

Flora of the Pin Valley National Park, Himachal Pradesh

**K. Chandra Sekar
S.K. Srivastava**



भारतीय वनस्पति सर्वेक्षण
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FOREWORD

India has established an elaborate Protected Area Network, comprising 510 Wildlife Sanctuaries, 97 National Parks, 8 Conservation and 2 Community Reserves spread across different biogeographic zones and biotic provinces, to ensure *in situ* conservation of its biodiversity as per the objectives cited in Articles 6 and 8 of the Convention on Biological Diversity. However, benchmark data on occurrence and distribution of the components of biodiversity within a protected area is an important prerequisite to facilitate management decisions. Primarily to aim at this objective, the Botanical Survey of India has an ongoing programme of survey and documentation of plant diversity of fragile ecosystems and protected areas of the country.

The present publication on the flora of Pin Valley National Park is an outcome of this programme of the department. The study area is very significant as it falls under the cold desert ecosystem of North-West Himalaya, which is not only highly fragile but also harbours unique flora. Conservation of this fragile ecosystem has become a matter of serious concern since the opening of trans-Himalayan region, where these cold deserts occur, to tourism and related developmental activities. Any disturbance in the biotic and abiotic components of this unique ecosystem is bound to cause severe ecological imbalance.

The book deals with 513 taxa, belonging to 243 genera under 64 families of Pteridophytes, Gymnosperms and Angiosperms, with a number of novelties for the Indian flora. The study also documents ca 200 medicinal plants used by local inhabitants.

I am sure this 'Flora' will be an important guiding document to managers of the Pin Valley National Park and for students, botanists and naturalists interested in cold desert flora of the country.

M. Sanjappa
Director

Botanical Survey of India
Kolkata
01.03.2009

PREFACE

The cold deserts of North-West Himalaya are characterized by an extremely low temperature and less precipitation. These areas are under increasing pressure of the recent rapidly expanding tourism industry and also are one of the least protected regions of India, as only about four per cent of these are covered under national network of protected areas. Even then no baseline information on the flora of these protected areas, so vital for formulating strategies for management of their resources, is as yet available. The survey and inventorying of plant wealth of the Pin Valley National Park in Lahaul-Spiti district in Himachal Pradesh was taken up to bridge this gap. This study is an outcome of extensive and intensive survey and collection of plants in the Pin Valley National Park during 2001 to 2003. The 'Flora' includes taxonomic descriptions of 513 taxa belonging to 243 genera under 64 families of Pteridophytes, Gymnosperms and Angiosperms, with identification keys, wherever necessary, with a note on phenology, habitat, exsiccate, distribution and uses, and is supported by 31 line drawings and 155 colour photographs. Out of 513 taxa recorded from the Park 505 taxa are Angiosperms, 3 Gymnosperms and five Pteridophytes.

The study has resulted in the discovery of one new species, *Festuca sanjappae* Chandra Sekar & S.K. Srivast. and four new records viz., *Elymus mutabilis* (Drobov) Tzvelev, *E. nodosus* (Nevski) Meld., *Oxytropis immersa* (Baker ex Aitch.) Bunge ex Ledeb., and *Poa hyllobates* Bor. for India. In addition, three species viz., *Myricaria albiflora* Grierson & Long, *Poa lutea* R.R. Stewart, *Poa psophagorum* Bor. are new records for N.W. Himalaya, 33 taxa are new records for Himachal Pradesh and 36 taxa are new additions to the flora of Lahaul-Spiti.

We express our indebtedness to Dr. M. Sanjappa, Director, Botanical Survey of India, Kolkata, for encouragement and facilities, Dr. D.K. Singh, Additional Director, BSI, Kolkata for his keen interest and ever encouraging motivation throughout the progress of this study, and to the Director, Pin Valley National Park for help and logistic support during the exploration in the area.

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One of us (KCS) acknowledges the scholarly guidance and valuable comments provided by Prof. R.D. Gaur, Jis-Dean & Head, Department of Botany, H.N.B. Garhwal University, Srinagar, Garhwal and the financial assistance received from the Ministry of Environment and Forests, Government of India under the project 'Assessment of Floristic Diversity in Protected Area Network of India, Phase-I, Biosphere Reserves and National Parks'. He is also pleased to express deep sense of gratitude to Drs. Kanad Das, S.K. Singh, Manish Kandwal, Arun Chauhan, Prashant K. Pusalkar, Richa Pal and Pragya Badoni, Ex-Senior Research Fellows, BSI, Dehra Dun for their valuable suggestions and constant support throughout the course of study.

Last, but not the least we also extend our sincere thanks to all the staff members of BSI, Northern Circle, Dehra Dun and all the local people of the Pin Valley National Park for their constant support and co-operation throughout the work.

Date: 01.03.2009

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&
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INTRODUCTION

The diverse physiography and geology of the country together with varied climatic conditions have resulted in the prevalence of all possible types of vegetation ranging from tropical to subtropical; temperate to alpine; humid evergreen rain forests to dry deciduous forests; hot dry deserts to cold deserts; mangroves to submerged; saline to fresh water; sand dunes to swamps. Owing to the above varied factors, India harbours over 45,000 species of plants, which include ca 17500 species of Angiosperms; 48 species of Gymnosperms and 1,200 species of Pteridophytes (Singh & Singh, 2002).

India is one of the twelve mega-diversity countries of the world (Sharma & Singh, 2001), which is losing its biodiversity, both in terms of decline in the population of individual species as well as the degradation of ecosystems, at an alarming rate. It is estimated that about 10 per cent of our flowering plants alone have become rare or threatened due to various reasons. The foremost amongst the responsible factors are the anthropogenic, like clearance of forest areas for expansion of industries and agriculture on prime forest land, urbanization and large development projects leading to depauperization of natural habitats, pollution and over utilization of biological resources. To overcome this threat, India's effort has been significant in the declaration of the largest Protected Area Network (PAN) to safeguard valuable plant resources (Singh & Hajra, 1996; Chowdhery & Hajra, 2000).

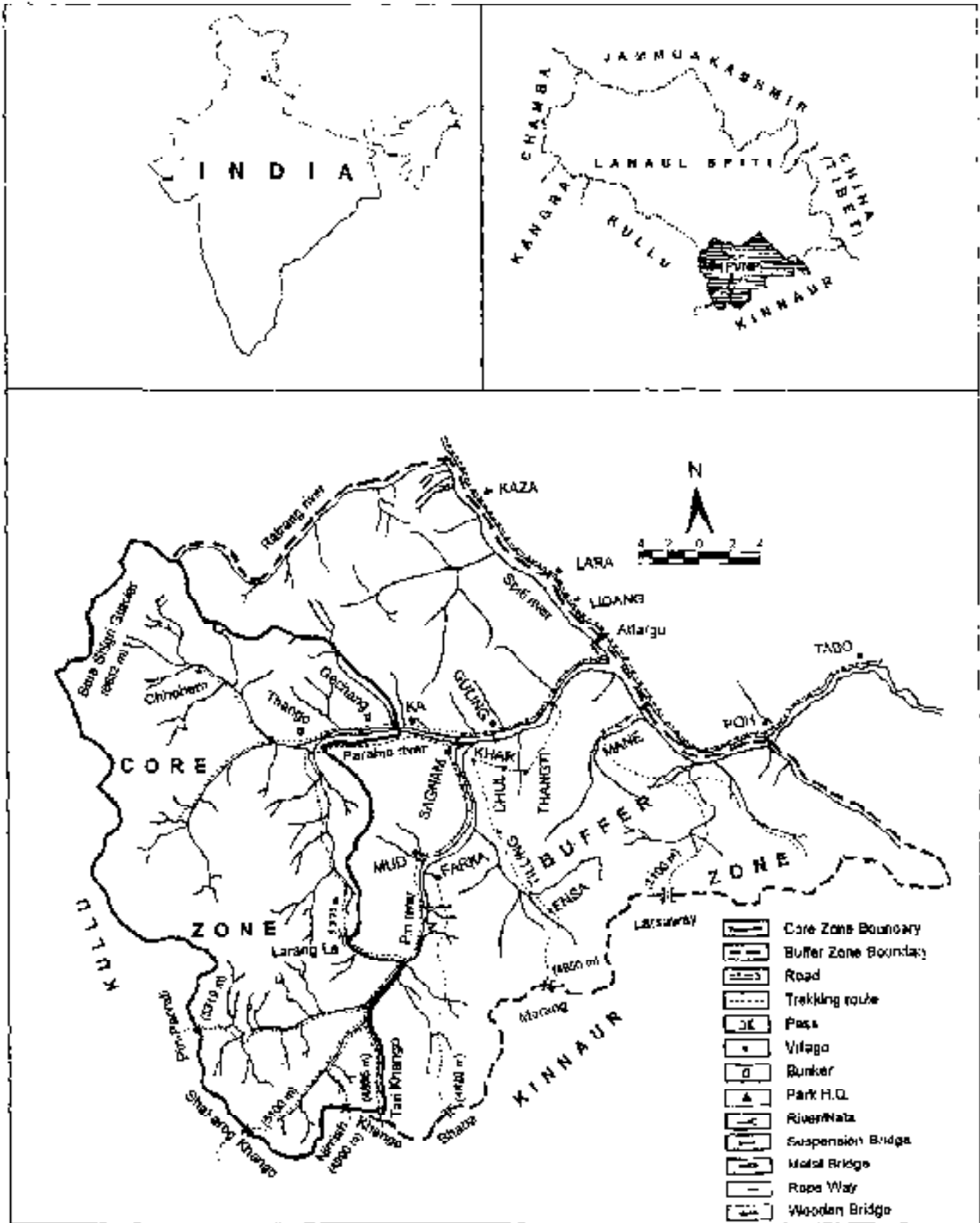
The country has already established an extensive Protected Area Network, consisting of 14 Biosphere Reserves, 97 National Parks and 510 Wildlife Sanctuaries, covering 4.77 per cent of its total land mass, to address its conservation needs of representative ecosystems and habitats of endangered species in different phytogeographical regions of the country (Rodgers & al., 2002).

The protected area network in Himachal Pradesh is represented by 2 National Parks and 32 Wildlife Sanctuaries to preserve the immense faunistic and floristic wealth prevailing in varied ecosystems (Singh & Singh, 2002). Among these, one of the important ecosystems, i.e. cold desert is shared by the state's largest district, Lahaul-Spiti. Pin Valley National Park (study area) situated in this fragile ecosystem, thus forms one of the important National Parks of the country. Opening of this National Park to tourism and related developmental activities has become a matter of serious concern. Any change or disturbance in the biotic and abiotic components is bound to cause imbalance in the ecosystem (Murri, 2001; Singh & Singh, 2002). Keeping in view the above considerations and the vast destruction of habitat dwindling flora and fauna, it is initiated to undertake the task of survey, study and to prepare the inventory of the floristic diversity of the Pin Valley National Park.

GEOGRAPHICAL LOCATION

Pin Valley National Park (named after the Pin River) located between 31°61'40" to 32° 21'20" N Latitudes and 77° 4'21" to 78° 6'19" E Longitudes in the cold desert area of North West Himalaya in Spiti subdivision of Lahaul-Spiti district, Himachal Pradesh, India. The National Park was established in the year 1987 vide I.P. Government notification No. Frs (B) I (7) 31 / 86 dated 09.01.1987. The Bara Shigri glacier, follows the Ratang river up to Rangrik are formed the northern boundary, the Spiti river up to Poh as eastern boundary. While the southern and western sides of the Park are bounded by Kinnaur and Kullu districts respectively (Map 1).

Map. 1. The Pin Valley National Park (PVNP)



TOPOGRAPHICAL AND PHYSICAL FEATURES

Pin Valley National Park is situated in the cold desert area in Himachal Pradesh. The Park covers an area of 675 sq. km in core zone and 1150 sq. km in buffer zone (Pandey, 1991; Chandra Sekar & al., 2003). The Park is in the rain shadow of the Pir Panjal range and vegetation is greatly influenced by the Great Himalayan ranges as the entire tract is located in the trans-Himalayan region (Johnsingh & al., 1999). The craggy cliff, narrow gorges, rushing streams and snowy peaks are characteristics of this area (Photo 1-5, 10-15). The altitude within the park ranges from 3615 to 6632 m above mean sea level (MSL). The slope ranges from 30°–40°.

DRAINAGE

The Pin river is ca 50 km long, originating in the Sukhand ranges in the Greater Himalaya and constitutes an important right bank tributary of Spiti river. The Pin river flows in a northern direction, until it reaches Sagnam, where it is joined by one of its major tributaries, the Parahio river (Map 1; Photo 4, 5). From here, the river flows eastwards, and ultimately joins the Spiti river at Sushuna, near Dankhar (Mangain, 1975; Johnsingh & al., 1999).

GEOLOGY AND SOIL.

The geology of Spiti reflects complete sequence of exposed sediments from Pre-Cambrian era to the Cretaceous period (Wadia, 1978). The area is characterized by sharp changes in combinations of quartzite, shales, limestones and conglomerates. Majority of the area is rich in fossils, mainly brachiopods, trilobites, ammonites, bivalves and also certain corals and algae, indicating its Tethyan past (Johnsingh & al., 1999).

The high altitude desert soil is predominantly sandy and shallow, derived mainly from mechanical disintegration of rocks, due to, marked diurnal and seasonal fluctuations of temperature. Avalanches and streams deposit large amount of soil in the lower valley and alluvial fans, allowing a particularly rich plant cover. The soil is basically silty clay-loam and alkaline in nature, with pH ranging from 7.2-7.9. It is also poor in organic matter, which ranges from 0.08 to 1.7% (Singh & Gupta, 1990). The data on physio-chemical properties of soil recorded from Kaza and Tabo in Spiti subdivision are provided in Table 1.

Table 1. Physico-chemical properties of Soil

Location of Soil Sample	Altitude (m)	Location of Soil Sample	Mechanical separates (%)			Texture	pH	Organic matter	Potassium (%)	Phosphorus (%)	Calcium	Sodium
			Sand	Silt	Clay							
Kaza	3750	Kaza	35.80	37.60	26.60	Silty Clay	7.9	1.70	0.16	0.022	1.79	0.036
Tabo	3500	Tabo	28.40	40.20	30.80	loam	7.2	0.08	0.10	0.017	2.01	0.041

Source: Singh & Gupta, 1990

Soils in general are poor in potassium, phosphorus and sodium. At both the sites, calcium percentage was maximum followed by potassium, sodium and phosphorus in decreasing order. The great insulation and absence of any water action in Spiti has led to the accumulation of abundant detrital products on the dry uplands and valleys forming a mantle rock or regolith of fresh, undecomposed fragments of different rocks which appear to be high in calcium content. Due to this, the soils are rich in calcium and its availability to the plants is also high because, the weathered complex containing calcium cannot be leached under the low precipitation and due to continuous weathering of rock, the supply of this

mineral to the soil is maintained constantly. The soil samples of Tabo have recorded lower concentration of all nutrients as compared to the soil samples of Kaza (Singh & Gupta, 1990).

CLIMATE

Johnsingh & al. (1999) distinguished 4 seasons in the Pin Valley National Park as

- a. Spring : Late April to end of June
- b. Summer : Early July to middle of September
- c. Autumn : Late September to end of November
- d. Winter : Early December to middle of April

Spring is characterized by patchy snowmelt and sprouting between April and June. The peak vegetation pulse coincides with the peak summer from July to September. The summer season is marked by number of cloudy days with occasional rain and snow, and temperature fluctuations with a minimum of 4^oC and to maximum of 30^oC. Pin Valley has more moist summer and winter as compared to other parts of Spiti. With the onset of autumn, the temperature steadily declines and senescence of most plants set in. In winter the rivers freeze and form natural roads.

Precipitation

High mountain ranges enclosing the Pin Valley National Park act as a barrier against monsoon currents. It has, therefore, an almost rainless summer. There are occasional showers during the monsoon period and severe snowfalls in winter. The snowfall is occasional or even nil during September to October, but regular snowfall usually starts from the middle of November and continues till early April.

Temperature

The temperature shows great fluctuation during different months of the year. The daily minimum temperature remains below zero for more than seven months (October to May) in a year, and even the daily maximum temperature stays below freezing in January and February (Johnsingh & al., 1999). The mean maximum and minimum temperature for ten years period (1994-2003) recorded in Tabo has been provided in Table 2. The fluctuation in the temperature during the different months of a year (2002) has been shown in Table 3.

Table 2. Mean Annual Temperature in Tabo (in °C)

Year	Maximum	Minimum
1994	11.51	-3.12
1995	14.66	-4.30
1996	8.23	-3.92
1997	10.52	-5.17
1998	9.45	-6.21
1999	11.08	5.24
2000	8.54	-4.17
2001	9.23	3.63
2002	9.14	4.15
2003	11.21	-4.61

Source : Regional Horticultural Research Sub Station (RHRSS), Tabo, Spiti

Table 3. Monthly distribution of Temperature in the year 2002 recorded in Tabo (in °C)

Month	Maximum	Minimum
January	-3.2	-18.1
February	-1.6	-14.3
March	-1.1	-11.7
April	4.2	-1.3
May	15.7	-0.9
June	16.4	9.2
July	29.8	12.6
August	27.3	8.1
September	16.2	-0.7
October	8.4	-3.8
November	-1.9	-11.7
December	0.5	17.3

Source: Regional Horticultural Research Sub Section (RHRS), Uves, Spiti

Humidity

The air is generally very dry, particularly in summer. The air is very dry except during occasional rain or snowfall in even winter.

Winds

The winds are generally gentle at the lower elevations but strong at the higher reaches. The direction of wind depends much on the nature of the terrain. Generally, the winds are northerly to north-easterly in summer and westerly to north-westerly during the remaining period of the year.

PEOPLE

It is difficult to hazard a guess whether it was the adventurous zeal or force of circumstances, which led people to establish themselves in these remote and inhospitable areas of Pin Valley. *Bhotis* who inhabit the valley are culturally similar to the Tibetans (Verma, 1997; Jhusingli & al., 1999). Buddhism is their main religion, which was established after Guru Padmasambhava preached his doctrine here in the 9th century AD. Traditionally, the people are agropastoralists, leading a subsistence life-style, cultivating barley, peas and potatoes. Livestock, consisting of yaks, *drus* (yak-cow hybrids), sheep and goats are raised for milk and donkeys as beasts of burden. The local breeds of *Chamuri* horses are raised for sale in Ladakh. Killing of animals is not allowed in Buddhism and wild animals are therefore not poached.

The buffer zone of the Park comprises 17 villages holding a population of about 1600 people. The biggest settlement is Sagnatn with about 62 families, located at the junction of the Parshio and Pin rivers (Photo. 1-7). People draw fuel wood and fodder for the livestock from the National Park. Women knit socks and gloves, and weave shawls, while men make ropes from goat and yak hair.

FAUNA

The Park is specially renowned for the protection of endangered Snow Leopard (*Panthera uncia*). The large wild mammals recorded in the Park area are *Ibex* (*Capra ibex sibirica*), and red fox (*Vulpes*

vulpes). Smaller carnivores like stone marten (*Martes flava*) and Himalayan weasel (*Mustela uluica*) are also found (Johsingh & al., 1999).

VEGETATION

The vegetation is of dry alpine type. This type of vegetation is due to scanty rainfall, low capacity of the substratum to retain moisture and excessive topping and grazing. The area remains under snow for more than six months in a year, but in the summers the mountain slopes, meadows, moraines and pastures present a spectacular display of alpine flowers. The principal vegetative growth starts at the commencement of summer, when melting snow provides abundant moisture to the herbaceous vegetation to run its full course with great rapidity. The vegetation is most prominent in August, but disappears by the end of September or by early October.

The alpine zone has two broad groups:

1. Alpine scrubs and 2. Alpine meadows

1. Alpine Scrubs

These are chiefly met with on rocks, ridges and on stony slopes and generally appear above the tree limit and in similar habitats, ascending almost up to 4200 m. The chief shrubby components are *Cassiope fastigiata*, *Cotoneaster gilgitensis*, *Lonicera asperifolia*, *L. semencovi*, *L. spinosa*, *Rosa webbiana*, *Salix flabellaris* etc. The herbaceous elements are species of *Anaphalis*, *Anemone*, *Artemisia*, *Aster*, *Astragalus*, *Bupierium*, *Lipichium*, *Hirgeron*, *Hirttrichium*, *Gentiana*, *Gentiana*, *Ligusticum*, *Myosotis*, *Oxytropis*, *Polygonum*, *Potentilla*, *Primula*, *Ranunculus*, *Saxifraga*, *Sedum*, *Silene*, *Stellaria*, *Suaeda*, *Thalictrum* and several members of the Brassicaceae and Poaceae (Photo. 8).

2. Alpine Meadows

The alpine meadows are long undulating grassy plains or pasture lands, which are interrupted by glacial moraines at certain places. The common herbaceous elements include *Aconitum violaceum*, *Arabis himalayica*, *Archieia subnana*, *Aster flaccidus*, *Astragalus munroi*, *A. webbiana*, *Corydalis meifolia*, *Dalphinium himalayicum*, *Dracopis heterophyllum*, *Picrochiza karrova*, *Rhuncu spiciformis*, *Trollius oculis*, *Waldbeimia glabra*, *W. somnensis* and species of *Juncus*, *Luzula*, *Pedicularis*, *Polygonum*, *Potentilla*, *Primula*, *Ranunculus*, *Rhodiola*, *Suastraea*, *Saxifraga* and *Senecio* (Photo. 9). The members of Cyperaceae and Poaceae are also common in the alpine meadows, prominent among them are *Bromus japonicus*, *Calamagrostis pseudophragmites*, *Carex nivalis*, *C. stenophylla*, *Ligmus nutans*, *Festuca kashmiriana*, *F. valesiaca*, *Oxyropis lateralis*, *Poa alpina*, *P. ludens*, *P. lahulensis*, *Stipa arabica*, *Vriatum spicatum*, etc.

ADAPTATION OF VEGETATION TO THE EXTREME CLIMATE

(a) **Temperature:** Temperature plays a major role in governing the flora of a cold desert. The air temperature often remains below 0°C for months together. As the temperature falls the atmospheric precipitation changes from rain into snow which enables the solar radiation to warm up the ground, causing variation in temperature of the soil itself. This variation in the ground and air temperature plays an important role in the biology of cold desert plants by influencing the opening of buds, growth of leaves, flowering and fruiting, etc.

The day temperature as high as 15°C and that of night as low as -16°C shows great fluctuations, but at very shallow soil depths the difference in minimum and maximum temperatures becomes almost

insignificant. Thus, soil mitigates extremes of temperature, making the survival of plants possible. In areas of stony grounds, open cliff faces, creeks and rocks where soil is absent or scanty, the solar radiation is more intense. Such rock areas very high temperatures during the day, and becomes very cold during the night. In such extreme situations only a few selected and highly specialized plants such as *Astragalus candolleanus*, *A. munroi*, *A. oplites*, *A. rhizanthus*, *A. webbianus*, *Corydalis transjohba* and *Saxifraga flagellaris* are able to grow. Certain characteristic adaptations to overcome the severe cold include: (i) Dense protective covering of hairs which form a felt-like coating on the entire surface of the exposed plant and acts as a thermal blanket. (ii) Many cold desert plants survive very low temperatures and thermal fluctuations by forming a dense, closely packed mats, e.g. *Arenaria festucoides*, *Primula minutissima*, *Volix flabellaris*, *Walibolium glabrum*. (iii) Development of a thick, woody and deep root system which help the plants that grow on exposed rocks and crevices to fight extremes of temperature e.g. *Lipbedra geraniiflora*, *E. intermedia*, *Astragalus candolleanus* and *A. strabelligerus*.

The other specializations developed by these plants are the high concentration of cell sap of plant cell due to conversion of starch into soluble sugar during the nights, which are normally much longer. This increased cell sap concentration lowers the freezing point by several degrees and this is how the cold desert plants survive temperatures as low as -15°C to 20°C (Chowdhery & Rao, 1990).

(b) Water: Rainfall in cold deserts is negligible and snow is the only available source of water to the inhabiting plants. A thick mat of snow covers entire area of the Pin Valley for a long period, which not only affects the availability of water but also plant growth and development. The development of prostrate and creeping habit as in case of *Dracopis hirsuta heterophyllum*, *Walibolium stoliczkaei*, *W. tomentosum*, *Astragalus dibornitachy*, and *A. peduncularis* is an adaptation to avoid the crushing weight of snow layer for long periods.

In cold deserts experience the plants undergo a period of dormancy during winter. With the rise in temperature during summer, the snow melts releasing huge amount of water, which is dispersed quickly due to steep slopes and impervious substratum. Therefore, the plants can use very small amount of water and are forced to adapt themselves to extreme dry conditions. The noticeable xerophytic adaptations are: (i) mat or carpet-like formations by aggregation to retain maximum water within them; (ii) development of long, thick tap roots capable to reach deep in the rock crevices to draw available water; (iii) succulent habit in leaves and stem for storing water.

(c) Mist: Prevalence of mist is a common in high altitudes. It reduces the light intensity and at the same time distribute light more evenly due to refraction caused by suspended water droplets that provide moisture to plants.

(d) Winds: High velocity winds are in the park dry the atmospheric air, increasing the transpiration rate in plants (Murti, 2001). They also erode the soil thereby uprooting the plants. The adaptations to strong wind currents include the development of a strong, thick taproot, prostrate habit and restricting the erect growth of plants.

(e) Light: Due to lower air density at high altitudes the solar radiation reaches soil surface easily and in higher intensity. The hairy covering and reddish colour of the branches and leaves protect the plants against intense radiation. The strong ultraviolet radiation has also a stinging effect on the high altitude plants. It slows down the vegetative growth of the plants thus producing dwarf forms.

REPRODUCTIVE STRATEGIES

During the very short favourable period the cold desert plants have to complete the entire reproductive cycle right from the opening of buds to sprouting of leaves and flowers, fruiting and even dispersal of seeds. Thus reproduction and dispersal in cold desert plants is an important aspect, which maintains the population of this scanty vegetation under the existing adverse conditions. The reproduction is accomplished both by seed formation and by the vegetative propagation. The amount of energy spent in producing a new shoot through sexual reproduction is more or less 10,000 times more than that of vegetative multiplication. Vegetative reproduction is tend to be common as carbohydrates, the basic source of energy are a limiting factor. The species that reproduce by seeds take several years longer to reach the seed producing stage than the plants (of same species) growing in hotter climate (Chowdhery & Rao, 1990). Some of the cold desert plants are annual or monocarpic, i.e. producing the fruits and seeds only once. *Salsola collina* belongs to this category. Some perennial species are also monocarpic but survive only for 2-3 seasons. They have large taproots, full of stored food material synthesized in the first season and used for flowering and fruiting in the following year. Cold climates are not favourable for sexual reproduction due to very low temperature, short growing season and poor nutrient availability. In order to make sexual reproduction process easy and effective these plants therefore have evolved certain physiological adaptations that support them during the various stages of reproduction, like development and formation of ovule, pollen, attracting the pollinating agents etc. for successful pollination and seed formation.

The green leaves of plants make use of sunlight for producing carbohydrates through the process of photosynthesis, at the same time the flowers use this energy for heating purposes which accelerates the growth of pollen and seeds. Some of the flowers also have ultra violet patterns that attract the pollinators. The bowl or saucer-shaped flowers of *Anemone*, *Ranunculus*, *Saxifraga* and many others are usually heliotropes and have highly reflective inner surface of petals; in the central region of these flowers lie carpels and many stamens. This shape acts as a small dish antenna focussing the reflected light and heat on the center of the flower where stamens and carpels effectively retain the heat gained through such radiation. This energy accumulation by flowers helps in pollination. It has also been reported that the insects that visit flowers for nectar also absorb heat from flowers and maintain temperature as high as 30-32°C in excess of the atmospheric temperature. Thus, the heat so acquired enhances their metabolic activities including reproduction and obviously insects seek out the warm flowers in cold desert areas. On the other hand, plants could conserve energy by accomplishing pollination at the same time the loss of food in the form of nectar. In this way a sort of symbiotic relationship is maintained between insects and plants in cold desert areas (Murri, 2001).

Brilliantly coloured flowers can attract insects for pollination and facilitate sexual reproduction. Species of *Aconitum*, *Astragalus*, *Corydalis*, *Delphinium*, *Gentiana*, *Geranium*, *Meconopsis*, *Oxytropis*, *Potentilla*, *Primula* and *Saxifraga* produce bright, sparkling flowers of red, yellow, blue, violet or purple. These plants spend much of their energy to produce large, attractive, flowers, no matter how big the plant is. Anemones, Campanulas, Gentians, Primulas and Saxifragas have large flowers as compared to the size of the plant.

Seed production is quite enormous in cold desert species to compensate losses due to perennial drought, heavy snowfall, eroding slopes with shifting sands and stones, and overgrazing. Only a few seeds ultimately succeed in establishing the plants. Therefore, many species resort to vegetative reproduction through bulbs, bulbils, runners, stolons, offsets and through production of new branches from rootstocks.

SPECIALIZED HABITS AS SURVIVAL STRATEGY

The plants of cold deserts exhibit a number of specialized habits to counter harsh climate. Few such developments of specialized habits are reviewed, on the basis of Chowdhery & Rao (1990).

(i) **Cushion-forming habit:** Cushion, clump or mat forming habit is very common in cold desert plants. Such plants are perennial, short and sturdy with woody stem; deep root system capable of penetrating rock crevices and fissures to provide firm anchorage and nutrition to the plant. The heavily lignified stem gives out numerous short, creeping branches just above the ground level that get repeatedly branched and densely packed with leaves and flowers forming dense hemispheric cushion. Such a habit protects from the strong wind action, strong thermal radiations, desiccating effect of air, loss of water through transpiration, in maintaining the balance of temperature fluctuations between air and soil and from the continuous pressure of snow layer which may be several feet thick for months together, e.g. species of *Astragalus*, *Draba*, etc. *Astragalus ophioides*, *A. strabiliferus* and *Caragana verticilar* form variously shaped spiny cushion on the rocky ground (Photo. 60 & 62).

(ii) **Diminutive or miniature habit:** Although the cold desert plants are generally dwarf and stunted, some of them are so significantly reduced that one may not even notice them in field. *Suaeda glacialis*, *Ephedra flabellata*, *Cleistoma leucocelaena* and *Sagina saginoides* attain a maximum height of are often 1-5 cm. In case of *Corydalis crassifolia*, *Thermopsis inflata* and *Draconophthalon heterophyllum* the plants develop deep penetrating perennial rootstocks from which annual branches are produced down among the rocks or stones and they bear leaves and flowers in clusters just above the stones or rocks.

(iii) **Bushy habit:** The number of woody plants in cold arid region is exceedingly low. *Caragana verticilar*, *Ephedra gerardiana* and *Ulmus spinosa* form dense bushy clumps with woody branches barely attaining 30-50 cm height.

INTRODUCED PHYTODIVERSITY

To meet their needs for food, fodder, fuel, timber, vegetables, herbal medicines, etc. local people have introduced several plant species, thereby bringing a remarkable diversity in the floristic components of this area.

Recently a cold tolerant and fast growing European *Populus* sp. was introduced to meet the increased demand of fuel and fodder. *Astragalus solutocarpus*, *Caragana verticilar*, *Hippophae rhamnoides* subsp. *turkestanica*, *Myricaria germanica*, *Myrtana elegans* and *Rosa webbiana* are only found bushes and there are no tree species occurring naturally in the Park.

Several species have been introduced in marshy depressions near habitations and river courses. These are of special significance to the local populations as a source of fuel, fodder, timber, etc. These include species of *Salix*, *Populus* and *Juniperus*. Some species like *Populus alpinus* and *Lythra oligosperma* have been selected for improvement of soil substratum (Murti, 2001).

CULTIGENS

In spite of the scanty rainfall, dry cold climate, very limited agricultural land and meager irrigation facilities, the people with their inherent indomitable spirit and great agricultural skill grow crops in this inhospitable terrain. *Hordeum vulgare* is the main cereal crop. *Lent culinaris* is grown as a pulse crop. The principal vegetable crops include *Pisum sativum* and *Allium* spp. Potato (*Solanum tuberosum*) is an important cash crop. *Melothra jalapa*, *M. sativa* and *M. x indica* are commonly cultivated for fodder.

Melilotus officinalis, *Astragalus densiflorus* and *Trigonella emodi* are also encouraged in the field along with *Medicago* spp. In some places *Cannabis sativa* is also under cultivation.

MEDICINAL AND OTHER ECONOMIC PLANTS

a. Medicinal Plants

The Pin Valley National Park is the rich reservoir of medicinal plants, evidently as many as 200 species are in usage by local people for the treatment of various ailments (Chandra Sekar & Srivastava, 2003, 2004). However, some of the reputed medicinal herbs of commercial value are *Aconitum heterophyllum*, *Arnebia euchroma*, *Artemisia maritima*, *Bergonia strucheyi*, *Dactyloctenium aegyptium*, *Ephedra gerardiana*, *Hyoscyamus niger*, *Physoclaina praecox*, *Picrorhiza kurroa*, *Rubus spiciformis*, *R. webbiana* and *Thymus linearis*.

Aswal and Mehrotra (1994) recorded few flowering plants of interesting biological activity. These are *Arnebia euchroma* (Abortifacient), *Codonopsis ovata* (Oxytocic), *Ephedra gerardiana* (Oxytocic), *Saunthalia thomsonii* (Oxytocic), *Hippophae rhamnoides* subsp. *turkestanica* (Oxytocic), *Nepeta eriostachya* (Diuretic), *Picrorhiza kurroa* (Hepatoprotective) and *Synotis kuntziana* (Spasmolytic).

b. Fruits

The wild edible fruits are *Capparis spinosa*, *Cotoneaster falconeri*, *Ephedra gerardiana*, *Hippophae rhamnoides* subsp. *turkestanica*, *Ribes orientale*, *Rosa hookeriana* and *R. webbiana*.

c. Vegetables

The plant materials used for cooking include *Allium carolinianum*, *A. cepa*, *A. stoliczkyi*, *Carum carvi*, *Chaerophyllum acuminatum*, *C. reflexum*, *C. villosum*, *Chenopodium album*, *C. botrys*, *Cicer microphyllum*, *Eremurus himalaicus*, *Mentha longifolia* and *Rumex acetosa*.

d. Fodder and fuel

Astragalus chlorostachys, *A. pedunculatus*, *Caragana verticillata*, *Cicer microphyllum*, *Ephedra gerardiana*, *Lerocleum candicans*, *Hippophae rhamnoides* subsp. *turkestanica*, *Medicago falcata*, *M. sativa*, *Myricaria albiflora*, *M. germanica* subsp. *alopeuroides*, *Myrsina elegans*, *Populus ciliata*, *Salix denticulata*, *S. flabellata*, *S. fruticulosa*, *S. wallichiana* and *Trigonella emodi* are used for fodder and fuel purposes. The wood of *Juniperus recurva*, *Populus ciliata* and *Salix denticulata* are used for timber and implements.

e. Dye

The species viz. *Arnebia euchroma*, *Gevanium pratense* and *Onosma hispidum* are used for dye.

f. Incense and perfumes

The incense and perfumes are obtained from *Cassiope fastigiata*, *Chrysanthemum pyrethroides*, *Delphinium brunonianum*, *Rhododendron anthopogon* and *Waldheimia glabra*.

g. Plants for improvement of soil substratum

Fremontia persica, *Festuca ovina* and *Poa alpina* are planted to improve soil substratum.

h. Narcotic

Cannabis sativa is used as narcotic.

i. Fence

For fence making *Hippophae rhamnoides* subsp. *turkestanica* is used.

WILD RELATIVES OF CULTIVATED PLANTS

Some important wild relatives of cultivated species include *Turdium brevisubulatum*, *Pennisetum orientale*, *Cicer microphyllum*, *Lepidium capitatum*, *Allium carabianum*, *A. stoliczkae*, *Prunus cerasus* and *Ribes orientale*. Species of *Allium*, *Cicer* and *Turdium* have got potential genoplasm to improve their cultivated species with regard to high yield and cold resistance.

ENDEMIC PLANTS

The species namely *Festuca sanjappa* Chandra Sekar & S.K. Srivast. is endemic to the Pin Valley National Park. The other taxa which are endemic to the cold desert region of Western Himalaya (including Tibet) and are also found in the area viz., *Anaphalis royleana*, *Astragalus melanostachys*, *A. munroi*, *A. webbianus*, *Calamagrostis stoliczkae*, *Christula crassifolia*, *Corydalis crassifolia*, *Dactylorhiza hatagirea*, *Draba lasiophylla*, *Elymus russellii*, *Eritrichium fruticulosum*, *Luphorbia tibetica*, *Euphrasia jaeschkei*, *E. parvifolia*, *Pensula jaeschkeana*, *Poa labialis*, *P. jakoneti*, *Saussurea jacea*, *Semenoria thomsonii*, *Tanacetum tibeticum*, *Veronica biloba* var. *minima* and *Waldheimia stoliczkae*.

THREATENED PLANTS

The rare and endangered plants from the Park have been enumerated in table 4 & 5 on the basis of Schaffer (1981).

Table 4. Rare taxa from the Pin Valley National Park

S. No.	Name of species	Family
1.	<i>Artemisia gmelinii</i>	Asteraceae
2.	<i>Astragalus melanostachys</i>	Fabaceae
3.	<i>A. munroi</i>	Fabaceae
4.	<i>Corydalis crassifolia</i>	Fumariaceae
5.	<i>Draba altaica</i>	Brassicaceae
6.	<i>Dracocephalum heterophyllum</i>	Lamiaceae
7.	<i>Eremurus himalaicus</i>	Liliaceae
8.	<i>Eritrichium nanum</i>	Boraginaceae
9.	<i>Galium tibeticum</i>	Rubiaceae
10.	<i>Gentiana leucomeiensis</i>	Gentianaceae
11.	<i>Lonicera semonovii</i>	Caprifoliaceae
12.	<i>L. spinosa</i>	Caprifoliaceae
13.	<i>Leydia serotina</i>	Liliaceae
14.	<i>Podianthus rhinanthoides</i>	Scrophulariaceae
15.	<i>Rhodola imbricata</i>	Crassulaceae
16.	<i>Saussurea gnaphalodes</i>	Asteraceae
17.	<i>Thermopsis inflata</i>	Fabaceae
18.	<i>Veronica minima</i>	Scrophulariaceae
19.	<i>Viola himalaica</i>	Violaceae
20.	<i>Waldheimia stoliczkae</i>	Asteraceae

Table 5. Endangered species from the Pin Valley National Park

S. No.	Name of species	Family
1.	<i>Acunatum heterophyllum</i>	Ranunculaceae
2.	<i>Arachis euchromis</i>	Boraginaceae
3.	<i>Dactylocteniza batagirea</i>	Orchidaceae
4.	<i>Ephedra gerardiana</i>	Ephedraceae
5.	<i>Fremurus himalaicus</i>	Liliaceae
6.	<i>Hyoxyanthus niger</i>	Solanaceae
7.	<i>Juniperus recorta</i>	Cupressaceae
8.	<i>Jurinea dolomiaca</i>	Asteraceae
9.	<i>Physochlaina praealta</i>	Solanaceae
10.	<i>Pterorhiza kurnoua</i>	Scrophulariaceae
11.	<i>Ribetes spiroforme</i>	Polygonaceae
12.	<i>R. webbiana</i>	Polygonaceae

BIOTIC AND NATURAL INTERFERENCES

Biotic interferences: Considerable damage to the flora and vegetation is caused by inhabitants in the vicinity of the Park, and by migratory livestock from the adjoining Kullu and Kinnaur districts.

People depend upon the Park for fuelwood. They uproot and dry the shrubby vegetation, since there are virtually no trees. The species of *Ephedra*, *Lonicera*, *Myricaria*, *Rosa* and *Salix* are some of the preferred fuelwood species. The green vegetation consisting of *Cicer microphyllum*, *Festuca olgae*, *Poa annua*, *P. labulensis*, *Sansurea jacea*, *Thalictrum foetidum*, etc. are collected as fodder and stored for winter stall-feeding of livestock. Migratory livestock of sheep and goats graze on the unvalled pasture and destroy the vegetation through physical injury to herbaceous vegetation, seedling and saplings (Photo. 16). The impact of grazing by cows, goats, horses, donkeys, yaks, mules, etc. is also serious, especially near the habitations (Photo. 17-19). Fire caused by human activities is most injurious to vegetation.

Natural interferences: The extreme climatic conditions i.e. sub-zero temperature with great diurnal fluctuations, scanty and erratic rainfall, heavy snowfall, howling winds, ultraviolet radiation, desiccating exposure to the sun, landslides, snow slides, avalanches, soil erosion etc. are the cause damage to the vegetation (Photo. 20).

PREVIOUS BOTANICAL EXPLORATIONS

The pioneer plant collector of this region was W. Koelz, who explored Mane and Guling (the buffer area in the Park) in the first half of the 20th century. After the notification of the Pin Valley National Park in 1987, scientists of Wildlife Institute of India, Dehra Dun; Botanical Survey of India, Northern Circle, Dehra Dun and forest officials of Spiti forest division made extensive surveys (including fauna). Notable among these were B.S. Nogi, Pandey, G.S. Rawar, S.K. Murti, Surendra Singh, A.J.T. Johnsingh, Nura Manjrekar, Yash Veer Bhatnagar, C.P. Kala and S.K. Srivastava.

Aswal & Mehrotra (1994) published Flora of Lahaul-Spiti. Johnsingh & al. (1999) recorded 378 plant species from the Park in connection with the studies on ecology and conservation of Asiatic

Ilex Murti (2001) published *Flora of Cold Deserts of Western Himalaya* in which he included monocotyledonous plants from Lahaul-Spiti. A few publications have also appeared on the medicinal plants of this area (Sood & al., 2001, Kala, 2002).

FLORISTIC ANALYSIS

A total of 513 taxa have been described in the present enumeration. These belong to 243 genera and 64 families of Pteridophytes, Gymnosperms and Angiosperms. Among 513 taxa, 505 are Angiosperms, 3 are Gymnosperms and 5 are Pteridophytes. The Angiosperms are distributed in 505 taxa, belong to 237 genera and 60 families, of these, the dicot plants are distributed in 409 taxa, belonging to 191 genera and 49 families and the monocot plants are distributed in 96 taxa, belonging to 46 genera and 11 families (Table 6).

Table 6. Number of families, genera and taxa in the Pin Valley National Park

Group	Families	Genera	Taxa
PTERIDOPHYTES	02	04	05
GYMNOSPERMS	02	02	03
ANGIOSPERMS			
Dicotyledons	49	191	409
Monocotyledons	11	46	96
TOTAL	64	243	513

Out of 64 families recorded from the Pin Valley National Park, 37 are represented by single genus. The ten numerically dominant families of the flora with their respective genera and taxa are listed in table 7, whereas the dominant genera of the Park with their respective taxa are listed in table 8.

Table 7. Ten dominant families of the Pin Valley National Park

Family	Genera	Taxa
POACEAE	32	72
ASTERACEAE	31	59
FABACEAE	14	41
BRASSICACEAE	17	30
POLYGONACEAE	09	30
SCROPHULARIACEAE	07	25
CARYOPHYLLACEAE	08	22
RANUNCULACEAE	10	21
LAMIACEAE	12	18
BORAGINACEAE	08	18

Table 8. Ten dominant genera of the Pin Valley National Park

Genera	Taxa
<i>Astragalus</i>	17
<i>Poa</i>	14
<i>Potentilla</i>	10
<i>Silene</i>	8
<i>Artemisia</i>	8
<i>Polygonum</i>	8
<i>Ranunculus</i>	7
<i>Oxytropis</i>	7
<i>Veronica</i>	7
<i>Festuca</i>	7

A comparison of ten dominant families of Angiosperms in the Pin Valley National Park, Lahaul Spiti, Great Himalayan National Park, Kullu, Himachal Pradesh and India have been provided in Table 9. It may be noted that the Poaceae occupy first position in the Pin Valley National Park and India, and second in Lahaul-Spiti, Great Himalayan National Park, Kullu and Himachal Pradesh.

Table 9. A comparison of ten dominant families of Angiosperms in the Pin Valley National Park, Lahaul-Spiti, Great Himalayan National Park, Kullu, Himachal Pradesh and India

Pin Valley National Park	Lahaul-Spiti	Great Himalayan National Park	Kullu	Himachal Pradesh	India
(Present study)	(Aswal & Mehrotra, 1994)	(Singh & Rawat, 2000)	(Dhaliwal & Sharma, 1999)	(Chowdhery & Wadhwa, 1984)	(Karthikeyan, 2000)
Poaceae	Asteraceae	Asteraceae	Asteraceae	Asteraceae	Poaceae
Asteraceae	Poaceae	Poaceae	Poaceae	Poaceae	Orchidaceae
Fabaceae	Brassicaceae	Ranunculaceae	Fabaceae	Fabaceae	Fabaceae
Brassicaceae	Fabaceae	Rosaceae	Lamiaceae	Rosaceae	Asteraceae
Polygonaceae	Rosaceae	Liliaceae	Rosaceae	Scrophulariaceae	Rubiaceae
Scrophulariaceae	Scrophulariaceae	Lamiaceae	Ranunculaceae	Lamiaceae	Cyperaceae
Caryophyllaceae	Ranunculaceae	Fabaceae	Polygonaceae	Cyperaceae	Euphorbiaceae
Ranunculaceae	Apiaceae	Brassicaceae	Brassicaceae	Ranunculaceae Scrophulariaceae	Acanthaceae
Lamiaceae	Polygonaceae	Apiaceae	Apiaceae	Apiaceae	Lamiaceae
Boraginaceae	Cyperaceae	Cyperaceae	Cyperaceae	Brassicaceae	Rosaceae

It is interesting to note that the Orchidaceae, which occupy second place in India, is totally absent from the 10 dominant families of Pin Valley National Park, Lahaul-Spiti, Great Himalayan National Park, Kullu and Himachal Pradesh as a whole. Singh & al. (2002) recorded 1192 species of Orchids from India, whereas they recorded only 288 species from Western Himalayan region.

Murti (2001) recorded 13 species from Cold desert regions of Western Himalaya, but only 2 species recorded from the Pin Valley National Park.

As regards the flora of Lahaul-Spiti, the seven dominant families are common to the Pin Valley National Park, although their sequence of dominance is different, except for Scrophulariaceae.

PHYTOGEOGRAPHICAL ANALYSIS

The floristic survey and analysis of species reveals that apart from indigenous elements, the flora contains species which are cosmopolitan or are common with adjoining and far off countries. The flora is closely related to the Tibetan and Turkish floristic elements. The cosmopolitan elements are represented by *Capsella bursa-pastoris*, *Cheynodium album*, *Lolium corniculatum*, *Medicago sativa*, *Poa annua*, *Taraxacum officinale*, *Trifolium pratense*, *Verbascum thapsus*, etc.

The boreo-alpine elements of northern arctic Europe and southern European mountains, find their extreme eastern range of distribution in the Western Himalaya. Species of *Aconitum*, *Agrostis*, *Calcha*, *Droba*, *Hiplobotium*, *Festuca*, *Centiana*, *Oxyria*, *Pedicularis*, *Poa*, *Polygonum*, *Potentilla*, *Primula*, *Ranunculus*, *Saxifraga*, *Sedum*, *Silene*, *Sisymbrium*, *Stellaria*, *Thalictrum*, *Thlaspi*, etc are in the Pin Valley National Park.

A few genera which are widely distributed in the Alps, Central Europe, extending eastwards to the Caucasus, the Hindukush and the Pamirs, find their way to Himalaya, extending further to Tien Shan, the Altai mountains. These are Euro-Siberian elements. These genera are, *Allium*, *Bupleurum*, *Calamagrostis*, *Elymus*, *Eurotia*, *Ceranium*, *Cicum*, *Leontopodium*, *Lonicera*, *Oxytropis*, *Scrophularia*, *Vilpa*, *Vicia*, etc

The Mediterranean genera, which are widely distributed in Southern Europe, North Africa, Western Asia and find their extension eastwards to Turkestan, Afghanistan, Western Himalaya and Alai Pamirs are species of *Arenaria*, *Arnebia*, *Artemisia*, *Delphinium*, *Heracleum*, *Alysois*, *Alysicaria*, *Nepeta*, *Neraco*, *Thymus*, *Trifolium*, etc.

Genera like *Astragalus*, *Caragana*, *Carex*, *Comisia*, *Fremurum*, *Nauusurea*, *Vanortum*, *Taraxacum*, *Thermopsis* and *Waldheimia* are distributed in comparatively smaller area from Siberia to Mongolia, the Altai mountains, central Tien Shan, the Alai Pamirs and the Western Himalaya including the Pin Valley National Park.

CONSERVATION

Pin Valley National Park is characterized by scanty vegetation and has number of important food plants which are selected by the local settlers after several years of trial and error method. The wide climatic and physiographic diversity has forced the local people to grow their own cultivars of food, fodder and fruit plants. Various crops in the Trans-Himalayan region exhibits wide range of genetic diversity. Several cereal crops which are commonly cultivated are reported to have disease tolerant properties, well adapted to cold and arid conditions. Besides, the Park also possesses a variety of non-conventional legumes and grasses which are also utilized. These are *viz.*, *Cicer*, *Astragalus*, *Caragana*, *Medicago*, *Lolium*, *Hordeum*, *Poa*, etc. (Chowdhery & Rao, 2000).

The cold desert ecosystem of North-West Himalaya is recognized as one of the fragile and threatened ecosystems of India. Any change or disturbance in the biotic and abiotic components of this unique ecosystem is bound to cause imbalance in the ecosystem (Murti, 2001). In Pin Valley National Park, considerable amount of damage to the flora and vegetation caused by people living in

the vicinity of the Park area and the animals such as migratory livestock from the adjoining districts of Kullu and Kinnaur. Already devoid of tree species, people are using the species of *Myricaria*, *Myrtanus*, *Ulmicum*, *Rosa*, *Salix* and *Ephedra* for fuel wood, thus giving the area a barren look. The green vegetation mainly consist of *Cicer microphyllum*, *Saussurea jacea*, *Thalictrum fuscidum*, *Poa labialis*, *Festuca valesiaca*, *Cousinia thomsonii* etc. are being collected as fodder and stored for winter stall-feeding of livestock. Migratory livestock of sheep and goats graze the unrivalled pasture and destroy the herbaceous vegetation and give physical injury to seedlings and saplings.

The following important measures are of urgent need to conserve the biodiversity of the Park. Firstly, grazing by migratory livestock in the pastures and alpine meadows should be banned completely. Secondly, the species, which are suggested as rare or endangered should be protected and multiplied under both *in situ* and *ex situ* conservation. Lastly, introduction of the fuel wood plants in the buffer zone of the Park, through social forestry should be done in order to provide alternate fuel sources during the winter months and so to allow the shrubby species like *Hippophae*, *Myrtanus*, *Myricaria*, *Rosa* and *Salix* flourish naturally.

The success of such conservation programme depends on the participation of local people. It is imperative to educate the local inhabitants about the floristic wealth and also about the rare and endangered medicinal and other economically useful plants of this area.

MATERIALS AND METHODS

FIELD SURVEY, COLLECTION AND PRESERVATION

The present work on the flora of the Pin Valley National Park is based on extensive and intensive field surveys made along different topographic and climatic gradients in the Pin Valley National Park (Figs. 21-24). More than 4000 specimens, belonging to 924 field numbers were collected from the Park. Observation on habit, habitat, abundance, ecological features and other characters of the species such as height, colour of flowers were recorded during field surveys, and for each species 8-10 specimens were collected. Localities of plants that were in vegetative condition, were carefully marked to relocate them in subsequent trips to collect them in flowering and fruiting. Small herbs were carefully uprooted and collected entirely; for larger specimens representative portions were severed. The specimens were (field) numbered and placed in polythene bags, which were enclosed in a vasculum to avoid excessive desiccation or wilting. Flowers and fruits of economically important and rare plants were fixed in 40% formalin for further study and reference. All the specimens were carefully checked on return to the base camp/camping site; field notes restudied and entered into proper field books. Three to six specimens of each species were pressed and the remaining were retained for detailed study.

Each specimen was glued on to a standard herbarium sheet (42 x 28 cm) after drying and poisoning as suggested by Jain & Rao (1977). A label showing the name of the plant, family, local name(s), habit, habitat, distribution, uses if any, place and date of collection, altitude of the locality, and collector's name and number was affixed at the bottom right-hand corner of the sheet.

IDENTIFICATION

All the specimens were identified with the help of latest monographs, revisions and floras, and then compared with authentic specimens/cibachromes available in the herbaria of Botanical Survey of India, Dehra Dun (BSD), Forest Research Institute, Dehra Dun (DD), Central National Herbarium, Howrah (CAF) and Royal Botanic Gardens, Kew (K) wherever needed.

All the herbarium specimens cited in this flora were deposited in BSD, if not specified otherwise. The specimens of the taxa that are not collected during the present study, but available in other herbaria were also included in this flora. They were also studied and their identities were confirmed as far as possible. The other consulted herbaria are abbreviated according to Holmgren & al. (1990) in *Index Herbariorum*, whereas the herbarium of Wildlife Institute of India, Dehra Dun is abbreviated as WII. The nomenclature of all taxa was brought up-to-date in accordance with the International Code of Botanical Nomenclature [St. Louis Code (Greuter & al., 2000)].

ETHNOBOTANICAL INFORMATION

The ethno botanical information was obtained either through interview of the experienced and elderly tribal people or local medicinemen (Amchis), during the period of field study. The informants were requested to accompany to the field. Sometimes a particular plant was picked up and queries were made on the medicinal use of the same. Both men and women have been approached for information and the latter gave more information on this aspect probably because they have to take care of their children and the invalids at home. The men on other hand often have to deal with the domestic animals than the women: they know medicinal herbs that are meant for animals (veterinary medicine). All the information were scrutinized and verified against different informants. After confirmation of

ethnobotanical uses against the specimens, including mode and preparation of medicine, entries were made in the field book under respective field number, to include ethnobotanical notes with the plant specimen.

PRESENTATION STYLE

The present work has been broadly divided into three groups *viz.*, Pteridophytes, Gymnosperms and Angiosperms. The families of Pteridophytes are arranged as per the system of classification of Pichi-Sermolli (1977), those of Gymnosperms and Angiosperms are arranged as per Bentham & Hooker's system of classification (1862-1883), with a little modification regarding splitting of the families as proposed by Hutchinson (1973) and Cronquist (1981).

Each family, is followed by total number of genera and species, main range of distribution in the world (Mabberley, 1996); number of genera and species in India (Pteridophytes: Dixit, 1984; Chandra, 2000. Gymnosperms: Sahni, 1990; Aswal & Mehrotra, 1994. Angiosperms: Santapan & Henry, 1973; Aswal & Mehrotra, 1994; Karthikeyan & al., 1989; Gaur, 1999; Karthikeyan, 2000; Murri, 2001; Nair & Thomas, 2002; Singh & al., 2002; Sanjappa, 2002; Singh & Mathur, 2002; Deb, 2002; Singh & Prasad, 2002; Murri, 2002; Balakrishnan, 2002; Mao & al., 2002; Mukherjee, 2002; Munshi & al., 2002; Swaminathan & al., 2002), Flora of India or Vascicles of flora of India and other revisionary and monographic studies as far as possible have been consulted) and is followed by taxonomic and/or nomenclatural notes (if any) and the generic key.

The genera are also alphabetically numbered in the key and are given in the same order in the text. Within each family, the generic name is followed by the name of its author(s), total number of species and main range of distribution in the world and in India based on the above references, taxonomic and/or nomenclatural notes (if any) and the key to species. The species are alphabetically numbered in the key and are given in the same order in the text.

For each species and/or infraspecific taxa, reference is made to currently accepted binomial with author(s) name (Brummitt & Powell, 1992) with original citation and reference to monographic studies and floras following by the basionym (if any), important synonym(s); latest monographs and revisions, if any; relevant regional floras, besides some specific publications related with the nomenclature of the taxon, studies relating to the present work and is followed by the vernacular name (s) in Spiti dialect, if any, in italics. The captions of Figure (Fig) and Photograph (Photo) with corresponding number have been given in bold in the right hand corner of the ending sentence. A concise and brief description depicting the salient features of each species is given. In description, the measurements are made in metric scales. Simple measurements without qualification refer to the length only; whereas compound measurements *L* 3-8 x 2-3 cm represent, 3-8 cm range of length and 2-3 cm range of breadth. The description is followed by flowering and fruiting period. This is followed by the status with habitat range, locality of occurrence, collector's names, collection number and herbarium acronym (Folmgren & al., 1990) if different from BSD; distribution in India and outside based on herbaria and literature sources followed by a line of ethnobotanical uses.

The remarks on taxonomic affinities, the phenotypic variability of the population (if any) nomenclatural note wherever necessary and observations on threatened species are given under 'Note'. Most of the cultivated taxa are often met with as an escape, so the, cultivated taxa are also included in the keys and in the systematic treatment.

The 'key' is an important aspect of the work and is most frequently used and hence special care has been taken in its construction. The keys are indented as in Flora of India and are based as far as possible on easily observable macroscopic characters. However, sometimes microscopic characters have also been considered to devise a suitable key. When a species has infraspecific taxa other than the typical one, its name has been included in the specific key but when a species has both typical and other infraspecific taxa, key to infraspecific taxa has been provided under the species concerned. The keys, thus constructed are applicable only to the present work.

In the systematic treatment, enumerated as new records for India, North-West Himalaya, Himachal Pradesh and new species have been mainly illustrated. The photographs of the species have been provided as far as possible and aligned as per Flowers of the Himalaya (Polunin & Srinton, 1984) and Tropica (Graf, 1981) with few modifications.

KEY TO THE GROUPS AND FAMILIES

- | | | |
|-------------------------|---|---|
| 1a. | Plants seed-bearing | 2 |
| b. | Plants non seed-bearing | I. PTERIDOPHYTES |
| 2a. | Seeds or ovules naked, borne on the surface of megasporophyll; fertilization by direct contact with pollen tube and without stigma; endosperm formation pre fertilization | II. GYMNOSPERMS |
| b. | Seeds or ovules enclosed; fertilization by indirect contact and through stigma; endosperm formation post fertilization | III. ANGIOSPERMS |
| I. PTERIDOPHYTES | | |
| 1a. | Leaves represented by narrow and simple microphylls | 1. EQUISETACEAE |
| b. | Leaves represented by megaphylls or distinct lamina | 2. DRYOPTERIDACEAE |
| II. GYMNOSPERMS | | |
| 1a. | Branches jointed at nodes; leaves opposite | 1. EPHEDRACEAE |
| b. | Branches not jointed at nodes; leaves alternate or whorled | 2. CUPRESSACEAE |
| III. ANGIOSPERMS | | |
| 1a. | Leaves generally reticulate-veined; perianth mostly 4 or 5-merous, rarely 3-merous; embryo with two cotyledons | 2 |
| b. | Leaves generally parallel veined; perianth mostly 3-merous; embryo with one cotyledon | 51 |
| 2a. | Plants parasitic | 3 |
| b. | Plants not parasitic | 4 |
| 3a. | Twining herbs | 36. CUSCUTACEAE |
| b. | Erect herbs | 39. OROBANCHACEAE |
| 4a. | Prostrate herbs; climbing or straggling shrubs | 5 |
| b. | Erect or climbing herbs; shrubs or small trees | 7 |
| 5a. | Plants armed | 5. CAPPARACEAE |
| b. | Plants not armed | 6 |
| 6a. | Petals united | 35. CONVULVACEAE |
| b. | Petals free | 1. RANUNCULACEAE (<i>Clematis</i>) |

7a.	Petianth 2-seriate, differentiated into an outer calyx and an inner corolla	8
b.	Petianth usually 1-seriate, mostly sepaloid, rarely absent	44
8a.	Petals free or very rarely connate at base; stamens not epipetalous	9
b.	Petals united; stamens mostly epipetalous	30
9a.	Sepals usually free or rarely connate at base; petals and stamens hypogynous	10
b.	Sepals united at least in their lower halves; petals and stamens perigynous	23
10a.	Sepals free, distinct, not adnate to the ovary; stamens usually indefinite	11
b.	Sepals often united, distinct or adnate to the ovary; stamens usually definite	18
11a.	Carpels free	1. RANUNCULACEAE
b.	Carpels united or rarely free; if free, then the leaves usually stipulate	12
12a.	Ovary 1-locular	13
b.	Ovary 2 to many locular	9. MALVACEAE
13a.	Placentation parietal	14
b.	Placentation free central or basal	17
14a.	Sepals 2 or 3	15
b.	Sepals 4 or 5	16
15a.	Flowers actinomorphic	2. PAPAVERACEAE
b.	Flowers zygomorphic	3. FUMARIACEAE
16a.	Stamens tetradynamous; fruit a silqua or silicle	4. BRASSICACEAE
b.	Stamens not tetradynamous; fruit a capsule or berry	6. VIOLACEAE
17a.	Shrubs; stems woody, purplish grey-brown; leaves scaly	8. TAMARICACEAE
b.	Herbs; stems mostly not woody, greenish or yellowish; leaves well developed.	7. CARYOPHYLLACEAE
18a.	Disc annular, adnate to the stamens, often glandular, very rarely absent; ovules perichalous	19
b.	Disc round, adnate to the base of calyx tube or lining it; ovules erect or ascending	15. RHAMNACEAE

Botanical Survey of India	22
19a. Stipules present, if absent, then flowers actinomorphic	20
b. Stipules absent; flowers zygomorphic	13. BALSAMINACEAE
20a. Fruits spinous	11. ZYGOPHYLLACEAE
b. Fruits not spinous	21
21a. Fruit a samara	14. SIMAROUBACEAE
b. Fruit not a samara	22
22a. Leaves entire; stamens shortly united at base	10. LINACEAE
b. Leaves much dissected; stamens free up to base	12. GERANIACEAE
23a. Ovary of 1 carpel, if more than 1, then free or connate at base	24
b. Ovary of more than 1 carpel, united, inferior	29
24a. Ovary of 1 carpel, superior; stamens usually 10, 4 or 2-adelphous; if many then connate at least at base	25
b. Ovary of more than 1 carpel, free or connate at base	26
25a. Corolla papilionaceous; fruit a pod	16. FABACEAE
b. Corolla not papilionaceous; fruit a berry or capsule	20. GROSSULARIACEAE
26a. Stipules usually present; stamens usually many; carpels usually many, free, inserted on an elongate torus or enclosed in a hollow hypanthodium and adnate to it	17. ROSACEAE
b. Stipules absent; stamens or as many as petals; carpels as many as petals or fewer	27
27a. Hypogynous scales present at the base of stamens; receptacle neither hollowed nor elongated	21. CRASSULACEAE
b. Hypogynous scales absent; receptacle usually hollowed or elongated	28
28a. Stamens 5	19. PARNASSIACEAE
b. Stamens 8-10	18. SAXIFRAGACEAE
29a. Flowers in umbels	23. APIACEAE
b. Flowers in spikes or racemes	22. ONAGRACEAE
30a. Flowers hypogynous; ovary superior	31
b. Flowers epigynous; ovary inferior	39
31a. Corolla actinomorphic	32
b. Corolla zygomorphic or nearly so	40. LAMIACEAE
32a. Stamens twice as many as corolla lobes	30. ERICACEAE

b.	Stamens equal to number of corolla lobes or less	33
33a.	Stamens opposite to corolla lobes	34
b.	Stamens alternate with corolla lobes	35
34a.	Placentation free central; stigma 1	31. PRIMULACEAE
b.	Placentation parietal; stigmas 2	32. GENTIANACEAE
35a.	Corolla 4-lobed	41. PLANTAGINACEAE
b.	Corolla 5-lobed	36
36a.	Fruit of 4 outlets	34. BORAGINACEAE
b.	Fruit a capsule or berry	37
37a.	Ovary 3 locular	33. POLEMONIACEAE
b.	Ovary 2 locular	38
38a.	Flowers in ebracteate cymes or solitary	37. SOLANACEAE
b.	Flowers in bracteate racemes or spikes	38. SCROPHULARIACEAE
39a.	Flowers aggregated in involucrate heads	40
b.	Flowers not aggregated in involucrate heads	41
40a.	Anthers not coalesced along their margins	27. MORINACEAE
b.	Anthers coalesced along their margins (syngnathous)	28. ASTERACEAE
41a.	Shrubs	24. CAPRIFOLIACEAE
b.	Herbs	42
42a.	Fruit of indehiscent achenes or drupes	43
b.	Fruit a dehiscent capsule	29. CAMPANULACEAE
43a.	Interpetiolar stipules present	25. RUBIACEAE
b.	Interpetiolar stipules absent	26. VALERIANACEAE
44a.	Flowers bisexual	45
b.	Flowers unisexual	47
45a.	Leaves with sheathing stipules; fruit a nut	44. POLYGONACEAE
b.	Leaves exstipulate; fruit a utricle	46
46a.	Perianth scarious; stamens connate at base into a short tube	42. AMARANTHACEAE
b.	Perianth not scarious; stamens free	43. CHENOPODIACEAE
47a.	Herbs	48
b.	Shrubs or trees	50

48a.	Flowers minute, naked, arranged in cyathia	46. EUPHORBIACEAE
b.	Flowers in axillary clusters or paniculate	49
49a.	Stinging hairs present; stamens inflexed in bud	47. URTICACEAE
b.	Stinging hairs absent; stamens erect in bud	48. CANNABACEAE
50a.	Flowers in axillary cymose clusters (male) or solitary (female)	45. ELAEAGNACEAE
b.	Flowers in pendulous spikes (Catkins)	49. SALICACEAE
51a.	Aquatic or marshy plants	52
b.	Plants terrestrial	53
52a.	Plants submerged	58. ZANNICHELLIACEAE
b.	Plants not submerged	57. JUNCAGINACEAE
53a.	Leaves grass-like; perianth if present, not coloured	54
b.	Leaves not grass-like; perianth coloured	56
54a.	Flowers in close-set spikes or spikelets; ovary 1-carpelled	55
b.	Flowers in axillary or terminal cymes; ovary 3-carpelled	55. JUNCACEAE
55a.	Culms usually solid and triquetrous; flowers in the axil of a single glume	59. CYPERACEAE
b.	Culms usually with hollow internodes and terete; flowers enclosed within a bract and bracteole (lemma and palea)	60. POACEAE
56a.	Ovary superior	57
b.	Ovary inferior	59
57a.	Flowers arranged in spadix	56. ARACEAE
b.	Flowers not arranged in spadix	58
58a.	Plants aromatic	54. ALLIACEAE
b.	Plants not aromatic	53. LILIACEAE
59a.	Flowers actinomorphic	60
b.	Flowers zygomorphic	50. ORCHIDACEAE
60a.	Perianth more or less differentiated into separate whorls of calyx and corolla; anthers introrse	51. ZINGIBERACEAE
b.	Perianth not differentiated into separate whorls of calyx and corolla; anthers extrorse	52. IRIDACEAE



1. Attargu Bridge (A Gateway to PVNP)



2. Habitat at 3650m in the buffer zone of PVNP
'Sagnam' — Village



3. Habitation in the buffer zone of PVNP
'Mud' Village



4. The Pin River



5. Parahio Catchment in PVNP



6. People of PVNP



7. Folk dance at Kungri Monastery in PVNP



8. Alpine scrub



9. Alpine meadows



10. Pin Parvati Pass (5319m)



11. On way to Bara Shigri Glacier



12. Bhaba Pass (4820m)

Flora of the Pin Valley National Park



13. On way to Larang La (ca 5240m)



14. Larang La (5375m)



15. On way to Larsaway Pass (ca 5060m)



16. Over grazing by Migratory Livestock



17. Over grazing by Yaks



18. Over grazing by Mules



19. Over grazing by donkeys



20. Eroded slopes



21. Bunker at Thango



22. Base camp at Sanpat



23. Base camp at Kilung



24. Camp at the base of Larang La



25. *Ephedra intermedia* Schrank & C.A. Mey.



26. *Aconitum rotundifolium* Kar. & Kir.



27. *Aquilegia fragrans* Benth.



28. *Aquilegia moorcroftiana* Wall. ex Royle



29. *Clematis ladakhiana* C. Grey-Wilson



30. *Delphinium brunonianum* Royle



31. *Delphinium cashmerianum* Royle



32. *Halerpestes sarmentosa* (Adams) Komarov



33. *Halerpestes tricuspis* (Maxim.) Hand. - Mazz.



34. *Ranunculus hirtellus* Royle



35. *Ranunculus pulchellus* C.A. Mey.



36. *Thalictrum foetidum* L.



37. *Corydalis crassifolia* Royle



38. *Corydalis meifolia* Wall.



39. *Arabidopsis himalaica* (Edgew.) O. Schultz



40. *Christolea crassifolia* Cambess.



41. *Christolea himalayensis* (Cambess.) Jafri



42. *Draba lasiophylla* Royle



43. *Lepidium latifolium* L.



44. *Capparis spinosa* L.
var. *himalayensis* (Jafri) Jacobs



45. *Arenaria festucoides* Benth.



46. *Arenaria kansuensis* Maxim.



47. *Dianthus orientalis* Adams



48. *Silene moorcroftiana* Wall. ex Benth.



49. *Silene rechingeri* Bocq.



50. *Silene vulgaris* (Moench) Garcke.



51. *Stellaria tibetica* Kurz



52. *Myricaria albiflora* Grierson & Long



53. *Myricaria germanica* (L.) Desv.
subsp. *alopecuroides* (Schrenk) Kitam.



54. *Linum perenne* L.



55. *Geranium pratense* L.



56. *Astragalus candolleanus* Royle ex Benth.



57. *Astragalus coluteocarpus* Boiss.



58. *Astragalus peduncularis* Royle ex Benth.



59. *Astragalus rhizanthus* Royle ex Benth.



60. *Astragalus strobiliferus* Royle ex Benth.



61. *Astragalus webbianus* Graham ex Benth.



62. *Caragana versicolor* Benth.



63. *Cicer microphyllum* Benth.
(Flowers Purple)



64. *Cicer microphyllum* Benth.
(Flowers White)



65. *Oxytropis microphylla* (Pallas) DC.



66. *Oxytropis tatarica* Cambess.



67. *Thermopsis inflata* Cambess.



68. *Trigonella gracilis* Benth.



69. *Cotoneaster gilgitensis* Klotz.



70. *Potentilla arbuscula* D. Don
var. *pumila* (Hook. f.) Hand.-Mazz.



71. *Potentilla argyrophylla* Wall. ex Lehm.



72. *Potentilla cuneifolia* Bertol.



73. *Potentilla salesoviana* Stephan



74. *Rosa hookeriana* Bertol.



75. *Bergenia stracheyi* (Hook. f. & Thomson) Engler



76. *Saxifraga flagellaris* Willd. ex Sternb.
subsp. *stenophylla* (Royle) Hulten



77. *Saxifraga pseudo-pallida* Engler & Irmsch.
var. *bellidifolia* Engler & Irmsch.



78. *Saxifraga sibirica* L.



79. *Ribes orientale* Desf.



80. *Hylotelephium ewersii* (Ledeb.) Ohba



81. *Rhodiola crenulata* (Hook. f & Thomson) Ohba



82. *Rhodiola heterodonta* (Hook. f & Thomson)
A. Bor.



83. *Rhodiola tibetica* (Hook. f. & Thomson) Fu



84. *Rosularia alpestris* (Kar. & Kir.) A. Bor.



85. *Epilobium angustifolium* L.



86. *Epilobium latifolium* L.



87. *Chaerophyllum villosum* Wall. ex DC.



88. *Ferula jaeschkeana* Vatke



89. *Heracleum candicans* Wall. ex DC.



90. *Pleurospermum candollii* (DC.) Benth. ex C.B. Clarke



91. *Semenovia thomsonii* (C.B. Clarke) Manden.



92. *Lonicera asperifolia* (Decne.) Hook. f. & Thomson



93. *Lonicera spinosa* (Jacq. ex Decne.) Walp.



94. *Anaphalis triplinervis* (Sims.) C.B. Clarke
var. *intermedia* (DC.) Airy-Shaw



95. *Artemisia dubia* Wall. ex Bess.
var. *subdigitata* Ling



96. *Aster flaccidus* Bunge



97. *Chrysanthemum pyrethroides* (Kar. & Kir.)
B. Fedtsch - Rostit.



98. *Cicerbita macrorhiza* (Royle) P. Beauv.



99. *Cousinia thomsonii* C.B. Clarke



100. *Erigeron acer* L.



101. *Psychrogeton andryaloides* (DC.)
Novopkr. ex Krasch.



102. *Saussurea jacea* (Klotz.) C.B. Clarke



103. *Taraxacum officinale* Weber



104. *Waldheimia glabra* (Decne.) Regel



105. *Waldheimia stoliczkai* (C.B. Clarke) Ostanf



106. *Waldheimia tomentosa* (Decne.) Regel



107. *Youngia glauca* Edgew.



108. *Codonopsis ovata* Benth.



109. *Primula macrophylla* D. Don



110. *Gentianella moorcroftiana* (Wall. ex G. Don)
Airy-Shaw



111. *Arnebia euchroma* (Royle ex Benth.)
I.M. Johnst.



112. *Arnebia guttata* Bunge



113. *Cynoglossum lanceolatum* Forssk.



114. *Lindelofia longiflora* (Benth.) Baill.



115. *Convolvulus arvensis* L.



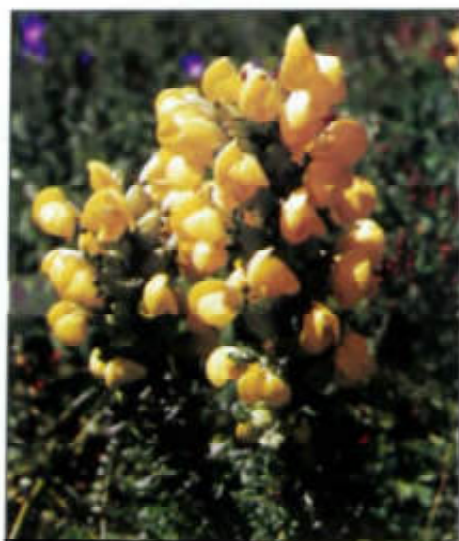
116. *Cuscuta europaea* L.
(On *Cicer microphyllum* Benth.)



117. *Hyoscyamus niger* L.



118. *Solanum tuberosum* L.



119. *Pedicularis bicornuta* Klotz.



120. *Pedicularis longiflora* Rudolph
subsp. *tubiformis* (Klotz.) Pennell



121. *Scrophularia scabiosaefolia* Benth.



122. *Verbascum thapsus* L.



123. *Veronica anagallis-aquatica* L.



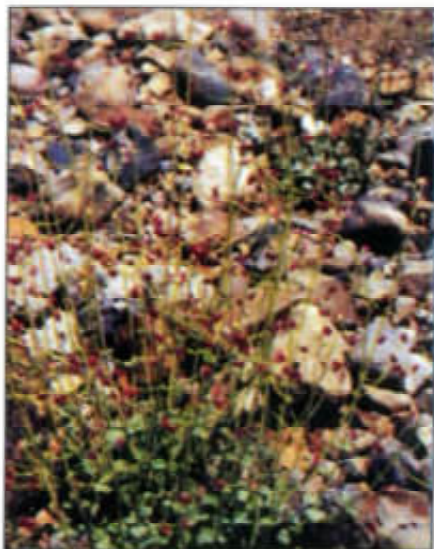
124. *Veronica lanosa* Royle ex Benth.



125. *Hyssopus officinalis* L.



126. *Nepeta eriostachya* Benth.



127. *Nepeta floccosa* Benth.



128. *Nepeta longibracteata* Benth.



129. *Thymus linearis* Benth.



130. *Plantago depressa* Willd.



131. *Chenopodium foliosum* (Moench)
Asch.



132. *Aconogonum tortuosum* (D. Don) Hara



133. *Bistorta affinis* (D. Don) Greene



134. *Bistorta vivipara* (L.) S.F. Gray



135. *Oxyria digyna* (L.) Hill



136. *Polygonum tubulosum* Boiss.



137. *Rheum spiciforme* Royle



138. *Rheum webbianum* Royle



139. *Rumex dentatus* L.
subsp. *klotzschianus* (Meisn.) Rechb. f.



140. *Rumex nepalensis* Spreng.



141. *Rumex patentia* L.
subsp. *orientalis* (Bernh. ex Schult. f.) Danser



142. *Hippophae rhamnoides* L.
subsp. *turkestanica* Rousi



143. *Populus ciliata* Wall. ex Royle



144. *Salix flabellaris* Anders.



145. *Salix fruticulosa* Anders.



146. *Dactylorhiza hatagirea* (D. Don) Soo



147. *Iris ensata* Thunb.



148. *Eremurus himalaicus* Baker



149. *Allium carolinianum* DC.



150. *Juncus membranaceus* Royle ex D. Don



151. *Kobresia schoenoides* Steud.



152. *Bromus danthoniae* Trin.



153. *Hordeum vulgare* L.



154. *Melica persica* Kunth
(Inflorescence Golden Yellow)



155. *Melica persica* Kunth
(Inflorescence Brown)

SYSTEMATIC ENUMERATION

I. PTERIDOPHYTES

1. EQUISETACEAE

One genus with ca 15 species, almost cosmopolitan; 5 species in India.

Equisetum L.

Equisetum diffusum D. Don, Prodr. Fl. Nep. 19, 1825; Baker, Handb. Fern Allies 3, 1887; R.D. Dixit, Gen. Indian Precid. 19, 1981.

Perennials. Stems tufted, erect, 28-32 cm high with small central hollow and 6-12 square grooved ribs; sterile and fertile stems alike. Sheaths loose, 6-9 mm long; ribs very distinctly grooved; teeth linear or lanceolate, greenish brown, distinctly keeled. Branches densely whorled, ascending, solid. Sporophylls oblong-cylindrical, 3-5 cm long, obtuse; peduncle short. Spores round, reddish brown.

Sporophylls: August-September.

Scarce; on moist slopes, near streams in water logged condition, Ghang-Kugn, 3700 m, 03.09.2002, K. Chandu Sekar 102966.

Distrib.: India: Assam, Himachal Pradesh, Jammu & Kashmir, Meghalaya, Sikkim and Uttarakhand; Bhutan; Burma; China; Nepal and Pakistan.

2. DRYOPTERIDACEAE

About 47 genera and ca 1700 species, cosmopolitan; 14 genera and 202 species in India.

- | | |
|--|-----------------------|
| 1a. Petiole with at least 3 vascular bundles | 3. Dryopteris |
| b. Petiole with 2-vascular bundles | 2 |
| 2a. Stipes and rachis pubescent | 2. Cystopteris |
| b. Stipes and rachis glabrous | 1. Athyrium |

1. *Athyrium* Roth

One genus with ca 180 species, cosmopolitan, 46 in India.

Athyrium attenuatum (C.B. Clarke) Tagawa in Acta Phytotax. Geobot. 16: 117, 1956; Khaliq, Illustr. Fern Fl. W. Himal. 7: 30, 2000. *Athyrium filix-javanica* Ching & Y.T. Hsieh var. *attenuatum* C.B. Clarke, Trans. Linn. Soc. London (Bot.) 1: 492, 1880; S. Chandra, Ferns India 123, 2000.

Perennials; rhizomes erect to suberect, covered with persistent leaf bases, scaly; scales lanceolate, acuminate, cartil. brown. Stipes 5-10 cm long, covered with light brown scales. Lamina broadly lanceolate, 20-40 x 10-15 cm, much tapering at ends, 2-pinnate; pinnae 18-20 pairs, alternate; pinnules 18-20 pairs, alternate, oblong. Sori small, in a single row on either side of the costule, indusiate; indusium persistent, margin highly fimbriate, light brown. Spores yellowish brown.

Sori: July-September.

Scarce; on rocky slopes, Mud-Harbok, 4000 m, 01.08.2002, K. Chandu Sekar 102908.

Distrib: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan; Bhutan; China; Nepal and Pakistan.

2. *Cystopteris* Bernh.

About 12 species distributed in temperate regions; 6 in India.

- 1a. Lamina broadly ovate-lanceolate; pinnae never overlapping *2. C. fragilis*
 b. Lamina sub-deltoid to ovate-lanceolate; pinnae overlapping *1. C. dickiana*

1. *Cystopteris dickiana* R. Sim in Gard. Fern. J. ser. 2: 308. 1848; Alston & Bonner in Amer. Fern J. 41: 76. 1954; Bir & Trikha, Nova Hedw. 24: 22. 1974; Khullar in Indian Fern J. 12: 181. 1995. *C. fragilis* (L.) Bernh. subsp. *dickiana* (R. Sim) Hyland., Uppsala Univ. Arsskr. 7: 59. 1945; S. Chandra, Ferns India 140. 2000.

Perennials; rhizomes short creeping, covered with persistent leaf bases, scaly; scales lanceolate, acuminate, light brown. Stipes 4-15 cm long, scaly at base; scales light brown. Lamina lanceolate, 10-20 x 4-6 cm, 2-pinnate; pinnae 8-15 pairs, alternate, lanceolate, 2.2-5 x 1-2 cm; pinnules 4-7-pairs, lanceolate-ovate. Sori medial, 2-4 pairs on each side of the main vein of the pinnule, rounded, confluent at maturity, indusiate; indusia ovate-lanceolate, hairy, pale yellow. Spores dark brown.

Sori: July - September.

Rare; on rocky slopes. Larang La - Tsriya, 4100 m, 06.08.2003, K. Chandu Sekar 103750.

Distrib: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia, Europe and N. America.

2. *Cystopteris fragilis* (L.) Bernh. in Schrad. Neu. J. Bot. 1(2): 27. t.2, f9. 1806; R.D. Dixit, Cens. Indian Pterid. 30. 1984; Khullar in Indian Fern J. 12: 181. 1995; S. Chandra, Ferns India 139. 2000. *Polypodium fragile* L., Sp. Pl. 1091. 1753.

Perennials; rhizomes short-creeping, covered with persistent leaf bases, scaly; scales lanceolate to ovate-lanceolate, 4-5 x 1-2 mm, acuminate, light brown. Stipes 1-15 cm long, fragile, scaly at base; scales lanceolate, acuminate. Lamina lanceolate, 10-20 x 4-6 cm, 2-pinnate, glabrous; pinnae 8-15 pairs, alternate; pinnules 4-7 pairs, 0.5-1 cm long, margin crenate or variously lobed. Sori medial, 2-4 pairs on each side of the main vein of the pinnule. Spores dark brown.

Sori: July - September.

Common; on rocky slopes. Chhotem, 4100 m, 13.07.2003, K. Chandu Sekar 103269.

Distrib: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia, Africa, America and Europe.

3. *Dryopteris* Adanson

About 225 species, subcosmopolitan; 77 (incl. hybrids) in India.

Dryopteris barbigera (Moench ex Hook.) Kuntze, Revis. Gen. Pl. 2: 812. 1891; S. Chandra, Ferns India 171. 2000. *Nephrodium barbigerrum* Moench ex Hook., Sp. Fil. 4: 113. 1862.

Perennials; rhizomes thick, scaly. Stipes 10-12 cm long, very densely scaly and fibrillose; scales broadly ovate-lanceolate, 1-1.5 cm long, margins with 2 or 3-filamentous projections, pale brown.

Lamina ovate-lanceolate to oblong-lanceolate, 20-40 cm long, 2-pinnate; pinnae many, 16-20-pairs, 8-13 cm long; pinnules 10-15 pairs, sessile, 1.4-2 cm long. Soei submedia, 3-5 pairs in a row on either side of the costae, rounded. Spores dark brown.

Fl & Fr: June - September.

Rare; on moist slopes. Near Uriya, 04.08.2002, *K. Chandra Sekar* 100604.

Distribution: India: Assam, Himachal Pradesh, Jammu & Kashmir, Sikkim, Uttarakhand and West Bengal; Afghanistan; Bhutan; China; Nepal; Pakistan and Taiwan.

II. GYMNOSPERMS

1. EPHEDRACEAE

One genus with 65 species distributed in N. hemisphere and S. America; 8 species in India.

Ephedra L.

- 1a. Tubifera twisted; male spikes in dense whorls at the nodes *E. F. intermedia*
 1b. Tubillus straight; male spikes 1-3 together at the nodes *E. L. granitosa*

1. *Ephedra gerardiana* Wall. ex Stapf in Akad. Wiss. Wien. Math. Nat. Kl. Denksch. 56(2): 75, t. 3, t. 18. 1889, *nom. Florn*, Kungl. Sv. Vetensk. Handl. ser. 3, 12(1): 21, 1933; K.C. Sahni, *Gymnosp. India & Adj. Count.* 145, 1990; Aswai & Mehroua, *Fl. Labial-Spirif* 577, 1994.

Shrubs, densely tufted, 40-60 cm high. Stems woody. Branchlets ascending, smooth, green. 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, 7-9 mm long, red. Seeds 2, black.

Fl & Fr: June - September.

Common; on rocky slopes. Tilling, 3700 m, 26.08.2002, *K. Chandra Sekar* 100695.

Distribution: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China and Pakistan.

2. *Ephedra intermedia* Schrank & C. A. Mey in *Mon. Ser. Nat. Acad. St. Petersburg* 6: 5, 1845 & *Monog. Ephedra* 88, 1846; Hook.f., *Fl. Brit. India* 5: 863, 1890; K.C. Sahni, *Gymnosp. India & Adj. Count.* 143, 1990. **Photo. 25**

Shrubs with erect, ascending, long, lax, glaucous branchlets. Leaf sheaths 2-3 mm long. Male spikes subglobose, numerous in dense whorls at the nodes; bracts broadly obovate, connate, obtuse. Staminal column shortly exserted; anthers 5 or 6. Female spikes solitary, paired or whorled, 2-flowered; tubillus exserted, twisted. Fruits ovoid, 5-6 mm long, red. Seeds 2 or 3, black.

Fl & Fr: June - September.

Common; on rocky slopes. Mikliin, 3650 m, 11.07.2002, *K. Chandra Sekar* 100410.

Distribution: India: Himachal Pradesh and Jammu & Kashmir; China and Pakistan.

2. CUPRESSACEAE

Twenty genera and 135 species, subcosmopolitan; 4 genera and 15 species in India.

Juniperus L.

About 50 species distributed from N. hemisphere to tropical Africa; 7 in India.

Juniperus recurva Buch.-Ham. ex D. Don, Prodr. Fl. Nepal. 55. 1825; Hook.f., Fl. Brit. India 3: 647. 1888; K.C. Sahni, Gymnosp. India & Adj. Countr. 99. 1990; Aswal & Mehrotra, Fl. Lahual Spiti 579. 1994.

Monococious trees or shrubs, 4-8 m high; bark greyish-brown, thin, peeling off in fibrous strips; branches pendulous. Leaves appressed, awl shaped, 1.5-3.6 mm long, tip horny, sharp. Male cones on the tip of branchlets, 2-4 mm long; scales imbricate. Female cones with 4-6 scales. Fruits subglobose, blue black. Seeds ovoid.

Fl. & Fr.: June - September.

Rare; on rocky slopes. Manu, 3800 m, 27.08.2002, K. Chandu Jekar 100734 (Cultivated ?).

Distrib.: India: Arunachal Pradesh, Uttamchal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan; Myanmar; China; Nepal and Pakistan

III. ANGIOSPERMS**I. RANUNCULACEAE**

About 58 genera and ca 1750 species mainly distributed in North temperate regions; 28 genera and 191 species in India

- | | |
|---|-----------------------|
| 1a. Flowers actinomorphic | 3 |
| b. Flowers zygomorphic | 2 |
| 2a. Upper sepal with a spur | 6. Delphinium |
| b. Upper sepal without a distinct spur | 1. Aconitum |
| 3a. Sepals and petals each with a distinct spur | 3. Aquilegia |
| b. Sepals and petals without spur | 4 |
| 4a. Fruit 2 to many-seeded follicle | 5 |
| b. Fruit 1-seeded achene | 6 |
| 5a. Leaves undivided | 4. Caltha |
| b. Leaves divided | 9. Trollius |
| 6a. Woody or herbaceous climbers | 5. Clematis |
| b. Plants not as above | 7 |
| 7a. Sepals petaloid; petals absent | 8 |
| b. Sepals and petals present | 9 |
| 8a. Flowers in racemes or panicle | 10. Thalictrum |
| b. Flowers 1 or 2 or in an umbel-like inflorescence | 2. Anemone |

- 9a. Stems rooting at the nodes; carpels rugose with prominent veins **7. Halerpestes**
 1. Stems not rooting at the nodes; carpels without prominent veins **8. Ranunculus**

1. *Aconitum* L.

About 300 species distributed in North-temperate region; 27 in India.

- 1a. Leaves all or most from hypogeous base of stem **2**
 b. Leaves basal and cauline **1. *A. heterophyllum***
 2a. Leaves divided to more than half into narrow linear-lanceolate lobes; follicles densely yellowish hairy **3. *A. violaceum***
 b. Leaves divided to half or less than half into obovate or cuneate lobes; follicles not hairy **2. *A. rotundifolium***

1. *Aconitum heterophyllum* Wall. ex Royle, Illustr. Bot. Himal. t.13, 1833 :t.56, 1835; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 29, 1872; M.A. Rau in B.D. Sharma & al., Fl. India 1: 15, 1993; Aswal & Mehrotra, Fl. Lahaul Spiti 44, 1994. *Marshe Meuthok.*

Biennials; roots tuberous. Stems erect, 28-41 cm high. Lower most leaves long petioled, orbicular-cordate to ovate-cordate, deeply 5-lobed with crenate lobes; upper leaves sessile, ovate-elongate, semi-amplexicaul, irregularly crenate-dentate. Racemes 2.5-3.5 cm long. Bracts ovate, acute, sharply toothed. Sepals greenish blue, marked with red veins; uppermost one navicular, shortly beaked. Filaments glabrous, pale green. Follicles straight, 1.5-2 cm long, glabrous.

Fl. & Fr.: August-September.

Rare; on rocky slopes. Kiling-Larang La, 4000 m, 02.08.2003, K. Chandra Sekar 103778.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Nepal and Pakistan.

Paste of roots is given to cure diarrhoea.

2. *Aconitum rotundifolium* Kar. & Kir. in Bull. Soc. Nat. Mosc. 15: 139, 1842; M.A. Rau in B.D. Sharma & al., Fl. India 1: 21, 1993; Aswal & Mehrotra, Fl. Lahaul Spiti 46, 1994. *A. napellus* L. var. *rotundifolium* (Kar. & Kir.) Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 29, 1872. **Photo. 26**

Biennials; roots tuberous. Stems erect, 18-30 cm high. Leaves sub-basal, arranged in a loose rosette, orbicular-truncate, divided to half or less than half into obovate or cuneate lobes; secondary lobes acute. Flowers yellow in few flowered racemes. Uppermost sepal boat shaped, pubescent. Petals glabrous. Filaments sparingly hairy. Follicles 0.9-1.2 cm long, softly hairy.

Fl. & Fr.: August-September.

Scarce; on rocky slopes. Kiling-Larang La, 4800 m, 02.08.2003, K. Chandra Sekar 103773.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Afghanistan; Nepal; Pakistan and Turkistan.

Extract of stem is given to cure cough.

3. *Aconitum violaceum* Jacquem. ex Stapf in Ann. Roy. Bot. Gard. Calc. 10: 144, 1905; M.A. Rau in B.D. Sharma & al., Fl. India 1: 23, 1993; Aswal & Mehrotra, Fl. Lahaul Spiti 46, 1994. **4.**

multifidum Royle, Illustr. Bot. Himal. 56. 1834, non Koch & Reichenb. 1827. *A. napellus* L. var. *multifidum* (Royle) Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 29. 1872. *Ladakh Mendok, Doker*

Biennials; roots tuberous. Stems erect, 19-28 cm high. Leaves very few, orbicular, cordate, 3-4.5 cm dia., deeply 5-partite; upper leaves much reduced. Flowers in few-flowered racemes, 2-2.2 cm long, pubescent, violet; bracts linear, much reduced. Uppermost sepal boat-shaped, ca 2 cm long; upper lateral sepals suborbicular to subquadrate; lower lateral sepals oblong, obtuse. Petals glabrous. Filaments hairy in the upper part. Fillicies densely yellowish hairy.

Fl. & Fr.: August - September.

Rare; on rocky slopes. Mud Larang La, 4400 m, 21.08.2002, K. Chandra Sekar 100660.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Nepal and Pakistan.

Decoction of tubers mixed with milk and sugar is given to cure high fever.

2. *Anemone* L.

About 144 species distributed in Eurasia, Sumatra, S. & E. Africa and N. America to Chile; 17 in India.

Anemone ovalaris Buch.-Ham. in DC., Syst. Nat. 1: 211. 1817, Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 9. 1872; M.A. Rau in B.D. Sharma & al., Fl. India 1: 35. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 50. 1994. *Karaun Mendok*

Biennials; rootstock tuberous. Stems 20-60 cm high. Lower most leaves long petioled, orbicular-cordate, 7-8 cm dia., deeply 3 to 5-lobed with crenate lobes; cauline one short petioled or sessile, 3-4 cm dia., semi amplexicaul, irregularly crenate-dentate. Cymes many flowered; scape stout, 7-13 cm long. Flowers white. Sepals ovate-oblong to ovate-lanceolate, 4-10 mm long, obtuse, silky outside. Filaments slender. Achenes broadly elliptic, ca 7 x 5 mm, compressed with ca 1 mm long, glabrous, hooked beak.

Fl. & Fr.: June - October.

Scarce; on rocky slopes. Mud-Bolpur, 3860 m, 01.08.2002, K. Chandra Sekar 102813.

Distrib.: India: Himachal Pradesh, Sikkim, Tamil Nadu and Uttarakhand; China; Myanmar; Nepal and Sri Lanka.

3. *Aquilegia* L.

About 80 species distributed in N. temperate zone; 5 in India.

1a. Sepals 2-2.4 cm long; lamina of petals 1.5-1.8 cm long *1. A. fragrans*

b. Sepals 1.3-1.6 cm long; lamina of petals 1-1.1 cm long *2. A. moorcroftiana*

1. *Aquilegia fragrans* Benth. in Maund's Botanist 4: t. 181, l. 21. 1840; M.A. Rau in B.D. Sharma & al., Fl. India 1: 42. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 52. 1994. *A. vulgaris* L. subsp. *alpina* Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 24. 1872. **Photo. 27**

Biennials; rootstock slender, covered by remnants of petioles of former year in its uppermost part. Stems 33-55 cm high. Basal leaves petioled, 2 or 3-ternate; leaflets cuneate to obovate, 2-3-lobed almost to the base, segments lobed again, cauline leaves gradually reduced upwards, the uppermost

leaves bract like with 1-3 lanceolate, acuminate segments. Flowers nodding, whitish purple. Sepals 2-2.4 x 0.9-1 cm, obtuse to acute, slightly pubescent. Lamina of petals truncate, 1.5-1.8 cm long; spur 1.5-1.6 cm long, slightly curved. Follicles 1.5-1.8 cm long, densely pubescent.

Fl. & Fr.: June - September.

Scarce; on rocky slopes. Chitola, 4100, 13.07.2003, K. Chandra Sekar 103281.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Pakistan.

2. *Aquilegia moorcroftiana* Wall. ex Royle, *Illustr. Bot. Himal.* 55, t. 21, 1834; M.A. Rau in B.D. Sharma & al., *Fl. India* 1: 42, 1993; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 53, 1994. *A. vulgaris* L. subsp. *pyrenaica* Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 24, 1872, *pp.* 1. *vulgaris* L. subsp. *viriosa* Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 24, 1872. *Nomok.*

Photo. 28

Biennials; rootstock slender, covered by remnants of pedicels of former year in its uppermost part. Stems 23-40 cm high. Basal leaves petioled, 2 or 3-ternate; leaflets obovate cusped, 0.2-2 cm long, 2-3-lobed almost to the base; segments lobed again; cauline leaves gradually reduced in size upwards; upper most leaves bract-like with 1-3 lanceolate, acuminate segments. Flowers nodding, pale purplish to blue-purple. Sepals 1.3-1.6 x 0.6-0.7 cm, acute-obtuse, petaloid. Lamina of petals obovate, 1-1.1 cm long; spur 1.2-1.6 cm long, slightly curved. Follicles 1.6-2 cm long, pubescent.

Fl. & Fr.: June - September.

Occasional; on rocky slopes. Nur Pasture, 4100 m, 21.07.2002, K. Chandra Sekar 100498.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China; Nepal and Pakistan.

Paste of flowering twigs is applied externally in knee pain.

4. *Caltha* L.

About 12 species mostly in temperate regions; 2 in India.

Caltha palustris L., *Sp. Pl.* 550, 1753; Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 21, 1872; M.A. Rau in B.D. Sharma & al., *Fl. India* 1: 47, 1993; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 54, 1994.

Perennial herbs; rootstock tuberous, creeping, densely fibrous rooted. Stems erect, 18-35 cm high. Leaves deltoid or reniform, deeply cordate at base, obtuse at apex, sharply crenate-dentate along margins; upper cauline leaves sessile, clasping the stems. Flowers yellow. Sepals obovate to oblong, 1.2-1.3 cm long, obtuse, petaloid. Follicles sessile, elongate-oblong, 8-9 mm long, flattened, with hard surfaces and transverse ridges.

Fl. & Fr.: June - September.

Scarce; on stream beds. Mud-Latang La, 4100 m, 18.08.2002, K. Chandra Sekar 102893.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia; Europe and N. America.

5. *Clematis* L.

About 295 species chiefly in temperate regions; 32 in India.

Clematis ladakhiana C. Grey-Wilson in *New Bull.* 44: 49, ff. 1 N P, 4 D F. 1989; M.A. Rau in B.D. Sharma & al., *Fl. India* 1: 68. 1993; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 55. 1994. *C. orientalis* L. var. *acutifolia* Hook.f. & Thomson, *Fl. Ind.* 9. 1855 & in Hook.f., *Fl. Brit. India* 1: 5. 1876. *Anok Rai*

Photo. 29

Shrubs, climbing or straggling. Stems 1-2 m long, tinged with purplish brown, sparsely pubescent. Leaves pinnate; leaflets narrow-lanceolate, 2.2-7 x 0.5-1.8 cm, acute. Panicle lax; peduncles 1.1-3.5 cm long. Bracts similar to leaves. Sepals ovate-lanceolate, 1.4-1.8 x 0.4-0.6 cm, acute to acuminate, glabrous outside, sparsely pubescent along the margins, densely pubescent inside. Filaments 6-8 mm long. Styles up to 4 cm long in fruits.

Fl. & Fr.: July - September.

Common; on rocky slopes. Tilling, 3850 m, 26.08.2002, K. Chandra Sekar 100694.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; China and Pakistan.

Extract of roots and young shoots is given orally to cure stomach pain.

6. *Delphinium* L.

About 320 species distributed in N. temperate to tropical Africa; 24 in India.

1a. Plants glandular hairy in upper parts; bracteoles mostly near to the flower base on pedicels

1. *D. brunonianum*

b. Plants not glandular hairy in upper parts; bracteoles placed away from flower base on pedicels

2. *D. cashmerianum*

1. *Delphinium brunonianum* Royle, *Illustr. Bot. Himal.* 56. 1834; Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 27. 1872; M.A. Rau in B.D. Sharma & al., *Fl. India* 1: 86. 1993; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 56. 1994. *Harsu Keeta Dasai*

Photo. 30

Perennial herbs; rootstock slender. Stems 33-67 cm high, lower most leaves petioled, pentagonal, reniform, 2-6 cm wide, 5-fid to the middle, segments with a few teeth or lobules. Flowers bluish-purple. Sepals pubescent with soft white hairs, veined, persistent; upper sepal round-ovate, 2-2.6 cm long, obtuse; spur straight, 1.2-1.4 x 0.7-0.8 cm; lateral sepals 2.5-2.8 cm long; broadly ovate, obtuse. Petals black; upper petal 1.4-1.6 cm long; spur 1.1-1.2 cm long; lower petals strongly oblique, oblong-obovate; claw 6-7 mm long. Follicles 6-7 mm long, pubescent.

Fl. & Fr.: July - September.

Scarce; on moist slopes. Chhohem, 4160 m, 13.07.2003, K. Chandra Sekar 103258.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China; Nepal and Pakistan.

Paste of tender shoots is given with tea to cure cold.

2. *Delphinium cashmerianum* Royle, *Illustr. Bot. Himal.* 55. 1834; Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 26. 1872; M.A. Rau in B.D. Sharma & al., *Fl. India* 1: 89. 1993; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 57. 1994. *Kbarga Dasai*

Photo. 31

Perennial herbs; rootstock slender, woody. Stems 22-38 cm high. Leaves reniform, pentagonal, 2-6 cm in dia., palmately 5-7-lobed to the middle. Flowers bluish-purple. Sepals pubescent with soft white hairs, veined, persistent; upper sepal 2-2.5 x 1.2-1.3 cm, obtuse; spur straight, conical 1.2-1.3 x 0.5-0.8 cm; lateral sepals 1.5-1.8 x 0.6-0.9 cm, obtuse; lower sepals rhombic-obovate, 1.5-1.7 x 0.6-0.8 cm. Petals dark purple to light blue; upper pair slightly oblique; limb 1-1.1 cm long, glabrous; spur 0.8-1 cm long; lower petals strongly oblique, oblong obovate, long-bearded; claw 7-8 mm long. Follicles hairy.

Fl. & Fr.: August - September.

Scarce; on rocky slopes. Thango-Kilung, 4500 m, 01.08.2003, K. Chandra Sekar 103719.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China; Nepal and Pakistan.

Decoction of leaves is given to cure cough and cold.

7. *Halerpestes* Greene

About 10 species distributed in Asia and America; 2 in India.

- | | |
|---|-------------------------|
| 1a. Achenes 80-130, on oblong capitulum | 1. <i>H. sarmentosa</i> |
| b. Achenes 40-50, on roundish capitulum | 2. <i>H. tricuspis</i> |

1. ***Halerpestes sarmentosa*** (Adams) Komarov in Komarov & Klob., *Als. Key Pl. Far. East U.S.S.R.* 1: 550. 1931; M.A. Rau in B.D. Sharma & al., *Fl. India* 1: 103. 1993; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 58. 1994. *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.* **Photo. 32**

Perennial herbs. Stems creeping, with long, filiform stolons rooting at the nodes. Leaves long petioled, oblong-ovate to rounded ovate, 6-9 x 3.5-7.5 mm, obtuse at base, crenately lobed; central one usually larger than the others. Sepals ovate, 3-3.5 x 2.5-4 mm, glabrous. Petals oblong-ovate, about as long as sepals, 2-2.5 mm dia, shortly clawed. Achenes 80-130, on oblong capitulum.

Fl. & Fr.: July - August.

Scarce; on water logged stream beds. Thango, 3900 m, 11.07.2002, K. Chandra Sekar 100421.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan; Nepal; Pakistan and U.S.S.R.

2. ***Halerpestes tricuspis*** (Maxim.) Hand.-Mazz. in *Acta Hort. Gotob.* 13: 135. 1939; M.A. Rau in B.D. Sharma & al., *Fl. India* 1: 103. 1993; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 59. 1994. *Ranunculus tricuspis* Maxim., *Pl. Tangu.* 12. 1889. *R. cymbalariae* Hook.f. & Thomson in Hook.f., *Fl. Brit. India* 1: 17. 1872, *p.p.* **Photo. 33**

Perennial herbs. Stems creeping with long filiform stolons rooting at the nodes. Leaves broadly ovate or orbicular in outline, 0.5-1.3 cm long and broad, tripartite; segments oblong, obtuse; petioles 1-2 cm long. Flowers 7-8 mm diam., yellow. Sepals narrowly ovate, 3-4 mm long, green. Petals obovate, 4-5 mm long, yellow. Achenes 40-50, on roundish capitulum.

Fl. & Fr.: June - September.

Scarce; on river beds, Chhohem, 4100 m, 13.07.2003, K. Chandra Sekar 103261.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Sikkim; Bhutan; China; Mongolia; Nepal; Pakistan and U.S.S.R.

8. *Ranunculus* L.

About 600 species distributed in temperate regions; 33 in India.

- | | |
|--|---------------------------|
| 1a. Aquatic herbs; leaves all submerged | 2 |
| b. Terrestrial or marshy herbs; leaves all at or submerged | 3 |
| 2a. Basal leaves dissected into capillary segments | ? <i>R. trichophyllus</i> |
| b. Basal leaves not dissected into capillary segments | 3. <i>R. nutans</i> |
| 3a. Annual herbs | 6. <i>R. scleratus</i> |
| b. Perennial herbs | 4 |
| 4a. Leaves divided | 5 |
| b. Leaves not divided | 5. <i>R. palmellus</i> |
| 5a. Rootstock fibrous | 6 |
| b. Rootstock not fibrous | 1. <i>R. adoxifolius</i> |
| 6a. Basal leaves palmate-partite; achenes glabrous | 4. <i>R. palmatifidus</i> |
| b. Basal leaves tripartite; achenes pubescent | 2. <i>R. hirtellus</i> |

1. *Ranunculus adoxifolius* Hand.-Mazz. in Acta Hort. Gotob. 13: 152. 1939; M.A. Rau in B.D. Sharma & al., Fl. India 1: 115. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 63. 1994.

Perennial herbs; roots numerous. Stems ascending, 7-12 cm high, sparingly branched. Basal leaves ovate-cordate to suborbicular, 1-1.8 cm long, sparsely silky pubescent, with narrowly ternate lobes; cauline leaves similar but smaller and less divided; upper ones sessile. Flowers solitary, 0.8-1 cm dia., yellow. Sepals broadly ovate, 2.3-3 mm long, sparsely pubescent. Petals obovate, 3.5-3.8 x 2.5-2.7 mm, yellow. Achenes sub-globose, 0.8-1 mm long.

Fl. & Fr: July - September.

Rare; on stream beds. Larang La-Tariya, 4700 m, 06.08.2003, K. Chandra Sekar 103763.

Distrib: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; Nepal and Pakistan.

2. *Ranunculus hirtellus* Royle, Illustr. Bot. Himal. 53. 1835; M.A. Rau in B.D. Sharma & al., Fl. India 1: 121. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 65. 1994. *Sectaku, Sitatiku*

Photo. 34

Perennial herbs; rootstock fibrous. Stems erect, 15-20 cm long, pilose. Basal leaves, long-petioled, reniform to orbicular, 0.6-1.1 x 0.7-1.3 cm, deeply tripartite; cauline leaves sessile, vaginate and amplexicaul at base, tripartite. Flowers 8-18 mm dia., yellow. Sepals ovate-oblong, 4-5 mm long, obtuse at apex. Petals obovate-suborbicular, cuneate. Achenes oblong-suborbicular, 1.2-1.5 mm long, pubescent.

Fl. & Fr: June - September.

Scarce; on moist slopes. On the way from Fariya to Pin Parvati Pass, 4200 m, 24.07.2003, K. Chandra Sekar 103656.

Distrib: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan; China; Nepal and Pakistan.

Extract of whole plant is given as a cure to fever.

3. *Ranunculus natans* C.A. Mey. in Ledeb., Fl. Altaica 2: 315. 1830; M.A. Rau in B.D. Sharma & al., Fl. India 1: 124. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 68. 1994. *R. hyperboreus* Rottb. var. *natans* (C.A. Mey.) Regel in Bull. Sci. Nat. Mosc. 34: 43. 1861; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 18. 1872.

Perennial aquatic herbs, floating; roots fibrous. Leaves reniform, 0.8-1.6 x 1.5-2.2 cm, 3-5-lobate to the middle, lobes shallowly crenate; all leaves with 2 scarious auricles at base; petiole 1-3 cm long; Flowers 0.8-1.2 cm dia., yellow. Sepals ovate, 3-4 mm long, glabrous. Petals obovate to rounded ovate, 5-6 mm long. Achenes 1.5-1.9 mm long, numerous, inflated, glabrous.

Fl. & Fr.: July - August.

Scarce; on river beds. Chhohem, 4100, 13.07.2003, K. Chandra Sekar 103262.

Distrib: India: Himachal Pradesh and Jammu & Kashmir; Afghanistan; Central Asia; China; Mongolia; Nepal; Pakistan and U.S.S.R.

4. *Ranunculus palmatifidus* Riedl in Kew Bull. 34(2): 362. 1979; M.A. Rau in B.D. Sharma & al., Fl. India 1: 125. 1993.

Perennial herbs; rootstock fibrous. Stems erect, 30-50 cm high. Basal leaves long petioled, subreniform, 5-8 cm wide, palmati-partite, sparsely pilose, densely ciliate along margins; cauline leaves subsessile or sessile. Flowers 2-2.2 cm dia., yellow; peduncles long, densely strigulose. Sepals ovate-elliptic, 5-6 x 2-4 mm, densely villous. Petals obovate-cuneate, undulate at margin. Achenes arranged in an ovoid to oblong head, inflated, glabrous.

Fl. & Fr.: July - September.

Rare; on stream beds, Larang La-Fariya, 3950 m, 06.08.2003, K. Chandra Sekar 103762.

Distrib: India: Himachal Pradesh and Jammu & Kashmir; Pakistan.

Notes: Aswal & Mehrotra (1994) doubted its occurrence in Lahaul-Spiti. Its occurrence has been confirmed by the present collection.

5. *Ranunculus pulchellus* C.A. Mey. in Ledeb., Fl. Altaica 2: 333. 1830; M.A. Rau in B.D. Sharma & al., Fl. India 1: 125. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 69. 1994. **Photo. 35**

Perennial herbs; roots fibrous. Stems erect, 10-25 cm high, glabrous. Leaves elongate-elliptic to lanceolate-oblong, acute, entire, glabrous. Flowers solitary, 1.2-1.8 cm dia., yellow. Sepals ovate-lanceolate, 4-5 mm long, subacute, scarious and red-brown hairs in margins. Petals broadly ovate, 7-9 mm long. Achenes obovoid, 1.3-1.5 mm long, inflated, glabrous.

Fl. & Fr.: July - September.

Scarce; on river beds. Chhohem, 4100 m, 13.07.2003, K. Chandra Sekar 103260.

Distrib: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan; China; Iran; Nepal; Pakistan and U.S.S.R.

6. *Ranunculus sceleratus* L., Sp. Pl. 551. 1753; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 19. 1872; M.A. Rau in B.D. Sharma & al., Fl. India 1: 128. 1993.

Annuals. Stems erect, 18-35 cm high. Basal leaves petioled, reniform, 2-2.5 cm dia., 3-partite at base, segments obovate, bluntly 3-5 toothed; upper stem leaves sessile, 3-lobed; lobes linear-oblong, deeply crenate to lobulate. Flowers numerous, 5-7 mm dia., yellow. Sepals ovate, 2-3 x 1.2-1.5 mm, obtuse, deflexed, pubescent outside. Petals obovate, shorter than sepals. Achenes obovoid, 0.7-1.1 mm long, compressed.

Fl. & Fr: July - September.

Rare; on stream beds. Ratang river beds, 3700 m, 02.09.2002, K. Chandra Sekar 100789.

Distrib: India: Assam, Bihar, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Manipur, Punjab, Uttarakhand, Uttar Pradesh and West Bengal; China; Egypt; Europe; Iran; Japan; Myanmar; Nepal; Pakistan; Syria and U.S.S.R.

Note: Aswal & Mehrotra (1994) doubted its occurrence in Lahaul-Spiti on the basis of Chowdhury & Wadhwa (1984). Its occurrence has been confirmed by present collection (Singh & al., 2003).

7. *Ranunculus trichophyllus* Chaix in Villars. Hist. Pl. Dauph. 1: 335. 1786; M.A. Rau in B.D. Sharma & al., Fl. India 1: 130. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 69. 1994.

Perennial herbs, aquatic. Leaves all submerged, 2-3 cm long, divided into many capillary segments, dark green; petioles 4-5 mm long, sheathed at base with an auricle of the same length. Flowers 1.2-1.4 cm dia., white. Sepals elliptic, 3-3.5 mm long, reflexed. Petals obovate, 5-6 x 2-2.5 mm long, white. Achenes obovoid, 1.2-1.5 mm long, strongly ribbed, hispid.

Fl. & Fr: July - September.

Rare; in swamps. Chbohem, 4150 m, 12.07.2003, K. Chandra Sekar 103218.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia, Africa; Europe and N. America.

9. *Thalictrum* L.

About 330 species distributed in N. temperate region, New Guinea, tropical America, tropical and S. Africa; 21 in India.

***Thalictrum foetidum* L.**, Sp. Pl. 545. 1753; M.A. Rau in B.D. Sharma & al., Fl. India 1: 135. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 71. 1994. *T. vaginatum* Royle, Illustr. Bot. Himal. 52. 1834. *T. minus* L. var. *foetidum* (L.) Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 14. 1872. *Katang Tangche*

Photo. 36

Perennial herbs. Stems 36-52 cm high, glandular pubescent. Leaves ternately compound; glabrous above, glandular-punctate beneath, hairy on nerves; segments orbicular, tridentate. Flowers in panicles, pendulous. Bracts linear-lanceolate. Sepals elliptic, 3.0-3.5 x 1.5-2 mm. Anthers apiculate. Achenes ovoid-oblong, 2-2.5 mm long, slightly compressed, finely glandular-pubescent.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Mud-Tilling, 3800 m, 26.08.2002, K. Chandra Sekar 102954.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia to Europe.

10. Trollius L.

About 31 species distributed in N. temperate region; 3 in India.

Trollius acaulis Lindl. in Edwards, Bot. Reg. Misc. 56. 1842; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 22. 1872; M.A. Rav in B.D. Sharma & al., Fl. India 1: 144. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 73. 1994.

Perennial herbs; rootstock stout, covered with remains of old petioles round the base of the flowering stems. Stems 11-20 cm high. Basal leaves long petioled, palmately 5-partite; segments oblong lanceolate; cauline leaves similar, but with much shorter petioles. Flowers solitary, 4-5 cm dia., yellow orange. Sepals broadly ovate, obtuse. Petals linear, cuneate, rounded at the apex. Follicles 1.7-2 cm long.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Lanjak-Larsa Pass, 4300 m, 05.08.2002, K. Chandra Sekar 100615.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Nepal and Pakistan.

2. PAPAVERACEAE

Twenty three genera and ca 230 species distributed in N. temperate region; 5 genera and 27 species in India.

Meconopsis Viguier

About 50 species distributed in Himalaya to W. China and Europe; 16 in India.

Meconopsis aculeata Royle, Illustr. Bot. Himal. 67, t. 15. 1833; Hook.f. & Thomson in Hook.f., Fl. Brit. India 1: 118. 1872; Debnath & M.P. Nayar in B.D. Sharma & N.P. Balakr., Fl. India 2: 11. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 78. 1994. *M. bikramii* Aswal in Indian J. Forest. 8(1): 84. 1985.

They Mindok

Biennials, prickly. Stems erect, up to 50 cm high, leafy throughout, covered with 2-7 mm long bristles. Leaves irregularly pinnatifid; upper cauline leaves sessile, smaller; segments ovate-triangular, obtuse. Flowers in racemes, blue. Sepals broadly oblong-orbicular, 1.2-1.8 cm long. Petals obovate to suborbicular, 3.2-3.5 x 3-3.3 cm. Filaments 5-8 mm long; anthers golden yellow. Capsules dehiscent by 4-6 valves, 1-1.3 cm long. Seeds subreniform, 0.7-1 mm long.

Fl. & Fr.: August - September.

Rare; on rocky slopes. Mud-Tharbik, 4050 m, 01.08.2002, K. Chandra Sekar 102811.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan.

Paste of petals is given with milk to reduce the body pain.

3. FUMARIACEAE

Seventeen genera and ca 530 species distributed in N. temperate region, tropical Africa and S. Africa; 4 genera and 65 species in India.

Corydalis DC.

About 400 species mainly in Northern temperate regions; 53 in India.

- | | |
|--|--------------------------|
| 1a. Upper petal dorsally winged | 4. <i>C. stricta</i> |
| 1b. Upper petal not dorsally winged | 2 |
| 2a. Spur shorter than lamina of the upper petal | 3 |
| 2b. Spur as long as lamina of the upper petal | 2. <i>C. govaniensis</i> |
| 3a. Fruits inflated, broadly ovoid to suborbicular | 1. <i>C. crassifolia</i> |
| 3b. Fruits not inflated, oblong-ellipsoid | 3. <i>C. meifolia</i> |

1. **Corydalis crassifolia** Royle, *Illustr. Bot. Himal.* 68. 1834; J.L. Ellis & N.P. Balakr. in B.D. Sharma & N.P. Balakr., *Fl. India* 2: 48. 1993; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 81. 1994.

Chagapa Mensa, Puhaut Photo. 37

Perennial herbs. Stems erect, 10-20 cm high. Radical leaves long-petioled reniform, cuneate at base, deeply divided into 3-5-lobed, fleshy; cauline leaves sessile, verticillate, similar to radical leaves. Racemes 10-16 flowered. Bracts oblanceolate to obovate-lanceolate, cuneate at base. Flowers white with blue spots. Sepals ovate, cordate, acute. Petals broad, obtuse; lower petals slightly deflexed. Capsules obovoid, papery valved, 1.4-2.6 x 0.8-1.7 cm, inflated.

Fl. & Fr.: July - October.

Rare; on rock-crevices. Tariya, 4200 m, 21.07.2003, K. Chandni Sekar 103611.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; China and Pakistan.

Decoction of whole plant is given with curd to control profuse bleeding during menstruation.

2. **Corydalis govaniensis** Wall., *Tent. Fl. Nep.* 55. 1824-26; J.L. Ellis & N.P. Balakr. in B.D. Sharma & N.P. Balakr., *Fl. India* 2: 60. 1993.

Perennial herbs. Stems 24-38 cm high, glabrous. Radical leaves petioled, ovate-oblong to suborbicular, 1-4 cm long, 3-5-pinnuled, pinnules deeply dissected; cauline leaves similar to radical leaves but very much reduced, dentate to almost entire. Racemes 10-25-flowered. Bracts 1-3 x 0.5-1.5 cm. Flowers 2-2.5 cm long, yellow. Sepals 0.8-1 mm dia., conspicuously denticulate, white. Outer petals dorsally winged; lower sub-saccate at base. Capsule oblong, 1-1.5 x 0.3-0.4 cm, subrounded to subobovate at the apex. Seeds 6-8.

Fl. & Fr.: July - September.

Rare; on rocky slopes. Panjho catchment, 18.08.1994, Nima 213 (W11).

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Nepal and Pakistan.

3. **Corydalis meifolia** Wall., *Tent. Fl. Nep.* 55, t. 41. 1824-26; J.L. Ellis & N.P. Balakr. in B.D. Sharma & N.P. Balakr., *Fl. India* 2: 66. 1993; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 82. 1994. **Photo. 38**

Perennial herbs. Stems erect, 30-40 cm high. Radical leaves long-petioled, finely bipinnatisect, triangular to oblong, 8-28 x 6-13 cm; cauline leaves becoming shorter and subsessile upwards; petioles sheathed at base. Racemes 15-20-flowered. Flowers yellow. Sepals oblong, 1.5-3 x 1-1.5 mm, irregularly serrate-laciniate. Upper petals 1.3-1.5 cm long, with prominent rounded crest at the tip; spur 1.5-2.5 mm long; lower petals 3-5 mm long. Capsules narrowly obovoid, broadly elliptic, clavate.

Fl. & Fr.: July - September.

Rare; on rocky slopes. Kibung, Larang La, 4650 m, 02.06.2003, K. Chandra Sekar 103722.

Distrib.: India: Himachal Pradesh, Sikkim and Uttarakhand; Bhutan; China; Nepal and Pakistan.

4. *Corydalis stricta* Steph. ex DC., Syst. Nat. 2: 123. 1821; J.L. Ellis & N.P. Balakr. in B.D. Sharma & N.P. Balakr., Fl. India 2: 73. 1993. *Larsi Membek*

Perennial herbs. Stems erect, 31-43 cm high. Radical leaves petioled, many, 7-15 x 2-3 cm, 2 or 3-pinnatisect, somewhat fleshy; cauline leaves sessile to conspicuously stalked, few to many, similar to radical leaves but gradually becoming smaller upwards. Bracts 3-6 mm long, acute-acuminate. Flowers 1.2-1.5 cm long, yellow. Sepals ovate to lanceolate, 2-4 mm long, fimbriate at base. Upper petals slender, abruptly semiglobose near the apex; lower petals similar to the lamina of upper petal, slender, narrow below. Capsules linear, 2-3 x 0.2-0.25 cm. Seeds many.

Fl. & Fr.: July - September.

Rare; on rocky slopes. Thangti, 4000 m, 27.08.2002, K. Chandra Sekar 102980.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Asia.

Extract of peduncles is given with milk as a cure to asthma.

4. BRASSICACEAE

About 365 genera and ca 3250 species, cosmopolitan, especially in temperate regions; 64 genera and 207 species in India.

- | | | |
|-----|---|---------------------|
| 1a. | Fruits beaked; cotyledons conduplicate | 2 |
| | b. Fruits not beaked; cotyledons acuminate or incumbent | 3 |
| 2a. | Fruits lomentum; beak 2-3 cm long | 14. Raphanus |
| | b. Fruits siliquae; beak 1-2 cm long | 3. Brassica |
| 3a. | Fruits compressed at right angles to the septum; replum much narrower than the width of the fruit | 4 |
| | b. Fruits terete, angular, inflated or compressed parallel to the septum; replum equalling the width of the fruit | 7 |
| 4a. | Seed 1 in each locule | 9. Lepidium |
| | b. Seeds 2 to many in each locule | 5 |
| 5a. | Valves of fruits winged or shortly keeled | 17. Thlaspi |
| | b. Valves of fruits neither winged nor keeled | 6 |

- | | |
|--|-------------------------|
| 6a. Fruits triangular-obcordate | 4. <i>Capsella</i> |
| b. Fruits ellipsoid to globose | 8. <i>Hymenolobus</i> |
| 7a. Fruits indehiscent, nut-like; valves thick or spongy | 16. <i>Tauscheria</i> |
| b. Fruits dehiscent or transversely breaking into seed-bearing segments; valves neither thick nor spongy | 8 |
| 8a. Fruits less than 3-times longer than broad | 9 |
| b. Fruits more than 8-times longer than broad | 10 |
| 9a. Septal cells with parallel walls | 7. <i>Draba</i> |
| b. Septal cells with polygonal walls | 13. <i>Ptilotrichum</i> |
| 10a. Calyx closed at anthesis; sepals erect | 11 |
| b. Calyx open at anthesis; sepals spreading or ascending | 13 |
| 11a. Scapes with leaves | 12 |
| b. Scapes without leaves | 12. <i>Parrya</i> |
| 12a. Fruits transversely breaking into several 2-seeded parts; seeds not winged | 5. <i>Chorispora</i> |
| b. Fruits not breaking into 2-seeded parts; seeds winged | 10. <i>Matthiola</i> |
| 13a. Cotyledons accumbent | 14 |
| b. Cotyledons incumbent | 16 |
| 14a. Aquatic herbs; stems glabrous, rooting at nodes | 11. <i>Nasturtium</i> |
| b. Terrestrial herbs; stems densely hairy, not rooting at nodes | 15 |
| 15a. Basal leaves spatulate to obovate, 3-5-dentate above | 6. <i>Christolea</i> |
| b. Basal leaves oblanceolate or oblong-obovate, entire, dentate or sinuate-dentate | 2. <i>Arabis</i> |
| 16a. Seeds not mucilaginous when soaked | 1. <i>Arabidopsis</i> |
| b. Seeds mucilaginous when soaked | 15. <i>Sisymbrium</i> |

1. *Arabidopsis* Heynh.

About 20 species distributed in N. temperate to tropical Africa; 9 in India.

- | | |
|--|-------------------------|
| 1a. Racemes bracteate; siliquae subspreading and slightly curved | 1. <i>A. himalaica</i> |
| b. Racemes ebracteate; siliquae erect and straight | 2. <i>A. mollissima</i> |

1. *Arabidopsis himalaica* (Edgew.) O.E. Schulz in Engl., *Pflanzenz.* IV. 105 (heft 86) : 283. 1924; Hajra & al. in B.D. Sharma & al., *Fl. India* 2: 227. 1993; Aswal & Mehrotra, *Fl. Lahaul-Spiti*. 89. 1994. *Arabis himalaica* Edgew. in *Trans. Linn. Soc. London* 20: 31. 1846. **Photo. 39**

Biennials. Stems erect, 20-35 cm high, hispid. Basal leaves rosulate, oblong-obovate, 2-4 x 0.6-1.2 cm, obtuse; cauline leaves sessile, oblong-ovate, amplexicaul. Racemes 24-32-flowered, bracteate. Flowers 3-4 mm dia. Sepals ovate-oblong, 2-2.5 x 0.8-1 mm. Petals 3-5 x 1-1.5 mm, white. Siliquae linear, 2.5-

3.2 cm long, glabrous, compressed, slightly curved. Seeds 0.5-0.7 mm dia.

Fl. & Fr.: July - August.

Common; on rocky slopes. Chhohem, 4100 m, 13.07.2003, K. Chandra Sekar 103242.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan; Bhutan; China; Nepal and Pakistan.

2. Arabidopsis mollissima (C.A. Mey.) N. Busch, Fl. Sib. & Or. Extr. 1: 136, 1913; Hajra & al. in B.D. Sharma & N.P. Balakr., Fl. India 2: 228, 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti, 90, 1994. *Symbrium mollissimum* C.A. Mey. in Ledeb., Fl. Altaica 3: 140, 1831. Nagesw. Menon

Biennials. Stems erect, 20-32 cm high, pubescent. Basal leaves shortly petioled, rosulate, oblong-obovate, 2-4 x 0.5-1.0 cm, obtuse; cauline leaves sessile, oblong-ovate, amplexicaul. Racemes 14-17 cm long, 20-40-flowered. Flowers 3.5-4.5 mm dia. Sepals ovate-oblong, 1.8-2 x 0.6-1 mm. Petals 3-4 x 0.8-1.2 mm, pinkish. Siliqua linear, 1.5-3 cm long, sparsely pubescent, straight. Seeds 20-28 in each locule, 0.8-1 mm long.

Fl. & Fr.: July - August.

Scarce; on rocky slopes. Lanjuk-Bhaha pass, 4250 m, 04.06.2002, K. Chandra Sekar 100000.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan; Bhutan; China; C. Asia; Nepal; Pakistan and U.S.S.R.

Crushed leaves are externally applied to cure wounds in cattle.

2. Arabis L.

About 180 species distributed in N. temperate region, Mediterranean to tropical Africa; 9 in India.

- | | |
|--|----------------------------|
| 1a. Cauline leaves auricled or amplexicaul to subamplexicaul at base | 2 |
| b. Cauline leaves not auricled and nor amplexicaul at base | 3. <i>A. tenuirostris</i> |
| 2a. Seeds either margined or narrowly winged | 3 |
| b. Seeds neither margined nor winged | 4 |
| 3a. Fruits pubescent | 2. <i>A. neta</i> |
| b. Fruits glabrous | 3. <i>A. pterosperma</i> |
| 4a. Basal leaves entire | 4. <i>A. recta</i> |
| b. Basal leaves toothed or crenate-serrate | 1. <i>A. amplexicaulis</i> |

1. Arabis amplexicaulis Edgew. in Trans. Linn. Soc. London 20: 31, 1851; Hajra & H.J. Chowdhery in B.D. Sharma & N.P. Balakr., Fl. India 2: 100, 1993; Aswal & Mehtrota, Fl. Lahaul-Spiti 93, 1994.

Annuals. Stems suberect, 21-39 cm high, hispidulous. Basal leaves petioled, ovate-oblong, 3-11 x 1-3 cm, attenuate at base, subacute at apex, coarsely toothed; cauline leaves ovate to ovate-oblong, 1.5-4 cm long, amplexicaul, acute. Racemes 15-34-flowered. Sepals ovate, 4-5 x 0.5-1 mm. Petals 7-10 x 2-3.5 mm, white. Siliqua linear, 30-40 x 1-1.5 mm, acute, glabrous. Seeds 18-22 in each locule, 0.6-0.9 mm long.

Fl. & Fr.: April - May.

Scarce; on rocky slopes. Larang La-Tariya, 4700 m, 06.08.2003, K. Chandra Sekar 103765.

Distrib.: India: Himachal Pradesh; Jammu & Kashmir and Uttarakhand; Afghanistan; Bhutan; Nepal and Pakistan.

2. ***Arabis nova*** Vill., Prosp. Pl. Dauph. 39. 1779; Hajra & H.J. Chowdhery in B.D. Sharma & N.P. Balakr., Fl. India 2: 101. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiri 94. 1994. *A. auriculata* Lam., Encycl. Meth. Bot. 1: 219. 1783; Hook.f. & T. Anderson in Hook.f., Fl. Brit. India 1: 135. 1872, *p.p.* Nagai Menba

Annuals. Stems erect, 20-38 cm high, stellately hairy. Basal leaves petioled, oblong spatulate, 1-2.5 x 1-2 cm, obtuse at apex, sinuate; cauline leaves ovate-oblong, 0.8-1.8 x 0.6-1.4 cm, amplexicaul, acute. Racemes 13-15 cm long, 6-10-flowered. Sepals 1.5-2 mm long. Petals 3-4 x 1-1.2 mm, white. Siliquae linear-oblong, 2-2.7 x 0.1-0.12 cm, acute, compressed, sparsely pubescent. Seeds 0.7-1 mm long.

Fl. & Fr.: June - August.

Scarce; on rocky slopes. Lanjuk-Bhaba pass, 3900 m, 03.08.2002, K. Chandra Sekar 100584.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia and Mediterranean.

Paste of young siliquae is given to cure dysentery in cattle.

3. ***Arabis pterosperma*** Edgew. in Trans. Linn. Soc. London 20: 33. 1851; Hajra & H.J. Chowdhery in B.D. Sharma & N.P. Balakr., Fl. India 2: 103. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiri 94. 1994.

Biennials. Stems erect, 18-34 cm high, sparsely pubescent. Basal leaves petioled, obovate-oblong, 2-3.8 x 0.4-1.2 cm, obtuse, toothed; cauline leaves oblong, 1-1.8 x 0.3-0.8 cm, amplexicaul, obtuse, rounded. Racemes 6-8 cm long, 18-26-flowered. Sepals elliptic-oblong, 3-4 mm long. Petals spatulate, 5-7 x 1.5-2 mm, white. Siliquae linear, 3.5-5 x 0.1-0.12 cm, glabrous. Seeds 25-30 in each locule.

Fl. & Fr.: June - August.

Rare; on rocky slopes. Chhohem, 4150 m, 12.07.2003, K. Chandra Sekar 103223.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Bhutan; Nepal and Pakistan.

4. ***Arabis recta*** Vill., Prosp. Pl. Dauph. 3: 319. 1788; Hajra & H.J. Chowdhery in B.D. Sharma & N.P. Balakr., Fl. India 2: 103. 1993. *Shukla*

Annuals. Stems erect, 13-26 cm high, pubescent. Basal leaves petioled, obovate to oblong, 1-1.8 x 0.2-0.4 cm, acute, entire; cauline leaves ovate to oblong, 0.8-1.2 x 0.2-0.3 cm, amplexicaul, obtuse at apex. Racemes 6-12 cm long, 9-18-flowered. Flowers white. Sepals 1.5-2 mm long. Petals 2.8-3 mm long. Siliquae linear, 2-3 cm long, glabrous. Seeds 0.5-0.7 mm long.

Fl. & Fr.: July - August.

Scarce; on rocky slopes. Tariya, 4000 m, 25.07.2003, K. Chandra Sekar 103694.

Distrib.: India: Himachal Pradesh; Europe.

5. *Arabis tenuirostris* O.F. Schulz in Notizbl. Bot. Gart. Berlin 9: 1066. 1927; Hajra & H.J. Chowdhery in B.D. Sharma & N.P. Balakr., Fl. India 2: 105. 1993; Aswal & Mehrotra, Fl. Lahaul Spiti 95. 1994.

Biennials. Stems erect, 19-30 cm high, pubescent. Basal leaves shortly petioled, spatulate to oblanceolate, 1.3-3.8 x 0.3-1 cm, obtuse, sinuate-dentate, pubescent; cauline leaves oblong obovate to linear, 0.8-1.6 x 0.2-0.4 cm, obtuse, toothed. Racemes 8-10 cm long, 8-18-flowered. Sepals oblong, 2-3.5 mm long. Petals obovate, 4-5 mm, connate, white. Siliquae linear, 6-7 cm long, acute, glabrous. Seeds 20-28 in each locule, 0.8-1 mm long.

Fl. & Fr.: June - July.

Source: on rocky slopes. Gechang - Thango, 3850 m, 10.07.2003, K. Chandra Sekar 101173.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Pakistan.

3. *Brassica* L.

Thirty five species chiefly in Eurasia and Mediterranean regions; 6 in India.

Brassica rapa L. subsp. *campestris* (L.) Clapham in Fl. Brit. Isles, ed. 2: 124. 1962; Hajra & al. in B.D. Sharma & N.P. Balakr., Fl. India 2: 138. 1993. *B. campestris* L., Sp. Pl. 666. 1753; Aswal & Mehrotra, Fl. Lahaul-Spiti 97. 1994. *Aunkar*

Annuals. Stems erect, 42-57 cm high, hispidulous. Basal leaves petioled, lyrate-pinnatifid, 8-10 x 3-5 cm, hispidulous, cauline leaves sessile, oblong-lanceolate, 4-7 cm long, amplexicaul, glabrous, glaucous. Racemes corymbose, 30-35-flowered. Sepals 4-6 x 2 mm. Petals 0.8-1 x 0.35-0.45 cm, yellow. Siliquae linear, 3.5-7 x 0.2-0.3 cm, subtorulose, beaked; beak 1-2 cm long. Seeds globose, yellow-brown.

Fl. & Fr.: June - September.

Source: cultivated and found as an escape. Guling, 3700 m, 26.08.2002, K. Chandra Sekar 100715.

Distrib.: India: Throughout India; Asia and Europe.

Whole plant is orally given to cattle for the removal of placenta after delivery.

4. *Capsella* Medik.

Five species distributed in temperate regions; 1 in India.

Capsella bursa-pastoris (L.) Medik., Pflanzen-Gart. 85. 1792, Bhaumik in B.D. Sharma & N.P. Balakr., Fl. India 2: 189. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 99. 1994. *Thlaspi bursa-pastoris* L., Sp. Pl. 647. 1753. *Chuchi*

Annuals. Stems erect, 18-34 cm high, glabrous. Basal leaves shortly petioled, rosulate, oblong-lanceolate, 2-12 x 0.5-3 cm, pinnati-partite; cauline leaves sessile, ovate-lanceolate to linear, 1-5 x 0.4-1.8 cm, auricled and clasping at base, acute. Sepals oblong, ca 1.5 x 1 mm, obtuse. Petals oblanceolate, 2-2.2 x 0.5-1 mm, white. Pods obcordate-triangular, 5-9 x 4-6 mm, scarcely attenuate at base, slightly emarginate at apex, with wide apical notch. Seeds pale brown.

Fl. & Fr.: June - August.

Occasional; on stream beds. Mad-Larang Ia, 3800 m, 19.08.2002, K. Chandra Sekar 102914.

Distrib: Throughout India; cosmopolitan except in the tropics.

Decoction of whole plant is taken twice a day in kidney problems.

5. *Chorispota* R. Br. ex DC.

Thirteen species distributed in E. Mediterranean region and C. Asia; 5 in India.

Chorispota sabulosa Cambess. in Jacquem., Voy. Inde 4: 15. t. 15. 1844; Hajra & al. in B.D. Sharma & N.P. Balakr., Fl. India 2: 116. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 102. 1994.

Mentok Karbon

Perennial herbs. Stems suberect, 8-18 cm high, sparsely glandular hairy. Basal leaves petioled, rosette, oblanceolate to spatulate, 2-6 x 0.2-1 cm, deeply pinnatifid to irregularly dentate; cauline leaves similar to radical leaves but gradually becoming smaller upwards. Racemes 10-20 flowered. Sepals elliptic-oblong, 3-4 mm long. Petals 6-9 x 3-4 mm, pink. Siliquae cylindrical, torulose to moniliform, 1.2-1.5 x 0.2-0.3 cm, glabrous.

Fl & Fr: July - August.

Scarce; on stream beds. Near Bhaba Pass, 4800 m, 03.08.2002, K. Chandra Sekar 100585.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia.

6. *Christolea* Cambess.

Thirteen species distributed in C. Asia, Himalaya and Alaska; 7 in India.

- | | |
|--|---------------------------|
| 1a. Plants above 15 cm high; siliquae broadly linear to oblong-ovate | 1. <i>C. crassifolia</i> |
| b. Plants below 13 cm high; siliquae linear-oblong | 2. <i>C. himalayensis</i> |

1. *Christolea crassifolia* Cambess. in Jacquem., Voy. Inde 4: 17. t. 17. 1844; Hajra & H.J. Chowdhery in B.D. Sharma & N.P. Balakr., Fl. India 2: 119. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 103. 1994.

Lukmuk Photo. 40

Perennial herbs. Stems suberect, 23-37 cm high, sparsely villous. Leaves obovate-oblong, 2-4.5 x 0.7-1.8 cm, deeply 3-5-toothed towards the apex, fleshy, 3-veined. Racemes 6-8 cm long, 10-20-flowered. Flowers 4.5-6.5 mm dia. Sepals 3-3.5 mm long. Petals 5-6 mm long, white, with purple base. Siliquae broadly linear to oblong-ovate, 1.5-2.7 x 0.3-0.4 cm, acute at both ends, glabrous, compressed. Seeds 5-10 in each locule.

Fl & Fr: June - August.

Scarce; on rocky slopes. Guling, 3700 m, 26.08.2002, K. Chandra Sekar 100717.

Distrib: India: Himachal Pradesh and Jammu & Kashmir, Afghanistan; China; C. Asia and Pakistan.

Fresh leaves are used as a nutritious vegetable and to improve eyesight.

2. *Christolea himalayensis* (Cambess.) Jaffri in Notes Roy. Bot. Gard. Edinb. 22: t.3, f.1, t. 1955; Hajra & H.J. Chowdhery in B.D. Sharma & N.P. Balakr., Fl. India 2: 119. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 103. 1994. *Choranthus himalayensis* Cambess. in Jacquem., Voy. Inde 4: 14. 1844. *Lukmuk*

Photo. 41

Perennial herbs; rootstock much divided. Stems suberect, 8-12 cm high, sparsely pubescent. Basal leaves rosulate, spatulate-obovate, 1-1.5 x 0.5-0.8 cm, bluntly 3-5-toothed above; cauline leaves spatulate to linear, small. Racemes 7-10 cm long, 12-22-flowered. Flowers 5-6 mm dia. Sepals 2.5-3 mm long. Petals 4-6 mm long, distinctly veined, violet. Siliquae linear-oblong, 2-2.8 x 0.2-0.3 cm, compressed. Seeds many.

Fl & Fr: July - September.

Common; on rocky slopes. Jarang La-Tariya, 4700 m, 06.08.2003, K. Chandra Sekar 103152.

Distrib: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan, Bhutan; China and Pakistan.

Decoction of young roots is given in menstrual complaints.

7. *Draba* L.

About 300 species distributed in N. temperate region and S. America; 33 in India.

- | | |
|---|--------------------------|
| 1a. Flowering shoots not leafy | 2 |
| b. Flowering shoots leafy | 3 |
| 2a. Petals 4.5-5.5 mm long; siliculae oblong-ellipsoid | <i>S. D. nigra</i> |
| b. Petals 2.5-3.5 mm long; siliculae ovoid | <i>6. D. strackii</i> |
| 3a. Plants with short branched hairs | 4 |
| b. Plants with simple hairs | <i>1. D. altaica</i> |
| 4a. Hairs homotrichous (short and branched hairs) | 5 |
| b. Hairs heterotrichous (short branched hairs mixed with simple or forked long hairs) | <i>4. D. lasiophylla</i> |
| 5a. Stems above 10 cm high; seeds 16-12 in each locule | <i>3. D. lancoletta</i> |
| b. Stems below 10 cm high; seeds 3-6 in each locule | <i>2. D. glomerata</i> |

1. *Draba altaica* (C.A. Mey.) Bunge in Delect. Sem. Hort. Dorpat. 8. 1841; Basak in B.D. Sharma & N.P. Balakr., Fl. India 2: 153. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 106. 1994. *D. rupestris* R. Br. var. *altaica* C.A. Mey. in Ledeb., Fl. Altaica 3: 71. 1831. *Traba Menca*

Perennial herbs; rootstock covered with withered leaf bases. Stems erect, 5-8 cm high. Basal leaves rosulate, lanceolate: 1-2 x 0.1-0.2 cm, acute, 1-2-dentate towards the apex; cauline leaves oblong-ovate, 2-4-dentate towards the apex. Racemes 4-8-flowered. Flowers 2-2.5 mm dia. Sepals oblong-elliptic, 1-1.5 mm long. Petals obovate, 2-2.5 x 1-1.5 mm, white. Siliculae ovate-oblong, 3-5 x 1.5-2 mm, acute, glabrous. Seeds brown.

Fl & Fr: June - August.

Scarce; on moist slopes. Chhohem, 4050 m, 12.07.2003, K. Chandra Sekar 103209.

Distrib: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan; Bhutan; China; C. Asia; Nepal; Pakistan and W. Siberia.

2. *Draba glomerata* Royle, Illustr. Bot. Himal. 71. 1834; Basak in B.D. Sharma & N.P. Balakr., Fl. India 2: 158. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 107. 1994.

Perennial, caespitose herbs. Stems erect, 5-8 cm high, densely covered with soft, short, whitish, branched hairs. Basal leaves petioled, rosulate, narrowly oblong, 0.5-1.5 x 0.1-0.25 cm, obtuse; cauline leaves sessile, oblong-ovate. Racemes 10-15 flowered. Flowers 2-3 mm dia. Sepals 1-1.5 mm long. Petals obovate, 1.5-2 x 0.5-1 mm, white. Siliculae oblong-ovoid, 3-4.5 x 1-1.5 mm, sparsely pubescent. Seeds ovate-oblong.

Fl. & Fr.: June - August.

Rare; on rocky slopes. Chhohem, 4150 m, 12.07.2003, K. Chandra Sekar 103252.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China; Nepal and Pakistan.

3. *Draba lanceolata* Royle, *Illustr. Bot. Himal.* 72, 1834; Basak in B.D. Sharma & N.P. Balakr., *Fl. India* 2: 161, 1993; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 108, 1994. *Mentok, Jabar*

Perennial, caespitose herbs. Stems erect, 14-22 cm high, sparsely pubescent. Basal leaves petioled, rosulate, lanceolate, 1-2 x 0.2-0.5 cm, attenuate, subacuminate; cauline leaves sessile, ovate-lanceolate, 0.8-1 x 0.1-0.3 mm, subacuminate. Racemes 10-15 flowered, bracteate. Sepals narrowly oblong, 1.8-2.2 mm long. Petals oblong-ovate, 2.2-3 mm long. Siliculae linear-oblong, 0.6-1.4 x 0.15-0.2 cm, sparsely hairy. Seeds 15-20 in each locule.

Fl. & Fr.: June - August.

Scarce; in rock-crevices. Near Pin Parvati Pass, 5000 m, 22.07.2003, K. Chandra Sekar 103626.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; America; C. Asia; Pakistan and U.S.S.R.

4. *Draba lasiophylla* Royle, *Illustr. Bot. Himal.* 71, 1834; Basak in B.D. Sharma & N.P. Balakr., *Fl. India* 2: 161, 1993; Aswal & Mehrotra, *Fl. Lahaul Spiti* 108, 1994. *Cireya Menzobok*

Photo. 42

Perennial, caespitose herbs. Stems erect, 14-23 cm high, sparsely pubescent. Basal leaves petioled, rosulate, lanceolate, 1-1.8 x 0.2-0.4 cm, acute, densely pubescent; cauline leaves sessile, ovate-oblong, 0.4-1.1 x 0.2-0.4 cm, acute, denticulate along margins, pubescent. Racemes 10-14-flowered. Flowers 3-4 mm dia. Sepals oblong-elliptic, 2-2.5 mm long. Petals oblong-ovate, 2.5-3.5 mm long, white. Siliculae oblong-ellipsoid, 6-9 x 1-2 mm, acute, pubescent. Seeds 3 or 4 in each locule.

Fl. & Fr.: June - August.

Scarce; on rocky slopes. Thango-Kilung, 4400 m, 31.07.2003, K. Chandra Sekar 103717.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China and Nepal.

Note: Endemic to the Himalaya.

Juice of whole plant mixed with turmeric powder is applied externally to cure rheumatism.

5. *Draba olgae* Regel & Schmalh. in Regel, *Descr. Pl. Nov. in Fedtsch.* 8, 1882; Basak in B.D. Sharma & N.P. Balakr., *Fl. India* 2: 164, 1993.

Perennial, caespitose herbs. Stems erect, 6-10 cm high. Leaves rosulate, oblong-elliptic, 0.6-1.1 x 0.2-0.4 cm, acute, entire, pubescent. Racemes lax, 15-28-flowered. Flowers 4-5 mm dia. Sepals oblong-ovate, 2-2.5 mm long, pubescent. Petals obovate, 4.5-5.5 mm long, cuncate at base, yellow. Siliculae

oblong-ellipsoid, $1.7 \times 2.2-2.5$ mm, often slightly curved near the apex, sparsely pubescent. Seeds 5 or 6 in each locule.

Fl. & Fr.: June - August.

Occasional; on rocky slopes, Larang La, 5010 m, 04.08.2003, *K. Chandu Sekar* 103139.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; C. Asia.

6. *Draba oreades* Schrenk in Fischer & C.A. Mey., *Flora. Pl. Nov.* 2: 56. 1842; Basak in B.D. Sharma & N.P. Balakr., *Fl. India* 2: 164. 1993; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 109. 1994.

Perennial, caespitose herbs. Stems suberect, 5-8 cm high. Leaves rosulate, obovate-oblong to elliptic-obovate, $5-20 \times 1-4$ mm, attenuate at base, acute at apex. Racemes 5-14-flowered. Flowers 3-4 mm dia. Sepals oblong, 2-2.5 mm long. Petals oblanceolate, 2.5-3.5 \times 1-1.5 mm, yellow. Stuctae ovoid, 3-6 \times 3-5 mm, rounded at base, acute, glabrous, flattened. Seeds 3-6 in each locule, ovoid.

Fl. & Fr.: June - August.

Rare; on stream beds, Mud Tharvik, 4000 m, 23.08.2002, *K. Chandu Sekar* 102038.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia.

8. *Hymenolobus* Nutt. ex Torrey & Gray

Five species mainly in Europe, C. Asia, Australia, N. America and Chile; 1 in India.

Hymenolobus procumbens (L.) Nutt. ex Torrey & Gray, *Fl. N. America* 1: 117. 1838; Bhattach in B.D. Sharma & N.P. Balakr., *Fl. India* 2: 195. 1993; *Lepidium procumbens* L., *Sp. Pl.* 2: 643. 1753.

Annuals. Stems procumbent, 8-20 cm high. Basal leaves petioled, rosulate, oblong-elliptic, 1-3 \times 0.5-0.8 cm, sparsely pubescent; cauline leaves smaller, 0.5-1.5 cm long, cuncate at base. Racemes up to 1 cm long, 15-24-flowered. Flowers 1-1.5 mm dia. Sepals 0.8-1 \times 0.3-0.5 mm. Petals as long as the sepals, white. Siliquae ellipsoid, 3-4 \times 1.5-2 mm, slightly emarginate at apex, glabrous. Seeds ellipsoid, 4-5 mm long, pale brown.

Fl. & Fr.: July - August.

Rare; on stream beds, Gochang, 3800 m, 26.08.2002, *K. Chandu Sekar* 100/19.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia; Australia; Europe; N. Africa and N. America.

9. *Lepidium* L.

About 140 species, cosmopolitan; 10 in India.

- | | |
|--|-------------------------|
| 1a. Annuals or biennials; stamens 2 or 4 | 2. <i>L. virginicum</i> |
| b. Perennial herbs; stamens 6 | 1. <i>L. latifolium</i> |

1. *Lepidium latifolium* L., *Sp. Pl.* 644. 1753; Bhattach in B.D. Sharma & N.P. Balakr., *Fl. India* 2: 203. 1993; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 113. 1994. *Condition. Chief Use*

Photo. 43

Perennial herbs. Stems erect, 43-69 cm high, glabrous. Basal leaves petioled, ovate-lanceolate, 5-8 x 2-4 cm, acute to obtuse, entire to serrate; upper leaves sessile, oblong-elliptic, serrate to entire. Racemes 40-60-flowered, ebracteate. Flowers 2-2.5 mm dia. Sepals ovate-oblong, 1-1.2 mm long, obtuse. Petals spatulate, 2-2.2 x 1-1.2 mm, white. Stamens 6. Siliculae ovoid globose, 1.5-2 mm long, obtuse, glabrous. Seeds oblong-elliptic, brown.

Fl. & Fr.: June - August.

Scarce; on rocky slopes. Mud, 3700 m, 29.07.2002, *K. Chandra Sekar* 100529.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Asia; Australia; Europe and N. Africa.

2. *Lepidium virginicum* L., Sp. Pl. 645. 1753; Bhaumik in B.D. Sharma & N.P. Balakr., Fl. India 2: 207. 1993; Aswal & Mehrotra, Fl. Lahaul Spiti 114. 1994.

Biennials. Stems 24-43 cm high, sparsely pubescent. Basal leaves petioled, oblanceolate, 4-8 x 0.7-1.5 cm, attenuate at base, acute at apex; cauline leaves sessile, oblanceolate to linear-lanceolate, 1-2.5 x 0.1-0.4 cm, attenuate, acute. Sepals elliptic, 1-1.5 mm long, glabrous. Petals obovate-spatulate, 1.5-2.5 mm long, white. Stamens 2 or 4. Siliculae broadly ovoid-subglobose, 3-4 x 2.5-3 mm, broadly notched at apex, glabrous. Seeds ovoid.

Fl. & Fr.: June - August.

Scarce; on stream beds. Chhohem, 4100 m, 23.07.2002, *K. Chandra Sekar* 100508.

Distrib.: India: Bihar, Himachal Pradesh, Jammu & Kashmir, Sikkim, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal; Asia; Europe and N. America.

10. *Matthiola* R. Br.

Fifty five species distributed in Northern hemisphere; 2 in India.

Matthiola flavida Boiss., Diagn. Pl. Nov. Or. Ser. 1, 6: 9. 1845; Hajra & al. in B.D. Sharma & N.P. Balakr., Fl. India 2: 219. 1993. Fig. 1

Perennial herbs. Stems 23-44 cm high, pubescent. Basal leaves petioled, elliptic-ovate to linear-elliptic, 2-7 x 0.5-2.2 cm, sinuate; upper leaves shortly petioled to sessile, oblanceolate to linear, sinuate-toothed. Racemes 10-21 cm long, 10-13-flowered. Flowers fragrant. Sepals 0.8-1 cm long. Petals oblong-linear, 1.5-2 x 0.15-0.25 cm, entire, purple. Siliquae linear-oblong, 6-10 x 0.2-0.25 mm, pubescent, compressed. Seeds 10-24, winged.

Fl. & Fr.: June - July.

Rare; on rocky slopes. Kilong-Larang La, 4500 m, 02.08.2003, *K. Chandra Sekar* 103777.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Asia.

11. *Nasturtium* R. Br.

About 2 species distributed in N. hemisphere; 2 in India.

Nasturtium officinale W.T. Aiton, Hortus. Kew. ed. 2, 4: 110. 1812; Hook.f. & T. Anderson in Hook.f., Fl. Brit. India 1: 133. 1872; Hajra & H.J. Chowdhety in B.D. Sharma & N.P. Balakr., Fl. India 2: 125. 1993. *Sisymbrium nasturtium-aquaticum* L., Sp. Pl. 657. 1753. *Rorippa nasturtium-aquaticum* (L.) Hayek, Sched. Fl. Lixs. 3-4: 22. 1905; Aswal & Mehrotra, Fl. Lahaul-Spiti 116. 1994. *Rorippa*

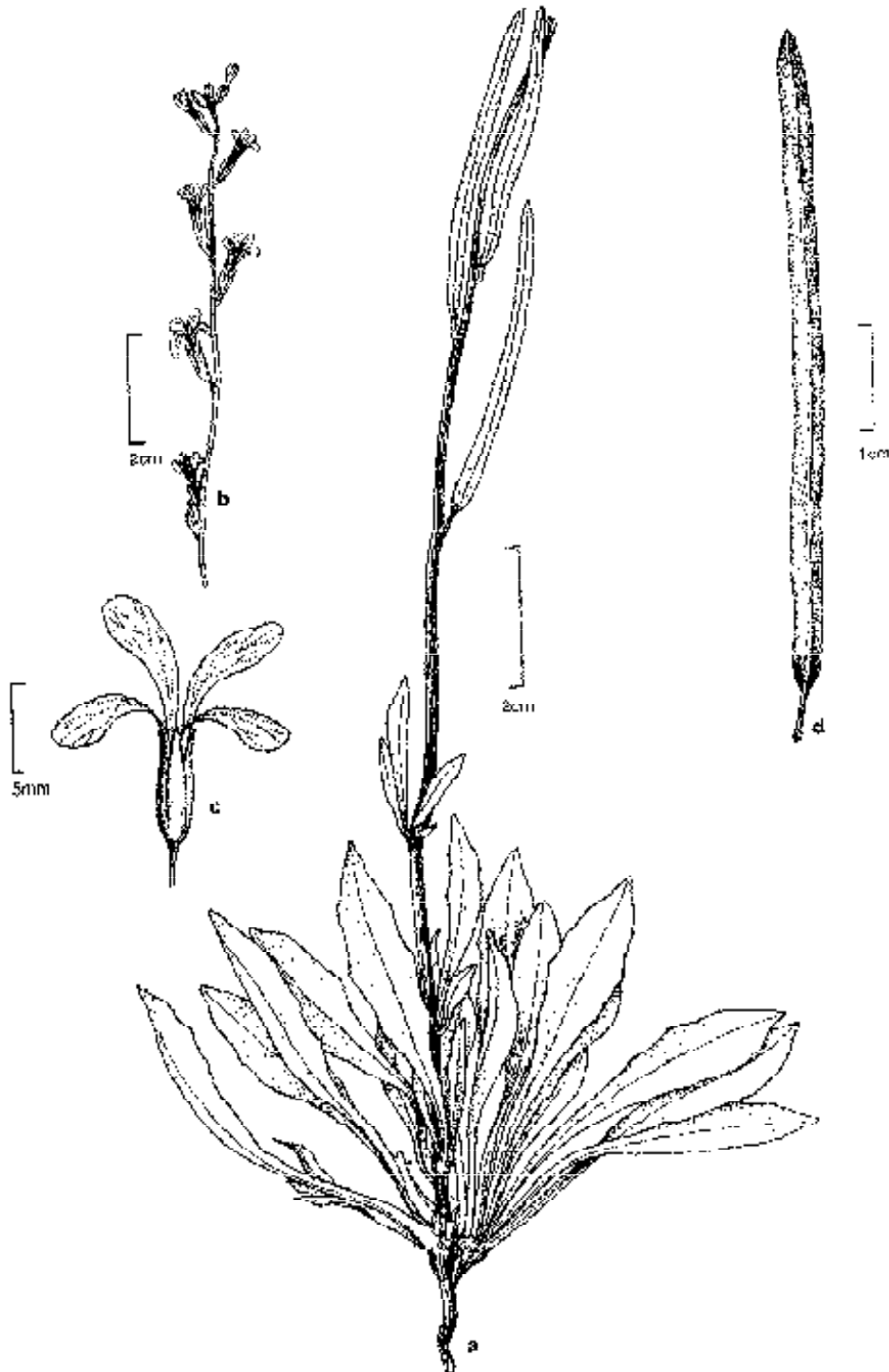


Fig. 1 *Middulola flavida* Boiss. a. Habit, b. Flowering twig, c. Flower, d. Siliqua

Perennial herbs; rooting below at the nodes. Stems procumbent, 20-39 cm high. Leaves lyrate-pinnate; leaflets 5-9, auricled at the base; terminal leaflet suborbicular; lateral leaflets entire to serrate-toothed. Racemes 8-12 cm long, 10-20-flowered. Flowers 3-4 mm dia. Sepals oblong, 2-2.2 x 1-1.2 mm. Petals obovate, 4.5 x 1.5-2 mm, white. Siliquae oblong, 1.2 x 0.2-0.25 cm, glabrous. Seeds ovoid.

Fl. & Fr.: June - August.

Occasional; on stream beds. Mane-Iansa pass, 3800 m, 30.09.2002, *K. Chandra Sekar* 100785.

Distrib.: Throughout India; Asia; Temperate & subtropical Africa and Europe.

It is a green leaf vegetable and is said to improve eyesight.

12. *Parrya* K. Bc.

About 25 species distributed in N. temperate region; 5 in India.

Parrya nudicaulis (L.) Boiss., *Fl. Orient.* 1: 159, 1867; Hajra & al. in B.D. Sharma & N.P. Balakr., *Fl. India* 2: 223, 1993. *Cardaminis nudicaulis* L., *Sp. Pl.* 654.1753. Fig. 2

Perennial herbs; rhizome stout. Stems 21-34 cm high, sparsely glandular. Leaves scapose; petioled, rosulate, linear-lanceolate, 4-15 x 0.5-1.5 cm, entire or minutely serrate-toothed. Racemes 10-15-flowered. Flowers 1.5-2 cm dia. Sepals 0.7-1 x 0.1-0.2 cm. Petals obovate, 1.5-2.1 x 0.5-0.7 cm, white. Siliquae oblong, 3-6.5 x 0.3-0.5 cm, attenuate at base and apex, margin often undulate, glandular, compressed. Seeds suborbiculate.

Fl. & Fr.: June - August.

Rare; on rocky slopes. Chhobern, 4200 m, 12.07.2002, *K. Chandra Sekar* 103283.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Arctic Europe and Asia.

13. *Ptilotrichum* C.A. Mey.

About 12 species mainly in C. Asia; 1 in India.

Ptilotrichum canescens (DC.) C.A. Mey. in Ledeb., *Fl. Altaica* 3: 66, 1831; Debnath in B.D. Sharma & N.P. Balakr., *Fl. India* 2: 99, 1993. *Alyssum canescens* DC., *Syst. Nat.* 2: 322, 1821. Fig. 3

Perennial herbs. Stems suberect, 5-10 cm high, covered with stellate and branched, appressed, dimorphic hairs. Leaves sessile, linear-lanceolate, 0.5-1.3 x 0.1-0.22 cm. Racemes 15-18-flowered, ebracteate. Flowers 3-4 mm dia. Sepals lanceolate to oblong, 2-2.5 x 1-1.5 mm. Petals 3-3.5 x 2-2.5 mm, white. Siliculae ovate-oblong, 3-5 x 2-3 mm, acute, entire, densely pubescent. Seeds ovoid-oblong, brown.

Fl. & Fr.: June - August.

Rare; on rocky slopes. Kilung-Larang La, 4500 m, 02.08.2003, *K. Chandra Sekar* 103779.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Altai; China and Pakistan.

14. *Raphanus* L.

Three species distributed in W. & C. Europe, Mediterranean to C. Asia; 2 in India.

Raphanus sativus L., *Sp. Pl.* 669, 1753; Hajra & al. in B.D. Sharma & N.P. Balakr., *Fl. India* 2: 145, 1993; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 122, 1994. *Labuk Mo*

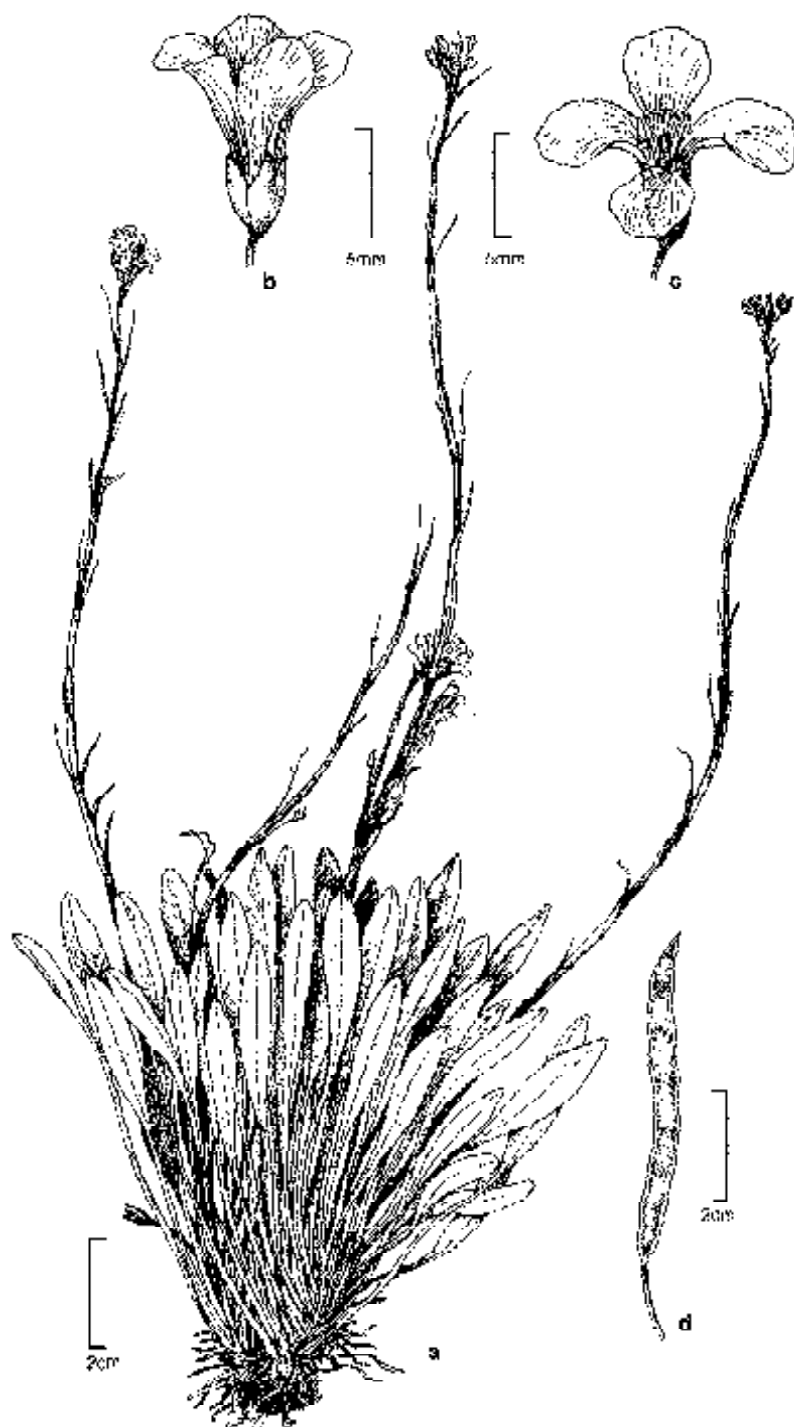


Fig. 2. *Puzosia nudicaulis* (L.) Boiss. a. Habit, b & c. Flower, d. Siliqua

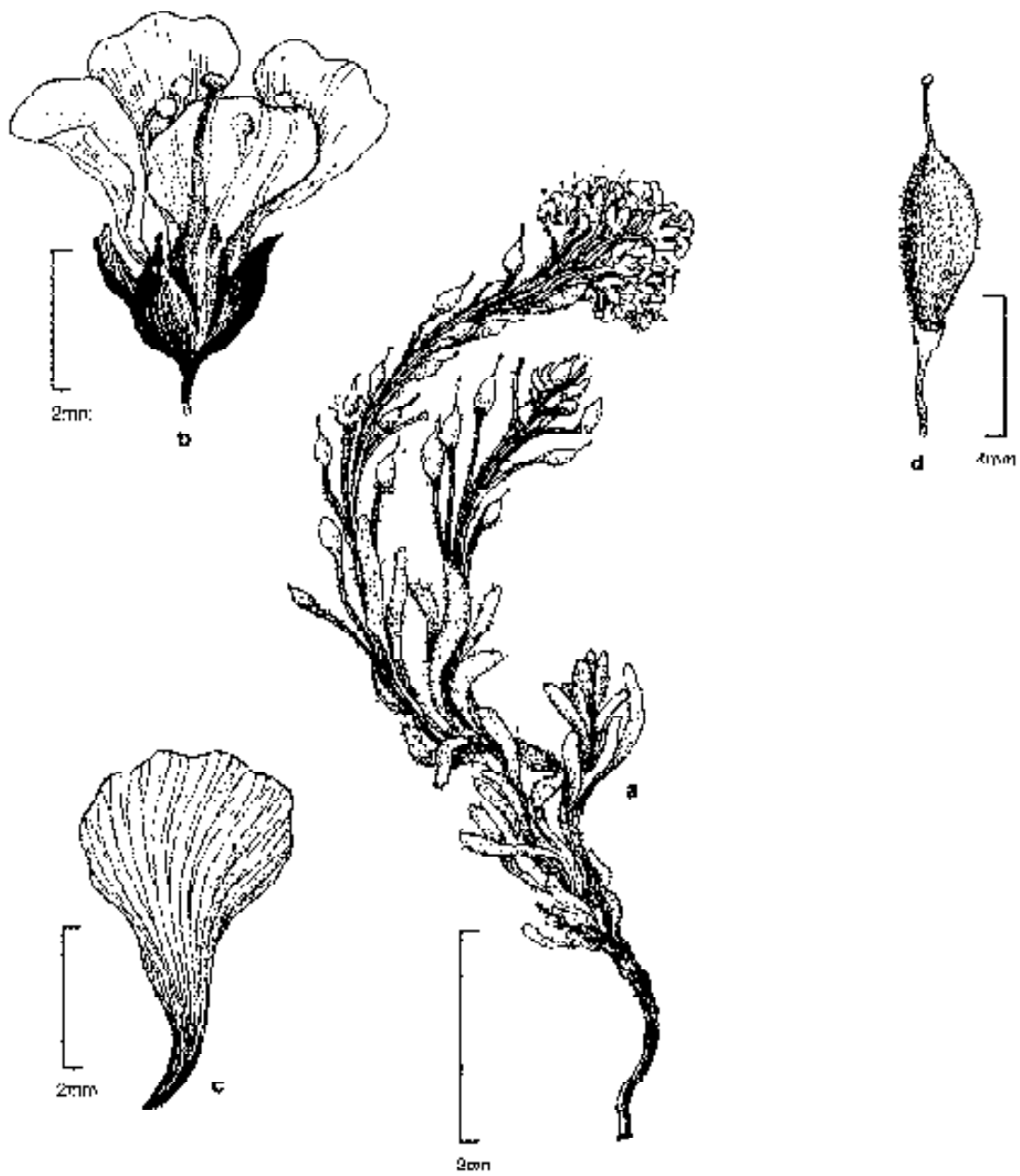


Fig. 3. *Ptilotrichon caulescens* (DC.) C.A. Mey. a. Habit, b. Flower, c. Petal, d. Siliculae

Annual herbs; roots tuberous. Stems erect, 41-59 cm high. Basal leaves long petioled, 3-5-jugate; terminal lobe suborbicular; lateral lobes oblong ovate, obtuse at apex; upper most leaves subsessile to sessile, linear, small, dentate. Racemes 20-28 cm long, 15-23 flowered. Flowers 1.5-2 cm dia. Sepals oblong, subequal, 6-8 x 1.5-2 mm. Petals obovate, 1.5-2 x 0.5-0.7 cm, white. Siliquae oblong-ellipsoid, 3-5.5 x 0.4-0.5 cm, ciliate.

Fl. & Fr.: July - August.

Cultivated. Sagnam, 3650 m, 12.07.2002, K. Chandra Sekar 100435.

Distrib.: Widely cultivated throughout World.

Juice of whole plant is taken to be relieved of kidney stones.

15. *Sisymbrium* L.

About 90 species, distributed in Eurasia, S. Africa and N. America; 7 in India.

Sisymbrium brassiciforme C.A. Mey. in Ledeb., Fl. Altaica 3: 129. 1831; Hajra & al. in B.D. Sharma & N.P. Balakr., Fl. India 2: 243. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 117. 1994. *U.S.P. Mendok*

Annuals. Stems erect, 40-56 cm high. Basal leaves long petioled, lyrate, terminal lobe ovate-oblong, lateral lobes similar but smaller; upper leaves subsessile to sessile, linear, gradually becoming smaller. Racemes 30-40-flowered, up to 25 cm long in fruit. Flowers 4-5 mm dia., yellow. Sepals 3-4 mm long, Petals 6-8 x 1-1.5 mm. Siliquae linear, 5-8 cm long, glabrous. Seeds oblong, brown.

Fl. & Fr.: June - August.

Scarce; on rocky slopes. Chhohem, 4050 m, 23.07.2002, K. Chandra Sekar 100507.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Asia.

16. *Tauscheria* Fisch. ex DC.

Monotypic distributed from E. Europe to India.

Tauscheria lasiocarpa Fisch. ex DC., Syst. Nat. 2: 563. 1821; Bhaumik in B.D. Sharma & N.P. Balakr., Fl. India 2: 176. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 118. 1994. *Clim, Khabdan*

Annual herbs. Stems erect, 20-30 cm high. Leaves sessile, ovate-cordate, 1-4.5 x 0.5-2.2 cm, amplexicaul, entire. Racemes 12-15 cm long, 30-35-flowered. Flowers 1.5-2 mm dia. Sepals oblong-lanceolate, 1-1.5 mm long. Petals spatulate, 1.5-2 x 0.5-1 mm, yellow. Siliculae cymbiform, 5-6 x 2.5-3 mm, pubescent. Seeds 1.5-2.5 mm long, brown.

Fl. & Fr.: June - August.

Scarce; on stream beds. Mud-Trilling, 3800 m, 26.08.2002, K. Chandra Sekar 102961.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Asia and Europe.

The pounded siliculae are applied externally to head ache.

17. *Thlaspi* L.

About 60 species distributed in N. temperate region; 6 in India.

- 1a. Flowers 6-7 mm dia.; siliculae oblong-ellipsoid 1. *T. andersonii*
 b. Flowers 3-5 mm dia.; siliculae obovoid 2. *T. montanum*

1. ***Thlaspi andersonii*** (Hook.f. & Thomson) O.F. Schütz in Ann. Akad. Wiss. Wien., Math.-Nat. 63: 98. 1926; Bhaumik in B.D. Sharma & N.P. Balakr., Fl. India 2: 211. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 199. 1994. *Thridella andersonii* Hook.f. & Thomson in J. Linn. Soc., London (Bot.) 5: 177. 1861. *Vernou Mentok*

Perennial herbs. Stems prostrate, 8-15 cm high, glabrous. Basal leaves petioled, rosulate, spatulate, 1-2 x 0.4-1.2 cm, dentate; cauline leaves ovate-oblong, 0.5-1 x 0.4-0.8 cm, amplexicaul, auriculate at base. Racemes 3-4 cm long, 15-20 flowered. Flowers 6-7 mm dia. Sepals ovate, 2-2.5 x 1-1.2 mm. Petals oblong-ovate, 5-6 x 2-2.5 mm, white. Siliculae oblong-ellipsoid, 6-8 x 1.5-2 mm, acute.

Fl. & Fr.: July - August.

Scarce; on rocky slopes. Lanjuk-Bhaba pass, 4250 m, 04.08.2002, K. Chandan Sekar 100599.

Districts: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Bhutan; China and Nepal.

2. ***Thlaspi montanum*** L., Sp. Pl. 647. 1753; Bhaumik in B.D. Sharma & N.P. Balakr., Fl. India 2: 213. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 120. 1994. *Mentok Karchow*

Perennial herbs. Stems erect, 17-28 cm high, glabrous. Basal leaves petioled, oblong-obovate, 1.5-7 x 0.5-2 cm; cauline leaves sessile, ovate-cordate, 1.5-2.5 x 0.5-1.5 cm, auriculate at base. Racemes 20-34-flowered. Flowers 3-5 mm dia. Sepals oblong-ovate, 2.5-3 mm long. Petals spatulate, 4.7 x 2-3 mm, truncate at base, white. Siliculae obovoid, 5-8 x 2-3.5 mm, obtuse to truncate at apex. Seeds oblong-ovate.

Fl. & Fr.: June - August.

Scarce; on rocky slopes. Mud-Tilling, 3700 m, 26.08.2002, K. Chandan Sekar 102940.

Districts: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; America; Asia and Europe.

5. CAPPARACEAE

Thirty nine genera and 650 species distributed in warm temperate region; 7 genera and 55 species in India.

***Capparis* L.**

About 250 species distributed in warm temperate regions; 29 in India.

Capparis spinosa* L. var. *himalayensis (Jafri) Jacobs in Blumea 13: 419. 1965; Sundararagh. in B.D. Sharma & N.P. Balakr., Fl. India 2: 296. 1993. *C. himalayensis* Jafri in Pakistan J. For. 6: 197. t. 1, f. 1, B. 1956; Aswal & Mehrotra, Fl. Lahaul-Spiti 123. 1994. *Sumukha*

Photo. 44

Straggling shrubs, pubescent, aromatic. Leaves ovate-suborbicular, 3-4.5 x 2.5-4 cm, spine-tipped, pubescent. Flowers 3.5-5 cm dia. Sepals slightly zygomorphic, pubescent; posterior sepal 2.5-4.5 x 1-1.5 cm, narrowed at base; others 1.5-2.5 x 0.8-1.5 cm. Petals slightly exceeding sepals, white; posterior

petal obovate, 2.8-3.6 x 1.6-1.8 cm; others obovate-cuneate, 2-3 x 1-1.6 cm. Fruits oblong-ellipsoid, 3-5 x 1.8-2.5 cm, ribbed, red.

Fl. & Fr.: June - August.

Source: on rocky slopes, Guling, 3700 m, 26.08.2002, *K. Chandu Sekar* 100722.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand, Nepal and Pakistan.

Fruit paste applied externally on wounds and inflammations.

6. VIOLACEAE

About 20 genera and ca 800 species; 3 genera and 41 species in India.

Viola L.

About 400 species chiefly in temperate regions; 35 in India.

Viola kunawarensis Royle, *Illustr. Bot. Himal.* 75, t. 18, f. 3, 1834; S.P. Banerjee & Pramanik in B.D. Sharma & N.P. Balakr., *Fl. India* 7: 367, 1993; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 125, 1994.

Kunlinsae

Perennial herbs, 5-7 cm high, acaulescent, glabrous; rootstock slender. Leaves petioled, ovate-oblong to orbiculate, 1.2 x 0.5-1 cm, attenuate at base, glabrous; stipules lanceolate, 2-3 mm long, acuminate, membranaceous. Flower 0.8-1.2 cm dia. Sepals 2.5-3.2 mm long. Petals obovate-oblong, 0.8-1.2 cm long, purple; spur 1.5-2 mm long, obtuse. Capsules elliptic, 2.5-3 mm long, acute, glabrous.

Fl. & Fr.: June - August.

Source: on rocky slopes, Kilung-Larang Ia, 4900 m, 02.08.2003, *K. Chandu Sekar* 103727.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan; China; Pakistan and Nepal.

Fresh leaf juice applied on cuts.

7. CARYOPHYLLACEAE

Eightyseven genera and ca 2300 species, cosmopolitan, mainly confined to temperate and warm N. hemisphere; 25 genera and 122 species in India.

- | | |
|---|-----------------------|
| 1a. Sepals free or united at base only | 3 |
| b. Sepals united to form a distinct tube | 6 |
| 2a. Leaves stipulate | 7. <i>Spergularia</i> |
| b. Leaves exstipulate | 3 |
| 3a. Capsules globose to ovoid, dehiscent by valves or teeth which are neither reflexed nor revolute | 4 |
| b. Capsules cylindrical, dehiscent by small teeth, which are often revolute | 2. <i>Cerastium</i> |
| 4a. Styles 4 or 5 | 5. <i>Sagina</i> |
| b. Styles 2 or 3 | 5 |

- 5a. Petals deeply bilobed 8. *Stellaria*
 b. Petals unilobed 1. *Arenaria*
 6a. Styles 3-5; carpophore present 6. *Silene*
 b. Styles 2; carpophore absent 7
 7a. Bracteoles present, adpressed to calyx 3. *Dianthus*
 b. Bracteoles absent 4. *Gypsophila*

1. *Arenaria* L.

About 150 species distributed in N. temperate regions; 24 in India.

- 1a. Annuals; stems sub-erect; leaves not subulate 3. *A. terpyliifolia*
 b. Perennials; caespitose; leaves fasciculate, subulate, often spiny 2
 2a. Flowers in cymes 1. *A. festucoides*
 b. Flower solitary 2. *A. kansuensis*

1. *Arenaria festucoides* Benth. in Royle, *Illustr. Bot. Himal.* 81, t. 21, f. 3, 1834; Majumdar in B.D. Sharma & N.P. Balakr., *Fl. India* 2: 511, 1993; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 128, 1994. *Karsa Mendok* Photo. 45

Perennial herbs. Stems 10-15 cm high, densely caespitose. Leaves subulate, concave, 0.6-1.5 x 0.1-0.12 cm, pungent, rigid, ciliate at margin, 1-nerved beneath. Flowers 1-3. Peduncle glandular-pubescent. Bracts ovate-subulate. Sepals ovate-lanceolate, 7-9 mm long, acuminate, pungent, glabrous. Petals linear-oblong, 1-1.2 cm long, white. Capsules oblong, 5-7 mm long, coriaceous. Seeds subreniform, 1.5-2 mm dia., pale brown.

Fl. & Fr.: June - August.

Occasional; on rocky slopes. Larang La-Tariya, 4700 m, 06.08.2003, *K. Chandra Sekar* 103766.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China and Pakistan.

Paste of petals is applied externally to cure pimples.

2. *Arenaria kansuensis* Maxim. in Bull. Akad. Imp. Sci. St.-Petersbourg 26: 428, 1880; Majumdar in B.D. Sharma & N.P. Balakr., *Fl. India* 2: 512, 1993; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 129, 1994. Photo. 46

Perennial herbs. Stems erect or ascending, densely caespitose, 12-18 cm high. Leaves 3 angular, 6-7 mm long, pungent, scarios and ciliate along margin, glabrous; upper most leaves bract-like, ciliate. Flower solitary, 0.8-1.2 cm dia. Sepals 6-8 mm long, acute, hyaline-margined. Petals elliptic, 0.7-1 cm long, obtuse, white. Ovary globose. Capsules ovoid-oblong, 3-4.5 mm long. Seeds densely cristate tuberculate margin.

Fl. & Fr.: July - September.

Occasional; on rocky slopes. Near Tariya, 3900 m, 03.08.2002, *K. Chandra Sekar* 100591.

Distrib.: India: Himachal Pradesh and Uttarakhand; Bhutan; China; Nepal and Pakistan.

3. *Arenaria serpyllifolia* L., Sp. Pl. 423. 1753; Majumdar in B.D. Sharma & N.P. Balakr., Fl. India 2: 515. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 129. 1994. *Atank*

Annuals. Stems suberect, 17-26 cm high. Leaves subsessile, ovate to ovate-lanceolate, 3-7 x 2-5 mm, acute. Flowers numerous in cymes. Bracts herbaceous. Sepals ovate-lanceolate, 3-4 x 0.8-1.1 mm, acute, 3-5 ribbed, bristly. Petals narrowly obovate, 1.2-1.5 x 0.7-0.8 mm, entire, white. Capsules flask-shaped, 3-3.5 mm long, 6-valved. Seeds rounded-reniform, 0.5-0.7 mm dia., dark brown.

Fl. & Fr.: June - August.

Scarce; on marshy places. Charbik, 3900 m, 21.07.2003, K. Chandan Sekar 103621.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Punjab, Rajasthan, Sikkim, Tamil Nadu, Uttarakhand and Uttar Pradesh; Asia; Australia; Europe and N. America.

3. *Cerastium* L.

About 100 species almost cosmopolitan; 7 in India.

Cerastium cerastioides* (L.) Britton in Mem. Torrey Bot. Club 5: 150. 1894; Majumdar in B.D. Sharma & N.P. Balakr., Fl. India 2: 521. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 130. 1994. *Stellaria cerastioides* L., Sp. Pl. 422. 1753. *Cerastium frigidum* Vill., Hist. Pl. Dauphine 3: 645. 1789. *Trappa

Perennial herbs. Stems erect to ascending, 20-27 cm high. Leaves sessile, linear-oblong to oblong-lanceolate, 10-15 x 2-3 mm, obtuse. Flowers in cymes. Bracts leaf-like. Sepals linear-lanceolate, 4-5 mm long, glandular-pubescent. Petals 8-9 mm long, 2-lobed, white. Capsules 7-9 mm long, 6-valved; teeth revolute. Seeds subreniform, 0.4-0.6 mm dia., yellow-brown.

Fl. & Fr.: July - September.

Scarce; on moist slopes. Chhohem, 4100 m, 13.07.2003, K. Chandan Sekar 103257

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Punjab and Uttarakhand; Asia; Africa and Europe.

Note: The specimens (Nima 138) annotated as *Cerastium vulgatum* from the Pin Valley National Park in 'WIP' herbarium are in fact *C. cerastioides*.

Extract of whole plant is taken to stop vomiting.

3. *Dianthus* L.

About 300 species distributed from Eurasia to Africa and N. America; 9 in India.

Dianthus orientalis* Adams in Weber, & Mohr, Beitr. 1: 54. 1805; Majumdar in B.D. Sharma & N.P. Balakr., Fl. India 2: 531. 1993. *D. fimbriatus* M. Bieb., Fl. Taur. Cauc. 1: 332. 1808. **Photo. 47*

Perennial herbs; rootstock woody. Stems erect, 25-35 cm high, glabrous. Leaves linear, 1.5-5.5 x 0.1-0.2 cm, acute, serrulate along margin, glabrous, 3-nerved. Bracteoles ovate, acuminate. Calyx tubular, 1.5-1.7 cm long; teeth triangular, 3-4 mm long, acute. Petals obovate-oblong, limb fimbriate, claw exerted, white or rose. Capsules oblong, opening by 4-teeth.

1a. Leaves flaccid; calyx 12-18 mm long

i. var. *angustatus*

b. Leaves rigid; calyx 20-25 mm long

ii. var. *monticola*

i. var. **angulatus** (Royle ex Benth.) Majumdar in B.D. Sharma & N.P. Balakr., Fl. India 2: 532. 1993; *Dianthus angulatus* Royle ex Benth. in Royle, Illustr. Bot. Himal. 79. 1834; Aswal & Mehrotra, Fl. Lahaul-Spiti 132. 1994. *Mendok Limo*

Fl. & Fr.: June - August.

Common; on rocky slopes. Chhoketa, 4100 m, 13.07.2003, K. Chandra Sekar 103275.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China; Iran; Turkey and U.S.S.R.

ii. var. **orientalis** *Sekko Shinu, Sibpo*

Fl. & Fr.: June - August.

Scarce; on rocky slopes. Mud, 3700 m, 29.07.2002, K. Chandra Sekar 100528.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Afghanistan; China; Iran; Turkey and U.S.S.R.

4. *Gypsophila* L.

About 150 species mainly distributed in Eurasia, Egypt, Australia and New Zealand; 2 in India.

Gypsophila cerastifolia D. Don, Prodr. Fl. Nepal. 213. 1825; Majumdar in B.D. Sharma & N.P. Balakr., Fl. India 2: 535. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 133. 1994. *Mentok Anutha*

Perennial herbs. Stems erect, 11-22 cm high, 4-angular, sparsely pubescent. Basal leaves long-petioled, spatulate, 1.5-4.5 x 0.5-1.6 cm, attenuate at base, mucronulate at apex; cauline ones subsessile, obovate, 0.8-1.3 x 0.3-0.6 cm, rounded at apex. Calyx campanulate, 4-6 mm long; teeth oblong, 3-3.5 mm long, acute. Petals spatulate, 7-8 mm long, limb exerted from the calyx, white. Capsules subround, 5-6 mm long. Seeds subreniform, brown, tuberculate.

Fl. & Fr.: June - August.

Scarce; on rocky slopes. Lanjuk-Bhaba Pass, 3900 m, 03.08.2002, K. Chandra Sekar 100593.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Bhutan and Nepal.

Paste of whole plant is applied on cuts and wounds.

5. *Sagina* L.

About 20 species chiefly in N. temperate region; 4 in India.

Sagina saginoides (L.) Karsten, Deut. Fl. 539. 1882; Majumdar in B.D. Sharma & N.P. Balakr., Fl. India 2: 559. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 136. 1994. *Spergula saginoides* L., Sp. Pl. 441. 1753.

Perennial, caespitose herbs. Stems procumbent to ascending, 4-7 cm high. Leaves linear, 4-7 mm long, connate at base, acute at apex, glabrous. Sepals ovate-oblong, 1.5-2 mm long, rounded at apex, glabrous, narrowly scarious at margin. Pedicels 0.8-2 cm long. Sepals ovate, 1.5-2 mm long, glabrous. Petals oblong-ovate, 1-1.8 mm long, white. Capsules ovoid, 3-4 mm long. Seeds broadly deltoid, 0.3-0.4 mm dia., brown.

Fl. & Fr.: June - August

Rare; on stream beds. Mud-Larung La, 4100 m, 18.08.2002, K. Chandu Sekar 102902.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim, Tamil Nadu, Uttarakhand and Uttar Pradesh; Asia; Europe; N. America; N.W. Africa and U.S.S.R.

6. *Silene* L.

About 700 species distributed in N. hemisphere, 28 in India.

- | | |
|--|--|
| 1a. Inflorescence paniculate with long, sometimes short lateral cymes (rarely reduced to opposite pairs or one flower) | 2 |
| b. Inflorescence dichasial or monochasial cymes, not paniculate | 3. <i>S. vulgaris</i> |
| 2a. Pedicels with 2-bracteoles | 6. <i>S. moorcroftiana</i> |
| b. Pedicels without bracteoles | 3 |
| 3a. Styles 3 | 1. <i>S. amoena</i> |
| b. Styles 4 or 5 | 4 |
| 4a. Calyx above 1.2 cm dia | 7. <i>S. roehringeri</i> |
| b. Calyx below 1.2 cm dia | 5 |
| 5a. Seeds dorsally winged | 3. <i>S. gemisperma</i> subsp. <i>himalayensis</i> |
| b. Seeds dorsally echinate or tuberculate, not winged | 6 |
| 6a. Antherophore less than 1.5 mm long; seeds less than 0.9 x 1 mm | 5. <i>S. madens</i> |
| b. Antherophore more than 2 mm long; seeds more than 1 x 1.2 mm | 7 |
| 7a. Petals 4-partite, more than 8 mm longer than sepals | 2. <i>S. edgeworthii</i> |
| b. Petals 2-partite, less than 8 mm longer than sepals | 4. <i>S. indica</i> |

1. *Silene amoena* L., Sp. Pl. 417. 1753; Majumdar in B.D. Sharma & N.P. Balakr., Fl. India 2: 562. 1993. *S. nana* Willd., Enum. Pl. 474. 1800; Aswal & Mehrotra, Fl. Lahaul-Spiti 143. 1994.

Perennial herbs. Stems erect, 35-50 cm high, glabrous. Radical leaves linear-lanceolate, 1.5-5 x 0.15-0.2 cm, acute, margin ciliate; cauline ones similar but smaller. Flowers 1-1.4 cm long, often in whorls. Bracts small, subulate, ciliate. Calyx campanulate, 0.8-1.1 cm long, rounded at base, membranous, teeth rotundate, obtuse. Petals deeply 2 partite, pale yellow; lobes oblong, obtuse. Capsules oblong. Seeds reniform, 0.7-0.8 mm long, brown.

Fl. & Fr.: July - September.

Source: on rocky slopes. Chhohem, 4200 m, 13.07.2003, K. Chandu Sekar 103284.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Asia and U.S.S.R.

2. *Silene edgeworthii* Bocq. in Candollea 22: 13. 1907; Majumdar in B.D. Sharma & N.P. Balakr., Fl. India 2: 563. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 138. 1994. *Agrostemma fimbriatum* Wall. ex G. Don, Gen. Hist. 1: 417. 1831, non *Silene fimbriata* Sims, 1806. *Ladonia indica* (Reichb. ex Orth) Benth. var.

fimbriata (Wall. ex G. Don) Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 225. 1874.

Perennial herbs. Stems ascending, 23-41 cm high. Leaves ovate-lanceolate, 3.9 x 0.7-1.8 cm, acute, glabrous. Cymes 5-13-flowered. Flowers drooping. Sepals campanulate, 1.1-1.4 x 1.1-1.4 cm, hirsute on nerves; teeth broadly triangular, scarious and ciliate along margin. Petals 1.5-2.2 cm long, 4-partite, pale yellow; lobes lacinate with 2-appendages. Capsules globose. Seeds reniform, brown.

Fl. & Fr.: June - August.

Rate: on moist slopes. Chidohem, 4100 m, 13.07.2003, K. Chandra Sekar 103243.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China.

3. *Silene gonosperma* (Rupr.) Bocq. subsp. ***himalayensis*** (Rohrb.) Bocq. in Candollea 22: 7. 1967; Majumdar in B.D. Sharma & N.P. Balakr., Fl. India 2: 567. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 139. 1994. *Lysichis apetala* L. var. *himalayensis* Rohrb. in Linnaea 36: 220. 1869-1870. *L. 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(1964). *Sumtbeck*

Perennial herbs. Stems erect, 16-28 cm high. Basal leaves in rosettes, petioled, oblanceolate-lanceolate, 2.5 x 0.3-0.6 cm, acute, sparsely hirsute along margin and nerves; cauline leaves sessile, lanceolate, glandular. Cymes 1-3-flowered. Flowers nodding. Sepals campanulate, 1.1-1.5 cm long, inflated; teeth broadly triangular, obtuse. Petals 1.3-1.7 cm long; limb up to 3 mm long. Capsules broadly ovoid. Seeds reniform, dark brown.

Fl. & Fr.: July - September.

Scarce: on rock-crevices. Near Pin-Parvati Pass, 5020 m, 22.07.2003, K. Chandra Sekar 103628.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan; China and U.S.S.R.

Decoction of whole plant is given to cure fever.

4. *Silene indica* Roxb. ex Outh in DC., Prodr. 1: 368. 1824; Majumdar in B.D. Sharma & N.P. Balakr., Fl. India 2: 568. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 140. 1994. *Lysichis indica* (Roxb. ex Outh) Benth. in Royle, Illustr. Bot. Himal. 81. 1834.

Perennial herbs. Stems erect, 28-41 cm high. Leaves linear-lanceolate, 2.2-7 x 0.5-2.8 cm, acute, sparsely pubescent. Cymes 5-17-flowered. Sepals campanulate, oblong-globose, 1.2-1.4 x 0.6-1.6 cm, membranous; teeth broadly ovate, 2-3 mm long, obtuse, margin minutely ciliate. Petals 1.5-1.8 cm long, red-brown; limb 2-lobed, each lobe further divided. Capsules ovoid, 1.1-1.2 x 0.7-0.8 cm. Seeds reniform, 1.1-1.2 mm long, brown.

Fl. & Fr.: July - September.

Rate: on rocky slopes. Tharbik, 3900 m, 02.08.2002, K. Chandra Sekar 102838.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Bhutan; China and Nepal.

5. *Silene madens* Majumdar in J. Ind. Bot. Soc. 42: 648. 1963(1964); Majumdar in B.D. Sharma & N.P. Balakr., Fl. India 2: 571. 1993. *Lysichis macrohiza* Royle ex Benth. in Royle, Illustr. Bot. Himal. 80. 1834. *Dusi lama, Menta Khai Shakeshan*

Perennial herbs. Stems erect, 8-15 cm high, glandular-pubescent. Basal leaves petioled, lanceolate to obovate spatulate, subacute, pubescent; cauline leaves sessile, lanceolate, small. Flower solitary. Sepals broadly oblong, 1.2-1.8 cm long, pubescent. Petals 1.1-1.6 cm long, purple; limb 2-lobed, scarcely crenulate. Capsules smooth, tomentose, brown. Seeds dorsally rounded, wingless, minutely concentrically granulate, pale-chestnut in colour.

Fl. & Fr.: June - August.

Scarce; on rocky slopes. Tariya, 4200 m, 21.07.2003, *K. Chandra Sekar* 103610

Distrib.: India: Himachal Pradesh; Nepal.

Extract of leaves is taken in fever and giddiness.

6. *Silene moorecroftiana* Wall. ex Benth. in Royle, *Illustr. Bot. Himal.* 79, 1835; Majumdar in B.D. Sharma & N.P. Balakr., *Fl. India* 2: 571, 1993; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 141, 1994. *Uttam Mentok, Garum Mendok* **Photo. 48**

Perennial herbs. Stems ascending to erect, 20-38 cm high, pubescent to hirsute. Basal leaves spatulate-lanceolate, 3-4.5 x 0.1-0.3 cm; cauline ones linear-lanceolate, small, obtuse. Cymes terminal or subterminal. Sepals cylindrical-clavate, 2.3-2.7 cm, glandular pubescent; teeth ovate. Petals exserted, white; limb 6-7 mm long, 2-lobed; claw auriculate, with a long acute tooth. Capsules ovoid, 1.1-1.3 cm long. Seeds flat.

Fl. & Fr.: July - September.

Occasional; on rocky slopes. Chhohem, 4050 m, 22.07.2002, *K. Chandra Sekar* 100503.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China; Nepal and Pakistan.

The paste of young inflorescence is applied externally on fractured bone to reduce pain.

7. *Silene rechingeri* Bocq. in Candollea 22: 11, 1967; Majumdar in B.D. Sharma & N.P. Balakr., *Fl. India* 2: 573, 1993. **Photo. 49**

Perennial herbs. Stems ascending, 17-25 cm high. Basal leaves very narrowly oblanceolate, 3-6 x 0.5-1.2 cm, obtuse; cauline leaves very narrowly elliptic, smaller, glandular-hirsute. Sepals vesiculiform, 1-1.3 x 1.6-2 cm, densely glandular-hirsute, membranous; teeth broadly triangular, 3-4 mm long, scabrous and ciliate along margin. Petals 1.6-2 cm long, pale yellow; limb 2-lobed; claw cuneiform, 1-1.2 cm long, auriculate. Capsules ovoid, 1-1.1 cm long. Seeds globose to reniform, 1-1.2 x 1.3-1.5 mm, purple.

Fl. & Fr.: July - September.

Occasional; on moist rocky slopes. Larang Lal-Tariya, 4700 m, 06.08.2003, *K. Chandra Sekar* 103753.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; China.

8. *Silene vulgaris* (Moench) Garcke, *Fl. N. Mitt. Deutschland* ed. 9: 64, 1869; Majumdar in B.D. Sharma & N.P. Balakr., *Fl. India* 2: 577, 1993; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 143, 1994. *Behen vulgaris* Moench, *Methodus* 709, 1794. *Kurmuk Chi* **Photo. 50**

Perennial herbs. Stems ascending, 30-50 cm high, glabrous. Leaves ovate to ovate-lanceolate, 2.5-5 x 1.5-2.5 cm, attenuate at base, acute at apex, upper leaves gradually smaller. Flowers 2-2.5 x 1.2-1.8 cm, drooping. Sepals campanulate, 1.4-1.8 cm long; teeth broadly triangular, acute. Petals white; limb 2-lobed with a pouch-like enlargement. Capsules globose, 0.9-1 cm long. Seeds reniform, 1-1.2 mm long, black.

Fl. & Fr.: July - September.

Rare; on stream beds. Tariya, 4000 m, 10.08.2002, *K. Chandu Sekar* 100648.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia; Europe and N. Africa.

Extract of whole plant is applied externally for the treatment of skin diseases.

7. *Spargularia* (Pers.) J. Presl & C. Presl, *nom. cons.*

Twenty five species, cosmopolitan; 2 in India.

- | | |
|---|----------------------|
| 1a. Stems ascending, 35-60 cm long; petals ovate, white | <i>1. S. diandra</i> |
| b. Stems decumbent, 5-14 cm long; petals ovate-lanceolate, pink | <i>2. S. rubra</i> |

1. *Spargularia diandra* (Guss.) Heldr. & Sart. in Herb. Grac. Norm. 492: 1124. 1855. *Arenaria diandra* Guss., Prod. Soc. 1: 515. 1827. **Fig. 4**

Biennials. Stems ascending, 35-60 cm high, sparsely pubescent. Leaves sessile, linear-subulate, 0.5-2 cm long, acute, glabrous; fascicled mostly on one side of node. Stipules linear, 1.4-2.6 x 0.2-0.35 cm, base of the stipules united around node, acute. Cymes 8-15 cm long. Bracts linear, 0.8-1.1 x 0.1-0.2 cm, acute. Sepals ovate-lanceolate, 3-4 mm long, glabrous. Petals ovate, 4-5 mm long, entire, white. Capsules ovoid, 3-4 mm long. Seeds 2-3 x 2-2.5 mm, brown.

Fl. & Fr.: July - September.

Occasional; on rocky slopes. Gechang-Thango, 4000 m, 15.07.2002, *K. Chandu Sekar* 100450.

Distrib.: India: Himachal Pradesh and Uttar Pradesh; Asia; Europe and N. Africa.

Note: This species was first reported by Naithani & Dayal (1981) for India from Uttar Pradesh. The present collection is a new record for Himachal Pradesh.

2. *Spargularia rubra* (L.) J. Presl & C. Presl, Fl. Cech. 94. 1891; Majumdar in B.D. Sharma & N.P. Bakht. Fl. India 2: 580. 1993. *Arenaria rubra* L., Sp. Pl. 423. 1753. *Spargula rubra* (L.) Edgew. & Hook.f. in Hook.f., Fl. Brit. India 1: 244. 1874. **Fig. 5**

Annuals or biennials. Stems decumbent, branched, 5-14 cm long. Leaves opposite, linear-oblong, 0.6-1.3 cm long, tapering at base, awned at apex, fasciculate. Stipules lanceolate, united around the node, acuminate. Sepals ovate-lanceolate, 3-4 mm long, broadly scarious-margined. Petals ovate-lanceolate, 3-4 mm long, pink. Capsules ovoid, 3-4 mm long. Seeds subtriangular, 0.4-0.5 mm dia., brownish.

Fl. & Fr.: June - September.

Scarce; along the streams. Near Tariya, 3900 m, 02.08.2002, *K. Chandu Sekar* 100566.

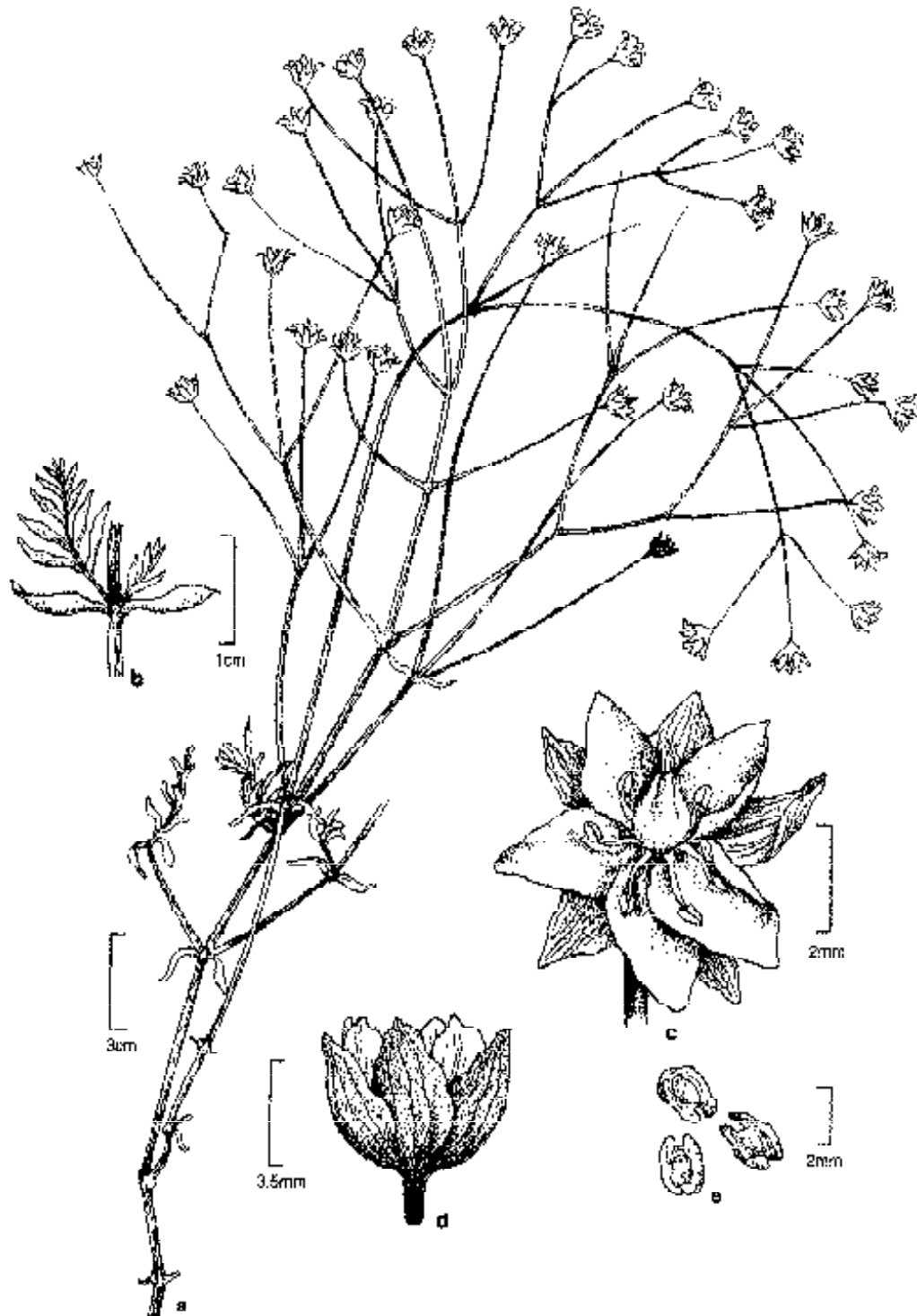


Fig. 4. *Spergularia dendra* (Guss.) Heldr. & Sart. a. Habit, b. Leaf, c. Flower, d. Capsule enclosed in calyx, e. Seeds

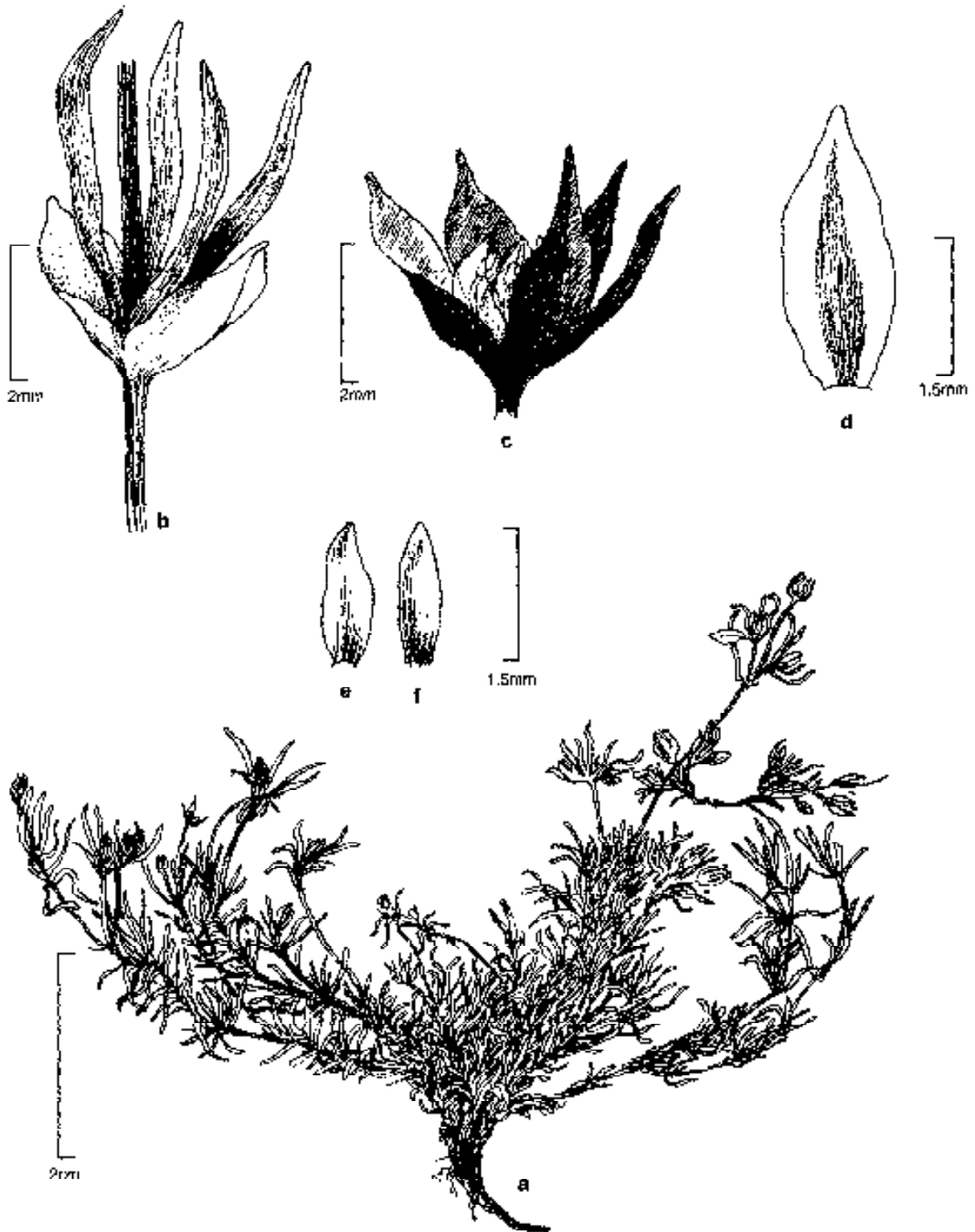


Fig. 5. *Spergularia rubra* (L.) J. Presl & C. Presl. a. Habit, b. Node, c. Flower, d. Sepal, e. & f. Petal - dorsal & ventral view

Distrib.: India: Jharkhand, Himachal Pradesh, Jammu & Kashmir, Punjab, Uttarakhand and Uttar Pradesh; Asia; Europe and N. Africa.

Note: Majumdar (*l.c.*) mentioned its distribution in Pakistan, where as Ghazanfar & Nasir (1986) in Flora of Pakistan have not mentioned this species.

8. *Stellaria* L.

About 150-200 species, cosmopolitan; 17 in India.

- | | |
|---|----------------------|
| 1a. Ovary 3 locular; capsules 1 or 2-seeded | <i>S. monosperma</i> |
| b. Ovary 1 locular; capsules more than 2-seeded | 2 |
| 2a. Stems glandular-pubescent | <i>S. tibetica</i> |
| b. Stems glabrous or sparsely pubescent | 3 |
| 3a. Densely tufted rigid herbs; filaments dilated at base | <i>S. decumbens</i> |
| b. Taxily tufted flaccid herbs; filaments not dilated at base | <i>S. polaris</i> |

1. *Stellaria decumbens* Edgew. in Trans. Linn. Soc. London 20: 35, 1846; Majumdar in B.D. Sharma & N.P. Balakr., Fl. India 2: 582, 1993. *S. albertina* (Fisch. ex Steud.) F.N. Williams in Bull. Herb. Boiss. Ser. 2, 7: 830, 1907.

Perennial, caespitose herbs. Stems ascending, 11-20 cm long, somewhat 4-angular, sparsely pubescent. Leaves linear-lanceolate to ovate lanceolate, 0.3-1 x 0.1-0.15 cm, acute at apex. Flowers solitary or 1-3-flowered in sessile cymes. Sepals oblong lanceolate, 3-4 mm long, acute, glabrous, scarious at margin. Petals narrow, 1-2 mm long, deeply 2 partite, white. Capsules shorter than the sepals. Seeds suborbicular, dark-brown.

Fl. & Fr.: July - September.

Scarce; on moist slopes, Tariya, 4000 m, 25.07.2003, K. Chandra Sekar 103698.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Pakistan, U.S.S.R.; China; Mongolia and Nepal.

2. *Stellaria monosperma* Buch. Ham. ex D. Don, Prodr. Fl. Nepal. 215, 1825; Majumdar in B.D. Sharma & N.P. Balakr., Fl. India 2: 585, 1993; Anwal & Mictrotra, Fl. Lahaul-Spiti 146, 1994.

Karso Mendok, Sibche, Mendok Lasha

Perennial herbs. Stems prostrate to ascending or scrambling, 46-58 cm high, 4 angled, hairy at nodes. Leaves sessile, linear-lanceolate to ovate lanceolate, 3-9 x 0.8-1.7 cm, cordate at base, acuminate at apex, crisped on margin, sparsely pubescent. Cymes many-flowered. Bracts linear-lanceolate, 2.5-3 mm long, green. Sepals oblong-lanceolate, 3-6 mm long, acuminate. Petals as long as sepals, 2-fid to middle, white. Capsules 3-7 x 3.5-4 mm. Seeds suborbicular to angular orbicular, dark brown.

Fl. & Fr.: July - September.

Scarce; on stream beds, Thidim, 3675 m, 13.07.2002, K. Chandra Sekar 100446.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Punjab, Uttarakhand and West Bengal, Afghanistan; Bhutan; Iran; Nepal and Pakistan.

Paste of flower buds applied externally to cure pimples.

3. *Stellaria palustris* Retz., Fl. Scand. Prodr. ed. 2, 106. 1795; Majumdar in B.D. Sharma & N.P. Balakr., Fl. India 2: 586. 1993; Aswad & Mehrotra, Fl. Lahaul Spiti 147. 1994. *S. glauca* With., Art. Brit. Pl. ed. 3, 2: 420. 1796.

Perennial herbs. Stems suberect, 18-30 cm high, glabrous, 4-angled. Leaves sessile, linear-lanceolate, 2.2-4.2 cm long, rounded at base, acuminate at apex, glabrous. Flowers 1.2-1.6 cm dia.; pedicels 3-6 cm long. Sepals lanceolate, 5-6 mm long, acute, 3-nerved. Petals 5.5-7 mm long, 2-fid to base, white. Capsules broadly ovoid, 5-6 mm long. Seeds ovoid, 0.7-0.8 x 1-1.2 mm, reddish brown.

Fl. & Fr.: July - September.

Rare; on rocky slopes. Chhohem, 23.07.1992, Nima 129 (WII).

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Asia; Europe and U.S.S.R.

4. *Stellaria tibetica* Kurz in Monr 285, 1872; Majumdar in B.D. Sharma & N.P. Balakr., Fl. India 2: 589. 1993. *Che Chip Menlok* Fig. 6; Photo. 51

Biennials. Stems ascending, 8-15 cm high, glandular-pubescent. Leaves sessile, linear-oblong, 0.8-2 x 0.5-0.7 cm, acute to subacute. Cymes axillary and terminal, few-flowered. Bracts 3-4 mm long, coriaceous. Flowers 0.8-1.1 cm dia. Sepals elliptic, 5-6 mm long, acute, scarious at margin. Petals 2-fid with obtuse lobes, white. Stamens shorter than sepals. Capsules broadly ovoid, 5-6 mm long, 6-valved. Seeds flat, muricate, brown.

Fl. & Fr.: July - September.

Scarce; on stream beds. Mud-Tariya, 4000 m, 03.08.2002, K. Chandra Sekar 103699.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; China and Pakistan.

8. TAMARICACEAE

Four genera and ca 78 species distributed in Eurasia and Africa, especially from Mediterranean to C. Asia; 3 genera and 16 species in India.

- | | |
|---|---------------------|
| 1a. Stamens connate to half or more of their length | 1. Myricaria |
| b. Stamens free | 2. Myrtana |

1. *Myricaria* Desv.

About 10 species distributed in Europe and Asia; 6 in India.

- | | |
|--|---|
| 1a. Bracts lanceolate to ovate-lanceolate, with narrow scarious margin | 1. <i>M. albiflora</i> |
| b. Bracts oblong-obovate with broad scarious margin | 2. <i>M. germanica</i> subsp. <i>alopeuroides</i> |

1. *Myricaria albiflora* Grierson & Long in Notes Roy. Bot. Gard. Edinb. 40: 116, f. 1. 1982; B.V. Shetty & R.P. Pandey in B.D. Sharma & Sanjappa, Fl. India 3: 12. 1993; Chandra Sekar & al. in Ann. Bur. 11(2): 182. 2(8)3. *Humbu* Fig. 7; Photo. 52

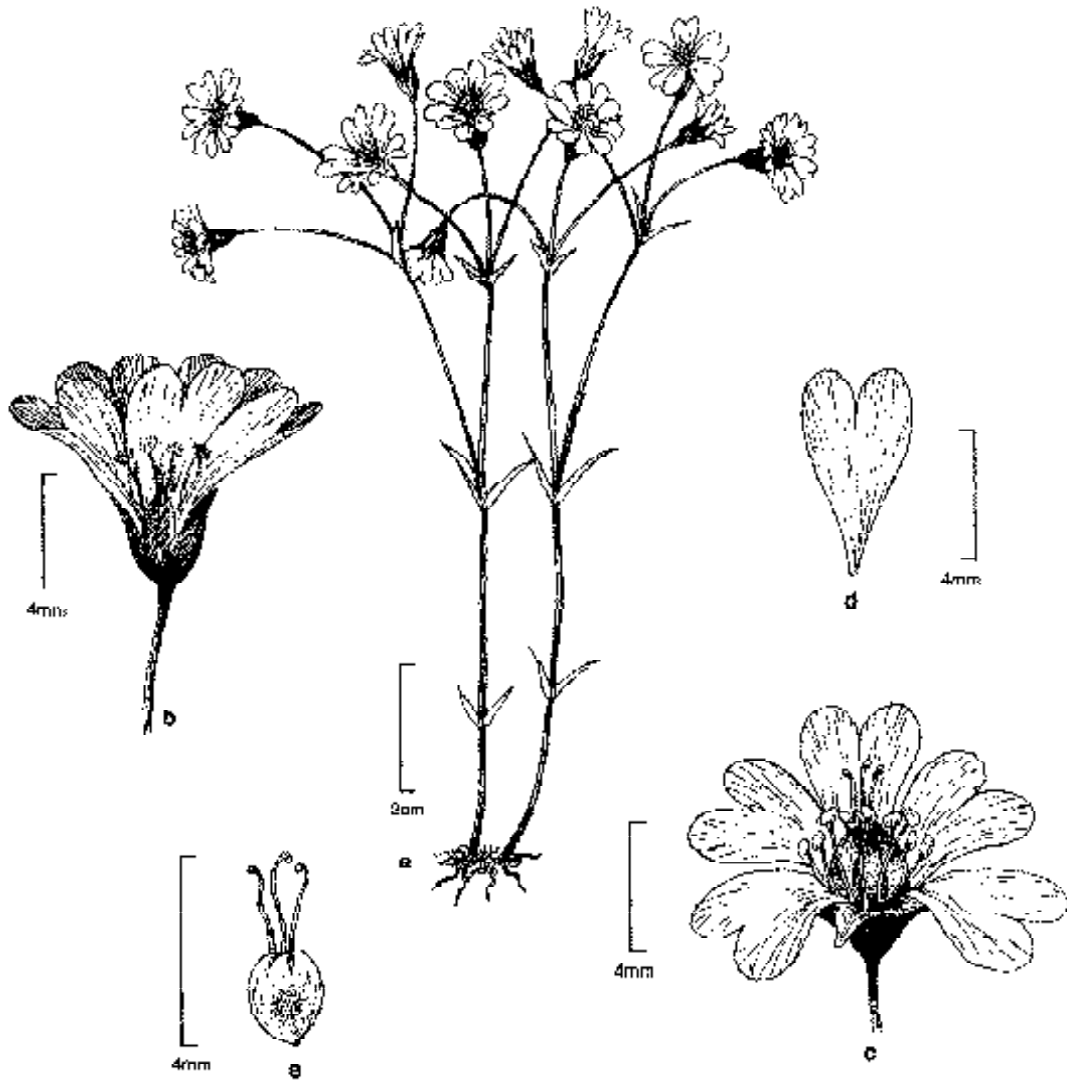


Fig. 6. *Sedaria tibetica* Klotz. a. Habit, b & c. Flower, d. Petal, e. Capsule

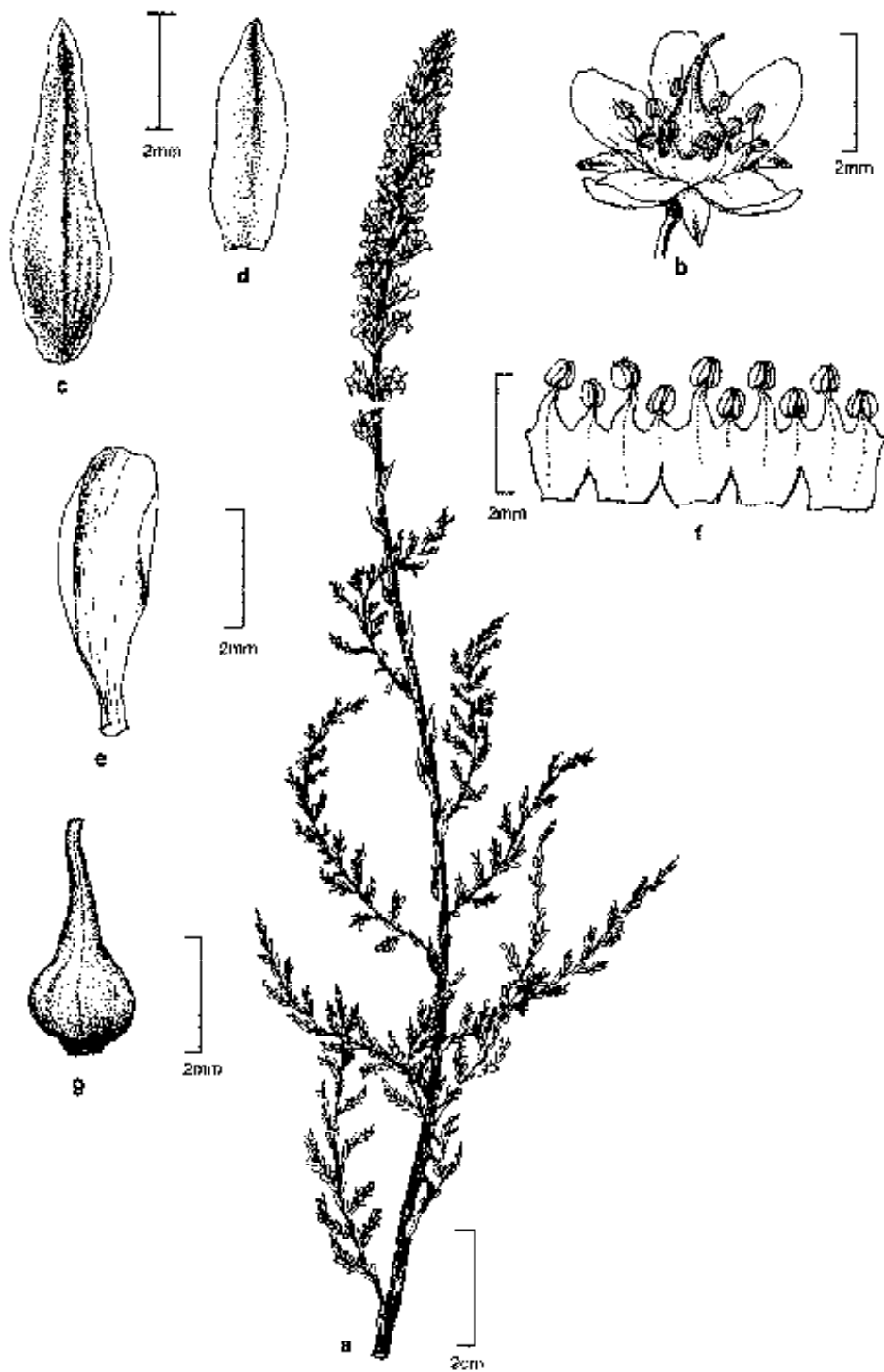


Fig. 7. *Myricaria albiflora* Grierson & Long a. Flowering branch, b. Flower, c. Bract, d. Sepal, e. Petal, f. Androecium, g. Pistil

Shrubs. Stems erect, 1-2 m high. Leaves linear to ovate-lanceolate, 2-3.5 x 0.5-1.5 mm, subacute to acuminate, subentire. Racemes 4-8 x 0.8-1 cm. Bracts lanceolate to ovate-lanceolate, 3.5-6.5 x 1-2 mm, acute, subentire. Flowers 2.2-3.5 mm dia.; pedicels 2-3 mm long. Sepals lanceolate, 3-4 x 1 mm, acute to subacute. Petals obovate-spathulate, 4-4.5 x 1.5-2 mm, white. Stamens connate about half their length from base. Seeds obovoid to ellipsoid.

Fl. & Fr.: June - September.

Scarce, on stony river beds. Larang La to Thango, 4100 m, 21.08.2002, K. Chandu Sekar 100670.

Distrib.: India: Himachal Pradesh and Sikkim; Bhutan and China.

Decoction of whole plant given as blood purifier.

2. *Myricaria germanica* (L.) Desv. subsp. *alopecuroides* (Schrenk) Kitam., Fl. Afghanistan 272, 1960; B.V. Shetty & R.P. Pandey in B.D. Sharma & Sanjappa, Fl. India 3: 13, 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 149, 1994. *M. alopecuroides* Schrenk in Fisch. & C. A. Mey., Enum. Pl. Nov. 1: 65, 1841.

Photo. 53

Shrubs. Stems erect, 1-2.5 m high. Leaves ovate-lanceolate, 2-5.6 x 0.5-2 mm, obtuse to subacute, subentire to obscurely denticulate. Racemes 6-11 cm long. Bracts oblong-obovate, 4-8 x 2-5 mm. Sepals ovate-lanceolate, 3-6 x 1-2 mm, acute to obtuse. Petals obovate-spathulate, 5-7 x 2-3.5 mm, pink. Stamens connate about half their length from base. Seeds oblong-ellipsoid.

Fl. & Fr.: June - September.

Occasional; on river beds. Chhohem, 4000 m, 12.07.2003, K. Chandu Sekar 103201.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; Pakistan and U.S.S.R.

2. *Myrtama* Ovcz. & Kinsik

Monotypic distributed in N.W. Himalaya, S.W. U.S.S.R. and W. China.

Myrtama elegans (Royle) Ovcz. & Kinsik in Dokl. Acad. Nauk Tadzh. SSR 20 (7): 56, 1977; B.V. Shetty & R.P. Pandey in B.D. Sharma & Sanjappa, Fl. India 3: 19, 1993. *Myricaria elegans* Royle, Illust. Bot. Himal. 214, 1835. *Tamaricaria elegans* (Royle) Qaiser & Aï in Blumea 24: 153, 1978, *nom. illeg.*; Aswal & Mehrotra, Fl. Lahaul-Spiti 150, 1994. *Trach*

Shrubs. Stems erect, 1-3 m high. Leaves ovate-lanceolate, 0.6-1.4 x 0.2-0.4 cm, narrowed at base, subobtuse at apex, subentire. Racemes 6-17 cm long. Bracts broadly ovate to ovate-lanceolate, 3-5.5 x 1.5-3 mm, acute to acuminate. Flowers 4-5 mm dia. Sepals 1.5-3 x 1-2 mm, connate half their length. Petals 4-7 x 2.5-3 mm, slightly notched at apex. Stamens free. Capsules 0.8-1.2 cm long. Seeds obovoid-ellipsoid, 1.5-2 mm long, beaked.

Fl. & Fr.: June - September.

Common; on stream beds. Debsa, 4050 m, 25.07.2002, K. Chandu Sekar 100515.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China; Pakistan and U.S.S.R.

Note: Parker (1918) had recorded it from Lahaul-Spiti. Aswal & Mehrotra (*l.c.*) could not collect it. Its occurrence has been confirmed by the present collection.

Paste of aerial parts applied externally as a pain reliever in rheumatism.

9. MALVACEAE

About 110 genera and ca 1800 species, cosmopolitan, especially in tropical region; 22 genera and 93 species in India.

Malva L.

About 40 species distributed in Mediterranean, temperate Asia and tropical Africa; 7 in India.

- 1a. Epicalyx lobes ovate; petals obovate, 1.5-2.5 cm long 1. *M. sylvestris*
 b. Epicalyx lobes linear to lanceolate; petals oblong, 7-8 mm long 2. *M. verticillata* var. *rafiqi*

1. **Malva sylvestris** L., Sp. Pl. 689. 1753; T.K. Paul in B.D. Sharma & Sanjappa, Fl. India 3: 363. 1993. *Palasa*

Biennials. Stems erect to decumbent, 1-1.5 m high. Leaves long petioled, reniform to suborbicular, cordate at base, 3-7 lobed; lobes semicircular to oblong, obtuse, crenate. Stipules ovate, 4-6 x 2-3 mm, acute. Flowers 1-4 in axillary fascicles; pedicels 0.5-2.5 cm long. Epicalyx lobes ovate. Calyx divided to the middle; lobes broadly triangular, 3.7 x 2.4 mm, acute, persistent. Corolla dark purple; petals obovate, 1.5-2.5 x 0.5-1 cm, emarginate, glabrous. Schizocarps 2-3 x 4-8 mm, glabrous; mericarps 1.5-2 mm dia., sparsely pubescent.

Fl & Fr: June - September.

Rare; on stream beds. Mune, 3650 m, 27.08.2002, K. Chandru Sekar 100739.

Distrib.: India: Assam, Delhi, Himachal Pradesh, Jammu & Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Tamil Nadu, Uttarakhand and Uttar Pradesh; Asia and Europe.

Paste of stem and petiole given as a laxative.

2. **Malva verticillata** L. var. **rafiqi** S. Abedin in Nasir & Ali, Fl. W. Pakistan 130: 45. 1979; T.K. Paul in B.D. Sharma & Sanjappa, Fl. India 3: 365. 1993. *Cham Hba*

Biennials. Stems erect to decumbent, 58-72 cm high. Leaves long petioled, suborbicular, 2-6 x 2-5 cm, cordate at base, 5-6-lobed; lobes orbicular, rounded at apex. Stipules lanceolate to deltoid, 3-5 x 2-4 mm, acuminate. Flowers 2-4, in axillary lax fascicles; pedicels 0.6-1.5 cm long. Epicalyx segments linear to lanceolate. Calyx 6-8 mm long; lobes deltoid-lanceolate, acute. Petals oblong, 7-8 mm long, lobed at apex, purple. Schizocarps 4-5 mm dia.; mericarps 1.5-2 mm dia., sparsely pubescent.

Fl & Fr: June - September.

Occasional; on stream beds. Tilling, 3800 m, 26.08.2002, K. Chandru Sekar 100708.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China and Pakistan.

Decoction of the whole plant taken to cure wet pleuritis.

10. LINACEAE

About 14 genera and ca 250 species, cosmopolitan; 5 genera and 12 species in India.

Linum L.

About 180 species distributed in subtropical and temperate regions; 5 in India.

Linum perenne L., Sp. Pl. 277. 1753; Hajra in B.D. Sharma & Sanjappa, Fl. India 3: 579, 1993; Aswal & Mehrotra, Fl. Lahaul Spiti 154, 1994. *Tin Dihu* Photo. 54

Perennial herbs. Stems many from the base, ascending, 45-65 cm high, glabrous. Leaves sessile, lanceolate, 0.6-2.2 x 0.1-0.2 cm, acute, 1-3-nerved. Flowers 1.6-2 cm dia.; pedicels 1-1.7 cm long. Sepals ovate, 4-5 x 2-3 mm, acute, glandular along margin. Petals obovate, 1-1.2 cm long, blue. Ovary 5-locular. Capsules subglobose, 5-7 mm dia., dehiscent into 10 cocci. Seeds compressed, shining, dark brown.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Grechang, 3730 m, 15.07.2002, K. Chandra Sekar 100462.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Asia; Europe and N. America.

Paste of flower petals given as a cure to insomnia.

11. ZYGOPHYLLACEAE

Twenty seven genera and ca 285 species distributed in tropical and subtropical regions; 6 genera and 15 species in India.

Tribulus Tournef. ex L.

Twenty five species distributed in tropical and subtropical regions, especially in dry Africa; 5 in India.

Tribulus terrestris L., Sp. Pl. 387. 1753; P. Singh & V. Singh in Hajra & al., Fl. India 4: 55, 1997. *Kataam Menthak*

Annual herbs. Stems prostrate, 20-30 cm long, hairy. Leaves paripinnate 3-5 cm long; leaflets 8-14, ovate to elliptic-oblong, 0.4-1 x 0.2-0.26 cm, obtuse. Stipules subulate to falcate, 2.5 x 1-1.5 mm. Flowers 0.8-1 cm dia.; pedicels 0.8-1 cm long. Sepals ovate-lanceolate, 2-4 x 1.5-2 mm, acute. Petals obovate, 2.5-5.5 x 1-3 mm. Ovary 1-1.5 mm dia., hairy. Fruits 0.4-0.8 x 0.8-1 cm; mericarps densely crested and tuberculate on dorsal side, densely hairy to glabrescent with 2 long patent and 2 short downwardly directed spines.

Fl. & Fr.: May - October.

Occasional; on rocky slopes. Guling, 3700 m, 26.08.2002, K. Chandra Sekar 100721.

Distrib.: Pantropical.

Extract of fruits given in kidney pain.

12. GERANIACEAE

Eleven genera and about 700 species mainly in temperate regions; 5 genera and 44 species in India.

Geranium L.

About 300 species mainly in temperate and montane tropics; 27 in India.

- 1a. Leaves palmately 3-5-lobed; flowers less than 2 cm dia. 1. *G. uspadense*
 b. Leaves palmately 7-9-lobed; flowers more than 2 cm dia. 2. *G. pratense*

1. *Geranium nepalense* Sweet, Geraniaceae 1: t. 12. 1820; Aswal & Mehrotra, Fl. Lahaul-Spiti 158. 1994; Malhotra in Hajra & al., Fl. India 4: 75. 1997. *G. radicans* DC., Prodr. 1: 639. 1824. *G. affine* Wight & Arn., Prodr. Fl. Ind. Orient. 133. 1834, *non* Ledeb. 1831.

Perennial herbs; rootstock slender. Stems ascending, 18-25 cm high. Leaves orbicular, 3-5 x 3.5-5.2 cm, palmately 3-5-lobed; segments subequal, irregularly lobed and toothed. Stipules narrowly lanceolate. Flowers 0.8-1 cm dia., usually solitary, on long axillary peduncles. Sepals 4-4.8 mm long. Petals orbicular, 5-7 mm long, pink. Anthers violet-blue. Fruits 1.5-2 cm long (including beak).

Fl. & Fr.: June - September.

Rare; on rocky slopes, Mane-Larsa Pass, 3800 m, 29.08.2002, K. Chandra Sekar 100769.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Tamil Nadu, Uttarakhand and Uttar Pradesh; Afghanistan; China; Japan; Pakistan and Sri Lanka.

2. *Geranium pratense* L., Sp. Pl. 681. 1753; Aswal & Mehrotra, Fl. Lahaul Spiti, 158. 1994; Malhoua in Hajra & al., Fl. India 4: 78. 1997. *Polo Mentok, Paulo* Photo. 55

Perennial herbs; rootstock short. Stems erect, 22-35 cm high, sparsely pubescent. Leaves orbicular, 3-5 cm dia., palmately 7-9 lobed; lobes ovate, further deeply cut into oblong, acute, toothed segments. Stipules subulate-lanceolate, 1-1.3 cm long. Inflorescence 2-flowered. Bracts subulate. Flowers 2.5-3.8 cm dia. Sepals 1-1.2 cm long, awned. Petals entire, ciliate at base, blue to white. Fruits 3-3.5 cm long (including beak); beak glandular-hairy.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Mud, 2700 m, 29.07.2002, K. Chandra Sekar 100531.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Temperate Eurasia.

Flowers used as a colouring agent in local drug preparations; extract of root given to cure cough and cold.

13. BALSAMINACEAE

Two genera and about 850 species chiefly in tropical Old World; 2 genera and 203 species in India.

Impatiens L.

About 850 species mainly in tropical and N. temperate regions; 203 in India.

- 1a. Flowers 2.5-3 cm long, excluding the spur; capsules above 2 cm long 1. *I. sulcata*
 b. Flowers 1.8-2.2 cm long, excluding the spur; capsules below 2 cm long 2. *I. thomsonii*

1. *Impatiens sulcata* Wall. in Roxb., Fl. Ind. 2: 458. 1824; Aswal & Mehrotra, Fl. Lahaul Spiti 163. 1994; Vivek. & al. in Hajra & al., Fl. India 4: 213. 1997.

Annuals. Stems erect, 30-40 cm high, fistular, glabrous. Leaves petioled, ovate-elliptic to elliptic-oblong, 7-12 x 2-2.5 cm, acuminate, shallowly crenate serrate along margin, sparsely pubescent. Flowers axillary, 2.5-3 cm long. Bracts 5-6 x 2-3 mm. Lateral sepals obliquely ovate, 6-8 x 3.4 mm with 1-2 mm long appendage. Lip bucciniform, 1.2-1.4 x 1-1.3 cm; spur 5-7 mm long. Standard 2-lobed, keeled on dorsal side. Wings 2-2.2 cm long, basal lobes 0.8-1 x 0.6-0.8 cm; distal lobes linear-oblong. Capsules elongate, 2.5-3 cm long, narrowly clavate.

Fl. & Fr.: July - September.

Rare; on rocky slopes. Mane-Larsa Pass, 3900 m, 30.08.2002, K. Chandra Sekar 100784.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Punjab, Sikkim, Uttarakhand, Uttar Pradesh and W. Bengal; Bhutan; China; Nepal and Pakistan.

2. *Impatiens thomsonii* Hook. f. in J. Linn. Soc., London (Bot.) 4: 128. 1860; Aswal & McLaurin, Fl. Lahaul-Spiti 163. 1994; Virek & al. in Hajra & al., Fl. India 4: 216. 1997. *Dapo Mendok*

Annuals. Stems erect, 23-41 cm high. Leaves lanceolate-elliptic to elliptic-oblong, 6.5-12 x 1.5-2.8 cm, acuminate, coarsely serrate along margin. Stipules pinnate, glandular. Inflorescence like an umbel. Bracts linear-lanceolate, 2-5 mm long. Flowers 1.8-2.2 cm long. Lateral sepals ovate to ovate-lanceolate, 3-5 x 2-4 mm. Lip navicular, 0.7-1.1 cm long; spur filiform, 3-5 mm long. Standard suborbicular-obcordate, 0.5-0.8 x 0.8-1 cm. Wings 1.2-1.4 cm long, 2-lobed; basal lobes triangular-ovate, distal lobes oblanceolate. Capsules 0.8-1.8 cm long, clavate.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Lanjuk, 4200 m, 07.08.2002, K. Chandra Sekar 100627

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan and Pakistan.

Children use the stem as a whistle.

14. SIMARUBACEAE

Thirteen genera and about 110 species, chiefly in tropical regions; 9 genera and 16 species in India.

Ailanthus Desf., *nom. cons.*

About 5 species mainly in tropical and subtropical regions of Asia and Australia; 4 in India.

Ailanthus altissima (Mill.) Swingle in J. Wash. Acad. Sci. 6: 493. 1916; R.K. Basak in Hajra & al., Fl. India 4: 410. 1997; Chandra Sekar & al. in Indian J. For. 26(2): 97. 2003. *Toxicodendron altissimum* Mill., Gard. Dict. ed. 8, n. 10. 1768.

Deciduous trees; 4-8 m high. Leaves 20-35 cm long, glabrous; leaflets 4-10 pairs, lanceolate, 4-7 x 2-3 cm, acuminate. Inflorescence a panicle, 10-20 cm long. Calyx lobes 0.8-1 mm long. Petals 2-4 mm long. Ovary 1.2-1.5 mm long, glabrous; styles connate up to middle; stigma peltate, 5-lobed. Fruits linear-oblong, 3-4.5 x 0.6-0.9 cm, glabrous, membranous, somewhat spirally twisted, 1-seeded.

Fl. & Fr.: June - September.

Rare; on rocky slopes (cultivated?). Mane. 3650 m, 27.08.2002, K. Chandra Sekar 100742.

Distrib: India: Haryana, Himachal Pradesh, Jammu & Kashmir, Punjab, Uttarakhand and Uttar Pradesh; China and Pakistan.

15. RHAMNACEAE

Forty nine genera and about 900 species, cosmopolitan especially in tropical and subtropical regions; 15 genera and 68 species in India.

Rhamnus L.

About 125 species distributed from N. hemisphere to Brazil and S. Africa; 11 in India.

- 1a. Erect shrubs; leaves more than 4.5 cm long. 2. *R. triquetra*
 b. Prostrate shrubs; leaves less than 3 cm long. 1. *R. prostrata*

1. *Rhamnus prostrata* Jacq. ex Parker in Bull. Misc. Inform. 1921: 217. 1921; Arwal & Mehrotra, Fl. Lahaul-Spiti 166. 1994; Bhandari & Bhansali in N.P. Singh & al., Fl. India 5: 192. 2000. *Saato*

Deciduous shrubs. Stems prostrate, 40-60 cm long; branches ending in thorns; nodes swollen around the leaf scars. Leaves elliptic, 0.7-1.5 x 0.4-0.6 cm, mucronate, glabrous. Flowers fascicled in the axils of leaves. Calyx lobes deltoid, acute. Petals minute, obovate, cucullate. Ovary 3-loculed; styles 3-cleft. Fruits obovoid-globose, 4-5 x 2-3 mm, black. Seeds 2-2.5 x 1.5-2 mm, shining.

Fl. & Fr.: June - September.

Scarce; on rocky slopes. Tariya, 4000 m, 25.07.2003, K. Chandra Sekar 103700.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; Iran and Pakistan.

Used as a fuel wood.

2. *Rhamnus triquetra* Wall. in Roxb., Fl. Ind. 2: 376. 1824. Brandis, For. Fl. 92. 1874; Bhandari & Bhansali in N.P. Singh & al., Fl. India 5: 195. 2000; Chandra Sekar & al. in (Indian J. Forest. 26(2): 98. 2003. *Chara Loom*

Deciduous shrubs. Stems erect, 0.8-2 m tall, tomentose. Leaves oblong-lanceolate, 4.6-12 x 2-5 cm, tapering at base, acuminate at apex, crenate, teeth tipped by deciduous mucro. Inflorescence a raceme. Bracts 1.2-1.4 cm long. Flowers 4-5 mm dia. Calyx lobes deltoid, 2-2.5 mm long, acute. Petals broadly obovate, 1-1.5 mm long, emarginate, glabrous. Ovary 3-loculed; styles 3-cleft. Fruits obovoid, 5-6 x 4-5 mm. Seeds obovoid.

Fl. & Fr.: June - September

Rare; on stream beds. Dhul, 3700 m, 27.08.2002, K. Chandra Sekar 102995.

Distrib: India: Himachal Pradesh, Jammu & Kashmir, Maharashtra, Punjab, Uttarakhand and Uttar Pradesh; Nepal and Pakistan.

16. FABACEAE

About 643 genera and ca 18000 species, cosmopolitan; 133 genera and 973 species in India.

- 1a. Stamens free **12. *Thermopsis***
 b. Stamens diadelphous or monadelphous 2

2a. Leaflets 3	3
b. Leaflets more than 3	7
3a. Leaflets toothed	4
b. Leaflets entire	5. Desmodium
4a. Pods rounded	5
b. Pods elongated	6
5a. Flowers in dense heads	13. Trifolium
b. Flowers in long racemes	9. Melilotus
6a. Pods straight	14. Trigonella
b. Pods spirally twisted	8. Medicago
7a. Leaflets 5	7. Lotus
b. Leaflets more than 5	8
8a. Pinnate leaves ending in tendrils or bristles	9
b. Pinnate leaves neither ending in tendrils nor bristles	11
9a. Stipules entire; pods broadly oblong	6. Lens
b. Stipules not entire; pods narrowly oblong to linear oblong or sagittate to semisagittate	10
10a. Stipules almost as large as the leaflets	11. Pisum
b. Stipules smaller than the leaflets	4. Cicer
11a. Calyx very oblique	12
b. Calyx not oblique	13
12a. Leaves paripinnate	2. Caragana
b. Leaves imparipinnate	3. Chesneya
13a. Keel mucronate	10. Onyctropis
b. Keel not mucronate	1. Astragalus

1. Astragalus L.

About 1750 species mainly distributed in N. temperate regions; 85 in India.

1a. Hairs basifixed	2
b. Hairs medifixed	16
2a. Stigma penicillate	3
b. Stigma not penicillate	4
3a. Pods sessile	<i>1. A. anthracinum</i>
b. Pods stipitate	<i>5. A. colubinarum</i>

Bommal Survey of India	76
4a. Leaves imparipinnate	5
b. Leaves paripinnate	14
5a. Flowers sessile or subsessile, forming a compact head or raceme	9. <i>A. leucocarpus</i>
b. Flowers pedicellate, not forming a compact head or raceme	6
6a. Pods sessile or stipe less than 1 mm long	7
b. Pods stipitate, stipe more than 1 mm long	11
7a. Internodes longer than the stipules	9
b. Internodes shorter than the stipules	8
8a. Ovary and pods glabrous	17. <i>A. webbiana</i>
b. Ovary and pods pilose	15. <i>A. rhizanthus</i>
9a. Bracts longer than the calyx; pods 2-seeded	10. <i>A. melanostachys</i>
b. Bracts shorter than the calyx; pods more than 2-seeded	10
10a. Pods arcuate, semilunar	8. <i>A. ladakensis</i>
b. Pods not as above	6. <i>A. densiflorus</i>
11a. Internodes longer than the stipules	12
b. Internodes shorter than the stipules	3. <i>A. candolleanus</i>
12a. Ovary and pods glabrous	4. <i>A. chlorostachys</i>
b. Ovary and pods pubescent	13
13a. Calyx 3-4 mm long; pods 0.9-1.3 cm long	7. <i>A. himalayanus</i>
b. Calyx 1.6-1.8 cm long; pods 2.2-2.4 cm long	11. <i>A. murrai</i>
14a. Calyx obconic, pointed at base	16. <i>A. strobiliferus</i>
b. Calyx not obconic	15
15a. Leaflets 9 pairs or less	2. <i>A. bicuspis</i>
b. Leaflets 10 pairs or more	13. <i>A. ophioides</i>
16a. Fruiting calyx inflated	12. <i>A. nivalis</i>
b. Fruiting calyx not inflated	14. <i>A. peduncularis</i>

1. *Astragalus amherstianus* Benth. ex Royle in Royle, *Illustr. Bot. Himal.* 199. 1835; Baker in Hook.f., *Fl. Brit. India* 2: 119. 1876; Sanjappa, *J.eg. India* 84. 1992; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 170. 1994.

Perennial herbs. Stems 24-42 cm high, densely pilose. Leaves imparipinnately compound; leaflets sessile, ovate to elliptic, 4-9 x 1.5-3.5 mm, obtuse, sparsely pilose. Stipules 3-3.5 mm long, acute. Racemes 4-5.2 cm long. Bracts 0.8-1 mm long, pilose. Calyx 3.5-4 mm long, slightly pilose; teeth ca 2.5 mm long. Corolla pale cream, tinged with light rose; vexillum 4.5-5 mm long; wings 4.2-5 mm long; keel 4-4.5

mm long. Pods sessile, 0.8-1.1 x 0.25-0.3 cm, acuminate, 10-12-seeded.

Fl. & Fr.: July - October.

Rare; on rocky crevices. Thangti, 4010 m, 27.08.2002, *K. Chandu Sekar* 102982.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; Nepal and Pakistan.

2. *Astragalus bicuspis* C. Fisch. in Bull. Soc. Nat. Mosc. 26(2): 406. 1853; Baker in Hook.f., Fl. Brit. India 2: 135. 1876; Sanjappa, Leg. India 85. 1992; Aswal & Mehrotra, Fl. Lahaul-Spiti 171. 1994.

Perennial herbs. Stems 23-54 cm high; young branches densely pilose. Leaves paripinnately compound, 2.5-5 cm long, pilose; leaflets 8-18, elliptic-obovate, 0.6-1.1 cm long, acute, glabrous above, pilose beneath. Stipules free, pilose. Flowers 2-4 in loose cluster. Calyx 1.2-1.3 cm long, densely pilose; teeth 6-6.5 mm long. Corolla yellow; vexillum 2-2.6 cm long; wings 1.8-2.2 cm long; keel 1.5-1.8 cm long. Pods 1.2-1.6 cm long, pilose, 8-10-seeded.

Fl. & Fr.: July - October.

Rare; on stream beds. Ghidim, 3800 m, 05.09.2002, *K. Chandu Sekar* 100799.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Punjab and Uttarakhand; Nepal and Pakistan.

3. *Astragalus candolleanus* Royle ex Benth. in Royle, Illustr. Bot. Himal. 199. 1835; Baker in Hook.f., Fl. Brit. India 2: 132. 1876; Sanjappa, Leg. India 85. 1992; Aswal & Mehrotra, Fl. Lahaul-Spiti 171. 1994.

Kebatu Photo. 56

Perennial herbs. Stems suberect, 24-56 cm high, sparsely pubescent. Leaves imparipinnate, 7-12.5 cm long; leaflets 17-25, elliptic-oblong, 1.2-1.3 cm long, sparsely pubescent. Stipules 6-7 mm long, free. Racemes compact, 3-4 cm long. Bracts 4-6.5 mm long. Calyx 1.2-1.3 cm long, pubescent; teeth 5-6 mm long. Corolla yellow; vexillum 2-2.3 cm long; wings 1.8-2.1 cm long; keel 1.6-1.7 cm long. Pods bilocular, 1.7-2.6 cm long, pubescent with spreading hairs.

Fl. & Fr.: June - October.

Scarce; on moist slopes. Pin-Parvati to Tariya, 4300 m, 24.07.2003, *K. Chandu Sekar* 103677.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Nepal and Pakistan.

Leaves are good fodder.

4. *Astragalus chlorostachys* Lindl. in Trans. Hort. Soc. London 2: 249. 1830; Baker in Hook.f., Fl. Brit. India 2: 128. 1876; Sanjappa, Leg. India 85. 1992; Aswal & Mehrotra, Fl. Lahaul-Spiti 171. 1994.

Perennial herbs. Stems 34-58 cm high, pubescent. Leaves imparipinnately compound, 7-15 cm long; leaflets 13-17, oblong, 1.2-2 cm long, obtuse, glabrescent above, white-pubescent beneath. Stipules lanceolate. Racemes axillary; peduncles 5-10 cm long. Bracts lanceolate. Calyx 6-7 mm long, finely pubescent. Corolla yellow; vexillum 1.2-1.4 cm long, glabrous; wings 1.1-1.2 cm long. Ovary glabrous. Pods 1.2-1.3 cm long, glabrous, 6-10-seeded.

Fl. & Fr.: July - September.

Scarce; on stream beds. Lanjula-Bhaba pass, 4200 m, 04.08.2002, K. Chandra Sekar 102884.

Distrib: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Bhutan; Nepal and Pakistan.

5. *Astragalus coluteocarpus* Boiss., *Diagn. Pl. Or. Nov. Scr.* 1(9): 65. 1849; Sanjappa, *Leg. India* 86. 1992; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 172. 1994. Ram Photo. 57

Perennial herbs. Stems 43-86 cm high, glabrous. Leaves imparipinnately compound, 12-20 cm long; leaflets oval-orbicular, obtuse, pubescent on both sides. Stipules broadly ovate to lanceolate, 0.8-1 cm long. Racemes axillary, peduncled; peduncles 7-14 cm long. Bracts 4-7 mm long. Calyx 0.7-1 cm long, sparsely pubescent; teeth 4.5-5 mm long. Corolla yellow; vexillum 1.4-1.8 cm long; wings 1.2-1.4 cm long; keel 1.1-1.2 cm long. Pods stipitate, 1.5-2 cm long, pointed at ends.

Fl. & Fr: July - October.

Occasional; on stream beds. Mud-Tharbik, 3700 m, 23.08.2002, K. Chandra Sekar 102926.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan and Pakistan.

6. *Astragalus densiflorus* Kar. & Kit. in *Bull. Soc. Nat. Mosc.* 15: 329. 1842; Baker in Hook.f., *Fl. Brit. India* 2: 125. 1876; Sanjappa, *Leg. India* 86. 1992; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 173. 1994.

Perennial herbs. Stems 12-18 cm high, appressed pubescent. Leaves imparipinnate, 2.5-7 cm long; leaflets 9-13, ovate-oblong, 3-8 x 1-3 mm, subobtuse, sparsely pubescent. Stipules 3-5 mm long. Spikes axillary, peduncled; peduncles 2.5-10 cm long, pubescent. Bracts 3-4 mm long, pubescent with black hairs. Calyx 4-5 mm long, pubescent; teeth 1.5-2 mm long. Corolla yellow; vexillum 6-7 mm long; wings 5.5-6 mm long; keel 3.8-4.3 mm long. Pods 1-loculed, orbicular, 2.5-3 mm dia., pubescent, 1-2-seeded.

Fl. & Fr: June - September.

Rare; on slopes. Parahio catchment, 17.07.1992, Nima & Yashvir 5 (WII).

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China; Pakistan and U.S.S.R.

7. *Astragalus himalayanus* Klotzsch in Klotzsch & Garcke, *Bot. Jbergr. Reise Wald.* 160. t. 4. 1862; Baker in Hook.f., *Fl. Brit. India* 2: 126. 1876; Sanjappa, *Leg. India* 89. 1992; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 174. 1994.

Perennial herbs. Stems 32-53 cm high, sparsely pubescent along the internodes. Leaves imparipinnately compound, 3.5-5 cm long; leaflets 21-25, oblong, 0.6-1.3 cm long, obtuse, appressedly pubescent. Stipules lanceolate, minute. Racemes axillary, peduncled. Bracts very minute. Calyx 3-4.5 mm long, pubescent with black and white hairs; teeth 1-1.5 mm long. Vexillum 1.2-1.6 cm long; keel slightly longer than wings and shorter than the vexillum. Ovary pubescent. Pods 1-loculed, 0.9-1.3 cm long, pubescent.

Fl. & Fr: July - September.

Common; on river beds. Chhobera, 1050 m, 12.07.2003, *K. Chandra Sekar* 103207.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Nepal and Pakistan.

8. ***Astragalus ladakensis*** N.P. Balakr. in J. Bombay Nat. Hist. Soc. 63(2): 328, 1966; Sanjappa, Leg. India 94, 1992; Aswal & Mehrotra, J. Lahaul Spiti 175, 1994. *Astragalus strictus* Graham ex Benth. in Royle, Illustr. Bot. Himal. 198, 1835; Baker in Hook.f., Fl. Brit. India 2: 124, 1876.

Perennial herbs. Stems caespitose, ascending, 10-20 cm high, appressed pubescent. Leaves imparipinnate, 2.5-5 cm long; leaflets 19-25, oblong, 0.6-1 cm long, obtuse, entire, appressed white pubescent. Stipules deltoid, free, foliaceous. Racemes axillary; peduncles 5-12 cm long. Bracts longer than pedicel. Calyx 4-5 mm long, pubescent with white and black hairs; teeth 1.5-2 mm long. Vexillum 0.8-1 cm long; wings 6.5-7.5 mm long; keel 5-7 mm long. Pods acute, 6-8 mm long, pubescent with white and black hairs, 6-8-seeded.

Fl. & Fr.: July - September.

Occasional; on rocky slopes. Mud-Tharbik, 4000 m, 23.08.2003, *K. Chandra Sekar* 102930.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Bhutan; China; Nepal and Pakistan.

9. ***Astragalus leucocephalus*** Graham ex Benth. in Royle, Illustr. Bot. Himal. 198, t. 32, f. 2, 1835; Baker in Hook.f., Fl. Brit. India 2: 128, 1876; Sanjappa, Leg. India 90, 1992; Chandra Sekar & al. in Ann. For. 11(1): 53, 2003.

Perennial herbs. Stems caespitose, ascending, 12-20 cm high, densely tomentose. Leaves imparipinnately compound, 3.5-10 cm long; leaflets 21-39, oblong, 3-7 mm long, subacute, entire, densely pubescent. Stipules alternate below the middle, foliaceous. Racemes compact, peduncles 7-12 cm long. Bracts lanceolate. Calyx 4-5 mm long, white-pubescent. Corolla pale yellow; vexillum 6-8 mm long; keel shorter than vexillum and wings. Pods sessile, 1-loculed, 4-5 mm long, finely pubescent, 3-4-seeded.

Fl. & Fr.: July - October.

Rare; on rocky slopes. Thangtu, 4000 m, 21.08.2002, *K. Chandra Sekar* 102985.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; Nepal and Pakistan.

10. ***Astragalus melanostachys*** Benth. ex Donge in Mem. Acad. Sci. St.-Pec. Ser. 7, 11: 21, 1868; Baker in Hook.f., Fl. Brit. India 2: 125, 1876; Sanjappa, Leg. India 91, 1992; Aswal & Mehrotra, J. Lahaul-Spiti 176, 1994. *Mudok Karter*

Perennial herbs. Stems 30-42 cm high, glabrous. Leaves imparipinnate; leaflets 11-15, elliptic-oblong, 0.8 x 1.6 x 0.3-0.6 mm, revolute, glabrous above, sparingly pubescent beneath. Stipules 3-8 mm long, connate. Racemes axillary; peduncles 3-10 cm long, pubescent. Bracts 3-4 mm long, pubescent. Calyx 3.5-5 mm long, densely pubescent with black and white hairs; teeth 2.2-2.5 mm long. Corolla pale pink; vexillum 6-7 mm long; wings 5-6 mm long; keel 4-5 mm long. Pods 1-loculed, glabrous, 4-5 mm long, densely pubescent, 2-seeded.

Fl. & Fr.: July - September.

Scarce; on moist slopes. Shrim-Chhohem, 3950 m, 12.07.2003, *K. Chandra Sekar* 101192.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China; Nepal; Pakistan and U.S.S.R.

11. *Astragalus munroi* Benth. ex Bunge, in Mem. Acad. Sci. St.-Petersbourg Ser. 7, 11: 30. 1868 & 12: 35. 1869; Sanjappa, Leg. India 91. 1992; Aswal & Mehrotra, Fl. Lahaul-Spiti 176. 1994.

Perennial herbs; roots woody. Stems 23-34 cm high, densely villous. Leaves imparipinnate; leaflets 19-23, oblong, 1.2 x 0.2-0.4 cm, obtuse, entire, villous. Stipules lateral, 0.9-1.7 cm long, villous. Racemes axillary. Bracts 0.9-1 cm long, villous. Calyx 1.6-1.8 cm long, villous; teeth 8-9 mm long. Corolla yellow; vexillum 2.1-2.2 cm long, glabrous. Pods stipitate, 2.2-2.4 cm long, inflated, many-seeded.

Fl. & Fr.: July - October.

Rare; on rocky slopes. Mane Larsa Pass, 06.08.2002, *K. Chandra Sekar* 100767.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China and Pakistan.

12. *Astragalus nivalis* Kar. & Kir. in Bull. Soc. Nat. Mosc. 15: 34). 1842; Baker in Hook.f., Fl. Brit. India 2: 137. 1876; Sanjappa, Leg. India 92. 1992; Aswal & Mehrotra, Fl. Lahaul-Spiti 176. 1994.

Ulam mentbok

Perennial herbs. Stems erect, 23-38 cm high, white-pubescent. Leaves imparipinnate, 2-5 cm long, pubescent; leaflets 11-17, oblong-oval, 2-5 mm long, obtuse, appressed hairy. Stipules 3-6 mm long, connate, encircling the stem. Racemes 6-20 flowered. Bracts 2-3 mm long, pubescent with black and white hairs. Calyx 0.8-1 cm long, densely pubescent with white and black hairs; teeth ca 1 mm long. Corolla violet; vexillum 1.5-1.8 cm long; wings 1.5-1.7 cm long; keel 1.4-1.6 cm long. Pods 0.5-1 x 0.2-0.3 cm, pubescent.

Fl. & Fr.: June - September.

Scarce; on rocky slopes. Sanpat, 04.08.2002, *K. Chandra Sekar* 102465.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; China; Pakistan and U.S.S.R.

13. *Astragalus oplites* Benth. ex Parker in Bull. Misc. Inform. 1921: 270. 1921; Sanjappa, Leg. India 92. 1992; Aswal & Mehrotra, Fl. Lahaul-Spiti 177. 1994.

Keela

Perennial herbs. Stems 43-64 cm high; young branches pilose. Leaves paripinnately compound, 7-16 cm long; leaflets 20-36, elliptic-oblong, 0.5-1.1 cm long, obtuse, glabrous above, pilose beneath. Stipules lanceolate, pilose on the margins with several conspicuous nerves. Racemes 2-5-flowered; peduncles 1.5-2.6 cm long. Calyx 1.2-1.6 cm long, white-pilose; teeth 4-4.5 mm long. Corolla yellow; vexillum 2.5-2.8 cm long, glabrous; wings 2.2-2.3 cm long; keel 1.7-1.8 cm long. Pods 1.7-1.8 cm long, pilose, 16-18-seeded.

Fl. & Fr.: June - September.

Occasional; on rocky slopes. Chhohem, 4300 m, 14.07.2003, *K. Chandra Sekar* 103290.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China and Pakistan.

14. *Astragalus peduncularis* Royle ex Benth. in Royle, Illustr. Bot. Himal. 199. 1835; Baker in Hook.f., Fl. Brit. India 2: 136. 1876; Sanjappa, Leg. India 92. 1992; Aswal & Mehrotra, Fl. Lahaul-Spiti 177. 1994.

Photo. 58

Perennial herbs. Stems 35-40 cm high, appressed pubescent. Leaves imparipinnate, 5-10 cm long; rachis pubescent; leaflets 15-25, elliptic-oblong, 1-1.9 cm long, obtuse, appressed pubescent. Stipules 6-8 mm long, encircling the stem, acute. Racemes 10-18 cm long-peduncled. Bracts 2-3 mm long, black pubescent. Calyx 0.8-1 cm long, pubescent with black and white hairs; teeth 1-1.5 mm long. Corolla yellow; vexillum 1.5-1.6 cm long; wings 1.3-1.4 cm long; keel 0.9-1.1 cm long. Pods sessile, 1-1.5 cm long, appressed pubescent, 6-10-seeded.

Fl. & Fr.: June - August.

Rare; in rock-crevices. Thango, 3900 m, 08.07. 2002, *K. Chandra Sekar* 100480.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; U.S.S.R. and Pakistan.

15. *Astragalus rhizanthus* Royle ex Benth. in Royle, *Illustr. Bot. Himal.* 199. 1835; Baker in Hook.f., *Fl. Brit. India* 2: 132. 1876; Sanjappa, *Leg. India* 93. 1992; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 178. 1994. **Photo. 59**

Perennial herbs. Aerial stem almost absent. Leaves imparipinnate, 16-26 cm long; leaflets oblong, 1.5-2 x 0.5-1 cm, glabrous above, pilose beneath. Stipules obovate, 1.4-1.5 cm long, margins ciliate. Bracts linear, small. Calyx 1.5-1.6 cm long; teeth 3-6 mm long. Corolla yellow; vexillum 2.3-2.5 cm long; wings 2.1-2.3 cm long; keel 1.8-2 cm long. Ovary pilose. Pods 1.2-2 cm long, densely silky, 15-20-seeded.

Fl. & Fr.: June - October.

Occasional; on rocky slopes. Tariya to Pin-Parvati, 4200 m, 24.07.2003, *K. Chandra Sekar* 103662.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan and Pakistan.

16. *Astragalus strobiliferus* Royle ex Benth. in Royle, *Illustr. Bot. Himal.* 199. 1835; Baker in Hook.f., *Fl. Brit. India* 2: 135. 1876; Sanjappa, *Leg. India* 95. 1992; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 178. 1994. *Shila* **Photo. 60**

Perennial herbs; roots woody. Stems 21-32 cm high; young branches woolly. Leaves paripinnate, 2.5-5 cm long; leaflets 10-14, oblanceolate, 5-6 mm long, mucronate, silky-pubescent. Stipules connate behind the rachis, membranous. Flowers few, sessile, in the axils of the leaves, scarcely exceeding the stipules. Calyx obconic, 6-6.5 mm long, cleft to the base, densely woolly. Corolla yellow; vexillum panduriform; wings and keel equal to the vexillum. Pods sessile, 5-6 mm long, silky.

Fl. & Fr.: June - September.

Common; on rocky slopes. Tiling, 3800 m, 26.08.2002, *K. Chandra Sekar* 100706.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan and Pakistan.

17. *Astragalus webbianus* Graham ex Benth. in Royle, *Illustr. Bot. Himal.* 199. 1835; Baker in Hook.f., *Fl. Brit. India* 2: 132. 1876; Sanjappa, *Leg. India* 96. 1992; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 179. 1994. **Photo. 61**

Perennial herbs; roots woody. Aerial stem almost absent. Leaves imparipinnately compound, 7-15 cm long; leaflets oblong, 0.8-1.4 x 0.1-0.3 cm, obtuse, glabrous to subglabrous. Stipules 1.2-1.7 cm long. Inflorescence short-peduncled. Bracts 0.7-1.2 cm long. Calyx 1.5-1.6 cm long; teeth 3-4 mm long.

Corolla yellow; vexillum 2.3-2.5 cm long; wings 1.9-2.2 cm long; keel shorter than the wings. Pods sessile, 1.2-2 cm long, glabrous, 15-20 seeded.

Fl. & Fr.: June - September.

Scarce; on rocky slopes. Tariya to Pin-Paryati Pass, 4300 m, 24.07.2003, *K. Chandu Sekar* 103674.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China and Pakistan.

2. *Caragana* Fabric.

About 80 species distributed from C. Asia to China; 12 in India.

***Caragana versicolor* Benth.** in Royle, *Illustr. Bot. Himal.* 198. 1835; Sanjappa, *Leg. India* 110. 1992; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 180. 1994. *C. pygmaea auct. non* (L.) DC. 1825; Baker in Hook.f., *Fl. Brit. India* 2: 116. 1876. **Photo. 62**

Shrubs. Stems 34-43 cm high. Leaves paripinnately compound; rachis 7.5-10 mm long, spinescent, persistent; leaflets 4, narrowly oblanceolate, 6-7.5 mm long, pubescent when young, glabrous when mature. Stipules trifid, spiny. Flowers yellow. Calyx 4-5 mm long, glabrous; teeth triangular, short. Corolla 1.2-1.5 cm long. Pods linear, 2.1-2.5 cm long, glabrous.

Fl. & Fr.: June - September.

Occasional; on rocky slopes. Chhohem, 4030 m, 13.07.2003, *K. Chandu Sekar* 101200.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China and Pakistan.

3. *Chesneya* Lindl. ex Eull.

About 20 species distributed from SW and C. Asia to Mongolia; 2 in India.

***Chesneya cuneata* (Benth.) Ali** in *Scientist* 3(1): 3. 1959 & *Biologia* 10: 50. 1964; Sanjappa, *Leg. India* 112. 1992; Aswal & Mehrotra, *Fl. Lahaul Spiti* 180. 1994. *Gnoldenstaedtia cuneata* Benth. in Royle, *Illustr. Bot. Himal.* 200. 1835.

Perennial herbs; rootstock woody. Aerial stems 6-8 cm long, pubescent. Leaves imparipinnate, rachis 2-10 cm long, sparsely pilose; leaflets obovate to oblong-obovate, 0.4-1.6 x 0.2-1.3 cm, truncate to emarginate at apex, sparsely tomentose. Inflorescence a cyme; peduncles 3-10 cm long. Calyx 1.5-1.7 cm long; teeth 4-7 mm long. Corolla yellow; vexillum 2.1-3.2 cm long, pubescent outside; wings 2-2.9 cm long; keel 1.6-2.5 cm long. Pods 4-5.7 x 0.7-0.8 cm, glabrous. Seeds 10-12, reniform, brown.

Fl. & Fr.: July - September.

Scarce; on rock-crevices. Thango-Kilung, 4020 m, 31.07.2003, *K. Chandu Sekar* 103701.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China and Pakistan.

4. *Cicer* L.

About 40 species distributed from Morocco to China; 3 in India.

***Cicer microphyllum* Benth.** in Royle *Illustr. Bot. Himal.* 200. 1835; Baker in Hook.f., *Fl. Brit. India* 2: 176. 1876; Sanjappa, *Leg. India* 113. 1992; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 181. 1994. *Chari* **Photo. 63, 64**

Annuals. Stems prostrate, 23-40 cm long, branched, glandular-pubescent. Leaves 4-13 cm long, generally ending in a tendril, sometimes in a leaflet. Leaflets 8-22, 0.6-1.6 x 0.4-0.8 cm, truncate at base, apiculate at apex, upper half of the margin incised dentate, pilose on both sides. Peduncles 2-8 cm long, ending in a spine. Flowers pedicellate; pedicels 5-8 mm long. Calyx tube very oblique, 1-1.2 cm long, pilose; teeth subequal, 5-7 mm long. Corolla purple or white; vexillum 2-2.2 cm long. Pods 2-2.4 x 0.8-1 cm, beaked, many seeded.

Fl. & Fr.: June - October.

Scarce on rocky slopes. Chohem, 4100 m, 13.07.2013, K. Chandu Sekar 103238.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan, China and Pakistan.

5. *Desmodium* Desv.

About 450 species distributed in subtropical regions, especially in E. Asia, Brazil and Mexico; 40 in India.

Desmodium elegans DC. in Ann. Sci. Nat. Paris 4: 100, 1825; Sanjappa, Leg. India 352, 1992. *Desmodium tilifolium* (D. Don) G. Don, Gen. Syst. 2: 297, 1832; Baker in Hook.f., Fl. Brit. India 2: 168, 1876.

Shrubs. Stems 0.6-1.4 m high; branches densely pubescent. Leaves trifoliolate; petiole 3.7-7.5 cm long; leaflets orbicular-ovate to obovate, 5.2-6.3 cm long, obtuse to acuminate, scarcely pubescent, silky hairy beneath. Stipules 4-5 mm long. Panicle 13-23 cm long. Bracts 2-2.5 cm long. Calyx 2-2.5 mm long, villous; teeth shorter than the tube. Corolla 1-1.1 cm long, purple. Pods sessile, 3-7 x 0.5-0.6 cm, upper suture almost straight; lower indented between the seeds, pubescent; joints 6-8 mm long.

Fl. & Fr.: July - September.

Rare; on rocky slopes. Mane Lasa Pass, 3600 m, 29.08.2002, K. Chandu Sekar 100760.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan, Bhutan; China: Nepal and Pakistan.

6. *Lens* Mill.

Four species, distributed in Mediterranean, W. Asia and Africa; 2 in India.

Lens culinaris Medik., Vozles. Churpf. Phys. Ges. 2: 361, 1787; Sanjappa, Leg. India 202, 1992; Aswal & Mehrotra, Fl. Lahaul-Spiti 185, 1994; *Erasm. Ind. L.*, Sp. Pl. 738, 1753; Baker in Hook.f., Fl. Brit. India 2: 179, 1876. *Maacul*

Annuals. Stems erect, 15-30 cm high, pilose. Leaves pinnately compound, rachis ending in a short bristle; leaflets 4-7 pairs, 0.5-1.4 x 0.1-0.3 cm, truncate to rence at apex, entire, pilose. Inflorescence 1-4-flowered, the axis continues after giving rise to flowers. Calyx 5-6 mm long, pilose; teeth subequal, 3-4 mm long, acute. Corolla purple; vexillum 5-6 mm long. Pods 0.8-1.4 x 0.5-0.8 cm, glabrous, 2-seeded, compressed.

Fl. & Fr.: July - September.

Cultivated. Often seen as an escape in waste places. Thangti, 3700 m, 27.08.2002, K. Chandu Sekar 102978.

Distrib: Throughout India; Asia and Europe.

7. Lotus L.

About 100 species, distributed in N. temperate region; 2 in India.

Lotus corniculatus L., Sp. Pl. 775. 1753; Baker in Hook.f., Fl. Brit. India 2: 91, 1876, *f.p.*; Sanjappa, Leg. India 205. 1992; Aswal & Mehrotra, Fl. Lahaul-Spiti 186. 1994.

Perennial herbs. Stems prostrate, ascending; branches glabrous. Leaves pinnate; leaflets cuneate-obovate to narrowly obovate, 0.5-1.5 x 0.3-0.8 cm, obtuse. Inflorescence an umbel, axillary, 3-6-flowered. Bracts sessile, leaf-like. Calyx 5-6 mm long; teeth unequal. Corolla yellow; vexillum 0.8-1.4 cm long. Pods cylindrical, 1.2-2.1 x 0.2-0.3 cm, glabrous.

Fl. & Fr.: June - September.

Rare; on rocky slopes. Manc, 3650 m, 27.08.2002, K. Chandu Sekar 100743.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; Africa; Bhutan; China; Cyprus; Egypt; Iraq; Iran; Korea; Lebanon; Mongolia; Nepal; Pakistan; Palestine; Syria; Turkey and U.S.S.R.

8. Medicago L.

About 85 species, chiefly in Europe, Mediterranean, Ethiopia and S. Africa; 8 in India.

- | | |
|---|-----------------------|
| 1a. Pod forming more than 1 spiral | 2. <i>M. sativa</i> |
| b. Pod not forming more than 1 spiral | 2 |
| 2a. Curvature of the pod making a semicircle | 1. <i>M. falcata</i> |
| b. Curvature of the pod more pronounced than a semicircle | 3. <i>M. s. varia</i> |

1. Medicago falcata L., Sp. Pl. 779. 1753; Baker in Hook.f., Fl. Brit. India 2: 90, 1876; Sanjappa, Leg. India 209. 1992; Aswal & Mehrotra, Fl. Lahaul-Spiti 187. 1994. *Baker*

Perennial herbs. Stems erect, 23-34 cm high, sparsely pubescent. Leaves imparipinnate; leaflets 3, obovate to linear-lanceolate, 0.8-1.9 x 0.2-0.5 cm, serrate in the upper part. Stipules rooted in the lower half. Racemes 3-5 cm long, many-flowered. Calyx 4-5 mm long; teeth as long as the tube. Corolla 0.8-1.1 cm long. Pods crescent-shaped, 0.8-1.1 x 0.2-0.25 cm, appressed-pilose to glabrescent, 2-8-seeded.

Fl. & Fr.: July - September.

Occasional; on stream beds. Mud-Tariya, 3800 m, 03.08.2002, K. Chandu Sekar 102844.

Distrib: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; Europe; Nepal; Pakistan; Turkey and U.S.S.R.

Leaves are used as vegetable.

2. Medicago sativa L., Sp. Pl. 778. 1753; Sanjappa, Leg. India 210. 1992; Aswal & Mehrotra, Fl. Lahaul-Spiti 188. 1994. *Baker*

Biennials. Stems erect, 31-43 cm high, pubescent to subglabrous. Leaves imparipinnate; leaflets 3, obovate to sublinear, 0.5-2 x 0.3-0.6 cm, dentate at apex, appressed pubescent. Stipules dentate at base.

Racemes 2.6-5.8 cm long; peduncle much longer than petiole. Calyx teeth as long as the tube. Corolla 0.6-1.2 cm long, violet. Pods in a loose spiral of 1.5-4-turns, glabrous to appressed-pilose, 10-20 seeded.

Fl. & Fr.: June-September.

Scarce; on stream beds. Tilling, 3700 m, 26.08.2002, K. Chandra Sekar 100697.

Distrib.: Throughout N. India; Central Asia to Europe and N. Africa.

Leaves used as vegetable.

3. *Medicago x varia* Matten, Fl. Rusl. 3: 87, 1792-95; Sanjappa, Leg. India 210, 1992; Chandra Sekar & al. in Ann. For. 11(1): 53, 2003 *Bakum, Nov*

Perennial herbs. Stems erect, 30-45 cm high, glabrous. Leaves imparipinnately compound; leaflets 3, obovate to linear-lanceolate, 0.5-2 x 0.2-0.6 cm, serrate in the upper part. Stipules toothed in the lower half. Racemes 3-6 cm long; peduncle much longer than petiole. Calyx 4-5 mm long; teeth as long as the tube. Corolla 0.8-1.1 cm long. Pods curved more than a semicircle, 0.8-1.3 x 0.25-0.3 mm, glabrous, 6-10-seeded.

Fl. & Fr.: July-September.

Common; on stream beds. Gechang, 3730 m, 16.07.2002, K. Chandra Sekar 100471.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Europe; Nepal; Pakistan; Turkey and U.S.S.R.

9. *Melilotus* Mill.

About 20 species distributed in temperate and subtropical Eurasia, N. Africa and Ethiopia; 4 in India.

Melilotus officinalis (L.) Desf. in Lam. Encycl. Meth. 4: 63, 1796; Baker in Hook.f., Fl. Brit. India 2: 89, 1876; Sanjappa, Leg. India 212, 1992; Aswal & Mehrotra, Fl. Lahaul Spiti 189, 1994. *Trifolium melilotus-officinale* L., Sp. Pl. 765, 1753. *Ladak: Bakum, Ladakhi Bakum*

Biennials. Stems erect, 46-82 cm high. Leaves imparipinnate; leaflets of lower leaves obovate-ovate, the upper ovate-lanceolate, 0.8-1.8 x 0.2-0.6 cm, serrate. Stipules of lower leaves entire, the upper minutely serrate. Racemes 4-11 cm long, 10-16-flowered. Calyx teeth unequal. Corolla 5-6 mm long, yellow; vexillum and wings equal in size, longer than the keel. Pods 3-5 mm long, glabrous, transversely striated.

Fl. & Fr.: July-September.

Common; on rocky slopes. Chibohem, 4050 m, 22.07.2002, K. Chandra Sekar 100506.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Africa; America; China; Europe and Pakistan.

Leaf juice is used to improve the eyesight and the whole plant is given to increase the milk content in cows.

10. *Oxytropis* DC.

About 300 species distributed in N. temperate regions; 17 in India.

- | | |
|--|-----------------------------|
| 1a. Leaves, bracts and calyx gland-dotted | 6. <i>O. microphylla</i> |
| b. Leaves, bracts and calyx not gland-dotted | 2 |
| 2a. Pods membranous, inflated | 3 |
| b. Pods not as above | 4 |
| 3a. Mucro of the keel less than 1 mm long | 7. <i>O. latarica</i> |
| b. Mucro of the keel more than 1 mm long | 1. <i>O. cachemiriana</i> |
| 4a. Aerial stem prominent | 5 |
| b. Aerial stem absent or reduced | 6 |
| 5a. Lateral calyx teeth less than 2 mm long | 3. <i>O. hypoglottoides</i> |
| b. Lateral calyx teeth more than 2 mm long | 5. <i>O. lapponica</i> |
| 6a. Calyx teeth less than 2.5 mm long | 2. <i>O. humifusa</i> |
| b. Calyx teeth 2.5 mm or more long | 4. <i>O. immersa</i> |

1. *Oxytropis cachemiriana* Cambess. in Jacquem., *Voy. Inde* 4: 38, t. 44. 1844; Baker in Hook.f., *Fl. Brit. India* 2: 139. 1876; Sanjappa, *Leg. India* 224. 1992; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 190. 1994. *Suntuk*

Perennial herbs; rootstock woody. Stems erect, 20-30 cm high, pilose, spreading. Leaves imparipinnate, 2.5-11 cm long, covered with long spreading hairs; leaflets sessile, elliptic, 0.4-1.3 x 0.1-0.2 cm, acute, entire, pilose; hairs spreading. Flowers in heads; peduncle 4-14 cm long. Bracts 6-8 mm long, pilose. Calyx 8-9 mm long, pilose; teeth 4-5 mm long. Corolla purple; vexillum 1.3-1.4 cm long; mucro of the keel 1.5-2 mm long. Pods 1.1-1.3 cm long, tapering at ends, pilose.

Fl. & Fr.: June - September.

Scarce; on moist slopes. Pin-Parvati to Tariya, 4200 m, 24.07.2003, K. Chandra Sekar 103678.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China and Pakistan.

Decoction of leaves is used to cure fever, cold and cough.

2. *Oxytropis humifusa* Kar. & Kir. in *Bull. Soc. Nat. Mosc.* 15: 535. 1842; Sanjappa, *Leg. India* 225. 1992; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 195. 1994. *Oxytropis lapponica* var. *humifusa* (Kar. & Kir.) Baker in Hook.f., *Fl. Brit. India* 2: 137. 1876.

Perennial herbs; rootstock woody. Aerial stem much reduced, covered with persistent leaf bases and stipules. Leaves imparipinnate, 3.5-7 cm long; leaflets 13-23, subsessile, elliptic to lanceolate, 3-6 x 1.5-2.5 mm, acute-obtuse, entire, densely pilose. Flowers in heads; peduncle 4-11 cm long. Bracts 2-3 mm long. Calyx 6-7.5 mm long; teeth 2-2.5 mm long. Corolla purple; vexillum 1-1.2 cm long; wings 1.1-1.15 cm long; keel 0.9-1 cm long. Young pods pubescent.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Near Larang La, 4600 m, 18.08.2002, K. Chandu Sekar 102946.

Distrib. India: Himachal Pradesh and Jammu & Kashmir; Afghanistan; China; Nepal; Pakistan and U.S.S.R.

3. *Oxytropis hypoglottoides* (Baker) Ali in Kew Bull. 28(2): 306. 1973. *Astragalus hypoglottoides* Baker in Hook.f., Fl. Brit. India 2: 124. 1876. *Sin Tea*

Perennial herbs. Stems erect, 18-25 cm high, elongated. Leaves imparipinnately compound; leaflets 9-19, elliptic to elliptic-ovate, acute to obtuse, entire. Stipules leaf opposed, 5-8 mm long, united at the base, foliaceous, sparsely glabrous above, pilose beneath. Racemes axillary; peduncle 4-11.5 cm long. Bracts 2-4 mm long, pubescent. Calyx 5-5.5 mm long, black pubescent; teeth 1.5-2 mm long. Corolla violet; vexillum 0.85-1 cm long. Pods 0.8-1.6 x 0.15-0.25 cm, glabrous.

Fl. & Fr.: June - September.

Scarce; on rocky slopes. Chhoham, 4050 m, 13.07.2003, K. Chandu Sekar 101197.

Distrib. India: Himachal Pradesh and Jammu & Kashmir; China; Pakistan and U.S.S.R.

Said to be used for making holy books in Tibet.

4. *Oxytropis immersa* (Baker ex Aitch.) Bunge ex Ledtsch. in Beih. Bot. Cbl. 22(2): 212. 1907; Ali in Nasir & Ali, Fl. W. Pakistan 100: 119. 1977. *Astragalus immersus* Baker ex Aitch. in J. Linn. Soc. London (Bot.) 18: 45. 1881. **Fig. 8**

Perennial herbs; rootstock woody. Aerial stem absent. Leaves imparipinnate, 1.8-3.5 cm long; leaflets sessile to subsessile, 9-19, elliptic, 2.6 x 1.2 mm, acute, entire, sparsely pilose. Stipules papery, scantily pilose on the margin. Racemes condensed; peduncles 3.5-6.5 cm long. Bracts 2-3 mm long. Calyx 4-5.5 mm long, pilose; teeth ca 2.5 mm long. Corolla light blue-violet; vexillum 1-1.1 cm long; wings 8-9.5 mm long; keel 7.5-8.5 mm long. Pods stipitate, 0.7-1 cm long, sparsely pilose, 3 or 4-seeded; sipe 1-1.5 mm long.

Fl. & Fr.: June - September.

Scarce; on moist slopes near streams. Tariya to Pin-Parvati, 4300 m, 24.07.2003, K. Chandu Sekar 103673

Distrib. India: Himachal Pradesh; Afghanistan; Iran; Pakistan and U.S.S.R.

Note. The variety *immersa* differs from var. *junaliensis* Ali in having stipules scantily pilose along the margin.

5. *Oxytropis lapponica* (Wahl.) Gay. Corresp. Flora Helv. 10: 30. 1827; Baker in Hook.f., Fl. Brit. India 2: 137. 1876; Sanjappa, Leg. India 225. 1992; Arwad & Mehrotra, Fl. Lahaul-Spiti 191. 1994. *Phaca lapponica* Wahl., Veg. Clim. Helv. 131. 1831. *Oxytropis lapponica* var. *scandiantha* Baker in Hook.f., Fl. Brit. India 2: 137. 1876.

Perennial herbs; roots woody. Stems ascending, 18-30 cm high. Leaves imparipinnate, 4-13 cm long; leaflets lanceolate to elliptic-lanceolate, 0.4-1.5 x 0.1-0.3 cm, entire, acute to acuminate, pilose on both surfaces. Stipules leaf opposed, pilose. Flowers in axillary and terminal peduncled heads. Bracts 3-5.5 mm long. Calyx 4.5-6.5 mm long; teeth 2-2.5 mm long. Corolla purple; vexillum 0.8-1.1 cm long; wings 7-8 mm long; keel 6.5-7.5 mm long with ca 2 mm long mucro. Pods stipitate, 1-1.1 x 0.4-0.5 cm, apiculate, pilose, 8-10 seeded.

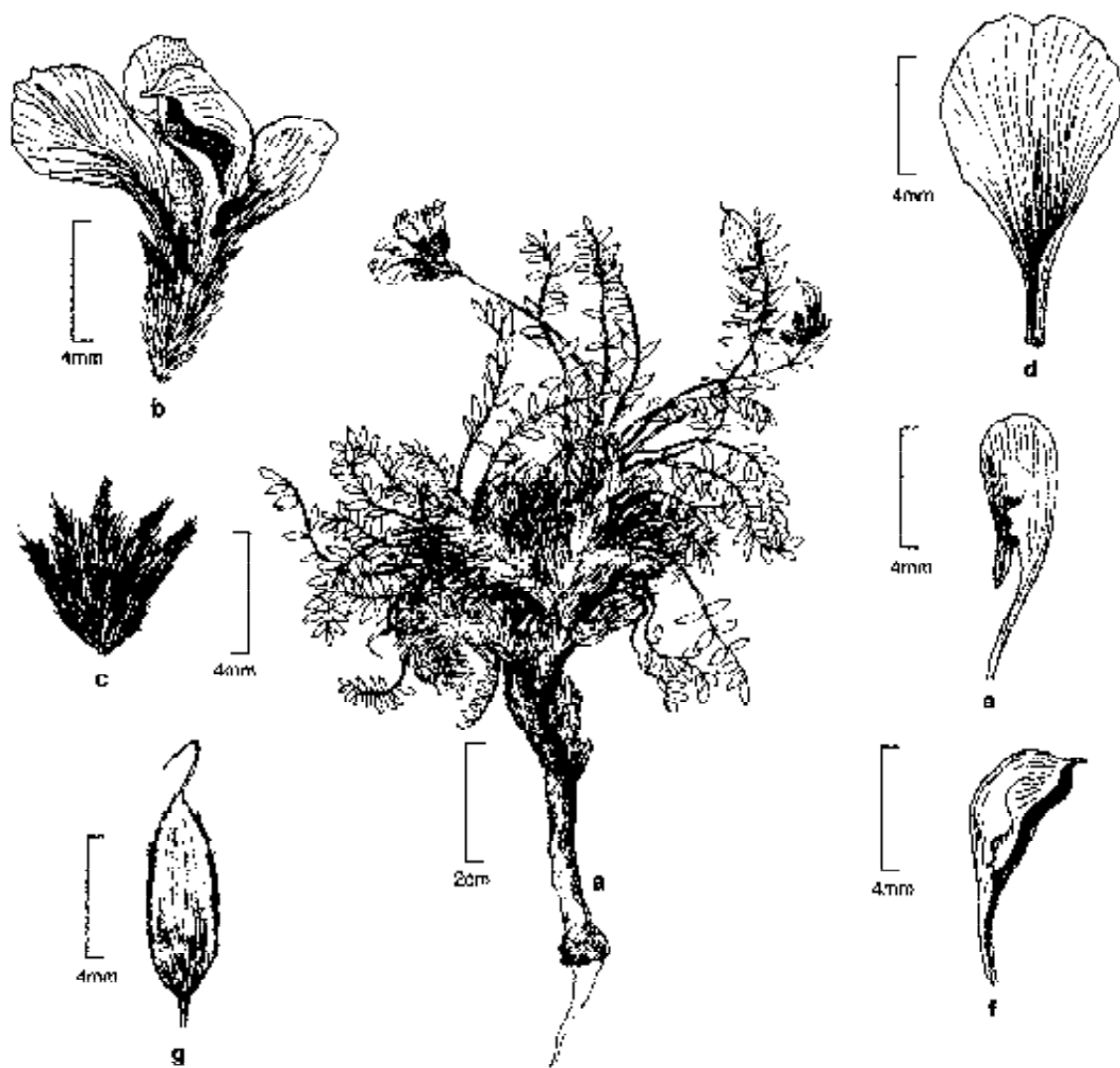


Fig. 8. *Oxytropis immersa* (Baker ex Aitch.) Bunge ex Fedtsch. a. Habit, b. Flower, c. Calyx, d. Vexillum, e. Wing, f. Keel, g. Pod

Fl. & Fr.: June – September.

Occasional; on rocky slopes. Mane, 3800 m, 03.09.2002, *K. Chandra Sekar* 102967.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand, Australia; China; Hungary; Italy; Nepal; Norway; Pakistan; Spain; Sweden; Switzerland and U.S.S.R.

6. *Oxytropis microphylla* (Pallas) DC., Prodr. 2: 279, 1825; Baker in Hook.f., Fl. Brit. India 2: 139, 1876, *p.p.*; Sanjappa, Leg. India 226, 1992; Aswal & Mehrotra, Fl. Lahaul-Spiti 192, 1994. *Phaca microphylla* Pallas, Reise 3: 744, 1776. **Photo. 65**

Perennial herbs; roots woody. Aerial stems absent. Leaves 6-18 cm long, yellow-pilose, hairs yellow; leaflets subsessile, linear-oblong, 6.7 x 2-4 mm, entire, obtuse, gland-dotted, pilose. Flowers in peduncled raceme, bracteate. Bracts 4-5 mm long, gland-dotted and pilose. Calyx 1-1.1 cm long, glandular with brown tubercles; teeth 2-2.5 mm long. Corolla blue; vexillum 1.9-2.1 cm long. Pods stipitate, 1.5-1.1 x 0.35-0.45 cm, acuminate, glandular, tuberculate.

Fl. & Fr.: June – September.

Occasional; on moist slopes. Chhohem, 4150 m, 12.07.2003, *K. Chandra Sekar* 103215.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; Mongolia; Nepal; Pakistan and U.S.S.R.

7. *Oxytropis tatarica* Cambess. & Bunge in Mem. Acad. Sci. St.-Petersbourg Ser. 7, 22: 16, 1874; Baker in Hook.f., Fl. Brit. India 2: 138, 1876; Sanjappa, Leg. India 226, 1992; Aswal & Mehrotra, Fl. Lahaul-Spiti 193, 1994. *Sibara* **Photo. 66**

Perennial herbs; roots woody. Aerial stems absent. Leaves imparipinnate, 2.5-5 cm long, canescent; leaflets sessile, oblanceolate-oblong, 3.7 x 2-3 mm, mucronate, entire. Stipules densely pilose. Flowers in peduncled head; peduncle 2.6-8 cm long. Bracts 3-3.5 mm long, canescent. Calyx 4-5 mm long, densely pilose; teeth ca 2 mm long. Corolla violet; vexillum 7-8 mm long; wings 6-7 mm long, keel 5.5-6 mm long, mucro 0.5-1 mm long. Pods globose, 0.8-1 x 0.6-0.8 cm; covered with spreading white hairs.

Fl. & Fr.: June – September.

Occasional; on rocky slopes. Sanpat, 4200 m, 04.08.2002, *K. Chandra Sekar* 102872.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; Nepal; Pakistan and Turkistan.

11. *Pisum* L.

Two species mainly in Mediterranean and W. Asian; 2 in India.

***Pisum sativum* L.**, Sp. Pl. 727, 1753; Baker in Hook.f., Fl. Brit. India 2: 161, 1876; Sanjappa, Leg. India 229, 1992; Aswal & Mehrotra, Fl. Lahaul-Spiti 194, 1994.

Annuals. Stems 35-65 cm high, glabrous, glaucous. Leaves paripinnate; rachis ending in a branched tendril; leaflets 2-8, dentate. Stipules obliquely ovate, 2-7 cm long, semi-amplexicaul at the base, toothed at least below. Calyx 0.8-1.5 cm long; teeth subequal, longer than the tube. Corolla white, violet or purple; vexillum 1-2.5 cm long. Pods 4.7 x 1.2-1.7 cm, glabrous.

- 1a. Seeds more than 8, unblotched i. var. *sativum*
 b. Seeds 4-8, blotched ii. var. *arvense*

i. var. *sativum*

Maitar, Tamas kurre

Fl. & Fr.: June - September.

Cultivated. Gechang, 3730 m, 16.07.2002, *K. Chandra Sekar* 100470.

Distrib.: Throughout the world.

Seeds are used as a pulse.

ii. var. *arvense* (L.) Poir. in Lam. Encycl. Meth. Bot. 5: 456. 1804; Aswal & Mehrotra, Fl. Lahaul Spiti 194. 1994. *P. arvense* L., Sp. Pl. 727. 1753; Baker in Hook.f., Fl. Brit. India 2: 181. 1876.

Fl. & Fr.: June - September.

Cultivated. Tilling, 3800 m. 26.08.2002, *K. Chandra Sekar* 100709.

Distrib.: Throughout the world.

Seeds are used as a pulse.

12. *Thermopsis* R. Br.

Thirteen species chiefly in E. Asia and N. America; 2 in India.

Thermopsis inflata Cambess. in Jacquem., Voy. Inde. 4: 34, t. 39. 1843; Baker in Hook.f., Fl. Brit. India 2: 63. 1876; Sanjappa, Leg. India 261. 1992; Aswal & Mehrotra, Fl. Lahaul-Spiti 196. 1994. **Photo. 67**

Perennial herbs; roots woody; rhizomes creeping. Stems erect, 20-28 cm high. Leaves alternate, palmately trifoliolate; leaflets ovate to obovate, 1-1.6 x 0.5-1.1 cm, obtuse, mucronate, entire, sparsely pilose. Stipules free, foliaceous. Inflorescence a raceme, 2 or 3-flowered at each node. Bracts 1.2-1.3 cm long, united at base, pilose. Calyx 1.6-1.7 cm long, pilose; upper teeth ca 3 mm long; lower one 5-6 mm long. Corolla light yellow; vexillum 2.2-2.3 cm long. Stamens free. Pods 4.2-5 cm long, inflated, 6-10-seeded.

Fl. & Fr.: June - September.

Rare: on rocky slopes. Kilung Larang La, 4850 m, 02.08.2003, *K. Chandra Sekar* 103726.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; Nepal and Pakistan.

13. *Trifolium* L.

About 238 species distributed in temperate and subtropical regions, except Australia; 11 in India.

Trifolium pratense L., Sp. Pl. 768. 1753; Baker in Hook.f., Fl. Brit. India 2: 86. 1876; Sanjappa, Leg. India 262. 1992; Aswal & Mehrotra, Fl. Lahaul-Spiti 196. 1994. *Hublum*

Perennial herbs. Stems erect to decumbent, 21-30 cm high. Leaves trifoliolate. Leaflets obovate to broadly elliptic, 1.5-3 cm long, obscurely dentate, glabrous. Stipules ovate-lanceolate, free portion abruptly mucronate. Inflorescence a head, 0.8-2 cm dia. Flowers sessile. Calyx pubescent; lowest tooth longer

than others and the calyx cup. Corolla purple to pink; vexillum 1.3-1.8 cm long. Pods opening by a lid.

Fl. & Fr.: July - September

Rare; on rocky slopes. Tilling, 3800 m, 26.08.2002, K. Chandra Sekar 100702.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim, Tamil Nadu and Uttarakhand; Asia; Europe; N. Africa and N. America.

Used as fodder to increase the lactation in cattle and also for reducing redness.

14. *Trigonella* L.

About 50 species distributed in Mediterranean, Macronesia, S. Africa and Australia; 12 in India.

- | | |
|--|-----------------------|
| 1a. Mature pods pilose | 3. <i>T. patiens</i> |
| b. Mature pods glabrous | 2 |
| 2a. Sépales foliaceous; corolla more than 6 mm long | 1. <i>T. emodi</i> |
| b. Sépales not foliaceous; corolla less than 6 mm long | 2. <i>T. gracilis</i> |

1. ***Trigonella emodi*** Benth. in Royle, *Illustr. Bot. Himal.* 197. 1835; Baker in Hook.f., *Fl. Brit. India* 2: 88. 1876; Sanjappa, *Leg. India* 264. 1992; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 197. 1994

Annuals. Stems suberect, 20-30 cm high. Leaves trifoliolate; leaflets obovate, 0.8-2.2 x 0.4-1.1 cm, inciso-dentate, glabrous above, pilose beneath. Stipules 3-7 mm long, foliaceous, serrate at margins. Racemes axillary, 2-7-flowered, condensed; peduncles 2-3 cm long, pilose. Bracts 0.8 - 1 mm long. Calyx 4-5 mm long, minutely pilose; teeth 2-2.5 mm long. Corolla yellow; vexillum 6-7 mm long; wings 6-6.5 mm long; keel 5-6 mm long. Pods 1.4-1.5 x 0.2-0.3 cm, glabrous, prominently veined, 5 or 6-seeded.

Fl. & Fr.: July - September.

Scarce; on slopes. Parahio catchment, 17.07.1992, *Nima* 305 (WII).

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan, Bhutan; Nepal; Pakistan and Turkistan.

2. ***Trigonella gracilis*** Benth. in Royle, *Illustr. Bot. Himal.* 197. 1835; Baker in Hook.f., *Fl. Brit. India* 2: 88. 1876; Sanjappa, *Leg. India* 265. 1992; Chandra Sekar & al. in *Ann. For.* 11(1): 54. 2003.

Photo. 68

Perennial herbs. Stems trailing, 25-36 cm high, glabrous. Leaves trifoliolate; leaflets obovate-cuneate, 0.5-1.2 x 0.3-0.7 cm, renate, minutely toothed, glabrous. Sépales linear. Racemes axillary, 1-5-flowered; peduncle longer than the leaf, ending in an awn. Calyx 3.5-4 mm long; teeth almost as long as the tube. Corolla ca 5 mm long, yellow; vexillum 1.5 mm long; wings and keel shorter than the vexillum. Pods 0.5-1.2 x 0.25-3 cm, glabrous, marked with distinct transverse veins, 1-3-seeded.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Debsa, 4050 m, 24.07.2002, K. Chandra Sekar 100516.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Nepal and Pakistan.

3. *Trigonella pubescens* Edgew. ex Baker in Hook.f., Fl. Brit. India 2: 88, 1876; Sanjappa, Leg. India 266, 1992; Aswal & Mehrotra, Fl. Lahaul-Spiti 198, 1994.

Annuals. Stems ascending, 20-40 cm high, pubescent. Leaves trifoliolate; leaflets obovate-oblong, 1.2-2 cm long, dentate. Stipules linear, faintly toothed. Inflorescence 1-3 flowered; peduncles 1-2 cm long, not ending in awn. Calyx 3-3.5 mm long, pubescent; teeth longer than the tube. Corolla 6-7 mm long, yellow; vexillum 5-7 mm long; wings and keel shorter than the vexillum. Pods linear-oblong, 1.2-1.6 x 0.4-0.5 cm, pilose, 10-12-seeded.

Fl. & Fr.: July - September.

Scarc; on rocky slopes. Sagnam, 3650 m, 27.08.2002, K. Chandra Sekar 100727.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China; Nepal and Pakistan.

17. ROSACEAE

About 95 genera and ca 2825 species, subcosmopolitan; 32 genera and about 450 species in India.

- | | |
|---------------------------------------|-----------------------|
| 1a. Plants armed | 5. Rosa |
| b. Plants not armed | 2 |
| 2a. Leaves simple | 3 |
| b. Leaves compound | 4 |
| 3a. Fruits not enclosed in calyx tube | 4. Prunus |
| b. Fruits enclosed in calyx tube | 1. Cotoneaster |
| 4a. Basal leaves more than 12 cm long | 2. Geum |
| b. Basal leaves less than 12 cm long | 5 |
| 5a. Stamens 10 or less than 10 | 6. Sibbaldia |
| b. Stamens numerous | 3. Potentilla |

1. *Cotoneaster* Meckl.

Two hundred and sixty one species chiefly in temperate regions of the Old World, 59 in India.

Cotoneaster gilgitensis Klotz. in Wiss. Z. Univ. Halle 15: 539, 1966; Aswal & Mehrotra, Fl. Lahaul-Spiti 201, 1994; Arv. Kumar & Panigrahi, Rosac. India 3: 91, 1995. **Photo. 69**

Shrubs. Stems erect to suberect, 50-70 cm high, glabrous. Leaves oblong-ovate, 1.6-3.5 x 0.8-2 cm, broadly cuneate at base, obtuse at apex, glabrous above, sparsely tomentose beneath. Stipules 4-5 mm long. Flowers long-pedicellate, nodding; pedicel 1-1.2 cm long. Calyx sparsely villous when young, glabrescent later. Petals ca 2 mm long, white, somewhat rosy at base. Achenes globose to subglobose, 5-7 mm long, scarlet; nutlets 2 or 3.

Fl. & Fr.: July - October.

Rare; in rock-crevices. Gechang, 3900 m, 14.07.2003, K. Chandra Sekar 103295.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand.

2. Geum L.

About 40 species chiefly in temperate and cold regions; 6 in India.

Geum elatum Wall. ex G. Don, Gen. Hist. 2: 526. 1832; K.M. Purohit & Parigrahi, Ruscac. India 1: 158. 1991; Arora & Mehrotra, Fl. Lahaul-Spiti 205. 1994.

Gyompa mendok, Turu silva Menta

Perennial herbs. Stems erect to suberect, 35-43 cm high. Basal leaves 12-18 cm long, lyrate-interruptedly pinnate; leaflets incise-dentate, hairy on both surfaces; cauline ones oblong, 2-12 x 1-3.5 cm, pinnatifid, hairy. Flowers 1.8-3.5 cm dia. Sepals ovate-triangular, 5-7.5 x 4-5 cm, acute, white. Petals obovate-obcordate, 1-1.5 x 1-1.5 cm, glabrous, yellow. Achenes obovate-ellipsoid, 0.8-1 cm long, villosus.

Fl. & Fr.: July - September.

Rate: on rocky slopes, Mud-Tharbik, 4000 m, 07.08.2002, K. Chandra Sekar 102803.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Bhutan; China; Nepal and Pakistan.

Extract of leaves taken with cow milk as a cure to jaundice.

3. Potentilla L.

About 500 species distributed in N. temperate regions; 63 in India.

- | | |
|---|---|
| 1a. Achenes clothed and concealed by long woolly hairs | 2 |
| b. Achenes naked and not concealed by any hairs | 5 |
| 2a. Herbs; bark not peeling off; caudex aerial, with a rosette of radical leaves | 3 |
| b. Shrubs; bark peeling off; caudex subterranean, without a rosette of radical leaves | 4 |
| 3a. Caudex not clothed by remnants of stipules | 6. <i>P. conifolia</i> |
| b. Caudex imbricately clothed by remnants of stipules | 7. <i>P. crinocarpa</i> |
| 4a. Leaves entire | 2. <i>P. arbuscula</i> var. <i>pumila</i> |
| b. Leaves dentate | 10. <i>P. sukamianae</i> |
| 5a. Styles claviform | 5. <i>P. hujerica</i> subsp. <i>microcrofilii</i> |
| b. Styles not claviform | 6 |
| 6a. Styles rod-shaped | 1. <i>P. anserina</i> |
| b. Styles clavicleiform or coniform | 7 |
| 7a. Styles clavicleiform | 8. <i>P. gelida</i> |
| b. Styles coniform | 8 |

- 8a. Leaves 5-9-foliate 9. *P. multifida*
 b. Leaves trifoliate 9
- 9a. Flowers red 4. *P. astrisanguinea*
 b. Flowers yellow 3. *P. argyrophylla*

1. *Potentilla anserina* L., Sp. Pl. 495. 1753; Aswal & Mehrotra, Fl. Lahaul-Spiti 209. 1994; Dikshit & Panigrahi, Rosac. India 4: 100. 1998.

Perennial herbs; rootstock imbricately clothed with the relics of brown stipules. Stems creeping, 28-40 cm long. Leaves interruptedly imparipinnate; leaflets sessile, oblong-obovate, 1-2.5 cm long, deeply serrate-dentate, appressed-hairy above, silky beneath. Flowers axillary, solitary, 1.2-2.1 cm dia. Sepals broadly ovate, 5-8 x 2-2.5 mm, acute-acuminate. Petals obovate, 0.9-1.6 cm long, rounded at apex, entire, yellow. Achenes dorsally sulcate, glabrous.

Fl & Fr.: June - September.

Common; on moist slopes. Gechang, 3900 m, 14.07.2003, K. Chandra Sekar 103298.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Asia; America; Australia; Europe and U.S.S.R.

2. *Potentilla arbuscula* D. Don var. ***pumila*** (Hook.f.) Hand. Mazz., Symb. Sin. 7: 308. 1933; Aswal & Mehrotra, Fl. Lahaul-Spiti 210. 1994; Dikshit & Panigrahi, Rosac. India 4: 52. 1998. *P. fruticosa* L. var. *pumila* Hook.f., Fl. Brit. India 2: 348. 1878. **Photo. 70**

Shrubs. Stems prostrate-ascending. Leaves imparipinnate; leaflets obovate, 3-7 x 1.5-3 mm, entire, densely appressed silky-soft long hairs above, glabrous except sparsely silky hairy midrib beneath. Flower solitary, 1-1.5 cm dia.; pedicel 2-3 mm long. Sepals ovate, 7-8 x 3-4 mm, acute, entire. Petals obovate, 1.3-1.6 cm long, narrowed at base, rounded at apex, entire, yellow. Achenes concealed with long woolly hairs.

Fl & Fr.: July - October.

Scarce; on rocky slopes. Near Gechang, 10.08.1994, S.K. Murti & S. Singh 88230.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Sikkim; Bhutan; China and Nepal.

3. *Potentilla argyrophylla* Wall. ex Lehmann, Nov. Strip. Pug. 3: 36. 1831; Dikshit & Panigrahi, Rosac. India 4: 182. 1998. *P. astrisanguinea* Ledeb. var. *argyrophylla* (Wall. ex Lehmann) Grierson & Long in Notes Roy. Bot. Gard., Edinb. 37(2): 353. 1979; Aswal & Mehrotra, Fl. Lahaul-Spiti 211. 1994.

Mentok Karta, Kbu Lumbee, Sepho mendok **Photo. 71**

Perennial herbs. Stems erect-ascending, 20-30 cm high, densely hairy. Leaves trifoliate, 3-9 cm long; leaflets elliptic-ovate to elliptic-oblong, 0.8-7.5 x 0.3-5 cm, sparsely hairy above, densely woolly beneath. Flowers 1.5-3 cm dia.; pedicels 3-6 cm long. Sepals ovate, 0.4-1.2 x 0.15-0.4 cm, acute-acuminate, entire. Petals obovate-cuneate, longer than the sepals; veins dichotomously branched, yellow. Ovary oblong-ovoid. Achenes glabrous.

Fl & Fr.: June - September.

Scarce; on moist rocky slopes. Tariya to Pin-Parvati pass, 24.07.2003, K. Chandra Sekar 103658.

Distrib: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan; Bhutan; Nepal and Pakistan.

Note: *Potentilla argrophylla* and *P. atrisanguinea* are very similar to one another, being distinguished mainly by flower colour (yellow in *P. argrophylla* and red in *P. atrisanguinea*). Gleason & Long (1979) treated *P. argrophylla* as a variety of *P. atrisanguinea* on the rule of priority. However, on the basis of the genetical isolation and the reports on sterility of hybrids between *P. argrophylla* and *P. atrisanguinea*, Wolf (1908) treated them as distinct species. Wolf (1908) observation has been followed by Dikshit & Panigrahi (*loc.*) and is being followed here also.

4. *Potentilla atrisanguinea* Ledeb., Bot. Cab, 8, t. 786. 1824; Aswal & Mehrotra, Fl. Lahaul-Spiti 210. 1994; Dikshit & Panigrahi, Rosac. India 4: 180. 1998. *Mendok* Tashy Nodjo, *Mendok* Marpa.

Perennial herbs. Stems erect ascending, 20-30 cm high, densely hairy. Leaves trifoliate, 2-10 cm long; leaflets elliptic-ovate to elliptic-oblong, 0.8-7.5 x 0.3-5 cm, acutely to obtusely 5-30 dented at margin, densely appressed hairy above, densely woolly beneath. Flowers 1.5-3 cm dia. Sepals ovate, 0.4-1.2 x 0.15-0.4 cm, acute-acuminate, entire. Petals obcordate-cuneate, 0.6-1.4 cm long; veins dichotomously branched, red. Ovary oblong-ovoid. Achenes glabrous.

Fl. & Fr: June - October.

Scarce; on moist slopes. Tariya to Pin-Parvati, 4200 m, 24.07.2003, K. Chandra Sekar 103695.

Distrib: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Nepal and Pakistan.

Crushed flowers applied to reduce pain caused by insect stings.

5. *Potentilla bifida* f. subsp. *moorcroftii* (Wall. ex Ledeb.) Sreek. ex Panigrahi in Rheede 1: 17 f. A-E. 1991; Dikshit & Panigrahi, Rosac. India 4: 81. 1998. *P. moorcroftii* Wall. ex Ledeb., Nov. Stirp. Pug. 3: 29. 1831. *P. bifida* L., Sp. Pl. 497. 1753; Aswal & Mehrotra, Fl. Lahaul-Spiti 212. 1994.

Mendok sekho, Aungba mendok marbo

Perennial herbs. Stems 8-15 cm high. Leaves imparipinnate, 2-4 cm long; leaflets sessile, linear-oblong, 0.4-1.2 x 0.2-0.5 cm, 2 or 3-lobed, lobes acute-obtuse, appressed-hairy. Flowers 0.8-1.5 cm dia., pedicel 1.5-3.5 cm long. Sepals broadly ovate, 3-4 x 2-3 mm, acute, entire, appressed hairy. Petals obovate, 4-7 mm long, narrowed at base, rounded at apex, yellow. Achenes ovate, obtuse, glabrous, brown.

Fl. & Fr: July - September.

Rare; on rocky slopes. Mud-Larang La, 4000 m, 18.08.2002, K. Chandra Sekar 102906.

Distrib: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand, Afghanistan; Bhutan; China; Europe; Iran; Mongolia; Nepal; Pakistan and U.S.S.R.

Extract of leaves applied with salted curd externally to get relieved from head ache.

6. *Potentilla cuneifolia* Bertol., Misc. Bot. 24: 15, t. 2. 1863; Dikshit & Panigrahi, Rosac. India 4: 67. 1998. *See Yakul, Mendok Sekho, Pந்து Mendok. Photo. 72*

Perennial tufted herbs. Stems procumbent-ascending, 14-22 cm high. Leaves trifoliate; leaflets sessile-subsessile, obovate-orbicular, 0.4-1.5 x 0.3-0.5 cm, obtusely 2-5 toothed at apex, closely appressed glossy hairy. Flowers 2-3 cm dia. Sepals ovate, 0.7-1.1 x 0.3-0.4 cm, acute-acuminate, appressed-hairy. Petals obovate, exceeding the sepals, narrowed at base, rounded at apex, yellow. Ovary ovoid, 0.5-1 mm long, obtuse, long-hairy. Achenes concealed by hairs.

Fl. & Fr.: June - October.

Occasional; on rocky slopes. Debsa, 4045 m, 24.07.2002, *K. Chandra Sekar* 100512.

Distrib.: India: Arunachal Pradesh; Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Bhutan; China; Nepal; Myanmar and Pakistan.

7. *Potentilla eriocarpa* Wall. ex Lehm., Nov. Stirp. Pug. 3: 35. 1831; Aswal & Mehrotra, Fl. Lahaul-Spiti 214.1994; Dikshit & Panigrahi, Rosac. India 4: 70. 1998.

Perennial herbs; rootstock woody, imbricately clothed with remnants of broad stipules, brown to dark-brown. Stems ascending, 18-26 cm high. Leaves trifoliate; leaflets sessile to subsessile, obovate, 1-4.5 x 0.4-2.2 cm, base gradually narrowed and attenuated, 3-7-dentate at apex, glabrous; lobes ovate with acute apex. Flowers 2-3 cm dia. Sepals ovate, 5-8 x 3-4.5 mm, acute-acuminate, entire. Petals obovate, longer than sepals, narrowed at base, retuse at apex, yellow. Ovary oblong, obtuse. Achenes concealed by long woolly hairs.

Fl. & Fr.: June - October.

Rare; on slopes. Kailung, 19.07.1992, *Nina & Yasbeer* 166 (WII).

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Bhutan and China.

8. *Potentilla gelida* C.A. Mey., Ind. Pl. Cauc. et ad mare Casp. Collect. 167. 1831; Aswal & Mehrotra, Fl. Lahaul-Spiti 214.1994; Dikshit & Panigrahi, Rosac. India 4: 128. 1998. *See Mentink*

Perennial herbs; rootstock sturdy, covered with brown remnants of stipules. Leaves trifoliate; leaflets obovate, 0.9-2 x 0.5-1.2 cm, concave at base, rounded at apex, margin 4-9-incised lobed in the upper two third of the leaflet and often up to base; teeth ovate with acute-obtuse apex. Flowers 1.2-2.4 cm dia. Sepals ovate, 3-5 x 1.5-2.5 mm, acute, entire. Petals obovate, 4-9 mm long, emarginate. Ovary ovoid, glabrous. Achenes glabrous, smooth.

Fl. & Fr.: July - September.

Scarce, on moist slopes. Near Pin-Parvati Pass, 5200 m, 23.07.2003, *K. Chandra Sekar* 103641.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China; Iran; Mongolia; Pakistan and U.S.S.R.

Decoction of leaves given to cure cough and cold.

9. *Potentilla multifida* L., Sp. Pl. 496. 1753; Aswal & Mehrotra, Fl. Lahaul-Spiti 216. 1994; Dikshit & Panigrahi, Rosac. India 4: 141. 1998. *See Phulu, Sitaka, Tra Bahla*

Perennial herbs; rootstock stout. Stems ascending-erect, 16-22 cm high. Leaves imparipinnate, 3.5-8 cm long; leaflets 5-9, sessile, 3-4.5 x 1.5-2 mm, attenuated at base, irregularly and deeply

pinatipartite into 7-11 linear-oblong lobes; lobes spreading and obtuse at apex. Flowers 1.2-1.3 cm dia. Sepals ovate, 3-4 x 1.5-2.2 mm, acute, entire. Petals orbicular-obovate, 3-6 mm long, yellow. Achenes glabrous, rugose.

Fl. & Fr.: June - September.

Frequent; on rocky slopes. Thangso-Shaim, 3900 m, 11.07.2003, K. Chandan Sekar 101184.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; America; China; Europe; Iran; Japan; Mongolia; Pakistan and U.S.S.R.

Decoction of leaves given as a cure to fever.

Note. *Potentilla multifida* is a highly polymorphic species. Due to hybridization in nature, the existence of transitional individuals is difficult to classify them into clear-cut taxa (Juzepczuk, 1971; Dikshit & Panigrahi, *lc.*).

10. *Potentilla salesoviana* Stephan in Mem. De la Soc. Des. Natur. de Mosc. 2: 6. t.3, 1809; Aswal & Mehrotra, 14. Lahaul-Spiti 217.1994; Dikshit & Panigrahi, Rosac. India 4: 57. 1998. **Photo. 73**

Shrubs. Stems erect-ascending, 20-35 cm high. Leaves imparipinnate, 2-7.8 cm long, finely appressed hairy; leaflets 7-9, oblong, 1.6-3 x 1.1-1.8 cm, rounded at base, 7-15-toothed, teeth ovate with acute apex. Flowers 1.5-2.6 cm dia. Sepals ovate, 0.7-1.4 x 0.4-0.7 cm, acute acuminate, entire. Petals obovate, exceeding the sepals, narrowed at base, rounded at apex, entire, white. Achenes oblong-ovoid, 1-1.5 mm long, concealed by long woolly hairs.

Fl. & Fr.: June - October.

Common; on rocky slopes. Thudin, 3650 m, 30.07.2002, K. Chandan Sekar 100533.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Afghanistan; Bhutan; China; Iran; Mongolia; Nepal; Pakistan and U.S.S.R.

4. *Prunus* L.

More than 200 species distributed in temperate and tropical regions; 38 in India.

***Prunus cerasus* L.**, Sp. Pl. 474. 1753; Ghora & Panigrahi, Rosac. India 2: 66.1995.

Shrubs, 1.5-2.5 m high. Leaves: elliptic-ovate, 3-5 x 1.5-3 cm, acute at base, short acuminate at apex, serrate at margin, glabrous; veins 8-10 pairs. Stipules oblong, 6-7 x 1-1.5 mm, serrate. Flowers 1.8-2 cm dia.; pedicel 3-4 cm long. Sepals oblong, 4-5 x 2-3 mm. Petals obovate, 0.8-1 x 1.1-1.2 cm, white. Fruits globular, 1-1.2 x 1-1.3 cm dia., depressed at apex, red.

Fl. & Fr.: June - September.

Rare (cultivated?); on rocky slopes. Mane, 3700 m, 27.08.2002, K. Chandan Sekar 100737.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Europe.

Fruits are edible.

5. *Rosa* L.

One hundred to one hundred and fifty species, distributed from N. temperate to tropical regions;

57 in India.

- 1a. Leaflets ovate-obovate 1. *R. hookeriana*
 b. Leaflets orbicular 2. *R. webbiana*

1. ***Rosa hookeriana*** Bertol., Misc. 24: 172-173, t. 1. 1863, *non* Wall., Num. List. No. 691. 1829, *non. nuda*; Ghora & Panigrahi, Rosac. India 2: 243. 1995. Cya Photo. 74

Shrubs, 1-2 m, high; branches prickly; prickles 4-8 mm long. Leaves imparipinnate, 3-8 cm long; leaflets 7-9, ovate-obovate, 1.3-2.1 x 0.9-1.5 cm, cuneate at base, obtuse at apex, glabrous to sparsely pubescent. Stipules 0.8-1.2 x 0.2-0.3 cm, acuminate, margin ciliate and glandular. Bracts 7-9 x 2-3.5 mm, foliaceous. Flowers 2-4.5 cm dia. Sepals lanceolate, 1.1-1.9 cm long, subserose at apex, margin serrate. Petals obovate, 1.8-2.2 x 0.8-1.4 cm, pink. Fruits ovoid, 1-1.5 cm long, fleshy, red.

Fl & Fr: June - September.

Common; on rocky slopes. Gechang, 3700 m, 11.07.2002, K. Chandra Sekar 100401.

Distrib: India: Himachal Pradesh.

Decoction of fruits is given to cure stomach pain.

2. ***Rosa webbiana*** Wall. & Royle, Illustr. Bot. Himal. 208, t. 42, f. 2. 1839; Aswal & Mehrotra, Fl. Lahaul-Spiti 223, 1994; Ghora & Panigrahi, Rosac. India 2: 264. 1995. Chermung Shureeli

Shrubs, 1-1.5 m high; branches prickly; prickles 3-7 mm long. Leaves imparipinnate, 3-7 cm long; leaflets 7-9, orbicular, 1-1.8 x 0.8-1.4 cm, slightly tapering at base, rounded at apex, serrate at margin, sparsely pubescent. Flowers 2-4 cm dia. Sepals lanceolate, 1-1.7 x 0.2-0.3 cm, slightly serrate at margin, glandular-pubescent outside, glabrous inside. Petals orbicular, 1.5-2 cm long, depressed at apex, pink. Fruits 1.2-1.4 cm long, globose, fleshy, red.

Fl & Fr: June - September.

Rare; on rocky slopes. Kaa, 3675 m, 12.07.2002, K. Chandra Sekar 100443.

Distrib: India: Himachal Pradesh, Jammu & Kashmir, Punjab and Uttarakhand; Afghanistan; China; England; Nepal; N. America; Pakistan; Turkey and U.S.S.R.

Fruits are edible.

6. *Sibbaldia* L.

About 22 species chiefly distributed in N. temperate regions; 12 in India.

Sibbaldia parviflora Willd. in Ges. Naturf. Fr. Neme Schr. 2: 125, t. 5, f. 2. 1799; Aswal & Mehrotra, Fl. Lahaul-Spiti 226, 1974; Dikshit & Panigrahi, Rosac. India 4: 258. 1998. Padam, Luma

Perennial herbs; rootstock prostrate. Stems ascending-erect, 15-22 cm high. Leaves trifoliate, 2-4 cm long; leaflets sessile, obovate or fan-shaped, 2-7-toothed at apex, densely tomentose. Flowers 5-7 mm dia.; pedicel 4-8 mm long. Episepals linear-lanceolate, acute. Sepals ovate, 1.2-2 mm long, acute. Petals spatulate 1.5-2.7 mm long, gnawed at apex, yellow.

Fl & Fr: June - September.

Scarce; on rocky slopes. Tariya to Pin Parvati, 4200 m, 24.07.2003, K. Chandru Sekar 103661.

Distrib: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia and Europe.

Juice of leaves mixed with mustard oil applied externally in joint pain.

18. SAXIFRAGACEAE

About 35 genera and ca 660 species, subcosmopolitan, especially in N. temperate & cold regions; 17 genera and 148 species in India.

- | | |
|--------------------------------|----------------------------|
| 1a. Leaves more than 4 cm long | 1. <i>Bergenia</i> |
| b. Leaves less than 4 cm long | 2. <i>Saxifraga</i> |

1. *Bergenia* Moench

Six to eight species chiefly distributed in temperate & subtemperate E. Asia; 3 in India

Bergenia stracheyi (Hook.f. & Thomson) Engl. in Bot. Zeit. 26: 842. 1868; Yeo in Kew Bull. 20: 128. 1966; Aswal & Mehrotra, Fl. Lahaul-Spiti 232. 1994. *Saxifraga stracheyi* Hook.f. & Thomson in J. Linn. Soc., London (Bot.) 2: 61. 1857; C.K. Clarke in Hook.f., Fl. Brit. India 2: 398. 1878.

Shulo Mendok, Shulo go Mendok Photo. 75

Perennials, 14-20 cm high. Leaves obovate to oblong obovate, 6-15 x 4-8 cm, cuneate at base, rounded at apex, crenate to dentate at margins, glabrous or sparsely ciliate. Scapes 10-18 cm long, glabrous to glandular villous. Flowers pink ringed. Sepals oblong, 5-7 mm long, obtuse, glabrous to pubescent. Petals 0.7-1 cm long; limb orbicular. Capsules 1-1.3 x 0.5-0.6 cm. Seeds elongated, 0.8-1 mm long, dark brown.

Fl. & Fr.: June - August.

Scarce; on moist rocky slopes. Larang La - Tariya, 4600 m, 06.08.2003, K. Chandru Sekar 103751.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; Pakistan and USSR

Incense of flowers is inhaled to cure asthma.

2. *Saxifraga* L.

About 140 species distributed in N. temperate regions; ca 50 in India.

- | | |
|-----------------------------------|--|
| 1a. Stolons present | 1. <i>S. flagellaris</i> |
| b. Stolons absent | 2 |
| 2a. Bulbils present in leaf-axils | 5. <i>S. tibetica</i> |
| b. Bulbils absent | 3 |
| 3a. Leaves entire | 3. <i>S. parnassifolia</i> |
| b. Leaves toothed | 4 |
| 4a. Flowers yellow or red | 4. <i>S. pseudo-pallida</i> var. <i>himalayensis</i> |
| b. Flowers white | 2. <i>S. pallida</i> |

1. *Saxifraga flagellaris* Willd. ex Sternb. Rev. Sax. 25, t. 6. 1810; C.B. Clarke in Hook.f., Fl. Brit. India 2: 397. 1878; Aswal & Mehrotra, Fl. Lahaul-Spiti 138. 1994.

Perennial herbs. Stolons 2-8 mm dia., glabrous. Stems erect, 8-12 cm high, sparsely glandular; leaves congested, basal, sessile, obovate to ovate-lanceolate, 0.8-1.2 cm long, glandular. Flowers 2-8; pedicels glandular. Sepals 4-6 mm long, free or adnate at base, acute. Petals broadly ovate or obovate, 0.7-1.4 cm long. Filaments as long as the sepals, glabrous. Capsules globose-ovoid.

It is a very variable species with a wide geographic range (Ghazanfar, 1977). Following subspecies occur in Pin Valley National Park.

- | | |
|-------------------------------------|-----------------------------------|
| 1a. Corolla campanulate | ii. subsp. <i>komarovii</i> |
| b. Corolla not campanulate | 2 |
| 2a. Stolons capillary, ca 2 mm dia. | iii. subsp. <i>stenophylla</i> |
| b. Stolons thick, ca 8 mm dia. | i. subsp. <i>crassiflagellata</i> |

i. subsp. ***crassiflagellata*** (Hulten in Sv. Bot. Tidskr. 58(1): 96. 1964; Aswal & Mehrotra, Fl. Lahaul-Spiti 237. 1994.

Fl. & Fr.: July - September.

Rare; on rocky slopes. Sanpat, 4350 m, 04.08.2002, K. Chandra Sekar 102869.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Baltistan and Pakistan.

ii. subsp. ***komarovii*** (A. Los.) Hulten in Sv. Bot. Tidskr. 58(1): 97. 1964; Aswal & Mehrotra, Fl. Lahaul-Spiti 237. 1994. *Saxifraga komarovii* A. Los. in Komarov, Fl. U.S.S.R. 9. Add. 8: 486-87. 1939. *Mentok Uerpo*

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Larjuk-Bhaba pass, 3800 m, 03.08.2002, K. Chandra Sekar 100592.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Afghanistan; China and Pakistan.

Extract of whole plant taken as a cure to cough.

iii. subsp. ***stenophylla*** (Royle) Hulten in Sv. Bot. Tidskr. 58(1): 94. 1964; Aswal & Mehrotra, Fl. Lahaul-Spiti 238. 1994. *Saxifraga stenophylla* Royle, Illustr. Bot. Himal. 227, t. 50, f. 1. 1835. **Photo. 76**

Fl. & Fr.: July - September.

Occasional; on moist rocky slopes. Thango-kilung, 4200 m, 31.7.2003, K. Chandra Sekar 103707.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Pakistan.

2. *Saxifraga pallida* Wall. ex Seringe in DC., Prodr. 4: 38. 1830; Aswal & Mehrotra, Fl. Lahaul-Spiti 240. 1994.

Annuals or biennials. Stems erect or decumbent, 12-16 cm high, glabrous and sparsely pubescent upwards. Radical leaves long-petioled, ovate-lanceolate, 0.7-1.2 x 0.4-0.6 cm, dentate-crenate, glabrous; cauline ones sessile, similar in shape to radical leaves but smaller. Flowers solitary or in few-flowered corymbs, white. Sepals elliptic. Capsules ovoid to globose.

Fl. & Fr.: June - August.

Rare; along the stream beds. Mud Tharbile, 4000 m, 1.8.2002, *K. Chandra Sekar* 102804.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Nepal and Pakistan.

3. *Saxifraga parnassifolia* D. Don in Trans. Linn. Soc. London 13: 405, 1821; Aswal & Mehrotra, Fl. Lahaul-Spiti 240, 1994. *Sorsa mendak*

Annuals. Stems erect, 9-13 cm high, glandular-hairy. Basal leaves long petioled, broadly ovate, 1.8-2.2 cm long, subcordate at base, obtuse at apex, glabrous to sparsely villous; cauline ones ovate, amplexicaul, glandular-ciliate. Inflorescence a corymb. Bracts ovate-lanceolate, glandular-ciliate. Flowers yellow. Sepals ovate, 3-4 mm long, obtuse, glandular. Petals broadly oblong, 5-6 mm long, narrow at base. Carpels connate at base; style 2-3 mm long.

Fl. & Fr.: July - September.

Rare; on rocky slopes. Mud, 3750 m, 02.08.2002, *K. Chandra Sekar* 102842.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Nepal and Pakistan.

Decoction of whole plant given in fever.

4. *Saxifraga pseudo-pallida* Engl. & Irmsch. var. *bellidifolia* Engl. & Irmsch. in Engl. Jahrb. 53: 117, 1916; Aswal & Mehrotra, Fl. Lahaul-Spiti 241, 1994. **Photo. 77**

Annuals or biennials, 8-10 cm high. Basal leaves few, ovate, 0.8-1 cm long, entire to crenate, sparsely villous, petiole 0.8-1 cm long; cauline ones sessile, lanceolate. Flowers 1 or 2, bracteate, reddish. Bracts linear, 3-5 mm long, entire. Sepals ovate, 3-4 mm long, connate at base, subacute at apex, glabrous. Petals spatulate, as long as sepals. Capsules 5-8 mm long, beaked. Seeds striated, tuberculate on ridges.

Fl. & Fr.: July - September.

Scarce; on moist slopes. Chhohem, 4150 m, 12.07.2003, *K. Chandra Sekar* 103216.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Pakistan.

Note. *Saxifraga pseudo-pallida* var. *bellidifolia* is distinguished from the typical variety *pseudo-pallida*, by the length of the petals, which are above the length of sepals.

5. *Saxifraga sibirica* L., Sp. Pl. ed. 2, 577, 1762; Aswal & Mehrotra, Fl. Lahaul-Spiti 242, 1994.

Lasvo karmo Mentok **Photo. 78**

Annuals, 16-22 cm high. Basal leaves reniform, 0.5-3 cm dia., 5-7-lobed; petioles 2.5-3.5 cm long, glandular with small bulbils in the leaf axils, upper most cauline ones subsessile, ovate, 3-lobed, sparsely pubescent to glabrous. Flowers 1-6; pedicel densely villous. Bracts ovate, ca 5 mm long. Sepals oblong, 3-4 mm long, acute, glandular-pubescent. Petals obovate, 0.8-1.2 cm long, cuneate at base, 3-7-nerved. Seeds oblong; testa minutely reticulate.

Fl. & Fr.: July - September.

Scarce; on moist stream beds. Thango-Kilung, 4100 m, 31.07.2003, *K. Chandra Sekar* 103704.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia and Europe.

Juice of whole plant given with curd to cure dysentery.

19. PARNASSIACEAE

Single genus with about 15 species mainly distributed in N. hemisphere; 13 species in India.

Parnassia L.

Parnassia laxmanni Pall. ex Schult., Syst. Veg. 6: 696. 1820; Aswal & Mehrotra, Fl. Lahaul-Spiti 138. 1994.

Annuals. Stems erect or ascending, 14-18 cm high. Leaves ovate or ovate-oblong, 1.3-3 x 1.2-2.6 cm, cordate at base, obtuse at apex. Scapes monophyllous in the lower half. Flowers 1.1-1.4 cm dia. Calyx tube 1.5-2 mm long; lobes ovate lanceolate, 3-5 x 2-2.5 mm, acute. Petals spatulate, 0.8-1 x 0.4-0.5 cm, obtuse-acute, entire or slightly fimbriate, 5-nerved. Staminalodes broadly dilated upwards, 3-lobed. Capsules obconic below, subhemispheric above.

Fl. & Fr.: June - August.

Rare; on moist slopes. Mud-Tharbik, 4000 m, 01.08.2002, K. Chandra Sekar 102819.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan; China; C. Asia; Mongolia; Pakistan and Siberia.

20. GROSSULARIACEAE

Twenty four genera and ca 330 species, cosmopolitan; 1 genus with 9 species in India.

Ribes L.

About 150 species chiefly in temperate N. hemisphere; 9 in India.

Ribes orientale Desf., Hist. Arb. 2: 88. 1809; Aswal & Mehrotra, Fl. Lahaul-Spiti 245. 1994. *Jasmo* Photo. 79

Shrubs, polygamodioecious, 50-60 cm high. Twigs pubescent, glandular and sticky. Leaves orbicular, 1.3 x 2-4.8 cm, obscurely 3-5-lobed; lobes inciso-crenate, obtuse, dorsally covered with stiff glandular hairs; petiole 0.7-2.8 cm long. Inflorescence a raceme; male racemes 2-5 cm long, 15-30 flowered; female racemes 1-2 cm long, 5-15-flowered. Bracts linear-lanceolate, 2-3 mm long. Flowers 4-5 mm long, greenish or yellowish. Calyx tube 1.5-2 mm long, glandular; lobes ovate. Petals spatulate. Berries 4-6 mm dia., deep red.

Fl. & Fr.: June - September.

Occasional; on moist slopes. Chhohem, 4010 m, 12.07.2003, K. Chandra Sekar 103210.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; SW Asia to Greece.

Juice of fruits taken in menstrual complaints.

21. CRASSULACEAE

Thirty three genera and about 1100 species, almost cosmopolitan; 10 genera and 71 species in India.

- | | |
|---|-------------------------|
| 1a. Ovary stipitate, attenuate at the base | 1. Hylotelephium |
| b. Ovary sessile, not attenuate at the base | 2 |
| 2a. Radical leaves scaly | 2. Rhodiola |
| b. Radical leaves not scaly | 3. Rosularia |

1. Hylotelephium Ohba

Eight species distributed in N. temperate regions; 1 in India.

Hylotelephium ewersii (Ledeb.) Ohba in Bot. Mag. Tokyo 90: 50. 1977; Arwal & Mehrotra, Fl. Jammu-Spiti 248. 1994. *Sedum ewersii* Ledeb., Icon. Pl. Fl. Ross. 1: 14, t. 58. 1829; C.B. Clarke in Hook. f., Fl. Brit. India 2: 421. 1878.

Photo. 80

Perennials, 21-30 cm high; rhizomes woody. Leaves opposite, broadly ovate or suborbicular, 1.5-2 cm long, cordate at base, bluntly short-acuminate at apex, obscurely denticulate at margin, grey; the lower broadly elliptic. Inflorescence a compound corymb, 2-3 cm dia. Calyx with 5-lanceolate lobes; lobes 1-2 mm long. Petals 5, elliptic lanceolate, 4-5 mm long, acute, pink. Stamens 10, slightly longer than petals, with blackish anthers. Follicles erect, 3-4 mm long, with short and reflexed beak. Seeds lanceolate, 0.2-0.5 mm long, brown.

Fl. & Fr.: July - August.

Rare; on rocky slopes, Tariya - Mud, 4000 m, 07.08.2003, K. Chandra Sekar 103769.

Distrib.: India; Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Altai; Mongolia; Nepal; Pakistan; Turkestan and U.S.S.R.

2. Rhodiola L.

About 50 species chiefly distributed in N. temperate regions; 12 in India.

- | | |
|--|----------------------------|
| 1a. Upper part of rhizomes densely surrounded by tufts of the former years flowering stems | 5. <i>R. tibetica</i> |
| b. Upper part of rhizomes usually lacking the remains of the former years old flowering stems, if present, then not tufted | 2 |
| 2a. Inflorescence ebracteate; flowers sessile | 3. <i>R. heterodonta</i> |
| b. Inflorescence bracteate; flowers subsessile to pedicellate | 3 |
| 3a. Ovary straight and not conspicuously out-curved in the upper part | 4 |
| b. Ovary straight but abruptly and conspicuously out-curved in the upper part | 1. <i>R. hupharenoides</i> |
| 4a. Leaves broadly elliptic, crenulate along the margins | 2. <i>R. crenulata</i> |
| b. Leaves narrowly obovate to narrowly elliptic, remotely denticulate along the margins | 4. <i>R. imbricata</i> |

1. *Rhodiola bupleuroides* (Wall. ex Hook.f. & Thomson) Fu in Acta. Phyt. Sin. Addit. 1: 124. 1965; Aswal & Mehrotra, Fl. Lahaul-Spiti 249. 1994. *Sedum bupleuroides* Wall. ex Hook.f. & Thomson in J. Linn. Soc., London (Bot.) 2: 98. 1858; C.B. Clarke in Hook.f., Fl. Brit. India 2: 418. 1878. *Sedum elongatum* Wall. ex Hook.f. & Thomson in J. Linn. Soc., London (Bot.) 2: 98. 1858; C.B. Clarke in Hook.f., Fl. Brit. India 2: 419. 1878. *Dogra Mentbok*

Perennial herbs, 25-40 cm high; rhizomes thick. Leaves alternate, broadly elliptic, 0.8-3 x 0.6-2 cm, attenuate, obtuse, irregularly serrate along the margins. Bracts similar to the cauline leaves in shape but smaller. Flowers dioecious, 5 merous, 4-6 mm dia. Sepals 1.5-3.7 mm long, glabrous, purple red. Petals dark purplish-red; in male obovate to narrowly obovate, 2.8-3.2 x 1.2-1.5 mm, shortly mucronulate at apex, entire along the margins; in female narrowly oblong-ovate, 1.5-3 x 0.5-0.7 mm, entire. Fruits 5-12 mm long, brown. Seeds 1.5-1.8 mm long, reddish brown.

Fl. & Fr.: June - August.

Scarce; among the rock-crevices. Chhohem, 4100 m, 13.7.2003, *K. Chandra Sekar* 103246.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Bhutan; Burma; China; Nepal and Pakistan.

Juice of rhizomes given as a cure to whooping cough.

2. *Rhodiola crenulata* (Hook.f. & Thomson) Ohba in J. Jap. Bot. 51: 386. 1976; Aswal & Mehrotra, Fl. Lahaul-Spiti 250. 1994. *Sedum crenulatum* Hook.f. & Thomson in J. Linn. Soc., London (Bot.) 2: 96. 1858; C.B. Clarke in Hook.f., Fl. Brit. India 2: 417. 1878. *Kharak Mentbok* Photo. 81

Perennial herbs, 16-20 cm high; rhizomes very thick, subcylindrical, 2-2.5 cm dia. Flowering stems simple, fastigiate, 13-16 cm long, robust, glabrous. Leaves alternate, broadly elliptic, 1-3 x 0.5-1.3 cm, rounded at the apex, minutely crenulate along margin. Bracts oblong-elliptic, minutely crenulate along the margins. Flowers dioecious. Sepals 4-6 mm long, lobes obtuse, entire. Follicles erect, 12-15 mm long, red to brown. Seeds 2-2.2 mm long, brown.

Fl. & Fr.: June - August.

Scarce; in rock-crevices. Larang La, 5010 m 4.8.2003. *K. Chandra Sekar* 103740.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Bhutan; China; Nepal and Pakistan.

Juice of fresh rhizomes is given in stomach pain and decoction of tubers is taken to cure cough and cold.

3. *Rhodiola heterodonta* (Hook.f. & Thomson) A. Bor. in Komarov, Fl. U.S.S.R. 9: 32. 1939; Aswal & Mehrotra, Fl. Lahaul-Spiti 250. 1994. *Sedum heterodontum* Hook.f. & Thomson in J. Linn. Soc. London (Bot.) 2: 95. 1858; C.B. Clarke in Hook.f., Fl. Brit. India 2: 417. 1878. *Yulo* Photo. 82

Perennial herbs; rhizomes very thick, subcylindrical to narrowly ovoid, 2-3 cm dia. Stems erect, 23-36 cm high. Leaves remotely arranged, alternate, sessile, broadly triangular-ovate, 1.2-2.3 x 1-1.5 cm, obtuse, repandous to nearly entire. Sepals 2-4.5 mm long, glabrous, greenish. Petals narrowly

rhombic-elliptic to oblong, 1.5-3.5 mm long, glabrous. Follicles 6-8 mm long, conspicuously out curved in the upper ventral side, brown. Seeds nearly ellipsoid, 1.2-1.5 mm long, rounded at apex, brown.

Fl. & Fr.: June - August.

Rare; in rock-crevices. Shrim, 4000 m, 20.7.2002, *K. Chandu Sekar* 100492.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China; Iran; Mongolia; Nepal; Pakistan and U.S.S.R.

Juice of rhizomes is taken to cure diarrhoea.

4. *Rhodiola imbricata* Edgew. in Trans. Linn. Soc. London 20: 47. 1846; Singh in J. Econ. Taxon. Bot. 3: 625. 1982; Aswal & Mehrotra, Fl. Lahaul-Spiti 251. 1994. *Sedum imbricatum* (Edgew.) Walp. in Ann. Bot. Syst. 1: 325. 1848; Ohba in Ohashi, Fl. East Himal. 3: 306. 1975. *S. imbricatum* Hook.f. & Thomson in J. Linn. Soc., London (Bot.) 2: 101. 1858. *Tibetum*

Perennial herbs; rhizomes very thick, subcylindrical to ovoid, 2.5-3.2 cm dia. Flowering stems 3-5, erect, 10-20 cm long. Leaves alternate, narrowly obovate to elliptic, 2-3 x 0.3-0.6 cm, acute, remotely denticulate along the margins. Bracts narrowly elliptic, 7-10 mm long, entire. Sepals 4-6 mm long; the lobes linear-ovate, 3-4 x 0.8-1 mm. Petals oblong-obovate, 5-6.5 mm long, entire. Follicles erect, 8-12 mm long, brown. Seeds ellipsoid, 1-1.5 mm long, reddish brown.

Fl. & Fr.: June - August.

Scarce; in rock-crevices. Near Pin-Parvati Pass, 5100 m, 22.07.2003, *K. Chandu Sekar* 103634.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Nepal and Pakistan.

Juice of whole plant (including rhizomes) is given to cure tuberculosis.

5. *Rhodiola tibetica* (Hook.f. & Thomson) Fu in Act. Phyt. Sin. Addit. 1: 121. 1965; Ohba in Journ. Fac. Sci. Univ. Tokyo 3(12): 190. 1978. Singh & U.C. Bhattach. in J. Econ. Taxon. Bot. 3: 303. 1982; Aswal & Mehrotra, Fl. Lahaul-Spiti 252. 1994. *Sedum tibeticum* Hook.f. & Thomson in J. Linn. Soc., London (Bot.) 2: 96. 1858; C.B. Clarke in Hook.f., Fl. Brit. India 2: 418. 1878. *Logani* **Photo. 83**

Perennial herbs; rootstock 1.5-3 cm thick, loosely covered with scaly leaves. Flowering stems 2-8, 8-25 cm high, fastigiated. Leaves sessile, alternate, loosely imbricate, lanceolate-oblong, 0.4-1.3 x 0.15-0.75 cm, rounded at base, acute to obtuse at apex. Inflorescence a terminal corymb, 1-3.5 cm dia.; 2-20-flowered. Flowers 4-5 mm dia., dioecious, 5-merous, reddish. Sepals 2-4.5 mm long, green; lobes oblong to triangular. Petals lanceolate, 2.8-5.5 mm, acute, pink-red. Follicles erect, 5-8 mm long, brown. Seeds many, 1.8-2.5 mm long, brown.

Fl. & Fr.: June - August.

Occasional; on stony alpine slopes. Tariya to Pin-Parvati Pass, 4200 m, 24.07.2003. *K. Chandu Sekar* 103663.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China and Pakistan.

Decoction of leaves is taken to cure cough and cold.

3. Rosularia (DC.) Scapf

Twenty seven species distributed in N. Africa & Europe to C. Asia; ca 5 in India.

Rosularia alpestris (Kar. & Kir.) A. Bor. in Komarov, Fl. U.S.S.R. 9: 129. 1939; Jansson in Jansson & Rechinger, Fl. Iran, 72: 26. 1970; Ohba in J. Jap. Bot. 52: 2. 1977; Aswal & Mehrotra, Fl. Lahaul Spiti 254. 1994. *Umbelliferus alpestris* Kar. & Kir. in Bull. Soc. Nat. Mosc. 15: 354. 1842. *Sempervivum acuminatum* Decne. in Jacquem., Voy. Inde t. 74, p. 1. 1844; C.B. Clarke in Hook.f., Fl. Brit. India 2: 422. 1878. *Sedum acuminatum* (Decne.) R. Hamet in Candollea 4: 21. 1929. *Sempervivella acuminata* (Decne.) Berger in Engl. & Prantl, Pflanzenfam. ed. 2. 18: 467. 1930. *Tsangji Taboo* **Photo.** 84

Perennials; roots globose-tuberous. Stems arising from axils of rosulate leaves, erect or ascending, 6-11 cm high, leafy. Leaves fleshy, flat; basal leaves oblong-lanceolate, 1.5-2.5 x 0.3-0.6 cm, acuminate; cauline ones sessile, oblong or oblong-lanceolate, acuminate. Sepals lanceolate, 5-7 mm long, acute, glabrous, 3-nerved. Petals lanceolate, 6-9 mm long, connate at base, acute, recurved and divergent at the apex, pink. Follicles convergent; beak 0.8-1 mm long, glabrous. Seeds ovoid, 0.6-0.7 mm long, brown.

Fl. & Fr.: June - August.

Common; in rock-crevices and stony glacial moraines. Debsa, 4050 m, 24.07.2002, K. Chandra Sekar 100517.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; Nepal; Pakistan and U.S.S.R.

22. ONAGRACEAE

Eighteen genera and about 650 species, cosmopolitan especially in temperate and warm America; 6 genera and 49 species in India.

- | | |
|--------------------------------------|---------------------|
| 1a. Capsules conspicuously ribbed | 2. Oenothera |
| b. Capsules not conspicuously ribbed | 1. Epilobium |

1. Epilobium L.

About 165 species chiefly in temperate regions; ca 30 in India.

- | | |
|--|---|
| 1a. Leaves alternate or spirally arranged; calyx tube absent; the style deflexed | 2 |
| b. Leaves opposite or verticillate, at least below; calyx tube present; the style very rarely reflexed | 3 |
| 2a. Plants above 60 cm high; inflorescence not leafy, more than 18-flowered | 1. <i>E. angustifolium</i> |
| b. Plants below 60 cm high; inflorescence leafy, less than 18-flowered | 3. <i>E. latifolium</i> |
| 3a. Stigma distinctly 4-lobed | 2. <i>E. hirsutum</i> |
| b. Stigma not distinctly 4-lobed | 4 |
| 4a. Plants 6-12 cm high, caespitose | 4. <i>E. kishinouyei</i> |
| b. Plants 30-37 cm high, ascending or suberect | 5. <i>E. royleanum</i> forma <i>glabrum</i> |

1. ***Epilobium angustifolium*** L., Sp. Pl. 347. 1753; C.B. Clarke in Hook.f., Fl. Brit. India 2: 582, 1879; Aswal & Mehrotra, Fl. Lahaul-Spiti 263. 1994. *Mendok, Juchikpa* Photo. 85

Perennial herbs; roots woody. Stems simple, 0.6-1 m high. Leaves spirally arranged, attenuate to short petiolate, narrowly lanceolate, 2.5-12 x 0.5-3 cm, acute, obscurely denticulate, glabrous. Racemes 23-28-flowered. Sepals 9-13 x 1.6-2 mm, arule, canescent. Petals obovate, 1.2-1.5 x 0.7-0.8 mm, entire, pink. Style 1-1.7 cm long; stigma deeply 4-lobed and recurved, exerted beyond anthers. Capsules 4-7 cm long. Seeds 1-1.2 x 0.3-0.4 mm, irregularly foveolate; coma 0.8-1 cm long, white.

Fl. & Fr.: July - September.

Rare; on rocky slopes. Kilung, 4000 m, 02.08.2003, K. Chandra Sekar 103724.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia to Turkey; Europe to North Africa and North America to Mexico.

Flowers are offered to God.

2. ***Epilobium hirsutum*** L., Sp. Pl. 347. 1753; C.B. Clarke in Hook.f., Fl. Brit. India 2: 583. 1879. *Epilobium hirsutum* L., var. *sericum* (Benth. ex Wall.) C.B. Clarke in Hook.f., Fl. Brit. India 2: 584. 1879. *Epilobium hirsutum* L. var. *lactum* (Wall.) C.B. Clarke in Hook.f., Fl. Brit. India 2: 528. 1879.

Perennial herbs. Stems well-branched, 45-60 cm high, covered throughout with spreading long villous hairs. Leaves sessile and clasping, oblong-lanceolate, 2-7 x 0.5-3 cm, subcuneate at base, acute at apex, villous-pubescent. Sepals 6-9 x 2-2.6 mm, apiculate, densely pubescent. Petals 0.6-1.6 x 0.6-1 cm, deeply notched, bright rose-purple. Style 0.5-1 cm long, erect; stigma deeply 4-lobed and recurved. Capsules 3-10 cm long, villous. Seeds 0.8-1.2 mm long; coma 5-7 mm long, dull white.

Fl. & Fr.: July - September.

Rare; on rocky slopes. Mani-Lansa pass, 3600 m, 30.08.2002, K. Chandra Sekar 100787.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia, Africa, Eurasia and N. America.

3. ***Epilobium latifolium*** L., Sp. Pl. 347. 1753; C.B. Clarke in Hook.f., Fl. Brit. India 2: 583. 1879; Aswal & Mehrotra, Fl. Lahaul-Spiti 265. 1994. *Chamaenerion latifolium* (L.) Fr. & Lange in Fl. Dan. Fasc. 49, t. 7. 1877.

Perennial herbs, forming large colonies by sprouting from woody root-stock. Stems 20-40 cm high. Leaves spirally arranged, elliptic to lanceolate-elliptic, 1-4.5 x 0.5-1.5 cm, glabrous. Flowers strongly recurved before anthesis. Sepals 1.1-1.5 x 0.3-0.32 cm, acute. Petals 1.1-2.6 x 0.6-1.9 cm, caudate, bright rose purple to pale pink. Style 0.35-1 cm long, sharply deflexed; stigma deeply 4-lobed and recurved. Capsules 4.5-7 cm long. Seeds 1.3-2 mm long, acuminate.

- | | |
|---|-----------------------------|
| 1a. Stems densely strigose; style hairy near the base | ii. subsp. <i>speciosum</i> |
| 1b. Stems glabrescent; style glabrous | i. subsp. <i>latifolium</i> |
| | Photo. 86 |

Fl. & Fr.: July - September.

Frequent; on rocky slopes. Tatiya, 4000 m, 10.08.2002, K. Chandra Sekar 100646.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia, America and Europe.

ii. subsp. **speciosum** (Decne.) Raven in Bull. Brit. Mus. Nat. Hist. Bot. 2: 349, 1962; Aswal & Mehrotra, Fl. Lahaul-Spiti 265, 1994. *Epilobium speciosum* Decne. in Jacquem., Voy. Inde 4: 57, t. 69, 1844. *Gatlik Pa, Chashek / Anbu Mentok.*

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Chhohem, 4350 m, 14.07.2003, K. Chandra Sekar 103293.

Distrib: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Nepal and Pakistan.

Extract of plant is given to cure cough and cold.

4. *Epilobium leiophyllum* Hausskn. in Oestert. Bot. Z. 29: 52, 1879; Raven in Bull. Brit. Mus. Nat. Hist. Bot. 2: 376, 1962; Aswal & Mehrotra, Fl. Lahaul-Spiti 266, 1994.

Perennial herbs, delicate, low-growing. Stems branched from the base, 6-12 cm high, sparsely strigillose, with indistinct lines decurrent from the margins of the petioles. Leaves sessile, elliptic to sub-ovate, 1-2 x 0.5-1 cm, rounded at both ends, indistinctly serrulate, subglabrous, with scattered hairs on the margins. Sepals 2.8-3.3 x 0.8-1 mm. Petals 3-4.5 mm long, purplish-rose. Style 1.2-1.8 mm long; stigma clavate. Capsules 3-4.5 cm long. Seeds obovoid, 0.8-1 mm long; coma 4-5 mm long, white.

Fl. & Fr.: July - August.

Scarce; on moist slopes. Chhohem, 4100 m, 13.07.2003, K. Chandra Sekar 103256.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan.

5. *Epilobium royleanum* Hausskn. forma **glabrum** Raven in Bull. Brit. Mus. Nat. Hist. Bot. 2: 360, 1962; Huch & Raven in Nasir & Ali, Fl. Pakistan 139: 25, 1981. **Fig. 9**

Perennial herbs. Stems 30-37 cm high, glabrous except for distinct strigillose lines decurrent from the margins of the petiole. Leaves petioled, lanceolate-ovate, 2-5 x 1-2.8 cm, acute to subacuminate, serrulate, strigillose, subcoriaceous; petiole 2-8 mm long. Sepals 3-4.2 x 1.2-1.5 mm, pubescent. Petals 4-6.5 mm long, rose-purple. Style 3-4 mm long; stigma obovoid, capitate. Capsules 4-6 cm long. Seeds obovoid, 0.7-1.2 mm long, papillose; coma 4-5.5 mm long, dull white.

Fl. & Fr.: June - August.

Occasional; on moist slopes. Saguan - Gechang, 3750 m, 09.07.2003, K. Chandra Sekar 101166.

Distrib: India: Himachal Pradesh and Jammu & Kashmir; Pakistan.

Note: This forma is distinguished from the other format by the glabrous stem except for distinct strigillose lines decurrent from the margins of the petiole.

2. *Oenothera* L.

One hundred and twenty four species, chiefly in America; 5 in India.

Oenothera rosea Soland. in Ait., Hort. Kew. 2: 3, 1789; C.B. Clarke in Hook.f., Fl. Brit. India 2: 582, 1879. *Hartmannia rosea* (L. Herit. ex Ait.) G. Don in Sweet, Hort. Brit. ed. 3, 236, 1839.

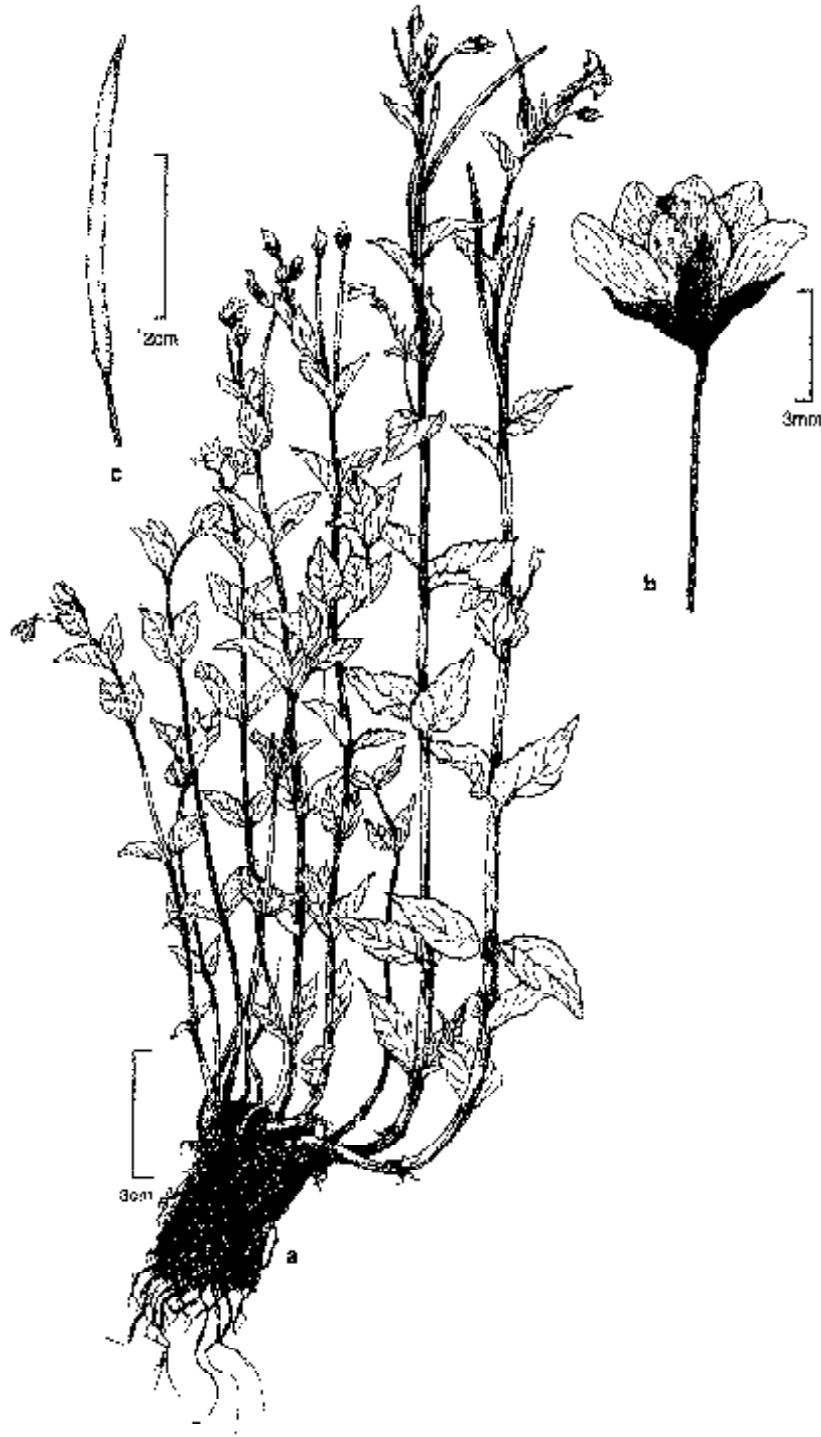


Fig. 9. *Epilobium royleanum* Hooker, forma *glabrum* Raven. a. Habit, b. Flower, c. Capsule

Perennial herbs. Stems 30-60 cm high. Leaves narrowly ovate, 2-3.2 x 1.2 cm, subentire; petiole 0.2 - 1.5 cm long. Sepals 0.7-1.2 cm long. Petals obovate, 0.4-1.1 cm long, rose purple. Style 0.8-1.2 cm long; stigma surrounded by the anthers. Capsules clavate, 1-2.5 cm long. Seeds in several indistinct rows in each locule, oblong-obovoid, 0.7-0.8 mm long, finely granular.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Mane-Jarsa Pass, 3800 m, 30.08.2002, *K. Chandru Sekar* 100783.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Meghalaya, Sikkim, Uttarakhand and Uttar Pradesh; Throughout the warmer regions of the world.

23. APIACEAE

About 446 genera and ca 3540 species, cosmopolitan especially in North temperate and tropical regions; 72 genera and 288 species in India.

- | | |
|---|-------------------------|
| 1a. Fruits with both primary and secondary ribs | 2 |
| b. Fruits with only primary ribs evident, secondary ribs lacking | 3 |
| 2a. Fruits densely covered by bristles | 11. <i>Torilis</i> |
| b. Fruits glabrous | 4. <i>Coriandrum</i> |
| 3a. Fruits terete or compressed laterally | 4 |
| b. Fruits compressed or strongly flattened dorsally, some or all ribs winged | 6 |
| 4a. Fruits elongate, linear to oblong and at least twice as long as broad | 5 |
| b. Fruits oblong to globose or elliptic, less than twice as long as broad | 2. <i>Carum</i> |
| 5a. Leaves pinnately, ternate-pinnately or ternately divided to decompose | 3. <i>Chaerophyllum</i> |
| b. Leaves all simple and entire | 1. <i>Bupleurum</i> |
| 6a. Fruits with lateral and at least some dorsal ribs equally or unequally winged | 7 |
| b. Fruits with lateral ribs not winged, dorsal ribs low, filiform or obsolete | 9 |
| 7a. Plants distinctly caulescent, usually with cauline leaves, and bearing only evidently compound umbels | 8 |
| b. Plants not distinctly caulescent, the rays appearing like peduncles bearing simple umbels | 8. <i>Pleurospermum</i> |
| 8a. Calyx teeth minute or obsolete; involucre usually inconspicuous or lacking | 7. <i>Ligusticum</i> |
| b. Calyx teeth usually prominent; involucre prominent | 9. <i>Selinum</i> |
| 9a. Stems reddish; vittae not visible on dorsal or on commissural surfaces of fruit | 5. <i>Ferula</i> |
| b. Stems greenish; vittae clearly visible on dorsal surface of fruit, and usually also on commissural surface | 10 |
| 10a. Roots tuberous | 10. <i>Scmnovia</i> |
| b. Roots fibrous or thickened, not tuberous | 6. <i>Heracleum</i> |

1. *Bupleurum* L.

About 180 species chiefly in Eurasia, N. America and S. Africa; 27 in India.

***Bupleurum falcatum* L.**, Sp. Pl. 237, 1753; C.B. Clarke in Hook.f., Fl. Brit. India 2: 676, 1879; Mukh. & Constance, Umbell. India 61, 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 277, 1994.

Manliak Shokho

Perennial herbs, base woody. Stems 40-65 cm high. Basal leaves lanceolate, 4-15 x 0.25-0.8 cm, lower narrowed into a petiole, acute, 7-veined; middle and upper leaves linear to lanceolate, falcate, gradually shorter, base slightly amplexicaul, acuminate, 7-9-veined. Umbels terminal and lateral. Rays 5-8. Involucrel of 5 or 6 bracteoles; bracteoles linear-lanceolate, 1-3 mm long, acute, 3-veined. Flowers yellow. Petals ovate to obovate. Fruits oblong to oblong-ovoid, 2.5-5.5 x 1-1.5 mm; furrows 3-veinate.

Fl. & Fr.: July-September.

Common; on rocky slopes. Chhohem, 4100 m, 13.07.2003, K. Chandra Sekar 103270.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia and Europe.

2. *Carum* L.

About 30 species distributed in temperate and warm regions; 3 in India.

***Carum carvi* L.**, Sp. Pl. 260, 1753; C.B. Clarke in Hook.f., Fl. Brit. India 2: 680, 1879; Mukh. & Constance, Umbell. India 118, 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 281, 1994. *Mara*

Perennial herbs; roots fusiform, elongated. Stems erect, 40-70 cm high. Leaves bipinnatisect, 3-4.8 cm long; segments filiform to lanceolate; lower leaves petioled, upper ones sessile; sheathing at bases; sheath margin white, membranous. Umbels compound, lax, terminal and lateral. Rays 5-9, unequal. Flowers white or white-redish. Calyx teeth obscure. Fruits ovoid to oblong, 3-4 mm long, ridges prominent and obtuse; furrows 1-veinate, yellowish brown; pedicels very unequal.

Fl. & Fr.: June-September.

Occasional; on rocky slopes. Gechaag, 3730 m, 16.07.2002, K. Chandra Sekar 100469.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia, Europe and N. Africa.

3. *Chaerophyllum* L.

About 35 species distributed in N. temperate regions; 5 in India.

- | | |
|---|-------------------------|
| 1a. Leaflets oblong lanceolate | <i>2. C. reflexum</i> |
| b. Leaflets linear-lanceolate or lanceolate | 2 |
| 2a. Leaves 2 or 3-pinnate; leaflets finely divided | <i>3. C. villosum</i> |
| b. Leaves 1 or 2-pinnate; leaflets not finely divided | <i>1. C. acuminatum</i> |

1. *Chaerophyllum acuminatum* Lindl. in Royle, Illustr. Bot. Hortul. 232, 1835; C.B. Clarke in Hook.f., Fl. Brit. India 2: 691, 1879; Mukh. & Constance, Umbell. India 41, 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 282, 1994.

Annuals; roots fusiform. Stems erect, 30-50 cm high. Leaves ovate, 3.5-18 x 2.5-14 cm, 1 or 2-pinnate; pinnae linear-lanceolate, margin regularly serrate. Rays 7-10, unequal. Involucre of 4-6 bracteoles; bracteoles lanceolate, acuminate, white hairs at margins. Petals obovate, white. Fruits 6-8 x 1.5-1 mm, constricted into a very short neck at apex, ridges conspicuous; furrows 1-vittate; inner seed face deeply sulcate.

Fl. & Fr.: June-September.

Rare; on moist slopes. Mud-Larang La, 4200 m, 18.08.2002, K. Chandra Sekar 102894.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan.

2. *Chaerophyllum reflexum* Lindl. in Royle, *Illustr. Bot. Himal.* 233.1835; C.B. Clarke in Hook.f., *Fl. Brit. India* 2: 691.1879; Mukh. & Constance, *Umbell. India* 42.1993; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 282.1994.

Annuals; roots elongated. Stems erect 56-64 cm high, glabrous to sparsely hairy; hairs deflexed, white. Leaves ovate, 4-15 x 3-10.5 cm, bipinnate; leaflets oblong to lanceolate, glabrous to pubescent. Rays 6-12. Involucre of 5-8 lanceolate bracteoles. Umbellets with 1-7 perfect flowers and several staminate flowers. Petals obovate, white. Fruits linearly oblong to fusiform, 0.6-1 x 0.2-0.3 cm, narrowed towards the apex, ridges prominent; furrows 1-vittate; inner seed face sulcate.

Fl. & Fr.: June-September.

Rare; on moist slopes. Mud-Larang La, 3800 m, 18.08.2002, K. Chandra Sekar 102895.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan and Pakistan.

3. *Chaerophyllum villosum* Wall. ex DC., *Prodr.* 4: 225.1830; C.B. Clarke in Hook.f., *Fl. Brit. India* 2: 690.1879; Mukh. & Constance, *Umbell. India* 43.1993; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 282.1994.

Photo. 87

Annuals; roots elongated, fusiform. Stems erect, 40-60 cm high, pubescent with deflexed white hairs. Leaves ovate, 10-18 x 2-12 cm, 2 or 3-pinnate, pubescent; leaflets lanceolate, 2-5 x 2-2.5 mm, sparsely hispid to glabrous; petiole 2-8 cm long. Rays 6-10, glabrous to pubescent. Involucre of 3-6 linear lanceolate bracteoles, white ciliate at margins. Petals obovate, white. Fruits linear-oblong, 6-9 x 1.5-2.2 mm, narrowed towards the apex, ridges conspicuous; furrows 1-vittate; inner seed face deeply sulcate.

Fl. & Fr.: June-September.

Scarce; on moist slopes. Mud-Larang La, 3900 m, 19.08.2002, K. Chandra Sekar 102909.

Distrib.: India: Afghanistan, Himachal Pradesh, Jammu & Kashmir, Sikkim, Meghalaya, Uttarakhand, Uttar Pradesh and West Bengal; Bhutan; Nepal and Pakistan.

4. *Coriandrum* L.

Three species chiefly in S.W. Asia; 1 in India.

Coriandrum sativum L., *Sp. Pl.* 256.1753; C.B. Clarke in Hook.f., *Fl. Brit. India* 2: 717. 1879; Mukh. & Constance, *Umbell. India* 43.1993; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 283.1994. *Ala, Husk*

Annuals. Stems erect, 30-40 cm high. Basal leaves ovate, 3-15 x 2-9 cm, pinnate; leaflets 1-2 x 0.5-1 cm; cauline ones with pinnately decomposed, linear to filiform, 0.2-1.3 x 0.4-0.5 cm, ultimate divisions

obuse. Rays 3-8, 1-2.5 cm long. Involucrel of a few linear bracteoles. Calyx teeth prominent, unequal. Petals white to light purple. Styles slender, spreading, 1.5-2 mm long. Fruits subglobose, 2-3.5 mm long; inner seed face concave.

Fl. & Fr.: June-September.

Cultivated. Occasionally met as an escape. Guling, 26.08.2002, *K. Chandu Sekar* 100714.

Distrib.: Cosmopolitan.

For culinary purpose, as a spice.

5. *Ferula* L.

About 172 species distributed from Mediterranean to C. Asia; 5 in India.

Ferula jaeschkeana Vatke in *Ind. Sem. Hort. Berol.*, Append. 2, 1876; C.B. Clarke in Hook. f., *Fl. Brit. India* 2: 708, 1879; Mukh. & Constance, *Umbell. India* 222, 1993; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 285, 1994. *Kel. Photo. 88*

Perennial herbs; roots thick and woody. Stems erect, 0.6-1.2 m high, much branched above. Leaves ovate, 20-40 cm dia., pinnate; leaflets narrowly oblong to oblong-elliptic, 5-15 x 1.5-5 cm, obtuse, finely crenate-serrate; cauline leaves reduced upward with prominent inflated sheaths. Umbels cotyledose. Rays 8-22, subequal. Petals yellow. Fruits oblong ovoid, 1.5-1.8 x 1-1.1 cm, rounded at ends, red; furrows 1-vittate.

Fl. & Fr.: June-September.

Occasional; on moist slopes. Gechang-1hangs, 4000 m, 14.07.2003, *K. Chandu Sekar* 103289.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China; Pakistan and Turkistan.

Note: *Ferula jaeschkeana* is distinct from *F. narthosa* Boiss. in having leaflets crenate serrate margin.

6. *Heracleum* L.

About 65 species, distributed in N. temperate and tropical regions; 20 in India.

- | | |
|--|--------------------------|
| 1a. Leaf segments more than 10 cm long | 1. <i>H. sandwicense</i> |
| 1b. Leaf segments less than 10 cm long | 2. <i>H. pinnatum</i> |

1. *Heracleum candicans* Wall. ex DC., *Prodr.* 4: 192, 1830; C.B. Clarke in Hook. f., *Fl. Brit. India* 2: 714, 1879; Mukh. & Constance, *Umbell. India* 236, 1993. [*H. lanatum* Michx., *Fl. Bor. Am.* 1: 166, 1830; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 286, 1994. *Hes. Shoma, Tankaar Photo. 89*

Biennials. Stems erect, 1-1.4 m high, pubescent. Leaves oblong to ovate, 10-40 x 10-25 cm, pinnate; leaflets oblong-ovate, 5-10 x 2-8 cm, serrate-dentate along the margin; petioles stout, 5-30 cm long. Rays 15-35, pubescent. Involucrel of 3-7 linear to lanceolate bracteoles. Calyx teeth linear. Petals oblanceolate-obovate, unequally emarginated; mucronate. Fruits oval-orbicular, 0.5-1 x 0.5-0.6 cm, minutely pubescent; dorsal and intermediate ridges filiform, lateral winged.

Fl. & Fr.: June - September.

Common; on moist slopes. Mad Taziya, 3900 m, 23.07.2003, K. Chandru Sekar 103645.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Bhutan; China; Nepal and Pakistan.

Extract of plant given as a cure to diarrhea / dysentery and vomiting.

2. *Heracleum pinnatum* C.B. Clarke in Hook.f., Fl. Brit. India 2: 712. 1879; Mukh. & Constance, Umbell. India 233.1993.

Biennials. Stems erect, 40-50 cm high. Leaves oblong, 9-30 x 4-13 cm, pinnate; leaflets short-petioled, oblong-ovate to orbicular, 1.5-5 x 1.5-4 cm, serrate at margin, sparsely pubescent; the larger leaflets frequently lobed. Rays 10-30, unequal, 3-10 cm long, hispidulous. Involucel of 5-8 bracteoles; bracteoles linear-oblong, 2-4 mm long, hispidulous. Calyx teeth linear, minute. Petals ovate-obovate, white; outer radiant. Ovary pubescent. Fruits obovate, 6-8 x 5-6 mm, light green-white.

Fl. & Fr.: June - September.

Occasional; in rock-crevices. Raurang river bed, 3980 m, 11.07.2002, K. Chandru Sekar 100402.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Baltistan; China and Pakistan.

7. *Ligusticum* L.

About 50 species chiefly in N. temperate regions; 4 in India.

Ligusticum thomsonii C.B. Clarke in Hook.f., Fl. Brit. India 2: 698. 1879; Mukh. & Constance, Umbell. India 118. 1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 288. 1994.

Biennials. Stems erect, 35-50 cm high, glabrous. Leaves oblong to oblong-ovate, 10-15 x 3-8 cm, pinnate; leaflets sessile, ovate-orbicular, 1-4 x 1-2.5 cm, pinnately lobed to pinnatifid. Rays 10-17, 1-3 cm long. Involucel of 5-8 bracteoles; bracteoles linear-lanceolate, white-margined. Calyx teeth minute. Petals ovate-obovate, white. Fruits ovoid, 2.5-3 x 1-1.5 mm, subtetrate; ridges narrowly winged, dorsal and intermediate almost as broad as the lateral; furrows 2 or 3-verticillate; inner seed face plane.

Fl. & Fr.: June-September.

Scarce; on rocky slopes. Kilung-Larang La, 4800 m, 02.08.2003, K. Chandru Sekar 103728.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan; China; Nepal and Pakistan.

7. *Pleurospermum* Hoffm.

About 50 species distributed in Europe, Central Asia and the Himalaya; 19 in India.

- | | |
|---------------------------------|------------------------|
| 1a. Bracteoles entire | 1. <i>P. candollii</i> |
| b. Bracteoles pinnately divided | 2. <i>P. stellatum</i> |

1. *Pleurospermum candollii* (DC.) Benth. ex C.B. Clarke in Hook.f., Fl. Brit. India 2: 703. 1879; Mukh. & Constance, Umbell. India 192.1993; Aswal & Mehrotra, Fl. Lahaul-Spiti 291.1994. *Hymenolaena candollii* DC., Prodr. 4: 245.1830. **Photo. 90**

Biennials, 15-32 cm high, 1-1.2 cm thick, fistular, base covered with persistent leaf bases. Leaves oblong, 3-15 x 1.6-5.5 cm, pinnate; leaflets ovate-orbicular, 0.5-2 cm dia., dentate and ternately or pinnately lobed. Rays 6-14. Involucre of 10-15 bracteoles; bracteoles entire, oblong-obovate, obtuse, broadly white margined. Calyx teeth oval, minute. Petals ovate-obovate, white. Fruits oblong-ovoid, 4.5 x 1.5-2.5 mm, laterally compressed, narrowly winged; furrows 2-3 vittate, commissure 6-vittate; inner seed face deeply grooved.

Fl. & Fr.: July-September.

Rare; in moist rocky slopes. Thango-Kilung, 4250 m, 31.07.2003, K. Chandra Sekar 103706.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan.

2. *Pleurospermum stellatum* (L. Don) Benth. ex C.B. Clarke in Hook.f., Fl. Brit. India 2: 705. 1879; Mukh. & Constance, Umbell. India 197.1993. *Selinum stellatum* L. Don, Prodr. Fl. Nepal. 185.1825.

Biennials, 8-15 cm high, fistular, base covered with persistent leaf bases. Leaves oblong to ovate, 2-10 x 1-3 cm, 1 or 2-pinnate; leaflets ovate-orbicular, 0.5-2.2 cm dia., pinnately or ternately incised to pinnatifid. Involucre of 2-8 bracts; bracts oblong to ovate, filiceous, pinnatifid. Rays 2-20. Involucre of 8-12 bracteoles; bracteoles pinnately divided, oblong to obovate, broadly white-scariosus-margined. Calyx teeth ovate, minute. Petals obovate, white. Fruits oblong ovoid, 4-6 x 2-3 mm, glabrous; ribs broadly and subequally winged; furrows 1-vittate; inner seed face grooved.

Fl. & Fr.: June - August.

Scarce; on rocky slopes. Thango-Kilung, 4200 m, 31.07.2003, K. Chandra Sekar 103705.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China; Nepal and Pakistan.

9. *Selinum* L.

About 8 species distributed in N. temperate regions; 9 in India.

Selinum wallichianum (DC.) Raizada & H.C. Saxena in Indian Forester 92: 323.1966; Mukh. & Constance, Umbell. India 197.1993. *Pseudoselinum wallichianum* DC., Prodr. 4: 181.1830.

Biennials. Stems erect, 60-80 cm high, glabrous; base fibrous. Leaves triangular-ovate, 15-30 cm dia., finely pinnately to ternate-pinnately decompose; ultimate divisions linear, 1-3 x 0.5-1 cm. Rays 15-30, scabrid. Involucre of 5-10 bracteoles; bracteoles linear, white-margined. Calyx teeth prominent, linear, 0.5-1.5 mm long, white-margined. Petals oblanceolate to obovate, glabrous. Fruits oblong-ellipsoid to ovoid, 4-6 x 2-2.6 mm, dorsally flattened, glabrous.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Mud Larang La, 3900 m, 18.08.2002, K. Chandra Sekar 102896.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; Nepal and Pakistan.

10. *Semenovia* Regel & Herder

Eighteen species distributed in Asia; 1 in India.

Semenovia thomsonii (C.B. Clarke) Mandern., Trudy Tbilissi. Bot. Inst. 20: 23.1959; Mukh. & Constance, Umbell. India 250.1993. *Heracleum thomsonii* C.B. Clarke in Hook.f., Fl. Brit. India 2: 711.1879; Aswal & Mehrotra, Fl. Lahaul-Spiti 286.1994. *Atchak Karpo*, Aya Photo. 91

Perennial herbs; roots tuberous. Stems ascending to erect, 30-60 cm high, glabrescent pubescent. Leaves clustered at base, oblong-ovate, 5-15 x 2-3.8 cm, pinnate to bipinnate; leaflets shortly petioled or sessile, oblong-orbicular, 0.5-3 x 0.5-2 mm, pubescent. Involucre of 3-5 bracts; bracts linear, pubescent. Rays 3-12, pubescent. Involucel of 5 or 6 pubescent bracteoles. Calyx teeth triangular, minute. Petals unequally emarginated; outer radiant, white. Fruits oblong ellipsoid, 4-6 x 2.5-3.5 mm, pubescent.

Fl. & Fr.: June - September.

Common; in rock-crevices. Thangru-Kilung, 4400 m, 31.07.2003, K. Chandra Sekar 103716.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan and Pakistan.

Decoction of fruits given to cure severe headache.

11. *Torilis* Adams.

Fifteen species distributed from Mediterranean region to E. Asia; 5 in India.

Torilis japonica (Houtt.) DC., Prodr. 4: 219. 1830; Mukh. & Constance, Umbell. India 25.1993.
Caucalis japonica Houtt., Nat. Hist. Pl. 8: 42.1777.

Annual herbs. Stems ascending-erect, 60-75 cm high. Leaves triangular-ovate, 1 or 2-pinnate; leaflets lanceolate-oblong, 0.5-4 x 2-15 cm, glabrous; petioles 1.5-2.5 cm long. Involucre of 4-10 bracts; bracts linear, 0.8-1 cm long, hispid. Rays 4-10, spreading, 1-1.5 cm long, hispid. Involucel of 3-7 bracteoles; bracteoles filiform, 3-4 mm long. Calyx teeth triangular-lanceolate. Petals white. Fruits ovoid, 3-4 x 2-3 mm; bristles incurved.

Fl. & Fr.: June - August.

Scarce; on rocky slopes. Mane, 04.09.2002, K. Chandra Sekar 100796.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia; Europe and N. & S. America.

24. CAPRIFOLIACEAE

Fifteen genera and 420 species distributed in Eurasia, America, Australia, Mediterranean and tropical Africa; 7 genera and 72 species in India.

Lonicera L.

About 180 species distributed in N. hemisphere to Mexico and the Philippines; ca 40 in India.

- | | |
|-----------------------------------|--------------------------|
| 1a. Corolla white with pink tinge | 3. <i>L. spinosa</i> |
| b. Corolla yellow | 2 |
| 2a. Stems glabrous to subglabrous | 2. <i>L. semenovi</i> |
| b. Stems hispid | 1. <i>L. asperifolia</i> |

1. *Lonicera asperifolia* (Decne.) Hook.f. & Thomson in J. Linn. Soc., London (Bot.) 2: 166. 1858; C.B. Clarke in Hook.f., Fl. Brit. India 3: 14. 1880; Aswal & Mehrotra, Fl. Lahaul-Spiti 301. 1994.
Xylosteum asperifolium Decne. in Jacquem., Voy. Inde 4: 77. t. 85. 1844. **Photo. 92**

Shrubs. Stems erect, 0.9-1.5 m high, branched, hispid. Leaves ovate or elliptic, 2-3 x 0.5-1.2 cm, more or less rounded at base, subacute at apex, sparsely hairy at margins. Bracts ovate, 5-7 mm long, glandular-pubescent, hispid. Calyx tube glandulose. Corolla 1.3-1.8 cm long, tubular, narrow, gibbous at base, yellow; lobes at least half as long as the tube, subequal. Stamens and style exerted. Berries in pairs with persistent calyx, free, ovoid, 0.6-1.1 cm long, orange-red.

Fl. & Fr.: June - August.

Scarce; on slopes. Chhohem, 4050 m, 13.07.2003, K. Chandra Sekar 101196.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia.

2. *Lonicera scmetnovii* Regel, Acta Hort. Petrop. 5: 608, 1877; Aswal & Mehrotra, Fl. Lahaul-Spiti 305, 1994. *L. glauca* sensu Hook.f. & Thomson in J. Linn. Soc., London (Bot.) 2: 166, 1858, non Hill, 1768; C.B. Clarke in Hook.f., Fl. Brit. India 3: 11, 1880.

Shrubs. Stems dwarf, 50-60 cm high, densely branched, glabrous-subglabrous. Leaves elliptic-oblong, 0.8-2 x 0.5-0.8 cm, glabrous, recurved. Bracts ovate, glabrous. Corolla tubular, 2-2.5 cm long, narrow and gibbous at the base, yellow; unequally 5-lobed; lobes rounded, much smaller than the corolla tube. Stamens and style slightly exerted. Berries in pairs, free or more or less confluent, ovoid, 0.4-1 cm long, red.

Fl. & Fr.: July - September.

Rare; in rock crevices. Lung La Tariyu, 4050 m, 06.08.2003, K. Chandra Sekar 103755.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia.

3. *Lonicera spinosa* (Jacquem. ex Decne.) Walp., Repert. Bot. Syst. 2: 449, 1843; Aswal & Mehrotra, Fl. Lahaul-Spiti 305, 1994. *Xylosteum spinosum* Jacquem. ex Decne. in Jacquem., Voy. Inde 4: 78, t. 86, 1835.

Shiyabu, Tharu, Shija Photo. 93

Shrubs. Stems prostrate, 0.7-1.2 m long, branched, glabrous, spinescent; spines 1-2.5 cm long. Leaves subsessile or shortly petioled, linear-oblong, 4-8 mm long, revolute at margins, glabrous. Bracts linear-oblong, foliaceous. Corolla 0.8-1.5 cm long, glabrous, white with pink tinge, fragrant. Stamens and styles exerted. Berries ellipsoid, 0.6-1 cm long, orange-red.

Fl. & Fr.: June - September.

Scarce; on rocky slopes along with *Ceratopogon viridiflor* Benth. Chhohem, 4050 m, 13.07.2003, K. Chandra Sekar 101199.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia.

Paste of flower buds is applied to be relieved of dandruff.

25. RUBIACEAE

About 630 genera and ca 10200 species, cosmopolitan especially in tropical and subtropical regions; 113 genera and 616 species in India.

- | | |
|--|--------------------|
| 1a. Corolla funnel-shaped | 1. <i>Asperula</i> |
| b. Corolla rotate | 2 |
| 2a. Leaves cordate at base; fruit a fleshy berry | 3. <i>Rubia</i> |
| b. Leaves not cordate at base; fruit a 2-seeded nutlet | 2. <i>Galium</i> |

1. *Asperula* L.

About 90 species distributed in Eurasia; 2 in India.

Asperula oppositifolia Regel & Schmalh. subsp. *pseudo-cynanchica* Wrendl. in Ann. Naturhist. Mus. Wien 56: 132, f. 49a, 51. 1948; Aswal & Mehrotra, Fl. Lahaul-Spiti 307. 1994. *A. cynanchica sensu* Hook.f., Fl. Brit. India 3: 209. 1881, *non* L., 1753. *Penma Mendok*

Perennial herbs; rootstock woody. Stems ascending, 18-25 cm high, slender, terete; branches 4-angled. Leaves scattered, flat, linear-oblong, 0.6-1.1 x 0.1-0.2 cm, obtuse, nerveless; the lower whorled; upper opposite. Flowers in terminal, umbel-like fascicles. Bracts linear-oblong, acute. Corolla 1.5-2.5 mm long, pink; segments 4, triangular, shorter than the tube. Fruits 1-1.5 mm dia., granulate.

Fl & Fr.: July - September.

Scarce; on rocky slopes. Farka, 3750 m, 30.07.2002, K. Chandu Sekar 100534.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia and Europe.

2. *Galium* L.

About 300 species almost cosmopolitan; 24 in India.

- | | |
|---|---------------------------|
| 1a. Fruits clothed with bristles | 2 |
| b. Fruits glabrous | 1. <i>G. acutum</i> |
| 2a. Fruits clothed with straight bristles | 5. <i>G. serpylloides</i> |
| b. Fruits clothed with hooked bristles | 3 |
| 3a. Leaves 3-nerved from the base | 4. <i>G. boreale</i> |
| b. Leaves 1-nerved from the base | 4 |
| 4a. Leaves in whorls of 4-6; peduncle 1 or 2-flowered | 6. <i>G. tibeticum</i> |
| b. Leaves in whorls of 6-8; peduncle 3 or more flowered | 5 |
| 5a. Stems smooth, glabrous | 3. <i>G. asperuloides</i> |
| b. Stems prickly along the angles | 2. <i>G. aparine</i> |

1. *Galium acutum* Edgew. in Trans. Linn. Soc. London 20: 61. 1846; Hook.f., Fl. Brit. India 3: 208. 1881.

Perennial herbs, forming cushion. Stems flaccid and decumbent, interlaced, 12-22 cm long, glabrous, leafy. Leaves in whorls of 4-6, crowded, linear to linear-lanceolate, 1.5-2.2 x 0.5-1.3 cm, mucronate, glabrous; nerves obsolete. Flowers 1-3 in leaf axils. Calyx lobes obsolete. Corolla minute, pale white; segments lanceolate, acuminate. Fruits didymous, 1.2-2 mm dia., glabrous, granulate.

Fl. & Fr.: June - August.

Scarce, on moist slopes. Mud-Jawang La, 3900 m, 18.08.2002, K. Chandra Sekar 102898.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim, Uttarakhand and Uttar Pradesh; China, Nepal and Pakistan.

2. *Galium aparine* L., Sp. Pl. 108. 1753; Hook.f., Fl. Brit. India 3: 205. 1881; Aswal & Mehrotra, Fl. Lahaul Spiti 308. 1994. *Pin damba*

Annuals. Stems trailing or climbing, 10-20 cm long, 4-angular, clothed with minute recurved bristles. Leaves in whorls of 6-8, sessile, linear to spatulate-oblong, 1.2-3 x 0.2-0.3 cm, obtuse or mucronate, glabrous except prickly midrib and margin. Cymes axillary and terminal, few-flowered. Calyx tube small; lobes nearly absent. Corolla small, rotate, greenish-white. Stamens 5 or 4. Fruits small, didymous, clothed with spreading hooked bristles.

Fl. & Fr.: June - August.

Occasional, on moist slopes. Thango, 3950 m, 19.07.2002, K. Chandra Sekar 100485.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim, Uttarakhand and Uttar Pradesh; Asia; Europe and N. Africa.

3. *Galium asperuloides* Vdgew. in Trans. Linn. Soc. London 20: 61. 1846; Aswal & Mehrotra, Fl. Lahaul Spiti 309. 1994. *G. triflorum* *unct. nov.* Michx., 1803; Hook.f., Fl. Brit. India 3: 205. 1881.

Perennial herbs. Stems decumbent-ascending, 30-50 cm high, 4-angled, glabrous. Leaves 6-8 in a whorl, sessile, linear lanceolate or oblong, 2-3.1 x 0.1-0.22 cm, acute. Cymes axillary and terminal, few-flowered. Calyx tube short; teeth absent. Corolla rotate, 4-lobed, white with yellow tinge; lobes ovate, acute. Stamens 4, protruding. Ovary 2-celled; style short, 2 fid. Fruits globose, small, 2-seeded, clothed with hooked bristles.

Fl. & Fr.: June - August.

Scarce, on rocky slopes. Sanpat, 4800 m, 23.07.2003, K. Chandra Sekar 103646.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim, Uttarakhand and Uttar Pradesh; Asia; America and Europe.

4. *Galium boreale* L., Sp. Pl. 108. 1753; Hook.f., Fl. Brit. India 3: 205. 1881; Aswal & Mehrotra, Fl. Lahaul Spiti 309. 1994. *Kartaugh Mentak*

Perennial herbs. Stems erect, 21-46 cm high, sparsely pubescent. Leaves 3 or 4 in a whorl, sessile, lanceolate, 2-3.6 x 0.5-1.1 cm, obtuse, scabrid, 3-nerved at base. Cymes axillary and terminal, many-flowered. Bracts ovate. Corolla white; lobes subacute. Fruits 1-1.5 mm dia., clothed with hooked bristles.

Fl. & Fr.: June - August.

Scarce, on rocky slopes. Mud, 3700 m, 29.07.2002, K. Chandra Sekar 100527.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Asia; America and Europe.

5. *Galium serpylloides* Royle ex Hook.f. in Hook.f., Fl. Brit. India 3: 207. 1881; Aswal & Mehrotra, Fl. Lahaul Spiti 310. 1994. *Menduk barbo*

Perennial herbs; roots woody. Stems suberect, 8-10 cm high, much branched. Leaves in whorls of 4, sessile, ovate-oblong or elliptic, 4-6 x 2-3.5 mm, obtuse, recurved at margin; nerves obscure. Inflorescence axillary and terminal, 2 or 3-flowered. Flowers minute. Calyx segments ovate, acute. Corolla pale-white. Fruits densely clothed with long woolly straight bristles.

Fl. & Fr.: June - August.

Occasional; on moist slopes. Chhohem, 4050 m, 12.07.2003, *K. Chandra Sekar* 103206.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Pakistan.

6. *Galium tibeticum* Aswal & Mehrotra in J. Econ. Taxon. Bot. 2: 236. 1981 et Fl. Lahaul-Spiti 310. 1994. *G. pauciflorum* Bunge, Enum. Pl. Chin. 35. 1831, non Willd. ex DC., 1830; Hook.f., Fl. Brit. India 3: 205. 1881.

Annuals. Stems ascending, 10-16 cm high, filiform. Leaves opposite or in whorls of 4-6, obovate-oblong, cuspidate, membranous, minutely scabrid at margin with slender midrib. Flower solitary or rarely 2, axillary and terminal. Corolla minute, white. Fruits very small, covered with hooked bristles.

Fl. & Fr.: June - August.

Rare; on moist slopes near streams. Thango-Kilung, 4350 m, 31.07.2003, *K. Chandra Sekar* 103714.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China and Pakistan.

3. *Rubia* L.

About 60 species, distributed in Asia, C. & W. Europe and Mediterranean region; 11 in India.

Rubia cordifolia L., Syst. Nat. ed. 12, 3: 229. 1768; Hook.f., Fl. Brit. India 3: 202. 1881; Deb & Malik in Bull. Bot. Surv. India 10(1): 6. 1968; Aswal & Mehrotra, Fl. Lahaul-Spiti 311. 1994.

Perennial herbs. Stems climbing, acutely 4-angled with minute, recurved prickles on angles. Leaves in whorls of 3 or 4, long-petioled, ovate-oblong to lanceolate, 5-7.2 cm long, cordate at base, acute-acuminate at apex; petioles 2-3.4 cm long. Cymes many-flowered. Bracts cordate. Flowers minute. Corolla lobes lanceolate, tips incurved. Anthers globose. Fruits globose, 1-3 mm dia., glabrous.

Fl. & Fr.: July - September.

Rare; on slopes. Parahio Catchment, 14.10.1990. *G.S. Ranat* 2894 (WIT).

Distrib.: Throughout India; Asia and Tropical Africa.

26. VALERIANACEAE

About 10 genera and ca 300 species, cosmopolitan, especially in N. temperate regions; 5 genera and 27 species in India.

Valeriana L.

About 200 species widely distributed in N. temperate regions; 12 in India.

Valeriana himalayana Grubov in Not. Syst. Herb. Inst. Bot. Acad. Sci. URSS 19: 344. 1959; Aswal & Mehrotra, Fl. Lahaul-Spiti 313. 1994. *V. dioica* C.B. Clarke in Hook.f., Fl. Brit. India 3: 211. 1881, *pp.*, non L., 1753.

Mendok karsa, Mentak Nakpu

Perennial herbs. Stems erect, 25-32 cm high, glabrous. Scape solitary or 2-3. Radical leaves entire, oblong to suborbicular, 1-2.5 x 0.8-1.6 cm, crenulate or subterete; lower cauline leaves pinnati-partite, ovate-oblong to elliptic-ovate, with 1-3 lateral lobes; the uppermost cauline leaves with narrower lobes. Inflorescence a dichotomous corymb. Bracts lanceolate, 3-4 mm long, acute or obtuse. Ovary glabrous; stigma 2 or 3-fid. Achenes shorter than the bracts, 2.5-3 mm long, glabrous. Pappus segments 10-13.

Fl & Fr.: June - August.

Rare; on rocky slopes, Tharvik, 4000 m, 23.08.2002, K. Chandra Sekar 100677.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia.

Extract of whole plant is applied externally on cuts.

27. MORINACEAE

Two genera and 13 species distributed from Balkans to the Himalaya and China; 2 genera and 8 species in India.

Morina L.

About 10 species distributed from Balkans to Sino-Himalaya; ca 6 in India.

Morina longifolia Wall. ex DC., Prodr. 4: 644. 1830; C.B. Clarke in Hook.f., Fl. Brit. India 2: 126. 1882; Collett, Fl. Siml. 240. 1902; Chandra Sekar & al. in Indian J. Forest. 26(2): 98. 2003. *Androk*

Perennial herbs. Stems erect, 30-70 cm high, glabrous, upper shoots tomentose. Leaves lanceolate, spinose to sinuate at margin; radical leaves 8-20 cm long; cauline ones similar but smaller, opposite or whorled. Involucral bracts broadly ovate, 2-4 cm long, acuminate, leafy, pubescent, villous at the base. Involucel campanulate, 7-8 mm long, villous. Calyx 2-lobed, pubescent; lobes acute or obtuse. Corolla tube 2.5-2.7 cm long, pubescent; lobes 6-7 mm long, obtuse. Filaments hairy near anther bases, much shorter than the corolla lobes. Achenes 3-3.5 mm long.

Fl & Fr.: June - September.

Rare; on rocky slopes. Mud-Tharvik, 4000 m, 01.08.2002, K. Chandra Sekar 102814.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; Nepal and Pakistan.

Root extract is given to cattle to free them from intestinal worms.

28. ASTERACEAE

About 1528 genera and ca 22750 species, cosmopolitan; 166 genera and 800 species in India.

- | | | |
|-----|---|----------------------|
| 1a. | Heads homogamous; florets all ligulate or tubular or tubuliform | 2 |
| b. | Heads heterogamous; florets both ray and disk | 27 |
| 2a. | Florets all ligulate | 3 |
| b. | Florets all tubular | 12 |
| 3a. | Plants scapigerous | 28. <i>Taraxacum</i> |
| b. | Plant not scapigerous | 4 |

4a. Leaves with broad, rounded sheathing base	5
b. Leaves without sheathing base	6
5a. Involucral bracts more than 3 seriate	24. Scorzonera
b. Involucral bracts 1-seriate	29. Tragopogon
6a. Stems more or less stellate-hairy	16. Hieracium
b. Stems without stellate hairs	7
7a. Achenes contracted at ends	8
b. Achenes not contracted at ends	9
8a. Stems with hooked hairs; pappus feathery	21. Picris
b. Stems without hooked hairs; pappus simple	12. Crepis
9a. Achenes distinctly beaked	10
b. Achenes not distinctly beaked	31. Youngia
10a. Involucral bracts black bristly	11
b. Involucral bracts not as above	18. Lactuca
11a. Achenes rugose	9. Cicerbita
b. Achenes smooth	13. Dubyaea
12a. Anther cells tailed or auricled or mucronate at the base	13
b. Anther cells cleft at base or subentire	21
13a. Style arms linear, obtuse or styles of sterile florets undivided	14
b. Style arms of bisexual florets truncate or appendaged	19
14a. Leaves spiny	15
b. Leaves not spiny	17
15a. Pappus hairs free	10. Cousinia
b. Pappus hairs connate into a ring at the base	16
16a. Pappus hairs feathery	6. Breea
b. Pappus hairs not feathery	7. Carduus
17a. Involucral bracts appendaged	1. Acroptilon
b. Involucral bracts not appendaged	18
18a. Pappus hairs many-seriate	17. Jurinea
b. Pappus hairs 1-seriate	23. Saussurea
19a. Style arms of female florets flattened or narrowly clavate, papillose	11. Cremanthodium

- b. Style arms of female florets truncate or obtuse, pinnulate 20
- 20a. Anther base with tailed auricles 26. *Synotis*
- b. Anther base without tailed auricles 25. *Senecio*
- 21a. Anther cells tailed 22
- b. Anther cells not tailed 24
- 22a. Bisexual florets all sterile, styles undivided or notched 23
- b. Bisexual florets all or mostly fertile; styles divided 15. *Gnaphalium*
- 23a. Pappus hairs connate or subconnate 19. *Leontopodium*
- b. Pappus hairs quite free 2. *Anaphalis*
- 24a. Heads rayed 25
- b. Heads disciform 26
- 25a. Diffuse or tufted herbs; peduncles less than 15 cm long 30. *Waldheimia*
- b. Usually erect herbs; peduncles more than 15 cm long 8. *Chrysanthemum*
- 26a. Heads racemose or panicled; involucrel bracts few seriate 3. *Artemisia*
- b. Heads in corymbs; involucrel bracts many seriate 27. *Tanacetum*
- 27a. Pappus hairs usually long, copious 28
- b. Pappus hairs very short, not copious 20. *Myriactis*
- 28a. Heads disciform or with inconspicuous ray florets, almost as long as or scarcely longer than the involucre 4. *Aster*
- b. Heads distinctly radiate, ligules clearly longer than the involucre 29
- 29a. Ligule less than 4 mm long 5. *Brachyaetis*
- b. Ligule more than 4 mm long 30
- 30a. Pappus usually 2-seriate 14. *Erigeron*
- b. Pappus usually 1-seriate 22. *Psychrogeton*

1. *Acroptilon* Cass.

Two species mainly in Eastern and Central Asia; 1 in India.

Acroptilon repens (L.) DC., Prodr. 6: 663. 1837; Hajra in Hajra & al., 11. India 12: 152. 1995; Chandra Sekar & al. in Indian J. Forest. 26(2): 98. 2003. *Centaura repens* L., Sp. Pl. 916. 1753. Fig. 10

Annuals. Stems erect, 35-45 cm high, densely leafy. Leaves sessile, oblong-lanceolate to linear, 1.2-1.4 x 0.2-0.35 cm, remotely dentate, recurved on the margin. Involucrel bracts many-seriate; outer broadly ovate to limulate, scarious; inner oblong; appendage densely ciliate on back and margin. Corolla pink. Achenes 2-3 mm long, smooth. Pappus 4-6 mm long.

Fl. & Fr.: July - August.

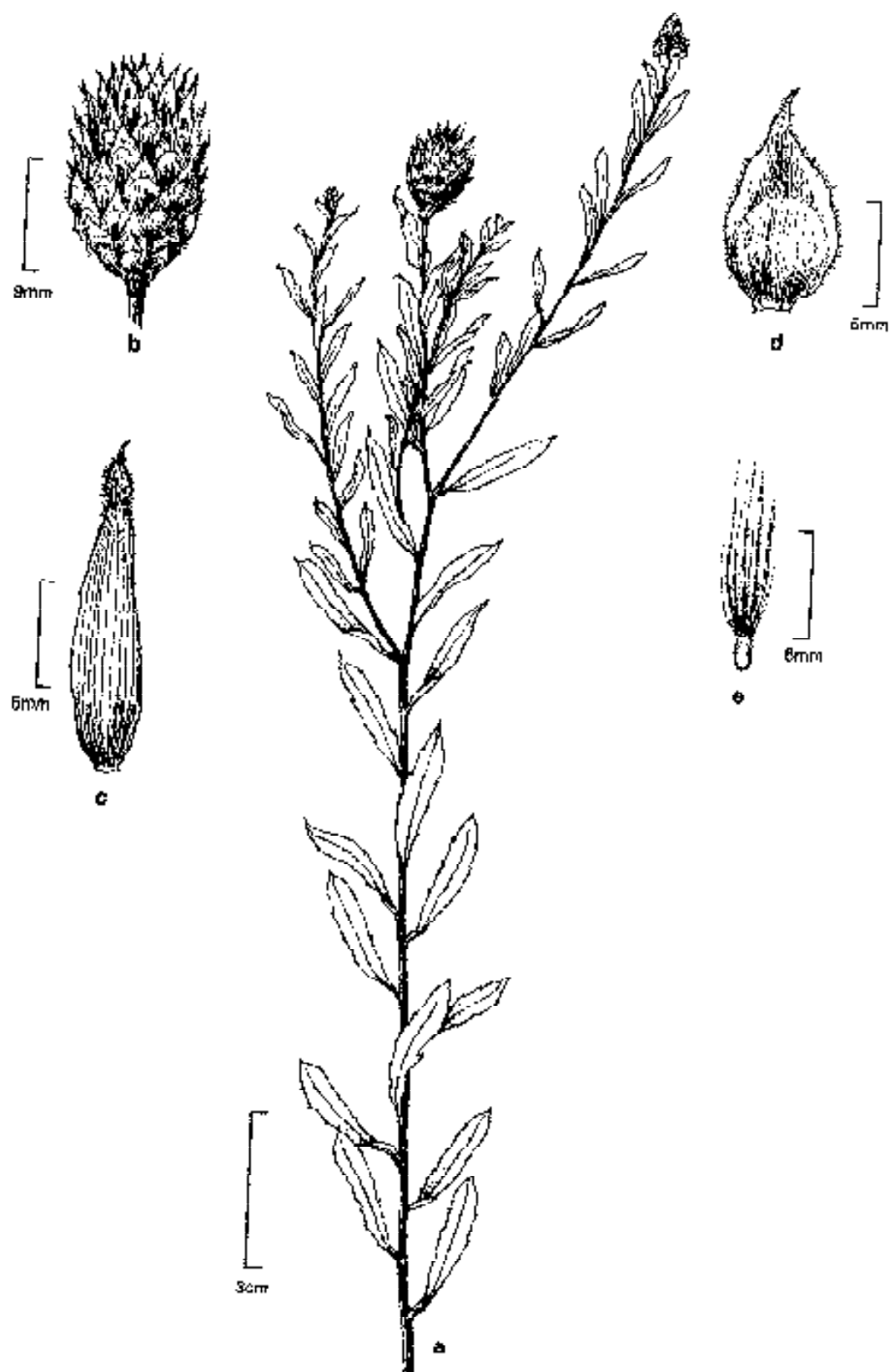


Fig. 10. *Acroptilon repens* (L.) DC. a. Habit, b. Head, c. & d. Involucral bract, e. Achene with pappus

Rare; on moist slopes. Tilling, 3700 m, 26.08.2002, K. Chandra Sekar 100699.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Asia; C.I.S.; Iran and N. America.

2. *Anaphalis* DC.

About 110 species distributed in Europe, Asia and N. America; 31 in India.

- | | |
|---|---------------------------|
| 1a. Leaves lax, scattered all over the stem | 2 |
| b. Leaves usually below lower half of the stem, densely congested or aggregated at base | 1. <i>A. contorta</i> |
| 2a. Leaves 1-nerved | 2. <i>A. royleana</i> |
| b. Leaves 1-3-nerved | 3. <i>A. triplinervis</i> |

1. *Anaphalis contorta* (D. Don) Hook.f., Fl. Brit. India 3: 284. 1881; Aswal & Mehrotra, Fl. Lahaul-Spiti 324. 1994; P.C. Pant in Hajra & al., Fl. India 13: 59. 1995. *Antennaria contorta* D. Don in Bot. Reg. 7: t. 605. 1825. *Anaphalis tenella* DC., Prodr. 6: 273. 1838. *Pakil Karjo Mendak*

Annuals. Stems erect-decumbent, 18-35 cm high, white-cottony tomentose. Leaves crowded, sessile, narrowly linear-oblong, 0.3-3.5 x 0.05-0.3 cm, auricled at base, acute-obtuse at apex, often revolute at margin, pubescent beneath, 1-nerved. Heads 2-4 mm dia. Involucral bracts many seriate; outer broadly ovate-oblong; inner narrowly linear-oblong. Ray florets yellow. Disc florets yellow-brown. Achenes oblong. Pappus white.

Fl & Fr.: June - August.

Scarce; on moist slopes. Near Tariya, 4000 m, 07.08.2002, K. Chandra Sekar 100630.

Distrib.: India: Arunachal Pradesh, Haryana, Himachal Pradesh, Jammu & Kashmir, Meghalaya, Punjab, Sikkim, Uttarakhand and Uttar Pradesh; Afghanistan; Bhutan; China; Nepal; Pakistan and Philippines.

Note. A highly polymorphic species showing considerable variation in leaves and indumentum.

Paste of whole plant is applied externally to cure muscle pain.

2. *Anaphalis royleana* DC., Prodr. 6: 272. 1838; Hook.f., Fl. Brit. India 3: 280. 1881; Aswal & Mehrotra, Fl. Lahaul-Spiti 326. 1994; P.C. Pant in Hajra & al., Fl. India 13: 71. 1995. *Khirchee Mentak*

Perennial herbs; rootstock woody. Stems ascending, 20-40 cm high. Leaves linear-oblong, 4-3.2 x 0.1-0.4 cm, acute, woolly beneath, 1 nerved. Heads 5-7 mm dia.; peduncles woolly tomentose. Involucral bracts many-seriate; outer ovate; inner narrowly elliptic. Ray florets 2.5-3 mm long, pale brown. Disc florets 2-3 mm long, brown. Achenes oblong, 1-1.2 mm long. Pappus hairs white, barbed.

Fl & Fr.: June - September.

Common; on moist slopes. Tariya, 4000 m, 25.07.2003, K. Chandra Sekar 103681.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Bhutan; China; Nepal; N. Myanmar; Pakistan and Taiwan.

Decoction of young leaves taken in stomach pain.

3. *Anaphalis triplinervis* (Sims.) C.B. Clarke, Comp. Ind. 105. 1876; Hook.f., Fl. Brit. India 3: 281. 1881; P.C. Pant in Hajra & al., Fl. India 13: 77. 1995. *Antennaria triplinervis* Sims. in Bot. Mag. 51: t. 2468. 1823.

Perennial herbs. Stems ascending, 21-36 cm high. Leaves narrowly lanceolate or obovate-spathulate, 0.4-3.4 x 0.1-0.5 cm, acute, 1-3-nerved. Heads 0.3-1.5 cm dia.; peduncles 0.3-1 cm long, densely woolly. Involucral bracts many-seriate, ovate-lanceolate, 1.5-2.5 mm long. Ray florets 2-3 mm long, obscurely 4-toothed. Disc florets 2-3 mm long, 5-toothed. Achenes oblong, 0.8-1.1 mm long. Pappus hairs bristly, white.

- 1a. Heads many, 3-4 mm dia. i. var. *intermedia*
 b. Heads 1-3, 0.8-1.5 cm dia. ii. var. *monocephala*

i. var. ***intermedia*** (DC.) Airy Shaw in Bot. Mag. 158: t. 9396. 1935; P.C. Pant in Hajra & al., Fl. India 13: 77. 1995. *Antennaria triplinervis* Sims. var. *intermedia* DC., Prodr. 6: 270. 1838. *Antennaria triplinervis* Sims. var. *cuneifolia* DC., Prodr. 6: 270. 1838. *Anaphalis cuneifolia* (DC.) Hook.f., Fl. Brit. India 3: 280. 1881. *Mendak karkho* **Photo. 94**

Fl & Fr: July - September.

Rare; on moist slopes near streams. Kilang Larang La, 4800 m, 04.08.2003, K. Chandru Sekar 103742.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Nepal and Pakistan.

ii. var. ***monocephala*** (DC.) Airy Shaw in Bot. Mag. 158: t. 9396. 1935. P.C. Pant in Hajra & al., Fl. India 13: 77. 1995. *Anaphalis monocephala* DC., Prodr. 6: 272. 1838. *A. nubigena* DC., Prodr. 6: 272. 1838; Hook.f., Fl. Brit. India 3: 279. 1881.

Fl & Fr: July - September.

Rare; on slopes. Parahio catchment, 28.07.1992, Nima 159 (WI).

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Bhutan; China; Nepal; Pakistan and Taiwan.

3. *Artemisia* L.

About 350 species distributed in N. temperate regions; 34 in India.

- 1a. Receptacle naked 5. *A. maritima* var. *thomsoniana*
 b. Receptacle hairy or obscurely pubescent 2
 2a. Outer florets female, fertile; disc florets sterile 3
 b. Outer female florets and disc florets fertile 5
 3a. Plants perennial 4
 b. Plants annual 1. *A. capillaris*
 4a. Heads secund; cauline leaves with stipule-like appendage at the base 4. *A. japonica*

1. Heads not secund; cauline leaves without appendage at the base 2. *A. dubia* var. *subdigitata*
 5a. Heads less than 4 mm long 8. *A. wallichiana* forma *nitida*
 b. Heads more than 4 mm long 6
 6a. Herbs rhizomatous 7
 b. Herbs non-rhizomatous 3. *A. gmelinii*
 7a. Heads subglobose or campanulate 6. *A. racchurbiana*
 b. Heads hemispheric 7. *A. strongylocephala* var. *cachemirica*

1. *Artemisia capillaris* Thunb., Fl. Jap. 309. 1784; Hook.f., Fl. Brit. India 3: 323. 1881; Aswal & Mehrotra, Fl. Lahaul-Spiti 331. 1994; B.D. Naithani in Hajra & al., Fl. India 12: 16. 1995. *Aatong*

Annuals; rootstock woody. Stems erect, 40-50 cm high, dull purple to pale white. Radical leaves broadly ovate, 4-5 cm long, 1-3-pinnatisect; lobes setaceous; cauline ones pinnatisect. Heads sessile. Involucral bracts oblong, 1-2 mm long, obtuse with white scarious margin. Receptacle small, slightly convex. Outer florets female, fertile, ca 1 mm long. Disc florets sterile, 1-1.8 mm long; limb 5-fid. Achenes narrowly obovoid, obscurely striate, brown.

Fl. & Fr.: July - September.

Occasional; on rocky slopes. Gechang, 3730 m, 16.07.2002, *K. Chandra Sekar* 100466.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Punjab and Uttarakhand; Afghanistan to Europe; Japan and Pakistan.

Decoction of young inflorescence is given to cure pneumonia.

2. *Artemisia dubia* Wall. ex Bess. var. *subdigitata* Ling in Kew Bull. 42(2): 444. 1987; B.D. Naithani in Hajra & al., Fl. India 12: 19. 1995. **Photo. 95**

Perennial herbs. Stems erect-ascending, 30-45 cm high, purple. Leaves 2-5 cm long; lower leaves 2 or 3-pinnatifid; lobes linear-lanceolate to lanceolate; upper ones narrowly lanceolate, trifid-pinnatisect. Heads sessile or shortly peduncled, solitary and distant or in clusters of 2 or 3. Outer involucral bracts oblong, 1-3.5 mm long, obtuse, with brown scarious margin; inner broadly oblong, 2-2.5 mm long, obtuse. Outer florets female, fertile. Disc florets sterile; limb obscurely 5-lobed.

Fl. & Fr.: June - August.

Scarce; on rocky slopes. Sagnam, 3675 m, 27.08.2002, *K. Chandra Sekar* 100724.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Bhutan; China; Nepal and Pakistan.

3. *Artemisia gmelinii* Web. ex Stechm., Dissert de Hort. 30. 1775; Aswal & Mehrotra, Fl. Lahaul-Spiti 332. 1994; B.D. Naithani in Hajra & al., Fl. India 12: 23. 1995. *A. sacrorum* Ledeb. in Mim. Acad. St.-Petersbourg 5: 571. 1815; Hook.f., Fl. Brit. India 3: 326. 1881.

Perennial herbs; rootstock woody. Stems erect, 30-55 cm high. Leaves long-petioled, 1-6 cm long, 2 or 3-pinnatisect. Heads 6-15-flowered. Involucral bracts linear oblong to ovate, 1-3 x 0.2-0.5 mm, sparsely to densely hoary tomentose. Receptacle conic, small. Outer florets female, 1.5-1.8 x 0.5-1 mm,

fertile; corolla obscurely lobed. Disc florets, 1.8-2.2 x 0.8-1 mm; limb 5-lobed. Achenes oblanceolate, 0.8-1 x 0.3-0.5 mm, obscurely white-ribbed.

Fl. & Fr.: July - September.

Scarce; on rocky slopes, Gechang, 3900 m, 14.07.2003, K. Chandu Sekar 103299.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China; C.I.S.; Mongolia and Pakistan.

4. *Artemisia japonica* Thunb., Fl. Japan 310. 1785; B.D. Naithani in Hajra & al., Fl. India 12: 28. 1995. *A. parviflora* Roxb. ex D. Don, Prodr. Fl. Nepal. 181. 1825; Hook.f., Fl. Brit. India 3: 322. 1881.

Perennial herbs. Stems erect ascending, 40-65 cm high, grooved. Leaves sessile, 2-4.5 cm long, with a stipule like appendage at the base; upper cauline leaves linear, cuneate, acutely 2-8-fid; uppermost leaves entire. Heads 2-3 mm dia., greenish-white. Involucral bracts broadly oblong, 0.8-1 mm long, with broad scarious margin; innermost almost hyaline. Outer florets female, fertile; corolla slender, obscurely 3-fid. Disc florets sterile, 1-1.5 mm long. Achenes ellipsoid.

Fl. & Fr.: July - September.

Scarce; on moist slopes near streams. Thango, 3800 m. 11.07.2002, K. Chandu Sekar 100425.

Distrib.: India: Bihar, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Meghalaya, Orissa, Rajasthan, Sikkim, Uttarakhand and Uttar Pradesh; Afghanistan; Bhutan; China; Japan; Myanmar, Nepal and Pakistan.

5. *Artemisia maritima* L. var. *thomsoniana* C.B. Clarke, Comp. Ind. 160. 1876; B.D. Naithani in Hajra & al., Fl. India 12: 33. 1995. *A. brevifolia* Wall. ex DC., Prodr. 6: 103. 1838; Hook.f., Fl. Brit. India 3: 324. 1881.

Perennial aromatic herbs; rootstock woody, branched. Stems erect or spreading, 35-50 cm high. Leaves 0.3-4 cm long, 2-pinnatisect, white-tomentose beneath; lobes small, spreading, linear, obtuse. Heads suberect, sessile, crowded, with 3-11-florets, subtended by a setaceous leafy bracteole, brown-white. Involucral bracts broadly oblong to obovate, 2-3 mm long, with white-scarious margin. Receptacle naked, small. Flowers all tubular, bisexual, 1.5-2 mm long, fertile.

Fl. & Fr.: June - August.

Rare; on rocky slopes. Ratrang river bed, 3700 m, 11.07.2002, K. Chandu Sekar 100411.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Nepal and Pakistan.

6. *Artemisia roxburghiana* Wall. ex Bess. in Bull. Soc. Nat. Mosc. 9: 57. 1836; Hook.f., Fl. Brit. India 3: 326. 1881; B.D. Naithani in Hajra & al., Fl. India 12: 38. 1995.

Perennial herbs. Stems erect, 40-90 cm high, sparsely minutely pubescent. Leaves 4-6 cm long, 2-pinnatifid, grey-white or white woolly beneath; lower leaves long petioled, oblong; middle and upper ones sessile, ovate, lobes ovate-lanceolate, acute. Heads subsessile, 3-4 mm dia. Involucral bracts 2 or 3-seriate, ovate-oblong, with broad scarious margin. Outer florets female, fertile; corolla narrowly tubular, obscurely 3-fid. Disc florets fertile, tubular.

Fl. & Fr.: July - September.

Scarce; on moist slopes, Thangri, 3700 m, 27.08.2002, K. Chandra Sekar 102976.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China; Nepal and Pakistan.

7. *Artemisia stronglylocephala* Pamp. var. *cachemirica* Pamp. in Nuovo Giorn. Bot. Ital. n.s. 34: 176. 1927; B.D. Naithani in Hajra & al., Fl. India 12: 44. 1995. *Burti Kshu Mndok*

Perennial herbs. Stems ascending, 35-70 cm high, grooved, obtusely angled, distinctly long hairy, purple. Leaves 1.8-4 cm long, pinnatifid; segments dentately lobed; lobes acuminate; rachis narrow, more or less pilose above, tomentose beneath. Heads sessile, hemispheric, lax-flowered, 3-4 mm dia. Involucral bracts purple. Disc florets fertile, purple; corolla tube small, glandular, gradually narrow, attenuate.

Fl. & Fr.: July - September.

Scarce; on rocky slopes, Mud-Iarang La, 3900 m, 18.08.2002, K. Chandra Sekar 102897.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Pakistan.

Decoction of young inflorescence is taken in fever.

8. *Artemisia wallichiana* Bess. forma *nitida* (Pamp.) B.D. Naithani in Hajra & al., Fl. India 12: 46. 1995. *A. moorjhanu* Wall. ex DC. forma *vilida* Pamp. in Nuovo Giorn. Bot. Ital. n.s. 34: 681. 1927. *Padm*

Perennial herbs. Stems ascending, 35-65 cm high, hoary, yellow. Leaves ovate-oblong, white-tomentose beneath, 2-pinnatifid; lobes ovate-lanceolate, acute. Heads sessile, campanulate, 4-6 mm dia., with 15-20-florets. Involucral bracts 2-3 x 0.8-1.5 mm; outer obovate, white-tomentose; inner broadly oblanceolate. Receptacle broad, hemispheric. Outer florets female, fertile, slender, 1-1.2 mm long. Disc florets fertile, 1-2 x 0.3-0.5 mm, limb 5-rid, dull purple. Achenes 0.5-1 mm long.

Fl. & Fr.: July - September.

Scarce; on moist slopes, Tariya, 4000 m, 24.07.2003, K. Chandra Sekar 103679.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China and Pakistan.

Leaf extract is given to cure cough and cold.

4. Aster L.

About 250 species distributed in America, Eurasia and Africa; 23 in India.

- | | |
|---|------------------------|
| 1a. Heads less than 2 cm dia.; pappus hairs red-brown | 1. <i>A. altaicus</i> |
| b. Heads more than 2 cm dia.; pappus hairs white | 2. <i>A. floccidus</i> |

1. *Aster altaicus* Willd., Enum. Hort. Berol. 881. 1809; Hook. & Th. Brit. India 3: 251. 1881; Hajra in Hajra & al., Fl. India 12: 81. 1995. *Heteropappus altaicus* (Willd.) Novopokr in Sched. ad. Herb. Fl. Ross. 8: 193. 1922; Aswal & Mehrotra, Fl. Lahaul Spiti 358. 1994. *A. altaicus* (Willd.) Novopokr. var. *canstani* (Nees) Serg. in Kirilov, Fl. W. Siberia 11: 226. 1949.

Perennial herbs. Stems erect or semiprostrate, 30-55 cm high, branched, strigose-pubescent. Leaves linear-lanceolate, 1.5 x 0.5-1 cm, attenuate at base, acute at apex, entire, appressed-strigose pubescent. Head solitary, 1.2-1.5 cm dia. Involucral bracts 2 or 3-seriate, linear-lanceolate, 4-6 mm

long, acuminate. Ray florets 14-16; tube 1.5-2 mm long. Disc florets 3-5 mm long, yellow; tube 1.5-2 mm long. Achenes obovoid, ca 2 mm long, pale brown. Pappus 2-5 mm long, red-brown.

Fl. & Fr.: July - September.

Occasional; on moist slopes. Sagnam, 3700 m, 27.08.2002, K. Chandra Sekar 108726.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan: Altai Mountains; China; Iran; Nepal and Pakistan.

2. *Aster flaccidus* Bunge in Mem. Acad. Sci. St.-Petersbourg 2: 599. 1835; Aswal & Mehrotra, Fl. Lahaul-Spiti 339. 1994; Hajra in Hajra & al., Fl. India 12: 86. 1995. *A. heterochaeta* C.B. Clarke, Comp. Ind. 44. 1876; Hook.f., Fl. Brit. India 3: 250. 1881. *A. tibeticus* Hook.f., Fl. Brit. India 3: 251. 1881. *Tonden Anjo Mentok* **Photo. 96**

Perennial herbs. Stems erect, 10-20 cm high. Basal leaves spatulate or oblanceolate-lanceolate, 1.5-5.1 x 0.5-1.3 cm, acute, villous; cauline ones 2 or 3, oblong, semi-amplexicaul. Head solitary, 3-4 cm dia. Involucral bracts 2-seriate, linear-lanceolate. Ray florets many; tube 1.5-2 mm long; ligule 1-1.8 cm long, blue. Disc florets 5-6 mm long, yellow. Achenes narrowly obovoid, 1.5-2 mm long, brown. Pappus hairs white.

Fl. & Fr.: July - September.

Scarce; on moist slopes. Chhohem, 4150 m, 12.07.2003, K. Chandra Sekar 103231.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; C. Asia; Nepal and Pakistan.

Leaf juice applied on cuts.

5. *Brachyactis* Ledeb.

Five species distributed in N. Asia and N. America; 3 in India.

- | | |
|-------------------------------|------------------------|
| 1a. Heads more than 1 cm dia. | <i>1. B. pubescens</i> |
| b. Heads less than 1 cm dia. | <i>2. B. raylei</i> |

1. *Brachyactis pubescens* (DC.) Aitch. & C.B. Clarke in J. Linn. Soc., London (Bot.) 18: 68. 1880; Aswal & Mehrotra, Fl. Lahaul-Spiti 340. 1994; Hajra in Hajra & al., Fl. India 12: 101. 1995. *Conyza pubescens* DC., Prodr. 5: 381. 1836. *Brachyactis robusta* Benth. in Hook.f., Icon. Pl. 12: sub. t. 1106. 1872; Hook.f., Fl. Brit. India 3: 254. 1881. *Paksi Dovo Mentok*

Annuals. Stems erect-ascending, 35-50 cm high, stout, glandular-pubescent. Leaves obovate, narrowed at base, toothed, pubescent. Heads 1-1.3 cm dia. Involucral bracts 2 or 3-seriate, subequal, linear to linear-lanceolate, acute; inner somewhat scarious. Female flowers many-seriate, all filiform. Bisexual flowers 5-20. Achenes obovate-lanceolate, 2-4 mm long, hairy. Pappus 4-5 mm long, white-brown.

Fl. & Fr.: July - September.

Scarce; on moist slopes. Farka-Bhaba Pass, 4000 m, 03.08.2002, K. Chandra Sekar 100580.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; Nepal and Pakistan.

2. *Brachyactis roylei* (DC.) Wendellbo in Nytt Mag. Bot., Oslo 1: 62. 1952; Aswal & Mehrotra, Fl. Lahaul-Spiti 341. 1994; Hajra in Hajra & al., Fl. India 12: 101. 1995. *Conyza roylei* DC., Prodr. 5: 381. 1836. *Brachyactis umbrosa* Benth. in Hook.f., Icon. Pl. 12: sub. t. 1106. 1872; Hook.f., Fl. Brit. India 3: 253. 1881.

Annuals. Stems ascending, 15-30 cm high, branched, glandular-pubescent. Leaves obovate, 1.2-2.1 x 0.3-0.5 cm, cuneate at base, lobulate, pubescent. Heads 0.7-1 cm dia. Involucral bracts 2-seriate, 2-3 mm long, female florets many-seriate, filiform. Achenes obovate, 1.5-2 mm long, sparsely silky. Pappus 4-5 mm long, white.

Fl & Fr: July - September.

Common; on moist slopes. Gechang, 3700 m, 24.08.2002, K. Chandra Sekar 100680.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; C. Asia; Nepal and Pakistan.

6. *Breca* Less.

About 250 species, distributed in N. temperate regions; 1 in India.

***Breca arvensis* (L.) Less.**, Syn. Comp. 9. 1832; Aswal & Mehrotra, Fl. Lahaul-Spiti 341. 1994; Hajra in Hajra & al., Fl. India 12: 155. 1995. *Serratula arvensis* L., Sp. Pl. 820. 1753. *Karbo Tia*

Perennial herbs. Stems erect, 40-80 cm high, leafy. Leaves sessile, pinnatifid, 7.5-11.5 cm long, white-lanate beneath. Head solitary, variable; male globose, 1.2-2.5 cm dia.; female campanulate, much longer. Involucral bracts 4 or 5-seriate; outermost triangular-ovate, ending in a short spine; inner gradually longer with undulate, often recurved tips; innermost linear-lanceolate, scarious. Achenes smooth. Pappus brown-white.

Fl & Fr: July - September.

Scarce; on moist slopes. Mane, 3650 m, 27.08.2002, K. Chandra Sekar 100738.

Distrib: India: Bihar, Himachal Pradesh, Jammu & Kashmir, Punjab, Uttarakhand, Uttar Pradesh and W. Bengal; Asia; Europe and introduced in N. America.

7. *Carduus* L.

Ninety one species distributed in Eurasia, Mediterranean region and S. African mountains; 4 in India.

***Carduus edelbergii* Rehb.f.**, Symb. Afghan. 2: 175. 1955; Aswal & Mehrotra, Fl. Lahaul-Spiti 341. 1994; Hajra in Hajra & al., Fl. India 12: 159. 1995.

Biennials. Stems erect, 36-62 cm high, interrupted winged; wings spinulose. Leaves sessile, 5-20 x 1.4-4.2 cm, waved spinous. Heads solitary, 2.5-3.6 cm dia., involucre hemispheric or subcampanulate; involucral bracts subulate-lanceolate, 1-1.6 cm long, spiny at tip, reflexed. Flowers 1.5-2 cm long, pink-purple. Achenes 4.5-5 mm long, glabrous, granulate, pale brown. Pappus 1-1.5 cm long, dull white.

Fl & Fr: June - September.

Scarce; on rocky slopes. Thango, 3800 m, 01.08.2002, K. Chandu Sekar 102821.

Distrib: India: Himachal Pradesh and Jammu & Kashmir; Afghanistan and Pakistan.

8. *Chrysanthemum* L.

About 200 species distributed in Asia, Europe and America; 16 in India.

Chrysanthemum pyrethroides (Kar. & Kir.) B. Fedtsch-Rostit., Turke Sr. 737. 1915; Aswal & Mehrotra, Fl. Lahaul-Spiti 343. 1994; B.D. Naitani in Hajra & al., Fl. India 12: 49. 1995. *Richteria pyrethroides* Kar. & Kir. in Bull. Soc. Imp. Nat. Misc. 120. 1842. *Chrysanthemum richteria* Benth., Gen. Pl. 2: 426. 1873; Hook.f., Fl. Brit. India 3: 315. 1881. *Burse Mendok* **Photo. 97**

Perennial herbs, 15-30 cm high, branches tufted, leafy; rootstock woody. Radical leaves 3-10 x 1-1.5 cm, 2 or 3-pinnatisect; lobes oblong-linear, aristate; cauline ones few, 2-7 x 0.3-1.4 cm, 2 or 3-pinnatisect. Heads solitary, 1-3 cm dia., involucrel bracts oblong-lanceolate to elliptic-lanceolate, 4-5 x 0.8-1 mm, acute. Receptacle spherical, naked. Ray flowers female, 1-1.3 x 0.2-0.4 cm; ligule white, obscurely 3-fid. Disc flowers yellow, bisexual; limb 4 or 5-fid. Achenes cylindrical. Pappus lobes broadly oblong.

Fl & Fr: June - September.

Scarce; on moist slopes. Thango, 3950 m, 19.07.2002, K. Chandu Sekar 100486.

Distrib: India: Himachal Pradesh and Jammu & Kashmir; China and Pakistan.

The fumes from smoked plant are inhaled to cure from asthma.

9. *Cicerbita* Wallr.

Eighteen species, distributed in N. temperate Old World, especially in mountains; 6 in India.

Cicerbita macrorhiza (Royle) P. Beauv. in Bull. Soc. Bot. Geneve, Ser. 2, 2: 120. 1910; Mangain & R.R. Rao in Hajra & al., Fl. India 12: 272. 1995. *Antiquidium macrorhizum* Royle, Illustr. Bot. Himal. 251. t. 61. f. 1. 1835. *Lactuca macrorhiza* (Royle) Hook.f., Fl. Brit. India 3: 408. 1881; Aswal & Mehrotra, Fl. Lahaul Spiti 368. 1994. *Mendok Kbente, Dubnaba, Mendok Nonso Mendok* **Photo. 98**

Perennial herbs; rootstock elongated. Stems ascending, 20-35 cm high. Leaves variable, 10-22 x 1.2-4 cm; lower leaves petioled with toothed auricle; upper ones sessile, auricled at base. Heads 1-1.8 x 0.5-0.8 cm. Involucrel bracts many-seriate; outer bracts ovate lanceolate, 3-5 x 1.2 mm; inner linear-oblong. Ligules violet-purple. Anthers bluish. Achenes elliptic-lanceolate, 5-7 mm long, dark brown or black. Pappus 4-5 mm long, silvery white.

Fl & Fr: June - September.

Common; on rocky slopes. Shim-Chhuhem, 4000 m, 12.07.2003, K. Chandu Sekar 101185.

Distrib: India: Himachal Pradesh, Jammu & Kashmir, Manipur, Punjab, Sikkim, Uttarakhand, Uttar Pradesh and W. Bengal; Afghanistan; Bhutan; China; Iran; Nepal and Pakistan.

Juice of rootstock given to cure stomach pain.

10. *Cousinia* Cass.

About 500 species distributed from E. Mediterranean to C. Asia and the W. Himalays; 5 in India.

Cousinia thomsonii C.B. Clarke, Comp. Ind. 213. 1876; Hook.f., Fl. Brit. India 3: 360. 1881; Aswal & Mehrotra, Fl. Lahaul-Spiti 346. 1994; Hajra in Hajra & al., Fl. India 12: 175. 1995. *Tibet Sci*

Photo. 99

Perennial herbs. Stems erect, stout, 23-58 cm high. Basal leaves deeply interruptedly pinnatifid, 12.5-22 x 1.8-3.2 cm, densely white tomentose beneath; lobes triangular, with a stout nerve and long spine; cauline ones ovate-lanceolate with spiny tip and lobes. Heads 2.5-5 cm dia. Involucral bracts many, triangular-lanceolate, 1-3.2 cm long, spiny at tip; outer recurved. Corolla 1.2-1.6 cm long, purplish. Achenes obovoid, glabrous. Pappus scabrid.

Fl. & Fr.: June - September.

Scarce; on rocky slopes. Gechang, 3720 m, 15.07.2002, K. Chandra Sekar 100451.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; Nepal and Pakistan.

11. *Cremanthodium* Benth.

About 70 species distributed mainly in India, China and Nepal; 14 in India.

Cremanthodium arnicoides (Wall.) R. Good in J. Linn. Soc., London (Bot.) 48: 288. 1929; Aswal & Mehrotra, Fl. Lahaul-Spiti 347. 1994; R. Mathur in Hajra & al., Fl. India 13: 307. 1995. *Sonchus arnicoides* Wall., Cat. n. 3138. 1831; Hook.f., Fl. Brit. India 3: 351. 1881.

Region Cherpo Mensa, Region Mensa, Regionie

Perennial herbs. Stems erect, 40-70 cm high. Leaves oblong-ovate or elliptic-oblong, 2-16 x 1.7-9 cm, obtuse, coarsely dentate to entire; basal leaves narrowed into a stout, 6-8 cm long petiole; upper ones sessile with amplexicaul base. Capitula bright yellow. Involucral bracts oblong-ovate, 7-8 x 1.2-2 mm, connate at base, obtuse. Ray florets 1.2-1.5 cm long; ray broadly elliptic, 3 or 4-dentate at apex; tube 4-5 mm long. Achenes 5-6 mm long, pale brown. Pappus 3-5 mm long, white.

Fl. & Fr.: July - September.

Common; on moist slopes. Tariya, 4100 m, 08.08.2002, K. Chandra Sekar 100637.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan.

Paste of whole plant applied externally on wounds in cattle.

12. *Crepis* L.

About 200 species distributed in N. hemisphere, S. Africa and S. America; 9 in India.

Crepis multicaulis Ledeb., Fl. Altaica 4: 125. 1833; Aswal & Mehrotra, Fl. Lahaul Spiti 349. 1994; Mangain & R.R. Rao in Hajra & al., Fl. India 12: 230. 1995. *Jak Kart Metlak*

Perennial herbs. Stems erect, 24-40 cm high, slender. Radical leaves long petioled, narrowly obovate-spatulate, 3-9 x 1-2 cm, pinnatifid; cauline ones bract-like. Heads erect, 7-9 x 2-3 mm, with many

florets. Outer involucrel bracts ovate-lanceolate, minute; inner ones linear-lanceolate. Ligules yellow. Achenes narrowly fusiform, 3-4 mm long, 10-12-ribbed, reddish brown. Pappus 3-4 mm long, white.

Fl. & Fr.: June - September.

Scarce; on moist slopes. Paru - Bhaba Pass, 03.08.2002, K. Chandra Sekar 100578.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; China; Norway; Pakistan and Turkey.

Juice of young plants given to cure running nose.

13. *Dubyaea* DC.

Ten species distributed in Himalayan region and W. China; 2 in India.

Dubyaea hispida (D. Don) DC., Prodr. 7: 247. 1838; Margain & R.R. Kao in Hajra & al., Fl. India 12: 275. 1995. *Hieracium hispidum* D. Don, Prodr. Fl. Nep. 165. 1825. *Lactuca dubyaea* C.B. Clarke, Comp. Ind. 271. 1876; Hook.f., Fl. Brit. India 3: 409. 1881. *Mentok Chashin Dekho*

Perennial herbs; rhizomes creeping. Stems erect, 40-70 cm high, robust, leafy. Leaves 5-15 x 3-5 cm; lower leaves ovate-lanceolate; petioles winged; upper sessile and gradually reduced. Heads nodding, 1.5-3 x 1.3-2 cm. Involucrel bracts unequal; outer linear-lanceolate, 6-9 mm long; inner linear-oblong, 1.3-1.6 cm long. Ligules yellow. Anthers yellow. Achenes lanceolate, 8-9 mm long. Pappus 1-1.2 cm long, white.

Fl. & Fr.: July - September.

Scarce; on moist slopes. Near Tanya, 05.08.2002, K. Chandra Sekar 100613.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim, Uttarakhand, Uttar Pradesh and West Bengal; Bhutan; China; Myanmar; Nepal and Pakistan.

Extract of young plants given as a remedy to children suffering from dysentery.

14. *Erigeron* L.

About 150 species, cosmopolitan especially in N. America; 14 in India.

- 1a. Heads trimorphic 1. *E. acer*
 b. Heads dimorphic 2. *E. uniflorus*

1. *Erigeron acer* L., Sp. Pl. 863. 1753, '*acris*'; Hook.f., Fl. Brit. India 3: 255. 1881; Hajra in Hajra & al., Fl. India 14: 117. 1995.

Annuals. Stems erect, 30-40 cm high. Basal leaves petioled, elliptic-obovate, 2.5-8 x 0.5-1 cm, remotely serrate; cauline sessile, lanceolate. Involucre 0.8-1 cm dia. Involucrel bracts 2 or 3-seriate, linear-lanceolate, 3-6 mm long. Florets trimorphic. Ligules 3-5 mm long, purplish; female florets elongate, 2.5-3 mm long; disc florets 4-5 mm long. Achenes oblanceolate, 1.5-2 mm long, sparsely pubescent.

- 1a. Plants with dense crispate hairs i. var. *acer*
 b. Plants without dense crispate hairs ii. var. *multicaulis*
 f. var. *acer* *Ashak* Photo. 100

Fl. & Fr.: July - September.

Common; on moist slopes. Gechang Thango, 3850 m, 10.07.2003, K. Chandra Sekar 101176.

District: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia and Europe.

Decoction of whole plant taken to be relieved from cough and cold.

ii. var. *multicaulis* (Wall. ex DC.) C.B. Clarke, Comp. Ind. 53. 187. 1876; Aswal & Mehrotra, Fl. Lahaul-Spiti 352. 1994; Hajra in Hajra & al., Fl. India 12: 118. 1995. *L. multicaulis* Wall. ex DC., Prodr. 5: 292. 1836. *E. alpinus* var. *multicaulis* (Wall. ex DC.) Hook.f., Fl. Brit. India 3: 255. 1881. *Lucknow*

Fl. & Fr.: June-September.

Common; on rocky slopes. Thango-Kilung, 4100 m, 31.07.2003, K. Chandra Sekar 103708.

District: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; Bhutan; China; Nepal and Pakistan.

Leaf-smoke is often inhaled to relieve from breathing trouble that aggravate during winter.

2. *Erigeron uniflorus* L., Sp. Pl. 864. 1753; Aswal & Mehrotra, Fl. Lahaul-Spiti 355. 1994; Hajra in Hajra & al., Fl. India 12: 126. 1995.

Annuals. Stems erect, 25-40 cm high. Basal leaves obovate-lanceolate, 2.1-7.3 x 0.5-0.8 cm; cauline leaves linear-oblong, gradually small upwards. Head solitary. Involucral bracts 2 or 3-seriate, linear lanceolate, longer than disc, hirsute, recurved. Ligules numerous, linear. Achenes about as long as the pappus, villous. Pappus of outer series small.

Fl. & Fr.: July - September.

Scarce; on moist slopes. Tariya-Pin-Parvati Pass, 4100 m, 24.07.2003, K. Chandra Sekar 103668.

District: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China and Pakistan.

15. *Gnaphalium* L.

About 50 species, cosmopolitan; 10 in India.

Gnaphalium luteo-album L. subsp. *affine* (D. Don) Koster in Blunca 4(3): 484. 1941; P.C. Pant in Hajra & al., Fl. India 13: 89. 1995. *G. affine* D. Don, Prodr. Fl. Nepal. 173. 1825. *G. luteo-album* L. var. *multiceps* DC., Prodr. 6: 222. 1838; Hook.f., Fl. Brit. India 3: 288. 1881.

Annuals. Stems erect, 20-35 cm high, white woolly tomentose. Leaves sessile, oblong-spathulate, 2.6 x 0.5-1.2 cm, narrowed down to the stem, obtuse, densely white woolly tomentose beneath, 1-nerved; upper ones linear-lanceolate. Heads clustered, 3-4.5 mm dia. Involucral bracts many-seriate, elliptic-lanceolate, yellow. Ray florets female, 1.5-2 mm long, 3 or 4-toothed. Disc florets bisexual, 5-toothed. Achenes linear. Pappus hairs white.

Fl. & Fr.: July - September.

Rare; on moist slopes. Mud-Tilling, 3800 m, 26.08.2002, K. Chandra Sekar 102951.

District: Throughout India; Asia; Africa; Australia and Europe.

16. *Hieracium* L.

About 90 species chiefly in Asia, Europe, N. America and South Africa from tropical, temperate to alpine mountain regions; 6 in India.

Hieracium crocatum Fries, Symb. Hierac. 183. 1864; Hook.f., Fl. Brit. India 3: 400. 1881; Mangain & R.R. Rao in Hajra & al., Fl. India 12: 240. 1995. Mendok Kurser

Perennial herbs. Stems erect, 40-60 cm high, branched. Leaves sessile or shortly petioled, elliptic-lanceolate, 2.5-8 x 0.6-1.6 cm, minutely toothed, glaucous beneath, sparsely ciliate towards margin. Heads erect, 1-2 x 0.5-0.8 cm. Outer involucrel bracts ovate-lanceolate, 4-6 x 1-1.5 mm; inner linear-lanceolate, 0.9-1.2 x 0.1-0.15 cm. Ligules 5-toothed. Achenes 4-5 mm long, subcompressed, black-brown. Pappus 5-6 mm long, soft, white.

Fl. & Fr.: July - September.

Rare; on rocky slopes. Tilling, 3800 m, 26.08.2002, K. Chandra Sekar 100705.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Asia and Europe.

plant ash is massaged on the gums to be relieved of toothache.

17. *Jurinea* Cass.

About 200 species distributed in C. Europe, Mediterranean region to China; 2 in India.

Jurinea dolomiaea Boiss., Fl. Orient. Suppl. 311. 1888; Hajra in Hajra & al., Fl. India 12: 183. 1995. *Dolomiaea macrocephala* Royle, Illustr. Bot. Himal. 251. t. 57. 1835. *Jurinea macrocephala* (Royle) C. B. Clarke, Comp. Ind. 237. 1876, non DC., 1838; Hook.f., Fl. Brit. India 3: 378. 1881. *Jurineella macrocephala* (Royle) Aswal & Goel in Indian J. For. 11(4): 339. 1988. Khuk Lang Mendok

Perennial acaulescent herbs; root woody. Leaves oblong-lanceolate, 15-30 x 3.5-12.6 cm, deeply pinnatifid, white-lanate above, densely white-tomentose beneath. Heads 3-20, short-peduncled, 1.5-2.7 cm dia. Involucrel bracts 1.8-3.5 cm long; outer ovate-lanceolate; inner elliptic-lanceolate. Receptacular bristles united into lacinate cup. Corolla 2-3 cm long. Achenes cuneate-obovate, 6-8 mm long, compressed. Pappus 2-2.5 cm long, brown.

Fl. & Fr.: July - September.

Rare; on moist rocky slopes. Mud-Jarang La, 4300 m, 18.08.2002, K. Chandra Sekar 102892.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China; Nepal and Pakistan.

Decoction of tuberous roots is considered to enhance vitality in men.

18. *Lactuca* L.

About 75 species, cosmopolitan especially in N. temperate regions; 24 in India.

- | | | |
|-----|-------------------------------|----------------------------|
| 1a. | Achenes beaked | 2 |
| | b. Achenes not beaked | 2. <i>L. orientalis</i> |
| 2a. | Leaves entire | 1. <i>L. dolichophylla</i> |
| | b. Leaves variously dissected | 3. <i>L. tatarica</i> |

1. ***Lactuca dolichophylla*** Kitam. in Hara, Fl. F. Himal. 1: 341. 1966; Aswal & Mehrotra, Fl. Lahaul-Spiti 367. 1994; Mangain & R.R. Rao in Hajra & al., Fl. India 12: 299. 1995. *L. longijolia* DC., Prodr. 7: 135. 1838; Hook.f., Fl. Brit. India 3: 405. 1881.

Biennials. Stems erect, 1-1.2 m high. Leaves sessile, lanceolate or linear lanceolate, 5-16 x 0.5-1.4 cm, base sagittate with 2 stipules-like auricles. Heads 1-1.5 x 0.3-0.5 cm, 10-25-flowered. Ligules pink-blue. Outer involucre bracts ovate, 2-3 x 1-2 mm, pale green; inner linear-lanceolate, 8-12 x 2-2.5 mm. Achenes elliptic-oblancoate, 5-7 mm long (including the beak), smooth, brown. Pappus 4-6 mm long, white.

Fl. & Fr.: July - September.

Rare; on moist slopes. Thangri, 3700 m, 27.08.2002, K. Chandra Sekar 102992.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; Nepal and Pakistan.

2. *Lactuca orientalis* (Boiss.) Boiss., *Fl. Orient.* 3: 819. 1875; Hook.f., *Fl. Brit. India* 3: 404. 1881; Aswal & Mehrotra, *Fl. Lahaul Spiti* 369. 1994; Mangain & R.R. Rao in Hajra & al., *Fl. India* 12: 295. 1995. *Phenopus orientalis* Boiss., *Voy. Bot. Mod. Esp.* 2: 390. 1838. *Acebkma*

Perennial herbs; rootstock woody. Stems ascending-erect, 25-45 cm high, branched, silvery. Leaves 2-5 x 0.5-0.9 cm, narrow, sparse; lower pinnatifid, spreading, triangular, acute, lobes slightly toothed; upper elliptic or oblanceolate, entire. Heads solitary or 2 or 3 in axillary fascicles. Outer involucre bracts ovate lanceolate, 2-5 x 1-2 mm; inner bracts linear-oblong, 0.7-1 x 0.15-0.22 cm. Corolla yellow. Achenes 4-5 mm long, yellow-pale brown. Pappus 4-5 mm long, silvery.

Fl. & Fr.: July - September.

Common; on rocky slopes. Sagnam - Mud, 3750 m, 26.08.2002, K. Chandra Sekar 102965.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Afghanistan; C. Asia and Pakistan.

Paste of flower heads is applied on forehead in headache.

3. *Lactuca tatarica* (L.) C.A. Mey., *Enum., Fl. Cauc.* 56. 1831; Aswal & Mehrotra, *Fl. Lahaul Spiti* 370. 1994; Mangain & R.R. Rao in Hajra & al., *Fl. India* 12: 287. 1995. *Sonchus tataricus* L., *Mant.* 2: 572. 1772. *Lactuca clarkii* Hook.f., *Fl. Brit. India* 3: 406. 1881. *L. tatarica* C.A. Mey. var. *tibetica* Hook.f., *Fl. Brit. India* 3: 406. 1881.

Annuals. Stems erect, 25-35 cm high, glabrous, leafy. Leaves sessile, sinuate toothed, 5-12 x 1-2 cm, amplexicaul, pungent at apex. Heads 1.2-2 x 0.4-0.7 cm, many-flowered. Outer involucre bracts oblong ovate, 4-6 x 2-3 mm; inner linear-oblong, 1.1-1.4 x 0.2-0.3 cm. Ligules pale blue. Anthers bluish. Achenes narrowly oblong, 5-6 mm long (including the beak), 4-6-ribbed. Pappus 0.9-1.2 cm long, white.

Fl. & Fr.: July - September.

Scarce; on moist slopes. Tharbik, 4000 m, 24.08.2002, K. Chandra Sekar 100678.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Afghanistan; China; C. Asia; Europe; Iran; Mongolia and Pakistan.

19. *Leontopodium* (Pers.) R. Br.

Fifty eight species distributed in the mountains of Asia, Europe and S. America; 8 in India.

1a. Involucre bracts less than 2 cm long

1. *L. alpinum*

b. Involucral bracts more than 2 cm long

2. *L. himalayanum*

1. ***Leontopodium alpinum*** Cass. in Dict. Sci. Nat. 25: 474. 1822; Hook.f., Fl. Brit. India 3: 279. 1881; P.C. Pant in Hajra & al., Fl. India 13: 104. 1995. *Kheola W'ari*

Perennial herbs. Stems erect, 10-15 cm high, white-tomentose. Leaves 0.5-2.3 x 0.2-0.3 cm; basal leaves clustered, spatulate; cauline ones scattered, linear-lanceolate, narrowed at base or abruptly stem clasping, obtuse. Heads clustered, 5-8 mm dia., subtended by linear-oblong, densely tomentose, foliaceous bracts. Involucral bracts 3 or 4-seriate, white-woolly. Ray florets 2-3 mm long, 4-toothed; corolla 2.5-3 mm long, 5-lobed. Achenes oblong. Pappus hairs white.

Fl & Fr: July - August.

Rare; on rocky slopes. Chhohen, 4150 m, 12.07.2003, *K. Chandra Sekar* 103228.

Distrib: India: Himachal Pradesh and Jammu & Kashmir; C. Asia and Europe.

Extract of plants mixed with mustard oil is massaged to cure leg and back pain.

2. ***Leontopodium himalayanum*** DC., Prodr. 6: 276. 1838; Aswal & Mehrotra, Fl. Lahaul-Spiti 373. 1994; P.C. Pant in Hajra & al., Fl. India 13: 106. 1995.

Perennial herbs. Stems erect, 12-22 cm high, white-cottony hairy. Leaves linear-lanceolate, 0.8-4.8 x 0.1-0.3 cm, stem clasping at base, acute, grey-white woolly beneath. Heads 4-8 mm dia., subtended by lanceolate to linear, foliaceous bracts. Involucral bracts 3 or 4-seriate. Ray florets female, 3-4 mm long; corolla filiform, 3-lobed. Disc florets bisexual; corolla 2-3 mm long, 5-lobed. Achenes 0.8-1 mm long. Pappus hairs white.

Fl & Fr: June - September.

Parahio catchment, Kilung, 19.07.1992, *Nima & Yasbir* 10 (W11).

Distrib: India: Himachal Pradesh; Jammu & Kashmir and Uttarakhand; Bhutan; China; Nepal and Pakistan.

20. *Myriactis* Less.

Twelve species distributed from Caucasus to Japan and New Guinea; 5 in India.

Myriactis wallichii Less. in Linnaea 6: 129. 1831; Hook.f., Fl. Brit. India 3: 247. 1881; Hajra in Hajra & al., Fl. India 12: 135. 1995. *Karnab Mendok*

Annual herbs. Stems erect, 16-28 cm high, ribbed. Leaves elliptic lanceolate, 1.5-5.2 x 1-1.9 cm, unequally serrate, hispidulous; petioles 1-2.3 cm long, narrowly winged; upper leaves sessile. Heads semiglobose, 5-6 mm dia., on slender peduncles. Involucral bracts erect, 2-3 mm long. Marginal flowers 3-5-seriate, elliptic-linear. Receptacle convex. Achenes 1.5-2 mm long, flat, smooth.

Fl & Fr: June - September.

Scarce; on moist slopes. Mud, 3900 m, 02.08.2002, *K. Chandra Sekar* 102834.

Distrib: India: Himachal Pradesh, Sikkim and Uttarakhand; Asia.

Note: Collett (1921) treated this species under *M. nepalensis* as it is very closely allied to *M. nepalensis* Less., but differs from it in marginal flowers which are 3-5-seriate and ligules (of marginal flowers) elliptic-linear. Aswal & Mehrotra (1994) doubted its occurrence in Lahaul-Spiti.

21. *Picris* L.

About 40 species distributed in Europe, N. Africa, N. Asia and S. Asia from subtropical to temperate mountain regions; 1 in India.

Picris hieracioides L. subsp. *kaímaensis* Kitam. in Acta Phyt. Geobot. 27: 37. 1957; Aswal & Mehrotra, Fl. Lahaul-Spiti 374. 1994; Mangain & R.R. Rao in Hajra & al., Fl. India 12: 235. 1995.

Checkakpa

Annuals or biennials. Stems 0.6-1.2 m high, corymbosely branched. Basal leaves petioled, oblanceolate, 10-16 x 2-3.3 cm, sinuate-toothed; cauline ones sessile, half amplexicaul or stem-clasping, entire. Heads terminal, cylindric. Outer involucrel bracts ovate lanceolate, 2.4 x 1-1.5 mm, densely hairy; inner linear-lanceolate, 1-1.2 x 0.1-0.2 cm, hairy. Stamens 5. Achenes ellipsoid, 4-5 mm long. Pappus white feathery.

Fl. & Fr.: July - September.

Rare; on moist slopes. Gechang, 3800 m, 24.08.2002, K. Chandra Sekar 100685.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Meghalaya, Sikkim and Uttarakhand; Bhutan; Nepal and Pakistan.

Extract of plant mixed with salted curd is given to cure jaundice.

22. *Psychrogeton* Boiss.

About 20 species distributed in S. W. and C. Asia; 1 in India.

Psychrogeton andryaloides (DC.) Novopkr. ex Krasch. in Acta Inst. Bot. Acad. Sci. U.R.S.S. Ser. 1, Fasc. 3: 343. 1937; Aswal & Mehrotra, Fl. Lahaul-Spiti 375. 1994; Hajra in Hajra & al., Fl. India 12: 138. 1995. *Cunyrza andryaloides* DC., Prodr. 5: 377. 1836. *Erigeron andryaloides* (DC.) Benth. ex C.B. Clarke, Comp. Ind. 52. 1876; Hook.f., Fl. Brit. India 3: 255. 1881. **Photo. 101**

Perennial herbs with thick woody rootstock. Leaves densely crowded, spatulate, 2.5-5.2 cm long, entire or lobulate at margin. Scapes 3-4 cm long, 1 or 2 linear-leaved. Heads 1.2-1.5 cm dia. Involucrel bracts linear, acute, pubescent. Ligules short, broad, revolute. Achenes 3-4 mm long, flat, narrow, silky. Pappus 1 seriate, white, turning reddish.

Fl. & Fr.: July - September.

Common; on rocky slopes. Chhohem, 4050 m, 13.07.2003, K. Chandra Sekar 103240.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China; C.I.S. and Pakistan.

23. *Saussurea* DC.

About 300 species distributed in Eurasia; 61 species in India.

- | | |
|---|--------------------------|
| 1a. Plants densely woolly | 2 |
| b. Plants not densely woolly | 3. <i>S. jacea</i> |
| 2a. Leaves oblong-obovate or obovate-lanceolate; pappus white or dull white | 1. <i>S. glacialis</i> |
| b. Leaves linear-lanceolate; pappus pale brown or dull blue | 2. <i>S. gnaphalodes</i> |

1. **Saussurea glacialis** Herd. in Bull. Soc. Nat. Mosc. 40, 3: 144. 1867; Hajra in Hajra & al., Fl. India 12: 199. 1995. *Akitha* Fig. 11

Perennial polycarpic herbs; rhizomes thick, long. Leaves radiating from a common center, not regularly arranged, short-petioled, oblong-obovate or obovate-lanceolate, 2-4.2 x 0.3-1.2 cm, densely woolly, white-greenish; petioles 2-3.2 cm long, densely woolly. Inflorescence hemispheric, 2.5-4.3 cm dia. Involucral bracts often red, scarious. Pappus white or dull white.

Fl & Fr: July - September.

Rare; on rocky slopes. Near Pin Parvati Pass, 5320 m, 23.07.2003, K. Chandras Sekar 103637.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China; C. Asia; Pakistan and W. Siberia.

Paste of whole plant is eaten with curd to enhance vitality of men.

2. **Saussurea gnaphalodes** (Royle ex DC.) Sch.-Bip. in Linnaea 19: 331. 1846; Aswal & Mehrotra, Fl. Lahaul-Spiti 378. 1994; Hajra in Hajra & al., Fl. India 12: 200. 1995. *Aplotaxis gnaphalodes* Royle ex DC., Prodr. 6: 542. 1838. *Saussurea sorocephala* (Schrenk) Sch.-Bip. in Linnaea 19: 331. 1876. *Saussurea sorocephala* Hook.f. & Thomson in C.B. Clarke, Comp. Ind. 226. 1876.

Perennial herbs, densely tufted; rootstock much branched. Stems absent or very short, thickly woolly or cottony. Leaves linear lanceolate, 1.2-2.5 cm long, obscurely toothed, densely woolly. Heads cylindrical, 1-1.3 cm dia. Florets 0.8-1.2 cm long, embedded in dense woolly hairs. Involucral bracts lanceolate, silky. Achenes narrow, 5 angled. Pappus pale brown or dull blue.

Fl & Fr: July - September.

Parahio catchment, Kulung, 5100 m, 19.07.1992, Nimsa & Yarbveer 11 (WIT).

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China, C. Asia, Nepal and Pakistan.

3. **Saussurea jacea** (Klotz.) C.B. Clarke, Comp. Ind. 233. 1876; Aswal & Mehrotra, Fl. Lahaul-Spiti 379. 1994; Hajra in Hajra & al., Fl. India 12: 204. 1995. *Aplotaxis jacea* Klotz. in Bot. Ergebn. Reise Pr. Walden. 79-80. 1862; Hook.f., Fl. Brit. India 3: 375. 1881. *Sbor* Photo. 102

Perennial herbs. Stems 0.6-1 m high, terete. Leaves sessile, 5-9.5 x 2.5-4.8 cm, ovate-oblong, half-amplexicaul, obtuse-acute, quire entire, scaberrulous on both surfaces. Head solitary, 1-2 x 0.8-1.3 cm. Outer involucral bracts ovate; inner ones lanceolate, with purple margin. Receptacle narrow with curved bristles, exceeding the involucre. Corolla 1.3-1.6 cm long. Achenes smooth. Pappus 1-1.2 cm long, brown.

Fl & Fr: July - September.

Scarce; on moist rocky slopes. Gechang, 3900 m, 24.08.2002, K. Chandras Sekar 100682.

Distrib: India: Himachal Pradesh and Jammu & Kashmir; Afghanistan and Pakistan.

Smoke of flower heads is inhaled to cure asthma.

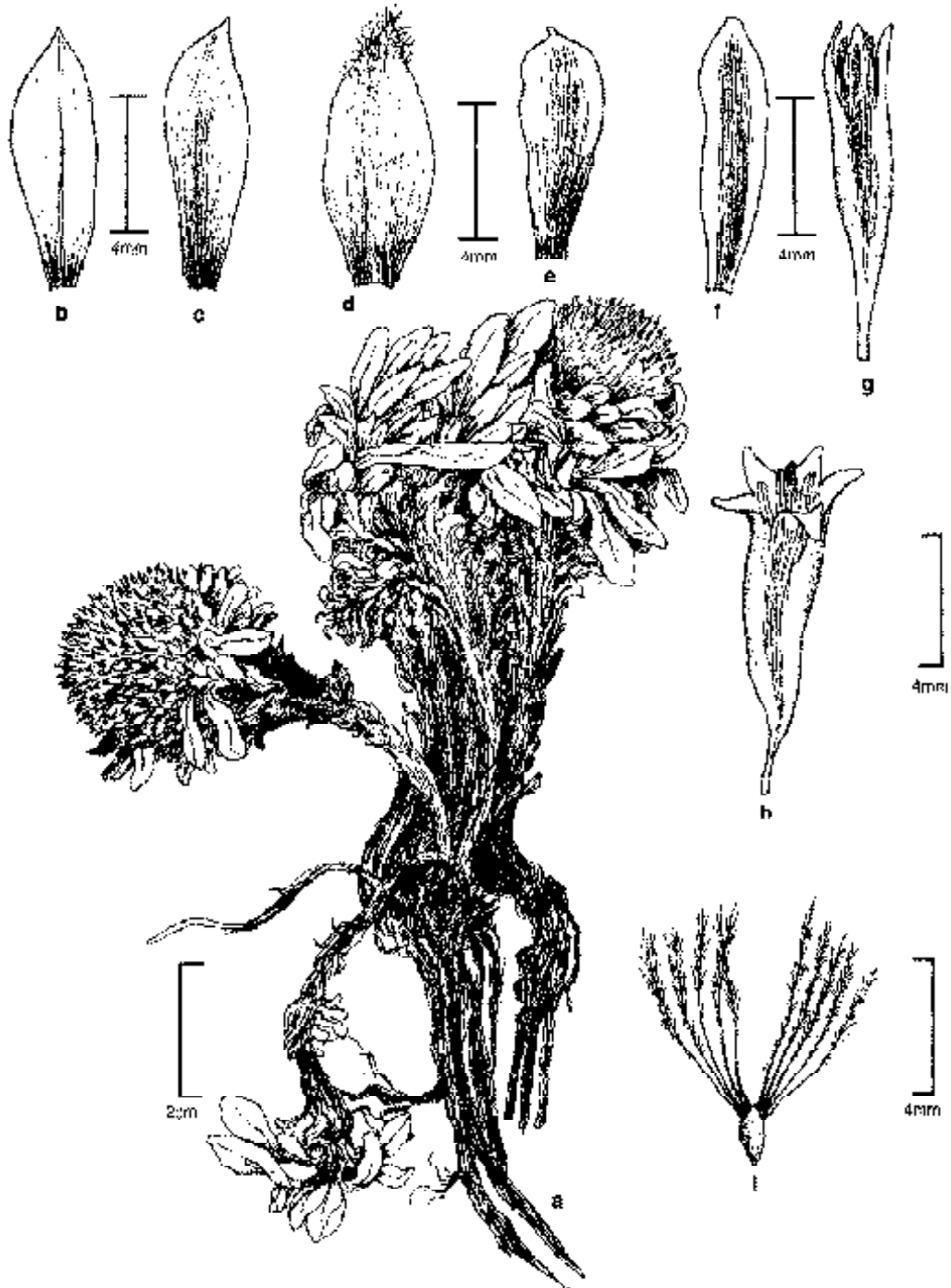


Fig. 11. *Saussurea glacialis* Herd. a. Habit. b-d. Outer involucral bract, e & f. Inner involucral bract, g & h. Flower, i. Achene with pappus.

24. *Scorzonera* L.

About 175 species distributed from Mediterranean to C. Asia; 2 in India.

Scorzonera virgata DC., Prodr. 7: 125. 1838; Aswal & Mehrotra, Fl. Lahaul Spiti 381. 1994; Mangain & R.R. Rao in Hajra & al., Fl. India 12: 338. 1995. *Boma Isa*

Perennial herbs; rootstock woody. Stems erect, 24-40 cm high, grooved. Leaves crowded at the base of stem, sessile, 5-26 x 0.1-0.4 cm, sheathed at the base, glabrous. Heads erect, campanulate, 2-3.5 x 0.5-0.8 cm, on a long peduncle. Outer involucrel bracts ovate-cordate, 3-7 x 2-4 mm, unequal; inner linear-lanceolate, 1-2 x 0.4-0.6 mm. Ligules 4 or 5-toothed, yellow. Achenes lanceolate, 1.2-1.5 cm long, subcompressed, many-ribbed. Pappus feathery, 0.8-1.2 cm long, yellowish.

Fl. & Fr.: June - August.

Common; on rocky slopes. Shrim-Chhohetu, 4000 m, 12.07.2003, K. Chandra Sekar 101191.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; China; Mongolia and Pakistan.

Given as fodder to cattle to increase lactation.

25. *Senecio* L.

About 1250 species, cosmopolitan; 44 in India.

1a. Leaves both radical and cauline

2. *S. laetus*

b. Leaves only cauline

1. *S. desfontainii*

1. *Senecio desfontainii* Druce, Brit. Pl. List, ed. 2: 61. 1928; R. Mathur in Hajra & al., Fl. India 13: 248. 1995. *S. chrysanthemifolius* DC., Prodr. 6: 345. 1838; Hook.f., Fl. Brit. India 3: 341. 1881.

Annuals. Stems suberect, 30-40 cm high. Leaves oblong, 2.3-5.1 x 0.5-1 cm, obtuse, irregularly pinnatifid; lobes linear-oblong. Heads radiate, 7-8 mm dia. Involucre campanulate, 4-5 x 2-4 mm. Involucrel bracts 15-20, linear-lanceolate, 4-5 x 0.8-1 mm, blackish. Ray florets 8-12, 5-6 mm long; ray elliptic-oblong, 2-3 mm broad, revolute. Disc florets very slender, 5-6 mm long. Achenes cylindrical, 2-3 mm long. Pappus white hairy.

Fl. & Fr.: July - August.

Common; on moist slopes. Sagnam, 3650 m, 27.08.2002, K. Chandra Sekar 100731.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Asia and N. Africa.

2. *Senecio laetus* Edgew. in Trans. Linn. Soc. London 20: 74. 1846; Aswal & Mehrotra, Fl. Lahaul-Spiti 384. 1994; R. Mathur in Hajra & al., Fl. India 13: 263. 1995. *S. chrysanthoides* DC., Prodr. 6: 365. 1838. Hook.f., Fl. Brit. India 3: 339. 1881. *Tugru Seva Mentok, Tugru sobu Mentok*

Perennial herbs. Stems erect, 28-38 cm high. Leaves both radical and cauline, radical leaves petioled, ovate-lanceolate, 8-12 x 3-6 cm, attenuate at base, obtuse, lyrate-pinnatifid; cauline leaves sessile, ovate-lanceolate, with auricled base. Heads radiate, bracteolate. Involucre campanulate, 3-4 mm dia. Involucrel bracts 10-12, oblong to oblong-lanceolate, acute, brown. Ray florets oblong, 5-6.5 mm long, 3-toothed at apex. Disc florets numerous, 5-5.5 mm long. Achenes cylindrical, 2-2.5 mm long, strongly ribbed, pale-brown.

Fl. & Fr.: July - September.

Scarce; on moist slopes. Thangti, 4000 m, 27.08.2002, K. Chandra Sekar 102981.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Bhutan; Nepal and Pakistan.

Description of young plant is given to cure whooping cough.

26. *Synotis* (C.B. Clarke) C. Jeffrey & Y.L. Chen

About 50 species distributed in Sino-Himalayan region and China; 19 in India.

Synotis kunthiana (Wall. ex DC.) C. Jeffrey & Y.L. Chen in Kew Bull. 29 (2): 288. 1984; Aswal & Mehrotra, Fl. Labaul-Spiti 388. 1994; R. Mathur in Hajra & al., Fl. India 13: 292. 1995. *Senecio kunthianus* Wall. ex DC., Prodr. 6: 369. 1838; Hook.f., Fl. Brit. India 3: 354. 1881. Karma Mendok

Perennial herbs. Stems erect, 35-60 cm high. Leaves petioled, ovate-elliptic to linear-lanceolate, 3.5-5.2 x 1-2.5 cm, acute, coarsely mucronulate-toothed. Heads radiate, 0.8-1.2 cm dia., bracteolate. Involucre broadly campanulate. Involucral bracts oblong-lanceolate, 5-7 x 1-1.5 mm, subacute, herbaceous. Ray florets 7-8 mm long; ray linear-oblong, 4-5 mm long, 3-toothed at apex; limb 5-lobed. Achenes flat, 0.8-1.4 mm long, ribbed. Pappus pale yellow hairy.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Mud-Larang La, 4000 m, 20.08.2002, K. Chandra Sekar 100663.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Nepal and Pakistan.

27. *Tanacetum* L.

About 150 species distributed in North temperate regions; 12 in India.

- | | | |
|-----|-------------------------------------|-----------------------------|
| 1a. | Leaves all cauline | 2 |
| | b. Leaves radical and cauline | 2. <i>T. dolichophyllum</i> |
| 2a. | Involucral bracts glabrous | 3 <i>T. fruticosum</i> |
| | b. Involucral bracts pubescent | 3 |
| 3a. | Receptacle conical | 1. <i>T. artemisioides</i> |
| | b. Receptacle convex or hemispheric | 4. <i>T. tibeticum</i> |

1. *Tanacetum artemisioides* Sch.-Bip. ex Hook.f., Fl. Brit. India 3: 318. 1881; B.D. Naithani in Hajra & al., Fl. India 12: 60. 1995. *Artemisia fasciculata* C.B. Clarke, Comp. Ind. 162. 1876.

Bansi Mendok Fig. 12

Perennial herbs. Stems erect, 32-45 cm high, appressed pubescent. Leaves 1-2.5 cm long, sub-palmately 1 or 2-pinnatisect; segments small, oblong, obtuse; upper cauline leaves sessile. Heads sessile, 3-4 mm dia. with 16-18 florets. Involucral bracts broadly concave, 3-4 mm long, coriaceous, pubescent. Receptacle conical, naked. Outer florets female, fertile, 1-seriate. Disc florets bisexual, fertile; tube cylindrical; limb 5-fid. Achenes 0.5-1 mm long.

Fl. & Fr.: July - September.

Scarce; on moist slopes. Tariya, 4000 m, 08.08.2002, K. Chandra Sekar 100635.

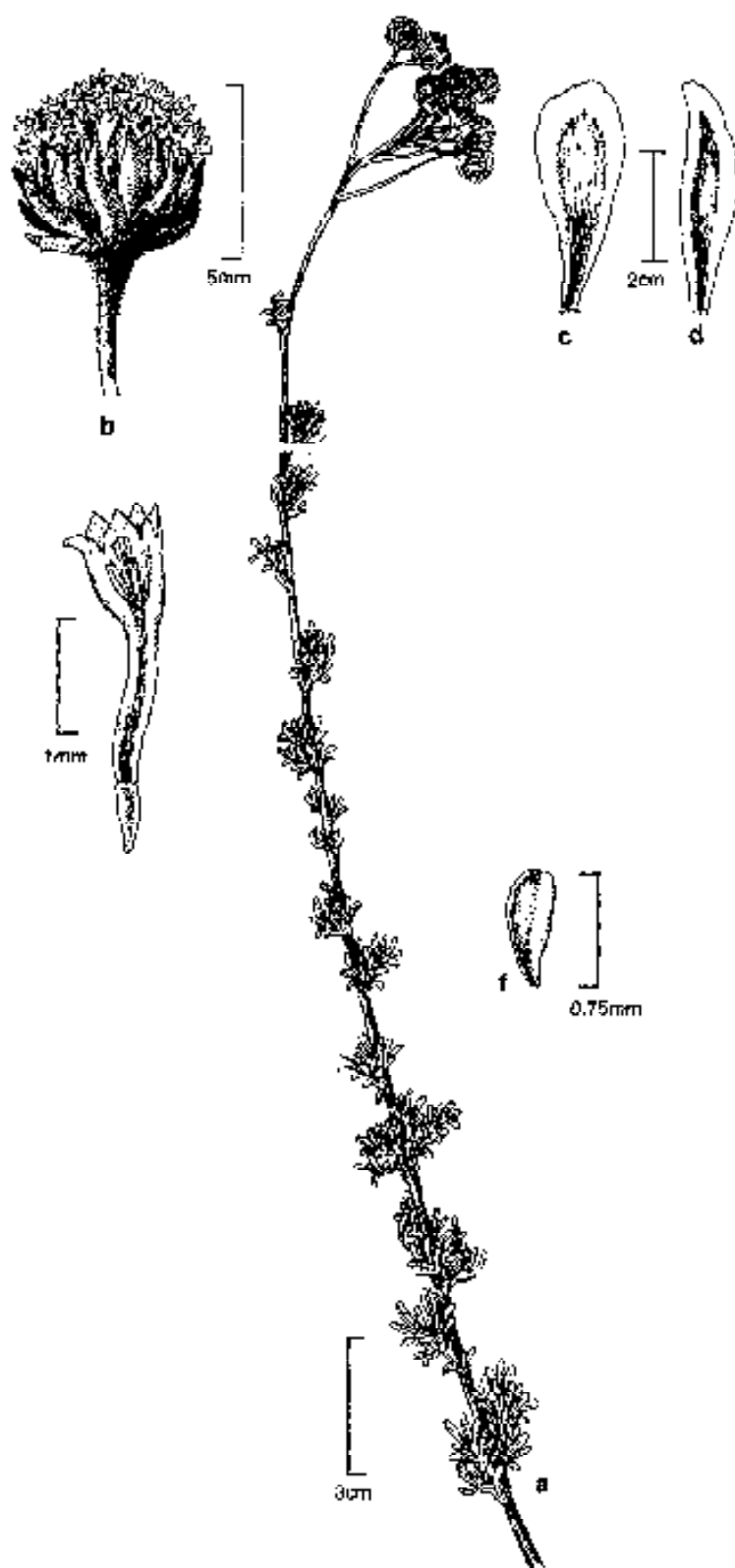


Fig. 12. *Tanacetum artemisioides* Sch.-Bip. ex Hook.f. a. Habit. b. Head, c & d. Involucral bract. e. Floret. f. Achene

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Bhutan; China and Pakistan.

Increase is preferred to reduce pain in lungs.

2. **Tanacetum dolichophyllum** (Kitam.) Kitam. in Hara & al., Enum. Fl. Pl. Nepal 3: 45. 1982; B.D. Naithani in Hajra & al., Fl. India 12: 60. 1995. *Chrysanthemum dolichophyllum* Kitam. in Acta Phyt. Geobot. 33: 73. 1968. *Buru Mendok*

Perennial herbs; rootstock woody. Stems erect, 30-40 cm high. Leaves 3-pinnatisect, hairy; segments oblong-linear, radical leaves petioled, 8-12 cm long; cauline ones sessile, 6-8 cm long. Heads 1-1.2 cm dia. with 40-50-florets, woolly. Involucral bracts narrowly oblong, 5.5-7 mm long, acute. Receptacle hemispheric, naked. Outer florets absent. Disc florets bisexual, fertile, 5-6 mm long; limb 5-fid. Achenes narrowly obovoid, 1-2 mm long, 5-ribbed.

Fl. & Fr.: July - August.

Rare; on rocky slopes. Near Tariya, 4000 m, 05.08.2002, K. Chandra Sekar 100610

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Bhutan; Nepal and Pakistan.

Decoction of plant is given to cure asthma.

3. **Tanacetum fruticosum** Ledeb., Fl. Altaica 4: 58. 1833; Hook.f., Fl. Brit. India 3: 318. 1881; B.D. Naithani in Hajra & al., Fl. India 12: 61. 1995. **Fig. 13**

Perennial herbs; rootstock woody. Stems erect, 32-45 cm high. Leaves 2-4 cm long, 1 or 2-pinnatisect, segments spreading, oblong linear, obtuse. Heads many, sessile, 5-6 mm dia. Involucral bracts many-seriate, broadly oblong, glabrous. Receptacle conic, naked. Outer florets female, fertile, 1-seriate, 2 or 3-fid. Disc florets bisexual, fertile; tube cylindrical; limb 5-fid.

Fl. & Fr.: July - September.

Rare; on rocky slopes. Kilung-Jarang Ia, 4850 m, 03.08.2003, K. Chandra Sekar 103733.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Afghanistan; China; Mongolia; Pakistan; Turkistan and U.S.S.R.

4. **Tanacetum tibeticum** Hook.f. & Thomson ex C.B. Clarke, Comp. Ind. 154. 1876; Hook.f., Fl. Brit. India 3: 319. 1881; Aswal & Mehrotra, Fl. Lahaul-Spiti 390. 1994; B.D. Naithani in Hajra & al., Fl. India 12: 66. 1995.

Perennial herbs; rootstock thick, woody. Stems many, crowded, 8-10 cm high, grey-tomentose. Leaves dense, 1-1.3 cm long, palmately pinnatisect; lobes linear, 1-3 mm long, obtuse. Heads more or less globose, 0.8-1.2 cm dia., yellow. Involucral bracts ovate-oblong, 2-3 mm long. Receptacle convex or hemispheric. Outer florets female, fertile, 1-seriate. Disc florets bisexual, fertile, 2-2.5 mm long; tube cylindrical; limb 5-fid. Achenes 5-ribbed.

Fl. & Fr.: July - September.

Parahio catchment, Nima 214 (VII).

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Sikkim; Nepal and Pakistan.



Fig. 13. *Tanacetum fruticosum* Ledeb. a. Habit, b & c. involucre bract. d. Flower. e. Achene.

28. *Taraxacum* Weber

More than 1000 taxa distributed in cold temperate regions; 82 species recorded from India.

- 1a. Ligules white 1. *T. leucanthum*
 b. Ligules yellow 2. *T. officinale*

1. *Taraxacum leucanthum* (Ledeb.) Ledeb., Fl. Ross. 2: 315. 1844; Mangain & R.R. Rao in Hajra & al., Fl. India 12: 252. 1995. *Leontodon leucanthum* Ledeb., Fl. Altaica 4: 154. 1833.

Perennial herbs; rootstock rhizomatous. Scapes few from the base, 6-10 cm high. Leaves all radical, 5-6 x 0.5-0.8 cm, narrowed towards base, pinnatifid or runcinate, sparsely pubescent. Head solitary, 1-1.3 x 0.8-1 cm. Outer involucre bracts ovate-oblong, 3-5 x 1-1.5 mm; inner ones linear-lanceolate, 1-1.3 x 0.1-0.2 mm. Ligules white. Achenes oblong-lanceolate, 6-9 mm long, strongly ribbed, yellow. Pappus 5-6 mm long, white.

Fl & Fr: June - August.

Occasional; on moist slopes. Chohem, 4050 m, 12.07.2003, K. Chandra Sekar 103211.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China; C.I.S.; Mongolia and Pakistan.

2. *Taraxacum officinale* Weber in Wigg., Prim. Fl. Hols. 56. 1780; Hook.f., Fl. Brit. India 3: 401. 1881; Aswal & Mehrotra, Fl. Lahaul-Spiti 391. 1994; Mangain & R.R. Rao in Hajra & al., Fl. India 12: 252. 1995. *Sershen Mendok* Photo. 103

Perennial herbs; rootstock rhizomatous. Scapes 16-25 cm high, glabrous, fleshy, ribbed. Leaves radical, oblanceolate-oblong, 4-20 x 1-3.5 cm, pinnatifid or runcinate-pinnatifid, variously lobed. Heads 1.5-2 x 0.8-1.3 cm. Outer involucre bracts ovate-lanceolate, 2-2.5 x 2-2.4 cm; inner ones oblong-lanceolate, 1-1.6 x 0.2-0.3 cm. Ligules yellow. Achenes oblong lanceolate, 0.9-1.2 cm long, yellowish. Pappus 6-8 mm long, pale white.

Fl & Fr: June - September.

Common; on moist slopes. Grechang, 3730 m, 15.7.2002, K. Chandra Sekar 100464.

Distrib: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Meghalaya, Punjab, Sikkim, Tamil Nadu and Uttarakhand; China; Nepal and Pakistan.

29. *Tragopogon* L.

About 110 species distributed in temperate Eurasia and Mediterranean region; 5 in India.

- 1a. Achenes less than 2 cm long 2. *T. gracilis*
 b. Achenes more than 2 cm long 1. *T. dubius*

1. *Tragopogon dubius* Scop., Fl. Carn. ed. 2, 2: 95. 1722; Mangain & R.R. Rao in Hajra & al., Fl. India 12: 341. 1995. *Tragopogon pratense sensu* Hook.f., Fl. Brit. India 3: 418. 1881, non L. 1753. *Yaash Bone Bone*

Perennial herbs. Stems 25-45 cm high, leafy. Leaves crowded at base, sessile, linear-lanceolate, 10-18 x 0.3-1.5 cm, with broad sheathing base. Heads broadly campanulate, 2.5-5.3 x 1-2.1 cm; peduncle 6-12 cm long. Involucral bracts 1-seriate, oblong-lanceolate, 3-6 x 0.5-0.8 cm. Ligules yellow. Achenes linear-lanceolate, 2.5-3 cm long, strongly mucronate. Pappus 1.8-2.4 cm long, feathery with soft white hairs.

Fl. & Fr.: June - September.

Common; on moist slopes. Gechang, 3700 m, 15.07.2002, *K. Chandra Sekar* 100452.

Distrib.: India; Himachal Pradesh and Jammu Kashmir; Afghanistan and Pakistan.

Extract of young leaves applied on cuts.

2. *Tragopogon gracilis* D. Don in Mem. Wern. Soc. 3: 414. 1820; Aswal & Mehrotra, Fl. Lahaul-Spiti 393. 1994; Mangain & R.R. Rao in Hajra & al., Fl. India 12: 341. 1995.

Perennial herbs; rootstock rhizomatous. Stems erect, 35-50 cm high, leafy. Leaves crowded at the base of stem, sessile, linear-lanceolate, 5-17 x 0.5-0.7 cm, sheathing at base, glabrous. Heads erect, cylindric-campanulate, 2.5-4 x 0.8-1.5 cm; peduncle 7-11 cm long. Involucral bracts 1-seriate, lanceolate, 2.5-4 x 0.3-0.5 cm. Ligules yellow. Achenes linear-lanceolate, 1-1.5 cm long, smooth. Pappus 1.2-1.8 cm long, feathery, pale yellow.

Fl. & Fr.: June - September.

Parahio catchment, 11.8.1994, *Nima & Yashveer* 146 (VII).

Distrib.: India; Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan and Pakistan.

30. *Waldheimia* Kar. & Kir.

Eight species distributed in C. and E. Asia; 5 in India.

- | | |
|-----------------------------------|---------------------------|
| 1a. Leaves cuneiform | 1. <i>W. glabra</i> |
| b. Leaves oblong or linear-oblong | 2 |
| 2a. Woolly herbs | 3. <i>W. tomentosa</i> |
| b. Glabrous herbs | 2. <i>W. strobilifera</i> |

1. *Waldheimia glabra* (Decne.) Regel in Acta Hort. Petrop. 6: 309. 1879; Aswal & Mehrotra, Fl. Lahaul-Spiti 394. 1994; B.D. Naithani in Hajra & al., Fl. India 12: 69. 1995. *Allardia glabra* Decne. in Jacquem., Voy. Inde 4: 88. t. 96. 1844. *Mendak chakar* Photo. 104

Perennial herbs, strongly aromatic. Stems creeping, 10-20 cm long, glabrous. Leaves cuneiform, 1-4 cm long; lobes entire or toothed. Heads terminal, 1.5-2 cm dia. Involucral bracts ovate-lanceolate to elliptic-lanceolate, 4-6 x 0.5-1 mm. Ray florets 1-1.3 x 0.2-0.3 cm. Ligule broadly elliptic to elliptic-oblong, purple. Disc florets bisexual, tubular, 3-4 x 0.3-0.5 mm, yellow; limb 5-fid, dark purple. Achenes 1.2-1.5 x 0.2-0.5 mm, angled, glandular. Pappus linear, 1.5-2 mm long, acute.

Fl. & Fr.: July - September

Scarce; on moist slopes. Kilung-Jarang Ia, 4975 m, 04.08.2003, *K. Chandra Sekar* 103737.

Distrib: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Altai mountains; China; Nepal and Pakistan.

Paste of whole plant applied externally to cure wounds.

2. *Waldheimia stoliczkae* (C.B. Clarke) Ostanĭ, in Heads, South Tibet 6(3): 38 (List Fl. Pl. Asia) 1922; Aswal & Mehrotra, Fl. Lahaul-Spiti 395. 1994; B.D. Naithani in Hajra & al., Fl. India 12: 71. 1995. *Allardia stoliczkae* C.B. Clarke, Comp. Ind. 145. 1876; Hook.f., Fl. Brit. India 3: 313. 1881.

Gyasi Chensu Photo. 105

Perennial herbs. Stems ascending, 10-15 cm high. Leaves lanceolate to linear-lanceolate, 2-4 cm long, 2-pinnatisect; segments linear. Heads terminal, 1.5-2 cm dia. Involucral bracts ovate-lanceolate to narrowly elliptic, 5-7 x 1-2 mm. Ray florets neuter; 0.5-1.3 x 0.1-0.2 cm. Ligule narrowly elliptic, 3-fid, pink. Disc florets female, 2-3 x 0.3-0.5 mm, tubular; limb 5 fid. Achenes obscurely obconic, 0.8-1 x 0.2-0.5 mm, angled. Pappus linear, 1-2 mm long, yellow.

Fl. & Fr.: July - August.

Common; on moist rocky slopes. Saupat, 4350 m, 04.08.2002, *K. Chandra Sekar* 102867.

Distrib: India: Himachal Pradesh and Jammu & Kashmir; China and Pakistan.

Decoction of young flower heads taken to cure diarrhoea.

3. *Waldheimia tomentosa* (Decne.) Regel in Acta Hort. Petrop. 6: 310. 1879; Aswal & Mehrotra, Fl. Lahaul-Spiti 395. 1994; B.D. Naithani in Hajra & al., Fl. India 12: 72. 1995. *Allardia tomentosa* Decne. in Jacquem., Voy Inde 4: 87, t. 95. 1844; Hook.f., Fl. Brit. India 3: 313. 1881.

Gaathock, Luknrikpa Photo. 106

Perennial herbs. Stems tufted, ascending, 16-25 cm high. Leaves oblong-lanceolate, 3-7 cm long, 1 or 2-pinnatisect; segments oblong-linear. Heads terminal, 3-6.5 cm dia. Involucral bracts ovate-oblong to ovate-lanceolate, 6-9 x 2-3 mm, woolly. Ray florets neuter, 1.5-2.5 x 0.4-0.5 cm, purple-white. Ligule oblanceolate-oblong, prominently 2-fid. Disc florets bisexual, narrowly tubular, 3-4 x 0.1-0.2 mm; limb 5-fid. Achenes cylindrical, 2-3 x 0.5-0.8 mm, winged at angles. Pappus linear, flat, purple.

Fl. & Fr.: June - September

Occasional; on moist slopes. Tariya, 4000 m, 25.07. 2003, *K. Chandra Sekar* 103693.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China; Nepal and Pakistan.

Paste of leaves applied externally in rheumatism. Whole plant used to prepare incense for religious purposes.

31. *Youngia* Cass.

About 40 species distributed in Asia; 13 in India.

Youngia glauca Edgew. in Trans. Linn. Soc. London 20: 79. 1846; Mangain & R.R. Rao in Hajra & al., Fl. India 12: 327. 1995. *Crepis flexuosa* (DC.) C.B. Clarke, Comp. Ind. 254. 1876. *Crepis glauca* Benth., Gen. Pl. 2: 515. 1873; Hook.f., Fl. Brit. India 3: 394. 1881. *Sekho Shipo* Photo. 107

Annuals. Stems erect-ascending, 20-35 cm high, glabrous. Radical leaves few, petioled, obovate-spathulate, 2.3-4.4 cm long, sinuate-toothed, pinnatifid; lobes acute; cauline ones sessile, linear, entire. Heads terminal and sublateral, 1-1.3 cm long, few-flowered. Outer involucre bracts minute, ovate-obovate, glabrous. Ligules yellow. Achenes 4-5 mm long, hardly-beaked, obscurely striated, longer than the pappus. Pappus simple, white.

Fl. & Fr.: July - August.

Scarce; on rocky slopes. Shrim-Chhohem, 4000 m, 12.07.2003, K. Chandra Sekar 101193.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan.

29. CAMPANULACEAE

Eighty two genera and about 2000 species, cosmopolitan; 12 genera and 46 species in India.

- | | |
|-------------------------------------|----------------------|
| 1a. Capsules with an elongated beak | 2. <i>Codonopsis</i> |
| b. Capsules with blunt apex | 1. <i>Campanula</i> |

1. *Campanula* L.

About 300 species distributed in N. temperate regions; ca 15 in India.

- | | |
|--|---------------------------|
| 1a. Cauline leaves linear | 2. <i>C. aristata</i> |
| b. Cauline leaves lanceolate to ovate | 2 |
| 2a. Plants hirsute to strigose or hoary pubescent; flowers less than 1 cm long | 1. <i>C. argyrotricha</i> |
| b. Plants glabrous to hirsute or pubescent; flowers up to 5 cm long | 3. <i>C. pallida</i> |

1. *Campanula argyrotricha* Wall. ex DC., Prodr. 7: 473. 1839; Hook.f., Fl. Brit. India 3: 441. 1881; Aswal & Mehrotra, Fl. Lahaul-Spiti 398. 1994. *Urthuk*

Annuals. Stems procumbent, 10-20 cm high, pubescent. Leaves ovate, 0.5-1 x 0.3-0.5 cm, cuneate-cordate at base, acute at apex, coarsely toothed along the margins, sparsely white-pubescent. Inflorescence 1 or 2-flowered; peduncle 0.8-2 cm long; pedicels ca 0.5 mm long. Calyx ovate-lanceolate, acute. Corolla campanulate, 0.6-1.2 cm long, sparsely hairy outside, light blue. Style exerted. Capsules globose. Seeds minute, numerous.

Fl. & Fr.: July - September.

Scarce; on moist rock-crevices. Tariya, 4300 m, 23.07.2003, K. Chandra Sekar 103643.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan.

Paste of fruits mixed with rhizome paste of *Rhodiola crenulata* (Hook. f. & Thomson) Ohba is given to cure stomach ulcers.

2. *Campanula aristata* Wall. in Roxb., Fl. Ind. 2: 98. 1824; Hook.f., Fl. Brit. India 3: 441. 1881; Aswal & Mehrotra, Fl. Lahaul-Spiti 399. 1994. *Tenthi*

Annuals. Stems erect, 23-35 cm high, glabrous. Basal leaves long-petioled, linear to oval, 2-3 cm long, glabrous; cauline ones sessile, linear to linear-lanceolate, 1-3 cm long, glabrous. Flower solitary, terminal. Calyx lobes linear, 5-9 mm long. Corolla funnel-shaped, about as long as the calyx lobes, blue. Style exerted. Capsules narrowly oblong, contracted at the top. Seeds ellipsoid.

Fl. & Fr.: June - August.

Scarce; on moist slopes. Tariya-Pin Parvati Pass, 4200 m, 24.07.2003, K. Chandu Sekar 103651.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan and Pakistan.

Decoction of flowers and fruits given to cure cough.

3. *Campanula pallida* Will., *Asiat. Res.* 13: 375. 1820 & in Roxb., *Fl. Ind.* 2: 100. 1824; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 400. 1994.

Annuals. Stems erect to suberect, 30-40 cm high, branched, hispid. Leaves sessile or short petioled, lanceolate-ovate, 4-6 x 0.5-2 cm, crenate to dentate along the margins, pilose. Calyx segments triangular to lanceolate. Corolla campanulate, 0.7-1 cm long, hairy outside, lobed, light purple; segments short. Style included. Capsules globose to ovoid, hirsute, dehiscing from the base.

Fl. & Fr.: June - August.

Rare; on stream beds. Dhul, 3700 m, 27.08.2002, K. Chandu Sekar 102998.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan, Nepal and Pakistan.

2. *Codonopsis* Will.

About 30 species distributed from Asia to Malasia; ca 15 in India.

1a. Plants twining

1. *C. clematidea*

1b. Plants suberect or decumbent

2. *C. ovata*

1. *Codonopsis clematidea* (Schrenk) C.B. Clarke in Hook.f., *Fl. Brit. India* 3: 433. 1881; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 401. 1994. *Wahlenbergia clematidea* Schrenk in Fisch. & C.A. Mey., *Enum. Pl. Nov.* 1: 38. 1841. *Kumuk*

Perennial herbs, roots thick, elongated. Stems twining, 60-90 cm long, branched, glabrous to sparsely pilose. Leaves opposite or alternate, ovate or ovate-lanceolate, 2.5-3 x 1.5-2 cm, pubescent. Flowers terminal on long-peduncled. Calyx segments overlapping at base, ovate-lanceolate, 1-2 cm long. Corolla campanulate, base more than 1 cm broad, grey-blue. Anthers oblong, 3-5 mm long. Stigma broadly 3-lobed; lobes ovate, papillate. Seeds ellipsoid.

Fl. & Fr.: July - August.

Occasional; on stream beds. Farkā Bhaba Pass, 3800 m, 12.08.2002, K. Chandu Sekar 100653.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia.

Extract of flowers given to cure diarrhoea.

2. *Codonopsis ovata* Benth. in Royle, *Illustr. Bot. Himal.* 2:3, t. 69, f. 3. 1835; Hook.f., *Fl. Brit. India* 3: 433. 1881; Antony in *Notes Roy. Bot. Gard. Edinb.* 15: 186. 1926; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 401. 1994. *Kamuk Cbt Mentak* Photo, 108

Perennial herbs. Stems suberect or decumbent, 30-46 cm long, sparsely hairy. Leaves alternate, ovate, 2-4 cm long, cordate-cuneate at base, obtuse or acute at apex, entire. Flower solitary, terminal, long peduncled; peduncle up to 15 cm long. Calyx-lobes elliptic-oblong. Corolla campanulate, 1.7-3 cm long, glabrous, sky-blue. Capsules obconic, depressed.

Fl. & Fr.: June - August.

Rare; on moist slopes. Farka, 3800 m, 31.7.2002, K. Chandra Sekar 100345.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan.

Children suck flower sap as a stimulant.

30. ERICACEAE

One hundred and seven genera and about 3400 species, cosmopolitan; 13 genera and ca 175 species in India.

1a. Leaves imbricate, appressed to the stem

1. Cassiope

b. Leaves alternate or clustered, not appressed to the stem

2. Rhododendron

1. Cassiope D. Don

Eleven species chiefly distributed in the Himalaya; 2 in India.

Cassiope fastigiata (Wall.) D. Don in *Edinb. New Philos. J.* 17: 158. 1834; Aswal & Mehrotra, *Fl. Lahaul Spiti*, 403. 1994; Chandra Sekar & S.K. Srivast. in *Ethnobotany* 15: 45. 2003. *Andronoclea fastigiata* Wall., *Asiat. Res.* 13: 394. 1829. *Plain Tea*

Perennial caespitose herbs, 10-25 cm high; branches many, fastigiata. Leaves sessile, thick, ovate-oblong, 4-6 mm long, continued into a long cuspidate apex, dorsal surface appressed to the stem, ventral surface with a longitudinal groove. Flowers axillary, solitary or sometimes in clusters of 2 or 3. Bracts elliptic, 2-3 mm long. Pedicels 4-6 mm long, villous. Corolla campanulate, white. Anthers spurred. Capsules ovoid, 4-5 mm long. Seeds numerous, minute.

Fl. & Fr.: June - September.

Common; along with *Rhododendron anthopogon* D. Don subsp. *hypenanthum* (Balf. f.) Cullen. Tharvik, 4200 m, 02.08.2002, K. Chandra Sekar 102822.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; Bhutan; Nepal and Pakistan.

Incense of whole plant is inhaled to ease respiration.

2. Rhododendron L.

About 850 species distributed in N. hemisphere, especially in Himalaya, S. E. Asia & Malasia; ca 80 in India.

Rhododendron anthopogon D. Don subsp. **hypenanthum** (Balf.f.) Cullen in Notes Roy. Bot. Gard. Edinb. 37: 327. 1979; Aswal & Mehrotra, Fl. Lahaul-Spiti 404. 1994. *R. hypenanthum* Balf.f. in Notes. Roy. Bot. Gard. Edinb. 9: 291. 1916; C.B. Clarke in Hook.f., Fl. Brit. India 3: 472. 1882. *Shank phain*

Shrubs, aromatic, 15-25 cm long; branches rough and scaly. Leaves elliptic-oblong, 1-3 cm long, subobtus, dorsal surface rough, wrinkled, ventral densely covered with brown-scales; petioles 3-5 mm long. Flowers in terminal clusters of 5-15. Bracts ovate, margin ciliate. Calyx lobes ovate, 3-4 mm long, obtuse, ciliate along the margin. Corolla 1.2-1.5 cm long yellow; lobes orbicular, out-spreading. Capsules ovoid, 4-6 mm long.

Fl. & Fr.: June - September.

Rare; on rocky slopes. Near Latiya, 4000 m, 04.08.2002, K. Chandra Sekar 100605.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia.

Decoction of whole plant given to relieve fever.

31. PRIMULACEAE

Twenty two genera and ca 825 species, subcosmopolitan especially in N. Hemisphere; 10 genera and 183 species in India.

Primula L.

About 425 species distributed in the N. hemisphere; ca 135 in India.

- | | |
|--|-----------------------------|
| 1a. Corolla tube longer than the calyx | 2 |
| b. Corolla tube shorter than the calyx | 9 |
| 2a. Bracts usually saccate | 3 |
| b. Bracts never saccate | 4 |
| 3a. Teeth of the bract less than 2 mm long | 4. <i>P. nutans</i> |
| b. Teeth of the bract more than 3 mm long | 1. <i>P. involucrata</i> |
| 4a. Minute herbs | 5 |
| b. Robust herbs | 2. <i>P. macrophylla</i> |
| 5a. Leaves farinose | 5. <i>P. reptans</i> |
| b. Leaves farinose | 3. <i>P. minusstma</i> |
| 6a. Leaves dimorphic | 6. <i>P. sarmentosa</i> |
| b. Leaves isomorphic | 7. <i>P. sempervivoides</i> |

1. **Primula involucrata** Wall. ex Duby in DC., Prodr. 8: 42. 1844; Hook.f., Fl. Brit. India 3: 488. 1882; Nasir in Nasir & Ali, Fl. Pakistan 157: 26. 1984. *P. nunroi* Lindl. in Edwards Bot. Reg. 33, t. 15. 1847; Aswal & Mehrotra, Fl. Lahaul-Spiti 415. 1994. *Janage Mendok*. *Mendok karpa*

Perennial herbs, effarinate, slender. Leaves all radical, long petioled, suborbicular to elliptic-oblong, obtuse, entire to obscurely denticulate along the margin. Scapes 10-28 cm long, 2-5-flowered. Bracts 0.9-1.8 cm long, auricled. Calyx broadly campanulate, 5-7.5 mm long; lobes triangular or broadly lanceolate. Corolla white, pink-tinged; tube 1.1-1.3 cm long; limb 1.5-2 cm broad; lobes obovate, 5-7 mm long, reflex to emarginate. Capsules oblong, slightly exceeding the calyx, yellowish-brown.

Fl. & Fr.: June - August.

Scarce; on stream beds. Tariya, 4000 m, 03.08.2002, K. Chandra Sekar 102847.

Distrib.: India: Arunachal Pradesh, Assam, Himachal Pradesh, Jammu & Kashmir, Meghalaya, Sikkim and Uttarakhand; Bhutan; China; Nepal and Pakistan.

Extract of whole plant given in headache.

2. *Primula macrophylla* D. Don, Prodr. Fl. Nepal. 80. 1825; Aswal & Mehrotra, Fl. Lahaul-Spiti 413. 1994. *P. purpurea* Royle, Illustr. Bot. Himal. 311, t. 77, f. 2. 1835. *Khishle Menduk* **Photo. 109**

Perennial herbs, surrounded by the remains of old leaves. Leaves lanceolate to elliptic-lanceolate, 3-29 x 0.4-4 cm, cuneate at base, acute or obtuse at apex, denticulate to finely crenulate. Scapes 13-26 cm long, 6-28-flowered. Pedicels 1.5-3 cm long. Bracts 1-1.6 cm long. Calyx subcylindric, 0.8-1.2 cm long; lobes lanceolate, 4-5 mm long, sparsely puberulous. Corolla pink-violet; tube 0.9-1.2 cm long, exceeding the calyx, limb 1.5-1.6 cm dia., lobes obtuse or 2-lobed, 0.6-1 cm dia., entire. Capsules broadly cylindrical, 1.2-1.7 cm long.

Fl. & Fr.: June - August.

Scarce; on rocky slopes. Chhohem, 4150 m, 13.07.2003, K. Chandra Sekar 103234.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan; Bhutan; China; Nepal and Pakistan.

Decoction of young inflorescence is taken to cure wet pleuritis.

3. *Primula minutissima* Jacq. ex Duby in Mem. Soc. Phys. Hist. Nat. Genev 10: t. 1, f. 3. 1844; Hook.f., Fl. Brit. India 3: 494. 1882, *excl. var. spatulata* Watt; Aswal & Mehrotra, Fl. Lahaul-Spiti 414. 1994.

Perennial herbs, mat-forming, stoloniferous. Leaves lanceolate to oblanceolate, 6-9 x 1.5-2.5 mm, cuneate at base, acute or obtuse at apex, minutely serrate at margin, yellow-farinate beneath. Scapes 2-4 cm long, 2-5-flowered. Bracts lanceolate, 2-2.5 mm long, dilated at base. Calyx campanulate, 2-2.5 mm long, glabrous; lobes glandular along the margins. Corolla pink or pink-purple; tube 6-9 mm long, exceeding the calyx; limb 0.6-1.1 cm dia.; lobes obovate, 3-4 x 3-3.5 mm. Capsules ovoid.

Fl. & Fr.: June - August.

Rare; on moist slopes. Chhohem, 4150 m, 12.07.2002, K. Chandra Sekar 1032179.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan; China; Nepal and Pakistan.

4. *Primula nutans* J.G. Georgi, *Bemerk. einer Reise Russ. Reich.* 1: 200. 1775; Nasir in Nasir & Ali, *Fl. Pakistan* 157: 23. 1984. *P. sibirica* Jacq., *Misc. Austr.* 1: 161. 1778; Hook.f., *Fl. Brit. India* 3: 487. 1882; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 418. 1994.

Annuals or biennials, 8-15 cm high; rhizomes short and slender. Leaves spatulate, 1.2-4 x 0.5-1 cm, attenuate towards the base, obtuse at apex, entire to subdentate along the margin. Scapes 3-6 cm long, 1-4-flowered. Bracts elliptic-oblong, obtuse. Calyx tubular-campanulate, 5-6 mm long; lobes ovate, obtuse. Corolla rose to lavender-pink; tube 1-1.4 cm long; limb 1.2-1.5 cm dia.; lobes obovate, 4-5 x 3-4 mm, emarginate to retuse, yellow. Capsules tubular-cylindric, exceeding the calyx.

Fl. & Fr.: June - August.

Rare; on moist slopes. Mud-Tariya, 4000 m, 03.08.2002, K. Chandra Sekar 102849.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia; Europe and N. America.

5. *Primula reptans* Hook.f. ex Watt. in J. Linn. Soc., London (Bot.) 20: 14, t. 13 B. 1882; Hook.f., *Fl. Brit. India* 3: 494. 1882; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 416. 1994.

Perennial herbs, stoloniferous. Leaves spatulate; lamina orbicular-cuneate, 2-4 cm long, lobulate; lobes irregular; petioles 0.5-1 cm long, winged. Scapes 0.7-1.2 cm long. Flower solitary. Pedicel 2-4 mm long. Bracts lanceolate, 2-3 mm long, glabrous. Calyx campanulate, purple-pink or violet pink; limb 1.1 cm dia.; lobes 4-7 x 4-6.5 mm, emarginate, white.

Fl.: July - August.

Rare; on moist slopes. Chhohem, 4150 m, 12.07.2003, K. Chandra Sekar 103217 b.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Nepal and Pakistan.

6. *Primula sarmentosa* (Wall.) Bennet & Raizada in *Indian Forester* 107: 435. 1981. *Androsace sarmentosa* Wall. in Roxb., *Fl. Ind.* 2: 14. 1824; Hook.f., *Fl. Brit. India* 3: 498. 1882; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 409. 1994. *Lakri Marpau Menduk*

Perennial herbs. Leaves in rosettes, dimorphic, pale green; outer leaves oblong-obovate to obovate, 3-4.5 x 2.5-3 mm, obtuse, pubescent; inner ones oblanceolate to broadly lanceolate, 0.9-1.44 x 0.2-0.5 cm, obtuse to subacute. Scapes 1.7-4.5 cm long, 6-8-flowered. Bracts obovate, 6-7 x 1.5-2.5 mm, leafy. Calyx cupular, 2.5-2.8 mm long; lobes obtuse. Corolla tube 2.5-2.7 mm long; limb 7-9 mm dia.; lobes obovate, 2-3 mm long. Capsules ovoid, more or less included in the calyx.

Fl. & Fr.: June - August.

Rare; on rocky slopes. Near Tariya, 4000 m, 06.08.2002, K. Chandra Sekar 100621.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China and Pakistan.

Extract of whole plant taken in stomach pain.

7. *Primula sempervivoides* Kuntze, *Rev. Gen.* 1: 400. 1891. *Androsace sempervivoides* Jacq. ex Duby in DC., *Prodr.* 8: 50. 1844; Hook.f., *Fl. Brit. India* 3: 497. 1882; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 410. 1994.

Perennial herbs, stoloniferous; stolons with 3-6 nodes, 1.5-5 cm long, sparsely pubescent, brown-red. Leaves in rosettes, isomorphic, obovate to oblanceolate, 0.5-1.5 x 0.3-0.65 cm, glabrous, ciliate along the margins. Scapes 12-30 cm long, glandular pubescent, 1-15 flowered. Bracts lanceolate to oblanceolate, 4-7 mm long, obtuse. Calyx campanulate, 3-3.5 mm long. Corolla pink, tube shorter than the calyx; lobes unequal, obovate-cuneate, 2.5-4 mm long, slightly retuse; throat annulate. Capsules ovoid to subglobose.

Fl & Fr.: June - August.

Rare; on moist slopes. Mud-Larang La, 3950 m, 20.08.2002, K. Chandra Sekar 100659 a.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Pakistan.

32. GENTIANACEAE

Seventy eight genera and about 1225 species, cosmopolitan especially in temperate and subtropical regions; 24 genera and ca 190 species in India.

- | | |
|--|------------------------|
| 1a. Corolla with basal pits or spurs | 4. <i>Swertia</i> |
| b. Corolla without basal pits or spurs | 2 |
| 2a. Corolla with interlobal plicae | 1. <i>Gentiana</i> |
| b. Corolla without interlobal plicae | 3 |
| 3a. Calyx lobes equal, without ciliated intracalyxular membrane;
corolla lobes not fringed | 2. <i>Gentianella</i> |
| b. Calyx lobes unequal, with ciliated intracalyxular membrane;
corolla lobes frequently fringed | 3. <i>Gentianopsis</i> |

1. *Gentiana* L.

Three hundred and sixty one species chiefly in temperate and arctic regions; ca 62 in India.

- | | |
|-----------------------------------|---------------------------|
| 1a. Corolla less than 2.5 cm long | 2 |
| b. Corolla more than 2.5 cm long | 3 |
| 2a. Erect herb | 1. <i>G. coronata</i> |
| b. Decumbent herb | 2. <i>G. leucomelaena</i> |
| 3a. Flower solitary | 4. <i>G. tibiflora</i> |
| b. Flowers in panicles | 3. <i>G. tianshanica</i> |

1. *Gentiana coronata* Royle, *Illustr. Bot. Himal.* 278, t. 68, 1835; C.B. Clarke in Hook.f., *Fl. Brit. India* 4: 114, 1883; S. Garg, *Gentian. N.W. Himal.* 100, 1987; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 424, 1994.

Annuals, 2-5 cm high, densely tufted. Leaves sessile, linear-lanceolate, 1.5-4.5 x 0.2-1.2 cm, acute, obscurely 3-nerved. Flowers terminal, 1-1.5 cm long. Bracts linear-oblong, 0.8-1.2 cm long, mucronate. Calyx tubular; tube 0.7-1.2 cm long; lobes linear-lanceolate, 2-6 mm long, acute. Corolla

subinfundibuliform, violet to blue; throat fimbriate; tube 0.9-1.4 cm long; lobes ovate, 2-3 x 1-2 mm, subacute-obtuse. Capsules oblong-cuneate, 5-6 x 3-4 mm. Seeds oblong, numerous.

Fl. & Fr.: June - August.

Rare; on stream beds. Sanpat, 4300 m, 04.08.2002, *K. Chandra Sekar* 102858.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China and Pakistan.

2. *Gentiana leucomelaena* Maxim. ex Kusn. in Mcl. Biol. Acad. Imp. 13: 175. 1891; S. Garg, *Gentian.* N.W. Himal. 118. 1987; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 425. 1994. *Buksuk shipo*

Annuals, decumbent. Branches ascending, 1.2-4 cm high. Radical leaves spatulate, 6-8 x 3-5 mm, mucronate; cauline ones oblong-elliptic, 3-6 x 2-3 mm, mucronate. Flower solitary, terminal. Calyx tubular, nearly funnel-shaped; tube 3-6 mm long; lobes triangular, acute. Corolla blue; tube 4-7 mm long; lobes ovate, 2.3 x 1-2 mm, acute. Capsules obovate-subglobose, 4-5 x 3-4 mm. Seeds numerous, oblong-ellipsoid, brown.

Fl. & Fr.: June - August.

Occasional; on moist slopes. Gechang-Thango, 3850, 10.07.2003, *K. Chandra Sekar* 101174.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China; Mongolia and Pakistan.

Whole plant grounded together with petals of *Polypodium caeruleum* L. and *Gentianopsis paludosa* (Hook.) Ma given to cure jaundice.

3. *Gentiana tianshanica* Rupr. in Mem. Acad. Sci. St. Petersbourg 7(4): ser. 19: 61. 1869. S. Garg, *Gentian.* N.W. Himal. 92. 1987; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 92. 1994. *G. decumbens sensu* C.B. Clarke in Hook.f., *Fl. Brit. India* 4: 117. 1883, *non* L. *Lande Kummik Mendok*

Perennial herbs. Branches ascending, 15-30 cm high, 4-angled. Radical leaves rosulate, narrowly oblong to elliptic-lanceolate, 3.5-12 x 0.8-1.5 cm, acute; cauline ones subsessile, lanceolate to linear-lanceolate, 2.8-4.5 x 0.4-1 cm, acute. Panicle lax; peduncle 1.5-4.5 cm long. Bracts narrowly lanceolate, 1.4-2 cm long. Calyx tubular; tube 1-1.5 cm long; lobes linear, 4-7 x 1-2 mm, unequal. Corolla subinfundibuliform, pink-white to deep blue; tube 1.3-1.7 cm; lobes ovate-oblong, 5-7 x 4-6 mm. Capsules oblong-ellipsoid, 1-1.8 cm long, 3-6 mm broad. Seeds numerous, brown.

Fl. & Fr.: June - August.

Rare; on rocky slopes. Tariya, 4000 m, 10.08.2002, *K. Chandra Sekar* 100647.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China; Pakistan and U.S.S.R.

Plant extract given to cure giddiness.

4. *Gentiana tubiflora* (G. Don) Griseb., *Gen. Sp. Gentian.* 277. 1839; C.B. Clarke in Hook.f., *Fl. Brit. India* 4: 116. 1883; S. Garg, *Gentian.* N.W. Himal. 88. 1987; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 428. 1994. *Fricata tubiflora* G. Don, *Gen. Hist.* 4: 189. 1837. *Tiktou Aunpo Mensa*

Perennial herbs, gregarious, branched, glabrous. Leaves elliptic-oblong, 0.7-1.4 x 0.2-0.5 cm, acute, denticulate along the margin. Flower solitary, terminal, tubular. Calyx tubular; tube 0.7-1.2 cm long;

lobes ovate-lanceolate, 4-7 x 2-2.5 mm, acute. Corolla infundibuliform, violet to deep blue; tube cylindrical, 1.8-2.5 cm long; lobes ovate, 0.8-1 x 3-4 mm, mucronulate. Capsules ellipsoid, 1-1.5 cm long, rounded at base, acuminate at apex. Seeds numerous, glistening white.

Fl. & Fr.: June - August.

Rare; on moist slopes. Near Tariya, 4000 m, 06.08.2002, K. Chandra Sekar 100618.

Distrib.: India: Himachal Pradesh, Sikkim and Uttarakhand; China and Nepal.

Whole plant paste mixed with salted curd given in jaundice.

2. *Gentianella* Moench

About 125 species, chiefly distributed in temperate regions; ca 8 in India.

1a. Corolla fimbriate in the throat

2. *G. tenella*

b. Corolla not fimbriate in the throat

1. *G. moorcroftiana*

1. *Gentianella moorcroftiana* (Wall. ex G. Don) Airy Shaw in Hook., Icon. Pl. 5: t. 3431, 1943 (in adnote); S. Garg, *Gentian. N.W. Himal.* 149, 1987; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 430, 1994. *Gentiana moorcroftiana* Wall. ex G. Don, *Gen. Hist.* 4: 182, 1837. *Teekta Moudak, Moudak Sekhon, Sumteek*

Photo. 110

Annuals. Stems erect, 18-30 cm long; branches 4-lineolate. Radical leaves obovate-spathulate, 1.2-3 x 0.5-1 cm, subobtusely-ovate; cauline sessile, lanceolate to narrowly oblong, 1.3-4 cm long, amplexicaul, acute-subobtusely. Flowers tubular, 4-5-merous. Calyx subcampanulate; tube 2-6 mm long; lobes narrowly oblong, unequal, 0.5-1.5 cm long. Corolla campanulate, purplish-blue; tube 0.8-2 cm long; lobes oblong-elliptic, 0.5-1.2 cm long, subobtusely-ovate. Capsules oblong ellipsoid, 1.7-2.2 x 4-6 mm. Seeds numerous, yellow brown.

Fl. & Fr.: July - August.

Scarce; on moist slopes along the streams. Chhohem, 4050 m, 22.07.2002, K. Chandra Sekar 100501.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China; Nepal and Pakistan.

Juice of whole plant given in headache.

2. *Gentianella tenella* (Rottb.) Borner, *Fl. Deutsche, Volk*, 542, 1912; S. Garg, *Gentian. N.W. Himal.* 140, 1987; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 430, 1994. *Gentiana tenella* Rottb. in *Könl. Selsk. Skrift. (Acta Hafn.)* 10: 436, t. 2, 6, 1770.

Annuals. Stems 0.6-1 cm high. Radical leaves rosulate, elliptic-obovate, 0.8-2 x 0.3-0.7 cm, subobtusely-ovate; cauline ones sessile to subsessile, ovate-oblong to ovate-elliptic, 0.5-2 x 0.2-0.7 cm, amplexicaul, acute. Flower solitary, terminal, 4 or 5-merous. Calyx 4 or 5-partite, glabrous; lobes unequal, ovate-lanceolate to elliptic-oblong, 4-9 x 3-5 mm. Corolla violet-blue to blue; tube longer than the lobes; lobes oblong-ovate, 3-9 x 2-4 mm. Capsules ovate-ellipsoid, 1-2 cm long, compressed. Seeds subglobose, numerous, yellow-brown.

Fl. & Fr.: July - August.

Scarce; on moist slopes along the streams. Chhohem, 4000 m, 13.07.2003, *K. Chandra Sekar* 103273.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia; Europe; North and Central America.

3. *Gentianopsis* Ma

Species 16-25 distributed in N. temperate Asia and America; 3 in India.

- 1a. Radical leaves linear-oblong 1. *G. detonsa*
 b. Radical leaves elliptic-oblong 2. *G. paludosa*

1. ***Gentianopsis detonsa*** (Roth.) Ma in Acta Phytotax. Sinica 1: 7. 1951; S. Garg, Gentian. N.W. Himal. 143. 1987; Aswal & Mehrotra, Fl. Lahaul-Spiti 431. 1994. *Gentiana detonsa* Roth. in Koenig, Selsk. Skrift. (Acta Hafn.) 10: 435. t. 1. f. 3. 1770. *Chaturk*

Annuals or biennials, 10-20 cm high. Radical leaves rosulate, linear-oblong, 1-3 x 0.3-0.6 cm, subobtusely-acute, 1-3-nerved; cauline ones sessile, linear to oblong-linear, 1.5-3 cm long. Flower solitary, terminal. Calyx tube 0.5-1.1 cm long; lobes unequal, scarious at margins. Corolla narrowly funnel-shaped, blue; tube 1.3-3 cm long; lobes 4, 0.6-1.1 cm, narrowly oblong-obovate, subobtusely-acute. Capsules oblong-ellipsoid, 1.3-2.8 cm long. Seeds numerous, subglobose, brown.

Fl. & Fr.: July - August.

Scarce; on moist slopes along streams. Gechang Thango, 3850 m, 10.07.2003, *K. Chandra Sekar* 101177.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Asia; Europe and North America.

Whole plant extract given in jaundice.

2. ***Gentianopsis paludosa*** (Hook.) Ma in Acta Phytotax. Sinica 1: 11. 1951; S. Garg, Gentian. N.W. Himal. 145. 1987; Aswal & Mehrotra, Fl. Lahaul-Spiti 432. 1994. *Cyathrek*

Annuals or biennials, 14-26 cm high. Radical leaves rosulate, elliptic-oblong, 1-4.5 x 0.6-1.5 cm, obtuse, 3-nerved; cauline ones ovate-elliptic to ovate-lanceolate, 2-4.2 x 0.5-1.5 cm, subobtusely to acute. Flower solitary, terminal. Calyx prominently keeled; tube 0.9-1.6 cm long; lobes unequal, ovate-triangular, 6-9 x 4-6 mm, acute. Corolla pale-pink to deep blue; tube 1.7-3.5 cm long; lobes 4, obovate-oblong, 1-2 cm long. Capsules oblong-obovoid, 1.5-5 cm long. Seeds numerous, subglobose, 1-2 mm long, blackish-brown.

Fl. & Fr.: July - August.

Scarce; along the streams. Tariya to Pin-Patvati Pass, 4000 m, 24.07.2003, *K. Chandra Sekar* 103654.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; Nepal and Pakistan.

Decoction of whole plant given to cure insomnia.

4. *Swertia* L.

About 50 species mainly distributed in N. temperate Africa and Malasia; ca 32 in India.

- 1a. Annuals; stem solid, slender; leaves subsessile 1. *S. ciliata*

b. Perennial herbs; stems hollow, thick; radical

leaves long-petioled

2. *S. petiolata*

1. *Swertia ciliata* (G. Don) Burt. in Notes Roy. Bot. Gard. Edinb. 26(3): 272. 1965; S. Garg, *Gentian. N.W. Himal.* 168. 1987; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 4: 178. 1937. *Ophelia ciliata* G. Don, *Gen. Hist.* 4: 178. 1837.

Annuals. Stems 40-60 cm high, solid, purplish-green. Leaves subsessile, lanceolate, 1.5-9 x 0.3-3.5 cm, attenuate, acute, ciliate along the margin. Panicled leafy. Bracts linear-lanceolate, 1.3 x 0.2-1 cm, foliaceous. Flowers 5-merous, 5-8 mm long. Calyx scaberrulous; lobes lanceolate, 4-7 mm long, acute. Corolla white-purple to purple-blue; lobes 5, ovate-lanceolate, 4-7 x 3-4 mm, acuminate. Capsules ellipsoid, 0.6-1 cm long. Seeds globose, numerous, yellow.

Fl. & Fr.: July - August.

Rare; along the streams. Gechang, 3800 m, 24.08.2002, K. Chandra Sekar 100686.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Punjab and Uttarakhand; Afghanistan; China; Nepal and Pakistan.

2. *Swertia petiolata* D. Don in *Lond. Edinb. Philos. Mag. J. Sci.* 8(43): 77. 1836; C.B. Clarke in Hook.f., *Fl. Brit. India* 4: 128. 1883; S. Garg, *Gentian. N.W. Himal.* 190. 1987; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 436. 1994.

Karna Mendok

Perennial herbs; rhizomatous. Stems 30-40 cm high, hollow. Radical leaves long petioled, lamina elliptic-oblong, 3.5-16 cm long, subobovate; cauline usually sessile, narrowly lanceolate, 2-5.5 cm long, subobovate-acute. Bracts narrowly elliptic-lanceolate, 1.5-2.5 x 0.6-1 cm, acuminate. Calyx lobes linear-lanceolate, acuminate. Corolla varying in colour from blue-white; lobes 5, narrowly oblong, subobovate. Capsules oblong-ellipsoid, 0.8-1.5 cm long. Seeds numerous, red-brown.

Fl. & Fr.: July - August.

Rare; on moist slopes. Near Tariya, 4000 m, 05.08.2002, K. Chandra Sekar 100614.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China and Pakistan.

33. POLEMONIACEAE

About 20 genera and ca 290 species distributed in Eurasia and America; 1 genus and 2 species in India.

Polemonium L.

About 25 species distributed in N. temperate regions; 2 in India.

Polemonium caeruleum L., *Sp. Pl.* 162. 1753; C.B. Clarke in Hook.f., *Fl. Brit. India* 4: 133. 1885; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 437. 1994. *Ann. Ser. Mendok, Lande Kumuk Mendok, Dusi Lama Mentu.*

Perennial herbs. Stems erect, 40-60 cm high, sparsely hairy, leafy. Leaves pinnate, 5-22 cm long; leaflets many, sessile, lanceolate to ovate-lanceolate, 1-4 x 0.3-0.8 cm. Calyx campanulate, 0.5-1 cm long, hairy. Corolla funnel-shaped, 1.5-2 cm dia., blue; tube very short. Stamens included. Style protruded. Capsules ellipsoid, 4.5 mm dia., included in the calyx, dehiscent by 3 valves.

Fl. & Fr.: June - August.

Occasional; on rocky slopes. Mud-Tharbik, 3950 m, 01.08.2002, K. Chandra Sekar 102801.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia; Europe and N. America.

Flower extract taken to cure stomach pain.

34. BORAGINACEAE

About 130 genera and ca 2300 species mainly in tropical and temperate regions; 43 genera and 209 species in India.

- | | |
|--|-----------------------|
| 1a. Faucal appendages on corolla present | 3 |
| b. Faucal appendages on corolla absent | 2 |
| 2a. Corolla-lobes reduced to teeth | 8. <i>Onosma</i> |
| b. Corolla-lobes distinct | 1. <i>Arnebia</i> |
| 3a. Nulets smooth at the margins | 7. <i>Myosotis</i> |
| b. Nulets glochidiate-appendiculate at the margins | 4 |
| 4a. Nulets globose, semiglobose or napiform | 5 |
| b. Nulets more or less pyramidal to truncate or pyramidal-oblong | 6 |
| 5a. Anthers at maximum 3-times longer than broad | 2. <i>Cynoglossum</i> |
| b. Anthers often more than 3-times longer than broad | 6. <i>Lindelofia</i> |
| 6a. Nulets more or less equal to the elongated gynobase, attached for nearly the whole length, exceeded by styles | 5. <i>Lappula</i> |
| b. Nulets much surpassing the stout pyramidal gynobase, attached obliquely and supramedially by the deltoid or ovate areola, surpassing the styles | 7 |
| 7a. Fruiting calyx reflexed | 4. <i>Hackelia</i> |
| b. Fruiting calyx erect or ascending | 3. <i>Eritrichium</i> |

1. *Arnebia* Forssk.

About 25 species distributed in Mediterranean region, tropical Africa and Himalaya; 5 in India.

- | | |
|---|------------------------|
| 1a. Corolla orange-yellow | 3. <i>A. guttata</i> |
| b. Corolla pink or purple-white | 2 |
| 2a. Inflorescence broader than long | 2. <i>A. ruschiana</i> |
| b. Inflorescence much longer than broad | 1. <i>A. benthamii</i> |

1. *Arnebia benthamii* (Wall. ex G. Don) L.M. Johnston in J. Arnold Arboret. 25: 56. 1954. *Febinnia benthamii* Wall. ex G. Don, Gen. Syst. 4: 333. 1838. Aswal & Mehrotra, Fl. Lahaul-Spiti 440.1994.

Macrotomia benthami (Wall.) DC. in DC., Prodr. 10: 27. 1846; C.B. Clarke in Hook.f., Fl. Brit. India 3: 177. 1883. *Khamed, Batangul, Balchar.*

Perennial herbs, with thick purple roots. Stems erect, 32-50 cm high, fistular, unbranched, densely covered with white trichomes. Leaves narrowly lanceolate, 5.5-10.2 cm long, acute, entire; cauline ones leaves gradually reduced in size upwards. Spike terminal, solitary. Bracts linear lanceolate, acuminate. Sepals linear, 2-3.4 cm long. Corolla purple to pink; tube more or less equal to the calyx length; mouth 6-11 mm dia. Style shortly bifid; stigmas 2, capitate. Nutlets ovoid, 1-2.5 mm long, acute.

Fl & Fr: June - August.

Occasional; on moist slopes. Mud-Tharbik, 3900 m, 23.08.2002, K. Chandra Sekar 102927.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan.

Root extract taken to cure blood pressure.

2. *Arnebia euchroma* (Royle ex Benth.) I. M. Johnston in Contr. Gray Herb. 73: 49. 1924; Aswal & Mehrotra, Fl. Lahaul-Spiti 441. 1994. *Lilbospermum euchromum* Royle ex Benth. in Royle, Illust. Bot. Himal. 305. 1836. *Macrotomia perennis* (Schrenk) Boiss., Fl. Orient. 4: 212. 1875; C.B. Clarke in Hook.f., Fl. Brit. India 4: 177. 1883. *Ratan jut, Khamed Photo. 111*

Perennial herbs with thick purple roots. Stems ascending 22-40 cm high, fistular, covered with white trichomes. Basal leaves petioled, lanceolate, 2-5.5 cm long, acute; middle and upper cauline leaves sessile, lanceolate, reduced in size upwards; upper ones usually much shorter and broader. Cymes 5-6 cm dia., many-flowered. Bracts leaf-like. Calyx 0.8-1.15 cm long in flowers, 1-2 cm in fruits. Corolla funnel-shaped, pink or pink-white; tube as long as the sepals. Nuts irregularly and coarsely tuberculate.

Fl & Fr: July - September.

Occasional; on moist slopes. Nur Pasture, 4000 m, 21.07.2002, K. Chandra Sekar 100493.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China and Pakistan.

Red dye extracted from the root.

3. *Arnebia guttata* Bunge, Index Sem. Horti Dorpat. 1840: 7. 1840; Aswal & Mehrotra, Fl. Lahaul-Spiti 442. 1994. *A. tibetana* Kurz in J. Asiat. Soc. Bengal 43 (2): 189. 1872; C.B. Clarke in Hook.f., Fl. Brit. India 4: 176. 1883. *Photo. 112*

Perennial herbs, with thin purple roots. Stems ascending or decumbent-procumbent, 20-30 cm high, densely covered with soft appressed white trichomes. Leaves covered with white trichomes; basal leaves oblanceolate, coriaceous; cauline ones oblong-ovate, shorter than the basal leaves. Cymes terminal. Bracts equalling or slightly exceeding the calyx. Sepals 0.6-1 cm long, densely hairy. Corolla orange to yellow; tube 0.8-1.3 cm long. Nutlets ovoid, 1-2 mm long, tuberculate.

Fl & Fr: July - September.

Scarce; on rocky slopes. Thango-Kilung, 4000 m, 31.07.2003, K. Chandra Sekar 103702.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China and Pakistan.

2. *Cynoglossum* L.

About 75 species distributed in temperate and warm regions, especially in the Old World; 14 in India.

- | | |
|--|----------------------------|
| 1a. Nutlets 2-3 mm long | 2 |
| b. Nutlets 3.2-5 mm long | 3 |
| 2a. Style filiform, long, cylindrical | 4. <i>C. wallichii</i> |
| b. Style fleshy thick, short, 4-angled | 1. <i>C. lanceolatum</i> |
| 3a. Cauline leaves oblong, obtuse to subacute, gradually narrowed towards the base | 3. <i>C. nervosum</i> |
| b. Cauline leaves ovate, acute to acuminate, roundish at base | 2. <i>C. microglochium</i> |

1. *Cynoglossum lanceolatum* Forssk., Fl. Aegypt.-Arab. 41. 1775; C.B. Clarke in Hook.f., Fl. Brit. India 4: 156. 1883; Kazmi in J. Arnold Arbor. 52: 343. 1971; Aswal & Mehrotra, Fl. Lahaul-Spiti 443. 1994. **Photo. 113**

Biennial or perennial herbs. Stems ascending, 20-40 cm high, covered densely with stout, white tuberculate trichomes. Leaves broadly lanceolate, 2.5-5.2 cm long, strongly nerved beneath; basal leaves petioled; cauline ones subsessile or sessile, much reduced in size. Racemes branched, 10-18 cm long. Flowers pedicelled. Calyx-lobes obtuse. Corolla light blue. Nutlets ovoid, 2-3 mm long.

Fl. & Fr.: June - September.

Common; on rocky slopes. Shrim-Chohem, 4000 m, 12.07.2003, *K. Chandra Sekar* 101188.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim, Uttarakhand and Uttar Pradesh; Afghanistan; China; Nepal; Pakistan and Philippines.

2. *Cynoglossum microglochium* Benth. in Royle, Illustr. Bot. Himal. 305. 1836; C.B. Clarke in Hook.f., Fl. Brit. India 4: 158. 1883; Kazmi in J. Arnold Arbor. 52: 348. 1971; Aswal & Mehrotra, Fl. Lahaul-Spiti 444. 1994.

Perennial herbs. Stems erect, 35-50 cm high, densely covered with white trichomes. Leaves lanceolate to oblong-lanceolate, 5-6 x 2.5-3.2 cm, densely soft hairy beneath; cauline ones subsessile or sessile, gradually reduce in size upwards. Racemes dense, 2-10 cm long. Calyx-lobes elliptic, obtuse, villous. Corolla pale blue to light purple; tube shorter than the calyx-lobes. Nutlets ovoid, puberulous.

Fl. & Fr.: July - September.

Occasional; on rocky slopes. Sagnam, 3650 m, 12.07.2002, *K. Chandra Sekar* 100431.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan.

3. *Cynoglossum nervosum* Behtz. ex C.B. Clarke in Hook.f., Fl. Brit. India 4: 158, 1883; Kazmi in J. Arnold Arbor. 52: 349. 1971; Aswal & Mehrotra, Fl. Lahaul-Spiti 444. 1994.

Perennial herbs. Stems erect, 35-50 cm high, covered with crisped white spreading trichomes. Basal leaves petioled, ovate to oblong-ovate, 2.4-4.3 cm long; lower cauline ones short-petioled, lanceolate; middle and upper ones sessile, narrow to broadly lanceolate. Racemes 6-14 cm long, lax. Calyx lobes 2-5 mm long. Corolla widely campanulate, blue; tube very short. Nutlets ovoid, 2-3 mm long.

Fl. & Fr.: June-September.

Scarce; on moist slopes. Sanpat, 4100 m, 23.07.2003, *K. Chandra Sekar* 103648.

Distrib.: India: Himchal Pradesh and Jammu & Kashmir; Pakistan.

4. *Cynoglossum wallichii* G. Don, Gen. Hist. 4: 354. 1838; C.B. Clarke in Hook.f., Fl. Brit. India 4: 157. 1883; Kazmi in J. Arnold Arb. 52: 346. 1971; Aswal & Mehrotra, Fl. Lahaul Spiti 445.1994.

Biennials. Stems erect, 32-48 cm high, branched above, densely covered by spreading, tuberculate, white trichomes. Basal leaves petioled, shorter, lanceolate to obovate, 2-3.6 x 0.5-2.1 cm, acute; lower cauline leaves 2-4 x 0.6-2.3 cm, acute; middle and upper ones subsessile to sessile. Racemes 7-11 cm long. Calyx-lobes oblong in fruit. Corolla pale to deep blue. Nuts ovoid.

Fl. & Fr.: June-September.

Scarce; in moist places near streams. Sagnam, 3650 m, 12.07.2002, *K. Chandra Sekar* 100429.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan.

3. *Fritrichium* Schrad. ex Gaudin

About 30 species distributed in N. temperate regions; ca 5 in India.

- | | |
|--|--|
| 1a. Basal leaves in rosettes, sessile | 3. <i>F. nanum</i> subsp. <i>villosum</i> |
| b. Basal leaves not in rosettes, petiolate | 2 |
| 2a. Cauline leaves gradually narrowed towards base | 2. <i>F. fruticulosum</i> |
| b. Cauline leaves broad at base | 3 |
| 3a. Cauline leaves ovate to oblong-ovate, usually covered with trichomes of unequal length | 4. <i>F. spatulatum</i> var. <i>thumsoni</i> |
| b. Cauline leaves oblong-lanceolate, usually covered with trichomes of equal length | 1. <i>F. canum</i> |

1. *Fritrichium canum* (Benth.) Kitam. in Act. Phytotax. Geobot. 19: 103. 1963; Kazmi in J. Arnold Arb. 51: 390. 1970; Aswal & Mehrotra, Fl. Lahaul-Spiti 447. 1994. *Fehinospernum canum* Benth. in Royle, Illustr. Bot. Himal. 306. 1836. *Fritrichium strictum* Decne. in Jacquem., Voy. Inde 125. 1844; C.B. Clarke in Hook.f., Fl. Brit. India 4: 164. 1883.

Perennial herbs. Stems ascending, 16-25 cm high, unbranched, densely covered with appressed white trichomes. Leaves 3.2 - 3.8 cm long; basal leaves petioled, lanceolate, gradually attenuated towards the petioles; cauline leaves sessile, oblong-lanceolate, 2-2.8 cm long, acute, glabrous or sparsely pubigerous. Racemes 5-7 cm long, branched. Flowers 4-5 mm dia. Calyx lobes oblong. Corolla blue. Nuts 4, covered with thin short trichomes.

Fl. & Fr.: July-August.

Scarce; on rocky slopes. Debsa, 29.06.1992, *Nima & Yasayer* 18 (W11).

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Baltistan and Pakistan.

2. *Eritrichium fruticosum* Klotz. in Reise Pr. Wald. Bot. 96. 1862; Kazmi in J. Arnold Arb. 51: 387. 1970; Aswal & Mehrotra, Fl. Lahaul-Spiti 447. 1994. *E. strictum* (Klotz.) C.B. Clarke in Hook.f., Fl. Brit. India 4: 164. 1883.

Perennial herbs. Stems ascending, 18-25 cm high, branched, densely covered with appressed white trichomes. Leaves covered uniformly with appressed trichomes; basal leaves petioled, ovate-lanceolate, 3-3.6 cm long, attenuate towards the base; cauline leaves sessile. Racemes 5 - 6.5 cm long, branched, 10-15-flowered. Flowers 4-5 mm dia. Calyx lobes oblong. Corolla blue. Nuts 4, pubescent with short, stiff trichomes.

Fl. & Fr.: June - September.

Rare; on rocky slopes. Shrim Chhohem, 4000 m, 12.07.2003, K. Chandra Sekar 101186.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Pakistan.

3. *Eritrichium nanum* (Vill.) Schrad. subsp. *villosum* (Ledeb.) Brand in Engl., Pflanzent. IV. 252 (heft 97): 189. 1931; Kazmi in J. Arnold Arbor. 51: 386. 1970; Aswal & Mehrotra, Fl. Lahaul-Spiti 448. 1994. *Myosotis villosa* Ledeb., Mem. Acad. St.-Petersbourg 5: 516. 1815. *E. basiflorum* C.B. Clarke in Hook.f., Fl. Brit. India 4: 165. 1883.

Perennial herbs, densely caespitose, 8-12 cm high. Leaves covered uniformly with appressed trichomes; basal leaves numerous, sessile, oblong-lanceolate, 0.6-1.8 x 0.3-0.7 cm; cauline ones few. Racemes 3-5 cm long, 3-6-flowered. Flowers 2-4.5 mm dia. Calyx lobes oblong-lanceolate. Corolla campanulate to rotate, blue to white; tube equalling or slightly exceeding the calyx. Nuts 1-2.2 mm long, minutely dentate along margins.

Fl. & Fr.: June - August.

Rare; on rocky slopes. Chhohem, 4150 m, 12.07.2003, K. Chandra Sekar 103229.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan.

4. *Eritrichium spathulatum* (Benth.) C.B. Clarke var. *thomsoni* (C.B. Clarke) Kazmi in J. Arnold Arbor. 51: 389. 1970; Aswal & Mehrotra, Fl. Lahaul-Spiti 448. 1994. *Omphalodes thomsoni* C.B. Clarke in Hook.f., Fl. Brit. India 4: 155. 1883. *Eritrichium strictum* Decne. var. *thomsoni* C.B. Clarke in Hook.f., Fl. Brit. India 4: 164. 1883. *H. thomsoni* (C.B. Clarke) I.M. Johnston in J. Arnold Arbor. 21: 53. 1940.

Perennial herbs. Stems decumbent, 10-20 cm high, weak, covered with short appressed white trichomes. Basal leaves petioled, ovate lanceolate, 1.5-2.5 x 0.5-0.6 cm; cauline ones sessile, oblong-ovate. Racemes lax, many-flowered. Calyx-lobes oblong-ovate, 2-3 mm long, reflexed in fruits. Corolla rotate to campanulate, with a broad white-yellow eye. Nuts 1-2 mm long, glabrous.

Fl. & Fr.: July - August.

Rare; on rocky slopes. Kilung-Latang I a, 4800 m, 05.08.2003, K. Chandra Sekar 103747.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China and Pakistan.

Note: Differs from var. *spathulatum* in having glabrous nuts.

4. *Hackelia* Opiz

Forty five species distributed in N. temperate and C. & S. America; 1 in India.

Hackelia uncinata (Royle ex Benth.) C. E. C. Fisch. in Bull. Misc. Inform. 1932: 298. 1932; Kazmi in J. Arnold Arbor. 51: 398. 1970; Aswal & Mehrotra, Fl. Lahaul-Spiti 449. 1994. *Cynoglossum uncinatum* Royle ex Benth. in Royle, Illustr. Bot. Himal. 305. 1836. *Paracaryum glaberrimum* Benth. & Hook.f., Gen. Pl. 2: 850. 1876; C.B. Clarke in Hook.f., Fl. Brit. India 4: 161. 1883. *Pajon*: *Ampo Mendok*

Perennial herbs. Stems erect, 34-46 cm high. Basal leaves petioled, cordate-ovate, 4.3-5.5 cm long; cauline leaves shortly petioled, orbicular to elliptic-lanceolate, obtuse at base, acute-acuminate at apex, sparsely hairy. Racemes 5-15 cm long, lax, strigose. Calyx lobes oblong, 2-3 mm long, acute; in fruits ovate, 4-5.5 mm long, reflexed. Corolla campanulate to rotate, 6-7.5 mm dia., blue; tube equalling the calyx. Nudlets prominent, long-glochidiate.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Mud-Larang La, 3950 m, 20.08.2002, K. Chandra Sekar 100658.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Pakistan.

5. *Lappula* Gilib.

About 40 species distributed in Eurasia and N. America; 4 in India.

Lappula barbata (M. Bieb.) Gurke var. *caricensis* (Boiss.) Brand in Engl., Pflanzenz. IV. 252 (heft 97): 141. 1931; Kazmi in J. Arnold Arbor. 51: 509. 1970; Aswal & Mehrotra, Fl. Lahaul-Spiti 451. 1994. *Fehinosperrum cariensis* Boiss., Diagn. Pl. Orient. 4: 40. 1844. *Pin Jamba*

Annuals or biennials. Stems erect, 30-42 cm high, covered with soft, appressed to subappressed trichomes. Basal leaves rosulate, 2.8-5.1 cm long, lanceolate to linear-lanceolate, entire, covered on both surfaces with white trichomes; cauline ones sessile, linear, gradually reduced upwards. Racemes 5-20 cm high. Calyx lobes linear-oblong, hairy. Corolla infundibuliform to campanulate, 3.5-5 mm dia., white to blue-white. Nudlets 2.5-3.5 mm long.

Fl. & Fr.: June-September.

Occasional; on moist slopes. Thango, 3950 m, 19.07.2002, K. Chandra Sekar 100484.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan.

5. *Lindlofia* Ledeb.

Eleven species distributed from C. Asia to the Himalaya; 5 in India.

- | | |
|--|---------------------------|
| 1a. Corolla tube much shorter than the limb; filaments shorter than anthers | 1. <i>L. anechusoides</i> |
| b. Corolla tube equalling or much longer than the limb; filaments more or less equalling anthers | 2 |
| 2a. Corolla lobes oblong | 3. <i>L. stylosa</i> |
| b. Corolla lobes ovate | 2. <i>L. longiflora</i> |

1. *Lindlofia anechusoides* (Lindl.) Ledeb. in Hamburg, Certenzzeit. 6: 352. 1850; Kazmi in J. Arnold Arbor. 52: 334. 1971; Aswal & Mehrotra, Fl. Lahaul-Spiti 452. 1994. *Cynoglossum anechusoides* Lindl. in Edwards Bot. Reg. 28: f. 14. 1842. *Paracaryum heliosarpum* Kerner. Ber. Nat. Med. Innsbruck 1 (Suppl.): 105. 1870; C.B. Clarke in Hook.f., Fl. Brit. India 4: 161. 1883.

Perennial herbs. Stems erect or decumbent, 45-70 cm high, fistulose, covered with long soft trichomes. Basal leaves petioled, spatulate-lanceolate, 5-15 cm long; cauline leaves petioled, lanceolate,

gradually reduced upwards; near apex sessile, lanceolate to linear-lanceolate. Racemes 8-21 cm long, few-flowered. Calyx lobes narrowly oblong. Corolla blue-purple; tube much shorter than the limbs. Filaments shorter than the anthers. Nutlets globose.

Fl. & Fr.: June- August.

Parahio catchment, 25.06.1992, *Nima & Yashveer* 16 (WII).

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan.

2. *Lindelofia longiflora* (Benth.) Baill., *His. Des. Pl.* 10: 379. 1890; Kazmi in *J. Arnold Arbor.* 52: 341. 1971; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 453. 1994. *Cynoglossum longiflorum* Benth. in *Royle, Illustr. Bot. Himal.* 305. 1836. *Show Res. Photo. 114*

Perennial herbs. Stems erect or decumbent, 45-53 cm high, covered sparsely to densely with white, crisped trichomes. Basal leaves spatulate-lanceolate, 7-16 cm long, attenuate or narrowed into petioles, acute at apex; cauline ones sessile, oblong-lanceolate to ovate, base slightly dilated, acute; near apex semi-amplexicaul. Racemes 8-22 cm long. Calyx lobes obtuse at apex. Corolla blue; tube equalling or much longer than limb. Nutlets pyramidal-oblong.

Fl. & Fr.: June-August.

Common; on rocky slopes. Shrim-Chhohem, 4000 m, 12.07.2003, *K. Chandra Sekar* 101187.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan.

3. *Lindelofia stylosa* (Kar. & Kir.) Brand in Engl., *Pflanzenr.* 1v. 252 (heft 78): 83. 1921; Kazmi in *J. Arnold Arbor.* 52: 337. 1971; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 454. 1994. *Cynoglossum stylosum* Kar. & Kir. in *Bull. Soc. Nat. Mos.* 15: 409. 1842. *Lindelofia benthami* Hook.f., *Fl. Brit. India* 4: 159. 1883.

Perennial herbs. Stems erect, 40-55 cm high, covered with spreading trichomes. Basal leaves long-petioled, narrow-lanceolate, 12-18 x 2-3.2 cm, narrowed into long petioles, acute at apex; cauline ones subsessile, 7-8 cm long; upper ones sessile, linear, acute. Racemes terminal. Calyx lobes linear-lanceolate, densely covered with white trichomes. Corolla dark purple-blue; lobes ovate. Nutlets broadly pyramidal-oblong.

Fl. & Fr.: June-August.

Parahio catchment, Kilung, 25.06.1992, *Nima & Yashveer* 15 (WII).

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Nepal and Pakistan.

7. *Myosotis* L.

About 100 species distributed in temperate regions; 6 in India.

Myosotis silvatica Ehrh. ex Hoffm., *Deutsch. Fl. Od. Bot. Taschenb.* 1: 61. 1791; C.B. Clarke in *Hook.f., Fl. Brit. India* 4: 173. 1883 (*ghatica*); Kazmi in *J. Arnold Arbor.* 52: 687. 1971; Aswal & Mehrotra, *Fl. Lahaul Spiti* 455. 1994. *Anurkar Mentok, Thurge*

Annuals or biennials. Stems erect, 15-35 cm high. Basal leaves long-petioled, oblong-elliptic to oblong-lanceolate, 2.6-3.5 x 0.4-0.7 cm, rounded or obtuse at apex; cauline ones sessile, gradually

reduced upwards. Racemes 5-20 cm long, apex often divided. Calyx villous; teeth lanceolate, longer than the tube. Corolla blue-purple to blue white. Nudlets ovoid, glabrous, blackish-brown.

Fl. & Fr.: June - August.

Occasional; on moist slopes. Chhobern, 4200 m, 12.07.2003, K. Chandra Sekar 103212.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia and Europe.

Decoction of whole plant given to cure dysentery.

8. *Onosma* L.

About 150 species distributed from Mediterranean to the Himalaya and China; ca 14 in India.

Onosma hispidum Wall. ex D. Don, Gen. Hist. 4: 371. 1838; Kazmi in J. Arnold Arb. 52: 505. 1971; Aswal & Mehrotra, Fl. Lahaul-Spiti 456. 1994.

Perennial herbs, with strong and thick tap roots. Stems erect, 40-60 cm high, covered densely with bristly, white trichomes. Basal leaves oblong-oblancoate, 5-6.7 x 1-1.3 cm, rounded at base, obtuse at apex; upper cauline leaves shorter and narrower. Racemes 3-12 cm long, often forked. Bracts foliaceous. Calyx lobes linear, reduced to teeth. Corolla glabrous, blue to deep purplish blue. Nudlets ovoid trigonal, acute, pubescent on ridges.

Fl. & Fr.: June-August.

Parahio Catchment, Gechang, 17.07.1992, Nima & Yasbeer 192 (WIT).

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan and Siberia to France.

35. CONVULVULACEAE

Fifty six genera and about 1600 species; 29 genera and 199 species in India.

Convolvulus L.

About 100 species, cosmopolitan especially in temperate regions; ca 10 in India.

Convolvulus arvensis L., Sp. Pl. 153. 1753; C.B. Clarke in Hook.f., Fl. Brit. India 4: 219. 1883; Aswal & Mehrotra, Fl. Lahaul-Spiti 460. 1994; Chandra Sekar & S.K. Srivast in Ethnobotany 15: 45. 2003.

Mendok Senok Photo. 115

Perennial herbs. Stems 40-90 cm long, branched at the base, prostrate, glabrous to pubescent. Leaves ovate-lanceolate to oblong, 2.4 x 0.3-3 cm, sagittate to hastate, acute to obtuse. Flowers axillary, campanulate. Sepals broadly oblong, 4-5 mm long, obtuse, sparsely pubescent to glabrous. Petals 1.6-1.8 cm long, pale pink to lilac with dark purple bands. Filaments unequal, 5-7 mm long; anthers 1.5-2 mm long. Ovary glabrous. Capsules globose, 4-5 mm dia. Seeds 3-4 mm long, dark brown, tuberculate.

Fl. & Fr.: July - September.

Common; on moist slopes. Shrim, 4000 m, 20.07.2002, K. Chandra Sekar 100488.

Distrib.: Throughout the temperate and tropical regions of the world.

Decoction of flower buds is used as a purgative.

36. CUSCUTACEAE

Single genus with about 145 species, cosmopolitan; ca 12 species in India.

Cuscuta L.

Cuscuta europaea L., Sp. Pl. 124. 1753; C.B. Clarke in Hook.f., Fl. Brit. India 4: 227. 1883; Rajput & Tahir in Nasir & Ali, Fl. Pakistan 189: 15. 1988; Aswal & Mehrotra, Fl. Lahaul Spiti 462. 1994. *C. planiflora* Tenore, Fl. Nap. 3: 250, pl. 220, f. 3. 1824-29. *C. approximata* Bab. in Ann. Nat. Hist. 13: 253, t. 4, f. 3. 1884. **Photo. 116**

Annuals. Stems light to dark brown. Leaves minute, oblong to triangular, 1-2 x 0.3-2 mm, scarious to fleshy, sometime obsolete. Flowers in globose clusters; each cluster having 8-22 flowers, 1.5-3.2 mm long. Bracts leaf like. Calyx lobes 5, oblong-elliptic, 1.5-3 x 0.5-1.5 mm, acute-obtuse. Corolla campanulate; lobes oblong-elliptic, acute-obtuse; tube 1.2-1.5 mm long; scales membranous, slightly fringed, 0.5-1.5 mm long. Capsules globose-conical, 1.5-2-2.5 mm, enveloped with a withered corolla.

Fl. & Fr.: July - September.

Common; along the streams, climbing on *Cicer microphyllum* Benth. Debsa, 3600 m, 4000 m, 27.07.2002, K. Chandra Sekar 100521.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia; Europe; N. Africa and N. America.

Note: A polymorphic species, *C. approximata* Bab. and *C. planiflora* Tenore do not have much difference with *C. europaea*, and have been treated as synonymous to *C. europaea* (Rajput & Tahir, *l.c.*).

37. SOLANACEAE

Ninety four genera and about 2950 species, subcosmopolitan especially in S. America; 17 genera and ca 75 species in India.

- | | |
|---------------------------------------|------------------------|
| 1a. Anthers connivent, forming a cone | 3. Solanum |
| b. Anthers not connivent | 2 |
| 2a. Flowers in spikes | 1. Hyoscyamus |
| b. Flowers in terminal corymbs | 2. Physochlaina |

1. Hyoscyamus L.

About 15 species distributed in S.W. & C. Asia, W. Europe, N. Africa to Somalia; 3 species in India.

Hyoscyamus niger L., Sp. Pl. 179. 1753; C.B. Clarke in Hook.f., Fl. Brit. India 4: 244. 1883; Aswal & Mehrotra, Fl. Lahaul-Spiti 463. 1994; Chandra Sekar & S.K. Sivast. in Ethnobotany 15: 45. 2003. *Cheruku* **Photo. 117**

Biennials, 30-60 cm high, pubescent to hairy. Leaves sessile, ovate-oblong, 5-12.5 x 2.8-7.5 cm, semi-amplexicaul, sinuate to pinnately lobed, glandular-pubescent, especially on the nerves and margins. Calyx campanulate to infundibuliform, 1.4-1.6 cm long (up to 2.4 cm in fruits), glandular-pilose; lobes

triangular, aristate. Corolla infundibuliform, 2-2.8 cm long, pale yellow with brown-purple nerves; lobes unequal, obtuse. Pyxidium pitcher shaped, 1.1-1.3 cm long. Seeds reniform, 0.8-1.2 mm, rugose-tuberculate, brown.

Fl. & Fr.: July - September.

Occasional; on moist slopes. Gechang, 3700 m, 24.08.2002, K. Chandra Sekar 100679.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia; Europe; N. Africa and N. America.

Decoction of leaves and fruits is given in whooping cough and asthma. The fried leaves are applied over forehead to relieve pain (headache).

2. *Physochlaina* G. Don

Six species chiefly distributed in China; 1 in India.

Physochlaina praealta (Decne.) Miers in Ann. Mag. Nat. Hist. Ser. 2, 5: 473. 1850; C.B. Clarke in Hook.f., Fl. Brit. India 4: 244. 1883; Aswal & Mehrotra, Fl. Lahaul Spiti 464. 1994; Chandra Sekar & S.K. Srivast. in Ethnobotany 15: 46. 2003. *Belenia praealta* Decne. in Jacquem., Voy. Inde 4: 114, t. 120. 1844.

Mula

Biennials, 40-60 cm high, branched, pubescent. Leaves ovate-oblong, 7-11 x 5-9.5 cm, pubescent; midrib prominent beneath. Inflorescence a corymb. Calyx tubular-campanulate, 0.9-1.1 cm long, glandular-pubescent; lobes ovate, 3.5-5 mm long. Corolla infundibuliform, 2-3 cm long, yellow; lobes obtuse, wavy with green-brown veins. Stamens exerted; anthers oblong, 2-3 mm long. Capsules oblong, 7-9 mm long. Seeds reniform, 2-3 mm long, rugose-tuberculate, brownish yellow.

Fl. & Fr.: July - September.

Rare; on rocky slopes. Farka-Bhaba Pass, 3800 m, 21.08.2002, K. Chandra Sekar 100757.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Pakistan to China.

Seeds are burnt and the ash is applied in toothache.

3. *Solanum* L.

About 1700 species, subcosmopolitan especially in subtropical regions; ca. 40 in India.

Solanum tuberosum L., Sp. Pl. 185. 1753; Aswal & Mehrotra, Fl. Lahaul-Spiti 466. 1994.

Allu Photo. 118

Perennial herbs, erect, 30-40 cm high; tubers of various shapes and sizes. Shoots pubescent, pale green. Leaves imparipinnate, 2.8-4.8 x 2-3 cm, subobtusely-acute, glabrous, pale green; segmented pairs 4 or 5. Inflorescence paniculate cyme, 2-5-flowered. Corolla pink to white or light purple; limb 2-2.5 cm dia.

Fl. & Fr.: June - September.

Common; in cultivation. Gechang, 3730 m, 15.07.2002, K. Chandra Sekar 100463.

Distrib.: Cultivated throughout the World.

Potato is widely cultivated for its edible tubers.

38. SCROPHULARIACEAE

About 268 genera and ca 5100 species, cosmopolitan especially in temperate and tropical mountains; 62 genera and ca 368 species in India.

- | | |
|---|------------------------|
| 1a. Stamens 5 | 6. Verbascum |
| b. Stamens 4 or 2 | 2 |
| 2a. Corolla with the upper lobes external, overlapping in the bud | 5. Scrophularia |
| b. Corolla with the lower lobes internal, not overlapping in the bud | 3 |
| 3a. Upper lobes of corolla flattened or widely arched; anthers all distinct | 4 |
| b. Upper lobes of corolla narrowly arched; anthers frequently cohering | 6 |
| 4a. Usually root parasites; corolla pink | 2. Leptorhabdos |
| b. Usually not parasites; corolla white to violet-blue | 5 |
| 5a. Plants rhizomatous; leaves mostly radical | 4. Picrorhiza |
| b. Plants scarcely rhizomatous; leaves not mostly radical | 7. Veronica |
| 6a. Leaves dentate or dentate-lobed; corolla usually less than 1 cm long; seeds with fine white longitudinal ridges | 1. Euphrasia |
| b. Leaves usually pinnatifid or bipinnatifid; corolla usually more than 1 cm long; seeds smooth | 3. Pedicularis |

1. Euphrasia L.

About 170 species chiefly distributed in Europe; 25 in India.

- | | |
|--|-------------------------|
| 1a. Herbs, distally with eglandular hairs | 2 |
| b. Herbs, distally with gland-tipped hairs | 3 |
| 2a. Bracts with lateral lobes obtuse-acute at apex; mid lobe broadly orbicular | 4. <i>E. paucifolia</i> |
| b. Bracts with lateral lobes acuminate at apex; mid lobe acute | 3. <i>E. jaeschkei</i> |
| 3a. Bracts 4-5 mm long with 5-7 pairs of obtuse to acute lobules | 2. <i>E. himalayica</i> |
| b. Bracts 6-7 mm long with 4 or 5 pairs of acute to aristulate lobules | 1. <i>E. flabellata</i> |

1. *Euphrasia flabellata* Pennell, Scroph. W. Himal. 112. 1943; Aswal & Mehrotra, Fl. Lahaul-Spiti 468. 1994.

Annuals. Stems decumbent-ascending, 7-13 cm high, finely pubescent with recurved white hairs. Leaves ovate-oblong, 5-6 x 3-4 mm, obtuse, with 3-4-pairs of lobules. Bracts ovate-lanceolate, 6-7 mm long, acuminate, finely glandular or pubescent with 4 or 5 pairs of obtuse-acute at apex, mid lobe to aristulate lobules. Calyx 5-7 mm long, finely glandular-pubescent; lobes elliptic-lanceolate. Corolla dorsally 6-7 mm long, white; upper lip 2-2.5 mm long; lower lip 4-5 mm long. Anthers brown. Capsules 4-5.5 mm long, ovoid, finely pilose-ciliate. Seeds brown.

Fl. & Fr.: July - August.

Scarce; moist places near streams. Mud-Larang La, 4000 m, 19.08.2002, *K. Chandra Sekar* 102912.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan.

Decoction of whole plant is given to cure fever.

2. *Euphrasia himalayica* Wettst., *Monogr. Euphrasia* 180, t. 4, ff. 291-295, 1896; Pennell, *Scroph. W. Himal.* 109, 1943; Aswal & Mehrotra, *Fl. Lahaul Spiti* 496, 1994.

Annuals. Stems erect-ascending, 13-26 cm high, pubescent with recurved white hairs. Leaves ovate, 1-1.8 x 0.6-1 mm, obtuse at apex, with 3 or 4 pairs of acute lobules. Bracts ovate, 4-5 mm long, acuminate, glandular-pubescent, with 5-7 pairs of obtuse to acute lobules. Calyx glabrous to glandular-pubescent; lobes elliptic-lanceolate. Corolla white with yellow throat. Capsules truncate, sparsely ciliate.

Fl. & Fr.: July - August.

Occasional; on moist slopes, Gechang Thango, 3850 m, 10.07.2003, *K. Chandra Sekar* 101175.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China and Pakistan.

3. *Euphrasia jaeschkei* Wettst., *Monogr. Euphrasia* 80, t. 2, f. 5, 1896; Pennell, *Scroph. W. Himal.* 103, 1943; Aswal & Mehrotra, *Fl. Lahaul Spiti* 469, 1994.

Annuals. Stems erect, branched, 13-24 cm high, distally with eglandular hairs. Leaves sessile, ovate-oblong, 0.8-1.2 x 0.6-1 cm, with 3-5 pairs of acute lobules. Bracts ovate-elliptic, glandular-pubescent with lateral lobes acuminate at apex, mid lobes acute. Calyx lobes elliptic-lanceolate or ovate lanceolate, aristulate or acute. Corolla white, hairy. Capsules truncate.

Fl. & Fr.: July - August.

Scarce; on moist slopes near streams, Mud-Tariya, 4000 m, 03.08.2002, *K. Chandra Sekar* 102848.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Pakistan.

4. *Euphrasia paucifolia* Wettst., *Monogr. Euphrasia* 198, t. 12, f. 4, 1896; Pennell, *Scroph. W. Himal.* 102, 1943; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 470, 1994. *Nagesar jentok*

Annuals. Stems erect ascending, 6.5-8.5 cm high, minute, few branched, hairy; many from the root-stock. Leaves oblong-ovate or elliptic-ovate, longer than wide, pubescent to puberulent, lobed; lobes broadly ovate-rounded. Flowers in terminal racemes. Bracts foliaceous; with lateral lobes obtuse-acute, mid-lobe broadly orbicular, sparsely hairy. Corolla 5-7 mm long, white with dark violet streaks. Capsules truncate.

Fl. & Fr.: July - August.

Scarce; on moist slopes near streams. Near Tariya, 4250 m, 05.08.2002, *K. Chandra Sekar* 100612.

Distrib.: India : Himachal Pradesh and Jammu & Kashmir; Pakistan.

Leaf extract applied on forehead in headache.

2. *Leptorhabdos* Schrenk

Monotypic distributed from Caucasus, Iran to C. Asia and Himalaya.

Leptorhabdos parviflora (Benth.) Benth. in DC., *Prodr.* 10: 510, 1846; Pennell *Scroph. W. Himal.* 94, 1943; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 472, 1994. *Cierardia parviflora* Benth., *Scroph. Ind.* 48, 1835.

Perennial herbs; root parasite. Stems erect, 35-60 cm high, simple, glabrous below, glandular-pubescent above. Leaves ovate-lanceolate, 2-4.4 cm long, regularly pinnatisect; segments linear or filiform. Racemes very slender, 8-12 cm long, 6-16-flowered. Bracts linear-lanceolate. Calyx 2.5-3.5 mm long, lobed; lobes lanceolate-ovate, acute. Corolla 1.6-2.3 cm long; limb 1-3 mm dia. Capsules 2.5-3.2 mm long.

Fl. & Fr.: July - September.

Rare; growing on the root of *Populus ciliata* Wall. in moist slopes near streams. Gechang, 3800 m, 24.8.2002, K. Chandra Sekar 100684.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China; C. Asia; Iran and Pakistan.

3. *Pedicularis* L.

More than 350 species distributed in N. hemisphere; ca 105 in India.

- | | |
|--|--|
| 1a. Leaves opposite or whorled; inflorescence fasciculate clusters | 3. <i>P. pectinata</i> |
| b. Leaves alternate; inflorescence more continuous | 2 |
| 2a. Flowers yellow | 3 |
| b. Flowers pink purple | 4 |
| 3a. Plants more than 20 cm long; beak of galea exerted well beyond the deeply cleft lower lip of the corolla | 1. <i>P. bicornuta</i> |
| b. Plants less than 20 cm long; beak of galea incurved, not longer than the lower lip of the corolla | 2. <i>P. longiflora</i> subsp. <i>tubiformis</i> |
| 4a. Lower lip of corolla 1.4-2 cm dia., its lobes eciliate; hood of galea not twisted | 5. <i>P. rhinanthoides</i> |
| b. Lower lip of corolla 1.2-1.6 cm dia., its lobes ciliolate; hood of galea twisted | 4. <i>P. punctata</i> |

1. *Pedicularis bicornuta* Klotz. in Bot. Ergebn. Reise. Waldern. 109, t. 61. 1862; Hook.f., Fl. Brit. India 4: 312. 1884; Pennell, Scroph. W. Himal. 145. 1943; Aswal & Mehrotra, Fl. Lahaul-Spiti 476. 1994.

Lakari Mendok Photo. 119

Annuals. Stems 24-36 cm high, stout, simple, leafy. Leaves alternate, linear-oblong, 10-26 cm long, pinnatifid to the middle; lobes rounded, crenate or lobulate. Racemes 13-20 cm long with many, crowded flowers. Bracts crenate. Calyx broadly oblong; lobes crested. Corolla yellow, almost twice as long as the calyx; upper lip annular, produced into a slender, curved bifid tail; lower 2-2.5 cm dia. Capsules oblong lanceolate, 2.2-2.6 cm long, finely acuminate. Seeds 1-3 mm long, reticulate.

Fl. & Fr.: June - August.

Occasional; on moist slopes near streams. Sagnam, 3650 m, 08.07.2003, K. Chandra Sekar 101158.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China and Pakistan.

Paste of immature flower buds applied on wounds.

2. *Pedicularis longiflora* Rudolph subsp. *tubiformis* (Klotz.) Pennell, Scroph. W. Himal. 150. 1943; Aswal & Mehrotra, Fl. Lahaul-Spiti 478. 1994. *P. tubiformis* Klotz. in Klotz. & Garcke, Bot. Ergebn. Reise Waldern. 106, t. 57. 1862. *Aongba Mendick* **Photo. 120**

Perennial herbs with thick rootstock. Stems erect or ascending, 7-15 cm high, stout, often branched. Basal leaves petioled, 2-7 x 0.6-1.3 cm, linear-lanceolate, pinnatifid or pinnatisect with crenate, short lobules; petioles 1.2-2.5 cm long; cauline ones short-petioled or sessile, similar to basal leaves but smaller. Racemes subcapitate. Bracts leaf-like. Flowers 3.5-6.2 cm long. Calyx 0.7-0.8 cm long. Corolla bright yellow with small spots on the lower lip. Capsules oblong-lanceolate, acute. Seeds at 1 mm long, black.

Fl. & Fr.: July - September.

Common; on river beds. Sagnam, 3650 m, 23.08.2002, *K. Chandra Sekar* 100667.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; C. Asia; Nepal; Pakistan and Siberia.

Decoction of whole plant given to cure dysentery.

3. *Pedicularis pectinata* Wall. ex Benth., Scroph. Ind. 52. 1835; Hook.f., Fl. Brit. India 4: 306. 1884, excl. var. *pyramidalata* (Royle) Hook.f., 1884; Pennell, Scroph. W. Himal. 132. 1943; Aswal & Mehrotra, Fl. Lahaul-Spiti 479. 1994.

Perennial herbs. Stems 20-30 cm high, simple or branched, glabrous. Basal leaves long-petioled, 7.5-15 cm long, pinnate; pinnac further pinnatifid dentate; cauline ones whorled, shortly petioled, 6-9.5 cm long, pinnatisect with serrate segments. Calyx 1-1.2 cm long; with acute, entire; inflated in fruit. Corolla 1.5-1.8 cm long, rose-red. Filaments hairy. Capsules ovoid, 5-6.5 mm long, acute. Seeds 2-3 mm long, ridged and deeply pitted, pale.

1a. Lower bracts lanceolate ii. subsp. *pectinata*

b. Lower bracts ovate i. subsp. *bipinnatifida*

i. subsp. *bipinnatifida* Pennell, Scroph. W. Himal. 134. 1943; Aswal & Mehrotra, Fl. Lahaul-Spiti 480. 1994.

Fl. & Fr.: July-August.

Rare; on moist slopes. Tariya, 4200 m, 21.07.2003, *K. Chandra Sekar* 103615.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Pakistan.

ii. subsp. *pectinata* *Lakeri Murpo*

Fl. & Fr.: June - August.

Scarce; on rocky slopes. Saupat, 4350 m, 04.08.2002, *K. Chandra Sekar* 102857.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China and Pakistan.

Whole plant juice taken to cure dysentery.

4. *Pedicularis punctata* Decne. in Jacquem., *Voy. Inde* 4: 117. 1844; Pennell, *Scroph. W. Himal.* 154. 1943; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 481. 1994. *P. sibbaniiba sensu* Hook.f., *Fl. Brit. India* 4: 313. 1884. *Lakri Anbu Mensa Dasbai*

Perennial herbs. Stems many from the root, erect-ascending, 15-40 cm high, leafy. Leaves petioled, linear-oblong, pinnatifid or pinnatisect; lobes many, short, crenulate. Flowers in axillary and terminal racemes. Bracts foliaceous. Calyx 0.6-1.1 cm long; lobes crested. Corolla rose-pink; tube very slender; lower lip 1.2-1.6 cm dia.; hood of galea twisted. Capsules broadly oblong, 0.8-1.2 cm long, acute. Seeds 1-1.1 mm long, oblong, obtuse.

Fl. & Fr.: June - August.

Scarce; on moist slopes. Sanpat, 4350 m, 04.08.2002, *R. Chandni Sekar* 102856.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China and Pakistan.

Whole plant paste applied to cure muscle pain.

5. *Pedicularis rhinanthoides* Schrenk in Fisch. & C.A. Mey., *Enum. Pl. Nov.* 1: 22. 1841; Hook.f., *Fl. Brit. India* 4: 314. 1884; Pennell, *Scroph. W. Himal.* 151. 1943; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 482. 1994. *Lakri Serbu Mentak*

Perennial herbs. Stems suberect-ascending, 20-30 cm high. Leaves basal, 2-4 cm long with 9-12 pairs of pinnae; pinnae ovate to oblong-ovate, irregularly dentate-lobed; teeth sharp, often cuspidate. Racemes very short. Bracts foliaceous. Calyx 1-1.2 cm long, sparsely villous, membranous; with 2-short, crenate teeth. Corolla pale pink; tube externally minutely pubescent; lower lip 1.4-1.6 cm dia. Capsules 1.1-1.3 cm long. Seeds 1-1.2 mm long, oblong, obtuse.

1a. Beak not longer than the hood of the galea, simply incurved ii. subsp. *rhinanthoides*

b. Beak longer than the hood of the galea, incurved, but distally often also upcurved i. subsp. *labelata*

i. subsp. ***labelata*** (Jacquem.) Tsoong, *Fl. Reip. Pop. Sin* 68: 263. 1863; Pennell, *Scroph. W. Himal.* 152. 1943. *P. labelata* Jacquem., *Voy. Inde* 4: 118, t. 123. 1844. *Lakri Marpo Mentak*

Fl. & Fr.: June - August.

Rare; on moist slopes. Farka-Bhaba Pass, 4000 m, 04.08.2002, *R. Chandni Sekar* 100597.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia and Europe.

ii. subsp. ***rhinanthoides***

Fl. & Fr.: June - August.

Occasional; on stream beds. Sanpat, 4200 m, 04.08.2002, *R. Chandni Sekar* 102853.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; Nepal and Pakistan.

4. *Picrohiza* Royle ex Benth.

Monotypic species distributed in Himalaya.

Pennell (1943) described *Picrohiza scrophulariiflora* Pennell, but Mabberley (1998) treated this species under *Picrohiza kurrooa* Royle ex Benth.

Picrohiza kurrooa Royle ex Benth., Scroph. Ind. 47. 1835; Hook.f., Fl. Brit. India 4: 290. 1884; Pennell, Scroph. W. Himal. 63. 1943; Aswal & Mehrotra, Fl. Lahaul-Spiti 484. 1994. *Paral. Cbe Mensa*

Perennial herbs; runners rooting at intervals, producing new plants. Stems erect-ascending, 18-25 cm high. Leaves elliptic-oblong-lanceolate, 4-10 x 1-3.2 cm, acute, sharply serrate. Flowering scapes ascending, stout, longer than the leaves. Racemes 4-10 cm long. Bracts oblong-lanceolate, 8-9 mm long, obtuse, ciliate, somewhat brown-pubescent. Sepals lanceolate, 0.6-1 cm long, acute. Corolla 4-5 mm long, violet; lobes ovate-lanceolate, acuminate. Capsules 0.9-1 cm long, brown. Seeds 1-1.4 mm dia., brown.

Fl. & Fr.: June - September.

Rare; on moist rocky slopes. Mud-Larang La, 4200 m, 21.08.2002, K. Chandan Sekar 100665.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; Nepal and Pakistan.

Decoction of whole plant given in fever.

5. *Scrophularia* L.

About 200 species distributed from N. temperate to tropical America; 13 in India.

- | | |
|---|-----------------------------|
| 1a. Sepals rounded at tip, scarious-margined | 2 |
| b. Sepals acute at tip, not scarious-margined | 1. <i>S. calycina</i> |
| 2a. Corolla 3-4 mm long; capsules 3-4 mm long | 3. <i>S. scabiosaefolia</i> |
| b. Corolla 6-9 mm long; capsules 5-6 mm long | 2. <i>S. decomposita</i> |

1. *Scrophularia calycina* Benth., Scroph. Ind. 18. 1835; Hook.f., Fl. Brit. India 4: 253. 1884; Pennell, Scroph. W. Himal. 43. 1943; Aswal & Mehrotra, Fl. Lahaul Spiti 485. 1994. *Shoma Karpa Tsa Thal*

Annuals. Stems erect, 21-40 cm high, 4-angled, sparsely pubescent. Leaves ovate to ovate-lanceolate, 2.5-7.5 cm long, acute, coarsely toothed; petioles 0.5-2 cm long. Flowers crowded in leafless cymes. Sepals 3-4 mm long, acute at tip. Corolla 5-7 mm long, externally glandular-pubescent, green. Capsules ovoid, 4-6 mm long, acuminate. Seeds oblong, brown.

Fl. & Fr.: June - August.

Occasional: on moist slopes. Mud-Tharvik, 4000 m, 01.08.2002, K. Chandan Sekar 102807.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan.

Paste of whole plant is applied on cuts.

2. *Scrophularia decomposita* Royle ex Benth., Scroph. Ind. 18. 1835; Pennell, Scroph. W. Himal. 55. 1943. *S. lucida* L., Syst. Nat. ed. 10, 2: 1114. 1759; Hook.f., Fl. Brit. India 4: 256. 1884. *Khalshasha Mensa*

Perennial herbs; rootstock stout. Stems ascending, 23-45 cm high, sharply 4-angled, relatively few and little branched. Leaves 2-4.5 cm long, ovate to elliptic-lanceolate, coarsely toothed to pinnatifid, dark green. Cymes ascending, shortly peduncled in long contracted panicles. Bracts linear-lanceolate. Sepals rounded at tip, margin broadly scarious. Corolla 6-9 mm long. Capsules ovoid, 5-6 mm long. Seeds brown.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Near Tariya, 4200 m, 07.06.2002, K. Chandra Sekar 100628.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China and Pakistan.

Decoction of leaves is given to cure heart ailments.

3. ***Scrophularia scabiosaefolia*** Benth. in DC., Prodr. 10: 311. 1846; Hook.f., Fl. Brit. India 4: 256. 1884; Pennell, Scroph. W. Himal. 53. 1943; Aswal & Mehrotra, Fl. Lahaul-Spiti 447. 1994. **Photo. 121**

Perennial herbs; roots woody. Stems several from the base, 30-50 cm high, slender, branched, sharply quadrangular. Leaves petioled, lanceolate elliptic, 2-5 x 1-2 cm, acute at apex. Cymes ascending, 2-4-flowered; rachis, peduncles and pedicels glandular-puberulent. Sepals 1.5-2 mm long, green. Corolla 3-4 mm long, pink; the upper lobes longer, projecting; the lower 3 lobes recurved. Style 2-3 mm long. Capsules 3-4 mm long, shortly beaked. Seeds 0.8-1 mm long, dark brown.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Thango-Shritn, 3900 m, 11.07.2003, K. Chandra Sekar 101179.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Afghanistan and Pakistan.

6. ***Verbascum* L.**

About 360 species distributed in Eurasia, Ethiopia and E. Africa; 4 in India.

Verbascum thapsus L., Sp. Pl. 177. 1753; Hook.f., Fl. Brit. India 4: 250. 1883; Pennell, Scroph. W. Himal. 40. 1943; Aswal & Mehrotra, Fl. Lahaul-Spiti 488.1994. *Gymnar Menthaok* **Photo. 122**

Perennial herbs; rootstock woody. Stems erect, 35-60 cm high, densely clothed with soft yellowish-grey stellate-tomentum. Basal leaves petioled, oblanceolate, 10-20 cm long, entire, densely tomentose; cauline sessile or shortly petioled, oblanceolate to ovate-oblong, densely tomentose; upper ones sessile, smaller. Spike 15-25 cm long. Calyx 5-lobed; lobes imbricate. Corolla rotate, yellow. Capsules ovoid. Seeds numerous, rugose.

Fl. & Fr.: June - August.

Common; on rocky slopes. Boltar, 3850 m, 01.08.2002, K. Chandra Sekar 100551.

Distrib.: Widespread over the Northern Hemisphere.

Decoction of leaves is given to cure asthma and other pulmonary diseases.

7. *Veronica* L.

About 180 species distributed in N. temperate regions; 35 in India.

- | | |
|---|---------------------------------|
| 1a. Main stem terminating in inflorescence | 2 |
| b. Main stem never terminating in an inflorescence | 5 |
| 2a. Perennials | 4 |
| b. Annuals | 3 |
| 3a. Stems 20-30 cm high; capsules shorter than the calyx | 3. <i>V. bifida</i> |
| b. Stems 5-10 cm high; capsules almost equal to the calyx | 6. <i>V. minima</i> |
| 4a. Corolla 6-8 mm long | 4. <i>V. limosa</i> |
| b. Corolla up to 5 mm long | 5. <i>V. hircocarpa</i> |
| 5a. Leaves all petioled, oblong-ovate, rounded at apex | 2. <i>V. beccabunga</i> |
| b. Leaves at least the upper on the flowering stems sessile and clasping, lanceolate to nearly ovate, acute at apex | 6 |
| 6a. Pedicels strongly ascending, making the raceme less than 1 cm wide | 7 |
| b. Pedicels spreading, usually distally upcurved, making the raceme over 1 cm wide | 7. <i>V. sabina</i> |
| 7a. Rachis, pedicels, sepals and capsules glabrous | 1. <i>V. anagallis-aquatica</i> |
| b. Rachis, pedicels, sepals and capsules glandular pubescent | 8. <i>V. secunda</i> |

1. *Veronica anagallis-aquatica* L., Sp. Pl. 12. 1753; Hook.f., Fl. Brit. India 4: 293, 1884 (*anagallis*); Pennell, Scroph. W. Himal. 89. 1943; Aswal & Mehrotra, Fl. Lahaul-Spiti 490. 1994. **Photo. 123**

Perennials herbs. Stems creeping below; 15-40 cm high, glabrous, succulent. Leaves sessile, 2-4.5 x 0.7-1.3 cm, oblong-lanceolate, sub-amplexicaul at base, subobovate, subentire or crenate to serrulate at margin. Racemes axillary, 7-12 cm long, 5-7 mm dia., slender. Bracts linear-oblong, 1.5-2 mm long. Sepals 2-4.8 mm long, subacute, glabrous. Corolla 0.4-1 cm long, pale violet. Capsules broadly ovoid, 6-8 mm long. Seeds ovoid.

Fl. & Fr.: June - August.

Scarcely on swampy place. Gechang - Thango, 3850 m, 10.07.2003, K. Chandra Sekar 101172.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia, Africa, Europe and N. America.

2. *Veronica beccabunga* L., Sp. Pl. 12. 1753; Hook.f., Fl. Brit. India 4: 293. 1884; Pennell, Scroph. W. Himal. 88. 1943; Aswal & Mehrotra, Fl. Lahaul Spiti 490. 1994. *Pa. sbuk. ko Loma*

Annuals. Stems ascending-decumbent, 20-30 cm high, glabrous, succulent. Leaves elliptic-oblong to lanceolate-oblong, rounded at apex, obscurely crenate at margin. Racemes axillary, 5-10 cm long, 6-15-flowered. Sepals ovate-oblong, 3-5 mm long, subacute. Corolla 8-9 mm dia., blue or pink. Capsules broadly ovoid. Seeds ovoid-oblong, biconvex.

Fl. & Fr.: June - September.

Scarce; along the banks of streams. Tariya, 4000 m, 25.07.2003, K. Chandra Sekar 103680.

Distrib: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia, Europe and N. Africa to Japan.

Extract of whole plant applied externally as a relief to joint pain.

3. *Veronica biloba* L., Mant. Pl. 172. 1771; Hook.f., Fl. Brit. India 4: 294. 1884; Pennell, Scroph. W. Himal. 80. 1943; Aswal & Mehrotra, Fl. Lahaul-Spiti 491. 1994. *Sibichee, Sibupka*

Annuals. Stems ascending, 20-30 cm high, diffusely branched, glabrous. Leaves sessile or subsessile, lanceolate to oblanceolate-ovate, 0.6-2 cm long, obtuse, entire. Main stem terminating in an inflorescence, 5-15-flowered. Sepals ovate to elliptic-lanceolate, 3-6 mm long, connate at the base, acute. Corolla blue-violet, shorter than the sepals. Capsules globose, 2-3 mm dia., 2-4-seeded. Seeds oblong or boat-shaped, more or less deeply pitted.

Fl. & Fr: July - September.

Occasional; on moist slopes, Sagnam, 3650 m, 08.07.2003, K. Chandra Sekar 101163.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan and China westward to south-eastern Europe.

Paste of capsules given in giddiness.

4. *Veronica lanosa* Royle ex Benth., Scroph. Ind. 45. 1835; Pennell, Scroph. W. Himal. 74. 1943; Aswal & Mehrotra, Fl. Lahaul-Spiti 493. 1994. *V. deligens sensu* Hook.f., Fl. Brit. India 4: 292. 1884. *p.p., non* Wall., 1835. *Mendok Aarpan La* Photo. 124

Perennial herbs; rootstock woody. Stems many from the root, erect-ascending, 30-40 cm high. Leaves sessile, oblong-lanceolate, 2-3.6 x 0.8-1.4 cm, acute, crenate-serrate, sparsely pubescent. Main stem terminating in an inflorescence. Racemes 8-15 cm long, slender. Bracts foliaceous. Sepals linear-oblong, 6-9 mm long, subacute. Corolla 6-8 mm long, violet to bluish-violet. Capsules oblong-ovoid, obtuse.

Fl. & Fr: June - August.

Scarce; on moist slopes. Tariya, 4000 m, 20.07.2003, K. Chandra Sekar 103604.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China; Nepal and Pakistan.

Decoction of young inflorescence given to cure breathing trouble.

5. *Veronica lasiocarpa* Pennell, Scroph. W. Himal. 75. 1943; Aswal & Mehrotra, Fl. Lahaul-Spiti 493. 1994.

Perennial herbs. Stems slightly decumbent, simple, 10-20 cm high. Leaves sessile, ovate-obovate, 0.7-2 x 0.5-1 cm, rounded-obtuse, crenate to nearly entire, pilose. Racemes terminal. Bracts oblanceolate, 3-4.5 mm long, entire. Sepals oblong-elliptic, 3-4 mm long, obtuse; uppermost minute. Corolla 3-4.5 mm long, glabrous; the lobes widely orbicular, violet, un-streaked. Capsules obcordate-ovate, 3-4 mm long, hirsute-pubescent. Seeds ovoid, 5-6 mm long, yellow-brown.

Fl. & Fr.: July - September.

Rare; on moist slopes near streams. Near Tariya, 4100 m, 05.08.2002, *K. Chandra Sekar* 100611.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan.

6. *Veronica minima* (Nair) K. Chandra Sekar & S.K. Srivast. *stat. nov.* *Veronica biloba* L. var. *minima* Nair in Bull. Bot. Surv. India 5: 327, 1963.

Annuals; stems erect, 5-10 cm high, branched from the base, glabrous. Leaves opposite below, alternate above, sessile, oblanceolate, 3-6 x 1.5-2 mm, obtuse, entire. Flower axillary, solitary. Pedicel slender, 3-6 mm long. Sepals connate in pairs at base, ovate, 2-4 mm long, acute. Corolla rotate, shorter than the sepals, blue. Stamens 2, slightly exserted; anther-cells almost parallel. Ovary 2-celled, each with 4 ovules. Stigma subcapitate. Capsules didymous, lobes flattened, almost equal to the calyx; locules 2-4-seeded. Seeds oblong or boat-shaped, pitted, brown.

Fl. & Fr.: July - August.

Scarce; on moist slopes. Tariya, 4100 m, 21.07.03, *K. Chandra Sekar* 103617.

Distrib.: India: Himachal Pradesh (Lahaul-Spiti).

Note: It differs from *V. biloba* in having erect and less than 10 cm high stem and capsules almost equal to the calyx, so we have raised it to the specific level.

Paste of the whole plant taken to cure dysentery.

7. *Veronica salina* Schur, *Enum. Pl. Transsylv.* 492, 1866; Pennell, *Scroph. W. Himal.* 90, 1943; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 494, 1994. *Chamsu*

Annuals. Stems erect or decumbent, 15-40 cm high. Leaves ovate-lanceolate to elliptic-lanceolate, 2.5-4 cm long, acute, obscurely crenate-serrate; lower ones shortly petioled; upper ones sessile and stem-clasping, acute. Racemes axillary, 2-3 cm dia., 8-16-flowered; pedicels spreading, distally upcurved, glandular-pilose. Sepals 4-5 mm long, glandular-pilose. Corolla 6-8 mm long, bluish. Style 1-1.7 mm long. Capsules 3-3.5 mm long, glandular-pilose.

Fl. & Fr.: June - August.

Scarce; on stream banks. Guling, 3700 m, 26.08.2002, *K. Chandra Sekar* 100712.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir, Asia and Europe.

Whole plant extract taken for gastric problems.

8. *Veronica secunda* Pennell, *Scroph. W. Himal.* 89, 1943.

Annuals. Stems erect, 20-90 cm high. Leaves opposite, elliptic-oblong to oblong-lanceolate, 3-6 x 1.5-2.5 cm, acute, glandular-pubescent. Racemes from middle and upper axils, 10-20 cm long, densely glandular-pilose throughout, secund. Bracts linear-lanceolate, entire. Corolla ca 5 mm long, glabrous; the lobes ovate, acute at apex, lavender-coloured. Styles ca 2 mm long; stigma capitate. Capsules 3-3.5 mm long, slightly compressed. Seeds 0.4-0.5 mm long, smooth, brown.

Fl. & Fr.: July - August.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Pakistan.

Note: Pennell (*l.c.*) described this species on the basis of *W. Kooly* collection (NY) from the Buffer zone of Pin Valley National Park (Guling). It is included here based on Pennell (*l.c.*).

39. OROBANCHACEAE

About 15 genera and 210 species distributed in N. hemisphere, especially in temperate and subtropical Old World; 7 genera and ca 32 species in India.

Orobanche L.

About 150 species distributed in temperate and subtropical regions; 10 in India.

Orobanche alba Stephon *ex* Willd., Sp. Pl. 3: 350. 1800; Aswal & Mehrotra, Fl. Lahaul-Spiti 496, 1994. *O. epithymum* DC., Pl. Franc. 3: 490. 1805; Hook.f., Fl. Brit. India 4: 325. 1885.

Annual or biennial, 15-30 cm high, glandular-pubescent, slender, brown. Scales ovate-lanceolate, 1.5-2 cm long. Spikes 5-10 cm long. Bracts as long as the corolla-tube. Calyx 2-5 segmented; segments ovate-lanceolate. Corolla campanulate, 1.5-1.8 cm long, glandular-pubescent, red-brown; lobes unequal; upper lobe erect, sub-hooded to straight, short; lower sub-spreading and crenulate. Stamen inserted below on the corolla-tube; filaments glabrous, except the base; anthers sparsely pubescent to glabrous. Stigma-lobes contiguous, red-brown. Capsules ovoid, 0.6-1 cm long.

Fl. & Fr.: July - September.

Parahio catchment, Aug 93, Nima & Yashveer 216 (WII).

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia.

40. LAMIACEAE

Two hundred and fifty one genera and about 6700 species, cosmopolitan; 72 genera and ca 435 species in India.

- | | |
|---|-------------------------|
| 1a. Herbs | 2 |
| b. Shrubs | 10. Plectranthus |
| 2a. Anthers 2-celled; cells not diverging | 3 |
| b. Anthers 2 celled; cells at length diverging | 6 |
| 3a. Stamens didynamous | 4 |
| b. Stamens not didynamous | 6. Mentha |
| 4a. Anther-cells at length confluent | 3. Elsholtzia |
| b. Anthes-cells not confluent | 5 |
| 5a. Calyx 15-nerved | 4. Hyssopus |
| b. Calyx 10-13 nerved | 6 |
| 6a. Corolla distinctly 2-lipped | 1. Clinopodium |
| b. Corolla subequally 4-lobed or obscurely 2-lipped | 7 |
| 7a. Bracts forming an involucre | 8. Origanum |

- | | |
|-------------------------------------|--------------------------|
| 1a. Bracts not forming an involucre | 12. <i>Thymus</i> |
| 8a. Calyx 15-nerved | 9 |
| b. Calyx 5-10-nerved | 10 |
| 9a. Calyx 5-toothed | 7. <i>Nepeta</i> |
| b. Calyx 2-lipped | 2. <i>Dracoccephalum</i> |
| 10a. Anthers hairy | 5. <i>Lamium</i> |
| b. Anthers glabrous | 11 |
| 11a. Flowers pink | 11. <i>Stachys</i> |
| b. Flowers blue-purple | 9. <i>Phlomis</i> |

1. *Clinopodium* L.

About 20 species chiefly in temperate regions; 7 in India.

- | | |
|---|-----------------------|
| 1a. Whorls many-flowered, compact; corolla more than 10 mm long | 2. <i>C. vulgare</i> |
| b. Whorls few-flowered, loose; corolla less than 10 mm long | 1. <i>C. umbrosum</i> |

1. *Clinopodium umbrosum* (Bieb.) C. Koch in *Linnaea* 21: 673. 1848; Aswal & Mehrotra, Fl. Lahaul-Spiti 503. 1994. *Melissa umbrosa* Bieb., Fl. Tauro-Cauc. 2: 63. 1808. *Calamintha umbrosa* Fisch. & C.A. Mey., Ind. Sem. Hort. Petrop. 6: 6. 1840; Hook.f., Fl. Brit. India 4: 650. 1885; Mukh. in Rec. Bot. Surv. India 14(1): 98. 1940.

Annuals or biennials, proclumbent or decumbent, sparsely hairy. Leaves ovate, 1.5-3 cm long, rounded at base, acute or obtuse at apex, serrate at margins. Flowers in loose axillary whorls. Bracts as long as the calyx. Calyx 4-6 mm long; upper lip with 3 triangular teeth; lower with 2 very narrow teeth, slightly longer than the upper; tube sparsely hairy outside with long hairs. Corolla 6-8 mm long purple; tube shortly exerted. Nuts subglobose, small, smooth, pale brown.

Fl. & Fr.: July - September.

Scarce; on moist slopes. Tariya-Lacang La, 3800 m, 30.08.2002, K. Chandru Sekar 100773.

Distrib: India: Arunachal Pradesh, Assam, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia.

2. *Clinopodium vulgare* L., Sp. Pl. 587. 1753; Aswal & Mehrotra, Fl. Lahaul-Spiti 504. 1994. *Calamintha clinopodium* Benth. in DC., Prodr. 12: 233. 1848; Hook.f., Fl. Brit. India 4: 650. 1885; Mukh. in Rec. Bot. Surv. India 14(1): 98. 1940. *Mendak Marbau, Mukrin Mendak.*

Annuals or biennials; rootstock stoloniferous; branches erect, softly hairy. Leaves ovate, 2.5-3.5 cm long, rounded at the base, acute or obtuse at apex, slightly toothed at margins. Flowers axillary and terminal. Bracts filiform, forming an involucre. Calyx 6-8 mm long, hispid with glandular hairs; teeth slender and subulate, 3 in the upper lip and 2 in the lower; the lower calyx-teeth slightly longer than the upper. Corolla 1.5-2.3 cm long, hairy, purple. Nuts subglobose, smooth, pale brown.

Fl. & Fr.: July - September.

Scarce; on moist slopes. Tharbik, 3900 m, 02.08.2002, K. Chandru Sekar 102835.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia; America; Europe and N. Africa.

The fumes from smoked plant are inhaled to get relief from breathing trouble.

2. *Dracocephalum* L.

About 45 species distributed in Eurasia, Mediterranean region and N. America; 8 in India.

Dracocephalum heterophyllum Benth., *Tabiat. Gen. Spec.* 738. 1835-1836; Hook.f., *Fl. Brit. India* 4: 665. 1885; Mukh. in *Rec. Bot. Surv. India* 14(1): 136. 1940; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 505. 1994.

Small herbs, aromatic. Stems ascending, 15-25 cm high, glabrous. Leaves oblong-ovate, 2-6 cm long, subcordate at base, obtuse at apex, crenate or serrate at margin, glabrescent. Spikes large, dense-flowered. Bracts obovate, membranous, green; teeth long-awned. Calyx 1.5-2.5 cm long, membranous, distinctly 2-lipped; upper lip broad, larger than the lower lip, 3-toothed; teeth broadly ovate, aristate; lower lip 2-toothed, teeth lanceolate, acuminate. Corolla 2-3 cm long, densely hoary pubescent; tube slender, mouth inflated, lower lip short. Nutlets narrowly obovoid, 3-5 mm long, brown.

Fl. & Fr: July - September

Rare; on rocky slopes. Sanpat to Pin-Parvati Pass, 5319 m, 23.07.2003, K. Chandra Sekar 103638.

Distrib: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; Nepal; Pakistan and Turkestan.

3. *Elsholtzia* Willd.

About 35 species chiefly distributed in temperate Old World region; 12 in India.

- | | |
|--|--|
| 1a. Leaves oblong-lanceolate; corolla pink | 1. <i>E. densa</i> |
| b. Leaves ovate-oblong; corolla yellow | 2. <i>E. eriostachya</i> var. <i>pusilla</i> |

1. ***Elsholtzia densa*** Benth., *Tabiat. Gen. Spec.* 714. 1835; Hook.f., *Fl. Brit. India* 4: 645. 1885; Mukh. in *Rec. Bot. Surv. India* 14(1): 91. 1940; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 506. 1994. *Kalb Tsa*

Annuals. Stems 20-40 cm high, sparsely pubescent. Leaves shortly petioled, oblong-lanceolate, 3-8 cm long, cuneate at base, acute or obtuse at apex, serrate at margin, softly pubescent. Spikes 2-4 cm long, stout, cylindric, villous. Bracts orbicular, shorter than the flowers. Calyx campanulate or cupular, minute in flower, about 6 mm long in fruit, membranous, inflated; teeth rounded, short. Corolla minute, pink; tube very short, villous. Nutlets ellipsoid, 2-2.5 mm long.

Fl. & Fr: July - September.

Scarce; on moist slopes. Mud-Filling, 3800 m, 26.08.2002, K. Chandra Sekar 102960.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China and Pakistan.

2. ***Elsholtzia eriostachya*** (Benth.) Benth. var. ***pusilla*** (Benth.) Hook.f., *Fl. Brit. India* 5: 654. 1885; Mukh. in *Rec. Bot. Surv. India* 14(1): 91. 1940; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 507. 1994. *Elsholtzia pusilla* Benth., *Tabiat. Gen. Sp.* 714. 1835.

Annuals. Stems slender, 8-15 cm high. Leaves shortly petioled, ovate-oblong, 1-2 cm long, cuneate at base, obtuse at apex, denticulate along the margin, softly hairy. Spikes solitary at the end of the stem,

1.5-3 cm long. Bracts ovate, small; whorls confluent with imbricating flowers. Calyx campanulate; teeth triangular, minute. Corolla very minute, yellow. Nutlets ellipsoid, 1-2 mm long.

Fl. & Fr.: July - September.

Scarce; on moist slopes. Tariya, 4100 m, 21.07.2003, *K. Chandu Sekar* 103616.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; Nepal and Pakistan.

4. *Hyssopus* L.

Five species distributed from Mediterranean to C. Asia and S. Europe; 1 in India.

Hyssopus officinalis L., Sp. Pl. 569. 1753; Hook.f., Fl. Brit. India 4: 649. 1885; Mukh. in Rec. Bot. Surv. India 14(1): 94. 1940; Aswal & Mehrotra, Fl. Lahaul-Spiti 508. 1994. *Tangra* Photo. 125

Annuals or biennials, 20-40 cm high, with numerous branches from a woody stem. Branches diffuse. Leaves sessile, linear-oblong, 0.8-2.5 cm long, obtuse, entire. Spikes mostly terminal, many-flowered, secund. Calyx funnel-shaped, 5-6 mm long, puberulous outside, glabrous inside; teeth triangular, acute. Corolla bluish purple; upper lip erect, notched; lower spreading, 3 lobed. Stamens exserted. Nutlets narrow, smooth, dark brown.

Fl. & Fr.: July - September.

Common; on rocky slopes. Sagnam Thidim, 3650 m, 12.07.2002, *K. Chandu Sekar* 100436.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia and Europe.

Extract of young plants given to expel kidney stones.

5. *Lamium* L.

About 40 species distributed in Eurasia and N. Africa; 3 in India.

- | | |
|---------------------------------|---------------------------|
| 1a. Upper leaves amplexicaul | 1. <i>L. amplexicaule</i> |
| b. Upper leaves not amplexicaul | 2. <i>L. rhomboidatum</i> |

1. *Lamium amplexicaule* L., Sp. Pl. 579. 1753; Hook.f., Fl. Brit. India 4: 679. 1885; Mukh. in Rec. Bot. Surv. India 14(1): 161. 1940; Aswal & Mehrotra, Fl. Lahaul-Spiti 508. 1994.

Annuals, decumbent, slender, 20-30 cm high, branching from the base, glabrescent. Leaves amplexicaul, orbicular, 1-1.8 cm dia., inciso-crenate at margins; petioles 2-3 cm long, much shorter upwards. Flowers few; in distant axillary whorls. Calyx 4-5 mm long, villous; teeth slightly shorter than the tube, acuminate. Corolla 1.5-2 cm long, purple-red; tube very slender; lips short. Nutlets 1.5-2 mm long, brown with very prominent scaly marks all over.

Fl. & Fr.: June - August.

Scarce; on moist slopes. Farang La - Tariya, 4500 m, 06.08.2003, *K. Chandu Sekar* 103761.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia; Europe and N. Africa.

2. *Lamium rhomboidum* (Benth.) Benth., *Labiat. Gen. Spec.* 509. 1834; Hook.f., *Fl. Brit. India* 4: 678. 1885; Mukh. in *Rec. Bot. Surv. India* 14(1): 160. 1940; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 509. 1994. *Friantbera rhomboides* Benth. in Hook., *Bot. Misc.* 3: 380. 1833.

Annuals or biennials, densely softly velvety. Stems 20-30 cm high, densely tomentose. Leaves petioled, widely rhomboid, 2.5-8 cm dia., base abruptly decurrent on the very thick woolly petiole, deeply crenate. Flowers few, in axillary whorls. Bracts subulate, woolly. Calyx 1.5-2 cm long, densely woolly; teeth lanceolate, acuminate. Corolla 3-4 cm long, purplish; tube straight, glabrous within, galea broad, woolly. Nutlets obovoid, 4-5 mm long, brown.

Fl. & Fr.: June - August.

Rare; on rocky slopes, Larang La Tariya, 4800 m, 06.08.2003, K. Chandra Sekar 103760.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan; China; Nepal; Pakistan and Turkestan.

6. *Mentha* L.

About 25 species mainly distributed in temperate Old World; 6 in India.

Mentha longifolia (L.) Huds. 14. *Angl.* 221. 1762; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 509. 1994. *M. spicata* L. var. *longifolia* L., *Sp. Pl.* 576. 1753. *M. sylvestris* L., *Sp. Pl.* ed. 2, 804. 1763; Hook.f., *Fl. Brit. India* 4: 647. 1885; Mukh. in *Rec. Bot. Surv. India* 14(1): 87. 1940. *Taling, Kot*

Annuals or biennials, strongly aromatic. Stems diffuse, 20-30 cm high, hoary-tomentose. Leaves shortly petioled, lanceolate-ovate, 3-8 cm long, rounded-cordate at base, acute at apex, very sharply toothed at margins. Spikes terminal, 3-8 cm long. Bracts lanceolate. Flowers shortly pedicelled. Calyx campanulate, hairy; teeth lanceolate, acute. Corolla light pink; tube as long as the calyx, sparsely hairy outside. Stamens protruding; filaments glabrous. Nutlets pale brown, conspicuously delicately reticulated.

Fl. & Fr.: June - August.

Scarce; on moist slopes, Thangti, 4000 m, 27.08.2002, K. Chandra Sekar 102984.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia and Europe.

Whole plant used in preparing chutney.

7. *Nepeta* L.

About 250 species distributed in Eurasia, North Africa and tropical Africa; ca 35 in India.

- | | |
|---|-----------------------------|
| 1a. Flowers in continuous spikes or heads | 2 |
| b. Flowers in distinct clusters | 3. <i>N. flavosa</i> |
| 2a. Glabrous to pubescent herbs | 3 |
| b. Densely woolly herbs | 4. <i>N. longibracteata</i> |
| 3a. Leaves distinctly petioled; bracts linear-elliptic | 1. <i>N. discolor</i> |
| b. Leaves not distinctly petioled; bracts ovate to obovate-lanceolate | 2. <i>N. crinitachya</i> |

1. *Nepeta discolor* Royle ex Benth. in Hook., *Bot. Misc.* 3: 378. 1833; Hook.f., *Fl. Brit. India* 4: 659. 1885; Mukh. in *Rec. Bot. Surv. India* 14(1): 124. 1940; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 511. 1994. *Kot, Bahlu Tesa*

Annuals or biennials, ascending, 20-40 cm high; rootstock woody, elongated. Leaves distinctly petioled, 0.5-1.5 cm long, broadly ovate, cordate-rounded at base, subacute at apex, crenate along the margin; petioles 3-8 mm long. Spikes ovoid or cylindrical, very dense and interrupted, villous. Bracts linear-elliptic, 6-8 mm long, mucronate, ciliate. Calyx narrowly tubular, 6-8 mm long, villous; teeth filiform, as long as the tube. Corolla 0.8-1 cm long, pale blue; tube shortly exerted.

Fl. & Fr.: July - September.

Common; on moist slopes. Tariya, 4000 m, 09.08.2002, K. Chandra Sekar 100638.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan and Pakistan.

Paste of whole plant is given internally to cure asthma.

2. *Nepeta eriostachya* Benth., *Labiat. Gen. Sp.* 734, 1834; Hook.f., *Fl. Brit. India* 4: 657, 1885; Mukh. in *Rec. Bot. Surv. India* 14(1): 123, 1940; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 512, 1994. **Photo. 126**

Annual herbs, with subsimple ascending stems, 20-25 cm high, sparsely hairy. Leaves subsessile or sessile, 1-2 cm long, ovate, cordate at base, obtuse at apex, crenate, sparsely pubescent. Spikes cylindrical, 2-7 cm long, dense-flowered, villous. Bracts ovate to obovate-lanceolate, 5-7 mm long, ciliate. Calyx 6-7 mm long, membranous, villous; teeth slender, as long as the tube, softly ciliate. Corolla 1.2-1.5 cm long, bright blue. Stamens included; anther-cells divergent.

Fl. & Fr.: July - September.

Common; on moist slopes. Chhohem, 4300 m, 13.07.2003, K. Chandra Sekar 103288.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan.

3. *Nepeta floccosa* Benth., *Labiat. Gen. Sp.* 736, 1835; Hook.f., *Fl. Brit. India* 4: 662, 1885; Mukh. in *Rec. Bot. Surv. India* 14(1): 121, 1940; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 513, 1994. *Kat Mentak* **Photo. 127**

Annuals or biennials. Stems many, erect-ascending, 28-40 cm high, obtusely quadrangular, floccose with white wool. Leaves thick, long-petioled, orbicular-cordate, sinuate; lamina 3-8 cm dia.; petioles stout, 2-4 cm long. Panicle spreading, dense-flowered, woolly. Bracts linear. Calyx 6-8 mm long, villous; mouth oblique; teeth much shorter than the tube. Corolla 0.8-1.2 cm long, pink; tube slender; mouth wide; lips short. Nutlets linear-oblong, 2-2.5 mm long, smooth, black.

Fl. & Fr.: July - August.

Scarce; on rocky slopes. Sagnam-Thidim, 3700 m, 27.08.2002, K. Chandra Sekar 100730.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Afghanistan; China; E. Turkestan and Pakistan.

Extract of whole plant given in menstrual complaints.

4. *Nepeta longibracteata* Benth., *Labiat. Gen. Sp.* 737, 1835; Hook.f., *Fl. Brit. India* 4: 660, 1885; Mukh. in *Rec. Bot. Surv. India* 14(1): 124, 1940; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 515, 1994. **Photo. 128**

Annuals, aromatic. Stems ascending, 8-15 cm high, woolly pubescent. Leaves obovate, cuneate at base, crenate or lobulate, softly villous; lamina 0.5-1.2 cm dia.; petiole slightly shorter than the blade. Flowers crowded in subglobose heads. Bracts obovate, villous with long silky hairs. Calyx 7-8 mm long, silky; teeth subequal, filiform, nearly as long as the tube. Corolla 1.5-2 cm long, blue; tube funnel-shaped, much exserted; limb small. Stamens included. Nuts oblong, 0.8-1.1 mm long.

Fl. & Fr.: July - August.

Rare; on glacial moraines. Thango-kilung, 4300 m, 31.07.2003, K. Chandra Sekar 103709.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; China and Pakistan.

8. *Origanum* L.

Thirty six species distributed in Eurasia and Mediterranean; 1 in India.

***Origanum vulgare* L.**, Sp. Pl. 590. 1753; Hook.f., Fl. Brit. India 4: 648. 1885; Mukh. in Rec. Bot. Surv. India 14(1): 136. 1940; Aswal & Mehrotra, Fl. Lahaul-Spiti 517. 1994. *Nakar Menduk*

Biennials, stoloniferous. Stems 35-48 cm high, sparsely pubescent. Leaves broadly ovate, 1.5-2.5 cm long, obtuse, entire, sparsely hairy. Cymes corymbose, ovoid, 0.7-2.5 cm long. Bracts lanceolate-ovate, obtuse or acute. Flowers polygamous; larger ones bisexual; smaller ones pistillate. Calyx campanulate, enlarged in fruit; teeth short; throat hairy at mouth. Corolla pink; tube longer than the calyx; upper lip flat, notched; lower 3-lobed, spreading. Stamens in unequal pairs. Nutlets smooth, brown.

Fl. & Fr.: June - September.

Scarce; on moist slopes. Tariya-Larang La, 4000 m, 20.08.2002, K. Chandra Sekar 100660.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia; Europe and N. Africa.

9. *Phlomis* L.

About 100 species distributed from Mediterranean to C. Asia and China; 11 in India.

***Phlomis bracteosa* Royle ex Benth.** in Hook., Bot. Misc. 3: 383. 1833; Hook.f., Fl. Brit. India 4: 693. 1885; Mukh. in Rec. Bot. Surv. India 14(1): 197. 1940; Aswal & Mehrotra, Fl. Lahaul-Spiti 517. 1994. *Sboma mentok*

Annuals or biennials. Stems 40-55 cm high, 4-angled, pubescent. Leaves petioled, ovate, broadly cordate at base, obtuse at apex, crenate, tomentose with straight or often mixed with stellate hairs; lamina 5-10 cm long. Whorls many-flowered, 2-3 cm dia. Bracts linear-lanceolate, 1-1.1 cm long, membranous, ciliate. Calyx 1-1.2 cm long; teeth 3-4 mm long, slender and ciliate. Corolla blue purple; galea fringed with white hairs. Nutlets obovoid, 2-3 mm long, rounded at apex.

Fl. & Fr.: June - August.

Occasional; on moist slopes. Sanpar, 4350, 04.08.2002, K. Chandra Sekar 102860.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan.

Filtered extract of whole plant applied as eye drops.

10. *Plectranthus* L'Herit.

About 200 species mainly distributed in tropical and subtropical regions of the Old World; ca 30 in India.

Plectranthus rugosus Wall. ex Benth. in Wall., Pl. Asiat. Rar. 2: 17. 1830-31; Hook.f., Fl. Brit. India 4: 620. 1885; Mukh. in Rec. Bot. Surv. India 14(1): 47. 1940; Aswal & Mehrotra, Fl. Lahaul-Spiti 518. 1994.

Shrubs. Stems erect, 0.7-1 m high. Leaves short petioled, ovate-elliptic, 1.5-3.5 cm long, obtuse, crenate, slightly thick or leathery, densely white-tomentose beneath. Cymes axillary, lax-flowered. Calyx tubular-campanulate, 3-4 mm long, subequally 5-toothed; teeth subequal, acute-obtuse. Corolla 3-4 mm long, purple; tube very short, abruptly decurved; lips large; lower longer. Nutlets oblong.

Fl. & Fr.: July - September.

Rare; on slopes, near cultivated land. Mane-Jansa Pass, 3650 m, 29.08.2002, K. Chandra Sekar 100762.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan and Pakistan.

11. *Stachys* L.

About 300 species chiefly distributed in temperate and subtropical regions, except Australia; ca 10 in India.

Stachys sericea Wall. ex Benth. in Wall., Pl. Asiat. Rar. 1: 64. 1830; Hook.f., Fl. Brit. India 4: 675. 1885; Mukh. in Rec. Bot. Surv. India 14(1): 188. 1940. *S. bikanerii* Aswal & Mehrotra in J. Econ. Taxon. Bot. 4(3): 1028. 1983 & Fl. Lahaul-Spiti 521.1994 *Pukin karpō Mendok*

Annuals or biennials. Stems erect, 40-55 cm high, 4-angled, densely villous with long hairs. Leaves shortly petioled, ovate, 4-6 cm long, acute, crenate, sparsely hirsute with soft hairs. Flowers in axillary whorls; whorls many-flowered. Bracts 6-7 mm long. Calyx 7-8 mm long, villous; teeth triangular, much shorter than the tube, spinescent; spines coloured. Corolla pink; tube scarcely exerted. Nutlets oblong, 1-2 mm long, brown.

Fl. & Fr.: June - September.

Occasional; on moist slopes. Mud-Tharik, 4000 m, 01.08.2002, K. Chandra Sekar 102816.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia.

12. *Thymus* L.

About 350 species distributed in temperate Eurasia; 2 in India.

Thymus linearis Benth. in Wall., Pl. Asiat. Rar. 1: 31. 1830; Aswal & Mehrotra, Fl. Lahaul-Spiti 521. 1994. *T. serpyllium* L., Sp. Pl. 590. 1753; Benth. in DC., Prodr. 12: 200. 1848; Hook.f., Fl. Brit. India 4: 649. 1885; Mukh. in Rec. Bot. Surv. India 14(1): 95. 1940. *Padupa Mendok*, *Pagtooma*, *Mendok Rego*, *Pindum* Photo. 129

Perennial aromatic herbs; rootstock woody. Stems prostrate, 20-25 cm long, much branched. Leaves sessile, 0.6-1.6 cm, oblong-ovate or lanceolate, truncate at base, obtuse at apex, entire,

conspicuously gland dotted. Flowers polygamous, in compact, capitate spikes; male flowers larger. Calyx hairy outside and at the mouth inside; upper lip 3-toothed; lower 2-toothed; teeth linear, ciliate. Corolla purple; tube as long as the calyx. Stamens subequal; filaments exserted. Nudules smooth.

Fl. & Fr.: July - September.

Common; on moist rocky slopes. Sanpat, 4350 m, 04.08.2002, K. Chandra Sekar 102855.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia; Europe and N. Africa.

Paste of young plants given to improve memory of children.

41. PLANTAGINACEAE

Three genera and about 275 species, cosmopolitan; 1 genus with 12 species in India.

Plantago L.

About 270 species, cosmopolitan; 16 in India.

- | | |
|--|-------------------------|
| 1a. Ovary 2-ovuled | 3. <i>P. lanceolata</i> |
| b. Ovary 3 to many-ovuled | 2 |
| 2a. Ovary with 6-20 ovules | 3 |
| b. Ovary with 3-5 ovules | 1. <i>P. depressa</i> |
| 3a. Calyx short stipitate; capsules globose; seeds up to 6 | 2. <i>P. himalaica</i> |
| b. Calyx not stipitate; capsules ovoid or depressed; seeds 6-20. | 4. <i>P. major</i> |

1. *Plantago depressa* Willd., Enum. Pl. Hort. Berol. Suppl. 8. 1813; Aswal & Mehrotra, Fl. Lahaul-Spiti 505. 1994. *P. tibetica* Hook.f. & Thomson in Hook.f., Fl. Brit. India 4: 706. 1885. **Photo. 130**

Annuals. Stemless. Leaves in rosettes, elliptic to elliptic-lanceolate to ovate, 5-10 cm long, sparsely irregularly denticulate at margin. Scapes 6-15 cm long, arched. Spikes dense above, lax below. Bracts triangular-ovate, concave, shorter than calyx. Sepals obovate-elliptic, 1-2 mm long. Corolla tube equal to the calyx; lobes elliptic to ovate, 0.5-0.7 mm long. Capsules nearly twice as long as the calyx, conically attenuated. Seeds 3-5, 1.2-1.5 mm long, compressed, purple-brown.

Fl. & Fr.: June - September.

Scarce; on moist slopes near streams. Thango-Shrim, 3900 m, 11.07.2003, K. Chandra Sekar 101181 a.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia; Europe and N. America.

2. *Plantago himalaica* Pilger in Engl., Pflanzen. IV, 269 (heft 102). 62. 1937; Aswal & Mehrotra, Fl. Lahaul-Spiti 524. 1994. *P. brachyphylla* Fildgew. ex Decne. in DC., Prodr. 13: 696. 1852, *non* Roem. & Schult., 1818; Hook.f., Fl. Brit. India 4: 706. 1885, *p.p.*

Perennial herbs. Stemless. Leaves in rosettes, very variable in shape, usually 2-6 cm long, ovate to broadly ovate, 1.5-2.5 cm long, membranous. Scapes 2-3, 10-17 cm long, erect. Spikes narrow, cylindrical,

2-5 cm long. Bracts ovate, 2-3 mm long, obtuse. Calyx shortly stipitate; sepals elliptic to nearly orbicular, 2-2.5 cm long. Corolla tube slightly exceeding the calyx; lobes lanceolate-ovate, 1-1.5 mm long, obtuse. Capsules short, globose. Seeds up to 6.

Fl. & Fr.: June - September.

Scarce; on moist slopes near streams. Thangu-Shria, 3900 m, 11.07.2003, K. Chandra Sekar 101181 b.

Distrib.: India: N. India; China; Nepal and Pakistan.

3. *Plantago lanceolata* L., Sp. Pl. 113. 1753; Hook.f., Fl. Brit. India 4: 706. 1885; Aswal & Mehrotra, Fl. Lahaul-Spiti 525. 1994. *Buten Amjok*

Perennial herbs. Stemless. Leaves lanceolate-elliptic, 10-25 x 1-3 cm, acute, membranous. Scapes erect, 15-30 cm high, sulcate, sparsely covered with white hairs. Spikes dense, conic-cylindrical or subglobose to globose, 1-3 cm long. Bracts broadly ovate, 4-5 cm long, narrowly caudate, crose-undulate at margin. Sepals 3-3.5 mm long; anterior sepals connate, obovate, bilobed. Corolla lobes ovate. Seeds 2, smooth.

Fl. & Fr.: June - August.

Occasional; on moist slopes. Gechang, 3730 m, 16.07.2002, K. Chandra Sekar 100467.

Distrib.: India: N. India; Asia; Europe; North Africa and introduced all over the world.

Seeds are prescribed as a remedy for constipation.

4. *Plantago major* L., Sp. Pl. 112. 1753; Hook.f., Fl. Brit. India 4: 705. 1885; Aswal & Mehrotra, Fl. Lahaul-Spiti 525. 1994.

Perennial herbs. Stemless. Leaves in rosettes, ovate elliptic, 10-20 x 3-6.5 cm, rounded at apex, entire. Scapes many, erect, 13-15 cm high. Spikes slender 5-12 cm long. Bracts ovate-oblong, acute. Calyx 2.5-3 mm long, glabrous; sepals broadly elliptic to oblong, obtuse. Corolla 2-4 mm long, light yellow-green; lobes elliptic-ovate to narrowly triangular, 1-1.2 mm long, obtuse. Capsules globose, 2-3 mm long, glabrous. Seeds 6-10, 1-1.5 mm long, rugulose, black.

Fl. & Fr.: June - September.

Scarce; in moist places near streams. Thangu, 3950 m, 11.07.2002, K. Chandra Sekar 100422.

Distrib.: Throughout India; Asia; Europe and introduced all over the world.

42. AMARANTHACEAE

About 70 genera and ca 750 species distributed in tropical and warm regions; 20 genera and 60 species in India.

- | | |
|--|-----------------------|
| 1a. Leaves alternate | 2. <i>Amaranthus</i> |
| b. Leaves opposite or clustered | 2 |
| 2a. Leaves woolly tomentose beneath | 3. <i>Cyathula</i> |
| b. Leaves glabrous or sparsely pubescent beneath | 1. <i>Achyranthes</i> |

1. *Achyranthes* L.

Six to eight species distributed in Old World tropics and subtropics; ca 4 in India.

Achyranthes aspera L., Sp. Pl. 204. 1753; Hook.f., Fl. Brit. India 4: 730. 1885; Chandra Sekar & al. in Indian J. Forest. 26(2): 98. 2003. Chbir

Perennial herbs. Stems erect to subscandent, simple to much-branched, distinctly to obscurely 4-angled. Leaves opposite, obovate-ovate, 3-8 x 1.2-4 cm, acute, entire; petioles 1-1.8 cm long. Spikes slender, 20-35 cm long, appressed hairy. Bracts and bracteoles ovate, spinescent. Flowers deflexed. Perianth lobes 5, scarious; lobes lanceolate, acute. Stamens 5, alternate with 5 staminodes; staminodes fimbriate. Utricles oblong, 1-seeded.

Fl. & Fr.: June - September.

Rare; on rocky slopes. Mud-Bhaba Pass, 3800 m, 29.08.2002, K. Chandra Sekar 100782.

Distrib.: Throughout India; Asia; Africa; America and Australia.

Roots are chewed to be relieved from toothache.

2. *Amaranthus* L.

About 60 species distributed in temperate and tropical regions; ca 20 in India.

- | | |
|---------------------|-----------------------|
| 1a. Plants armed | 2. <i>A. spinosus</i> |
| b. Plants not armed | 1. <i>A. cruentus</i> |

1. *Amaranthus cruentus* L., Syst. Nat. ed. 10, 2: 1269. 1759. Aswal & Mehrotra, Fl. Lahaul-Spiti 527. 1994. *A. paniculatus* L., Sp. Pl. ed. 2, 1406. 1763; Hook.f., Fl. Brit. India 4: 718. 1885.

Annuals. Stems erect-ascending, 40-59 cm high, glabrous, pale-green; branched in upper part. Leaves ovate-lanceolate to rhomboid, 6-10 x 4-6 cm, acuminate, subentire, glabrous; petioles 2.5-4 cm long. Inflorescence a paniculate spikes, terminal and axillary, 8-12 cm long. Bracts ovate, acuminate. Tepals 5, lanceolate, 1.5-3.5 mm, acute. Capsules subglobose to ovoid. Seeds 0.7-1 mm, compressed, shining, black.

Fl. & Fr.: June - September.

Rare; along the irrigation channel. Sagnam, 3675 m, 27.08.2002, K. Chandra Sekar 100725.

Distrib.: Throughout India; cultivated or found as an escape in Asia and Africa.

2. *Amaranthus spinosus* L., Sp. Pl. 991. 1753; Hook.f., Fl. Brit. India 4: 718. 1885; Chandra Sekar & al. in Ann. For. 11(1): 56. 2003. Lansho

Annuals. Stems erect-ascending, 30-60 cm high, stout. Leaves lanceolate-oblong, 2.5-6 x 1.5-4.2 cm, rense, glabrous; petioles 0.5-4.5 cm long; each leaf-axil bearing a pair of fine, spines up to 2 cm long. Flowers polygamous, in axillary and terminal spicate clusters; female flowers in the lower part and male flowers in the upper part. Bracts ovate. Tepals 5, spatulate-oblong, mucronulate, pale green. Seeds 0.7-1 mm long, compressed, shining, black.

Fl. & Fr.: June - September.

Rare; on moist slopes. Manc-Larsa pass, 3700 m, 30.08.2002, K. Chandra Sekar 100788.

Distrib: Throughout India; Asia; Africa; America and Europe.

Seeds are prescribed with lukewarm water to generate body heat during winter.

3. *Cyathula* Blume

About 25 species distributed in tropical regions; 4 in India.

Cyathula tomentosa Moq. in DC., Prodr. 13(2): 327. 1849; Hook.f., Fl. Brit. India 4: 722. 1885.

Perennial herbs. Stems woody at base, erect suberect, 50-80 cm high. Leaves shortly petioled, ovate-lanceolate, 8-12 x 4-8 cm, acute-acuminate, entire, densely hairy above, woolly tomentose beneath. Flowers in compact, globose heads, arranged in terminal 15-30 cm long spikes. Bracts ovate. Tepals linear-lanceolate with hooked spines in imperfect flowers; tepals of perfect flowers scarious, alternate with 5-fringed lobes or staminodes. Utricle 2-nerved, enclosed by perianth lobes. Seeds ovoid.

Fl. & Fr: July - September.

Cultivated. Manc, 3600 m, 29.08.2002, K. Chandra Sekar 100759.

Distrib: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Meghalaya, Punjab, Sikkim, Uttar Pradesh and Uttarakhand; Asia.

43. CHENOPODIACEAE

About 103 genera and ca 1300 species, cosmopolitan especially in drier areas; 24 genera and 71 species in India.

- | | |
|---|-----------------------------|
| 1a. Flowers bisexual | 2 |
| b. Flowers unisexual | 3 |
| 2a. Leaves ending in pungent tips | 4. <i>Salsola</i> |
| b. Leaves not ending in pungent tips | 2. <i>Chenopodium</i> |
| 3a. Fruiting bracts with long silky hairs | 3. <i>Krascheninnikovia</i> |
| b. Fruiting bracts without hairs | 1. <i>Atriplex</i> |

1. *Atriplex* L.

About 300 species distributed in temperate and subtropical regions; 7 in India.

Atriplex crassifolia C.A. Mey. in Ledeb., Ic. Pl. Fl. Ross. 1: 11. t. 42. 1829; Hook.f., Fl. Brit. India 5: 6. 1886. *A. laciniata* Aitch., Cat. Punjab Pl. 125. 1869, *non* L., 1753.

Annuals, monoecious. Stems erect-ascending, 25-40 cm high, branched from the base, slender, glaucous. Leaves shortly petioled; upper leaves linear-lanceolate, acute, entire; lower ones fleshy, hastate-triangular to oblong-lanceolate, cuneate, sinuate-dentate. Flowers in small, interrupted, leafless glomerules forming paniculate spikes. Male flowers charrate; sepals 3-5, oblong, obtuse at apex. Female flowers 2-bracteate; bracts flat, accrescent, rhombic ovate, 4-8 mm long, dilated in fruit and forming a 2-valved covering to the utricle. Utricle farinose, membranous. Seeds black brown.

Fl. & Fr: June - September.

Scarce; on rocky slopes. Guling, 5700 m, 26.08.2002, K. Chandra Sekar 100720.

Distrib: India: Himachal Pradesh, Jammu & Kashmir, Haryana, Punjab and Uttar Pradesh; Asia.

2. *Chenopodium* L.

About 100 species mainly in the temperate regions; 10 in India.

- | | |
|--|--------------------------|
| 1a. Plants aromatic | 2. <i>C. botrys</i> |
| b. Plants not aromatic | 2 |
| 2a. Tepals 5, herbaceous | 3 |
| b. Tepals 1-3, succulent | 3. <i>C. foliosum</i> |
| 3a. Seeds punctulate with rounded margin | 4. <i>C. spulchrosum</i> |
| b. Seeds keeled | 1. <i>C. album</i> |

1. *Chenopodium album* L., Sp. Pl. 219. 1753; Hook.f., Fl. Brit. India 5: 3. 1886; Aswal & Mehrotra, Fl. Lahaul-Spiti 531. 1994.

Annuals. Stems erect or ascending, 20-45 cm high, angular ribbed, often red-streaked. Leaves shortly petioled, ovate-rhomboid, 8-10 x 3.5-4.8 cm, cuncate, acute-obtuse, coarsely dentate-serrate to incised. Flowers bisexual, in paniculate clusters, crowded in axillary or terminal spikes. Tepals 5, orbicular-ovate, connate at base, herbaceous. Stamens 5, opposite to tepals. Seeds small, smooth, keeled.

Fl. & Fr: June - September.

Occasional; on moist irrigation channels. Kaa, 3675 m, 13.07.2002, K. Chandra Sekar 100444.

Distrib: Almost throughout India; cosmopolitan.

Used as vegetable.

2. *Chenopodium botrys* L., Sp. Pl. 219. 1753; Hook.f., Fl. Brit. India 5: 4. 1886; Aswal & Mehrotra, Fl. Lahaul-Spiti 532. 1994. *Shukpa Tra*

Annuals, aromatic. Stems erect-ascending, 25-45 cm high, grooved or ribbed, pale-green. Leaves oblong-lanceolate, 2.5-6 x 0.5-3 cm; lower ones petioled, pinnately lobed, glandular-pubescent; periles 1-3 cm long; upper ones sessile, nearly entire, obtuse. Flowers crowded in short, axillary panicles. Tepals 5, orbicular-ovate, obtuse, glandular-pubescent, pale-green. Stamens 5, opposite to tepals. Seeds subglobose, smooth.

Fl. & Fr: July - September.

Scarce; by the side of irrigation channel. Guling, 3700 m, 26.08.2002, K. Chandra Sekar 100711.

Distrib: India: Himachal Pradesh, Jammu & Kashmir, Sikkim, Uttarakhand and Uttar Pradesh; Asia; Europe; N. Africa and introduced into America.

3. *Chenopodium foliosum* (Moench) Asch., Prodr. Fl. Brandenb. 1: 572. 1864; Aswal & Mehrotra, Fl. Lahaul-Spiti 532. 1994. *Monocarpus foliosum* Moench, Methodus 342. 1794. *Chenopodium hirtum* Hook.f., Fl. Brit. India 5: 5. 1886. Yer Photo. 131

Annuals. Stems ascending, 30-45 cm high, glabrous. Leaves petioled, triangular hastate or deltoid, 2-6 cm long, cordate, acuminate, unequally toothed; petioles 2-3.5 cm long. Flowers conspicuous, scarlet-red, fleshy, arranged on sessile clusters forming terminal or axillary leafy spikes. Tepals 1-3, not enclosing the fruit, succulent, scarlet-red. Seeds subglobose with obtuse margins.

Fl. & Fr.: July - September.

Scarce; on moist slopes near streams. Nur Pasture, 4050 m, 21.07.2002, K. Chandra Sekar 100499.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia; Europe and N. Africa.

Juice of fruits is given to cure stomach pain.

4. *Chenopodium opulifolium* Schrad. ex Koch & Ziz., Cat. Pl. Palat. 6. 1814; Hook.f., Fl. Brit. India 5: 3. 1886. *C. album* var. *opulifolium* (Schrad. ex Koch & Ziz.) Aswal in Aswal & Mehrotra, Fl. Lahaul-Spiti 531. 1994.

Annuals. Stems erect or ascending, 35-45 cm high, angular-ribbed, often red-streaked. Leaves shortly petioled, ovate-rhomboid, 8-10.5 x 3.5-4.5 cm, cuneate, obtuse, sinuate. Flowers bisexual, in paniculate clusters, crowded in axillary or terminal spikes. Tepals 5, orbicular-ovate, connate at base, herbaceous. Stamens 5, opposite to tepals. Seeds small, punctulate with rounded margin.

Fl. & Fr.: June - September.

Scarce; on moist slopes. Mud-Tilling, 3800 m, 26.08.2002, K. Chandra Sekar 102949.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia and Europe.

3. *Krascheninnikovia* Gueldenst.

Eight species distributed in Mediterranean region; 1 in India.

Krascheninnikovia ceratoides (L.) Gueldenst. in Nov. Comm. Acad. Sci. Petrop. 16: 555. 1772. *Acyris ceratoides* L., Sp. Pl. 979. 1753. *Entrobia ceratoides* (L.) C.A. Mey. in Ledeb., Fl. Altaica 4: 239. 1833; Aswal & Mehrotra, Fl. Lahaul-Spiti 534. 1994. *Sheng*

Perennial herbs. Stems erect, 34-52 cm high, stellate hairy. Leaves shortly petioled, linear lanceolate, 1-2.3 x 0.3-0.7 cm, obtuse, margin often recurved; upper ones sessile. Flowers minute, unisexual. Male flowers spicate, ebracteate; stamens 4; filaments filiform. Female flowers axillary, 2-bracteate. Fruiting-bracts crowded along the upper parts of the branches, conspicuous for their long silky white hairs; hairs 4-7 mm long.

Fl. & Fr.: July - September.

Common; on rocky slopes. Ratarang bed, 3700 m, 11.07.2002, K. Chandra Sekar 100412.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia; Europe from Spain eastward and N.W. America.

4. *Salsola* L.

About 150 species, cosmopolitan; 4 in India.

Salsola collina Pall., Ill. Pl. 34, t. 26. 1803; Hook.f., Fl. Brit. India 5: 17. 1886; Singh & al., in Ann. For. 11(1): 61. 2003.

Annuals, annual, prostrate in habit. Stems decumbent, 9-16 cm long, glabrous. Leaves sessile, broadly subulate-linear, 1.2-2.1 x 0.1-0.25 cm, sub-amplexicaul, rigid, flaccid, ending in pungent tips. Flowers 1-3, axillary. Tepals lanceolate, unequal, membranous. Utricle ovoid, membranous. Seeds horizontal, testa membranous; embryo spiral.

Fl. & Fr.: July - September.

Scarce; on moist slopes near streams, Mane, 3700 m, 27.08.2002, K. Chandra Sekar 100736.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; China; Pakistan; Siberia and U.S.S.R.

44. POLYGONACEAE

About 46 genera and ca 1100 species, cosmopolitan especially in temperate regions; 18 genera and ca 164 species in India.

- | | |
|---|----------------------|
| 1a. Flowers unisexual | 9. Rumex |
| b. Flowers bisexual | 2 |
| 2a. Perianth 4-6-cleft; stigma limbiate, peltate or horse-shoe-shaped | 3 |
| b. Perianth 3-5-cleft; stigma capitate | 4 |
| 3a. Nuts 3-winged | 8. Rheum |
| b. Nuts 2-winged | 5. Oxyria |
| 4a. Nuts twice as long as tepals or more; cotyledons convolute | 3. Fagopyrum |
| b. Nuts as long as or much shorter than the tepals; cotyledons flat | 5 |
| 5a. Stipules 2-partite; stamens 2-4 | 4. Koenigia |
| b. Stipules not 2-partite; stamens 5-8 | 6 |
| 6a. Flowers few (1-5) in the axil of leaves | 7. Polygonum |
| b. Flowers in spurious heads, spikes or panicles | 7 |
| 7a. Bracts ovate lanceolate | 8 |
| b. Bracts tubular | 6. Persicaria |
| 8a. Flowers in spiciform racemes | 2. Bistorta |
| b. Flowers in panicles | 1. Aconogonum |

1. *Aconogonum* Reichb.

About 15 species mainly in Asia, Japan and N. America; ca 10 in India.

- | | |
|---------------------|---------------------------|
| 1a. Leaves petioled | 1. <i>A. rumicifolium</i> |
| b. Leaves sessile | 2. <i>A. tortuosum</i> |

1. *Aconogonum rumicifolium* (Royle ex Bab.) H. Hara in Fl. E. Himal. 632. 1966 (in Adnot.), *Polygonum rumicifolium* Royle ex Bab. in Trans. Linn. Soc. London 18: 112. 1838; Aswal & Mehta, *Fl. Lahaul-Spiti* 550. 1994.

Perennial herbs. Stems 40-60 cm high, gregarious. Leaves petioled, broadly ovate or ovate-cordate, subacute, margin even or undulate and bristly, sparsely pubescent on both surfaces. Stipules large, lax, glabrous. Flowers in axillary and terminal panicles. Bracts ovate-lanceolate. Perianth 1.5-3 mm dia., 3-5-cleft, greenish-white. Nuts broadly ovate, acute, about as long as the tepals.

Fl. & Fr.: July - August.

Scarcely on moist slopes. Mud-Larang La, 3906 m, 18.08.2002, *K. Chandra Sekar* 102886.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; Nepal and Pakistan.

2. *Aconogonum tortuosum* (D. Don) H. Hara in Fl. F. Himal. 632. 1966 (in Adnot.). *Polygonum fortunei* D. Don, Prodr. Fl. Nepal. 71. 1825; Hook.f., Fl. Brit. India 5: 52. 1886; Aswal & Mehrotra, Fl. Lahaul Spit 551. 1994. *Ahaha*, *Agel Davaj* **Photo. 132**

Biennial or perennial herbs; roots woody. Stems with divaricate branches, glabrous, red-brown. Leaves sessile, elliptic-obovate, 2-4.5 cm long, obtuse or acute, coriaceous. Stipules short, truncate. Flowers in short, terminal, dense panicle. Perianth 2.5-4 mm long, white; lobes erect, oblong. Stamens 8. Nuts ovoid, trigonous, pale, included in the campanulate perianth.

Fl. & Fr.: June - August.

Common; on rocky slopes. Chhohem, 4150 m, 13.07.2003, *K. Chandra Sekar* 103235.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China, Nepal and Pakistan.

Decoction of young peduncle is given with curd to cure dysentery.

2. *Bistorta* (L.) Adans.

About 50 species mainly in temperate regions of Eurasia and N. America; ca 10 in India.

- | | |
|------------------------------------|---------------------------|
| 1a. Rootstock branched | 2 |
| b. Rootstock not branched | 3. <i>B. vivipara</i> |
| 2a. Stipules less than 1.3 mm long | 2. <i>B. varcinifolia</i> |
| b. Stipules more than 1.3 mm long | 1. <i>B. affinis</i> |

1. *Bistorta affinis* (D. Don) Greene, Leaflets Bot. Oha. 1: 21. 1904; H. Hara in Ohaahi, Fl. East. Himal. 3: 29. 1975. *Polygonum affine* D. Don, Prodr. Fl. Nepal. 70. 1825; Hook.f., Fl. Brit. India 5: 33. 1886; Aswal & Mehrotra, Fl. Lahaul-Spiti 541. 1994. *Caadook* **Photo. 133**

Perennial herbs; rootstock woody, branched. Stems erect, 15-30 cm high, glabrous. Leaves mostly radical, linear-lanceolate or oblanceolate, 4-8 x 1-2.5 cm, acute or obtuse, glabrous, margin crenulate and recurved; cauline ones few, sessile or subsessile. Stipules 1.5-2.5 cm long, entire or split in the upper half, reddish. Racemes 5-7 x 0.7-1.2 cm, many-flowered; peduncle 5-9 cm long, glabrous. Perianth elliptic-oblong 2-3 mm dia., rose-pink. Nut 3-gonous.

Fl. & Fr.: June - September.

Common; on moist slopes, Chhohem, 4100 m, 13.07.2003, K. Chandu Sekar 103239.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; Nepal and Pakistan.

Decoction of young inflorescence given to cure giddiness.

2. *Bistorta vacciniifolia* (Wall. ex Meisn.) Greene, Leaflets Bot. Obs. 1: 21. 1904; H. Hara Fl. L. Himal. 69. 1966; H.J. Chowdhery & Wadhwa, Pl. Himach. Prad. 2: 609. 1984. *Polygonum vacciniifolium* Wall. ex Meisn. in Wall, Pl. Asiat. Rar. 3: 54. 1832; Hook.f., Fl. Brit. India 5: 31. 1886; Aswal & Mehrotra, Fl. Lahaul-Spiti 552. 1994. *Langang Mentok*

Perennial herbs; rootstock thick woody, branched. Stems tufted, trailing or creeping, glabrous. Leaves shortly petioled or sessile, elliptic, tapering at ends, entire, glabrous. Stipules 0.6-1.1 mm, membranous, lacinate with prominent nerves. Racemes terminal, spike-like, 3-10 cm long. Bracts acuminate. Perianth elliptic-oblong, 4-5 mm dia., pink; 5-segmented. Nut trigonous.

Fl. & Fr.: June - September.

Rare; on moist slopes. Lanjuk, 3900 m, 02.08.2002, K. Chandu Sekar 100563.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Bhutan; China; Nepal and Pakistan.

Juice of whole plant given to cure dysentery.

3. *Bistorta vivipara* (L.) S.F. Gray, Nat. Arr. Brit. Pl. 2: 268. 1821; H. Hara, Fl. East Himal. 2: 22. 1971. *Polygonum viviparum* L., Sp. Pl. 360. 1753; Aswal & Mehrotra, Fl. Lahaul-Spiti 552. 1994. *Mendok chuli Anbo Photo. 134*

Perennial herbs; rootstock woody, unbranched. Stems erect, 16-30 cm high, simple. Radical leaves long-petioled, oblong-lanceolate, 3-10 cm long; cuneate at base, revolute at margin, prominently reticulate-veined; upper cauline ones sessile, narrowly lanceolate, acute. Spikes erect, 8-10 x 1.1-1.5 cm, the lower flowers transformed into bulbils. Bracts ovate, acuminate. Perianth 5-segmented to base, 3-3.5 mm long, rose. Anthers dark violet. Nut trigonous.

Fl. & Fr.: June - August.

Scarce; on rocky slopes. Gechang-Thango, 3850 m, 10.07.2003, K. Chandu Sekar 101171.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia; America and Europe.

2. *Fagopyrum* Mill.

Eight species distributed in Asia and E. Africa; 3 in India.

- | | |
|---------------------------|-------------------------|
| 1a. Stems pubescent | 1. <i>F. dibotrys</i> |
| b. Stems glabrous | 2 |
| 2a. Nuts acutely 3-angled | 2. <i>F. esculentum</i> |

b. Nuts obscurely 3-angled

3. *F. tataricum*

1. **Fagopyrum dibotrys** (D. Don) H. Hara, Fl. R. Himal. 69. 1966. *Polygonum dibotrys* D. Don, Prodr. Fl. Nep. 73. 1825. *Mentok Janka*

Annuals or biennials. Stems erect, 40-60 cm high, pubescent. Leaves broadly triangular, 4-6 x 2.5 cm, hastate; lower leaves long-petioled; petioles 2-5 cm long; upper ones stem-clasping. Stipules tubular, thin. Flowers in racemes, bisexual, white, forming lax, 5-10 cm long panicles. Perianth 5-segmented; segments ovate. Stamens 8, alternate with the nectar glands. Nuts ovoid, 3-5 mm long.

Fl. & Fr.: June - August.

Scarce; on moist slopes near stream. Dhul, 3700 m, 27.08.2002, K. Chandra Sekar 102996.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; Nepal and Pakistan.

2. **Fagopyrum esculentum** Moench., Methodus 290. 1794; Hook.f., Fl. Brit. India 5: 55. 1886; Aswal & Mehrotra, Fl. Lahaul-Spiti 537. 1994. *Kel*

Annuals. Stems erect, 35-50 cm high, glabrous, succulent, red-brown. Leaves broadly triangular, 2.5-5 x 2-4 cm, cordate at base, acute at apex, entire; petioles 2-4 cm long. Stipules tubular. Flowers in axillary and terminal cymes, peduncle 8-12 cm long. Bracts ovate-lanceolate. Perianth 5-segmented; segments obovate. Stamens 8. Nuts 5-6 mm long, smooth, acutely 3-angled, pale-brown.

Fl. & Fr.: June - August.

Mainly cultivated, occasionally met with as an escape in waste places. Mane, 3700 m, 03.09.2002, K. Chandra Sekar 101155.

Distrib.: Cultivated throughout India; Asia and Europe.

3. **Fagopyrum tataricum** (L.) Gaertn., Fruct. Sem. Pl. 2: 182, t. 119, f. 6. 1790; Hook.f., Fl. Brit. India 5: 55. 1886; Aswal & Mehrotra, Fl. Lahaul-Spiti 537. 1994. *Polygonum tataricum* L., Sp. Pl. 364. 1753. *Ahalbu*

Annual herbs. Stems erect, 35-60 cm high, glabrous, smooth, red-brown. Leaves broadly triangular, 2.5-6.5 x 2-4.5 cm, cordate-hastate at base, acute, entire, glabrous. Flowers in axillary and terminal cymes, bisexual; peduncle 10-15 cm long. Perianth pink-white, 3-5-cleft. Stamens 8. Styles 3, slender, free. Nuts 3-4 mm long, deeply grooved, glabrous, obscurely 3-angled, dark-brown.

Fl. & Fr.: July - August.

Rare; met as an escape along agricultural fields. Sagnatn, 3650 m, 27.08.2002, K. Chandra Sekar 100729.

Distrib.: India: Commonly cultivated throughout the Himalaya; Asia and Europe.

4. **Koenigia** L.

Six species distributed in N. Eurasia; ca 4 in India.

Koenigia delicatula (Meisn.) H. Hara in Fl. East. Himal. 70. 1966 & in Hara & al., Enum. Fl. Pl. Nepal. 3: 174. 1982. *Polygonum delicatulum* Meisn. in DC., Prodr. 14: 127. 1856; Hook.f., Fl. Brit. India 5: 24. 1886; Aswal & Mehrotra, Fl. Lahaul-Spiti 544. 1994. *Shubel*

Annuals. Stems decumbent-ascending, 35-50 cm high, much branched, slender, flaccid, sparsely hairy on joints and upper parts, otherwise glabrescent. Leaves few, distant, ovate-elliptic, 0.8-1.5 x 0.5-1 cm, acute, glabrous; the lower leaves shortly petioled, upper ones sessile. Stipules 2-partite, 2-3 mm long. Flowers 4-5 mm dia. Perianth white, tinged with pink, 5-segmented. Filaments short, protruding. Nuts ovoid, trigonous, smooth.

Fl & Fr.: July - September.

Scarce; on moist slopes. Tatiya, 4200 m, 21.07.2003, *K. Chandra Sekar* 103613.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Bhutan; China; Nepal and Pakistan.

Decoction of stems given to cure dysentery.

5. *Oxyria* Hill

Monotypic distributed from arctic to mountains of Eurasia.

Oxyria digyna (L.) Hill in Hort. Kew. 158. 1769; Hook.f., Fl. Brit. India 5: 58. 1886; Aswal & Mehrotra, Fl. Lahaul-Spiti 538. 1994. *Rumex digynus* L., Sp. Pl. 337. 1753. *Junco Jauchii* Photo. 135

Perennial herbs. Stems erect or ascending, 16-30 cm high. Leaves radical, rarely 1 or 2 on the stems, long-petioled, reniform or orbicular-reniform, 2-4 cm dia. Flowers bisexual, 2-6 at the end of branches and forming a slender racemiform inflorescence; pedicels slender, jointed below. Perianth 4-segmented; of these 2 obovate, 1-1.5 x 0.8-1 mm, the two others navicularly folded and about half as broad. Stamens 6. Fruits laterally compressed, winged, the coloured wings as broad as the achene.

Fl & Fr.: June - September.

Common; on moist slopes. Nur Pasture, 4050 m, 21.07.2002, *K. Chandra Sekar* 100496.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia; America and Europe.

6. *Persicaria* Willd.

About 150 species, subcosmopolitan; 40-50 in India.

- | | |
|--|--|
| 1a. Stems prickled | 4. <i>P. perfoliata</i> |
| b. Stems not prickled | 2 |
| 2a. Flowers solitary or in corymbose heads | 3 |
| b. Flowers in spikes or panicles | 4 |
| 3a. Petioles winged; nuts biconvex | 3. <i>P. nepalensis</i> |
| b. Petioles not winged; nuts trigonous | 1. <i>P. capitata</i> |
| 4a. Annuals; stems glabrous; leaves acute at the apex | 2. <i>P. hydropiper</i> |
| b. Perennials; stems pubescent; leaves acuminate at the apex | 5. <i>P. pubescens</i> var. <i>acuminata</i> |

1. *Persicaria capitata* (Buch.-Ham. ex D. Don) H. Gross in Engl., Bot. Jahrb. 49: 277. 1913; H. Hara, Fl. L. Himal. 70. 1966 & in H. Hara & al., Enum. Fl. Pl. Nepal. 3: 175. 1982; Chandra Sekar & al. in Indian J. Forest. 26(2): 98. 2003. *Polygonum capitatum* Buch.-Ham. ex D. Don, Prodr. Fl. Nepal. 73. 1825; Hook.f., Fl. Brit. India 5: 44. 1886.

Annuals or biennials. Stems prostrate, creeping ascending, 30 cm long, simple, pubescent, red-brown; rooting at base. Leaves shortly petioled, elliptic-ovate, 2.5-4 x 2-3.5 cm, acute, entire, hoary-tomentose. Stipules tubular, glandular hairy, brown-papery. Flowers capitate; heads distinctly stalked, 0.8-1.2 cm dia. Bracts ovate, acute. Perianth pink-purple; 5-segmented, oblong-ovate. Stamens 8. Styles 3-fid. Nuts trigonous, enclosed in perianth.

Fl. & Fr.: July - September.

Rare; on moist slopes near streams. Mane-Larsa Pass, 3900 m, 30.08.2002, K. Chandra Sekar 100776.

Distrib: India: Arunachal Pradesh, Assam, Himachal Pradesh, Jammu & Kashmir, Punjab, Sikkim, Uttarakhand and Uttar Pradesh; Asia.

2. *Persicaria hydropiper* (L.) Spach, Hist. Veg. 10: 536. 1841; H. Hara, Fl. L. Himal. 2: 23. 1971 & in H. Hara & al., Enum. Fl. Pl. Nepal. 3: 176. 1982; Aswal & Mehrotra, Fl. Lahaul-Spiti 546. 1994. *Polygonum hydropiper* L., Sp. Pl. 361. 1753; Hook.f., Fl. Brit. India 5: 39. 1886.

Annuals. Stems erect-ascending, 35-70 cm long, with decumbent or creeping base, glabrous. Leaves shortly petioled, lanceolate or oblong-lanceolate, 5-10 x 1-2 cm, narrowed at base, acute at apex, gland-dotted, midrib minutely hairy. Stipules tubular, 1-2 cm long. Flowers in cylindric, interrupted, 4-12 cm long racemes. Bracts 2-3 mm long. Perianth white pink; 5-segmented, orbicular ovate, glandular. Stamens 8. Nuts trigonous, brown.

Fl. & Fr.: July - September.

Scarce; on moist rocky slopes. Mane-Larsa Pass, 3900 m, 30.08.2002, K. Chandra Sekar 100772.

Distrib: India: Arunachal Pradesh, Assam, Himachal Pradesh, Jammu & Kashmir, Punjab, Sikkim, Uttarakhand and Uttar Pradesh; Asia; Europe; N. Africa and N. America.

3. *Persicaria nepalensis* (Meisn.) H. Gross in Engl., Bot. Jahrb. 49: 277. 1913; H. Hara, Fl. L. Himal. 72. 1966 & in H. Hara & al., Enum. Fl. Pl. Nepal. 3: 177. 1982. *Polygonum nepalense* Meisn., Monogr. Polyg. 84, t. 7, f. 2. 1826; Aswal & Mehrotra, Fl. Lahaul-Spiti 547. 1994. *P. alatum* Hamilt. ex Spreng. var. *nepalense* (Meisn.) Hook.f., Fl. Brit. India 5: 42. 1886.

Annuals. Stems erect-ascending, 30-40 cm high, much branched from the base, slender, red-purple. Leaves ovate-cordate or rhomboid, 2-4.5 x 1.5-3 cm, acute, entire, glabrous; petioles winged, with 2 basal auricle. Stipules cup-shaped, glabrous. Flowers in peduncled heads. Bracts ovate-cordate. Perianth pink-white; 4 or 5-segmented, rounded, subequal. Styles slender. Nuts biconvex to obscure trigonous, gland-dotted, black.

Fl. & Fr.: July - September.

Rare; in moist places. Thangti, 3800 m, 27.08.2002, K. Chandra Sekar 102990.

Distrib: India: Arunachal Pradesh, Assam, Himachal Pradesh, Jammu & Kashmir, Punjab, Sikkim, Tamil Nadu, Uttarakhand and Uttar Pradesh; Asia; Europe and Tropical Africa.

4. *Persicaria perfoliata* (L.) H. Gross in Engl., Bot. Jahrb. 49: 275 & 281. 1913; Hara, Fl. E. Himal. 72. 1966. *Polygonum perfoliatum* L., Sp. Pl. ed. 2, 521. 1763; Hook.f., Fl. Brit. India 5: 46. 1886. Fig. 14

Perennial herbs. Stems creeping, 65-90 cm long, branched, covered with sharp prickles. Leaves long petioled, peltate, 2-3.8 x 3-4 cm, glabrous above, prickly on veins beneath; petioles 3-7 cm long. Ocrea leaf-like, amplexicaul. Flowers in short, compact, solitary, terminal or axillary racemes. Stipules erect, longer than pedicels, acute. Perianth greenish, the orbicular overlapping segments becoming blue and succulent. Nuts subglobose, 1-2 mm dia., black.

Fl. & Fr.: July - August.

Rare; on rocky slopes. Larang La-Tatiya, 4800 m, 06.08.2003, K. Chandra Sekar 103759.

Distrib.: India: Himachal Pradesh, Sikkim and Uttarakhand; Afghanistan; China; Formosa; Japan; Korea; Malaysia and Pakistan.

5. *Persicaria pubescens* (Blume) H. Hara var. *acuminata* (Franch. & Sav.) H. Hara in J. Jap. Bot. 17: 335. 1941; H. Hara, Fl. E. Himal. 74. 1966. *Polygonum hydropiper* var. *acuminata* Franch. & Sav., Enum. Pl. Jap. 2: 474. 1877. Diku Tsa

Perennial herbs. Stems prostrate-ascending, 35-55 cm high, pubescent, rooting at lower nodes. Leaves narrowly lanceolate, 6-10 x 1.5-2 cm, acuminate, entire, glabrescent above, strigosely hairy beneath. Stipules densely hairy. Flowers in subpaniculate racemes. Bracts ovate, glabrous. Perianth pink-white; lobes orbicular-ovate, glandular. Nut trigonous, small, black.

Fl. & Fr.: June - September.

Scarce; on moist slopes. Mad, 3700 m, 26.08.2002, K. Chandra Sekar 102963.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia; Australia and Europe.

Root paste applied externally on wounds.

7. *Polygonum* L.

About 200 species, cosmopolitan; 25-30 in India.

- | | |
|---|-----------------------------|
| 1a. Twining or climbing herbs | 3. <i>P. consolvulus</i> |
| b. Erect or decumbent herbs | 2 |
| 2a. Internodes concealed by closely imbricated leaves and stipules | 3 |
| b. Internodes not concealed by closely imbricated leaves and stipules | 4 |
| 3a. Flowers solitary | 5. <i>P. paronychioides</i> |
| b. Flower not solitary | 8. <i>P. tuberosum</i> |
| 4a. Leaves linear to narrowly oblong-spathulate | 5 |
| b. Leaves elliptic obovate, oblong or oblanceolate lanceolate | 6 |
| 5a. Leaves lanceolate-spathulate | 6. <i>P. plebejum</i> |

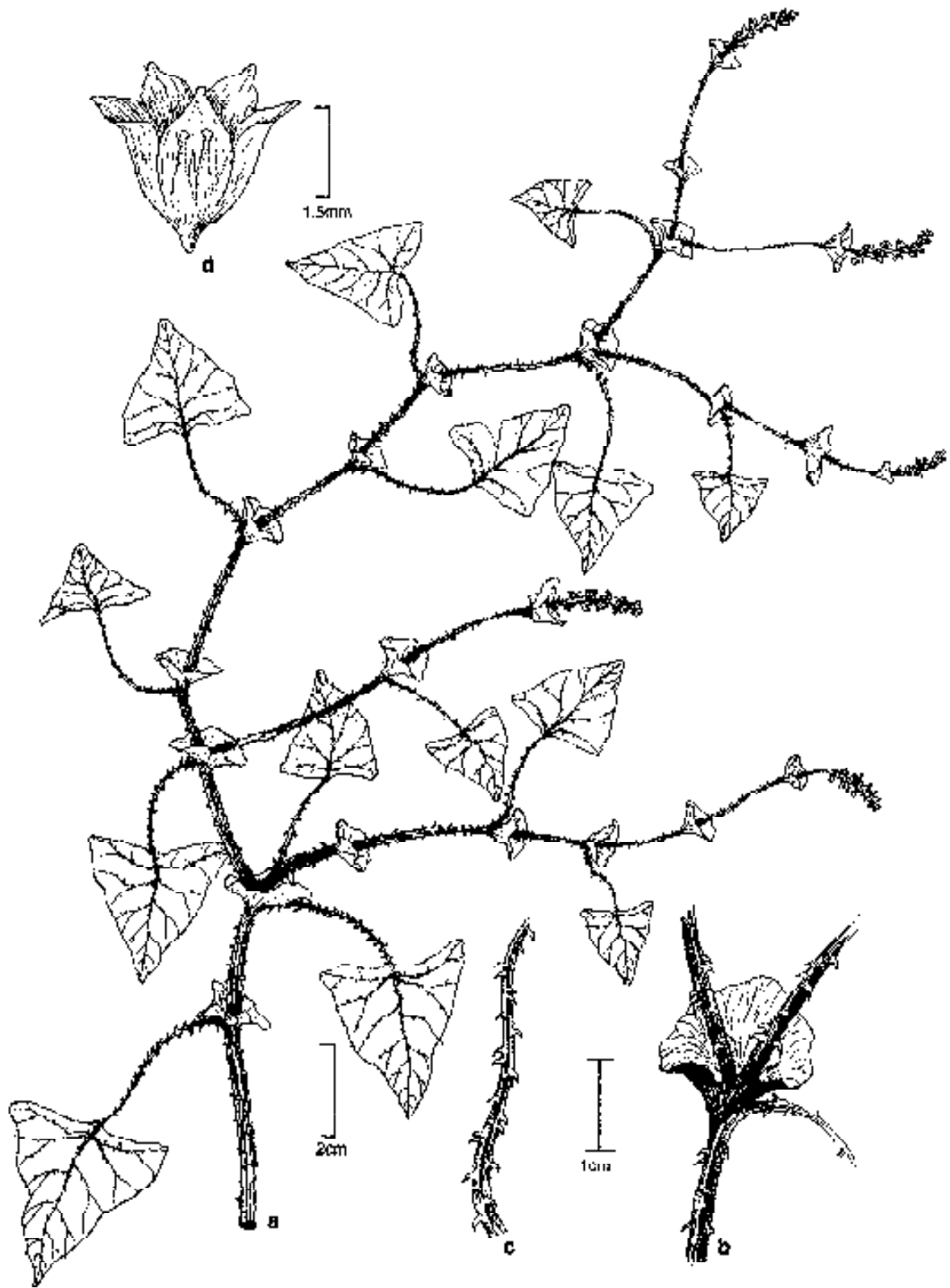


Fig. 14. *Persicaria perfoliata* (L.) H. Gross. a. Habit, b. Node, c. Petiole, d. Flower

- b. Leaves linear to narrowly oblong spatulate 4. *P. molliaeforme*
- 6a. Annuals 1. *P. aviculare*
- b. Perennials 7
- 7a. Stipules ovate lanceolate 2. *P. cognatum*
- b. Stipules ovate 7. *P. recumbens*

1. **Polygonum aviculare** L., Sp. Pl. 362. 1753; Hook.f., Fl. Brit. India 5: 26. 1886; Aswal & Mehrotra, Fl. Lahaul-Spiti 543. 1994. *Khilumbi, Uhar*

Annuals. Stems procumbent or ascending, 20-32 cm high, glabrous. Leaves broadly elliptic to obovate-oblong, 1.3-2.5 x 1-1.2 cm obtuse to subacute, nerveless. Stipules tubular, shorter than the internodes, hyaline, lacerate. Flowers in axillary clusters, small. Perianth divided to the middle, obconical in lower part; lobes pale green, narrowly white-rose margined. Nuts ovoid, obtusely trigonous, minutely rugosely striolate.

Fl. & Fr.: July - September.

Occasional; on moist slopes. Mud-Larang La, 4000 m, 19.08.2002, K. Chandra Sekar 102920.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia; Europe and U.S.S.R.

Extract of flower buds applied on forehead in headache.

2. **Polygonum cognatum** Meisn., Monogr. Polyg. 91. 1826; Hook.f., Fl. Brit. India 5: 25. 1886; Aswal & Mehrotra, Fl. Lahaul-Spiti 544. 1994.

Perennial herbs; rootstock woody. Stems prostrate or ascending, 10-15 cm long, glabrous. Leaves elliptic-lanceolate, 0.8-1.2 cm long, obtuse or acute, thick, nerveless; petioles 7-8 mm long. Stipules ovate, acute or acuminate, subentire, silvery white. Flowers in axillary clusters. Perianth very thick, reddish; lobes with white margins. Nuts ovoid, 1-2 mm long, obtusely trigonous, compressed, black.

Fl. & Fr.: July - September.

Occasional; on rocky slopes. Mud-Larang La, 3900 m, 18.08.2002, K. Chandra Sekar 102901.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia and Europe.

3. **Polygonum convolvulus** L., Sp. Pl. 364. 1753; Hook.f., Fl. Brit. India 5: 53. 1886; Khanna & al., Dicot. Pl. Uttar Pradesh 318. 1999.

Annuals. Stems prostrate or twining, 30-50 cm long, puberulous at angles. Leaves 2.5-3.5 cm long, sagittate-cordate, acuminate, angles obtuse or acute, glabrous above, puberulous beneath; petiole slender, 2-3 cm long. Stipules short. Racemes suberect, short; pedicels recurved. Perianth lobes obtuse, green, with white margins. Nuts 0.8-1.2 mm long, black.

Fl. & Fr.: July - September.

Rare; on moist slopes. Thango, 3950 m, 18.07.2002, K. Chandra Sekar 100481.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia; Europe and N. Africa.

4. **Polygonum molliciforme** Boiss., *Diagn. Ser.* 1, 7: 84, 1846; Hook.f., *Fl. Brit. India* 5: 27, 1886; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 547, 1994.

Annuals. Stems decumbent-spreading, 4-5 cm long, filiform, rigidly flexuous, red; bearing axillary clusters of stipules and flowers. Leaves spreading, linear to narrowly oblong spatulate, 0.6-1 cm long, apiculate, setaceous, 3-5 nerved with recurved margin. Stipules 1 or 2-nerved, split to the middle into several lanceolate segments, white. Perianth concealed by the stipules. Nuts ovoid, acute, obtusely trigonous.

Fl. & Fr.: July - August.

Occasional; on moist slopes. Chhohem, 4150 m, 12.07.2003, K. Chandra Sekar 103220.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China; Iran and Pakistan.

5. **Polygonum paronychioides** C.A. Mey. in *Bull. Soc. Nat. Mosc.* 356, 1838; Hook.f., *Fl. Brit. India* 5: 26, 1886; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 548, 1994.

Perennial herbs; rootstock very stout, woody. Stems erect-ascending, up to 10 cm high, branched, scaberrulous. Leaves linear lanceolate, 1-1.3 cm long, with a deciduous mucro, margin recurved. Internodes concealed by the closely imbricated leaves and stipules. Stipules with two faint nerves. Flower axillary, solitary. Perianth lobed, white at margin. Nuts 1-2 mm long, broadest in the middle, smooth, black.

Fl. & Fr.: June - September.

Scarce; on slopes. Chhohem, 4100 m, 13.07.2003, K. Chandra Sekar 103253.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Afghanistan; Iran and Pakistan.

6. **Polygonum plebejum** R. Br., *Prodr.* 420, 1810; Hook.f., *Fl. Brit. India* 5: 27, 1886; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 549, 1994. *Serrachon*

Annuals. Stems prostrate or decumbent-ascending, 23-38 cm long, much-branched, purple-tinged, glabrous. Leaves lanceolate-spatulate, 1.2-2.5 cm long, narrowed towards the base, rounded at apex, glabrous. Flowers 1-5, axillary, 3-6 mm dia. Perianth white pink; lobes orbicular-oblong, with a green median streak. Nut trigonous, polished.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Tariya, 4000 m, 20.07.2003, K. Chandra Sekar 103606.

Distrib.: Almost throughout India; Asia, Afghanistan to China; Australia and Malasia.

Decoction of whole plant is given with curd to cure dysentery.

7. **Polygonum recumbens** Royle ex Bab. in *Trans. Linn. Soc. London* 18: 116, 1838; Hook.f., *Fl. Brit. India* 5: 25, 1886; Khanna & al., *Dicot. Pl. Uttar Pradesh* 320, 1999.

Perennial herbs; rootstock stout. Stems prostrate and ascending, 35-45 cm long, much branched, grooved. Leaves petioled, broadly elliptic-obovate, 1.2-2 cm long, obtuse or acute; nerves obscure. Stipules ovate-lanceolate, 0.5-1 cm long, with a strong excurrent nerve on each side. Perianth obovoid, 5-lobed, white with pink-tinged. Nuts 1-2 mm long, broadest below the middle, shining, black.

Fl. & Fr.: June - August.

Rare; on moist slopes. Chhohem, 4100 m, 13.07.2003, K. Chandra Sekar 103254.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia.

8. *Polygonum tubulosum* Boiss., *Diagn. Pl. Or. Nev. Ser.* 1(7) 83. 1846; Hook.f., *Fl. Brit. India* 5: 27. 1886; Aswal & Mehrotra, *Fl. Lahaul Spiti* 551. 1994. **Photo. 136**

Annuals. Stems prostrate, 7-15 cm long, branches bearing flowers throughout their length. Leaves sessile, crowded, linear-lanceolate, 1-1.3 x 0.1-0.3 cm, acute, margins recurved, glabrous. Stipules tubular, 2-3 mm long, subentire, faintly 1 or 2-nerved. Flowers sessile in axillary clusters. Perianth ovoid, 2-4.5 mm long, lobed; lobes 0.5-1.5 mm dia., pink. Nuts trigonous, smooth, shining.

Fl. & Fr.: June - September.

Occasional; in rock-crevices. Naa, 3675 m, 12.07.2002, K. Chandra Sekar 100442.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China; Iran and Pakistan.

8. *Rheum* L.

About 30 species chiefly distributed in temperate and subtropical regions; ca 10 in India.

- 1a. Stemless; inflorescence spike 1. *R. spiciforme*
 b. Stems prominent; inflorescence panicle 2. *R. wehbianum*

1. *Rheum spiciforme* Royle, *Illustr. Bot. Himal.* 318, t. 78. 1836; Hook.f., *Fl. Brit. India* 5: 55. 1886; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 554. 1994. *Joms Lachi* **Photo. 137**

Perennial herbs; rootstock woody, thick. Leaves all radical, orbicular or broadly ovate or cordate, 15-30 cm dia., glabrous above, sparsely puberulous beneath. Racemes 1-3, 15-30 cm long, dense-flowered; peduncle and rachis stout, glabrous. Bracts ovate, 1-3 mm long, scarious. Fruits broadly oblong-ellipsoid, 0.6-1.2 cm long, wings broader than the disc, red.

Fl. & Fr.: June - August.

Scarce; on moist sandy slopes. Kiling-Larang La, 4600 m, 03.08.2003, K. Chandra Sekar 103735.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan and Pakistan.

Fresh peduncle are eaten raw to increase the sexual vigourness of men.

2. *Rheum wehbianum* Royle, *Illustr. Bot. Himal.* 318, Pl. 78a. 1836; Hook.f., *Fl. Brit. India* 5: 57. 1886; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 554. 1994. *Jolancho* **Photo. 138**

Perennial herbs. Stems erect, robust, 0.7-1 m high, 1-2 cm dia., glabrous, green. Leaves long-petioled, orbicular-cordate or reniform, 10-30 cm dia., rounded or subacute at apex, glabrous; petioles 3-8 cm long, glabrous. Panicles axillary and terminal, many-flowered. Flowers 2-4 mm dia., pale yellow or white. Fruits broadly oblong or globose, notched at both ends, pale brown.

Fl. & Fr.: June - September.

Occasional, on moist slopes. Nur Pasture, 4050 m, 21.07.2002, K. Chandra Sekar 100495.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China; Nepal and Pakistan.

Decoction of stem is given to cure stomach pain.

9. *Rumex* L.

About 200 species distributed in temperate regions; ca 15 in India.

- | | |
|-------------------------------|---|
| 1a. Leaves hastate | 2 |
| b. Leaves not hastate | 3 |
| 2a. Stems deeply grooved | 3. <i>R. hastatus</i> |
| b. Stems not grooved | 1. <i>R. acetosa</i> |
| 3a. Annuals | 2. <i>R. dentatus</i> subsp. <i>klotzschianus</i> |
| b. Perennials | 4 |
| 4a. Fruiting perianth fringed | 4. <i>R. nepalensis</i> |
| b. Fruiting perianth entire | 5. <i>R. patens</i> subsp. <i>orientalis</i> |

1. *Rumex acetosa* L., Sp. Pl. 337. 1753; Hook.f., Fl. Brit. India 5: 60. 1886; Aswal & Mehrotra, Fl. Lahaul-Spiti 555. 1994. *Cheonusa*

Perennial dioecious herbs. Stems erect-ascending, 30-50 cm high, glabrous, green-brown. Radical leaves long-petioled, oblong-obovate to ovate-oblong, 3-7 x 1.5-3 cm, cordate, hastate, glabrous above, sparsely pubescent beneath; cauline ones sessile, similar to radical leaves but smaller. Stipules ragged. Racemes lax, 15-25 cm long, leafy. Flowers green-purple, 2-6 mm long; pedicels 1-3 mm long. Stamens 6. Styles 3. Valves of ripe female perianth broadly ovate-cordate, pink or crimson-red. Nut 3-angled, brown or black.

Fl. & Fr.: June - August.

Scarce; on moist slopes. Tharvik, 4000 m, 21.07.2003, K. Chandra Sekar 103622.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia; Europe from the Caucasus westward and N. America.

Decoction of leaves is given to cure high fever.

2. *Rumex dentatus* L. subsp. *klotzschianus* (Meisn.) Reichb.f., Beih. Bot. Centralb. 49: 19. 1932 & in Candollea 12: 119. 1949. *R. klotzschianus* Meisn. in DC., Prodr. 14(1): 57. 1856.

Sbonu Chinn, Sbonu Mendak **Photo. 139**

Annuals. Stems erect, 40-70 cm high, glabrous. Leaves oblong-obovate to elliptic-oblong, 10-15 x 3-6.8 cm, rounded or cordate at base, obtuse, margin undulate or crisp; petioles of variable length, 3-6.5 cm in basal leaves; upper ones subsessile. Flowers arranged in verticillate panicles. Perianth lobes 2-seriate; inner segments broadly ovate, much enlarged in fruits, tubercled on the back, irregularly toothed at margin. Nuts acutely trigonous, brown.

Fl. & Fr.: June - August.

Occasional; on moist slopes, Thanga, 3850 m, 17.07.2002, *K. Chandra Sekar* 100474.

Distrib.: India: Arunachal Pradesh, Assam, Himachal Pradesh, Jammu & Kashmir, Punjab, Sikkim, Uttarakhand, Uttar Pradesh and West Bengal; Asia and Europe.

3. *Rumex hastatus* D. Don, Prodr. Fl. Nepal, 74. 1825; Hook.f., Fl. Brit. India 5: 60. 1886; Chandra Sekar & al. in Ann. For. 11(1): 57. 2003. *Chamiso*

Perennial herbs. Stems erect, 40-60 cm high, much-branched, deeply grooved, pale grey. Leaves narrowly triangular hastate, 1.5-3.2 cm long, glaucous, 3-lobed; upper ones sometimes linear. Racemes very slender, panicle. Flowers green white. Perianth segments 6, outer whorl of perianth ovate, pale-green or pink-red; inner fruiting whorls orbicular, entire, pink. Stamens 6. Style 3; stigma fringed. Nuts trigonous, narrowly winged, net-veined.

Fl. & Fr.: June - August.

Rare; on rocky slopes. Mane-Larsa pass, 3650 m, 29.08.2002, *K. Chandra Sekar* 100761.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan; China; Nepal and Pakistan.

Decoction of leaves given for high fever.

4. *Rumex nepalensis* Spreng., Syst. Veg. 2: 159. 1825; Hook.f., Fl. Brit. India 5: 60. 1886; Aswal & Mehrotra, Fl. Lahaul-Spiti 556. 1994. *Soma Deju* **Photo. 140**

Perennial herbs. Stems erect, 40-80 cm high, branched. Radical leaves long-petioled, ovate-oblong or triangular-ovate, 8.5-18 x 5-10.5 cm, cordate at base, glabrous; cauline ones sessile or subsessile, similar but smaller. Flowers in whorls, forming almost leafless long panicle. Perianth 6-lobed, fringed, pale-green; fruiting sepals ovate triangular, minutely dentate at margin. Ovary acutely 3-angled. Nuts enclosed in the hooked fruiting tepals.

Fl. & Fr.: June - September.

Scarce; on moist slopes. Sagnan, 3650 m, 08.07.2003, *K. Chandra Sekar* 101159.

Distrib.: India: Arunachal Pradesh, Assam, Himachal Pradesh, Jammu & Kashmir, Punjab, Sikkim, Tamil Nadu, Uttarakhand and Uttar Pradesh; Asia; Europe and S. Africa.

5. *Rumex patientia* L. subsp. *orientalis* (Bernh. ex Schult.f.) Danser in Nedert. Kruidk. Arch. 1923: 11. 1924; Aswal & Mehrotra, Fl. Lahaul-Spiti 556. 1994. *R. orientalis* Bernh. ex Schult.f., Syst. 7: 1433. 1830; Hook.f., Fl. Brit. India 5: 58. 1886. *Sboms* **Photo. 141**

Perennial herbs. Stems erect, 0.6-1 m high, robust, branched. Leaves entire; lower ones long-petioled, oblong-obovate, 3.5-9 cm long, cordate, glabrous; upper ones sessile or subsessile, lanceolate-obovate, 2-6 cm long, glabrous. Flowers 1-3 mm dia., green, in crowded whorls, forming leafy panicle, often very dense in fruit. Fruiting sepals orbicular, cordate, entire.

Fl. & Fr.: June - September.

Scarce; on moist slopes. Sanpat, 4900 m, 23.07.2003, *K. Chandra Sekar* 103644.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China; Greece; Pakistan; Syria and westward to Asia Minor.

A good fodder.

45. ELAEAGNACEAE

Three genera and ca 45 species distributed in temperate and subtropical regions; 2 genera and 19 species in India.

Hippophae L.

Three species distributed in Eurasia; 3 in India.

Hippophae rhamnoides L. subsp. *turkestanica* Rousi in Ann. Bot. Fenn. 8: 208. 1971; Aswal & Mehrotra, Fl. Lahaul-Spiti 556. 1994. *Chama* Photo. 142

Shrubs, 1-2 m high. Shoots often modified into spines. Leaves linear-lanceolate, 2-6 x 0.3-0.6 cm, obtuse, covered with peltate and stellate-scales, especially on the lower surface. Male flowers in clusters at the base of the shoot, 2-2.5 mm long. Tepals free, suborbicular. Stamens free, sessile; anthers 1.2-1.5 mm long. Female flowers in clusters of 2-4, pedicellate; pedicel 2-2.5 mm long, slender. Tepals 3-4 mm long, connate, acute, stellately hairy inside. Ovary ovoid, ca 2 mm long. Fruits subglobose, 6-7 mm dia., succulent. Seed solitary, 3-4 mm long, unequally bilobed.

Fl. & Fr.: July - September.

Common; on rocky slopes, mainly along the streams and rivers. Tilling, 3700 m, 26.08.2002, *K. Chandra Sekar* 100696.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China; Mongolia and Pakistan.

Thorny branches are used to fence the cultivated fields and buildings. The wood provides fuel and handles for household implements. Fruit juice is taken to cure cough, cold and fever.

46. EUPHORBIACEAE

About 315 genera and ca 8100 species, cosmopolitan; 84 genera and ca 527 species in India.

Euphorbia L.

About 2000 species, cosmopolitan; ca 60 in India.

Euphorbia tibetica Boiss. in DC., Prodr. 15(2): 114. 1866; Hook.f., Fl. Brit. India 5: 260. 1887; Aswal & Mehrotra, Fl. Lahaul-Spiti 562. 1994.

Perennial herbs; rootstock stout, woody. Stems many, suberect or straggling, 20-30 cm long, dichotomously branched, greenish. Leaves sessile to subsessile, linear-lanceolate, 0.8-1.5 x 0.3-0.4 cm, rounded at apex, glabrous. Involucres 1-2 mm dia.; glands large, transversely oblong. Capsules shortly stipitate, 1.5-2.5 mm dia., furrows between the oblong cocci not deep, smooth. Seeds oblong-obovoid, smooth.

Fl. & Fr.: July - September.

Rare; on rocky slopes. Tariya Mud, 4000 m, 07.08.2003, K. Chandra Sekar 103776.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China and Pakistan.

47. URTICACEAE

Forty eight genera and ca 1050 species distributed from tropical to temperate regions; 29 genera and 153 species in India.

Urtica L.

About 80 species, subcosmopolitan; 4 in India.

Urtica dioica L., Sp. Pl. 984. 1753; Hook.f., Fl. Brit. India 5: 548. 1888; Aswal & Mehrotra, Fl. Lahaul-Spiti 563. 1994. *Marga*

Perennial herbs. Stems ascending, 45-70 cm high, with stinging hairs. Leaves ovate-lanceolate to oblong, 3-6 x 1.5-3.5 cm, subcordate to truncate at base, acuminate at apex, crenate-serrate at margin, glabrous, sparsely pubescent beneath. Stipules free, ovate-lanceolate. Flowers dioecious, in cymes, which are combined into a secund paniculiform inflorescence. Tepals 4, oblong, obtuse, hairy. Achenes suborbicular-ovate, compressed.

Fl. & Fr.: June - September.

Occasional; along streams and on moist slopes. Thangti, 3800 m, 27.08.2002, K. Chandra Sekar 102989.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China; Pakistan and westward to the Atlantic.

Note: Closely allied to *U. parviflora* Roxb., but can easily be distinguished by free stipules and dioecious flowers. *U. parviflora* is characterized by connate stipules and monoecious flowers.

48. CANNABACEAE

Two genera and 4 species distributed in the North temperate regions; 2 genera and 2 species in India.

Cannabis L.

Monotypic genus distributed in C. to S.E. Asia and tropical Africa.

Cannabis sativa L., Sp. Pl. 1027. 1753; Hook.f., Fl. Brit. India 5: 487. 1888; Aswal & Mehrotra, Fl. Lahaul-Spiti 564. 1994. *Cathaya*

Annual, aromatic herbs. Stems erect, 30-60 cm high, branched. Leaves 5-7-foliolate or paritite; upper ones simple; leaflets or segments lanceolate-oblong to elliptic, acuminate at apex, coarsely serrate, thinly glandular hairy above, appressed-pubescent and glandular-punctate beneath. Flowers dioecious. Male flowers in short cymes, combined into terminal panicle. Female flowers solitary, axillary, forming leafy-spikes. Fruits green-yellowish, smooth.

Fl. & Fr.: June - September.

Scarce; on moist slopes. Mane, 3650 m, 27.08.2002, K. Chandra Sekar 100753.

Distrib.: Wild in N.W. Himalaya and cultivated throughout India; China; Iran; Pakistan; U.S.S.R. and cultivated elsewhere.

Leaves, fruits and shoot tips used as narcotic.

49. SALICACEAE

Two genera and about 435 species, subcosmopolitan; 2 genera and ca 64 species in India.

- | | |
|------------------------------------|-------------------|
| 1a. Disc of 1 or 2 separate glands | 2. <i>Salix</i> |
| b. Disc cupular or annular | 1. <i>Populus</i> |

1. *Populus* L.

About 35 species distributed in temperate regions; ca 10 in India.

Populus ciliata Wall. ex Boyle, *Illustr. Bot. Himal.* 346, t. 84a, f. 1, 1839; Hook.f., *Fl. Brit. India* 5: 638, 1888; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 569, 1994. *Chara* Photo. 143

Medium-sized trees; bark green-grey; buds sticky. Leaves broadly ovate, 4-6 x 2-3.5 cm, cordate, acuminate at apex, crenate-serrulate; teeth minutely ciliate, 3-5-nerved; petioles 2-3.5 cm long. Flowers in compact catkins; male 4.5-6.5 cm long; female 7-10 cm long. Male flowers: bracts oblanceolate, fringed with long hairs; disc obliquely cup-shaped, crenulate; stamens many; anthers oblong. Female flowers: disc embracing half the ovary, undulate at margin; stigma 3 or 4, obcordate. Capsules broadly ovoid, 0.9-1.1 cm long, 3 or 4-valved. Seeds enveloped in long silky hairs.

Fl. & Fr.: June - September.

Cultivated, near habitation. Guling, 3700 m, 24.07.2002, K. Chandru Sekar 100511.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; cultivated throughout Asia and Europe.

2. *Salix* L.

About 400 species, distributed in Cold temperate regions; ca 35 in India.

- | | |
|------------------------------------|--------------------------|
| 1a. Capsules densely silky | 4. <i>S. wallichiana</i> |
| b. Capsules glabrous | 2 |
| 2a. Leaves serrulate at margins | 1. <i>S. denticulata</i> |
| b. Leaves crenulate at margins | 3 |
| 3a. Petioles less than 1.5 mm long | 3. <i>S. fruticulosa</i> |
| b. Petioles more than 1.5 mm long | 2. <i>S. flabellaris</i> |

1. *Salix denticulata* Anderss. in *Vet. Akad. Handl. Stockh.* 1850: 481, 1851; Neum. & Skovt. in *Reichb.f., Fl. Iran.* 65: 35, 1969; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 572, 1994. *Langma*

Shrubs or small trees. Leaves elliptic obovate, 2-2.5 cm long, serrulate at margins, green above, white or pale-lanate beneath. Stipules minute. Flowers appear after the leaves, catkins androgynous. Male catkins 2.5-5 cm long; rachis villous. Stamens 2; filaments villous. Female catkins 2-6.5 cm long,

flexuous; rachis villous. Bracts (in male & female) narrowed towards the base, rounded at apex, truncate or minutely 2 or 3-lobed, ciliate, pale yellowish. Ovary ovoid-conic; sipe shorter than the glandular disc; stigma 2-lobed. Capsules shortly stipitate, glabrous.

Fl. & Fr.: June - August.

Common; on river beds. Chhohem, 4100 m, 13.07.2003, *K. Chandra Sekar* 103248.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Nepal and Pakistan.

2. *Salix flabellaris* Anderss. in *Ver. Akad. Handl.* 1850: 497. 1851; Hook.f., *Fl. Brit. India* 5: 634. 1888; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 572. 1994. *Dandak* **Photo. 144**

Shrubs, dwarf. Branches stout, glabrous. Leaves elliptic-obovate, 1-2 x 0.5-1 cm, obtuse, crenulate at margins, glabrous; petioles 3-4 mm long. Flowers appear after the leaves. Male catkins 1.2-3 cm long; rachis puberulous. Bracts obovate, brown. Disc of 2 erect glands. Stamens 2, free, glabrous. Female catkins 1.5-3 cm long. Disc half surrounding the base of the ovary. Ovary subsessile, glabrous; style short; stigmas spreading, entire. Capsules ovoid, 2-3 mm long, glabrous, red.

Fl. & Fr.: June - August.

Scarce; on moist slopes. Sanpat to Pin-Parvari Pass, 4800 m, 23.07.2003, *K. Chandra Sekar* 103639.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; Nepal and Pakistan.

Extract of leaves is given for stomach pain.

3. *Salix fruticulosa* Anderss. in *J. Linn. Soc., London (Bot.)* 4: 53. 1860; Parker, *For. Fl. Punjab* 505. 1973. **Photo. 145**

Shrubs, dwarf. Leaves 1-2.2 cm long, elliptic lanceolate, rounded or acute at apex, glabrous, crenulate at margins; petioles 0.8-1.2 mm long. Male catkins 1-2.3 cm long; rachis densely hairy. Bracts oblong, rounded at apex, glabrous. Disc of a solitary, erect gland. Stamens 2, filaments free. Female catkins 0.8-2 cm long; rachis densely hairy. Bracts oblong. Disc of a solitary, erect gland. Ovary subsessile, fusiform; style deeply cleft; stigmas clavate, entire. Capsules sessile, glabrous.

Fl. & Fr.: June - August.

Common; on river beds. Chhohem, 4100 m, 13.07.2003, *K. Chandra Sekar* 103247.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand, Pakistan.

4. *Salix wallichiana* Anderss. in *Ver. Akad. Handl. Stockh.* 1850: 477. 1851; Hook.f., *Fl. Brit. India* 5: 628. 1888; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 575. 1994.

Shrubs or small trees. Leaves 2.5-3.5 x 1.4-2.7 cm, oblong-lanceolate, acute, serrulate, obscurely glandular; petioles 2-5 mm long. Stipules coarsely toothed. Male catkins 2-3 cm long; rachis villous. Bracts oblanceolate, densely silky on both sides, dark brown. Disc of a solitary, erect gland. Stamens 2; filaments free. Female catkins 4-6 cm long; rachis villous. Bracts obovate-oblong. Disc of a solitary, erect gland. Ovary ovoid, densely silky; stigmas subsessile. Capsules with an elongated, conical apex, densely silky.

Fl. & Fr.: June - August.

Common; on river bed. Gechang, 3720 m, 15.07.2002, *K. Chandra Sekar* 100455.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan; Bhutan; China; Nepal and Pakistan.

50. ORCHIDACEAE

Seven hundred and eighty eight genera and about 18500 species, cosmopolitan; 184 genera and ca 1230 species in India.

- | | |
|--|------------------------|
| 1a. Plants with segmented tubers; leaves 3-6 | 1. Dactylorhiza |
| b. Plants with undivided tubers; leaves 1-3 | 2. Ponerorchis |

1. *Dactylorhiza* Neck. ex Nevski

About 30 species, distributed in temperate Eurasia, Alaska, Mediterranean region and Macronesia; 2 in India.

Dactylorhiza hatagirea (D. Don) Soo, Gen. Dactylorhiza 4. 1962; Aswal & Mehrotra, Fl. Lahaul-Spiti 583. 1994; Murti, Fl. Cold Des. W. Himal. 1: 88. 2001. *Orchis hatagirea* D. Don, Prodr. Fl. Nepal. 23. 1825.

L. ang. Na Photo. 146

Perennial herbs, 10-30 cm high; roots tuberous, divided into 2-4 finger-like processes. Stems fistular, leafy upward. Leaves 3-6, oblong-lanceolate, 6-15 x 3-5 cm. Spikes dense, cylindric. Bracts longer than the flowers, acuminate. Flowers pink or purple, variable in size. Lateral sepals ovate, reflexed; dorsal ovate-oblong, 0.6-1 cm long. Petals obliquely ovate to broadly lanceolate. Lip oblong, 0.8-1.1 cm long, obtusely 3-lobed. Spur more or less equal to the ovary.

Fl. & Fr.: June - August.

Common; on stream beds. Sagnam Gechang, 3750 m, 09.07.2003, *K. Chandra Sekar* 101165.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; Nepal and Pakistan.

Note: *Orchis latifolia* L., which has long been considered the well-known "Hatha Jathi" or "Salam Panja" of indigenous system of medicine, is a European species, and the Indian Plant is *Dactylorhiza hatagirea* (D. Don) Soo (Aswal & Mehrotra, *l.c.*; Murti, *l.c.*).

Paste of tubers given in kidney pain. Flowers offered in monastics.

2. *Ponerorchis* Reichb.f.

About 10 species distributed in N.E. America and Temperate Eurasia; 3 in India.

Airy Shaw (1973) treats this genus synonymous to *Gymnadenia* R. Br.

Ponerorchis chusua (D. Don) Soo, Acta Bot. Acad. Sci. Hung. 12: 352. 1966; Aswal & Mehrotra, Fl. Lahaul-Spiti 587. 1994; Murti, Fl. Cold Des. W. Himal. 1: 99. 2001. *Orchis chusua* D. Don, Prodr. Fl. Nepal. 23. 1825; Hook.f., Fl. Brit. India 6: 127. 1890.

Biennials; tubers oblong, 7-15 cm long, entire. Stems weak. Leaves 1-3, linear lanceolate, 4-10 x 1-2 cm, acute. Spikes 2-8 cm long, lax. Bracts lanceolate. Flowers 1-2 cm dia., purple. Lateral sepals oblong lanceolate, reflexed; dorsal sepal orbicular. Petals broadly ovate, truncate at base, subacute at apex. Lip longer than the sepals, deeply 3-lobed; lobes equal, oblong, blunt, the lateral ones diverging. Spur cylindrical, slightly clavate, as long as and appressed to the ovary.

Fl. & Fr.: July - August.

Rare; in meadows. Parahito catchment, 26.07.1992, *Njima & Yashwan* 175 (WIT).

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Uttarakhand and Sikkim; China and Nepal.

51. ZINGIBERACEAE

Fifty two genera and about 1100 species distributed in the tropical regions; 24 genera and 191 species in India.

Roscoeia Sm.

Seventeen species distributed in the Himalaya and China; 3 in India.

Roscoeia alpina Royle, *Illustr. Bot. Himal.* 361, t. 89, f. 1. 1839; Baker in *Hook.f., Fl. Brit. India* 6: 207. 1890.

Biennials, 18-25 cm high; roots fleshy. Leaf blades lanceolate to ovate-lanceolate, subacute; sheaths shorter than the leaf-blades, forming an apparent stem. Flowers 1-5, dark purple. Calyx tube 2.5-4 mm long, split on one side to the base. Corolla tube longer than the calyx; anterior lobes erect, orbicular, 1.3-1.5 cm long; lateral lobes oblong. Labellum 1.5-2 cm long, bifid in lower half. Staminodes circular to elliptic, shorter than lateral lobes. Fertile stamens about as long as the staminodes; anther-cells linear. Style slender; stigma erect, ciliate on margin.

Fl. & Fr.: June - August.

Rare; on stream beds. Mucl-Jarang Ia, 4000 m, 18.08.2002, *K. Chandru Sekar* 102889.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Bhutan; China; Nepal and Pakistan.

52. IRIDACEAE

Fifty two genera and about 1700 species, cosmopolitan especially in S. Africa. E. Mediterranean and C. & S. America; 5 genera and 21 species in India.

Iris L.

About 210 species distributed in Eurasia, N. Africa and N. America; 18 in India.

Iris ensata Thunb. in *Trans. Linn. Soc. London* 2: 328. 1794; *Hook.f., Fl. Brit. India* 6: 272. 1892; *Murri, J'l. Cold Des. W. Himal.* 1: 102. 2001. **Photo. 147**

Perennial herbs; rootstock stout. Stems tufted with fibrous sheaths. Leaves linear, 30-45 cm long, grooved, glaucous. Spathe 8-10 cm long, 2-3-flowered, green; valves lanceolate. Flowers pedicelled, lilac. Perianth lobes 6; outer reflexed, rhomboid-ovate, shorter than claw obtuse; inner lobes oblanceolate; perianth tube absent. Ovary 3-gonous; style arms linear, acutely 2-fid at apex. Capsules cylindrical, 4-8 cm long, 6-ribbed, beaked.

Fl. & Fr.: June - July.

Occasional; along the irrigation channels. Guling, 3700 m, 26.08.2002, *K. Chandra Sekar* 100723.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia.

53. LILIACEAE

About 288 genera and ca 4950 species, cosmopolitan; 45 genera and ca 214 species in India.

- | | |
|---------------------------------|--------------------|
| 1a. Plants more than 30 cm high | 1. <i>Eremurus</i> |
| b. Plants less than 30 cm high | 2 |
| 2a. Flowers white | 3. <i>Lloydia</i> |
| b. Flowers yellow | 2. <i>Gagea</i> |

1. *Eremurus* M. Bieb.

About 45 species distributed in Europe, W. & C. Asia; 2 in India.

Eremurus himalaicus Baker in J. Linn. Soc., London (Bot.) 15: 283. 1876; Hook.f., Fl. Brit. India 6: 332. 1892; Aswal & Mehrotra, Fl. Lahaul-Spiti 592. 1994; Muri, Fl. Cold Des. W. Himal. 1: 111. 2001. *Mobak* Photo. 148

Biennials; rootstock covered by remnants of perioles of former year in its uppermost part. Scapes stout, 0.8-1.8 m high. Leaves radical, broadly linear-lanceolate, 30-50 x 3-5 cm, acute-obtuse. Racemes terminal, dense, 40-50 cm long. Bracts subulate-lanceolate, equalling the pedicels. Flowers 2-3 cm dia., white. Perianth 6-partite; lobes oblong, almost as long as the filament. Stamens 6; filaments dilated at the base. Ovary 3 celled; style filiform; stigma slightly 3 lobed. Capsules 0.8-1.3 cm dia., rugose, loculicidal.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Shrim, 3900 m, 13.07.2003, *K. Chandra Sekar* 103244.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Pakistan and Turkestan.

Note: It is a characteristic plant of dry alpine zone; the distribution of which is restricted to Lahaul, North Kashmir and Chini/Tchalis of Badkhan, and appears to be an endangered species (Aswal & Mehrotra, 1994).

Raw fruits are given in stomach pain.

2. *Gagea* Salisb.

About 70 species distributed in temperate Eurasia; 8 in India.

Gagea kunawurensis (D. Don) Greuter in Israel J. Bot. 19: 155. 1970; Muri, Fl. Cold Des. W. Himal. 1: 114. 2001. *Lloydia kunawurensis* D. Don in Royle, Illustr. Bot. Himal. 388, t. 93, f. 3. 1840. *Gagea persica* Boiss., Diagn. Pl. Or. 1, 7: 108. 1846 & Fl. Orient. 5: 210. 1882; Hook.f., Fl. Brit. India 6: 355. 1892.

Biennials, 10-20 cm high; rootstock bulbous. Stems short, terminating in inflorescence. Leaves linear-lanceolate, as long as the inflorescence, acute. Inflorescence a unilateral dichotomous cyme. Bracts linear, each bearing a flower or a bulbil in its axil. Flowers yellow. Perianth lobes 6, linear, obtuse. Stamens 6; filaments nearly as long as the lobes. Ovary 3-angled, 3-celled; stigma entire. Capsules oblong, nearly as long as the perianth.

Fl. & Fr.: July - August.

Rare; in rock-crevices. Paraliio catchment areas, 26.06.1992, *Nona* 83 (W11).

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Iran; Pakistan and Turkestan.

3. *Lloydia* Salisb. ex Reichb. *nom. cons.*

Twelve species distributed in Eurasia and N. America; 7 in India.

Lloydia serotina (L.) Reichb., Fl. Germ. Excurs. 102. 1830; Aswal & Mehrotra, Fl. Lahaul-Spiti 594. 1994; Murti, Fl. Cold Des. W. Himal. 1: 118. 2001. *Bulbodium serotinum* L., Sp. Pl. 294. 1753.

Biennials, 16-25 cm high, unbranched; bulbs elongated, coats membranous. Basal leaves 1-3, linear, 5-16 cm long; cauline leaves linear. Flowers 1-4, in terminal raceme, nodding, campanulate. Perianth lobes 6, distinct, ultimately spreading, oblanceolate, acute-obtuse, white. Stamens 6; filaments filiform; anthers basifixed. Ovary oblong, 3-celled; stigma capitate. Capsules globose, 3 valved. Seeds compressed.

Fl. & Fr.: July - August.

Rare; in rock-crevices. Chhohem, 4150 m, 13.07.2003, *K. Chandra Sekar* 103233.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia; America and Europe.

54. ALLIACEAE

About 30 genera and 850 species, cosmopolitan; 3 genera and ca 32 species in India.

Allium L.

About 690 species distributed in Eurasia; ca 30 in India.

- | | |
|-------------------------------------|---------------------------|
| 1a. Bulbs with distinct rhizome | 2 |
| b. Bulbs without distinct rhizome | 3. <i>A. stoliczkaei</i> |
| 2a. Plants cultivated; tepals white | 2. <i>A. cepa</i> |
| b. Plants wild; tepals rose | 1. <i>A. carolinianum</i> |

1. *Allium carolinianum* DC. in Red. Lib. 1: 101. 1804; Aswal & Mehrotra, Fl. Lahaul-Spiti 597. 1994; Murti, Fl. Cold Des. W. Himal. 1: 131. 2001. *A. blandum* Wall., Pl. Asiat. Rar. 3: 38, t. 260. 1832; Hook.f., Fl. Brit. India 6: 339. 1892. *Labor Photo. 149*

Perennial aromatic herbs; bulbs cylindrical to ovoid; outer coats coriaceous, dull brown; inner ones membranous. Scapes 27-40 cm high; base covered with leaf bases. Leaves 5 or 6, broadly linear to lanceolate, falcate, obtuse. Heads 1.5-3 cm dia., many-flowered. Tepals lanceolate, 6-7 mm long, rose.

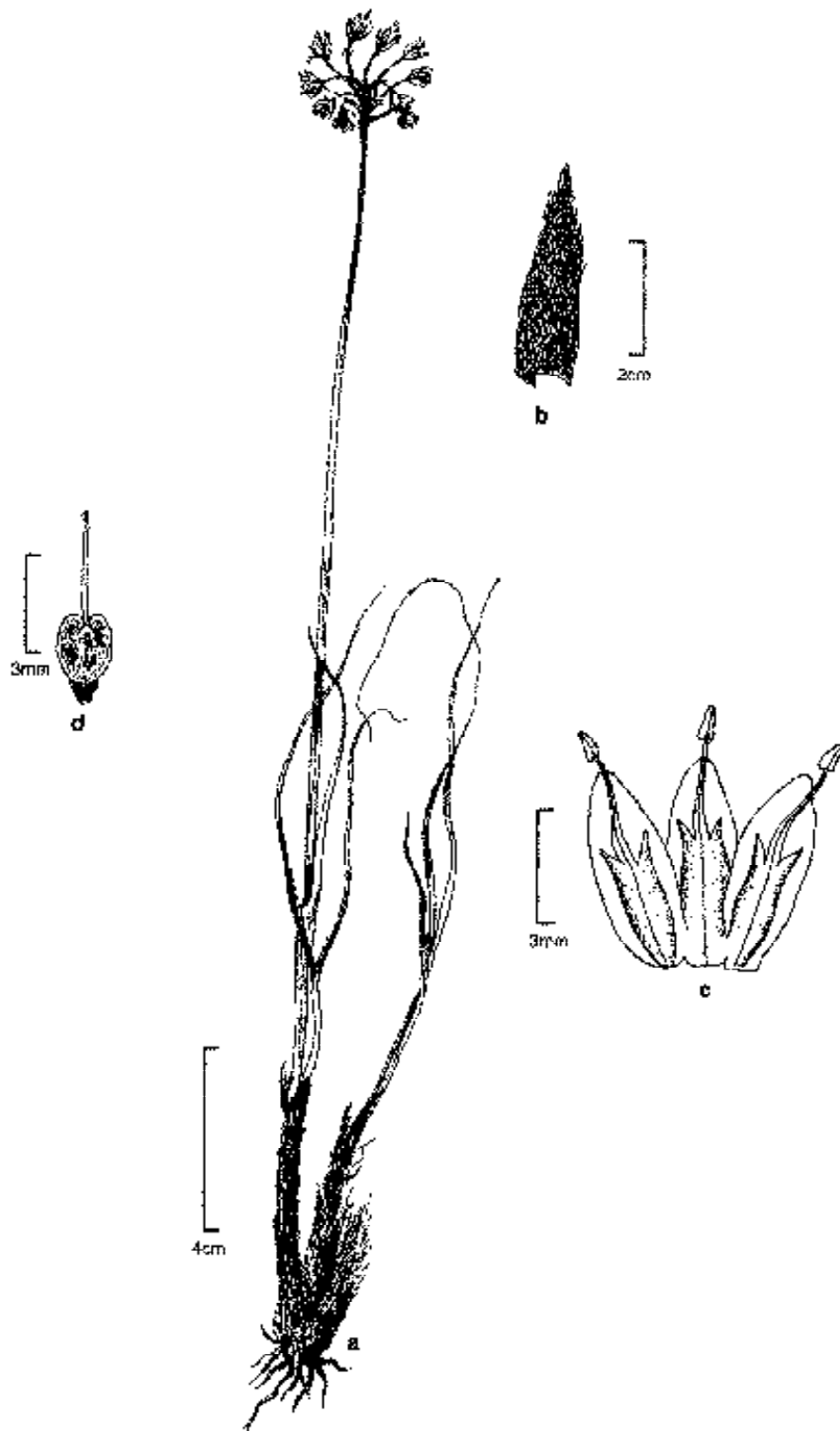


Fig. 15. *Allium stoliczki* Regel a. Habit. b. Coat of bulb, c. Split open perianth with stamens, d. Ovary

Filaments 8-9 mm long, connate at the base, entire. Style exserted; stigma capitate. Capsules globose. Seeds elliptic-ovoid, 2-3 mm long, granular.

Fl. & Fr.: July - August.

Rare; on rocky slopes. Nur Pasture, 4050 m, 21.07.2002, K. Chandra Sekar 100494.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia.

2. *Allium cepa* L., Sp. Pl. 300. 1753; Hook.f., Fl. Brit. India 6: 337. 1892; Aswal & Mehrotra, Fl. Lahaul-Spiti 600. 1994; Murti, Fl. Cold Des. W. Himal. 1: 144. 2001. *Pearl*

Perennial herbs; bulbs clustered, cylindrical to ovoid; coats papery white to brownish. Scapes stout, 60-90 cm high, glabrous, fistular, green. Leaves cylindrical, 12-13 cm long, glabrous, fistular, green. Heads 3-5 cm dia., dense-flowered. Flowers white, stellate; pedicels 1-1.3 cm long. Tepals oblong, 4-5 mm long, obtuse. Filaments exserted, inner 2 toothed at the base. Capsules globose, 2-3.5 mm long.

Fl. & Fr.: July - August.

Cultivated. Mud, 3750 m, 25.08.2002, K. Chandra Sekar 100693.

Distrib.: Cosmopolitan.

3. *Allium stoliczki* Regel in Acta Horti Petrop. 2: 160. 1875; Murti, Fl. Cold Des. W. Himal. 1: 139. 2001. *Chuzekta* Fig. 15

Perennial herbs; bulbs tufted, ovoid, elongated, 2-4 cm long; coats reticulately fibrous, reddish brown. Scapes slender, 20-35 cm high. Leaves 3-6, basal, linear, acute. Heads globose, 1.5-2.5 cm dia., dense flowered. Flowers campanulate, 6-8 mm dia., pink. Tepals oblong-lanceolate, 5-7 mm long, obtuse-acute. Filaments exserted, inserted above the base of the tepals, connate at base. Capsules globose.

Fl. & Fr.: July - August.

Rare; on rocky slopes. Tilling, 3700 m, 26.08.2002, K. Chandra Sekar 100701.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; China and Pakistan.

Paste of fresh bulbs given with curd to enhance vitality in men.

55. JUNCACEAE

Seven genera and about 430 species chiefly in temperate regions; 2 genera and 53 species in India.

Juncus L.

About 300 species, cosmopolitan; ca 28 in India.

- | | | |
|-----|--------------------------|----------------------|
| 1a. | Inflorescence unbranched | 2 |
| b. | Inflorescence branched | <i>J. spiculatus</i> |

- 2a. Anthers less than 2 mm long; capsules straight *2. J. membranaceus*
 b. Anthers 2-3 mm long; capsules arcuate *1. J. concinnus*

1. *Juncus concinnus* D. Don, Prodr. Fl. Nepal. 44. 1825; Hook.f., Fl. Brit. India 6: 399. 1892; Murti, Fl. Cold Des. W. Himal. 1: 149. 2001. *China*

Perennial herbs, 10-20 cm high; stoloniferous. Leaves linear, subtubular to flattened, 5-7 x 1-1.7 mm, acute, glabrous. Head solitary, terminal, 6-9 mm dia., 6-11-flowered. Lowest bract slightly exceeding head, 1.2-1.8 cm long, brown. Flowers subsessile, 5-6 mm long. Perianth lobes subequal; inner slightly exceeding the outer, oblong-lanceolate, subobtus. Anthers 2-3 mm long; filaments exerted, 4-6 mm long. Capsules ovoid-lanceolate, 6-9 x 1.5-2 mm, arcuate.

Fl. & Fr.: June - September.

Occasional; on stream beds. On the way to Bhaba Pass from Farka, 4000 m, 05.08.2002, K. Chandra Sekar 100608.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; Nepal and Pakistan.

Note: This species is quite similar to *J. thomsonii* Buchen. except for difference in the colour of flowers which is brownish in the latter.

2. *Juncus membranaceus* Royle ex D. Don in Trans. Linn. Soc. London 18: 317. 1840; Hook.f., Fl. Brit. India 6: 397. 1892, *p.p.*; Aswal & Mehrotra, Fl. Lahaul-Spiti 605. 1994; Murti, Fl. Cold Des. W. Himal. 1: 152. 2001. *Serbo Mendok* **Photo. 150**

Perennial herbs, 30-40 cm high; stoloniferous. Leaves linear, subtubular to flattened, 0.5-1.3 x 0.1-0.2 cm, acute. Head solitary, terminal, 8-20-flowered. Lowest bract ovate-lanceolate, as long as the head. Flowers subsessile, 6-7 mm long. Perianth lobes subequal; inner slightly exceeding the outer, oblong-lanceolate, subobtus. Stamens included; anthers 1.3-1.4 mm long. Capsules ovoid-lanceolate, 6-8 x 2.5-3 mm, beaked, brown.

Fl. & Fr.: June - September.

Common; on river beds. Sagnam-Gechang, 3750 m, 09.07.2003, K. Chandra Sekar 101168.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan; China; Nepal and Pakistan.

3. *Juncus sphacclatus* Deene. in Jacq., Voy. Inde 172, t. 172. 1844; Hook.f., Fl. Brit. India 6: 398. 1892; Aswal & Mehrotra, Fl. Lahaul-Spiti 606. 1994; Murti, Fl. Cold Des. W. Himal. 1: 155. 2001. *Isa Mendok, Isa Nakpo*

Perennial herbs, 25-38 cm high; stoloniferous. Leaf-blades subrigid, setaceous-canicular, 1.5-2 mm dia., long acuminate; sheaths brown. Heads corymbose to subcorymbose, brown. Lowest bracts exceeding the heads. Flowers subsessile, 6-8 mm long. Perianth lobes subequal; inner slightly longer, lanceolate, subobtus, brown. Stamens slightly shorter than the perianth. Capsules oblong-ovoid, 5-9 x 2-2.5 mm, conic above, with a beak up to 2 mm long, dark red-brown.

Fl & Fr: June - September.

Common; on stream beds. Chhohum, 3975 m, 12.07.2003, K. Chandra Sekar 103203.

Distrib: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan; China; Nepal and Pakistan.

56. ARACEAE

About 105 genera and ca 2550 species distributed in tropical and subtropical regions; 29 genera and ca 126 species in India.

Arisaema Mart.

About 150 species, distributed in North America, Asia and E. Africa; 45 in India.

Arisaema jacquemontii Blume, Rumphia 1: 95. 1836; Hook.f., Fl. Brit. India 6: 505. 1893; Murti, Fl. Cold Des. W. Himal. 1: 163. 2001. *Sboma mendak*

Biennial dioecious herbs, 30-45 cm high; tubers subglobose. Leaves 1-2, digitately compound; leaflets 5-7, unequal, obovate-lanceolate, 7-20 x 2.5 cm, caudate-acuminate; petiole 15-20 cm long. Spathe green, striped with white; tube 3.5 cm long; limb ovate-lanceolate, narrowed into a long, green, thread-like 4-6 cm long tail. Spadix prolonged into a tapering appendage. Male flowers a stipitate head of 3-anthers. Ovary 1-celled. Berries globose, 3.5-4.2 mm dia., red.

Fl & Fr: July - August

Rare; on rocky slopes. Mud-laraag La, 4000 m, 20.08.2002, K. Chandra Sekar 100662.

Distrib: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan; China; Nepal and Pakistan.

57. JUNCAGINACEAE

Four genera and ca 20 species distributed in temperate and cold regions; 1 genus and 2 species in India.

Triglochin L.

Seventeen species, cosmopolitan; 2 in India.

1a. Fruits oblong-ovoid, less than 5 mm long, more than 1.5 mm broad;

carpels separating entirely during dehiscence

1. *T. maritimum*

b. Fruits linear-clavate, more than 5 mm long, less than 1.5 mm broad;

carpels remaining connate with the stigma during dehiscence

2. *T. palustre*

1. *Triglochin maritimum* L., Sp. Pl. 338. 1753; Hook.f., Fl. Brit. India 6: 563. 1893; Aswal & Mehrotra, Fl. Lahaul-Spiti 608. 1994; Murti, Fl. Cold Des. W. Himal. 1: 167. 2001. *Sbulsha*

Perennials; rhizomes stout. Scapes 20-45 cm high. Leaves linear-subulate, 10-18 cm long, terete but slightly flattened at the tip. Racemes 20-35 cm long. Flowers 2-3 mm dia., green. Perianth lobes 6, ovate-elliptic, 2-2.3 x 1.8-2.3 mm, rounded at apex. Carpels 6. Fruits oblong-ovoid, 3-4 x 1.7-2.2 mm with hexagonal margin; mericarps separating completely on dehiscence, slightly grooved on the back, each 1-seeded.

Fl. & Fr.: June - August.

Scarce; in swampy places. Chhobem, 4100 m, 13.07.2003, K. Chandra Sekar 103264.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia; Europe; N. Africa and N. America.

Crushed plants are used as soap.

2. *Triglochin palustre* L., Sp. Pl. 339. 1753; Hook.f., Fl. Brit. India 6: 563. 1885; Aswal & Mehrotra, Fl. Lahaul-Spiti 608. 1994; Murri, Fl. Cold Des. W. Himal. 1: 167. 2001. *T. himalensis* Royle, Illustr. Bot. Himal. 402. 1834. *Cbasa*

Perennial herbs; rhizomes long, slender. Scapes erect, slender, 28-40 cm high. Leaves semi-terete, linear, 8-18 cm long, sheathing at base. Racemes terminal, 20-46-flowered, 15-25 cm long. Perianth lobes 6, elliptic-ovate, 1.5-2 x 1-1.6 mm, green with purple margin. Fruits linear-clavate, 0.6-9.5 x 0.8-1.1 mm, narrowing towards base, appressed to the axis, separating into three mericarps from below upwards, but mericarps remaining connate with stigma after dehiscence; mericarps terete, subulate.

Fl. & Fr.: June - August.

Common; in freshwater marshes. Thango, 3900 m, 02.07.2002, K. Chandra Sekar 100504.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; America; Asia; Europe and N. Africa.

58. ZANNICHELLIACEAE

Four genera and ca 17 species, cosmopolitan; one genus with 1 species in India.

Zannichellia L.

About 5 species, cosmopolitan; 1 in India.

Zannichellia palustris L., Sp. Pl. 969. 1753; Aswal & Mehrotra, Fl. Lahaul-Spiti 611. 1994; Murri, Fl. Cold Des. W. Himal. 1: 179. 2001. *Z. palustris* L. subsp. *pedicellata* Wahlenb. & Rosen in Nov. Act. Soc. Sci. Upsal. 8: 227. 254. 1821; Hook.f., Fl. Brit. India 6: 568. 1864.

Perennial submerged herbs, monoecious; rhizomatous. Leaves opposite or in whorls, linear, sheathing at base; sheaths mostly ligulate at apex. Cymes axillary; spathe cup-shaped, deciduous. Flowers sessile; pedicels 0.4-1 mm long. Male flower of single stamen; filament slender. Female flower of 2-9 carpels; single ovuled, pendulous; style very short, 1.8-2.4 mm long in fruit; stigma peltate, wavy. Achenes 2-5, 1-1.5 mm long.

Fl. & Fr.: June - August.

Common; Gechang, 3800 m, 14.07.2003, K. Chandra Sekar 103294.

Distrib.: Cosmopolitan.

59. CYPERACEAE

Ninety eight genera and ca 4350 species, cosmopolitan, especially in temperate regions; 38 genera and 543 species in India.

1a. Utricles enclosing nut completely

1. *Carex*

b. Utricles enclosing nut partially

2. Kobresia**1. Carex L.**

About 2000 species, cosmopolitan; ca 140 in India.

- 1a. Inflorescence of solitary or paired spikelets 2. *C. microglochin*
 b. Inflorescence of more than 2 spikelets 2
 2a. Cladophylls present; style 3-fid, rarely 2-fid 3
 b. Cladophylls absent; style 2 fid 5. *C. stenophylla*
 3a. Utricle sessile; nut orbicular-ovoid 4. *C. orbicularis*
 b. Utricle subsessile; nut obovate or oblong-elliptic 4
 4a. Utricle long-beaked, mouth bidentate; nut oblong-elliptic 3. *C. nivalis*
 b. Utricle beakless or shortly beaked, mouth truncate or emarginate; nut obovate 1. *C. melanantha*

1. Carex melanantha C.A. Mey. in Ledeb., Fl. Altaica 4: 216. 1833; C.B. Clarke in Hook.f., Fl. Brit. India 6: 733. 1894; Aswal & Mehrotra, Fl. Lahaul-Spiti 618. 1994; Murti, Fl. Cold Des. W. Himal. 1: 198. 2001.

Perennial herbs, 25-40 cm high; rhizomes elongated. Stems trigonous. Leaves flat, linear. Racemes 4-5 cm long. Spikelets 3-5, upper fastigate, 0.6-1.5 cm long; lateral female. Female glumes ovate-lanceolate, 3.5-4 mm long, acute or shortly acuminate, margin hyaline, brown. Style slender; stigmas 3. Utricle sessile, trigonous, obovate-elliptic, beakless or shortly beaked, membranous, inflated, yellowish. Nuts subsessile, trigonous, obovoid, 2-2.5 mm long, brownish.

Fl. & Fr.: July - August.

Scarce; on moist sandy soil along streams. Chhohem, 4000 m, 12.07.2003, K. Chandra Sekar 103227.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan; China; Nepal; Pakistan; Siberia and Turkey.

2. Carex microglochin Wahlenb. in Vet. Akad. Handl. Stokh. 24: 140. 1803; C.B. Clarke in Hook.f., Fl. Brit. India 6: 711. 1894; Aswal & Mehrotra, Fl. Lahaul-Spiti 619. 1994; Murti, Fl. Cold Des. W. Himal. 1: 200. 2001.

Perennial herbs, 8-15 cm high; rhizomes elongated, woody. Stems obscurely trigonous. Leaves flat, linear. Racemes 8-12 cm long, solitary or paired spikelets. Spikelets terminal, 0.7-1 cm long. Female glumes ovate, 2.5-3 mm long, obtuse, hyaline at margin, brown. Style slender; stigmas 3. Utricle sessile, trigonous, beaked, membranous, inflated, brown. Nuts subsessile, oblong-ellipsoid, 1-2 mm long.

Fl. & Fr.: July - August.

Scarce; on moist sandy slopes. Chhohem, 4100 m, 13.07.2003, K. Chandra Sekar 103263.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan; Canada; China; Italy; Nepal; N. America; Pakistan; Sweden and U.S.S.R.

3. Carex nivalis Boott in Proc. Linn. Soc. Bot. 1: 256. 1846; C.B. Clarke in Hook.f., Fl. Brit. India 6: 732. 1894, *p.p.*; Aswal & Mehrotra, Fl. Lahaul-Spiti 619. 1994; Murti, Fl. Cold Des. W. Himal. 1: 201. 2001.

Birsen Nalabo Tsa

Perennial herbs, 0.8-1.3 m high; rhizomes short, woolly. Stems trigonous. Leaves clustered at base, flat or conduplicate, linear to linear-lanceolate. Racemes 3-6 cm long. Lower bracts foliaceous. Spikelets 3-5, solitary or paired. Female glumes lanceolate-oblong or oblong-elliptic, mucronate, involute at margin, purple-black. Style slender; stigmas 3. Utricle sessile, trigonous, long beaked, membranous, compressed. Nuts stipitate, oblong-ellipsoid, trigonous.

Fl. & Fr.: July - August.

Occasional; in alpine meadows. Larang Ja - Tariya, 4000 m, 06.08.2003, K. Chandra Sekar 103749.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Afghanistan; China; Nepal and Pakistan

A good fodder.

4. *Carex orbicularis* Boott in Proc. Linn. Soc. Bot. 1: 254, 1845 & in Trans. Linn. Soc. Bot. 20: 134, 1846; Aswal & Mehrotra, Fl. Lahaul-Spiti 621, 1994; Murri, Fl. Cold Des. W. Himal. 1: 203, 2001. *C. erostriata* Boott ex C.B. Clarke in Hook.f., Fl. Brit. India 6: 711, 1894. *C. vulgaris sensu* C.B. Clarke in Hook.f., Fl. Brit. India 6: 711, 1894, *non* Fries 1842. *C. rigida sensu* C.B. Clarke in Hook.f., Fl. Brit. India 6: 711, 1894, *non* Crowden 1894.

Perennial herbs, 60-80 cm high, stoloniferous. Stems trigonous. Leaves flat, linear-lanceolate. Racemes 3-5 cm long. Lowest bracts foliaceous. Spikelets 3-5, oblong or globose, upper 2 appressed; lower one distant; terminal male; lateral female. Female glumes oblong-ovate, obtuse, black-brown. Style thickened at base; stigmas 3. Utricle sessile, globose ovoid, membranous, inflated. Nuts sessile, orbicular-ovoid, trigonous.

Fl. & Fr.: July - August.

Scarce; in moist sandy slopes. Chhohem, 4100 m, 13.07.2003, K. Chandra Sekar 103250.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia.

5. *Carex stenophylla* Wäbl. in Vet. Acad. Nya Handl. Stockh. 24: 142, 1803; C.B. Clarke in Hook.f., Fl. Brit. India 6: 700, 1894, *pp.*; Aswal & Mehrotra, Fl. Lahaul-Spiti 623, 1994; Murri, Fl. Cold Des. W. Himal. 1: 209, 2001. *C. bosa*

Perennial herbs, 15-20 cm high; rhizomes elongated, woody, creeping. Stems trigonous. Leaves flat, linear, as long as the stem. Spikes 7-15 cm long, ebracteate. Spikelets 5-6. Female glumes ovate-lanceolate, 3.2-3.8 mm long, acute, hyaline at margin. Style slender; stigmas 2. Utricle stipitate, plano-convex, beaked, subinflated, brown, turning to black. Nuts stipitate, oblong-ovoid, 1.5-2 mm long, black.

Fl. & Fr.: June - August.

Occasional; on moist sandy slopes. Chhohem, 4100 m, 13.07.2003, K. Chandra Sekar 103279.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Asia; Europe and N. America.

2. *Kobresia* Willd.

About 35 species, chiefly distributed in temperate regions; ca 25 in India.

- 1a. Stems covered by blade bearing sheaths at base 1. *K. laxa*
 b. Stems covered by bladeless sheaths at base 2. *K. schoenoides*

1. ***Kobresia laxa*** Nees in Wight, Contr. Bot. Ind. 119, 1834; C.B. Clarke in Hook.f., Fl. Brit. India 6: 698, 1894; Aswal & Mehtoura, Fl. Lahaul-Spiti 629, 1994; Murti, Fl. Cold Des. W. Himal. 1: 225, 2001.

Perennial herbs, 30-40 cm high; rhizomes short, woody. Stems trigonous, scaberulous on the angles above. Leaves clustered at base, flat, linear. Spike interrupted. Spikes 6-10. Spikelets many, linear-oblong. Glumes lanceolate-ovate, acute, hyaline on margin. Style cylindrical; stigmas 3. Prophylls sessile, obscurely trigonous, 4.5-5 mm long. Nuts linear-oblong, 2.5-3 mm long.

Fl. & Fr.: July - August.

Common; on moist sandy slopes. Tatiya in Pin-Parvati Pass, 4200 m, 24.07.2003, *K. Chandra Sekar* 103657.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; Nepal and Pakistan.

2. ***Kobresia schoenoides*** Steud., Synop. Cyper. 246, 1855; C.B. Clarke in J. Linn. Soc., London (Bot.) 20: 378, 1883 & in Hook.f., Fl. Brit. India 6: 697, 1894, *p.p. excl. syn. Fijina schoenoides* C.A. Mey. in Ledeb., Fl. Altaica 4: 235, 1833. **Photo. 151**

Perennial herbs, 50-70 cm high; rhizomes short, woody. Stems compressed, trigonous. Leaves clustered at base, flat or conduplicate, linear. Spikes 3-5 flowered, 1 pistillate and others staminate, terminal male, lateral androgynous. Glumes oblong, obtuse, hyaline at margin, fuscous. Style cylindrical; stigmas 3. Prophylls oblong, connate at base, obtuse, hyaline at apex. Nuts sessile, trigonous, oblong-obovoid, 2.5-3 mm long.

Fl. & Fr.: July - August.

Scarce; on sandy glacial moraines. Chhohem, 4050 m, 13.07.2003, *K. Chandra Sekar* 103236.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Bhutan; China; Nepal; Pakistan; Siberia and U.S.S.R.

60. POACEAE

About 668 genera and 9500 species, cosmopolitan; 263 genera and 1291 species in India.

- 1a. Spikelets with 1 to many florets, breaking up at maturity above the glumes or if falling entire then not 2 florets, if 2 florets then both bisexual or the upper barren 2
 b. Spikelets with 2 florets, falling entire at maturity; both florets bisexual or upper floret bisexual, lower floret male or barren 2:
 2a. Ovary with a fleshy hairy apical appendage; style arising from beneath 3
 b. Ovary without a fleshy hairy apical appendage; style terminal 7
 3a. Inflorescence an open or contracted panicle 7. **Bromus**
 b. Inflorescence a spike or raceme 4

4a. Spikelets solitary at the nodes of the rachis, borne upon a pedicel 1-3 mm long, with several florets	6. Brachypodium
b. Spikelets 1-several at the nodes of the rachis, quite sessile or if on a short pedicel either with 1 floret or borne in pairs at least in the middle of the spike	5
5a. Spikelet with 1 floret	20. Hordeum
b. Spikelet with 3-7 florets	6
6a. Glumes 1-nerved	22. Leymus
b. Glumes more than 1-nerved	14. Elymus
7a. Spikelets containing 1 fertile floret	8
b. Spikelets containing 2 or more fertile flowers (rarely 1, but this succeeded by several sterile lemmas reduced to a clavate mass in <i>Melica</i>)	20
8a. Inflorescence a spike	11. Cynodon
b. Inflorescence a panicle	9
9a. Lemma indurated at maturity or if hyaline, then 2-lobed with the lobes produced as 2 stout scabrid bristles	10
b. Lemma hyaline or membranous at maturity, not 2-lobed	11
10a. Spikelets dorsally compressed; callus glabrous	24. Oryzopsis
b. Spikelets laterally compressed; callus densely bearded	30. Stipa
11a. Spikelets with 1 floret	12
b. Spikelets with more than 1 floret	15
12a. Panicle very dense	13
b. Panicle lax	14
13a. Spikelets falling entire at maturity	2. Alopecurus
b. Spikelets breaking up above the persistent glumes	26. Phleum
14a. Spikelets 4-9 mm long; callus bearded	8. Calamagrostis
b. Spikelets 1.5-3.5 mm long; callus not bearded	1. Agrostis
15a. Spikelets with 3 flowers	19. Hierochloa
b. Spikelets with 2 to several flowers	16
16a. Annuals	4. Avena
b. Perennials	17
17a. Lemma lobes lacerate	12. Deschampsia
b. Lemma lobes acute to aristulate	18

- | | |
|---|---------------------------|
| 18a. Lemma awnless or with an awn of up to 1.2 mm long | 21. Koeleria |
| b. Lemma with an awn of 0.4-2.2 cm long | 19 |
| 19a. Spikelets 0.9-2.8 cm long | 18. Helictotrichon |
| b. Spikelets 4-8.5 mm long | 32. Trisetum |
| 20a. Plants tall reed-like with large plumose panicle | 21 |
| b. Plants slender without large plumose panicle | 22 |
| 21a. Ligules membranous | 3. Arundo |
| b. Ligules a line of hairs | 27. Phragmites |
| 22a. Lemma 1-3-nerved | 23 |
| b. Lemma 5 to many-nerved | 24 |
| 23a. Lemma entire at apex | 15. Eragrostis |
| b. Lemma 2-toothed at apex | 31. Tripogon |
| 24a. Sheaths open along the edges | 25 |
| b. Sheaths tubular, fused along the margin | 23. Melica |
| 25a. Lemma strongly keeled all along the back | 28. Poa |
| b. Lemma rounded on the back | 26 |
| 26a. Annuals | 16. Eremopoa |
| b. Perennials | 17. Festuca |
| 27a. Spikelet solitary | 28 |
| b. Spikelets paired | 30 |
| 28a. Spikelets subtended by 1-many bristles | 29 |
| b. Spikelets not subtended by bristles | 13. Digitaria |
| 29a. Bristles persisting on the axis after spikelets falling | 29. Setaria |
| b. Bristles falling with the spikelets | 25. Pennisetum |
| 30a. Racemes arranged in a panicle with its common axis longer than the lowest raceme, not supported by spathes | 9. Chrysopogon |
| b. Racemes solitary, paired or subdigitate, often supported by spathes | 31 |
| 31a. Racemes with an involucre composed of 2 homogamous pairs of spikelets | 5. Bothriochloa |
| b. Racemes reduced to 3 heteromorphic spikelets enclosed in a boat-shaped spathe | 10. Cymbopogon |

1. *Agrostis* L.

About 220 species mainly in temperate and tropical regions; 22 in India.

Agrostis L. and *Calamagrostis* Adans. differ in habit, the former typically with an open panicle and a preference for drier habitats whereas the latter is with contracted to spiciform or capitate panicle and preferring damper habitats. They intergrade completely, *Agrostis* L. is best distinguished by its thinner Lemma.

- | | |
|--|--------------------------|
| 1a. Lemma hairy | 1. <i>A. pilosula</i> |
| b. Lemma glabrous | 2 |
| 2a. Palea minute, much less than half as long as the lemma | 3. <i>A. vincalis</i> |
| b. Palea at least half as long as the lemma | 2. <i>A. stolonifera</i> |

1. ***Agrostis pilosula*** Trin. in Mem. Acad. Sci. St.-Petersbourg, Ser. 6, 6: 372. 1841; Aswal & Mehrotra, Fl. Lahaul-Spiti 642. 1994; Murti, Fl. Cold Des. W. Himal. 1: 250. 2001. *Calamagrostis jacquemontii* Hook.f., Fl. Brit. India 7: 264. 1896.

Annuals, tufted. Culms geniculately ascending, 40-60 cm high. Leaf-blades flat, 8-50 x 0.2-0.5 cm, scabrid; ligules 4-6 mm long, truncate. Panicle broadly ovate-lanceolate, 10-28 cm long. Spikelets 2.5-3.5 mm long, breaking up at maturity above the persistent glumes. Glumes acute, awnless, scabrid on the keels. Lemma 2-3 mm long, acute, hairy; awn 4-6 mm long, twisted below. Palea 1-2 mm long. Anthers 1-1.5 mm long.

Fl. & Fr.: July - September.

Occasional; on rocky slopes. Thango - Shrim, 3900 m, 11.07.2003, K. Chandra Sekar 101180.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Kerala, Sikkim, Tamil Nadu, Uttarakhand and Uttar Pradesh; Bhutan; China; Nepal and Pakistan.

2. ***Agrostis stolonifera*** L., Sp. Pl. 62. 1753; Bor, Grass. Burma, Ceylon, India & Pakistan 390. 1960; Aswal & Mehrotra, Fl. Lahaul-Spiti 642. 1994; Murti, Fl. Cold Des. W. Himal. 1: 251. 2001. *Chusa, Shuk. var.*

Perennials, tufted, stoloniferous. Culms erect or geniculately ascending, 46-70 cm high, smooth. Leaf-blades flat, 1.5-9.5 x 0.1-0.4 cm, sparsely scaberulous; ligules 1.5-4.5 mm long. Panicle linear to lanceolate, 3-11 cm long, the branches clustered. Spikelets 2-3 mm long, breaking up at maturity above the persistent glumes. Glumes acute, awnless, rough on the keels. Lemma 1.5-2.5 mm long, very blunt. Palea half to two-third the length of the lemma. Anthers 1-1.5 mm long.

Fl. & Fr.: July - September.

Occasional; on rocky slopes. Gechang, 3730 m, 16.07.2002, K. Chandra Sekar 100468.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Kerala, Sikkim, Tamil Nadu, Uttarakhand and Uttar Pradesh; Asia; Europe and N. America.

3. ***Agrostis vincalis*** Schreb., Spicil. Fl. Lips. 47. 1771; Aswal & Mehrotra, Fl. Lahaul-Spiti 643. 1994; Murti, Fl. Cold Des. W. Himal. 1: 252. 2001. *A. canina sensu* Hook.f., Fl. Brit. India 7: 255. 1896, *non* L. 1753.

Perennials, tufted; rhizomes creeping. Culms erect or geniculately ascending, 35-55 cm high, smooth. Leaf-blades flat, 2-13 x 0.1-0.35 cm; ligules 1-4 mm long, obtuse. Panicle lanceolate to narrowly ovate, 3-20 cm long, green-purplish or brown. Spikelets 2-3.3 mm long, breaking up at maturity above the

persistent glumes. Glumes lanceolate, acute. Lemma 1.5-2.5 mm long, very blunt, awnless or with a fine bent awn 2-3 mm long arising from slightly below the middle. Palea minute. Anthers 1-1.5 mm long.

Fl & Fr: July - September.

Rare; on stream beds. Tilling, 3700 m, 26.08.2002, K. Chandra Sekar 100698.

Distrib: India: Himachal Pradesh, Jammu & Kashmir, Tamil Nadu and Uttarakhand; Asia and Europe.

2. *Alopecurus* L.

Thirty six species distributed in N. temperate regions; 6 in India.

Alopecurus arundinaceus Poir. in Lam., Encycl. Meth. Bot. 8: 776. 1808; Bot. Grass. Burma, Ceylon, India & Pakistan 393. 1960; Aswal & Mehroua, Fl. Lahaul Spiti 643. 1994.

Perennials. Culms erect, 56-75 cm high, not rooting from the nodes. Leaf-blades 6-35 x 0.4-1.1 cm, glabrous; ligules 2-4.5 mm long, obtuse. Panicle broadly cylindrical, 2-8 x 0.8-1.3 cm. Spikelets 4-6 mm long. Glumes acute, slightly divergent at apex; keels and nerves covered with silky hairs up to 2 mm long. Lemma 4-6.2 mm long, slightly obliquely truncate; awn exceeding the tip of the lemma by up to 4.5 mm, but included in the glumes. Anthers 2-3.5 mm long.

Fl & Fr: July - September.

Scarce; on rocky slopes. Tariya, 4000 m, 25.07.2003, K. Chandra Sekar 103686.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia and Europe.

3. *Arundo* L.

Three species distributed in Mediterranean region; 1 in India.

Arundo donax L., Sp. Pl. 81. 1753; Hook.f., Fl. Brit. India 7: 302. 1896; Bot. Grass. Burma, Ceylon, India & Pakistan 413. 1960.

Perennials; rhizomes woody. Culms erect, 2-3 m high. Leaf-blades distichous, linear-lanceolate, 30-50 x 3-4 cm, glabrous, smooth. Panicle 30-50 x 5-8 cm. Spikelets 1-1.5 cm long. Glumes subequal, lanceolate to ovate-lanceolate, 0.9-1.2 cm long; lower glume a little shorter than the upper one. Lemma lanceolate, 0.8-1.2 cm long, hairy all over the back below the middle, 3-5-nerved.

Fl & Fr: July - September.

Scarce; on rocky slopes. Mud, 3750 m, 25.08.2002, K. Chandra Sekar 100688.

Distrib: Throughout India; Tropical Asia; Mediterranean region eastwards to Myanmar; North Africa; introduced into many parts of the World.

4. *Avena* L.

About 25 species distributed in Mediterranean and middle east, extending to northern Europe and widely introduced to other temperate regions; 5 in India.

Avena fatua L. subsp. *meridionalis* Malz. in Bull. Appl. Bot. Gen. Pl. Br., Suppl. 38: 304. 1930; Tzvelev, Poaceae URSS 239. 1976. *Avena meridionalis* (Malz.) Rozhev. in Fedtsch. & al. Fl. Turkmen. 1: 105. 1932; Bot. Grass. Burma, Ceylon, India & Pakistan 434. 1960. *Her kasampa* Fig. 16

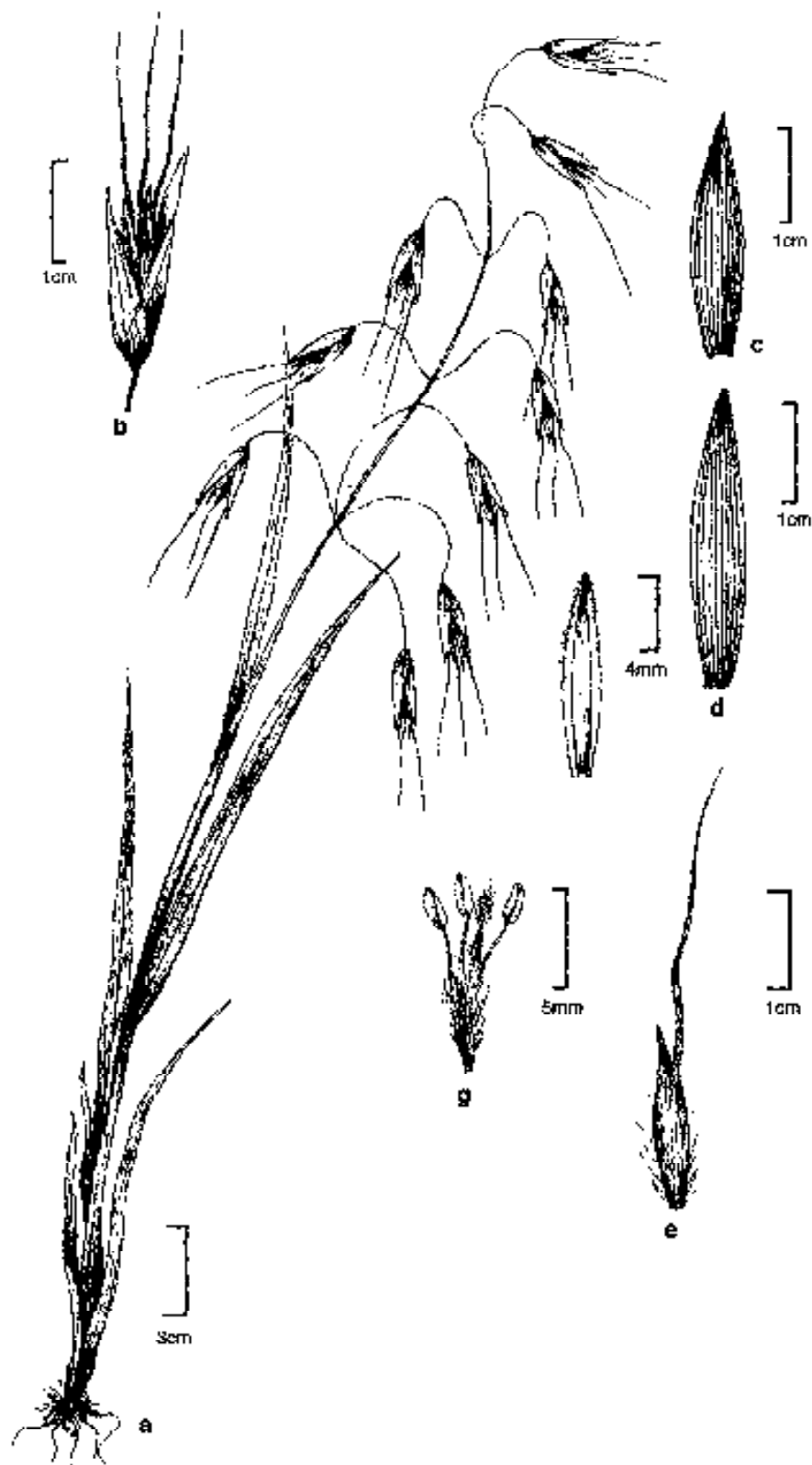


Fig. 15. *Avana fatua* L. subsp. *meridionalis* Matz. a. Habit, b. Spikelet, c. Lower glume, d. Upper glume, e. Lemma, f. Palea, g. Flower

Annuals. Culms erect or geniculately ascending, 40-70 cm high, simple. Leaf-blades 10-35 x 0.2-1 cm, glabrous; ligules 3-6 mm long. Panicle nodding, broadly pyramidal, 10-25 cm long. Spikelets with 2 or 3 florets, pendulous, 2.5-3 cm long, the rachilla articulated beneath. Glumes lanceolate, finely acute. Lemma 1.6-2.5 cm long, densely bearded around the callus with 2-5 mm long brown hairs; awn 2-4 cm long, geniculate; column dark brown.

Fl. & Fr.: July - September.

Scarce; on stream beds. Tilling, 3800 m, 26.08.2002, K. Chandra Sekar 100707.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Asia; East Africa and introduced into America.

5. *Bothriochloa* Kuntze

About 35 species mainly in subtropical regions; 14 in India.

- 1a. Lower glume of sessile spikelet with a pit 2. *B. pernisa*
 b. Lower glume of sessile spikelet without pit 1. *B. ischaemum*

1. *Bothriochloa ischaemum* (L.) Keng in Contr. Biol. Lab. Sci. Soc. China, Bot. Ser. 10: 201. 1936; Bor, Grass. Burma, Ceylon, India & Pakistan 108. 1960; Aswal & Mehrotra, Fl. Lahaul-Spiti 645. 1994; Murti, Fl. Cold Des. W. Himal. 1: 264. 2001. *Andropogon ischaemum* L., Sp. Pl. 1047. 1753; Hook.f., Fl. Brit. India 7: 171. 1896.

Perennials, tufted. Culms geniculately ascending, 40-60 cm high. Leaf-blades 2-8 x 0.2-0.35 cm. Racemes subdigitate, 3-4 cm long; peduncles glabrous. Spikelets of two kinds, sessile and pedicelled. Sessile spikelets oblong-lanceolate, 3.5-4.5 mm long; lower glume lanceolate-ovate, 4-4.5 mm long, acute, hairy below the middle, chartaceous, not glossy, without a pit; upper glume lanceolate-ovate, 4-4.5 mm, acute-acuminate, hairy. Pedicelled spikelets glabrous on the back, without a pit.

Fl. & Fr.: July - September.

Scarce; on stream beds. Saguam, 3650 m, 27.08.2002, K. Chandra Sekar 100728.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia; Europe and North Africa.

2. *Bothriochloa pernisa* (L.) A. Camus in Ann. Soc. Linn. Lyon n.s. 76: 164. 1931; Bor, Grass. Burma, Ceylon, India & Pakistan 108. 1960; Murti, Fl. Cold Des. W. Himal. 1: 265. 2001. *Ulochea pernisa* L., Mant. 2: 301. 1771.

Perennials, stoloniferous. Culms erect-ascending, 40-60 cm high. Leaf-blades 0.5-2.5 x 0.25-0.4 cm, the lower shorter than the upper and crowded at the base of the culm. Racemes subdigitate, 2.5-5 cm long, pilose. Spikelets of two kinds; sessile and pedicelled. Sessile spikelet narrowly elliptic, 3.5-4.5 mm long; lower glume lanceolate-obovate, 4-4.2 mm long, hairy below the middle, cartilaginous, with a deep circular pit above middle; upper glume lanceolate-ovate, 3-4 mm long, acute-acuminate, hairy. Pedicelled spikelet glabrous on the back, pitted.

Fl. & Fr.: June - October.

Scarce; on rocky slopes. Mane, 3650 m, 27.08.2002, K. Chandra Sekar 100754.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Arabia eastwards to S.E. Asia.

2. *Brachypodium* P. Beauv.

Seventeen species distributed in temperate Eurasia and tropical America; 3 in India.

- 1a. Leaf-sheaths and culms glabrous; awn of lemma shorter than the lemma 1. *B. pinnatum*
 b. Leaf-sheaths and culms hairy; awn of lemma equal or longer than the lemma 2. *B. sylvaticum*

1. *Brachypodium pinnatum* (L.) P. Beauv., Ess. Agrost. 101, 155. 1812; Hook.f., Fl. Brit. India 7: 363. 1896; Bor, Grass. Burma, Ceylon, India & Pakistan 450. 1960; Chandra Sekar & al. in Phytotaxon, 3: 61. 2003. *Bromus pinnatus* L., Sp. Pl. 78. 1753. **Fig. 17**

Perennials, rhizomatous. Culms geniculately ascending, 60-95 cm high, glabrous, with a dark brown ring on node. Leaf-blades 11-20 x 0.2-0.3 cm, loosely hairy above, glabrous beneath; sheaths glabrous. Spikelets 2-6 cm long with 6-14 florets. Lower glume lanceolate, 0.9-1.1 cm long, sharply pointed, 1-nerved; upper glume narrowly oblong, 1.1-1.3 cm long, short-awned, 3-nerved. Lemma oblong-lanceolate, 1.3-1.5 cm long, tipped by an awn up to 6 mm long. Palea shorter than the lemma. Anthers 1-2 mm long.

Fl. & Fr: June - September.

Scarce; on stream beds. Mud to Pin-Parvati Pass, 4700 m, 16.08.2002, *K. Chandra Sekar* 102968.

Distrib: India: Himachal Pradesh and Jammu & Kashmir; Asia and Europe.

2. *Brachypodium sylvaticum* (Huds.) P. Beauv., Ess. Agrost. 101, 155. 1812; Hook.f., Fl. Brit. India 7: 362. 1896; Bor, Grass. Burma, Ceylon, India & Pakistan 450. 1960; Aswal & Mehrotra, Fl. Lahaul-Spiti 646. 1994; Murri, Fl. Cold Des. W. Himal. 1: 266. 2001; Chandra Sekar & al. in Phytotaxon, 3: 61. 2003. *Festuca sylvatica* Huds., Fl. Angl. 1: 38. 1762.

Perennials, without rhizomes. Culms erect or ascending, 40-90 cm high, hairy. Leaf-blades 14-22 x 0.3-0.4 cm; sheaths hairy. Spikelets 2-4 cm long with 8-16 florets. Lower glume lanceolate, 6-8 mm long, sharply pointed, 5-7-nerved; upper glume narrowly oblong, 0.8-1.1 cm long, short-awned, 7-9-nerved. Lemma oblong-lanceolate, 0.7-1.1 cm long, acute, tipped by an awn up to 1.2 cm long. Anthers 3.5-4 mm long.

Fl. & Fr: June - September.

Occasional; on moist slopes. Chhokem, 4400 m, 14.07.2003, *K. Chandra Sekar* 103291.

Distrib: India: Himachal Pradesh, Jammu & Kashmir, Meghalaya, Nagaland, Sikkim, Tamil Nadu and Uttarakhand; Asia and Europe.

Note: This is an extremely variable species. Hooker (*loc.*) mentioned four varieties under *B. sylvaticum* (Huds.) P. Beauv., which differ in length of awn, callus of the floret, their indumentum, sessile or pedicelled spikelets etc. Bor (*loc.*) merged all four varieties, which is further supported by Cope (1982). The detailed critical study of the specimens lodged in BSID and DID also reveal overlapping characters of the species which do not support any varietal splitting as earlier observed by Bor (*loc.*) and Cope (1982).

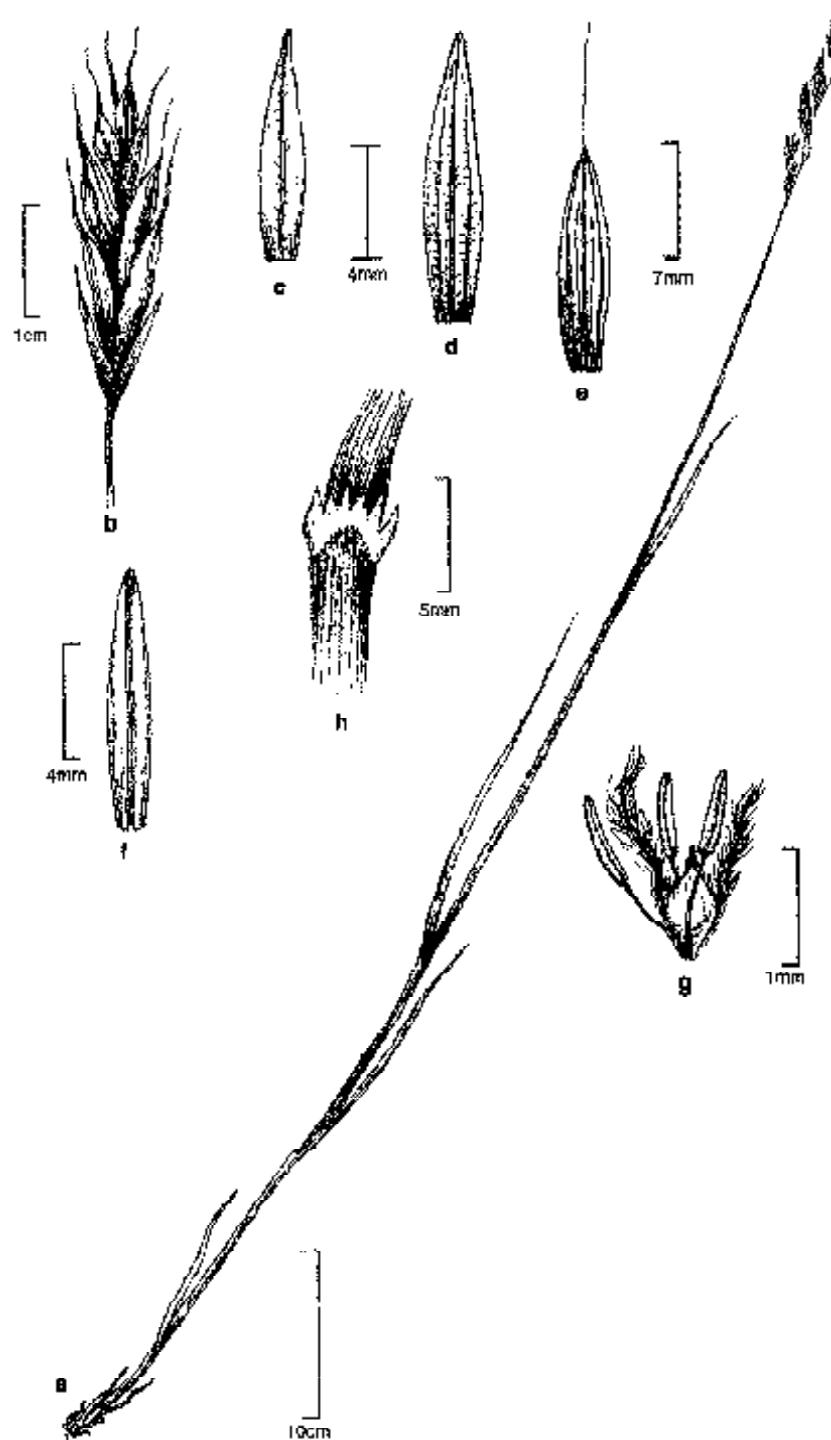


Fig. 17. *Brachypodium pinnatum* P. Beauv. a. Habit, b. Spikelet, c. Lower glume, d. Upper glume, e. Lemma, f. Palea, g. Flower, h. Ligule

7. *Bromus* L.

About 100 species distributed in temperate regions of both hemispheres; 16 in India.

- | | |
|-------------------------------|-------------------------|
| 1a. Upper lemma 3-awned | 1. <i>B. danthoniae</i> |
| b. Upper lemma 1-awned | 2 |
| 2a. Spikelets wedge shaped | 3. <i>B. tectorum</i> |
| b. Spikelets not wedge-shaped | 2. <i>B. japonicus</i> |

1. *Bromus danthoniae* Trin. in C.A. Mey. Verz. Pfl. Cauc. 24. 1831; Bor, Grass. Burma Ceylon, India & Pakistan 454. 1960; Murri, Fl. Cold Des. W. Himal. 1: 270. 2001. **Photo. 152**

Annuals. Culms erect or geniculate ascending, up to 23 cm high. Leaf-blades 3-12 x 0.2-0.3 cm. Panicle ovate, 3-11 cm long. Spikelets oblong-elliptic, 15-30 mm long (excluding the awns). Lower glume lanceolate, 5-8 mm long, 3-5 nerved; upper glume narrowly ovate, 6.5-9 mm long, 7-9-nerved. Lemma 0.9-1.2 cm long, 3-awned, 9-11-nerved. Palea shorter than the lemma, ciliolate on keels. Anthers 1-1.8 mm long.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Chholem, 4050 m, 13.7.2003, K. Chandu Sekar 101195.

Distrib.: India: Himachal Pradesh; China; Middle east to Southern U.S.S.R. and Pakistan.

2. *Bromus japonicus* Thunb. ex Murr., Syst. Veg. 119. 1784; Bor, Grass. Burma, Ceylon, India & Pakistan 455. 1960; Aswal & Mehrotra, Fl. Lahaul-Spiti 649. 1994; Murri, Fl. Cold Des. W. Himal. 1: 273. 2001.

Annuals. Culms erect or geniculate ascending, 45-65 cm high. Leaf-blades 10-18 x 0.1-0.35 cm. Panicle 6-19 cm long, lax and spreading. Spikelets ovate to oblong-lanceolate, 1.2-3 cm long (excluding the awns) with 7-15 florets. Lower glume lanceolate, 4-6 mm long, 3-nerved, upper glume ovate, 5-7.5 mm long, 7-nerved. Lemma elliptic-oblong, 7.5-10 mm long, hyaline at margin, minutely 2-toothed at apex, coriaceous, 7-nerved; awn subapical. Palea ciliolate on keels. Anthers 0.5-1.3 mm long.

Fl. & Fr.: July - August.

Scarce; on stream beds. Mud-Tilling, 3800 m, 26.08.2002, K. Chandu Sekar 102956.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia; Europe eastwards to Japan and North America.

3. *Bromus tectorum* L., Sp. Pl. 77. 1753; Hook.f., Fl. Brit. India 7: 359. 1896; Bor, Grass. Burma, Ceylon, India & Pakistan 456. 1960; Aswal & Mehrotra, Fl. Lahaul-Spiti 651. 1994; Murri, Fl. Cold Des. W. Himal. 1: 276. 2001.

Annuals. Culms erect, 30-40 cm high. Leaf-blades 8-16 x 0.2-0.3 cm. Panicle nodding, 2-5 cm long. Spikelets narrowly wedge-shaped with 4-8 florets. Glumes with silvery hyaline margin; lower glume narrowly lanceolate, 5-8 mm long, 1-nerved; upper glume narrowly oblong-lanceolate, 0.7-1.1 cm long, 3-nerved. Lemma linear-lanceolate, 0.9-1.4 cm long, 2-toothed at the apex, silvery hyaline at margin, 7-nerved, herbaceous; awn as long as or slightly longer than lemma. Palea shorter than lemma, ciliolate on keels. Anthers 0.5-1 mm long.

Fl. & Fr.: June - August.

Scarce; on rocky slopes. Bolnar, 3850 m, 01.08.2002, *K. Chandra Sekar* 100557.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; C. Asia; Europe; Mediterranean region and Siberia eastward to China.

8. *Calamagrostis* Adans.

About 230 species distributed in temperate regions and tropical mountains; 9 in India.

- | | |
|--|-------------------------------|
| 1a. Callus hairs 2 or 3 times longer than the length of the floret | 2 |
| b. Callus hairs as long as the floret or shorter than the floret | 4. <i>C. stoliczkaei</i> |
| 2a. Awn of the lemma less than the length of the floret | 3 |
| b. Awn of the lemma more than the length of the floret | 1. <i>C. emodensis</i> |
| 3a. Awn emerging from the tip of the lemma | 3. <i>C. pseudophragmites</i> |
| b. Awn not emerging from the tip of the lemma | 2. <i>C. epigejos</i> |

1. *Calamagrostis emodensis* Griseb. in Nachr. Ges. Wiss. Göttingen 80. 1868; Bor, Grass. Burma, Ceylon, India & Pakistan 395. 1960; Aswal & Mehrotra, Fl. Lahaul-Spiti 652. 1994; Murti, Fl. Cold Des. W. Himal. 1: 279. 2001. *Tarax Frim*

Perennials, tufted; rhizomes creeping. Culms erect, 0.7-1 m high. Leaf-blades flat, 15-42 x 0.7-1.1 cm, scabrid above; ligules 1-3 mm long, obtuse. Panicle nodding, ovate to lanceolate, 13-30 cm long, faintly purple-tinged. Spikelets 5-8 mm long. Glumes unequal, subulate-lanceolate, scaberulous on the keels. Lemma about half the length of the glumes, 2-toothed at apex; awn 4-9 mm long, arising above the middle of the lemma and below the top third.

Fl. & Fr.: July - September.

Common; on rocky slopes. Thango, 3950 m, 18.07.2002, *K. Chandra Sekar* 100483.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; Nepal and Pakistan.

2. *Calamagrostis epigejos* (L.) Roth, Tent. Fl. Germ. 1: 34. 1788; Bor, Grass. Burma, Ceylon, India & Pakistan 396. 1960; Murti, Fl. Cold Des. W. Himal. 1: 279. 2001. *Arundo epigejos* L., Sp. Pl. 81. 1753. *Bireem Karpu Isa*

Perennials, tufted; rhizomatous. Culms erect, 0.7-1 m high. Leaf-blades flat, 18-42 x 0.2-0.8 cm, scaberulous; ligules 4-9 mm long. Panicle erect, narrowly lanceolate to oblong, 15-28 cm long, dense and spike-like, often purple-tinged. Spikelets 4.5-6.5 mm long. Glumes subequal, linear-lanceolate, scaberulous. Lemma about half the length of the glumes, smooth, 2-toothed at apex; awn 1-2.5 mm long, arising at or near the middle of the lemma, scarcely projecting beyond the glume tips.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Mud-Tharbik, 4000 m, 23.08.2002, *K. Chandra Sekar* 102933.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Europe eastwards to Eastern Asia and Pakistan.

3. *Calamagrostis pseudophragmites* (Hall.f.) Koel., Deset. Gram. 106, 1802; Bor. Grass. Burma, Ceylon, India & Pakistan 396, 1960; Aswal & Mehrotra, Fl. Lahaul-Spiti 653, 1994; Murti, Fl. Cold Des. W. Himal. 1: 281, 2001. *Arundo pseudophragmites* Hall.f. in Arch. Bot. Leipzig 1(2): 11, 1797. *Risa*

Perennials, tufted; rhizomes creeping. Culms erect, 0.65-1.1 m high. Leaf-blades 20-30 x 0.25-0.8 cm; ligules 4-6 mm long. Panicle lanceolate to oblong, 4-32 cm long, dense and spike-like with purple tinged. Spikelets 5-9 mm long; Glumes unequal, narrowly lanceolate, scaberulous on the keels. Lemma about half the length of the glumes, truncate-denticulate at apex, smooth; awn 1-3 mm long and scarcely projecting beyond the glume tips.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Shrim, 4000 m, 20.07.2002, K. Chandra Sekar 100490.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Europe and the Mediterranean region eastwards through temperate Asia to Siberia and Mongolia.

4. *Calamagrostis stoliczkae* Hook.f., Fl. Brit. India 7: 262, 1896 (as *C. stutzkae*); Bor. Grass. Burma, Ceylon, India & Pakistan 397, 1960; Murti, Fl. Cold Des. W. Himal. 1: 284, 2001. **Fig. 18**

Perennials, tufted; rhizomes creeping. Culms erect, 50-70 cm high. Leaf-blades convolute, 16-28 x 0.3-0.55 cm, scabrid; ligules 2-4.8 mm long, lacerate. Panicle erect, lanceolate, 7-15 cm long, deep purple. Spikelets 4-7 mm long, the rachilla prolonged and densely long-hairy. Glumes subequal, lanceolate-acuminate, scaberulous. Callus hairs about as long as the floret. Lemma about two-third the length of the glumes, scaberulous, 4-toothed at apex; awn 2.5-4.5 mm long, arising from the base of the teeth.

Fl. & Fr.: July - September.

Scarce; on stream beds. Thango, 3800 m, 27.08.2002, K. Chandra Sekar 102979.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan.

9. *Chrysopogon* Trin.

Twenty six species distributed in the tropical and subtropical regions of the Old World, chiefly in Asia and Australia; 16 in India.

Chrysopogon gryllus (L.) Trin. subsp. *echinulatus* (Nees) Cope in Kew Bull. 35: 701, 1980. Aswal & Mehrotra, Fl. Lahaul-Spiti 656, 1994; Murti, Fl. Cold Des. W. Himal. 1: 288, 2001. *Rhaphis echinulata* Nees in Royle, Illustr. Bot. Himal. 417, 1840. *Chrysopogon echinulatus* (Nees) Wats. in Atkins., Gaz. N.W. India 10: 392, 1882; Bor. Grass. Burma, Ceylon, India & Pakistan 108, 1960.

Perennials. Culms erect, 60-90 cm high, robust. Leaf-blades 20-30 x 0.2-0.35 cm, bluntly acute-acuminate, glabrous. Panicle 6-18 cm long, bearing short racemes of 2 or 3 joints. Spikelets of two kinds, sessile and pedicelled. Sessile spikelet narrowly oblong. Lower glume 5-8 mm long, minutely hispidulous at apex, mucronate; upper lemma minutely bidentate with a shortly pubescent awn of 1.3-1.5 cm long. Pedicelled spikelets 0.7-1.1 cm long. Lower glume bearing an awn of 3-7 mm long.

Fl. & Fr.: June - October.

Scarce; on rocky slopes. Mane-larsa Pass, 3900 m, 30.08.2003, K. Chandra Sekar 100774.

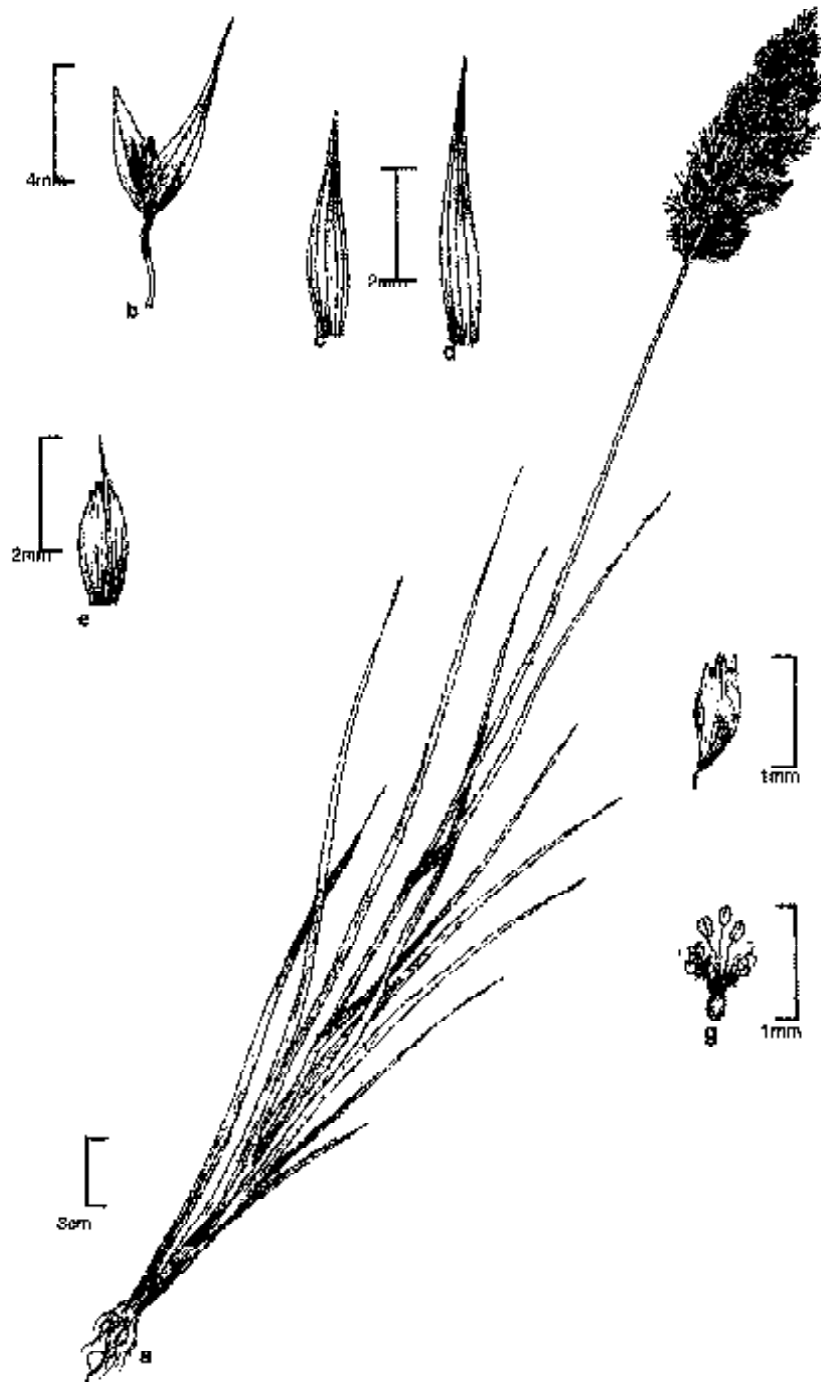


Fig. 18. *Calamagrostis stoliczkae* Hook.f. a. Habit, b. Spikelet, c. Lower glume, d. Upper glume, e. Lemma, f. Palea, g. Floret

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan.

10. *Cymbopogon* Spreng

About 56 species distributed in old world tropics and subtropics; ca 20 in India.

Cymbopogon jwarancusa (Jones) Schult. subsp. *olivieri* (Boiss.) Soenarko in Reinwardtia 9: 307. 1977; C.B. Clarke in Hook.f., *Fl. Brit. India* 6: 711. 1894; Aswal & Mehrotra, *Fl. Lahaul Spiti* 657. 1994; Murti, *Fl. Cold Des. W. Himal.* 1: 295. 2001. *Andropogon jwarancusa* Jones in *Asiat. Res.* 4: 109. 1795; Hook.f., *Fl. Brit. India* 7: 203. 1896. *A. olivieri* Boiss., *Diagn.*, Ser. 1, 1(5): 76. 1844.

Perennials. Culms geniculately ascending, 0.65-1.2 m high. Leaf-blades 15-25 x 0.2-0.4 cm; basal sheaths glabrous, coiled; ligules 2-4 mm long. False panicle erect, 15-35 cm long; spatheoles lanceolate to narrowly elliptic, 1.5-2.5 cm long, becoming reddish. Racemes 13-22 cm long; internodes and pedicels densely ciliate along the margin and on the back. Sessile spikelet lanceolate, 4.5-5.5 mm long; lower glume shallowly concave on the back; upper lemma deeply bifid, awned; awn 0.7-1 cm long.

Fl. & Fr.: July - September.

Rare; on rocky slopes. Farka-Bhaba Pass, 3800 m, 21.08.2002, K. Chandra Sekar 100756.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Iraq; Nepal; Pakistan and Socotra.

Note: Leaves are lemon-scented.

11. *Cynodon* A.Rich

Eight species in tropical and subtropical regions; 4 in India.

Cynodon dactylon (L.) Pers., *Syn. Pl.* 1: 85. 1805; Hook.f., *Fl. Brit. India* 7: 288. 1896; *Bot. Grass. Burma, Ceylon, India & Pakistan* 469. 1960. *Panicum dactylon* L., *Sp. Pl.* 58. 1753.

Perennials, stoloniferous with slender underground rhizomes. Culms 18-35 cm high, slender. Leaf-blades often short and narrow; 2-10 x 0.2-0.35 cm, scaberulous; ligule a short ciliate rim less than 0.3 mm long. Racemes 4-6, in a single whorl, 2-7 cm long. Spikelets 2-2.5 mm long. Glumes lanceolate, 1-nerved. Lemma silky pubescent on keels, lateral nerves often glabrous. Palea glabrous, scaberulous on keels. Anthers 0.8-1.2 mm long. Caryopsis laterally compressed.

Fl. & Fr.: June - September.

Rare; on rocky slopes. Manc. 3650 m, 27.08.2002, K. Chandra Sekar 100752.

Distrib: Throughout India; Tropical and warm temperate regions throughout the world.

12. *Deschampsia* P. Beauv.

About 40 species distributed in temperate and cold regions of both hemispheres; 2 in India.

Deschampsia caespitosa (L.) P. Beauv., *Ess. Agrost.* 91, 160. 1812; Hook.f., *Fl. Brit. India* 7: 273. 1896; *Bot. Grass. Burma, Ceylon, India & Pakistan* 435. 1960; Aswal & Mehrotra, *Fl. Lahaul-Spiti* 659. 1994; Murti, *Fl. Cold Des. W. Himal.* 1: 300. 2001. *Aira caespitosa* L., *Sp. Pl.* 64. 1753.

Perennials. Culms erect, 0.6-1 m high. Leaves mostly basal; blades 7-30 x 0.2-0.35 cm, flat; ligules scarious, 1.2-1.5 cm long. Panicle oblong, 10-30 cm long; spikelets with 2 florets, green with silvery

sheen. Glumes oblong to narrowly elliptic, acute-obtuse, 3-nerved; upper glume elliptic, acute. Lemma elliptic-oblong, 3-4.5 mm long, 4-toothed or 2-lobed; lobes lacerate, awned from near the base; awn straight, 3-5 mm long, scarcely projecting beyond the glumes.

Fl. & Fr.: July - August.

Scarce; on rocky slopes. Sanpat, 4350 m, 04.08.2002, K. Chandra Sekar 102824.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; temperate regions of both hemispheres and mountains of tropical Africa.

13. *Digitaria* Haller

About 220 species in tropical and subtropical regions; 26 species in India.

Digitaria ciliaris (Retz.) Koel, Descr. Gram. 27, 1802; Cope in Nasir & Ali, Fl. Pakistan 143: 228, 1982. *Panicum ciliare* Retz., Obscrv. Bot. 4: 16, 1786. *Digitaria hijerinii* Willd., Enum. Pl. 92, 1809; Bor. Grass. Burma, Ceylon, India & Pakistan 298, 1960.

Annuals. Culms decumbent at the base, geniculate ascending, 40-68 cm high. Leaf-blades broadly linear, 3-20 x 0.3-0.8 cm. Inflorescence: digitate, composed of 2-10 racemes; racemes 6-20 cm long. Spikelets narrowly elliptic, 2.5-3.3 mm long, acute. Lower glume triangular, 0.2-0.4 mm long; upper glume 1.5-2.5 mm long, 3-nerved. Lower lemma 2.5-3.1 mm long, 7-nerved; nerves smooth and evenly spaced. Caryopsis ellipsoid, light brown.

Fl. & Fr.: July - September.

Rare; on stream beds. Ratang river bed, 3700 m, 04.09.2002, K. Chandra Sekar 100791.

Distrib.: Throughout India; China; Mauritius; Pakistan and Arabia.

14. *Elymus* L.

About 150 species distributed in temperate regions, especially in Asia; 17 in India.

- | | |
|--|------------------------|
| 1a. Spikelets in groups of 2 or 3 in the middle of the rachis | 3. <i>E. nutans</i> |
| b. Spikelets solitary at all nodes of the rachis | 2 |
| 2a. Lemma with an awn longer than the body of the lemma | 3 |
| b. Lemma with an awn shorter than the body of the lemma or mucronate | 4 |
| 3a. Lemma glabrous below and scabridulous towards apex | 5. <i>E. sp.</i> |
| b. Lemma minutely puberulous | 4. <i>E. russellii</i> |
| 4a. Lemma smooth and glabrous on the back | 2. <i>E. nodosus</i> |
| b. Lemma scaberulous on the back | 1. <i>E. mutabilis</i> |

1. *Elymus mutabilis* (Drobov) Tzvelev in Pl. As. Cent. 4: 217, 1968; Cope in Nasir & Ali, Fl. Pakistan 143: 629, 1982; Chandra Sekar & S.K. Srivast. in Indian Forest. 130(12): 1475, 2004. *Agropyron mutabilis* Drobov in Trav. Mus. bot. Acad. Sci. Russ. 16: 88, 1916; Bor. Grass. Burma, Ceylon, India & Pakistan 663, 1960. Fig. 19

Perennials, tufted. Culms erect or geniculate ascending, 70-87 cm high, sparsely hairy. Leaf-blades flat, 10-22 x 0.6-1.1 cm. Spikelets elliptic-lanceolate to ovate-lanceolate, 0.6-1.5 cm long, 3-5

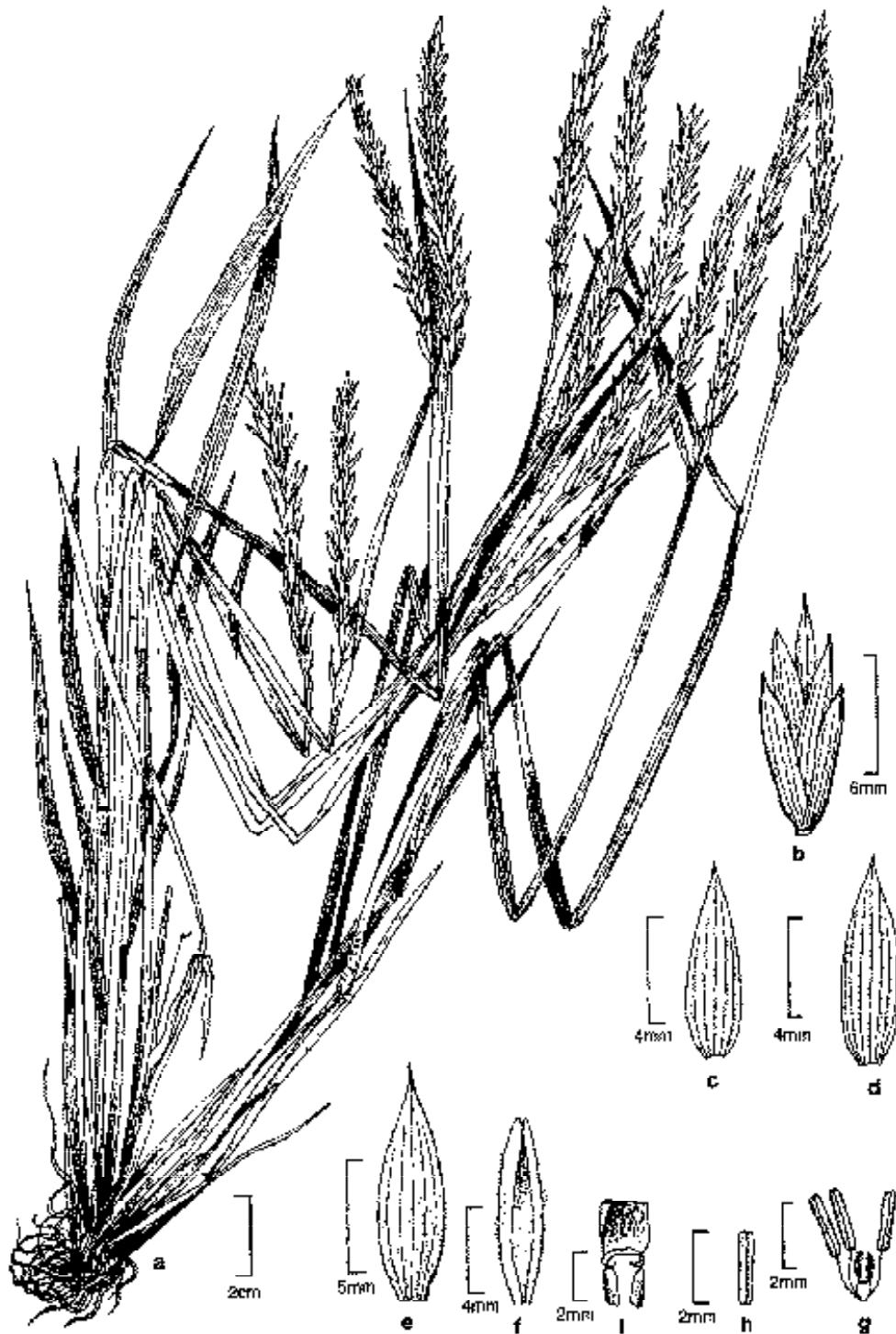


Fig. 19. *Elymus mutabilis* (Erebos) Tzevelev. a. Habit, b. Spikelet, c. Lower glume, d. Upper glume, e. Lemma, f. Palea, g. Floret, h. Anther, i. Ligule

flowered. Glumes subequal, linear-lanceolate to oblong-lanceolate, 0.7-1 cm long, gradually tapering to a mucro; mucro 1-2 mm long. Lemma lanceolate to oblong-lanceolate, 0.9-1.3 cm long, 5 nerved, gradually tapering to a mucro or a short awn 1.3-2.5 mm long. Palea 8.5-9 mm long, scabrid on back. Anthers 2-2.5 mm long. Caryopsis 8-9 mm long, brown.

Fl. & Fr.: July - September.

Rare; on rocky slopes. Chhohem, 4100 m, 13.07.2003, *K. Chandru Sekar* 103259.

Distrib.: India: Himachal Pradesh; Arctic Eurasia; Caucasus; C. Asia and North America.

2. *Elymus nodosus* (Nevski) Meld. in J. Linn. Soc., London (Bot.) 76: 376. 1978; Cope in Nasir & Ali, *Fl. Pakistan* 143: 624. 1982. *Agropyron nodosum* Nevski in Korn., *Fl. URSS* 2: 646. 1934. **Fig. 20**

Perennials, tufted. Culms erect or geniculately ascending, 40-60 cm high. Leaf-blades flat or involute. 12-18 x 0.2-0.3 cm, scabrid above, smooth beneath. Spike erect, 6-13 cm long; rachis joints scabrid along the margin. Spikelets with 3-7 florets. 1-1.8 cm long. Glumes unequal, oblong, obtuse or truncate, smooth, glabrous; lower glume 6-8 mm long; upper glume 8-9 mm long. Lemma oblong-lanceolate, 0.8-1 cm long, glabrous. Palea as long as the lemma. Anthers 3-4 mm long.

Fl. & Fr.: July - September.

Rare; on rocky slopes. Ratrang riverbed. 3700 m, 11.07.2002, *K. Chandru Sekar* 100405.

Distrib.: India: Himachal Pradesh; Caucasus eastwards through southern U.S.S.R. and the Middle East to Central Asia.

3. *Elymus nutans* Griseb. in *Nachr. Ges. Wiss. Göttingen* 1868: 72. 1868; *Bot. Grass. Burma, Ceylon, India & Pakistan* 670. 1960; Aswal & Mehrotra, *Fl. J. Lahaul-Spiti* 663. 1994; Murri, *Fl. Cold Des. W. Himal.* 1: 314. 2001. *Clinelymus nutans* (Griseb.) Nevski in *Bull. Jard. Bot. Acad. Sc. U.R.S.S.* 30: 644. 1932.

Perennials, tufted. Culms erect or geniculately ascending, 35-60 cm high. Leaf-blades flat, 6-20 x 0.15-0.4 cm, smooth or scabrous. Spike often flexuous, 5-15 cm long. Spikelets paired at the nodes of the rachis, shortly but distinctly pedicelled. Glumes narrowly lanceolate, 4-9 mm long, acute, conspicuously 2 or 3-nerved. Lemma narrowly lanceolate, 0.8-1.1 cm long (excluding the awn), acute, scabrid; awn flexuous, 1.5-3 cm long.

Fl. & Fr.: July - September.

Common; on rocky slopes. Chhohem, 4050 m, 23.07.2002, *K. Chandru Sekar* 100510.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China; C. Asia; Pakistan and Nepal.

Note. It is very similar to *Elymus sibiricus* L. which differs in having sessile spikelets and awn as long as the glume.

4. *Elymus russellii* (Meld.) Cope in Nasir & Ali, *Fl. Pakistan* 143: 618. 1982. *Agropyron russellii* Meld. in *Bot. Grass. Burma, Ceylon, India & Pakistan* 694. 1960; Chandru Sekar & S.K. Srivast. in *Ann. For.* 12(1) : 317.2004. *Rice Karpu Tea, Frim. Kivu* **Fig. 21**

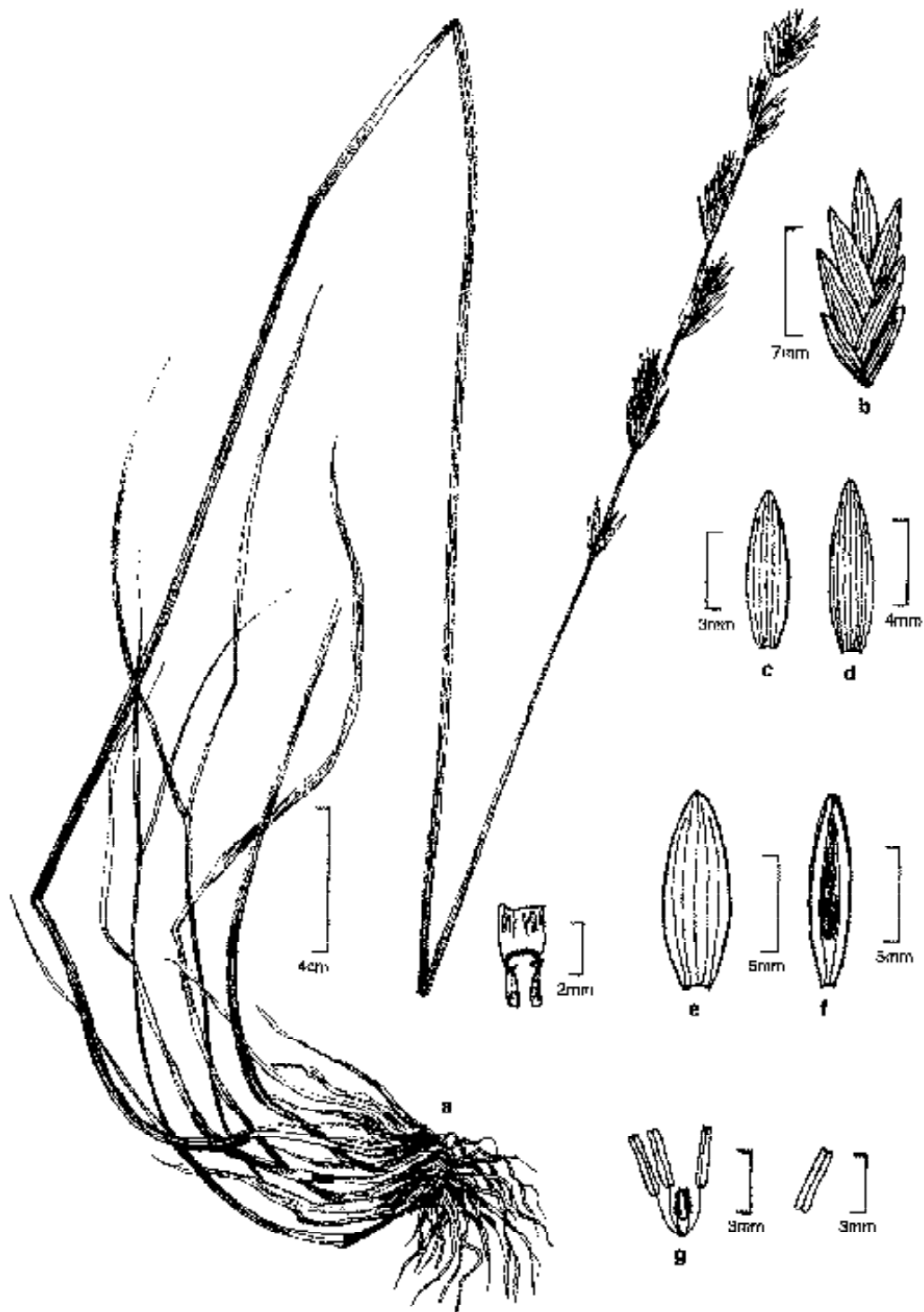


Fig. 20. *Elymus nodosus* (Nevsio) Melch. a. Habit, b. Spikelet, c. Lower glume, d. Upper glume, e. Lemma, f. Palea, g. Floret, h. Anther, i. Ligule

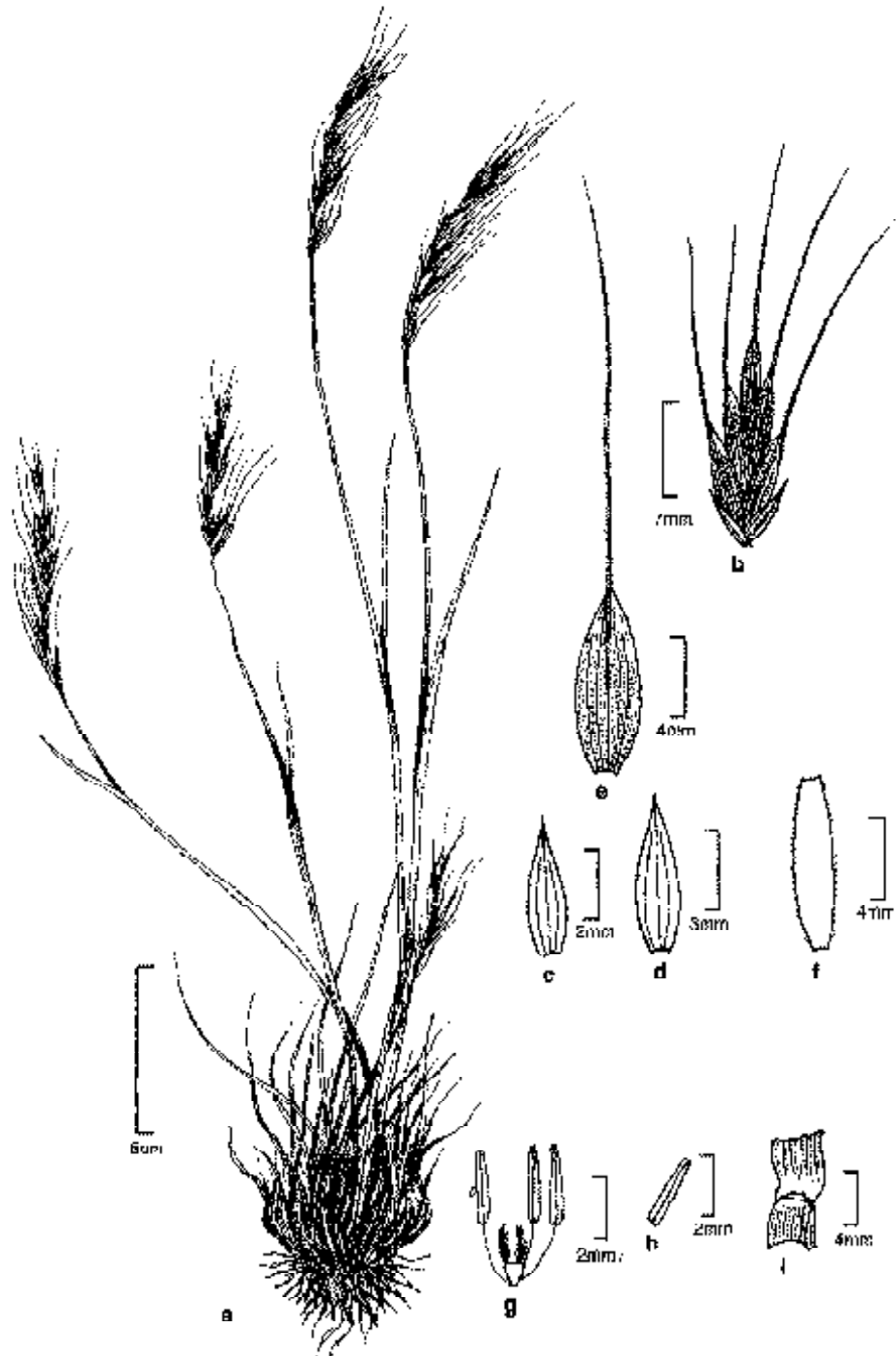


Fig. 21. *Elymus russellii* (Meld.) Cope. a. Habit, b. Spikelet, c. Lower glume, d. Upper glume, e. Lemma, f. Palea, g. Flower, h. Anther, i. Ligule

Perennials, tufted. Culms erect, slender, 35-60 cm high. Leaf blades flat or folded, 5-15 x 0.2-0.4 cm, scabrous above, smooth beneath. Spike lax, erect or nodding, 8-15 cm long; rachis joints scabrid along the margin. Spikelets 1.4-1.6 cm long (excluding the awns). Glumes subequal, oblong-elliptic, 0.7-1.1 cm long, acuminate. Lemma oblong-lanceolate, 1-1.2 cm long (excluding the awn), puberulous on the back, with a stout awn 1-2.2 cm long. Palea as long as the body of the lemma. Anthers 2-2.5 mm long.

Fl & Fr: July - September.

Scarce; on moist slopes. Chhohem, 4100 m, 13.07.2003, K. Chandru Sekar 103266.

Distrib: India: Himachal Pradesh and Jammu & Kashmir; Pakistan.

5. *Elymus* sp.

Perennials, tufted. Culms geniculate ascending, 18-38 cm high. Leaf blades 4-9 x 0.1-0.2 cm, loosely rolled, glabrous. Spikelets 1-1.8 cm long (excluding the awns) with 6-8 florets; rachilla twisted above the glumes. Glumes subequal, elliptic; lower glume 2-2.5 mm long, mucronate at the tip, 3-nerved; upper glume 4-6 mm long, narrowed above into a short awn 4-6 mm long, 4 or 5-nerved. Lemma elliptic, 7-9 mm long, awned at apex, glabrous below, scabridulous towards apex, 5-nerved; awn 2.5-4 cm long, straight or slightly flexuous, deciduous. Palea as long as the body of the lemma, slightly emarginate at apex. Anthers 2-2.5 mm long.

Fl & Fr: July - August.

Common; on moist slopes. Chhohem, 4200 m, 12.07.2003, K. Chandru Sekar 103214.

Note: This species is closely allied to *Elymus caninus* (L.) L., but differs in having 2-6 mm long glumes and lemma having 2.5-4 mm long awn.

15. *Eragrostis* Wolf

About 350 species, mainly in the tropics and subtropics; ca 30 in India.

Eragrostis amabilis (L.) Wight & Arn. in Hook. & Arn., Bot. Beechey Voy. 251. 1833; Munro in J. Linn. Soc., London (Bot.) 6: 43. 1862; Nicolson & al. in Regnum Veg. 119: 309. 1988. *Poa amabilis* L., Sp. Pl. 68. 1753. *Eragrostis tenella* (L.) P. Beauv. ex Roem. & Schult., Syst. Veg. 2: 576. 1817.

Annuals, tufted. Culms erect or geniculate ascending, 19-38 cm high. Leaf blades flat, 6-8 x 0.12-0.35 cm. Panicle elliptic, 2-11 cm long, open; the branches spreading and bearing oblong yellowish glands but not sticky. Spikelets with 4-8 florets, oblong-ovate, 1.5-2.2 mm long, breaking up from the apex. Glumes subequal, ovate, 0.5-1 mm long, acute. Rachilla fragile. Lemma ovate-oblong, 0.6-1 mm long, broadly obtuse, scabrous. Palea ciliate on keels. Caryopsis ellipsoid, 0.4-0.5 mm long.

Fl & Fr: July - September.

Rare; on stream beds. Mane, 3700 m, 03.09.2002, K. Chandru Sekar 100792.

Distrib: Throughout India; Throughout the tropics.

16. *Premopoa* Rozhev.

Four species, distributed from Eastern Mediterranean to Western China; 2 in India.

Eremopoa altaica (Trin.) Rozhev. in Komarov, Fl. U.R.S.S. 2: 431. 1934; Cope in Nasir & Ali, Fl. Pakistan 143: 420. 1982; Aswal & Mehrotra, Fl. Lahaul-Spiti 666. 1994; Murti, Fl. Cold Des. W. Himal. 1: 324. 2001. *Aira altaica* Trin. in Mem. Sav. Etr. Acad. St.-Petersbourg 2: 526. 1835. *Jambi chusa*

Annuals, tufted. Culms erect, 17-35 cm high. Leaf-blades 2-8 x 0.1-0.3 cm, scabrid above; ligules 1-2 mm long. Panicles broadly ovate, 3-18 cm long, moderately very loose. Spikelets 3.5-6 mm long, 2-6-flowered. Lower glume lanceolate, 1-2 mm long, acute. Upper glume narrowly ovate, 1.5-2.5 mm long, acute-subacute. Lemma ovate-elliptic, 2.5-3.5 mm long, abruptly acute to long acuminate, minutely hairy on the keels. Anthers 0.3-0.7 mm long.

Fl. & Fr.: July - September.

Occasional; on stream beds. Chhohem, 4050 m, 22.07.2002, K. Chandra Sekar 100502.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; Altai; Pakistan; Turkey and Urals.

17. *Festuca* L.

About 450 species distributed in temperate and subtropical regions; 27 in India.

- | | |
|---|--------------------------|
| 1a. Glumes hyaline | 4. <i>F. elgae</i> |
| b. Glumes herbaceous | 2 |
| 2a. Leaf-blades scabrid on the lower surface | 3 |
| b. Leaf-blades smooth on the lower surface | 6 |
| 3a. Leaf-blades 6-sided in section | 3. <i>F. kashmiriana</i> |
| b. Leaf-blades flattened-cylindrical in section | 4 |
| 4a. Leaf-blades 5-nerved | 7. <i>F. valesiaca</i> |
| b. Leaf-blades 7-nerved | 5 |
| 5a. Awn of the lemma 1-1.5 mm long | 1. <i>F. altaica</i> |
| b. Awn of the lemma 1.4-1.6 cm long | 6. <i>F. ranjappae</i> |
| 6a. Anthers less than 1.4 mm long. | 5. <i>F. panirica</i> |
| b. Anthers 1.4 mm or more long | 2. <i>F. bartmannii</i> |

1. *Festuca altaica* Drobov in Trav. Mus. Bol. Acad. Sci. Russ. 16: 134, t. 17/5. 1916; Murti, Fl. Cold Des. W. Himal. 1: 329. 2001. *Beetem Lu*, *Beerwah Tika*

Perennials, densely tufted. Culms erect, 14-35 cm high. Leaf-blades folded-setaceous, 3-7.5 cm long, smooth above, scabrid beneath; ligules 0.3-0.6 mm long. Panicle oblong to narrowly oblong, 2.5-6 cm long, contracted, the branches ascending, scabrid. Spikelets 6-8 mm long (excluding the awns) with 4-6 florets. Lower glume 2-3.5 mm long, 1-nerved; upper glume 3.5-4.7 mm long, 3-nerved. Lemma elliptic-oblong, 4-5.5 mm long, scabrid in the upper part, awned; awn 1-1.5 mm long. Palea scabrid on keels. Anthers 1.5-2.2 mm long. Ovary glabrous.

Fl. & Fr.: June - September.

Scarce; on rocky slopes. Tariya, 4000 m, 21.07.2003, K. Chandra Sekar 103620.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Central Asia and Turkey eastwards to Afghanistan.

Given to cattle to improve the milk content.

2. *Festuca hartmannii* (Markgr.-Dannenb.) Alexeev in Byull. Mosk. Obsch. Ispyt. Prior. 83(4): 121. 1978; Murti, Fl. Cold Des. W. Himal. 1: 331. 2001. *F. ovina* L. subsp. *coelestis* St.-Yves var. *hartmannii* Markgr.-Dannenb. in Bot. Jahrb. 85: 376. 1966.

Perennials, tufted. Culms erect, 20-40 cm high. Leaf-blades folded-seraccous, 7-15 cm long; ligules 0.2-0.4 mm long. Panicle narrowly oblong, 2-6 cm long, contracted; the branches ascending, scabrid. Spikelets 4.5-6 mm long (excluding the awns) with 3-5 florets. Lower glume 2-3 mm long, 1-nerved; upper glume 3-4.2 mm long, 3-nerved. Lemma narrowly oblong lanceolate, 3-4.2 mm long, scabrid towards apex, awned; awn 1-2 mm long. Palea scabrid on keels. Anthers 1.4-2 mm long. Ovary glabrous.

Fl. & Fr: July - August.

Occasional; on rocky slopes. Gochang Thango, 3850 m, 10.07.2003, K. Chandra Sekar 101169.

Distrib: India: Himachal Pradesh and Jammu & Kashmir; Pakistan.

3. *Festuca kashmiriana* Stapf in Hook.f., Fl. Brit. India 7: 351. 1896 (excl. var. *debilis* and var. *simlensis*); Bor, Grass. Burma, Ceylon, India & Pakistan 538. 1960; Aswal & Mehrotra, Fl. Lahaul-Spiti 668. 1994; Murti, Fl. Cold Des. W. Himal. 1: 331. 2001. *Kasuum Tsa. Bireem tukun Tsa*

Perennials, tufted. Culms erect or geniculately ascending, 35- 60 cm high. Leaf-blades folded-seraccous, 6-20 cm long; ligules 0.4-0.5 mm long. Panicle narrowly lanceolate to ovate, 5.5-13 cm long; the branches ascending or spreading, scabrid. Spikelets 1-1.3 cm long (excluding the awns) with 4-6 florets. Lower glume 2.5-4 mm long, 1-nerved. Lemma narrowly elliptic, 5.5-7 mm long, scabrid above, awned; awn 1.5-3 mm long. Palea scabrid along the keels. Anthers 2-3.2 mm long.

Fl. & Fr: July - August.

Common; on rocky slopes. Larang La-Tariya, 4700 m, 06.08.2003, K. Chandra Sekar 103756.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China and Pakistan.

Given to cattle to improve the milk content.

4. *Festuca olgae* (Regel) Krivol., Not. Syst. Herb. Inst. Bot. Acad. Sci. U.R.S.S. 20: 56. 1960; Aswal & Mehrotra, Fl. Lahaul-Spiti 669. 1994; Murti, Fl. Cold Des. W. Himal. 1: 332. 2001. *Molinia olgae* Regel in Acta Horti Petrop. 7: 625. 1881. *Festuca sibirica* Hack. ex Boiss., Fl. Orient. 5: 626. 1884; Stapf in Hook.f., Fl. Brit. India 7: 355. 1896. *Tulo Mentok*

Perennials, dioecious. Culms ascending, 34-58 cm high. Leaf blades 2-3.5 x 0.2-0.3 cm, flat, prominently ribbed above. Ligules 0.8-1 mm long, without auricles. Panicle 9-12 cm long, branches scabrid. Spikelets with 4-6 florets, 0.9-1 cm long. Glumes hyaline; lower glume 4-4.2 mm long; upper glume 4.3-5.5 mm long. Lemma narrowly oblong-lanceolate, 6.5-8 mm long, awnless, broadly hyaline on the margin. Palea scabrid along the keels. Male floret: Anthers 3-3.5 mm long; ovary aborted. Female floret: Ovary 0.8-1.1 mm, densely hairy at apex; anthers aborted.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Thango-Kilung, 4500 m, 01.08.2003, *K. Chandra Sekar* 103721.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia.

5. *Festuca pamirica* Tzvelev, Nov. Syst. Herb. Inst. Bot. Acad. Sci. U.R.S.S. 20: 422. 1960; Murri, Fl. Cold Des. W. Himal. 1: 333. 2001.

Perennials, tufted. Culms erect, 18-30 cm high. Leaf-blades folded-sericeous, 5-9.5 cm long, smooth on the lower surface; ligules 0.3-0.5 mm long. Panicle narrowly oblong, 3-5 cm long, contracted. Spikelets 5.5-8 mm long (excluding the awns) with 3-6 florets. Lower glume 2.4-3 mm long, 1-nerved; upper glume 3-4.2 mm long, 3-nerved. Lemma oblong elliptic, 3.5-5 mm long, scabrid towards apex, awned; awn 1-2 mm long. Palea scabrid on keels, smooth below. Anthers 0.5-1.2 mm long.

Fl. & Fr.: July - August.

Scarce; on rocky slopes. Shrim-Chihohem, 4000 m, 12.07.2003, *K. Chandra Sekar* 103189.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan and Pamirs.

6. *Festuca sanjappae* Chandra Sekar & S. K. Srivast. in J. Jap. Bot. 80: 72. 2005. **Fig. 22**

Perennials. Culms erect, 28-43 cm high, slender. Leaf-blades flat, 6-10.2 x 0.3-0.4 cm, 7-nerved. Panicle elliptic-oblanccolate, 6.5-14 cm long. Spikelets ovate-lanceolate to elliptic-ovate with 4-5 florets. Lower glume 3.7-4 mm long, shortly acuminate, 1-nerved; upper glume 4-4.5 mm long, acuminate, 3-nerved. Lemma elliptic-oblanccolate, 3-4 mm long; awn 1.4-1.6 cm long. Palea lanceolate, 3.2-3.5 mm long. Caryopsis 3-3.5 mm long.

Fl. & Fr.: July - September.

Scarce; on moist slopes. Chihohem, 4100 m, 13.07.2003, *K. Chandra Sekar* 103271 (Holotype CAL; Isotype BSD).

Distrib.: India: Himachal Pradesh.

Note: This species is closely allied to *F. akiva*, but differs in the length of the awn of lemma (1.4-1.6 cm long). In *F. akiva* the length of the awn of lemma is 1-1.5 mm.

7. *Festuca valesiaca* Schleich. ex Gaud., Agrost. Helv. 1: 242. 1811; Aswal & Mehrotra, Fl. Lahaul-Spiti 670. 1994; Murri, Fl. Cold Des. W. Himal. 1: 373. 2001. *Hircan. Aungpa Yia*

Perennials, tufted. Culms erect, 20-40 cm high. Leaf-blades folded-sericeous, 6-14 cm long, scabrid on the lower surface; ligules 0.3-0.5 mm long. Panicle narrowly oblong, 3.5-11 cm long, contracted. Spikelets 4-5.5 mm long with 5-7 florets. Lower glume 2-3.5 mm long, 1-nerved; upper glume 3-5 mm long, 3-nerved. Lemma narrowly oblong-elliptic, 3-4 mm long, scabrid in the upper part, awned; awn 1-3 mm long. Palea scabrid on keels, smooth below. Anthers 2-3 mm long.

Fl. & Fr.: July - August.

Scarce; on moist slopes. Tatiya, 4000 m, 25.07.2003, *K. Chandra Sekar* 103691.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia from Turkey and the Caucasus eastwards through Siberia and the Middle East to Mongolia and Europe.

Grass used for religio-magico purposes.

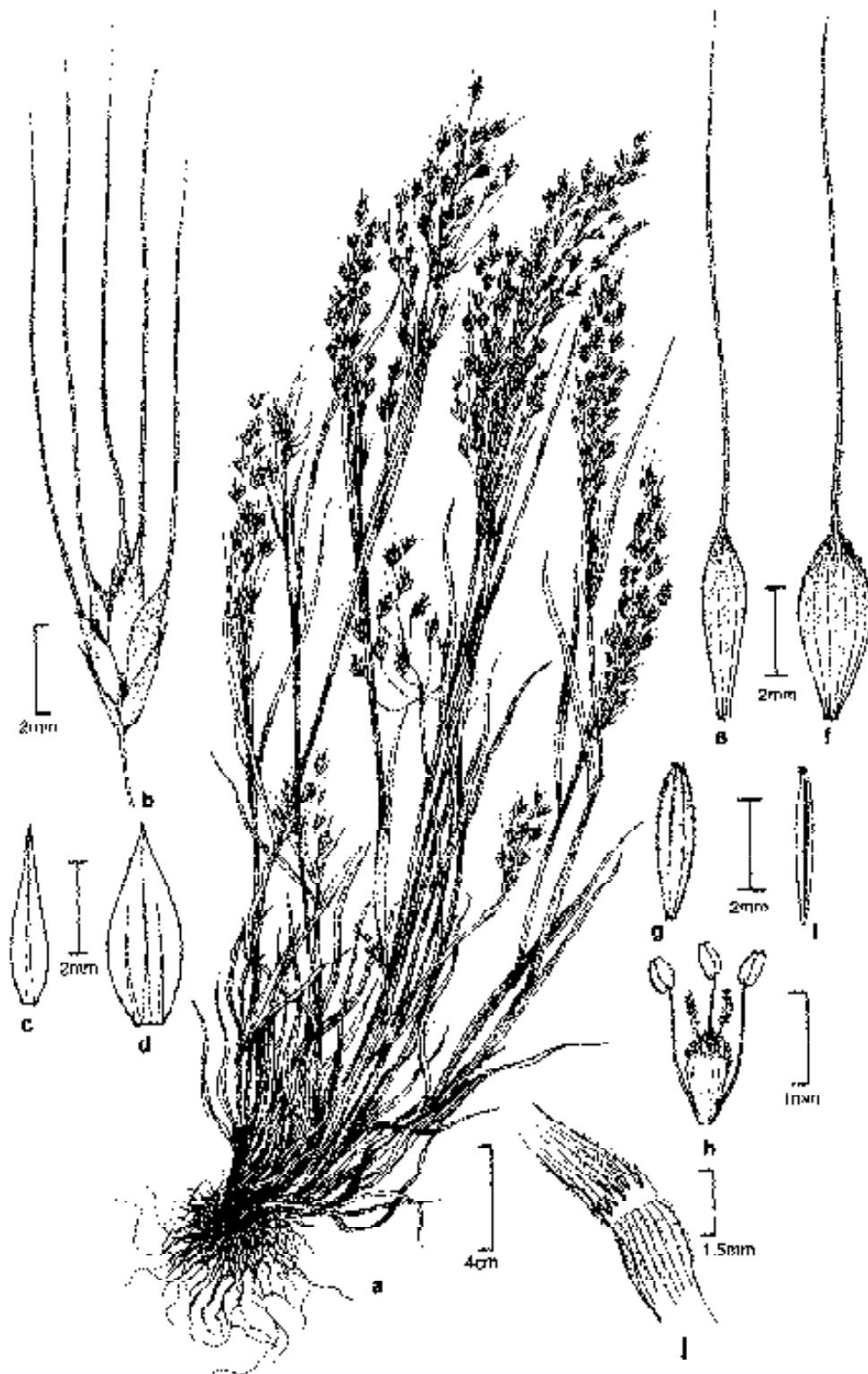


Fig. 23. *Festuca sanjappae* Chandr. Sekar & S.K. Srivast. a. Habit, b. Spikelet, c. Lower glume, d. Upper glume, e. Lemma from the side view, f. Lemma, g. Pilea, h. Floret, i. Caryopsis, j. Ligule

18. Helictotrichon Besser ex Roem. & Schult.

About 100 species chiefly in the temperate Eurasia; 3 in India.

Helictotrichon virescens (Nees ex Steud.) Henr. in Blumea 3: 425, 1940; Bot. Grass. Burma, Ceylon, India & Pakistan 439, 1960. *Trisetum virescens* Nees ex Steud., Syn. Pl. Glum. 1: 226, 1854. *Tripska Damba* Fig. 23

Perennials, tufted. Culms erect, 60-95 cm high. Leaf-blades 8-32 x 0.2-0.6 cm scaberulous above, flat, green. Panicle loose, somewhat nodding, 12-35 cm long; branches ascending. Spikelets oblong, 0.9-1.4 cm long with 3 florets. Glumes lanceolate to oblong-lanceolate, hyaline at apex and margin; lower glume 5-9 mm long, 1-3-nerved; upper glume 0.6-1.2 cm long, 5-nerved. Lemma 0.75-1.2 cm long, shallowly 2-toothed at apex, hyaline at margin, subcoriaceous, scabrid on nerves; awn from just above the middle, 1-1.8 cm long, geniculate.

Fl. & Fr.: July - August

Scarce; on stream beds. Thangri, 3800 m, 27.08.2002, K. Chandra Sekar 102986.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Myanmar, China; Nepal and Pakistan.

19. Hierochloa R. Br.

About 20 species distributed in temperate regions; 3 in India.

Hierochloa laxa R. Br. ex Hook.f., Fl. Brit. India 7: 222, 1896; Bot. Grass. Burma, Ceylon, India & Pakistan 441, 1960; Aswal & Mehtotra, Fl. Lahaul-Spiti 671, 1994; Murd., Fl. Cold Des. W. Himal. 1: 338, 2001.

Perennials, rhizomatous. Culms ascending, 48-72 cm high. Leaf-blades 2.5-16 x 0.4-0.8 cm, rounded at base, abruptly pointed at apex, glabrous. Panicle oblong, 5-14 cm long. Spikelets 5-7 mm long. Glumes ovate, 4-6.5 mm long, acute. Male floret with lemma 4.5-5.2 mm long, shallowly toothed at apex, awned; awn 1-2.5 mm long. Lemma of fertile floret 3-4 mm long, sparsely hairy above the middle, awn ca 1 mm long.

Fl. & Fr.: July - September

Scarce; on stream beds. Tatiya, 4100 m, 09.08.2002, K. Chandra Sekar 100639.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China; Nepal and Pakistan.

20. Hordeum L.

About 20 species distributed in the temperate regions; 5 in India.

1a. Annuals, cultivated

2. *H. vulgare*

b. Perennials, wild

1. *H. brevisubulatum* subsp. *nevskianum*

1. Hordeum brevisubulatum (Trin.) Link. subsp. **nevskianum** (Bowden) Tzvelev in Nov. Sist. Vyssh. Rast. 1971: 66, 1971; Cope in Nasir & Ali, Fl. Pakistan 143: 640, 1982. *Hordeum nevskianum* Bowden in Can. J. Genet. Cytol. 7: 396, 1965. Fig. 24

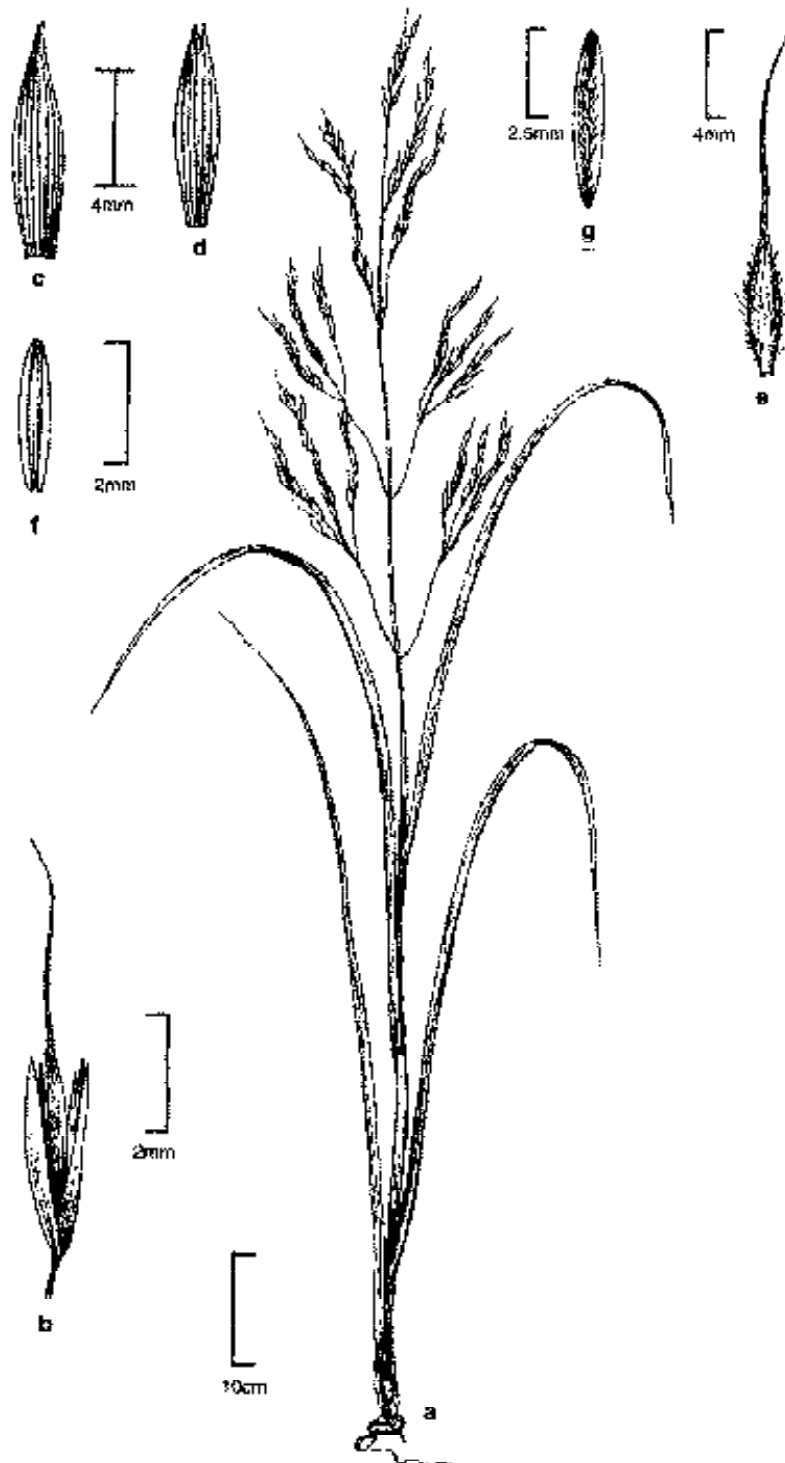


Fig. 23. *Helictotrichon virescens* (Nees ex Steud.) Henr. a. Habit, b. Spikelet, c. Lower glume, d. Upper glume, e. Lemma, f. Palea, g. Caryopsis

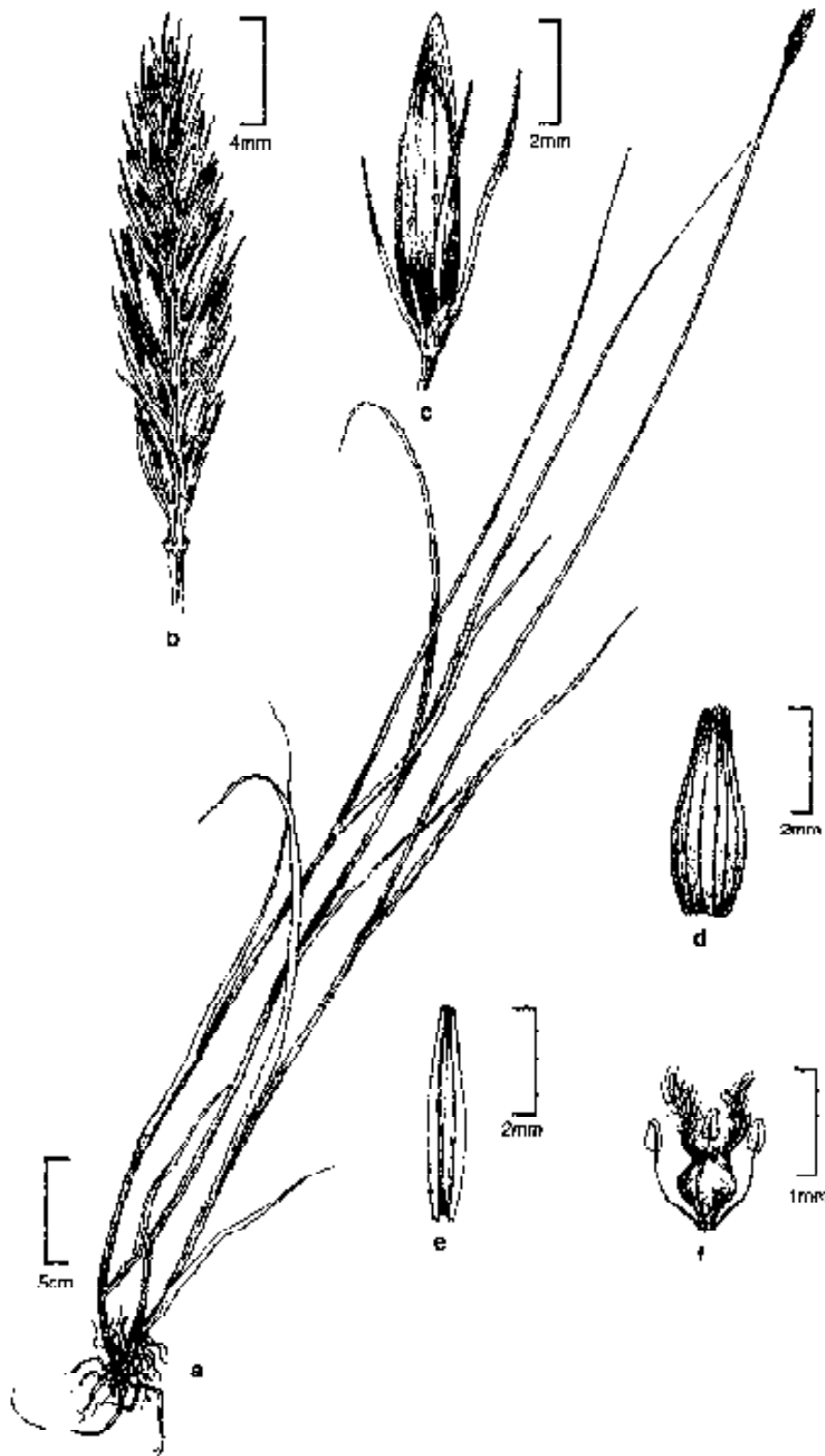


Fig. 24. *Hordeum brevifolium* (Trin.) Link subsp. *navaklanum* (Bardhan) Tereles u. Habit. b. Spike, c. Spikelet, d. Lemma, e. Palea, f. Flower

Perennials, tufted. Culms geniculate ascending, 40-70 cm high. Leaf-blades 12-14 x 0.1-0.3 cm, glabrous. Spike slender, 1.8-2 cm long; rachis smooth, scabrid on nerves. Glumes setaceous, 2.5-4 mm long, scabrid. Lemma lanceolate, 2.5-3.5 mm long, scabrid-puberulous; awn 1.8-2.2 mm long. Palea as long as the lemma. Anthers 1.8-2.2 mm long.

Fl. & Fr.: July - September.

Rare; on stream beds. Tharlik-Larang La, 4950 m, 25.08.2002, K. Chandra Sekar 100689.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Afghanistan; Nepal; Pakistan; Siberia and China.

Note. It differs from *Hordeum brevisulcatum* (Trin.) Link subsp. *sarkestanicum* (Nevski) Tzevelev in having short awn (2-2.2 mm long).

2. *Hordeum vulgare* L., Sp. Pl. 84, 1753; Aswal & Mehrotra, Fl. Lahaul-Spiti 701, 1994; Murri, Fl. Cold Des. W. Himal. 1: 421, 2001. *Ramba Nakpantlu, Joo, Nawa* Photo. 153

Annuals. Culms erect, 20-48 cm high. Leaf-blades flat, 6-19 x 0.4-1.6 cm, glabrous. Spike linear-oblong, 4-6 cm long (excluding awn). Spikelets 3 at each node, all the spikelets of each triad fertile so that there are 6 longitudinal rows of fertile spikelets in each spike. Glumes narrowly linear lanceolate, 4-6 mm long. Lemma ovate-lanceolate, 0.9-1.1 cm long (excluding awns), 5-nerved; awn 4-6 cm long. Palea 2-keeled.

Fl. & Fr.: July - August.

Common on cultivation, often met with as an escape. Kaa, 3675 m, 13.07.2002, K. Chandra Sekar 100445.

Distrib.: India: Cultivated throughout the Himalaya; throughout the temperate regions.

An important cereal.

21. *Koeleria* Pers.

About 35 species, distributed in temperate regions; 2 in India.

***Koeleria macrantha* (Ledeb.) Schult.**, Mant. 2: 345, 1824; Aswal & Mehrotra, Fl. Lahaul-Spiti 673, 1994; Murri, Fl. Cold Des. W. Himal. 1: 344, 2001. *Aira macrantha* Ledeb. in Mem. Acad. Sci. St.-Petersbough 5: 515, 1812.

Perennials, tufted. Culms erect or ascending, 20-40 cm high, simple. Leaf-blades 7-14 x 0.1-0.2 cm, flat, sparsely hairy; ligules 0.6-1 mm long. Panicle narrowly oblong, 2-9 cm long. Spikelets with 2 or 3 florets, shining, green. Glumes subequal, mucronate or shortly aristulate; lower glume narrowly lanceolate, 3-4 mm long, 1-nerved; upper glume oblong-elliptic, 4-5.2 mm long, 3-nerved. Lemma oblong elliptic, 3.5-5.2 mm long, acuminate, 3-nerved. Anthers 1.5-2 mm long.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Farka, 3800 m, 30.07.2002, K. Chandra Sekar 100536.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; throughout temperate regions of the Northern hemisphere.

22. *Leymus* Hochst.

About 40 species distributed in temperate regions; 1 in India.

Leymus succalitus (Georg.) Tzvelev. Pl. Asiat. Cent. 4: 209. 1968; Aswal & Mehrotra, Fl. Lahaul-Spiti 673. 1994; Murti, Fl. Cold Des. W. Himal. 1: 345. 2001. *Trisetum succalitus* Georgi, Bernerk. Reise 1: 198. 1775. *Flymus darysachus* Trin. in Ledeb., Fl. Altaica 1: 120. 1829; Hook.f., Fl. Brit. India 7: 374. 1896; Bor, Grass. Burma, Ceylon, India & Pakistan 669. 1960.

Perennials, tufted. Culms erect, 55-80 cm high. Leaf-blades 9-20 x 0.2-0.55 cm, scabrid above, smooth beneath. Spike 8-16 cm long. Spikelets 2 or 3 at nodes. Glumes narrowly lanceolate, 1-1.5 cm long (including awn), ciliate along the margin, 1-nerved. Lemma lanceolate or elliptic, 0.8-1.2 cm long, acute, hairy all over the back, produced into an awn at apex; awn 1-3 mm long.

Fl. & Fr.: June - August.

Scarce; on rocky slopes. Mud-Larung Ia, 4000 m, 19.08.2002, K. Chandru Sekar 102913.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Central Asia; China; Pakistan and Siberia.

23. *Melica* L.

About 60 species, in subtropical regions except Australia; 5 in India.

Melica persica Kunth, Rev. Gram. 1: 122, 351, t. 89. 1830; Bor, Grass. Burma, Ceylon, India & Pakistan 592. 1960; Aswal & Mehrotra, Fl. Lahaul-Spiti 674. 1994; Murti, Fl. Cold Des. W. Himal. 1: 347. 2001. *M. jacquemontii* Decne. in Cambess., Pl. Rar. 174, t. 175. 1844. *M. capani* sensu Hook.f., Fl. Brit. India 7: 329. 1896, non Guss. 1832. *M. canescens* (Regel) Lavrenko in Kom., Fl. U.R.S.S. 2: 752. 1934; Bor, Grass. Burma, Ceylon, India & Pakistan 592. 1960. *Sagih River* Photo. 154, 155

Perennials; rhizomatous and forming clumps 12-28 cm dia. Culms erect or ascending, 15-30 cm high. Leaf-blades flat, linear, 5-14.5 x 0.2-0.38 cm; ligules 0.5-3 mm long, obtuse to truncate. Panicle 3.5-11 cm long, spike-like. Spikelets gaping, 5-9 mm long, yellow or lightly to deeply suffused with purple. Lower glume broadly ovate, 2.5-6 mm long, acute; upper glume lanceolate, as long as the spikelet, acute. Lemma elliptic, 4-7 mm long, acute, the dorsal surface clothed with tubercle-based hairs 4-5 mm long.

Fl. & Fr.: July - September.

Common; on rocky slopes. Thidim, 3850 m, 01.08.2002, K. Chandru Sekar 100555.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; middle East from Turkey to Afghanistan; Pakistan and U.S.S.R.

Note: Very variable in habit, colour of spikelets and size of florets. We have followed Cope (1982), Aswal & Mehrotra (1994) and Murti (2001) in considering the above mentioned synonyms as morphological variants of a single species.

24. *Oryzopsis* Michx.

About 35 species distributed in temperate and subtropical regions of N. hemisphere, 11 in India.

- 1a. Lemma narrowly lanceolate to linear; anthers distinctly bearded at apex 2
 b. Lemma ovate to elliptic; anthers never distinctly bearded at apex *J. O. wendelboi*
 2a. Awn terminal 2, *O. pubiflora*
 b. Awn subterminal 1, *O. lateralis*

1. *Oryzopsis lateralis* Stapf in Hook. f., Fl. Brit. India 7: 234. 1896, non *Milium laterale* Munro ex Regel, 1880; Bor, Grass. Burma, Ceylon, India & Pakistan 640. 1960; Murri, Fl. Cold Des. W. Himal. 1: 355. 2001. *Piptatheron gracile* Mez in Leddes, Repert. 17: 211. 1921; Aswal & Mehrotra, Fl. Lahaul Spiti 679. 1994. *O. gracilis* (Mez) Pilger in Not. Bot. Gart. Mus. Berlin 14: 346. 1939. *Chota risa*, Bireem Yakuba

Perennials, densely tufted. Culms 25-40 cm high. Leaf-blades slightly rolled, 6-18 x 0.1-0.2 cm, minutely pilose above, glabrous beneath. Panicle 6-20 cm long, branches erect-ascending. Spikelets lanceolate to almost linear, 3-4.5 mm long, 2-lobed at apex, densely covered with stiff white hairs; awn subterminal, 3-6 mm long, exerted from the glumes, deciduous. Anthers 1.7-2.5 mm long, densely bearded at apex.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Thango, 3950 m, 17.07.2002, *K. Chandru Sekar* 100479.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Nepal and Pamirs eastwards through the Himalaya to China.

2. *Oryzopsis pubiflora* Hack. in Stapf, Denkschr. Akad. Wiss. Wien, Math-nat. Kl. 50: 8. 1885; Bor in Reichb.f., Fl. Iran. 70: 410. 1970.

Perennials. Culms 34-55 cm high. Leaf-blades flat, 10-18 x 0.1-0.25 cm, pubescent above. Panicle 4-17 cm long; the branches erect. Spikelets lanceolate, 0.5-1 cm long. Lemma narrowly linear-lanceolate, 4-6 mm long, acute, covered all over by stiff white hairs; awn terminal, exerted from the glumes, 2-4 mm long, deciduous. Anthers 2-3 mm long.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Sanpat, 4350 m, 04.08.2002, *K. Chandru Sekar* 102861.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Pakistan and the Pamirs.

3. *Oryzopsis wendelboi* Bor in Nytt Mag. Bot. 1: 16. 1952; Bor, Grass. Burma, Ceylon, India & Pakistan 641. 1960; Murri, Fl. Cold Des. W. Himal. 1: 358. 2001. *O. himiki* Bor in Kew Bull. 6: 445. 1952; Bor, Grass. Burma, Ceylon, India & Pakistan 639. 1960. *Piptatheron hilarine* Pazij in Not. Syst. Herb. Inst. Bot. & Zool. Acad. Sci. Uzbekistan. 10: 20. 1948; Aswal & Mehtotra, Fl. Lahaul-Spiti 679. 1994.

Perennials, densely tufted. Culms 32-50 cm high. Leaf-blades flat, 5-25 x 0.15-0.3 cm, sparsely pilose above, scaberrulous beneath. Panicle lax, 8-28 cm long. Spikelets lanceolate, 4-8 mm long. Lemma narrowly ovate, 2.4-4.5 mm long, 2-lobed at apex; lobes rounded and each bearing a dense tuft of stiff hairs; awn subterminal, 1.8-4 mm long, slightly exerted from the glumes, deciduous. Anthers 1.5-2.5 mm long, with a few short hairs but never distinctly bearded at apex.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Mud-Larang La, 3800 m, 19.8.2002, *K. Chandra Sekar* 102922.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; Pakistan and the Pamirs.

25. *Pennisetum* Rich.

About 130 species, distributed in tropical and subtropical regions; 12 in India.

- | | |
|----------------------|------------------------|
| a. Bristles plumose | <i>2. P. orientale</i> |
| b. Bristles glabrous | <i>1. P. flaccidum</i> |

1. *Pennisetum flaccidum* Griseb., Goett. Nachr. 86. 1868; Bor, Grass. Burma, Ceylon, India & Pakistan 344. 1960; Aswal & Mehrotra, Fl. Lahaul-Spiti 676. 1994; Murri, Fl. Cold Des. W. Himal. 1: 360. 2001.

Perennials, rhizomatous. Culms erect, 45-65 cm high. Leaf-blades linear, 5-31 x 0.4-0.8 cm, flat. Panicle linear, 4-18 cm long; rachis scaberulous. Spikelets lanceolate, 4.5-6.5 mm long. Lower glume 1.2-1.7 mm long, subacute; upper glume 2-4.5 mm long, acute to acuminate. Lemma 3.7-4.5 mm long, acuminate. Lower floret male; anthers without tuft of hairs at apex.

Fl. & Fr.: July - September.

Scarce; on stream beds. Gechang, 3800 m, 24.08.2002, *K. Chandra Sekar* 100683.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; China and Pakistan.

2. *Pennisetum orientale* Rich. in Pers., Syn. Pl. 1: 72. 1805; Hook. f., Fl. Borl. India 7: 86. 1876; Bor, Grass. Burma, Ceylon, India & Pakistan 345. 1960; Murri, Fl. Cold Des. W. Himal. 1: 361. 2001.

Perennials, rhizomatous. Culms ascending, 45-80 cm high. Leaf-blades 20.35 x 0.5-1 cm, sparsely pubescent. Panicle linear, 8-20 cm long, often interrupted; rachis with shallow angular ribs, scaberulous to pubescent. Spikelets lanceolate, 4-6.5 mm long. Lower glume 1-1.5 mm long, obtuse; upper glume 1.5-3 mm long, acute to acuminate. Lemma 4-6 mm long, acuminate. Anthers apiculate, without a tuft of hairs at apex.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Mane-Larsa Pass, 3800 m, 30.08.2002, *K. Chandra Sekar* 100775.

Distrib: Throughout India; Afghanistan; China and Pakistan.

26. *Phleum* L.

Fifteen species in N. temperate regions and S. America; 3 in India.

Phleum alpinum L., Sp. Pl. 59. 1753, Aswal & Mehrotra, Fl. Lahaul-Spiti 677. 1994; Murri, Fl. Cold Des. W. Himal. 1: 364. 2001. *Jarsi Tso*

Perennials, tufted, shortly rhizomatous. Culms ascending, 20-45 cm high. Leaf blades 8-15 x 0.35-7 cm, glabrous; ligules 1-2 mm long, obtuse. Panicle 1-4.5 cm long, cylindrical-ovoid, 0.7-1.3 cm dia., purple. Spikelets 3-5.5 mm long (including awns). Glumes truncate, stiffly ciliate on keels, scabrid on sides; awn 1-3 mm long. Lemma 2-2.8 mm long, 3-5-nerved, minutely hairy on nerves. Anthers 1-1.5 mm long.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Tariya, 4000 m, 25.07.2003, K. Chandra Sekar 103687.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; throughout the Arctic regions and on mountains in the N. hemisphere, penetrating southwards to Southern Chile along mountains in the New World.

27. *Phragmites* Adams.

Three species, cosmopolitan; 2 in India.

- 1a. Leaf blades smooth beneath, filiform and flexuous at apex; ligules 1-1.5 mm long 1. *P. australis*
 1b. Leaf-blades scabrid beneath, stiff at apex; ligules less than 1 mm long 2. *P. karka*

1. *Phragmites australis* (Cav.) Trin. ex Steud., Nom. Bot., ed. 2, 2: 324, 1841; Aswal & Mehrotra, Fl. Lahaul-Spiti 678, 1994; Murti, Fl. Cold Des. W. Himal. 1: 366, 2001. *Arundo australis* Cav. in Anales Hist. Nat. Madrid 1: 100, 1799. *Phragmites communis* Trin., Fund. Agrost. 134, 1820; Hook.f., Fl. Brit. India 7: 303, 1896; Bor, Grass. Burma, Ceylon, India & Pakistan 416, 1960.

Perennials, rhizomatous. Culms erect, 2-3 m high. Leaf-blades 20-60 x 0.8-3 cm, the tip filiform and flexuous at apex, glabrous, smooth beneath. Panicle 20-46 x 5-7 cm. Spikelets 1.2-1.8 cm long. Lower glume 3-4.5 mm long; upper glume lanceolate, 5-9 mm long, sharply acute. Rhachilla hairs copious, 0.6-1 cm long, silky. Lower glume 3-4.5 mm long; upper glume lanceolate, 5-9 mm long, sharply acute. Lemma linear-lanceolate to linear-oblong, 0.8-1.5 cm long; fertile lemma very narrowly lanceolate, 0.9-1.3 cm long.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Parke to Bhaba Pass, 3800 m, 21.08.2002, K. Chandra Sekar 100755.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; temperate regions of both hemispheres.

2. *Phragmites karka* (Retz.) Trin. ex Steud., Nom. Bot., ed. 2, 2: 324, 1841; Hook.f., Fl. Brit. India 7: 304, 1894; Bor, Grass. Burma, Ceylon, India & Pakistan 416, 1960; Murti, Fl. Cold Des. W. Himal. 1: 366, 2001. *Arundo karka* Retz., Observ. Bot. 4: 21, 1786. *Damba*

Perennials, rhizomatous. Culms erect, 3-4 m high. Leaf blades 30-60 x 1.2-3 cm, stiff at apex, glabrous, rough beneath. Panicle 30-50 x 8-14 cm; the lowest node often many-branched in a whorl. Spikelets 0.9-1.2 cm long. Lower glume just over half as long as the upper; upper glume narrowly elliptic, 4-6 mm long, acute to subacute. Rhachilla-hairs 4-7 mm long. Lemma narrowly elliptic, 0.75-1.1 cm; fertile lemma narrowly lanceolate, 0.8-1 cm long.

Fl. & Fr.: July - September.

Occasional; on rocky slopes. Near Gechang, 3800 m, 03.09.2002, K. Chandra Sekar 102972.

Distrib.: Throughout India; Africa; Asia; Australia; Europe; Polynesia and Tropical Africa.

28. *Poa* L.

About 200 species distributed in temperate to alpine regions, throughout the world; 56 in India.

- | | |
|---|--|
| 1a. Keels of palea ciliate | 11. <i>P. nepalensis</i> |
| b. Keels of palea scabrid or scirpilosu | 2 |
| 2a. Annuals | 3 |
| b. Perennials | 4 |
| 3a. Lower glume 1-nerved | 14. <i>P. stewartiana</i> |
| b. Lower glume 3-nerved | 6. <i>P. hybridus</i> |
| 4a. Lemma scabrid or glabrous on keels | 1. <i>P. nitchisonii</i> |
| b. Lemma ciliate in the lower part of keels | 5 |
| 5a. Callus glabrous | 6 |
| b. Callus ciliate | 13 |
| 6a. Lemma hairy between nerves (at least at the basal part) | 7 |
| b. Lemma glabrous between nerves | 9 |
| 7a. Lower glume 1 nerved; anthers more than 2.2 mm long | 4. <i>P. jainoueri</i> |
| b. Lower glume 3 nerved; anthers up to 2 mm long | 8 |
| 8a. Surface of lower panicle-branches smooth; spikelets ovate | 2. <i>P. alpina</i> |
| b. Surface of lower panicle-branches scabrid; spikelets elliptic | 9. <i>P. subulatus</i> |
| 9a. Palea scirpilosu on keels | 10 |
| b. Palea scabrid on keels | 11 |
| 10a. Spikelets 4-7 mm long; lemma 3.8-4.1 mm long | 7. <i>P. imperialis</i> |
| b. Spikelets 3.8-4.5 mm long; lemma 2.5-2.8 mm long | 13. <i>P. sikkimensis</i> |
| 11a. Surface of lower panicle branches smooth | 8. <i>P. kashii</i> |
| b. Surface of lower panicle-branches scabrid | 12 |
| 12a. Lower panicle-branches 2-4; lower glume lanceolate | 10. <i>P. prophygatum</i> |
| b. Lower panicle-branches 1 or 2; lower glume ovate | 3. <i>P. attenuata</i> |
| 13a. Surface of lemma ciliate or scabrid at least at the basal part | 10. <i>P. lideni</i> |
| b. Surface of lemma glabrous | 5. <i>P. glauca</i> subsp. <i>himalaiana</i> |

1. *Poa nitchisonii* Boiss., Fl. Orient. 5: 602. 1884; Bor. Grass. Burma, Ceylon, India & Pakistan 554. 1960; Rajbh. in Ohba & Malla, Himal. Pl. 2: 187. 1991; Cope in Nasir & Ali, Fl. Pakistan 143: 414. 1982. **Fig. 25**

Perennials, tufted. Culms 15-30 cm high, terete, smooth. Leaf-blades linear, 2-8 x 0.2-0.4 cm; ligules 0.8-1 mm long. Panicle lanceolate-oblong. Spikelets oblong, 4.5-8 mm long with 3-5 florets. Lower glume 1.8-3 x 0.7-1 mm, subulate, 1-nerved; upper glume ovate-lanceolate, 2-3.5 x 1-1.5 mm, 3-nerved. Rachilla 0.5-1 mm long. Callus glabrous. Lemma oblong, 2.8-4 x 1.5-2 mm, obtuse, margin

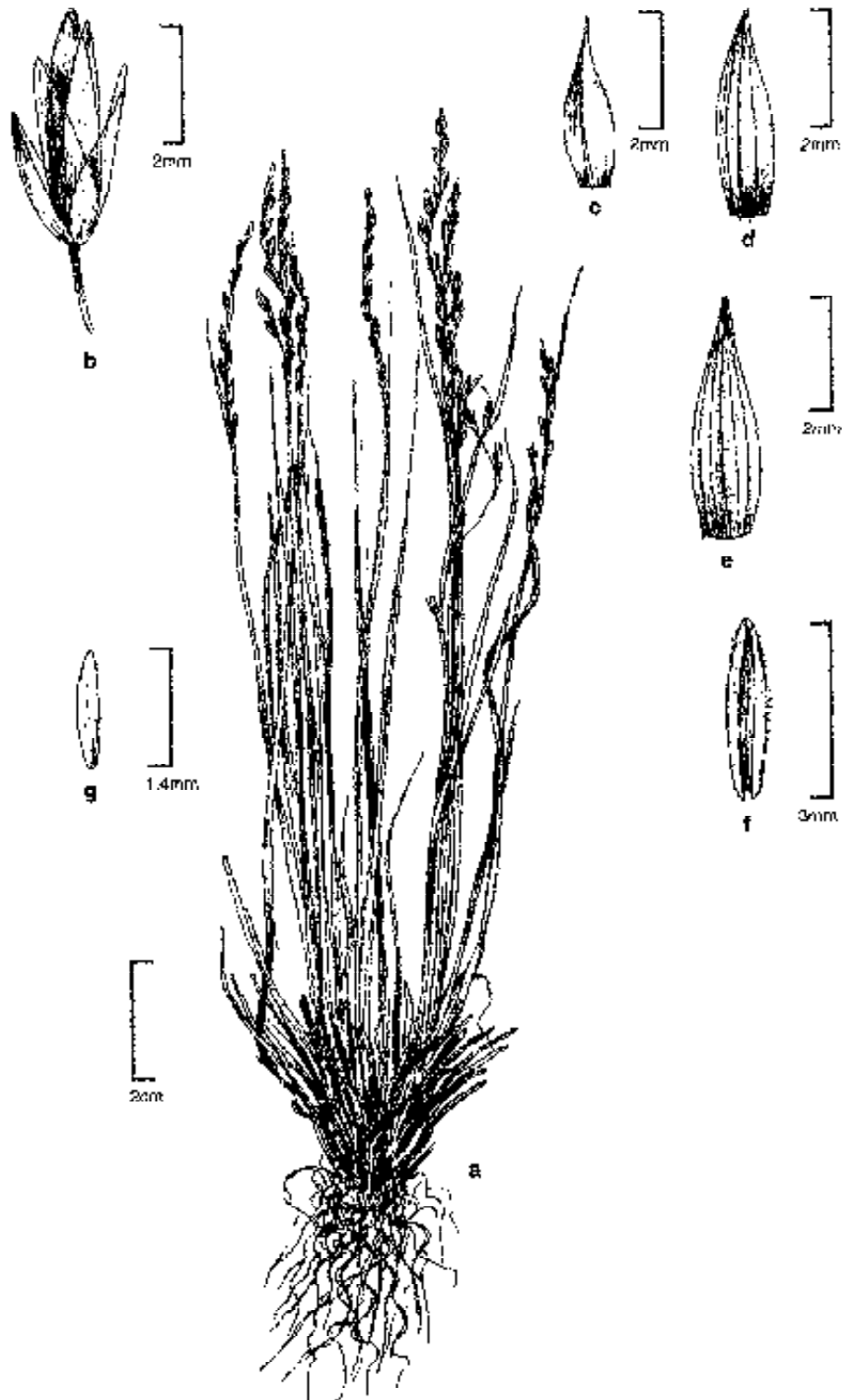


Fig. 25. *Poa altchisonii* Boiss. a. Habit, b. Spikelet, c. Lower glume, d. Upper glume, e. Lemma, f. Palea, g. Caryopsis

hyaline, glabrous; keels scabrid or sparsely ciliate on the lower part. Palea elliptic, 2.2-3.2 x 0.6-0.7 mm; keels scabrid. Caryopsis 1.2-1.6 mm long.

Fl & Fr.: July - September.

Scarce; on moist slopes. Chhohem, 4150 m, 12.07.2003, *K. Chandra Sekar* 103221.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Afghanistan; Iran and Pakistan.

2. *Poa alpina* L., Sp. Pl. 67. 1753; Stapf in Hook.f., Fl. Brit. India 7: 338. 1896; Bor, Grass. Burma, Ceylon, India & Pakistan 555. 1960; Rajbh. in Ohba & Malla, Himal. Pl. 2: 187. 1991; Aswal & Mehrotra, Fl. Lahaul-Spiti 683. 1994; Murri, Fl. Cold Des. W. Himal. 1: 370. 2001.

Autogisa, Tsa Rambu Nakpan, Sanr Tza, Kensa

Perennials, tufted. Culms 16-35 cm high. Leaf-blades oblong-lanceolate, 2-9.5 x 0.1-0.4 cm; ligules 1.5-3 mm long. Panicle ovate, 2-7 x 1-3.2 cm. Spikelets ovate, 4-7 mm long with 3-6 florets. Lower glume ovate, 2.7-4 x 1.5-2 mm, acute, 3-nerved; upper glume elliptic, 3-4.2 x 2-2.4 mm, acute, 3-nerved. Rachilla 0.4-0.5 mm long. Callus glabrous. Lemma ovate-oblong, 3-4 x 1.5-2.2 mm, obtuse, margin hyaline, surface hairy in lower half; keels ciliate in lower half and scabrid in the upper half. Palea elliptic-oblong, 3-3.8 x 0.7-1 mm; keels semipilose. Anthers 1.2-1.5 mm long. Caryopsis 1.5-1.7 mm long.

Fl & Fr.: June - August.

Common; on rocky slopes. Chhohem, 4150 m, 12.07.2003, *K. Chandra Sekar* 103225.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Asia; Europe and N. America.

A good fodder grass.

3. *Poa attenuata* Trin. in Mem. Acad. Sci. St.-Petersbourg Sav. Etrang. 2: 327. 1835; Cope in Nasir & Ali, Fl. Pakistan 143: 417. 1982; Rajbh. in Ohba & Malla, Himal. Pl. 2: 194. 1991; Murri, Fl. Cold Des. W. Himal. 1: 371. 2001. Fig. 26

Perennials, tufted. Culms erect, 15-35 cm high. Leaf-blades 1.5-5 cm long; ligules 1.5-3 mm long. Panicle oblong-lanceolate, 1.5-6 x 0.5-1 cm. Spikelets elliptic, 4-5.5 mm long with 2-4 florets. Lower glume ovate, 2-3.2 x 0.9-1.1, 3-nerved; upper glume ovate-elliptic, 2.5-3.5 x 1-1.3 mm, acute, 3-nerved. Callus glabrous. Lemma elliptic-oblong, 2-3.2 x 1.5-1.6 mm, glabrous; keels ciliate. Palea elliptic-oblong, 2.5-2.9 x 0.4-0.7 mm; keels scabrid. Anthers 1-1.2 mm long.

Fl & Fr.: July - September.

Scarce; on rocky slopes. Chhohem, 4100 m, 13.07.2003, *K. Chandra Sekar* 103251.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Asia; Mongolia and Siberia.

Note: The species is not reported from Himachal Pradesh (Chowdhery & Wadhwa, 1984), although Rajbandari (*et al.*) cited a specimen collected from Lahaul & Spiti district [Lahaul, 9.6.1941, *Bor* 14749 (1)].

4. *Poa falconeri* Hook.f. ex Stapf in Hook.f., Fl. Brit. India 7: 342. 1896; Bor, Grass. Burma, Ceylon, India & Pakistan 556. 1960; Rajbh. in Ohba & Malla, Himal. Pl. 2: 201. 1991; Murri, Fl. Cold Des. W. Himal. 1: 374. 2001.

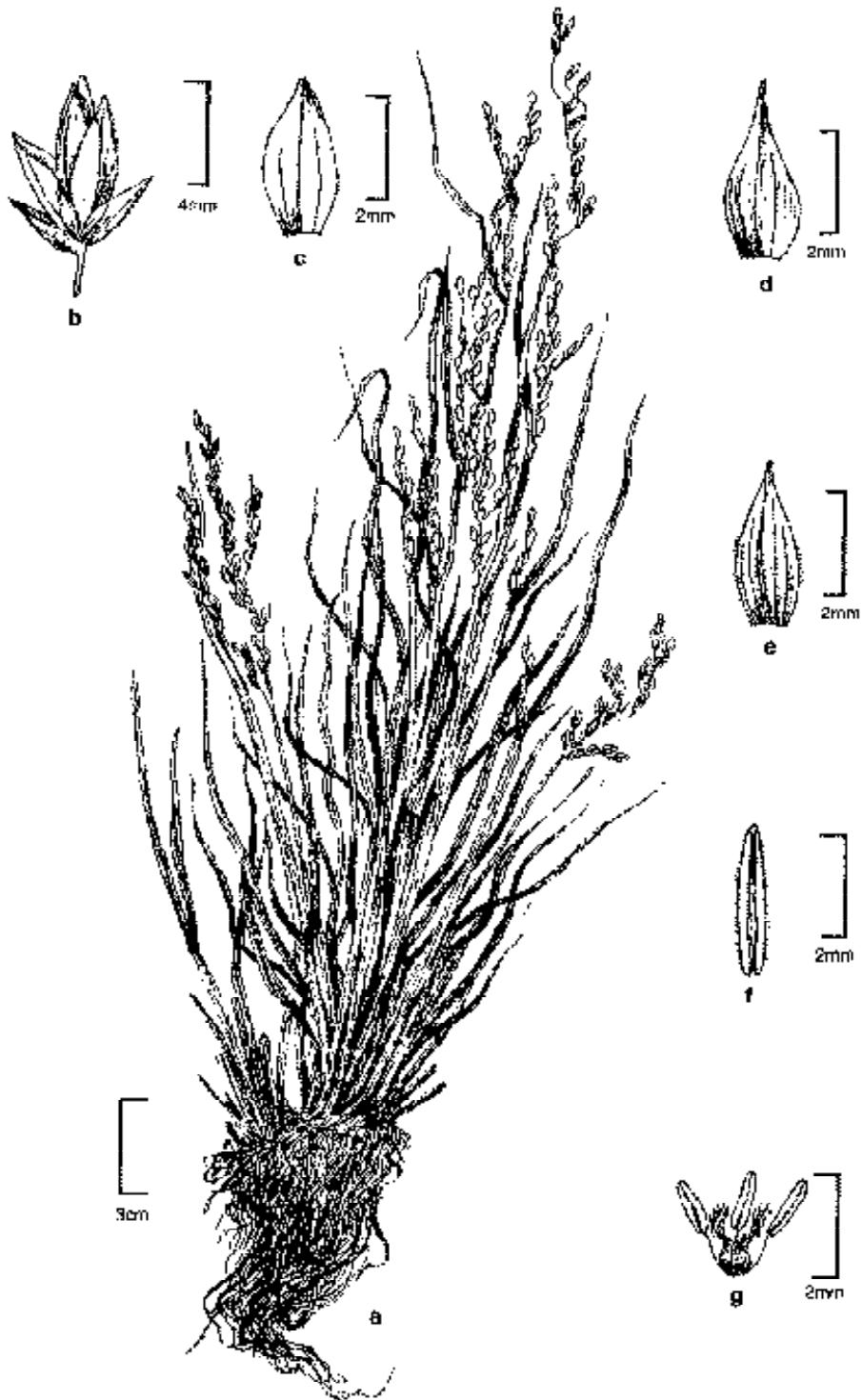


Fig. 26. *Poa attenuata* Trin. a. Habit, b. Spikelet, c. Lower glume, d. Upper glume, e. Lemma, f. Palea, g. Floret

Perennials, short stoloniferous. Culms 32-46 cm high. Leaf-blades linear, 4-20 x 0.1-0.35 cm; ligules 1.5-3.5 mm long. Panicle oblong, 6-20 x 1-4.5 cm, branches spreading. Spikelets elliptic-oblong, 5-7.8 mm long with 2 or 3 florets. Lower glume oblong, 2.8-4.3 x 0.6-2 mm, acute, 1-nerved; upper glume ovate-oblong, 3.4-5 x 1.2-2 mm, acute, 3-nerved. Callus glabrous. Lemma elliptic-oblong, 4-6 x 1.5-2 mm, acute-obtuse with minute hairs in lower part; keels short ciliate in lower half. Palea elliptic-oblong, 3.6-5.5 x 0.6-0.8 mm; keels scabrid. Anthers 2.5-2.8 mm long. Caryopsis 1-1.2 mm long.

Fl. & Fr.: July - September.

Rare; on rocky slopes. Gechang, 3900 m, 14.07.2003, K. Chandra Sekar 103297.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Bhutan to Pakistan.

Note: *Poa fulconeri* Hook.f. ex Stapf is an endemic species of the Himalaya (Rajshandari, *l.c.*).

5. *Poa glauca* Vahl subsp. *litwinowiana* (Ovcz.) Tzvelev in Nov. Sist. Vyssh. Rast. 1974: 322. 1974; Rajbh. in Ohba & Malla, Himal. Pl. 2: 204. 1991; Aswal & Mehrotra, Fl. Lahaul-Spiti 686. 1994; Murri, Fl. Cold Des. W. Himal. 1: 375. 2001. *P. litwinowiana* Ovcz. in Izv. Tadzhik. Bazy Bot. 1: 22. 1933; Bor, Grass. Burma, Ceylon, India & Pakistan 558. 1960.

Perennials, tufted. Culms 18-25 cm high. Leaf-blades linear, 2.5-4.2 cm long; ligules 1.8-2 mm long. Panicle oblong, 1.5-4 x 0.4-1 cm, branches ascending. Spikelets ovate-elliptic, 3-5.2 mm long with 2 or 3 florets. Lower glume ovate elliptic, 2.5-3 x 1-1.8 mm, acute, 3-nerved; upper glume elliptic, 2-3.5 x 1.2-1.7 mm, 3-nerved. Callus with short hairs. Lemma elliptic-oblong, 3.5 x 1.5-1.8 mm, obtuse, glabrous; keels ciliate in lower half. Palea elliptic, 2.5-3 x 0.7-0.9 mm; keels scabrid. Anthers 1.5-1.8 mm long.

Fl. & Fr.: July - August.

Occasional; on moist slopes. Gechang, 3730 m, 15.07.2002, K. Chandra Sekar 100459.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China; Central Asia; Pakistan and U.S.S.R.

6. *Poa hylobates* Bor in Bull. Bot. Surv. India 7: 132. 1965; Melderis in Hara & al., Unum. Fl. Pl. Nepal 1: 143. 1978; Rajbh. in Ohba & Malla, Himal. Pl. 2: 209. 1991; Chandra Sekar & al. in Ann. Bot. 11(2): 185. 2003. *Bireum* Tsa Fig. 27

Annuals. Culms 18-32 cm high, terete, 2 or 3-noded. Leaf-blades linear, 4-4.7 x 0.1-0.12 cm; ligules 2-2.5 mm long. Panicles 5-5.5 x 0.5-0.9 cm; branches spreading, lower branches 2 or 3, scabrid. Spikelets elliptic, 3.5-4 mm long with 3 florets. Lower glume lanceolate, 2.2-2 x 0.8-1 mm, acute, 3-nerved; upper glume elliptic, 2.5-2.7 x 1.1-1.2 mm, acute, 3-nerved. Rachilla 0.9-1 mm long. Callus glabrous. Lemma oblong, 2.9-3.1 x 1-1.2 mm, obtuse, glabrous; keels ciliate in lower part. Palea elliptic-oblong, 2.4-2.6 x 0.5-0.6 mm; keels scabrid. Anthers 1.4-1.6 mm long.

Fl. & Fr.: June - September.

Rare; on rocky slopes. Lanjuk, 3900 m, 02.08.2002. K. Chandra Sekar 100569.

Distrib.: India: Himachal Pradesh; Nepal.

7. *Poa imperialis* Bor in Kew Bull. 1957: 414. 1957 in Grass. Burma, Ceylon, India & Pakistan 557. 1960; Rajbh. in Ohba & Malla, Himal. Pl. 2: 210. 1991. *Tala Aetha* Tsa

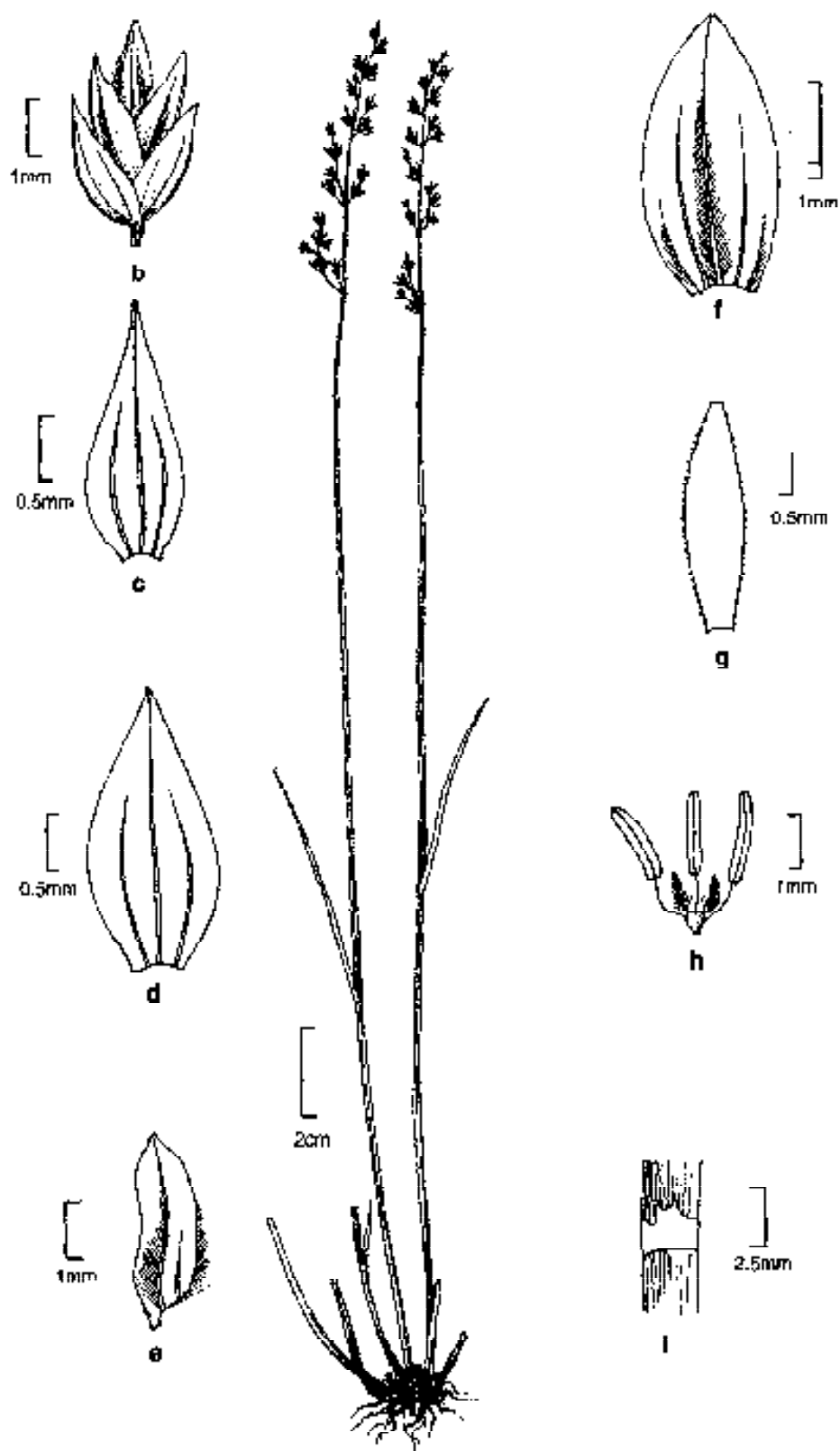


Fig. 27. *Poa hystrix* Hor. a. Habit, b. Spikelet, c. Lower glume, d. Upper glume, e. Lemma- side view, f. Lemma, g. Palea, h. Floret, i. Ligule

Perennials, stoloniferous. Culms 30-60 cm high, terete, smooth. Leaf-blades linear, 14-19 x 0.4-0.6 cm; ligules 4-6 mm long. Panicle 8-16 x 2.5 cm, branches spreading. Spikelets elliptic-oblong, 4-7 mm long with 4-7 florets. Lower glume elliptic, 3-3.2 x 1-1.5 mm, 1-nerved; upper glume oblong, 3.5-4.1 x 1.6-2 mm, acute, 3-nerved. Callus glabrous. Lemma elliptic-oblong, 3.8-4.1 x 2-2.3 mm, acute, glabrous; keels ciliate in lower half. Palea elliptic-oblong, 3-3.2 x 0.6-0.8 mm; keels semipilose. Anthers 0.6-1 mm long.

Fl. & Fr.: June - September.

Scarce; on rocky slopes, Mud-Tiling, 3800 m, 26.08.2002, K. Chandra Sekar 102943.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Nepal and Pakistan.

Note : It resembles *P. sikkimensis* (Stapf) Bor in habit, lower glume and callus, palea-keels and length of anthers, but differs from it in the length of the spikelets and lemma.

8. *Poa kanaii* Rajbh. in Acta Phytotax. Geobot. 39: 58. 1988 & in Ohba & Malla, Himal. Pl. 2: 213. 1991. *Beereem Tsa* Fig. 28

Perennials, loosely tufted. Culms 13-18 cm high. Leaf-blades linear, 3-4 x 0.1-0.2 cm; ligules 2-3 mm long. Panicle ovate-oblong, 1.5-4 x 0.6-0.8 cm. Spikelets elliptic, 4.5-4.7 mm long with 2-3 florets. Lower glume elliptic, 2-3.9 x 1-1.5 mm, acute, 1 or 3-nerved; upper glume elliptic, 3-4.3 x 1.5-2 mm, acute, 3-nerved. Callus glabrous. Lemma ovate-elliptic, 4-4.5 x 1.8-2.2 mm, minutely scabrid in lower part; keels ciliate in lower third. Palea elliptic-oblong, 3-3.7 x 0.5-0.7 mm; keels scabrid. Anthers 1.2-1.8 mm long.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Near Mud, 3700 m, 02.08.2002, K. Chandra Sekar 102840.

Distrib.: India: Himachal Pradesh and Uttarakhand; Nepal.

9. *Poa lahulensis* Bor in Kew Bull. 1948: 138. 1948 & Grass. Burma, Ceylon, India & Pakistan 558. 1960; Rajbh. in Ohba & Malla, Himal. Pl. 2: 217. 1991; Aswal & Mehrotra, Fl. Lahaul-Spiti 687. 1994; Marti, Fl. Cold Des. W. Himal I: 377. 2001.

Beereem Tsa, Tsa Beereem Nakpo, Karom Nakpo Tsa, Beereem Juungu Tsa

Perennials, tufted. Culms 14-30 cm high. Leaf-blades linear, 2-6 cm long; ligules 1.2-2.5 mm long. Panicle oblong, 2-4 x 0.8-0.9 cm, branches ascending. Spikelets elliptic, 5-7.2 mm long, acute with 2-7 florets. Lower glume elliptic-oblong, 3.4-3.6 x 1.2-1.5 mm, acute, 3-nerved; upper glume oblong-elliptic, 3.6-3.8 x 1.5-1.6 mm, acute, 3-nerved. Callus glabrous. Lemma oblong, 3.5-4 x 1.6-1.9 mm, obtuse, ciliate hair in lower part; keels ciliate in lower half. Palea elliptic-oblong, 3.1-3.4 x 0.6-0.8 mm; keels semipilose. Anthers 1.5-1.9 mm long. Caryopsis 1-1.4 mm long.

Fl. & Fr.: June - September.

Common; on rocky slopes. Saupal, 4300 m, 04.08.2002, K. Chandra Sekar 102870.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China and Pakistan.

Note : It resembles with *P. alpina* L. but it can easily be distinguished by having elliptic spikelets.

10. *Poa ludens* R.R. Stewart in Brittonia 5: 420. 1945; Bor, Grass. Burma, Ceylon, India & Pakistan 558. 1960; Rajbh. in Ohba & Malla, Himal. Pl. 2: 217. 1991; Chandra Sekar & al. in Rheedeia 14: 67.2004. *Beereem Uarma, Urshi* Fig. 29

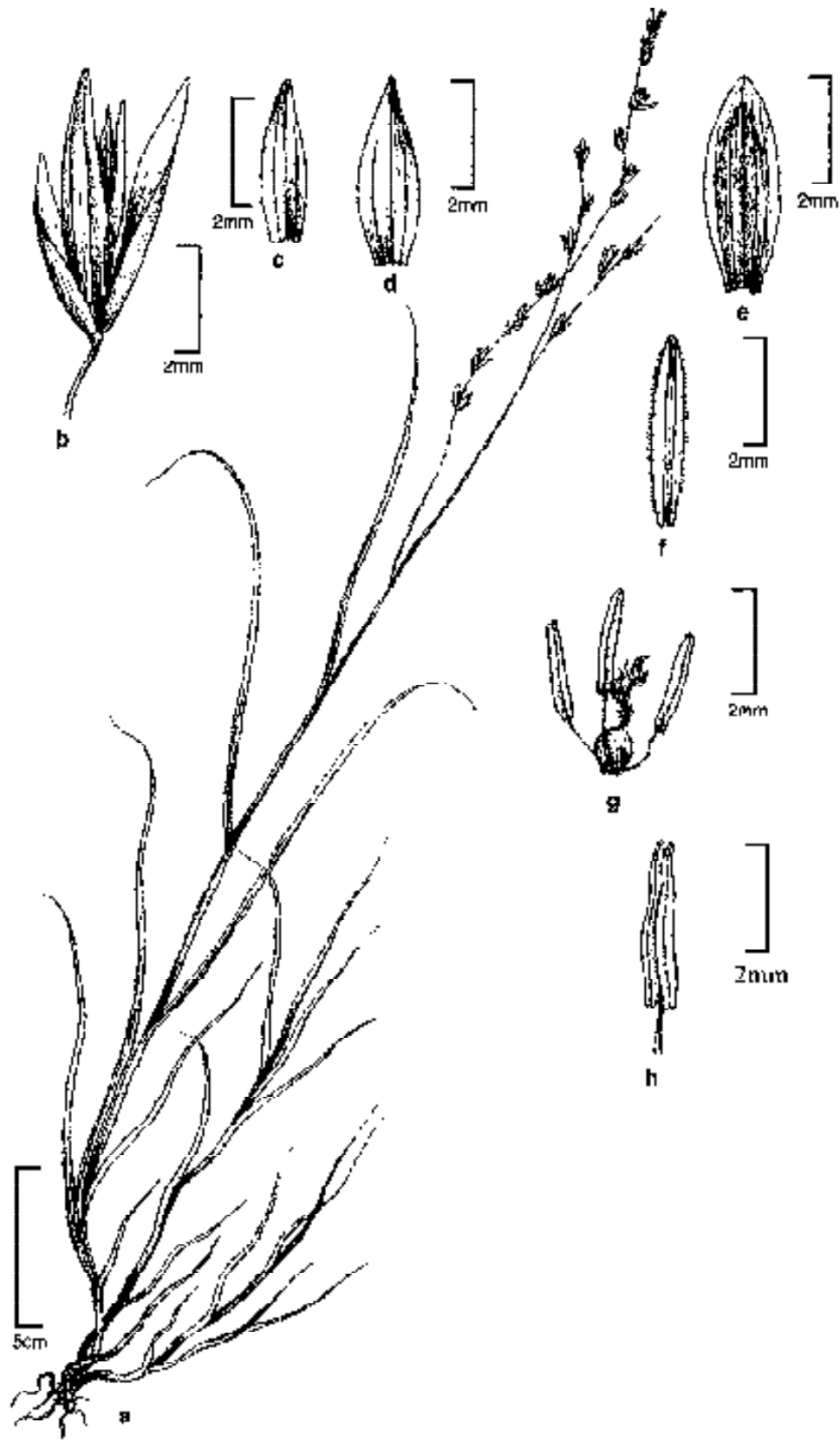


Fig. 28. *Poa kanzii* Rajbh. a. Habit, b. Spikelet, c. Lower glume, d. Upper glume, e. Lemma, f. Palea, g. Flower, h. Anther

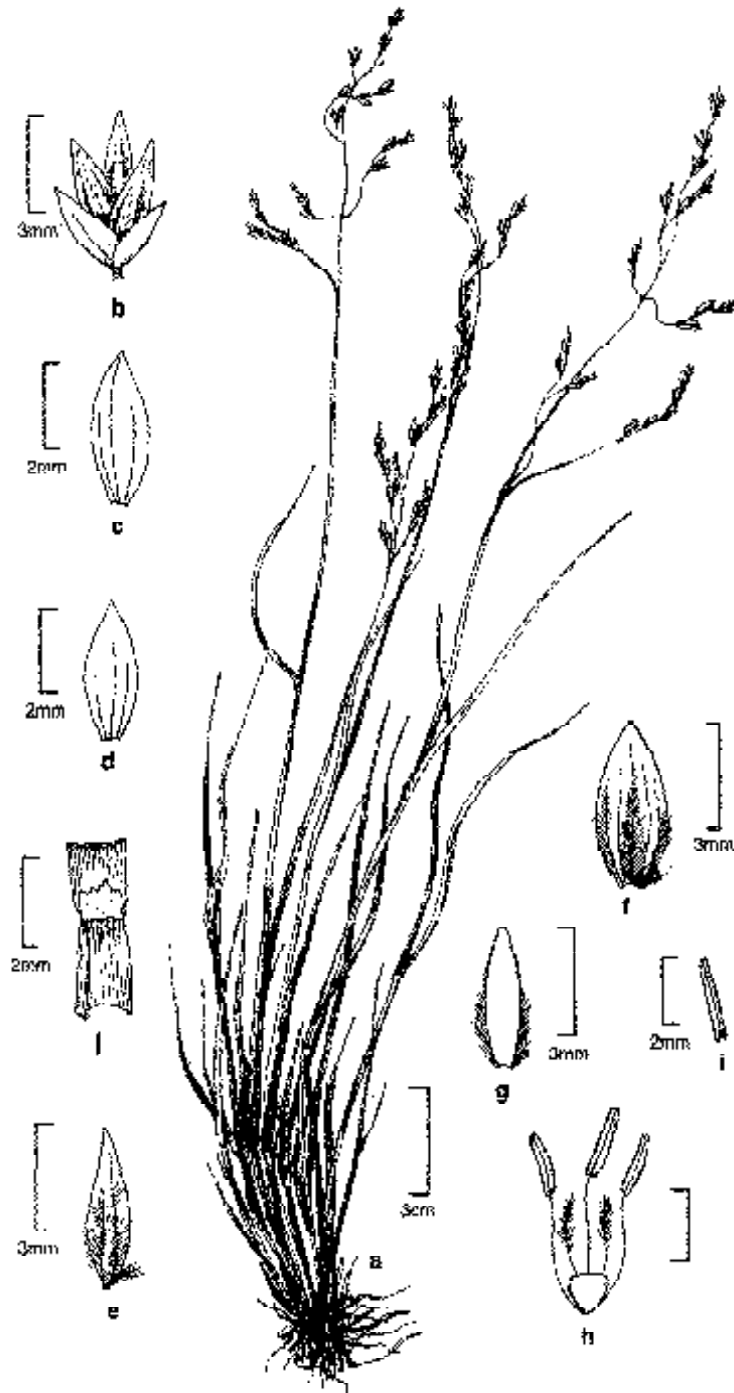


Fig. 29. *Poa ludens* R. R. Stewart. a, Habit, b, Spikelet, c, Lower glume, d, Upper glume, e, Lemma - side view, f, Lemma, g, Palea, h, Flower, i, Anther, j, Ligule.

Perennials, tufted. Culms 32-55 cm high. Leaf-blades linear, 1.5-5 x 0.1-0.2 cm; ligules 0.6-1 mm long. Panicle oblong, 4.5-8 x 1.5-4.5 cm; branches spreading. Spikelets elliptic, 3.7-5.5 mm long with 3 or 4 florets. Lower glume elliptic-oblong, 2.1-3.5 x 0.9-1.2 mm, acute, 1 or 3 nerved; upper glume elliptic-oblong, 3.4 x 1.2 mm, acute, 3 nerved. Callus ciliate. Lemma elliptic-oblong, 3.7-4.2 x 1.5-2 mm, acute; keels ciliate in lower part. Palea elliptic-oblong, 3.4-3.8 x 0.5-0.7 mm; keels scabrid. Anthers 1.8-2.5 mm long.

Fl. & Fr.: July - September.

Common; on rocky slopes. Chhohera, 4400 m, 13.07.2003, *K. Chandra Sekar* 103285.

Distrib.: India: Himachal Pradesh and Sikkim; China; Bhutan and Nepal.

11. *Poa nepalensis* Wall. ex Duthie, Grass. N.W. India 40. 1883; Bor, Grass. Burma, Ceylon, India & Pakistan 558. 1960; Rajbh. in Ohba & Malla, Himal. Pl. 2: 221. 1991; Murti, Fl. Cold Des. W. Himal. 1: 380. 2001. *P. annua* L. var. *nepalensis* Griseb. in Nachr. Ges. Wiss. Ges. Wiss. 1868: 75. 1868; Stapf in Hook.f., Fl. Brit. India 7: 346. 1896.

Perennials, tufted. Culms 25-45 cm high. Leaf-blades linear, 5-15 x 0.1-0.3 cm; ligules 1-1.5 mm long. Panicle oblong, 4-14 x 1-4.5 cm; branches spreading. Spikelets elliptic, 3.5-4.6 mm long, acute with 2-5 florets. Lower glume elliptic, 1.5-2.2 x 0.6-0.8 mm, acute, 1-nerved; upper glume ovate-elliptic, 1.9-2.5 x 1.2-1.5 mm, acute, 3-nerved. Callus with long hairs. Lemma oblong-elliptic, 2.4-2.9 x 1.6-1.8 mm, obtuse, glabrous; keels ciliate in lower half. Palea oblong elliptic, 1.9-2.1 x 0.5-0.6 mm; keels ciliate. Anthers 0.6-0.8 mm long. Caryopsis 1.6-2 mm long.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Mud-Tharbik, 4000 m, 01.08.2002, *K. Chandra Sekar* 102810.

Distrib.: India: Arunachal Pradesh, Assam, Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; Pakistan.

12. *Poa poophagorum* Bor in Kew Bull. 1948: 143. 1948; Bor, Grass. Burma, Ceylon, India & Pakistan 559. 1960; Rajbh. in Ohba & Malla, Himal. Pl. 2: 213. 1991; Chandra Sekar & al. in Rheedea 14: 68.2004. *Bireum* Tra, Tra Beeren **Fig. 30**

Perennials, tufted. Culms 20-40 cm high. Leaf-blades linear, 1.5-4.5 cm long; ligules 2.2-3 mm long. Panicle linear, 2-11 x 0.6-1.5 cm; branches ascending. Spikelets elliptic, 3-4.1 mm long with 2 or 3 florets. Lower glume lanceolate, 2-2.6 x 0.6-1.2 mm, acute, 3-nerved; upper glume elliptic-lanceolate, 2.2-2.9 x 0.8-1.4 mm, acute, 3-nerved. Callus glabrous. Lemma oblong, 2.5-3.2 x 1-1.4 mm, acute; keels ciliate in lower part. Palea elliptic-oblong, 2.2-2.8 mm long; keels scabrid. Anthers 1.2-1.7 mm long. Caryopsis 1.2-1.4 mm long.

Fl. & Fr.: July - September.

Scarce; on rocky slopes. Larang La, 5000 m, 05.08.2003, *K. Chandra Sekar* 103745.

Distrib.: India: Himachal Pradesh and Sikkim; China; Bhutan to Nepal.

Note. It resembles *P. mustangensis* Rajh. in habit and floral characters, but differs from it in the smooth culm, the length and obscure intermediate nerves of the lemma and the glabrous ligule.

13. *Poa sikkimensis* (Stapf) Bor in Kew Bull. 1952: 130. 1952; Bor, Grass. Burma, Ceylon, India & Pakistan 560. 1960; Rajbh. in Ohba & Malla, Himal. Pl. 2: 216. 1991; Aswal & Mehrotra, Fl. Lahaul-Spiti 689. 1994; Murti, Fl. Cold Des. W. Himal. 1: 383. 2001. *P. annua* L. var. *sikkimensis* Stapf in Hook.f., Fl. Brit. India 7: 346. 1896.

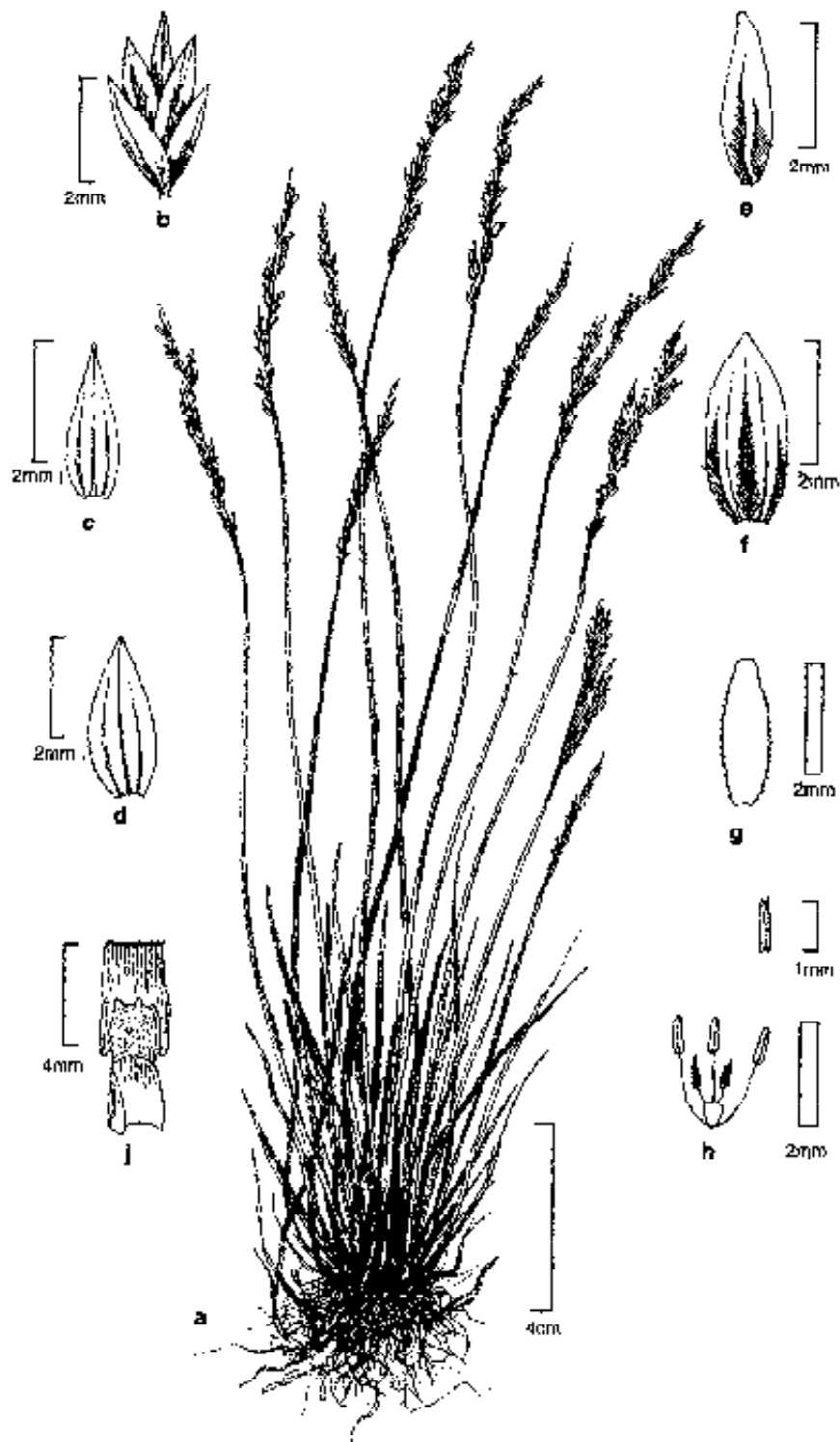


Fig. 30. *Poa prostratum* Bor. a. Habit, h. Spikelet, c. Lower glume, d. Upper glume, e. Lemma - side view, f. Lemma, g. Palea, h. Floret, i. Anther, j. Ligule

Perennials, tufted. Culms 18-30 cm high. Leaf-blades linear, 1.5-10 cm long; ligules 1.5-4 mm long. Panicle oblong, 3.5-14 x 2-3.5 cm, branches spreading. Spikelets oblong, 3.8-4.5 mm long with 3 or 4 florets. Lower glume lanceolate, 1.5-2.8 x 0.7-1 mm, acute, 1 or 3 nerved; upper glume elliptic-obovate, 2.1-2.5 x 1-1.5 mm, acute, 3-nerved. Callus glabrous. Lemma broadly elliptic, 2.5-2.8 x 1.4-1.6 mm, obtuse, glabrous; keels ciliate in lower half. Palea elliptic-oblong, 2.2-2.4 x 0.5-0.7 mm; keels setripilose. Anthers 0.5-1 mm long.

Fl. & Fr.: July - August.

Occasional; on rocky slopes. Thango-Kilung, 4500 m, 01.08.2003, K. Chandu Sekar 103720.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir, Sikkim and Uttarakhand; China; Nepal and Pakistan.

14. *Poa stewartiana* Bor in Kew Bull. 1951: 185. 1951 *et* Bor, Grass. Burma, Ceylon, India & Pakistan 561. 1960; Rajbh. in Ohba & Malla, Himal. Pl. 2: 240. 1991; Aswal & Mehrotra, Fl. Lahaul-Spiti 690. 1994; Murri, Fl. Cold Des. W. Himal. 1: 384. 2001.

Annuals. Culms 17-30 cm high. Leaf-blades linear, 4.5-15 x 0.1-0.3 cm; ligules 1.8-2.5 mm long. Panicle linear, 4.5-8 x 0.8-1.2 cm. Spikelets elliptic, 3.5-6 mm long with 2-4 florets. Lower glume lanceolate, 2-3 x 0.5-0.8 mm, acuminate, 1-nerved; upper glume oblong-elliptic, 3-4.5 x 1-1.2 mm, 3-nerved. Callus with ciliate hairs. Lemma elliptic-oblong, 2.5-4.5 x 1.5-1.8 mm, acute; keels ciliate in lower half. Palea elliptic-oblong, 2.1-3 x 0.4-0.5 mm; keels semipilose. Anthers 0.8-1 mm long.

Fl. & Fr.: June - September.

Scarce; on rocky slopes. Manc, 3800 m, 03.09.2002, K. Chandu Sekar 102971.

Distrib.: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Pakistan.

29. *Setaria* P. Beauv.

About 150 species, in the tropical and subtropical regions; 12 in India.

- | | |
|---|----------------------|
| 1a. Upper glume as long as the upper lemma | <i>2. S. viridis</i> |
| b. Upper glume shorter than the upper lemma | <i>1. S. pumila</i> |

1. *Setaria pumila* (Poir.) Ruem. & Schult., Syst. Veg. 2: 891. 1817; Cope in Nasir & Ali, Fl. Pakistan 143: 181. 1982; Murri, Fl. Cold Des. W. Himal. 1: 402. 2001. *Panicum pumilum* Poir., Encycl. Meth. Bot., Suppl. 4, 273. 1816. *Setaria pallide-fusca* (K. Schum.) Stapf & C.E. Hubb. in Kew Bull. 1930: 259. 1930; Bor, Grass. Burma, Ceylon, India & Pakistan 363. 1960.

Annuals, loosely tufted. Culms ascending, 32-55 cm high. Leaf-blades linear, 3-25 x 0.2-0.9 cm. Panicle spikeiform, cylindrical, 1-8 cm long; rachis tomentellous; bristles slender, 0.3-1.2 cm long, fulvous. Spikelets ovoid, 1.5-3 mm long. Glumes 1-2 mm long. Lemma 2.5-3.2 mm long; upper lemma rugose to corrugate. Palea, 2.5-3 mm long. Lower floret male or sterile.

Fl. & Fr.: July - September.

Occasional; on rocky slopes. Manc-Larsa pass, 3750 m, 29.08.2002, K. Chandu Sekar 100763.

Distrib.: Throughout India; tropical and temperate regions of the Old World and North America.

2. *Setaria viridis* (L.) P. Beauv., Ess. Agrost. 51, 17. 178. 1812; Bor, Grass. Burma, Ceylon, India & Pakistan 365. 1960; Aswal & Mehrotra, Fl. Lahaul-Spiti 695. 1994; Murri, Fl. Cold Des. W. Himal. 1: 403. 2001. *Panicum viride* L., Syst. Nat. ed. 10, 2: 870. 1759.

Annuals, loosely tufted. Culms geniculately ascending. Leaf-blades broadly linear to narrowly lanceolate, 5-20 x 0.4-1.2 cm, rounded at the base, scaberrulous at margin, flaccid; sheaths glabrous or pubescent. Panicle spiciform, linear, 2-12 cm long; rachis puberulous-hispidulous; bristles 0.3-1.2 cm long. Spikelets ellipsoid, 2-2.8 mm long. Lower glume ca 2 mm long; upper glume as long as the spikelets. Lemma 2-2.6 mm long; upper lemma finely rugose. Lower floret barren.

Fl. & Fr.: July - September.

Scarce; on rocky slopes, Mane-larsa Pass, 3650 m, 27.08.2002, K. Chandra Sekar 100751.

Distrib.: India: Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Meghalaya, Punjab, Sikkim, Uttarakhnad, Uttar Pradesh and West Bengal; Bhutan; China; Nepal and Pakistan.

30. *Stipa* L.

About 300 species distributed in tropical and temperate regions; 25 in India.

- 1a. Awn unigeniculate, 10-20 cm long 2. *S. caucasica*
 b. Awn bigeniculate, 7-10 cm long 1. *S. arabica*

1. *Stipa arabica* Trin. & Rupr., Sp. Gram. Stip. 77. 1872; Cope in Nasir & Ali, Fl. Pakistan 143: 420. 1982. *S. zeyvitsiana* (Trin.) Griseb. in Ledeb., Fl. Ross. 4: 450. 1852; Bor, Grass. Burma, Ceylon, India & Pakistan 647. 1960. Fig. 31

Perennials. Culms ascending, up to 70 cm high. Leaf-blades involute, setaceous, up to 2.5 mm wide when flattened, sparsely pubescent. Panicle linear, 15-35 cm long, partially enclosed by the slightly inflated sheath of the uppermost leaf. Glumes narrowly lanceolate, 25-35 mm long, long acuminate, 3-nerved. Lemma terete, 8-11.5 mm long (including callus), shortly hairy with rows of hairs not quite reaching the summit, with a crown of hairs at apex, awned; awn bigeniculate, 10-20 cm long, articulated at the base, column hairs 0.5-1 mm long; bristle plumose with hairs 2-4 mm long.

Fl. & Fr.: July - September.

Occasional; on moist slopes, Chhohem, 4100 m, 13.7.2003, K. Chandra Sekar 103274.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Sinai eastwards through Iran, Caucasus and Afghanistan to Pakistan and Southern USSR.

2. *Stipa caucasica* Schmalh. in Ber. Deutsch Bot. Ges. 10: 293. 1892; Bor, Grass. Burma, Ceylon, India & Pakistan 644. 1960; Murri, Fl. Cold. Des. W. Himal. 1: 406. 2001.

Perennials, tufted. Culms erect, 34-55 cm high. Leaf-blades involute, straceous, stiff and pungent, glabrous; ligules 0.5-0.7 mm long, shaggy. Panicle narrow, 5-11 cm long, contracted, partially enclosed by the inflated sheath of the uppermost leaf. Glumes subequal, lanceolate, 1.8-2.2 cm long, long acuminate, 5-nerved. Lemma terete, 0.9-1.3 cm long, awn unigeniculate, 8-13 cm long, articulated at base.

Fl. & Fr.: July - September.

Occasional; on rocky slopes. Gechang, 3730 m, 16.07.2002, K. Chandra Sekar 100472.

Distrib.: India: Himachal Pradesh and Jammu & Kashmir; Caucasus eastwards to Central Asia.

Note: *Stipa caucasica* is closely allied and often confused with *S. purpurea* Griseb., but can easily be separated by unigeniculate awn with a rigidly falcate bristle, as *S. purpurea* is characterised by bigeniculate awn.

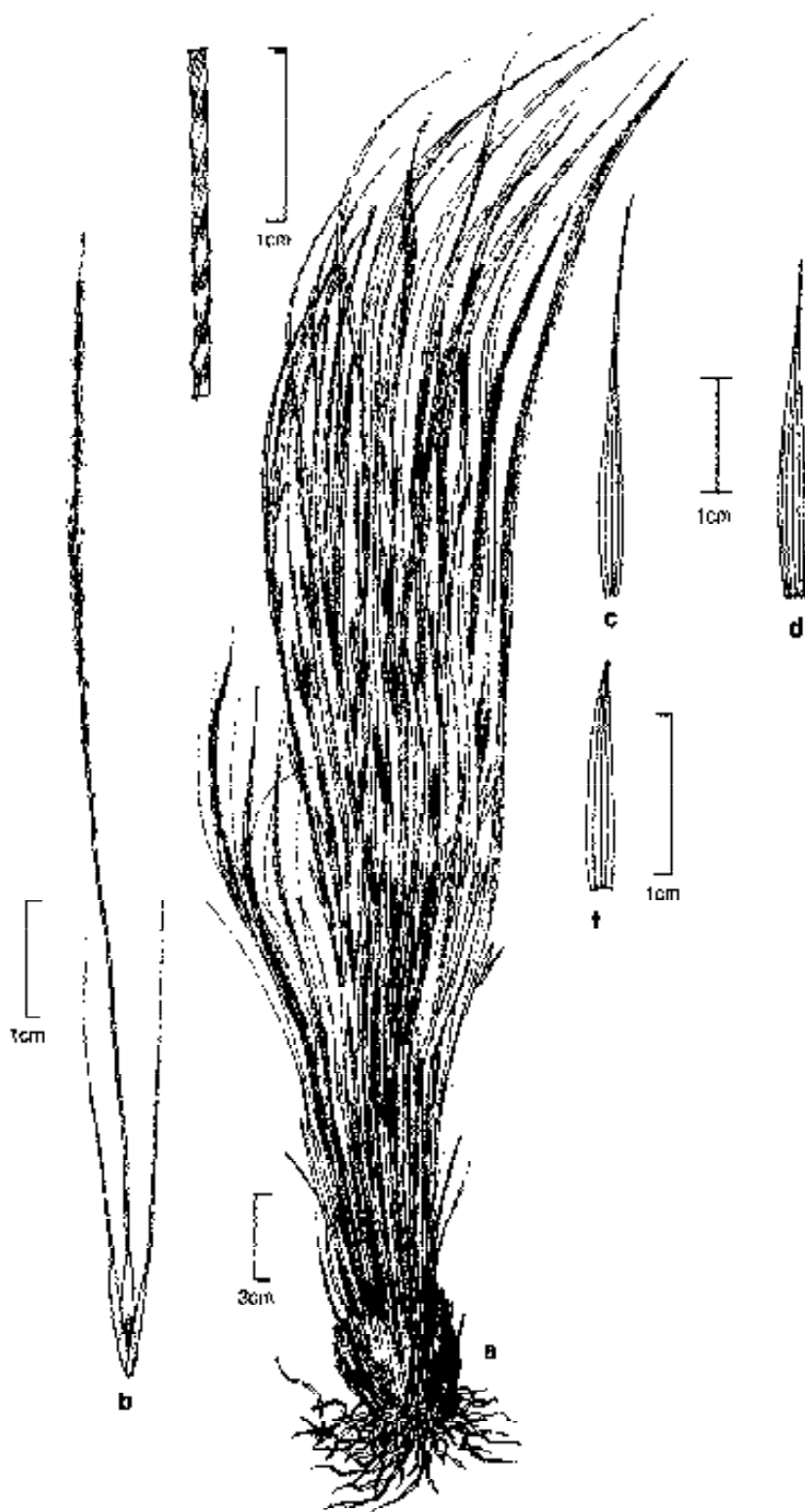


Fig. 31. *Stipa arabica* Trin. & Rupr. a. Habit, b. Spikelet, c. Lower glume, d. Upper glume, e. Lower portion of awn (lemma), f. Pilea

31. *Tripogon* Roem. & Schult.

About 20 species distributed in tropical Old World; 12 in India.

Tripogon purpurascens Duthie in Ann. Roy. Bot. Gard. Calcutta 9: 74, t. 92. 1901; Cope in Nasir & Ali, Fl. Pakistan 143: 77. 1982.

Perennials, tufted. Culms erect, 28-40 cm high, slender. Leaf-blades 5-15 cm long, *filiform*, convolute. Spikes 3-16 cm long, straight or somewhat curved. Spikelets with 2-5 florets, 3.5-7 mm long. Lower glume narrow, 1.5-2.5 mm long, 1-nerved; upper glume lanceolate, 2.6-4 mm long, 1-nerved. Callus bearded in front. Lemma 2.4-3.5 mm long, truncate and 2-toothed at apex with a minute awn between teeth; lateral nerves minutely excurrent.

Fl. & Fr: July - August.

Scarce; on rocky slopes. Thangti, 3700 m, 27.08.2002, K. Chandra Sekar 102993.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; China; Nepal; Pakistan and Oman.

32. *Trisetum* Pers.

About 70 species distributed in temperate regions, excluding Africa; 7 in India.

- | | |
|---|-----------------------|
| 1a. Panicle spiciform or ovoid; lemma 4-5 mm long | 2. <i>T. spicatum</i> |
| b. Panicle not spiciform or ovoid; lemma 5.5-7 mm long. | 1. <i>T. clarkei</i> |

1. *Trisetum clarkei* (Hook.f.) R.R. Stewart in Brittonia 5: 431. 1945; Bot. Grass. Burma, Ceylon, India & Pakistan 447. 1960; Aswal & Mehertra, Fl. Lahaul-Spiti 700. 1994; Murti, Fl. Cold Des. W. Himal. 1: 418. 2001. *Avena clarkei* Hook.f., Fl. Brit. India 7: 278. 1896. *Ranaba Karpa Tsa*

Perennials, tufted. Culms erect, 34-56 cm high, puberulous especially below the inflorescence. Leaf-blades 4-20 x 0.15-0.25 cm, pubescent-scaberulous, flat. Panicle lanceolate-subcylindrical, 4.5-18 x 1.3 cm, axis and branches puberulous. Spikelets 5-8.5 mm long (excluding the awns) with 2 or 3 florets. Glumes lanceolate, acute; lower glume 4-6 mm long, 3-nerved; upper glume 5.5-7 mm long. Lemma narrowly elliptic, 5.5-7 mm long, awned, awn 4-8 mm long, strongly recurved.

Fl. & Fr: July - September.

Scarce; on stream beds. Tanya, 4100 m, 08.08.2002, K. Chandra Sekar 100633.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Nepal and Pakistan.

2. *Trisetum spicatum* (L.) Richt., Pl. Europ. 1: 59. 1980; Bot. Grass. Burma, Ceylon, India & Pakistan 448. 1960; Aswal & Mehertra, Fl. Lahaul-Spiti 701. 1994; Murti, Fl. Cold Des. W. Himal. 1: 419. 2001. *Avena spicata* L., Sp. Pl. 64. 1753. *Bireem Tsa*

Perennials, tufted. Culms erect, 34-46 cm high, puberulous with short reflexed hairs especially below the inflorescence. Leaf-blades 4-10 x 0.1-0.3 cm, villous-scaberulose, flat. Panicle ovoid to cylindrical, 1.5-7 cm long; axis and branches puberulous. Spikelets 4-7.5 mm long (excluding the awns) with 2 or 3 florets. Glumes elliptic, acute, subequal; lower glume 3.5-4.5 mm long, 1-3-nerved; upper glume 4-6 mm long. Lemma elliptic, 4-5 mm long, awn 2-6 mm long, strongly recurved.

Fl. & Fr: July - September.

Scarce; on rocky slopes. Chbohem, 4050 m, 12.07.2003, K. Chandra Sekar 103205.

Distrib: India: Himachal Pradesh, Jammu & Kashmir and Uttarakhand; Arctic and alpine regions of Northern hemisphere.

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