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PLANT WEALTH OF NANDA DEVI BIOSPHERE RESERVE

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PREFACE

The basic objectives of the Biosphere Reserves are to conserve the diversity and integrity of biotic communities of plants and animals within natural and seminatural ecosystems for present and future use; to safeguard the genetic diversity on which their evolution depends and to provide area and facilities for ecological and environmental research, education and training.

Over the years, the guidelines, for the planning and management of the Biosphere Reserves have been expanded to make them more relevent to human needs and economically and socially acceptable to the populations concerned. Despite various lacunae and imperfections in the realization of these objectives, the primary functions of a Biosphere Reserve remains to facilitate *in situ* conservation to all forms of life along with its support system in its totality so that it could serve as a referral system for monitoring and evaluating changes in natural ecosystems, training of specialists and environemntal education.

Based on the recommendations made by the core group set up under the Man and Biosphere Programme (MAB) of the Government of India, 14 biodiversity rich sites were identified for establishing Biosphere Reserves throughout the country. Though the project documents of all the sites have been prepared, yet only eight such sites are so far declared as Biosphere Reserves. The Nandadevi Biosphere Reserve, which came into existence on 1st January, 1988, is one of them.

In the present publication an attempt has been made to document the plant wealth of the Nanda Devi Biosphere Reserve based on a number of botanical explorations in the area for over a decade by the authors themselves. The flora of reserve comprises 793 species of vascular plants, distributed in 406 genera and about 120 families. These are arranged according to the Bentham and Hooker's system of classification, except that the genera within a family and species within a genus are arranged alphabetically to make it more user friendly. Key to the genera under each family and that to the species under each genus have been provided for easy identification. Besides, the data on phenology, habit, habitat, etc. for each species has also been given. The book also briefly provides data on plants of the Reserve with considerable ethnobotanical siginificance. It is hoped that the flora will be useful to Botanists, Environmentalists, Researchers and the Managers of the Biosphere Reserve alike.

Inspite of all possible care and attention there is always a possibility of some ommissions, errors or discrepancies getting crept into. It will be greatly appreciated if the users of this book very kindly bring such deficiencies to the notice of the authors.

We are thankful to the authorities of the State Forest Department, Government of Uttar Pradesh in general and those of the Nanda Devi Biosphere Reserve in particular for the help provided during the course of field study in the area, to Shri A.R.K. Sastry, formerly Joint Director-in-Charge, Publication Division of the Botanical Survey of India, Calcutta and his various colleagues for their help in various ways during the course of this publication, and to Dr. D.K. Singh, Deputy Director, Botanical Survey of India, Northern Circle, Dehra Dun, for valuable suggestions.

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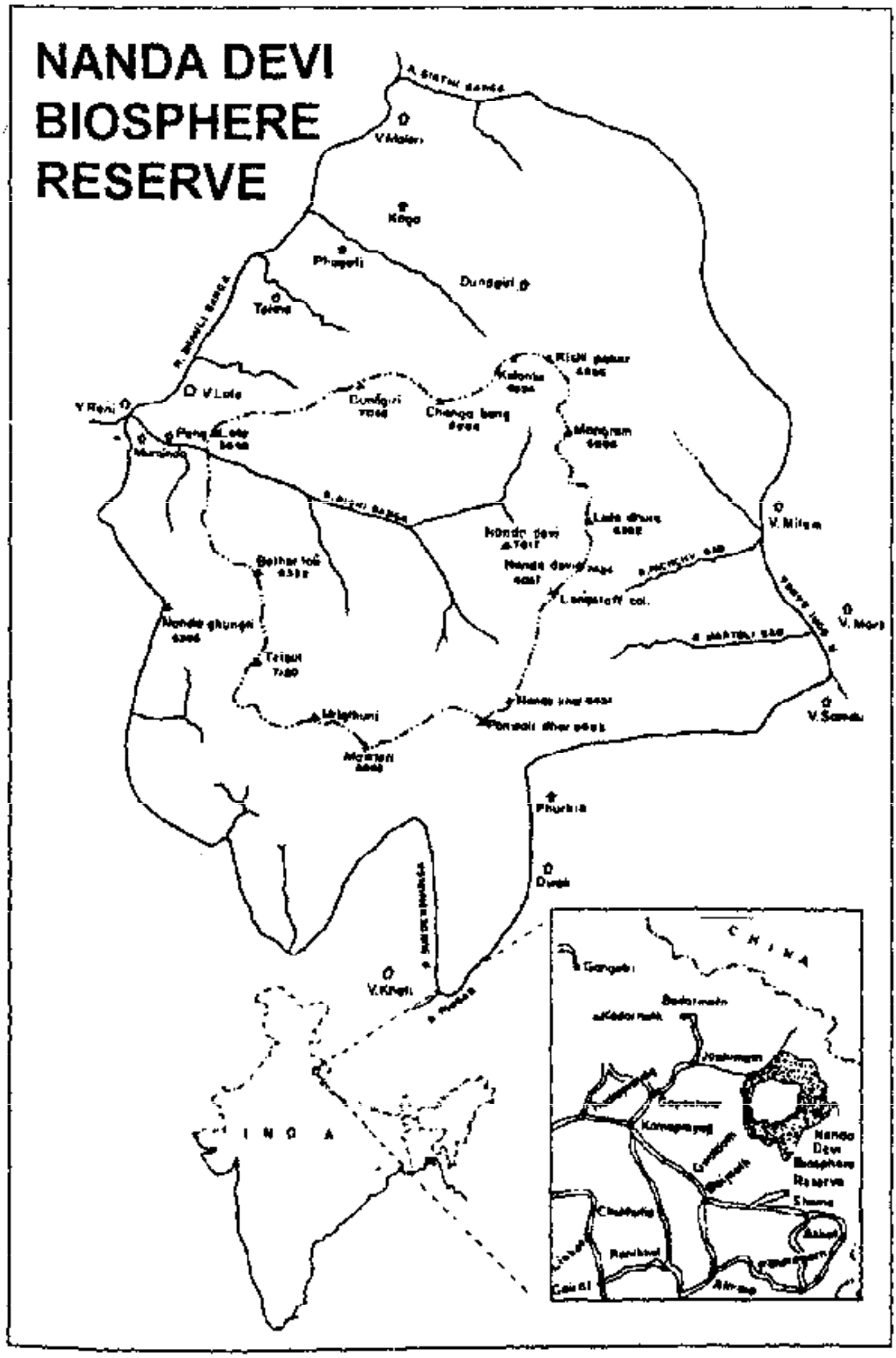
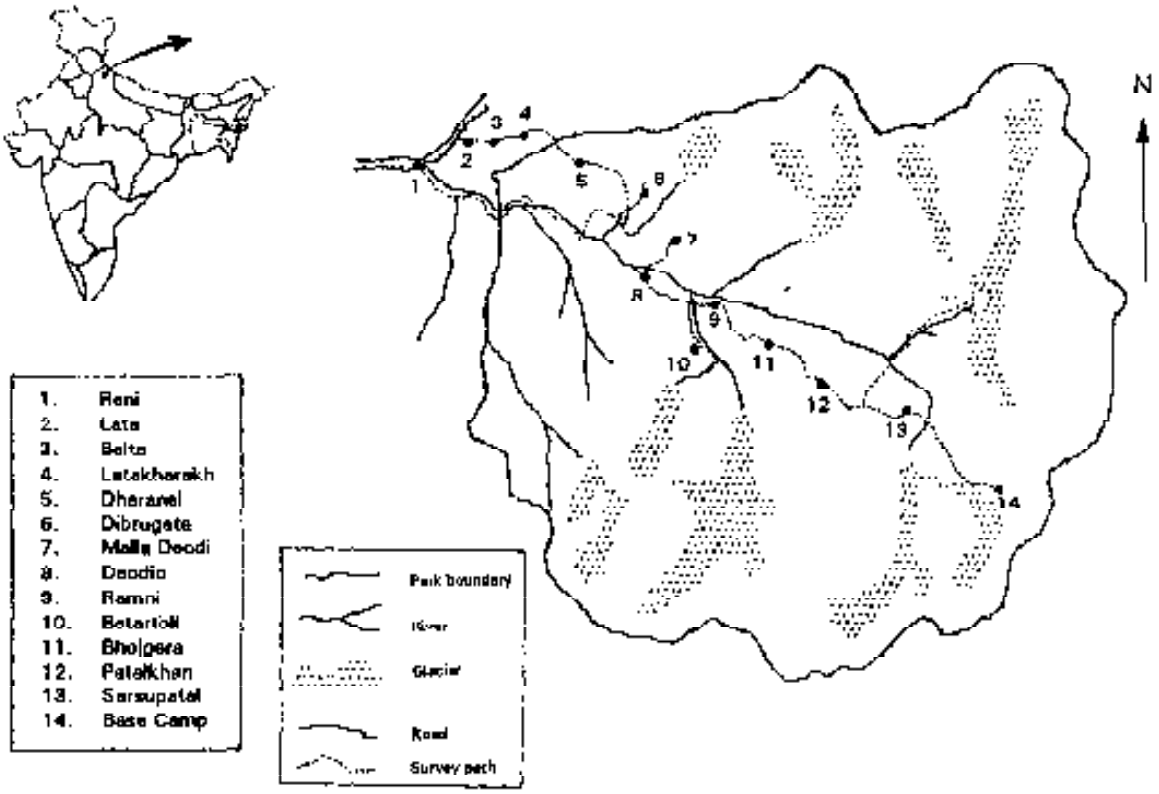
NANDA DEVI BIOSPHERE RESERVE



ROUTE MAP TO SARSUPATAL BASE CAMP OF NANDA DEVI



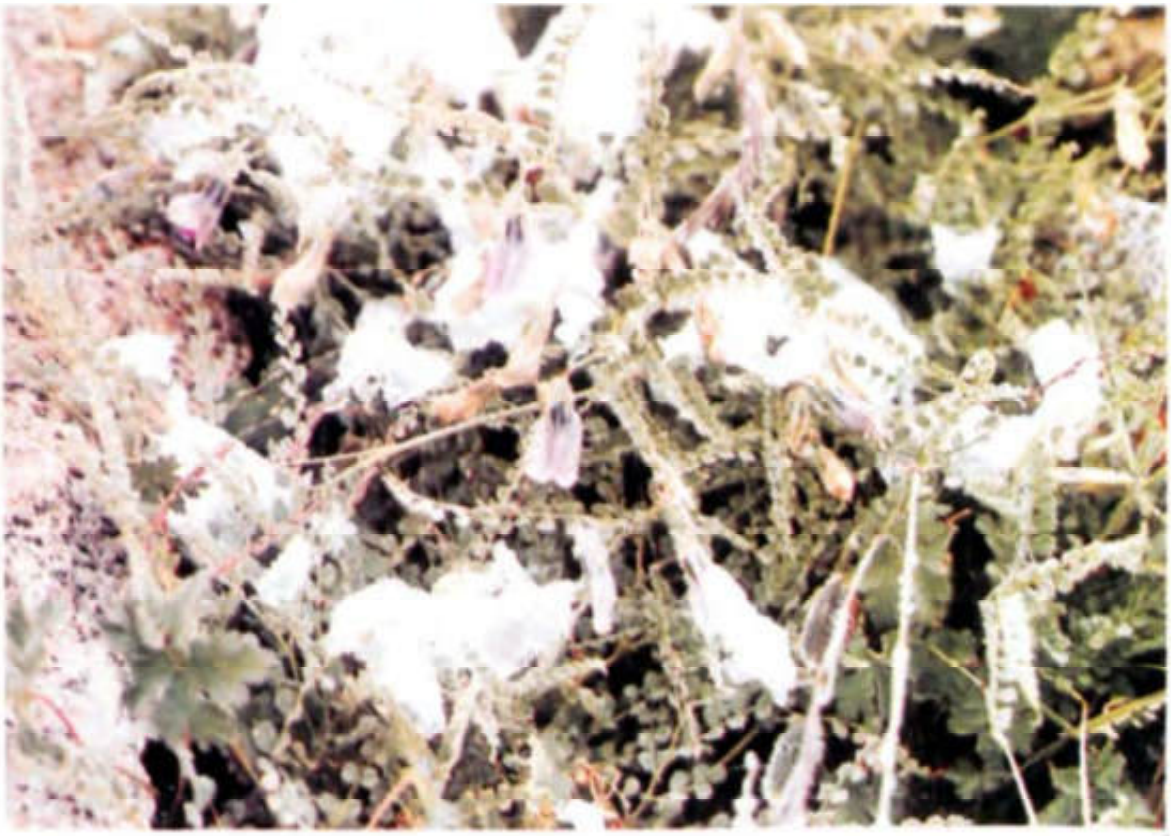
Aconitum violaceum Jacq. & Stapf

Local inhabitant of the area

A view of Trisuli on way to Baguavasa

Apple in cultivation around Tolma and Lata village

Dioscorea deltoidea Wallich ex Kunth



Cicer microphyllum Benth.

Podophyllum hexandrum Wallich ex Royle

Pinus wallichiana forest

A coniferous forest with **Sorbaria tomentosa** in foreground

Saussurea graminifolia Wallich ex DC.

Lopping from the **Quercus-Rhododendron** forest

A view of Dhauliganga valley

Acomastylis elata (Wallich ex Royle) Bolle

Alpine grassland with **Rhododendron campanulatum** bushes

Alpine meadows

Alpine Grassland at Himtoli

Alpine grassland

Alpine grassland - Grazing

A view of subalpine forest

A view of exposed scrub vegetation

A view of coniferous forest

A view of mixed forest

Rosa webbiana Wallich ex Royle

Hanging Lichens - **Usnea** sp. A good fodder for the Musk Deer during snowy winters

A view of cold temperate vegetation

Glacial moraine showing dominant vegetation of Saussurea obvallata

INTRODUCTION

The purpose of the formation of the Biosphere Reserve is to conserve *in situ* all forms of life, along with its support system, in its totality, so that it could serve as a referral system for monitoring and evaluating changes in natural ecosystems. The primary objectives of a Biosphere Reserve are to conserve the diversity and integrity of biotic communities of plants and animals within natural ecosystems, including the genetic diversity of cultivated crops and domesticated animals and their wild relatives, studies on natural ecosystems and comparative studies on man modified ecosystems and to provide facilities for education and training.

The varied physiographic and climatic conditions, met in different parts of India, supports highly luxuriant and diverse flora than that of any other country, of comparable size, in the eastern hemisphere. About 48,000 species, belonging to various plant groups are estimated to occur in India. Of these *ca* 17,500 species are of flowering plants (Phanerogams) alone, which include *ca* 5000 taxa so far not known to occur beyond the present political boundary of our country.

The rich floristic resources of our country notwithstanding, our vegetational wealth has considerably depleted, both qualitatively as well as quantitatively, in recent times owing to various reasons. In this process many species of plants have suffered destruction and reached the threatened category, some are even considered to have become extinct. The dependence of man on plant resources, for his various basic requirements is too well known to be emphasised. Ironically, however, the man himself began to destroy the same resources from the advent of civilisation through various anthropogenic practices, particularly the expansion of biotic activities in primeval forest areas, and the over-exploitation of natural resources, thus seeking to transform the biosphere into a sort of anthroposphere. This, coupled with the forces of population growth, today threaten to destroy the delicate equilibrium that exists between the man and the biosphere.

Realising the implications of such disastrous circumstances, directly influencing the very existence of man, various conservational programmes havebeen launched world over for both *in situ* as well *ex situ* conservation of plant resources.

The programme of Biosphere Reserve is one such measure, which was initiated under the 'Man & Biosphere' (MAB) Programme by UNESCO in 1971 and intends to provide long term *in situ* conservation to all the biotic communities viz., plants, animals and micro-organisms to facilitate their self-perpetuation and undisturbed evolution of the entire living resources. Biosphere Reserve supports and complements the protected areas like National Parks, Sanctuaries and Tiger Reserves, etc. While sanctuaries are mainly species oriented and National Parks habitat oriented, the Biosphere Reserve covers the entire array of diversity, met within an area, including the species diversity, the genetic diversity and the ecosystem diversity.

Nanda Devi Biosphere Reserve, one of the 9 Biosphere Reserve areas declared so far in India, came into existence on January 1, 1988, with a total protected area of *ca* 2000 sq. km and having a core zone of approximately 630 sq. km, mainly part of the erstwhile Nanda Devi National Park in Garhwal Himalaya. It represents the unique West Himalayan ecosystem. The Biosphere Reserve includes total 17 villages in its buffer zone out of which 10 villages fall under District Chamoli, 4 in Almora and 3 in Pithoragarh. The core zone, which is very difficult to reach, has no human habitation and is apparently unaffected from any biotic influence. The region was almost *terra incognita* till 1934 when Tilman and Shipton penetrated the hidden valley and opened the route to Nanda Devi through Rishi Ganga. This pristine area was thus exposed to the rigors of biotic interferences, caused mostly by various mountaineering expeditions that followed unauthorised herb collectors and poachers year after year, leading to the damage and destruction of both flora and fauna.

A recent study conducted in the core zone of the Biosphere (formerly Nanda Devi National Park) revealed 312 plant species distributed over 199 genera and 81 families (Hajra, 1983), which included many rare plants such as *Aconitum* Sp. *Podophyllum hexandrum, Cypripedium elegans, Picrorhiza scrophulariflora*, etc. Hajra (*l.c.*) also discussed different biotic factors straining the natural vegetation in the area. Subsequently, Botanical Survey of India the nodal organisation entrusted with the task of survey, documentation and conservation of floristic resources of our country, undertook a detailed study of the flora of Nanda Devi Biosphere Reserve including both core as well as the buffer zone of this reserve. Consequently *ca* 800 species of plants have been recorded from

this region as a result of intensive survey conducted in the area during the past decade by the authors.

In order to examine the suitability of such areas the National Man & Biosphere Committee has selected fourteen areas in India, out of which nine have been declared as Biosphere Reserves. The Nanda Devi Biosphere Reserve is one of them.

AREA AND TOPOGRAPHY

The Nanda Devi Biosphere Reserve lies approximately between 30°16' to 30°41'N latitude and 79°40' to 80°05'E longitude with a spread of about 2000 sq. km and a range of altitude between 1500 m to 5600 m. It is in the Chamoli district of the Garhwal Himalayas of Uttar Pradesh. The Eastern and Southern rims of the Biosphere form the border of Chamoli district with Pithoragarh and Almora districts respectively.

The boundaries of the Biosphere run from village Reni along the river Dhauliganga upto village Malari in the North-West, then in the South-Eastern direction along the tributary of river Girthiganga to Unta Dhura. From here it follows the tributary of River Pindar running South-East up to Martoli (through Milam) then turning South-West towards Khati, again, along the river Pindar, through the villages of Purkhia and Dwali. From Khati it runs North wards along the Sunderdhunga Gad up to Somder (through Sukhram under the Bhanoti along the Nullah), then Dhak, Mulkhet, Baratoli Tribhuj, Nanda Ghungti to Rgnti, and then takes a turn to North Westerly direction to village Reni.

The Reserve is demarcated by high mountain ranges offering snowfalls and corniced ridges to the outer world. The Reserve is easily accessible through its North-Western boundary alone, that too for a short period from the last week of May till October. The Rishi Gorge does not allow an easy access to the Reserve. The mountain rim has on it such major peaks as Dunagiri (7066 m), Changabang (6864 m), Kalanka (6931 m), Rishi Pahar (6992 m), Nanda Devi East (7434 m), Nanda Khat (6611 m), Mrigthuni (6855 m), Trisul (7120 m), and Bethartoli Himal (6252 m), Nanda Devi (7816 m), India's second highest mountain peak, is situated on a short ridge projecting from the Eastern rim

joining the main summit with Nanda Devi East. A sharp Hog's-Back ridge from Dunagiri culminating in 3848 m high Lata peak and a rugged, glacier-scarred ridge from Bethartoli converge onto the Western end of the Rishi Gorge, compressing the river in a narrow, steep-sided gorge. Entry into the basin is over the Lata ridge at Dharansi Col (4250 m), a short distance up the ridge above Lata peak.

The original Nanda Devi Sanctuary, comprising the area East of Ramani and encircled by high mountain ranges and peaks of Rishikot, Changbang, Mangram, Deodanla, Sakram, Lata Dhuta, Nanda Devi East, Nanda Kot, Panwelli Dharm, Maiktoli, Devistan I, II and III has been proposed for the core zone.

The Nanda Devi Basin or the 'Sanctuary' itself is a vast glacial basin segmented by a series of parallel ridges with a North-South trend, emanating from the encircling mountain ramparts.

The most important is the Devistan-Rishikot ridge, which separates the inner "Sanctuary" at the base of Nanda Devi from the rest of the basin the outer "Sanctuary". The Malthuni Ridge between Dharansi and Dibrughetta is a short but very prominent ridge form the Northern range and its magnificent cliffs drop into the Rishi Gorge, opposite equally magnificent cliffs terminating into a jagged spur from the Bethartoli Himal.

The inner "Sanctuary" is composed of a glacier system divisible into the North Inner "Sanctuary" and the South Inner "Sanctuary" by Nanda Devi mountain. The Northern system is by and large at a lower altitude with a bigger area. There are three large glaciers, viz. Nanda Devi North, the Rishi North and the Changabang glacier. The Southern system has the Nanda Devi South and the Rishi South glaciers. It's Southern counterparts, though like all Himalayan glaciers, been retreating thus their lower stretches resembling collapsed heaps of rubble and glacial debris with lateral moraines forming high distinctive ridges above the subsiding glaciers. Each system gives rise to ablation streams, the North Rishi and the South Rishi which flow along the precipitous cliffs of Nanda Devi. A short distance below their confluence, the Rishi flows into its stupendous upper gorge cutting, at right angles, across the Devistan-Rishikot ridge.

Clearing the upper gorge, the Rishi receives the tumultuous Ramani stream, which drains the Ramani glacier basin on the northracing down a precipitous gorge. Little further downstream, the Trisul torrent, draining the extensive basins of the Trisul and Bethartoli glaciers, joins the Rishi from the South. The Ramani and the Trisul glacier systems form important features of the Outer "Sanctuary"

The Rishi stream continues along its chasm, receiving various torrents from both sides, some through narrow impassable gorges, other as graceful waterfalls. It finally enters the awesome lower gorge, guarded by overhanging cliffs, and skirts the Lata peak to merge with the Dhauli Ganga near Reni village. The Rishi Gorge cuts all the ridges at right angles and, is therefore, difficult to negotiate. Except for this narrow, steep-sided gorge, the entire basin is well above 3500 m.

The surrounding villages : The Northern wall from Lata to Rishi Pahar divides the Nanda Devi basin from the Dhauli Ganga. Of the several ravines and glaciers scarring the northern face, the Bagani Glacier, draining the lovely Dunagiri valley, is the most significant. The Eastern wall from Rishi Pahar to the bifurcation of the Traill's Pass ridge runs parallel to the great Milam glacier. Several other glaciers as well carry the snow and ice into the main Milam glacier. The Southern ridge from the Traill's pass bifurcation to Trisul-II overlooks the warm foothills to the South and offers an unbroken barrier to the warm, moist winds. The heavy precipitation on this face drains several valleys, the Sunderdhunga valley being the most significant, into the Pindar, which is a major tributary of the Alakananda. The Western ridge, formed by Trisul and Bethartoli Himal, also receives heavy precipitation on its Western face which gets drained, Nandakini and Birahi Ganga Rivers, into the Alakananda.

The Rishi Ganga itself, through Dhauli Ganga, and other major rivers like the Pindar, the Nandakini and the Birahi Ganga, forms the important part of the Alakananda's watershed. The Alakananda is the Eastern twin of the Bhagirathi. The two join to form the Ganga, the water of which govern the destinies of the millions inhabiting the Gangetic plain. A high dam is projected on the Ganga. But one of the foremost considerations in context with this ambitious project

should be the quantity of silt brought down by the turbulent rivers. Particularly the erosion of the Nanda Devi Basin will have to be taken into account. People of the area are fully aware of the disastrous effects of floods, caused by deforestation of the mountain slopes, having experienced such major disasters as the Ghona Tal flood in the last century and the Alakananda flash floods of 1970 (Khacher, 1978).

CLIMATE

The Nanda Devi complex is situated at the turning point where the Himalayan chain changes its North-West to South West trend to a West to East trend. Thus the entire Southern mountain wall, with its extensions to the West and East along the Trisul II Jatropani ridge and Nandakot range beyond the Traill's Pass respectively, exposes a continuous Southern aspect to the lower foothills and the sun. These slopes, as also the Western watershed ridge of Trisul and Berthartoli, its Western ridge of Trisul and Berthartoli and Western bifurcation of Nanda Ghumti, cause considerable updrafts of warm air throughout the year, resulting in high precipitation and heavy cloud cover. During the rainy season these ranges receive the full blast of the South-West monsoon and rainfall is extremely heavy. The monsoon effect starts in the third week of June.

The snow conditions, with thick snow cornices overhanging the Southern ridge, and the more active glaciers like the Nanda Devi South, the Rishi South and the Trisul Glaciers, suggest heavier snowfalls on the Southern side. The "Sanctuary", by virtue of its configuration, enjoys a sub-climate of its own. There is obviously a mass of cold air on the basin which exerts a significantly powerful effect on the precipitation in the Almora and Chamoli Districts.

The cold air on the basin creates a dry climate with low annual precipitation. Inside the "Sanctuary" the snowline is a well above 4500 m as against the heavy winter snow on the Dharansi Col and the Malthuni ridge considerably below this altitude. Snow is thicker and generally at a lower altitude on the Southern side of "Sanctuary" than the Northern, which conforms to the general conditions on the South and North aspects of mountains in the

Northern hemisphere. The entire Northern side of the "Sanctuary" receives more direct sun rays and is consequently warmer, with more rapid thawing of snow.

While the glacial basins and upper slopes experience strong diurnal winds, the gorge itself, unlike other major Himalayan valleys, is very well sheltered. While strong winds are a regular feature on the higher slopes from a couple of hours before sunset to almost sundown, the nights are invariably calm. The diurnal winds produce clouds in the afternoon and there is usually a light drizzle or sleet towards the evening (in the month of June). With the onset of the monsoon stream in the third week of June, there is considerable inflow of warm air up the gorge resulting in light mist over the high meadows and this warm air has a profound effect on the wintery conditions which lingers on late into summer. The mists and low clouds in June keep the soil moist a factor not found in the drier inner Himalayan valleys or on the Tibetan Plateau. Thus, the Nanda Devi "Sanctuary", though receiving little precipitation, supports a lusher vegetation than other valleys.

A very distinctive feature of the weather around Nanda Devi is the fact that unlike other major Himalayan peaks, the great mountain has very little cloud formation on it in the afternoons (Khacher, 1979).

VEGETATION

The Biosphere Reserve, situated in the border of Garhwal and Kumaon Himalayas, supports an altitudinally distributed vegetation, dense in growth and diverse in rich species content. The geographical location, climate and topography has all contributed to the characteristic vegetation and flora of the area. Due to relative non interference of the forest by man, there are still many virgin primary forest patches throughout the Biosphere Reserve. However, the stratification is not clearly distinguishable as the topography is irregular and intercepted by valleys and plateaus of various extent.

At Ramani the common trees are mainly *Betula utilis* i.e. Bhojpatra. The path from Ramani to Bhujgara is through the *Betula-Rhododendron* forests along the Rishiganga River bank with common shrubby plants, like species of *Salix*, *Sorbus*, *Ribes*, *Rosa*, *Lonicera* and *Rhododendron lepidotum*. Besides, several

herbaceous plants, like species of *Epilobium*, *Geranium*, *Astragalus*, *Polygonatum*, *Thalictrum*, *Polygonum*, *Bupleurum*, *Viola*, *Potentilla*, *Anemone*, *Delphinium* etc. are also common sight. In open areas near the spring, plants belonging to the families Cyperaceae and Juncaceae are also common. The area beyond Bhujgara, Patalkhan and Sarsupatal surroundings is completely devoid of tree species and exhibits Bugyals extending up to the base camp. The dominant plants all along the Bugyals are *Rhododendron lepidotum*, *R. anthopogon*, *Juniperus* sp. and *Salix* sp. Plants of tufted habit like *Cassiope fastigiata*, *Sedum*, *Saussurea sudhanshui*, etc. are also common in this area. Other herbaceous plants include species of *Primula*, *Pedicularis*, *Poa*, *Allium*, *Corydalis*, *Polygonum*, *Saxifraga*, *Tanacetum*, *Geranium*, *Lloydia*, *Carex*, *Kobresia*, etc.

At Latakharak there are thickly wooded slopes all around and the dominant trees in such areas are *Abies pindrow*, *A. spectabilis*, *Acer acuminatum*, *Betula utilis*, *Rhododendron campanulatum*, *Sorbus foliolosa*, etc. Tree layer is dense and close together. With the gradual change in elevation the vegetational pattern also changes. Immediately after Latakharak there is a vast stretch of land (on way to Dharansi Pass) which is known as "Bugyal" or alpine meadow, and the vegetation composed of only dwarf shrubs and herbaceous plants. Shrubby plants like *Cotoneaster microphyllus*, *Juniperus* sp. *Rhododendron anthopogon*, *R. lepidotum*, etc. are generally found scattered all over in these Bugyals.

The dominant herbaceous plants are blue flowered *Cyananthus* spp., *Iris* sp., *Aconitum* spp., *Aster* sp., *Gentiana* sp., purple flowered *Arnebia* sp., *Allium* sp., *Lactuca* sp., *Polygonatum* sp., white flowered *Anaphalis* sp., *Stellera chamaejasme*, *Fagopyrum dibotrys*, *Euphrasia* sp., *Pinguicula alpina*, *Saxifraga* sp., yellow flowered *Senecio* sp., *Ligularia* sp., *Cremanthodium* sp., *Sedum* sp., *Rhodiola* sp., *Saxifraga* sp., *Potentilla* sp., *Sibbaldia* sp., etc.

Milam is on Eastern boundary of the Biosphere Reserve. The main route to the Milam glacier starts from Bageshwar via Thal, Nachni, Tejam, Girgaon, Kalamuni Pass, Munsiyari on the right bank of the Gori Ganga river, Rathi, Bogdwar to Martoli. The main bridle path to Martoli branches off from the Milam Glacier's route to Reelkot and proceeds to Martoli situated on the high

spark above the Gori Ganga river. Situated at 4400 m, the flat ridge is surrounded on all sides by snow crowned mountains. The ridge is close to Nandadevi and Bankattia range of Mountains. Interspersed with numerous glaciers the bugyals are covered with many delicate alpine herbs of considerable interest. The interesting plants include species of *Allium*, *Anemone*, *Sedum* and *Corallorhiza*. The *Corallorhiza* being a terrestrial orchid having jointed coralloid rhizome with sheathed elongated scape bearing small pale green flowers. Similarly the moraine flora also abounds in plants of varied colours. The glacial vegetation includes *Arnebia benthamii*, *Primula elliptica*, *Saxifraga sibirica*, species of *Androsace* and *Iris kumaonensis*. The interesting plants of the area are golden yellow flowered *Trollius acaulis*, woolly herb like *Waldheimia tomentosa*, *Anemone rupicola*, a grass like bulbous herb *Allium stracheyi*, yellow coloured *Potentilla argyrophylla* and pink coloured *Potentilla argyrophylla* var. *atrosanguinea*. Intermixed with the alpine herbs, sedges, grasses and the shrubs of *Berberis*, *Salix* and *Ephedra gerardiana*, are also found in considerable abundance.

From Martoli the path descends down to 3650 m to join the main bridle path to Milam closely following the Goriganga valley. This area is completely devoid of plants of tree habit. The Gori ganga valley widens out and is flanked by mountains of gigantic heights. The right side of the valley exhibits bugyals extending up to the snow line, whereas the left bank presents woody shrubs of *Juniperus*, *Berberis*, *Rosa*, *Ribes*, *Salix*, *Lonicera* and *Caragana*. The interesting aspect of their distribution is that they form closely set association like *Juniperus* *Caragana* association and *Berberis* *Rosa* association. Intermixed with *Juniperus* *Caragana* association, one can also see *Ribes himalense*. Similarly *Salix lindleyana* is associated with *Berberis* - *Rosa* association.

The path from Martoli to Milam is very scarce in alpine herbs. As this area is constantly swept by piercing icy winds it is completely devoid of trees. However, dwarf *Betula utilis* forests are found to exist in the valleys sheltered by precipitous or gentle sloppy mountain walls. The plants of shrubby habit often appear in hemispherical mounds to overcome the injurious effects of icy cold winds. Under the shade of decumbent woody shrubs one could see species of *Polygonatum*, *Thalictrum*, *Lactuca* and *Bupleurum*. The most interesting plant of the area is the insectivorous herb *Pinguicula alpina* growing in abundance on moist soil. Some other alpine herbs of this area are *Guldenstaedtia himalaica*, *Primula elliptica*, species of *Androsace* and *Pedicularis longiflora*.

Next, the path leads into Milam, Johari village, situated between 30°21' North latitude and 80°9' East longitude near the junction of Goriganga and Gunka rivers. Milam is the last Indian village on the old Indo-Tibetan trade route through Untadhura pass. Milam and its environs command a beautiful scenery, all around. The area, chiefly composed of sub-alpine vegetation is devoid of trees. The Goriganga valley is rich in alluvial soil and used extensively to grow Buck-wheat, Barley and Potato.

From Milam onwards many water falls are seen emerging from the adjacent mountains and ultimately joining the river. Milam glacier is India's biggest glacier. It is formed by the snow precipitated from Eastern Trisul peaks (7735 m) and, number of surrounding craggy peaks. The glacier gives birth to Goriganga river which flows down and joins the Kali river (Sharada). The glacial zone gently raises from 4000 m to 5500 m. The beauty of the glacier in the beginning is concealed under mud and stone for nearly 10 km and the remaining 3 km exhibits the enormous icy deposits, followed by Trisul (East) at its head. Another interesting aspect of this glacier is the presence of several small and big Kunds or lakes all along the way to the foot of the glacial Trisul zone.

The vegetational types in this area are very distinct and are distributed in the Goriganga valley and moraine belt and bugyals, extending from 4500 m to 6000 m. In addition, the big kunds support many interesting alpine plants all along their margins.

The vegetation of glacial moraine :

Beyond Milam, up to the beginning of glacier, the path is interspersed with boulders of varied sizes and land slides. The sub-alpine vegetation is represented by yellow flowered *Berberis* sp., white flowered *Rosa*, *Ribes grossularia*, species of *Juniperus*, *Lonicera* and *Ephedra gerardiana*. Intermixed with the shrubs are small semi erect, prostrate, cushion forming or tufted species of *Androsace*, *Arnebia*, *Stellaria*, *Sedum*, *Astragalus* and *Thymus*. The interesting carpet forming herbs are the species of *Potentilla*, *Ranunculus* and *Anemone*. As the glacier is receding at a fast rate the newly formed moraine belt is an excellent area to study the invasion of plants from the adjacent mountains and bugyals. The successful invaders are species of *Lonicera* and *Berberis*, followed

by *Rosa* and *Ephedra*. Among the herbs, species of *Sedum*, *Ranunculus*, *Stellaria*, *Taraxacum*, *Trifolium*, *Anemone* and *Astragalus* are found in abundance. There are deep sheets of water locally called kunds. Such kunds support, at their periphery, some sedges like *Eleocharis palustris* and grasses. The rocky slopes of the valley are mostly covered with species of *Cotoneaster* and *Juniperus*. They seem to stabilize the falling slopes and offer an opportunity for the successful invasion and colonisation of plants from surrounding areas. The stabilised lateral moraines present gregarious growth of *Rumex nepalensis*, and *Hippophae* mixed with species of *Cotoneaster*, *Berberis* and *Ephedra*. At several places the lateral moraine is bleak and desolate of plant life due to constant land slides.

Observations on the flora of Bugyals :

The fine grassy slopes met with at higher altitudes are locally known as the Bugyals. The flora is very distinct and the slopes are covered with graceful herbs of different growth forms and colourful flowers. Their formation is generally noticed above 3500 m, especially near the glacial valleys and mountains. They are formed on the gentle mountain slopes. The rich meadows are found to be extremely nourishing and invigorating for sheep and other animals.

In Johar, especially in Malla Johar patti, the Bugyals extend from the Tibetan border down to the Goriganga valley as far as its junction with the Ralam valley. Their continuity is often disturbed by perpetual snow clad peaks or passes. The landscape consists of continuous stretch of green meadows, interspersed with shallow or deep gorges or valley. The striking feature of the Bugyal is the dominance of alpine herbs, sometimes almost to the exclusion of grasses and sedges. The shallow valleys or grooves are often forested with *Betula utilis*. Associated with it are the alpine shrubby vegetation and some sciophytic undergrowths.

The rich herbage is chiefly composed of delicate semi-erect or decumbent, prostrate, cushioned or tufted plants of varied colours. Plants of tree habit are found in shallow valley or up to 3500 m. Beyond 3500 m and up to snow line plants of tree habit are scanty. The woody shrubs are frequently stunted and often exhibit suffruticose habit. Another interesting aspect of the flora is

continuous successive occurrence of carpets of graceful herbs in patches, almost to the exclusion of other plants from early April to the end of September.

The distribution pattern of Bugyal flora mostly depends upon soil and climatic conditions. As the winter snow begins to melt in late March or early April, the areas thus exposed form an ideal spot for the appearance of certain species of *Primula, Trollius* and *Anemone*. Within a short time they display their colour. One of the loveliest of this group of herbage is *Primula macrophylla* with purple flowers. Associated with it are the yellow and red flowered *Potentillas* and yellow flowered *Caltha palustris*, growing close to the melted snow. In between, it is not uncommon to see the handsome yellow flowered *Nomocharis oxypetala* and the grass like herb *Nomocharis nana* with deep blue coloured flowers. One could also see hundreds of *Alchemilla vulgaris* and species of *Ranunculus* springing up. A noteworthy feature of all these plants is that they are short lived and one set of plants is replaced by another as the summer wears on. The main reason for their short life is the incessent change in edaphic conditions. With the onset of summer, the physical condition of the every patch of ground undergoes constant change. This is the root cause for the instability and succession of plants. Another striking feature of Bugyal plant distribution is that in the same habitat one could see the growth of several related or unrelated species and only one species dominates the entire habitat, almost to the exclusion of the other species. This may be due to difference in the physico-chemical nature of the soil. Just like edaphic factors, climatic factors are also equally important in the study of Bugyal vegetation. Most of the perennial herbs appear only when conditions are congenial for their life. Otherwise they lie buried in snow. This accounts for the sudden appearance of hundreds of graceful herbs on the newly exposed soil near the snow line.

Of botanical interest above the snow line is the occurrence of certain fleshy herbs of the genera *Sedum* and *Saxifraga* in the exposed rocky crevices situated far from meadows. The rising air currents from the mountains and valley are the main agents in the distribution of seeds to such inaccessible places. Thus the importance of air-currents and plant distribution in the Himalayas await careful investigation. In any such study the importance of Birds and Animals cannot be overlooked.

The distribution pattern of Bugyal flora is of much interest, because the vegetational change is in accordance with the elevation and each species has its

own range of tolerance beyond which it cannot grow. The lower zone of the Bugyals, between 3500 m to 5000 m, is always forested by the stunted low bushes of *Rhododendron campanulatum, R. anthopogon, Salix lindleyana,* and *Betula utilis.* Their luxuriance is often seen when they happen to grow in grooves or valleys. The wind swept birch trees adopt a recumbent habit and their formation in the groove protects them from icy cold winds of the surrounding glacial mountains. The soil beneath them is generally rich in humus and is well drained under its shade and especially near the edges one could see the above mentioned stunted bushes displaying handsome coloured flowers. The birch forests at Martoli Bugyal are very extensive and form an important source of fuel for the local people during the summer months. The well drained humus soil beneath the birch forest forms an ideal habitat for many alpine sciophytic herbs. The common species from the zone include *Viola biflora, Anemone rupicola, Sedum ewersii, Primula elliptica* and *P. denticulata.* Close to the streams, in the Betula groove, are yellow flowered *Caltha palustris,* yellow flowered *Corydalis govaniana* with slender feathery foliage, white-pink flowered *Primula elliptica,* bell shaped, pink-white flowered *Gaultheria trichophylla* and bloomy delicate, creamy, bell shaped flowers of *Cassiope fastigiata.*

Unlike the Martoli Bugyals, the Milam Bugyals support thick forest of *Juniperus communis* and *J. indica* shrubs. The Birch forest is completely replaced by the bushes of procumbent Junipers. They are found to grow very well on sunny and dry zones of the bugyals. The Junipers prefer sunny stabilised dry habitat to well drained humus habitat of birch trees. Under their shade one could see plants which prefer rather in dry soil. The interesting shady herbage of this habitat includes *Bupleurum falcatum, Polygonatum verticillatum, Androsace sarmentosa, Vicatia conifolia, Scutellaria prostrata, Thymus linearis* and the parasitic *Orobanche alba.* The Junipers are sometimes found in association with *Caragana versicolor* and *Lonicera purpurascens* and other undergrowths. However, near moist places and grooves of Milam Bugyals one can see thick stunted bushes of *Rhododendron campanulatum, Rhododendron anthopogon,* and *Salix lindleyana.*

In and about 3500 m to 4000 m elevation the meadow harbours *Ranunculus hirtellus, R. laetus, R. pulchellus, Thalictrum elegans* and *T. alpinum.* The graceful Anemones are represented by *A. rivularis, A. polyanthes* and beautiful white yellow or blue flowered *A. obtusiloba* and *A. rupicola.* Close to the

streamlets, carpets of *Caltha palustris* in association with *Primula elliptica* and *Gaultheria trichophylla* are often found.

The Brassicaceae is represented by many species of *Draba, Arqbis,* and *Capsella bursa-pastoris.* Among the high altitude members of Leguminosae, frequently seen plants are *Parochetus communis, Guldenstaedtia himalaica, Trigonella emodi,* and blue, orange and yellow flowered species of *Astragalus.* The noteworthy plants of *Rosaceae* are *Alchemilla vulgaris,* matforming woody *Cotoneaster microphyllus, Sibbaldia purpurea* and several yellow, red and pink flowered Potentiallas. In this range white flowered *Anaphalis,* yellow flowered *Senecio* and pink flowered *Saussurea* represent the vast family Asteraceae. The tufted growth habit displayed by *Cassiope fastigiata,* and delicate water loving *Gaultheria trichophylla* represent the interesting Ericaceous plants. All over the slopes hundreds of *Primula* species, followed by dense blazing red carpets of *Bistorta affinis* are seen. Associated with them one can frequently see *Bistorta vivipara, Euphorbia stracheyi,* white flowered *Lloydia serotina* and *Callianthemum cashmerianum.* The grassy carpet is often covered with brilliant blue flowered Gentians in thousands, pink to white flowered *Thymus linearis, Plantago himalaica, Oxyria digyna,* and *Iris kumaonensis.* In stoney places, particularly in the rocky crevices, species of big leaved *Rheum* and *Sedum* make their appearance frequently. Most of the wind swept stony places are covered with lovely cushions of particoloured flowers of Androsaces and Saxifrages. Sometimes all around the rocky places the meadows exhibit hemispherical mounds of clumps of Junipers and *Lonicera obovata.* The Bugyals are mainly represented by species of *Cyperus* and *Carex* of the sedge family. The dominating grasses are species of *Agrostis.* Above 4000 m the meadow consists of *Danthonia cachemyriana, Bromus* sp. *Elymus* and sedges like *Eleocharis palustris, Kobresia* sp. *Carex setigera, C. nubigena* and *C. obscura.* Mixed with the above are found species of *Stipa.*

Around 5000 m and up to the snowline the vegetation is scanty, more or less scattered and seldom do they appear in close association. The handsome herbs are short-lived and bloom during short summer season when the warm moist air is blowing. They appear to complete their life cycle between the cold winds of spring and autumn. Many of the herbs found above 5000 m have graceful, silvery, woolly vegetative as well as floral parts. The interesting woolly herbs of Asteraceae are *Waldheimia tomentosa, Anaphalis royleana* and *Sassurea* species with wool like foliage. The family Boraginaceae is represented

by *Arnebia benthamii* and species of *Eritrichium*. The interesting woolly plants of this area are *Delphinium cashmerianum* and *Thermopsis barbata*.

The striking feature of the vegetation round about kunds of the glacial zone is very interesting. Kunds are nothing but small or big sized water collection or lakes fed by glacial water or rain and snow. Of the several kunds in this zone only Shandilya kund at 4000 m and Surya kund at 5200 m are of considerable size and the vegetation in and around them is of some interest. Shandilya kund is situated on the lateral moraine and it is a clean sheet of water fed by rain and snow. The lake supports *Ranunculus natans* and a few sedges and grasses, confined only to margins. The next kund that received our attention was Surya kund situated at 5200 m surrounded by glacial wall of considerable height. The glacier-fed lake, especially the edges and the surrounding area present herbage of varied hue and colour. The prettiest leak like herb is the deep purple flowered *Primula macrophylla*. This is followed by the golden yellow coloured *Trollius acaulis*. Associated with it are the sky blue, bell shaped flowers of *Nomocharis nana*, scarlet coloured spikes of *Bistorta affinis*, yellow coloured flowers of *Podophyllum emodi*, dull-green bluish coloured flowers of *Aconitum heterophyllum*, locally called Atis whose roots are medicinal. The other interesting lacustral herbs of this area are *Oxygraphis endlicheri*, *Ranunculus pulchellus* and *Waldheimia tomentosa* with pink flowers. The rocky crevices are covered with fleshy herbs like *Saxifraga flagellaris* with long questing tendrils, *Saxifraga brunonis*, *Rhodiola crenulata*, etc. On the lateral moraines and also amidst boulders *Epilobium* sp. is frequently seen. On the moraine zones are *Iris kumaonensis*, small bell like pink-white flowered *Gaultheria trichophylla* and *Cassiope fastigiata* along with the species of *Lonicera*, *Salix*, *Cotoneaster* and *Astragalus*.

The Pindari glacier is in the Southern boundary of the Biosphere Reserve, between Nandakhet and Nandakot mountains. It is joined by Bankattia glacier from the Eastern Bankattia snow peaks. The meeting place of the glaciers form the medial moraine of considerable length. The parallel sides of the U-shaped glacial valley constitute the lateral moraine.

Beyond Purkia, up to the foot of the Pindari glacier, the flora is very distinct and covered with variegated graceful herbs of bright colours. After a steep ascent up to Martoli at 4300 m the vegetation becomes alpine in character.

At Martoli one can see the replacement of shrubby vegetation by small semi-erect, prostrate, cushioned or tufted plants in the widely stretched alpine meadows, locally called Bugyal, which support a very rich nourishing grass for horses. The Bugyal, surrounded on all sides by snow covered mountains is situated in a valley and constitutes a major part of Pindari valley. The Pindari river flows in a deep gorge and the ridges present varied types of growth forms. Plants of tree habit are not seen in the valley. They are replaced by woody, semi-erect or prostrate plants like *Juniperus recurva*, *Salix elegans*, *Rhododendron lepidotum* and *R. anthopogon*. Another common woody prostrate shrub of wide distribution is *Cotoneaster microphyllus*. This plant is remarkable for its mat-forming habit and appears first to colonize the rocks free from snow or ice. Plants of tufted habit are *Cassiope fastigiata*, *Rhodiola quadrifida*, different species of *Astragalus*, etc. The pretty, blue to red tinged fruits of prostrate *Gaultheria trichophylla* are very attractive as they form a regular carpet in the valley. The other handsome herbs of the valley are prostrate pink flowered *Thymus linearis*, white flowered woolly herb *Anaphalis nepalensis* and *A. cuneifolia*, yellow flowered herb *Potentilla argyrophylla* and dark crimson flowered *P. argyrophylla* var. *atrosanguinea*. During the ascent from Bugyal to the foot of the Pindari glacier one can experience the rich aroma of the herb *Tanacetum* with small yellow heads. This alpine herb forms a regular mat and is collected for its 'gogal', a gum resin used for incense. The yellow flowered *Taraxacum officinale*, *Aster stracheyi*, a woolly herb *Leontopodium brachyactis* and *Senecio laetus* are the other members of Asteraceae frequently seen in the alpine herbage.

The margins of the rivulet beds support varied type of graceful herbs. The common genera are *Corydalis*, *Anemone*, *Pedicularis*, *Sedum*, *Potentilla*, *Primula*, *Androsace*, *Epilobium*, *Polygonum*, *Poa*, *Juncus* and *Carex*. The most attractive herb is the deep blue flowered *Cyananthus lobatus*.

The dominating plant all along the lateral moraine is *Cotoneaster microphyllus*. This is followed by *Cassiope fastigiata* and species of *Rhododendron*. Amidst the big boulders one can see more or less the same alpine herbs noticed in adjacent bugyals. The medial moraine flora is chiefly composed of *Saxifraga*, *Sedum*, *Cotoneaster*, *Tanacetum*, *Aster* and *Potentilla*.

The vegetation of the mountains surrounding the Pindari valley is quite interesting. The mountains are steep with, boulders of varied size, and support vegetation up to 5300 m. Beyond it is the zone of perpetual snow. The interesting plants of this area are *Saussurea obvallata,* (locally called Brahma Kamal), a showy plant with transparent bracts, *Primula* spp., *Aconitum falconeri, Meconopsis aculeata, Morina longifolia, Swertia* spp. etc.

Some of the plants of medicinal value collected in this region are *Nardostachys grandiflora,* a highly valued herb for its aroma and stimulating properties and *Picrorhiza scrophulariflora,* locally called 'Katugi' the tonic prepared out of whose root is said to have cooling effect. The broad leaved *Rheum moorcroftianum* whose red fleshy petioles are said to be edible, was also collected. Other interesting collections from this area include *Lycopodium clavatum, Asplenium* spp. and *Equisetum* spp.

Of the several glaciers in the Garhwal and Kumaon Himalayas, Pindari glacier is the most attractive and easily accessible, and as such has provided considerable attraction to naturalists.

Botanically the area can be divided in three distinct vegetational zones. A subalpine region from 3700-4000 m, a moraine zone from 4000-4250 m and an alpine zone from 4500 m to snow line.

Rupkund is situated at an altitude of ca 4850 m within the Southern outer fringes of Nanda Devi Biosphere Reserve and is just at the base of Trisul massif. The enchanting landscapes of the high Himalayas have attracted many tourists since time immemorial. Among the Nanda Devi group of mountains, the beautiful peaks of Nandakhot (6872 m), Dunagiri (7025 m), Nandaghunti and others, including Trisul being in the neighbourhood of the area, attract many mountaineers also.

Rupkund can be approached from many places. The most popular route is from Karan Prayag via Tharali, Debal, Mandoli, Wan, Bedni bugyal, Kalu Abhinayak and Baguavasa. The other route is from Nandaprayag via Ghat, Sital, Sutal, Bhainswara, Latakupri, Bhunjari and Hemkundi. From Sutal, Rupkund can also be approached via Talkapor along the Rupkund Nala. The vegetation along Rupkund Nala is not disturbed and more or less virgin as there is no human interference. There is dense forest of *Quercus-Acer-Rhododendron* with

Cicerbita macrorhiza (Royle) Beauv.

Saussurea stracheyana (O. Ktze.) Lipschitz

rich undergrowth of herbaceous and shrubby plants along with high altitude bamboos. They are replaced by *Betula-Rhododendron* forests. Beyond this type of forest there are alpine meadows as the route joins the main Bedini Bugyal. Wan the last village on way to Rupkund from Loharijung, is approached through a crooked forest of *Quercus leucotrichophora* and *Rhododendron arboreum*. The main track within the forest offers an interesting assemblage of temperate species with good number of epiphytes.

Some of the herbaceous plants along the route are *Anaphalis triplinervis, Corydalis chaerophylla, Elsholtzia fruticosa, Gentiana* sp., *Geranium* spp., *Polygonum* sp., etc.

Some of the common plants near Wan are *Indigofera heterantha, Salix elegans, Viburnum erubescens, Hippophae salicifolia*, etc. Surrounding mountains in the neighbourhood of Wan have a dense forest of *Quercus semecarpifolia* and *Rhododendron arboreum*. Besides these groves of *Cedrus deodara, Cupressus torulosa* with scattered trees of *Picea smithiana* are also seen.

Vegetation near Vedini Ganga valley is of mixed forest of *Acer acuminatum, Quercus semecarpifolia, Rhododendron arboreum, Taxus wallichiana* and occasionlly *Picea smithiana.*

The dense forest of *Rhododendron, Quercus* is replaced by alpine bugyals at Vedini where only herbaceous plants like *Gentiana argentea, Ranunculus hirtellus, Sibbaldia parviflora, Taraxacum officinale, Trachydium garhwalicum*, etc. can be seen. *Danthonia cachemyriana, Stipa roylei, Kobresia duthiei, K. nepalensis* are some of the common grasses and sedges on the alpine slopes. *Delphinium vestitum, Swertia cuneata* and *Gaultheria trichophylla* are also found scattered all around. Shrubs like *Rhododendron lepidotum, R. anthopogon* are common in the alpine region.

UTILITARIAN ASPECT OF THE FLORA

The area is very rich in medicinal, ornamental and other economic plants. Over and above there is crop diversity in different altitudinal zones. Certain

commonly grown crops are *Allium*, Cucurbits, chenopodes, etc. Others are extensively cultivated, e.g. buck wheat, amaranthes, beans, potato, pseudo-cereals and millets. Several species of *Amaranthus* are cultivated by the villagers, both for leaves and for grain. Similarly *Chenopodium album* is cultivated for leaves and grain. There is a great diversity in grain types with variation in inflorescence, colour, size of the plant. Buck wheat or *Fagopyrum esculentum* and *F. tataricum* are grown in the high altitude zone at Malari, Milam, Wan, etc. There are several local types available for *F. esculentum* which is extensively grown in almost all places in the proposed recreational zone. *Panicum miliaceum* and *Secale cereals* (Ura) are also cultivated mainly for grains.

Vegetables

Among vegetables, potato (*Solanum tuberosum*) is widely cultivated along with cucumber (*Cucumis sativus*); radish (*Raphanus sativus*) chilly (*Capsicum annuum*); fresh bean (*Phaseolus vulgaris*); *cabbage (Brassica oleracea* var. *capitata); cauliflower (Brassica oleracea* var. *botrytis);* cabbage leaved mustard (*Brassica juncea* var. *rugosa*); sweet belladonna Matazor, Sarangum Hindi (*Phytolacca acinosa)*, chuhva *(Amaranthus caudatus)*, marsha *(A. paniculatus)*, etc.

Fruits

The villagers around the Biosphere Reserve also cultivate some of the common fruit trees of the hills for example, apple *(Malus pumila)*, peach *(Prunus persica)*, common plum *(Prunus domestica)*, pear *(Pyrus pyrifolia* var. *culta)*, common apricot *(Prunus armeniaca)*, etc.

Medicinal plants

The area is very rich in medicinal plants. Following are some of the important medicinal plants which are found in the area. As the uses are mentioned in most of the literature of medicinal plants, only names of plants are mentioned below:

Aconitum balfourii Stapf (Gobari-Nepali), *A. falconeri* Stapf (Bikh-Garhwal), *A. violaceum* Jacq. ex Stapf, *Actaea spicata* L., *Anemone obtusiloba* D. Don, *Delphinum brunonianum* Royle (Musk larkspur), *D. denudatum* Wallich {(Apavisha-Sans-Vishalakarori, Jadivar, (Nirbisi)}, *Thalictrum alpinum* L., *T. elegans* Wallich ex Royle (Id-Salap), *Berberis aristata* DC., (Kingor) *Podophyllum hexandrum* Royle (Papra), *Meconopsis aculeata* Royle, *Arabidopsis thaliana* (L.) Heynh., *Capsella bursa-pastoris* (L.) Medik. (Shepherd's purse), *Geranium wallichianum* D. Don ex Sw. (Laljhari, Liljelhri), *Acer acuminatum* Wallich ex D. Don, *Rhus punjabensis* Stewart (Allara, Dosmila), *Thermopsis barbata* Royle, *Princepia utilis* Royle (Bekkra, Bhekol), *Hedera nepalensis* K. Koch, *Viburnum cotinifolium* D. Don, *Galium aparine* L., *Nardostachys grandiflora* DC. (Balchhar, Jatamansi), *Valeriana hardwickii* Wallich, *Artemisia maritima* L. (Kirmola), *Saussurea costus* (Flac.) Lipsch. (Kut), *Rhododendron arboreum* Sm. (Burans), *Rhododendron campanulatum* D. Don (Cherailu), *Jasminum humile* L. (Peeli chameli), *Syringa emodi* Wallich ex Royle (Kmalayan lilac), *Arnebia benthamii* (Wallich ex G. Don) Johnston (Balchar), *Arnebia euchroma* (Royle) Johnston, *Picrorhiza scrophulariflora* Royle ex Benth. (Katki, Karu), *Dactylorhiza hatagirea* L. (Salam).

Important timber plants

Pinus wallichiana A.B. Jackson Blue Pine (Kail-Hindi), wood is of commercial importance, *Cedrus deodara* (Roxb.) Loud. (Deodar-Hindi) Himalayan Cedar, strongest of Indian Coniferaceae woods used for door and window frames, *Picea smithiana* Boiss. West Himalayan Spruce (Ragha-Garhwal) - wood is used for planking, rough furniture, etc., *Taxus wallichiana* Zucc. Himalayan yew (Thuner, Thano-Hindi)-wood is used for cabinet work and other fancy articles. *Abies spectabilis* (D. Don) Spach - East Himalayan Silver Fir, *A. pindrow* Royle-Himalayan silver fir, yields light wood used for packing cases, planking, *Cupressus torulosa* (Surai) etc.

ANALYSIS OF THE FLORA

The flora of Nanda Devi Biosphere Reserve includes taxonomic treatment of 739 species of Angiosperms distributed in 378 genera and 98 families. In addition to this 11 species of Gymnosperm, distributed in 8 genera and 4

families, and 51 species of pteridophytes distributed in 26 genera and 18 families are also treated.

ANGIOSPERMS

	Families	Genera	Species
Diocots	86	301	600
Monocots	12	77	139
Total :	98	378	739

GYMNOSPERMS

Families	Genera	Species
4	8	11

PTERIDOPHYTES

Families	Genera	Species
18	26	51

Table 1: Ten dominant families of Nanda Devi Biosphere Reserve

Families	Number of Genera	Number of Species
1. Asteraceae	44	82
2. Poaceae	30	46

	Families	Number of Genera	Number of Species
3.	Rosaceae	16	43
4.	Ranunculaceae	14	43
5.	Lamiaceae	18	32
6.	Leguminosae (Fabaceae)	16	32
7.	Orchidaceae	19	30
8.	Cyperaceae	6	26
9.	Apiaceae	13	24
10.	Polygonaceae	10	23

Table 2: 10 Largest Families in Flora of British India, Flora of Chamoli District and Flora of Nanda Devi Biosphere Reserve

	Flora of Nanda Devi Biosphere Reserve	Flora of Chamoli District	Flora of British India
1.	Asteraceae	Asteraceae	Orchidaceae
2.	Poaceae	Leguminosae	Poaceae
3.	Rosaceae	Orchidaceae	Rubiaceae
4.	Ranunculaceae	Poaceae	Leguminosae
5.	Lamiaceae	Lamiaceae	Euphorbiaceae

	Flora of Nanda Devi Biosphere Reserve	Flora of Chamoli District	Flora of British India
6.	Leguminosae	Cyperaceae	Acanthaceae
7.	Orchidaceae	Urticaceae	Asteraceae
8.	Cyperaceae	Rubiaceae	Cyperaceae
9.	Apiaceae	Euphorbiaceae	Lamiaceae
10.	Polygonaceae	Acanthaceae	Urticaceae

ETHNOBOTANY

Buffer zone of Nanda Devi Biosphere Reserve includes 11 villages of district Chamoli, 4 villages of Pithoragarh and 3 of Almora. All the villages of Pithoragarh and Chamoli districts are mainly inhabited by the Botia tribals, popularly known as "Johari" and "Talchla" respectively.

The people of this area were basically traders, and had intimate trade relations with Tibet. Apart from this, they used to migrate between their summer and winter homes. Owing to this they developed a very good knowledge of wild plants and plant products. As the essential commodities were hard to reach these remote areas they used to fulfil their day to day sustenance needs from the nature.

Nevertheless, the influx of civilization and developmental activities, enticed them to more or less settled way of life.

The people in these villages are by and large now dependent on marginal subsistence agriculture and cattle and sheep rearing. Still they look forward to various plant species around them for meeting their day to day requirement and also to supplement their resources. The table below lists some of the plant species of the area, of considerable ethnobotanical value, along with their local names and the part of the plant used.

Name	Family	Local Name	Plant parts used	Uses		
				Edible	Medicinal	Miscellaneous
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Aconitum bulfouri Stapf	Ranunculaceae	Bish	Tuberous roots		Used in fever and various pains, highly poisonous.	
A. heterophyllum Wallich ex Royle		Mithu or Atish			Used in fever and various pains, also used as tonic, less poisonous.	
Thalictrum foliolosum DC.		Dhyakul or Mamiri	Roots		Used in various urinary and eye diseases, also used as blood purifire and as tonic.	
Paeonia emodi Wallich ex Royle	Paeoniaceae	Hadgans or Gandrain			Used in various urinary diseases.	
Stephania glabra (Roxb.) Miers	Menispermaceae	Ghindharu	Tuberous roots		Said to be good in various blood problems, fever and bronchitis.	
Podophyllum hexandrum Royle	Podophyllaceae	Papra or Charpa	Fruit		Good in fever, also used as tonic and in cancerous diseases.	
Berberis aristata (Roxb.) DC.	Berberidaceae	Kingor	Fruits and roots	Fruits are eaten raw or mixed with mustard oil	Roots are used in various eye diseases and in diarrhoea	Extract of roots is used in making dye.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Berberis aristata Roxb. ex DC.	Berberidaceae	Kingor	Fruit and roots	Fruits are eaten raw or mixed with mustard oil.	Roots are used in various eye diseases, also used in diarrhoea.	Extract of roots is used in making dye.
B. chitria Lindl.	"					
Rhus parviflora Roxb.	Anacardiaceae	Tungla	Fruit and leaves	Fruits are used raw.	The smoke of leaves have psycoactive effect.	
Primula sikk Royle	Rosaceae	Bhokal	Fruit	Fruits are crushed and edible oil is extracted.		
Rosa anserinaefolia Boiss.	Rosaceae	Gorshyapla	Fruit and roots	Fruits are eaten raw.	Roots are crushed and used in various urinary diseases.	
R. sericea Lindl.	"	Shyapla				
R. webbiana Wallich ex Royle	"			"		
Rubus ellipticus Sm.	"	Hisalu	Fruit	Fruits are eaten raw.		
R. foliolosus D. Don		Kali, Hisalu			The fruits are said to be good in constipation	
R. niveus Thunb.	"	"				
Bergenia ciliata (Haw.) Sternb.	Saxifragaceae	Pasanbhed or Silphori	Thick root stocks		Extract of roots used as cooling agent, tonic and in fever.	

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ribes alpester Wallich	Grossulariaceae	Darbag	Fruit	Ripe fruits are eaten raw and are used in pickles.		
R. himalense Royle ex D. Don						
Viburnum cotinifolium D. Don	Caprifoliaceae	Gena	Fruit and seeds	Seeds are crushed and edible oil is extracted, fruits are eaten raw.		
Nardostachys grandiflora DC.	Valerianaceae	Masi or Jatamasi	Roots		The fragrant root stocks used as cooling agent and as tonic, also used in various heart problems.	
Artemisia maritima L.	Asteraceae	Safed Purcha	Leaves			Leaves are used in worship.
Cirsium wallichii DC.		Kandaya	Stem	Pith of the stem is taken raw and is said to be good in thirst.		
Gerbera gossypina (Royle) Beauv.		Kapasi	Leaves			The wool of leaves is used to get fire by friction between a piece of stone and iron.
Saussurea obvallata (DC.) Edgew		Brahmkamal	Flowers			Flowers are used in worship.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Rhododendron arboreum Sm.	Ericaceae	Buransi	Flowers	The squash is prepared from the flower.	The juice of flowers is said to be cooling agent and good in diarrhoea.	
R. anthopogon D. Don	"	Kodya	Leaves	Leaves are used as substitute of tea.		
R. lepidotum Wallich ex G. Don		Taghishya or Tukkar				
Picrorhiza scrophulariiflora Pennell	Scrophulariaceae	Katki	Seeds & roots		They are used in fever, as purgative and as tonic.	
Verbascum thapsus L.	"	Akalbir	Entire plant			This plant is used in certain "Jadu Toda"
Fagopyrum dibotrys (D. Don) Hara	Polygonaceae	Ban, Ogal	Leaves	Leaves are cooked as vegetable.	These are said to have healing effect.	
Rheum moorcroftianum Royle	"		Roots and Leaves	Leaves are cooked as vegetables.	Thick root stock are used as healing agent.	
R. tibeticum Maxim. ex HOOK.f.	"			"		
Rumex hastatus D. Don		Kilmor	Leaves	Leaves are crushed with spices to make "Chatni"		

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Hippophae salicifolia D. Don	Elaeagnaceae	Sanjoteruwa or Tarwa	Fruits	Fruits are eaten raw and are used in making pickels and "Chutni"		
Cannabis sativa L.	Cannabinaceae	Bhang,	Leaves, Inflorescence and seeds	Seeds are eaten raw and are used as spices. The leaves are dried to obtain BHANG from the the glandular leaves and from inflorescence (female one) GANJA is prepared. Both these have high psychoactive activity.	The leaves and seeds are supposed to be good healing agent. The drug obtained from leaves and inflorence is intoxicating and analgesic, also used in stomachace.	The stems are shaked in water and thrashed to get a good quality fiber
Urtica dioica L.	Urticaceae	Kandali	Leaves	Leaves are cooked as vegetable.	The cooked leaves are said to be very good in certain feminine diseases. The leaves are also applied in artheritis.	The stems are soaked in water and then thrashed to obtain fiber.
Betula utilis D. Don	Betulaceae	Bhoj or Bhojpatra	Cell sap	Dried cell sap (Betula gum) is used as substitute of tea.	The Bhoj tea is said to give a very good healing effect.	
Corylus jacquemontii Decne.	Corylaceae	Bhutia Badam or Kabasi	Seeds	Seeds are roasted and eaten.		

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Allium humile Kunth	Liliaceae	Jimbo	Leaves	Aromatic leaves are used as condiment.		
Allium stracheyi Baker	-		-			
Polygonatum verticillatum (L.) All.		Salam or Salam Mishri	Tubers		The tubers are used as tonic and in fever.	
Taxus wallichiana Zucc.	Taxaceae	Thuner	Stem bark	Stem bark is used as substitute of tea.	The tea of *Taxus* bark is said to have a great healing effect, also used in fever.	
Cupressus torulosa D. Don	Cupressaceae	Surai	Leaves			The leaves are used in preparing "BALMA" used in preparing local drinks (DARU)

DICOTYLEDONES

1. RANUNCULACEAE
(The Buttercup Family)

The family, consisting chiefly of herbaceous plants, is characterised by having numerous stamens spirally arranged around the base of 1 to many free carpels. Both calyx and corolla or only one of these may be present and usually all or some of the petals secret nectar. The fruits are generally achenes or follicles.

Comprises about 50 genera and 1900 species, occurring generally in cold temperate regions of the Northern Hemisphere; 28 genera and 190 species are recorded from India, 14 genera and 43 species have been collected from Nanda Devi Biosphere reserve. The members are all herbaceous ornamentals decorating the Himalayan floor with flowers of varied colour.

1a.	Plants twining or climbing	**7. Clematis**
b.	Plants usually erect	2
2a.	Fruit a berry	**2. Actaea**
b.	Fruit usually single seeded achene or many-seeded follicles	3
3a.	Sepals and petals both present	6
b.	Sepals petal-like; petals absent	4
4a.	Flowers solitary	**6. Caltha**
b.	Flowers in cymes or in panicles	5
5a.	Flowers in umbelliform cymes with ear like involucre	**3. Anemone**
b.	Flowers in panicles; involucre absent	**13. Thalictrum**
6a.	Stemless herbs	7
b.	Herbs with stem	9
7a.	Sepals persistent, enlarged after flowering	**10. Oxygraphis**
b.	Sepals deciduous or withering early	8
8a.	Petals white or pinkish tinged	**5. Callianthemum**
b.	Petals yellow	**9. Halerpestes**
9a.	Upper sepal hood-like, boat-shaped or helmet shaped	**1. Aconitum**
b.	Upper sepal neither hood-like, nor boat shaped or helmet shaped	10
10a.	Flowers blue, purple or white	11
b.	Flowers usually yellow or golden yellow	13
11a.	Flowers irregular	**8. Delphinium**
b.	Flowers regular	12
12a.	Erect perennial herbs	**4. Aquilegia**
b.	Densely caespitose herbs	**11. Paraquilegia**

13a.	Fruit a spherical cluster of small, many-seeded follicles	**14. Trollius**
b.	Fruit a group of achenes, smooth, tubercled or spinous	**12. Ranunculus**

1. ACONITUM L.

The genus comprises about 300 species, occurring chiefly in temperate regions; about 27 species in India, five species are recorded from Nanda Devi Biosphere Reserve. Root-tubers of some Aconites are known as 'Bish' and occupy an important place in the Indian Pharmacopoeia from very ancient times.

The scientific name *Aconitum* is derived from *akoniton* or *akon* meaning an arrow. In ancient times the juice of the root of *Aconitum* was used to poison arrows.

1a.	Herbs, usually 10-30 cm high	**5. A. violaceum**
b.	Herbs usually 50-100 cm high	2
2a.	Cauline leaves stem-clasping, sessile	**4. A. heterophyllum**
b.	Cauline leaves not stem clasping	3
3a.	Inflorescence and fruits (carpels) with yellow hairs	**1. A. balfourii**
b.	Inflorescence and fruits (carpels) without yellow hairs	4
4a.	Flowers compact at the end of stem; carpels quite glabrous	**2. A. falconeri**
b.	Flowers loose at the end of stem or branches; carpels tomentose	**3. A. ferox**

1. Aconitum balfourii Stapf

A biennial herb with paired or ternate tuberous roots, ca 1 m high. Flowers many at the end of branches, blue, helmet-shaped.

The species is recorded from sub-alpine region. Generally found in shady places amidst boulders on the bank of Rishi Ganga river. Flowers during September-October. Tubers are used locally as medicine in fever.

2. Aconitum falconeri Stapf

A biennial herb with paired tuberous roots, up to 1 m high. Leaves scattered. Flowers crowded at the ends of branches, blue.

Frequent around Ramani and Himtoli area, 3500 m. Flowers during August-September.

3. Aconitum ferox Wallich ex Ser.

A biennial herb, up to 1 m high. Leaves palmately. Flowers at the end of branches, blue.

The species occurs in moist areas near *Betula* and *Abies* forest between 3000-3500 m. Flowers during August-September.

4. Aconitum heterophyllum Wallich Fig. 1.

A perennial herb with paired tuberous roots and erect stem, up to 90 cm high. Leaves sessile and stem clasping. Flowers blue.

The plant, locally known as 'Atis' (Hindi), has been recorded from Milam glacier surroundings, confined to shady places at 3500 m. Due to over-exploitation from the natural habitat, for its medicinal value, the species has become rare.

5. Aconitum violaceum Jacq. ex Stapf

A biennial herb with paired tubers, 10-30 cm high. Leaves 1 or 2, deeply 5-partite. Flowers solitary blue.

The species is frequent on alpine grassy slopes near Dharansi Pass around 4500 m. Tubers are used medicinally. Flowers during July-September.

2. ACTAEA L.

The genus comprises about 10 species, occurring chiefly in colder parts of the northern temperate zone; only one species recorded from India which is also found in Nanda Devi Biosphere Reserve.

The scientific name *Actaea* is derived from *aktea*, meaning the elder, in allusion to the shape of the leaves.

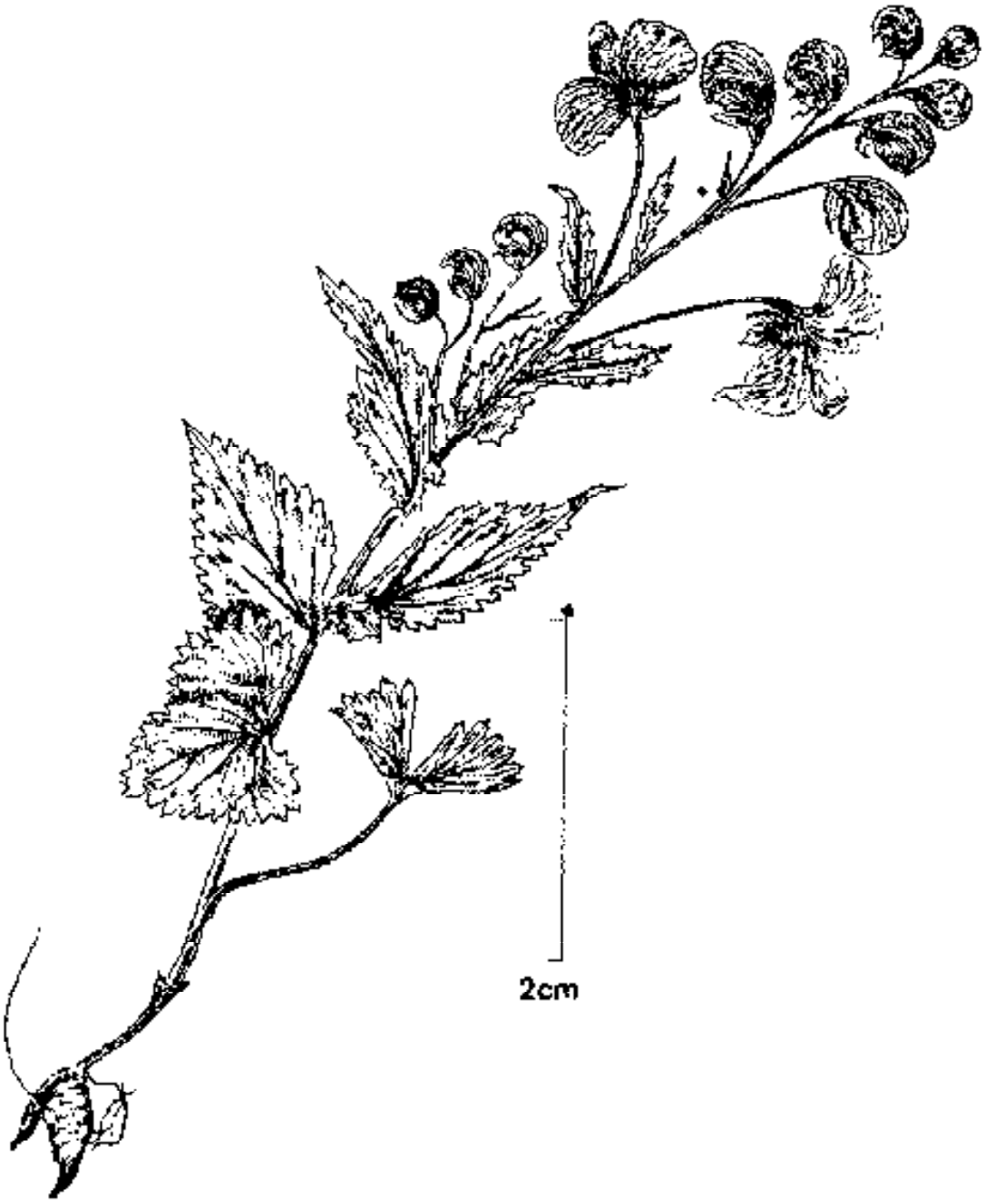


Fig. 1. Aconitum heterophyllum Wallich

Actaea spicata L. var. **acuminata** (Wallich *ex* Royle) Hara

A perennial, foetid herb, up to 60 cm high. Leaves bipinnate or ternately compound. Flowers at the end of branches, white. Fruits ca 1 cm across, at first green later turning blackish.

The plant is generally found as an undergrowth in forests, ravines and streams sides, at about 3500 m altitude near Himtoli and Deodi. This is a poisonous plant and the typical *A. spicata* is known in English as "Baneberry" or "Christophers" and used against skin diseases and asthma. Flower and fruiting in May-September.

3. ANEMONE L.

A genus of cold and temperate regions with about 150 species in the world; about 17 in the Himalayan region and 6 species are recorded from the Nanda Devi Biosphere Reserve. Anemones are usually perennial rhizomatous herb with white or purple flowers, 2-3 leafy bracts below flowers and fruits in a head, embedded in wool or not.

The scientific name *Anemone* is derives from *anemos* meaning wind; referring to the habitat as most of the species of *Anemone* occur in wind-swept high altitude. In some Greek legends, Anemone was a name given to the daughter of the winds.

1a.	Achenes embedded in woolly hairs	2
b.	Achenes not embedded in woolly hairs	3
2a.	Flowers many	6. A. vitifolia
b.	Flowers few, 1-3	4. A. rupicola
3a.	Lamina of radical leaves 3-partite, 3-sect or 3 dentate or 3-foliolate	4
b.	Lamina of radical leaves 5-partite or 5-7-lobed	5
4a.	Achenes (fruits) 2.5 x 1.5 cm	1. A. obtusiloba
b.	Achenes 7 x 5 mm	3. A. rivularis
5a.	Sepals 5-8	2. A. polyanthes
b.	Sepals usually 4	5. A. tetrasepala

1. Anemone obtusiloba D. Don

A perennial herb with woody rootstock, 15-30 cm high. Leaves radical 3-partite. Flowers 1-3, white, yellow or blue.

The species is abundant in alpine grassy high slopes at Dibrugheta and near Dharansi Pass at ca 3500-4500 m. Flowers during June-July.

2. Anemone polyanthes D. Don

A perennial, silky hairy herb with stout woody rootstock, 20-30 cm high, densely villous. Leaves long petioled white.

Common in alpine grassy slopes near Himtoli, Dharansi, Dibrugheta, Ramani at 3500-4500 m altitude. Flowers during June-October.

3. Anemone rivularis Buch.-Ham.

A perennial, silky pubescent herb with stout woody rootstock, up to 1 m high. Leaves 3-5-lobed or partite. Flowers white, blue or purplish.

Recorded in alpine meadows and near stream sides on way to Milam glacier at an altitude 3500-4500 m, i.e. eastern side of the Biosphere Reserve and less frequent towards north western side. Flowers during June-July.

4. Anemone rupicola Camb.

A perennial, softly silky hairy herb, up to 30 cm high. Leaves 3-lobed. Flowers 1-2, purplish-white.

Found in alpine meadows amongst Juniper or *Rhododendron* scrub near Ramani, Sarsupatal, on way to Milam glacier, from 2800-4800 m. Flowers during June-July.

5. Anemone tetrasepala Royle

Hairy or glabrous herb with woody, fibrous rootstock, up to 60 cm high. Leaves deeply 5-partite, long petioled. Flowers white.

It is less frequent in the north western side of the Biosphere Reserve and has been recorded from the eastern side of the Reserve. Flowers during July-August.

6. Anemone vitifolia Buch.-Ham. ex DC.

A robust, pubescent herb, up to 1 m high. Flowers white. Achenes woolly.

Locally common on grassy hill slopes near Peng and on way to Pindari glacier at 1500-3000 m. Flowers during July-August.

4. AQUILEGIA L.

The genus comprises about 100 species, growing mostly in north temperate zone; 5 species from the Western Himalayan region, one species occurs in Nanda Devi Biosphere Reserve.

The generic name is derived from the Greek *aquila* and eagle, referring to the form of sepals or spurs resembling the claws of an eagle.

Aquilegia pubiflora Wallich ex Royle

A perennial, softly pubescent herb. Leaves compound 2-pinnate. Flowers solitary, spurred, purple.

The plant is grows in shady places amidst boulders near Himtoli at an altitude of 3500 m. Less frequent in north-western areas. Flowers during June-July.

5. CALLIANTHEMUM C.A. Meyer

The genus comprising about 10 species, of which 3 species are known from the Himalayas usually in high altitude regions; 1 species has been recorded from the Biosphere Reserve.

The scientific name *Callianthemum* is derived from *Kalos*, meaning beautiful, and *anthos*, meaning flower, thus referring to its pretty flowers.

Callianthemum pimpinelloides (D. Don ex Royle) Hook.f. & Thoms.

A small, densely caespitose, glabrous, perennial herb with fibrous roots, up to 15 cm high. Flowers white or pale-orange.

In alpine meadows at 4000-5000 m in eastern part of the Reserve, on way to Milam glacier. Flowers during May-June.

6. CALTHA L.

The genus comprises about 20 species, mostly in northern temperate and arctic regions; 3 in the Himalayan region and one in the Nanda Devi Biosphere Reserve.

The generic name is derived from Greek *Kalathos*, a goblet; referring to the form of the corolla to a golden cup.

Caltha palustris L.

A perennial, glabrous herb with stout creeping rhizomes. Leaves reniform or deltoid-cordate. Flowers yellow.

The species is popularly known as Marsh Marigold and is a very variable; common in marshes and along streams at Martoli and Milam bugyals reaching an altitude of 5000 m. Flowers during July-August.

7. CLEMATIS L.

The genus comprises about 250 species, occurring chiefly in sub-tropical and temperate regions; about 31 species in India, 5 species in the Nanda Devi Biosphere Reserve.

The scientific name *Clematis* is derived from *Klema*, meaning a vine branch. A genus with woody climbing stems and opposite pinnate or trifoliate leaves; 4-5 petaloid sepals which are uniseriate; white, yellowish, reddish or purplish and feathery persistent style.

1a.	Leaves fascicled at node	**1. C. barbellata**
b.	Leaves opposite	2
2a.	Flowers purplish-brown inside or tinged red violet outside	**5. C. orientalis**
b.	Flowers creamy-white or lemon-yellow	3
3a.	Petiole or leaf-stalk bases of opposite leaves are united together at the node forming a wing like structure	**2. C. connata**
b.	Petiole or leaf-stalk bases are not united together	4
4a.	Filaments glabrous.	**3. C. grata**
b.	Filaments hairy throughout	**4. C. graveolens**

1. Clematis barbellata Edgew.

A large woody climber. Flowers bell-shaped, axillary, hairy, purplish-brown, with and densely bearded anthers.

The species is found in shady places amidst shrubs on way to Himtoli at 2500-3500 m. Flowers during June-July.

2. Clematis connata DC.

A large woody climber. Leaves 3-7 foliolate, with petiole bases of opposite leaves united or fused together at the node forming a wing like structure. Flowers white to yellowish cream. Fruits densely hairy.

The species is frequent at 2000-3000 m above Tolma, on way to Himtoli and on way to Garpak from Ruing village, amidst shrubs at the edge of the forest. Flowers during August-October.

3. Clematis grata Wallich

A robust climber with grooved branches. Leaves 3-5-foliolate. Flowers creamy-white, fragrant.

The species is frequent amidst shrubs along the road sides near Lata and Suraithota villages at 1500-2500 m, flowers in August-September.

4. Clematis graveolens Lindl.

A tall, slender, perennial climber. Leaves pinnately compound. Flowers pale lemon-yellow coloured with strong smell.

The species can easily be recognised in the field by its spreading sepals hairy filaments and flowers being in panicles.

Throughout the Malari area at elevations of about 2500-3000 m in open sunny places, on hill slopes alongwith *Rosa, Berberis, Lonicera*, etc. Flowers and Fruits during May-September.

5. Clematis orientalis L.

A climbing shrub, with sparsely hairy angular branches, up to 8 m tall. Leaves 1-2 pinnate up to 9-foliolate. Flowers greenish yellow tinged with red-violet outside.

The species is frequent along the road side on hill slopes beyond Malari on way to Sumna, amidst *Rosa, Ribes*, etc. ascending up to 3000 m. Flowers during Aug.-Sept.

8. DELPHINIUM L.

The genus comprising about 200 species, occurs chiefly in temperate regions; about 23 species in India, 4 species in the Nanda Devi Biosphere Reserve.

The generic name is derived from the Greek *'Delphis'*, a dolphin, referring to the shape of the flowers. The English name for plants of this genus is 'Lark spur'.

1a.	Flowers few, in lax inflorescence	2
b.	Flowers many, in dense racemes	3
2a.	Pedicels (flower-stalk) adpressed to the stem	**3. D. denudatum**
b.	Pedicels erect, not adpressed to stem	**4. D. vestitum**
3a.	Sepals with white hairs	**1. D. brunonianum**
b.	Sepals without white hairs	**2. D. cashmerianum**

1. Delphinium brunonianum Royle

A perennial herb with a musky odour when fresh, up to 1 m high. Leaves 5-fid hairy. Flowers blue.

The species recorded from the Core zone near Bhujgara-Ramani at about 3500-5000 m, is not frequent in the Reserve. Flowers during August-September.

2. Delphinium cashmerianum Royle

A perennial herb. Leaves simple, palmately lobed. Flowers large, very hairy, blue-purple with a broad inflated conical spur.

The species is frequent in Alpine grassy slopes at 3500-4500 m. Flowers during August-September.

3. Delphinium denudatum Wallich ex Hook.f. & Thoms. **Fig. 2.**

A perennial, much branched herb, 15-80 cm high. Leaves suborbicular 3 to 5-partite. Flowers fragrant blue or violet.

The species is frequent at 2000-3500 m, on way to Dharansi from Sonnwara and Lata. Flowers during July-August.

4. Delphinium vestitum Wallich ex Royle

An erect herb, up to 1 m high. Leaves suborbicular, 5-7 lobed, hairy dense, purplish-blue flowers at the end of stem.

The species is common in open hill slopes near Lata, Himtoli at 2000-3500 m and grows with *Impatiens*, *Urtica*, etc. Flowers during July-August.

9. HALERPESTES Greene

The genus comprising 7 species in temperate Eurasia, N. America and India; about 2 species in India, 1 in the Nanda Devi Biosphere Reserve.

The generic name is derived from Greek name *halos* meaning sea and *earpestes* a creeper.

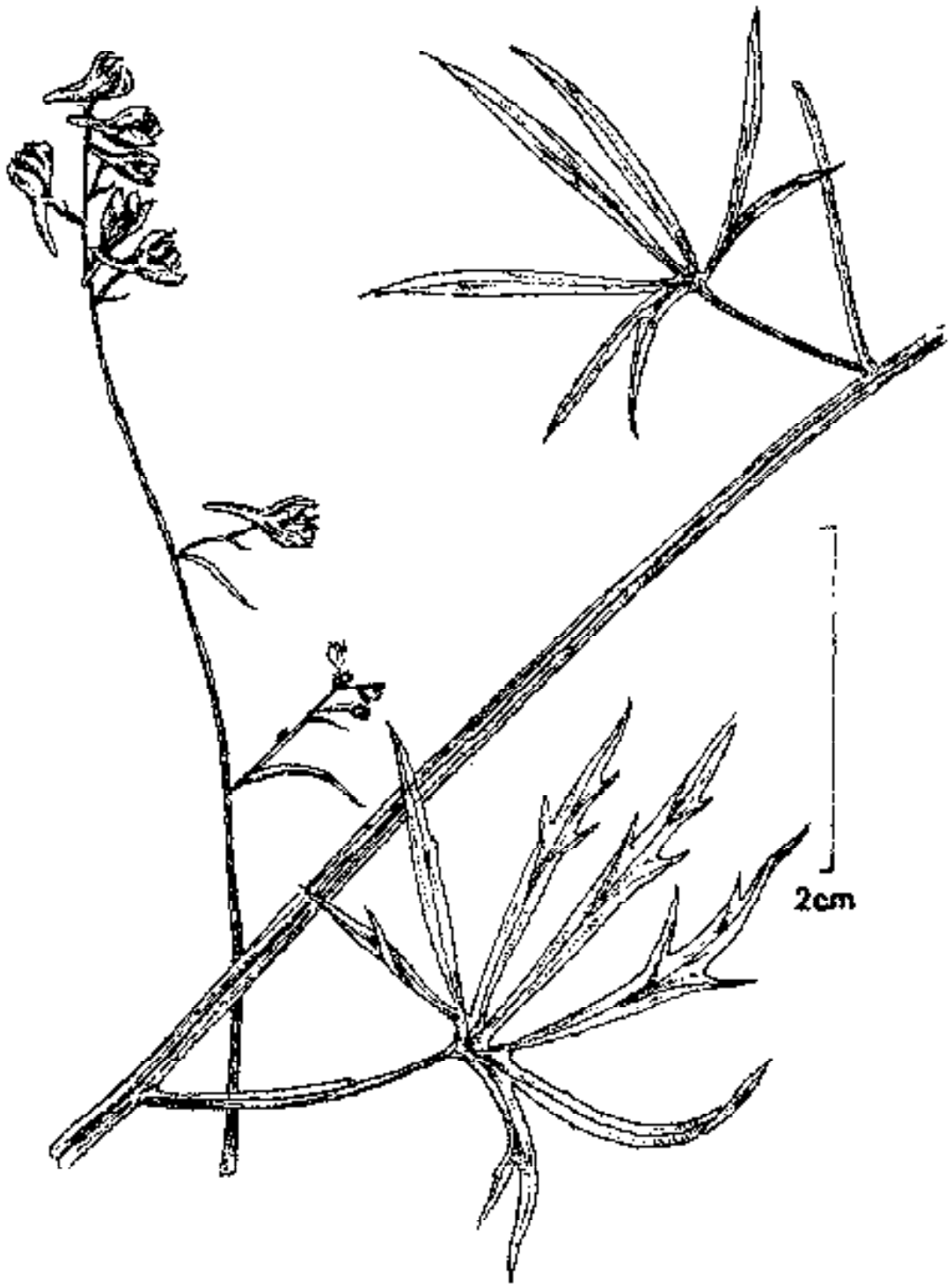


Fig. 2. Delphinium denudatum Wallich ex Hook.f. & Thoms.

Halerpestes tricuspis (Maxim.) Hand.-Mazz.

A low, aquatic herb. Leaves broadly ovate or orbicular, shallowly or deeply tripartite. Flowers solitary, yellow.

A very variable species, frequent in marshy places at 4000-5000 m near Milam bugyal. Flowers during June-July.

10. OXYGRAPHIS Bunge

The genus comprises about 5 species, occurring in alpine region; only one species is known from India which has been recorded from Nanda Devi Biosphere Reserve also.

The scientific name is derived from *Oxys* meaning acid, and *graphis* meaning a drawing or pencil.

Oxygraphis endlicheri (Walp.) Bennet & Chandra

A perennial, tufted low herb. Radical leaves ovate or orbicular. Flowers solitary, yellow.

The species is common in alpine meadows, mossy rocks and damp places at 4500-5000 m, near Dharansi and Milam glacier. Flowers during June - July.

11. PARAQUILEGIA Drumm. & Hutch.

The genus comprises about 8 species, confined to Central Asia, Afghanistan and Himalaya; 2 species are known from Indian Himalayan region and also from the Nanda Devi Biosphere Reserve.

The generic name *Paraquilegia* is derived from the Greek *Para* meaning beside or near and *aquila*, an eagle i.e. the genus is near to *Aquilegia*.

1a.	Seeds puberulous	1. **P. anemonoides**
b.	Seeds glabrous	2. **P. microphylla**

1. Paraquilegia anemonoides (Willd.) Ulbr.

A densely tufted herb, 10-20 cm high. Leaflets ternately lobed. Flowers solitary, pale lavender to blue or white.

The species is frequent at 3500-4500 m in mountain cliff edges, ravines and rock crevices on way to Dharansi. Flowers during July-August.

2. Paraquilegia microphylla (Royle) J.R. Drumm & Hutch.

A small, hairy herb forming large clumps up to 15 cm high. Leaves 2-3 ternatisect. Flowers solitary, cup-shaped usually blue or lilac.

The species is scattered in the core zone near Dharansi, Patalkhan to Bhujgera, at 3500-5000 m. Flowers during July-August.

12. RANUNCULUS L.

A cosmopolitan genus, comprising about 400 species, mostly known from temperate regions 37 species in India, 6 species in the Nanda Devi Biosphere Reserve.

The generic name is derived from Greek word *rana*, a frog, literally meaning a little frog, in fanciful allusion to the aquatic habitat of some species.

1a.	Flowers white	**6. R. trichophyllus**
b.	Flowers yellow	2
2a.	Floating herbs	**4. R. natans**
b.	Terrestrial herbs usually in moist places	3
3a.	Leaves usually undivided	**5. R. pulchellus**
b.	Leaves 3-partite	4
4a.	Achenes turgid, without intermarginal rib	**2. R. hirtellus**
b.	Achenes flattened with intermarginal rib	5
5a.	Achenes smooth	**3. R. laetus**
b.	Achenes dotted	**1. R. diffusus**

1. Ranunculus diffusus DC.

A perennial, hairy herb with spreading hairs 15-40 cm high. Flowers yellow. Achenes compressed, glabrous.

Common throughout the area a 1800-3000 m on grassy hill slopes. Flowers and fruits during June-August.

2. Ranunculus hirtellus Royle

A perennial, erect or decumbent, pubescent herb. Leaves 3-partite. Flowers 1-1.5 cm wide.

The species is frequent near Martoli and Milam at 3000-5000 m. Flowers during June-August.

3. Ranunculus laetus Wallich ex Royle

A perennial, erect, much branched hairy or subglabrous, herb, 30-50 cm high. Leaves 3-partite. Flowers ca 3 cm across, yellow.

The species is common in temperate and sub-alpine regions in damp places at 3000-3500 m. Flowers during July-August.

4. Ranunculus natans C.A. Mey.

A perennial, aquatic, prostrate herb. Leaves reniform. Flowers 1 cm across, yellow.

The species is frequent in Milam bugyal in moist places at 4000 m. Flowers during June-July.

5. Ranunculus pulchellus C.A. Mey.

An erect, perennial herb. Basal leaves entire or 3-lobed. Leaves 3-lobed. Flowers solitary yellow.

The species is frequent at 4000-5000 m near Martoli and Milam. Flowers during June-July.

6. Ranunculus trichophyllus Chaix

A perennial, aquatic, dark green herb. Leaves all submerged, 2-3 cm long and broad, divided. Flowers 1.2-1.5 cm wide, white.

The species is frequent in temperate and sub-alpine regions in and around streams at 4000-5200 m alt. and was recorded from Milam and surrounding areas. Flowers during May-July.

13. THALICTRUM L.

A genus of usually temperate and alpine regions, comprising some 150 species; about 20 species are native to India, 8 species are recorded from Nanda Devi Biosphere Reserve.

The scientific name *Thalictrum* is derived from *Thallo* meaning to grow green or to flourish; in allusion to the bright colour of the young shoots. Usually perennial branched herbs with 2 to 3-pinnate or ternate, often repeatedly ternatisect with numerous leaflets and small greenish-yellowish-white or purplish flowers.

1a.	Herbs, usually not more than 40 cm high	2
b.	Herbs usually more than 40 cm high	3
2a.	Leaves all or mostly radical; flowers in racemes, stigma not incurved	**1. T. alpinum**
b.	Leaves radical and cauline; flowers in panicles, stigma incurved	**3. T. elegans**
3a.	Anthers without beak or mucronate tip	**6. T. javanicum**
b.	Anthers beaked, apiculate or mucronate	4
4a.	Achenes sessile	5
b.	Achenes short, long stalked	6
5a.	Anthers beaked; achenes 2-5	**5. T. foliolosum**
b.	Anthers apiculate; achenes more than 5	**4. T. foetidum**
6a.	Achenes with stalks as long or longer than achenes	**7. T. reniforme**
b.	Achenes with stalks much shorter	7
7a.	Flowers greenish white, *ca* 2 cm across	**2. T. cultratum**
b.	Flowers purplish, less than 1 cm across	**8. T. secundum**

1. Thalictrum alpinum L.

A small, slender, glabrous herb, up to 10 cm high. Leaves only basal, 3-5 lobed. Flowers greenish purple.

This is a highly variable species, frequent in alpine region at Dharansi, Sarsupatal, Martoli, Milam Bugyals at 3500-4500 m. Flowers during May-August.

2. Thalictrum cultratum Wallich

A perennial, glabrous, erect herb, up to 1 m high. Leaves 2-pinnate. Flowers usually in large, lax much branched clusters, greenish-white. Fruits compressed (achenes).

The species is common at 3000-3500 m altitude near Himtoli and on way to Pindari glacier. Flowers during July-August.

3. Thalictrum elegans Wallich ex Royle **Fig. 3.**

An erect, slender herb, 15-40 cm high. Leaves decompound. Flowers greenish-purplish.

The species is frequent in the core zone in alpine cliff edges, rocky slopes, moraines on way to Ramani from Deodi, Sarsupatal and on way to Milam glacier at 3500-5000 m. Flowers during July-August.

4. Thalictrum foetidum L.

A tall, widely branched leafy perennial. Leaves ternately decompound-pinnate (3-5 times divided), glandular hairy. Flowers nodding, greenish-yellow.

This is a highly variable species, not much frequent in the Biosphere Reserve. It has been recorded on way to Pindari glacier at 3000 m altitude. Flowers during July-August.

5. Thalictrum foliolosum DC.

A tall, robust, bushy, perennial, branched herb, reaching nearly 2-3 m in height. Leaves pinnately decompound. Flowers white outside, greenish or purplish inside.

The species is popularly known as *'Mamira'* or *'Pilzari'* in Hindi and is common throughout the Biosphere Reserve usually in shady places at 3000-4000 m. An extract from the root is used medicinally. Flowers and fruits during August-September.

Fig. 3. Thalictrum elegans Wallich ex Royle

6. Thalictrum javanicum Blume

An erect, glabrous herb, up to 1 m high. Leaves ternately decompound. Flowers white or pale purple.

The species is frequent at lower altitude at 2000-3000 m on way to Pindari and Milam glaciers. Flowers during June-July.

7. Thalictrum reniforme Wallich

An erect, much branched herb up to 1 m high. Leaves 2-ternately compound. Flowers small greenish.

The species is scattered at 3500-4000 m near Dibrugheta. Flowers during June-August.

8. Thalictrum secundum Edgew.

An erect, glabrous herb, 30-90 cm high. Leaves usually 2 to 3-pinnate, subsessile. Flowers purplish.

The species is frequent in sub-alpine region at 3500-4000 m near Ramani and Pindari bugyals. Flowers during June-August.

14. TROLLIUS L.

The genus comprises about 25 species in north temperate and arctic regions; 3 species are known from the Indian Himalayan region, 1 species has been recorded from the Nanda Devi Biosphere Reserve.

The generic name, derived from torolya, refers to the round shield-shaped leaves.

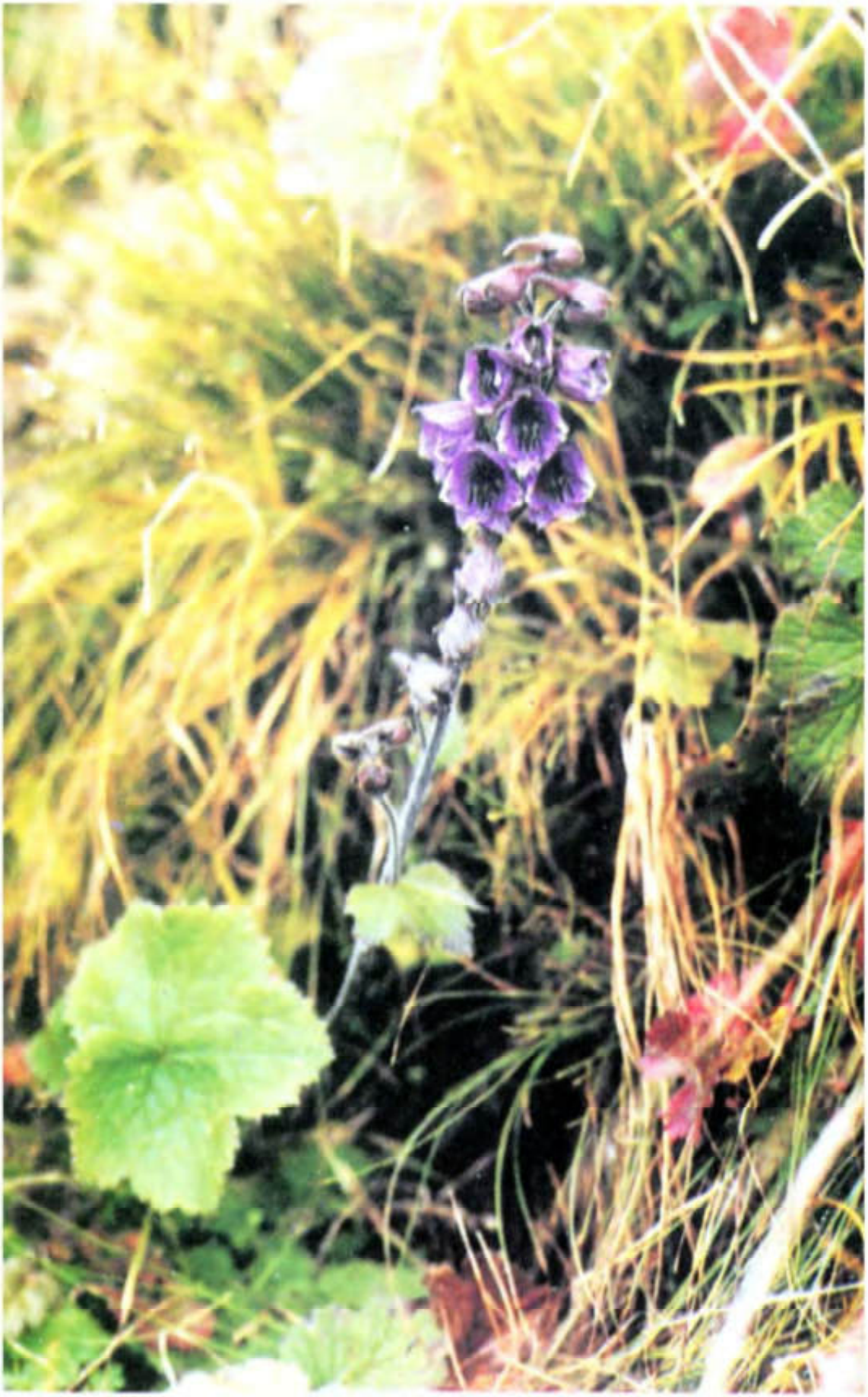
Trollius acaulis Lindl.

A stout herb with fibrous rootstock, up to 20 cm high. Leaves palmately 5-partite. Flowers solitary, orange-yellow.

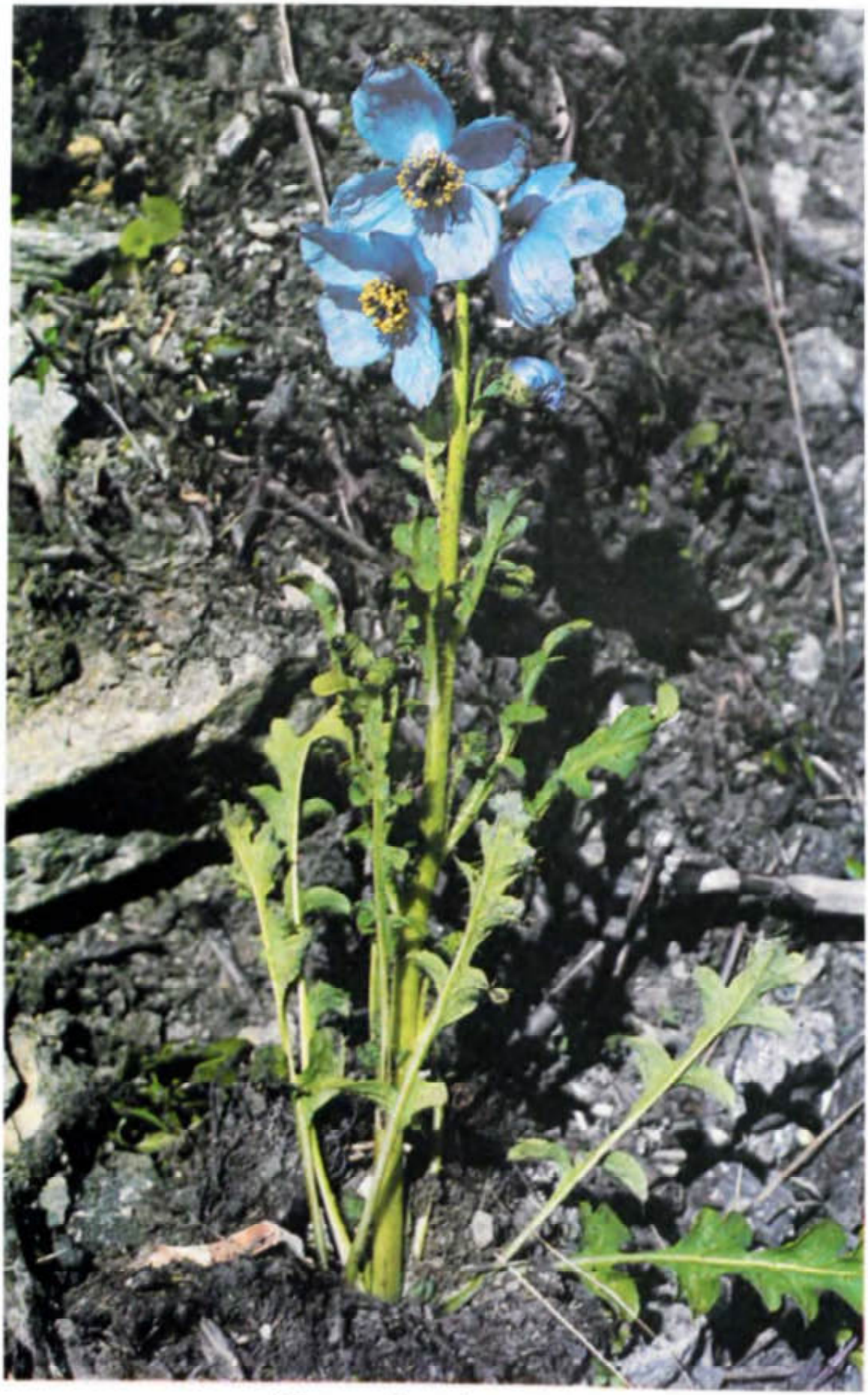
Delphinium brunonianum Royle

Delphinium cashmerianum Royle

Caltha palustris L.



Delphinium vestitum Wallich ex Royle

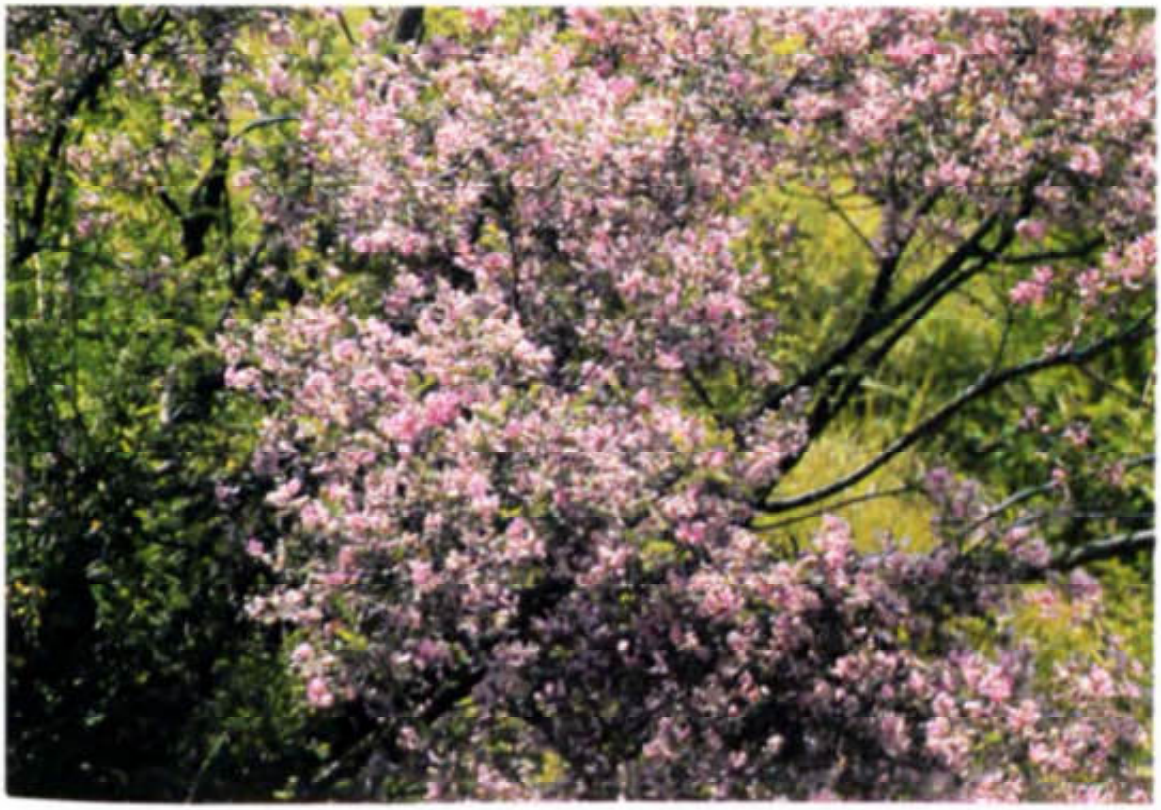


Meconopsis aculeata Royle

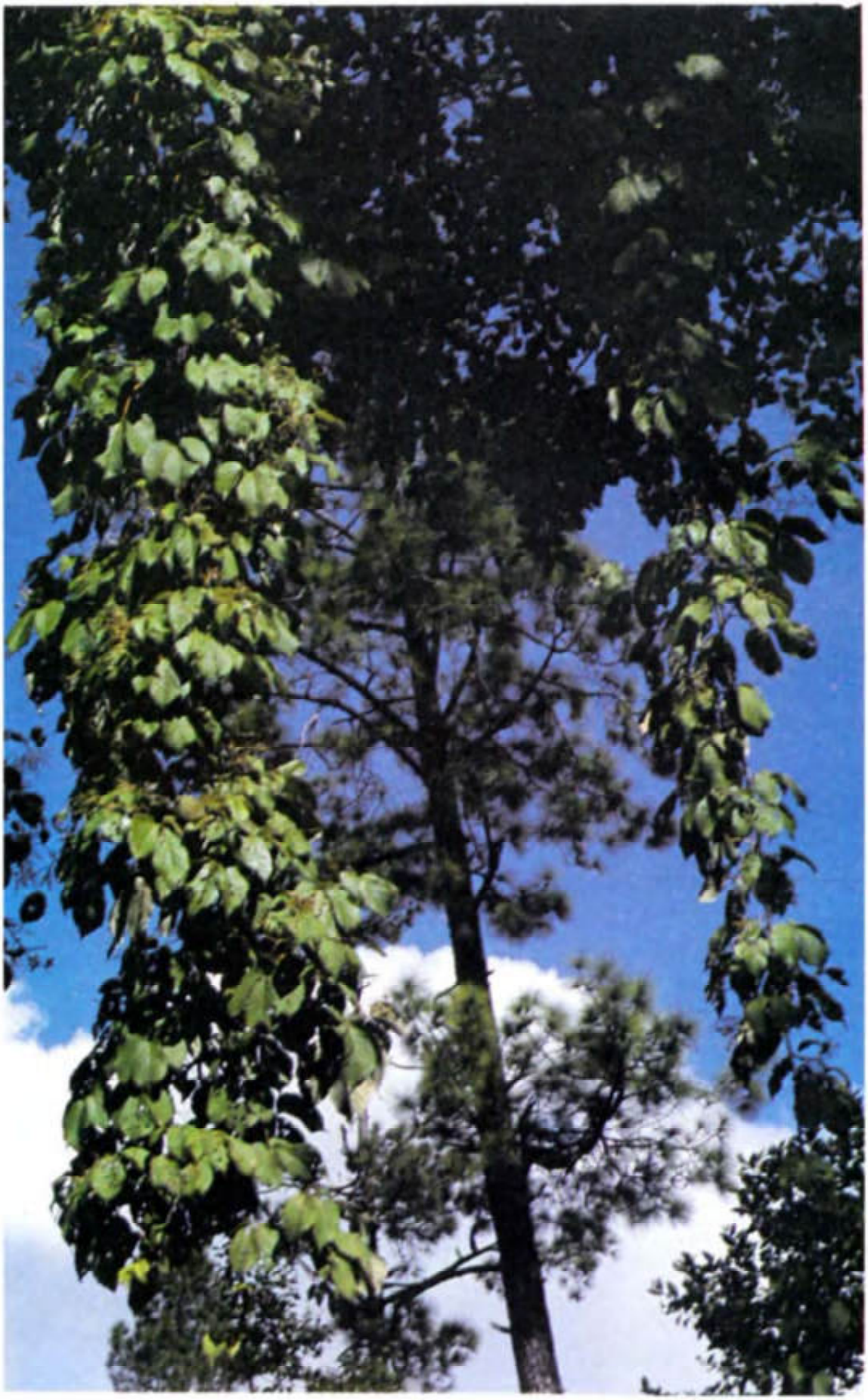
Impatiens amplexicaulis Edgew.

Impatiens scabrida DC.

Corydalis flabellata Edgew.



Indigofera heterantha Wallich ex Brandis



Parthenocissus semicordata (Wallich) Planch.

The species is frequent at 4000-5000 m in alpine slopes near Martoli and Milam bugyals. Flowering and fruiting during June-July.

2. PAEONIACEAE

A small, monogeneric family of the north temperate region, earlier included in Ranunculaceae, but now recognized as distinct family due to its persistent sepals, a fleshy disk at the base of carpels and seeds with arils.

PAEONIA L.

The genus comprises about 40 species, known from Asia, Europe and North West America; 1 species recorded from India and is known from the area.

According to the Greek mythology Paeon, a pupil of Aesculapius to whom Leto, mother of *Artemis* and *Apollo*, gave the plant informing him of its merits. In gratitude of the effective cures administered by Paeon, Pluto changed him into this plant. In the Torjan war, the legendary physician, Paeon cured the Gods of their wounds. This is the ancient name used by Theophrastus.

Paeonia emodi Wallich ex Royle **Fig. 4.**

A glabrous perennial herb with fleshy tuberous roots, upto 1 m high. Leaves 1 to 2 ternately compound with decurrent entire or incised leaflets. Flowers showy, 25-10 cm across, usually white (pink or red). Follicles 1 or 2, 3-4 cm long, with black shining smooth seeds.

The plant commonly called 'Himalayan Peony' grows at 2000-2500 m in shady places on the bank of river Rishiganga. Flowers during March-June.

3. CIRCAEASTERACEAE

The family Circaeasteaceae from south-western Asia differs from the Ranunculaceae in having leaves with dichotomous, free venation; nodes unilacunar; flowers reduced without petals or petaloid nectaries and orthotropous ovules. According to Arther Cronquist (1981), if *Kingronia* is kept in the

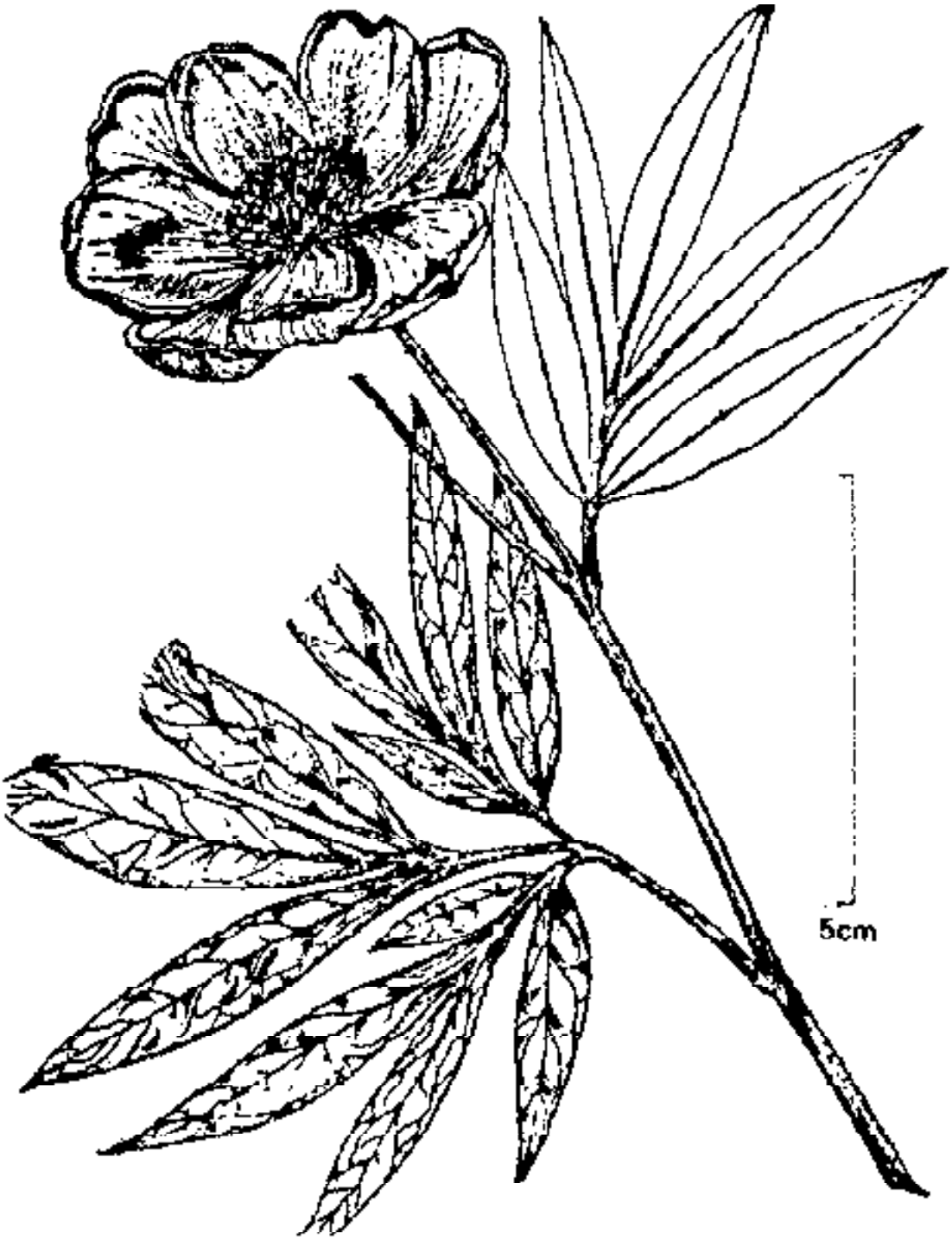


Fig. 4. Paeonia emodi Wallich ex Royle

Ranunculaceae as some authors do, then there is hardly any valid reason to maintain Circaeasteraceae as a separate family, as the venation of the petals of some species of *Ranunculus* is also openly dichotomous.

CIRCAEASTER Maxim.

A monotypic genus known from India, Bhutan, Nepal, Tibet and W. China.

The generic name is derived from *Circe*, the famous anchantress of Greek mythology; *aster* star like flower.

Circaeaster agrestis Maxim. **Fig. 5.**

A slender annual, up to 15 cm high. Leaves with crowded false whorl which are rhomboidly spathulate and cuspidately toothed. Flowers minute with scale like sepals, 2 stamens and 1-3 carpels.

This is a rare plant in the Reserve and is known only from Dibrugata, Deodi area and Rupkund nala surroundings at about 3500–4000 m. It grows in shady places mostly under the boulders. Flowers during June-July.

4. SCHISANDRACEAE

The family, comprising 2 genera and 47 species in the world, is represented mostly by the climbing shrubs with regular flowers, drupe like fruit and 1-5, flattened seeds.

Two, genera and 6 species in India, only one species in the Biosphere Reserve.

SCHISANDRA Michx.

The genus comprises over 18 species in S.E. Asia and S.E. U.S.A., 6 in India, only one in the Biosphere Reserve.

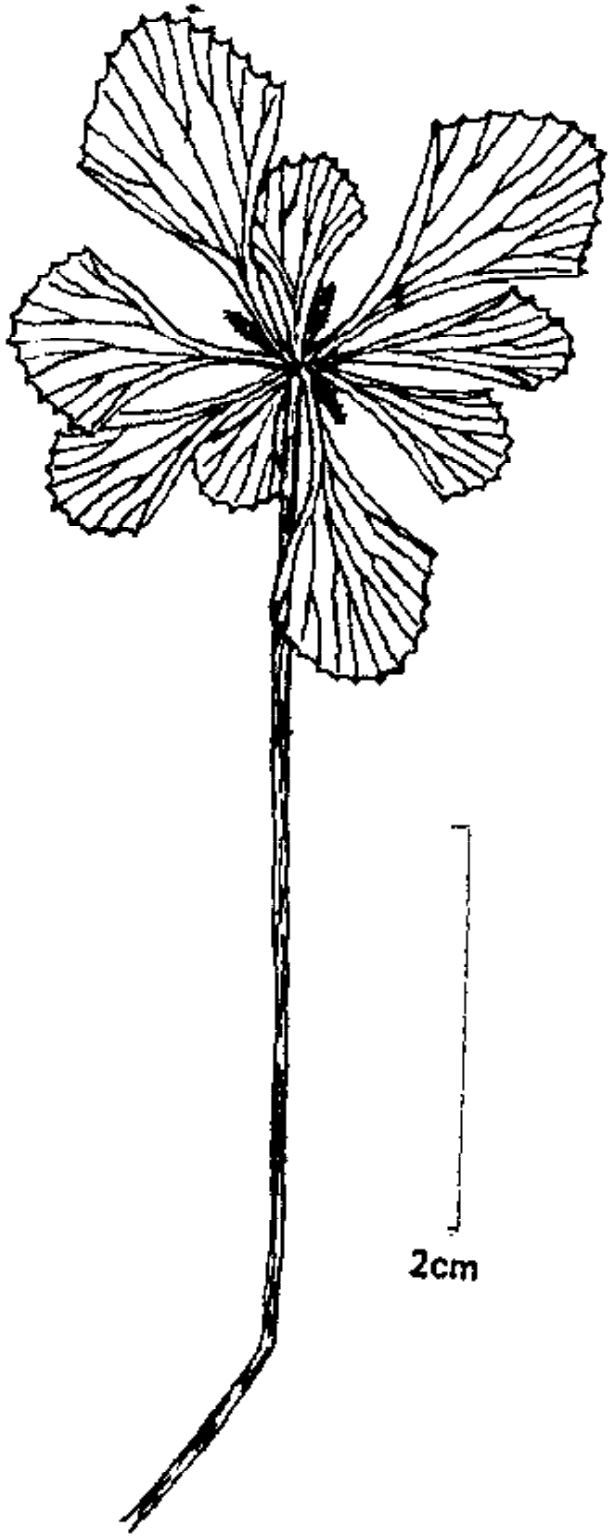


Fig. 5. Circaeaster agrestis Maxim.

The generic name derived from Schizo to split and aner-male, referring to the cleft anthers.

Schisandra grandiflora (Wallich) Hook.f.

Climbing or straggling shrubs. Leaves elliptic-ovate to oblong lanceolate. Flowers large.

Found to grow around Chhenabari-Kalikana area in mixed forest at about 2200-2800 m. Flowering and fruiting during May August.

5. MENISPERMACEAE
(Moonseed family)

The family is represented mostly by twining shrubs and herbs. A few are erect plants. Inflorescence racemose with ultimate branches cymose. Flowers rarely bright coloured. Fruits drupaceous.

Comprising 65 genera and 350 species in the world; about 19 genera and 35 species in India, only one genus and one species in our area.

STEPHANIA Lour.

The genus is represented by 40 species in the world; 4 in India and only one in Nanda Devi Biosphere area.

The genus is named after Prof. Frederick Stephan.

Stephania glabra (Roxb.) Miers

Herbaceous twiners. Leaves orbicular, acute or acuminate with 9-12 main nerves. Flowers minute, greenish-yellow.

Found along the roadside and in waste places in the buffer zone area of Suraithota-Lata at 1800-2200 m. Flowering and fruiting during May Aug.

6. BERBERIDACEAE
(Barbery family)

The family is represented mostly by shrubby plant characterised by globose, regular flowers with free sepals and petals, hypogynous; stamens 4-6, opposite the petals; carpels 1-3. Fruits berries or follicles.

It comprises 4 genera and 575 species in the world; 3 genera and 68 species in India out of which Nanda Devi Biosphere Reserve area is represented by one genus and 7 species.

BERBERIS L.

Plants of this group are popularly known as 'KINGOR' in the entire Garhwal and Kumaon region. The plants are bush forming low or up to 8 m high shrubs with axillary 1-3, radiate thorns. Flowers are yellow in axillary racemes, subcorymbs or umbellate inflorescence. The stem and root juice of the plants are used in some eye troubles and in some places for dying. The ripe fruits (Berries) covered with whitish powder are either blue or red, edible.

'Berberys' is an Arabian name and commonly called Barberry.

1a.	Low shrubs, hardly exceeding 50 cm; flowers solitary	**6. B. kumaonensis**
b.	Large shrubs; flowers not solitary	2
2a.	Inflorescence branched racemes	3
b.	Inflorescence simple raceme	4
3a.	Large shrubs more than 2 m high; berries oblong or linear oblong narrowed at both ends	**3. B. chitria**
b.	Shrubs not more than 1.5 m high; berries ovoid	**4. B. edgeworthiana**
4a.	Up to 1.5 m high shrubs	**5. B. jaeschkiana**
b.	More than 1.5 m high shrubs	5
5a.	Large, 5-8 m high shrubs; leaves broadly ovate or obovate	**7. B. pachycantha**
b.	Less than 4 m high shrubs; leaves not as above	6
6a.	Leaves sparingly toothed, glossy green	**1. B. aristata**
b.	Leaves distinctly spinous toothed, glaucous beneath	**2. B. asiatica**

1. Berberis aristata DC.

Shrubs, attaining a height up to 3 m, stem bark pale-grey, rough. Leaves elliptic-lanceolate, entire or spinous toothed. Flowers in drooping racemes. Fruits ovoid or oblong with prominent style.

The species is common throughout the area between 1800-3000 m growing in the forest areas. Flowering and fruiting during April November.

2. Berberis asiatica Roxb.

Bushy shrubs, attaining height up to 2 m, bark pale-yellow. Leaves ovate or oblong-ovate, distinctly spinous toothed. Flowers in racemes. Fruit globose, blue-black with distinct style.

The species is common throughout the area between 1600-2700 m in forest areas. Flowering and fruiting during March September.

3. Berberis chitria Edwards **Fig. 6.**

Bushy shrubs, 2-3.5 m high, stem bark brownish-grey to pale-grey, young shoots reddish. Leaves ovate-obovate, entire or minutely spinous toothed. Flowers in racemes. Fruits oblong or linear oblong narrowed at both ends.

Found to grow on shady hill slopes in forest areas in gravel soils, common throughout the area, ascending up to 2600 m. Flowering and fruiting during March September.

4. Berberis edgeworthiana Schneid.

Much branched shrubs, ca 1.5 m high, stem bark grey-brownish to yellowish. Leaves obovate, serrate fascicled. Flowers yellow. Berries ovoid, red.

The species is found to grow near Himtoli in the core zone of Biosphere Reserve on hill slopes, ascending upto 3300. Flowering and fruiting during June-October.

5. Berberis jaeschkiana C.K. Sch.

Shrubs, 0.5-1.5 m high stem bark pale-grey. Leaves ovate or lanceolate, spinous toothed. Flowers in subcorymbose inflorescence. Fruit oblong.

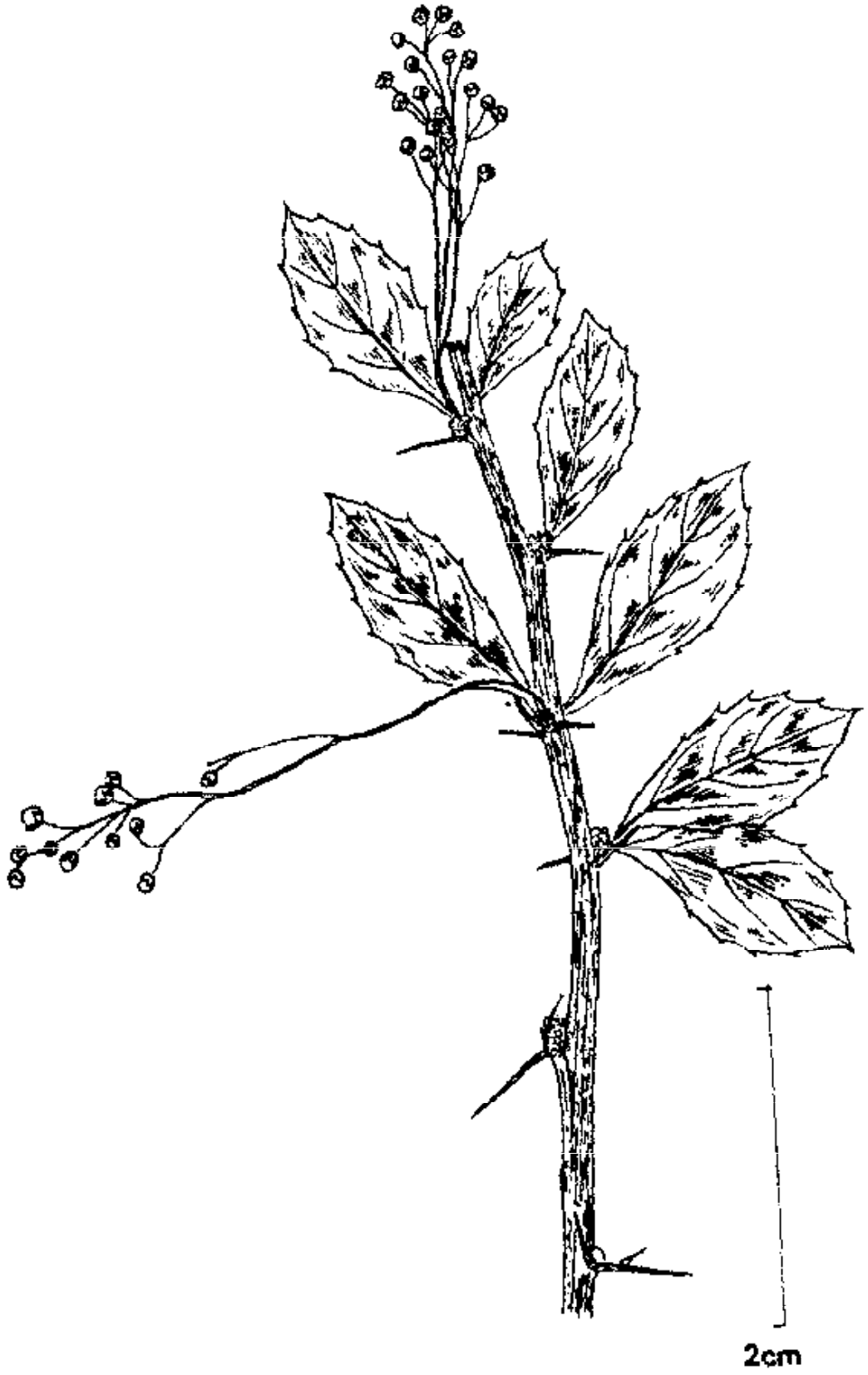


Fig. 6. Berberis chitria Edwards

The species is not common in the area, found to grow in cold temperate to sub-alpine region ascending upto 3000 m, in gravel soils in rocky places. Flowering and fruiting during June October.

6. Berberis kumaonensis Schneid.

Low shrubs. Leaves obovate-orbicular or oblanceolate with the spines longer than the leaves. Flowers solitary. Fruit ovoid.

The plants grow on rocks in sub-alpine and alpine region between 2800-4000 m. Not common. Flowering and fruiting during June August.

7. Berberis pachycantha Koehne

Bushy, deciduous shrubs, attain up to 8 m. Leaves broadly ovate or obovate. Flowers in pendulous racemes. Fruit oblong.

The species is found to grow on rocks in cold temperate to alpine region between 2600-400 m. Not common. Flowering and fruiting during May October.

7. LARDIZABALACEAE
(Lardizabala Family)

This family is represented mostly by climbing shrubs. Rarely trees. Leaves digitate, palmate rarely pinnate. Flowers in racemes or in axillary fascicles. Fruit berries.

Comprising 8 genera and 35 species in the world; about 3 genera and 3 species in India, only one species in Nanda Devi Biosphere Reserve.

HOLBOELLIA Wallich

The genus is represented by 10 species in the world; 1 in India and in Nanda Devi Biosphere area.

The genus is named after Frederick Ludwing Holboell, Superintendent of Royal Botanic Garden, Copenhagen.

Holboellia latifolia Wallich

Climbing shrubs. Leaves digitate. Flowers subcorymbose, purplish green, sweet scented.

Found to grow in mixed forest around Kalikona-Chhenabari area at 1800-2700 m. Flowering and fruiting during March - June.

8. PODOPHYLLACEAE
(Himalayan May Apple family)

The family is represented by one genus. Plants are usually herbaceous with a solitary terminal flower and peltate leaves.

PODOPHYLLUM L.

A genus of herbs having poisonous roots and leaves, commonly called 'May Apple' as the fruits ripen in late May. The scientific name derived from *Podos* a root and *phyllon*, a leaf referring to the shape of the leaves.

Podophyllum hexandum Wallich ex Royle **Fig. 7.**

A perennial, 2-leaved, 30-50 cm high herb. Leaves lobed. Flowers pinkish-white.

A rare species and recorded from Dharansi surroundings at 3500-4500 m in rock crevices. Flowers during April-June. This is an important medicinal plant with the rhizome containing *Podophyllin*, recently investigated as a possible drug treatment of cancer.

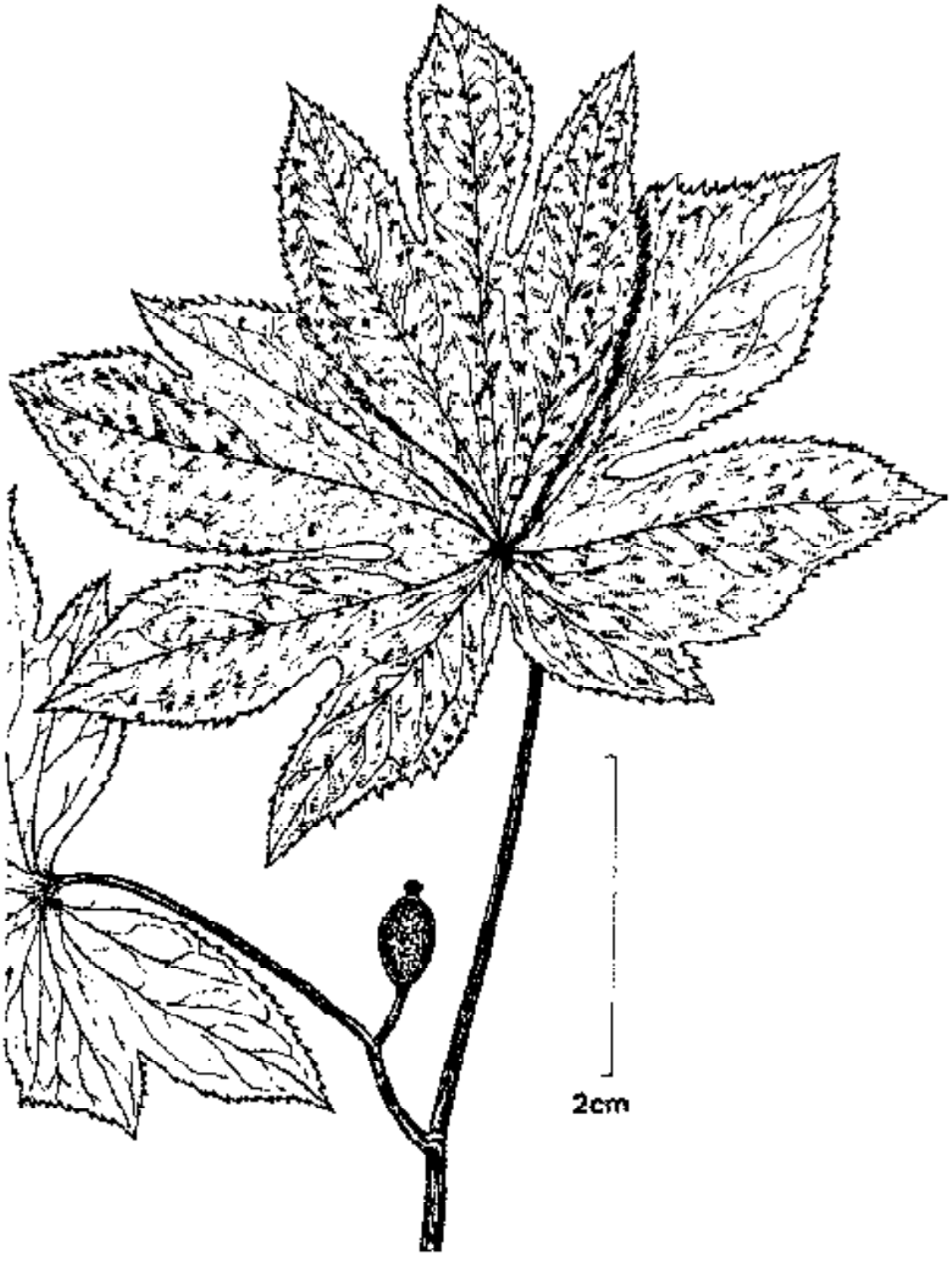


Fig. 7. Podophyllum hexandum Wallich ex Royle

9. PAPAVERACEAE
(Poppy family)

The family is mostly represented by herbaceous plants characterised by large showy flowers, nodding in buds, sepals 2, petals 4, caducous; stamens 2, hypogynous. Fruit capsules, dehiscing by pores or valves.

Comprises 26 genera and over 250 species in the world, mostly in north temperate region; 3 genera and 25 species in India, only one genus and one species in the Biosphere Reserve.

MECONOPSIS Vig.

The genus comprises over 40 species; 20 in India, chiefly distributed in Himalayan region, 1 in the Biosphere Reserve.

The scientific name is derived from Greek, *Meken* a poppy and *Opsis* resemblance, referring to the appearance of the plant.

Meconopsis aculeate Royle

Prickly herbs, 30-50 cm high, stems simple. Flowers solitary, blue, showy, ca 4.6 cm across.

The species is found to grow on hill slopes amidst boulders, in core zone area of Biosphere Reserve around Dharansi, and Ramni-Bhujgara. Rare. Flowering and fruiting during June October.

10. FUMARIACEAE
(Fumitory family)

The family is represented by annual or perennial herbs. Leaves mostly divided. Flowers irregular; sepals 2, deciduous; petals 4 usually dissimilar pairs, 2 outer large one or both gibbose or spurred. Stamens 6 in 2 bundles. Fruit 2-valved capsules.

Comprises 16 genera and ca 450 species in the world; 3 genera and 41 species in India, one genus and 12 species in the Biosphere Reserve.

CORYDALIS DC.

The genus comprises *ca* 300 species; about 31 species in India, 12 species in the Nanda Devi Biosphere Reserve.

The plants of this genus are annual or perennial herbs, common throughout the area in shady moist places except a few, which grow in dry open hill slopes. The leaves are compound. Flowers in racemes, petals 4, spurred yellow or yellow with purple tips.

The scientific name is derived from a greek word Korudalos a lark, referring to the spur of the flower resembling the spur of a lark.

1a.	Flowers blue; stem bare naked	**1. C. cashemeriana**
b.	Flowers yellow; stem base covered with old leaf sheaths	2
2a.	Lowest pair of the leaflet longer than the subsequent pairs; leaves primarily ternately divided	3
b.	Lowest pair of the leaflets not longer than the subsequent pairs; leaves pinnatisect	7
3a.	Stems simple	**5. C. erithmifolia**
b.	Stems branched	4
4a.	Leaves equally 2-ternate; terminal segments not longer than the lateral segments	**2. C. casimiriana**
b.	Leaves unequally ternate; terminal segments much longer than the lateral segments	5
5a.	Leaf segments once or twice completely divided; ultimate segment decurrent	**3. C. chaerophylla**
b.	Leaf segment 2-3 times divided, ultimate segment distinct	6
6a.	Ultimate segment linear or oblong; seeds shining	**12. C. vaginans**
b.	Ultimate segments rounded, seeds opaque-punctate	**4. C. cornuta**
7a.	Stems branched	8
b.	Stems simple	11
8a.	Leaflets reniform, thick	**7. C. flabellata**
b.	Leaflets not reniform, thin	9
9a.	Leaf segments simple pinnatisect, lobules ovate	**11. C. thyrsiflora**
b.	Leaf segments 2-3 pinnatisect, lobules linear	10
10a.	Flower spurs purple with upper limb green brown to purple	**9. C. meifolia**
b.	Flower spur not as above	**10. C. stracheyi**
11a.	Radical leaves as long as the stem; flowers high yellow	**8. C. govaniana**
b.	Radical leaves shorter than the stem; flowers yellow purple tipped	**6. C. elegans**

1. Corydalis cashemeriana Royle

Herbs with bulbous root stocks. Flowers blue.

Not very common, found in mixed forests and subalpine area around Himtoli-Tolma and Rupkund area between 3000-4000 m. Flowering and fruiting during May August.

2. Corydalis casimiriana Duthie & Prain

Tufted annual herbs, stems week. Flowers ca 1 cm long, blue. Pods linear.

Found to grow amidst grasses on shady-moist hill slopes in forest area in Malari region at 2800-3500 m. Flowering and fruiting during July - September.

3. Corydalis chaerophylla DC.

Annuals, stems erect, branched. Flowers yellow. Pods linear-oblong.

A rare species, found to grow in shady places as a forest undergrowth, ascending upto 2500 m. Flowering and fruiting during July September.

4. Corydalis cornuta Royle

Annual plants, stems procumbent or erect. Flowers yellow, tipped with purple. Pods oblong.

Common throughout the temperate and alpine region between 1800-4000 m. Found to grow in forest areas in shady moist places in association with *Geranium*, *Senecio*, *Pimpinella* and *Bupleurum* species. Flowers during May Septembe*r*.

5. Corydalis crithmifolia Royle

Small perennials with fusiform root stocks, sometimes with 2-3 tubers, stems slender, erect. Flowers yellow tipped with purple.

This is common in the core zone area of Biosphere Reserve around Sarsupatal. Found to grow in open hill slopes at 3000-4000 m, amidst grasses. Flowering and fruiting during July September.

6. Corydalis elegans Wallich

Perennial with thick, woody rootstocks, stems erect or procumbent. Flowers yellow, purple tipped.

This is a rare species of the group in the region. The plants are found to grow on hill slopes around Furkia/Pindari moraine between 3000-4500 m. Flowering and fruiting during August September.

7. Corydalis flabellata Edgew. **Fig. 8.**

Erect, robust, perennial, stems much branched, forming a small bush like habit. Leaf-lets broad, thick, flabellate, whitish-green. Flowers yellow. Pods linear.

Common on dry open sandy hill slopes at 2800-3200 m around Malari. Flowering and fruiting during July September.

8. Corydalis govaniana Wallich

Erect, tufted annuals with deep, stout rootstock. Flowers yellow. Pods oblong.

Common throughout the area in shady, marshy places on hill slopes, between 2500-4000 m. The species is able to withstand the winter season with the help of deep stout rootstock. Flowering and fruiting during May September.

9. Corydalis meifolia Wallich

Perennial herbs with stout, deep rootstocks, stems erect or procumbent, branched. Leaflets linear. Flowers yellow with purple spur, upper limb green-brown to purple tipped.

Common in rock crevices, shady hill slopes; also found to grow on open hill slopes in Pindari Bugyal area between 3000-4000 m. Flowering and fruiting during August October.

10. Corydalis stracheyi Duthie ex Prain

Perennial herbs with thick rootstocks, stems weak, branched. Flowers yellow or white. Pods small, oblong or oblong-ovate.

Fig. 8. Corydalis flabellata Edgew.

This is a common species growing in rock crevices in core zone area near Dharansi Pass and in Pindari moraine area at 3400-4500 m. Flowering and fruiting during July - September.

11. Corydalis thyrsiflora Prain

Perennial erect herbs, stems branched. Radical leaves stout with long petiole. Flowers yellow in terminal racemes. Pods oblong.

This rare species grows on hill slopes amidst grasses at 3400-4500 m. Flowering and fruiting during August September.

12. Corydalis vaginans Royle

Stems weak, procumbent. Radical leaves few or many. Flowers yellow in 2-12 cm long racemes. Pod obovate-oblong or ovate.

The species is common in temperate and subalpine Himalaya, grows amidst grasses on hill slopes at 2500-4000 m. Flowering and fruiting during May August.

11. BRASSICACEAE
(Mustard Family)

The family is represented by herbaceous plants, annual or perennial, rarely shrubs. Flowers cross-formed, arranged usually in racemes or corymbs.

Comprising or 375 genera and 3200 species in the world, cosmopolitan in distribution; about 80 genera and 115 species in India, 6 genera and 8 species in Nanda Devi Biosphere area.

1a.	Large herbs; stems hollow, fleshy	**5. Megacarpaea**
b.	Small herbs; stems solid, not fleshy	2
2a.	Fruit triangular flat	**3. Capsella**
b.	Fruit not triangular	3
3a.	Fruit less than 1 cm long	**4. Draba**
b.	Fruit more than 1 cm long	4

4a.	Leaves pinnatisect or pinnatifid	6. Rorippa
b.	Leaves simple	5
5a.	Septum 1-veined	1. Arabidopsis
b.	Septum not veined	2. Arabis

1. ARABIDOPSIS Schr.

The genus is represented by 12 species in the world; 8 in India and 2 species in our area. Plants of this genus are herbaceous with white purple or rosy flowers. Stem leaves sagittate or simple.

The scientific name is derived from a greek word *Opsis* meaning appearance referring to its resemblance to the genus *Arabia*

1a.	Stem leaves sagittate; flowers purple tinged with white	1. A. himalaica
b.	Stem leaves simple; flowers white	2. A. thaliana

1. Arabidopsis himalaica (Edgew.) Schultz.

Erect, hispid herbs, 20-35 cm high. Leaves sagittate. Flowers purple tinged with white.

Common around Dibrugheta-Deodi area on hill slopes at 3000-4000 m. Flowering and fruiting during June - July.

2. Arabidopsis thaliana (L.) Heynh.

Annual, slender, stellately hairy herbs, 4-10 cm high. Leaves simple. Flowers white.

Found to grow around Dibrugheta-Deodi area on hill slopes at 3000-4000 m. Flowering and fruiting during July September.

2. ARABIS L.

The genus includes about 125 species in the world; 7 in India and only one in the Biosphere Reserve,

The scientific name is derived from Arabia, as it is originally known from Arabia.

Arabis pterosperma Edgew.

Annual, erect, stellately hairy herbs. Leaves mostly crowded at the bae. Flowers white. Fruit linear.

Found to grow around Martoli-Milam area in moist, shady alpine meadows at 3500-4000 m. Flowering and fruiting during April September.

3. CAPSELLA Medik.

The genus is represent by *ca* 100 species in the world and only one in India which is also present in our area. The scientific name is derived from Latin Capsella - a little box, referring to the fruit.

Capsella bursa-pastoris (L.) Medic.

Annual, erect, glabrous or stellately hairy herbs. Radical leaves pinnatisect, stem leaves oblong. Flowers white. Fruit triangular, flat.

Found to grow around Dharansi and Martoli-Milam area on open hill slopes at 2800-3800 m. Flowering and fruiting during April September.

4. DRABA L.

The genus is represented by *ca* 300 species in the world; 20 in India and 2 species are present in the Biosphere Reserve.

The scientific name is derived form a Greek word Draba -acrid, biting, referring to the taste of the leaves.

1a.	Flowers yellow; pods linear	**1. D. gracillima**
b.	Flowers white; pods twisted	**2. D. lasiophylla**

1. Draba gracillima Hook.f. & Thoms

Weak, ascending herbs, stems many coming out from the rootstocks. Flowers small, yellow. Pods linear.

Grows around Dibrugheta-Ramni and Sarsupatal area on hill slopes at 3000-4000 m. Flowering and fruiting during June September.

2. Draba lasiophylla Royle

Tufted, perennial, densely hairy herbs. Leaves crowded at the base. Flowers white. Pods short, twisted.

Grows around Mortoli-Milan area on hill slopes at 3000-4000 m. Flowering and fruiting during June September.

5. MEGACARPAEA DC.

The genus is represented by about 10 species in the world; and in India and in Nanda Devi Biosphere area.

The scientific name is derived from Greek world *Megas* - great and *Karpos*- fruit; in allusion to the large pods.

Megacarpaea polyandra Benth.

Perennial, large, aromatic herbs, stems hollow, fleshy. Leaves deeply lobed. Flowers white, arranged in corymbs.

Grows around Himtoli area in grassy hill slopes in shady places at 3000-3500 m. Flowering and fruiting during April-September.

6. RORIPPA Scop.

The genus is represented by *ca* 70 species in the world, 4 in India and only one is present in Nanda Devi Biosphere Reserve.

The scientific name is derived from a german local name Roripen.

Rorippa indica (L.) Hiern.

Annual, erect herbs, stems ribbed. Leaves elliptic, toothed. Flowers pale-yellow. Fruit cylindrical.

Found to grow around Martoli-Milam area near watery places and in shady moist places at 3500-4500 m. Flowering and fruiting during April - September.

12. VIOLACEAE
(Violet Family)

The plants of this family, which are mostly herbs or sometimes shrubby also are characterised by both regular or irregular 2-bracteate flowers with 5 sepals, equal or unequal petals 5 and 5 stamens. Fruit 3-valved capsules.

The family comprising 22 genera and 990 species, is cosmopolitan in distribution; 3 genera and over 41 species in India, one genus and 3 species in Biosphere area.

VIOLA L.

The plants popularly known as 'VNASPA' are annual or perennial in nature. These plants are found to grow in shady moist places in forest areas. The stems are very short or none. The flowers are solitary or 2 on peduncles, lower petal is largest and spurred, yellow or yellow-lilac. Fruit dehiscent.

The flowers of the plant are believed to be useful in cough when taken with tea.

Viola is a latin name for pansy and violets.

1a.	Flowers yellow	**2. V. biflora**
b.	Flowers lilac or pale-blue	2
2a.	Stems developed; leaves ovate-cordate	**3. V. pilosa**
b.	Stems none or very short; leaves triangular	**1. V. betonicifolia**

1. Viola betonicifolia Smith

Deep rooted, annual herbs, stems very short or none. Leaves triangular. Flowers solitary, lilac.

Common in moist shady places near cultivated fields and in forest areas on hill slopes between 1000-2500 m. Flowering and fruiting during March September.

2. Viola biflora L.

Annual, semi erect herbs. Leaves reniform. Flowers solitary, yellow.

The species is common throughout the area between 2000-4000 m, in rock crevices and on hill slopes in forest areas in shady moist places. Flowering and fruiting during June October.

3. Viola pilosa DC.

Stoloniferous herbs, stems leafy. Leaves ovate-cordate, crenate-serrate. Flowers lilac or pale-blue.

Common on hill slopes in shady moist places near Rishiganga Valley between 2500-3000 m. Flowering and fruiting during August September.

13. POLYGALACEAE
(Milkwort family)

The plants of this family are represented by herbaceous as well as shrubby habits characterised by irregular, 3-bracteate flowers; 5, unequal sepals, 5 or 3, unequal petals, the inferior often keel-shaped. Fruit usually 2- seeded capsules.

Comprises *ca* 12 genera and 800 species in world; 2 genera and 21 species in India, 1 genus and 2 species the Biosphere Reserve area.

POLYGALA L.

The genus is common in the buffer zone area of the Biosphere Reserve. These are annual or perennial. Leaves alternate simple, entire. Flowers in racemes. Sepals 5 in 2 series, 3 outer green and 2 inner ovate or oblong, large. Petals 3 unequal. Stems 8 united in 2-sets. Capsules fattened, often enclosed in persisting calyx.

The generic name is derived form Greek word *Polys* meaning much and *Gala*-Milk, referring to its reputation as a good fodder.

1a. Leaves linear; flowers in lax terminal racemes **1. P. abyssinica**
b. Leaves elliptic-oblong or ovate-oblong; flowers clustered in axillary racemes **2. P. crotalarioides**

1. Polygala abyssinica Fresen

Erect, perennial herbs, stems erect. Leaves linear. Flowers pink purple. Fruit ovate.

The species is common in and around the buffer zone of the Biosphere Reserve, growing on open hill slopes in sandy soils, ascending up to 2000-2600 m. Flowering and fruiting during July September.

2. Polygala crotalarioides Buch.-Ham. ex DC.

Perennial, densely hairy herbs, stems decumbent. Leaves simple, elliptic-oblong or ovate-oblong, sessile. Flower pink crowded in leaf axils. Fruits heart shaped.

Common on hill slopes in open places and in rock crevices at 2000-2500 m. Flowering and fruiting during in April October.

14. CARYOPHYLLACEAE
(Pink family)

The family usually shows herbaceous or rarely shrubby habit. Flowers regular, in cymes nearly solitary. Sepals 4-5 free united, petals as many as

sepals or 0; stamens twice the number of petals rarely 5. Capsules membranous, fleshy or berry like.

A cosmopolitan family comprising *ca* 80 genera and 2000 species in the world; 20 genera and 105 species in India, 6 genera and 19 species in Biosphere Reserve area.

1a.	Sepals fused	**4. Silene**
b.	Sepals free or connate at the base only	2
2a.	Petals absent	3
b.	Petals present	4
3a.	Densely tufted herbs forming hemispheric cushions	**6. Thylacospermum**
b.	Herbs not as above, stems much branched, slender	**2. Minuartia**
4a.	Petals 2-fid or 2-partite	**5. Stellaria**
b.	Petals entire or lacerate	5
5a.	Leaves terete, base united in a scarious sheath	**3. Sagina**
b.	Leaves not terete, base not untied	**1. Arenaria**

1. ARENARIA L.

The genus is represented by about 250 species in the world mostly in Northern Hemisphere; about 20 species in India, 6 in our area.

The plants are annual or perennial, often tufted herbs. Flowers solitary or in cymes, white, rarely pink, pentamerous, petals entire, lacerate or retuse. Fruit capsules often shorter than the calyx.

The generic name is derived from a Latin word *Arena* meaning sand, referring to the sandy habit.

1a.	Densely tufted herbs; leaves subulate	2
b.	Loosely tufted herbs; leaves not subulate	3
2a.	Flowers solitary; peduncles very short	**5. A. perlevis**
b.	Flowers in cymes; peduncles elongated	**2. A. festucoides**
3a.	Flowers solitary	**1. A. ciliolata**
b.	Flowers in cymes	4
4a.	Leaves orbicular	**4. A. orbiculata**
b.	Leaves ovate or elliptic	5
5a.	Leaves more or less glandular; sepals 1-nerved	**3. A. neelgherrensis**
b.	Leaves not glandular; sepals 3-5-nerved	**6. A. serpyllifolia**

1. Arenaria ciliolata Edgew.

Perennial, laxly tufted herbs. Leaves fringed with long jointed hairs. Flowers solitary, white.

Grows on hill slopes in the core zone of Biosphere Reserve in and around Dharansi-Himtoli between 3000-5000 m. Flowering and fruiting during June - September.

2. Arenaria festucoides Benth. **Fig. 9.**

Perennial, densely tufted, cushion forming herbs. Leaves linear. Flowers in cymes, white.

Plants usually grow on hill slopes, open places and in sandy soils, ascending up to 4500 m, common in core zone area of Biosphere Reserve near Himtoli and Dharansi-Sarsupatal. Flowering and fruiting during June-October.

3. Arenaria neelgherrensis Wight & Arn.

Semi erect or procumbent herbs, stems much branched at base. Leaves elliptic more or less glandular. Flowers in cymes, white.

Grows on hill slopes, amidst grasses in and around Milam, Dibrugheta bugyals between 3000-4000 m; common. Flowering and fruiting during May October.

4. Arenaria orbiculata Royle ex Edgew.

Prostrate herbs, stems much branched at base. Leaves orbicular. Flowers ca 1 cm across, white, in terminal cymes.

The species grows in both open and shady hill slope amidst grasses around Martoli bugyals at 3000-4500 m. Flowering and fruiting during May December.

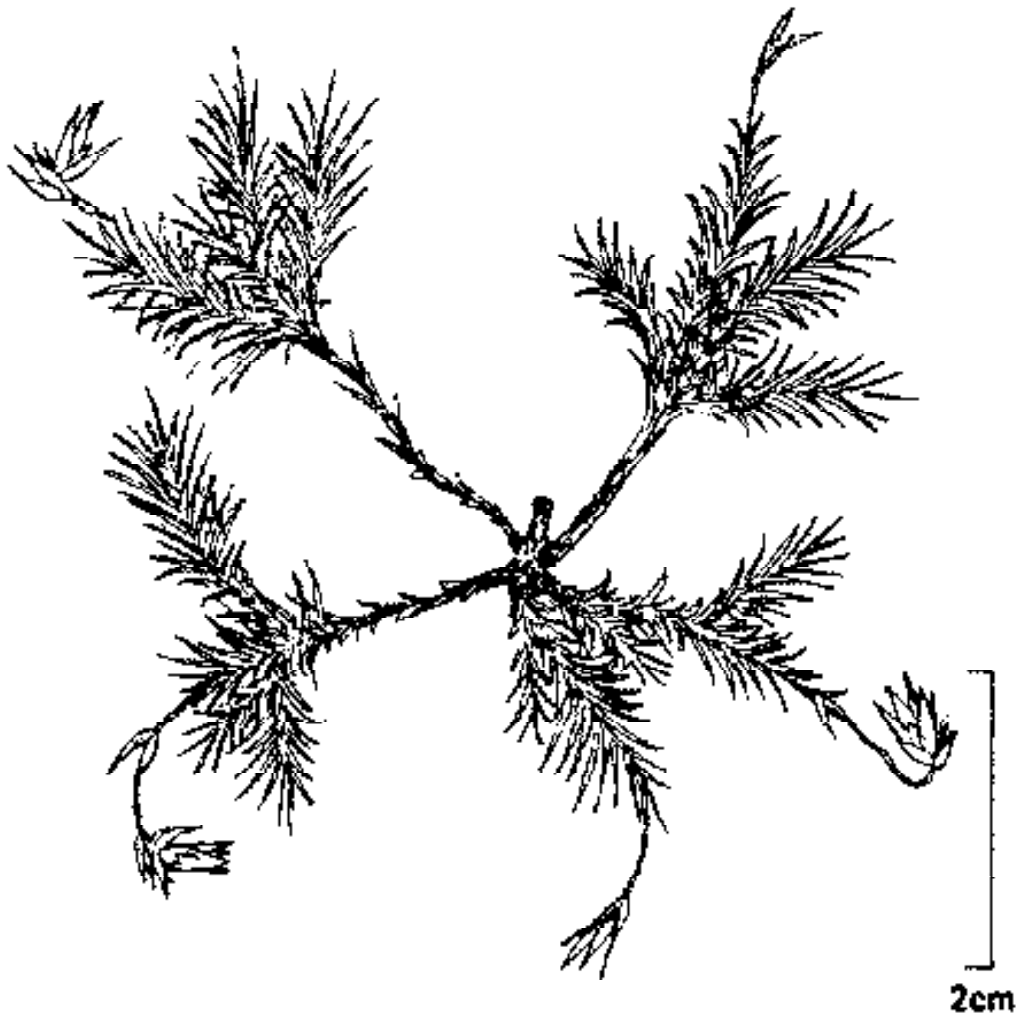


Fig. 9. Arenaria festucoides Benth.

5. Arenaria perlevis (Williams) Hand.-Maz.

perennial, densely tufted herbs. Leaves subulate, minutely ciliate. Flowers solitary, white.

Found on hill slopes near Sarsupatal area in core zone of Biosphere Reserve at 3600-4200 m. Flowering and fruiting during June September.

6. Arenaria serpyllifolia L.

Perennial herbs, stems much branched, pubescent. Leaves ovate. Flowers white, sepals 3-5, ribbed.

The species is found to grow on open hill slopes. Common around Bagrigar on way to Dunagiri and Dharansi-Dibrugheta at 2000-3500 m. Flowering and fruiting during July August.

2. MINUARTIA Loefl. ex L.

The genus comprise annual or perennial herbs with over 120 species in the world; few in India, only one present in the Biosphere Reserve.

The generic name is given after John Minuart, Spanish Apothecary and Professor of Botany.

Minuartia lineata (C.A. Mey.) Bornm.

Perennial, tufted, herbs, stems much branched, slender. Leaves flexuous. Flowers white.

Common in the core zone area of the Biosphere Reserve on hill slopes amidst grasses in shady places at 3000-4000 m. Flowering and fruiting during July September.

3. SAGINA L.

The genus is represented by 30 species, mostly in North temperate region, mountains of Africa, Himalaya, New Guinea and Andese; only one species is present in Nanda Devi Biosphere Reserve area.

The scientific name is derived from a Latin word *Sagina* a stuffing feeding, in illusion to nourishing qualities for sheep.

Sagina saginoides (L.) Karsten

Perennial, tufted, bright green herbs, stems numerous. Leaves both radical and cauline. Flowers white.

The species is found to grow in moist, shady hill slopes around Martoli bugyals between 3000-4000 m. Flowering and fruiting during June - October.

4. SILENE L.

The genus is represented by 500 species in the world, mostly in North temperate region; about 25 species in India, 7 in our area.

The plants are annual or perennial herbs. Flowers solitary or in cymes; calyx inflated, campanulate clavate or tubular, petals 5, entire or lacinate often with 2-basal scales. Stamens 10, capsules 3-6-toothed or valved.

The generic name is derived from a Latin word Silenus spittle or foam, referring to silky secretion in some of the species.

1a.	Capsules dehiscing by teeth to equal number of styles	2
b.	Capsules dehiscing by teeth twice the styles	4
2a.	Scape like herbs; seeds compressed winged	2. S. gonosperma subsp. himalayensis
b.	Simple or branched herbs; seeds reniform not winged	3
3a.	Petals fimbriate; styles 5	1. S. edgeworthii
b.	Petals 2-fid; styles 3	3. S. indica
4a.	Calyx densely glandular, viscose	6. S. viscosa
b.	Calyx not as above	5
5a.	Flowers white	7. S. vulgaris
b.	Flowers pink or brown-purple	6
6a.	Leaves elliptic-lanceolate; branches brown-purple	4. S. kumaonensis
b.	Leaves linear-lanceolate, branches dull yellowish-brown	5. S. persica subsp. moorcroftiana

1. **Silene edgeworthii** Bocquet

Perennial, erect with woody rootstocks, stems branched. Leaves elliptic-lanceolate or elliptic-ovate. Flowers white to reddish green.

The species is common in the core zone of the Biosphere Reserve, growing on hill slopes amidst grasses at 2300-2800 m. Flowering and fruiting during September October.

2. **Silene gonosperma** (Rupr.) Bocquet subsp. **himalayensis** (Roxb.) Bocquet

Erect herbs, 30-40 cm high. Flowers 1-3, nodding; calyx inflated, brownish-green; petals white.

The plants are found to grow on hill slopes near Bhujgara-Ramni area at 3500-4400 m. Flowering and fruiting during July September.

3. **Silene indica** Roxb. ex Otth

Perennials, erect, with stout rootstocks, stems branched at base. Leaves elliptic-ovate, sessile. Flowers whitish to pinkish-brown; petals 2-fid.

The species is common in the core zone around Himtoli, growing on hill slopes amidst grasses, ascending upto 2700 m. Flowering and fruiting during August October.

4. **Silene kumaonensis** Williams

Herbs, erect, branched, dull purplish hairy. Flowers purplish white.

The species is found in the core zone area of Biosphere Reserve. Commonly growing in rock crevices and on hill slopes in shady places around Kaga area on way to Dunagiri at 2500-3000 m. Flowering and fruiting during July September.

5. **Silene persica** Boiss. subsp. **moorcroftiana** (Roxb.) Chowdhari

Perennial herbs with deep woody rootstocks, stem erect, many from the base. Leaves linear or linear-oblong. Flowers white pinkish. Fruit ovoid.

The species is common in the buffer zone area, on hill slopes in open places in sandy soils, ascending upto 3500 m. Flowering and fruiting during July September.

6. Silene viscosa (Linn.) Pers.

Perennial, erect herbs, stems branched at the base. Leaves obovate, spathulate. Flowers white or purplish-white.

The species grows in core as well as buffer zone in shady places on hill slopes amidst grasses or under bushes. Common around Dunagiri area between 3300-4000 m. Flowering and fruiting during July October.

7. Silene vulgaris (Moench.) Garcke

Perennial herbs, tall, ascending, stems branched. Leaves elliptic-oblong. Flowers drooping, white. Capsules globose.

This is a common species found in buffer as well as to core zone of Biosphere Reserve in grassy hill slopes, ascending up to 3000 m. Flowering and fruiting during July October.

5. STELLARIA Edgew.

The genus comprises about 120 species in the world, mostly of cosmopolitan distribution; 20 species in India, 3 in the Biosphere Reserve.

The plants are mostly of herbaceous habit. Flowers in dichotomous cymes, very rarely solitary; petals 5 or 4, 2-fid or 2-partite or absent, stamens 10 or 8; capsules short, dehiscent.

The generic name is derived from the latin word *stella* - star, in illusion to star-shaped flowers.

1a.	Tufted herbs; roots fusiform of fleshy fibres	1. S. decumbens
b.	Plants not as above	2
2a.	Capsules 1-2-seeded; leaves crisped	3. S. monosperma
b.	Capsules many-seeded; leaves not crisped	2. S. media

1. Stellaria decumbens Edgew.

Annual, prostrate, tufted herbs. Leaves linear-lanceolate. Flowers ca 6.5 mm across, solitary or in cymes, white.

The plants are common on hill slopes amidst grasses around Milam-Martoli bugyals, 3200-5000 m. Flowering and fruiting during March October.

2. Stellaria media (L.) Vill.

Annual, diffused herbs, stems flaccid. Leaves ovate, dotted. Flowers ca 8 mm across, in axillary or terminal cymes, white.

This is the commonest species of group, found throughout the buffer zone of Biosphere Reserve, at 1800-2200 m. Flowering and fruiting occurs throughout the year.

3. Stellaria monosperma Buch.-Ham. ex D. Don = *S. crispata* Wall.

Spreading, tender herbs, stems branched. Leaves crisped, sessile. Flowers white; seeds 1-2, large.

The plants grow on hill slopes in shady places. Common in the buffer zone around Tolma and Peng area (1800-3000 m).

6. THYLACOSPERMUM Fenzl.

A monotypic genus with its name derived from Greek word *Thylakas* meaning a sack or pouch and *Sperma*, a seed.

Thylacospermum caespitosum (Camb.) Schischk.

Herbs, densely tufted forming hemispheric cushions. Leaves minute. Flowers sessile, white.

The plants commonly grow on hill slopes in shady places in the buffer zone around Tolma and Peng at 2400-3000 m. Flowering and fruiting during August - October.

15. HYPERICACEAE
(St. John's Wort Family)

The family comprises 8 genera and over 550 species in the world; 2 genera and 24 species in India, 1 genus and 4 species in our area.

The plants of this family are mostly shrubs or herbs. Flowers yellow.

HYPERICUM L.

The genus comprises over 400 species; 22 species in India, 4 in our area.

The generic name is derived from Greek word *Hyper* meaning above and *eikon* the image, the plant was supposed to ward of evil spirits.

1a.	Erect herbs	**1. H. elodeoides**
b.	Shrubs	2
2a.	Styles longer than the ovary	**3. H. oblongifolium**
b.	Styles shorter than the ovary	3
3a.	Branches 2-edged; sepals elliptic obtuse	**4. H. uralum**
b.	Branches terete; sepals ovate	**2. H. hookerianum**

1. Hypericum elodeoides Choisy **Fig. 10.**

Perennial, erect herbs, stems cylindrical. Leaves sessile. Flowers yellow, arranged in terminal branched cymes.

Found around Tolma-Himtoli area in mixed forest amidst grasses at 2000-3300 m. Flowering and fruiting during June October.

2. Hypericum hookerianum Wt. & Arn.

Shrubs, more than 1 m tall, deciduous stems terete. Flowers yellow; petals orbicular; styles shorter than the ovary.

Common around buffer zone of the Reserve on rocks at 1700-2000 m. Flowering and fruiting during June September.

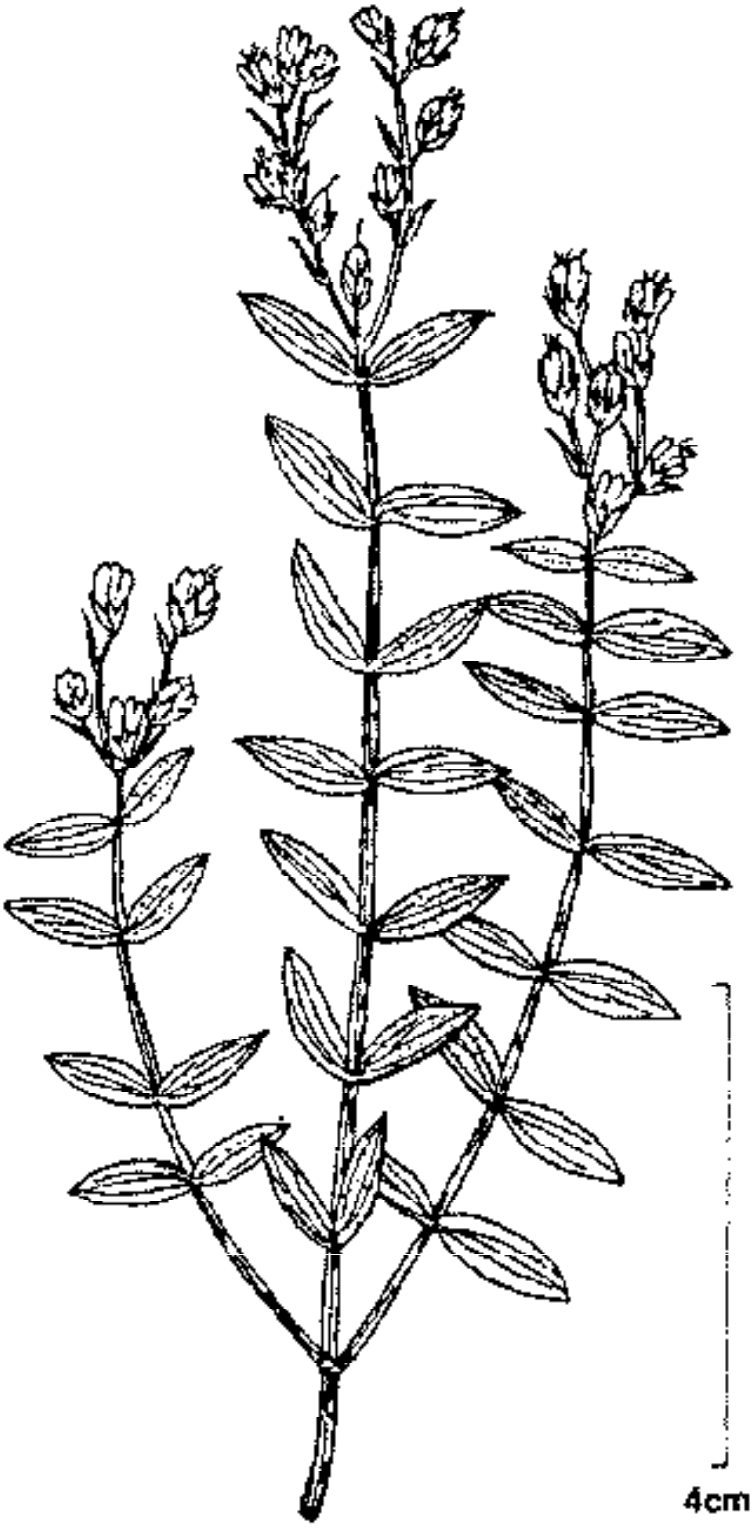


Fig. 10. Hypericum elodeoides Choisy

3. Hypericum oblongifolium Choisy

Evergreen shrubs, 70-90 cm high. Flowers yellow; styles longer than the ovary.

Common around buffer zone of the Reserve area on rocky places at 1600-2000 m. Flowering and fruiting during June September.

4. Hypericum uralum Buch.-Ham. ex D. Don

Evergreen shrubs, branches spreading. Leaves decurrent. Flowers yellow, arranged in terminal racemes; ovary longer than the styles.

Found around Buffer zone of the Reserve in rocky moist shady places at 1700-22 m. Flowering and fruiting during June September.

16. MALVACEAE

The family comprises *ca* 88 genera and 1000 species in world, distributed in tropics, subtropics and temperate regions of the world; 22 genera and about 93 species in India, 3 genera and 5 species are present in Nanda Devi Biosphere Reserve.

The plants are annual or perennial herbs, shrubs, rarely trees or woody climbers. Flowers arranged in various types of inflorescence. Stamens monadelphous, staminal column surrounds the ovary and style.

1a.	Carpels densely spinescent; styles twice as many as carpels	3. Urena
b.	Carpels not spinescent; styles as many as carpels	2
2a.	Bracteols absent, stigma apical or nearly so	2. sida
b.	Bracteols 3; stigma decurrent on the adaxial side of style	1. Malva

1. MALVA L.

The genus comprises 30 species, distributed in temperate and subtropics of the old world and naturalized in new world; 7 species in India, 2 in the Nanda Devi Biosphere Reserve.

Plants are annual biennial or perennial herbs or undershrubs. Leaves reniform to suborbicular-cordate.

1a.	Erect herbs; petals much longer than the calyx	**2. M. verticillata**
b.	Decumbent or prostrate herbs; petals, equalling the calyx	**1. M. parviflora**

1. Malva parviflora L.

Annual decumbent or prostrate, herbs, 14-40 cm high. Flowers bluish-white or pale-pink.

Common around the buffer zone, ascending upto 2200 m. Flowering and fruiting during April-June.

2. Malva verticillata L.

Herbs, erect, 30-100 cm high. Flowers purplish.

Found on hill slopes in buffer zone, ascending upto 3000 m. Flowering and fruiting during May October.

2. SIDA L.

The genus comprises 200 species, distributed in tropical and subtropical region of the world; 12 species in India, only 2 species occur in the Nanda Devi Biosphere Reserve.

The plants are annual or perennial herbs or undershrubs. Flowers yellow or yellowish-white.

1a.	Mericarps 6-12; peduncles jointed near the top	**2. S. cordifolia**
b.	Mericarp 5; peduncles jointed about the middle	**1. S. cordata**

1. Sida cordata (Burm.f.) Borss.

Prostrate or ascending herbs, upto 1 m high, branched throughout or mostly towards the base. Flowers yellow.

Common, in buffer zone area in waste places, ascending upto 1500 m. Flowering and fruiting during June October.

2. Sida cordifolia L.

Undershrubs with unpleasant smell, up to 1 m high. Petioles and pedicels tomentose. Flowers yellow.

Common, in buffer zone area on hill slopes and in waste places, ascending upto 1200 m. Flowering and fruiting during June October.

3. URENA L.

This monotypic genus is pantropical. The plants are annual or perennial shrubs or undershrubs. Leaves many-lobed. Flowers pink or purplish-red.

Urnea lobata L. **Fig. 11.**

Undershrubs or shrubs, erect 0.5 to 2 m high. Petioles and pedicels stellately hairy. Flowers solitary or 2-3 in clusters.

Found in the buffer zone in near cultivated fields and in forest areas, ascending up to 1500 m. Flowering and fruiting during June November.

17. TILIACEAE

The family comprises *ca* 50 genera and 450 species, distributed in tropical and subtropical regions of the world; 8 genera and 53 species in India, 3 genera and 3 species in Nanda Devi Biosphere Reserve.

The plants are trees, shrubs, undershrubs, herbs or woody climbers with stellate or simple hairs. Flowers bracteate, petals 4-5 free, sometimes sepaloid, rarely absent.

1a.	Fruit a drupe	2. Grewia
b.	Fruit a capsule	2
2a.	Petals glandular at the base; fruit echinate	3. Triumfetta
b.	Petals not glandular at base; fruit not echinate	1. Corchorus

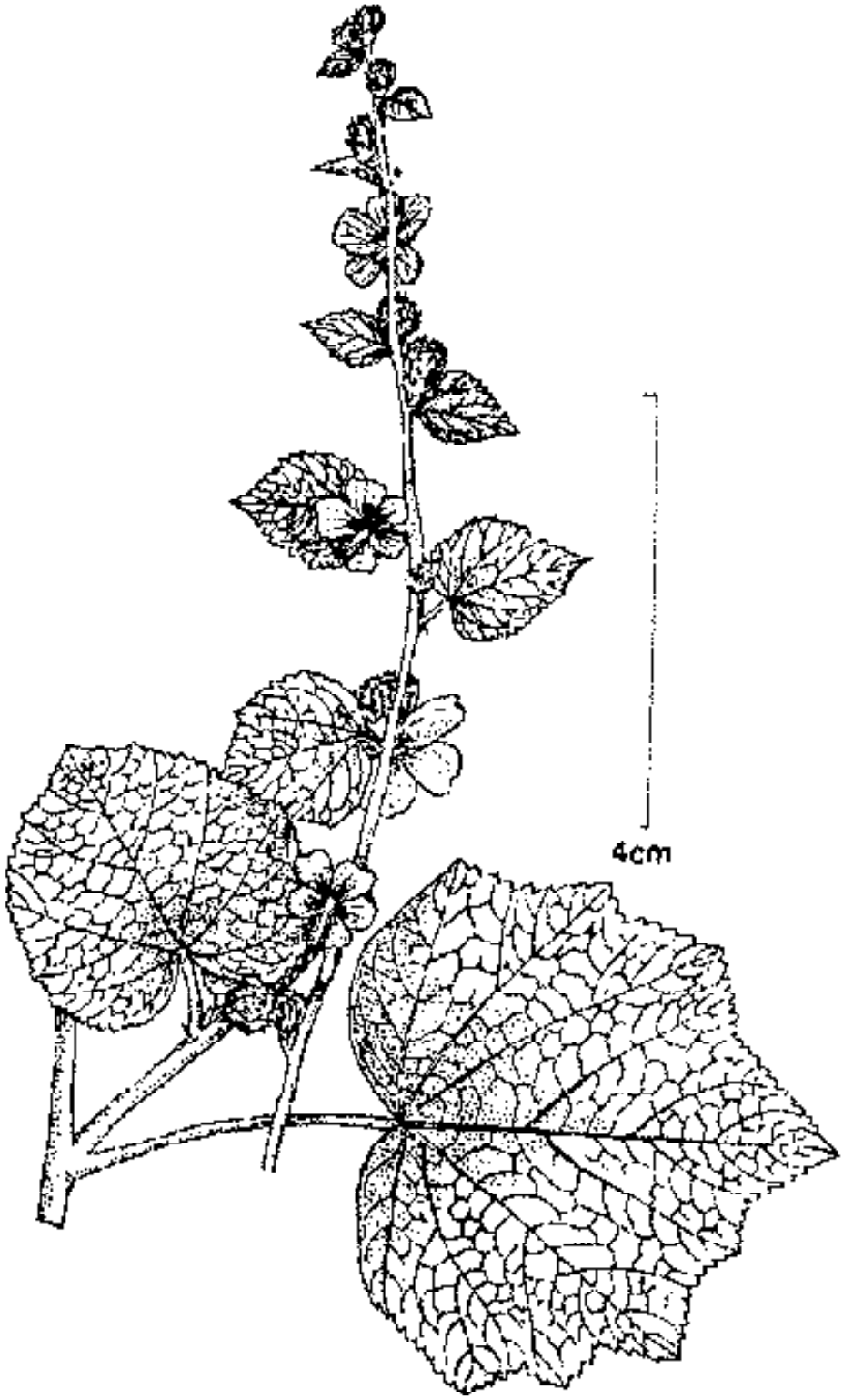


Fig. 11. Urnea lobata L.

1. CORCHORUS L.

The genus comprises *ca* 100 species in the world; 8 species in India, only one is found in Nanda Devi Biosphere Reserve.

These are herbs, shrubs or undershrubs. Leaves alternate, stipules filiform. Flowers small; petals 5 or 4, free.

Corchorus aestuans L.

Annual, much branched herbs, 10-60 cm high. Leaves lanceolate or ovate. Flowers leaf-opposed, yellow.

Found on hill slopes and in waste places in the buffer zone area, ascending upto 1800 m. Flowering and fruiting during August February.

2. GREWIA L.

The genus comprises ca 150 species in the world; ca 31 species in India, one in Nanda Devi Biosphere Reserve.

The plants are trees shrubs or climbers. Leaves alternate. Flowers 5-merous. The generic name is given after a famous English Chatomist Nehemiah Grew.

Grewia optiva J.R. Drumm. ex Burrett

Small trees. Leaves ovate or ovate-elliptic. Flowers white or pale-yellow, in axillary or leaf-opposed cymes. Fruit 2-4-lobed.

The plants are commonly found along the cultivated fields. Flowering and fruiting during June-November.

3. TRIUMFETTA L.

The genus comprises *ca* 160 species in the world; 8 in India, only one in Nanda Devi Biosphere Reserve.

These are shrubs, undershrubs or herbs with stellate hairs. Leaves simple. Flowers 5-merous. Fruit capsular.

The Genus is named after an Italian botanist and author, John Triumfetti.

Triumfetta rhomboidea Jacq.

Herbs or undershrubs, 0.5-1 m high, erect, much branched. Leaves rhomboid-ovate, palmately 3-lobed or entire. Flowers yellow.

Common throughout the area in buffer zone, ascending upto 1400 m. Flowering and fruiting during August - January.

18. LINACEAE

The family comprises *ca* 13 genera and ca 300 species; 5 genera and ca 12 species are present in India, only one genus and one species occur in Nanda Devi Biosphere area. The plants of this family are cosmopolitan in distribution.

These are herbs, shrubs or rarely trees. Leaves usually alternate rarely opposite. Flowers bisexual, regular; sepals 4-5; petal, 5, blue, white, yellow or rosy. Fruit capsule or drupe.

REINWARDTIA Dumort.

The genus comprising 2 species is restricted to Asia; both present in India, only one in Nanda Devi Biosphere Reserve area.

The genus is named after Casper George Carl Reinwardt, the founder Director of the Botanic Garden at Buitenzorg.

Reinwardtia indica Dumort.

Undershrubs, tufted, 0.7-1.4 m high. Leaves elliptic-obovate or narrowly oblong-lanceolate. Flowers solitary, yellow, scented.

Grows on waste places, ascending up to 1700 m.

19. GERANIACEAE
(Geranium family)

The family comprises about 5 genera and about 750 species in the world; 3 genera and about 25 species in India, one genus and 5 species are present in the Nanda Devi Biosphere Reserve.

The plants of this family are mostly herbaceous and are cosmopolitan in distribution. Several plants are of ornamental value.

GERANIUM L.

The genus comprises *ca* 400 species in the world; 21 species in India, 5 in the Nanda Devi Biosphere Reserve.

The generic name is derived from a Greek word *Geranos* a crane, in illusion to the long beak of carpels.

1a.	Flower buds pyramidal, flowers less than 2 cm across	**3. G. robertianum**
b.	Flower buds oblong, or ovoid	2
2a.	Flowers 2.5 cm across	3
b.	Flowers less than 2.0 cm across	4
3a.	Much branched herbs; leaves 3-5-lobed; stipules very large	**5. G. wallichianum**
b.	Not much branched; leaves 5-7-lobed; stipules small	**1. G. donianum**
4a.	Glandular hairy herbs; leaves reniform, 7-fid	**4. G. rotundifolium**
b.	Eglandular herbs; leaves pentagonal, deeply 3-5-lobed	**2. G. nepalense**

1. Geranium donianum Sweet

Herbs, stout, pubescent, 10-20 cm high. Leaves 5-7-lobed. Flowers purplish.

Found around Ramni-Sarsupatal area in shady moist places between 3500-4400 m. Flowering and fruiting during June September.

2. Geranium nepalens Sweet

Annual or perennial, trailing herbs, stems ribbed. Leaves palmately lobed. Flowers light pink or purple.

Found around buffer zone of the Reserve in shady places between 1600-2500 m. Flowering and fruiting during June September.

3. Geranium robertianum L.

Herbs, annual or perennial, glandular hairy, strongly scented. Leaves 3-5-lobed. Flowers streaked with dark and light red.

Found around Dibrugheta area in shady moist places between 3000-4000 m. Flowering and fruiting during June September.

4. Geranium rotundifolium L. **Fig. 12.**

Annual or perennial herbs with spreading branches. Leaves reniform, 7-lobed. Flowers purplish.

Found to grow on hill slopes around Ramni-Bhujgara area between 3500-4000 m. Flowering and fruiting during June September.

5. Geranium wallichianum D. Don **Fig. 13.**

Herbs, perennial, trailing or ascending, sometimes erect, very variable. Leaves 5-lobed. Flowers purple.

Found throughout the area in moist shady places between 2000-3000 m. Flowering and fruiting during June - September.

20. OXALIDACEAE
(Wood Sorrel Family)

The family comprises 3 genera and over 875 species, mostly distributed in the tropical region of the world; 2 genera and 12 species in India, 1 genus and one species in the Biosphere Reserve.

The plants are mostly perennial herbs with tuberous or bulbous to stoloniferous stems.

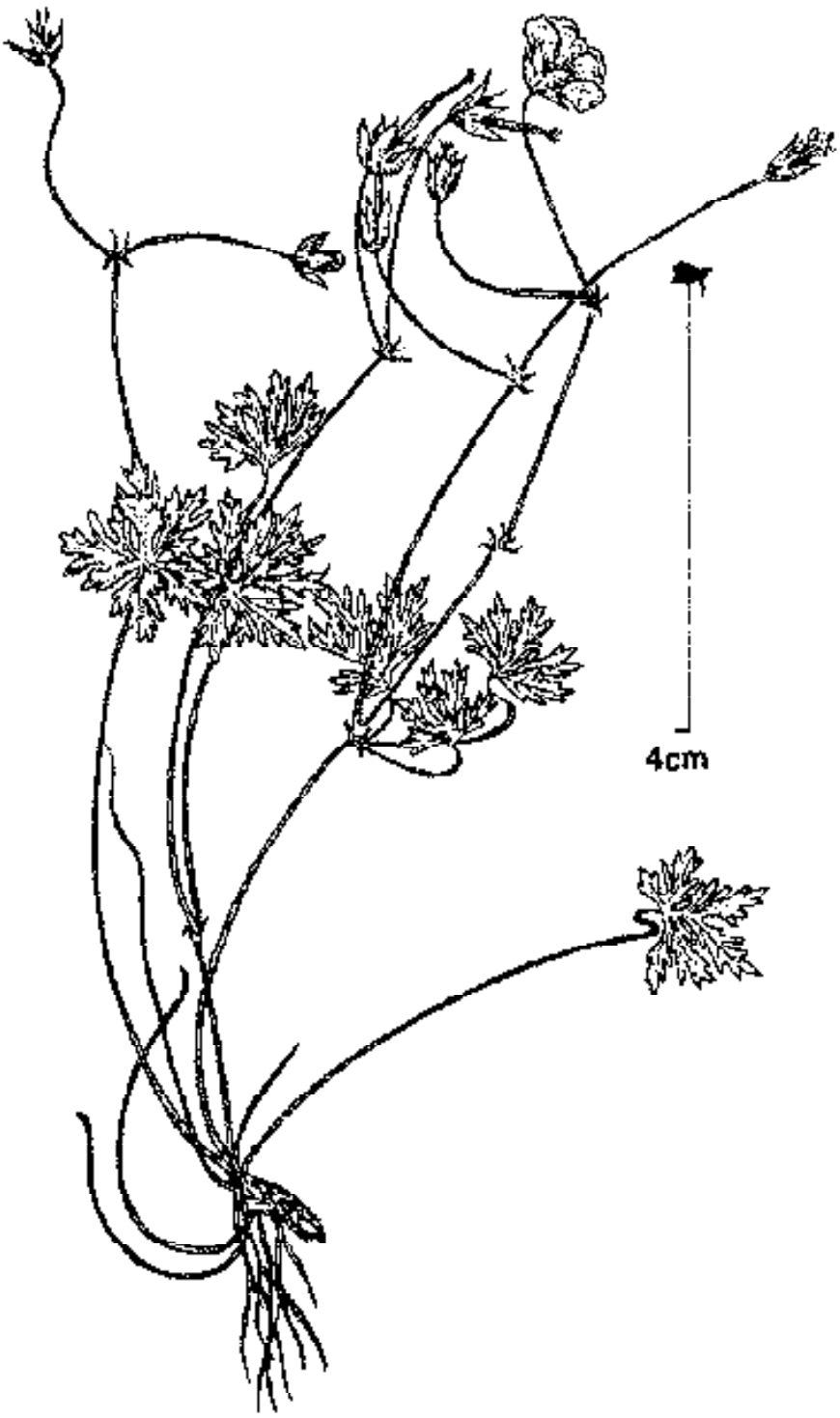


Fig. 12. Geranium rotundifolium L.

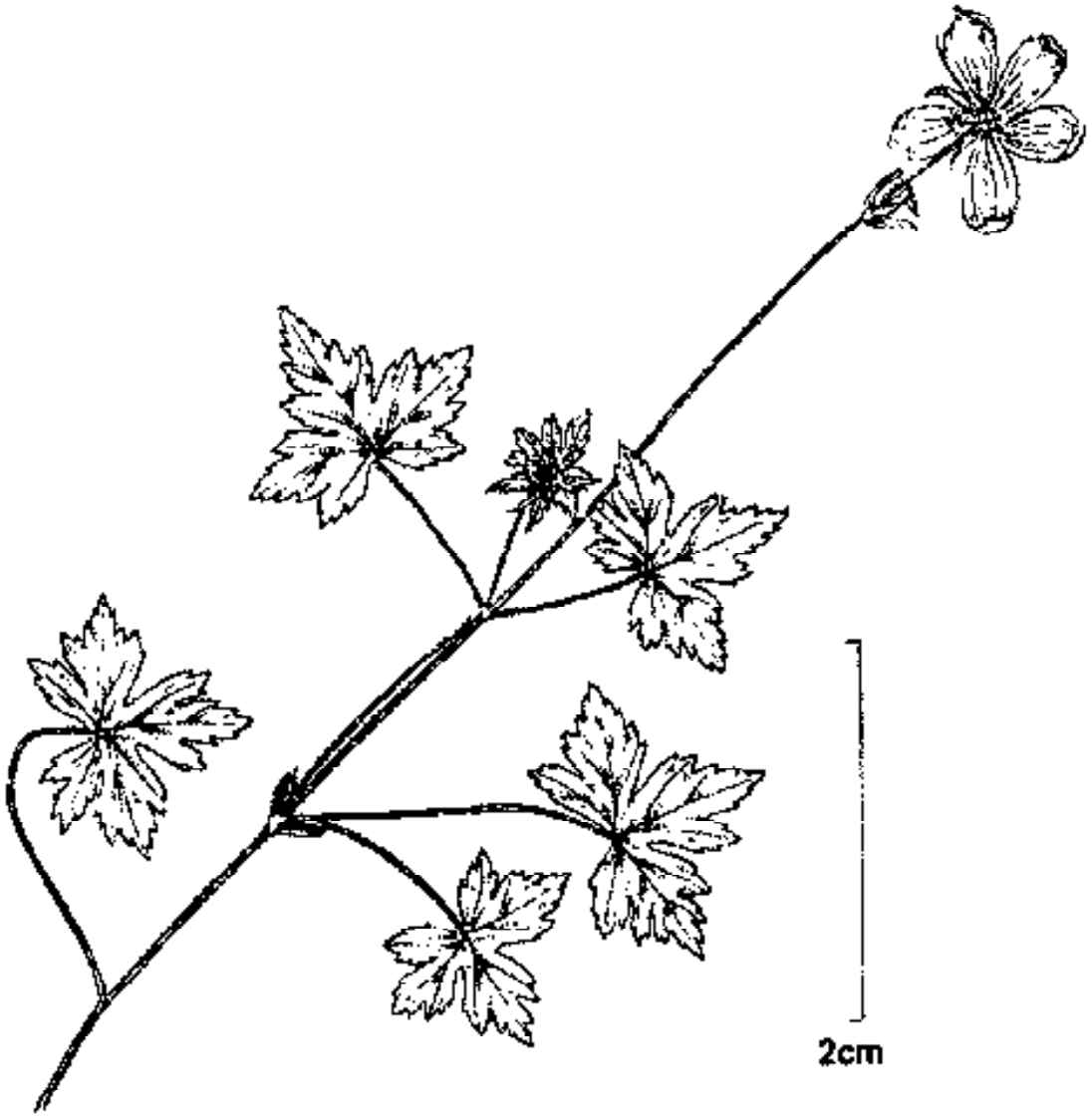


Fig. 13. Geranium wallichianum D. Don

OXALIS L.

The genus comprises over 800 species, mostly distributed in S. Africa and America; 6 species in India, only one species occur in Nanda Devi Biosphere area.

The generic name is derived from a greek word *Oxys* meaning acid, referring to the acidic taste of leaves.

Oxalis corniculata L.

Herbs, perennial, appressed hairy, stems creeping, rooting at the base. Leaves 3-foliate. Flowers yellow. Capsules (Fruit) oblong.

Common throughout the area upto 3000 m on grassy hill slopes. Flowering and fruiting during March November.

21. BALSAMINACEAE
(Balsam Family)

The family comprises, about 4-5 genera and 600 species, distributed chiefly in Africa and North America; about 2 genera and 176 species in India, one genus and 6 species in Nanda Devi Biosphere Reserve.

The plants are mainly herbaceous. Several plants are of ornamental value.

IMPATIENS L.

The genus consists of over 500 species; about 175 species in India, 6 species in Nanda Devi Biosphere Reserve area.

The generic name is derived from Latin word *Impatiers* meaning impatient, referring to sudden bursting of capsules when touched.

1a.	Flowers yellow	2
b.	Flowers pink, purple or white	3
2a.	Pubescent herbs; flowers 2.5-4 cm long, spur spotted with brown	4. I. scabrida
b.	Glabrous herbs; flowers less than 2 cm long, spur not spotted	3. I. racemosa
3a.	Leaves stem clasping, amplexicaule	1. I. amplexicaulis
b.	Leaves not stem clasping, stalked	4

4a.	Flowers less than 2 cm long, white or white tinged with pink	**6. I. thomsonii**
b.	Flowers more than 2 cm long, pink or purple	5
5a.	Glandular hairy herbs; flowers pink	**2. I. glandulifera**
b.	Glabrous herbs; flowers purple	**5. I. sulcata**

1. Impatiens amplexicaulis Edgew.

Herbs, erect, glabrous. Leaves sessile, amplexicaule, stem clasping. Flowers 2.2-2.7 cm long, purple. Fruit slender.

Grows in the buffer zone of the area on the hill slopes between 2500-3200 m. Flowering and fruiting during July September.

2. Impatiens glandulifera Royle

Herbs, tall, erect, glabrous. Flowers 2.2-2.6 cm long, arranged in racemes, pink, spur short. Fruit club shaped.

Found around buffer zone on hill slopes, 2000-3200 m. Flowering and fruiting during July September.

3. Impatiens racemosa DC.

Herbs, erect, small to tall, very variable, glabrous herbs. Flowers 1-1.5 cm across, yellow. Capsules linear.

Found around Himtoli and Beltakharak-Lathakharak area on hill slopes between 2500-3500 m. Flowering and fruiting during July October.

4. Impatiens scabrida DC.

Herbs, tall, erect, pubescent, stems ribbed. Flowers 2.5-4 cm long, yellow, spur prominently present, spotted with brown. Capsule linear.

Found around Belta-Latakharak and Tolma - Himtoli area on hill slopes at 2000-2800 m. Flowering and fruiting during July October.

5. Impatiens sulcata Wallich

Herbs, tall, glandular, 0.7 m - 1 m high. Flowers 2-3 cm long, purple, spur prominently present. Capsules (Fruit) linear.

These plants are found to grow around Dhoodhganga-Dibrugheta and Deodi area on hill slopes at 3000-3500 m. Flowering and fruiting during July October.

6. Impatiens thomsonii Hook.f.

Herbs, glabrous, 10-15 cm high. Flowers white or white tinged with pink, spur prominently present. Capsules (Fruit) club shaped.

Found to grow around Himtoli-Latakharak area on hill slopes at 2500-3300 m. Flowering and fruiting during July September.

22. RUTACEAE

The family comprises 150 genera and about 900 species, distributed in tropics and temperate region of the world; 24 genera and 86 species in India, 2 genera and 2 species in Nanda Devi Biosphere Reserve area.

The plants are mostly shrubs and trees a few are herbs, many of them are of horticulture value.

1a.	Leaves simple; stamens 5	2. Skimmia
b.	Leaves 1-2 pinnate; stamens 6-10	1. Boenninghausenia

1. BOENNINGHAUSENIA Reich.

The genus comprises 1-4 species in the world, probably represented by a single species in India and the Nanda Devi Biosphere Reserve.

The scientific name is given after C.M.F. Boenninghausen, a German Botanist.

Boenninghausenia albiflora (Hook.) Reichb.

Herbs, perennial, erect, slender, 15-60 cm high. Leaves pinnate. Flowers white, arranged in leafy panicles.

Occurs throughout the buffer zone in shady places at 1500-2500 m. Flowering and fruiting during July October.

2. SKIMMIA Thunb.

The genus comprises about 4 species, 1 species present in India and the Nanda Devi Biosphere Reserve.

The plants of this genus are strongly scented shrubs.

The generic name is derived from a Japanese name Skimmi, referring to harmful fruit and poisonous alkaloid skimmianin.

Skimmia laureola (DC.) Sieb. & Zucc. ex Walp.

Shrubs, evergreen, glabrous, 0.9-1.5 m high, strongly aromatic. Flowers yellowish-white, arranged in panicles. Fruit ellipsoid.

Grows in the buffer zone of the Reserve around Lata-Belta area at 2500-3000 m. Flowering and fruiting during April November.

23. MELIACEAE
(Mahogany family)

The family comprises about 50 genera and 550 species; about 19 genera and 85 species in India, one genus and 2 species are present in Nanda Devi Biosphere area.

The plants are mostly trees or shrubs, few are undershrubs.

TOONA M. Roem.

The genus comprises about 15 species in the world; all of them present in India out of which 2 are present in Nanda Devi Biosphere Reserve. The timber of some of the species is very useful.

The generic name is derived from a Hindi name Toon.

1a.	Leaflets serrate; inflorescence longer than the leaves	**2. T. serrata**
b.	Leaflets entire; inflorescence smaller than the leaves	**1. T. ciliata**

1. Toona ciliata M. Roem.

Trees, large, deciduous. Leaves pinnate, leaflets entire. Flowers cream coloured, arranged in panicles. Fruit oblong.

Found around buffer zone of the Reserve at 1200-1500 m. Flowering and fruiting during March August.

2. Toona serrata (Royle) M. Roem.

Trees, deciduous. Leaves pinnate, leaflets serrate. Flowers pinkish, arranged in panicles;, panicles longer than the leaves. Fruit ovoid.

Common around Reni-Kalikota-Chhenabari area in mixed forest at 2000-2800 m. Flowering and fruiting during May October.

24. AQUIFOLIACEAE
(Holly family)

The family consists of 3 genera and over 400 species; 1 genus and 25 species in India, one species in the Biosphere Reserve.

These are usually trees or shrubs with alternate or opposite stipulate leaves. Flowers in cymes or in fascicles rarely in racemes.

ILEX L.

The genus comprises about 400 species in the world; ca 25 species in India, one in the Nanda Devi Biosphere Reserve.

The generic name is derived from a old name of a plant Holm Oak (*Quercus ilex*).

Ilex dipyrena Wallich

Trees, small, evergreen. Leaves spinous toothed. Flowers dense, white, arranged in axillary, branched cymes. Fruit globose.

Found around Kalikona-Chhanabari area in mixed forest at 2500-2800 m. Flowering and fruiting during May November.

25. CELASTRACEAE
(Staff Tree Family)

This family comprises 55 genera and about 850 species in the world; about 13 genera and over 110 species in India, one genus and one species in the Biosphere Reserve.

The plants of this family are trees or shrubs with simple, opposite or alternate stipulate leaves. Flowers arranged usually in cymes.

EUONYMUS L.

A total of about 175 species occur in the world; 29 are recorded from India, only one species in Nanda Devi Biosphere Reserve.

The generic name is derived from a Greek word *Euonymon*, meaning good name.

Euonymus fimbriatus Wallich ex Roxb.

Deciduous shrubs or small trees, 7-10 m high. Leaves 2-serrate. Flowers greenish yellow. Fruit tapering with 4 wings.

Found around Chhenabari - Kalikona and Tolma Himtoli area in mixed forest at 2000-3000 m. Flowering and fruiting during May October.

26. RHAMNACEAE

(Buckthorn Family)

The family comprises about 58 genera and 900 species; 12 genera and over 50 species in India, 3 genera and 4 species in the Biosphere Reserve.

The plants are mostly trees or shrubs, very often climbing. Leaves simple usually stipulate. Flowers arranged in cymes or in corymbs.

1a.	Fruit of 3 pyrenes or cocci	**2. Rhamnus**
b.	Fruit 1-3-celled stone	2
2a.	Stipules spiny; leaves 3-5-nerved	**3. Ziziphus**
b.	Stipules not spiny; leaves penninerved	**1. Berchemia**

1. BERCHEMIA DC.

The genus is represented by about 500 species in the world; about 70 species in India out of which only one is present in our area.

The generic name is given after B.von M. Berchem, a French Botanist.

Berchemia edgeworthii Lawson

Shrubs, deciduous, glabrous. Leaves sub elliptic, stipules ovate-lanceolate. Flowers yellowish green, arranged in pairs. Fruit purple-black.

Found in the buffer zone of the Reserve at 2000-2900 m. Flowering and fruiting during May October.

2. RHAMNUS L.

The genus comprises about 150 species in the world; about 9 species in India, 2 species in Nanda Devi Biosphere Reserve.

The generic name is derived from a Greek name *Rumnos*, meaning a prickly plant.

1a.	Erect shrubs; leaves 3-5 cm long	**2. R. virgatus**
b.	Prostrate shrubs; leaves not more than 1.5 cm long	**1. R. prostrata**

1. Rhamnus prostrata Jacq. ex Parker

Prostrate, very rigid, thorny shrubs, stem bark slightly peeling off. Flowers minute, greenish, arranged in fascicles. Fruit obovoid, 3-celled.

Common around Milan glacial moraine on sandy and stony soils at 3500-4700 m. Flowering and fruiting during May August.

2. Rhamnus virgatus Roxb.

Spinous, deciduous shrubs, 2-3 m high shrubs, bark peeling off. Leaves serrate. Flowers yellowish-green, arranged in axillary clusters. Fruit globose.

Grows around Chhenabari-Dhoodganga and Dibrugheta-Sonwara area between 2400-3600 m. Flowering and fruiting during March October.

3. ZIZIPHUS Mill.

The genus comprises about 100 species; 17 in India, only one in our area.

The generic name is derived from a Greek word *Zizyphan* which is a name of Mediterranean Jujube.

Ziziphus mauritiana Lamk.

Shrubs, deciduous, armed, young branches tomentose. Leaves elliptic ovate, ovate or orbicular, woolly tomentose beneath. Flowers green, in cymes. Fruit globose.

Common around Suraithota area in waste places at 1900-2200 m. Flowering and fruiting during May September.

27. VITACEAE
(Grape Family)

The family comprises 12 genera and 700 species in the world; 8 genera and over 61 species in India, 2 genera and 2 species are present in our area.

Some plants of the family produce edible fruit. The grape is known all over the world for its delicious taste.

1a. Leaves 3-foliate; large deciduous climbers **1. Parthenocissus**

b. Leaves 5-foliate; evergreen climber, usually creeping over the stony surface of ground **2. Tetrastigma**

1. PARTHENOCISSUS Planch.

The genus comprises of 15 species; 3 species present in India, only one species occurring in the Nanda Devi Biosphere Reserve.

Parthenocissus semicordata (Wallich) Planch.

The generic name is derived from Greek world Parthenos meaning virgin and kissosmeaning luy a translation of Virginia Creeper.

Large, deciduous climbers, tendrils much branched, leaf opposed. Leaves 3-foliate, purplish pink or brownish on lower surface. Flowers yellowish green arranged in cymes. Fruits purplish black.

Found in the buffer zone of the reserve, climbing over trees, around Lata-Latakharak, 2000-2700 m. Flowering and fruiting during May November.

2. TETRASTIGMA Planch.

The genus comprises about 100 species; about 7 species in India, only one occurring in the Nanda Devi Biosphere Reserve.

The generic is derived from Greek word tetra meaning four Stigma meaning stigma, referring the numbers of stigma.

T. serrulatum (Roxb.) Planch.

Evergreen, climbing herbs, tendrils simple or forked (branched). Leaves pedately 5-foliate. Flowers greenish, arranged in cymes. Fruits elliptic-globose, black.

Common around buffer zone of the Reserve, Lata-Latakharak, 1800-2500 m. Flowering and fruiting during May-September.

28. HIPPOCASTANACEAE

(Horse Chest nut family)

The family comprises about 2 genera and 15 species; 1 genus and 4 species in India, only one species in Nanda Devi Biosphere Reserve.

The plants of this family are trees, covered with resinous scales, distributed mainly in North temperate and South American region.

AESCULUS L.

(The Horse-Chest nuts)

The genus comprises about 25 species; 4 in India, one in the Nanda Devi Biosphere Reserve.

The generic name is derived from a Greek word *Esca* meaning food, referring food value of its kernels.

Aesculus indica (Colebr. ex Camb.) Hook.

Large, deciduous trees. Leaves digitately 5-9-foliate, leaflets oblong-lanceolate or lanceolate. Flowers yellowish or pale white, arranged in panicles. Fruit ovoid.

These Himalayan Horse chest nuts are common around Kalikana-Chhenalari and Tolma-Himtoli area, 2000-2700 m. Flowering and fruiting during May October.

29. ACERACEAE

(Maple Family)

The family comprises 2 genera and over 200 species; one genus and 15 species in India, 4 in the Biosphere Reserve.

The family is distributed mostly in North America, N.W. Africa, Europe, Asia and Indonesia.

ACER L.

The genus comprises of about 200 species, about 15 species present in India out of which 4 species are occurring in our area. These MAPLE-trees are supposed to be good timber.

The generic name is derived from a Latin word AC meaning sharp.

1a.	Leaves 5-7 lobed, lobes entire	**3. A. cappadocicum**
b.	Leaves 5-lobed, 2-side lobes sometime wanting, lobes serrate-toothed	2
2a.	Lobes of leaves pointed in tail like tips	**1. A. acuminatum**
b.	Lobes of leaves acuminate	3
3a.	Leaf lobes closely serrate, pale glaucous beneath	**2. A. caesium**
b.	leaf lobes distantly serrate toothed, pale green beneath	**4. A. sterculiaceum**

1. Acer acuminatum Wallich ex D. Don

Medium sized to large, deciduous trees. Leaves 5-lobed, lobes sharply serrate, acuminate-long pointed. Flowers greenish, arranged in glabrous corymbs. Fruit glabrous, wings erect or slightly divaricate.

Found in mixed forest around Chenabari-Dhoodh ganga and Deodi-Dibrugheta area, 2400-3500 m. Flowering and fruiting during April November.

2. Acer caesium Wallich ex Brandis

Large, deciduous trees. Leaves 5-lobe, lobes closely serrate, acuminate, pale glaucous beneath. Flowers yellowish-green, arranged in puberulous corymbs. Fruit glabrate, wings divergent, sometimes overlapping.

Found in mixed forest around Kalikona-Dhoodh Ganga area, 2000-3200 m. Flowering and fruiting during March October.

3. Acer cappadocicum Gledt.

Small to medium sized trees. Leaves are 5-7-lobed, lobes, entire cordate, acuminate, glossy green. Flower greenish-yellow, arranged in terminal glabrous, panicles. Fruit glabrous, wings-divaricate.

Found in mixed forest around, Kolikona, Chhenabari-Dhoodhgarga area, 2200-3000 m. Flowering and fruiting during March-June.

4. Acer sterculiaceum Wallich

Trees, small to medium sized, deciduous. Leaves 3-5-lobed, lobes distantly toothed, serrate, acuminate, pale green beneath. Flowers yellowish green, in branched hairy racemes. Fruit densely hairy, wings divergent or erect.

Common around Kalikon-Chhenabari and Tolma-Himtoli area at 2000-3100 m. Flowering and fruiting during March-October.

30. SABIACEAE

The family comprise about 3 genera and 160 species; 2 genera and over 19 species in India, one genus and species in the Biosphere Reserve.

MELIOSMA Blume

The genus comprises about 100 species; 9 species in India, one in the Nanda Devi Biosphere Reserve.

The plants are mostly shrubs or trees.

The generic name is derived from the Greek word *Meli* meaning honey and *Osme* meaning scent, referring to the fragrant flowers.

Meliosma dillenifolia (Wallich ex Wt. & Arn.) Walp.

Large, deciduous shrubs or small trees. Leaves simple, elliptic-obovate, closely toothed, acuminate, rusty pubescent beneath. Flowers white, arranged in terminal panicles. Fruit globose, reddish brown.

Found around Belta-Latakhark and Tolma-Himtoli area at 2200-2800 m. Flowering and fruiting during May October.

31. ANACARDIACEAE

(Cashew Family)

The family consists about 77 genera and over 600 species; about 21 genera and 40 species in India, one genus and 2 species in the Biosphere Reserve.

RHUS L.

The genus comprises about 250 species; 13 species in India, 2 in the Nanda Devi Biosphere Reserve.

These are mostly shrubs or trees with milky resinous juice; some of the plants produce edible fruit, which are intoxicating when taken in excess.

The generic name is derived from a Greek word *Rhous* meaning sumac. The genus is commonly known as Sumac.

1a.	Leaves pinnate, leaflets 7-15	2. R. punjabensis
b.	Leaves 3-foliate	1. R. parviflora

1. **Rhus parviflora** Roxb.

Shrubs, evergreen, 1-3 m high. Leaves 3-foliate, leaflets obovate, tomentose. Flowers minute, yellowish-green, arranged in panicles. Fruit ovoid, brownish.

Found on rocks around Suraithota-Malari area, 1700-2600 m. Flowering and fruiting during May-October.

2. **Rhus punjabensis** Stewart

Small deciduous, trees. Leaves pinnate, leaflets 7-15, tomentose. Flowers greenish-yellow, arranged in panicles. Fruit rounded compressed, densely pubescent.

Common around Pangrani and Kali Kona area at 2000-3000 m. Flowering and fruiting during May-October.

32. LEGUMINOSAE Juss. (FABACEAE)
(Pea family)

A very large and economically important family. Many authors like Takhtajan, Hutchinson considered the Papilionaceae, Caesalpiniaceae and Mimosaceae as separate families. Family Papilionaceae can be easily recognised by its irregular butterfly like flowers, usually with compound leaves and 10 stamens, usually fused by their filaments; Caesalpiniaceae with free stamens and more or less regular flowers and Mimosaceae with regular flowers and many stamens.

The family is represented by nearly 700 genera and 17,000 species of cosmopolitan distribution; about 191 genera and ca 1152 species in India, chiefly in Western peninsular India and Himalaya 16 genera and 32 species in the Biosphere Reserve. The plant of this family exhibit a great range of variation in habit having almost all types i.e. trees, shrubs, herbs, water plants, xerophytes and climbers.

1a.	Stamens free	2
b.	Stamens adelphous	3
2a.	Shrubs with connate stipules	**13. Piptanthus**
b.	Herbs with free stipules	**14. Thermopsis**
3a.	Stamens monodelphous	**4. Crotalaria**
b.	Stamens diadelphous	4
4a.	Pods jointed	5
b.	Pods not jointed	6
5a.	Joint indehiscent	**5. Desmodium**
b.	Joint dehiscent	**7. Hedysarum**
6a.	Petioles ending in a tendril or a bristle	**3. Cicer**
b.	Petioles not ending in a tendril or a bristle	7
7a.	Leaves usually toothed	8
b.	Leaves usually entire	9
8a.	Leaves digitately 3-foliate; petals caducous	**12. Parochetus**
b.	Leaves pinnately 3-foliate; petals persistent.	**15. Trigonella**
9a.	Leaves 3-foliate	10
b.	Leaves more than 3-foliate	11

10a.	Erect shrubs or perennial herbs	9. Lespedeza
b.	Climbing or trailing herbs	16. Vigna
11a.	Leaves 5-foliate	10. Lotus
b.	Leaves more than 5 foliate (sometimes simple in *indigofera* than anthers apiculate)	12
12a.	Hairs medifixed; anthers apiculate	8. Indigofera
b.	Hairs basifixed; anthers not apiculate	13
13a.	Calyx very oblique	2. Caragana
b.	Calyx not oblique	14
14a.	Keel very short	6. Guldenstaedtia
b.	Keels long	15
15a.	Keel cuspidata	11. Oxytropis
b.	Keel obtuse	1. Astragalus

1. ASTRAGALUS L.

The genus is represented by about 2000 species in the world, mainly in North temperate zone of Western and Central Asia, otherwise cosmopolitan in distribution; ca 85 species in India, 7 in the Biosphere Reserve. Majority of the plants exhibit xerophytic character, a few yield gum.

The generic name is derived from Greek word *Astron* meaning a star, and *Gola* meaning milk. The genus is commonly known as "Milk Vetch".

1a.	Stigma penicillate	1. A. amherstianus
b.	Stigma not penicillate	2
2a.	Flowers lilac or purple	5. A. himalayanus
b.	Flowers yellow or pale-yellow	3
3a.	Flowers in elongated racemes	4
b.	Flowers clustered	5
4a.	Leaflets 17-19; pods ensiform, subcompressed	4. A. graveolens
b.	Leaflets 13-17; pods oblong, turgid	3. A. chlorostachys
5a.	Flowers in heads, embeded in white wool	6. A. leucocephalus
b.	Flowers not so congested, not embedded in wool	6
6a.	Stems present	2. A. candolleanus
b.	Stems absent	7. A. webbianus

1. Astragalus amherstianus Royle ex Benth.

Herbs, 30-50 cm high, stems densely pilose. Leaflets 9-23, ovate or elliptical, pilose. Inflorescence axillary pedunculate racemes. Corolla pale-yellow tinged with crimson or light rose. Pods semilunar.

Grows on hill slopes amidst grasses in association with *Polygonum* species in Dunagiri area at 2400-3000 m. Flowering and fruiting during June-September.

2. Astragalus coandolleanus Royle ex Benth.

Suberect or prostrate, tufted shrubs, with thick, woody rootstocks, stems short. Leaves up to 12.5 cm long, leaflets 17-25, elliptic or oblong, glabrous or sparsely hairy. Inflorescence sessile or pedunculate, compact. Corolla yellow. Pod 1.5-2.5 cm long.

Grows on open hill slopes in sandy soils. Common around Martoli area at 3000-4500 m. Flowering and fruiting during June-September.

3. Astragalus chlorostachys Lindl.

Pubescent shrubs. Leaflets obtuse. Flowers yellow. Pods turgid, glabrous.

Not common, found around Suraithota area on way to Lata area at 2000 m. Flowering and fruiting during July October.

4. Astragalus graveolens Buch.-Ham. & Benth.

Shrubs or undershrubs. Leaves 10-17 cm long, leaflets 15-27, elliptic-ovate, obtuse, glabrous. Inflorescence axillary, pedunculate racemes. Corolla yellow. Pods 2-4 cm long, ensiform.

Common on hill slopes in open places around Suraithoda-Malari, ascending up to 2700 m. Flowering and fruiting during July September.

5. Astragalus himalayanus Klotz.

Elongated herbs, stems may or may not be weak. Leaflets thin. Flowers purple.

Commonly grows in Himtoli area on way to Tolma at 2500 m. Flowering and fruiting during July October.

6. Astragalus leucocephalus Grah. ex Benth.

Perennial herbs, stems caespitose, ascending, densely tomentose. Leaves 2-11 cm long, leaflets 21-41, oblong, densely pubescent. Inflorescence compact head like pedunculate raceme, densely woolly. Corolla yellow. Fruit ca 5 mm long.

Common on hill slopes in open places, throughout the area, ascending up to 3000 m around Dunagiri area. Flowering and fruiting during May-September.

7. Astragalus webbianus Grah. ex Benth.

Perennial herbs, aerial stems almost absent. Leaf rachis hard and spiny. Inflorescence sessile or shortly peduncled. Flowers yellow.

Plants grow on open hill slopes in sandy soils. Common around Milam area at 3500-4000 m. Flowering and fruiting during June August.

2. CARAGANA Lam.

The genus is represented by 15 species in the world spread throughout Central Asia; about 7 species in India, one in Nanda Devi Biosphere region.

Usually low shrubs with leaf rachis and stipules spine tipped.

The generic name in derived from a Mangolian word Carachana referring to ornamental shrubs.

1a.	Leaves digitate, leaflets oblanceolate glabrous	2. C. versicolor
b.	Leaves imparipinnate, leaflets linear-oblong, pubescent	1. C. nubigena

1. Caragana nubigena Bunge.

Shrubs, dwarf, ca 10 cm high. Leaves imparipinnate, leaflets 18-30. Flowers axillary, yellow. Pods sparsely hairy.

Grows on hill slopes in open places in sandy soils. Common around Kaga area on way to Dunagiri at 4000-4500 m. Flowering and fruiting during June-September.

2. Caragana versicolor (Wallich) Benth.

Rigid shrubs, up to 60 cm high. Leaves digitately compound, rachis spinescent, persistent. Flowers axillary, solitary, yellow. Pods ca 2.5 cm long, linear.

Grows on open hill slopes in sandy soils. Common throughout Milam-Martoli area at 3000-4000 m. Flowering and fruiting during May August.

3. CICER L.

About 20 species in the world, mostly in North Africa, Abyssinia and from East Mediterranean to Central Asia; 2 species in India, one species in Biosphere Reserve area. *Cicer arietinum* Linn. is cultivated for edible, protein rich seeds.

The generic name is derived from a Greek word *Kykis* meaning force or strength, referring to its nourishing qualities.

Cicero microphyllum Benth. **Fig. 14.**

Annual, erect or decumbent herbs, stems much branched. Stipules foliaceous, leaflets 8-22, obcordate, gradually decreasing in size upwards. Flowers purple. Pods 2-3 cm long, beaked.

Grows on hill slopes amidst boulders. Common around Milam moraines and bugyals at 3300-4000 m. Flowering and fruiting during June August.

4. CROTALARIA L.

The genus is represented by about 550 species in the world, mostly in tropics and subtropics, few in temperate Himalaya; ca 86 species in India, two species in Nanda Devi Biosphere Reserve.

The plants are herbs or shrubs, some are grown for fodder and a few yield fibre.

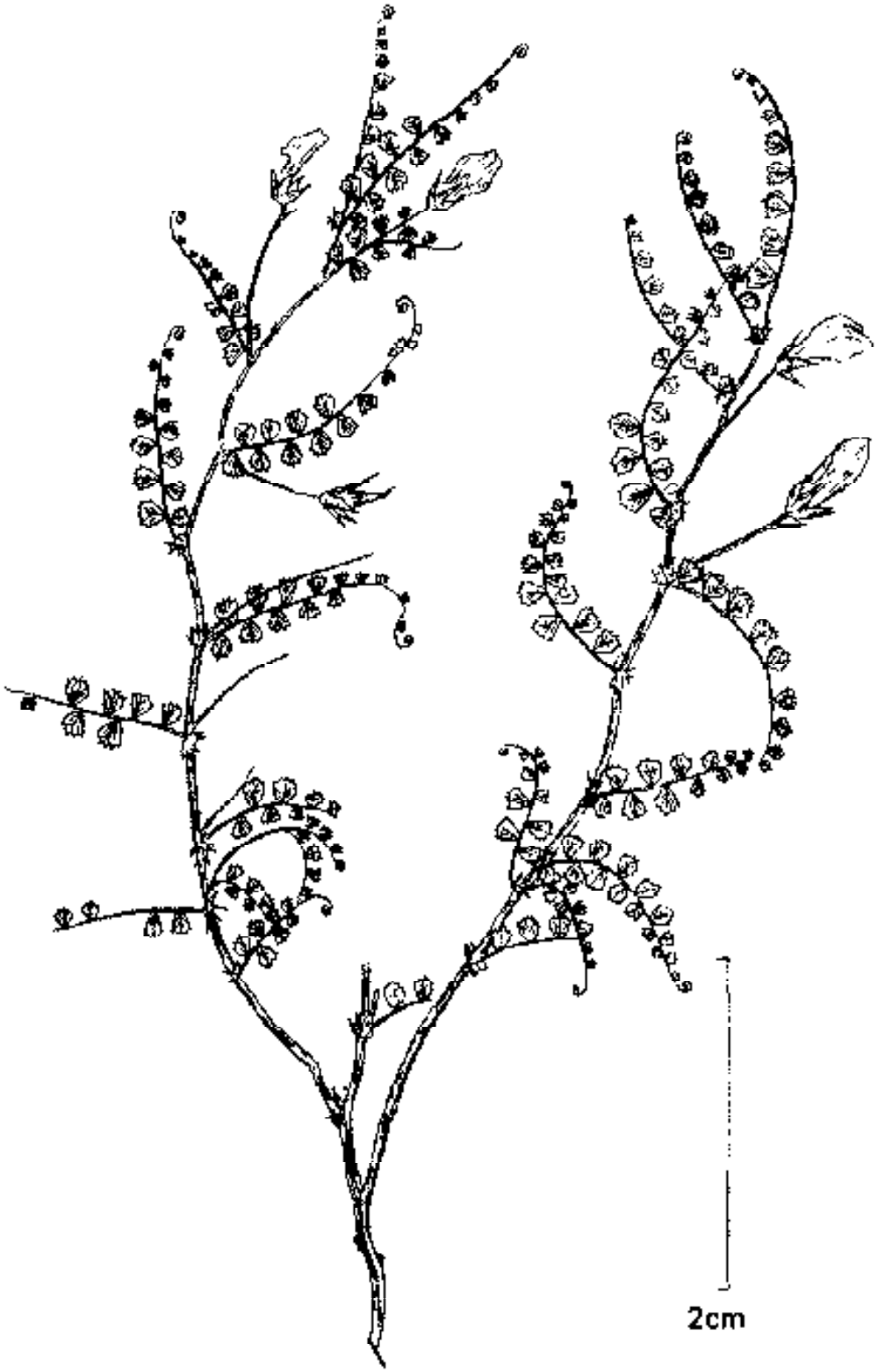


Fig. 14. Cicero microphyllum Benth.

The generic name is derived from a Greek word *Krotalon* meaning a rattle, referring to the seed in the inflated pods which make a rattling sound.

1a.	Pods more than 2.5 cm long; stipules large, decurrent as conspicuous as wings	**1. C. alata**
b.	Pods less than 1.5 cm long; stipules not as above	**2. C. albida**

1. Crotalaria alata Buch.-Ham. ex D. Don.

Densely hairy undershrubs. Stipules large, winged. Flowers yellow.

Not common, found around Suraithota area. 1800 m. Flowering and fruiting during August-November.

2. Crotalaria albida Heyne ex Roth

Herbs or undershrubs, perennial, much branched, silvery pubescent. Flowers yellow.

Not very common, found on hill slopes on way to Malari and Donagiri area, 2500 m. Flowering and fruiting during July November.

5. DESMODIUM DC.

The genus is represented by ca 450 species in the world, mainly in tropics, subtropics and temperate Himalaya; ca 45 species in India, 4 in Nanda Devi Biosphere area.

The plants of this genus show a great range of variation in habit, from erect, prostrate to decumbent herbs, small to large shrubs and even dwarf trees.

The generic name is derived from a Greek name *Desmos* meainign a bond referring to jointed pods.

1a.	Tufted, prostrate herbs	**4. D. microphyllum**
b.	Erect or suberect shrubs or undershrubs	2
2a.	Leaves 1-foliate	**2. D. gangeticum**
b.	Leaves 3-foliate	3

3a.	Tomentose shrubs; pods pubescent	1. **D. elegans**
b.	Hairy undershrubs; pods rusty hooked hairy	3. **D. heterocarpon**

1. **Desmodium elegans** DC.

Shrubs, 1.5-2.5 m high, branches pubescent. Leaves 3-foliate, leaflets orbicular, ovate to obovate. Inflorescence panicle. Flowers pale-lilac to dark purple.

Common around Tolma-Lata area on hill slopes at 2300-3000 m. Flowering and fruiting during June – September.

2. **Desmodium gangeticum** (L.) DC.

Undershrubs, pubescent, erect. Leaves simple. Flowers pink. Pods curved, with 6-8 joints.

Common, grows in buffer zone area, ascending up to 2000 m. Flowering and fruiting during April – December.

3. **Desmodium heterocarpon** (L.) DC.

Deciduous undershrubs. Leaves 3-foliate. Flowers purple. Pods hooked hairy, with 4-8 joints.

Common, grows in buffer zone area, ascending up to 2200 m. Flowering and fruiting during July – October.

4. **Desmodium microphyllum** (Thunb.) DC.

Herbs, tufted, prostrate or trailing. Leaves 3-foliate. Flowers bluish-purple. Pods with 4-5 joints.

Common, grows in waste places and along the road side, ascending up to 2000 m. Flowering and fruiting during July – October.

6. GULDENSTAEDTIA Fisch.

The genus is represented by ca 7 species in the world; about 3 in India and one in the Biosphere Reserve. Usually perennial herbs.

The generic name is given after I.A. von Gueldentaedtia, who studied the flora of Caucasus.

Guldenstaedtia himalaica Baker

Herbs prostrate, ca 4 cm high, stems silky. Leaflets obcordate. Flowers terminal, solitary, corolla blue.

Commonly grows on open hill slopes around Milam glacial moraine at 3400-4000 m. Flowering and fruiting during June September.

7. HEDYSARUM L.

The genus is represented by ca 150 species in the world, distributed throughout temperate zone; about 8 species in India and one in our area. Usually herbs with red flowers in long peduncled, axillary racemes.

The generic name is derived from a Greek word *Hedys* meaning sweet, referring to its ornamental value.

Hedysarum kumaonensis Benth. ex Baker **Fig. 15.**

Perennial, tufted herbs, stems none. Leaves ca 13 cm long, leaflets elliptic-ovate, silky-hairy on lower surface. Flowers crowded in pedunculate raceme; corolla pink.

Not common, found on open hill slopes in sandy soils around Martoli area at 3000-4000 m. Flowering and fruiting during June September.

8. INDIGOFERA L.

About 700 species of the genus are present in the world; about 50 in India, 2 species and one variety in Nanda Devi Biosphere Reserve.

Fig. 15. Hedysarum kumaonensis Benth. ex Baker

The generic name is derived from Latin word *Indigo* meaning blue dye and *fero* meaning to bear.

1a.	Flowers deep red	1. I. hebepetala
b.	Flowers pink purple	2
2a.	Pods more than 3 cm long; flowers more than 1 cm long	3. I. heterantha var. gerardiana
b.	Pods less than 3 cm long; flowers less than 1 cm long	2. I. heterantha

1. Indigofera hebepetala Benth. & Brandis

Large, deciduous shrubs, silvery pubescent. Bracts boat shaped. Flowers deep red.

Not common, found around Tolma area at 2000 m. Flowering and fruiting during May August.

2. Indigofera heterantha Wallich ex Brandis **Fig. 16.**

Shrubs, 30-60 cm high, young branches silvery pubescent. Leaves imparipinnate, leaflets 13-31. Flowers pale-pink or purple. Fruit cylindric.

Grows along the bridal path and on hill slopes, common in buffer zone area of Suraithota-Tolma, ascending upto 2500 m. Flowering and fruiting during May-October.

3. Indigofera heterantha var. **gerardiana** (Wallich ex Baker) Ali

Shrubs, 1.5 to 2.5 m high. These are more robust than the var. *heterantha*. Inflorescence are also longer than the variety typica.

The plants are common along the bridal path and in mixed forest of *Cedrus-Abies* and *Taxus*, at 2200-3500 m. Flowering and fruiting during May - October.

9. LESPEDEZA Mich.

About 30 species in the world, distributed in Siberia, China, Japan, N. America and Java; about 80 species in India, one in our area.

Herbs or shrubs, flowers copious in racemes or crowded in leaf axils.

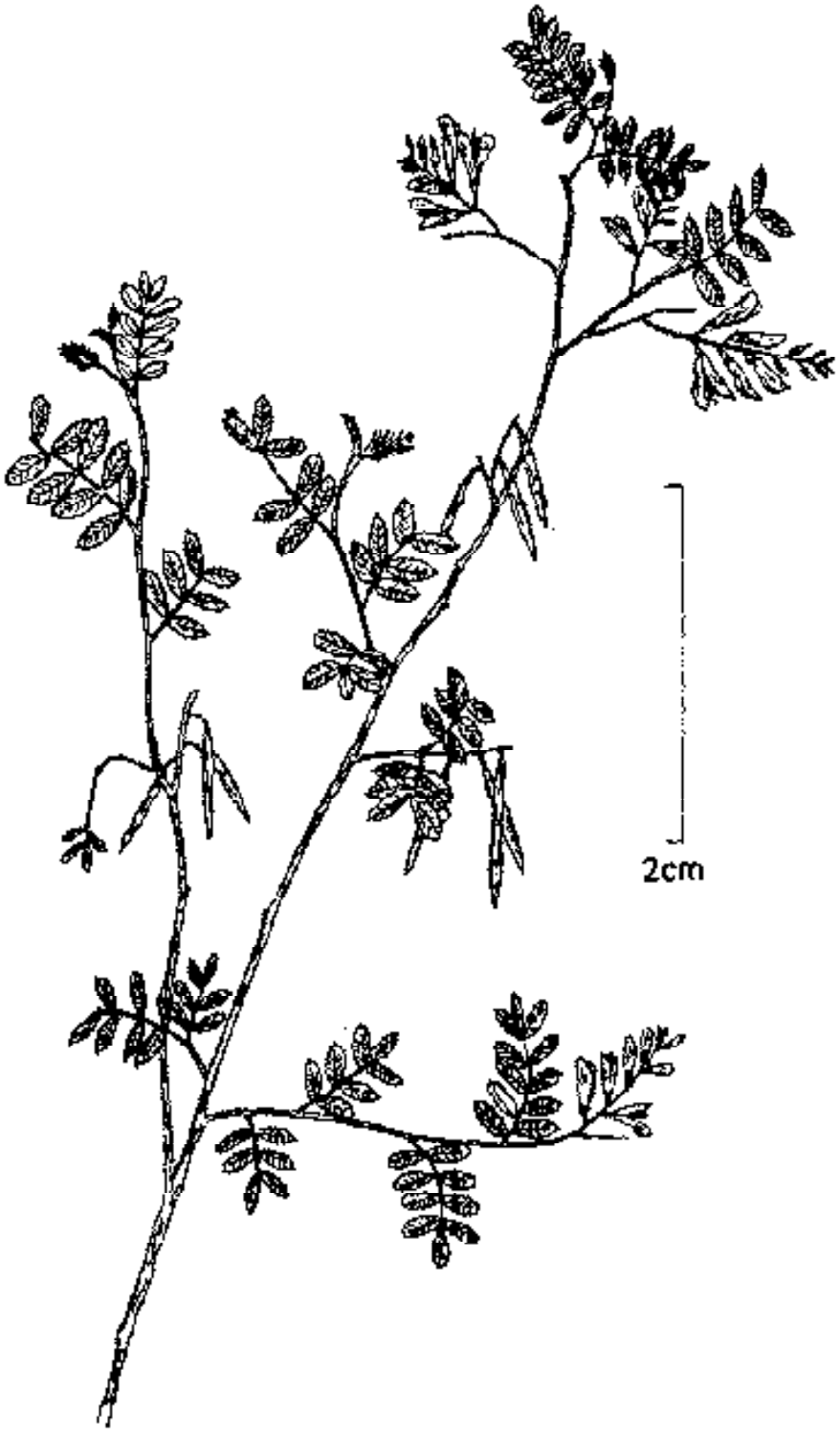


Fig. 16. Indigofera heterantha Wallich ex Brandis

The generic name is given after V.M. de Cespedes, Spanish Governer of Florida and a great patron of botany.

Lespedeza juncea (L.f.) Pers.

Herbs or undershrubs, perennial, 0.30-1 m high, barnches densely pubescent. Leaves 3-foliate, leaflets silky below. Inflorescence 2-4-flowered, shortly peduncled umbels; flowers pale-yellow or pink.

Common around Lata and Tolma area. 2300-3000 m on open hill slopes. Flowering and fruiting during June October.

10. LOTUS L.

About 50 speceis in the world, distributed throughout North and South temperate regions; 2 species in India, one in the Biosphere Reserve.

Herbs. Leaves 5-foliate. Pods linear, turgid, septate.

Lotus corniculatus L.

Herbs, perennial, prostrate, ascending or decumbent. Leaves 5-foliate, 2-lower leaflets at the base resembling stipules. Inflorescence 3-6-flowered, axillary umbel. Flowers yellow.

Common around Malari area on open hill slopes at 3000-3500 m. Flowering and fruiting during March September.

11. OXYTROPIS DC.

The genus is represented by ca 100 species in the world; about 12 species in India, one species in our area.

Herbaceous perennials. Flowers in dense heads. Pods oblong or roundish.

The generic name is derived from Greek word *Oxys* meaning sharp and *tropis* meaning keel, referring to sharp pointed keel.

Oxytropis lapponica (Wahb.) Gay.

Perennial, tufted herbs, stems well developed. Leaves imparipinnately compound. Flowers in axillary or terminal pedunculate heads, blue purple. Pods ca 10-11 mm long, apiculate.

Grows on hill slopes amidst grasses. Common in the core zone and around Milam-Mattoli area at 3000-4000 m. Flowering and fruiting during June-September.

12. PAROCHETUS Buch.-Ham. ex D. Don

This is a monotypic genus, distributed in subtropical to alpine Himalaya.

The generic name is derived from the Greek word *Para* meaning beside and *Ochetos* meaning a brook, referring to the habit of the plant.

Parochetus communis Buch.-Ham. ex D. Don

Annual, creeping herbs, rooting at various places from nodes. Leaves 3-foliate. Flowers axillary or in pairs, violet.

Growing on hill slopes amidst grasses in shady moist places. Common around Milam-Martoli area and Himtoli, at 3000-4000 m. Flowering and fruiting during April September.

13. PIPTANTHUS D. Don

A monotypic genus, the name of which is derived from Greek word *Pipto* meaning to fall and *Anthos* meaning flowers, referring to the nature of the flowers.

Piptanthus nepalensis D. Don **Fig. 17.**

Evergreen shrubs. Leaves 3-foliate, linear-lanceolate, stipules amplexicaule. Flowers yellow, in axillary racemes. Pods flat.

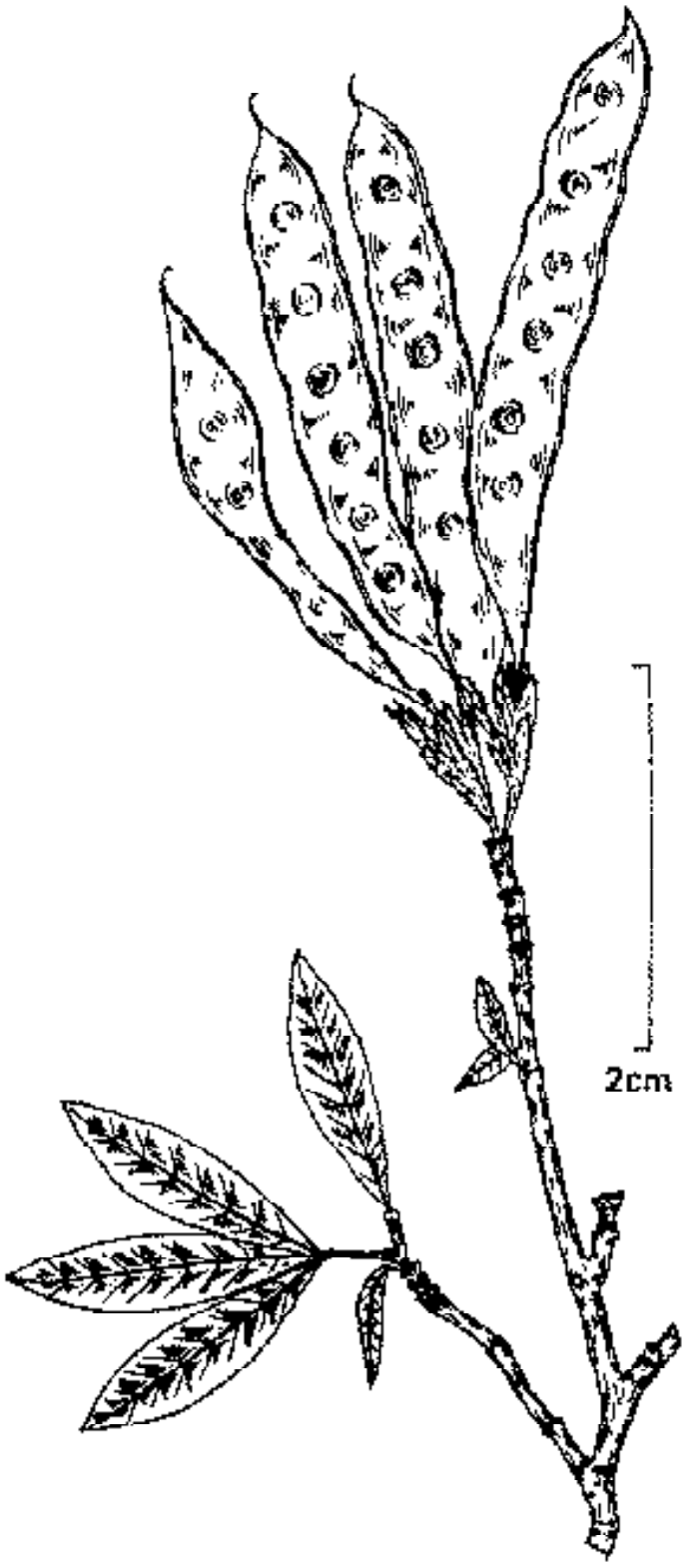


Fig. 17. Piptanthus nepalensis D. Don

Common around Martoli area at 3000-4000 m, on open rocky hill slopes in sandy soils. Flowering and fruiting during May-July.

14. THERMOPSIS R. Br.

The genus is represented by about 12 species in the world, mainly in China, Japan and N. America; 2 species in India and one in our area.

Perennial herbs. Leaves stipulate, 3-foliate, bracts large leafy.

The generic name is derived from Greek word *Thermos* meaning heat and *opsis* meaning resemblance.

Thermopsis barbata Royle **Fig. 18.**

Perennial, tufted herbs, stems densely pilose. Leaves 3-foliate, leaflets lanceolate. Flowers crowded in short axillary racemes, dark purple.

Common around Himtoli and Milam-Martoli area on open hill slopes in sandy soils at 3000-4500 m. Flowering and fruiting during June September.

15. TRIGONELLA L.

About 135 species in the world, distributed mostly in Mediterranean, Europe, Asia, South Africa and Australia; about 11 species in India, 4 in Nanda Devi Biosphere Reserve area.

The generic name is derived from Greek word *Tri* meaning three and *Gonu* meaning angle, referring to triangular appearance of petals.

1a.	Pods sickle-shaped	1. T. corniculata
b.	Pods not sickle-shaped	2
2a.	Pods pilose	4. T. pubescens
b.	Pods glabrous	3
3a.	Inflorescence ending in an awn	3. T. gracilis
b.	Inflorescence not ending in awn	2. T. emodi

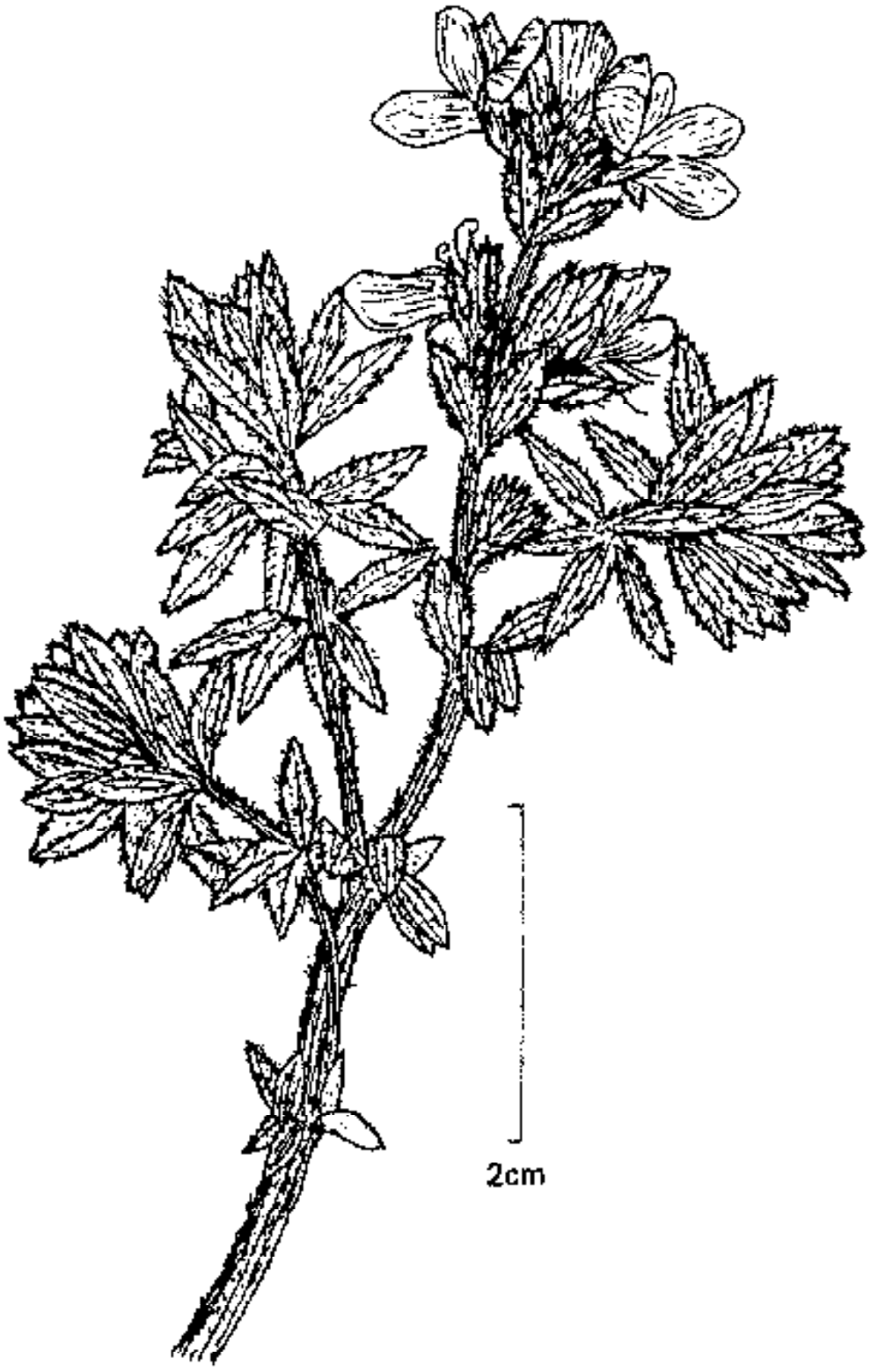


Fig. 18. Thermopsis barbata Royle

1. Trigonella corniculata (L.) L.

Perennial, erect or procumbent herbs, stems branched. Leaflets obovate to oblong-cuneate, obtuse or emarginate. Inflorescence many-flowered racemes. Fruit 1-3 cm long, curved.

Common throughout the area in buffer zone, on hill slopes and along the bridal path amidst grasses at 1800-2600 m. Flowering and fruiting during June - September.

2. Trigonella emodi Benth.

Erect, perennial herbs, stems much branched. Leaflets obovate, inciso-dentate. Inflorescence axillary, condensed racemes. Pods ca 1.5 cm long.

Common throughout the area on hill slopes, amidst grasses ascending up to 4000 m. Flowering and fruiting during June September.

3. Trigonella gracilis Benth.

Perennial, trailing herbs, stems 15-35 cm long. Leaflets obovate-cuneate, retuse. Inflorescence few-flowered. Calyx teeth as long as tube. Fruit ca 1 cm long, glabrous.

Grows on hill slopes amidst grasses. Common in buffer zone around Suraithota-Tolma-Lata at 1800-2600 m. Flowering and fruiting during June October.

4. Trigonella pubescens Edgew. ex Parker

Herbs, 30-40 cm high. Leaflets obovate-oblong. Inflorescence 1-3-flowered. Calyx teeth longer than the tube. Corolla slightly exserted. Fruit 1-1.6 cm long, linear-oblong, pilose.

Common on hill slopes amidst grasses in buffer zone as well as in core zone area, ascending up to 3000 m. Flowering and fruiting during June October.

16. VIGNA Savi

About 80-100 species in tropics, abundant in Africa and Asia; about 10 species in India and one in the Biosphere area.

The is name is named after Dominico Vigna, Professor of Botany of Pisa.

Vigna vexillata (L.) A. Rich.

Perennial, climbing or trailing herbs. Leaves 3-foliate, leaflets ovate to lanceolate. Inflorescence axillary, subumbellate, 2-6-flowered. Flowers yellow, pink or purple.

Common around Tolma, Lata and Peng area on hill slopes at 2200-2000 m. Flowering and fruiting during July October.

33. ROSACEAE
(Rose family)

A cosmopolitan family with about 122 genera and 3400 species in the world; about 30 genera and ca 225 species in India, mainly in temperate Himalaya, 16 genera and *ca* 42 species in Nanda Devi Biosphere Reserve.

A large, economically important family of herbaceous, shrubby and tree species, sometimes with thorns and prickles. Leaves simple or compound with stipules. Flowers often showy, stamens many. Fruits are mostly edible.

1a.	Fruit enclosed within the calyx tube or adnate to it	2
b.	Fruit not enclosed in the calyx tube	6
2a.	Herbs; calyx equipped with hooked bristles	**2. Agrimonia**
b.	Shrubs or trees; calyx not equipped with hooked bristles	3
3a.	Stipules persistent	**11. Rosa**
b.	Stipules deciduous	4
4a.	Fruit drupaceous	**4. Cotoneaster**
b.	Fruit pomaceous	5
5a.	Leaves simple	**10. Pyrus**
b.	Leaves pinnate (except in *S. cuspidata*)	**15. Sorbus**
6a.	Annual or perennial herbs	7
b.	Shrubs or trees	10

7a.	Leaves simple, orbicular-reniform	**3. Alchemilla**
b.	Leaves compound, not orbicular-reniform	8
8a.	Fruit succulent, consisting of enlarged recepticle bearing minute achenes	**5. Fragaria**
b.	Fruit dry, consisting of numerous achenes	9
9a.	Achenes hairy; styles terminal, long	10
b.	Achenes glabrous (except *P. fruticosa*) styles lateral short	11
10a.	Styles hooked at the tip or below in fruits	**1. Acomastylis**
b.	Styles straight in fruits	**6. Geum**
11a.	Stamens numerous	**7. Potentilla**
b.	Stamens 4, 5 or 10	**13. Sibbaldia**
12a.	Spinous or prickly shrubs	11
b.	Shrubs or trees without prickles or spines	12
13a.	Fruit one seeded drupe; stipules minute	**8. Prinsepia**
b.	Fruit of many succulent druplets; stipules distinct	**12. Rubus**
14a.	Carpels one	**9. Prunus**
b.	Carpels more than one	13
15a.	Leaves pinnate.	**14. Sorbaria**
b.	Leaves simple	**16. Spiraea**

1. ACOMASTYLIS Green

The genus comprises about 13 species; 2 in India, one in Biosphere Reserve.

Acomastylis elata (Wallich ex Royle) F. Bolle **Fig. 19.**

Tufted herbs. Leaves hairy, spreading. Flowers bright yellow.

Common in the core zone area at 3000-4000 m. Flowering and fruiting during June September.

2. AGRIMONIA L.

About 8 species in the world, mainly distributed in North temperate regions and South America; ca 4 species in India, one in our area.

Leafy perennial herbs. Flowers yellow, in terminal spike forming racemes.

The scientific name to the genus is given because of its supposed properties to cure eye diseases called "Argema".

Fig. 19. Acomastylis elata (Wallich ex Royle) F. Bolle

Agrimonia aitchisonii Sch.-Tam.

Herbs, annual or perennial, erect, 45-75 cm high. Leaflets large and small, alternating each other. Flowers yellow, in terminal spikes. Fruit covered in bristly calyx crown.

Common around Tolma, Belta area on shady hill slopes amidst grasses, ascending up to 2500 m. Flowering and fruiting during May June.

3. ALCHEMILLA L.

About 300 species in world, chiefly native to the American Andes, a few are distributed in Europe and North India; 6 species in India and one in our area.

Herbs. Leaves orbicular, lobed or deeply divided. Flowers yellow.

The generic name is derived from an Arabic name Alkemelych referring to its uses in alchemy in ancient times.

Alchemilla vulgaris L.

Diffused or prostrate, annual or perennial, low herbs, stems ca 1.5 cm long. Leaves orbicular-reniform, deeply lobed. Flowers minute, in terminal corymbs, yellowish.

Scattered around Martoli bugyals (alpine meadows) on moist places amidst grasses at 4000-4500 m. Flowering and fruiting during June September.

4. COTONEASTER Ehrhart ex Medik.

This is one of the large genera of the flowering plants, said to be represented by 50 to about 261 species in the world; about 59 species in India out of which 5 are present in the Biosphere Reserve.

The generic name is derived from Latin word *Cotoneum* meaning quince and *aster* meaning rsemblance.

1a.	Flowers white	2
b.	Flowers pink	4
2a.	Erect shrubs	**2. C. affinis**
b.	Prostrate shrubs	3
3a.	Leaves pale bristly beneath	**5. C. microphyllus**
b.	Leaves densely white hairy beneath	**4. C. integrifolius**
4a.	Prostrate shrubs	**3. C. garhwalensis**
b.	Erect or suberect shrubs	**1. C. acuminatus**

1. Cotoneaster acuminatus Lindl.

Deciduous, erect shrubs. Leaves ca 4 cm long, ovate-lanceolate. Flowers ca 0.8 cm in diam., pinkish. Fruit ca 0.8 cm long, reddish.

Scattered around Martoli on hill slopes at 3500-4000 m. Flowering and fruiting during June September.

2. Cotoneaster affinis Lindl.

Large, deciduous shrubs or up to 3 m high trees. Leaves elliptic or oblanceolate, tomentose beneath. Flowers in panicles, white.

Scattered around Sonwara-Pangrani on hill slopes, ascending upto 2800 m. Flowering and fruiting during June September.

3. Cotoneaster garhwalensis Koltz.

Prostrate shrubs. Leaves ovate, acute, lower surface hairy. Flowers solitary, pinkish. Fruit reddish-brown.

Scattered around Martoli-Milam area on rocks at 3800-4500 m. Flowering and fruiting during May October.

4. Cotoneaster integrifolius (Roxb.) Klotz.

Much branched, prostrate shrubs. Leaves elliptic-oblong, glossy above, pubescent beneath. Flowers solitary, white. Fruit oblong.

Common around Himtoli area on rocks at 2800-3700 m. Flowering and fruiting during May September.

5. Cotoneaster microphyllus Wallich ex Lindl.

Evergreen, prostrate, much branched shrubs. Leaves obovate, often much variable, hairy on lower surface. Flowers solitary, ca 0.8 cm in diam., white.

Common around Himtoli-latakharak, Dibrughata and Malari area on rocky hill slopes and on boulders at 3000-4500 m. Flowering and fruiting during April-October.

5. FRAGARIA L.

About 6-7 species distributed mainly in mountain region of Northern hemisphere and S. America; about 4 species in India, one in the Biosphere Reserve.

The generic name is derived from Latin word *frag* meaning the root of Frango. Fragum is a strawberry plant and Linnaeus used the adjectival from referring to the fruit.

Fragaria nubicola Lindl. ex Lacatia

Semi erect, slender herbs with glabrous runners. Leaflets silvery. Flowers 1.8-2.5 cm in diam., white.

Scattered around Himtoli area on hill slopes amidst grasses at 2800-3500 m. Flowering and fruiting during May October.

6. GEUM L.

The genus comprises about 40 species in world; one in India and the Nanda Devi Biosphere Reserve.

Geum roylei Bolle

Herbs hairy. Radical leaves long. Flowers pale-yellow, styles jointed in the middle.

Grows in core zone area at 2700-3200 m. Flowering and fruiting during June September.

7. POTENTILLA L.

About 500 species in the world, widely distributed throughout the globe mainly in North temperate and Arctic regions; about 45 species in India, 10 in Nanda Devi Biosphere Reserve.

Mostly perennial herbs, rearly shrubs, stipules adnate to the petioles. Flowers solitary or in corymbose cymes. Some of the plants are highly medicinal.

The generic name is derived from the Latin word *Potens* meaning powerful refering to its medicinal properties.

1a.	Leaves digitately 3 foliate	2
b.	Leaves pinnately compound	6
2a.	Flowers crimson	**2. P. argyrophylla** var. **atrosanguinea**
b.	Flowers yellow	3
3a.	Achenes sunken in very long receptacular hairs	4
b.	Achenes not sunken in receptacular hairs	5
4a.	Tufted herbs; stems very short; calyx lobes triangular	**4. P. cuneata**
b.	Ascending herbs; stem 10-30 cm long; calyx lobes ovate acute	**4. P. eriocarpa**
5a.	Flowers in panicled cymes; leaflets acutely toothed	**1. P. argyrophylla**
b.	Flowers 1-4 in slender pedicels; leaflets 4-5, crenate at the tip, base entire	**9. P. gelida**
6a.	Leaves interruptedly pinnate, alternate pairs much smaller	**8. P. fulgens**
b.	Leaves not interruptedly pinnate, alternate pairs not smaller	7
7a.	Flowers 1-2; dwarf, densely tufted herbs	**10. P. microphylla**
b.	Flowers more than 2	8
8a.	Leaflets pinnatifid	**11. P. multifida**
b.	Leaflets not pinnatifid	9
9a.	Achenes not concealed in recepticular hairs	**3. P. bifurca**
b.	Achenes completely concealed in the receptacular hairs	10
10a.	Low erect shrubs; leaflet, coriaceous	**7. P. fruticosa** var. **rigida**
b.	Dwarf tufted or depressed shrubs; leaflets silky	**6. P. fruticosa** var. **pumila**

1. Potentilla argyrophylla Wallich ex Lehm. var. argyrophylla

Herbs, perennial or annual, up to 50.0 cm high, stems and leaves silvery. Leaves 3-foliate. Flowers yellow.

Common around Himtoli, Dibrugheta, Dharansi, Milam and Martoli area on open hill slopes in association with *Geranium, Polygonum, Anemone, Heracleum, Aster* and *Senecio* sp. at 3000-4500 m. Flowering and fruiting during June October.

2. Potentilla argyrophylla var. **atrosanguinea** (Ledd.) Hook.f.

This variety differs from the var. *argyrophylla* in having crimson red flowers.

Common, in association with *P. argyrophylla* on grassy hill slopes at 3200-4500 m. Flowering and fruiting during June October.

3. Potentilla bifurca L.

Depressed, perennial, silky hairy herbs. Leaves crowded over the stem in a crown, leaflets elliptic-lanceolate, acute. Flowers solitary, yellow.

Common on open hill slopes in sandy soil around Martoli-Milam area at 3500-4500 m. Flowering and fruiting during June-September.

4. Potentilla cuneata Wallich ex Lehm.

Perennial, tufted herbs. Leaves 3-foliate, leaflets 3-fid, silky hairy. Flowers solitary, yellow. Achenes hidden in dense silky receptacular hairs.

Common on moist rocky hill slopes around Ramni, Milam-Martoli area 3500-4500 m. Flowering and fruiting during June-October.

5. Potentilla eriocarpa Wallich ex Lehm. **Fig. 20.**

Ascending, glabrous herbs with very stout rootstock. Peduncles and petioles very slender; leaflets 3, toothed. Flower solitary, petals much longer than calyx, yellow.

Scattered in open places on hill slopes, amidst grasses at 3000-4000 m. Flowering and fruiting during August September.

6. Potentilla fruticosa L. var. **pumila** Hook.f.

Perennial, rigid, spreading shrubs. Leaflets linear-lanceolate, acute, silky. Flowers solitary, ca 2 cm in diam., yellow. Achenes sunken in silky hairs.

Scattered around Milam glacial moraines on open places in sandy and rocky soils at 4000-5000 m. Flowering and fruiting during June-September.

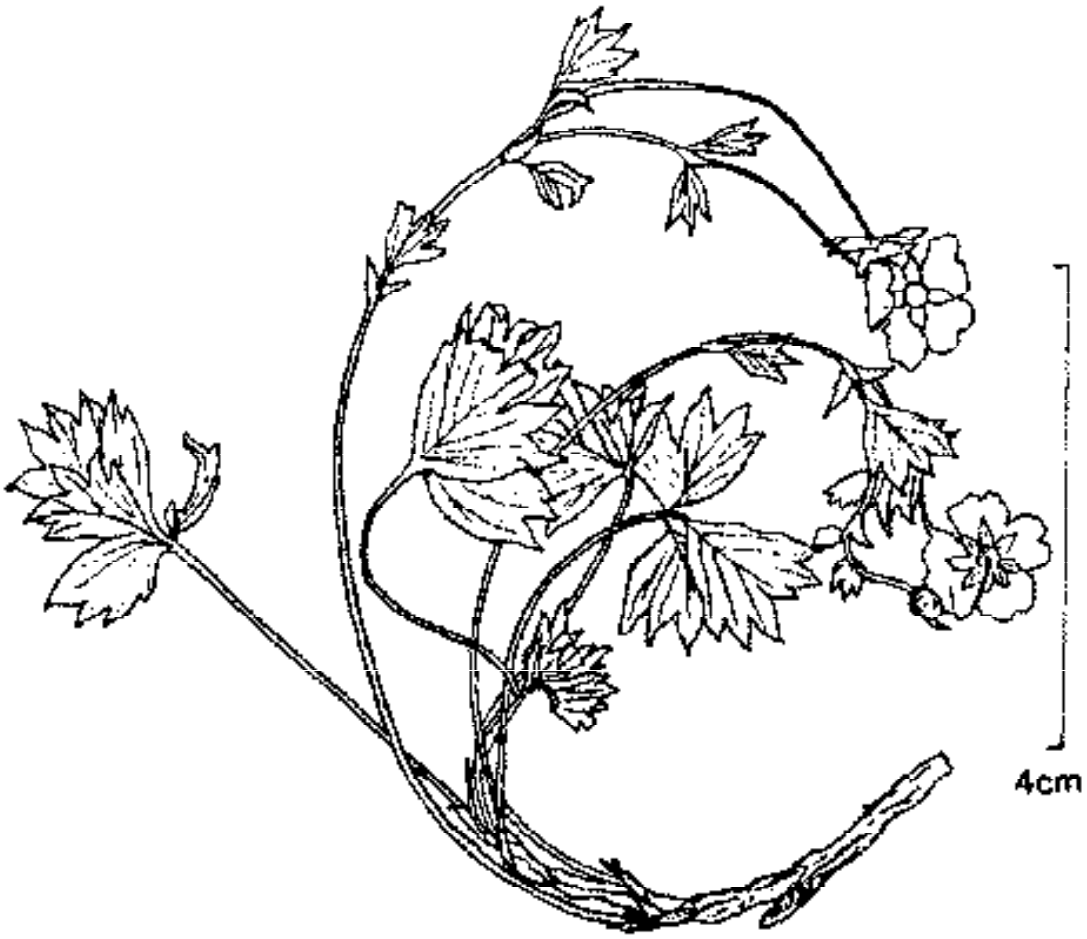


Fig. 20. **Potentilla eriocarpa** Wallich ex Lehm.

7. Potentilla fruticosa L. var. **rigida** (Wallich ex Lehm.) Wolf.

Shrubs or undershrubs. Leaflets 3-7, elliptic, apiculate, coriaceous. Flowers ca 3 cm in diam, solitary, yellow.

Scattered around Deodi-Dibrugheta on hill slopes at 3500-4500 m. Flowering and fruiting during June September.

8. Potentilla fulgens Wallich ex Hook. **Fig. 21.**

Perennial, deep rooted, prostrate or erect, robust herbs. Leaflets numerous, small and large alternating with each other, silvery tomentose on lower surface. Flowers yellow.

Common around Tolma-Himtoli and Belta area on open hill slopes, in sandy soils at 2500-3500 m. Flowering and fruiting during June October.

9. Potentilla gelida C.A. Mey.

Annual or perennial, decumbent herbs. Leaves 3-foliate; leaflets wedge shaped, bluntly toothed. Flowers solitary, yellow.

Scattered around Martoli-Milam area on moist hill slopes amidst grasses, at 3500-4500 m. Flowering and fruiting during June September.

10. Potentilla microphylla D. Don

Densely tufted, perennial, low herbs. Leaflets numerous, minute, silky beneath. Flower solitary, ca 1.5 cm across, yellow.

Scattered around Dharansi area on hill slopes amidst grasses at 3500-4500 m. Flowering and fruiting during June-October.

11. Potentilla multifida Linn.

Decumbent, perennial herbs. Leaflets 3-5, multifid, white tomentose beneath. Flowers solitary, ca 1.5 cm in diam., yellow.

Scattered around Martoli-Milam area on moist shady places amidst grasses, at 4000-4500 m. Flowering and fruiting during May September.

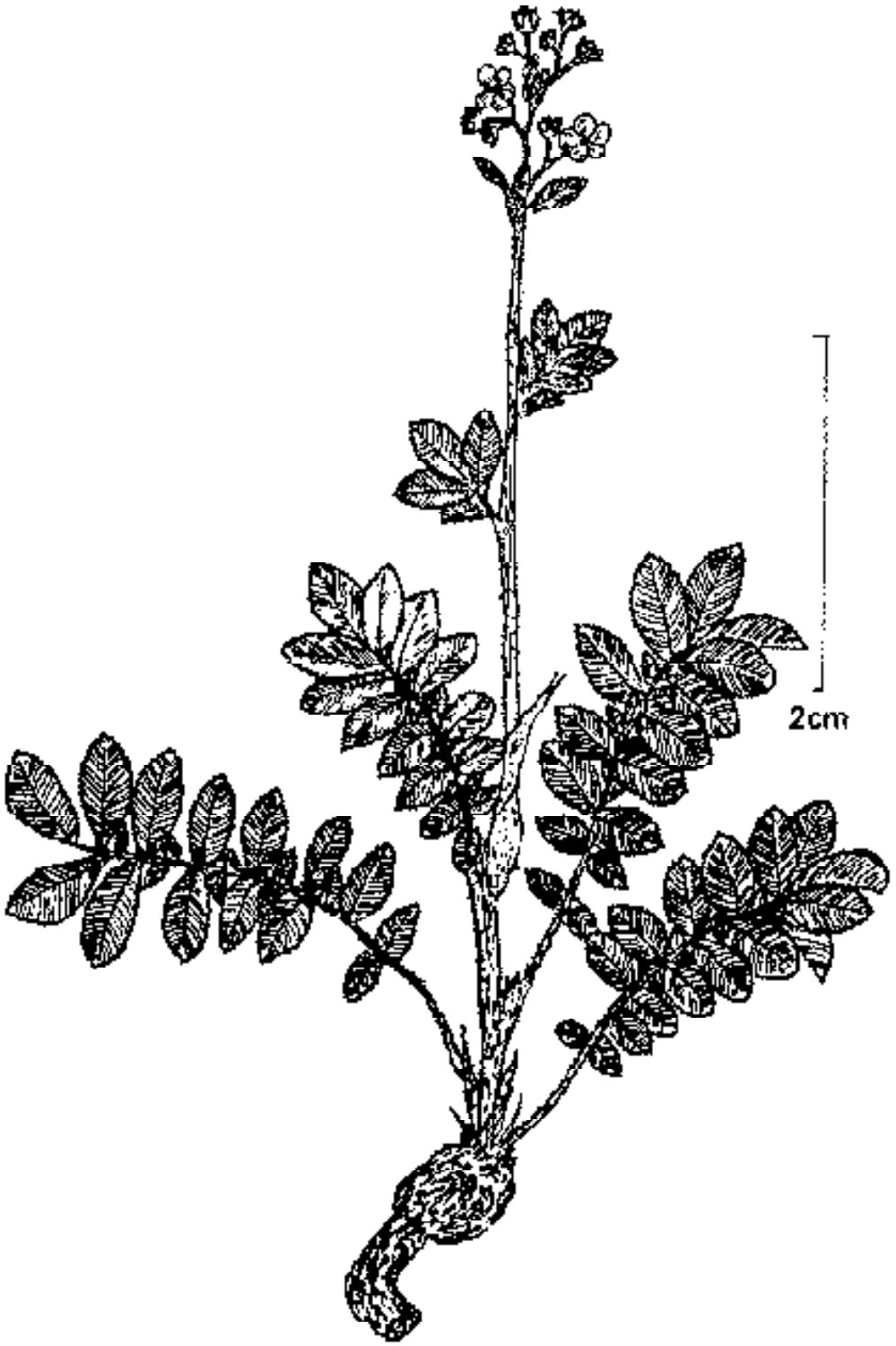


Fig. 21. Potentilla fulgens Wallich ex Hook.

8. PRINSEPIA Royle

The genus is represented by only one species in India, mainly in temperate Himalaya, the same is also represented in Nanda Devi Biosphere area.

The genus is named after James Prinsep, Meterologist and Secretary of the Asiatic Society of Bengal.

Prinsepia utilis Royle

Large, spinous, deciduous shrubs. Leaves lanceolate, serrate, glabrous. Flowers axillary, white. Fruit ellipsoid, 1-seeded drupe, blue-black when ripe.

Common around Suraithota-Lata area at 2000-2500 m in open hill slopes and along the road side. Flowering and fruiting during April October.

9. PRUNUS L. (*sensu stricto*)

The genus comprises over 40 species in the world; 10 in India, 3 in the Biosphere Reserve. The plants are trees or shrubs; many are cultivated for their fruits.

Prunus is an ancient Latin name for Plum and Cherry trees.

1a.	Flowers arranged in racemes, white	**1. P. cornuta**
b.	Flowers solitary or fascicled, pink	2
2a.	Medium sized trees	**3. P. persica**
b.	Small shrubs	**2. P. jacquemontii**

1. Prunus cornuta (Wallich ex Royle) Steud.

Small, deciduous trees. Leaves oblong-lanceolate or oblong-ovate, acuminate. Flowers white, in axillary or terminal drooping racemes.

Common throughout the area in buffer zone, ascending upto 3200 m. Flowering and fruiting during May October.

2. Prunus jacquemontii Hook.f.

Small, deciduous shrubs. Leaves elliptic-obovate or oblong, serrate, glabrous. Flowers pink.

Grows in Malari area at 3000-3500 m. Flowering and fruiting during May - August.

3. Prunus persica (L.) Batsch.

Small, deciduous trees. Leaves lanceolate, ovate-lanceolate or oblong-lanceolate. Flowers pink.

Common throughout the area, ascending upto 3000 m. Flowering and fruiting during January October.

10. PYRUS L. (sensu stricto)

The genus comprises over 30 species in the world; 5 in India, 2 in the Biosphere Reserve. Plants are trees or shrubs. Fruits fleshy. The pyrus meaning Pear.

1a.	Leaves tomentose beneath, margins lobulate or serrate; fruits orange yellow	**1. P. lanata**
b.	Leaves glabrous, margins entire or crenate; fruits blackish-grey	**2. P. pashia**

1. Pyrus lanata D. Don

Small, deciduous trees, young twigs white tomentose, glabrous when mature. Leaves ovate-elliptic, ovate, tomentose beneath. Flowers white. Fruit globose or pyriform, orange-yellow.

Grows around Kalikona area in mixed forest at 2200-2500 m. Flowering and fruiting during April-May.

2. Pyrus pashia Buch.-Ham. ex D. Don.

Medium sized trees, stem bark grey-brown. Leaves elliptic-lanceolate, serrate. Flowers in terminal corymbs, ca 2 cm across. Fruit globose, grey-green with raised white spots, edible.

Common on hill slopes around Suraithota-Lata area. Flowering and fruiting during April October.

11. ROSA L.

The genus comprises many prickly shrubs, sometimes climbing or trailing, with showy flowers. Many of them are of medicinal value. About 250 species of the genus are known in the world; 10-12 in India, 4 in Biosphere Reserve.

The generic name is derived from Greek word *Rhodon*.

The roses are cultivated all over the world for their beautiful flowers and certain medicinal properties.

1a.	Sepals deciduous in fruit	**1. R. anserinaefolia**
b.	Sepals persistent	2
2a.	Flowers white or yellow, 4-merous	**3. R. sericea**
b.	Flowers pink, pentamerous	3
3a.	Leaves 1.2-5 cm long; leaflets oblong-orbicular	**4. R. webbiana**
b.	Leaves 5-20 cm long; leaflets elliptic	**2. R. macrophylla**

1. Rosa anserinaefolia Boiss.

Deciduous, subscandant, prickly shrubs, prickles hooked. Flowers solitary, sometimes in corymbs, white; sepals deciduous in fruit. Fruit globose.

Common around Milam area on open hill slopes at 3500-4500 m. Flowering and fruiting during May September.

2. Rosa macrophylla Lindl.

Deciduous, prickly shrubs, ca 3 m high, prickles straight. Leaflets whitish pubescent beneath. Flowers solitary or in corymbs, pinkish. Fruit ovoid-oblong, glandular-hairy.

Common around Deodi, Himtoli and Milam area on open hill slopes at 3000-4000 m. Flowering and fruiting during May October.

3. Rosa sericea Lindl.

Deciduous, prickly shrubs, ca 4 m high, young branches densely clothed with glandular bristles. Leaflets 7-12. Flowers solitary, white. Fruit ovoid red.

Common around Milam, Himtoli, Dibrugheta and Deodi area at 3500-4500 m. Flowering and fruiting during May September.

4. Rosa Webbiana Wallich ex Royle **Fig. 22.**

Deciduous, prickly shrubs, 2-3 m high, stem bark reddish-brown to pinkish, prickles numerous, straight. Leaflets 5-9. Flowers often solitary, pink or reddish. Fruit globose or ovoid, red.

Common around Himtoli and Milam area at 3000-4500 m on open hill slopes. Flowering and fruiting during May September.

12. RUBUS L.

Over 50 species in India; 4 in the Biosphere Reserve. This is a very variable genus, mostly shrubs, erect or climbing, some are creeping herbs. The fruit of the genus, known as Black berry, Dewberry and Raspberry are edible.

The generic name is derived from the word Rub meaning red, referring to the colour of the fruit.

1a.	Flowers white; fruit orange or yellow	2
b.	Flowers pink or red; fruit black	3
2a.	Stems white waxy; pedicels glabrous, prickly	**1. R. biflorus**
b.	Stems not white waxy; pedicels tomentose	**2. R. ellipticus**
3a.	Leaflets 5-7	**4. R. niveus**
b.	Leaflets 3	**3. R. foliolosus**

1. Rubus biflorus Buch.-Ham. ex Sm.

Subereet, deciduous, prickly shrub, stems white waxy. Leaves 3 to 5-foliate. Flowers white. Berries orange.

Common around Kalikana area, ascending upto 2700 m. Flowering and fruiting during April July.

2. Rubus ellipticus Sm.

Evergreen, shrubs, ca 2.5 m high, young branches tomentose, older one brown bristly, prickly. Leaflets 3. Flowers white; calyx tomentose. Fruit yellow, edible.

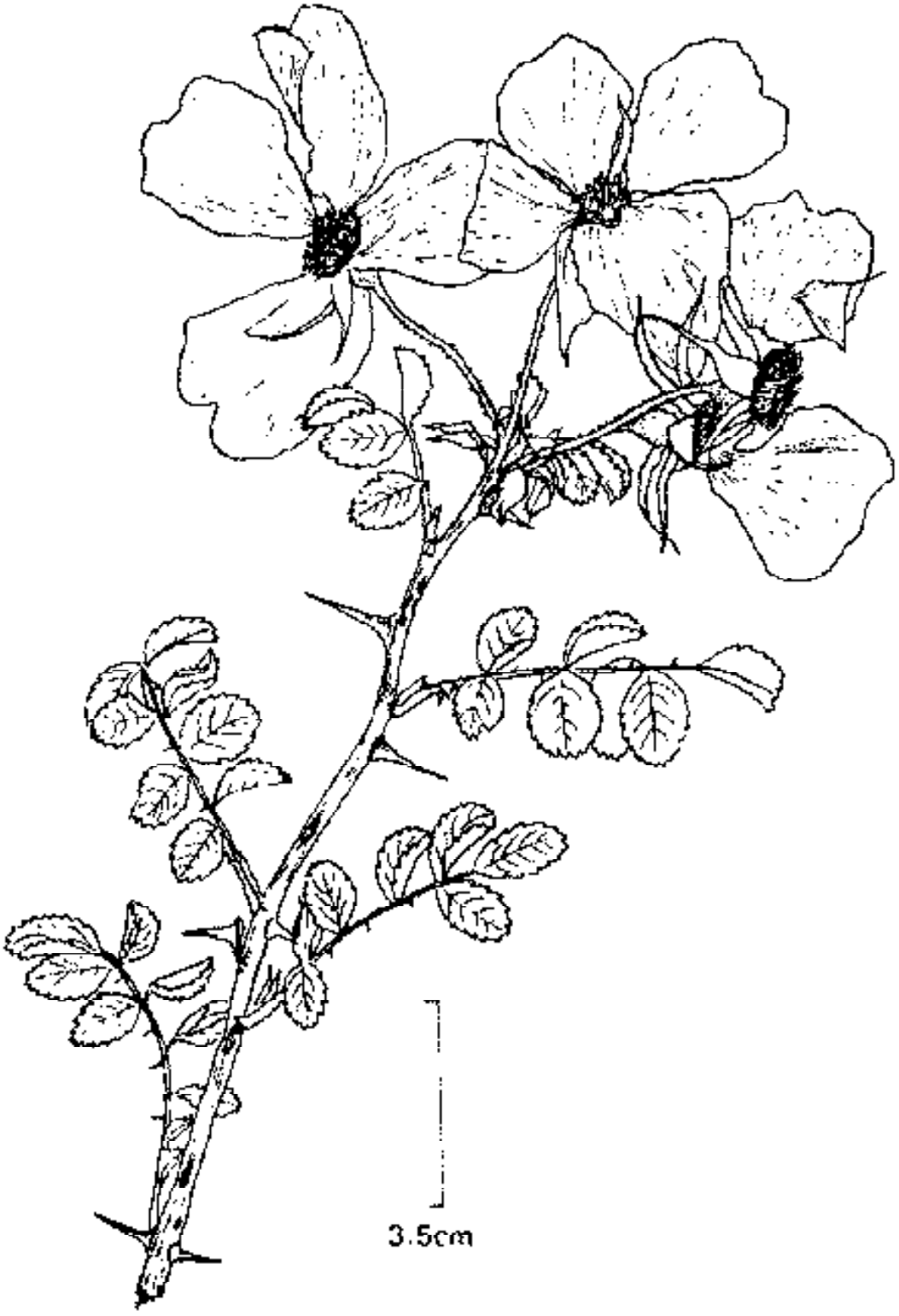


Fig. 22. Rosa Webbiana Wallich ex Royle

Common around Suraithota-Lata area along the bridal path, at 1800-2300. Flowering and fruiting during March - June.

3. Rubus foliolosus D. Don

Deciduous, spreading, prickly shrubs. Leaflets 3, glabrous. Flowers solitary or in pairs, prickly. Fruit black.

Found around Himtoli area, common at 2000-3000 m. Flowering and fruiting during June October.

4. Rubus niveus Thunb.

Large, suberect shrubs with straggling stems. Leaves, 5-7-foliate; leaflets white tomentose beneath. Flowers pink. Fruit black.

Common around Reni-Kalikana, Tolma-Himtoli area ascending up to 2600 m. Flowering and fruiting during March July.

13. SIBBALDIA L.

The genus is represented by about 20-25 species in the world; ca 4 species in India, 3 in the Biosphere Reserve. These are mostly deep rooted perennial, herbs distributed in alpine or cold temperate areas.

This genus is named after Sir Rober Sibbald, Professor of Botany at Edinburgh.

1a.	Leaflets 5-9	**2. S. purpurea**
b.	Leaflets 3	2
2a.	Flowers solitary or in pairs	**3. S. tetrandra**
b.	Flowers in branched cymes	**1. S. cuneata**

1. Sibbaldia cuneata Horem. ex Kuntz.

Perennial, spreading herbs, stem much branched at the base. Leaves 3-foliate, silky hairy. Flowers yellow, in terminal corymbs.

Common around Martoli area in moist shady places at 3000-3600 m. Flowering and fruiting during May October.

2. **Sibbaldia purpurea** Royle

Procumbent, perennial herbs, stems branched. Leaflets 5, sessile, hairy. Flowers purple.

Scattered around Dharansi area, on open hill slopes in gravel soils at 3200-4000 m. Flowering and fruiting during June September.

3. **Sibbaldia tetrandra** Bunge

Perennial, densely tufted herbs. Leaves 3-foliate, leaflets 3-fid, silky hairy. Flowers yellow.

Scattered around Bhujgara area in shady places at 3500-4000 m. Flowering and fruiting during June September.

14. SORBARIA A. Br.

About 10 species in world; 2-4 in India, only one species in Nanda Devi Biosphere area.

Woody or semiwoody plants. Flowers small, numerous in terminal panicles.

Sorbaria is a Latin word meaning resembling *Sorbus*.

Sorbaria tomentosa (Lindl.) Rehdr.

Deciduous shrubs or small trees. Leaves pinnate, leaflets lanceolate, serrate, acuminate. Flowers small, white, in terminal, large, branched panicles.

Common around Tolma, Lata and on way to Malari from Suraithota at 2000-3000 m. Flowering and fruiting during June September.

15. SORBUS L.

About 100 species in the world; about 10 in India, 2 in Biosphere Reserve. The plants are mostly deciduous trees or shrubs, some are grown for ornamental purposes.

The generic name *Sorbus* means the mountain ash.

1a. Robust trees or shrubs, young twigs and inflorescence brown tomentose **2. S. ursina**
b. Slender shrubs, twigs and inflorescence glabrous or glabrescent **1. S. microphylla**

1. Sorbus microphylla Wenzing **Fig. 23.**

Deciduous, subscandent or up to 4 m high shrubs. Leaves pinnate, leaflets 17-29, sharply serrate, glabrous. Flowers pink. Fruit pink.

Scattered around Dunagiri area on hill slopes at 3500-4200 m. Flowering and fruiting during May October.

2. Sorbus ursina (Wenzing) Decne.

Large, deciduous shrubs, ca 0.6 m high. Leaflets 17-25, rachis red-brown tomentose. Flowers crowded, pinkish-white, fragrant.

Scattered around Dibrugheta at 3500-4000 m. Flowering and fruiting during May October.

16. SPIRAEA L.

The genus is represented by about 100 species in the world; about 10-15 in India, 2 in Nanda Devi Biosphere area.

The plants are mostly deciduous shrubs.

The generic name is derived from the Greek word *Spira* meaning spiral, referring to the ancient use of these flowers in making wreaths and garlands.

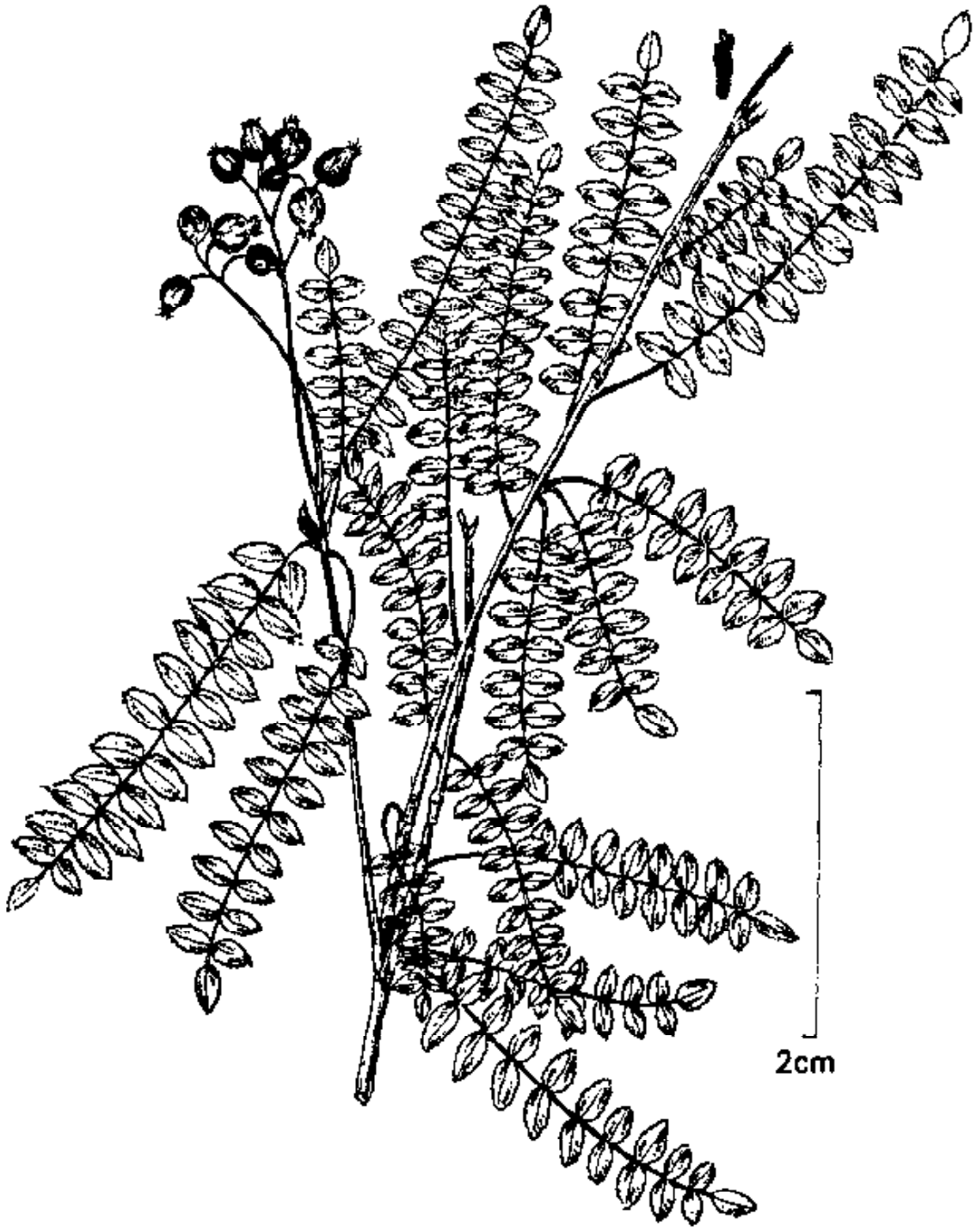


Fig. 23. Sorbus microphylla Wenzing

1a.	Flowers white uni-orbisexual	**2. S. canescens**
b.	Flowers pink, unisexual	**1. S. bella**

1. Spiraea bella Sims.

Deciduous, erect shrubs, ca 1.5 m high. Leaves serrate. Flowers ca 0.8 cm in diam., pinkish.

Common around Himtoli area at 3000-3500 m. Flowering and fruiting May-September.

2. Spiraea canescens D. Don **Fig. 24.**

Deciduous, erect, shrubs ca 2 m high. Leaves simple, entire. Flowers ca 0.8 cm in diam., white.

Common around Tolma-Himtoli, Suraithota-Tolma and Lata-Belta area at 2000-3200 m. Flowering and fruiting during May October.

34. SAXIFRAGACEAE
(Saxifrag family)

The family is represented by 80 genera and about 1250 species, mostly cosmopolitan; about 6 genera and 65 species in India, two genera and 12 species in the Biosphere Reserve.

1a.	Root stocks very thick; leaves large with a large sheath at the base of the petiole	**1. Bergenia**
b.	Root stocks not thick; leaves small, without sheaths at the base of petiole	**2. Saxifraga**

1. BERGENIA Moench.

The genus is represented by about 10 species in the world; about 3 in India, two in the Biosphere Reserve.

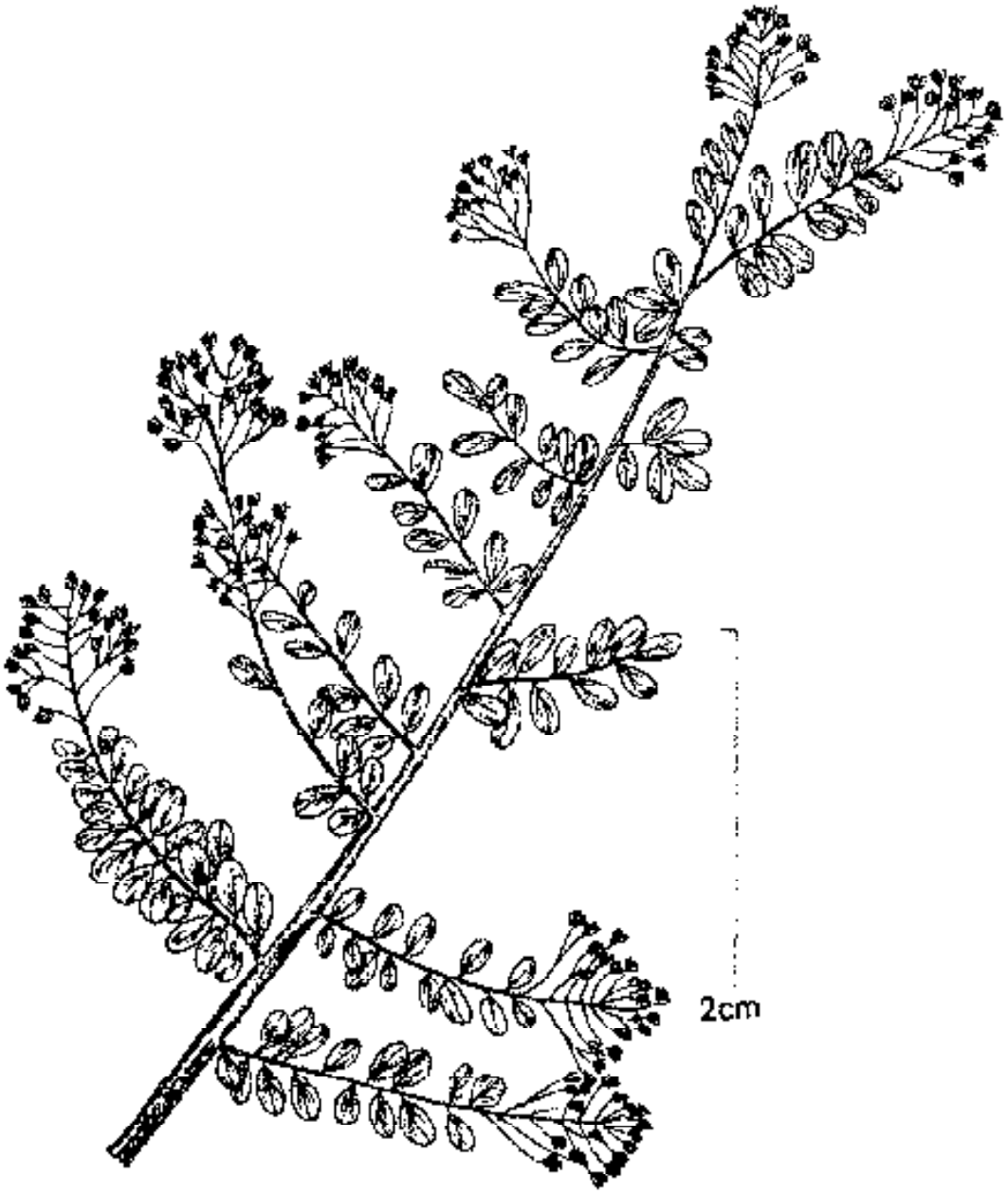


Fig. 24. Spiraea canescens D. Don

Rosa sericea Lindl.

Sorbus ursina (Wenzing) Decne.

Saxifraga diversifolia Wallich ex Ser.

Rhodiola heterodonta (Hook.f. & Thoms.) A. Boriss.

Heracleum lanatum Michx.

Selinum elatum (Edgew.) Hiroe

Viburnum cotinifolium D. Don

Aster flaccidus Bunge

Echinops cornigerus DC.

Cirsium wallichii DC.

Prenanthes brunoniana Wallich ex DC.

The plant of this genus are perennial herbs. Thick stout root stock of *B. ciliata* is well known for its medicinal uses.

The generic name is given after K. August von Bergen. a German Botanist.

1a.	Leaves crenate, base cuneate	**2. B. stracheyi**
b.	Leaves entire, base cordate	**1. B. ciliata**

1. Bergenia ciliata (Haw.) Sternb.

Perennial herbs with thick rootstocks, stems very short. Leaves simple, orbicular-ovate, entire, hairy. Flowers in corymbs, white-rose.

Common around Roing and Tolma area on rocks in moist shady places at 2500-3500 m. Flowering and fruiting during in March October.

2. Bergenia stracheyi (Hook.f. & Thoms) Engl. **Fig. 25.**

Perennial herbs with very thick rootstocks, stems very short, fleshy. Leaves simple, oblong-ovate, crenate. Flowers in corymbs, pinkish-white.

Common around Dharansi and Dibrugheta-Ramni-Bhujgara area on moist shady rocks at 2500-4500 m. Flowering and fruiting during May - September.

2. SAXIFRAGA L.

Over 400 species in the world, mostly in temperate and alpine regions; about 50 species in India, 10 species in the Biosphere Reserve.

The name of this genus is derived from Latin word *Saxum* meaning a stone and *frango* meaning to break, referring to characteristic of some of the species.

1a.	Tufted herbs, stems short	**9. S. saginoides**
b.	Not tufted, stems elongated	2
2a.	Flowers yellow	3
b.	Flowers white	8

Fig. 25. Bergenia stracheyi (Hook.f. & Thoms) Engl.

3a.	Stem rising from the basal tuft of rosulate leaves, with the thread like stolons terminating in rooting buds; leaves entire	4
b.	Stems not rising from the basal tuft of rosulate leaves, stolons absent; leaves spinulose	6
4a.	Glabrous herbs	**3. S. brunonis**
b.	Glandular, ciliate herbs	5
5a.	Sepals adnate at the base	**7. S. flagellaris** subsp. **mucronulata**
b.	Sepals free	**6. S. flagellaris** subsp. **crassiflagellata**
6a.	Leaves oblong-lanceolate; bulbils absent	**4. S. diversifolia**
b.	Leaves linear-lanceolate; bulbils present at the axils of upper leaves	7
7a.	Stems much branched	**5. S. filicaulis**
b.	Stems simple	**2. S. brachypoda** var. **fimbriata**
8a.	Flowers solitary	**8. S. granulifera**
b.	Flowers 3-6 together	9
9a.	Cauline leaves lobed, lobes 3-angular, sometimes altogether absent; radical leaves 7-12 lobes	**1. S. asarifolia**
b.	Cauline leaves elliptic-ovate; radical leaves 5-7 lobed.	**10. S. sibirica**

1. Saxifraga asarifolia Sternb.

Annual, erect herbs, 2-30 cm high, stems laxly villous. Radical leaves orbicular. Flowers 3-6 together, white.

Common around Ramni-Bhujgara area on shady hill slopes at 3500-4500 m. Flowering and fruiting during July September.

2. Saxifraga brachypoda D. Don var. fimbriata (DC.) Engl. & Irmsch.

Annual, erect, herbs, 10-20 cm high, stems glabrous or sparsely ciliate. Leaves spinulose, bulbils present in upper axils. Flowers solitary or 2-3, yellow.

Common around Deodi-Dibrugheta, on hill slopes in shady places at 3500-4000 m. Flowering and fruiting during July September.

3. Saxifraga brunonis Wallich ex Ser.

Annual, erect herbs, 4-6 cm high, runners present. Leaves rosulate, cauline leaves linear. Flowers solitary or 2-4, yellow.

Common around Ramni-Deodi, on shady moist hill slopes and on mossy boulders at 3400-4000 m. Flowering and fruiting during July September.

4. Saxifraga diversifolia Wallich ex Ser.

Annual, erect herbs, 10-20 cm high, stems glandular hairy. Cauline leaves amplexicaule; radical leaves ovate narrowed into petiole. Flowers terminal, 1-3, yellow.

Common around Himtoli, Deodi-Ramni area on shady moist hill slopes at 3200-3800 m. Flowering and fruiting during July September.

5. Saxifraga filicaulis Wallich ex Ser.

Annual, erect herbs, ca 15 cm high, stems much branched, glandular hairy. Leaves linear-oblong, minutely denticulate. Flowers solitary, yellow.

Common around Deodi-Ramni area on hill slopes in moist places and in rock crevices at 3300-4000 m. Flowering and fruiting during July October.

6. Saxifraga flagellaris Willd. ex Sternb. subsp. **crassiflagellata** Hutten.

Perennial, erect herbs, stems ca 3.5 cm high, sparsely glandular ciliate, stolons present. Leaves crowded at the base. Flowers 2-3, terminal, yellow.

Scattered on hill slopes and in glacial moraines, around Milam-area at 3500-4500 m. Flowering and fruiting during June September.

7. Saxifraga flagellaris Willd. ex Sternb. subsp. **mucronulata** (Royle) Engl. & Irmsch.

Stolons glandular ciliate. Flowers 2-4, in terminal corymbs, yellow; sepals adnate, base at glandular ciliate.

Common on shady moist grassy hill slopes around Milam bugyals at 3800-5000 m. Flowering and fruiting during June September.

8. Saxifraga granulifera H. Smith

Annual, erect herbs, 15-20 cm high. Radical leaves reniform, cauline palmately 4-8 lobed. Flowers terminal, solitary, yellow.

Common around Deodi-Dibrughata area on hill slopes in moist shady places at 3300-4000 m, flowering and fruiting in July September.

9. Saxifraga saginoides Hook.f. & Thom.

Annual, erect, tiny herbs, stems 1.5-2 cm high. Leaves imbricate. Flowers yellow.

Scattered around Dharansi area on hill slopes and in rock crevices in shady moist places at 3500-4500 m. Flowering and fruiting during June - September.

10. Saxifraga sibirica L.

Annual, erect herbs. Leaves orbicular, obtusely 5-7-lobed, glabrous. Flowers terminal, 3-4 together, white.

Common in Milam bugyals, growing in rock crevices in moist shady places at 3500-4000 m. Flowering and fruiting during June September.

35. GROSSULARIACEAE

(Gooseberry family)

The family is represented by about 2 genera and 200 species in the world, mainly in temperate regions; 1 genus and 3 species in Biosphere Reserve.

The plants are mostly shrubs, sometimes spiny. Leaves often with resinous glands. Flowers in racemes or sub-solitary.

RIBES L.

About 150 species in the world; ca 10 species in India, 3 in Biosphere Reserve. Prickly or unarmed shrubs. Fruits of many of the species are edible.

The generic name is derived from an Arabic name Ribas meaning acid tasting.

1a.	Flowers solitary or 1-3 in clusters; prickly shrubs	**1. R. alpester**
b.	Flowers in racemes; not prickly shrubs	2
2a.	Calyx limb campanulate	**2. R. himalense**
b.	Calyx limb not campanulate	**3. R. orientale**

1. Ribes alpester Wallich ex Dcne.

Deciduous, prickly shrubs, stem bark peeling off, thorns 3-radiate. Leaves crowded on dwarf shoots. Flowers solitary or crowded, white.

Common on open hill slopes around Malari, Tolma-Himtoli and Martoli area at 3500-4000 m. Flowering and fruiting during May September.

2. Ribes himalense Royle ex Dcne.

Deciduous shrubs, ca 3 m high. Leaves pale beneath. Flowers greenish-yellow or brownish-pink, in pendulous racemes. Berries red and black.

Scattered around Ramni area near Trisuligar river at 3500-3900 m. Flowering and fruiting during July October.

3. Ribes orientale Desf.

Deciduous, unarmed shrubs. Leaves orbicular or reniform, 3-5-lobed. Flowers purplish-brown, in racemes. Berries globose, orange red.

Common around Malari, Tolma-Himtoli area at 3000-4000 m, in open places. Flowering and fruiting during June October.

36. PHILADELPHACEAE
(Mock-orange family)

The family is represented by 7 genera and about 135 species in the world, mostly in S. Europe, East Asia and N. America; 2 genera and 2 species in Biosphere Reserve.

Plants are mostly shrubs or trees with more or less stellate, pubescent, simple leaves. Flowers mostly in terminal cymes, rarely solitary.

1a.	Stamens 20-40	**2. Philadelphus**
b.	Stamens 8-10	**1. Deutzia**

1. DEUTZIA Thunb.

The genus comprises about 50 species in the world; 7 in India, only one in Biosphere Reserve.

The generic name is given after John vander Deutz, Sheriff of Amesterdam, patron and friend of Cart Thunberg.

Deutzia compacta Craib.

Deciduous shrubs, 2 m high, stem bark peeling off. Leaves sessile, stellately hairy. Flowers white, in branched corymbose cymes.

Common on hill slopes, Sonwara-Pangrani at 3300-3800 m. Flowering and fruiting during April October.

2. PHILADELPHUS

The genus comprises over 75 species; one in India and the Biosphere Reserve.

The generic name is derived from a Greek name *Philadelphon* meaning a sweet flowering shrub.

Philadelphus tomentosus Wallich ex G. Don

Deciduous, scandent herbs, ca 2 cm high. Leaves petiolate, serrate, tomentose beneath. Flowers white, in terminal racemes, fragrant. Fruit opening in 4-valves.

Common on hill slopes around Dibrugheta-Sonwara at 3200-3800 m. Flowering and fruiting during May - October. The fiber from this plant is used in making ropes.

37. PARNASSIACEAE
(Grass of Parnassus family)

A monogeneric family with about 50 species in the world, about 11 in India, one in the Biosphere Reserve.

The plants are annual or perennial scapigerous herbs with thick rootstocks. Leaves simple. Flowers regular.

PARNASSIA L.

The generic name is given after Mt. Parnassus, Greece. These plants are supposed to have originated in Mt. Parnassus.

Parnassia nubicola Wallich ex Royle **Fig. 26.**

Annual or perennial, erect, glabrous herbs, ca 30 cm high. Scape 1-flowered, white.

Common on shady hill slopes amidst grasses around Dibrugheta at 3500-4000 m. Flowering and fruiting during July October.

38. CRASSULACEAE
(Stonecrop family)

About 35 genera and 1500 species of cosmopolitan distribution, most abundant in S. Africa; about 6 genera and 70 species in India, 2 genera and 9 species in the Biosphere Reserve. The plants are perennial, xerophytic herbs with fleshy stems and leaves.

1a. Flowers dioecious, rarely monoecious, 4-merous **1. Rhodiola**
b. Flowers monoecious, often 5-merous **2. Sedum**

Fig. 26. Parnassia nubicola Wallich ex Royle

RHODIOLA L.

The genus comprises ca 50 species in the world mostly distributed in North temperate region; 7 in the Biosphere Reserve.

The plants are fleshy. Flowers are 4-merous mostly dioecious, very rarely monoecious.

1a.	Flowers red or pink	2
b.	Flowers white or pale yellow	5
2a.	Cymose heads enclosed in leafy bracts	**2. R. crenulata**
b.	Cymose heads not enclosed in leafy bracts	3
3a.	Leaves ovate, inciso-dentate, margins prominently white	**3. R. heterodonta**
b.	Leaves linear-lanceolate, or oblong-elliptic, entire or toothed, not white margined	4
4a.	Leaves oblong-elliptic, more than 2 cm long; cymes many-flowered	**1. R. bupleuroides**
b.	Leaves linear-lanceolate, less than 1 cm long; cymes 1-6-flowered	**5. R. quadrifida**
5a.	Petals white	**6. R. sinuata**
b.	Petals yellow	6
6a.	Leaves entire; style recurved in fruit	**4. R. imbricata**
b.	Leaves dentate; style not recurved in fruit	**7. R. wallichiana**

1. Rhodiola bupleuroides (Hook.f. & Thoms.) Fu

Perennial, erect, herbs, 15-35 cm high. Leaves whorled, oblong-elliptic, toothed, flowers reddish, in terminal, dense, cymose heads.

Common on hill slopes and on mossy boulders in shady moist places in Milam bugyal area, 3600-4500 m. Flowering and fruiting during June September.

2. Rhodiola crenulata (Hook.f. & Thoms.) H. Ohba

Succulent, tufted, perennial herbs, 5-20 cm high. Leaves elliptic-oblong, irregularly toothed. Flowers purplish, in terminal, dense cymes, surrounded by leafy bracts.

Common on hill slopes and in rock clefts in open places around Milam and Dharansi area, 3500-4500 m. Flowering and fruiting during June - September.

3. Rhodiola heterodonta (Hook.f. & Thoms) A. Boriss.

Perennial, erect, herbs, 30-60 cm high. Leaves ovate with densely white margins, base auriculate. Flowers crowded, purplish-rose.

Common on hill slopes in Dibrugheta and Deodi-Ramni area, 3500-4500 m. Flowering and fruiting during in June August.

4. Rhodiola imbricata Edgew.

Perennial, erect, herbs, 7-35 cm high, stems many. Leaves oblong, entire. Flowers yellow, in terminal, dense, cymose heads.

Common on hill slopes amidst grasses and on mossy boulders around Milam area, 4000-5000 m. Flowering and fruiting during June September.

5. Rhodiola quadrifida (Pallas) Fischer et Meyer **Fig. 27.**

Perennial, erect, herbs, 5-15 cm high, stems many. Leaves oblong or linear-lanceolate. Flowers 1-6, in terminals cymes, red.

Common on hill slopes and in rock cliffs around Martoli, Dharansi, Sonwara-Dibrugheta area, 3500-4500 m. Flowering and fruiting during May September.

6. Rhodiola sinuata (Royle ex Edgew.) Fu

Perennial, erect, tufted herbs, 5-15 cm high. Leaves sinuate, pinnatifid. Flowers crowded in leafy cymes, white.

Common on hill slopes around Dibrugheta-Deodi area, 3000-4000 m. Flowering and fruiting during June October.

7. Rhodiola wallichiana (Hook.f.) Fu

Perennial, erect, herbs 20-25 om high with thick rootstocks, stems many. Flowers crowded, yellow.

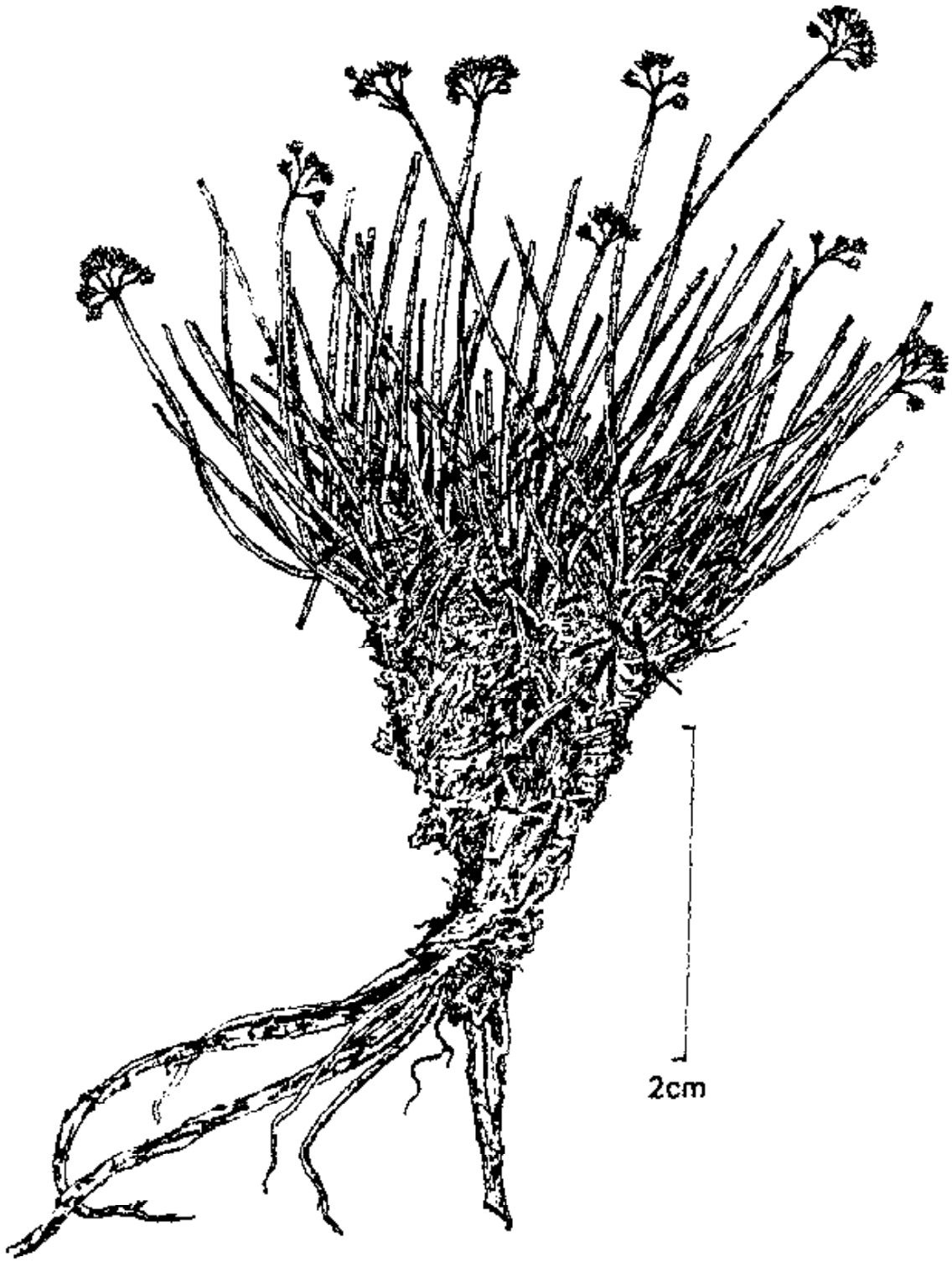


Fig. 27. Rhodiola quadrifida (Pallas) Fischer et Meyer

Common on hill slopes around Deodi-Dibrugheta, 3000-4500 m. Flowering and fruiting during June October.

2. SEDUM L.

The genus comprises 600 species; about 50 in India, mostly Himalayan, 2 in the Biosphere Reserve.

The generic name is derived from a Latin word *Seder* meaning to sit, referring to the habit of some of the species which grow on rocks.

1a.	Follicles 3-5, divaricate	**1. S. multicaule**
b.	Follicles 5, erect	**2. S. trullipetalum**

1. Sedum multicaule Wallich ex Lindl.

Perennial, erect herbs, 7-20 cm high, stems many from the base. Leaves cylindric. Flowers yellow.

Common on hill slopes and in rock crevices in shady places around Dharansi area, 3500-4500 m. Flowering and fruiting during July October.

2. Sedum trullipetalum Hook.f. & Thoms.

Perennial, erect herbs, 5-10 cm high. Cauline leaves imbricate, linear-lanceolate. Flowers yellow or yellowish-white.

Common on hill slopes and on mossy boulders in shady moist places along Ramni-Trisuligar River, 3500-4500 m. Flowering and fruiting during July October.

39. ONAGRACEAE
(Evening-Primrose family)

The family comprises 21 genera and over 640 species in the world; 4 genera and over 40 species in India, 3 genera and 5 species in Nanda Devi Biosphere Reserve area.

The plants are mostly herbaceous, a few are shrubs or trees, distributed mainly in temperate and tropical region of the world.

1a.	Petals 2; stamens 2	1. Circaea
b.	Petals 4; stamens 8	2
2a.	Capsules (Fruit) club shaped, 8-winged	3. Oenothera
b.	Capsules, elongated, 4-angled	2. Epilobium

1. CIRCAEA L.

The genus comprises over 10 species, 3 in India, only one species in Nanda Devi Biosphere Reserve.

These are herbs. Flowers are very small, white.

The generic name is derived from a Greek word *Circe*, referring to the famous enchantrees of Greek mythology.

Circaea alpina Linn.

Herbs, 5-45 cm high. Leaves broadly ovate. Flowers white, arranged in terminal racemes. Fruits 1 to 2-celled, 1 or 2-seeded.

Common on hill slopes around Latakharak and Deodi-Romni area at 2500-3500 m. Flowering and fruiting during July August.

2. EPILOBIUM L.

The genus comprises over 200 species in the world; 30 species occurring in India, 2 in Nanda Devi Biosphere Reserve.

The plants are mostly herbs with regular or irregular, purple-pink or white flowers.

The generic name is derived from Greek word *Epi* meaning upon and *lobes* meaning pod referring to the position of petals inserted upon the long pod-like ovary.

1a.	Stigma entire or slightly emarginate	**1. E. cylindricum**
b.	Stigma distinctly 4-lobed	**2. E. latifolium**

1. Epilobium cylindricum D. Don

Erect herbs, 25-90 cm high. Leaves sessile or very shortly petiolate, glabrous. Flowers regular, pink or pale-pink.

Found around Ramni, Deodi and Dharansi area, 3000-3500 m. Flowering and fruiting during July October.

2. Epilobium latifolium L.

Glabrous or pubescent herbs, 25-70 cm high. Leaves oblong, alternate. Flowers irregular, purple or pink, arranged in leafy inflorescence.

Common on hill slopes around Deodi-Ramni area at 3400-4500 m. Flowering and fruiting during July October.

3. OENOTHERA L.

The genus comprises 80 species in the world, distributed mostly in America and West Indies; 1 or 2 species in India, only one in the Biosphere Reserve.

The generic name is derived from the Greek word *Oinos* meaning wine and *thera* meaning a catching. In ancient times the roots of some of the species were eaten after meals as incentive to wine drinking.

Oenothera rosea Ait.

Erect herbs, 15-30 cm high. Leaves lanceolate, acuminate, glabrous or hairy. Flowers regular, pink. Fruit elongated, 4-angled.

Common in the buffer zone of the Reserve around Suraithota-Reni area, 1900-2400 m. Flowering and fruiting during May September.

40. APIACEAE
(Parsley family)

About 300 genera with over 2850 species, distributed throughout the world but abundant in North temperate region; about 53 genera and 198 species in India, 13 genera and 24 species in the Biosphere Reserve. Mostly aromatic herbs with hollow stems.

1a.	Leaves simple with entire margins	**2. Bupleurum**
b.	Leaves compound, margins not entire	2
2a.	Fruit tubercled; bractlets pinnate	3
b.	Fruit nor tubercled;, bractlets minute	5
3a.	Bractlets white margined	**9. Pleurospermum**
b.	Bractlets not white margined	4
4a.	Fruit ovate, ribs slender	**4. Chamaesciadium**
b.	Fruit prismatic to ellipsoid, ribs inflated	**12. Trachydium**
5a.	Fruit strongly compressed, lateral ridges broadly to narrowly winged	6
b.	Fruit terete or compressed, lateral ridges not winged	7
6a.	Dorsal and internal ridges small or absent	**6. Heracleum**
b.	Dorsal and internal ridges very prominent to narrowly winged	**10. Selinum**
7a.	Fruit linear to cylindrical or ellipsoid, more than 4 times longer than the broad	**3. Chaerophyllum**
b.	Fruit ovate to ovoid, not more than 3 times longer than broad	8
8a.	Fruit pubescent to pilose or hipped	9
b.	Fruit glabrous or scaly	11
9a.	Fruit 2-3-vittate, laterally compressed	**8. Pimpinella**
b.	Fruit 1-vittate, densely compressed, or slightly laterally compressed	10
10a.	Rays 2-10; fruit slightly laterally compressed	**5. Eriocycla**
b.	Rays 10-50; fruit subterrate to dorsally compressed	**11. Seseli**
11a.	Carpels concave on inner face	**13. Vicatia**
b.	Carpels plane or very slightly concave on inner face	12
12a.	Roots tuberous	**1. Acronema**
b.	Roots not tuberous	**7. Ligusticum**

1. ACRONEMA (Wallich) Falc. ex Edgew.

Herbs or shrubs, comprising about 15 species in the world; 2 in India, 1 in the Biosphere Reserve.

The generic name is derived from Greek word *Akros* means summit and *Nema* meaning filament.

Acronema tenera (DC.) Edgew.

Semierect, perennial, tuberous herbs, 15-25 cm high. Lower cauline leaves pinnate. Fruit ovate-oblong, narrowed upward, green, glabrous.

Common around Ramni and Bujgar area, on hill slopes and along the bridal path, 2300-4000 m. Flowering and fruiting during July - October.

2. BUPLEURUM L.

Mostly perennial herbs, comprising about 150 species in the world; about 16 species in India, 4 in the Biosphere Reserve.

The generic name is derived from a Greek word *Bupleurous* meaning ox-rib.

1a.	Leaves distinctly petioled	**4. B. lanceolatum**
b.	Leaves sessile or amplexicaule	2
2a.	Leaves oblong-ovate or ovate-lanceolate	**1. B. candollii**
b.	Leaves linear or lincar-oblong	3
3a.	Leaves spathulate; bracts usually absent	**2. B. falcatum var. marginatum**
b.	Leaves not spathulate; bracts 1-4	**3. B. hamiltonii**

1. Bupleurum candollii Wallich ex DC.

Erect, perennial herbs, 15-30 cm high. Leaves oblong, coriaceous, acute or obtuse. Flowers yellow or greenish-yellow.

Common on open hill slopes amidst grasses around Belta-Lata Kharak and Himtoli area, 2500-4000 m. Flowering and fruiting during June October.

2. Bupleurum falcatum var. marginatum (Wallich ex DC.) C.B. Clarke

Erect, perennial herbs, 0.3-1 m high. Leaves linear, margins cartilaginous, somewhat curved. Flowers pale-yellow. Fruit green.

Common around Lata-Suraithota along the bridal path amidst grasses and in Himtoli area, 1200-2000 m. Flowering and fruiting during July October.

3. **Bupleurum hamiltonii** Balak.

Erect, perennial herbs, 0.3-1 m high, stem flexuous. Leaves narrowly oblong, punctate. Flowers yellow or greenish-yellow.

Common around Tolma area in shady places amidst grasses, 2000-3000 m. Flowering and fruiting during June - October.

4. **Bupleurum lanceolatum** Wallich ex DC.

Stout, erect, perennial herbs, 0.3-1.5 m high. Lower cauline leaves ovate-lanceolate, distinctly petiolate. Flowers yellowish.

Common on hill slopes and along the bridal path amidst grasses, around Suraithota-Tulma and Lata-Belta area, 1500-3000 m. Flowering and fruiting during June-September.

3. CHAEROPHYLLUM L.

Glabrous or hairy, mostly annual or perennial herbs. Comprising about 40 species in the world; 5 in India, 2 in the Biosphere Reserve.

The generic name is derived from Greek word *Chairo* meaning to rejoce and *Phyllon* meaning leaf, referring to the fragrant smell of flowers.

1a.	Stems and leaves stiff hairy, hairs projecting downwards	2. C. villosum
b.	Stems and leaves glabrous or slightly hairy	1. C. reflexum

1. **Chaerophyllum reflexum** Lindl.

Erect, perennial herbs, 0.15 to 1 m high, with tuberous, rootstocks, stems glabrous or sparsely hairy. Leaves ternate-pinnate. Flowers white or pinkish white, rays 6. Fruit oblong green.

Common on hill slopes in shady places amidst grasses, around Himtoli area and Belta-Latakharak, 2000-3000 m. Flowering and fruiting during June September.

2. Chaerophyllum villosum Wallich ex DC.

Erect, perennial herbs. 0.3-1 m high, with tuberous rootstocks, stems hairy. Leaves ternate-pinnate. Flowers white or whitish-pink. Fruits densely hairy.

Common around Tolma-Himtoli and Lata-Latakharak area in shady places on the hill slopes and along the bridal path, 2000-3000 m. Flowering and fruiting during July October.

4. CHAMAESCIADIUM H. Wolff

Mostly perennial herbs, comprising about 7 species; 1 or 2 in India; 1 in the Biosphere Reserve.

The generic name is derived from Greek word *Chamai* meaning dwarf and *sium* meaning ancient, referring to its resemblance to genus *Sium*.

Chamaesciadium garhwalicum (H. Wolff) Norman.

Erect, stout perennial herbs, 10-25 cm high, with thick woody rootstock. Leaves are pinnatisect, glabrous. Flowers yellowish-white. Rays ca 15. Fruits green.

The plant grows in shady places on hill slopes. Not common, occurring around Dharansi area, 3000-4000 m, flowering and fruiting in July - October.

5. ERIOCYCLA Lindl.

The genus comprises about 7 species, mostly distributed in alpine region, 1 in the Biosphere Reserve.

Eriocycla caespitosa (Edgew.) H. Wolff

Tufted, perennial herbs, 6-25 cm high, stems with many lateral branches, pubescent. Flowers yellowish-white, rays 4-8. Fruit villous when young.

Not common, growing on hill slopes in sandy soils, around Sarsupatal area, 3000-4000 m. Flowering and fruiting during June- September.

6. HERACLEUM L.

The genus is represented by about 75 species in the world; 20 in India, 2 in the Biosphere Reserve. Plants of this genus are mostly perennial herbs, highly aromatic, some are of great medicinal importance.

The generic name is derived from a Greek word *Herakles*, ancient Greek name of a plant sacred to Hercules.

1a.	Fruit whitish; leaves bipinnate	**2. H. thomsonii**
b.	Fruit brownish; leaves ternate	**1. H. lanatum**

1. Heracleum lanatum Michx.

Tall, erect, perennial, robust herbs, 0.3-2 m tall. Leaves compound. Flowers yellow to greenish yellow. Fruit orbicular to ovate.

Common throughout the area around Tolma-Himtoli on hill slopes, 2000-3000 m. in association with *Geranium, Snecio, Polygonum* sp. Flowering and fruiting during April August.

2. Heracleum thomsonii C.B. Clarke

Erect, annual or perennial herbs, 15-30 cm high, stems grey pubescent. Leaves 2-pinnate. Flowers white. Fruits elliptic, white, pubescent.

Not common, found on open hill slopes in sandy soils around Malari and Latakharak area, 3000-4000 m. Flowering and fruiting during June September.

7. LIGUSTICUM L.

Mostly perennial herbs, comprising about 100 species in the world; 18 in India, only 1 the Biosphere Reserve. Flowers white.

The genus is named after Liguria, the Italian province where these plants are found in abundance.

Ligusticum elatum (Edgew.) C.B. Clarke

Tall, erect, perennial herbs, 0.7-1 m high, stems glabrous. Leaves 1-2 pinnate. Flowers white. Fruit ovate, glabrous.

Common, on hill slopes amidst grasses around Himtoli and Donagiri area, 2000-3000 m. Flowering and fruiting during July October.

8. PIMPINELLA L.

Annual or perennial herbs, comprising about 150 species; 30 in India, 1 in the Biosphere Reserve. Some are cultivated for the fruit which are used in perfume industry.

Pimpinella is a corrupted from of a Latin word *Bipennula* indicating 2-pinnate leaves.

Pimpinella diversifolia DC.

Tall, erect, perennial or annual herbs, 0.6-1.5 m high, stems hairy. Leaves 1-pinnate. Flower white.

The plants are common along the road side in Lata-Suraithota area and along the bridal path and hill slopes around Suraithota-Tolma area, 1500-2000 m. Flowering and fruiting during May September.

9. PLEUROSPERMUM Hoffm.

Mostly perennial herbs, comprising about 80 species; 14 in India, 4 are in the Biosphere Reserve. Some are of good medicinal importance.

The generic name is derived from Greek word *Pleura* meaning riband and *sperma* meaning seed, referring to ribbed seeds.

1a. Bracts entire or toothed at the apex **1. P. angelicoides**
b. Bracts pinnatifid at the apex 2

2a.	Bracteols 6-10, ovate lanceolate	**4. P. stylosum**
b.	Bracteols 5-8, oblong or elliptic	3
3a.	Leaves 1-2 pinnate; fruit dorsally compressed	**3. P. stellatum**
b..	Leaves 3-4 pinnate; fruit ellipsoid	**2. P. densiflorum**

1. Pleurospermum angelicoides (DC.) C.B. Clarke

Very robust, perennial herbs 1-2 m tall. Leaves 2-pinnate, pinnae ovate-oblong or elliptic, dentate or serrate. Flowers white, rays 10-30. Fruit oblong-elliptic, green.

Common around Himtoli and Dibrughata, on hill slopes amidst grasses, 2500-4000 m, in association with *Polygonum Geranium, Anemone,* etc. Flowering and fruiting during July October.

2. Pleurospermum densiflorum (Lindl.) C.B. Clarke

Erect, perennial herbs, 10-30 cm high, stems glabrous. Leaves 2-ternately decompound, segment linear-lanceolate. Flowers white, rays 8-12. Fruits ellipsoid.

Common around Dharansi area on hill slopes amidst grasses and along the bridal path and hill slopes in Donagiri area, 3000-4000 m. Flowering and fruiting during July October.

3. Pleurospermum stellatum (G. Don) C.B. Clarke

Perennial, erect herbs, up to 30 cm high. Flowers white, stems glabrous. Leaves pinnately divided, leaflets ovate-pinnatifid.

Not common, to growing on hill slopes in sandy soils around Dunagiri area towards glacier, 3000-4000 m. Flowering and fruiting during July - September.

4. Pleurospermum stylosum C.B. Clarke

Erect, perennial, robust, herbs, 40-70 cm high. Leaves pinnately divided, leaflets ovate, pinnatifid. Flowers white, rays 10-35. Fruit longer than wide.

Not common, growing on hill slopes around Himtoli area amidst grasses, 2500-3500 m. Flowering and fruiting during July October.

10. SELINUM L.

About 35 species, mainly in North temperate region in S. Africa; 5-6 species in India, 4 in the Biosphere Reserve.

The generic name is derived from a Greek word *Selinon* a name for Parsley, referring to the resemblance of leaves.

1a.	Fruit dorsally much compressed	2
b.	Fruits subquadrate	3
2a.	Dorsal and intermediate ridges distinctly winged	**2. S. elatum**
b.	Dorsal and intermediate riges not winged or with indistinct wings	**4. S. wallichianum**
3a.	Secondary pinnae pinnatifid; bractiols often lobed	**1. S. candollii**
b.	Secondary pinnae serrate, scarcely lobed or pinnate; bracteols 1-2 pinnate	**3. S. vaginatum**

1. Selinum candollii DC.

Perennial herbs, 0.9-1 m high, stems fistular. Leaves ternately compound. Flowers white, rays 10-35. Fruit elliptic.

Common, on hill slopes on way to Ramni from Deodi amidst grasses and along the bridal path, 3000-4000 m. Flowering and fruiting during July October.

2. Selinum elatum (Edgew.) Hiroe

Tall, erect, pubescent, perennial herbs, stems fistular. Leaves decompound. Umbels leaf-opposed; flowers white, rays 20, unequal. Fruit dorsally compressed.

Common, on hill slopes around Dibrugheta amidst grasses, 2500-4000 m. Flowering and fruiting during July October.

3. Selinum vaginatum (Edgew.) C.B. Clarke

Tall erect, perennial, herbs, 0.2-1 m high glabrous & hairy. Leaves 2-pinnate to 3-pinnate. Flowers white, rays 15-30. Fruit oblong.

Common on hill slopes around Himtoli area amidst grasses, 2000-4000 m. Flowering and fruiting during July October.

4. Selinum wallichianum (DC.) Raizada et Saxena

Perennial, erect herbs, 1-1.5 m high, well branched, stems fistular. Leaves 2-pinnate. Flowers white. Fruit elliptic-ovoid.

Common around Himtoli and Latakharak area 2000-4000 m, amidst grasses in association with a *Geranium & Polygonum* species. Flowering and fruiting during July-October.

11. SESELI L.

Annual or perennial herbs, comprising about 75 species, 6 in India, only 1 in the Biosphere Reserve. Few are medicinal.

Sesali is a Greek name used by Hippocrates for an umbeliferous plant.

Seseli sibiricum (L.) Boiss.

Tall, erect perennial herbs, ca 1 m high, stems pubescent. Flowers white, umbels terminal and lateral, rays ca 30, unequal. Fruit densely villous.

Not common, found around Himtoli area on hill slopes amidst grasses, 2500-3500 m. Flowering and fruiting during June September.

12. TRACHYDIUM L.

Mostly perennial herbs, comprising about 15 species; 3-4 in India, 1 in the Biosphere Reserve. A few are undershrubs as well.

The generic name is derived from Greek word *Trachys* meaning rough and *eidus* meaning like.

Trachydium roylei Lindl.

Dwarf, stunted, perennial, fistular herbs, stems reduced with thick woody rootstocks. Leaves mostly radical, membranous. Flowers white or pinkish-white. Fruit ellipsoid.

Few, on hill slopes, around Dharansi area in the core zone of Biosphere Reserve 3000-4000 m. Flowering and fruiting during June October.

13. VICATIA DC.

A small genus with only 5 species in the world, distributed mainly in Himalaya; 3 in India, only one in the Nanda Devi Biosphere Reserve.

Vicatia coniifolia DC.

Slender, annual or perennial herbs, 10-40 cm high. Leaves pinnately compound or pinnatisect. Flowers purple. Fruit glabrous.

Common around Himtoli area amidst grasses, 2000-3500 m. Flowering and fruiting during May September.

41. ARALIACEAE
(Ginseng family)

A cosmopolitan family comprises about 55 genera and 700 species, distributed mainly in Indomalayan region; 2 genera and 2 species in the Biosphere Reserve. Plants of this family are mostly trees or shrubs, very rarely herbs.

1a.	Prickly shrubs; leaves compound	**1. Acanthopanax**
b.	Evergreen, climbing shrubs, not prickly; leaves simple	**2. Hedera**

1. ACANTHOPANAX Miq.

The genus comprises about 15 species; 2 in India, only one in the Biosphere Reserve. Shrubs or small trees, glabrous, with palmate or digitate leaves.

The generic name is derived from Greek word *Akantha* meaning thorn (spine) and *Panax* meaning ginseng.

Acanthopanax cissifolius (Griff. ex Seem.) Harms

Erect, prickly shrubs, 2.5 m high, stems glabrous. Leaves digitately compound, leaflets serrate. Flowers greenish-yellow. Fruit glabrous.

Few, growing on hill slopes and on rocks around Dibrugheta and Sonnwara, 2500-3500 m. Flowering and fruiting during May September.

2. HEDERA Linn.

The genus comprises about 15 species; only one in India and the Nanda Devi Biosphere Reserve.

Hedera is a Latin name for Ivy. This name is probably derived from Celtic word Hedrâ, signifying a cord.

Hedera nepalensis Koch.

Evergreen climbing shrubs, stems woody. Leaves very variable, coriaceous. Flowers green. Fruit greenish-yellow, orange, globose berries.

Common on rocks around Dibrugheta-Sonwara area, 2000-3000 m. Flowering and fruiting during March October.

42. CORNACEAE
(Dogwood family)

The family comprises about 13 genera and 100 species in the world, mostly in tropical and North temperate regions; about 7 genera and 14 species in India, one genus and species in the Biosphere Reserve. Trees or shrubs. Very rearly herbs.

CORNUS L.

Many species of this genus have been recently transferred to *Bothrocaryum*, *Dendrobenthamia* and *Swida*.

The *Cornus* means a horn in Latin, referring to the wood of the plants which is hard and durable as horn.

Cornus macrophylla Wallich

Deciduous trees, 15-30 m high. Leaves opposite, adpressed hairy. Flowers cream-white, in branched cymes, scented. Fruit ovoid, purplish-black.

Common throughout the hills in forested areas around Sonwara, Pangrani area, 1800-2500 m. Flowering and fruiting during May October.

43. CAPRIFOLIACEAE

(Honeysuckle family)

The family comprises about 18 genera and 450 species in the world, mainly in Eastern North America and Eastern Asia. The plants are mostly shrubs or trees, a few are herbs.

1a.	Flowers regular; fruit 1-seeded	2
b.	Flowers irregular; fruit more than 1-seeded	3
2a.	Calyx lobes elongated, feathery	**1. Abelia**
b.	Calyx lobes slightly toothed	**5. Viburnum**
3a.	Fruit 3-seeded; tall, hirsute herbs	**4. Triosteum**
b.	Fruit many seeded; shrubs or small trees	4
4a.	Corolla tube oblique; stems solid	**3. Lonicera**
b.	Corolla tube not oblique; stems hollow	**2. Leycesteria**

1. ABELIA Brown

The genus comprises about 30 species; one in India and the Biosphere Reserve.

This genus is named after Dr C.B. Clarke Abel, Physician to Lord Amherst's Embassy in Peking.

Abelia triflora R. Br. ex Wallich

Shrubs, 2.5 m high. Leaves lanceolate or obovate-lanceolate, ciliate on margins when young. Flowers white or white tinged with pink, fragrant, clustered at the end of branches.

Found around Belta-Latakharak area, 2500-3000 m. Flowering and fruiting during May September.

2. LEYCESTERIA Wallich

The genus comprises about 6 species; 5 in India and only one in the Biosphere Reserve the plants are undershrubs. Flowers are whorled in spikes.

This genus is named after illium Leycester, Chief Judge of Bengal, a patron of horticulture and frier of N. Wallich.

Leycesteria formosa Wallich ex Roxb.

Deciduous shrubs, 1.5-2.5 m high. Leaves ovate or ovate-lanceolate. Bracts leaf like. Flowers ca 2 cm long, white or pink. Fruit 1.2 cm long, ovoid or ellipsoid berries, red turning black.

Common along the Rishiganga, on rocks and hill slopes in moist shady forest, 1500-2500 m. Locally known as "Bhenlear". Flowering and fruiting during April August.

3. LONICERA L.

This is one of the largest genera of the family comprising about 200 species in the world; 40 in India, 5 in the Biosphere Reserve. The plants are erect or scandent to prostrate herbs.

The genus is named after Adam Lonicer, a German Botanist and Physician.

1a.	Corolla prominently 2-lipped	2
b.	Corolla not distinctly 2-lipped	3

2a.	Leaves more than 2.5 cm long	**5. L. webbiana**
b.	Leaves less than 2 cm long	**1. L. hypoleuca**
3a.	Leaves more than 2.5 cm long	**3. L. purpurascens**
b.	Leaves less than 2 cm long	4
4a.	Leaves linear	**4. L. spinosa**
b.	Leaves elliptic-oblong, or oblong-lanceolate, never linear	**2. L. obovata**

1. Lonicera hypoleuca Decne.

Much branched, deciduous shrubs, 1-4 m high, stem woody. Leaves broadly ovate-orbicular, pubescent-tomentose. Flowers yellow.

Common on open hill slopes in sandy soils around Malari area, 2800-3500 m. Flowering and fruiting during May - September.

2. Lonicera obovata Royle ex Hook.f & Thoms. **Fig. 28.**

Deciduous, shrubs, 1-2 m high. Leaves obovate or elliptic-obovate. Flowers creamy-white or greenish-yellow. Fruit ca 1.2 cm long berries, ovoid, blue-black.

Common on rocks hill slopes throughout the area around Ramni and Dharansi in alpine region, 3000-4000 m. Flowering and fruiting during May September.

3. Lonicera purpurascens Walp.

Deciduous erect, shrubs, 1-20 m high, young shoots purplish, glabrous. Leaves elliptic, oblong or lanceolate, opposite. Flowers in pairs, pink-purple, funnel shaped. Fruits globose.

Common on open hill slopes in alpine region 2800-4000 m, around Martoli area. Flowering and fruiting during May September.

4. Lonicera spinosa (Decne.) Jacq. ex Walp.

Deciduous, branched shrubs, 0.3-1 m high. Leaves linear-oblong, pale beneath, margins recurved. Flowers ca 1.4 cm long, white or whitish-pink. Fruits ca 0.5 cm long, ellipsoid, berries.

Fig. 28. Lonicera obovata Royle ex Hook.f. & Thoms.

Found around Dibrugheta - Sarsupatal and Milam. 3700-4500 m. Flowering and fruiting during May - July.

5. Lonicera webbiana Wallich ex DC.

Medium sized or large, deciduous shrubs, up to 5 m high. Leaves 2-4 cm long, variable, elliptic to oblong-lanceolate, tomentose or pubescent beneath. Flowers 0.9-0.7 cm long, ovoid, red.

Common on hill slopes, in core zone around Dharansi-Dibrugheta, 2500-3500 m. Flowering and fruiting during May September.

4. TRIOSTEUM L.

About 10 species in the world; only one in India and the Biosphere Reserve.

The generic name is derived from a Greek word *Tri* meaning three and *osteum* meaning a bone, referring to three hard seeds.

Triosteum hirsutum Wallich

Annual or perennial, herbs or undershrubs, ca 1 m high, stems with spreading hairs, rootstocks thick. Leaves 0.6-1.2 cm long, obovate-elliptic. Flowers ca 0.8 cm long, whorled, greenish outside, purplish inside. Fruit ovoid or ellipsoid.

Not common, grows on hill slopes around Himtoli area, 3000-3500 m. Flowering and fruiting during June August.

5. VIBURNUM L.

Shrubs or small trees; about 200 species; 17 in India, 2 in the Biosphere Reserve. The buds and fruits of some species are edible.

The generic name is derived from Latin word *Vieo* meaning to tie, referring the pliability of some of the branches.

1a.	Flowers in panicled or thyrisiform cymes	2. *V. erubescens*
b.	Flowers in corymbs	1. *V. cotinifolium*

1. Viburnum cotinifolium D. Don

Deciduous shrubs, 2-5 m high, twigs stellately tomentose. Leaves ovate, elliptic or suborbicular, pubescent. Flowers ca 0.8 cm long, in corymbose cymes, whitish tinged with pink. Fruit oblong, red turning black.

Common throughout the area in cold temperate forests, 1800-3000 m. Flowering and fruiting during March October.

2. **Viburnum erubescens** Wallich ex DC.

Deciduous shrubs, 2-4 m high, stems glabrous. Leaves elliptic or elliptic-oblong, sharply toothed, lower surface pubescent. Flowers ca 0.8 cm long, in terminal drooping panicles, white tinged with pink. Fruit ellipsoid red.

Not common, grows along the bridal path around Dibrugheta, 2500-3000 m. Flowering and fruiting during May - June.

44. RUBIACEAE
(Madder family)

The family comprises about 500 genera and over 7000 species, distributed mostly in tropical and temperate regions, about 76 genera and 274 species in India, 3 genera and 6 species in the Biosphere Reserve.

1a.	Flower enclosed by membranous tubular bracts; shrubs	2. *Leptodermis*
b.	Flowers not enclosed by bracts; herbs	2
2a.	Extensive climbers; leaves cordate	3. *Rubia*
b.	Trailing, twining or scandent herbs; leaves in whorl, not caudate	1. *Galium*

1. GALIUM L.

A cosmopolitan genus comprising about 400 species in the world; about 25 species in India, 3 in Nanda Devi Biosphere Reserve. Annual or perennial herbs, with whorled stipulate leaves.

The generic name is derived from Greek word *Gala* meaning milk, referring to the practice of using some of the species for curding of milk for cheese making.

1a.	Fruits smooth; prostrate herbs	**1. G. acutum**
b.	Fruits hooked, bristly; trailing herbs	**2**
2a.	Leaves 3-nerved from the base, 4 in a whorl	**3. G. elegans**
b.	Leaves laterally nerved, 6-8 in a whorl	**2. G. aparine**

1. Galium acutum Edgew.

Scandent herbs, stems interlaced, smooth. Leaves very small, six in a whorl. Flowers white, minute. Fruit smooth.

Common in core zone area around Deodi and Dibrugheta, 2500-4000 m. Flowering and fruiting during July October.

2. Galium aparine L.

Trailing herbs, stems prickly. Leaves 6-8 in a whorl, linear, mucronate, bristly. Flowers white tinged with green. Fruits with hooked bristles.

Common around Himtoli on hill slopes amidst grasses and twining over bushes, 2800-4000 m. Flowering and fruiting during July October.

3. Galium elegans Wallich ex Roxb.

Trailing herbs. Leaves 4 in a whorl, ovate, 3-nerved from the base. Flowers white tinged with yellow.

Common in temperate regions in shady places, ascending up to 2500 m. Flowering and fruiting during June August.

2. LEPTODERMIS Wallich

The genus comprises about 30 species in the world, distributed mainly from Himalaya to Japan; 5-7 species in India, 2 in the Biosphere Reserve.

The generic name is derived from the Greek word *Leptos* meaning slender and *Desmos* meaning bond, referring to the nature of the fruit in allusion to the slender jointed pods.

1a.	Corolla pubescent on outer surface; leaves densely hairy	**1. L. kumaonensis**
b.	Corolla glabrous outside; leaves glabrous or sparsely hairy	**2. L. lanceolata**

1. Leptodermis kumaonensis Parker

Erect, deciduous shrubs, 1-2 m high, stems glabrous. Leaves lanceolate or elliptic, entire, crowded at the tips. Flowers white or purplish, solitary or 3-5 in clusters. Fruits ca 6 cm long.

Common in cold temperate forest areas, around Ramni and Martoli area, 3700-4500 m. Flowering and fruiting during May-November.

2. Leptodermis lanceolata Wallich

Erect, deciduous shrubs, 1.5-3.5 m high, stems glabrous. Leaves lanceolate, entire. Flowers creamy white to pink purple in head-like clusters. Fruit sub-cylindric.

Common throughout the area in valleys and also in waste lands, 1500-2500 m. Flowering and fruiting during May December.

3. RUBIA L.

The genus comprising often climbing herbs has about 60 species in the world, distributed mainly in Western and Central Europe, Mediterranean, tropical South and East Africa, Asia and tropical America; 9-10 species in India, one in the Biosphere Reserve.

The generic name is derived from a Latin word *Ruber* meaning red, referring to the reddish dye obtained from the roots.

Rubia manjith Roxb. ex Flem.

Extensive, herbaceous climbers, stems acutely 4-angled, prickly. Leaves ovate, entire, prickly. Flowers pinkish-brown or reddish, in axillary branched cymes. Fruit globose, dark purple.

Common throughout the area near cultivated fields along the bridal path and in forest areas, 1500-2500 m. Flowering and fruiting during June October.

45. VALERIANACEAE
(Valerian family)

The family comprises 13 genera and about 400 species in the world, distributed mainly in Northern Hemisphere and South America; 4 genera and 14 species in India; 2 genera and 3 species in the Biosphere Reserve. Annual or perennial herbs, very rarely shrubs.

1a.	Calyx enlarged in fruit; stamens 4	**1. Nardostachys**
b.	Calyx pappose in fruit; stamens 3	**2. Valeriana**

1. NARDOSTACHYS DC.

Only two species are known, both are Himalayan, 1 species in the Biosphere Reserve. The plants are of immense medicinal importance.

The generic name is derived from Greek word *Nardos*, the Indian spikenard and *stachys* meaning spike.

Nardostachys grandiflora DC. **Fig. 29.**

Perennial, erect herbs, 20-30 cm high, root stocks thick, stout, covered with fibrous leaf sheaths. Leaves spathulate, oblong or sub-ovate. Flowers pink. Fruit compressed.

Not common, found on hill slopes in Ramni Bhujgara, Rupkund-Baguvabasa and Martoli-Milam area, 3000-4000 m. Flowering and fruiting during July October.

2. VALERIANA L.

About 250 species in the world; 12 in India, 2 in the Biosphere Reserve. Mostly perennial herbs; a few are of great medicinal importance.

The generic name is derived from the Latin word *Valere* meaning healthy, referring to its medicinal properties.

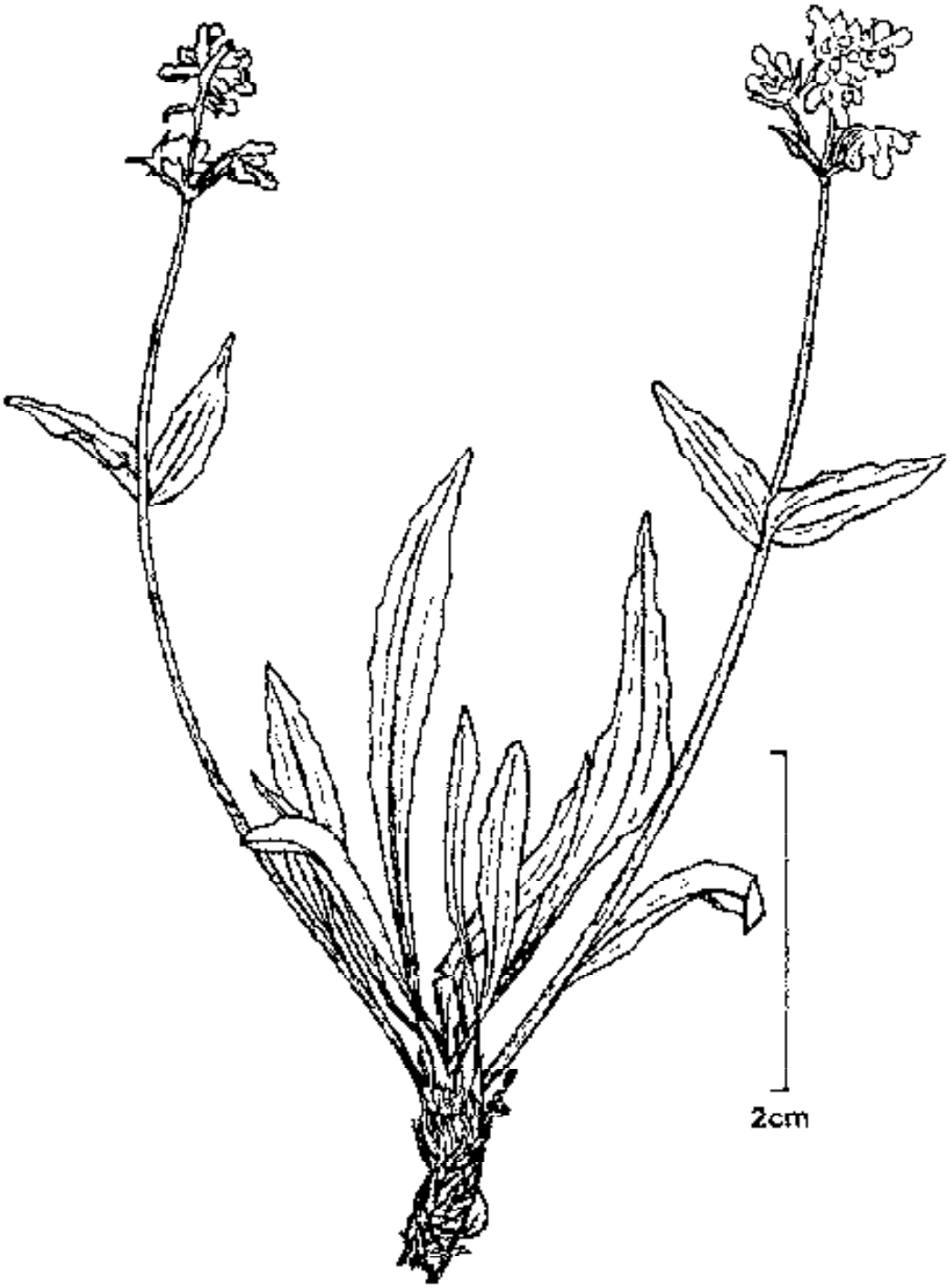


Fig. 29. Nardostachys grandiflora DC.

1a.	Radical leaves persistent; glabrous herbs; fruits glabrous	**1. V. dioica**
b.	Radical leaves not persistent; pubescent herbs; fruit hairy	**2. V. hardwickii**

1. Valeriana dioica L.

Perennial, decumbent, stoloniferous herbs, 10-30 cm high. Radical leaves persistent, ovate, entire, long petioled, cauline leaves pinnatifid. Flowers pale-pink. Fruit glabrous.

Common on hill slopes amidst grasses around Dharansi in core zone of the Biosphere Reserve, 3000-4000 m. Flowering and fruiting during May September.

2. Valeriana hardwickii Wallich

Perennial erect herbs, ca 50 cm high, stems glabrous. Radical leaves not persistent, cauline leaves pinnately compound, hairy. Flowers pinkish-white, in dichotomously branched corymbose cymes.

Not common, found on hill slopes amidst grasses around Deodi and Dibrugheta, 2000-3000 m. Flowering and fruiting during June October.

46. DIPSACACEAE
(Teasel family)

A small family with 4 genera and about 15 species, distributed mainly in Europe, Eastern Asia, Central and Southern Africa.

1a.	Flowers in axillary clusters; leaves spinous toothed	**2. Morina**
b.	Flowers not in axillary clusters; leaves not spinous toothed	2
2a.	Flowers in terminal head-like clusters, white	**1. Dipsacus**
b.	Flowers in 2-3-chotomous cymes, pale-blue	**3. Triplostegia**

1. DIPSACUS L.

Perennial herbs; comprising about 15 species, 6 in India, only one in the Biosphere Reserve.

The generic name derived from Greek word *Dipsa* meaning thirst, referring to the leaves holding water.

Dipsacus inermis Wallich

Tall, erect herbs, stems ribbed, stiff hairy, scabrid. Lower leaves pinnatifid, toothed, upper leaves mostly 3-lobed. Flowers white, in dense, terminal heads.

Common throughout in cold temperate forests around Tolma-Himtoli, 1800-3000 m. Flowering and fruiting during July October.

2. MORINA L.

Perennial herbs, comprising about 10 species, distributed mainly in temperate and alpine Himalaya. 2 in India, both are present in the Biosphere Reserve.

The genus is named after Henery Geroge Moon, a Botanist of Sri Lanka.

1a.	Flowers pink; bracteols shorter than the calyx	2. **M. longifolia**
b.	Flowers yellow; bracteols equalling the calyx	1. **M. coulteriana**

1. Morina coulteriana Royle **Fig. 30.**

Erect herbs, 30-50 cm high, stems simple. Leaves oblong, spinous toothed, whorled. Flowers yellow, crowded in whorls in interrupted spikes, supported by leafy bracts.

Common in cold temperate and alpine regions on open hill slopes or under *Juniperus* bushes around Milam area, 3000-4000 m. Flowering and fruiting during June October.

2. Morina longifolia Wallich ex DC. **Fig. 31.**

Erect herbs, ca 50 cm high, stems simple. Leaves oblong, spinous-toothed, sessile. Flowers pink, crowded in whorls in interrupted spikes supported by leafy bracts.

Common on open hill slopes in gravel soils, in cold temperate and alpine region throughout the area, 3000-4000 m. Flowering and fruiting during June - October.

Fig. 30. Morina coulteriana Royle

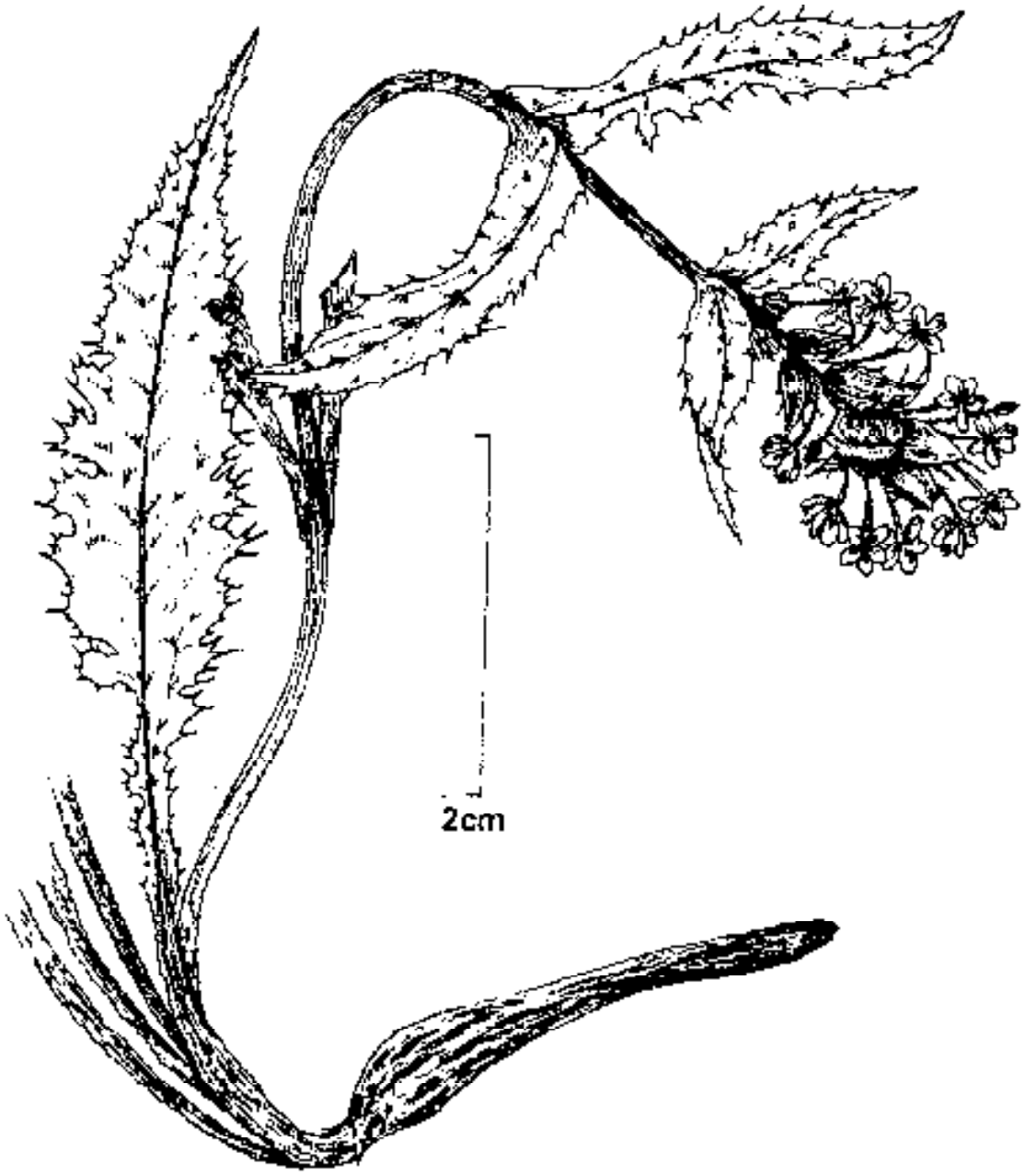
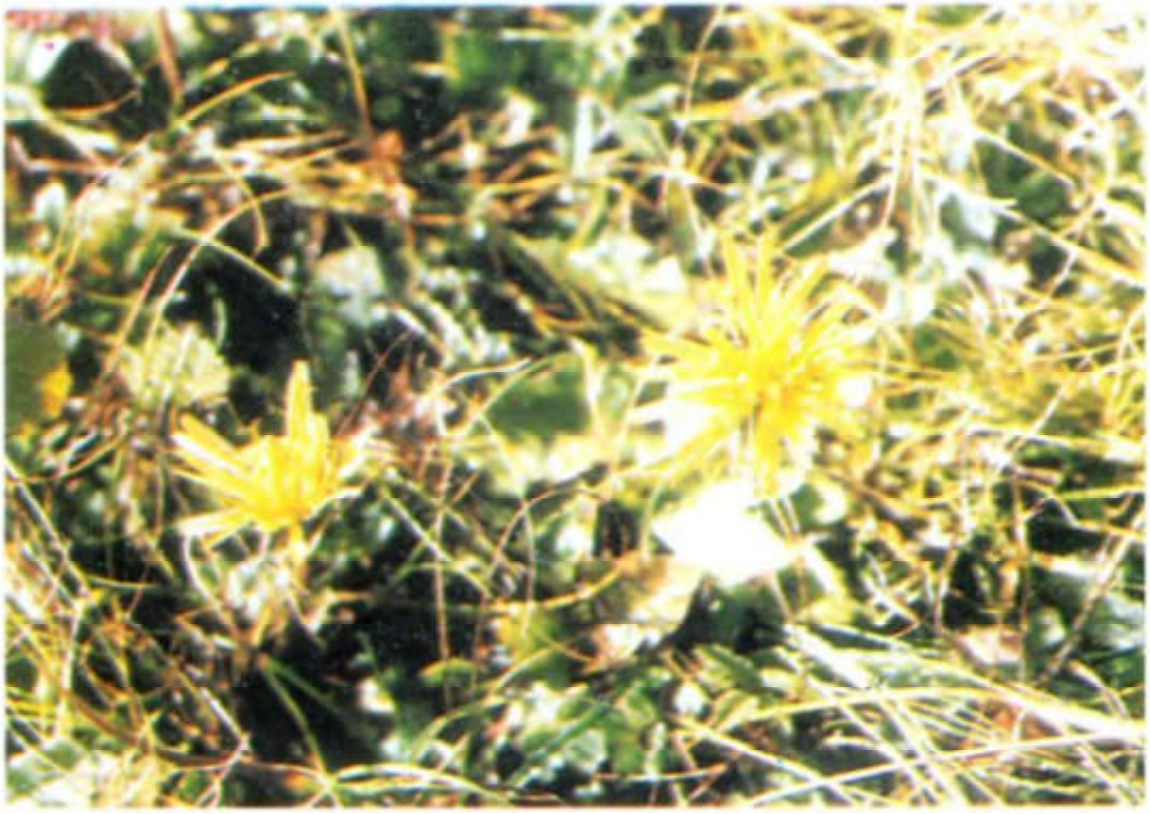


Fig. 31. Morina longifolia Wallich ex DC.

Epilobium latifolium L.

Saussurea obvallata (DC.) Edgew.



Taraxacum officinale Weber

Waldhemia tomentosa (Decne.) Regel

Saussurea simpsoniana (Field. & Gard.) Lipschitz

Euphrasia Sp.

Cassiope fastigiata (Wallich) D. Don

Cyananthus microphyllus Edgew.

Gaultheria trichophylla Royle

Rhododendron arboreum Sm.

3. TRIPLOSTEGIA Wallich ex DC.

The genus comprises only 2 species in the world; 1 in India and the Biosphere Reserve.

The generic name is derived from a Latin word *triplex* meaning triple and *stegia* meaning roof.

Triplostegia glandulifera Wallich ex DC.

Erect herbs, stems well branched, pubescent. Leaves pinnatifid or deeply toothed. Flowers small, pale-blue. Fruits shortly beaked.

Not common, found on hill slopes amidst grasses around Bedni bugyal-Rupkund area, 3300-4000 m. Flowering and fruiting during May - September.

47. ASTERACEAE (Daisy or Aster family) (Compositae)

One of the largest families consisting largely of herbaceous perennials, biennials or annuals; often with latex; some are shrubs or small trees. The family is characterised by involucrate inflorescence head, the 5-lobed gamopetalous corolla, the unusual presence of pappus/scales/awns in place of calyx, the inferior bicarpellate, unilocular ovary with a single basal ovule and the achene type of fruits.

The family comprises little over 1100 genera, and about 30,000 species, distributed more or less throughout the globe, particularly abundant in the Mediterranean, semi-arid temperate and mountain regions of the world; about 167 genera and 1052 species in India, ca 4 genera and 82 species in Nanda Devi Biosphere Reserve.

Economically the family is important as the source of sunflower oil (often cultivated in the Buffer zone at the edge of Potato field). Many plants are useful in medicines. Several plants are of ornamental value e.g. *Tagetes*, *Chrysanthemum*, *Dahlia* etc.

1a. Capitula entirely ligulate; disc florets absent, sap milky (Sub family Cichorioideae) Cichorieae

b. Capitula radiate or disciform; disc florets tubular, 5-lobed; sap watery (Sub family Asteroideae) 2

2a.	Anther tips without distinct tongue like, hyaline appendages; phyllaries spinescent	Mutisieae
b.	Anther tips with distinct tongue like, hyaline appendages; phyllaries spinescent or not	3
3a.	Head discoid, homogamous; receptacle naked; corolla never yellow	Eupatorieae
b.	Heads radiate or rarely discoid, homogamous; receptacle naked or with paleas; corolla yellow or otherwise	4
4a.	Involucral bracts usually spinescent; anther bases tailed; style arms short, thickened towards base; leaf margins spiny toothed	Cardueae
b.	Involucral bracts not spinescent; anther bases sagittate; style arms rounded or truncate, leaf margin entire or dentate, not spinescent	5
5a.	Leaves all alternate; receptacles mostly naked; pappus of bristles	6
b	Leaves alternate or opposite; receptacle with paleas, rarely naked, pappus of bristles, awns or scales	7
6a.	Heads mostly discoid, sometimes radiate; anther base obtuse not tailed; style branched with hairy appendages; achenes mostly compressed, hairs multicellular	Asteroideae
b.	Heads mostly radiate, rarely discoid; anther base tailed; style branches unappendaged; achenes terete or subterete, hair arachnoid	Inuleae
7a.	Pappus copious, soft, silky and capillary, or setose	Senecioneae
b.	Pappus of awns, or bristles	8
8a.	Involucral bracts without transparent margins; leaves opposite, mostly 3-nerved from base or trifoliate; receptacle conspicuous; pappus present	Heliantheae
b.	Involucral bracts with hyaline, transparent margins; leaves alternate with a strong midvein; receptacle inconspicuous; pappus absent	Anthemideae

TRIBE 1. CICHORIEAE

1a.	Scapigerous herbs	41. Taraxacum
b.	Usually non-scapigerous herbs	2
2a.	Perennial herbs, more or less stellately hairy; achenes truncate	26. Hieracium
b.	Annual or perennial herbs, without stellate hairs; achenes beaked or truncate	3
3a.	Plants mostly with radical leaves; achenes usually contracted at both ends, 10-many ribbed	4
b.	Plants with radical as well as cauline leaves; achenes distinctly beaked or truncate, 3-20 ribbed	5
4a.	Hispid herbs with straight or hooked spines; pappus usually feathery	31. Picris
b.	Glabrous or hairy herbs without spines; pappus simple	18. Crepis
5a.	Achenes strongly compressed with 2-4 main ribs	6
b.	Achenes slightly obcompressed with 5-10 main ribs	7
6a.	Involucre with 5-20 florets; leaves not stem clasping; pappus setae monomorphic; achenes beaked	28. Lactuca
b.	Involucre with 80 or more florets; leaves often stem clasping; pappus setae dimorphic; achenes not beaked	38. Sonchus

7a.	Involucral bracts consisting of distinct inner and outer series	**33. Prenanthes**
b.	Outer involucral bracts more or less evenly and gradually passing into inner	8
8a.	Involucral bracts densely black bristly hairy; achenes glabrous	**19. Dubyaea**
b.	Involucral bracts sparsely black bristly hairy; achenes rugose	**13. Cicerbita**

TRIBE 2. MUTISIEAE

1a.	Sub scapigerous herbs; heads solitary or 2-3 fascicled on the erect scape, homogamous	**3. Ainsliaea**
b.	Scapigerous herb; heads solitary, heterogamous, radiate or homogamous	**24. Gerbera**

TRIBE 3. EUPATORIEAE

1a.	Pappus of more than 10 capillary bristles	**22. Eupatorium**
b.	Pappus of scales	**2. Ageratum**

TRIBE 4. CARDUEAE

1a.	Heads one-flowered, crowded into involucrate globose balls	**20. Echinops**
b.	Heads many-flowered, separate	2
2a.	Outer involucral bracts hooked at apex	**5. Arctium**
b.	Outer involucral bracts not hooked at apex	3
3a.	Filaments hairy or papillose	4
b.	Filaments glabrous	5
4a.	Pappus hairs simple, not feathery	**11. Carduus**
b.	Pappus hairs feathery	**14. Cirsium**
5a.	Involucral bracts appressed with long erect spreading or recurved spines	**16. Cousinia**
b.	Involucral bracts not spinescent	6
6a.	Pappus many-seriate, rough or feathery	**27. Jurinea**
b.	Pappus hairs 1-seriate, simple or feathery	**35. Saussurea**

TRIBE 5. ASTEREAE

1a.	Flowers usually in scorpioid panicles	**38. Solidago**
b.	Flowers usually not in scorpioid panicles	2
2a.	Pappus absent	**31. Myriactis**
b.	Pappus hairs usually long	3
3a.	Outer florets rarely ligulate, 2-3-toothed	**15. Conyza**
b.	Outer florets with prominent ligules	4
4a.	Ligules usually above 1 cm long, 1 mm broad	**7. Aster**
b.	Ligules usually less than 1 cm long; 1 mm broad	5
5a.	Ligules ca 3 mm long	**9. Brachyactis**
b.	Ligules ca 5-8 mm long	**21. Erigeron**

TRIBE 6. INULEAE

1a.	Bisexual florets all sterile; styles undivided or notched	2
b.	Bisexual florets all or mostly fertile; style divided	3
2a.	Pappus hairs connate or subconnate	**29. Leontopodium**
b.	Pappus hairs free	**4. Anaphalis**
3a.	Involucral bracts subulate	**32. Phagnalon**
b.	Involucral bracts ovate-oblong, oblanceolate, spathulate or elliptic	**25. Gnaphalium**

TRIBE 7. SENECIONEAE

1a.	Involucral bracts in one series	2
b.	Involucral bracts 2 or multiseriate	4
2a.	Anther bases with tailed auricles	**40. Synotis**
b.	Anther bases obtuse	3
3a.	Leaves triangular, deltoid or palmately lobed, auriculate or exauriculate; capitula always discoid, white, pink or yellow, in simple racemes or panicles	**10. Cacalia**
b.	Leaves simple, lyrate or pinnately lobed; capitula radiate or discoid, always yellow, solitary, axillary or few to many in terminal corymbs	**36. senecio**
4a.	Leaves without vaginate sheathing bases	**43. Tussilago**
b.	Leaves with vaginate sheathing bases	5
5a.	Involucral bracts densely greyish tomentose with blackish glandular pubescence	**17. Cremanthodium**
b.	Involucral bracts glabrous or pubescent, never densely tomentose	**30. Ligularia**

TRIBE 8. HELIANTHEAE

1a.	Receptacle not paleaceous	**1. Adenocaulon**
b.	Receptacle paleaceous	2
2a.	Leaves divided to the base or deeply pinnatifid	**8. Bidens**
b.	Leaf simple	3
3a.	Stem sparsely or densely pubescent	**23. Galinsoga**
b.	Stem with multicellular hairs often gland-tipped	**37. Siegesbeckia**

TRIBE 9. ANTHEMIDEAE

1a.	Head disciform	2
b.	Heads	3
2a.	Involucral bracts multiseriate; heads arranged in corymbs	**41. Tanacetum**
b.	Involucral bracts few seriate; heads racemose or panicled never corymbose	**6. Artemisia**

3a.	Heads shortly peduncled; achenes 5-angled	**44. Waldheimia**
b.	Heads long peduncled; achenes 5-10 ribbed	**12. Chrysanthemum**

1. ADENOCAULON W.J. Hooker

There are about 5 species distributed in Japan, North and South America and in temperate Asia; 1 in India and the Biosphere Reserve.

The scientific name *Adenocaulon* refers to the gland-dotted achenes.

Adenocaulon himalaicum Edgew.

An erect herbs. Leaves orbicular-subreniform or sub-hastate, angled or toothed, 7.5-10 cm across, grey cottony hairy beneath. Achenes with stalked glands.

Frequent around Kathi at 2500 m. Flowers during August-September.

2. AGERATUM L.

This is an American genus with about 45 species distributed throughout the tropics; 2 species in India, 1 in the Biosphere Reserve.

Ageratum name is given in allusion to the flowers retaining their colour for a long time, i.e. a meaning not and *geres*, old age.

Ageratum conyzoides L.

An erect, hispidly hairy herb, usually 30-70 cm high. Flower heads small, dense at the end of branches, blue or white.

Common near the villages in the Biosphere Reserve. Flowers during May - September.

3. AINSLIAEA DC.

The genus comprises about 10 species known from Myanmar, Nepal, Pakistan, Bhutan, Japan, China, W. Malaysia; 1 in the Biosphere Reserve.

The scientific name is attributed to Dr. Whitelaw Ainslie, author of *Materia Medica* (1826).

Ainsliaea aptera DC.

An erect herb, 30-90 cm high. Leaves long-petioled, triangular or orbicular-cordate, hairy. Flower heads greenish white.

The species is found throughout, in shady, temperate forests. Flowers during May September.

4. ANAPHALIS DC.

This genus, chiefly known from Europe, America and Asia, comprises about 40 species; 31 species in India, distributed usually in the Himalayan region and some are endemic in Tamil Nadu, Kerala and Karnataka, 8 in the Biosphere Reserve.

The generic name indicates its distinction from genus *Gnaphalium*, i.e. A meaning not and Knaphalion meaning *Gnaphalium*.

1a.	Involucral bracts obtuse, erect in flowers	2
b.	Involucral bracts acute, spreading in flowers	3
2a.	Leaves lanceolate	**3. A. margaritacea**
b.	Leaves linear	4
3a.	Leaves spathulate, basal lobes decurrent	**1. A. busua**
b.	Leaves sessile, amplexicaule	**2. A. contorta**
4a.	Heads 1-2.5 cm in diam.	5
b.	Heads less than 1 cm in diam.	6
5a.	Leaves less than 5 cm long, obovate	**4. A. nepalensis**
b.	Leaves 5-10 cm long, ovate or oblong-ovate	7
6a.	Upper leaves with scarious naked awn	**7. A. triplinervis var. monocephala**
b.	Upper leaves without awn	**6. A. triplinervis var. triplinervis**
7a.	Brown woolly herbs; roots twisted	**8. A. xylorhiza**
b.	Not brown woolly; roots not twisted	**5. A. royleana**

1. Anaphalis busua (Buch.-Ham. ex D. Don) DC.

Tall, erect herbs. Leaves linear, spathulate, basal lobes decurrent. Heads white, in branched corymbs.

Common throughout the area, ascending up to 3500 m. Flowering and fruiting during July October.

2. Anaphalis contorta (D. Don) Hook.f.

A very variable, stout or slender herbs, 15-20 cm high. Linear leaves cottony beneath or on both surfaces, margin recurved. Flower heads in dense clusters, ca 4 mm across, white.

The species is frequent throughout the area at 2500-3500 m. Flowers during August-September.

3. Anaphalis margaritacea (L.) Benth.

A perennial, robust, simple leafy herb, 30-80 cm high. Leaves spreading or horizontal, tapering from the middle to half-amplexicaul, simple or auricled at base, densely clothed with cinnamomeous wool, 3-5-nerved. Flower heads many, subglobose, 6-8 mm across, white.

The species grows on hill slopes around Tolma-Himtoli area at 2500-3500 m. Flowering and fruiting during August October.

4. Anaphalis nepalensis (Spreng.) Hand.-Mazz.

A perennial herb with simple tufted stems, 7.5-20 cm high. Leaves elliptic or lanceolate, 1-nerved. Flower heads 1-5, white, ca 1.5 cm across.

The species is common at 3500-4500 m near Dharansi and Pindari area. Flowers during August September

5. Anaphalis royleana DC.

A perennial herb, 15-25 cm or more high, with many stems from the root. Leave sessile, linear or linear-oblong, woolly beneath or both surfaces, 1-nerved. Flower heads 6-8 mm across, white.

The species is frequent near Dharansi, Dibrugheta and Deodi at 3000-4500 m. Flowering and fruiting during August September.

6. Anaphalis triplinervis (Sims.) C.B. Clarke var. **monocephala** (DC.) Airy-Shaw.

An erect, slender herb, 4-8 cm high. Leaves narrwoly ovate-lanceolate, upper leaves usually with a prominent scarious, naked awn. Flower heads 1-5, 1-1.5 cm across, white.

The species is common in the alpine grassland near Pathelkhan, Bhojgar and Ramani. Flowering and fruiting during July August.

7. Anaphalis triplinervis (Sims.) C.B. Clarke var. **triplinervis.**

A stout or robust herb, up to 45 cm high. Leaves 7.5-20 cm long, ovate or elliptic-oblong, amplexicaul or even auricled at base, 3-7-nerved, densely clothed with white wool beneath, cobwebby above. Flower heads 1.2-1 cm across, white.

The species is common at 2000-3500 m around Pindari and surrounding areas. Flowering and fruiting during June October.

8. Anaphalis xylorhiza Sch.- Bip. ex Hook.f.

Densely, tufted herb, up to 15 cm high, clothed with spreading brown wool. Leaves sessile linear-oblong. Flower heads many, clustered.

Near Dunagiri glacier at 3600 m. Flowering and fruiting during August October.

5. ARCTIUM L.

The genus, known from Europe, Afghanistan, China, Pakistan and Nepal, comprises 6 species; 1 in India and the Biosphere Reserve.

The involucral bracts become hooked and woody after the flowers wither and aid in the fruit dispersal.

The generic name is derived from a Greek word *Arction.*

Arctium lappa L. **Fig. 32.**

An erect, branched herb, 40-75 cm high. Leaves ovate-cordate. Involucral bracts subulate, hooked. Flower heads purplish. Achenes grey, mottled with black.

The species is frequent at Malari at about 3000 m. Flowering and fruiting during July - August. The plants, popularly known as "Great Bundock", have edible rootstock which is also used in medicines.

6. ARTEMISIA L.

The plants of this group are known as 'worm-wood' or 'mugwort'. Usually strongly scented herbs with usually spirally arranged, pinnately dissected leaves and 1-many flower heads.

There are about 400 species, distributed in Northern temperate regions, South America, South Africa; 40 species in India, 7 in the Biosphere Reserve.

The generic name is given after Artemis (daughter of Jupiter) and Latona (Sister of Apollo) of Greek mythology.

1a.	Heads homogamous	**6. A. maritima**
b.	Heads heterogamous	2
2a.	Disc florets sterile	3
b.	Disc floret, fertile	5
3a.	Anual herbs; leaves pinnatisect	**1. A. capillaris**
b.	Perennial herbs; basal leaves 3-fid or absent, cauline leaves entire	4
4a.	Stems purplish, glabrous	**3. A. dubia var. subdigitata**
b.	Stems pale-green, sparsely hairy	**2. A. dubia var. dubia**
5a.	Rhizomatous, perennial herbs	**7. A. roxburghiana**
b.	Perennial herbs, rhizomes absent	6
6a.	Leaf segemnts pectinately pinnatifid, rachis often pectinately winged; heads hemispheric, subsecund	**5. A. gmelinii**
b.	Leaf segments not pectinately pinnatifid, rachis simple winged; heads subglobose, not subsecund	**4. A. filiformilobulata**

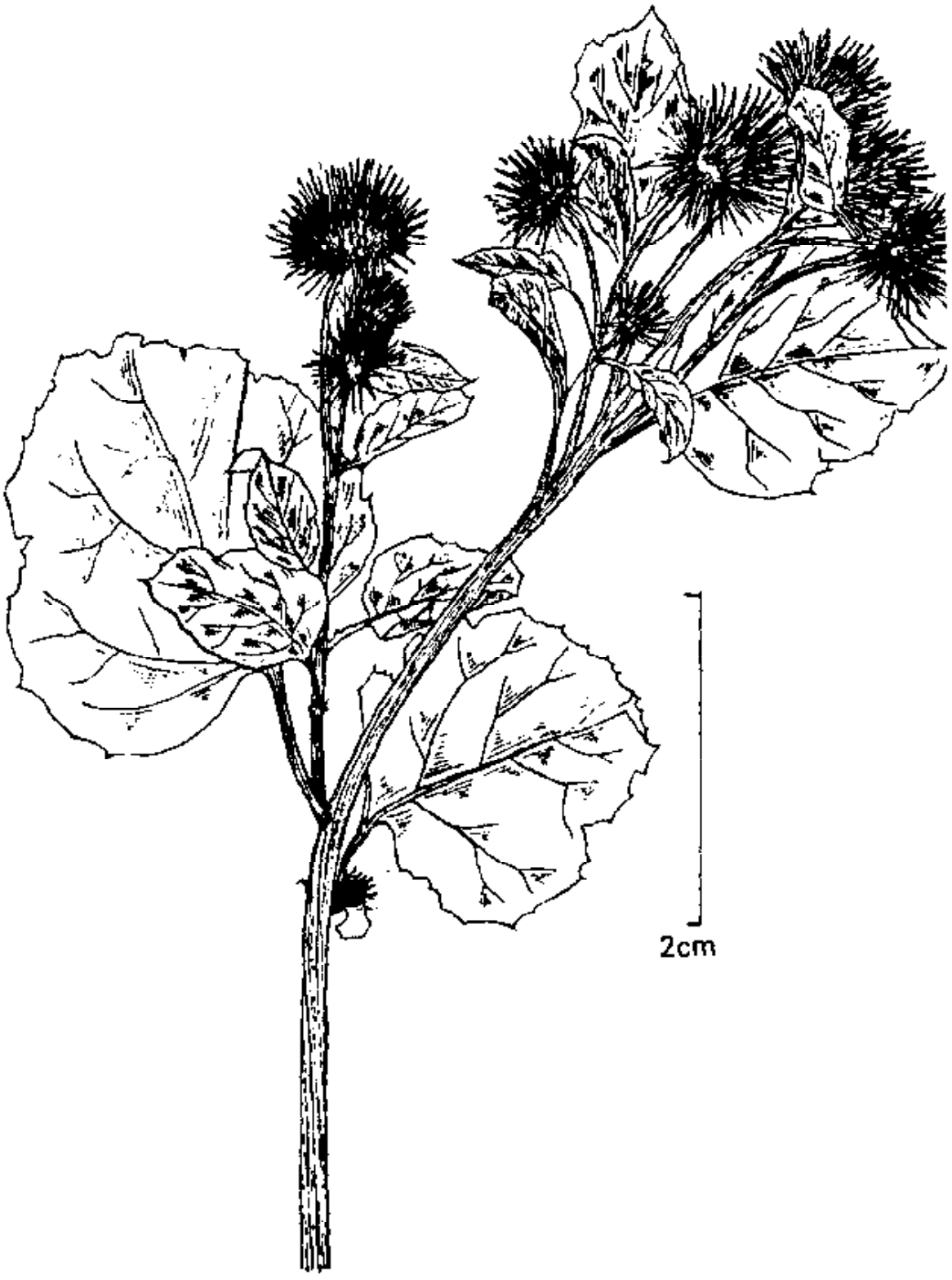


Fig. 32. Arctium lappa L.

1. Artemisia capillaris Thunb.

Annual, glabrous to sparsely hairy herbs, 20-70 cm or more high. Leaves pinnatisect. Flower heads small, sessile.

The species is common on open hill slopes near Malari, 3000 m. Flowering and fruiting during July August.

2. Artemisia dubia Wall. ex Bess. var. **dubia.**

An erect, glabrous or minutely hairy herbs, up to 1.5 cm high with pale-green stem. Basal leaves 3-fid or absent, cauline-leaves 2-7 cm long, usually entire. Flower heads 1.5-3 mm across, greenish yellow.

The species is common along the bridal path on way to Tolma, and Malari surroundings, 2500-3500 m. Flowering and fruiting during July August.

3. Artemisia dubia Wallich ex Bess. var. **subdigitata** Ling.

Stems purplish, glabrous. Flower heads 2-3 mm across.

Common on open hill slopes, near Lata village 2500 m. Flowering and fruiting during July September.

4. Artemisia filiformilobulata Ling & Puri

An erect, perennial, aromatic herbs, up to ca 70 cm high. Leaves 2-3-pinnatisect, subsessile. Flower heads 1.5-2 mm across, dense, greenish white.

The species is common on open hill slopes amidst grasses, near Himtoli-Lata, 3500 m. Flowers during August September.

5. Artemisia gmelinii Web. ex Steckm.

An erect, sparsely to densely hairy herbs, 10-80 cm high. Leaves 1-6 cm long, white tomentose beneath, 2-3-pinnatisect, more or less spreading. Flower heads 1.5-3 mm across, nodding, whitish green.

Common on open hill slopes at Latakharak, Peng, area, 3000-3500 m. Flowers during July August.

6. Artemisia maritima L. **Fig. 33.**

Eng.-Drooping sea-worm wood.

An erect or spreading, usually stunted, aromatic herbs, 60-80 cm high, stem much branched, wiry. Leaves minute, often white tomentose, linear. Flower heads brownish white or yellow.

The species is common on open hill slopes in sandy soil around Malari area, 3500 m. Flowering and fruiting during July August.

7. **Artemisia roxburghiana** Wallich ex Bess.

A perennial herb, 50-90 cm high with horizontal creeping rhizome. Leaves much dissected. Flower heads 3-4 mm across, purplish.

Common on open hill slopes near Dunagiri, Garpak and Lata area at 2500-3000 m. Flowering and fruiting during August September.

7. ASTER L.

The genus comprises about 60 species occurring chiefly in America, Eurasia and Africa; ca 23 species in India; 5 in the Biosphere Reserve.

The plants of the genus are of ornamental importance and are grown in gardens.

The scientific name *aster* a star meaning refers to the form of the flower.

1a.	Deciduous shrub	**1. A. albescens**
b.	Herbs	2
2a.	Heads more than 3 together	**4. A. peduncularis**
b.	Heads solitary	3
3a.	Robust, erect herbs; leaves lanceolate or oblong-lanceolate	**2. A. diplostephioides**
b.	Small, stemless stoloniferous herbs; leaves obovate-spathulate or obovate oblanceolate	4

Fig. 33. Artemisia maritima L.

4a. Tomentose woolly herbs; achenes glabrate 3. **A. flaccidus** subsp. **glandulosus**
b. Pubescent or villous herbs; acheens, pubescent or silky 5. **A. stracheyi**

1. Aster albescens (DC.) Hand. Mazz.

An erect, branched shrub, 50-150 cm high. Leaves elliptic-lanceolate to ovate. Flower heads ca 6 mm across, loosely clustered at the end of branches, pink, mauve or white.

Common in *Abies-Acer* forest clearings and along the edge of the forest near Himtoli, Pangrani Belta and Latakharak, 1800-3500 m. Flowering and fruiting during July August.

2. Aster diplostephioides (DC.) C.B. Clarke

An erect, perennial unbranched herb, 10-15 cm high. Leaves oblanceolate, glandular. Flower heads solitary, 4.5-7.5 cm across, mauve or blueish-white.

Common on open hill slopes at Latakharak, Dharansi, Dibrugheta, and Himtoli area, 3000-4500 m. Flowering and fruiting during July September.

3. Aster flaccidus Bunge subsp. **glandulosus** (Keissl.) Onno

An erect, perennial herb, 3-15 cm high, villous or glandular hairy. Leaves spathulate or obovate, glabrous or ciliate, peduncles distinctly glandular. Flower heads solitary, 3-4 cm across, blue or mauve.

Common in the core zone around Pathalkha-Bhujgara area, 4000-5000 m. Flowers during July August.

4. Aster peduncularis Wallich ex Nees

An erect, glabrous or thinly villous, rhizomatous, perennial herb, 10-80 cm high, flexuouse. Leaves ovate to lanceolate, hairy. Flower heads solitary or many, 2.5-3.5 cm across, bluish-mauve or white.

This species is frequent near Kathi and the surrounding area, 2400-3000 m. Flowering and fruiting during September October.

5. Aster stracheyi Hook.f.

An erect herb, 5-16 cm high, villous with long stolons. Leaves elliptic spathulate, oblong or obovate. Flower heads solitary, ca 1.5 cm across, blue or mauve.

The species is frequent at Pindari moraine, 3400-4000 m. Flowering and fruiting during July September.

8. BIDENS L.

The genus comprises about 230 species distributed throughout the world; 10 in India, 1 in Biosphere Reserve.

The scientific name *Bidens* means - *bis*, twice and *Dens*, a tooth; in allusion to the wedge shaped achenes with pappus.

Bidens pilosa L.

A very variable, erect, pilose or pubescent herb, 15-60 cm high. Leaves variable 3-fid or 3-sect. Flower heads yellow or pale-yellow.

Common near the villages at the boundary of the Biosphere Reserve, 2500-3000 m. Flowers during August September.

9. BRACHYACTIS Ledeb.

The genus comprises 6 species, occurring chiefly in Central Asia and North America; 3 species in India, 1 in the Biosphere Reserve.

The scientific name *Brachyactis* means short ray flowers.

Brachyactis roylei (DC.) Wend.

An erect, glandular-pubescent, branched herb, 12-30 cm high. Leaves, obovate or elliptic, pubescent. Flower heads ca 1.2 cm across, often in every leaf axil, white.

The species is found on open hill slopes near Malari at 3000 m. Flowering and fruiting during July August.

10. CACALIA L.

There are about 50 species, usually known from Eastern Asia, North and Central America, Eastern Russia and the West Indies; 5 species in India, 2 in the Biosphere Reserve. The plants are easily recognised by its leaves being deltoid or palmately lobed with discoid Flower heads.

1a.	Shrubby herbs; leaves deltoid, 3-lobed	1. C. levingii
b.	Slender herbs; leaves 3-7 angled, palmately lobed	2. C. pentaloba

1. Cacalia levingii (C.B. Clarke) R. Mathur

A perennial, shrubby, glabrous, branched herb. Leaves deltoid, 3-lobed. Flower heads cylindrical, yellow.

The species is frequent at Pindari bugyals, 3400-4000 m. Flowering and fruiting during August October.

2. Cacalia pentaloba Hand.-Mazz.

An erect, slender, flexuous, glabrous or sparsely hairy herb, 60-90 cm high. Leaves membranous 3-7-angled or palmately lobed, toothed. Flower heads narrow, drooping with ligules.

The species is frequent on way to Himtoli from Tolma, 2600-3000 m. Flowering and fruiting during August September.

11. CARDUUS L.

The genus comprises about 100 species, occurring chiefly in Europe and Asia; 4 species in India; 1 in the Biosphere Reserve.

Carduous refers to spiny nature of the plant.

Carduus edelbergii Rech.f. subsp. **lanatus** Kazmi

A biennial, stout thistle, 30-100 cm high, with spinulous winged stem. Leaves spinous, pinnatifid. Flower heads 2.5-4 cm across, solitary or fascicled, pink or dark purple.

Common near the cultivated fields around Malarian, 2900-3000 m. Flowering and fruiting during July August.

12. CHRYSANTHEMUM L.

There are about 200 species, occurring chiefly in Europe, Asia, Africa and America; 4 in India, 1 in the Biosphere Reserve.

Usually an annual or perennial herb. Heads large, terminal, rayed.

The scientific name is derived from *Chrysos*, gold and *anthemon*, flower; referring to the colour of the flowers.

Chrysanthemum indicum L.

"Guledaudi", cultivated as ornamental.

13. CICERBITA Wallroth

Cicerbita, an Italian name of medieval period for a group of Compositae closely related to *Lactuca*, about 18 species known from China, Tibet, Pakistan, Nepal, Bhutan, Europe and Canada; 6 in India; 1 in the Biosphere Reserve.

Cicerbita macrorhiza (Royle) Beauv.

Glabrous or sparsely hairy, branched herbs, up to 90 cm high. Leaves very variable, usually narrow, pinnatifid or pinnate, membranous. Heads grey-blue.

The species is common on grassy hill slopes in Eastern and the Western part of the Biosphere Reserve at Belta, Kathi, 2400-3500 m. Flowering and fruiting during August September.

14. CIRSIUM P. Mill.

The genus comprises about 150 species, occurring chiefly in North temperate zone; 7 in India, 2 in the Biosphere Reserve.

Most of the species of this genus are extremely variable and it is difficult to distinguish one from the other.

The generic name is derived from a Greek word *Kirsos* meaning a swelled vein referring to its supposedly healing properties.

1a.	Inner involucral bracts dilated at the tips; stems pubescent	2. C. wallichii
b.	Inner involucral bracts not dilated at the tip; stems cottony	1. C. verutum

1. Cirsium verutum (D. Don) Sprong.

A stout, erect herb, 0.3-1.8 m high, branched above. Leaves pinnatifid, teeth and lobes spiny. Flower heads 3.5-6 cm across, solitary or fascicled.

Common in the buffer zone near Suraithota-Tolma area, 1500-2500 m. Flowering and fruiting during August September.

2. Cirsium wallichii DC.

An erect, leafy herb, 1-3.5 m high with spreading branches. Leaves pinnatifid with spines. Flower heads 1.8-3.8 m across, solitary or fascicled, greenish white.

Common in the buffer zone near Tolma village at an elevation of 2500 m. Flowering and fruiting during August September.

15. CONYZA Less.

The genus comprises about 60 species, occurring chiefly in temperate and subtropical regions of the world; 10 species in India, 2 in the Biosphere Reserve.

The scientific name *Conyza* refers to the powdery covering on the plant.

1a. Pappus hairs usually red; flower heads 2-3 mm across — 2. C. stricta
b. Pappus hairs white; flower heads 5-6 mm across — 1. C. canadensis

1. Conyza canadensis (L.) Cronq.

A slender, much branched, pubescent or hairy herb, 15-90 cm high. Leaves linear to linear-lanceolate. Flower heads 5-6 mm across, pale-rosy white or purplish.

Common on open hill slopes amidst grasses near Peng, ascending up to 2500 m. Flowers during July August.

2. Conyza stricta Willd.

Much branched, roughly hairy or hoary pubescent herbs, up to ca 25 cm high. Leaves linear to spathulate-obovate. Flower heads many, minute yellowish, 2-3-mm across.

The species is frequent at 1000-1800 m near Malari. Flowering and fruiting during August September.

16. COUSINIA Cass.

The genus comprises 400 species, occurring chiefly in Eastern Mediterranean and Central Asia; 5 species in India, 1 in the Biosphere Reserve.

The genus, named after M. Cousin, a French Botanist, comprises thistle like herbs with spiny leaves.

Cousinia thomsonii C.B. Clarke

An erect, stout, cottony, branched, perennial herbs, ca 30 cm high. Leaves deeply interruptedly pinnatifid, densely white tomentose beneath. Flower heads 2.5-5 cm across, suberect or nodding, purplish.

The species is frequent along the Eastern and Western boundary of the Biosphere Reserve at an altitude of 3000-4000 m. Flowering and fruiting during August September.

17. CREMANTHODIUM Benth. emend. R. Good.

The genus comprises about 55 species, distributed in Nepal, Tibet, China; 14 species in India, one in Nanda Devi Biosphere Reserve.

The scientific name refers to the nodding character of the flower heads, i.e. *Kremao*, meaning to hang and *anthodium* meaning flower head.

Cremanthodium arnicoides (Wallich ex DC.) R. Good

An erect, stout, hairy or white tomentose herb, up to ca 1 m high. Leaves oblong-ovate or elliptic-oblong. Flower heads solitary or many, drooping, bright yellow.

The species is common at Dibrugheta, Himtoli, on way to Bhujgara from Ramani and Sarsupatal on way to Dharansi, 3500-5000 m. Flowering and fruiting during July August.

18. CREPIS L.

The genus comprises about 200 species, distributed in Asia, Europe, America and Australia; 19 species in India; 2 in the Biosphere Reserve.

1a. Stems, leafy, many from the root, dichotomously divaricatingly much branched — 1. C. flexuosa
b. Flowering stem leafless, subcorymbosaly branched — 2. C. sancta

1. Crepis flexuosa (DC.) Benth.

A small, densely branched herb. Basal leaves ovate-spathulate, lobed, cauline leaves entire. Flower head 8-12 mm across, yellow.

The species is frequent in Milam bugyals at an elevation of 4000-5000 m. Flowering and fruiting during July August.

2. Crepis sancta (L.) Babcock

A hispid or glandular hairy, annual herb. Basal leaves obovate or elongate-spathulate, toothed. Flower heads ca 1 cm across, yellow.

The species is scattered in Milam moraine at an elevation of 4000-5000 m. Flowering and fruiting during July August.

19. DUBYAEA DC.

The genus, comprising about 10 species, is endemic to Sino-Himalayan region; 2 species in India, 1 in the Biosphere Reserve.

The genus is named after J. Dubey, Botanist.

Dubyaea hispida DC. **Fig. 34.**

A perennial, hairy herb, 15-45 cm high, branched. Leaves with winged petiole and half-amplexicaule base. Flower heads ca 2.5 cm across, yellow, nodding or drooping, peduncles hispid with black glandular hairs.

The species is common in the Eastern and Western part of Dharansi, Pindari bugyals and other places at 3400-4500 m. Flowering and fruiting during August September.

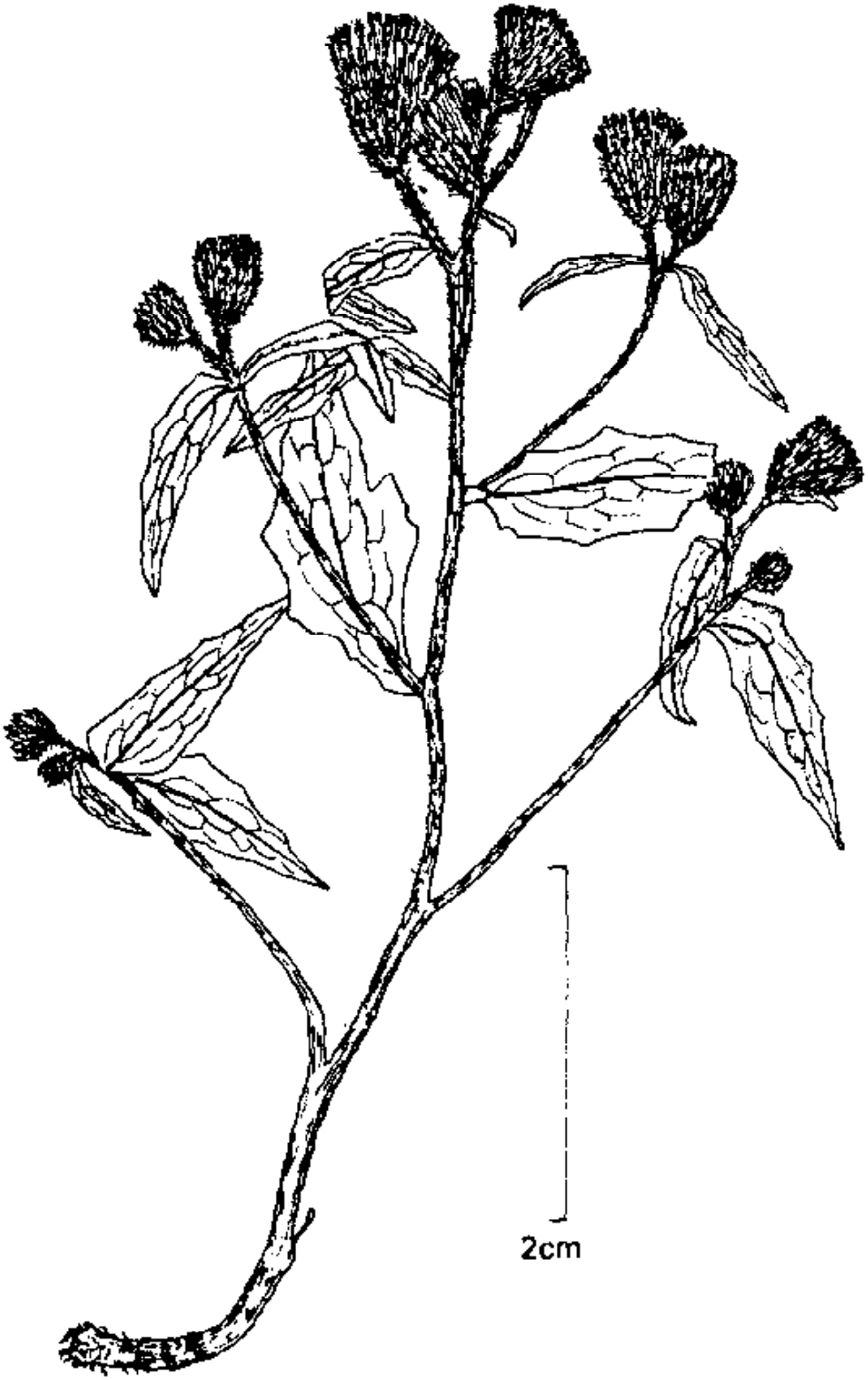


Fig. 34. Dubyaea hispida DC.

20. ECHINOPS L.

The genus comprises about 100 species, distributed in Europe, Africa, Asia; 3 species in India, 1 in the Biosphere Reserve.

The scientific name *Echinops* refers to the spiny globe shaped inflorescence, i.e. *echinos* meaning a hedge-hog and *ops* meaning appearance.

Echinops cornigerus DC.

Thistle-like herbs, 30-60 cm high, branched from base. Leaves spiny lobed. Flower-heads 2.5-3.5 cm across, white.

Occurs chiefly in the buffer zone near the villages, 1500-2500 m. Flowering and fruiting during August September.

21. ERIGERON L.

A cosmopolitan genus especially in North America, comprising over 200 species; 14 species in India, 2 in the Biosphere Reserve.

The generic name is derived from the worlds *Er* meaning spring and *geron* meaning old man, alluding to its worn out appearance.

1a. Radical leaves obovate or oblong-ovate; ligules heardly exceeding the pappus **1. E. acre**

b. Radical leaves lanceolate; ligules distinctly exceeding the pappus **2. E. multiradiatus**

1. Erigeron acre L.

An erect, hairy herb, 15-50 cm high. Leaves elliptic to obovate or lanceolate. Flower heads purplish.

On open hill slopes near Malari at an elevation of 3000 m. Flowering and fruiting during August September.

2. Erigeron multiradiatus (Lindl. ex DC.) C.B. Clarke

An erect, hirsute or pubescent, simple or branched herb, 15-60 cm high. Leaves obovate to lanceolate, sessile. Flower heads 3-5 cm across, usually solitary, dark purple.

Common in subalpine and alpine meadows near Himtoli-Dharansi, 3000-4500 m. Flowering and fruiting during July September.

22. EUPATORIUM L.

The genus comprises over 1200 species distributed in Asia, Europe, Africa but chiefly in Mexico; 7 in India, only one species in the Biosphere Reserve.

The genus is named after Mithridates Eupator, King of Pontus, who found out the plant antidote against Poison.

Eupatorium adenophorum Spreng.

Erect, much branched, foetid, annual or perennial herbs. Leaves ovate or rhomboid-ovate. Heads white, in axillary or terminal corymbs.

Common in waste places around Suraithola Malari area, 1800-2400 m. Flowering and fruiting during March June.

23. GALINSOGA Ruiz et Pavon

The genus comprises about 16 species, distributed all over the new world; 2 in India; 1 in the Biosphere Reserve.

The genus is named after Mariano Martinez Galinsoga, Superintendent of the Madrid Botanic Garden.

Galinsoga parviflora Cav.

A weak, erect, branched, glabrous herb. Leaves membranous, toothed. Flower heads ca 6 mm across, yellow.

A common weed introduced from America. Scattered near the villages, along the boundary of the Biosphere Reserve. Flowering and fruiting during July-September.

24. GERBERA L.

The genus comprises about 70 species, chiefly occurring in Africa, Madagascar, Asia, Indonesia; 7 species in India, 1 in the Biosphere Reserve.

The genus is named after Traugot Gerber, a German naturalist.

Gerbera gossypina (Royle) Beauv.

Low herbs. Leaves obovate or oblanceolate, cottony beneath. Flower heads 2.5-6 cm across, cottony.

Common near Peng and Dakuri Pass, 1700-2600 m. Flowering and fruiting during August September.

25. GNAPHALIUM L.

A cosmopolitan genus comprising about 200 species; 10 species in India; 1 in the Biosphere Reserve.

The scientific name *Gnaphalion* means soft down; alluding to the woolly covering of the plants.

Gnaphalium affine D. Don

An erect, very variable, branched herb, 10-40 cm high, woolly. Leaves oblong-spathulate. Flower heads crowded, whitish yellow.

Common at Suraithota at 1500-2500 m. Flowering and fruiting during July - August.

26. HIERACIUM L.

The genus comprises about 1000 species, chiefly occurring in temperate, regions; 7 species in India, 1 in the Biosphere Reserve.

The scientific name of the genus, commonly called Hawkweed, derives from *hierex*, a hawk or falcon. The Greek classical name *Hierakion* is used for these yellow flowered Compositae.

Hieracium vulgatum Fries

An erect, hirsute or glabrate herb, ca 70 cm high. Cauline leaves almost sessile. Flower heads many, yellow.

Common near Himtoli area, 2500-3500 m. Flowering and fruiting during August September.

27. JURINEA Cass.

The genus comprises 10 species; 2 in India, 1 in the Biosphere Reserve.

Jurinea dolomiaea Boiss.

Stemless, perennial herbs. Leaves pinnatifid, 4-18 cm long. Heads many, corolla 2-3 cm long, pappus brown.

Common in alpine meadows, 3000-4000 m. Flowering and fruiting during July September.

28. LACTUCA L.

The genus is represented by 100 species, chiefly occurring in temperate Eurasia, extending to tropical and South Africa; 22 species in India; 2 in the Biosphere Reserve.

The scientific name refers to the milky juice which the plant possesses. *Lac* means milk. The genus includes the Garden Lettuce.

1a. Stems dichotomously branched from the base; leaves lyrate or pinnatifid, rarely entire **1. L. dissecta**

b. Stems pinnately branched; leaves lanceolate or linear-lanceolate, entire **2. L. dolichophylla**

1. Lactuca dissecta D. Don

An annual, glabrous or pubescent, dichotomously branched, slender herb, 10-30 cm high. Leaves entire or lyrate or runcinate-pinnatifid, cauline semi amplexicaul, base auricled or sagittate. Flower heads cylindric, blue.

Common on open hill slopes or in shady places near Ruing, 1500-2500 m. Flowering and fruiting during July August.

2. Lactuca dolichophylla Kitam.

An annual or biennial, glabrous, erect herb, 1-1.5 m high, paniculately branched above. Leaves sessile, very long or linear-lanceolate, entire or sparingly half pinnatifid, distantly lobed. Flower heads erect, bluish.

Scattered beyond Tolma village on way to Himtoli, near cultivated fields at an elevation of ca 3000 m. Flowering and fruiting during August - September.

29. LEONTOPODIUM (Pers.) R. Brown

The genus comprises about 30 species, chiefly occurring in Europe, Asia and South America; 9 in India; 1 in the Biosphere Reserve.

The scientific name refers to the flower heads resembling to a lion's foot; *leon* meaning a lion and *pous*, a foot.

Leontopodium brachyactis Gaud.

Very variable herb, usually erect, 2.5-17 cm high, densely leafy or woolly. Leaves sessile or semi amplexicaul or stem clasping. Flower heads ca 1.2 cm long, yellow.

Common at Dibrugheta, Deodi, Latakharak, 3000-3500 m. Flowering and fruiting during July August.

30. LIGULARIA Cass.

The genus comprises about 150 species, chiefly of European-Asiatic distribution; 10 species in India, 1 in the Biosphere Reserve.

The scientific name refers to the strap-like ray florets.

Ligularia amplexicaulis DC.

A perennial, robust, herb, 0.6-1.2 m high. Leaves orbicular to reniform, irregularly toothed, glabrous. Flower heads 1-2 cm across, yellow.

The species is frequent at 3400-3600 m. Flowering and fruiting during August -September.

31. MYRIACTIS Less.

The genus comprises about 10 species, chiefly Asiatic and African; 5 species in India; 1 in Biosphere Reserve. The genus can be recognised by the absence of pappus.

The scientific name *Myriactis* is derived from *Myrios* meaning a myrind and *aktis*, ray or sun beam, referring to the numerous ray-florets.

Myriactis javanica (Blume) DC.

Herbs, 30-90 cm high, hairy. Leaves lanceolate-elliptic. Flower head ca 8 mm across, white.

Common near Suraithota and other villages, 1500-3000 m. Flowering and fruiting during August September.

32. PHAGNALON Cass.

The genus comprises about 40 species, distributed chiefly in Mediterranean, Canaries group of Island, Central and West Asiatic regions; 3 species in India, 1 in the Biosphere Reserve.

Usually the plants are herbaceous, cottony woolly.

Phagnalon niveum Edgew.

Tufted undershrub or herbs with thick rootstock, branches 5-25 cm long, slender, woody. Leaves sessile. Flower heads 3-6 mm across, solitary or fascicled, axillary, pale yellow to pinkish.

Scattered on way to Latakharak in temperate to subalpine regions. Flowering and fruiting during August September.

33. PICRIS L.

The genus is commonly called 'Ox-tongue' and used as pot herb, comprises about 50 species, chiefly distributed in Europe, temperate Asia, Australia, Newzealand, 1 in India and the Biosphere Reserve.

The generic name is derived from Greek word *Pikros* meaning bitter.

Picris hieracioides L.

An erect, branched, hairy herb, 0.3-1 m high. Flower heads 1.2-1.6 cm across, yellow.

The species is frequent on way to Himtoli above Tolma vaillage, 2500-3500 m. Flowering and fruiting during July August.

34. PRENANTHES L.

The genus comprises about 40 species, distributed in South Africa, Mediterranean region, Europe, Asia and America; 6 in India; 2 in the Biosphere Reserve.

Milky, semi-erect herbs with homogamous heads.

The generic name is derived from the Greek word *Prenes* meaning drooping and *Anthos* meaning a flower, referring to the drooping flower heads.

1a.	Flowers rose-purple or whitish, 3-5 together	**1. P. brunoniana**
b.	Flowers blue, subsolitary	**2. P. violaefolia**

1. Prenanthes brunoniana Wallich ex DC.

An erect herb, 0.3-1.2 m high, hairy or glabrous, simple or branched. Leaves very variable. Flower heads 6-10 mm across, rose-purple.

The species is frequent at Ruing to Garpak, Dwali, 3000-3500 m. Flowering and fruiting during August September.

2. Prenanthes violaefolia Decne.

A small, very slender herb. Leaves long petioled, ovate-cordate or deltoid or hastate, 2.5-5 cm long leaves. Flower heads few, pendulous, purplish.

The species is frequent at Pindari bugyals, 3000-3400 m. Flowering and fruiting during August September.

35. SAUSSUREA DC.

The genus comprises about 403 species, occurring chiefly in temperate Asia; about 62 species in India, 11 in the Nanda Devi Biosphere Reserve.

The genus is named after Horace Benedict de Saussure (1740-99), a Swiss Botanist.

There are a few species which are valued for their aromatic roots and medicinal properties e.g. *S. costus*, known as costus or 'Kuth'. The plant is cultivated on a small scale near Dronagiri.

1a.	Heads embedded in white wool	2
b.	Heads not embedded in wool	3
2a.	15-30 cm high herbs; involucral bracts linear or linear-oblong	**6. S. gossypiphora**
b.	10-15 cm, high herbs; involucral bracts lanceolate	**10. S. simpsoniana**

3a.	Heads enclosed in inflated membranous uppermost leaves	**8. S. obvallata**
b.	Heads not enclosed in inflated leaves	4
4a.	Heads solitary or 2-3	5
b.	Heads in corymbs or in clusters	7
5a.	Stems 0.3-1 m high; leaves oblong-lanceolate	**5. S. fastuosa**
b.	Stems absent or very short, less than 20 cm long; leaves linear	6
6a.	Densely tufted herbs; leaves hairy or glabrate beneath, never woolly	**11. S. sudhanshui**
b.	Erect herbs; leaves woolly beneath	**7. S. graminifolia**
7a.	Heads in axillary or terminal clusters	**3. S. costus**
b.	Heads in corymbs	8
8a.	Stems simple; outer pappus bristle few or many	**2. S. candolleana**
b.	Stems corymbosely branched above; outer pappus bristle absent	9
9a.	Heads nodding	**4. S. deltoidea**
b.	Heads erect or suberect	10
10a.	Leaves entire or sinuate-lobed or pinnatifid; heads purplish	**1. S. albescens**
b.	Leaves lyrate or pinnatifid; heads white	**10. S. stracheyana**

1. Saussurea albescens (DC.) Sch.-Bip.

An erect, slender herb, 0.6-2 m high. Leaves narrowly oblong, entire or lobed, 10-30 cm long. Flower heads about 1.2 cm across, purplish.

Common on open hill slopes near Tolma and Peng at 2000-3000 m. Flowering and fruiting during June October.

2. Saussurea candolleana Wallich ex DC.

An erect leafy herbs, 30-90 cm high. Leaves oblong or ovate-lanceolate, denticulate, cottony beneath, with blade forming a wing down the stem. Flower heads ca 1 cm across.

The species is frequent near Malari, Pindari bugyals, Rupkund surroundings at 2000-3000 m. Flowering and fruiting during August October.

3. Saussurea costus (Falc.) Lipschitz

An erect, pubescent herb, 1-2.5 m high. Leaves irregularly toothed, membranous. Flower heads in clusters of 2-5, 2.5-3.5 cm across, purple.

Cultivated at Dunagiri at an elevation of ca 3500 m. Flowering and fruiting during August September.

4. Saussurea deltoidea (DC.) Sch.-Bip.

An erect herb, grooved, 1.2-2.6 cm high, branched above. Cauline leaves lobed, white tomentose or cottony beneath. Flower heads 1.2-3.7 cm across, purple.

The species is frequent at Kathi, 2000-3000 m. Flowering and fruiting during August September.

5. Saussurea fastuosa (Decne.) Sch.-Bip.

An erect herb, branched above, glabrous or cottony, up to 1 m high. Leaves oblong or oblong-lanceolate, finely toothed, glabrous or cottony. Flower heads 2-6 cm across, solitary, terminal.

The species is common around Pindari bugyals, 3000-3500 m. Flowering during August October.

6. Saussurea gossypiphora D. Don.

Perennial or biennial, erect, spongy herbs 15-20 cm high, densely white woolly. Heads many, embedded in wool.

Rare, found around Baguabasa in Rupkund area, on stony hill slopes at 4000-5000 m. Flowering and fruiting during August October.

7. Saussurea graminifolia Wallich ex DC. **Fig. 35.**

A stout, densely woolly, shining herb, 5-25 cm high. Leaves narrowly linear, woolly beneath, recurved. Flower heads solitary, densely woolly, 2.5-3.5 cm across, purple.

The species has been reported from Pindari bugyal and surroundings at 3500 m. Flowers during July September.

8. Saussurea obvallata (DC.) Edgew. **Fig. 36.**

An erect, simple herb, 15-45 cm high. Leaves oblong to elongate-obovate toothed. Flower heads enclosed by boat shaped papery bracts, 1-1.8 cm across, purple.

Common at Dharansi and Rupkund surroundings area, 3500-4500 m. Flowering and fruiting during July August.

Fig. 35. Saussurea graminifolia Wallich ex DC.

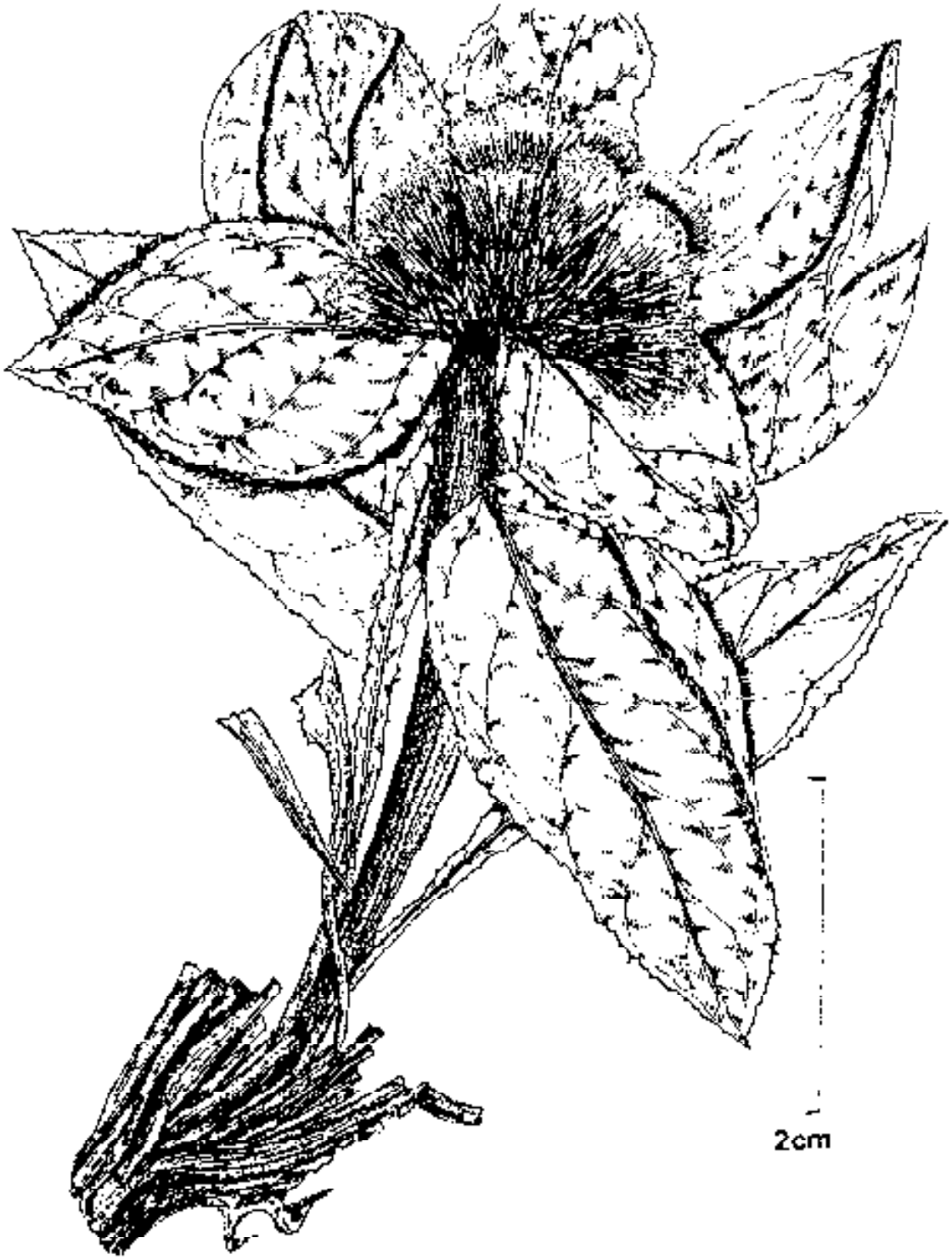


Fig. 36. Saussurea obvallata (DC.) Edgew.

9. Saussurea simpsoniana (Field. & Gard.) Lipschitz

An erect, densely woolly herb, 5-15 cm high. Leaves lobed. Flower heads many, woolly, purple.

Grows on hill slopes at 4000-5000 m. Flowering and fruiting during July - October.

10. Saussurea stracheyana (O. Kuntze) Lipschitz

An erect, abundantly branched herb, 30-60 cm high. Leaves lobed. Flower heads ca 1.2 cm across, white.

Common near Suraithota, Tolma along the bridal path, 2500-3000 m. Flowering and fruiting during July August.

11. Saussurea sudhanshui Hajra

A densely tufted, sometimes cushion-forming herb, 3-6 cm high. Leaves linear-lanceolate, laxly hairy beneath. Flower heads 1-2 cm across, purple.

Rare, collected only from alpine meadow at Dharansi and Sarsupatal at an elevation of 4500-5000 m. Flowers during August September.

36. SENECIO L.

One of the largest cosmopolitan genus with ca 1000 species; 43 in India, 4 in Nanda Devi Biosphere Reserve.

The scientific name *Senecio* refers to the white hair like pappus of these herbs.

1a.	Stems glandular pubescent; ligules absent; involucral bracts 5	**1. S. candolleanus**
b.	Stems not glandular pubescent; ligules present; involucral bracts 10-14	2
2a.	Dwarf herbs; leaves all cauline	**2. S. kraschenninnikovii**
b.	Tall herbs; leaves both radical and cauline	3
3a.	Lower leaves lyrate pinnatifid	**3. S. laetus**
b.	Lower leaves linear-oblong or obovate, irregularly crenate loblate, never lyrate pinnatifid	**4. S. nudicaulis**

1. Senecio candolleanus Wallich ex DC.

A slender, glandular-pubescent or hairy herb, 30-45 cm high. Leaves long-petioled, ovate, acute white tomentose beneath. Flower heads about 6 cm across, yellow.

The species is frequent at Pindari moraine at an elevation of 3400 m. Flowers during July August.

2. Senecio kraschenninikovii (Schischk.).

Dwarf, much branched herbs, stems glabrous. Leaves pinnatifid. Heads yellow. Achene glabrous.

Found around Malari area, 2800-4000 m. Flowering and fruiting during August September.

3. Senecio laetus Edgew.

A perennial, sparsely tomentose, rhizomatous, erect herb. Leaves ovate-lanceolate or oblanceolate, lyrate-pinnatifid. Flower heads in terminal corymbs, bright yellow.

Common near Malari at an elevation of 2500-3000 m. Flowers during July - August.

4. Senecio nudicaulis Buch.-Ham. ex D. Don

A glabrous or sparsely pubescent herb, ca 30 cm high. Leaves linear or obovate-oblong or spathulate. Flower heads yellow, ca 8 mm across with 3-nerved involucral bracts.

The species is frequent at 2000-3000 m on open hill slopes on way to Peng and other localities in the buffer zone. Flowers during August September.

37. SIEGESBECKIA L.

The genus comprises about 9 species, occurring chiefly in tropical and warm temperate region: 1 in India and the Biosphere Reserve.

The genus, with small heads surrounded by 5 involucral bracts covered with very sticky glandular hairs, is named after john George Siegesbeck, German Botanist and Director of Botanic Garden, St. Petersburg.

Siegesbeckia orientalis L.

An annual, erect, crisped hairy herbs, 30-90 cm high, with spreading opposite lower branches. Leaves triangular-ovate, toothed. Flower heads yellow.

Common near the villages in North-Western part of the Reserve, ascending up to 2000 m. Flowering and fruiting during August September.

38. SOLIDAGO L.

The genus comprises about 100 species, distributed chiefly in Eurasia and America; 4 species in India, 1 in the Biosphere Reserve.

The Latin name *Solido* means to strengthen or to put together. Hence the plant Goldenroad was named *Solidago*. The genus includes 'Canadian Goldenrod' (*S. canadensis*), considered in medieval European medicine as a 'wound herb', as decoctions were applied to wounds and ulcers; usually cultivated in India.

Solidago virga-aurea L.

An erect, pubescent, unbranched herb, 30-60 cm high. Leaves oblong-lanceolate, toothed. Flower heads yellow, in clusters.

Common in open places on way to Himtoli at an elevation of 3000 m. Flowering and fruiting during July September.

39. SONCHUS L.

A cosmopolitan genus with about 50 species; 4 species and 2 subspecies in India, 2 in the Biosphere Reserve.

1a.	Basal lobes of stem leaves rounded	**1. S. brachyotus**
b.	Basal lobes of stem leaves acute	**2. S. oleraceus**

1. Sonchus brachyotus DC.

A perennial erect, 'herb, 0.2-1.9 m high, slender, branched from base. Leaves entire or spinous, toothed. Flower heads 1-5.2 cm across, yellow.

Grows on waste places in buffer zone, 1800-200 m. Flowering and fruiting during March November.

2. Sonchus oleraceus L.

An annual herb, 15-50 cm high, glabrous or sparsely glandular hispid, branched above. Leaves very variable, lanceolate, half amplexicaul. Flower heads ca 1.8 cm across, yellow.

Grows on waste places in buffer zone, 1800-200 m. Flowering and fruiting during March November.

40. SYNOTIS (C.B. Clarke) Jeffrey & Chen

The genus comprises about 50 species endemic to Sino-Himalayan region; 19 species in India, 2 in Nanda Devi Biosphere Reserve. Plants are erect or subscandent, without prehensive petioles; involucral bracts in one series; anther base with tailed auricles.

1a.	Petioles with broad toothed wings; heads ebracteate	**1. S. alata**
b.	Petioles without toothed wings; heads bracteate	**2. S. kunthiana**

1. Synotis alata (Wallich ex DC.) Jeffrey & Chen **Fig. 37.**

A perennial, rhizomatous herb, 5-50 cm high with greyish-yellow hairs on the stem. Leaves usually at the base of flowering stems, densely hairy beneath. Flower heads cylindrical, densely hairy, yellow.

The species is frequent in shady places near Himtoli at 3000-3500 m. Flowering and fruiting during July September.

Fig. 37. Synotis alata (Wallich ex DC.) Jeffrey & Chen

2. Synotis kunthiana (Wallich ex DC.) Jeffrey & Chen

A stout, glabrous-puberulous, leafy herb, up to ca 30 cm high. Leaves coarsely toothed, snow white beneath. Heads many at the end of branches, ca 1 cm across, yellow.

The species is frequent at 3000-3500 m on way to Dharansi from Latakharak. Flowers during August September.

41. TANACETUM L.

A genus comprising about 70 species in North temperate regions; 12 species in India, 1 in the Biosphere Reserve.

Tanacetum fruticulosum Ledeb.

An erect, perennial, woolly herbs, 20-45 cm high. Leaves lobed. Flower heads ca 6 mm across, many.

The species is frequent near Himtoli area, 2700-3200 m. Flowering and fruiting during August October.

42. TARAXACUM Weber.

The genus is highly polymorphic with over 1000 species mainly in the cold temperate regions. Hooker (1881) has reported 2 species and 4 varieties from India while van Soest (1963) has reported 75 species. In absence of literature we preferred to treat all our collections under one species only.

Taraxacum officinale Weber.

Perennial herbs, flowering scape 5.25 cm or more high. Leaves all radical, lobed, pinnatifid to runcinate-pinnatifid. Flower heads solitary, yellow.

The species is found scattered throughout the area, ascending up to 4500 m. Flowering and fruiting during June October.

43. TUSSILAGO L.

A monotypic genus, distributed in China, North Africa, Europe, Asia, China, North America and India.

The generic name is derived from a Latin word *Tussis* meaning cough, referring to the properties of leaves and flowers of curing cough.

Tussilago farfara L.

A perennial herb, 8-20 cm high, white-tomentose. Leaves all radical (at base), orbicular, toothed, white tomentose beneath. Flower heads yellow.

This species is frequent around Martoli, 3000-3500 m. Flowering and fruiting during July October.

44. WALDHEIMIA Kar. & Kir.

A genus comprising about 8 species, predominantly Himalayan and Central Asiatic; 5 species in India, 1 in the Biosphere Reserve. Usually perennials, diffuse or tufted herbs.

Waldheimia tomentosa (Decne.) Regel

A strongly aromatic, tufted, perennial herb. Leaves lobed, 1-2-pinnatisect. Flower heads purplish white.

The species is frequent in Milam glacial moraine, 3500-4500 m. Flowers during June August.

48. CAMPANULACEAE
(Bellflower family)

The family comprises 35 genera and about 600 species, mostly confined to temperate and subtropical regions and in mountains of tropics; about 8 genera

and 48 species in India, mainly in Himalayan region, 3 genera and 5 species in Nanda Devi Biosphere Reserve.

1a.	Extensive twiner	2. Codonopsis
b.	Erect, semi-erect or prostrate herbs	2
2a.	Flowers terminal, solitary	3. Cyananthus
b.	Flowers in racemes or in panicles	1. Campanula

1. CAMPANULA L.

The genus comprises over 300 species; about 15 in India, 2 in Nanda Devi Biosphere Reserve.

The scientific name is derived from the Latin word *Campana* meaning a bell, referring to the shape of flowers.

1a.	Leaves sessile; flowers purple	2. C. pallida
b.	Leaves petioled; flowers pale-purple or lilac	1. C. colorata

1. Campanula colorata Wallich

Erect, suberect, ascending or straggling, perennial herbs, roughly hairy. Leaves irregularly serrate-dentate. Flowers pale-purple or lilac, arranged in loose racemes.

Common throughout the area, ascending upto 3500 m on hill slopes and rocks in almost all type of habitats. Flowering and fruiting during April September.

2. Campanula pallida Wallich Fig. 38.

Erect perennial herbs, 20-50 cm high, stems angular, hairy. Leaves elliptic-lanceolate, toothed, hairy, sessile. Flowers ca 0.9 cm long, purple.

Common throughout the area on hill slopes at 1500-3000 m, amidst grasses. Flowering and fruiting during April September.

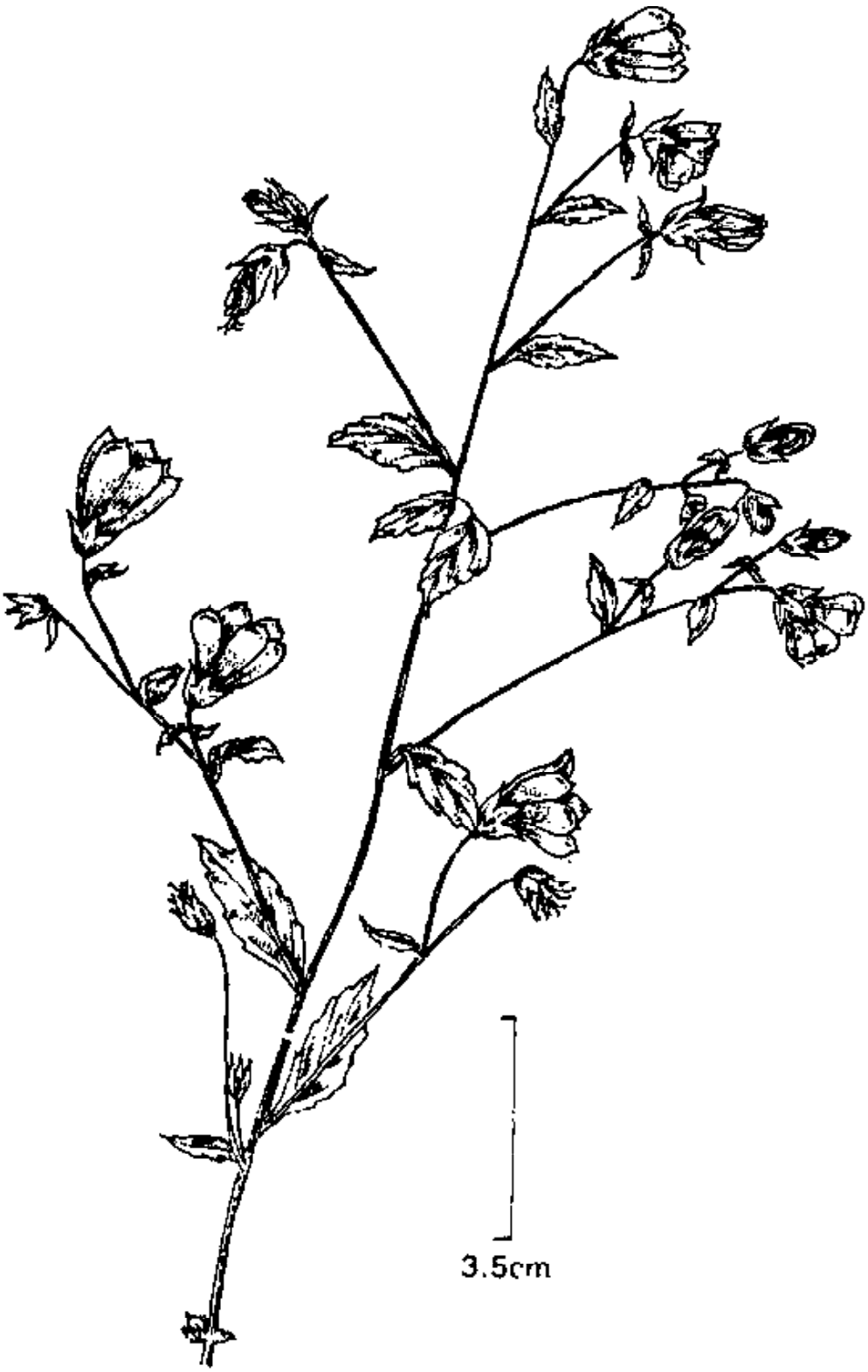


Fig. 38. Campanula pallida Wallich

2. CODONOPSIS Wallich

About 30 species in the world; about 15 in India, 1 in the Biosphere Reserve. The plants are mostly perennial erect or climbing herbs. Flowers conspicuous.

The generic name is derived from Greek word *Kodon* meaning a bell and *opsis* meaning resemblance, referring to the shape of flowers.

Codonopsis rotundifolia Benth.

Twining herbs, stems hairy. Leaves opposite, crenate-toothed, hairy. Flowers green, yellowish-green.

Not common, found on hill slopes, twining over shrubs around Dharansi and Dibrugheta in the core zone of the Biosphere Reserve, 3000-4000 m. Flowering and fruiting during July September.

3. CYANANTHUS Wallich ex Benth.

The genus is represent by about 30 species in the world; 9 in India 2 in Nanda Devi Biosphere Reserve. The plants are annual or perennial herbs.

1a.	Leaves entire, margins recurved	2. C. microphyllus
b.	Leaves lobed, margins not recurved	1. C. lobatus

1. Cyananthus lobatus Wallich ex Benth. Fig. 39.

Annual, erect or semierect herbs, 15-35 cm high. Leaves lobed. Flowers blue, showy, solitary, calyx with black-brown hairs.

Common throughout the area on hill slopes amidst grasses in the core zone of the Biosphere Reserve, 3000-4500 m. Flowering and fruiting during June September.

Fig. 39. Cyananthus lobatus Wallich ex Benth.

2. Cyananthus microphyllus Edgew.

Prostrate or semi-erect herbs, 10-20 cm high, stems many from the base. Leaves elliptic-ovate, margins recurved. Flowers blue, terminal, solitary, calyx with black-brown hairs.

Common throughout the area on hill slopes and in rock crevices in shady moist places, 2500-4000 m. Flowering and fruiting during June October.

49. ERICACEAE
(Heath family)

The family comprises about 100 genera and 3000 species, almost cosmopolitan in distribution except in deserts; about 8 genera and ca 115 species in India, 3 genera and 7 species in the Biosphere Reserve. They are small undershrubs, to trees, some are epiphytic.

1a.	Leaves crowded at the end of branches; flowers in corymbs, sometimes solitary in *R. lepidotum*	**3. Rhododendron**
b.	Leaves imbricate or alternate	2
2a.	Leaves imbricate, adpressed to the stem	**1. Cassiope**
b.	Leaves alternate not adpressed to the stem	**2. Gaultheria**

1. CASSIOPE D. Don

The genus of small shrubs, comprises about 10 species; 2 in India, only one in Nanda Devi Biosphere Reserve.

The generic name is given after Cassiope. According to Greek mythology Cassiope was the wife of Cepheus, King of Ethiopia and mother of Andromeda.

Cassiope fastigiata (Wallich) D. Don

Under shrubs, 8-20 cm high, stems slender, woody, basal portion usually procumbent. Leaves small, ovate-oblong, imbricate. Flowers axillary, solitary, drooping, white.

Common around Martoli-Milam, Ramni-Bhujgar and Patalkhan area, 3500-4500 m, on open hill slopes. Flowering and fruiting in June August.

2. GAULTHERIA L.

The genus is represented by about 200 species; about 12 in India, 1 in the Biosphere Reserve.

The plants are erect or scandent shrubs, fruits of some species are edible, oil obtained from the leaves is used as flavouring agent.

The genus is named after Jean Francois Gaulthier, a French physician and botanist.

Gaultheria trichophylla Royle

Perennial herbs or undershurbs, ca 6 cm high, procumbent or prostrate, stems hairy-hirsute. Leaves lanceolate-elliptic or oblong, toothed, alternate. Flowers dull purple, axillary, solitary.

Common around Martoli-Milam, Dibrugheta-Sonwara, 3000-4000 m on hill slopes and on moist rocks. Flowering and fruiting during June September.

3. RHODODENDRON L.

The genus comprises about 500 species, distributed mainly in China, Tibet, Myanmar, New Guinea, South Asia, Europe and U.S.A.; about 80 in India, mainly concentrated in Eastern Himalaya, 5 in Nanda Devi Biosphere Reserve. The palnts are evergreen or deciduous shrubs or trees.

The generic name is derived from the Greek word *Rhod* meaning rose or red and *Dendron* meaning tree, referring to the appearance of flowers which are in bunches. This genus has a great ornamental value.

1a.	Small shrubs, less than 1 m high; leaves less than 5 cm long	2
b.	Trees or large shrubs, more than 1 m high; leaves more than 5 cm long	3
2a.	Flowers purple, reddish or reddish-purple, solitary or 2-3 together	**5. R. lepidotum**
b.	Flowers pale-yellow, 4-12 together in a corymb	**1. R. anthopogon**
3a.	Leaves pale, yellowish green, glabrous beneath	**3. R. barbatum**
b.	Leaves with silvery scales or cinnamon or buff coloured tomentum beneath	4
4a.	Flowers bright red or pinkish; leaves with silvery scales beneath	**2. R. arboreum**
b.	Flowers pale-yellow; leaves with brownish tomentum beneath	**4. R. campanulatum**

1. Rhododendron anthopogon D. Don Fig. 40.

Evergreen, aromatic shrubs, 30-60 cm high, stem bark peeling of in papery strips. Leaves elliptic or elliptic-oblong, crowded at the end of branches, upper surface glandular, lower yellowish-brown tomentose. Flowers pale-yellow, in dense corymbs. Fruits ovoid.

Found to occur in alpine Himalaya above tree line. Common around Ramni-Bhujgara, Martoli-Dharansi and Milam area, 3000-4500 m, in open places or mostly in sandy soil. Flowering and fruiting during June November.

2. Rhododendron arboreum Sm.

(Honey ball Rhododendron)

Small to medium sized trees, stem bark pinkish-brown. Leaves oblong or oblong-lanceolate, crowded at the end of branches, glossy green above, pale beneath. Flowers bright red, showy, crowded in large corymbs. Fruits cylindric, curved.

Common throughout the area in temperate region, 1500-3000 m. Flowering and fruiting occurs during April October.

3. Rhododendron barbatum Wallich ex G. Don.

Small trees. Leaves oblong-acute, glabrous beneath, petioles bristly. Flowers deep red.

Fig. 40. Rhododendron anthopogon D. Don

Rare; a few scattered trees are seen near Belta and Pindari area. Flowering and fruiting during May October.

4. Rhododendron campanulatum D. Don

Evergreen, large shrubs or small trees, stems spreading and decumbent, bark smooth pinkish-brown. Leaves elliptic or elliptic oblong, glossy green above, brownish tomentose beneath. Flowers purple or purplish-white, in lax corymbs. Fruit cylindric, curved.

Occurs throughout the area in alpine region forming gregarious patches. Common around Himtoli, Latakharak, Dibrugheta and Martoli, 3200-3500 m. Flowering and fruiting during May October.

5. Rhododendron lepidotum Wallich ex D. Don

Shrubs, 15-90 cm high, stems often curved at the base. Leaves oblanceolate or oblong-oblanceolate, crowded at the end of branches, aromatic with scattered scales beneath. Flowers red, purple or reddish-purple, solitary or 2-3 together. Fruits oblong.

Common around Martoli, Latakharak, Dibrugheta and Himtoli, 3000-4000 m, mostly in open places in sandy soils. Flowering and fruiting during June October.

50. MONOTROPACEAE

This is a small family represented by about 12 genera and 21, species distributed mainly in North temperate and tropical mountains; one genus and species in the Biosphere Reserve. These are mostly parasitic herbs, with leaves reduced to scales.

The generic name is derived from the Greek word *Monos* meaning one and *Tropos* meaning turn, referring to the stem turned one way with nodding flowers.

MONOTROPA L.

About 5 species in the world; 1 in India and the Biosphere Reserve.

Monotropa hypopitys L.

Saprophytic herbs, 10-20 cm high, stems simple, hairy or pubescent, pale-brown. Leaves absent, scales ovate-oblong. Flowers waxy white, solitary, terminal.

Grows in shady moist places on decaying materials. Common around Tolma-Himtoli, 2000-3000 m. Flowering and fruiting during June - October.

51. PRIMULACEAE
(Primrose family)

The family comprises over 28 genera and 1000 species, cosmopolitan in distribution; 4 genera and 164 species in India, mostly in temperate and alpine Himalaya, 3 genera and 16 species in the Biosphere Reserve.

1a.	Flowers in racemes or solitary; corolla tube not distinct	**2. Lysimachia**
b.	Flowers in umbels or solitary on radical stalk; corolla tube distinct	2
2a.	Corolla tube longer than the calyx	**3. Primula**
b.	Corolla tube shorter than the calyx .	**1. Androsace**

1. ANDROSACE L.

The genus comprises over 100 species; over 17 species in India, 4 in Nanda Devi Biosphere Reserve.

The generic name is derived from the Greek word *Aner* meaning a man and *Sakes* meaning a shield, referring to the appearance of anthers.

1a.	Flowers solitary	2
b.	Flowers in umbels	3
2a.	Flowers purple; leaf margins silky-ciliate	**2. A. globifera**
b.	Flowers pale-pink; leaves densely hairy	**4. A. villosa**

3a.	Flowers pink or pink-purple; leaves ovate-lanceolate, entire	3. A. sarmentosa
b.	Flowers white; leaves orbicular-cordate, lobed, lobes lobulate	1. A. geraniifolia

1. Androsace geraniifolia Watt

Stoloniferous, laxly villous herbs. Leaves rounded-cordate, petiolate, petioles much longer than the leaves. Flowers pinkish-white.

Common on open hill slopes amidst grasses around Bedni bugyal-Baguabasa in Rupkund area, 2500-400 m. Flowering and fruiting during May October.

2. Androsace globifera Duby

Densely tufted, cushion forming, perennial herbs, stems very short, branches densely packed. Leaves obovate-oblong, pubescent, silky-ciliate on margins, densely imbricate, scape short, 1-flowered. Flowers dull purple.

Common on open hill slopes in alpine regions around Dharansi, Sarsupatal and Martoli-Milam, 3500-4500 m. Flowering and fruiting during, June October.

3. Androsace sarmentosa Wallich **Fig. 41.**

Stoloniferous herbs, stolons leafless except at the nodes. Leaves silky pubescent, scapes stout, many-flowered. Flowers Pink or Pink-purple.

Common in moist shady hill slopes amidst grasses around Deodi-Rammi area, 3000-4000 m. Flowering and fruiting during June September.

4. Androsace villosa L.

Tufted herbs. Leaves ca 5 mm long, in globose rosettes, densely hairy. Flowers solitary, pale-pinkish.

Fig. 41. Androsace sarmentosa Wallich

Forming cushions on rocks around Martoli-Milam area, 3600-4500 m. Flowering and fruiting during June - July.

2. LYSIMACHIA L.

The genus comprises over 200 species, cosmopolitan in distribution, about 12 species in India, only one in Nanda Devi Biosphere.

The generic name is given after King Lysimachos of Greek mythology.

Lysimachia lobelioides Wallich

Tall, annual herbs, suberect or erect, glabrous. Leaves ovate-lanceolate to elliptic-ovate, margins gland dotted. Flowers white or pale-purplish, arranged in racemes.

Found in buffer zone of the Reserve around Suraithota-Raini area, 1800-2200 m. Flowering and fruiting during May - July.

3. PRIMULA L.

About 500 species in the world, about 140 in India, chiefly in temperate and alpine area, 11 in the Biosphere Reserve.

The generic name is derived from a Latin word *Primus* meaning first, referring to the early flowering of the plants. The genus consists of beautiful dwarf plants of alpine region commonly known as "Primrose".

1a.	Flowers rose-red or mauve-pink	2
b.	Flowers blue; purple yellow, white or pink-purple	3
2a.	Leaves equalling or exceeding the scapes; flowers rose-red	**11. P. rosea**
b.	Leaves shorter than the scapes; flowers mauve-pink	**3. P. edgeworthii**
3a.	Flowers white, yellowish or white tinged with purple	4
b.	Flowers blue or purple	6
4a.	Flowers white, tinged with purple	**10. P. munroi**
b.	Flowers yellow or white, not tinged with purple	5
5a.	Scapes much longer than the leaves	**6. P. involucrata**
b.	Scapes much shorter than the leaves	**5. P. hookeri**

6a.	Scapes 1-flowered, sometimes with 2 flowers	**8. P. minutissima**
b.	Scapes more than 3-flowered	7
7a.	Corolla lobes entire	**7. P. macrophylla**
b.	Corolla lobes emarginate or retuse	8
8a.	Leaves narrowed at base into winged petiole	**4. P. elliptica**
b.	Leaves not as above	9
9a.	10-30 cm high herbs with basal buds persistent	**2. P. denticulata**
b.	Tufted, less than 10 cm high herbs, basal buds absent	10
10a.	Leaves obovate; flowers blue	**1. P. atrodenta**
b.	Leaves oblong-elliptic; flowers pink-purple	**9. P. moorcroftiana**

1. Primula atrodentata Sm.

Small, tufted herbs, 6-13 cm high. Leaves obovate-spathulate, dentate. Flowers blue, sessile or with very short pedicels.

Rare, grows in shady moist places around Rishiganga valley, 3500-4000 m. Flowering and fruiting in June October.

2. Primula denticulata Sm. **Fig. 42.**

Erect herbs, 10-30 cm high, stems simple. Leaves crowded at the base. Flowers purple, crowded in head-like umbel, showy.

In cold temperate and alpine region. Common around Latakharak, Martoli, Milam and Dharansi-Sarsupatal area, on moist hill slopes 3000-4000 m. Flowering and fruiting during May October.

3. Primula edgeworthii (Hook.f.) Pax

Small, tufted herbs. Leaves dimorphic at flowering and fruiting time, glabrous, not lobed. Flowers mauve-pink, scape not exceeding the leaves.

Common in shady moist places on hill slopes around Bedni bugyal-Baguabasa, Rupkund area, 3000-4000 m. Flowering and fruiting during June - October.

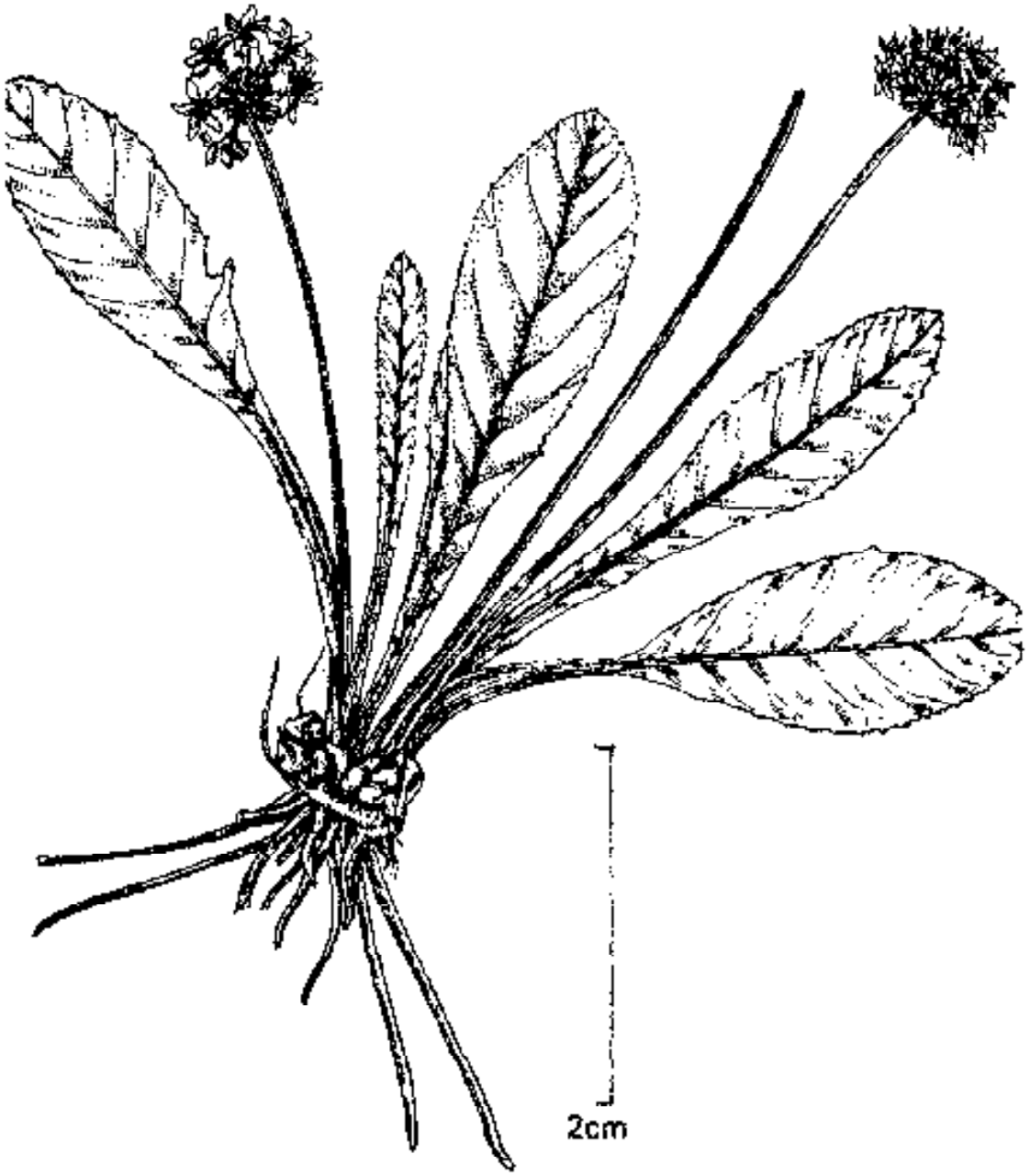


Fig. 42. **Primula denticulata** Sm.

Primula denticulata Sm.

Primula macrophylla D. Don

Gentiana venusta (G. Don) Griseb.

Pedicularis hoffmeisteri Klotz.

Boschniakia himalaica Hook. & Thoms. ex Hook.f.

Orobanche alba Stephon ex Willd.

Phytolacca acinosa Roxb.

Dracocephalum heterophyllum Benth.

Bistorta affinis (D. Don) Greene

Bistorta vaccinifolia (Wallich ex Meissn.) Greene

Oxyria digyna (L.) Hill

4. Primula elliptica Royle

Small herbs with thick rootstocks. Leaves elliptic-ovate, toothed, obtuse at the tip, narrowed at base into winged petiole. Flowers purple, in umbels.

Common on hill slopes in shady places around Martoli bugyal, 3500-4500 m. Flowering and fruiting during June August.

5. Primula hookeri Watt

Tufted herbs with thick, rhizomatous rootstocks. Leaves ovate, toothed. Flowers minute, yellow or white.

Common on hill slopes in moist shady places around Martoli bugyal, 3500-4500 m. Flowering and fruiting during June - July.

6. Primula involucrata Wallich ex Duby

Erect herbs. Leaves coriaceous, not mealy. Scapes stout, flowers white.

Few, in shady-moist places around Rishiganga valley, 3000-4000 m. Flowering and fruiting during June September.

7. Primula macrophylla D. Don

Erect herbs, 15-30 cm high. Leaves crowded, white or mealy beneath. Scapes stout 3-15-flowered, flowers purple, showy, sometimes in two whorls. Fruit ca 2.5 cm long.

Common, on moist shady hill slopes around Dharansi, Martoli, Milam and Saraupatal area, 3500-4500 m. Flowering and fruiting during May September.

8. Primula minutissima Jacq. ex Duby

Very small, densely tufted, stoloniferous herbs. Leaves crowded, dark green. Scapes mostly 1-flowered, flowers bright purple.

Not common, occurs on shady moist hill slopes around Dharansi and Sarsupatal area, 3500-4000 m. Flowering and fruiting during July September.

9. Primula moorcroftiana Wallich ex Klatt.

Perennial herbs. Leaves large, up to 20 cm long, oblong-elliptic, narrowed to spathulate petiole at base. Flowers pink-purple, in umbels.

Common on hill slopes around Milam bugyal area, 3600-4600 m. Flowering and fruiting during June August.

10. Primula munroi Lindl.

Tall, erect herbs, 10-20 cm high. Leaves long petioled. Scapes stout, 2-6-flowered, flowers white with purple tinge.

Not common, grows on shady moist hill slopes around Sarsupatal area, 3500-4000 m. Flowering and fruiting during July September.

11. Primula rosea Royle

Tufted herbs. Leaves dense, crenulate or toothed, subsessile. Scapes equalling or shortly exceeding the leaves, flowers rose-red.

Not common, grows in shady-moist places around Rishiganga valley, 3500-4000 m. Flowering and fruiting during July September.

52. OLEACEAE

About 29 genera and 600 species, cosmopolitan in distribution; 10 genera and about 90 species in India, 2 genera and 3 species in the Biosphere Reserve. Mostly shrubs and trees.

1a.	Leaves pinnately compound; fruit berries	**1. Jasminum**
b.	Leaves simple; fruit capsular	**2. Syringa**

1. JASMINUM L.

The genus comprises about 300 species; about 40 in India, 2 in the Biosphere Reserve. These are climbing or erect shrubs. Many species are cultivated for their foliage and fragrant flowers. A few are grown for Jasmine-oil which is widely used in perfumery.

The generic name is derived from an Arabic name Ysmyn which is referred to sweet scented scandent shrubs.

1a.	Leaves opposite, flowers white	2. J. officinale
b.	Leaves alternate; flowers yellow	1. J. humile

1. Jasminum humile L.

Erect, deciduous shrubs, ca 2.5 m high. Leaves alternate, imparipinnate, leaflets 5-7, decreasing in size downwards, petioles and rachis with distinct, thick wing on either side. Flowers yellow, in terminal corymbs.

Common in open forest around Dibrugheta, 1800-2700 m. Flowering and fruiting during May October.

2. Jasminum officinale L.

Deciduous, climbers. Leaves imparipinnate, leaflets 3-7. Flowers white, arranged in terminal cymes.

Found around Kalikona-Chhenobari in mixed forests, 2200-2600 m. Flowering and fruiting during May September.

2. SYRINGA L.

The genus comprises about 5 species; 2 in India, 1 in the Biosphere Reserve.

Syringa emodi Wallich ex Royle **Fig. 43.**

Large, deciduous shrubs. Leaves elliptic-oblong, narrowed at both ends, pale beneath. Flowers white, fragrant, arranged in dense panicles.

Found around Dodhganga-Dibrugheta and Dibrugheta-Ramni area, 2700-3500 m. Flowering and fruiting during May October.

53. GENTIANACEAE

About 80 genera and 900 species, distributed throughout the globe about 14 genera and 144 species, in India 5 genera and 14 species in the Biosphere Reserve. Exhibits, a great range of variation in habitat and form, mostly perennial herbs, some are shrubs.

1a.	Corolla glandular or spurred at the base	2
b.	Corolla neither glandular nor spurred	3
2a.	Corolla spurred at the base; leaves 5-nerved	**3. Halenia**
b.	Corolla glandular at the base; leave 3-nerved	**5. Swertia**
3a.	Corolla rotate, bluish-white with greenish nerve	**4. Lomatogonium**
b.	Corolla tubular or campanulate, not rotate, green nerves absent	4
4a.	Leaf margins recurved; corolla tube fringed at the top	**2. Gentianella**
b.	Leaf margins not recurved; corolla tube not fringed at the top	**1. Gentiana**

1. GENTIANA L.

About 500 species in the world; about 60-65 in India, mostly Himalayan, 5 in Nanda Devi Biosphere Reserve. The flowers are usually sessile.

This genus is named after Gentius, King of Illyria, who, according to legends, first discovered the medicinal properties of the plant.

1a.	Corolla 2.5 cm or more long	2
b.	Corolla less than 2 cm long	3
2a.	Corolla tubular-campanulate, 1.25 cm wide	**4. G. stipitata**
b.	Corolla tubular, never campanulate, less than 0.7 cm wide	**5. G. venusta**
3a.	Stems naked below	**2. G. capitata**
b.	Stems leafy below	4

Fig. 43. Syringa emodi Wallich ex Royle

4a.	Flowers in 3-flowered cymes; cauline leaves silvery shining	1. G. argentia
b.	Flower clustered in terminal heads; leaves not silvery shining	3. G. carinata

1. Gentiana argentea (Royle ex D. Don) C.B. Clarke

Erect herbs, 2-5 cm high, stems leafy. Cauline leaves silvery shining, lanceolate, radical leaves ovate. Flowers blue, often in 3-flowered cymes.

Common on hill slopes amidst grasses around Deodi-Dibrugheta, 3000-3500 m. Flowering and fruiting during April - June.

2. Gentiana capitata Buch.-Ham. ex D. Don

Small, erect, rosete type herbs, ca 3 cm high, stems naked below. Leaves broadly ovate, crowded. Flowers bluish white with purple band on the back, in terminal leafy heads.

Grows on hill slopes amidst grasses around Martoli and Dharansi area, 2000-3500 m. Flowering and fruiting during March June and September October.

3. Gentiana carinata (D. Don) Griseb.

Small, erect herbs, ca 3 cm high. Radical leaves ovate or elliptic-ovate, cauline leaves obovate, sessile. Flowers clustered in terminal heads, pretty blue, corolla folded.

Common on hill slopes amidst grasses around Martoli bugyals, 3500-4000 m. Flowering and fruiting during June September.

4. Gentiana stipitata Edgew.

Small tufted perennial herbs, stems many from the base. Radical leaves oblong-elliptic, cauline leaves ovate. Flowers solitary, bluish-white.

Common on hill slopes amidst grasses around Milam area, 3200-3600 m. Flowering and fruiting during June September.

5. Gentiana venusta Wallich ex Griseb. **Fig. 44.**

Stemless herbs. Leaves elliptic or obovate, obtuse, dense. Flowers blue, tubular, calyx lobes small, oblong, acute.

Common on hill slopes amidst grasses around Dharansi, 3500-4000 m. Flowering and fruiting during June October.

2. GENTIANELLA Moench

The genus comprises over 260 species in the world; about 8 in India, mostly distributed in North Western Himalaya, 2 in the Biosphere Reserve.

1a.	Leaves oblong-ovate; corolla fimbriate in throat	**2. G. pedunculata**
b.	Leaves linear-lanceolate, corolla not fimbriate in throat	**1. G. maddeni**

1. Gentianella maddeni (C.B. Clarke) Airy-Shaw

Erect, annual, tufted herbs, stems many from the base. Leaves opposite, linear-lanceolate, margins recurved. Flowers light violet, in subterminal cymes.

Common on open hill slopes amidst grasses around Martoli area, 3000-3600 m. Flowering and fruiting during June October.

2. Gentianella pedunculata (D. Don) H. Sm.

Erect or straggling herbs, 6-10 cm high, stems branched. Leaves oblong-ovate, lower leaves spathulate. Flowers blue, terminal, solitary.

Common on open hill slopes, mostly in sandy soils around Bhujgara-Ramni area, 3500-4500 m. Flowering and fruiting during June October.

3. HALENIA Borkh.

The genus comprises over 100 species in the world; 2 in India, 1 in the Biosphere Reserve.

Fig. 44. Gentiana venusta Wallich ex Griseb.

Halenia elliptica D. Don

Erect, glabrous herbs, stems slightly winged. Leaves all opposite, sessile, ovate or elliptic-ovate. Flowers blue or pale-blue.

Common throughout the area in mixed forests and open hill slopes amidst grasses, 2400-3700 m. Flowering and fruiting during July October.

4. LOMATOGONIUM Braun

Lomatogonium carinthiacum (Wulf.) Reichnb.

Erect, annual herbs, ca 15 cm high, filiform, stems many from the base, glabrous. Radical leaves oblong-obovate, cauline leaves ovate. Flowers bluish-white with greenish nerves, rotate.

Common on hill slopes amidst grasses around Bujgar-Ramni and Martoli area, 3500-4000 m. Flowering and fruiting during August October.

5. SWERTIA L.

About 100 species in world; 35-40 in India, 5 in the Biosphere Reserve.

The genus is named after Emmanuel Swert of Haurlem, a famous cultivator of bulbs and flowers in Holland.

1a.	Perennial herbs, stems hollow; peduncles 1-3 flowered	**4. S. cuneata**
b.	Annual herbs, stems solid; flowers in panicles	2
2a.	Flowers all 5-merous	3
b.	Flowers all 4-merous	4
3a.	Corolla white with a broken purple ring at the base	**5. S. paniculata**
b.	Corolla purple or pale-red with a complete dark purple ring at the base	**3. S. ciliata**
4a.	Two glands on each corolla lobe	**2. S. chirayita**
b.	One gland on each corolla lobe	**1. S. angustifolia**

1. Swertia angustifolia Buch.-Ham. ex D. Don.

Tall, erect herbs, stems narrowly winged. Leaves linear-lanceolate, 1-nerved. Flowers blue or greenish-blue or whitish-blue, 4-merous.

Common throughout the area between 2000-2400 m. Flowering and fruiting during July September.

2. Swertia chirayita (Roxb. ex Flem.) Karsten

Tall, erect, robust-herbs. Leaves broadly lanceolate, acute. Flowers yellowish-green, tinged with purple.

Common in the mixed temperate forest and on open hill slopes, 2300-2800 m. Flowering and fruiting during July September.

3. Swertia ciliata (G. Don) Burt Fig. 45.

Erect, annual herbs, 15-60 cm high, stems 4-liniolate, glabrous. Leaves opposite, lanceolate, 3-nerved from the base. Flowers in leafy panicle, white, throat violet.

Common throughout the area, on open hill slopes amidst grasses and in forest areas, 2500-3000 m. Flowering and fruiting during July October.

4. Swertia cuneata Wallich ex D. Don

Erect herbs, 10-20 cm high, with perennial rootstocks, stems hollow. Cauline leaves oblong-spathulate, petioled, peduncles long, 1-3 flowered. Flowers blue.

Common around Dharansi area, on open hill slopes in moist places amidst grasses, 3500-4000 m. Flowering and fruiting during July October.

5. Swertia paniculata Wallich

Erect, annual herbs, stems branched. Leaves oblong-lanceolate. Flowers white with a broken purple ring at the base.

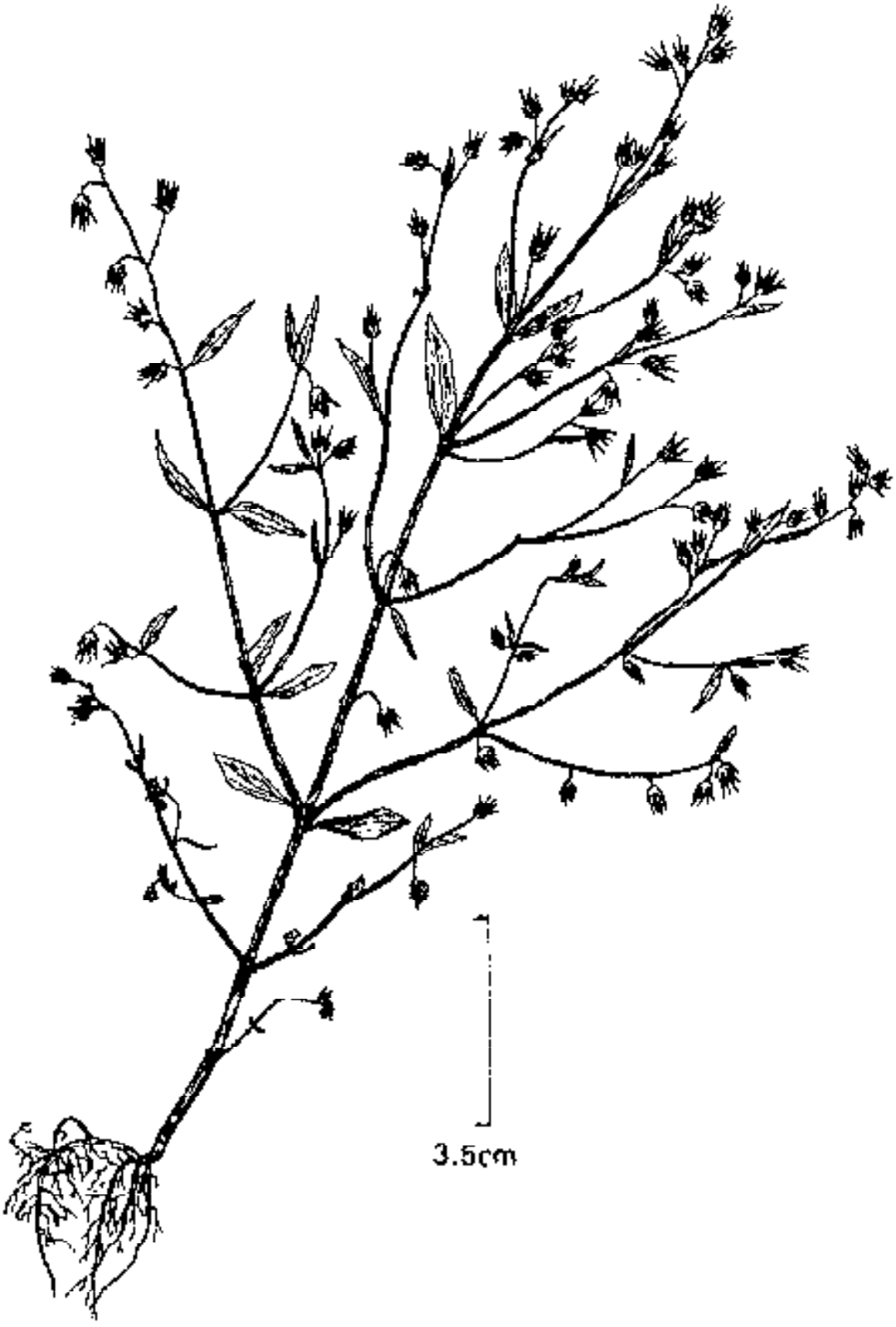


Fig. 45. Swertia ciliata (G. Don) Burt

Common in temperate mixed forest, 2000-2500 m. Flowering and fruits during July September.

54. BORAGINACEAE
(Borage family)

About 100 genera and 2000 species are known in the world, distributed mainly in tropical and temperate region, centre being Mediterranean; about 35 genera and 137 species in India; 7 genera and 9 species in the Biosphere Reserve.

1a.	Receptacle flat; scar basal	2
b.	Receptacle convex or conical; scar up to the whole length of nutlets or up to middle	4
2a.	Flowers in bracteate racemes	1. Arnebia
b.	Flowers in ebracteate racemes	3
3a.	Corolla tube cylindric, long, lobes erect or suberect	6. Mertensia
b.	Corolla tube very short, lobes spreading-twisted	7. Myosotis
4a.	Scar up to the apex of nutlets	3. Cynoglossum
b.	Scar up to the middle of nutlets	5
5a.	Nutlets laterally compressed, smooth	2. Asperugo
b.	Nutlets glochidiate	6
6a.	Racemes elongate furcate, lax; calyx lobes acute	5. Hackelia
b.	Racemes simple or branched; calyx lobes obtuse	4. Eritrichium

1. ARNEBIA Forsk.

The genus comprises about 30 species; 5 in India; 2 species in our area.

The plants are mostly hispid, annual herbs. Some are of medicinal

1a.	Inflorescence globose or broader than long; leaves with only midrib	2. A. euchroma
b.	Inflorescence much elongated, longer than broad; leaves with 3-5 ribs	1. A. benthamii

1. Arnebia benthamii (Wallich ex G. Don) Johnston **Fig. 46.**

Erect, perennial, densely hispid herbs, thick rootstock, stout with purple-red. Radical leaves lanceolate. Flowers crowded in terminal dense spikes, pale-pink or rosy.

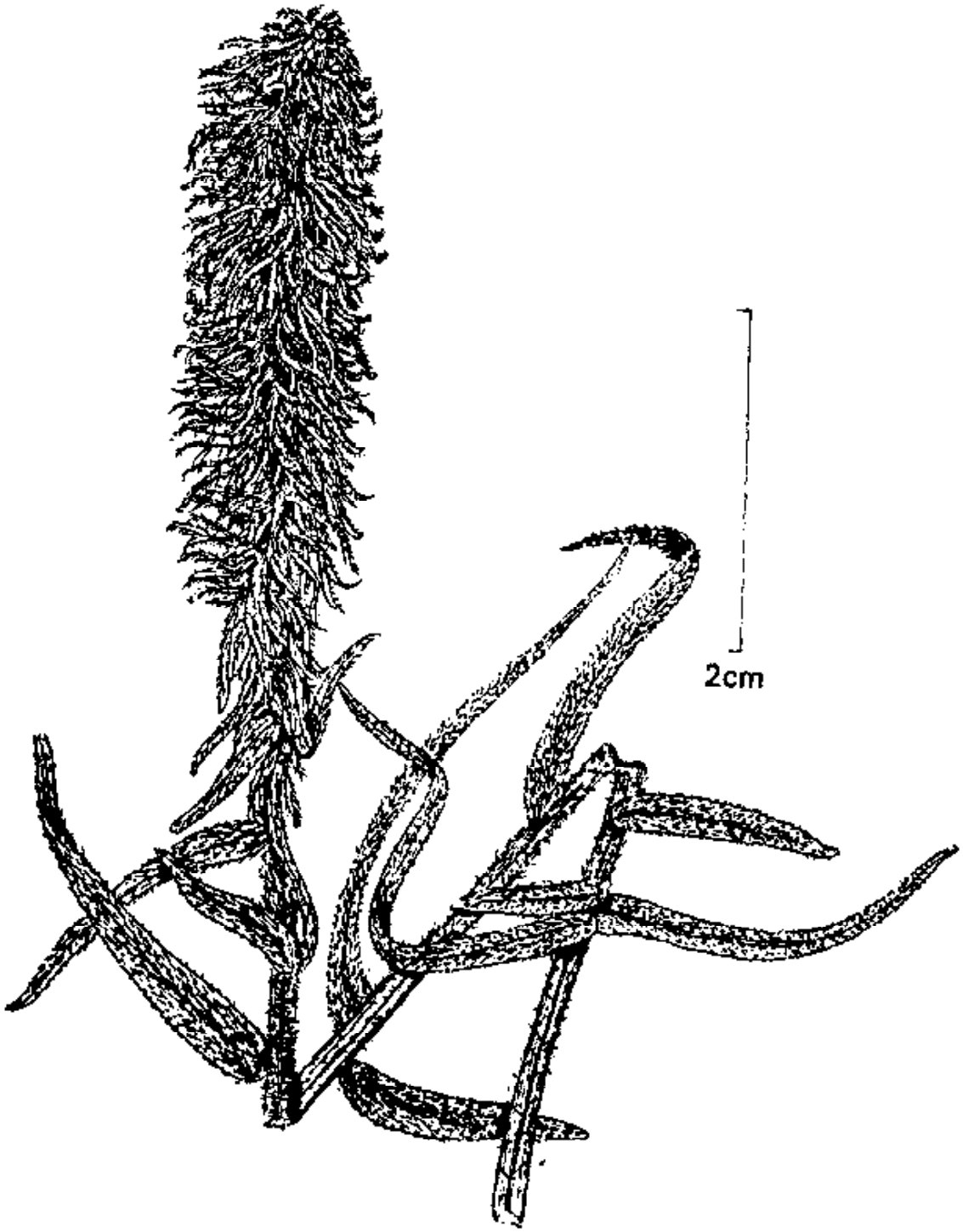


Fig. 46. Arnebia benthamii (Wallich ex G. Don) Johnston

On hill slopes amidst *Geranium*, *Polygonum* on passes. Common around Himtoli, Sarsupatal and Milam area, 3000-5000 m. Flowers and fruits during May September.

2. Arnebia euchroma (Royle) Johnston

Perennial, erect herbs, 10-30 cm high, thick rootstock deep, stem hirsute. Leaves oblong, hirsute. Flowers purplish, crowded in short, many-flowered spikes.

On hill slopes amidst grasses in rocky places. Common around Sarsupatal area, 3500-4500 m. Flowers and fruits during July September.

2. ASPERUGO L.

A monotypic genus.

The generic name is derived from a Latin word *Asper* meaning rough, referring to rough surface.

Asperugo procumbens L.

Decumbent or prostrate, annual herbs, stems weak, hairy. Leaves oblong, spathulate, sessile, hairy, hairs with bulbous base. Flowers axillary, blue.

Grows on hill slopes in moist places amidst grasses. Common around Milam-Martoli area, 3500-4500 m. Flowers and fruits during May September.

3. CYNOGLOSSUM L.

The genus comprises 50-60 species, distributed in temperate and subtropical regions; about 13 species in India, 1 in the Biosphere Reserve.

The generic name is derived from Greek word *Kyon* meaning a dog and *Glossa* meaning tongue, referring to the rough texture of the leaves.

Cynoglossum glochidiatum Wallich ex Benth.

Perennial, erect herbs, stems hairy. Leaves lanceolate, entire or slightly toothed, spathulate, hairy; hairs with bulbous base. Flowers blue, in forked racemes. Nutlets bristly on all sides.

Common throughout the area on open hill slopes and in mixed forest at 2000-3000 m. Flowers and fruits during May September.

4. ERITRICHIUM Schrad.

The genus has about 70 species; 4 or 5 in India; 1 in the Biosphere Reserve.

The generic name is derived from Greek word *Erion* meaning wool and *Thrix* meaning hair, referring to the woolly nature of the herb.

Eritrichium canum (Benth.) Kitam.

Erect, perennial herbs, rootstock, thick woody, stems many from the base. Radical leaves oblong-lanceolate, silky hairy. Flowers blue in terminal branched racemes. Nutlets bristly.

Grows on hill slopes in open places on sandy soils. Common around Martoli area, 5200-4500 m. Flowering and fruiting during June September.

5. HACKELIA Opiz.

About 40 species known in the world; 1 in India and the Biosphere Reserve.

The genus is named after P. Hackel, Professor of Agriculture Leitmeritz.

Hackelia uncinata (Royle ex Benth.) Fischer **Fig. 47.**

Herbs, ca 1 m high, stems laxly hairy. Radical leaves ovate-cordate, laxly hairy. Flowers small, white or whitish-blue, in lax racemes.

Fig. 47. Hackelia uncinata (Royle ex Benth.) Fischer

Common around Dibrugheta-Dharansi area in the core zone of Biosphere Reserve on hill slopes in open places at 3500-4000 m. Flowering and fruiting during June September.

6. MERTENSIA Roth

The genus comprises over 50 species; 8 in India; 1 in the Biosphere Reserve.

The genus is named after Francis karl Mertens, Professor of Medicine at Bremen, Germany.

Mertensia racemosa Benth. ex C.B. Clarke

Decumbent, annual or perennial herbs, stems weak, softly hairy. Radical leaves ovate, with long stalks, softly hairy. Flowers white, in racemes. Nutlets smooth.

Not common, on hill slopes between 2500-3500 m. Flowering and fruiting during May - July.

7. MYOSOTIS L.

About 50 species are known of this genus; 6 in India, 2 in the Biosphere Reserve.

The generic name is derived from Greek word *Myos* meaning a mouse and *Otos* meaning an ear, referring to the leaves which resemble ear of a Mouse.

1a.	Lower leaves sessile	1. M. alpestris
b.	Lower leaves stalked	2. M. sylvatica

1. Myosotis alpestris F.W. Schmidt

Tufted herbs, stems many from the base, spreading hairy. Leaves oblong, spathulate, hairy. Flowers blue, in racemes. Nutlets smooth.

Grows on rocky hill slopes in open places, common around Martoli area at 3000-4000 m. Flowering and fruiting during June October.

2. Myosotis sylvatica Hoffm.

Tufted herbs, 30-40 cm high, stems hairy; hairs spreading. Leaves oblong, lower leaves stalked. Flowers blue, in lax racemes.

Common around Dharansi area in the core zone of Biosphere Reserve on sandy soils between 3500-4000 m. Flowering and fruiting during June October.

55. CONVOLVULACEAE
(Morning-glory family)

The family is represented by about 55 genera and over 1650 species, distributed mainly in tropical and temperate regions; about 30 genera and 158 species in India; 3 genera and 3 species in the Biosphere Reserve.

The plants are mostly herbs, shrubs or rarely trees, several are climbers, few are thorny xerophytes.

1a.	Leafless, parasitic herbs	2. Cuscuta
b.	Leafy herbs	2
2a.	Style branched; stigma linear	1. Convolvulus
b.	Style simple; stigma capitate	3. Ipomoea

1. CONVOLVULUS L.

The genus comprises 250 species, cosmopolitan in distribution; 10 species in India; 1 in the Biosphere Reserve.

Convolvulus arvensis L.

Prostrate, twining herbs. Leaves ovate-lanceolate to sagittate. Flowers purplish white.

Common on hill slopes around Malari and Milam in sandy soil at 3000-3500 m. Flowering and fruiting during June August.

2. CUSCUTA L.

The plants are parasitic twiners, causing several damages to the plants. The genus has about 170 species in tropical and temperate regions of the globe; about 12 species in India; 1 in the Biosphere Reserve.

Cuscuta europaea L.

Slender, twining, leafless herbs, stems pale yellow or pinkish. Flowers waxy white tinged with pink, in sessile globose heads.

Common on hill slopes around Dibrugheta in the core zone of Biosphere Reserve at 3000-400 m. Flowering and fruiting during July October.

3. IPOMOEA L.

The genus comprises 500 species, mostly distributed in tropical and warm temperate regions 60 species in India; 1 in the Biosphere Reserve.

Ipomoea purpurea (L.) Roth.

Extensive twining herbs. Leaves cordate, ovate hairy. Flowers large, pink.

Common, on way to Malari near cultivated fields between 1700-2000 m.

56. SOLANACEAE
(Nightshade family)

The family is represented by about 90 genera and 2000 species, distributed mainly in the tropical and temperate regions of the globe, chief centre being Central and South America; about 15 genera and 88 species in India; 3 genera and 3 species in the Biosphere Reserve.

1a.	Flowers sessile	**1. Hyoscyamus**
b.	Flowers distinctly stalked	2
2a.	Fruits capsular	**2. Physochlaina**
b.	Fruits berries	**3. Solanum**

1. HYOSCYAMUS L.

The genus comprises about 20 species; 2 in India; 1 in the Biosphere Reserve. The leaves of some species are used as medicine.

The generic name is derived from Greek word *Hyoskyamos* meaning Hog-Bean. This was used in curing asthma in Ancient time.

Hyoscyamus niger L. **Fig. 48.**

Perennial, erect herbs, stems viscid. Radical leaves stalked; cauline leaves sessile, ovate-ovoid. Flowers pale yellow or green.

Common on open hill slopes and along the roadside in the cold desert areas of Malari in sandy soils at 3000-3500 m. Flowering and fruiting during June August.

The leaves are used as sedative, narcotic and also in treatment of asthma.

2. PHYSOCHLAINA G. Don

The genus has about 10 species; only 1 in India and the Biosphere Reserve. Leaves of few species are used medicinally.

The generic name is derived from Greek word *Physa* meaning a bladder and *Chlaina* meaning cloak, referring to the inflated calyx.

Physochlaina praealta (Decne.) Miers

Erect, gregarious, viscid, perennial herbs, stems hairy. Leaves ovate-oblong. Flowers greenish-yellow in terminal corymbs. Fruit capsular.

Commonly seen on hill slopes in sandy soil around Milam area at 3500-4500 m. Flowering and fruiting during June September.

3. SOLANUM L.

The genus comprises, about 1700 distributed mainly in temperate regions of the globe; about 40 species in India; 1 in the Biosphere Reserve.

The generic name is derived from Latin word *Solor* meaning soothe, referring to soothing properties.

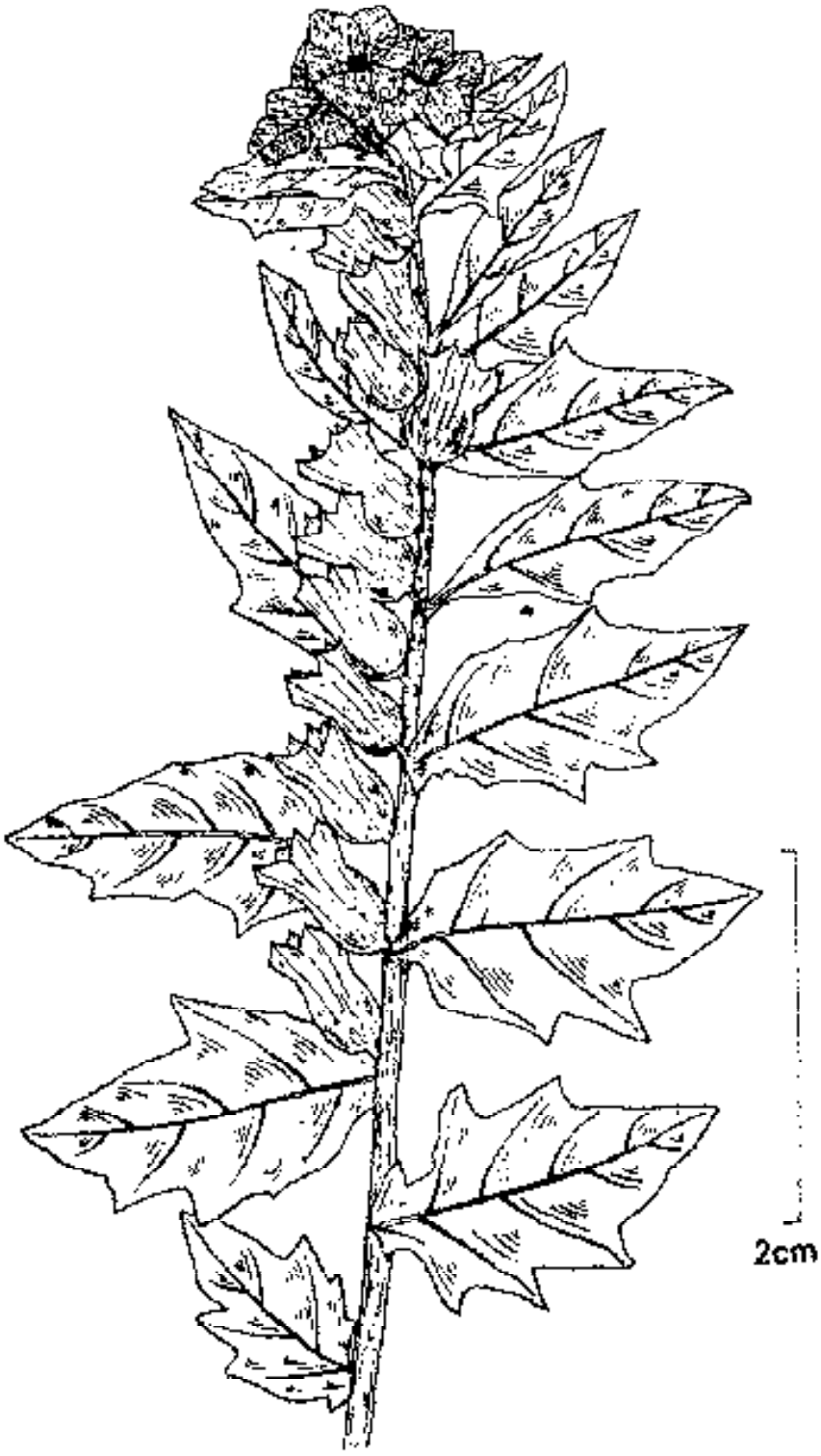


Fig. 48. Hyoscyamus niger L.

The genus includes several plants of edible, medicinal and ornamental value.

Solanum nigrum L.

Erect herbs, stem branched. Leaves alternate, ovate-lanceolate, bluntly toothed. Flowers white, in umbels. Fruit spherical.

Common throughout the area in valleys and temperate regions between 2000-2500 m. Flowering and fruiting during April October.

57. SCROPHULARIACEAE
(Figwort family)

This is a quite large family comprising about 220 genera and 3000 species, cosmopolitan in distribution; about 57 genera and 350 species in India, 8 genera and 20 species in the Biosphere Reserve. Plants are herbs, shrubs and trees, some are root parasite, a few are of medicinal value.

1a.	Yellow-brown, woolly tomentose herbs	7. Verbascum
b.	Herbs not as above	2
2a.	Stamens 4	3
b.	Stamens 2	7
3a.	Corolla 2-lipped	4
b.	Corolla not 2-lipped	6
4a.	Calyx 4-lobed	1. Euphrasia
b.	Calyx 5-lobed	5
5a.	Upper lip of corolla 2-lobed	3. Mazus
b.	Upper lip of corolla not lobed	4. Pedicularis
6a.	Prostrate herbs; leaves dimorphic	2. Hemiphragma
b.	Erect herbs; leaves not dimorphic	6. Scrophularia
7a.	Rootstock thick, covered with leaf base; flowers dimorphic	5. Picrorhiza
b.	Rootstock not as above; flowers uniform	8. Veronica

1. EUPHRASIA L.

The genus is represented by about 25 in India mostly in Himalayan region; 4 in the Biosphere Reserve.

The generic name is derived from the Greek word *Euphrasia* meaning delight, commonly known as "Eye-Bright", some of the plants are believed to cure certain eye diseases.

1a.	Distally pubescent herbs with gland tipped hairs	**1. E. densiflora**
b.	Herbs with glandless hairs (some times a few glandular hairs present intermixed)	2
2a.	Mid lobes of bracts broadly rounded, lateral lobes barely acute	**4. E. platyphylla**
b.	Mid lobes of bracts acute, lateral lobes acuminate to attenuate or aristate	3
3a.	Bracts evidently spreading hairy	**2. E. kurramensis**
b.	Bracts glabrate or puberulent, not spreading hairy	**3. E. laxa**

1. Euphrasia densiflora Pennell

Erect herbs, ca 18 cm high, stems branched, pubescent. Leaves ovate, with 3 pairs of lobules mostly fallen. Flowers in terminal dense spikes, white. Fruits (capsules) ca 0.6 cm long.

Grows on hill slopes in watery places. Common around Martoli area at 3000-4000 m. Flowering and fruiting during June September.

2. Euphrasia kurramensis Pennell

Annual herbs, 20-25 cm high, stems simple or branched below. Leaves semi-glaucescent beneath. Flowers white.

On hill slopes in moist places amidst grasses. Common around Dibrugheta in the core zone of Biosphere Reserve, 3500-4000 m. Flowering and fruiting during July September.

3. Euphrasia laxa Pennell

Annual erect herbs, stems much branched. Lateral lobes of bracts acuminate to attenuate, puberulent to glabrate. Flowers white.

On hill slopes amidst grasses. Common around Doonagiri area at 3000-3500 m. Flowering and fruiting during July September.

4. Euphrasia platyphylla Pennell

Erect, annual herbs, stems slender. Leaves orbicular-ovate, obtusely lobed, pubescent. Flowers in terminal spikes, white with violet lining inside.

On hill slopes amidst grasses around Martoli area at 3000-4500 m. Flowering and fruiting during June September.

2. HEMIPHRAGMA Wallich

A monotypic genus of prostrate herbs.

The generic name is derived from Greek word *Hemi* meaning half and *Phragma* meaning partition, referring to the division of the capsule.

Hemiphragma heterophyllum Wallich

Prostrate, slender, hairy herbs. Leaves dimorphic, orbicular-cordate, ovate or reniform. Flowers pink, axillary. Fruits ovoid.

Common on hill slopes mostly on stoney soils around Dhoodhganga-Kalikora at 2400-3000 m. Flowering and fruiting during May October.

3. MAZUS Lour.

The genus has about 20 species on the globe; about 8 in India; 1 in the Biosphere Reserve.

The generic name is derived from the Greek word *Mazos* meaning one of the breasts, a teat, referring to the mouth of corolla covered with tubercles.

Mazus pumilus (Burm.f.) Steenis

Small, procumbent, annual herbs, stems many from the base. Radical leaves ovate, obtusely toothed. Flowers in racemes, white.

Common throughout the area in valleys in shady moist places between 2000-2500 m. Flowering and fruiting during April October.

4. PEDICULARIS L.

About 500 species of this genus are known in the world; 100 in India; 6 in the Biosphere Reserve. The plants of this genus are popularly known as LOUSCWORTS.

The generic name is derived from Latin word *Pediculus* meaning a lower and Pediculatis meaning relating to lice, referring to the belief that infection of sheep with lice was due to the presence of the species of *Pedicularis*.

1a.	Flowers pink or pink-purple	2
b.	Flowers yellow	5
2a.	Leaves alternate	**1. P. bifida**
b.	Leaves opposite or whorled	3
3a.	Beak of upper lip strongly decurved or coiled; bracts entire	**5. P. pectinata**
b.	Beak of upper lip straight or very slightly decurved; bracts deeply lobed	4
4a.	Leaves opposite; corolla tube much longer than the calyx	**6. P. porrecta**
b.	Leaves whorled; corolla tube slightly longer than the calyx	**2. P. gracilis**
5a.	Corolla tube more than 1 cm long, much exerted	**4. P. longiflora** var. **tubiformis**
b.	Corolla tube short, not exerted	**3. P. hoffmeisteri**

1. Pedicularis bifida (Buch.-Ham. ex D. Don) Pennell

Annual, erect herbs, stems branched at the base. Leaves alternate, petioled. Flowers bright pink.

On hill slopes in temperate forests at 2200-3000 m. Flowering and fruiting during July September.

2. Pedicularis gracilis Wallich ex Benth.

Erect, annual herbs, stems branched. Leaves whorled, pinnatifid. Flowers pink-purple.

Common on hill slopes from temperate to alpine region between 2500-4000 m. Flowering and fruiting during July September.

3. Pedicularis hoffmeisteri Klotz.

Tall, erect herbs. Leaves ovate-oblong, dentate-lobed, hairy. Flowers ca 30 cm long, yellow, in terminal racemes.

Grows on hill slopes in moist places amidst grasses. Common around Himtoli & Martoli area between 3000-4000 m. Flowering and fruiting during June October.

4. Pedicularis longiflora Rudolph var. **tubiformis** (Klotz.) Tsoong

Gregarious, tufted herbs, stems many from thick rootstocks. Radical leaves persistent, whorled oblong-linear, pinnatifid; cauline leaves opposite. Flowers axillary, yellow.

Common around Milam-Martoli area, on hill slopes in shady moist places at 3500-4500 m. Flowering and fruiting during June September.

5. Pedicularis pectinata Wallich ex Benth. **Fig. 49.**

Erect herbs, stems branched at the base. Radical leaves persistent, oblong, pinnatifid; cauline leaves whorled. Flowers in terminal, dense racemes forming spikes, pink.

Common around Himtoli and Milam-Martoli area, on moist hill slopes amidst grasses at 3500-4500 m. Flowering and fruiting during June October.

6. Pedicularis porrecta Wallich ex Benth.

Perennial herbs with many stems from the base. Leaves opposite, pinnatifid. Flowers pink.

Common throughout the area around Dibrugheta-Sarsupatal at 3500-4200 m. Flowering and fruiting during June September.

Fig. 49. Pedicularis pectinata Wallich ex Benth.

5. PICRORHIZA Royle ex Benth.

Only 2 species of this genus are known, both are Indian, distributed in alpine Western Himalaya; 1 in the Biosphere Reserve. The roots of these plants are used as tonic and purgative.

The generic name is derived from the Greek word *Pikros* meaning bitter and *Rhiza* meaning roots, referring to the presence of bitter alkaloid "Picrorhizin" in the roots.

Picrorhiza scrophulariiflora Pennell

Perennial herbs, ca 40 cm high, rootstock thick, clothed with leaf bases. Leaves subradical, spathulate, serrate, hairy. Flowers sky blue.

Common around Deodi, Ramni, Dhansari and around Baguabasa-Rupkund area in the core zone of Biosphere Reserve on hill slopes amidst grasses at 3000-4500 m. Flowering and fruiting during June - July.

6. SCROPHULARIA L.

The genus comprises about 300 species; about 23 in India, 2 in the Biosphere Reserve.

The generic name is derived from Latin word *Scrofula*, referring to the belief that it is useful in curing scrofula.

1a.	Stamens exserted; sepals rounded	2. S. himalensis
b.	Stamens included; sepals acute to attenuate	1. S. calycina

1. Scrophularia calycina Benth.

Erect herbs, ca 60 cm high. Leaves ovate-lanceolate. Flowers greenish-purple or white, in dense cymes. Stamens included.

Around Dhansari area in the core zone of Biosphere Reserve, on open hill slopes amidst grasses at 3000-4000 m. Flowering and fruiting during May October.

2. Scrophularia himalensis Royle ex Benth.

Erect herbs, ca 50 cm high. Leaves ovate-lanceolate. Flowers green, in lax cymes. Stamens exserted.

On hill slopes, ascending up to 2500 m. Flowering and fruiting during June-October.

7. VERBASCUM L.

About 300 species of the genus are known in the world; only 6 in India; 1 in the Biosphere Reserve.

Verbascum thapsus L.

Perennial herbs, 30-70 cm high, stem simple, densely yellow-grey woolly tomentose. Leaves ovate-oblong, lanceolate. Flowers yellow, in terminal, woolly spikes.

On open hill slopes, mostly on dry sandy soils. Common throughout the area between 1500-3500 m. Flowering and fruiting during major part of the year.

8. VERONICA L.

The genus comprises about 300 species; 32 in India, 4 in the Biosphere Reserve. A few species of the genus are edible.

The genus is named in honour of St. Veronica.

1a.	Main stem not terminating in inflorescence; leaves all opposite	**1. V. cephaloides**
b.	Main stem terminating in inflorescence; upper leaves alternate	2
2a.	Corolla lobes 5; sepal all equal	**4. V. umbelliformis**
b.	Corolla seemingly 4; uppermost sepal much smaller than other four	3
3a.	Corolla 1.5-2.5 cm long; stems 10-40 cm long	**2. V. himalensis**
b.	Corolla 0.6-0.8 cm long; stems 5-15 cm long	**3. V. macrostemon**

1. Veronica cephaloides Pennell

Erect, simple or branched, pubescent herbs. Leaves ovate, crenate-dentate. Flowers blue.

Around Dunagiri area on hill slopes at 2700-3000 m. Flowering and fruiting during July September.

2. Veronica himalensis D. Don

Herbs, 10-40 cm high, stems many from the root, slender, pubescent. Leaves ovate-oblong, pubescent, sessile. Flowers purple. Fruit oblong.

Common around Dharansi, on hill slopes in shady moist places at 3200-4000 m. Flowering and fruiting during July September.

3. Veronica macrostemon Bunge ex Ledeb.

Perennial, hoary-pubescent, diffused herbs, 5-10 cm high. Leaves elliptic or elliptic-ovate, sessile. Flowers blue.

Grows around Kalikana-Dhoodhganga, Dibrugheta area on hill slopes, 2500-3500 m. Flowering and fruiting during July September.

4. Veronica umbelliformis Pennell

Suberect herbs, 5-15 cm high, stems pubescent. Leaves ovate or oblong, entire, subsessile or shortly petioled. Flowers blue, in sessile heads.

On hill slopes in shady moist places amidst grasses. Common around Sarsupatal at 3200-4000 m. Flowering and fruiting during July September.

58. OROBANCHACEAE

(Broomrape family)

The family comprises 13 genera and over 180 species, mostly distributed in North temperate Europe and Asia and a few in America and tropics; about

9 genera and over 54 species in India; 3 genera and 3 species in the Biosphere Reserve.

1a.	Corolla lobes subequal spreading, not 2-lipped	**1. Aeginetia**
b.	Corolla 2-lipped	2
2a.	Upper lip 2-lobed	**3. Orobanche**
b.	Upper lip entire	**2. Boschniakia**

1. AEGINETIA L.

The genus comprises 10 species; 2 in India, 1 in the Biosphere Reserve.

The genus is named after Paul Aeginette, a celebrated Physician.

Aeginetia indica L.

Leafless, herbaceous, root parasite. Scapes solitary, covered with few scales near the base. Flowers solitary, purple.

In coniferous forest around Belta, 2500-2800 m. Flowering and fruiting during August October.

2. BOSCHNIAKIA Mey.

The genus comprises 3 species; only 1 species in India and the Biosphere Reserve.

Boschniakia himalaica Hook. & Thoms. ex Hook.f.

Robust, pale-brown, parasitic herbs, tuberous at the base. Scales many. Flowers purplish-white.

Around Dunagiri and Dibrugheta, Deodi and Dharansi area at 3000-3500 m. Flowering and fruiting during June September.

3. OROBANCHE L.

This is the largest genus of the family comprising over 140 species; 10 in India, 1 in the Biosphere Reserve.

The generic name is derived from Greek word *Orobos* meaning vetch and *Ancho* meaning to strangle, supposed to kill the plant on which it grows.

Orobanche alba Stephon ex Willd.

Scapigerous, erect, glandular-pubescent, red or purple-brown, parasitic herbs. Scales alternate. Flowers red brown.

Around Himtoli Deodi-Dibrugheta and Kalikana-Chhenobari area at 2700-3300 m. Flowering and fruiting during May October.

59. LENTIBULARIACEAE

The family comprises 4 genera and 170 species of cosmopolitan distribution; 2 genera and over 29 species in India, only 1 in the Biosphere Reserve. The plants are insectivorous herbs, mainly found in watery, moist places.

PINGUICULA L.

The genus is represented by over 40 species; only 1 in India known to occur in alpine Himalaya; 1 in the Biosphere Reserve.

The generic name is derived from Latin word *Pinguis* meaning flat, referring to the greasy appearance of the plant.

Pinguicula alpina L.

Erect herbs, with rosulate, entire radical leaves. Flowers white with yellow spots.

Rare around Bhujgar-Ramni area amidst grasses at 3500-3800 m. Flowering and fruiting during June July.

60. BIGNONIACEAE
(Bignonia family)

The family comprises 120 genera and over 650 species, chiefly distributed in tropical regions, very few in subtropical-temperate region; only 1 species in the Biosphere Reserve.

INCARVILLEA Juss.

The genus comprises about 15 species; 3 in India, 1 in the Biosphere Reserve.

The genus is named after Fr. Pierre d' Incarville, botanical correspondent of French Botanist Bernard De Jussien.

Incarvillea arguta (Royle) Royle

Glabrous, perennial undershrubs or small shrubs, stems weak, trailing. Leaves pinnate. Flowers pink.

On rocks, around Lata-Reni area at 1900-2200 m. Flowering and fruiting during June August.

61. ACANTHACEAE
(Acanthus family)

The family comprises about 250 genera and over 2500 species, distributed chiefly in America, Australia, Indomalaysia, Africa and Brazil; about 68 genera and over 337 species in India; 4 genera and 4 species in the Biosphere Reserve.

1a.	Corolla lobes sub equal, spreading	2
b.	Corolla 2-lipped	3
2a.	Calyx 4-parted, toothed, teeth spinous; bracts none	**1. Barleria**
b.	Calyx 5-parted, not spinous; bracts present	**3. Goldfussia**
3a.	Corolla pale-purple with white branched vein on the lip	**4. Justicia**
b.	Corolla pink with few purple spots	**2. Diclipiera**

1. BARLERIA L.

The genus comprises over 230 species; 26 species in India, 1 in the Biosphere Reserve.

Barleria cristata L.

Erect undershrubs. Leaves lanceolate to ovate-elliptic. Flowers violet or violet-white; calyx spinous toothed.

Common in the buffer zone of the area, on rocks in shady places at 1900-2200 m. Flowering and fruiting during March September.

2. DICLIPTERA Juss.

The genus comprises 10 species; 7 in India, 1 in the Biosphere Reserve.

Dicliptera roxburghiana Nees

Erect or procumbent, perennial herbs often rooting below. Leaves ovate-lanceolate. Flowers pink-purple, combined in terminal spikes.

In the buffer zone, Lata-Reni area at 1900-2200 m. Flowering and fruiting throughout the year.

3. GOLDFUSSIA Nees

The genus has over 30 species, chiefly distributed in Himalayas, Philippine Islands and Java. Often considered as congeneric with *Strobilanthes* Bl.

The genus is named after George. A. Goldfuss, Professor of Natural History at Bonn, Germany.

Goldfussia dalhousiana Nees

Tall, perennial herbs. Leaves elliptic-ovate, toothed. Flowers blue, clustered in short spikes.

Around Lata-Belta area at 2000-2600 m. Flowering and fruiting during June-November.

4. JUSTICIA L. (*Sensu stricto*)

The genus comprises over 100 species; 20 in India, only 1 is present in the Biosphere Reserve.

The genus is named after James Justice, Scottish Horticulturist and Botanist.

Justicia procumbens L. var **simplex** (D. Don) Yamazaki

Much branched, erect or ascending, hairy herbs. Leaves ovate or ovate-lanceolate, shortly petioled. Flowers pale purple.

Common around Lata-Suraithola area at 1900-2200 m. Flowering and fruiting during March October.

62. LAMIACEAE
(Mint family)

The family comprises about 180 genera and 3500 species, distributed throughout the globe; about 64 genera and over 380 species in India, mainly in mountainous region, 18 genera and 32 species in the Biosphere Reserve. These are mostly aromatic herbs, many of them are of utmost economic value.

1a.	Flowers 2-lipped	2
b.	Flowers not 2-lipped, regular	16
2a.	Stamens 2	**15. Salvia**
b.	Stamens 4	3
3a.	Lower lip of the corolla distinctly 3-lobed	4
b.	Lower lip of corolla entire or lateral lobes very small	5
4a.	Lower lip of corolla boat-shaped; flowers in lax panicles or in racemes	**13. Plectranthus**
b.	Lower lip of corolla not boat-shaped	**6. Lamium**
5a.	Calyx 2-lipped	6
b.	Calyx not 2-lipped, teeth equal or so	10
6a.	Corolla tube sharply recurved	**14. Scutellaria**
b.	Corolla tube straight	7

7a.	Flowers white; calyx 15-nerved	**3. Dracocephalum**
b.	Flowers pink purple or purplish-violet or blue; calyx 10-13 nerved	8
8a.	Calyx mouth closing after flowering	**14. Prunella**
b.	Calyx mouth remaining open after flowering	9
9a.	Flowers pink-purple; leaves less than 1.3 cm long	**18. Thymus**
b.	Flowers blue; leaves more than 1 cm long	**2. Clinopodium**
10a.	Upper lip of the corolla concave or hood like	11
b.	Upper lip of the corolla flat or nearly so	13
11a.	Inner or upper pair of stamens longer than the outer or upper pai	**10. Nepeta**
b.	Outer or lower pair of the stamens longer than the inner or upper ones	12
12a.	Calyx with 10 teeth	**7. Leucas**
b.	Calyx 5-toothed	14
13a.	Flowers less than 2 cm long, pink spotted with purple	**17. Stachys**
b.	Flowers more than 2 cm long, blue purple	**12. Phlomis**
14a.	Leaves 2.5 cm or more long	15
b.	Leaves less than 1 cm long	**9. Micromeria**
15a.	Flower in axillary whorls, blue or lilac	17
b.	Flowers in short spikes, pink or pink-purple	**11. Origanum**
16a.	Whorls of flowers axillary, secund; calyx 15-nerved	**5. Hyssopus**
b.	Whorls of flowers not secund; calyx 10-nerved	**1. Ajuga**
17a.	Stamens in unequal pair, flowers white, purple or yellow	**4. Elsholtzia**
b.	Stamens in equal pair flowers lilac	**8. Mentha**

1. AJUGA L.

The genus comprises 50 species in the world out of which 7 are present in India and in the Biosphere Reserve.

1a.	Leaves entire or subentire; flowers blue	**2. A. parviflora**
b.	Leaves crenate; flowers pinkish-white	**1. A. brachystemon**

1. Ajuga brachystemon Maxim.

Procumbent or prostrate, perennial herbs, stout with woody rootstocks, stems many from the base. Radical leaves oblong-ovate, spathulate; cauline sessile. Flowers minute, in whorls forming terminal dense spikes, pink.

Common around Martoli area on hill slopes and in rock crevices at 2000-3500 m. Flowering and fruiting during April October.

2. Ajuga parviflora Benth.

Perennial, procumbent, low herbs with stout rootstock, stem branched, pubescent. Leaves ovate-oblong, spathulate, purple beneath. Flowers in dense spikes, blue.

Common throughout the area on hill slopes, 1500-4000 m. Flowering and fruiting during May October.

2. CLINOPODIUM L.

The genus comprises about 10 species, mainly in North temperate regions of the globe, about 8 species are known in India; 1 in the Biosphere Reserve.

A few are of medicinal importance.

Clinopodium umbrosum (M. Bieb.) C. Koch.

Decumbent or erect, annual herbs, stems hairy. Leaves ovate, toothed, acute, petiolate, hairy. Flowers in clusters, blue.

Common throughout the area under forest cover amidst grasses at 1800-2700 m. Flowering and fruiting during April October.

3. DRACOCEPHALUM L.

The genus has about 50 species; 8 in India; 1 in the Biosphere Reserve. A few are cultivated for the oil extracted from the leaves.

The generic name is derived from Greek word *Drakon* meaning dragon and *Kephale* meaning head, referring to the appearance of the heads of the flowers.

Dracocephalum heterophyllum Benth.

Annual or perennial, decumbent or prostrate, annual herbs. Flowers white, tinged with purple. Roots are used as vegetable.

Common throughout the area on hill slopes, mostly on open sandy soils at 3000-3800 m. Flowering and fruiting during July September.

4. ELSHOLTZIA Willd.

The genus comprises about 40 species; 12 in India; 4 in the Biosphere Reserve. A few are known for yielding essential oil.

The genus is named after Johann Sigismund Elsholtz, a German botanist.

1a.	Spikes upto 20 cm long; large undershrubs	2. E. fruticosa
b.	Spikes less than 10 cm long; annual herbs	2
2a.	Small, tender herbs, upto 10 cm high	4. E. strobilifera
b.	15-90 cm high herbs	3
3a.	Bracts rounded or broadly ovate; nutlets opaque	1. E. eriostachya
b.	Bracts narrow, linear subulate or acicular; nutlets shining	3. E. stachyodia

1. Elsholtzia eriostachya (Benth.) Benth.

Erect herbs, 10-60 cm high, strongly aromatic, stems much branched, softly hairy. Leaves oblong, ovate-oblong, denticulate. Flowers yellow, in solitary spikes.

Common throughout the area around Deodi-Dibrugheta, Dunagiri and Malari on hill slopes amidst grasses at 3000-4500 m. Flowering and fruiting during July September.

2. Elsholtzia fruticosa (D. Don) Rehder

Tall, erect herbs, upto 1.2 m high, aromatic. Leaves lanceolate or elliptic lanceolate, pubescent. Flowers white, in long spikes.

Common along the bridal path and in mixed forest around Lata-Belta area, at 2000-2800 m. Flowering and fruiting during June September.

3. Elsholtzia stachyodia (Link) Raizada & Saxena

Erect herbs, upto 90 cm high, aromatic. Leaves ovate, toothed, pubescent, flowers white.

Common on hill slopes around buffer zone area at 1500-2700 m.

4. Elsholtzia strobilifera (Benth.) Benth.

Small herbs. Leaves ovate, crenate. Flowers pale-purple, arranged in cone like spikes.

Common around Dibrugheta-Sarsupatal and Bagua basa-Rupkund area on hill slopes at 3300-4700 m. Flowering and fruiting during June October.

5. HYSSOPUS L.

The genus comprises about 15 species, only one species in India and the Biosphere Reserve.

A few are of medicinal importance.

Hyssopus officinalis L.

Perennial herbs or undershrubs, stems much branched, glabrous. Leaves sessile, entire, obtuse. Flowers bluish-purple.

Common around Malari area on open hill slopes, mostly in sandy soils at 2800-3400 m. Flowering and fruiting during July September.

6. LAMIUM L.

The genus is represented by approximately 40 species in world; 3 in India, 2 species in Nanda Devi Biosphere Reserve.

The generic name is derived from the Latin word *Lamios* meaning the throat, referring to the form of the flowers.

1a. Leaves ovate, deeply and irregularly toothed, acuminate; flowers white **1. L. album**
b. Leaves orbicular, crenate, obtuse; flowers pink **2. L. amplexicaule**

1. Lamium album L.

Erect, annual herbs, stems strongly ribbed, hairy. Leaves ovate, irregularly and deeply toothed, acuminate, hairy. Flowers crowded in axillary whorls, white.

Common around Martoli area on hill slopes at 2000-4000 m. Flowering and fruiting during April September.

2. Lamium amplexicaule L.

Decumbent, annual herbs, stems hairy. Leaves orbicular, crenate, obtuse, hairy; upper sessile; lower petiolate. Flowers crowded in axillary whorls, pinkish.

Common on hill slopes in open places around Martoli-Milam area at 3000-4000 m. Flowering and fruiting during March September.

7. LEUCAS R. Br.

The genus comprises about 110 species, distributed mainly in tropical America, West Indies, Africa and Indo Malesia; 40 species in India, 1 in the Biosphere Reserve.

The generic name is derived from Greek word *Leukos* meaning white, referring to the colour of the flowers.

Leucas lanata Benth.

Erect, perennial herbs, stems white silky to tomentose. Leaves ovate, crenate, softly white silky, tomentose. Flowers clustered in axillary whorls, white.

Common throughout the area on rocks and on hill slopes in open places, at 1500-2500 m. Flowering and fruiting during April November.

8. MENTHA L.

The genus has about 25 species, distributed mainly in North temperate region of the globe; ca 6 species in India, 1 in the Biosphere Reserve.

Aromatic herbs. A few are of great economic importance.

The generic name is derived from the Greek word *Mintha* meaning mint.

Mentha longifolia (L.) Huds.

Erect, annual or perennial herbs, stems hoary pubescent. Leaves lanceolate, ovate or oblong. Flowers in spikes, small, lilac.

Common on hill slopes mostly in open places in sandy soil around Malari area at 2800-3300 m. Flowering and fruiting during July September.

9. MICROMERIA Benth.

About 100 species of the genus are known in the world; 3 in India, distributed mainly in Himalaya; 1 in the Biosphere Reserve.

The generic name is derived from the Greek word *Mikros* meaning small and *Meris* meaning part, referring to the small flower.

Micromeria biflora (Buch.-Ham.) Benth.

Procumbent or prostrate, perennial, aromatic herbs, stems slender, branched, hairy. Leaves ovate-elliptic, acute. Flowers crowded in axillary cymes, pink.

Common throughout the forest areas in open places and in rock crevices at 1800-3500 m. Flowering and fruiting during March October.

10. NEPETA L.

The genus has about 250 species, distributed in temperate Eurasia, North Africa and mountains of tropical Africa; about 35 species in India, almost all confined to temperate and alpine Himalaya; 4 in the Biosphere Reserve.

The generic name is derived from the Latin word *Nepa* meaning scorpion.

1a.	Floral whorls in panicles	**4. N. leucophylla**
b.	Floral whorls in spikes	2
2a.	Leaves white tomentose	**1. N. discolor**
b.	Leaves not white tomentose	3
3a.	Leaves distinctly stalked; flowers purple-blue	**3. N. laevigata**
b.	Leaves sessile or subsessile; flowers deep blue	**2. N. eriostachya**

1. Nepeta discolor Royle ex Benth.

Annual or perennial herbs, with elongated, rootstock, stem weak. Leaves broadly ovate, small, white tomentose. Flowers white or pale-blue.

Common on hill slopes amidst grasses around Donagiri and Deodi-Ramni area at 2400-3300 m. Flowering and fruiting during July September.

2. Nepeta eriostachya Benth.

Erect, sparsely hairy, herbs. Leaves broadly ovate, sessile or subsessile. Flowers deep blue, in spicate whorls.

On hill slopes and in mixed forest around Tolma-Himtoli and Donagiri area at 2500-3500 m. Flowering and fruiting during July October.

3. Nepeta laevigata (D. Don) Hand.-Maz.

Erect, sparsely hairy, herbs. Leaves ovate or triangular. Flowers purple blue, in spicate whorls.

On hill slopes and in mixed forest around Tolma-Himtoli and Donagiri area at 2500-3500 m. Flowering and fruiting during June October.

4. Nepeta leucophylla Benth.

White tomentose, erect herbs. Leaves ovate with distinct stalk, cordate at base. Flowers lilac-blue.

Around Jumma-Donagiri area, 2500-3000 m. Flowering and fruiting during July October.

11. ORIGANUM L.

The genus has about 20 species; 1 in India and the Biosphere Reserve. Essential oil, extracted from a few species, is used in soap industry.

The generic name is derived from the Greek word *Oveos* meaning a mountain and *Ganos* meaning Joy. Popularly known as "Joy of Mountain" referring to scent and colour of its flowers.

Origanum vulgare L.

Erect, aromatic herbs, 30-70 cm high, stems hairy. Leaves ovate, entire, petiolate. Flowers small, clustered, purplish-white or pink.

Common throughout the area on hill slopes amidst grasses and along the bridal paths at 1500-4000 m. Flowering and fruiting occurs during July-October.

12. PHLOMIS L.

The genus is represented by 10 species in the world; 11 in India and two in Nanda Devi Biosphere reserve area.

1a.	Leaves densely hispid; bracts spinescent; flowers pink	**2. P. macrophylla**
b.	Leaves hairy; bracts simple; flowers blue	**1. P. bracteosa**

1. Phlomis bracteosa Royle ex Benth.

Erect, annual or perennial herb, stems strongly 4-angled, hairy. Leaves ovate, crenate, acute, base caudate. Flowers crowded in axillary whorls, bluish.

Common around Martoli-Milam and Himtoli area on hill slopes at 3400-4500 m. Flowering and fruiting during July October.

2. Phlomis macrophylla Wallich ex Benth.

Tall, erect, annual or perennial herbs, stems hairy. Leaves ovate, crenate, hairy. Flowers crowded in axillary whorls, pink.

Common on hill slopes around Martoli-Milam area on hill slopes at 3000-5000 m. Flowering and fruiting during May September.

13. PLECTRANTHUS L'Herit

The genus comprises ca 250 species mainly distributed in tropical Africa to Japan, Malaysia, Australia and Pacific; ca 30 species in India; 3 species in the Biosphere Reserve.

1a.	Lower surface of leaves white tomentose	**2. P. rugosus**
b.	Lower surface of leaves not white tomentose	2
2a.	Corolla tube straight	**3. P. striatus**
b.	Corolla tube abruptly decurved	**1. P. japonicus**

1. Plectranthus japonicus (Burm.f.) Koidzuma

Erect, perennial herbs or undershrubs. Leaves ovate-lanceolate. Flowers blue or violet.

Common on slopes in mixed forest and on slopes amidst *Impatiens* sp., around Tolma-Himtoli and Donagiri area at 2500-3000 m. Flowering and fruiting during July October.

2. Plectranthus rugosus Wallich ex Benth.

Tall, erect, densely pubescent, perennial herbs or undershrubs. Leaves oblong or ovate, toothed. Flowers white.

Common throughout the area at 2000-3000 m. Flowering and fruiting during July October.

3. Plectranthus striatus Benth.

Erect herbs. Leaves ovate, dentate-crenate. Flowers white.

Common throughout the buffer zone area around Tolma, Jumna and Lata area at 2200-3000 m. Flowering and fruiting during July October.

14. PRUNELLA L.

The genus comprises 7 species, distributed in temperate Eurasia, North west Africa and North America; only 1 species in India, and the Biosphere Reserve.

Prunella vulgaris L.

Annual, erect, hairy herbs. Leaves distinctly stalked, ovate. Flowers violet, in terminal clusters.

Common throughout the temperate and subalpine regions at 2000-3400 m. Flowering and fruiting during June October.

15. SALVIA L.

The genus comprises about 700 species, distributed mainly in tropical and temperate regions of the globe; about 25 species in India, 3 in the Biosphere Reserve.

The generic name is derived from a Latin word *Salvus* meaning whole, well-preserved, in allusion to the qualities attributed to Sage. In early times sage has been used for curing all kinds of diseases, for stuffing meat and game.

1a.	Flowers yellow	3. S. nubicola
b.	Flowers blue	2
2a.	White, woolly, tomentose herbs; leaves sessile	2. S. lanata
b.	Hairy herbs; leaves stalked	1. S. hians

1. Salvia hians Royle ex Benth.

Tall, robust, annual or perennial herbs, stems viscidly hairy. Leaves ovate-hastate or cordate, toothed, petiolate. Flowers blue.

Common throughout the area in forest areas in shady places at 2700-3500 m. Flowering and fruiting during July October.

2. Salvia lanata Roxb.

White, woolly tomentose, erect herbs. Leaves oblong, sessile, floral leaves large, orbicular. Flowers blue.

Around buffer zone area at 2200-2700 m. Flowering and fruiting during June September.

3. Salvia nubicola Wallich ex Sw. **Fig. 50.**

Tall, erect, viscidly hairy herbs. Leaves crenate, ovate-oblong, stalked. Flowers yellow.

Common throughout the area at 2300-3000 m. Flowering and fruiting during July October.

16. SCUTELLARIA L.

The genus comprises 300 species in the world; about 17 in India, 2 in Nanda Devi Biosphere Reserve.

The generic name is derived from the Latin word *Scutella* meaning a little saucer or shield, referring to the form of fruiting calyx.

1a.	Flowers blue; petioles more than 1 cm long	**1. S. discolor**
b.	Flowers white, yellow inside; petioles less than 1 cm long	**2. S. prostrata**

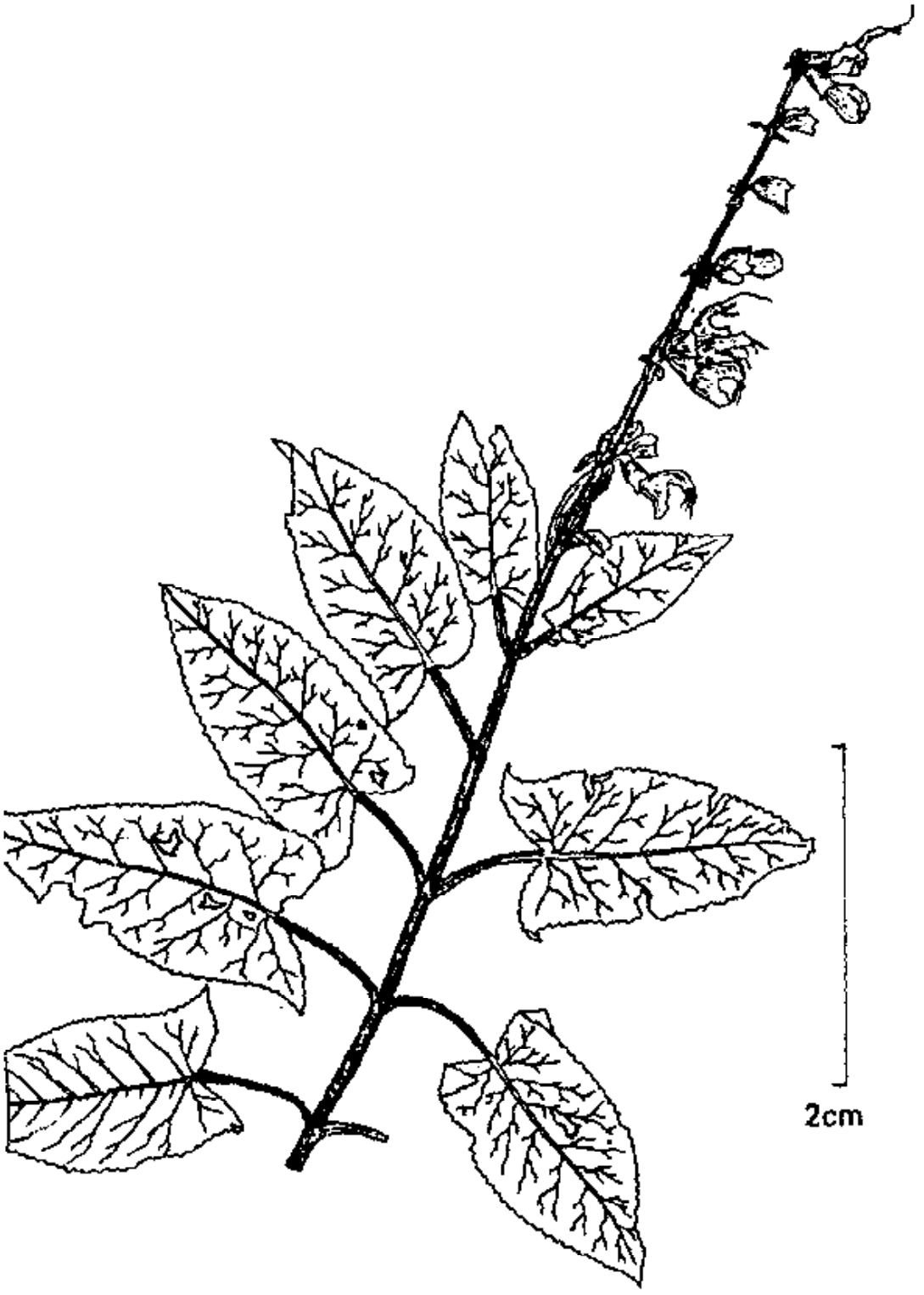


Fig. 50. Salvia nubicola Wallich ex Sw.

1. Scutellaria discolor Colebr.

Decumbent or erect, perennial herbs, stems rooting at the base. Leaves ovate, elliptic-ovate, petiolate. Flowers blue in racemes.

Common throughout the area in temperate forest area on hill slopes amidst grasses at 1400-2200 m. Flowering and fruiting during April October.

2. Scutellaria prostrata Jacq. ex Benth. Fig. 51.

Prostrate, annual or perennial, tufted, small herbs with thick rootstock, stems branched. Leaves ovate, obtusely toothed, pubescent or tomentose. Flowers crowded in condensed spikes, white outside, yellow inside.

Common around Martoli-Milam area along the bridal path and on open hill slopes in sandy soils at 3000-3500 m. Flowering and fruiting during June September.

17. STACHYS L.

The genus comprises ca 300 species distributed in Northern and Southern tropical and subtropical regions excluding Australia and Newzealand; ca 9 species in India 1 in the Biosphere Reserve.

Stachys sericea Wallich ex Benth.

Tall, erect, tomentose herbs. Leaves ovate or oblong, cordate. Flowers purple.

Common on hill slopes throughout the buffer zone area around Jumma-Donagiri area at 2500-3000 m. Flowering and fruiting during July October.

18. THYMUS L.

The genus comprises about 300 species; 2 in India 1 in the Biosphere Reserve. Spongy aromatic herbs.

Leaves of a few species are used as vegetable.

Fig. 51. Scutellaria prostrata Jacq. ex Benth.

The generic name is derived from Greek word *Thumes* meaning courage, strength derived from Thyo meaning to perform sacrifice.

Thymus linearis Benth.

Prostrate or procumbent, perennial, tufted, aromatic herbs, stems slender, branched. Leaves ovate-lanceolate. Flowers crowded in small terminal spikes, pink purple.

Common on open hill slopes forming gregarious patches in dry sandy soil, at 3000-4500 m. Flowering and fruiting during June October.

63. PLANTAGINACEAE

The family comprises 3 genera and over 270 species, widely distributed throughout the globe; 1 genus and 10 species in India, 1 genus with 1 species is found in the Biosphere Reserve.

1. PLANTAGO L.

The genus has over 265 species mostly cosmopolitan in distribution; 10 species in India, 1 in the Biosphere Reserve.

The scientific name Plantago meaning sole of the foot.

Plantago himalaica Pilger

Perennial herbs. Leaves elliptic-ovate with 3-5 main veins. Flowers greenish white, on cylindric spikes.

Common around Reni-Kalikona area on hill slopes at 2200-2600 m. Flowering and fruiting during May September.

64. NYCTAGINACEAE
(Four-O'clock family)

The family comprises 30 genera and over 290 species, chiefly distributed in tropics, abundant in America; 4 genera and 16 species are known in India, 1 genus with 1 species in the Biosphere Reserve.

1. BOERHAAVIA L.

The genus comprises over 40 species; 8 in India; only 1 in our area.

The genus is named after Herman Boerhaav, a famous Dutch Physician and Professor of Botany.

Boerhaavia diffusa L.

Erect, decumbent-ascending to scrambling, perennial herbs, stems tinged with purple. Leaves in unequal pairs. Flowers bright purple.

Common around buffer zone along the roadside in open area at 1800-2200 m. Flowering and fruiting throughout the year.

65. ILLECEBRACEAE

Though the family is being treated by several workers under family Caryophyllaceae, Hooker (1885) has been followed in the present work.

The family comprises about 17 genera and 70 species, distributed mostly in warm dry regions; 1 genus and species in India and the Nanda Devi Biosphere Reserve.

Annual or perennial herbs. Flowers small, petals absent.

HERNIARIA L.

The genus comprises about 35 species, distributed in Europe, Mediterranean to Afghanistan and South Africa, 3 in India, 1 in the Biosphere Reserve.

Herniaria hirsuta L.

Small, prostrate, tufted, perennial herbs. Leaves small, narrowly ovate, greenish-brown. Flowers minute, green.

On open hill slopes in sandy soil around Milam area at 3000-3300 m. Flowering and fruiting during July September.

66. AMARANTHACEAE
(Amaranth family)

The family comprises about 65 genera and over 850 species, mainly distributed in tropical and temperate regions of the world; about 17 genera and over 50 species in India, 4 genera and 5 species in the Biosphere Reserve.

1a.	Flowers crowded in globose spikes	4. Cyathula
b.	Flowers crowded in short or long spikes	2
2a.	Bracts not spinescent	3. Celosia
b.	Bracts spinescent	3
3a.	Flowers in long, terminal, simple spikes	1. Achyranthes
b.	Flowers in short, axillary spikes, or in panicles	2. Amaranthus

1. ACHYRANTHES L.

The genus comprises about 50 species; 4 in India, 2 in our area.

The generic name derived from Greek word *Achuron* meaning chaff and *anthos* meaning flower, referring to the chaffy nature of perianth.

1a.	Spikes about 10-20 cm long, robust; leaves leathery	1. A. aspera
b.	Spikes 5-10 cm long, slender; leaves not leathery	2. A. bidentata

1. Achyranthes aspera L.

Annual or perennial, erect herbs. Leaves ovate to orbicular-ovate or elliptic-ovate, thick leathery. Flowers crowded in terminal robust spikes.

Common throughout the buffer area at 1800-2200 m. Flowering and fruiting during May September.

2. Achyranthes bidentata Blume

Perennial, erect herbs. Leaves elliptic-ovate, lanceolate or orbicular-ovate, thin. Flowers crowded in terminal, slender spikes.

Common in the buffer zone area at 1800-2000 m. Flowering and fruiting during May-October.

2. AMARANTHUS L.

The genus comprises over 50 species; 20 in India, only 1 in our area.

The scientific name is derived from Greek *A* meaning not and *Mairaino* meaning to wither amarantos meaning unfading, referring to long lasting qualities of flowers.

Amaranthus paniculatus L.

Erect, ca 0.8-1.5 m high herbs with narrowly ovate leaves. Flowers red or yellowish, in terminal panicles.

Commonly cultivated throughout the area and also found as an escape.

3. CELOSIA L.

The genus has over 60 species; 4 in India, only 1 in our area.

The generic name is derived from a Greek word *Kelos* meaning burnt of blood-spot, referring to the red colour of the flower in some of the species.

Celosia argentea L.

Annual, erect herbs. Leaves elliptic-ovate or rhomboid. Flowers red, purple or yellow, arranged in dense, cylindrical spikes.

Common in the buffer zone area at 1800-2200 m. Flowering and fruiting during August November.

4. CYATHULA Blume

The genus comprises over 25 species; 4 in India; only 1 in the Biosphere Reserve.

Cyathula tomentosa (Roth) Moq.

Straggling, densely tomentose, undershrubs. Leaves elliptic-lanceolate, densely tomentose beneath. Flowers arranged in globose spikes.

In buffer zone area at 1900-2200 m. Flowering and fruiting in June October.

67. CHENOPODIACEAE

(Goosefoot family)

The family comprises about 102 genera and over 1400 species, chiefly distributed in Australia, the pampas, the Prairies, the Mediterranean coast, Central Asia, South Africa, Coast of West Caspian and around the shores of Red Sea; about 16 genera and 40 species in India, 2 genera and 6 species in the Biosphere Reserve.

1a. Leaves brown tomentose; flowers unisexual, female flowers axillary, solitary ..... 1. Axyris

b. Leaves not brown tomentose; flowers bisexual, clustered in axillary and terminal spokes ..... 2. Chenopodium

1. AXYRIS L.

The genus comprises over 7 species; 1 in India and the Biosphere Reserve.

The generic name is derived from a Greek word *Axyros* meaning rough, referring to the nature of the leaves.

Axyris hybrida L.

Annual, erect, stout herbs. Leaves ovate, brown tomentose. Male flowers clustered in axillary spikes; female flowers axillary solitary.

Common on hill slopes around Martoli area at 2600-3500 m. Flowering and fruiting during July September.

2. CHENOPODIUM L.

The genus comprises over 110 species; 8-10 in India; 5 in the Biosphere Reserve.

The generic name is derived from Greek word *Chen* meaning a goose and *Podion* meaning a little foot, referring to the shape of the leaves in some species.

1a.	Strongly aromatic herbs	2. C. botrys
b.	Non aromatic or slightly foetid herbs	2
2a.	Sepals 1-3, succulent	3. C. foliosum
b.	Sepals 5, thin	3
3a.	Leaves broadly triangular, shining	4. C. hybridum
b.	Leaves not triangular, mealy	4
4a.	Leaves rhomboid or deltoid, upper one lobed	5. C. opulifolium
b.	Leaves ovate or lanceolate, not lobed	1. C. album

1. Chenopodium album L.

Erect, annual herbs. Leaves variable, purple tinged. Flowers greenish.

Near cultivated fields in the buffer zone area at 1800-2300 m. Flowering and fruiting during April October.

2. Chenopodium botrys L.

Strongly aromatic, glandular herbs. Leaves oblong, lobed. Flowers minute, greenish.

Common around Deodi-Ramni area and near the villages at 2000-3500 m. Flowering and fruiting during July August.

3. Chenopodium foliosum (Moench) Aschers.

Erect, slightly foetid herbs. Leaves triangular, hastate or deltoid. Flowers minute, greenish, calyx succulent.

Around Malari area at 2800-3100 m. Flowering and fruiting during July August.

4. Chenopodium hybridum L.

Erect, glabrous, shining herbs. Leaves broadly triangular. Flowers minute, greenish.

Around Malari area on hill slopes at 2800-3000 m. Flowering and fruiting during July August.

5. Chenopodium opulifolium Schrad ex Koch & Ziz.

Erect or ascending herbs. Leaves rhomboid or deltoid, upper leaves lobed. Flowers minute, greenish.

Around Malari area on hill slopes at 2800-3000 m. Flowering and fruiting during July August.

68. PHYTOLACCACEAE

(Pokeweed family)

The family comprises about 12 genera and over 100 species chiefly distributed in tropical America and South Africa; 2 genera and 2-3 species are present in India, 1 genus with 1 species in the Biosphere Reserve.

PHYTOLACCA L.

The genus comprises over 35 species; about 2 in India; 1 in our area.

The generic name is derived from Greek word *Phyton* meaning a plant and Latin word *Lacca* meaning lac derived from Hindi word lakh, in illusion to the colour of the fruit and staining qualities of the fruit juice. These are commonly known as Pokeweed.

Phytolacca acinosa Roxb.

Tall, erect, stout herbs, stems succulent. Leaves broadly lanceolate. Flowers pale green.

Around Lata-Beltakharak, 2000-2600 m. Flowering and fruiting during August September. Also cultivated for vegetables.

69. POLYGONACEAE

(Buckwheat or knotweed family)

The family has about 40 genera and 800 species, chiefly distributed in North temperate regions of the world; 12 genera and about 110 species in India, 10 genera and 23 species in the Biosphere Reserve.

1a.	Inner sepals enlarged in fruit, flowers unisexual	**10. Rumex**
b.	Inner sepals not enlarged in fruit, flowers bisexual	2
2a.	Nuts winged	3
b.	Nuts not winged (winged in *Fallopia*)	4
3a.	Leaves large, more than 12 cm long; nutlets mostly 3-winged	**9. Rheum**
b.	Leaves small, less than 6 cm long; nuts mostly 2-winged	**6. Oxyria**
4a.	Nuts partially enclosed in the perianth	**3. Fagopyrum**
b.	Nuts completely enclosed in the perianth	5
5a.	Stipules minute, 2-partite	**5. Koenigia**
b.	Stipules tubular	6
6a.	Extensive herbaceous climbers or twiners	**4. Fallopia**
b.	Erect or prostrate herbs, not climbers or twiners	7
7a.	Flowers few in axillary clusters	**8. Polygonum**
b.	Flowers in spiciform racemes, in globose heads or in panicles	8
8a.	Stipules truncate, ciliate	**7. Persicaria**
b.	Stipules not as above	9
9a.	Flowers in spiciform racemes	**2. Bistorta**
b.	Flowers in panicles	**1. Aconogonum**

1. ACONOGONUM Reichnb.

Perennial or annual herbs, stems succulent or simple, branched. Leaves broad ovate-elliptic, elliptic-oblong or ovate cordate. Flowers in panicles, greenish or white.

1a.	Stems succulent, pale; leaves ovate-cordate	2. A. rumicifolium
b.	Stems neither succulent, nor pale; leaves ovate-elliptic or elliptic-oblong	1. A. molle

1. Aconogonum molle (D. Don) Hara

Erect, perennial herbs, undershrubs or shrubs, stems much branched. Leaves up to 14 cm long, ovate-elliptic or elliptic-oblong, entire. Flowers white, numerous, minute, in axillary panicles.

Common on hill slopes in watery places on temperate to alpine hill slopes, 2000-4000 m. Flowering and fruiting during July October.

2. Aconogonum rumicifolium (Royle ex Bab.) Hara

Herbs, ca 60 cm high, thick, pale stems succulent. Leaves broadly ovate-cordate. Flowers in terminal and axillary dense panicles, green.

Common on hill slopes in shady places around Dunagiri and Bhujgar-Ramni area, 3200-4000 m. Flowering and fruiting during August October.

2. BISTORTA Scop.

Annual or perennial, erect or procumbent herbs. Branches simple or trailing. Leaves variously shaped, linear-oblong, ovate-lanceolate to elliptic-lanceolate, crenulate or entire. Flowers in terminal spikes, white-pink or pink.

1a.	Stems branched, branches prostrate or trailing; leaf margins recurved	2. B. vaccinifolia
b.	Stems simple	2
2a.	Tufted herbs; leaves oblong-elliptic or elliptic-lanceolate	1. B. affinis
b.	Not tufted; leaves linear or linear-oblong	3. B. vivipara

1. Bistorta affinis (D. Don) Greene

Tufted, perennial herbs, rootstock thick, stems simple. Leaves oblong-elliptic or elliptic-lanceolate, crenulate. Flowers pinkish-white, in terminal spikes.

Common throughout the area in cold temperate to subalpine hill slopes amidst grasses, 2000-4500 m. Flowering and fruiting during June - September.

2. Bistorta vaccinifolia (Wallich ex Meisn.) Greene **Fig. 52.**

Tufted, procumbent, perennial herbs, rootstock stout, woody, stem branches trailing. Leaves ovate-lanceolate. Flowers pink, crowded in terminal, loose spikes.

Common throughout the area in moist places, on rocks and on rocky hill slopes, 2500-4500 m. Flowering and fruiting during July October.

3. Bistorta vivipara (L.) S.F. Gray

Annual or perennial, herbs 30-50 cm high, erect. Radical leaves long petioled, linear or linear-oblong, crenulate. Flowers crowded in dense spikes, pink.

Common on the hill slopes around Dharansi, Malari and Dunagiri area in shady moist places, 3000-4000 m. Flowering and fruiting during July September.

3. FAGOPYRUM Mill.

Erect, annual or perennial herbs, stems branched. Leaves triangular glabrous or hairy. Flowers in axillary or terminal cymes or in panicles white or pink.

The genus is represented by 5 species in the world; about 3 in India, 2 in the Biosphere Reserve.

The generic name is derived from Latin word *Fagus* meaning a beech tree and *Pyros* meaning wheat, referring to Buckwheat, producing grain like seeds and each shaped like a beech nut.

1a.	Flowers white, in panicles; pubescent herbs	**1. F. dibotrys**
b.	Flowers pink, in axillary or terminal cymes; glabrous herbs	**2. F. esculentum**

1. Fagopyrum dibotrys (D. Don) Hara

Annual or perennial, erect herbs, stems branched, sparsely hairy. Leaves

Fig. 52. Bistorta vaccinifolia (Wallich ex Meisn.) Greene

triangular or hastate, angles acute. Flowers numerous, in terminal and axillary lax panicles, white.

Common throughout the area on moist grassy hill slopes, 2000-4000 m. Flowering and fruiting during June September.

2. Fagopyrum esculentum Moench

Annual or perennial, erect herbs, stem glabrous. Leaves triangular or hastate. Flowers pink, in axillary and terminal cymes.

The plant is commonly known as 'Ogal' in the area and is being cultivated all around. The plant in wild state grows around villages, 2500-4000 m. Flowering and fruiting during July October

4. FALLOPIA Adans.

Extensive herbaceous climbers, twining or prostrate herbs. Leaves ovate-cordate. Flowers pale green in axillary, stalked racemes. Nuts winged.

The generic name is derived from greek word *Fallo* meaning to deceive and Open meaning opening or hole.

1a. Extensive herbaceous climbers; pedicels winged at the base **2. F. pterocarpa**
b. Twining or prostrate herbs; pedicels usually winged below the middle **1. F. dumetorum**

1. Fallopia dumetorum (L.) Holub

Twining or prostrate herbs. Leaves broadly ovate-cordate. Flowers pale-green fruiting perianth broadly oblong or ovate. Nuts broadly winged.

Not common, on hill slopes around Malari area, 3000-3500 m. Flowering and fruiting during July September.

2. Fallopia pterocarpa (Wallich ex Meissn.) Holub

Extensive herbaceous climbers, stems ribbed. Leaves ovate, entire base cordate. Flowers pale green, in small axillary, stalked racemes, tepals winged. Fruits winged.

Climbing over bushes on hill slopes, 1500-3000 m. Flowering and fruiting during July October.

5. KOENIGIA L.

The genus comprises over 7 species, distributed mainly in temperate Himalaya, East Australia and South America.

Koenigia delicatula (Meissn.) Hara

Herbs, stems, 5-10 cm high, stems delicate, filiform, purplish-green. Leaves small, ovate, sessile. Flowers minute, green.

On hill slopes around Dharansi and Donagiri area, 4000 m. Flowering and fruiting during July September.

6. OXYRIA Hill

The genus is probably monotypic. The generic name is derived from Greek word *Oxys* meaning sharp or bitter taste.

Oxyria digyna (L.) Hill

Erect, perennial herbs. Rootstock thick, stems soft, glabrous, many from the base. Leaves radical, orbicular-reniform. Flowers in terminal lax racemes, pink. Fruit winged.

Common in dry region on open sandy hill slopes, 2500-4500 m. Flowering and fruiting during June September.

6. PERSICARIA Mill.

Annual or perennial, erect or prostrate herbs. Leaves ovate-elliptic, ovate-lanceolate or elliptic-lanceolate. Flowers in dense terminal spikes, in globose heads or in branched panicles, white or pink.

1a.	Flowers in branched panicles, white	**3. P. polystachya**
b.	Flowers crowded in globose heads,-pink or white tinged with pink	2
2a.	Petioles winged, often amplexicaule; flowers white tinged with pink	**2. P. nepalensis**
b.	Petioles not auricled at the base, not amplexicaule; flowers pink	**1. P. capitata**

1. Persicaria capitata (Buch.-Ham. ex D. Don) H. Gross

Perennial, prostrate herbs, stems well branched, hairy. Leaves ovate or elliptic-ovate, nerves ciliate. Flowers in stalked, globose heads, pink, showy.

Common throughout the area in shady moist, mostly rocky places, 1500-3300 m. Flowering and fruiting during May October.

2. Persicaria nepalensis (Meissn.) H. Gross

Erect to trailing, annual or perennial herbs, stem ribbed, rooting at the nodes. Leaves ovate or deltoid-ovate, petioles winged. Flowers white with pinkish tint, crowded in stalked, globose heads.

Common on hill slopes on mossy boulders, 1800-4000 m. Flowering and fruiting during June October.

3. Persicaria polystachya (Wallich ex Meissn.) H. Gross **Fig. 53.**

Tall, erect, perennial undershrubs or shrubs, stems well branched, ribbed. Leaves lanceolate or oblong-lanceolate, crenulate. Flowers white in branched panicles.

Common on hill slopes in subalpine and alpine regions, 2600-4000 m. Flowering and fruiting during July October.

7. POLYGONUM L.

Hara & Wiliams (Enum. Fl. Pl. Nepal. 3: 172-189. 1982) treated *Polygonum* species under several genera. The same splitting has been followed

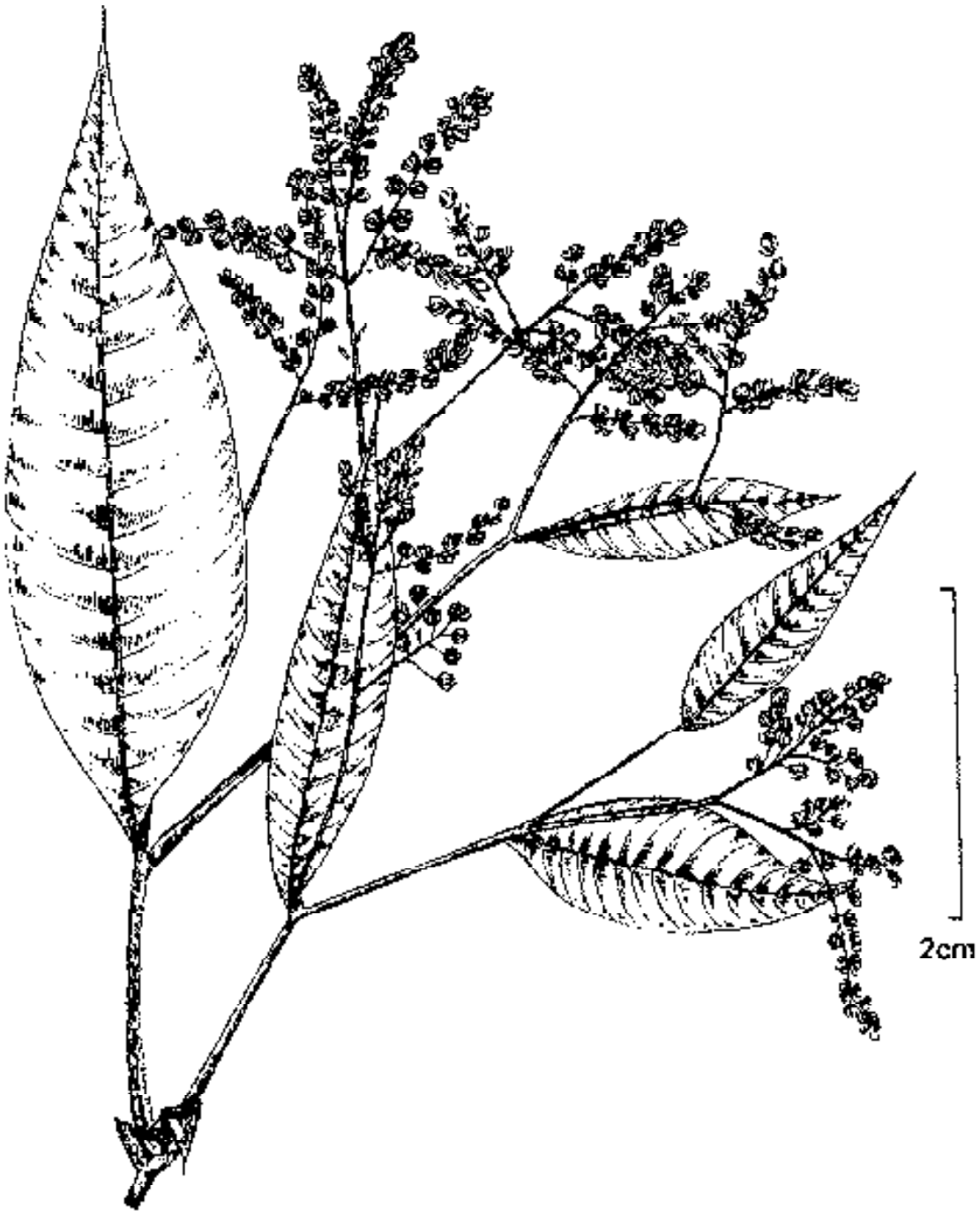


Fig. 53. Persicaria polystachya (Wallich ex Meissn.) H. Gross

in the present work. *Polygonum* L. (*sensu lato*) is represented by nearly 300 species in the world out of which about 80 are present in India.

Annual or perennial, erect, diffused prostrate or procumbent herbs. Flowers minute, few, axillary, white, or pinkish-white or greenish-white.

The generic name is derived from Greek word *Polys* meaning many and *Gonia* meaning the knee-joints, retrerring to many joints in the rhizome.

1a.	Perennial herbs; leaves shortly petioled	2. P. recumbens
b.	Annual herbs; leaves sessile	1. P. aviculare

1. Polygonum aviculare L.

Prostrate, annual herbs, stems grooved, glabrous. Leaves elliptic-oblong or lanceolate, sessile. Flowers few, in axillary clusters, green, tipped with white.

Common around hill slopes in Dunagiri area on open places, 2500-4500 m. Flowering and fruiting during June October.

2. Polygonum recumbens Royle ex Bab.

Procumbent, perennial herbs, stems branched, ribbed. Leaves ovate or elliptic-ovate, entire, shortly petioled. Flowers minute, greenish-white.

Common on hill slopes, mostly in rock crevices, 2000-4000 m. Flowering and fruiting during July November.

8. RHEUM L.

The genus is represented by approximately 50 species in the world; 10 in India; 4 in the Nanda Devi Biosphere Reserve.

The generic name is derived from a greek word *Rheo* meaning to flow, in allusion to the purgative properties.

Stout, perennial herbs, stems present or absent. Leaves large, orbicular or broadly orbicular-ovate; petioles long. Flowers clustered in axillary or terminal racemes arranged in panicles. Nutlets 2-4-winged.

1a.	Stemless herbs	2
b.	Stems well developed	3
2a.	Leaves pubescent beneath; flowers sessile; stamens included	**2. R. moorcroftianum**
b.	Leaves glabrous; flowers pedicellate; stamens exserted	**3. R. spiciforme**
3a.	Panicles hairy; flowers purple	**1. R. australe**
b.	Panicles glabrous; flowers pale-yellow	**4. R. webbianum**

1. Rheum australe D. Don

Robust, perennial herbs, 1.5-2 m high, stems thick. Leaves large, orbicular, ovate, entire, pubescent beneath. Flowers purple in axillary and terminal panicles.

Not very common, seen around Martoli area on hill slopes, 3000-4000 m. Flowering and fruiting during June September.

2. Rheum moorcroftianum Royle

Perennial, stemless herbs, rootstock stout, woody. Leaves large, orbicular, pubescent beneath. Flowers in spikes; spikes long stalked.

Common, around Milam and Dharansi area on hill slopes, 3500-4500 m. Flowering and fruiting during June September.

3. Rheum spiciforme Royle

Perennial, stemless herbs, rootstock very thick, stout. Leaves large, broadly orbicular-ovate, glabrous on both surfaces. Flowers white, in spikes.

On hill slopes around Martoli-Milam area, 3500-5000 m. Flowering and fruiting during June September.

4. Rheum webbianum Royle

Perennial, erect, robust herbs, rootstock thick, woody. Leaves large, orbicular, margins wavy. Flowers pale-yellow, in axillary and terminal condensed racemes.

Around Milam-Martoli area on hill slopes, 3500-5000 m. Flowering and fruiting during July October.

9. RUMEX L.

The genus is represented by approximately 200 species all over the world; 13 in India, 3 in the Nanda Devi Biosphere Reserve.

These are perennial herbs. Stems simple or branched. Leaves hastate, ovate or elliptic ovate. Flowers in axillary clusters or in panicled racemes, unisexual, bisexual or polygamous, nuts included in enlarged perianth.

1a.	Leaves broadly ovate or elliptic-ovate; flowers bisexual	3. R. nepalensis
b.	Leaves hastate; flowers unisexual or polygamous	2
2a.	Cauline leaves sessile; perianth valves orbicular	1. R. acetosa
b.	Cauline leaves petiolate; perianth valves notched at both the ends	2. R. hastatus

1. Rumex acetosa L.

Perennial, erect, 50-70 cm high herbs, stems simple, ribbed, glabrous. Leaves hastate, entire, obtuse. Flowers in terminal, contracted panicles, pinkish.

Common around Reni, Lata and Suraithota area, 1000-2500 m. Flowering and fruiting during May October. The leaves are used as vegetables.

2. Rumex hastatus D. Don

Branched perennial herbs or undershrubs. Leaves hastately 3-lobed or 3-angular. Fruiting sepals orbicular, pink.

Common around Reni-Malari area on rocks, 1800-2400 m. Flowering and fruiting during April October.

3. Rumex nepalensis Spreng.

Tall, erect, robust, annual or perennial herbs, up to 1 m high, stems glabrous. Leaves ovate or elliptic-ovate, entire, base cordate. Flowers bisexual, arranged in whorls in terminal long racemes, pinkish.

Common throughout the area in watery places, 1700-3000 m. Flowering and fruiting during June October.

70. PEPEROMIACEAE

The family comprises 4 genera and about 1000 species distributed in tropical and subtropical region. The plants are mostly succulent herbs or subshrubs.

PEPEROMIA Ruiz & Pav.

This is the largest genus of the family Peperomiaceae distributed in tropical and subtropical region, especially in America.

P. tetraphylla (Forst.f.) Hook. & Arn.

Small, succulent, erect herbs, branches rooting at the nodes. Leaves orbicular-ovate. Flowers green, minute, whorled in four.

Common throughout the area in temperate forests on tree trunks and boulders, 1800-2700 m. Flowering and fruiting during July October.

71. LAURACEAE
(Laural family)

The family comprises ca 32 genera and 2000-2500 species, mainly distributed in tropical and sub-tropical regions of the globe. Plants are mostly trees and shrubs with leathery, evergreen leaves containing oil glands.

1a.	Evergreen shrubs, young shoots tomentose or pubescent	1. Lindera
b.	Medium or small sized trees, branches glabrous	2. Neolitsea

1. LINDERA Thunb.

About 100 species are known in world; 15 in India; 1 in the Biosphere Reserve. Mostly aromatic trees or shrubs.

The genus is named after Johann Linder, a Swedish Botanist.

Lindera pulcherrima (Nees) Benth. ex Hook.f.

Evergreen shrubs, young branches tomentose or pubescent. Leaves elliptic-oblong, entire, 3-nerved from the base. Flowers clustered in axillary, sessile heads. Fruits ellipsoid.

Common in mixed forest, mostly in Oak-*Rhododendron* associations 1900-2600 m. Flowering and fruiting during May September.

2. NEOLITSEA (Benth.) Merr.

The genus is represented by 20 species in the world, mainly in Indo-Malesian region; about 6 in India and 2 in Nanda Devi Biosphere Reserve.

Evergreen, small or medium sized trees, branches glabrous. Leaves alternate or clustered at the end of branches, glabrous. Flowers white, greenish-white or pale-yellow.

1a.	Leaves oblong-oblanceolate; fruits oblong, narrowed	**1. N. cuipala**
b.	Leaves oblong-elliptic; fruits ovoid	**2. N. pallens**

1. Neolitsea cuipala (Buch.-Ham. ex D. Don) Koster.

Evergreen, small-medium sized trees. Leaves oblong-oblanceolate, glabrous, clustered at the end of branches. Flowers white. Fruits oblong, narrowed.

Common in mixed forest area, 1600-2600 m. Flowering and fruiting during April-October.

2. Neolitsea pallens (D. Don) Momiyama

Small or medium sized trees. Leaves oblong-elliptic, entire, upper surface glabrous, shining, whitish beneath. Flowers arranged in sessile clusters. Fruits ovoid.

Common in mixed forest, 2000-3000 m. Flowering and fruiting during March October.

72. THYMELAEACEAE
(Mezereum family)

The family has about 50 genera and 500 species, distributed in the tropical and temperate regions of the globe, especially in Africa; 10 genera and 20 species in India, 3 genera and 3 species in the Biosphere Reserve.

Most of the plants are shrubs, some are trees and climbers, very few herbs.

1a.	Perennial herbs	2. Stellera
b.	Shrubs	2
2a.	Leaves thick, glabrous when young; flowers white	1. Daphne
b.	Leaves thin, silky when young; flowers yellow	3. Wikstroemia

1. DAPHNE L.

About 70 species in India; 1 in the Biosphere Reserve.

According to Greek mythology *Daphne*, a nymph and daughter of earth goddess Gea.

Daphne papyracea Wallich ex Steud.

Erect, shrubs, ca 1.5 m high. Young shoots silky-tomentose. Leaves oblong-elliptic or sublanceolate, narrowed at both end. Flowers white, clustered in terminal, sessile heads. Fruits ovoid, blood-red.

Common in mixed forest, mainly in Oak-*Rhododendron* associations 1000-3000 m. Flowering and fruiting during January May.

2. STELLERA L.

The genus is considered to be monotypic.

The genus is named after Georg Wilhelm Steller, A German naturalist.

Stellera chamaejasme L.

Perennial, herbs, 15-30 cm high, rootstock woody, stems branched from the base. Leaves elliptic-ovate. Flowers white, tinged with purple.

Rare, around Himtoli and Sarsupatal area, 3000-4500 m. Flowering and fruiting during July September.

3. WIKSTROEMIA Endl.

Over 70 species; 2 in India; 1 in the Biosphere Reserve. These are shrubs or undershrubs.

The genus is named after Johannes Emanuel Wickstroem, a Swedish Botanist.

Wikstroemia canescens Meissn.

Deciduous, erect, shrubs. Leaves thin, elliptic-oblong, silky when young. Flowers yellow.

Around Jumma area, 2000-2500 m. Flowering and fruiting during June October.

73. ELAEAGNACEAE
(Oleaster family)

The family is represented by 3 genera and 50 species distributed chiefly in Northern Hemisphere; 2 genera and 10 species in India; 2 genera and 3 species in the Biosphere Reserve.

These are much branched shrubs often with leathery entire leaves covered with scaly hairs.

1a. Leaves stellately hairy on upper surface, silvery-scaly beneath; flowers bisexual **1. Elaeagnus**

b. Leaves not-stellately hairy, tomentose or silvery-brown granular scaly beneath; flowers unisexual **2. Hippophae**

1. ELAEAGNUS L.

Total about 50 species; 8 in India; 1 in the Biosphere Reserve. Fruits of few species are edible.

Elaeagnus parviflora Wallich ex Royle

Erect, thorny, bushy, shrubs, young shoots covered with silvery scales. Leaves elliptic-lanceolate, upper surface stellately hairy, silvery scaly beneath. Flowers white. Fruits ellipsoid, silvery.

Common on hill slopes on way to Malari in sandy soil, 2000-3000 m. Flowering and fruiting during March-September.

2. HIPPOPHAE L.

The genus is represented by 3 species in the world out of which 2 are present in India and Nanda Devi Biosphere Reserve area.

Large or small shrubs. Leaves white tomentose or silvery-brown granular scaly beneath. Flowers crowded on lateral branches. Fruits yellow.

The generic name is derived from the Greek word *Hippos* meaning a horse and *Phao* meaning to destroy, referring to poisonous properties of seeds.

1a. Low shrubs; stem bark yellowish-brown; leaves silvery-brown granular scaly beneath **2. H. tibetana**

b. Large shrubs; stem bark grey-black; leaves white scaly or hairy beneath **1. H. salicifolia**

1. Hippophae salicifolia D. Don

Tall shrubs or small sized trees. Leaves linear-lanceolate, alternate, white scaly beneath. Flowers laterally crowded, brownish. Fruits globose, winged.

Not very common, seen in Pang area, 2500-3500 m. Flowering and fruiting during March October.

2. Hippophae tibetana Schlecht. **Fig. 54.**

Small sized, much branched, bushy shrubs, stems yellowish-brown, young shoots granular scaly. Leaves oblong or linear-oblong, silvery-brown, granular scaly. Flowers on lateral branches. Fruits oblong-globose, yellow.

Very common, more or less forming carpet around Milam glacier area on sandy soil, in open places 3500-5000 m. Flowering and fruiting during July September.

74. LORANTHACEAE

The family comprises 36 genera and over 1300 species, chiefly distributed in tropical and temperate regions, mostly shrubby, parasitic; about 11 genera and over 50 species in India, 3 genera and 3 species in the Biosphere Reserve.

1a.	Flowers bisexual	**2. Dendrophthoe**
b.	Flowers unisexual	2
2a.	Minute, less than 1 cm high herbs; anthers on the middle of the petal	**1. Arceuthobium**
b.	Shrubs; anthers not as above	**3. Korthalsella**

1. ARCEUTHOBIUM Bieb.

The genus comprises over 20 species; only 2 in India, 1 in our area. Commonly known as "Dwarf Mistletoe".

Arceuthobium minutissimum Hook.f.

Tiny, pale-yellow or greenish-yellow, parasitic, leafless herbs. Flowers minute, pale-yellow.

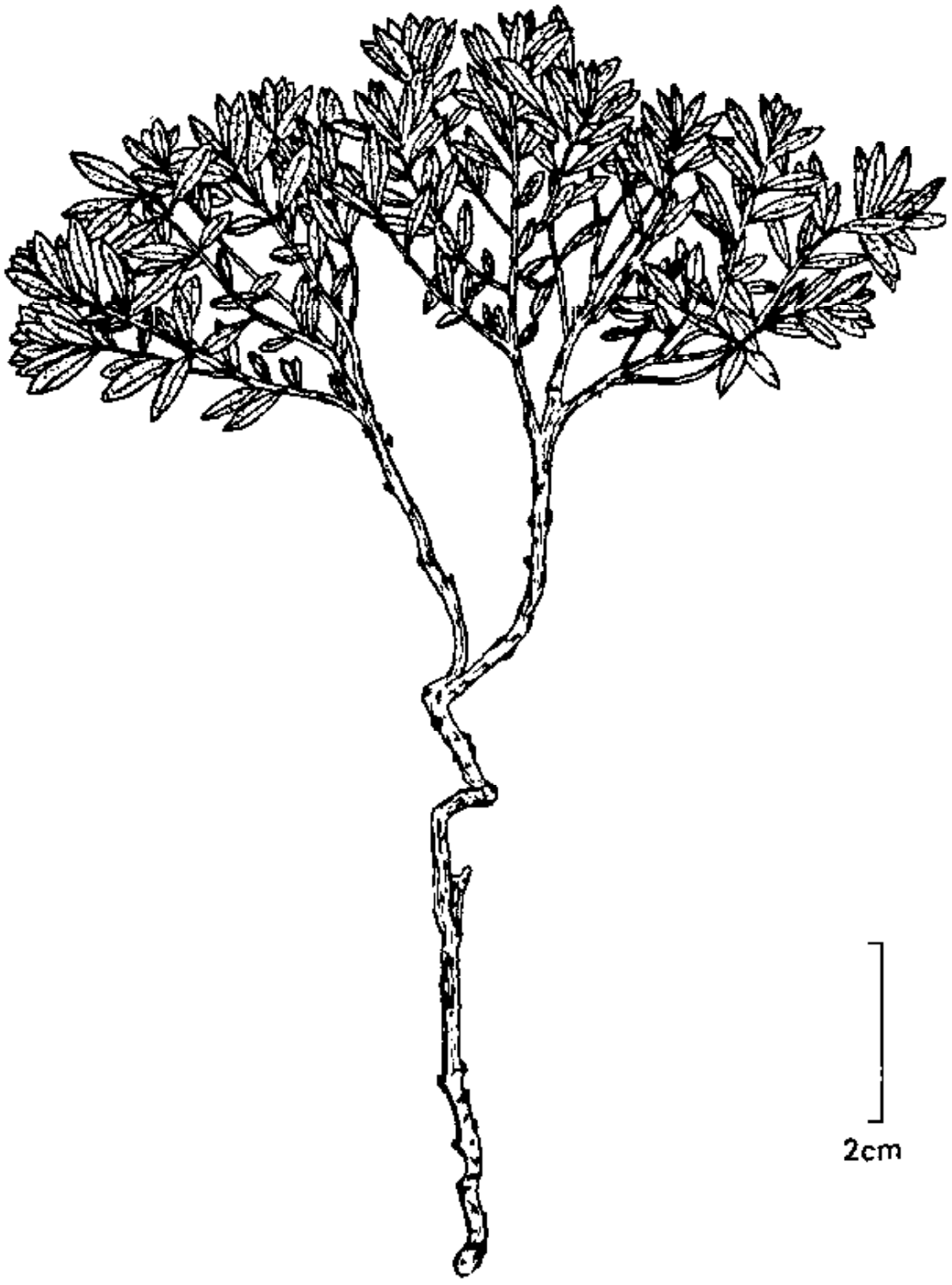


Fig. 54. Hippophae tibetana D. Don

Common parasite on *Pinus wallichiana*, seen around buffer zone, 2200-2600 m. Flowering and fruiting during July August.

2. DENDROPHTHOE Mart.

Over 30 species chiefly distributed in Africa, Indo-Malesia and Tropical Australia; 7 species India; 1 in the Biosphere Reserve.

The generic name is derived from the Greek word *Dendron* meaning a tree and *Pthoe* meaning corruption, referring to parasitic habit.

Dendrophthoe falcata (L.f.) Etting.

Undershrubs. Leaves ovate-lanceolate to spathulate. Flowers crowded in axillary racemes, bright red.

Around Lata, parasitic on various trees. 2000-2200 m. Flowering and fruiting during September November.

3. KORTHALSELLA van Tiegh

Over 45 species; 1 in India; 1 in the Biosphere Reserve.

The generic name is given after Peter William Korthals, a Dutch Botanist.

Korthalsella opuntia (Thunb.) Merr.

Green, leafless shrubs, branches fleshy, flat, joints narrow. Flowers fascicled in cup-shaped bracts at the tips of internodes. Berries red.

Around Lata area, 2000-2400 m. Flowering and fruiting during April July.

75. SANTALACEAE

The family comprises ca 30 genera and 400 species, distributed chiefly in tropical and temperate regions of the globe. Mostly semi-parasitic shrubs, herbs and trees.

THESIUM L.

About 300 species; only 3 in India; 1 in the Biosphere Reserve. Usually root parasites.

Thesium himalense Royle ex Edgew.

Procumbent, root parasitic herbs, stems slender, ribbed. Leaves linear, alternate, sessile. Flowers axillary, solitary, white.

Not very common, growing on hill slopes around Bhujgar area and in Martoli bugyals, 2500-4500 m. Flowering and fruiting during June October.

76. EUPHORBIACEAE
(Spurge family)

The family is represented by about 300 genera and over 5000 species of cosmopolitan distribution; about 61 genera and over 336 species in India, 5 genera and 7 species in the Biosphere Reserve. Mostly trees and shrubs; some are herbaceous. Several are xerophytics; mostly poisonous. Many plants are economically important.

1a.	Cells of ovary 1-ovuled	2
b.	Cells of ovary 2-ovuled	3
2a.	Deciduous shrubs; leaves and stems with milky latex	**4. Excoecaria**
b.	Weak, straggling herbs; leaves and stems without milky latex	**1. Acalypha**
3a.	Male and female flowers contained in calyx-like involucre	**3. Euphorbia**
b.	Male and female flowers distinctly arranged	4
4a.	Petals present	**2. Arachne**
b.	Petals absent	**5. Phyllanthus**

1. ACALYPHA L.

The genus comprises 400 species; about 10 species in India; 1 in the Biosphere Reserve. The plants of this genus are herbs or undershrubs; some are cultivated in gardens.

Acalypha brachytachya Hornem.

Annual, straggling, weak herbs, stems pubescent with ovate, crenate, long stalked leaves. Fruits hairy.

Common throughout the buffer zone in mixed forest at 2000-2500 m. Flowering and fruiting during July-October.

2. ARACHNE Necker

The genus comprises 25 species; 4 in India; 1 in the Biosphere Reserve. These are herbs, undershrubs or shrubs.

Arachne cordifolia (Decne.) Hurusawa

Small shrubs. Leaves thin, oblong-ovate, entire. Flowers green, long stalked. Fruits 6-valved.

Common around Kalikora area, 2200-2600 m. Flowering and fruiting during June September.

3. EUPHORBIA L.

The genus is represented by about 2000 species in the world; about 60 in India; 3 in Nanda Devi Biosphere area.

These are herbs or shrubs or small trees with milky latex. Flowers are arranged in cytheum, subtended by involucres.

The genus is named after Euphorbus, a court physician to King of Juba of Mauretania.

1a.	Leaves opposite	**1. E. hirta**
b.	Leaves alternate	2
2a.	Umbels compound; style connate below the middle	**2. E. pilosa**
b.	Umbels solitary; styles free	**3. E. stracheyi**

1. Euphorbia hirta L.

Erect or ascending, perennial herbs, stems branched from the base. Leaves ovate-oblong to elliptic, serrate, base oblique. Flowers greenish-brown. Fruits depressed-globose.

Common along the roadside around Lata-Suraithota area, 2000-2500 m. Flowers throughout the year.

2. Euphorbia pilosa L.

Tall, erect herbs, ca 70 cm high herbs, stems branched above. Leaves linear-lanceolate, serrulate, Cythea umbellate. Involucral bracts yellowish.

Common on hill slopes around Dibrugheta-Sonwara area, 2500-3500 m. Flowering and fruiting during May October.

3. Euphorbia stracheyi Boiss.

Perennial, erect or prostrate herbs, stems many from the base. Leaves oblong or obovate, obtuse. Cythea arranged in terminal umbels.

Common on hill slopes in alpine meadows throughout the area, 3500-5000 m. Flowering and fruiting during April September.

4. EXCOECARIA L.

Over 40 species; 7 in India; only 1 in our area.

The generic name is derived from Latin word *Excaeco* meaning blind, as the acrid latex may cause blindness.

Excoecaria acerifolia F. Didrichs.

Giant shrubs or small trees. Leaves elliptic-ovate or elliptic-lanceolate to ovate. Flowers minute in terminal bisexual spikes.

Around Kalikona-Chhenabari area 2400-2600 m. Flowering and fruiting during March October.

5. PHYLLANTHUS L.

The genus comprises 1600 species; about 40 in India; 1 in the Biosphere Reserve.

Phyllanthus urinaria L.

Annual or perennial, erect, glabrous herbs with oblong or linear-oblong leaves. Fruits echinate.

Common throughout the buffer zone area, 1200-2400 m. Flowering and fruiting during July October.

77. BUXACEAE

The family comprises about 4 genera and over 100 species. These are chiefly distributed in tropical and subtropical regions, very few in temperate area. The plants are mostly evergreen shrubs, few are trees, rarely herbs.

SARCOCOCCA Lindl.

The genus comprises over 15 species, 3 in India; 1 in our area.

The generic name is derived from Greek word *Sarkos* meaning flesh and *Kokkos* meaning Kernel, referring to fleshy kernel.

Sarcococca saligna (D. Don) Muell.-Arg.

Evergreen, glabrous shrubs. Leaves linear or linear-lanceolate. Flowers yellowish-green, fragrant. Fruits dark purple.

Around Kaliokona-Chhenabari area in mixed forests, 2200-2700 m. Flowering and fruiting during May October.

78. ULMACEAE (URTICACEAE *sensu* BH)
(Elm family)

The family comprises 15 genera and over 200 species, chiefly distributed in tropical and temperate regions; about 5 genera and over 18 species in India; 2 genera and 2 species in the Biosphere Reserve.

1a.	Fruits winged	2. **Ulmus**
b.	Fruits not winged	1. **Celtis**

1. CELTIS L.

Over 80 species; 8 in India, only 1 in the Biosphere Reserve.

Celtis australis L.

Large, deciduous trees. Leaves, obliquely ovate or elliptic-ovate, coarsely serrate. Flowers in axillary clusters or in racemes.

Common in mixed forest around Chhenabari-Kalikona area 2400-2600 m. Flowering and fruiting during March-April and September October.

2. ULMUS L.

Over 45 species; 2 in India; only one is in the Biosphere Reserve.

Ulmus wallichiana Planch.

Large trees, young branches tomentose. Leaves obliquely elliptic-ovate, doubly serrate. Flowers in dense racemes.

Around chhenabari-Kalikona area in mixed forest, 2400-2600 m. Flowering and fruiting during March June.

79. CANNABINACEAE

The family is represented by 2 genera and 3 species, 1 genus and 1 species in India and the Biosphere Reserve.

CANNABIS L.
(The Hemp)

This is a monotypic genus, cultivated for its fibre and drugs.

Kannabis is the ancient Greek name to hemp, *C. sativa* L.

Cannabis sativa L. **Fig. 55.**

Tall, erect, highly aromatic, glandular hairy herbs, with palmately lobed leaves. Flowers unisexual, greenish, highly aromatic.

Grows in abundance around Suraithota-Reni and Syraithota-Malari area in waste places. Flowering and fruiting during July September.

"BHANG" is obtained from the dried leaves and another substance "Ganja or Charas" is obtained from the inflorescence and glandular hairy leaves. Both these substances have psychoactive effect on human body. The seeds of the plants are also eaten raw and as spices.

80. MORACEAE

The family comprises 53 genera and 1400 species, distributed mainly in tropical and subtropical regions of the globe, a few in temperate region.

1a. Flowers arranged inside the hollow receptacle **1. Ficus**
b. Flowers arranged in catkins **2. Morus**

1. FICUS L.

The genus comprises 1000 species; about 70 in India, 4 in the Biosphere Reserve. The plants are trees, shrubs, root climbers, twiners and ephiphytes.

The generic name is derived from a latin word *Ficus* meaning a fig tree.

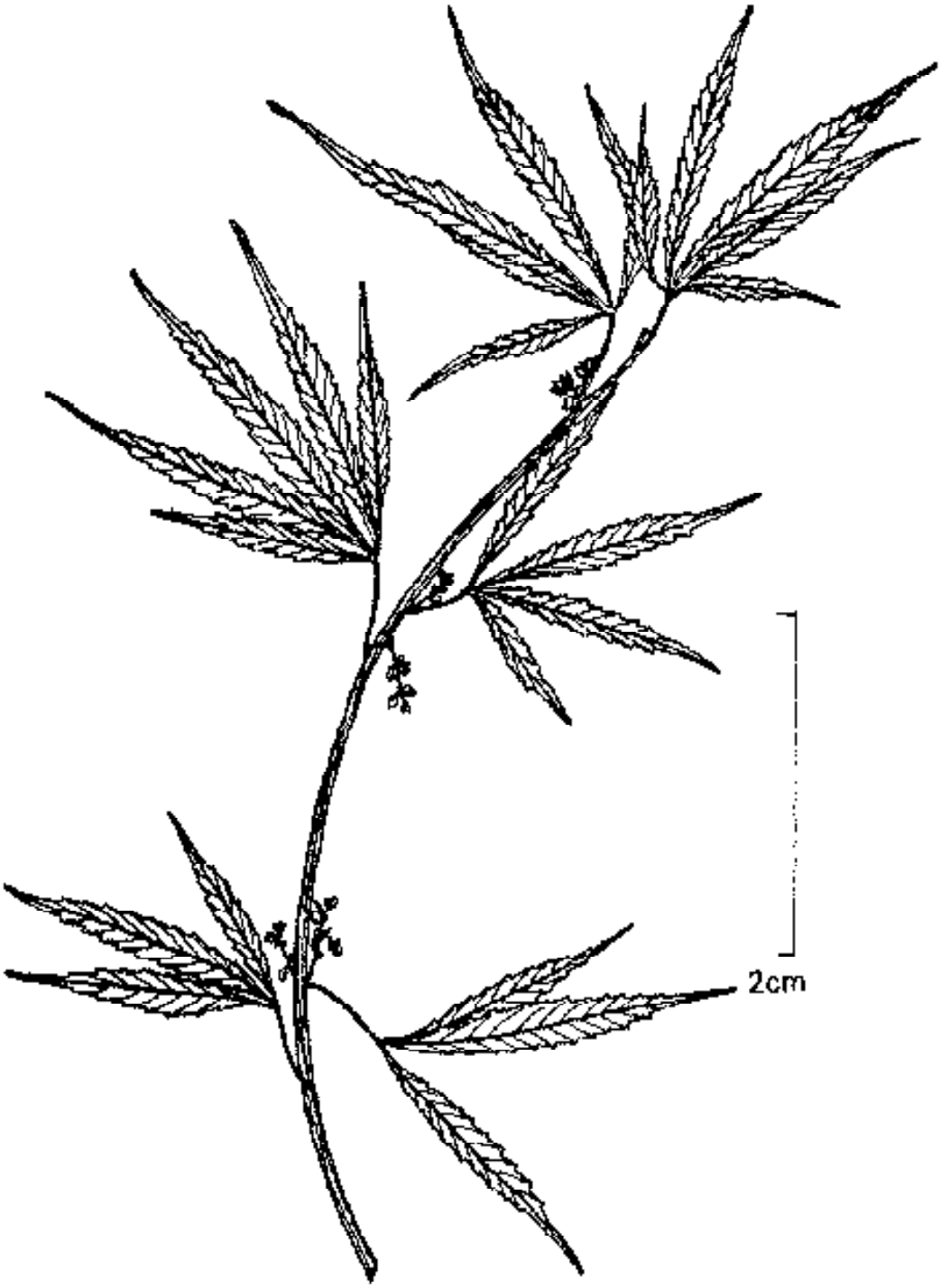


Fig. 55. Cannabis sativa L.

1a.	Trees	3
b.	Climbers or straggling shrubs	2
2a.	Receptacles sessile or subsessile; leaves elliptic oblong	**4. F. sarmentosa**
b.	Receptacles with long stalks; leaves broadly elliptic or ovate, twice as long as broad	**1. F. hederacea**
3a.	Leaves shining green, tips acuminate, caudate	**3. F. religiosa**
b.	Leaves rough on upper surface pubescent beneath, tip not caudate	**2. F. palmata**

1. Ficus hederacea Roxb.

Extensive, evergreen climbers, rooting from the stem and branches. Leaves elliptic-ovate, entire. Receptacle (Figs) stalked, solitary or in pairs.

Common on rocks around Chhenabari-Kalikona area, 2200-2700 m. Flowering and fruiting during March - July.

2. Ficus palmata Forssk.

Small, deciduous trees. Leaves, ovate-rounded, sometimes lobed, upper surface rough, hispid beneath. Figs pyriform.

A few plants seen in the buffer zone area near villages. Flowering and fruiting during June September.

3. Ficus religiosa L.

Large, deciduous trees, usually at first epiphytic. Leaves broadly ovate, tip acuminate, tail like. Figs depressed, globose.

A few plants seen around the buffer zone. Flowering and fruiting during April - June; September December.

4. Ficus sarmentosa Buch.-Ham. ex Sm.

Extensive, evergreen climbers. Leaves oblong, entire. Figs globose, axillary, solitary.

Around Chhenabari-Kalikona area, 2200-2600 m. Flowering and fruiting during April - June.

2. MORUS L.

The genus comprises 10 species; about 5 in India; 1 in the Biosphere Reserve. The plants are commonly known as Mulberries.

The generic name is derived from a caltic word "more" signifying black referring to the colour of fruit.

Morus serrata Roxb.

Deciduous trees. Leaves broadly ovate, serrate, acuminate. Flowers green. Fruits white-pink, sweet.

A solitary plant seen in the buffer zone area. Flowering and fruiting during February June.

81. URTICACEAE
(Nettle family)

The family comprises about 45 genera and 550 species, distributed in tropical and temperate regions of the globe; about 21 genera and 114 species in India, 6 genera and 12 species in the Biosphere Reserve.

Plants of this family are herbs, shrubs, or trees. Inflorescence (arrangement of flowers) cymose often condensed into pseudoheads.

1a.	Shrubs or trees	2
b.	Annual or perennial herbs	3
2a.	Flower heads arranged in interrupted spikes; perianth dry	**1. Boehmeria**
b.	Flower heads not as above; perianth fleshy	**2. Debregeasia**
3a.	Leaves opposite	4
b.	Leaves alternate	6
4a.	Plants with stinging hairs	**8. Urtica**
b.	Plants without stinging hairs	5
5a.	Flowers in saucer like pseudoheads	**5. Lecanthus**
b.	Flowers in axillary clusters or in panicles	**7. Pilea**
6a.	Plants with stinging hairs	**4. Girardinia**
b.	Plants without stinging hairs	7
7a.	Flowers in saucer like pseudoheads	**3. Elatostema**
b.	Flowers in axillary or terminal spiked clusters	**6. Parietaria**

1. BOEHMERIA Jacq.

About 100 species; 12 species in India; 2 in the Biosphere Reserve.

The genus is named after George Rudolf Boehmer, a Professor of Botany at Wirtterburgh.

1a.	Leaves alternate, lanceolate, crenate	**2. B. rugulosa**
b.	Leaves opposite, orbicular-ovate roughly toothed	**1. B. platyphylla**

1. Boehmeria platyphylla D. Don **Fig. 56.**

Perennial herbs or shrubs, stems hairy throughout. Leaves broadly ovate-orbicular. Flowers minute, in axillary spikes.

Common in buffer zone around Reni-Malari area, 1900-2400 m. Flowering and fruiting during May September.

2. Boehmeria rugulosa Wedd.

Gaint shrubs or small trees, young branches hispid-rugulose. Leaves lanceolate, crenate. Flowers clustered in interrupted spikes.

Common in buffer zone, around Remi-Malari area, 1900-2400 m. Flowering and fruiting during May September.

2. DEBREGEASIA Gaud.

Over 6 species; 5 in India; 1 in the Biosphere Reserve.

The generic name is given after Prosper Justin de Bregeas.

Debregeasia longifolia (Burm.f.) Wedd.

Small shrubs. Leaves linear-elliptic, white-grey beneath. Flowers small greenish-brown, in small heads.

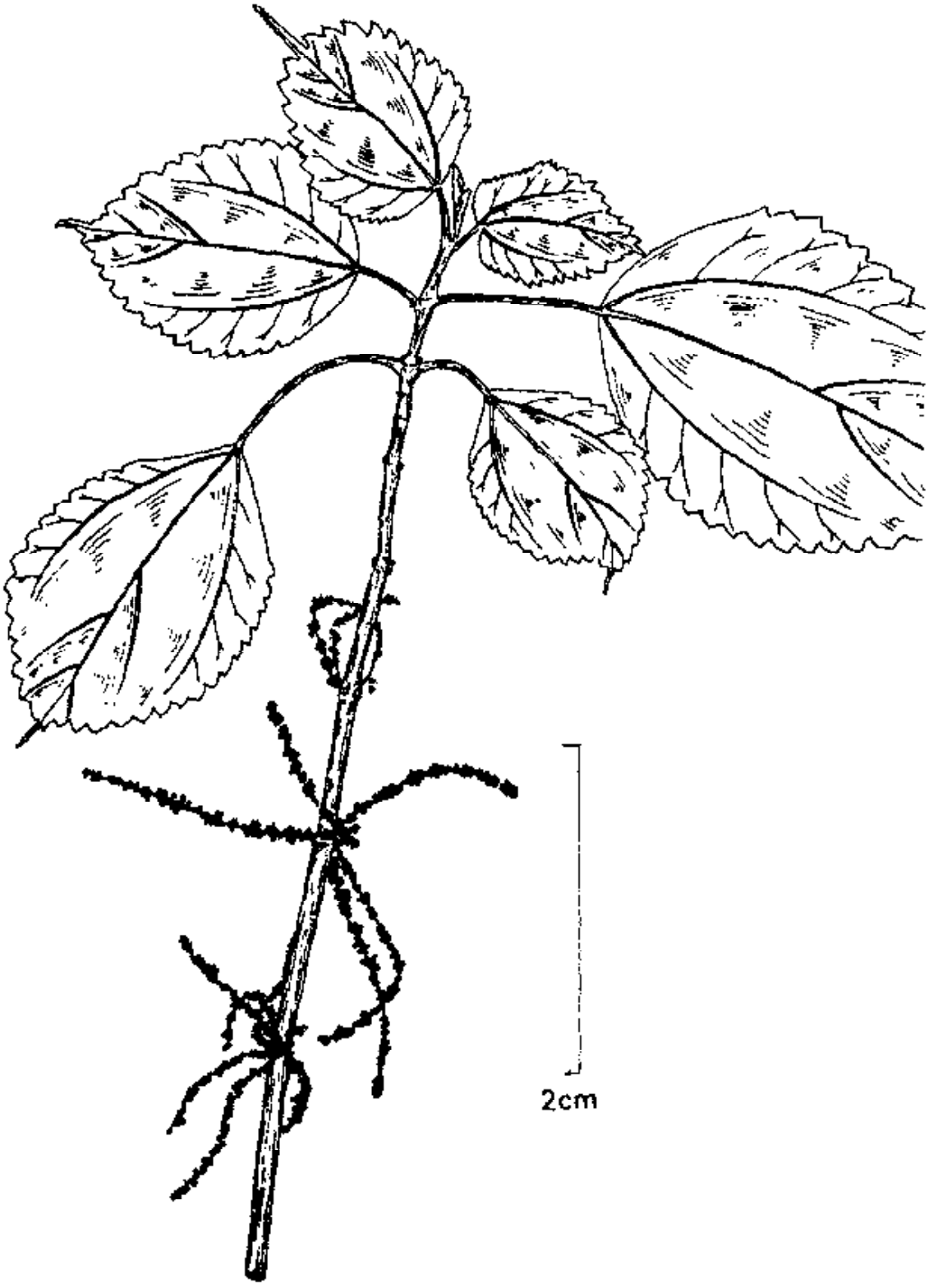


Fig. 56. Boehmeria platyphylla D. Don

Common around Reni-Malari area, 1800-2500 m. Flowering and fruiting during September November.

This is a very good fodder plant of the area.

3. ELATOSTEMA J.R. & G. Forst.

The genus comprises about 200 species; about 35 in India, 2 in the Biosphere Reserve. The plants are herbs or undershrubs.

1a.	Erect herbs; leaves toothed towards the tip	2. E. surculosum
b.	Prostrate or ascending herbs; leaves toothed throughout	1. E. sessile

1. Elatostema sessile J.R. & G. Forst.

Prostrate herbs, rooting at nodes. Leaves ovate-lanceolate, toothed, sessile. Flowers minute, arranged in pseudoheads.

Around Kalikana Chhenabari area near watery places, 2400-2800 m. Flowering and fruiting during June September.

2. Elatostema surculosum Wt.

Slender, erect herbs with lanceolate-leaves. Flowers minute, arranged in pseudoheads.

Around Reni-Kalikona area, 2000-2600 m. Flowering and fruiting during June September.

4. GIRARDINIA Gaud.

About 8 species; 2 in India; 1 in the Biosphere Reserve. Perennial herbs or shrubs with stinging hairs.

Girardinia diversifolia (Link) Friis.

Robust, perennial herbs with stinging bristles. Leaves broadly ovate, deeply lobed. Flowers small, greenish.

Common in buffer zone around Lata-Suraithota, 1800-2200 m. Flowering and fruiting during August September.

5. LECANTHUS Wedd.

The genus comprises about 3 species; 2 in India and the Biosphere Reserve.

1a.	4-10 cm high herbs; pseudoheads less than 1 cm in diam	1. L. peduncularis
b.	30-70 cm high herbs; pseudoheads more than 1 cm in diam	2. L. wallichii

1. Lecanthus peduncularis (Royle) Wedd.

Small 4-10 cm high, succulent, pubescent herbs. Leaves ovate, unequal, opposite. Fruits red.

Around buffer zone area, near watery places in mixed forest, 2000-3000 m. Flowering and fruiting during July October.

2. Lecanthus wallichii Wedd.

Robust, 30-70 cm high, pubescent herbs. Leaves cordate. Fruits ovoid, purple.

In buffer zone near watery places in mixed forest, 2000-3000 m. Flowering and fruiting during July October.

6. PARIETARIA L.

About 30 species; 2 in India, 1 in the Biosphere Reserve. Mostly herbs, rarely undershrubs.

The generic name is derived from a Latin word *Paries* meaning wall, referring to the habit as they mostly grow on old walls.

Parietaria micrantha Ledeb.

Diffused perennial herbs 4-12 cm high, stems slender, matted. Leaves ovate, thin. Flowers in axillary, clustered cymes.

Arceuthobium minutissimum Hook.f.

Rhododendron campanulatum D. Don

Convolvulus arvensis L.

Cannabis sativa L.

Betula utilis D. Don

Nomocharis oxypetala (Royle) Wilson

Incarvillea arguta (Royle) Royle

Goodyera repens (L.) R. Br.

Habenaria diphylla Dalz.

Allium wallichii Kunth

Common on hill slopes in shady places around Malari and Dibrugheta, 2800-3700 m. Flowering and fruiting during August September.

7. PILEA Lindl.

The genus comprises about 400 species; 20 in India, 2 in the Biosphere Reserve. Plants are herbs, rarely undershrubs.

1a.	Small, less than 15 cm high; herbs, stems glabrous	1. **P. racemosa**
b.	Large, more than 20 cm high; herbs, stems hairy	2. **P. umbrosa**

1. Pilea racemosa (Royle) Tuyama

Small, 3-15 cm high, glabrous herbs. Leaves rounded-ovate, serrate. Flowers minute.

In buffer zone area in watery places in subalpine region, 3000-3500 m. Flowering and fruiting during July October.

2. Pilea umbrosa Wedd.

Tall, erect, hairy herbs. Leaves ovate-lanceolate, coarse, toothed. Flowers minute.

Around buffer zone area, 2000-3000 m. Flowering and fruiting during July-October.

8. URTICA L.

About 50 species; 3 in India, 1 in the Biosphere Reserve. Perennial herbs or shrubs with stinging hairs. A few species are edible.

The generic name is derived from Latin word *Uro* meaning to burn, referring to the stinging hairs present in most of the species.

Urtica dioica L.

Tall, erect, ca 1 m high, perennial stinging hairy herbs or undershrubs, stems grooved. Leaves ovate-cordate. Flowers in axillary clusters, greenish.

Common on hill slopes around Himtoli area, 2500-3000 m. Flowering and fruiting during May August.

82. JUGLANDACEAE
(Walnut family)

The family comprises 7 genera and 50 species, chiefly distributed in temperate and subtropical region; 2 genera and over 7 species in India, 1 genus with 1 species in the Biosphere Reserve.

JUGLANS L.

Over 15 species; only one in India mainly distributed in temperate Himalaya, 1 in the Biosphere Reserve.

Juglans regia L.

Large deciduous trees. Leaves 5-9 foliate, tomentose when young; leaflets elliptic to oblong-lanceolate. Male flowers in Catkins; female flowers 1-3, sessile. Fruit drupaceous, globose or ovoid, pubescent, green tinged with pink.

Common on the hill slopes between 2200-3000 m in the temperate region of the Biosphere Reserve. Flowering and fruiting during February - November.

83. BETULACEAE

The family comprises 2 genera and over 54 species chiefly, distributed in North temperate and tropical mountains; 2 genera and 6 species in India, 3 genera and 4 species in the Biosphere Reserve.

1a. Bracts of the fruiting spikes forming a woody cone — **1. Alnus**
b. Bracts of the fruiting spikes not forming woody cone — **2. Betula**

1. ALNUS L.
(The Alders)

Over 35 species; 2 in India, 1 in the Biosphere Reserve.

The generic name is derived from a Latin word *Elder* meaning near and *Lan* meaning edge of the river, referring to the habit.

Alnus nepalensis D. Don

Tall, deciduous or subdeciduous trees. Leaves elliptic, entire or very rarely serrulate. Male flowers in catkins, finely arranged in terminal panicles; female flowers in axillary racemes.

Common around Reni-Lata area, 1800-2200 m. Flowering and fruiting during October December.

2. BETULA L.
(The Birch)

About 50 species; 4 in India, 2 species in the Biosphere Reserve.

The generic name is derived from Latin word *Betula* derived from Celtic Betu commonly know as "Birch".

1a. Bark conspicuously peeling off in papery layers; twigs and petiolcs silvery, soon becoming glabrous **2. B. utilis**
b. bark not so conspicuously peeling off; twigs and petioles tomentose **1. B. alnoides**

1. Betula alnoides Buch.-Ham. ex D. Don

Large deciduous trees. Twigs tomentose when young. Leaves ovate or ovate-lanceolate. Flowers in spikes. Fruits winged nut.

Common in mixed forest, 2000-3200 m in temperate region of the Biosphere Reserve. Flowering and fruiting during March - June.

2. Betula utilis D. Don **Fig. 57.**

Small, deciduous trees, stem bark white or silvery grey, peeling off in papery layers. Leaves ovate, serrate. Flowers in spikes. Fruits winged nut.

Common on hill slopes, 3500-4000 m, in alpine region of the Biosphere Reserve. Flowering and fruiting during May October.

84. CORYLACEAE
(Hazelnut family)

A monogeneric family comprising 15 species, distributed mainly in North temperate region. The plants are trees or shrubs with simple, alternate, stipulate leaves.

CORYLUS L.
(The Hazels)

Over 15 species; 2 in India; 1 in the Biosphere Reserve.

The generic name is derived from a Latin word *Korys* meaning a helmet, referring to calyx covering the fruit.

Corylus jacquemontii Decne. **Fig. 58.**

Large, deciduous trees, young branches glandular hairy. Leaves ovate or obovate, acuminate, sharply lobulate. Male catkins arranged in short racemes; female flowers in small bud like spikes. Fruit (Nut) with enlarged bracts.

Common around Kalikona area, 2200-2500 m. Flowering and fruiting during April - June. The seeds are known as "Bhotia Badam" and eaten raw.

85. FAGACEAE
(Beech family)

The family comprises 8 genera and over 900 species, cosmopolitan in distribution; two genera and over 70 species in India, 1 genus with 2 species in the Biosphere Reserve. These are monoecious trees.

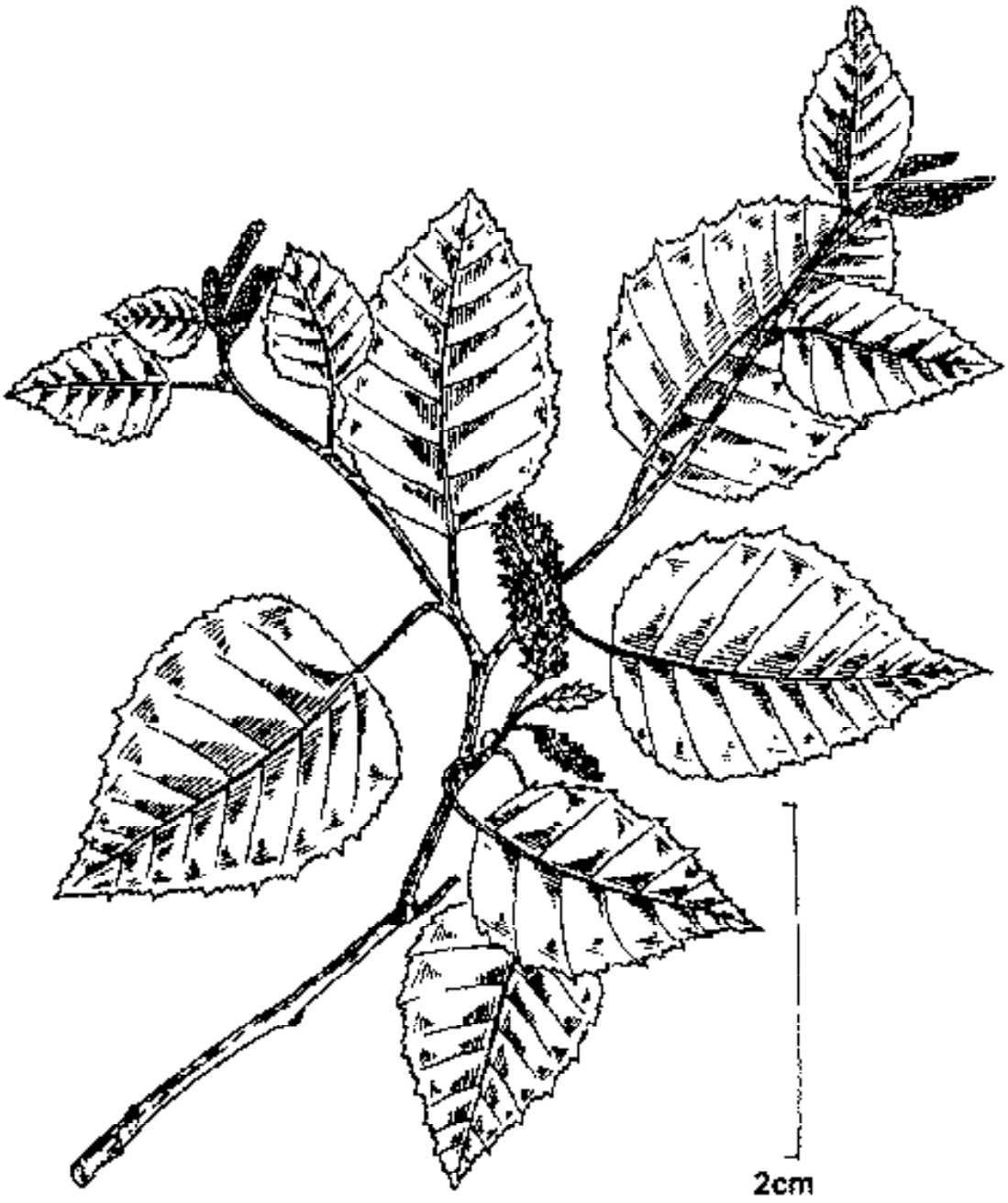


Fig. 57. Betula utilis D. Don

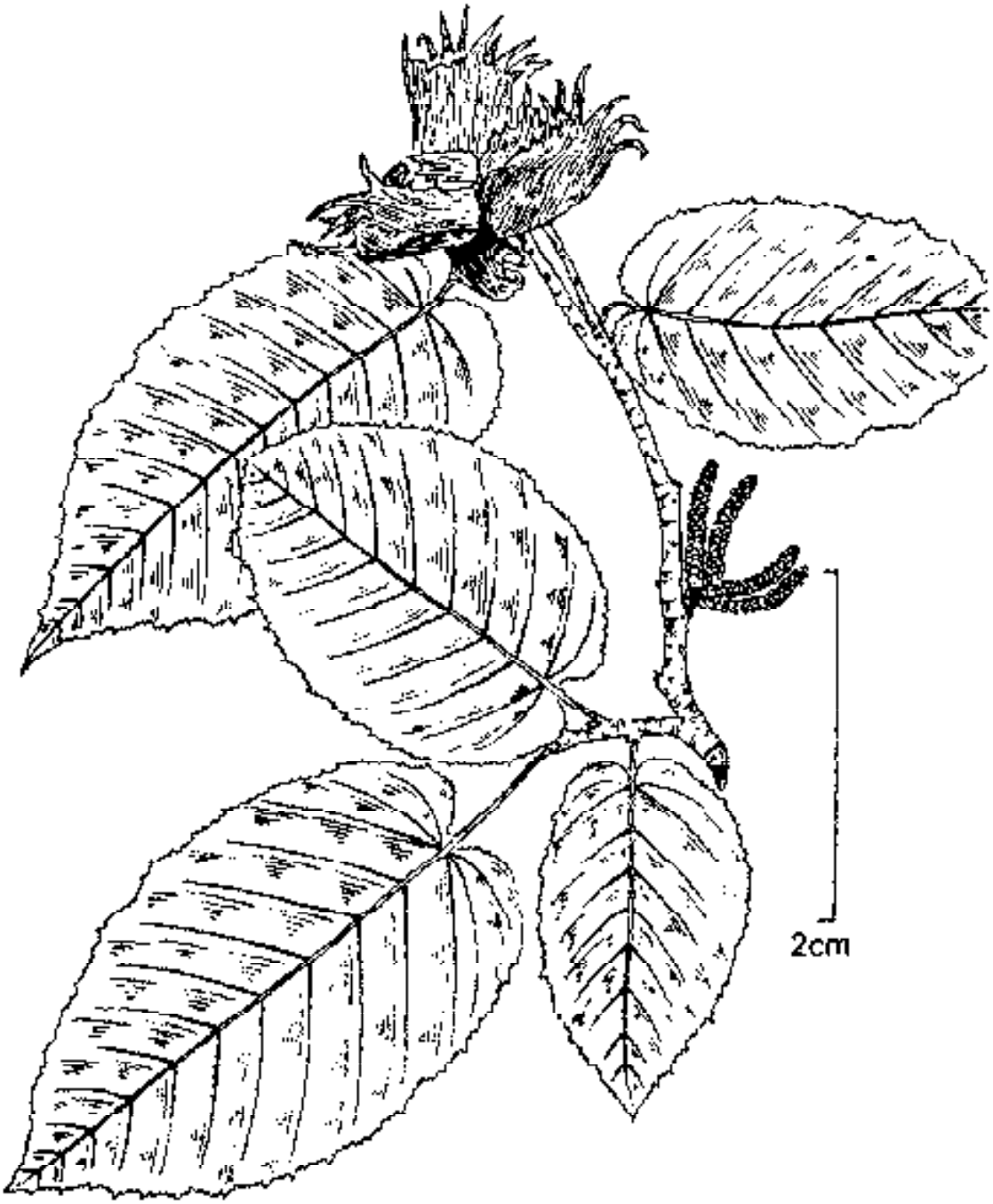


Fig. 58. Corylus jacquemontii Decne.

QUERCUS L.
(The Oaks)

The genus comprises over 300 species; 20 in India, 2 in the Biosphere Reserve. These are deciduous or evergreen trees, rarely shrubs.

The generic name is derived from Celtic word *Quer* meaning fine and *Cuez* meaning a tree, referring to the fine tree. Oaks are considered as a source of strength.

1a.	Young shoots stellately pubescent; acorns (fruit) ovoid	**1. Q. dilatata**
b.	Young shoots brown tomentose; acorns subglobose	**2. Q. semecarpifolia**

1. Quercus dilatata Royle

Large trees. Leaves oblong, oblong-elliptic to elliptic-lanceolate, serrate. Acorns (fruit) ovoid.

In mixed forest around Kalikona area, 2000-2400 m. Flowering and fruiting during April October.

2. Qurecus semecarpifolia J.E. Sm. **Fig. 59.**

Tall trees, young shoots brown tomentose. Leaves elliptic, elliptic-oblong entire, or spinous toothed. Acorns (fruit) subglobose.

Common around Himtoli area, 2600-3500 m. Flowering and fruiting during May August.

86. SALICACEAE
(Willow family)

The family comprises 3 genera and over 530 species mainly distributed in North temperate region; only 2 genera and over 35 species in India, 2 genera and 6 species in the Biosphere Reserve.

Fig. 59. Quercus semicarpifolia J.E. Sm.

1a.	Disk of 1 or 2 separate glands; petioles short	**2. Salix**
b.	Disk cupular or annular; petioles long	**1. Populus**

1. POPULUS L.

Over 40 species; 9 in India, only 1 in the Biosphere Reserve. The plants are trees with scaly, often resinous buds.

Populus ciliata Wallich ex Royle

Large deciduous, trees. Leaves broadly ovate, acuminate, crenate-serrulate, minutely pubescent beneath. Male flowers in compact catkins.

Common around Kalikona-Chhenabari area, 2200-2600 m. Flowering and fruiting during March - June.

2. SALIX L.
(The Willows)

The genus comprises over 500 species; about 35 in India, 6 in the Biosphere Reserve. These are mostly trees or shrubs, some are prostrate.

The generic name is derived from Celtic word Sal meaning near and Lis meaning water, in illusion to its place of growth.

1a.	Erect shrubs	2
b.	Prostrate shrubs	5
2a.	Stem single from the base	**6. S. wallichiana**
b.	Stems many from the base or much branched at the base	3
3a.	Shrubs, not exceeding 0.7 m	**2. S. fruticulosa**
b.	Shrubs, exceeding 1.2 m	4
4a.	Leaves ovate-elliptic, serrate with gland tipped teeth, clothed with loose silky hairs when young	**3. S. karelinii**
b.	Leaves elliptic-oblong or obovate, not gland tipped, not silky hairy	**1. S. denticulata**
5a.	Leaves entire, margins revolute	**5. S. lindleyana var. microphylla**
b.	Leaves serrulate, margins not revolute	**4. S. lindleyana var. lindleyana**

1. Salix denticulata Anders.

Deciduous shrubs, twigs reddish-brown, young shoots pubescent. Leaves elliptic-oblong or ovate, serrulate. Flowering after the leaves. Capsules glabrous.

Common on hill slopes in mixed forest and in alpine region, 2200-4000 m, throughout the Biosphere Reserve area. Flowering and fruiting during March July.

2. Salix fruticulosa Turcz.

Erect, deciduous spreading shrubs, young shoots pubescent or tomentose. Leaves elliptic-oblong or elliptic-obovate, acute. Capsules glabrous.

Common around Dibrugheta-Soriwara area, 3000-3500 m. Flowering and fruiting during May October.

3. Salix karelinii Turcz.

Tall, deciduous shrubs, stems much branched from the base, slightly curved. Leaves ovate or elliptic-ovate, serrate with gland tipped teeth. Rachis of male catkin silky.

Common throughout the area around Martoli, Milam and Ramni-Sarsupatal area, 3000-4500 m. Flowering and fruiting during May September.

4. Salix lindleyana Wallich ex Anders. var. lindleyana

Small, deciduous shrubs, stems creeping, young shoots glabrous. Leaves elliptic-oblong or oblong-lanceolate, serrulate. Flowers after the leaves. Fruiting catkins long. Fruits glabrous.

Common on hill slopes, 3000-4000 m in alpine region of Biosphere area. Flowering and fruiting during June October.

5. Salix lindleyana Wallich ex Anders. var. **microphylla** Anders.

Differs from *S. lindleyana* var. *lindleyana* in entire, hairy leaves with undulate margins.

Common on hill slopes around Martoli area 3000-3800 m. Flowering and fruiting during June September.

6. Salix wallichiana Anders.

Deciduous trees or shrubs. Leaves lanceolate or ovate-elliptic, entire, silky pubescent beneath. Flowers appearing before leaves.

Common around Malari and Sonwara area, 2000-3500 m. Flowering and fruiting during May September.

MONOCOTYLEDONES

78. ORCHIDACEAE

(The Orchid family)

The family comprises 735 genera and over 17000 species, cosmopolitan in distribution chiefly in tropical and temperate region, very rare in arctic region; about 1100 species in India; 19 genera and 30 species in the Biosphere Reserve.

The plants of the family are terrestrial and epiphytic, some of them saprophytic as well. The distinctive character of the orchid is the column, an organ formed by the union of style, stigma and stamens. Within the column is a canal leading from the stigmatic surface to the ovary.

Many of the orchids are grown by florists, amateurs and fanciers for the odd and showy flowers.

1a.	Rhizomes coralloid	2
b.	Rhizomes not coralloid	3
2a.	Pollinia 2	**7. Epipogium**
b.	Pollinia 4	**3. Corallorhiza**

3a.	Lip folded, forming an inflated pouch	**4. Cypripedium**
b.	Lip not folded, pouch absent	4
4a.	Leafless herbs	5
b.	Leafy herbs	6
5a.	Flowers pale yellowish	**7. Epipogium**
b.	Flowers dark green	**15. Neottia**
6a.	Lip distinctly spurred or saccate at the base	7
b.	Lip neither spurred nor saccate	
7a.	Lip spurred	8
b.	Lip saccate at the base	16
8a.	Rhizomatous herbs	9
b.	Tuberous herbs	10
9a.	Leaves solitary; sepals and petals forming hook	**1. Aorchis**
b.	Leaves 2-4; sepals and petals not forming hooks	**2. Calanthe**
10a.	tubers palmately 2-5-lobed	11
b.	Tubers not palmately-lobed	12
11a.	Spur slender, filiform, longer than the ovary	**9. Gymnadenia**
b.	Spur cylindrical, equalling the ovary	**5. Dactylorhiza**
12a.	Spur long cylindric, appendages of stigma distinct	**10. Habenaria**
b.	Spur not cylindric, appendages of stigma not distinct	13
13a.	Pollinia waxy	**17. Oreorchis**
b.	Pollinia granular	14
14a.	Flowers pink	**16. Nenttianthe**
b.	Flowers greenish	**18. Peristylus**
15a.	Flowers many in terminal racemes	**11. Herminium**
b.	Flowers solitary	**17. Oreorchis**
16a.	Spikes spirally twisted, flowers white or pink	**19. Spiranthes**
b.	Spikes not spirally twisted, flowers white, yellowish-green or green	17
17a.	Pollinia 4	18
b.	Pollinia 2	19
18a.	Column very short; lip superior	**14. Malaxis**
b.	Column long; lip inferior	**12. Liparis**
19a.	Flowers white	**8. Goodyera**
b.	Flowers greenish or yellowish-green	20
20a.	Flowers in bracteate racemes	**6. Epipactis**
b.	Flowers in ebracteate racemes	**13. Listera**

1. AORCHIS Vermeneen

These are small alpine plants with rhizome. Leaf solitary from the base of stem. Inflorescence with 1-4 flowers. Sepals and petals forming a hook, pollinia 2.

2 species in W. Himalaya; 1 in the Biosphere Reserve.

Aorchis roborovskii (Maxim) Sied.

A terrestrial, 5-15 cm high herb with solitary leaf. Flowers 1-2, 1-1.5 cm across, purple, with trilobed lip.

On open hill slopes, amidst grasses. Common from Bhojagara to pathalkhan, 3500-4000 m. Flowering and fruiting during July September.

2. CALANTHE R. Br.

Terrestrial herbs. Leaves plicate. Inflorescence axillary. Flowers in erect raceme. Pollinia 8, waxy.

About 120 species in the world; over 25 in India, 1 in the Biosphere Reserve.

The generic name is derived from Greek word *Kalos* meaning beautiful and *Anthos* meaning a flower, referring to brightly coloured flowers.

Calanthe tricarinata Lindl.

Pseudobulbous herb, 30-70 cm high, pseudobulbs 2-2.5 cm long, ovoid. Leaves 2-4. Inflorescence 3-50 cm long, 8-12-flowered. Flowers 2-2.5 cm across, greenish white.

Dibrugheta to Sonwara, in shady places, 3300-4000 m. Flowers during April -June.

3. CORALLORHIZA Gagnebin

Leafless terrestrial herbs. Scape simple sheathed.

The genus comprises about 15 species in the world; 2 species in India, 1 in the Biosphere Reserve.

Corallorhiza anandae Malhotra et Balodi

Terrestrial, erect, annual or perennial herbs with coralloid rhizomes. Flowers pale-green, in terminal spikes.

Around Martoli bugyal, 4500 m. Flowering and fruiting during June-July.

4. CYPRIPEDIUM L.

Terrestrial herbs with creeping rhizome. Flowers usually solitary, rarely in pairs. Lip sessile with large inflated, saccate mid-lobe. Anthers 2.

The genus comprises over 50 species; 4 in India; 2 in the Biosphere Reserve.

The generic name is derived from Greek word *Kypris* meaning Venus, Aphrodite and *Pedilon* meaning slipper (wrongly latinized as pedium) commonly known as "Venus slipper" or "Ladies slipper orchid".

1a. Leaves 2, opposite; lip ca 1 cm long — 1. C. elegans
b. Leaves 3 or more, alternate; lip more than 2 cm — 2. C. himalaicum

1. Cypripedium elegans Reichb.f. Fig. 60.

A pubescent herb, up to ca 10 cm high. Leaves 2, opposite, orbicular sessile. Flowers brownish with dark brown lines.

Rare, around Dibrugheta-Deodi in Alpine meadows, 3300-4000 m. Flowering and fruiting during July August.

2. Cypripedium himalaicum Rolfe Fig. 61.

Herbs, 25-30 cm high with three or four loose, tubular, acute sheaths enclosing the stem. Leaves usually 3. Flowers brownish-purple, ca 6 cm across.

Around Latakharak-Dharansi in Alpine meadows, 2700-3700 m. Flowering and fruiting during July August.

5. DACTYLORHIZA Necker ex Nevski

Slender or robust plants with palmately lobed tubers. Column short, pollinia 2.

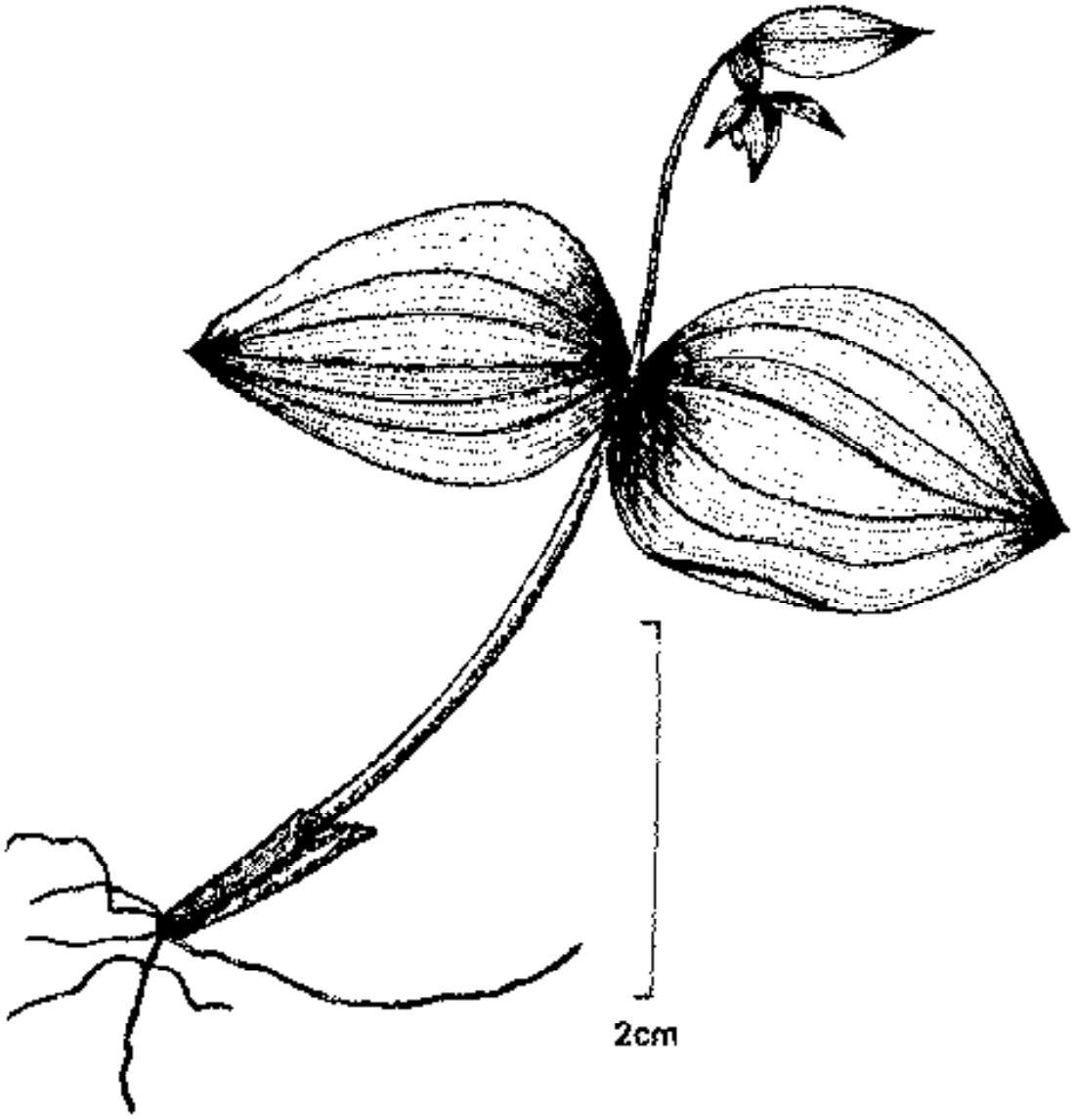


Fig. 60. Cypripedium elegans Reichb. f.

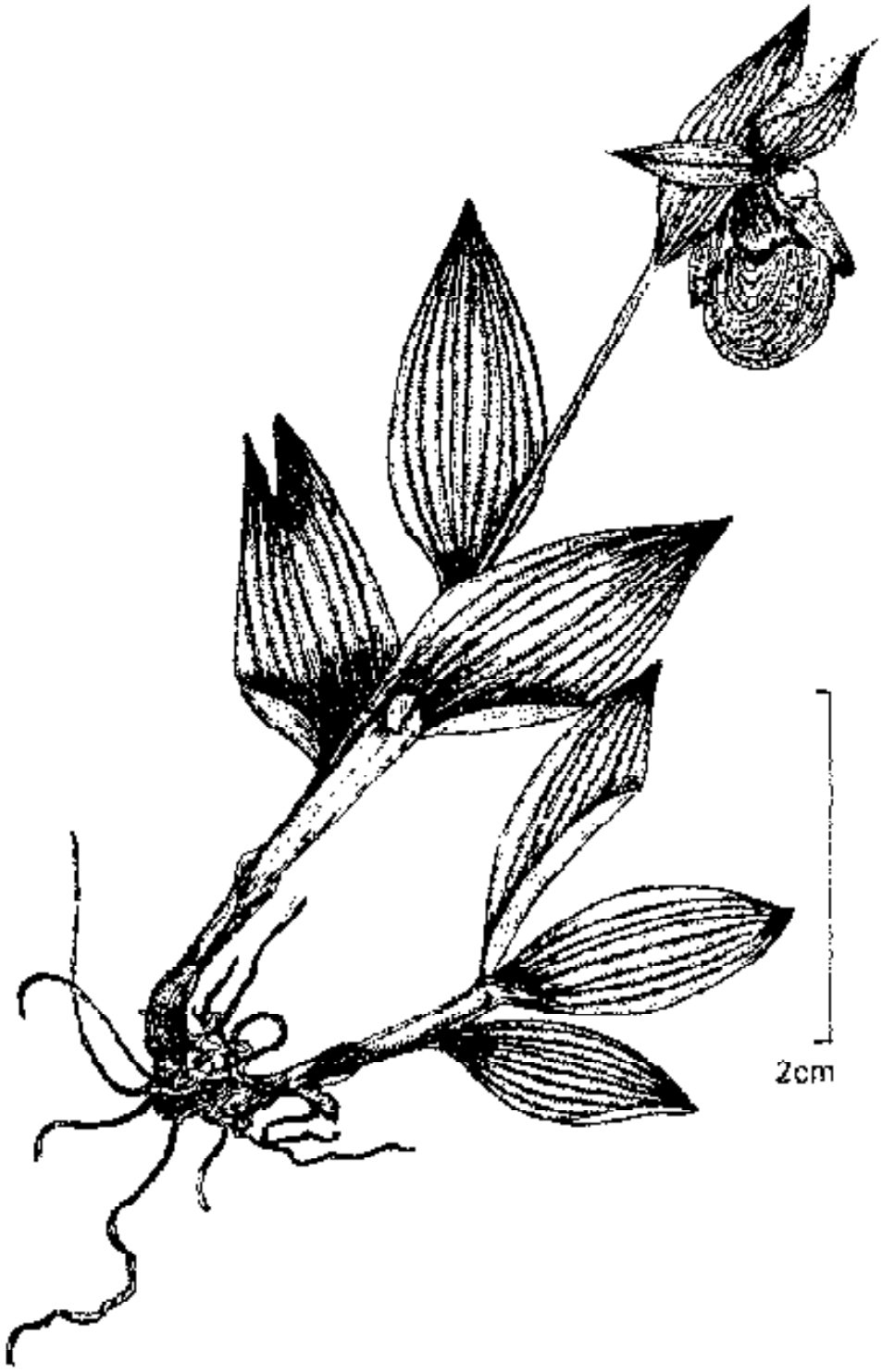


Fig. 61. Cypripedium himaluicum Rolfe

Dactylorhiza hatagirea (D. Don) Soo

Robust herbs, up to 60 cm high, tubers 2-5 lobed; stem leafy upwards. Leaves 3-6. Inflorescence densely flowered. Flowers purplish-lilac or rose.

Near Tolma, on hill slopes and around Dibrugheta area, 2600-3800 m. Flowering and fruiting during July August.

6. EPIPACTIS L.

Terrestrial herbs with horizontal or vertical, often short rhizomes, and numerous fleshy roots. Stem erect. Leaves sessile. Pollinia 2.

This genus comprises over 25 species; 4 species in W. Himalaya, 2 in our area.

The generic name is derived from the Greek word *Epipegnus* meaning to coagulate, alluding to supposed effect on milk.

1a.	Flowers in subsecund racemes	**2. E. helleborine**
b.	Flowers in long, lax racemes	**1. E. gigantea**

1. Epipactis gigantea Dougl. ex Hook.

Erect herbs, up to 90 cm high. Leaves flat. Flowers drooping, distant, ca 2.5 cm across, green.

On way to Latakharak, near Pangrani, on way to Sonwara, 2000-2700 m. Flowering and fruiting during July September.

2. Epipactis helleborine (L.) Crantz.

Plants up to 70 cm high; rhizome very short. Leaves spreading, elliptic or ovate-lanceolate. Flowers green, flushed with red, violet or yellowish-green, 1.3-2 cm across.

On hill slopes around Tolma to Himtoli, 2000-2600 m. Flowering during July August.

7. EPIPOGIUM R. Br.

Terrestrial, leafless, saprophytic herbs; rhizome tuberous or coralloid, without roots; stems sheathed. Flowers few, pollinia 2.

The genus comprises about 3 species; 2 in india, mostly in W. Himalaya, 1 in the Biosphere Reserve.

The generic name is derived from Greek word *Epi* meaning upon and *Pogon* meaning beard, referring to the presence of hairs on the lip.

Epipogium aphyllum Sw.

Saprophytic herb with coralloid, branched, rhizome, stems up to ca 30 cm high, pale-yellowish. Leaves absent. Flowers pale-yellow, partly pinkish, nodding, about 2 cm across.

Near Himtoli in *Abies* forest, 2200-2600 m. Flowers during August September.

8. GOODYERA R. Br.

Terrestrial leafy herbs. Leaves usually thick, petioled. Flowers small, many. Pollinia 2.

The genus comprises over 50 species; 14 in India, 6 species in W. Himalaya; 2 in our area.

The generic name is given after John Goodyer of Oxford.

1a. Sac of the lip projecting beyond the bases of the sepals — 1. G. fusca
b. Sac of the lip not projecting beyond the sepals — 2. G. repens

1. Goodyera fusca (Lindl.) Hook.f.

Herbs, 20-30 cm high with glabrous stems. Leaves fleshy 2.5-3.5 cm long. Flowers crowded, ca 5 cm long, white, flushed green.

Around Dharansi-Latakharak area on alpine meadows amidst boulders, 2600-3000 m. Flowering and fruiting during August September.

2. Goodyera repens (L.) R. Br.

Herbs, 10-20 cm high with creeping rhizome. Leaves crowded near the base. Inflorescence 2.5-5 cm long, densely flowered. Flowers 3.5 mm across, white, flushed with brownish pink.

Near Tolma-Belta and surroundings, on moist places 2200-2700 m. Flowers during July August.

9. GYMNADENIA R. Br.

Robust herbs with palmate tuberoides, stems leafy. Inflorescence many-flowered. Flowers rose or purplish-lilac, rarely white.

1 species in the Biosphere Reserve.

Gymnadenia orchidis Lindl.

Herbs, 30-50 cm high with digitate tubers, stems clothed at base with tubular sheaths. Leaves 4-5. Spike 4-12 cm long, densely flowered. Flowers ca 7 mm across, pinkish or violet.

Around Himtoli area on hill slopes amidst grasses, 2500-3000 m. Flowers during July August.

10. HABENARIA Willd.

Terrestrial herbs with tubers. Leaves thin, base sheathing. Flowers in terminal inflorescence. Pollinia 2, granular.

17 species in W. Himalaya; 6 species in the Biosphere Reserve.

The generic name is derived from a latin word *Habena* meaning a rim, in allusion to the long strap shaped lip in some of the species.

1a.	Lip trilobed or tripartite	2
b.	Lip entire	4
2a.	Leaves more than 2 in the upper two third of stem,	**6. H. stenopetala**
b.	Leaves 2	3
3a.	Leaves opposite, apex usually rounded	**3. H. diphylla**
b.	Leaves sub opposite, apex cuspidate to acute	**1. H. aitchisonii**
4a.	Spur upturned, apical part hooked; petals yellow, lip yellow	**4. H. edgeworthii**
b.	Spur deflexed; petals green, lip green	5
5a.	Spur shorter than ovary	**2. H. clavigera**
b.	Spur usually longer than ovary	**5. H. latilabris**

1. Habenaria aitchisonii Reichb.f.

Herbs, up to 40 cm high. Leaves 2, near the base of scape, sub opposite. Spike 3-8 cm long, 15-20-flowered. Flowers 8 mm across, pale green, fragrant.

On way to Dunagiri, 2400-3300 m. Flowers during July August.

2. Habenaria clavigera (Lindl.) Dandy

Stout herbs, 30-60 cm high. Leaves many, ovate or oblong. Spikes 20-25 cm long. Flowers crowded, green.

On way to Roopkund, 3000-3500 m. Flowering and fruiting during July August.

3. Habenaria diphylla Dalz.

A terrestrial herb with two fleshy, ovate-oblong or sub-orbicular leaves. Scape many-flowered. Flowers ca 1 cm across, greenish white.

Near Tolma, 2400-3000 m, on hill slopes. Flowering and fruiting during July September.

4. Habenaria edgeworthii Hook.f. ex Collett

A stout, leafy herb, 30-60 cm high. Leaves fleshy, ovate or oblong, lanceolate, acute or acuminate. Spike 8-20 cm long, many-flowered. Flowers ca 1.5 cm across, yellow.

Around Lata village, on open grassy slopes, 1900-2200 m. Flowering and fruiting during July September.

5. Habenaria latilabris (Lindl.) Hook.f.

Herbs, 20-30 cm high. Leaves 3-5, scattered, elliptic-oblong, 5-10 cm long. Spike ca 12 cm long, laxly flowered. Flowers 1-4 cm across, green.

Near Tolma on hill slopes and on way to Peng, 2200-2800 m. Flowering in August September.

6. Habenaria stenopetala Lindl.

Herbs, 20-60 cm high. Leaves 15-20 cm long, ovate-lanceolate or oblong-lanceolate. Raceme densely flowered. Flowers pale green.

Near Peng, on hill slopes, 2200-2600 m. Flowering and fruiting during August September.

11. HERMINIUM Guettard

Slender herbs with more or less globose or round tubers. Leaves few, inflorescence dense flowered. Flowers small, greenish. Pollinia 2.

This genus comprises over 30 species, about 13 in India, ca 8 species in W. Himalaya 2 in the Biosphere Reserve.

1a. Lip much longer than sepals, lateral lobes much longer than midlobe **1. H. lanceum**

b. Lip equal or little longer than sepals, lateral lobes never longer than midlobe **2. H. monorchis**

1. Herminium lanceum (Thunb. ex Sw.) Vuijk

Herbs, 15-70 cm high. Leaves usually three, linear-lanceolate, acuminate. Spike cylindrical, dense, 6-20 cm long. Flowers crowded, small, green.

In Pine forest and on grassy open slopes near Lata village, 2000-2400 m. Flowers during August September.

2. Herminium monorchis (L.) R. Br.

Herbs, 7-15 cm high. Leaves 2-3, oblong-lanceolate. Spike ca 4 cm long, densely flowered. Flowers yellowish green, ca 5 mm across.

Around Dibrugheta-Deodi area, 3000-3500 m on open hill slopes with *Cotoneaster*, and *Parnassia* species. Flowering and fruiting during August September.

12. LIPARIS Rich.

Terrestrial or epiphytic herbs. Leaves membranous. Inflorescence terminal, many-flowered. Flowers small. Pollinia 4.

The genus comprises over 260 species; 45 in India, ca 10 species in W. Himalaya, only 1 species in our area.

The generic name is derived from the Greek word *Liparos*, meaning fat, greasy and hence smooth, referring to soft glossy surface of leaves.

Liparis rostrata Reichb.f.

Pseudobulbous herbs, pseudobulbs ca 2 cm long, crowded. Leaves 2, opposite. Inflorescence 15-20 cm long, laxly flowered. Flowers ca 2 cm across, yellow-green.

Near Lata village on way to Himtoli in Pinus forest, 2200-2800 m. Flowering and fruiting during July August.

13. LISTERA R. Br.

Rhizome more or less slender. Leaves 2. Flowers small, greenish, pollinia 2.

The genus comprises of 30 species, over 10 in India; 5 species in North-west Himalaya; 2 in the Biosphere Reserve.

The genus is named after Martin Lister, an English physician and naturalist.

1a.	Racemes 2-6 cm long	**1. L. nandadeviensis**
b.	Racemes 1-2.5 cm long	**2. L. tenuis**

1. Listera nandadeviensis Hajra

An erect, slender, 13-20 cm high herb with fleshy, fibrous roots. Leaves 2, sessile, opposite. Raceme slender, 2-6 cm long. Flowers green.

On moss covered rocks in *Abies-Betula* forest, near Himtoli, 2400-2700 m. Flowers during August September.

2. Listera tenuis Lindl.

An erect, slender, 12-15 cm high herb. Leaves two, sessile, opposite. Raceme 2-5-flowered, 1-2.5 cm long. Flowers green.

Found to grow in Sub-alpine Himalays in *Abies-Pinus-Rhododendron-Betula* Forest. Deodi to Ramani, 3000-3500 m. Flowering during July August.

14. MALAXIS Sol. & Sw.

Leaves one or more, membranous, plicate. Flowers small, green. Pollinia 4.

The genus comprises over 300 species, about 17 in India, 7 species in W. Himalaya, only 1 in the Biosphere Reserve.

The generic name is derived from *Malaxis* a Greek word meaning softening.

Malaxis muscifera (Lindl.) Kuntz. (*Microstylis muscifera* (Lindl.) Ridl.

Pseudobulbous herbs, pseudobulb more or less ovoid, stems 10 cm high. Leaves two, unequal. Inflorescence 10-20 cm long. Flowers yellowish green, ca 3 mm across.

Around Belta-Latakharak, in shady places, 2600-3000 m. Flowering and fruiting during July September.

15. NEOTTIA Guettard

Rhizome robust, with densely crowded fleshy roots. Flowers fleshy. Pollinia 2.

The genus comprises over 9 species; 5 species from W. Himalaya; 1 in the Biosphere Reserve.

Neottia listeroides Lindl.

Erect, ca 40 cm high herbs with densely crowded roots, stems brownish-olive-green with loose sheaths. Leaves absent. Inflorescence many-flowered. Flowers brownish-olive-green or dark green.

Near Himtoli, 2500-3000 m on grassy hill slopes. Flowering and fruiting during July September.

16. NEOTTIANTHE Schl.

The genus comprises about 6 species; 2 in India and the Biosphere Reserve.

1a. Lip bent downwards; spur tapering downwards, faintly incurved — **1. N. calcicola**
b. Lip boat shaped; spur conoidal, curved forwards — **2. N. secundiflora**

1. Neottianthe calcicola (W.W. Sm.) Schl.

8-12 cm high, erect or semi-erect herbs. Leaves 2, lanceolate to sub-linear. Spike ca 4 cm long, usually 6-12 flowered. Flowers secund, lip 3-lobed.

Around Dibrugheta-Deodi, on open hill slopes amidst *Cotoneaster* and grasses, 3300-3600 m. Flowering and fruiting during August September.

2. Neottianthe secundiflora (Hook.f.) Schl.

Erect herbs, 5-20 cm high. Flowers secund, pink, perianth connivent except lip to form a hood like structure.

Around Himtoli-Dharansi area on hill slopes, 3000-3700 m. Flowering and fruiting during July September.

17. OREORCHIS Lindl.

The genus comprises about 15 species; 3 in India mostly distributed in Himalaya; 1 in the Biosphere Reserve.

Oreorchis micrantha Lindl.

Pseudobulbous, herbs; pseudobulbs ovoid-conic, base with few fibres. Leaves usually 2, linear-lanceolate, 15-30 cm long. Scape from the side of pseudobulb. Racemes few flowered. Flowers pale-yellow, lip white.

Dibrugheta to Sanwara, on hill slopes, 3200-3600 m. Flowering and fruiting during June September.

18. PERISTYLUS Bl.

The genus comprises over 60 species; 6 in India; 1 in the Biosphere Reserve.

Peristylus elisabethae (Duthie) Gupta

20-30 cm high herbs with 2-3 leaves usually towards the base of stem. Spike 15-20 cm long, lax flowered. Flowers small, green.

Near Belta and Latakharak, on hill slopes, 2400-3000 m. Flowering and fruiting during August October.

19. SPIRANTHES Rich.

The genus comprises 25 species; 2 in India; 1 in the Biosphere Reserve.

Spiranthes sinensis (Pers.) Ames.

Slender, 15-40 cm high herbs. Leaves spreading, linear 3-10 cm long. Flowers small, crowded, secund, rose-purple or white.

Around buffer zone area on hill slopes, 2000-3000 m. Flowering and fruiting during August - October.

78. ZINZIBERACEAE

The family comprises 45 genera and about 700 species chiefly distributed in tropical region of the globe; and 3 species in the Biosphere Reserve.

The plants of this family are perennial aromatic herbs usually with fleshy rhizomes, often with tuberous roots.

1a.	Connective of anthers not spurred at the base	2. Hedychium
b.	Connective of anthers spurred at the base	2
2a.	Flowers yellow	1. Cautleya
b.	Flowers purple	3. Roscoea

1. CAUTLEYA Royle

The genus comprises 5 species all Himalayan; 1 in the Biosphere Reserve.

Cautleya spicata (Sm.) Baker

Tall, erect herbs with broad 30-50 cm long leaves. Flowers yellow, many.

Around Kalikona-Chhenabari area in shady moist places. 2300-2800 m. Flowering and fruiting during July - September.

2. HEDYCHIUM Koenig

The genus comprises about 50 species; 25 in India; 1 in the Biosphere Reserve.

Hedychium spicatum Buch.-Ham. ex Sm. **Fig. 62.**

Tall, erect, robust herbs. Leaves broadly lanceolate, tip long tail like. Flowers white, fragrant.

Around the buffer zone area in mixed forest in moist shady places, 2200-2600 m. Flowering and fruiting during July October.

3. ROSCOEA Sm.

The genus comprises about 15 species; 3 in India; 1 in the Biosphere Reserve.

Roscoea alpina Royle

10-25 cm high herbs. Flowers dark purple, corolla tube much longer than the calyx.

Around bufferzone area in mixed moist forest and on slopes, 2200-2700 m. Flowering and fruiting during July September.

89. HAEMODORACEAE

Perennial, herbaceous plants with radical linear or ensiform, sessile leaves. Flowers usually regular, bisexual, 3-merous, in racemes, terminating into a slender scapes. Perianth bell-shaped. Fruit a capsule.

14 genera and 75 species mainly from South Africa, Australia, Western and Tropical America and Asia; 2 genera and 25 species in the Biosphere Reserve.

1a.	Scape pubescent; pereianth lobes recurved	**1. Aletris**
b.	Scape glabrous; perianth lobes not recurved	**2. Ophiopogon**

ALETRIS L.

The genus comprises over 25 species; 4 in India; 1 in the Biosphere Reserve.

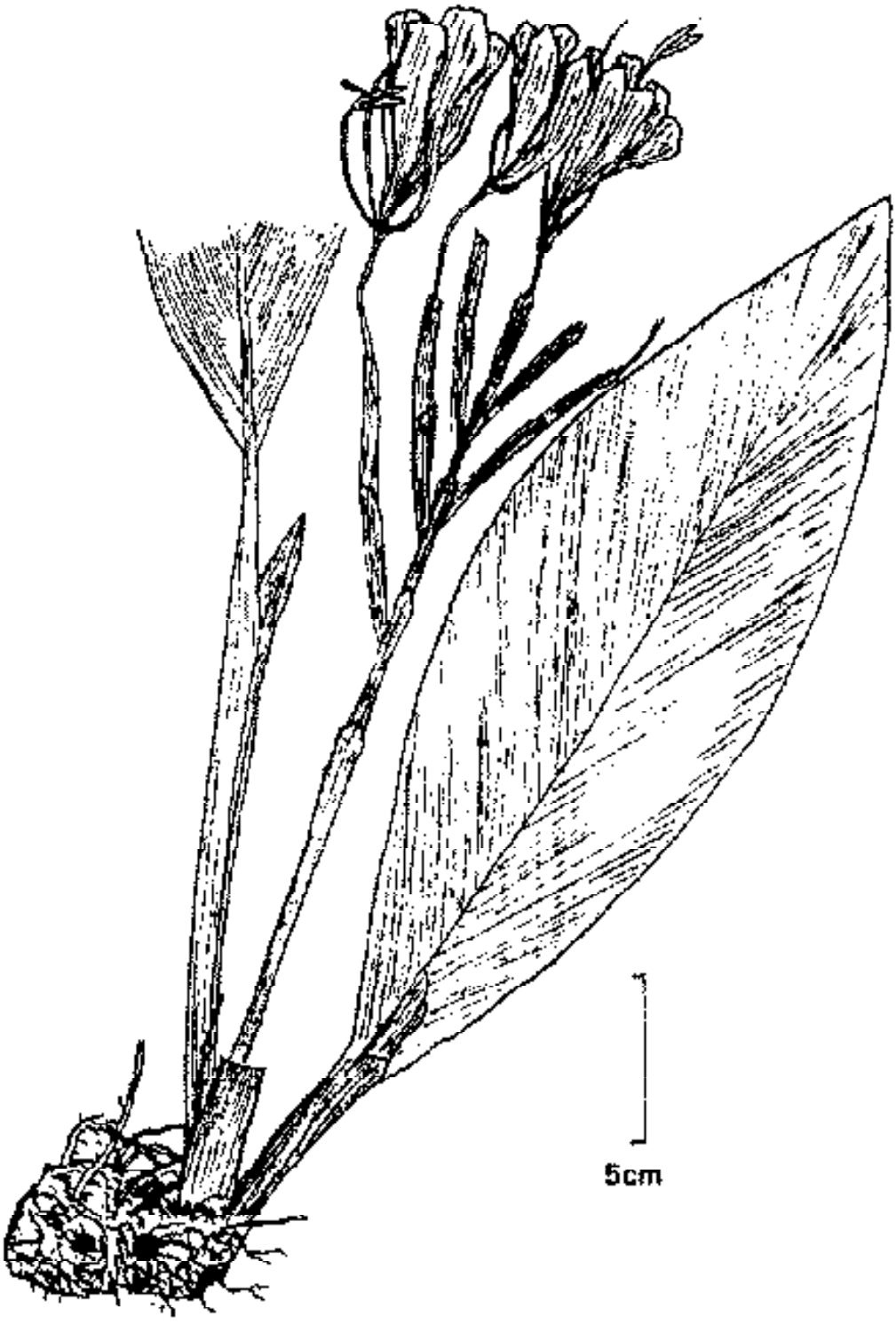


Fig. 62. Hedychium Spicatum Buch.-Ham. ex Sm.

The generic name is derived from the Greek word *Aletron,* meal; referring to the powdery appearance of some species.

Aletris pauciflora (Klotz.) Hand.-Mazz.

A small scapose 10-30 cm high herb, with grass like leaves. Flowers white or pinkish-white. Fruits globose, opening by 3-valves.

Common in alpine meadows, 3500-4500 m. Ramani to Bhojgara, Sarsupatal to Patalkhan and Martoli bugyals. Flowering and fruiting during June September.

2. OPHIOPOGON Ker-Gawl.

The genus comprises over 20 species; 8 in India; 1 in the Biosphere Reserve.

Ophiopogon intermedius D. Don

Perennial, grass-like, erect herbs with very short stem covered with old leaves. Leaves linear, glabrous. Flowers white. Fruits ovoid with bright-blue seeds.

Around Himtoli, on slopes amidst boulders, 2800-3200 m. Flowering and fruiting during July September.

90. IRIDACEAE

(Iris family)

Perennial, herbaceous plants with narrow, sword-like leaves. Flowers showy, bisexual. Fruit a capsule.

The family comprises 60 genera and 800 species. The chief centres of distribution, South Africa and Tropical America, 1 genus and one species in the Biosphere Reserve.

IRIS L.

Herbs with fleshy, cylindric roots. Leaves chiefly radical, linear, entire. Flowers showy, solitary or in pairs.

Genus comprises about 300 species mostly from Northern temperate regions; 1 in the Biosphere Reserve.

The Greek name for the rainbow, referring to the hues of the flowers.

Iris kumaonensis D. Don ex Royle **Fig. 63.**

Herbs, 15-30 cm high or more, usually tufted herb with creeping, thick rootstock. Flowers bright-lilac. Outer perianth segments mottled and bearded with a central line of yellow-tipped hairs. Capsule ovoid.

Around Latakharak to Dharansi, Dibrugheta and Martoli, on slopes, 3500-4500 m. Flowering and fruiting during March September.

91. DIOSCOREACEAE
(Yam family)

The family comprises 5 genera and over 750 species distributed in tropical to temperate regions, 1 genus and over 50 species in India; 1 genus with 1 species in the Biosphere Reserve.

Climbing shrubs, trailing herbs or twining climbers. Leaves simple or digitately 3-5-foliolate. Flowers minute, 1-sexual in spikes or racemes. Capsule hard, 3-valved.

DIOSCOREA L.

The genus comprises over 600 species; in India 50 species are known to occur; 1 in the Biosphere Reserve.

Trailing herbs or twining climbers arising from tubers. The tubers are usually known as yams and largely cultivated for food.

Fig. 63. Iris kumaonensis D. Don ex Royle

The scientific name is derived from *Dioscorides*, the classical author.

Dioscorea deltoidea Wallich ex Griseb. **Fig. 64.**

Twiners, glabrous or nearly so. Leaves alternate, ovate-lanceolate, variable. Spikes solitary. Male-spikes very slender, 7.5-35 cm long. Female ca 15 cm long. Capsule wings broad.

Rare, on way to Sonwara from Dibrugheta and near Tolma village, 2500-3500 m. An important medicinal plant. Flowering during June July.

92. LILIACEAE
(Lily family)

This is one of the largest-family of flowering plants. The family comprises 250 genera and 3700 species; about 36 genera and over 149 species in India; 9 genera and 1 species in the Biosphere Reserve.

Plants usually possessing bulbs or rhizomes or swollen corms with narrow, parallel-veined leaves. Perianth-segments (petals) in two whorls. Stamens 6; ovary superior.

1a.	Bulbous herbs	2
b.	Herbs with creeping rootstocks, often tuberous	5
2a.	Leaves radical; stem scape like	**1. Allium**
b.	Stems leafy not scape like	3
3a.	Anthers versatile	**4. Lilium**
b.	Anthers dorsifixed	4
4a.	Flowers white	**5. Lloydia**
b.	Flowers yellow	**6. Nomocharis**
5a.	Leaves reduced, needle like, spinous or scales.	**2. Asparagus**
b.	Leaves not reduced	6
6a.	Leaves all radical or scape with solitary leaf	**3. Clintonia**
b.	Leaves not radical; stems with more than one leaf	7
7a.	Leaves in single terminal whorl	**9. Trillidium**
b.	Leaves in many whorls or alternate	8
8a.	Flowers in axillary racemes	**7. Polygonatum**
b.	Flowers in terminal racemes	**8. Smilacina**

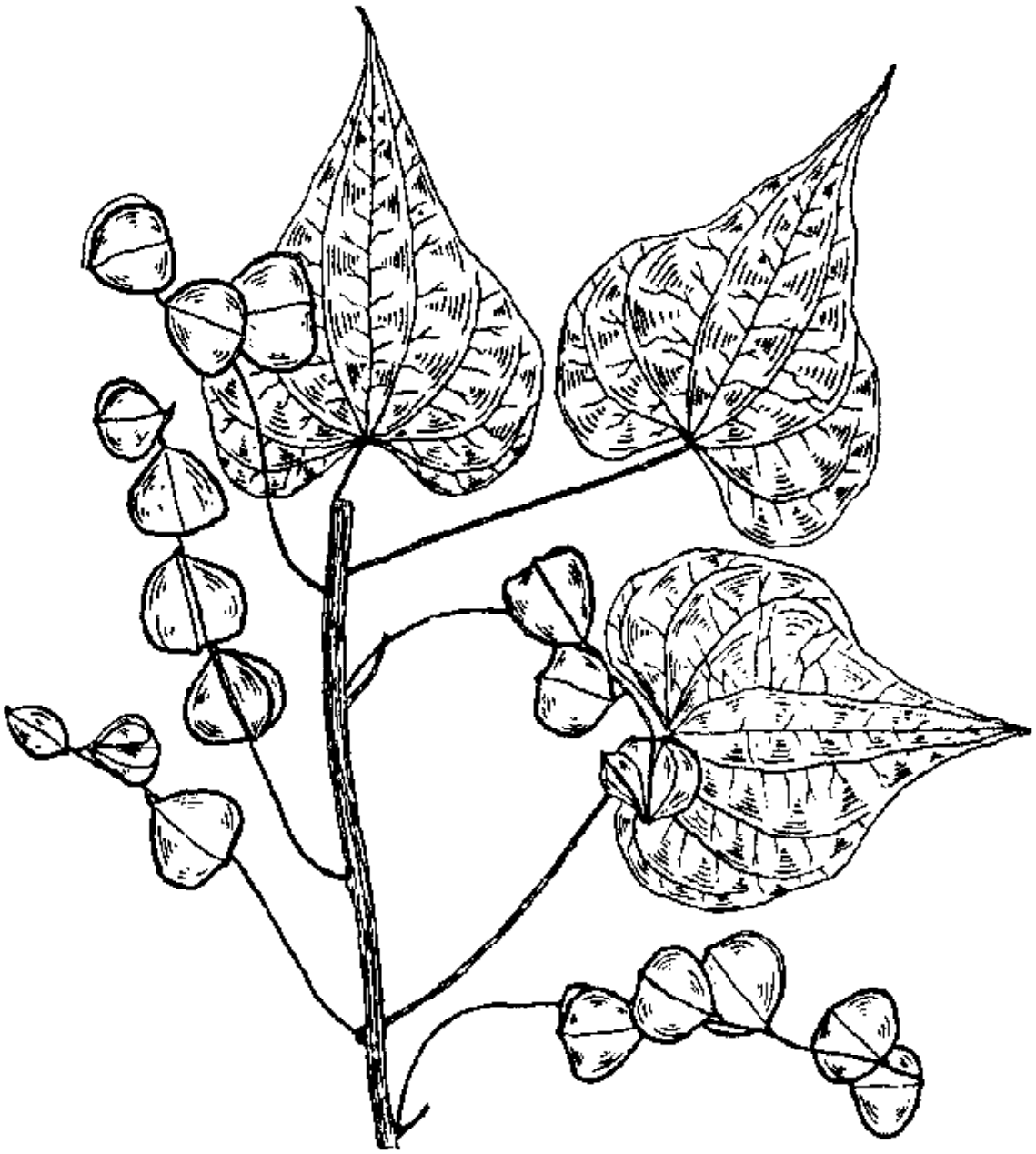


Fig. 64. Dioscorea deltoidea Wallich ex Griseb.

1. ALLIUM L.

The genus comprises over 500 species; over 30 species are known from India; 3 in the Biosphere Reserve.

Can be recognised by its dense flowers forming an umbel. Petals usually free. ovary superior.

Allium is a Latin name for Garlic. (This has been dealt under Amaryllidaceae by some authors).

1a.	Outer scales of bulb of reticulated fibres; flowers white	**1. A. humile**
b.	Outer scales of bulbs membranous, not of reticulate fibres; flowers purplish-white, rosy or purplish	2
2a.	Stamens longer than the perianth	**2. A. stracheyi**
b.	Stamens equal to or shorter than the perianth	**3. A. wallichii**

1. Allium humile Kunth

Bulbs clustered, scales of the bulb of reticulated fibres. Leaves many, flat, ca 4 mm broad. Flowers white, star-shaped.

Common near Latakharak at 3500 m, on stony slopes. Flowering and fruiting during June August.

2. Allium stracheyi Baker **Fig. 65.**

A bulbous herb up to 30 cm high, with dense flowered heads. Flowers purplish-white with many stamens which are longer than perianth.

On open hill slopes amidst *Cotoneaster* sp., Dibrugheta- Deodi, Himtoli, on way to Belta and Sarspatal. Flowering and fruiting during July October.

3. Allium wallichii Kunth

Roots fibrous. Leaves ensiform, flat. Umbel ca 5 cm across, lax-flowered. Flowers purple, stamens equalling or shorter than the perianth.

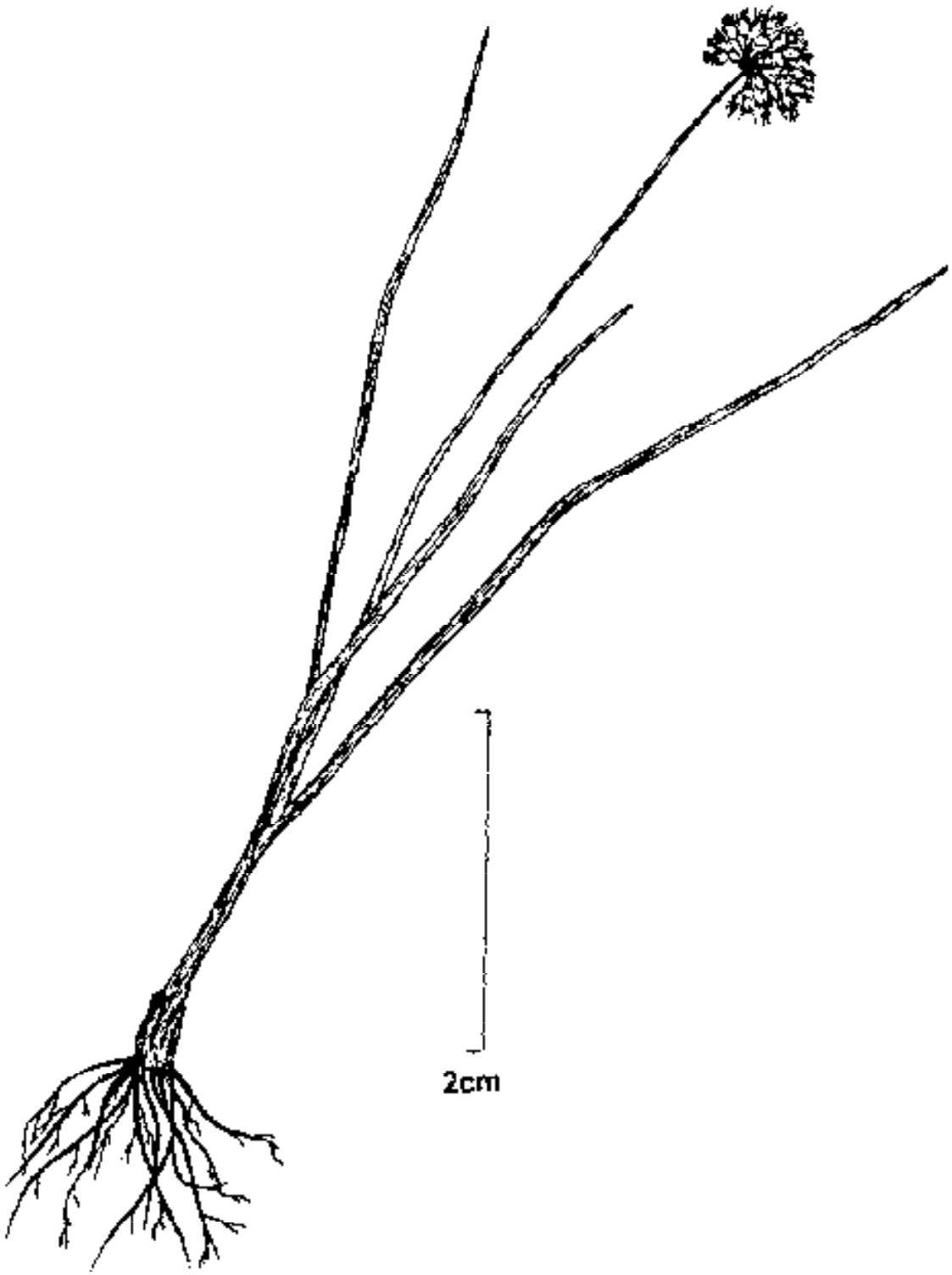


Fig. 65. Allium stracheyi Baker

On open hill slopes, amidst grasses, near Dharansi on way to Dibrugheta and Himtoli, 2700-3500 m. Flowering and fruiting during July October.

2. ASPARAGUS L.

The genus comprises ca 300 species; over 20 in India; 1 in the Biosphere Reserve.

Leaves reduced to scales of spines. Clusters of needle-like cladodes present. Flowers small.

Asparagus filicinus Buch.-Ham. ex D. Don

A tall, erect or twining plant with flat curved cladodes in clusters of 2-6, spines absent. Flowers solitary or paired on slender stalks, greenish.

Scattered in the forest, 2400-3000 m. Flowering and fruiting during June - August.

3. CLINTONIA Rafin.

The genus comprises over 10 species; only in India; 1 in the Biosphere Reserve.

Clintonia udensis Trautv & Meyer var. **alpina** (Kunth ex Baker) Hara

Herbs with creeping rootstock. Leaves subradical, 3-4, elliptic to obovate. Flowers white or pale violet in a dense terminal cluster.

On hill slopes. Flowering and fruiting during July September.

4. LILIUM L. (Lily)

The genus comprises over 80 species; 10 in India; 1 in the Biosphere Reserve.

Usually erect leafy herbs with funnel-shaped solitary flowers.

Lilium wallichianum J.A. & J. H. Schultes

Ca 1.5 m high herb with linear leaves. Flowers white, large, funnel-shaped with curved petals. Stamens shorter.

On open grasslands or slopes, Pangrani, on way to Reni, about 2000 m. Rare. Flowering and fruiting during July September.

5. LLOYDIA Salisb. ex Reichb.

The genus comprises over 10 species a few in India.

Bulbous plants with white or creamy, funnel-shaped flowers.

The generic name is given after Edward Lloyd a botanist.

Lloydia serotina (L.) Reichb.f.

8-20 cm, high herbs, with filiform leaves and solitary white flowers, petals elliptic, ca 1 cm long. Stamens shorter than petals. Capsules roundish, obovate.

Sarsupatal and Near Dharansi, in alpine rocky slopes at 3500-4500 m. Flowering and fruiting during June August.

6. NOMOCHARIS Franch.

The genus comprises over 15 species, 1 in India; 1 in the Biosphere Reserve.

Latin-*Nomos* meadow and *charis* grace, referring to the plants growing in pasture lands.

1a.	Leaves more than 10 cm long, narrowly linear	1. N. nana
b.	Leaves less than 8 cm long, elliptic-lanceolate	2. N. oxypetala

1. Nomocharis nana (Klotz.) E.H. Wilson

15-40 cm high herbs. Leaves narrowly linear. Flowers bluish, solitary.

On way to Bhujgara from Ramani, Dibrugheta to Dharansi. Flowering and fruiting during June August.

2. Nomocharis oxypetala (Royle) E.H. Wilson

20-50 cm high, stout herbs. Leaves elliptic-lanceolate. Flowers solitary, pale-yellow.

Around Himtoli, Dibrugheta to Deodi, on open slopes, 3500-4000 m. Flowering and fruiting during June August.

7. POLYGONATUM Mill.
(SOLOMON'S SEAL)

The genus comprises about 50 species; 15 in India; 3 species in our area.

Latin-*polys*, many and *gonia* the knee-joint, referring to the many joints in the rhizome.

1a.	Leaves opposite rarely alternate	**2. P. graminifolium**
b.	Leaves whorled	2
2a.	Leaf tips cirrhose	**1. P. cirrhifolium**
b.	Leaf tips not cirrhose	**3. P. verticillatum**

1. Polygonatum cirrhifolium (Wallich) Royle

25-35 cm high herbs. Rhizome creeping. Leaves in whorls of 3-6, linear to narrow-lanceolate. Peduncles 2-flowered. Flowers purplish.

On open slopes, near Lata, Ramani to Deodi in mixed forest 2600-3500 m. Flowering and fruiting during May August.

2. Polygonatum graminifolium Hook.f.

An erect 15-20 cm high herb, with opposite, linear leaves. Peduncles 2-flowered. Flowers purplish-white.

On open slopes, common near Sarsupatal, Himtoli and adjacent area, 2600-4000 m. Flowering and fruiting during July August.

3. Polygonatum verticillatum (L.) All. Eng. (Whorled Solomon's Seal).

An erect herb with many whorls of narrow leaves. Flowers axillary, white, tubular, small, pendulous. Fruit a berry, dark-purple when ripe.

On way to Dharansi, 2600-3500 m. Flowering and fruiting during June October.

Young shoots are used as vegetable.

8. SMILACINA Desf.

The genus comprises over 25 species; 4 in India; 1 in the Biosphere Reserve.

Smilacina purpurea Wallich

30-70 cm high, erect herbs with creeping rhizome. Leaves in two ranks, broadly elliptic or oblong, 6-12 cm long. Flowers in spike-like clusters, purplish.

Around Dibrugheta, Sonnwara, Himtoli, 3000-3500 m. Flowering and fruiting during May August.

9. TRILLIDIUM Kunth

Genus comprises 22 species; 1 in the Biosphere Reserve.

Trillidium govanianum (D. Don) Kunth

15-35 cm high glabrous, erect, herbs. Leaves 3, broadly ovate. Flowers purple or brownish-purple with spreading petals. Fruits globose.

On way to Himtoli from Dharansi, 3500-4000 m. Flowering and fruiting during May August.

93. SMILACACEAE

(Greenbrier family)

The family comprises 4 genera and over 375 species; 1 genus with 2 species in the Biosphere Reserve. These are mostly climbers or straggling, rhizomatous shrubs or herbs, stems often prickly.

SMILAX L.

The genus comprises over 300 species; 24 in India; 2 in the Biosphere Reserve.

These are mostly shrubby or herbaceous climbing or straggling plants with reticulately veined leaves.

1a.	Stems straggling branches prickly; flowers white	1. **S. aspera**
b.	Stems erect; flowers purple	2. **S. vaginata**

1. Smilax aspera L.

Straggling shrubs, branches Zigzag, prickly. Leaves linear-lanceolate to ovate-lanceolate. Flowers white, arranged in umbellate spikes.

In buffer zone area, 1800-2000 m. Flowering and fruiting during April-October.

2. Smilax vaginata Decne.

Erect shrubs. Leaves ovate, elliptic-ovate or orbicular ovate. Flowers purplish, arranged in umbels.

Around Dhoodhganga-Dibrugheta area, 2500-3500 m. Flowering and fruiting during May - June.

94. COMMELINACEAE
(Spiderwort family)

The family comprises 38 genera and over 500 species, mostly distributed in tropical and subtropical areas; these are herbs with jointed, succulent stems and sheathing leaves.

1a.	Flowers clustered in simples heads, fertile stamens 6	**2. Cyanotis**
b.	Flowers in scorpioid cymes, fertile stamens 3, staminodes	**1. Commelina**

1. COMMELINA L.

The genus comprises 255 species, 6-8 species in India; 2 in the Biosphere Reserve.

The genus is named after Casper commelia, professor of botany at Amsterdam.

1a.	Leaves ovate, fruit 5-seeded	**1. C. benghalensis**
b.	Leaves lanceolate, fruit 3-seeded	**2. C. paludosa**

1. Commelina benghalensis L.

Slender, creeping herbs, stems rooting at the base. Leaves ovate, tip rounded. Flowers blue or pale blue.

Common throughout the buffer zone area in shady moist places, 1800-2200 m. Flowering and fruiting during July October.

2. Commelina paludosa Bl.

Slender, creeping herbs. Leaves lanceolate, acute. Flowers blue or pale blue with one petal white. Seeds minutely dotted.

Common around Reni-Kalikona, Chhenotari area in shady moist places, 1800-2500 m. Flowering and fruiting during July September.

CYANOTIS D. Don

Over 50 species; 14 in India; 1 in the Biosphere Reserve.

Cyanotis vaga (Lour.) Schult.

Slender, creeping, tufted, annual herbs, rooting at the nodes. Leaves linear-lanceolate. Flowers blue, in scorpioid cymes.

Common throughout the area ascending upto 2800 m. Flowering and fruiting during July October.

95. JUNCACEAE
(Rush family)

The family comprises 9 genera and 400 species; 2 genera and over 32 species in India; 2 genera and 6 species in the Biosphere Reserve.

Tufted grass-like plants usually known from temperate to alpine regions of the Himalaya.

1a.	Hairy herbs; leaf sheaths entire; seeds 3	2. Luzula
b.	Glabrous herbs; leaf sheath splitting down one side, seeds many	1. Juncus

JUNCUS L.

The genus comprises over 300 species, over 28 in India; 5 in the Biosphere Reserve.

Flowers usually in a dense head or in a branched cluster, regular with six papery scale-like green, brown or whitish petals and 6 stamens. Fruit a many-seeded capsule.

The generic name is derived from the Latin word *Juncus*, a rush.

1a.	Flowers in solitary heads	2
b.	Flowers in compound heads or in panicles	4
2a.	Leaves many, upper cauline leaves present	**4. J. membranaceus**
b.	Leaves few, only at the base of stems	3
3a.	Lower floral bracts more than 1.2 cm long; cymes 3-5 flowered	**1. J. bracteatus**
b.	Lower floral bracts less than 1.0 cm long	**5. J. thomsonii**
4a.	Flowers in compound heads, stamens exserted	**2. J. concinnus**
b.	Flowers in panicles, stamens included	**3. J. himalensis**

1. Juncus bracteatus Buch.-Ham.

Tufted herbs, 15-20 cm high. Leaves few, filiform. Flowers pale or dark.

On open hill slopes, Martoli and Milam bugyals, 4000-5000 m. Flowering and fruiting during June September.

2. Juncus concinnus D. Don

A tufted herb, 20-30 cm high with filiform leaves and subsessile white flowers.

In marshy places at Deodi-Bhojgara, 3500-4500 m. Flowering and fruiting during July October.

3. Juncus himalensis Klotz.

A stout, rigid 20-40 cm high herb, with filiform leaves. Inflorescence irregularly branched. Flowers brownish in clusters. Fruits dark shining brown.

In marshy places, Dharansi-Bhojgara, 4000-4500 m. Flowering during July-August.

4. Juncus membranaceus Royle ex D. Don

A tufted 25-30 cm high herb, with filiform leaves and solitary white flowers.

In open marshy places, Dharansi area at ca 4500 m. Flowering and fruiting during July September.

5. Juncus thomsonii Buch.-Ham.

Tufted 5-15 cm high herbs with 1-2 very short leaves. Flowers white.

Near watery places around martoli and Milam area, 3500-4000 m. Floweirng and fruiting during July September.

LUZULA DC.

The genus comprises over 75 species; 4 in India; 1 in the Biosphere Reserve.

Luzula spicata DC.

Herbs with grass like leaves. Flowers dark brown.

Around Martoli and Milam bugyals, 3500-4500 m. Flowering and fruiting during June August.

96. ARACEAE

The family comprises 115 genera and over 2000 species, chiefly distributed in tropical and temperate regions, abundant in tropics; 24 genera and 136 species are known in India; 1 genus with 5 species in the Biosphere Reserve.

ARISAEMA Mart.

The genus comprises over 150 species; 42 species are known in India; 5 in the Biosphere Reserve.

The generic name is derived from Greek word *Aron* meaning arun and *Haema* meaning blood, referring to its close alliance to genus *Arum*.

1a.	Leaves 3-foliate	2
b.	Leaves more than 3-foliate	3

2a.	Spath, tube ribbed, green on pale ground; middle leaflet rhomboidly orbicular	**4. A. propinquum**
b.	Spath, tube not ribbed, green striped with purple; middle leaflet elliptic	**2. A. intermedium**
3a.	Leaves digitately compound	**3. A. jacquemontii**
b.	Leaves pedately compound	4
4a.	Appendage of spadix elongated much exserted	**5. A. tortuosum**
b.	Appendage of spadix not elongated, included	**1. A. flavum**

1. Arisaema flavum Schott

Perennial herbs with crom like rhizome. Leaves pedately compound, leaflets 9-11. Spathe very short.

Common around Tolma-Himtoli and Reni-Kalikona area in mixed forest, 1900-3000 m. Flowering and fruiting during June October.

2. Arisaema intermedium Blume.

Erect, perennial herbs. Leaves digitately 3-foliate, middle leaflet elliptic. Spathe greenish, striped with purple.

Common around Tolma-Himtoli and Reni-Kolikona area in mixed forest, 2000-3000 m. Flowering and fruiting during May September.

3. Arisaema jacquemontii Blume.

Erect, perennial herbs. Leaves digitately compound, leaflets 5-7, elliptic or obovate-lanceolate. Spath, green, striped with white, gradually narrowed into a thread like tail.

Common around Tolma-Himtoli, Belta-Latakharak area, 2200-3000 m. Flowering and fruiting during May September.

4. Arisaema propinquum Schott

Erect, perennial herbs. Leaves digitately compound, leaflets 3, middle leaflets rhomboidly-orbicular. Spath green on pale ground, tube ribbed.

Around Tolma-Himtoli, Belta-Latakharak and Kalikona-Chhenabari area, in mixed forest, 2200-3200 m. Flowering and fruiting during May September.

5. Arisaema tortuosum (Wallich) Schott

Erect perennial herbs. Leaves pedately compound, leaflets 5-19, linear-lanceolate. Spathe pale green, spadix much elongated, much exserted.

Common around Tolma-Himtoli, Belta-Latakharak and Chhenabari-Kalikona area, in mixed forest, 2200-3200 m. Flowering and fruiting during June September.

97. CYPERACEAE
(Sedge family)

This is one of large families of the flowering plants comprising of 90 genera and over 4000 species, distributed throughout the globe; about 22 genera and over 405 species in India; 6 genera and species in the Biosphere Reserve.

The plants are perennial grass like herbs mostly in wet places, stems are solid and often trigonous with sheathing leaves in 3-ranks.

1a.	Nuts enclosed in utricles	2
b.	Nuts not enclosed in utricles	3
2a.	Utricles opening on adaxial surface	**6. Kobresia**
b.	Utricles opening on the apex	**1. Carex**
3a.	Leaves reduced to bladeless sheath	**3. Eleocharis**
b.	Leaves well developed	4
4a.	Perianth present in the form of 6 bristles, bristle divided at the base to numerous white hairs	**4. Eriophorum**
b.	Perianth not as above	5
5a.	Flowering glumes spirally arranged	**5. Fimbristylis**
b.	Flowering glumes distichously arranged	**2. Cyperus**

1. CAREX L.

Glabrous perennials. Utricle enclosing nut bottle-shaped, mouth of its beak entire, notched or shortly slit.

Species about 2000, 140 in India; in the Biosphere Reserve.

Careo, to want; in allusion to the upper spikes being without seeds.

1a.	Style 3-fid	2
b.	Style 2-fid	12
2a.	Terminal spike completely male	3
b.	Terminal spike not completely male	8
3a.	Utricle abruptly narrowed into small notched beak	4
b.	Utricle beak deeply 2-fid	7
4a.	Utricle trigonous	5
b.	Utricle strongly 2-edged, with concave face	**13. C. setigera**
5a.	Spikes 4-14; utricles hispid	**6. C. inanis**
b.	Spikes 3-5; utricles scabrous bristly	6
6a.	Rhizome short, densely caespitose, glumes lanceolate	**8. C. nandadeviensis**
b.	Rhizome elongated, creeping, glumes obovate-oblong	**3. Cardiolepis**
7a.	Utricle very short, much compressed ovoid	**4. C. haematostoma**
b.	Utricle long, not compressed, ellipsoid-lanceolate	**5. C. hirtella**
8a.	Utricle not beaked	**2. C. atrata**
b.	Utricles beaked	8
9a.	Lower bracts sheathing	**9. C. nivalis**
b.	Lower bracts not sheathing	9
10a.	Leaves slightly shorter than the stem or longer than the stem	10
b.	Leaves much shorter than the stem utricle granular, pale	11
11a.	Leaves longer than the stem, utricle granular yellow	**11. C. obscura**
b.	Leaves slightly shorter than the stems, utricle smooth, yellow	**12. C. psychrophila**
12a.	Lowest spike 2.5-7.5 cm long; lowest bract often exceeding the inflorescence	**7. C. lehmanii**
b.	Lowest spike less than 2.5 cm long; lowest bract equalling the inflorescence	**1. C. alpina**
13a.	Utricles many nerved, small red glands scattered all over between the nerves	**10. C. nubigena**
b.	Utricle obscurely nerved, red glands absent	**14. C. stenophylla**

1. Carex alpina Sw.

A slender, glabrous, 10-65 cm high tufted herb, with short, woody, slender rhizome. Leaves much shorter than stem near its base. Spikes slender, or short, cylindric, ca 8 mm long.

Around Milam bugyals, 4000-5000 m. Flowering and fruiting during June - October.

2. **Carex atrata** L.

Glabrous, up to ca 60 cm high herbs with creeping rhizome. Leaves almost as long as stem. Spikes 3-6, up to ca 2.5 cm long, cylindric, dense. Glumes ca 4 mm, ovate-acuminate, female often uniformly black except margin. Nut sessile, much smaller than utricle.

Around Milam bugyals, 4000-5200 m. Flowering and fruiting during June - September.

3. **Carex cardiolepis** Nees

Glabrous, 15-45 cm high herbs, caespitose. Leaves often nearly as long as stem, flat. Spikes 3-5, distant, cylindric, terminal one male. Utricle shorter than glume. Nut obovoid, trigonous.

Scattered, on open hill slopes at Himtoli surroundings, Dibrugheta, Deodi, Sarsupatal 3500 m. Flowering and fruiting during June September.

4. **Carex haematostoma** Nees

Glabrous, 20-75 cm high, usually terete herbs. Leaves 10-50 cm long, flat. Spikes 4-10, linear-cylindric. Nut oblong-obovoid, trigonous obtuse.

On way to Deodi from Dibrugheta on open hill slopes, ca 3500 m. Flowering and fruiting during June September.

5. **Carex hirtella** Drejer

Tufted 30-50 cm high herbs. Leaves very narrow, enrolled when dry, 10-25 cm long. Spikes usually 3 male, 3 female, 2-25 cm long, brownish. Utricle 6-8 mm long, ellipsoid-lanceolate.

Ramani-Bhujgara, 3500-4000 m. Flowering and fruiting during June September.

6. Carex inanis Kunth

Rhizome short, stem 5-25 cm high, slender. Leaves overlapping stem, narrow. Spikes greyish-green, 4-10 or more, cylindric, terminal one male. Female glumes ovate. Utricle small.

On open hill slopes on way to Deodi from Dibrugheta, 3300-3800 m. Flowering during June July.

7. Carex lehmannii Drejer

Slender, glabrous herbs, spikes cylindric to oblong. Lowest spike 2.5-7.5 cm, distant, lowest bract usually much overtopping inflorescence. Utricle ca 2 mm.

In open grasslands, near Ramani and on way to Roopkund, 3000-4200 m. Flowering during July August.

8. Carex nandadeviensis Ghildiyal, Bhattacharyya & Hajra

Herbs 20-27 cm high. Leaves clustered at base, subequalling or slightly exceeding the stem, spikes 7-10 cm long, spikelets 3-5. Nuts obovoid.

Common in alpine grasslands, on way to Bojgara from Ramni. Flowering and fruiting during July August.

9. Carex nivalis Boott

Terminal spike wholly male or female at top. The glumes cinnamonous. Utricle broad, much compressed. Nut small, stalked.

In moist places near the spring, on open hill slope, amidst *Senecio, kobresia* etc. Ramani-Bhujgara, 3300-4000 m. Flowering and fruiting July September.

10. Carex nubigena D. Don **Fig. 66.**

Rhizome short. Stem 15-75 cm high. Lower leaves long. Inflorescence usually greenish, becoming brownish, dense ovoid. Spikes ca 5 mm, dense. Utricle small. Nut compressed.

Common, Deodi to Dibrugheta, 3000-3500 m. Flowering and fruiting during August September.

11. Carex obscura Nees

Glabrous, stoloniferous, slender herbs, 30-60 cm high. Leaves often over topping stems, flat. Spikes usually 3-7, oblong or cylindric, often very close, subsessile or lower sometimes peduncled. Utricle as long as glume, oblong.

On open hill slopes, Dibrugheta - Deodi area, 3000-3600 m. Flowering and fruiting during June September.

12. Carex psychrophila Nees

Glabrous 30-60 cm high, slender herbs. Leaves weak. Spikes almost cylindric, dense, lowest peduncled. Glumes small, ovate, chestnut coloured. Utricle small, obscurely nerved. Nut black.

On open hill slopes with *Iris* sp., *Gentiana* etc. at 3500 m. Flowering during June - July.

13. Carex setigera D. Don

Glabrous, stoloniferous, 30-60 cm high herbs. Rhizome long creeping. Leaves nearly as long as stem. Spikes 4-8, cylindric, terminal, 1 usually male, usually 3.5-5 cm long. Utricle brownish-green, very hispid, nerveless. Nuts ellipsoid, dark brown.

On way to Sonnwara, Martoli bugyals, 3500-5000 m. Flowering and fruiting during June September.

Fig. 66. Carex nubigena D. Don

14. Carex stenophylla Wahlenb.

Ca 15 cm high herbs. Leaves usually as long as stem. Spikes ovoid, male at top, glumes strongly scarious-edved. Utricle black, thick-walled, ellipsoid-acuminate.

Milam bugyal, Sarsupatal, 4200-5400 m. Flowering and fruiting during June September.

2. CYPERUS L.

The plants are erect, simple, leafy only near base. Inflorescence umbellate or capitate. Spikelets linear or oblong, compressed. Glumes distichous. Stamens 1-3. Nut trigonous.

The generic name is derived from the Greek name *Kypeiros*, a sedge.

1a.	Style 2-fid	2. C. globusus
b.	Style 3-fid	2
2a.	Rachilla of spikelets persistent	1. C. cuspidatus
b.	Rachilla of spikelets deciduous	3. C. paniceus var. roxburghianus

1. Cyperus cuspidatus Kunth

Slender annuals. Spikelets small, in umbels. Glumes strongly 3-nerved. Nut oblong-ovoid, half the length of glume.

On way to Belta, Dibrugheta to Deodi, 2700-3600 m. Flowering and fruiting during June September.

2. Cyperus globosus All.

Glabrous, tufted, 10-60 cm high herbs. Umbels apparently simple or condensed into 1 head. Spikelets clustered, linear, many-flowered, much compressed, brownish or black. Nut small, ellipsoid, chestnut-black.

On way to Malari, 2500-3000 m. Flowering and fruiting during June September.

3. Cyperus paniceus (Rottb.) Boeck. var. **roxburghianus** Kukenth.

Ca 60 cm high herbs, stolons very slender. Umbels simple; rays up to 5 cm long; bracts 5-7. Spikelets ca 5 mm long, 1-flowered.

On way to Pang, 2200-2700 m. Flowering and fruiting during June September.

3. ELEOCHARIS R. Br.

Species about 200, 14 in India; 1 in the Biosphere Reserve.

Generic name is derived from the generic name *Helos*.

Eleocharis palustris R. Br.

Rhizome black or chest nut, creeping. Stems 10-50 cm high. Spikelet ellipsoid or cylindric, dense-flowered, brownish. Glumes obtuse. Bristles 6, as long as nut. Nut obovoid, much narrowed at top.

Martoli and Milam bugyals, 3500-5200 m. Flowering and fruiting during June September.

4. ERIOPHORUM L.

The genus comprises over 20 species; 3 in India; 1 in the Biosphere Reserve.

Eriophorum comosum Wallich

Herbs, robust, glabrous, 10-50 cm high. Leaves often overtopping stems with serrulate edges, lower sheaths brownish black. Umbel compound or decompound. Spikelets many, rusty-brown, many-flowered. Nuts oblong-ellipsoid, beaked, smooth, brownish-black.

On way to Pang, very common, 2200-2700 m. Flowering and fruiting during May October.

5. FIMBRISTYLIS Vahl

The genus comprises over 300 species, 50 in India; 1 in the Biosphere Reserve.

These sedges have tufted stems and flowers without bristles or scales.

Fimbristylis dichotoma (L.) Vahl

Annual, tufted sedges with grooved stems. Leaves one third of the stem, glabrous. Spikelets brown, cylindric. Nuts flattened, longitudinally stripped.

Common around buffer zone area in watery places, 2400-3000 m. Flowering and fruiting during May September.

6. KOBRESIA Will.

Ca 50 species from N. temperate region; ca 20 in India; 6 in the Biosphere Reserve.

Glabrous perennials. Stem simple with terminal spike. Leaves near base only. Spikes uni or bi-sexual. Spikelets male or female, 1-flowered or bisexual with one female flower at base. Nut usually as long as glume.

Named after Dr. Paul von Kobres a German and a great promotor of botany.

1a.	Spikes compound, subpaniculate, dense	2
b.	Spikes simple, not dense	3
2a.	Nuts oblong attenuated into beak	**5. K. royleana**
b.	Nuts narrowly oblong, apiculate	**3. K. laxa**
3a.	Spikes oblong; bracteols elliptic-oblong	**6. K. schoenoides**
b.	Spikes linear, bracteoles	4
4a.	Stems densely tufted, clothed at base with testaceous sheaths	**4. K. nepalensis**
b.	Stems not as above	5
5a.	Spikelets 3-4-flowered	**1. K. capillifolia**
b.	Spikelets 2-flowered	**2. K. duthiei**

1. Kobresia capillifolia (Decne.) C.B. Clakre

Leaves linear; sheaths brownish. Spikes linear, brownish or yellowish, ca 2.5 cm long; bracteoles obtuse, erect, margins scarious. Spikelets mostly 3-4-fid. Nut shorter than glume.

Common around Dharansi, Dibrugheta, Bhojgara-Ramani, Martoli, bugyals, on open grasslands at 3000-5000 m. Flowering and fruiting during August September.

2. Kobresia duthiei C.B. Clarke

Densely caespitose, 10-20 cm high herbs. Leaves many, almost half the length of stem, flat. Spikes linear, dense, green, 2.5 cm long, very rigid. Spikelets 2-fid. Nut almost as long as glume.

Common around Bhojgara to Ramani, Sarsupatal in open hill slopes, at ca 5000 m. Flowering during July - August.

3. Kobresia laxa Nees

Slender, 20-50 cm high herbs, with short creeping rhizome. Leaves almost as long as stem. Panicle 5-10 cm long, narrow with slender erect branches. Spikes uni or bisexual.

On way to Sonwara, Martoli bugyals, on open slopes, 3500-4500 m. Flowering during June July.

4. Kobresia nepalensis (Nees) Kuken. **Fig. 67.**

Densely tufted 15-20 cm high, herbs. Leaves linear. Spikes 1-2.5 cm brown.

Common near Dibrugheta, Sonwara, Ramani, Sarsupatal, on open hill slopes, 3500-5000 m. Flowering during August October.

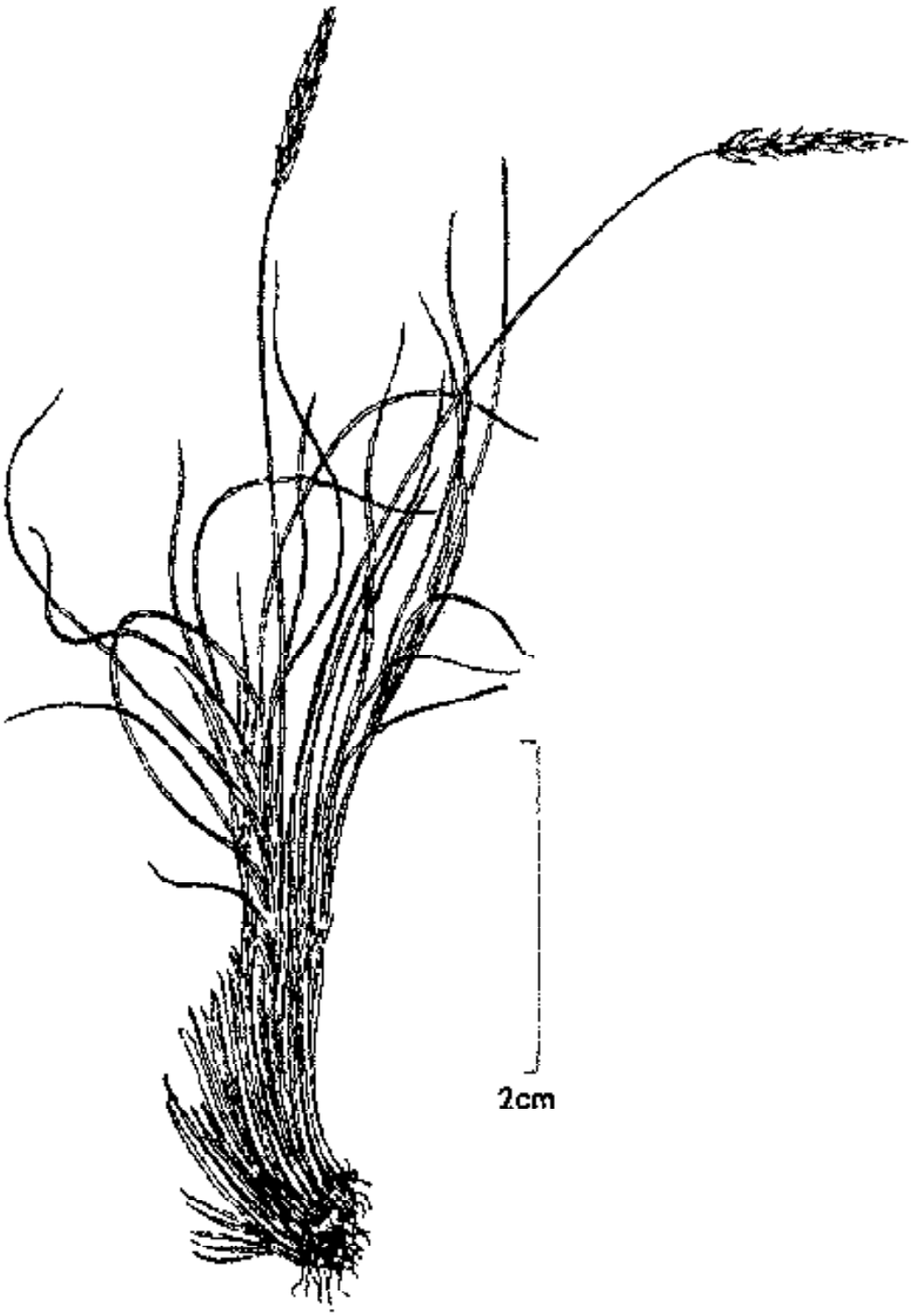


Fig. 67. Kobresia nepalensis (Nees) Kuken.

5. **Kobresia royleana** (Nees) Boeck.

Stout herbs. Leaves linear, flat when dried. Spikes brownish, or ferruginous-brown. Spikelets 3-4-flowered.

Common around Sarsupatal, Martoli bugyals, on open grasslands, 4500-5200 m. Flowering during July August.

6. **Kobresia schoenoides** (C.A. Mey.) Steud.

Stout, rigid herbs, 10-40 cm high. Leaves as long as stems or more, linear, channelled, incurved; sheaths shining brown. Spikes oblong, dense, Spikelets 1-5-flowered. Nut black.

Scattered in bugyals in open grass-lands, Dharansi, Ramani-Bhujgara, Sarsupatal, 5600 m. Flowering during July August.

98. POACEAE

A family consisting chiefly of annual or perennial herbs, rarely shrubs or trees with erect or creeping stems, usually branched. Stems cylindrical, rarely flattened, jointed, usually hollow in internodes. Leaves solitary at the nodes, sometimes crowded at the base of stem, alternate and 2-rowed consisting of sheath, ligule and blade. Inflorescence made up of spikelets arranged in a panicle or in spikes or racemes, usually terminal, each inflorescence being subtended by a bladeless sheath. Spikelets consisting of bracts distichously arranged along a slender axis; the two lower bracts empty, the succeeding to many bracts each enclosing a flower and opposed by a hyaline scale, the whole termed a floret. Glumes or lemmas often bearing 1 or many stiff bristles. Flowers usually bisexual, sometimes unisexual, small and inconspicuous. Perianth represented by 2 rarely 3 minute hyaline or fleshy scales. Stamens usually 3, rarely more, ovary 1-locular with 1 anatropous ovule, style usually 2. Fruit mostly caryopsis.

Comprises about 620 genera and 10,000 species distributed throughout the world.

1a. Spikelets 2 flowered, falling entire at maturity, usually the upper floret hermaphrodite and the lower male or barren and if the latter, often reduced to lemma or rarely the lemma entirely absent, all alike or more often differing in size, shape and structure, frequently dorsally compressed 2

b. Spikelets 1 to many flowered, breaking up at maturity above the more or less persistent glumes, or if falling entire then not 2-flowered with the lower floret male or barren and the upper hermaphrodite, usually more or less laterally compressed or terete 13

2a. Female spikelets completely enclosed in a metamorphosed leaf sheath which takes the form of a spherical or cylindrical osseous or ivory bead-like structure **12. Coix**

b. Female spikelets, not enclosed as above 3

3a. Glumes rigid, upper lemmas usually awned 4

b. Glumes membranous, upper lemmas usually awnless 10

4a. Spikelets of each pair similar, sessile and the pedicelled hermaphrodite, joints of panicle thin **19. Eulalia**

b. Spikelets of each pair dissimilar, pedicelled male or sterile or completely absent or if more or less similar than the joint, of raceme and the pedicel thick and swollen 5

5a. Joint, of rachis and pedicel of the pedicelled spikelets swollen, 3-angled, rounded or flattened 6

b. Joints of rachis and pedicel narrow, seldom thickned upwards, occasionally with a translucent longitudinal groove 7

6a. Sessile spikelets with a male and a hermaphrodite floret, upper lemma awned rarely awnless; Inflorescence spathaceous **3. Apluda**

b. Sessile spikelets with a hermaphrodite floret only or occasionally with a male floret below, upper lemma awnless; Inflorescence not spathaceous **23. Phacelurus**

7a. Racemes not interrupted by spathes or solitary at the end of branches, racemes collected in whorled panicles **11. Chrysopogon**

b. Panicles of racemes interrupted by spathes or the espathcate racemes digitate or in pairs or solitary and terminal 8

8a. Upper lemma of the sessile spikelet, awned from the base, pedicelled spikelets often reduced to a pedical **5. Arthraxon**

b. Upper lemma of the sessile spikelet awned from the tip or upper lemma reduced to the hyaline base of the awn, very rarely unawned; pedicelled spikelets well developed 9

9a. Involucre spikelets absent margins of the lower glume of the sessile spikelets sharply infolded, 2-keeled, awn glabrous **2. Andropogon**

b. Involucral spikelets present margins of the lower glume not sharply infolded, rounded at the base, at the most keeled, awn usually hairy **28. Themeda**

10a. Spikelets subtended by involucre of bristles, bristles many or solitary **25. Setaria**

b. Bristles absent 11

11a. Lower glume absent, spikelets palnoconvex **22. Paspalum**

b. Lower glume present, spikelet not planoconvex 12

12a. Upper lemma membranous **16. Digitaria**

b. Upper lemma crustaceous **7. Brachiaria**

13a. Tall woody, shrubby bamboos; leaf blades flat many nerved with petiole like base, articulated with the sheath **27. Thamnocalamus**

b. Perennial or annual herbaceous grasses; leaf blades sessile not articulated with sheaths 14

14a. Upper florets reduced and represented by a bundle of empty, rudimentary lemmas	**21. Melica**
b. Florets not reduced as above	15
15a. Spikelets 1-flowered	16
b. Spikelets 2-many flowered	21
16a. Spikelets awnless	17
b. Spikelets awned or with a distinct mucro	18
17a. Inflorescence digitate	**13. Cynodon**
b. Inflorescence not digitate	**1. Agrostis**
18a. Awns 3-fid	**4. Aristida**
b. Awns simple	19
19a. Lemma indurated at maturity	**26. Stipa**
b. Lemma membranous	20
20a. Callus hairs very short or absent	**1. Agrostis**
b. Callus hairs much longer than the lemma	**10. Calamagrostis**
21a. Spikelets awnless, sometimes with a small	22
b. Spikelets distinctly awned	25
22a. Lemmas 1-3 nerved	**18. Eragrostis**
b. Lemmas 5-nerved or 11 nerved	23
23a. Lemmas not-keeled on the back	**20. Festuca**
b. Lemmas keeled on the back	24
24a. Lemmas produced into mucro inflorescence 1-sided panicle	**14. Dactylis**
b. Lemmas and inflorescence not as above	**24. Poa**
25a. Tall reed like grasses, inflorescence plumose	**6. Arundo**
b. Small or tall grasses, inflorescence not plumose	26
26a. Inflorescence solitary terminal	**29. Tripogon**
b. Inflorescence not as above	27
27a. Lemmas lobed, awned in the sinus	28
b. Lemmas awned from the entire tip or from back	29
28a. Glumes as long as the spikelets	**15. Danthonia**
b. Glumes shorter than the spikelets	**9. Bromus**
29a. Top of the ovary with hairy appendage	30
b. Top of the ovary hairy or glabrous but never with hairy appendage	31
30a. Spikelets 2 or more at each node	**17. Elymus**
b. Spikelets solitary at each node	**8. Brachypodium**
31a. Glumes usually as long or longer than the lowest floret	**30. Trisetum**
b. Glumes usually shorter than the lowest floret	**20. Festuca**

1. AGROSTIS L.

Agrostis is a genus of usually temperate and cold regions, comprising about 150-200 species, ca 26 species are recorded from India and 2 from the Biosphere Reserve.

The scientific name is derived from *agros* field a Greek name for all grasses. Usually annuals with much divided panicles 1 flowered spikelets.

1a. Lemma hairy, awned, awns 4-6 mm long 1. A. pilosula
b. Lemma glabrous, awnless or with a fine bent awn, 2-4.5 mm long arising from slightly below the middle 2. A. vinealis

1. Agrostis pilosula Trin.

Tufted annual, ca 30 cm high, erect or decumbent. Leaf-blades flat or convolute. Panicle ovate to lanceolate, 10-20 cm long, loose and open or contracted, brownish green or purplish.

Ramni-Bhujgara, Dharansi and on way to Dunagiri. Flowering during August -September.

2. Agrostis vinealis Schreb.

A slender, 10-20 cm high, erect, tufted perennial. Leaf-blades flat or convolute, 2-10 cm long. Panicles 3-10 cm long, usually contracted, dense, greenish purple.

On open alpine meadows, Dharansi. Flowering during August.

2. ANDROPOGON L.

Andropogon is usually a genus of tropical region and most prolific in Africa and America and is commonly known as Blue stem or broom sedge. The scientific name is derived from *adros*, male and *pogon* beard, referring to the tufts of hairs in the spikelets which resemble a man's beard.

About 100 species; 1 species in the Biosphere Reserve.

Andropogon munroi C.B. Clarke

A tufted, 60-90 cm high, stout or slender, usually erect and branching herb. Leaves narrowly linear, hairy at base. Spikes most often 4-6, unequal, 2.5-7.5 cm long, greenish.

Common on hill slopes with *Cotoneaster, sedum, Allium, Carex,* etc. at Himtoli, Ruing, 3000-3500 m. Flowering during August September.

3. APLUDA L.

A name used by Pliny for a small, slender grass.

The scientific name is derived from *apluda,* chaff; in allusion to the resemblance of the involucres to chaff.

Apluda mutica L.

A rambling perennial with solid leafy stems, branched, 30-90 cm long or more, bent at the joints. Leaves flat, rough, narrow, 10-45 cm long, finely jointed. False panicle linear, up to ca 30 cm long.

Very common near Peng, ca 2500 m. Flowering in August September Eaten by cattle.

4. ARISTIDA L.

Latin *arista,* awns; referring to the long awns.

A genus of about 26 species throughout tropics and subtropics; ca 17 species in India; 1 in the Biosphere Reserve.

Aristida adscensionis L.

A tufted 30-50 cm high perennial. Leaves linear, up to 15 cm long. Panicle 10-25 cm long, green or brownish. Awns ca 2.0 cm long.

On way to Lata at 2500 m. Flowering in August

5. ARTHRAXON P. Beauv.

The genus comprises ca 25 species, 21 in India; 1 in the Biosphere Reserve.

Arthraxon lancifolius (Trin.) Hochst.

Erect hairy herbs. Leaves lanceolate-oblong. Rachis and joints hairy, spikelets tinged with purple.

Common around buffer zone area 1600-2000 m. Flowering and fruiting during July October.

6. ARUNDO L.

The genus comprises ca 15 species; 1 in India and the Biosphere Reserve.

Arundo donax L.

Tall reed-like, perennial grasses, sometimes creeping near the base. Leaves smooth. Panicles large, plumose. Styles 2, feathery.

In bufferzone area, 1800-2500 m. Flowering and fruiting during August October.

7. BRACHIARIA Griseb.

The genus comprises 50 species, 18 in India; only one in our area.

Brachiaria villosa (Lamk.) A. Camus

Annual, erect, hairy grasses. Leaves amplexicaule, hairy. Spikelets alternate.

Common around bufferzone area, 2000-2300 m. Flowering and fruiting during July September.

8. BRACHYPODIUM P. Beauv.

Greek name *brachys*, short and *pous*, foot, referring to the short stalk of the spikelets. A genus of about 17 species; 3 in India; 1 in the Biosphere Reserve.

The genus includes species commonly known as purple false broom.

Brachypodium distachyon (L.) P. Beauv.

An erect or ascending 15-20 cm high, tufted annual. Leaf blades flat, 10-12 cm long, sheaths pubescent. Spikelets few, green, pubescent or hairy, 8-12-flowered, compressed.

Malari and on way to Ruing, 2700 3500 m. Flowering during August September.

9. BROMUS L.

From *Bromos,* food; an ancient Greek name for wild oats, commonly called "Broom grass" of temperate and cold regions.

A genus of 90 species in temperate regions; 12 species in India, some are introduced, 2 in the Biosphere Reserve.

1a. Leaf blades 15-30 cm long, panicle 5-15 cm long, spikelets lanceolate **1. B. pectinatus**

b. Leaf blades 3-5 cm long, inflorescence (Panicles) 10-35 cm long, spikelets oblong **2. B. ramosus**

1. Bromus pectinatus Thunb.

An erect or ascending, up to 70 cm high herb. Leaf blades ca 15-30 cm long. Panicles 5-15 cm long, lax and nodding, spikelets lanceolate, 4-10. Flowered, laterally somewhat compressed.

On open alpine grasslands, Dharansi at about 4500 m. Flowering during August September.

2. Bromus ramosus Huds.

A perennial, smooth, 60-100 cm high herb. Leaf-blades 3-5 cm long, flat, hairy. Panicle 10-35 cm long, lax, nodding, spikelets narrowly oblong, laxly 4-12-flowered.

Ramni-Deodi, in the forest, ca 3500 m. Flowering during August September.

10. CALAMAGROSTIS Adans

From the Greek *calamos*, a reed and *agrostis*, grass, in allusion to the plant resembling the reed.

A genus of ca 280 species in temperate regions, throughout the world, 7 species in India; 3 in the Biosphere Reserve.

1a.	Awns on lemma inserted at the middle or below this point	3. C. scabrescens
b.	Awns on lemma inserted above the middle on dorsal surface	2
2a.	Panicles congested, spikelet dark purple	2. C. pulchella
b.	Panicles lax, spikelets green or faintly tinged with purple	1. C. emodensis

1. Calamagrostis emodensis Griseb.

A perennial, tufted, up to ca 1.0 m tall herb. Leaf-blades 30-45 cm long. Panicle nodding, large, plume-like. Spikelets ca 6 mm long.

Dibrugheta to Deodi, common in the subalpine regions amidst boulders, ca 3000-4000 m. Flowering during August September.

2. Calamagrostis pulchella Griseb.

A densely tufted, erect, 30-35 cm high grass. Leaf-blades ca 25 cm long, usually flat. Panicle 6-8 cm long, crowded, dark purple. Spikelets smaller than the proceeding and not so scaberulous.

In alpine meadows, common around Dharansi, 3500-4500 m. Flowering during August September.

3. Calamagrostis scabrescens Griseb.

A tufted perennial, 40-75 cm high, erect, scaberulous beneath thepanicle. Leaf-blades 15-35 cm long, flat, scaberulous. Panicle 8-10 cm long, dense, tinged with purple.

In alpine meadows, common around Dharansi-Dibrugheta, 3500-4000 m. Flowering during August September.

11. CHRYSOPOGON Trin.

The Greek name *chrysos*, gold and *pogon* a beard referring to the yellow awns. A genus of 24 species in tropical and warm temperate regions of the old world; ca 15 species in India, 2 subspecies of *C. gryllus* are present in the Biosphere Reserve.

1a.	Panicles lax; awns 2.5-3.5 cm long	2. C. gryllus ssp. gryllus
b.	Panicles contracted; awns 1.2-1.8 cm long	1. C. gryllus ssp. echinulatus

1. Chrysopogon gryllus (L.) Trin. subsp. **echinulatus** (Nees) T.A. Cope.

A perennial, 35-100 cm high, erect, robust grass. Leaf-blades 15-30 cm long. Panicle 10-15 cm long.

Common near Tolma village, ca 2500 m. Flowering during August-September.

2. Chrysopogon gryllus (L.) Trin. subsp. **gryllus**

A large, coarse, tufted grass, 30-150 cm tall. Leaves 15-45 cm long, very narrow, usually hairy, edges minutely spinous toothed. Panicle lax, 18-30 cm long. Spikelets in threes, purplish brown.

Common near Lata-Suraithota along the road side on open hill slopes, 2500-3000 m. Flowering during August September.

12. COIX L.

The genus comprises 5 species, 4 in India; only 1 in the Biosphere Reserve.

Coix lacryma-jobi L.

Annual or perennial erect grasses. Leaves lanceolate. Female spikelets enclosed in ovoid-globose whitish heard involucre.

Common around buffer zone area, 1600-1800 m. Flowering and fruiting during July September.

13. CYNODON Rich.

Greek *cyon*, a dog and *odous*, a tooth; referring to the nature of the leaves, on the stolons. A genus of 8 species in the warm and temperate regions, 3 in India; 1 in the Biosphere Reserve.

Cynodon dactylon (L.) Pers.

A perennial grass with slender rhizomes. Stem slender up to ca 30 cm long. Leaf-blades short and narrow. Racemes usually 4-6 digitate.

This is a grass with an extremely wide distribution.

Common near Suraithota at 2200-2500 m. Flowering during August September.

14. DACTYLIS L.

From the Greek *dactulos*, a finger; supposed to refer to the division of the inflorescence.

A genus of about 5 species in temperate Europe and Asia, widely introduced elsewhere, 1 species in the Biosphere Reserve.

Dactylis glomerata L. subsp. **himalayensis** Domin

A perennial, tufted, smooth, erect or spreading, slender or stout, 20-100 cm tall herb. Leaf-blades, 15-30 cm long. Spikelets green or tinged with purple, stalked, flattened, 3-5-flowered.

Common in Biosphere Reserve. Himtoli-Tolma at 3000-3500 m. Flowering during August September.

15. DANTHONIA DC.

In honour of Etienne Danthoine, a French botanist.

A genus of about 130 species in temperate regions throughout the world; 2 species in India; 2 in the Biosphere Reserve.

1a.	Panicles very short	**1. D. cachemyriana**
b.	Panicles long	**2. D. schneideri**

1. Danthonia cachemyriana Jaub. & Spach

A caespitose, filiform, erect or decumbent, perennial up to 20 cm high. Leaf-blades linear-acute, involute, up to 15 cm long. Inflorescence a congested panicle, 2-3 cm long; spikelets crowded.

A common grass in rocky slopes, around Malari, ca 3000 m. Flowering during August September.

2. Danthonia schneideri Pilger

A densely tufted perennial grass with woody rootstock, up to ca 50 cm high. Lef-blades filiform, 20-30 cm long. Inflorescence a dense panicle, 5-10 cm long, with many spikelets.

Dharansi-Dibrugheta, Himtoli, Tolma at 2500-4000 m. Flowering during August September.

16. DIGITARIA Haller

Greek *digitus*, a finger, referring to the finger like spikes.

A genus of about 200 species in tropical and temperate regions; ca 25 species in India, 1 in the Biosphere Reserve.

D. ciliaris (Retz.) Koel.

An annual, 30-60 cm or more high, decumbent at base, ascending. Leaf-blades flat 5-15 cm long. Inflorescence digitate or sub-digitate, composed of 8-10 racemes, ca 12 cm long.

Common on hill slopes around Tolma and Suraithota at 2000-3000 m. Flowering and Fruiting during June September.

17. ELYMUS L.

Tufted, perennials. Inflorescence a spike.

A genus of about 100 species; ca 4 species in India, 2 in the Biosphere Reserve.

1a. Awns of lemma strongly recurved at maturity; palea as long as the lemma
1. E. longe-aristatus subsp. canaliculatus

b. Awns straight or slightly flexuous; palea shorter than the lemma
2. E. semicostatus

1. Elymus longe-aristatus (Boiss.) Tzvelev subsp. **canaliculatus** (Nevski) Tzvelev

Erect or ascending, ca 50 cm high, tufted, perennials. Leaf blades flat or loosely rolled. Spikes ca 10 cm long, spikelets 5-9-flowered. Awn curved, inflated at base, grooved along its inner face.

On way to Deodi from Dibrugheta at 3500 m. Flowering during August September.

2. Elymus semicostatus (Nees ex Steud.) Meld.

A tufted perennial, ca 30 cm high, usually erect or ascending. Leaf-blades flat, 10-30 cm long. Spikes 12-18 cm long. Spikelets 6-8-flowered.

Suraithota-Tolma and on way to Roopkund at ca 3000 m.

18. ERAGROSTIS Wolf

A genus of ca 300 species mainly in the tropics and subtropics; 1 in the Biosphere Reserve.

Eragrostis nigra Nees ex Steud. **Fig. 68.**

A perennial, erect, stout or slender, simple or branched 15-50 cm high grass. Leaves usually basal and flat. Panicles 15-30 cm long, loosely branched. Spikelet olive grey.

Common along the roadside around Suraithota, Malari, 2500-3000 m. Flowers during August September.

19. EULALIA Kunth

A genus of about 30 species in the old world tropics; 13 species in India; 1 in the Biosphere Reserve.

Eulalia mollis (Griseb.) O. Ktze.

A slender, tufted, 25-30 cm high grass. Leaves 5-10 cm long, flat, usually at base. Spikes 3-10, 2.5-5 cm long, crowded, silvery-silky with long hairs.

Common along the roadside around Suraithota, ca 2500 m.

20. FESTUCA L.

Greek *fatuca*, grass, derived from the Celtic word fest, signifying pasture or food.

A large genus of about 300 species in temperate and subtropical regions; ca 16 species in India; 4 in the Biosphere Reserve.

1a.	Panicles linear, not more than 1 cm broad	2
b.	Panicles not-linear, lax, much broader	4
2a.	Ligule of a narrow rim	**5. F. valesiaca**
b.	Ligule equally biauriculate	3
3a.	Leafleades 15-20 cm long; panicles 5-7 cm long	**2. F. polycolea var. polycolea**
b.	Leafleades 8-12 cm long; panicles 2.5-3 cm long	**3. F. polycolea var. brevis**
4a.	Leaves less than 0.3 cm broad; spikelets 3-9 flowered	**4. F. rubra**
b.	Leaves more than 0.3 cm broad; spikelets 1-3 flowered	**1. F. nandadevica**

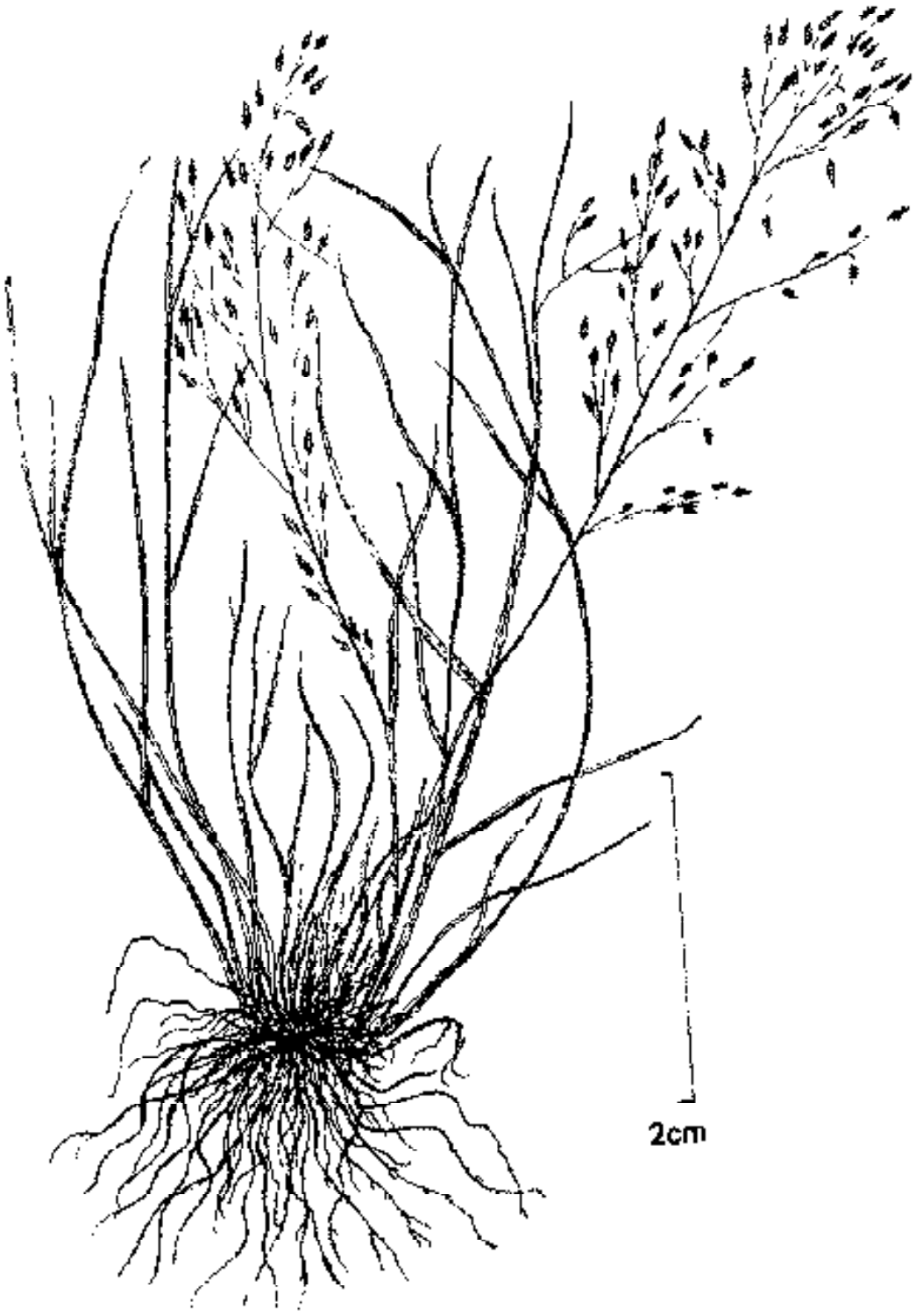


Fig. 68. Eragrostis nigra Nees ex Steud.

1. Festuca nandadevica Hajra

30-70 cm high grass. Stem smooth. Leaf-blades hairy, flat or involute, 3-18 cm long. Panicle 25-30 cm long, lax, nodding. Spikelets 1-3 flowered.

Deodi-Ramni, 3500 m. Flowering during August September.

2. Festuca polycolea Stapf var. **polycolea**

A densely tufted, grass. Leaves setaceous, 15-20 cm long, smooth. Panicle ovate or narrower, 5-7 cm long, erect. Spikelets greenish.

In alpine meadows, common, around Ramni-Bhujgara, 2500-4000 m. Flowering during August September.

3. Festuca polycolea Stapf var. **brevis** Stapf

A tufted herb, up to 25 cm high. Leaf-blades 8-12 cm long. Panicle 2.5-3 cm long. A dwarfed form of *F. polycolea.*

Ramani to Deodi, Bhojgara 3300-4000 m. Flowering during August September.

4. Festuca rubra L.

Densely tufted, perennial, 15-25 cm high, erect grasses. Stems slender and wiry. Leaf-blades folded, setaceous up to 12 cm long. Panicle lanceolate to oblong; spikelets 3-9-flowered.

Common in alpine meadows at Dharansi, 3500-4500 m. Flowering during August September.

5. Festuca valesiaca Schleich ex Gaud.

A tufted perennial, 15-20 cm high, erect, slender grass. Leaf-blades setaceous 7-15 cm long. Panicle 5-8 cm long. Spikelets 5-7-flowered.

Common in alpine meadows, Bujgara-Sarasaupathar 4000-5000 m. Flowering during July August.

21. MELICA L.

From the Grek *meli*, honey, referring to sweet properties of the grass.

A genus of about 60 species in temperate regions; 9 species in India; 1 in the Biosphere Reserve.

Melica persica Kunth **Fig. 69.**

Ca 30 cm high perennial grass, erect or ascending. Leaf-blades linear, 5-10 cm long, usually enrolled. Panicle ca 10 cm long, spikelets purplish.

On open hill slopes around Malari, ca 3000 m. Flowering during August - September.

22. PASPALUM L.

The genus comprises ca 250 species, 14 in India; only 1 in the Biosphere Reserve.

Paspalum paspalodes (Michx.) Scribn.

Annual creeping grasses, rooting at nodes, spikes whitish-green.

In buffer zone, 1500-1700 m. Flowering and fruiting during July September.

23. PHACELURUS Griseb.

From the Greek *phakelos*, a cluster and *aura*, tao; indicating the nature of the spikes.

A genus of about 8 species; 1 in India; 1 in the Biosphere Reserve.

Fig. 69. Melica persica Kunth

Phaceluras speciosus (Steud.) C.E. Hubbard

A rhizomatous perennial, 18-50 cm high, erect grass. Leaf-blades flat, folded or convolute, 8-15 cm long. Inflorescence 8-10 cm long, spikelets sessile, green.

Around Ruing, 2600-3000 m. Flowering during August September.

24. POA L.

From the Greek *Poa*, fodder, commonly known as 'blue grass' or alpine Blue grass.

A genus of about 200 species, cosmopolitan but usually in temperate and alpine regions; ca 44 species in India; 2 in the Biosphere Reserve.

1a.	Spikelets ovate, keels of palea long ciliate below	**1. P. alpina**
b.	spikelets elliptic-lanceolate, oblong or wedge shaped; keels of palea scabrid	**2. P. pagophila**

1. Poa alpina L.

A densely tufted, 10-35 cm high, terete, smooth grass. Leaves chiefly crowded at the base, flat. Panicle broadly ovate, spikelets 3-6-flowered, broadly ovate, crowded.

Common in Dharansi on the alpine slopes, 3500-4500 m. Flowering during August September.

2. Poa pagophila Boc

A slender, loosely tufted, erect perennial, 40-50 cm high grass. Leaf-blades flat or folded, scabrid at margins. Panicle, 5-10 cm long, erect or inclined. Spikelets green, generally tinged with purple.

Ramani to Bhojgara, on alpine slopes, 3500-4000 m. Flowering during August September.

25. SETARIA P. Beauv.

The genus comprises ca 140 species; 15 in India, 2 in the Biosphere Reserve.

1a.	Spikelets deciduous; lowest lemma paleate	**2. S. viridis**
b.	Spikelets persistent; lowest lemma not paleate	**1. S. italica**

Setaria italica (L.) Beauv.

Tall, grasses. Leaves lanceolate flate. Spikelets in cylindric dense yellowish panicles.

Common around Malari area, 2700-3000 m. Flowering and fruiting during July September.

Setaria viridis (L.) Beauv.

Erect, annual grasses. Leaves glabrous. Spikelets in spike like panicles, bristles greenish tinged with red.

Common around Juraithota-Malari area, 2500-3000 m. Flowering and Fruiting during July September.

26. STIPA L.

From the Greek *stupe*, tow, referring to the long, entangled awns.

A genus of about 3000 species, mainly in temperate-regions; ca 16 species in India; 2 in the Biosphere Reserve.

1a.	Column of awn twisted	**2. S. sibirica**
b.	Column of awn not twisted	**1. S. roylei**

1. Stipa roylei (Nees) Mez.

A densely tufted, slender grass, ca 45 cm high. Leaf-blades 16-20 cm long, flat. Panicle 15-25 cm long, very narrow, not spreading, spikelets greenish.

Common in Dibrugheta on alpine slopes, 3200-3500 m. Flowering during August September.

2. Stipa sibirica (L.) Lamk.

A tufted, ca 45 cm high grass. Leaf-blades flat, ca 7 m wide. Panicle narrow, ca 20 cm long. Spikelets green.

Common near Tolma 2500-3000 m. Flowering during August - September.

It is said to be poisonous to cattle, sheep and goats.

27. THAMNOCALAMUS Munro

The name is derived from *thamnos*, a shrub and *kalamos*, a reed, referring to the shrubby nature of the plant.

5 species are recorded from Eastern Asia. 2 from Nanda Devi Biosphere Reserve.

1a.	Leaf sheaths bristly at the tip; spikelets 4-8-flowered	2. T. spathiflora
b.	Leaf sheaths not bristly; spikelets 1-flowered	1. T. falconeri

1. Thamnocalamus falconeri Hook.f. ex Munro

Erect shrub like plants, usually 2-4 m high, stem 1.2-1.8 cm in diam. with 20-35 cm long internodes. Branches many at the nodes with bracteate sheaths. Stem-sheaths 20-30 x 6-8 cm; ligule narrow, dark hairy.

On way to Dibrugheta as undergrowth in mixed forest at 2700-3300 m. Flowering and fruiting during May October.

2. Thamnocalamus spathiflora (Trin.) Munro

A gregarious plant, 4-7 m high, stem 1.2-1.8 cm in diam., young greenish, older yellow or reddish brown, with 15-35 cm long internodes. Stem-sheaths, loose, glabrous with ciliate margins.

On way Dibrugheta as undergrowth in mixed forest, 2800-3300 m. Flowering and fruiting during May October.

28. THEMEDA Forssk.

In Greek the *theos*, God and *medion*, a plant name.

A genus of 19 species in tropical and subtropical regions, ca 16 species in India, 1 in the Biosphere Reserve.

Themeda anathera (Nees ex Steud.) Hack.

A weak, densely tufted, erect perennial, 35-55 cm high grass. Leaf-blades 10-25 cm long. Panicle 15-25 cm long, loose. Involucral spikelets covered with grey hairs.

On way to Lata, ca 2500 m, on rocky slopes. Flowering during August - September. This is a good fodder grass.

29. TRIPOGON Roem. & Schult.

In Greek *Tri*; three and *pogon*, a beard, referring to the 3-awned flowering glumes of some species.

A genus of about 30 species in the tropics and subtropics; 12 species in India; 2 in the Biosphere Reserve.

1a.	Lemma cleft at the apex into 4-lobes	**1. T. filiformis**
b.	Lemma cleft at the apex into 2-lobes	**2. T. purpurascens**

1. Tripogon filiformis Nees ex Steud.

A tufted, slender, perennial, glabrous grass, 10-40 cm high. Leaves very narrow, 10-15 cm long, spikes 5-10 cm long. Spikelets crowded, 4-10-flowered.

Along the river banks near Suraithota, common, 2500-3000 m. Flowering during August September.

2. Tripogon purpurascens Duthie

10-60 cm high grass, whole plant with purple tinge. Spikes 3-10 cm long, spikelets distant, 3-6 flowered.

On way to Belta 2700-3200 m. Flowering and fruiting in August September.

30. TRISETUM Pers.

A genus of about 75 species in temperate regions ca 6 species in India; 1 in the Biosphere Reserve.

Trisetum clarkei (Hook.f.) R.R. Stewart

A tufted perennial ca 30 cm high, erect, grass. Leaf-blades ca 15 cm long. Panicle more or less dense. Spikelets 2-3-flowered.

Common, Ramani, Bhojgara, 3000-3500 m. Flowering during August September.

GYMNOSPERMS

Gymnosperms are usually trees or shrubs rarely climbers and characterized by usually needle like leaves and unisexual inflorescence (flowers). Ovules naked, not enclosed in an ovary.

99. EPHEDRACEAE
(Ephedra family)

Usually, much branched shrubby plants with opposite scale like leaves and unisexual flowers. Female flowers usually in pairs and with bracts. Seed enclosed in perianth.

The only genus Ephedra is distributed in warm temperate North and South America and Eurasia.

EPHEDRA L.

The plants are readily distinguished by their evergreen horsetail-like stems, usually open and straggling habit, and small deciduous cones borne in stem axils.

44 species; 8 in India; 1 in the Biosphere Reserve.

Ephedra gerardiana Wallich ex Stapf (GERAD'S EPHEDRA)

Erect, rigid, tufted shrubs with terete, slender branches. Flowers subsessile, whorled. Fruits ovoid with red, fleshy, succulent bracts, clustered. Seeds 2, 4-6 mm long, black.

This species is common in the drier regions at Malari and near Bhujgara. Flowering and fruiting during May October.

100. TAXACEAE
(Yew family, taxads)

Usually evergreen trees or shrubs with spirally arranged, mostly 2-ranked, flat, needle-like leaves. Male and female cones mostly found on different trees.

5 genera; 2 in India; 1 in our area.

TAXUS L.
(The Yew)

Evergreen trees or shrubs with linear, 2-ranked leaves. Seeds erect, borne in a fleshy cup, young ones green, bright red when ripe.

10 species; 1 in India.

Taxus wallichiana Zucc. **Fig. 70.**

Vern. name *Thuner* (Common Yew).

Medium sized trees, about 8 m high with spreading branches and linear, bifarious, more or less falcate leaves. Flowers dioecious. Female flowers solitary, seated on a cup-shaped disc.

Around Dibrugheta-Sonwari and Tolma-Himtoli at 2500-3000 m. Flowering and fruiting March November.

101. PINACEAE
(Pine family)

Trees or shrubs, monoecious or dioecious. Leaves needle like or scale like. Male flowers in deciduous catkins. Female flowers in cones. Seeds two, usually winged.

10 genera and 250 species, distributed in N. Hemisphere southwards to Sumatra, Java, C. America and the W. Indies; 6 genera in India.

1a.	Cones pendulous, woody, persistent	2
b.	Cones erect, scales sheding off upon the tree leaving central axis	3
2a.	Leaves acicular in bundles	**4. Pinus**
b.	Leaves tetragonal or flattened	**3. Picea**
3a.	Leaves in tufts	**2. Cedrus**
b.	Leaves distichous or spirally arranged	**1. Abies**

1. ABIES Mill.
(The Silver Firs)

Tall, evergreen trees. Leaves spiral, needle like, usually flattened. Cones erect, scales thin, breaking away from a persistent woody axis when ripe.

4 species in the Himalaya, 2 in our area.

1a.	Young shoots hairy; leaves 2.5-5.0 cm long, spreading, spirally arranged	**2. A. spectabilis**
b.	Young shoots glabrous; leaves upto 10 cm long, distichous	**1. A. pindrow**

Fig. 70. Taxus wallichiana Zucc.

1. Abies pindrow (Royle) Spach.

Vern.: *Roga, Chilla.*

Lofty trees, 30-40 m tall, glabrous. Bark dark grey or brown, rough, becoming more or less deeply furrowed with maturity. Leaves distichous, those above much smaller than those below, flattened. Flowers monoecious, catkins clustered. Cones solitary or in distant pairs.

Belta surroundings Dodhganga area, 2500-3200 m. Flowers during April-May. Cones ripen in September November.

2. Abies spectabilis (D. Don) Spach.

Large evergreen trees, 30-45 m tall with cylindric crown. Leaves spirally arranged, up to ca 5 cm long, linear, flat, white beneath. Cones cylindric or oblong, dark-purple.

Dibrugheta, Himtoli, Latakharak, 3000-3500 m. Flowers in April May. Cones during September November.

2. CEDRUS Trew.
(The Cedrus)

Large evergreen trees with long and dwarf shoots and spiral leaves.

This scientific name cedrus has been derived from Cedron, a small river in Judaea which is the original home of the Cedrus species. This 'Timber-of-the Gods' (Devadara) was mentioned by Valmiki and Kalidasa in Indian epics.

One species in the Himalaya.

Cedrus deodara Loud.

Vern.: *Deodar*

Large, robust, evergreen trees with reddish-brown branches and needle-like leaves in clusters. Flowers usually monoecious. Catkins solitary at the ends of branches, cylindric. Cones solitary, erect, ovoid, dark brown.

Near Tolma, on way to Dunagiri. Flowers during September October. Cones ripen during October November of the following year.

3. PICEA A. Dietr.
(The spruces)

Large evergreen trees with whorled branches. Leaves scattered, spiral. Cones pendulous.

Spruces are widely distributed in temperate regions of the Northern Hemisphere, Europe, Asia Minor, the Caucasus, Siberia, China, Japan, N. America and the Himalaya.

Ca 60 species; 3 in India, 1 in our area.

Picea smithiana (Wallich) Boiss. (*P. morinda* Link) (West Himalayan spruce).

Vern.: *Raga, Kathela or Kala-Chiulu.*

Large evergreen trees 10-50 m tall with whorled, horizontal or drooping branches and hanging branchlets. Leaves spirally arranged all round branches. Flowers monoecious. Catkins solitary. Cones solitary, terminal.

Common on way to Dibrugheta - Sonwari. Flowers in April. Cones ripen during October November.

4. PINUS L.
(Pines)

Evergreen trees with leaves in clusters of 2 to 5, sheathed at base, needle-like. Male cones in clusters at base of young shoots, cylindrical. Female cones, ovoid or ellipsoid, subterminal.

Pines are widely distributed in the Northern hemisphere, N. America, Asia Minor, Myanmar, Philippines, Central America, Florida, Bahamas and Honduras. 91 species; 7 in India; 1 in the Biosphere Reserve.

Pinus wallichiana A.B. Jackson

Vern.: *Hindi Kail;* Eng. *Blue Pine.*

Resinous timber trees, usually 10-50 m tall with bluish-green leaves, borne in clusters of 5. Male cones ca 1 cm long, brownish. Female cones (mature) 12-16 cm long, ellipsoid.

Common near Belta, Latakharak, and Dibrugheta surrounding, 2000-3500 m. Flowering during April-June. Cones ripen in September - November.

A very interesting feature is noticed in Dibrugheta where the Blue pine is seen distributed above the Betula trees.

102. CUPRESSACEAE

The family comprises 19 genera and about 250 species. Cosmopolitan in distribution; 2 genera.

Evergreen trees or shrubs. Leaves opposite, usually 4-ranked; juvenile leaves needle like, adult scale-like and adpressed. Flowers monoecious. Catkins numerous, ovoid, small. Cones of 4-12 peltate scales, globose, woody. Seeds compressed and winged.

1a.	Cones fleshy, berry like	1. Juniperus
b.	Cones dry of woody scales	2. Cupressus

1. CUPRESSUS L.

Ca 20 species in the world, 2 in the Himalaya, 1 in our area.

Cupressus torulosa D. Don

Large 30-50 m tall, evergreen trees, with spreading, more or less pendulous branches. Cones globose, sessile, erect, bluish-green, seeds narrowly winged.

This species is common near Suraithota and most probably planted along the road sides on way to Tolma village, also common around Reni-Lata area, 2500 m. Flowers during June - February. Fruits during October November.

2. JUNIPERUS L.
(The Junipers)

Aromatic evergreen shrubs or small trees. Leaves often glandular on the back, needle like, in whorles of 3 or scale like, opposite, in pairs or threes. Flowers monoecious or dioecious. Catkins small, cylindric, ovoid. Cones composed of 2-6 opposite or ternate scales. Fruits berry-like cone, seeds not winged.

1a.	Tip of leaves not appressed, flowers axillary	**1. J. communis var. sexatilis**
b.	Tip of leaves closely appressed, flowers terminal	2.
2a.	Procumbent shrubs; cone 1-seeded	**3. J. indica**
b.	Erect shrubs; cone 2-5 seeded	**2. J. recurva**

1. Juniperus communis L. **var. sexatilis** Pallos

Bushy, spreading shrub, with greyish-green, oblong-lanceolate or subulate, crowded leaves.

Common at Malari at about 3000 m. Flowering during April-May; Fruits in October, the second year.

2. Juniperus indica Bertol **Fig. 71.**

Vern.: *Bitaru.*

Bushy shrubs with procumbent stems. Leaves on lower branches linear, pungent, in the terminal branchlets closely imbricate, appressed. Flowers

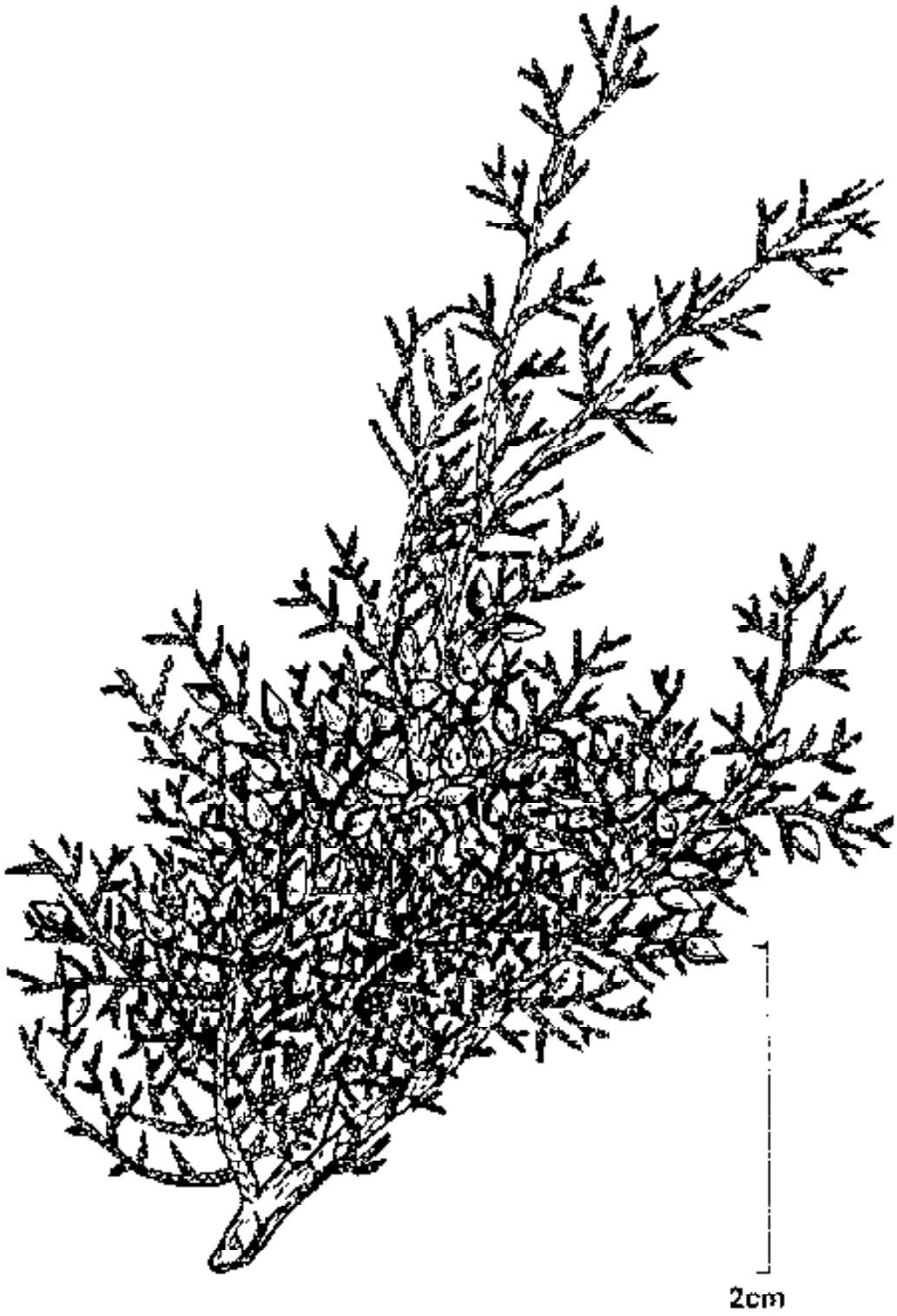


Fig. 71. Juniperus indica Bertol

dioecious, terminating in short or very short lateral branchlets. Fruits ovoid, blue when ripe.

Common around Latakharak-Dharansi, Dibrugheta, 3500-5000 m. Flowers during May - June: Fruits during July September.

3. **Juniperus recurva** Buch.-Ham. ex D. Don (Drooping Juniper)

Small 10-15 m high trees, with light green dimorphic (two types) leaves, lower branches with subulate, upper scale-like, imbricate, closely appressed. Flowers dioecious. Fruits subglobose, ca 6 mm across, 2-5-seeded.

Scattered near Malari and Ruing, 2500-3000 m. Flowers during June - July; Fruits in November of the second year.

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

The Pteridophytic flora of the Indian region is very rich and is represented by 67 families, 191 genera and more than 1000 species.

In Nanda Devi Biosphere Reserve there are about 24 genera and 66 species, under 16 families.

103. ADIANTACEAE

Terrestrial; Rhizome creeping or ascending or short and oblique forming a small caudex; paleae usually present. Fronds pinnatifid to pinnately compound; sori superficial, dorsal or marginal to submarginal, sporangia mostly large, shortly stalked.

One genus and 25 species in India; 1 genus 2 in the Biosphere Reserve.

ADIANTUM L.

(*Adiantos*, dry; water will not lie on the fronds).

Sori marginal, oblong or linear, indusium of same shape as the sorus.

25 species; 3 in our area.

1a.	Rhizomes erect; rachis dichotomously forked	2. A. pedatum
b.	Rhizome creeping; rachis not dichotomously forked	2
2a.	Pinnules large, upper outer margins 3-6 lobed	1. A. capillus-veneris
b.	Pinnules small, upper outer margin 2-3 lobed	3. A. venustum

1. Adiantum capillus-veneris L.

Fronds bipinnate; stipe suberect, 10-22 cm long, blackish, naked. Sori roundish or obreniform, places in the roundish sinuses of the crenations.

Dibrugheta to Sonwara, ca 3000 m.

2. Adiantum pedatum L.

Stipes 15-30 cm long, dark chestnut-brown, glabrous. Fronds dichotomous, with the main divisions flabellately branched. Central pinnae 15-22 cm long, 2.5-3.7 cm broad. Sori roundish or transversely oblong.

Not very common, in Thamnocalamus forest on hill slopes in shady places around Talkapar-Roopkund.

3. Adiantum venustum D. Don

Rhizome long creeping. Stipe dark brown or chestnut red with 3-4 pinnate fronds; fertile lobes with 1-3 notches, each notch bearing a large sorus at the bottom.

In the buffer zone area in mixed forest in shady moist places, 2000-2700 m.

104. ASPIDIACEAE

(*Aspidos*, the indusium being like a shield i.e. species of this family having shield like indusium).

10 genera and 47 species; 1 genus and 1 species in the biosphere reserve.

CYRTOMIUM Presl

Terrestrial ferns with short and stout rhizome. Fronds pinnate, coriaceous. Indusium orbicular, peltate.

5 species in India; 1 in the Biosphere reserve.

Cyrtomium caryotideum (Wallich ex Hook. et Grev.) Presl

15-30 cm long, densely clothed with large, dark scales. Pinnules sharply toothed and generally with a long sharp auricle on one or both sides at base.

Pangrani, rare in the Biosphere reserve.

105. ASPLENIACEAE

Epiphytes or terrestrials with short rhizome. Scales clathrate, hairs usually present. Fronds crowded. Sori elongate, a long veins fully covered with indusium when young.

3 genera, 53 species; 1 genus and 8 species in the Biosphere Reserve.

ASPLENIUM L.

(A, privative, splen, spleen; in allusion to its medical properties).

Terrestrial or epiphytic, fronds simple to pinnately compound. Sori linear or oblong.

50 species; 8 species in the Biosphere reserve.

1a.	Lamina simple, margins entire or deeply pinnatifid	2
b.	Lamina variously compound	3
2a.	Lamina margins entire	2. A. ensiforme
b.	Lamina margins lobed or forked	1. A. dalhousiae
3a.	Lamina simply pinnate	4
b.	Lamina bipinnatifid or bipinnate or more	5

4a.	Lamina less than 5 cm long, with a few lateral pinnae	6. A. septentrionale
b.	Lamina 5.0-15 cm long with many lateral pinnae	7. A. trichomanes
5a.	Lamina 1-pinnate to 2-pinnate	8. A yunnanense
b.	Lamina 2-pinnate or more	6
6a.	Lamina subtripinnate or more	3. A. fontanum subsp. pseudofontanum
b.	Lamina 2-pinnate	7
7a.	Fronds stiff, ultimate segments contracted	5. A. pekinense
b.	Fronds soft and delicate, ultimate segments not contracted	4. A kukkonenii

1. Asplenium dalhousiae Hook.

Scales subulate. Fronds deeply and regularly pinnatifid throughout. Sori copious on all the lobes in two rows, linear-oblong.

Common on rocks around Lata-Belta area.

2. Asplenium ensiforme Wallich ex Hook. & Grev.

Stipes 2.5-7.5 cm long, erect, scaly below. Fronds 20-50 cm long, coriaceous, acuminate at apex, entire at margin, the lower part gradually narrowed, sori broad, reaching nearly to the margin.

Rare, on rocks, in moist places, around Sutal-Roopkund area.

3. Asplenium fontanum Subsp. pseudofontanum (Kossinsky) Reichst. & Schnell.

Stipes tufted, green, 5-10 cm long, wiry, slender, glabrous. Fronds 7.5-15 cm long, oblong-lanceolate. Pinnae numerous. Sori copious, covering nearly the whole segment.

Rare, on hill slopes, amidst boulders, around Malari area.

4. Asplenium kukkonenii Viane, Rasbach & Reicht. **Fig. 72.**

Tufted ferns with short rhizome densely covered with brown scales. Fronds 4-8 cm long; stipes 1-1.5 cm long. Pinnae 8-12 pairs, cut down to the rachis.

Common on rocks, around Lata-Belta area.

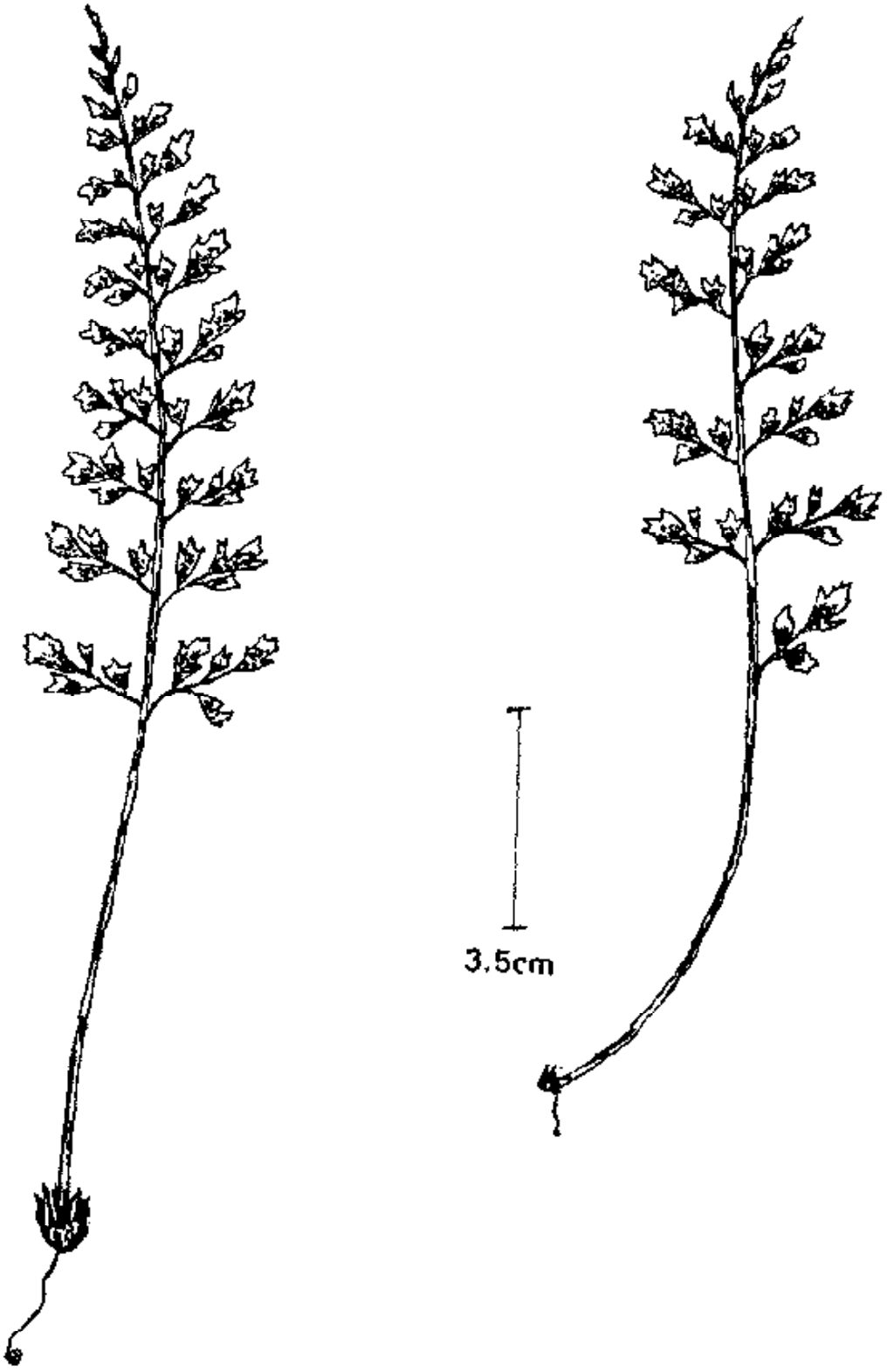


Fig. 72. Asplenium kukkonenii Viane, Rasbach & Reicht.

5. Asplenium pekinense Hance

Tufted, ca 18 cm high. Rhizome short. Stipes dark-brown, scaly. Fronds 9-10 cm long. Pinnae usually 10-15 pairs, sori linear.

Rare, on rocky slopes, around Tolma village.

6. Asplenium septentrionale (L.) Hoffm.

Tufted fern, 10-20 cm high, erect. Stipes greenish-brown at base. Fronds 2.5-5 cm long, coriaceous, glabrous, pinnate. Sori very long; involucres also much elongated, attached near the margin.

Common, Dharansi to Dibrugheta, ca 4000 m.

7. Asplenium trichomanes L.

Densely tufted fern. Stipes 2.5-10 cm long, glossy brown or black. Fronds 15-30 cm long, ca 1.2 cm broad with 15-30 opposite pairs of sessile horizontal pinnae. Sori-linear oblong, 3-6 cm each side of the midrib.

Common, on rock crevices and hill slopes around Belta and Himtoli 3000-3500 m.

8. Asplenium yunnanense Franch.

Tufted ferns, 5-10 cm high. Stipes slender, brownish. Fronds 7-10 cm long, narrow. Pinnae many, sori copious covering nearly the whole segment.

Common in rock-crevices and on hill slopes, around Suraithota-Lata area.

106. ATHYRIACEAE

Usually terrestrials. Rhizome short, forming a stock. Sori dorsal, oblong to linear, more or less curved and flat with indusia of similar shape. Sporangia globose with slender stalks.

13 genera and 85 species; 4 genera in the Biosphere reserve.

1a.	Stipe, rachis and lamina with articulated hairs	**4. Lunathyrium**
b.	Articulated hairs absent	2
2a.	Sori globose not elongated	**2. Cystopteris**
b.	Sori elongated	3
3a.	Veins anastomosing; sori diplazard	**3. Diplazium**
b.	Veins free rarely anastomosing towards the margins only	**1. Athyrium**

1. ATHYRIUM Roth

Rhizome usually erect. Fronds large, decompound. Veins usually free. Sori dorsal, elongated. Indusia usually elongate or reniform.

38 in India; 6 species in the Biosphere reserve.

1a.	Fronds 50-90 cm long; lobes of pinnae sharply incised	**5. A. schimperi**
b.	Fronds up to 50 cm long; lobes of pinnae not sharply incised	2
2a.	Fronds 25-50 cm long	3
b.	Fronds small, upto 25 cm long	
3a.	Stipes straw coloured; lobes of pinnae crenate	**1. A. atkinsoni**
b.	Stipes black coloured; pinnae with toothed, rounded lobes	**6. A. wallichianum**
4a.	Fronds narrow, tapering at both ends	**2. A. attenuatum**
b.	Fronds not tapering at both ends	
5a.	Stipes upto 5 cm long; fronds up to 15 cm long	**4. A. rupicola**
b.	Stipes 5-10 cm long; fronds up to 25 cm long	**3. A. duthiei**

1. Athyrium atkinsoni Bedd.

Stipes ca 15 cm long, erect, straw-coloured. Fronds 25-45 cm long; pinnae 7-9 pairs. Sori one to each segment of the basal vein.

Common on hill slopes amidst boulders around Talkapar area.

2. Athyrium attenuatum (C.B. Clarke) Tagawa

Stipes densely clothed with scales at base. Fronds small, very narrow, much tapering at both ends. Pinnae deeply, regularly pinnatifid into oblong, serrated segments.

Common on hill slopes near marshy places around Dronagiri area.

3. Athyrium duthiei (Bedd.) Bedd.

Rhizome wide-creeping, black-stipe ca 8 cm long with brown scales. Fronds narrow, ca 25 cm long, ovate-lanceolate, sori 6-8 to each pinnule.

Common in the area around Latakharak, in *Betula-Rhododendron* forest.

4. Athyrium rupicola (Hope) C. Chr.

Stipes up to 5 cm, scales brownish. Fronds 10-15 cm long.

Not common, on rocks around Sutol-Roopkund area.

5. Athyrium schimperi Moug ex Fée

Rhizome wide-creeping. Fronds up to 90 cm long. Stipes 15-22 cm long. Lobes of pinnules sharply incised.

Common, on shady hill slopes amidst boulders.

6. Athyrium wallichianum Ching

Tufted fern. Stipes 10-15 cm long, densely clothed with large dark-brown scales. Fronds 30-45 cm long. Rachises clothed with long scales.

Common, Dharansi ca 4500 m.

2. CYSTOPTERIS Bernh.

Cystos a cyst in allusion to the inflated indusium.

Fronds membranaceous, sori globose, indusium membranaceous, suborbicular.

4 species in India; 1 in the Biosphere reserve.

Cystopteris fragilis (L.) Bernh.

Stipes ca 10 cm long. Fronds weak. Sori 2-12 to a pinnule.

Common, on alpine hill slopes in rocky places around Roopkund area.

3. DIPLAZIUM Sw.

Diplaso meaning double i.e. the double indusia or involucres.

Some of the sori double i.e. on each side of the vein, each furnished with a linear indusium.

Ca 30 species in India, 1 in the Biosphere reserve.

Diplazium frondosum (C.B. Clarke) Christ

Ca 1 m high. Fronds bipinnate. Sori in two oblique rows in the segments, indusium linear.

Common, on shady places around suraithota-Lata-Tolma area.

4. LUNATHYRIUM Koidz.

Terrestrial. Fronds decompound, hairs articulate and the rachis groove not open to admit the groove of secondary rachises.

2 species in India; 1 in the Biosphere reserve.

Lunathyrium allantodioides (Bedd.) Ching

Ca 1 m high. Stipes 15-20 cm or more long. Fronds ca 1 m or more long. Pinnae numerous. Sori in close regular rows, short, oblong.

Common, on hill slopes in shady places, along the streams, around Talkapar area.

107. CHEILANTHACEAE

Terrestrials. Rhizome short with many fibrous roots. Stipe usually dark, polished. Fronds small, coriaceous, hairy or scaly. Sori marginal, more or less confluent with a false indusium.

1 genus, 26 species in India; 1 genus with 2 species in the Biosphere Reserve.

CHEILANTHES Sw.

(*Cheilos*, lip or margin; *anthos*, flower; the fructification on the margin).

Terrestrial, usually xerophytic. Fronds tufted, bi to tripinnatifid, veins free, sori marginal, protected by reflexed margins. 2 species in the Biosphere reserve.

1a.	Stipes reddish-brown; scales present throughout the frond	**1. C. albomarginata**
b.	Stipes chest-nut coloured; scaly at the base only	**2. C. subvillosa**

1. Cheilanthes albomarginata C.B. Clarke

15-30 cm high tufted fern. Stipes shorter or longer than frond, reddish-brown, shining. Fronds deltoid or deltoid-lanceolate, when very young completely covered beneath with lanceolate brown scales and with yellowish or whitish powder. Involucres lacerate on the margins.

Not common, on hill slopes in rocky places around Belta area.

2. Cheilanthes subvillosa Hook.

Densely tufted fern, 12-15 cm high. Stipes 2-6 cm long, chestnut coloured, clothed with lanceolate, acuminate scales at base. Fronds 4-8 cm long, 2-3 cm broad or more. Pinnae 5-10 pairs, the lower ones distant. Involucre continuous, slightly crenulate.

Rare, on rocky hill slopes around Lata-Belta area, ca 3000 m.

108. CRYPTOGRAMMACEAE

Sori terminal on the veins or placed upon a continuous linear receptacle, which connects the species of several veins.

2 genera, 10 species in India; 2 genera and 4 species in the Biosphere reserve.

1a.	Fronds dimorphic; sori submarginal	**1. Cryptogramma**
b.	Fronds not dimorphic; sori marginal	**2. Onychium**

1. CRYPTOGRAMMA R. Br.

(*Kryptos*, hidden; *gramme*, a line)

Sterile and fertile fronds usually different from the same root.

Cryptogramma brunoniana Wallich ex Hook. & Grev.

Glabrous, tufted fern, 6-20 cm high. Stipe pale brown. Fronds 2-5 cm long, 1.5-2 cm broad, oblong, 3-4 pinnatifid. Sori terminal on the veins, confluent when mature.

Common, on rock crevices around Roopkund area.

2. ONYCHIUM Kaulf.

(Onychion, a little nail; resemblance to the fertile segments of the frond).

Terrestrial. Rhizome creeping, scaly. Fronds subcoriaceous. Sori elongate. Indusia membranous.

8 species in India, 2 in Biosphere reserve.

1a.	Fronds tufted, large	**1. O. contiguum**
b.	Fronds not tufted, fragile, small	**2. O. fragile**

1. Onychium contiguum Wallich ex Hope

Tufted, stout, erect plants. The root stock generally creeping. Stipes straw-coloured or pale brown, scaly at base. Fronds subcoriaceous, fertile frond very finely cut, often 5-pinnate. Pinules and segments many.

Not common, on open hill slopes around Belta area.

2. Onychium fragile Verma & Khullar.

Stipe small, fragile. Lamina 3-4 pinnate. Indusia pale-brown, spores large.

Not common, under boulders around Soraithota area.

109. DAVALLIACEAE

Epiphytes or rarely terrestrials. Rhizome creeping. Fronds usually decompound, coriaceous. Sori marginal or submarginal, covered by a reniform or suborbicular indusium, which is open at apex.

5 genera and 21 species in India; 1 genus with 3 species in the Biosphere Reserve.

ARAIOSTEGIA Copel.

Rhizome long creeping. Fronds articulated upon the rhizome. Sori intra or submarginal. Veins forked.

9 species in India; 3 in the Biosphere Reserve.

1a. Rhizome scales golden in colour; stipes scaly at base; sori globose, at the base of ultimate segments **1. A. hookeri**

b. Rhizome scales brown; stipes naked; sori reniform 2

2a. Rhizome clothed with ovate-lanceolate, spreading scales **2. A. pseudocystopteris**

b. Rhizome clothed with broadly ovate-acuminate scales **3. A. pulchra**

1. Araiostegia hookeri (Moore ex Bedd.) Ching

Rhizome stout, scales dense, golden. Stipes 15 cm long, scaly at base. Fronds 3-4 pinnatifid. Sori at the base of ultimate lobes.

Common, epiphytic on tree branches, around Latakharak area, ca 3500 m.

2. Araiostegia pseudocystopteris (Kze.) Copel.

Rhizome creeping, clothed with spreading scales. Stipe naked. Fronds ca 25 cm long, 12 cm broad, ultimate segments very acute. Sori reniform. Common.

On rocks, around Belta area, 2500-3000 m.

3. Araiostegia pulchra (D. Don) Copel.

Rhizome creeping, clothed with light-brown, lanceolate-acuminate scales. Stipe 10-15 cm long, naked. Fronds 22-37 cm long, 10-20 cm broad. Sori copious, superficial on veins, reniform.

Common on hill slopes in rock crevices around Tolma-Himtoli area, 3000-3500 m.

110. DENNSTAEDTIACEAE

Sori at the apex of vein; indusium cup-shaped.

4 genera and 15 species in India; 1 genus and 1 species in the Biosphere reserve.

EMODIOPTERIS Ching et Wu

Terrestrial, rhizome cylindrical; fronds bipinnatifid, lateral pinnae, 30-40 pairs. Sori globose.

1 species and 1 variety in India; 1 species in the Biosphere reserve.

Emodiopteris appendiculata (Wallich ex Hook.) Ching et Wu

Fronds 30-45 cm long, 15 cm broad, bipinnate; rachis hairy; pinnae close together. Sori 2-6 to a pinnule placed at the base of the sinuses.

Common around Peng village on hill slopes, in shady moist places, ca 2500 m.

111. DRYNARIACEAE

Fronds articulate with the caudex with either a separate sterile frond like an oak leaf or the base of the frond pinnatifid and oak-leaf-like.

1 genus, 4 species in India; 1 species in the Biosphere reserve.

DRYNARIA (Bory) J. Sm.

(Dryads, the sterile fronds being like oak-leaves, a tree sacred to the Dryads).

Drynaria mollis Bedd.

Rhizome creeping. Scales subulate, golden. Fronds firm, membranous, dimorphous; sterile ones 10-15 cm long, sessile, ovate, deeply pinnatifid. Fertile fronds shortly stipitate, ovate-lanceolate, softly hairy, deeply pinnatifid. Sori forming single series close to costa.

Common around Tolma area on rock crevices, 2500 m.

112. HEMIONITIDACEAE

6 genera and ca 20 species in India; 2 genera and 2 species in the Biosphere reserve.

1a. Rhizome covered with dark purplish-brown bristles; veins anastomosing near the margin **2. Gymnopteris**

b. Rhizome not covered with bristles; veins simple, one to two times forked ending into conspicuous hydathode **1. Coniogramme**

1. CONIOGRAMME Fée

Terrestrial. Fronds simple, pinnate to tripinnate. Veins free ending into hydathodes. Sori non indusiate, linear

12 species in India; 1 in the Biosphere Reserve area.

Conigramme intermedia Hieron.

Rhizome creeping. Stipes naked, glabrous. Fronds 30-120 cm long, simply pinnate. Veins very close, forked from the base. Sori running along all the branches.

Common around Talkapar area on hill slopes along the streams.

2. GYMNOPTERIS Bernh.

Sori long, linear, arising from the veins and veinlets on the under surface, veins forked.

1 species in the Biosphere reserve.

Gymnopteris vestita (Wallich ex Moore) Underw.

Tufted ferns. Stipes 7-15 cm long; scales at base dense, silky. Fronds linear, simply pinnate.

Common on hill slopes in shady moist places, around Tolma area.

113. BOTRYCHIACEAE

Perennial, terrestrial herbs. Rhizomes short, scales absent. Fertile and sterile fronds separate. Capsule deeply 2-valved.

1 genus and 1 species in the Biosphere Reserve.

BOTRYCHIUM Sw.

(*Botrys*, a bunch; fructifications like a bunch of grapes).

Terrestrial, fleshy herbs. Rhizome small, solid, with fleshy roots. Fronds erect, the sterile segments foliaceous; fertile segments paniculate, terminal. sporangia globose.

1 species in the Biosphere reserve.

Botrychium lunaria (L.) Sw.

Rhizome enclosed by brown sheaths, stipes erect, smooth, succulent. Fronds solitary.

Scattered at 3500 m on open slopes, Dibrugheta to Deodi.

114. OSMUNDACEAE

Terrestrial ferns. Rhizome clothed with persistent leaf-bases. Scales absent. Fronds pinnately compound. Capsule 2-valved.

1 genus in the Biosphere Reserve.

OSMUNDA L.

From *Osmunder* one of the names of Thor, a Celtic divinity.

Fronds pinnate or bipinnate; veins forked, free. Fertile frond on the upper or middle portion.

1 species in the Biosphere reserve.

Osmunda claytoniana L. **Fig. 73.**

A tufted fern up to ca 1 m high, clothed with ferruginous tomentum when young. Fronds simple pinnate, uppermost and lower barren, intermediate fertile; fertile pinnae shorter.

Common on subalpine meadows around Latakharak area and Himtoli 3000-3600 m.

115. POLYPODIACEAE

Epiphytes or terrestrials. Rhizome creeping, densely paleate. Scales adpressed. Fronds articulate with rhizomes, pinnate to irregularly lobed, usually coriaceous. Veins reticulate. Sori exindusiate. Sporangia stalked.

27 genera, 135 species in India; 3 genera and 6 species in the Biosphere reserve.

1a. Fronds simple; veins forming areoles with free included veinlets; sori in a single row on either side of midrib **1. Lepisorus**
b. Fronds simple to pinnate; veins forming areoles along midrib or lateral veins; sori single rowed 2
2a. Fronds large, simple to pinnate, glaucous or bluish-white beneath; veins anastomosing drynaroid type, lateral veins distinct. **2. Phymatopteris**
b. Fronds pinnatifid to pinnate, not glaucous or bluish-white beneath; veins anastomosing, not drynaroid type **3. Polypodiodes**

1. LEPISORUS (Sm.) Ching

Rhizomes creeping. Frond single. Sori large or small, globose or spherical in a single row on each side of midrib.

25 species in India, 2 in the Biosphere reserve.

1a. Fronds tufted, dull brown; sori deeply sunk **2. L. sesquipedalis**
b. Fronds distant, brownish-green; sori not deeply sunk **1. L. kashyapii**

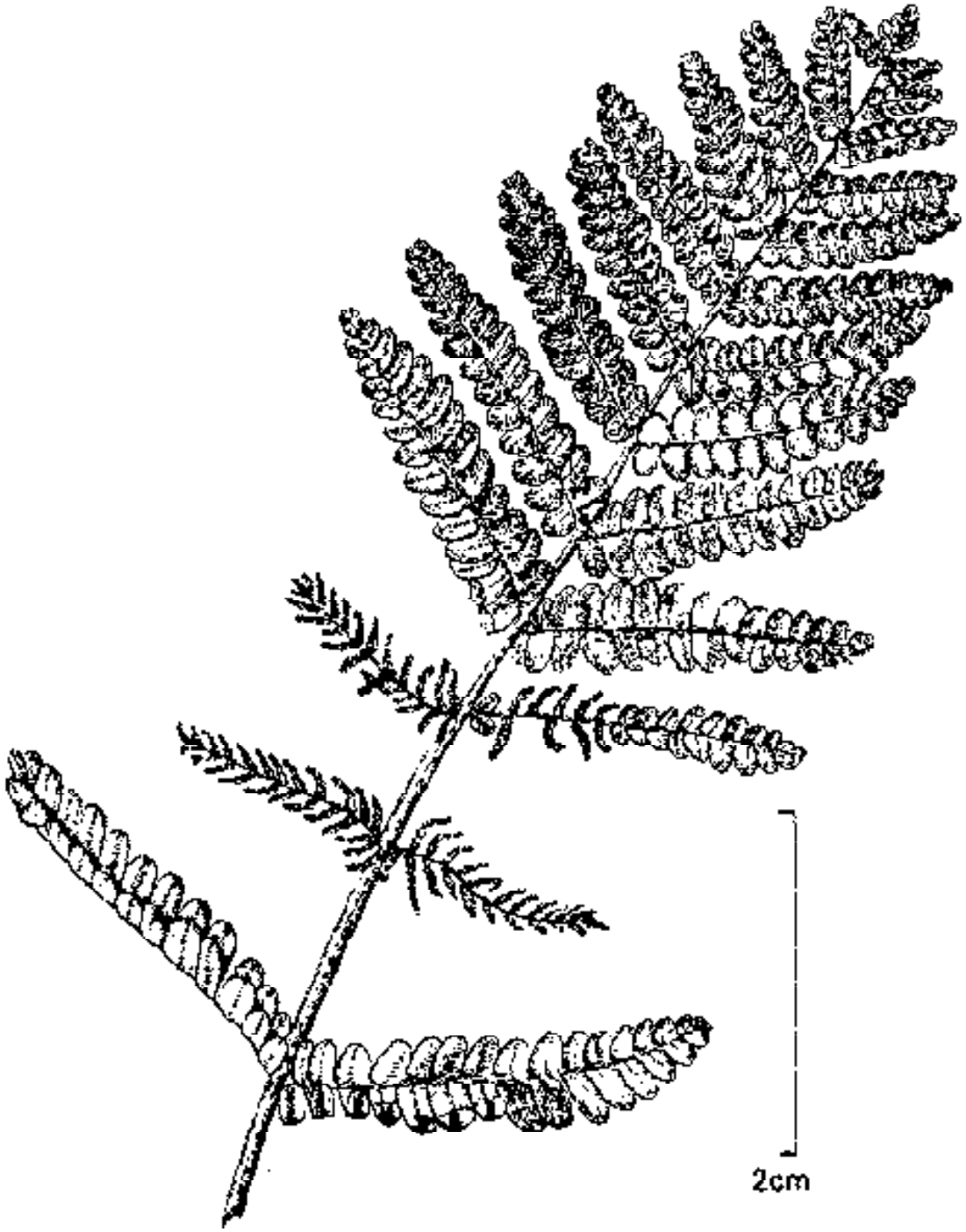


Fig. 73. Osmunda claytoniana L.

1. Lepisorus kashyapii (Mehra) Mehra

Rhizome wide, creeping, loosely attached. Fronds brownish-green.

Common around Sutol-Roopkund area, epiphytic.

2. Lepisorus sesquipedalis (Smith) Fras.-Jenk.,

Rhizome wide-creeping. Scales lanceolate, dull brown. Fronds up to 60 cm long, 2.5-5 cm broad. Sori more or less deeply sunk.

Common, Dharansi to Dibrugheta, 4500 m.

2. PHYMATOPTERIS Pic.-Ser.

Rhizome long creeping. Stipes smooth. Fronds simple, pinnatifid or pinnatisect. Sori large, round, usually sunk in distinct cavities.

The genus is represented in India by 16 species; 2 in our area.

1a.	Stipe 15-22 cm long; sori in a single row near the midrib	**1. P. ebenipes**
b.	Stipe 5-12 cm long; sori in a single row near the costa	**2. P. malacodon**

1. Phymatopteris ebenipes (Hook.) Pic-Ser. (*Phymatodes ebenipes* (Hook.) Ching

Rhizome stout, creeping, elongated and knotted with short, frondiferous branches. Scales black, ovate-lanceolate. Stipes 15-22 cm long, glabrous. Fronds 15-45 cm long, 20-25 cm broad. Sori in a single row near the midrib.

Common, in rock crevices around Roopkund.

2. Phymatodes malacodon (Hook.) Pic-ser.

Rhizome creeping, stout, paleaceous with dense subulate scales. Stipes 5-12 cm long. Fronds coriaceous, base scooped out and subcordate, margins serrulate. Sori large, arranged in a single series nearer the costa.

Common, on hill slopes in rocky places around Donagiri.

3. POLYPODIODES Ching

Epiphytic. Rhizome scales fusco-brown, irredescent. Fronds pinnatifid; veins anastomosing. Sori single along costa.

2 species in our area.

1a. Fronds 8-12 cm long delicate; rhizome thin — **2. P. microrhizoma**
b. Fronds 30-60 cm long, robust; rhizome thick — **1. P. amoena**

1. Polypodiodes amoena (Wallich ex Mett.) Ching

Caudex creeping, stout, densely paleaceous with subulate scales which are sub-adpressed. Fronds 30-60 cm long, 15-25 cm broad, deeply pinnatifid, Sori subglobose, sunken.

Common on mossy boulders around Belta, 3000 m.

2. Polypodioides microrhizoma (C.B. Clarke ex Baker) Ching

Rhizome wide-creeping, clothed with grey-brown, ovate or lanceolate scales. Stipes 12 cm long. Fronds 8-12 cm long, lanceolate, often caudate at apex, ca 30 cm long, deeply pinnatifid. Sori uniserial.

Not common, epiphytic on tree trunks, around Roopkund.

116. SINOPTERIDACEAE

4 genera and 9 species; 2 genera and 2 species in the Biosphere Reserve.

1a. Fronds pinnate to decompound; sori marginal, indusium formed by reflexed margin, confluent — **1. Notholaena**
b. Fronds bipinnatifid, sori intramarginal, protected by a continuous scariose reflexed intramarginal introse indusium — **2. Pellaea**

1. NOTHOLAENA R. Br.

(*Nothos*, spurious; *laenos*, wool-the scales on back of frond pseudo-woolly.

Sori marginal without a distinct involucre; veins free.

2 species in India; 1 in our area.

Notholaena marantae (L.) Desv.

Rhizome stout, horizontal, densely paleaceous with soft silky ferruginous, finely pointed subulate scales; stipes stout, purplish black, 7.5-15 cm long, densely hirsute. Fronds 10-25 cm long, oblanceolate, sori forming a broad border, extending from margin towards costule.

Common, Dibrugheta to Deodi, 3300-3500 m.

2. PELLAEA Link

Pellaea nitidula (Wallich ex Hook.) Hook. ex Baker

Stipes crowded, many, hispid, with subulate deciduous, chaffy dark brown scales. Fronds up to 1 cm long, coriaceous, glabrous, pinnate-pinnatifid. Sori intramarginal.

Common on rock crevices, around Lata villate.

117. THELYPTERIDACEAE

Rhizomes creeping; palea with glandular or setose hairs. Fronds pinnate to tripinnate. Sori dorsal, superficial round to elongate. Indusia reniform or sometimes absent. Sporangia usually with glandular hairs.

21 genera, 80 species in India, 1 genus and 1 species in the Biosphere reserve.

PSEUDOPHEGOPTERIS Ching

Rhizome long creeping, slender. Stipe and rachis usually reddish, scaly at base. Sori exindusiate.

4 species in India; 1 in the Biosphere Reserve.

Pseudophegopteris levingei (C.B. Clarke) Ching

50-60 cm high, rhizome creeping. Fronds weak and flaccid; pinnae 3-7 cm long, lower ones very distant and sparingly covered with long needle like hairs.

Not common, in *Cedrus* forests around Belta, ca 3000 m.

118. WOODSIACEAE

In India the family is represented by 2 genera and 8 species and 2 species in the Biosphere Reserve.

WOODSIA R. Br.
(In honour of Joseph Wood, a British Botanist).

Small herbaceous tufted ferns with globose sori.

1a. Fronds 30-40 cm long, oblong, pinnate; pinnae distant, alternate, sessile; indusium larger than sorus **2. W. elongata**

b. Fronds 3-6 cm long, 3-5 jugate; indusium fragile, globose, enclosing the sori **1. W. cycloloba**

1. Woodsia cycloloba Hand.-Maz.

Densely tufted 3-6 cm high herb, glandular hirsute throughout. Rhizome creeping. Fronds 3-5 jugate. Indusium fragile, globose and enclosing the sori.

Rare above Ramani on way to Bhujgara, 4000 m.

2. Woodsia elongata Hook.

Tufted fern, 30-40 cm high, glandulosely pilose. Pinnae distant, alternate, sessile. Sori globose, indusium larger than the sorus.

Common, on rocky slopes around Roopkund area, 3500 m.

119. SELAGINELLACEAE

Annual or perennial usually terrestrial, herbaceous, creeping or erect plants bearing rhizophores. Branches dichotomous, usually all in one plane. Leaves minute, 1-nerved, hetero-morphous, adpressed to the stem. Strobili usually terminal.

SELAGINELLA P. Beauv.

59 species in India; 3 in the Biosphere Reserve.

1a. Plants xerophytic; stems bright pinkish-red except apical part; leaves isomorphic on the main stem; sporophyll of the strobilus uniform. **2. S. kashmiriana**

b. Plants not xerophyte; stems not pinkish-red; lower leaves dimorphic throughout; sporophyll of the strobilus dimorphic 2

2a. Lateral leaves cordate at base, acute at apex, median leaves cordate **3. S. pallidissima**

b. Lateral leaves subcordate at base, acuminate to aristate, median leaves oblique at base **1. S. chrysocaulos**

1. Selaginella chrysocaulos (Hook. & Grev.) Spring

Slender herbs, usually erect, branches from the base, rhizophores and stolons arising at base. Leaves minute, dimorphic. Strobilus 0.1-0.5 cm long. Spores round, dark brown.

Common on rocks, around Roopkund area.

2. Selaginella kashmiriana (Milde) Dixit

Spreading, dichotomously branched herbs. Leaves dimorphic, spirally arranged.

Common, terrestrial or on moist moss covered rocks, around Ruing area.

3. Selaginella pallidissima Spring

Straggling, slender herbs; rhizophores 1-3 cm long, slender. Leaves dimorphic, green, minute. Strobilus ca 5 mm long.

Terrestrial, common around Tolma-Soraithota on shady, moist hill slopes.

120. EQUISETACEAE

In India represented by 1 genus and 7 species; 1 species in the Biosphere Reserve.

EQUISETUM L.

Equisetum diffusum D. Don

Tufted herbs, 20-30 cm high, erect. Fertile and sterile branches alike; branchlets 5-6 at each node in a whorl. Strobilus ca 2 cm long.

Common on sandy soil, near Dronagiri.

Dactylorhiza hatagirea (D. Don) Soo

Thamnocalamus falconeri Hook.f. & Munro

Ephedra gerardiana Wallich ex Stapf

Cupressus torulosa D. Don

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