or stramineous or pale yellow, hairy just below the rachis, base scaly; rachis hairy; hairs white, unicellular. Lamina 1-pinnate, large to huge, up to 2 m long, 60 cm broad, ovate-lanceolate, lower surface sparsely hairy, upper glabrous; pinnae 25-30 pairs or more, up to 16 cm long, 2 cm broad, close, opposite to subopposite, sessile, elongate-oblong, deeply lobed; veins 7-12 pairs in a lobe, simple, free in lowermost 1-2 pairs of lobes reaching the sinus, never anastomosing. Sori exindusiate, generally on lower veins. Spores dark brown.

Sori : September - March.

Generally found near water falls and ravines in shady situation, 1000-2400 m.

Selected specimens : Kishanganga Valley, Dhani-Titwal, 1500 m, R.R. & I. P. Stewart 17407 (CAL); Poonch : Mandi-Loran, 1500-2500 m, Vohra & Naithani 78277 (BSD); Kathua: Kot, Banjal, Uniyal & Singh 90330 (BSD).

5. PHEGOPTERIS Fée

Phegopteris connectilis (Michx.) Watt., Canad. Nat. 29. 1870; Khullar *et al.* in Nova Hedw. 38: 640. 1983. *Polypodium connectilis* Michx., Fl. Bor. Amer. 2: 271. 1803. *Phegopteris vulgaris* Mett., Fil. Hort. Lips 83. 1856 *nom. illeg.*; Bedd., Handb. Ferns Brit. India 290. 1883. *Polypodium phegopteris* L., Sp. Pl. 1089. 1753.

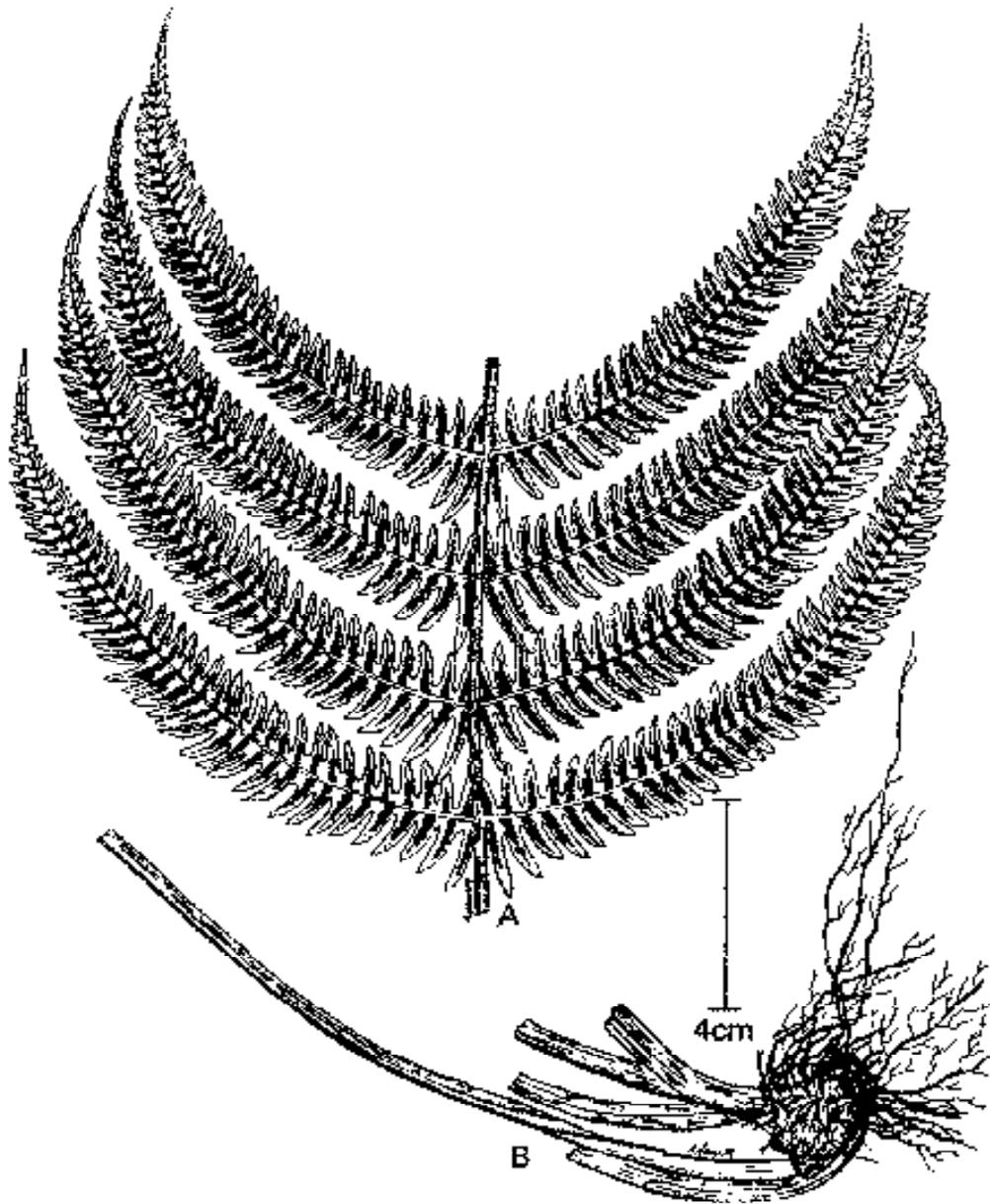


Fig. 33. *Glaphyopteridopsis erubescens* (Wallich ex Hook.) Ching

Rhizomes long creeping, thin, branched, apex scaly. Scales light brown, linear lanceolate, sparsely hairy. Stipes distant, 16-20 cm long, stramineous, base dark. Rachis scaly. Lamina 2-pinnatifid, 15-20 cm long, 10-15 cm broad, subdeltoid. Pinnae linear-lanceolate, acute, opposite, adnate, deeply lobed; lobes entire, crenate; lowermost pinnae distant and largest; veins usually simple, forked in largest lobes. Sori exindusiate, circular, subterminal. Sporangia sometimes hairy; hairs short. Spores brown.

Sori : July - September.

Frequent, growing in moist or marshy situations or near by streams, 2500-3000 m.

Selected specimens : Baramulla : Bagtor, Burzil-nalah, Wadhwa 84039 (BSD).

6. PRONEPHRIUM Presl

- | | |
|--|-----------------------------|
| 1a. Sori exindusiate | ...2. <i>P. penangianum</i> |
| 1b. Sori indusiate; indusia with few hairs | ...1. <i>P. nudatum</i> |

1. *Pronephrium nudatum* (Roxb.) Holttum in *Blumea* 20: 111. 1972; Khullar *et al.* in *Nova Hedw.* 38: 645. 1983. *Polypodium nudatum* Roxb. in *Calcutta J. Nat. Hist.* 4: 491. 1844. *Polypodium multilineatum* Wallich ex Hook., *Sp. Fil.* 5: 11. 1863; C.B. Clarke in *Trans. Linn. Soc. London* 1: 547. 1880. *Nephrodium moulemeinense* Bedd., *Ferns. Brit. India* Suppl. 18. 1876.

Rhizomes creeping. Stipes 2-3 cm, distant, 30-50 cm long, light brown, very sparsely scaly; scales few, brown, ovate, glabrous; rachis very sparsely scaly; scales smaller than those on stipes. Lamina 1-pinnate, up to 1 m long or longer, 30-50 cm broad, coriaceous, glabrous; pinnae at least 12 pairs, 18-36 cm long and 3-5 cm broad, alternate, shortly petiolate, narrow oblong, widest near base, margin sharply crenate; veins 15-20 pairs, upper 2-3 free, rest anastomosing into a zig-zag excurrent veinlet. Sori indusiate, small, round and medial; indusia round or reniform, small. Sporangia not setose. Spores brown with many, very short, spines.

Sori : October - March.

Rare, growing on rocky moist slopes or near the streams, 1400-1600 m.

Reported by Khullar *et al.* (1983) from Poonch.

2. *Pronephrium penangianum* (Hook.) Holttum in *Blumea* 20: 110, 1972; Khullar *et al.* in *Nova Hedw.* 38: 646, 1983. *Polypodium penangianum* Hook., *Sp. Fil.* 5: 13, 1863. *Nephrodium costatum* Bedd., *Ferns Brit. India* t. 220, 1867. *Dryopteris rampans* (Baker) C. Chr., *Index Fil.* 287, 1905; Stewart in *Bull. Torrey Bot. Club* 72: 408, 1945.

Rhizomes creeping. Stipes up to 120 cm long, light brown, sparsely scaly; scales few, brown, ovate, glabrous. Rachis reddish, lower minutely hairy, upper surface glabrous. Lamina 1-pinnate, 1-2 m long, 40-50 cm broad, coriaceous-submembranous, glabrous; pinnae at least 18 pairs, 20-30 cm long, 1.5-2.5 cm broad, narrow, linear, apex margin crenate-serrate, sharply dentate; veins 6-8 pairs, very oblique, all except upper 2-3 pairs anastomosing, with zig-zag excurrent veins. Sori exindusiate, small. Sporangia not setose. Spores brown.

Sori : March - June.

Rare, growing in most shady rocks or near water falls, 1200-1600 m.

Reported by Stewart (1945) from Tawi valley Jhelum valley & Poonch.

7. PSEUDOCYCLOSORUS Ching

- 1a. Stipes and rachis circular; base of lower 6-10 pairs of pinnae reduced, all with a distinct green lamina ...1. *P. canus*
 1b. Stipes and rachis quadrangular; base of more than 10 pinnae reduced, without distinct green lamina ...2. *P. tylodes*

1. *Pseudocyclosorus canus* (Baker) Holttum & Grimes in Kew Bull. 34: 509. 1979; Khullar, Illus. Fern Fl. W. Himal. 2: 215. 2000. *Nephrodium canum* Baker, Syn. Fil. 267. 1867.

Rhizomes long creeping, thick. Stipes up to 3 cm distant on Rhizomes, 10-25 cm long, shorter than lamina, stramineous or light brown, hairy, stipes glabrous, base scaly; scales brown, broad ovate; rachis hairy. Lamina pinnate, 70-100 cm long, 15-40 cm broad, lanceolate with white hairs; pinnae 25 pairs or more, 10-15 cm long, 1.5-2.2 cm broad, alternate, short petiolate, base truncate, margin deeply lobed to the costae; lobes many, tip pointed, basal pair of lobes shortened in lower pinnae; lower 6-10 pairs of pinnae much reduced, usually narrowed at base, apex caudate; veins in pinnae lobes simple, reaching to the margin. Sori indusiate, small; indusia brown, reniform.

Sori : Throughout the year.

Uncommon, grows in forests near the streams and damp shaded places, between 1000-1800 m altitude.

Reported by Khullar (2000) from Poonch (Bamber Gali) and Kathua district.

2. *Pseudocyclosorus tylodes* (Kunze) Ching in Acta Phytotax. Sinica 8: 324. 1963; Holttum in Kew Bull. 34. 503. 1980; Khullar, Illus. Fern Fl. W. Himal. 2: 218. 2000. *Aspidium tylodes* Kunze in Linnaea 24: 244. 283. 1851.

Rhizomes erect, thick. Stipes 30-40 cm long, light brown, quadrangular, hairy, becoming glabrous with age; rachis quadrangular, hairy or glabrous. Lamina pinnate, 30-45 cm long, 10-20 cm broad, oblong-lanceolate, hairy or glabrous; pinnae 20-30 pairs, 12-15 cm long; 1-2 cm broad, narrowly lanceolate, alternate, base subtruncate; margin deeply lobed to the costae, linear, falcate, basal lobe in the middle pinnae the largest; lower larger, 4-5 pair of pinnae distant, gradually reduced; reduced pinnae many, lowest represented by dark coloured sterophores, on stipes without

Sori : May – September.

Frequent, growing in humid and wet places, 1200-2600 m.

Selected specimens : Kashmir; Sind valley, 2250 m. *E.N. Trotter* 10168 (DD); Pir Panjal, Haripur, 2250 m. *G.A. Gammie s.n.* (DD).

2. *Pseudophegopteris pyrhorhachis* (Kunze) Ching in *Acta Phytotax. Sinica* 8: 315. 1963. subsp. ***distans*** Fraser-Jenkins, *New species Syndrome Indian Pteridology & Ferns Nepal* : 21. 1997; Khullar, *Illus. Fern Fl. W. Himal.* 2: 223. 2000. *Polypodium pyrhorhachis* Kunze, *Linnaea* 24: 257. 1851. *Lusterea microstegia* Bedd., *Ferns Brit. India* t. 39. 1865. *Polypodium late-repens* Trotter *et Hope* in *J. Bombay Nat. Hist. Soc.* 12: 628. 1899. *Dryopteris laterepens* (Trotter) C. Chr., *Index Fil.* 274. 1905; Stewart in *Bull. Torrey Bot. Club.* 72: 409. 1945.

Rhizomes short creeping or suberect. Stipes 20-25 cm long, shorter than the lamina, thick, dark brown to dark purple or stramineous, base dark; hairy with brown scales. Lamina pinnate, 50-75 cm long, 2-4 cm broad, opposite to subopposite, oblique, apex pinnatifid, deeply lobed to costae; lobes 1-2 cm long; basal lobes more developed with the margin crenately lobed or pinnatifid halfway to costules; lower 2-4 pairs of pinnae distant and reduced; veins 8-10 pairs in the lobes of pinnae. Sori exindusiate, small, 2-3 on each lobe.

Sori : June – October.

Scattered, in wet places, along stream beds or by streams in forest between 1500-2400 m altitude.

Reported by Khullar (2000) from Kathua : Kodal.

3. *Pseudophegopteris pyrhorhachis* (Kunze) Ching subsp. ***pyrhorhachis***; Chandra, *Indian Ferns* 313. 2000; Khullar *et al.* in *Nova Hedw.* 38: 653. 1983.

Rhizomes short-creeping or sub-erect. Stipes 20-50 cm long, shorter than lamina, stout dark-brown to dark-purple, stramineous, base dark;

rachis similar to Stipes, brownish or stramineous, hairy. Lamina 2-pinnatifid. 50-70 cm long 20-30 cm broad, herbaceous, hairy; pinnae 20-30 pairs, 15-20 cm long 2-4 cm broad, opposite or sub-opposite, middle ones alternate, sessile, oblique, apex pinnatifid, deeply lobed to the costa; lobes 1-2 cm long, alternate, base broad, adnate; lower 2-4 pairs of pinnae distant and reduced; veins 8-10 pairs corresponding to lobes pinnae, simple or forked, free, hairy. Sori exindusiate, small, 1-3 per lobe, orbicular or running along veins. Spores brown, perinate.

Sori : July - October.

Reported by Stewart (1945) from Chittapani valley, Rattanpir and Dardpur and Khullar *et al.* (1983) from Tangmarg, Pahlgam-Aru, Batot and Kistwar area.

9. STEGNOGRAMMA Blume

Stegnogramma mollissima (Fisch. ex Kunze) Fraser-Jenkins, New species Syndrome Indian Pteridology & Ferns Nepal : 237. 1997; Khullar, Illus. Fern Fl. W. Himal. 2: 232. 2000. *Gymnogramma mollissima* Fisch ex Kunze in Linnaea 23: 255. 310. 1850. *Stegnogramma pozoi* (Lagasc.) K. Iwats. in Acta Phytotax. Geobot. 19: 124. 1963; Khullar *et al.* in Nova Hedw. 38: 658. 1983. **Fig. 34**

Rhizomes short creeping, apex with brown scales. Stipes 8-30 cm long, light brown, base dark brown, hairy. Lamina 1-pinnate, 15-30 cm long, 6-15 cm broad, lanceolate to narrowly oblong-lanceolate, herbaceous to subcoriaceous hairy; pinnae 6-10 pairs, lower pinnae free, distal ones adnate, apex pinnatifid; free pinnae 2.5-8.5 cm long, less than 2 cm broad, subopposite-alternate, shortly petiolate; lobes entire, blunt or rounded; lower 1-2 pairs of pinnae smaller than those above; veins 6-8 pairs in a lobe, pinnate, free, never anastomosing. Sori exindusiate, elongated, medial. Spores dark-brown.

Sori : October - June.

Occasional, occurs around 1500-2400 m in shady marshy places.



Fig. 34. *Stegnogramma mollissima* (Fisch. ex Kunze) Fraser-Jenkins

Selected specimens : Kathua district, Banjal, 1800 m, *Uniyal & Singh* 90330 (BSD).

10. THELYPTERIS Schmid.

Thelypteris palustris (Salisb.) Schott., Gen. Fil. ad. t. 10. 1834; Ching in Bull. Fan Mem. Inst. Biol. 6: 330. 1936; Khullar *et al* in Nova Hedw. 38: 660. 1983; Khullar, Illus. Fern W. Himal. 235. 2000. *Polypodium palustris* Salisb., Prodr. 403. 1796. *Nephrodium thelypteris* (L.) Strempp., Fil. Beol. Syn. 32. 1822; C.B. Clarke in Trans. Linn. Soc. London 1: 717. 1880. *Lastrea thelyptis* (L.) Bory, Dict. Class 9: 233. 1826; Bedd., Handb. Ferns Brit. India 241. 1883. *Dryopteris thelypteris* (L.) A. Gray, Man. 630. 1848; Stewart in Bull. Torrey Bot. Club 72: 408. 1945. **Fig. 35**

Rhizomes long creeping, thin, stipes 30-40 cm long, stramineous, glabrous; base dark brown; rachis stramineous, hairy. Lamina 1-pinnate, 30-70 cm long, 15-20 cm broad; sterile generally broader than fertile ones, lanceolate, apex acuminate, herbaceous, both surfaces hairy; pinnae many, fertile 20-30 pairs, 6-10 cm long, 1.2-1.5 cm broad, distant, alternate, sessile, lanceolate; veins 6-8 pairs, free, lowest pair reaching the sinus. Sori indusiate, small, submedial; indusia light brown, reniform, margin wavy. Spores perinate, spinulose, dark brown.

Sori : August - March.

Reported by Stewart (1945) from Srinagar, Sind valley, Bandipur, Lolab valley.

11. TRIGONOSPORA Holttum

Trigonospora ciliata (Wallich ex Benth.) Holttum in Blumea 19: 29. 1971; Khullar *et al.* in Nov. Hedw. 38: 661. 1983; *Aspidium ciliatum* Benth., Fl. Hongk. 455. 1861; *Thelypteris ciliata* (Wallich ex Benth.) Ching in Bull. Fan Mem. Inst. Biol. 6: 289. 1936.

Rhizomes erect. Stipes fascicular, stramineous, longer in fertile fronds, hairy; rachis hairy. Lamina 1-pinnate, 40-50 cm long, 10-18 cm broad,

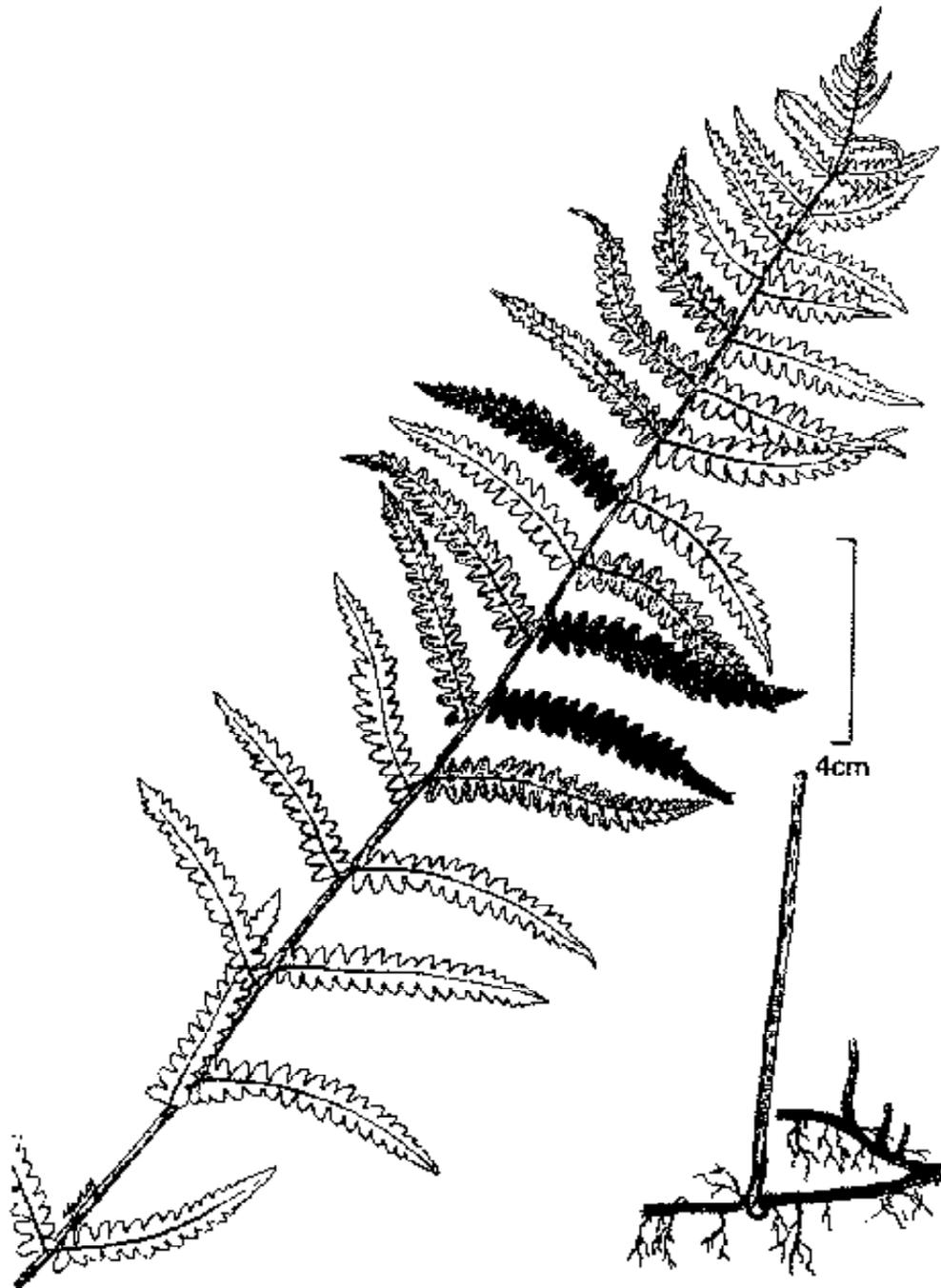


Fig. 35. *Thelypteris palustris* (Salisb.) Schott.

oblong, subcoriaceous, lower surface hairy; pinnae 20-25 pairs, lower pinnae not reduced, not deflexed, apex entire, acute or acuminate; sterile pinnae lobed half-way to the costa; lobes 10-12 pairs, oblique, subfalcate, linear to oblong; veins 3-6 in a lobe, acroscopic; basal vein always ends at the sinus between two lobes. Sori round, indusiate. Spores light brown.

Sori : September - March.

Rare, between 1200-1800 m, in marshy hill slopes.

Selected specimens : Kathua district near Bhund-Kot; *Uniyal & Singh* 90326 (BSD).

TECTARIACEAE

TECTARIA Cav.

Tectaria coadunata (J. Smith) C. Chr. in Contr. U.S. Nat. Herb. 26: 331. 1933; Dixit, Cens. Indian Pterid. 142. 1984. *Sagenia coadunata* J. Sm. in Hook., J. Bot. London 4: 184. 1841. *Aspidium coadunatum* Wallich ex Hook. & Grev., Icon. Fil. 2: 203. 1831. *Nephrodium cicutarium* var. *coadunatum* C.B. Clarke in Trans. Linn. Soc. London 1: 540. 1880.

Terrestrials, 30-80 cm high. Rhizomes stout, short-creeping. Stipes not winged up to 20 cm long, scaly at base; basal scales brown, lanceolate, pubescent. Fronds ovate-deltoid, pinnate to bipinnatifid with few pairs of free lateral pinnae below the pinnate or pinnatifid apical portion; rachis and stipes stramineous, covered with small ctenitis hairs; costae, veins both surfaces and margins bearing ctenitis hairs; texture thin; veins anastomosing, areolae with included veinlets. Sori brown on ends of veinlets; indusia thin, brown, reniform.

Sori : May - September.

Frequent, growing in shady forest, slopes or rocky situations 500-1600 m in North-Eastern regions of Kathua District.

DRYOPTERIDACEAE

- 1a. Veins anastomosing, usually with 1-3 inwardly directed free veinlets. Sori many, irregularly scattered ...1. *Cyrtomium*
- 1b. Veins not anastomosing. Sori \pm few, usually in 1 row on either side of the costa :
- 2a. Indusia reniform, rarely globose; pinnules not or only weakly auricled with \pm rounded auricles, usually bearing several spinose teeth at the pinnule tip ...2. *Dryopteris*
- 2b. Indusia orbicular; pinnules strongly auricled, with \pm acute, pointed auricles, usually bearing a simple long spinose tooth at the tip and also at the pinnule tip ...3. *Polystichum*

1. CYRTOMIUM Presl.

- 1a. Pinnae margin entire ...3. *C. macrophyllum*
- 1b. Pinnae margin toothed :
- 2a. Pinnae narrow, upper surface dark-green, very glossy, under surface bearing microscales ...2. *C. falcatum*
- 2b. Pinnae broad, upper surface light green; undersurface without microscales :
- 3a. Pinnae margin strongly toothed; auricles well developed atleast on upper acroscopic base ...1. *C. caryotideum*
- 3b. Pinnae margin finely serrate or even subentire from base to middle with small distant teeth towards the apex of pinnae; auricles usually very weakly developed or absent ...4. *C. nervosum*

1. *Cyrtomium caryotideum* (Wallich ex Hook. & Grev.) Presl, Tent. Pterid. 86, Pl. 2.f. 26. 1836; Tagawa in Phytotax. Geobot. 3: 64, Pl. 3. f. 14. 1934; Dixit, Cens. Indian Pterid. 140. 1984; Khullar, Illus. Fern Fl. W. Himal. 256. 2000. *Aspidium caryotideum* Wallich [List No. 376. 1828 (*nom. nud.*)] ex Hook. & Grev., Icon. Fil. t. 69. 1828. *A. falcatum* C.B. Clarke in Trans. Linn. Soc. London 1: 512. 1880. *pp. Cyrtomium*

falcatum var. *caryoideum* (Wallich ex Hook. & Grev.) Bedd., Handb. Ferns Brit. India 211. t. 106. 1883.

Terrestrials, 50-80 cm high. Rhizomes short, ascending or erect. Stipes 25-30 cm long, densely scaly at base; scales oblong to ovate, lanceolate, dark-brown. Lamina 30-45 cm long, imparipinnate; pinnae 2-6 pairs, short stalked, coriaceous, ovate-lanceolate, falcate, acuminate, acute or obtuse at base, auriculate on the upper or on both sides; margin minutely and sharply serrate; veins anastomosing. Sori scattered; indusia serrulate. Spores round, papillose.

Sori : April September.

Occasional, on moist shady rocks, 1200-2200 m.

Selected specimens : Udhampur : Jakher forests, S. Kumar 81385 (BSD).

2. *Cyrtomium falcatum* (L.f.) Presl, Tent. Pterid. 86; 1836; Bedd., Handb. Ferns Brit. India : 211. 1883; Khullar, Illus. Fern Fl. W. Himal. 2: 258. 2000. *Potypodium falcatum* L.f., Suppl. Sp. Pl. 446. 1781.

Rhizomes short, erect, thick, covered with persistent leafbases, densely scaly. Stipes 12-20 cm long, stramineous, thick scaly, base densely scaly; scales brown to light brown; rachis fibrillose. Lamina pinnate, 20-25 cm long, 10-20 cm broad, lanceolate; lower surface glaucous green, bearing small light brown macroscales; upper surface dark green, glossy; glabrous pinnae 8-10 pairs, large 8-12 cm long, narrow, 2-5 cm broad, alternate, shortly petiolate, oblong-lanceolate, falcate, margin lobato-serrate; terminal pinnae strongly auricled on both sides. Sori indusiate large, round; indusia light brown.

Sori : September March.

Cultivated as an ornamental, rarely found wild between 1500-2200 m altitude in damp shaded places.

Reported by *Khullar* (2000) from Poonch area.

3. *Cyrtomium macrophyllum* (Makino) Tagawa in Acta Phytotax. Geobot. 3: 63. 1924. *Aspidium falcatum* var. *macrophyllum* Makino in Bot. Mag. Tokyo 16: 90. 1902. *Cyrtomium muticum* (Christ) Ching in C. Chr., Index Fil. Suppl. 3: 66. 1933; Ching in Icon. Fil. Sin. 4: 184. 1937. *C. falcatum* var. *muticum* Christ in Lecomte, Nol. Syst. 1: 37. 1909. **Fig. 36**

Rhizomes short, thick, erect, densely covered with large, dark-brown to black, ovate-acuminate, fimbriate scales. Stipes 15-30 cm long, dark stramineous, densely scaly at base. Lamina oblong, 30-45 cm long, 15-30 cm broad, pinnate, with large, hastate, cuneate, terminal simple pinnae; pinnae 3-7-jugate, subopposite or alternate upwards, falcate; basal ones broadly ovate, the upper ones oblong-ovate, up to 10 cm long 5-7 cm broad, acuminate, base rounded, shortly petiolate. Pinnules simple, not lobed or auricled; texture chartaceous, green, glabrous above; veins anastomosing; rachis fibrillose-scaly. Sori small, rounded, scattered; indusia large, grey.

Sori : July - September.

Occasional, between 2000-3500 m elevation, in shady moist forest slopes.

Selected specimens : Kashmir. 1899. *Inayat* 23230 (DD).

Note : A large fern of similar habit as of *Cyrtomium caryotideum* from which it differs in generally larger, oblong-ovate pinnae with rounded or rotundo-cuneate and almost equal-sided base without deltoid and auricled. It is rarely found in N.W. Himalaya.

4. *Cyrtomium nervosum* Ching & Shing in Shing in Acta Phytotax. Sinica Add. 1: 46. 1965; *Khullar*, Illus. Fern Fl. W. Himal. 2: 263. 2000.

Rhizomes short, erect, thick, covered with persistent Stipes bases, densely scaly. Stipes 15-25 cm long, stramineous, thick, scaly, scales brown to dark brown, up to 1 cm broad, lanceolate or ovate; rachis fibrillose.

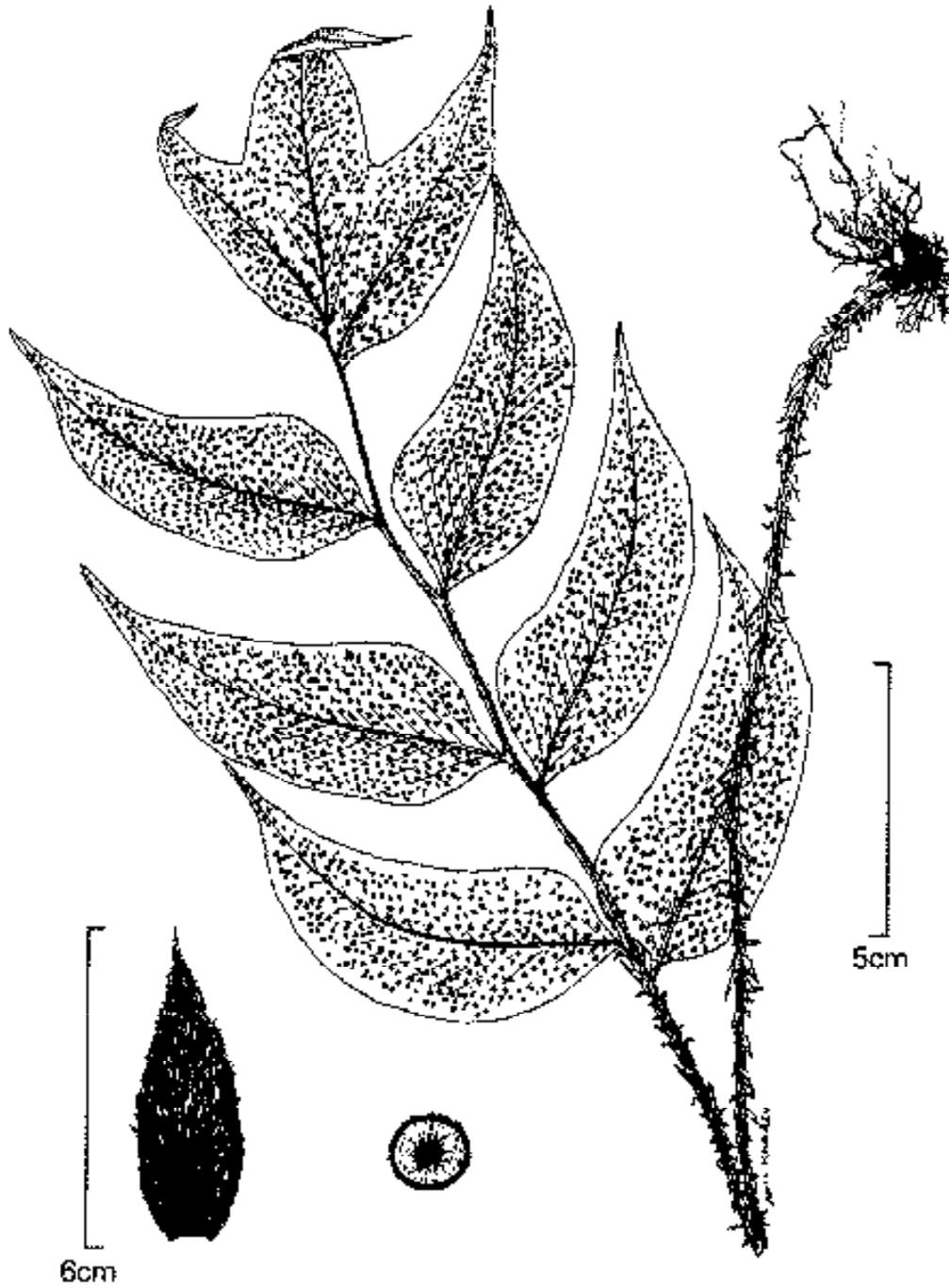


Fig. 36. *Cyrtomium macrophyllum* (Makino) Tagawa

Lamina pinnate, large, 20-46 cm long, 10-15 cm broad, lanceolate, texture thick, lower surface pale-green, upper dark-green, glabrous, often slightly glossy; pinnae 7-10 pairs, large, 8-12 cm long 3-5 cm broad, alternate, short petiolate, oblong, lanceolate, falcate, without an auricle, basiscopic margin very rounded, without an auricle, margin finely toothed from about half way up with very short teeth. Sori indusiate, round, large; indusia light brown, circular.

Sori : August - November.

Found between 1500-2500 m altitude, in damp and well-shaded moist places, in the forest and ravines.

Reported by Khullar (2000) from Muzaffarabad, Chikar: Poonch, Bagh, Srimang, Kathua, Kadal.

2. DRYOPTERIS Adanson

- 1a. Lamina triangular, lowest pair of pinnae largest :
 - 2a. Lamina 2-pinnate; pinnules symmetrical; only upper half of the frond fertile :
 - 3a. Fronds dimorphic ...6. *D. cochleata*
 - 3b. Fronds not dimorphic :
 - 4a. Stipes very sparsely scaly; pinnules small ...13. *D. nigropaleacea*
 - 4b. Stipes scaly at least to the middle; pinnules large :
 - 5a. Stipes scales furcous-brown to mid-brown, lower surface of lamina dark-green ...17. *D. stewartii*
 - 5b. Stipes scales black, lower surface of lamina light-green ...10. *D. juxtaposita*
 - 2b. Lamina 3-pinnate or 3-pinnatifid; pinnules asymmetrical; usually complete, frond fertile :
 - 6a. Lamina pale-green; pinnules narrower with small lobes, lower 2-3 pairs of pinnae sterile ...15. *D. ramosa*
 - 6b. Lamina dark-green; pinnules wide with large lobes, entire frond fertile ...4. *D. caroli-hopei*

- 1b. Lamina lanceolate or narrow, lowest pair of pinnae slightly reduced :
- 7a. Lamina simple pinnate; pinnae margin shallowly lobed to the costa ...7. *D. dickinsii*.
- 7b. Lamina deeply pinnatifid; pinnae margin deeply lobed to the costa :
- 8a. Stipes scales not predominantly narrow but widely ovate; lamina herbaceous :
- 9a. Pinnae margin 1/3 - 1/2 way lobed to the costa ...14. *D. pandu*
- 9b. Pinnae margin deeply lobed to the costa :
- 10a. Fronds turning brown at the end of growing season; pinnules small, margin lobed, narrowly and acutely toothed ...9. *D. flix-mas*
- 10b. Fronds turning pale yellow at the end of growing season; pinnules large, margin toothed ...5. *D. chrysocoma*
- 8b. Stipes scales predominantly or all narrow; lamina coriaceous :
- 11a. Margin of pinnae lobes shallowly or markedly lobed ...3. *D. blanfordii*
- 11b. Margin of pinnae lobes entire to subentire, but not lobed :
- 12a. Lamina triangular-lanceolate, base widely truncate; Stipes half the length of the lamina :
- 13a. Stipe base bearing ovate-lanceolate scales extending up the Stipes, upper surface of rachis deeply clothed with pale hair like fibrils ...8. *D. edwardsii*
- 13b. Stipe base bearing all narrowly lanceolate scales which become linear further up the Stipes, rachis clothed with linear scales ...12. *D. lepidopoda*

- 12b. Lamina lanceolate or narrowly-lanceolate, gradually tapering towards a narrow base; stipes short, 1/4 the length of the lamina :
- 14a. Mid and lower Stipes scales ovate to lanceolate :
- 15a. Rachis scales grey-brown to yellowish-brown ...16. *D. redactopinnata*
- 15b. Rachis scales black ...20. *D. zayuensis*
- 14b. Mid and lower Stipes scales lanceolate to narrowly lanceolate :
- 16a. Fronds smaller (20-45 x 5-6 cm) ...19. *D. xanthomelas*
- 16b. Fronds large (35-60 x 14-18 cm) :
- 17a. Lamina bearing numerous scattered fimbriellae
- 18a. Plant up to 120 cm long ...2. *D. berbigeri*
- 18b. Plant up to 45 cm long ...11. *D. komarovii*
- 17b. Lamina without fimbriellae :
- 19a. Stipes and rachis with few scales; lamina cordate at the base ...18. *D. serrato-dentata*
- 19b. Stipes and rachis bearing many scales; lamina tapering to the base ...1. *D. acutodentata*

1. *Dryopteris acutodentata* Ching in Bull. Fan. Mem. Inst. Biol. (Bot.) 8: 432. 1938; Khullar, Illus. Fern Fl. W. Himal. 2: 274. 2000. *D. flix-mas* (L.) Schott. subsp. *kingii* (Hope) C. Chr., Index Fil. : 265. 1905, non *D. kingii* (Bedd.) C. Chr., 1905. *Nephrodium kingii* Hope in J. Bombay Nat. Hist. Soc. 12: 661, t. 9. 1899.

Rhizomes short, erect, thick, scaly. Stipes short, 10-12 cm long, light-brown to stramineous, scaly; scales dark-brown to more blackish, broadly-

lanceolate; rachis scaly becoming smaller and narrow higher up. Lamina pinnate or bipinnatifid. 15-30 cm long. 5-10 cm broad: lanceolate, fragile, texture thinly herbaceous, upper surface glabrous: pinnae 10-15 pairs, 6 cm long, 2 cm broad, distinct in the lower half, close in the upper half, alternate, deeply pinnatifid, lobed to the costa; lowest pair of pinnae almost as long as the pair above; pinnules 10 pairs, 1 cm long, 0.4 cm broad, veins 6-7 pair in each groups, costae and costules scaly below. Sori indusiate, round, 2-4 pairs in a row; indusia brown, reniform.

Sori : August September.

Grows among rocks, usually above the forest zone from 3000-4000 m altitude.

Reported by Khullar (2000) Kashmir, from Tragbal pass (3600 m).

2. *Dryopteris barbiger* (T. Moore ex Hook.) Kuntze, Rev. Gen. Pl. 2: 812. 1891; Fr. Jenkins in Bull. Brit. Mus. (N.H.) 18: 380-381. 1989. *Nephrodium barbigerum* T. Moore ex Hook., Sp. Fil. 4: 113. 1862. *Nephrodium falconeri* Hook., Sp. Fil. 4: 123. Pl. 254. 1862. *Lastrea falconeri* (Hook.) Bedd., Ferns Brit. India 1: 41. Pl. 41. 1865.

Rhizomes stout, erect, covered with persistent Stipes bases. Fronds medium to large, up to 115 cm long, forming a basket. Stipes thick, long: 2/3 length of the lamina, densely scaly at the base; scales large, ovate-lanceolate, thick, glossy, pale-brown. Lamina twice pinnate, becoming third time pinnatifid below in the large plants, ovate-lanceolate up to 30 cm wide, with a somewhat widely truncate tapering apex, bearing up to 25 pairs of pinnae; pinnae linear-lanceolate, herbaceous, pale to mid-green above, bearing numerous scattered, small, very narrow, hair like pale brown scales on the costae and scattered over the lamina, particularly on the underside, bearing up to 20 pairs of medium sized pinnules; pinnules narrow, longer than wide, lanceolate, deeply lobed; pinnule-apices rounded or obliquely pointed. Sori small, usually well spaced out in two rows, one each side midway between the centre and margin of the pinnules, indusiate; indusia small, thin, deciduous. Spores regular.

Sori : August September.

Common, on open slopes or between bushes in alpine meadows, 3000-4200 m.

Selected specimens : Kashmir : Khalinmarg 3600 m, *T.A. Rao* 456 (BSD); Baramulla : Rajdhan, 3600 m, *Wadhwa* 83802 (BSD).

3. *Dryopteris blanfordii* (Hope) C. Chr., Index Fil. 254. 1905; Fr-Jenkins in Bull. Brit. Mus. Nat. Hist. (Bot.) 18: 386. 1989. *Nephrodium blanfordii* Hope in J. Bombay Nat. Hist. Soc. 12: 624, Pl. 11, 1899.

Fronds large, up to 90 cm long. Stipes of medium length, 1/3 to 1/2 the length of the lamina. base densely clothed with ovate-lanceolate, thin, glossy, slightly crinkled, dark-brown scales. Lamina twice-pinnate, becoming third time deeply pinnatifid below in large plants, up to 35 cm wide, slightly tapered below to a truncate base, becoming many, up to 28 pairs of slightly distant pinnae; pinnae linear-lanceolate to triangular-lanceolate below, herbaceous, dark green and glossy above, bearing scattered, small hair-like scales on the lower surface of the costae; medium sized, pinnules up to 20 pairs narrow, lanceolate, stalked at the base of pinnae. Sori small, not crowded, in two rows, one on each side, midway between the centre and margin of the pinnules, indusiate. Indusia slightly curved down at the edge becoming brown. Spores irregular.

Sori : August - September.

Occasional, growing on forest floor or rocks in upper level forests to alpine meadows, 2000-3500 m.

Selected specimens : Kashmir : Baramulla, Gureze area, *Wadhwa* 83970 (BSD); Sonamarg, *Trotter* 33877 (DD); Sind valley, Baltal, 3100 m, *Gammie s.n.* Acc. No. 16361 (CAL); Pir Panjal, 3200 m, *Gammie s.n.* Acc. No. 11529 (CAL).

4. *Dryopteris caroli-hopei* Fraser-Jenkins in Bull. Brit. Mus. Nat. Hist. (Bot.) 18: 422-425, f. 50. 1989.

Fronds large, up to 120 cm high, two to three arising from the prostrate underground Rhizomes. Stipes long, 2/3 of the length of lamina

or of equal length, base densely clothed with ovate-lanceolate, thin, pale brown to rusty brown scales, becoming scattered. Lamina three time pinnate, widely triangular-lanceolate, up to 60 cm wide, not tapered below, bearing up to 20 pairs of continuous pinnae; pinnae triangular-lanceolate, herbaceous, hair like pale scales on the costae below; pinnules large up to 22 pairs narrowly triangular-lanceolate, stalked, pinnatisect except near the tips of the pinnae, where they are deeply pinnatifid, apices obtusely or acutely pointed. Sori small, not crowded, in two rows, one on each side of the centre of the pinnules, midway between the centre or margins, indusiate. Indusia flat, thin. Spores regular.

Sori : August September.

Few, growing in forest slopes or open hill slopes. (1500-2200 m).

Selected specimens : Jammu : Udhampur, Vaishnodevi, S.P. Khullar s.n. (PAN).

5. *Dryopteris chrysocoma* (Christ) C. Chr., Index Fil. 257. 1905; Fraser-Jenkins in Bull. Brit. Mus. Nat. Hist. (Bot.) 18: 371-374. f. 25. 1989; Khullar & Sharma in Pangtey & Joshi, West Himal. Env. Probl. Devel. 1: 337. 1987. *Aspidium filix-mas* var. *chrysocoma* Christ in Bull. Herb. Boiss. 6: 966. 1898. *Dryopteris macrocarpa* Stewart in Bull. Torrey Bot. Club 72: 406. 1945.

Fronds up to 120 cm long, upright or hanging over rocks. Stipes thick, 1/4 to 1/2 the length of the lamina, sparsely glandular, smooth, pale, densely clothed with narrowly lanceolate, pale brown scales at the base, which become smaller scattered, pale scales further up and on the rachis. Lamina becoming twice pinnate below, lanceolate, up to 27 cm wide, bearing up to 25 pairs of separate pinnae; pinnae linear, herbaceous, pale-green, slightly impressed. Sori large, in two short lines, midway between the margins and centre of the lobes, becoming crowded together, indusiate. Indusia flashy, white. Spores regular, dark-brown.

Sori : July September.

Frequent, on forest floors or growing on the exposed rocks 1600-2800 m.

Selected specimens : Kashmir : Rattanpir, 2440 m, Trotter 234 (DD).

6. *Dryopteris cochleata* (Buch.-Ham. ex D. Don) C. Chr., Index Fil. : 258. 1905; Khullar *Illus. Fern Fl. W. Himal.* 2: 288. 2000. *Nephrodium cochleatum* Buch.-Ham. ex D. Don, Prodr. Fl. Nepal. 6. 1925; C.B. Clarke in Trans Linn. Soc. London 1: 521. 1880. *N. filix-mas* Rich. var. *cochleatum* (Buch.-Ham. ex D. Don) Hook., Sp. Fil. 4: 116. 1862.

Rhizomes long, decumbent, scandent, thick, scaly. Fronds dimorphic with distinct fertile and sterile ones. Sterile fronds many, spreadout with one or two fertile fronds, erect in the middle. Stipes 20-40 cm long, longer than fertile fronds, stramineous, cylindrical, scaly and fibrillose, base densely scaly. Sterile lamina pinnate or bipinnate, 30-70 cm long, up to 50 cm broad, lanceolate or triangular, base truncate; pinnae 10-15 pairs, 12-15 cm long, up to 4.5 cm broad, subopposite to alternate, petiolate. Fertile lamina 30-70 cm long, narrow, 7-15 cm broad, erect lanceolate; pinnae 10-12 pairs, 7-10 cm long, 2-3 cm broad, ascendant, subopposite to alternate, petiolate, triangular-lanceolate; margin deeply lobed to the costae; pinnules 9-12 pairs, 1.5-2 cm long, up to 0.4 cm broad, contracted. Sori indusiate, very large, crowded, round, 5-7 pairs in a single row. Indusia pale-brown, reniform.

Sori : March - June.

Common, in chir-pine or mixed forest slopes between 700-1200 m altitude.

Khullar (2000) from Poonch, Rattan-pir, Jammu and Kathua district.

7. *Dryopteris dickinsii* (Franch. et Savat) C. Chr., Index Fil. 262. 1905; Fraser Jenkins in Bull. Brit. Mus. Nat. Hist. (Bot.) 18: 337. 1989; Khullar & Sharma in Pangtey & Joshi, West Himal. Env. Probl. Devel. 1: 337. 1987. *Aspidium dlchinsii* Franch. & Savat, Enum. Pl. Jap. 2: 236. 1877. *Lasterea tibetica* (Franch.) Bedd., Ferns Brit. India Suppl. 52. 1892.

Fronds up to 80 cm long. Stipes 1/4 the length of the lamina bearing short, widely lanceolate, glossy, pale brown to dark-brown scales at base; wider and short, pale brown scales on the upper Stipes and rachis. Lamina once pinnate, narrow, up to 20 cm wide, bearing up to 25 pairs of pinnae; pinnae herbaceous, almost slightly succulent, pale-green above, glabrous and smooth-textured with impressed veins on the lower sterile pinnae; the pinnae bearing deep, rectangular or extended, rounded lobes with narrowed, truncate apices approximate. Sori distinct from the other species of this group, being positioned in a more or less narrow belt away from the pinnae-costa on either side not far from the edge, or becoming arranged in loops around the lobes, indusiate. Indusia small, very thin, scarious; spores irregular.

Sori : March - June.

Rare, growing in shady coniferous forest slopes, 1700-2500 m.

Reported by Fraser-Jenkins (1989) from Tangdur forest, near Baramulla and Lolab Valley.

8. *Dryopteris edwardsii* Fraser-Jenkins, *New Species Syndrome Indian Pteridophytes & Ferns Nepal*, 138, 1997; Chandra, *Ferns India*, 176, 2000. *D. yigongensis* Ching & S.K. Wu in Wu, *Fl. Xizang*, 1: 253, 1983; Fraser-Jenkins in *Bull. Brit. Mus. Nat. Hist. (Bot.)* 18(5): 348, 1989; Nakaike & Malik, *Crypt. Fl. Pakistan* 1: 277, 1992; Khullar, *Illus. Fern Fl. W. Himal.* 351, 2000.

Rhizomes short, erect, thick scaly. Stipes long, sparsely scaly and fibrillose, densely scaly at base; scales broad, ovate or linear-lanceolate, margin toothed, fibrils long, hair like, light brown, margin toothed; rachis stramineous, sparsely scaly and fibrillose, scales and fibrills as on Stipes. Lamina 1-2 pinnate, lanceolate; texture herbaceous, both surfaces fibrillose, fibrills long, light brown. Sori indusiate, small, round, submedial; indusia brown, reniform, small, thin. Spores dark-brown.

Selected specimens : Jammu Division : Kathua, Sarthal, Gulmarg. S.P. Khullar 5439 (PAN).

9. *Dryopteris filix-mas* (L.) Schott., Gen. Fil. ed. Pl. 9, 1834; Stewart in Bull. Torrey Bot. Club 72: 405, 1945; Dixit, Cens. Indian Pterid. 150, 1984; Khullar & Sharma in Pangtey & Joshi, West. Himal. Env. Probl. Devel. 1: 337, 1987; Fraser-Jenkins in Bull. Brit. Mus. Nat. Hist. (Bot.) 18: 375-377, 1989. *Polypodium filix-mas* L., Sp. Pl. 1090, 1753. *Lastrea filix-mas* Presl, Tent. Pterid. 76, 1836. Fig. 37

Rhizomes short, erect with dark brown scales. Fronds up to 80 cm long, pinnatifid. Stipes thick and short, 1/4 to 1/3 the length of the lamina. The base densely clothed with large, lanceolate to ovate-lanceolate pale-brown scales, becoming slightly smaller and scattered further up on the Stipes and rachis. Lamina twice pinnate, narrowly lanceolate, up to 25 cm wide with slightly truncate base, bearing up to 27 pairs of continuous pinnae: pinnae linear-lanceolate, herbaceous, pale to midgreen above, hairs like, pale scale on the costae, bearing up to 20 pairs of pinnules; pinnules short, longer than broad, attached to the costae; veins forked. Sori medial, not crowded, in two rows, one on each side of the centre of the pinnules, indusiate; indusia slightly curved down at the edges. Spores regular.

Sori : August - September.

Occasional, on open rocky slopes, sub-alpine to alpine meadows. 2700-3900 m.

Selected specimens : Kashmir : Kishan Ganga Valley - Nangu Parwat, Stewart 19304 (CAL); Minimarg, R.R. & I.D. Stewart 19189 (CAL).

10. *Dryopteris juxtaposita* Christ in Bull. Acad. Int. Geogr. Bot. 17: 138, 1907; Fraser-Jenkins in Bull. Brit. Mus. Nat. Hist. (Bot.) 18: 393, 1989. *Lastrea odontoloma* T. Moore, Index Fil. 90, 1858. *nom. nud.*, non Beddome, 1864. *Nephrodium filix-mas* var. *normalis* C.B. Clarke in Trans. Linn. Soc. London 1: 519, Pl. 68, 1880. Fig. 38

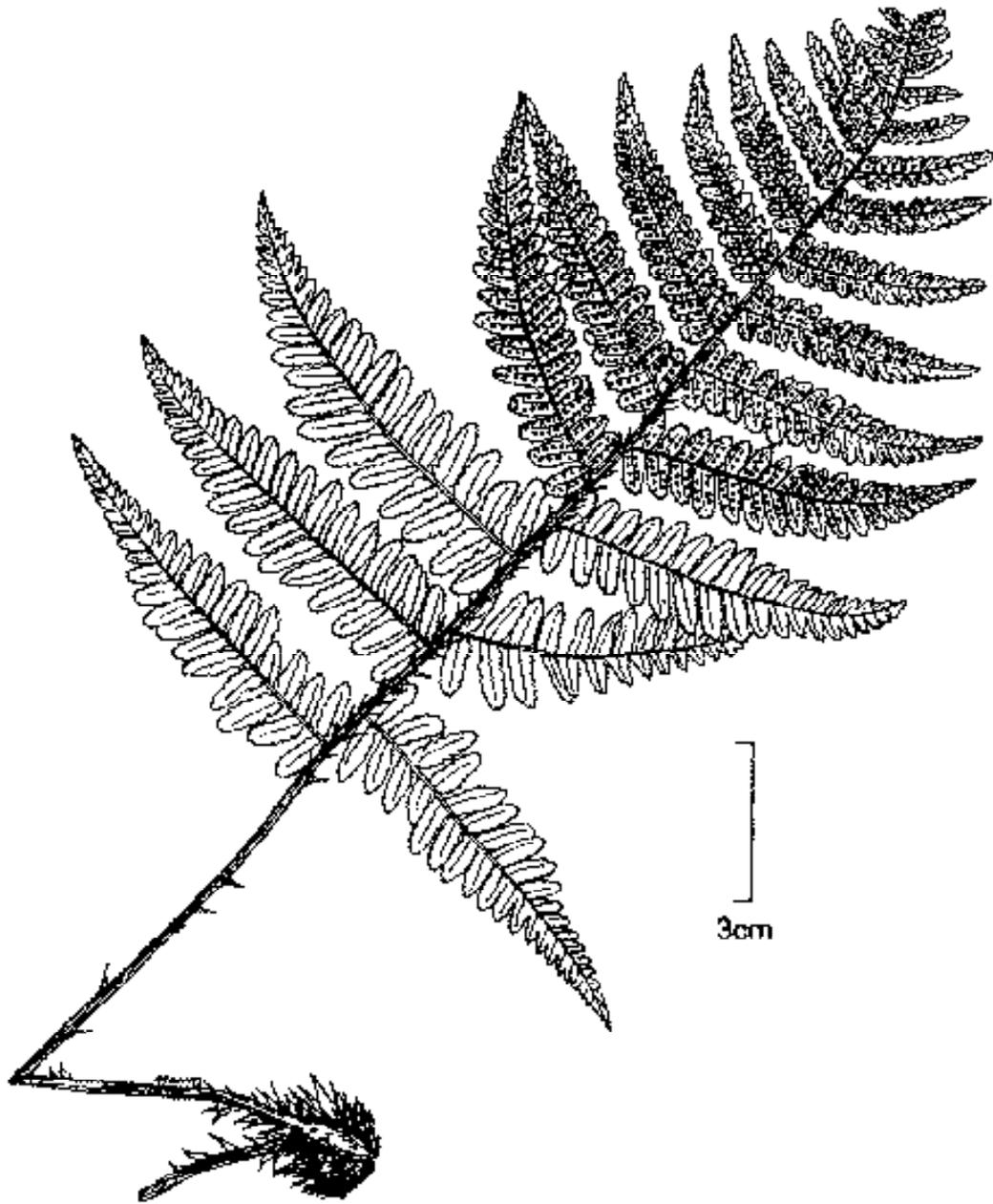


Fig. 37. *Dryopteris filix-mas* (L.) Schott.

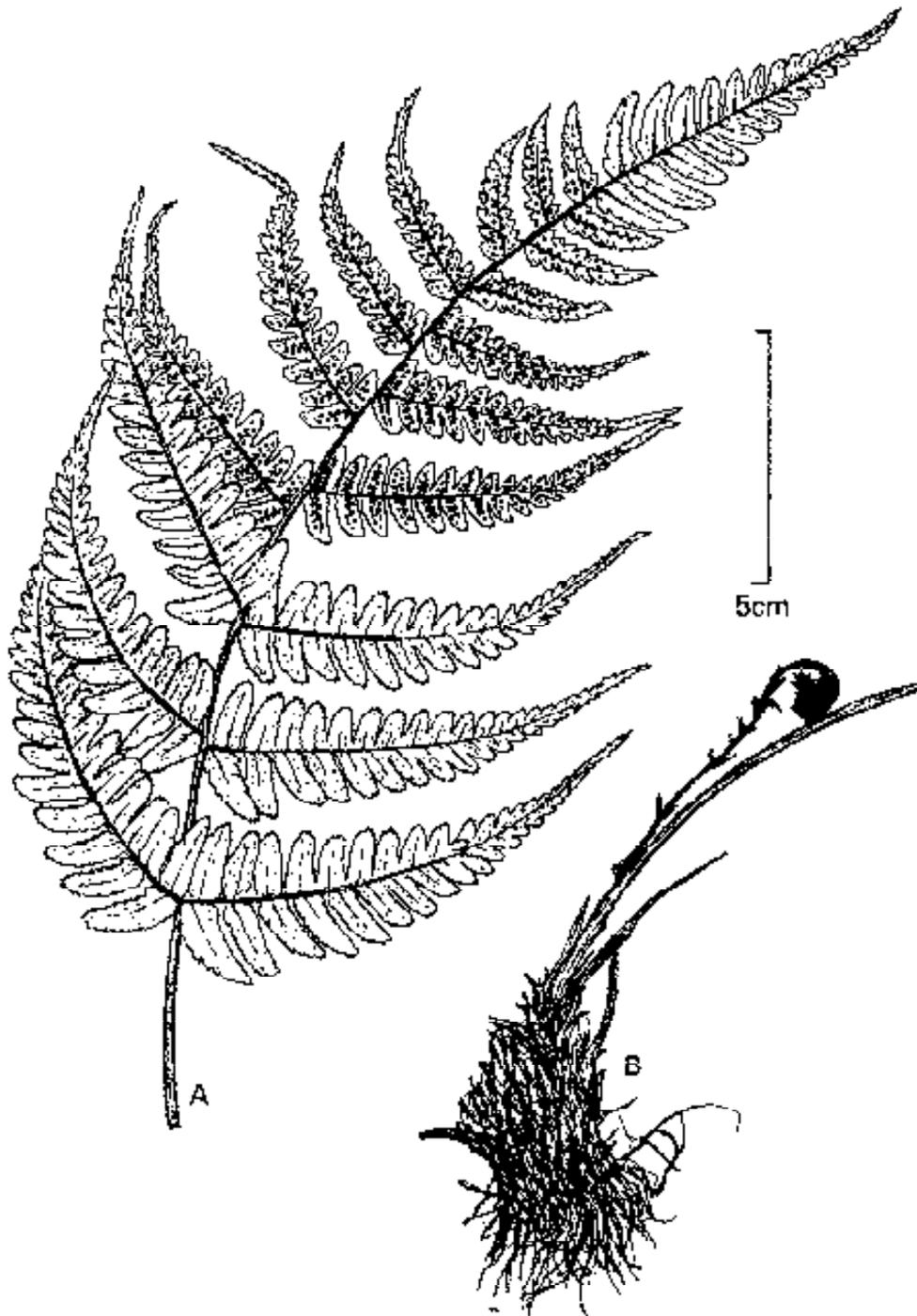


Fig. 38. *Dryopteris juxtaposita* Christ

Rhizomes short or slightly creeping, with few or densely covered by dark-brown scales. Fronds medium to large, up to 95 cm long. Stipes long, $2/3$ the length of the lamina, base clothed with long narrowly, lanceolate, pale brown scales; widest part of the base clothed with large ovate-lanceolate, thick, glossy scales. Lamina twice pinnate, elongated, triangular-lanceolate, bearing up to 25 pairs of distant pinnae; pinnae with dark coloured patch on the costae at the point of attachment to the rachis, elongated, triangular-lanceolate, herbaceous, pale-green, bearing up to 20 pairs of pinnules; pinnules longer than broad, stalked or with a narrow point of attachment to the pinnae-costa, not crowded, lobed; lobes wide, rectangular with truncate apices, the basal pair being longer. Sori sometimes borne throughout the frond, small, not crowded, in two rows, one on each side midway between the centre and margins of pinnules, indusiate. Indusia slightly curved down at the edge and thin. Spores irregular

Sori : August - October.

Frequent, growing on the open forest or along the sides of the rocks, 1500-3000 m.

Selected specimens : Poonch : Mandi-loran, *Vohra & Naithani* 78279 (BSD); Ramban-Benihal, *P. Chandra*, 10185 (LWG).

11. *Dryopteris komarovii* Kossin. in Bot. Mat. Gerb. Glam. Bot. Sada (Not Syst. Hort. Petrop.) 2: 1. 1921; Khullar, *Illus. Fern Fl. W. Himal.* 305. 2000. *D. sub-barbigera* Ching in C.Y. Wu, *Fl. Xizangica* 1: 26. 1983; *D. barbigera* (Moore) Kuntze. subsp. *komarovii* (Kossin.) Fraser-Jenkins in *Bull. Brit. Mus. Nat. Hist. (Bot.)* 18: 384. 1989.

Fronds smaller than *D. barbigera* (up to 45 cm long), arising from much-branched tufted rhizomes, thus forming a clump. Stipes usually somewhat short, $1/3$ the length of the lamina, with paler scales. Lamina more narrowly lanceolate, up to 15 cm wide, with a more acute and gradually tapering apex, and more blue-green above. Pinnae more separate and more upright; pinnules, shorter shallowly lobed. Spores regular.

Sori : July - September.

Occasional, growing on rocky hill slopes or rock crevices of the alpine meadows, 3000-4500 m.

Selected specimens : Kashmir : Daman pass, Baltal & Sind valley, *Duthie* 11613 (DD); Kamri pass, *R.R. & I.D. Stewart*, 18715 (CAL).

12. *Dryopteris lepidopoda* Hayata, *Icon. Pl. Formosa* 4: 161 t. 101. 1914; *Khullar*, *Illus. Fern Fl. W. Himal.* 2: 308. 2000.

Rhizomes short, erect, thick, scaly. Stipes 20-30 cm long, base dark-brown, becoming stramineous towards the rachis, base densely scaly; scales dark-brown or black, lanceolate; rachis stramineous, fibrillose, fibrils dark-brown. Lamina pinnate, 25-40 cm long, 15-20 cm broad, triangular-lanceolate, base widely truncate, both surfaces scaly along costae; pinnae 9-14 pairs, 8-12 cm long 1.8-2.5 cm broad, alternate, shortly petiolate, margin deeply lobed to the costa, rarely becoming pinnate, lobes up to 10 pairs, 1 cm long, 0.4 cm broad; lowest pair of pinnae almost equal in size to the next few pairs above; veins in a pinna lobe 4-5 pairs, forked. Sori indusiate, round, 3-4 pairs in a single regular row; indusia dark-brown, reniform.

Grows on forest-floor at 2700 m altitude.

Reported by *Khullar* (2000) from Sarthal in Kathua district.

13. *Dryopteris nigropaleacea* (Fraser-Jenkins) Fraser-Jenkins in *Bolm. Soc. Broteriana* 11. 55: 238. 1982 & *Bull. Brit. Mus. Nat. Hist. (Bot.)* 18: 396. 1989. *D. pallida* subsp. *nigropaleacea* Fraser-Jenkins in *Candollea* 32(2): 316. 1977.

Rhizomes short, thick, with dark-brown to black scales. Fronds up to 90 cm long. Stipes up to 45 cm long with narrowly lanceolate, pale-brown scales at base, the widest part of the base clothed with ovate-lanceolate, blackish scales, which rapidly become very scattered further up the Stipes. Lamina twice pinnate, elongated, triangular-lanceolate, up to 30 cm wide, not tapered below, bearing up to 20 pairs of pinnae; pinnae with dark coloured patches on the costa at the point of attachment to the

rachis, elongated, triangular-lanceolate, bearing 14-18 pairs of small pinnules; pinnules somewhat long, narrow, stalked or with a narrow point of attachment to the pinnae-costa except towards the tips of the pinnae where they become widely narrow, rectangular with rounded-truncate apices. Sori small, not crowded, in two rows, one on each side midway between the centre and margins of the pinnules, indusiate; indusia curved down at edge. Spores regular.

Sori : April September.

A species of the mid-level forest zones, growing on the ground in open situations, 1300-2700 m.

Selected specimens : Doda : Batote, T.A. Rao 7360; Bhaderwah, T.A. Rao 7914 (BSD); Kathua : Banjal, Uniyal & Singh 90333 (BSD); Udhampur : Basantgarh, S. Kumar 81337 (BSD).

14. *Dryopteris panda* (C.B. Clarke) Christ in Bull. Acad. Int. Geogr. Bot. Mans 19: 175. 1909; Khullar, Illus. Fern Fl. W. Himal. 2: 318. 2000. *Nephrolepis filix-mas* Rich. var. *panda* C.B. Clarke in Trans. Linn. Soc. London 1: 519. 1880. *Lastrea filix-mas* Pr. var. *panda* (C.B. Clarke) Bedd., Handb. Ferns Brit. India 251. 1883.

Rhizomes long, erect, thick, scaly. Stipes 15-30 cm, as long as the lamina, base dark-brown, rest stramineous, thick, base scaly, higher up Stipes becoming sparsely scaly, apex of acuminate rachis stramineous with small scales. Lamina pinnate, 20-50 cm long, 10-18 cm broad, somewhat narrow lanceolate with a truncate base; pinnae 12-15 pairs, 5-11 cm long, 2-3 cm broad, alternate, sessile, lanceolate, base much broadened, apex acuminate, margin lobed 1/3 to 1/2, slightly more to the costa; veins in groups of 4-6 pair, pinnate. Sori indusiate, large, round indusia light-brown, reniform.

Sori : September November.

Uncommon, grows on open hill slopes between 2700-3000 m altitude.

Reported by Khullar (2000) from Kashmir.

15. *Dryopteris ramosa* (Hope) C. Chr., Index Fil. 287. 1905; Stewart in Bull. Torrey Bot. Club 72: 406. 1945; Fraser-Jenkins in Bull. Brit. Mus. Nat. Hist. (Bot.) 18: 425. 1989. *Nephrodium ramosum* Hope in J. Bot. London 34: 126. 1896 & J. Bombay Nat. Hist. Soc. 14: 739. t. 32. 1903.

Rhizomes short, slightly creeping, more or less densely clothed with thin, brown, lanceolate-linear scales. Fronds up to 100 cm high, 2-3 fronds arising from the apex of Rhizomes. Stipes long, 1/2 the length of the lamina, base of the Stipes densely clothed with long, lanceolate, narrow scales, which become lanceolate to ovate-lanceolate on the widest part of the base of Stipes, becoming smaller, less dense further up the Stipes, upper Stipes and lower rachis bear scattered, small, pale-brown scales. Lamina three times pinnate, widely triangular-lanceolate, not tapered below, bearing up to 25 pairs of pinnae; pinnae triangular-lanceolate, thinly herbaceous, pale-green and glabrous, bearing 20-25 pairs of pinnules; pinnules long, narrowly triangular-lanceolate, stalked, pinnatisect, but becoming deeply pinnatifid in the upper part of the lamina; pinnules apices long and acutely pointed, bearing acute teeth. Sori not crowded, in two rows, one on each side of the centre and margins, indusiate. Indusia small, flat. Spores regular.

Sori : June - September.

Frequent, growing on moist humus covered forest floor or along road sides. 2000-4000 m.

Selected specimens : Baramulla : Barnai, Wadhwa, Murti & Pant 85073 (BSD); Kishangaŋga Valley, Wadhwa 85071 (BSD); Gulmarg, Hajra 73646 (BSD); Gulmarg, Duthie 11208 (CAL); Aherbal, T.A. Rao 9266; Doda Batkot-Furfuzal, T.A. Rao 9769 (BSD); Rattan Pir; C.B. Clarke 28310 (CAL).

16. *Dryopteris redactopinnata* Basu & Panigr. in Indian J. For. 3: 270. 1980; Dixit, Cens. Indian Pterid. 153. 1984; Khullar & Sharma in Pangtey & Joshi, West. Himal. Env. Probl. Dev. 1: 339. 1987; Fraser-Jenkins in Bull. Brit. Mus. Nat. Hist. (Bot.) 18: 346. 1989. **Fig. 39**

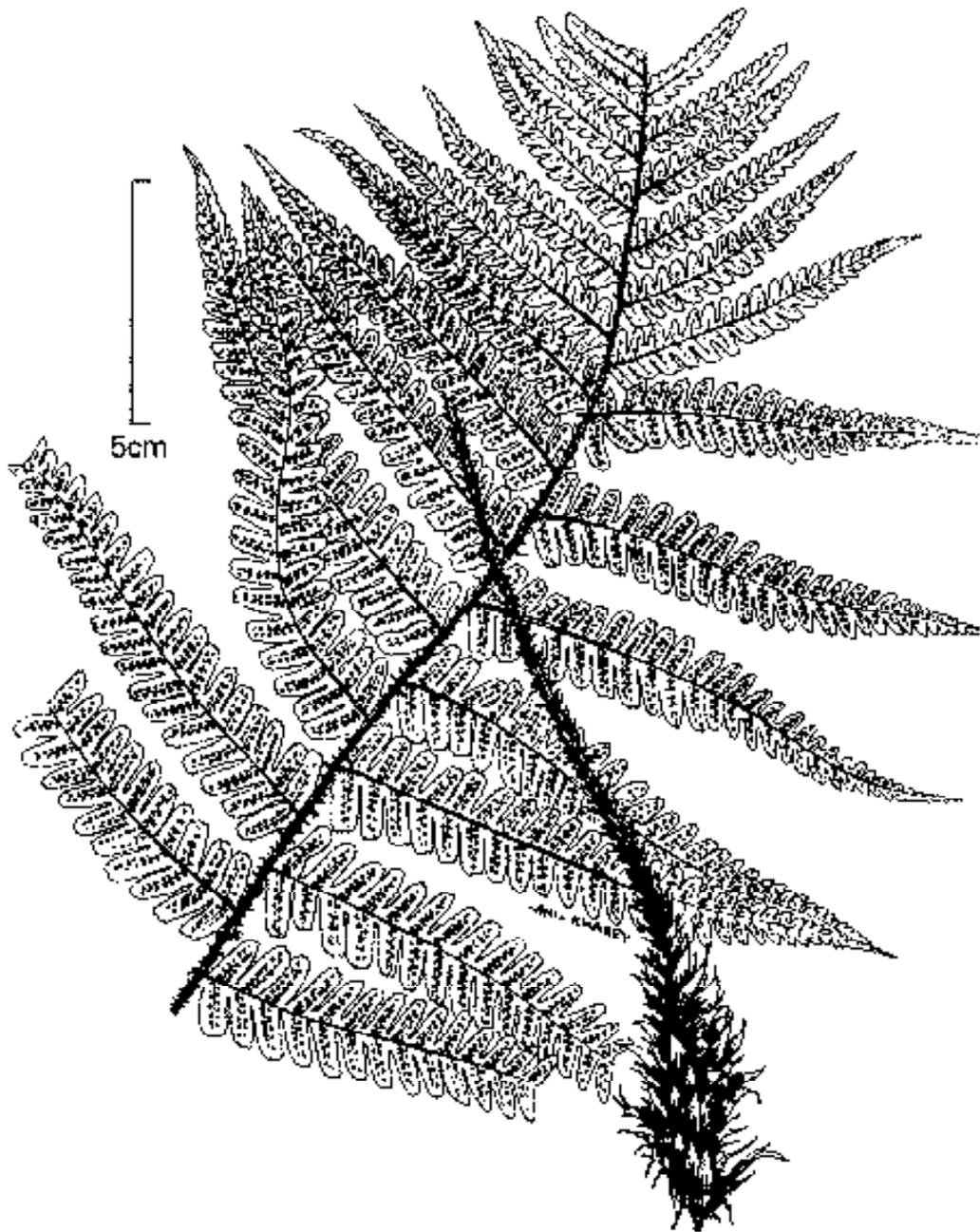


Fig. 39. *Dryopteris redactopinnata* Basu & Panigr.

Fronde medium-sized, up to 95 cm long, forming almost perfect shuttlecocks. Stipes 10-15 cm long, base very densely clothed with ovate-lanceolate, dark-brown to black scales. Lamina once pinnate, a second time pinnatifid, nearly becoming twice pinnate, narrowly lanceolate, up to 25 cm wide, bearing up to 40 pairs, continuous narrow, regular pinnae; pinnae linear, coriaceous, the upper surface slightly glossy and light green bearing small, scattered, narrow, hair-like pale-brown fibrillae on the costae; pinnae bearing up to 20 pairs; regular, crowded, small, rectangular lobes; lobes joined only at the bases; veins once forked or simple. Sori up to 6 pairs in two rows, indusiate; indusia thick, becoming brown, persistent. Spores irregular.

Sori : August - September.

Frequent, on open shady hill slopes or forest floor, 2000-3000 m.

Selected specimens : Kashmir : Kishanganga valley, Keran, 2000 m, R.R. & I.P. Stewart 17624 (CAL).

17. *Dryopteris serrato-dentata* (Bedd.) Hayata, *Icon Pl. Formos.* 4: 179. f. 116. 1914; Fraser-Jenkins in *Bull. Brit. Mus. Nat. Hist. (Bot.)* 18: 377. 1989. *Lastrea filix-mas* var. *sarrato-dentata* Bedd., *ems Brit. India Suppl.* 55. 1892. *Nephrodium sarrato-dentatum* (Bedd.) Hope in *J. Bombay Nat. Hist. Soc.* 12: 622. pl. 10. 1899.

Rhizomes erect, scaly. Fronds somewhat delicate, up to 60 cm long, arising in a group or small basket from the Rhizomes apex. Stipes thin, as long as the length of the lamina, stipes base bearing small lanceolate or ovate-lanceolate, pale brown to dark brown scales and becoming very scattered, small and narrow further up on the rachis. Lamina frost-sensitive, twice pinnate, triangular-lanceolate or elongated triangular, not tapered towards the base, bearing few, up to 12 pairs contiguous pinnae; pinnae elongated, triangular-lanceolate, herbaceous, pale to midgreen above, glabrous, bearing up to 16 pairs of small pinnules; pinnules short, widely attached to the costae; lobes truncate, with few long-acute teeth. Sori small, not crowded, in two rows, one on each side midway between centre and margin of the pinnules, indusiate; indusia small, flat, thin with jagged edge. Spores regular.

Sori : August - October.

Rare, growing in subalpine to alpine shady hill slopes, 2700-3000 m.

Selected specimens : Kashmir : Liddar Valley, 4000 m, *Duthie* 13221 (DD).

18. *Dryopteris stewartii* Fraser-Jenkins in *Kalikasn Philip. J. Biol.* 7: 272. 1979 & in *Bull. Brit. Mus. Nat. Hist. (Bot.)* 18: 398. 1989. *D. odontoloma* f. *brevifolia* Mehra & Khullar in *Res. Bull. Panjab Univ.* 11: 25: (3-4), 107. f. 12. 1980 (*nom. inval.*). **Fig. 40**

Rhizomes short, with few dark brown scales. Fronds up to 110 cm high. Stipes long, up to 1/2 the length of the lamina, stipes base clothed with long lanceolate, pale brown scales; the widest part of the Stipes base densely clothed with large ovate-lanceolate, glossy scales, which become more scattered further up the Stipes; rachis becoming scattered, with small, dark brown scales. Lamina twice pinnate or pinnatifid below, elongated-triangular to lanceolate, up to 36 cm wide, bearing 16-20 pairs of pinnae; pinnae elongated, triangular-lanceolate, herbaceous, pale to mid-green and glabrous above, bearing 14-18 pairs of pinnules; pinnules long stalked or with a narrow point of attachment to the pinnae-costae; lobes crowded, rectangular with rounded truncate apices. Sori not crowded, in two rows, one on each side, midway between the centre and margins of pinnules; lower pinnule lobes bearing two short rows of sori, indusiate; indusia flat curved down at the edge. Spores irregular.

Sori : April - September.

Common, on forest slopes below the alpine zones, 2000-3000 m.

Selected specimens : Pirpanjal Range : Banihal, 1968, *T.A. Rao* 7660; Aherbal, *T.A. Rao* 9272 (BSD); Dachigam, *R.R. Rao & Kumar* 83535 (BSD); Bhaderwah, *Uniyal* 80199 (BSD); Srinagar, 1800 m, *Gammie s.n.* Acc. No. 16355 (CAL).

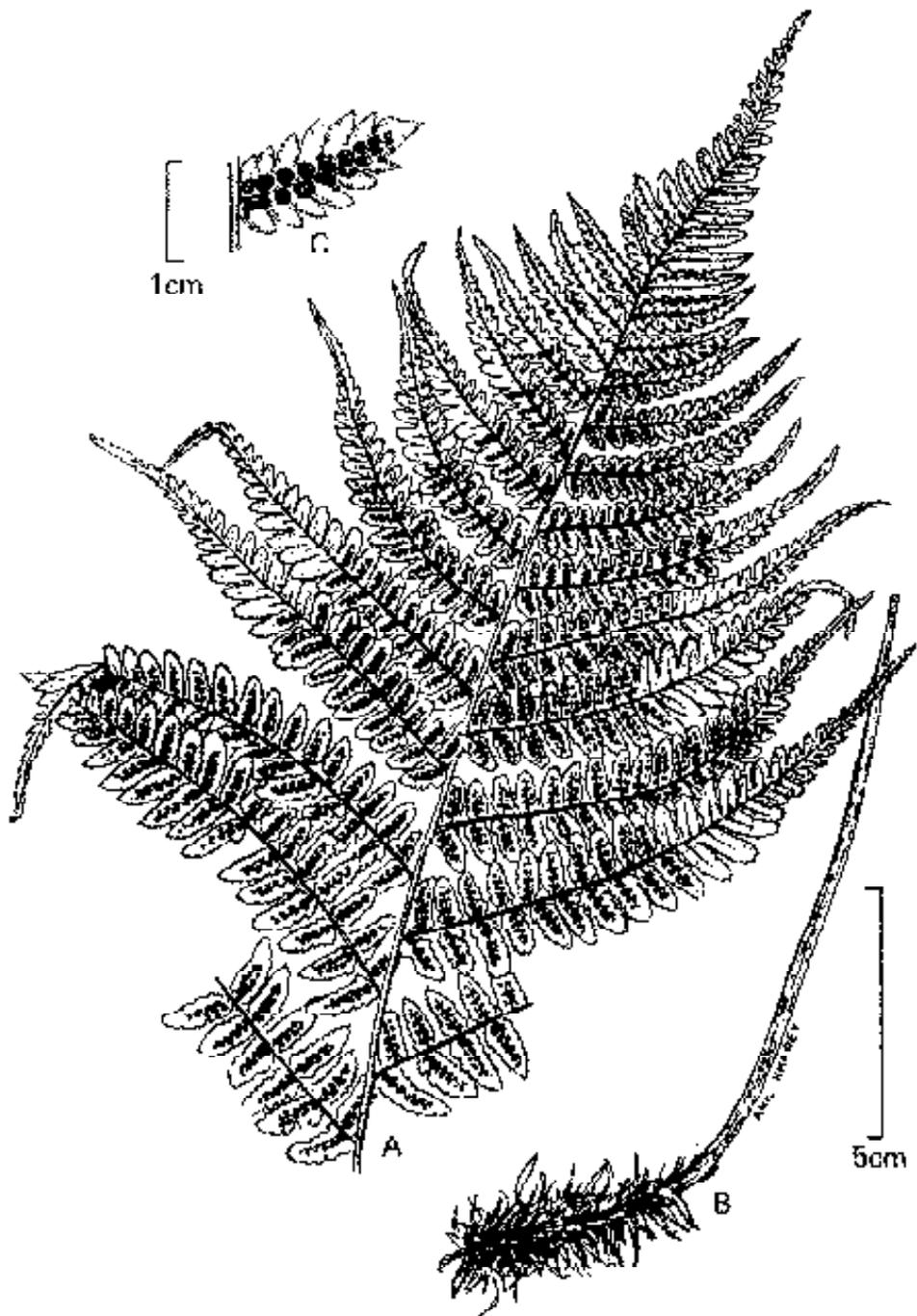


Fig. 40. *Dryopteris stewartii* Fraser-Jenkins

19. *Dryopteris xanthomelas* (Christ) C. Chr., Index Fil. Suppl. 41. 1913; Khullar, Illus. Fern Fl. W. Himal. 2: 347. 2000. *Aspidium xanthomelas* Christ in Bull. Geogr. Mans. 117. 1906. *Dryopteris pulcherrima* Ching in Bull. Fan. Mem. Biol. (Bot.) 8: 422. 1938; Fraser-Jenkins in Bull. Brit. Mus. Nat. Hist. (Bot.) 18: 342-345. 1989. *Nephrodium filix-mas* var. *fibrillosa* C.B. Clarke in Trans. Linn. Soc. London 1: 520. pl. 70. 1880. *Dryopteris rosthornii sensu* Stewart in Bull. Torrey Bot. Club 72. 404. 1945; *D. chingii* Nair in Indian For. 94: 169. 1968. **Fig. 41**

Rhizomes short, erect, densely covered with thin, short, pale-brown, lanceolate hair-tipped scales. Fronds up to 70 cm long. Stipes usually short, 1/5 the length of lamina, bearing a tuft of long straight narrow, lanceolate, mid-brown scales at base, with dense mass of ovate-lanceolate, dark-brown castaneous scales above. Rachis densely clothed with short, narrowly lanceolate, dark to pale-brown scales, mixed with short hair-like fibrillae. Lamina once pinnate, a second time pinnatifid, nearly twice pinnate at the bases of the lower-middle pinnae, base bearing up to 35 pairs of short narrow, regular pinnae; pinnae linear, herbaceous or slightly coriaceous, the upper surface dark green, bearing small hair-like pale-brown fibrillae on the costae; pinnae bearing up to 20 pairs of regular small, mostly rectangular lobes; pinnae-lobes joined only at the base. Sori in two rows, one on either side of the centre of the pinnae lobe, indusiate. Indusia thick, becoming brown. Spores irregular.

Sori : July - September.

Frequent, growing in shaded places of open forest slopes, 2700-4000 m.

Selected specimens : Gulmarg, Khullar 5439 (PAN).

20. *Dryopteris zayuensis* Ching & S.K. Wu in C.Y. Wu, Fl. Xizangica 1: 255. 1983; Khullar, Illus. Fern Fl. W. Himal. 2: 357. 2000.

Rhizomes short, erect, scaly. Stipes long densely scaly and fibrillose; scales large, black, lanceolate or ovate; rachis scaly, upper Stipes and lower to mid rachis bearing very dense black scales. Lamina 1-2 pinnate, up

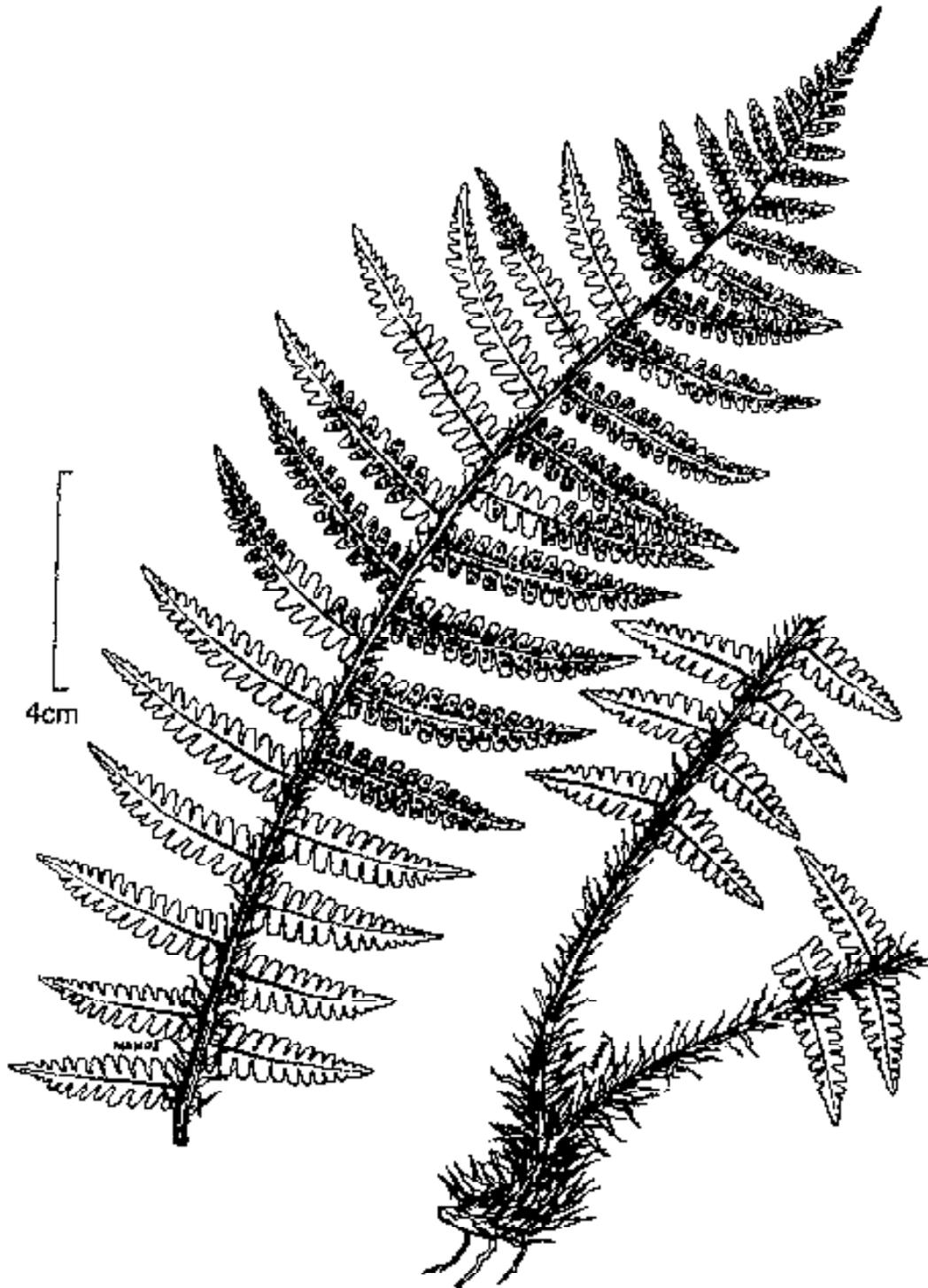


Fig. 41. *Dryopteris xanthomelas* (Christ) C. Chr.

to 40 cm long, 15 cm broad, lanceolate, tapering to the narrow base; pinnac 15 pairs, 6-10 cm long, 1.5-2.5 cm broad, margin deeply lobed to the costa or becoming pinnate; pinnules 10 pairs, up to 2 cm long, 0.5 cm broad; veins 7 pairs in a pinnule. Sori indusiate, small, 3-4 pair per pinnule; indusia rounded, reniform.

Sori : August - September.

A mid-high altitude species.

Reported by Khullar (2000) from Kashmir; Tangmarg, Ferozepur Nullah, and Sarthal in Kathua district.

HYBRIDS

1. *Dryopteris x liddarensis* Fraser-Jenkins in Bull. Brit. Mus. Nat. Hist. (Bot.) 18: 460, 1989; Khullar, Illus. Fern Fl. W. Himal. 2: 358, 2000.

A fern of higher altitude growing in crevices of non-calcareous, west facing cliffs at 3400 m altitude.

Reported by Khullar (2000) and Fraser-Jenkins (1989) from Pahalgam and Liddar Valley near Bajipath.

2. *Dryopteris x macdonellii* Fraser-Jenkins in Bull. Brit. Mus. Nat. Hist. (Bot.) 18: 464, 1989; Khullar, Illus. Fern Fl. W. Himal. 2: 358-359, 2000.

Grows in open places among low bushes at 2130 m.

Reported by Khullar (2000) and Fraser-Jenkins (1989) from Kashmir.

3. *POLYSTICHUM* Roth

1a. Rachis with subterminal proliferous vegetative bud ...4. *P. lentum*

1b. Rachis without a proliferous vegetative bud :

2a. Lamina pinnate; pinnae margin shallowly lobed :

- 3a. Plant small, fragile, texture herbaceous ...3. *P. lachenense*
- 3b. Plant large, texture coriaceous or subcoriaceous :
- 4a. Lamina sub-coriaceous; pinnae nearly as broad as long, upper surface dull-green, not glossy ...8. *P. obliquum*
- 4b. Lamina very coriaceous; pinnae nearly half as broad as long, upper surface glossy ...5. *P. lonchitis*
- 2b. Lamina sub 2-pinnate, or bipinnatifid; pinnae margin deeply lobed :
- 5a. Lamina sub 2-pinnate; pinnae with few pinnules :
- 6a. Lamina herbaceous :
- 7a. Lamina small, narrow (1.5-5 cm broad) :
- 8a. Lower surface of lamina almost glabrous, apex of lobes with a single prominent tooth ...11. *P. shensiense*
- 8b. Both surfaces of lamina fibrillose. apex of lobes without prominent teeth :
- 9a. Plants small; fronds fragile; lower margin of pinnae unlobed ...14. *P. thomsonii*
- 9b. Plants large, densely scaly, fronds upright, forming clumps, pinnae deeply lobed ...10. *P. prescottianum* var. *prescottianum*
- 7b. Lamina large broad :
- 10a. Lamina base truncate, both surfaces fibrillose, apices of lobes pointed ...15. *P. wilsonii*
- 10b. Lamina base broadly truncate, much tapered below, lower surface fibrillose ...1. *P. bakerianum*
- 6b. Lamina sub-coriaceous :
- 11a. Plants of the forest floor; lamina large, 30-35 cm long, upright ...13. *P. stimulans*

- 11b. Plants dwelling on rocks; lamina small
up to 25 cm long, generally curved ...7. *P. mehrae*
- 5b. Lamina always 2-pinnate; pinnae with many pinnules :
- 12a. Lamina sub coriaceous to herbaceous :
- 13a. Rachis without broad scales ...2. *P. discretum*
- 13b. Rachis with broad scales :
- 14a. Stipes densely scaly ...12. *P. squarrosum*
- 14b. Stipes scaly at base, higher up
stipes fibrillose ...6. *P. luctuosum*
- 12b. Lamina coriaceous :
- 15a. Plants sparsely fibrillose; pinnules
often smaller and less lobed; stipes
scales wide and dark ...9. *P. piceo-paleaceum*
- 15b. Plants densely fibrillose; pinnules longer
pointed and lobed; stipes scales not wide
and dark ...16. *P. yunnanense*

1. *Polystichum bakerianum* (Atkins. ex C.B. Clarke) Diels, Nat. Pfl. 1: 191. 1899; Khullar & Sharma in Pangtey & Joshi, West. Himal. Environ. Probl. Develop. 1: 340. 1987; Dixit, Cens. Indian Pterid. 156. 1984, *P. aculeatum* var. *bakerianum* Atkins. ex C.B. Clarke in Trans. Linn. Soc. London 1: t. 66. 1880. *P. prescottianum* var. *bakerianum* (Atkins. ex C.B. Clarke) Bedd., Handb. Ferns Brit. India 210. 1883. *Aspidium bakerianum* Atkins. in Baker Ic. Pl. t. 1656. 1886.

Rhizomes short, erect, with ovate-lanceolate, light-brown scales. Stipes 25-40 cm long, densely covered by ovate-lanceolate, light-brown scales. Lamina sub-2-pinnate, herbaceous, large, broad, up to 40 cm long, 6-8 cm broad, base broadly truncate or much tapered below to auricles; lower surface fibrillose; upper surface scantily fibrillose or glabrous; pinnae 2-3 cm, pinnatifid, apex of the lobes less acute. Sori in upper half of the lamina; indusia reniform-rounded.

Sori : August - October.

Rare, between 3000-4200 m, growing on alpine hill slopes or meadows.

Selected specimens : Kashmir valley, C.B. Clarke 30992 (CAL).

2. **Polystichum discretum** (D. Don) J. Smith in J. Bot. 3: 413. 1841; Diels, Nat. Pfl. 1(4): 199. 1899; Dixit, Cens. Indian Pterid. 157. 1984; Fraser-Jenkins & Khullar in Indian Fern J. 2: 2-3. 1985. *Aspidium discretum* D. Don, Prodr. Fl. Nepal. 4. 1824.

Rhizomes tufted, short, with dark brown scales. Stipes tufted, 20-35 cm long, with dark-brown scales, fibrillose below. Lamina 2-pinnate, subcoriaceous or herbaceous, 20-40 cm long, 8-12 cm broad, ovate-lanceolate, not attenuated at base; rachis without broad scales; pinnae numerous, lanceolate; pinnules oblong, acutely pointed with prominent teeth; veins pinnate or forked in the segments of the pinnules. Sori towards the apex or at the apex of the lower veinlets; spore perisporiate, light brown.

Sori : May - October.

Frequent, 2000-3000 m altitude, in shady forest slopes or ravines.

Selected specimens : Udhampur, S. Kumar 81384 (BSD); Vaishno Devi-Bhairon Temple, Uniyal 77460 (BSD); Kathua : Banjal, Uniyal & Singh 90342, 90344 (BSD).

3. **Polystichum lachenense** (Hook.) Bedd., Ferns Brit. India Pl. 32. 1865 & Handb. Ferns Brit. India 203. 1883; Khullar & Sharma in Pangtey & Joshi, West. Himal. Environ. Probl. Develop. 1: 340. 1987. *Aspidium lachenense* Hook., Sp. Fil. 4: 8. pl. 212. 1862. **Fig. 42**

Small, delicate ferns with short, erect Rhizomes; Rhizomes scales dark brown. Stipes 3-7 cm long, dark brown, glossy, with dense scaly. Lamina bipinnatifid to 1-pinnate, narrowly lanceolate, 5-18 cm long, 1.2-3 cm broad, texture herbaceous; pinnae small, less than 2 cm long 1.5 cm broad, margin shallowly lobed, under surfaces of pinnae clothed with small scales. Sori dorsal on veinlets, chiefly on upper half of lamina; indusia large, membranaceous, round-reniform. Sori 1-6 to 9 pinnae. Spore dark brown, globose.

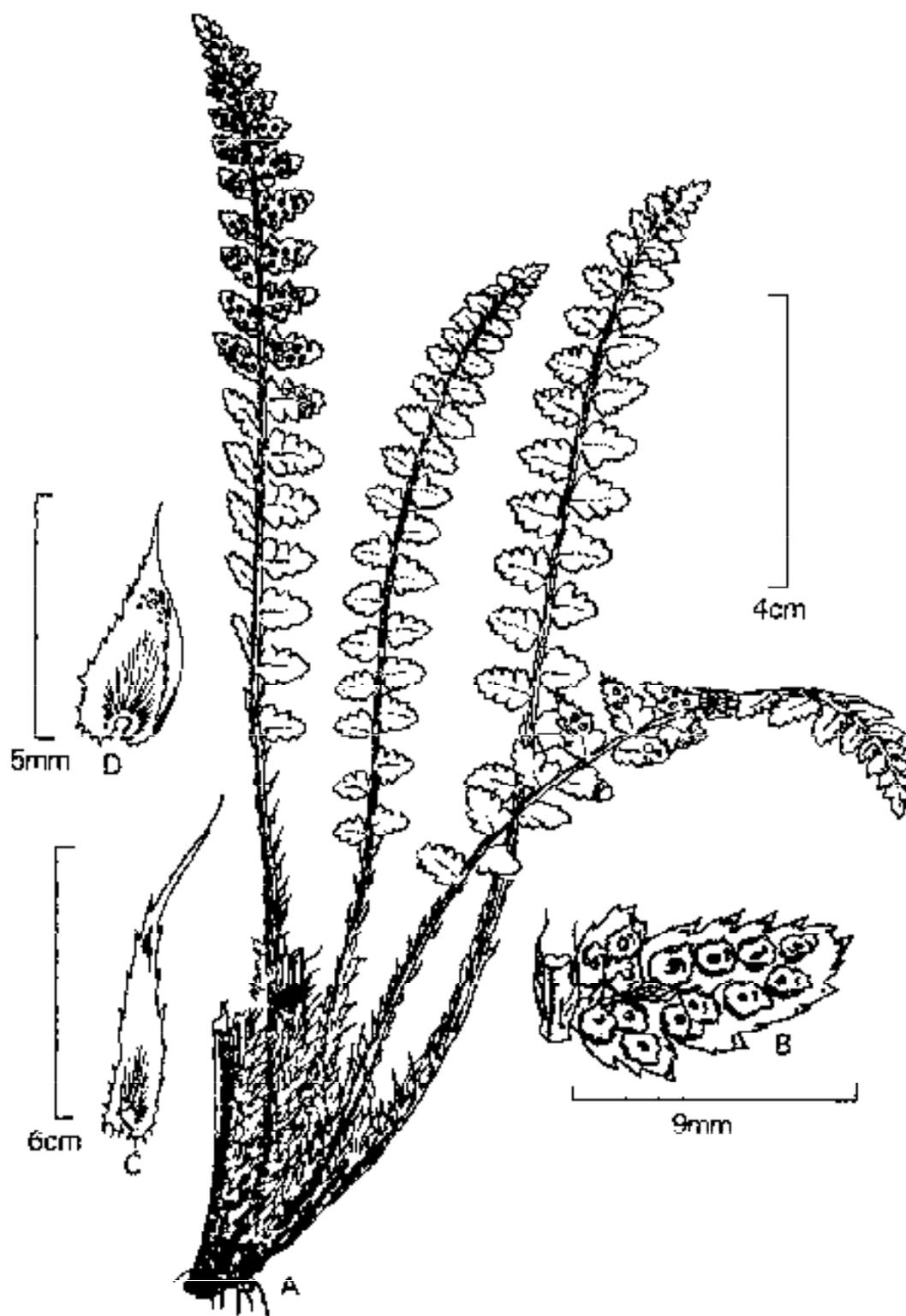


Fig. 42. *Polystichum lachenense* (Hook.) Bedd.

Sori : July - October.

Occasional, growing above 3000 m among rocks on rocky hill slopes.

Selected specimens : Liddar Valley, 4000-4500 m, *Duthie* 13131 (CAL), 14128 (DD); *Maj. Sedgewick s.n.* 7277 (CAL); Gulmarg, 4200 m, *S.P. Khullar* 5488 (PAN).

4. *Polystichum lentum* (D. Don) Moore, Index Fil. 86. 1858; Khullar, Illus. Fern Fl. W. Himal. 2: 377. 2000. *Aspidium lentum* D. Don, Prodr. Fl. Nepal. 4: 1825; Hope in J. Bombay Nat. Hist. Soc. 14: 462. 1902.

Rhizomes short, ascending, woody, scaly. Stipes rather long, 12-16 cm, light brown, scaly; scales brown to blackish, broadly-ovate or linear-lanceolate; rachis sparsely scaly fibrillose. scales light brown, a characteristic subterminal rooting bud is present. Lamina pinnate, 15-40 cm long, 4-8 cm broad, linear-lanceolate, narrowed towards base; pinnae 20-25 pairs, 3.5-4 cm long, 1.5-2.5 cm broad, distant, alternate, shortly petiolate, oblong, margin entire, spinulose with each tooth ending in a distinct spine, deeply lobed; veins in 5-6 pairs. Sori indusiate, 8-12 pairs, in a row on either side of the costa, generally on upper half of the fronds; indusia pale-brown, orbicular.

Sori : Throughout of the year.

Occasionally found growing on shady rocks or creviceous in shady damp places between 1200-2400 m altitude.

Reported by Khullar (2000) from Kadal, North of Basoli in Kathua district.

5. *Polystichum lonchitis* (L.) Roth, Tent. Fl. Germ. 3: 71. 1799; Bedd., Ferns Brit. India t. 128. 1867 & Handb. Ferns Brit. India 207. 1883; Stewart in Bull. Torrey Bot. Club 72: 411. 1945; Khullar & Sharma in Pangtey & Joshi, West. Himal. Envir. Probl. Develop. 1: 340. 1987; Dhir in Bibliotheca Pterido. 1: 77. 1980. *Polypodium lonchitis* L., Sp. Pl. 1080.

1753. *Aspidium lonchitis* Sw. in Schrad. J. 1800 (2): 30. 1801; C.B. Clarke in Trans. Linn. Soc. London 1: 505. 1880; Hope in J. Bombay Nat. Hist. Soc. 14: 458. 1902.

Rhizomes short, erect, nearly naked, scaly. Stipes densely tufted, 3-10 cm long, stout, erect, densely clothed with large reddish-brown lanceolate scales. Lamina 15-30 cm long, 4-6 cm broad, 1-pinnate throughout, robust; texture coriaceous-subcoriaceous; pinnae very numerous, often imbricated, 2-3 cm long, 0.5-1 cm broad, ovate, rhomboid, subfalcate, the two sides unequal, point mucronate, edge spinulose-serrated, apex sharply auricled at the base and obliquely truncate. Sori usually in two rows.

Sori : July - October.

Common, growing between 2700-3600 m, on rocks in humus situations of cold temperate alpine zones.

Selected specimens : Kashmir : Kishanganga Valley, 4000 m, *Duthie* 14112 (DD); Sonamarg, 3000 m, *Trotter* 177 (DD); Gilgit : Nelter Valley, 4000 m, *Duthie s.n.* (DD).

6. *Polystichum luctuosum* (Kunze) Moore, Index Fil. 95. 1859; Khullar & Sharma in Pangtey & Joshi, West Himal. Envir. Probl. Develop. 1: 341. 1987; Khullar, Illus. Fern Fl. W. Himal. 383. 2000. *Aspidium luctuosum* Kunze in Linnaea 10: 548. 1835-36. *Polystichum tsus-simense* (Hook.) J. Smith, J. Hist. Fil. 219. 1875; Stewart in Bull. Torrey Bot. Club 72: 412. 1945; Dixit, Cens. Indian Pterid. 160. 1984. *Aspidium tsus-simense* Hook., Sp. Fil. 4: 16. p. 220. 1862. Fig. 43

Rhizomes short, tufted, with dark-brown, lanceolate scales. Stipes 20-30 cm long, slender, almost as long as lamina, with lanceolate to widely lanceolate, dark-brown scales at base higher up Stipes fibrillose. Lamina sub 2-pinnate, subcoriaceous, 20-30 cm long 8-15 cm broad, rigid, with stiff and spiny serrations; pinnae 5-10 cm long, 1.5-3 cm broad, margin lobed, lower edge of pinnae base truncate; pinnules 1-2 cm long less than 1 cm wide. Sori terminal, usually produced from the base of laminae upward; indusia orbicular with entire margin.

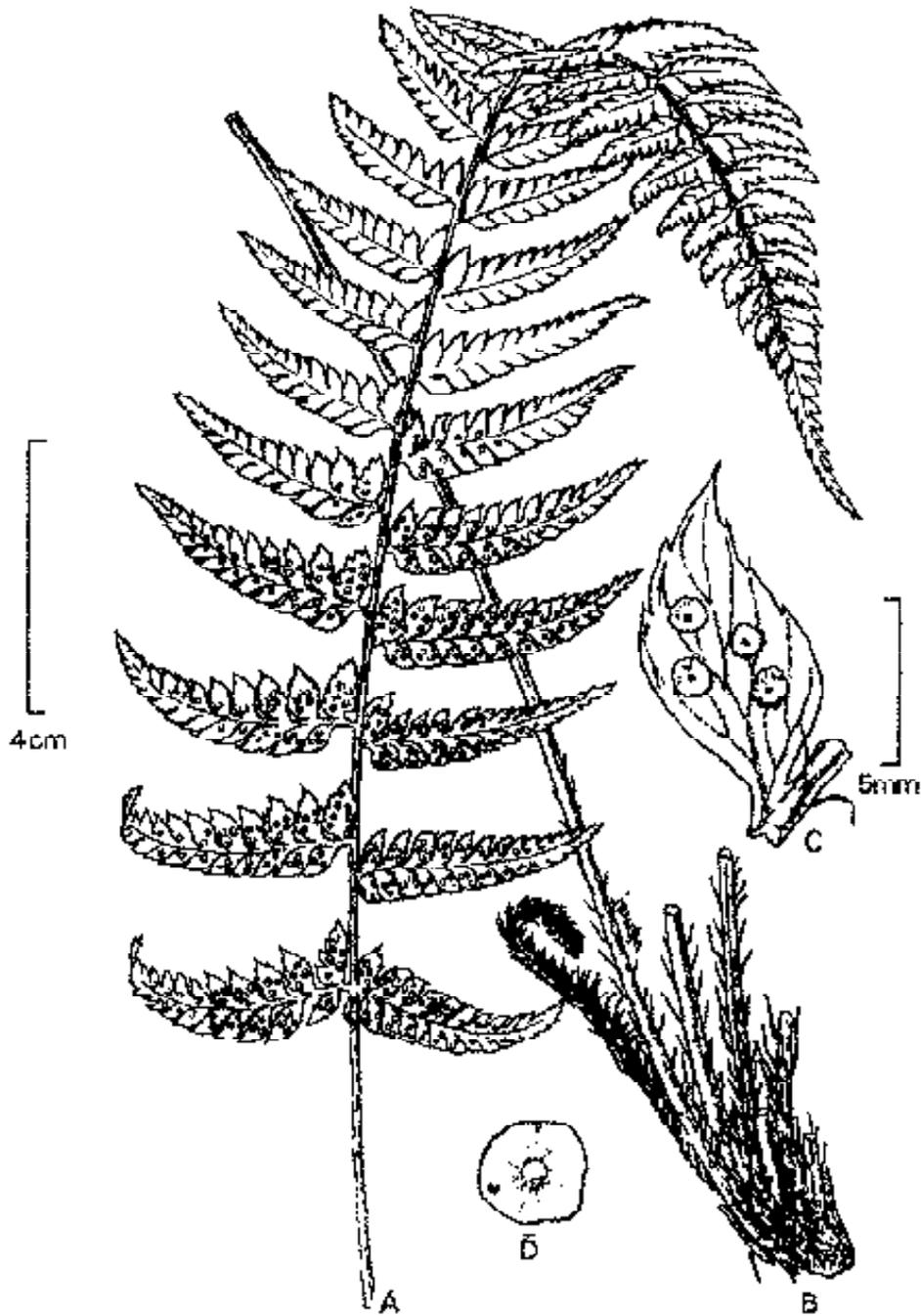


Fig. 43. *Polystichum luctuosum* (Kunze) Moore

Sori : June - October.

Very rare, between 1300-2400 m in shady moist places of drier valleys.

Selected specimens : Kishanganga valley, below Titwal. 1300 m, R.R. & I.D. Stewart 17387 (CAL); Poonch, 2000 m, Stewart 25567 (DD); Jhelam Valley, Trotter, s.n. (DD).

7. *Polystichum mebrae* Fraser-Jenkins & Khullar in Indian Fern J. 2: 10-11. 1985; Khullar, Illus. Fern Fl. W. Himal. 389. 2000. *Aspidium acanthophyllum* Franch in Bull. Soc., Franc. 32: 28. 1885.

Rhizomes short, erect, thick, densely scaly. Stipes short, 2-4 cm long, stramineous, thick, densely scaly and fibrillose; scales light-brown, broadly ovate-lanceolate to linear lanceolate; rachis somewhat densely scaly, fibrillose. Lamina once pinnate-bipinnatifid, in the larger fronds becoming tripinnate, 9-25 cm long, 3-5 cm broad, narrowly lanceolate, hardly narrowed towards the base, curved sideways and not straight, coriaceous; pinnae 20-30 pairs, 1-3 cm long, 1-1.5 cm broad, oblong-lanceolate, alternate, shortly petiolate, deeply pinnatifid or becoming pinnate in large fronds; pinnules or lobes falcate, the margins bearing few spinose, serrate-dentate teeth. Sori large, medial, 8-20 on each pinnae. Spores mid-brown, perisporate.

Sori : May - September.

Occasional, growing on the surface of rocks in shady places between 1500-2400 m altitude.

Selected specimens : North East of Kathua district (DD).

8. *Polystichum obliquum* (D. Don) T. Moore, Index Fil. : 87. 1858; Khullar, Illus. Fern Fl. W. Himal. 2: 397. 2000. *Aspidium obliquum* D. Don, Prodr. Fl. Nepal 3. 1825; Hope in J. Bombay Nat. Hist. Soc. 14: 463. 1902.

Rhizomes short, ascendent, scaly. Stipes 5-12 cm long, stramineous, thin, scaly; scales sparse, light-brown; rachis sparsely scaly; scales small.

Lamina pinnate, 8-30 cm long, 2-4 cm broad, linear to linear-lanceolate; texture subcoriaceous, dull-green, not glossy; pinnae 10-15 pairs, up to 2 cm long, 1.5 cm broad, generally distant, alternate, petiolate; sterile pinnae sometimes toothed at the end of veinlet, lowest pair of pinnae generally distant; veins in groups of 4-5 pairs. Sori indusiate, closer to the costa, 8-15 pairs in a single row; indusia pale-brown, orbicular.

Sori : Major part of the year.

Not common, occurring on dark, shaded, moist dripping rocks, between 1200-2100 m. altitude.

Reported by Khullar (2000) from Kadol, North of Basoli in Kathua district.

9. *Polystichum piceo-paleaceum* Tagawa in Acta Phytotax. Geobot. 5: 255. 1936; Fraser-Jenkins & Khullar in Indian Fern J. 2: 4-10. 1985; Khullar & Sharma in Pangtey & Joshi, West. Himal. Env. Probl. Develop. 1: 341. 1987; Khullar, Illus. Fern Fl. W. Himal. 401. 2000.

Rhizomes short, erect and scaly. Stipes 15-30 cm long, stipes and rachis bearing ovate-lanceolate, blackish scales. Lamina 2-pinnate, subcoriaceous or herbaceous, 25-60 cm long and 10-17 cm broad, elongate-oblong, apex abruptly acuminate; pinnae margin deeply lobed or 2-pinnate, 5-9 cm long, 1-2 cm broad, linear-lanceolate, apex gradually attenuate; pinnules 10-15 mm, rhomboid, ovate, with spiny serrations on margin, under surfaces sparsely clothed with small, aciculate scales. Sori terminal on veinlets, intermedial to costa; indusia persistent, fimbriate on margin.

Sori : May - September.

Frequent, between 2000-3000 m, growing in moist forest floor.

Selected specimens : Udhampur : Vaishnodevi temple, B.P. Uniyal 80146 (BSD); Jakher forest S. Kumar 81384 (BSD); Kathua: Banjal, Uniyal & Singh 90339 (BSD).

10. *Polystichum prescottianum* (Wallich ex Mett.) T. Moore, Index Fil. 101. 1858; Khullar, Illus. Fern Fl. West. Himal. 404. 2000. *P. prescottianum* Bedd., Handb. Ferns Brit. India 210. t. 105. 1883; Stewart in Bull. Torrey Bot. Club, 72: 411. 1945. *Aspidium prescottianum* Wallich ex Mett., Pheg. Asp. 48. n. 110. 1858; C.B. Clarke in Trans. Linn. Soc. London 1: 510. 1880. var. ***prescottianum***. **Fig. 44**

Rhizomes short, erect, scaly. Stipes 5-8 cm long, with ovate and linear scales near the base, soft lax, hair-like, pale coloured scales on Stipes. Lamina sub 2-pinnate, herbaceous, narrow, 15-30 cm long, 3-3.5 cm broad, very scaly; pinnae deeply lobed on both sides into small lobes which may be free (2-pinnate), ovate, oblong narrow and elongate-lanceolate, acuminate, furnished with subulate scales beneath. Sori on upper half of lamina; indusia rounded-reniform, fimbriate on margin.

Sori : August - October.

Common, between 3000-4000 m elevation, growing on open alpine meadows.

Selected specimens : Ladakh : Dras, 3200 m, *Duthie s.n.* (DD); Khillanmarg, *T.A. Rao* 457 (BSD); Sioj-Kailash, *Vohra & Naithani* 83000 (BSD). Gulmarg, 3200 m, *Murugesan* 65623 (BSD).

11. *Polystichum shensiense* Christ in Bull. Geogr. Bot. Mans. 113. 1906; Khullar & Sharma in Pangtey & Joshi, West. Himal. Env. Probl. Dev. 1: 342. 1987; Fraser-Jenkins, Himal. Ferns, Guid Polyst. 13. 1997, Khullar, Illus. Fern Fl. West. Himal. 2: 407. 2000. *P. consimile* Ching., Icon. Fil. Sin. 5: t. 237. 1958; Pichi-Sermolli, Index Fil. Suppl. Quantum 253. 1965.

Rhizomes short, erect, densely clothed with dark brown, ovate-acuminate scales. Stipes 10-12 cm long, sparsely clothed scales at base; scales as on Rhizomes, glabrous or with few scale above. Lamina 20-28 cm long, 3 cm broad, linear-lanceolate, acuminate, base slightly narrowed, pinnate; pinnae 30-35 pairs, imbricate, petiolate, deflexo-recurvate, 1.5 cm long, subrhombic-triangular, apex short, acute or bluntish, base unequal, cut straight below, truncate above, margin aristate-serrate with long

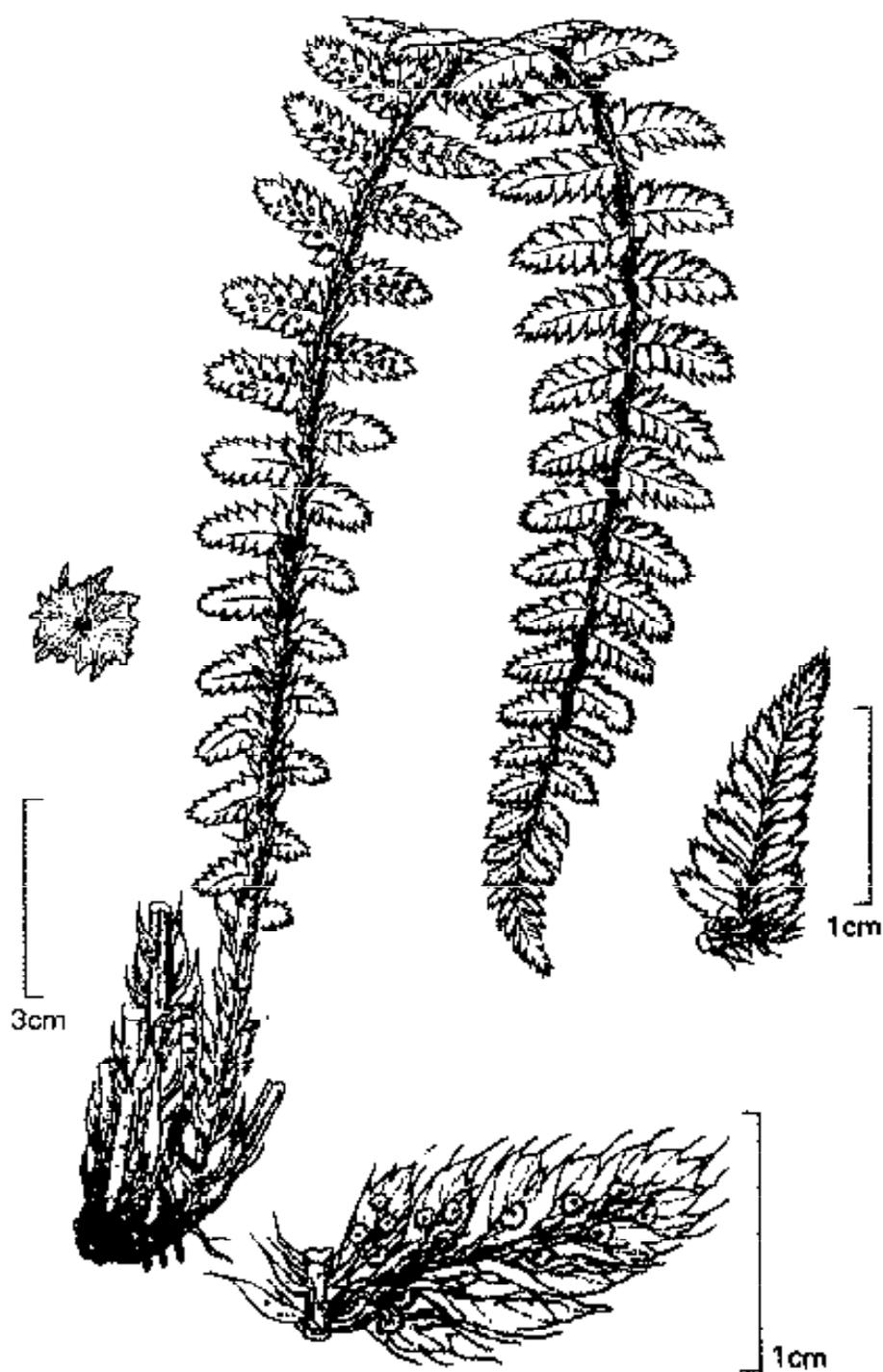


Fig. 44. *Polystichum prescottianum* (Wallich ex Mett.) T. Moore

spreading spines, the lowest pinnae smaller, less than 1 cm long, deflexed; texture herbaceous, glabrous on both sides. Veins indistinct, forked. Sori small, inter-marginal, indusium entire.

Sori : August - October.

Rare, found in Kashmir valley, between 2400-3500 m.

Reported by Khullar & Sharma (1987) from North Kashmir.

12. *Polystichum squarrosus* (D. Don) Fée, Gen. Fil. 278. 1850-52; Stewart in Bull. Torrey Bot. Club 72: 412. 1945; Khullar, Illus. Fern Fl. W. Himal. 2: 409. 2000. *P. aculeatum* Sw. var. *rufo-barbatum* C.B. Clarke in Trans. Linn. Soc. London 1: 509. 1880. *Aspidium squarrosus* D. Don. Prodr. Fl. Nepal. 4. 1825.

Rhizomes erect or sub-erect, densely scaly; scales up to 2 cm long, elliptic-lanceolate, acute, acuminate, dark-brown. Stipes tufted, 15-30 cm long, densely scaly throughout. Lamina subcoriaceous, sub 2-pinnate, lanceolate, 30-70 cm long, 10-20 cm broad, base sub-truncate. Pinnae up to 30 pairs, subopposite, almost sessile, largest 20 x 4 cm, oblong, lanceolate; pinnules ovate, basiscopic margin excised at base, incised to the costule, basal basiscopic lobes larger than next above; veins up to 5 pairs at the basal acroscopic lobe. Sori in two sub-marginal rows, borne at the end of veinlets, brown. Spores copious, brown, reniform; exine smooth walled.

Sori : Throughout the year.

Common, between 1300-2700 m, growing in undergrowth of shady forest slopes.

Selected specimens : Poonch : Sarmarg, 2000 m, Stewart 25568 (DD); Udhampur : Vaishno Devi-Vaironghati, B.P. Uniyal 77459 (BSD); Kathua : Kot-Banjai, Uniyal & Singh 90332 (BSD).

13. *Polystichum stimulans* (Kunze ex Mett.) Bedd., Ferns Brit. India 31. 1865; C. Chr., Contr. U.S. Nat. Herb. 26. 185. 1931; Khullar, Illus. Fern Fl. W. Himal. 413. 2000. Chandra, Ferns India 211. 2000.

Aspidium stimulans Kunze ex Mett, Frang. Pheg. Asp. 327. 1858.
Polystichum stimulans Presl, Tent. Pterid. 38. 1836. *nom. nud.* *Aspidium*
pungens Wallich, List No. 368. 1828. *nom. nud.*

Rhizomes short, erect, scaly, with long wiry roots arising from the rhizomes; fronds 8-28 cm long, tufted, unipinnate, coriaceous, scaly; scales dark brown, concolorous, small, dentate projection along the margins; rachis fibrillose. Lamina 8-20 cm long, pinnae 20-25 pairs, largest in the middle, alternate, pinnatisect, both surface glabrous, lower surface light yellow, upper surface glabrous, dark green when dry, whole of the frond fertile. Sori 8-20, large, indusiate; indusium irregularly lobed. Spore perisporiate, exine smooth walled.

Reported by Chandra (2000).

14. *Polystichum thomsonii* (Hook.) Bedd., Ferns Brit. India 1: Pl. 126. 1866 & Handb. Ferns Brit. India 206. 1883; Stewart in Bull. Torrey Bot. Club. 72: 412. 1945; Khullar, Illus. Fern Fl. W. Himal. 2: 414. 2000. *Aspidium thomsonii* Hook., 2nd Cent. Ferns t. 25. 1860; Hook. & Baker, Syn. Fil. 251. 1874; C.B. Clarke in Trans. Linn. Soc. London 1: 508. 1880.

Rhizomes short with few, light brown scales. Stipes slender, stramineous, 5-10 cm long with few large basal scales, fibrillose, scaly upwards; rachis stramineous. Lamina fragile, sub 2-pinnate, herbaceous, 10-17 cm long, 1.5-3 cm broad, green, slightly fimbriose, narrowly-lanceolate, acuminate, narrowed below; lower margin of pinnae unlobed, except for the narrow, very obliquely inserted lobes towards the apex. Sori solitary on each lobe, terminal on veinlets; indusia round or subovate. Spore perisporiate, smooth walled, brown.

Sori : June - October.

Occasional, between 1700-3000 m, growing on shaded moist rock crevices.

Selected specimens : Chandanwari, 3200 m, T.N. Khoshoo 2413 (PAN).

15. *Polystichum wilsonii* Christ in Bot. Gaz. 51: 353. 1911; Khullar & Sharma in Paugtey & Joshi, West Himal. Environ. Probl. Develop. 1: 343. 1987. **Fig. 45**

Rhizomes erect, densely covered by the light brown scales. Stipes 10-20 cm long, densely covered with membranaceous, lanceolate scales. Lamina sub 2-pinnate, herbaceous, 20-30 cm long, 6-8 cm broad, base truncate, both surfaces fibrillose; pinnae lanceolate, apex acuminate, base cuneate with small scales on under surface of pinnae; apices of lobes acutely pointed. Sori dorsal on veinlets, medial to costa; indusia membranaceous, round, reniform, fimbriate on margin. Spore dark-brown, exine tuberculated.

Sori : August - October.

Rare, on dry alpine slopes, between 3500-4500 m.

Selected specimens : Dagwan, 3500 m, B.M. Wadhwa 67003 (BSD).

16. *Polystichum yunnanense* Christ, Not. Syst. 1: 34. 1909; Khullar, Illus. Fern Fl. W. Himal. 2: 420. 2000.

Rhizomes short, erect, thick, woody, oblique densely scaly. Stipes 5-15 cm long, brown, base with wide ovate scales; stipes and rachis with reddish, fibrillose, small scales. Lamina 2-pinnate, 15-50 cm long, 6-10 cm broad, lanceolate narrow towards the base, broadest in the middle; texture subcoriaceous, often dark bluish-green, with slight depressions on the upper surface of the lamina above each sorus; pinnae 18-20 pairs, 6-15 cm long, 1-2 cm broad, close, alternate, short petiolate; pinnules up to 15 pairs, 1-2 cm long, 0.5 cm broad, elongated, margin more lobed and apices more pointed, lowest acroscopic pinnule on each pinnae frequently long; veins pinnate. Sori indusiate, medial; indusia pale brown orbicular.

Sori : September to March.

Common, in moist places, along the forest-floor, around 2000 m altitude.

Selected specimens : Udhampur : Jakher-forests, S. Kumar 81384 (BSD); Kathua, on way from Kote to Banjar Uniyal & S. Singh 90339 (BSD).



Fig. 45. *Polystichum wilsonii* Christ

HYBRIDS

Polystichum x flemingii Fraser-Jenkins, Aspects of Plant Sciences 13: 277. 1991; Khullar, Illus. Fern Fl. W. Himal. 2: 422. 2000.

Note : This taxa is similar to *P. yunnanense* but differs with it's pinnules being more lobed with acute apices.

NEPHROLEPIDACEAE

NEPHROLEPIS Schott

Nephrolepis cordifolia (L.) Presl, Tent. Pterid. 29. 1836; Bedd., Handb. Ferns Brit. India 282. t. 144. 1883. *Polypodium cordifolia* L., Sp. Pl. 2: 1089. 1753.

Rhizomes sub-erect, the wiry fibers bearing large oval scaly tubers (during summer). Stipes 4-10 cm long or more long, paleaceous, with few scales at base. Lamina up to 50 cm long, 5-8 cm broad at base, linear-lanceolate, pinnate; pinnae numerous, 2.5-4 cm long, 1-1.5 cm wide at base, glabrous, truncate or cordate at base, auricled above, the fertile ones crenate, acuminate; sterile ones shorter and more obtuse. Sori about half-way between the midrib and margin in a single row; indusia firm, lunate or reniform.

Sori : July - November.

Cultivated as an ornamental plant in gardens.

DAVALLIACEAE

ARAIOSTEGIA Copel.

- 1a. Stipes thin; plant size 20 x 14 cm; pinnae distant,
not touching one another ...2. *A. pulchra*
1b. Stipes thick; plant size 60 x 30 cm; pinnae not distant,
touching one another ...1. *A. pseudocystopteris*

1. **Araiostegia pseudocystopteris** (Kunze) Copel, in Philipp. J. Sci. 34: 241. 1937; Mehra & Bir in Res. Bull. Panjab Univ (N.S.) 15: 119.

1964; Dixit, Cens. Indian Pterid. 169. 1984; Khullar & Sharma in Pangtey & Joshi, West. Himal. Env. Probl. Devel. 1: 344. 1987; Khullar, Illus. Fern Fl. West. Himal. 461. 2000. *Leucostegia pseudocystopteris* Kunze, Bot. Zeit. 68. 1850; Bedd., Handb. Ferns Brit. India 54. 1883. *Davallia pulchra* var. *pseudocystopteris* C.B. Clarke in Trans. Linn. Soc. London 1: 444. 1880.

Rhizomes up to 8 mm thick, wide-creeping, clothed with more spreading scales; scales golden brown, ovate. Stipes 5-10 cm long, scaly at base. Fronds approximate. Lamina oblong, deltoid, 10-25 cm long, 5-15 cm broad, quadripinnate, 3-12-jugate, sessile, ultimate pinnules pinnatifid with 2-4 cm long, ligulate, acute segments; texture thin, herbaceous, pale green. Sori copious; indusium small, membranous, grey. Sporangia 10-12-celled annulus. Spores bilateral, granulated.

Sori : September October.

Occasionally found, as an epiphytes on tree trunks, 1700 2600 m.

Reported by Khullar and Sharma (1987) Jammu Division (Vaishno Devi area).

2. *Aralostegia pulchra* (D. Don) Copel. in Philipp. J. Sci. 34: 241. 1927; Mehra & Bir in Res. Bull. Panjab. Univ. (N.S.) 15. 119. 1964; Dhir in Biblioth. Pterido. 1: 57. 1980; Dixit, Cens. Indian Pterid. 169. 1984; Khullar & Sharma in Pangtey & Joshi, West. Himal. Env. Probl. Devel. 1: 344. 1987; Khullar, Illus. Fern Fl. West. Himal. 2: 461. 2000. *Davallia pulchra* D. Don, Prodr. Fl. Nepal. 11: 1825; C.B. Clarke in Trans. Linn. Soc. London 1: 442. 1880. *Leucostegia pulchra* (D. Don) J. Smith in London J. Bot. 1: 426. 1842; Bedd., Handb. Ferns Brit. India 52. t. 25. 1883; Stewart in Bull. Torrey Bot. Club 72: 413. 1945.

Rhizomes fleshy, rounded 8-10 mm thick, wide creeping, clothed with broad-obtuse often peltately attached scales. Stipes 12-15 cm long, naked. Fronds 20-35 cm long 10-20 cm broad, lanceolate-deltoid, 3-4 pinnatifid, lowest pinnae 3-5 cm long 2-3 cm broad, cut down to a narrowly winged rachis into deeply pinnatifid segment, ultimate lobes narrow, lanceolate, not distant, not very acute; texture thin, herbaceous. Sori copious, as broad as the segment; indusium membranous. Sporangia 10-12 celled annulus. Spores bilateral, granulated.

Sori : August - October.

Rare, found as an epiphytes on tree trunks or lithophytes on shady rock crevices, 1800-2500 m.

Reported by Beddome (1883) from Kashmir valley.

BLECHNACEAE

WOODWARDIA J. Smith

Woodwardia unigemmata (Makino) Nakai in Bot. Mag. Tokyo 39: 103. 1925; Dixit, Cens. Indian Pterid. 173. 1984; Khullar & Sharma in Pangtey & Joshi, West. Himal. Env. Probl. Devel. 1. 344. 1987; Khullar, Illus. Fern Flora W. Himal. 2: 479. 2000. *W. radicans* (L.) J. Smith var. *unigemmata* Makino in J. Japan. Bot. 2: 7. 1818. *W. radicans sensu* Bedd., Handb. Ferns Brit. India 135. t. 68. 1883; Hope in J. Bombay Nat. Hist. Soc. 13: 459. 1901; Stewart in Bull. Torrey Bot. Club 72: 418. 1945. **Fig. 46**

Rhizomes ascending, densely scaly at base; scales yellowish brown, membranaceous, ovate-lanceolate, hair pointed. Stipes 30-40 cm long with yellow, ovate-lanceolate scales. Fronds caespitose, firm. Lamina ample, oblong-ovate, bipinnate, 30-60 x 15-35 cm; rachis distinct, firm, sparsely covered with small yellow scales; having large scaly buds towards the apex; pinnae 10-12-jugate, segments oblong-lanceolate, acuminate; venation obscure, marginal veinlets free, basal areolae with uniserial sori; texture rigidly coriaceous. Sori short, oblong, deeply sunk; indusiate; indusium brown, thick; sporangia with 18-20-celled annulus. Spores light yellow, globose to oval.

Sori : September - June.

Occasionally, growing in moist, shaded and humus rich hill slopes, 1400-2500 m.

Selected specimens : Poonch : Mandi-loran, Vohra & Naithani 78274; Doda : Bhadarwah, Vohra & Naithani 82789 (BSD); West of Kashmir, Inayat 202133 (CAL); Kote Banjal, Uniyal & S. Singh 90329 (BSD).



Fig. 46. *Woodwardia unigemmata* (Makino) Nakai

SALVINIACEAE

SALVINIA Seguiet

- 1a. Pinnac hastate, four hairs on the tip of each papilla joined at their tips; sporocarps loose ...1. *S. molesta*
- 1b. Pinnac ovate-oblong, four hairs on the tip of each papilla not joined but free and spreading; sporocarps in clusters ...2. *S. natans*

1. *Salvinia molesta* Mitchell in Brit. Fern Gaz. 10: 251. 1972; Khullar, *Illus. Fern Fl. W. Himal.* 2: 484. 2000.

Aquatic, free floating, biennial or annual, herbaceous fern. Rhizomes hairy, small, brown. Floating young leaves 0.75 x 1.5 cm matured leaves 2.5 x 4.5 cm, sessile, sub opposite, oblong-ovate, deltate, folded, lamina fusing with mid-rib in the basal region, upper surface covered with brown branched hairs with "egg-beater" like hairs in linear rows; submerged leaves terminating in a 2-3 cm long axis with 1 or 2 branches of loose sporocarps, surrounded by 30-45 root like filiform segments. Sporocarps pedunculate, sessile, 2-4 per branch, in rather loose rows.

A fast growing aquatic weed, in ponds and lake, up to the 1200 m, altitude.

Reported by Khullar (2000) from Jammu.

2. *Salvinia natans* (L.) All., *Fl. Pedem.* 2: 289: 1785; Stewart in *Bull. Torrey Bot. Club* 72: 424. 1945; Dixit, *Cens. Indian Pterid.* 174. 1984; Dhir in *Biblioth. Pterido.* 1: 51. 1980; Khullar *et al.* in *Pangtey & Joshi, West Himal. Env. Probl. Devel.* 1: 345. 1987. *Marsilea natans* L., *Sp. Pl.* 2: 1099. 1753.

Aquatic, free floating, annual, herbaceous ferns. Rhizomes horizontal, branch hairy, siphonostelic. Leaves two types; upper green, floating leaves exposed to the air in pairs, midrib distinct with anastomosing veins, dorsal surface covered with papillae and ventral surface covered with straight,

multicellular hairs; submerged leaves finely divided into numerous root like segments. Sori in special seed like structure, called sporocarps. Sporocarps globose or ovoid, brown with hexagonal cells, containing two types of sporangia, some megasporangia and others microsporangia, covered by minute, multicellular hairs.

Sori : August September.

Common, on ponds, paddy fields and lakes, 1400-1800 m.

Selected specimens : Srinagar : Dal lake 1700 m. T.A. Rao 7739 (BSD); *s. loc.*, Nair 37083 (BSD); Meebold-806 (CAL); Naribal on way to Gulmarg, A.S. Rao 63688 (BSD) *s. loc.*

AZOLLACEAE

AZOLLA Lamk.

Azolla pinnata R. Br., Prodr. Fl. Nov. Holl. 167. 1810; Holttum, Fl. Malaya 2: 621. 1968; Devol, Fl. Taiwan (ed. 2) 1: 60. 1980; Dixit, Cens. Indian Pterid. 174. 1984; Khullar *et al.* in Pangtey & Joshi, West. Himal. Env. Probl. Devel. 1: 344. 1987.

Free-floating, small aquatic, annual ferns, 2 x 1 cm, triangular. Roots up to 4.5 cm long, unbranched with numerous root hairs. Leaves less than 0.5 cm long, bilobed with one floating and another submerged lobe, small imbricating upper aerial lobe covered with papillae and overlapping the Rhizomes; lower submerged lobe only one cell in thickness. Sori in sporocarps borne in pairs; microsporocarps globose and megasporocarps ovoid, containing a basal megasporangium. Spores small, round.

Sori : July November.

Common, in ponds or stagnant water near villages of lower altitude, 350-1200 m.

Reported by Khullar *et al.* (1987) from south west of Kathua.

G Y M N O S P E R M S

(D. Basu)

KEY TO THE FAMILIES

- 1a. Branches jointed at nodes. Leaves opposite ...**Ephedraceae**
 1b. Leaves alternate or whorled :
 2a. Ovules pendulous ...**Pinaceae**
 2b. Ovules erect :
 3a. Leaves linear. Female cone with 1-flower;
 scales imbricate ...**Taxaceae**
 3b. Leaves scale-like or subulate. Female cone
 with more than 1-flower; scales decussately
 opposite, peltate ...**Cupressaceae**

EPHEDRACEAE**EPHEDRA L.**

- 1a. Mature female bracts hardened along midrib,
 produced laterally into wing like expansion ...5. *E. przewalskii*
 1b. Mature bracts of female spike often narrowly
 membranous margined, at length becoming
 thick and fleshy :
 2a. Tubillus twisted :
 3a. Seeds 2-3 mm long; bracts of female
 inflorescence connate in lower third ...4. *E. pachyclada*
 3b. Seeds 5-6 mm long; bracts of female
 inflorescence connate in two third ...2. *E. intermedia*
 2b. Tubillus straight :
 4a. Tubillus not more than 1 mm long ...1. *E. gerardiana*
 4b. Tubillus 1.5-3.5 mm long :
 5a. Strobilus up to 7 mm long; seeds
 4-7 mm long ...3. *E. nebrodensis*
 5b. Strobilus 7-10 mm long; seeds 3.5-
 4.5 mm long ...6. *E. regeliana*

1. *Ephedra gerardiana* Wallich ex Stapf in Akad. Wiss. Wien. Math. Nat. Kl. Denksch. 56(2): 75, t. 3, f. 18. 1889; Kachroo *et al.*, Fl. Ladakh 148. 1977; Sahni, Gymnosp. India & Adj. Countr. 145. 1990. *E. vulgaris* Hook.f., Fl. Brit. India 5: 640. 1890. *Asmain buit, Chabbat* (Ladakhi).

Densely tufted shrubs, up to 120 cm high; stems woody, gnarled. Branches dark green, erect or ascending. Leaf sheaths ca 2.5 mm long, 2-toothed. Male spikes ovate, 1-3 together at nodes; flowers 4-8; bracts connate. Female spikes solitary, 1-2 flowered; tubillus straight. Fruits ovoid, orange-red. Seeds 2, black.

Strobilii appear : May July; *Mature* : October.

Gregarious amidst stones and rocks.

Selected specimens : Ladakh, Shyok-Durbuk, *Viswanathan* 55078; whisky Nallah, *Bhattacharyya* 40913 (BSD). Srinagar, Takht 2500 m, *Lambert* 200; Jhelum valley: 1925; *Lambert* 222; Ladakh, Lamayuru 3500 m, *Koelz* 2733 Zanskar 3500 m, *Koelz* 2870 Burzil Pass, Gilgit Road, *Stewart* 20126. Bhuti Nullah 4-4500 m, *Keshavanand* 1513 (DD).

Uses : Fruit sweet and edible (*Viswanathan*, 1999).

2. *Ephedra intermedia* Schrank *et* Mey. in Mem. sci. Nat. Acad. Petersb. 6.5.1845 *et* in Monogr. Ephedra 88. 1846; Hook.f., Fl. Brit. India 5: 863 1890; Sahni, Gymnosp. India & Adj. Countr. 143. 1990. *Ephedra, Chhapat*.

Shrubs; branchlets glaucous, striate. Leaf sheaths up to 3 mm long, 2-toothed. Male spikes in dense whorls at nodes; bracts broadly obovate, connate. Female spikes solitary, paired or whorled, 2-flowered; tubillus exserted, twisted. Fruits red, ovoid.

Strobilii appear : May : *Mature* : October.

On dry sandy slopes.

Selected specimens : Ladakh, on way to Khardungla, *Bhattacharyya* 71520; Miru, Purang valley, *Bhattacharyya* 41085; Chumathang. *Chowdhery & Uniyal* 86164; Namika La, *Wadhwa* 58874 (BSD).

2.1. var. *tibetica* Stapf, Monogr. Art. Gatt. Ephedra Wien. 62. 1889; Hook.f., Fl. Brit. India 5: 863. 1890; Sahni, Gymnosp. India & Adj. Countr. 143. 1990.

Shrubs, up to 1.2 m tall; bark scabrous, sometimes bluish. Internodes elongate.

Included after Sahni (*loc. cit.*)

3. *Ephedra nebrodensis* Tineo var. *procera* (Fisch. et Mey.) Stapf in Acad. Wiss. Wien. Math. Nat. Kl. Denksch. 56(2): 77.t. 3 f.1-7. 1889; Sahni, Gymnosp. India & Adj. Countr. 147. 1990.

Shrubs, up to 1.8 m tall. Branches smooth, slender, rigid; branchlets perfectly smooth. Male spikelets solitary or 2-3 together, sessile-crowded, few flowered. Female cones 1-flowered, narrower, pedunculate; tubillus straight. Fruits globose.

Strobilii appear : June *Mature* : September.

Selected specimens : Gilgit, *Stapf* 292 (DD).

4. *Ephedra pachyclada* Boiss., Fl. Orient. 5: 713. 1885; Hook.f., Fl. Brit. India 5: 641. 1888; Sahni, Gymnosp. India & Adj. Countr. 142. 1990.

Shrubs, below 1 m high; branches stout, straight. Male spikes densely crowded, sessile; anthers 6-8, sessile, crowded, large. Female bracts connate in lower third; tubillus curved. Seeds 2-3 mm long.

Strobilii appear : May

Included after Sahni, (*loc. cit.*).

5. *Ephedra przewalskii* Stapf in Akad. Wiss. Wien. Math. Nat. Kl. Denksch. 56(2): 40. 1889; Sahni, *Gymnosp. India & Adj. Countr.* 140. 1990.

Erect shrubs, up to 1.25 m tall, branches colourless, up to 25 cm long. Leaves in twos or threes, connate up to half the length. Male spikes solitary or 2-3 together, sessile; bracts yellow, 2 mm long, connate at base; staminal column exerted; anthers 5-8, shortly stipitate. Female spikes solitary, usually sessile, 2-3 together; tubillus straight, 2.5 mm long, exerted. Seeds pale brown, ovate, 3-4 mm long.

Strobilii appears : Ladakh, April May; *Mature* : Sept. Oct.

Selected specimens : Ladakh, Bed of Shyok river, Stewart s.n. (DD).
Rare.

6. *Ephedra regeliana* Florin in Svensk vet. Akad. Handb. Ser. 3: 12(1): 17. 1933; Sahni, *Gymnosp. India & Adj. Countr.* 148. 1990.
Tsecheldumb.

Dwarf shrubs, dioecious; branchlets ascending. Leaves opposite, membranous margined; sheath with triangular teeth. Male strobilii 1-3, sessile or shortly pedunculate; bracts suborbicular-ovate, connate up to 1/3. Female strobilii 1-2 flowered. Seeds 3.5-4.5 mm long.

CUPRESSACEAE

JUNIPERUS L.

- 1a. Leaves awl-shaped or needle-like :
 - 2a. Leaves jointed at base ...1. *J. communis*
 - 2b. Leaves not jointed at base :
 - 3a. Trees ...4. *J. recurva*
 - 3b. Shrubs ...5. *J. squamata*
- 1b. Leaves mostly scale-like on adult trees; awl-shaped leaves occasional on branchlets :
 - 4a. Leaves minutely toothed on margins ...2. *J. indica*

4b. Leaves entire :

5a. Leaves with strongly impressed glands.

Fruits blackish, spherical or oblong ...6. *J. turkestanica*

5b. Leaves with a glandular furrow on back.

Fruits dark purplish brown, globose ...3. *J. polycarpus*

1. *Juniperus communis* L., Sp. Pl. 1040. 1753; Hook.f., Fl. Brit. India 5: 646. 1888; Sahni, Gymnosp. India & Adj. Countr. 101. 1990; J.B. Singh & Kachroo, For. Fl. Pir Panjal 159. 1994. *Betar, Bithal* (Hindi), *Shupa*. Fig. 47

Erect shrubs, up to 1.5 m tall; highly branched; bark scaling off in papery sheets, reddish-brown. Leaves awl shaped, 10-15 mm long, sharp pointed, spreading sessile. Male strobilii solitary, cylindrical, ca 8.5 mm long; stamens yellow, in 5-6 whorls. Female strobilii green, ca 2.1 mm long. Fruits bluish or black on maturity, 8.5-13 mm in diam., with 3 minute points at top. Seeds 2-3, elongated-ovoid, 3 cornered with depression.

Selected specimens : Habba-Khatoun, Wadhwa, Murti & Pant 84985; Thajwas mountains, T.A. Rao 9543; Udhampur, Latidhuna. Swami 1304 (BSD).

Note : Oil of Junipers extracted from unripe strobilii.

2. *Juniperus indica* Bertol, Misc. Bot. 23: 228. t. 1. 1862; Sahni, Gymnosp. India & Adj. Countr. 102. 1990. *J. wallichiana* Hook.f. & Thomson ex Partl. in DC., Prodr. 16(2): 482. 1868; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 27. 1972. *J. pseudosabina* auct., non Fisch. & Mey.; Hook.f., Fl. Brit. India 5: 646. 1888. *Shukpa*.

Diocious trees, up to 18 m tall; ultimate divisions of adult branches 4 sided. Leaves 4-ranked, in whorls of 3, up to 6 mm long, awl shaped, sharply pointed; leaves on lower branches scale like. Fruits ovoid, blue when mature. Seed single, ovoid, with two or three depressions.

Strobilii : April - August.

Included after Stewart (*loc. cit.*).

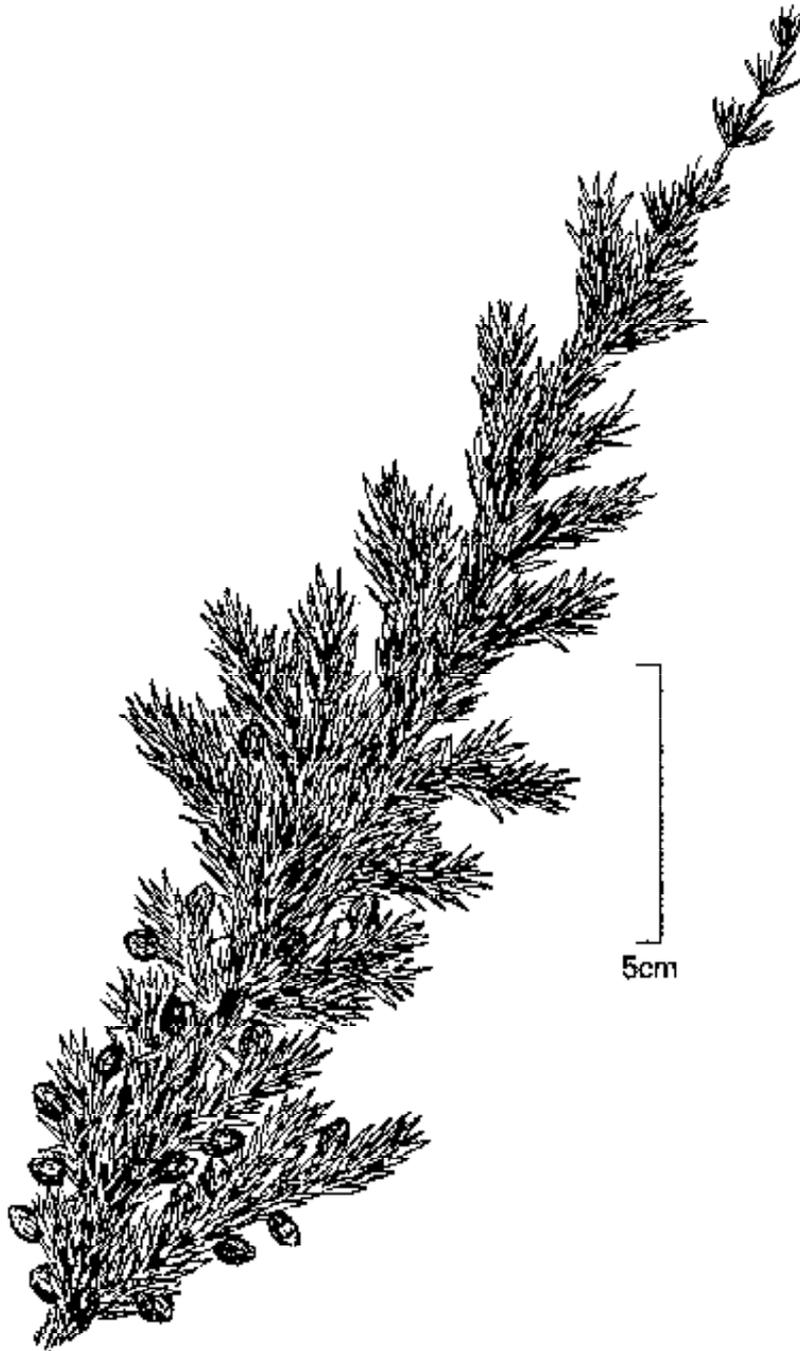


Fig. 47. *Juniperus communis* L.

3. *Juniperus polycarpus* C. Koch in *Linnaea* 22: 303. 1849; Salmi, *Gymnosp. India & Adj. Countr.* 98. 1990. *Juniperus excelsa* M.B., *Fl. Taur. Cauc.* 2: 425. 1828; Stewart in Nasir & Ali, *Annot. Cat. Vasc. Pl. W. Pak. & Kashmir* 27. 1972. *J. macropoda* Boiss., *Fl. Orient.* 5: 709. 1884; Hook.f., *Fl. Brit. India* 6: 647. 1888; Kachroo *et al.*, *Fl. Ladakh* 148. 1977. *Dhup, Pada* (Hindi); *Sukpa*. Fig. 48

Shrubs or evergreen trees, 12-15 m tall; trunk over 1 m in girth. Leaves light green, linear, 8 mm long, appressed, pungent; of the upper branches scale-like. Male cone on a scaly stalk berry like, subglobose, 8-9 mm in diam., resinous. Seeds 2-5.

Strobilii appear : July August; *Mature* : October.

Selected specimens : Kargil, *Bhattacharyya* 41201; Habba Khatun, *Wadhwa, Murti & Pant* 84998 (BSD).

Note : Wood very suitable for furniture, buildings, pencil making and also burnt as incense in monastries.

4. *Juniperus recurva* Buch. Ham. ex D. Don, *Prodr. Fl. Nepal.* 55. 1825; Hook.f., *Fl. Brit. India* 5: 647. 1888. Salmi, *Gymnosp. India & Adj. Countr.* 99. 1990; J.B. Singh & Kachroo, *For. Fl. Pir Panjal* 159. 1994. *Bitru, Itru* (Poonch).

Trees or shrubs with graceful, drooping habit, up to 10 m tall; bark greyish brown, thin, peeling off in fibrous strips; branches pendulous. Leaves awl-shaped, adpressed, 0.15-0.36 cm long, tip horny, sharp. Male and female strobilii on same or on different plants. Male terminal or in axils of leaves; stamens 12-16. Fruits dark purplish brown or black, ovoid, 0.8-1.3 cm in diam. Seeds solitary, ovoid, pitted.

Strobilii appear : April July; *Mature* : September. October.

Selected specimens : Burzil chawk, gilgit Road 4000-2500 m, *Stewart* 19760 (DD); Jhelum valley, 3500 m, *Keshavanand* 199 (DD); Pissu ghati 3500 m, *Vaid s.n.* (DD).

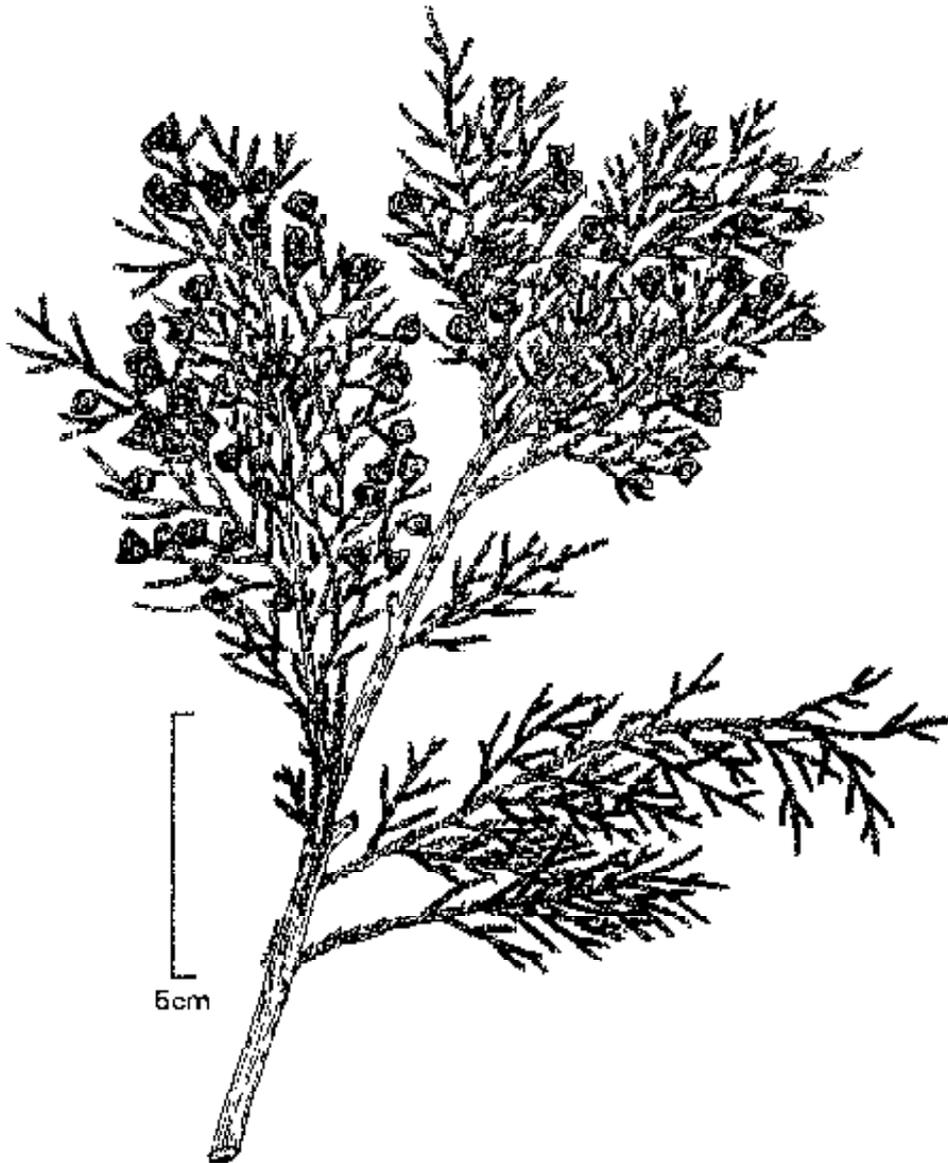


Fig. 48. *Juniperus polycarpus* C. Koch

Uses : Wood used as firewood. Young shoots are sometimes used to add flavour to dishes (Kirm *et al.*, 1999).

5. *Juniperus squamata* Buch.-Ham. ex D. Don in Lambert, Descr. Gen. Pinus 2: 17. 1824; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 27. 1972; Sahni, Gymnosp. India & Adj. Countr. 101. 1990. *J. recurva* var. *squamata* Parl. in DC., Prodr. 16: 481; Hook.f., Fl. Brit. India 5: 647. 1888.

Bush. Stem decumbent; young shoots grooved. Leaves in whorls of 3, awl-shaped, tapering to a short point, whitish and concave on the upper surface, convex on the lower surface, furrowed. Fruits ellipsoid, black when mature. Seed solitary, ovoid, ridged, with 3-4 depressions.

Strobili appear : May June; *Mature* : June September.

Included after Stewart (*loc. cit.*).

6. *Juniperus turkestanica* Komarov. in Not. Syst. Herb. Hort. Bot. Reip. Rose 5: 26. 1924; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 27. 1972; Sahni, Gymnosp. India & Adj. Countr. 103. 1990.

Shrubs or trees; branches erect or spreading. Leaves ca 0.1 cm long, scale like with strongly impressed glands. Fruits blackish, succulent, shining. Seeds oblong or spatulate, 0.6 x 0.4 cm, grooved.

Cones appear and mature : April September.

Included after Sahni (*loc. cit.*).

TAXACEAE

TAXUS Tour.

Taxus wallichiana Zucc. in Abhandl. Bayer. Acad. Classe Math. Phys. 3: 805. t. 5. 1843; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 27. 1972; G. Singh & Kachroo, For. Fl. Srinagar 230.

1976. *Taxus baccata* L. subsp. *wallichiana* (Zucc.) Pilger in Engler, Pflanzenr. (4-5). 18: 112. 1903; Sahni, Gymnosp. India & Adj. Countr. 39. 1990. *T. baccata* L., Sp. Pl. 1040. 1753; Hook.f., Fl. Brit. India 5: 648. 1888. *Birmi*, *Postil*, *Postul*, (Kashmiri).

Graceful trees, up to 6 m tall. Leaves 2-4 cm long, linear, more or less spreading, 2-ranked. Male strobilii stalked, with sporophylls borne terminally in subglobose heads, surrounded by scales at base. Female strobilii solitary; ovules surrounded at base by a cup shaped disk; disk red. Seeds olive green, ca 8 mm long.

Strobilii appear : May; *Mature* : November.

Selected specimens : Babrishi 2600 m, T.A. Rao 421; Kistwar/Nagin lake, 1800-3850 m, T.A. Rao 7831 (BSD); Banihal 3500-4000, Keshavanand 116 (DD).

Note : Bark used as a substitute of tea. Wood used for making ploughs and axils of carts. Chemical extracted from leaves known as *Taxol* is used in treatment of ovarian and breast cancer.

PINACEAE

- 1a. Cones pendulous, woody, persistent :
 - 2a. Leaves acicular, in bundles ...4. *Pinus*
 - 2b. Leaves neither acicular, nor in bundles ...3. *Picea*
- 1b. Cones erect; scales shedding off upon tree leaving central axis :
 - 3a. Leaves distichous ...1. *Abies*
 - 3b. Leaves in tufts ...2. *Cedrus*

1. ABIES Miller

- 1a. Crown narrowly cylindrical; branchlets glabrous, Female cones 10-18 cm long ...1. *A. pindrow*
- 1b. Crown some what pyramidal; young branchlets hairy in the grooves. Female cones ca 7 cm long ...2. *A. spectabilis*

1. **Abies pindrow** Royle, *Illus. t.* 86. f. a-c. 1836 *et* 350. 1839; Stewart in Nasir & Ali, *Annot. Cat. Vasc. Pl. W. Pak. & Kashmir* 25. 1972; G. Singh & Kachroo, *For. Fl. Srinagar* 230. 1976; Sahni, *Gymnosp. India & Adj. Countr.* 78. 1990. *Badar, Drewar* (Kashmiri); *Budul*.

Lofty, evergreen trees; crown narrowly cylindrical; branches short; branchlets glabrous. Leaves 2.5-6.2 cm long two ranked, notched at the tip, undersurface with 2 silvery bands on either side of the midrib. Male catkins in clusters. Female strobili in cones; cones dark purple, 10-15 cm long, erect winged; scales fan shaped. Seeds two, winged.

Cones appear : April; *Mature* : September.

Selected specimens : Gulmarg. Rao 166; Thajwas T.A. Rao 9542 (BSD); Gokaldara 3500 m, Jhelum valley Keshavanand 1213 (DD).

Uses : Wood used for planking, ceiling and for making packing cases. (Kirm *et al.*, 1999).

2. **Abies spectabilis** (D. Don) Mirb. in *Mem. Mus. Hist. Nat. Paris* 13: 70. 1825; Sahni, *Gymnosp. India & Adj. Countr.* 78. 1990. *Pinus spectabilis* D. Don in Lamb., *Deser. Gen. Pinus* 2. 3: 2. 1824. *Abies webbiana* (Wallich) Lindl., *Penny Cyclop.* 7. 1833; Hook.f., *Fl. Brit. India* 5: 654. 1888. *Panchali, Tung* (Poonch). **Fig. 49**

Trees with a wider crown; young shoots grooved, hairy in the grooves. Leaves up to 2.5 cm long, flattened, notched at the tip, dark green above, with two conspicuous white bands of stomata beneath. Female cones dark purple, erect; scales fan shaped, suddenly contracted to a short claw. Seeds winged.

Cones appear : April; *Mature* : September.

Included after Sahni (*loc. cit.*).

2. CEDRUS *Trev. nom. cons.*

Cedrus deodara (Roxb. ex D. Don) G. Don in Loud., *Arb. Brit.* 388. 1830; Stewart in Nasir & Ali, *Annot. Cat. Vasc. Pl. W. Pak. & Kashmir* 25. 1972; Sahni, *Gymnosp. India & Adj. Countr.* 86. 1990; J.B. Singh & Kachroo, *For. Fl. Pir Panjal* 158. 1994. *Pinus deodara* Roxb.,

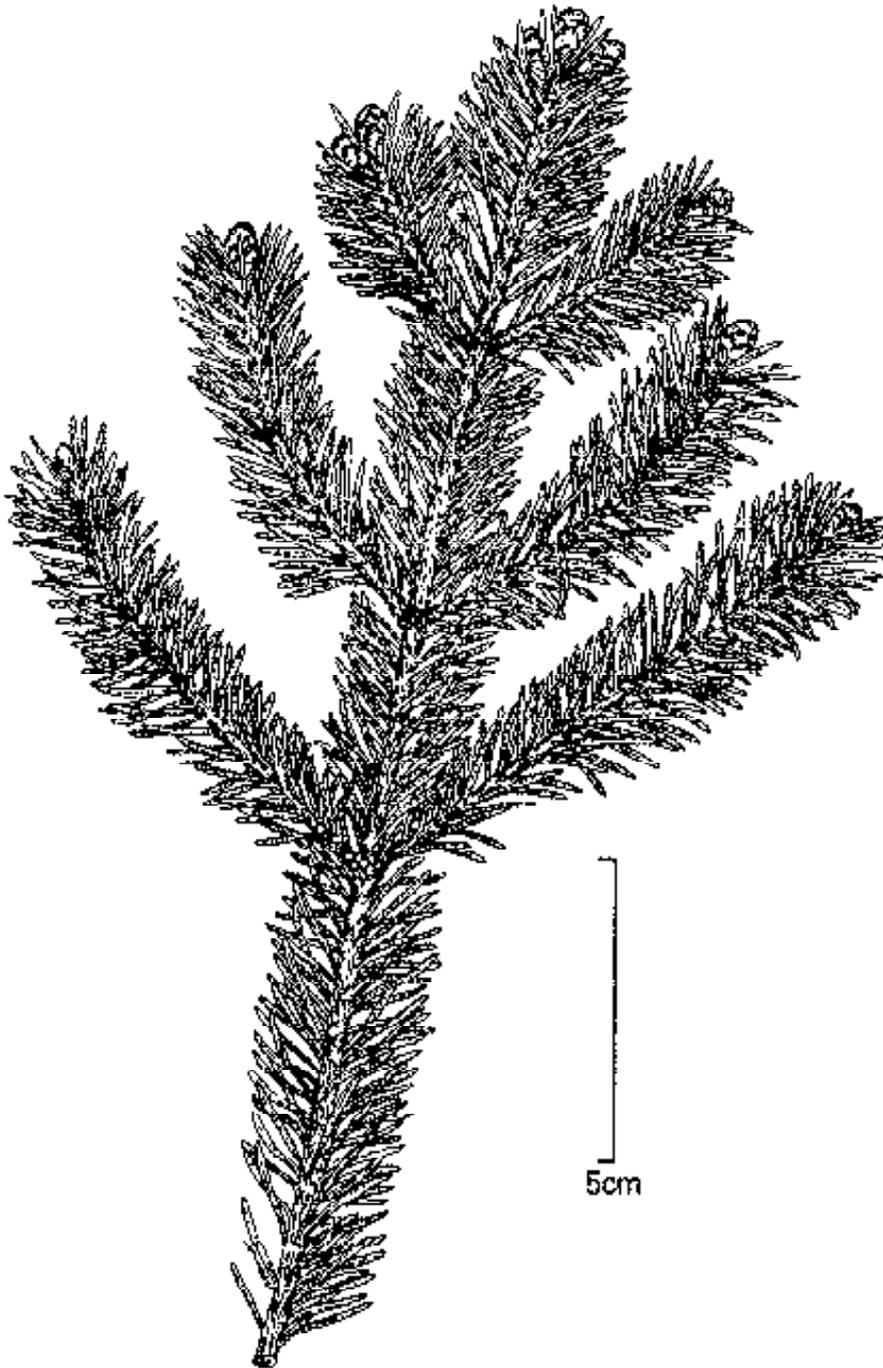


Fig. 49. *Abies spectabilis* (D. Don) Mirb.

ex D. Don in Lamb. Descr. Gen. Pinus 2: 8. 1824. *Cedrus libani* Rich. var. *deodara* Hook.f. in Himal. J. 1: 257., et Fl. Brit. India 5: 653. 1888. *Deodar, Deari* (Hindi).

Evergreen, monoecious trees, up to 80 m tall; branches pendulous; bark almost black, rough; old stem furrowed. Leaves dark green, 2.5-3.5 cm long, needle like, in tufts of 15-20, sheaths short. Male catkins solitary at the ends of branchlets, cylindrical; stamens with 2 pollen sacs. Female cones erect, barrel shaped, solitary at the end of branches; scales fan shaped. Seeds triangular, with a single wing.

Cones appear : June August September; *Mature* : after 1 year.

Selected specimens : Mashadi, Hajra 82511 (BSD); Udampur, Patni top, Swami 938 (BSD). Gulmarg 3500 m, *Gummie s.n.*; Hamchipura, Shopyan, Sher Singh 39288 (DD); Jammu-Srinagar Road 2000 m, *Tikka Kukkonem* 7047 (DD).

Uses : Oil extracted from heartwood is used in piles, ulcers, skin disorders and rheumatic pains. Decoction of bark is used in fever and dysentery (Kirn *et al.* 1999).

3. PICEA Dietr.

Picea smithiana (Wallich) Boiss., Fl. Orient. 5: 700. 1884; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 25. 1972; G. Singh & Kachroo, For. Fl. Srinagar 230. 1976; Sahni, Gymnosp. India & Adj. Countr. 71. 1990. *Pinus smithiana* Wallich, Cat. 6063. 1827 et Pl., Asiat. Rar. 3: 24, t. 246. 1832. *Picea morinda* Link in Linnaea 15: 522. 1841; Hook.f., Fl. Brit. India 5: 653. 1888. Fig. 50

Evergreen trees, pyramidal; branches pendulous, whorled, hanging like tassels. Needles spirally arranged, 2.5-3.8 cm long, dark green, quadrangular in cross section, with 2 lines of stomata on all sides. Male catkins solitary, erect. Female cones solitary, dark brown, 10-17 x 2.5-5 cm, pendulous, cigar shaped. Seeds black; wing light brown, spoon shaped.

Cones appear : July August *Mature* : after 2 years.

Selected specimens : Trumbo, Wadhwa & Murti 48657 (BSD); Gulmarg, *Bhattacharyya* 71172 (BSD); Bhadarwah Vohra & Naithani 82832 (BSD); Pahalgam T.A. Rao 63660 (BSD); Kachkora 1850-2150

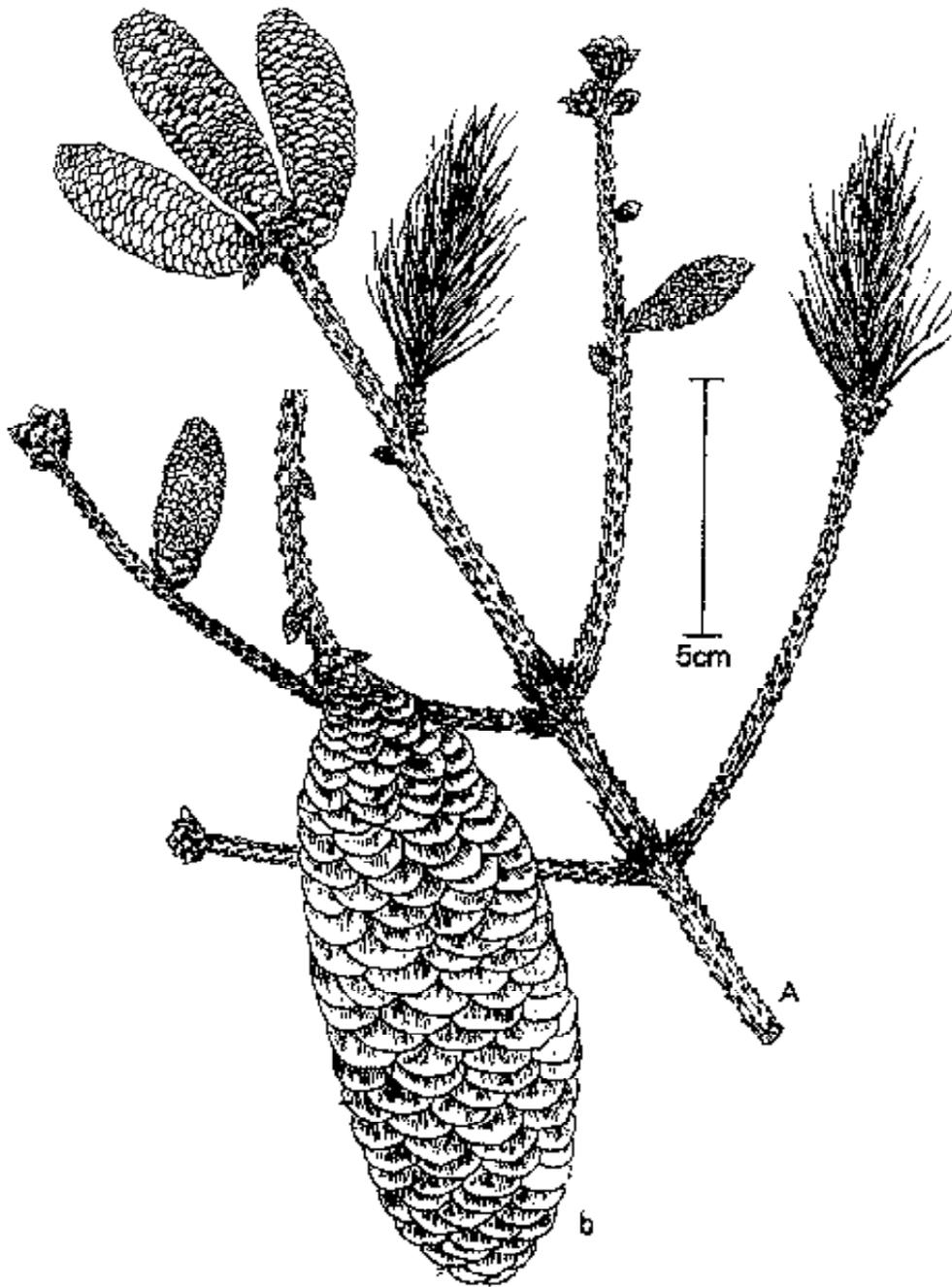


Fig. 50. *Picea smithiana* (Wallich) Boiss.

m (Pir Panjal), Kashmir, *Ganmie s.n.* (DD); Jhelum valley 3000-3500 m, *Kohli s.n.* (DD).

Uses : In construction of houses, Oleoresin is applied on cracks of heels. Bark is used for thatching (Kirn *et al.*, 1999).

4. PINUS L.

- 1a. Leaves in fascicles of 5 ...3. *P. wallichiana*
 1b. Leaves in fascicles of 3 :
 2a. Leaves stiff, less than 15.5 cm long. Seeds
 ca 2.5 cm long ...1. *P. gerardiana*
 2b. Leaves soft, more than 15.5 cm long, seeds
 up to 1 cm long ...2. *P. roxburghii*

1. *Pinus gerardiana* Wallich ex Lamb., Descr. Genus Pinus 2. 115. t. 79. 1832; Hook.f., Fl. Brit. India 5: 652. 1888; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 25. 1972; Sahni, Gymnosp. India 65. 1990. *Chilgoza* (Hindi).

Trees, up to 20 m tall, with stout trunk; branches horizontal or decurved, tips ascending; bark smooth, silvery. Leaves in fascicles of 3, dark green, less than 15.5 cm long, serrulate. Cones 12-18 x 8.5-12 cm, glaucous; scales woody with a recurved beak. Seeds ca 2.5 cm long, cylindric oily, with a short caducous wing.

Cones appear : May - October *Mature* : September (2 years)

Selected specimens : Astor, valley 3000-3500 m, *Duthie* 12242 (DD).
 Rare.

Note : Seeds edible.

2. *Pinus roxburghii* Sargent, Silva N. America 2: 9. 1897; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 26. 1972; Sahni, Gymnosp. India & Adj. Countr. 66. 1990. *P. longifolia* Roxb., Fl. Ind. 3: 651. 1832; Hook.f., Fl. Brit. India 5: 652. 1888.

Trees, up to 30 m tall; branches whorled; crown elongated to pyramidal, umbrella shaped afterwards. Leaves in bundles of 3, bright green, 20-33 cm long, covered with sheath at base. Strobilii dioecious. Male catkins

ca 1.3 cm long. Female cones solitary or 2-5 together, 10.2-20 x 7.5-13 cm; scales pyramid shaped, thick, woody; beak pointed or curved. Seeds with long, thin, membranous wing.

Cones appear : April May *Mature*: September October.

Selected specimens : Painthal, Hajra 82343 (BSD).

Uses : Wood used in construction of houses. Seeds are eaten after boiling. Resin is applied on cracks of heels (Kirn *et al.*, 1999).

3. *Pinus wallichiana* A.B. Jackson in Kew Bull. 85. 1938; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 26. 1972; G. Singh & Kirn in Fl. Jammu 1: 373. 1981; Sahni, Gymnosp. India & Adj. Countr. 58. 1990; J.B. Singh & Kachroo, For. Fl. Pir Panjal 158. 1994. *P. excelsa* Wallich ex D. Don in Lamb., Descr. Gen. Pinus 2: 5. 51. 1824, non Lam. 1778; Hook.f., Fl. Brit. India 5: 651. 188. *P. griffithii* Mc Clelland in Griff., Notul. 4: 17. 1854. (*nom illeg.*), *Kail* (Kashmiri); *Kayur*. **Fig. 51**

Trees, up to 50 m tall; bark smooth, slate coloured when young, rough with shallow fissures when old. Leaves in fascicles of 5, bluish or greyish green. 11-18 cm long, slightly bent. Male strobilii ca 0.6 cm long. Female strobilii at the ends of shoots, usually 2-3 together. Ripe cones 15-30 cm long, cylindrical; scales thin with obtuse tips. Seeds 6-10 mm long; wing 1.5-3 cm long, obliquely truncate.

Cones appear : March April; *Mature* : August September.

Selected specimens : Sauziea, Naithani 78373 (BSD); Panzgam, Rao 63573 (BSD); Dagwan, Wadhwa 67006 (BSD); Pahalgam, A.S. Rao 63663 (BSD); Gulmarg, T.A. Rao 146 (BSD); Patnitop-Kud, Swami 891 (BSD); Jai Road, Bhadarwah, Uniyal 80184 (BSD).

Note : Timber used for Planking furniture. Resin yields better quality of turpentine oil.

Apart from these species, *Araucaria cunninghamii* Sweet, *Cupressus arizonica* Green var. *bonita* Lem, *Cupressus torulosa* D. Don, *Ginkgo biloba* L., *Sequoiadendron giganteum* (Lindl.) Buchholz, *Thuja orientalis* L. are also cultivated in gardens and along road sides in different parts of the state.

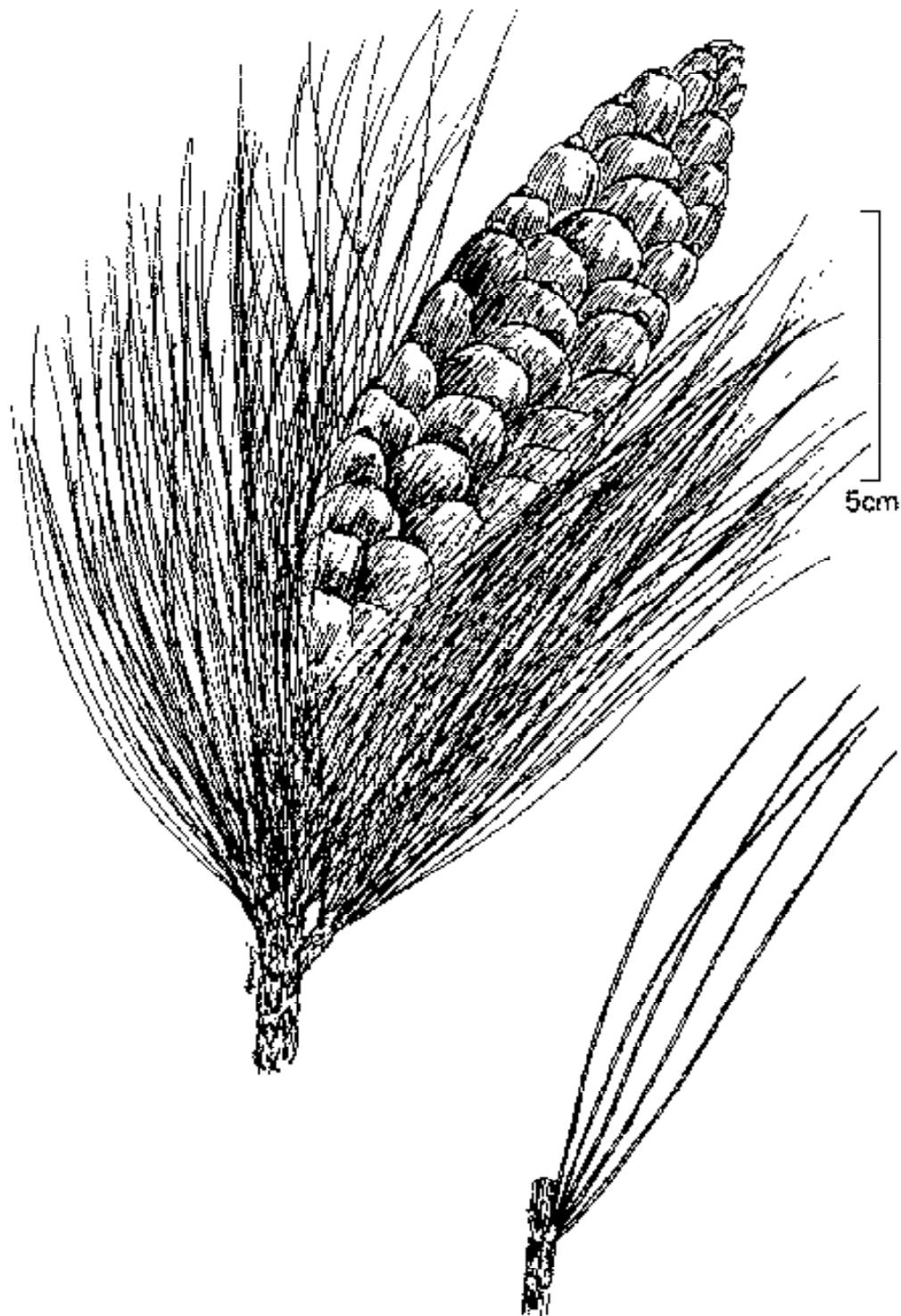


Fig. 51. *Pinus wallichiana* A.B. Jackson

ANGIOSPERMS

KEY TO THE FAMILIES

(B.P Uniyal)

- 1a. Leaves reticulately veined, rarely parallel veined.
Embryo with 2 cotyledons :
- 2a. Parasites :
- 3a. Root parasites :
- 4a. Fleshy herbs **Balanophoraceae**
- 4b. Non fleshy herbs :
- 5a. Flowers regular **Monotropaceae**
- 5b. Flowers irregular **Orobanchaceae**
- 3b. Stem parasites :
- 6a. Leafy shrubs :
- 7a. Flowers unisexual **Viscaceae**
- 7b. Flowers bisexual **Loranthaceae**
- 6b. Leafless twiners :
- 8a. Stamens 5 or 4 **Cuscutaceae**
- 8b. Perfect stamens 9 **Lauraceae (Cassytha)**
- 2b. Non parasitic plants :
- 9a. Plants climbers, twiners or scandent :
- 10a. Petals united :
- 11a. Plants with milky latex :
- 12a. Corona absent **Apocynaceae**
- 12b. Corona present :
- 13a. Anthers connate into
a column **Asclepiadaceae**
- 13b. Anthers free **Periplocaceae**
- 11b. Plants without milky latex :
- 14a. Calyx deeply 5-lobed **Convolvulaceae**
- 14b. Calyx tubular, 5-lobed
at tip **Gentianaceae**

- 10b. Petals free or absent or perianth represented
by a single whorl :
- 15a. Perianth of single whorl :
- 16a. Stipules ocreate present **Polygonaceae**
- 16b. Stipules not ocreate :
- 17a. Perianth coloured, tube inflated
at base **Aristolochiaceae**
- 17b. Perianth not as above :
- 18a. Flowers bisexual **Basellaceae**
- 18b. Flowers dioecious **Cannabaceae** (*Humulus*)
- 15b. Perianth of sepals and petals :
- 19a. Flowers with corona **Passifloraceae**
- 19b. Corona absent :
- 20a. Fruit a pod :
- 21a. Corolla papilionaceous **Papilionaceae**
- 21b. Corolla not papilionaceous **Caesalpiniaceae**
- 20b. Fruit other than a pod :
- 22a. Plants tendrillar :
- 23a. Flowers unisexual **Cucurbitaceae**
- 23b. Flowers hermaphrodite
or polygamous :
- 24a. Fruit a berry **Vitaceae**
- 24b. Fruit a capsule or drupe
or samaroid :
- 25a. Fruit a capsule,
inflated **Sapindaceae**
- 25b. Fruit a drupe
or samaroid **Rhamnaceae**
- 22b. Plants not tendrillar :
- 26a. Leaves digitate **Lardizabalaceae**
- 26b. Leaves not digitate :
- 27a. Flowers minute or
very small :
- 28a. Petals with
transparent lines **Sabiaceae**

- 28b. Petals not as above. Flowers dioecious **Menispermaceae**
- 27b. Flowers quite prominent :
- 29a. Ovary inferior. Flowers polygamo-dioecious **Combretaceae**
- 29b. Ovary superior. Flowers hermaphrodite or polygamous :
- 30a. Stamens 10 **Malpighiaceae**
- 30b. Stamens 3-5 or 2 **Celastraceae**
- 9b. Plants other than climbers/twiners :
- 31a. Aquatics :
- 32a. Plants with small bladders **Lentibulariaceae**
- 33b. Plants devoid of bladders :
- 33a. Corolla of combined petals :
- 34a. Ovary inferior or adnate to calyx **Asteraceae**
- 34b. Ovary superior or free
- 35a. Flowers regular :
- 36a. Ovary 1 celled **Menyanthaceae**
- 36b. Ovary 2 celled **Convolvulaceae**
- 35b. Flowers irregular :
- 37a. Bracts conspicuous. Stems usually with swollen joints **Acanthaceae**
- 37b. Bracts minute or absent. Stem joints not swollen **Scrophulariaceae**
- 33b. Corolla of distinct petals or petals absent :
- 38a. Leaves whorled, dissected into capillary segments or entire or pinnately divided :
- 39a. Leaves dichotomously divided. Petals absent **Ceratophyllaceae**
- 39b. Leaves entire or pinnately divided :
- 40a. Flowers in terminal spikes **Haloragidaceae**

- 40b. Flowers arranged otherwise **Hippuridaceae**
- 38b. Leaves not in whorls
- 41a. Leaves all dissected into capillary segments **Ranunculaceae**
- 41b. Leaves not as above or dimorphic :
- 42a. Leaves often peltate. Calyx of distinct sepals:
- 43a. Carpels irregularly scattered, sunk in pits of the turbinate disc; ovules 1-2; seeds without albumen **Nelumbonaceae**
- 43b. Carpels confluent with one another or with the disc into one ovary; ovules many; seeds albuminous **Nymphaeaceae**
- 42b. Leaves not peltate. Sepals combined :
- 44a. Leaves dimorphic. Fruits spiny **Trapaceae**
- 44b. Leaves of one kind. Fruits not spiny :
- 45a. Ovary superior or so **Lythraceae**
- 45b. Ovary inferior :
- 46a. Stamen 1 **Callitrichaceae**
- 46b. Stamens more than 1 :
- 47a. Flowers in umbels **Apiaceae**
- 47b. Flowers not as above **Onagraceae**
- 31b. Terrestrial or marsh plants :
- 48a. Petals present :
- 49a. Leaves gland dotted **Rutaceae**
- 49b. Leaves not gland dotted :
- 50a. Petals 2 **Resedaceae**
- 50b. Petals more than 2 :
- 51a. Gynoecium composed of 2 or more separate or nearly quite separate carpels :

- 52a. Leaves opposite or verticillate, never all radical :
- 53a. Stamens 15 or more :
- 54a. Leaves stipulate **Rosaceae**
- 54b. Leaves not stipulate :
- 55a. Shrubs or woody climbers **Ranunculaceae**
- 55b. Herbs, succulent or not :
- 56a. Leaves often fleshy and connate
at base. Flowers usually 5-merous
Crassulaceae
- 56b. Leaves not fleshy. Sepals 3.
Petals 6 **Papaveraceae**
- 53b. Stamens up to 15 :
- 57a. Succulent herbs **Crassulaceae**
- 57b. Non succulent shrubs, or trees **Coriariaceae**
- 52b. Leaves alternate or all radical :
- 58a. Leaves stipulate, sometimes stipules minute :
- 59a. Stamens more or less united into a column **Sterculiaceae**
- 59b. Stamens free from one another or nearly so :
- 60a. Herbs, usually scapigerous. Leaves
usually radical **Saxifragaceae**
- 60b. Herbs, shrubs or trees. Leaves cauline **Rosaceae**
- 58b. Leaves without stipules :
- 61a. Stamens more than double the number
of petals or numerous:
- 62a. Herbs :
- 63a. Sepals 3. Petals 6 **Papaveraceae**
- 63b. Sepals and petals usually 5 each :
- 64a. Disk present. Stamens centrifugal.
Seeds arillate **Paeoniaceae**
- 64b. Disk absent. Stamens centripetal.
Seeds not arillate **Ranunculaceae**
- 62b. Shrubs or trees :
- 65a. Petals and stamens perigynous **Rosaceae**
- 65b. Petals and stamens hypogynous **Annonaceae**
- 61b. Stamens 12 or fewer or double the number
of petals when more than 6 :

- 66a. Leaves compound :
- 67a. Herbs. Seeds with copious endosperm **Ranunculaceae**
- 67b. Herbs. Shrubs or trees. Seeds usually non
endospermous :
- 68a. A wood with resin ducts **Anacardiaceae**
- 68b. Wood without resin ducts **Rosaceae**
- 66b. Leaves simple
- 69a. Flowers unisexual **Menispermaceae**
- 69b. Flowers bisexual :
- 70a. Shrubs or trees. Seeds usually
arillate **Anacardiaceae**
- 70b. Herbs. Seeds not arillate :
- 71a. Torus elongated, Carpels usually
numerous **Ranunculaceae**
- 71b. Torus flat or concave. Carpels few :
- 72a. Carpels as many as petals **Crassulaceae**
- 72b. Carpels fewer than the
petals **Saxifragaceae**
- 51b. Gynoecium composed of 1 carpel or of 2 or more
united carpels, if carpels free below than the styles
or stigma united :
- 73a. Ovules attached to the wall or walls of the ovary
- 74a. Ovary superior :
- 75a. Petals free :
- 76a. Leaves opposite :
- 77a. Stamens in 3 or more separate
bundles. Leaves often gland
dotted **Hypericaceae**
- 77b. Stamens free, if united then not
in more than two bundles. Leaves
not or rarely glandular :
- 78a. Stamens monadelphous or diadelphous.
Flowers zygomorphic **Papilionaceae**
- 78b. Stamens. Flowers actinomorphic :
- 79a. Succulents. Carpels as many as petals **Crassulaceae**

- 79b. Non succulent herbs or shrubs. Carpels fewer than the petals :
 - 80a. Styles united **Lythraceae**
 - 80b. Styles not as above :
 - 81a. Indumentum stellate **Philadelphaceae**
 - 81b. Indumentum not stellate or absent **Hydrangeaceae**
- 76b. Leaves alternate or all radical :
 - 82a. Stamens numerous, more than 12 :
 - 83a. Filaments connate into a tube or column **Mimosaceae**
 - 83b. Filaments connate into separate bundles, free, partially adnate to a gynophore or connate at the base only:
 - 84a. Ovary on a gynophore **Capparaceae**
 - 84b. Ovary sessile or nearly sessile :
 - 85a. Flowers zygomorphic :
 - 86a. Petals and stamens hypogynous **Ranunculaceae**
 - 86b. Petals and stamens perigynous or so:
 - 87a. Upper petal outermost **Papilionaceae**
 - 87b. Upper petal innermost **Caesalpinaceae**
 - 85b. Flowers actinomorphic :
 - 88a. Stipules present, sometimes early deciduous :
 - 89a. Petals and stamens hypogynous **Anacardiaceae**
 - 89b. Petals and stamens perigynous **Rosaceae**
 - 88b. Stipules absent :
 - 90a. Herbs :
 - 91a. Sepals 2. Juice milky **Papaveraceae**
 - 91b. Sepals more than 2. Juice not milky :

- 92a. Leaves ternately compound. Carpel 1 **Ranunculaceae**
- 92b. Leaves pinnatisect. Carpels 2 **Brassicaceae**
- 90b. Shrubs or trees :
- 93a. Leaves compound **Mimosaceae**
- 93b. Leaves simple, scale like **Tamaricaceae**
- 82b. Stamens 12 or fewer
- 94a. Flowers zygomorphic :
- 95a. Stamens 4 or 6, opposite the petals **Fumariaceae**
- 95b. Stamens with at least one row alternate with the petals:
- 96a. Herbs. Connectives often produced **Violaceae**
- 96b. Herbs, shrubs or trees. Connectives not produced
- 97a. Placentas 3. Fertile stamens 5; staminodes 5 **Moringaceae**
- 97b. Placenta 1:
- 98a. Petals 3 **Polygalaceae**
- 98b. Petals more than 3:
- 99a. Upper petal outermost (corolla papilionaceous) **Papilionaceae**
- 99b. Upper petal innermost **Caesalpinaceae**
- 94b. Flowers actinomorphic :
- 100a. Leaves stipulate :
- 101a. Connectives produced **Violaceae**
- 101b. Connectives not produced **Droseraceae**
- 100b. Leaves without stipules :
- 102a. Stamens opposite to petals and equal in number :
- 103a. Leaves usually radical, palmi-nerved or lobed, peltate, not prickly margined **Podophyllaceae**
- 103b. Leaves on stems, simple or pinnate, often with prickly margins **Berberidaceae**

- 102b. Stamens with one row alternate with the petals :
- 104a. Herbs **Parnassiaceae**
- 104b. Shrubs or trees :
- 105a. Leaves simple, sometimes deeply divided :
- 106a. Leaves very small, scale like **Tamaricaceae**
- 106b. Leaves not as above, digitately lobed **Caricaceae**
- 105b. Leaves compound :
- 107a. Flowers in heads or dense spikes. Ovary of 1 carpel. Ovules more than 1 **Mimosaceae**
- 107b. Flowers neither in heads nor in dense spikes. Carpels usually more than 1: ovule solitary **Anacardiaceae**
- 75b. Petals more or less united :
- 108a. Stamens free from the corolla tube :
- 109a. Ovary composed of more than 1 carpel :
- 110a. Stamens numerous, more than twice the number of corolla lobes:
- 110b. Stamens definite in relation to corolla lobes :
- 111a. Stamens 4 **Polygalaceae**
- 111b. Stamens 5-12 :
- 112a. Leaves prominent **Pittosporaceae**
- 112b. Leaves scale like :
- 113a. Flowers axillary, solitary **Droseraceae**
- 113b. Flowers in slender spikes or racemes **Tamaricaceae**
- 109b. Ovary composed of a single carpel :
- 114a. Stamens connate into a column. Flowers dioecious **Menispermaceae**
- 114b. Stamens connate into a sheath or free. Flowers usually bisexual :

- 115a. Flowers actinomorphic. **Mimosaceae**
- 115b. Flowers zygomorphic **Papilionaceae**
- 108b. Stamens inserted on the corolla tube :
- 116a. Stamens twice the number of corolla lobes :
- 117a. Flowers zygomorphic **Polygalaceae**
- 117b. Flowers actinomorphic **Caricaceae**
- 116b. Stamens as many as corolla lobes or fewer :
- 118a. Stamens as many as corolla lobes :
- 119a. Leaves opposite :
- 120a. Carpels 2, free. Corona usually present. Pollen agglutinated into masses **Asclepiadaceae**
- 120b. Carpels 2, connate. Pollen not as above :
- 121a. Stamens 5 or more **Gentianaceae**
- 121b. Stamens 4:
122. Ovules numerous **Bignoniaceae**
- 122b. Ovules 1-2 in each locule **Verbenaceae**
- 119b. Leaves alternate or radical **Menyanthaceae**
- 118b. Stamens fewer than corolla lobes, 4 or 2 :
- 123a. Ovules 1-2 on each placenta **Verbenaceae**
- 123b. Ovules numerous on each placenta :
- 124a. Trees **Bignoniaceae**
- 124b. Herbs **Pedaliaceae**
- 74b. Ovary inferior or semi inferior

- 125a. Fleshy plants. Leaves usually reduced **Cactaceae**
- 125b. Plants not as above :
- 126a. Petals free :
- 127a. Flowers unisexual :
- 128a. Shrubs, often armed **Grossulariaceae**
- 128b. Herbs, unarmed :
- 129a. Leaves stipulate **Begoniaceae**
- 129b. Leaves exstipulate **Datisicaceae**
- 127b. Flowers bisexual :
- 130a. Ovary loculi superposed in two series. Leaves opposite or subopposite **Punicaceae**
- 130b. Ovary locule not superposed :
- 131a. Shrubs or trees :
- 132a. Leaves mostly stipulate **Grossulariaceae**
- 132b. Leaves not stipulate **Hydrangeaceae**
- 131b. Usually herbs :
- 133a. Sepals and petals imbricate **Philadelphaceae**
- 133b. Sepals valvate. Petals contorted **Onagraceae**
- 126b. Petals more or less united :
- 134a. Stamens numerous **Myrtaceae**
- 134b. Stamens usually definite **Rubiaceae**
- 73b. Ovules attached to the central axis or to the base or apex of the ovary :
- 135a. Ovary superior :
- 136a. Petals free :
- 137a. Leaves scale like **Tamaricaceae**
- 137b. Leaves well developed :
- 138a. Perfect stamens as many as petals and opposite to them :
- 139a. Leaves pellucid punctate **Myrsinaceae**
- 139b. Leaves not pellucid punctate :

- 140a. Calyx lobes or sepals imbricate :
- 141a. Ovary 1-3 locular; ovule, solitary, horizontal
or pendulous from near the top **Sabiaceae**
- 141b. Ovary 1-locular; ovules 1 or more in the
ovary basal :
- 142a. Petals often biglandular towards base.
Anthers opening by valves **Berberidaceae**
- 142b. Petals not glandular at the base. Anthers
opening by longitudinal slits **Primulaceae**
- 140b. Calyx lobes valvate :
- 141a. Disk present **Rhamnaceae**
- 141b. Disk absent :
- 144a. Herbs. Leaves in rosettes. Flowers
in scapose inflorescence **Plumbaginaceae**
- 144b. Shrubs or trees, rarely herbs. Flowers
not on scapes :
- 145a. Leaves exstipulate. Stamens
perigynous **Lythraceae**
- 145b. Leaves stipulate. Stamens
hypogynous **Sterculiaceae**
- 138b. Perfect stamens as many as petals and alternate to
them, or more, rarely fewer :
- 146a. Stamens 6, tetradynamous **Brassicaceae**
- 146b. Stamens not tetradynamous :
- 147a. Style basal :
- 148a. Leaves simple. Stamens numerous **Rosaceae**
- 148b. Leaves pinnate. Stamens 10 **Simaroubaceae**
- 147b. Style terminal or subterminal, sometimes
gynobasic:
- 149a. Flowers clearly zygomorphic :
- 150a. Stamens more than 12 :
- 151a. Petals and stamens
hypogynous **Tamaricaceae**
- 151b. Petals and stamens
epigynous or perigynous
Rosaceae

- 150b. Stamens 12 or less :
- 152a. Lower sepal elongated into a spur **Balsaminaceae**
- 152b. Lower sepal not elongated into a spur
or subsaccate :
- 153a. Inner 2 sepals often petaloid, larger.
Anthers often opening by an
apical pore **Polygalaceae**
- 153b. Sepals not as above. Anthers opening
by longitudinal slits **Saxifragaceae**
- 149b. Flowers actinomorphic or slightly zygomorphic :
- 154a. Stamens usually united into more than one
bundles :
- 155a. Leaves opposite, exstipulate **Hypericaceae**
- 155b. Leaves alternate or radical, if opposite
then stipulate **Tiliaceae**
- 154b. Stamens free or at least not united into several
bundles, sometimes united at the base or
monadelphous :
- 156a. Leaves opposite or verticillate, rarely
fascicled, never all radical or reduced :
- 157a. Leaves compound, rarely 1-foliolate with
distinctly tumid petiole, rarely sessile :
- 158a. Leaves gland dotted **Rutaceae**
- 158b. Leaves not gland dotted :
- 159a. Leaves stipulate :
- 160a. Ovules 2 or more in
each locule **Zygophyllaceae**
- 160b. Ovule solitary in
each locule **Staphyleaceae**
- 159b. Leaves exstipulate :
161. Filaments usually
connate **Meliaceae**
- 161b. Filaments usually free :
- 162a. Stamens fewer
than the petals
Oleaceae

- 162b. Stamens as many as or twice the number or more than the petals **Aceraceae**
- 157b. Leaves simple but occasionally deeply or variously divided :
- 163a. Ovary on a gynophore or distinctly stipitate :
- 164a. Leaves gland dotted **Rutaceae**
- 164b. Leaves not gland dotted :
- 165a. Ovules on the walls or on the intrusive septa **Capparaceae**
- 165b. Ovules on the central axis or from the base of ovary **Caryophyllaceae**
- 163b. Ovary sessile or rarely slightly stipitate :
- 166a. Stamens more than twice as many as the petals :
- 167a. Calyx imbricate or calyptrate **Papaveraceae**
- 167b. Calyx valvate :
- 168a. Stamens monadelphous or in fascicles opposite the petals **Sterculiaceae**
- 168b. Stamens free or shortly connate at base :
- 169a. Stamens inflexed in bud **Lythraceae**
- 169b. Stamens not inflexed in bud :
- 170a. Stipules paired, not interpetiolar **Tiliaceae**
- 170b. Stipule single, interpetiolar **Philadelphaceae**
- 224b. Stamens not more than twice as many as the petals :
- 171a. Shrubs or trees :
- 172a. Leaves stipulate; occasionally stipules rudimentary or of hairs :

- 173a. Disk absent or inconspicuous. Sepals usually
with a pair of glands outside **Malpighiaceae**
- 173b. Disk conspicuous. Calyx not glandular **Celastraceae**
- 172b. Leaves exstipulate, if stipulate then stipules
gland like :
- 174a. Stamens united into a tube **Meliaceae**
- 174b. Stamens free or united at base only :
- 175a. Ovules numerous in each locule **Pittosporaceae**
- 175b. Ovules few in each locule :
- 176a. Sepals with 2 glands outside
Malpighiaceae
- 176b. Sepals not glandular :
- 177a. Ovules pendulous from apex
of locules or axile :
- 178a. Sepals connate into a
long tube **Thymelaeaceae**
- 178b. Sepals free or calyx tube
very short :
- 179a. Sepals imbricate or
open :
- 180a. Stamens hypo-
gynous **Linaceae**
- 180b. Stamens peri-
gynous **Iteaceae**
- 179b. Sepals valvate
Combretaceae
- 177b. Ovules erect or ascending :
- 181a. Calyx imbricate **Aceraceae**
- 181b. Calyx valvate :
- 182a. Leaves gland dotted
Rutaceae
- 182b. Leaves not gland
dotted :
- 183a. Sepals free or
nearly so
Anacardiaceae

- 183b. Sepals united into a long tube **Lythraceae**
- 171b. Herbs, occasionally woody at base :
- 184a. Ovary incompletely septate; placentation
free central or basal :
- 184aa. Sepals free or connate, without
accessory lobes **Caryophyllaceae**
- 184ab. Sepals often with accessory lobes,
connate into a long tube **Lythraceae**
- 184b. Ovary completely septate :
- 185a. Leaves stipulate :
- 186a. Stipules paired :
- 187a. Ovules numerous **Elatinaceae**
- 187b. Ovules few :
- 188a. Branches usually
not articulated.
Sepals often unequal
Geraniaceae
- 188b. Branches articulated.
Sepals equal **Zygophyllaceae**
- 186b. Stipules solitary, occasionally
minute **Linaceae**
- 185b. Leaves not stipulate **Lythraceae**
- 156b. Leaves all radical or alternate :
- 189a. Stamens more than twice the number of sepals
and petals :
- 190a. Sepals valvate or open in bud :
- 191a. Anthers 1-locular; stamens
monadelphous :
- 192a. Leaves digitately compound **Bombacaceae**
- 192b. Leaves simple **Malvaceae**
- 191b. Anthers 2-locular :
- 193a. Stamens more or less united
into a tube or into bundles
Sterculiaceae
- 193b. Stamens free or united at
base only :

- 194a. Petals and stamens hypogynous **Tiliaceae**
- 194b. Petals and stamens perigynous or epigynous :
 - 195a. Anthers inflexed in bud **Lythraceae**
 - 195b. Anthers erect in bud **Anacardiaceae**
- 190b. Sepals imbricate or rarely completely connate
or calyptrate or cupular :
 - 196a. Petals and stamens perigynous :
 - 197a. Leaves stipulate **Rosaceae**
 - 197b. Leaves without stipules :
 - 198a. Stamens epipetalous **Styracaceae**
 - 198b. Stamens not epipetalous **Lythraceae**
 - 196b. Petals and stamens more or less hypogynous
or flowers unisexual:
 - 199a. Shrubs or trees :
 - 200a. Leaves compound or rarely uni-
foliolate, in the latter case petiole
tumid :
 - 201a. Stamens united into a tube **Meliaceae**
 - 201b. Stamens free :
 - 202a. Leaves gland dotted **Rutaceae**
 - 202b. Leaves not or rarely
gland dotted :
 - 203a. Torus elongated in
the fruit below
ovary **Simaroubaceae**
 - 203b. Torus not elongated :
 - 204a. Calyx imbricate
Anacardiaceae
 - 204b. Calyx valvate
Sapindaceae
 - 200b. Leaves simple :
 - 205a. Ovary stipitate **Capparaceae**
 - 205b. Ovary not stipitate **Dipterocarpaceae**
 - 199b. Herbs, rarely woody at base :
 - 206a. Leaves very sticky-glandular
with setose teeth **Droseraceae**

- 206b. Leaves not as above :
- 207a. Stamens connate at the base. Leaves
pinnate **Oxalidaceae**
- 207b. Stamens free **Ranunculaceae**
- 189b. Stamens as many as, twice as many or fewer than
the sepals or petals:
- 208a. Leaves compound, rarely unifoliolate, in the
latter case petiole tumid:
- 209a. Stamens united into a tube **Meliaceae**
- 209b. Stamens free or united at the base only :
- 210a. Leaves stipulate :
- 211a. Plants herbaceous, sometimes
slightly woody:
- 212a. Stamens with a scale at
the base of filaments
Zygophyllaceae
- 212b. Stamens without scale **Oxalidaceae**
- 211b. Shrubs or trees **Sapindaceae**
- 210b. Leaves exstipulate :
- 213b. Stipules intrapetiolar **Melanthaceae**
- 214a. Leaves gland dotted **Rutaceae**
- 214b. Leaves not gland dotted :
- 215a. Ovules pendulous
Simaroubaceae
- 215b. Ovules ascending or
horizontal :
- 216a. Herbs **Oxalidaceae**
- 216b. Shrubs or trees :
- 217a. Ovules about
8 in each
locule
Meliaceae
- 217b. Ovules 1
or more :

- 218a. Leaves palmately compound **Hippocastanaceae**
- 218b. Leaves not palmately compound
- 219a. Calyx imbricate **Anacardiaceae**
- 219b. Calyx valvate **Sapindaceae**
- 208b. Leaves simple, rarely completely reduced :
- 220a. Anthers opening by apical pores :
- 221a. Petals 3 **Polygalaceae**
- 221b. Petals 5 :
- 222a. Stamens 10 **Pyrolaceae**
- 222b. Stamens 5 **Pittosporaceae**
- 220b. Anthers opening by longitudinal slits :
- 223a. Shrubs or trees :
- 224a. Leaves stipulate :
- 225a. Calyx persistent, wing
 like in fruit. Petals
 contorted **Dipterocarpaceae**
- 225b. Calyx and petals not as
 above :
- 226a. Stamens perigynous,
 inserted on the calyx
 tube **Rosaceae**
- 226b. Stamens hypogynous or
 inserted on or at the
 base of disk **Celastraceae**
- 224b. Leaves without stipules or stipules
 inconspicuous :
- 227a. Stamens hypogynous or slightly
 perigynous :
- 228a. Stamens double the
 number of petals
 or fewer by abortion :
- 229a. Ovary unilocular
 Anacardiaceae
- 229b. Ovary 2 or more
 locular :

- 230a. Leaves gland dotted **Rutaceae**
 230b. Leaves not gland dotted **Sapindaceae**
- 228b. Stamens as many as petals or fewer :
- 231a. Disk absent :
- 232a. Ovules numerous **Pittosporaceae**
 232b. Ovules 1-2 in each locule :
- 233a. Petals imbricate or
 contorted, clawed **Linaceae**
 233b. Petals imbricate, not
 clawed **Aquifoliaceae**
- 231b. Disk present :
- 234a. Leaves gland dotted **Rutaceae**
 234b. Leaves not gland dotted :
- 235a. Wood resinous. Ovule
 solitary **Anacardiaceae**
 235b. Wood not resinous.
 Ovules usually 2 in
 each locules **Celastraceae**
- 227b. Stamens distinctly perigynous **Iteaceae**
- 223b. Herbs, sometimes slightly woody at base :
- 236a. Leaves densely covered with sticky gland
 tipped processes **Droseraceae**
 236b. Leaves not as above :
- 237a. Leaves stipulate :
- 238a. Sepals valvate **Tiliaceae**
 238b. Sepals imbricate :
- 239a. Ovary more or less
 deeply lobed **Geraniaceae**
 239b. Ovary entire :
- 237b. Leaves exstipulate :
- 240a. Petals and stamens hypogynous
 or very slightly perigynous **Linaceae**
 240b. Petals and stamens perigynous :
- 241a. Seeds endospermous **Saxifragaceae**
 241b. Seeds without endosperm :

- 242a. Carpels with a gland or scale at the base.
 Anthers erect in bud **Crassulaceae**
- 242b. Carpels without a gland or scale. Anthers;
 inflexed in bud **Lythraceae**
- 136b. Petals more or less united :
- 243a. Stamens the same number as corolla lobes and
 opposite to them :
- 244a. Ovules 2 or more in each locule :
- 245a. Shrubs or trees **Myrsinaceae**
- 245b. Herbs **Primulaceae**
- 244b. Ovules solitary in each locule or in
 the whole ovary :
- 246a. Trees or shrubs :
- 247a. Flowers usually dioecious.
 Stamens mostly free from
 or attached to the base of
 the corolla **Ebenaceae**
- 247b. Flowers bisexual. Stamens
 epipetalous **Sapotaceae**
- 246b. Herbs **Plumbaginaceae**
- 243b. Stamens fewer, equal to or numerous than
 the corolla lobes, alternating with them when
 equal in number :
- 248a. Stamens more than twice as many as
 corolla lobes :
- 249a. Anthers opening by pore or pore
 like slits **Ericaceae**
- 249b. Anthers opening by longitudinal
 slits :
- 250a. Flowers unisexual **Ebenaceae**
- 250b. Flowers bisexual **Myrtaceae**
- 248b. Stamens as many as or upto twice as
 many as or fewer than the corolla lobes :
- 251a. Stamens as many as or more than
 corolla lobes :
- 252a. Flowers zygomorphic :

- 253a. Ovary deeply 4-lobed; style gynobasic **Lamiaceae**
- 253b. Ovary not 4 lobed; style not gynobasic :
- 254a. Lower sepal spurred **Balsaminaceae**
- 254b. Lower sepal not spurred :
- 255a. Ovules numerous :
- 256a. Leaves simple :
- 257a. Corolla lobes induplicate or contorted **Solanaceae**
- 257b. Corolla lobes imbricate or folded **Scrophulariaceae**
- 256b. Leaves compound or 1-foliolate **Bignoniaceae**
- 255b. Ovules few :
- 258a. Anthers 1-locular **Selaginaceae**
- 258b. Anthers 2-locular **Verbenaceae**
- 252b. Flowers actinomorphic :
- 259a. Leaves opposite or verticillate or so :
- 260a. Anthers opening by pores or pore like slits:
- 261a. Herbs. Stamens epipetalous **Gentianaceae**
- 262a. Leaves exstipulate **Myricaceae**
- 262b. Leaves stipulate **Salicaceae**
- 261b. Woody plants. Stamens hypogynous **Ericaceae**
- 260b. Anthers opening by longitudinal slits :
- 263a. Leaves gland dotted or pustulate. Petals usually shortly united :
- 264a. Style terminal **Loganiaceae**
- 264b. Style gynobasic **Boraginaceae**
- 263b. Leaves not gland dotted. Petals united high up:
- 265a. Style single with one stigma :
- 266a. Flowers in dense spikes; corolla scarious **Plantaginaceae**
- 266b. Flowers not in dense spikes; corolla not scarious :

- 267a. Trees or shrubs :
- 268a. Stamens usually 2 **Oleaceae**
- 268b. Stamens 4 or more rarely 1 :
- 269a. Indumentum glandular, stellate or
lepidote **Buddlejaceae**
- 269b. Indumentum not as above **Loganiaceae**
- 267b. Herbs or scramblers :
- 270a. Pollen agglutinated in wax-like masses.
Flower usually with a corona **Asclepiadaceae**
- 270b. Pollen not in wax like masses :
- 271a. Corolla lobes contorted or
rarely valvate **Apocynaceae**
- 271b. Corolla lobes imbricate :
- 272a. Ovules few **Verbenaceae**
- 272b. Ovules numerous **Scrophulariaceae**
- 265b. Styles with more than 1 separate stigmas :
- 273a. Stamens double the number of corolla lobes :
- 274a. Trees or shrubs. Flowers dioecious **Ebenaceae**
- 274b. Mostly herbs. Flowers bisexual **Lythraceae**
- 273b. Stamens as many as corolla lobes :
- 275a. Style gynobasic **Boraginaceae**
- 275b. Style terminal :
- 276a. Trees or shrubs :
- 277a. Ovules numerous in each locule, if
solitary then corolla lobes valvate
Loganiaceae
- 277b. Ovules 2 in each locule. Corolla
lobes imbricate **Verbenaceae**
- 276b. Herbs :
- 278a. Ovary imperfectly locular by
the intrusive parietal placentas
Gentianaceae
- 278b. Ovary perfectly locular with
axile placentas :
- 279a. Ovary 3-5 locular; style
3-5 lobed **Polemoniaceae**

- 279b. Ovary 2-locular; style simple **Solanaceae**
- 259b. Leaves alternate or all radical or reduced :
- 280a. Stamens hypogynous or perigynous, free from the corolla or slightly adnate to its base :
- 281a. Anthers opening by pores :
- 282a. Anthers opening by terminal pores, often with appendages. Embryo with cotyledons **Ericaceae**
- 282b. Anthers opening by pores, without appendages. Embryo without cotyledons **Pyrolaceae**
- 281b. Anthers opening by longitudinal slits :
- 283a. Stamens 4-6 :
- 284a. Leaves gland dotted. Ovary mostly deeply lobed **Rutaceae**
- 284b. Leaves not gland dotted. Ovary mostly entire :
- 285a. Petals slightly united at base only :
- 286a. Ovules numerous in each locule **Pittosporaceae**
- 286b. Ovules 1-2 in each locule **Aquifoliaceae**
- 285b. Petals united high up, rarely free at base :
- 287a. Calyx lobes valvate. Anthers connivent around style **Campanulaceae**
- 287b. Calyx lobes imbricate **Plantaginaceae**
- 283b. Stamens more than 6:
- 288a. Stamens connate into a tube : **Meliaceae**
- 288b. Stamens free or slightly connate at base only :

- 289a. Corolla tubular, long. Disc absent **Ebenaceae**
- 289b. Corolla tube very short. Disc present or absent :
- 290a. Disk present **Simaroubaceae**
- 290b. Disk absent :
- 291a. Ovules few in each locule.
Calyx lobes valvate or open **Styracaceae**
- 291b. Ovules 1-2 in each locule.
Calyx lobes imbricate **Aquifoliaceae**
- 280b. Stamens inserted on the corolla tube or in a column adnate to the stigma :
- 291aa. Style gynobasic :
- 292a. Style 1. Fruit compressed of pyrenes or nutlets **Boraginaceae**
- 292b. Styles 2. Fruit capsular usually **Convolvulaceae**
- 291ab. Style terminal :
- 293a. Corolla valvate or plaited in bud.
- 294a. Ovules 1-4 in each locule **Convolvulaceae**
- 294b. Ovules numerous in each locule :
- 295a. Flowers with a corona **Asclepiadaceae**
- 295b. Flowers without a corona **Solanaceae**
- 293b. Corolla imbricate or contorted in bud :
- 296a. Corolla contorted
- 297a. Ovary mostly 3-locular **Polemoniaceae**
- 297b. Ovary 1-2 locular :
- 298a. Carpels completely united **Hydrophyllaceae**
- 298b. Carpels more or less free :
- 299a. Pollen agglutinated in wax like masses **Asclepiadaceae**
- 299b. Pollen not agglutinated few into wax like masses **Apocynaceae**

- 296b. Corolla imbricate
- 300a. Flowers in dense spikes **Plantaginaceae**
- 300b. Flowers not arranged as above :
- 301a. Herbs :
- 302a. Lower leaves opposite **Gentianaceae**
- 302b. All the leaves alternate **Solanaceae**
- 301b. Trees or shrubs **Ehretiaceae**
- 251a. Stamens fewer than the corolla lobes :
- 303a. Flowers actinomorphic :
- 304a. Corolla scarious **Plantaginaceae**
- 304b. Corolla not scarious :
- 305a. Shrubs. Stamens 2 **Oleaceae**
- 305b. Herbs :
- 306a. Corolla lobes imbricate **Scrophulariaceae**
- 306b. Corolla lobes induplicae or contorted-plicate **Solanaceae**
- 303b. Flowers zygomorphic :
- 307a. Placenta free basal; ovules numerous **Lentibulariaceae**
- 307b. Placenta axile, if subbasal then ovules very few :
- 308a. Ovules numerous in each locule or whole ovary, if 2 then superposed :
- 309a. Anthers mostly free from each other. Ovary 2-locular :
- 310a. Leaves usually simple **Scrophulariaceae**
- 310b. Leaves usually compound **Bignoniaceae**
- 309b. Anthers often connivent in pairs. Ovary 1-4 locular
- 311a. Herbs with vesicular glands. disk mostly in conspicuous **Pedaliaceae**

- 311b. Shrubs. Leaves often with ustolithys.
 Disk cupular or annular **Acanthaceae**
- 308b. Ovule solitary in each locul of the ovary,
 if 2 then collateral :
- 312a. Leave alternate **Selaginaceae**
- 312b. Leaves opposite or verticillate :
- 313a. Style gynobasic **Lamiaceae**
- 313b. Style terminal :
- 314a. Calyx bilabiate, 3 calyx lobes
 hooked **Phrymaceae**
- 314b. Calyx not bilabiate, lobes not
 hooked **Verbenaceae**
- 135b. Ovary inferior or semi inferior :
- 315a. Petals free :
- 316a. Flowers in umbels :
- 317a. Shrubs or tree, fruit usually
 a drupe **Araliaceae**
- 317b. Herbs. Fruit of dry indehiscent
 mericarp **Apliaceae**
- 316b. Flowers not in umbels :
- 318a. Leaves opposite or verticillate, rarely
 reduced to scales :
- 319a. Leaves stipulate :
- 320a. Stamens as many as
 and opposite to petals **Rhamnaceae**
- 320b. Stamens alternate with
 the petals or more or
 fewer than the petals **Rosaceae**
- 319b. Leaves exstipulate :
- 321a. Shrubs or trees :
- 322a. Stamens numerous :
- 323a. Ovary loculi
 superposed **Punicaceae**
- 323b. Ovary loculi not
 superposed :

- 324a. Leaves gland dotted. Style simple,
very rarely 3-4 lobed **Myrtaceae**
- 324b. Leaves with pellucid lines or with
stellate hairs. Styles 5-10 lobed
or styles 2-5, more or less free **Philadelphaceae**
- 322b. Stamens as many as or twice the
number of petals :
- 325a. Ovule solitary **Cornaceae**
- 325b. Ovules more than 1 :
- 326a. Stamens double the number
of petals **Onagraceae**
- 326b. Stamens not as above :
- 327a. Fruits drupaceous,
mostly winged or
angular **Combretaceae**
- 327b. Fruit a capsule or
berry **Hydrangeaceae**
- 321b. Herbs, if woody then leaves fleshy :
- 328a. Flowers in head **Cornaceae**
- 328b. Flowers not in heads **Onagraceae**
- 318b. Leaves all radical or alternate :
- 329a. Flowers unisexual **Begoniaceae**
- 329b. Flowers bisexual :
- 330a. Sepals 2 **Portulacaceae**
- 330b. Sepals more than 2 or obsolete :
- 331a. Stamens numerous :
- 332a. Herbs :
- 333a. Leaves stipulate **Rosaceae**
- 333b. Leaves without stipules
Saxifragaceae
- 332b. Shrubs or trees :
- 334a. Leaves gland dotted **Myrtaceae**
- 334b. Leaves not gland
dotted **Rosaceae**
- 331b. Stamens as many as or about
double the number of sepals
or petals or rarely fewer :

- 335a. Stamens as many as and opposite to petals **Rhamnaceae**
- 335b. Stamens as many as and alternate to petals
or more or fewer :
- 336a. Leaves stipulate **Rosaceae**
- 336b. Leaves without stipules :
- 337a. Herbs :
- 338a. Ovules more than 1 in each
locule :
- 339a. Scapigerous herbs.
Ovary 1-3 locular **Saxifragaceae**
- 339b. Stems leafy. Ovary
usually 4-locular **Onagraceae**
- 338b. Ovule solitary in each locule :
- 340a. Style 1; stigma capitate
or shortly lobed **Onagraceae**
- 340b. Style more than 1; stigma
capitate **Rosaceae**
- 337b. Shrubs or trees :
- 341a. Petals contorted **Onagraceae**
- 341b. Petals imbricate or valvate :
- 342a. Petals loriform **Alangiaceae**
- 342b. Petals not loriform :
- 343a. Petals imbricate.
Stamens various
Combretaceae
- 343b. Petals valvate, if
slightly imbricate then
stamens usually 5
Cornaceae
- 315b. Petals more or less united :
- 344a. Leaves opposite :
- 345a. Leaves stipulate :
- 346a. Leaves simple **Rublaceae**
- 346b. Leaves pinnate **Caprifoliaceae**
- 345b. Leaves exstipulate :

- 347a. Anthers mostly connivent or in pairs around the style :
- 448a. Calyx usually modified into a pappus.
Flowers usually in heads **Asteraceae**
- 448b. Calyx not modified as above. Flowers not in heads **Campanulaceae**
- 347b. Anthers free from each other :
- 349a. Leaves gland dotted. Stamens usually numerous **Myrtaceae**
- 349b. Leaves not gland dotted. Stamens definite :
- 350a. Plants herbaceous or woody at base :
- 351a. Flowers zygomorphic :
- 352a. Ovary with 1 perfect and usually 2 empty loculi **Valerianaceae**
- 352b. Ovary without empty loculi.
Flowers often capitate **Dipsacaceae**
- 351b. Flowers actinomorphic :
- 353a. Anthers 2-locular **Campanulaceae**
- 353b. Anthers 1-locular **Adoxaceae**
- 350b. Shrubs or trees :
- 354a. Stamens double the number of corolla lobes **Lythraceae**
- 354b. Stamens as many as corolla lobes **Caprifoliaceae**
- 344b. Leaves radical or alternate :
- 355a. Anthers more or less united into a ring around the style **Asteraceae**
- 355b. Anthers free or connate at base only :
- 356a. Stamens as many as and opposite to corolla lobes :
- 357a. Herbs **Primulaceae**
- 357b. Shrubs **Myrsinaceae**
- 356b. Stamens alternate with the corolla lobes or more or fewer :

- 358a. Corolla zygomorphic **Valerianaceae**
- 358b. Corolla actinomorphic :
- 359a. Plants herbaceous, often with milky juice :
- 360a. Leaves stipulate. Sepals 2 **Portulacaceae**
- 360b. Leaves exstipulate. Sepals more than 2 **Campanulaceae**
- 359b. Plants usually woody, without milky juice :
- 361a. Stamens free from corolla :
- 361b. Stamens epipetalous :
- 362a. Ovary 1-2 locular **Alangiaceae**
- 362b. Ovary 3-5 locular :
- 363a. Stamens 5 or 10 **Styracaceae**
- 363b. Stamens numerous **Symplocaceae**
- 48b. Petals absent :
- 364a. Gynoecium of 2 or more separate carpels :
- 365a. Shrubs or trees:
- 366a. Leaves stipulate **Sterculiaceae**
- 366b. Leaves exstipulate :
- 367a. Stamens usually opposite to petals. Carpels mostly 3, free **Menispermaceae**
- 367b. Stamens alternate to petals or irregularly inserted. Carpels in a single series **Phytolaccaceae**
- 365b. Herbs :
- 368a. Sepals free **Ranunculaceae**
- 368b. Sepals united into a tube **Rosaceae**
- 364b. Gynoecium of 1 or 2 or more united carpels :
- 369a. Ovules attached to the walls of ovary :
- 370a. Ovary superior :
- 371a. Stamens 6, tetradynamous **Brassicaceae**
- 371b. Stamens 1-numerous; if 6, not tetradynamous :
- 372a. Stamen 1 **Casuarinaceae**

- 372b. Stamens more than 1:
- 373a. Ovary composed of 1 carpel :
- 374a. Stamens numerous **Flacourtiaceae**
- 374b. Stamens 10 or fewer :
- 375a. Anthers erect in bud **Ulmaceae**
- 375b. Anthers inflexed in bud **Moraceae**
- 373b. Ovary composed of more than 1 carpel :
- 376a. Flowers unisexual in catkins **Salicaceae**
- 376b. Flowers bisexual not in catkins
- 377a. Calyx tubular **Lythraceae** :
- 377b. Calyx not tubular **flacourtiaceae**
- 370b. Ovary inferior :
- 378a. Leaves gland dotted **Myrtaceae**
- 378b. Leaves not gland dotted :
- 379a. Leaves stipulate :
- 380a. Flowers unisexual **Begoniaceae**
- 380b. Flowers bisexual **Saxifragaaceae**
- 379b. Leaves exstipulate **Datisceae**
- 369b. Ovules attached to the central axis or to the base or apex of the ovary :
- 381a. Ovary superior :
- 382a. Flowers unisexual :
- 383a. Leaves in whorls, scale like **Casuarinaceae**
- 383b. Leaves in globose heads :
- 384a. Flowers in globose heads **Platanaceae**
- 384b. Flowers arranged variously :
- 385a. Fruit utricle **Chenopodiaceae**
- 385b. Fruit other than utricle :
- 386a. Male flowers in catkins or spikes **Salicaceae**
- 386b. Male flowers neither in catkins nor in spikes :

- 387a. Ovary 3-celled; ovules 1-2 in each locule :
 - 388a. Leaves usually stipulate **Euphorbiaceae**
 - 388b. Leaves exstipulate **Buxaceae**
- 387b. Ovary 1-celled; ovule solitary in each locule :
 - 389a. Flowers crowded in a fleshy receptacle **Moraceae**
 - 389b. Flowers not in a fleshy receptacle :
 - 390a. Anthers inflexed in bud **Urticaceae**
 - 390b. Anthers erect in bud :
 - 391a. Leaves entire **Lauraceae**
 - 391b. Leaves not entire :
 - 392a. Trees. Fruit a drupa
or samara **Ulmaceae**
 - 392b. Shrubs. Fruit on
achene **Cannabaceae**
- 382b. Flowers bisexual :
 - 393a. Leaves opposite or verticillate, never all radical :
 - 394a. Leaves stipulate :
 - 395a. Placentation free central **Caryophyllaceae**
 - 395b. Placentation not free central :
 - 396a. Stipules ochreate. Fruit a nut **Polygonaceae**
 - 396b. Stipules not as above :
 - 397a. Leaves opposite **Caryophyllaceae**
 - 397b. Leaves verticillate
Molluginaceae
 - 394b. Leaves exstipulate :
 - 398a. Placentation free central **Caryophyllaceae**
 - 398b. Placentation axile, basal or apical :
 - 399a. Ovary and fruit compressed
contrary to the septum **Aceraceae**
 - 399b. Ovary if compressed then
not contrary to the septum
or septa :
 - 400a. Ovules 2 or more in each
locule of the ovary or
unilocular ovary :
 - 401a. Herbs :

- 402a. Sepals united into a tube. Stamens perigynous:
- 403a. Sepals imbricate **Aizoaceae**
- 403b. Sepals valvate **Lythraceae**
- 402b. Sepals free or nearly so. Stamens usually hypogynous:
- 404a. Leaves connate at base **Caryophyllaceae**
- 404b. Leaves not connate at base **Amaranthaceae**
- 401b. Shrubs or trees :
- 405a. Calyx more or less spreading or not tubular. Disk often present **Celastraceae**
- 405b. Calyx tubular. Disk absent or inconspicuous **Lythraceae**
- 400b. Ovule solitary in each locule :
- 406a. Stamens circinate involute in bud. Calyx often petaloid **Nyctaginaceae**
- 406b. Stamens not as above. Calyx rarely petaloid
- 407a. Woody stemmed undershrubs, shrubs or trees. Embryo straight **Thymelaeaceae**
- 407b. Herbs. Embryo more or less curved :
- 408a. Sepals united into a tube. Stamens perigynous **Aizoaceae**
- 408b. Sepals free or nearly so. Stamens mostly hypogynous:
- 409a. Calyx herbaceous **Chenopodiaceae**
- 409b. Calyx hyaline or scarious margined :
- 410a. Calyx scarious on margins only **Molluginaceae**
- 410b. Calyx hyaline all over **Amaranthaceae**
- 391a. Leaves alternate or radical or reduced to scales :
- 411a. Leaves stipulate :
- 412a. Stamens monadelphous **Sterculiaceae**
- 412b. Stamens free or united at the base only :

- 413a. Stamens as many as and alternate with the sepals
 - 414a. Herbs **Molluginaceae**
 - 414b. Shrubs or trees **Rhamnaceae**
- 413b. Stamens as many as and opposite to sepals
or more or fewer:
 - 415a. Ovary 2 or more locular :
 - 416a. Stamens perigynous. Ovary
1-3 locular **Saxifragaceae**
 - 416b. Stamens hypogynous. Ovary
3-5 locular **Molluginaceae**
 - 415b. Ovary unilocular :
 - 417a. Stipules ochreate **Polygonaceae**
 - 417b. Stipules not ochreate **Phytolaccaceae**
- 411b. Leaves without stipules :
 - 418a. Stamens as many as and alternating with the
calyx lobes **Aizoaceae**
 - 418b. Stamens as many as and opposite to calyx lobes
or fewer or more :
 - 419a. Leaves compound :
 - 420a. Herbs **Ranunculaceae**
 - 420b. Shrubs or trees :
 - 421a. Wood resinous **Anacardiaceae**
 - 421b. Wood non resinous :
 - 422a. Flowers mostly polyga
mous. Bark bitter **Simaroubaceae**
 - 422b. Flowers mostly
polygamodioecious.
Bark not bitter **Sapindaceae**
 - 419b. Leaves simple :
 - 423a. Stamens circinate involute
in bud **Nyctaginaceae**
 - 423b. Stamens not circinate involute
in bud :
 - 424a. Stamens perigynous or flowers
unisexual :
 - 425a. Herbs :

- 426a. Calyx long and tubular **Lythraceae**
 426b. Calyx tube short or absent **Aizoaceae**
- 425b. Shrubs or trees :
 427a. Calyx lobes imbricate **Thymelaeaceae**
 427b. Calyx lobes valvate **Lythraceae**
- 424b. Stamens hypogynous or slightly perigynous
 when accompanied by a disk :
 428a. Herbs :
 429a. Bracteoles absent :
 430a. Fruit a capsule **Molluginaceae**
 430b. Fruit a utricle **Chenopodiaceae**
 429b. Bracteoles present :
 431a. Sepals 4 **Phytolaccaceae**
 431b. Sepals **Amaranthaceae**
- 428b. Shrubs or trees :
 432a. Ovules solitary in each locule:
 seeds endospermous **Phytolaccaceae**
 432b. Ovules 2 in each locule. Seeds non
 endospermous **Sapindaceae**
- 381b. Ovary inferior to half inferior :
 433a. Leaves stipulate :
 434a. Flowers unisexual :
 435a. Stamens and ovules numerous **Begoniaceae**
 435b. Stamens and ovules few :
 436a. Male flowers without
 calyx **Corylaceae**
 636b. Calyx present in male flowers :
 437a. Ovules solitary **Moraceae**
 437b. Ovules 2 in each
 locule **Fagaceae**
 434b. Flowers usually bisexual **Rhamnaceae**
- 433b. Leaves exstipulate :
 438a. Flowers usually in catkins :
 439a. Leaves simple **Fagaceae**
 439b. Leaves pinnate **Juglandaceae**
 438b. Flowers not in catkins :

- 440a. Calyx calyptrate. Leaves gland dotted **Myrtaceae**
- 440b. Calyx not calyptrate. Leaves not gland dotted :
- 441a. Ovule 1, erect or axile :
- 442a. Maritime shrubs or trees with
often lepidote leaves **Elaeagnaceae**
- 442b. Not maritime. Leaves not lepidote
- 441b. Ovules pendulous or at the apex of a
basal placenta :
- 443a. Plants herbaceous **Aizoaceae**
- 443b. Shrubs or trees :
- 444a. Anthers opening by
valves **Lauraceae**
- 444b. Anthers opening by longi-
tudinal slits :
- 445a. Stamens inflexed in bud,
often double the
number of sepals **Combretaceae**
- 445b. Stamens erect in bud,
as many as the sepals **Santalaceae**
- 1b. Leaves usually parallel veined. Perianth 3-merous.
Embryo with 1 cotyledon :
- 446a. Aquatics :
- 447a. Plant body minute, not differentiated
into stem and leaves **Lemnaceae**
- 447b. Plants not as above :
- 448a. Ovary inferior **Hydrocharitaceae**
- 448b. Ovary superior :
- 449a. Flowers in globose clusters **Sparganiaceae**
- 449b. Flowers arranged otherwise :
- 450a. Flowers unisexual :
- 451b. Flowers in dense,
cylindric spikes **Typhaceae**
- 451b. Flowers in axils or
capitate :

- 452a. Flowers capitate on scape **Eriocaulaceae**
- 452b. Flowers axillary, solitary or few in
inflorescence :
- 453a. Ovule erect **Najadaceae**
- 453b. Ovule pendulous **Zannichelliaceae**
- 450b. Flowers bisexual :
- 454a. Inflorescence subtended by a spathe
like leaf sheath
- 455a. Carpels free or slightly united
at base **Butomaceae**
- 455b. Carpels usually completely
united **Pontederiaceae**
- 454b. Inflorescence not subtended by spathe
like leaf sheath :
- 456a. Flowers bracteate **Alismataceae**
- 456b. Flowers ebracteate :
- 457a. Flowers usually on one side
of inflorescence **Aponogetonaceae**
- 457b. Flowers arranged all around
the axis **Potamogetonaceae**
- 446b. Terrestrial or marshy plants :
- 458a. Inflorescence subtended by a spathe or
spathaceous bract :
- 459b. Ovary inferior :
- 460a. Perianth of separate calyx and
corolla **Musaceae**
- 460b. Perianth segments usually
alike, petaloid **Amaryllidaceae**
- 459b. Ovary superior :
- 461a. Flowers in a spadix enclosed in a spathe
- 462a. Aerial roots present **Pandanaceae**
- 462b. Aerial roots absent :
- 463a. Usually tall plants. Leaves
plicate in bud **Arecaceae**
- 463b. Plants usually herbaceous.
Leaves not as above **Araceae**
- 461b. Flowers not in a spadix :

- 464a. Carpels more or less completely united
with usually more than 1 stigma **Amaryllidaceae**
- 464b. Carpels free or only slightly united at base
or gynoecium reduced to 1 carpel with
stigma **Butomaceae**
- 458b. Inflorescence not subtended by a spathe or
spathaceous bract :
- 465a. Flowers in dense, cylindric spikes **Typhaceae**
- 465b. Flowers arranged otherwise :
- 466a. Ovary superior :
- 467a. Perianth absent or represented
by hypogynous scales or lodicules :
- 468a. Stems usually triquetrous.
Leaves usually with closed
sheaths **Cyperaceae**
- 468b. Stems usually terete. Leaves
usually with open sheaths **Poaceae**
- 467b. Perianth present, if absent, reduced
or modified then flowers not
arranged in the axils of glumes :
- 469a. Carpels free or slightly united
at base :
- 470a. Flowers ebracteate **Juncaginaceae**
- 470b. Flowers bracteate, **Allismataceae**
- 469b. Carpels more or less comple-
tely united :
- 471a. Perianth sepaloid or dry
and glumaceous **Juncaceae**
- 471b. Perianth of separate
calyx or corolla in two
or one series or of similar
segments, usually petaloid :
- 472a. Perianth of separate
calyx and corolla :
- 473a. Flowers in heads,
unisexual
Eriocaulaceae

- 473b. Flowers not in heads :
- 474a. Flowers ebracteate **Juncaginaceae**
- 474b. Flowers bracteate :
- 475a. Ovary unilocular **Trilliaceae**
- 475b. Ovary 2-3 locular **Commelinaceae**
- 472b. Perianth of similar or subsimilar segments:
- 476a. Anthers 1-locular **Smilacaceae**
- 476b. Anthers usually 2-locular :
- 477a. Leaves in dense tuft at the base, usually fibrous. Flowers in large panicles **Agavaceae**
- 477b. Leaves not as above **Liliaceae**
- 466b. Ovary semi inferior or inferior :
- 478a. Ovary semi inferior :
- 479a. Ovules numerous **Haemodoraceae**
- 479b. Ovules 2 **Liliaceae**
- 478b. Ovary completely inferior :
- 480a. Stamens 1 or 2 :
- 481a. Pollen agglutinated. Ovary twisted **Orchidaceae**
- 481b. Pollen and ovary not as above :
- 482a. Ligule absent **Cannaceae**
- 482b. Ligule present :
- 483a. Aerial parts aromatic. Leaves 2-ranked **Zingiberaceae**
- 483b. Aerial parts not aromatic. Leaves alternate or 4-ranked **Costaceae**
- 480b. Stamens 3 or 6 :
- 484a. Stamens 3 **Iridaceae**
- 484b. Stamens 6 :
- 485a. Climbers. Flowers unisexual **Dioscoreaceae**
- 485b. Erect herbs :
- 486a. Leaves thick, fibrous. Inflorescence terminal, long racemose **Agavaceae**
- 486b. Leaves not as above. Inflorescence from base **Hypoxidaceae**

RANUNCULACEAE

(B.P. Uniyal)

- 1a. Leaves opposite, rarely fascicled :
 - 2a. Perianth of single whorl ...11. *Clematis*
 - 2b. Perianth of double whorl ...6. *Atragene*
- 1b. Leaves alternate, whorled or in rosettes :
 - 3a. Flowers zygomorphic :
 - 4a. Flowers not spurred. Upper sepal hood like ...1. *Aconitum*
 - 4b. Flowers with spur :
 - 5a. Annuals. Follicle single ...12. *Consolida*
 - 5b. Perennials. Follicles 2-5 ...13. *Delphinium*
 - 3b. Flowers actinomorphic :
 - 6a. Sepals and petals spurred ...5. *Aquilegia*
 - 6b. Sepals and petals not spurred :
 - 7a. Fruit a berry ...2. *Actaea*
 - 7b. Fruit a follicle, achene or a capsule :
 - 8a. Fruit a follicle :
 - 9a. Flowers arranged in long racemes. Stamens longer than the corolla ...10. *Cimicifuga*
 - 9b. Flowers solitary or arranged differently. Stamens shorter than or equalling the corolla :
 - 10a. Leaves undivided ...8. *Caltha*
 - 10b. Leaves variously divided :
 - 11a. Sepals blue or whitish with blue veins. Follicles often united to form a capsule ...17. *Nigella*
 - 11b. Sepals usually white or yellow to orange, rarely lilac :

- 12a. Sepals yellow to orange ...23. *Trollius*
- 12b. Sepals white, green or rarely lilac :
- 13a. Stems simple, scapose. Flowers solitary ...19. *Paraquilegia*
- 13b. Stems branched, leafy. Flowers in dichasia ...16. *Isopyrum*
- 8b. Fruit an achene :
- 14a. Sepals petaloid. Petals absent :
- 15a. Achenes with long plumose styles ...20. *Pulsatilla*
- 15b. Achenes not as above :
- 16a. Flowers in racemes or panicles. Involucral leaves absent ...22. *Thalictrum*
- 16b. Flowers solitary, umbellate or in cymes. Involucral leaves present :
- 17a. Involucral leaves close to the flower ...15. *Hepatica*
- 17b. Involucral leaves distant from the flower ...4. *Anemone*
- 14b. Sepals and petals both present :
- 18a. Calyx persistent in mature fruit ...18. *Oxygraphis*
- 18b. Calyx deciduous after flowering :
- 19a. Achenes gibbous with empty pouches on either side; beak 2-3 times longer than the achene ...9. *Ceratocephala*
- 19b. Achenes not as above :
- 20a. Sepals petaloid, 5-8. Ovules pendulous :
- 21a. Petals with nectaries at base ...7. *Callianthemum*
- 21b. Petals without nectaries ...3. *Adonis*
- 20b. Sepals 5, green, herbaceous. Ovules erect :
- 22a. Stems present. Achenes not longitudinally ribbed ...21. *Ranunculus*

- 22b. Acaulescent. Achenes longitudinally
ribbed ...14. *Halerpestes*

I. ACONITUM L.

- 1a. Perennial herbs :
- 2a. Uppermost sepal helmet shaped, shortly beaked :
Follicles diverging ...5. *A. laeve*
- 2b. Uppermost sepal boat shaped, without beak.
Follicles contiguous ...6. *A. moschatum*
- 1b. Biennial herbs :
- 3a. Honey leaves hispid or hispidulous ...2. *A. deinorrhizum*
- 3b. Honey leaves glabrous :
- 4a. Carpels 3 ...8. *A. soongoricum*
- 4b. Carpels 5 :
- 5a. Carpels glabrous ...1. *A. chasmanthum*
- 5b. Carpels pubescent :
- 6a. Leaves basal and cauline :
- 7a. Leaves heteromorphic ...3. *A. heterophyllum*
- 7b. Leaves cordate, uniform ...4. *A. kashmiricum*
- 6b. Leaves all or most from hypogeous
base of the stem :
- 8a. Leaves very few at base, only
1-2 higher up; lamina laciniate ...9. *A. violaceum*
- 8b. Leaves mostly basal, in loose
rosettes; lamina with broad
lobes ...7. *A. rotundifolium*

1. *Aconitum chasmanthum* Stapf ex Holmes, Mus. Rep. Pharm. Soc. Gr. Brit. 2: 1903; Stapf in Ann. Roy. Bot. Gard. Calcutta 10: 142. t. 96. 1905; Riedl in Fl. Pak. 193: 35. 1991; Rau in Sharma *et. al.*, Fl. India 1: 8. 1993. *A. napellus* L., sp. aggr.; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 28. 1872.

Biennial herbs. Roots paired, tuberous. Leaves many, 4-6 x 5-9 cm, orbicular-reniform, palmately tri-partite to the base; lobes more or less

lacinate; basal long-petioled; upper short petioled. Flowers in a stiff, dense, up to 30 cm long, pubescent racemes. Sepals blue or bluish white, glabrous; helmet with long beak. Petals glabrous. Carpels 5, glabrous. Follicles oblong, glabrous. Seeds 3-winged.

Fl. & Fr. : August September.

Included after Rau, (*loc. cit.*).

2. *Aconitum deinorrhizum* Stapf in Ann. Roy. Bot. Gard. Calcutta. 10: 158. t. 103. 1905; Rau in Sharma *et. al.*, Fl. India 1: 8. 1993.

Biennial herbs. Stems 1.5-2 m. Leaves reniform 5-partite; lobes and teeth acute, finely pubescent. Inflorescence a raceme, up to 40 cm long, greyish pubescent. Sepals blue; uppermost boat or helmet shaped, shortly beaked. Petals densely pubescent; head 'S' shaped. Filaments hairy. Follicles 3, greyish pubescent.

Fl. & Fr. : August September.

On alpine slopes, between 3000-3500 m.

Selected specimens : Seoj-Kailash, 3500 m, Vohra & Naithani 82999A (BSD).

3. *Aconitum heterophyllum* Wallich ex Royle, Illus. Bot. Himal. t. 13. 1833 & 56. 1834; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 29. 1872; Stapf in Ann. Roy. Bot. Gard. Calcutta 10: 151. 1905; Riedl in Fl. Pak. 193: 32. 1991; Sharma & Jamwal, Fl. Upper Liddar valleys 1: 52. 1988; Rau in Sharma *et. al.*, Fl. India 1: 15. 1993. *Atees, Aris, Patis, Patris, Piwak.*

Erect herbs, up to 75 cm high. Stems glabrous, crisped pubescent above. Leaves heteromorphous; lower 3-8 cm across, orbicular or broadly ovate-cordate, usually 5-lobed; upper up to 13 x 9 cm, ovate or ovate-lanceolate, crenate or inciso-crenate, cordate at base. Racemes, 2.5-3.5 cm long. Sepals blue; upper helmet shaped, rounded at top, pointed

in front. Carpels 5, pubescent. Follicles 5, blackish brown, 1.5-2 cm long.

Fl. & Fr. : July - September.

On open slopes.

Selected specimens : Banihal ridge, 3330-3850 m, T.A. Rao 768 (BSD); Zozila, Hajra 74002 (BSD); Panikhar, Suru valley, 3300-4200 m. Wadhwa 59873 (BSD); Shekhpura, Wadhwa, Murti & Pant 85107 (BSD).

4. *Aconitum kashmiricum* Stapf ex Coventry. Wild Fls. Kashmir 3: 25.t. 13. 1930; Rau in Sharma *et. al.*, Fl. India 1: 16. 1993. *Pevak* (Kashmiri).

Erect, tuberous herbs, up to 30 cm high. Leaves few, up to 4 cm across, ovate or orbicular-cordate, glabrous, incised; lobes broad. Flowers 1-2, terminating the stem, blue. Uppermost sepal helmet shaped, shortly beaked. Filaments hairy in the upper part. Carpels 5, densely pubescent. Follicles 5, hairy.

Fl. & Fr. : July - September.

Selected specimens : Included after Rau (*loc. cit.*).

Note : H. Riedl (Fl. Pakistan 193: 33. 1991) has treated this species as a synonym of *A. heterophyllum* var. *bracteatum* Stapf, differentiating from *A. heterophyllum* var. *heterophyllum* by minutely dentate bracts and the follicles being glabrous from beginning.

5. *Aconitum laeve* Royle, Illus. Bot. Himal. 56. 1834; Sharma & Jamwal, Fl. Upper Liddar valleys 1: 51. 1988; Riedl in Fl. Pak. 193: 31. 1991; Rau in Sharma *et. al.*, Fl. India 1: 17. 1993. *A. lycoctonum* auct. non L.; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 28. 1872; Blatter, Beaut. Fls. Kashmir 23. 1927.

Fig. 52

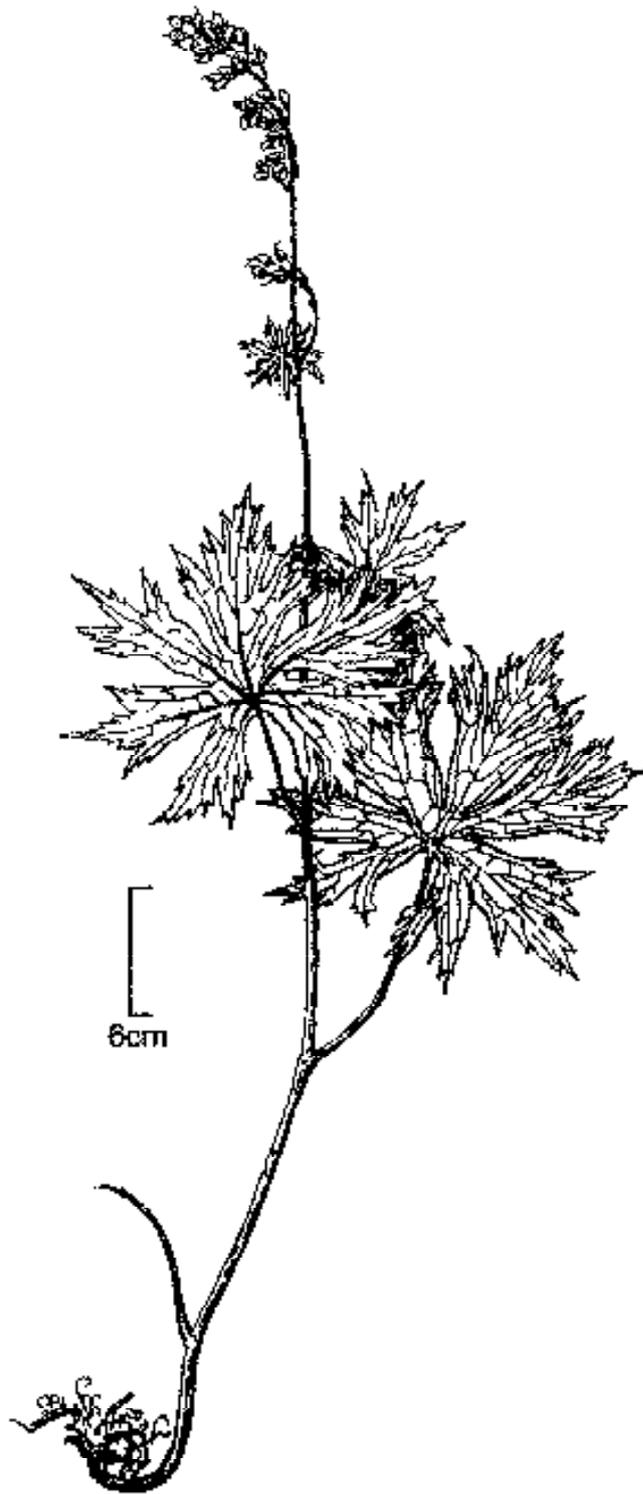


Fig. 52. *Aconitum laeve* Royle

Non tuberous, perennial herbs, up to 2 m tall. Basal leaves few, long petioled, usually withering at flowering time; cauline leaves up to 30 cm in diam., cordate-reniform, deeply palmatisect into 5-9 lobes. Flowers in leafy, up to 50 cm long panicles. Sepals white, yellowish or dull purple; uppermost helmet shaped, shortly beaked. Filaments winged to the middle. Carpels 3, divergent. Follicles 3, glabrous or yellowish hairy.

- 1a. Hairs curled, occasionally straight on uppermost
 sepal ...5.1. var. *curvipilosum*
 1b. Hairs straight, spreading ...5.2. var. *laeve*

5.1. var. *curvipilosum* Tamura & Lauener in Notes Roy. Bot. Gard. Edinb. 37: 433, 1979; Rau in Sharma *et al.*, Fl. India 1: 18, 1993.

Fl. & Fr. : August September.

Selected specimens : Gulmarg, *Bhattacharyya* 71180; *s. loc.*, *Nair* 37109 (BSD).

5.2. var. *laeve*

Fl. & Fr. : June August.

Selected specimens : Near Baltal, *Hajra* 74280 (BSD); Kishtwar/ Nagin Siru, 1800-3850 m, *T.A. Rao* 7841 (BSD); Pissu Ghats; 4000 m, *T.A. Rao* 9729 (BSD); Habba Khatoon, *Wadhwa, Murti & Pant* 8500 (BSD).

6. *Aconitum moschatum* (Bruehl) Stapf in Ann. Roy. Bot. Gard. Calcutta 10: 139. t. 94. 1905; Sharma & Jamwal, Fl. Upper Liddar valleys 1: 52. 1988; Rau in Sharma *et al.*, Fl. India 1: 19. 1993. *A. ferox* Wallich ex Seringe subsp. *moschatum* Bruehl in Ann. Roy. Bot. Gard. Calcutta 5: 109. t. 111. 1896.

Erect, unbranched, perennial herbs, up to 90 cm high, glabrous below, with soft spreading hairs above. Leaves ca 9 mm in diam.; orbicular-cordate or subreniform, palmately 5-partite; cauline leaves smaller; petiole

of basal leaves up to 30 cm long. Flowers in up to 40 cm long, panicles or racemes, viscid tomentose on the axis, lurid-purple. Uppermost sepal navicular. Anthers black. Carpels 3, contiguous. Follicles 1-3, glandular hairy.

Fl. & Fr.: August September.

Endemic.

Included after Stapf (*loc. cit.*).

7. *Aconitum rotundifolium* Kar. & Kir. in Bull. Soc. nat. Mosc. 15: 139. 1842; Riedl in Fl. Pak. 193: 38. 1991; Rau in Sharma *et. al.*, Fl. India 1:21.1993. *A. napellus auct. non L.*; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 28. 1872. *A. napellus* var. *rotundifolium* (Kar. & Kir.) Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 29. 1872; Blatter Beaut. Fls. Kashmir 24. 1927. **Fig. 53**

Biennial herbs, up to 90 cm high. Stems glabrous below, pubescent above. Leaves mostly basal, arranged in loose rosette, up to 10 cm in diam., orbicular-cordate or almost reniform, 5-7 partite. Flowers few, pale purplish, blue or pinkish mauve, in racemes. Uppermost sepal navicular. Carpels usually 5, rarely 4 to 6. Follicles softly hairy.

Fl. & Fr.: July September.

Selected specimens : Lakong, Ladakh, *Bhattacharyya* 52195 (BSD).

8. *Aconitum soongoricum* Stapf in Ann. Roy. Bot. Gard. Calcutta 10: 141. t. 95. 1905; Riedl in Fl. Pak. 193: 39. 1991; Rau in Sharma *et. al.*, Fl. India 1: 22. 1993.

Herbs, up to 70 cm high. Stems simple. Basal leaves withering at flowering time; upper leaves scattered, cordate-orbicular or reniform, 5 partite. Flowers blue, in terminal racemes. Lower bracts foliaceous. Upper sepal with long, slender beak. Petals glabrous. Carpels 3, glabrous. Mature follicles frequently less than 3, only one often developing.

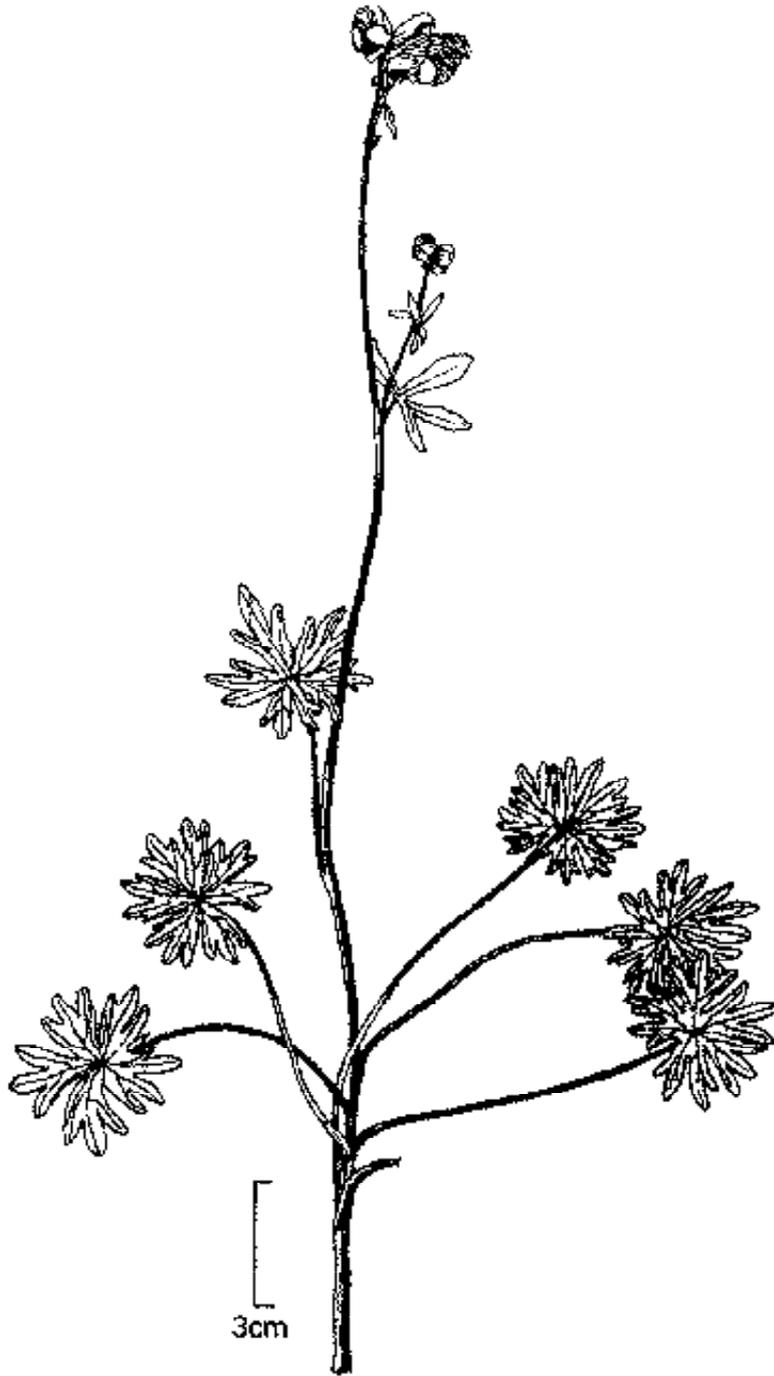


Fig. 53. *Aconitum rotundifolium* Kar. & Kir.

Fl. & Fr. : July August.

Included after Rau, (*loc. cit.*).

9. *Aconitum violaceum* Jacquem. ex Stapf in Ann. Roy. Bot. Gard. Calcutta 10: 144. 1905; Blatter, Beaut. Fls. Kashmir 24. 1927; Sharma & Jamwal, Fl. Upper Liddar valleys 1: 53. 1988; Riedi in Fl. Pak. 193: 34. 1991; Rau in Sharma *et. al.*, Fl. India 1: 23. 1993. *A. napellus* var. *multifidum* (Royle) Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 29. 1872. *Yangtso, Buma-nagpo.*

Biennial herbs, up to 60 cm high. Stems simple, erect or ascending from a hypogeous base. Leaves few, up to 7.5 cm in diam., orbicular-cordate or reniform, deeply 5-partite. Flowers purple-blue or violet, in racemes, rarely solitary. Uppermost sepal navicular. Petals with 'T' shaped head. Filaments winged in the lower part, hairy in the upper part. Carpels 5. Follicles densely yellowish hairy.

1a. Stems up to 60 cm high. Racemes stout, many flowered.

Flowers blue, variegated white ...9.1. var. *robustum*

1b. Stems up to 35 cm high. Racemes short, few flowered

or flowers solitary. Flowers blue, not variegated white

...9.2. var. *violaceum*

9.1. var. *robustum* Stapf in Ann. Roy. Bot. Gard. Calcutta 10: 146. 1905; Rau in Sharma *et. al.*, Fl. India 1: 23. 1993. *Mohand.*

Fl. & Fr. : August September.

Selected specimens : Kadara, Wadhwa 84106 (BSD).

Riedl (*loc. cit.*) treats this variety as synonymous to *A. chasmanthum* Stapf ex Holmes.

9.2. var. *violaceum*

Fl. & Fr. : August September.

On slopes amidst boulders.

Selected specimens : Mahagunesh pass, 3600 m, *Rau* 50325 (BSD); Pulu, Ladakh, *Wadhwa* 59921 (BSD); Near Dras, *Hajra* 74026 (BSD); South Pullu area, *Balodi* 91035 (BSD).

2. ACTAEA L.

Actaea acuminata Wallich ex Royle, *Illus. Bot. Himal.* 57. 1834; *Rau* in *Sharma et. al.*, *Fl. India* 1: 24. 1993. *A. spicata* auct. non L.; Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 29. 1872; Dhar & Kachroo, *Alpine Fl. Kashmir Himal.* 176. 1983. *Actaea spicata* L. var. *acuminata* (Wallich ex Royle) Hara in *J. Jap. Bot.* 51: 132. 1976. *Ricch Bhalara*.

Erect, perennial herbs or undershrubs, up to 90 cm high. Leaves alternate, 20-40 cm long, 2-3 pinnate; leaflets ovate-lanceolate, sharply dentate, pubescent beneath becoming glabrous later. Flowers in raceme; sepals white; petals ovate-elliptic. Berries brownish green when young, black when mature.

Fl. & Fr. : May August

On moist, shady slopes.

Selected specimens : On way to Barnai from Gurez, *Wadhwa, Murti & Pant* 85036 (BSD); Thajwas mountains, 3800 m, *T.A. Rao* 9561 (BSD); Jai hills, 2300 m, *T.A. Rao* 9107 (BSD); Gulmarg, 2900-3200 m, *T.A. Rao* 239 (BSD).

3. ADONIS L.

- 1a. Annuals. Flowers scarlet or yellow with a dark purple patch. Achenes angular ...1. *A. uestivalis*
 1b. Perennials. Flowers golden yellow. Achenes not angular ...2. *A. chrysocyathus*

1. *Adonis aestivalis* L., Sp. Pl. 771. 1753; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 15. 1872; Blatter, Beaut. Fls. Kashmir 1: 12. 1927; Rau in Sharma *et al.*, Fl. India 1: 26. 1993. *A. scrobiculata* Boiss., Fl. Orient. 1: 17. 1867; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 15. 1872.

Erect, annual herbs, up to 40 cm high. Stems simple or branched, leafy. Leaves ovate in outline, finely dissected into filiform segments; lower leaves petioled; upper sessile. Flowers solitary, terminal, up to 3 cm across; sepals glabrous; petals scarlet or yellow, with a dark purple patch. Achenes clustered in an ovoid or oblong head, angular, with depressions and one or two teeth on the inner angle near the beak.

Fl. & Fr. : April - June.

In open places, also in wheat fields.

Selected specimens : Kishtwar, Hargad enclosure, *Uniyal* 80272 (BSD); Udhampur, Sudh Mahadev, *Swami* 1171 (BSD); Doabgale, on the Jhelum, *Keshavanand* 982 (DD).

2. *Adonis chrysocyathus* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 15. 1872; Blatter, Beaut. Fls. Kashmir 11. 1927; Sharma & Jamwal, Fl. Upper Liddar Valleys. 1: 74. 1988; Rau in Sharma *et al.*, Fl. India 1: 26. 1993. *Tzemetz*, *Semshi*.

Perennial herbs, up to 30 cm high, enlarging in fruiting. Leaves tripinnatifid; lobes linear-lanceolate to ovate, rhomboid; lower leaves long petioled; petioles striate, flat; upper leaves sessile. Flowers solitary, terminal, 5-6 cm across. Sepals elliptical, petaloid. Petals golden 16-24, yellow, much exceeding the sepals. Achenes many in a globose head, *ca* 5 mm long obovoid-oblong, with thick parallel veins; beak *ca* 1.8 mm long, involute.

Fl. & Fr. : June - September.

On grassy slopes.

Selected specimens : Apharwat, T.A. Rao 9631 (BSD); Seshnag, 3600 m, Rau 50316 (BSD); Seshnag, Nair 36933 (BSD); Ladakh, Zozila, 3500 m, Bhattacharyya 71282 (BSD).

Note : Poisonous to cattle.

4. ANEMONE L.

- 1a. Achenes embedded in dense wool :
- 2a. Flowers many in decomposed cymes ...7. *A. vitifolia*
- 2b. Flowers 2-3 :
- 3a. Flowers dull red, 2-3 cm across ...1. *A. biflora*
- 3b. Flowers white, ca 5 cm across ...5. *A. rupicola*
- 1b. Achenes not embedded in dense wool :
- 4a. Flowers in umbels. Achenes strongly compressed :
- 5a. Involucels much smaller than the involucral leaves. Sepals usually 4 ...6. *A. tetrasepala*
- 5b. Involucels similar to involucral leaves. Sepals usually 5-8 ...3. *A. polyanthes*
- 4b. Flowers solitary or few on scapes or in compound cymes. Achenes not or slightly compressed :
- 6a. Flowers solitary or few on scapes ...2. *A. obtusiloba*
- 6b. Flowers many in compound cymes ...4. *A. rivularis*

1. *Anemone biflora* DC., Syst. Nat. 1: 201. 1820; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 7. 1872; Blatter, Beaut. Fls. Kashmir 5. 1927; Rau in Sharma *et al.*, Fl. India 1: 29. 1993. *A. coronaria* L. var. *biflora* (DC.) Finet et Gagnepain in Bull. Soc. Bot. Fr. 51: 60. 1904; Singh & Kachroo, For. Fl. Srinagar 160. 1976.

Herbs with tuberous rootstock. Radical leaves long petioled, 2-3-sect; lobes obovate-obtuse. Involucral leaves many-partite; involucels 2. Flowers dull red, 1-2 (-3) on scapes, 2-3 cm across. Sepals 5, oblong-ovate, hairy outside. Achenes embedded in dense wool.

Fl. & Fr. : March - August.

Selected specimens : Baramula, Right bank of Jhelum, Keshavanand 1136 (DD).

Note : According to Riedl (Fl. Pak. 193: 73. 1991) *A. biflora* sensu Hook.f. belongs to *A. tschernjaewii* Regel. He differentiates *A. tschernjaewii* from *A. biflora* DC. by the predominantly dull purplish colour of the flowers and sessile to cuneate segments of the leaves but in the description mentions the colour of sepals as white, pink or dull violet purplish.

2. *Anemone obtusiloba* D. Don, Prodr. Fl. Nepal. 194. 1825; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 8. 1872; Blatter, Beaut. Fls. Kashmir 6. 1927; Singh & Kachroo, For. Fl. Srinagar 160. 1976; Rau in Sharma *et al.*, Fl. India 1: 32. 1993. *Rattanjet* (U).

Perennial, tufted herbs, up to 30 cm high, variably hairy. Radical leaves suborbicular-reniform, deeply cordate, trisect, tridentate or trifoliolate, long petioled; cauline leaves similar in shape, divided more than half way. Involucral leaves resembling the leaves but smaller. Flowers golden yellow, white or bluish, 1-3 on scapes. Sepals 5-10 in number, elliptic-oblong or obovate. Achenes elliptic, terminated by a short, hooked beak.

Fl. & Fr. : April August.

- 1a. Leaves more than 2 cm across. Flowers smaller than the involucre in diameter. Sepals 10-20 mm long ...2.1. var. **obtusiloba**
- 1b. Leaves less than 2 cm across. Flowers larger than the involucre in diameter. Sepals 5-10 mm long ...2.2. var. **potentilloides**

2.1. var. *obtusiloba*

On open slopes.

Selected specimens : Latidhuna, Swami 1342 (BSD); Simthan top, Wadhwa, Murti & Pant 85419 (BSD); Seshnag, 3600 m, Nair 36958 (BSD); Sedan, 1700 m, T.A. Rao 9224 (BSD); Sonamarg, Chowdhery & Uniyal 85729 (BSD).

2.2. var. *potentilloides* Lauener in Notes Roy. Bot. Gard. Edinb. 23: 187. 1961; Rau in Sharma *et al.*, Fl. India 1: 33. 1993.

Selected specimens : Above Khillanmarg, 3000 m, Rau 50272 (BSD); Doda district, Seoj-Kailash, 3300 m, Vohra & Naithani 82972; Simthan top, 4300 m, Vohra & Naithani 83091 (BSD).

3. *Anemone polyanthes* D. Don, Prodr. Fl. Nepal. 194. 1825; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 9. 1872; Blatter, Beaut. Fls. Kashmir 8. 1927; Rau in Sharma *et al.*, Fl. India 1: 33. 1993. *A. narcissiflora* L. var. *polyanthes* (D. Don) Pinet & Gagnepain in Bull. Soc. Bot. Fr. 51: 56-76. 1904.

Stout, hairy herbs. Rootstock covered with fibrous remains of leaves. Radical leaves suborbicular-reniform, 5-7-lobed; lobes deeply trifid; petioles of radical leaves long. Inflorescence umbellate. Involucral leaves deeply trifid; lobes incised. Flowers white, up to 3.5 cm across. Achenes obovate winged, shortly beaked. Beak straight or curved.

Fl. & Fr. : June September.

On stony, shady slopes, and open hill slopes.

Selected specimens : Seoj-Kailash, 3500 m, Vohra & Naithani 82939 (BSD); on way to Amarnath, 3700 m, Nair 37038; Panchtarni, 3600 m, Nair 37008 (BSD); Liddar valley, Sorisal nallah, 4000-4500 m, Duthie 13368; Zandudi Gali, Gurez, A.C.F. 77 (DD).

4. *Anemone rivularis* Buch.-Ham. in DC., Syst. Nat. 1: 211. 1817; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 9. 1872; Rau in Sharma *et al.*, Fl. India 1: 35. 1993. *Kikisorang*.

Herbs, up to 1 m tall. Radical leaves up to 35 cm across, tripartite; divisions 3-5-lobed; lobes again divided into 3-4 lobules, serrate, bristly on both the surfaces; cauline leaves palmately finely dissected into many linear segments. Flowers many, white, blue or purplish outside, in compound cymes on long scapes, up to 4 cm across. Sepals 5-8, elliptic, obovate, silky outside. Achenes broadly elliptic, compressed, with hooked beak.

Fl. & Fr. : June September.

On moist slopes and along streams.

Selected specimens : Kashmir valley, *Falconer s.n.* (DD).

5. *Anemone rupicola* Cambess. in Jacquem., *Voy. Bot.* 4: 5. t. 2. 1835; Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 8. 1872; Rau in *Sharma et al.*, *Fl. India* 1: 37. f. 7. 1993. *A. rupicola* Cambess. var. *sericea* & *glabriuscula* Hook.f. & Thomson., *Fl. Ind.* 20. 1855 *et in* Hook.f., *Fl. Brit. India* 1: 8. 1872. *Tscheska, Simaso.*

Herbs up to 30 cm high, silky hairy. Radical leaves tripartite or lobed; segments dentate or serrate. Involucral leaves similar to basal leaves. Flowers 1-2 on scape, white, occasionally purplish outside, up to 8 cm across, silky outside. Achenes embedded in dense wool, shortly beaked.

Fl. & Fr. : June September.

On rocks and gravels.

Selected specimens : Panchtarni, 3600 m, *Nair* 37006, 37014 (BSD); Ladakh, Matyan, 3300 m, *Wadhwa* 58651 (BSD); Ladakh, above Bragnag, ca 5000 m, *Koelz* 2786 (DD); Kashmir, Bhotimali, opp. Budgam in Tilail, ca 4500 m, *Keshavanand* 1504 (DD); Apharwat, 11000', *Asst. Cons. Forests*, 44930 (DD).

6. *Anemone tetrasepala* Royle, *Illus. Bot. Himal.* 53. 1834; Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 10. 1872; Blatter, *Beaut. Fls. Kashmir* 7. 1927; Rau in *Sharma et al.*, *Fl. India* 1: 39. 1993. *Rattanfor* (L.)

Perennial herbs, up to 60 cm high. Rootstock woody, fibrous. Radical leaves suborbicular-subcordate or reniform, deeply 3 to 5-partite; segments deeply cut, serrate. Involucral leaves 3, sessile, irregularly dentate. Flowers white, in umbels, 3-4 cm across. Sepals 4. Achenes obovate-oblong, broadly winged, shortly beaked.

Fl. & Fr. : June - September.

In alpine meadows.

Selected specimens : Thajwas Mountains, 3800 m, *T.A. Rao* 9557 (BSD); Batote-Furfazal, 3200 m, *Rao* 9779 (BSD); Sarbal, *Wadhwa* 84134 (BSD); Jhelum valley, ca 3500 m, *Keshavanand* 185 (DD); Above. Chitranag, head of Bandipur nala, 3000-4000 m, *Keshavanand* 1402 (DD).

7. *Anemone vitifolia* Buch.-Ham. ex DC., *Syst. Nat.* 1: 210. 1817; Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 8. 1872; Rau in *Sharma et al.*, *Fl. India* 1: 40. 1993.

Stout, erect, pubescent, herbs, up to 1 m tall. Stems branched, sulcate. Radical leaves orbicular-cordate, up to 20 cm across, deeply 3-7-lobed, sharply toothed, densely white tomentose beneath, long petioled. Involucral leaves similar to radical leaves but smaller, stalked. Flowers white, 3-5 cm across. Sepals 5-8, ovate-elliptic. Achenes ellipsoid, in large globose heads.

Fl. & Fr. : July - October.

On moist slopes.

Selected specimens : Loran, 2000 m, *Vohra & Naithani* 78318 (BSD); near Bhairon Temple, Trikuta hills, *Uniyal* 77462 (BSD).

Blatter (*Beaut. Fls. Kashmir* 7. 1927) reported *Anemone rupestris* Hook.f. & Thomson from Kashmir but remarked "better to include under *A. obtusiloba* as a form".

5. AQUILEGIA L.

- | | |
|---|---------------------------|
| 1a. Stems leafless or with 1 small leaf | ...3. <i>A. nivalis</i> |
| 1b. Stems leafy : | |
| 2a. Spur much curved | ...4. <i>A. pubiflora</i> |
| 2b. Spur straight or hooked at tip : | |

- 3a. Pubescent or glandular herbs, Sepals obtuse ...1. *A. fragrans*
 3b. Glauous herbs, Sepals acute ...2. *A. moorcroftiana*

1. *Aquilegia fragrans* Benth. in Maund's Botanist 4: t. 181. f. 21. 1840; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 177. 1983; Rau in Sharma *et al.*, Fl. India 1: 42. 1993. *A. vulgaris* L. subsp. *alpina* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 24. 1872; Blatter, Beaut. Fls. Kashmir 25. 1927. *A. vulgaris* L. subsp. *pyrenaica* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 24. 1872. *p.p.*

Perennial herbs, up to 1 m tall. Stems branched, softly pubescent or glandular hairy. Basal leaves 2-3-ternate; leaflets cuneate-obovate, 2-3-lobed nearly to the base; cauline leaves reduced upwards. Flowers many, drooping, white or pale blue, up to 7.5 cm across fragrant. Sepals 5, petaloid. Petals 5, spurred; spur long. Follicles densely pubescent with glandular or eglandular hairs.

Fl. & Fr. : June September.

On boulder strewn slopes and as an undergrowth in *Pinus*, *Cedrus* forests.

Selected specimens : Thajwas, 3000 m, Rau 50201; Sonamarg, 2800 m, Rau 50262 (BSD); Ladakh, Matyan, *Bhattacharyya* 71326 (BSD); Bhadarwah-Seoj, *Vohra & Naithani* 83039 (BSD); Rumbak (Hemis N.P.), Ladakh, *S.K. Srivastava & Chauhan* 100897 (BSD).

Note : Riedl (Fl. Pak. 193: 20. 1991) mentions the occurrence of *A. fragrans* var. *kanawarensis* (Jacquem. ex Cawb.) H. Riedl from Kashmir. The variety differs from the typical variety in having glandular hairy follicles.

2. *Aquilegia moorcroftiana* Wallich ex Royle, Illus. Bot. Himal. 55. t. 21. 1834; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 177. 1983; Rau in Sharma *et al.*, Fl. India 1: 42. 1993. *A. vulgaris* L. subsp. *pyrenaica* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 24. 1872, *p.p.* *A. vulgaris* L. subsp. *viscosa* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 24. 1872.

Perennial herbs, up to 80 cm high, glandular hairy below the flowers. Leaves usually biternate, often bluish green, long petioled; leaflets obovate-cuncate, 2-3-fid nearly to the base. Flowers drooping. Sepals deep blue. Petals up to 18 x 8 mm, spurred acute or obtuse; slightly curved. Follicles 5, pubescent.

Fl. & Fr. : July August.

On dry stony slopes.

Selected specimens : Whisky Nallah, 4000 m, *Bhattacharyya* 40906 (BSD).

3. *Aquilegia nivalis* (Baker) Bruehl in J. Asiat. Soc. Bengal 61(2): 300. 1893; *Sharma & Jamwal, Fl., Upper Liddar Valleys* 1: 50. 1988; *Rau in Sharma et al., Fl. India* 1: 43. 1993. *A. glauca* Lindl. var. *nivalis* Baker in Gard. Chron. 2(10): 76. 1878. *A. vulgaris* L. subsp. *jucunda* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 24. 1872.

Perennial herbs, up to 30 cm high. Radical leaves biternate, long petioled; petioles flattened at the; leaflets suborbicular, deeply trifid. Flowers purple, mostly solitary, up to 6 cm across. Sepals large, broadly ovate, obtuse or acute. Petals much smaller. Stamens many; inner ones reduced to scales. Follicles 5, densely pubescent.

Fl. & Fr. : May August.

Selected specimens : Kashmir, on way to Panchtarni, *Nair* 36988 (BSD).

4. *Aquilegia pubiflora* Wallich ex Royle, Illus. Bot. Himal. 55. 1834; *Sharma & Jamwal, Fl. Upper Liddar valleys.* 1: 49. 1988; *Rau in Sharma et al., Fl. India* 1: 43. 1993. *A. vulgaris* L. subsp. *parviflora* (Walp.) Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 24. 1872. **Fig. 54**

Perennial, softly pubescent herbs, up to 75 cm high. Leaves biternate; leaflets deeply 3-lobed to the base, glabrous above, hairy beneath. Flowers

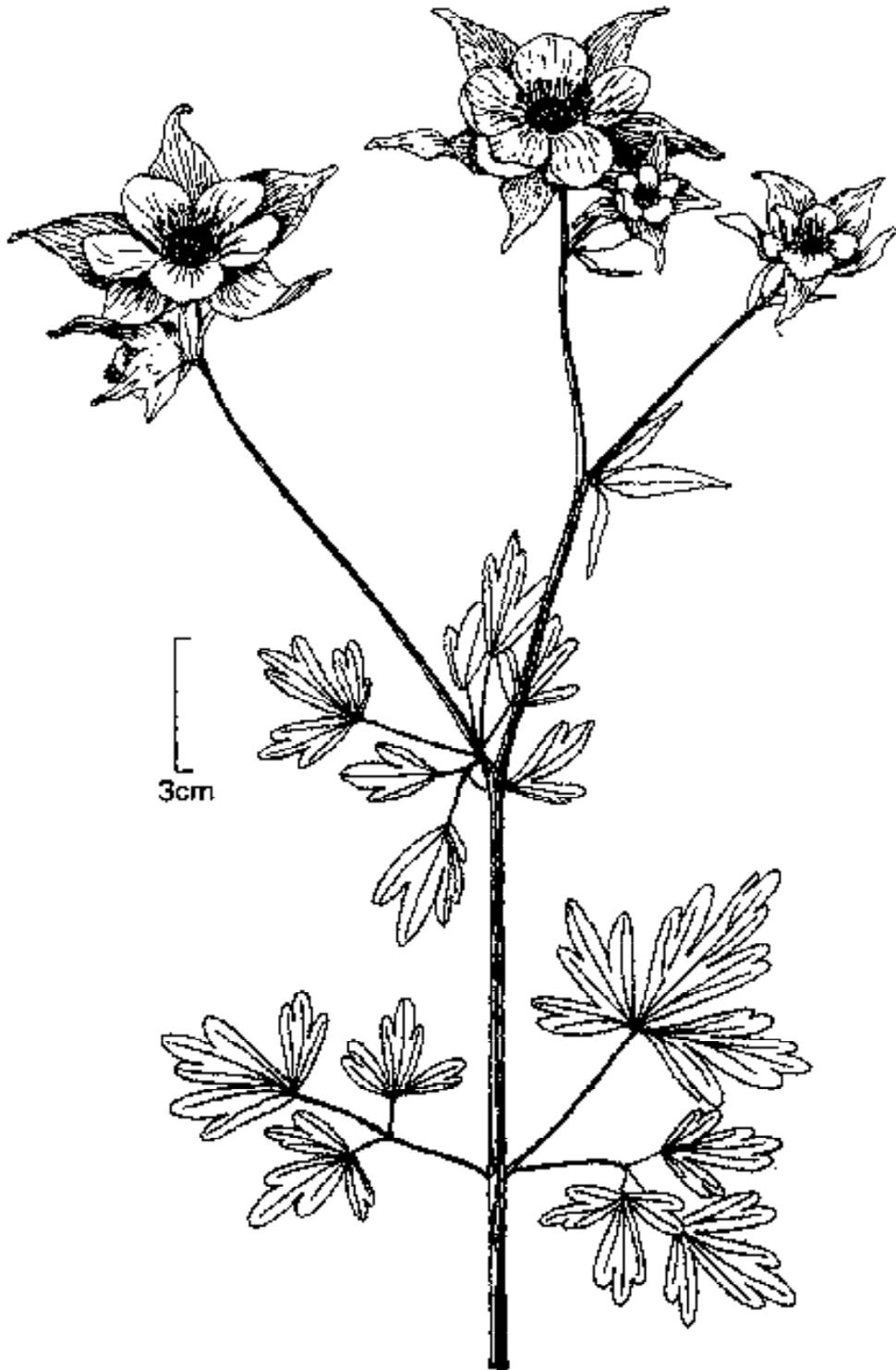


Fig. 54. *Aquilegia pubiflora* Wallich ex Royle

2-many. Sepals purple or blue, ovate-lanceolate, acute. Petals white or pale; spur hooked. Follicles hairy, tipped by persistent style.

Fl. & Fr. : May August.

On stony slopes in shade.

Selected specimens : Gulmarg road, Jigg. 2400 m, *Bhattacharyya* 71121 (BSD); Chandanwadi, 2900 m, *Nair* 36929 (BSD); Thajwas, 3000 m, *Rau* 50202 (BSD); Udampur, Gandh, *Swami* 1266 (BSD); Lidderwat Hill top, 3182 m, *T.A. Rao* 673 (BSD); Pahalgam, 2650 m, *T.A. Rao* 9680 (BSD).

6. ATRAGENE L.

Atragene sibirica L., Sp. Pl. 1: 543. 1753. *Clematis sibirica* Mill., Gard. Dict. ed. 8. no. 12. 1768. *C. alpina* Mill. subsp. *sibirica* (L.) O. Kuntze, Monogr. Clematis 162. 1885; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 264. 1972.

Climbing or prostrate shrubs. Leaves biternate; lobes ovate-lanceolate or lanceolate, acuminate, serrate, pubescent along the nerves. Flowers solitary. Sepals yellowish white, 3-5 cm long, minutely hairy outside and along margins. Petals flat, softly pubescent; outer ones broadened at apex, smaller than the sepals. Filaments long hairy, flattened. Achenes compressed, with long plumose styles.

Included on the basis of a specimen at CAL.

7. CALLIANTHEMUM C. Mey.

- 1a. Lamina of leaves deeply lobed; lobes dissected into linear, slender segments ...2. *C. anemonoides*
- 1b. Lamina of leaves shallowly lobed; lobes spreading and fan like or overlapping :
- 2a. Radical leaves rarely fully developed at flowering time; lobes overlapping. Petals usually truncate at apex ...1. *C. alatavicum*

- 2b. Radical leaves fully developed at flowering time; lobes fan shaped, spreading. Petals usually pointed at apex ...3. *C. pimpinelloides*

1. ***Callianthemum alatavicum*** Freyn in Bull. Herb. Boiss. 6: 882. 1898; Riedl in Fl. Pak. 193: 117. 1991; Rau in Sharma *et al.*, Fl. India 1: 45. 1993.

Perennial herbs. Stems many, up to 25 cm long, decumbent or ascending. Radical leaves oblong-elliptic, bipinnate; leaflets 3-6 pairs and a terminal one, deeply cut, rounded. Flowers solitary, up to 2.5 cm across. Sepals 5, green or purple. Petals 6-10, white, usually truncate at the apex prominently veined. Achenes globose, rugose.

Fl. & Fr. : May July.

Included after Rau (*loc. cit.*).

2. ***Callianthemum anemonoides*** (J. Zahlbr.) Endl. ex Heynh, Nomen. Bot. 2: 106. 1846; Rau in Sharma *et al.*, Fl. India 1: 45. 1993. *Ranunculus anemonoides* J. Zahlbr. in Flora 6: 220. 1823. *Callianthemum rutifolium auct. non* C.A. Mey.; Rao in Bull. Bot. Surv. India 2: 393. 1960.

Acaulescent herbs. Leaves from the crown of rootstock. Basal leaves subtriangular, bipinnate; lobes dissected into linear-oblong segments; petioles up to 30 cm long; cauline leaves similar but sessile; uppermost almost similar to bracts. Flowers solitary, terminating the scape. Petals pink to white, with orange nectaries. Achenes in globose clusters, strongly veined, very shortly beaked.

Fl. & Fr. : April July.

Selected specimens : Kungwatan, 3000 m, T.A. Rao 9282 (BSD).

3. ***Callianthemum pimpinelloides*** (D. Don ex Royle) Hook.f. & Thomson, Fl. Ind. 26. 1855; Sharma & Jamwal, Fl. Upper Liddar valleys. 4: 74. 1988; Riedl in Fl. Pak. 193: 117. 1991; Rau in Sharma *et al.*, Fl.

India 1: 46. 1993. *Ranunculus pimpinelloides* D. Don ex Royle, Illus. Bot. Himal 53. 1834. *Callianthemum cachemirianum* Cambess. in Jacquem., Voy. Bot. 4: 5. t. 3. 1844; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 14. 1872; Blatter, Beaut. Fls. Kashmir 25. 1927.

Perennial, caespitose herbs. Leaves broadly ovate or triangular, bipinnate; leaflets with obovate-acuminate lobes; petiole much exceeding the lamina, with a wide, membranous, triangular sheath. Flowers solitary, up to 3 cm across. Sepals 5, elliptic, obtuse. Petals white-pink, usually pointed at apex, nearly double the length of sepals, with a nectariferous pit at the base inside. Achenes ovoid, rugulose.

Fl. & Fr. : May July.

In moist, open situations in the vicinity of water.

Selected specimens : Pissughati, 4000 m, T.A. Rao 9725 (BSD); Jai hills, 2800 m, T.A. Rao 9114 (BSD); Jhelum valley, Nagmarg, 8-9000', Keshavanand 1190 (DD); Gurais, valley, Tilail nala, Kalobal, Inayat 25450 (DD).

8. CALTHA L.

Caltha palustris L., Sp. Pl. 558. 1753; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 21.1872; Riedl in Fl. Pak, 193: 24. 1991; Rau in Sharma *et al.*, Fl. India 1: 47. 1993. *C. govaniensis* Wallich ex Royle, Illus. Bot. Himal. 54. 1834. *Ba-Patar* (Kashmiri).

Perennial herbs, up to 80 cm high. Stems hollow, robust, branched. Leaves reniform, deeply cordate at base, crenate-dentate, obtuse, glabrous; basal ones long petioled; cauline short petioled or sessile. Flowers yellow or white, solitary or few. Sepals 5-8, oblong-ovate or elliptic. Follicles elongate-oblong, flattened, transversely ridged.

Fl. & Fr. : May September

1a. Flowers white

...1.1. var. *alba*

1b. Flowers yellow

...1.2. var. *palustris*

1.1. var. alba (Cambess.) Hook.f. & Thomson, Fl. Ind. 40. 1855 *et in* Hook.f., Fl. Brit. India 1: 21. 1872; Blatter, Beaut. Fls. Kashmir 18. 1927; Sharma & Jamwal, Fl. Upper Liddar valleys 1: 48. 1988; Rau in Sharma *et al.*, Fl. India 1: 47. 1993. *C. alba* Cambess. in Jacquem., Voy. Bot. 6. t. 4. 1844. *Traker*.

Fl. & Fr. : May August.

On moist, boulder strewn slopes near water.

Selected specimens : Zojila, 5500 m, *Bhattacharyya* 71231 (BSD); Synthan pass. 3500 m, *Vohra & Naithani* 83092 (BSD); on way to Gulmarg, *R.R. Rao & Kumar* 81626 (BSD); Dachigam Games Sanctuary, *Wadhwa* 66815 (BSD); Thajwas, 2800 m, *Rau* 50221 (BSD); Kajnag range, 2800-3500 m. *Duthie* 11075 (DD); Gulmarg, *Thapliyal* 26439 (DD); Panjla, Kamraj Dn, 6000', *Keshavanand* 888 (DD).

Note : Treated as separate species *C. alba* Cambess. by many workers.

1.2. var. palustris

On moist, boulder strewn slopes.

Selected specimens : Kashmir Valley, Gurez-Burzil nala *Wadhwa* 83919 (BSD) as *C. govaniiana* Wallich.

9. CERATOCEPHALA Moench

- 1a. Beak of achenes broadly falcate with empty
pouches far apart ...1. *C. falcata*
- 1b. Beak of achenes narrow, straight with empty
pouches close together ...2. *C. testiculata*

1. Ceratocephala falcata (L.) Pers., Syn. Pl. 1: 341. 1805; Kaul, Weed Fl. Kashmir valley 28. 1986; Riedl. in Fl. Pak. 193: 156. 1993; Rau in Sharma *et al.*, Fl. India 1: 50. 1993. *Ranunculus falcatus* L., Sp. Pl.

556. 1753: Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 16. 1872; Blatter, Beaut. Fls. Kashmir 17. 1927.

Herbs, up to 10 cm high. Leaves radical, palmately tripartite, with 2-3 entire or lobulate segments. Flowers yellow, solitary on scapes. Achenes many on elongated receptacle, 9-10 mm long, beaked; beak broad, falcate, with two empty pouches of cells on either side, placed far apart.

Fl. & Fr. : March May.

Selected specimens : Kishtwar, Uniyal 80275 (BSD); Falconer s.n. (DD).

2. *Ceratocephala testiculata* (Crantz) Roth, Enum. 1: 1014. 1827; Kaul, Weed Fl. Kashmir valley 27. 1986; Riedl in Fl. Pak. 193: 156. 1991; Rau in Sharma *et al.*, Fl. India 1: 50. 1993 (*Ceratocephalus*). *Ranunculus testiculatus* Crantz, Stirp. Austr. 2. 1763.

Annual herbs, up to 12 cm high, glabrescent or covered with woolly hairs. Leaves palmately trifid; segments narrow, linear, entire or 2-3-lobed. Flowers solitary, 5-10 mm across. Achenes 5-6 mm long, beaked; beak straight, long.

Fl. & Fr. : March May.

Included after Kaul (*loc. cit.*).

10. CIMICIFUGA L.

Cimicifuga foetida L., Syst. Nat. ed. 12: 659. 1767; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 30. 1872; Riedl in Fl. Pak. 193: 5. 1991; Rau in Sharma *et al.*, Fl. India 1: 51. 1993. **Fig. 55**

Perennial herbs, up to 2 m tall. Stems simple or branched. Leaves up to 25 cm long, ternately compound; leaflets broadly ovate-lanceolate, serrate-dentate. Flowers crowded in racemes. Sepals petaloid, obovate, concave. Petals bifid, with 2 rounded lobes at apex. Follicles oblong, flat, with curved beak.

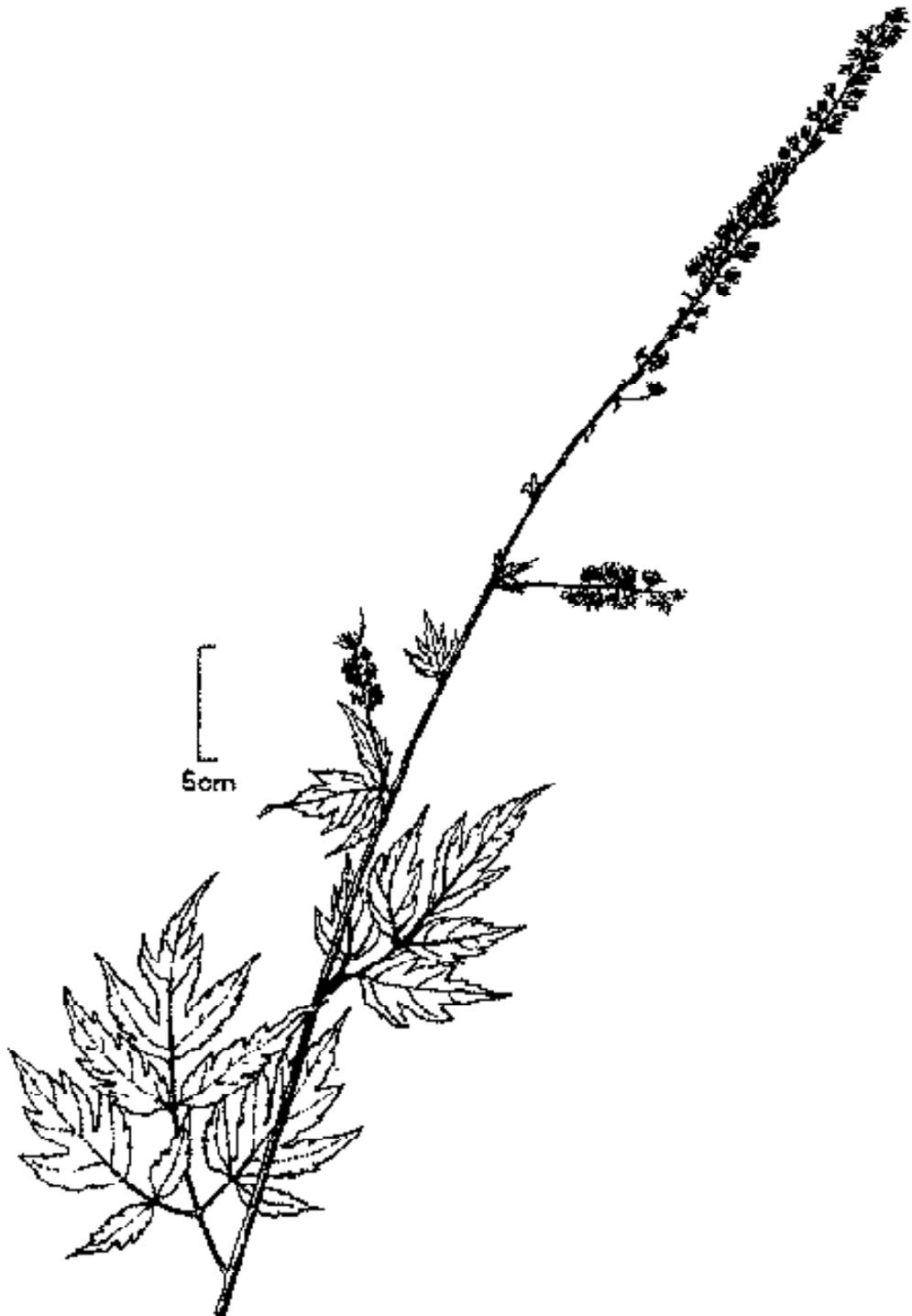


Fig. 55. *Clmificuga foetida* L.

Fl. & Fr. : August - September.

On grassy slopes.

Selected specimens : Sauziea-Gagriea, Vohra & Naithani 78362 (BSD); above Gulmarg, 2800 m, Rau 50280 (BSD); Banihal/upper munda, 2350-3835 m., T.A. Rao 7658 (BSD); Near Khillanmarg, ca 3300 m, Vaid 117539 (DD); Liddar valley, Ichnar nala, Inayat 25449 (DD).

11. CLEMATIS L.

- 1a. Lateral leaflets very small; terminal much longer ...1. *C. asplenifolia*
- 1b. Leaflets nearly equal :
 - 2a. Leaves fasciated at nodes :
 - 3a. Anthers densely bearded on back ...2. *C. barbellata*
 - 3b. Anthers glabrous ...9. *C. montana*
 - 2b. Leaves opposite:
 - 4a. Branches with 6 ribs :
 - 5a. Leaves 3-5-foliolate ...6. *C. grata*
 - 5b. Leaves bipinnately or ternately compound ...11. *C. puberula*
 - 4b. Branches more than 6-ribbed :
 - 6a. Filaments glabrous ...5. *C. gouriana*
 - 6b. Filaments hairy :
 - 7a. Petioles connate at base forming a leathery cup ...4. *C. connata*
 - 7b. Petioles not as above :
 - 8a. Branches glabrous or sparsely hairy :
 - 9a. Flowers solitary or 3-5 in an inflorescence. Sepals glabrous along inner margins ...7. *C. graveolens*
 - 9b. Flowers 5-many in a panicle. Sepals pubescent along inner margins :
 - 10a. Leaflets long acuminate. Filaments 2-3 times as long as anther ...8. *C. ladakhiana*

- 10b. Leaflets obtuse or acute;
filaments less than 2 times
as long as anthers ...10. *C. orientalis*
- 8b. Branches densely villous :
- 11a. Flowers solitary, axillary, on long
pedicels or terminal at the end of
branches ...12. *C. tangutica*
- 11b. Flowers 3-many in panicles ...3. *C. buchananiana*

1. ***Clematis aspleniifolia*** Schrenk, Enum. Pl. Nov. 2: 68. 1842;
Riedl in Fl. Pak. 193: 92. 1991.

Shrubs. Leaves somewhat coriaceous; lower broadly lanceolate to linear-lanceolate, entire, serrate-dentate or deeply incised; upper leaves pinnate; lateral leaflets smaller than the terminal, entire or dentate near apex; terminal leaflet deeply incised-dentate. Flowers in panicles. Sepals whitish, pubescent along margins. Filaments glabrous. Styles plumose.

Fl. & Fr. : April May.

Selected specimens : Gilgit, G.M. Giles 608 (CAL).

2. ***Clematis barbellata*** Edgew. in Trans. Linn. Soc. 20: 25. 1846;
Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 3. 1872; Riedl in Fl.
Pak. 193: 95. 1991; Rau in Sharma *et al.*, Fl. India 1: 59. 1993.

Woody climbers. Branches terete, glabrous or sparsely hairy. Leaves fascicled at nodes, 3-foliolate; leaflets ovate or ovate-lanceolate, lobed, incised-dentate or serrate, shortly stalked; terminal larger, up to 8.5 x 4.5 cm; laterals ca 6 x 4 cm. Flowers on axillary, long pedicels. Sepals dark red or dull purple, up to 30 x 8 mm, margined, velvety hairy on both the sides. Filaments bearded. Achenes broadly ovate, compressed, glabrous, with up to 5 cm long feathery tails.

Fl. & Fr. : April August.

On shady slopes.

Selected specimens : Hamal forest, *Keshavanand* 147 (DD).
vegetative.

3. Clematis buchananiana DC., Syst. Nat. 1: 140. 1817; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 6. 1872; Blatter, Beaut. Fls. Kashmir 1: 3. 1927; Riedl in Fl. Pak. 193: 89. 1991; Rau in Sharma *et al.*, Fl. India 1: 60. 1993. *C. buchananiana* DC. vars. *rugosa*, *tortuosa* and *vitifolia* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 6. 1872.

Shrubby climbers. Branches sulcate, hairy. Leaves pinnate; leaflets ovate-lanceolate, suborbicular, 3-7, ca 9 x 6.5 cm, obtuse-subacute, dentate-serrate to incised dentate or lobed, pubescent above, densely hoary especially on nerves beneath. Flowers white or creamy, in axillary panicles, 4-6 cm across. Sepals 25 x 6 mm, ribbed, recurved at tips, densely silky outside. Filaments hairy. Achenes densely hairy, tailed.

Fl. & Fr. : September - December.

Selected specimens : Udhampur, Patni top, *Swami* 1019 (BSD).

4. Clematis connata DC., Prodr. 1: 4. 1824; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 6. 1872; Blatter, Beaut. Fls. Kashmir 4. 1927. Singh & Kachroo, For. Fl. Srinagar 161. 1976; Riedl in Fl. Pak. 193: 91. 1991; Rau in Sharma *et al.*, Fl. India 1: 61. f. 11. 1993. var. *connata*. *Birdi* (Kashmiri).

Woody climbers, climbing by means of petioles. Branches glabrous, sulcate. Leaves pinnate; leaflets 3-7, broadly ovate, up to 12 x 9 cm; opposite petioles connate into a leathery ring. Flowers creamy or white, in panicles, showy. Sepals up to 20 x 9 mm, felted on both the sides. Filaments hairy. Achenes hairy, with plumose tails.

Fl. & Fr. : July - October.

Selected specimens : Poonch, Loran, 2000 m, *Vohra & Naithani* 78306 (BSD); Pir pass, Banihal ridge, *T.A. Rao* 7695 (BSD); Patni Top, Sanasar, 2300-2500 m, *T.A. Rao* 7418; Dachigam sanctuary, *Wadhwa* 66878; Kodara, *Wadhwa* 84108 (BSD).

5. Clematis gouriana Roxb. ex DC., Syst. Nat. 1: 138. 1817; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 4. 1872; Blatter, Beaut. Fls. Kashmir 2. 1927; Sharma & Kachroo, Fl. Jammu, 1: 87. 1981; Riedl in Fl. Pak. 193: 86. 1991; Rau in Sharma *et al.*, Fl. India 1: 64. 1993. *Totul.*

Tall climbers. Stems and branches ribbed, pubescent when young. Leaves pinnate or bipinnate; leaflets ovate-oblong or lanceolate, up to 8 x 3.5 cm, acute or acuminate, entire or with few teeth near apex. Flowers greenish white or yellowish in axillary or terminal panicles, up to 1.5 cm across. Filaments glabrous. Achenes densely hairy, with *ca* 5 cm long, feathery tail.

Fl. & Fr. : Major part of the year.

Climbing over a variety of shrubs and trees in the lower heights.

Selected specimens : Painal, Hajra 82368 (BSD); Around Katra, Uniyal 86721 (BSD); Udhampur, Swami 958 (BSD).

6. Clematis grata Wallich, Pl. Asiat. Rar. 1: 83. t. 98. 1830; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1:3. 1872; Blatter, Beaut. Fls. Kashmir 1. 1927; Singh & Kachroo, For. Fl. Srinagar 161. 1976; Riedl in Fl. Pak. 193: 88. 1991; Rau in Sharma *et al.*, Fl. India 1: 65. 1993. *Khari Kul, Birdi* (Kashmiri).

Shrubby climbers. Stems and branches deeply furrowed. Leaves pinnate; leaflets usually 5, ovate or ovate-lanceolate, up to 8 x 3 cm, thin, irregularly toothed at margins, often deeply 3-lobed, tomentose beneath. Flowers creamy, in large, leafy panicles, 1.5-2 cm across, fragrant. Sepals silky outside, distinctly nerved within. Filaments glabrous. Achenes ovate, compressed, densely hairy.

Fl. & Fr. : June - September.

Climbing over *Indigofera*, *Morus*, *Pyrus*, etc.

Selected specimens : Around Vaishno Devi, *Uniyal* 77427 (BSD); Bhadarwah-Kailash, *Vohra & Naithani* 82826 (BSD); Dachigam Sanctuary, ca 1800 m, *Wadhwa* 66770 (BSD); Laribal Hatchery area, *T.A. Rao* 63501; Jammu/Kud, 1650 m, *T.A. Rao* 7301 (BSD). Jhelum Valley, on banks of Athwattu nala, 6000-7000', *Keshavanand* 1384 (DD).

7. Clematis graveolens Lindley in J. Hort. Soc. 1: 307. 1846; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 4. 1872; Blatter, Beaut. Fls. Kashmir 3. 1927. Sharma & Kachroo, Fl. Jammu 1: 88. 1981; Riedl in Fl. Pak. 193: 92. 1991; Rau in Sharma *et al.*, Fl. India 1: 65. 1993.

Slender, much branched, climbers. Leaves pinnately or ternately decomposed; leaflets narrowly ovate, thin, incised or 3-lobed. Flowers in panicles or solitary, pale yellow, on up to 14 cm long peduncles, 3-5 cm across. Sepals, spreading, 2 x 1 cm, hairy along margins. Filaments hairy. Achenes ovoid, hairy.

Fl. & Fr. : July - October

Climbing over species of *Rhamnus*, *Ziziphus* and other bushes.

Selected specimens : Batote, Udhampur, 1200-1800 m, *Bhattacharyya* 41272 (BSD); on way to Rajouri, 1200-1500 m, *Vohra & Naithani* 78249 (BSD); Ladakh, Mulbekh, 3110 m, *Wadhwa* 58907 (BSD); Banganga-Adkumari, *Uniyal* 86678 (BSD).

8. Clematis ladakhiana Grey-Wilson in Kew Bull. 44: 49. ff. 4D-F. 1989; Rau in Sharma *et al.*, Fl. India 1: 68. 1993. *C. orientalis* var. *acutifolia* Hook.f. & Thomson, Fl. Ind. 9. 1855 *et* in Hook.f., Fl. Brit. India 1: 5. 1872. *C. orientalis* L. var. *longicaudata sensu* Mukherjee in Bull. Bot. Surv. India 1: 139. 1959, *non* Ledeb.

Climbing or straggling shrubs. Stems tinged with purplish brown. Leaves pinnate; leaflets 5-7, narrow lanceolate, up to 9 x 2 cm, entire or 1-2-lobed in the lower part, glabrous or subglabrous. Flowers yellow, often purplish tinged or spotted axillary. Bracts resembling the leaves. Sepals

15-25 x 4-10 mm, narrow lanceolate, elliptic, pubescent along margins, densely pubescent within. Styles up to 40 mm long in fruit.

Fl. & Fr. : July September.

Included after Grey Wilson (*loc. cit.*).

9. Clematis montana Buch.-Ham. ex DC., Syst. Nat. 1: 164. 1817; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 2. 1872; Blatter, Beaut. Fls. Kashmir 3. 1927; Sharma & Jamwal, Fl. Upper Liddar valleys. 1: 54. 1988; Rau in Sharma *et al.*, Fl. India 1: 69, f. 12. 1993. *Ridhballi* (Dogri).

Woody climbers. Branches terete. Leaves fasciated at nodes, ternate; leaflets ovate, oblong-elliptic to lanceolate, up to 9 x 4 cm, acute, coarsely toothed, sparsely hairy, more so on the nerves beneath. Flowers white or creamy, solitary or fasciated (2-3) in the axils, up to 8 cm across, showy. Sepals 4, ca 4 x 2.5 cm, elliptic, usually hairy outside, glabrous within. Filaments glabrous. Achenes obliquely ovate, glabrous or sparsely hairy.

Fl. & Fr. : April September.

Selected specimens : Sanasar, 2500m, T.A. Rao 9158 (BSD); R.R. Rao & Kumar 83540 (BSD); Udhampur, Sudh Mahadev, Swami 1979 (BSD); Harwan stream, ca 1800 m, Gammie s.n. (DD); Tawi valley, Keshavanand 13 (DD).

10. Clematis orientalis L., Sp. Pl. 543. 1753; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1:5. 1872; Blatter, Beaut. Fls. Kashmir 2. 1927; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 178. 1983; Grey-Wilson in Kew Bull. 44: 36.f. 2. 1989; Rau in Sharma *et al.*, Fl. India 1: 72. 1993. *Clematis orientalis* L. var. *obtusifolia* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 5. 1872. *Veechoo, Tiktima, Yamongnakpo.*

Climbers with slender, glabrous or pubescent branches. Leaves pinnate or bipinnate; leaflets up to 9, variable in shape, entire, 2-3-lobed or cleft

almost to the base, glabrous or sparsely pilose. Flowers in axillary or terminal cymes, 3-many. Bracts ovate, oblong or elliptic, entire or 2-3-lobed. Sepals 4, yellow or greenish yellow, up to 15 x 7.5 mm, oblong, ovate or elliptic, tomentose along margins, silky. Filaments hairy. Achenes pubescent.

Fl. & Fr. : July - September.

In shady, moist, valleys, rocky places climbing on *Hippophae* and *Myricaria* species.

1a. Sepals pubescent to glabrescent outside.

Leaves and stems pubescent ...10.2. var. *orientalis*

1b. Sepals glabrous outside except margins. Leaves and stems \pm glabrous :

2a. Leaflets almost as broad as long with obtuse or subobtuse lobes

...10.1. var. *latifolia*

2b. Leaflets atleast twice as broad with acute lobes

...10.3. var. *tenuifolia*

10.1. var. *latifolia* Hook.f. & Thomson, Fl. Ind. 9. 1855 *et in* Hook.f., Fl. Brit. India 1: 5. 1872; Grey-Wilson in Kew Bull 44: 73. 1989; Rau in Sharma *et al.*, Fl. India 1: 73. 1993.

Included after Rau (*loc. cit.*).

10.2. var. *orientalis*

Selected specimens : Upshi, 3600 m, *Bhattacharyya* 41057 (BSD); Phyang, 3500 m, *Vishwanathan* 54605 (BSD).

10.3. var. *tenuifolia* (Royle) Grey-Wilson in Kew Bull. 44: 42. 1989; Rau in Sharma *et al.*, Fl. India 1: 74. 1993. *C. tenuifolia* Royle, Illus. Bot. Himal. 51. 1834.

Included after Rau (*loc. cit.*).

11. *Clematis puberula* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 4. 1872; Kapur & Sarin, Fl. Trikuta Hills 73. 1990; Rau in Sharma *et al.*, Fl. India 1: 74. 1993.

Slender climbers. Stems deeply grooved, downy. Leaves pinnate or bipinnate, up to 20.5 cm long; leaflets ovate or ovate-lanceolate, entire or few-toothed, chartaceous. Flowers up to 2.8 cm across. Sepals 4-5, oblong-oblongate, acute, sericeously villous outside, glabrous inside. Filaments glabrous; connective not produced. Achenes compressed, silky.

Fl. & Fr. : September - December.

Included after Kapur & Sarin (*loc. cit.*).

12. *Clematis tangutica* (Maxim.) Korsch in Bull. Acad. Sci. Petersb. 9: 399, 575. 1898; Grey-Wilson in Kew Bull. 44: 53. 1989; Rau in Sharma *et al.*, Fl. India 1: 77. 1993. *Clematis orientalis* L. var. *tangutica* Maxim., Fl. Tangut. 113. 1889.

Decumbent, climbing or rarely erect shrubs. Branches angularly costate, pubescent. Leaves pinnatisect; leaflets 5-7, ovate, ovate-lanceolate or narrow elliptic, up to 5.5 x 1.5 cm, serrate, incised or toothed, sparsely pubescent above, glabrous or pubescent beneath. Flowers light yellow, tinged with brown or purplish brown outside, usually solitary, terminal or at nodes, nodding, long pedicelled. Sepals up to 3.4 x 1.6 cm, elliptic-lanceolate to oblong, silky pubescent outside, glabrous within. Filaments ciliate in lower half. Achenes pubescent.

Fl. & Fr. : July - August.

Included after Rau (*loc. cit.*).

Recently Chaurasia *et al.*, (1999) recorded *Clematis tibetana* Kuntze (*Zakzie*) from Ladakh region.

12. CONSOLIDA (DC.) S.F. Gray

1a. Bracteoles usually below the middle of the pedicel.

Sepals 12 mm long or more; spur more than
12 mm long

...1. *C. ambigua*

1b. Bracteoles usually above the middle of the pedicel.

Sepals less than 12 mm long; spur less than 11 mm long :

2a. Spur 9-11 mm long. Follicles 15 mm or more

long, strigose ...2. *C. orientalis*

2b. Spur up to 7 mm long. Follicles ca 10 mm long,

densley hairy ...3. *C. schlagintweitii*

1. *Consolida ambigua* (L.) Bail & Heywood in Fedde, Repert. Spec. Nov. 66: 151. 1962; Riedl in Fl. Pak. 193: 64. 1991; Rau in Sharma *et al.*, Fl. India 1: 81. 1993. *Delphinium ambiguum* L., Sp. Pl. ed. 2, 749. 1762.

Herbs, up to 1 m tall, pubescent above. Stems branched above. Basal leaves ovate, up to 5 x 4 cm, divided into linear-lanceolate, mucronate, 1-2 mm wide segments; cauline leaves gradually reduced upwards; upper ones sessile. Flowers blue, rosy or white, in panicles, up to 2.5 cm across. Bracteoles 2, below the middle of the pedicel. Upper sepal ovate, obtuse, spurred; spur ca 1.5 cm long. Petals 3-lobed; central lobe with 2 short lobules. Filaments abruptly dilated at base. Follicles cylindrical, pubescent. Seeds with transverse rows of scales.

Fl. & Fr. : March April.

Included after Rau (*loc. cit.*).

2. *Consolida orientalis* (Gay) Schroed., Abh. Zool.-Bot. Ges. Wien 4(5): 25. 1909; Riedl in Fl. Pak. 193: 67. 1991; Rau in Sharma *et al.*, Fl. India 1: 82. 1993. *Delphinium orientale* Gay in Desm. Cat. Dordogne 12. 1840.

Herbs, up to 1 m tall; stems retrose strigose below, crisped pubescent above with some gland tipped and some basally swollen hairs. Leaves crowded, multifid; segments linear-lanceolate-oblong, 1-2.5 mm wide, ciliolate. Flowers dark purple, pink or white. Bracteoles 2, near the apex of the pedicel. Sepals spurred, ca 1 cm long. Petals 3-lobed; central lobe bilobed. Filaments dilated at base. Follicles oblong-cylindric, strigose. Seeds obpyramidal with transverse rows of scales.

Fl. & Fr. : May September.

Included after Rau (*loc. cit.*).

3. *Consolida schlagintweitii* (Huth) Munz in J. Arn. Arb. 48: 191.f. 4C. 1967; Riedl in Fl. Pak. 193: 67. 1991; Rau in Sharma *et al.*, Fl. India 1: 82. 1993. *Delphinium schlagintweitii* Huth in Bull. Herb. Boiss. 1: 329. 1893.

Herbs, up to 1 m tall. Stems branched, glabrescent below, pubescent above, some hairs with swollen, yellow base. Cauline leaves sessile, multipartite; segments linear, 10-30 x 0.5-1.5 mm, strigulose. Flowers in racemes. Bracteoles 2, placed near the top of the pedicel. Sepals deep violet, spurred; spur 6-7 mm long. Petals 3-lobed. Follicles oblong, somewhat flattened, densely hairy.

Fl. & Fr. : July August.

Included after Rau (*loc. cit.*).

13. DELPHINIUM L.

- 1a. Flowers crowded in dense racemes. Pedicels up to 1 cm long. Sepals ca 1 cm long :
- 2a. Pedicels with spreading hairs. Spur hooked at the tip ...7. *D. uncinatum*
- 2b. Pedicels with appressed hairs. Spur not hooked :
- 3a. Upper sepal 6-9 mm long, bearded. Spur 5-7 mm long ...4. *D. kohatense*
- 3b. Upper sepal 10-13 mm long, glabrous; spur 14-16 mm long ...6. *D. roylei*
- 1b. Flowers in lax racemes. Pedicels longer than 1 cm. Sepals more than 10 mm long :
- 4a. Plants usually densely hairy. Sepals veiny, dry and papery with age; spur thick :
- 5a. Upper sepal 15-20 mm long ...8. *D. vestitum*
- 5b. Upper sepal more than 20 mm long :

- 6a. Plants glandular pubescent above. Bracteoles near to the flowers on the pedicel ...1. *D. brunonianum*
- 6b. Plants not glandular pubescent above. Bracteoles placed away from the flower ...2. *D. cashmerianum*
- 4b. Plants less hairy. Sepals not so veiny and papery, caducous; spur slender :
- 7a. Flowers several in inflorescence. Sepals 12-15 mm long. Upper petals bluish-whitish ...3. *D. denudatum*
- 7b. Flowers mostly solitary. Sepals 15-25 mm long. Upper petals almost black ...5. *D. pyramidale*

1. ***Delphinium brunonianum*** Royle, *Illus. Bot. Himal.* 56, 1834; Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 27, 1872; Riedl in *Fl. Pak.* 193: 56, 1991; Rau in Sharma *et al.*, *Fl. India* 1: 86, 1993. *Chargosposz.* Fig. 56

Perennial herbs, up to 1 m tall. stems glabrous to softly pubescent below, glandular pubescent above. Leaves somewhat reniform, 3-8 cm broad, hairy, 5-fid to the middle; lobes crenate or dentate incised with subobtusate teeth or short lobes. Flowers in corymbs or racemes. Bracteoles near flowers. Sepals blue, veined, membranous pubescent; upper sepal 20-30 mm long and as broad; spur 12-15 mm long, almost straight. Petals dark blue or black, white at tip. Follicles 4-5 (-7), pubescent. Seeds winged at angles.

Fl. & Fr. : July - September

On rocky slopes.

Selected specimens : Ladakh, Below Khardungla, Hajra 74125 (BSD); Khardungla, on way, *Bhattacharyya* 71578; Singola, 4900 m, *Bhattacharyya* 52140; Thanglong, 5000 m, *Bhattacharyya* 41028 (BSD); on way to Changla, *Chowdhery & Uniyal* 86153 (BSD); Manjkeo (Hemis N.P.), Ladakh, *S.K. Srivastava & Chauhan* 100983 (BSD); Liddar valley, 13-14000, Duthie 13370 (DD); above Bragnag, 15000', *Koeltz* 2804 (DD).

Note : Roots used as incense in Gompas of Lahul (Kapahi in *J. Econ. Tax. Bot.* 14: 5.1.1990).

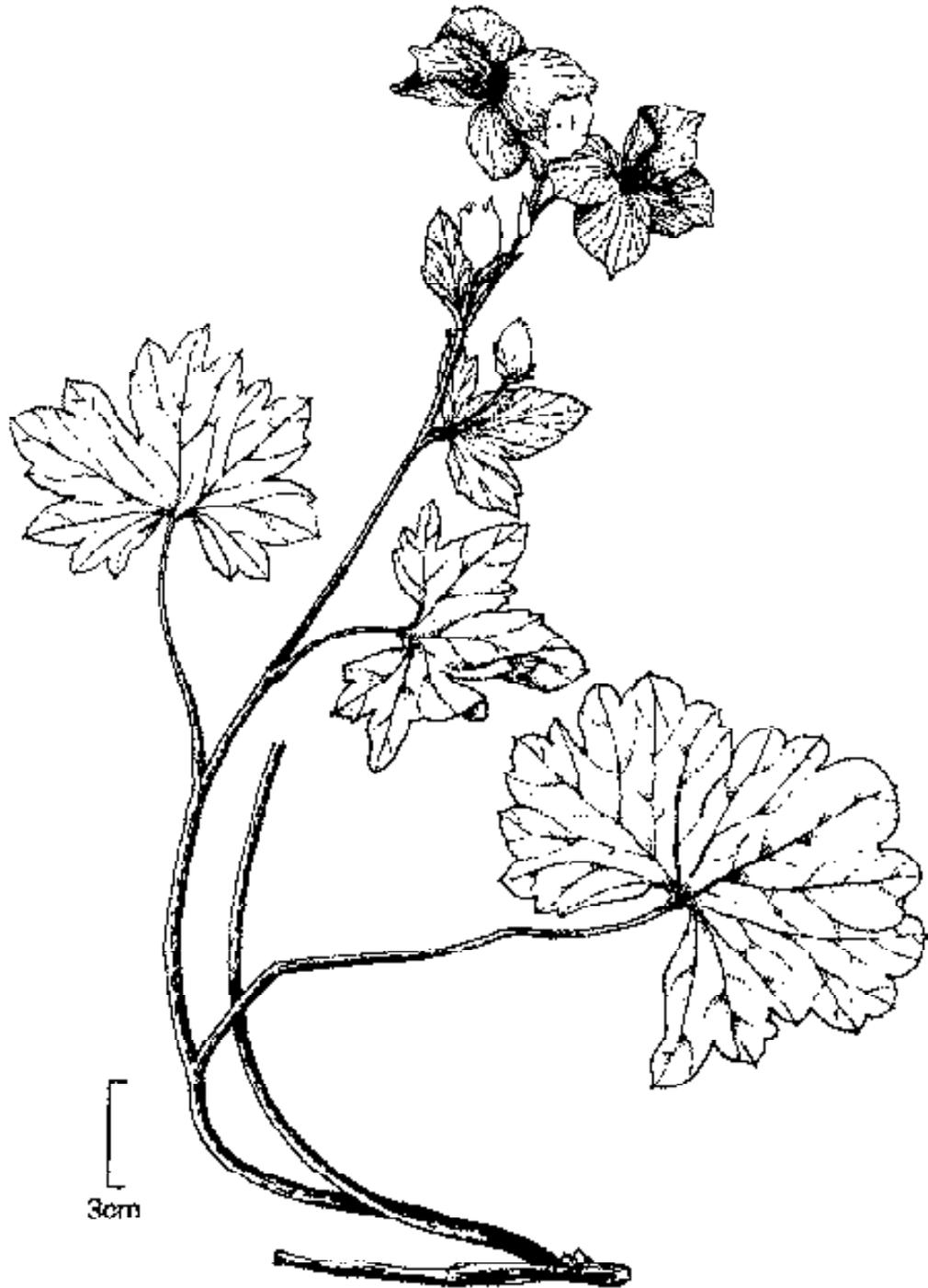


Fig. 56. *Delphinium brunonianum* Royle

2. **Delphinium cashmerianum** Royle, *Illus. Bot. Himal.* 55. 1834; Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 26. 1872; Blatter, *Beaut. Fls. Kashmir* 21. 1927; Riedl in *Fl. Pak.* 193: 53. 1991; Rau in Sharma *et al.*, *Fl. India* 1: 89. 1995. *Lunde-Kaown, Himalayan Larkspur.*

Slender, perennial herbs, up to 50 cm high. Stems subglabrous or strigosely hairy. Leaves reniform-pentagonal, 2-10 cm across, palmately 5-7-lobed; lobes lobulate or few toothed. Flowers in corymbs or panicles. Lower bracts foliose and divided; upper entire; bracteoles usually at a distance from flower. Sepals bluish purple, pubescent, reticulate-veined; upper sepal 20-30 x 12-15 mm; spur conical, straight, 12-15 mm long. Petals light-purple-dark blue. Follicles 3-7, hairy. Seeds covered with horizontal row of scales.

Fl. & Fr. : July September.

Selected specimens : Chandanwadi, 2900 m, *Nair* 36926 (BSD); near Amarnath cave, 3700 m, *Rau* 50319 (BSD); Ladakh, Dras, *Chowdhery & Uniyal* 85777 (BSD); Kashmir valley, Pissu ghati, 3182 m, *Vaid* 11733 (DD); Sarbal, below Harmukh, 3500-4000 m, *Keshavanand* 1363 (DD).

3. **Delphinium denudatum** Wallich ex Hook.f. & Thomson, *Fl. Ind.* 49. 1855 *et in* Hook.f., *Fl. Brit. India* 1: 25. 1872; Blatter, *Beaut. Fls. Kashmir* 22. 1927; Riedl in *Fl. Pak.* 193: 58. 1991; Rau in Sharma *et al.*, *Fl. India* 1: 90. 1993. *Karipait, Nirbisi.*

Perennial herbs, up to 80 cm high, much branched, subglabrous-strigosely pubescent in the upper part. Leaves suborbicular, 5-15 mm across, 3-5 partite; segments laciniate into oblong lobes or teeth; cauline leaves similar but smaller. Flowers in panicles, few. Bracts linear; bracteoles placed near the middle of pedicel. Sepals blue or violet; upper sepal 12-13 x 6-7 mm, pubescent; spur 14-15 mm long. Upper petal white, bluish at apex; lower petal blue or violet. Follicles 3, sparsely strigose or subglabrous. Seeds with irregularly arranged rows of scales.

Fl. & Fr. : April September.

In open, moist places.

Selected specimens : Gund, 2300 m, T.A. Rao 9577 (BSD); Udhampur dist, Hathimatha, Swami 1234 (BSD); Gool, ca 1800 m, Kumar 81388 (BSD); Kishanganga valley, 1800-2200 m, Keshavanand 222 (DD).

4. *Delphinium kohatense* (Bruehl) Munz in J. Arb. Arb. 48: 280.f. 4A 1967; Riedl in Fl. Pak. 193: 50. 1991; Rau in Sharma *et al.*, Fl. India 1: 94. 1993. *Delphinium saniculifolium* Boiss. var. *kohatense* Bruehl in Ann. Roy. Bot. Gard. Calcutta 5: 95. t. 117. ff 1-2. 1896.

Perennial herbs, up to 50 cm high. Roots tuberous. Stems sparsely strigulose, densely so in the inflorescence. Leaves 2-4 cm across, subglabrous to strigulose, trifid; segments cuneate; the laterals deeply divided with 5 subequal, pinnately lobulate or toothed lobes; cauline leaves few, reduced. Flowers in racemes. Bracts linear; bracteoles placed near the base of pedicel. Sepals pale blue; upper 6-9 x 3 mm, strigulose; spur cylindric, 5-7 mm long, obtuse. Petals bearded. Follicles 3, pubescent near apex.

Fl. & Fr. : July August.

Included after Rau (*loc. cit.*).

5. *Delphinium pyramidale* Royle, Illus. Bot. Himal. 56. 1834; Riedl in Fl. Pak. 193: 57. 1991; Rau in Sharma *et al.*, Fl. India 1: 98. 1993. *Delphinium elatum* L. var. *ranunculifolium* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 26. 1872.

Perennial herbs, up to 2 m tall. Stems glabrous or villous. Leaves rounded to pentagonal, up to 15 cm across, glabrous or villous along the veins beneath, 3-5 partite; segments broadly cuneate, cleft or incised, serrate; upper leaves resembling bracts. Flowers in racemes. Sepals blue or purplish, pubescent; upper ca 15 x 7 mm; spur 12-15 mm long, straight or decurved. Petals bluish black. Follicles 3, glabrous or pubescent. Seeds covered with laminate scales.

Fl. & Fr. : July September.

Selected specimens : Kashmir valley, Pharkian pass, Lolab forests, ca 3000 m, *Keshavanand* 495 (DD).

6. *Delphinium roylei* Munz in J. Arn. Arb. 48: 292. 1967; Riedl in Fl. Pak. 193: 57. 1991; Rau in Sharma *et al.*, Fl. India 1: 98. 1993. *D. incanum* Royle, Illus. Bot. Himal. 55. 1834, non E.D. Clarke 1812; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 25. 1872; Blatter, Beaut. Fls. Kashmir 1: 21. 1927.

Herbs, up to 1 m tall. Roots tuberous. Stems strigulose. Leaves 5-8 cm across, palmately multipartite; segments cuneate, sharply incised; lower leaves long petioled; upper smaller, short petioled or sessile. Flowers in racemes. Bracts linear; bracteoles near the base of pedicel. Sepals dark purplish blue; upper sepal 13-14 mm long; spur longer, cylindric. Follicles 3, strigose. Seeds with rows of scales.

Fl. & Fr. : May - September.

On stony slopes.

Selected specimens : Kashmir valley, Upper munda, 2350 m, T.A. Rao 7626 (BSD); Ogra Games Sanctuary, Wadhwa, Murti & Pant 85386 (BSD); Sonamarg, Chowdhery & Uniyal 85771 (BSD); on way to Zozila, Hajra 74017 (BSD); Patalvan-Minimarg, ca 3500 m, Wadhwa 83984 (BSD); Pharkian, Lolab forest, 2000-2300 m, *Keshavanand* 491 (DD); Liddar valley, Aishmakam, Inayat 25452 (DD).

7. *Delphinium uncinatum* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 24. 1872; Balodi *et al* in J. Econ. Tax. Bot. 15(2): 452. 1991; Riedl in Fl. Pak. 193: 48. 1991; Rau in Sharma *et al.*, Fl. India 1: 101. f. 14. 1993. **Fig. 57**

Herbs, up to 90 cm high, subglabrous below, densely pubescent above. Radical leaves crowded, 3-5 partite; segments pinnately dissected. Flowers in racemes or subpaniculate. Bracts lanceolate; bracteoles linear-lanceolate. Sepals bluish-purple; upper 7-8 mm long; spur 7-10 mm long, cylindric, hooked. Follicles 3, glabrous or hairy.



Fig. 57. *Delphinium uncinatum* Hook.f. & Thomson

Fl. & Fr. : May August.

On rocky slopes.

Selected specimens : Kishtwar, *Uniyal* 80308 (BSD).

8. *Delphinium vestitum* Wallich ex Royle, *Illus. Bot. Himal.* 55. 1834; Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 26. 1872; Blatter, *Beaut. Fls. Kashmir* 21, 1927; Riedl in *Fl. Pak.* 193: 52. 1991; Rau in *Sharma et al.*, *Fl. India* 1: 101. 1993.

Herbs, up to 1 m tall. Rootstock slender. Stems with spreading, deflexed hairs. Leaves mostly radical, suborbicular-broadly reniform. 5-12 cm across, hairy on both the surfaces, 5-7-lobed; lobes deeply incised-dentate. Flowers in racemes. Bracteoles attached above the middle. Sepals purplish blue or pale-violet, hairy; upper sepal 15-20 mm long; spur straight or curved. Stamens glabrous. Follicles 3, hairy. Seeds narrowly winged, devoid of scales.

Fl. & Fr. : August October

As undergrowth in *Rhododendron campanulatum* forest.

Selected specimens : Seoj-Bhaderwah, 3000 m, *Vohra & Naithani* 83082 (BSD); Gulmarg, ca 3200 m *D.F.O.*, 113 (DD).

Buth & Navachoo (in *J. Ethnobiol.* 8(2): 185-194, 1988) recorded *Delphinium viscosum* Hook.f. & Thomson (*Bilamonokh*) from Ladakh region.

14. HALERPESTES Greene

- 1a. Leaves crenately incised. Achenes 80-130. Capitulum oblong ...1. *H. sarmentosa*
 1b. Leaves tridentate, variously lobed or deeply incised. Achenes 40-50. Capitulum roundish ...2. *H. tricuspis*

1. *Halerpestes sarmentosa* (Adams) Komarov in Komarov & Klob., *Als. Key Pl. Far. East U.S.S.R.* 1: 550. 1931; Rau in *Sharma et al.*, *Fl.*

India 1: 103. 1993. *Ranunculus sarmentosus* Adams in Mem. Soc. Nat. Mosc. 9: 244. 1834. *R. cymbalariae* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 17. 1872 *p.p.*, non Pursh.

Perennial, stoloniferous glabrous herbs. Stems creeping. Leaves oblong ovate-rounded, reniform, 3-5-lobed; petioles flat, much exceeding the lamina. Flowers yellow, solitary or 2-3 on elongated peduncle. Achenes 80-130 on oblong capitulum, obliquely obovate.

Fl. & Fr. : July September

In the vicinity of water.

Selected specimens : Ladakh, Kargil-Panikhar, Chowdhery & Uniyal 85869 (BSD); Changla, 5200 m, Bhattacharyya 71738 (BSD); Mulbekh, 3310-3850 m. Wadhwa 58879 (BSD).

2. *Halerpestes tricuspis* (Maxim.) Hand.-Mazz. in Acta Hort. Gotob. 13: 135. 1939; Rau in Sharma *et al.*, Fl. India 1: 103. 1993. *Ranunculus tricuspis* Maxim., Fl. Tangut. 12. 1889. *Ranunculus cymbalariae* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 17. 1872 *p.p.*, non Pursh. *Sercharg.*

Creeping herbs. Leaves all basal, ovate-orbicular, shallowly-deeply tripartite; lobes oblong-oblongate, obtuse, glabrous; petioles up to 2 cm long. Scapes up to 2.5 cm long, 1-flowered; flowers yellow, up to 1 cm across. Sepals narrowly ovate, spreading. Petals obovate. Achenes 40-50, obovoid, up to 1 mm long, obscurely striate.

Fl. & Fr. : May September

On sandy soil along stream bed.

Selected specimens : Ladakh, Pang (Rupshu), 4600 m, Bhattacharyya 40966 (BSD); Kurgiakh, Tangtse, Hajra 74201 (BSD).

Note : Riedl (Fl. Pak. 193: 122. 1991) reported *H. lancifolius* (Bertol.) Hand.-Mazz. from Ladakh and included *Ranunculus palifolius*

Dunn (based on specimen collected by T. Thomson from Mulra valley, 3300 m) under its synonymy. The same specimen was earlier cited by Chatterjee (J. Bombay Nat. Hist. Society 56: 670-72. 1960) under *H. tricuspis* (Maxim.) Hand.-Mazz.

15. HEPATICA Mill.

Hepatica falconeri (Thomson) Juz. in Fl. U.R.S.S. 7: 284. 1937; Rau in Sharma *et al.*, Fl. India 1: 104. 1993. *Anemone falconeri* Thomson in Hook., Icon. Pl. t. 899. 1852; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 8. 1872; Blatter, Beaut. Fls. Kashmir 7. 1927; Riedl in Fl. Pak. in 193: 76. 1991.

Perennial herbs, up to 15 cm high. Rootstock covered by fibrous remains of old leaves. Radical leaves reniform-cordate, sparingly hairy, deeply 3-partite; segments again lobed; lobes entire, incised or dentate. Scapes hairy, equalling or exceeding the radical leaves. Involucral leaves 3, close to the flower, entire or rarely 3-lobed. Flowers white, ca 1.5 cm across. Sepals 5-7. Achenes in globose heads, silky hairy.

Fl. & Fr. : April - June.

Selected specimens : Udhampur, Gool, Swami 1205 (BSD); Kashmir valley, Jhelum valley, 2000-25000 m, Keshavanand 1207 (DD); near Gulmarg, 2000-2500 m, Duthie 11221. (DD).

16. ISOPYRUM L.

- 1a. Leaves 2-ternately compound; leaflets deeply dissected. Petals tubulose ...1. *I. anemonoides*
 1b. Leaves 3-4-ternately compound; leaflets not deeply dissected. Petals flat to shortly concave or cymbiform ...2. *I. ludlowii*

1. *Isopyrum anemonoides* Kar. *et Kir.* in Bull. Soc. Nat. Mosc. 15: 135. 1842; Lauener in Notes Roy. Bot. Gard. Edinb. 28: 265. 1968; Riedl in Fl. Pak. 193: 10. 1991; Rau in Sharma *et al.*, Fl. India 1: 105.

1993. *I. thalictroides auct. non L.*; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 23, 1872.

Delicate, glabrous herbs, up to 25 cm high. Radical leaves long petioled, biternate; leaflets deeply trilobed; cauline leaves similar, subsessile. Flowers white, pale lilac inside. Sepals 5, ovate. Petals tubulose. Follicles 2-4, free, broadly ovate, compressed.

Fl. & Fr. : May June.

Included after Rau (*loc. cit.*).

2. *Isopyrum ludlowii* Tamura et Lauener in Notes Roy. Bot. Gard. Edinb. 28: 272, 1968; Rau in Sharma *et al.*, Fl. India 1: 228, 1993.

Stems up to 20 cm high, glabrous below, papillose-pilose above. Basal leaves 3-4 ternate, up to 12 cm long; leaflets oblong, obovate or flabellate, up to 2.5 x 4.5 mm, entire or 3-lobed or partite; cauline leaves 2-3-ternate. Flowers 1-3. Pedicels up to 3 cm, elongating to 6 cm. Sepals elliptic or ovate-elliptic. Petals oblong or obovate-oblong, much shorter than the sepals, bilobed at apex.

Fl. & Fr. : June July.

In rock crevices in dry situations.

Included after Tamura & Lauener (*loc. cit.*).

17. NIGELLA L.

***Nigella sativa* L.**, Sp. Pl. 753, 1762; Riedl in Fl. Pak. 193: 28, 1991; Rau in Sharma *et al.*, Fl. India 1: 108, 1993.

Annual herbs, up to 30 cm high, loosely pubescent or shortly viscid hirsute. Leaves 1-3 pinnatisect; segments linear. Flowers solitary, not involucrate. Sepals white, ovate-oblong, shortly clawed. Petals shortly stipitate. Carpels 5, equalling the stamens in length. Follicles united, forming a capsule. Seeds ovoid to triquetrous, rugulose-tuberculate.

Fl. & Fr. : January - December.

Cultivated.

18. OXYGRAPHIS Bunge

Oxygraphis endlicheri (Walp.) Bennet & Chandra in Indian For. 108: 374. 1982; Rau in Sharma *et al.*, Fl. India 1: 109. f. 16. 1993. *Callianthemum endlicheri* Walp., Rep. 1: 33. 1842. *Ranunculus polypetalus* D. Don in Royle, Illus. Bot. Himal. 54. t. 11. f.2. 1834, *non* Rafin. 1817. *Oxygraphis polypetala* (D. Don) Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 21. 1872; Riedl in Fl. Pak. 193: 118. 1991. *O. glacialis auct.* *non* Bunge; Hook.f. & Thomson, Fl. Ind. 27. 1855 *et* in Hook.f., Fl. Brit. India 1: 21. 1872.

Perennial, tufted, acaulescent herbs with fibrous roots. Leaves radical, orbicular or ovate, 5-15 mm across, crenate; petioles 3-4 cm long. Flowers yellow, solitary on scapes. Sepals 5, ovate, obtuse, conspicuously nerved, persistent in fruit. Petals 11-15, oblong-elliptic, 3-5 nerved. Achenes ribbed along outer and inner angles, beaked.

Fl. & Fr. : April - August.

On moist alpine slopes and near melting snow.

Included after Rau (*loc. cit.*).

19. PARAQUILEGIA J.R. Drumm. & Hutch.

- | | |
|----------------------|-----------------------------|
| 1a. Seeds puberulous | ...1. <i>P. anemonoides</i> |
| 1b. Seeds glabrous | ...2. <i>P. microphylla</i> |

1. Paraquilegia anemonoides (Willd.) Ulbrich in Fedde Repert. 12: 369. 1922; Riedl in Fl. Pak. 193. 11. 1991; Rau in Sharma *et al.*, Fl. India 1: 110. 1993. *Aquilegia anemonoides* Willd. in Mag. Ges. Naturf. Ser. 5. 401. t. 9. 1811. *Isopyrum grandiflorum* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 23. 1872 p.p., *non* Fisch. ex DC. *Paraquilegia grandiflora*

(Hook.f. & Thomson) J.R. Drumm. & Hutch. in Kew Bull. Misc. Inform. 1920: 156. 1920; Blatter, Beaut. Fls. Kashmir 19. 1927.

Perennial herbs. Rootstock stout, covered with remains of old petioles. Leaves biternate; leaflets tridentate or tripartite; segments linear-oblong or obovate; petioles up to 10 cm long, dilated at base, auriculate. Flowers large, showy, solitary on scapes; scape with 2 opposite bracts attached above the middle. Follicles oblong, subcompressed. Seeds puberulous.

Fl. & Fr. : July September.

On rock crevices.

Selected specimens : Ladakh, Whisky Nullah, 4200 m, *Bhattacharyya* 40916 (BSD).

2. *Paraquilegia microphylla* (Royle) Drumm. & Hutch. in Kew Bull. Misc. Inform. 1920: 157. 1920; Rau in Sharma *et al.*, Fl. India 1: 111. 1993. *Isopyrum microphyllum* Royle, Illus. Bot. Himal. Mount t. 11 f. 4. 1833 et 58. 1834. *I. grandiflorum* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1.23.1872, *p.p. non* Fisch. ex DC.

Stems caespitose, rigid, up to 15 cm long, hairy. Leaves glabrous, 2-3-ternatisect. Flowers deep blue-white, 2-3 cm across. Seeds glabrous.

Fl. & Fr. : July September.

Included after Rau (*loc. cit.*).

Note : Drummond and Hutchinson (Kew Bull. Misc. Inform. 1920: 158, 1920) described *Paraquilegia caespitosa* from Kashmir. This species has not been treated by Rau (Fl. India 1: 110-111. 1993), Riedl (Fl. Pak. *loc. cit.*) has also not included this species in his account of Ranunculaceae.

20. PULSATILLA Mill.

***Pulsatilla wallichiana* (Royle) Ulbrich** in Not. Bot. Gart. Berlin 9: 226. 1925; Riedl in Fl. Pak. 193: 83. 1991; Rau in Sharma *et al.*, Fl.

India 1: 112. 1993. *Anemone wallichiana* Royle. Illus. Bot. Himal. 52.
1834. *A. albana* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 7. 1872.

Fig. 58

Tufted, perennial herbs, up to 30 cm high. Radical leaves shorter than the scape, bipinnatisect; ultimate lobes cuneate, 3-dentate at apex. Flowers red, solitary at the end of scapes; scapes elongating after flowering. Involucral leaves connate at base, softly hairy. Sepals 5-6, erect, oblong, reflexed at tips, sericeous outside. Achenes elliptic-lanceolate, ca 4 mm long, hairy on the margins, long tailed; tails ca 2.5 cm long.

Fl. & Fr. : July August.

In open places on sandy soil.

Selected specimens : Ladakh, Parkhachik, Chowdhery & Uniyal 85954 (BSD); Pulu, ca 4000 m Wadhwa 59741 (BSD).

21. RANUNCULUS L.

1a. Aquatics :

2a. Basal leaves all submerged and dissected into capillary segments :

3a. Flowers yellow ...9. *R. flavidus*

3b. Flowers white :

4a. Nectar pit elongated ...22. *R. sphaerospermus*

4b. Nectar pit lunate :

5a. Achenes 20-40 in a head, 1.5-2 mm long ...24. *R. trichophyllus*

5b. Achenes 60-90 in a head, ca 1 mm long ...19. *R. rionii*

2b. Leaves reniform, not dissected into capillary segments

...16. *R. natans*

1b. Terrestrial or marshy herbs:

6a. Annual herbs :

7a. Achenes in oblong heads, smooth ...21. *R. sceleratus*

7b. Achenes in globose or ovoid heads, tubercled :



Fig. 58. *Pulsatilla wallichiana* (Royle) Ulbrich

- 8a. Achenes tuberculate all over ...15. *R. muricatus*
 8b. Achenes tubercled on margins only ...2. *R. arvensis*
- 6b. Perennial herbs :
- 9a. Leaves usually undivided, rarely lobed :
- 10a. Flowers large, ca 3 cm across ...13. *R. lingua*
 10b. Flowers less than 1.5 cm across ...18. *R. pulchellus*
- 9b. Leaves divided or prominently lobed :
- 11a. Achenes tubercled ...8. *R. ficariifolius*
 11b. Achenes not tubercled :
- 12a. Achenes with intramarginal rib :
- 13a. Achenes dotted ...6. *R. diffusus*
 13b. Achenes not dotted :
- 14a. Receptacle pilose ...5. *R. cantoniensis*
 14b. Receptacle glabrous ...12. *R. laetus*
- 12b. Achenes without intramarginal rib :
- 15a. Stems creeping, stoloniferous :
- 16a. Flowers densely covered
 with reddish brown
 hairs ...20. *R. rufosepalus*
 16b. Flowers not as above ...11. *R. hyperboreus*
- 15b. Stems erect or decumbent :
- 17a. Leaves flabellate ...7. *R. felixii*
 17b. Leaves variously shaped
 but not flabellate :
- 18a. Rootstock slender
 or small, not fibrous :
- 19a. Flaccid herbs
 ...1. *R. adoxifolius*
 19b. Mat forming,
 non flaccid
 herbs ...4. *R. brotherusii*
- 18b. Rootstock tuberous
 or densely fibrous:
- 20a. Carpels sparingly
 hairy to densely
 pubescent :

- 21a. Radical leaves deeply cut, laciniate ...3. *R. ancheri*
 21b. Radical leaves broad, rotund, reniform or
 palmatipartite :
 22a. Lobes of radical leaves crenate or
 coarsely toothed. Achenes hairy or
 glabrescent at a later stage ...10. *R. hirtellus*
 22b. Lobes of radical leaves lanceolate,
 entire; Achenes glabrous ...17. *R. palmatifidus*
 20b. Carpels glabrous :
 23a. Leaves obliquely truncate at base. Flowers
 24-30 mm across ...23. *R. stewartii*
 23b. Leaves cordate or subcordate at base,
 reniform. Flowers up to 18 mm across ...14. *R. munroanus*

Note : The aquatic species are often treated under a separate genus *Batrachium*.

1. *Ranunculus adoxifolius* Hand.-Mazz. in Acta Hort. Gotob. 13: 152. 1939; Naithani & Aswal in Indian J. Bot. 7: 75. ff. AB 1984; Rau in Sharma *et al.*, Fl. India 1: 115. 1993. *R. affinis auct. non R. Br.*; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 18. 1872.

Perennial, subcaespitose, slender, flaccid, ascending herbs, up to 20 cm high. Basal leaves up to 2.5 cm long, ovate-cordate to suborbicular, sparsely silky puberulous; terminal leaflet broadly ovate, 3-partite; cauline leaves smaller, less divided. Flowers usually solitary, ca 1 cm across. Sepals broadly ovate, spreading. Petals yellow, up to 4.5 x 3.5 mm, obovate. Achenes in oblong, glabrous heads, ca 1 mm long, subglobose.

Fl. & Fr. : June - August.

Included after Naithani & Aswal (*loc. cit.*).

2. *Ranunculus arvensis* L., Sp. Pl. 780. 1753; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 20. 1872; Blatter, Beaut. Fls. Kashmir 16. 1927; Sharma & Kachroo, Fl. Jammu 1: 89. 1981; Riedl in Fl. Pak. 193: 131. 1991; Rau in Sharma *et al.*, Fl. India 1: 115. 1993. *Churmula*, *Chambul*, *Gagrkandh*.

Annual, sparsely adpressed, pilose herbs, up to 30 cm high. Lower leaves obovate-spathulate to oblanceolate, trifid, trilobed or trisect; middle cauline leaves divided into many linear, entire or toothed lobes. Flowers yellow. Sepals long hairy outside. Petals yellow, obovate. Achenes 4-8 in a whorl, obovate, compressed, hooked spiny along borders, tuberculate on the body, beaked; beak usually straight.

Fl. & Fr. : March - June.

In cultivated fields and open places.

Selected specimens : Kishtwar, *Uniyal* 80333 (BSD); Gulmarg, *T.A. Rao* 209 (BSD); Udhampur Dist., Ram Nagar, *Swami* 978 (BSD); Hills near Shankaracharya temple, *R.R. Rao & Kumar* 81667 (BSD).

3. *Ranunculus aucheri* Boiss. in *Ann. Sci. Nat.* 351. 1841; Stewart, in Nasir Ali, *Annot. Cat. Vasc. Pl. W. Pak. & Kashmir* 272. 1972; Rau in Sharma *et. al.*, *Fl. India* 1: 116. 1993.

Perennial, glabrescent or adpressed hirsute herbs, up to 30 cm high. Roots fibrous. Radical leaves ovate, trisect; segments deeply cut into linear, laciniate lobes, stalked. Flowers in divaricate corymbs or solitary. Sepals spreading, persistent. Petals broad obovate; nectarial scales conspicuous. Achenes obtusely triangular, pilose; beak unciniate.

Fl. & Fr. : May - July.

Included after Rau (*loc. cit.*).

4. *Ranunculus brotherusii* Freyn in *Bull. Herb. Boiss.* 6: 885. 1898; Dhar & Kachtoo, *Alpine Flora Kashmir Himal.* 178. 1983; Rau in Sharma *et al.*, *Fl. India* 1: 116. 1993. *R. affinis* Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 18. 1872 *p.p.*, non *R. Br. R. brotherusii* Freyn var. *latisectus* H. Riedl in *Kew Bull.* 34: 362. 1979.

Perennial herbs, up to 25 cm high. Stems glabrous or appressed white hairy. Basal leaves reniform, deeply 3-lobed or ternate; median lobe ovate,

3-lobulate; lateral lobes deeply 2-lobed; cauline leaves sessile, 2-4-partite, glabrous above, sparsely hirsute beneath. Flowers 1-2, ca 1 cm across. Sepals ovate-broadly oblong, membranous, appressed pilose. Petals yellow, obovate, tapering to a claw, silky. Achenes in a head, ca 1.5 mm long, obovoid, glabrous or hirsute, beaked.

Fl. & Fr. : July August.

Selected specimens : Ladakh, Hemis, *Hajra* 74080 (BSD); Tangise, *Viswanathan* 54797 (BSD); Ganglas, *Chowdhery & Uniyal* 86045; between Mahi and Nyoma, *Chowdhery & Uniyal* 86187 (BSD).

5. *Ranunculus cantoniensis* DC., Prodr. 1: 43. 1824; Kaul, Weed Fl. Kashmir valley 16.1986; Riedl in Fl. Pak. 193: 133. 1991; Rau in Sharma *et al.*, Fl. India 1: 117. f.17. 1993. *R. pennsylvanicus* auct., non L.f.; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 19. 1872 *p.p.* *R. riparius* Edgew. in Trans. Linn. Soc. 20: 28. 1846. *R. pennsylvanicus* L.f. subsp. *riparius* (Edgew.) H. Riedl in Kew Bull. 34(2): 364. 1979.

Perennial, erect or prostrate herbs, up to 1 m tall. Stems covered with dense, long, spreading hairs, sometimes rooting at nodes. Radical leaves ovate-broadly ovate, appressed hairy, 3-foliolate or ternatisect; segments trisect or irregularly deeply incised, long petioled; cauline leaves short petioled or sessile. Flowers solitary, up to 2.5 cm across. Sepals reflexed, densely hairy outside. Petals creamy or yellow, longer than the sepals. Achenes many, in globose or oblong heads, 2-3 mm long, broadly elliptic, compressed, with intramarginal ribs; beak short, straight or incurved.

Fl. & Fr. : May July.

Included after Kaul (*loc. cit.*).

6. *Ranunculus diffusus* DC., Prodr. 1: 38. 1824; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 19. 1872 (excluding synonyms *R. napaulensis* DC. and *R. subpinnatus* Wight & Arn.); Blatter, Beaut. Fls. Kashmir 16. 1927; Sharma & Jauwal, Fl. Upper Liddar valleys 1: 16. 1986; Riedl in Fl. Pak. 193: 140. 1991; Rau in Sharma *et al.*, Fl. India 1: 119. 1993.

Prostrate or decumbent, perennial herbs. Stems covered with spreading or retrorse hairs. Lower leaves ovate-orbicular, cordate, divided. Flowers solitary, axillary, up to 1.5 cm across; sepals ovate-lanceolate-elliptic, long hairy. Petals white or yellowish, obovate. Achenes in globose heads, compressed, with an intramarginal rib.

Fl. & Fr. : June - October

In moist places and on grassy slopes as an undergrowth in *Pinus Cedrus* forests.

Selected specimens : Patni top/Sanasar, 2300-2500 m, T.A. Rao 7449 (BSD); Puldoda-Bhaderwah, Vohra & Naithani 82782 (BSD); Vaishno Devi. Bhairon temple, Uniyal 77438 (BSD).

7. *Ranunculus felixii* A. Leveille in Fedde, Repert. Spec. Nov. 12: 281. 1913; Rau in Sharma *et al.*, Fl. India 1: 120. 1993.

Perennial herbs. Radical leaves flabellate; lobes linear; cauline leaves with filiform segments. Flowers yellow. Receptacle oblong. Carpels tomentose.

Fl. & Fr. : July - September

Included after Rau (*loc. cit.*).

8. *Ranunculus fleuriifolius* A. Leveille & Vaniot in Bull. Soc. Bot. Fr. 51: 289. 1904; Rau in Sharma *et al.*, Fl. India 1: 120. 1993. *R. flaccidus* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 20. 1872, *non* Pers. 1795; Kaul, Weed Fl. Kashmir valley 25. 1986.

Prostrate or decumbent herbs, forming dense patches, often rooting at nodes. Leaves up to 20 mm long and broad, broadly ovate, reniform or suborbicular, glabrous, 5-7-toothed at margins; petioles sheathing at base. Flowers solitary, leaf opposed, ca 1 cm across. sepals elliptic, reflexed. Petals yellow, obovate. Achenes 6-12, ellipsoid, compressed, with small tubercles, pubescent, surrounded by a narrow rim.

Fl. & Fr. : June July.

Included after Kaul (*loc. cit.*).

9. *Ranunculus flavidus* (Hand. Mazz) C. Cook in *Watsonia* 5: 29, 1963; Rau in Sharma *et al.*, *Fl. India* 1: 120, 1993. *Batrachium flavidum* Hand.-Mazz., *Meded. Gotob. Tradg. et Acta Hort. Gotob.* 13: 168, 1939.

Aquatic herbs. Stems branched, rooting at nodes. Leaves submerged, flaccid, up to 3 cm long, ending in filiform segments. Flowers solitary, up to 1.5 cm across. Sepals obovate, concave, rotund. Petals up to 8 x 5 mm with lunar nectar pit. Achenes in globose heads, ca 2.5 mm long, obovoid, transversely rugose.

Fl. & Fr. : June September.

Included after Rau (*loc. cit.*).

10. *Ranunculus hirtellus* Royle, *Illus. Bot. Himal.* 53, 1834; Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 18, 1872; Blatter, *Beaut. Fls. Kashmir* 15, 1927; Dhar & Kachroo, *Alpine Fl. Kashmir Himal.* 179, 1983; Riedl in *Fl. Pak.* 193: 145, 1991; Rau in Sharma *et al.*, *Fl. India* 1: 121, 1993. *Gandi, Mangol.*

Perennial, erect or decumbent, pubescent herbs, up to 25 cm high. Basal leaves, reniform, orbicular or broadly ovate, tripartite; segments obovate, incised and lobed, coarsely dentate; cauline leaves amplexicaul, entire or 3-partite. Flowers up to 1.5 cm across. Sepals oblong-elliptic, elliptic or ovate-oblong, appressed hairy. Petals yellow, oblong-broadly ovate. Achenes in ovoid heads, up to 1.7 mm long, oblong-suborbicular.

Fl. & Fr. : April October.

Common in moist places and alpine meadows.

Selected specimens : Ladakh, Zozila-Matyan, *Bhattacharyya* 71239 (BSD); Kashmir valley, Synthen pass, 4500 m, *Vohra & Naithani* 83127

(BSD); Udhampur, Gool, *Sivani* 1207 (BSD), Jai valley, 2500 m, *T.A. Rao* 9094 (BSD); Sedau, *T.A. Rao* 9227 (BSD); Jhelum valley, Nagmarg, *Keshavanand* 1194 (DD).

Uses : Aerial parts of plants considered to have a cooling effect in cattle (*Dar et al.*, 1984).

11. *Ranunculus hyperboreus* Rottb., *Scrift. Kjoeb. Selsk.* 10: 458, 1770; *Hook.f. & Thomson in Hook.f., Fl. Brit. India* 1: 18, 1872; *Blatter, Beaut. Fls. Kashmir* 14, 1927. *Rau in Sharma et al., Fl. India* 1: 121, 1993.

Perennial herbs. Stems creeping. Leaves ovate, orbicular or reniform, 3-7-lobed. Flowers yellow, solitary, axillary. Sepals reflexed. Petals as long as or slightly exceeding the sepals. Receptacle hirsute. Achenes numerous in head, obscurely ribbed.

Fl. & Fr. : May - September.

Selected specimens : Gulmarg, 3000 m *T.A. Rao* 278 (BSD).

12. *Ranunculus laetus* Wallich ex D. Don in *Royle, Illus. Bot. Himal.* 53, 1834; *Hook.f. & Thomson in Hook.f., Fl. Brit. India* 1: 19, 1872; *Blatter, Beaut. Fls. Kashmir* 16, 1927; *Sharma & Kachroo, Fl. Jammu* 1: 89, 1981; *Riedl in Fl. Pak.* 193: 141, 1991; *Rau in Sharma et al., Fl. India* 1: 122, 1993. *Khand bada, Kakandel, Kankhor.*

Perennial herbs, up to 70 cm high. Stems much branched, subglabrous or appressed hairy. Radical leaves long petioled; lamina ca 10 cm across, rounded-reniform, tripartite or dissected into sharply toothed lobes, appressed hairy on both the surfaces; cauline leaves shortly petioled or sessile. Flowers up to 3 cm across. Sepals lanceolate to ovate-lanceolate, densely hairy, wide membranous on the margin. Petals yellow, roundish, obovate. Achenes many, in globose heads, suborbicular, dotted, distinctly margined.

Fl. & Fr. : March - September.

In moist places. Frequent.

Selected specimens : Kishtwar, Sangramwat, *Uniyal* 80348 (BSD); Bhaderwah, *Uniyal* 80101 (BSD); Udhampur, Sudh Mahadev, *Swami* 1175 (BSD); Sunblar, *Wadhwa, Murti & Pant* 85461 (BSD); Doda Dist., near Muchhedi, *Hajra* 82539 (BSD); Sonamarg-Srinagar 1700 m, *Bhattacharyya* 41256 (BSD); Jhelum valley, Hamal. Kamraj Div., 2300 m, *Keshavanand* 151 (DD); Liddar valley, 2500-2800 m, *Duthie* 13444 (DD); Batote, ca 1800 m, *Thapliyal* 25599 (DD).

Uses : Plants used in intermittent fever, gout and asthma (Kapur in *J. Econ. Tax. Bot.* 14(3): 502. 1990).

13. *Ranunculus lingua* L., Sp. Pl. 775. 1753; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 16. 1872; Blatter, Beaut. Fls. Kashmir 1927; Rau in Sharma *et al.*, Fl. India 1: 122. 1993. Fig. 59

Tall, perennial, glabrous or sparsely pubescent herbs, up to 90 cm high. Stems ribbed. Basal leaves ovate-oblong, cordate at base, disappearing before flowering, long petioled; cauline leaves up to 20 x 3 cm long, oblong-lanceolate, entire or subdenticulate, parallel veined, short stalked or sessile. Flowers up to 5 cm across. Sepals patently villose, spreading. Petals yellow. Achenes on elongate receptacle, ca 2.5 mm long, obovate, minutely pitted; beak short, straight.

Fl. & Fr. : June August.

In marshy situations.

Selected specimens : Srinagar, *T.A. Rao* 9579 (BSD); Below Gandarbal (Sind river), *Duthie* 11450 (DD).

14. *Ranunculus munroanus* J.R. Drumm. in Kew Bull. Misc. Inform. 1925: 279. 1925; Sharma & Jamwal, Fl. Upper Liddar Valleys 1: 76. 1988; Riedl in Fl. Pak. 193: 150. 1991. Rau in Sharma *et al.*, Fl. India 1: 123. 1993 (*Munronianus*).



Fig. 59. *Ranunculus lingua* L.

Perennial herbs, up to 20 cm high. Stems flaccid, sparsely villous in the upper portion. Radical leaves long petioled; petioles flaccid; lamina reniform, glabrous, 3-lobed; lobes broadly obovate, crenate; cauline leaves similar but short petioled. Flowers on axillary peduncle, ca 9 mm across. Sepals oblong to oblong-ovate, navicular, glabrous. Petals obovate, broadly rounded to cuneate. Achenes in globose heads, glabrous, subinflated.

Fl. & Fr. : April - June.

Selected specimens : Above Gulmarg, 3000-3200 m, *Duthie* 11309 (DD).

15. *Ranunculus muricatus* L., Sp. Pl. 780, 1753; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 20, 1872; Blatter, Beaut. Fls. Kashmir 17, 1927; Singh & Kachroo, For. Fl. Srinagar 162, 1976; Riedl in Fl. Pak. 193: 129, 1991; Rau in Sharma *et. al.*, Fl. India 1: 124, 1993.

Annual, erect or diffusely branched, glabrous herbs, up to 30 cm high. Stems fistulose, usually branched. Radical leaves 3-5 cm across, suborbicular, reniform, trilobed or trisect; lobes coarsely crenate; cauline leaves tripartite. Flowers solitary, leaf opposed, ca 1 cm across. Sepals reflexed. Petals yellow, roundish-obovate. Achenes in globose heads, up to 8 x 3 mm, broadly elliptical, muricate, rarely emuricate, margined, dotted, beaked; beak broadly triangular, flat, hooked at tip.

Fl. & Fr. : Jan. - June.

In open, moist places. Common.

Selected specimens : Kathua, *Uniyal & S. Singh* 88594 (BSD); Around Kishtwar, *Uniyal* 80246 (BSD); Prem Nagar, *Swami* 984 (BSD); Srinagar, *T.A. Rao* 9584 (BSD).

16. *Ranunculus natans* C. Meyer in Ledeb., Fl. Alt. 2: 315, 1830; Riedl in Fl. Pak. 193: 135, 1991; Rau in Sharma *et al.* Fl. India 1: 124, 1993. *R. hyperboreus* Rottb. var. *natans* (C. Meyer) Regel in Bull. Sci. Nat. Mosc. 34: 343, 1861; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 18, 1872.

Aquatic, floating, perennial herbs. Stems sulcate, rooting at nodes. Leaves reniform, broader than long, 3-5 lobate; lobes rounded; petiole flat, with 2 membranous scales or auricles at base. Flowers leaf opposed, up to 1 cm across. Sepals concave, ovate-rounded-ovate. Petals obovate-ovate. Achenes numerous, in globose heads, inflated, glabrous; beak very short.

Fl. & Fr. : June - August.

Selected specimens : Ladakh, Tangtse, 4300 m. *Viswanathan* 54733 (BSD).

17. *Ranunculus palmatifidus* H. Riedl in *Kew Bull.* 34: 362. 1979 *et in Fl. Pak.* 193: 153. 1991; Rau in *Sharma et al.*, *Fl. India* 1: 125. 1993.

Perennial herbs, up to 50 cm high. Radical leaves long petioled; lamina up to 10 cm across, subreniform, loosely hairy on both the surfaces, tripartite; middle segment lanceolate; lateral segments deeply bifid; cauline leaves sessile or subsessile. Flowers up to 2.2 cm across. Sepals ovate-elliptic, densely villous. Petals yellow, obovate-cuneate. Achenes in ovoid to oblong head, inflated, glabrous; beak slightly curved, rarely hooked.

Fl. & Fr. : June - July.

Included after Riedl (loc. cit.).

18. *Ranunculus pulchellus* C. Meyer in *Ledeb.*, *Fl. Alt.* 2: 333. 1830; Hook.f. & Thomson in *Hook.f.*, *Fl. Brit. India* 1: 17. 1872; Blatter, *Beaut. Fls. Kashmir* 13. 1927; Dhar & Kachroo, *Alpine Fl. Kashmir Himal.* 179. 1983; Riedl in *Fl. Pak.* 193: 138. 1991; Rau in *Sharma et al.*, *Fl. India* 1: 125. 1993. *R. lobatus* Cambess. in *Jacquem.*, *Voy. Bot.* 5. t. 1 B. 1844; Hook.f. & Thomson in *Hook.f.*, *Fl. Brit. India* 1: 17. 1872. *Zumiso*.

Erect, perennial herbs, up to 35 cm high. Stems glabrous-sericeous. Radical leaves up to 5.5 x 1 cm, lanceolate-oblong, reniform or ovate-elliptic, entire with a few apical teeth; cauline leaves entire or palmatipartite, with scarious sheaths. Flowers ca 1.5 cm across. Pedicels sericeous. Sepals

ovate-lanceolate, wide scarious margined. Petals yellow, broadly ovate, much exceeding the sepals. Achenes in ovoid or subglobose head, ca 2 mm long, inflated, glabrous; beak straight or distally recurved.

Fl. & Fr. : May - October.

Common, in the vicinity of water.

Selected specimens : Tangtse, *Viswanathan* 54738 (BSD); Pang (Rupshu), 4600 m, *Bhattacharyya* 40994 (BSD); Gomburangzang, 4500 m, *Bhattacharyya* 52198 (BSD); Parkhachik-Rangdom, *Chowdhery & Uniyal* 85979 (BSD); Kargil, *Hajra* 74025 (BSD); Ganglas-Khardungla, *Chowdhery & Uniyal* 86114 (BSD).

19. *Ranunculus rionii* Lager in *Flora Regensb.* 31: 49. 1848; Rau in *Sharma et. al.*, *Fl. India* 1: 127. 1993. *Batrachium rionii* (Lager) Nyman in *Bot. Notiser* 98. 1852; Riedl in *Fl. Pak.* 193: 123. 1991.

Aquatic herbs. Leaves submerged, capillary, 3-4 cm long; laminate leaves absent. Flowers ca 1 cm across. Pedicels much exceeding the leaves. Petals white ovate, 3-5.5 mm, nectar pit lunate. Achenes numerous, subglobose, less than 1 mm long.

Fl. & Fr. : April - August.

Included after Rau (*loc. cit.*).

20. *Ranunculus rufosepalus* Franch. in *Ann. Sci. Nat. Ser.* 6: 15: 217. 1883; Riedl in *Fl. Pak.* 193: 146.f. 28 E. 1991; Rau in *Sharma et. al.*, *Fl. India* 1: 127. 1993.

Perennial herbs, up to 20 cm high, forming mats. Stems glabrous or with scattered, reddish brown hairs. Radical leaves long petioled; lamina palmately lobed; terminal lobe almost orbicular; cauline leaves pinnati-partite, sessile. Flowers to 2.2 cm across. Sepals covered with dense, reddish brown hairs outside. Petals yellow, broadly obovate, cuneate. Achenes in ovoid head, 2-2.5 mm, rounded-ovoid, glabrous, with a hooked beak.

Fl. & Fr. : June August.

Included after Riedl (*loc. cit.*).

21. *Ranunculus sceleratus* L., Sp. Pl. 551. 1753; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 19. 1872; Blatter, Beaut. Fls. Kashmir 14. 1927; Sharma & Kachroo, Fl. Jammu 1: 89. 1981; Riedl in Fl. Pak. 191: 132. 1991; Rau in Sharma *et al.*, Fl. India 1: 128. 1993.

Erect, annual, glabrous or sparsely pubescent herbs, up to 60 cm high. Stems hollow. Radical and lower cauline leaves reniform or suborbicular, divided almost up to base into 3 obovate segments; upper cauline leaves obovate, entire or bluntly 3-5-toothed at apex. Flowers many in racemes. Sepals somewhat reflexed, pubescent. Petals yellow, equalling the sepals. Achenes in oblong head, ca 0.75 mm long, obovoid; beak minute.

Fl. & Fr. : January June.

Common, in marshy situations.

Selected specimens : Aarchi, Uniyal 80373 (BSD); Bhaderwah, Uniyal 80215 (BSD); Udhampur city, Swami 759 (BSD); Talwara, Reasi, Swami 1112 (BSD).

22. *Ranunculus sphaerospermus* Boiss & Blanche in Boiss., Diagn. Ser. 2: 6. 1856; Rau in Sharma *et al.*, Fl. India 1: 129. 1993.

Aquatic herbs. Leaves all submerged, capillary segmented. Flowers up to 2.5 cm across. Peduncle much exceeding the leaves. Petals cream white, broadly obovate; nectar pit elongated, pyriform. Achenes somewhat rounded, glabrous.

Fl. & Fr. : July September.

Included after Rau (*loc. cit.*).

23. *Ranunculus stewartii* H. Riedl in Kew Bull. 34: 364, 1979 *et* in Fl. Pak. 193: 148, 1991; Rau in Sharma *et. al.*, Fl. India 1: 129, 1993.

Perennial herbs. Radical leaves long petioled; lamina broader than long, up to 2.8 x 4 cm, trisect; segments obovate or broadly obovate, palmately lobed; cauline leaves 1-2, tripartite. Flowers solitary, up to 3 cm across. Sepals with broad pellucid margins. Petals broadly obovate. Achenes arranged in globose to globose-ovoid head, 1-1.2 mm long, broadly elliptical; beak short.

Fl. & Fr. : May - June.

Included after Riedl (*loc. cit.*).

24. *Ranunculus trichophyllus* Chaix in Villars, Hist. Pl. Dauph. 1: 335, 1786; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 179, 1983; Rau in Sharma *et al.*, Fl. India 1: 130, 1993. *R. aquatilis* L. var. *trichophyllus* (Chaix) Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 16, 1872; Blatter, Beaut. Fls. Kashmir 17, 1927. *Batrachium trichophyllum* (Chaix) Bosche, Prodr. Fl. Bat. 17: 1850; Riedl in Fl. Pak. 193: 124, 1991. *Rengo*.

Annual or perennial, aquatic herbs. Leaves submerged, divided into capillary segments; petioles up to 4 cm long, auricled. Flowers solitary in leaf axils, *ca* 1.5 cm across. Sepals elliptic, 2.5-3.5 mm long; petals white, distinctly nerved; nectar pit lunate. Achenes *ca* 1.5 mm long, obovoid, transversely ridged, minutely beaked.

Fl. & Fr. : March - September.

Selected specimens : Dachigam games sanctuary, 1650-1800 m, Wadhwa 66796 (BSD); Ladakh, Kargil-Panikhar, Chowdhery & Uniyal 85868 (BSD); Chumathang-Mahi, Chowdhery & Uniyal 86170 (BSD); Udhampur Dist., Ram Nagar, Swami 563 (BSD).

Uses : Plant used in intermittent fever, rheumatism and asthma (Kapur, *loc. cit.*).

Following species have also been reported from the state by various authors. These need detailed studies.

1. *Ranunculus glacialisformis* Hand.-Mazz. in Acta Hort. Gotob. 13: 153. 1939; Riedl in Fl. Pak. 193: 149. 1991.

2. *Ranunculus jacquemontii* H. Riedl in Fl. Pak. 193: 151. 1991.

3. *Ranunculus karakaramicola* Tamura in Acta Phytotax. Geobot. 16: 169. 1956; Riedl in Fl. Pak. 193: 148. 1991.

4. *Ranunculus nivalis* L., Sp. Pl. 553. 1753; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 275. 1972.

5. *Ranunculus pangiensis* Watt in J. Linn. Soc. Bot. 18: 377. Pl. 9 B.f. 3-9. 1881; Riedl in Fl. Pak. 193: 143. 1991.

22. THALICTRUM L.

1a. Sepals longer than the stamens :

2a. Muricated bulbils present in the axil of leaves.

Achenes compressed ...2. *T. chelidonii*

2b. Muricated bulbils absent. Achenes slightly

compressed ...9. *T. pedunculatum*

1b. Sepals equal to or shorter than the stamens :

3a. Achenes laterally compressed, almost flattened :

4a. Flowers solitary or in pairs or arranged

terminally ...14. *T. secundum*

4b. Flowers in racemes or panicles :

5a. Achenes long stalked :

6a. Plants up to 30 cm high. Anthers

mucronate ...4. *T. elegans*

6b. Plants above 30 cm high. Anthers

long pointed ...11. *T. reniforme*

5b. Achenes sessile-subsessile :

7a. Leaves glandular pubescent

beneath ...10. *T. platycarpum*

7b. Leaves puberulous but not

glandular ...3. *T. cultratum*

3b. Achenes not compressed :

- 8a. Leaves with glands and multicellular hairs ...5. *T. foetidum*
- 8b. Leaves glabrous or slightly hairy :
- 9a. Flowers in simple racemes :
- 10a. Rhizomatous. Stems up to 15 cm high. Racemes terminal ...1. *T. alpinum*
- 10b. Roots fusiform. Stems more than 15 cm high. Long stalked flowers in the axils of upper leaves also ...12. *T. rutifolium*
- 9b. Flowers in panicles :
- 11a. Plants up to 30 cm high. Beak of achenes as long as the body of achenes ...13. *T. saniculiforme*
- 11b. Plants up to 3 m tall. Beak of achenes shorter than the body of achenes :
- 12a. Filaments club shaped ...7. *T. javanicum*
- 12b. Filaments filiform :
- 13a. Flowers polygamous. Achenes usually 2-5 ...6. *T. foliolosum*
- 13b. Flowers bisexual. Achenes usually more than 5 ...8. *T. minus*

1. *Thalictrum alpinum* L., Sp. Pl. 545. 1753; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 12. 1872; Blatter, Beaut. Fls. Kashmir 10. 1927; Riedl in Fl. Pak. 193: 105. 1991; Rau in Sharma *et al.*, Fl. India 1: 133. 1993. *T. alpinum* L. var. *microphyllum* (Royle) Hand.-Mazz., Symb. Sin. 311. 1931; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 179. 1983.

Perennial, glabrous herbs, up to 15 cm high. Stems simple, rarely branched, usually leafless. Radical leaves bipinnate, up to 10 cm long including petiole; leaflets obovate, shiny above, pale beneath, coriaceous, glabrous, 3-lobed or incised; lobes subacute or rounded. Flowers in simple, terminal racemes. Sepals 4, purplish or greenish, elliptic. Filaments filiform; anthers shortly mucronate. Achenes 5-7, elliptic-narrow-oblong, ribbed, sessile or shortly stalked; fruiting pedicels recurved.

Fl. & Fr. : June - September.

On shady river bed and in crevices of rocks.

Selected specimens : Panchtarni, 3600 m, Nair 37011 (BSD); Ladakh, Pang (Rupshu), 4600 m, Bhattacharyya 40975; Sorila, 4800 m, Bhattacharyya 52310 (BSD).

2. *Thalictrum chelidonii* DC., Prodr. 1: 11. 1824; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 11. 1872, *p.p.*; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 275. 1972; Rau in Sharma *et al.*, Fl. India 1: 134. 1993.

Perennial, much branched herbs, with mucronated bulbils often present in the axils of leaves. Leaves bipinnate; leaflets *ca* 3 x 3.5 cm, suborbicular or reniform, thin, obtusely lobed. Flowers in racemes or panicles, *ca* 2 cm across. Sepals white or lilac, *ca* 9 x 5 mm, exceeding the stamens. Anthers obtuse. Achenes many, obliquely obovate, compressed, thin, with 3 branched veins on each face, beaked.

Fl. & Fr. : August September.

On moist, partly shady slopes, 2900-3800 m.

Included after Rau (*loc. cit.*).

3. *Thalictrum cultratum* Wallich, Pl. Asiat. Rar. 2: 26. 1831; Hook.f. & Thomson in Hook. f., Fl. Brit. India 1: 11. 1872; Blatter, Beant. Fls. Kashmir 1: 9. 1927; Sharma & Jamwal, Fl. Upper Liddar valleys 1: 73. 1988. Riedl in Fl. Pak. 193. 1991; Rau in Sharma *et al.*, Fl. India 1: 134. 1993.

Perennial, branched, glabrous herbs, up to 1 m tall. Leaves bipinnate, sheathing and auricled at base; leaflets up to 1.8 x 1.5 cm, ovate or obovate, incised lobed or crenate-dentate, 3-lobed, minutely scattered glandular hairy beneath. Flowers in lax, leafy panicles. Sepals greenish-white, tinged purple, elliptic, obtuse. Anthers long pointed, 4-6 mm long. Achenes obliquely obovate, prominently 3-ribbed on each face, glabrous or glandular pubescent; beak short, straight.

Fl. & Fr. : June September.

On grassy slopes.

Selected specimens : Desu, 3200 m, T.A. Rao 9832 (BSD); Chandanwadi, 2000 m, T.A. Rao 9691 (BSD); Dagwan, 3500 m, Wadhwa 66992 (BSD).

4. ***Thalictrum elegans*** Wallich ex Royle, *Illus. Bot. Himal.* 51. 1834; Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 10. 1872; Blatter, *Beaut. Fls. Kashmir* 10. 1927; Sharma & Jamwal, *Fl. Upper Liddar Valleys* 1: 73. 1988; Riedl in *Fl. Pak.* 193: 101. 1991; Rau in Sharma *et al.*, *Fl. India* 1: 135. 1993.

Erect herbs, up to 40 cm high. Leaves bi or tripinnate, sessile or shortly petioled; leaflets 1-5 x 1-2 mm, ovate-elliptic, obovate, glabrous or minutely glandular on veins beneath, bluntly 3-lobed or partite. Flowers in leafy, racemose panicles. Sepals greenish purple, ca 3 x 1.75 mm, elliptic. Stamens 6-10; anthers mucronate. Achenes 4-7 x 2.5-4 mm, somewhat inflated, narrowly winged on back, ribbed, stalked; beak short, straight or curved.

Fl. & Fr. : June - October.

On open hill slopes.

Selected specimens : Lidderwat hill top, 3000 m, T.A. Rao 703 (BSD).

5. ***Thalictrum foetidum*** L., *Sp. Pl.* 545. 1753; Riedl in *Fl. Pak.* 193: 104. 1991; Rau in Sharma *et al.*, *Fl. India* 1: 135. 1993. *Thalictrum minus* L. var. *foetidum* (L.) Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 14. 1872. *T. vaginatum* Royle, *Illus. Bot. Himal.* 52. 1834; Dhar & Kachroo, *Alpine Fl. Kashmir Himal.* 179. 1983. *Chachoo, Maniroon, Haichingshah, Lesser meadow rue.*

Perennial, glandular pubescent herbs, up to 75 cm high. Leaves pinnately decompose; leaflets obovate or suborbicular, 3-lobed or dentate, glandular pubescent beneath. Flowers in panicles. Sepals elliptic. Anthers

apiculate. Achenes narrowed at both ends, ribbed, glandular, sessile; beak oblique.

Fl. & Fr. : June - September.

On shady slopes.

Selected specimens : Ladakh, Ganglas, *Chowdhery & Uniyal* 86068 (BSD); Whisky nallah, 4000 m, *Bhattacharyya* 40911; Kurgiakh, 4300 m. *Bhattacharyya* 52240 (BSD).

6. *Thalictrum foliolosum* DC., Syst. Nat. 1: 175. 1818; Riedl in Fl. Pak. 193: 108. 1991; Rau in Sharma *et al.*, Fl. India 1: 136. 1993. *Munira, Chaitra.*

Shrubs, up to 3 m tall. Leaves pinnately decomposed; leaflets *ca* 3 x 2.8 cm, ovate-suborbicular, bluntly toothed or lobed; lobes again trilobed. Flowers in large panicles, polygamous, sepals creamy, white or bluish white, obovate; filaments filiform; anthers acute or mucronate. Achenes 2-5, sessile, *ca* 3 mm long, strongly ribbed; style deciduous.

Fl. & Fr. : June - October.

On grassy slopes in shady places.

Selected specimens : Sanjhichat - Bhairon Temple; *Uniyal* 866891 (BSD); Poonch area, *Vohra & Naithani* 78223 (BSD).

Uses : Root-tonic, purgative, diuretic, (Kapur, *loc. cit.*)

7. *Thalictrum javanicum* Blume, Bijdr. 2: 1825; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 13. 1872; Kapur & Sarin, Fl. Trikuta Hills 77. 1990; Rau Sharma *et al.*, in Fl. India 1: 136. 1993.

Erect glabrous herbs, up to 1 m tall. Leaves ternately decomposed; leaflets *ca* 1.5 cm across, crenate or 3-lobed, veins on lower surface raised. Flowers in terminal panicles. Sepals white or purple. Filaments club shaped;

anthers obtuse. Achenes sessile, oblong, ellipsoid, strongly ribbed; style persistent, shortly hooked.

Fl. & Fr. : June - October.

In damp places

Selected specimens : Udhampur Dist., Latidhuna, Swami 1355 (BSD).

Uses : Root diuretic, purgative (Kapur, *loc. cit.*).

Note : Similar to *T. foliolosum* but anthers obtuse at apex, much shorter than the filaments which are club shaped and styles persistent and hooked.

8. *Thalictrum minus* L., Sp. Pl. 546. 1753; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 14. 1872; Kapur & Sarin, Fl. Trikuta Hills 77. 1990; Riedl in Fl. Pak. 193: 110. 1991; Rau in Sharma *et al.*, Fl. India 1: 137. 1993. *Chak-achoo, Gendhoor.*

Perennial, glabrous, rarely glandular herbs, up to 1.5 m tall. Leaves ternately decompose or pinnate; leaflets up to 3.5 x 3 cm, broadly ovate or suborbicular, subcordate, dark green above, pale green beneath, trilobed or trifid. Flowers in panicles. Sepals greenish or yellowish. Anthers mucronate. Achenes sessile broadly ovoid or oblong-ovoid, ribbed.

- | | |
|------------------------------------|---------------------------|
| 1a. Leaflets larger, 2.5-3 cm long | ...8.1. var. <i>majus</i> |
| 1b. Leaflets less than 2.5 cm | ...8.2. var. <i>minus</i> |

8.1. var. *majus* (Jacq.) Hook.f. & Thomson. Fl. Ind. 17. 1855 *et* in Hook.f., Fl. Brit. India 1: 1872; Rau in Sharma *et al.*, Fl. India 1: 138. 1993. *T. majus* Jacq., Fl. Austr. 5: 9. t. 430. 1796. *T. minus* L. subsp. *majus* (Crantz.) Rouy & Fouc., Fl. Fr. 1: 16. 1893; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 179. 1983; Riedl in Fl. Pak. 193: 110. 1991.

Fl. & Fr. : July - September.

On slopes amidst stones.

Selected specimens : Shekhpura, Wadhwa, Murti & Pant 85124 (BSD).

8.2. var. minus

Fl. & Fr. : June - September.

Selected specimens : Gulmarg, 3000 m, T.A. Rao 275 (BSD).

Uses : Infusion of leaves or decoction of root used in fever (Kapur, *loc. cit.*).

9. *Thalictrum pedunculatum* Edgew. in Trans. Linn. Soc. 20: 27. 1846; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 12. 1872; Blatter, Beaut. Fls. Kashmir 10. 1927; Sharma & Kachroo, Fl. Jammu 1: 163. 1981; Riedl in Fl. Pak. 193: 97. 1991; Rau in Sharma *et al.*, Fl. India 1: 138. 1993.

Perennial, glabrous herbs, up to 60 cm high. Leaves 2-3-ternate; leaflets up to 3 x 2.5 cm, obovate-suborbicular, 3-dentate or lobate, deep green and glabrous above, pale green beneath; lobes entire or crenate. Flowers in terminal panicles, 2-3 cm across. Sepals white, elliptic. Stamens much shorter than the sepals; anthers not pointed. Achenes 1.5-2 cm long, linear-oblong, prominently ribbed, long stipitate; beak incurved.

Fl. & Fr. : April - July

Included after Rau (*loc. cit.*).

10. *Thalictrum platycarpum* Edgew. in Trans. Linn. Soc. 20: 27. 1846; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 11. 1872; Sharma & Jamwal, Fl. Upper Liddar valleys 1: 73. 1988; Riedl in Fl. Pak. 193: 101. 1991; Rau in Sharma *et al.*, Fl. India 1: 139. 1993. *Maniiron*.

Perennial herbs, up to 60 cm high. Leaves 2-3-pinnate, sessile or subsessile; leaflets ovate-suborbicular or obovate, glabrous above, glandular pubescent beneath, lobed; lobes incised-dentate. Flowers in leafy panicles.

Sepals greenish, broadly elliptic. Anthers shortly mucronate. Achenes *ca* 5 mm long, obovate-triangular, ribbed, stalked; beak curved, up to 2.5 mm long.

Fl. & Fr. : June – October.

Included after Sharma & Jamwal (*loc. cit.*).

11. *Thalictrum reniforme* Wallich, Pl. Asiat. Rar. 2: 26, 1831; Hook.f. & Thomson in Hook.f., Fl. Brit. 1: 11, 1872; Rau in Sharma *et al.*, Fl. India 1: 140, 1993.

Large herbs, to 1.5 m tall. Leaves biternately compound; leaflets reniform, up to 5 x 7.5 cm across, thin, 3-lobed; lobes again lobed. Flowers greenish or pale white in panicles. Filaments short; anthers apiculate. Achenes up to 12 in a cluster, *ca* 4.5 mm long; ribbed, flat, puberulous, stalked; stalk *ca* 2 mm long.

Fl. & Fr. : August – October.

On slopes in *Quercus semecarpifolia* forest.

Selected specimens : Bhaderwah-Sooj, 2500 m, Vohra & Naithani 83002 (BSD).

12. *Thalictrum rutifolium* Hook.f. & Thomson, Fl. Ind. 14, 1855 *et in* Hook.f., Fl. Brit. India 1: 12, 1872 (*rutaefolium*); Riedl in Fl. Pak. 193: 107, 1991; Rau in Sharma *et al.*, Fl. India 1: 141, 1993.

Fig. 60

Weak, glabrous herbs, up to 60 cm high. Leaves bi- or tripinnate; leaflets up to 6 x 3 mm, ovate or obovate, trilobed or dentate; petioles sheathing, auricled. Flowers in racemes. Sepals greenish, up to 3 x 1 mm. Anthers shorter than the filaments, apiculate. Achenes fusiform, ribbed; stalks abruptly deflexed; beak short, straight.

Fl. & Fr. : June – August.



Fig. 60. *Thalictrum rutifolium* Hook.f. & Thomson

In moist places.

Selected specimens : Ladakh, Tangtse, 4500 m, *Viswanathan* 54750 (BSD); Pang-Sarchu, *Chowdhery & Uniyal* 86222 (BSD).

13. *Thalictrum saniculaeforme* DC., Prodr. 1: 12. 1824; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 13. 1872; Rau in Sharma *et al.*, Fl. India 1: 141. 1993.

Leaves 1-3, 15-25 cm, upper ones smaller; leaflets broadly ovate or obovate, rounded or subcordate at base, margins roundly toothed or lobed, glabrous. Peduncle \pm as long as the leaf, divaricately branched, few flowered. Sepals white, long-elliptic. Achenes *ca* 2 mm, ellipsoid, sessile.

Fl. & Fr. : April - September.

On moss covered boulders.

Selected specimens : Udhampur, Katra, *Swami* 1107 (BSD).

14. *Thalictrum secundum* Edgew. in Trans. Linn. Soc. 20: 26. 1846; Sharma & Jamwal, Fl. Upper Liddar valleys 1: 73. 1988; Riedl in Fl. Pak. 193: 99. 1991; Rau in Sharma *et al.*, Fl. India 1: 141. f. 18. 1993. *T. pauciflorum* Royle, Illus. Bot. Himal. 52. 1834; Hook.f., & Thomson in Hook.f., Fl. Brit. India 1: 11. 1872; Blatter, Beaut. Fls. Kashmir 9. 1927.

Erect, glabrous herbs, up to 90 cm high. Leaves biternate or bitripinnate; leaflets ovate, obovate or suborbicular, 3-4-lobed or incised, glabrous, deep green above, pale beneath. Flowers few, in panicles. Sepals purplish lanceolate. Anthers mucronate. Achenes *ca* 3 mm long, ribbed, sessile or subsessile; beak straight.

Fl. & Fr. : June - September.

Included after Sharma & Jamwal (*loc. cit.*).

DOUBTFUL SPECIES

Naqshi & Ara (J. Econ. Tax. Bot. 17(3): 663. 1993) have reported *Thalictrum aquilegifolium* L. from Gurais valley.

23. TROLLIUS L.

Trollius acaulis Lindl. in Bot. Reg. 28. Misc. 56. 1842; t. 32. 1843; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 22. 1872; Blatter, Beaut. Fls. Kashmir 18. 1927; Riedl in Fl. Pak. 193: 27. 1991; Rau in Sharma *et. al.*, Fl. India 1: 144. 1993.

Glabrous, perennial herbs. Rootstock stout, covered with fibres. stems up to 20 cm long, elongating in fruits. Radical leaves 3-8 cm across, orbicular-reniform, palmately 5-partite, long petioled; segments obovate-oblong-obovate, incised and toothed; upper cauline leaves nearly sessile. Flowers golden yellow-orange, solitary, up to 5.5 cm across. Sepals 6-8, petaloid, broadly ovate, obtuse, spreading. Petals 12-16, short or long clawed. Stamens numerous, longer than the petals. Follicles many, beaked.

Fl. & Fr. : June August.

On grassy slopes and near receding snow belts, 3500-6000 m.

Selected specimens : Pissughati, 4000 m, T.A. Rao 9717 (BSD); Seshnag 3600 m, Nair 36960 (BSD); Panchtarni, 3700 m, Nair 37019 (BSD); Kungwatan, Kaunsarnag, 3800 m, T.A. Rao 9335 (BSD); Kishanganga valley, 3000 m, Keshavanand 1240 (DD).

PAEONIACEAE

(B.P. Uniyal)

PAEONIA L.

Paeonia emodi Wallich ex Royle, Illus. Bot. Himal. 57. 1834; Hook.f. & Thomson in Hook.f., Fl. Brit. India. 1: 30. 1872; Rau in Fasc.

Fl. India 1: 5. 1978 *et in* Sharma *et al.*, Fl. India 1: 148. 1993; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 178. *P. emodi* var. *glabrata* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 30. 1872. Sharma & Jamwal, Fl. Upper Liddar valleys 1: 77. 1988. *Namekh, Mid.*

Erect herbs or undershrubs. Roots fleshy, tuberous; stems angled, or striate. Leaves alternate, up to 30 cm long, 1-2-ternate; leaflets entire or incised; ultimate segments up to 15 cm long, oblong or lanceolate, acute or acuminate, glabrous. Flowers white, usually in the axils of upper leaves, *ca* 12 cm across, peduncled; up to 10 cm long; bracts foliaceous. Sepals 5, herbaceous, orbicular, persistent. Petals 5-8, broadly oblong, finely veined. Stamens many. Follicles 1 or 2, 3-4 cm long, somewhat curved, glabrous or strigose; seeds smooth shining black.

Fl. & Fr. : March - September.

On slopes in shady places.

Selected specimens : Chandanwari, 3000 m, T.A. Rao 9690; Upper Munda 2350 m, T.A. Rao 9180 (BSD).

Uses : Roots, leaves and seeds are used medicinally (Rau, *loc. cit.*).

ANNONACEAE

(B.P. Uniyal)

MILIUSA Leschen. ex A. DC.

Miliusa velutina Hook.f. & Thomson, Fl. Ind. 151. 1855 *et in* Hook.f., Fl. Brit. India 1: 87. 1872; Sharma & Kachroo, Fl. Jammu 1: 90. 1981; D. Mitra in Sharma *et al.*, Fl. India 1: 222. 1993.

Large deciduous trees. Young branches tomentose. Leaves up to 30 x 15 cm, broadly ovate-elliptic to obovate or ovate-oblong, acute-acuminate, entire, softly tomentose on both the surfaces; petiole tomentose. Flowers pale yellow or greenish, 3-6 in leaf opposed cymes, *ca* 1.5 cm across.

Sepals 3, up to 8 x 3.5 mm, ovate, dense tomentose outside. Petals 6, densely tomentose; outer petals resembling the sepals; inner larger, ovate, ultimately turning black. Stamens numerous. Carpels numerous, villous. Fruits ovoid or ellipsoid, pilose, 1-2-seeded.

Fl. & Fr. : March - June.

In forest.

Selected specimens : Udampur, Thiel village, Swami 1126 (BSD).

Uses : Fruits edible.

MENISPERMACEAE

(B.P. Uniyal)

1a. Leaves peltate :

2a. Plants tomentose. Inflorescence paniculate, cymose
or racemiform ...1. *Cissampelos*

2b. Plants glabrous inflorescence umbellate ...3. *Stephania*

1b. Leaves not peltate :

3a. Leaf base acute or slightly cordate. Inflorescence
paniculate ...2. *Cocculus*

3b. Leaf base deeply cordate. Inflorescence
racemose ...4. *Tinospora*

1. CISSAMPELOS L.

Cissampelos pareira L. var. *hirsuta* (Buch.-Ham. ex DC.) Forman in Kew Bull. 22: 356. 1968; Gangopadhyay in Sharma *et al.*, Fl. India 1: 317. 1993. *C. hirsuta* Buch.-Ham. ex DC., Syst. Nat. 1: 535. 1817. *C. pareira* L., Sp. Pl. 1031. 1753, p.p.; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 103. 1872; Sharma & Kachroo, Fl. Jammu 1: 91. 1981. *Katori, Akhand, Patha.*

Slender, twining, softly tomentose, dioecious, perennials. Leaves 2.5-5.5 x 2.5-4 cm, suborbicular, reniform or broadly ovate, obtuse or apiculate,

densely hairy beneath; petiole equalling the leaf blade or longer. Flowers greenish white; male flowers in axillary corymbose cymes; female flowers in pendulous racemes, with many conspicuous, imbricate bracts. Drupes ovoid-subglobose, red when mature.

Fl. & Fr. : April - November.

Along roadsides and in the forest twining over bushes.

Selected specimens : On way to Rehalta, Hajra 82307 (BSD); Reasi, Uniyal 86606 (BSD); Udhampur city, Swami 612 (BSD); Poonch, Vohra & Naithani 78241 (BSD).

Uses : Roots used in cough and urinary troubles (Kapur, *loc. cit.*).

2. COCCULUS A. DC., *nom. cons.*

- | | |
|---------------------------------|-----------------------------|
| 1a. Erect shrubs or small trees | ...1. <i>C. laurifolius</i> |
| 1b. Woody climbers | ...2. <i>C. pendulus</i> |

1. *Cocculus laurifolius* DC., Syst. Nat. 1: 530. 1817; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 101. 1872; Gangopadhyay in Sharma *et al.*, Fl. India 1: 319. 1993; Swami & Gupta, Fl. Udhampur 41. 1998. *Garudi, Guduchi.* **Fig. 61**

Evergreen shrubs or small trees, monoecious. Branchlets and leaf axils with tufts of hairs. Leaves up to 15 x 5 cm, lanceolate or elliptic-lanceolate, entire, dark green, shining above, 3-nerved at base; nerves parallel. Flowers minute, yellowish, in axillary panicles; panicles shorter than the leaves. Bracts minute. *Male flowers* : sepals acute. Petals 2-lobed, clasping the stamens. *Female flowers* : staminodes 6. Styles reflexed. Drupes black globose, 4-5 mm across.

Fl. & Fr. : April - October.

Selected specimens : Udhampur Ghordi village, Swami 1124 (BSD).

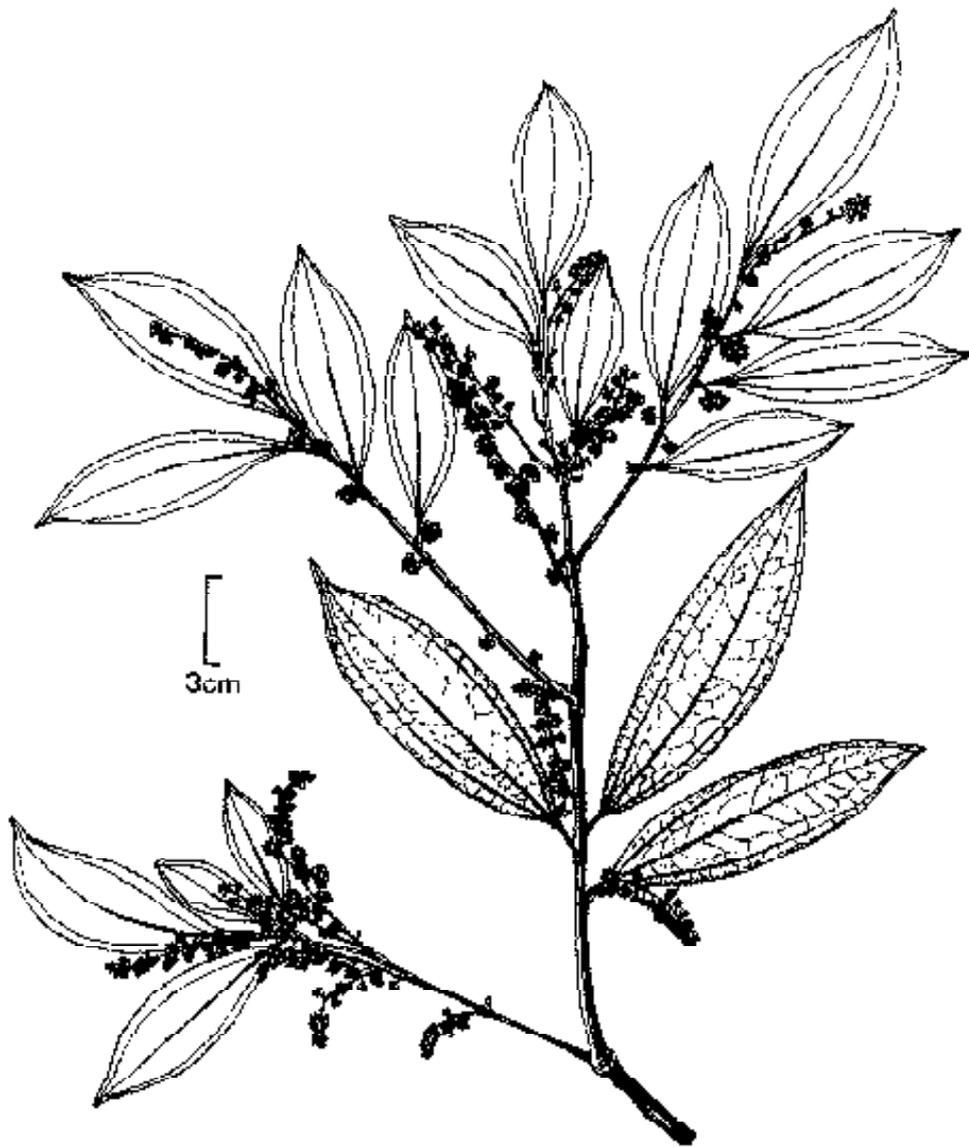


Fig. 61. *Cocculus laurifolius* DC.

2. *Cocculus pendulus* (J.R. & G. Forst.) Diels in Engl., Pflanzent. 46: 237. 1910; Pramanik & Thothathri in J. Econ. Tax. Bot. 7: 445. 1985; Gangopadhyay in Sharma *et. al.*, Fl. India 1: 320. 1993. *Epibaterium pendulum* J.R. & G. Forst., Char. Gen. Pl. 108. t. 54. 1776. *Cocculus laeba* DC., Syst. Nat. 1: 529. 1817; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 102. 1872. *Parwati*.

Climbing, monoecious shrubs. Stems and branches pubescent. Leaves up to 5 x 1.5 cm, suborbicular, oblong-lanceolate, oblong-ovate, acute or cuneate at base, subglabrous. Flowers greenish yellow; male in dense, axillary fascicles, sessile or subsessile; female usually solitary, axillary, rarely paired. Drupes black, globose-ovoid or obovoid or reniform, ridged, compressed.

Fl. & Fr. : Major part of the year.

Selected specimens : Mangla. Lambert acc. no. 44335 (DD); *s.loc.*, Williams 7961 (DD).

3. STEPHANIA Lour.

Stephania elegans Hook.f. & Thomson, Fl. Ind. 195. 1855 *et in* Hook.f., Fl. Brit. India 1: 103. 1872; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 283. 1972; Gangopadhyay in Sharma *et al.*, Fl. India 1: 333. 1993.

Glabrous climbers. Leaves *ca* 10 x 6 cm, deltoid-ovate, peltate, cordate-truncate at base, acuminate at apex. Flowers in axillary, long peduncled, solitary umbel. Male flowers purplish or greenish. Sepals glabrous obovate. Petals obovate. *Female flowers* : sepals 3-6, obovate. Petals obovate, stigmas 3 or 4, minute. Drupes red; endocarp transversely 10-ridged.

Fl. & Fr. : June - October.

Included after Stewart (*loc. cit.*).

4. TINOSPORA Miers

Tinospora cordifolia (Willd.) Hook.f. & Thomson, Fl. Ind. 184. 1855 *et in* Hook.f., Fl. Brit. India 1: 97. 1872; Sharma & Kachroo, Fl. Jammu 1: 90. 1981; Pramanik *in* Sharma *et al.* Fl. India 1: 347. 1993. *Menispermum cordifolium* Willd., Sp. Pl. 4: 826. 1806. *Gloe.*

Glabrous, deciduous, climbing shrubs. Stems corky, often lenticellate. Leaves up to 28 x 24 cm, broadly ovate-triangular, deeply cordate at base, acute or acuminate, glabrous; basal nerves 5-7, palmate. Flowers in racemes on leafless branches. Male flowers yellow, fascicled. Outer sepals ovate; inner elliptic, concave. Petals obovate, with incurved lateral edges. Female flowers usually solitary. Sepals and petals as in male flowers. Staminodes 6. Drupes globose-ovoid, red when mature.

Fl. & Fr. : March - November.

Selected specimens : Ramnagar, Swami 570 (DD); Pallanwala, Uniyal 92767 (BSD).

BERBERIDACEAE

(R. Mathur & B.P. Uniyal)

- | | |
|----------------------------|------------------------|
| 1a. Leaves simple | ...1. <i>Berberis</i> |
| 1b. Leaves compound : | |
| 2b. Shrubs. Fruit a berry | ...3. <i>Mahonia</i> |
| 2b. Herbs. Fruit a capsule | ...2. <i>Epimedium</i> |

1. BERBERIS L.

- | | |
|--|------------------------------|
| 1a. Evergreen shrubs : | |
| 2a. Fruits dark red or red purple : | |
| 3a. Ovules usually 1-2 : | |
| 4a. Stem dark red when mature, terete. Leaves
epuinose beneath | ... 14. <i>B. petiolaris</i> |
| 4b. Stems pale yellow, sulcate or angled.
Leaves pruinose beneath | ...6. <i>B. huegeliana</i> |

- 3b. Ovules more than 2 :
- 5a. Fruits large, ca 10 x 9 mm ...17. *B. stewartiana*
- 5b. Fruit not as above :
- 6a. Style conspicuous, 0.5-1.5 mm long :
- 7a. Stems pubescent or pubescent at least in early stages. Inflorescence loosely corymbose paniculate with flowers in groups of three ...4. *B. chitria*
- 7b. Stems always quite glabrous. Inflorescence racemose. Flowers not in groups of three ...1. *B. aristata*
- 6b. Style not conspicuous :
- 8a. Inflorescence 10-25-flowered, racemose ...8. *B. kashmirana*
- 8b. Inflorescence 2-10-flowered, subumbellate or subfascicled ...2. *B. brandisiana*
- 2b. Fruits black, pruinose :
- 9a. Stems sulcate ... 13. *B. parkeriana*
- 9b. Stems terete :
- 10a. Petals longer than inner sepals ...5. *B. glaucocarpa*
- 10b. Petals shorter than inner sepals ...10. *B. lycium*
- 1b. Deciduous shrubs :
- 11a. Flowers large, 14-20 mm across :
- 12a. Stems red or purple ...11. *B. orthobotrys*
- 12b. Stems yellow ...7. *B. jaeschkeana*
- 11b. Flowers up to 12 mm across :
- 13a. Inflorescence 15-30-flowered ... 12. *B. pachyacantha*
- 13b. Inflorescence 2-10-flowered :
- 14a. Berries usually pink to red ...9. *B. kunawurensis*
- 14b. Berries blue or black :
- 15a. Leaves linear, spinulose on margins ...18. *B. ulicina*
- 15b. Leaves broader, usually entire on margins :
- 16a. Style conspicuous ...3. *B. calliobotrys*
- 16b. Style absent :

- 17a. Inflorescence umbellate or subumbellate
 ...15. *B. pseudumbellata*
 17b. Inflorescence racemose or subfascicled ...16. *B. royleana*

1. *Berberis aristata* DC., Syst. Nat. 2: 8. 1821; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 110. 1872, *p.p.*; Sharma & Kachroo, Fl. Jammu 1: 91. 1981. Banerjee in Sharma *et al.*, Fl. India 1: 381. 1993.

Deciduous shrubs. Stems brownish, grooved; spines 1-2 cm long. Leaves obovate, 2-3 x 0.7-1.5 cm, obtuse or acute, entire or with a few spinose teeth near apex; veins prominent. Racemes 5-6 cm long. Pedicels up to 5-10 mm long. Sepals increasing gradually in size; outermost ovate, *ca* 1.5 x 1 mm; inner obovate, *ca* 7 x 3-4 mm. Petals obovate, 6-7 x 3-4 mm. Berries (immature) narrowly ellipsoid, *ca* 7 x 1.5 mm including style *ca* 1 mm.

Fl. : May June.

Included after Sharma & Kachroo (*loc. cit.*).

2. *Berberis brandisiana* Ahrendt in J. Asiat. Soc. Bengal 11: 2. 1945 *et in* J. Linn. Soc. 57: 106. 1961; Jafri in Fl. W. Pak. 87: 14. t. 4c. 1975; Sur in Sharma *et al.*, Flora India 1: 389. 1993.

Stems dark red, lustrous, subsulcate, glabrous; spines, simple-3-fid, rarely absent, 3-10 (-15) mm long. Leaves obovate, 2-4 (-7) cm long, 1-3 (-4) cm broad excluding petiole, entire or 8-15 spinulose at margins, obtuse-mucronate at apex. Inflorescence umbellate-racemose, 3-6-flowered, 2.5-4 cm long. Flowers 9-10 mm across. Pedicels 1-1.5 cm long. Berries red, obovoid, 9-10 x 6-7 mm, estylose, epruinose.

Fl. & Fr. : April July.

Included after Jafri (*loc. cit.*).

3. *Berberis calliobotrys* Aitch. ex Koehne, Deutsch. Dendr. 168. 1893; Ahrendt in J. Linn. Soc. 57: 225. f. 49. 1957; Jafri in Fl. W. pak.

87: 23. f. 3 E-G. 1975; Rao & Kumar in Sharma *et al.*, Flora India 1: 375. 1993.

Shrubs, reaching up to 2 m height. Stems red brown to pale brown, sulcate; spines usually trifid, 1-2 cm long. Leaves oblanceolate, oblong-obovate, 10-35 x 4-12 mm, entire or few spinose-serrate, acute-subobtuse. Racemes up to 10-flowered, subfascicled or racemose-fascicled, 1-3 cm long. Flowers yellow. Outer sepals *ca* 4 x 2.5 mm; inner longer, up to 6 mm x 4 mm. Petals nearly equalling or shorter than the inner sepals. Berries black, globose-ovoid or somewhat obovoid, pruinose to subpruinose, stylose.

Fl. & Fr. : April - November.

Selected specimens : Draphome, Dachigam Sanctuary, *ca* 1800 m, A.S. Rao 63605 (BSD).

4. ***Berberis chitria*** Lindl. in Bot. Reg. 9. t. 729, 1823; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 1872; Ahrendt in J. Linn. Soc. Bot. 57: 97 t. 15. 1961; Jafri in Fl. W. Pak. 87: 14.f. 4 A-B. 1975; Banerjee in Sharma *et al.*, Flora India 1: 381. 1993. *Berberis chitria* var. *occidentalis* Ahrendt in J. Bot. Lond. 80 (suppl.) 85, 1942 *et* J. Linn. Soc. 57: 97. 1961.

Shrubs, up to 4 m tall. Stems dark reddish brown, subglabrous-finely pubescent; spines simple or trifid, 1-3 cm long. Leaves obovate-elliptic or oblanceolate, up to 10 x 4 cm, subsessile, 3-9 spinulose at margins or entire. Inflorescence up to 12 cm long, 10-20-flowered, corymbose-paniculate with flowers in groups of 3. Flowers yellow, often tinged with red, 12-16 mm across. Sepals obovate; outer 2-4 mm; inner *ca* 7 mm long. Petals broadly elliptic, 8-9 mm long, emarginate. Berries dark red, *ca* 12-6 mm, pruinose, short stylose.

Fl. & Fr. : May - November.

Selected specimens : Mashadi, Hajra 82395 (BSD).

5. **Berberis glaucocarpa** Stapf in Bot. Mag. 101, subt. 9102. 1926; Ahrendt in J. Linn. Soc. 57: 90.f. 26. 1961; Jafri in Fl. W. Pak. 87: 13.f. 3 C. 1975; Uniyal & Rao in Sharma *et al.*, Fl. India 1: 371. 1993.

Shrubs. Stems pale yellow, terete; internodes *ca* 4 cm long; spines *ca* 1 cm long, usually solitary, simple, rarely 3-fid. Leaves elliptic-obovate, up to 8 x 2.5 cm, acute, margins 4-5 spinulose or entire, shiny green on both surfaces. Racemes 2-4 cm long. Pedicels *ca* 8 mm long. Prophyll *ca* 1 mm long. Sepals in 3 whorls; outer ovate, 2 mm long; median longer; inner ones obovate, *ca* 6 x 5 mm. Petals obovate, 7 x 4.5 mm. Berries black, oblong-globose, *ca* 8 mm long, pruinose, minutely stylose.

Fl. & Fr. : April August.

Included after Uniyal & Rao (*loc. cit.*).

6. **Berberis huegeliana** Schneid. in Bull. Herb. Boiss. Ser. 2. 5: 451. 1905; Ahrendt in J. Linn. Soc. Bot. 57: 94. 1961; Jafri in Fl. W. Pak. 87: 13. 1975; Singh & Kachroo, For. Fl. Srinagar 163. 1976; Rao & Naithani in Sharma *et al.*, Fl. India 1: 384. 1993.

Shrubs. Stems pale yellow; shoots puberulous, becoming glabrous on maturity; spines 1-2 cm long. Leaves oblong-obovate, 3-4.5 x 1.2-1.7 cm, subsessile or short petioled, margins usually with 1-4 spinules towards apex, subcoriaceous, pruinose grey and papillose beneath. Racemes 3-6 cm long, 10-18-flowered. Flowers *ca* 1 cm across. Pedicels 5-10 mm long. Inner sepals *ca* 6 mm long. Petals almost equalling the inner sepals, entire.

Fl. & Fr. : April May

Included after Singh & Kachroo (*loc. cit.*).

Endemic to J&K (Srinagar).

7. **Berberis jaeschkeana** Schneid. in Bull. Herb. Boiss. Ser. 2. 5: 399. 1905; Ahrendt in J. Linn. Soc. Bot. 57: 238. 1961; Jafri in Fl. W.

Pak. 87: 16, f. 5 C-H, 1975; Kornik *et* Kornik in Fl. Iran. 111: 7, 1975; Sharma & Jamwal, Fl. Upper Liddar valleys 1: 78, 1988; Das Gupta in Sharma *et al.*, Fl. India 1: 362, 1993.

Shrubs, ca 1 m tall, deciduous. Stems yellow brown on maturity, angular; spines 3-fid, 10-15 mm long. Leaves oblong-elliptic, 10-20 (23) mm long, 5-8 mm broad, generally green on both sides, usually 1-2-5 spinose serrulate on margins, sessile-subsessile. Inflorescence umbellate or subumbellate, up to 8-flowered. Flowers 9-12 mm across. Outer and middle sepals 4-6 mm long; inner 7-8 mm long, obovate. Petals \pm equalling the inner sepals. Berries red, oblong-ovoid, epruinose, 8-10 mm x 5-6 mm, inconspicuously stylose.

- 1a. Stems puberulous. Leaves with 3 or more serrations along margins ...7.1. var. *jaeschkeana*
 1b. Stems glabrous. Leaves entire or with 1-2 serrations ...7.2. var. *usteriana*

7.1. var. *jaeschkeana*

Fl. & Fr. : June August.

Selected specimens : Liddar vallay, 3500-4000 m, Duthie 13150 (DD); Pir Panjal, Alishad, ca 2800 m Gammie s.n. (DD).

7.2. var. *usteriana* Schneid. in Bull. Herb. Boiss. Ser. 2, 5: 399, 1905; Ahrendt in J. Linn. Soc. Bot. 57: 139, 1961; Jafri in Fl. W. Pak. 87: 18, 1975. *B. usteriana* (Schneid.) Parker in Indian For. 50: 399, 1924; Sharma & Kachroo, Fl. Jammu 1: 91, 1981; Dasgupta in Sharma *et al.*, Flora India 1: 364, 1993.

Fl. & Fr. : June September.

Selected specimens : Liddar valley, 3000-4000 m, Duthie 13150 (BSD); Alishad, Pir Panjal, ca 2800 m, Gammie s.n. (DD).

8. *Berberis kashmirana* Ahrendt in *J. Bot. London* 80 (Suppl.) : 97, 1943 *et in J. Linn. Soc. Bot.* 57: 107, 1961; Jafri in *Fl. W. Pak.* 87: 16, 1975; Rao & Kumar in Sharma *et al.*, *Fl. India* 1: 388, 1993.

Shrubs, 1-2 m tall. Stems glabrous, pale yellow, terete to subsulcate. Spines 3-fid, 1-1.5 cm long. Leaves narrowly obovate-oblong, 2-6 x 1-1.8 cm, closely 15-25-spinulose-serrate at margin. Racemes 3-4 cm long, laxly 10-25 flowered. Flowers 10-12 mm across, Pedicels 8-17 mm. Sepals larger than petals; outer ovate, *ca* 5.5 mm long; inner obovate, 6-7 mm long. Petals broadly elliptic, *ca* 4.5 mm long. Berries dark red, 9-10 mm, oblong-ellipsoid, pruinose, estylose or shortly stylose.

Fl. & Fr. : June July.

Included after Ahrendt (*loc. cit.*).

Endemic.

9. *Berberis kunawurensis* Royle, *Illus. Bot. Himal.* 64, 1834; Ahrendt in *J. Linn. Soc. Bot.* 57: 211, 1961; Jafri in *Fl. W. Pak.* 87: 22.f. 7A, 1975; Kornik *et* Kornik in *Fl. Iran.* 111: 7, t. 3, 1975; Sharma & Kachroo, *Fl. Jammu* 1: 91, 1981. *B. vulgaris* var. *aetnensis* Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 109, 1872; Uniyal & Rao in Sharma *et al.*, *Fl. India* 1: 379, 1993.

Shrubs. Stems pale-ashy or red-brown, subterete to sulcate, subangled; spines 0.5-2 cm long, mostly 3-fid. Leaves lanceolate, obovate or narrowly elliptic, acute to subacuminate, margins serrulate, 3-8 spinose. Panicles 10-40-flowered; peduncles 5-14 mm long. Flowers red brown, 5-6 mm in diam. Pedicels 1.5-4 mm long. Sepals in 2 whorls; outer ones oblong, 3-4 x 2-2.5 mm long; inner ones 4-5 x 3.5-4 mm, obovate. Petals elliptic-obovate, 4-5 x 3 mm. Berries bright orange red, 7-8 x 4-4.5 mm; oblong-elliptic, estylose or very shortly stylose.

Fl. & Fr. : May June.

Included after Sharma & Kachroo (*loc. cit.*).

10. *Berberis lycium* Royle in Trans. Linn. Soc. 17: 94. 1834; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 110. 1872; Ahrendt in J. Linn. Soc. Bot. 57: 87. 1961; Jafri in Fl. W. Pak. 87: 10. 1975; Singh & Kachroo, For. Fl. Srinagar 163. 1975; Uniyal & Rao, in Sharma *et al.* Fl. India 1: 372. 1993. *Rajaunt, Kasmal, Kowdach, Kustmul, Krumbal.*

Shrubs. Stems pale, terete or subsulcate; spines 6-20 mm long, subterete, 3-fid; lateral ones 7-12 mm long. Leaves subsessile, oblanceolate to obovate 2-7 x 0.6-1.2 cm, acute, mucronate, margins entire or 2-4 spinulose, greyish or white beneath. Inflorescence racemose or subfascicled. Flowers 7-8 mm in diam. Pedicels slender, up to 2 cm long. Prophylls ovate, 1 x 0.5 mm. Sepals in 3 whorls. Petals obovate, emarginate. Berries blue or black, ellipsoid-ovoid, minutely stylose.

Fl. & Fr. : May July.

Uses : Medicinal.

One of the commonest of *Berberis* species in India; very variable. The following varieties have been reported from Jammu & Kashmir :

- 1a. Stem slightly sulcate. Leaves becoming dull greenish below, not or scarcely papillose below ...10.3. var. *subvirescens*
 1b. Stem terete. Leaves whitish and conspicuously papillose beneath :
 2a. Inflorescence subfascicled ...10.2. var. *subfascicularis*
 2b. Inflorescence 5-13 cm long, racemose ...10.1. var. *lycium*

10.1. var. *lycium*

Selected specimens : Bharderwah, T.A. Rao 9020 (BSD); Bharderwah, Uniyal 80139 (BSD); Udhampur, Ram Nagar, Swami 540 (BSD); Tawi valley, ca 1300 m, Keshavanand 7 (DD); Srinagar, 1600-1800 m, Duthia 10835 (DD).

10.2. var. **subfascicularis** Ahrendt in J. Linn. Soc. London 57: 88. 1961; Uniyal & Rao in Sharma *et al.*, Flora India 1: 374. 1993.

Included after Uniyal & Rao (*loc. cit.*).

10.3. var. **subvirescens** Ahrendt in J. Linn. Soc. London 57: 88. 1961; Uniyal & Rao in Sharma *et al.*, Fl. India 1: 374. 1993.

Included after Uniyal & Rao (*loc. cit.*).

11. **Berberis orthobotrys** Bienert ex Aitch in J. Linn. Soc. Bot. 19: 150. 1882; Ahrendt in J. Linn. Soc. Bot. 57: 142. 1961; Jafri in Fl. W. Pak. 87: 10. 1975; Sharma & Jamwal, Fl. Upper Liddar valleys 1: 78. 1988; Rao & Kumar in Sharma *et al.* Fl. India 1: 366. 1993.

Shrubs. Stems dark red, red brown to pale whitish, sulcate. Leaves obovate, elliptic-obovate, 10-20 x 5-15 mm, acute or obtuse, spinose on margins, subsessile to obscurely petiolate. Inflorescence racemose or capitate or subfascicled, with 5-10 flowers. Pedicels 4-15 mm long. Berries red, 7-11 x 5-6 mm, oblong or ellipsoid, estylose.

- 1a. Leaves usually up to 2 cm long. Inflorescence congested, somewhat capitate; pedicels 5-10 mm long ...11.1. subsp. *capitata*
 1b. Leaves 2-3.5 cm long. Inflorescence somewhat lax; pedicels 10-12 mm long ...11.2. subsp. *orthobotrys*

11.1. subsp. **capitata** Jafri in Fl. W. Pak. 87: 20. f. 60 1975; Rao & Kumar in Sharma *et al.*, Fl. India 1: 367. 1993.

Fl. & Fr. : April - July.

Included after Jafri (*loc. cit.*).

11.2. subsp. **orthobotrys**

- 1a. Leaves grey pruinose beneath ...11.2.1. var. *canescens*
 1b. Leaves green, epruinose beneath :

- 2a. Pedicels 4-8 mm long ...11.2.4. var. *sinthanensis*
 2b. Pedicels 8-15 mm long :
 3a. Berries 9-10 mm long ...11.2.2. var. *conwayi*
 3b. Berries up to 7 mm long ...11.2.3. var. *orthobotrys*

11.2.1. var. *canescens* Ahrendt in J. Linn. Soc. Lond. 57: 144. 1961;
 Rao & Kumar in Sharma *et al.*, Fl. India 1: 368. 1993.

Spines concolorous, sulcate, 1-2.5 cm long. Leaves 10-25 x 3-8 mm, dull grey-green above, grey pruinose beneath. Inflorescence 5-10-flowered, umbellate-racemose. Pedicels 6-12 mm long. Sepals in 3 whorls. Petals with lanceolate glands. Berries red.

Fl. & Fr. : May November.

Included after Rao & Kumar (*loc. cit.*).

11.2.2. var. *conwayi* Ahrendt in J. Linn. Soc. Lond. 57: 143. 1961;
 Rao & Kumar in Sharma *et al.*, Fl. India 1: 368. 1993.

Leaves *ca* 3.5 x 2 cm. Inflorescence 4-8 flowered. Sepals in 2 series. Petals convolute protruding beyond petals. Berries *ca* 7 x 5 mm.

Fl. & Fr. : May August.

Included after Rao & Kumar (*loc. cit.*).

11.2.3. var. *orthobotrys*

Fl. & Fr. : May August

Included after Rao & Kumar (*loc. cit.*).

11.2.4. var. *sinthanensis* Ahrendt in J. Linn. Soc. Lond. 57: 143. 1961;
 Rao & Kumar in Sharma *et al.*, Fl. India 1: 369. 1993.

Leaves deciduous, spinulose along margins. Inflorescence 5-25 flowered. Pedicels 4-8 mm long. Petals subequal. Berries oblong dull red.

Included after Rao & Kumar (*loc. cit.*).

12. *Berberis pachyacantha* Koehne, Deutsche Dendr. 170. 1893; Ahrendt in J. Linn. Soc. 57: 191. 1961; Jafri in Fl. W. Pak. 87: 21. f. 5A 1975 Singh & Kachroo, For. Fl. Srinagar 164. 1976; Uniyal & Rao in Sharma *et al.*, Fl. India 1: 391. 1993.

Shrubs. Stems dark red or pale yellow, subterete; spines solitary or 3-fid or absent. Leaves 5-10 x 1.5-3.5 cm, obovate-elliptic or oblanceolate, spinuloses. Racemes 15-20-flowered. Peduncles *ca* 1.5 cm long. Pedicels up to 1.5 cm long. Sepals in 2-whorls; outer ones ovate-obtuse; inner ones obovate 5.5 x 3.5 mm. Petals acutely emarginate. Berries red, oblong-ovoid, *ca* 8 mm long estylose.

- 1a. Stems dark red to pale brownish. Flowers 7-9 mm across. Pedicels 10-15 mm long ...12.1. subsp. *pachyacantha*
 1b. Stems pale. Flowers 5-6 mm across. Pedicels 4-8 mm long ...12.2. subsp. *zabeliana*

12.1. subsp. *pachyacantha*

Fl. & Fr. : July - October.

Selected specimens : Synthen, 4000 m, Sarin 6481 (RRL); Kalapani, Kamrinula, Inayat 25468 (DD); Pahalgam, Liddar valley, 2300 m, Lambert 199 (DD); Gulmarg, *ca* 3000 m, Vaid acc. no. 131897 (DD).

12.2. subsp. *zabellana* (Schneider) Jafri in Fl. W. Pak. 87: 21.f. 5B 1975. *B. zabeliana* Schneider in Bull. Herb. Boiss. 2, 5: 667. 1905. *Danteuther kund, Kawdach, Sincorpa.*

Fl. & Fr. : May - November.

Selected specimens : Batkote, 2600 m, T.A. Rao 9759 (BSD); Kashmir valley, Hunter 10158 (DD); Wangat above Gandarbal, *ca* 2200 m, Witt s.n. (DD).

13. *Berberis parkeriana* Schneid. in Fedde Rep. 11: 162. 1912; Ahrendt in J. Linn. Soc. 57: 89. 1961; Jafri in Fl. W. Pak. 87: 11. f. 2 G.-J. 1975; Uniyal & Rao in Sharma *et al.*, Fl. India 1: 374. 1993.

Shrubs. Stems up to 2.5 m tall, sulcate; spines 1-2 cm long, 3-fid, slender, sulcate. Leaves lanceolate or narrowly obovate, 2-6 x 0.5-1.3 cm, acute, mucronate, entire, epappillose. Inflorescence subfascicled, racemose 4-18-flowered. Pedicels 8-14 mm long. Outer sepals oblong-elliptic, 2.5 x 1.5 mm, reddish; inner sepals obovate-elliptic, 5 x 4 mm. Petals narrowly oblong-elliptic, 4.5-5 x 2-3 mm, cuneate, subentire. Berries bright blue, ca 9 x 7 mm, pruinose, stylose.

Fl. & Fr. : April July.

Included after Uniyal & Rao (*loc. cit.*).

14. *Berberis petiolaris* Wallich ex G. Don, Syst. 1: 116. 1831; Ahrendt in J. Linn. Soc. 57: 9. 1961; Sharma & Kachroo, Fl. Jammu 1: 91. 1981; Rao & Naithani in Sharma *et al.*, Fl. India 1: 385. 1993.

Shrubs, up to 6.5 m tall; stems terete, deep red to red brown on maturity; spines solitary or absent. Leaves obovate-elliptic, up to 8 x 3 cm, entire or 1-2 spinulose on the margins. Inflorescence racemose or umbellate. Outer sepals ovate; inner larger, obovate. Petals obovate, equalling the inner sepals, entire; glands lanceolate. Berries ellipsoid or oblong, ca 7 x 3.5 mm, stylose.

Fl. & Fr. : May July

Selected specimens : Kalapani, Kamrinala, Inayat 25468 (DD).

15. *Berberis pseudumbellata* Parker in Kew Bull. 1921: 118. 1921; Ahrendt in J. Linn. Soc. Bot. 57: 226. 1961; Jafri in Fl. W. Pak. 87: 24. 1975; Singh & Kachroo, For. Fl. Srinagar 164. 1976; Rao & Kumar in Sharma *et al.*, Fl. India 1: 376. 1993. *Pakkad.*

Shrubs, up to 2-3 m tall, deciduous, glabrous. Stems slender, dark red to brownish or yellowish, spines simple to trifid, up to 15 mm long.

Leaves oblong-obovate, spatulate, narrowed into a ped, up to 35 x 20 mm, margin spinulose, somewhat greyish pruinose beneath. Inflorescence umbellate-subumbellate. Flowers ca 10 mm across. Outer sepals, ovate, 2-2.5 mm long; inner longer ca 5 mm long, obovate. Petals 5-6 mm long. Berries obovate-ovoid, pruinose, blue, shortly stylose or estylose.

- 1a. Inflorescence up to 10-flowered. Berries
pruinose ...15.2. subsp. *pseudumbellata*
- 1b. Inflorescence 10-15-flowered. Berries
scarcely pruinose ...15.1. subsp. *gilgitica*

15.1. subsp. *gilgitica* Jafri in Nasir & Ali, Fl. W. Pak. No. 87: 26. f. 8A. 1974; Rao & Kumar in Sharma *et al.*, Fl. India 1: 377. 1993.

Fl. & Fr. : May August.

Included after Jafri (*loc. cit.*).

15.2. subsp. *pseudumbellata*

Fl. & Fr. : May August.

Selected specimens : Batkote, 2600m, T.A. Rao 9759 (BSD); Kashmir valley, A.G. Hunter 10158 (DD); Wangat, above Gandarbal, ca 2200 m, Witt. s.n. (DD); Baramullah, Falconer s.n. (DD); Pahalgam, 2800 m. D.F.O. Kashmir, 3210 (DD).

16. *Berberis royleana* Ahrendt in J. Asiat. Soc. Bengal 11: 5. 1945 *et* J. Linn. Soc. 57: 227. 1961; Jafri in Fl. W. Pak. 87: 27. f 8D 1975; Rao & Kumar in Sharma *et al.*, Fl. India 1: 377. 1993.

Glabrous shrubs, up to 3 m tall. Stems red brown, sulcate; spines red, 3-fid, usually 10-15 mm long. Leaves broadly oblong-obovate, 7-15 (-25) x 6-12 mm, entire, grey pruinose beneath. Inflorescence 3-8-flowered, fascicled or subumbellate fascicled. Berries blue-black, grey. pruinose oblong, estylose.

Fl. & Fr. : May August.

Included after Rao & Kumar (*loc. cit.*).

17. *Berberis stewartiana* Jafri in Fl. W. Pak. 87: 24. t. 6F. 1975.

Shrubs branches reddish, sulcate, spines 1-3 fid; 1-2 cm long. Leaves obovate, 1.5-3 x 1.2 cm, minutely spine tipped, margins 2-6 spinulose dentate. Inflorescence 2-4 cm long, subumbellate or subracemose-pseudumbellate. Berries black red, globose-globose-obovoid, shortly stylose.

Fl. & Fr. : July August.

Included after Jafri (*loc. cit.*).

18. *Berberis ulicina* Hook.f. & Thomson, Fl. Ind. 227. 1855 *et* in Hook.f., Fl. Brit. India 1: 111. 1872; Ahrendt in J. Linn. Soc. Bot. 57: 228. f. 55. 1961; Jafri in Fl. W. Pak. 87: 28. f. 7D-E 1975; Rao & Kumar in Sharma *et al.*, Fl. India 1: 391. 1993. *Sinskingnama, Kiraring.*

Much branched, densely spiny shrubs, up to 3 m tall. Stems reddish brown; spines 3-fid, equalling the leaves. Leaves linear-lanceolate or narrowly oblanceolate, up to 15 x 2.5 mm, entire or 1-2 spinulose. Inflorescence fascicled or fascicled subumbellate, 3-6-flowered. Flowers orange yellow. Berries blackish, globose or suborbicular, estylose.

Fl. & Fr. : June September.

Selected specimens : Ladkah, Shyok, 4200 m, *Viswánathan* 55054 (BSD); Pulu nailah, North, 4,500-6000 m, *Wadhwa* 59924 (BSD).

Note : Kornik & Kornik (Fl. Iran. 111: 9.1975) recorded the occurrence of *Berberis integerrima* Bunge from I&K.

2. EPIMEDIUM L.

Epimedium elatum Morr. & Decne. in Ann. Soc. Nat. Ser. 2. 2:

356. 1834; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 112. 1872; Jafri in Fl. W. Pak. 87: 2. f. 1. A-F. 1975; Sharma & Jamwal. Fl. Upper Liddar Valleys. 1: 78. 1988; Rao & Hajra in Sharma *et. al.* Fl. India 1: 406. 1993. *Maccharmar*.

Erect, perennial herbs, up to 1 m tall. Leaves compound, 2-3 ternate, 10-30 x 8-15 cm inclusive of petiole; pinnae with 3 leaflets; leaflets ovate-cordate, 6 x 7.5 cm, terminal usually larger than the usually oblique laterals, margins spinulose serrate; petioles up to 10 cm long. Inflorescence paniculate; panicles up to 25 cm long, glabrous or glandular hairy. Bracts linear-lanceolate. Flowers white or pale yellow. Sepals petaloid, 8, ovate-lanceolate, acute. Petals lanceolate-elliptic; inner two honey bearing pair shorter, shoe shaped. Stamens 4, opposing the petals. Capsules submembranous, usually 2-3-seeded.

Fl. & Fr. : June July.

Selected specimens : Drang forest, T.A. Rao 384; Aharbal, 2000 m, T.A. Rao 9259; Desu, 3200 m, T.A. Rao 9834 (BSD); Shekhpora, Wadhwa, Murti & Pant 85101 (BSD).

Uses : The plant is used to kill mosquitoes.

3. MAHONIA Nutt.

Mahonia borealis Takeda in Notes Roy. Bot. Gard. Edinb. 6: 221. 1917; Ahrendt in J. Linn. Soc. Bot. 57: 307. 1961; Jafri in Fl. W. Pak. 87: 2. f. 1.6.1975; Guha Bakshi in Sharma *et al.*, Fl. India 1: 408. 1993.

Shrubs. Leaves up to 40 x 15 cm, odd-pinnate; leaflets opposite, oblong-ovate, oblong-lanceolate, up to 10 x 4 cm, distantly spinose-serrate. Flowers in fascicled racemes. Sepals increasing in size; outer ovate, acute; median oblong-ovate, subacute; inner oblong-obovate. Petals yellow, emarginate at apex; lobes acute, distinctly glandular. Berries blue, globose, ovoid, pruinose, shortly stylose.

Fl. & Fr. : April May.

Included after Guha Bakshi (*loc. cit.*).

PODOPHYLLACEAE

(B.P. Uniyal)

PODOPHYLLUM L.

Podophyllum hexandrum Royle, *Illus. Bot. Himal.* 1: 64. 1834; Singh & Kachroo, *For. Fl. Srinagar* 163. 1976; Sharma & Jamwal, *Fl. Upper Liddar valleys* 1: 19. 1988; Rao & Hajra in Sharma *et al.*, *Fl. India* 1: 415. 1993. *P. emodi* Wallich ex Honig., *Thirty five years in the East* 2: 35. Pl. 20. 1852; Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 112. 1872. *Vanvaigan, Bankakri, Demobkusu, Bangpheloutche, Wanwangun.*

Glabrous, somewhat succulent, perennial herbs, up to 60 cm high. Leaves 2, alternate, orbicular-reniform, up to 15 x 10 cm, 3-5 palmatisect; segments elliptic or obovate, entire or lobed. Flowers solitary, white or pinkish. Sepals 3, petaloid. Petals 6, obovate-oblong. Fruits ovoid or oblong-ellipsoid, pulpy, red when mature. Seeds many.

Fl. & Fr. : May - September.

Selected specimens : Ladakh, Panikhar, *Chowdhery & Uniyal* 85876 (BSD); Kargil-Suru, *Viswanathan* 55676 (BSD); Zozila, *Hajra* 74013 (BSD); Gulmarg, 2000 m, *Bhattacharyya* 71192 (BSD); Chandanwadi, 2900 m, *Nair* 36924 (BSD); Seshnag, 3600 m, *Rau* 50310 (BSD), Barwan, Kishenganga valley, *Wadhwa, Murti & Pant* 84927 (BSD); Jai/Kanasar, *T.A. Rao* 9141 (BSD).

Uses : Medicinally important species. Fruits edible.

LARDIZABALACEAE

(B.P. Uniyal)

HOLBOELLIA Wallich

Holboellia latifolia Wallich, *Tent. Fl. Nepal.* 24. t. 16. 1824; Hook.f. & Thomson, *Fl. Ind.* 1: 215. 1855 *et in* Hook.f., *Fl. Brit. India*

1: 108, 1872; Jafri in Fl. W. Pak. 60: 2, 1974; Nayar & Paul in Sharma *et. al.*, Fl. India 1: 423, 1993. Swami & Gupta, Fl. Udhampur 43, 1998.

Large, evergreen, climbing shrubs. Leaves digitately 3-9-foliolate; leaflets usually ovate-elliptic or oblong, up to 12 x 5 cm, entire, glabrous; petioles 4-8 cm long. Flowers in peduncled axillary fascicles, purplish-greenish white, fragrant. Sepals 6, in 2 whorls, 10-16 x 2.5-5 mm, oblong or oblong-elliptic. Petals 6, minute. Fruits rosy purple, up to 10 x 4 cm, oblong or ovate-oblong, many-seeded.

Fl. & Fr. : May - October.

Selected specimens : Katra, Udhampur, Swami 1237 (BSD).

Notes : Fruits edible.

NYMPHAEACEAE

(D. Basu & B.P. Uniyal)

- 1a. Densely prickly herbs. Sepals, petals and stamens
epigynous ...1. *Euryale*
- 1b. Non-prickly herbs. Sepals, petals and
stamens hypogynous to perigynous ...2. *Nymphaea*

1. EURYALE Salisb.

Euryale ferox Salisb. in Konig. & Sims., Ann. Bot. 2: 74, 1805. Hook.f. & Thomson in Hook.f., Fl. Brit. India. 1: 115, 1872; Blatter, Beaut. Fls. Kashmir 28, 1927; R.L. Mitra in Sharma *et al.*, Fl. India 1: 427, 1993. *Makhanu* (Hindi); *Jewar, Juwar* (Kashmiri).

Aquatic, submerged herbs with, prickly rootstock. Leaves floating, up to 120 x 110 cm, orbicular, coriaceous, peltate centrally, prickly along veins above. Flowers violet, shining, partially submerged. Sepals 4, fleshy, triangular-ovate, concave, prickly on back. Outer petals oblong, concave. Berries globular-ovoid, densely prickly.

Fl. & Fr. : July - October.

Selected specimens : Srinagar, Nagin lake Wadhwa & Vohra 351(CAL); Dal lake, 1900 m T.A. Rao 7728 (BSD); Kashmir, ca 1600 m, Gammie s.n. (DD).

Uses : Seeds are edible.

2. NYMPHAEA L.

- 1a. Primary veins prominently raised beneath.
 - Carpels free at the side ...4. *N. nouchali*
- 1b. Primary veins impressed beneath. Carpels entirely fused together :
 - 2a. Flowers yellow ...3. *N. mexicana*
 - 2b. Flowers white, rosy or red :
 - 3a. Rhizomes erect ...5. *N. tetragona*
 - 3b. Rhizomes horizontal :
 - 4a. Leaves scattered loosely on the rhizome ...6. *N. tuberosa*
 - 4b. Leaves crowded on the rhizomes :
 - 5a. All the filaments broader than their anthers. Fruits ovoid ...2. *N. candida*
 - 5b. Filaments of inner-most stamens not wider than their anthers. Fruits more or less spherical ...1. *N. alba*

1. *Nymphaea alba* L., Sp. Pl. 510. 1753; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 114. 1872; Kak in J. Econ. Tax. Bot. 7(3): 594. 1985; R.L. Mitra in Sharma *et. al.*, Fl. India 1: 429. 1993. *Brimposh* (Dogri); *Boomb*, *Bumim*.

Rootstock creeping. Leaves suborbicular, up to 28 x 26 cm. Flowers white, 10-15 cm in diam. Sepals ovate-oblong. Petals ca 20; outer oblong-lanceolate, equalling or longer than the sepals. Stamens numerous; filaments of inner stamens not wider than anthers; anthers without appendages. Fruits 3-4 cm across.

Fl. & Fr. : April - October.

Selected specimens : Wular lake, ca 1700 m, *Keshavanand* 1270 (DD); Wular lake, 1500-1800 m, *Duthie* 10858 (DD, CAL); Dal lake *Wadhwa & Vohra* 135 (CAL).

2. *Nymphaea candida* C. Presl in J. & C. Presl, Del. Prag, 224. 1822; Kak in J. Econ. Tax. Bot. 7(3): 596. 1985. R.L. Mitra in Sharma *et al.*, Fl. India 1: 430. 1993. *N. cachemeriana* Camb. in Jacq., Voy. Bot. 4: 11. 1844. *N. alba* L, var. *cachemeriana* (Camb.) Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 114. 1872.

Perennial herbs with black rhizome. Leaves elliptic, sub-orbicular, 10-20 x 9-19 cm, rounded or retuse at apex. Flowers white, 6-8 cm in diam. Sepals ovate-lanceolate to ovate oblong, green outside. Petals ca 12, outer ones oblong-lanceolate, obtuse at apex. Stamens ca 40; outer ones with lanceolate filaments. Fruits 3-3.5 cm in diam.

Fl. & Fr. : April - December.

Selected specimens : Wular lake, 1675 m, *Rao* 9489 (BSD); Nilnag, lake, 2000 m, *T.A. Rao* 9403; Nagin lake, ca 2400 m, *T.A. Rao* 757 (BSD); on way to Parol, *Hajra* 82434 (BSD).

3. *Nymphaea mexicana* Zucc. in Abh. Akad-Muench. 1: 365. 1832; Kaul & Naqshi in J. Bombay Nat. Hist. Soc. 85(2): 455. 1988.

Floating. Rhizomes erect. Leaves ovate, obscurely sinuate on margins, dark green above, with blackish dots beneath. Flowers yellow, ca 10 cm across.

Included after Kaul & Naqshi (*loc. cit.*).

4. *Nymphaea nouchali* Burm.f., Fl. Ind. 120. 1768; R.L. Mitra in Sharma *et al.*, Fl. India 1: 430. 1993. *Nymphaea stellata* Willd., Sp. Pl. 2: 1152. 1799; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 114. 1872; Kak in J. Econ. Tax. Bot. 7(3): 597. 1985.

Leaves elliptic-orbicular, repand to irregularly sinuate-dentate. Flowers yellow, pale bluish-blue-purple, 4-17 cm across. Sepals triangular-ovate. Petals 8-15. Stamens 25-40, appendaged. Fruits up to 4 cm across.

Fl. & Fr. : August - November.

Distrib. : Dal lake, Felconer's collector s.n. (DD); Dal lake, *Vaid* acc. no. 131900 (DD).

5. *Nymphaea tetragona* Georgi in Reise Russ. Reich. 1: 220. 1775; Kak in J. Econ. Tax. Bot. 7(3): 596. 1985; R.L. Mitra in Sharma *et al.*, Fl. India 1: 433. 1993. *N. pygmaea* Ait., Hort. Kew. ed. 23: 293. 1811; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 115. 1872.

Delicate herbs; rootstock covered with soft black hairs. Leaves orbicular-obovate or horse shoe shaped, 3-7 x 2.2-5.8 cm in diam., basal lobes diverging. Flowers white, 3-6 cm in diam. Sepals ovate-lanceolate to oblong lanceolate obtusely cucullate at apex. Petals *ca* 12; inner ones suddenly reduced. Stamens *ca* 50. Receptacle sharply tetragonous. Fruits 1.5-2 cm across.

Fl. & Fr. : July - October.

Selected specimens : Gulmarg, *ca* 2600-2800 m, *Duthie* 13057 (CAL, DD).

6. *Nymphaea tuberosa* Paine, Cat. Pl. Oneida 132. 1820; Kak in J. Econ. Tax. Bot. 7(3): 596. 1985; Kaul & Naqshi in J. Bombay Nat. Hist. Soc. 85(2): 455. 1988.

Tubers numerous, separating, slenderly attached on the rhizomes. Leaves somewhat orbicular; 12-25 cm in diam; petioles longitudinally brown striped. Flowers white, 4-9 cm across. Petals broad, concave.

Included after Kak (*loc. cit.*) and Kaul & Naqshi (*loc. cit.*).

DOUBTFUL SPECIES

Nymphaea lotus L. This species has been reported from J. & K. by Kaul & Naqshi *loc. cit.* 455. The leaves of *N. lotus* are distinctly

sinuate dentate and hence does not fit in the key as provided by Koul & Naqshi (*loc. cit.*).

NELUMBONACEAE

(D. Basu)

NELUMBO Adans.

Nelumbo nucifera Gaertn., *Fruct.* 1: 73, t. 19, f. 2, 1788; R.L. Mitra in Sharma *et al.*, *Fl. India* 1: 441, 1993. *Nelumbium speciosum* Willd. *Sp. Pl.* 2: 1258, 1799; Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 116, 1872; Sharma & Kachroo, *Fl. Jammu* 1: 92, 1981. *Pampos* (Kashmiri); *Kunal* (Hindi); *Pumbuch* (fruit), *Nalur* (Rhizome), *Ponbuch Gaur* (Seeds).

Perennial, aquatic herbs. Leaves, suborbicular, 20-80 cm in diam. glabrous and glaucous on both surfaces, dark green above, paler beneath, coriaceous, membranous when dry. Flowers rose pink or white, 8-25 cm across, fragrant; peduncles up to 2 m long, beset with scattered, hard, minute papillae. Sepals 1.5-5 x 0.8-3.5 cm, ovate or elliptic, concave, green or pinkish green. Petals *ca* 20 or *ca* 110, each 4-15 x 2-8 cm, elliptic, obtuse or subacute, concave, gradually becoming obovate to spatulate. Stamens up to 225, each 2.2-4.5 cm long; outermost in double form staminodial. Receptacles 2-4 cm across, spongy, yellow during anthesis, turn green, finally become dark brown, 5-10 cm across in fruit. Carpels 8-10 x 2-3 mm, becoming 2 x 1 cm in fruit, each differentiated into oblong, cylindrical ovary, short exserted stylodium with peltate, centrally depressed and papillose stigma.

Fl. & Fr. : March - December.

Selected specimens : Srinagar, Dal lake. Wadhwa & Vohra 131 (CAL); Dal lake, 1730 m, T.A. Rao 9602 (BSD). Wular lake, *ca* 1700 m, Keshavanand 1271 (DD).

PAPAVERACEAE

(S.C. Majumder)

1a. Styles absent. Stigmas discoid. Capsules opening
by pores just beneath the persistent stigmas

...3. *Papaver*

- 1b. Styles present or inconspicuous. Stigmas not discoid. Capsules opening usually by short valves :
- 2a. Styles distinct, conspicuously broad and large.
Stigmas forming a globular mass over the ovary ...2. *Meconopsis*
- 2b. Styles inconspicuous. Stigmas not forming a globular mass over the ovary ...1. *Argemone*

1. ARGEMONE L.

- 1a. Flowers bright yellow. Stigmatic lobes closely crowded together and appressed to the styles at anthesis; styles inconspicuous, 0-1 mm long in fruit ...1. *A. mexicana*
- 1b. Flowers white, turning pale yellow with age. Stigmatic lobes divergent and not appressed to the styles; styles conspicuous in fruit ...2. *A. ochroleuca*

1. *Argemone mexicana* L., Sp. Pl. 508. 1753; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 117. 1872; Sharma & Kachroo, Fl. Jammu 1: 92. 1981; Debnath & Nayar in Sharma *et al.*, Fl. India 2: 2. 1993. *Peela Kandiara, Shiolkanta.*

Glaucous, prickly herbs with yellow sap. Radical leaves 25-35 x 7-9 cm; cauline 5-10 x 2.5-4 cm, sinuate-pinnatifid, spiny on margins and veins, bluish green, variegated with white, sessile. Flowers yellow, solitary, terminal, subtended by leafy bracts at the base. Capsules 3-6-valved, prickly. Seeds numerous, brownish black, orbiculate, reticulate.

Fl. & Fr. : February May.

Native of Tropical America, common on roadside in fallow fields, waste places and as a weed in cultivated fields.

Selected specimens : Udampur, Ram Nagar, Swami 554 (BSD).

Uses : Juice used in dropsy, jaundice and cutaneous affections (Kapur, *loc. cit.*)

2. *Argemone ochroleuca* Sweet, Brit. Fl. Gard. 3: t. 242. 1829; Sharma & Kachroo, Fl. Jammu 1: 93. 1981; Debnath & Nayar in Sharma *et al.*, Fl. India 2: 5. 1993.

Erect, glabrous, prickly, annual herbs. Leaves 5-10 cm long, ash coloured; lower leaves in a rosette; upper ones sessile, semi-amplexicaul, sinuate-pinnatifid, prickly on nerves. Flowers white, turning pale yellow, solitary, terminal. Capsules spiny.

Fl. & Fr. : April - June.

Native of Mexico, naturalized in fallow fields, waste lands, road sides, etc, also found in cultivated fields.

Included after Sharma & Kachroo (*loc. cit.*).

2. MECONOPSIS Viguiet

1a. Flowering stems scapose or leafy at the base only ...3. *M. neglecta*

1b. Flowering stems leafy throughout :

2a. Leaves imperfectly 1-2 pinnatifid ...1. *M. aculeata*

2b. Leaves entire or sinuate-lobed. ...2. *M. latifolia*

1. *Meconopsis aculeata* Royle, Illus. Bot. Himal. 67. t. 15. 1834; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 118. 1872; Kachroo *et al.*, Flora Ladakh 48. 1977; Dhar & Kachroo, Alp. Fl. Kashmir Himal. 181. 1983; Debnath & Nayar in Sharma *et al.*, Fl. India 2: 11. 1993.

Prickly herbs. Stems ca 60 cm high. Leaves oblong, pinnatifid, rarely 2-pinnatifid, up to 30 cm long; segments oblong or ovate, triangular, obtuse. Flowers in racemes. Sepals 1-2 cm long, broadly oblong-ovate. Petals 4, rarely 6, blue, purplish blue or red, obovate-suborbicular. Ovary subglobose or ellipsoid; styles 0.2-1 cm long. Capsules dehiscent by 4-6 valves.

Fl. & Fr. : July - October.

Common amidst rocks on alpine slopes.

Selected specimens : Rajdhan, Wadhwa, Murti & Pant 84746 (BSD); Ladakh, Bhattacharyya 52123 (BSD); Ladakh, on way to Rangdom. Chowdhery & Uniyal 85971 (BSD); Sind valley, near Sonamarg, Duthie 11490 (DD); Pir Panjal, Inayat 25483 (DD).

2. *Meconopsis latifolia* (Prain) Prain in Bull. Misc. Inform. Kew 1915: 146. 1915; Jafri & Quiser in Nasir *et al.*, Fl. W. Pak. No. 61: 24. 1974; Debnath & Nayar in Fasc. Fl. Ind. 17: 20. 1984 *et in* Sharma *et al.*, Fl. India 2: 19. 1993; Naqshi & Ara in J. Econ. Tax. Bot. 17(3): 663. 1993. *M. sinuata* var. *latifolia* Prain in Curt., Bot. Mag. 134. t. 8223. 1908. *Kindiyara* (Kashmiri)

Stems 30-100 cm high, covered with yellowish brown or golden brown bristles. Leaves oblong or ovate-lanceolate, sinuate-lobed or deeply incised-serrate, rarely pinnatilobed; basal leaves 8-30 x 2-6 cm long; petioles bristly. Flowers in racemes. Sepals broadly oblong, 1-1.5 cm long. Petals pale blue or white, obovate or suborbicular, 2-3 cm long. Ovary ovoid, bristly; styles 1.5-3 mm long. Capsules 1-1.5 cm long, ellipsoid-oblong, bristly.

Fl. & Fr. : July - October.

Selected specimens : Jhelum Valley, 4000 m, Keshavanand 28523 (DD); Kishenganga valley, Keshavanand 25052 (DD).

Endemic.

3. *Meconopsis neglecta* G. Taylor, Acc. Genus *Meconopsis* 102. 1934; Jafri *et Quiser* in Nasir *et al.*, Fl. W. Pak. 61: 23. 1974; Dhar & Kachroo in Geobios N. Rep. 2: 132. 1983; Debnath & Nayar in Sharma *et al.*, Fl. India 2: 21. 1993.

Herbs, 10-20 cm high. Stems covered with persistent leaf bases. Leaves radical, 3.5 x 1 cm, deeply pinnatifid, densely covered on both the surfaces with pungent spines; lobes oblong, rounded at the apex.

Flowers solitary on scapes. Scapes up to 12 cm long, sparsely spiny. Petals 4, broadly ovate or suborbicular, 1.5-2 x 1.5-2 cm. Stamens numerous; filaments filiform; anthers yellow. Ovary ellipsoid, densely covered with pungent spines; styles distinct, ca 1 cm long; stigmas capitate.

Included after Dhar & Kachroo (*loc. cit.*).

3. PAPAVER L.

- 1a. Stems very short. Leaves all radical. Flowers born on leafless scapes ...4. *P. nudicaule*
- 1b. Stems long or rarely short. Leaves both radical and cauline. Flowers on leafy scapes :
 - 2a. Stigmatic segments keeled, with deeply dissected marginal lobes. Disc of capsules hemispherical ...3. *P. macrostomum*
 - 2b. Stigmatic segments not keeled, with shallow marginal lobes. Disc of capsules flat :
 - 3a. Terminal segment of leaves narrow, linear, awned. Capsules subglobose, with 4-8 stigmatic rays ...2. *P. hybridum*
 - 3b. Terminal segments of leaves broader, not awned. Capsules campanulate, with 6-15 stigmatic rays :
 - 4a. Terminal segment of leaves almost equal to lateral segments. Capsules oblong-ovate or clavate-cylindrical; rays of stigmatic disc 6-8 ...1. *P. dubium*
 - 4b. Terminal segment of leaves much longer than the lateral segments. Capsules campanulate; rays of stigmatic disc 9-13. ...5. *P. rhoeas*

1. *Papaver dubium* L., Sp. Pl. 1196. 1753; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 117. 1872; Blatter, Beaut. Fls. Kashmir 1: 29. 1927; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 287. 1972; Debnath & Nayar in Sharma *et al.*, Fl. India 2: 28. 1993.

Herbs, 14-40 cm high, hispid or bristly; basicauliramous. Leaves up to 10 x 3 cm, usually pinnatisect, sometimes pinnatifid, oblong-ovate, entire

or often dentate. Flowers brick red, terminal. Sepals 2, caducous. Petals ovate, caducous, 2.8 x 3-3.6 cm. Stamens few; filaments *ca* 9 mm long; anthers broad elliptic, *ca* 1 mm long. Capsules sessile, 5-18 x 3.9 mm, glabrous, with 6-8 stigmatic rays.

Fl. & Fr. : April August.

Occasional on the border of cultivated fields, by the road sides and in moist open situations.

Selected Specimens : Kishtwar, Dul road near Barwan Forest check post, *Uniyal* 80332 (BSD); Pampore 1750 m, *T.A. Rao* 9385 (BSD).

2. *Papaver hybridum* L., Sp. Pl. 506. 1753; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 117. 1872; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 287. 1972; Debnath & Nayar in Sharma *et al.*, Fl. India 2: 28. 1993.

Annual, sparingly branched, hispid herbs, up to 40 cm high. Leaves up to 30 cm; radical long petioled; cauline subsessile to sessile, pinnatifid to pinnatisect; terminal segment linear-lanceolate, awned at apex. Flowers scarlet, with a blackish blotch at base, solitary on scapes. Sepals 2, caducous, obtuse, sparingly hispid. Petals 4, overlapping and crumpled in bud. Filaments dilated. Capsules subglobose, bristly hispid, with 4-8 stigmatic rays.

Fl. & Fr. : March May.

A naturalised weed in wheat fields and wastelands.

Included after Debnath & Nayar (*loc. cit.*).

3. *Papaver macrostomum* Boiss., Fl. Orient. 1: 115. 1867; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 287. 1972; Singh & Kachroo, For. Fl. Srinagar 25, 27. 1976; Debnath & Nayar in Sharma *et al.*, Fl. India 2: 29. 1993.

Herbs, 20-40 cm high. Basal leaves up to 15 cm long, pinnatisect or deeply incised; segments linear-lanceolate or oblong-lanceolate, entire or coarsely sparsely dentate, terminating in a bristle, 1-4 cm long; upper leaves sessile. Peduncles 10-12 cm long, Sepals caducous. Petals bright red, 2-3 cm long. Stamens numerous; anthers 1-1.5 mm long. Capsules oblong-ellipsoid; 0.9-2.0 x 0.4-1 cm, stigmatic rays 5-10.

Fl. & Fr. : April August.

A naturalised weed in wheat fields and wastelands.

Selected specimens : Srinagar, ca 1700 m, *Gammie s.n.* (DD).

4. *Papaver nudicaule* L., Sp. Pl. 507. 1753; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 117. 1872; Blatter, Beaut. Fls. Kashmir 1: 28. Pl. 8. 1917; Kachroo *et al.*, Fl. Ladak 48. 1977; Sharma & Jamwal, Fl. Upper Liddar valleys 1: 79. 1988; Debnath & Nayar in Sharma *et al.*, Fl. India 2: 31. 1993. *Serchang*.

Perennial herbs. Leaves in basal rosette, up to 6 x 3 cm, pinnately 3-lobed; lobes usually pinnatifid. Flowers yellow or yellowish orange, solitary on scapes. Sepals concave, caducous. Petals 4, yellow to orange yellow, obovate-suborbicular. Stamens many; anthers 1-2 mm long. Capsules oblong to oblong-globose; stigmatic disc 7-8-ridged.

Fl. & Fr. : May August.

Rare, amidst rocky boulders on slopes.

Selected specimens : Changla, *Bhattacharyya* 71677 (BSD); Zingral-Chang La, ca 5000 m, *Wadhwa* 60079 (BSD); Chang La, *Chowdhery & Uniyal* 86127 (BSD); Panchtarni, 3800 m, *Nair* 36997; Mahagunesh pass, 3800 m, *Rau* 50327 (BSD); on way to Khardung la, Ladakh, *D.K. Singh & party*, 101073 (BSD).

5. *Papaver rhoas* L., Sp. Pl. 507. 1753; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 117. 1872; Blatter, Beaut. Fls. Kashmir 1: 29.

1927; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 288. 1972; Kaul, Weed Fl. Kashmir Valley 30. 1986; Debnath & Nayar in Sharma *et al.*, Fl. India 2: 31. 1993. *Lalpost, Post, Postekhiya* (Hindi).

Annual, erect, hispid herbs, 30-50 cm high. Stems covered with rigid bristles. Basal leaves usually ovate, pinnatisect; segments linear, acute, dentate, bristly hairy, hispid or glabrous; terminal segment much longer than lateral segments; basal and lower leaves petioled; upper cauline leaves sessile. Flowers usually scarlet, *ca* 7.5 cm in diam., solitary, terminal, bristly hairy. Sepals 2, bristly hairy. Petals red with black basal blotch, obovate. Stamens numerous; filaments linear, filiform; anthers oblong, *ca* 1 mm long. Capsules campanulate, 1-2 cm long, with 8-10 stigmatic rays.

Fl. & Fr : April - September.

This species is an escape from cultivation and is established as a weed.

Selected specimens : Air field, Srinagar Wheat fields, Kaul 16010-16012. (RRL)

CULTIVATED SPECIES

1. *Eschscholzia californica* Chamisso.

Perennial, erect to diffuse herbs; stems tall, quadrangular, dichotomously branched. Leaves radical or cauline. Flowers up to 8 cm in diam., solitary, axillary or terminal.

Native of North America. Cultivated in Indian gardens as an ornamental plant.

2. *Papaver somniferum* L. *Afeem* (Hindi)

Branched herbs. Leaves oblong, toothed or serrate. Flowers white, purple or scarlet.

Native of western Mediterranean region. Cultivated for opium in many parts of the state.

FUMARIACEAE

(S.C. Majumder)

11. Stamens 4, free ...3. *Hypocoum*
 1b. Stamens 6, diadelphous :
 2a. Fruits many-seeded ...1. *Corydalis*
 2b. Fruits 1-seeded ...2. *Fumaria*

1. CORYDALIS DC., *nom. cons.*

- 1a. Flowers mainly blue, pink or purple :
 2a. Spur shorter than the limb of upper petal ... 18. *C. nana*
 2b. Spur equal to or longer than the limb
 of upper petal :
 3a. Cauline leaves 2 or more :
 4a. Radical leaves absent, cauline leaves
 2, usually opposite :
 5a. Upper petals winged on margins,
 emarginate at apex; flowers
 showy ... 9. *C. diphylla*
 5b. Upper petals not winged on
 margins; acute or slightly acuminate
 at tip, flowers not showy ...17. *C. murreana*
 4b. Radical leaves present, cauline leaves
 2-4, alternate ...2. *C. alpestris*
 3b. Cauline leaves solitary or rarely 2 or
 absent ... 3. *E. cashmeriana*
- 1b. Flowers mainly yellow, rarely orange or white :
 6a. Cauline leaves fleshy, simple, reniform or
 suborbicular ... 7. *C. crassifolia*
 6b. Cauline leaves not as above :
 7a. All bracts entire :

- 8a. Stem simple, unbranched :
- 9a. Cauline leaves 4, flowers yellow,
without purplish tips ...5. *C. clarkii*
- 9b. Cauline leaves 2 or absent; flowers
pale yellow, purplish tipped ...8. *C. crithmifolia*
- 8b. Stem usually branched :
- 10a. Plants robust up to 130 cm
tall ...12. *C. flabellata*
- 10b. Plants slender, up to 50 cm
high :
- 11a. Leaves simply pinnate;
pinnae fan shaped ...1. *C. adiantifolia*
- 11b. Leaves 2-3-pinnatisect;
pinnae elongated, much
dissected ...24. *C. stricta*
- 7b. All or some of the bracts dissected, dentate,
lacinate or lobed :
- 12a. Cauline leaves absent, if present much
reduced :
- 13a. Racemes 10-15-flowered, exceeding
radical leaves ...20. *C. pseudocrithmifolia*
- 13b. Racemes 3-10-flowered, hardly
exceeding radical leaves ...26. *C. tibetica*
- 12b. Cauline leaves present, well developed :
- 14a. Cauline leaves usually 2, opposite, rarely
1 or 3:
- 15a. Cushion forming plants, up to 8 cm
high; racemes 3-10 flowered ...15. *C. hendersonii*
- 15b. Plant more than 10 cm high,
not forming cushion; racemes
10-140-flowered
- 16a. Bracts wedge shaped or
oblong, pectinate-incised; flowers
more than 20 mm long ...14. *C. govaniiana*
- 16b. Bracts not wedge shaped,
linear-lanceolate, entire or lower
ones dissected; flowers up to
18 mm long ...10. *C. falconeri*

- 14b. Cauline leaves usually several, alternate :
- 17a. Leaves primarily ternately divided :
- 18a. Rootstocks almost absent or very short; capsules subtorulose ...22. *C. stewartii*
- 18b. Rootstock present; capsules not subtorulose :
- 19a. Lower petal without gibbosity or pouch at base ...4. *C. casimiriana*
- 19b. Lower petal with pouch at base ...11. *C. filiformis*
- 17b. Leaves primarily pinnately divided :
- 20a. Spur of upper petal shorter than the limb :
- 21a. Stems ascending; pedicels 2-8 mm long; seeds minutely papillate ...23. *C. stracheyi*
- 21b. Stems erect; pedicels 10-15 mm long; seeds smooth :
- 22a. Robust herbs; upper petal 12-13 mm long; spur up to 5 mm long ...16. *C. meifolia*
- 22b. Weak herbs; upper petal 15-19 mm long; spur 6-8 mm long ...21. *C. sikkimensis*
- 20b. Spur of the upper petal equal to or exceeding the limb in length :
- 23a. Rootstock spindle shaped; branches confined to inflorescence region only; leaf segments obtuse ...13. *C. gortschakovii*
- 23b. Rootstock not spindle shaped; branches scattered; leaf segments acute or mucronate :
- 24a. Petiole bases broadly winged, sheathing at base; inflorescence racemose, unbranched :
- 25a. Rootstock almost absent; stems angled; flowers yellow, tipped purple ...6. *C. cornuta*

- 25b. Rootstock present; stems not angular;
 flowers not purple tipped ...27. *C. vaginans*
- 24b. Petiole bases not sheathing, occasionally
 narrowly winged; inflorescence thyrsoid,
 often branched :
- 26a. Racemes 30-40-flowered; flowers purple
 tipped; capsules ellipsoid, 3-4-seeded ...25. *C. thyrsoflora*
- 26b. Racemes 15-20-flowered; flowers not
 purple tipped; capsules oblong, 6-8-seeded ...19. *C. pakistanica*

**1. *Corydalis adiantifolia* Hook.f. & Thomson Fl. Ind. 1: 271. 1855
et in Hook.f. Fl. Brit. India 1: 127. 1872; Jafri in Nasir & Ali, Fl. W. Pak.
 73: 36. 1974; Ellis & Balakrishnan in Sharma *et al.*, Fl. India 2: 40. 1993.**

Tufted, bushy, succulent, glaucous herbs, 30-40 cm high; root stock
 woody covered with leaf bases. Leaves pinnate; pinnae reniform, 3-5
 lobulate; terminal segment with 2 lateral segments at base; petioles not
 sheathing at base. Inflorescence many-flowered racemes. Flowers yellow,
 tips brown. Bracts much exceeding the flower buds; lower bract as long
 as pedicel, upper one even longer than it in fruit. Posterior petal straight,
 slender, much larger than the incurved spur. Fruit a capsule, linear or broad
 elliptic.

- 1a. Capsules monomorphic ...1.1. var. *adiantifolia*
 1b. Capsules heteromorphic ...1.2. var. *heterocarpa*

1.1. var. *adiantifolia*

Capsule linear.

Fl. & Fr : July August.

Selected specimens : Ladakh, Namikala, Wadhwa 58876 (BSD).

**1.2. var. *heterocarpa* Jafri in Nasir & Ali, Fl. W. Pak. 73: 36. 1974;
 Ellis & Balakrishnan in Sharma *et al.*, Fl. India 2: 40. 1993.**

Capsules 15.22 x 2-3 mm broad, linear, on some branches and 15-
 20 x 6-7 mm, elliptic on some other branches.

Fl. & Fr : July August.

Included after Jafri (*loc. cit.*) and Ellis & Balakrishnan (*loc. cit.*).

2. ***Corydalis alpestris*** C.A. Mey., Verz. Pfl. Cauc. 176. 1831; Jafri in Nasir & Ali, Fl. W. Pak. 73: 19. 1974; Ellis & Balakrishnan in Sharma *et al.*, Fl. India 2: 40. 1993.

Perennial herbs, 3-20 cm high with rootstock like a scaly tuber, dividing below with 2-3 short, lanceolate scales between tuber and last basal leaf. Radical leaves 1-2, similar or smaller than cauline leaves; cauline leaves 2-4, scattered, alternate, ternate, with sessile, deeply 2-sect pinnae; lobules or ultimate segments oblong, mucronate, entire or 2-3-dentate; pinnae ca 20 mm in diam.; lobules 7-12 x 2-3 mm; petiole 5-8 cm long, sheathing at base. Racemes 5-8 flowered, bracteate, borne at same level as leaves. Bracts 10 x 3-8 mm, obovate, ovate, acute, entire, equal to pedicels. Flowers 15-18 mm long, bluish, rarely violet white. Sepals 1-2 mm long, square or oblong with short toothed margin. Upper petal shorter than slightly incurved spur, shortly acuminate. Style 3-4 mm long; stigma dilated curved. Capsules 10-15 x 5 mm, ellipsoid, narrowly obovate.

Fl. & Fr : June August.

Selected specimens : *S. loc.*, Duthie 13288 (CAL).

3. ***Corydalis cashmeriana*** Royle, Illus. Bot. Himal. 69. 1834, t. 16.f.1. 1833; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 123. 1872; Dhar & Kachroo, Alpine Fl. Kashmir Himl. 181. 1983; Ellis & Balakrishnan in Sharma *et al.*, Fl. India 2: 40. 1993.

Erect herbs, 8-20 cm high. Radical leaves few, 2-3 cm long, glaucous, long stalked; cauline leaves 1-2, alternate, elliptic oblong, lanceolate, palmately 3-partite, 3-lobed; pinnules, toothed or incised into linear or lanceolate, mucronate lobules. Inflorescence 5-8-flowered, subumbellate raceme. Flowers 1.2-2 cm long, green blue with dark tips; spur slightly down curved, blunt. Bracts at least lower one 3-fid. Capsules 1.5-2.5 x 0.25-0.3 cm, linear-oblong, deflexed.

Fl. & Fr. : June August.

On rocks in alpine pasture. Rare.

Selected specimens : Synthen top, *Vohra & Naithani* 83150 (BSD); Saugam valley, above Lidderwat *Duthie s.n.* (DD).

4. *Corydalis casimirlana* Duthie & Prain in J. Asiat. Soc. Bengal. II, 65(2): 27, 1896; Ellis & Balakrishnan in Sharma *et al.*, Fl. India 2: 43. 1993. *C. sibirica auct. non* (L.f.) Pers.; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 125. 1872. *pp.*

Herbs 15-45 cm high; branches many, grooved. Leaves mostly cauline, alternate, biternatisect; ultimate segments oblong-cuneate, obovate or oblanceolate; petioles channelled above. Racemes terminal, 4-11-flowered. Lower bracts ternately lobed; upper ones entire. Flowers yellow, occasionally purple tinged. Sepals dentate or faintly erose along margins. Upper petals 10-12 mm long, acute or short acuminate; spur equal to or exceeding inner petals in length, broad at base, often up curved. Capsules linear. Seeds uniseriate.

Fl. & Fr. : July September.

Included after Ellis & Balakrishnan (*loc. cit.*).

5. *Corydalis clarkei* Prain in J. Asiat. Soc. Bengal. II, 65(2): 34, 1896; Jafri in Nasir & Ali, Fl. W. Pak. 73: 1974; Sharma & Jamwal, Fl. Upper Liddar valleys 1: 85. 1988; Ellis & Balakrishnan in Sharma *et al.*, Fl. India 2: 46. 1993. *Corydalis moorcroftiana* Wallich ex Hook.f. & Thomson, Fl. Ind. 266. 1855; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 125. 1872.

Perennial, tufted, aromatic herbs, glaucous, up to 30 cm high; rootstock crowded with sheathing leaf bases. Radical leaves 4-5 jugately pinnate; pinnae sessile shortly petiolate ovate, often deeply 3-lobed; ultimate segments oblong-lanceolate. Cauline leaves 4, in 2 opposite or sub-opposite pairs. Inflorescence many-flowered racemes. Flowers yellow. Bracts

lanceolate-linear-elliptic, entire. Upper petals with broad dorsal wing. Capsules obovate or broadly ellipsoid.

Fl. & Fr. : June August.

Selected specimens : Ladakh, Pang, *Bhattacharyya* 40971 (BSD); Fairly common.

6. *Corydalis cornuta* Royle, *Illus. Bot. Himal.* 69. 1834; Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 126. 1872; Jafri in Nasir & Ali, *Fl. W. Pak.* 73: 17. 1974; Ellis & Balakrishnan in Sharma *et al.*, *Fl. India* 2: 40. 1993.

Annual or biennial, succulent herbs, 15-40 cm high; roots fusiform; stem sharply angled; branches straggling. Leaves 2-3 times pinnately divided; leaflets deeply lobed, segments entire; petiole long. Inflorescence many-flowered terminal racemes. Flowers yellow, with dark purple tip, \approx 1.25 cm long. Upper petals with entire crest; lower petal with a basal pouch; spur straight or curved. Style short, persistent. Capsules \approx 1.2 cm long, linear-obovate or ovate-oblong; stalk bent down.

Fl. & Fr. : July October.

Common.

Selected specimens : Kishtwar, Nagin siru, 1800-3800 m, *T.A. Rao* 7829; Banihal ridge, *T.A. Rao* 7668 (BSD); Chandanwari, *Murugesan* 65629 (BSD); Wasker, Dagwan, *Wadhwa* 66911 (BSD).

7. *Corydalis crassifolia* Royle, *Illus. Bot. Himal.* 69. 1834; Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 127. 1872; Jafri in Nasir & Ali, *Fl. W. Pak.* 73: 38. 1974; Sharma & Jamwal, *Fl. Upper. Liddar valleys* 1: 82. 1988; Ellis & Balakrishnan in Sharma *et al.*, *Fl. India* 2: 48. 1993. *C. crassissima* Cambess. in Jacq., *Voy. Bot.* 12: t. 11. 1844. **Fig. 62**

Perennial, prostrate, robust herbs, glabrous, glaucous, 10-28 cm high; rootstock slender, covered above with withered leaf bases; branches

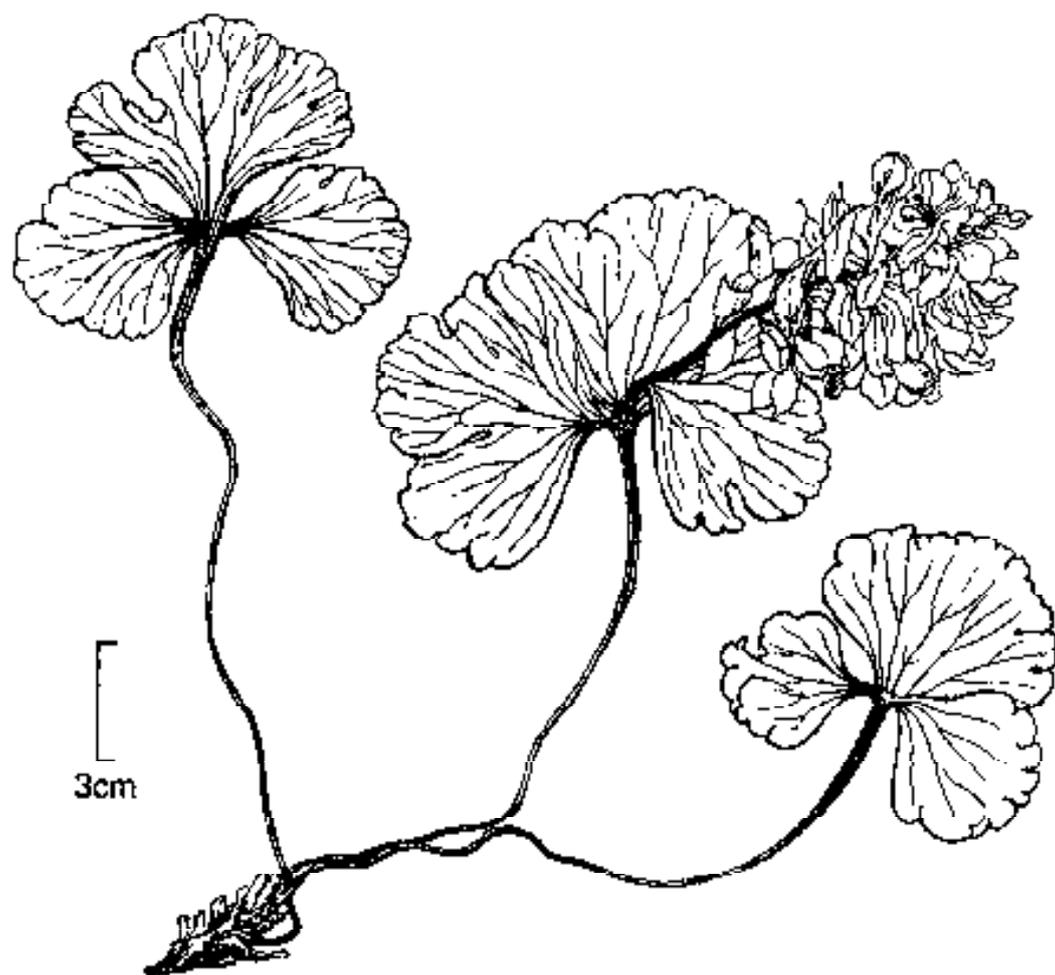


Fig. 62. *Corydalis crassifolia* Royle

1-2, simple. Radical leaves 12-30 x 5-12 cm, fleshy, reniform, deeply 3-5-lobed or partite; lobes semi-orbicular; petioles weve; cauline leaves 3, sub-opposite or whorled. Inflorescence 3-6 cm long, simple, densely flowered raceme. Bracts 1-2 x 0.5-1.2 cm, foliaceous, spatulate or obovate-lanceolate, entire. Flowers 1.5 to 2.5 cm long, purple pink; spur slightly down curved, blunt. Capsules 1.5-3.2 x 1.2-2.5 cm, ellipsoid or subglobose, inflated.

Fl. & Fr. : July - September.

Amidst rocky rubble. Occasional.

Selected specimens : Panchtarni, 3600 m, *Nair* 37016 (BSD); Near Amarnath cave, 4000 m, *Rau* 50320 (BSD), *Murugesan* 65632 (BSD), *Hujra* 74284 (BSD).

8. *Corydalis crithmifolia* Royle, *Illus. Bot. Himal.* 68, 1834; Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 123, 1872; Jafri in Nasir & Ali, *Fl. W. Pak.* 73: 12, 1974; Ellis & Balakrishnan in Sharma *et al.*, *Fl. India* 2: 49, 1993.

Perennial herbs, glaucous or pilose, 6-30 cm high; rootstock thick, covered with bases of withered leaves. Radical leaves up to 18 cm long, 2-3 ternate, long stalked; leaflets 1-2 cm across, each with 2 deeply dissected lobes; each-lobe again lobed. Inflorescence many-flowered raceme. Flowers 3 cm long, pale yellow, tip purple. Bracts 2-4 cm long, narrow, exceeding pedicels. Posticous petal vaulted, acute, half as long as slender spur, Capsules oblong, stalk recurved.

Fl. & Fr. : June to September.

Included after Ellis & Balakrishnan (*loc. cit.*).

9. *Corydalis diphylla* Wallich, *Tent. Fl. Nepal.* 54, 1826; Jafri in Nasir & Ali, *Fl. W. Pak.* 73: 6, 1974; Sharma & Jamwal, *Fl. Upper Liddar valleys* 1: 81, 1988; Ellis & Balakrishnan in Sharma *et al.*, *Fl. India* 2: 50, 1993. Swami & Gupta, *Fl. Udhampur* 45, 1998. *C. rutaefolia* Hook.f. & Thomson *Fl. Ind.* 262, 1855 *et in* Hook.f., *Fl. Brit. India* 1: 122, 1872. *Chimla*.

Slender herbs, up to 35 cm, glabrous with deeply buried tuber. Radical leaves absent; cauline leaves 2, 3-5 cm long, opposite or whorled when 3, 2-3 ternate; leaflets 2-3 cm long, oblong or ovate, entire or lobed; ultimate lobules ovate, oblong or elliptic-oblong. Inflorescence 5-10-flowered lax raceme. Flowers purple red or orange, with blunt dark tips. Bracts foliaceous, ovate, oblong-lanceolate, entire. Posticous petal infundibuliform, recurved, mostly down curved spur equal or longer than emarginate lamina of the posticous petal. Capsules 1-1.5 x 0.45 cm, ovate-oblong.

Fl. & Fr. : April July.

In moist, shady places.

Selected specimens : Udampur Swami 1221 (BSD); Kungwatan, T.A. Rao 9305; Thajwas mountains, 3,800 m, T.A. Rao 9568 (BSD).

9.1. var. *cyrtocentra* (Prain) Jafri in Nasir & Ali, Fl. W. Pak. 73: 6. 1974. *C. cyrtocentra* Prain in J. Asiat. Soc. Bengal 85: 20. 1896.

Leaves sessile, 2-ternate; petioles shorter than petiolules. Flowers ca 25 mm long, with long subcylindrical spur, much incurved and over arching the lamina of its tip.

Fl. & Fr. : July August.

Selected specimens : Ladakh, Dras, Rich 1083 (DD).

10. *Corydalis falconeri* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 124. 1872; Jafri in Nasir & Ali, Fl. W. Pak. 73: 10. 1974; Ellis & Balakrishnan in Sharma *et al.*, Fl. India 2: 54. 1993. *Ralchat* (Ladakhi).

Perennial, erect herbs, 15-50 cm high; rootstock slender, tuberous fusiform, at the end of a narrow portion of underground stem; with scale leaves and sheathing leaf at base. Radical leaves 10-20 cm long, bipinnatisect, with 1-2 pairs of lateral and cut terminal one. Flowers yellowish with purple tips in racemes 1-1.5 cm long. Bracts entire, linear-lanceolate, lowest 3-fid or pinnatifid, exceeding the reflexed pedicels.

Posterior petal vaulted, acute, winged on back equal to cylindric, slightly hooked spur. Capsules ca 1.5 cm long, oblong, much longer than persistent style. Seeds black, shining.

Fl. & Fr. : July August.

Selected specimens : Gulmarg, 3100 m, T.A. Rao 263 (BSD); Syntheru pass 4500 m, Vohra & Naithani 83136 (BSD).

11. **Corydalis filiformis** Royle, *Illus. Bot. Himal.* 65. 1834; Ellis & Balakrishnan in Sharma *et al.*, *Fl. India* 2: 55. 1993.

Annual or perennial herbs, bluish green. Leaves all cauline, thin, ternate or biternate; pinnae ovate-suborbicular, lobed; lobes narrowly oblong, obovate, obtuse. Racemes subcorymbose, 3-11-flowered. Lower bracts foliaceous. Flowers pale yellow. Sepals up to 3 x 2 mm, deeply fimbriate. Upper petal cristate, without dorsal wing; spur short, straight or upcurved; lower petal with a basal pouch. Stigma with 6 spical papillae. Capsules oblong. Seeds 8-18, biseriate.

Fl. & Fr. : June August.

Included after Ellis & Balakrishana (*loc. cit.*).

12. **Corydalis flabellata** Edgew. in *Trans. Linn. Soc. Bot.* 20: 30. 1851; Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 127. 1872; Blatter, *Beaut. Fls. Kashmir* 1: 34. 1927; Jafri in Nasir & Ali, *Fl. W. Pak.* 73: 34. 1974; Kachroo *et al.*, *Fl. Ladakh* 49. 1977; Ellis & Balakrishnan in Sharma *et al.*, *Fl. India* 2: 56. 1993. *Lepam.* Fig. 63

Herbs, erect, 30-60 cm high, rigid, highly branched. Radical leaves 15-25 cm long, pinnate, 4-6 pairs, 0.7-1.5 cm in diam., flabellate, crenate or lobed. Flowers yellow, 0.7-1.2 cm long, curved in racemes. Pedicels 5-15 cm long. Bracts linear, curved downwards. Posticous petal blunt, concave, twice as long as curved down inflated spur. Style slender. Fruit a capsule, 1.5-2.5 cm long, linear, spreading, deflexed. Seeds 8-10, dotted, shining.

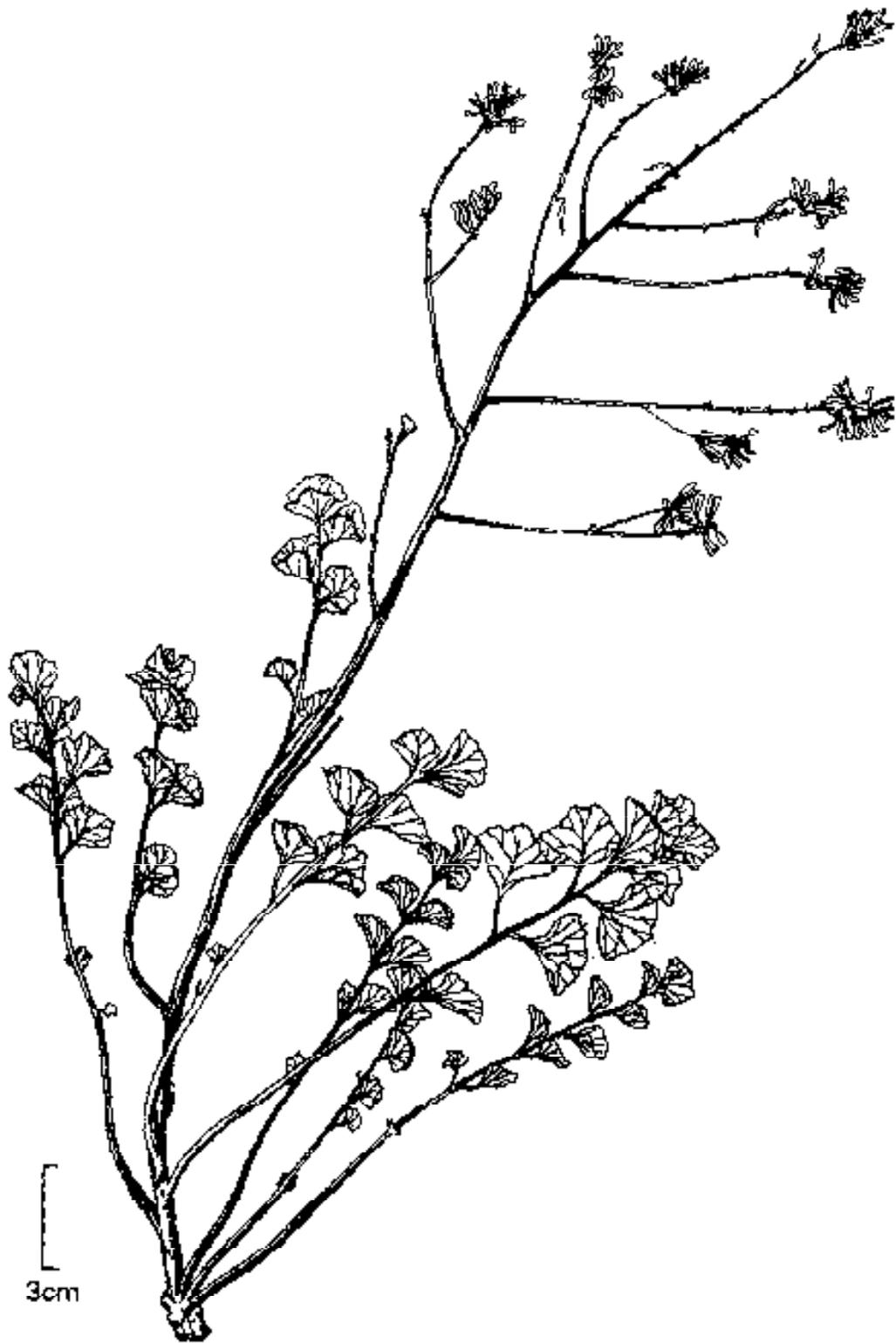


Fig. 63. *Corydalis flabellata* Edgew.

Fl. & Fr. : July August.

Common, on dry rocky slopes.

Selected specimens : Ladakh, Dumkher, *Chowdhery & Uniyal* 86033; Upshi to Lekcha, *Chowdhery & Uniyal* 86158 (BSD); Fatu la, *Viswanathan* 58997 (BSD); Dras-Kargil, *Wadhwa* 58781 (BSD); on way to Rumbak (Hemis N.P.), Ladakh, *S.K. Srivastava & Chauhan* 100902 (BSD).

13. *Corydalis gortschakovii* Schrenk., *Enum. Pl. Nov.* 1: 100. 1841; Jafri in Nasir & Ali, *Fl. W. Pak.* 73: 28. 1974; Ellis & Balakrishnan in Sharma *et al.*, *Fl. India* 2: 66. 1993; Naqshi & Ara in *J. Econ. Tax. Bot.* 17(3): 663. 1993. *C. moorcroftiana* Wallich ex Hook.f. & Thomson, *Fl. Ind.* 266. 1855 *et in* Hook.f., *Fl. Brit. India* 1: 125. 1872, *p.p.*

Herbs, 30-60 cm high, rootstock woody, spindle shaped, densely crowned with withered sheathing leafbases. Radical leaves bi- or subtripinnatisect; lower or lateral pinnae somewhat distant, smaller segments incised, long stalked. Flowers in racemes, yellow with purple tips, 0.6-2.5 cm long, arising from undivided axis which may be terminal or in the axils of leaves. Posticous petal as long as straight, blunt spur. Fruit a capsule, pointed at both ends. Seeds black, shining.

Fl. & Fr. : June August.

On exposed slopes. Frequent.

Selected specimens : On way to Busnai, *Wadhwa, Murti & Pant* 85053 (BSD).

14. *Corydalis govuniana* Wallich, *Tent. Fl. Nepal.* 55. 1826; Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 124. 1872; Blatter, *Beaut. Fls. Kashmir* 1: 32. 1927; Jafri in Nasir & Ali, *Fl. W. Pak.* 73: 20. 1974; Dhar & Kachroo, *Alpine Fl. Kashmir Himal.* 181. 1983; Ellis & Balakrishnan in Sharma *et al.*, *Fl. India* 2: 60. 1993.

Herbs, 10-60 cm high, tufted; rootstock thick, woody, covered with withered leaf sheaths. Radical leaves bi- or tripinnate, nearly equalling the

stem; pinnae oblong-ovate-suborbicular; pinnules variously cut into narrow segments; ultimate segments oblong-ovate; cauline leaves usually two, opposite or subopposite, smaller than the radical leaves. Inflorescence shorter to slightly exceeding the radical leaves. Flowers greenish yellow-bright yellow, 2-2.5 cm long. Bracts wedge shaped or oblong, pectinate-incised; lower bracts dissected to subentire. Upper petal crested dorsally; spur conical, straight or somewhat curved. Capsules oblong or ovoid, narrowed at base. Seeds 4-8, biseriate.

- 1a. Plants usually 30-60 cm high; inflorescence slightly exceeding radical leaves; with lower bracts usually pinnatisect. ...14.1. var. *govaniana*
- 1b. Plants usually 10-15 cm high; inflorescence not exceeding the radical leaves and somewhat horizontally expanding; lower bracts dissected to sub entire ...14.2. var. *malukiana*

14.1. var. *govaniana*

Fl. & Fr. : May July

On open hill slopes and alpine meadows. Frequent.

Selected specimens : Zozila, Hajra 74004; near Amarnath temple, Hajra 74286 (BSD); Bhadrwah, T.A. Rao 9123 (BSD); Badgam-Hasangaon, Wadhwa, Murti & Pant 85148 (BSD).

14.2. var. *malukiana* Jafri in Nasir & Ali, Fl. W. Pak. 73: 22. 1974.

Root stock densely covered with persistent sheathing leaf bases. Radical leaf segments 1-2 cm long, with sub sessile, alternate pinnules and lobules. Racemes dense, 25-30-flowered. Bracts pinnatisect to entire. Flowers greenish yellow.

Fl. & Fr. : June August.

On dry plains.

Selected specimens : Ladakh, along stream, *W. Koelz* 2114 (DD).

15. *Corydalis hendersonii* Hemsl. in J. Linn. Soc. Bot. 30: 109. 1895; Jafri in Nasir & Ali, Fl. W. Pak. 73: 29. 1974; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 82, 1983; Ellis & Balakrishnan in Sharma *et al.*, Fl. India 2: 60. 1993.

Perennial, 5-8 cm high, stout, herbs. Rootstock densely covered with elongated sheathing bases of leaves. Stems somewhat, fleshy, glabrous, glaucous. Radical leaves 2.5-5 cm long, glabrous, minutely glandular pilose at margins of sheathing petiole, bi-pinnatisect, 1.5-3 cm long, with ultimate segments narrow-linear, acute, mucronate; cauline leaves 1-3. Racemes condensed, hardly exceeding radical leaves, 5-10-flowered. Bracts leaf like, dissected. Flowers yellow, 16-20 mm long. Upper petal dorsally not winged; lower petal saccate at base, spur about half as long, tapering below. Capsules covered by bracts, oblong.

Fl. & Fr. : June August.

Selected specimens : Ladakh, Rupshu, *W. Koelz* 2256 (DD).

16. *Corydalis meifolia* Wallich, Tent. Fl. Nap. 55. t. 41. 1826. Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 126. 1872; Jafri in Nasir & Ali, Fl. W. Pak. 73: 30. 1974; Kachroo *et al.*, Fl. Ladakh 50. 1977; Ellis & Balakrishnan in Sharma *et al.*, Fl. India 2: 66. 1993. *C. meifolia* var. *sikkimensis* Prain in J. Asiat. Soc. Bengal 65: 37. 1896. *Nyetapu*.

Tufted herbs, 20-45 cm high, sparsely branched; stems covered with withered leafbases. Radical leaves, up to 35 x 15 cm, 3-pinnatisect, with 5-10 subopposite pinnae and a terminal one; lateral pinnac unequal, 2.5 x 1-2.5 cm, short petioluled; pinnules up to 2 cm long; lobules linear or capillary, 1 x 0.1 cm. Racemes 3-5 cm long, 15-20-flowered. Bracts dissected or pectinate. Bracts dissected or pectinate. Flowers 12-18 mm long, yellow with purple or violet tips; pedicels of lower flower longer or as long as bracts. Sepals inconspicuous. Upper petal limb with sub-orbicular dorsal wing, twice as long as short, obtuse, straight spur; spur

4-6 x 2.5-3 mm. Capsules 7-12 x 3-4 mm, oblong-ellipsoid, 4-6-seeded. Seeds about 2 mm in diam., shining black.

Fl. & Fr. : July August.

Selected specimens : Singola, 4800 m, *Bhattacharyya* 52170 (BSD).

17. *Corydalis murreeana* Jafri in Nasir & Ali, Fl. W. Pak. No. 73: 7, 1974.

Perennial herbs; rootstock tuberous. Radical leaves absent; cauline leaves usually two, 2-3-ternate; ultimate segments elliptic-oblong, entire or subentire. Racemes up to 15-flowered. Bracts ovate-oblong-lanceolate. Flowers about 15 mm long, pinkish-purple to whitish, usually crowded on smaller racemes. Upper petal not winged on margins, narrow; spur narrow, slender, slightly curved.

Fl. & Fr. : March July.

Included after Jafri (*loc. cit.*).

18. *Corydalis nana* Royle, Illus. Bot. Himal. 68. 1834; Ellis & Balakrishnan, in Sharma *et al.*, Fl. India 2: 67. 1993. *C. ramosa* Hook.f. & Thomson var. *nana* Hook.f., Fl. Brit. India 1: 125. 1872.

Dwarf herbs, up to 15 cm high, glabrous. Radical leaves bipinnate; petiole winged along margins; leaflets ca 2 cm long, lobed variously; ultimate lobules linear-oblong, obovate or lanceolate; cauline leaves 3-4. Racemes corymbose, 5-10-flowered. Bracts flabellate, dissected into linear segment. Pedicels thickened at tip, hooked in fruit. Flowers bluish grey tipped with green. Upper petals ciliate; spur somewhat down-curved, capsules narrowly obovoid.

Fl. & Fr. : August September.

Included after Ellis & Balakrishnan (*loc. cit.*).

19. *Corydalis pakistanica* Jafri in Nasir & Ali, Fl. W. Pak. 73: 26. 1974; Ellis & Balakrishnan in Sharma *et al.*, Fl. India 2: 68. 1993.

Perennial, diffuse, ascending herbs, 15-20 cm high, glabrous, sub glaucous; rootstock slender, covered with sheathing leafbases. Radical leaves 10-25 cm long, reaching the base of inflorescence, 2-3 pinnatisect; pinnae 3-5, sub-opposite, or in alternate pairs; pinnules sessile, 6-15 mm in diam., 4-5 lobuled; cauline lower leaves similar to radical leaves; upper one sessile, dissected with few lobes and lobules. Racemes terminal, 3-6 cm long, 15-20-flowered, lax later on. Bracts 10-30 mm long, linear-lanceolate to foliaceous. Flowers 1.5-1.7 cm long, yellowish, spur half as long slightly down curved. Sepals 1 mm diam., denticulate, whitish membranous. Upper petal dorsally winged wing reaching lamina base and tips of spur; rounded or obtuse; lower petal winged, saccate at base. Capsules 8-10 x 2.5-3 mm, oblong, 6-8-seeded, deflexed, on slightly longer pedicels. Seeds shining black *ca* 15 mm in diam., sub-seriate.

Fl. & Fr. : July August.

Included after Ellis & Balakrishnan (*loc. cit.*).

20. *Corydalis pseudocrithmifolia* Jafri in Nasir & Ali, *Fl. W. Pak.* 73: 12. f. 3D-F. 1974; Ellis & Balakrishnan in Sharma *et al.*, *Fl. India* 2: 70. 1993; Naqshi & Ara in *J. Econ. Tax. Bot.* 17(3): 663. 1993.

Perennial herbs, glaucous or pilose. Radical leaves bi-pinnatisect, 3-5 pair, pinnae ovate-orbicular, petiolulate, 1-2 cm in diam., 1-3 lobed; lobes sessile or subsessile; segments ovate-oblong, 2-5 x 1-2 mm, apex subrotund or mucronate. Racemes 10-15-flowered, lax. Bracts 10-20 mm long, entire or dissected into linear segments. Flowers greenish-yellow with purple tips, *ca* 2 cm long. Upper petal keeled on back; spur 12-15 mm long, cylindrical, base curved, dissected. Capsules 12-17 x 2.5 mm, apex round, base cuneate. Seeds *ca* 1.5 mm in diam., biseriate.

Fl. & Fr. : May August.

Selected specimens : Ladakh, Chortren among rock W. Koeltz 2664 (DD); Gilgit, Stewart 26467 (DD).

21. *Corydalis sikkimensis* (Prain) Fedde, *Repert Sp. Nov.* 17: 201. 1921; Jafri in Nasir & Ali, *Fl. W. Pak.* 73: 31. 1974; Sharma & Jamwal,

Fl. Upper Liddar valleys 1: 85, 1988; Ellis & Balakrishnan in Sharma *et al.*, Fl. India 2: 71, 1993. *C. duthiei* Maxim. var. *sikkimensis* Prain in J. Asiat. Soc. Bengal. 65: 33, 1896.

Herbs, glabrous, 29-30 cm high with simple stem; rootstock covered with sheathing leafbases. Radical leaves oblong, 2-3 pinnatisect with 4-5 pairs of lateral and a terminal pinnae; pinnae sessile or subsessile, deeply 3-lobed, ultimately segmented into numerous, linear, oblong or oblong-ovate, acute or oblong lobules; cauline leaves 2-4, alternate to sub-opposite. Racemes short, dense, 5-15-flowered. Lower bracts broadly ovate, laciniate; upper ones gradually smaller and entire. Flowers yellow. Upper petal dorsally winged; spur straight to subfalcate, conical; lower petal broadly winged, crested. Capsules narrowly ovoid-oblong.

Fl. & Fr. : July - August.

Selected specimens : Pahalgam, Stewart 8058 (DD).

22. *Corydalis stewartii* Fedde, Repert. Sp. No. 19: 119, 1923; Jafri in Nasir & Ali, Fl. W. Pak. 73: 19, 1974; Sharma & Jamwal, Fl. Upper Liddar valleys 1: 82, 1988; Ellis & Balakrishnan in Sharma *et al.*, Fl. India 2: 72, 1993.

Herbs, straggling or semi-erect, rather fleshy, glabrous, subglaucous, simple or branched. Leaves 2-3-pinnate, 10-20 x 3-8 cm, gradually short stalked or sessile; pinnae petiolulate, 0.5-1.5 cm long and broad, mostly 3-parted into obovate, oblong, cuneate, 0.5-1.2 cm long, rounded, truncate, sub-emarginate or mucronate-lobules. Racemes 5-10-flowered, terminal. Bracts incised upwards, entire, linear. Flowers yellow with brown tips, 0.9-1.3 cm long, spur slender, obtuse, curved, slightly longer than acute or sub-acuminate lamina of posticous petal. Capsule 1.2-1.5 x 0.15-0.2 cm, linear-oblong, sub-torrulose.

Fl. & Fr. : July - September.

Among scrubs by the wayside and along forest patch.

Included after Sharma & Jamwal (*loc. cit.*).

23. *Corydalis stracheyi* Prain in J. Asiat. Soc. Bengal. 65: 37. 1896; Liden in Bull. Brit. Mus. (Nat. Hist.) Bot. 18: 505. 1989; Ellis & Balakrishnan in Sharma *et al.*, Fl. India 2: 73. 1993.

Weak, diffuse herbs, 20-40 cm high; rootstock thick, split into several strands, covered with sheathing leafbases and scales. Radical leaves absent or few; cauline bipinnate with deeply divided; leaflets up to 5 x 1 mm, segments narrow lanceolate. Racemes lax, 2-11-flowered. Lower bracts linear-spathulate, often much divided; upper bracts narrowly oblanceolate, entire. Flowers yellow, occasionally orange with purplish green markings on keel. Sepals orbicular. Upper petal winged on back; spur rather straight. Style 2-2.5 cm long, Capsules about 6 mm long, obovoid. 5-9-seeded, with 10 prominent veins. Seeds biseriate, minutely papillose.

Fl. & Fr. : June - October.

On grassy slopes and in rock crevices. Frequent.

Selected specimens : Synthen top, Vohra & Naithani 83097 (BSD).

24. *Corydalis stricta* DC., Syst. Nat. 2: 123. 1821; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 126. 1872; Jafri in Nasir & Ali, Fl. W. Pak. 73: 31. 1974; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 182. 1983; Ellis & Balakrishnan in Sharma *et al.*, Fl. India 2: 73. 1993.

Herbs, 30-40 cm high; rootstock spindle shaped, crowned with shining leaf bases; stem erect, simple or branched. Radical leaves many, thick, 7.5-14 cm long, long-stalked, twice pinnately divided; pinnae 3-4-lobed, each lobe again ternately divided; cauline leaves gradually smaller upwards. Racemes densely 20-60-flowered. Bracts hyaline, scarious margined. Flowers yellow. Sepals fimbriate at base. Upper petals abruptly subglobose near the tip, narrowly winged dorsally, fimbriate at margins. Capsules linear, straight. Seeds 6-9, uniseriate.

Fl. & Fr. : June - August.

On rocky slopes.

Selected specimens : Tang lang la, 3800 m, Bhattacharyya 71770 (BSD); Chowdhery & Uniyal 86203 (BSD).

25. *Corydalis thyrsoflora* Prain in J. Asiat. Soc. Bengal 65 (2): 35. 1896; Jafri in Nasir & Ali, Fl. W. Pak. 73: 36. 1974; Sharma & Janwal, Fl. Upper Liddar valleys 1: 84. 1988; Ellis & Balakrishnan in Sharma *et al.*, Fl. India 2: 75. 1993. *C. gortschakovii* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 125. 1872, *non* Schrank.

Herbs, diffuse or ascending, 10-40 cm high, glabrous, sub-glaucous, from a thick, branched root-stock. Radical leaves 2-3 pinnatisect, long stalked; pinnae alternate or subopposite, petiolulate to sub-sessile, 1-4 x 1-2.5 cm; pinnules 3-7, 0.5-1.5 cm long and as broad, shallowly or deeply 3-5-segmented; segments oblong-obovate to linear, acute, mucronate 0.3-1.2 x 0.1-0.4 cm; cauline leaves alternate or subopposite, smaller upwards, stalkless. Inflorescence dense, thyrsoform panicle. Bracts leafy, linearly incised, upwards linear, entire. Flowers yellow with purplish tips, 4.5-1.7 cm long. Sepals much dissected along margins. Upper petal with broad dorsal wing; spur broad, straight, slightly down curved, blunt, as long as obtuse lamina of the posticous petal. Capsules 5-7 x 4 mm, ellipsoid. Seed 3-6.

Fl. & Fr. : July - September.

On boulder strewn slopes. Common.

Selected specimens : Pahalgam, T.A. Rao 9657 (BSD); Kolohai glacier, Rao 706 (BSD); Thajwas, Rao 50206 (BSD); Scoj, Kailash 3500-4500 m, Vohra & Naithani 82987; Synthen top 4500 m, Vohra & Naithani 83096 (BSD).

26. *Corydalis tibetica* Hook.f. & Thomson in Fl. Ind. 265. 1855 *et in* Hook.f., Fl. Brit. India 1: 124. 1872; Jafri in Nasir & Ali, Fl. W. Pak. 73: 29. 1974; Sharma & Janwal, Fl. Upper Liddar valleys 1: 83. 1988; Ellis & Balakrishnan in Sharma *et al.*, Fl. India 2: 74. 1993.

Herbs, bushy, diffused, erect, 5-20 cm long, glabrous, sub-pilose, glandular, glaucous; stem leafless, rarely 1-leaved. Radical leaves bi- or subtripinnatisect; pinnae ovate-suborbicular, shallowly-deeply dissected into pinnules; pinnule redivided into 3 segments; ultimate segments oblong-linear or narrowly oblanceolate. Racemes simple, 3-10-flowered. Flowers yellow-

tipped with brown or green. Sepals minute, denticulate. Upper petal with dorsal wings, reaching up to tip of spur, slightly denticulate; lower petal winged, sub-saccate at base. Capsules 7-9 x 2.5 mm, oblong-ovoid. Seeds 4-6, biseriate, shining black.

Fl. & Fr. : June - August.

In rock crevices. Common.

Selected specimens : Namik Ia, ca 3900 m, Wadhwa 58857 (BSD).

27. *Corydalis vaginans* Royle, *Illus. Bot. Himal.* 68. 1834; Jafri in Nasir & Ali, *Fl. W. Pak.* 73: 14. 1974; Ellis & Balakrishnan in Sharma *et al.*, *Fl. India* 2: 76. 1993 Swami & Gupta, *Fl. Udhampur* 45. 1998. *C. ramosa* Hook.f. & Thomson, *Fl. Ind.* 267. 1855. *C. ramosa* var. *vaginans* Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 125. 1872. *Mamira, Vanshatar* (Kashmiri).

Perennial, weak herbs, 10-60 cm high, leafy, glabrous, sub-glaucous; rootstock 3-5 mm broad, slender. Radical leaves 2 or 3-pinnate; pinnae and pinnules petioluled; pinnules deeply lobed; ultimate segments variable in shape, 2-12 x 1.5 mm. Racemes simple, 3-12 cm long, lax in fruit, 10-20-flowered. Flowers yellow. Sepals 1-1.5 mm in diam. dissected along margins, upper petal hooded, dorsally winged, entire or denticulate, crested, spur straight; lower petal winged and saccate at base. Capsules 7-10 x 3.5 mm, oblong-obovoid. Seeds 6-8, bi-seriate, 1.5-2 mm in diam., shining black.

Fl. & Fr. : May - August.

Common, among grasses, hedges and along river banks.

Selected specimens : Pahalgam, T.A. Rao 732 (BSD); Sonamarg, 2900 m, Rau 50246 (BSD); Gool, Swami 1217 (BSD); Pahalgam, Nair 36905 (BSD); s. loc., Murugesan 65630 (BSD).

Jafri (*Fl. W. Pak.* 73: 35. 1974) reported *Corydalis schelesnowiana* Regel & Schmalh. ex Regel from Ladakh but remarked "Doubtfully

distinct from *C. flabellata* Edgew. or *C. adiantifolia* Hook.f. & Thomson"

2. FUMARIA L.

- 1a. Bracts equalling or slightly exceeding the fruiting pedicels; corolla pale pinkish to white; fruits usually rounded at the tip ...1. *F. indica*
- 1b. Bracts shorter than the fruiting pedicels; corolla pink-violet with darker tips; fruits minutely apiculate at tip ...2. *F. vaillantii*

1. ***Fumaria indica*** (Haussk.) Pugsley in J. Linn. Soc. 44: 313. 1919; Jafri in Nasir & Ali, Fl. W. Pak. 73: 39. 1974; Sharma & Kachroo, Fl. Jammu 1: 93. 1981; Ellis & Balakrishnan in Sharma *et al.*, Fl. India 2: 84. 1993. *F. parviflora* Lam. subsp. *vaillantii* (Loisel) Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 128. 1872, *p.p. Pitpatra, Pitpapa, Shahtar*.

Annual herbs, slender, glaucescent, diffused, 10-50 cm high, angled, branched. Leaves highly dissected; ultimate segments flat, narrow linear-lanceolate, entire. Racemes 15-20-flowered. Flowers irregular, pinkish with dark purple tips, 6-8 mm long. Sepals caducous. Petals crested at back; spur ascending. Nuts globose, verrucose or rugose, with 2 pits at top when dry.

Fl. & Fr. : December - April.

Common weed in cultivated fields.

Selected specimens : Udhampur, Swami 0790 (BSD); Kishtwar Matta village, Uniyal 80287; Kathua, Uniyal 88577 (BSD).

2. ***Fumaria vaillantii*** Loisel. in Desv. J. Bot. 2: 358. 1809; Jafri in Nasir & Ali, Fl. W. Pak. 73: 40. 1974; Ellis & Balakrishnan in Sharma *et al.*, Fl. India 2: 85. 1993. *F. parviflora* Lam. subsp. *vaillantii* (Loisel.) Hook.f., Fl. Brit. India 1: 128. 1872, *p.p.*

Small, delicate herbs, up to 30 cm high. Leaves up to 9 x 5 cm; much dissected; segments flat, often finely lobed. Flowers 6-12 in racemes. Bracts 1/2 to 3/4 of the fruiting pedicel. Sepals lanceolate-obovate, laciniate-dentate. Petals 5-6 mm long, pinkish violet or pale pink, tip darker. Nutlets subglobose, apiculate at tip.

Fl. & Fr. : April June

Selected Specimens : On way to Shankaracharya hill, Rao & Kumar 81687 (BSD).

3. HYPECOUM L.

- 1a. Flowers white or slightly violet. Middle lobe of the inner petals not fringed. Fruits erect, with erect or horizontal pedicels ...1. *H. leptocarpum*
- 1b. Flowers yellow. Middle lobe of the inner petal with fringed margin. Fruits pendulous, on recurved pedicels ...2. *H. pendulum*

1. *Hypecoum leptocarpum* Hook.f. & Thomson, Fl. Ind. 1: 276. 1855 *et in* Hook.f., Fl. Brit. India 1: 120. 1872 Kachroo *et al.*, Fl. Ladakh 50. 1977; Ellis & Balakrishnan *in* Sharma *et al.*, Fl. India 2: 86. 1993. *Parpapata* (Ladakhi).

Annuals, 15-35 cm tall. Leaves rosulate, 2-3 pinnatisect; upper leaves sessile or subsessile. Flowers 0.8-1.5 cm across. Sepals 2, entire. Petals 4, in two whorls: outer 2 entire, not lobed, obtuse, apex keeled; inner 2 deeply 3-lobed; middle lobe spatulate, hooded. Stamens 4, each 5-6 mm long. Ovary *ca* 1 mm long; stigma 2, recurved. Capsules narrowly linear. Seeds brown, oblong.

Fl. & Fr. : June October.

Abundant on alluvial moist soil along nala.

Selected specimens : Ladakh, Ramsey, 3900 m, *Bhattacharyya* 41043 (BSD); Khardungla, 3900 m, *Wadhwa* 59944 (BSD); Tangtse, 4400 m *Viswanathan* 54743 (BSD); Ladakh, *ca* 5500 m, *Koelz* 2508L (DD).

2. *Hypocoum pendulum* L., Sp. Pl. 124. 1753; Singh & Kachroo, For. Fl. Srinagar 103. 1976; Ellis & Balakrishnan in Sharma *et al.*, Fl. India 2: 87. 1993. *F. procumbens* auct. non L.; Hook.f. & Thomson, Fl. Ind. 1: 275. 1855 *et in* Hook.f., Fl. Brit. India 1: 120. 1872.

Annuals, 5-24.5 cm high. Leaves 2-3 pinnatisect; cauline leaves palmatisect, subopposite. Flowers 0.8-1.2 cm across. Sepals 2, entire or shallowly incised at the margin. Petals 4, in two whorls; outer 2 entire or obscurely 3-lobed; inner 2, deeply 3-lobed. Stamens 4, free, 5-6 mm long. Ovary *ca* 5 mm long; styles slender with two divergent stigmas. Capsules indehiscent to pseudodehiscent. Seeds grey, obliquely semicircular.

1a. Capsules disarticulating; epidermis not peeling off ...2.1. var. *parviflorum*

1b. Capsules not disarticulating; epidermis peeling off ...2.2 var. *pendulum*

2.1. var. *parviflorum* (Karelina & Kir.) Cullen in Rech.f., Fl. Iran 34: 25, t. 7, f. 1 & 2 1966; Jafri & Qaiser in Fl. W. Pak. 61: 30. 1974; Ellis & Balakrishnan in Sharma *et al.*, Fl. India 2: 1993. *H. parviflorum* Karelina & Kir. in Bull. Soc. Nat. Mosc. 15: 141. 1842.

Fl. & Fr. : Mar. July.

Common in shaded situations and also in cultivated fields.

Included after Ellis & Balakrishnan (*loc. cit.*).

2.2. var. *pendulum*

Fl. & Fr. : Jan. July.

Included after Singh & Kachroo (*loc. cit.*).

Notes : The two varieties *H. pendulum* var. *pendulum* and *H. pendulum* var. *parviflorum* are closely allied. According to Jafri & Qaiser (*loc. cit.*) the outer petals of var. *pendulum* are rhomboid, subtrilobed to trilobed, whereas in var. *parviflorum* it is elliptic and entire. But according to Debnath & Nayar (Fasc. Fl. India 17: 42. 1984) the character of outer petals of the two varieties is variable and overlapping.

BRASSICACEAE

(S. Rajeshwari, B.P. Uniyal & D.K. Singh)

- 1a. Fruits beaked or biarticulated, beak with 1-few seeds. Cotyledons conduplicate :
- 2a. Fruits ovate or suborbicular, less than twice as long as broad ...21. *Crambe*
- 2b. Fruits not as above, more than twice as long as broad :
- 3a. Seeds biseriate in each locule :
- 4a. Calyx closed. Fruiting pedicels elongated and pendulous. Beak short ...24. *Diplotaxis*
- 4b. Calyx spreading. Fruiting pedicels short, erect. Beak long, ensiform ...29. *Eruca*
- 3b. Seeds uniseriate in each locule :
- 5a. Leaves simple. Calyx closed. Fruits compressed or tetragonal; beak obscure...19. *Conringia*
- 5b. Leaves pinnatisect. Calyx spreading. Fruits subcylindrical; beak distinct :
- 6a. Fruits distinctly biarticulated, usually indehiscent :
- 7a. Upper part of the fruit seed bearing ... 50. *Raphanus*
- 7b. Both upper and lower parts of the fruit seed bearing ...51. *Rapistrum*
- 6b. Fruits not or indistinctly biarticulated, usually indehiscent :
- 8a. Valve of fruits 1-nerved ...9. *Brassica*
- 8b. Valve of fruits 3-7-nerved ...53 *Sinapis*
- 1b. Fruits neither beaked nor biarticulated. Cotyledons accumbent or incumbent :
- 9a. Fruits compressed at right angle to septum; replum much narrower than the width of the fruit :

- 10a. Racemes condensed, subumbellate or corymbose in fruit :
- 11a. Plants glabrous. Valves of pods gibbous, 2-crested at back ...23. *Dilophia*
- 11b. Plants pubescent. Valves of pods neither gibbous nor crested ...34. *Hedinia*
- 10b. Racemes elongated in fruit :
- 12a. Fruits indehiscent or breaking into 1-seeded halves :
- 13a. Fruits unilocular, pendent ...36 *Isatis*
- 13b. Fruits bilocular, erect or spreading :
- 14a. Valves of the fruits reticulately veined pitted or tubercled
- 15a. Fruits *ca* 2 mm in diam ...20. *Coronopus*
- 15b. Fruits *ca* 10 mm in diam. ...61. *Uranodactylus*
- 14b. Valves of fruits not as above :
- 16a. Stamens 6 ...15. *Cardaria*
- 16b. Stamens more than 6 ...41 *Megacarpaea*
- 12b. Fruits dehiscent, liberating the seeds :
- 17a. Seeds in one each locule ...37. *Lepidium*
- 17b. Seeds more than one in each locule :
- 18a. Valves of fruits winged or shortly keeled ...58. *Thlaspi*
- 18b. Valves of fruits not as above :
- 19a. Fruits triangular-obcordate ...13. *Capsella*
- 19b. Fruits ellipsoid-globose :
- 20a. Valves of fruits convex, slightly compressed ...18. *Cochlearia*
- 20b. Valves of fruits flat, strongly compressed ...35. *Hymenolobus*
- 9b. Fruits terete, angled, inflated or compressed parallel to septum; replum equalling the width :

- 21a. Fruits indehiscent; valves usually thick or spongy :
- 22a. Fruits 2-3-loculed ...31. *Euclidium*
- 22b. Fruits 1-loculed :
- 23a. Stems glabrous. Pods winged ...56. *Tauscheria*
- 23b. Stems pubescent. Pods not winged ...43. *Neslia*
- 21b. Fruits dehiscent or transversely breaking into seed bearing segments; valves usually thin, not spongy :
- 24a. Fruits usually less than three times longer than broad, rarely more in some *Draba* spp. :
- 25a. Sepal cells with parallel walls :
- 26a. Petals entire or submarginate ...26. *Draba*
- 26b. Petals deeply bifid ...28. *Erophila*
- 25b. Sepal cells with polygonal walls :
- 27a. Flowers solitary, axillary ...11. *Buchingera*
- 27b. Flowers in racemes :
- 28a. Seeds winged ...2. *Alyssum*
- 28b. Seeds not winged ...48. *Ptilotrichum*
- 24b. Fruits more than eight times longer than broad, rarely lesser in *Rorippa* :
- 29a. Calyx closed at anthesis. Fruits tardily dehiscent or breaking up transversely :
- 30a. Cotyledons usually acumbent :
- 31a. Fruits with 2-4 apical appendages
- 32a. Fruits with 2 horns ...44. *Notoceras*
- 32b. Fruits with 4 horns ...57. *Tetracme*
- 31b. Fruits not appendaged :
- 33a. Scapes usually without leaves ...45 *Parrya*
- 33b. Scapes usually leafy :
- 34a. Fruits usually breaking up into many 2-seeded parts; seeds not winged ...16. *Charispora*

- 34b. Fruits usually not breaking up as above;
seeds often narrowly winged ...40. *Matthiola*
- 30b. Cotyledons usually incumbent :
- 35a. Flowers up to 6 in a raceme :
- 36a. Caulescent. Flowers 2-6 in a
raceme ...7. *Atelantha*
- 36b. Acaulescent. Scapes 1-flowered ...49. *Pycnophilanthus*
- 35b. Flowers 10-50 in a raceme :
- 37a. Flowers white, light pink or purple :
- 38a. Sepals 4-5 mm long. Mature fruits
up to 8 cm long ...39. *Malcolmia*
- 38b. Sepals ca 2 mm long. Mature
fruits ca 1 cm long ...32. *Goldbachia*
- 37b. Flowers yellow or orange ...30. *Erysimum*
- 29b. Calyx open at anthesis. Fruits readily dehiscent :
- 39a. Cotyledons usually accumbent :
- 40a. Flowers usually yellow :
- 41a. Petals much exceeding the sepals
...8. *Barbarea*
- 41b. Petals and sepals almost equal :
- 42a. Leaves usually simple. Flowers
on leafless scapes ...27. *Drabopsis*
- 42b. Leaves pinnate or pinnatifid.
Scapes leafy ...52 *Rorippa*
- 40b. Flowers usually purple or white :
- 43a. Scapes 1-flowered ...46. *Pegaeophyton*
- 43b. Flowers many in racemes :
- 44a. Filaments dentate-appendaged
...25. *Dontostemon*
- 44b. Filaments not dentate-
appendaged :
- 45a. Herbs, glabrous or
sparsely simple hairy :
- 46a. Cauline leaves sagittate-
amplexicaul ...60. *Turritis*
- 46b. Cauline leaves not as
above :

- 47a. Aquatics, rooting around nodes ...42. *Nasturtium*
- 47b. Terrestrials, not rooting at nodes ...14. *Cardamine*
- 45b. Densely hairy herbs; hairs forked or stellate :
 - 48a. Basal leaves short, spatulate-obovate ...17. *Christolea*
 - 48b. Basal leaves elongated, oblanceolate or oblong-obovate :
 - 49a. Fruits densely hairy47. *Phaeonychium*
 - 49b. Fruits almost glabrous ...5. *Arabis*
- 39b. Cotyledons mostly incumbent :
 - 50a. Leaves usually bipinnatisect :
 - 51a. Fruits 6-8 mm long ...55. *Smelowskia*
 - 51b. Fruits 15-30 mm long ...22. *Descurainia*
 - 50b. Leaves simple or lyrate pinnatifid :
 - 52a. Seeds mucilaginous when soaked :
 - 53a. Seeds uniseriate ...4. *Arabidopsis*
 - 53b. Seeds biseriate ...12. *Camelina*
 - 52b. Seeds not mucilaginous when soaked :
 - 54a. Basal leaves more or less cordate.
Seeds large, longitudinally striated ...1. *Alliaria*
 - 54b. Basal leaves and seeds not as above :
 - 55a. Lateral nectar glands annular;
middle glands present :
 - 56a. Fruits linear, elongated :
 - 57a. Flowers white or pink.
Valves 1-veined ...33. *Guillenia*
 - 57b. Flowers yellow. Valves
3-veined ...54. *Sisymbrium*
 - 56b. Fruits oblong, elliptic-oblong :
 - 58a. Fruits oblong, terete,
15-20 mm long ...6 *Arcyosperma*
 - 58b. Fruits elliptic-oblong,
flattened, 5-10 mm
long :
 - 59a. Sepals saccate at
base ...38. *Lignariella*

- 59b. Sepals not saccate at base ...3. *Aphragmus*
 55b. Lateral nectar glands paired; middle glands absent :
 60a. Sepals caducous. Seeds uniseriate ...59. *Torularia*
 60b. Sepals persistent. Seeds usually biseriate ...10. *Braya*

I. ALLIARIA Scop.

Alliaria petiolata (M. Bieb.) Cavara & Grande in Boll. Orto. Bot. Napoli 3: 418. 1913; Jafri in Fl. W. Pak. 55: 247. 1973; Singh & Kachroo, Forest Fl. Srinagar. 164. 1976; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 225. 1993. *Arabis petiolata* M. Bieb., Fl. Taur.-Cauc. 2: 126. 1808. *Sisymbrium alliaria* (L.) Scop. Fl. Carn. 2: 26. 1772; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 151. 1872. Fig. 64

Annual or biennial herbs, 20-40 cm high, erect, sparsely branched or simple, glabrous above, rarely sparsely hairy below. Basal leaves rosulate, cordate to reniform, 10-15 x 2-6 cm, dentate, long petioled; cauline leaves ovate-triangular, dentate, shortly petioled. Racemes up to 30 cm long, 15-30-flowered. Flowers white, ca 5 mm in diam. Pedicels 5-8 mm long, thickened. Sepals ca 2.5 mm long. Petals 5-8 x 2 mm. Siliquae linear, 30-70 x 2-2.5 mm, terete, straight, suberect or erect. Seeds dark brown to almost black, oblong, longitudinally striated.

Fl. & Fr. : April August.

In moist open places.

Selected specimens : Udampur Dist., Mantalai, Swami 1181 (BSD); Jhelum valley, Keshavanand 893 (DD).

2. ALYSSUM L.

Alyssum desertorum Stapf in Denk. Akad. Wiss. Wien. Math. Nat. Kl. 5: 302. 1886; Jafri in Fl. W. Pak. 55: 117. 1973; Kaul, Weed Fl. Kashmir valley 51. 1986; Debnath in Sharma *et al.*, Fl. India 2: 93. 1993. *A. minimum auct. non* Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 141. 1872.



Fig. 64. *Allaria petiolata* (M. Bieb.) Cavara & Grande

Annual, 5-25 cm high, spreading or ascending, branched mostly from the base, densely stellate hairy. Leaves oblanceolate or linear-lanceolate, 10-30 x 1-5 mm, sessile. Racemes up to 10 cm long, 30-40 flowered, ebracteate. Flowers pale yellow or dull whitish, ca 2 mm in diam. Pedicels ca 3 mm long. Sepals ca 1.5 mm long. Petals ca 2.5 mm long, broadest in the middle, tip finely emarginate, sparsely hairy at the back. Filaments of the outer two smaller stamens with scale like, notched appendages. Siliquae orbicular, 2.5-4 mm in diam., apex slightly emarginate. Seeds brown 2 in each locule, ovate-orbicular, narrowly winged.

Fl. & Fr. : March June.

Selected specimens : Baltistan, ca 3300 m, Duthie 11996 (DD).

3. APHRAGMUS Andr. ex DC.

Aphragmus oxycarpus (Hook.f. & Thomson) Jafri in Notes Roy. Bot. Gard. Edinb. 22 : 96. 1956 et in Fl. W. Pak. 55: 259. 1973; Hajra et al. in Sharma et al., Fl. India 2: 225. 1993. *Braya oxycarpa* Hook.f. & Thomson in J. Linn. Soc. Bot. 5: 169. 1861; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 186. 1983. *Braya alpina* auct. Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 155. 1872.

Perennial, 2-7cm high herbs, sparsely hairy, glabrous above. Basal leaves rosulate, spatulate to oblong, 10-24 x 2-4 mm, upper leaves oblong-elliptic to oblong-linear, 5-11 x 2-4 mm, glabrous. Racemes ca 5 cm long, 4-12-flowered. Flowers white or pinkish, ca 3 mm in diam. Pedicels 2-5 mm long. Sepals ca 2 mm long. Petals 3-4.5 mm long. Siliquae lanceolate to elliptic, 4.5-11 mm long, acute, glabrous. Seeds 4-6, brown, ellipsoid.

Fl. & Fr. : June July.

On wet stony debris.

Selected specimens : Liddar valley, ca 4000 m, Duthie 13427 (DD).

4. ARABIDOPSIS Heynh.

- 1a. Cauline leaves narrowed below, neither auricled nor amplexicaul :
- 2a. Basal leaves entire to subdentate. Fruits up to 20 mm long ...8. *A. thaliana*
- 2b. Basal leaves pinnatifid. Fruits 50-70 mm long :
- 3a. Flowers ca 3.5 mm across ...9. *A. wallichii*
- 3b. Flowers ca 5 mm across :
- 4a. Basal leaves not rosulate. Fruits blunt at tip with inconspicuous style ...5. *A. russelliana*
- 4b. Basal leaves rosulate. Fruits acute with conspicuous style ...7. *A. taraxacifolia*
- 1b. Cauline leaves broad at base, usually auricled and amplexicaul :
- 5a. Flowers yellow ...4. *A. pumila*
- 5b. Flowers not yellow :
- 6a. Fruits densely pubescent, less than 20 mm long; fruiting pedicels 2-3 mm long ...2. *A. lasiocarpa*
- 6b. Fruits almost glabrous, 20-60 mm long; fruiting pedicels 5-20 mm long :
- 7a. Annuals. Valves with a prominent midrib ...6. *A. stricta*
- 7b. Perennials. Valves striated or veins indistinct :
- 8a. Flowers bracteate ...1. *A. himalaica*
- 8b. Flowers ebracteate ...3. *A. mollissima*

1. Arabidopsis himalaica (Edgew.) O.E. Schulz in Engl., Pflanzenr. 86: 283. 1924; Jafri in Fl. W. Pak. 55: 272. 1973; Kachroo *et al.*, Fl. Ladakh 51. 1977; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 227. 1993. *Arabis himalaica* Edgew. in Trans. Linn. Soc. 20: 31. 1846. *Sisymbrium himalaicum* Hook.f. & Thomson in J. Linn. Soc. Bot. 5: 160. 1861; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 147. 1872.

Biennial or perennial herbs, 20-50 cm high, usually densely hispid with simple and branched hairs. Leaves more coarsely dentate. Racemes bracteate, many-flowered. Flowers white or pinkish. Pedicels 10-15 mm long, spreading. Siliquae 10-40 mm x 1 mm, glabrous or sometimes sparsely pubescent. Seeds 25-50 in each locule, ca 0.7 mm long.

Fl. & Fr. : May June.

Selected specimens : Synthan Pass, 4000 m, Vohra & Naithani 83107 (BSD).

2. ***Arabidopsis lasiocarpa*** Schulz in Engl., *Pflanzenr.* 86 (IV. 105): 282. 1924; Jafri in *Fl. W. Pak.* 55: 275. 1973; Hajra *et al.* in Sharma *et al.*, *Fl. India* 2: 228. 1993. *Sisymbrium lasiocarpum* Hook.f. & Thomson in *J. Linn., Soc. Bot.* 5: 662. 1861; Hook.f. & T. Anders. in Hook.f., *Fl. Brit. India* 1: 148. 1874.

Annual-biennial herbs, up to 45 cm high, greyish pubescent with simple or stellate hairs. Basal leaves ovate-spathulate, 8-25 x 4-6 mm, sinuate toothed petioled; cauline leaves obovate, sessile. Racemes 10-30-flowered, often bracteate below. Flowers white or lilac. Sepals oblong, ca 2 mm long, pubescent. Flowers white or lilac. Sepals oblong, ca 2 mm long, pubescent. Siliquae terete, straight, densely pubescent.

Fl. & Fr. : April June.

Included after Hajra *et al.* (*loc. cit.*).

3. ***Arabidopsis mollissima*** (C.A. Mey.) N. Busch, *Fl. Sib. et Or.* Extr. 1: 136. 1913; Jafri in *Fl. W. Pak.* 55: 271. 1973; Kachroo *et al.*, *Fl. Ladakh.* 51. 1977; Dhar & Kachroo, *Alpine Fl. Kashmir Himal.* 184. 1983; Hajra *et al.* in Sharma *et al.*, *Fl. India* 2: 228. 1993. *Sisymbrium mollissimum* C.A. Mey. in Ledeb., *Fl. Alt.* 3: 140. 1831; Hook.f. & T. Anders. in Hook.f., *Fl. Brit. India* 1: 147. 1872. *Sikiang*.

Perennial, 10-60 cm high herbs, erect, pubescent, rarely almost glabrous. Basal leaves spatulate or oblong-obovate, 20-60 x 6-15 mm,

toothed to almost entire, obtuse; cauline leaves lanceolate or oblong-ovate, auricled-sagittate at base, dentate, pubescent or canescent, sessile. Racemes 20-40-flowered, ca 20 cm long, ebracteate, rarely bracteate below. Flowers white, pinkish or purple; ca 4 mm in diam. Pedicels 10-15 mm long, filiform. Sepals ca 2.5 mm long. Petals 3-5 x 1-1.5 mm. Siliquae 20-45 x 1-1.5 mm. Seeds 20-40 in each locule, ca 1 mm long.

- 1a. Plants glabrous, only 3-5 hair near the base
of auricles ...3.1. var. *glaberrima*
1b. Plants pubescent ...3.2. var. *mollissima*

3.1. var. *glaberrima* (Hook.f. & T. Anders.) Naqshi & Javeid in J. Econ. Tax. Bot. 7(3): 619. 1985. *Sisymbrium mollissimum* var. *glaberrima* Hook.f. & T. Anders in Hook.f., Fl. Brit. India 1: 147. 1872.

Included after Naqshi & Javeid (*loc. cit.*) who reported it from Sonamarg and Ladakh.

3.2. var. *mollissima*

Fl. & Fr. : May July.

In alpine meadows under shade of rocks.

Selected specimens : Near Gulmarg, ca 3500 m, Duthie 11286 (DD).

4. *Arabidopsis pumila* (Steph.) Busch, Fl. Cauc. Crit. 3, 4: 457 & 465. 1909; Jafri in Fl. W. Pak. 55: 276. 1973; Singh & Kachroo, Forest Fl. Srinagar. 165. 1976; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 228. 1993. *Sisymbrium pumilum* Steph. in Willd., Sp. Pl. ed. 4. 3(1): 507. 1800. *Sisymbrium foliosum* Hook.f. & Thomson in J. Linn. Soc. Bot. 5: 160. 1862; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 148. 1872.

Annual, 3-45 cm high, erect or suberect herbs, usually pubescent with somewhat rigid hairs. Basal leaves rosulate, obovate-oblong, 10-80 x 5-35 mm, toothed, sometimes subentire; upper leaves few, oblong 10-50 x 3-10 mm, usually sagittate-amplexicaul, toothed to entire. Racemes

15-50-flowered, up to 20 cm long. Flowers yellow 2-2.5 mm in diam. Pedicels 5-10 mm long. Sepals 1.5-2 mm long. Petals 2-3 mm long. Siliquae 8-25 x 1-1.5 mm, linear, subcompressed, often upcurved, usually scabrous, rarely glabrous. Seeds 15-35 in each locule, ca 1 mm long.

Fl. & Fr. : March June.

Included after Singh & Kachroo (*loc. cit.*).

Note : Naqshi & Javeid have reproted *A. pumila* var. *foliosa* (Hook.f. & Thomson) Naqshi & Javeid (J. Econ. Tax. Bot, 7(3): 624. 1985) from the state. This variety differs from type variety in being much taller, having many cauline leaves, larger flowers and longer siliquae.

5. *Arabidopsis russelliana* Jafri in Notes Roy. Bot. Gard. Edinb. 22: 97. 1956 *et in* Fl. W. Pak. 55: 274. 1973; Rao & Chowdhery in Ind. J. For. 7: 257. 1984; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 229. 1993

Annual, up to 65 cm high, erect herbs, sparsely hairy below, glabrous above. Lower leaves runcinnate-pinnatifid, up to 8 x 2 cm, 5-7-jugate; upper leaves linear-oblong. Racemes up to 20 cm long, 10-30-flowered. Flowers pinkish, ca 3 mm in diam. Pedicels filiform, 8-20 mm long, spreading. Sepals 2-3 mm long. Petals 3.5-4.3 mm long. Siliquae linear, 35-78 x 1 mm, compressed, recurved, glabrous. Seeds 22-35 in each locule ca 1 mm long.

Fl. & Fr. : April June.

Included after Rao & Chowdhery (*loc. cit.*).

6. *Arabidopsis stricta* (Cambess.) N. Busch, Fl. Cauc. Crit. 3. 4: 457. 1909; Jafri in Fl. W. Pak. 55: 275. 1973; Singh & Kachroo, Forest Fl. Srinagar 25. 1976; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 229. 1993. *Malcolmia stricta* Cambess. in Jacquem., Voy. Bot. Ind. 4: 16. 1844. *Sisymbrium strictum* (Cambess.) Hook.f. & Thomson in J. Linn. Soc. Bot. 5: 161. 1862; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 149. 1872.

Annual or biennial, 30-50 cm high herbs, erect, branched, rigid, minutely stellate hairy. Basal leaves oblong-spathulate, toothed to entire, cuneate below; upper leaves 10-30 x 2-6 mm, oblong-linear sessile. Racemes 30-60-flowered, *ca* 30 cm long, often bracteate below. Flowers pink or white, *ca* 2.5 mm in diam. Pedicels 5-10 mm long, rigid. Sepals *ca* 2 mm long. Petals *ca* 3.5 mm long. Siliquae linear, terete or subcylindrical, 20-40 x 1 mm, not curved, glabrous. Seeds 20-30 in each locule, *ca* 0.7 mm long.

Fl. & Fr. : April - June.

Selected specimens : Barnai-Gurez. Wadhwa, Murti & Pant 85047 (BSD).

7. *Arabidopsis taraxacifolia* (T. Anders.) Jafri in Fl. W. Pak. 55: 274. 1973; Hajra *et al.*, in Sharma *et al.*, Fl. India 2: 231. 1993. *Arabis taraxacifolia* T. Anders. in Hook.f., Fl. Brit. India 1: 136. 1872.

Annual or biennial, much branched, hairy herbs. Basal leaves lyrate-pinnatifid, 4.8 x 0.5-1.5 cm, hairy, petioled; terminal lobe larger; lateral shorter; cauline leaves lanceolate, sessile. Racemes 10-20-flowered. Flowers *ca* 4 mm across. Sepals glabrous or pubescent. Petals pale rose or white, narrowly oblong. Siliquae linear, 3.5-6 cm long, flattened, glabrous, acute; seeds *ca* 1 mm long.

Fl. & Fr. : April - June.

Included after Hajra *et al.* (*loc. cit.*).

8. *Arabidopsis thaliana* (L.) Heynh. in Roll. & Heynh., Fl. Sachs. 1: 538. 1842; Jafri in Fl. W. Pak. 55: 278. 1973; Kachroo *et al.*, Fl. Ladakh 52. 1977; Sharma & Kachroo, Fl. Jammu 1: 96. 1981. Hajra *et al.* in Sharma *et al.*, Fl. India 2: 231. 1993. *Arabis thaliana* L., Sp. Pl. 665. 1753. *Stysymbrium thalianum* (L.) Gay & Monnard in Fl. Helv. 4: 348. 1829; Hook.f., & T. Anders. in Hook.f., Fl. Brit. India 1: 148. 1872. *Seching*.

Annual, 5-45 cm high herbs, erect, slightly hispid below, subglabrous above. Basal leaves rosulate, obovate-oblong, 15-50 x 5-10 mm, finely toothed or entire; upper leaves oblong or linear, cuneate below, sessile. Racemes 8-40-flowered, up to 20 cm long in fruiting. Flowers white, 2-3 mm in diam. Pedicels 5-15 mm long, filiform. Sepals 1.5-2 mm long. Petals 3-4 mm long. Siliquae linear, subcylindrical, 10-18 mm long, upcurved, glabrous. Seeds 20-30 in each locule, ca 0.5 mm long.

Fl. & Fr. : March - September.

Selected specimens : Junglote, Kathua, *Uniyal & Singh* 91226 (BSD); Kishtwar, Girinagar, *Uniyal* 80367 (BSD); Pahalgam, Liddar valley, *Inayat* 25489 (DD).

9. *Arabidopsis wallichii* (Hook.f. & Thomson) N. Busch, Fl. Cauc. Crit. 3. 4: 457. 1909; Jafri in Fl. W. Pak. 55: 273. 1973; Singh & Kachroo, Forest Fl. Srinagar 165. 1976; Kachroo *et al.*, Fl. Ladakh 52. 1977; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 232. 1993. *Sisymbrium wallichii* Hook.f. & Thomson in J. Linn. Soc. Bot. 5: 158. 1861; Hook.f. & T. Anders. in Fl. Brit. India 1: 149. 1872. *Sepanto*, *Pasaka*.

Annual-perennial herbs, 20-60 cm high, usually densely canescent. Basal leaves lyrate-pinnatifid to irregularly suborbicular, 15-70 x 5-20 mm, lateral lobes narrowly ovate to oblong, linear, remotely dentate to entire. Racemes 10-30-flowered, up to 20 cm, elongating. Flowers white, pinkish or pale lilac, ca 3 mm in diam. Pedicels 10-20 mm long, filiform. Sepals 2.5-3 mm long. Petals 3.5-4.5 mm long. Siliquae linear, 40-80 mm long, compressed, often somewhat recurved, glabrous. Seeds 20-35 in each locule, ca 1 mm long.

Fl. & Fr. : February - July.

Selected specimens : Below Patni, 1800 m, *Bhattacharyya* 71106 (BSD); Kishtwar, *Uniyal* 80315 (BSD).

Recently Naqshi & Javeid (1985) have described following new species of the genus from the state :

1. *Arabidopsis drassiana* Naqshi & Javeid in J. Econ. Tax. Bot. 7(3): 624. 1985.

2. *Arabidopsis surbalica* Naqshi & Javeid in J. Econ. Tax. Bot. 7(3): 623. 1985.

3. *Arabidopsis tibetica* Naqshi & Javeid in J. Econ. Tax. Bot. 7(3): 620. 1985.

5. ARABIS L.

1a. Cauline leaves absent, rarely 1-2 ...6. *A. saxicola*

1b. Cauline leaves usually many, if 1-2 then plants densely hairy :

2a. Cauline leaves cuneate or narrowed at the base :

3a. Perennial. Plants up to 20 cm high.

Fruits *ca* 6 cm long. Style *ca* 1.5 mm long

...8. *A. tibetica*

3b. Biennials. Plants more than 20 cm high.

Fruits *ca* 8 cm long. Style *ca* 2 mm long

...7. *A. tenuirostris*

2b. Cauline leaves amplexicaul, subamplexicaul or auricled :

4a. Seeds either margined or winged :

5a. Fruits pubescent

...3. *A. nova*

5b. Fruits glabrous :

6a. Flowers *ca* 10 mm across

...2. *A. bijuga*

6b. Flowers *ca* 5 mm across

...5. *A. pterosperma*

4b. Seeds neither winged nor margined :

7a. Basal leaves 3-4 cm long.

Flowers *ca* 5 mm across

...4. *A. pangiensis*

7b. Basal leaves 5-15 cm long.

Flowers *ca* 9 mm across

...1. *A. amplexicaulis*

1. *Arabis amplexicaulis* Edgew. in Trans. Linn. Soc. 20: 31. 1846; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 136. 1872; Jafri in Fl.

W. Pak. 55: 178. 1973; Singh & Kachroo, Forest Fl. Srinagar 165. 1976; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 100. 1993.

Perennial, 20-70 cm high herbs, hairy with forked or branched hairs. Basal leaves rosulate, obovate-oblong or oblanceolate, 5-15 x 1-3 cm, often dentate with short obtuse teeth, rarely sinuate-toothed, tip rounded or obtuse; cauline leaves 1-6 cm long, amplexicaul, slightly toothed or entire. Racemes 15-40-flowered. Flowers white, 5-10 mm in diam. Pedicels 9-15 mm long, glabrous. Sepals 4-6 mm long. Petals 7-10 mm. Siliquae linear-filiform 30-60 mm long, compressed, glabrous. Seeds many in each locule, ca 1 mm long.

Fl. & Fr. : May July.

Selected specimens : Bhaderwah, Uniyal 8019 (BSD); Upper munda, 2400 m. T.A. Rao 9195 (BSD).

2. **Arabis bijuga** G. Watt in J. Linn. Soc. Bot. 18: 378. 1881; Jafri in Fl. W. Pak. 55: 179. 1973; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 101. 1993.

Perennial, 15-40 cm high herbs, subglabrous or hairy. Basal leaves rosulate, ovate-oblong or oblanceolate. Cauline leaves oblong 1-3 x 0.2-0.8 cm, narrow, semi-amplexicaul. Flowers usually large. Pedicels up to 20 mm long, spreading. Siliquae linear, compressed, glabrous. Seeds many in each locule, margined.

Fl. & Fr. : May July.

Included after Hajra & Chowdhery (*loc. cit.*).

3. **Arabis nova** Vill., Prosp. Pl. Dauph. 39. 1779; Jafri in Fl. W. Pak. 55. 1973; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 185. 1983; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 101. 1993. *A. auriculata* Lam., Encycl. Meth. Bot. 1: 219. 1783; Singh & Kachroo, Forest Fl. Srinagar 166. 1976; Hook.f., & T. Anders. in Hook.f., Fl. Brit. India 1: 135. 1872.

Annual. 10-25 cm high herbs, pubescent with stellate hairs. Basal leaves spatulate or oblong-obovate, 5-30 x 2-20 mm, pubescent; upper leaves 5-20 x 2-15 mm, auricled at base, amplexicaul, acute; basal lobes obtuse. Racemes ca 15 cm long, 5-10-flowered. Flowers 3-4 mm in diam. Pedicels 5-7 mm long. Sepals 1.5-2 mm long. Petals 3-4.5 mm long. Siliquae linear-oblong, 21-44 mm long, compressed, acute, pubescent. Seeds 10-20 in each locule, ca 1 mm long.

Fl. & Fr. : April - June.

Selected specimens : Bhaderwah; *Uniyal* 80115 (BSD).

4. *Arabis panglensis* Watt in J. Linn. Soc. Bot. 18: 378. 1881; Jafri in Fl. W. Pak. 55: 177. 1973; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 101. 1993.

Perennial, tufted 10-20 cm high, densely hispid herbs. Basal leaves 3-6 x 0.4-1 cm, obtuse or acute, hairy; upper leaves oblong-linear, 15-30 x 2-4 mm, narrowed at base, pubescent. Racemes ca 15 cm long, 15-25-flowered. Flowers white, ca 5 mm in diam. Pedicels 10-18 mm long. Sepals 3-3.5 mm long. Petals 5-5.5 mm long. Siliquae 30-48 x 1-1.3 mm, glabrous. Seeds many, oblong.

Fl. & Fr. : June - July.

Included after Hajra & Chowdhery (*loc. cit.*).

5. *Arabis pterosperma* Edgew. in Trans. Linn. Soc. 20: 33. Jafri in Fl. W. Pak. 55: 177. 1973; Singh & Kachroo, Forest Fl. Srinagar 65. 1976; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 185. 1983; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 103. 1993. *A. alpina auct. non* L.; Hook.f., & T. Anders. in Hook.f., Fl. Brit. India 1: 135. 1872; Kachroo *et al.*, Fl. Ladakh 50. 1977.

Rhizomatous, perennial, 18-40 cm high herbs, hairy with forked hairs. Basal leaves spatulate, 15-38 x 5-13 mm, toothed, hairy; upper leaves 10-20 x 3-7 mm, toothed below, usually slightly auricled at base,

amplexicaul, sparsely hairy. Racemes up to 12 cm long in fruits, 20-28-flowered. Flowers pinkish, 4-5 mm in diam. Pedicels 7-11 mm long. Sepals 3-4 mm long. Petals 5-7 mm long. Siliquae 30-55 mm long, compressed, glabrous. Seeds 25-30 in each locule, margined.

Fl. & Fr. : May July.

Selected specimens : Khilan Marg, 3000 m, *T.A. Rao* 274 (BSD); Udhampur, *Swami* 1177 (BSD); Liddar valley, Laripura, *Inayat* 25515 (DD); Musjid valley, ca 4000 m, *Duthie* 13298 (DD).

6. *Arabis saxicola* Edgew. in Trans. Linn. Soc. Bot. 20: 32. 1846; Jafri in Fl. W. Pak. 55: 173. 1973; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 105. 1993.

Perennial, 9-30 cm high herbs, sparsely hairy. Scapes simple, aphyllous. Radical leaves oblanceolate, 1.5-5 x 0.2-0.6 cm, hairy; cauline leaves mostly absent (if present linear, entire). Racemes up to 8 cm long, lax, 5-10-flowered. Flowers white, ca 5 mm in diam. Pedicels 5-7 mm long, ascending and suberect. Sepals 3-3.5 mm long; petals 4.5-6.7 mm long, linear, cuneate. Siliquae 2-3.8 x 15 cm, linear, strongly compressed, acute, straight, glabrous. Seeds 12-15 x 1, 1 mm long.

Fl. & Fr. : April July.

- 1a. Herbs, up to 30 cm high. Pedicels ca 10 mm long ...6.1. var. *elatior*
1b. Herbs, up to 15 cm high. Pedicels ca 5 mm long ...6.2. var. *saxicola*

6.1. var. *elatior* (O.E. Schulz) Jafri in Notes Roy. Bot. Gard. Edinb. 22 (2): 100. 1956 *et* in Fl. W. Pak. 55: 173. 1973; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 105. 1993. *A. scaposa* O.E. Schulz var. *elatior* O. Schulz in Notizbl. Bot. Gart. Berlin. Dahlem 9: 1066. 1927.

Included after Hajra & Chowdhery (*loc. cit.*).

6.2. var. *saxicola*

Included after Hajra & Chowdhery (*loc. cit.*).

7. *Arabis tenuirostris* O.E. Schulz in Notizbl. Bot. Gart. Berlin Dahlem 9: 1066. 1927; Jafri in Fl. W. Pak. 55: 175. 1973; Singh & Kachroo, For. Fl. Srinagar 166. 1976; Kachroo *et al.*, Fl. Ladakh 51. 1977; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 105. 1993. *Chiki*.

Biennial, 20-40 cm high herbs, branched, subglabrous. Basal leaves spatulate to oblanceolate, 9-38 x 3-10 mm, sinuate-dentate, pubescent; cauline leaves oblong-obovate, 7-20 x 2-3.5 mm, toothed. Racemes up to 10 mm long, 14-20-flowered. Flowers white or pinkish, 4.5-5.8 mm in diam. Pedicels up to 9 mm long. Siliquae linear, 20-60 x 1.5 mm, compressed, glabrous. Seeds 20-30 in each locule, 1 mm long, not winged.

Fl. & Fr. : June July.

Selected specimens : Sonamarg, Wadhwa, Murti, & Pant 85225 (BSD).

Endemic.

8. *Arabis tibetica* Hook.f. & Thomson in J. Linn. Soc. Bot. 5: 143. 1861; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 136. 1872; Jafri in Fl. W. Pak. 55: 174. 1973; Kachroo *et al.*, Fl. Ladakh 51. 1977; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 106. 1993. *Tiktso*.

Perennial, 6-20 cm high herbs, often densely hairy, rarely glabrous. Basal leaves spatulate to oblanceolate, 12-38 x 3-10 mm, sinuate-dentate, pubescent; upper leaves 8-18 x 2-4 mm, toothed, lobulate. Racemes up to 10 cm long, 15-20-flowered. Flowers white-pale yellowish, 4.5-6 mm in diam. Pedicels up to 9 mm long. Sepals 3-4 mm long. Petals 5-7 mm long. Siliquae 30-60 mm long, compressed, acute, glabrous. Seeds 15-23 in each locule, hardly winged.

Fl. & Fr. : May July.

Selected specimens : Humboting La, 3900 m, Chowdhery & Uniyal 85990 (BSD); Whisky Nallah, 4000 m, Bhattacharyya 40895 (BSD); Dras,

Hajra 74034 (BSD); Manjkeo (Hemis N.P.), Ladakh, S.K. Srivastava & Chauhan 100994 (BSD).

Note : Naqshi described a new species *Arabis kashmirica* Naqshi (J. Econ. Tax. Bot. 5(3): 714-715.f. 1. 1984) from Tangmarg. It is allied to *Arabis nova* but differs in having non amplexicaul, subsessile to petiolate cauline leaves, longer and spreading petals and longer, thin pedicels.

6. ARCYOSPERMA O.E. Schulz

Arcyosperma primulifolium (Thomson) O.E. Schulz in Engler, Pflanzent. 86 (IV. 105): 182. 1924; Jafri in Fl. W. Pak. 55: 257. 1973; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 232. 1993. *Sisymbrium primulifolium* Thomson in Hook., J. Bot. 5: 18. 1853. *Eutrema prinulifolium* (Thomson) Hook.f. & Thomson in J. Linn. Soc. Bot. 5: 164. 1861; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 152. 1872.

Dwarf, perennial, 5-18 cm high herbs, glabrous. Radical leaves spatulate, obovate-oblong, 4.5-17 x 2-5 cm, densely rosulate; cauline leaves oblong-ovate or elliptic, 0.9-3 x 0.5-1.5 cm, semiamplexicaul. Racemes up to 5 cm long, up to 10-flowered. Flowers white or pinkish, ca 5 mm in diam. Pedicels 3.5-12 mm long, spreading, glabrous. Sepals 2.5-4 mm long. Petals 4.5-7 mm long, apex truncate. Siliquae oblong-terete, 14-20 x 2 mm, often slightly curved upwards. Seeds many, ca 1 mm long.

Fl. & Fr. : May July.

Included after Hajra *et al.* (*loc. cit.*).

7. ATELANTHERA Hook.f. & Thomson

Atelanthera perpusilla Hook.f. & Thomson in J. Linn. Soc. Bot. 5: 138. 1861; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 133. 1872; Jafri, in Fl. W. Pak. 55: 227. 1973; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 178. 1993.

Annual, 2-9 cm high herbs, erect, filiform, roughly hairy with bipartite appressed hairs. Leaves linear to oblong, 9-15 x 1-3 mm, sessile. Racemes

2-5-flowered. Flowers white, ca 3 mm in diam. Pedicels ca 1 mm long. Sepals ca 2 mm long. Petals ca 3.5 mm long. Siliquae linear, ca 20 mm long, subterete-compressed. Seeds 4-12 in each locule, oblong, 0.7 mm long.

Fl. & Fr. : April - June.

Included after J.D. Hooker & T. Anderson (*loc. cit.*).

8. BARBARAEA R. Br.

1a. Upper cauline leaves pinatifid or deeply dissected ... 1. *B. intermedia*

1b. Upper cauline leaves toothed or shallowly dissected...2. *B. vulgaris*

1. *Barbaraea intermedia* Boreau, *Fl. Cent. France*, 2: 48. 1840; Jafri in *Fl. W. Pak.* 55: 166. 1973; Singh & Kachroo, *Forest Fl. Srinagar* 25. 1976; Hajra & Chowdhery in Sharma *et al.*, *Fl. India* 2: 107. 1993. *B. vulgaris* var. *sicula* Hook.f. & T. Anders. in Hook.f., *Fl. Brit. India* 1: 134. 1872.

Biennial, 12-58 cm high herbs, erect, branched, glabrous. Basal leaves 3-11 x 1-3 cm, 3-5 lobed; terminal lobe ovate; upper leaves deeply lobed; lobes linear-oblong. Racemes 18-20 cm long, 15-25-flowered. Flowers yellow, 4.5-6 mm in diam. Pedicels ca 5 mm long. Sepals ovate-elliptic, 3.5 mm long. Petals 5-6 mm long. Siliquae linear-oblong, 12-28 mm long, terete compressed, acute, glabrous. Seeds many, ovate, ca 1.5 mm long.

Fl. & Fr. : May - June.

Selected specimens : Kashmir, *Thaptiyal* 26370 (DD).

2. *Barbaraea vulgaris* R. Br. in Aiton, *Hort. Kew.* ed. 2. 4: 109. 1812; Hook.f. & T. Anders in Hook.f., *Fl. Brit. India* 1: 134. 1872; Jafri in *Fl. W. Pak.* 55: 165. 1973; Singh & Kachroo, *Forest Fl. Srinagar* 166. 1976; Hajra & Chowdhery in Sharma *et al.*, *Fl. India* 2: 107. 1993. *B. vulgaris* var. *taurica* Hook.f., & T. Anders. in Hook.f., *Fl. Brit. India* 1: 134. 1872, non *B. taurica* DC.

Biennial or perennial, 25-85 cm high, erect. Basal leaves lyrate; 5-15 x 1.5-3 cm, terminal lobe ovate-oblong, larger than the laterals, base cordate; upper leaves 1-4 cm long, amplexicaul, dentate to sinuate. Racemes 17-20 cm long, 20-35 flowered. Flowers yellow, 4.5-6 mm in diam. Pedicels 3.8-10.5 mm long, slightly upcurved. Sepals ca 3 mm long. Petals 5-8 mm long. Siliquae 12-35 mm long, slightly upcurved, glabrous; seeds brown, many, 1.5 mm long.

Fl. & Fr. : April June.

Selected specimens : Sedau, 1700 m, T.A. Rao 9222 (BSD); Synthen, 3800 m. Vohra & Naithani 83094 (BSD); Baramula, ca 1700, Keshavanand 1151 (DD); Kalapani, Kamri nala, Inayat 25510 (DD).

9. BRASSICA L.

- 1a. Upper leaves stalked or narrowed at the base :
- 2a. Pedicels equal to or shorter than the sepals. Beak of the fruits 3-5 mm long ...3. *B. nigra*
- 2b. Pedicels longer than the sepals. Beak of the fruits 5-16 mm long :
- 3a. Lower leaves lyrate-pinnatifid, sparsely bristly. Beak of the fruits narrower than the stigma at the tip ...1. *B. juncea*
- 3b. Lower leaves runcinate-pinnatifid, ciliate and densely bristly beneath. Beak of the fruits as wide as the stigma at the tip ...6. *B. tournefortii*
- 1b. Upper leaves usually amplexicaul, rounded or deeply cordate at the base :
- 4a. All leaves glabrous ...4. *B. oleracea*
- 4b. Lower leaves bristly or ciliate :
- 5a. All leaves glaucous. Petals pale yellow ...2. *B. napus*
- 5b. At least the lowest leaves green. Petals bright yellow ...5. *B. rapa*

1. *Brassica juncea* (L.) Czern. et Coss. in Czern., *Conspect. Fl. Chark.* 8, 1859; Hook.f. & T. Anders. in Hook.f., *Fl. Brit. India* 1: 157.

1872; Jafri in Fl. W. Pak. 55: 25. 1973; Hajra *et al.*, in Sharma *et al.*, Fl. India 2: 133. 1993. *Sinapis juncea* L., Sp. Pl. 668. 1753. Nuskar, Rai.

Annual, 25-100 cm tall herbs, sparsely hairy below. Basal leaves lyrate-pinnatifid, margins toothed; middle leaves oblong-ovate, dentate; upper leaves oblong-linear, acute, narrowed at base. Racemes *ca* 30 cm long, laxly 20-35-flowered. Flowers golden yellow, 6.5-7 mm in diam. Pedicels 4.5-7 mm long, glabrous. Sepals oblong 4-6 mm long, glabrous. Petals obovate, 6-9 mm long, clawed. Siliquae 22-48 x 2-3 mm, subtetragonous, somewhat torulose, glabrous. Seeds globose, reddish-brown.

Fl. & Fr. : March - May.

Cultivated.

2. *Brassica napus* L., Sp. Pl. 666. 1753; Jafri in Fl. W. Pak. 55: 23. 1973; Naqshi & Javeid in J. Econ. Tax. Bot. 9(1): 91. 1987; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 135. 1993. *B. campestris* subsp. *napus* (L.) Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 156. 1872.

Annual or biennial, 25-140 cm tall herbs. All leaves glabrous and glaucous; basal leaves lyrate-pinnatisect, 4-20 x 2-5.5 cm, sub-bijugate; terminal lobe largest, ovate, crenate or dentate; middle and upper leaves lanceolate, base cordate, tip acute. Racemes corymbose, 15-40-flowered. Flowers pale yellow, 9-13 mm in diam. Pedicels 5-10 mm long. Sepals 4.5-7 mm long, glabrous. Petals obovate, 9-14 mm long. Siliquae linear, 35-90 x 2-4 mm, subtorulose, glabrous. Seeds yellowish-brown, blackish near the hilum globose.

Cultivated.

Brassica napus subsp. *napus* var. *quadrivalvis* (Hook.f. & Thomson) Schulz. and var. *trilocularis* (Roxb.) Schulz alongwith subsp. *napobrassica* are also reported to be cultivated in the state.

3. *Brassica nigra* (L.) Koch in Röhling, Deutschl. Fl. ed. 3. 4: 713. 1833; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 156. 1872; Jafri

in Fl. W. Pak. 55: 27. 1973; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 189. 1983; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 136. 1993. *Sinapis nigra* L., Sp. Pl. 668. 1753.

Annual, 25-90 cm high herbs, usually bristly below. Basal leaves deeply pinnatifid, 5-22 x 3-10 cm long, 1-3-jugate; terminal lobe ovate; lateral lobes ovate-oblong, dentate; upper leaves elliptic or lanceolate. Racemes ca 30 cm long, 35-55-flowered. Flowers bright yellow, ca 10 mm in diam. Pedicels 2-3 mm long. Sepals oblong, 3.5-5.2 mm long, obtuse. Petals 6.5-8.5 mm long, clawed. Siliquae subquadrangular, 9-20 x 1.5-2 mm. Seeds dark brown, 3-5 in each locule.

Fl. & Fr. : March May.

Included after Dhar & Kachroo (*loc. cit.*).

4. *Brassica oleracea* L., Sp. Pl. 667. 1753; Jafri in Fl. W. Pak. 55: 21. 1973; Naqshi & Javeid in J. Econ. Tax. Bot. 9(1): 90. 1987; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 21. 1993.

Glabrous herbs, up to 1 m tall. Lower leaves lyrate-pinnatifid; terminal lobe broadly ovate or suborbicular, dentate or crenate; laterals smaller; upper leaves simple lanceolate to oblong-lanceolate. Racemes congested or elongated, ebracteate. Flowers pale yellow, 10-15 cm across. Sepals erect, oblong, 8-12 x 2-3 mm. Petals obovate, 15-20 x 4-6 cm. Silique to 100 mm long; beak seedless or 1-seeded. Seeds reticulate.

CULTIVATED TAXA

1. *Brassica oleracea* var. *acephala* DC. Haak.
2. *Brassica oleracea* var. *gongylodes* L.
3. *Brassica oleracea* var. *capitata* L.
4. *Brassica oleracea* var. *botrytis* L.

Note : Naqshi & Javeid (J. Econ. Tax. Bot. 9(1): 91. 1987) described a new variety *Brassica oleracea* var. *kashmiriana* Naqshi & Javeid differing from var. *acephala* in having thicker and shorter stem and stalked, dentate cauline leaves and from var. *gongylodes* by longer and non globose stem and stalked upper leaves.

5. *Brassica rapa* L., Sp. Pl. 666. 1753; Jafri in Fl. W. Pak. 55: 24. 1973; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 138. 1993.

Biennial. Stems 80-95 cm high, branched, mostly glabrous. Tap root tuberous. Lower leaves lyrate-pinnatifid, 10-27 x 4.5-9.5 cm, 3-5-jugate, bristly; middle and upper leaves oblong-lanceolate, cordate at base, glabrous, glaucous, sessile. Racemes corymbose, 30-40-flowered. Flowers golden yellow, 5.5-10 mm in diam. Pedicels 5.5-1.4 mm long. Sepals 3.5-6 mm long. Petals 7.5-9.5 mm long. Siliquae linear, 35-30 x 2-3 mm, subtorulose, beaked. Seeds yellowish-brown, 7-12 in each locule, globose, finely reticulate-alveolate.

Fl. & Fr. : March April.

Extensively cultivated alongwith *B. rapa* subsp. *campestris* (L.) Clapham, *Duckchal*, *Tilgogul*, *Unskar*, *Yunskar*.

6. *Brassica tournefortii* Gouan, Illus. Obs. Bot. 44. t. 20A. 1773; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 156. 1872; Jafri in Fl. W. Pak. 55: 26. 1973; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 140. 1993.

Annual, erect, glabrate or hispid herbs, up to 70 cm high. Basal leaves runcinate-lyrate, hispid; terminal lobe often small, obliquely cordate; upper leaves oblong or linear. Racemes 10-20-flowered. Flowers yellow, ca 6 mm across. Sepals oblong, ca 3 mm long. Petals oblong-obovate, 4.5-6.5 mm long. Siliquae linear-oblong, 35-65 mm long, subtorulose; valve with 1-vein. Seeds dark brown, finely tuberculated, mucilaginous when soaked.

Fl. & Fr. : May June.

Included after Naqshi & Javeid (*loc. cit.*).

10. BRAYA Sternb. & Hoppe

- 1a. Leaves narrowly-linear. Petals *ca* 3 mm long.
 Inflorescence nearly capitate ...3. *B. tibetica*
- 1b. Leaves oblong. Petals *ca* 4 mm long.
 Inflorescence crowded corymbose :
- 2b. Fruits linear-oblong, up to 8 mm long ...2. *B. thomsonii*
- 2b. Fruits elliptic-oblong, up to 6 mm long ...1. *B. rosea*

1. *Braya rosea* (Turcz.) Bunge in Del. Sem. Hort. Dorpat 7. 1839; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 155. 1872; Jafri in Fl. W. Pak. 55: 261. 1973; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 234. 1993. *Draba rosea* Turcz. in Bull. Soc. Nat. Mosc. 87. 1838. *Braya aenea* Bunge in Del. Sem. Hort. Dorpat 7. 1839; Kachroo *et al.*, Fl. Ladakh 53. 1977.

Perennial, 2-10 cm high herbs, erect, sparsely hairy. Basal leaves rosulate, oblong-linear, 14-36 x 2-4 mm, entire or obscurely dentate, glabrous. Racemes 10-20-flowered. Flowers pinkish or white, *ca* 2.3 mm in diam. Pedicels *ca* 4 mm long. Sepals 2-2.3 mm long. Petals *ca* 3.5 mm long. Siliquae ellipsoid or oblong, 3.5-6.5 x 1-2 mm, glabrous. Seeds yellowish brown ovoid.

Fl. & Fr. : June - Augst.

Included after Kachroo *et al.* (*loc. cit.*).

2. *Braya thomsonii* Hook.f. in J. Linn. Soc. Bot. 5: 168. 1861; Jafri in Fl. W. Pak. 55: 261. 1973; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 235. 1993. *B. alpina auct. non* Sternb. & Hoppe; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 155. 1872; Kachroo *et al.*, Fl. Ladakh 53. 1977. *Ligantso*.

Perennial, 2.5-10 cm high herbs, pilose. Basal leaves rosulate, spatulate-oblong to linear-oblong, 12-32 mm long; upper leaves rarely

1 or absent. Racemes 2-2.2 cm long, 10-18-flowered. Flowers white, *ca* 3 mm in diam. Pedicels 4.5-6.5 mm long. Sepals *ca* 2.5 mm long. Petals 3.5-4.2 mm long. Siliquae linear-oblong, 4.5-7.2 mm long, glabrous. Seeds pale brown, *ca* 8-11, 6.5 mm long.

Fl. & Fr. : June August.

Included after Kachroo *et al.* (*loc. cit.*).

3. *Braya tibetica* Hook.f. & Thomson in J. Linn. Soc. Bot. 5: 168. 1861; Hook.f. & T. Anders. in Hook.f. Fl. Brit. India 1: 155. 1872; Kachroo *et al.* Fl. Ladakh 53. 1977; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 235. 1993.

Perennial, 3-7 cm high herbs, often pilose. Basal leaves densely rosulate, linear-oblong, 15-35 mm long, entire or shallowly toothed. Scapes without leaves. Racemes 15-22-flowered, capitate. Flowers white or pinkish, *ca* 2 mm in diam. Pedicels 2-3.5 mm long. Sepals *ca* 2 mm long. Petals *ca* 3 mm long. Siliquae ellipsoid, 3-4.5 mm long, hairy or glabrous. Seeds brown, ovoid.

Fl. & Fr. : June July.

Selected specimens : Ladakh. Pang, Rupshu, 4500 m, *Bhattacharyya* 40990 (BSD).

11. **BUCHINGERA** Boiss. & Hohen.

Buchingera axillaris Boiss. & Hohen. in Boiss., Diagn. Ser. 1. 8: 29. 1849; Jafri in Fl. W. Pak. 55: 123. 1973.

Annual, 9-40 cm high herbs, decumbent, hairy with minute stellate hairs. Leaves broadly elliptic, 1-4.5 x 1-3 cm, dentate, glabrous. Flowers white *ca* 2.5 mm in diam., pedicels up to 8.5 mm long. Sepals *ca* 2 mm long. Petals spatulate, *ca* 2.3 mm long. Siliquae broadly elliptic or suborbicular, 4.5-8 x 5.5-9 mm. Seeds brown, 1 in each locule, large, narrowly winged.

Fl. & Fr. : May July.

Included after Jafri (*loc. cit.*).

12. CAMELINA Crantz.

Camelina sativa (L.) Crantz., Stirp. Austr. 1: 17. 1762; Jafri in Fl. W. Pak. 55: 280. 1973; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 236. 1993. *Myagrum sativum* L., Sp. Pl. 641. 1753.

Annual or biennial herbs, up to 80 cm high, glabrous or sparsely hairy. Basal leaves oblong-lanceolate, up to 50 x 15 mm, entire or irregularly toothed, sessile; upper leaves linear or lanceolate, sagittate-amplexicaul. Flowers yellow, ca 3.5 mm across, up to 70 in racemes. Sepals ca 2.5 mm long. Petals ca twice the length of sepals. Fruits obovoid, 7-9 x 4.5 mm, rounded at tip; valves convex with a prominent mid rib.

Fl. & Fr. : March May.

Included after Hajra *et al.* (*loc. cit.*).

13. CAPSELLA Medik., *nom. cons.*

Capsella bursa-pastoris (L.) Medik., Pflanzengatt. 1: 85. 1792; Hook.f., & T. Anders. in Hook.f., Fl. Brit. India 1: 159. 1872; Jafri in Fl. W. Pak. 55: 90. 1973; Singh & Kachroo, Forest Fl. Srinagar 166. 1976; Sharma & Kachroo, Fl. Jammu 1: 96. 1981; Bhaumik in Sharma *et al.*, Fl. India 2: 189. 1993. *Thlaspi bursa-pastoris* L., Sp. Pl. 647. 1753. *Kralmund*, *Koezeat*.

Annual, ca 45 cm high herbs, glabrous or hairy. Basal leaves rosulate, up to 8 x 2 cm, usually pinnatifid, 5-8-jugate; upper leaves auricled. Racemes up to 30 cm long, many-flowered. Flowers white, ca 2.5 mm diam. Pedicels up to 18 mm long. Sepals ca 1.5 mm long. Petals ca 2.5 mm long; obovate-oblong, cuneate. Siliquae 5-8.5 x 3.5-5 m, triangular or obovate. Seeds pale-brown, oblong-elliptic.

Fl. & Fr. : March June.

On Sandy moist places, walls and near habitations.

Selected specimens : Ladakh, Diksit, 3200 m, Wadhwa 60026 (BSD); Igo nallah, 3400 m, *Bhattacharyya* 41100 (BSD); wular lake, *Rao & Kumar* 81679 (BSD); Bhaderwah, *Uniyal* 80232 (BSD).

14. CARDAMINE L.

- 1a. Plants robust, to 100 cm tall. Leaflets 30-80 mm long ...5. *C. macrophylla*
- 1b. Plants slender, up to 50 cm high. Leaflets up to 25 mm long :
- 2a. Petioles auricled at base ...3. *C. impatiens*
- 2b. Petioles not auricled :
- 3a. Flowers large, 7-13 mm across ...4. *C. toxostemonoides*
- 3b. Flowers small, 3-6 mm across :
- 4a. Leaflets 5-13 pairs ...2. *C. hirsuta*
- 4b. Leaflets 2-4 pairs :
- 5a. Pods acuminate ...6. *C. yunnanensis*
- 5b. Pods obtuse or acute ...1. *C. flexuosa*

1. *Cardamine flexuosa* With., Bot. Arr. Brit. Pl. ed. 3, 3: 578. t. 3. 1796; Jafri in Fl. W. Pak. 55: 169. 1973; Singh & Kachroo, Forest Fl. Srinagar 166. 1976; Sharma & Kachroo, Fl. Jammu 1: 95. 1981; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 110. 1993. *C. hirsuta* var. *sylvatica* (Link) Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 138. 1872, *p.p.*

Annual or biennial, flexuose, 10-40 cm high herbs. Basal leaves 2-9.5 x 1-2.2 cm, glabrous, irregularly lobulate or toothed. Racemes up to 8 cm long, 9-28-flowered. Flowers ca 3 mm across. Sepals 2-2.4 mm long. Petals white, ca 3 mm long. Siliquae linear 14-24 x 1 mm, compressed, glabrous; seeds many, ca 1 mm long.

Fl. & Fr. : March May.

Selected specimens : Bhaderwah, 2400 m, *T.A. Rao* 9053 (BSD).

2. **Cardamine hirsuta** L., Sp. Pl. 655. 1753; Jafri in Fl. W. Pak. 55: 169. 1973; Singh & Kachroo, Forest Fl. Srinagar 167. 1976; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 112. 1993. *C. hirsuta* L. var. *sylvatica* (Link) Hook.f. & T. Anders. in Fl. Brit. India 1: 138. 1872, *p.p.*

Annual, 10-28 cm high herbs, erect, often with a basal rosette of leaves only and a slender tap root. Basal leaves 2-10 x 1-2.5 cm, glabrous; leaflets ovate-orbicular or subreniform, 5-10 mm across, entire to irregularly lobulate, toothed. Racemes 10-28-flowered. Flowers white. Sepals 2-2.5 mm long. Petals *ca* 3 mm long. Siliquae 12-23 mm long, compressed, glabrous. Seeds many.

Fl. & Fr. : March May.

Selected specimens : Ratote, *Thapliyal* 25568 (DD).

3. **Cardamine impatiens** L., Sp. Pl. 655. 1753; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 138. 1872; Jafri in Fl. W. Pak. 55: 169. 1973; Singh & Kachroo, Forest Fl. Srinagar 166. 1976; Sharma & Kachroo, Fl. Jammu 1: 97. 1977; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 114. 1993.

Annual or biennial, 10-50 cm high herbs, erect, glabrous. Leaves pinnate with, 5-8 pairs of lateral leaflets and a terminal one; petioles auricled; leaflets 4-24 x 3-10 mm, lobulate, serrate-entire. Racemes up to 12 cm long, 20-28-flowered. Flowers white, 3-4 mm in diam. Pedicels *ca* 10 mm long. Sepals 2.5 mm long. Petals 4-4.5 mm long. Siliquae linear, 12-28 mm long, compressed, glabrous. Seeds many, oblong.

Fl. & Fr. : May July.

Selected specimens : Kungwatan, 3000 m, *T.A. Rao* 9288 (BSD); Bhaderwah, *Uniyal* 80132 (BSD); Near Gulmarg, 2600-3000 m, *Duthie* 11370 (DD).

4. **Cardamine loxostemonoides** O.E. Schulz in Notizbl. Bot. Gart. Berlin 9: 1069. 1927; Jafri in Fl. W. Pak. 55: 168. 1993; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 114. 1993.

Perennial, glabrous herbs with a creeping rhizome. Leaves pinnate; leaflets of basal leaves orbicular; terminal larger; of cauline leaves various. Racemes up to 15-flowered. Flowers lilac or pinkish. Sepals ca 3 mm long. Petals much exceeding the sepals. Siliquae linear, up to 5 cm long, compressed. Seeds brown, oblong.

Fl. & Fr. : May July.

Included after Jafri (*loc. cit.*).

5. *Cardamine macrophylla* Willd., Sp. Pl. 3: 484. 1800; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 139. 1872; Jafri in Fl. W. Pak. 55: 167. 1973; Singh & Kachroo, Forest Fl. Srinagar 25. 1976; Naqshi *et al.*, in J. Econ. Tax. Bot. 5(3): 716. 1984; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 115. 1993.

Perennial, 25-100 cm tall herbs, erect, glabrous. Leaves 5-15 cm long, long petioled, pinnate with 3-10 pairs of lateral leaflets and a terminal one; leaflets lanceolate, 1-7.5 cm long, sublobulate, serrate or sinuate-dentate, acute-acuminate. Racemes up to 20 cm long, 20-45-flowered. Flowers white or pinkish. 9-14 mm in diam. Pedicels up to 20 mm long. Sepals 5 mm long. Petals obovate-cuneate, 8-15 mm long. Siliquae 25-50 mm long, erect, glabrous. Seeds many, oblong, 1.5-2 mm long.

Fl. & Fr. : May July.

Selected specimens : Pahalgam, 3400 m, T.A. Rao 9674; Kansar, 2500 m, T.A. Rao 9157 (BSD); Trigun-Bela-Meemurg, Wadhwa, Murti & Pant 84666 (BSD). Liddar valley, ca 3000 m, Duthie 13477 (DD).

Note : Naqshi *et al.*, have reported subsp. *polyphylla* (D. Don) Schulz, from the valley.

6. *Cardamine yunnanensis* Franchet in Bull. Soc. Bot. Fr. 33: 398. 1886; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 118. 1993. *C. hirsuta* var. *oxycarpa* Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 138. 1872, *p.p.*

Diffusely branched herbs, up to 35 cm long. Leaves sparsely pubescent; terminal leaflets up to 5.5 x 2.5 cm; lateral leaflets ovate, obtuse, crenately toothed along margins. Flowers white or pink. Sepals oblong-ovate. Petals obovate, cuneate at base. Siliquae 2.5-3 cm long, acuminate.

Fl. & Fr. : May - September.

Included after Hajra & Chowdhery (*loc. cit.*).

15. *CARDARIA* Desv.

- 1a. Siliculae broadly ovate, obliquely cordate at base; valves with distinct reticulate venation ...2. *C. draba*
 1b. Siliculae ovate-orbicular, entire at base; valves with obscure venation ...1. *C. chalepense*

1. *Cardaria chalepense* (L.) Hand.-Mazz. in Ann. Nat. Hofm. Wien. 27: 55. 1913; Jafri in Fl. W. Pak. 55: 68. 1973; Bhaumik in Sharma *et al.*, Fl. India 2: 190. 1993.

Erect herbs. Basal leaves obovate, elliptic-oblong or lanceolate, up to 7 x 2 cm, entire or irregularly toothed, pubescent; middle and upper leaves sagittate-auricled at base. Flowers in corymbose panicles. Sepals obovate or oblong, 2-2.5 mm long, white margined. Petals exceeding the sepals. Siliculae ovate-suborbicular, glabrous or minutely pubescent; valves obscurely veined.

Fl. & Fr. : April - July.

Selected specimens : Kashmir. W. Gollan s.n. (DD).

2. *Cardaria draba* (L.) Desv. in Bot. Appl. 3: 163. 1814; Jafri in Fl. W. Pak. 55: 67. 1973; Kaul, Weed Fl. Kashmir valley 39. 1986. *Lepidium draba* L., Sp. Pl. 645. 1753; Hook.f., & T. Anders. in Hook.f., Fl. Brit. India 1: 160. 1872.

Perennial, 15-75 cm high herbs, erect, usually forked hairy. Basal leaves obovate-spathulate, 3-9.5 x 1-3.5 cm, sinuately toothed; upper leaves

oblong-lanceolate, ovate-oblong, 1-6.5 long, toothed, amplexicaul. Racemes up to 10 cm long, 20-45-flowered. Flowers white, ca 5 mm in diam. Pedicels up to 10 mm long. Sepals oblong, ca 2 mm long. Petals spatulate, clawed. Siliquae ovate, 4-4.5 x 3.5-4.5 mm, cordate. Seeds ovoid or ellipsoid, ca 2 mm long.

Fl. & Fr. : April July.

Included after Kaul (*loc. cit.*).

16. CHORISPORA R. Br. ex DC.

- 1a. Flowers yellow :
- 2a. Annuals or biennial. Siliquae usually with 3-4 articulations, moniliform ...2. *C. macropoda*
 - 2b. Perennials. Siliquae without articulations, often curved or subreflexed ...4. *C. sibirica*
- 1b. Flowers pink-violet or white :
- 3a. Plants annual ...5. *C. tenella*
 - 3b. Plants perennial :
 - 4a. Flowering stem short or absent. Fruiting pedicels up to 30 mm long. Petals 14-16 mm long ...1. *C. bungeana*
 - 4b. Flowering stem prominent. Fruiting pedicels up to 15 mm long. Petals 6-10 mm long ...3. *C. sabulosa*

1. *Chorispora bungeana* Fisch. & Mey. in Shrenk, Enum. Pl. Nov. 1: 96. 1841; Jafri in Fl. W. Pak. 55: 204. 1973; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 187. 1983; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 215. 1993.

Perennial, rhizomatous herbs. Radical leaves rosulate, 15-55 x 3-9.5 mm, pinnatifid or sinuate-toothed. Scapes up to 6 cm long, 1-flowered, rarely 2-5-flowered. Flowers pink-violet, 14-19 mm in diam. Pedicels up to 28 mm long. Sepals 6.5-8 mm. long. Petals 12-17 x 5-7 mm, emarginate at apex. Siliquae 15-28 mm long, torulose or moniliform.

Fl. & Fr. : May July.

Included after Dhar & Kachroo (*loc. cit.*).

2. *Chorispora macropoda* Trautv. in Bull. Soc. Nat. Mosc. 33. t. 109. 1860; Jafri in Fl. W. Pak. 55: 205. 1973; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 215. 1993.

Perennial. 4-9 cm high herbs, suberect, glandular or glabrous. Radical leaves oblong-spathulate, oblanceolate, 18-25 x 3.5-6.5 mm, sinuate-toothed. Racemes ca 6 cm long, 7-14-flowered. Flowers yellow, ca 6 mm in diam. Pedicels 5.5-7.8 mm long, glandular. Sepals ca 3 mm long. Petals spathulate; 5.5-6.8 x 3-3.3 mm, clawed. Siliquae ca 10 mm long, articulated, finely glandular hairy.

Fl. & Fr. : May July.

Included after Hajra *et al.* (*loc. cit.*).

3. *Chorispora sabulosa* Cambess. in Jacquem., Voy Bot. 15. t. 15. 1844; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 167. 1872; Jafri in Fl. W. Pak. 55: 205. 1973; Singh & Kachroo, Forest Fl. Srinagar 16. 1976; Kachroo *et al.*, Fl. Ladakh 54. 1977; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 216. 1993. *Imbuk*.

Perennial, 4-20 cm high herbs, suberect, glabrous or sparsely minutely hairy; hairs glandular and eglandular. Rosette leaves oblanceolate or spathulate, 15-75 x 2-8.5 cm long, deeply pinnatifid to irregularly dentate. Racemes 9-24-flowered. Flowers pink or white, ca 10 mm long. Sepals 2.5-3.5 mm long, pilose. Petals 5-10 mm long. Siliquae 14.5 x 1.5 mm, irregularly torulose, glabrous, glandular

Fl. & Fr. : May July.

On dry stony slopes.

Selected specimens : Ladakh, Zozila, 3550 m. *Bhattacharyya* 41226; Kurgiakh, 4400 m. *Bhattacharyya* 52205 (BSD); Fatu la, 3990 m, *Wadhwa* 58969 (BSD); Panikhar Parkhachick, *Chowdhery & Uniyal* 85955 (BSD).

4. *Chorispora sibirica* (L.) DC., Syst. Nat. 2: 437. 1821; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 167. 1872; Jafri in Fl. W. Pak. 55: 208. 1973; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 217. 1993. *Raphanus sibiricus* L., Sp. Pl. 669. 1753.

Annual, 5-28 cm high herbs, sparsely hairy with glandular and eglandular hairs. Basal leaves rosulate, oblanceolate, 15-45 x 2.5-7.5 mm, interruptedly pinnatifid; upper leaves similar to basal leaves. Racemes up to 15 cm long, 8-18-flowered. Flowers yellow, ca 8 mm in diam. Pedicels 8-15 mm long. Sepals ca 3.5 mm long, pilose. Petals 6-8 x 3.5-4 mm. Siliquae 12-18 mm long, often curved or subreflexed. Seeds suborbiculate, 8-10 on each side, ca 0.7 mm long.

Fl. & Fr. : June July.

Included after Hajra *et al.*, (*loc. cit.*).

5. *Chorispora tenella* (Pallas) DC., Syst. Nat. 2: 435. 1821; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 166. 1872; Jafri in Fl. W. Pak. 55: 206. 1973; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 186. 1983; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 234. 1993.

Annual, 9-38 cm high herbs, erect, glabrous or glandular. Basal leaves rosulate, 25-75 x 4-18 mm, sinuate-toothed; upper leaves similar to basal leaves. Racemes up to 20 cm long, 9-18-flowered. Flowers pink or violet ca 10 mm in diam. Pedicels up to 5 mm long. Sepals 4.5-6 mm long. Petals 8-10 x 2 mm. Siliquae linear-cylindrical, 20-34 mm long, subtorulose. Seeds brownish, suborbiculate.

Fl. & Fr. : April June.

Selected specimens : Ladakh, Parkhachick-Rangdom, Chowdhery & Uniyal 85963 (BSD).

17. CHRISTOLEA Cambess.

1a. Racemes ca 3-flowered

...5. *C. pumila*

1b. Racemes more than 6-flowered :

- 2a. Fruiting pedicels *ca* 6 mm long :
- 3a. Fruits up to 20 mm long, 8 mm broad ...3. *C. lanuginosa*
- 3b. Fruits 25-35 mm long, 2-4 mm broad ...7. *C. stewartii*
- 2b. Fruiting pedicels 8 mm or more long :
- 4a. Leaves usually with 8-10 blunt teeth or lobules ...6. *C. scaposa*
- 4b. Leaves up to 3-toothed :
- 5a. Fruits linear, *ca* 1 mm broad ...4. *C. parkeri*
- 5b. Fruits oblong-obovate, 2-4 mm broad :
- 6a. Plants more than 15 cm high. Leaves up to 2 cm broad ...1. *C. crassifolia*
- 6b. Plants up to 15 cm high. Leaves up to 1 cm broad ...2. *C. himalayensis*

1. *Christolea crassifolia* Cambess. in Jacquem., Voy. Bot. 4: 17. t. 17. 1844; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 154. 1872; Jafri in Fl. W. Pak. 55: 156. 1973; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 119. 1993. *Phlolum* (Ladakhi); *Krascheotz*.

Perennial, 14-38 cm high herbs, decumbent, usually glabrous, rarely villous. Leaves variable, 1-4.5 x 0.3-2.5 cm, 3-5-toothed. Racemes up to 8 cm long, 8-23-flowered. Flowers 4.5-6.5 mm in diam., white with pedicels up to 10 mm long. Sepals 2.5-3.5 mm long. Petals 4.5-5-8 mm long. Siliquae broadly ovate, 10-30 x 3.5-4 mm, compressed, glabrous or hairy. Seeds 5-10 in each locule, *ca* 2 mm long.

Fl. & Fr. : June July.

On exposed rocky slopes. Abundant.

Selected specimens : Ladakh, Mulbekh; 3310-3800 m, *Wadhwa* 58880; Khardung la, 3900 m, *Wadhwa* 59925 (BSD); Lamayuru, 3300 m, *Bhattacharyya* 71416; Saspole-Leh, *Chowdhery & Uniyal* 86038 (BSD); Puga, Rupshu, *ca* 5000 m, *Koelz* 2169 (DD).

2. *Christolea himalayensis* (Cambess.) Jafri in Notes Roy. Bot. Gard. Edinb. 22: 53. 1955 *et in* Fl. W. Pak. 55: 158. 1973; Hajra &

Chowdhery in Sharma *et al.*, *Fl. India* 2: 119. 1993. *Cheiranthus himalayensis* Cambess. in Jacquem., *Voy. Bot.* 14. 1844; Hook.f. & T. Anders. in Hook.f., *Fl. Brit. India* 1: 132. 1872; Kachroo *et al.*, *Fl. Ladakh* 54. 1977. *Fiam.*

Perennial, 4.5-14 cm high, spreading herbs. Radical leaves rosulate, spatulate-obovate, 9.5-14 x 4.5-9 mm, bluntly 2-5-toothed; cauline leaves spatulate to linear, fleshy, pilose. Racemes up to 10 cm long, 10-24-flowered. Flowers white, 4.5-6 mm in diam. Pedicels up to 10 mm long. Sepals 3 mm long. Petals 5.5-6 mm long. Siliquae linear-oblong, 18-30 mm long, compressed. Seeds many.

Fl. & Fr. : June July.

On dry rocky slopes. Frequent.

Selected specimens : Ladakh, Pang-Sarchu, Chowdhery & Uniyal 86231 (BSD); Tanglang la Ladakh, S.K. Srivastava & Chauhan 100879 (BSD).

3. *Christolea lanuginosa* (Hook.f. & Thomson) Ovcz. in *Sov. Bot.* 151. 1941; Jafri in *Fl. W. Pak.* 55: 156. 1973; Hajra & Chowdhery in Sharma *et al.*, *Fl. India* 2: 120. 1993. *Parrya lanuginosa* Hook.f. & Thomson in *J. Linn. Soc. Bot.* 5: 136. 1861; Hook.f., & T. Anders. in Hook.f., *Fl. Brit. India* 1: 132. 1872. *Measlo.*

Perennial herbs, up to 5 cm high, pilose with simple and furcate, white hairs. Radical leaves rosulate, spatulate, 6.5-14 x 2.5-5.5 mm, 2-3-toothed towards the apex. Racemes 8-15-flowered. Flowers mauve, ca 5 mm in diam. Pedicels up to 6 mm long. Sepals ca 3 mm long. Petals 4.5-5.5 x 2-2.3 mm. Siliquae ovate-oblong or broadly linear, 18-20 x 4.5-7 mm, acute, flattened, glabrous. Seeds greyish, 4-6 in each locule, ca 2 mm long.

Fl. & Fr. : June July.

Included after Hajra & Chowdhery (*loc. cit.*).

4. *Christolea parkeri* (Schulz) Jafri in Notes Roy. Bot. Gard. Edinb. 22 (1): 52. 1955 et in Fl. W. Pak. 55: 160. 1973; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 120. 1993. *Ermania parkeri* Schulz in Fedde, Repert. 31: 333. 1933.

Perennial, up to 10 cm high herbs, erect or suberect. Radical leaves spatulate, 9.5-14 x 2.5-4.5 mm, toothed; cauline leaves oblanceolate to linear. Racemes 9-15-flowered. Flowers white, tinged with purple, ca 5 mm in diam. Pedicels up to 7.5 mm long. Sepals, 3 mm long. Petals ca 4.5-8 mm long. Siliquae linear, ca 10 mm long, pilose.

Fl. & Fr. : June July.

Included after Hajra & Chowdhery (*loc. cit.*).

5. *Christolea pumila* (Kurz) Jafri in Fl. W. Pak. 55: 157. 1973; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 121. 1993. *Parrya pumila* Kurz in Flora 55: 18: 285. 1872.

Perennial herbs, pilose with mixed hairs. Leaves spatulate, entire or obscurely 2-3-toothed above. Flowers in racemes, about 3. Sepals 4-5 mm long. Petals ca 9 mm long. Siliquae oblong-obovate, short, flattened, pilose on margins.

Fl. & Fr. : June August.

Included after Hajra & Chowdhery (*loc. cit.*).

6. *Christolea scaposa* Jafri in Notes Roy. Bot. Gard. Edinb. 22(1): 38. f. 2. 1955 et in Fl. W. Pak. 55: 158. 1973; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 121. 1993.

Perennial, up to 9.5 cm high herbs, pilose; hairs usually simple, rarely furcate. Basal leaves rosulate, orbicular, 5-15 x 2-8 mm, bluntly toothed, subfleshy. Racemes up to 10 cm long, up to 18-flowered. Flowers greenish, ca 5 mm in diam. Pedicels up to 10 mm long, pilose. Sepals 3.5-4 mm long, rarely connate below. Petals 5.5-6 mm long. Siliquae oblong-linear, ca 11.5 mm long, compressed. Seeds biseriate.

Fl. & Fr. : June July.

Included after Hajra & Chowdhery (*loc. cit.*).

7. *Christolea stewartii* (T. Anders.) Jafri in Notes Roy Bot. Gard. Edinb. 22(1): 53. 1955 *et in* Fl. W. Pak. 55: 157. 1973; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 121. 1993. *Cheiranthus stewartii* T. Anders. in Hook.f., Fl. Brit. India 1: 132. 1872. *Tschalu*.

Fig. 65

Perennial, 2-6 cm high herbs, spreading or suberect, pilose. Basal leaves rosulate, spatulate, 8-28 x 4-8.5 mm, 3-5-toothed, pilose with simple and branched hairs, subfleshy. Racemes up to 6 cm long, 8-14-flowered. Flowers pale pink, 3.5-4.5 mm in diam. Pedicels *ca* 5.5 mm long. Sepals *ca* 2.5 mm long. Petals *ca* 4.5 mm long. Stamens 2, 2.3 mm long. Siliquae linear, 25-35 x 2.5-3.5 mm, compressed, glabrous. Seeds many, *ca* 1.5 mm long.

Fl. & Fr. : June July.

Common, in moraines.

Selected specimens : Ladakh, Sori la, 4800 m, *Bhattacharyu* 52297 (BSD).

Note : Dar and Naqshi described two new species of *Ermania*, viz. *E. kashmiriana* Dar & Naqshi and *E. kachrooi* Dar & Naqshi (*J. Bombay Nat. Hist. Soc.* 87 (2): 274-278. 1990) from the state. The genus *Ermania* is treated as a synonym to *Christolea* and, therefore, the above mentioned species may have to be treated accordingly.

Ermania kashmiriana is said to resemble *E. stewartii* (T. Anders.) Schulz and *E. himalayensis* (Cambess.) Schulz in habit but differs from the former by its dense, many-flowered racemes reaching up to 10 cm in fruit, longer (3-4 mm) stamens and narrower fruits, and from the latter by its radical leaves (10-20 x 3-10 mm), shorter fruiting pedicels (up to 7 mm long), longer stamens and longer fruits which are glabrous, do



Fig. 65. *Christolea stewartii* (T. Anders.) Jatri

not exceed 2 mm in width and usually lack a prominent midvein on their values.

Ermania kachrooi differs from *E. stewartii* (T. Anders.) Schultz, *E. himalayensis* (Cambess.) Schulz and *E. kashmiriana* Dar & Naqshi by the absence of basal rosette of leaves and presence of lower cauline leaves which are narrowed into stalk like lower half, 3-many-toothed in the apical half. From *Ermania kashmiriana* and *E. himalayensis*, it is said to be easily distinguished by its totally glabrous surface.

18. COCHLEARIA L.

Cochlearia cochlearioides (Roth) Santapau & Maheshw. in J. Bombay Nat. Hist. Soc. 54: 807. 1957; Bhaumik in Sharma *et al.*, Fl. India 2: 191. 1993. *Alyssum cochlearioides* Roth, Nov. Pl. Sp. 322. 1821. *Cochlearia flava* Roxb. ex Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 145. 1872.

Annual, diffusely branched, glabrous herbs. Leaves up to 12.5 cm long, lanceolate, entire or pinnatifid, lobed; lobes sinuate-toothed, auricled. Inflorescence corymbose, short racemose or scapose. Flowers yellow, small. Sepals spreading, equal at the base. Petals entire, shortly clawed. Siliculae globose, ovoid or oblong, smooth. Seeds biseriate, compressed, rugose.

Fl. & Fr. : August - October.

Included after Bhaumik (*loc. cit.*).

19. CONRINGIA Heist ex Fabr.

Conringia planisiliqua Fisch. & Mey. in Sem. Hort. Petrop. 3: 32. 4. 564. 1837; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 152. 1872; Jafri in Fl. W. Pak. 55: 49. 1973; Naqshi & Javeid in J. Econ. Tax. Bot. 9(1): 95. 1987; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 140. 1993. *Landyschran* (Ladakhi): *Khaskar*.

Annual, 9-35 cm high glabrous, glaucous. Leaves oblong-ovate, 3-10 x 1-3 cm, glabrous, entire; lower leaves obovate, obtuse, entire or

obscurely toothed, subsessile; upper leaves oblong-ovate, 2-8.5 x 1-5 cm, cordate, amplexicaul. Racemes up to 20 cm long, corymbose. Flowers pale yellow or white, ca 5 mm in diam. Pedicels 4-8 mm long. Sepals linear, 3.5-5 mm long. Petals oblong, 5.5-7 mm long, obtuse. Siliquae 35-85 x 1.5-2 mm, straight, glabrous. Seeds oblong, ellipsoid, 1.5 mm long.

Fl. & Fr. : April June.

Selected specimens : Shisar valley, ca 3500 m, Duthie 11949 (DD).

20. CORONOPUS J.G. Zinn.

Coronopus didymus (L.) Smith, Fl., Brit. 2: 691. 1804; Jafri in Fl. W. Pak. 55: 62. 1973; Singh & Kachroo, Forest Fl. Srinagar 167. 1976; Sharma & Kachroo, Fl. Jammu 1: 95. 1981; Bhaumik in Sharma *et al.*, Fl. India 2: 192. 1993. *Lepidium didymum* L., Mant. 1: 92. 1767. *Jangitilian*.

Annual, 14-28 cm high herbs, diffuse or procumbent, prostrate, glabrous. Basal and lower leaves rosulate, 4-9 cm long, pinnatisect; upper leaves 1.5-2.8 cm long, subsessile. Racemes up to 5 cm long, dense, flowered. Flowers greenish, minute. Pedicels 3-3.8 mm long. Petals rarely absent. Stamens only 2 or 4. Siliquae 1.5 x 2.5 mm. Seeds reniform, 1.5 mm long.

Fl. & Fr. : March June.

Selected specimens : Manasbal, Wadhwa, Murti & Pant 84610 (BSD); Udhampur, Kumar 81222 (BSD); Kishtwar, Uniyal 80247 (BSD).

21. CRAMBE L.

Crambe cordifolia Stev. subsp. *kotschyana* (Boiss.) Jafri in Fl. W. Pak. 55: 37. 1973; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 141. 1993. *Crambe kotschyana* Boiss., Diagn. Ser. 1. 6: 19. 1845. *C. cordifolia* var. *kotschyana* (Boiss.) O.E. Schulz in Das Pflanzenr. 70: 236. 1919; Singh & Kachroo, Forest Fl. Srinagar 167. 1976. *Bemma*.

Perennial, stout, 55-175 cm tall, glabrous herbs. Basal leaves cordate or reniform, 20-40 cm in diam., sinuate dentate, thick; petiole 12-28 cm long; upper leaves ca 1 cm long. Racemes lax or branched, ebracteate. Flowers white, 7-7.5 mm in diam. Pedicels 5-10 mm long. Sepals 2.8-4 mm long. Petals obovate-oblong, 5-7.5 mm long. Siliculae globose, 1.5-2.2 x 1 mm. 1-seeded.

Fl. & Fr. : April - June.

Included after Hajra *et al.* (*loc. cit.*).

22. DESCURAINIA Webb & Berth.

Descurainia sophia (L.) Webb & Berth. in Engl. & Prantl., *Pflanzenf.* 3, 2: 192. 1891; Jafri in *Fl. W. Pak.* 55: 281. 1973; Sharma & Kachroo, *Fl. Jammu* 1: 96. 1981; Dhar & Kachroo, *Alpine Fl. Kashmir Himal.* 187. 1983; Hajra *et al.* in Sharma *et al.*, *Fl. India* 2: 237. 1993. *Sisymbrium sophia* L., *Sp. Pl.* 659. 1753; Hook.f. & T. Anders. in Hook.f., *Fl. Brit. India* 1: 281. 1872. *Charilasi, Tseri-Latchij.*

Annual, 25-80 cm high herbs, erect, hairy below, glabrous above. Leaves pinnatisect, linear or oblong, 4.5-13 cm long; upper leaves sessile. Racemes up to 30 cm long, 40-80 flowered. Flowers yellow, 2-2.8 mm in diam. Pedicels 9-15 mm long, glabrous. Sepals 2 mm long. Petals 2-3.8 mm long. Siliquae linear, 14-32 x 1 mm, somewhat curved, glabrous. Seeds reddish-brown.

Fl. & Fr. : April - July.

On roof of huts, waste places and open situations.

Selected specimens : Phyang, Leh, 3500 m, Viswanathan 54682 (BSD); Dera, Chowdhery & Uniyal 85783 (BSD); Kurgiakh, 4300 m, Bhattacharyya 52225 (BSD); Wular lake, Rao & Kumar 89669 (BSD); Udhampur city, Swami 839 (BSD); Liddar valley, Inayat 25488 (DD).

23. DILOPHIA Thomson

Dilophia salsa Thomson in Hook., Kew J. Bot. IV. 5: 20. t. 12. 1853; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 161. 1872; Jafri in Fl. W. Pak. 55: 95. 1973; Kachroo *et al.*, Fl. Ladakh 56. 1977; Bhaumik in Sharma *et al.*, Fl. India 2: 193. 1993.

Perennial, 1.5-5 cm high, glabrous, much branched. Radical leaves densely rosulate, linear-oblong, spatulate, 8-23 x 1-5 mm, bluntly toothed, subsessile; cauline linear, fleshy, glabrous. Racemes 10-18-flowered, densely corymbose. Flowers white, 3-3.5 mm in diam. Pedicels up to 4.5 mm long. Sepals *ca* 2 mm long. Petals spatulate *ca* 3 mm long. Silliculae 2.5 mm in diam., with two wing like crests in the valves. Seeds 2-4 in each locule.

Fl. & Fr. : June July.

On moist sandy riverbed and in marshy situations. Occasional.

Selected specimens : Ladakh, Whisky Nallah, 4000 m, *Bhattacharyya* 40926 (BSD); Diksit, 3150 m, *Wadhwa* 600036 (BSD).

24. DIPLOTAXIS DC.

Diplotaxis muralis (L.) DC., Reg. Veg. Syst. Nat. 2: 634. 1981; Siddique *et al.* in Geobios 7: 166. ff. 1-6. 1988; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 143. 1993. *Sisymbrium murale* L., Sp. Pl. 658, 1753.

Ascending herbs, up to 40 cm high. Basal leaves in rosettes, spatulate, lyrate-pinnatifid, up to 3.5 x 1.2 cm, petioled; cauline leaves subsessile. Flowers in lax racemes, 5-10 mm in diam. Sepals ovate-lanceolate, *ca* 3 mm long, acute, hirtellous. Petals yellow, ovate-obovate, *ca* 6 mm long. Siliquae beaked, glabrous; seeds ovoid, finely reticulate.

Fl. & Fr. : June September.

Included after Hajra *et al.* (*loc. cit.*).

25. DONTOSTEMON Andrz. ex Ledeb.

Dontostemon glandulosus (Kar. & Kir.) O.E. Schulz in Notizbl. Bot. Gart. Berlin 10: 554. 1929; Jafri in Fl. W. Pak. 55: 191. 1973; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 122. 1993. *Arabis glandulosa* Kar. & Kir. in Bull. Soc. Nat. Mosc. 15: 146. 1842; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1:136. 1872; Kachroo *et al.*, Fl. Ladakh 50. 1977. *Umnaku*.

Annual, 4-20 cm high herbs, sparsely hairy with simple and glandular hairs. Basal leaves rosulate, narrowly spatulate, 10-25 mm long, entire or toothed. Racemes 10-25-flowered, ca 6 cm long. Flowers white or pinkish, 3-4 mm in diam. Pedicels up to 8 mm long, glandular. Sepals 2-2.5 x 3 mm long. Petals 3-5 mm long. Siliquae 15-25 mm long, glandular. Seeds brown, oblong-ellipsoid, 10-18 in each locule, ca 1 mm long.

Fl. & Fr. : June July.

Selected specimens : Mathoo. Phu, 5000 m, *Wadhwa* 59643 (BSD); Zangril, *Chowdhery & Uniyal* 86147 (BSD); Rupshu, ca 5000 m, *Koelz* 2260 (DD).

26. DRABA L.

- 1a. Petals absent ...18. *D. tenerrima*
- 1b. Petals present :
 - 2a. Flowering shoots leafless, rarely 1-2 leaves present :
 - 3a. Petals 4.5-6 mm long :
 - 4a. Racemes usually 15-30-flowered. Seeds ca 0.5 mm long ...14. *D. olgae*
 - 4b. Flowers 5-10 in a raceme. Seeds ca 1 mm long :
 - 5a. Plants with short, branched hairs. Fruits usually 10-15 mm long ...19. *D. tibetica*
 - 5b. Plants hairy with simple and branched hairs. Fruits 3-8 mm long :

- 6a. Leaves with a mid vein only ...1. *D. affghanica*
 6b. Leaves usually with 3 veins ...20 *D. trinervis*
- 3b. Petals 1.5-5 mm long:
- 7a. Plants floccose with short, branched
 or simple hairs :
- 8a. Fruits lanceolate or oblong-elliptic,
 compressed. Style 1-1.5 mm
 long ...21. *D. winterbottomii*
- 8b. Fruits ovoid, inflated. Style *ca*
 0.5 mm long ...8. *D. korshinskyi*
- 7b. Plants ciliate with simple or branched hairs :
- 9a. Petals *ca* 2.5 mm long ...12. *D. melanopus*
- 9b. Petals 3-6 mm long :
- 10a. Fruits linear or elliptic-oblong,
 compressed ...16. *D. setosa*
- 10b. Fruits ovoid or elliptic-ovate,
 subinflated or subcompressed :
- 11a. Basal leaves up to 25 mm
 long. Petals *ca* 1.5 mm
 broad ...15. *D. oreades*
- 11b. Basal leaves up to
 5 mm long. Petals
 2.5-3 mm broad ...4. *D. cachemirica*
- 2b. Flowering shoots usually many-leaved; rarely
 1/2 leaved :
- 12a. Annuals :
- 13a. Petals *ca* 4 mm long. Fruits 8-20 mm
 long, *ca* 2 mm broad ...17. *D. stenocarpa*
- 13b. Petals 1-2 mm long. Fruits 5-8 mm long,
ca 2.5 mm broad :
- 14a. Flowers 3-5 in a raceme. Petals
ca 1 mm long ...5. *D. ellipsoidea*
- 14b. Flowers many in a raceme. Petals
ca 2 mm long ...13. *D. nemorosa*
- 12b. Perennials :
- 15a. Seeds large, *ca* 2 mm long, obscurely
 winged ...3. *D. aubretoides*

- 15b. Seeds small, ca 1 mm long, not winged :
- 16a. Plants not caespitose. Fruits 10-20 x 2.5-3 mm ...6. *D. falconeri*
- 16b. Plants caespitose. Fruits up to 10 mm' long and 2 mm broad :
- 17a. Plants ciliate with simple or branched hairs ...2. *D. altaica*
- 17b. Plants tomentose with short branched hairs, rarely long simple hairs mixed :
- 18a. Sepals persisting in fruit. Fruits ovate-orbicular, not contorted ...11. *D. ludlowiana*
- 18b. Sepals caducous, oblong-linear, contorted :
- 19a. Plants hairy with short branched hairs mixed with simple or forked hairs ...10. *D. lasiophylla*
- 19b. Plants with short, branched hairs only :
- 20a. Seeds 3-6 in each locule ...7. *D. glomerata*
- 20b. Seeds 16-20 in each locule ...9. *D. lanceolata*

1. *Draba affghanica* Boiss., Fl. Orient. (suppl.) : 55. 1888; Jafri in Fl. W. Pak. 55: 134. 1973; Basak in Sharma *et al.*, Fl. India 2: 153. 1993. *D. alpina auct. non L.*; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 142. 1872, p.p.

Perennial, loosely caespitose herbs. Root stock prostrate, branched; scapes ca 4.5 cm long, aphyllous, pubescent. Basal leaves rosulate, oblanceolate, lanceolate, 4.5-17 x 2.5-4.5 mm, with simple or branched hairs, sessile. Racemes corymbose, 3-10-flowered. Flowers yellow, ca 5 mm in diam. Pedicels 5-9.5 mm long spreading or upcurved. Sepals oblong-elliptic, 2-3 mm long. Petals obovte, 4.5-6 mm long. Siliculae ovoid, 2.8-

8 x 2-3.5 mm, acute, minutely hairy, rarely glabrous. Seeds dark reddish-brown, ovate-oblong.

Fl. & Fr. : May July.

Included after Basak (*loc. cit.*).

2. *Draba altaica* (C.A. Mey.) Bunge in Delect. Sem. Hort. Dorpat. 8. 1841; Jafri in Fl. W. Pak. 55: 137. 1973; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 187. 1983; Basak in Sharma *et al.*, Fl. India 2: 153. 1993. *D. rupestris* R. Bt. var. *altaica* C.A. Mey. in Ledeb., Fl. Alt. 3: 72. 1831. *D. fladnitzensis auct. non* Wulf., Hook.f., & T. Anders. in Hook.f., Brit. India 1: 143. 1872.

Perennial, tufted herbs. Rootstock covered with withered leafbases and leaves. Basal leaves rosulate, lanceolate or elliptic, 4-18 x 1-5 mm, acute; cauline leaves oblong-ovate or narrowly lanceolate, hairy or subglabrous. Racemes corymbose, 4-12-flowered. Flowers white, *ca* 2.2 mm in diam. Pedicels up to 3-4.5 mm long. Sepals *ca* 1 mm long. Petals 2-2.5 x 1 mm. Siliculae ovate-oblong or oblong-elliptic, 2.5-4 x 1.5-2 mm, acute, glabrous. Seeds brown, 4-6 in each locule.

Fl. & Fr. : June August.

Selected specimens : Seoj-Kailash, 3500 m, Vohra & Naithani 82989 (BSD); Seshnag, 3800 m, Nair 36964 (BSD).

3. *Draba subretoides* Jafri in Notes Roy. Bot. Gard. Edinb. 22: 106. 1956 *et in* Fl. W. Pak. 55: 146. 1973; Basak in Sharma *et al.*, Fl. India 2: 154. 1993.

Biennial, rarely perennial, procumbent herbs, 14-18 cm high, hairy. Leaves elliptic-obovate, oblong-elliptic, 9-23 x 2-6.5 mm, obtuse, sessile. Racemes laxly 6-16-flowered. Petals ovate, 5-6 x 2-3 mm. Flowers yellow *ca* 2 mm in diam. Siliculae linear, curved, 10-22 x 2.5 mm, compressed, glabrous. Seeds 4-6 in each locule, oblong, slightly winged at margins.

Fl. & Fr. : April - June.

Included after Basak (*loc. cit.*).

Endemic.

4. *Draba cachemirica* Gandoger in Bull. Soc. Bot. France 46: 418. 1899; Jafri in Fl. W. Pak. 55: 133. 1973; Kachroo *et al.*, Fl. Ladakh 54. 1977; Basak in Sharma *et al.*, Fl. India 2: 155. 1993. *Draba glacialis* auct. non Adams; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 142. 1872, *p.p.*

Perennial, loosely-densely caespitose herbs. Scapes 2.5-3.5 cm long, aphyllous above. Basal leaves oblong-linear, 2.5-5 x 1 mm, obtuse, ciliate at margins. Racemes corymbose, 8-15-flowered. Flowers yellow ca 5 mm in diam. Pedicels up to 7 mm long, glabrous. Sepals oblong-ovate 2.5-3 mm long. Petals narrowly obovate, 4.5-5.5 mm long. Siliculae ovoid, 2.5-4 x 2.5 mm, acute. Seeds brown, 2-4 in each locule.

Fl. & Fr. : May - July.

Selected specimens : Kargil, 3300 m, Wadhwa 58769; Sankoo, Suru valley 3100-4100 m, Wadhwa 59820 (BSD).

Endemic.

5. *Draba ellipsoidea* Hook.f. & Thomson in J. Linn. Soc. Bot. 5 153. 1861; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 144. 1872; Jafri in Fl. W. Pak. 55: 146. 1973; Basak in Sharma *et al.*, Fl. India 2: 157. 1993.

Annual, 2.5-4 cm long, prostrate or ascending. Leaves obovate-oblongate, 4.5-10 x 2-3 mm, toothed, pubescent; hairs stellate. Racemes lax, 3-5 flowered. Flowers white, ca 1 mm in diam. Pedicels ca 12 mm long, filiform. Sepals oblong, ca 1 mm long. Petals narrowly spatulate, 1-1.5 mm long. Siliculae oblong-elliptic, 5-5.5 x 2.5 mm compressed, pubescent. Seeds brown, 6-8 in each locule, ovate.

Fl. & Fr. : July August.

Included after Basak (*loc. cit.*).

6. *Draba falconeri* O.E. Schulz in Engler, Pflanzenr. 89 (iv. 105): 300. 1927; Jafri in Fl. W. Pak. 55: 142. 1973; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 187. 1983; Basak in Sharma *et al.*, Fl. India 2: 158. 1993.

Perennial, 25-32 cm high herbs, often decumbent, hairy. Basal leaves rosulate, oblong-obovate, 9.5-14.5 x 2.5 mm, acute, entire; cauline leaves oblong-ovate, toothed. Racemes up to 20 cm long, 15-30-flowered. Flowers white, *ca* 5 mm in diam. Pedicels 14-23 mm long, hairy. Sepals *ca* 2.5 mm long. Petals 3.5-4.5 mm long. Siliculae linear-oblong, 10-15 mm x 2-3 mm, pubescent. Seeds 10-14 in each locule, oblong-ovate.

Fl. & Fr. : June August.

Included after Basak (*loc. cit.*).

7. *Draba glomerata* Royle, Illus. Bot. Himal. 1: 71. 1834; Jafri in Fl. W. Pak. 55: 138. 1973; Basak in Sharma *et al.*, Fl. India 2: 158. 1993. *D. lasiophylla auct. non* Royle; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 142. 1872, *p.p.*

Perennial, up to 8 cm, pubescent herbs. Basal leaves rosulate, narrowly oblong, 4.5-14 x 1-2.5 mm, tomentose; cauline leaves oblong-ovate. Racemes corymbose, 10-15-flowered. Flowers white, *ca* 3 mm in diam. Fruiting pedicels 2-4 mm long, tomentose. Sepals 1.5 mm long. Petals *ca* 2 mm long. Siliculae oblong-ovate, 3.5-4 x 1.5 mm, flattened, subglabrous. Seeds 3-6 ovate-oblong.

Fl. & Fr. : June August.

Selected specimens : Ladakh, Sorila, 4500 m, *Bhattacharyya* 52292, Khardungla, 5000 m, *Bhattacharyya* 71577; Changla, 5100 m, *Bhattacharyya* 71665 (BSD).

8. *Draba korshinskyi* (O. Fedtsch.) Pohle in Act. Hort. Petrop. 31: 484. 1914; Jafri in Fl. W. Pak. 55: 132. 1973; Basak in Sharma *et al.*, Fl. India 2: 161. 1993. *D. alpina* var. *korshinskyi* O. Fedtsch. in Act. Hort. Petrop. 21. 3: 266. 1903.

Perennial, caespitose herbs, pubescent. Fruiting scape aphyllous, up to 5 cm. Basal leaves densely rosulate, oblong-spathulate, 2.5-9.5 x 1.5-2 mm, with simple or branched hairs. Racemes 5-10-flowered, corymbose. Flowers yellow, ca 3.5 mm across. Petals obscurely emarginate at apex. Siliculae ovoid 3-4 x 2-2.5 mm, glabrous, acute. Seeds 4-6 in each locule, oblong-ovate.

Fl. & Fr. : June August.

Selected specimens : On way to Chang la, Chowdhery & Uniyal 86140 (BSD).

9. *Draba lanceolata* Royle, Illus. Bot. Himal. 1: 72. 1834; Jafri in Fl. W. Pak. 55: 140. 1973; Basak in Sharma *et al.*, Fl. India 2: 161. 1993. *D. incana* auct. non L.; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 2: 143. 1872, *p.p.*

Perennial, caespitose, up to 25 cm high herbs, homotrichous, tomentose. Basal leaves rosulate, oblanceolate or spathulate, 10-15 x 1.5 mm, dentate or entire; cauline dentate. Racemes lax, up to 10 cm long, 10-15-flowered. Flowers white, ca 2 mm in diam. Pedicels erect or ascending. Sepals narrowly oblong, ca 2 mm long. Petals oblong-ovate 2.5-3.5 mm long. Siliculae 5-14 x 1.5-2 mm, linear-oblong or elliptic-lanceolate. Seeds 15-20 in each locule.

Fl. & Fr. : June August.

Included after Basak (*loc. cit.*).

10. *Draba lasiophylla* Royle, Illus. Bot. Himal. 1: 71. 1834; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 143. 1872; Jafri in Fl. W. Pak.

55: 140. 1973; Kachroo *et al.*, Fl. Ladakh 55. 1977; Basak in Sharma *et al.*, Fl. India 2: 161. 1993. *Sasolo*.

Perennial, caespitose, 4-25 cm high herbs, suberect, heterotrichous. Basal leaves rosulate, lanceolate, spatulate, 9-18 x 2-5 mm, densely pubescent; cauline leaves 4-11 x 2-6 mm, toothed, pubescent, sessile. Racemes up to 10 cm long, lax, 10-15-flowered. Flowers white, 2.5-4 mm in diam. Pedicels 3.5-6 mm long, pubescent. Sepals narrowly oblong, 2 mm long. Petals 2.5-3.5 mm long. Siliculae 5-10 x 2 mm, ovate-oblong or oblong-narrow elliptic, pubescent. Seeds brownish, 10-18 in each locule.

Fl. & Fr. : June August.

Selected specimens : Zozila, 3500 m, *Bhattacharyya* 71278 (BSD); on way to Amarnath, *Nair* 37039 (BSD); Ganglas-Khardungla, *Chowdhery & Uniyal* 86093 (BSD).

11. *Draba ludlowiana* Jafri in Notes Roy. Bot. Gard. Edinb 22: 105. 1956 *et in* Fl. W. Pak. 55: 138. 1973; Basak in Sharma *et al.*, Fl. India 2: 162. 1993.

Perennial, caespitose, tomentose herbs, up to 20 cm high. Radical leaves rosulate, linear-lanceolate, 8-15 x 1-3 mm, acute, entire, tomentose; cauline leaves 1-3, elliptic or oblong-obovate, 2-8 x 1-3 mm, semiamplexicaul. Racemes laxly 15-20-flowered. Flowers white, *ca* 2 mm in diam. Sepals *ca* 1.5 mm long, persistent. Petals up to 3 mm long, emarginate. Siliculae ovate-orbicular, up to 4 x 3 mm, compressed. Seeds 3-5 in each locule.

Fl. & Fr. : June August.

On stony hill slopes.

Included after Basak (*loc. cit.*).

12. *Draba melanopus* Komarov in Trav. Soc. Nat. Petersb. 26: 102. no. 179. 1896; Jafri in Fl. W. Pak. 55: 143. 1973; Basak in Sharma *et al.*, Fl. India 2: 162. 1993.

Biennial or perennial herbs, much branched from the base. Scapes 2.5-13 cm long, aphyllous, hairy or subglabrous. Basal leaves rosulate, oblong-elliptic, 4-15 x 1.5-3 mm long, acute, hairy. Racemes lax, 5-14-flowered. Flowers light yellow, ca 2.5 mm in diam. Pedicels 3-8 mm long, glabrous. Sepals 1-1.2 mm long. Petals 2-3 mm long. Siliculae linear or oblong-obovate, 2.5-9.5 x 1-1.5 mm, glabrous, glabrous or hairy. Seeds 6-10 in each locule, oblong-ovate.

Fl. & Fr. : May July.

Included after Basak (*loc. cit.*).

13. *Draba nemorosa* L., Sp. Pl. 643, 1753; Jafri in Fl. W. Pak. 55: 143, 1973; Basak in Sharma *et al.*, Fl. India 2: 163, 1993. *D. muralis auct. non L.*; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India. 1: 144, 1872.

Annual, 5-35 cm high, erect herbs. Basal leaves oblong-obovate, 8-30 x 3.5-14 mm, obtuse, dentate; cauline leaves distant, oblong-ovate, 4-20 x 2.5-12 mm, toothed, acute. Racemes up to 25 cm long. Flowers pale yellow, ca 2 mm in diam. Pedicels filiform, 5-9 mm long, spreading. Sepals ca 1.5 mm long. Petals ca 2 mm long, submarginate at apex. Siliculae oblong-elliptic, 4.5-7 x 2-2.5 mm. Seeds 10-18 in each locule, ovoid.

Fl. & Fr. : May July.

Included after Basak (*loc. cit.*).

14. *Draba olgae* Regel & Schmalh. in Regel, Descr. Pl. Nov. Fedtsch., Reise Nach Turkest. Lief. 18: 8, 1882; Jafri in Fl. W. Pak. 55: 134, 1973; Basak in Sharma *et al.*, Fl. India 2: 164, 1993.

Perennial, caespitose herbs. Scapes 3-15 cm long, erect, aphyllous. Basal leaves rosulate, oblanceolate, lanceolate or oblong-elliptic, 5-14 x 2-3.5 mm, acute, densely ciliate. Racemes lax, 15-30-flowered. Flowers deep yellow, ca 5 mm in diam. Pedicels 7-13 mm long. Sepals 2-2.5 mm long, pubescent. Petals obovate, cuneate, 4.2-6 x 2-4 mm. Siliculae ellipsoid or oblong; 4.5-8 x 2.5-3 mm. Seeds 5-6 in each locule.

Fl. & Fr. : June July.

Included after Basak (*loc. cit.*).

15. *Draba oreades* Schrenk in Fisch. & Mey., Enum. Pl. Nov. 2: 56. 1842; Jafri in Fl. W. Pak. 55: 131. 1973; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 187. 1983; Basak in Sharma *et al.*, Fl. India 2: 164. 1993. *D. alpina auct. non* L.; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 142. 1872. *Piang.*

Perennial, caespitose herbs. Rootstock much branched. Scapes 2.5-8 cm long, aphyllous, suberect. Radical leaves rosulate, lanceolate or obovate-oblong to elliptic-obovate, entire or dentate, hairy. Racemes corymbose, 5-14-flowered. Flowers yellowish, *ca* 4 mm in diam. Pedicels 4-8 mm long. Sepals oblong, obtuse, 2-2.5 mm long. Petals oblanceolate or obovate. Siliculae 3-6 x 2-3.5 mm, flattened, acute, sparsely hairy. Seeds 3-6 in each locule, ovoid.

Fl. & Fr. : June July.

Selected specimens : Kashmir, Sheshnag, 3600 m, *Nair* 36955 (BSD); Chang la, 6000 m, *Viswanathan* 55100 (BSD); Musjid valley, 3500-4000 m, *Duthie* 13194 (DD).

16. *Draba setosa* Royle, Illus. Bot. Himal. 1: 71. 1834; Jafri in Fl. W. Pak. 55: 130. 1973; Basak in Sharma *et al.*, Fl. India 2: 167. 1993. *D. glacialis auct. non* Adams; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 142. 1872. *Zingla.*

Perennial, caespitose herbs. Scapes 5-14 cm long, aphyllous. Basal leaves densely rosulate, linear 9-15 x 1.5 mm setose along margins. Racemes corymbose, 5-10-flowered. Flowers yellow, 2.5-4 mm in diam., pedicels 3.5-5.5 mm long, filiform, glabrous. Sepals *ca* 2 mm long. Petals *ca* 3.2 mm long densely veined. Siliculae oblong-elliptic, 4.5-10 x 2.5-3.5 mm, acute, glabrous. Seeds 6-8 in each locule, oblong-ovate.

Fl. & Fr. : May August.

Selected specimens : Apharwat, 3730 m, T.A. Rao 488 (BSD).

17. *Draba stenocarpa* Hook.f. & Thomson in J. Linn. Soc. Bot. 5: 153. 1861; Jafri in Fl. W. Pak. 55: 145. 1973; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 187. 1983; Basak in Sharma *et al.*, Fl. India 2: 168. 1993. *D. linearis auct. non* Boiss; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 144. 1872. *Lepcha*.

Annual or biennial, 8-18 cm high herbs, hairy. Basal leaves rosulate, oblong-elliptic or oblong-ovate, 1.5-4 x 3-15 mm, acute; cauline leaves lanceolate, acute sessile. Racemes up to 20 mm long, 15-40-flowered. Flowers yellowish or white, *ca* 3.5 mm in diam. Pedicels filiform, 7-20 mm long. Sepals *ca* 2 mm long. Petals obcuneate, 3-5 mm long. Siliculae linear or ellipsoid-lanceolate, 7-18 x 2 mm, compressed, glabrous. Seeds 15-20 in each locule, ovate.

Fl. & Fr. : May July.

Included after Dhar & Kachroo (*loc. cit.*).

18. *Draba tenerrima* O.E. Schulz in Notizbl. Bot. Gart. Berlin 9: 640. 1932; Basak in Sharma *et al.*, Fl. India 2: 169. 1993. *Erophila tenerrima* (O.E. Schulz) Jafri in Fl. W. Pak. 55: 149. 1973.

Annual, delicate herbs, up to 5 cm high. Basal leaves rosulate, obovate or oblong-elliptic, 2-7.5 x 1.5-2.8 mm, subglabrous. Racemes lax, 3-6 flowered. Flowers greenish, *ca* 1 mm in diam. Pedicels 2-3.5 mm long, glabrous. Sepals 4, *ca* 1 mm long. Petals absent. Stamens only 4 (2 suppressed). Siliculae obovate-elliptic; 2.5-4 x 2.5 mm. Seeds 3-6 in each locule, ovate.

Fl. & Fr. : June July.

Included after Basak (*loc. cit.*).

Endemic.

19. *Draba tibetica* Hook.f. & Thomson in J. Linn. Soc. Bot. 5: 152. 1861; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 144. 1872; Jafri in Fl. W. Pak. 55: 141. 1973; Kachroo *et al.*, Fl. Ladakh 55. 1977; Basak in Sharma *et al.*, Fl. India 2: 169. 1993.

Perennial, caespitose herbs, 5-18 cm long, aphyllous. Basal leaves rosulate, oblong-lanceolate, 6.5-19 x 2-2.5 mm hairy. Racemes up to 10 cm long, 5-10-flowered. Flowers yellowish, *ca* 5 mm in diam. Pedicels 9-14 mm long. Sepals *ca* 2.5 mm long. Petals 4-5 mm long. Siliculae oblong-linear, 5-17 x 1.8 mm, flattened, acute, pubescent, rarely glabrous. Seeds 8-12, oblong-ovate.

Fl. & Fr. : June August.

Included after Kachroo *et al.* (*loc. cit.*).

20. *Draba trinervis* O.E. Schulz in Engler, Pflanzenr. 89 (iv. 105): 131. 1927; Jafri in Fl. W. Pak. 55: 136. 1973; Basak in Sharma *et al.*, Fl. India 2: 170. 1993.

Perennial, caespitose herbs. Scapes 1-5 cm long, aphyllous. Basal leaves rosulate, linear-elliptic, 4.5-8 x 1.5-2 mm, acute, hairy. Racemes lax, 5-9-flowered. Flowers yellow, *ca* 5 mm in diam. Pedicels 5-10 mm long, glabrous. Sepals 2-3 mm long. Petals 4-5.5 mm long. Siliculae ovoid, 4-5.5 x 3 mm, glabrous. Seeds 4-5 in each locule, ovate-oblong.

Fl. & Fr. : May June.

Selected specimens : Ladakh, Chang la, *ca* 6000 m, Viswanathan 55601 (BSD).

21. *Draba winterbottomii* (Hook.f. & Thomson) Pohle in Fedde, Repert. Sp. Nov. 32: 138. 1925; Jafri in Fl. W. Pak. 55: 138. 1973; Basak in Sharma *et al.*, Fl. India 2: 170. 1993. *D. tibetica* var. *winterbottomii* Hook.f. & Thomson in J. Linn. soc. Bot. 5: 152. 1861. *D. incompacta* auct. non Steven; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 142. 1872.

Perennial, caespitose herbs. Scapes 2-5 cm long, often aphyllous. Basal leaves rosulate, oblong-spathulate, 3-8 x 1-2 mm, floccose hairy. Racemes lax, 5-10-flowered. Flowers white, 4.5 mm in diam. Pedicels 5-9.5 mm long. Sepals \approx 2.5 mm long. Petals 3.5-4 mm long. Siliculae oblong-elliptic, 4.5-8 x 2 mm, acute, glabrous or sparsely hairy. Seeds 5-8 in each locule.

Fl. & Fr. : June August.

Included after Basak (*loc. cit.*).

27. DRABOPSIS C. Koch

Drabopsis verna C. Koch in *Linnaea* 15: 253. 1841; Jafri in *Fl. W. Pak.* 55: 182. 1973; Dhar & Kachroo, *Alpine Fl. Kashmir Himal.* 187. 1983; Hajra & Chowdhery in Sharma *et al.*, *Fl. India* 2: 123. 1993. *Arabis nuda* Belang. ex Boiss. in *Ann. Sci. Nat. Ser. 2.* 17: 54. 1842; Hook.f. & T. Anders. in Hook.f., *Fl. Brit. India* 1: 137. 1872; Singh & Kachroo, *For. Fl. Srinagar* 167. 1976.

Annual, 5-12 cm high herbs, erect, hairy below, glabrous above. Basal leaves in oblong-obovate, spathulate or oblong-lanceolate, 5-12 x 2-6 mm, entire or toothed, hairy. Scapes 5-15-flowered, ebracteate. Flowers pale yellow, \approx 3 mm in diam. Pedicels up to 14 mm long. Sepals 2 mm long. Petals 2.5-3 mm long. Siliquae 15-20 x 0.7-1 mm, slightly curved, glabrous. Seeds oblong, 8-12 in each locule.

- | | |
|---|-------------------------------|
| 1a. Fruits glabrous | ...1.2. var. <i>verna</i> |
| 1b. Fruits pubescent. sepals, petals and pedicels smaller | ...1.1. var. <i>hebecarpa</i> |

1.1. var. hebecarpa (N. Busch) Naqshi & Javeid in *J. Econ. Tax. Bot.* 5(4): 965. 1984. *Arabidopsis verna* (C. Koch) N. Busch var. *hebecarpa* N. Busch, *Fl. URSS* 8: 61. 1939.

Included after Naqshi & Javeid (*loc. cit.*).

1.2. var. verna

Fl. & Fr. : April - June.

Included after Singh & Kachroo (*loc. cit.*).

Naqshi & Javeid also described a new species *Drabopsis brevisiliqua* A.R. Naqshi & G.N. Javeid (J. Econ. Tax. Bot. 5(4): 966. 1984) from Harwan, J&K. It is said to differ from *D. verna* C. Koch in smaller size of plants, glabrous leaves, smaller flowers (in diam.), petals and fruits.

28. EROPHILA DC.

Erophila verna (L.) Besser, Enum. Pl. Volhyn. 22. 1822; Jafri in Fl. W. Pak. 55: 147. 1973; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 187. 1983; Basak in Sharma *et al.*, Fl. India 2: 171. 1993. *Draba verna* L., Sp. Pl. 642. 1753. *Erophila vulgaris* DC., Syst. Nat. 2: 356. 1821; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 145. 1872.

Annual, 2.5-25 cm high herbs, glabrous. Scapes aphyllous. Basal leaves rosulate, very variable, lanceolate to obovate, oblong, toothed, minutely hairy. Racemes lax, 9-19-flowered. Flowers white or pinkish, ca 2.5 mm in diam. Pedicels up to 6 mm long, glabrous. Sepals 1.3-2 mm long. Petals 2.5-3.5 mm long. Siliculae oblong-elliptic or suborbicular; 2.5-10 x 4 mm long. Seeds many in each locule.

Fl. & Fr. : March - June.

Selected specimens : Kashmir valley, Hunter 10163 (DD).

29. ERUCA Mill.

Eruca sativa Mill., Gard. Dict., ed. 8, 1: 1768; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 158. 1872; Jafri in Fl. W. Pak. 55: 33. 1973; Kaul, Weed Fl. Kashmir Valley 1986; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 143. 1993.

Annual, foetid, 10-75 cm high, erect herbs, subglabrous, rarely hispid. Basal leaves subrosulate, 8-15 x 5 cm, lyrate-pinnatifid, lobate; terminal

lobe larger, toothed; upper leaves toothed. Racemes lax, up to 30 cm long, 15-28-flowered. Flowers yellowish, 15-20 mm in diam. Pedicels 2.5-5 mm long. Sepals pale violet, 7-12 mm long, hairy. Petals obovate, 15-22 mm long, clawed. Siliquae oblong-ellipsoid, 14-30 x 3-4.5 mm, beaked. Seeds ovoid or subglobose. 6-12 in each locule.

Fl. & Fr. : April - June.

Selected specimens : Neelnag, ca 2400 m, *Thapliyal* 26480 (DD).

30. ERYSIMUM L.

- 1a. Annuals ...6. *E. repandum*
- 1b. Biennials or perennials :
 - 2a. Flowers ca 6 mm across ...7. *E. thomsonii*
 - 2b. Flowers more than 6 mm across :
 - 3a. Pedicels up to 5 mm long ...1. *E. aitchisonii*
 - 3b. Pedicels more than 5 mm long :
 - 4a. Leaves linear, 2-3 mm broad ...2. *E. altatum*
 - 4b. Leaves usually oblong-elliptic or lanceolate, 5-10 mm broad :
 - 5a. Mature pods broader, 2.5-3 mm ...3. *E. cachemiricum*
 - 5b. Mature pods ca 1.5 mm broad :
 - 6a. Sepals ca 5 mm long...4. *E. hieraciifolium*
 - 6b. Sepals ca 8 mm long ...5. *E. melicentae*

1. *Erysimum aitchisonii* O.E. Schulz in Notizbl. Bot. Gart. Berlin 9: 1080. 1927; Jafri in Fl. W. Pak. 55: 239. 1973; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 179. 1993.

Biennial, robust, 25-75 cm high herbs, erect, appressedly canescent with 2-4 partite hairs. Basal leaves rosulate, oblanceolate, 45-75 x 5-9 mm, toothed, acute. Racemes up to 30 cm long, 25-40-flowered. Flowers yellowish, 9-12 mm in diam. Pedicels up to 5 mm long. Sepals lanceolate, 5-8.5 mm long. Petals 11-15.5 mm long. Siliquae subcylindrical, 35-50 x 1.2 mm, appressedly hairy.

Fl. & Fr. : June July.

Rare.

Included after Hajra *et al.*, (*loc. cit.*).

2. ***Erysimum altaicum*** C.A. Mey. in Ledeb., Fl. Alt. 3: 153. 1831; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 154. 1872; Jafri in Fl. W. Pak. 55: 238. 1973; Singh & Kachroo, Forest Fl. Srinagar 19. 1976; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 180. 1993.

Perennial, 5-40 cm high herbs, erect, hoary with bipartite, appressed hairs. Basal leaves densely rosulate narrowly oblanceolate to linear-oblong, 25-45 x 1.5-3 mm, entire or dentate; cauline leaves linear. Racemes up to 25 cm long, 20-45-flowered. Flowers yellowish, ca 10 mm in diam. Pedicels 2-9.5 mm long. Sepals 5.5-7.5 mm long. Petals 9-15 mm long. Siliquae linear-oblong, 23-75 x 2 mm. Seeds oblong-elliptic, winged at the apex.

Fls. & Frs. : June July.

Included after Singh & Kachroo (*loc. cit.*).

3. ***Erysimum cachemiricum*** O.E. Schulz in Notizbl. Bot. Gart. Berlin 9: 1080. 1927; Jafri in Fl. W. Pak. 55: 237. 1973; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 180. 1993.

Biennial or perennial, 25-55 cm high herbs, erect, appressedly canescent with 4-partite hairs. Basal leaves rosulate, oblong-elliptic, 4-10 x 0.4-0.7 cm, acute; upper leaves similar. Racemes up to 20 cm long, 25-40-flowered. Flowers yellowish, ca 12 mm in diam. Pedicels up to 9 mm long. Siliquae linear, 25-50 x 2.5 mm hairy. Seeds oblong.

Fl. & Fr. : May July.

Included after Hajra *et al.* (*loc. cit.*).

Endemic.

4. *Erysimum hieraciifolium* L., Cent. Pl. 1: 18. 1755; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 153. 1872; Jafri in Fl. W. Pak. 55: 236. 1973; Singh & Kachroo, Forest Fl. Srinagar 168. 1976; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 182. 1993.

Biennial, prostrate, 25-80 cm high herbs. Basal leaves rosulate, elliptic-oblong to oblanceolate, 30-75 x 3-9 mm, cauline leaves similar. Racemes up to 38 cm long, 25-65-flowered. Flowers ca 10 mm in diam. Sepals 5-6 mm long. Petals 8-10 mm long, clawed. Siliquae linear-terete, 25-75 x 1.5 mm, hairy. Seeds oblong.

Fl. & Fr. : May July.

Selected specimens : Zozila-Gumri, Hajra 74014 (BSD); Bhaderwah-Sooj, 3000 m, Vohra & Naithani 83021 (BSD); Lati, Swami 1300 (BSD).

Note : A very polymorphic and complex species.

5. *Erysimum melicentae* Dunn in kew Bull. 1920: 336. 1920; Jafri in Fl. W. Pak. 55: 240. 1973; Singh & Kachroo, Forest Fl. Srinagar 168. 1976; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 184. 1993. *E. odoratum* auct., non Ehrh.; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 154. 1872; Kachroo *et al.*, Fl. Ladakh 57. 1977.

Biennial or perennial, 25-95 cm high herbs. Basal leaves rosulate, oblanceolate, 45-80 x 5-10 mm, toothed; cauline leaves similar. Racemes up to 20 cm long, 25-70 flowered. Flowers yellow, 10-15 mm in diam. Pedicels 9-14 mm long. Sepals 7-9 mm long. Petals 11-18 mm long. Siliquae 25-70 x 1.5 mm, linear-terete, hairy. Seeds many in each locule, oblong-terete.

Fl. & Fr. : May July.

Selected specimens : Aharbal Kungwatan, 2800 m, T.A. Rao 9271; Sonamarg, 3200 m, T.A. Rao 9573 (BSD) Kolhoi, Liddar, Valley, Inayat 25497 (DD); Sind valley, below Baltal, ca 3300 m, Duthie 11557 (DD).

6. *Erysimum repandum* L., Demons, Pl. 17. 1753; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 153. 1872; Jafri in Fl. W. Pak. 55: 241. 1973; Kachroo *et al.*, Fl. Ladakh 57. 1977; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 184. 1993. *Chharpa*.

Annual, erect, up to 40 cm high herbs, hoary with appressed hairs. Leaves lanceolate, oblanceolate or elliptic-oblong, to 6.5 x 10 mm, sinuate dentate to nearly entire, lower petioled, upper sessile. Racemes up to 50 cm long. 15-30-flowered. Flowers yellowish, ca 5 mm in diam. Pedicels up to 4 mm long. Sepals ca 4 mm long. Petals ca 7 mm long. Siliquae subcylindrical, linear-oblong, 15-85 x 1.5 mm, hairy. Seeds many in each locule, oblong-ellipsoid.

Fl. & Fr. : April June.

Included after Kachroo *et al.* (*loc. cit.*).

8. *Erysimum thomsonii* Hook.f. in J. Linn. Soc. Bot. 5: 165. 1861; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 154. 1872; Jafri in Fl. W. Pak. 55: 239. 1973; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 185. 1993.

Perennial, 6-40 cm high, erect herbs. Basal leaves rosulate, oblanceolate, linear-oblong, 25-50 x 1-3 mm; cauline leaves linear. Racemes up to 25 cm long. 20-45-flowered. Flowers yellowish ca 10 mm in diam. Pedicels 8.5-15 mm long. Siliquae linear, 35-85 x 2 mm. Seeds many in each locule.

Fl. & Fr. : June July.

Included after Hajra *et al.*, (*loc. cit.*).

31. EUCLIDIUM R. Br

- 1a. Cauline leaves petioled. Styles obliquely bent,
persistent. Fruits hairy ...1. *E. syriacum*
- 1b. Cauline leaves sessile. Style straight, deciduous.
Fruits glabrous ...2. *E. tenuissimum*

1. *Euclidium syriacum* (L.) R. Br. in Aiton, Hort. Kew., ed. 2, 4: 1812; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 165. 1872; Jafri in Fl. W. Pak. 55: 103. 1973; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 187. 1983; Bhaumik in Sharma *et al.*, Fl. India 2: 172. 1993. *Anastatica syriaca* L. Sp. Pl. ed. 2: 895. 1763.

Annual, 9-25 cm high, erect, branched, grey-pubescent herbs. Basal leaves pinnate 1.5-14 x 1-3 cm, toothed; upper leaves oblong or oblanceolate, sinuate-dentate or irregularly toothed on margins, subsessile. Racemes or spikes up to 10 cm long, 15-30-flowered. Flowers white, 1.5 mm in diam. Sepals ca 0.8 mm long. Petals spatulate, ca 1.5 mm long. Siliculae, globose or ovoid. Seeds dark brown, ovoid.

Fl. & Fr. : April - June.

Selected specimens : Dras valley, ca 3500 m, *Duthie* 11685; Near Srinagar, 1700-2000 m, *Duthie* 10929 (DD).

2. *Euclidium tenuissimum* (Pallas) O. Fedtsch. in Bull. Herb. Boiss. 2(4): 915. 1904; Jafri in Fl. W. Pak. 55: 104. 1973; Bhaumik in Sharma *et al.*, Fl. India 2: 173. 1993. *Vella tenuissima* Pallas, *Reise* 5: 506. 1793.

Annual, branched herbs to 40 cm high. Basal leaves sinuate-dentate to pinnatifid with larger apical lobe; cauline leaves linear-oblong-linear-lanceolate, to 6 x 1 cm, mostly entire, rarely irregularly toothed. Inflorescence spicate, elongating up to 25 cm in fruit. Sepals ovate-lanceolate. Petals pinkish white. Siliculae orbicular, longitudinally prominently six ribbed.

Fl. & Fr. : April - August.

On exposed sandy soil.

Selected specimens : Phyang nala, Leh, 3280 m. *Wadhwa* 59421 (BSD).

32. GOLDBACHIA DC.

Goldbachia laevigata (M. Bieb.) DC., Syst. Nat. 2: 577. 1821; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 166. 1872; Jafri in Fl.

W. Pak. 55: 229. 1973; Kaul, Weed Fl. Kashmir Valley 1986; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 185. 1993. *Raphanus laevigatus* M. Bieb., Fl. Taur. Cauc. 2: 129. 1808.

Annual, 10-45 cm high herbs, glabrous, rarely hispid. Basal leaves oblong-elliptic to oblanceolate, 2.5-10 x 2-2.5 cm, dentate; cauline leaves lanceolate to linear-oblong, 1.5-5 cm long, often amplexicaul; base auricled. Racemes lax, up to 20 cm long, 15-28-flowered. Flowers pale pinkish, 3 mm in diam. Pedicels up to 10 mm long. Sepals *ca* 2 mm long. Petals *ca* 4 mm long. Siliquae quadrangular 10 x 3 mm. Seeds oblong, 3 in each locule.

Fl. & Fr. : March May.

Included after Kaul (*loc. cit.*).

33. GUILLENIA E. Greene

- | | |
|----------------------------|------------------------------|
| 1a. Pods 4-6 cm long | ...1. <i>G. flaccidum</i> |
| 1b. Pods up to 1.5 cm long | ...2. <i>G. minutiflorum</i> |

1. *Guillenia flaccidum* (O. Schulz) Bennet in J. Econ. Tax. Bot. 4(2): 593. 1983; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 239. 1993. *Microsisymbrium flaccidum* O.E. Schulz in Notizbl. Bot. Gart. Berlin 9: 1090. 1927; Jafri in Fl. W. Pak. 55: 256. 1973.

Annual, 12-38 cm high herbs, simple, suberect, hairy, glabrous or subglabrous. Basal leaves laxly rosulate, lyrate pinnatipartite or obovate, 15-45 x 8-18 mm, 1-2-jugate; terminal lobe obovate-orbicular to suborbicular, denticulate; cauline leaves distant, oblanceolate or oblong-obovate, acute. Racemes up to 22 cm long, 8-20-flowered. Flowers white, *ca* 5 mm in diam. Pedicels 10-22 mm long, glabrous. Sepals *ca* 2.5 mm long. Petals 4.5-6 mm long. Siliquae 35-60 x 1 mm, glabrous. Seeds elliptic 20-25 in each locule.

Fl. & Fr. : April June.

Included after Hajra *et al.* (*loc. cit.*).

2. *Guillenia minutiflorum* (Hook.f. & Thomson) Bennet in J. Econ. Tax. Bot. 4(2): 593. 1983; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 240. 1993. *Sisymbrium minutiflorum* Hook.f. & Thomson in J. Linn. Soc. Bot. 5: 158. 1861; Hook.f., & T. Anders. in Hook.f., Fl. Brit. India 1: 149. 1872.

Small, annual, 4-20 cm high herbs, stellately hairy. Leaves pinnatisect, 1-2-lobed; lobes narrowly oblong or linear 3-10 x 0.5-2 mm. Racemes up to 10-12 cm long, 5-12-flowered. Flowers white or pinkish, 1.5-2 mm in diam. Pedicels filiform, up to 8 mm long. Sepals *ca* 1.2 mm long. Petals 1.5-2 mm long. Siliquae linear, 9-25 x 1 mm, subtorulose. Seeds oblong, 4-9 in each locule.

Fl. & Fr. : April - June.

Included after Hajra *et al.* (*loc. cit.*).

34. HEDINIA Ostenf.

Hedinia tibetica (Thomson) Ostenf. in Sven Hedin, S. Tibet 6(3): 76. f. 2. 1922; Jafri in Fl. W. Pak. 55: 92. 1973; Bhaumik in Sharma *et al.*, Fl. India 2: 193. 1993. *Hutchinsia tibetica* Thomson in Hook.f., Icon. Pl. 9. t. 900. 1852. *Capsella thomsonii* Hook.f. in J. Linn. Soc. Bot. 5: 172. 1861; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 159. 1872; Kachroo *et al.*, Fl. Ladakh. 53. 1977. *Shamso*.

Perennial, 5-25 cm long herbs, procumbent, hoary tomentose. Leaves pinnatisect, 9-45 x 8-15 mm, 5-10-jugate, hoary-tomentose. Racemes up to 10 cm long, 10-28-flowered. Flowers white *ca* 3 mm in diam. Pedicels *ca* 3 mm long. Sepals, 2 mm long. Petals 3-4 mm long. Silliculae 5-9 x 3-4 mm, hairy or glabrous. Seeds *ca* 1 mm long.

Fl. & Fr. : June - July.

In sandy places.

Selected specimens : Ladakh, Pang-Sarchu, Chowdhery & Uniyul 86224 (BSD).

35. HYMENOLOBUS Nutt. ex Torrey & Gray

Hymenolobus procumbens (L.) Nutt. ex Torrey & Gray, Fl. N. Amer. 1: 117. 1838; Jafri in Fl. W. Pak. 55: 94. 1973; Bhaumik in Sharma *et al.*, Fl. India 2: 195. 1993. *Lepidium procumbens* L., Sp. Pl. 643. 1753. *Capsella elliptica* C.A. Mey. in Ledeb., Fl. Ross. 1: 199. 1841; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 159. 1872; Kachroo *et al.*, Fl. Ladakh 53. 1977. *Sansha*.

Annual, 25-30 cm high herbs, procumbent, filiform. Basal leaves rosulate, oblong-elliptic, 8-35 x 2-9.5 mm, glabrous; upper leaves cuneate at base. Racemes up to 10 mm long, 5-25-flowered. Flowers white or dull yellow, minute, ca 1.5 mm in diam. Pedicels 2.5-10 mm long. Sepals ca 1 mm long. Petals 2.3-9.5 mm long. Siliculae ovoid or ellipsoid, 3-4 mm long, glabrous. Seeds pale brown, ellipsoid 6 x 1-0.6 mm long.

Fl. & Fr. : April - June.

In moist places by the side of nallah. Common.

Selected specimens : Ladakh, Tangtse, 4300 m, *Viswanathan* 54735 (BSD); Ganglas-Khardung La, *Chowdhery & Uniyal* 86082 (BSD).

36. ISATIS L.

- 1a. Fruits rounded at both ends: central rib distinctly 3-ridged ...1. *I. costata*
 1b. Fruits narrowed towards base: central rib simple ...2. *I. tinctoria*

1. *Isatis costata* C.A. Mey. in Ledeb., Fl. Alt. 3: 204. 1831; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 163. 1872; Jafri in Fl. W. Pak. 55: 76. 1973; Bhaumik in Sharma *et al.*, Fl. India 2: 198. 1993.

Annual or biennial, 35-115 cm tall, erect, glabrous herbs. Basal leaves obovate-oblong, 7-14 x 2-3 cm, dentate; subsessile, cauline leaves amplexicaul, lanceolate, glabrous; base auricled. Racemes paniced, 30-75-flowered. Flowers yellowish, 3-4 mm in diam. Sepals 1.5-1.7 mm long. Petals 2.5-3 mm long. Siliculae oblong-obovate, 9-14 x 3.5-6 mm, glabrous or minutely pubescent. Seeds oblong-ellipsoid.

Fl. & Fr. : May August.

Selected specimens : Basnai, Gurez, Wadhwa, Murti & Pant 85060 (BSD); Burzil pass, Inayat 25485 (DD); Above Gurais, ca 3000 m, Duthie 12589 (DD).

2. *Isatis tinctoria* L. Sp. Pl. 670. 1753; Hook.f., T. Anders. in Hook.f., Fl. Brit. India 1: 163. 1872; Bhaumik in Sharma *et al.*, Fl. India 2: 199. 1993.

Biennial or perennial, up to 1 m tall, glabrous or hirsute herbs. Basal leaves in rosettes, oblong-lanceolate or oblanceolate, up to 15 x 3 cm; cauline leaves smaller, linear or linear-lanceolate, amplexicaul. Inflorescence a panicle, elongating in fruit. Flowers yellow. Sepals 2-2.5 mm long, glabrous. Petals exceeding the sepals, oblong-obovate. Siliculae oblong, elliptic-obovate; wings thick. Seeds oblong-ellipsoid.

Fl. & Fr. : May September.

Selected specimens : Badgam nala, 3000-4000 m, Keshavanand 1522 (DD).

37. LEPIDIUM L.

1a. Stamens 6 :

2a. Fruits winged, notched at apex ...6. *L. sativum*

2b. Fruits not as above :

3a. Leaves acute. Racemes corymbose.

Calyx deciduous ...3. *L. latifolium*

3b. Leaves obtuse. Racemes densely capitate.

Calyx persistent ...4. *L. obtusum*

1b. Stamens 4 or 2 :

4a. Stems almost glabrous ...5. *L. ruderale*

4b. Stems distinctly puberulous :

5a. Hairs on stems capitate or glandular :

6a. Erect herbs; hairs capitate. Fruiting racemes elongated ...1. *L. apetalum*

- 6b. Procumbent herbs; hairs glandular. Fruiting
racemes capitate ...2. *L. capitatum*
5b. Hairs on stems neither capitate nor glandular ...7. *L. virginicum*

1. *Lepidium apetalum* Willd., Sp. Pl. 3: 439. 1800; Jafri in Fl. W. Pak. 55: 55. 1973; Bhaumik in Sharma *et al.*, Fl. India 2: 202. 1993. *L. ruderale auct. non L.*, 1753; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 160. 1872, *p.p.*

Annual or biennial, up to 30 cm high herbs, glabrous. Basal leaves pinnatisect, 2.5-5 x 1 cm; upper leaves linear, entire, toothed. Racemes up to 5 cm long, 20-40-flowered. Flowers *ca* 1 mm in diam. Pedicels up to 3.5 mm long. Sepals *ca* 0.8 mm long. Petals absent or rudimentary. Stamens 2 or 4 only, outer absent. Siliculae broadly elliptic, 2-2.5 x 2 mm. Seeds red-brown, ovate-oblong.

Fl. & Fr. : April - June.

Selected specimens : Kashmir, Hunterwebster 10173 (DD).

2. *Lepidium capitatum* Hook.f. & Thomson in J. Linn. Soc. Bot. 5: 175. 1861; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 160. 1872; Jafri in Fl. W. Pak. 55: 58. 1973; Kachroo *et al.*, Fl. Ladakh 59. 1977; Bhaumik in Sharma *et al.*, Fl. India 2: 202. 1993. *Chewlapu*.

Annual or biennial, up to 25 cm high herbs, procumbent, glandular hairy. Basal leaves pinnatifid, oblong, 3-5.5 x 2 cm acute; upper leaves pinnatifid, toothed. Racemes capitate, up to 3 cm long, dense, 20-30-flowered. Flowers white, *ca* 1 mm in diam. Sepals *ca* 1 mm long. Petals *ca* 1 mm long. Stamens 4. Siliculae ovate, 2.5-3 x 2.5 mm, notched at the apex, glabrous. Seeds pale brown, oblong-ovate.

Fl. & Fr. : May - June.

Selected specimens : On way to Manjkeo (Hemis N.P.), Ladakh, S.K. Srivastava & Chauhan 100973 (BSD); Ladakh, *ca* 4500 m. Koelz 2437 (DD).

3. *Lepidium latifolium* L., Sp. Pl. 644. 1753; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 160. 1872; Jafri in Fl. W. Pak. 55: 60. 1973; Kachroo *et al.*, Fl. Ladakh. 59. 1977; Bhaumik in Sharma *et al.*, Fl. India 2: 203. 1993. *Seoji*.

Perennial. 25-120 cm tall herbs, erect, glabrous. Basal leaves ovate-lanceolate, 5-15 x 2-5 cm, serrate, acute to obtuse; upper leaves lanceolate or oblong-elliptic, serrate to entire. Racemes corymbose, 20-50-flowered. Flowers pinkish at base, ca 2.5 mm in diam. Pedicels up to 5 mm long. Sepals suborbicular, 1 mm long. Petals spatulate, 2-2.5 mm long, clawed. Siliculae ovate-orbicular, 1.5-2 mm long. Seeds brown, oblong-elliptic.

Fl. & Fr. : May July.

Selected specimens : Karu, 3400 m, *Bhattacharyya* 4149 (BSD); Lansdung Vill., 3200 m, *Wadhwa* 60016 (BSD); Rumbak (Hemis N.P.), Ladakh, *S.K. Srivastava & Chauhan* 100949 (BSD).

4. *Lepidium obtusum* Basiner in Bull. Cl. Phys.-Math. Acad. Imp. Sci. St. Petersburg. 2: 203. 1844; Bhaumik in Sharma *et al.*, Fl. India 2: 203. 1993.

Perennial, glabrous herbs, up to 1 m tall, densely corymbosely branched. Leaves oblong, entire or obscurely sinuate, thick; nerves 3, indistinct. Racemes densely capitate. Pedicels filiform, pilose. Sepals suborbicular, white margined. Petals white suborbicular ca 2 mm long. Siliculae subcordate at base, subobtuse at tip, slightly pilose. Seeds elliptic-ovate.

Fl. & Fr. : May June.

Included after Bhaumik (*loc.cit.*).

5. *Lepidium rudérale* L., Sp. Pl. 645. 1753; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 160. 1872, *p.p.*; Kachroo *et al.*, Fl. Ladakh 59. 1977; Bhaumik in Sharma *et al.*, Fl. India 2: 206. 1993. *Saungso*.

Annual or biennial, foul-smelling, 10-30 cm high herbs; stem simple or branched, glabrous. Basal Leaves rosetted, pinnatifid; cauline leaves oblong, small narrowed, entire. Petals absent. Siliculae ovate or elliptic, 2-2.5 x 1.5-2 mm long, narrowly winged at the tip.

Fl. & Fr. : April - August.

In waste places.

Selected specimens : Leh, ca 3600 m. *Vaid* 7012, 7065 (DD).

6. *Lepidium sativum* L., Sp. Pl., 644, 1753; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 159, 1872; Jafri in Fl. W. Pak. 55: 55, 1973; Sharma & Kachroo, Fl. Jammu 1: 97, 1981; Bhaumik in Sharma *et al.*, Fl. India 2: 206, 1993.

Annual, 25-55 cm high herbs, branched, glabrous, rarely pilose. Basal leaves pinnatisect or lyrate-pinnate; 4-10 x 3-3.5 cm; upper leaves linear. Racemes 20-28-flowered. Flowers pinkish, 3 mm in diam. Pedicels 2-3 mm long. Sepals oblong, 1.5 mm long. Petals ca 3 mm long. Siliculae broadly elliptic to suborbicular, 4.5-6 x 3.5-4.5 mm, notched, glabrous, narrowly winged. Seeds brown, ca 3 mm long.

Fl. & Fr. : April - June.

Included after Sharma & Kachroo (*loc. cit.*).

7. *Lepidium virginicum* L., Sp. Pl. 645, 1753; Jafri in Fl. W. Pak. 55: 58, 1973; Naqshi & Javeid in J. Bombay Nat. Hist. Soc. 74: 392, 1977; Bhaumik in Sharma *et al.*, Fl. India 2: 207, 1993.

Annual or biennial herbs, up to 50 cm high; stems scarcely branched, minutely hairy or glabrous. Basal leaves oblanceolate, up to 9 x 1.5 cm, lyrate-pinnatifid; cauline leaves oblanceolate-linear-lanceolate, up to 2.5 x 4 cm, entire or serrate. Racemes many flowered. Sepals elliptic, ca 1 mm long, concave. Petals white, obovate-spathulate, 1-2 mm long. Siliculae broadly ovate-suborbicular, wingless or narrowly winged and

broadly shallowly notched, glabrous or pubescent. Seeds ovoid, narrowly winged.

1a. Stems glabrous. Siliculae wingless, pubescent ...7.1. var. *kashmiricum*

1b. Stems pubescent. Siliculae narrowly winged

glabrous

...7.2. var. *virginicum*

7.1. var. *kashmiricum* Dar & Naqshi in J. Bombay Nat Hist. soc. 87(2): 278. 1990.

Fl. & Fr. : June July.

Included after Dar & Naqshi (*loc. cit.*).

7.2. var. *virginicum*

Fl. & Fr. June October.

By the roadsides.

Included after Dar & Naqshi (*loc. cit.*).

38. LIGNARIELLA Baehni

Lignariella obscura (Dunn) Jafri in *Candollea* 134. 1957 *et in* Fl. W. Pak. 55: 260. 1973; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 241. 1993. *Draba obscura* Dunn in Kew Bull. 1924: 383. 1924.

Annual, prostrate, 2.5-11 cm long, glabrous herbs. Leaves spatulate, 4-20 x 2-8 mm, trilobed to entire. Flowers white or pinkish, ca 2.5 mm in diam. 4-12 in each raceme. Pedicels 5-11 mm long. Sepals 1.5-2 mm long. Petals 2-3 mm long. Siliquae linear-oblong, 9-18 x 1-2 mm. Seeds oblong-ovoid.

Fl. & Fr. : May July.

Selected specimens : Sangam valley, 3000-4000 m, Duthie 14133 (DD).

A new species *Lignariella duthiei* A.R. Naqshi (J. Econ. Tax. Bot. 3(3): 976, 1982) has been described from Mt. Kolhoi. It differs from *L. obscura* (Dunn) Jafri in having minute, simple and branched hairs and perennial, thick woody stem.

39. MALCOLMIA R. Br.

- 1a. Racemes 5-8-flowered. Siliquae almost glabrous ...2. *M. intermedia*
 1b. Racemes many-flowered. Siliquae hairy :
 2a. Petals white. Siliquae 2-3 cm long, strigosely
 pubescent ...3. *M. strigosa*
 2b. Petals violet. Siliquae 3.5-8 cm long, with
 forked hairs ...1. *M. africana*

1. *Malcolmia africana* (L.) R. Br. in Aiton, Hort. Kew. ed. 2. 4: 121, 1812; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 146, 1872; Jafri in Fl. W. Pak. 55: 218, 1973; Singh & Kachroo, Forest Fl. Srinagar 168, 1976; Kachroo *et al.*, Fl. Ladakh 57, 1977; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 186, 1993. *Hesperis africana* L., Sp. Pl. 663, 1753. *Chungpo*. **Fig. 66**

Annual, 10-25 cm high herbs, suberect, subglabrous. Leaves oblanceolate, oblong or subelliptic, entire or sinuate-dentate, acute. Racemes up to 20 cm long, 10-25-flowered. Flowers violet or pinkish, 4.5-6.5 mm in diam. Pedicels 2-4 mm long. Sepals 3-5 mm long. Petals 5.5-11 mm long. Siliquae linear-terete or subcylindrical, 3.5-6 x 0.15-0.18 cm. Seeds oblong, many.

Fl. & Fr. : March - June.

Selected specimens : Ladakh, Kurgiakh, 4300 m, Bhattacharyya 52215 (BSD); Khardung la, 3900 m. Wadhwa 59985 (BSD).

Note : A polymorphic species.

2. *Malcolmia intermedia* C.A. Mey., Verz. Pfl. Cauc. 186, 1831; Jafri in Fl. W. Pak. 55: 220, 1973; Hajra *et al.*, in Sharma *et al.*, Fl. India



Fig. 66. *Malcolmia africana* (L.) R. Br.

2: 187. 1993. *M. taraxacifolia* Balbis ex Vass. in Kom., Fl. U.R.S.S. 8: 283. 1939; Naqshi & Javeid in J. Bombay Nat. Hist. Soc. 74: 394. 1977.

Small, annual herbs, up to 10 cm high, glabrous or sparsely, branched hairy. Leaves oblong or oblanceolate to 6 x 1.5 cm, sinuate-dentate to nearly entire. Flowers whitish-pinkish, 5-8 in a raceme. Sepals 2-5-3 mm long, saccate at base. Petals 4-5 mm long. Siliquae linear-oblong, quadrangular. Seeds oblong.

Fl. & Fr. : February May.

Included after Naqshi & Javeid (*loc. cit.*).

3. *Malcolmia strigosa* Boiss., in Ann. Sci. Nat. Ser. 2. 17: 70. 1842; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 145. 1872; Jafri in Fl. W. Pak. 55: 220. 1973; Hajra *et al.*, in Sharma *et al.*, Fl. India 2: 187. 1993.

Stout, suberect or depressed annual herbs, branched from base. Basal leaves up to 7.5 cm long, spreading on the ground, long petioled; cauline shorter, oblong, oblanceolate or subelliptic, sinuate toothed or subentire. Flowers in racemes, numerous. Sepals *ca* 3 mm long. Petals dark purple or sometimes whitish, much exceeding the sepals. Siliquae terete or subquadrate, up to 3 cm long, tapering towards the apex, more hairy at base. Seeds somewhat 2-seriate at abse, 1-seriate above.

Fl. & Fr. : April June.

Included after Hajra *et al.* (*loc. cit.*).

40. MATTHIOLA R. Br.

Matthiola flavida Boiss., Diagn. Pl. Nov. Or. 1. 6: 9. 1845; Jafri in Fl. W. Pak. 55: 202. 1973; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 188. 1983; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 219. 1993. *M. odoratissima* auct. non (Pallas) R. Br.; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 131. 1872; Kachroo *et al.*, Fl. Ladakh 57. 1977. *Gamshu*.

Perennial, 14-95 cm high herbs, usually tomentose. Basal leaves oblanceolate, elliptic-ovate, 2-8 x 0.4-2.5 cm, sinuate, lobate; upper leaves oblanceolate to linear, sinuate-toothed. Racemes up to 30 cm long, 10-18-flowered. Flowers brownish mauve to purplish, 10-15 mm, often fragrant. Pedicels 3.5-5 mm long. Sepals 7-11 mm long. Petals oblong-linear, 14-20 mm long. Anthers 2-2.5 mm long. Siliquae linear-oblong, 10-15 x 0.2-0.3 cm, pubescent. Seeds many, winged.

Fl. & Fr. : April July.

Selected specimens : Leh, Phyang, 3800 m, *Viswanathan* 54652 (BSD); Khardung la, 3900 m, *Wadhwa* 59941 (BSD); on way to Rumbak (Hemis N.P.), Ladakh, *S.K. Srivastava & Chauhan* 100927 (BSD); Dras valley, below Matyan, 3000-3500 m, *Duthie s.n.* (DD).

Note : A polymorphic species.

41. MEGACARPAEA DC.

- 1a. Leaf segments entire. Siliculae obcordate, deeply notched at apex ...1. *M. bifida*
 1b. Leaf segments serrate or irregularly toothed. Siliculae suborbicular, bifid ...2. *M. polyandra*

1. *Megacarpaea bifida* Benth. in Hook., *Kew J. Bot.* 7: 357. t. 7. 1855; Hook.f. & T. Anders. in Hook.f., *Fl. Brit. India* 1: 161. 1872; Jafri in *Fl. W. Pak.* 55: 81. 1973; Bhaumik in *Sharma et al.*, *Fl. India* 2: 209. 1993. *Chater*.

Perennial, robust herbs. Basal leaves pinnatisect, entire, acute or acuminate; upper leaves oblanceolate, entire. Inflorescence racemose or subcorymbose reaching up to 50 cm in fruit. Flowers yellow, ca 5 mm in diam. Sepals distinctly veined. Petals obovate or elliptic-oblong. Siliculae conspicuously bifid at the apex; lobes diverging.

Fl. & Fr. : June August.

Included after Bhaumik (*loc. cit.*).

2. Megacarpaea polyandra Benth. in Hook., Kew J. Bot. 7: 356. t. 7. 1855; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 161. 1872; Jafri in Fl. W. Pak. 55: 81. 1973; Sharma & Jamwal, Fl. Upper Liddar valley. 104. 1988; Bhaumik in Sharma *et al.*, Fl. India 2: 210. 1993. *Chhach, Chater.*

Perennial, up to 1 m tall herbs, 1-2 cm high, robust, glabrous or subhairy. Basal leaves pinnatisect, 14-28 cm long, 7-9 lobate; lobes oblong-lanceolate, 10-20 cm long, serrate or sinuate-dentate; upper leaves smaller. Racemes up to 18 cm long, paniced, many-flowered. Flowers creamy yellow, ca 1 cm in diam. Pedicels up to 20 mm long. Sepals 5-5.2 mm long. Petals 4-5.5 mm long. Siliculae sub-orbicular, 3-3.5 x 3.5-5 cm, notched at the apex. Seeds brown, not winged.

Fl. & Fr. : May July.

Selected specimens : Kishanganga valley, 3500-4000 m, *Keshavumand* 612 (DD).

Uses : Leaves eaten as vegetable.

42. NASTURTIUM R. Br.

Nasturtium officinale R. Br. in Aiton, Hort. Kew. ed. 2. 4: 110. 1812; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 133. 1872; Jafri in Fl. W. Pak. 55: 185. 1973; Singh & Kachroo, Forest Fl. Srinagar 168. 1976; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 124. 1993. *Naghabar.*

Perennial, rhizomatous, 10-75 cm long, procumbent, ascending or floating, glabrous herbs. Leaves lyrate-pinnate; lower stalked, with 1-5 leaflets; upper sessile, auricled at base with 5-9 leaflets; terminal leaflet suborbicular or broadly cordate. Racemes up to 20 cm long, 10-20-flowered. Flowers ca 4 mm in diam. Pedicels 10-13 mm long. Sepals ca 2 mm long. Petals 4.5-5.5 mm long. Siliquae oblong, subcylindrical, 10-20 x 2.5 mm. Seeds many, ovoid.

Fl. & Fr. : April July.

Selected specimens : Bhaderwah, *Uniyal* 80104 (BSD); Machheri, Hajra 82542 (BSD); Gulmarg, *Thapliyal* 26440 (DD); Poonch, ca 2000 m, *Stewart* 25572 (DD).

43. NESLIA Desv.

Neslia apiculata Fisch., C.A. Mey. & Avc'-Lall in Ind. Sem. Hort. Petrop. 8: 68. 1842; Jafri in Fl. W. Pak. 55: 105. 1973; Bhaumik in Sharma *et al.*, Fl. India 2: 174. 1993. *Neslia paniculata auct., non* Desv.: Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 174. 1872.

Annual, 15-55 cm high herbs, erect, pubescent, hairy. Basal leaves oblong-lanceolate; 2.5-9 x 1-2 cm; cauline leaves 1-7.5 x 0.3-1.5 cm, amplexicaul, auricled. Racemes up to 30 cm long, 25-45-flowered. Flowers yellow, ca 4 mm in diam. Pedicels up to 9-14 mm long. Sepals ca 2 mm long. Petals ca 3 mm long. Siliculae lentiform-sub spherical, glabrous. Seeds brown.

Fl. & Fr. : March May.

Selected specimens : Kishtwar, *Uniyal* 80266 (BSD).

44. NOTOCERAS R. Br.

Notoceras bicornis (Aiton) Amo., Fl. Iber. 6: 636. 1873; Jafri in Fl. W. Pak. 55: 193. 1973; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 221. 1993. *Erysimum bicornis* Aiton, Hort. Kew. 2: 394. 1789. *Notoceras canariense* R. Br. in Aiton, Hort. Kew. ed. 2. 4: 117. 1812; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 140. 1872.

Annual, 12-25 cm long, spreading, hairy herbs. Leaves oblanceolate to linear-oblong. 9-50 x 2-10 mm. Racemes lax, 15-25-flowered. Flowers white ca 2 mm in diam. Pedicels 1.5-2 mm long. Sepals 1.5-2 mm long. Petals narrow, spatulate, 1.5-2.2 mm long. Siliquae 4-8 x 1.5-2 mm, hairy. Seeds 2-5 in each locule, ovoid.

Fl. & Fr. : April - June.

Included after Hajra *et al.* (*loc. cit.*).

45. PARRYA R. Br.

- 1a. Plants sparsely glandular. Scapes 10-15-flowered ...3. *P. nudicaulis*
 1b. Plants eglandular. Scapes 1-6-flowered :
 2a. Scapes 1-flowered. Flowers showy lilac or violet.
 Siliquae below 60 mm long ...1. *P. exscapa*
 2b. Scapes 3-6-flowered. Flowers white. Siliquae
 more than 60 mm long ...2. *P. minjanensis*

1. *Parrya exscapa* Ledeb., Ic. Pl. Ross. 1: 21. t. 86. 1829; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 131. 1872; Jafri in Fl. W. Pak. 55: 210. 1973; Kachroo *et al.*, Fl. Ladakh 57. 1977; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 223. 1993. *Sumu*.

Perennial, eglandular herbs. Radical leaves oblong or narrowly spatulate, 15-50 x 5-10 mm, irregularly toothed. Scapes 20-45 mm long, 1-flowered. Flowers showy, violet, 14-20 mm in diam. Sepals 7-10 mm long. Petals 14-20 mm long, clawed. Siliquae 35-60 x 4-6 mm, compressed, glabrous. Seeds many, brown, ovate-orbicular, narrowly winged.

Fl. & Fr. : May - July.

Included after Kachroo *et al.* (*loc. cit.*).

2. *Parrya minjanensis* Rech.f. in Phytion 3: 62. 1951; Jafri in Fl. W. Pak. 55: 211. 1973; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 223. 1993. *P. stenocarpa* var. *minjanensis* (Rech.f.) Kitam., Fl. W. Pak. & Afghan. 76. 1964, *p.p.*

Perennial, glabrous or rarely pubescent herbs. Radical leaves 25-70 x 10-15 mm, pinnatifid to entire, rarely subpinnatisect, usually 5-7-toothed. Scapes 10-30 cm long. Racemes 3-6-flowered. Flowers white, ca 10 mm in diam. Pedicels 3.5-4 mm long. Sepals 7-9 mm long. Petals

15-20 mm long. Siliquae 55-100 x 3-4 mm, compressed. Seeds many, oblong-ovate, narrowly winged.

Fl. & Fr. : June July.

Included after Hajra *et al.* (*loc. cit.*).

3. **Parrya nudicaulis** (L.) Regel in Bull. Soc. Nat. Mosc. 34 (3): 176. 1861; Jafri in Fl. W. Pak. 55: 211. 1973; Kachroo *et al.*, Fl. Ladakh 57. 1977; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 223. 1993. *Cardamine nudicaulis* L., Sp. Pl. 654. 1753. *Parrya macrocarpa* R. Br. in Parry's Voy., app. 11: 270. 1824; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 131. 1872. Fig. 67

Scapose, perennial herbs, sparsely glandular, rarely subglabrous. Radical leaves densely rosulate, pinnatipartite, lanceolate, 4-15 x 0.5-1.5 cm, glandular. Scapes 7-30 cm long. Racemes 10-15-flowered. Flowers violet or white, ca 20 mm in diam. Pedicels up to 30-45 mm long. Sepals ca 10 mm long. Petals 13-20 mm long. Siliquae linear-oblong, 25-65 x 3-5 mm, compressed, pointed, glandular. Seeds many, suborbicular, narrowly winged.

Fl. & Fr. : May July.

Selected specimens : Ladakh, Changla, Chowdhery & Uniyal 86152 (BSD); Zanskar, ca 3500 m, Koeltz 2959 (DD).

46. PEGAEOPHYTON Hayek & Hand.-Mazz.

Pegaeophyton scapiflorum (Hook.f. & Thomson) Marq. & Shaw in J. Linn. Soc. Bot. 48: 229. 1929; Jafri in Fl. W. Pak. 55: 164. 1973; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 126. 1993. *Cochlearia scapiflora* Hook.f. & Thomson. in J. Linn. Soc. Bot. 5: 154. 1861; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 145. 1872.

Perennial, depressed herbs, without aerial stem. Rootstock covered below with withered leafbases. Radical leaves rosulate, oblong-spathulate

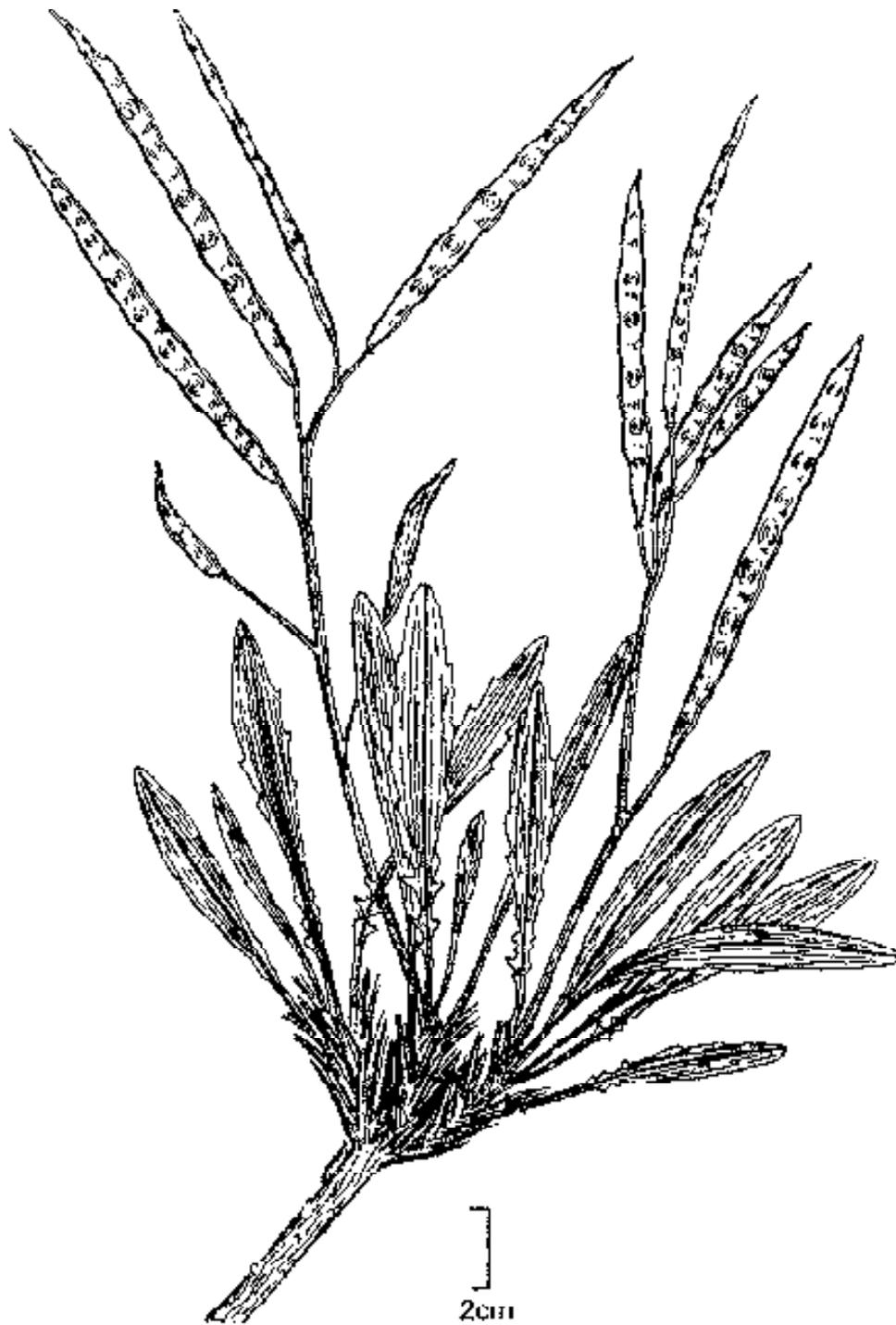


Fig. 67. *Parrya nudicaulis* (L.) Regel

or oblanceolate, 12-40 x 2-4.5 mm, entire or obscurely toothed, obtuse or acute, glabrous or sparsely hairy. Scapes 1.2-3.5 cm long, 1-flowered. Flowers 3.5-6.5 mm in diam. Sepals 2.8-4 mm long. Petals 3.5-6 mm long. Fruits oblong-ellipsoid, 5.5-8 x 3.5 mm, glabrous. Seeds biseriate.

Fl. & Fr. : June July.

Included after Hajra & Chowdhery (*loc. cit.*).

47. PHAEONYCHIUM Schulz.

- 1a. Radical leaves narrowly spatulate. Racemes 10-15-flowered. Pedicels up to 5 mm long ...1. *P. albiflorum*
 1b. Radical leaves narrowly oblanceolate to linear-oblong. Racemes 15-19-flowered. Pedicels above 5 mm long ...2. *P. parryoides*

1. *Phaeonychium albiflorum* (T. Anders.) Jafri in Fl. W. Pak. No. 55: 162. 1973; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 127. 1993. *Cheiranthus albiflorus* T. Anders. in Hook.f., Fl. Brit. India 1: 133. 1872. *Chunga*.

Perennial, 3-10 cm high herbs. Stellate hairy. Radical leaves narrowly spatulate or oblanceolate, up to 9-20 x 2-4 mm, entire or obscurely 1-3 lobulate; cauline leaves linear-lanceolate. Racemes 10-15-flowered. Flowers white, 4.5-6 mm in diam. Pedicels up to 5 mm long. Sepals *ca* 3 mm long. Petals 6.5-8 mm long. Siliquae 5 x 1 mm, densely pubescent.

Fl. & Fr. : June July.

Included after Hajra & Chowdhery (*loc. cit.*).

2. *Phaeonychium parryoides* (Kurz ex Hook.f. & T. Anders.) O.E. Schulz in Notizbl. Bot. Gart. Berlin 9: 1092. 1927; Jafri in Fl. W. Pak. 55: 161. 1973; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 127. 1993. *Cheiranthus parryoides* Kurz ex Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 132. 1872.

Perennial, suberect, densely pubescent or tomentose herbs. Leaves all radical, narrowly oblanceolate to linear-oblong 35-88 x 3.5-6 mm. Racemes 15-20-flowered, elongating up to 20 cm in fruit. Flowers white. 5-6.5 mm in diam. Pedicels 16-24 mm long. Sepals 3.5-4 mm long. Petals 6.5-7.8 mm long. Siliquae linear, 20 x 2 mm, flattened, stellately pubescent. Seeds suborbicular.

Fl. & Fr. : June July.

Included after Hajra & Chowdhery (*loc. cit.*).

48. PTILOTRICHUM C.A. Mey.

Ptilotrichum canescens (DC.) C.A. Mey. in Ledeb., Fl. Alt. 3: 66. 1831; Jafri in Fl. W. Pak. 55: 122. 1973; Debnath in Sharma *et al.*, Fl. India 2: 99. 1993. *Alyssum canescens* DC., Syst. Nat. 2: 322. 1821; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 141. 1872. **Fig. 68**

Perennial, 5-10 cm high herbs, suberect, clothed with stellate and branched appressed hairs. Leaves linear, 5-15 x 1-2.5 mm, sessile. Racemes 10-20-flowered, ebracteate. Flowers white or pinkish, ca 4 mm in diam. Pedicels filiform, ca 8 mm long. Sepals, 2.5 mm long. Petals 3.5 mm long. Siliculae ovate-oblong, 3-5 x 2-3 mm, acute, densely pubescent. Seeds brown, 1 in each locule, brown ovate-oblong.

Fl. & Fr. : May July.

Selected specimens : Tangtse, 3900 m, Bhattacharyya 71700 (BSD); Chang la, Chowdhery & Uniyal 86133 (BSD).

49. PYCNOPLINTHUS O.E. Schulz

Pycnoplinthus uniflorus (Hook.f. & Thomson) O.E. Schulz in Engler, Pflanzenr. 86: 199. 1924; Jafri in Fl. W. Pak. 55: 243. 1973; Kachroo *et al.*, Fl. Ladakh 58. 1977; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 188. 1993. *Braya uniflora* Hook.f. & Thomson in J. Linn. Soc. Bot. 5: 168. 1861; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 155. 1872.

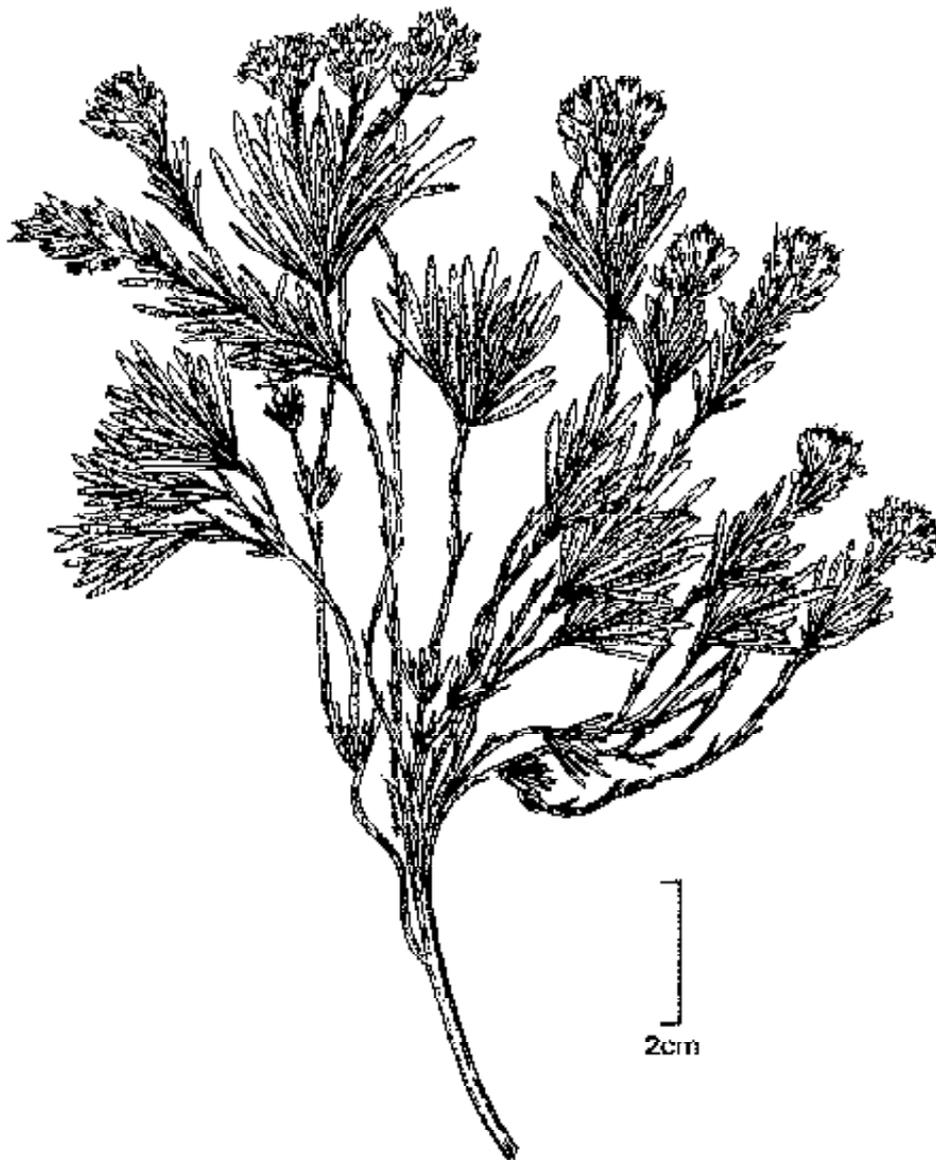


Fig. 68. *Ptilotrichum canescens* (DC.) C.A. Mey.

Perennial, caespitose herbs. Rootstock fusiform. Basal leaves narrowly linear, 10-18 mm long, glabrous; upper leaves absent. Scapes 1-flowered, as long as the leaves with flower overtopping the leaves. Flowers white turning to pale violet, 5.5-8 mm in diam. Sepals 2.5-3.5 mm long. Petals 4.5-5.8 mm long. Siliquae 8-12 mm long, glabrous. Seeds brown, 5-6 in each locule, ca 1.5 mm long, ovoid, finely reticulated.

Fl. & Fr. : June July.

In open meadows near glacier.

Selected specimens : Ladakh, Changla, 6000 m, *Viswanathan* 55097 (BSD); Chang la, *Bhattacharyya* 71680 (BSD); on way to Chang la, *Chowdhery & Uniyal* 86150 (BSD); Chang la, Ladakh, *D.K. Singh & party* 101095 (BSD).

50. RAPHANUS L.

- 1a. Taproot tuberous. Fruits hardly constricted between the seeds, not breaking into 1-seeded parts ...2. *R. sativus*
 1b. Taproot not tuberous. Fruits constricted between seeds, breaking into 1-seeded parts ...1. *R. raphanistrum*

1. ***Raphanus raphanistrum*** L., Sp. Pl. 669. 1753; Jafri in Fl. W. Pak. 55: 34. 1973; Naqshi & Javeid in J. Econ. Tax. Bot. 9(1): 94. 1987; Hajra *et al.*, in Sharma *et al.*, Fl. India 2: 145. 1993.

Annual herbs up to 1 m tall. Taproot slender. Stem densely coarse hairy at base. Lower leaves lyrate-pinnatifid, 15-20 x 1.2 cm; terminal lobe broadly obovate; lateral lobes 4-7 pairs, toothed along margins; upper leaves smaller. Racemes 10-50-flowered, up to 40 cm long in fruit. Flowers white or violet, 1.5-2 cm in diam. Sepals oblong, subequal; inner pair somewhat saccate at base. Petals obovate, long clawed. Siliquae cylindric, torulose, constricted between seeds. Seeds 3-8; beak slender.

Fl. & Fr. : January June

Included after Naqshi & Javeid (*loc. cit.*).

2. *Raphanus sativus* L., Sp. Pl. 669. 1753; J. Hook. f. & T. Anders. in Hook. f., Fl. Brit. India 1: 166. 1872; Jafri in Fl. W. Pak. 55: 35. 1973; Naqshi & Javeid in J. Econ. Tax. Bot. 9(1): 95. 1987; Hajra *et al.*, in Sharma *et al.*, Fl. India 2: 145. 1993. *Labuk*.

Annual or biennial herbs, up to 1 m tall. Tap root tuberous. Stem hispid below, glabrous above. Lower leaves lyrate-pinnatifid; terminal lobe suborbicular, crenate; lateral lobes much shorter, dentate; upper leaves much smaller, entire, dentate or lobed. Racemes many-flowered, up to 40 cm in fruit. Fruiting pedicels 10-20 mm long, clawed. Siliquae lanceolate-oblong or oblong-ellipsoid, terete; beak conical, seedless.

Fl. & Fr. : January April.

Widely cultivated.

51. RAPISTRUM Crantz.

Rapistrum rugosum (L.) All., Fl. Pedem. 1: 257. 1785; Jafri in Fl. W. Pak. 55: 39. 1973. *Myagrum rugosum* L., Sp. Pl. 640. 1753.

Annual, erect, herbs, up to 90 cm high, hispid below, glaucous above. Lower leaves pinnately lobed, 3-jugate, irregularly toothed; upper leaves lobed, toothed. Racemes subcorymbose. Racemes elongating in fruiting. Sepals subequal, 3-4 mm long. Petals light yellow with darker veins, about twice the length of sepals. Siliculae 5-10 mm long, hispid to glabrous; upper part globular or spherical-1-seeded; lower part 1-3-seeded.

Fl. & Fr. : April June.

Included after Jafri (*loc. cit.*).

52. RORIPPA Scop.

1a. Petals distinctly exceeding the sepals. Flowers

ca 4 mm across

...4. *R. sylvestris*

1b. Petals when present, not exceeding the sepals.

Flowers 2-2.5 mm across :

- 2a. Fruits 5-10 mm long, 2-2.5 mm broad. Lower and middle leaves pinnatifid, 3-5-jugate ...3. *R. palustris*
- 2b. Fruits 10-25 mm long, 1.1.5 mm broad. Leaves nearly simple :
- 3a. Annuals or biennials. Fruits short, turgid; seeds 100 or more ...1. *R. indica*
- 3b. Perennials. Fruits long, narrow. Seeds up to 90 ...2. *R. montana*

1. *Rorippa indica* (L.) Hiern, Cat. Afr. Pl. Welw. 1: 26 add. et corr. 1896; Jafri in Fl. W. Pak. 55: 189. 1973; Sharma & Kachroo, Fl. Jammu 1: 94. 1981; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 129. 1993. *Sisymbrium indicum* L., Mantissa Pl. 1: 93. 1767; *Nasturtium indicum* (L.) DC., Syst. Nat. 2: 199. 1821; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 134. 1872.

Annual or biennial, 45-70 cm high herbs, glabrous. Leaves pinnatifid, lyrate, 4.5-10 x 1.5-2.5 cm, sinuate and toothed, acute or acuminate. Racemes up to 30 cm long, 25-35-flowered. Flowers yellow, ca 2.5 mm in diam. Pedicels up to 5 mm long. Sepals 2-2.5 mm long. Petals 2-2.5 mm long. Siliquae 10-15 x 1.5 mm, slender. Seeds biscriate, numerous, minute.

Fl. & Fr. : April - June.

Selected specimens : Udhampur, Swami 1073 (BSD).

2. *Rorippa montana* (Wallich ex Hook.f. & T. Anders.) Small, Fl. S.E. United States, ed. 2: 1336. 1913; Jafri in Fl. W. Pak. 55: 188. 1973; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 131. 1993. *Nasturtium montanum* Wallich ex Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 134. 1872.

Perennial, 15-35 cm high herbs, glabrous. Leaves simple, 5-10 x 1.5-3 cm, entire or slightly toothed; lower leaves ovate-oblong; upper lanceolate, linear or obovate. Racemes up to 10 cm long, 15-25-flowered. Flowers yellow. Pedicels ca 5 mm long. Siliquae linear, 15-20 x 1 mm, glabrous. Seeds 50-90, uniseriate.

Fl. & Fr. : March - June.

Included after Hajra & Chowdhery (*loc. cit.*).

3. *Rorippa palustris* (L.) Besser. Enum. Pl. Volhyn. 27, 1822; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 131, 1993. *Sisymbrium amphibium* L. var. *palustre* L., Sp. Pl. 657, 1753. *Rorippa islandica auct. non* Oeder; Borbas, Balaton Tav. 2: 392, 1900; Jafri in Fl. W. Pak, 55: 189, 1973; Singh & Kachroo, For. Fl. Srinagar 168, 1976. *Nasturtium palustre* (L.) DC., Syst. Nat. 2: 191, 1821; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 133, 1872.

Annual or biennial, 10-65 cm high herbs, branched, glabrous. Lower leaves lyrate-pinnatifid, 5-15 x 1-3 cm, 3-5-jugate; upper leaves 1.5-5 x 0.5-2 cm. Racemes up to 20 cm long, 20-30-flowered. Flowers pale yellow, ca 2 mm in diam., pedicels 4-6 mm long. Sepals ca 2 mm long. Petals ca 2 mm long. Siliquae oblong-ellipsoid, 5-10 x 2-3 mm, apiculate, glabrous. Seeds pale brown, many

Fl. & Fr. : April - July.

Selected specimens : Gulmarg, 2600 m, *Bhattacharyya* 71186 (BSD); Sonamarg, *Wadhwa, Murti & Pant* 85221 (BSD); Udhampur, *Swami* 645 (BSD); Bhaderwah, *Uniyal* 80229 (BSD); Bandipur, on Wular lake, ca 1800 m, *Keshavanand* 552 (DD).

4. *Rorippa sylvestris* (L.) Besser, Enum. Pl. Volhyn 27, 1822; Javeid in Indian For. 99: 629, 1973; Singh & Kachroo, Forest Fl. Srinagar 169, 1976; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 132, 1993. *Sisymbrium sylvestre* L., Sp. Pl. 657, 1753.

Perennial, 15-40 cm high herbs, suberect or procumbent, glabrous. Leaves pinnate or deeply pinnatisect; lobes obovate to oblong, cuneate, sinuate-toothed. Racemes up to 15 cm long, 30-55-flowered. Flowers yellow, 4-5 mm in diam. Pedicels up to 12 mm long. Sepals ca 2.5 mm long. Petals 4-5 mm long. Siliquae cylindrical, linear-oblong, 9-16 x 2-2.5 mm, glabrous. Seeds many, ca 0.7 mm long.

Fl. & Fr. : May August.

Included after Singh & Kachroo (*loc. cit.*).

53. SINAPIS L.

Sinapis alba L., Sp. Pl. 668, 1753; Jafri in Fl. W. Pak. 55: 29, 1973; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 149, 1993. *Brassica alba* (L.) Rabenh., Fl. Lusatica, 1: 154, 1839; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 157, 1872.

Annual, up to 90 cm high herbs, erect, hairy. Lower leaves lyrate, 2-3-jugate, 5-15 x 2-6 cm, hispid; upper leaves subequally lobulate, sinuate-dentate. Racemes up to 30 cm long, many-flowered. Flowers yellow, ca 10 mm in diam. Pedicels up to 14 mm long. Sepals 4-5.5 mm long. Petals obovate, 7-12 mm long, clawed. Siliquae subcylindrical, 15-40 x 3-4 mm, torulose, hairy. Seeds pale brownish, 1-4 in each locule.

Fl. & Fr. : April June.

Note : "White mustard" is occasionally cultivated as green fodder and its seed has 35 per cent oil.

54. SISYMBRIUM L.

- 1a. Fruits tapering towards apex; pedicels inconspicuous ...6. *S. officinale*
- 1b. Fruits obscurely narrowed towards apex; pedicels conspicuous :
 - 2a. Pedicels nearly as thick as pod :
 - 3a. Cauline leaves nearly entire ...7. *S. orientale*
 - 3b. Cauline leaves deeply lobed ...1. *S. altissimum*
 - 2b. Pedicels not or slightly thickened in fruit :
 - 4a. Petals less than 5 mm long :
 - 5a. Fruits ascending, 25-40 mm long. Stigma somewhat 2-lobed ...4. *S. irio*
 - 5b. Fruits spreading, 60-80 mm long. Stigma depressed-capitate ...3. *S. heteromallum*

4b. Petals more than 5 mm long :

6a. Fruits ascending, 20-40 mm long ...5. *S. loeselii*

6b. Fruits spreading or so, more than 50 mm long ...2. *S. brassiciforme*

1. *Sisymbrium altissimum* L., Sp. Pl. 659. 1753; Jafri in Fl. W. Pak. 55: 252. 1973; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 242. 1993.

Annual or biennial, 15-75 cm high, erect, subglabrous herbs. Basal leaves 5-20 x 3-7.5 cm, loosely rosulate, runcinate-pinnatifid; upper leaves linear to filiform, 5-7 lobed. Racemes 10-25-flowered, up to 30 cm long in fruit. Flowers yellowish, 4.5-6 mm in diam. Pedicels 4-12 mm long. Siliquae linear-subcylindrical, 45-95 x 1-1.5 mm, usually straight, glabrous. Seeds brown, ellipsoid, 35-55 in each locule.

Fl. & Fr. : April July.

Included after Hajra *et al.* (*loc. cit.*).

2. *Sisymbrium brassiciforme* C.A. Mey. in Ledeb., Fl. Alt. 3: 129. 1831; Jafri in Fl. W. Pak. 249. 1973; Kachroo *et al.*, Fl. Ladakh 58. 1977; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 243. 1993. *S. columnae auct. non Jacq.*, Hook.f. & T. Anders. in Hook.f, Fl. Brit. India 1: 150. 1872.

Annual or biennial, 25-95 cm high, subglabrous herbs. Lower leaves ovate-oblong runcinate; upper leaves linear, subfleshy. Racemes 15-55-flowered, up to 25 cm long in fruit. Flowers yellow, ca 5 mm in diam. Pedicels 4.2-10 mm long. Sepals 3-4 mm long. Petals 4-8 mm long. Siliquae linear, subcylindrical, glabrous. Seeds brown, many, oblong, granulate.

Fl. & Fr. : May July.

Selected specimens : La Mayuru, Ladakh, 4500 m, Koelz 2762 (DD).

3. *Sisymbrium heteromallum* C.A. Mey. in Ledeb., Fl. Alt. 3: 132. 1831; Jafri in Fl. W. Pak. 55: 252. 1973; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 243. 1993.

Annual or biennial, 25-85 cm high, erect, hispid or subglabrous herbs. Leaves lyrate-pinnatipartite, shortly toothed. Racemes 25-45-flowered, up to 25 cm long in fruits. Flowers pale yellow, ca 3 mm in diam. Pedicels 7-15 mm long. Sepals 3-4 mm long. Petals 4-5 mm long. Siliquae linear-subcylindrical, 55-75 x 1 mm, glabrous. Seeds many, oblong-ellipsoid, finely granulated.

Fl. & Fr. : April - June.

Included after Hajra *et al.* (*loc. cit.*).

4. *Sisymbrium irio* L., Sp. Pl. 659. 1753; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 150. 1872; Jafri in Fl. W. Pak. 55: 250. 1973; Sharma & Kachroo, Fl. Jammu 1: 95. 1981; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 243. 1993.

Annual, 15-60 cm high herbs, branched, glabrous or sparsely hairy. Lower leaves pinnately lobed, 2-5-jugate, petioled; cauline leaves similar. Racemes 45-95-flowered, up to 30 cm long in fruits. Flowers yellow, ca 3 mm in diam. Pedicels filiform, 4-15 mm long. Sepals 2-2.5 mm long. Petals 3.2-4 mm long. Siliquae linear, 20-45 x 1 mm. Seeds yellowish-brown, 20-40 in each locule, oblong ellipsoid.

Fl. & Fr. : March - May.

Selected specimens : Sonamarg - Baltal, 4000 m. Wadhwa 58531 (BSD).

5. *Sisymbrium loeschii* L., Cent. Pl. 1: 18. no. 49. 1755; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 151. 1872; Singh & Kachroo, For. Fl. Srinagar. 169. 1976; Kachroo *et al.*, Fl. Ladakh 58. 1977; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 244. 1993.

Annual or biennial, 15-120 cm tall herbs, branched, rarely hispid, often glabrous or sparsely hairy. Lower leaves lyrate-pinnatipartite, lobed, dentate; upper leaves similar, subsessile. Racemes 45-95 flowered, in fruit up to 25-40 cm long. Flowers yellow, 5.5-8 mm in diam. Pedicels 5-15

mm long. \pm upcurved. Sepals 3-4 mm long. Petals 5-7 mm long. Siliquae linear-subcylindrical, 12-48 x 1 mm, upcurved. Seeds 12-30 in each locule, oblong-ellipsoid, papillose.

Fl. & Fr. : April - August.

Included after Singh & Kachroo (*loc. cit.*).

Note : A polymorphic species.

6. *Sisymbrium officinale* (L.) Scop., Fl. Carn. 2: 26. 1772; Jafri in Fl. W. Pak. 55: 255. 1973; Naqshi in Geobios 2: 164. 1975; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 244. 1993. *Erysimum officinale* L., Sp. Pl. 660. 1753.

Annual, erect, 22-45 cm high herbs, glabrous, rarely reflexed hairy. Basal leaves rosulate, deeply pinnatisect, irregularly toothed; cauline leaves small; lobes narrow. Racemes branched, 20-30-flowered. Flowers yellow, ca 4 mm in diam. Pedicels 2.5-3.8 mm long, thickened and appressed at axis. Sepals ca 2.3 mm long. Petals spatulate, 3.2-4.2 mm long. Siliquae reddish-brown 8.5-17.8 x 1.5 mm, conical at the apex, \pm hispid. Seeds 10 in each locule, ellipsoid.

Fl. & Fr. : April - August.

Included after Hajra *et al.* (*loc. cit.*).

7. *Sisymbrium orientale* L., Cent. Pl. 2: 24. 1756; Jafri in Fl. W. Pak. 55: 253. 1973; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 234. 1993. *Staga*.

Annual or biennial, up to 60 cm high herbs, hairy. Basal leaves rosulate, usually 4-5-jugate, segments ovate-oblong-lanceolate. Racemes 15-25 flowered, up to 20 cm long. Flowers yellowish, 5-6 mm in diam. Pedicels 3-6 mm long. Sepals 4-5 mm long. Petals 7-10 mm long. Siliquae linear-subcylindrical, 50-95 x 1 mm, usually hairy. Seeds 35-50 in each locule, ellipsoid.

Fl. & Fr. : April - August.

In open situations and rocky slopes.

Selected specimens : Kishtwar, *Uniyal* 80299 (BSD); Near Khanbal, *R.R. Rao & Kumar* 81614 (BSD); Ladakh, Shyok, 4200 m, *Viswanathan* 55039 (BSD); Ganglas - Khardung la, *Chowdhery & Uniyal* 86081 (BSD).

55. SMELOWSKIA C.A. Mey.

Smelowskia calycina (Steph. ex Willd.) C.A. Mey. in Ledeb., *Fl. Alt.* 3: 170. 1831; Jafri in *Fl. W. Pak.* 55: 282. 1973; Hajra *et al.*, in Sharma *et al.*, *Fl. India* 2: 246. 1993. *Lepidium calycinum* Steph. ex Willd., *Sp. Pl.* 3: 433. 1800.

Perennial, caespitose herbs, up to 30 cm high, densely pubescent. Radical leaves densely rosulate, pinnatisect, 30-60 x 5-12 mm, petioled; lobes narrowly oblong or linear; upper leaves nearly similar. Flowers pale-yellowish, ca 5 mm across, racemeose. Bracts often present in lower part. Sepals ca 3.5 mm long. Petals 5-6.5 mm long. Fruits ellipsoid, subterete, glabrous; valves convex, with a prominent midrib.

Fl. & Fr. : June - August.

Included after Hajra *et al.* (*loc. cit.*).

56. TAUSCHERIA Fisch. ex DC.

Tauscheria lasiocarpa Fisch. ex DC., *Syst. Nat.* 2: 563. 1821; Hook.f. & T. Anders. in Hook.f., *Fl. Brit. India* 1: 164. 1872; Jafri in *Fl. W. Pak.* 55: 102. 1978; Kachroo *et al.*, *Fl. Ladakh* 59. 1977; Bhaumik in Sharma *et al.*, *Fl. India* 2: 176. 1993. Fig. 69

Annual, 9-45 cm high herbs, erect, glabrous, glaucous. Leaves ovate, cordate, 9-50 x 2-2.5 mm, amplexicaul. Racemes up to 15 cm long, 30-40-flowered. Flowers white or yellowish, ca 2 mm in diam. Pedicels up to 4 mm long, spreading or deflexed. Sepals ca 1.2 mm long. Petals oblong, spatulate, ca 2.5 mm long. Siliquae cymbiform, 4-8 x 3-4 mm, hairy or glabrous. Seeds brown, ca 2.5 mm long.

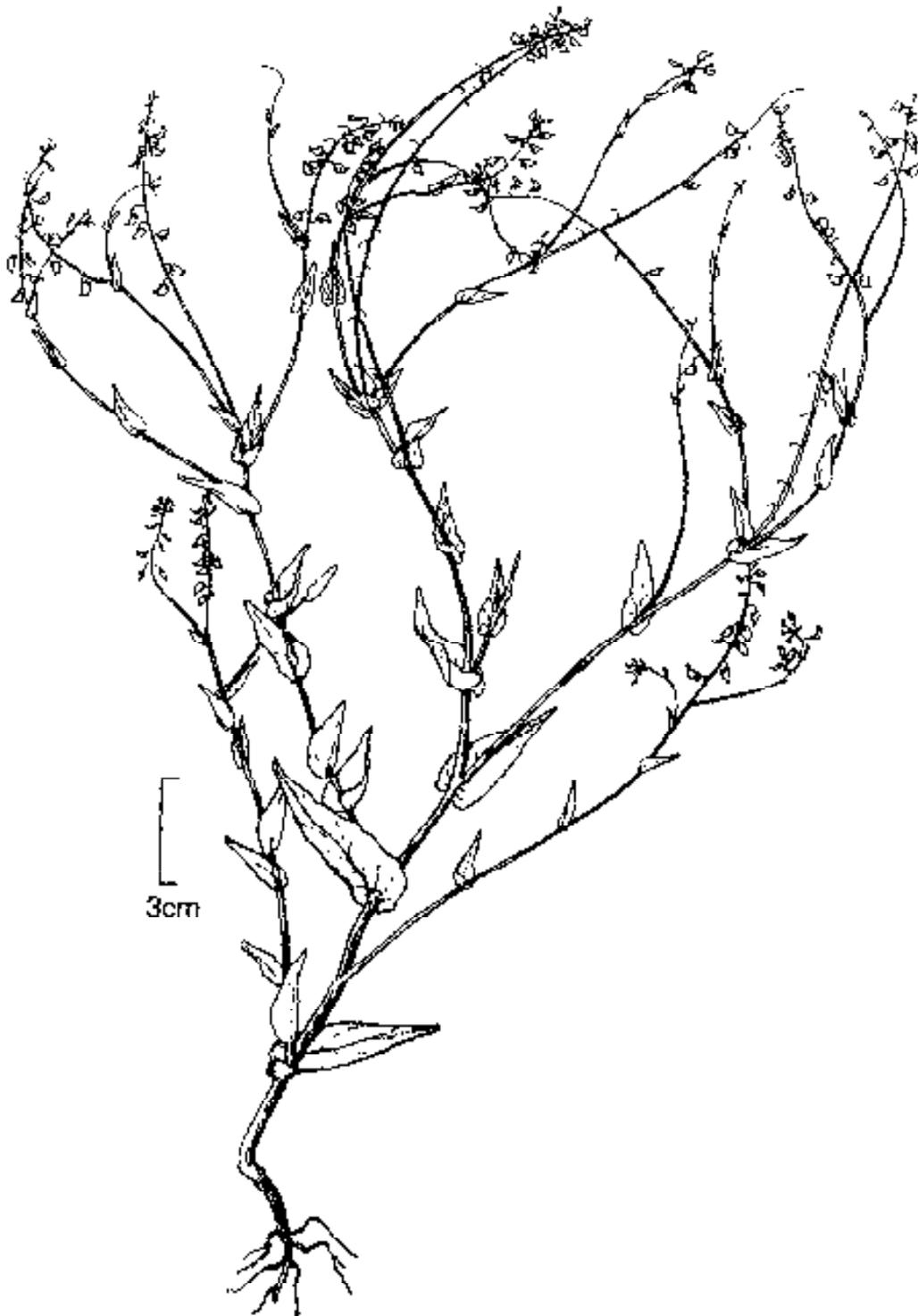


Fig. 69. *Tauscheria lasiocarpa* Fisch. ex DC.

Fl. & Fr. : July - September.

On dry, sandy slopes.

Selected specimens : Ladakh, Panikhar - Parkhachik, Chowdhery & Uniyal, 85933 (BSD).

57. TETRACME Bunge

Tetracme pamirica Vass. in Kom., Fl. U.R.S.S., ed 2, 8: addenda 648. t. 19. f. 5. 1939; Jafri in Fl. W. Pak. 55: 196. 1973; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 86. 1983.

Annual, 7-24 cm high herbs, spreading, stellate hairy. Lower leaves oblong-linear or lanceolate, 24-54 x 5-8 mm, dentate; upper leaves 9-38 x 2-7 mm. Racemes up to 10 cm long, 20-28-flowered, elongating in fruits. Flowers ca 1.5 mm in diam. Sepals ca 1 mm long. Petals nearly equalling the sepals. Siliquae subtortuose, 9-12 x 1 mm, scabrous. Seeds 4-6 in each locule, ca 1 mm long.

Fl. & Fr. : May - July.

Included after Dhar & Kachroo (*loc. cit.*).

58. THLASPI L.

- 1a. Fruits orbicular-broadly obovate, winged throughout the length :
- 2a. Fruits orbicular. Seeds striate ...2. *T. arvense*
- 2b. Fruits obovate. Seeds not striate ...4. *T. kotschyianum*
- 1b. Fruits usually oblong, oblong-elliptic or triangular, wingless or winged in the upper 2/3 only :
- 3a. Flowers 6-7 mm across. Fruits oblong-elliptic ...1. *T. andersonii*
- 3b. Flowers 3-5 mm across. Fruits oblong or obtriangular :
- 4a. Fruits oblong-obtriangular, straight. Plants up to 30 cm high ...5. *T. montanum*

4b. Fruits oblong, subcontorted. Plants up to
145 cm high :

5a. Fruits ca 1.5 mm broad ...6. *T. septigerum*

5b. Fruits 2-2.5 mm broad ...3. *T. cochlearioides*

1. ***Thlaspi andersonii*** (Hook.f. & Thomson) O.E.-Schulz in Ann. Akad. Wiss. Wien., Math.-Nat. N. 43: 98. 1926; Jafri in Fl. W. Pak. 55: 89. 1973; Bhaumik in Sharma *et al.*, Fl. India. 2: 211. 1993. *Iberidella andersonii* Hook.f. & Thomson in J. Linn. Soc. Bot. 5: 177. 1861; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 163. 1872.

Perennial, procumbent, 8-15 cm high herbs, glabrous, fleshy. Branches dimorphic; flowering ones with cordate, amplexicaul leaves, non flowering with spatulate, cuneate leaves. Radical leaves rosulate, spatulate, 9-28 x 4-11 mm, dentate at margins; cauline leaves ovate-oblong, 4-10 x 4.5-8.5 mm, auricled, amplexicaul. Racemes up to 4 cm long, 15-20-flowered, corymbose. Flowers 6-7 mm in diam. Pedicels up to 4 mm long, glabrous. Sepals 2-2.5 mm long. Petals oblong-ovate 5-6 mm long. Siliquae elliptic-oblong, 5.5-7.5 x 2 mm, acute, not or obscurely winged.

Fl. & Fr. : May July.

Included after Bhaumik (*loc. cit.*).

2. ***Thlaspi arvense*** L., Sp. Pl. 646. 1753; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 162. 1872; Jafri in Fl. W. Pak. 55: 84. 1973; Kachroo *et al.*, Fl. Ladakh 59. 1977; Bhaumik in Sharma *et al.*, Fl. India 2: 211. 1993.

Annual, up to 70 cm high herbs, glabrous, rarely sparsely hairy. Basal leaves 2-7.5 x 1-2 cm, oblanceolate, toothed; upper leaves lanceolate-oblong, 2-6 x 2 cm, auricled, amplexicaul, dentate. Racemes long, 30-65-flowered, up to 25 cm in fruiting. Flowers white, 3.5-5 mm in diam. Pedicels 9-14 mm long, glabrous. Sepals ca 2 mm long. Petals 3-4.5 mm long. Siliquae orbicular, up to 15 x 15 mm, deeply notched at the tip, glabrous. Seeds dark brown, ellipsoid, 4-5 in each locule.

Fl. & Fr. : April July.

A weed in cultivated fields.

Selected specimens : Sedau, 1700 m, *T.A. Rao* 9361 (BSD); Katra, *Swami* 1185 (BSD); Ladakh, Dras, 3100 m. *Bhattacharyya* 71371 (BSD); Rangdom. *Chowdhery & Uniyal* 85973 (BSD); Kargil, 3100 m, *Viswanathan* 55625 (BSD); Yurutse (Hemis N.P.), Ladakh, *S.K. Srivastava & Chauhan* 101032 (BSD); Khillanmarg, ca 3000 m, *Duthie* 11364 (DD).

3. *Thlaspi cochlearioides* Hook.f. & Thomson in J. Linn. Soc. Bot. 5: 177. 1861; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 162. 1872; Jafri in Fl. W. Pak. 55: 89. 1973; Bhaumik in Sharma *et al.*, Fl. India 2: 212. 1993.

Perennial, up to 8 cm long herbs, branched mostly from the base, glabrous. Basal leaves rosulate, spatulate, orbicular, 1.5-3 x 0.4-0.8 mm, toothed, petiolate; upper leaves elliptic-ovate or oblong-ovate, 5-20 x 3-8 mm, glabrous, subfleshy. Racemes corymbose, 10-15-flowered. Flowers 3.5-5 mm in diam. Pedicels up to 3 mm long, glabrous. Sepals ca 2.5 mm long. Petals obovate, ca 4.5 mm long. Siliquae oblong, 7-11 x 2.5 mm, curved. Seeds pale brown, oblong-ovate, 3-5, 1-1.5 mm long.

Fl. & Fr. : June August.

Selected specimens : Sangam valley, 4000-4500 m, *Duthie* 13271; Liddar valley, 4000-4500 m, *Duthie* 13409 (DD).

4. *Thlaspi kotschyannum* Boiss. & Hohen. in Boiss., Diagn. ser. 1, 8: 39. 1849; Jafri in Fl. W. Pak. 55: 85. 1973; Bhaumik in Sharma *et al.*, Fl. India 2: 212. 1993. *T. cardiocarpum* Hook.f. & Thomson in J. Linn. Soc. Bot. 5: 176. 1861; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 162. 1872; Singh & Kachroo, For. Fl. Srinagar 169. 1976.

Annual, up to 25 cm high, branched, glabrous herbs. Basal leaves 1-3 x 0.6-1 cm, entire; upper leaves cordate, 1-3.5 x 0.5-1.5 cm, amplexicaul, obtuse. Racemes up to 15 cm long, 25-45-flowered. Flowers

white, ca 2 mm in diam. Pedicels up to 4.5 mm long, spreading. Sepals ovate, ca 1.2 mm long. Petals linear-oblong, ca 3 mm long. Siliquae obovate-orbicular. Seeds reddish brown, ca 6 in each locule.

Fl. & Fr. : April July.

Included after Singh & Kachroo (*loc. cit.*).

5. *Thlaspi montanum* L., Sp. Pl. 647. 1753; Bhaumik in Sharma *et al.*, Fl. India 2: 213. 1993. *Thlaspi cochleariforme auct. non DC.*; Singh & Kachroo, For. Fl. Srinagar. 169. 1976. *T. cochleariforme* DC. subsp. *griffithianum* (Boiss.) Jafri in Notes Roy. Bot. Gard. Edinb. 22: 119. 1956. *T. alpestre auct. non L.*; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 162. 1872. *Bumuk*.

Perennial, 5-24 cm high, branched, glabrous herbs. Radical leaves rosulate, spatulate or oblong-ovate, 2-5.5 x 0.5-1.3 cm, entire; cauline leaves ovate-cordate, 1-2 cm long, amplexicaul, toothed. Racemes up to 15 cm long, 20-40-flowered. Flowers ca 5 mm in diam. Pedicels up to 8 mm long, glabrous. Sepals 2.5-3 mm long, with a narrow hyaline border. Petals white or 5-7 mm long. Siliquae oblong-obovate or obovate, 3.5-9.5 x 1.5-3.8 mm, glabrous. Seeds pale brown, oblong-ovate.

Fl. & Fr. : April July.

On slopes.

Selected specimens : Doda Dist., Jai valley, 7500 m, T.A. Rao 9504; Gulmarg, 8000', T.A. Rao 243 (BSD); Panchtarni, 3800 m, Nair 37000 (BSD); Ladakh, Lingti Pass, 5000 m Bhattacharyya 52320 (BSD).

6. *Thlaspi septigerum* (Bunge) Jafri in Notes Roy. Bot. Gard. Edinb. 22: 119. 1956 *et in* Fl. W. Pak. 55: 87. 1973; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 86. 1983; Bhaumik in Sharma *et al.*, Fl. India 2: 213. 1993. *Eutrema septigerum* Bunge, Verz. Pfl. Ostl. Altai, 73. 1836.

Perennial, 9-15 cm high, erect, glabrous herbs. Basal leaves loosely rosulate, suborbicular, 22-33 x 05-10 mm, entire; upper leaves lanceolate

or oblong 9-14 x 3-5 mm. Racemes up to 7 cm long, 10-15-flowered. Flowers white, 2.5-4 mm in diam. Pedicels up to 7 mm long, glabrous. Sepals 2 mm long. Petals *ca* 4 mm long. Siliquae oblong, 8.5-12 x 1.5 mm. Seeds ellipsoid, 4-8 in each locule, *ca* 1 mm long.

Fl. & Fr. : May July.

Selected specimens : Burzil pass, *ca* 4000 m, Duthie 14030 (DD).

Note : A new species *Thlaspi cornuticarpum* Naqshi (J. Econ. Tax. Bot. 5(3): 716-717.f. 2. 1984) has been described from J. & K. It is said to be close to *Thlaspi stenocarpum* Boiss. et Hohen. (described from Persia) but differs in smaller size of plants, spatulate to more or less orbicular radical leaves, entire cauline leaves, slightly upcurved pedicels and style equal to or longer than the horns.

59. TORULARIA (Coss.) O.E. Schulz

Torularia humilis (C.A. Mey.) O.E. Schulz ex Limpricht in Fedde, Rep. sp. Nov. 12: 390. 1922; Jafri in Fl. W. Pak. 55: 267. 1973; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 188. 1983; Hajra *et al.* in Sharma *et al.*, Fl. India 2: 247. 1993. *Sisymbrium humile* C.A. Mey. in Ledeb., Icon. Pl. Ross. 2: 16. t. 147. 1830; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 148. 1872. *Erekarpo*.

Biennial or perennial, 4-20 cm high, spreading, hairy or glabrous herbs. Basal leaves rosulate narrowly oblanceolate to linear-elliptic, 15-35 x 5-8 mm, cauline leaves similar. Racemes up to 10 cm long, 10-25-flowered. Flowers violet, pinkish or white, 2.5-4 mm in diam. Pedicels 3-8 mm long, suberect. Sepals elliptic, 2-3 mm long. Petals 3-5 mm long. Siliquae 7-25 x 1 mm, straight or slightly curved, torulose, glabrous.

Fl. & Fr. : May July.

Selected specimens : Upshi, Tang lang la, Hajra 74255 (BSD); Kurgiakh, 4300 m, Bhattacharyya 52252 (BSD); Between Da and Hanle, Rupshu, *ca* 5000 m, Koeltz 2289 (DD).

60. TURRITIS L.

Turritis glabra L., Sp. Pl. 666. 1753; Jafri in Fl. W. Pak. 55: 183. 1973; Dhar & Kachroo, Alpine Fl. Kashmir Himal. 189. 1983; Hajra & Chowdhery in Sharma *et al.*, Fl. India 2: 132. 1993. *Arabis glabra* (L.) Bernh., Syst. Verz. Erfurt. 1: 195. 1800; Hook.f. & T. Anders. in Hook.f., Fl. Brit. India 1: 135 1872; Singh & Kachroo, For. Fl. Srinagar 169. 1976.

Annual or biennial, 30-120 cm high, glabrous herbs, sometimes slightly hairy. Basal leaves 5-15 x 1.5-3.5 cm, entire or toothed, glabrous; upper leaves oblong ovate, 2-8 x 0.5-3 cm, sagittate-amplexicaul, entire, acute, glabrous, rarely hairy. Racemes up to 30 cm long. Flowers pale yellow, ca 5 mm in diam. Pedicels up to 10 mm long, erect. Sepals 2-4 mm long. Petals 4-6 mm long. Siliquae filiform, 25-70 mm long. Seeds many, ± biseriate, ovate-orbicular, ca 0.7 mm long.

Fl. & Fr. : May August.

Selected specimens : Liddar valley, 2400 m, T.A. Rao 540 (BSD); Singola, 4600 m, Bhattacharyya 52160 (BSD).

61. URANODACTYLUS A. Gilli

Uranodactylus silaifolius (Hook.f. & Thomson) Jafri in Abstract Biol. Sec., Pak. Assoc. Adv. Sc. 9, 1962 *et in* Fl. W. Pak. 55: 63. 1973. *Heldreichia silaifolia* Hook.f. & Thomson. in J. Linn. Soc. Bot. 5: 176. 1861.

Perennial, caespitose, 12-38 cm high herbs. Radical leaves rosulate, bipinnatisect; 4-12 x 2.5-4 cm, cauline leaves few, deeply dissected, linear-oblong lobes. Racemes up to 5.2 cm long, scapose, 20-28-flowered. Flowers yellowish-white, 4-5 mm in diam. Pedicels 5-10 mm long, hairy. Sepals oblong, 2-3 x 1.5 mm, obtuse. Petals spatulate, 4-5.5 x 2.5 mm, obscurely toothed. Siliquae suborbicular, 7-12 x 7-10 mm, laterally compressed, glabrous. Seeds brown, ovate, 1 in each locule, 4-5 mm long.

Fl. & Fr. : April June.

Included after Jafri (*loc. cit.*).

CAPPARACEAE

(R. Mathur)

- 1a. Herbs or undershrubs. Fruits not baccate ...2. *Cleome*
- 1b. Shrubs or trees. Fruits baccate :
 - 2a. Shrubs. Leaves simple ...1. *Capparis*
 - 2b. Trees. Leaves trifoliate ...3. *Crateva*

1. CAPPARIS L.

- 1a. Leaves caducous, plants appearing leafless ...1. *C. decidua*
- 1b. Leaves persistent :
 - 2a. Flowers solitary, axillary ...3. *C. spinosa*
 - 2b. Flowers variously arranged :
 - 3a. Twigs zig-zag. Flowers in terminal sub
corymbose umbels or on short lateral
twigs ...2. *C. sepiaria*
 - 3b. Twigs not zig-zag. Flowers in supra
axillary rows ... 4. *C. zeylanica*

1. **Capparis decidua** (Forssk.) Edgew. in J. Linn. Soc. Bot. 6: 184. 1862; S. Raghavan in Sharma *et al.*, Fl. India 2: 265, 1993. *Sodada decidua* Forssk., Fl. Aegypt.-Arab. 81. 1775. *Capparis aphylla* Roth, Nov. Sp. Pl. Ind. or 238. 1821; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 174. 1872; Sharma & Kachroo, Fl. Jammu 1: 99. 1981.

Shrubs or small trees. Stipular thorns yellowish, straight, rarely absent. Leaves caducous, linear-spathulate, 4-20 x 1-3 mm, often spine tipped. Racemes many-flowered. Flowers brick red or orange-red, up to 2.5 cm across. Sepals tomentose, floccose ciliate along margins. Petals pubescent. Fruits deep red, globose, slightly beaked, glabrous, smooth.

Fl. & Fr. : March November.

Included after Sharma & Kachroo (*loc. cit.*).

2. *Capparis septaria* L., Syst. Nat. ed. 10. 2: 1071. 1759; Hook. f. & Thomson in Hook.f., Fl. Brit. India 1: 176. 1872; Sharma & Kachroo, Fl. Jammu 1: 99. 1881; S. Raghavan in Sharma *et al.*, Fl. India 2: 289. 1993.

Climbing or spreading, armed, much branched, pubescent or grey hairy shrubs. Stipular thorns recurved. Leaves ovate, oblong lanceolate, elliptic-oblong to obovate-suborbicular, 1.5-6 x 1-3 cm, retuse, glabrous to pubescent. Flowers in terminal corymbose subumbels or on short, lateral twigs. Sepals ciliate along margins. Petals white, puberulous at base. Fruits yellow turning black, globose.

Fl. & Fr. : May August.

In dry and exposed places.

Selected specimens : Jammu-Nagrota, D.K. Singh & Uniyal 88522 (BSD); Ramnagar, Singh 15757 (RRL).

3. *Capparis spinosa* L., Sp. Pl. 503. 1753; Hook.f. & Thomson. in Hook.f., Fl. Brit. India 1: 173. 1872; Kachroo *et al.*, Fl. Ladakh 60. 1977; S. Raghavan in Sharma *et al.*, Fl. India 2: 294. 1993. *Kabra*.

Fig. 70

Diffused, branched, prostrate or trailing, glabrous or appressed pubescent shrubs. Stipular thorns divaricate, hooked. Leaves ovate, obovate, orbicular to elliptic, 1-4 cm long, acute to acuminate with spinescent tip, entire. Flowers white rosy-pink to purple later, axillary or solitary, terminal. Sepals nearly actinomorphic to zygomorphic; posterior sepal exceedingly saccate in the later case. Petals slightly exceeding the sepals. Fruits red, ellipsoid or oblong, ribbed.

- 1a. Sepals nearly actinomorphic. Petals not hooded ...3.2. var. *spinosa*
 1b. Sepals zygomorphic, one sepal and 2-petals hooded ...3.1. var. *himalayensis*

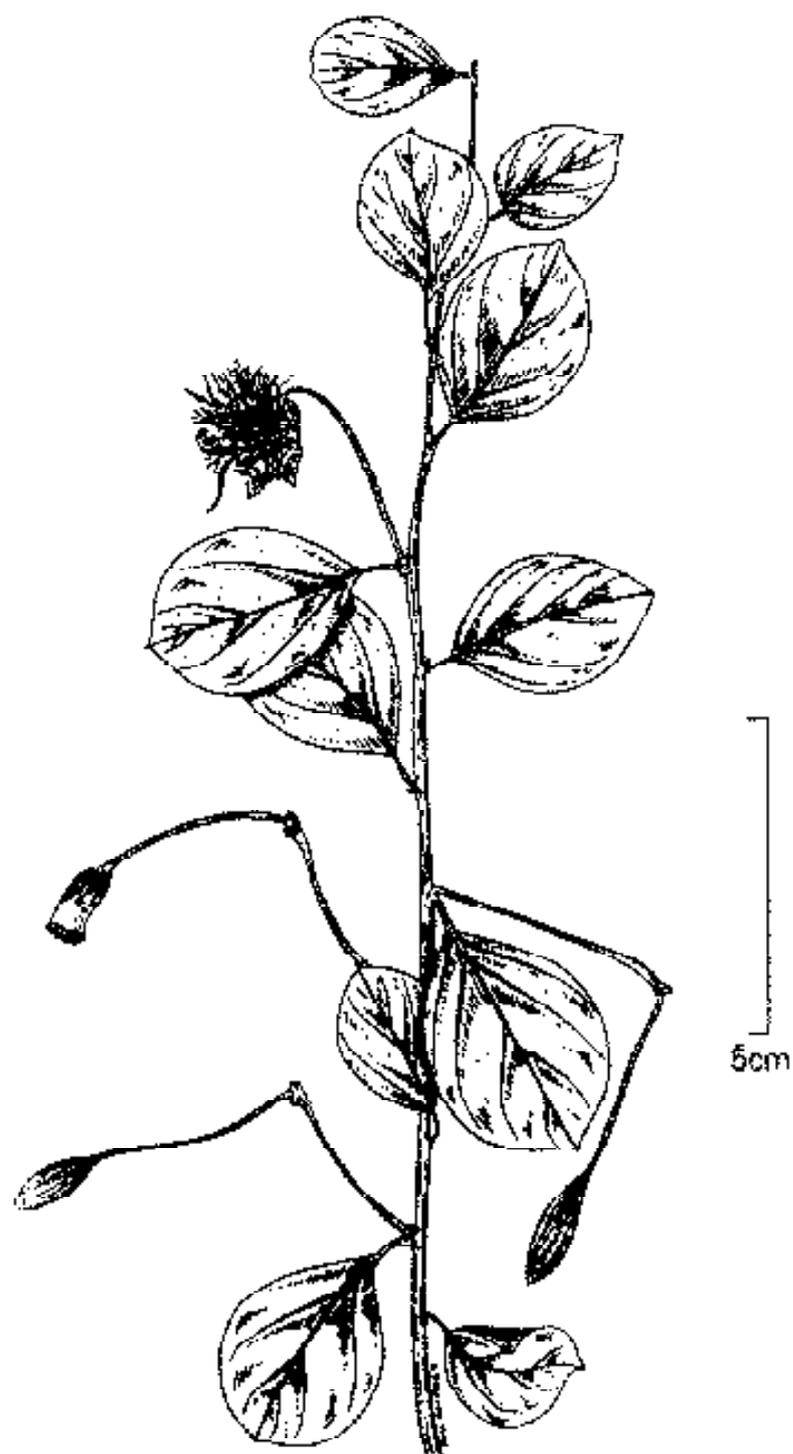


Fig. 70. *Capparis spinosa* L.

3.1. var. **himalayensis** (Jafri) Jacobs in *Blumea* 12: 419. 1965; S. Raghavan in Sharma *et al.*, *Fl. India* 2: 296. 1993. *C. himalayensis* Jafri. in Pak. J. For. 6: 197. t. l.f. 11. 1956. *C. spinosa* L. var. *leucophylla* sensu Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 173. 1872.

Fl. & Fr.: May August.

On rocky cliffs, and crevices at altitude of 1500-2000 m.

On way to Rumbak (Hemis N.P.), Ladakh, S.K. *Srivastava & Chauhan* 100918 (BSD).

3.2. var. **spinosa**

Fl. & Fr. : July November.

Selected specimens : Ladakh, La Mayuru, *Hajra* 74039 (BSD); Batalik, *Chowdhery & Uniyal* 86032 (BSD); Mulbekh, *Wadhwa* 58925 (BSD); Khaltse, 2900 m, *Bhattacharyya* 41170 (BSD); Thathri/Kishtwar, T.A. *Rao* 7768 (BSD).

4. **Capparis zeylanica** L., *Sp. Pl.* ed. 2: 720. 1762; S. Raghavan in Sharma *et al.*, *Fl. India* 2: 298. 1993. *C. horrida* L.f., *Suppl.* 264. 1781; Hook.f., & Thomson in Hook.f., *Fl. Brit. India* 1: 178. 1872.

Armed, climbing or scrambling, 2-5 m tall shrubs. Twigs rufous or greyish tomentose. Stipular thorns long, recurved. Leaves elliptic, oblong, lanceolate or ovate, 2.5-12 x 2-7 cm. Flowers white fading to pink or purple. Petals tomentose inside, repand. Filaments creamy white, turning to pink or purple. Fruits reddish orange to purple, globular or ellipsoid.

Fl. & Fr.: June Aug.

Selected specimens : Jammu, *Gupta* 12642-43 (RRI.).

2. CLEOME L.

- 1a. Leaves simple ...2. *C. fimbriata*
 1b. Leaves compound :
 2a. Androgynophore conspicuous, 5 mm or more long ...3. *C. gynandra*
 2b. Androgynophore absent, or if present then
 under 3 mm long :
 3a. Stamens 12-many ...5. *C. viscosa*
 3b. Stamens 6 :
 4a. Petals yellow with scaly appendages.
 Capsules densely glandular hairy ...4. *C. vahliana*
 4b. Petals white or pinkish, without
 appendages. Capsules sparsely glandular
 hairy ...1. *C. ariana*

1. *Cleome ariana* Hedge & Lammond in Rech.f., Fl. Iranica 68: 17. f. 2. 1970; Jafri in Fl. W. Pakistan 34: 24. f. 6A. 1973; S. Raghavan in Sharma *et al.*, Fl. India 2: 302. 1993.

Erect, 20-40 cm high, glandular, annual herbs, branched from the base. Leaves subcoriaceous; lower leaves petiolate, 3-foliolate; upper ones sessile, usually 1-foliolate, narrowly lanceolate, 5-25 x 1.5 mm, glandular. Flowers white or pinkish, in lax racemes, small. Sepals ovate, 1-2 x 0.6-0.7 cm. Petals twice as long as the sepals, linear-oblong. Stamens 6; filaments violet. Fruits linear-oblong, straight or slightly curved.

Fl. & Fr.: July - October.

Included after S. Raghavan (*loc. cit.*).

2. *Cleome fimbriata* Vicary in J. Asiat. Soc. Bengal 16: 1158. 1847; Jafri in Fl. W. Pakistan 34: 29. 1973; S. Raghavan in Sharma *et al.*, Fl. India 2: 308. 1993. *C. quinquenervia sensu* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 168. 1872.

Annual or perennial 30-60 cm high, glandular hairy herbs. Stems branched from the base. Leaves simple, suborbicular to broadly ovate-

cordate, 1.5-6 x 1-3.5 cm, apiculate, margins with stout, stalked glandular hairs. Flowers in racemes, yellowish with lilac or purple veins. Bracts ovate foliaceous. Petals dimorphic, two lanceolate, the other two broadly ovate with a crested scale at the junction of limb and claw. Fruits linear-oblong, acute, gynophore absent at both ends, glandular hairy.

Fl. & Fr. : October - November.

Included after S. Raghavan (*loc. cit.*).

3. *Cleome gynandra* L., Sp. Pl. 671. 1753; Sharma & Kachroo, Fl. Jammu 1: 98. 1981; S. Raghavan in Sharma *et al.*, Fl. India 2: 309. 1993. *Gynandropsis pentaphylla* (L.) DC., Prodr. 1: 238. 1824; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 171. 1872. **Fig. 71**

Erect, glandular hairy, annual, herbs. Leaves very variable, 3-7-foliolate; leaflets obovate to elliptic, 1-6 x 0.5-3 cm, acute or slightly acuminate. Flowers white or creamy, rarely pinkish, in corymbose racemes. Sepals 4, ovate to lanceolate, 2-7 mm long, glandular. Petals 4, obovate, 9-20 x 4-10 mm, long clawed. Androphore 1.5-2.5 cm long; stamens usually 10, 1-1.5-2.5 cm long. Gynophore 1.5-2 cm long. Capsules cylindrical or compressed-terete, narrowed at both ends, glandular pubescent, ribbed.

Fl. & Fr. : Major part of the year.

Selected specimens : Rihari. Sharma 15759 (RRL).

4. *Cleome vahliana* Fresen. in Mus. Senck 2: 110. 1837; S. Raghavan in Sharma *et al.*, Fl. India 2: 316. 1993. *C. brachycarpa* Vahl ex DC., Prodr. 1: 240. 1824 *p.p.*; Hook.f., & Thomson in Hook.f., Fl. Brit. India 1: 169. 1872; Sharma & Kachroo, Fl. Jammu 1: 98. 1981.

Fig. 72

Annual or perennial, glandular, viscid herbs, up to 50 cm high. Leaves 3-5-foliolate at base, ternate or simple above; leaflets obovate or oblong 0.3-1.2 x 0.1-0.5 cm, glandular pubescent. Flowers yellow, in racemes, lax. Bracts simple or 3-foliolate. Sepals glandular hairy. Petals glabrous.

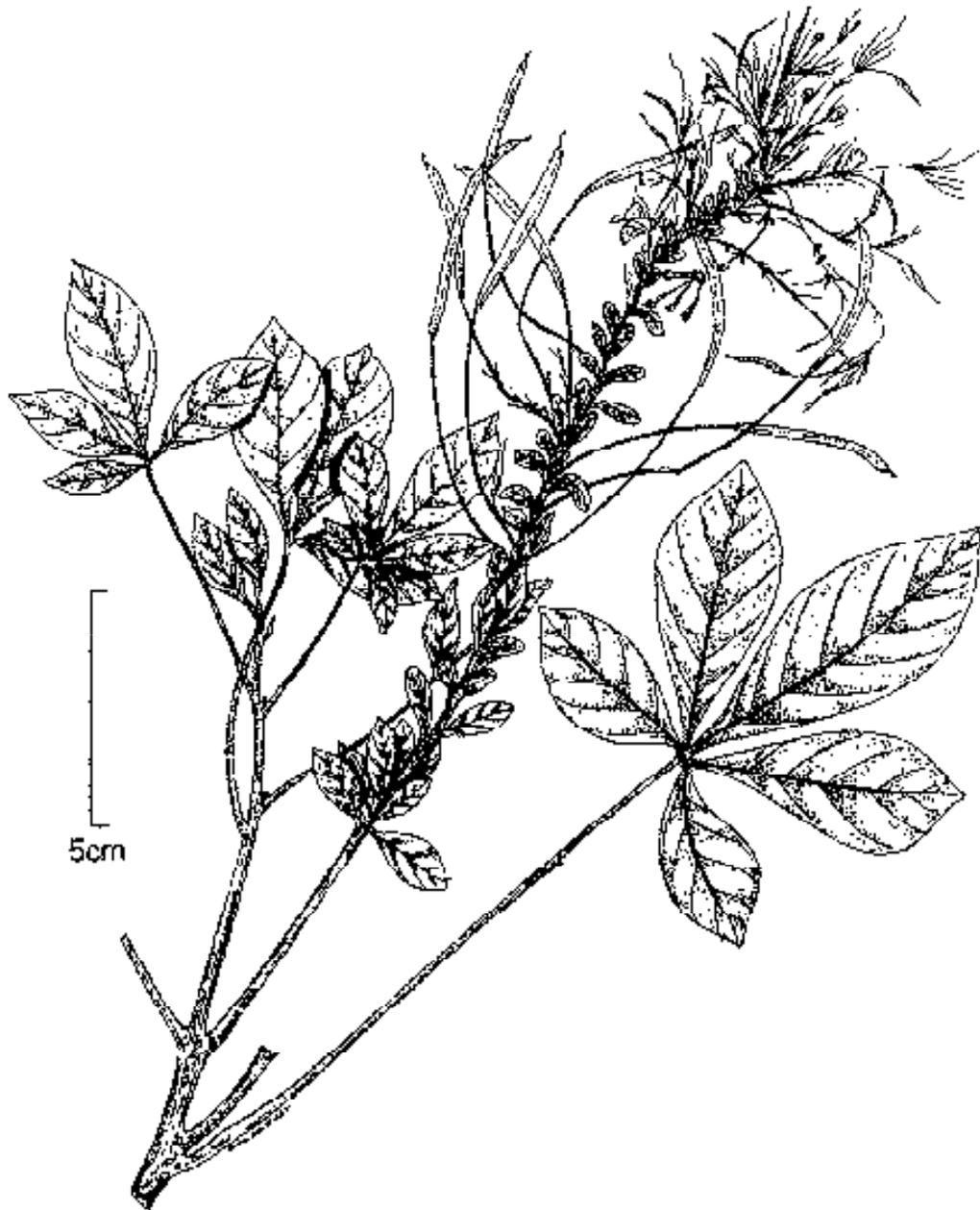


Fig. 71. *Cienme gynandra* L.

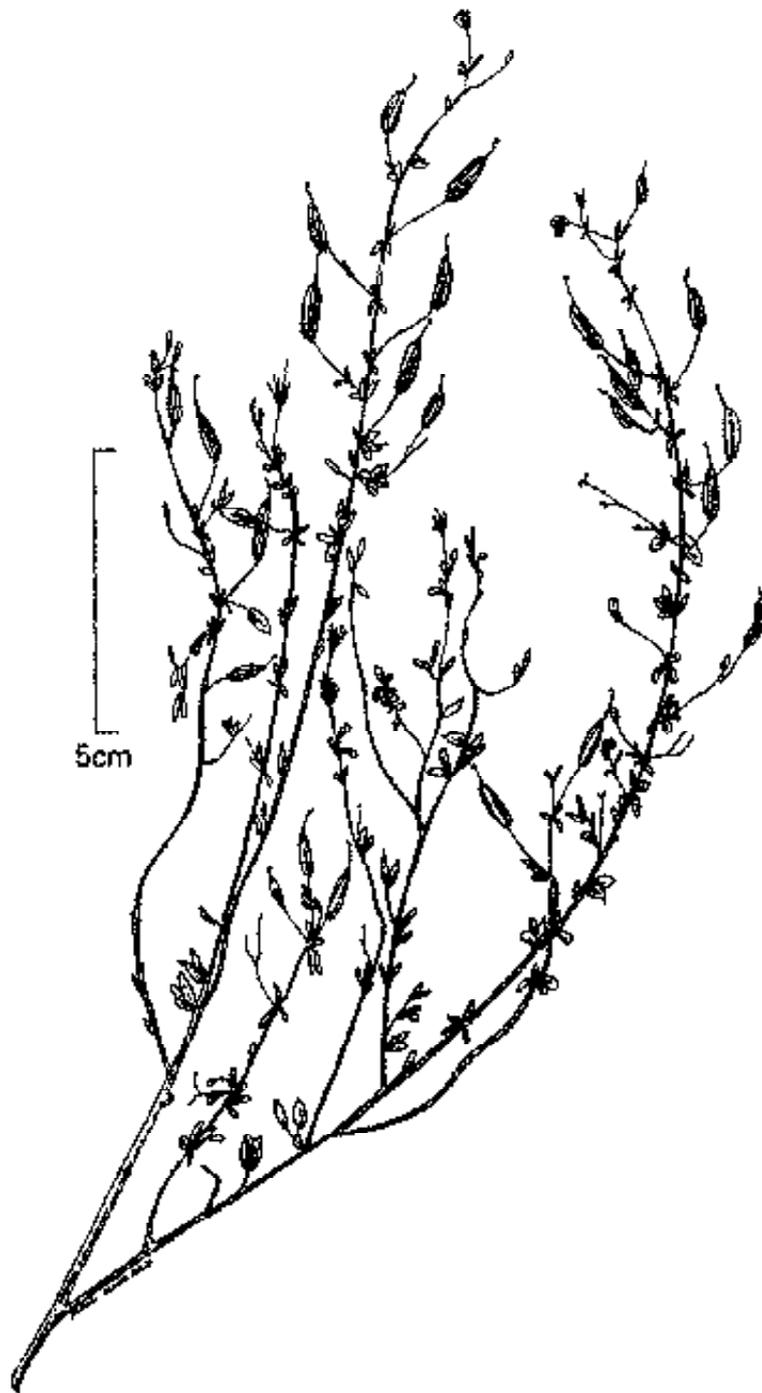


Fig. 72. *Cleome vahliana* Fresen.

with a scale like appendage above the claw. Capsules oblong, inflated, glandular pubescent.

Fl. & Fr. : Fruits : Major part of the year.

Selected specimens : Simbal, Singh 15644 (KRL).

5. *Cleome viscosa* L., Sp. Pl. 672. 1753; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 170. 1872; Sharma & Kachroo, Fl. Jammu 1: 98. 1981; S. Raghavan in Sharma *et al.*, Fl. India 2: 317. 1993.

Foetid, 0.3-1 m tall, viscid, annual herbs. Leaves 3-5 foliolate; leaflets 1.5-6 x 1-3 cm, elliptic or ovate, obovate-cuneate, acute or obtuse, laterally oblique. Flowers yellow in corymbiform leafy racemes. Bracts foliaceous. Sepals glandular hairy outside. Petals glabrous, distinctly veined. Fruits linear-oblong, striate, with a long, glabrous beak.

Fl. & Fr. : Throughout the year.

Commonly found in fields, old walls, road sides and Waste places.

Selected specimens : Salal Hydro electric project area, Uniyal 86652 (BSD); Jaganoo village, Udhampur, Swami 964 (BSD); Ribari, Singh 15755 (RRI).

3. CRTAEVA L.

***Crateva adansonii* DC. subsp. *odora* (Buch.-Ham.) Jacobs** in Blumea 12: 198. 1964; S. Raghavan in Sharma *et al.*, Fl. India 2: 322. 1993. *C. religiosa* Forst. f. var. *roxburghii* (R. Br.) Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 172. 1872. Fig. 73

Deciduous, unarmed trees, up to 15 m tall. Leaves 3-foliate; leaflets elliptic-lanceolate to ovate lanceolate, 5-12 x 2.5-6 cm, acuminate, oblique and cuneate at the base. Flowers greenish-white to yellow, in corymbose racemes, 3-6 cm in diam., appearing before the leaves. Fruits orange-red, globose. Seeds broadly ellipsoid, embedded in yellow pulp.



Fig. 73. *Crateva adansonii* DC. subsp. *odora* (Buch.-Ham.) Jacobs

Fl. & Fr.: April - August.

Selected specimens : Jammu Town, ca 700 m, *Keshavanand* 1 (DD); Jammu, *S.N.S.* 1074.

RESEDACEAE

(R. Mathur)

OLIGOMERIS Cambess.

Oligomeris linifolia (Vahl) Macbr., *Contrib. Gray Herb.* (n.s.) 53: 13. 1918; Sharma & Kachroo, *Fl. Jammu* 1: 99. 1981; Balakrishnan & Premanath in Sharma *et al.*, *Fl. India* 2: 337. 1993. *Reseda linifolia* Vahl in Hornem., *Hort. Hafn.* 2: 501. 1815. *Oligomeris glaucescens* Cambess. in Jacq., *Voy. Bot.* 4: 24. t. 25. 1844; Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 181. 1872. Fig. 74

Annual, glabrous, glaucous herbs, up to 15 cm high, branched from the base. Stems ribbed. Leaves clustered, narrowly linear; 1.5-7.5 x 1-3 cm; stipules minute, subulate. Flowers greenish white, in dense terminal spikes. Bracts connate at base. Sepals 2-4, connate at base. Petals 2, connate up to half or free. Fruits subglobose, deeply 4-lobed.

Fl. & Fr. : January - March.

In wasteland and moist places.

Included after Sharma & Kachroo (*loc. cit.*).

VIOLACEAE

(R. Mathur & U. Choudhary)

VIOLA L.

- 1a. Stipules pinnatifid or palmatifid. Style expanded and globose at top ...16. *V. tricolor*
 1b. Stipules entire or fimbriate. Style not globose at top :

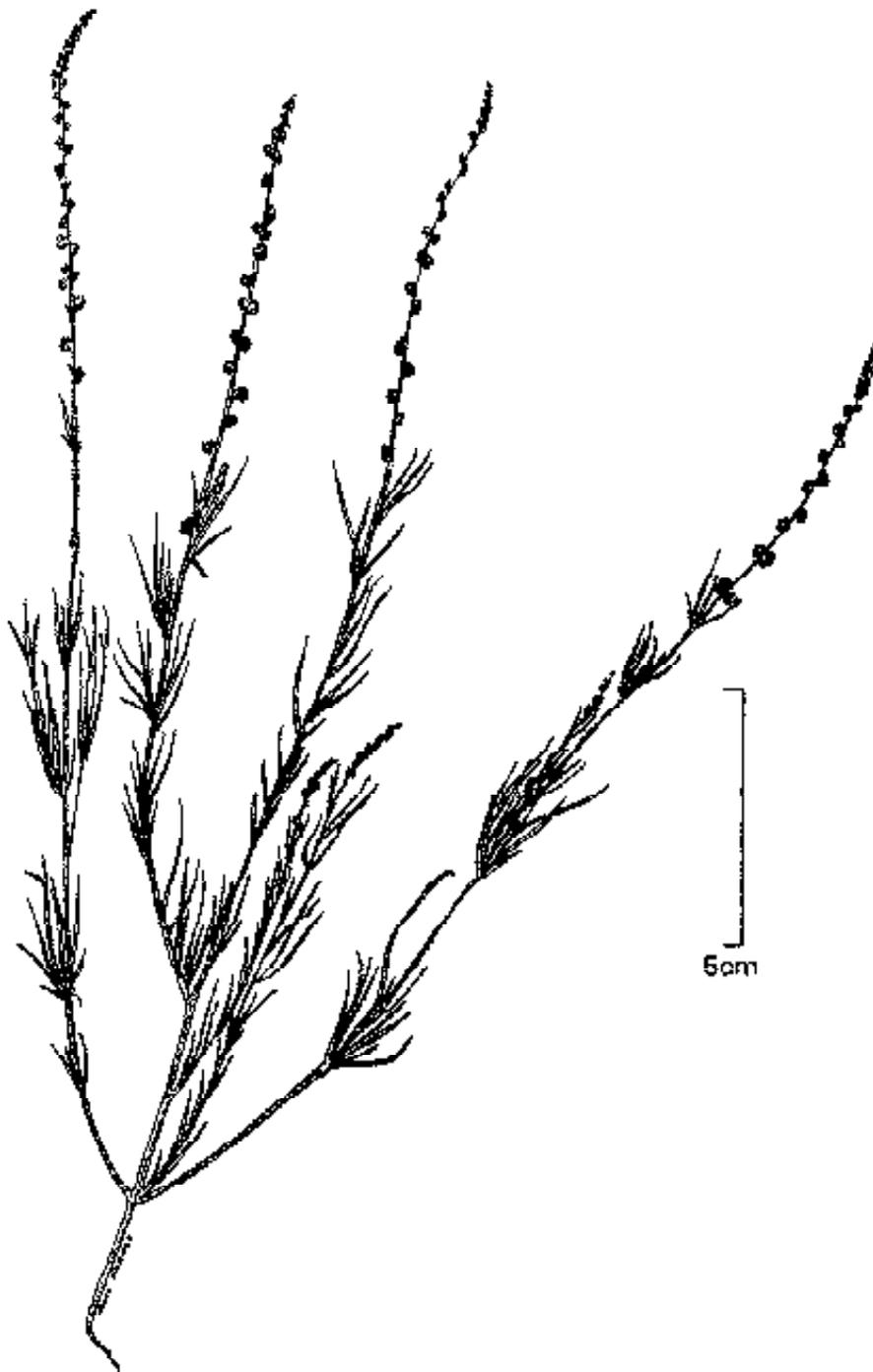


Fig. 74. *Oligomeris linifolia* (Vahl) Macbr.

- 2a. Flowers yellow. Stigma without beak ...2. *V. biflora*
- 2b. Flowers not yellow. Stigma beaked :
- 3a. Plants without superterranean stems or stolons. Stipules more or less adnate to petioles :
- 4a. Leaves deltoid or deltoid-ovate, acute, truncate or shallowly cordate at base ...1. *V. betonicifolia*
- 4b. Leaves ovate-oblong-orbicular, often obtuse at tip, deeply cordate at base :
- 5a. Sepals linear-lanceolate, acute-acuminate ...5. *V. fedtschenkoana*
- 5b. Sepals ovate, ovate-lanceolate, obtuse ...9. *V. kunawarensis*
- 3b. Plants with superterranean, decumbent or ascending stems or stolons. Stipules free from petioles :
- 6a. Stipules entire or with a few short teeth. Style with 2 laterally patent lobes at top :
- 7a. Leaves cordate-reniform; petioles not or scarcely winged ...6. *V. hamiltoniana*
- 7b. Leaves elliptic-ovate to oblanceolate; petioles conspicuously winged...4. *V. cinerea* var. *stocksii*
- 6b. Stipules fimbriate or with long acute teeth. Style without laterally patent lobes :
- 8a. Stipules foliaceous :
- 9a. Stipules up to 3.5 cm long, gland dotted ...8. *V. jordanii* var. *falconeri*
- 9b. Stipules up to 1 cm long, fimbriate...15. *V. sylvatica*
- 8b. Stipules not foliaceous :
- 10a. Leaves weakly cordate at base ...13. *V. rupestris*
- 10b. Leaves deeply cordate at base :
- 11a. Style decurved, not thickened upwards :
- 12a. Sepals acute. Stipules ciliate ...7. *V. indica*
- 12b. Sepals obtuse. Stipules glandular toothed ...10. *V. odorata*

- 11b. Styles erect, thickened upwards :
- 13a. Peduncles bracteolate above the middle
 ...12. *V. reichenbachiana*
- 13b. Peduncles bracteolate at the middle
 or below :
- 14a. Sepals obtuse. Lateral petals not hairy
 ...14. *V. suavis*
- 14b. Sepals acute; lateral petals bearded
 at base :
- 15a. Leaves canescent, obtuse ...3. *V. canescens*
- 15b. Leaves not cauescent, acute
 acuminate ...11. *V. pilosa*

1. *Viola betonicifolia* J. Smith in Rees, Cyclop. 37(1): Viola n. 7. 1817; Sharma & Jamwal, Fl. Upper Liddar valley. 1: 116. 1988; Banerjee & Pramanik in Sharma *et al.*, Fl. India 2: 355. 1993. *V. patrinii sensu* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 183. 1872, *p.p.*

Perennial, acaulescent herbs, up to 20 cm high. Leaves in rosette, ovate-oblong, linear-lanceolate to trigonular-hastate-triangular ovate, 1.5-8 x 0.5-2.5 cm, glabrous; petioles 2.5-10 cm long, winged above; stipules ovate-lanceolate, short fimbriate. Flowers white to purple with dark veins. Lateral petals usually bearded at base; spur cylindrical. Styles geniculate at base, clavate above. Capsules ellipsoid to oblong, glabrous.

- 1a. Leaves linear-lanceolate to triangular-ovate ...1.1. subsp. *betonicifolia*
 b. Leaves ovate-oblong to broadly lanceolate ...1.2. subsp. *jaunsarensis*

1.1. subsp. *betonicifolia*

Fl. & Fr. : May July.

Selected specimens : Ladakh, Dras-kargil Road, 3300 m, *Wadhwa* 58764 (BSD); Kashmir, Banihal mountains (facing Banihal valley), 1850-3835 m, *T.A. Rao* 7538 (BSD); Kashmir, Pahalgam, Liddar valley, *Inayat* 25520 (DD).

1.2. subsp. **jaunsarensis** (W. Beck.) Hara in J. Jap. Bot. 49 (5): 133, 1974; Banerjee & Pramanik in Sharma *et al.*, Flora India 2: 357, 1993.

Included after Banerjee & Pramanik (*loc. cit.*)

2. **Viola biflora** L., Sp. Pl. 2: 936, 1753; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 182, 1872; Singh & Kachroo, For. Fl. Srinagar 159, 1987; Banerjee & Pramanik in Sharma *et al.*, Fl. India 2: 357, 1993.

Erect or decumbent, glabrous or pubescent, 6-30 cm high herbs. Leaves reniform, 1.5-7.5 x 1-4 cm, crenate, pubescent; petioles up to 10 cm long; stipules ovate or oblong, denticulate. Peduncles up to 10 cm long. Flowers yellow, with brownish purple veins, solitary. Style geniculate at base, clavate distally. Capsules ovoid-oblong, ellipsoid.

Fl. & Fr. : April - October.

Selected specimens : Apharwat, 4000 m, T.A. Rao 479; Thajwas mountains, 3800 m, T.A. Rao 9558 (BSD); Ladakh, Pulu, 4560 m, Wadhwa 89718 (BSD); Kashmir, Yusmaidan, 2300 m, Thapliyal & Raizada 26470 (DD).

3. **Viola canescens** Wallich in Roxb., Fl. Ind. 2: 450, 1824; Sharma & Kachroo, Fl. Jammu 1: 100, 1981. Banerjee & Pramanik in Sharma *et al.*, Flora India 2: 359, 1993. *V. serpens* Wallich var. *canescens* (Wallich) Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 184, 1872. **Fig. 75**

Acaulescent, prostrate, stoloniferous herbs. Leaves reniform to ovate-cordate, 1.5-4.5 x 1.5-5 cm, obtuse, serrate, canescent above; stipules lanceolate, deeply fimbriate. Flowers pale-violet, on peduncles. Sepals pubescent, trinerved. Petals obovate, up to 1.2-5 cm. Styles clavate; stigma truncate, oblique. Capsules subglobose, pubescent.

Fl. & Fr. : March - June.

Selected specimens : Doda, towards North, Naithani 82717 (BSD); Domel, Singh, 15781 (RRL).

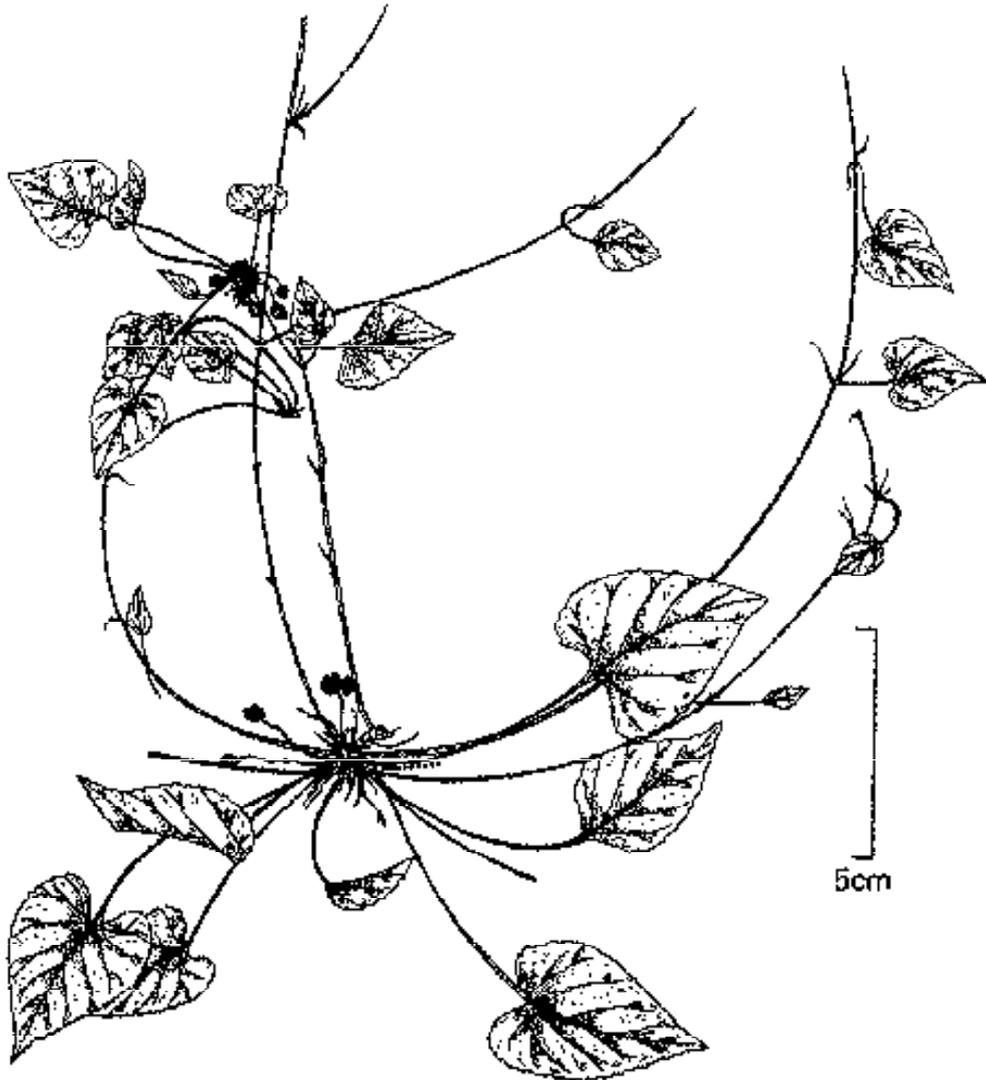


Fig. 75. *Viola canescens* Wallich

4. *Viola cinerea* Boiss. var. *stocksii* (Boiss.) W. Beck. in Beih. Bot. Centralbl. 2: 36: 37. 1918; Banerjee & Pramanik in Sharma *et al.*, Fl. India 2: 360. 1993. *V. cinerea sensu* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 185. 1872; Sharma & Kachroo, Fl. Jammu 1: 100. 1981.

Annual, small, glabrous herbs. Stems short, diffuse, branched. Leaves ovate, oblong-ovate, elliptic lanceolate to almost spatulate; 1-3.5 x .5-1.1 cm, stipules subulate, usually denticulate fimbriate. Flowers pale violet or white. Style clavate, compressed; stigma lateral, consisting of two oblong, parallel discs. Capsules cylindrical. 4-6 mm long, acute.

Fl. & Fr.: April - October.

Selected specimens : J. & K. : Nagrota, Singh 15774 (RRL).

5. *Viola fedtschenkoana* W. Beck. in O. Fedtsch., Fl. Az. Ross. 8: 31. 1915; Banerjee & Pramanik in Sharma *et al.*, Fl. India 2: 361. 1993.

Rhizomatous, decumbent herbs. Leaves ovate, cordate, 1.5-3 x 1.2-2.5 cm, subentire, glandular pubescent; stipules ovate-lanceolate, more or less fimbriate, glandular ciliate. Flowers pale violet, on ca 8 cm long peduncles; peduncles 2-bracteolate above. Sepals 7-15 mm long. Petals obovate-oblong, up to 15 mm long; lateral petals bearded at the base. Style swollen, hooked above.

1a. Peduncles 2-bracteolate a little above middle.

Styles papillose hairy ...5.1. var. *fedtschenkoana*

1b. Peduncles 2-bracteolate near the tip.

Styles not papillose hairy ...5.2. var. *nutzaffurabadensis*

5.1. var. *fedtschenkoana*

Fl. & Fr. : May - July.

Selected specimen : Seshnag, 3800 m, Nair 36954 (BSD); Agharwat, 4000 m, T.A. Rao 9640 (BSD).

5.2. var. **muzaffarabadensis** W. Beck. in Beih. Bot. Centralbl. 2: 40: 497. 1923; Banerjee & Pramanik in Sharma *et al.*, Fl. India 2: 362. 1993.

Fl. & Fr. : July - August.

Included after Banerjee & Pramanik (*loc. cit.*).

6. **Viola hamiltoniana** D. Don, Prodr. Fl. Nepal. 206. 1825; Banerjee & Pramanik in Sharma *et al.*, Fl. India 2: 363. 1993. *V. distans* Wallich in Trans. Med. Phys. Soc. Calc. 7: 227. 1835; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 183. 1872. *V. distans* var. *acaulis* Hook.f. & Thomson in Hook.f., Fl. Brit. India 2: 184. 1872; Blatter, Beaut. Fls. Kashmir 1: 45. 1927.

Annual, glabrous, stoloniferous, trailing herbs. Stems up to 28 cm long. Leaves variable, ovate or reniform, cordate, acute, crenate-serrate; stipules entire or fimbriate. Flowers pale-lilac or blue; pedunculate. Stigma obscurely 3-lobed. Capsules linear-oblong.

Fl. & Fr. : Throughout the year.

Edges of forests in grasslands and roadsides, 1000-2500 m.

Included after Blatter (*loc. cit.*).

7. **Viola indica** W. Beck. in Beih. Bot. Centralbl. 2, 20: 126. 1906; Banerjee & Pramanik in Sharma *et al.*, Fl. India 2: 366. 1993.

Stoloniferous herbs. Rootstocks densely articulated. Leaves ovate or ovate-oblong, 2-6 x 1.5-4 cm, crenate-serrate, subacuminate; stipules ovate-lanceolate, acute, ciliate. Flowers lilac, sweet scented. Sepals lanceolate, glabrous. Petals obovate-oblong; lateral petals smooth; spur bearded. Stigma shortly beaked.

Fl. & Fr. : February - June.

Included after Banerjee & Pramanik (*loc. cit.*).

8. *Viola jordani* Harry var. *falconeri* (Hook.f. & Thomson) W. Beck. in *Beih. Bot. Centralbl.* 2. 34: 380. 1917; Banerjee & Pramanik in Sharma *et al.*, *Fl. India* 2: 366. 1993. *V. falconeri* Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 185. 1872. **Fig. 76**

Annual, erect herbs. Stems up to 30 cm, with long internodes. Leaves ovate-cordate, 2-4.5 x 3-6.5 cm, broadly crenate, obtuse, gland dotted; stipules foliaceous, smaller below, gland dotted. Flowers blue with white marking in throat. Peduncles 5-7 cm long, bi-bracteolate above the middle. Sepals subulate-lanceolate. Petals orbicular-obovate. Styles inflated above; stigma decurved, oblique. Capsules glabrous, apiculate.

Fl. & Fr. : May - October.

Selected specimens : Aharbal, 2000m, T.A. Rao 9243 (BSD).

9. *Viola kunawarensis* Royle, *Illus. Bot. Himal.* 74. t. 18.f. 3. 1839; Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 185. 1872; Banerjee & Pramanik, in Sharma *et al.*, *Fl. India* 2: 367. 1993. *Leomentok*.

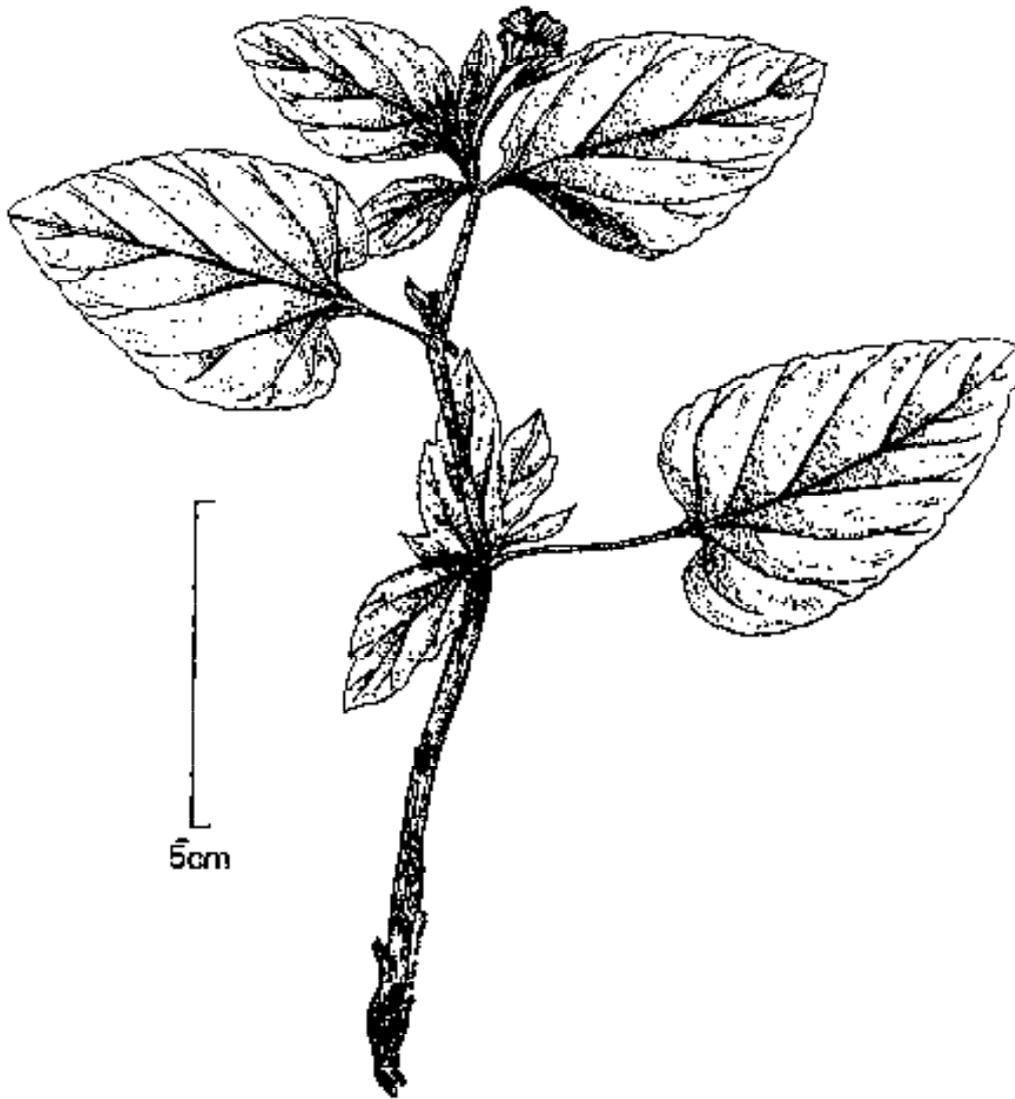
Fig. 77

Dwarf, acaulescent, glabrous herbs, up to 7 cm long. Rootstocks slender; stolons absent. Leaves tufted, oblong, obtuse 1.2 x 0.5-1 cm, subentire, cuneate; petioles shortly glandulose fimbriate. Flowers purple, on ca 8 cm long peduncles; peduncles bibracteolate at middle. Sepals and petals obovate-oblong, ca 10 mm long; spur short, obtuse. Style clavate, shortly incurved; stigma minutely beaked or not. Capsules elliptic, acute, glabrous.

Fl. & Fr. : May - September.

Selected specimens : Ladakh, Whisky Nallah, Rupshu (South), 4000 m, Bhattacharyya 40928 (BSD).

10. *Viola odorata* L., *Sp. Pl.* 934. 1753; Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 184. 1872; Sharma & Jamwal, *Fl. Upper Liddar valley*, 1: 115. 1988; Banerjee & Pramanik in Sharma *et al.*, *Fl. India* 2: 369. 1993. *Bunufsha*.



**Fig. 76. *Viola jordanii* Harry var. *falconeri*
(Hook.f. & Thomson) W. Beck.**



Fig. 77. *Viola kunawarensis* Royle

Small, erect, caulescent herbs. Rootstock stout, articulated; stolons 15-20 cm long, rooting at tips, slender. Leaves broadly ovate-cordate, 1.5-3.5 x 2-4 cm, obtuse, crenate; stipules lanceolate, subulate, glandular toothed. Flowers violet, white tinged, sweet scented, on 4-10 cm long, bibracteolate peduncles. Petals obovate-orbicular; spur cylindrical, obtuse, ca 4.5 mm long. Style hooked. Capsules globose, hirsute.

Fl. & Fr. : March August.

Selected specimen : Bhaironghati, Kapoor, 16595 (RRL).

11. *Viola pilosa* Blume, Cat. Gew. Buitenz 57. 1823; Sharma & Jamwal, Fl. Upper Liddar valley. 1: 115. 1988; Banerjee & Pramanik in Sharma *et al.*, Fl. India 2: 371. 1993. *V. serpens* Wallich ex Ging. in DC., Prodr. 1: 296. 1824; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 184. 1872.

Stoloniferous, prostrate herbs. Stems long, leafy. Leaves ovate to deltoid, 1.5-8 x 1-6 cm, serrate; stipules ovate-acuminate, subentire to dentate. Flowers white or pale-violet, on 2-8 cm long, pilose peduncles. Sepals linear-lanceolate. Petals obovate-oblong; lateral petals bearded at base. Styles subclavate, shortly beaked. Capsules ellipsoid.

Fl. & Fr.: March July.

Selected specimens : Jhelum valley, Hamal forest, 2100-2400 m, Keshavanand 165; Jammu, Chineni forest, 2200 m, Keshavanand 21 (DD).

12. *Viola reichenbachiana* Jord. ex Boreau, Fl. Centr. France, ed. 3. 2: 78. 1857; Banerjee & Pramanik in Sharma *et al.*, Fl. India 2: 373. 1993.

Annual, caulescent herbs. Rootstock articulated. Leaves in basal rosette, ovate or ovate-oblong, 1.5-3 x 1.5-2 cm, crenate, obtuse; stipules linear-lanceolate, fimbriate. Flowers violet, on 4.5-5 cm long peduncles. Sepals lanceolate, acute. Petals obovate-oblong. Lower two stamens spurred. Style clavate; stigma beaked. Capsules ovate, acute.

Included after Banerjee & Pramanik (*loc. cit.*).

13. *Viola rupestris* F. W. Schmidt in Neue Abh. Bohm. Ges. 1: 60. 1791; Sharma & Jamwal, Fl. Upper Liddar valley, 1: 116. 1988; Banerjee & Pramanik in Sharma *et al.*, Fl. India 2: 373. 1993.

Annual, caulescent, grey papillose hairy or glabrous, up to 4 cm long herbs. Leaves ovate-orbicular to rotundate-ovate, 1-1.2 x 0.5-2.5 cm, obtuse, crenate, glandular punctate, pilose; stipules lanceolate, more or less lobed at apex. Flowers violet or purplish-white, on *ca* 4.5-5 cm long peduncles; peduncles bibracteolate near apex. Sepals oblong-lanceolate, acute. Petals obovate-oblong. Style clavate; stigma beaked. Capsules elliptic-oblong, acute, hairy.

- 1a. Plants almost glabrous. Leaves deeply cordate
at base ...13.1. var. *himalayensis*
1b. Plants grey papillose hairy. Leaves slightly
cordate at base ...13.2. var. *rupestris*

13.1. var. *himalayensis* (Beck.) Banerjee & Pramanik in Fasc. Fl. India 12: 33, 34. 1983 *et in* Sharma *et al.*, Fl. India 2: 374. 1993. *V. himalayensis* Beck. in Fedde, Rep. Sp. nov. 17: 72. 1921.

Fl. & Fr. : Not known.

Included after Banerjee & Pramanik (*loc. cit.*).

13.2. var. *rupestris*

Fl. & Fr. : April - August.

Included after Banerjee & Pramanik (*loc. cit.*).

14. *Viola suavis* M. Bieb., Fl. Taur.-Cauc. 3: 164. 1819; Banerjee & Pramanik in Sharma *et al.*, Fl. India 2: 376. 1993.

Rhizomatous, acaulescent, glabrous herbs. Rootstock densely articulated. Leaves ovate or ovate-oblong, 1.5 x 1.2-3 cm, rotundate,

crenate, hispid on the lower surface especially on the nerves; stipules lanceolate, glandulose fimbriate to ciliate. Flowers purple with white centre. Stigma beaked. Capsules globose, adpressed pubescent.

Fl. & Fr. : March April.

Included after Banerjee & Pramanik (*loc. cit.*).

15. *Viola sylvatica* Fries ex Hartm.f. in Bot. Notiser 81. 1841; Banerjee & Pramanik in Sharma *et al.*, Fl. India 2: 376. 1993. *V. canina* L. var. *sylvatica* (Fries ex Hartm.f.) Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 185. 1872; Singh & Kachroo, For. Fl. Srinagar 150. 1987.

Annual, caulescent, small herbs. Stems many from the base. Leaves ovate-orbicular, 1.5-4.5 x 1.5-3.5, crenate-serrate, glabrous; stipules foliaceous, fimbriate. Flowers violet, *ca* 2 cm in diam., on 2.5-7.5 cm long peduncles. Sepals lanceolate, acute. Petals orbicular-obovate; spur *ca* 7.5 mm long. Style inflated above; stigma decurved. Capsules ovate, acute, glabrous.

Fl. & Fr. : June September.

Selected specimens : Kashmir, Seshnag, 3600 m, *Nair* 36954 (BSD); Narda range, Kishanganga valley, *Keshavanand* 798 (DD); Gulmarg 2400-2700 m, *Duthie* 11264 (DD).

16. *Viola tricolor* L., Sp. Pl. 935. 1753; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 182. 1872; Banerjee & Pramanik in Sharma *et al.*, Fl. India 2: 377. 1993.

Annual, 15-25 cm high, caulescent, glabrous to pubescent, diffusely branched herbs. Leaves both radical and cauline, variable, 1.5-4 x 0.5-1.5 cm; basal leaves ovate-subcordate; cauline leaves obovate-oblong or lanceolate, obtuse, dentate; petioles winged above; stipules up to 2.5 mm. Flowers violet, purplish or greenish yellow, on *ca* 6 cm long, bibracteolate peduncles. Sepals subulate mucronate. Petals orbicular-obovate; lateral petals bearded at the base; spur *ca* 5 mm long. Style geniculate at base; stigma hairy, laterally beaked. Capsules ovate, acute.

Fl. & Fr. : February June.

Cultivated in Indian gardens.

FLACOURTIACEAE

(R. Mathur)

- 1a. Plants unarmed. Flowers bisexual. Fruits capsular, globose
or ovoid or ellipsoid ...1. *Casearia*
- 1b. Plants armed. Flowers unisexual. Fruits berry like :
- 2a. Leaves ovate or orbicular, pubescent ...2. *Flacourtia*
- 2b. Leaves elliptic-oblong to lanceolate, glabrous ...3. *Xylocarpus*

I. CASEARIA Jacq.

- 1a. Leaves oblong-ovate-lanceolate, tomentose ...2. *C. tomentosa*
- 1b. Leaves broadly elliptic-oblong, glabrous ...1. *C. graveolens*

1. *Casearia graveolens* Dalz., in Kew J. Bot. 4: 107. 1852; C.B. Clarke in Hook.f., Fl. Brit. India 2: 592. 1879; Stewart in Nasir & Ali, Annot. Cat. Vas. Pl. W. Pak. & Kashmir 494. 1972; Mitra in Sharma *et al.*, Fl. India 2: 394. 1993.

Shrubs or trees, deciduous. Leaves broadly elliptic to elliptic-oblong, up to 20 x 12.5 cm, obtuse to short acuminate, crenate. Flowers greenish in axillary fascicles. Sepals pubescent at base, glabrous above. Stamens 10-12, alternating with the staminodes. Styles short; stigma capitate. Capsules orange yellow when mature, ellipsoid-oblong.

Fl. & Fr. : March July.

Included after Stewart (*loc. cit.*).

2. *Casearia tomentosa* Roxb., Fl. Ind. 2: 421. 1824; C.B. Clarke in Hook.f., Fl. Brit. India 2: 593. 1879; Sharma & Kachroo, Fl. Jammu 1: 101. 1981; Mitra in Sharma *et al.*, Fl. India 2: 397. 1993. *Casearia elliptica* Willd., Sp. Pl. 2: 628. 1799.

Unarmed shrubs or trees reaching up to 6 m. Leaves 7-10 x 3-6.5 cm, ovate to lanceolate, subcoriaceous, tomentose, crenate-serrate. Flowers greenish-yellow, in dense axillary fascicles. Stigma discoid. Capsules red, ellipsoid, many seeded.

Fl. & Fr. : March - May.

Selected specimens : Udampur, Reasi, *Swami* 1094 (BSD); Janglote, *Hajra* 82495; Near Samba, *Hajra* 82451 (BSD); Rasayan Gufa, *Kapoor* 16475 (RRL).

2. FLACOURTIA Commers ex L.'Herit

Flacourtia indica (Burm.) Merrill, *Interpr. Rumph. Herb. Amb.* 377. 1917; Sharma & Kachroo, *Fl. Jammu* 1: 101. 1981; Mitra in Sharma *et al.*, *Fl. India* 2: 402. 1993. *Gmelina indica* Burm., *Fl. Ind.* 132. t. 39, f. 5. 1768. *Flacourtia sepiaria* Roxb., *Pl. Corom.* 1: 48. t. 68. 1796; Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 194. 1875. *Kangu*.

Fig. 78

Armed, deciduous, dioecious shrubs or small trees, up to 15 m tall. Leaves very variable, ovate, oblong to orbicular, up to 6 cm long, acute or subobtuse, crenate to serrate. Male flowers yellowish green, in clusters on short, branched racemes. Female flowers yellowish green, solitary or 2, on short, villous branches. Fruits dark purple or red on maturity, ellipsoid-globose.

Fl. & Fr. : March - April.

Selected specimens : Udampur, Ramnagar, *Swami* 974 (BSD); Reasi, 1800 A. *Badhwar* 1100 (RRL).

3. XYLOSMA Forst.f.

Xylosma longifolium Clos. in *Ann. Soc. Nat.* 4. 8: 231. 1857; Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 194. 1872; Sharma & Kachroo, *Fl. Jammu* 1: 102. 1981; Mitra in Sharma *et al.*, *Fl. India* 2: 436. 1993.

Fig. 79

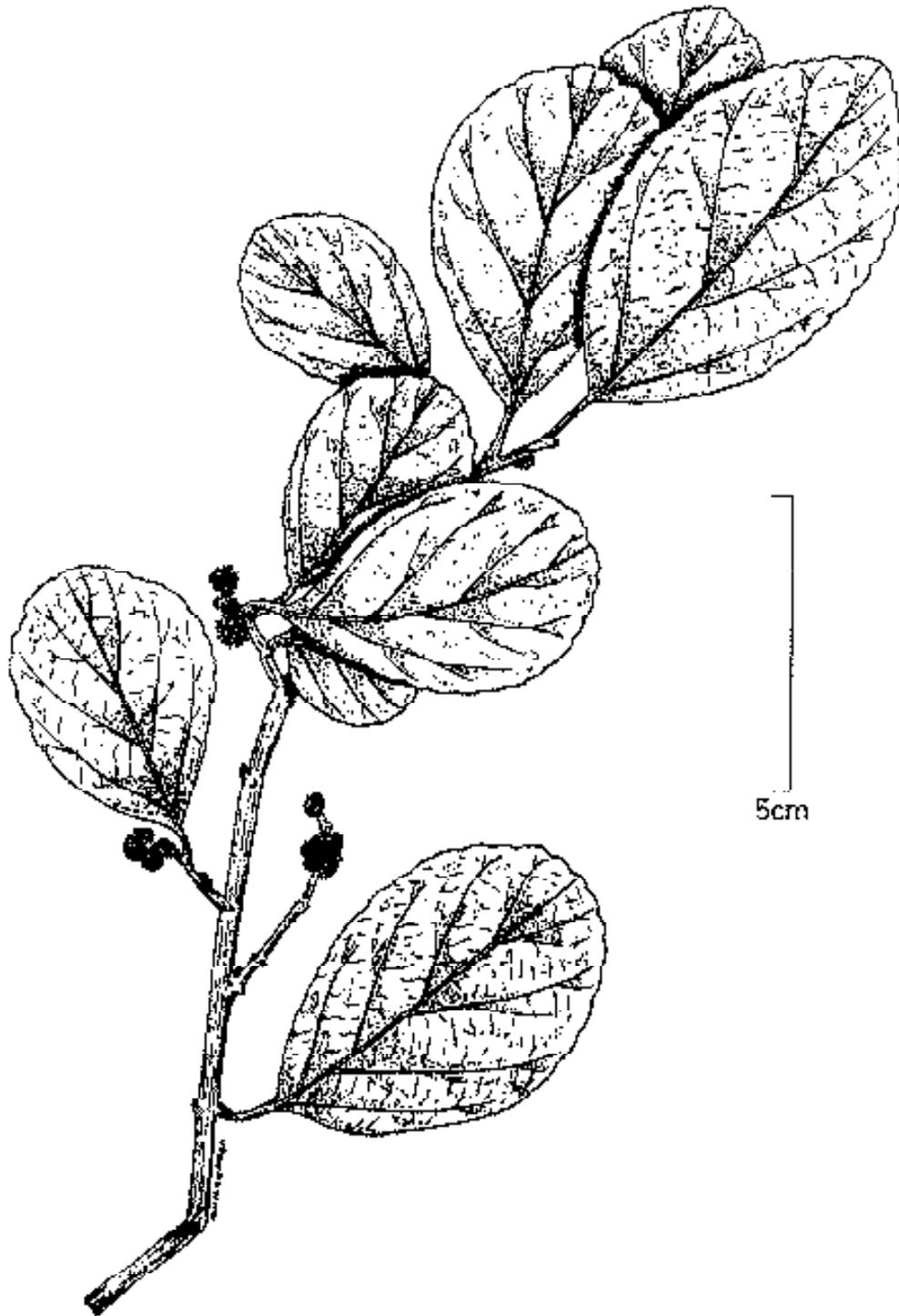


Fig. 78. *Flacourtia indica* (Burm.) Merrill



Fig. 79. *Xylosma longifolium* Clos.

Medium sized, evergreen trees, armed when young. Leaves elliptic-oblong to lanceolate, 5-12 cm long, acute to shortly acuminate, serrate coriaceous. Flowers greenish yellow, clustered on short, branched racemes. *Male flowers* : 4-6. *Female flowers* : pedicels pubescent. Sepals 4-6, imbricate. Petals 0. Style short; stigma lobed. Fruits red on maturity, turning black on drying, globose.

Fl. & Fr. : October February.

Selected specimens : Udhampur, Swami 1162 (BSD); Padunala-Painal, Hajra 82358 (BSD).

PITTOSPORACEAE

(R. Mathur & U. Choudhary)

PITTOSPORUM Banks ex Solander

Pittosporum napaulense (DC.) Rehder & Wilson, Pl. Wilson, 3: 326. 1916; Sharma & Kachroo, Fl. Jammu 1: 102. 1981; Nayar & Giri in Sharma *et al.*, Fl. India 2: 445. 1993. *Senecia napaulensis* DC., Prodr. 1: 347. 1824. *Pittosporum floribundum* Wight & Arn., Prodr. 154. 1834; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 199. 1872.

Shrubs or small trees. Leaves lanceolate to oblong-lanceolate, acute to acuminate, 4.5-20 x 2-6 cm, entire or slightly wavy, coriaceous, glabrous. Flowers in terminal corymbs. Sepals broadly ovate or oblong, 1.5-2.5 cm long, ciliate. Petals narrowly oblong, obtuse. Stamens 5; filaments ca 3 mm long. Capsules 6-7.5 mm in diam., globose, 4-8-seeded.

Fl. & Fr. : February December.

Included after Sharma & Kachroo (*loc. cit.*)

POLYGALACEAE

(R. Mathur)

POLYGALA L.

1a. Sepals falling off after flowering :

2a. Keel petal split at apex, not crested. Capsules

bipapillate at apex

...10. *P. ratarinowii*

- 2b. Keel petal entire, crested. Capsule not bipapillate
at apex ...5. *P. furcata*
- 1b. Sepals (atleast wing sepals) persistent :
- 3a. Wing sepals broader below the middle ...2. *P. arvensis*
- 3b. Wing sepals broader above the middle :
- 4a. Wing sepals falcate, acute. Middle lobe of
petals rounded ...9. *P. sibirica*
- 4b. Wing sepals not falcate, if falcate then obtuse.
Middle lobe of petals acute :
- 5a. Capsules glabrous :
- 6a. Stems angular, deeply furrowed. Flowers
dense in racemes ...7. *P. longifolia*
- 6b. Stems terete. Flowers lax in racemes :
- 7a. Stems with conspicuous cicatrices of fallen
leaves. Bracts and sepals hairy. Lateral petals
equal to or exceeding the keel petal ...6. *P. irregularis*
- 7b. Stems without such cicatrices. Bracts and
sepals glabrous. Lateral petals shorter than
the keel petal ...1. *P. abyssinica*
- 5b. Capsules ciliate along margins or
hispid-puberulous :
- 8a. Stems and racemes dichotomously
branched above. Wing sepals
emucronate ...8. *P. persicariifolia*
- 8b. Stems and racemes not as
above. Wing sepals mucronate :
- 9a. Leaves recurved on margins.
Wing sepals hyaline along
margins ...4. *P. erioptera*
- 9b. Leaves not recurved on
margins. Wing sepals
without hyaline margins ...3. *P. crotalarioides*

1. *Polygala abyssinica* Fresen. in Mus. Senck. 2: 273. 1837; Bennett in Hook.f., Fl. Brit. India 1: 202. 1872; Sharma & Kachroo, Fl. Jammu 1: 103. 1981; R.N. Banerjee in Sharma *et al.*, Fl. India 2: 456. 1993.

Fig. 80

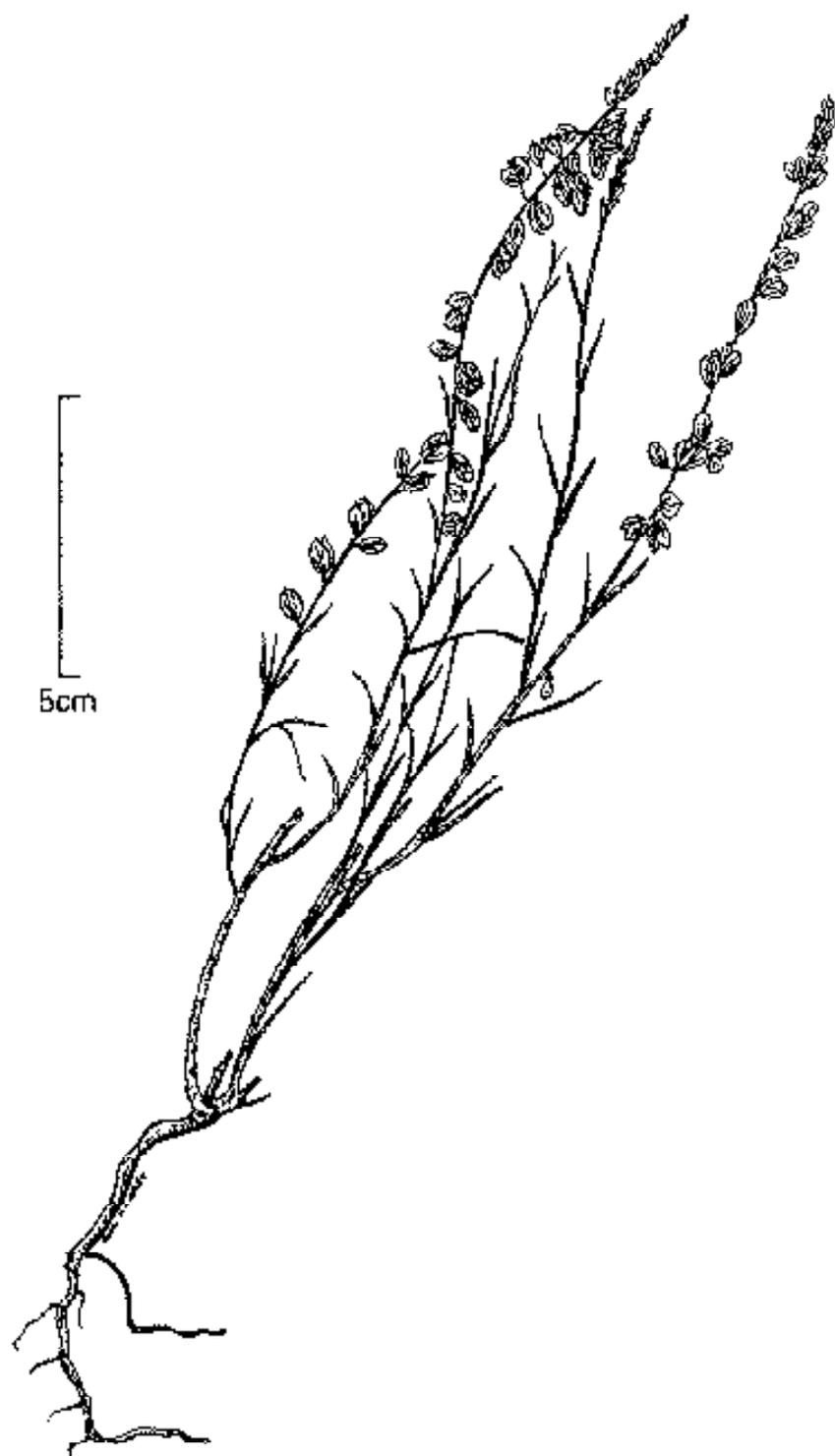


Fig. 80. *Polygala abyssinica* Fresen.

Perennial, glabrescent, suffruticose herbs, up to 45 cm high. Stems many from the base. Leaves obovate, oblong or linear-lanceolate, 6-20 x 0.5-3 mm, acute-acuminate, sessile; lower leaves smaller, obovate or oblong. Flowers in terminal, lax racemes. Sepals persistent, glabrous, in two rows; outer sepals unequal, narrowly hyaline margined; inner sepals obovate-slightly oblique, 4-4.5 x 3-3.5 mm, 3-nerved. Middle lobe of petals purple or pink, with tubercled crest. Capsules obovate, emarginate, winged.

Fl. & Fr. : March - September.

Usually in rocky places.

Selected specimens : Chenab valley, Batote, 1200-1700 m, *T.A. Rao* 7359; Kistawar/Makalkota, 1000-1600 m, *T.A. Rao* 7819 (BSD); Jammu, below Patni-Top, 1800 m, *Bhattacharyya* 71105 (BSD); Sunderbani-Naushera, *Uniyal* 92882 (BSD).

2. *Polygala arvensis* Willd., Sp. Pl. 3(2): 876. 1803; R.N. Banerjee in *Sharma et al.*, Fl. India 2: 460. 1993; Swami & Gupta, Fl. Udhampur 62. 1998. *P. chinensis auct. non* L., 1753; Bennett in Hook.f., Fl. Brit. India 1: 204. 1872, p.p.

Annual, procumbent, pubescent herbs. Stems 6-25 cm long. Leaves obovate, linear-lanceolate, elliptic or linear, 4-6.5 x 1-7 mm, mucronate, recurved. Flowers in axillary racemes. Sepals persistent, in two rows; outer sepals subequal, acute to acuminate, glabrous with broad membranous margins; inner sepals ovate-elliptic, ciliate at the apex, 3-4-nerved. Petals yellow, longer than the keel; middle lobe keeled, auricled at the base, with a crest of multifid or notched appendages. Capsules oblong-orbicular, emarginate, glabrous, winged.

Fl. & Fr. : August - November.

Selected specimens : Udhampur to Jammu, *Rao* 63693 (BSD); Basoli, *Hajra* 82590 (BSD); Bhamla-Akhnoor, *Uniyal* 92823 (BSD).

3. *Polygala crotalaroides* Buch.-Ham. ex DC., Prodr. 1: 327. 1824; Bennett in Hook.f., Fl. Brit. India 1: 201. 1872; R.N. Banerjee in

Sharma *et al.*, Fl. India 2: 466. 1993; Swami & Gupta, Fl. Udhampur 63. 1998.

Perennial, villous herbs. Stems up to 20 cm high. Leaves obovate, elliptic, 10-25 x 2-18 mm, obtuse. Flowers in axillary, dense racemes. Sepals persistent, in two rows; outer unequal; inner equal, obovate-elliptic, ca 7 mm long, many-nerved. Petals pink, purple or purplish white; middle lobe ciliate margined, keeled with 3 bundles of linear filiform appendages. Capsules orbicular, ca 4.5 mm long, emarginate, narrowly winged, ciliate along the margins.

Fl. & Fr. : June July.

Selected specimens : Udhampur, Majauli village, Swami 1263 (BSD); Panchari forest, Kumar 91463 (BSD); Kashmir, Jamai valley, ca 1000 m, Gammie s.n. (DD).

4. *Polygala erioptera* DC., Prodr. 1: 326. 1824; Bennett in Hook.f., Fl. Brit. India 1: 203. 1872; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 443. 1972; R.N. Banerjee in Sharma *et al.*, Fl. India 2: 467. 1993.

Annual or perennial, pubescent, erect or decumbent herbs. Branches erect or spreading from the base. Leaves linear, elliptic-obovate or oblanceolate, 2-3.5 x 0.7-8 mm, obtuse or acute, recurved along margins. Flowers bluish-purple, in axillary lax racemes. Bracts persistent, shorter than the pedicels. Sepals persistent; outer sepals unequal; upper larger than the lower ones, broadly membranous margined; inner sepals ovate, 3-5 x 1.5-3 mm, obtuse, oblique, pubescent, 3-nerved. Petals pink, 3 lobed; middle lobe keeled with a crest of 2-bundles of filiform, pale pink appendages; lateral lobes deltoid. Capsules elliptic-oblong, 2.5-5 x 1.5-3 mm, pubescent, winged. Seeds pilose.

Fl. & Fr. : January December.

Selected specimens : Sunderbani Naushera, Uniyal 92884 (BSD).

5. *Polygala fureata* Royle, *Illus. Bot. Himal.* 1: 19B (1-4). 1834; R.N. Banerjee in Sharma *et al.*, *Fl. India* 2: 469. 1993. *P. triphylla* var. *glaucescens* (Royle) Bennett in Hook.f., *Fl. Brit. India* 1: 201. 1872, *p.p.*

Annual, erect herbs. Stems 5-25 cm high, ascending. Leaves elliptic or ovate lanceolate, up to 6 x 3.5 cm, membranous, narrowed into a petiole. Flowers yellow, in secund racemes. Sepals unequal; outer sepals ovate; wings petaloid, elliptic. Petals 3-3.5 mm long; lateral petals oblong, obtuse; keel petal crested with 2 flap like appendages at back near the apex. Capsules orbicular, entire, narrowly winged.

Fl. & Fr.: June - December.

Included after R.N. Banerjee (*loc. cit.*).

6. *Polygala irregularis* Boiss., *Diagn. ser. I* 1: 8. 1842; R.N. Banerjee in Sharma *et al.*, *Fl. India* 2: 472. 1993.

Perennial or annual, pubescent herbs. Branches 15-40 cm long, spreading or widely ascending from the base. Lower leaves obovate, 15-20 x 2-3 mm, sessile; upper leaves linear-oblong, lanceolate, 25-40 x 3-5 mm, retuse, obtuse or acute, puberulous on both surfaces, coriaceous, sessile. Flowers in 5-12 cm long, lateral or terminal racemes, pedicelled; pedicels 1.5-2 mm long, hairy, pendulous, thickened at the apex. Bracts 3, ovate, strongly keeled, acute, ciliate, caducous. Sepals *ca* 2 mm long; outer linear-oblong to ovate with membranous, ciliate margins; wing sepals greenish white with purple or green veins; obliquely ovate or obovate, gibbous at the base, glabrous. Petals pink or purple; middle lobe 2.5-5 mm long with crested keel; lateral lobes 3-5 x 3-4 mm, ciliate at the base. Capsules 3-4 mm in diam., obliquely obovate or emarginate, winged.

Fl. & Fr. : Major part of the year.

Included after R.N. Banerjee (*loc. cit.*).

7. *Polygala longifolia* Poir. in Lamk., *Encycl.* 5: 501. 1804; Stewart in Nasir & Ali, *Annot. Cat. Vasc. Pl. W. Pak. & Kashmir* 443. 1972; R.N.

Banerjee in Sharma *et al.*, Fl. India 2: 476, 1993. *P. leptalea* DC., Prodr. 1: 325, 1824; Bennett in Hook.f., Fl. Brit. India 1: 202, 1872; Blatter, Beaut. Fls. Kashmir 1: 47, 1927.

Perennial herbs. Stems 20-60 cm high, angled or deeply furrowed, glabrous, simple or branched. Basal leaves obovate or oblong-lanceolate, revolute on margins, up to 25 x 5 mm; upper linear-oblong or linear-lanceolate, up to 40 x 4 mm. Racemes terminal, 2.5-5 cm long, tail like, naked, dense-flowered. Outer sepals green, puberulous along margins; wing sepals broad elliptic, 3-nerved. Petals purple or pinkish red; middle lobe keeled, crested with one bundle of 4-6, flattened, incised appendages. Capsules obovate, notched at tip, narrowly winged along margins.

Fl. & Fr. : June - January.

In hilly areas up to 1300 m alt.

Included after R.N. Banerjee (*loc. cit.*).

8. *Polygala persicariifolia* DC., Prodr. 1: 326, 1824; Bennett in Hook.f., Fl. Brit. India 1: 202, 1872; Blatter, Beaut. Fls., Kashmir 1: 47, 1927; Stewart in Nasir & Ali, Annot. Cat. Vas. Pl. W. Pak. and Kashmir 443, 1972; R.N. Banerjee in Sharma *et al.*, Fl. India 2: 480, 1993.

Fig. 81

Annual, pubescent, erect or ascending, slender, herbs. Leaves linear or elliptic lanceolate, up to 6 x 2 cm, acute or subacute, with a mucro at tip, subsessile. Flowers rosy or reddish violet, pink streaked, in axillary, leaf opposed or terminal racemes. Bracts 3, lanceolate. Sepals persistent; outer subequal, puberulous on margin; wings sepals petaloid. Petals pink, purple or yellowish with purple streaks; middle lobe keeled, with a crest of 2-3 bundles of forked appendages. Capsules elliptic, very narrowly winged, ciliate.

Fl. & Fr. : May - November.

Subtropical and temperate regions.

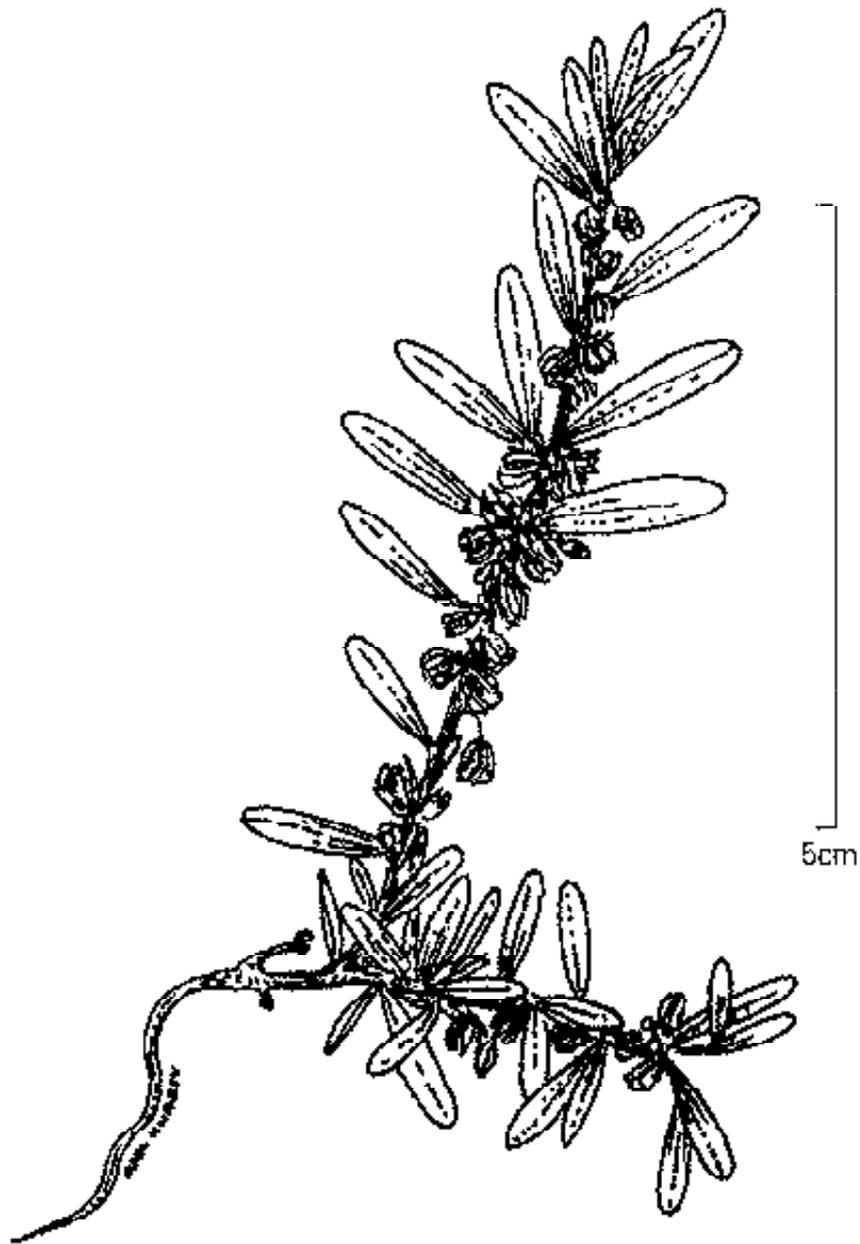


Fig. 81. *Polygala persicartifolia* DC.

Selected specimens : Udhampur, hills behind Madinala (Grahamor, Uniyal 86623 (BSD)).

9. *Polygala sibirica* L., Sp. Pl. 702. 1753; Bennett in Hook.f., Fl. Brit. India 1: 205. 1872 *p.p.*; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 443. 1972; R.N. Banerjee in Sharma *et al.*, Fl. India 2: 481. 1993.

Perennial, erect, pubescent, 10-25 cm high herbs. Stems many from the base. Leaves elliptic or linear-lanceolate, up to 35 x 10 mm, acuminate, coriaceous, scabrid above, hairy on nerves beneath. Flowers deep bluish purple, in terminal and axillary racemes. Bracts caducous. Sepals persistent; outer sepals subequal; wing sepals falcately ovate-lanceolate or obovate. Petals with lateral lobes linear oblong, middle lobe rounded, keeled, with much branched linear appendaged white crest on back near apex. Capsules orbicular, notched at apex, broadly winged.

Fl. & Fr. : April May

Selected specimens : Banihal mountains (facing Banihal valley), 2000 m, T.A. Rao 9175. Manasbal, 1750 m, T.A. Rao 9512; Chandanwari, 2700 m, T.A. Rao 625 (BSD); Kashmir, Chandigam forest, Lolab valley, 2000-2300; Keshavanand 1244. (DD).

10. *Polygala tatarinowii* Regel in Bull. Soc. Nat. Mosc. 34(2): 523. 1861; Sharma & Kachroo, Fl. Jammu 1: 102. 1981; R.N. Banerjee in Sharma *et al.*, Fl. India 2: 483. 1993. *P. triphylla* auct. non D.Don, nec. Burm.f.; Bennett in Hook.f., Fl. Brit. India 1: 201. 1872.

Erect, glabrous, annual herbs, up to 15 cm high. Stems slender, ribbed. Leaves ovate-broadly obovate, suborbicular-spathulate, 7.5-40 x 4-20 mm, mucronate, ciliate; petioles 3-10 mm long. Flowers deep yellow, in dense racemes. Peduncles bracteate; bracts caducous. Sepals in two rows, rugose; outer sepals concave; wing sepals orbicular, obovate or spathulate, 3-5-nerved. Petals deep yellow or pinkish; middle lobe keeled, split at the apex. Capsules discoid, 2-2.5 x 2-3 mm, 2-papillate at apex, rugose.

Fl. & Fr.: March - October.

Selected specimens : Sundarbani-Akhnour, *Uniyal* 92830 (BSD),
Hardoni, *Singh* 15725 (RRL).

CARYOPHYLLACEAE

(S.C. Majumder)

- 1a. Sepals free or united at base only ..Sub-family *Alsinoideae*
1b. Sepals united to form a distinct tube ...Sub-family *Silenoideae*

Sub-family ALSINOIDEAE

- 1a. Fruits indehiscent, 1-seeded ...3. *Herniaria*
1b. Fruits dehiscent, few to many-seeded :
 2a. Leaves stipulate :
 3a. Styles united at base ...8. *Polycarpaea*
 3b. Styles free at the base :
 4a. Leaves opposite, often in axillary
 fascicles; stipules connate. Styles 3 ...12. *Spergularia*
 4b. Leaves appearing whorled; stipules not
 connate. Styles 3-5 ...11. *Spergula*
 2b. Leaves without stipules :
 5a. Sepals united below ...14. *Thylacospermum*
 5b. Sepals free, rarely united at base only (*Stellaria*) :
 6a. Capsule valves as many as styles :
 7a. Styles fewer than sepals :
 8a. Styles 3. Capsules opening by
 3 valves ...6. *Minuartia*
 8b. Styles 2. Capsule opening by
 2 valves ...5. *Lepyrodiclis*
 7b. Styles as many as sepals :
 9a. Capsule valves entire. Sepals
 up to 3 mm long ...10. *Sagina*
 9b. Capsule valves bidentate.
 Sepals 5-10 mm long ...7. *Myosoton*

- 6b. Capsule valves twice the number of styles :
- 10a. Petals bifid to half way or more ...13. *Stellaria*
- 10b. Petals bilobed to 1/3 or emarginate or entire :
- 11a. Herbs with napiform tubes ...9. *Pseudostellaria*
- 11b. Herbs without tubes :
- 12a. Inflorescence umbellate ...4. *Holosteum*
- 12b. Inflorescence a cyme or panicle,
sometimes reduced to 1 flower :
- 13a. Petals bilobed to 1/3, sometimes
emarginate. Capsules cylindrical
...2. *Cerastium*
- 13b. Petals entire or subemarginate.
Capsules not cylindrical ...1. *Arenaria*

1. ARENARIA L.

- 1a. Leaves linear to acute, hardened and coriaceous at
margins and apex :
- 2a. Sepals acute, hardened at apex. Leaves never
densely imbricate :
- 3a. Plants perfectly glabrous ...9. *A. stracheyi*
- 3b. Plants glandular hairy ...3. *A. glanduligera*
- 2b. Sepals obtuse with membranous margins. Leaves
densely imbricate ...7. *A. polytrichoides*
- 1b. Leaves herbaceous or with a scarious margin
and setaceous :
- 4a. Sepals lanceolate to linear-lanceolate, with broad
scarious margin. Leaves subulate to linear, with
scarious margins :
- 5a. Flowers in cymes. Petals longer than sepals ...2. *A. festucoides*
- 5b. Flowers solitary. Petals shorter than sepals ...1. *A. bryophylla*
- 4b. Sepals various, rarely with a scarious margin,
leaves long, grass like, never scarious margined :
- 6a. Sepals hardened at base. Leaves long,
linear never broad ...4. *A. griffithii*
- 6b. Sepals not hardened at base. Leaves
lanceolate to ovate or orbicular,
herbaceous. flaccid :

- 7a. Plants annual, without sterile leafy shoot ...8. *A. serpyllifolia*
 7b. Plants perennial with sterile shoots :
 8a. Petals longer than the sepals ...5. *A. neelgherrensis*
 8b. Petals shorter than the sepals ...6. *A. orbiculata*

1. *Arenaria bryophylla* Fernald in Rhodora 21: 5. 1919. Stewart in Nasir & Ali, Ann. Cat. vasc. Pl. W. Pak. & Kashmir 238. 1972; Majumdar in Sharma *et al.*, Fl. India 2: 506. 1993. *Arenaria musciformis* Wallich ex Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 237. 1874.

Glabrous herbs forming matted, hard dense tufts. Root long and hard. Stem very short, densely leafy. Leaves 4.5-8.5 mm long, subulate, spreading and recurved, rigid, with broad scarious sheathing base, 1-nerved beneath. Flowers sessile, solitary. Calyx narrow, somewhat truncate and hardened at base; sepals oblong-lanceolate, ca 7 mm long, acute, 3 nerved, with broad scarious margin. Petals larger than the sepals, persistent, rounded at apex. Styles 3. Capsule globose 5-6 valved.

Fl. & Fr. : August - October.

Common in moist places along nala and on slopes.

Selected specimens : Ladakh, Chowdhery & Uniyal 86139 (BSD); Ladakh, Debring 4600 m, Bhattacharyya 41006 (BSD, CAL).

2. *Arenaria festucoides* Beath. in Royle, Illus. Bot. Himal. 81. 1834; Stewart in Nasir & Ali, Annot. Cat. vasc. Pl. W. Pak. & Kashmir 239. 1972; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 236. 1874; Dhar & Kachroo, Alp. Fl. Kashmir Himal. 191. 1983; Majumdar in Sharma *et al.*, Fl. India 2: 511. 1993.

Densely tufted herbs, 5-20 cm high. Leaves subulate, 6-38 mm long, rigid, pungent, recurved, concave, shining, 1-nerved beneath, margins ciliolate. Flowers 1-2. Peduncle glandular pubescent. Bracts ovate-subulate with broad scarious margins. Sepals ovate-lanceolate to subulate-lanceolate, 7-12 mm, acuminate, pungent, broadly scarious on margins, with 3 nerves merging into one. Petals ovate, longer than the sepals. Capsules oblong,

shorter than sepals, coriaceous, 6-valved. Seeds pale brown, ca 1.7 mm diam, flat, pale brown with a fimbriate wing.

Fl. & Fr. : July - October.

Cushion forming herbs on open slopes in alpine region.

Selected specimens : Ladakh, Dras, 3110-3250 m. Wadhwa 58604 (BSD); Kashmir, Falconer 257 (CAL).

3. *Arenaria glanduligera* Edgew. & Hook.f. in Hook.f. Fl. Brit. India 1: 240. 1874; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 239. 1972; Majumdar in Sharma *et al.*, Fl. India 2: 511. 1993.

Perennial, densely glandular pubescent, herbs. Stems 2-6 cm, shining, brownish below, with a line of hairs above. Leaves 3-7 x 2-3 mm, ovate or elliptic, acute or acuminate, glandular on surface and margins. Flowers solitary, terminal. Sepals 4-5 x 1.3 mm, ovate or lanceolate, scarious margined. Petals 5-6 x 2.5-4 mm, obovate. Capsules 6-valved. Seeds few.

Fl. : July - August.

Included after Stewart (*loc. cit.*).

4. *Arenaria griffithii* Boiss., Diagn. Fl. Orient. Nov. Ser. 2. 1: 89. 1853; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 237. 1874; Kachroo *et al.*, Fl. Ladakh 60. 1977; Majumdar in Sharma *et al.*, Fl. India 2: 512. 1993.

Tufted herbs, with suffruticose base, glabrous to glandular puberulent. Leaves densely crowded, setaceous, subulate, 7-9 mm long, ciliolate, pungent, one-nerved, apex sometimes recurved. Calyx thickened and rounded at apex: sepals ovate, 4.5 x 2.5 mm acute, concave, coriaceous, glandular, with broad, scarious margins. Petals obovate; ca 6.5 x 3.5 mm. Capsules globose or broadly ovoid, shorter than the sepals, coriaceous, 6-valved.

Fl. : June August

In dry clayey soil.

Selected specimens : Gilgit (1885) *Giles s.n.* Acc. No. 41582 (CAL); Kharbu-Ladakh Road, ca 3000 m. *Stewart* 21117 (DD).

5. *Arenaria neelgherrensis* Wight & Arn., *Prodr.* 43. 1834; Edgew. & Hook.f. in Hook.f., *Fl. Brit. India* 1: 239. 1874; Singh & Kachroo, *For. Fl. Srinagar* 170. 1976; Sharma & Jamwal *Fl. Upper Liddar Valley*. 134. 1988; Majumdar in Sharma *et al.*, *Fl. India* 2: 513. 1993.

Annual herbs. Stem procumbent, elongate, much branched, with a line of hairs. Leaves 6-15 x 3-6 mm, obovate or elliptic, obtuse, glabrous, gland dotted, subsessile. Flowers 3-4 mm in diam, solitary, axillary or in small terminal cymes. Pedicels 9-10 mm long, slender, viscid pubescent. Bracts leafy. Sepals ovate, 4 x 1.1 mm, acute, glabrous except a dorsal pubescent nerve, margins scarious. Petals longer than the calyx. Styles usually 3, sometimes 4. Capsules ovoid as long as the sepals. Seeds compressed, transversely striate.

Fl. & Fr. : April August.

Mostly among the scrubs in temperate zone, common in Aru-Lidderwat area.

Selected specimens : Ladakh, Matyan, 3200 m *Bhattacharyya* 71289 (BSD); Sonamarg, ca 3000 m, *Duthie* 11516 (DD); Sheshnag 3500 m. *Wadhwa & Vohra* 257 (CAL).

6. *Arenaria orbiculata* Royle ex Edgew. & Hook.f. in Hook.f., *Fl. Brit. India* 1: 240. 1874; Sharma & Jamwal, *Fl. Upper Liddar valley*. 134. 1988; Majumdar in Sharma *et al.*, *Fl. India* 2: 514. 1993.

Perennial herbs. Stem decumbent, with a line of hairs. Leaves 2-7 mm long, orbicular or elliptic, obtuse or apiculate, 1-nerved, subsessile. Flowers solitary or few in cymes. Sepals ovate or lanceolate, 3-4 x 1-

1.5 mm, 1-nerved, glabrous. Petals ovate-lanceolate. Capsules 6-valved. Seeds dark brown, many, smooth.

Fl. & Fr. : May - October.

In the clefts of rocks and dry places.

Selected specimens : Khorbula nullah 3500-4500 m, *Duthie* 11981 (CAL). Gulmarg, *Duthie* 11423; Gilgit, 3000-4000 m, *Duthie* 12379 (DD).

7. *Arenaria polytrichoides* Edgew. & Hook.f. in Hook.f., *Fl. Brit. India* 1: 237. 1874; Stewart in Nasir & Ali, *Ann. Vasc. Cat. Pl. W. Pak. & Kashmir* 240. 1972; Majumdar in Sharma *et al.*, *Fl. India* 2: 515. 1993.

Densely caespitose herbs, forming hemispherical tufts. Stem densely compressed, cylindrical. Leaves bright green, 3-6 mm long, densely imbricate, rigid, pungent, margins thickened, more or less ciliate towards broad scarious, sheathing base. Flowers minute, subsessile. Sepals broadly elliptic, 2.5-3 mm long, obtuse, concave. Petals ovate ca 4 mm long. Capsules broadly ovoid, equal to sepals coriaceous, shortly 5-6-valved. Seeds black, small, black, angular.

Fl. & Fr. : June - September.

Included after Stewart (*loc. cit.*).

8. *Arenaria serpyllifolia* L., *Sp. Pl.* 423. 1753; Edgew. & Hook.f. in Hook.f., *Fl. Brit. India* 1: 239. 1874; Singh & Kachroo, *For. Fl. Srinagar* 170. 1976; Kachroo *et al.*, *Fl. Ladakh* 61. 1977; Majumdar in Sharma *et al.*, *Fl. India* 2: 515. 1993.

Small annual herbs. Stems 10-30 cm, branched from base; branches slender, decumbent or suberect, hairy; hairs often recurved. Leaves ovate, lanceolate, 5-7 mm long, acuminate, stiff, with scattered bristles, subsessile. Flowers numerous in cymes; bracts herbaceous. Sepals 5, free, ovate lanceolate, 3-4 x 1 mm, acute, 3-5-ribbed, bristly. Petals 5, narrowly obovate, ca 1.5 x 0.8 mm. Stamens 10. Capsules with hard walls, 3.5 mm

long, 6-valved. Seeds dark brown, many, 0.5-0.7 mm in diam.; rounded reniform, papillose.

Fl. & Fr. : March September.

Common on bare grounds along paths, disturbed slopes, cultivated fields and also on shady rocks and under bushes.

Selected specimens : Neru Nala, Bhaderwah, *Uniyal* 80127 (BSD); Ladakh, Zozila, *Bhattacharyya* 41191 (BSD); Pir Pass, Banihal ridge, *Rao* 7679 (BSD).

9. *Arenaria stracheyi* Edgew. & Hook.f. in Hook.f., Fl. Brit. India. 1: 240. 1874; Kachroo *et al.*, Fl. Ladakh 61. 1977; Majumdar in Sharma *et al.*, Fl. India 2: 517. 1993.

Small, perennial, glabrous herbs. Stems up to 2.5 cm high, laxly caespitose. Leaves oblong lanceolate, 6-7.5 x 2 mm, acute or acuminate, thickened at apex. Flowers solitary, terminal. Pedicels ebracteate. Sepals lanceolate, 5 mm long, acuminate, coriaceous. Petals white, obovate, 7 x 4 mm. Capsules shorter than sepals, 6-valved, pale. Seeds somewhat auriform, smooth.

Fl. : August September.

Common on moist sandy riverbed around grassy mounds.

Selected specimens : Pang, Ladakh, *Bhattacharyya* 40967 (BSD).

2. CERASTIUM L.

- 1a. Styles usually 3 ...2. *C. cerastoides*
- 1b. Styles usually 5 :
 - 2a. Capsule teeth revolute, with plane margins ...3. *C. dahuricum*
 - 2b. Capsule teeth straight or spreading, margins recurved :
 - 3a. Leaves all linear oblong, subacute. Cymes in umbel-like clusters ...6. *C. thomsonii*

- 3b. Leaves ovate-oblong or obovate. Cymes lax or compact :
- 4a. Flowers 1-5. Sepals 7-10 mm long ...1. *C. alpinum*
- 4b. Flowers many. Sepals up to 5 mm long :
- 5a. Flowers in compact clusters. Fruiting pedicels not exceeding sepals. Sepals 5, with long white hairs projecting beyond apex ...5. *C. glomeratum*
- 5b. Flowers in dichasia. Fruiting pedicels exceeding the sepals. Sepals glabrous ...4. *C. fontanum* subsp. *triviale*

1. *Cerastium alpinum* L., Sp. Pl. 438. 1753; Kachroo *et al.*, Fl. Ladakh 62. 1977; Majumdar in Sharma *et al.*, Fl. India 2: 521. 1993.

Perennial herbs, 7-20 cm high, glabrous or hairy. Leaves ovate or elliptic-lanceolate, ca 10 x 5 mm, acute to obtuse. Flowers 1-5, on pedicels 1-4 cm long. Bract acute with scarious margin. Sepals 7-10 mm long, acute, truncate at base. Petals white, twice as long as sepals, bifid. Capsules 8-14 mm long, narrower and slightly curved upwards. Seeds 1-1.4 mm in diam., acutely tubercled.

Fl. : May - June.

Included after Kachroo *et al.* (*loc. cit.*).

2. *Cerastium cerastoides* (L.) Britton in Mem. Torrey Bot. Club. 5: 152. 1894; Singh & Kachroo, For. Fl. Srinagar 170. 1976; Majumdar in Sharma *et al.*, Fl. India 2: 521. 1993. *Stellaria cerastoides* L. Sp. Pl. 422. 1753. *Cerastium trigynum* Vill., Hist. Pl. Dauph. 3: 645. 1789; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 227. 1874.

Perennial herbs. Stems slender, glabrous, except a line of short hairs. Leaves, lanceolate to linear 6-18 x 0.5-2 mm obtuse, pale green, usually curved. Flowers in cymes. Bracts leaflike. Pedicels slender, glandular pubescent. Sepals linear, lanceolate, 4-5 mm long, uninerved, glandular pubescent. Petals white, ca 9 mm long, 2 lobed. Capsules 7-9 mm long, 6 valved. Seeds brown, dorsally with a row of tubercles.

Fl. & Fr. : July - September.

Common and often gregarious in alpine pasture land, especially in limestone tracts.

Selected specimens : Pahalgam, T.A. Rao 9664 (BSD); Synthen top, 4500 m, Vohra & Naithani 83199 (BSD); Kolhoi glacier Wadhwa & Vohra 312 (CAL); Mahagunesh pass, Nair 36978 (BSD).

3. *Cerastium daburicum* Fisch. in Spreng., Fl. Min. Cogn. Pugill. 2: 65. 1815; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 227. 1874; Singh & Kachroo, For. Fl. Srinagar 25. 1976; Majumdar in Sharma *et al.*, Fl. India 2: 523. 1993.

Tall, perennial herbs. Leaves ovate or oblong, 25-60 x 10-22 mm, acute or rarely obtuse, sessile. Flowers in cymes. Pedicels 10-20 mm, up to 40 mm in fruit. Sepals oblong-elliptic, 9-10 mm long, acute, shining, with scarious margins. Petals obovate, 18-19 mm long, 2-lobed; claws ciliate. Capsules 15-19 mm long, striate, many nerved. Seeds tubercled.

Fl. & Fr. : June - September.

Fairly common as *Abies* forest undergrowth, along roadside and also along the streamlets.

Selected specimens : Gulmarg, Bhattacharyya 71185 (BSD); Kashmir Falconer 245 (CAL); Kashmir, Kiarri Pass Duthie s.n. (DD, CAL).

4. *Cerastium fontanum* Baumg. subsp. *triviale* (Link) Jalas. in Arch. Soc. Zool. Bot. Fenn. "Vanamo" 18: 63. 1963; Dhar & Kachroo, Alp. Fl. Kashmir Himal. 191. 1983; Majumdar in Sharma *et al.*, Fl. India 2: 523. 1993. *Cerastium vulgatum* L. var. *triviale* Link; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 228. 1874.

Laxly caespitose herbs. Leaves oblong-elliptic to ovate, sessile acute, hairy, 10-30 x 3-10 mm. Cymes glandular pubescent. Sepals 3-5 mm long, hairy, with scarious margins and glandular apices. Petals white, bifid up

to 1/5 or 1/3 of length. Stamens 10, with yellow anthers. Capsules cylindrical, 9-12 mm long.

Fl. & Fr. : April - September.

Common along wayside, in moist, shaded, slopy, situations.

Selected specimens : Udhampur, Martah vill. Swami 567 (BSD); Kashmir, Kumar 81302 (BSD); Kashmir, T.A. Rao 566 (CAL).

5. *Cerastium glomeratum* Thuill., Fl. Env. Paris ed. 2: 226. 1799; Singh & Kachroo For. Fl. Srinagar 170. 1976; Majumdar in Sharma *et al.*, Fl. India 2: 523. 1993. *Cerastium vulgatum* L. var. *glomerata* Thuill.; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 228. 1874. *Shimnar*.

Annual herbs, 10-40 cm high, with erect or ascending flowering shoots, glandular pubescent. Leaves lanceolate, ovate or elliptic, oblong, 10-25 x 6-9 mm, apiculate, white hairy. Cymes clustered. Sepals lanceolate, 4-5 mm long, acuminate. Petals white, bifid, as long as sepals. Capsule cylindrical, 7-9 mm long, curved upwards, opening by 10 straight teeth. Seeds pale brown, rugose-tubercled.

Fl. & Fr. : July - October.

Occasional weed of lawns, margins of wheat fields, also found on dry open slopes.

Selected specimens : Bhandarwah, Uniyal 80152 (BSD); J & K. Bach Pass, Wudhwa & Vohra 508 (CAL); Kashmir, T.A. Rao 655 (CAL).

6. *Cerastium thomsonii* Hook.f., Fl. Brit. India 1: 228. 1874; Majumdar in Sharma *et al.*, Fl. India 2: 524. 1993.

Herbs, 15-40 cm high, glandular hairy. Stem slender, erect, branched at base. Leaves linear-oblong, 20-30 x 2-4 mm, subacute. Cymes few-flowered. Flowers 12-19 mm in diam. Sepals oblong-lanceolate, 6-7 mm long, acute with scarious margins. Petals 8-9 mm long broad. Capsules cylindrical, 10-12 mm long, 3-4 mm broad. Seeds many, flattened.

Fl. & Fr.: June August.

Selected specimens : Gilgit, Tanner 26 (DD).

Note : Kachroo *et al.* (1977) and Chaurasia *et al.*, (2001) recorded the occurrence of *C. vulgatum* var. *tibetica* Edgew. & Hook.f. (Tyndong) from Ladakh.

3. HERNIARIA L.

- 1a. Annuals. Stamens usually 2-3. Flowers 1-1.5 mm across ...2. *H. hirsuta*
 1b. Perennials. Stamens 5. Flowers 1.5-2.5 mm across :
 2a. Style distinct ...1. *H. cachemiriana*
 2b. Style not distinct ...3. *H. incana*

1. *Herniaria cachemiriana* Gay in Duchartre, Rev. Bot. 2: 370. 1847; Singh & Kachroo, For. Fl. Srinagar 176. 1976; Majumdar in Sharma *et al.*, Fl. India 2: 538. 1993.

Perennial, prostrate herbs. Branches 3-20 mm long, pubescent. Leaves elliptic-oblong to oblong-ovate, 3-10 (-15) mm long, strigose pubescent when young, margins entire, ciliate; stipules minute, ovate-triangular. Flowers green in leaf-opposed cymes, 1.8-2 mm long, turbinate when young. Sepals 5, free, oblong-elliptic. Stamens 5, bifurcate. Stigma 2, divergent. Fruits ovoid. Seed lenticular.

Fl. : April July.

On dry rocky slopes between 1700 2000 m.

Included after Singh & Kachroo (*loc. cit.*).

2. *Herniaria hirsuta* L., Sp. Pl. 218. 1753; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 4: 712. 1885 (under Illecebraceae); Majumdar in Sharma *et al.*, Fl. India 2: 538. 1993.

Annual herbs. Stems 4-22 cm. Branches alternate, densely covered with strigose, patent hairs. Leaves elliptic to oblong-ovate, up to 8 x 2.5

mm with stiff hairs. Flowers in dense clusters, often contiguous in short lateral branches, 1-1.5 mm in diam. Sepals 5, hirsute with rigid, white, spreading hairs. Stamens usually 2-3. Fruits scarcely equalling the sepals, with a short style, with 2 erect or subdivergent stigma lobes. Seeds blackish, ca 0.5 mm across.

Fl. & Fr. : April - August.

Occasional on open submoist slopes between 1500-2600 m.

Selected specimens : Kishtwar, *Uniyal* 80269 (BSD); Chandi Gam, *T.A. Rao* 9433; Shankracharya Hill, *T.A. Rao* 340 (BSD); Kashmir, *T.A. Rao* 340 (CAL); Jhelum valley, *Duthie* 10882 (CAL).

3. *Herniaria incana* Lam., *Encycl. Meth. Bot.* 3: 124. 1789; Singh & Kachroo, *For. Fl. Srinagar* 107. 1976; Majumdar in Sharma *et al.*, *Fl. India* 2: 538. 2000. *Herniaria hirsuta* var. *incana* (Lam.) Hook.f., *Fl. Brit. India* 4: 112. 1885.

Perennial herbs with stout woody rootstock. Stems 10-25 cm, with dense rigid hairs. Leaves spatulate to oblanceolate, up to 12 x 3 mm, densely stiff hairy; stipules pubescent outside. Flowers in more or less contiguous clusters, 1.5-2 mm across. Sepals 5, patent, scabrid hairy. Stamens 5. Stigma sessile with 2 divergent lobes. Fruits shorter than and enclosed by sepals.

Fl. & Fr. : April - July.

Commonly found on dry rocky slopes in the valley.

Included after Singh & Kachroo (*loc. cit.*).

4. HOLOSTEUM L.

Holosteum umbellatum L., *Sp. Pl.* 88. 1753; Edgew. & Hook.f. in Hook.f., *Fl. Brit. India* 1: 227. 1874; Singh & Kachroo, *For. Fl. Srinagar* 171. 1976; Majumdar in Sharma *et al.*, *Fl. India* 2: 539. 1993. **Fig. 82**



Fig. 82. *Holosteum umbellatum* L.

Annual herbs, slender. Stems 4-20 cm, erect or ascending. Basal leaves narrow, spatulate to lanceolate, 10-25 mm long; upper leaves smaller, linear to ovate, acute, sessile. Flowers 3-16 in cyme. Pedicels filiform, 7-20 mm long, erect at first, soon deflexed at base. Bracts ca 1 mm, narrow, membranous. Sepals ca 2 mm long, margins scarious. Petals white, longer than sepals. Stamens 5 or 10. Styles 3. Capsules cylindrical 4-6 mm long. Seeds peltate, keeled on either side.

Fl. & Fr. : March - September.

Common on disturbed slopes and on moist soil on the banks of small streams.

Selected specimens : Ladakh, Chusul, Viswanathan 55016 (BSD); Kashmir, Falconer 242 (CAL).

5. LEPYRODICLIS Fenzl

- 1a. Flowers in cymes or solitary. Petals ovate or spatulate, retuse ...1. *L. holosteoides*
 1b. Flowers solitary. Petals linear, entire ...2. *L. tenera*

1. *Lepyrodiclis holosteoides* (C.A. Mey.) Fenzl ex Fisch. & Mey., Enum. Pl. Nov. 1: 93. 1841; Dhar & Kachroo, Alp. Fl. Kashmir Himal. 192. 1983; Majumdar in Sharma *et al.*, Fl. India 2: 540. 1993. *Gouffelia holosteoides* C.A. Mey., Verz. Pfl. Casp. 217. 1831. *Arenaria holosteoides* Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 241. 1874; Kachroo *et al.*, Fl. Ladakh. 60 1977. **Fig. 83**

Slender, much branched glabrous or glandular pubescent herbs, 60-90 cm high. Leaves linear or linear-lanceolate, 25-75 mm long, spreading, acute or acuminate sessile. Pedicels ebracteate in solitary, axillary flowers, bracteate in cymes. Sepals usually linear-lanceolate, 5-6 x 0.7-1 mm, obtuse, glabrous to glandular ciliate. Petals white, spatulate to obovate, retuse. Capsules globose, shorter than calyx, 2-valved, few seeded. Seeds tubercled.

Fl. & Fr. : June - September.

Common in alpine rocky, places and margins of cultivated fields.



Fig. 83. *Lepyrodiclis holosteoides* (C.A. Mey.) Fenzl ex Fisch. & Mey

Selected specimens : Upshi East, Shera, Ladakh; *Bhattacharyya* 41137; Ladakh, Hemis, *Bhattacharyya* 71632 (BSD); Khatse, *Wadhwa* 60052, 58607 (BSD); Tangtse, 4400 m, *Viswanathan* 54742 (BSD).

2. *Lepyrodiclis tenera* Boiss., *Diagn. Pl. Orient. Nov. Ser. 2. 1:* 84. 1853; Stewart in Nasir & Ali, *Cat. Pl. W. Pak. & Kashmir* 245. 1972. *Arenaria tenera* Edgew. in Hook.f., *Fl. Brit. India* 1: 242. 1874.

Very slender, annual, tufted, herbs. Stems 60-90 cm long, filiform, flaccid, branched. Leaves elliptic or oblong lanceolate, acute, membranous, petioled. Flowers solitary, axillary. Sepals ovate, oblong or lanceolate, 10-28 mm long acute, densely ciliate. Petals white, linear, entire, ca 5 mm long, dilated upwards. Capsules globose, ca 2 mm in diam., 2-valved. Seeds 4, subglobose, acutely tubercled.

Fl. & Fr. : May July.

Common in shady places, up to ca 2800 m.

Selected specimens : Kishtwar, *Uniyal* 80302 (BSD); Kashmir, 2000-2800 m, *Thomson s.n.* Acc. No. 41872 (CAL).

6. MINUARTIA L.

- 1a. Plants 3-7 cm high. Leaves dentate-crenate. Cymes few-flowered. Seeds smooth or reticulate :
- 2a. Petals equal to or longer than sepals.
Seeds smooth or obscurely reticulate ...1. *M. biflora*
- 2b. Petals shorter than the sepals. Seeds reticulate ...4. *M. sedoides*
- 1b. Plants 10-30 cm high. Leaves entire. Cymes many-flowered. Seeds honey-combed, distinctly tuberculate :
- 3a. Cymes lax. Pedicels much longer than the sepals, usually with a pair of bracteoles near the middle...3. *M. kashmirica*
- 3b. Cymes compact. Pedicels shorter than the sepals, without bracteoles ...2. *M. ebracteolata*

1. *Minuartia biflora* (L.). Schinz & Thell. in Bull. Herb. Boiss. Ser. 2. 7: 404. 1907; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 228. 1972; Majumdar in Sharma *et al.*, Fl. India 2: 545. 1993. *Stellaria biflora* L., Sp. Pl. 1: 422. 1753.

Slender, caespitose, dwarf, perennial herbs. Leaves crowded and imbricating on vegetative shoots, loosely arranged on flowering shoots, linear, 7-13 x 6-1.2 mm, slightly connate at base, glabrous. Pedicels terminal, 2-4 mm long. Sepals 5, ovate-oblong, 4-5 x 1.5-2 mm, acute, narrowly scarious margined, glabrous, trinerved. Petals oblong, as long as or slightly longer than sepals, membranous, finely veined inside. Stamens 10; filaments 2-2.5 mm long, glabrous. Capsules 3-valved, glabrous, shining. Seeds reddish, ovoid, smooth or very obscurely reticulate.

Fl. & Fr. : July - September.

Fairly common on moist shady hill slopes.

Selected specimens : Chilas, 3355 m, Wadhwa & Vohra 627 (CAL); Khillenmarg, 3000 m, Rau 50289 (BSD).

2. *Minuartia ebracteolata* Majumdar & Giri in Candollea 38: 343. 1983; Majumdar in Sharma *et al.*, Fl. India 2: 545. 1993.

Erect or loosely tufted, perennial herbs with vegetative shoots and 10-14 cm long flowering shoots. Leaves linear, slightly connate at base, glandular-pubescent. Cymes few-flowered, compact. Pedicels densely glandular pubescent, 1-4 mm long, ebracteolate. Sepals 5, strongly trinerved, acute or apiculate at apex, with broad scarious margins. petals 5, oblong, 8-9 x 3.5-4 mm, finely veined inside, membranous. Stamens 5, attached to the base of the petals; filaments 6-7 mm long, glabrous. Ovary urceolate, glabrous. Styles 3, 2 mm long, glabrous; stigma flattened. Capsules 6-7 mm long, 3-valved. Seeds dark red, ovoid 0.5 mm long, honey combed and clearly tubercled.

Fl. & Fr. : June - September.

Common in moist places on open hill slopes in alpine zones.

Selected specimens : Pissu ghati, 3800 m, T.A. Rao 9726 (BSD, CAL).

3. *Minuartia kashmirica* (Edgew.) Mattf. in Bot. Jahrb. Syst. 57 (Beibl. 126) 7: 32. 1921; Majumdar in Sharma *et al.*, Fl. India 2: 547. 1993. *Arenaria kashmirica* Edgew. in Hook.f., Fl. Brit. India 1: 236. 1874; Dhar & Kachroo, Alp. Fl. Kashmir. Himal. 191. 1983. *Minuartia foliosa* (Royle ex Edgew. & Hook.f.) Majumdar in J. Ind. Bot. Soc. 44: 142. 1965. *Minuartia lineata* Bomm. in Beih Bot. Zbl. 27. 318. 1910; Sharma & Jamwal, Fl. Upper Liddar valley, 133. 1988. *Khilimentok, Pianzo, Lingze.*

Erect or loosely tufted, glabrous to glandular pubescent, perennial herbs, with 25 cm long erect flowering shoots. Leaves linear, 12-15 x 0.75-1 mm, entire, acuminate, 1-3-nerved. Cymes axillary or terminal, umbellate or subumbellate. Flowers 6-8 mm in diam. Pedicels 10-22 mm long, with a pair of ovate, acute, 1.5-2 mm long bracteoles. Sepals 5, ovate-lanceolate 4-5 x 1.25-1.5 mm, with narrow scarious margins. Petals 5, oblanceolate, 8-9 x 3.5-4.5 mm, entire, membranous. Stamens 10. Capsules 5-6 mm long. Seeds reniform or cuneoid, honeycombed and tubercled.

Fl. & Fr.: May - September.

Common on alpine cliffs, open rocky ground and high meadows.

Selected specimens : Sonamarg hills, T.A. Rao 9574 (BSD); Sheshnag Wadhwa & Vohra 258 (CAL); Sind Valley, Duthie 11, 492 (CAL).

4. *Minuartia sedoides* (L.) Hiern in. J. Bot. 37: 321. 1899; Majumdar in Sharma *et al.*, Fl. India 2: 547. 1993. *Cherleria sedoides* L., Sp. Pl. 425. 1753.

Densely caespitose, dwarf perennials, forming yellowish green cushion. Flowering shoots scarcely coming out of the cushion. Leaves linear-triangular, 4-6 x 0.75-1 mm, shortly dentate, glabrous. Flowers unisexual,

usually solitary, rarely 2-3, axillary or terminal. Sepals 5, ovate-oblong, 3-4 x 1.25-1.5 mm, acute, with narrow scarious margins, trinerved. Petals usually absent in female flowers, shorter than sepals in male flowers, membranous. Stamens 10 in male flowers, shorter than sepals. Capsules glabrous. Seeds reddish, 'comma' like, finely reticulate.

Fl. & Fr. : July - September.

Selected specimens : Kashmir, *Wadhwa & Vohra* 62 (CAL); Kashmir, Baltistan, *Duthie* 13888 (CAL).

7. MYOSOTON Moench

Myosoton aquaticum (L.) Moench, *Meth.* 225. 1794; Singh & Kachroo, *For. Fl. Srinagar* 171. 1976; Majumdar in *Sharma et al.*, *Fl. India* 2: 548. 1993. *Cerastium aquaticum* L., *Sp. Pl.* 439. 1753. *Stellaria aquatica* (L.) Scop., *Fl. Carn. ed. 2.* 1: 319. 1772; Edgew. & Hook.f. in Hook.f., *Fl. Brit. India* 1: 229. 1874.

Perennial herbs, up to 1 m tall, suberect or decumbent, upper part glandular pubescent. Leaves narrowly ovate, ca 2.5 x 1-2 cm, acute; the lower often petiolate, the upper sessile. Bracts foliaceous. Sepals ovate, oblong, obtuse, 5-6 mm long, up to 10 mm in fruit. Petals 6-7 mm long, bifid up to base. Capsules ovoid, ca 9 mm long, dehiscing into 5, bidentate valves. Seeds brown, numerous, reniform to subglobose, tuberculate.

Fl. & Fr. : May - September.

Common in moist, shady places and along streams.

Selected specimens : Laribal, 5500, *Rao* 63518 (BSD); Kungwatan, *T.A. Rao* 9291; Kashmir, Kishtwar, *T.A. Rao* 7883 (BSD); Limbar nullah, *Duthie* 11027 (DD); Pahalgam, 2135 m, *Wadhwa & Vohra* 180 (CAL).

8. POLYCARPAEA Lam.

Polycarphaea corymbosa (L.) Lamk., *Tab. Encycl.* 2: 129. 1797; Edgew. & Hook.f. in Hook.f., *Fl. Brit. India.* 1: 245. 1874; Sharma &

Kachroo, Fl. Jammu 1: 106. 1981; Majumdar in Sharma *et al.*, Fl. India 2: 549. 1993. *Achyranthes corymbosa* L., Sp. Pl. 205. 1753. *Machachi*, *Dolphuli*. Fig. 84

Annual or perennial herbs, erect or suberect, dictomously branched, densely tomentose to glabrescent. Leaves linear, 5-20 x 0.5-1 mm, aristate, 1-nerved; stipules lanceolate or subulate, fimbriate. Dichastal cymes crowded and arranged in corymbs. Sepals 5, lanceolate, 2.5-5 mm long, acuminate, glabrous, scarious. Petals 5, ovate, 0.5-1 mm long, obtuse. Capsules brown ellipsoid, 1-2.5 mm long, 3-valved, entire, shining. Seeds light brown, reniform, 2-6 mm broad.

Fl. & Fr.: July - December.

Common in sandy, gravelly and rocky places, particularly in Jammu.

Selected specimens : Jammu Dist., Kundakhad, *Uniyal* 92783 (BSD).

9. PSEUDOSTELLARIA Pax.

Pseudostellaria heterantha (Maxim.) Pax in Engler & Harms, Pflanzenfam. ed. 2. 16C. 318. 1934; Majumdar in Sharma *et al.*, Fl. India 2: 555. 1993. *Krascheninnikovia heterantha* Maxim. in Bull. Acad. Imp. Sci. St. Petersburg. 18: 376. 1873. *Stellaria bulbosa* auct. non Wulf.; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 231. 1874, *p.p.*

Erect, slender, perennials from a creeping rootstock. Stems simple with a line of hairs between the nodes. Leaves in 2-6 pairs, opposite or opposite-decussate ovate or lanceolate, up to 5 x 1.2 cm, sessile or contracted into a short petiole, elliptic. Chasmogamic flowers white, solitary, ca 1 cm across. Fruits and seeds unknown.

Fl. : April - June.

Occasional on humus laden ground under coniferous trees.



Fig. 84. *Polycarpaea corymbosa* (L.) Lamk.

Selected specimens : Kungwatan, T.A. Rao 9315 (BSD, CAL); Thajwas mountain, 4000 m, T.A. Rao 9565 (CAL).

10. SAGINA L.

- 1a. Flowers usually pentamerous ...3. *S. saginoides*
 1b. Flowers usually tetramerous :
 2a. Upper leaves ciliate towards base. Pedicels
 erect after anthesis ...1. *S. apetala*
 2b. Upper leaves not ciliate towards base. Pedicels
 curved downwards after anthesis ...2. *S. procumbens*

1. *Sagina apetala* Arduino, Animadv. Bot. Sp. 2: 22. t. 8. f. 1. 1763; Singh & Kachroo, For. Fl. Srinagar 172. 1976; Majumdar in Sharma *et al.*, Fl. India 2: 557. 1993.

Annual, slender, loosely tufted herbs. Stems leafy, 4-11 cm high, central and lateral stems erect or decumbent, many-flowered. Leaves linear, 3-5 mm long, awned, ciliate or glabrous, the upper ones always ciliate near base. Pedicels glabrous or glandular, 2-14 (-20) mm long, filiform and erect in fruit. Sepals 4, ovate-oblong, obtuse. Petals minute or absent. Stamens 4. Capsules 2.5-3 mm long, valves obtuse. Seeds brown, deltoid or cuneoid, smooth or honeycombed, dorsally grooved.

Fl. & Fr.: March - September.

Common on lawns and pastured slopes.

Selected specimens : Kashmir, Falconer 263 (CAL); Jhelam valley, Duthie 10888 (DD).

2. *Sagina procumbens* L., Sp. Pl. 128. 1753; Majumdar in Sharma *et al.*, Fl. India 2: 558. 1993.

Perennial, mat forming herbs. Lateral stems and branches procumbent, rooting at base. Leaves linear, 5-10 mm long, glabrous, mucronate at apex. Flowers solitary. Pedicels recurved near the top after

anthesis. Sepals broadly ovate, obtuse. Petals minute or absent. Capsules exceeding the sepals, 4-valved. Seeds blackish brown, deltoid, dorsally grooved.

Fl. & Fr. : May August.

Included after Majumdar (*loc. cit.*).

3. *Sagina saginoides* (L.) Karsten, Deutsche Fl. 539. 1882; Kachroo *et al.*, Fl. Ladakh 63. 1977; Majumdar in Sharma *et al.*, Fl. India 2: 559. [1993]. *Spergula saginoides* L., Sp. Pl. 441. 1775. *Sagina procumbens auct. non L.*; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 242. 1874, *p.p.*

Perennial, tufted, glabrous herbs. Leafy, shoots numerous, decumbent. Basal leaves up to 2 cm; cauline leaves linear, glabrous, 4-10 mm long, mucronate or awned at tip. Flowers 5 merous. Pedicels 8-24 mm long, erect. Sepals ovate, 1.5-2 mm long, rounded, glabrous, margins narrowly scarious. Petals white, rounded to ovate, shorter than sepals. Capsules ovoid 3-4 mm long, exceeding the sepals. Seeds light brown, 0.3-0.5 mm in diam., smooth or indistinctly granulate, dorsally grooved.

Fl. & Fr.: May October.

Abundant on moist loose soil on rocks.

Selected specimens : Ladakh, Sera village, *Bhattacharyya* 41141 (BSD, CAL); Yarikah, Tangmarg 2300 m, *T.A. Rao* 160 (CAL); Panikhar, *Chowdhery & Uniyal* 85924 (BSD).

11. SPERGULA L.

- 1a. Styles 5. Capsules opening by 5 valves. Seeds sharply keeled or with a very narrow wing ...1. *S. arvensis*
 1b. Styles 3. Capsules opening by 3 valves. Seeds compressed, broadly winged ...2. *S. fallax*

1. *Spergula arvensis* L., Sp. Pl. 440. 1753; Edgew. & Hook.f. in

Hook.f., Fl. Brit. India. 243. 1874; Singh & Kachroo, For. Fl. Srinagar 173. 1976; Majumdar in Sharma *et al.*, Fl. India 2: 578. 1993.

Annual herbs, 7-40 cm high, with ascending stems, branched at the base. Leaves linear, up to 80 mm long, fleshy, glandular hairy above, channelled beneath. Flowers 4-7 mm in diam., in cymose panicles. Pedicels 1-2.5 cm. Bracts small, scarious. Sepals 5, ovate, 3-5 mm long, obtuse, with a narrow scarious margins. Petals 5, white, obovate, slightly larger than sepals, obtuse. Capsules ovoid, 7-10 mm long, with 5 valves. Seeds blackish grey, subglobose, keeled or very narrowly winged.

Fl. & Fr. : Throughout the year.

Selected specimens : Included after Singh & Kachroo (*loc. cit.*).

2. *Spergula fallax* (Lowe) E.H. Krause in Sturm. Deutschl. Fl. ed. 2. 5: 21. 1901; Majumdar in Sharma *et al.*, Fl. India 2: 578. 1993. *Spergularia fallax* Lowe in Hook., J. Bot. Kew Gard. Misc. 8: 289. 1856; Sharma & Kachroo, Fl. Jammu 1: 105. 1981. *Spergula pentandra sensu* Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 243. 1874.

Annual herbs, up to 40 cm high. Stems ascending or decumbent, branched at the base. Leaves opposite, with axillary fascicles, appearing whorled, 0.5-3 cm long. Flowers in cymose panicles. Pedicels 4-12 mm long. Bracts *ca* 1 mm long, scarious. Ssepals ovate, with narrow scarious margins. Petals white, ovate, entire. Capsules ovoid, 4-5 mm long. Seeds glossy black, 1.5 mm in diam. including the broad scarious wing.

Fl. & Fr. : December April.

Common as a garden weed in moist places.

Included after Sharma & Kachroo (*loc. cit.*).

12. SPERGULARIA (Pers.) J. & C. Presl

Spergularia rubra (L.) J. & C. Presl., Fl. Cech. 94. 1819; Sharma & Kachroo, Fl. Jammu 1: 106. 1981; Majumdar in Sharma *et al.*, Fl. India

2: 580. 1993. *Arenaria rubra* L., Sp. Pl. 423. 1753. *Spergula rubra* Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 244. 1874.

Annual or biennial herbs. Stem decumbent, branched, 5-25 cm long. Leaves opposite, linear, 4-25 mm long, tapering, awned at apex; stipules lanceolate, acuminate, silvery. Sepals ovate-lanceolate, 3-4 mm long, glandular, broadly scarious margined. Petals pink, shorter than sepals, ovate. Styles 3. Capsule ovoid, as long as sepals. Seeds brownish, subtrigonus.

Fl. & Fr. : February - September.

Common on grassy slopes and along roadside preferring calciferous habitats.

Selected specimens : Chandanvadi, Nair 36916 (BSD); Rao & Kumar 81647 (BSD); Kashmir, T.A. Rao 219 (CAL).

13. STELLARIA L.

- 1a. Ovary 3 locular. Capsules 1-2-seeded ...5. *S. monosperma*
- 1b. Ovary 1-locular. Capsule few to many-seeded :
 - 2a. Sepals free to the base :
 - 3a. Styles 3 :
 - 4a. Petals shorter than the sepals ...4. *S. media*
 - 4b. Petals longer than the sepals :
 - 5a. Branches hairs woolly pubescent with white ...8. *S. semivestita*
 - 5b. Branches densely glandular hairy ...10. *S. tibetica*
 - 3b. Styles 2 :
 - 6a. Plant glaucous. Capsules as long as sepals. Seeds compressed, papillate at margins ...12. *S. webbiana*
 - 6b. Plants tomentose above. Capsules shorter than the sepals. Seeds orbicular, smooth ...3. *S. himalayensis*
 - 2b. Sepals connate at base forming a funnel shaped calyx base :

- 7a. Densely tufted herbs. Filaments dilated at base ...1. *S. decumbens*
- 7b. Laxly tufted, flaccid herbs. Filaments not dilated at base :
- 8a. Plants variously pubescent ...7. *S. patens*
- 8b. Plants glabrous, or ciliolate at leaf-bases only :
- 9a. Petals 0. Capsules twice as long as the sepals ...9. *S. subumbellata*
- 9b. Petals present. Capsule as long as, or shorter than the sepals :
- 10a. Leaves not thick margined ...11. *S. uliginosa*
- 10b. Leaves thick margined :
- 11a. Leaves ciliolate.
Bracts wholly scarious ...2. *S. graminea*
- 11b. Leaves not ciliolate. Bracts when present scarious margined ...6. *S. palustris*

1. *Stellaria decumbens* Edgew. in Trans. Linn. Soc. 20: 35. 1846; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 234. 1844; Majumdar in Sharma *et al.*, Fl. India 2: 582. 1993. *Stellaria cherleriae* (Fisch.) Williams in Bull. Herb. Boiss. Ser. 2. 7: 830. 1907; Kachroo *et al.*, Fl. Ladakh 64. 1977; Sharma & Jamwal, Fl. Upper Liddar valleys. 132. 1988.

Cushion like, shining, tufted herbs. Stems many, decumbent or erect, somewhat quadrangular; branches lax or dense fascicled, glabrous or puberulous in a line. Leaves lanceolate or linear-lanceolate, 3-5 mm long, ciliolate, 1-nerved or nerveless. Flowers solitary or 1-3-many in sessile cymes. Sepals 4-5, oblong-lanceolate, acute or acuminate. Petals very short, narrow, bipartite. Stamens 10. Capsule shorter than the sepals. Seeds 2-8, dark brown, suborbicular, dotted.

- 1a. Cymes many-flowered ...1.3. var. *polyantha*
- 1b. Cymes 1-3-flowered :
- 2a. Plants forming dense, globose tufts. Leaves incurved at apex ...1.4. var. *pulvinata*
- 2b. Plants not forming tufts. Leaves not incurved at apex :

- 3a. Leaves in axillary fascicles ...1.2. var. *minor*
 3b. Leaves not as above ...1.1. var. *decumbens*

1.1. var. *decumbens*. *S. decumbens* Edgew. var. *edgeworthii* Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 234. 1874 et var. *stracheyi* Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 234. 1874.

Fl. & Fr. : July - October.

Common along banks throughout in morainal zone particularly in Liddar valley.

Selected specimens : Kashmir, T.A. Rao 724 (CAL); Kashmir, Badzulkod nala, 4000-4500 m, Duthie 13403 (CAL).

1.2. var. *minor* Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 234. 1874; Majumdar in Sharma *et al.*, Fl. India 2: 583. 1993.

Fl. & Fr. : July - October.

Included after Majumdar (*loc. cit.*).

1.3. var. *polyantha* Edgew. & Hook.f. in Hook.f., Fl. Brit. India. 1: 235. 1874; Blatter, Beaut. Fls. Kashmir 1: 54. 1927; Majumdar in Sharma *et al.*, Fl. India 2: 583. 1993.

Fl. : June - October.

In rocky and gravelly places in alpine regions.

Included after Majumdar (*loc. cit.*).

1.4. var. *pulvinata* Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 235. 1874; Majumdar in Sharma *et al.*, Fl. India 2: 583. 1993. *Stellaria cherleriae* var. *uniflora* (Fisch.) Williams in Bull. Herb. Boiss. Ser. 2: 832. 1907; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 254. 1972.

Fl. : September - October.

Selected specimens : Kolohoi glacier, T.A. Rao 724 (BSD); Kashmir, Pahalgam, Clarke 31071 (CAL).

2. *Stellaria graminea* L., Sp. Pl. 422. 1753; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 233. 1874; Blatter, Beaut. Fls. Kashmir 53. 1927; Majumdar in Sharma *et al.*, Fl. India 2: 583. 1993.

Perennial herbs, 10-40 cm high, glabrous except leaf margins at base. Flowering shoots tufted, quadrangular. Leaves narrow, linear-oblong, 12-30 mm long, acute, with thick margins, sessile. Cymes terminal. Bracts oblong-lanceolate. Flowers 7-10 mm in diam. Sepals green, linear-oblong, 4-7 mm long, shining, 3-nerved, with membranous margins. Petals white. Styles 3. Capsules shorter than sepals, ovoid-oblong. Seeds reddish brown, rough, granulate.

Fl. : May - July.

Selected specimens : Deosai plains, Stewart 20037 (DD, CAL); Ladakh, Meebold 3637 (CAL).

Note : the plant is said to be poisonous. The alkaloid content is maximum during flowering period.

3. *Stellaria himalayensis* Majumdar in J. Ind. Bot. Soc. 44: 141. 1965 *et in* Sharma *et al.*, Fl. India 2: 584. 1993. *Stellaria latifolia* (Benth. ex G. Don) Edgew. ex Hook.f. in Hook.f., Fl. Brit. India. 1: 231. 1874; Blatter, Beaut. Fls. Kashmir 51. 1927.

Procumbent, branched herbs, 7-25 cm high, tomentose above. Leaves 5-17 x 4-8 mm; the lower broader, ovate, cordate or orbicular, short petioled, thick margined; upper smaller, lanceolate. Flowers solitary. Sepals 4, subulate, lanceolate, 5-7 mm long, with narrow scarious margins. Petals 4, white, twice as long as sepals. Stamens 8. Styles 2. Capsule, ovoid. Seeds brown, suborbicular, compressed, smooth.

Fl. & Fr. : April - June.

Common on rocky ground and shady slopes.

Included after Blatter (*loc. cit.*).

4. *Stellaria media* (L.) Vill., Hist. Pl. Dauph. 3: 615. 1789, *p.p.*; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 230. 1874 *p.p.*; Blatter, Beaut. Fls. Kashmir 52. 1927; Dhar & Kachroo, Alp. Fl. Kashmir Himal. 194. 1983; Majumdar in Sharma *et al.*, Fl. India 2: 585. 1993. *Alsine media* L., Sp. Pl. 272. 1753. *Kakoon*.

Herbs, 10-60 cm high. Stems decumbent or suberect. Leaves 3-28 cm long; the lower ovate, cordate or cuneate at base, acute or shortly acuminate, long petioled; the upper sessile, ovate or elliptic. Flowers numerous in terminal cymes. Pedicels glandular pubescent. Sepals 5, ovate-lanceolate, obtuse or subacute, 4-5 mm long, with a narrow scarious margin, usually glandular hairy. Petals 5, white, shorter than the sepals. Stamens 3-10. Styles 3. Capsules ovoid-oblong, longer than the calyx. Seeds reddish brown, with acute conical tubercles.

Fl. & Fr. : Throughout the year.

Common and most variable weed on roadside, cultivated land and waste shady places.

Selected specimens : Ladakh, 3400 m, *Bhattacharyya* 41099 (BSD, CAL); Chandanwari, 3000 m, *Wadhwa & Vohra* 840 (CAL).

5. *Stellaria monosperma* Buch.-Ham. ex D. Don, Prodr. Fl. Nep. 215. 1825; Sharma & Jamwal, Fl. Upper Liddar valley. 131. 1988; Majumdar in Sharma *et al.*, Fl. India 2: 585. 1993. *Stellaria crispata* Wall. ex Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 229. 1874. (*nom illeg.*).

Herbs, 60-120 cm tall. Stem quadrangular, shining, nodes often hairy. Leaves glabrous, oblong or lanceolate, 3-20 cm long, 1-4 cm broad, acuminate, cordate at base, crisped on margins, sessile or petioled. Flowers

white in branched cymes. Peduncles and pedicels divaricate, slender, glandular pubescent. Bracts green, 2.5-3 mm long. Sepals 5, oblong-lanceolate, 5-6 mm long, acuminate, margin narrowly scarious. Petals 5, 2-fid. Stamens 10. Styles 3. Capsules 4 mm in diam., 6-valved. Seeds 1 or 2, dark brown, with conical tubercles, notched, 2.5-3 mm in diam.

- 1a. Sepals 5-6 mm long. Leaves sessile ...5.1. var. *monosperma*
 1b. Sepals 3-4 mm long. Leaves petioled ...5.2. var. *paniculata*

5.1. var. *monosperma*

Fl. & Fr. : July October

Common along banks and on humus covered ground under coniferous forest.

Selected specimens : Kashmir; T.A. Rao 628 (CAL); Kashmir, Kishenganga valley, ca 2800 m, Stewart 19547 (CAL).

5.2. var. *paniculata* (Edgew.) Majumdar in J. Ind. Bot. Soc. 44: 141. 1965 *et in* Sharma *et al.*, Fl. India 2: 586. 1993. *Stellaria paniculata* Edgew. in Trans. Linn. Soc. 20: 35. 1846; Edgew & Hook.f. in Hook.f., Fl. Brit. India 1: 229. 1874.

Leaves petiolate, elliptic or lanceolate, acuminate, 4-10 cm long, 2-3 cm broad; nerves spreading, one intermarginal. Cymes glandular, many-flowered, terminal and axillary. Sepals 3-4 mm long, oblong-lanceolate. Petals 2-lobed, shorter than the sepals. Capsules as long as calyx, 6-valved. Seed one, up to 2 mm in diam., sub-orbicular, beaked.

Fl. & Fr.: July October.

A weak straggling herb in the shade of rock.

Included after Majumdar (*loc. cit.*).

6. *Stellaria palustris* Retz., Fl. Scand. Prodr. ed. 2: 106. 1795; Kachroo *et al.*, Fl. Ladakh. 65. 1977; Majumdar in Sharma *et al.*, Fl.

India 2: 586. 1993. *Stellaria glauca* With., Bot. Art. Brit. Pl. ed. 3. 2: 420. 1796; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 233. 1874. *Khatta*.

Perennial herb. Stems 4-angled, glabrous. Flowering shoots 9-30 cm high, slender, weak and brittle. Leaves linear lanceolate, 1.5-5 cm long, acuminate, glabrous with thick margin, sessile, midrib distinct. Flowers 12-18 mm in diam. Pedicels 3-6 cm long. Sepals lanceolate, acute, green, 3-veined, broadly scarious. Petals white, bifid to base, as long as or longer than the sepals. Stamens 10. Styles 3. Capsules ovoid, 6-valved. Seeds reddish brown, ovoid 0.7 x 1 mm, bluntly tubercled.

Fl. & Fr. : July - September.

Selected specimens : Ladakh, Sorila, 4800 m, *Bhattacharyya* 52295 (BSD, CAL); Chilung, Ladakh, ca 3500 m, *Meebold* 3636 (CAL).

7. *Stellaria patens* D. Don, Prodr. Fl. Nep. 215. 1825; Majumdar in Sharma *et al.*, Fl. India 2: 587. 1993. *Stellaria longissima* Wallich ex Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 232. 1874; Blatter, Beaut. Fls. Kashmir 53. 1927.

Herbs, laxly tufted, decumbent. Stems 15-45 cm high with dense, long silky hairs. Leaves lanceolate to narrowly elliptical, 12-21 mm long, acute, sessile 1-nerved. Flowers solitary, axillary or in terminal cymes. Peduncle erect, 25-65 mm long. Sepals 5-6 mm long, glabrous, with broad scarious margins. Petals white, as long as sepals. Stamens 10. Styles 3. Capsules shorter than the sepals: 5-valved. Seeds dark brown, tubercled.

Fl. & Fr. : May - November.

On rocky, shady, moist slopes.

Included after Blatter (*loc. cit.*).

8. *Stellaris semivestita* Edgew. in Hook.f., Fl. Brit. India 1: 230. 1874; Kachroo *et al.*, Fl. Ladakh 65. 1977; Majumdar in Sharma *et al.*, Fl. India 2: 588. 1993.

Caespitose herbs. Stems 15-45 cm long, decumbent; branches ascending, crowded, pubescent with white woolly hairs, partly glabrous. Leaves spreading, linear, subulate, 8-32 x 1-2 mm, recurved, 1-nerved; pedicels 20-28 mm long. Flowers solitary, ca 12 mm in diam. Sepals lanceolate, 6 mm long, acuminate, with broad scarious margins. Petals larger than sepals. Stamens 10. Styles 3. Capsules elliptic-oblong, 6-valved. Seeds deep brown, few, suborbicular, flattened, rough with blunt elevation.

Fl. & Fr. : April September.

Occasional on open slopes.

Included after Kachroo *et al.* (*loc. cit.*).

9. *Stellaria subumbellata* Edgew. in Hook.f, Fl. Brit. India. 1: 233. 1874; Blatter, Beaut. Fls. Kashmir 54. 1927; Kachroo *et al.*, Fl. Ladakh 65. 1977. Majumdar in Sharma *et al.*, Fl. India 2: 589. 1993.

Glabrous herbs, up to 15 cm high. Stems very slender, ascending, sometimes tufted. Leaves linear or elliptic oblong, 3-16 mm long, acute with thick margins, sessile. Flowers ca 4 mm in diam., solitary, axillary or in terminal subumbellate cymes. Bracts membranous. Sepals ovate-lanceolate, acute, 2-2.5 mm long with scarious margins, 3-nerved. Petals absent. Stamens 5. Styles 3. Capsules subcylindric, narrowly ovate, ca 4 mm long, 5-valved. Seeds pale brown, angular, ovate, rough.

Fl. & Fr. : August September.

Selected specimens : Kanipatri nala (West of Zojila), ca 4000 m, Duthie 14140 (DD); Jhallcla, Baltistan, ca 5000 m, Stewart 20729 (CAL); Deosai Plains, ca 4300 m, Duthie 14134 (DD).

10. *Stellaria tibetica* Kurz in Flora 55: 285. 1872; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 231. 1874; Kachroo *et al.*, Fl. Ladakh 65. 1977; Majumdar in Sharma *et al.*, Fl. India 2: 589. 1993.

Herbs, densely glandular pubescent. Stems 9-14 cm, ascending, base shining. Leaves suberect, oblong, acute to subacute, 8-20 x 5-7 mm, sessile,

cymes peduncled, erect, few-flowered. Pedicels 3-6 mm. Bracts coriaceous, 3-4 mm long; bracteoles ca 2 mm long. Flowers erect. Sepals elliptic, 5-6 mm long, acute with scarious margins. Petals bifid; lobes obtuse. Stamens shorter than sepals. Styles 3, slender, 2-3 mm long. Capsules broadly ovoid, 6-valved, shorter than sepals. Seeds 8-9, brown, flat.

Fl. & Fr. : July August.

Common on alpine dry stony slopes.

Selected specimens : Ladakh, Whisky Nallah, 4000 m, *Bhattacharyya* 40900 (BSD, CAL).

11. *Stellaria uliginosa* Murray, Prodr. Stirp. Goetting 55. 1770; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 233. 1874; Blatter, Beaut. Fls. Kashmir. 54. 1927; Majumdar in Sharma *et al.*, Fl. India 2: 589. 1993.

Glabrous, procumbent or suberect, annual herbs. Stems slender, 4-angled, glaucous, 10-40 cm high. Leaves ovate, lanceolate to linear-lanceolate, acute or acuminate, 8-25 mm long with sometimes undulate margin, and mucronate apex, sessile. Bracts scarious with central midrib. Sepals lanceolate to subulate, 2.5-3.5 mm long, acuminate. Petals white, minute, or absent, bifid to the base; lobes divergent. Stamens 10. Styles 3. Capsules ovoid, 6-valved, subequal to sepals. Seeds pale brown, 0.5-0.6 mm, smooth.

Fl. & Fr. : March September.

Occasionally found on moist sand along trickling stream and on wet ground near stones in dense patches.

Selected specimens : Ladakh, Tsokar Lake, 4500 m, *Bhattacharyya* 41014 (BSD); Burzil Chowki, Gilgit Road, ca 3500 m, *Stewart* 19802 (CAL).

12. *Stellaria webblana* (Benth. ex G. Don) Edgew. & Hook.f. in Hook.f., Fl. Brit. India. 1: 230. 1874; Blatter, Beaut. Fls. Kashmir. 51.

1927; Majumdar in Sharma *et al.*, Fl. India 2: 591. 1993. *Leucostemmu webbiana* Benth. ex G. Don, Gen. Syst. 1: 449, 1831.

Slender herbs, decumbent, 15-30 cm high, glabrous or with sparse whitish hairs. Stems quadrangular, branched. Leaves spreading, linear, acicular, 8-20 mm long, rigid, 1-nerved, shining. Flowers white, axillary, suberect. Pedicels 25-50 mm long, axillary. Sepals lanceolate, 4-5-7 mm long, acuminate, shining with broad scarious margins. Petals 10-11 mm, 2-fid up to middle; lobes narrow, obtuse. Stamens 8. Styles 2. Capsules ovoid, 6-valved. Seeds pale brown, 0.8-1 mm in diam., compressed, papillate at margins.

Fl. & Fr. : March - May.

Included after Blatter (*loc. cit.*).

14. THYLACOSPERMUM Fenzl

Thylacospermum caespitosum (Cambess.) Schischk. in Spiosk Rast. Gerb. Russk Fl. Ross. Akad. Nauk 9: 90. 1932; Majumdar in Sharma *et al.*, Fl. India 2: 592. 1993. *Periandra caespitosa* Cambess. in Jacquem., Voy. 4(Bot): 27, t. 29. 1835. *Thylacospermum rupifragum* (Kar. & Kir.) Schrenk., Enum. Pl. Nov. 2: 53. 1842; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 243. 1874; Kachroo *et al.*, Fl. Ladakh 66. 1977.

Perennial, caespitose, herbs, glabrous. Stems numerous, forming large spherical or hemispherical cushions, 25 cm or more in diam. Leaves ovate 2-4 mm, densely imbricate, ovate, acuminate, concave-convex, margin and apex thickened. Flowers ca 2.5 mm in diam., solitary at the apex of stem, sessile, hidden in between leaves. Petals greenish, oblong, entire, shorter than the calyx. Stamens inclined; glandules small, oblong, between bases of filaments. Capsules shining, 4-valved, or irregularly 6-valved.

Fl. & Fr. : June - September.

Rare, on rock-faces in alpine meadows.

Selected specimens : Sorila, Ladakh, 4800 m. *Bhattacharyya* 52284 (BSD, CAL); Ladakh, Mathoo-phu 5300 m. *Wadhwa* 59669 (BSD).

Subfamily SILENOIDEAE

- 1a. Calyx tube with commissural veins alternating with midrib of sepals. Styles 3-5 :
- 2a. Fruit a berry ...1. *Cucubalus*
- 2b. Fruit a capsule :
- 3a. Capsule teeth twice as many as styles ...6. *Silene*
- 3b. Capsule teeth as many as styles ...4. *Lychnis*
- 1b. Calyx tube without commissural veins. Styles 2-3 :
- 4a. Calyx tube with scarious intervals between nerves :
- 5a. Seeds peltate with facial hilum ...5. *Petrorhagia*
- 5b. Seeds reniform with lateral hilum ...3. *Gypsophila*
- 4b. Calyx tube without scarious intervals between nerves :
- 6a. Epicalyx present; calyx tube not winged ...2. *Dianthus*
- 6b. Epicalyx absent; calyx tube 5-winged ...7. *Vaccaria*

1. CUCUBALUS L.

Cucubalus baccifer L., Sp. Pl. 1: 413. 1753; Edgew. & Hook.f. in Hook.f., Fl. Brit. India. 1: 222. 1874; Blatter, Beaut. Fls. Kashmir 61. 1927, Singh & Kachroo, For. Fl. Srinagar 171. 1976; Majumdar in Sharma *et al.*, Fl. India 2: 525. 1993.

Perennial herbs, 60-90 cm high. Flowering shoots diffusely branched, covered with white hairs. Leaves ovate, acuminate, membranous, hairy; the upper sessile. Calyx tube 8-12 mm long; teeth 5, unequal. Petals greenish white, deeply 2-lobed. Stamens 10, didymous. Fruits globular, on a short carpophore. Seeds reniform, black at maturity.

Fl. & Fr. : May September.

Very common in forest shade especially in Lidderwat, also found on grassy slopes near rocky damp situations.

Selected specimens : Khillanmarg, *Mallotra* 12236 (BSD); Loran, 2000 m, *Vohra & Naithani* 78316 (BSD); Pahalgam, Baisaran, 2900 m, *T.A. Rao* 574; Batkote, 2600 m, *T.A. Rao* 9739; Banihal, *T.A. Rao* 7623 (BSD); Gulmarg, 2600 m, *Bhattacharyya* 71153 (BSD); Dagwan, 3500 m, *Wadhwa* 66998 (BSD); Udhampur, Gool, *Swami* 1282 (BSD); Liddar valley, *Duthie* 13066 (CAL).

2. DIANTHUS L.

- 1a. Margins of petals fimbriate :
- 2a. Calyx 25-40 mm long ...5. *D. crinitus*
- 2b. Calyx less than 25 mm long ...9. *D. orientalis*
- 1b. Petals entire, subentire or dentate :
- 3a. Limb of petals barbulate ...4. *D. chinensis*
- 3b. Limb of petals ebarbulate :
- 4a. Calyx 20 mm or more long :
- 5a. Flowers in paniculate cymes ...3. *D. caryophyllus*
- 5b. Flowers solitary or few :
- 6a. Calyx 50 mm long ...7. *D. falconeri*
- 6b. Calyx 20-35 mm long :
- 7a. Calyx teeth pungent ...8. *D. Jacquemontii*
- 7b. Calyx teeth not pungent ...2. *D. cachemiricus*
- 4b. Calyx 12 mm long or less :
- 8a. Bracteoles (4-) 6. Calyx 9-11-nerved ...1. *D. anatolicus*
- 8b. Bracteoles 2. Calyx 7-nerved ...6. *D. deltoides*

1. *Dianthus anatolicus* Boiss., *Diagn. Pl. Orient.* 1, 1: 22. 1843; Edgew. & Hook.f. in Hook.f., *Fl. Brit. India.* 1: 214 1874; Stewart in Nasir & Ali *Annot. Cat. Vasc. Pl. W. Pak. & Kashmir* 242, 1972; Kachroo *et al.*, *Fl. Ladakh* 61, 1977; Majumdar in Sharma *et al.*, *Fl. India* 2: 527, 1993. *Isatzingma*. Boiss.

Small, slender, densely tufted herbs. Stems 25-35 cm, usually 1-flowered. Radical leaves narrow, slender, up to 30 mm long, 3-nerved, acuminate, midrib and margins much thickened; cauline ca 24 mm long, canaliculate. Bracteoles (4)- 6(-8), broadly cuspidate, sometimes with a foliaceous points, shorter than calyx. Calyx 9-11-nerved, apex attenuate;

teeth lanceolate, acute, scarious margined, ciliolate. Petals rose coloured, oblong-spathulate, obtuse, dentate, glabrous.

Fl. & Fr. : May August.

Common on dry rocky slopes.

Selected specimens : Ladakh, Drass. *Chowdhery & Uniyal* 85776 (BSD); Dras 3040 m, *Vaid* 6996 (DD); Gilgit Road, ca 3000 m, *Stewart* 19803 (DD); Gilgit, *Webster & Nasir* 6409 (DD); Mapanon 2743 m, *Clarke* 29567 F(CAL); Baltistan, Shagar Thang valley, 3000-3500 m, *Duthie* 12134 (CAL).

2. *Dianthus cachemiricus* Edgew. in Hook.f., Fl. Brit. India. 1: 214. 1874; Blatter, *Beaut. Fls. Kashmir* 1: 48. 1927; Stewart in Nasir *et* Ali, *Annot. Cat. Vasc. Pl. W. Pak. & Kashmir* 242. 1972; Majumdar in Sharma *et al.*, Fl. India 2: 528. 1993.

Small, perennial herbs. Stems 48-52 cm high, branched from the base, erect, slender, glabrous. Leaves linear, narrow, channelled, acuminate, 3-nerved; radical up to 34 mm long; upper up to 24 mm long. Flowers solitary or few, terminal. Bracteoles lanceolate, with a long foliaceous point, sometimes as long as the calyx. Calyx purple, ca 25 mm long; teeth 5, ovate, lanceolate, acuminate, 7-nerved, margins scarious. Petals 5; pink, obovate, pink; blade 12-16 x 25 mm, margins dentate or almost entire. stamens 10. Styles 2. Capsules opening by 4 teeth.

Fl. : September.

Selected specimens : Chorwan, Gilgit Rd, ca 2800 m, *Stewart* 19673 (CAL); Churwan, ca 2800 m *Forest* 63(DD).

3. *Dianthus caryophyllus* L., Sp. Pl. 411. 1753; Edgew. & Hook.f. in Hook.f., Fl. Brit. India. 1: 214. 1874; Stewart in Nasir & Ali, *Annot. Cat. Vasc. Pl. W. Pak. & Kashmir* 242. 1972; Blatter, *Beaut. Fls. Kashmir* 1: 48. 1927; Majumdar in Sharma *et al.*, Fl. India 2: 528. 1993.

Erect, perennial herbs, glabrous and glaucous. Stems 60-70 cm, stout, jointed and leafy below. Leaves opposite, channelled, thick, obtuse, 5-nerved; central nerve prominent; lateral obscure; radical leaves 92-98 mm long; cauline linear, 70-75 mm long, recurved. Flowers rose purple or white, in loosely paniced cymes, long-pedicelled, fragrant. Bracteoles 4, obovate, 6-7 mm long mucronate. Calyx cylindrical, 25-30 mm long, teeth 5, narrow, scarious winged, 9-nerved. Petals dentate and crenate. Stamens 10; anthers oblong. Capsules cylindrical-ovoid, longer than calyx.

Fl. : Nov. January.

Selected specimens : Baltistan, 2230 m, *T. Thomson s.n.* (CAL).

4. *Dianthus chinensis* L., Sp. Pl. 411. 1753; Majumdar in Sharma *et al.*, Fl. India 2: 528. 1993. *D. seguieri* Vill., Hist. Pl. Douch. 1: 330. 1786; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 215. 1874; Kachroo *et al.*, Fl. Ladakh 62. 1977.

Perennial herbs, up to 50 cm high. Leaves lanceolate, 20-50 x 1-5 mm, acuminate. Leaves linear-lanceolate, entire, acuminate, channelled, 3-5-nerved. Flowers solitary or in lax cymes. Pedicels 2-5 mm long. Bracteoles 4, half the length of the calyx. Calyx subcylindrical, 14-20 x 3-4.5 mm, widest in the lower half; teeth lanceolate, acuminate. Petals pink, yellowish beneath, barbulate, dentate. Capsules ovoid, sessile.

Fl. : June August.

Included after Kachroo *et al.* (*loc. cit.*).

5. *Dianthus crinitus* Smith in Trans. Linn. Soc. London 2: 300. 1794; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 215. 1874; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 242. 1972; Kachroo *et al.*, Fl. Ladakh 61. 1977; Majumdar in Sharma *et al.*, Fl. India 2: 530. 1993. *Liamtnang*.

Erect, robust, perennial herbs, with suffruticose bases. Branches rigid, 20-45 cm high, few-flowered. Leaves narrow, linear, acute, 1-nerved,

those of flowering shoots shorter than internodes. Flowers solitary. Bracteoles 4-6, lanceolate, ovate to cuspidate. Calyx 25-40 mm long; teeth linear-lanceolate, up to 10.5 mm long. Petals white to pale pink, multifid to more than half of the blade, ebarbulate.

Fl. : June August.

On stony ground.

Selected specimens : Kashmir, T.A. Rao 346 (CAL) Gilgit, Niltar Valley, 2000-2300 m, Duthie s.n.; Gilgit, Tanner 29; Baltistan, Indus Valley, Duthie s.n. (DD).

6. *Dianthus deltoides* L., Sp. Pl. 411. 1753; Edgew. & Hook.f. in Hook.f., Fl. Brit. India. 1. 214; 1874; Kachroo *et al.*, Fl. Ladakh 62. 1977; Majumdar in Sharma *et al.*, Fl. India 2: 530. 1993. *Khenchpa*.

Tufted herbs, scabro-puberulent. Stems, terete, slender, forked. Leaves 12 mm long, 3-nerved; radical oblanceolate; cauline linear-lanceolate, acute. Flowers shortly pedicellate, scented, 18 mm in diam. Bracts 2, rarely 4, ovate, acute, spreading, coriaceous, scarious margined. Calyx slender; teeth lanceolate, acuminate, scarious winged, 7-nerved, often dark coloured. Petals pale, flesh coloured, rose-purple or rarely white, obovate, ca 70 mm long. Capsules cylindric. Seeds smooth, reticulate.

Fls. : July August.

Included after Kachroo *et al.* (*loc. cit.*).

7. *Dianthus falconeri* Edgew. in Hook.f., Fl. Brit. India. 1: 214. 1874; Blatter, Beaut. Fls. Kashmir 1: 49. 1927; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 242. 1972; Majumdar in Sharma *et al.*, Fl. India 2: 531. 1993.

Perennial herbs, suffrutescent, with woody rootstock. Stems branched, rigid, 30-60 cm high. Leaves linear, 70-150 x 3 mm, channelled; radical 3-nerved; cauline 1-nerved. Flowers usually solitary. Bracts 4, ovate, long

cuspidate, ca 12 mm long. Calyx 50 mm long; teeth 9-11-nerved. Petals pink, finely dentate, smooth.

Fl. : July.

Selected specimens : Pahalgam, 2135 m, *Wadhwa & Vohra* 827 (CAL); Srinagar 2376 m, *Clarke* 29071D (CAL).

8. *Dianthus Jacquemoutii* Edgew. in Hook.f., Fl. Brit. India. 1: 214. 1874; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 242, 1972; Kachroo *et al.*, Fl. Ladakh 62, 1977; Majumdar in Sharma *et al.*, Fl. India 2: 531, 1993.

Small, caespitose herbs with woody rootstocks. Stems 15-25 cm high, slender, 1-flowered, quadrangular. Leaves linear, acute, coriaceous, flat, uninerved; radical up to 30 mm long, recurved; cauline up to 22 mm long. Flowers scented. Bracts 4, obovate, 4-6 mm long. Calyx 18-25 mm long; teeth acuminate, scarious winged, 7-nerved, pungent with hard tips. Petals 5, deeply dented; pink, obovate, cuneate. Stamens 10. Styles 2.

Fls. : July Sept.

On rocky slopes and drier gravelly places, more frequently in E. Liddar Valley.

Selected specimens : Gulmarg Road, 1600 m, *Bhattacharyya* 71130 (BSD); Yarikah T.A. Rao 122 (BSD); Sunapur, ca 1800 m, *Gammie s.n.*, Baramula, Jhelum Valley, ca 1800 m, *Keshavanand* 988 (DD); Kashmir, ca 2300 m, *Clarke* 28620 C (CAL).

9. *Dianthus orientalis* Adams in Web. *et* Mohr, Beitr. 1. 54: 1805; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 242, 1972; Majumdar in Sharma *et al.*, Fl. India 2: 531, 1993. *D. fimbriatus* M. Bieb., Fl. Taur. Cauc. 1: 332, 1808; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 215, 1874.

Perennial herbs, 15-40 cm high, with woody, stout branched stocks. Stems many, rigid, erect, one-flowered. Leaves linear, 20-70 mm, rigid,

erect, 3-nerved, plain or channelled. Flowers usually solitary, pedicelled. Bracteoles 4-8, oval or oblong, 5-6 mm long, acute. Calyx 20-25 mm long, broadest below, narrowed towards apex; teeth lanceolate. Petals white or pink, fimbriate for 1/3 the length of the blade. Capsules oblong, opening by 4 teeth.

- 1a. Leaves rigid, broad, subacute. Calyx 20-25 mm ...9.2. var. *orientalis*
 1b. Leaves flaccid, linear acute serrulate. Calyx
 12-18 mm long ...9.1. var. *angulatus*

9.1. var. *angulatus* (Royle ex Benth.) Majumdar in Sharma *et al.*, Fl. India 2: 532. 1993. *D. angulatus* Royle ex Benth. in Royle, Illus. Bot. Himal. 79. 1834; Edgew. & Hook.f. in Hook.f., Fl. Brit. Ind. 1: 215. 1874; Kachroo *et al.*, Fl. Ladakh 61. 1977.

Fl. : June - October.

Common on dry open slopes.

Specimens sepcimens : Gilgit, 3000-3600 m, Duthie 12363 (CAL).

9.2. var. *orientalis*

Fl. & Fr. : June - September.

Selected specimens : Baltistan, 2800-3000 m. Stewart 20273 (DD).

3. GYPSOPHILA L.

- 1a. Leaves obovate-spathulate. Cymes lax. Calyx
 ca 6 mm long ...1. *G. cerastioides*
 1b. Leaves linear, obtuse. Cymes capitate. Calyx
 ca 2 mm long ...2. *G. sedifolia*

1. *Gypsophila cerastioides* D. Don, Prodr. Fl. Nepal 213. 1825; Edgew. & Hook.f. in Hook.f., Fl. Brit. India. 1: 217. 1874; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. 4 Kashmir 242. 1972; Dhar

& Kachroo. Alp. Fl. Kashmir Himal. 192; 1983; Majumdar in Sharma *et al.*, Fl. India 2: 535. 1993.

Perennial herbs. Stems many, erect, pilose, 4-angled. Leaves pilose; radical spatulate, long petioled; cauline obovate, rounded at apex. Flowers in lax terminal corymb. Calyx campanulate; segments lanceolate, densely ciliate with curved hairs. Petals white, mauve or white with purple streaks, spatulate-obovate and emarginate. Stamens 10, short, unequal. Capsules 5-valved, shorter than calyx. Seeds brown, tubercled.

Fl. & Fr. : May - October.

Common on eroded alpine slopes; often gregarious on shaded gravelly banks.

Selected specimens : Kote-Banjul, Kathua, Uniyal & S. Singh 90365 (BSD); Seoj-Kailash, 3500 m, Vohra & Naithani 82945 (BSD); Pahalgam, Tulin lake, 3800 m. T.A. Rao 967 (BSD); Gulmarg, Duthie 11296 (CAL).

2. *Gypsophila sedifolia* Kurz in Flora 30: 285. 1872; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 217. 1874; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 242. 1972; Kachroo *et al.*, Fl. Ladakh 62. 1977; Majumdar in Sharma *et al.*, Fl. India 2: 537. 1993.
Chiktakpa.

Perennial, tufted herbs, pubescent throughout. Roots stout, woody. Leaves fascicled, linear, 6 mm long, obtuse, thick, nerveless. Flowers white, in capitate cymes, 4-6 mm in diam. Bracts linear, obtuse. Calyx ca 2 mm long, 5 lobed; teeth obtuse, margins scarious. Capsule included in calyx.

Fl. & Fr. : May - July.

Occasional on sandy mound and rocky slopes.

Selected specimens : Khardungla, 3800 m, Bhattachayrya 71533 (BSD); Dras-Kargil Road, 3110 m, Wadhwa 58701 (BSD). Kharbu : Ladak Road, Stewart 21097 (DD).

DOUBTFUL TAXA

Gypsophila floribunda (Kar. & Kir.) Turcz. ex Ledeb., Fl. Ross. 1: 775. 1842; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 245. 1972; Ghazanfar & Nasir in Nasir & Ali, Fl. Pak. 175: 92. 1986. *Dichoglottis floribunda* Kar. & Kir. in Bull. Soc. Nat. Mosc. 14: 165. 1841.

Gypsophila muralis L., Sp. Pl. 408. 1753; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 245. 1972; Ghazanfar & Nasir in Nasir & Ali, Fl. Pak. 175: 95. 1986. var. **stepposa** (Klok) Schischk. in Fl. Yugo-vost. 4: 300. 1930. *G. stepposa* Klok in Soc. Bot. de Russia 6: 137. 1921.

Gypsophila pilosa Huds. in Phil. Trans. Ray, Soc. Lond (B)56: 252. 1767; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 245. 1972; Ghazanfar & Nasir in Nasir & Ali, Fl. Pak. 175: 92. 1986.

4. LYCHNIS L.

Lychnis coronaria (L.) Desr. in Lamk., Encycl. 3: 643. 1792; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 222. 1874; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 246. 1972; Dhar & Kachroo, Alp. Fl. Kashmir Himal. 192. 1983; Majumdar in Sharma *et al.*, Fl. India 2: 542. 1993. *Agrostemma coronaria* L., Sp. Pl. 1: 436. 1753. *Augavda*, Chutjal.

Herbs, uniformly softly tomentose with silky white hairs. Stems 70-75 cm high. Radical leaves spathulate to lanceolate. 7-12 cm long, cauline leaves oblong, 4-7 cm long. Pedicels long. Calyx conical, 1.5-2 cm long, 10-nerved; teeth contorted to left. Petals red purple, ca 2.5 cm long. Capsules almost sessile, included in calyx; valves 5, quite entire.

Fls. : May August.

Fairly common on stony soil along stream edge.

Selected specimens : Dachigam game sanctuary. Wadhwa 66825

(BSD); Batkote, Furfazal, 3000 m. *T.A. Rao* 9788; Dachigam sanctuary, *T.A. Rao* 63506, 63514; Yarikah Forest, *T.A. Rao* 28 (BSD).

5. PETRORHAGIA (Ser.) Link.

Petrorhagia alpina (Habl.) P.W. Ball & Heywood in Bull. Brit. Mus. (Nat. Hist.) Bot. 3: 145. 1964; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 249. 1972; Sharma & Jamwal, Fl. Upper Liddar Valley. 118. 1988; Majumdar in Sharma *et al.*, Fl. India 2: 549. 1993. *Gypsophila alpina* Habl. in Neue. Nord. Beytr. Phys. Geogr. 4: 57. 1783. *Tunica stricta* (Ledeb.) Fischer & C. Meyer, Index Sem. Hort. Bot. Petrop. 4: 50. 1837; Edgew. & Hook.f. in Hook.f., Fl. Brit. India. 1: 216. 1874.

Annual, erect, glabrous, herbs, up to 40 cm high, branched. Basal leaves rosulate, linear spatulate to oblong; 5-30 mm long; cauline leaves linear, acute, 1-veined. Calyx glabrous, green, with 1 veined teeth, Petals white, linear-oblong, 3-6 mm long, not clawed. Seeds blackish brown ovate-oblong, with thickened margin.

Fl. & Fr. : May - September.

Occasional on gravelly way side and amidst boulders on dry places.

Selected specimens : Shekhpura, Wadhwa, Murti & Pant 85127 (BSD); Kashmir, 3040 m, *Duthie* 10970 (DD); Kashmir, ca 1300 m. *Meebold* 3640 (CAL).

6. SILENE L.

1a. Inflorescence dichasial or monochasial cymes :

2a. Cymes monochasial ...2. *S. caespitella*

2b. Cymes dichasial :

3a. Fruiting calyx inflated, nerves anastomosing ...21. *S. vulgaris*

3b. Fruiting calyx not inflated, nerves not anastomosing ... 5. *S. conoidea*

1b. Inflorescence racemosely paniculate :

- 4a. Pedicels 2 bracteolate :
- 5a. Calyx 18-25 mm long. Auricle of claw
of the petal toothed ...13. *S. moorcroftiana*
- 5b. Calyx up to 10 mm long. Auricle of
the claw of the petal not toothed ...19. *S. stewartii*
- 4b. Pedicels ebracteolate :
- 6a. Panicles spreading, not racemiform ...10. *S. kunawurensis*
- 6b. Panicles racemiform, not spreading :
- 7a. Calyx cylindrical, subcoriaceous,
adpressed in fruit ...20. *S. viscosa*
- 7b. Calyx campanulate, inflated, membranous,
not adpressed in fruit :
- 8a. Styles 3 ...1. *S. amoena*
- 8b. Styles 4-5 :
- 9a. Calyx teeth more than half the total
length of calyx ...3. *S. cancellata*
- 9b. Calyx teeth less than half the total
length of calyx :
- 10a. Calyx more than 1.2 cm across,
much inflated :
- 11a. Anthophore less than 2 mm
long :
- 12a. Seeds with setae or
papillae, wings absent ...17. *S. setisperma*
- 12b. Seeds without setae or
papillae, winged ...15. *S. nigrescens*
- 11b. Anthophore more than
2 mm long :
- 13a. Petals 4-partite. Seeds
winged ...11. *S. laxantha*
- 13b. Petals bifid. Seeds
without wings ...16. *S. rechingeri*
- 10b. Calyx less than 1.2 cm across,
slightly inflated :

- 14a. Seeds dorsally winged :
- 15a. Calyx campanulate. Seeds laterally compressed, broadly winged ...7. *S. falconeri*
- 15b. Calyx not campanulate. Seeds not laterally compressed, narrowly winged ...8. *S. gonosperma*
- 14b. Seeds not winged :
- 16a. Anthophore less than 1.5 mm long. Seeds less than 0.9 x 1 mm :
- 17a. Plants not glandular hairy ...14. *S. nepalensis*
- 17b. Plants glandular hairy :
- 18a. Plants dwarf, less than 15 cm high ...12. *S. madens*
- 18b. Plants more than 30 cm high ...18. *S. songarica*
- 16b. Anthophore more than 2 mm long. Seeds more than 1 x 1.2 mm :
- 19a. Petals 4 partite ...6. *S. edgeworthii*
- 19b. Petals bifid :
- 20a. Anthophore 2-3 mm long. Petals exceeding the calyx by 3-4 mm ...9. *S. indica*
- 20b. Anthophore more than 3 mm long. Petals exceeding the calyx by 6-8 mm ...4. *S. cashmeriana*

1. *Silene amoena* L., Sp. Pl. 1: 417. 1753; Majumdar in Sharma *et al.*, Fl. India 2: 562. 1993. *Silene tenuis* Willd., Enum. Hort. Berol. 1: 474. 1809; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 219. 1874; Blatter, Beaut. Fls. Kashmir 1: 56. 1927; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 252. 1972; Singh & Kachroo, For. Fl. Srinagar 172. 1976.

Perennial herbs, usually, glabrous. Stems many, erect or ascending, 15-46 cm high. Basal leaves linear-lanceolate, 30-80 x 1-4 mm, acute or acuminate, usually glabrous, ciliate at base, broadened upwards; cauline leaves few. Inflorescence raceme like panicle, composed of short cymules. Flowers 12-14 mm long, often in whorls. Bracts short, subulate, ciliate. Calyx campanulate, 9-13 mm long, membranous, 10-nerved, base rounded.

Petals deeply 2 partite; lobes oblong, obtuse, auricled. Capsules oblong. Seeds with 5 dorsal and 5 lateral rows of tubercles.

Fl. & Fr. : July September.

Rare, on open grassy and rocky hill sides and on alpine grassy slopes.

Selected specimens : Ladak, Tangste 4400 m, *Viswanathan* 54763 (BSD); Amarnath 3700 m, *Nair* 37052 (BSD); Jhelum Valley, 4000-4500 m, *Keshavanand* 840 (DD); Kashmir, *Duthie* 11931 (CAL).

2. *Silene caespitella* Williams in J. Linn. Soc. Bot. 38: 403. 1909; Majumdar in Sharma *et al.*, Fl. India 2: 562. 1993. *Silene maheshwari* Bocquet in Candollea 22: 4. 1967.

Perennial herbs. Lower leaves linear-spathulate, 2-6 (-10) x 2-5 mm, acute, glabrous, 1-nerved; the upper linear, gradually smaller, sessile. Cymes (1-) 3-11 (-15)-flowered. Calyx a little inflated, 2.5-3 x 5-6 mm, slightly hirsute, more hirsute on nerves; teeth recurved, triangular, acute, with ciliate margin. Petals ca 1-1.5 mm, exceeding calyx; claw cuneiform, auriculate, and 2, with 2 lateral teeth towards base; scales 2 at throat. Stamens included. Ovary 1-1.5 x 2.5 (3) mm. Capsules 10 toothed. Seeds grey or dark brown, minute, tuberculate.

Fl. & Fr. : July September.

Fairly common in rocky crevices on slopes.

Selected specimens : Ladakh, Khaltsi-Saspole, 2700 m, *Wadhwa* 59224; Hemis, 3600 m, *Wadhwa* 59696 (BSD); Baltistan, *Duthie* 12001 (DD).

3. *Silene cancellata* (Edgew. & Hook.f.) Majumdar in J. Ind. Bot. Soc. 42: 660. 1963 *et in* Sharma *et al.*, Fl. India 2: 563. 1993. *Lychnis cancellata* Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 226. 1874.

Slender, erect, densely pubescent herbs. Stems densely covered with long spreading hairs, glandular pubescent above. Leaves ovate-lanceolate or orbicular, up to 5 cm long; radical leaves petioled; cauline sessile. Flowers in distant pairs, short pedicelled. Calyx subcampanulate, densely tomentose, viscid glandular, 10-nerved, 5-toothed. Petals 4-fid; claw auricled. Stamens and carpophores woolly. Seeds granulate.

Fl. & Fr. : July - September.

Included after Majumdar (*loc. cit.*).

4. *Silene cashmeriana* (Royle ex Benth.) Majumdar in J. Ind. Bot. Soc. 42: 649. 1963 *et in* Sharma *et al.*, Fl. India 2: 563. 1993. *Lychnis cashmeriana* Royle ex Benth. in Royle, Illus. Bot. Himal. 80. 1834; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 224. 1874; Dhar & Kachroo. Alp. Fl. Kashmir Himal. 192. 1983.

Perennial herb. Scapes erect, simple, robust, 30-60 cm high, hirsute upwards. Leaves linear to lanceolate, 45-80 x 6-15 mm, ciliate-scabrous on margins, nerves hirsute. Cymes 3-10-flowered. Bracts large, 18-30 mm long. Calyx vesiculiform, clavate campanulate, 17 x 9 mm at maturity, membranous, hirsute, anastomosing; teeth triangular, acute, margins scarious, ciliate. Petals longer than the calyx; claw included; limb bifid; lobes entire or a little incised. Stamens not exceeding the corolla throat. Capsules 5-toothed. Seeds reniform, dorsally tuberculate or papillate.

Fl. & Fr. : July - October.

Selected specimens : Sind Valley, ca 3000 m, Duthie 11515 (DD); Srinagar, 2400 m, Clarke 29117 (CAL); Kashmir, 1800-2300 m, Thomson s.n. (CAL).

5. *Silene conoidea* L., Sp. Pl. 418. 1753; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 218. 1874; Blatter, Beaut. Fls. Kashmir 1: 57. 1927; Majumdar in Sharma *et al.*, Fl. India 2: 564. 1993; Dhar & Kachroo, Alp. Fl. Kashmir Himal. 193. 1983.

Annual herbs, glandular pubescent. Stems dichotomously branched, 15-45 cm high. Leaves 30-120 x 4-11 mm; the cauline sessile, oblong or lanceolate, acute. Inflorescence terminal panicle of dichotomous cymes. Flowers few, erect. Calyx tubular, narrow upwards, 15-23 mm long, finely grooved, inflated in fruit; teeth long, 1/3 of the tube. Petals pink; limb short, obovate, entire or erose; claw auricled; scales 2 at base. Stamens 10. Capsules ovoid, pointed, enclosed in the inflated calyx; teeth 6. Seeds with 5 dorsal and 5 lateral rows of tubercles.

Fl. & Fr. : March August.

Fairly common on exposed sandy soil.

Selected specimens : Ladakh, Sankoo 3100 m, *Wadliwa* 59825 (BSD); Matta village, Kishtwar, *Uniyal* 80291 (BSD); Drass, 2800 m, *Bhattacharyya* 4122 (BSD); Sunagai, ca 1800 m, *Gammie s.n.* (DD).

6. *Silene edgeworthii* Bocquet in *Candollea* 22: 13, 1967; Majumdar in *Sharma et al.*, *Fl. India* 2: 565, 1993. *Lychnis indica* (Roxb. ex Otth.) Benth. var. *fimbriata* (Wallich ex G. Don) Edgew. & Hook.f. in Hook.f., *Fl. Brit. India*, 1: 225, 1874; Stewart in Nasir & Ali, *Annot. Cat. Vasc. Pl. W. Pak. & Kashmir*, 246, 1972; Sharma & Jamwal, *Fl. Upper Liddar Valley*, 1: 129, 1988.

Perennial herbs, 30-40 cm high. Leaves elliptic or ovate-lanceolate, 3-11 x 7-20 mm, acute, glabrous or glabrescent. Cymes 5-20 (-29)-flowered. Flowers drooping, finally erect. Calyx large, inflated, campanulate, mouth open, 12 x 14 mm at maturity; teeth 5, margins scarious, ciliate; nerves hirsute. Petals exceeding the calyx; lobes laciniate. Stamens a little exceeding the corolla throat. Capsules globose. Seeds greyish brown, reniform.

Fl. & Fr. : August September.

Common in the forest clearings and in open scrubs.

Selected specimens : Vaishnodevi, *Uniyal* 77401 (BSD); Bheaderwah Jai, *Vohra & Naithani* 82922 (BSD); Banihal Mountians, 2350-3330 m, *T.A. Rao* 7642 (BSD).

7. *Silene falconeri* (Rohrb.) Bocquet in *Candollea* 22: 9. 1967; Majumdar in Sharma *et al.*, *Fl. India* 2: 565. 1993. *Melandrium falconeri* Rohrb. in *Linnaea* 36: 220. 1869-70. *Lychnis apetala* auct. non L.; Edgew. & Hook.f. in Hook.f., *Fl. Brit. India* 1: 222. 1874, *p.p.*; Stewart in Nasir & Ali, *Annot. Cat. Vasc. Pl. W. Pak. & Kashmir* 246. 1972. *Khizingtse*.

Perennial, tufted herbs. Scapes many, glandular hirsute. Radiacal leaves narrowly oblanceolate, cuneiform, up to 38 x 7 mm, glandular hirsute; cauline 1-3 pairs, narrow elliptic, cymes 1-3-flowered. Calyx broad campanulate, hirsute, membranous; teeth scarious and ciliate along margins. Petals longer than the calyx; limb bifid; lobes rounded or 2-toothed; claw narrowly auriculate. Styles 5. Capsules 10-toothed. Seeds flat, broadly winged.

Fl. & Fr. : July - September.

Included after Majumdar (*loc. cit.*).

8. *Silene gonosperma* (Rupr.) Bocquet in *Candollea* 22: 7. 1967; Majumdar in Sharma *et al.*, *Fl. India* 2: 567. 1993. *Physolychnis gonosperma* Rupr. in *Mem. Acad. Imp. Sci. St. Petersburg* 14: 4. 1969. *Lychnis himalayensis* (Rohrb.) Edgew. & Hook.f. in Hook.f., *Fl. Brit. India* 1: 223. 1874. *Silene himalayensis* (Rohrb.) Majumdar in *J. Ind. Bot. Soc.* 42: 648. 1963. *Silene wahlenbergella* Chaudhuri in *Notes Royal Bot. Gard. Edin.* 22: 237. 1957; Dhar & Kachroo, *Alp. Fl. Kashmir Himal.* 193. 1983.

Perennial tufted herbs. Stems short, glandular pubescent. Basal leaves in rosettes, oblanceolate, up to 80 x 6 mm, glabrous or hirsute on both surface, Cymes 1-3-flowered. Calyx ovoid-fusiform, cylindrical or campanulate, densely hirsute. Anthophore villous, with broad purple-brown nerves. Petals equal to or slightly exceeding the calyx, with a very short, emarginate or bifid limb. Capsules broadly ovoid; teeth 10, recurved. Seeds dark brown angular, narrowly-winged.

- 1a. Plants pubescent. Calyx ovoid-fusiform, not inflated, constricted at mouth ...8.1. subsp. *gonosperma*
 1b. Plants glandular-hirsute. Calyx cylindrical-campanulate, inflated, not constricted ...8.2. subsp. *himalayensis*

8.1. subsp. gonosperma

Fl. & Fr. : July - September.

Selected specimens : Seoj-Kailash 3500 m, *Vohra & Naithani* 82991 (BSD); Ladakh, Tang Lang la, *Hajra* 74241 (BSD); Changa la, *Chowdhery & Uniyal* 86145 (DD); Gilgit, Niltar Valley 3500-4000 m, *Duthie* 12375 (DD); Jhelum Valley 4000-4500 m, *Keshavanand* 26138 (DD); Lamchan Nala, 3500-4000 m, *Duthie* 13774 (CAL).

8.2. subsp. himalayensis (Rohrb.) Bocquet in *Candollea* 22: 7. 1967; Majumdar in *Sharma et al.*, *Fl. India* 2: 567. 1993. *Lychnis apetala* L. var. *himalayensis* Rohrb. in *Linnaea* 36: 220. 1869-1870. *L. himalayensis* (Rohrb.) Edgew. in *Hook.f.*, *Fl. Brit. India* 1: 223. 1874. *Gayongarlo*.

Fl. & Fr. : June - September.

Included after Majumdar (*loc. cit.*).

9. *Silene indica* Roxb. ex Otth. in *DC.*, *Prodr.* 1: 368. 1824; Majumdar in *Sharma et al.*, *Fl. India* 2: 568. 1993. *Lychnis indica* (Roxb. ex Otth.) Benth. in *Royle, Illus. Bot. Himal.* 81. 1834; Edgew. & *Hook.f.* in *Hook.f.*, *Fl. Brit. India* 1: 225. 1874; *Blatter, Beaut. Fls. Kashmir Himal.* 60. 1927; *Stewart* in *Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir* 246. 1972. *Lappu*.

Perennial herbs. Leaves narrow, lanceolate, sometimes elliptic-ovate, 20-70 x 10-20 mm, acute, glabrous or hirsute. Cymes 5-22 (-30)-flowered. Pedicels elongate. Calyx cylindrical or campanulate, little inflated, membranous; teeth broadly triangular, margins scarious, slightly glandular ciliate. Petals exceeding the calyx by 3-4 mm, limb bilobed; lobes entire or crenulate; appendages 2. Capsules up to 12 x 8 mm, ovoid; teeth 8-10, recurved. Seeds brownish tuberculate or papillate dorsally.

Fl. & Fr. : July - October.

Selected specimens : Kashmir, *T.A. Rao* 400 (CAL).

10. *Silene kunawurensis* Royle ex Benth. in Royle, *Illus. Bot. Himal.* 79. 1834; Edgew. & Hook.f. in Hook.f., *Fl. Brit. India.* 1: 220. 1874; Stewart in Nasir & Ali, *Annot. Cat. Vasc. Pl. W. Pak. & Kashmir* 251. 1972; Sharma & Jamwal, *Fl. Upper Liddar Valley.* 1: 120. 1988; Majumdar in Sharma *et. al.*, *Fl. India* 2: 570. 1993.

Perennial tufted herbs. Branches arising from rootstock, usually prostrate, slender. Flowering scape 15-30 cm high, slender, usually glabrous upwards. Leaves grasslike, 40-70 x 3-5 mm, the upper gradually shorter. Inflorescence reduced to opposite pairs of flowers at nodes. Flowers few. Pedicels slender. Calyx 9-12 x 3-4 mm, membranous, 10-ribbed, quite glabrous; teeth obtuse sometimes pubescent, with scarious margins. Petals linear-oblong, deeply bipartite, without auricles. Capsule ovoid, twice as long as gynophore. Seeds dorsally channelled, sides almost flat.

Fl. : July August.

Included after Sharma & Jamwal (*loc. cit.*).

11. *Silene laxantha* Majumdar in *J. Ind. Bot. Soc.* 42: 650. 1963 *et in* Sharma *et. al.*, *Fl. India* 2: 570. 1993. *Lychnis pilosa* Edgew. in Hook.f., *Fl. Brit. India* 1: 226. 1874; Blatter, *Beaut. Fls. Kashmir* 61. 1927; Stewart in Nasir & Ali., *Annot. Cat. vasc. Pl. W. Pak. & Kashmir* 247. 1972.

Perennial glandular hairy herbs. Middle cauline leaves elliptic to orbicular, 12-22 x 25-35 mm, acute or apiculate. Cymes thyriform, 1-7-flowered. Calyx inflated, long campanulate, 8-9 x 16-20 mm, membranous, densely woolly. Petals exceeding calyx, much auriculate; limb 4-partite. Filaments villous at base. Capsules light brown, 13-14 x 8 mm; teeth 10. Seeds deep brown, small, dorsally with 0.2-0.4 mm long papillae.

Fl. & Fr. : July September.

Included after Blatter (*loc. cit.*).

12. *Silene madens* Majumdar in J. Ind. Bot. Soc. 42: 648. 1963
et in Sharma *et al.*, Fl. India 2: 571. 1993. *Lychnis macrorhiza* Royle
ex Benth. in Royle, Illus. Bot. Himal. 80: 1834; Edgew. & Hook.f. in
 Hook.f., Fl. Brit. India 1: 223. 1874.

Perennial herbs, 10-15 cm high. Roots thick, elongated. Stems many
 tufted, short, simple, glandular pubescent. Leaves lanceolate to obovate-
 spatulate; the lower narrowed to long petioles; the upper sessile, all
 pubescent. Flowers solitary, erect. Calyx broadly oblong, 12-18 mm long,
 inflated, vesicular; nerves faint, pubescent. Petals shorter than calyx; limb
 deep purple, short, 2-fid, scarcely crenulate. Seeds minutely concentrically
 granulate, dorsally round, wingless.

Fl. & Fr. : July August.

Fairly common on loose open stony slopes.

Selected specimens : Ladakh. Lacha Lung la, 4800 m, *Bhattacharyya*
 40952 (BSD).

13. *Silene moorcroftiana* Wallich *ex* Benth. in Royle, Illus. Bot.
 Himal. 79. 1834; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 219. 1874;
 Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 251.
 1972; Dhar & Kachroo, Alp. Fl. Kashmir Himal. 192. 1983; Majumdar
in Sharma *et al.*, Fl. India 2: 571. 1993. *Luksukpa*.

Perennial herbs, pubescent. Scapes many from a woody rootstock,
 densely tufted, erect, 15-45 cm long. Radical leaves spatulate, lanceolate,
 30-50 (-90) x 1-2 m, acute; cauline linear or linear-lanceolate, acute or
 obtuse, shorter. Cymes terminal or subterminal. Flowers few in a cyme,
 erect, bracteate. Calyx tubular-clavate, slender below, glandular-puberulent,
 10-nerved. Petals reddish or white, exserted, claw auricled. Stamens 5,
 epipetalous. Capsule ovoid, 9-13 mm long. Seeds flat, not grooved.

Fl. & Fr. : July September.

Fairly common on moist open slopes along nullah and in rock
 crevices near water.

Selected specimens : Ladakh, Drass, Chowdhery & Uniyal 85831 (BSD); Zojila, Hajra 74260 (BSD); Ladakh, Tangste-Lukung Road, 3925 m, Wadhwa 60106(BSD); Ladakh, Upshi East Shera 3400 m. *Bhattacharyya* 41124 (BSD); Ladakh, Phyang-Leh, 3700 m, *Viswanathan* 54647 (BSD); Manjkeo (Hemis N.P.), Ladakh, *S.K. Srivastava & Chauhan* 100988 (BSD).

14. *Silene nepalensis* Majumdar in J. Ind. Bot. Soc. 42: 649. 1963 *et in* Sharma *et al.*, Fl. India 2: 572. 1993. *Lychnis multicaulis* Wallich ex Benth. in Royle, Illus. Bot. Himal. 80. 1834; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 224. 1874.

Tall herbs. Leaves linear or linear spatulate, acute, glabrous; lower 50-90 x 5-9 mm, gradually reduced upwards. Cymes 1-5-flowered. Calyx campanulate, a little inflated; teeth triangular, with scarious and ciliate margins. Petals 2-3 mm, exceeding the calyx. Stamens included. Capsules 11-12 x 6-7 mm. Seeds small, nearly papillate.

Fl. & Fr. : July - November.

Common along the road in grassy places near cultivation.

Selected specimens : Loran, Sultanpathri 2000-2500 m, *Naithani* 78347; Loran area, 2000-2500 m; *Naithani* 78352 (BSD); Gulmarg, *T.A. Rao* 264 (BSD).

15. *Silene nigrescens* (Edgew.) Majumdar in J. Ind. Bot. Soc. 42: 647. 1963 *et in* Sharma *et al.*, Fl. India 2: 572. 1993. *Lychnis nigrescens* Edgew. in Hook.f., Fl. Brit. India 1: 223. 1874; Stewart. in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 247. 1972.

Perennial herbs, laxly tufted. Scapes erect, many, slender, with blackish glandular hairs. Radical leaves 30-60 x 2-10 mm, linear to oblanceolate acute, glabrous, blackish upwards. 1-nerved, margins ciliate; cauline leaves 2-5 pairs, linear, smaller. Cymes 1-3-flowered. Calyx much inflated, membranous, glandular hirsute. Petals pink, ca 4 mm longer than the calyx; claw auriculate. Stamens longer than calyx throat. Capsules

ca 11 x 12 mm, globose, 5-toothed. Seeds deep brown, broadly winged.

Fl. : June - October.

Selected specimens : Kargil Valley, 4000-4500 m, *Duthie* 13909 (DD).

16. *Silene rechingeri* Bocquet in *Candollea* 22: 11. 1967; Majumdar in Sharma *et al.*, *Fl. India* 2: 573. 1993. *Lychnis cuneifolia* Royle ex Benth. in Royle, *Illus. Bot. Himal.* 1: 80. 1834; Edgew. & Hook.f. in Hook.f., *Fl. Brit. India* 1: 226. 1874.

Perennial, laxly tufted, erect 10-25 cm high, herbs, blackish hairy above, with 1-3 pairs of leaves. Basal leaves very narrowly oblanceolate, 30-60 x 5-12 mm, obtuse or rounded at apex, glandular hirsute; cauline leaves lanceolate, smaller, much glandular hirsute. Cymes 1-5 (-7)-flowered. Pedicels 1-7 cm long. Calyx vesiculiform, inflated, densely glandular hirsute, margins scarious and ciliate, woolly. Petals 6-7 mm exceeding the calyx, claw cuneiform, auriculate, villose at base; limb bifid; teeth 2 at throat, truncate; stamens a little exceeding the throat, filaments woolly at base. Capsule ovoid, 10-11 mm thick, smooth, purple, Shining.

Fl. & Fr. : July - September.

Common on loose stony hill slopes.

Selected specimens : Ladakh, Lachalunga la, 4700 m, *Bhattacharyya* 40958; Ladakh, Sorila, 4800 m, *Bhattacharyya* 52289; Ladakh, Thang Lang la, *Bhattacharyya* 41024 (BSD).

17. *Silene setisperma* Majumdar in *J. Ind. Bot. Soc.* 42: 649. 1963 *et in* Sharma *et al.*, *Fl. India* 2: 573. 1993. *Lychnis inflata* (Wallich ex G. Don) Benth. in Royle, *Illus. Bot. Himal.* 80: 1834; Edgew. & Hook.f. in Hook.f., *Fl. Brit. India* 1: 225. 1874.

Herbs, up to 40 cm high. Scapes minutely pubescent, glandular-pubescent above, swollen at nodes. Leaves 40-60 x 15-22 mm; basal leaves elliptic, petioled; upper lanceolate, smaller. Flowers solitary, terminal. Calyx

pale green with dark brown nerves, much inflated, membranous; teeth broad. Carpophore short, woolly. Seeds with rows of papillae or setae.

Fl. & Fr. : July - August.

Included after Majumdar (*loc. cit.*).

18. *Silene songarica* (Fischer, C.A. Mey. & Ave-Lall.) Bocquet in *Candollea* 22: 3. 1967; Majumdar in Sharma *et al.*, *Fl. India* 2: 574. 1993. *Melandrium songaricum* Fischer, C.A. Mey. & Ave-Lall, *Suppl. Ind. Sem. Hort. Petrop.* 9: 14. 1844. *Lychnis brachypetala* Hornem., *Suppl. Hort. Bot. Hafn.* 51. 1819; Edgew. & Hook.f. in Hook.f., *Fl. Brit. India.* 1: 223. 1874; Stewart in Nasir & Ali, *Annot. Cat. Vasc. Pl. W. Pak. & Kashmir* 246. 1972.

Slender, glandular hairy herbs. Scapes numerous, up to 60 cm high, simple, with black glandular hairs. Leaves 4-5 pairs, all cauline, linear spatulate to linear elliptic, 15-70 x 2.5 (-7) mm. Cymes 1-7-flowered. Pedicels short. Calyx small, slightly inflated, mouth constricted; teeth triangular, acute, margins scarious, ciliate. Petals short; claw narrowly auriculated; limb bilobed; lobes rotundate. Carpophore short or absent. Stamens included. Capsules slightly exceeding the calyx. Seeds minute.

Fl. & Fr. : June - September.

Common amidst boulders with *Sedum*.

Selected specimens : Ladakh, Khardung la, Hajra 74177 (BSD); Chusul, 5500 m, Viswanathan 55020 (BSD); Ladakh, Bhattacharyya 52287 (BSD); Sheshmarg, 3660 m, Wadhwa & Vohra 849 (CAL); Ladakh, Chunagaud, Stewart 21045 (DD).

19. *Silene stewartii* (Edgew.) Majumdar in *Bull. Bot. Surv. India* 16: 153. 1974 *et in* Sharma *et al.*, *Fl. India* 2: 574. 1993. *Lychnis stewartii* Edgew. in Hook.f., *Fl. Brit. India.* 1: 224. 1874; Blatter, *Beaut. Fls. Kashmir* 59. 1927.

Slender, grass like herbs. Flowering stems 15-25 cm high. Leaves narrow, linear to lanceolate, up to 55 x 2 mm, 1-nerved. Flowers few, small, solitary

in upper axils or in opposite pairs, nodding. Pedicels pubescent, with two linear bracteoles in the upper part. Calyx oblong 8-10 mm long, membranous, pubescent; teeth rounded, scarious. Petals obovate; limb very short, recurved, 2-partite; claw very broad, auricled, little longer than calyx. Carpophore densely woolly. Capsules longer than calyx.

Fl. & Fr. : July August.

Included after Blatter (*loc. cit.*).

20. *Silene viscosa* (L.) Pers., Syn. Pl. 1: 497. 1805; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 252. 1972; Majumdar in Sharma *et al.*, Fl. India 2: 577. 1993. *Cucubulus viscosus* L., Sp. Pl. 1: 414. 1753. *Silene griffithii* Boiss., Fl. Orient. 1: 637. 1867; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 220. 1874.

Perennial, stout herbs. Stems robust, tomentose, viscous above, simple or branched. Radical leaves spatulate-lanceolate, 50-95 x 10-18 mm, acuminate, narrowed into a broad petiole; cauline leaves oblong or ovate lanceolate, 40-80 x 20-40 mm, acuminate, velvety, sessile. Racemes branched, composed of cymes, opposite. Pedicels 8-10 mm long. Calyx cylindrical, 15-22 mm long, 10 nerved; teeth acute, glabrous. Petals white deeply bilobed, without scales or appendages. Carpophore ca 4 mm long. Capsules oblong, up to 16 x 11 mm. Seeds minute, triangular-reniform.

Fl. & Fr. : May October.

Included after Majumdar (*loc. cit.*).

21. *Silene vulgaris* (Moench) Garcke, Fl. N. Mitt. Deutschl. ed. 9: 64. 1869; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 252. 1972; Singh & Kachroo, For. Fl. Srinagar 172. 1976; Kachroo *et al.*, Fl. Ladakh 64. 1977; Majumdar in Sharma *et al.*, Fl. India 2: 577. 1993. *Behen vulgaris* Moench, Methodus 709. 1794. *Silene inflata* Sm.; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 218. 1874.

Perennial, velvety or glabrous, glossy herbs. Stems 30-150 cm tall, erect cylindrical. Leaves ovate, 25-70 x 10-35 mm, acute; upper leaves

gradually smaller. Inflorescence drooping, loose, terminal dichotomous cymes. Bracts thin. Calyx ca 20 mm long, ovoid, inflated, 15-20-ribbed; teeth 5. Petals 5; limb 2-lobed with a pouch-like enlargement. Stamens 10. Styles 3. Capsule globose, opening by 6 teeth.

Fl. & Fr. : June September.

Common among scrubs, generally in shaded situations in forest.

Selected specimens : Desu Rakh, 3000 m, T.A. Rao 9810; Banihal Valley, 1850 m T.A. Rao 7495; Upper munda, 2300 T.A. Rao 9193; Tangmarg, 2600 m., T.A. Rao 110; Thajwas, 3000 m T.A. Rao 50203 (BSD); Zojila, Hajra 74268 (BSD); Dachigam Game Sanctuary, Wadhwa 66871 (BSD); Erin Nala, Jhelum Valley, 2000-2300 m, Keshavanand 27062 (DD); Kishunganga Valley, ca 2800 m, Hukum Singh 1704 (DD).

7. VACCARIA Medik.

Vaccaria pyramidata Medik., Phil. Bot. 1: 96, 1789; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 256, 1972; Sharma & Kachroo, Fl. Jammu : 103, 1981; Majumdar in Sharma, *et al.*, Fl. India 2: 593, 1993. *Saponaria vaccaria* L., Sp. Pl. 409, 1753; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 217, 1874, *p.p.*

Glabrous, annual herbs, 30-60 cm high, with slender tap root. Leaves cordate-lanceolate, up to 75 x 18 mm, acute, glabrous, sessile. Inflorescence loose, corymbose, dichasial cymes. Flowers erect. Pedicels slender. Calyx tube inflated, 5-angled; teeth 5, triangular. Petals pink coloured. Capsules globular, 4-valved, included. Seeds black, globose, granulate.

Fl. & Fr. : May September.

An occasional weed of wheat, pea and sarson fields.

Selected specimens : Ladakh, Sera village, 3500 m, Bhattacharyya 41122; Dras, 3100 m, Bhattacharyya 71340 (BSD); Chandanwari, 3000 m, T.A. Rao, 612 (BSD); Kishtwar, Malipeta, Uniyal 80325 (BSD).

PORTULACACEAE

(S.K. Murti)

PORTULACA L.

- 1a. All leaves opposite. Hairs all around nodes. Membranous bracteoles absent ...4. *P. quadrifida*
- 1b. All leaves not opposite, middle cauline leaves spirally arranged. Hairs, if present, only axillary and in the capitulum. Membranous bracteoles present :
- 2a. Largest leaves obovate to spatulate. Axillary hairs inconspicuous. Sepals distinctly carinate ...2. *P. oleracea*
- 2b. Largest leaves linear to elliptic; axillary hairs conspicuous. Sepals not carinate :
- 3a. Flowers up to 1 cm across. Petals up to 1.2 cm long. Stamens up to 30 ...3. *P. pilosa*
- 3b. Flowers more than 2.5 cm across; petals 1.2-2.5 cm long; stamens more than 40 ...1. *P. grandiflora*

1. *Portulaca grandiflora* Hook. in Bot. Mag. n.s. 3, t. 2885. 1829; Sharma & Kachroo, Fl. Jammu 1: 107. 1981; M.K.V. Rao in Sharma *et al.*, Fl. India 3: 3. 1993.

Prostrate-ascending, succulent herbs up to 30 cm long. Stems rooting at the nodes below. Leaves alternate or subopposite, linear, 20-25 x 2-3 mm, with axillary hairs 5 mm long. Inflorescence a capitulum, 2-4-flowered, flowering successively. Flowers pink, red, orange or yellow, ca 2.5 cm across, surrounded by 8-10 mm long hairs and bracteoles. Bracteoles deltoid, 3-4.5 mm long. Sepals 2, 5-12, mm long. Petals 5, obovate, up to 2.5 x 1 cm. Stamens many. Ovary half inferior, 1-celled; styles 5-12 fid. Capsules globose.

Fl. & Fr. : April - October.

Commonly cultivated, also found in waste places, near habitations, along drains as escape; tropical American plant, naturalised in India.

Selected specimens : Katra, Swami 1249 (BSD).

2. *Portulaca oleracea* L., Sp. Pl. 445. 1753; Thiselton Dyer in Hook.f., Fl. Brit. India 1: 246. 1874; Sharma & Kachroo, Fl. Jammu 1: 107. 1981; M.K.V. Rao in Sharma *et al.*, Fl. India 3: 4. 1993. *Kulpa, Nunar, Gulidopher.*

Prostrate or ascending, perennial, succulent herbs, up to 40 cm long. Stems rooting at the nodes. Leaves spiral to subopposite, spatulate, obovate-oblong, 3-4 cm long, with inconspicuous axillary hairs. Inflorescence a capitulum, 2-30-flowered. Flowers yellow, surrounded by bracteoles and inconspicuous hairs. Bracteoles 5-6 mm long. Sepals 2, 8-10 mm long, boat shaped. Filaments connate below. Ovary half inferior, ultimately 1-celled; style 4-5 mm long, with 3-5 arms. Capsules ovate, with a caducous operculum.

Fl. & Fr. : Almost throughout the year.

Common in waste places, near habitations, along drains.

Selected specimens : Srinagar, 1590 m, *Bhattacharyya* 71208 (BSD); Udhampur city, *Swami* 998 (BSD); Near check post, C.I.S.F. Salal project, *Uniyal* 86657 (BSD).

3. *Portulaca pilosa* L., Sp. Pl. 445. 1753; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 237. 1972; M.K.V. Rao in Sharma *et al.*, Fl. India 3: 6. 1993.

Prostrate or ascending, succulent herbs, 10-30 cm long. Stems rooting at the nodes below. Leaves spiral, linear to obovate, 4-28 x 0.5-4 mm; axillary hairs 1-18 mm long. Inflorescence a capitulum, 2-8-flowered. Flowers red, purple or pink, ca 1 cm across, surrounded by membranous bracteoles and hairs. Bracteoles 0.7-2.5 mm long. Sepals ecarinate. Petals 4-6, obovate. Stamens 10-16. Styles with 3-7 arms. Capsules globose; operculum half the length of capsule.

Fl. & Fr. : April - October.

Common in waste places, near habitations and along drains.

Selected specimens : Hills behind Madinala and Grahmor, Uniyal 86618 (BSD); Kathua, Hajra 82480 (BSD).

4. *Portulaca quadrifida* L., Mant. Pl. 73. 1767; Thiselton Dyer in Hook.f., Fl. Brit. India 1: 247. 1874; Sharma & Kachroo, Fl. Jammu 1: 107. 1981; M.K.V. Rao in Sharma *et al.*, Fl. India 3: 6. 1993.

Diffuse, creeping, annual or perennial herbs, up to 8 cm long. Stems rooting at the nodes below; nodes encircled by a whorl of hairs. Leaves succulent, opposite, ovate-oblong to elliptic, 2-20 x 0.6-7 mm, cordate, with 4-5 mm long axillary hairs. Flowers yellow, solitary, terminal, rarely 2, 0.8-1 cm across, surrounded by hairs and 4 involucreal leaves. Sepals 2, boat shaped, *ca* 3 mm long. Petals 4, obovate, 4-5 mm long. Stamens 8 or 12, adnate to petals. Ovary half inferior, 1-celled; style usually with 4 arms. Capsules obovate, oblong or conical.

Fl. & Fr. : April - November.

Common in waste places, fields, along drains, near habitations.

Included after Sharma & Kachroo (*loc. cit.*).

TAMARICACEAE

(S. Kumar)

- | | |
|---|------------------------|
| 1a. Stamens monadelphous | ...1. <i>Myricaria</i> |
| 1b. Stamens free : | |
| 2a. Leaves flat. Styles absent. Seeds beaked | ...2. <i>Myrtama</i> |
| 2b. Leaves scale like. Styles present. Seeds not beaked | ...3. <i>Tamarix</i> |

1. MYRICARIA Desv.

- | | |
|--|---------------------------|
| 1a. Plants prostrate. Racemes 1-3-flowered | ...3. <i>M. prostrata</i> |
| 1b. Plants erect. Racemes many-flowered : | |

- 2a. Bracts long acuminate ...2. *M. germanica* subsp. *alopecuroides*
 2b. Bracts not acuminate :
 3a. Leaves lanceolate. Petals 2.5-3 mm broad ...1. *M. davurica*
 3b. Leaves elliptic. Petals ca 1.5 mm broad ...4. *M. squamosa*

1. *Myricaria davurica* (Willd.) Ehrenb. in *Linnaea* 2: 278. 1827; Stewart in Nasir & Ali, *Annot. Cat. Vas. Pl. W. Pak. & Kashmir* 487. 1972; Shetty & Pandey in Sharma *et al.*, *Fl. India* 3: 13. 1993. *Tamarix davurica* Willd., *Abh. Akad. Berl.* 85. 1816.

Sparsely leafy shrubs. Stems 2.5-3 m tall with greyish brown bark. Leaves lanceolate-oblong, 0.4-1.5 x 0.1-0.3 cm, obtuse, narrowed at base. Flowers pink in usually lateral, dense racemes. Pedicels 0.2-0.3 cm long. Capsules pyramidal, 0.7-1 x 0.2-0.3 cm, elongated. Seeds many, glabrous.

Fl. & Fr. : June July.

Included after Shetty & Pandey (*loc. cit.*).

2. *Myricaria germanica* (L.) Desv. subsp. *alopecuroides* (Schrenk) Kitam., *Fl. Afgh.* 272. 1960; Shetty & Pandey in Sharma *et al.*, *Fl. India* 3: 13. 1993. *M. alopecuroides* Schrenk in Fisch. & C.A. Mey., *Enum. Pl. Nov.* 1: 65. 1841. *M. bracteata* Royle, *Illus. Bot. Himal.* 1: 241. t. 44. f. 2. 1835. *M. germanica sensu* Dyer in Hook.f., *Fl. Brit. India* 1: 250. 1874. *Umbao*. Fig. 85

Glabrous shrubs. Stems up to 2 m tall, glaucous green when young, purplish brown at maturity. Leaves linear-lanceolate, 0.1-0.6 cm long, sessile. Flowers pink, in 5-45 cm long, terminal spike like racemes. Bracts long acuminate. Capsules 0.7-1 cm long. Seeds brown, crowned by a stalked coma.

Fl. & Fr. : July September.

Common on gravelly stream beds (2100-3300 m).

Selected specimens : Leh-Thicksey, *Wadhwa* 59365; Mulbekh-Shergul, *Wadhwa* 58790 (BSD).

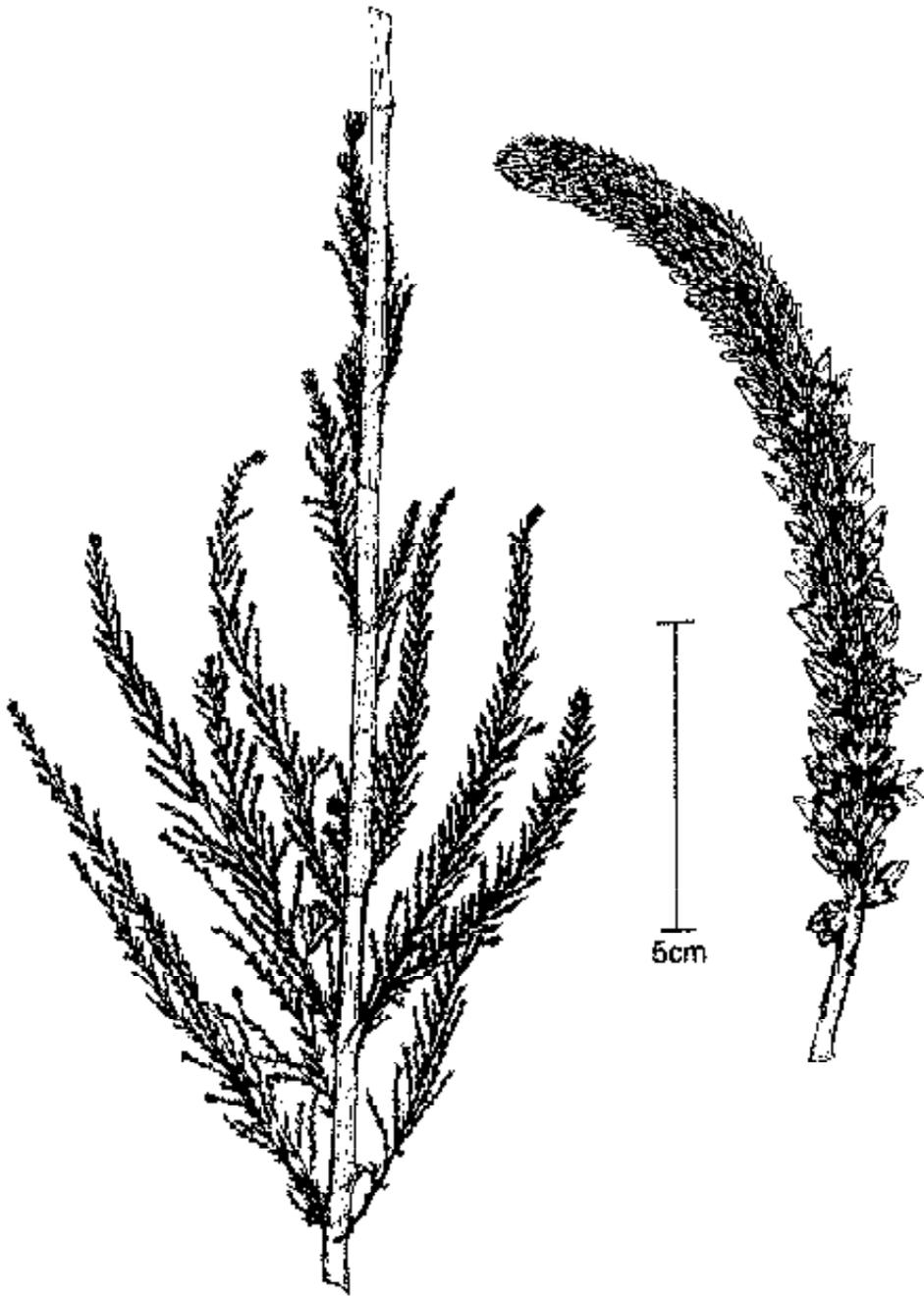


Fig. 85. *Myricaria germanica* (L.) Desv. subsp. *alopecuroides* (Schrenk) Kitam.

3. *Myricaria prostrata* Hook.f. & Thomson ex Benth. & Hook.f., in Benth., Gen. Pl. 1: 161. 1862 *p.p.*; Qaiser in Fl. Pak. 141: 47. 1982; Shetty & Pandey in Sharma *et al.*, Fl. India 3: 15. 1993. *M. germanica* (L.) Desv. var. *prostrata* (Hook.f. & Thomson ex Benth. & Hook.f.) Dyer in Hook.f., Fl. Brit. India 1: 250. 1874.

Prostrate, densely branched herbs with brownish bark. Leaves elliptic-lanceolate 0.2-0.4 x *ca* 0.1 cm. Flowers pink 1-3 in axillary racemes. Capsule 1.2-1.5 cm long, with persistent sepals, petals and stamens, dehiscent by 3-4 valves. Seeds oblong, tapering at base.

Fl. & Fr. : September - November.

Included after Shetty & Pandey (*loc. cit.*).

Rare.

4. *Myricaria squamosa* Desv. in Ann. Sci. Nat. ser. 1, 4: 350. 1825; Qaiser in Fl. Pak. 141: 1982; Shetty & Pandey in Sharma *et al.*, Fl. India 3: 17. 1993. *M. dahurica* DC. var. *microphylla* Bunge, Suppl. Fl. Alt. 79. 1836. *M. germanica* (L.) Desv. var. *squamosa* (Desv.) Maxim., Fl. Tangut. 96. 1889.

Erect, glabrous shrubs with densely leafy branches. Stems 2-3 m tall. Leaves alternate, elliptic-oblong, 0.3-0.8 x 0.1-0.2 cm, subacute. Flowers pink, in racemes. Capsules pyramidal, elongated, 0.7-1 cm long. Seeds many, glabrous.

Fl. & Fr. : June - July.

Included after Shetty & Pandey (*loc. cit.*).

2. MYRTAMA Ovcz. & Kinz

Myrtama elegans (Royle) Ovcz. & Kinz in Dokl. Acad. Nauk Tadz. SSR 20(7): 56, 57. 1977; Shetty & Pandey in Sharma *et al.*, Fl. India 3: 19. 1993. *Myricaria elegans* Royle, Illus. Bot. Himal. 214. 1835; Dyer

in Hook. f., Fl. Brit. India 1: 250. 1874; Stewart in Nasir & Ali, Annot. Cat. Vas. Pl. W. Pak. & Kashmir 487. 1972. *Oumbu*. **Fig. 86**

Glabrous herbs with spreading branches. Stems 3-4 m tall with reddish brown or blackish bark. Leaves elliptic-lanceolate, 0.8-1.5 x 0.3-0.4 cm, subacute, entire. Flowers in 10-25 cm long racemes; sterile below, fertile above. Capsules 0.8-1 cm long. Seeds beaked; beak comose.

Fl. & Fr. : July August.

Selected specimens : Kharbu, Ladakh, 2500 m, *Bhattacharyya* 71387; Upshi, Riyul valley, 3600 m, *Bhattacharyya* 41094 (BSD); Lansdong village, 3200 m, *Wadhwa* 60004 (BSD); Near Mahi, *Chowdhery & Uniyal* 86180; on way to Rangdom, *Chowdhery & Uniyal* 85974 (BSD).

Notes : The twigs are used as fodder and wood as fuel.

3. TAMARIX L.

- | | |
|---|------------------------------|
| 1a. Flowers unisexual | ...2. <i>T. dioica</i> |
| 1b. Flowers bisexual : | |
| 2a. Petals persistent | ...5. <i>T. ramosissima</i> |
| 2b. Petals deciduous : | |
| 3a. Disc confluent epilophic | ...4. <i>T. leptostachya</i> |
| 3b. Disc mesodiscine : | |
| 4a. Racemes 2-5 cm long. Leaves sessile with narrow base | ...1. <i>T. arceuthoides</i> |
| 4b. Racemes up to 12 cm long. Leaves pseudo-vaginate to amplexicaul | ...3. <i>T. indica</i> |

1. *Tamarix arceuthoides* Bunge, Beitr. Fl. Russl. 119. 1852 et in Mem. Sav. Etr. St. Petersb. 7: 295. 1854; Stewart in Nasir & Ali, Annot. Cat. Vas. Pl. W. Pak. & Kashmir 489. 1972; Shetty & Pandey in Sharma *et al.*, Fl. India 3: 22. 1993.

Glabrous shrubs or small trees. Stems 2-4 m tall, densely branched, with reddish brown or pinkish bark. Leaves ovate-deltoid, 0.1-0.15 x

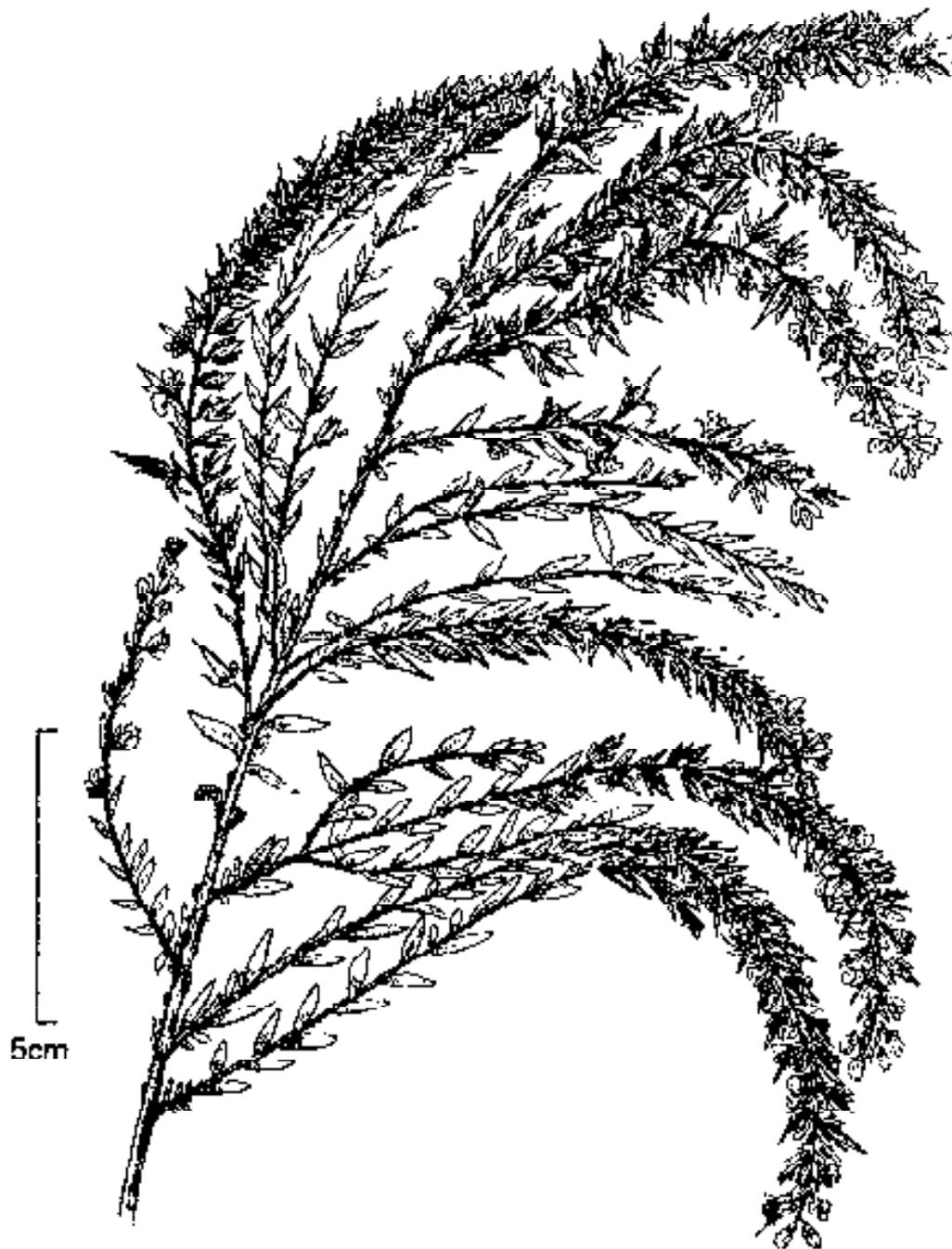


Fig. 86. *Myrtama elegans* (Royle) Ovcz. & Kinz

0.05 cm, acute with narrow base and minutely papillose margins, sessile. Racemes aestival and vernal, erect or spreading, dense, 1.5-8 x 0.25-0.4 cm, compound. Flowers pink. Disc purplish, deeply 5-lobed; lobes notched thus becoming obscurely 10-lobed. Capsules 0.3-0.5 x ca 0.1 cm, dehiscent by 3 longitudinal valves.

Fl. & Fr. : March - September.

Included after Shetty & Pandey (*loc. cit.*).

2. *Tamarix dioica* Roxb. ex Roth, Nov. Pl. Sp. 185. 1821; Dyer in Hook.f., Fl. Brit. India. 1: 249. 1872; Sharma & Kachroo, Fl. Jammu 1: 108. 1981; Shetty & Pandey in Sharma *et al.*, Fl. India 3: 24. 1993. *Pilchi, Lei, Jhau.* Fig. 87

Trees or shrubs, up to 3 m tall. Branches reddish glabrous, drooping. Leaves tubular, 0.15-0.3 cm long, sheathing, minute, truncate, acuminate, glabrous. Racemes aestival, dense, drooping. Male 3-8 x 0.7-0.8 cm, loosely compound; female 3-9 x 0.3-0.5 cm. Flowers pink or purple, 0.3 cm across. Stamens 5, inserted in 5-lobed disc. Styles 3, exserted. Capsules oblong.

Fl. & Fr. : April - November.

Selected specimens : Tevit-Sumru, Ladakh, Hajra 74135 (BSD).

Note. A gregarious shrub along the banks of river.

3. *Tamarix indica* Willd. in Ges. Naturf. Fr. Neue Schr. 4: 214. 1803; Stewart in Nasir & Ali, Annot. Cat. Vas. Pl. W. Pak. & Kashmir 491. 1972 (in Dubia); Shetty & Pandey in Sharma *et al.*, Fl. India 3: 25. 1993. *T. gallica* L. var. *indica* (Willd.) Dyer in Hook.f., Fl. Brit. India 1: 248. 1874. *Aaktampat, Argelta, Daktampiat, Tamarisk.*

Tall shrubs or small sized trees with reddish brown bark. Stems 2-8 m high, glabrous. Leaves pseudo-vaginate, ovate with deltoid base, amplexicaul or auriculate, sessile; younger ones 1-2 mm long, acute. Racemes both vernal and aestival; vernal simple; aestival densely compound,

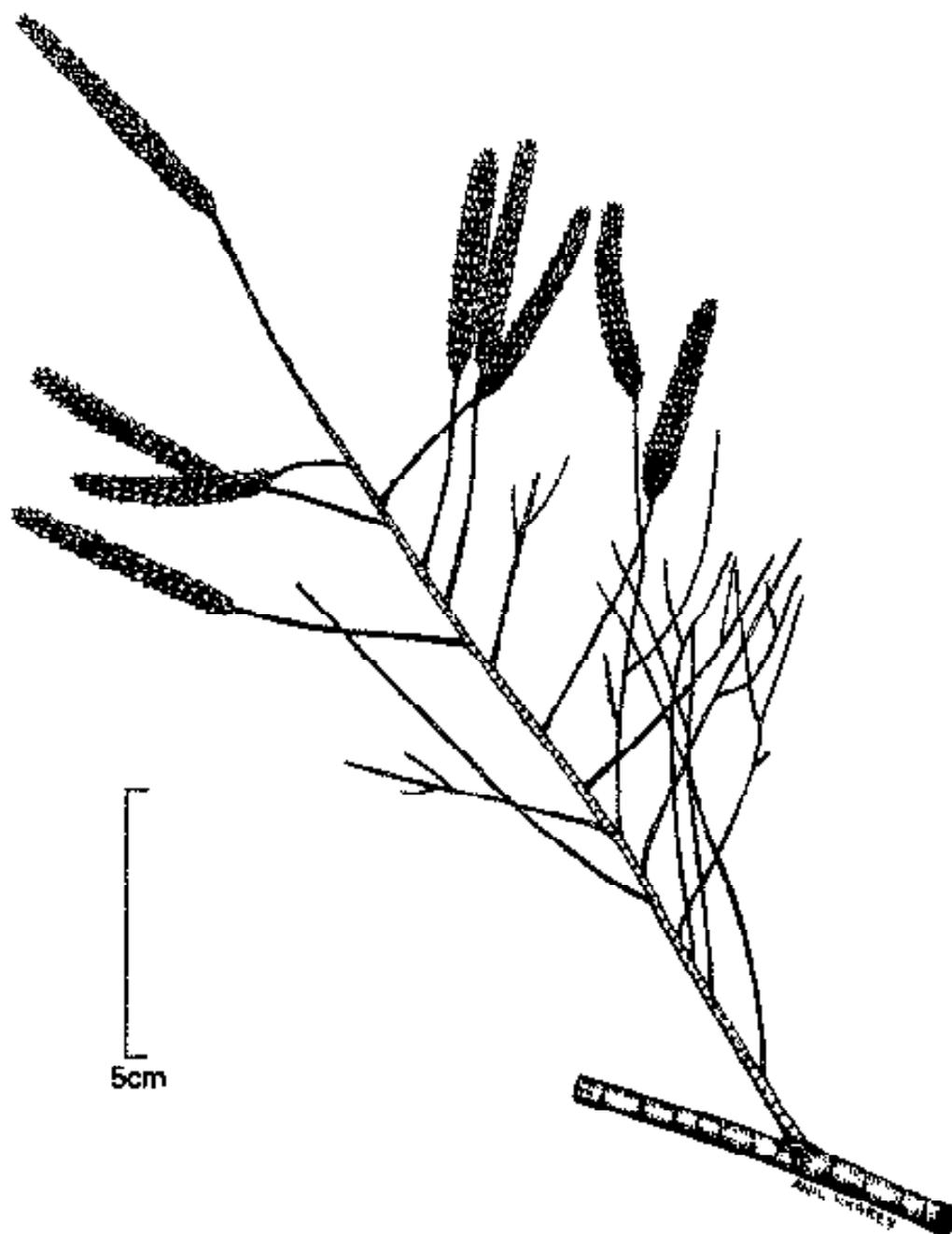


Fig. 87. *Tamarix dioica* Roxb. ex Roth

3-12 cm long. Stamen filaments inserted in between 10 lobes of mesodiscine disc. Styles 3, clavate. Capsules conical-triangular, ca 6 mm long.

Included after Stewart (*loc. cit.*).

4. *Tamarix leptostachya* Bunge, Beitr. Fl. Russl. 117. 1852 *et in* Mem. Sav. Etr. St. Petersb. 7: 293. 1854; Shetty & Pandey in Sharma *et. al.*, Fl. India 3: 29. 1993. *T. gallica* L. var. *micrantha* Ledeb., Fl. Ross. 2: 135. 1843 *p.p.*

Glabrous shrubs, up to 3 m tall with reddish brown or greyish bark. Leaves narrowly ovate to lanceolate, 0.2-0.4 x 0.1-0.2 cm, acute. Racemes aestival, densely compound, 4-12 x 0.3-0.35 cm, peduncled; peduncles 0.5-2.5 cm long. Flowers pink, pedicelled. Filaments fused with disc lobes. Capsules ca 0.2 cm long.

Fl. & Fr. : May - October.

Included after Shetty & Pandey (*loc. cit.*).

5. *Tamarix ramosissima* Ledeb., Fl. Alt. 1: 424. 1829. Ic. Pl. Fl. Ross 3: 17. 1831; Qaiser in Nasir & Ali, Fl. Pak. 141: 19. 1982. *T. gallica* L. var. *pallasii* auct. non Desv.; Dyer in Hook.f., Fl. Brit. India 1: 250. 1874. *Agrelta*.

Shrubs or small trees. Stems 1-5 m tall with reddish brown bark. Leaves ovate or deltoid cordate, 0.2-0.5 cm. x 0.1-0.2 cm, acute, sessile. Racemes aestival and vernal both; aestival densely compound; vernal simple loose, 1-5 x 0.3 -0.4 cm, peduncled; peduncle 0.2-1 cm long. Flowers pinkish purple. Stamens 5, filaments filiform, inserted between the lobes of disc; lobes of disc deeply emarginate. Styles 3, clavate. Capsules trigonous, 0.4-0.5 x 0.1 cm, dehiscing by 3 longitudinal slits.

Fl. & Fr. : June - July.

Included after Qaiser (*loc. cit.*).

ELATINACEAE

(S.K. Murti & B.P. Uniyal)

- 1a. Flowers pentamerous. Sepals free, acute, with thick midrib ...1. *Bergia*
 1b. Flowers trimerous. Sepals connate at base, obtuse, midrib absent ...2. *Elatine*

1. BERGIA L.

Bergia ammannioides Roxb. ex Roth, Nov. Pl. Sp. 219. 1821; Dyer in Hook.f., Fl. Brit. India 1: 251. 1874; Sharma & Kachroo, Fl. Jammu 1: 108. 1981; J. Bhattacharyya in Sharma *et al.*, Fl. India 3: 33. 1993.

Erect or decumbent, annual herbs. Stems and branches pinkish, glandular pubescent. Leaves opposite, oblong-obovate to elliptic-oblong, occasionally lanceolate, 4-25 x 2-15 mm. acute, finely serrate, pubescent or glabrous; stipules triangular, hairy, serrate. Inflorescence axillary, fasciculate cyme, dense, 6-12 or more-flowered. Flowers red, up to 2 mm across. Sepals 3, 1.5-2 mm long; lanceolate, acute, keeled. Petals 3, 1-2.5 mm long, lanceolate or oblanceolate, acute. Ovary 3-5 locular; styles 3-5. Capsules reddish, ovoid or sub-globose.

Fl. & Fr. : January - May.

Common in marshy places and wet cultivated fields.

Included after Sharma & Kachroo (*loc. cit.*).

2. ELATINE L.

- 1a. Flowers subsessile to pedicelled. Stamens shorter than the sepals ...1. *E. ambigua*
 1b. Flowers sessile. Stamens exceeding the sepals ...2. *E. triandra*

1. ***Elatine ambigua*** Wight in Hook., J. Bot. 2: 103. t. 5. 1831; Dyer

in Hook.f., Fl. Brit. India 1: 250. 1874; J. Bhattacharyya in Sharma *et al.*, Fl. India 3: 39. 1993.

Glabrous herbs 1-4 cm high; stems rooting at nodes. Leaves up to 5 x 2 mm, elliptic to oblong-lanceolate, entire, penninerved with the nerves ending in hydathodes at margins. Flowers axillary, solitary at alternating nodes. Sepals 3, oblong. Petals 3, ovate-oblong. Stamens 3, alternating with the petals. Stigmas 3, sessile. Capsules globose, faintly 3-loculed. Seeds 4-6 in each locule, with hexagonal, raised reticulations.

Fl. : Feb.

Included after J. Bhattacharyya (*loc. cit.*).

2. *Elatine triandra* Schknh., Bot. Handb. ed. 2, 1: 345. t. 109b. f. 2. 1808; Kak in J. Econ. Tax. Bot. 14(1): 9. 1990; J. Bhattacharyya in Sharma *et al.*, Fl. India 3: 42. 1993.

Glabrous, aquatic or limicolous herbs. Stems creeping, rooting at nodes. Leaves up to 6 mm long, elliptic oblong or ovate-oblong, penninerved with gland like hydathodes along margin. Flowers axillary, solitary broadly ovate. Stamens 3, alternating with the petals. Capsules depressed subglobose. Seeds 6-12 in each locule, with hexagonal, raised reticulations.

Fl. & Fr. : October - December.

Included after Kak (*loc. cit.*).

HYPERICACEAE

(Bipin Balodi)

HYPERICUM L.

1a. Herbs. Stamens 3-adelphous. Ovary 3-celled :

2a. Calyx not glandular ciliate ...7. *H. perforatum*

2b. Calyx glandular ciliate :

3a. Styles shorter than or as long as the ovary

...4. *H. himalaicum*

- 3b. Styles longer than the ovary :
- 4a. Stems stout. Stamens shorter than the petals ...3. *H. elodeoides*
- 4b. Stems weak. Stamens equalling the petals ...9. *H. wightianum*
- 1b. Shrubs. Stamens 5-adelphous. Ovary 3-celled :
- 5a. Styles longer than the ovary :
- 6a. Stems and branches terete. Stamens ca 30 in each fascicle ...6. *H. oblongifolium*
- 6b. Stems and branches 2-4 lined when young, terete only at maturity. Stamens ca 20 in each fascicle ...2. *H. dyeri*
- 5b. Styles as long as or half as long as the ovary :
- 7a. Flowers less than 4 cm across. Styles as long as the ovary ...8. *H. uratum*
- 7b. Flowers 4.5-6 cm across. Styles half as long as the ovary :
- 8a. Leaves distinctly petioled. Styles recurved ...5. *H. hookerianum*
- 8b. Leaves sessile. Styles not recurved ...1. *H. choisianum*

1. *Hypericum choisianum* Wallich ex Robson in Fl. W. Pakistan 32: 6, 1979; Biswas in Sharma *et. al.*, Fl. India 3: 54, 1993. *H. hookerianum* Wight & Arn. var. *leschenaultii sensu* Dyer in Hook.f., Fl. Brit. India 1: 254, 1874, *p.p. Norysca hookeriana* (Wight & Arn.) Wight var. *leschenaultii* (Dyer) Kimura in Hara, Fl. E. Himal. 210, 1966, *p.p.* excl. type.

Shrubs, up to 2 m tall. Stems branched. Leaves ovate, oblong-lanceolate or lanceolate, 3-9 x 1-3.5 cm, acute, entire. Flowers 1-4 in subcorymbose cymes. Sepals elliptic-lanceolate or lanceolate-ovate, 0.8-1 cm long. Petals yellow, obliquely obovate, 2-2.5 cm long. Stamens numerous, much shorter than the petals. Styles half as long as the ovary. Fruits 1-1.8 cm long, ovoid.

Fl. & Fr. : May - September.

Included after Biswas (*loc. cit.*).

2. *Hypericum dyeri* Rehder in J. Arn. Arb. 20: 422. 1939; Biswas in Sharma *et al.*, Fl. India 3: 54. 1993. *H. lysimachioides* Wallich ex Dyer in Hook.f., Fl. Brit. India 1: 254. 1874, *non* Boiss; Sharma & Kachroo, Fl. Jammu 1: 107. 1981.

Shrubs, up to 1 m tall. Stems branched. Leaves ovate-lanceolate to elliptic-lanceolate, 1.5-5 x 0.6-3 cm, acute or obtuse, punctate with black-brown glands. Flowers 2-4, in subcorymbose or corymbose cymes. Sepals 0.6-1 cm long, linear-lanceolate or linear. Petals yellow 1.2-2 cm long. Stamens numerous, included. Styles longer than the ovary. Fruits *ca* 1 cm long, ellipsoid-oblong with persistent styles.

Fl. & Fr. : May - September.

On rocky slopes and in *Quercus*, *Rhododendron* forest.

Selected specimens : Mashadi, Hajra 82510 (BSD); Puldoda-Bhaderwah, Vohra & Naithani 82751 (BSD).

3. *Hypericum elodeoides* Choisy in DC. Prodr. 1: 551. 1824; Dyer in Hook.f., Fl. Brit. India 1: 255. 1874; Biswas in Sharma *et al.*, Fl. India 3: 56. 1993.

Perennial, erect herbs. Stems terete, stoloniferous. Leaves ovate-lanceolate, lanceolate or oblong-lanceolate, 1.5-5 x .5-1.8 cm, cordate-amplexicaul or rounded at the base, acute or obtuse, glabrous. Flowers many, in terminal corymbose racemes. Sepals lanceolate, linear lanceolate or narrowly elliptic, *ca* 0.7 cm long, acute, glandular-ciliate. Petals yellow, oblanceolate *ca* 1.2 cm long. Stamens numerous, included. Styles longer than the ovary. Fruits *ca* 0.7 cm long, ovoid or oblong-ovoid.

Fl. & Fr. : May - September.

Included after Biswas (*loc. cit.*).

4. **Hypericum himalaicum** Robson in J. Jap. Bot. 52: 287. 1977; Biswas in Sharma *et al.*, Fl. India 3: 64. 1993. *H. nepaulense* auct., non Choisy, 1824; Dyer in Hook.f., Fl. Brit. India 1: 256. 1874. *p.p.*

Perennial, erect or decumbent, up to 40 cm high herbs. Stems terete, rooting at basal nodes. Leaves ovate, elliptic-oblong or oblong, *ca* 2 x 1.5 cm, cordate or rounded at base, acute or obtuse. Flowers solitary or up to 12 in axillary, subcorymbose cymes. Sepals elliptic-lanceolate or ovate-lanceolate, 0.4-0.7 cm long, black glandular ciliate. Petals yellow, oblong-lanceolate, *ca* 1 cm long. Stamens numerous. Ovary equalling the styles or slightly shorter. Fruits *ca* 0.8 cm long, ellipsoid.

Fl. & Fr. : June - September.

On moist slopes by the stream side.

Selected specimens : Lidderwat valley, *ca* 3000 m, T.A. Rao 640 (BSD).

5. **Hypericum hookerianum** Wight & Arn., Prodr. 99. 1834; Dyer in Hook.f., Fl. Brit. India 1: 254. 1874. *p.p.* excl. var. *leschenaultii*; Sharma & Kachroo, Fl. Jammu 1: 107. 1981; Biswas in Sharma *et al.*, Fl. India 3: 64. 1993. *Norysca hookeriana* (Wight & Arn.) Wight, Illus. Ind. Bot. 1: 113. 1838.

Shrubs, up to 2.0 m tall. Stems stout, branched. Leaves ovate, ovate-oblong or broadly lanceolate, up to 9 x 3.5 cm rounded or cuneate at base, obtuse or mucronate at the tip, glabrous, black glandular punctate above. Flowers solitary or 3-10 together in corymbose or subcorymbose cymes. Sepals obovate or elliptic-obovate, 0.4-0.6 cm long, obtuse, closely dentate towards apex. Petals yellow, obliquely obovate, 2-2.5 cm long, black brown punctate. Stamens numerous. Ovary 0.7-1 cm long; styles 5. Fruits oblong-ovoid *ca* 1.5 cm long.

Fl. & Fr. : May - September.

Included after Biswas (*loc. cit.*).

6. *Hypericum oblongifolium* Choisy, Prodr. Monogr. Hyperic. 42, t. 4. 1821; Sharma & Kachroo, Fl. Jammu 1: 107. 1981; Biswas in Sharma *et al.*, Fl. India 3: 73. 1993. *H. cernuum* Roxb. ex D. Don, Prodr. Fl. Nepal. 218. 1825; Dyer in Hook.f., Fl. Brit. India 1: 253. 1874. *Liggi*.

Shrubs, up to 2 m tall. Stems erect, procumbent or ascending. Leaves oblong-elliptic or ovate-oblong, 0.4-1 cm long, acute or cuneate at base, subacute or obtuse at the tip, glabrous above, glaucous beneath, glandular punctate on both surfaces, sessile. Flowers solitary or 2-6 together in terminal corymbose cymes. Sepals elliptic-lanceolate or ovate, 0.5-1 cm long, acute or obtuse. Petals yellow, obovate, 2-3 cm long, showy. Stamens numerous. Styles much longer than the ovary. Fruits ovoid to conical-ovoid, ca 1.5 cm long.

Fl. & Fr. : May September.

On shady slopes.

Selected specimens : Jakher forest area, *Kumar* 81373 (BSD); Sudh mahadev, *Swami* 1176 (BSD); Bhaderwah, *Uniyal* 80172; Sanjichat-Bhairon temple, *Uniyal* 86697 (BSD).

7. *Hypericum perforatum* L., Sp. Pl. 2: 785. 1753; Dyer in Hook.f., Fl. Brit. India 1: 255. 1874; Sharma & Kachroo, Fl. Jammu 1: 107. 1981; Biswas in Sharma *et al.*, Fl. India 3: 73. 1993. *Mongol.* **Fig. 88**

Perennial, erect, up to 45 cm high herbs. Branches ascending. Leaves ovate or elliptic-oblong, 2-2.5 cm long, cuneate or rounded at base, acute, obtuse or mucronate at apex, black-brown gland dotted along margins, sessile or subsessile. Flowers solitary or many in branched corymbose or subcorymbose cymes. Sepals ovate-lanceolate or lanceolate, 0.3-0.8 cm long, acute-acuminate. Petals yellow, oblanceolate 0.8-1.2 cm long. Stamens numerous. Style much longer than the ovary. Fruits ovoid or pyramidal ca 0.7 cm long.

Fl. & Fr. : June September.

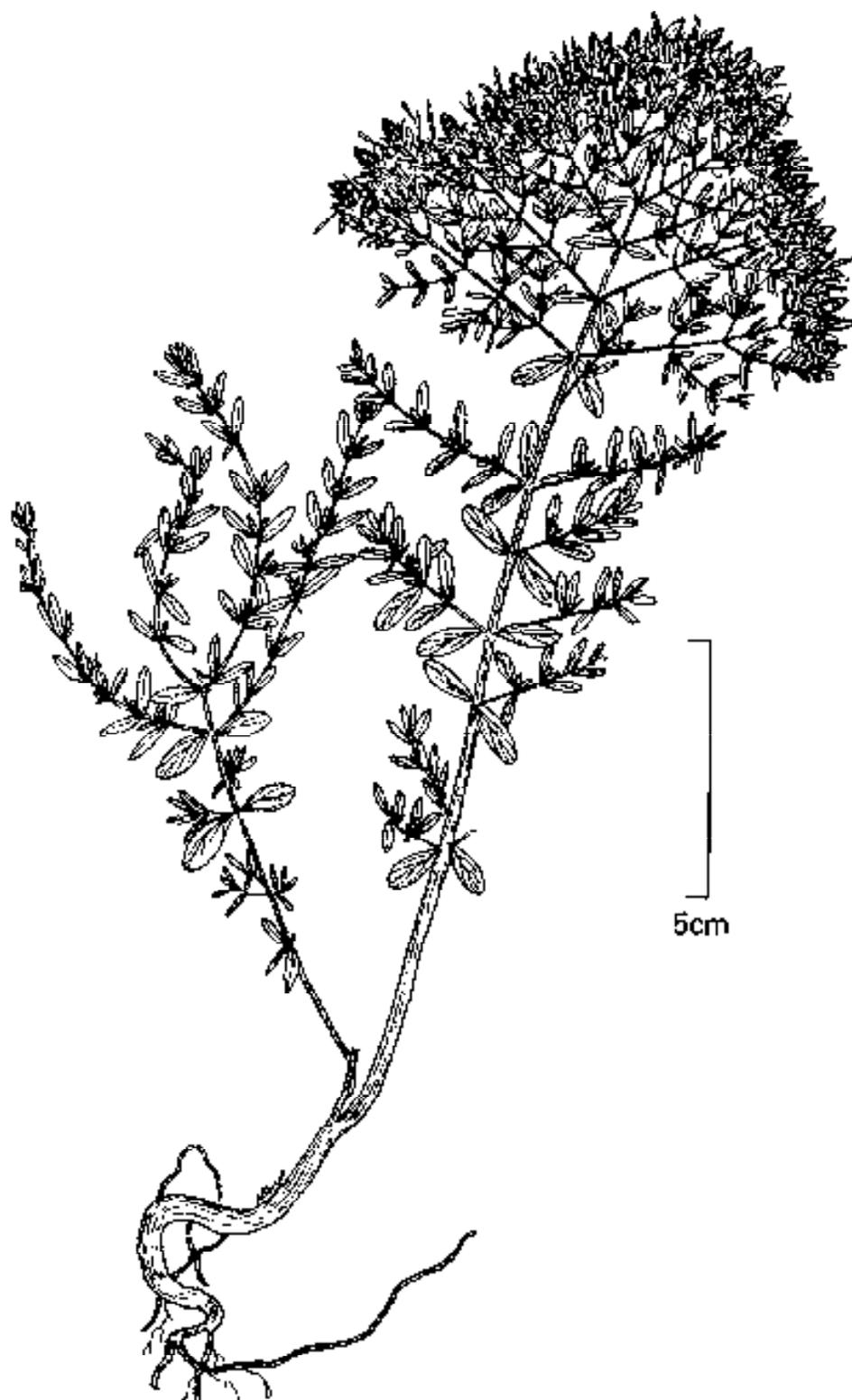


Fig. 88. *Hypericum perforatum* L.

On slopes and in open moist places.

Selected specimens : Tangmarg Jigg, 1800 m, *Bhattacharyya* 71129 (BSD); Sonamarg, *Chowdhery & Uniyal* 85722 (BSD); Kishtwar, *Uniyal* 80268 (BSD); Loran-Mandi, 1500-2500 m, *Vohra & Naithani* 78260 (BSD); Gurez-Barnai, *Wadhwa, Murti & Pant* 85044; Ovara Games Sanctuary, *Wadhwa, Murti & Pant* 85389 (BSD).

8. *Hypericum uralum* Buch.-Ham. ex D. Don in Sims, Bot. Mag. t. 2375. 1823 et Prodr. Fl. Nepal. 218. 1825; Biswas in Sharma *et al.*, Fl. India 3: 77. 1993. *H. patulum* auct. non Thunb. ex Murray; Wallich ex Dyer in Hook.f., Fl. Brit. India 1: 254. 1874. *Norysca urala* (Buch.-Ham. ex D. Don) K. Koch, Hort. Dendrobl. 66. 1853.

Shrubs, up to 2.5 m tall. Leaves lanceolate to ovate-lanceolate, 1.7-2.7 x .5-1.5 cm, cuneate, obtuse or acute, glabrous above, glaucous beneath, sessile. Flowers few in corymbose cymes. Sepals elliptic-oblong, 0.5-0.8 cm long, obtuse, punctate, black gland-dotted. Petals golden-yellow obovate to suborbicular 1.2-1.7 cm long. Stamens numerous, in 5 fascicles. Styles 5, equalling the ovary. Fruits ovoid.

Fl. & Fr. : May - October.

Included after Biswas (*loc. cit.*).

9. *Hypericum wightianum* Wallich ex Wight & Arn., Prodr. 99. 1834; Biswas in Sharma *et al.*, Fl. India 3: 78. 1993. *H. napaulense* auct. non Choisy 1824; Dyer in Hook.f., Fl. Brit. India 1: 256. 1874, *p.p.*

Perennial, up to 40 cm high herbs. Stems decumbent or ascending, sometimes prostrate, rooting at nodes. Leaves ovate, obovate or ovate-elliptic to oblong-elliptic, 1-3 x 0.5-1.5 cm, subcordate-amplexicaul at the base, obtuse or subacute at apex. Flowers in terminal corymbose cymes. Sepals oblong-elliptic or lanceolate, 0.5-0.7 cm long, acute or obtuse, punctate, black gland dotted along margins. Petals yellow with red spots, oblanceolate 0.6-1 cm long. Stamens numerous, in 3 fascicles. Ovary shorter than the styles. Fruits ellipsoid-globose.

Fl. & Fr. : May - September.

Included after Biswas (*loc. cit.*).

Recently Chaurasia *et al.*, (1998) recorded *Hypericum leptocarpus* Hook.f. & Thomson (*Meerang*) from Zaskar valley in Ladakh, which is most likely *Hypocoum leptocarpum* Hook.f. & Thomson.

DIPTEROCARPACEAE

(B.P. Uniyal)

SHOREA Roxb. *ex* Gaertn.f.

Shorea robusta Roxb. *ex* Gaertn.f., *Suppl. Carp.* 3: 48. t. 186. 1805; Dyer in Hook.f., *Fl. Brit. India* 1: 306. 1874; Kapur & Sarin, *Fl. Trikuta Hills* 89. 1990; Janardhanan in Sharma *et al.*, *Fl. India* 3: 237. 1993.

Deciduous trees, up to 50 m tall; bark 0.6-1.0 cm long, longitudinally fissured in old trees. Leaves ovate-oblong, up to 40 x 25 cm, short acuminate, glabrous, coriaceous when mature; stipule falcate, densely covered with peltate scales, caducous. Flower creamy arranged in racemose panicles. Calyx segments ovate or triangular, covered with dense yellow pubescence. Petals buff silky outside, 10-13 nerved. Fruits 5 winged, three larger and two smaller.

Fl. & Fr. : May - July.

Uses : A tree of timber value, wood provides good fuel.

Included after Kapur & Sarin (*loc. cit.*).

MALVACEAE

(Bipin Balodi)

1a. Flowers polygamous or polygamodioecious :

2a. Trees. Flowers arranged in panicles, polygamous.

Epicalyx segments 4-6, oblong, spatulate

...7. *Kydia*

- 2b. Herbs. Flowers arranged in racemes, polygamo-dioecious. Epicalyx absent ...12. *Sidalcea*
- 1b. Flowers 2-sexual :
- 3a. Style branches and stigma twice the number of carpels. Mericarps glochidiate, spiny ...14. *Urena*
- 3b. Style branches as many as the carpels, or the style undivided and stigma entire :
- 4a. Fruit schizocarpic breaking into mericarps. Staminal column without teeth, apex splitting into numerous anthers :
- 5a. Epicalyx absent :
- 6a. Calyx campanulate. Mericarps 5-10, 1-seeded ...11. *Sida*
- 6b. Calyx cupular. Mericarps 10-20, 2-3 seeded ...2. *Abutilon*
- 5b. Epicalyx present :
- 7a. Epicalyx segments 7-12. Staminal tube antheriferous up to below the middle ...3. *Althaea*
- 7b. Epicalyx segments 3. Staminal tube antheriferous only in the apical part :
- 8a. Leaves ovate to oblong-lanceolate; lobes absent. Flowers yellow ...10. *Malvastrum*
- 8b. Leaves orbicular-ovate, orbicular-reniform or cordate, angled or lobed. Flowers pink-lilac, occasionally white :
- 9a. Stipules foliaceous. Epicalyx segments ovate-orbicular or ovate, connate at the base ...8. *Lavatera*
- 9b. Stipules not foliaceous. Epicalyx segments, linear or oblong-ovate, free ...9. *Mulva*
- 4b. Fruit capsular. Carpels not separating from each other. Staminal column 5-toothed at the tip, antheriferous throughout at least up to below the middle :
- 10a. Style unbranched or superficially divided into very short branches :

- 11a. Twigs covered with ferruginous, peltate scales. Epicalyx segments lanceolate, caducous. Capsules more or less woody, indehiscent ...13. *Thespesia*
- 11b. Twigs without peltate scales. Epicalyx segments cordate, foliaceous. Capsules fibrous, dehiscent ...5. *Gossypium*
- 10b. Style divided into 5 divergent branches :
- 12a. Calyx spathaceous, irregularly 2-3-lobed ...1. *Abelmoschus*
- 12b. Calyx campanulate, 5-lobed :
- 13a. Capsules winged ...4. *Floria*
- 13b. Capsules not winged ...6. *Hibiscus*

1. ABELMOSCHUS Medik.

- 1a. Corolla 6-9 cm in diam., yellow with purple centre.
Capsules ellipsoid or ovate-elliptic
...2. *A. manihot* ssp. *tetraphyllus* var. *pungens*
- 1b. Corolla 3-6 cm in diam., white turning pinkish at maturity.
Capsules pyramidal-ovoid ...1. *A. ficulneus*

1. *Abelmoschus ficulneus* (L.) Wight & Arn. ex Wight. Cat. 14, 1833; Naqshi *et al.* in *Annals Miss. Bot. Gard.* 75(4): 1507, 1988; Paul in Sharma *et al.*, *Fl. India* 3: 304, 1993. *Hibiscus ficulneus* L., *Sp. Pl.* 695, 1753; Masters in Hook.f., *Fl. Brit. India* 1: 340, 1874.

Annual or perennial, up to 1.5 m tall herbs. Young branches prickly hairy; hairs with bulbous base, or simple. Leaves orbicular, 2-12 cm long, with cordate base, palmately 3-5 partite, scabrous; petioles long. Flowers axillary, solitary or in terminal racemes. Epicalyx 0.9-1.5 cm long; segments 5-6, lanceolate, caducous. Calyx 5-toothed, spathaceous. Corolla white, turning pinkish at maturity, 3-6 cm in diam. Fruits pyramidal-ovoid, 2-4 cm long, 5-angled.

Fl. & Fr. : September - March.

Included after Naqshi *et al.* (*loc. cit.*).

Very rare.

2. **Abelmoschus manihot** (L.) Medik. subsp. **tetraphyllus** (Roxb. ex Hornem.) Borss. var. **pungens** (Roxb.) Hochr. in *Candollea* 2: 87. 1924; Paul in Sharma *et al.*, *Fl. India* 3: 307. 1993. *Hibiscus pungens* Roxb., *Fl. Ind.* 3: 213. 1832; Masters in Hook.f., *Fl. Brit. India* 1: 341. 1874. *Abelmoschus pungens* (Roxb.) Voigt, *Hort. Calc.* 119. 1845; Abedin in *Fl. W. Pakistan* 130: 27. 1979; Naqshi *et al.*, in *Ann. Miss. Bot. Gard.* 75(4): 1508. 1988.

Annual or perennial, up to 2 m tall herbs. Stems and branches densely covered with yellow bristly hairs. Leaves broadly ovate or orbicular, cordate, palmately 3-7-lobed; lobes entire or coarsely serrate. Flowers axillary, solitary, rarely subracemose at the end of branches. Epicalyx 1-2.5 cm long; segments 4-6. Calyx 2-2.5 cm long, 5-toothed, spathaceous, caducous. Corolla yellow with purple centre, 6-9 cm in diam. Fruits ellipsoid or ovate-elliptic, 3-6 cm long, 5-angular, shortly beaked.

Fl. & Fr. : July - December.

Included after Naqshi *et al.* (*loc. cit.*).

2. ABUTILON Miller

- | | |
|---|-----------------------------|
| 1a. Staminal tube much longer than the corolla | ...2. <i>A. indicum</i> |
| 1b. Staminal tube much shorter than the corolla : | |
| 2a. Staminal tube glabrous | ...4. <i>A. theophrasti</i> |
| 2b. Staminal tube hairy or pubescent : | |
| 3a. Fruits cylindrical; mericarps usually 10 | ...3. <i>A. ramosum</i> |
| 3b. Fruits ovoid; mericarps 13-16 | ...1. <i>A. bidentatum</i> |

1. **Abutilon bidentatum** Hochst. ex A. Rich., *Tent. Fl. Abyss.* 1: 68. 1847; Masters in Hook.f., *Fl. Brit. India* 1: 326. 1874; Naqshi *et al.* in *Ann. Miss. Bot. Gard* 75(3): 1519. 1988; Paul in Sharma *et al.*, *Fl. India* 3: 261. 1993.

Annual or perennial, erect herbs or undershrubs, tomentose with stellate hairs. Leaves broadly ovate, 2-20 x 15-17 cm, deeply cordate, acute-

acuminate, crenate-dentate, densely pubescent; stipules filiform. Flowers solitary or 2-3 together. Calyx cup shaped, 0.5-0.7 mm long, 5-lobed; lobes lanceolate. Corolla yellow, obovate, 0.6-0.9 cm long. Staminal tube included. Fruits ovoid; mericaps 13-16, acute-acuminate.

Fl. & Fr. : August-December.

Selected specimens : Mangla, ca 600 m, Lambert 267; Jasrota, ca 400 m, Lambert 290 (DD).

2. *Abutilon indicum* (L.) Sweet, Hort. Brit. 54. 1826; Masters in Hook.f., Fl. Brit. India 1: 326. 1874; Sharma & Kachroo, Fl. Jammu 1: 111. 1981; Naqshi *et al.*, in Ann. Miss. Bot. Gard. 75(4): 1519. 1988; Paul in Sharma *et al.*, Fl. India 3: 266. 1993. *Sida indica* L., Cent. Pl. 2: 26. 1756.

Annual or perennial, erect herbs. Stems densely stellately hairy. Leaves broadly ovate or suborbicular, 2-7 cm long, cordate, acute-acuminate, coarsely dentate; stipules 3-angular. Flowers solitary, axillary. Calyx 5-lobed; lobes lanceolate-ovate, slightly accrescent in fruit. Corolla orange-yellow. Staminal tube much longer than the corolla. Fruits ovoid-truncate; mericarps 15-25.

Fl. & Fr. : April-September.

Selected specimens : Palballan, ca 1700 m, Gammie s.n. (DD); Sumbal, ca 1900 m, Witt. s.n., acc. no. 13714 (DD).

3. *Abutilon ramosum* (Cav.) Guill. & Perr. in Guill. *et al.*, Fl. Seneg. Tent. 1: 68. 1830; Masters in Hook.f., Fl. Brit. India 1: 328. 1874; Sharma & Kachroo, Fl. Jammu 1: 111. 1981; Naqshi *et al.*, in Ann. Miss. Bot. Gard. 75(4): 1518. 1988; Paul in Sharma *et al.*, Fl. India 3: 271. 1993. *Sida ramosa* Cav., Diss. 1: 28. t.6.f.1. 1785.

Perennial herbs or undershrubs. Stems with stellate and simple hairs. Leaves broadly ovate, 2.5-12 x 2.5-11 cm, cordate, acuminate, coarsely serrate-crenate, often 3-lobed; stipules filiform. Flowers axillary or terminal, solitary or paired or peduncle divided above dichotomously as in cymes. Calyx campanulate, 0.3-0.5 cm long, stellately pubescent. Corolla yellow,

0.8-1.5 cm long. Staminal tube included. Fruits cylindrical; mericarps usually 10.

Fl. & Fr. : August - October.

Selected specimens : Jasrota, ca 600 m, Lambert 289 (DD).

4. *Abutilon theophrasti* Medik., Malv. 28. 1787; Abedin in Fl. W. Pakistan 130: 61. 1979; Naqshi *et al.* in Ann. Miss. Bot. Gard. 75(4): 1518. 1988; Paul in Sharma *et al.*, Fl. India 3: 274. 1993. *A. avicennae* Gaertn., Fruct. Sem. Fl. 2: 251. t. 135. f. 1. 1791; Masters in Hook.f., Fl. Brit. India 1: 327. 1874.

Annual, erect herbs or undershrubs. Stems slender, densely velutinous. Leaves orbicular or broadly ovate, 3.5-16 x 4-13 cm, deeply cordate, acuminate, crenulate or undulate; stipules linear-filiform, 0.6-0.8 cm long. Flowers axillary, solitary or in few flowered terminal racemes. Calyx 0.8-1.1 cm long, 5-lobed; lobes ovate or lanceolate. Corolla yellow, 1.2-1.5 cm long. Fruits hemispherical; mericarps 12-16.

Fl. & Fr. : May - August.

Included after Naqshi (*loc. cit.*).

3. **ALTHAEA L.**

- 1a. Leaves deeply 3-5 fid or parted. Branches stellately pubescent. Epicalyx segments 7-9, lanceolate ...1. *A. broussonetiifolia*
 1b. Leaves 3-angular to broadly ovate or shallowly 3-lobed. Branches tomentose. Epicalyx segments 8-12, linear ...2. *A. officinalis*

1. *Althaea broussonetiifolia* Iljin in Shishkin & Bobrov, Fl. U.R.S.S. 15: 678. 1949; Naqshi *et al.* in Ann. Miss. Bot. Gard. 75(4): 1515. 1988.

Perennial, erect or semierect herbs. Branches stellately pubescent. Leaves deeply 3-5 fid or parted; lobes oblong-lanceolate, dentate, densely

pubescent. Flowers in axillary, pedunculate panicles. Epicalyx segments 7-9, lanceolate. Calyx 0.6-1 cm long, 5-lobed, persistent. Corolla pink, 2-2.5 cm in diam.; petals obovate, oblong-obovate, slightly notched at the tip. Mericarps 12-18, stellately pubescent.

Fl. & Fr. : July August.

Included after Naqshi *et al.* (*loc. cit.*).

2. *Althaea officinalis* L., Sp. Pl. 686. 1753; Masters in Hook.f., Fl. Brit. India 1: 319. 1874; Naqshi *et al.* in Ann. Miss. Bot. Gard. 75(4): 1515. 1988; Paul in Sharma *et al.*, Fl. India 3: 354. 1993.

Erect, perennial herbs. Branches densely tomentose. Leaves 2.5-7 cm long, triangular to broadly ovate or slightly 3-lobed, irregularly dentate-serrate, acute, pubescent; petioles 1-4 cm long; stipules linear-lanceolate. Flowers many, born on axillary peduncles. Epicalyx segments 8-12, linear. Calyx 0.6-1.2 cm long, 5-lobed; lobes connate below the middle. Corolla pinkish-white, 2-3 cm in diam; petals obovate or oblong-obovate. Mericarps 10-15.

Fl. & Fr. : July September.

Included after Paul (*loc. cit.*).

4. FIORIA Mattei

Fioria vitifolia (L.) Mattei in Bot. Ort. Bot. Palermo 2: 71. 1916; Naqshi *et al.* in Ann., Miss. Bot. Gard. 75(4): 1503. 1988; Paul in Sharma *et al.*, Fl. India 3: 310. 1993. *Hibiscus vitifolius* L., Sp. Pl. 696. 1753; Masters in Hook.f. Fl. Brit. India 1: 338. 1874.

Annual or perennial, 0.8-1.5 m tall herbs. Stems tomentose-stellate hairy. Leaves 2-13 cm long, broadly ovate to orbicular, cordate, serrate-crenate, entire or 3-5-lobed, stellately tomentose beneath; petioles 2-11 cm long. Flowers axillary, solitary or clustered at the end of branches; pedicels 1.5-6.5 cm long. Epicalyx of 7-12 linear segments. Calyx 5-lobed, campanulate; lobes 0.7-1.5 cm long, ovate to deltoid. Corolla yellow with

purple centre, twisted, 3-5 cm in diam. Capsules 1.5-2 cm long, orbicular, shortly beaked.

Fl. & Fr. : April - December.

Included after Naqshi *et al.* (*loc. cit.*).

5. GOSSYPIUM L.

- 1a. Epicalyx laciniate with 7-9 long teeth. Stipules ovate-falcate ...2. *G. hirsutum*
 1b. Epicalyx entire or dentate. Stipules linear ...1. *G. arboreum*

1. *Gossypium arboreum* L., Sp. Pl. 693. 1753; Masters in Hook.f., Fl. Brit. India 1: 347. 1874; Naqshi *et al.* in Ann. Miss. Bot. Gard. 75(4): 1509. 1988; Paul in Sharma *et al.*, Fl. India 3: 387. 1993.

Annual or perennial, 1-2 m tall herbs. Young shoots pubescent, with purple tinge. Leaves ovate to orbicular or subreniform, 5-7-lobed or parted; lobes oblong-lanceolate, acute, hairy. Flowers axillary, solitary. Epicalyx segments entire or dentate; foliaceous, cordate. Calyx cup shaped, 5-toothed. Corolla yellow or purplish. Staminal tube included. Capsules ovoid, beaked, fibrous. Seeds densely covered with long and short hairs.

Fl. & Fr. : May - July.

Included after Naqshi *et al.* (*loc. cit.*).

2. *Gossypium hirsutum* L., Sp. Pl. 975. 1753; Naqshi *et al.* in Ann. Miss. Bot. Gard. 75(4): 1509. 1988; 1988; Paul in Sharma *et al.*, Fl. India 3: 389. 1993.

Annual, erect herbs or large perennial undershrubs. Stems much branched, tinged with red, dorsally hairy. Leaves 3-10 x 3-15 cm, broadly cordate or orbicular, 3-lobed, rarely 5-lobed; lobes triangular-ovate, acuminate, simple or stellately hairy. Flowers axillary, solitary. Epicalyx 2-4 cm long, ovate, laciniate with 7-9 long teeth. Calyx cupular, 0.5-0.7 cm long. Corolla pale-yellow, rarely purplish. Staminal tube included. Capsules ovoid, beaked. Seeds thickly covered with white hairs.

Fl. & Fr. : May July.

Selected specimens : Lauki Khad, Pallanwala, *Uniyal* 92765 (BSD).

6. HIBISCUS L.

- 1a. Stems prickly or bristly. Epicalyx segments forked at apex ...2. *H. cannabinus*
- 1b. Stems neither prickly nor bristly. Epicalyx segments not forked at apex :
 - 2a. Epicalyx segments very short, often caducous ...4. *H. lobatus*
 - 2b. Epicalyx segments long, persistent :
 - 3a. Seeds hairy :
 - 4a. Leaves 3-lobed. Epicalyx segments linear-lanceolate. Calyx divided nearly to base ...3. *H. hirtus*
 - 4b. Leaves not lobed. Epicalyx segments filiform. Calyx divided up to middle...5. *H. micranthus*
 - 3b. Seeds glabrous or tuberculate :
 - 5a. Calyx inflated in fruit; lobes many veined ...6. *H. trionum*
 - 5b. Calyx not inflated; lobes 3-veined ...1. *H. caesius*

1. *Hibiscus caesius* Garcke, Bot. Zeit. 7: 850. 1849; Naqshi *et al.* in Ann. Miss. Bot. Gard. 75(4): 1506, 1988; Paul in Sharma *et al.*, Fl. India 3: 334. 1993. *H. gibsoni* Stocks ex Harvey & Sonder, Fl. Cap. 2: 587. 1862; Masters in Hook.f., Fl. Brit. India 1: 339. 1874.

Erect herbs or undershrubs, up to 2 m tall. Branches sparsely bristly. Leaves deeply 3-5-lobed; lobes 2-7 cm long, oblong-lanceolate, serrate, upper surface simple hairy, lower surface stellately hairy. Flowers axillary, solitary. Epicalyx segments 8-10, radiate, needle like, subspiny. Calyx 5-lobed; lobes lanceolate, 1.5-3 cm long, acuminate, strongly 3-nerved, minutely ciliate. Corolla yellow with purple centre, 3-5 cm in diam. Fruits ovoid, beaked.

Fl. & Fr. : September December.

Included on the authority of Naqshi *et al.* (*loc. cit.*).

2. *Hibiscus cannabinus* L., Syst. Nat. ed. 10(2): 1149. 1759; Masters in Hook.f., Fl. Brit. India 1: 339. 1874; Paul in Sharma *et al.*, Fl. India 3: 324. 1993.

Annual or perennial herbs, up to 4 m tall. Lower leaves unlobed; upper 3-5-7-lobed or parted; lobes long, linear, lanceolate-elliptic, serrate; mid nerve with a nectary beneath; stipules linear-subulate. Flowers axillary; solitary or racemose. Pedicels prickly. Epicalyx segments, 7-8, shorter than the calyx. Calyx lobes long acuminate, arachnoid tomentose, bristly; mid nerve with a large nectary on outside. Corolla yellow with a crimson centre. Staminal column antheriferous throughout. Fruits ovoid-globose, beaked, dehiscent by 5 valves.

Fl. & Fr. : August - November.

Selected specimens : Sunderbani, *Uniyal* 92899 (BSD).

Uses : Fibre is obtained from the stem. Leaves are used in making pickles. (Paul, *loc. cit.*).

3. *Hibiscus hirtus* L., Sp. Pl. 694. 1753; Masters in Hook.f., Fl. Brit. India 1: 335. 1874; Paul in Sharma *et al.*, Fl. India 3: 329. 1993.

Undershrubs, up to 1.5 m tall, minutely stellately hairy. Leaves ovate, up to 6 x 3 cm, entire or 3-lobed; upper ones ovate-lanceolate, smaller, crenate-serrate or irregularly dentate; mid nerve often with an oblong nectary beneath; stipules linear, ciliate. Flowers axillary, solitary or in racemes or panicles. Pedicels exceeding the petioles. Epicalyx segments 6-9, free, linear-lanceolate. Calyx divided nearly to base; lobes linear-lanceolate, hairy. Corolla pink or white, rotate. Staminate column antheriferous throughout. Fruits shorter than the calyx, globose. Seeds densely ferruginous woolly.

Fl. & Fr. : November - June.

Selected specimens : Jammu, ca 500 m, *Lambert* 147; Jammu, ca 350 m, *Lambert* 261 (DD).

4. **Hibiscus lobatus** (Murray) Kuntze., Rev. Gen. Pl. 3, 2: 19, 1898; Sharma & Kachroo, Fl. Jammu 1: 112, 1981; Naqshi *et al.* in Ann. Miss. Bot. Gard. 75(4): 1506, 1988; Paul in Sharma *et al.*, Fl. India 3: 336, 1993. *Solandra lobata* Murray, Comm. Soc. Reg. Sc. Goetting 6: 20.t.1, 1785. *Hibiscus solandra* L' Herit., Stirp. Nov. 1: 103, t. 49, 1788, *nom. Illeg.*; Masters in Hook.f., Fl. Brit. India 1: 336, 1874.

Annual, erect herbs, up to 1 m tall. Branches pubescent. Leaves 2-9 cm long, polymorphic; upper leaves linear-lanceolate or lyrate; lower leaves 3-lobed; lobes linear, pubescent. Flowers axillary, solitary, sometimes in terminal racemes. Epicalyx segments 6-8, minute. Calyx campanulate, 5-lobed; lobes lanceolate. Corolla white to pale-yellow, up to 2 cm in diam. Fruits ovoid, beaked.

Fl. & Fr. : July - January.

Selected specimens : Jammu 4 km before Buchamandi, *Uniyal* 92609; Kundakhad, *Uniyal* 92785 (BSD).

5. **Hibiscus micranthus** L.f., Suppl. Pl. 308, 1781; Masters in Hook.f., Fl. Brit. India 1: 335, 1874; Naqshi *et al.* in Ann. Miss. Bot. Gard. 75(4): 1506, 1988; Paul in Sharma *et al.*, Fl. India 3: 330, 1993.

Erect, up to 2.5 m tall shrubs. Branches slender, terete, scabrid with stellate hairs. Leaves ovate or oblong-ovate, 1.5-4.6 cm long, acute or obtuse, serrate, scabrid-stellately hairy. Flowers axillary, solitary. Epicalyx segments 6-8, filiform, hairy. Calyx 5-lobed; lobes lanceolate-triangular. Corolla white or pink. Fruits globose dehiscent into 5 valves.

Fl. & Fr. : April - May.

Included after Naqshi *et al.* (*loc. cit.*).

6. **Hibiscus trionum** L., Sp. Pl. 697, 1753; Masters in Hook.f., Fl. Brit. India 1: 334, 1874; Naqshi *et al.* in Ann. Miss. Bot. Gard. 75(4): 1504, 1988; Paul in Sharma *et al.*, Fl. India 3: 341, 1993. **Fig. 89**

Annual, erect or decumbent, 30-50 cm high herbs. Stems and branches hispid. Leaves ovate or orbicular-ovate, 2.5-7 cm long, upper

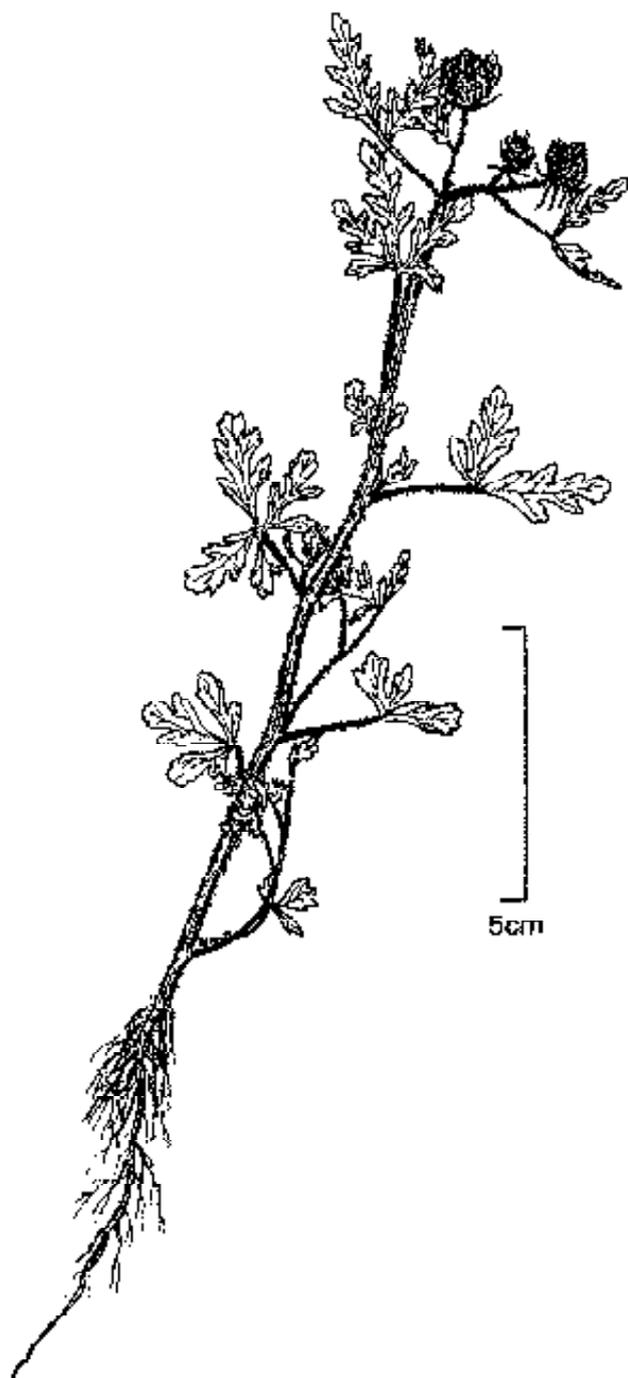


Fig. 89. *Hibiscus trilobum* L.

leaves 3-5-lobed; lobes oblong or ovate-oblong, pinnatisect, punctate, stellately hairy beneath. Flowers axillary, solitary. Epicalyx 1-1.5 cm long; segments, 8-13, linear, hispid. Calyx campanulate, 5-lobed; lobes 1-2 cm long, inflated in fruit. Corolla pale-yellow with dark purple centre, 1.5-3 cm in diam. Fruits 1-2 cm long, oblong, strigose-hispid.

Fl. & Fr. : July - January.

Selected specimens : Bhaderwah-Kailash, Vohra & Naithani 82792 (BSD); on way to Srinagar, Chowdhery & Uniyal 85705 (BSD); Lolab forest, Jhelum valley, ca 2000 m, Keshavanand 526 (DD); Srinagar, ca 1700 m, Gammie s.n. (DD).

7. KYDIA Roxb.

Kydia calycina Roxb., Pl. Corom. 3: 11. t. 215. 1819 *et*. Fl. Ind. 3: 188. 1832; Masters in Hook.f., Fl. Brit. India 1: 348. 1874; Sharma & Kachroo, Fl. Jammu 1: 110. 1981; Naqshi *et al.* in Ann. Miss. Bot. Gard. 75(4): 1508. 1988; Paul in Sharma *et al.*, Fl. India 3: 344. 1993.

Medium sized trees. Young branches stellately pubescent. Leaves suborbicular, usually lobed or angled, stellately pubescent, gland present at the base on abaxial side. Flowers in panicles, polygamous. Epicalyx segments 4-6, oblong, spatulate, spreading in fruit, densely stellate-hairy. Calyx 0.4-0.5 cm long, 5-fid. Corolla 1.2 cm in diam. Petals 5, white. Capsules subglobose, stellately hairy.

Fl. & Fr. : September - November.

On hill slopes.

Selected specimens : Banganga-Adkumari, Uniyal 86669 (BSD).

8. LAVATERA L.

Lavatera cachemiriana Cambess. in Jacq., Voy. Ind. 4: 29. t. 32. 1844; Masters in Hook.f., Fl. Brit. India 1: 319. 1874; Singh & Kachroo,

For. Fl. Srinagar 151. 1976; Naqshi *et al.* in Ann. Miss. Bot. Gard. 75(4): 1517. 1988; Paul in Sharma *et al.*, Fl. India 3: 355. 1993. *Wansotsal, Jangilsochal, Wansochal.*

Erect, perennial herbs. Young branches densely stellately-pubescent. Leaves orbicular-cordate, 4-9 cm long, crenate-dentate; lower leaves 5-lobed; upper ones 3-5-lobed; lobes ovate to deltoid; stipules foliaceous. Flowers axillary, solitary. Epicalyx segments 3, ovate or orbicular-ovate, 1-1.5 cm long, stellately hairy. Calyx longer than the epicalyx, stellately-pubescent. Corolla pink-lilac. 4-7.5 cm in diam; petals obovate, notched at the tip. Fruits discoid 1-1.5 cm in diam.

Fl. & Fr. : July - October.

Selected specimens : Banihal top, 2350-3330 m, T.A. Rao 7641 (BSD); Dachigam games Sanctuary, Wadhwa 66728 (BSD); Loran-Sultan pathri, 2000-2500 m, Vohra & Naithani 78332 (BSD); Sonamarg, Chowdhery & Uniyal 85754 (BSD).

9. MALVA L.

- 1a. Epicalyx segments oblong, oblong-lanceolate, ovate or ovate-lanceolate :
- 2a. Leaves 5-7-lobed. Staminal tube with simple or 2-rayed hairs ...2. *M. bucharica*
- 2b. Leaves 3-5-lobed. Staminal tube with stellate hairs :
- 3a. Schizocarps hairy. Petals less than thrice as long as the calyx ...1. *M. ambigua*
- 3b. Schizocarps glabrous. Petals 3-5 times longer than the calyx :
- 4a. Stipules ovate-lanceolate. Flowers usually 5 or more in a fascicle ...3. *M. mauritiana*
- 4b. Stipules lanceolate. Flowers usually 1-4 in each fascicle ...7. *M. sylvestris*
- 1b. Epicalyx segments linear-lanceolate :
- 5a. Mericarps distinctly reticulate on dorsal surface, angles keeled ...6. *M. parviflora*

- 5b. Mericarps smooth or finely ridged, angles not keeled :
- 6a. Calyx slightly accrescent. Mericarps 12-15, pubescent ...5. *M. neglecta*
- 6b. Calyx distinctly accrescent. Mericarps 9-12 :
- 7a. Plants glabrescent. Staminal column simple hairy towards upwards or glabrous. Fruiting calyx 10 mm or more long ...8. *M. verticillata* var. *rafiqii*
- 7b. Plants pubescent. Staminal column retrorse hairy throughout. Fruiting calyx less than 10 mm long ...4. *M. mohileviensis*

1. *Malva ambigua* Guss., Fl. Orient. Prodr. 2: 331. 1828; Naqshi *et al.* in Ann. Miss. Bot. Gard. 75(4): 1511. 1988; Paul in Sharma *et al.*, Fl. India 3: 357. 1993. *M. sylvestris* var. *eriocarpa* Boiss., Fl. Orient. 1: 819. 1867; Masters in Hook.f., Fl. Brit. India 1: 320. 1874.

Annual or perennial, small, weak herbs. Stems erect or ascending. Young branches stellately hairy. Leaves 1.5-3 cm long, sub-orbicular, 3-5-lobed, serrate, glabrescent. Flowers axillary, solitary or up to 7 in fascicles. Epicalyx segments oblong-ovate, 0.2-0.5 cm long, hairy. Calyx 0.3-0.6 cm long; lobes ovate-deltoid, stellately-pubescent. Corolla lilac. Fruits *ca* 0.6 cm in diam., pubescent, beaked.

Fl. & Fr. : May August.

Included after Naqshi *et al.* (*loc. cit.*).

2. *Malva bucharica* Iljin in Bot. Mater. Gerb. Glavn. Bot. Sada RSFSR 5: 4. 1924; Naqshi *et al.* in Ann. Miss. Bot. Gard. 75(4): 1512. 1988.

Erect or ascending, perennial herbs. Stems terete, glabrate. Leaves suborbicular or ovate-orbicular, cordate, 5-7-lobed, glabrate, margins serrate-dentate. Flowers axillary, in fascicles of 3 or crowded at the end of branches. Epicalyx segments oblong or oblong-lanceolate. Calyx 0.3-0.6

cm long; lobes accrescent, glabrate. Corolla purplish; petals ovate, oblong-obovate, notched. Fruits 0.6-0.7 cm in diam., glabrate.

Fl. & Fr. : August March.

Included after Naqshi *et al.* (*loc. cit.*).

3. *Malva mauritiana* L., Sp. Pl. 689. 1753; Naqshi *et al.* in Ann. Miss. Bot. Gard. 75(4): 1512. 1988; Paul in Sharma *et al.*, Fl. India 3: 357. 1993. *M. sylvestris* var. *mauritiana* (L.) Boiss., Fl. Orient 1: 819. 1867; Masters in Hook.f., Fl. Brit. India 1: 320. 1874.

Biennial or perennial, erect, up to 2 m tall herbs or undershrubs. Stems rigid, glabrescent. Leaves orbicular-ovate, 3-8 cm long, slightly 3-5-lobed, crenate, sparsely hairy. Flowers axillary, 5-15 in fascicles. Epicalyx segments, ovate to ovate-oblong, 0.3-0.4 cm long. Calyx 0.5-0.8 cm long; lobes triangular. Corolla dark pink. Fruits 0.5-0.7 cm in diam., glabrous.

Fl. & Fr. : October May.

Included after Naqshi *et al.* (*loc. cit.*).

4. *Malva mohilevlensis* Downar, Bull. Soc. Mosc. 1: 177. 1861; Naqshi *et al.* in Ann. Miss. Bot. Gard. 75(4): 1514. 1988; Paul in Sharma *et al.*, Fl. India 3: 359. 1993.

Annual herbs. Stems weak, ca 1.5 m tall with purplish tinge. Young branches pubescent. Leaves suborbicular, 1.4-4.5 cm long, cordate at the base, 5-7-lobed, dentate-crenulate or serrulate, sparsely pubescent above, stellately pubescent beneath. Flowers in axillary fascicles, 4-7 together. Epicalyx segments 0.3-0.5 cm long, linear, ciliate on margins. Calyx ca 0.5 cm long; lobes triangular. Corolla pinkish, ca 1 cm long; petals obovate. Fruits ca 0.5 cm in diam., glabrous.

Fl. & Fr. : January March.

Included after Naqshi *et al.* (*loc. cit.*).

5. *Malva neglecta* Wallr., Syll. Pl. Nov. Ratish. 1: 140. 1824; Naqshi *et al.* in Ann. Miss. Bot. Gard. 75(4): 1513. 1988; Paul in Sharma *et al.*, Fl. India 3: 359. 1993. *M. rotundifolia* L., Sp. Pl. 689. 1753; Master in Hook.f., Fl. Brit. India 1: 320. 1874. *Sheomou, Suchal.*

Biennial or perennial, erect or prostrate, 15-60 cm high herbs. Stems branched, pubescent with stellate hairs. Leaves reniform or sub-orbicular, 0.5-2.2 x 1.5-5 cm, cordate at base, crenate-dentate, slightly 5-7-lobed, sparsely hairy. Flowers axillary, 3-4 in fascicles, occasionally solitary. Epicalyx segments lanceolate or linear-lanceolate. Calyx lobes 0.5-0.7 cm long. Corolla purplish-pink, rarely whitish; petals oblong-obovate. Fruits 0.5-0.7 cm in diam, pubescent.

Fl. & Fr. : April - September.

Selected specimens : Pir Pass/Banihal ridge, T.A. Rao 7753 (BSD); Wular lake, ca 1800 m, Keshavanand 934 (DD).

6. *Malva parviflora* L., in Boejer, Demonstr. Pl. Hort. Ups. 18. 1753; Masters in Hook.f., Fl. Brit. India 1: 321. 1874; Sharma & Kachroo, Fl. Jammu 1: 109. 1981; Naqshi *et al.* in Ann. Miss. Bot. Gard. 75(4): 1514. 1988; Paul in Sharma *et al.*, Fl. India 3: 361. 1993.

Annual, semierect herbs. Stems ascending or prostrate, stellately hairy, glabrescent later. Leaves orbicular-reniform, 1.5-7 cm across, cordate, slightly 3-7-lobed, crenate-serrate, sparsely hairy or stellately hairy beneath. Flowers in compact axillary fascicles, solitary or paired. Epicalyx segments ca 0.5 cm long, linear, slightly ciliate. Calyx 0.3-0.5 cm long, stellately hairy. Corolla white to bluish-white with pinkish top. Fruits 0.5-0.6 cm in diam., glabrous.

1a. Plants ascending, branched from the base.

Flowers solitary or paired or rarely more
in fascicles

... 6.1. var. *microcarpa*

1b. Plants prostrate or procumbent, branched
throughout. Flowers many in compact
fascicles

...6.2. var. *parviflora*

6.1. var. *microcarpa* (Pers.) Loscos, *Trat. Pl. Aragon* 2: 203. 1877; Paul in Sharma *et al.*, *Fl. India* 3: 361. 1993. *Malva microcarpa* Pers., *Syn. Pl.* 2: 251. 1806; Naqshi *et al.* in *Ann. Miss. Bot. Gard.* 75(4): 1513. 1988.

Fl. & Fr. : March - October.

Included after Naqshi *et al.* (*loc. cit.*).

Rare.

6.2. var. *parviflora*

Fl. & Fr. : October - March.

Selected specimens : Ladakh, Hemis, 3600 m, *Bhattacharyya* 71638; Dras, 3200 m. *Bhattacharyya* 71401 (BSD). Pahalgam, *Vaid s.n.*, acc. no. 118295 (DD).

7. *Malva sylvestris* L., *Sp. Pl.* 689. 1753; Masters in Hook.f., *Fl. Brit. India* 1: 320. 1874; Naqshi *et al.* in *Ann. Miss. Bot. Gard.* 75(4): 1511. 1988; Paul in Sharma *et al.*, *Fl. India* 3: 363. 1993. *Sotsal.*

Biennial or perennial, erect or ascending, up to 2 m tall herbs. Stems glabrescent. Leaves suborbicular, 1.5-8 x 1-11 cm, truncate to broadly cordate, 3-lobed, crenate-dentate. Flowers axillary, solitary or in fascicles of 2-4. Epicalyx segments ovate-oblong, 0.3-0.5 cm long, ciliate. Calyx 0.3-0.6 cm long, sparsely stellately hairy. Corolla pink-purple; petals obovate. Fruits ca 0.6 cm in diam., glabrous.

Fl. & Fr. : August - March.

Selected specimens : Srinagar, *Mrs. Wright s.n.*, acc. no. 106819 (DD).

8. *Malva verticillata* L., Sp. Pl. 689. 1753. var. *rafiqii* Abedin in Fl. W. Pak. 130; 45. 1979; Naqshi *et al.* in Ann. Miss. Bot. Garden 75(4): 1515. 1988; Paul in Sharma *et al.*, Fl. India 3: 365. 1993.

Annual or biennial, erect herbs. Stems somewhat purplish, sparsely pubescent; hairs stellate. Leaves sub-orbicular, cordate or subtruncate, slightly 3-5-lobed. Flowers in loose axillary fascicles, 3-5 together. Epicalyx segments linear or linear-lanceolate. Calyx 0.4-0.5 mm long, stellately hairy. Corolla purplish; petals 0.6-0.8 cm long, minutely notched at the tip. Fruits 0.5-0.7 cm in diam., enclosed in accrescent calyx.

Fl. & Fr. : March - October.

Selected specimens : Hirpur, Pir Panjal, ca 2000 m, Gamnie s.n. (DD).

10. MALVASTRUM A. Gray

Malvastrum coromandelianum (L.) Garcke in Bonplandia 5: 295. 1857; Sharma & Kachroo, Fl. Jammu 1: 109. 1981; Naqshi *et al.* in Ann. Miss. Bot. Gard. 75 (4): 1522. 1988; Paul in Sharma *et al.*, Fl. India 3: 277. 1993. *Malva coromandeliana* L., Sp. Pl. 687. 1753. *Malvastrum tricuspdatum* (R. Br.) A. Gray. Pl. Wright. 1: 16. 1852; Masters in Hook.f., Fl. Brit. India 1: 321. 1874.

Erect or suberect, up to 1 m tall herbs or undershrubs. Stems and branches sparsely pubescent-stellately hairy. Leaves oblong-lanceolate, ovate or lanceolate, up to 6.5 x 3.5 cm, serrate-dentate, acute or obtuse, base rounded or acute, appressed simple hairy. Flowers axillary, solitary or fascicled. Epicalyx segments 3, linear, persistent. Calyx 0.6-0.8 cm long, 5-lobed; lobes ovate, acuminate, stellately hairy. Corolla yellow 1.5-2 cm in diam. Fruits discoid, 0.6 cm in diam.; mericarps 8-14.

Fl. & Fr. : July - December.

Selected specimens : Kathua, Uniyal & S. Singh 88591 (BSD); Udhampur, Mansar, D.K. Singh & Uniyal 88552 (BSD); Udhampur, Kiamar 81239 (BSD); Reasi, Uniyal 77478 (BSD).

11. SIDA L.

- 1a. Mericarps 5 :
- 2a. Leaves palmately nerved. Mericarps smooth, mucronate ...2. *S. cordata*
- 2b. Leaves penninerved. Mericarps with reticulations, awned :
- 3a. Stems with 1-2 spiny emergence at the base of petiole. Mericarps with 2 divergent apical awns ...6. *S. spinosa*
- 3b. Stems without spiny emergences. Mericarps with 2 convergent apical awns ...1. *S. alba*
- 1b. Mericarps 6-12 :
- 4a. Mericarps indehiscent ...4. *S. ovata*
- 4b. Mericarps dehiscent :
- 5a. Mericarps with 2, retrorsely hairy awns ...3. *S. cordifolia*
- 5b. Mericarps with or without awns, awns when present not retrorsely hairy ...5. *S. rhombifolia*

1. *Sida alba* L., Sp. Pl. ed. 2: 960. 1763; Naqshi *et al.* in Ann. Miss. Bot. Gard. 75(4): 1521. 1988; Paul in Sharma *et al.*, Fl. India 3: 283. 1993.

Tall, erect herbs or undershrubs, up to 1 m tall. Branches stellately hairy. Leaves elliptic-obovate, 1-2.5 x 0.5-2 cm, serrate-crenulate, minutely stellately pubescent beneath, glabrescent above; stipules 0.5 cm long, filiform. Flowers axillary, solitary or 2-together. Calyx 0.4-0.9 cm long, campanulate; lobes triangular. Corolla yellow, 0.6-1 cm in diam. staminal tube 0.2-0.3 cm long, hirsute. Fruits globose, 0.4-0.6 cm across, globose, depressed; mericarps 5, membranous, pubescent at tip.

Fl. & Fr. : August - December.

Included after Naqshi *et al.* (*loc. cit.*).

2. *Sida cordata* (Burm.f.) Borss. in Blumea 14: 182. 1866; Sharma & Kachroo, Fl. Jammu 1: 109. 1981; Naqshi *et al.* in Ann. Miss. Bot.

Gard. 75(4): 1520. 1988; Paul in Sharma *et al.*, Fl. India 3: 283. 1993. *Melochia cordata* Burm.f., Fl. Ind. 143. 1768. *Sida humilis* Cav., Diss. 5. t. 134. f. 2. 1788; Masters in Hook.f., Fl. Brit. India 1: 322. 1874.

Perennial, prostrate or procumbent herbs. Stems branched, stellately hairy, mixed with long, spreading simple hairs. Leaves, ovate or orbicular-ovate, 0.6-8 x 0.3-5.5 cm crenate-dentate, cordate, acute or acuminate, stellately appressed hairy, mixed with simple hairs. Flowers axillary, solitary or subpaniculate. Calyx 0.3-0.5 cm long; lobes deltoid, acuminate. Corolla yellow, 0.7-1 cm long. Fruits globose, depressed; mericarps 5, mucicous, membranous.

Fl. & Fr. : Throughout the year.

Along roadsides and in waste places.

Selected specimens : Rehalta, Hajra 82580 (BSD); Udhampur, Swami 743 (BSD); Jammu, Pallanwala, *Uniyal* 92666 (BSD).

3. *Sida cordifolia* L., Sp. Pl. 684. 1753; Masters in Hook.f., Fl. Brit. India 1: 324. 1874; Naqshi *et al.* in Ann. Miss. Bot. Gard. 75(4): 1521. 1988; Paul in Sharma *et al.*, Fl. India 3: 285. 1993. **Fig. 90**

Tall, erect, perennial herbs or undershrubs. Stems densely pubescent or villous-tomentose. Leaves suborbicular, ovate, ovate-lanceolate or ovate-oblong, 0.7-6 x 0.4-5 cm, irregularly crenate-dentate, sub-cordate or rounded at base, stellately pubescent. Flowers axillary, solitary or in pairs, sometimes fascicled at the tip. Calyx campanulate, 0.5-1 cm long; lobes triangular, acute, stellately hairy. Corolla yellow, 0.9-1.2 cm long. Fruits subdiscoid, 0.5-0.9 cm in diam.; mericarps 9-10, dehiscent.

Fl. & Fr. : Throughout the year.

Selected specimens : Jammu, Pallan, *Uniyal* 92776 (BSD); Jammu, ca 350 m, *Lambert* 263 (DD).

4. *Sida ovata* Forssk., Fl. Aegypt.-Arab. 124. 1775; Naqshi *et al.* in Ann. Miss. Bot. Gard. 75(4): 1521. 1988; Paul in Sharma *et al.*, Fl.

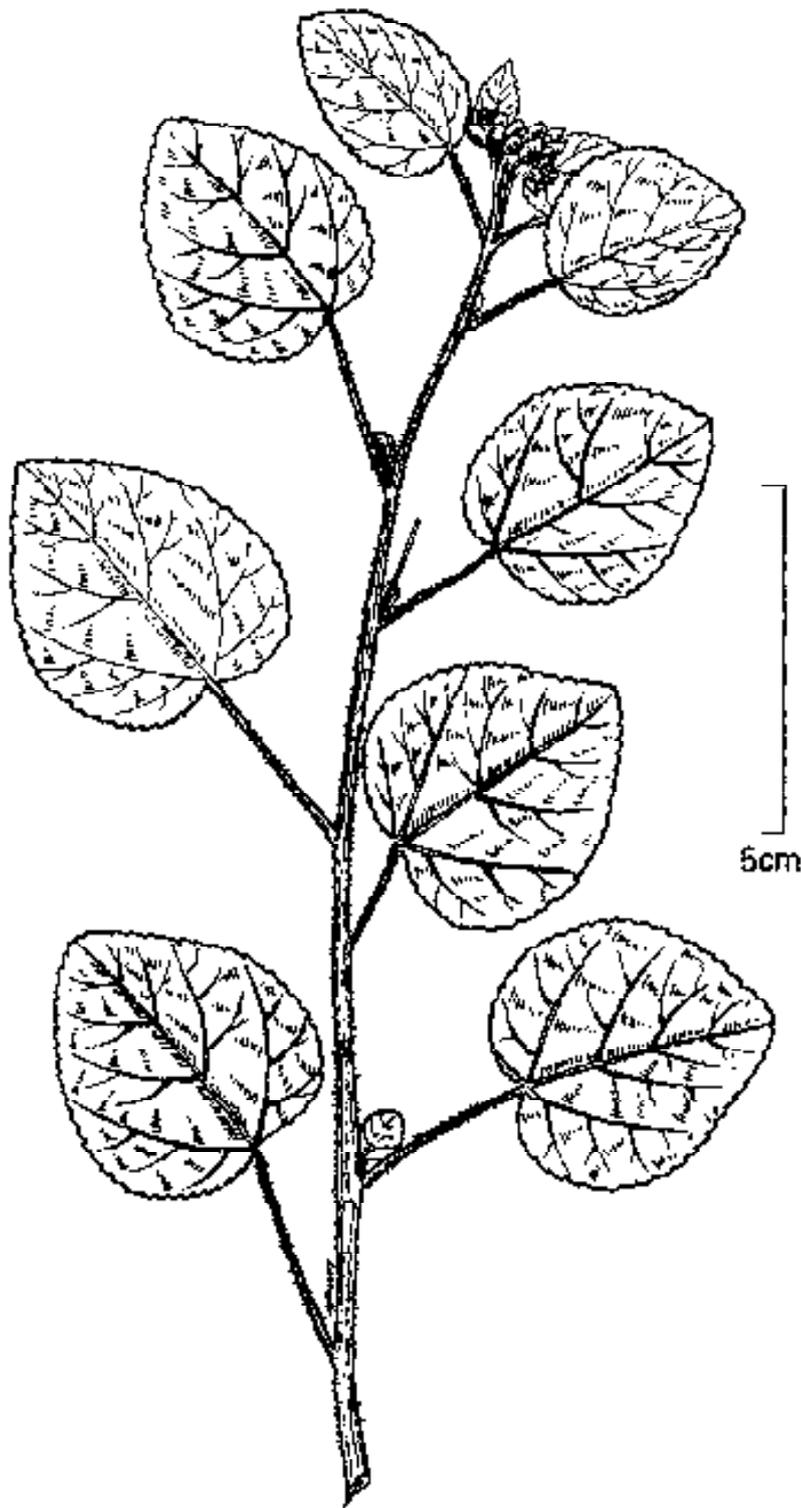


Fig. 90. *Sida cordifolia* L.

India 3: 288. 1993. *S. grewioides* Guill. et Ferr. in Guill et al. Fl. Seneg. Tent. 1. 71. 1830; Masters in Hook.f., Fl. Brit. India 1: 323. 1874.

Perennial, erect herbs or undershrubs. Branches stellately pubescent. Leaves ovate-oblong, 1.5-5 x 1-4 cm, obtuse, entire at the base, crenate-serrate at the tip, rounded or cuneate at base, stellately-pubescent. Flowers axillary, solitary or in pairs. Calyx campanulate, 0.4-0.8 cm long; lobes triangular, acuminate, stellately pubescent. Corolla white, 1-1.5 cm in diam. Fruits globose-depressed, 0.3-0.6 cm in diam., mericarps 7-8, indehiscent.

Fl. & Fr. : August - December.

Included after Naqshi et al. (*loc. cit.*).

5. *Sida rhombifolia* L., Sp. Pl. 684. 1753; Masters in Hook.f., Fl. Brit. India 1: 323. 1874; Paul in Sharma et al., Fl. India 3: 289. 1993. *S. rhombifolia* var. *obovata* Wallich ex Masters in Hook.f., Fl. Brit. India 1: 324. 1874. *Sida yunnanensis* Hu, Fl. China, Fam. 153: 16. t. 16. f. 7. 1955; Naqshi et al. in Ann. Miss. Bot. Gard. 75(4): 1520. 1988.

Perennial, erect herbs or undershrubs. Stems, branches, leaves beneath and pedicels stellately hairy, intermixed with long, spreading simple hairs. Leaves broadly rhomboid-ovate oblong, up to 8 x 5 cm, crenate-serrate, acute or obtuse, often rounded at the tip, glabrous above; petioles 0.3-1 cm long. Flowers axillary, solitary or in clusters of 2-5. Calyx campanulate, ovate or ovate-lanceolate, 0.4-0.6 cm long, acute, hairy. Corolla orange-yellow, ca 1 cm long. Fruits depressed globose; mericarps 5, densely stellately hairy.

Fl. & Fr. : Throughout the year.

Common along roadside and in waste places.

Selected specimens : Jammu, Buchamandi, *Uniyal* 92681; Udhampur, Reasi, *Uniyal* 77403 (BSD).

6. *Sida spinosa* L., Sp. Pl. 683. 1753; Masters in Hook.f., Fl. Brit. India 1: 323. 1874; Paul in Sharma et al., Fl. India 3: 292. 1993.

Annual or perennial herbs or undershrubs. Branches often with spiny tubercles below the leaves. Leaves ovate-oblong, rarely orbicular, up to 30 x 25 mm, acute, serrate; stipules 1-2.5 mm long, linear, hairy. Flowers axillary, solitary or in clusters of 2-5. Pedicels jointed above the middle. Calyx campanulate; lobes triangular. Corolla yellowish. Mericarps 5, trigonous, with 2 divergent awns.

Fl. & Fr. : Major part of the year.

Selected specimens : Jammu, ca 500 m, Lambert 262 (DD).

12. SIDALCEA A. Gray

Sidalcea neomexicana A. Gray subsp. *thurberi* (Robinson ex A. Gray) Hitchcock in Univ. Wash. Pub. Bot. 18. 1957; Naqshi *et al.* in Ann. Miss. Bot. Gard. 75(4): 1523. 1988. *Sidalcea parviflora* Greene var. *thurberi* Robinson ex A. Gray, Syn. Fl. N. Amer. 11: 305. 1897.

Perennial, erect herbs. Stems and branches glabrescent, glaucous. Leaves orbicular, palmately lobed, glabrescent; stipules deciduous, small. Flowers arranged in terminal racemes. Female flowers smaller than the perfect flowers. Epicalyx absent. Calyx 0.4-0.7 cm long; lobes 3-angular, stellately-pubescent. Corolla rose-purple, 1-1.6 cm long. Staminal tube 2-seriate. Mericarps beaked, 1-seeded.

Fl. & Fr. : July - September.

Included after Naqshi *et al.* (*loc. cit.*).

13. THESPESIA Solander ex Correa

Thespesia populnea (L.) Solander ex Correa in Ann. Mus. 9: 290. t. 8. f. 1. 1807; Masters in Hook.f., Fl. Brit. India 1: 345. 1874; Naqshi *et al.* in Ann. Miss. Bot. Gard 75(3): 1510. 1988; Paul in Sharma *et al.*, Fl. India 3: 352. 1993. *Hibiscus populneus* L., Sp. Pl. 694. 1753.

Small, 3-8 m tall, bushy trees. Young twigs covered with brownish peltate scales giving coppery appearance. Leaves ovate-cordate, sometimes

deltoid, entire, 5-20 x 5.5-15 cm, acuminate; stipules linear-lanceolate. Flowers axillary, solitary. Epicalyx segments 3, minute. Calyx cupular, 0.8-1 cm long, 5-toothed; teeth minute. Corolla light yellow with dark purple centre, campanulate 5-6 cm long; petals obliquely obovate. Staminal tube cylindrical, included. Capsules globose, 2-3.5 cm across, indehiscent.

Fl. & Fr. : August - January.

Included after Naqshi *et al.* (*loc. cit.*).

14. URENA L.

Urena lobata L., Sp. Pl. 692. 1753; Masters in Hook.f., Fl. Brit. India 1: 329. 1874; Sharma & Kachroo, Fl. Jammu 1: 111. 1981; Naqshi *et al.* in Ann. Miss. Bot. Gard. 75(4): 1522. 1988; Paul in Sharma *et al.*, Fl. India 3: 380. 1993.

Erect, up to 2 m tall herbs or undershrubs. Stems and branches stellately pubescent. Leaves variously shaped, 2-12 x .5-12.5 cm long, shallowly 3-lobed or unlobed, serrate-crenate, acute or obtuse, stellately pubescent; stipules linear. Flowers axillary, solitary or 2-3 in fascicle. Epicalyx segments 5, connate. Calyx campanulate or tubular; lobes 0.4-0.6 cm long, equalling the epicalyx. Corolla pink, 2-3 cm in diam.; petals obovate. Fruits subglobose, 1 cm in diam., glochidiate; mericarps 4-5.

Fl. & Fr. : July - October.

Selected specimens : Udhampur, Reasi, *Uniyal* 77494; Jammu, on way to Buchamandi, *Uniyal* 92616. (BSD).

CULTIVATED TAXA

Alcea lavateriflora (DC.) Boiss.

Alcea pallida (Waldst & Kait.) Bess.

Alcea rosea L. *Sazahmuth*, *Sazposh*, *Sudooposh*.

Hibiscus schizopetalus (Masters.) Hook.f.

Hibiscus syriacus L.

BOMBACACEAE

(Bipin Balodi)

BOMBAX L.

Bombax ceiba L., Sp. Pl. 511. 1753. *p.p.*; Nayar & Biswas in Sharma *et al.*, Fl. India 3: 398. 1993. *B. malabaricum* DC., Prodr 1: 479. 1824; Masters in Hook.f., Fl. Brit. India 1: 349. 1874. *Salmalia malabarica* (DC.) Schott in Schott & Endl., Melet. Bot. 35. 1832; Sharma & Kachroo, Fl. Jammu 1: 113. 1981. *Simbal*.

Tall trees, attaining height of up to 40 m. Trunk usually buttressed, initially prickly, branching high up in whorls. Leaves digitately 5-7-foliolate; leaflets elliptic-lanceolate, 10-25 x 7-10 cm, narrowed at base, entire, acuminate, glabrous above, puberulous beneath. Flowers bright red or pinkish-white, solitary or in clusters. Calyx campanulate, irregularly 2-5-lobed, puberulous outside, silky inside. Petals 5, obovate to elliptic-obovate, 7-18 cm long, recurved, fleshy. Stamens, many in 6 bundles, in 2-series. Styles 4-6.5 cm long; stigma 5-fid; lobes spreading. Fruits oblong-ovoid, 5-valved, silky inside. Seeds embedded in creamy-white wool.

Fl. & Fr. : April - June.

Common in forests.

Selected specimens : Udhampur, Krimchi-Mansar, Swami 867 (BSD).

STERCULIACEAE

(B.P. Uniyal)

- 1a. Herbs or undershrubs ... 2. *Melochia*
- 1b. Shrubs or trees :
 - 2a. Flowers unisexual or polygamous; petals absent ...4. *Sterculia*
 - 2b. Flower bisexual; petals present :
 - 3a. Flowers zygomorphic; staminal tube dilated.
 - Seeds wingless ...1. *Helicteres*

3b. Flowers actinomorphic; staminal tube narrow.

Seeds winged

... 3. *Pterospermum*

1. HELICTERES L.

Helicteres isora L., Sp. Pl. 963. 1753; Masters in Hook.f., Fl. Brit. India 1: 365. 1874; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. 485. 1972; Sharma & Jamwal, Fl. Jammu 1: 113. 1981; Malick in Sharma *et al.*, Fl. India. 3: 426. 1993.

Large shrubs, attaining the height of a small tree; branches rough, stellate hairy. Leaves broadly elliptic, elliptic-obovate, ovate-cordate or suborbicular, up to 23 x 15 cm, somewhat oblique at base, often 3-lobed, scabrous above, hairy or tomentose beneath. Flowers axillary, mostly solitary, crimson, Calyx gibbous, densely stellate hairy. Petals unequal, 2 lower shorter and broader than the 3 upper. Fruits cylindrical, spirally twisted.

Fl. & Fr. : Major part of the year.

Selected specimens : Padunala, Painal, Hajra 82351(BSD). Seen in vegetative condition between Pallanwala-Buchamandi.

2. MELOCHIA L.

Melochia corchorifolia L., Sp. Pl. 675. 1753; Masters in Hook.f., Fl. Brit. India 1: 374. 1874; Sharma & Kachroo, Fl. Jammu 1: 114. 1981; Malick in Sharma *et al.*, Fl. India 3: 441. 1993. **Fig. 91**

Herbs or undershrubs, up to 1 m, tall, with 2 lines of hairs along internodes. Leaves ovate, ovate-lanceolate, oblong, oblong-ovate or suborbicular, up to 10 x 7 cm, coarsely serrate. Flowers densely crowded in terminal peduncled heads. Bracteoles 4-5. Calyx ciliate; teeth lanceolate. Petals white or pink, obovate-spathulate. Fruits subglobose, depressed. Seeds trigonous.

Fl. & Fr. : Major part of the year.

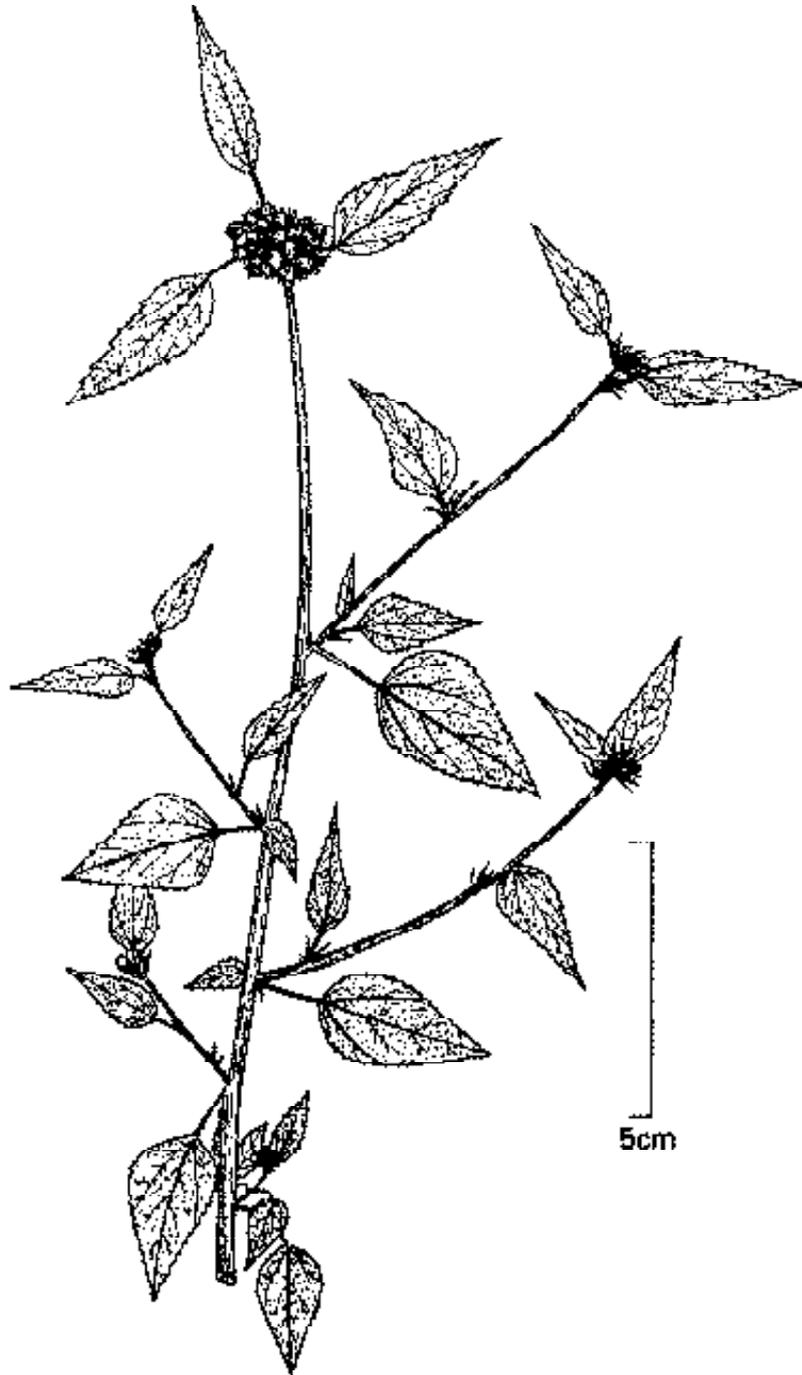


Fig. 91. *Melochia corchorifolia* L.

Selected specimens : Udampur, Grahmor, *Uniyal* 86663 (BSD).

3. PTEROSPERMUM Schreb.

Pterospermum acerifolium (L.) Willd., Sp. Pl. 3: 729. 1800; Masters in Hook.f., Fl. Brit. India 1: 368. 1874 *p.p.*; Sharma & Kachroo, Fl. Jammu 1: 114. 1981; Chandra in Sharma *et al.*, Fl. India 3: 448. 1993. *Pentapetes acerifolia* L., Sp. Pl. 698. 1753.

Trees, up to 25 m tall., young parts rusty tomentose. Leaves, broadly ovate-obovate, orbicular or rectangular, up to 40 x 30 cm, lobed or coarsely toothed, coriaceous, glabrescent above, grey or white pubescent beneath. Flowers mostly solitary, white, 10-15 cm long. Sepals rusty pubescent outside. Petals linear-oblong, revolute. Staminodes club-shaped. Fruits 10-20 x 3-6 cm, woody, 5-angled, brown tubercled. Seeds winged.

Fl. & Fr. : March - December.

Included after Sharma & Kachroo (*loc. cit.*).

Note : Leaves are used as plates.

4. STERCULIA L.

Sterculia villosa Roxb. ex Smith in Rees, Cycl. 34: no. 16. 1816; Masters in Hook.f., Fl. Brit. India 1: 355. 1874; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 485. 1972; Malick in Sharma *et al.*, Fl. India 3: 472. 1993.

Medium sized, deciduous trees. Branchlets with scars of fallen leaves; young parts, petals and inflorescence brown tomentose. Leaves up to 40 x 40 cm, palmately 5-7-lobed; lobes oblong or ovate-oblong, acuminate. Flowers creamy, in panicles, unisexual. Calyx campanulate, 5-lobed, hairy. Petals absent. Follicles 3-5, red inside, rusty villous outside. Seeds black.

Fl. & Fr. : December - September.

Selected specimens : Janglote, *Hajra* 82497 (BSD).

On slopes with *Mallotus philippensis* and *Pinus roxburghii*.

Note : Fibre is obtained from the bark.

TILIACEAE

(Bipin Balodi)

- 1a. Fruits covered with uncinatae spines ...3. *Triumfetta*
- 1b. Fruits not covered with uncinatae spines :
 - 2a. Fruits capsular, 3-5-celled ...1. *Corchorus*
 - 2b. Fruits drupaceous ...2. *Grewia*

1. CORCHORUS L.

- 1a. Prostrate herbs ...2. *C. depressus*
- 1b. Erect or suberect herbs :
 - 2a. Capsules terminating into 3, bifid, spreading tips :
 - 3a. Capsules 6-angled, winged on 3 angles ...1. *C. aestuans*
 - 3b. Capsules cylindric, not winged ...4. *C. tridens*
 - 2b. Capsules not terminating into 3, bifid, spreading tips :
 - 4a. Capsules 3-angled, 3-loculed ...5. *C. trilocularis*
 - 4b. Capsules subcylindric, 10-ribbed, 5-loculed ...3. *C. olitorius*

1. *Corchorus aestuans* L., Syst. Nat. ed. 10. 1: 1079. 1758; Sharma & Kachroo, Fl. Jammu 1: 115: 1981; Daniel & Chandrabose in Sharma *et al.*, Fl. India 3: 485. 1993. *C. acutangulus auct. non* Forssk; Lam., Encycl. Method. Bot. 2: 104. 1786; Masters in Hook.f., Fl. Brit. India 1: 398. 1874.

Erect, annual herbs. Stems branched; branches with purple tinge, hairy-pubescent. Leaves lanceolate or ovate-lanceolate, 2-10 x 1-5 cm, serrate, acute, oblique or rounded at the base, glabrous above, pilose beneath. Flowers yellow, 2-3, in leaf-opposed cymes. Sepals tinged with purple, linear-oblong, acute. Petals obovate, 0.4-0.5 cm long. Fruits 1.5-2.7 cm long, 3 winged.

Fl. & Fr. : July - October.

Selected specimens : Basholi, Hajra 82602 (BSD); Udhampur, Swami 704 (BSD); Hills behind Grahmor, Uniyal 86625 (BSD); Jammu, on way to Buchamandi, Uniyal 92617 (BSD).

2. *Corchorus depressus* (L.) Vicary in J. Asiat. Soc. Bengal 16: 1160. 1847; Ghafoor in Fl. W. Pakistan. 75: 22. 1974; Daniel & Chandrabose in Sharma *et al.*, Fl. India 3: 486. 1993. *Antichorus depressus* L., Mant. 1: 64. 1767. *Corchorus antichorus* Raeusch, Nom. Bot. ed. 3. 158. 1797; Masters in Hook.f., Fl. Brit. India 1: 398. 1874.

Perennial, woody herbs. Stems much branched; branches prostrate; young shoots hairy. Leaves elliptic or elliptic-ovate, 0.4-1.2 cm long, crenate-serrate, glabrous or sparsely hairy. Flowers yellow, 2-4 in leaf opposed subsessile cymes, 0.5-0.8 cm across. Sepals linear or linear-oblong, 0.3-0.5 cm long. Petals spatulate, equalling the sepals. Fruits oblong-cylindric, straight or slightly curved, glabrous.

Fl. & Fr. : October - February.

Included after Daniel & Chandrabose (*loc cit.*).

3. *Corchorus oltorius* L., Sp. Pl. 529. 1753; Masters in Hook.f., Fl. Brit. India 1: 397. 1874; Sharma & Kachroo, Fl. Jammu 1: 116. 1981; Daniel & Chandrabose in Sharma *et al.*, Fl. India 3: 487. 1993; Swami & Gupta, Fl. Udhampur 78. 1998.

Annual or biennial herbs, up to 1.5 m tall. Leaves oblong-lanceolate, lanceolate to ovate-lanceolate, up to 15 x 5 cm, serrate, with the serrations mostly prolonged into filiform processes, glabrous except on nerves; stipules subulate 8-12 cm long. Flowers yellow, 1-2, in leaf opposed cymes. Sepals linear-oblong, 5-7 mm long, apiculate. Petals oblong-spathulate, equalling the sepals, obtuse. Fruits subcylindric, 10-ribbed, 5-loculed, beaked; beak entire.

Fl. & Fr. : July - January.

Selected specimens : Ramnagar, Swami; 682 (BSD).

4. *Corchorus tridens* L., Mant. Pl. 566. 1771; Masters in Hook.f., Fl. Brit. India 1: 398. 1874; Sharma & Kachroo, Fl. Jammu 1: 116. 1981; Daniel & Chandrabose in Sharma *et al.*, Fl. India 3: 488. 1993.

Erect, annual, low herbs. Stems branched; branches ascending, pubescent. Leaves linear-oblong, oblong-lanceolate to lanceolate, 0.5-1.5 x 4-7 cm, crenate-serrate; petioles pubescent. Flowers yellow, 1-3 on leaf opposed peduncles. Capsules 1.5-3 cm long, slender, terete, ending in 3 short radiating beaks.

Fl. & Fr. : September - October.

Included after Sharma & Kachroo (*loc. cit.*).

5. *Corchorus trilocularis* L., Mant. Pl. 77. 1767; Masters in Hook.f., Fl. Brit. India 1: 397. 1874; Daniel & Chandrabose in Sharma *et al.*, Fl. India 3: 488. 1993; Swami & Gupta, Fl. Udhampur 78. 1998. **Fig. 92**

Annual, much branched herbs, up to 1.5 m tall. Leaves oblong-lanceolate to broadly oblong-elliptic, up to 10 x 3.5 cm, crenate-serrate with the basal most serrations often prolonged into filiform processes, with the basal most serrations often prolonged into filiform processes, sparsely hairy, more so along nerves; stipules setose. Flowers yellow, 1-3, in leaf opposed cymes. Sepals linear-oblong, ca 4.5 mm long, acuminate. Petals 5-6.5 mm long, obtuse. Fruits triangular, scabrous-tuberculate, 3-loculed; beak ca 2.5 mm long, undivided.

Fl. & Fr. : Major part of the year.

Selected specimens : Udhampur, Mansar, Swami 1011 (BSD).

2. GREWIA L.

- | | |
|--|---------------------------|
| 1a. Peduncles capillary, 1-2-flowered | ...5. <i>G. tenax</i> |
| 1b. Peduncles not capillary, 3-many-flowered : | |
| 2a. Leaves 3-7-nerved | ...1. <i>G. eriocarpa</i> |

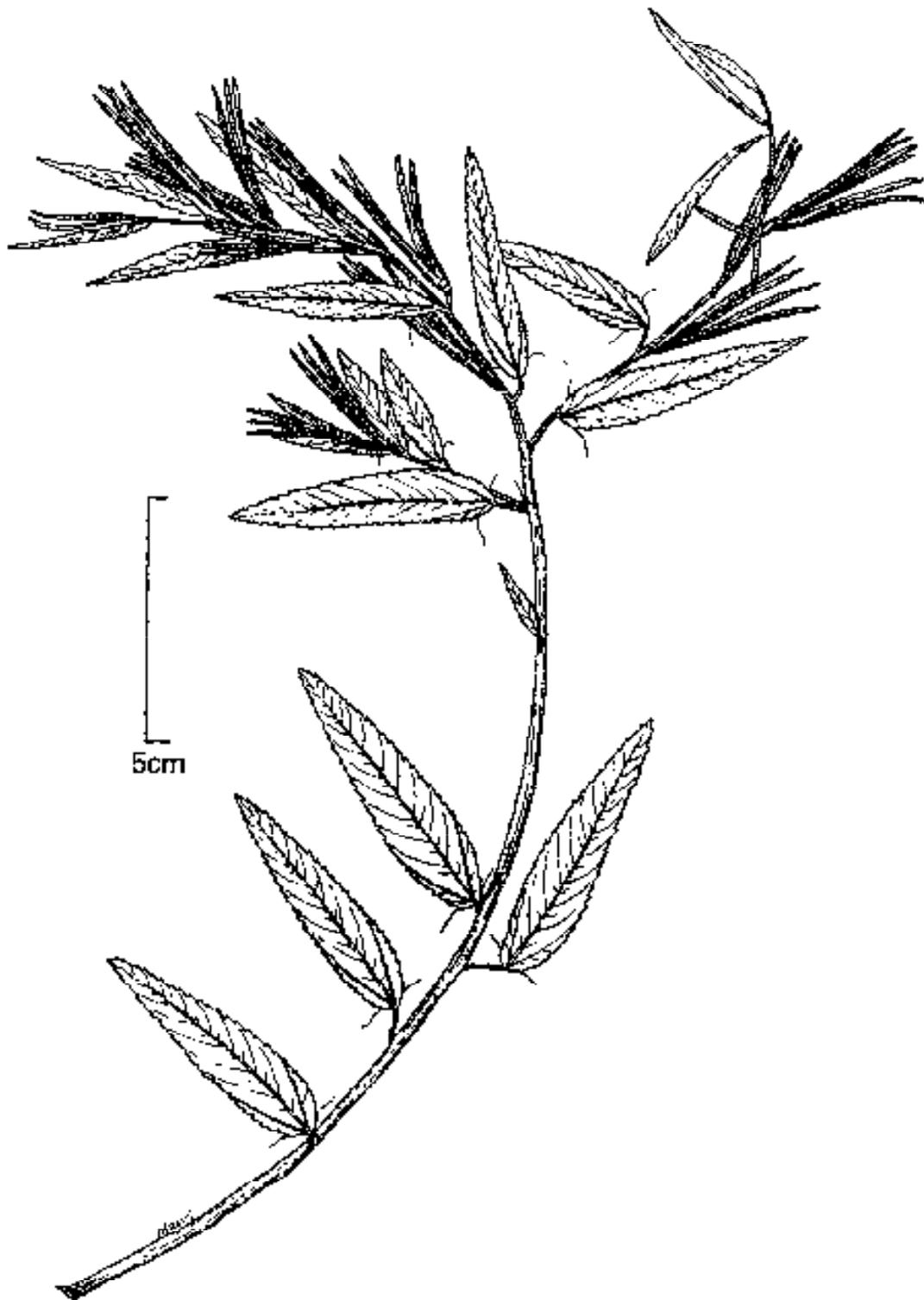


Fig. 92. *Corchorus trilocularis* L.

- 2b. Leaves 3-4-nerved :
- 3a. Leaves glabrous or glabrescent ...4. *G. serrulata*
- 3b. Leaves scabrid, pubescent or tomentose :
- 4a. Peduncles solitary ...3. *G. optiva*
- 4b. Peduncles more than one ...2. *G. oppositifolia*

1. *Grewia eriocarpa* A.L. Juss. in Ann. Mus. Natl. Hist. Nat. 4: 93. 1804; Daniel & Chandrabose in Sharma *et al.* Fl. India 3: 497. 1997. *G. elastica* Royle, Illus. Bot. Himal. 1: 104. t. 22. 1834; Ghafoor in Fl. W. Pakistan 75: 13. 1974. *G. asiatica* var. *vestita* Masters in Hook.f., Fl. Brit. India 1: 387. 1874.

Small sized trees. Stem bark grey-green; young shoots yellowish pubescent. Leaves obovate, elliptic-obovate or orbicular-ovate, 4-8 x 5-15 cm. acuminate, obscurely 3-lobed at the tip, scabrous-stellately hairy along the nerves above, tomentose-pubescent beneath. Flowers yellow, 2-4, in axillary cymes. Sepals linear-oblong, 0.6-0.8 cm long. Petals shorter than the sepals. Fruits globose or obscurely 2-4-lobed, hairy, fleshy.

Fl. & Fr. : April - September.

Selected specimens : Katra, near Banganga, *Untyal* 86668 (BSD).

2. *Grewia oppositifolia* Buch.-Ham. ex D. Don, Prodr. Fl. Nepal. 227. 1825; Masters in Hook.f., Fl. Brit. India 1: 384. 1874; Daniel & Chandrabose in Sharma *et al.*, Fl. India 3: 503. 1993.

Shrubs or small trees. Leaves ovate, elliptic or elliptic-ovate, up to 9 x 5.5 cm, crenate-serrate, stellate pubescent above, woolly beneath. Flowers white, in leaf opposed, axillary or terminal cymes. Sepals lanceolate 1.2-1.6 cm long. Petals ovate-lanceolate, emarginate. Fruits black on maturity globose, 4-lobed.

Fl. & Fr. : Major part of the year.

Included after Daniel & Chandrabose (*loc. cit.*).

3. *Grewia optiva* Drumm. ex Burret in Notizbl. Bot. Gart. Berl.-Dahlem. 9: 962. 1926; Sharma & Kachroo, Fl. Jammu 1: 114. 1981; Daniel & Chandrabose in Sharma *et al.*, Fl. India 3: 504. 1993. *Daman*.

Small sized trees. Stem bark grey-green, rough; young shoots pubescent. Leaves ovate-elliptic to broadly ovate, 2.5-15 x 3.5-10 cm, crenate, acute-acuminate, scabrous above, densely pubescent beneath. Flowers yellowish-red, 2-8 in axillary cymes. Sepals linear-oblong, long, hairy. Petals long, ovate, 0.8-1.2 cm. Fruits globose, 2-4-lobed.

Fl. & Fr. : April - September.

Abundant near villages and in forests.

Selected specimens : Basholi, Hajra 82598 (BSD); Katra, Udhampur, Swami 1029 (BSD); Udhampur, Kumar 81231 (BSD).

4. *Grewia serrulata* DC., Prodr. 1: 510. 1824; Daniel & Chandrabose in Sharma *et al.*, Fl. India 3: 509. 1997. *G. glabra* Blume, Bijdr. 115. 1825; Ghaffoor in Fl. W. Pakistan 75, 11. 1974. *G. laevigata* auct. non Vahl; Masters in Hook.f., Fl. Brit. India 1: 389. 1874.

Large shrubs or small trees. Young shoots thinly stellate hairy. Leaves lanceolate, ovate-lanceolate, elliptic-ovate or obovate, 1-18 x 1.5-7 cm, acute, serrate or serrulate, glabrescent above, pilose beneath. Flowers whitish-yellow, in umbellate cymes. Sepals oblong or lanceolate, 0.8-1.5 cm long. Petals narrowly obovate. Fruits slightly dorsoventrally compressed, subglobose or globose when lobed.

Fl. & Fr. : March - September.

Selected specimens : Basholi, Hajra 82595 (BSD).

5. *Grewia tenax* (Forssk.) Fiori in Agric. Colon. 5: Suppl. 23. 1912; Sharma & Kachroo, Fl. Jammu 1: 115. 1981; Daniel & Chandrabose in Sharma *et al.*, Fl. India 3: 511. 1993. *Chandara tenax* Forssk., Fl. Aegypt.-Arab. 105. 1775. *Grewia populifolia* Vahl, Symb. Bot. 1: 33. 1790; Masters in Hook.f., Fl. Brit. India 1: 385. 1874.

Tall shrubs. Stems much branched; stem bark grey or brownish-black; young shoots stellately hairy. Leaves ovate, elliptic-ovate or ovate-lanceolate, .5-4 x .5-2.5 cm, hairy. Flowers 1-3 together. Sepals hairy outside. Petals white, linear-oblong ca 1.5 cm long. Fruits 4-lobed, orange-red when ripe.

Fl. & Fr. : April August.

Selected specimens : Jammu-Nagrota, D.K. Singh & Uniyal 88507 (BSD); Kathua, Jasrota, ca 650 m, Lambert 286 (DD).

3. TRIUMFETTA L.

- 1a. Flowers orange. Capsules glabrous ...1. *T. annua*
 1b. Flowers yellow. Capsules pubescent or tomentose :
 2a. Capsules oblong-ovoid; uncinat spines on fruit
 hairy ...2. *T. pentandra*
 2b. Capsules globose; uncinat spines glabrous ...3. *T. rhomboidea*

1. *Triumfetta annua* L., Mant. Pl. 73. 1767; Masters in Hook.f., Fl. Brit. India 1: 396. 1874; Ghafoor in Fl. W. Pakistan 75: 16. 1974; Daniel & Chandrabose in Sharma *et al.*, Fl. India 3: 518. 1993.

Annual, erect herbs, up to 60 cm high, glabrous except for a single line of hairs on one side. Leaves ovate or ovate-lanceolate, up to 12 x 6 cm, acute-acuminate, serrate, 3-5-costate, hairy. Inflorescence in 3-flowered, leaf-opposed cyme. Flowers orange, ca 0.8 cm across. Sepals apiculate. Petals spatulate, nearly equalling the sepals. Stamens much exserted. Fruits globose, covered with uncinat, glabrous spines.

Fl. & Fr. : August September.

Included after Ghafoor (*loc. cit.*).

2. *Triumfetta pentandra* A. Rich. in Guill. *et al.*, Fl. Seneg. Tent. 93. t. 19. 1831; Ghafoor in Fl. W. Pakistan 75: 19. 1975; Daniel & Chandrabose in Sharma *et al.*, Fl. India 3: 518. 1993. *T. neglecta* Wight & Arn., Prodr. Fl. Penin. Ind. Or. 1: 75. 1834; Masters in Hook.f., Fl. Brit. India 1: 396. 1874.

Annual, erect, 30-60 cm high herbs. Stems stellate hairy. Leaves rhomboid-ovate, 3-10 x 4-9 cm, entire or palmately 3-lobed, 3-5-costate; terminal leaves simple, hairy above, stellate hairy beneath. Flowers yellow, in leaf opposed cymes, 0.4-0.6 cm across. Sepals apiculate. Petals spatulate equalling the sepals. Fruits oblong-ovoid, hairy; spines with a line of spreading hairs on upper side.

Fl. & Fr. : July - October.

Included after Daniel & Chandrabose (*loc. cit.*).

3. *Triumfetta rhomboidea* Jacq., Enum. Pl. Carib. 22. 1760; Masters in Hook.f., Fl. Brit. India 1: 395. 1874; Ghafoor in Fl. W. Pakistan 75: 17. 1974; Sharma & Kachroo, Fl. Jammu 1: 115. 1981; Daniel & Chandrabose in Sharma *et al.*, Fl. India 3: 520. 1993.

Tall, erect, perennial herbs. Stems much branched, hairy-pubescent. Leaves rhomboid or rhomboid-ovate, 2-9 x 3-8 cm, 3-7-costate, palmately 3-lobed or lobes obscure, acute, cuneate cordate at the base, hairy; hairs simple or stellate. Inflorescence in terminal or leaf-opposed cymes. Flowers yellow, 0.5-0.7 cm across. Sepals oblong, apiculate. Petals equalling or slightly shorter than the sepals. Fruits globose, tomentose; spines glabrous.

Fl. & Fr. : August - October.

Selected specimens : Udhampur, Grahmor, Uniyal, 86629 (BSD).

LINACEAE

(Bipin Balodi)

- 1a. Leaves petiolate. Styles 3-4. Capsules 3-4 celled ...2. *Reinwardtia*
 1b. Leaves sessile. Styles 3. Capsules 5-celled ...1. *Linum*

1. LINUM L.

- 1a. Flowers blue or purple :
 2a. Annuals. Stems simple below. Capsules scarcely
 exceeding the sepals ...4. *L. usitatissimum*

- 2b. Perennials. Stems many from the base. Capsules
 much exceeding the sepals ...2. *L. perenne*
- 1b. Flowers yellow :
- 3a. Pedicels longer than the calyx ...1. *L. corymbulosum*
- 3b. Pedicels usually equalling the calyx ...3. *L. strictum*

1. *Linum corymbulosum* Reichenb., Fl. Germ. Excurs. 843. 1832; Stewart in Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 432. 1972; Hajra in Sharma *et al.*, Fl. India 3: 578. 1993. *L. strictum* L. var. *corymbulosum* (Reichenb.) Planch. in Hook., J. Bot. 7: 476. 1848; Hook.f., Fl. Brit. India 1: 411. 1874. *L. strictum* L. subsp. *corymbulosum* (Reichb.) Rouy, Fl. Fr. 4: 60. 1897; Singh & Kachroo, For. Fl. Srinagar 109. 1976.

Annual herbs, up to 45 cm high. Leaves linear-lanceolate, 2-3 cm long, scabrid on margins. Flowers in lax, spreading corymbose cymes; sepals ovate, ca 6 mm long, scabrid and glandular margined. Petals yellow, obovate. Stamens 5; staminodes 5, alternating with the stamens. Capsules subglobose, dehiscent into 10 cocci.

Fl. & Fr. : March June.

Included after Hajra (*loc. cit.*).

2. *Linum perenne* L., Sp. Pl. 1: 277. 1753; Hook.f., Fl. Brit. India 1: 411. 1874; Hajra in Sharma *et al.*, Fl. India 3: 579. 1993.

Perennial, erect, or ascending herbs. Stems many from the base. Leaves lanceolate, sometimes lower oblong, obtuse and upper linear, acute, 0.6-2.5 cm long, sessile. Flowers in cymes, blue. Sepals 4-5 mm long, ovate or obovate, glandular at margins. Petals 10-12 mm long, obovate. Fruits 5-8 mm across, longer than the sepals.

Fl. & Fr. : April September.

Selected specimens : Dras; Chowdhery & Uniyal 85803 (BSD); Dras, 3000 m, Bhattacharyya 41197; Kharbu-Kargil, 2600 m., Bhattacharyya 71399 (BSD); Dras-Kargil, Wadhwa 58745. (BSD).

3. *Linum strictum* L., Sp. Pl. 279. 1753; Hook.f., Fl. Brit. India 1: 411. 1874; Hajra in Sharma *et al.*, Fl. India 3: 579. 1993.

Annual, slender herbs. Stems corymbosely branched above, glabrous or sparsely hairy. Leaves 10-15 mm long, linear or linear-oblong or sometimes lanceolate, acute, glabrous or puberulous. Flowers in corymbose cymes. Sepals 3-6 mm long, glandular at margins. Petals yellow. Capsules globose, shorter than the calyx.

Fl. & Fr. : April August.

Included after Hajra (*loc. cit.*).

4. *Linum usitatissimum* L., Sp. Pl. 277. 1753; Hook.f., Fl. Brit. India 1: 410. 1874; Hajra in Sharma *et al.*, Fl. India 3: 580. 1913; Naqshi & Ara in J. Econ. Tax. Bot. 17(3): 665. 1993. *Alish.*

Annual herbs, up to 1.2 m tall. Stems erect, branched above. Leaves linear-linear lanceolate, 1-4 cm long, 3-nerved. Flowers in axillary cymes. Sepals ovate-elliptic, nerved. Petals blue or purple, rarely white, obovate or broadly rounded. Stamens connate at base. Capsules globose, scarcely exceeding the sepals.

Fl. & Fr. : January August.

Selected specimens : Baneri-Haryachak, Uniyal & S. Singh 91305 (BSD); Churulam village, Wadhwa, Murti & Pant 85009 (BSD).

2. REINWARDTIA Dumort.

Reinwardtia indica Dumort., Comm. Bot. 19. 1822; Stewart in Sharama & Kachroo, Fl. Jammu 1: 117. 1981. Hajra in Sharma *et al.*, Fl. India 3: 581. 1993. *Reinwardtia trigyna* (Roxb.) Planch. in Hook.f., J. Bot. 7: 522, 1848 *et in* Hook.f., Fl. Brit. India 1: 412. 1874. *Linum trigyna* Roxb. Asiat. Res. 6: 357. 1799, *non* L., 1753.

Tufted, perennial herbs or undershrubs. Stems prostrate or ascending, branched, glabrous. Leaves elliptic-obovate or oblong-lanceolate, 1-2 x

0.6-4.5 cm, entire or creante-serrate, acute or obtuse, glabrous. Flowers 2-2.5 cm across. Sepals lanceolate 0.5-1 cm long, acute. Petals yellow obovate, abruptly narrowed at the base. Capsules globose.

Fl. & Fr. : January - December.

Selected specimens : Udhampur city, Swami 1048 (BSD).

MALPIGHIACEAE

(S. Kumar)

- 1a. Flowers actinomorphic. Styles 3. Samaras surrounded by a lateral wing ...1. *Aspidopterys*
 b. Flowers zygomorphic. Style 1, Samaras with one long middle and two short lateral wings ...2. *Hiptage*

1. ASPIDOPTERYS A. Juss.

Aspidopterys wallichii Hook.f., Fl. Brit. India 1: 421. 1874; Sharma & Kachroo, Fl. Jammu 118. 1981; Srivastava in Hajra *et al.*, Fl. India 4: 12. 1997. Fig. 93

Climbers, with slender, white-tomentose branches. Leaves ovate, 10-18 x 3-6 cm, acute or acuminate, subcordate at base, silky-white tomentose beneath; petioles 1-1.2 cm long, white tomentose. Panicles 15-30 cm long, lax. Flowers *ca* 0.8 cm across. Pedicels up to 2.5 cm long. Calyx lobes ovate, *ca* 1.5 mm long, glabrous. Petals creamy white, obovate, 4-5 mm long. Stamens 10; filaments up to 2 mm long, filiform. Styles 3, glabrous. Samara, orbicular, oblong to ovate, 3, surrounded by a membranous wing.

Fl. & Fr. : August - March.

2. HIPTAGE Gaertn.

Hiptage benghalensis (L.) Kurz in J. Asiat Soc. Bengal 43: 136. 1874; Sharma & Kachroo, Fl. Jammu 1: 117. 1981. *Banisteria benghalensis*

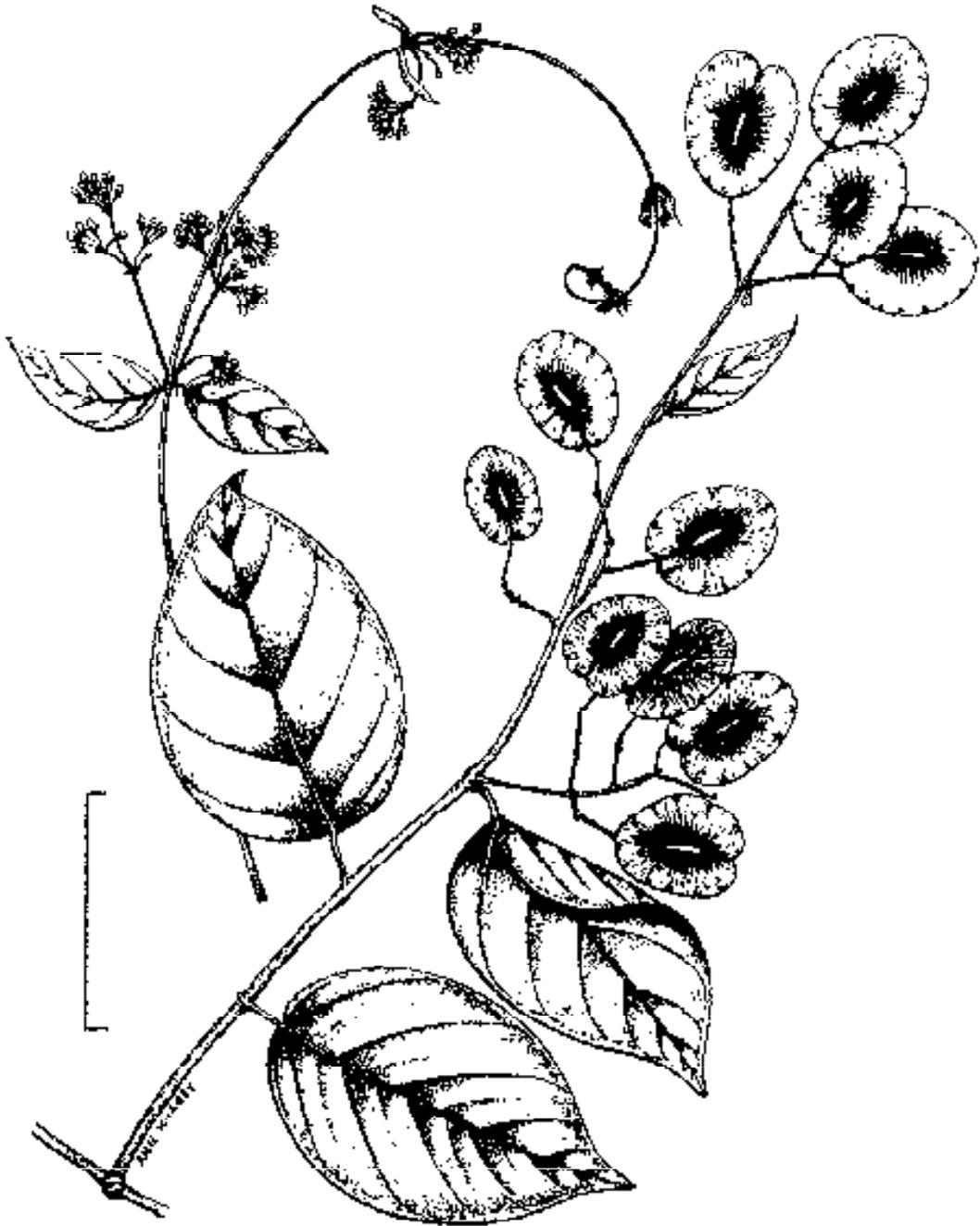


Fig. 93. *Aspidopterys wallichii* Hook.f.

L., Sp. Pl. 427, 1753. *Hiptage madagblota* Gaertn., Fruct. 2: 169. 1791; Hook.f., Fl. Brit. India 1: 418. 1874. *Madhavalata* (Hindi).

Woody climbers or shrubs with appressed-tomentose or silky young parts. Leaves oblong or ovate-lanceolate, 10-20 x 4-8 cm, acuminate, cuneate at base, coriaceous, glabrous; petioles 1.5-2 cm long, silky pubescent. Racemes 10-20 cm long, erect, tomentose. Pedicels swollen towards apex. Flowers white 1.5-2 cm across, fragrant. Calyx 8-10 mm long; fulvous-sericeous outsides; glands 4-5 mm long. Corolla of 5 petals: petals ca 1 cm long, clawed, 5th petal with yellow base. Stamens 10; filaments 10 mm in longer and 6 mm in shorter ones. Style 1, ca 1.5 cm long, slightly curved. Samaras winged; lateral wings oblong, 2-3 cm long, middle oblanceolate, 4-6 mm long, dorsal crista ca 1 cm long.

Fl. & Fr. : March - June.

Selected specimens : Mansar, Udhampur, Swami 1155 (BSD).

Growing independently on roadside or as climber. Also cultivated in gardens in plains.

ZYGOPHYLLACEAE

(B.P. Uniyal)

- | | |
|---|------------------------|
| 1a. Flowers in cymes. Fruit a drupe : | |
| 2a. Leaves simple. Stamens 15 | ...2. <i>Nitraria</i> |
| 2b. Leaves bifoliate. Stamens 10 | ...1. <i>Balanites</i> |
| 1b. Flowers solitary. Fruit a capsule or schizocarp : | |
| 3a. Leaves simple. Fruits capsular | ...3. <i>Peganum</i> |
| 3b. Leaves compound. Fruits schizocarpic | ...4. <i>Tribulus</i> |

1. *BALANITES* Del.

Balanites roxburghii Planch. in Ann. Sc. Nat. Bot. Ser. 4. 2: 258. 1854; Bennett in Hook.f., Fl. Brit. India 1: 522. 1875; P. Singh & V. Singh in Hajra *et al.*, Fl. India 4: 40. 1997.

Deciduous shrubs or small trees, armed; thorns simple or forked, often bearing leaves and flowers. Leaflets 2, elliptic-oblong, obovate-oblong or lanceolate, 1.5 x 1.3 cm, pubescent. Flowers pale-greenish yellow, in axillary fascicled cymes. Sepals *ca* 3 mm long, elliptic-ovate, dense pubescent outside, silky hairy inside. Petals elliptic-oblong, silky hairy inside. Stamens 10. Fruits ovoid or subspherical, 5-grooved.

Fl. & Fr. : Major part of the year.

Included after Singh & Singh (*loc. cit.*).

2. NITRARIA L.

Nitraria schoberi L., Syst. Nat. ed. 10: 1044. 1759; Ghafoor in Fl. W. Pak. 76: 3. f. 1 A. E. 1974; P. Singh & V. Singh in Hajra *et al.*, Fl. India 4: 47. 1997.

Woody shrubs. Young branches greyish pubescent, spiny at the tip. Leaves fascicled, oblong-spathulate, 20-50 x 3-8 mm, obtuse, mucronulate, sessile; stipules minute. Flowers sessile, *ca* 4 mm across. Sepals broadly ovate, glabrous or glabrescent, slightly connate at base. Petals oblanceolate, *ca* 3 mm long, tip incurved. Stamens 5 in each of the 3 whorls. Drupes reddish-purple, ovoid-spherical, glabrous.

Fl. & Fr. : December - March.

Included after Singh & Singh (*loc. cit.*).

3. PEGANUM L.

Peganum harmala L., Sp. Pl. 444. 1753; Hook.f., Fl. Brit. India. 1: 486. 1875; Sharma & Kachroo, Fl. Jammu 1: 118. 1981; Kachroo *et al.*, Fl. Ladakh 68. 1977; P. Singh & V. Singh in Hajra *et al.*, Fl. India 4: 48. 1997. *Isbaund.* **Fig. 94**

Perennial, glabrous herbs, up to 1 m tall, woody at the base. Leaves 3-7.5 cm long, multifid; sessile; lobes linear-lanceolate to elliptic. Flowers

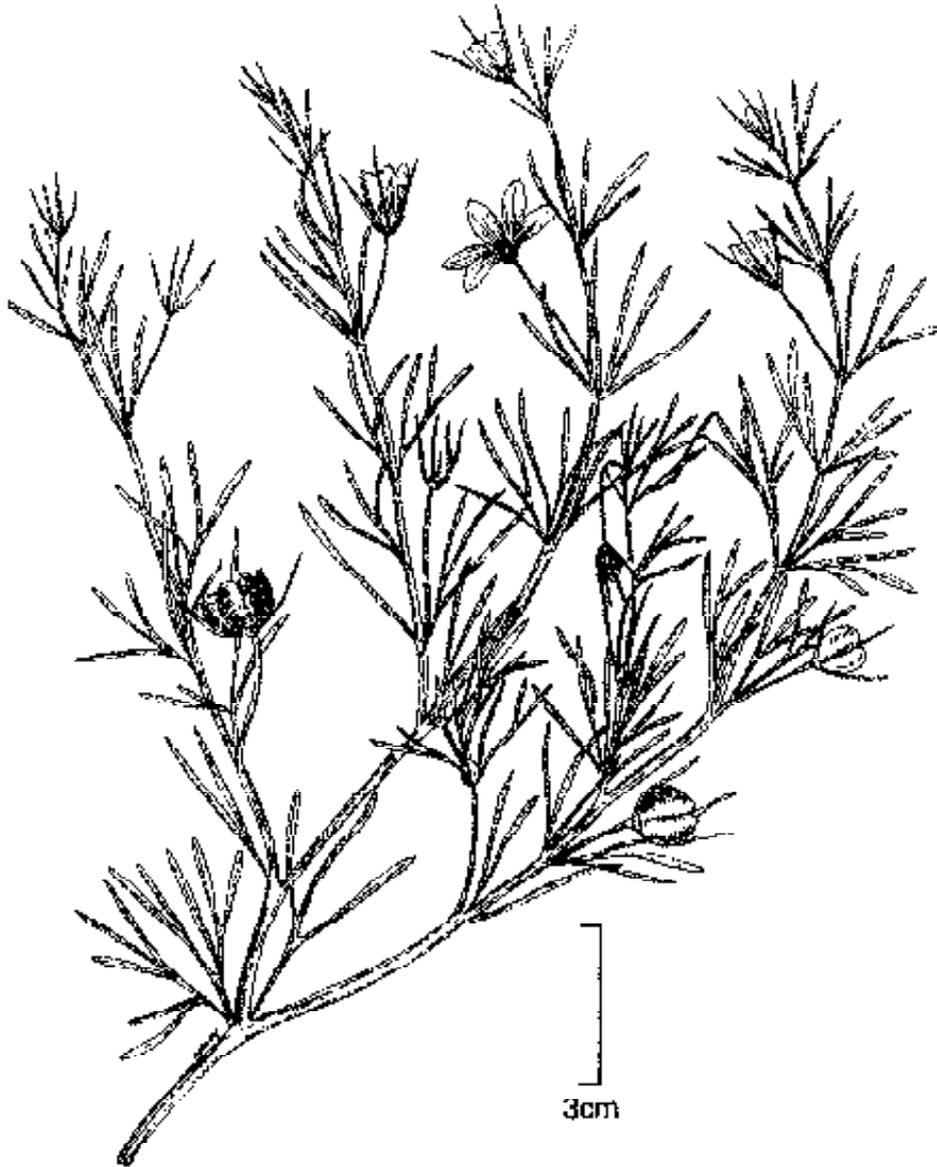


Fig. 94. *Peganum harmala* L.

white or creamy, on 1.5-2 cm long pedicels, 2-3 cm across. Sepals 5, linear, 15-20 x 1-2 mm, usually pinnatifid. Petals 5, oblong, oblong-elliptic, 10-17 x 4-6 mm. Stamens 12-15. Capsules subglobose, depressed at apex.

1a. Leaf segments 2-4 mm broad. Sepals ca 20 x 2 mm. Capsules ca 15 mm across ...1.1.var. *harmala*

1b. Leaf segments 1-2 mm broad. Sepals ca 15 x 1 mm. Capsules ca 10 mm across ...1.2.var. *stenophyllum*

1.1. var. *harmala*

Fl. & Fr. : March - October.

Selected specimens : Ladakh, Leh, 3200 m, *Bhattacharyya* 41151 (BSD); Ganglas, *Chowdhery & Uniyal* 86078 (BSD); Near Thicksey, 3500 m, *Wadhwa* 59374 (BSD).

1.2. var. *stenophyllum* Boiss., *Fl. Orient.* 1: 917. 1867; P. Singh & V. Singh in *Hajra et al.*, *Fl. India* 4: 48. 1997. *Isband.*

Fl. & Fr. : March - October.

Selected specimens : Hari Parbat, *T.A. Rao* 9578 (BSD); on way to Srinagar, 1400 m, *Bhattacharyya* 7111 (BSD).

Uses : Red dye is obtained from the seeds.

4. TRIBULUS Tourn. ex L.

Tribulus terrestris L., *Sp. Pl.* 387. 1753; Edgew. & Hook.f. in Hook.f., *Fl. Brit. India* 1: 423. 1874, *p.p.*; Sharma & Kachroo, *Fl. Jammu* 1: 118. 1981; P. Singh & V. Singh in *Hajra et al.*, *Fl. India* 4: 55. 1997. *Zama, Thangtsar.*

Prostrate, procumbent or suberect, gray green, annual, hairy herbs. Branches hirsute-sericeous. Leaves pinnately compound; leaflets 8-14, ovate-oblong, narrow elliptic, 4-11 x 2-5 mm, oblique; stipules subulate-falcate.

Flowers yellow, pedicelled, 8-10 mm across. Sepals ovate-lanceolate, minutely ciliate on scarious margins. Petals 2.5-5 x 1-3 mm. Stamens 10. Stigma 5-rayed. Fruits with 2 or 4 spines, hairy.

Fl. & Fr. : June - October.

Selected specimens : Ladakh, Phyang - Leh, 3500 m, *Viswanathan* 54199 (BSD); Bema, *Chowdhery & Uniyal* 86009 (BSD); Tshe, 3400 m, *Bhattacharyya* 71615 (BSD); Nima, *Balodi* 91081 (BSD); Kargil, 2800-3000 m, *Wadhwa* 60190 (BSD); Jammu, on way to Buchamandi, *Uniyal* 92621 (BSD).

BIEBERSTEINIACEAE

(B.P. Uniyal)

BIEBERSTEINIA Steph. ex Fischer

Biebersteinia odora Steph. ex Fischer in Mem. Soc. Imp. Natur. Moscou 1: 89.t. 9, 1806; Malhotra in Hajra *et al.*, Fl. India 4: 60, 1997. *Khardung*. Fig. 95

Glandular, pubescent herbs, up to 1 m tall. Leaves 6-15 cm long, pinnatisect; leaflets 12-18 pairs, irregularly lobed; lobes pinnatifid. Flowers yellow, in racemes. Bracts ca 5 mm long, foliaceous; bracteoles, pedicels glandular hairy. Sepals elliptic-oblong, glandular pubescent. Petals nearly orbicular. Nutlets rugose.

Fl. & Fr. : July - August.

On dry rocky slopes.

Selected specimens : Ladakh, Leh-Khardung Ia, near Pulu, 4575 m, *Wadhwa* 59769 (BSD); Lachalung Ia, 4800 m, *Bhattacharyya* 40960 (BSD); Ganglas-Khardung Ia, *Chowdhery & Uniyal* 86098 (BSD); South Pulu, *Balodi* 91016 (BSD); Puga, Rupshu, ca 5000 m, *Koelz* 2162 (DD).

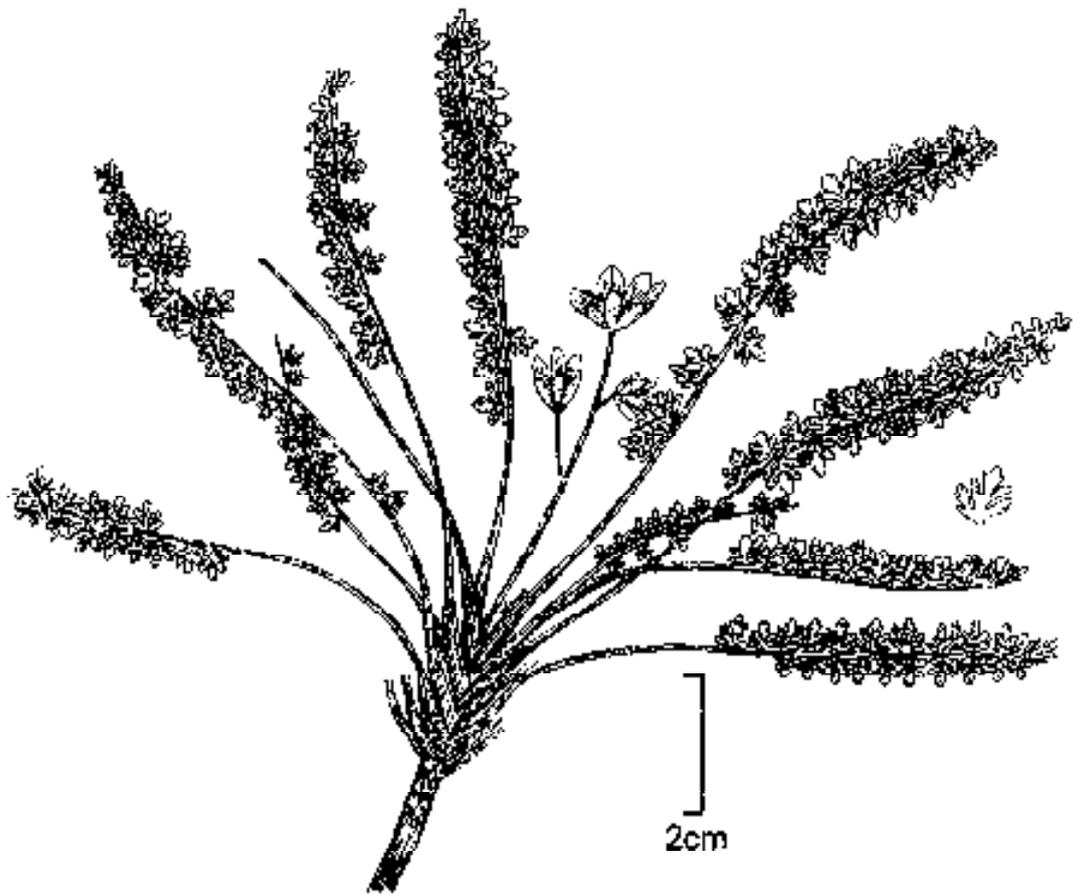


Fig. 95. *Biebersteinia odora* Steph. ex Fischer

GERANIACEAE

(R. Mathur & B.P. Uniyal)

- 1a. Leaves longer than broad. Stamens 5 ...1. *Erodium*
 1b. Leaves not longer than broad. Stamens 5-10 ...2. *Geranium*

1. **ERODIUM** L. Herit ex Aiton

- 1a. Leaves velvety beneath. Sepals not awned.
 Mericarps not pitted below beak ...3. *E. tibetanum*
 1b. Leaves shortly pubescent beneath but not velvety.
 Sepals mucronate or awned. Mericarps pitted
 below beak :
 2a. Sepals mucronate. Filaments not toothed ...1. *E. cicutarium*
 2b. Sepals awned. Filaments toothed on one side ...2. *E. stephanianum*

1. ***Erodium cicutarium*** (L.) L. Herit ex Aiton, Hort. Kew. 2: 414. 1789; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 434. 1874; Singh & Kachroo, For. Fl. Srinagar 202. 1976. *Geranium cicutarium* L., Sp. Pl. 618. 1753.

Annuals, up to 120 cm high, erect or straggling, glandular pubescent or eglandular. Leaves 20-50 x 8-27 mm, pinnatisect; segments pinnatifid, glandular-pubescent; stipules ovate-lanceolate, 2.5-5 mm, scarious, ciliate, sometimes connate. Flowers 2-8 on 2.5-6.5 cm long peduncles. Sepals ovate-lanceolate, 3-4 mm long, glandular pubescent. Petals slightly exceeding the sepals, pubescent, dilated at base. Staminodes lanceolate, shorter, glabrous. Beak 2.5-3.5 mm long, appressed-pubescent. Mericarps ca 5.5 mm long with bristle like yellow hairs, faintly furrowed.

Fl. & Fr. : March April.

In open places by the stream side.

Selected specimens : Kashmir valley, Gulmarg road, before Tungmarg, 1800 m, *Bhattacharyya* 71133 (BSD); Upper Munda, 2350 m,

T.A. Rao 9211; Pahalgam, ca 2500 m, *T.A. Rao* 742 (BSD); Doda Dist., Manthala Nala. *Uniyal* 80156; Kishtwar, Aarchi. *Uniyal* 80385 (BSD).

2. *Erodium stephanianum* Willd., Sp. Pl. 3: 625, 1800; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 434, 1874; Kachroo *et al.*, Fl. Ladakh 67, 1977; Malhotra in Hajra *et al.*, Fl. India 4: 66, 1997. *Tikziang*.

Annuals, up to 40 cm high. Branches diffuse, pubescent. Leaves 2-pinnatisect; segments pinnatifid into linear, acute lobes; stipules lanceolate 5-7 mm long, acute. Flowers 2-5, peduncled. Sepals lanceolate, 5 mm long, 5-nerved, hairy on nerves, membranous; awns 2.5-3 mm long. Petals pink, broadly ovate, as long as sepals, nerves ciliate at base. Filaments 4-4.5 mm long, dilated at base, 2-toothed, ciliate. Beak 2.3-3.5 cm long, appressed pubescent. Mericarps ca 6 mm long, white setose with 2 pits.

Fl. & Fr. : June August.

On moist sandy soil along nala.

Selected specimens : Ladakh, Karo, 3400 m, *Bhattacharyya* 71617 (BSD); Khardung la, 3900 m, *Wadhwa* 59934; Leh-Thicksay, *Wadhwa* 59416 (BSD).

3. *Erodium tibetanum* Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 434, 1874; Malhotra in Hajra *et al.*, Fl. India 4: 66, 1997. *Zema*.

Annuals, stemless, hoary. Leaves oblong-ovate, incise-create, 3-fid, velvety beneath; stipules obovate, obtuse, not awned, scarious, ciliate. Flower 2 or more, peduncled; peduncles shorter than the leaves. Sepals pubescent with a knob instead of mucro. Petals elliptic, longer than the sepals. Ovary silky, stipitate, with stiff white hairs, split on back. Beak 17-25 mm long, 3-4 times the length of cells, rough on outer side, brown hairy on inner side, hairy at apex.

Fl. & Fr. : July September.

On sandy plains.

Selected specimens : Ladkahi, Towards Ganglas, *Balodi* 91092 (BSD); Karu-shukti, *Chowdhery & Uniyal* 86121 (BSD); Miru, 3700 m. *Bhattacharyya* 41068 (BSD); Leh, 3700 m, *Viswanathan* 54709 (BSD).

2. GERANIUM L.

- 1a. Herbs with reddish stems and branches :
 - 2a. Mericarp keeled, rugose, reticulate ...6. *G. lucidum*
 - 2b. Mericarp glabrous ... 16. *G. robertianum*
- 1a. Herbs not reddish :
 - 3a. Stems much reduced, not conspicuous ...15. *G. regelii*
 - 3b. Stems conspicuous :
 - 4a. Sepals awned
 - 5a. Rhizomatous herbs; rhizome elongated ... 2. *G. collinum*
 - 5b. Non-rhizomatous herbs :
 - 6a. Leaves divided up to base. Mericarps rugose, hairy & wrinkled ...3. *G. divaricatum*
 - 6b. Leaves not divided up to the base. Mericarps not wrinkled :
 - 7a. Flowers nodding ...5. *G. lambertii*
 - 7b. Flowers not nodding :
 - 8a. Awn stout ...14. *G. rectum*
 - 8b. Awns not stout :
 - 9a. Flowers white or pale-pink with 3-5 purple nerves ...19. *G. sibiricum*
 - 9b. Flowers blue-purple or reddish pink :
 - 10a. Mericarps hairy, smooth. ...21. *G. tuberaria*
 - 10b. Mericarps glandular-pubescent :
 - 11a. Leaves 5-lobed; lobes rhomboid ...4. *G. himalayense*

- 11b. Leaves 7-9-lobed; lobes ovate ...12. *G. pratense*
- 4b. Sepals not awned :
- 12a. Flowers clustered amongst the uppermost involucre like leaves ...11. *G. polyanthes*
- 12b. Flowers not arranged as above :
- 13a. Leaves orbicular-reniform :
- 14a. Mericarp deeply, transversely furrowed ...7. *G. muscatense*
- 14b. Mericarp not deeply furrowed :
- 15a. Mericarp nearly spherical ...8. *G. molle*
- 15b. Mericarp elongated :
- 16a. Sepals ciliated & rigid ...10. *G. ocellatum*
- 16b. Sepals not ciliate :
- 17a. Leaves dark green above purple beneath ...9. *G. nepalense*
- 17b. Leaves not as above :
- 18a. Leaves red-dotted. Petals not ciliate ...17. *G. rotundifolium*
- 18b. Leaves not red-dotted. Petals ciliate :
- 19a. Mericarps hairy ...22. *G. wallichianum*
- 19b. Mericarps glandular pubescent ...20. *G. swatense*
- 13b. Leaves palmately lobed :
- 20a. Flowers purple, violet or white with lilac-pink nerves. Mericarp and beak glandular pubescent ...1. *G. clarkei*
- 20b. Flowers blue, pink :

- 21a. Glandular-pubescent herbs. Petals obcordate ...13. *G. pusillum*
 21b. Appressed pubescent or villous herbs. Petals
 obovate ...18. *G. rubifolium*

1. *Geranium clarkei* Yeo, Hardy Geraniums 188. 1986; Malhotra in Hajra *et al.*, Fl. India 4: 70. 1997.

Herbs, perennial, rhizomatous. Basal leaves 5-15 cm across, 7-partiate nearly to base; lobes mostly 2-3 times as broad, margin toothed; teeth mucronate. Flowers on 1.5-8 cm long peduncles. Sepals 1-3 mm long with 1.5-2.5 mm long mucro. Petals purplish violet or white, 22-29 x 18-22 mm, with lilac-pink nerves. Stamens shorter than the sepals. Fruits *ca* 3.5 and long including beak; mericarp and beak glandular hairy.

Fl. & Fr. : June August.

Along irrigation channels in drier areas in Kashmir, 2100-4200 m.

Included after Malhotra (*loc. cit.*).

2. *Geranium collinum* Steph. ex Willd., Sp. Pl. 3: 705. 1800; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 429. 1874, *non* L'Herit, 1787-88. *Legkatin*.

Herbs, 15-60 cm high, perennial, rhizomatous. Rhizomes elongated. Stems 15-25 cm long, divaricate, pubescent or glandular. Leaves orbicular, 1.5-8 cm, 5-7-lobed below the middle; segments obtusely 3-5-lobed; petioles of lower leaves up to 3 cm long; stipules subulate-lanceolate, 5-9 mm long, entire, pubescent. Flowers on 3-15 cm long peduncles; peduncles recurved. Sepals elliptic-oblong, 6-9 mm long, 3-5-nerved, pubescent or glandular hairy; awn 1-2 mm long. Petals lilac, rose or white, ovate, 1.4-2 cm long, ciliate. Mericarps pubescent or glandular-pubescent.

Fl. & Fr. : July Sept.

On open irrigated slopes.

Selected specimens : Ladakh, Lakong, 4500 m, *Bhattacharyya* 52187; Matyan, 3200 m, *Bhattacharyya* 71307 (BSD).

3. *Geranium divaricatum* Ehrh. in Beitr. Naturk. 7: 164. 1792; Malhotra in Hajra *et al.*, Fl. India 4: 70. 1997.

Herbs, annual, 20-60 cm high, branched. Leaves 3-10 cm broad, pentagon, palmately dissected nearly to the base into 5 rhombic, incised-dentate lobe, appressed hirsute or glandular hairy; petioles glandular hairy. Flowers on 1.5-5 cm long peduncles, with two spreading pedicels. Bracts linear-lanceolate. Sepals ovate, shortly awned hispid. Petals pale-pink, slightly longer than the sepals, with brighter nerves. Beak rough hairy. Mericarps rugose, hairy and wrinkled above.

Fl. & Fr. : May July.

Usually found along forest edges and sometimes along rocky shady places.

Included after Malhotra (*loc. cit.*).

4. *Geranium himalayense* Klotz., Bot. Ergebn. Reise Waldemar 122.t. 16. 1862; Nasir in Fl. Pak. 149: 23. 1983; Malhotra in Hajra *et al.*, Fl. India 4: 71. 1997. *G. pratense sensu* Edgew & Hook.f. in Hook.f., Fl. Brit. India 1: 429. 1874 *p.p.*, non L. 1753; Singh & Kachroo, For. Fl. Srinagar 202. 1976.

Herbs, perennial, hairy to pubescent. Radical leaves pentagonal, palmately 5-lobed; lobes rhomboid, pinnately incised, acute; stipules subulate-lanceolate, 6-9 mm long; petioels of leaves ca 20 cm long; cauline leaves sessile. Flowers 3-3.5 cm in diam., on 3-14 cm long peduncles; peduncles glandular hairy or pubesent. Sepals ovate-lanceolate, 8-10 mm long, awned; awns 1.5-2.5 mm long. Petals obovate, 1.5-2.5 cm long, rounded; claw ciliate. Beak up to 2.5 cm long, glandular pubescent. Mericarp ca 4 mm long, glandular pubescent.

Fl. & Fr. : June September.

Selected specimens : Musjid valley, ca 4000 m, Duthie 14143; Baiihal pass, ca 2700 m, Keshavanand 104 (DD); below Gulmarg, ca 2700 m, Hearle 11382 (DD).

5. *Geranium lambertii* Sweet, Geraniaceae 4: t. 338. 1827; Nasir in Fl. Pak. 149; 16. 1983; Malhotra in Hajra *et al.*, Fl. India 4: 72. 1997. *G. grevilleanum* Wallich, Pl. Asiat. Rar. 3: 4. 1. 209. 1831; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 430. 1874, *p.p.*; Blatter, Beaut. Fls. Kashmir 66. 1927; Sharma & Jamwal, Fl. Upper Liddar Valleys 146. 1988.

Herbs, 30-70 cm high, ascending, pubescent. Leaves reniform, 5.5-11 cm in diam., palmately 5-lobed; lobes rhomboid, pubescent-villous; stipules broadly lanceolate, 9-14 mm long, pubescent or villous, 2-fid at apex; petioles up to 7 cm long, densely villous. Flowers nodding, 4-6 cm across, on glandular hairy, bracteate peduncles. Sepals elliptic-ovate, glandular hairy on nerves; awn ca 1 mm long. Petals pale-pink or rarely white with purple nerves, 1.5-2 cm long, villous at base. Ovary black when dry.

Fl. & Fr. : June July.

Selected specimens : Baltal, Sind valley, ca 3000 m, Gammie s.n. (DD).

6. *Geranium lucidum* L., Sp. Pl. 682. 1753; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 433. 1874; Blatter, Beaut. Fls. Kashmir 69. 1927; Nasir in Fl. Pak. 149: 4. 1983; Malhotra in Hajra *et al.*, Fl. India 4: 72. 1997; Swami & Gupta, Fl. Udhampur 82. 1998.

Herbs, annual, suberect, branched, glabrous. Stems 10-30 cm; branches bright red. Leaves suborbicular to reniform, 1-4 cm broad, 5-7-lobed; lobes 1.5-2.5 mm long, 5-fid, short, broadly lanceolate, glabrous; petioles pubescent. Flowers solitary or 2, ca 1.2 cm across, on long peduncles; peduncles larger than petioles, hairy. Sepals ovate 5-7 mm long, ovate, acuminate, 3-nerved, glabrous-rugose. Petals rose red, 8-9 mm long; claw glabrous. Beak 7-8 mm long, very slender. Mericarps keeled, rugose-reticulate, glabrous.

Fl. & Fr. : March August.

Selected specimens : Udhampur city, *Swami* 507 (BSD).

7. *Geranium mascatense* Boiss., *Diagn. Pl. Or Nov. Ser. 1, 1: 59. 1842*; Nasir in *Fl. Pak.* 149: 8. 1983. *G. ocellatum* Cambess. var. *persicum* Pau in Pau & Viciosa, *Trab. Mus. Nac. Cienc. Nat. Ser. Bot. Madrid* 14: 18. 1918.

Herbs, up to 45 cm long, diffuse, pubescent. Leaves reniform, up to 5 cm across, palmatifid, 5-7-lobed; stipules lanceolate, subulate, hairy. Flowers solitary or paired, 1-1.5 cm in diam., on axillary peduncles. Sepals 4-4.5 mm long, twice as sepals, pink with dark purple centre; beak up to 15 mm long. Mericarps up to 3 mm long, deeply furrowed transversely, puberulous.

Fl. & Fr. : March May.

Selected specimens : Kathua, *Uniyal & S. Singh* 88583 (BSD); Doda dist., Jai road, Bhadrawah, *Uniyal* 80182; Bank of Neru nallah, Bhaderwah, *Uniyal* 80124 (BSD).

Note : Similar to *G. ocellatum*, But differs in the larger (up to 3 mm long), transversely deeply furrowed and puberulous mericarps.

8. *Geranium molle* L., *Sp. Pl.* 682. 1753; Edgew. & Hook.f. in Hook.f., *Fl. Brit. India* 1: 432. 1874; Blatter, *Beaut. Fls. Kashmir* 68. 1927; Malhotra in Hajra *et al.*, *Fl. India* 4: 74. 1997.

Herbs, annual. Stems stout, diffuse, softly villous, glandular. Leaves orbicular, 7-9-lobed; lobes obtusely lobulate. Flowers on axillary peduncles. Petals purplish pink, obcordate, exceeding the sepals, ciliate at base. Beak 3-8 mm long. Mericarps nearly spherical.

Included after Edgeworth and J.D. Hooker (*loc. cit.*).

9. *Geranium nepalense* Sweet, *Geraniaceae* 1: t. 12. 1820; Edgew. & Hook.f. in Hook.f., *Fl. Brit. India* 1: 430. 1874; Blatter, *Beaut. Fls.*

Kashmir 67. 1927; Sharma & Jamwal, Fl. Upper Liddar Valleys 147. 1988; Malhotra in Hajra *et al.*, Fl. India 4: 1997.

Perennial herbs, up to 25 cm high, diffuse, slender, pubescent or silky hairy. Leaves orbicular, 3-7.5 cm, 3-5-lobed; segments subequal, dark green, purple beneath, brownish above, irregularly lobed. Flowers 1-1.2 cm across, solitary or 2 on long axillary peduncles. Sepals 4.5-5 mm long. Petals pink with 3 dark purple streaks, 5-8.5 mm long rounded, notched. Beak 1-1.5 cm long. Mericarps 3-3.5 mm long.

Fl. & Fr. : April - October.

Selected specimens : Ladakh, Menchi Gaon, Kargil-suru road, 3000 m, Viswanathan 55666 (BSD); Saspole, ca 3500 m, Wadhwa 59283; Kashmir valley, Dachigam, ca 1800 m, Wadhwa 67029 (BSD); Kupwara, 1800 m, Rao 9430; Upper munda, 2400 m, Rao 9186 (BSD); Udhampur Dist., Gandh, Ramnagar, Swami 1275 (BSD); Kathua Distt., Machhedi, Hajra 82536 (BSD).

10. *Geranium ocellatum* Cambess. in Jacq., Voy. 4. Inde 33. t. 38. 1844; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 433. 1874; Blatter, Beaut. Fls. Kashmir 69. 1927; Sharma & Kachroo, Fl. Jammu 1: 119. 1981; Malhotra in Hajra *et al.*, Fl. India 4: 75. 1997.

Herbs, 12-45 cm high, diffuse, straggling, hoary-pubescent. Leaves reniform, 1-5 cm, palmatifid, 5-7-lobed; lobes 3-5-fid; stipules lanceolate, subulate hairy. Flowers solitary or paired, 1-1.5 cm in diam., on axillary peduncles. Sepals 4-4.5 mm long, ciliate, rigid, apiculate. Petals pink with dark purple centre; obovate, broadly obcordate, twice as large as sepals, beak 7-15 mm long. Mericarp ca 2.5 cm long.

Fl. & Fr. : March - April.

Major part of the year.

Selected specimens : Udhampur Distt., Swami 1220 (BSD).

11. *Geranium polyanthes* Edgew. & Hook. in Hook.f., Fl. Brit. India 1: 431. 1874; Malhora in Hajra *et al.*, Fl. India 4: 78. 1997.

Herbs, up to 15-25 cm high, slightly hairy, stems slender, naked below and bears clusters of flowers amongst uppermost in volucre-like leaves. Leaves orbicular or reniform, 3.5-5 cm in diam., 7-9-lobed; lobes 3-7-fid, obtuse, pilose; petioles of radical leaves very long, upper sessile; stipules variable, ovate-acuminate or subulate-lanceolate. Flowers in umbels; umbel 3-10-flowered; pedicels glandular-hairy, 7-25 mm long; funnel shaped. Sepals shortly awned. Petals reddish-purple. Fruit compressed, keeled, strongly reticulate, glabrous, ca 2.5 mm long; beak slender.

Fl. & Fr. : June August.

Included after Malhotra (*loc. cit.*).

12. *Geranium pratense* L., Sp. Pl. 681. 1753; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 429. 1874, *p.p.* Blatter. Beaut. Fls. Kashmir 66. 1927; Sharma & Jamwal, Fl. Upper Liddar valleys 1: 146. 1988; Malhotra in Hajra *et al.*, Fl. India 4: 78. 1997. *Gugchuk*.

Herbs, 15-40 cm high stout, erect. Stems with spreading hairs. Leaves 3-5 cm in diam., 7-9-palmately pinnatifid; lobe ovate, deeply cut into small segments; segments toothed; stipules lanceolate, ca 1.3 cm long, rarely bifid. Inflorescence lax, 2-flowered; flowers 2.5-4 cm across. Petals 1-1.2 cm long, awned; petals bluish-purple with dark veins, red or white, entire or notched, ciliate at base. Fruits ca 3.5 cm long including the beak. Mericarp and beak glandular hairy.

Fl. & Fr. : June August.

Along irrigation channels in drier areas between 3000-4500 m.

Included after Sharma & Jamwal (*loc. cit.*).

13. *Geranium pusillum* L., Syst. Nat. ed. 10. 1144. 1759; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 432. 1874; Blatter, Beaut. Fls.

Kashmir 68. 1927; Nasir in Fl. Pak. 149: 9. 1983; Malhotra in Hajra *et al.*, Fl. India 4: 80. 1997.

Annual, very slender, much branched, glandular, pubescent herbs. Leaves 1-2.5 cm broad, deeply 5-9-lobed; lobes 3-fid; stipules ovate-lanceolate, 1.5-2 mm long, rarely 2-fid. Flowers *ca* 4 mm across, on 2-flowered peduncles. Sepals ovate or oblong, 1.5-3 mm long, glandular-pubescent. Petals pink or blue purple, obcordate, exceeding the sepals, ciliate at base, glandular pubescent. Mericarps appressed-pubescent.

Fl. & Fr. : April May.

Included after Blatter (*loc. cit.*).

14. *Geranium rectum* Trautv. in Bull. Soc. Nat. Mosc. 33(2): 459. 1860; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 429. 1874, *p.p.* Blatter, Beaut. Fls. Kashmir 68. 1927; Nasir in Fl. Pak. 149: 17. 1983; Dhar & Kachroo, Alp. Fl. Kashmir Himal. 195. 1983; Malhotra in Hajra *et al.*, Fl. India 4: 81. 1997.

Herbs, up to 25 cm high, slender. Stems 5-angled, subglabrous. Leaves opposite, 7-10 cm in diam., membranous, sparingly hairy on both the surfaces; petioles of radical leaves very long and slender. Flowers *ca* 3.5 cm in diam., on *ca* 20 cm long, bracteate peduncles. Sepals narrow, oblong with a stout awn, glabrous. Petals obovate, retuse, ciliate at the base.

Fl. & Fr. : July August.

Included after Dhar & Kachroo (*loc. cit.*).

15. *Geranium regelli* Nevski in Trudy Bot. Inst. Akad. Nauk. SSR Ser. 1. Fl. Sist. Vyss. Rast. 4: 304. 1937; Nasir in Fl. Pak. 149: 19. 1983; Malhotra in Hajra *et al.*, Fl. India 4: 82. 1997.

Herbs, 5-20 cm high. Stems much reduced or absent; rhizomes much developed. Leaves orbicular-subreniform; 0.9-1.4 x 1.5-2.4 cm, 5-7-angled,

pubescent; stipules up to 3 mm long. Flowers bluish purple. Sepals ovate to ovate-lanceolate, up to 1 cm long glandular, apiculate, white along margin. Petals obovate. 1.4-1.6 cm long, densely ciliate at base.

Fl. & Fr. : June July.

Included after Malhotra (*loc. cit.*).

16. *Geranium robertianum* L., Sp. Pl. 681. 1753; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 432. 1874; Blatter, Beaut. Fls. Kashmir 69. 1927; Sharma & Jamwal, Fl. Upper Liddar Valleys 1: 147. 1988; Malhotra in Hajra *et al.*, Fl. India 4: 82. 1997. Fig. 96

Herbs, often reddish, up to 40-50 cm high, hairy. Leaves triangular-ovate to pentagonal-orbicular 2-7 x 3-8 cm; basal in rosette; upper opposite, palmatisect; petioles up to 15 cm long, glandular-hispid; stipules triangular, ovate-lanceolate, 2-4 mm long. Flowers ca 2.5 cm in diam., on 6-7 cm long, 2-flowered peduncles; peduncles glandular-hairy. Sepals lanceolate-ovate 5-7 x 1.5-2.5, 3-nerved, glandular-hairy. Petals obovate, twice as long as sepals; claw narrow, reddish-pink; beak up to 1.2 cm long, oblong, glabrous. Mericarps 2.5-3 mm long, glabrous.

Fl. & Fr. : June October.

Selected specimens : Batkote, 2600 m, T.A. Rao 9746 (BSD), Thayan, Wadhwa, S.K. Murti & P.C. Pant 84178 (BSD); Liddar valley, 2000-2300 m, Duthie 13078 (DD); Kundleshali forest, Kishenganga valley, ca 2300 m, Keshavanand 254 (DD); Lidderwat, ca 3500 m, Vaid s.n. (DD).

17. *Geranium rotundifolium* L., Sp. Pl. 683. 1753; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 84. 1874; Blatter, Beaut. Fls. Kashmir 68. 1927; Nasir in Fl. Pak. 149. 8. 1983; Malhotra in Hajra *et al.*, Fl. India 4: 84. 1997.

Annual, slender, glandular hairy herbs, branched from reddish base. Stems 10-40 cm, ascending. Leaves 2-5 cm across, reniform, 5-7-lobed; lobes broad, obtusely lobulate, red-dotted; petioles 2-16 cm long; stipules

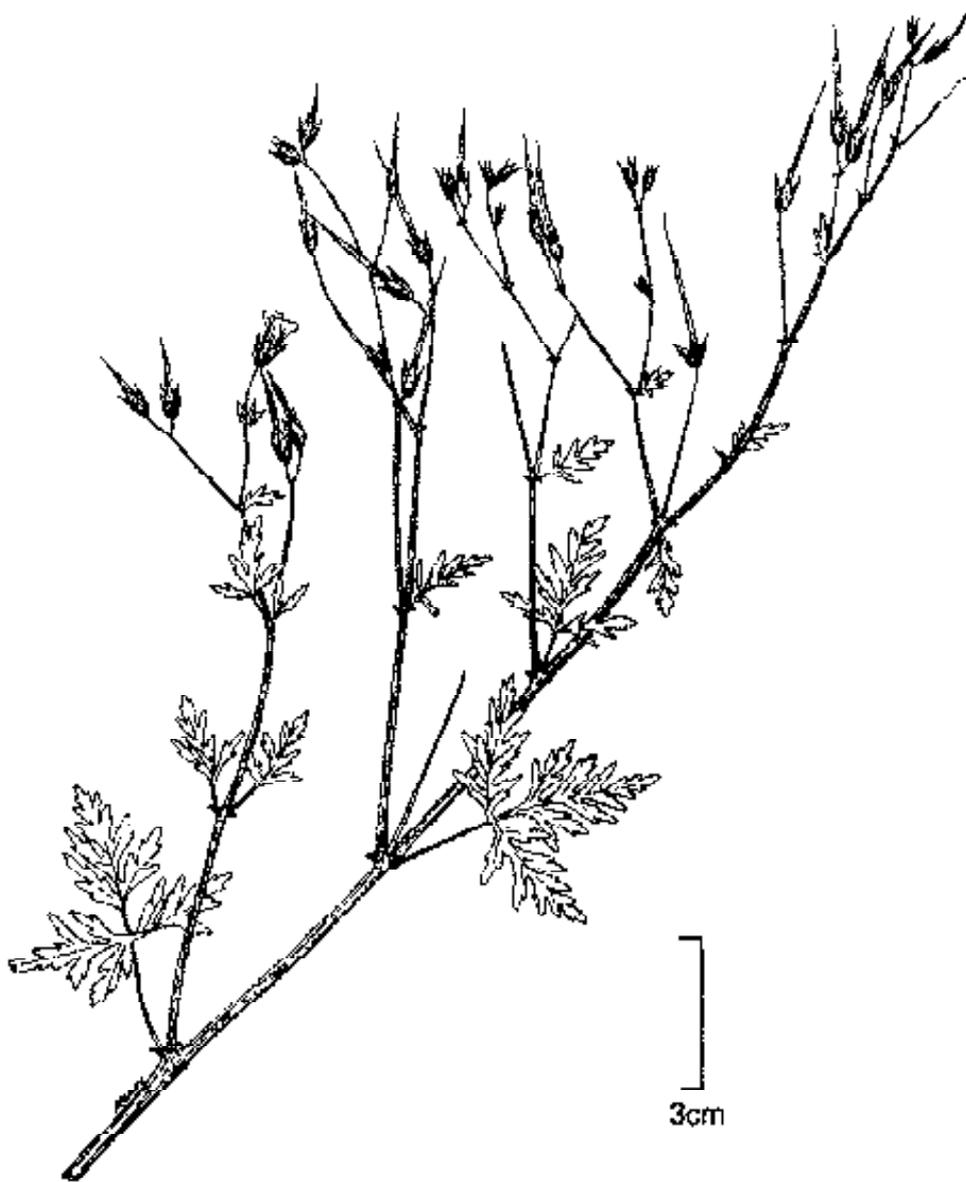


Fig. 96. Geranium robertianum L.

wedge shaped, 1.5-3.5 mm long, acuminate. Flowers 6-7 mm across, on slender, 2-flowered, axillary peduncles. Sepals 3.5-4.5 mm long, retuse. Petals entire, exceeding the sepals. Beak 0.8-1 cm long, hairy. Mericarps hairy.

Fl. & Fr. : March April.

An undergrowth in shaded places, up to 3000 m.

Selected specimens : Sind valley, 2000-2300 m, *Duthie* 11456 (DD).

18. *Geranium rubifolium* Lindl. in Edwards, Bot. Reg. 26: t. 67. 1840; Nasir in Fl. Pak. 149: 17. 1983; Malhotra in Hajra *et al.*, Fl. India 4: 84. 1997. *G. kishtvariense* Knuth in Fedde, Rep. 19: 229. 1923; Dhar & Kachroo, Alp. Fl. Kashmir Himal. 195. 1983.

Herbs, up to 90 cm high. Stems appressed pubescent to villous. Leaves 3-10 x 4.5-14 cm, palmatipartite, pilose; segments irregularly serrate, mucronate; petioles 4.5-13 cm long; stipules 0.8-1.4 cm long, 2-fid. Flowers ca 2 cm across, on 1-2-flowered peduncles. Sepals 7-8 mm long, broadly lanceolate to elliptic, glandular-pubescent. Petals obovate, pink, 1.2-1.7 cm long, ciliate at base. Beak up to 2.5 cm long, glandular-pubescent. Mericarp pubescent.

Fl. & Fr. : July Aug.

Selected specimens : Aru, Liddar valley, *Inayat* 25546 (DD).

19. *Geranium sibiricum* L., Sp. Pl. 683. 1753; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 431. 1874; Blatter, Beaut. Fls. Kashmir 67. 1927; Kachroo *et al.*, Fl. Ladakh 68. 1977; Malhotra in Hajra *et al.*, Fl. India 4: 84. 1997. *Eyamiomentok*.

Herbs, perennial, much branched, hairy. Leaves 2-2.5 x 3-7 cm, 5-partite; segments rhomboid, acute, incised; petioels up to 6 cm long, densely pubescent at base. Flowers peduncled; peduncles slender, one-flowered. Sepals 4-5 mm long, awned, equalling or exceeding the petals.

Petals white or pale-pink with 3-5 purple nerves, 5-7 mm long, notched. Mericarps 3.5 mm long.

Fl. & Fr. : June July.

Selected specimens : Indus valley, ca 2700-3000 m, Duthie s.n. (DD).

20. *Geranium swatense* Schonb.-Tem. in Rech. f., Fl. Iran. 69: 22. 1970; Nasir in Fl. Pak. 149: 27. 1983; Malhotra in Hajra *et al.*, Fl. India 4: 87. 1997.

Perennial herbs, up to 45 cm or more high. Stems ascending, diffuse, slender, glandular-villous. Leaves reniform, 1.5-4 x 3-7 cm in diam., 5-7-angled, palmatipartite, pilose; segments rhomboid, 3-lobed, 3-fid, subacute; petioles appressed-pubescent or hairy; stipules ovate, 4.5-6 mm long, acuminate. 2-fid, pubescent. Flowers peduncled; peduncles up to 10 cm long, 2-flowered, glandular. Bracts 5-6.5 mm long, glandular. Sepals ovate-lanceolate 0.7-1 cm long, glandular-pubescent; awn up to 1.5 mm long. Petals pink purple obovate, 1.1-4 cm long, ciliate. Beak ca 2 cm long, glandular. Mericarps ca 4 mm long, glandular hairy.

Fl. & Fr. : June August.

Included after Malhotra (*loc. cit.*).

21. *Geranium tuberaria* Cambess. in Jacq., Voy. Inde 4: 33. t. 37. 1844; Edgew & Hook.f. in Hook.f., Fl. Brit. India 1: 431. 1874; Blatter, Beaut. Fls. Kashmir 67. 1927; Nasir in Fl. Pak. 149: 13. 1983; Kachroo *et al.*, Fl. Ladakh 68. 1977; Malhotra in Hajra *et al.*, Fl. India 4: 87. 1997. *Yusiang*.

Perennial, 30-60 cm high, slender, erect, glandular, herbs. Rootstock tuberous. Leaves orbicular-reniform, 3-4 cm across, 5-7 partite; segments pinnatifid; petioles 3-4 cm long; stipules ovate. Flowers 1.3-1.5 cm across, 2-peduncle; peduncles terminal, umbellate or fascicled, glandular hairy. Bracts leafy, pinnatifid. Sepals 3.5-8 mm long, obtuse, awned, very hairy. Petals 1.3-1.5 cm long, obtuse, retuse, ciliate; claw reddish pink, well-

developed. Beak *ca* 2.5 cm long, pubescent-villous. Mericarps *ca* 2.5 mm long, smooth, hairy.

Fl. & Fr. : May June.

Included after Malhotra (*loc. cit.*).

22. *Geranium wallichianum* D. Don ex Sweet, Geraniaceae 1: t. 90. 1822; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 430. 1874; Blatter, Beaut. Fls. Kashmir 65. 1927; Malhotra in Hajra *et al.*, Fl. India 4: 88. 1997; Sharma & Jamwal, Fl. Upper Liddar valleys 1: 146. 1988. *Kawashud. Perhi.*

Perennial herbs, up to 120 cm high, erect or trailing, branched, hairy. Leaves orbicular, 4-12.5 cm, palmately 3-5-lobed; stipules up to 1.2 cm long, oblong, obtuse; petioles 3-12 cm long, pubescent. Flowers 2.7-3.6 cm across, in *ca* 3 cm long, 2-peduncles. Sepals 6-9 mm long, bristly hairy on nerves. Petals deep pink or purplish pink with dark ciliate centre, 1.5-1.7 x 1.3-1.6 cm, slightly notched, claw densely ciliate. Beak 2.5-3 mm long, pubescent inside. Mericarps 4-5 mm long, hairy.

Fl. & Fr. : July October.

Selected specimens : Udhampur Distt., Ratote, 1200-1700 m, T.A. Rao 7332 (BSD); Waskar Dagwan, 2300-3000 m, Wadhwa 66916 (BSD); Doda Dist., Bhadrawah-Seoj, 3000 m, J.N. Vohra & B.D. Naithani 83049 (BSD); Kubbi forest, Jhelum valley, *ca* 3000 m, Keshavanand 1080 (BSD); Pahaigam, 2400 m, Vaid s.n. (DD).

BALSAMINACEAE

(D. Basu & B.P. Uniyal)

IMPATIENS L.

1a. Leaves amplexicaul

...1. *I. amplexicaulis*

1b. Leaves not amplexicaul :

- 2a. Leaves opposite or whorled :
- 3a. Flowers less than 1 cm long :
- 4a. Flowers epedunculate. Lip bucciniform ...12. *I. meeboldii*
- 4b. Flowers pedunculate. Lip navicular ...17. *I. thomsonii*
- 3b. Flowers more than 1 cm long :
- 5a. Petioles glandular ...9. *I. glandulifera*
- 5b. Petioles not glandular :
- 6a. Lateral sepals glandular on one or both margins ...8. *I. flemingii*
- 6b. Lateral sepals not as above :
- 7a. Flowers umbellate, up to 1.5 cm long ...17. *I. thomsonii*
- 7b. Flowers axillary, more than 1.5 cm long :
- 8a. Flowers yellowish white ...14. *I. racemosa*
- 8b. Flowers pink, purple or dark crimson ...16. *I. sulcata*
- 2b. Leaves alternate :
- 9a. Flowers less than 1 cm long :
- 10a. Capsules turgid in the middle ...13. *I. pahalgamensis*
- 10b. Capsules not turgid in the middle :
- 11a. Bracts minute, setaceous ...6. *I. brachycentra*
- 11b. Bracts prominent ...10. *I. laxiflora*
- 9b. Flowers more than 1 cm long :
- 12a. Flowers epedunculate ...3. *I. balsamina*
- 12b. Flowers pedunculate :
- 13a. Basal lobe of wings produced upwards anteriorly into decurved lobule ...7. *I. edgeworthii*
- 13b. Basal lobe of wings not as above :
- 14a. Lateral sepals glandular on one or both margins ...8. *I. flemingii*
- 14b. Lateral sepals eglandular on margins :
- 15a. Flowers rose and yellow with red nerves ...4. *I. bicolor*
- 15b. Flowers not as above :
- 16a. Racemes fascicled or whorled on peduncle ...5. *I. bicornuta*
- 16b. Racemes not as above :

- 17a. Distal lobe of wings 2-4-toothed along inner margin ...2. *I. balfourii*
- 17b. Distal lobe of wings not toothed along inner margin :
- 18a. Lateral sepals pubescent ...15. *I. scabrida*
- 18b. Lateral sepals glabrous ...11. *I. lemanningii*

1. *Impatiens amplexicaulis* Edgew. in Trans. Linn. Soc. 20: 37. 1846; Hook.f. & Thomson in Hook.f., Fl. Brit. India, 1: 469. 1815; Blatter, Beaut. Fls. Kashmir 1: 74. 1927; Vivekanathan *et al.*, in Hajra *et al.*, Fl. India 4: 117. 1997.

Glabrous herbs, 30-60 cm high. Leaves opposite or alternate, ovate-lanceolate, 7-14 cm long, acuminate, crenate-dentate; crenatures gland-tipped; amplexicaul. Flowers purple-pink, 1.5-2.5 cm long, in axillary clusters, Lateral sepals ovate. Lip obliquely navicular, spurred; spur, filiform, abruptly constricted. Capsules linear-clavate.

Fl. & Fr. : June August.

Included after Blatter (*loc. cit.*).

2. *Impatiens balfourii* Hook.f. in Bot. Mag. 59: 698. t. 7878. 1903; Blatter, Beaut. Fls. Kashmir 1: 72. Pl. 17, 3. 1927; Vivekanathan *et al.* in Hajra *et al.*, Fl. India 4: 123. 1997.

Glabrous herbs, highly branched, up to 90 cm high. Leaves alternate ovate-lanceolate, 7-15 cm long, acute-acuminate, serrate, base of leaves wedge shaped; petioles with two glands at base. Flowers white, pink or yellow, 6-8 in racemes. Lateral sepals 2, orbicular. Lip bucciniform, gradually constricted into a spur; tip of spur swollen; standard fleshy. Capsules linear.

Fl. & Fr. : June October.

Included after Blatter (*loc. cit.*).

3. *Impatiens balsamina* L., Sp. Pl. 938. 1753; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 453. 1874; Blatter, Beaut. Fls. Kashmir 1: 74. 1927; Vivekananthan *et al.* in Hajra *et al.*, Fl. India 4: 123. 1997.

Annual herbs, 45-60 cm high, hairy. Leaves alternate, lanceolate elliptic, 3-9 x 1-3 cm, acuminate, serrated; petioles glandular. Flowers purple-pink or white, solitary or rarely clustered in the axils of leaves. Lateral sepals ovate-lanceolate, sparsely ciliate. Lip cymbiform; spur filiform; incurved; standard with a crest, terminating into green point. Capsule ellipsoid hairy.

Fl. & Fr. : March September.

Specimens selected : Srinagar, Sukhral, Hajra 82551 (BSD).

4. *Impatiens bicolor* Royle, Illus. Bot. Him. 151. t. 28. 1834; Singh & Kachroo, For. Fl. Srinagar 203. 1976; Vivekananthan *et al.* in Hajra *et al.*, Fl. India 4: 125. 1997. *I. amphorata* Edgew. in Trans. Linn. Soc. 20: 39. 1846; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 475. 1874.

Annual herbs, glabrous stout, 30-90 cm high. Leaves alternate, ovate, elliptic to elliptic-oblong, 6-15 x 2.5-6 cm acuminate, crenate; petioles glandular; stipular glands sessile. Flowers rosy and yellow, red nerved, aggregated on top of peduncles. Bracts at the base of pedicels. Lateral sepals with a short appendage. Lip bucciniform, abruptly constricted into a filiform spur; standard orbicular. Capsules linear, subtortuose.

Fl. & Fr. : May September.

Selected specimens : Liddar valley, Aru, Sharma 14617 (RRL); Chandanwari, Nair 37066 (BSD).

5. *Impatiens bicornuta* Wallich in Roxb., Fl. Ind. 2: 460. 1824; Vivekananthan *et al.* in Hajra *et al.*, Fl. India 4: 125. 1997.

Succulent herbs, up to 1 m tall. Leaves alternate, elliptic-lanceolate-oblong, up to 23 x 8 cm, crenate, appendaged between crenations; stipular

glands present. Flowers rosy or yellow, in subterminal racemes. Lateral sepals with a gland tipped awn. Lip bucciniform; spur short, incurved, abruptly constricted; standard cucullate. Capsules oblong.

Fl. & Fr. : July - October.

Selected specimens : Dagwan, Wadhwa 66960 (BSD).

6. *Impatiens brachycentra* Kar. et Kir. in Bull. Soc. Nat. Mosc. 1: 179. 1842; Hook.f. & Thomson in Hook.f., Fl. Brit. India. 1: 481. 1874; Blatter, Beaut. Fls. Kashmir, 1: 73. 1927; Naqshi & Ara in J. Econ. Tax. Bot. 17(3): 665. 1993; Vivekananthan *et al.* in Hajra *et al.*, Fl. India 4: 127. 1997.

Slender, annual herbs, 12-50 cm high, branched, glabrous. Leaves alternate, elliptic, ovate, 2-13 x 1.2-5 cm, acuminate, serrate-crenate, with purplish gland tipped teeth. Flowers white-creamy, in axillary or subterminal racemes. Bracts minute, setaceous. Lip boat shaped; spur filiform, straight or absent. Capsules fusiform or clavate.

Fl. & Fr. : May - September.

Selected specimens : Doda dist. Seoj-Kailash, Vohra & Naithani 82952 (BSD); Yarikah Rao 33 (BSD); Dachigam, Wadhwa 66832 (BSD); Liddar valley, Inayat s.n. (DD).

7. *Impatiens edgeworthii* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 476. 1875; Blatter, Beaut. Fls. Kashmir, 1: 72. 1927; Singh & Kachroo, For. Fl. Srinagar 203. 1976; Vivekananthan *et al.* in Hajra *et al.*, Fl. India 4: 144. 1997.

Robust, annual herbs, 0.3-1.5 m tall, highly branched. Leaves alternate, elliptic-ovate, 6-20 x 3.8 cm, acuminate, sharply serrate with glandular hairs. Flowers yellow, streaked with red, in subterminal racemes. Lateral sepals ovate, with prominent mid-nerve. Lip bucciniform; spur gradually constricted; standard cucullate. Capsules linear, erect.

Fl. & Fr. : August - October.

Selected specimens : Liddar valley, Aru, *Inayat s.n.* (DD); Armiun nullah, *Sharma* 14609 (DD); Gulmarg, *Nair* 37106 (BSD).

8. *Impatiens flemingii* Hook.f. in Rec. Bot. Surv India 4: 5, 1904; Vivekananthan *et al.* in Hajra *et al.*, Fl. India 4: 146, 1997. *I. parviflora sensu* Hook.f. in Rec. Bot. Surv. India 4: 10, 1904.

Annual herbs. Leaves alternate or opposite, elliptic, ovate-lanceolate, acute-acuminate, shallowly crenate dentate; lower teeth gland tipped. Flowers white or pink. Lateral sepals with few appendages on margins. Lip navicular; spur filiform, abruptly constricted, curved; standard obcordate-suborbicular. Capsules linear.

Fl. & Fr. : June August.

Selected specimens : Sankaracharyya temple, *Nair* 37066 (BSD).

9. *Impatiens glandulifera* Royle, Illus. Bot. Himal. 151. t. 28. f. 2, 1835; Dhar & Kachroo, Alp. Fl. Kashmir Himal. 195, 1983; Vivekananthan *et al.* in Hajra *et al.*, Fl. India 4: 151, 1997. *I. roylei* Walp., Rep. Bot. Syst. 1: 475, 1842; Hook.f., Fl. Brit. India 1: 468, 1875. *Ganglitz*.

Perennial herbs, up to 2 m tall, succulent. Leaves opposite or whorled, elliptic, lanceolate or oblong, acute-acuminate, crenate-serrate; teeth filiform, appendaged; petiole glandular; stipules stout, gland tipped. Flowers pink-purple, in subterminal racemes or umbels. Lateral sepals appendaged. Lip bucciniform; spur filiform, incurved, 3.5 mm long; standard suborbicular. Capsules obovate.

Fl. & Fr. : July September.

Selected specimens : Srinagar, Baltal, *Hajra* 74279 (BSD); Gulmarg, *Bhattacharyya* 71196 (BSD); Sonamarg *Rao* 801 (BSD); Dagwan *Wadhwa* 66953 (BSD); Dachigam, *Wadhwa* 66837 (BSD); Liddar valley, *Inayat s.n.* (DD).

10. *Impatiens laxiflora* Edgew. in Trans. Linn. Soc. 20: 40, 1846; Hook.f., Fl. Brit. India 1: 479, 1875; Vivekananthan *et al.* in Hajra *et al.*,

Fl. India 4: 170. 1997. *I. micranthemum* Edgew. in Trans. Linn. Soc. 20: 40. 1846; Hook.f., Fl. Brit. India 1: 481. 1875. *I. laxiflora* var. *sikkimensis* Hook.f. in Fl. Brit. India. 1: 480. 1875.

Herbs, 60-120 cm tall, branched, glabrous. Leaves alternate, rarely opposite, elliptic-lanceolate, up to 12 x 4 cm, acuminate, crenate; lower crenations with filiform appendages. Flowers white or rosy, on axillary peduncles. Lateral sepals usually long acuminate. Lip shallowly navicular; spur filiform, straight or curved. Capsules clavate.

Fl. & Fr. : July - October.

Selected specimens : Above Pahalgam, Inayat s.n. (DD).

11. *Impatiens lemanningii* Hook.f. & Thomson in J. Linn. Soc. Bot. 4: 154. 1860; Vivekananthan *et al.* in Hajra *et al.*, Fl. India 4: 171. 1997.

Erect glabrous herbs. Leaves alternate, ovate, acute, crenate, membranous. Flowers 1-2 on peduncle. Lateral sepals 2, ovate. Lip navicular; standard orbicular, appendaged. Capsules fusiform, acute.

Included after Vivekananthan *et al.* (*loc. cit.*).

12. *Impatiens meeboldii* Hook.f. in Kew Bull. Misc. inform. 1910: 291. 1910; Vivekananthan *et al.* in Hajra *et al.*, Fl. India 4: 181. 1997.

Slender, erect herbs, up to 30 cm high. Leaves opposite or clustered, 3-5 cm long, lower ovate to ovate-lanceolate, acuminate, serrulate; upper leaves sessile; stipular glands minute, globose. Flowers white with purple lip, in umbels or racemes. Lateral sepals 2. Lip bucciniform, cuspidate; spur straight; standard orbicular. Capsules clavate-oblong.

Fl. & Fr. : June - September.

Selected specimens : Gurais, Meebold 2467 (DD).

13. *Impatiens pahalgamensis* Hook.f. in Kew Bull. Misc. inform.

1910: 291. 1910; Vivekananthan *et al.* in Hajra *et al.*, Fl. India 4: 188. 1997.

Erect, glabrous herbs, up to 40 cm high. Leaves alternate, ovate to ovate-lanceolate, 4-5 cm long, acute, crenate, thick. Flowers rosy, 3-6 on peduncles. Sepals 2. Lip funnel shaped or boat like; spur short, incurved; standard orbicular, beaked at apex. Capsules ellipsoid or linear-oblong.

Fl. & Fr. : July - September.

Selected specimens : Pahalgam, Meebold 2464 (DD).

Rare, endemic.

14. *Impatiens racemosa* DC., Prodr. 1: 688. 1824; Hook.f., Fl. Brit. India 1: 479. 1875; Vivekananthan *et al.* in Hajra *et al.*, Fl. India 4: 199. 1997. *I. laxiflora* auct. non Edgew.; Hook.f., Fl. Brit. India 1: 479. 1875 *p.p.*

Erect, glabrous herbs, up to 1 m tall. Leaves alternate, rarely opposite, elliptic-ovate to elliptic-oblong or lanceolate, 7.5-18.5 cm long, acuminate, crenate or crenate-serrate; stipular glands 2, large, rarely absent. Flowers yellow white, blotched reddish, 6-10 in racemes. Bracts with glandular filiform appendages. Lateral sepals falcate, usually appendaged. Lip shallowly navicular; spur curved; standard orbicular. Capsules linear or clavate.

Fl. & Fr. : June - October.

Selected specimens : Poonch area, Vohra & Naithani 7821 (BSD); Kashmir, Duthie 323983 (DD).

15. *Impatiens scabrída* DC., Prodr. 1: 687. 1824; Blatter, Beaut. Fls. Kashmir. 1: 75. 1927; Vivekananthan *et al.* in Hajra *et al.*, Fl. India 4: 207. 1997.

Robust herbs, up to 1.2 m tall. Leaves alternate, ovate-lanceolate-ovate-oblong, up to 17 x 8.5 cm serrate-dentate, filiform, appendaged;

petioles with 2 sessile glands at base. Flowers yellow, speckled with brown. 1-4 on peduncles. Lateral sepals ovate. Lip boat shaped; spur abruptly constricted, curved; standard suborbicular, crested. Capsules oblong.

Fl. & Fr. : July - August.

Selected specimens : Sonamarg, *Hajra* 74021 (BSD); Paliphora Waskar *Wadhwa* 66889 (BSD); Bhaderwah, Jai, *Vohra & Naithani* 82923 (BSD).

16. *Impatiens sulcata* Wallich in Roxb., *Fl. Ind.* 2: 458. 1924; Hook.f. in *Fl. Brit. India* 1: 469. 1875; Blatter, *Beaut. Fls. Kashmir* 1: 71. 1927; Vivekananthan *et al.* in *Hajra et al.*, *Fl. India* 4: 213. 1997. *I. gigantea* Edgew. in *Trans. Linn. Soc.* 20: 38. 1846; Singh & Kachroo, *For. Fl. Srinagar* 204. 1976.

Annual herbs. Stems fleshy, hollow. Leaves usually opposite or whorled, ovate-elliptic to elliptic-oblong or oblanceolate, up to 18 x 2.5 cm, acuminate, crenate-serrate; upper teeth gland tipped; stipules pulvinate. Flowers pink, purple or dark crimson, axillary. Lateral sepals obliquely ovate, appendaged. Lip bucciniform; spur abruptly constricted, inflexed; standard bilobed. Capsules narrowly clavate.

Fl. & Fr. : July - October.

Selected specimens : Katra, Vaishnodevi, *Uniyal* 77462 (BSD); Srinagar-Masondi, *Hajra* 82394 (BSD).

17. *Impatiens thomsonii* Hook.f. in *J. Linn. Soc.* 4: 128. 1830 *et* in *Fl. Brit. India* 1: 469. 1875; Blatter, *Beaut. Fls. Kashmir* 1: 73. 1927; Vivekananthan *et al.* in *Hajra et al.*, *Fl. India* 4: 216. 1997.

Herbs, up to 60 m high. Leaves opposite, narrowly ovate or lanceolate-elliptic to elliptic-oblong, 2.5-12 x 3 cm acuminate, crenate-serrate, bristle like glands on serrations; stipules pulvinate. Flowers pale pink or crimson, in umbels. Lateral sepals ovate to ovate-lanceolate. Lip

navicular, spotted with brown or yellow; spur filiform, abruptly constricted or absent; standard suborbicular-obcordate. Capsules clavate.

- 1a. Lip spurred ...17.2. var. *thomsonii*
 1b. Lip not spurred ...17.1. var. *ecalcarata*

17.1. var. *ecalcarata* Hook.f. in Rec. Bot. Surv. India 4: 8. 1904; Vivekananthan *et al.* in Hajra *et al.*, Fl. India 4: 216. 1997.

Included after Vivekananthan *et al.* (*loc. cit.*).

17.2. var. *thomsonii*

Fl. & Fr. : July August.

Selected specimens : Ladakh, Matyan, *Bhattacharyya* 71264 (BSD); Gulmarg, *Hajra* 73653 (BSD); Bhandarwah, *Vohra & Naithani* 82864 (BSD); Dagwan, *Wadhwa* 66987 (BSD); Liddar valley, *Inayat s.n.* (DD).

OXALIDACEAE

(R. Mathur & B.P. Uniyal)

- 1a. Leaflets pinnate ...1. *Biophytum*
 1b. Leaflets digitate ...2. *Oxalis*

1. BIOPHYTUM DC.

- 1a. Sepals about half the length of petals ...1. *B. reinwardtii*
 1b. Sepals almost equalling the petals ...2. *B. sensitivum*

1. *Biophytum reinwardtii* (Zucc.) Klotz. in Peters, Reise Mosamb. Bot. 1: 85. 1862; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 437. 1874; Manna in Hajra *et al.*, Fl. India 4: 236. 1997. *Oxalis reinwardtii* Zucc. in Abh. Akad. Muench. 1: 274. 1829-1830.

Annual herbs; stems hispidly pubescent. Leaflets 10-20 pairs, oblong, tip rounded. Flowers yellow, small on slender, pendant peduncles. Sepals

5. lanceolate, glandular, hispid. Petals equalling the sepals. Capsules elliptic, shining, not overtopped by the sepals.

Fl. & Fr. : July December.

Included after Manna (*loc. cit.*).

2. *Biophytum sensitivum* DC., Prodr. 1. 690. 1824, Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 436. 1874; Manna in Hajra *et al.*, Fl. India 4: 236. 1997.

Annual, hispid herbs, up to 35 cm high. Leaflets 6-15 pairs, elliptic, terminal ones obovate, largest up to 15 x 7 mm. Flowers yellow, shortly pedicellate; peduncles very variable, hispid, glandular hispid. Sepals subulate, rigid, glandular, hispid, much exceeding the capsules. Petals twice as long as the sepals. Capsules elliptic, shining, overtopped by the sepals.

Fl. & Fr. : August January.

Included after Manna (*loc. cit.*).

2. OXALIS L.

- | | |
|---|-----------------------------|
| 1a. Flowers yellow | ...2. <i>O. corniculata</i> |
| 1b. Flowers white, pink or pink with purple streaks : | |
| 2a. Flowers solitary on long peduncles; not umbellate | ...1. <i>O. acetosella</i> |
| 2b. Flowers many in subumbellate cymes : | |
| 3a. Sepals with 2 yellow glands near the apex | ...3. <i>O. corymbosa</i> |
| 3b. Sepals with reddish-brown tip | ...4. <i>O. richardiana</i> |

1. *Oxalis acetosella* L., Sp. Pl. 435. 1753; Edgew. & Hook.f., in Hook.f., Fl. Brit. India 1: 436. 1874; Nasir in Fl. W. Pak. 4: 2. 1971; Manna in Hajra *et al.*, Fl. India 4: 242. 1997. *Tchokchin*. **Fig. 97**

Small, creeping, 4-18 cm long, perennial herbs, rhizomatous. Rhizomes scaly. Leaves radical, 3-foliolate; leaflets broadly obovate, 12-



Fig. 97. *Oxalis acetosella* L.

35 x 15-45 mm, emarginate. Flowers solitary on long, 2-bracteate peduncles. Capsules ovoid, 2-3-seeded. Seeds ribbed.

Fl. & Fr. : April - May.

In shady places.

Selected specimens : Udampur, Gool. *Swami* 1214 (BSD); Nangli Nalah, 2500 m. *T.A. Rao* 428 (BSD); Liddar Valley, Kinimala Nala, *Inayat* 25550 (DD); Jhelum valley, Ditwas forest, ca 2700 m. *Keshavanand* 940 (DD).

2. *Oxalis corniculata* L., Sp. Pl. 435. 1753; Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 436. 1874; Sharma & Kachroo, Fl. Jammu. 1: 120, 1981; Manna in Hajra *et al.*, Fl. India 4: 242. 1997. *Chukichin, Tsoktsin.*

Creeping, pubescent herbs, rooting at the nodes. Leaves 3-foliolate; leaflets obovate, 4-15 x 8-32 mm, pilose. Flowers yellow, in axillary subumbels, solitary to many. Capsules subcylindric, pubescent.

Fl. & Fr. : March - December.

In moist shady places.

Selected specimens : Dachigam Game Sanctuary, 1500 m, *Wadhwa* 66812 (BSD); Janglote, *Hajra* 82178 (BSD); Dachigam Game Sanctuary, *A.S. Rao* 63562 (BSD).

3. *Oxalis corymbosa* DC., Prodr. 1: 696. 1824; Manna in Hajra *et al.*, Fl. India 4: 246. 1997. *O. martiana* Zucc. in Denkschr. Akad. Moench. 9: 144. 1823-24; Sharma & Kachroo, Fl. Jammu 1: 120. 1981.

Fig. 98

Herbs, bulbiferous, pubescent. Leaves radical, tufted, 3-foliolate; leaflets up to 18 x 25 cm, membranous, appressed hairy on both surfaces, 2.6 cm broad. Flowers in subumbellate cymes on long peduncles. Fruits oblong.

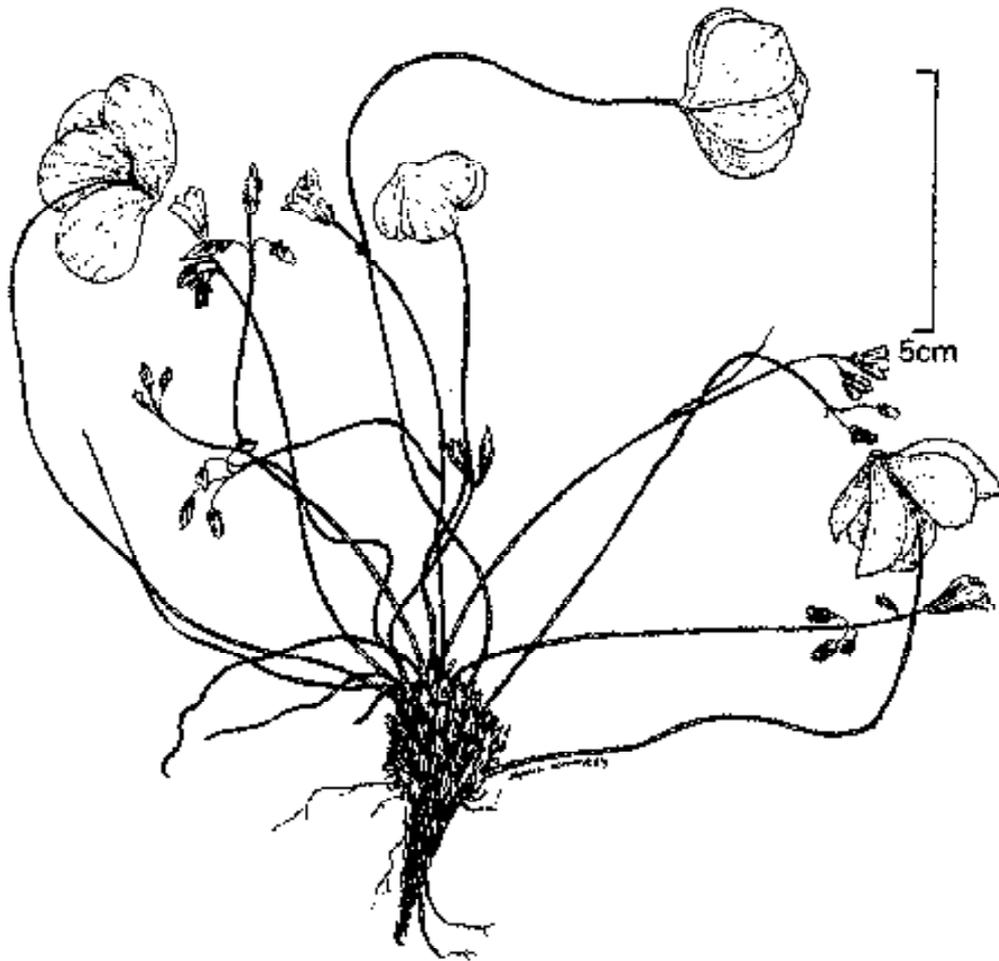


Fig. 98. *Oxalis corymbosa* DC.

Fl. & Fr. : September - January.

Selected specimens : Udhampur, Mansar, *Swami* 892 (BSD), Jammu, Bahadur 1647 (DD); Tilotalab, *Singh* 15741 (RRL).

4. *Oxalis richardiana* Babu, Herb. Fl. Dehra Dun. 104. 1977. *O. intermedia* A. Rich, Eass. Fl. Cuba 315. 1845, non Steud., 1841; *O. latifolia auct. non* HBK, Nov. Gen. et Sp. 5: 184. t. 467. 1821; Sharma & Kachroo, Fl. Jammu, 1: 120. 1981.

Puberulous herbs; bulbils clustered or solitary. Leaflets triangular, 15-40 x 30-70 mm, glabrous. Flowers on scapes, many, subumbellate. Pedicels 1-1.8 cm long, glabrous. Sepals lanceolate, 3.5 mm long, with reddish-brown; tip green, base streaked, obovate-lanceolate. Filaments unequal.

Fl. & Fr. : June - August.

Selected specimens : Ramnagar, *Swami* 910 (BSD); Jammu, Tilo Talab, *Singh* 15790 (RRL).

RUTACEAE

(S.C. Majumder)

1a. Plants armed :

2a. Leaves trifoliolate; petioles not winged ...1. *Aegle*

2b. Leaves trifoliolate to imparipinnate; petioles winged :

3a. Rachis winged. Carpels completely united. Fruit

a berry ...5. *Naringi*

3b. Rachis not winged. Carpels united above only. Fruit

a follicle ...7. *Zanthoxylum*

1b. Plants unarmed :

4a. Leaves simple. Stamens 5 ...6. *Skimmia*

4b. Leaves pinnate. Stamens 6-10 :

5a. Shrubs or small trees ...4. *Murraya*

5b. Herbs. Fruits of distinct carpels :

- 6a. Leaves 2-3-pinnate; petioles slender ...2. *Boenninghausenia*
 6b. Leaves once pinnate; petioles stout ...3. *Dictamnus*

1. AEGLE Correa, *nom. cons.*

Aegle marmelos (L.) Correa in Trans. Linn. Soc. London 5: 223. 1800; Hook.f., Fl. Brit. India 1: 516. 1875; Sharma & Kachroo, Fl. Jammu 1: 121. 1981; Nair & Nayar in Hajra *et al.*, Fl. India 4: 264. 1997. *Crateva marmelos* L., Sp. Pl. 444. 1753. *Bilon* (Dogri); *Bill*.

Glabrous, deciduous trees, 5-6 m tall; bark grey. Thorns axillary, 2-3 cm long. Leaves usually trifoliolate, occasionally 5-foliolate; leaflets 5-12 x 2-6 cm, ovate or elliptic-lanceolate, acuminate, crenate; laterals sessile. Flowers greenish white, in axillary panicles appearing with new leaves, scented. Calyx cupular, caducous. Petals 4 or 5, glandular. Fruits globose, woody, 5-10 cm in diam., much larger under cultivation.

Fl. & Fr. : June - December.

Very common in Ramnagar forest, Bilawar, Mirpur and Udhampur area.

Selected specimens : Janglote, Hajra 82498 (BSD).

2. BOENNINGHAUSENIA Reichb.

Boenninghausenia albiflora (Hook.) Meissn., Pl. Vasc. Gen. 2: 44. 1837; Hook.f., Fl. Brit. India 1: 486. 1875; Nair & Nayar in Hajra *et al.*, Fl. India 4: 357. 1997; Swami & Gupta, Fl. Udhampur 87. 1998. *Ruta albiflora* Hook., Exot. Fl. 1: 79. 1823.

A slender, erect branching, perennial-rooted herbs, 30-60 cm high, glabrous or somewhat pubescent. Leaves 2-3 pinnate; leaflets up to 2 x 1 cm, ovate or obovate, membranous, glaucous beneath; the terminal largest, petioled. Cymes leafy, many-flowered. Flowers white, ca 6 mm in diam., inclined or nodding. Calyx very small. Corolla oblong obtuse. Pedicels of ovary variable in length. Fruits 6-8 mm in diam., membranous.

Fl. Fr. : July February.

In moist places.

Selected specimens : Loran, across river, 2000-2500 m, *Vahra* & *Naithani* 78307 (BSD); Hathimatha, *Swami* 1030 (BSD); Ruttan Pir, ca 2700 m, *Gammie s.n.* (DD).

3. DICTAMNUS L.

Dictamnus albus L., Sp. Pl. 383. 1753; Hook.f., Fl. Brit. India 1: 487. 1875; Blatter, Beaut. Fls. Kashmir 1: 75. 1927; Dhar & Kachroo, Alp. Fl. Kashmir Himal. 196. 1983; Nair & Nayar in Hajra *et al.*, Fl. India 4: 361. 1997. *Sarp-buti* (Kashmiri).

Strong smelling herbs, up to 1 m tall. Leaves odd pinnate, 16-30 cm long, gland dotted; leaflets dark green, 7-15, oblong-elliptic, ovate or ovate-lanceolate, up to 7 x 3 cm, sessile. Flowers white, striped with pinkish lines, membranous forming an erect, terminal raceme up to 30 cm long or more, showy. Sepals 5, lanceolate, glandular, persistent. Petals 5, much longer than the sepals, spreading. Stamens 10, as long as petals. Ovary stipitate, 5-carpellate, deeply 5-lobed. Fruit a hard, almost woody capsule, 5-valved.

Fl. & Fr. : May September.

Common on stony, open slopes.

Selected specimens : Sonamarg, *Chowdhery & Uniyal* 85773 (BSD); Sonamarg hills, 3000 m., *T.A. Rao* 9571; Upper Munda 2350 m, *T.A. Rao* 9181 (BSD); Sonamarg, Sind valley, ca 2800 m, *Gammie s.n.*; Sind valley, ca 3000 m, *Duthie* 11497 (DD); Mawar River basin, Jhelum valley, ca 2300 m, *Keshavanand* 178 (DD).

4. MURRAYA L., *nom. cons.*

Murraya koenigii (L.) Spreng., Syst. Vcg. 2: 315. 1825; Hook.f., Fl. Brit. India 1: 503. 1875; Sharma & Kachroo, Fl. Jammu 1: 121. 1981;

Nair & Nayar in Hajra *et al.*, Fl. India 4: 351. 1997. *Bergera koenigii* L., Mant. Pl. 563. 1771.

Deciduous, aromatic shrubs, reaching to the height of a small tree. Leaves up to 50 cm long; leaflets 9-25, ovate or rhomboid, 2-6.5 x 1-3 cm, oblique at base, entire or crenulate, dark green above, paler beneath. Flowers white, in terminal corymbs, fragrant, 5-8 mm long. Berries ovoid, about 1 cm long, rough, black when ripe.

Fl. & Fr. : April August.

Under shade in forests.

Selected specimens : Kuthua, Hajra 82457 (BSD).

5. NARINGI Adans.

Naringi crenulata (Roxb.) Nicolson in Saldanha & Nicolson, Fl. Hassan Dist. 387. 1976; Nair & Nayar in Hajra *et al.*, Fl. India 4: 302. 1997. *Limonia crenulata* Roxb., Pl. Corom. 1: 60, t. 86. 1798. *Limonia acidissima auct. non L.*; Hook.f., Fl. Brit. India 1: 507. 1875. *Feronia limonia* (L.) Swingle in J. Wash. Acad. Sci. 4: 328. 1914; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 437. 1972.

Fig. 99

Semievergreen trees, up to 10 m tall, armed. Leaves imparipinnate, up to 15 cm long with winged petioles and rachis; leaflets opposite, ovate, elliptic or oblanceolate, up to 5 x 2 cm, sessile. Flowers in subumbellate racemes on axillary or terminal, short leafy branchlets. Sepals 4, ovate-orbicular or deltoid. Petals 4, elliptic or oblong, *ca* 7 mm long, obtuse, glandular. Stamens 8; filaments with a prominent midnerve. Ovary glandular; 4 loculed. Fruits globose, bluish black when mature.

Fl. & Fr. : April January.

Seen in Jasrota, near remains of palace.

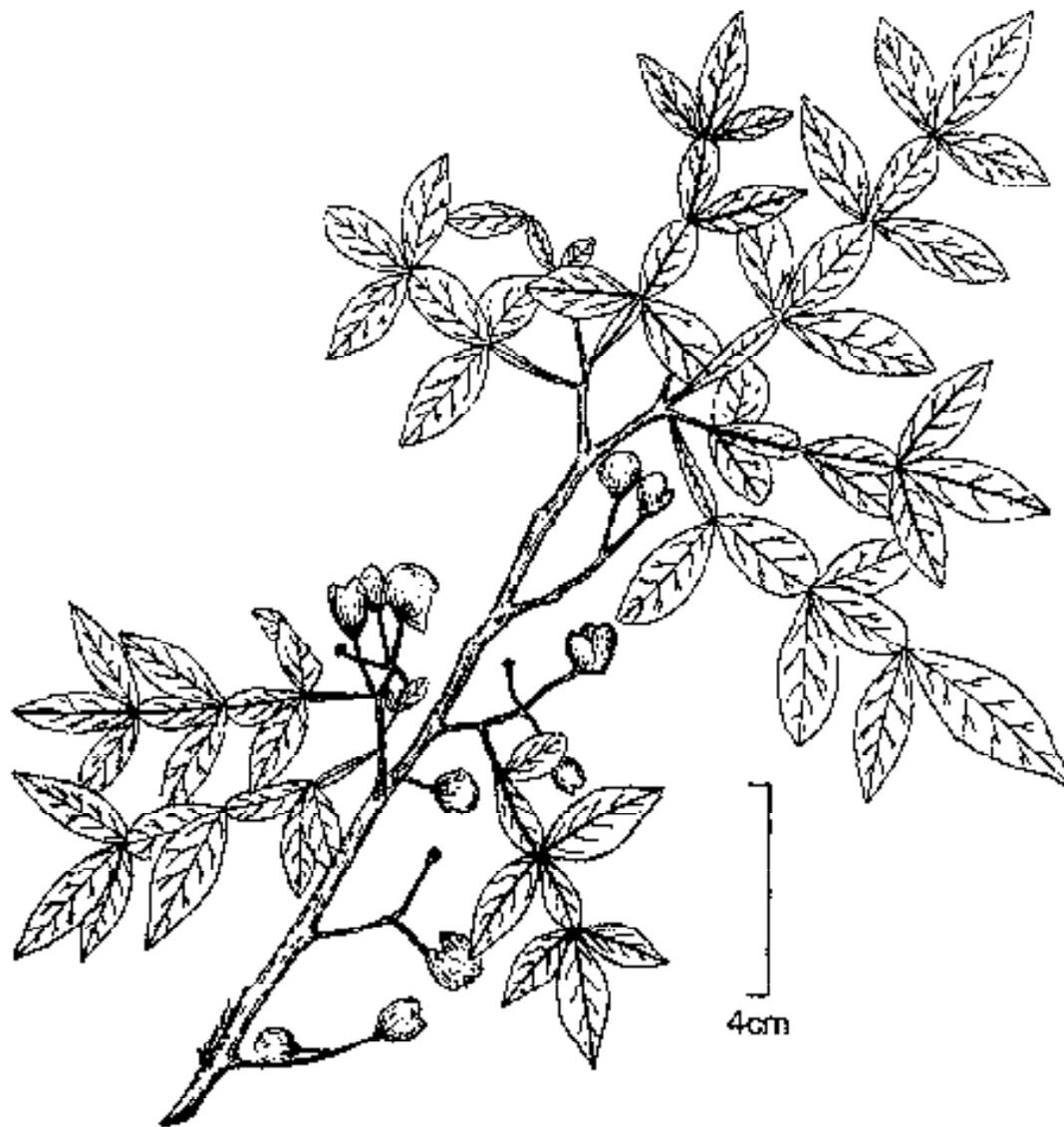


Fig. 99. Naringi crenulata (Roxb.) Nicolson

6. SKIMMIA Thunb.

Skimmia anquetilia N.P. Taylor & Airy Shaw in Bot. Mag. 182: 170-171. t. 789. 1980; Nair & Nayar in Hajra *et al.*, Fl. India 4: 394, 1997; Swami & Gupta, Fl. Udhampur 88. 1998. *Skimmia laureola sensu* Hook.f., Fl. Brit. India 1: 499. 1875, *non* DC.; Sharma & Kachroo, Fl. Jammu 1: 121. 1981. *Ner* (Kashmiri).

Erect, strongly aromatic, 0.6-2 m high, gregarious, evergreen shrubs with whitish bark. Leaves oblong-lanceolate or oblanceolate, 6-15 x 1.5-4.5 cm, crowded towards extremities, thick, softly coriaceous, orange-smelling when crushed; lateral nerves obscure. Flowers white or greenish-yellow, in 3-4 cm long, dense panicles, polygamous. Calyx lobes imbricate. Stamens 5, alternate with and equalling the petals, 0 in female flowers. Drupes red, 0.6-1.5 cm long, fleshy, ovoid with 2 (sometimes 1 or 3), 1-seeded stones.

Fl & Fr. : May - September.

Very common in *Abies* forest as undergrowth. Sometimes found in pure patches, also mixed with other shrubs under firs on the slopes.

Selected specimens : Gulmarg, 2600 m, *Bhattacharyya* 71141 (BSD); Kunzalwan to Bagtore, *Wadhwa & Murti* 84030 (BSD); Gulmarg, *T.A. Rao* 9612 (CAL); Jai, 1830 m., *Wadhwa & Yohra* 570 (CAL); Gulmarg, ca 3300 m, *G.A. Gammie s.n.* (DD); Kubbi forest, Erinbasin, *Keshavanand* 1089 (DD).

7. ZANTHOXYLUM L.

Zanthoxylum armatum DC., Prodr. 1: 727. 1824; Nair & Nayar in Hajra *et al.*, Fl. India 4: 379. 1997; Swami & Gupta, Fl. Udhampur 88. 1998. *Zanthoxylum alutum* Roxb., Fl. Ind. 3: 768. 1832; Hook.f., Fl. Brit. India 1: 493. 1875; Sharma & Kachroo, Fl. Jammu 1: 121. 1981. *Jangli marteh*.

Shrubs or small trees with dense foliage and pungent aromatic taste and smell. Prickles vertically flattened. Leaves 6-18 cm long; leaflets ovate-

lanceolate or elliptic-oblong, elliptic-lanceolate, rarely ovate. Petioles glabrous, narrowly winged, with 2-stipular prickles at the base. Panicles loose, sparingly branched. Flowers 3-5 mm in diam. Calyx 6-8-lobed. Stamens 6-8. Fruits pale red, globose, 5 mm in diam.

Fl. & Fr. : March - September.

Along the bridle path and by the roadside.

Selected specimens : Sukral, Hajra 82550 (BSD); Udhampur, Kumar 81488 (BSD); Sunderbani-Naushera, Uniyal 92879 (BSD).

CULTIVATED SPECIES

Citrus aurantifolia (Christmann) Swingle (= *Limon aurantifolia* Christmann). *Kaghzi-Nimbu* (Hindi).

Large shrubs or small trees, with small, globose or ovoid fruits. Commonly cultivated for edible fruits.

Citrus aurantium L. *Narangi* (Hindi).

Trees or shrubs with elliptic-lanceolate or ovate leaves and purple white flowers. Cultivated for its edible fruits.

Citrus maxima (Burm.) Merr. (= *Citrus aurantium* L. var. *grandis* L.). *Pamelo, Shaddock, Chakotra*.

Trees with pubescent young parts. Flowers large, white. Fruits pale yellow, large, globose or pyriform. Cultivated for its edible fruits.

Citrus limon (L.) Burm.f. (= *Citrus medica* L. var. *limon* L.)

Thorny trees, with ovate-elliptic, crenate leaves, white flowers tinged with pink-purple and oval or oblong fruits. Occasionally cultivated for its fruits.

Citrus medica L. *Nimbu* (Hindi)

Large shrub or tree with axillary spines white flowers and globose fruits. Commonly cultivated for its fruits.

Citrus sinensis (L.) Osbeck (= *Citrus aurantium* L. var. *sinensis* L.). *Malta*, *Musambi* (Hindi).

Trees or shrubs, with ovate to elliptic, emarginate leaves. Flowers pure white. Fruits globose, tight skinned. Cultivated for edible fruits.

Feronia elephantum Correa. *The Elephant or Wood Apple*.

A small deciduous tree. Leaflets 5-7, cuneate or obovate, tip crenate. Flowers dull red. Cultivated for edible fruits.

Murraya paniculata (L.) Jack. (= *Murraya exotica* L.). *Murua*, *Jaswanti* (Hindi).

Large shrubs or small trees. Leaflets 3-7, ovate, obovate or rhomboid, shining above, glabrous. Flowers white, fragrant. Fruits red. Ornamental.

SIMAROUBACEAE

(R. Mathur & U. Chaudhary)

1a. Stamens 10. Sepals and petals not persistent.

Fruits winged.

...1. *Ailanthus*

b. Stamens 4-5. Sepals and petals persistent in fruits.

Fruits not winged.

...2. *Picrasma*

1. AILANTHUS Desf., *nom. cons.*

Allanthus altissima (Mill.) Swingle in J. Wash. Acad. Sci. 6: 996. 1967; Basak in Hajra *et al.*, Fl. India 4: 410. 1997; Singh & Kachroo, For. Fl. Srinagar 154. 1987. *Toxicodendron altissimum* Mill., Gard. Dict. ed. 8 no. 10. 1768. *Ailanthus glandulosa* Desf. in Mem. Acad. Sci. Paris 1786. 265. t. 8. 1788; Bennett in Hook.f., Fl. Brit. India 1: 518. 1875.

Fig. 100

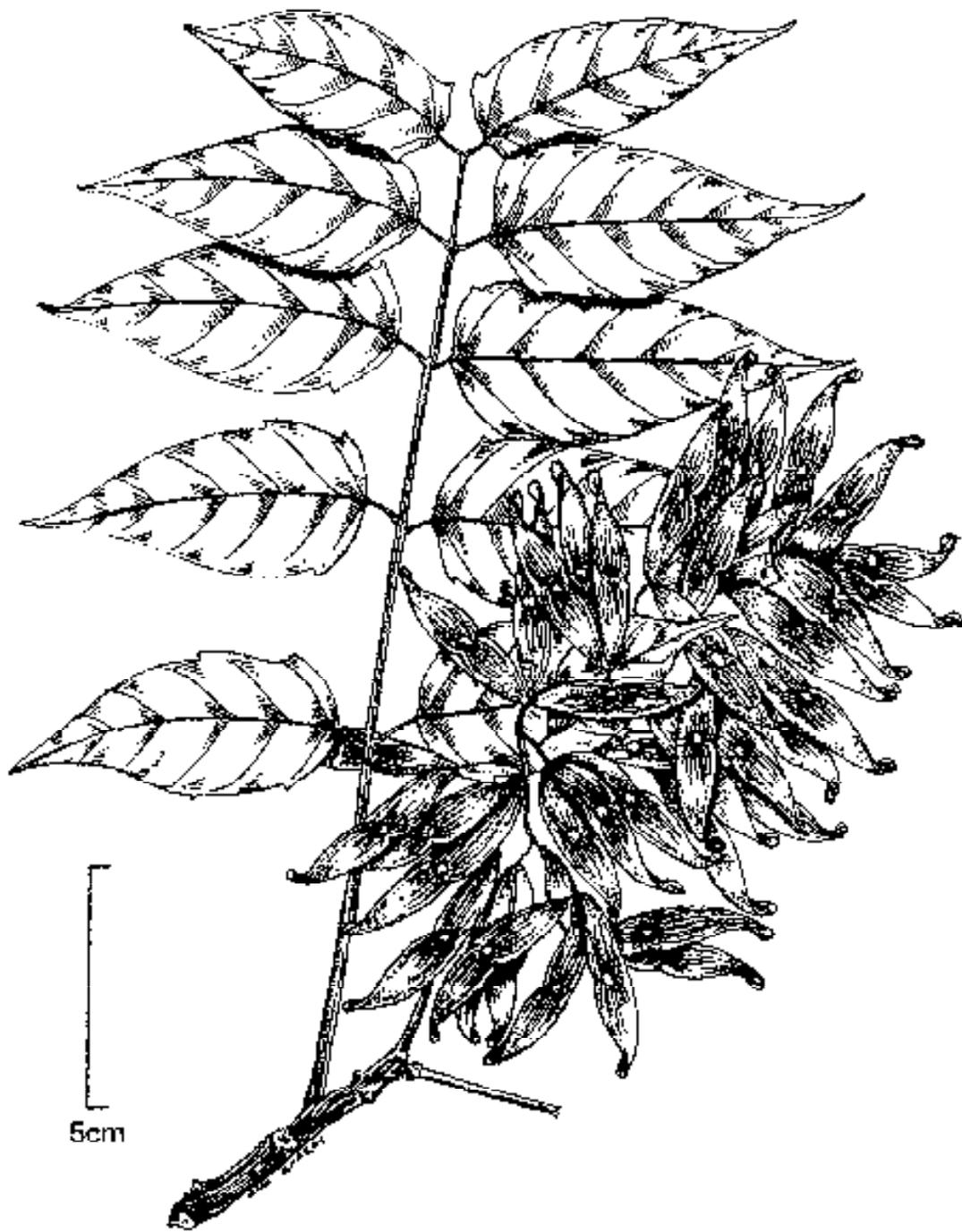


Fig. 100. *Ailanthus altissima* (Mill.) Swingle

Deciduous trees. Leaves pinnate, 30-50 cm long; leaflets 4-10 pairs, lanceolate, acuminate, 2-4-toothed at the base; teeth glandular at the base. Flowers very small, 10-25 cm long panicles. Sepals ca 1 mm long. Petals 2.5-4 mm long. Filaments filiform, longer than the anthers. Fruits samaras, linear-oblong, membranous, spirally twisted.

Fl. & Fr. : April - August.

Selected specimen : Srinagar, 1590 m, *Bhattacharyya* 71213 (BSD); Bhaderwah, *Uniyal* 80224 (BSD); Srinagar, 1500 m, *Rau* 50228 (BSD); Kashmir, *Shankracharya Temple*, 1900 m, *Nair* 37097 (BSD).

2. PICRASMA Blume

Picrasma quassioides (D. Don) J.J. Bennett, *Pl. Java Rar.* 198. 1844. A.W. Bennet in *Hook.f., Fl. Brit. India* 1: 520. 1875; Basak in *Hajra et al., Fl. India* 4: 419. 1997; Sharma & Kachroo, *Fl. Jammu* 1: 121. 1981. *Sinaha quassioides* D. Don, *Prodr. Fl. Nepal.* 248. 1825.

Trees or scrambling shrubs. Branches stout, lenticellate. Leaves imparipinnate, ca 30 cm long; leaflets 9-15, opposite, ovate to lanceolate, 4-12 x 1.5-6 cm, acuminate; lowest pair much smaller. Flowers in axillary, corymbose, pubescent panicles, polygamous. Sepals minute, imbricate. Petals ovate or oblong-obovate. Stamens equalling the petals; filaments at the base. Drupes black, 1-5 in clusters, obovoid or globose.

Fl. & Fr. : February - September.

Included after Sharma & Kachroo (*loc. cit.*).

MELIACEAE

(R. Mathur & B.P. Uniyal)

- 1a. Staminal tube not appendaged ...3. *Toona*
 1b. Staminal tube appendaged:
 2a. Leaves once pinnate; indumentum of simple hairs. Stigma 3-lobed. Drupes 1-seeded ...1. *Azadirachta*

- 2a. Leaves bi- or tripinnate; indumentum of stellate hairs. Stigma 4-8-lobed. Drupes 3-8-seeded ...2. *Melia*

1. AZADIRACHTA A. Juss.

Azadirachta indica A. Juss. in Mem. Mus. Par. 19, 221. 1830; Sharma & Kachroo, Fl. Jammu 1: 122. 1981. *Melia azadirachta* L., Sp. Pl. 385. 1753; Hiern in Hook.f., Fl. Brit. India 1: 544. 1875. Jain & Bennet in Hajra *et al.*, Fl. India 4: 478. 1997.

Trees, up to 15 m tall. Leaves imparipinnate; leaflets alternate to opposite, ovate, 2.5-7 x 1.5-4 cm, acuminate, subsessile. Flowers sweet scented. Drupes greenish yellow, oblong, 1-seeded.

Fl. & Fr. : April May.

Selected specimens : Jammu, B.K. Abrol 1785, 5770, 5773 (RRL).

2. MELIA L.

Melia azedarach L., Sp. Pl. 1: 384. 1753; Hiern. in Hook.f., Fl. Brit. India 1: 544. 1875; Singh & Kachroo, For. Fl. Srinagar 154. 1976. Jain & Bennet in Hajra *et al.*, Fl. India 4: 494. 1997. Fig. 101

Trees, up to 12 m tall. Leaves 2-3-pinnate, up to 60 cm long; leaflets opposite, elliptic, 2.5-5 x 0.5-1.5 cm, acuminate, serrate, oblique at the base; subsessile. Flowers lilac, in axillary panicles, sweet scented. Drupes yellow, globose, 5-6-seeded.

Fl. & Fr. : April August.

Selected specimens : Kishtwar, Uniyal 80323 (BSD); Shankracharyya Hill, 1800 m, Thapliyal & Raizada 26308 (DD); Kishenganga Valley, 900 m, Hukum Singh 1642 (DD).

3. TOONA (Endl.) M. Roem.

- 1a. Flowers white, honey scented, in simple panicles. Staminoles absent. ...1. *T. ciliata*



Fig. 101. *Melia azedarach* L.

- b. Flowers cream coloured, not honey scented, in drooping panicles. Staminodes present ...2. *T. sinensis*

1. *Toona ciliata* Roem., Syn. Hesp. 139. 1846; Sharma & Kachroo, Fl. Jammu 1: 122. 1981; Jain & Bennet in Hajra *et al.*, Fl. India 4: 504. 1997. *Cedrela toona* Roxb. ex Rottl. & Willd. in Ges. Naturf. Fr. New Schr. 4: 198. 1883; Hiern in Hook.f., Fl. Brit. India 1: 568. 1875. **Fig. 102**

Trees. Leaves paripinnate, 15-45 cm long; leaflets 4-10 pairs, alternate or opposite, ovate, lanceolate or elliptic, 5-13 x 2-4.5 cm, acuminate, long petiolulate. Flowers white, in panicles, honey scented. Capsules ca 2 cm long, 5-celled. Seeds winged at both the ends.

Fl. & Fr. : March June.

Selected specimens : Reasi, Swami 1102 (BSD).

2. *Toona sinensis* (A. Juss.) M. Roem., Fam. Nat. Syn. Monogr. 1: 138. 1846; Jain & Bennet in Hajra *et al.*, Fl. India 4: 510. 1997. *Cedrela sinensis* A. Juss. in Mem. Mus. Hist. Nat. 19: 294. 1830. *C. serrata* Royle, Illus. Bot. Himal. Mount. 144. t. 28. 1839. **Fig. 103**

Trees, up to 20 m tall. Leaves usually imparipinnate, but often a terminal leaflet present, 50-80 cm long; leaflets opposite, elliptic to lanceolate, up to 25 x 7 cm, serrate. Flowers cream coloured, in drooping panicles. Sepals obovate, ca 2 mm long. Petals oblong, ca 5 mm long, imbricate. Stamens 5, alternating with 5 staminodes. Capsules brown, oblong, 5-locular. Seeds ca 1.5 cm long, winged at the upper end.

- 1a. Leaflets 15-25 cm long ...2.1. var. *grandifolia*
 1b. Leaflets less than 15 cm long :
 2a. Leaflets glabrous when mature ...2.3. var. *sinensis*
 2b. Leaflets puberulous on main nerves
 beneath when mature ...2.2. var. *puberula*

2.1. var. *grandifolia* (A. Chev.) Bahadur, Monogr. Gen. Toona 121. 1988; Jain & Bennet Hajra *et al.* Fl. India 4: 511. 1997. *T. microcarpa*

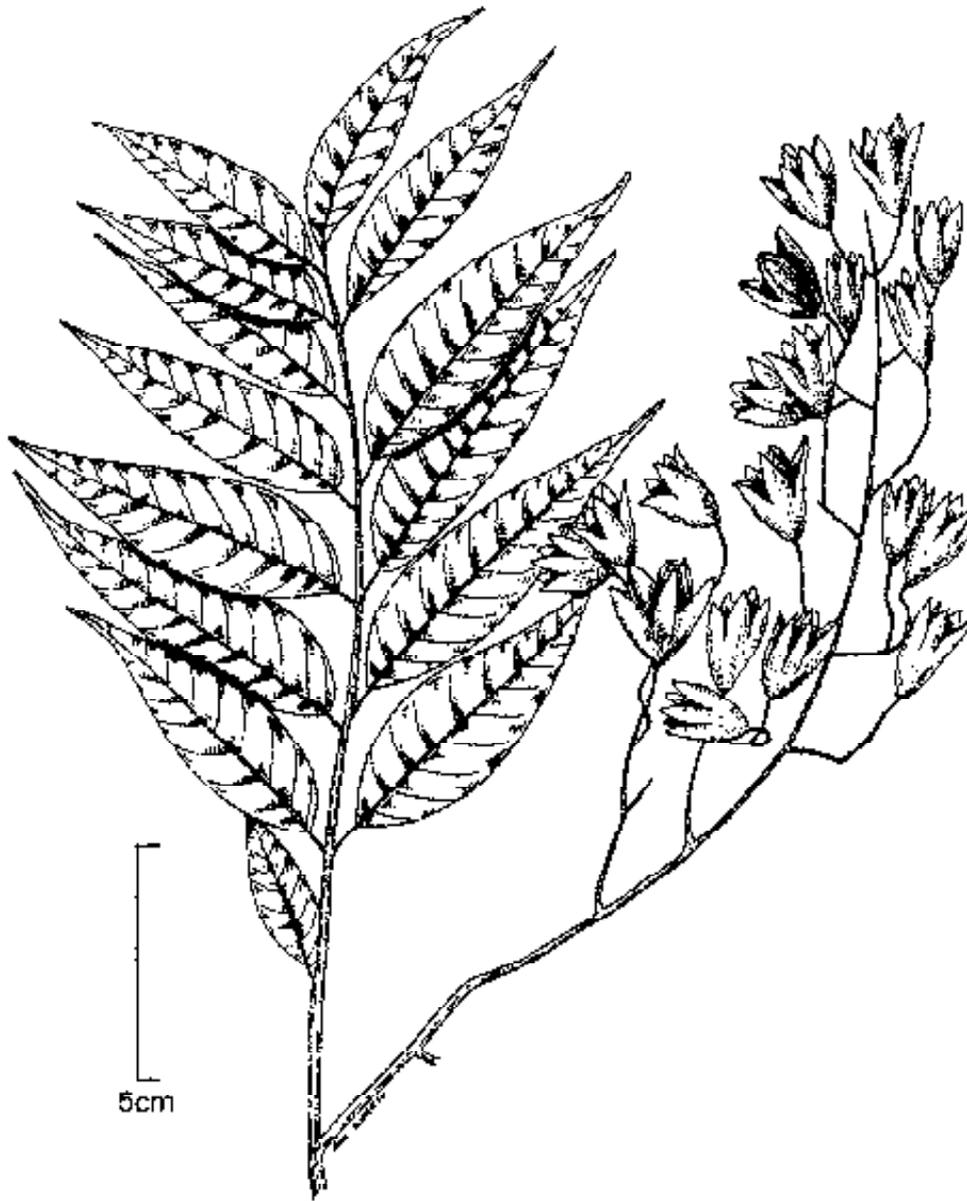


Fig. 102. *Toona ciliata* Roem.

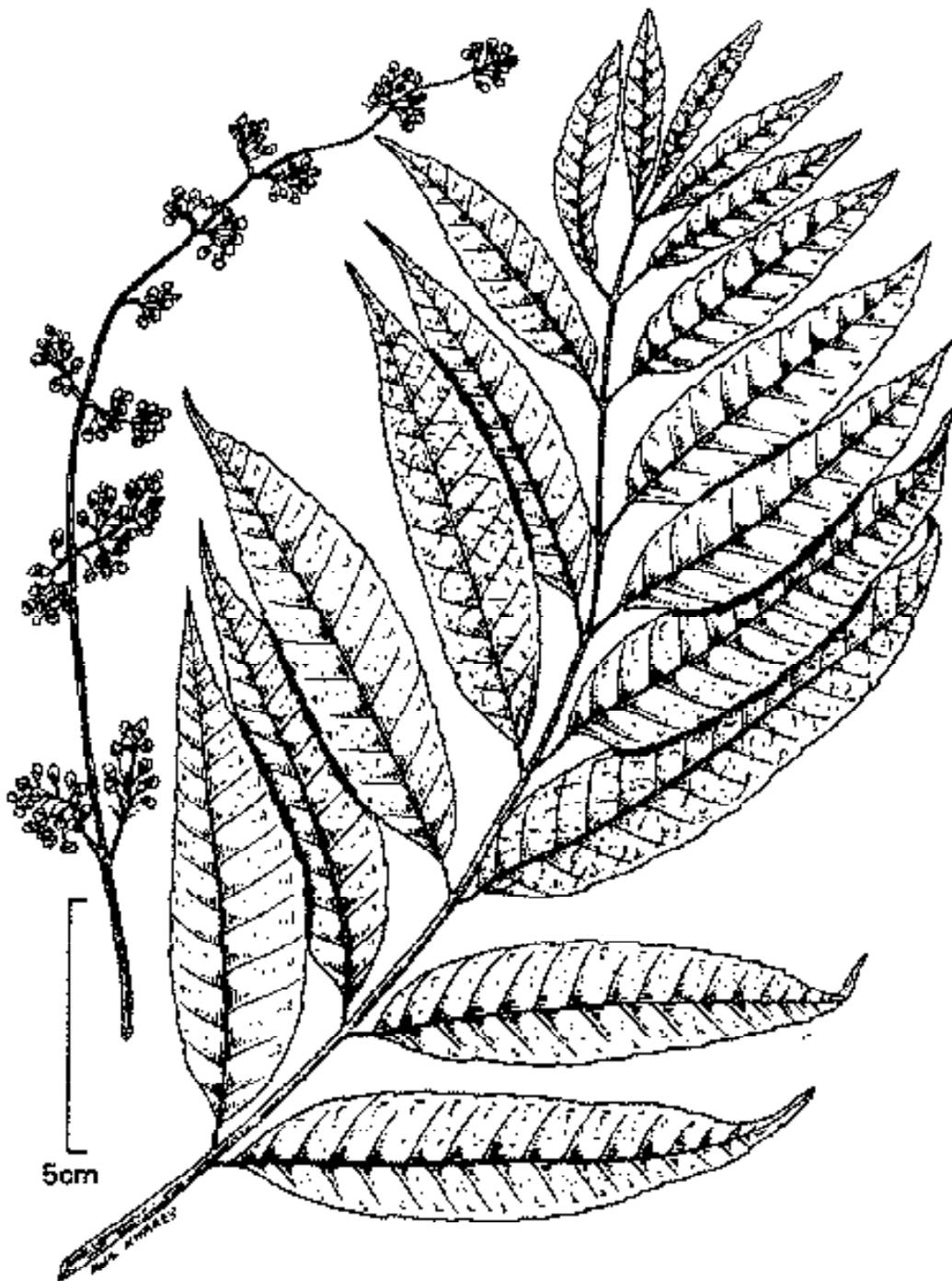


Fig. 103. *Toona sinensis* (A. Juss.) M. Roem.

(C. DC) Hartus, var. *grandifolia* A. Chew in Rev. Int. Bot. Appl. Agric. Trop. 24: 158. 1944.

Fl. & Fr. : September – February.

Included after Jain & Bennet (*loc. cit.*).

2.2. var. **puberula** (C. DC.) Bahadur, Monogr. Toona 122. 1988; Jain & Bennet in Hajra *et al.* Fl. India 4: 512. 1997. *Cedrela serrata* Royle var. *puberula* C. DC. in Rec. Bot. Surv. India 3: 363. 1908.

Fl. & Fr. : May – June.

Selected specimens : Udampur, Latidhuna; Swami 1319 (BSD); Chenab valley, 1300 m, T.A. Rao 9166 (BSD).

2.3. var. **sinensis**

Fl. & Fr. : May – October.

Included after Jain & Bennet (*loc. cit.*).

AQUIFOLIACEAE

(D. Basu)

ILEX L.

- 1a. Leaves spinous throughout along margins ...1. *I. dipyrrena*
 1b. Leaves entire or with few teeth near the tip only ...2. *I. excelsa*

1. *Ilex dipyrrena* Wallich in Roxb., Fl. Ind. 1: 473. 1820; Hook.f., Fl. Brit. India 1: 599. 1875; Kapur & Sarin, Fl. Trikuta hills. 100. 1990; Basu in Singh *et al.*, Fl. India 5: 54. 2000. Fig. 104

Evergreen trees, up to 14 m tall. Leaves elliptic-oblong or ovate-lanceolate, 4-10 x 2-4 cm, margins revolute, spinous, oldest leaves entire

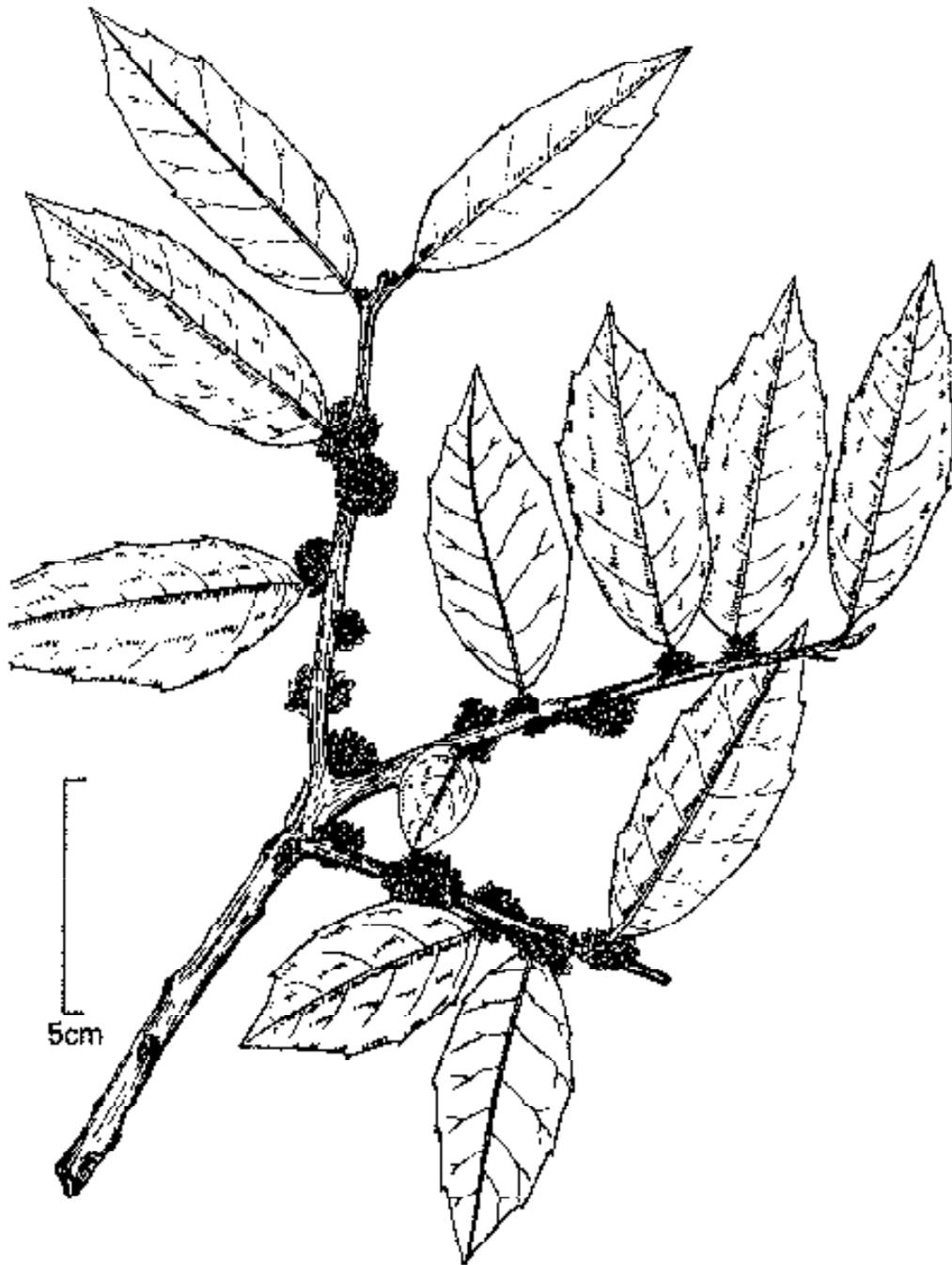


Fig. 104. *Ilex dipyrena* Wallich

margined. Inflorescence fasciculate. Flowers 4-merous. *Staminate inflorescence* : Pedicels 2-3 mm long; basal prophylla 2, 1.5 mm long. Sepals patelliform; lobes membranous, ciliate. Petals ovate, united at base. Stamens 4, longer than petals. *Pistillate inflorescence* : Pedicels 1-3 mm long. Sepals, petals as in staminate flowers. Stamminodes shorter than the petals; sterile anthers ovate. Ovary ovoid; stigma discoid, 2-4-lobed persistent. Drupes scarlet when mature, globose, 5-7 x 5 mm. Stones usually 2, rarely 3-4.

Fl. & Fr. : April - October.

Selected specimens : Vaishno Devi, *Uniyal* 7746 (BSD).

Uses : Wood yields inferior quality timber.

2. *Ilex excelsa* (Wallich) Hook.f., *Fl. Brit. India* 1: 603, 1875; Swami & Gupta, *Fl. Udhampur* 91, 1998; Basu in Singh *et al.*, *Fl. India* 5: 55, 2000. *Cassine excelsa* Wallich in Roxb., *Fl. Ind.* 2: 276, 1824. *Tumari* (Hindi).

Evergreen trees, up to 10 m tall; bark white-grey, wrinkled. Leaves ovate, elliptic or elliptic-oblong, 5-10 x 2-4 cm, entire, pubescent below. Inflorescence 3-7 (-15)-flowered cymes. Flowers 4-5 merous. *Staminate inflorescence* : Pedicels 2-5 mm long, puberulous; basal prophylla 1-2. Sepals patelliform, ca 1 mm long, lobes 4-5, rounded, elliptic. Petals oblong, ca 2 mm long, eciliate, united at base. Stamens free, alternating with petals, longer than petals, inserted at base of petals. Rudimentary ovary pulvinate, ca 1 mm long, rostellate, 5-cleft at apex. *Pistillate inflorescence* : Peduncles 5-12 mm long, puberulous, broad; lobes 5-6, eciliate, persistent. Petals ovate ca 2 mm long. Stamminodes shorter than the petals. Ovary ovoid-ellipsoid. Drupes 5(-6), elliptic; stones 4-5 mm.

Fl. & Fr. : December - June.

Included after Swami & Gupta (*loc. cit.*).

CELASTRACEAE

(P.C. Pant & R. Mathur)

- 1a. Leaves opposite or sub opposite :
 2a. Fruits capsular, dehiscent ...3. *Euonymus*
 2b. Fruits dry or pulpy drupe, indehiscent ...1. *Cassine*
 1b. Leaves alternate :
 3a. Plants thorny. Flowers white ...4. *Maytenus*
 3b. Plants not thorny; flowers yellowish green ...2. *Celastrus*

1. CASSINE L.

Cassine paniculata (Wight & Arn.) Loeb.-Callen in *Adansonia* Ser. 2, 15: 220. 1975; Ramamurthy in Singh *et al.*, *Fl. India* 5: 83. 2000. *Elaeodendron paniculatum* Wight & Arn., *Prodr.* 157. 1834. *E. glaucum sensu* Lawson in Hook.f., *Fl. Brit. India* 1: 623. 1875, *non Pers. p.p.* *Cassine glauca* (Rottb.) O. Kuntze, *Rev. Gen. Pl.* 1: 114. 1891; Stewart in Nasir & Ali, *Annot. Cat. Vas. Pl. W. Pak. & Kashmir* 460. 1972. *Jangela, Gangera* (Kashmiri)

Tall trees. Leaves opposite to sub-opposite, ovate-lanceolate, 3-16 x 1.5-7.5 cm, crenate, membranous to subcoriaceous, dark green, shining above, acute at apex. Flowers white, in dichotomous cymes. Sepals 5 lobed. Petals 5. Disk thick. Fruits drupaceous, elliptic.

Fl. & Fr. : February November

Included after Stewart (*loc. cit.*).

2. CELASTRUS L.

Celastrus paniculatus Willd., *Sp. Pl.* 1: 1125. 1797; Sharma & Kachroo, *Fl. Jammu* 1: 122. 1981; Swami & Gupta, *Fl. Udhampur* 1998; Ramamurthy in Singh *et al.*, *Fl. India* 5: 87. 2000. *Malkangni*.

Scandent shrubs. Young branches and shoots pendulous. Leaves alternate, elliptic to ovate-oblong, 4-12 x 2-10 cm, serrate, glabrous,

membranous-subcoriaceous. Flowers greenish yellow, in axillary or terminal panicles, polygamous. Sepals 5 lobed. Petals 5. Disc cupular. Fruits capsular, yellow, subglobose, trilobed.

Fl. & Fr. : April - August.

Selected specimens : Akhnoor-Sunderbani, *Untyal* 92810 (BSD).

3. EUONYMUS Tour. ex L.

1a. Fruits winged :

2a. Petals fimbriate. ...4. *E. pendulus*

2b. Petals entire. ...2. *E. fimbriatus*

1b. Fruits not winged :

3a. Fruits with spines. ...1. *E. echinatus*

3b. Fruits without spines ...3. *E. hAMILTONIANUS*

1. *Euonymus echinatus* Wallich, ex Roxb., *Fl. Ind.* 2: 410. 1824; Lawson in Hook.f., *Fl. Brit. India* 1: 611. 1875; Sharma & Kachroo, *Fl. Jammu* 1: 123. 1981; Ramamurthy in Singh *et al.*, *Fl. India* 5: 98. 2000.

Climbing shrubs. Leaves ovate-lanceolate, 2-5.5 x 1-3 cm, serrate, acuminate, coriaceous, very shortly petioled. Flowers greenish white in axillary cymes. Sepals and Petals 4. Fruits capsular, globose, covered with prickles. Seeds black.

Fl. & Fr. : August - January.

Including after Sharma & Kachroo (*loc. cit.*).

2. *Euonymus fimbriatus* Wallich ex Roxb., *Fl. Ind.* 2: 408. 1824; Lawson in Hook.f., *Fl. Brit. India* 1: 611. 1875; Singh, & Kachroo. *For. Fl. Srinagar.* 152. 1976; Ramamurthy in Singh *et al.*, *Fl. India* 5: 98. 2000.

Fig. 105

Shrubs or small sized trees. Leaves opposite, ovate, 2-10 x 0.5-4.5 cm, membranous, serrulate to sharply denticulate. Flowers creamy in

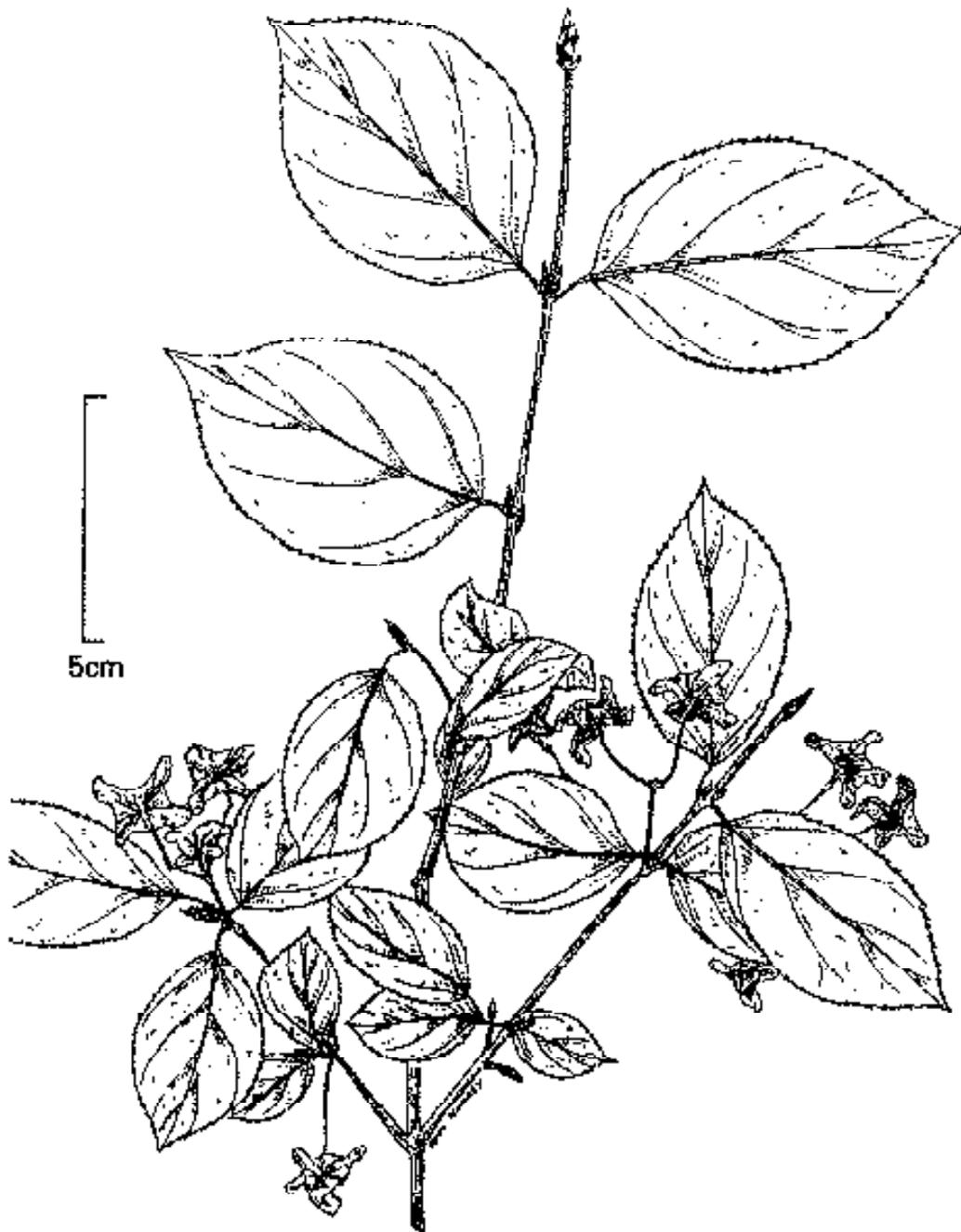


Fig. 105. *Euonymus fimbriatus* Wallich ex Roxb.

umbellate fascicles. Sepals 5 lobed. Petals 4, broadly ovate. Fruits capsular, leathery. Seeds ovoid.

- 1a. Leaf margins with sharp biserratures ...2.1. var. *fimbriatus*
 1b. Leaf margins uniformly denticulate ...2.2. var. *serratus*

2.1. var. *fimbriatus*

Fl. & Fr. : May - September.

On rocky soil in mixed forests.

Selected specimens : Waksar-Dagwan, Wadhwa 66899 (BSD); Kashmir Valley, Duthie 13324 (DD).

2.2. var. *serratus* Blakelock in Kew Bull. 1951. 279. 1951; Ramamurthy in Singh *et al.*, Fl. India 5: 99, 2000.

Fl. & Fr. : May - September.

Along borders of cultivated fields.

Selected specimens : Gicinagar, Kishtwar, Uniyal 80355 (BSD).

3. *Euonymus hamiltonianus* Wallich in Roxb, Fl. Ind. 2: 403. 1824; Lawson in Hook.f., Fl. Brit. India 1: 612. 1875; Sharma & Kachroo, Fl. Jammu 1: 123. 1981; Ramamurthy in Singh *et al.*, Fl. India 5: 102. 2000.

Small trees. Leaves lanceolate to elliptic-oblong, 1.5-12 x 0.5-4.5 cm, membranous, margins finely serrate, acuminate at apex. Flowers in dichotomous cymes. Sepals 4-lobed. Petals 4, with revolute margins. Fruits capsular, turbinate, deeply 3-4-lobed.

Fl. & Fr. : June - October.

On slopes along with *Rhamnus* and in the forest tracts.

Selected specimens : Loran area, Vohra & Naithani 78341 (BSD); Pahalgam, ca 2500 m, T.A. Rao 545; Aharbal, T.A. Rao 9256; Daksum, Rao 9793; Chandigam, Lolab Valley, T.A. Rao 9466 (BSD).

4. *Euonymus pendulus* Wallich ex Roxb., Fl. Ind. 2: 406. 1824; Lawson in Hook.f., Fl. Brit. India 1: 612. 1875; Sharma & Kachroo, Fl. Jammu 1: 123. 1981; Ramamurthy in Singh *et al.*, Fl. India 5: 106. 2000.

Fig. 106

Small trees, with drooping branches. Leaves opposite, oblong-lanceolate or oblong, 5-10 x 2-7 cm, coriaceous, glabrous on upper surface, margins sharply serrate, Flowers in axillary cymes. Sepals 5-lobed. Petals 5, ovate-oblong. Stamens 5, equalling the petals. Fruits capsular. Seeds enveloped in reddish aril.

Fl. & Fr. : April - December.

Included after Sharma & Kachroo (*loc. cit.*).

Note : Leaves are reported to be used as fodder.

4. MAYTENUS Molina

Maytenus royleanus (Wallich ex Lawson) Cufodont. in Senck. Biol. 43: 313. 1962; Siddiqui in Fl. W. Pak. 109: 11. 1977; Ramamurthy in Singh *et al.*, Fl. India 5: 125. 2000. *Gymnosporia royleana* Wallich ex Lawson in Hook.f., Fl. Brit. India 1: 620. 1875.

Fig. 107

Shrubs with slightly angled or straight branches. Leaves ovate-obovate, 1.5-4.5 x 0.5-2.5 cm, glabrous, serrulate. Flowers in dichotomous cymes. Sepals 4-5-lobed. Petals 4-5, oblong-ovate. Disk lobed. Fruits capsular, turbinate. Seeds arillate.

Fl. & Fr. : January - September.

On hill slopes and as hedge in open places.

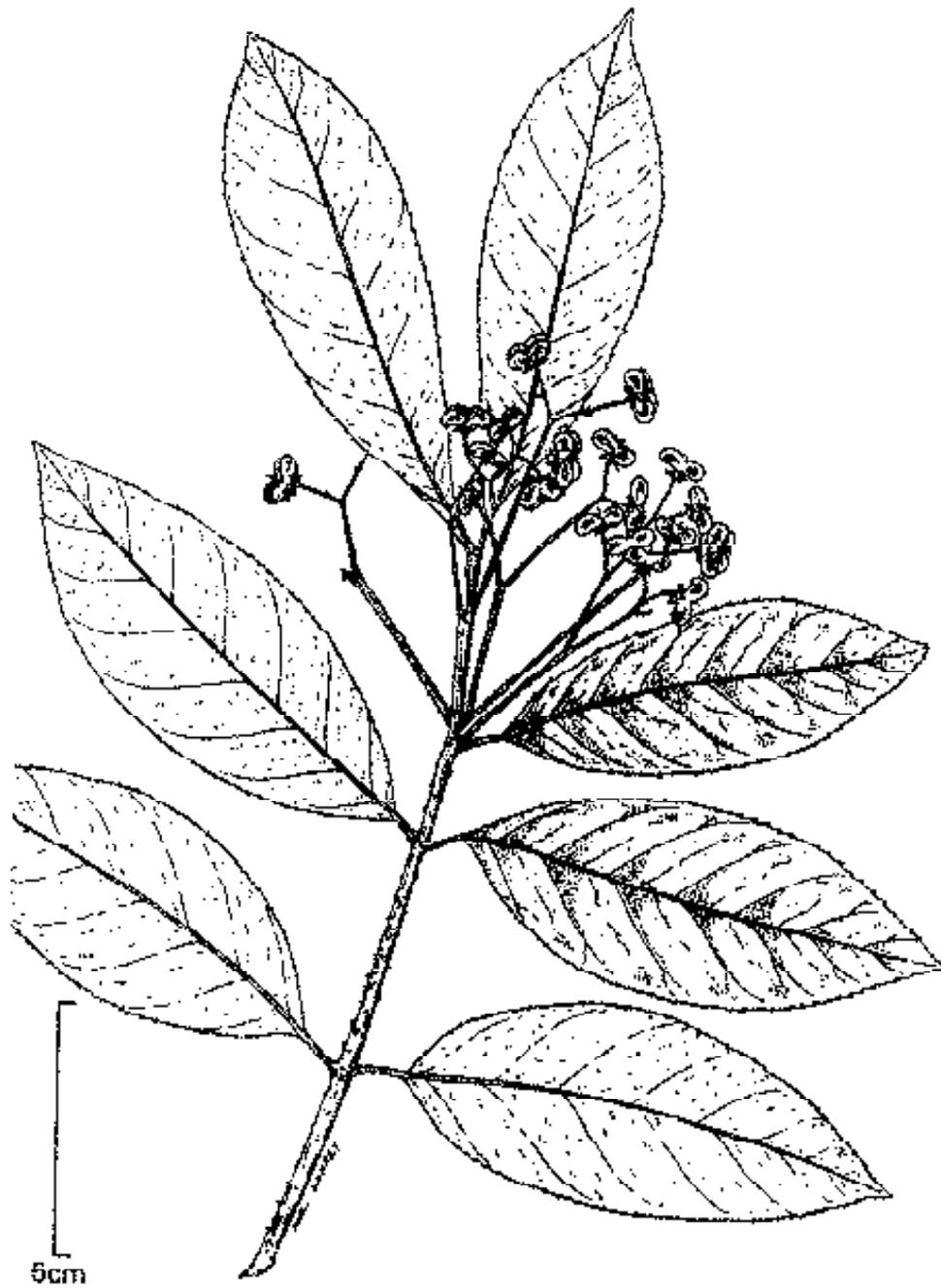


Fig. 106. *Euonymus pendulus* Wallich ex Roxb.

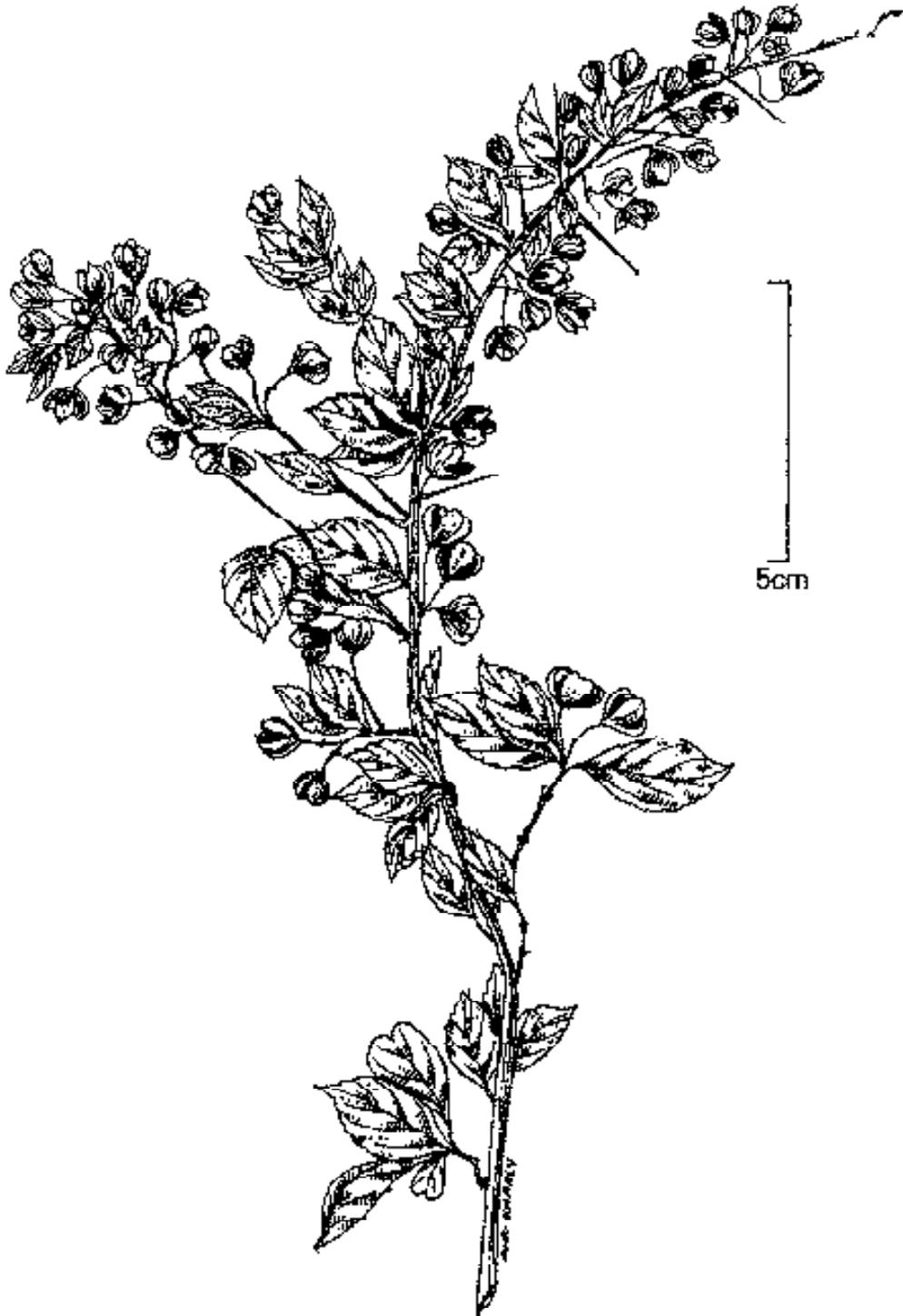


Fig. 107. *Maytenus royleanus* (Wallich ex Lawson) Cufodont.

Selected specimens : Poonch, *Vohra & Naithani* 78244 (BSD); Katra, Reasi, *Uniyal* 77354; Syot, *Uniyal* 92893 (BSD); Sudh Mahadev, Udhampur, *Swami* 1067; Mansar, *Uniyal & Singh*, 91347 (BSD).

RHAMNACEAE

(R. Mathur)

- 1a. Armed shrubs or trees :
- 2a. Fruits drupaceous; drupes globose .
- 3a. Leaves prominently 3-nerved ...8. *Ziziphus*
- 3b. Leaves penninerved :
- 4a. Shrubs or small trees. Leaves alternate. Flowers
in simple or compound racemes ...5. *Rhamnus*
- 4b. Shrubs. Leaves sub-opposite. Flowers sessile,
in terminal panicles or axillary spikes ...6. *Sageretia*
- 2b. Fruits berry like; berries cylindrical ...1. *Berchemia*
- 1b. Plants unarmed :
- 5a. Climbing, cirrhose shrubs :
- 6a. Inflorescence umbellate ...3. *Helinus*
- 6b. Inflorescence racemose or paniculate :
- 7a. Leaf margins crenate-serrate; serratures not
glandular mucro-tipped ...7. *Ventilago*
- 7b. Leaf margins serrate with serratures glandular-
mucro tipped ...2. *Gouania*
- 5b. Trees or erect shrubs :
- 8a. Flowers in axillary cymes. Peduncles swollen and
fleshy ...4. *Hovenia*
- 8b. Flowers in simple or compound racemes. Peduncles
not as above ...5. *Rhamnus*

1. BERCHEMIA Neck. ex DC.

- 1a. Climbing shrubs. Flowers in axillary panicles ...2. *B. floribunda*
- 1b. Erect, diffuse undershrubs. Flowers in axillary
or terminal fascicles :
- 2a. Flowers 6-merous ...1. *B. edgeworthii*
- 2b. Flowers 5-merous ...3. *B. lineata*

1. **Berchemia edgeworthii** Lawson in Hook.f., Fl. Brit. India 1: 638. 1875; Qaiser & Nazimuddin in Fl. Pak. 140: 5. 1981; Bhandari & Bhansali in Singh *et al.*, Fl. India 5: 165. 2000.

Small, unarmed shrubs. Leaves alternate, suborbicular, ovate-elliptic, ca 1.5 cm long, entire, penninerved; petioles 1-3 mm long; stipules as long as the petioles. Flowers yellowish-green in axillary 2-3-flowered clusters, hexamerous. Calyx 5-lobed; lobes acute, longer than the tube. Drupes blue-purple, ovoid-cylindrical.

Fl. & Fr. : June July.

Included after Qaiser & Nazimuddin (*loc. cit.*).

Rare, near the lakes.

2. **Berchemia floribunda** (Wallich) Brongn., Mem. Fam. Rham. 50. t. 2.1.1826; Lawson in Hook.f., Fl. Brit. India 1: 637. 1875; Bhandari & Bhansali Singh *et al.*, Fl. India 5: 165. 2000. *Ziziphus floribunda* Wallich in Roxb., Fl. Ind. 2: 368. 1824; Qaiser & Nazimuddin in Fl. Pak. 140: 4. 1981.

Large climbers. Leaves elliptic or ovate-oblong, up to 8 cm long, acuminate, entire glabrous, paler beneath, stipulate; stipules bifid. Flowers in panicles, pentamerous. Calyx 5-lobed; lobes acute, slightly keeled at the tip. Petals 5. Fruits purple, cylindrical or ellipsoid, ca 1.5 cm long.

Fl. & Fr. : June July.

Selected specimens : Bufiliaz-Bahramgala, 1500-2000 m, Naithani & Vohra 78436 (BSD).

3. **Berchemia lineata** (L.) DC., Prodr. 2: 23. 1825; Lawson in Hook.f., Fl. Brit. India 1: 638. 1875; Bhandari & Bhansali in Singh *et al.*, Fl. India 5: 167. 2000.

Diffuse undershrubs. Branches puberulous. Leaves ovate-elliptic, 0.7-3 x 0.3-2 cm., obtuse, mucronate, rounded at the base, glabrous, entire;

petioles 2.5-3.5 mm long, stipules setaceous. Flowers in axillary or terminal fascicle, 2-4 in a fascicle; pentamerous. Pedicels 2-3 mm long. Petals 5, ca 2 mm long, encircling the stamens. Stamens 3, 2-2.5 mm long, inserted below the disc; anthers with flat filaments. Drupes bluish, ellipsoid or cylindrical 6-10 x 3-5 mm, glabrous. Seeds black and compressed.

Fl. : May November.

On rocks.

Selected specimens : Kishanganga Valley, Kashmir Basin 1800 m. *Keshavanand* 241 (DD).

2. GOUANIA Jacq.

Gouania microcarpa DC., Prodr. 2: 40. 1825; Lawson in Hook.f., Fl. Brit. India 1: 643. 1875; Bhandari & Bhansali in Singh *et al.*, Fl. India 5: 176. 2000. **Fig. 108**

Climbing shrubs; branchlets densely brownish hairy. Tendrils axillary. Leaves 2.8-9.5 x 1.5-5.6 cm, elliptic-ovate, acute, rounded at the base, serrate; serratures glandular tipped; petioles 5-16 mm long, villous with brownish hairs; stipules 3-6 mm long, subulate, pubescent. Flowers, sessile, in clusters arranged in racemes, white; bracteoles conspicuous, 2-3 mm long, lanceolate; calyx-lobes deltoid; thickened at the apex, keeled inside up to middle, densely pubescent; petals oblanceolate, spatulate. Polished green glabrous, crowned by persistent calyx, 3 winged; wings yellow.

Fl. & Fr. : June may.

Included after Bhandari & Bhansali (*loc. cit.*).

3. HELINUS E. Meyer

Helinus lanceolatus Brandis, For. Fl. 574. 1874; Lawson in Hook.f., Fl. Brit. India 1: 644. 1875; Sharma & Kachroo, Fl. Jammu 1: 125. 1981; Bhandari & Bhansali in Singh *et al.*, Fl. India 5: 179. 2000. **Fig. 109**

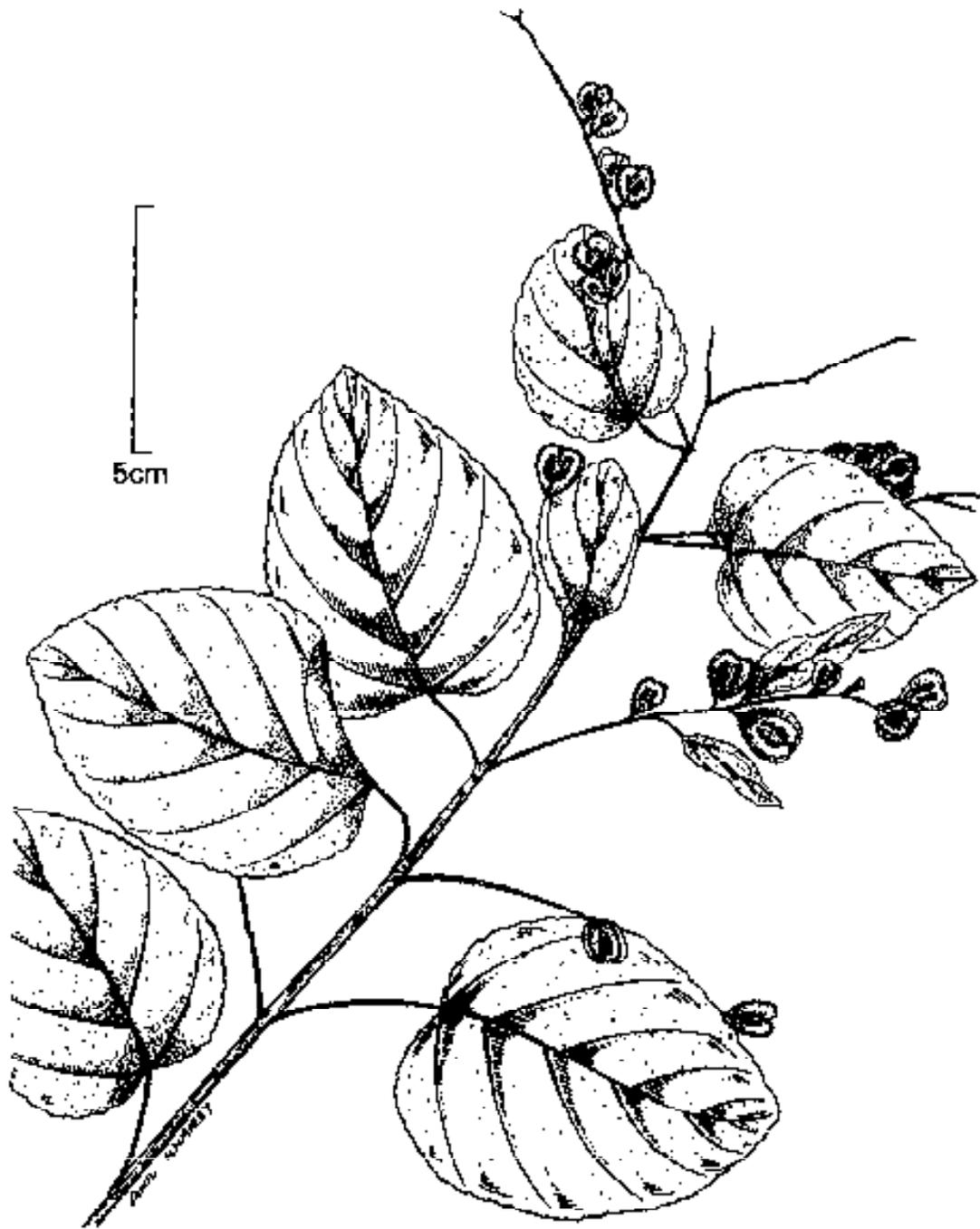


Fig. 108. *Gouania microcarpa* DC.

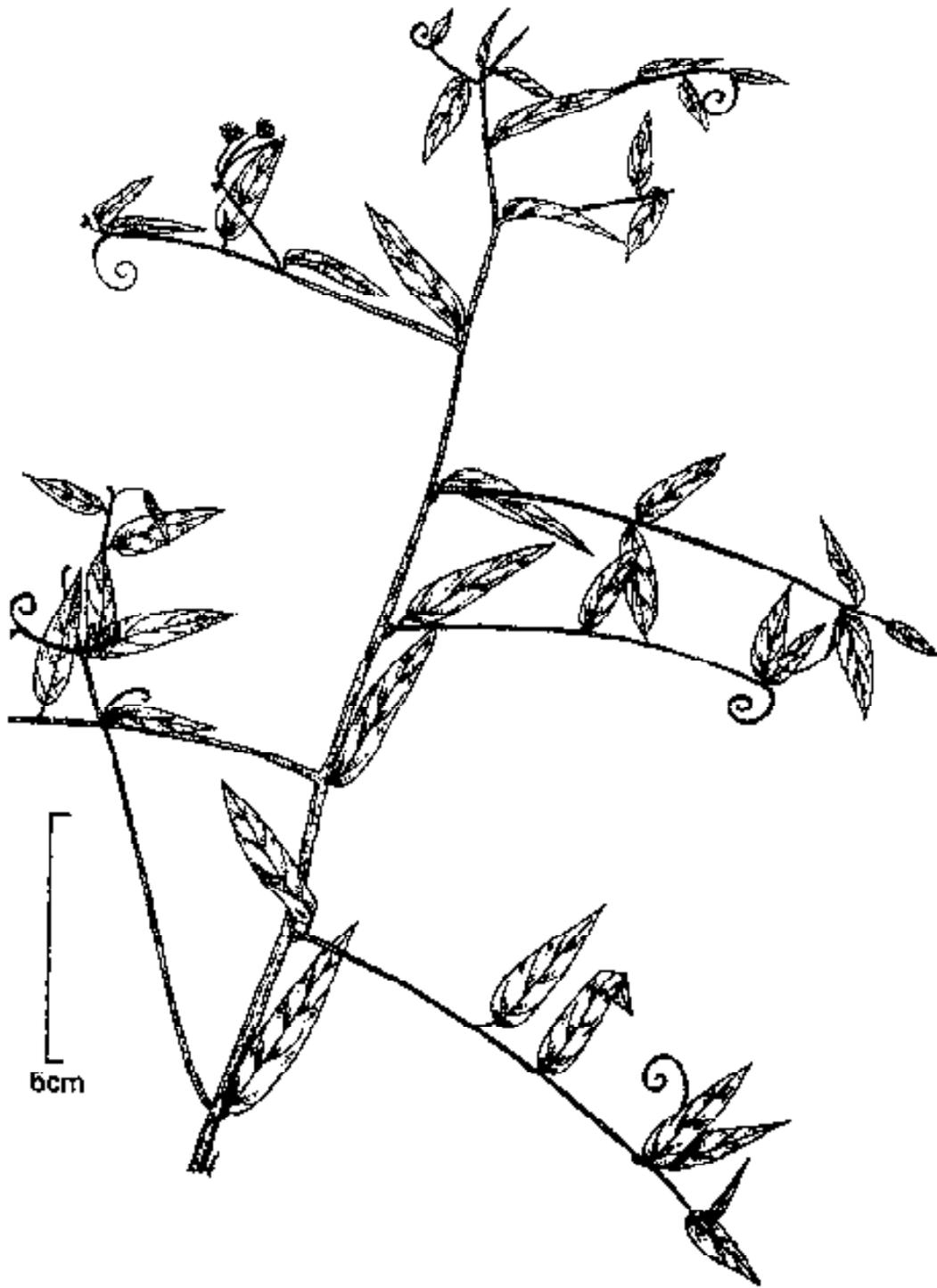


Fig. 109. *Helinus lanceolatus* Brandis

Slender, twining, glabrous shrubs. Branchlets ending in short, simple tendrils. Leaves alternate, ovate to ovate-lanceolate, 2.5-3.5 cm. entire. Flowers umbellate, on long slender peduncles. Petals 5, inserted on the margin of the disc, margin and apex incurved enclosing stamens. Fruits obovoid, not winged, coriaceous.

Fl. & Fr. : March May.

In forest margins, in dry open woody vegetation, along the ravines and banks of streams.

Selected specimens : Poonch-Kalai, 1200-1500 m, *Vohra & Naithani* 78240 (BSD); Jhajar Kotli, Udhampur, *Swami* 1118. (BSD); Kishanganga valley, *Keshavanand* 687 (DD).

4. HOVENIA Thunb.

Hovenia dulcis Thunb., Nov. Gen. 8. 1781 et Fl. Jap. 101. 1784; Lawson in Hook.f., Fl. Brit. India 1: 640. 1875; Bhandari & Bhansali in Singh *et al.*, Fl. India 5: 180. 2000.

Small, unarmed trees. Leaves, alternate, cordate-ovate, 8-12 cm x 4-6 cm, caudate-acuminate, entire or deeply and sharply serrate, glabrous. Flowers white, in axillary pedunculate cymes. Calyx 5-fid, broadly obconical; segments ovate, coriaceous. Petals 5. Stamens 5, longer than the petals. Fruits coriaceous, 3-seeded, on thick, fleshy peduncles.

Fl. & Fr. : April June.

By the side of river and streams.

Selected specimens : Jammu Province, banks of Bislar stream, Chenab valley, 1500 m, *Keshavanand* 155 (DD).

5. RHAMNUS L.

1a. Procumbent, small shrubs

...4. *R. procumbens*

1b. Erect, tall shrubs or trees :

- 2a. Armed shrubs; branches often ending in a thorn :
- 3a. Leaves up to 2.2 cm long, glabrous above, velvety beneath ...2. *R. pentapomica*
- 3b. Leaves up to 4 cm long, glabrous on both surfaces or minutely pubescent on lower surface :
- 4a. Leaves alternate or subopposite, fascicled on short branchlets :
- 5a. Branches straight; branchlets forming a dense rounded crown ...1. *R. dahuricus*
- 5b. Branches divergent; branchlets not as above ...5. *R. prostrata*
- 4b. Leaves opposite, not fascicled ...3. *R. persica*
- 2b. Unarmed trees or shrubs :
- 6a. Deciduous trees or shrubs; branches purplish. Flowers in axillary clusters ...6. *R. purpurea*
- 6b. Evergreen shrubs; branches not purplish. Flowers in axillary racemes ...7. *R. triqueter*

1. *Rhamnus dahuricus* Pall. in Reiss. 3: 721. 1776 et Fl. Ross. 2. t. 61. 1789; Lawson in Hook.f., Fl. Brit. India 1: 639. 1875; Bhandari & Bhansali in Singh *et al.*, Fl. India. 5: 185. 2000. *R. virgata* Roxb., Fl. Ind. 2: 351. 1824; Sharma & Kachroo, Fl. Jammu 1: 125. 1981.

Spinescent, large shrubs or small trees. Leaves opposite, elliptic, obovate, 1.5-8 x .5-3 cm, acuminate, glabrous. Flowers greenish, in axillary clusters, tetramerous, on slender pedicels. Calyx lobes deltoid, 5-7 mm long, not keeled. Petals linear or spatulate. Drupes obovate-orbicular, ca 1.5 cm long, 1-seeded.

Fl. & Fr. : May August.

Selected specimens : Dachigam Sanctuary, Wadhwa 66870 (BSD); Kishtawar, Zeor village, Uniyal 80997 (BSD), Loran, across the river, 2000-2500 m, Vohra & Naithani 78301 (BSD).

2. *Rhamnus pentapomica* Parker in Kew Bull. 1921: 216. 1921; Sharma & Kachroo, Fl. Jammu, 1: 125. 1981; Bhandari & Bhansali in

Singh *et al.*, Fl. India 5: 189. 2000. *R. persica* Lawson in Hook.f., Fl. Brit. India 1: 638. 1875, *p.p. non* Boiss.

Deciduous shrubs or small trees. Branches velutinous, ending in thorns. Leaves oblong, elliptic-lanceolate, 1.2-5 x 0.4-2.2 cm, acute, glabrous above, velvety beneath; petioles 2-10 cm long, pubescent. Flowers crowded in the axils of fascicled leaves. Pedicels 3-5 mm long. Calyx lobes deltoid, acute. Petals deeply cucullate, enclosing stamens. Drupes black, obovoid-globose.

Fl. & Fr. : October March.

Selected specimen : Kashmir, Mangla, Lambert 268 (DD).

3. *Rhamnus persica* Boiss., Fl. Orient. 2: 17. 1872; Lawson in Hook.f., Fl. Brit. India 1: 638. 1875; Bhandari & Bhansali in Singh *et al.*, Fl. India 5: 190. 2000.

Deciduous, armed shrubs or small trees, up to 6 m tall. Leaves alternate or fascicled on short shoots, ovate, elliptic-lanceolate, obovate or oblong, 1.5-3 x 0.7-1.5 cm, coriaceous, obtuse. Flowers in the axils of leaves, clustered. Pedicels short, *ca* 5 mm long. Calyx lobes deltoid, not keeled, glabrous. Drupes obovoid, 5-7 mm long. Seeds shining.

Fl. & Fr. : March December.

Included after Bhandari & Bhansali (*loc. cit.*).

4. *Rhamnus procumbens* Edgew. in Trans. Linn. Soc. 20. 43. 1851; Lawson in Hook.f., Fl. Brit. India 1: 640. 1875; Bhandari & Bhansali in Singh *et al.*, Fl. India 5: 190. 2000. Fig. 110

Small, prostrate shrubs. Leaves lanceolate or elliptic, 2.5-4 cm long, acute, serrulate, coriaceous; petioles 2-7 mm long; stipules persistent, subulate. Flowers in axillary fascicles on slender pedicels. Calyx lobes deltoid, not keeled. Petals absent. Drupes obovoid, 3-5 mm in diam., fleshy.

Fl. & Fr. : May June.



Fig. 110. *Rhamnus procumbens* Edgew.

Common on rocks.

Included after Bhandari & Bhansali (*loc. cit.*).

5. *Rhamnus prostrata* Jacq. ex Parker in Kew Bull. 1921 : 217, 1921; Sharma & Kachroo, Fl. Jammu, 1: 126. 1981; Qaisar & Nazimuddin in Fl. Pak. 140: 22. 1981; Bhandari & Bhansali, in Singh *et al.*, Fl. India 5: 192. 2000. Fig. 111

Armed, tall deciduous shrubs; branches stiff and divaricate. Leaves 4.5-14 x 2.5-7.5 cm, oblong to elliptic-lanceolate, glabrous above, minutely tomentose beneath; petioles 1-3 mm long. Flowers greenish in axillary clusters, tetramerous. Calyx lobes deltoid, acute. Petals minute, obovate or spatulate, enclosing the stamens. Fruits black obovoid-globose, 2-4 celled.

Fl. & Fr. : July - October.

Selected specimen : Minimarg, 2700 m, Stewart 19175 (DD). Ladakh, Dras, 2800 m. *Bhattacharyya* 41204 (BSD); Ladakh, Zongtse, 4500 m, *Viswanathan* 55079 (BSD); Ladakh, on way to Mathoo-phu, 3900 m, *Wadhwa* 59609 (BSD).

6. *Rhamnus purpureus* Edgew. in Trans. Linn. Soc. 20.44. 1851; Lawson in Hook.f., Fl. Brit. India 1: 639. 1875; Sharma & Kachroo, Fl. Jammu : 125. 1981; Dhar & Kachroo, Alp. Fl. Kashmir Himal. 196. 1983; Bhandari & Bhansali in Singh *et al.*, Fl. India 5: 193. 2000.

Deciduous, unarmed, trees or shrubs. Branchlets purplish. Leaves alternate, ovate-elliptic or ovate-lanceolate, 5-10 x 1.5-8 cm, acute. Flowers reddish in small, axillary clusters, 0.7-1.5 cm long. Petals absent. Drupes reddish, obovoid. Seeds black, heart shaped.

Fl. & Fr. : June - August.

In fir forests, in shady places.



Fig. 111. *Rhamnus prostrata* Jacq. ex Parker

Selected specimens : Kishanganga valley, Keyan, 2400-2700 m. *Keshavanand* 215; Kashmir, Jhelum valley, Daitwas forest, Kihuhama Range, 2400 m, *Keshavanand* 1278 (DD); Gulmarg, 2400-2700 m, *Duthie* 13037 (DD).

7. *Rhamnus triqueter* (Wallich) Brandis, For. Fl. 92. 1874; Lawson in Hook.f., Fl. Brit. India 1: 639. 1875; Sharma & Kachroo, Fl. Jammu 1: 125. 1981; Bhandari & Bhansali in Singh *et al.*, Fl. India 5: 195. 2000. *Ceanothus triqueter* Wallich in Roxb., Fl. Ind. 2: 376. 1824.

Small, evergreen trees; bark blackish purple. Branches and leaves slightly tomentose. Leaves ovate to elliptic-oblong, 6-12 cm x 2.5-4 cm, petioles *ca* 1-1.5 cm long. Flowers red, fasciated in axillary racemes. Calyx lobes deloid, up to 2.5 mm long. Petals broadly obovate. Styles 3-4 cleft, cohering near the apex. Drupes obovoid, 3-lobed.

Fl. & Fr. : June August.

In Chir forests.

Selected specimens : Muchhedi-Sukral, *Hajra* 82505 (BSD); Jammu, Tawi valley, 900 m, *Gammie s.n.* (DD); Jammu, Adel forest, Kotli, 900 m, *Keshavanand* 648 (DD); Balmarg, 1350 m, *Lambert*, 233 (DD).

6. SAGERETIA Brongn.

- 1a. Leaves persistently woolly on lower surface ...1. *S. brandrethiana*
- 1b. Leaves glabrous or pubescent on lower surface becoming glabrous later :
 - 2a. Stamens longer than the petals ...3. *S. kishwarensis*
 - 2b. Stamens shorter than or equalling the petals :
 - 3a. Flowers pubescent ...4. *S. parviflora*
 - 3b. Flowers glabrous :
 - 4a. Leaves less than 2 cm long. Petals mucronate ...2. *S. kashmirensis*
 - 4b. Leaves more than 2 cm long. Petals not mucronate ...5. *S. thea*

1. *Sageretia brandrethiana* Aitch. in J. Linn. Soc. 8: 62. 1865; Lawson in Hook.f., Fl. Brit. India 1: 642. 1875; Bhandari & Bhansali in Singh *et al.*, Fl. India 5: 198, 2000. *S. thea* var. *brandrethiana* (Aitch.) Qaisar & Nazimuddin in Fl. Pak. 140: 8: 1981. *Ganger* (Kashmiri).

Tall, spinescent, up to 5 m tall, white tomentose shrubs. Branches stiff, diverging. Leaves elliptic, or oblong, 1-2.5 x 0.5-2 cm, acute, entire or subdentate; shortly petioled. Flowers in axillary or terminal, sessile panicles. Calyx lobes ca 2 mm long, keeled. Petals obovate. Drupes black, ovoid, obtuse, succulent, 3-lobed, with raised nerves.

Fl. & Fr. : May June.

Selected specimens : Kashmir, 900 m, Singh 1819 (RRL); Kishanganga valley, Karnal stream, 900 m, Keshavanand 265 (DD).

2. *Sageretia kashmirensis* Bhandari & Bhansali in J. Econ. Tax. Bot. 5(4): 923. f. 2. 1984 *et in* Singh *et al.*, Fl. India 5: 200. 2000.

Armed, or unarmed shrubs. Branches glabrous; spines ca 4 cm long, strong. Leaves ovate, 0.6-1.6 x 0.5-1.2 cm, obtuse, distantly serrulate, glabrous on both surfaces; stipules up to 8 cm long, caducous; petioles short, 1-2 cm long, hairy. Flowers in axillary and terminal panicles, sessile, 2-3 in a cluster. Bracts 1-2 mm long, caducous. Petals obovate, notched at the tip, with a mucro.

Fl. & Fr. : July August.

Selected specimens : Kashmir, Bhandarwah, 1830 m, Wadhwa & Vohra 560 (CAL).

Endemic to Kashmir.

3. *Sageretia kishtawarensis* Bhandari & Bhansali in J. Econ. Tax. Bot. 5(4): 925. f. 3. 1984 *et in* Singh *et al.*, Fl. India 5: 202. 2000.

Armed shrubs. Branches scandent, white speckled. Leaves opposite, rotundate or orbicular, 1-2.5 x 0.6-2 cm, subcoriaceous, obtuse, minutely

serrate, glabrous on both surfaces. Flowers 2-3, in clusters arranged in terminal and axillary panicles. Sepals deltoid, 1.5-2.5 mm long, acute, margins thick, keeled below the middle, long, cucullate. Filaments acicular.

Fl. & Fr. : May - December.

Selected specimen : Bhaderwah/Jai, T.A. Rao 9035; Thathri/Kishtwar, T.A. Rao 7770; Bhaderwah, T.A. Rao 7920 (BSD).

4. *Sageretia parviflora* (Roem. & Schult.) G. Don, Gen. Syst. 2: 29. 1832; Bhandari & Bhansali in Singh *et al.*, Fl. India 5: 202. 2000. *Rhamnus parviflora* Roem. & Schult., Syst. Veg. 5: 295. 1819. *Sageretia oppositifolia* Brongn., Mem. Fam. Rham. 53: 1826; Lawson in Hook.f., Fl. Brit. India 641. 1875. *S. filiformis* (Roth) G. Don, Gen. Syst. 2: 29, 1832; Qaisar & Nazimuddin in Fl. Pak. 140: 7. 1981.

Large, armed, shrubs or small trees. Branches often climbing, angular; young parts tomentose. Leaves ovate, elliptic or lanceolate, 2.5-10.2 x 1-3.5 cm, shortly acuminate, subcoriaceous, dark green, shining above, hairy on nerves beneath; petioles 2-14 mm long, villous; stipules linear, 1.5-3 mm long, villous. Flowers sessile. Petals obovate, 1-1.5 mm long. Drupes black, turbinate with persistent style.

Fl. & Fr. : July - January.

Common in hedges and forests along road sides in open, dry places.

Selected specimens : Udampur, Ghordi village, Swami 1133; Udampur city Swami 670 (BSD); Buffiaz-Bahramgala, 1500-2000 m, Vohra & Naithani 78429 (BSD).

5. *Sageretia thea* (Osbn.) Johnston in J. Arn. Arb. 49: 337. 1968; Qaisar & Nazimuddin in Fl. Pak. 140: 7. 1981; Bhandari & Bhansali in Singh *et al.*, Fl. India 5: 204. 2000. *Rhamnus thea* Osbn., Dagb. Ostind. Resa 232. 1757. *Sageretia theezans* (L.) Brongn., Mem. Fam. Rham. 53. 1826; Sharma & Kachroo, Fl. Jammu 1: 126. 1981; Lawson in Hook.f., Fl. Brit. India 1: 641. 1875. *S. theezans* var. *diospyrifolia* Lawson in Hook.f., Fl. Brit. India 1: 642. 1875.

Armed shrubs. Leaves opposite at the base, alternate above, elliptic or ovate, 2.5-3 cm long, distinctly serrate, glabrous, glaucous on both surfaces, paler beneath. Flowers in long, slender spikes or in terminal and lateral panicles, up to 4 mm in diam. Petals yellow, obcordate, emarginate. Fruits dark brown, globose, fleshy, rugose.

Fl. & Fr. : May November..

On the roadside rocks and in open scrub forests.

Selected specimens : Poonch-Kalai, 1200-1500 m, *Vohra & Naithani* 78239 (BSD); Batote/chenab valley, 1200-1700 m, *T.A. Rao* 7335 (BSD); Udhampur, Mantalai, *Swami* 1192 (BSD); Jammu, Tawi valley, Chinani forest, *Keshavanand* 38 (DD),

7. VENTILAGO Gaertn.

Ventilago denticulata Willd. in Ges. Naturf. Fr. Neue. Schr. 3: 417. 1801; Bhandari & Bhansali in Singh *et al.*, Fl. India 5: 217. 2000. *V. calyculata* Tul. in Ann. Sci. Nat. Ser. 8. 4: 124. 1857; Lawson in Hook.f., Fl. Brit. India 1: 631. 1875.

Large, woody, climbing shrubs. Leaves ovate or ovate-elliptic 4-16 x 2.5-8.5 cm, subacute, oblique at base, subcoriaceous, crenate-serrate or rarely entire. Flowers in terminal or axillary panicles. Calyx lobes deltoid, hairy within. Petals spatulate, ca 1.5 mm long. Fruit a samara, pubescent.

Fl. & Fr. : March June.

Included after Bhandari & Bhansali (*loc. cit.*).

8. ZIZIPHUS Tourn. ex Mill.

- 1a. Drupes dry, covered with dense grey tomentum ...7. *Z. xylopyra*
- 1b. Drupes fleshy, glabrous :
 - 2a. Erect shrubs or trees :
 - 3a. Shrubs with drooping branches ...4. *Z. mauritiana*

- 3b. Shrubs with branches not drooping :
- 4a. Branchlets fasciculate ...2. *Z. glabrata*
- 4b. Branchlets not fasciculate :
- 5a. Branches brownish with purplish warty growth and purple thorns ...5. *Z. oxyphylla*
- 5b. Branches spreading, pubescent with straight thorns ...3. *Z. jujuba*
- 2b. Climbing or scandent shrubs :
- 6a. Branches glabrous, drupes pyriform ...6. *Z. rugosa*
- 6b. Branches hairy or tomentose; drupes globose or egg-shaped, black or yellow ...1. *Z. funiculosa*

1. *Ziziphus funiculosa* Buch.-Ham. ex Lawson in Hook.f., Fl. Brit. India 1: 636. 1875; Bhandari & Bhansali in Singh *et al.*, Fl. India 5: 227. 2000.

Large, armed, climbing shrubs. Branches slender, golden silky hairy; prickles stout, recurved. Leaves obliquely ovate or elliptic-oblong, 5-10 x 2-4 cm, oblique at the base, glabrous, serrate, 3-nerved. Flowers arranged in panicles. Calyx lobes deltoid, 2 mm long, acute, glabrous inside, tomentose outside, thickened at the margins. Petals obovate, 1.5 mm long, spreading. Filaments flat. Fruits yellow, egg shaped, 1.3-1.8 cm long, glabrous.

Fl. & Fr. : March - October.

Included after Bhandari & Bhansali (*loc. cit.*).

2. *Ziziphus glabrata* Heyne ex Roth, Nov. Pl. Sp. 159. 1821; Lawson in Hook.f., Fl. Brit. India 1: 633. 1875; Bhandari & Bhansali in Singh *et al.*, Fl. India 5: 229. 2000.

Unarmed trees. Branchlets glabrous. Leaves lanceolate or ovate-oblong, 1.8-10.3 x 1.3-5.2 cm, acute, crenate, glabrous, shining, bifarious; petioles 3-9 mm long; stipules filiform, deciduous. Flowers yellowish green, in axillary fascicles, puberulous, on 4-5 mm long pedicels. Calyx lobes 2-3 mm long, glabrous, keeled up to the middle. Petals obtriangular, 1-

2 mm long, acute. Filaments flattened. Styles 2-cleft, connate up to the middle, curved. Fruits globose, 10-11 mm in diam., flattened.

Fl. & Fr. : September - January

In dry plains and in grasslands at low elevations.

Included after Bhandari & Bhansali (*loc. cit.*).

3. *Ziziphus jujuba* Mill., Gard. Diet. ed. 8: 1768; Qaisar & Nazimuddin in Fl. Pak. 140: 15. 1981; Bhandari & Bhansali in Singh *et al.*, Fl. India 5: 232. 2000. *Z. vulgaris* Lam., Encycl. 3: 317. 1789; Lawson in Hook.f., Fl. Brit. India 1: 632. 1875; Sharma & Kachroo, Fl. Jammu 1: 124. 1981. *Brei, Bari.*

Evergreen shrubs, with spreading and pubescent branches; prickles straight. Leaves elliptic, ovate or orbicular, 2.5-6 cm x 4 cm, entire or toothed, oblique at the base, dark green above, yellowish tomentose beneath. Flowers greenish yellow, in axillary clusters. Fruits yellow, becoming orange-red on ripening, globose, fleshy.

Fl. & Fr. : May - June.

On dry slopes and forest openings.

Selected specimens : Kashmir, 1650 m, Wadhwa 66789 (BSD); Kashmir, 1750 m, T.A. Rao 9506 (BSD).

4. *Ziziphus mauritiana* Lam., Encycl. 3: 319. 1789; Qaiser & Nazimuddin in Fl. Pak. 140: 10. 1981; Bhandari & Bhansali, in Singh *et al.*, Fl. India 5: 233. 2000. *Rhamnus jujuba* L., Sp. Pl. 194. 1753. *Ziziphus jujuba* (L.) Gaertner, Fruct. 1: 203. 1788, *non* Mill., 1768; Lawson in Hook.f., Fl. Brit. India 1: 632. 1875; Sharma & Kachroo, Fl. Jammu 1: 124. 1981. *Malah, Granda.* Fig. 112

Armed, evergreen shrubs, up to 4 m tall. Branches drooping, softly hairy. Leaves alternate, elliptic-ovate, orbicular, entire or toothed, dark

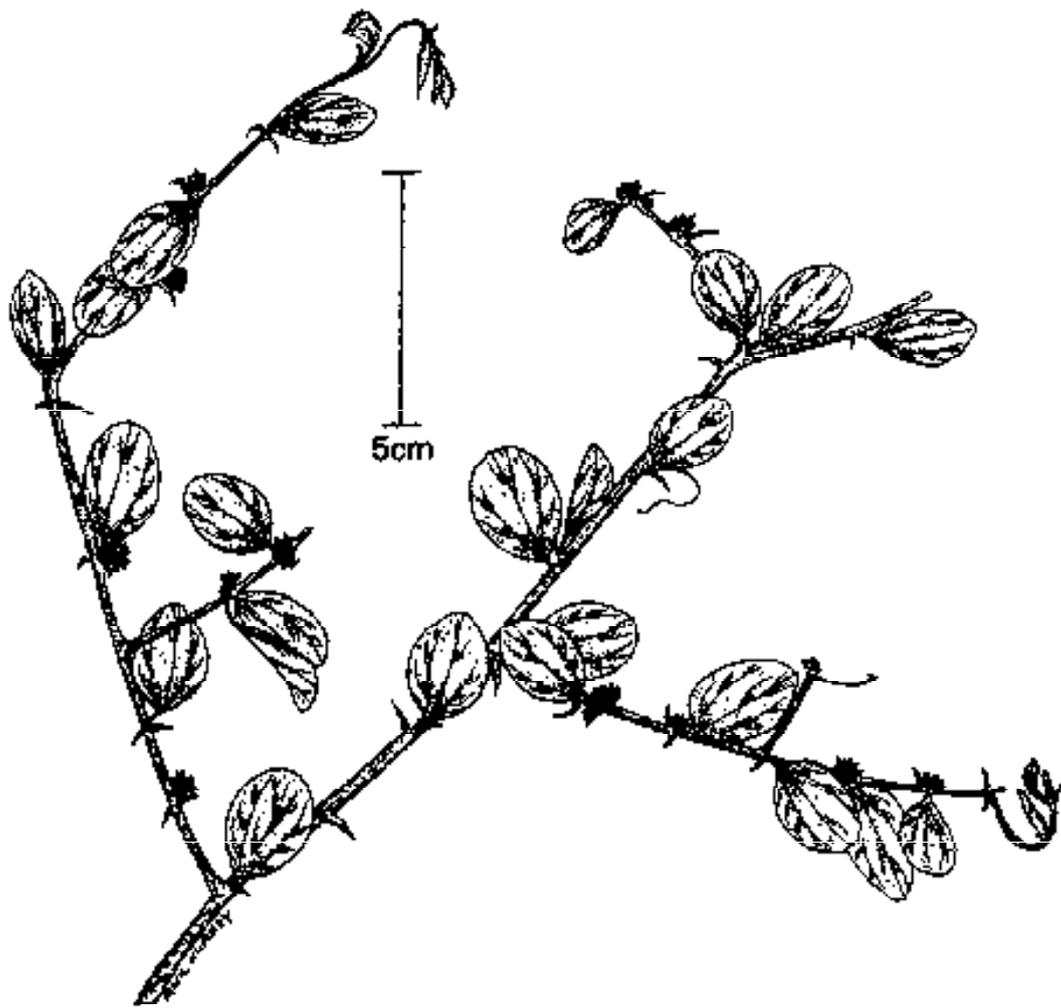


Fig. 112. *Ziziphus mauritiana* Lam.

green, with 3-prominent veins above, pale and woolly beneath. Flowers in axillary clusters. Calyx lobes glabrous. Fruits yellow, becoming orange, red, globose, fleshy.

Fl. & Fr. : May - September.

On dry slopes and forest openings.

Selected specimens : Udampur, Binbara, *Hajra* 82407 (BSD); Jammu, Kud, 380-1650 m, *T.A. Rao* 7319 (BSD); Udampur Aerodrome, *Swami* 881 (BSD).

5. *Ziziphus oxyphylla* Edgew. in *Trans. Linn. soc.* 20: 43. 1846; Lawson in *Hook.f., Fl. Brit. India* 1: 634. 1875; Sharma & Kachroo, *Fl. Jammu* 1: 124. 1981; Qaisar & Nazimuddin in *Fl. Pak.* 140: 14. 1981; Bhandari & Bhansali in *Singh et al., Fl. India* 5: 239. 2000. **Fig. 113**

Armed, deciduous, glabrous shrubs or trees. Branches brownish, with purplish warty growths and purple thorns. Leaves obliquely ovate, 3-6 x 1.5-3.5 cm, acute, glabrous, crenate-serrate. Flowers yellowish green, fascicled in the axils of the leaves. Calyx lobes 2-3 mm long, thickened along margins. Petals clawed. Drupes black, ovoid *ca* 8 cm long, fleshy.

Fl. & Fr. : March - May.

Selected specimens : Banganga-Adhkumari, *Uniyal* 77392; Salal Hydro-Electric project area, *Uniyal* 86646 (BSD); Poonch-Kalai, 1200-1500 m, *Vohra & Naithani* 78225 (BSD). Kishanganga valley, 1000 m, *Keshavanand* 1662 (DD).

6. *Ziziphus rugosa* Lamk., *Encycl.* 3: 319. 1789; Lawson in *Hook.f., Fl. Brit. India* 1: 636. 1875; Qaiser & Nazimuddin in *Fl. Pak.* 140: 11. 1981; Bhandari & Bhansali in *Singh et al., Fl. India* 5: 240. 2000.

Armed, scandent shrubs or small trees. Leaves broadly elliptic or ovate-oblong, 5.5-13 x 3-10.5 cm, oblique or cordate at the base, glabrous above, densely tomentose beneath. Flowers greenish yellow in axillary and

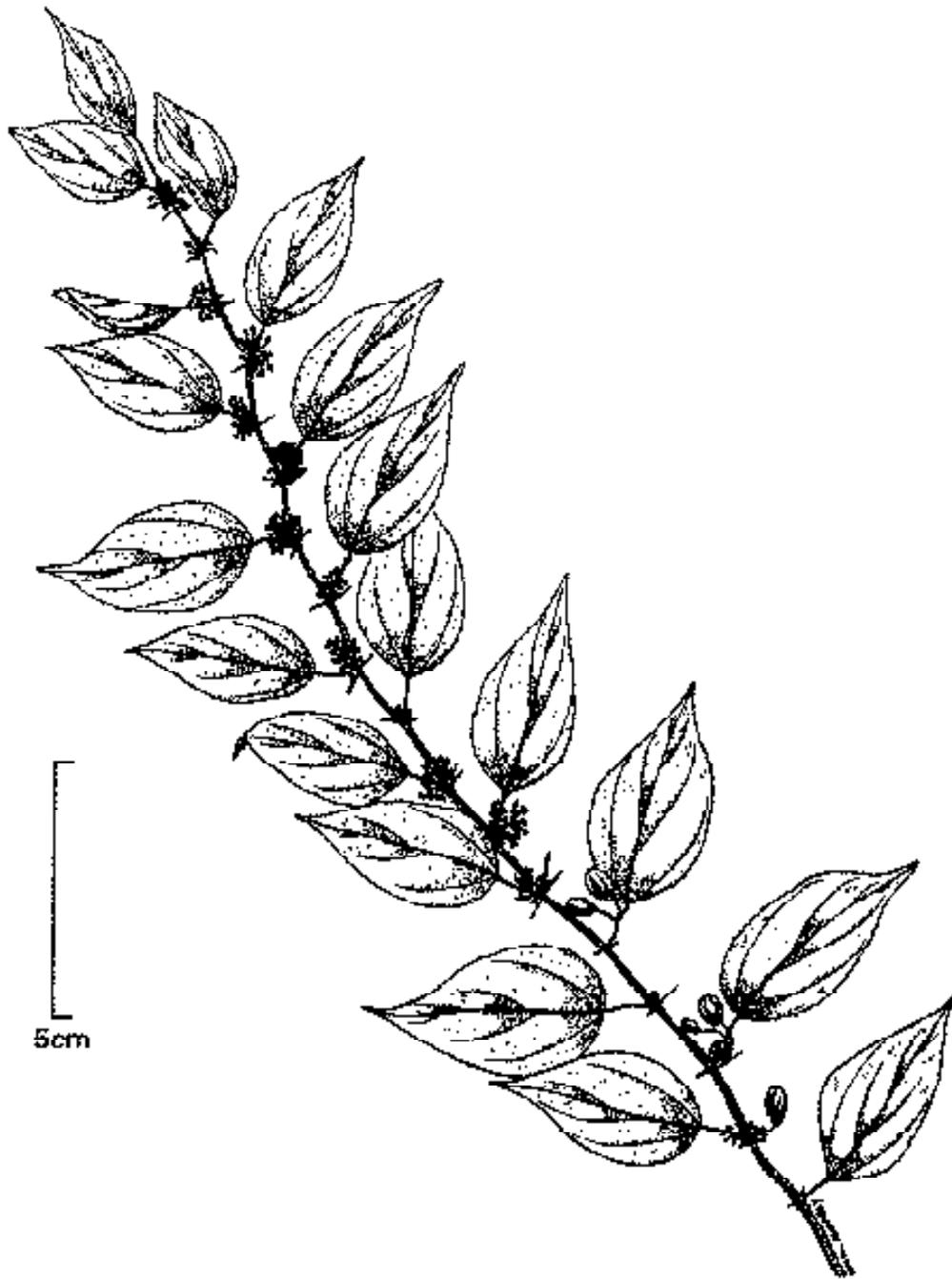


Fig. 113. *Ziziphus oxyphylla* Edgew.

terminal, long panicles. Drupes fleshy. Calyx lobes pubescent outside obovoid-globose

Included after Bhandari & Bhansali. (*loc. cit.*).

7. *Ziziphus xylopyra* (Retz.) Willd., Sp. Pl. 1: 1104. 1797; Lawson in Hook.f., Fl. Brit. India 1: 634. 1875; Bhandari & Bhansali in Singh *et al.*, Fl. India 5: 243. 2000. *Rhamnus xylopyrus* Retz., Obs. Bot. 2: 11. 1781.

Erect trees or straggling shrubs. Leaves elliptic-oblong, ovate-oblong or suborbicular, 3.5-3 cm x 3-5.5 cm, acute, crenate-serrate, oblique, at base, glabrous above, tomentose beneath; stipular prickles paired, one straight and the other hooked. Flowers greenish-yellow in axillary or paniculate cymes. Calyx lobes keeled up to middle. Petals 1.5-2 mm long. Drupes globose, 2-2.5 cm in diam., covered with dense grey-tomentum.

Fl. & Fr. : June July.

Selected specimens : Poonch, *Abrol* 1877 (RRL).

Recently *Ziziphus nummularia* (Burm.f.) Wight & Arn. (*Ber*) has also been recorded from the state.

VITACEAE

(R. Mathur)

- 1a. Flowers polygamous :
 - 2a. Inflorescence not tendril bearing. Leaves 5-foliolate ...5. *Tetrastigma*
 - 2b. Inflorescence usually tendril bearing :
 - 3a. Leaves simple. Petals 5, usually calyptrate ...6. *Vitis*
 - 3b. Leaves simple or digitate. Petals 4-5, spreading or recurved ...1. *Ampelocissus*
- 1b. Flowers hermaphrodite :
 - 4a. Leaves coriaceous, thickly pubescent on both surfaces; lateral leaflets slightly oblique; the broader side often lobed; petioles up to 4 cm long ...3. *Cayratia*

4b. Leaves membranous, glabrous; lateral leaflets oblique, one side semi-cordate and the other elliptic; petioles up to 10.5 cm long :

5a. Tendrils without disk like adhesive appendages ...2. *Ampelopsis*

5b. Tendrils with disk like adhesive appendages

...4. *Parthenocissus*

1. AMPELOCISSUS Planch.

Ampelocissus latifolia (Roxb.) Planch. in Vigne Amer. 8: 374. 1884. Shetty & Singh in Singh *et al.*, Fl. India 5: 256. 2000. *Vitis latifolia* Roxb., Fl. Ind. 2: 474. 1824; Lawson in Hook.f., Fl. Brit. India 1: 657. 1875.

Fig. 114

Large, herbaceous, perennial climbers. Leaves sub-orbicular-cordate, 5-lobed; lobes dentate, tomentose beneath, petioles shorter than the leaves. Tendrils long, bifid. Flowers dark reddish-brown, pentamerous, on short, thick pedicels in compound pyramidal panicles. Petals conspicuous. Fruits black, when mature, globose, 2-4-seeded.

Fl. & Fr. : May July.

Selected specimens : Udampur dist., Mantalai village, Swami 1191 (BSD); Jakhpar, Hajra 82425 (BSD); Kashmir, Poonch, Abrol 1917 (RRL).

2. AMPELOPSIS A. Rich. ex Michaux

Ampelopsis vitifolia (Boiss.) Planch. in DC., Monogr. Phan. 5: 454. 1857; Shetty & Singh in Singh *et al.*, Fl. India 5: 266. 2000. *Vitis persica* Boiss., Fl. Or. 1: 955, 1867.

Slender, spreading climbers. Branches glabrous, pale-brown. Leaves broadly ovate, 4.5-10 cm long, 3-lobed, cordate, caudate acuminate, coarsely toothed, glabrous, pale beneath, 5-nerved; petioles up to 5 cm long. Flowers green, on stout, short pedicels. Petals 5, free. Styles subulate. Fruits black with two rings of persistent calyx at the base.

Fl. & Fr. : May September.

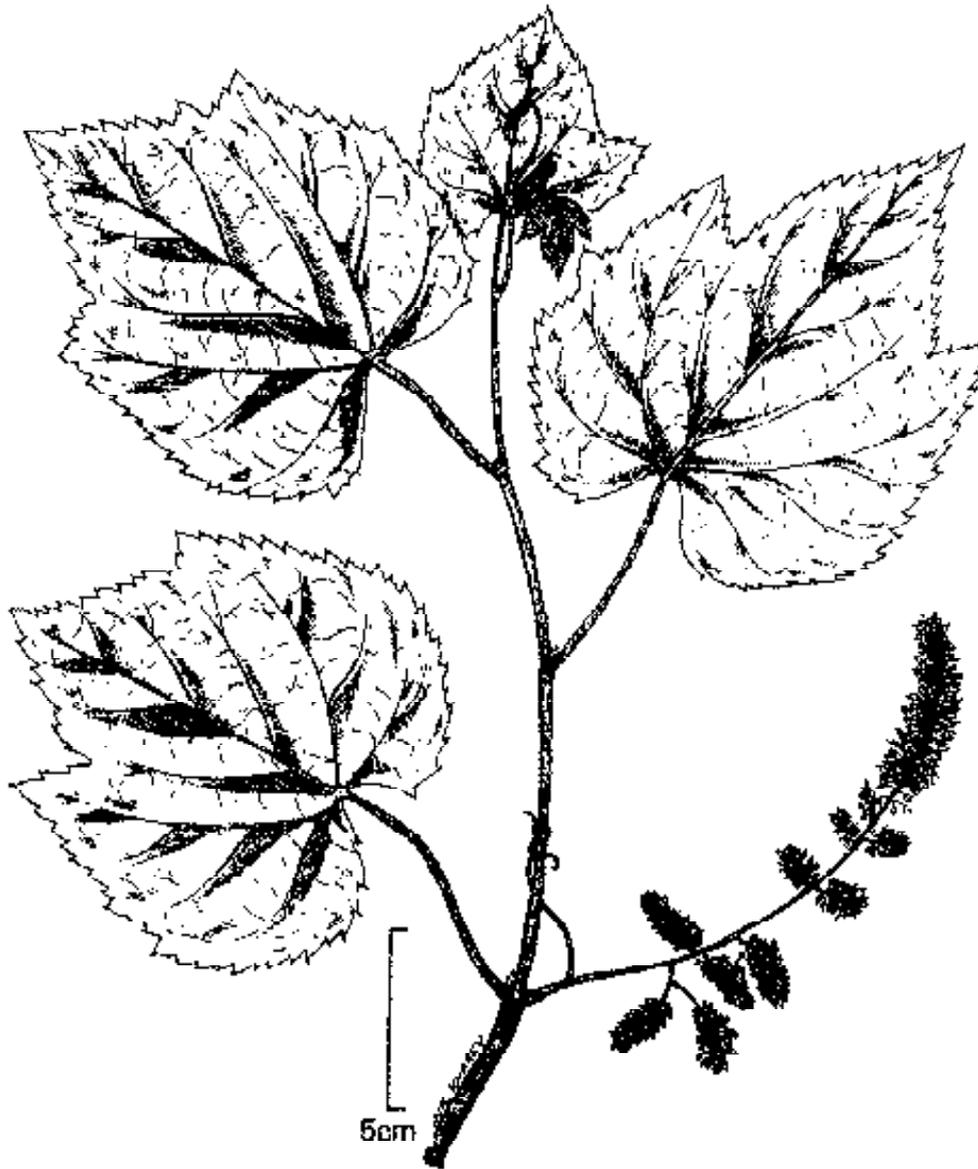


Fig. 114. *Ampelocissus latifolia* (Roxb.) Planch.

Included after Shetty & Singh (*loc. cit.*).

3. CAYRATIA A.L. Juss.

Cayratia trifolia (L.) Domin in *Biblioth. Bot.* 89: 370. 1927; Shetty & Singh in Singh *et al.*, *Fl. Ind.* 5: 275. 2000. *Vitis trifolia* L., *Sp. Pl.* 203. 1753. *Cissus carnososa* Lam., *Encycl.* 1: 31. 1789. *Vitis carnososa* (Lam.) Wallich ex Lawson in Hook.f., *Fl. Brit. India* 1: 654. 1875. *Cayratia carnososa* (Lam.) Gagnep. in *Not. Syst.* 1: 347. 1911. *Char.* **Fig. 115**

Large, herbaceous, perennial climbers. Young shoots clothed with pubescence. Leaves stipulate; stipules oblong, trifoliolate. Leaflets ovate or elliptic, lateral two shortly petioled. Flowers greenish-white, tetramerous, in leaf-opposed cymes; peduncles longer than the petioles. Petals conspicuous. Fruits black, 2-4-seeded.

Fl. & Fr. : July August.

Selected specimens : Jammu, Katra, Hajra 82301 (BSD); Jammu, Talab Tiloo, Gupta 12607 (RRL); Bahafort, Sarin 13667, 13668 (RRL).

4. PARTHENOCISSUS Planch.

Parthenocissus semicordata (Wallich) Planch. in DC., *Monogr. Phan.*, 5: 451. 1887; Shetty & Singh in Singh *et al.*, *Fl. India* 5: 302. 2000. *Vitis semicordata* Wallich in Roxb., *Fl. Ind.* 2: 481. 1824; Sharma & Kachroo, *Fl. Jammu* 1: 126. 1981. *V. himalayana* var. *semicordata* (Wallich) Lawson in Hook.f., *Fl. Brit. India* 1: 655. 1875. **Fig. 116**

Large climbers, up to 18 m. Leaves trifoliolate with 3 ovate, acuminate, sharply toothed, stalked leaflets; leaflets, up to 18 x 10 cm, shining, dark green above pale below, glabrous on both surfaces or pubescent beneath. Flowers greenish yellow, ca 5 mm in diam. Petals 4, reflexed. Stamens 5. Fruits blackish-purple.

Selected specimens : Jammu, Banganga, Ardhkumari, Uniyal 77393 (BSD); Udhampur dist., Laidhuna, Swami 1374 (BSD); Kashmir, Kumar 81844 (BSD).

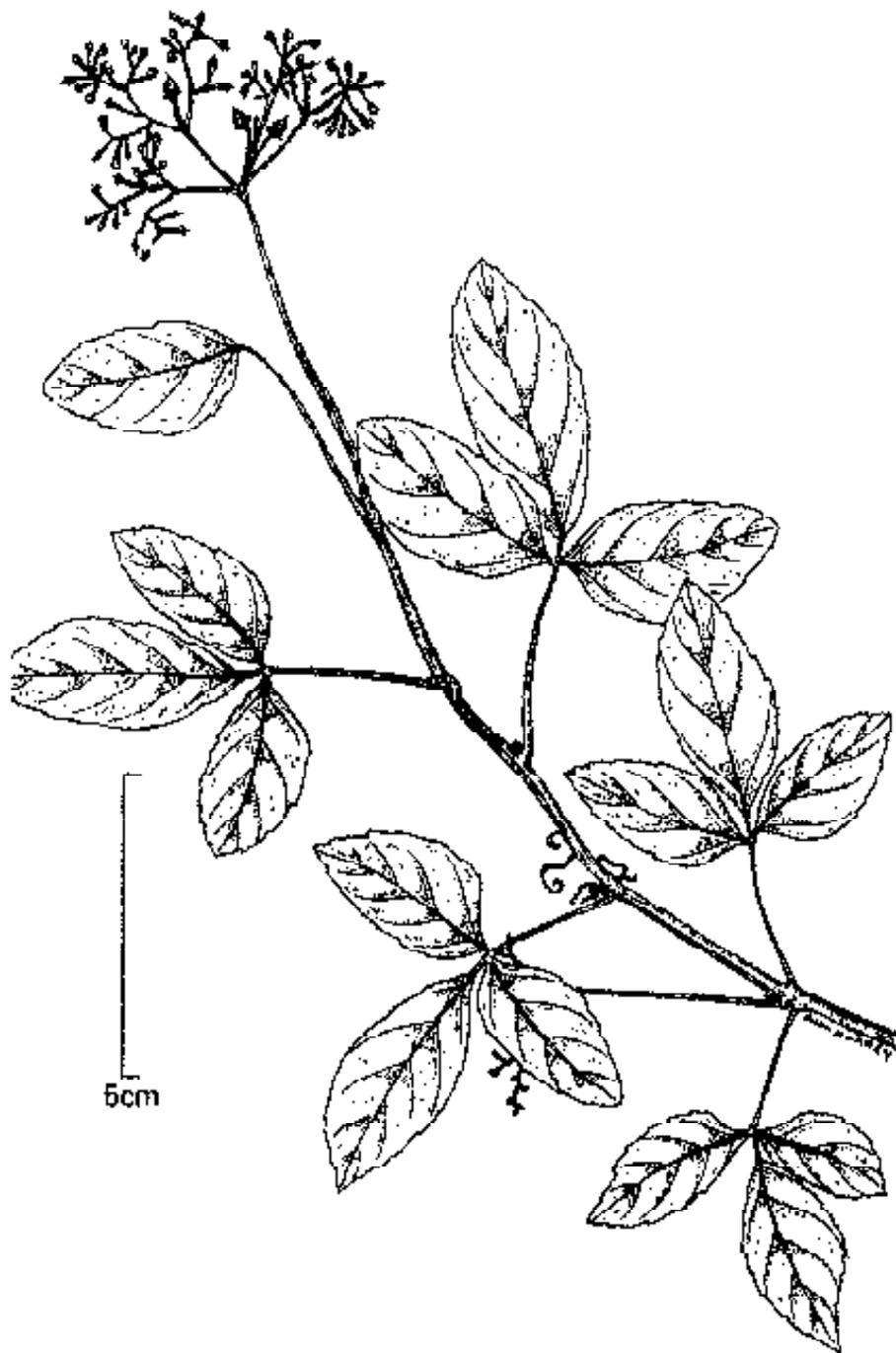


Fig. 115. *Cayratia trifolia* (L.) Domin



Fig. 116. *Parthenocissus semicordata* (Wallich) Planch.

5. TETRASTIGMA (Miq.) Planch.

1. *Tetrastigma serrulatum* (Roxb.) Planch. in DC., *Mongr. Phan.* 5: 432. 1887; Shetty & Singh in Singh *et al.*, *Fl. India* 5: 319. 2000. *Cissus serrulata* Roxb., *Fl. Ind.* 1: 432. 1820. *Vitis capriolata* D. Don, *Prodr. Fl. Nepal.* 188. 1825. Lawson in Hook.f., *Fl. Brit. India* 1: 659. 1875; Stewart in Nasir & Ali, *Annot. Cat. Vasc. Pl. W. Pak. & Kashmir* 470. 1972.

Slender, wiry, glabrous creepers. Leaves stipulate, pedately 5-foliolate, petioled; leaflets lanceolate, ovate or subobovate, 3-6 x 1.5-3 cm, acute, bristly serrate; petioles 3-4.5 cm long. Flowers in axillary and terminal cymes, pedicelled; pedicels bracteate. Bracts scarious. Fruits black, globose, 2-4-seeded.

Fl. & Fr. : August - September.

Selected specimens : Tibtum. S.L. Kapoor 16298 (RRL).

6. VITIS L.

- 1a. Herbaceous, slender climbers ...1. *V. flexuosa*
- 1b. Woody climbers :
 - 2a. Leaves densely reddish tomentose beneath.
 - Inflorescence of thyriform-cymes ...3. *V. Jacquemontii*
 - 2b. Leaves greyish tomentose. Inflorescence of paniculate umbels :
 - 3a. Leaves deeply 5-lobed ...4. *V. vinifera*
 - 3b. Leaves deeply 3-lobed ...2. *V. heyneana*

1. *Vitis flexuosa* Thunb. in *Trans. Linn. Soc. London.* 2: 332. 1794. var. *parvifolia* (Roxb.) Gagnep. in Sargent, *Pl. Wilson* 1: 103. 1911; Shetty & Singh in Singh *et al.*, *Fl. India* 5: 321. 2000. *V. parvifolia* Roxb., *Fl. Ind.* 1: 475. 1824; Lawson in Hook.f., *Fl. Brit. India* 1: 652; 1875; Stewart in Nasir & Ali, *Annot. Cat. Vasc. Pl. W. Pak. & Kashmir.* 470. 1972.

Slender, glabrous climbers. Tendrils bifid. Leaves broadly ovate, 5-7 x 8 cm deeply 3-lobed, acuminate, dentate or serrate, petioled. Flowers

green, minute, pentamerous on long, slender pedicels in umbellate panicles; panicles ca 3 cm long. Petals connate at the apex. Styles very short. Fruits black, globose, 2-4-seeded.

Fl. & Fr. : April May.

Selected specimens : Bhaderwah, Sarolbagh, *Uniyal* 80195 (BSD); Chenab valley, 1200 m, *Keshavanand* 78 (DD).

2. *Vitis heyneana* Roem. & Schultes, *Syst. Veg.* 5: 318. 1819; Shetty & Singh in Singh *et al.*, *Fl. India* 5: 322. 2000. *Vitis lanata* Roxb., *Fl. Ind.* 2: 474. 1824; Lawson in Hook.f., *Fl. Brit. India* 1: 651. 1875. *V. lanata* var. *glabra* Lawson in Hook.f., *Fl. Brit. India* 1: 651. 1875. Sharma & Kachroo, *Fl. Jammu*; 126. 1981.

Woody climbers. Leaves 3-lobed, ovate, 5-8 x 6 cm, cordate, acuminate, dentate, pubescent above, densely rusty or reddish tomentose beneath, petiolate. Flowers green, small, pentamerous, on slender pedicels in large, compound, paniced umbel. Petals pale-yellow, connate at the apex. Fruits black, globsoe, black, 1-seeded.

Fl. & Fr. : April May

Selected specimens : Traida, *Dhar* 1914 (RRL), Jammu Province, Udhampur, Latidhuna village, *Swami* 1312 (BSD).

3. *Vitis Jacquemontii* Parker, *For. Fl. Punjab.* ed. 2: 559. 1924 & in *Indian For.* 59: 63. t. 8. 1933; Shetty & Singh in Singh *et al.*, *Fl. India* 5: *Ampelocissus Jacquemontii* (Parker) Raizada, *Suppl. Fl. Upp. Gang. Plain* 44. 1976. *V. lanata* auct. non Roxb., 1824. Fig. 117

Scandent shrubs, densely reddish-tomentose. Branches terete. Tendrils 2-fld. Leaves variable, broadly ovate to suborbicular, 6-20 x 6-18 cm, simple to lobed, cordate to truncate at the base, glabrous above, reddish-floccose tomentose beneath; petioles 3-9 cm long. Flowers in thyrsiform, paniculate cymes, ca 2 mm long, on 2-6 cm long peduncles. Pedicels 2-3 mm long. Stamens ca 1.5 mm long. Fruits ca 7 mm in diam., 1-3-seeded.

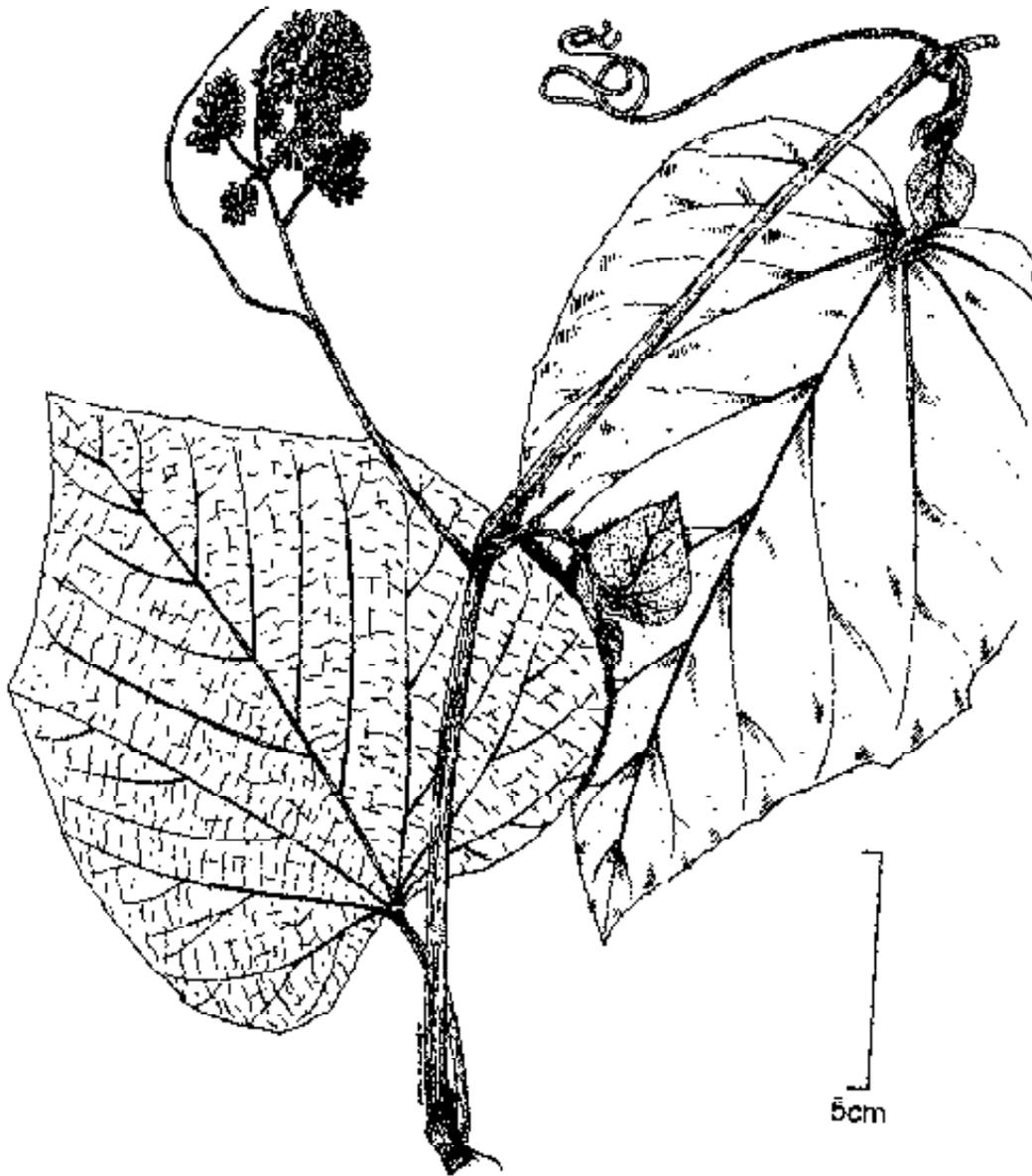


Fig. 117. *Vitis Jacquemontii* Parker

Fl. & Fr. : May August.

Selected specimens : Udhampur, Latidhuna village, *Swami* 1312 (BSD); Kashmir, *S. Kumar* 81422 (BSD).

4. *Vitis vinifera* L. Sp. Pl. 202. 1753; Lawson in Hook.f., Fl. Brit. India 1: 652. 1875. Singh & Kachroo, For. Fl. Srinagar, 154. 1976; Singh & Shetty in Singh *et al.*, Fl. India 5: 324. 2000. *Dachh, Gun.*

Large, woody climbers with long, bifid tendrils. Leaves suborbicular-cordate, deeply 5-lobed, irregularly dentate, glabrous above, grey floccose tomentose beneath, shortly petioled. Flowers green, fragrant, pentamerous on slender peduncles in umbelliform cymes forming large, terminal pyramidal panicles. Bracts oblong, deciduous. Petals oblong, connate at the top, free at the base. Styles very short, thick. Fruits bluish-black, 2-4-seeded.

Fl. & Fr. : August September.

Selected specimens : Kashmir, Dachigam game sanctuary, 5500 m, *Wadhwa* 66801 (BSD).

LEEACEAE

(R. Mathur)

LEEAL.

Leea aslatica (L.) Ridsdale in Manilal, Bot. Hist. Hort. Malab. 189. 1980; Naithani in Singh *et al.*, Fl. India 5: 330. 2000. *Phytolacca asiatica* L., Sp. Pl. 474. 1753. *Leea crispa* L., Syst. Nat. ed. 12. 2: 627. 1767; Lawson in Hook.f., Fl. Brit. India 1: 665. 1875. *L. aspera* Edgew. in Trans. Linn. Soc. 20: 36. 1846; Lawson in Hook.f., Fl. Brit. India 1: 665. 1875. *L. edgeworthii* Santapau in Rec. Bot. Surv. India 16: 54. 1953; Sharma & Kachroo, Fl. Jammu 1: 126. 1981.

Annual herbs or undershrubs. Leaves imparipinnate or bipinnate; leaflets in 2-3 pairs, on long stalks, ovate-oblong, 8-16.5 cm long.

acuminate, obtusely dentate, scabrous on both sides with white appressed hairs; petioles simple, not winged. Flowers in cymes, sessile or shortly pedicelled; pedicels with deciduous bracts. Fruits black, succulent.

Fl. & Fr. : July September.

Selected specimen : Dhar Road, Manu Rehalta, Hajra 82312 (BSD); Sunderbani-Akhnoor, Uniyal 92858 (BSD).

SAPINDACEAE

(P.C. Pant)

- | | |
|--------------------------------|----------------------------|
| 1a. Herbaceous climbers | ...1. <i>Cardiospermum</i> |
| 1b. Shrubs or trees : | |
| 2a. Fruits compressed, winged | ...2. <i>Dodonaea</i> |
| 2b. Fruits globose, not winged | ...3. <i>Sapindus</i> |

1. CARDIOSPERMUM L.

Cardiospermum halicacabum L., Sp. Pl. 366. 1753; Hiern in Hook.f., Fl. Brit. India 1: 670. 1875; Sharma & Kachroo, Fl. Jammu 1: 127. 1981; Pant in Singh *et al.*, Fl. India 5: 356. 2000.

Annual or perennial, pubescent to glabrous, climbing herbs with tendrils. Branches slender, furrowed. Leaves deltoid or ovate, biternate; leaflets deeply cut. Flowers white, small in umbellate cymes, atoping circinate tendrils. Sepals 4, Petals 4. Fruits capsular, broadly pyriform, trigonous, capsular, winged on angles. Seeds globose, black.

Fl. & Fr. : August October.

Scattered along road sides, hedges and in waste places.

Selected specimens : Katra-Reasi, Uniyal 77356 (BSD); Udhampur: Ramnagar, Swami 684 (BSD); Basholi, Hajra 2591 (BSD).

2. DODONAEA L.

Dodonaea viscosa Jacq., Enum. Syst. Pl. 19. 1760. Hiern in Hook.f., Fl. Brit. India 1: 697. 1875; Sharma & Kachroo, Fl. Jammu 1: 127. 1981; Pant in Singh *et al.*, Fl. India 5: 361. 2000. *Santha*.

Evergreen shrubs to small trees. Shoots somewhat angular; younger part scurfy, puberulous. Leaves alternate, oblanceolate, 0.7-8 x 0.3-1.5 cm, glabrous, with shining yellowish resin dots, subacute or notched at apex, sessile. Flowers very small. Sepals oblong, equalling the stamens. Capsules compressed, membranous, winged, 1-2-seeded. Seeds black.

Fl. & Fr. : January - September

Common in stony ravines, sometimes gregarious on sandy rocky cliffs.

Selected specimens : Udhampur, Kud, 2000 m, T.A. Rao 9011 (BSD); Udhampur, Ramnagar Swami 727 (BSD); Rehalta - Thein Dam, Hajra 82567 (BSD).

3. SAPINDUS L.

Sapindus mukorossi Gaertn., Fruct. 1: 342. t. 70. f. 3. 1788; Hiern in Hook.f., Fl. Brit. India 1: 683. 1875; Sharma & Kachroo, Fl. Jammu 1: 127. 1981; Pant in Singh *et al.*, Fl. India 5: 382. 2000.

Small to medium sized, deciduous trees; bark rough, dark to pale grey. Leaves pinnate; leaflets lanceolate-oblong, 3.5-17 x 0.5-5 cm, opposite or alternate, glabrous, acuminate or obtuse, base oblique; petiolules up to 0.4 cm. Flowers white or purple in terminal and lateral panicles. Calyx hairy outwards. Petals 5. Stamens up to 10, exserted. Fruits sub-globose, fleshy, wrinkled on maturity, saponaceous. Seeds black, solitary.

Fl. & Fr. : April - February.

Included after Sharma & Kachroo (*loc. cit.*).

HIPPOCASTANACEAE

(P.C. Pant & R. Mathur)

AESCULUS L.

Aesculus indica (Wallich ex Cambess.) Hook.f. in Curtis, Bot. Mag. t. 5117. 1859; Hiern in Hook.f., Fl. Brit. India 1: 675. 1872; Singh & Kachroo, For. Fl. Srinagar, 155. 1987; Pant in Singh *et al.*, Fl. India 5: 389. 2000. *Pavia indica* Wallich ex Cambess. in Jacq., Voy. Ind. 4: 31. 1844. *Ban Akhrot*, *Khandoon*.

Large, deciduous trees. Leaves digitately 5-9-foliolate; leaflets oblong-lanceolate to oblanceolate 5-9, 7-32 x 1.5-12.5 cm, acuminate, sharply serrate, undersurfaces glaucous. Flowers many, in small, pubescent cymes, arranged in terminal, erect, pyramidal panicles. Calyx tubular, shortly 5-lobed; lobes unequal, densely clothed with grey tomentum. Petals 4, clawed, tomentose on the outer side, with white, yellow or orange red throat. Stamens exserted. Fruit a capsule, reddish-brown, ovoid or subpyriform. Seeds 1-3, dark-brown, shining.

Fl. & Fr. : April - November.

Selected specimens : Upper munda, 2350 m, T.A. Rao 9209; Sonamarg, 3300 m, T.A. Rao 821 (BSD); Dachigam Games Sanctuary, Wadhwa, Murti & Pant 85377 (BSD).

ACERACEAE

(R. Mathur)

ACER L.

- | | |
|--------------------------------------|------------------------------|
| 1a. Leaves not lobed | ...5. <i>A. oblongum</i> |
| 1b. Leaves lobed or pinnate | |
| 2a. Leaves pinnate | ...4. <i>A. negundo</i> |
| 2b. Leaves 3-7-lobed : | |
| 3a. Leaves 5-7-lobed; margins entire | ...3. <i>A. cappadocicum</i> |

- 3b. Leaves usually 3-lobed or rarely 5-lobed; margins
scared or toothed :
- 4a. Lobes narrowed into long, linear tail like
tips ...1. *A. acuminatum*
- 4b. Lobes pointed, but not produced in tail like tips :
- 5a. Margins of leaves not fringed, lower surfaces
white ...2. *A. caesium*
- 5b. Margins of leaves minutely fringed, lower
surfaces green or pale green ...6. *A. pentapomicum*

1. *Acer acuminatum* Wallich ex D. Don, Prodr. Fl. Nepal. 249. 1825; Sharma & Jamwal, Fl. Upper Liddar valleys 1: 151. 1988; Nayar & Datta in Singh *et al.*, Fl. India 5: 394. 2000. *A. caudatum non* Wallich; Hiern in Hook.f., Fl. Brit. India 1: 695. 1875 *p.p.*

Elegant, deciduous trees. Branches glabrous. Leaves 6-12 cm long, 3-5-lobed; lobes triangular, sharply and coarsely toothed, acuminate; acumen *ca* 1 cm long; petioles reddish, 5-10 cm long, slender, pubescent. Inflorescence racemose, glabrous. Flowers greenish, 4-6-merous, *ca* 5 mm across. Sepals 4, oblong. Petals ovate, *ca* 4 mm long, shorter than the sepals. Stamens 4-6, very long. Fruits bright red, in lax, long stalked clusters.

Fl. & Fr. : April June

Selected specimens : Kashmir, above Desu, 2700 m, *Lambert* 92; Kashmir, Kistawar Div., 1800 m, *Lambert* 14. (DD).

2. *Acer caesium* Wallich ex Brandis, For. Fl. N.W. C. India 111. t. 21, 1874; Hiern in Hook.f., Fl. Brit. India 1: 695. 1875; Sharma & Jamwal, Fl. Upper Liddar valley 1: 151. 1988; Nayar & Datta in Singh *et al.*, Fl. India 5: 394. 2000. *Tilpatra*.

Large, deciduous trees, up to 25 m tall. Leaves 8-15 cm long, palmately 3-5-lobed; lobes broader than long, unequal, acuminate, reddish above, pale and glaucous beneath, serrulate; petioles 5-15 cm long, stout. Flowers greenish yellow in branched, flat topped clusters, *ca* 5 mm in

diam. Sepals obovate, 3-4 mm long. Petals shorter than the sepals. Stamens 8, inserted inside the disc. Fruits winged; wings divergent or overlapping; nuts dark brown, with a hump like swelling.

Fl. & Fr. : March - October.

Selected specimens : Gulmarg, 1800-1900 m, *T.A. Rao* 250; Thajwas moraine, Kashmir, 3500 m, *T.A. Rao* 9537; Aharbal/Kungwatan, 2000 m, *T.A. Rao* 9273 (BSD); Hamal forest, Jhelum valley, 2100 m, *Keshavanand* 157; Jhandapani stream below Banihal Pass, Jhelum valley, 2100-2400 m, *Keshavanand* 105 (DD).

3. *Acer cappadocicum* Gledt. in Schrif. Ges. Nat. Freunde Berl. 6: 116. t. 2. 1785; Nayar & Datta in Singh *et al.*, Fl. India 5: 397. 2000. *A. pictum* sensu Hiern in Hook.f., Fl. Brit. India 1: 696. 1875; Singh & Kachroo, For. Fl. Srinagar 155. 1976. **Fig. 118**

Large trees, up to 20 m tall. Leaves 4.5-10.5 x 5-12 cm, 5-7-lobed; lobes lanceolate or caudate, cordate, glabrescent, entire; petioles 2.5-8 cm long, longer than the leaves. Flowers yellowish green, in corymbose cymes. Male and female flowers on same branch. Sepals oblong. Petals spatulate, equalling the calyx. Stamens 8, shorter than the calyx. Fruits winged; wings divaricate, recurved.

Fl. & Fr. : April - September.

In the mesophytic forests.

Selected specimens : Dachigam game sanctuary, 1500-1800 m, *Wadhwa* 6680 (BSD); Jhelum valley, Panjla forest, 1500-1600 m, *Keshavanand* 1257; Jhelum valley, Khukang, Erin Nala, *Keshavanand* 1181 (DD).

4. *Acer negundo* L., Sp. Pl. 1056. 1753; Stewart in Nasir & Ali, Annot. Cat. Vas. Pl. W. Pak. & Kashmir 462. 1972.

Deciduous small, trees. Leaves pinnately compound, ash coloured. Flowers apetalous, 4-merous.

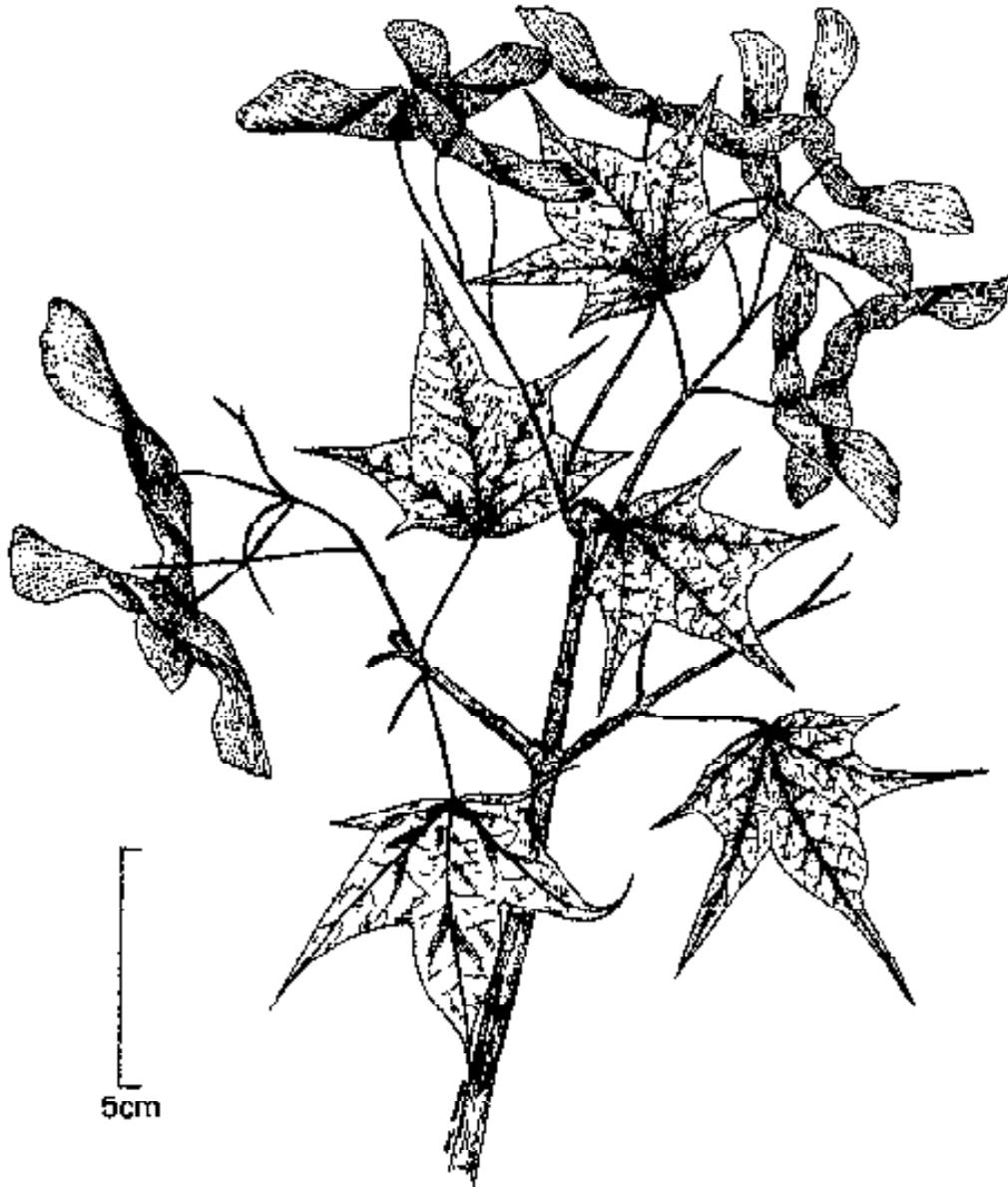


Fig. 118. *Acer cappadocicum* Gledt.

Fl. & Fr. : May - June

Selected specimens : Srinagar, Shankracharya hill, 1800 m, *Thaplial* & *Raizada* 26278 (DD).

5. *Acer oblongum* Wallich ex DC., Prodr. 1: 593. 1824; Hiern in Hook.f., Fl. Brit. India 1: 693. 1875; Sharma & Kachroo, Fl. Jammu 1: 127. 1981; Nayar & Datta in Singh *et al.*, Fl. India 5: 402. 2000.

Small or medium sized, evergreen trees. Leaves ovate-lanceolate, oblong to broadly lanceolate, 8-12 x 2-8 cm, acuminate, rounded at the base, pubescent above, glaucous beneath. Flowers pentamerous, greenish-white, in dense terminal, branched, hairy clusters. Sepals linear, acute, pubescent. Petals narrowly lanceolate. Stamens 8, inserted on disk. Styles free nearly to the base. Fruits winged; wings veined, narrowed at the base, glabrous.

Fl. & Fr. : March - September.

Selected specimens : Tanda Pass, *Parmer* 13144, 13145, 13146 (RRL).

6. *Acer pentapomicum* J.L. Stewart ex Brandis, For. Fl. N.W. & C. India 111. 1874; Hiern in Hook.f., Fl. Brit. India 1: 694. 1875; Sharma & Kachroo, Fl. Jammu 1: 127. 1981; Nayar & Datta in Singh *et al.*, Fl. India 5: 406. 2000.

Trees. Branches reddish. Leaves 4-5-12 cm, 3-5 lobed; lobes spreading; upper lobes broad, oval, acute to acuminate, obtrusely dentate, cordate or truncate at base, pale on both surfaces, with 3-5 basal nerves; petioles as long as the leaves, thinly tomentose. Flowers greenish white, pentamerous in glabrous panicles, terminating the short shoots. Sepals obovate. Petals obovate, shorter than the sepals. Styles connate at the top. Fruits glabrous, winged; wings *ca* 2.5-cm long, diverging.

Fl. & Fr. : June - August.

On banks of streams in dry inner valleys.

Selected specimens : Karnah basin, Kishenganga valley, 900-1800 m, *Keshavanand* 238 (DD); Chandigam, Kamraj Div., 1800 m, *J.F. Fuller* 5530 (DD).

STAPHYLEACEAE

(P.C. Pant)

STAPHYLEA L.

Staphylea emodi Wallich ex Brandis, For. Fl. N.W.C. India 114. 1874; Hiern in Hook.f., Fl. Brit. India 1: 698. 1875; Singh & Kachroo, For. Fl. Srinagar 155. 1976; Sharma & Kachroo, Fl. Jammu 1: 127. 1981; Pant in Singh *et al.*, Fl. India 5: 414. 2000. *Chitra, Nag-daun, Chhal Chhatar* (Kashmiri).

Deciduous shrubs; bark smooth, pale grey, spotted. Leaves petioled, trifoliolate; leaflets elliptic, 1.5-11 x 2-7 cm, glabrous above, more or less pubescent beneath, sharply serrate, apex acuminate, obliquely acute at base; laterals sessile, terminal with short petiolule. Flowers white in usually drooping panicles. Calyx 5-parted. Petals 5, oblong. Fruits inflated capsules, broadly ovoid. Seeds brown, obovoid-globose.

Fl. & Fr. : April - December.

Common in mesophytic forests, between 2000-3000 m.

Included after Singh & Kachroo (*loc. cit.*).

SABIACEAE

(S.C. Majumder)

- 1a. Scandent shrubs or climbers. Sepals and petals equal.
 Stamens 4-5, all fertile ...2. *Sabia*
- 1b. Trees. Sepals and petals unequal. Stamens 5; outer
 3 staminodial, inner 2 fertile ...1. *Meliosma*

1. MELIOSMA Blume

Meliosma simplicifolia (Roxb.) Walp., Rep. 1: 103. 1842; Hook.f., Fl. Brit. India 2: 5. 1876. Majumder in Singh *et al.*, Fl. India 5: 425. 2000. *Millingtonia simplicifolia* Roxb., Pl. Corom. 3: 50. t. 254. 1820. *Meliosma pungens* Wallich ex Wight & Arn. in Arn. Edinb. New Phil J. 15: 178. 1833; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak. & Kashmir 463. 1972.

Evergreen trees, up to 20 m tall. Leaves elliptic-lanceolate to obovate-oblong, up to 50 x 18 cm, entire or dentate. Flowers usually in terminal panicles, rarely in axillary panicles, sessile. Empty bracts 1-6. Sepals 4-5. Inner petals shallowly to deeply bifid. Fruits globose.

Fl. & Fr. : May - September.

Included after Stewart (*loc. cit.*).

2. SABIA Colebr.

Sabia campanulata Wallich in Roxb., Fl. Ind. 2: 311. 1824; Hook.f., Fl. Brit. India 2: 1. 1876; Sharma & Kachroo, Fl. Jammu 1: 127. 1981; Majumder in Singh *et al.*, Fl. India 5: 430. 2000.

Woody climbers or scandent shrubs. Young shoots pubescent. Leaves oblong or oblong-ovate to lanceolate, 3-10 (-15) x 1-3.5 cm, acuminate, acute at base; nerves 4-6 pairs; petioles 5-12 mm long, pubescent. Sepals 5, united at base, ca 3 mm long. Petals 5, free, 8-12 mm long, subrounded to obovate, obtuse. Stamens 5. Drupes 1-or 2-lobed, reniform, 5 wrinkled.

Fl. & Fr. : March - June.

Occasional on shady slopes.

Selected specimens : Chinani forest, Lauri valley, ca 2300 m, Keshavanand 51 (DD); Poonch. Serimarg. Stewart & Nasir 25503 (DD).

ANACARDIACEAE

(R. Mathur)

- 1a. Leaves compound :
- 2a. Drupes tomentose or pilose ...5. *Rhus*
- 2b. Drupes glabrous :
- 3a. Petals absent ...4. *Pistacia*
- 3b. Petals present :
- 4a. Flowers white. Drupes 2-5-seeded ...7. *Spondias*
- 4b. Flowers yellow, greenish white or greenish
red. Drupes 1-seeded ...2. *Lannea*
- 1b. Leaves simple :
- 5a. Leaves strongly aromatic; petioles longer than the leaves.
Fruting pedicels plumose ...1. *Cotinus*
- 5b. Leaves not aromatic; petioles shorter than the leaves.
Pedicels not plumose :
- 6a. Only 1-stamens fertile ...3. *Mangifera*
- 6b. All the stamens fertile ...6. *Semecarpus*

1. COTINUS Mill.

Cotinus coggygria Scop. in Fl. Carn. ed. 2, 1: 220. 1772; Nasir in Fl. Pak. 152: 2. 1983; Chandra & Mukherjee in Singh *et al.*, Fl. India 5: 449. 2000. *Rhus cotinus* L., Sp. Pl. 267. 1753; Hook.f., Fl. Brit. India 2: 9. 1876.; Sharma & Kachroo, Fl. Jammu 1: 128. 1981. **Fig. 119**

Deciduous, small trees or shrubs. Young branchlets, petioles and undersides of leaves pubescent. Leaves strongly aromatic, obovate or elliptic, up to 15 x 3 cm, obtuse, entire, finely tomentose beneath, petioled; petioles longer than the leaves. Flowers unisexual, in large panicles, on slender pedicels; pedicels of the sterile flowers elongate in flowering and covered with dense, long-silky hairs. Petals 5. Carpels 3, syncarpous; ovary 2 mm in diam., densely pubescent; styles 3, eccentric; stigmas capitate. Drupes obliquely obovate, ca 5 x 4 mm, with conspicuous veins when ripe.

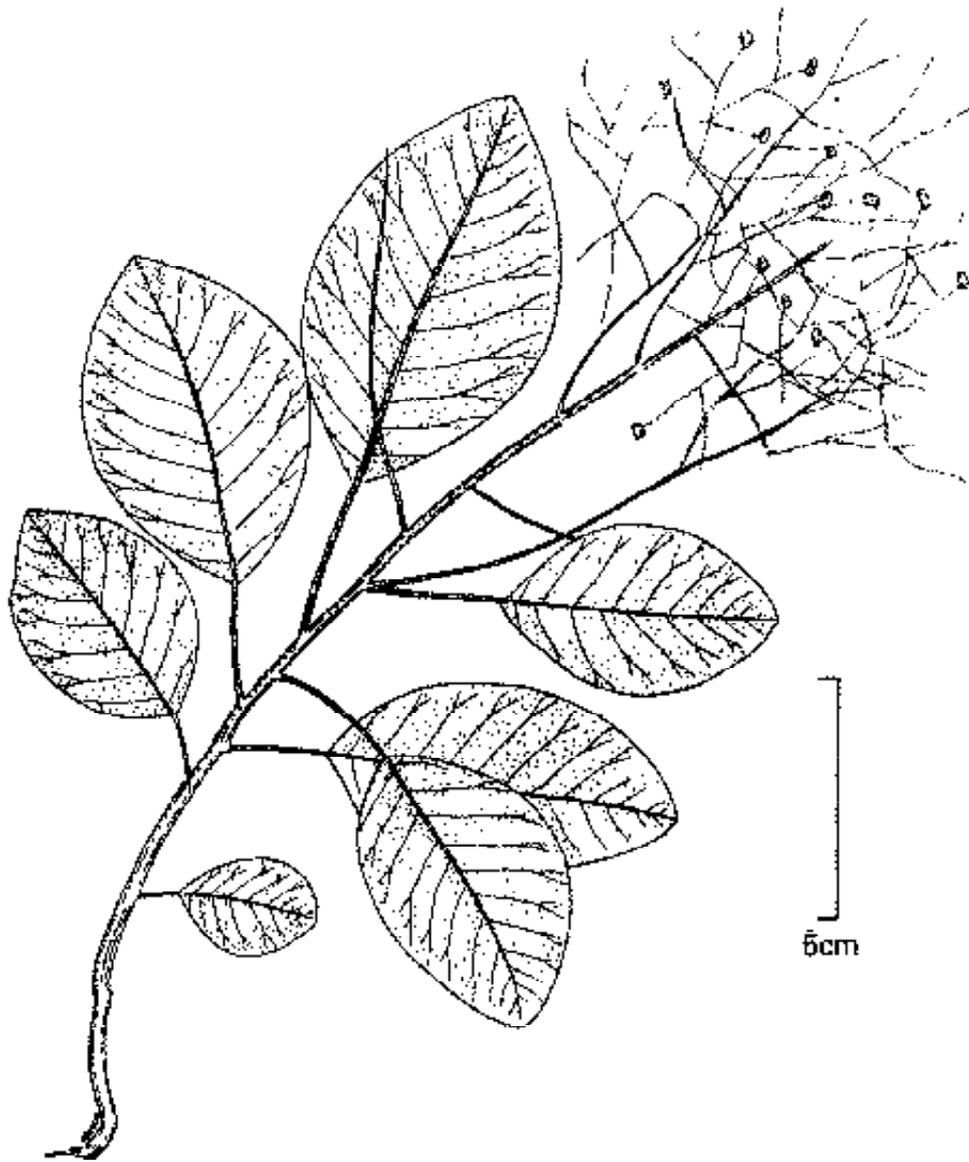


Fig. 119. *Cotinus coggygria* Scop.

Fl. & Fr. : April - September.

In dry forests and along the roadsides.

Selected specimens : Bhaderwah, Sarolbagh, *Uniyal* 80188 (BSD); Udhampur, Thial village, Ramkot, *Swami* 1146. (BSD); Kishenganga valley, 1200-1500 m, *Hukum Singh* 1840 (DD); Kashmir, Rishiganga valley, 900 m, *Keshavanand* 1660 (DD).

2. LANNEA A. Rich.

Lannea coromandelica (Houtt.) Merrill in J. Arn. Arb. 19: 353. 1938; Sharma & Kachroo, Fl. Jammu 1: 127. 1981; Chandra & Mukherjee in Singh *et al.*, Fl. Ind. 5: 463. 2000. *Dialicum coromandelicum* Houtt., Nat. Hist. 2: 39. t. 5, f. 2. 1974. *Odina wodier* Roxb., Fl. Ind. 2: 293. 1832; Hook.f., Fl. Brit. India 2: 29. 1876.

Large, deciduous trees; young branches pubescent. Leaves imparipinnate, dark brown, ca 23 cm long, crowded at the end of branches; leaflets 5-11, ovate-oblong, 1.2-12 x 1.5 cm, acuminate, glabrous, membranous. Flowers greenish pink or yellowish, small, unisexual, 4-5-merous, shortly peduncled, in compact fascicles or racemes. Calyx 4-5-lobed, persistent; lobes obtuse, ciliate. Petals oblong, longer than the sepals. Stamens 8-10, disk 8-lobed, ovary sessile. Styles 3-4, short, stout. Drupes reniform, ca 1.5 cm long, stony, dirty brown.

Fl. & Fr. : March - May.

Selected specimens : Udhampur/Kud, 1800 m, *T.A. Rao* 9007 (BSD).

3. MANGIFERA L.

Mangifera indica L., Sp. Pl. 200, 1753. in Hook.f., Fl. Brit. India 2: 13. 1876; Brandis, Ind. Trees 206. 1971; Chandra & Mukherjee in Singh *et al.*, Fl. India 5: 466. 2000.

Large trees. Leaves simple, oblong-lanceolate 10.5-14 cm long coriaceous; petioles up to 5 cm long. Flowers sessile, polygamous in

terminal panicles; panicles large, erect, pubescent; small. Calyx 5-lobed; lobes tomentose. Petals elliptic, with branched ridges. Fruit a drupe, of variable sizes, fleshy with sweet juice.

Fl. & Fr. : April August.

Mostly planted.

4. PISTACIA L.

Pistacia khinjuk Stocks in Hook.f., Kew J. Bot. 4: 143. 1852; Sharma & Kachroo, Fl. Jammu 1: 128. 1981; Chandra & Mukherjee in Singh *et al.*, Fl. India 5: 482. 2000. *P. integerrima* Stewart ex Brandis, For. Fl. 122. t. 22. 1876; Hook.f., Fl. Brit. India 2: 13. 1876.

Deciduous trees. Stems and branches glabrous. Leaves petiolate, compound, 12-13.4 cm long; leaflets opposite, 4-5 pairs, lanceolate, long acuminate, entire, oblique at the base, shortly petiolate. Flowers greenish-yellow, in panicles. *Male flowers* : panicles short, compact, pubescent. Sepals shorter than the stamens. Stamens deep red. Female flowers on short pedicels in long, lax panicles. Sepals 4, linear, supported by 2 ovate bracts; bracts shorter than the sepals. Sepals and bracts deciduous. Style 3-fid, with broad recurved stigma. Fruit a drupe, dry, with broad, recurved stigma, broader than long, rugose glabrous, grey to dirty red.

Fl. & Fr. : March June.

Selected specimens : Udhampur dist., Ramnagar, Swami 543 (BSD); Manu-Dhar Road, ca 3000 m, Hukum Singh 1654 (DD); Kishenganga valley, 2500-3000 m, Keshavanand 662 (DD).

5. RHUS L.

- | | |
|---|---------------------------|
| 1a. Stamens 10 | ...2. <i>R. himalaica</i> |
| 1b. Stamens 5 : | |
| 2a. Upper parts of leaf petioles winged. Drupes tomentose | ...1. <i>R. chinensis</i> |

- 2b. Upper part of leaf petioles not winged :
- 3a. Flowers in drooping, lax panicles ...4. *R. succedanea*
- 3b. Flowers in terminal or axillary panicles :
- 4a. Flowers in axillary panicles; panicles shorter than the leaves. Petals greenish-white with dark conspicuous veins. Drupes pilose ...5. *R. wallichii*
- 4b. Flowers in compact, terminal panicles; panicles equalling the leaves. Petals white. Drupes clothed with dark-red, velvety tomentum ...3. *R. punjabensis*

1. *Rhus chinensis* Miller, Gard. Dict. ed. 8. sub. no. 7. 1768; Chandra & Mukherjee in Singh *et al.*, Fl. India 5: 486. 2000. *R. semialata* Murray in Comm. Soc. Sci. Goett. 6: 27. t. 3. 1784; Hook.f., Fl. Brit. India 2: 10. 1876; Sharma & Kachroo, Fl. Jammu 1: 128. 1981. *R. javanica* Thunb., Fl. Jap. 121. 1785, *non* L., 1753. Fig. 120

Medium sized, deciduous trees. Stems branches and young inflorescence brownish-grey pubescent. Leaves imparipinnate; upper part of the petiole winged; leaflets 4-6 pairs, opposite, dentate; terminal leaflets petioled; lateral leaflets sessile. Flowers white or pale-yellow, in large terminal panicles. Drupes tomentose.

Fl. & Fr. : April - September.

Selected specimens : Reasi, Kapoor 2004 (RRL).

2. *Rhus himalaica* (Hook.f.) Chandra & Mukherjee in Singh *et al.*, Fl. India 5: 488. 2000. *R. succedanea* L. var. *himalica* Hook.f., Fl. Brit. India 2: 12. 1876.

Trees, up to 18 m tall. Leaves imparipinnate; leaflets 3-5 pairs, ovate-oblong, acuminate, entire 9-12 x 4-5 cm, base obliquely rounded, puberulous on the undersurface, petiolate. Flowers in axillary panicles, puberulous. Petals oblong, 2 x 1 mm. Stamens 10, 1-1.5 mm long. Drupes globose to obliquely orbicular, 6-8 mm in diam., glabrous, waxy.

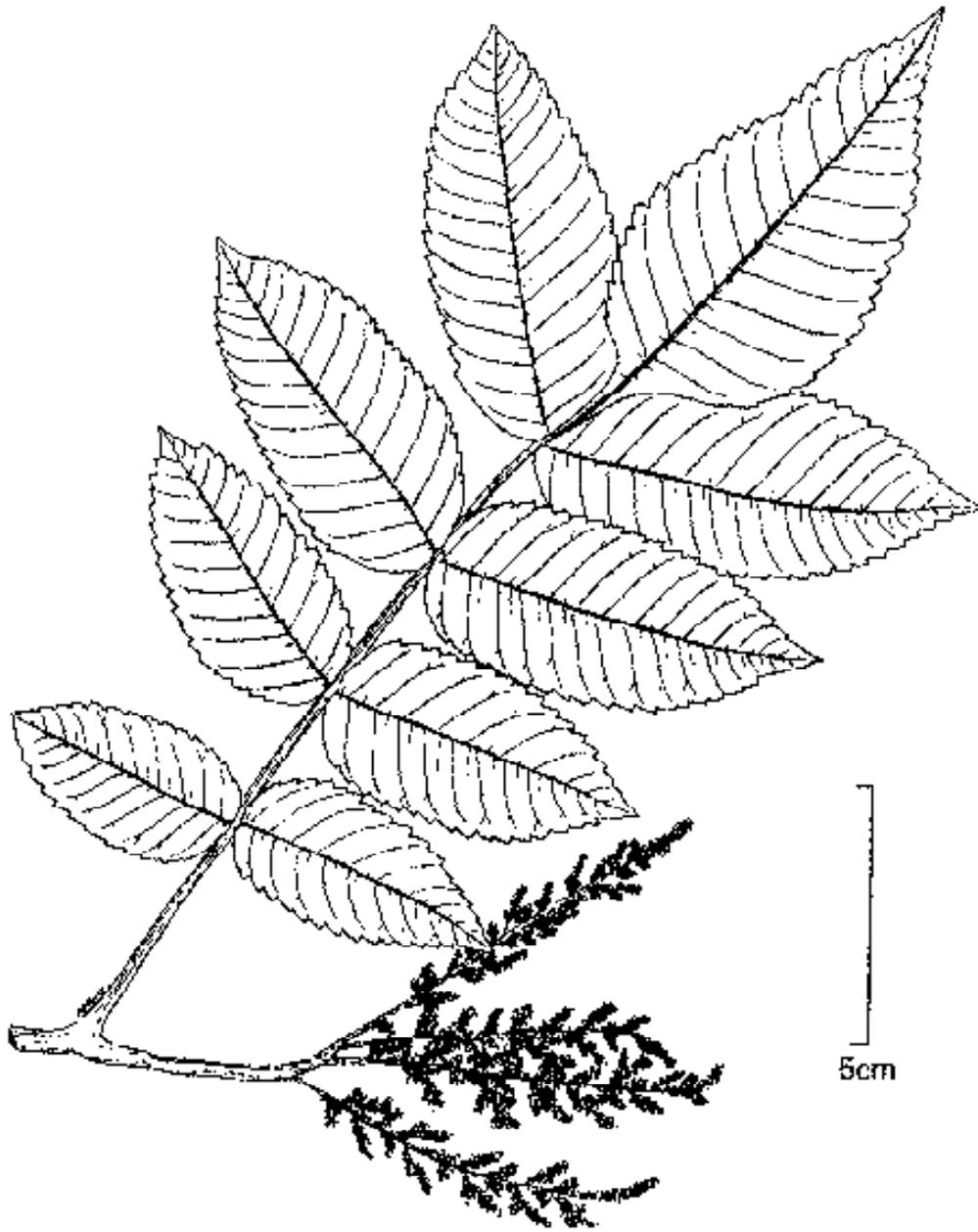


Fig. 120. *Rhus chinensis* Miller

Fl. & Fr. : Apr. Sept.

Himalaya from 1000-2000 m.

Included after Chandra & Mukherjee (*loc. cit.*).

Note : The stem juice causes blisters on the skin and makes black stain on paper. The fruit is used for the treatment of Phthisis.

3. *Rhus punjabensis* Stewart in Brandis, For. Fl. 120. 1874; Hook.f., Fl. Brit. India 2: 10. 1876; Sharma & Kachroo, Fl. Jammu 1: 128. 1981; Chandra & Mukherjee in Singh *et al.*, Fl. India 5: 492. 2000.

Deciduous, small trees. Branches, petioles and young inflorescence clothed with soft, rusty pubescence. Leaves imparipinnate; leaflets 5-6 pairs, opposite, entire. Flowers in compact terminal panicles; panicles broad, shorter than the leaves. Petals white or pale-yellow. Drupes ca 4 mm in diam., clothed with dark-red velvety tomentum.

Fl. & Fr. : May September.

Selected specimens : Jammu, Patnitop, Sarin 12482 (RRL); Kashmir, Jhelum valley, Kamal forest, Kamraj, 1850 m. Keshavanand 152 (DD).

4. *Rhus succedanea* L., Mant. 2: 221. 1771; Hook.f., Fl. Brit. India 2: 12. 1876; Sharma & Kachroo, Fl. Jammu 1: 128. 1981; Chandra & Mukherjee in Singh *et al.*, Fl. India 5: 494. 2000. *R. acuminata* DC., Prodr. 2: 68. 1825. *R. succedanea* L. var. *acuminata* (DC.) Hook.f., Fl. Brit. India 2: 12. 1876. *Arkola*, *Arkhur*. Fig. 121

Small or medium sized, glabrous, deciduous trees. Leaves imparipinnate; leaflets opposite, 3-6 pairs, ovate-lanceolate, entire, long acuminate. Flowers pedicelled, drooping in lax panicles. Flowering branches very slender. Petals greenish white, obovate, longer than the sepals. Drupes 1.5 cm in diam. yellow to light-brown, glabrous.

Fl. & Fr. : May July.

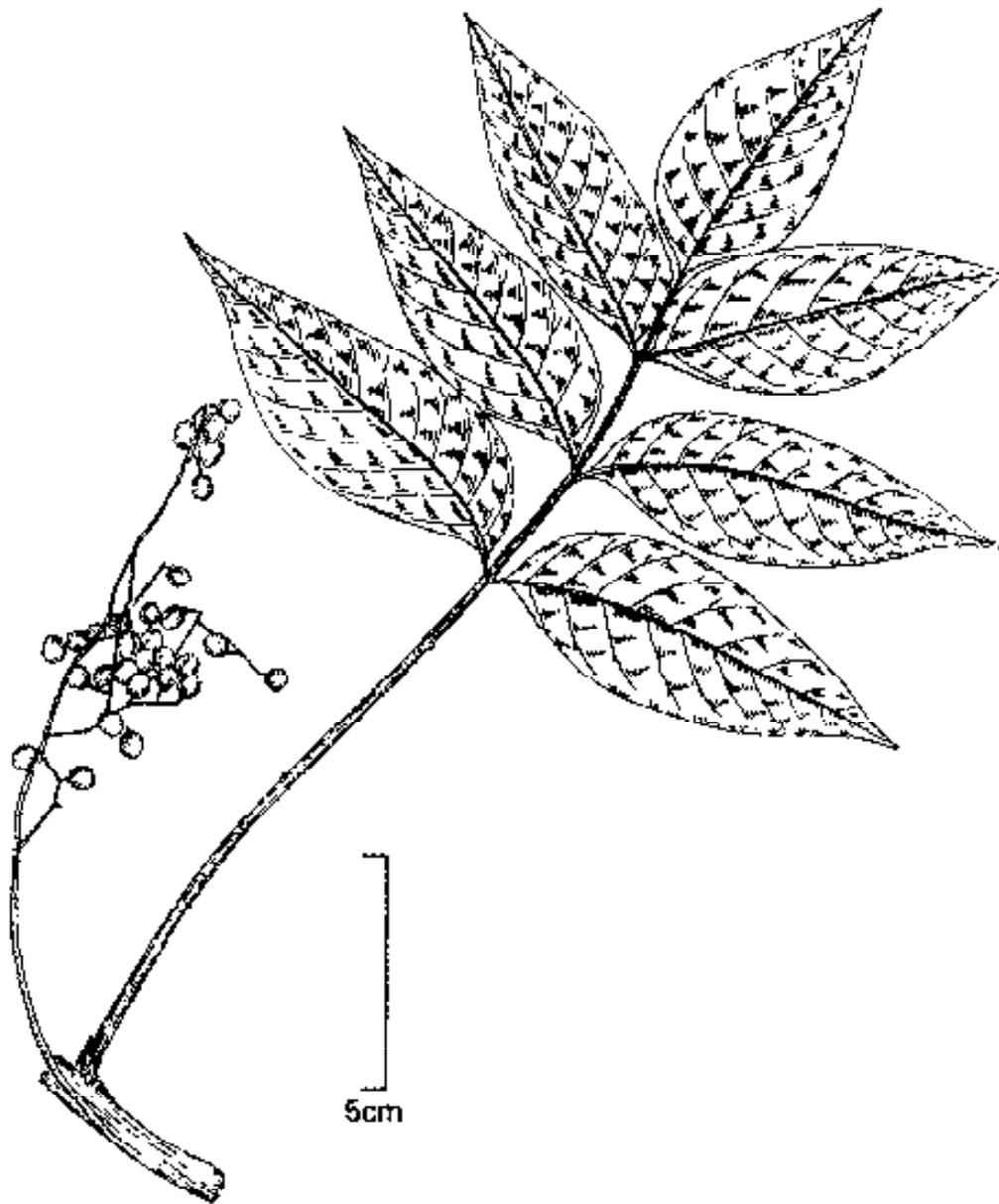


Fig. 121. *Rhus succedanea* L.

Selected specimens : Bhaderwah, Sarin 139751 (RRL); Kashmir, Keshavanand 287 (DD); Kashmir, Liddar valley, 1800-2100 m, Duthie 13070; Kashmir, Gulmarg, 2100 m, Duthie 573 (DD).

5. *Rhus wallichii* Hook.f., Fl. Brit. India 2: 11, 1876; Chandra & Mukherjee in Singh *et al.*, Fl. India 4: 496, 2000. **Fig. 122**

Deciduous trees. Stems, branches and young inflorescence with grey bark, black raised spots and yellowish tomentum. Leaves imparipinnate; leaflets 3-5 pairs, 8-15 cm long, entire. Flowers sessile or sub-sessile, in axillary panicles; panicles much shorter than the leaves. Petals greenish, white, with dark conspicuous veins, obovate, longer than the sepals. Drupes 1.5 cm in diam., pilose or glabrous.

Fl. & Fr. : May June.

Selected specimens : Muktesar, R.M. Badhwar 1996 (RRL).

6. SEMECARPUS L.

***Semecarpus anacardium* L.f.**, Suppl. 182, 1781; Hook.f., Fl. Brit. India 2, 30, 1876, Chandra & Mukherjee in Singh *et al.*, Fl. India 5: 500, 2000. **Fig. 123**

Tall, deciduous trees. Leaves coriaceous, 6.5-25 x 4.5-16.2 cm, obovate, oblong, rounded at the apex, often contracted below the middle; pubescent beneath; petioles up to 2.5 cm long. Flowers in axillary and terminal panicles, greenish white. Nuts reniform, dark brown to black.

Fl. & Fr. : March January.

Selected specimens : S. loc., P.C.S. 16242 (RRL).

7. SPONDIAS L.

***Spondias plinnata* (L.f.) Kurz**, Prelim. Rep. For. & Veg. Pegu A. 44. & B 42, 1875; Stewart in Nasir & Ali, Annot. Cat. Vasc. Pl. W. Pak & Kashmir 459, 1972; Chandra & Mukherjee in Singh *et al.*, Fl. India

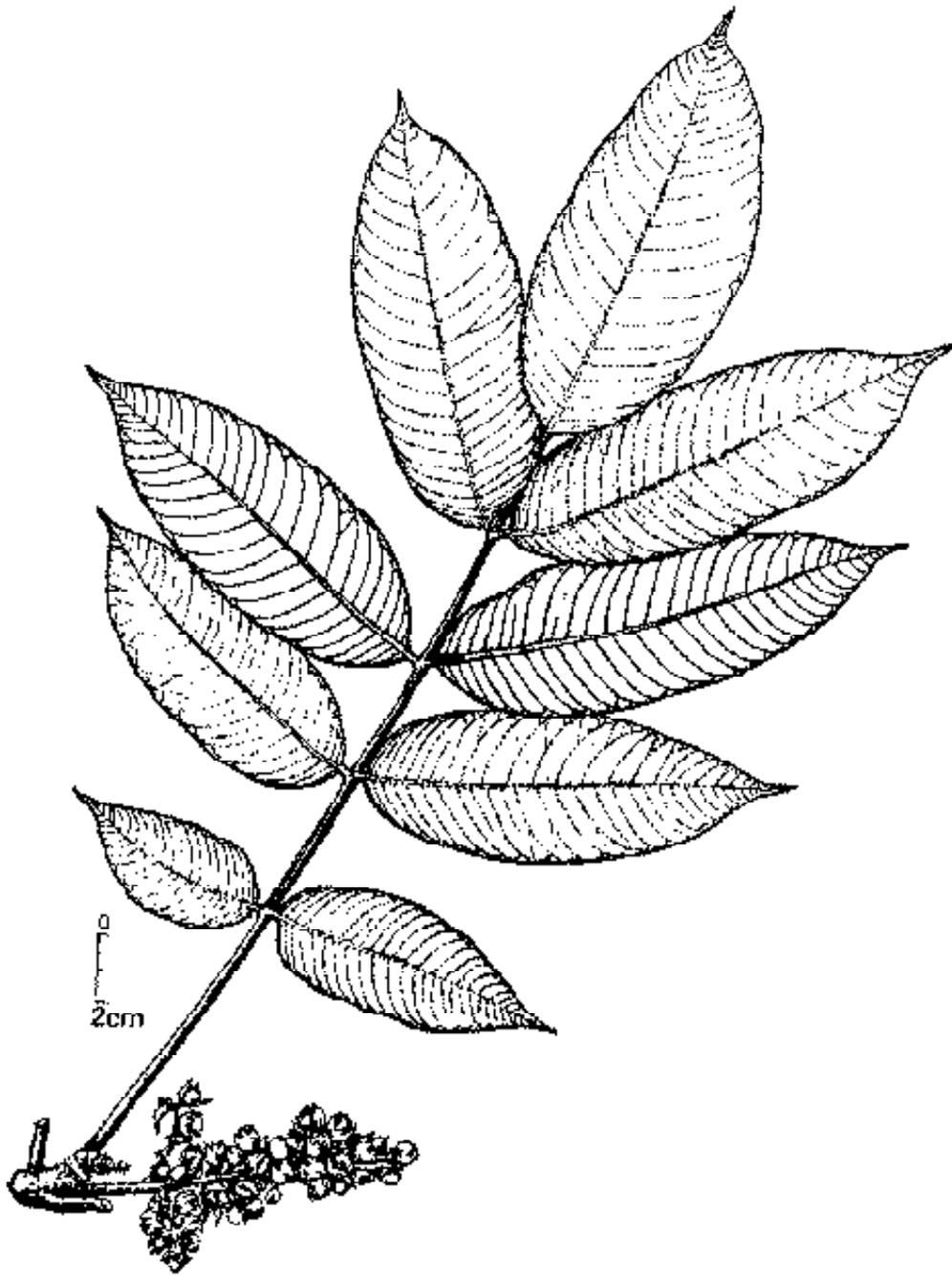


Fig. 122. *Rhus wallehiil* Hook.f.

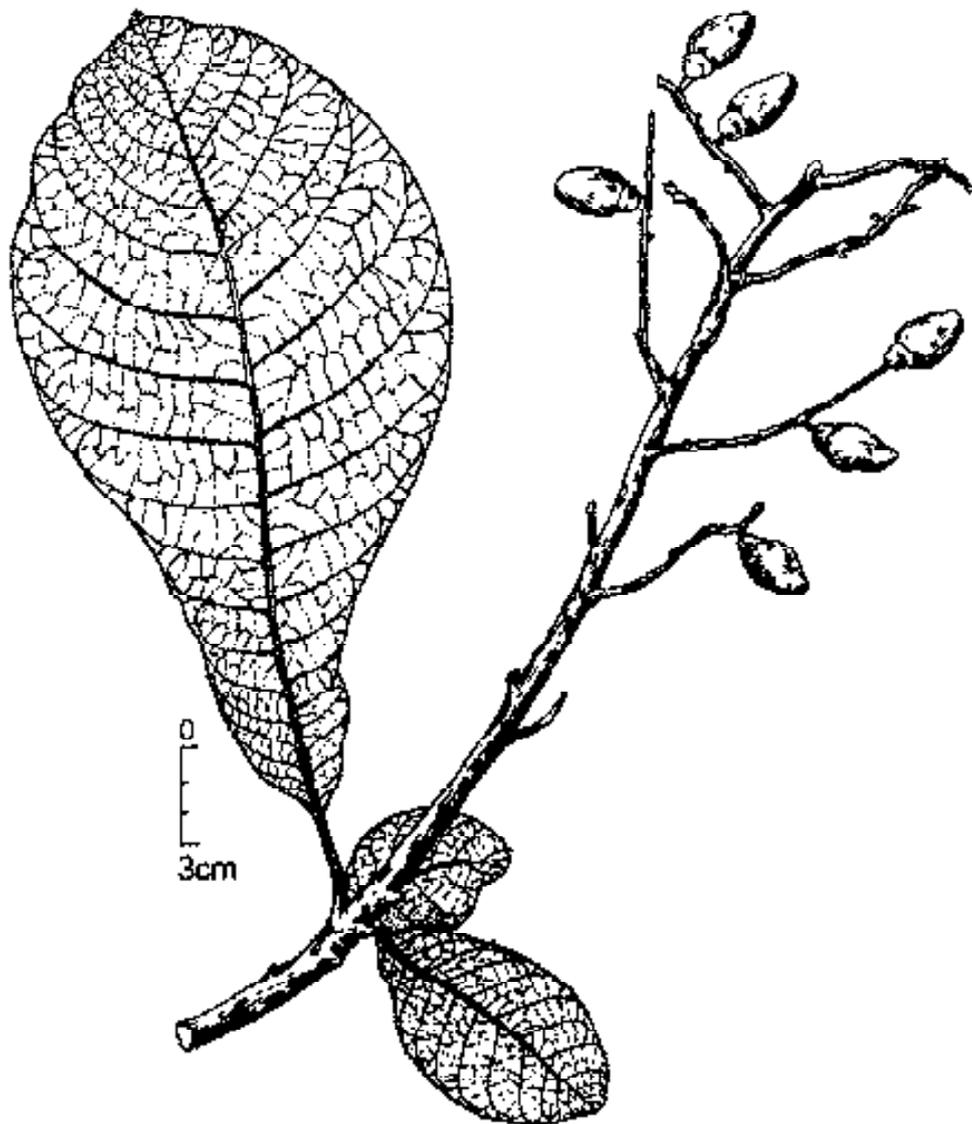


Fig. 123. *Semecarpus anacardium* L.f.

5: 507. 2000. *Mangifera pinnata* L.f., Suppl. 156. 1751. *Spondias mangifera* Willd., Sp. Pl. 2: 751. 1799; Hook.f., Fl. Brit. India 2: 92. 1876.

Deciduous, glabrous, aromatic trees. Leaves imparipinnate, ca 2-12 cm long; leaflets 3-5 pairs, opposite, elliptic-oblong, acuminate. Flowers white, pentamerous, sessile or subsessile, clustered on stout, branched panicles. Ripe drupes yellow, ovoid-oblong, ca 4 cm long.

Fl. & Fr. : April - December.

Included after Stewart (*loc. cit.*).

CORIARIACEAE

(R. Mathur)

CORIARIA L.

Coriaria nepalensis Wallich, Pl. As. Rar. 3: 67. t. 289. 1832; Hook.f., Fl. Brit. India 2: 44. 1876; Sharma & Kachroo, Fl. Jammu : 128. 1981; Rau in Singh *et al.*, Fl. India 5: 511. 2000.

Large, glabrous shrubs; branches reddish-brown. Leaves sessile, elliptic, 2.5-5 cm long, acute, entire, conspicuously 3-veined, sessile. Flowers one or many in axillary clusters. Petals 5, smaller than sepals when young, later enlarge and become fleshy. Stamens and styles red or purplish, protruding. Fruits black, enclosed in enlarged petals.

Fl. & Fr. : August - September.

Selected specimens : Sauzica-Gagria, 2500-3000 m, *Naithuni*, 78382 (BSD); Sunderbani-Akhnoor, *Uniyal* 92857 (BSD); Kishanganga valley, Karnah basin, 1800 m, *Keshavanand* 224 (DD).

MORINGACEAE

(R. Mathur)

MORINGA Adans.

Moringa oleifera Lam., Encycl. Meth. Bot. 1: 398. 1785; Uniyal in Singh *et al.*, Fl. India 5: 516. 2000. *M. pterygosperma* Gaertn., Fruct.

Sem. Pl. 2: 314. 1791; Hook.f. Fl. Brit. India 2: 45. 1876; Sharma & Kachroo, Fl. Jammu 1: 128. 1981; Swami & Gupta, Fl. Udhampur 102. 1998. *Sahjana*.

Medium sized, deciduous trees, up to 15 m tall; young parts pubescent. Leaves tripinnate, up to 70 cm long; leaflets 5-9 pairs, obovate or elliptic-ovate, 2-2.5 x 1 x 1.5 cm, entire. Flowers in spreading axillary panicles. Capsules 3-gonous, up to 45 cm long, 9-ribbed when young, 3-angled on maturity.

Fl. & Fr. : Feb. April Jan.

Selected specimens : Jammu, B.K. Abrol, 1937 (RRL); Ramnagar, B.M. Singh 15680. (RRL).

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