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WEED FLORA OF KASHMIR VALLEY

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FOREWORD

Weeds are defined as plants growing where they are not wanted. With the intensive culture of crop plants, where maximum yield is the sole criterion; weeds have been found to be one of the important causes of reduction in yield. The study of weeds—their identity, habitat, morphology and life history; have assumed great importance recently, especially so in India. In Kashmir their importance is all the more greater, since local economy is practically dependent upon the crops grown in limited summer season.

The book is practically the first definitive work on the subject and is specially indispensable for the Kashmir region. Author has done a marvellous work by presenting a weed flora of agricultural crops in and around the valley. The Valley of Kashmir which is endowed with great scenic beauty, is also known since ancient times for specialised crops, i.e., saffron and vegetables grown on floating islands.

The book contains critical taxonomic treatment of 401 weed species belonging to 251 genera distributed over 56 families of Angiosperms. It is represented by 223 natives and 178 introduced species. Proper keys for identification and important phenological data has been provided. There are a number of new records for Kashmir and some for the country as a whole. Illustrations of 100 common weed species, made by the author himself, are also provided.

It is hoped that the book will be useful to the students of botany, amateur collectors and agriculturists.

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SRINAGAR,
June 14, 1985.

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M.K. KAUL

SRINAGAR,
Nov. 26, 1985.

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INTRODUCTION

DEFINITION AND CHARACTERISTICS OF A WEED

A weed in general is a "plant out of place" and may have many definitions such as an unwanted plant; an unsightly, useless or harmful plant; any plant growing in the cultivated fields to the injury of the crop or desired vegetation; plant growth that gives an unfavourable appearance to an area etc. (Jaques 1959). For the purpose of this study a "weed" is taken in its widest sense, which comprises all the definitions given above.

The most important properties that enable the plants to occur as weeds in different habitats are :

1. Capability to thrive under adverse conditions as well as those favourable for crop.
2. Capacity to produce new plants vegetatively if seed production is prevented by mechanical means.
3. Some weeds produce toxic substances, stiff hairs, spines, thorns etc. which protect them.
4. Most weeds have the capacity to produce enormous quantity of seeds which help in their spread and distribution over large areas.
5. Seeds of some weed species remain dormant for as many as 20-40 years. According to Muenscher. (1955) seeds of *Chenopodium album* and *Portulaca oleracea* germinated after having been buried for 20-40 years; those of *Plantago lanceolata* germinated after 10 years.
6. Seeds of weed species mature even after removal from the fields soon after fertilization of flowers. Weeds belonging to the family Compositae often exhibit this character.
7. Seeds of most weeds are provided with special structures for dispersal. Weeds belonging to family Compositae produce silky hairs at the apices of the achenes which help in dissemination; some seeds are sticky and others are provided with spines, hooks and other structures so that these get stuck to the animals and birds who carry these to long distances.
8. Life cycles of weeds coincide with the crop, thereby ensuring the mixture of crop grain and weed seed during the harvest. *Echinochloa crus-galli* is a common weed of rice fields of Kashmir exhibiting this feature.

ORIGIN OF WEEDS

Man made and man-managed vegetation offer special opportunities for weed invasion since :

1. Crops are seldom grown in areas to which they are native and are seldom cultivated in the natural state. Consequently they are inferior to the natural vegetation of an area in terms of competition. The invasion of crops by weed is, therefore, simply the

process of replacement of a less competitive plant by a more efficiently adapted one—a feature of plant succession.

2. Crops are usually sown in rows, since it is easier to design equipment for sowing or planting in this way and for further cultural operations. A consequence of this is that gaps between the rows, in the early stages of crop growth, are available for colonization of other species.

3. Crops are usually grown in pure stands because they are then easier to sow, cultivate, fertilize, harvest and to ensure higher yields. A single species, however, seldom fully exploits a habitat. A crop may fail to exploit the light falling on the area in spring and early summer because its leaf area in spring and early summer develops slowly, it may fail to exploit the whole growing season as it may have an innately short growing cycle; it may fail to utilize the available water or nutrient supply through the distribution of its root system. Other species or "Weeds" may successfully exploit these wasted resources in the habitat.

4. A large percentage of weeds are not native plants. In this study we find that many European plants thrive as weeds in Kashmir.

5. It is widely held by laymen and professionals alike that weeds, unlike other plants are capable of growing practically every where; if certain weeds do not occur in a specific region, state or country, it is because they have not been introduced there. Some weeds are indeed so tolerant of varying climatic and local ecological conditions as to lend considerable credulence to this belief.

Weeds may be absent from limited areas e.g., specific farms, either because : (i) they have not been yet introduced or have been successfully eradicated; or (ii) because they are not adapted to grow there.

Regions of the world which have similar climates and in which similar crops are grown, usually possess many weed kinds in common.

DISTRIBUTION OF WEEDS

Of the various agents by which plants are disseminated, man, wind, water and animals play an important role (Ridley, 1930). The ways by which weeds are disseminated are :

1. Dissemination as ornamentals

Some plants brought as ornamentals have a tendency to escape as weeds e.g., *Delphinium incanum, Linaria dalmatica, oenothera drummondi. Bellis perennis* etc.

2. Dissemination through impurities in crop seeds

The seeds of some weeds are about the same size, shape and weight as some crop seeds and are therefore planted along with the crop.

3. Dissemination through agricultural implements & manures

Perennial weeds tend to make appearance before the crop has started growth and during ploughing the perennating organs of these weeds are cut into pieces or carried to long distances in the fields.

4. Dissemination through hay and feed stuffs

Animal feed carry weed seeds along with the grain and hay etc. as impurity and are eaten. These are passed through the alimentary canal as such and excreted at different places where they germinate to produce new plants.

5. Dissemination through wind

Many weed seeds produce hairs, wings and other appendages which render them light to be carried easily by wind.

6. Dissemination through water

Seeds are carried by water to long distances. Such seeds are frequently washed into streams by surface run-off during heavy rains. Irrigation is major disseminating agent as it carries weed seeds from different areas into the fields.

7. Dissemination through animals

Animals are one of the best weed disseminating agents as they wander from place to place. Many weeds produce seeds which are sticky and provided with certain hook like appendages by which they are carried about by clinging to wool or fur of larger animals. Rodents and ants also help in seed dissemination. *Medicago lupulina* and *M. minima* are common weeds of lawns, grasslands, meadows, which produce such sceds. Many birds eat certain fruits and seeds which pass through the digestive tracts remaining viable because of thier hard covering and are excreted out.

WEEDS AND THE ORIGIN OF CROPS

Certain authors opine that an efficient and well adapted weed may find itself taken up and turned into a crop (Harper, 1959). This is generally accepted as the mode of origin of oats and rye. The last meal of the iron age man whose body was found in a bog at Tollund, Denmark is supposed to have consisted largely of a mixture of barley, *Commelina linicola* and *Polygonum lapathifolium*. Other archaeological evidence of deliberate collection for food is available for *Spergula arvensis*, *Chenopodium album*, *Polygonum* and *Bromus* spp. Other weeds which have been gathered included species of *Stellaria* and *Galeopsis* (Harper, 1959).

In this connection, it would appear reasonable that our crops themselves, are in fact, the cultivated, and enormously improved descendents of the ruderals, which colonized the rubbish heaps of primitive man. "If our crops are cultivated ruderals, then in a very real sense the history of weed is the history of man" (Harper, 1959).

GEOGRAPHY OF THE AREA

The State of Jammu and Kashmir, mostly a mountainous area of 2,22,870 sq km, occupies a central position in the continent of Asia and is located in the north-western corner of India between 32°16′ to 37°0′ North latitude and 73°26′ to 80°30′ East longitude. The present study covers the Valley of Kashmir which includes the district of Srinagar completely and some adjoining areas of Baramulla and Anantnaga districts. Srinagar is the summer capital of the state and lies at 1676 m above sea level.

Bioclimate

The Kashmir Valley falls in the temperate zone and has a marked variation in temperature and precipitation. Summer rains are uncertain because of mountainous barriers. The average annual precipitation is about 66 cm. The maximum rainfall is received in the months of March and April and at times in May. The relative humidity in the morning hours varies between 78 per cent and 90 per cent while in the evening hours it varies between 46 per cent and 78 per cent. The maximum temperature seldom touches 37°C while the minimum temperature does not fall below -7°C and occasionally, however, it may go down even below -12°C. The first snowfall usually occurs in the last week of December.

Soils

According to Butt (1966) the temperate zone of Kashmir consists of 4 basic soil types :

i. Lower Belt,
ii. Karewas,
iii. Lower Belt Kandi and
iv. Forest Belt Kandi.

The area under present study mostly falls in the *Lower Belt* and *Karewas*.

i. *Lower Belt :* In this area there is good accumulation of organic matter and nitrogen and soils are mostly of sandy or silty clay loam type. Organic matter content ranges from 34,000 lbs to 60,000 lbs and nitrogen content ranges from 2,000 to 5,000 lbs. per acre. Both the "total" as well as "available" content of nitrogen is very high and the quantity of phosphorus is good enough to meet field crop requirements. The average pH ranges from 5.4 to 6.7 (Butt, 1966). The high contents of organic matter in these soils is attributable to the huge additions of plant residues through crop stubbles, natural vegetation and animal excretory products. This area is under the cultivation of cereal crops like rice, wheat and maize; vegetable crops and fruit crops.

ii. *Karewas* : According to Wadia, Pleistocene or post-pliocene ice age deposits of fluviable, lacustrine or glacial nature have spread over many parts of Kashmir, to which the local name "Karewa" has been given. The Karewa chiefly consists of loam or loamy clay with faint stratification.

Here the organic matter content ranges from 8,000 to 36,000 lbs and nitrogen content from 400 to 2,000 lbs per acre (Butt, 1966). In spite of good "total" phosphate content the "available" phosphorus is poor. The pH ranges from 5.7 to 7.5. The natural vegetation is poor. Besides wheat, pulses, and oil bearing crops such as moog, gram, lin-seed etc.; saffron is also cultivated in these soils.

iii. *Kandi* : The Kandi soil is a local version for gravelly soil which may have recently originated from hilly areas and is suited for maize cultivation.

Crops

The total area under different crops in Kashmir is tabulated in Table 1.

TABLE 1.

*Total area sown under different crops in Kashmir.

Crop	Area under cultivation Area sown (in 100 hectares)
Rice	162
Wheat	11
Maize	102
Pulses & Millets	24
Fruits & vegetables	31
Oil seeds	24
Condiments & spices	1
Other non-food crops	4
	352

*Data from Digest of Statistics (1975-76), J & K Govt.

i. *Cereal crops* : The main cereal crops of Kashmir are wheat, rice and maize. Wheat is sown in November to December and remains under snow during winter and is harvested in May to June. Rice and maize are sown in May and harvested by September to October.

ii. *Vegetable crops* : Vegetables cover a considerable area of cultivation in Kashmir with certain fields meant exclusively for them. At times vegetables are grown in orchards and frequently on floating islands in the lakes of Kashmir. The common vegetables are : 'Hakh Sag' (*Brassica oleracea* var. *sagi*), Karam (*Brassica oleracea* var. *karmi*), carrot, turnip, cabbage, cauliflower, raddish, chillies, tomato, brinjal, potato, onion etc. The vegetables are also grown on floating strips of land in lakes.

iii. *Fruit crops* : Kashmir Valley is notable for its orchards. Fruit trees are perennial and offer opportunities for weed invasion because of considerable space left between them. The main fruits of Kashmir are apples, pears, apricots, almonds, walnuts, peaches, cherries, grapes, loquat, pomegranates, etc.

iv. *Saffron* : Saffron is a specialized crop and is sown mostly in the Pampore area. The fields for saffron cultivation are exclusively meant for growing this crop. Bulbs are sown in August or September and flowering occurs in October (often synchronous) of the following year. Once sown 2-3 crops are taken from the same plant. Saffron of commerce is the trifid style of the flower.

v. *Grasses and forage crops* : Cattle feed is mostly derived from straws of cereals and from plant residues of pulse crops and other legumes. Even for providing fresh leafy fodder, grasses such as *Cynodon dactylon*, *Poa annua*, *Bothriochloa ischaemum*, *Hordeum murinum*, *Lolium temulentum*, *Bromus inermis* and others are allowed to grow in areas which form grazing grounds. Some forage legumes like *Medicago sativa*, *Trifolium pratense* etc. are cultivated at certain places.

OBJECTIVES OF THE PRESENT STUDY

Crop plants along with the associated weeds represent a typical plant community, the study of which has attracted the attention of taxonomists as well as ecologists. Taxonomists generally restrict their observations mainly to the species content of weed infestations in the crop fields. Ecologists on the other hand enquire into the botanical composition and distribution pattern of weeds. Further, weeds being one of the most important pests lowering agricultural production, their control is recognised as a major problem in the forum of Agriculture or land development programme. In Kashmir no attempt has been made yet to study the weed problem. The extent of damage caused by weeds depends upon the nature of weeds, their strength, the association with the crops and other biotic and edaphic characters Joshi (1973) in the 4th Conference of Asian Pacific Weed Science Society held in New Zealand read an article 'Some problems and progress of weed control in India—1948-72' reviewing the losses caused by different weeds and State-wise-coverage/target of weed control during 1969-74. One of the objectives of the coordinated weed control scheme is to investigate the weed flora of the various regions.

Early attempts in controlling weeds were mainly mechanical; use of chemicals was introduced towards the end of the last century. Before taking any step to control weeds, especially by means of chemicals, a thorough knowledge about their taxonomy, morphology and life history must be sought because of selective and differential behaviour of herbicides. Survey of weed flora associated with different crops, wastelands, orchards, playgrounds and other places covers an integral part of the programme on weed research. The present study includes a critical taxonomic treatment of all kinds of weed species and data regarding their seed output, mode of dissemination, germination, viability flowering and fruiting, habitat conditions, root system, distributional pattern etc. This work, it is hoped, will also be of considerable help to workers on the regional flora of the country. As the flora of Kashmir is yet to be compiled, the present work will certainly contribute towards the compilation of such a floristic work.

REVIEW OF LITERATURE ON WEEDS OF INDIA

Unfortunately 'weeds' have for many years been regarded as slightly improper material for study and almost all aspects of their biology except those closely related to control measures have been badly neglected. Recently, however, studies on all aspects of weed biology have gaiaed momentum. Indian work on the ecology of ruderals and crop area weeds finds a general extensive coverage in such reviews as 'Thirty years of Ecological Research' (Misra, 1967); Contribution to Botany by Prof. R. Misra' (Pandeya, 1967) and 'A decade of plant Ecological Research at Benaras Hindu University' (Singh & Singh, '67). A detailed list on 'Weeds of Agricultural Importance of India' was published by Joshi and Singh, 1965.

Earlier publications on the weed flora are mostly in the form of manuals and handbooks (Kenoyer, 1924; Thadulingam and Narayan, 1932; Luthra, 1938; Singh and Mittal, 1941 and Thakur, 1954). In 1952, 13 weed control schemes on co-ordinated basis were sanctioned by Indian Council of Agricultural Research. The work has started in Tamil Nadu and Bose Research Institute, Calcutta and subsequently in other states of India. The main objective of the co-ordinated weed control scheme was to investigate the weed flora of the regions.

Reports are available on the ecological survey of paddy fields from several parts of the country (Misra and Mohanty, 1962; Dutta and Maiti, 1963; Pandey and Shah, 1964; Shanker, 1965, 1966). In general these reports provide the information on number of weeds, the families to which they belong and the flowering periods. Some of the workers (Pandey and Shah *l.c.* and Shankar *l.c.*) have described the temporol changes in the habitat conditions of the paddy fields and concommittant changes in the weed flora. Cyperaceae holds the largest share of the weed infestation in the paddy fields, closely followed by Gramineae.

Weed flora of the rabi crops has been reported by several workers (Singh, 1961; Tripathi, 1963, 64 and Shanker, 1970). Some of the workers have reported weeds of both Kharif and Rabi seasons (Edwards, *el al* 1963; Bajpai and Verma, 1964; Mehra and Singh, 1969 and Farode, 1969). The weed flora of research farms growing medicinal plants has also been tackled by some workers (Misra and Chaudhari, 1973). Others (Tripathi *l.c.* and Shanker, *l.c.*) reporting on ecological surveys of weeds of rabi crops have categorised preponderance of weeds into such classes as abundant, frequent, occasional and rare. A series of articles have been published on common weeds of south Indian Tea fields (Haridas and Venkataramani, 1972; Haridas and Sharma, 1971, 1973).

ECONOMIC IMPORTANCE OF WEEDS

In 1930 report of Agricultural Services Department Committee, U.S. Chamber of Commerce, the estimated losses due to different groups are as follows :

1. Diseases of livestock (not including deaths from poisonous plants). ... $250,000,000
2. Plant disease (10 leading crops and forests trees). ...$1,190,000,000
3. Insect pests of plants and animals. $1,125,000,000
4. Weeds .. $3,000,000,000

Shaw (1964) pointed out that the annual national loss in agricultural production due to

weeds and their cost of control exceeds 4.5 billion dollars in U.S.A.

In India, we feel that the weeds are responsible for significant loss of agricultural and horticultural produce. Luthra (1938) estimated that there may be reduction of 30 per cent in the crop yield due to weeds. Kumar (1940) reviewed that wild rice reduced the yield of paddy from 50-60 per cent in Himachal Pradesh & Madhya Pradesh. Asana (1951) reported that unchecked weed growth in a wheat field took up as much as 17 lbs of Nitrogen from an acre of land reducing the yields by nearly 2 quintals i.e. 410 lbs. to an acre. According to Joshi (1973) it is observed that losses caused by weeds could in some cases be as high as 70-80 per cent. Even if we take the loss to be 10 per cent (almost conservative estimate) of the total agricultural produce, the amount for this country would come to Rs. 4,200/- million for principal cereals, pulses. oil seeds, cotton, sugarcane and chillies. According to a recent announcement of Dr. S.R. Barooah, Fertilizer Commissioner of India, it is estimated that weeds eat away 30 to 40 per cent of the plant nutrient applied to crops. He said that 66,000 tonnes of nutrients would be saved every year if the weed control programme could be taken seriously. It is, therefore, necessary to make a detailed survey of weeds before any physio-ecological approach towards their elimination is made.

MATERIALS AND METHODS

This work is based on field collections made from 1968-1972 over a period of 4 years. Almost every field in the locality was visited frequently and the specimens collected were pressed in the laboratory after a careful examination of the different parts. Notes regarding root systems, average seed out-put, germination, flower colour etc. were entered in the field books. Collections were provisionally identified with the help of relevant floristic works. Illustrations were drawn from the living specimens.

Work in the Herbaria

All collections were compared with authentic specimens at several recognised herbaria of the country such as Forest Research Institute, Dehra Dun (DD); Botanical Survey of India, Northern Circle, Dehra Dun (BSD); Central National Herbarium Sibpur, Howrah (CAL); provisional identifications were confirmed by matching the specimens with authentic collections. The specimens of which the identity seemed doubtful were submitted for favour of confirmation to well known authorities in India and abroad whose help has been acknowledged at relevant places.

Nomenclature

The families have been grouped together in accordance with Bentham and Hooker's Classification.

Every affort has been made to settle the legitimate name for eacn species. Important references have been cited. Relevant synonyms have been appended wherever necessary.

Keys

Convenient keys to the genera and species are given. These keys have been designed to help the reader to place the genus or the species to which the plant belongs. They have been made as simple as possible, often adapted from existing floras. Genera under a family and the species within a genus are treated in the same sequence, as they appear in respective keys in the body of this work.

Description and field data

Weed species have been described from materials collected and from field observa-

tions. The descriptions have been checked with authentic floristic works. Habitat characters and observations on the root systems make an original contribution to our existing knowledge. The period of flowering, type of seed dissemination and preliminary data regarding viability of seeds, average seed out-put and germination, form an important contribution so far as this weed study is concerned. Various weeds act as indicator plants and throw considerable light on the nature of habitat and some soil factors.

Local names and uses

Generally local names have a limited advantage in identifications of the plants as the same plant may be called by different names in different areas of the same district; or a number of plant species may be called by the same name. A scientific name which is internationally accepted carries more importance. Even so local names have a definite limited utility so they are iucluded wherever known and found feasible to record.

Illustrations

As illustrations form an important part in the ready identification of a species, it was felt that at least those weed species which are not illustrated in any of the readily available works. should be illustrated. From a purely Botanical point of view, there is no doubt, that nothing else can replace a good line diagram for conveying precise details, as structure of flower, fruits etc. for correct identification. One hundred weed species have been illustrated in the present work. All illustrations are prepared by the author.

ABBREVIATIONS

Some of the references commonly cited in the text have been abbreviated for the sake of convenience. These are :

Blatter	Blatter, E. *Beautiful Flowers of Kashmir.* Vols. 1-2. 1928-1929.
BOBSI	*Bulletin of the Botanical Survey of India.*
Bor	Bor, N.L. *The Grasses of Burma, Ceylon, India and Pakistan* (excluding Bambusae). 1960.
Collett	Collett, H. *Flora Simlensis.* 1902.
CAL	Central National Herbarium, Sibpur, Howrah.
DCA	Darlington, C.D & Wylie, A.P. *Chromosome Atlas of Flowering Plants.* 1955.
DD	Herbarium of Forest Research Institute, Dehradun.
FBI	Hooker, J.D. *et al. Flora of British India.* Vols. 1-7. 1872-97.
Kitamura	Kitamura, S. *Flora of Afghanistan.* Res. Kyoto Univ. Sci. Exped. 2 : 1-486, 1960.
Polunin	Polunin, G. *Flowers of Europe.* Oxford University Press. London. 1969.
RBSI	*Records of the Botanical Survey of India.*
Stewart	Stewart R.R. An annotated catalogue of the vascular plants of West Pakistan and Kashmir. In E. Nasir & S.I. Ali, *Flora of Pakistan,* 1972.

Note :— Voucher specimens cited in the text collected by author (*Kaul*) have been deposited in Blatter Herbarium, Bombay (BLAT) and Regional Research Laboratory Herbarium, Srinagar, Kashmir.

ANGIOSPERMS

DICOTYLEDONS

RANUNCULACEAE

Key to the genera

1. Flowers spurred, fruit a follicle — **Delphinium**
1. Flowers not spurred, fruit an achene :
   2. Flowers small, or large and showy, of variable colours :
      3. Terrestrial plants, flowers large and showy :
         4. Rootstock woody or tuberous, leaves segmented, segments orbicular — **Anemone**
         4. Rootstock never woody, leaves segmented, segments filiform — **Adonis**
      3. Aquatic plants, flowers small and white — **Batrachium**
   2. Flowers generally showy, always yellow :
      5. Leaves radical and cauline, segmented, flowers leaf opposed or panicled — **Ranunculus**
      5. Leaves all radical, segmented, flowers solitary on woolly scapes — **Ceratocephalus**

DELPHINIUM Linnaeus

Key to the species

1. Spur cylindric or inflated; follicles 3, hairy — **roylei**
1. Spur subulate; follicles 3, inflated — **denudatum**

Delphinium roylei Munz in J. Arn. Arb. 48 : 292, 1977; Stewart 267. *D. incanum* Royle Illus. Bot. Him. 55, 1835 non E.D.; Clarke 1812; FBI 1 : 25; Blatter 1 : 21; Cov. Wild Fls. Kashmir 3 : 11, pl. 6, 1929; Rao in RBSI 18(2) : 13, 1960. **(Fig. 1)**

Annual herbs. Stem 15-50 cm. erect, branched or unbranched, leafy, hoary. Radical leaves palmately segmented, 3-5.5 cm diam; petiolate; petiole up to 1.5 cm., downy; segments sub-pinnatifid and linear; soon falling off. Cauline leaves similar 1.5-2.5 cm diam, subsessile to sessile; generally upper ones sessile, alternate, 3-partite, segments multifid, linear, glabrous or slightly tomentose. Racemes 3.6-15 cm long, simple, terminal and dense flowered. Bracts 0.5-2 cm long, leafy segments linear; bracteoles 2, up to 3 mm long linear, hoary, opposite or alternate. Flowers 2-3 cm long, deep blue, pedicellate; pedicel 1-1.8 cm long, tomentose. Sepals 5, bluish smaller than the spur, slightly hairy outside spur up to 1 cm long, cylindrical or inflated. Petals smaller, deep blue. Stamens many generally 10-15, filaments with flattened bases tapering upwards, anthers small, somewhat globular. Ovaries generally 3, elongated and beaked ovules small, many. Follicles 3, tomentose. Seeds up to 2 mm diam; many, slightly triangular, brown with wrinkled seed coat.

Germination : March-April.

Fl. & Fr. : May-Aug.

Dissemination : The seeds are light, easy to be carried by wind. This is probably an escape from cultivation.

Habitat : A very rare weed found in wheat and linseed fields, on open and drier situations. Fertile soil indicators.

Geographical distribution : Temperate Himalaya; Kashmir to Kumaon.

Specimen examined : *Gammie s.n.* (25-7-1891) Kangan, Kashmir (DD); *Keshavanand* 25889 (14-8-1907) Kashmir (DD); *Kaul* 215A (22-6-1970) Hyderpora wheat fields.

Delphinium denudatum Wallich ex Hook. f. & Thoms. Fl. Ind. 49, 1855; FBI 1 : 25; Collett 12-13; Blatter 1 : 22; Cov. Wild. Fls. Kashmir 3 : 13, 1929; Rao in BOBSI 2 : 394, 1960; Stewart 266.

Annual herbs. Stem 30-55 cm erect branched, rarely unbranched woody below, leafy, hoary towards the apices of the branches. Radical leaves palmately segmented, 9-16 cm, petiole up to 0.5 cm long, slightly hairy segments linear, entire, sub-pinnatifid, glabrous or hairy (young growth densely hairy). Cauline leaves similar to radical ones, shortly stalked, 5-9 partite, alternate, glabrous or slightly hairy. Bracts linear, 2-3 partite, bracteoles 2, densely hairy. Flowers 2-3.5 cm long, pale to deep blue, in lax much branched racemes Sepals pale blue; pubescent outside, anterior petals 2-fid, spur up to 2.5 cm long, somewhat subulate, hairy on both sides. Stamens many, filaments slender, anthers globular. Ovary 3-celled, free, slightly pubescent when young. Follicles 3, inflated. Seeds many, brown with a wrinkled seed coat.

Germination : Early March (Spring).

Fl. & Fr. : May-July.

Dissemination : Wind is the main seed disseminating agent.

Habitat : The species is found in orchards and some vegetable gardens.

It prefers to grow in loose, aerated, fertile and nitrogenous soils.

Geographical distribution : West temperate Himalaya : From Kashmir to Kumaon.

Specimens examined : *Gammie s.n.* (10-5-1891) Srinagar (DD); *Kaul* 159 (26-4-1970) Shalteng, Srinagar orchards.

Chromosome report : 2n = 16 (Kaul & Gohil 1973).

ANEMONE Linnaeus

Anemone biflora DC. Syst. 1 : 201, 1818; FBI 1 : 17; Bamber in Plants of Punjab, 453, 1916; Blatter 1 : 5-6; Kitamura in Fl. Afghanistan 119, 1960; Stewart 260. **(Fig. 2)**

Perennial herbs with flowering stem up to 20 cm and a tuberous rootstock 1.5-2.5 cm diam. Scape slender and glabrous, sometimes slightly hairy towards the flower. Leaves directly arising from the rootstock, petiolate; petiole 2.5-10.0 cm long, slender and glabrous; 3 fid lobes suborbicular or broadly cuneate, generally 1-3 partite, glabrous. Involucral leaves (leaves on the scape) sessile, lobed to the middle or even base, similar in shape to the radical ones. Flowers 2-3.5 cm diam white with a pinkish tinge, showy. Sepals 4-9, lobes broader in the middle and tapering towards both ends. Petals 0; stamens many, anthers as well as filaments are reddish, anthers basifixed, longer than the filaments. Achenes up to 3 mm diam with a curved style, all over hairy, embedded in dense wool especially at maturity.

Germination : The bulbs start sprouting soon after the winter is over and snow melts

from the soil surface in late February or early March.

Fl. & Fr. : End of March-April.

Dissemination : The seeds are produced in large numbers and because of woolly structures covering it are easily carried by wind; but these are not viable and do not germinate. The plant reproduces vegetatively and bulbs are mostly carried with the soil from one place to another, during ploughing or other field operations.

Habitat : It grows on slopes, mounds and fallow fields. Indicators of compact gravelly soils.

Geographical distribution : Iran, Turkestan, Afghanistan and India : Kashmir.

Specimens examined : *Keshvanand* 1136 (3-4-1909) Baramulla (DD); *Kaul* 116 (12-3-1970) Sanat Nagar orchards.

Chromosome report : 2n=16 (Kaul & Gohil 1973).

ADONIS Linnaeus

Adonis aestivalis Linn., Sp. Pl. 771, 1762; FBI 1 : 15; Collett 8; Blatter 1 : 12; Stewart 260. **(Fig. 3)**

Annual herbs. Stems up to 45 cm erect, unbranched or slightly branched towards the apices, hairy, hairs spreading, quite apart. Leaves alternate, many segmented with linear, filiform and generally glabrous segments, 3-8 cm. long; lower petiolate; petiole somewhat hairy. Flowers bracteate, bracts leafy; 1.5-4.0 cm diam., showy, solitary terminal. Petals 5-10, oblong, variously coloured commonly reddish or purplish, sometimes faint pink with a dark scarlet eye at the base. Stamens many with dark anthers. Achenes 2-4 mm diam. slightly longer than broad, arranged on a somewhat flat receptacle, beaked: beak slightly decurved, glandular, oblong with a deppression just below the beak, angular.

Germination : March (early spring).

Dissemination : The seeds are somewhat heavy and are mostly disseminated through animals and also ploughing implements.

Habitat : A common spring weed of orchards, wheat fields, pea fields, linseed fields and some grasslands. Generally found on fertile, moist alluvial soils. Loam indicator.

Geographical distribution : Europe, Mediterranean region, Central Asia, Iran, Afghanistan, Western Himalaya : from Kashmir to Kumaon, Hazara & Peshawar.

Specimens examined : *Keshavanand* 27065 (3-6-1908) Dobgah, Srinagar (DD); *Kaul* RRL 5940 (12-3-1969) Habak orchards.

BATRACHIUM S.F. Gray

Batrachium trichophyllum (Chaix) Bosch. Prod. Bot. 7, 1850; Kitamura 122.

Ranunculus trichophyllus Chaix in Vill Hist. Pl. Dauph. 1 : 335, 1786; Stewart 273.

R. aquatalis L. var. *trichophyllum* Baker ex Hook. f. & Thoms. in Hook. f., FBI 1 : 16, 1872.

Annual herbs with long trailing stem, rooting at nodes. Leaves with linear and filiform large segments; stipules membranous, slightly tobular. Fruit a globular head of achenes, up to 5 mm. diam. Achenes up to

0.3-0.5 mm diam., oblong with a rounded apex and small beak, minutely hairy, hairs white.

Germination : April - May. The seeds germinate under water.

Fl. & Fr.: June - July.

Dissemination : The flowers come out of the surface of water for pollination and produce seeds which after maturity fall into water. The water acts as main disseminating agent.

Habitat : A common weed growing in shallow water, streams, ditches and paddy fields. The weed is submerged in the water and only flowers come out of surface of water. It possesses a gregarious habit.

Indicator of muddy or damp soils.

Root system : The roots are thoroughly branched which bind the plants in the muddy soils and do not allow these to be carried along with the running water.

Geographical distribution : Himalaya, Europe, Siberia, Afghanistan, North America.

Specimens examined : *Kaul* RRL 16027 (29-5-1971) Awantipore, paddy fields.

Remarks : I have followed Kitamura (1960) in considering *Batrachium* as a distinct genus.

Chromosome report : 2n= 32 (Love & Love vide Taxon 14(6) : 196, 1965).

RANUNCULUS Linnaeus

Key to the species

1. Perennial herbs, achenes smooth with short beaks :
   2. Terrestrial or semi-aquatic herbs with erect or decumbent stems :
      3. Semi-aquatic herbs. Stem erect; fruit a globular or elongated head of many achenes :
         4. Leaves simple, tongue-shaped; flowers 5 cm. diam. **lingua**
         4. Leaves 3-fid segments oblanceolate; flowers 1 cm. diam. **sceleratus**
      3. Terrestrial herbs. Steam decubent; fruit a globose head of any achenes **diffusus**
   2. Terrestrial herbs with erect stems :
      5. Leaves with 3 leaflets, each leaflet petiolate **cantoniensis**
      5. Leaves simple, deeply 3-segmented **laetus**
1. Perennial tufted small herbs, achenes tubercled. **flaccidus**
1. Annual herbs, achenes echinate or tubercled :
   6. Achenes echinate, not margined **arvensis**
   6. Achenes tubercled or smooth, margined **muricatus**

Ranunculus lingua L., Sp. Pl. 549, 1753; FBI 1 : 16; Blatter 1 : 13, pl. 2. t. 5.

Perennial herbs with a thick creeping rootstook which is about 45 cm long. Stem 50cm - 12 cm. erect, fistular, light green, glabrous. The lower leaves are tongue shaped or cordate, 12 cm - 20 cm x 3.5 cm - 6 cm, sessile, margins entire; upper stem leaves are lanceolate, semiamplexicaule, much smaller, generally entire or with a few teeth. Flowers up to 5 cm. diam., pedicellate, shining yellow and showy, forming a small panicle. Sepals

and petals 5, stamens many. Achenes broad, flat, pitted, beak elongated aggregated in a globular head.

Germination : Spring (March).

Fl. & Fr. : May - August.

Dissemination : The seeds are disseminated mainly by water.

Habitat : An occasional herb of floating islands and marshlands associated with *Typha latifolia*. Marsh indicators.

Root system : A thick but fistular stoloniferous rootstock going up to 45 cm. in muddy soil; bunches of adventitious roots arise from the nodes.

Geographical distribution : Warm temperate zone, Furope, N & W Asia, Himalaya.

Specimens examined : Kaul 359 (2-6-1973) Dal Lake floating islands.

Ranunculus sceleratus L. Sp. Pl. 551, 1753; FBI 1 : 19; Collett 10; Blatter 1 : 15; Hand., Mazz. Acta Horti. Gotoburg 13 : 162-1940; Kitamura in Res. Kyoto Res. Exped. 8 : 93, 1966; Rao in BOBSI 2 : 394, 1960; Polunin 104; Stewart 273. **(Fig. 4)**

Perennial herbs. Stem 20-100 cm erect, often stout, fleshy, somewhat fistular, branched, glabrous or slightly puberulous near the apices of the branches. Radical leaves deeply 3-lobed, lobes segmented, deeply toothed 4.0-9.5 cm., petiole 4.5-7 cm, glabrous and succulent. Cauline leaves 3-fid, segments 2.0-6.5 cm oblanceolate, glabrous, sessile. Flowers up to 1 cm diam., pale yellow, stalked; stalk 0.5-2.5 cm or more elongated in fruit. Sepals 5, 1.5-2.5 mm diam; glabrous, reflexed, caducous. Petals equal in number, longer than sepals, lobes oval, spreading, falling off soon. Fruit an oblong head of many inflated, not margined, smooth, blunt or sharp pointed, wrinkled achenes, up to 1.2 cm long; each achene 2 mm diam; the head finally becoming cylindrical, Receptacle oblong, glabrous or slightly pilose.

Germination : April.

Fl. & Fr. : June-September.

Dissemination : The seeds are mostly disseminated by water.

Habitat : As the weed reproduces both vegetatively and by seed, it proves to be a difficult weed inhabiting ditches, shallow water puddles due to rains. irrigation channels of wheat fields etc. Marsh indicators.

Root system : Stoloniferous root system going to considerable distances inside the soil. The cut pieces give rise to new plants.

Geographical distribution : North temperate zone.

Specimens examined : Kaul RRL 911 (20-5-1969) Ganderbal fallow fields; *Kaul* RRL 16015 (18-3-1971) Hyderpora, wheat fields.

A variable form of this species collected from Srinagar is different in following points :

1. Annual herbs,
2. Stem up to 20 cm in height, never fistular,
3. Flowers up to 0.5 cm diam.
4. Fruit an oblong head of several achenes, up to 0.5 cm long.

Germination : Middle February.

Fl. & Fr. : Mid March-Mid July.

Specimens examined : *Kaul* 132 (29-3-1970) Chishma Shahi swamps; *Kaul* 180 (11-5-1970) Hyderpora wheat fields.

Ranunculus diffusus DC., Prodr. 1 : 38, 1824; FBI 1 : 19, pp.; Finet & Gagnep. in Bull. Soc. Bot. Fr. 51 : 308, 1904; Rao in BOBSI 2 : 394, 1960.

Perennial prostrate herbs with a thick rootstock from which arise long stoloniferous roots. Stem up to 20 cm decumbent, longitudinally ribbed, hairy, hairs white, spreading and lax. Radical leaves 3.5-8 cm diam. petiolate; petiole 5-10.5 cm slightly hairy; generally 5-partite, segments cuneate or obovate, sharply toothed, middle one longest giving the leaf an ovate outline, slightly hairy, hairs spreading. Cauline leaves short stalked or sessile, similar but shorter. Flowers 0.9-1.8 cm diam. pedicellate; pedicel glabrous or hairy; deep yellow. Sepals 5, 0.3 to 0.8 cm diam. hairy, caducous. Petals 5, slightly longer than the sepals with a small nectary at the base. Stamens many, anthers basifixed, filaments slightly longer than the anthers. Fruit a globose head of smooth, flattened, minutely dotted achenes. Each achene 0.2-9.4 mm diam. style very short, straight or curved. Receptacle smooth.

Germination : The seeds remain dormant for the winter and spring and start germination in early summer (early June).

Fl. & Fr. : August-October.

Dissemination : Water is the main seed disseminating agent. The rain water carries the mature seeds to the fields.

Habitat : The weed prefers to grow in moist and well irrigated fields and is found in damp areas or the margins of paddy fields.

Root system : The rootstock is thick sending down long creeping rootlets which act as soil binders.

Geographical distribution : Sumatra, Java.

Specimens examined : *Kaul* RRL 19729 (29-9-1971) Hyderpora paddy fields.

Ranunculus cantoniensis DC., Prodr. 1 : 43, 1824; Hand.-Mazz. in Acta Hort. Gotoberg 13 : 165, 1940; Stewart 270. **(Fig. 5)**

R. pensylvanicus auct. non L. f. (1781); FBI 1 : 19; Sabnis in J. Bombay Nat. Hist.Soc. 42 : 126, 1942.

Perennial herbs. Stem up to 70 cm rooting at the base only, roots thick and stoloniferous; generally, solid, branched, densely hairy towards the base and less hairy upwards; hairs white. Radical leaves long petioled; petioles up to 15 cm long, densely hairy; often divided into 3 leaflets; each leaflet with a petiole 0.5-2.5 cm hirsute, deeply cut into somewhat linear segments; segments pinnatifid, pubescent, more pubescence on under surface. Cauline leaves short stalked, upper ones sessile; leaflets with small petioles or sessile, deeply cut into many linear segments, lower surface silky pubescent. Flowers up to 2 cm diam. pedicels up to 5.5 cm. long, glabrous or minutely pabescent; yellow; sepale 5, ovate slightly longer than broa l, non green at maturity, hairs long, silky caducous. Petals 5, alternating with the sepals, oblong, shining yellow nactary present. Stamens many, anthers basifixed, filaments small. Achenes up to 3 mm. diam glabrous, beaked, beak small but straight, raised, glabrous, aggregated on a somewhat hairy receptacle.

Germination : The seeds start sprouting in spring (April).

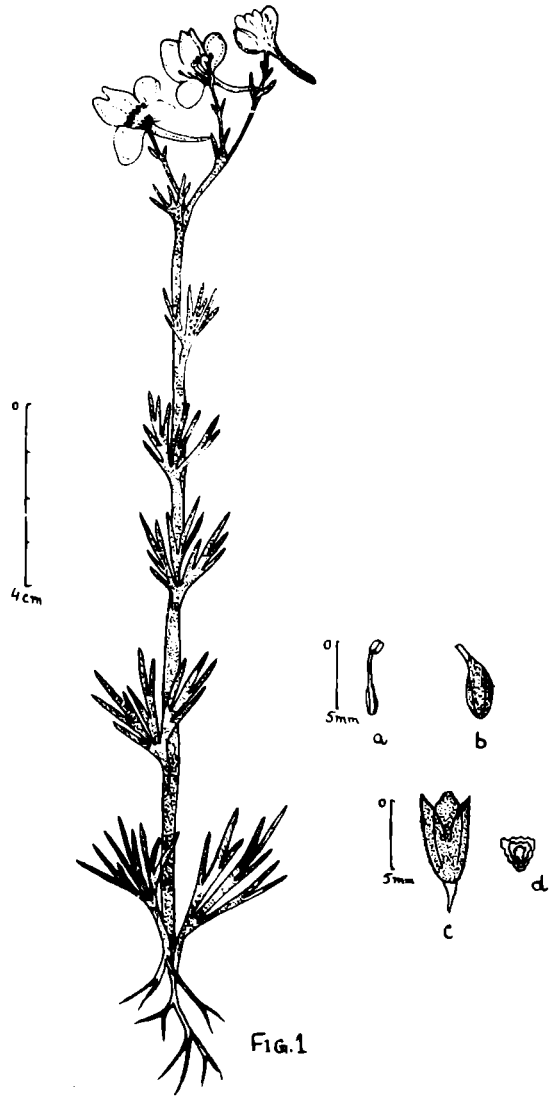


Fig. 1. *Delphinium roylei* Munz (a flowering plant)
a. stamen, b. follicle, c. an ovary, d. seed.

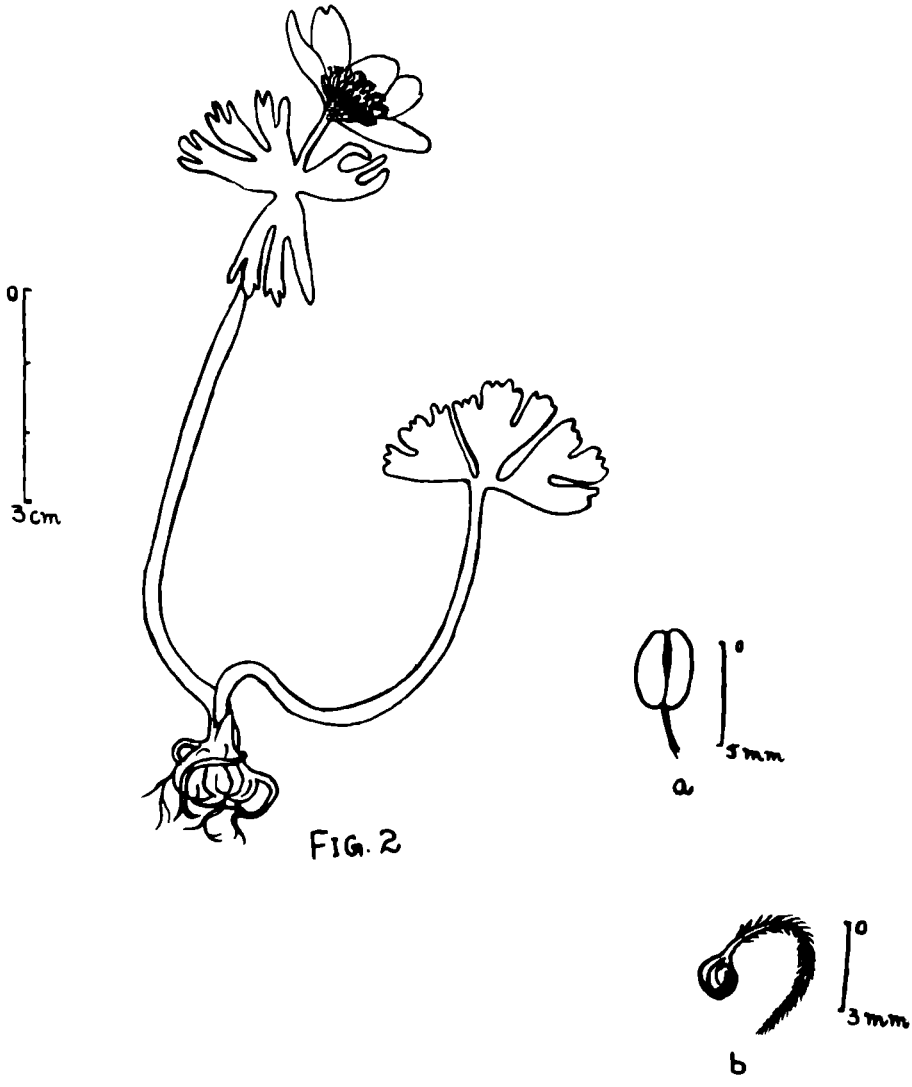


Fig. 2. *Anemone biflora* DC. (a flowering plant)
a. stamen, b. an achene

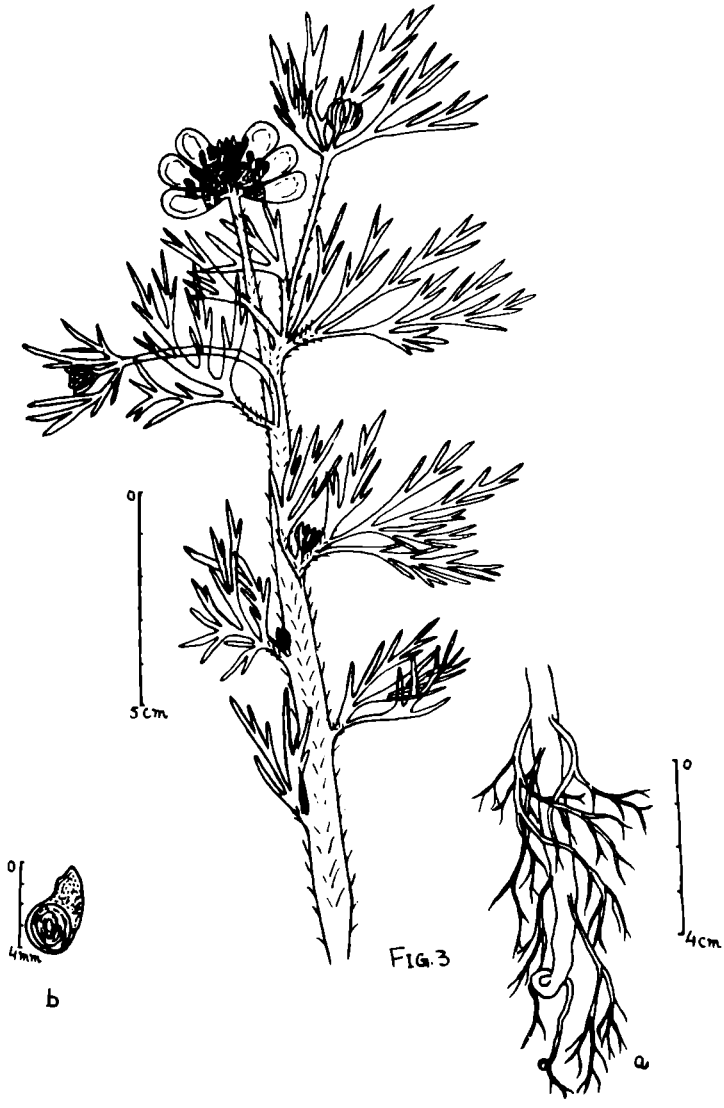


Fig. 3 *Adonis aestivalis* Linn. (a flowering shoot)
a. Root system, b. an achene

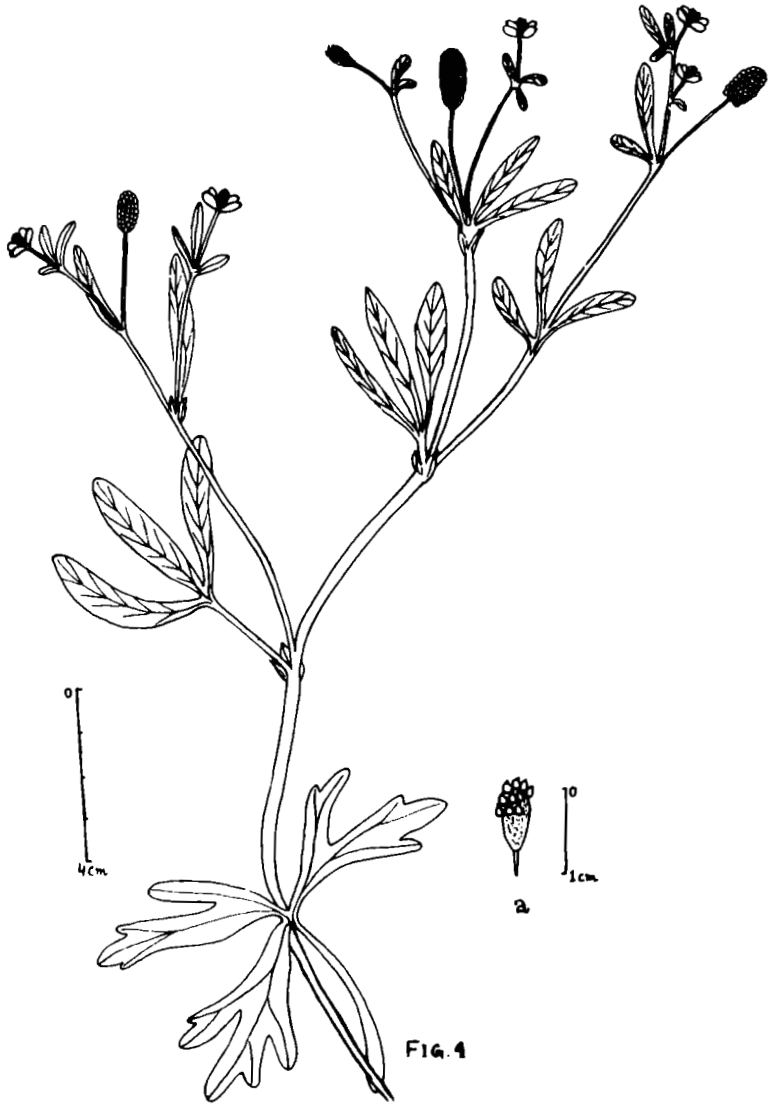


Fig. 4. *Ranunculus sceleratus* Linn. (a flowering shoot)
a. a fruit with achenes

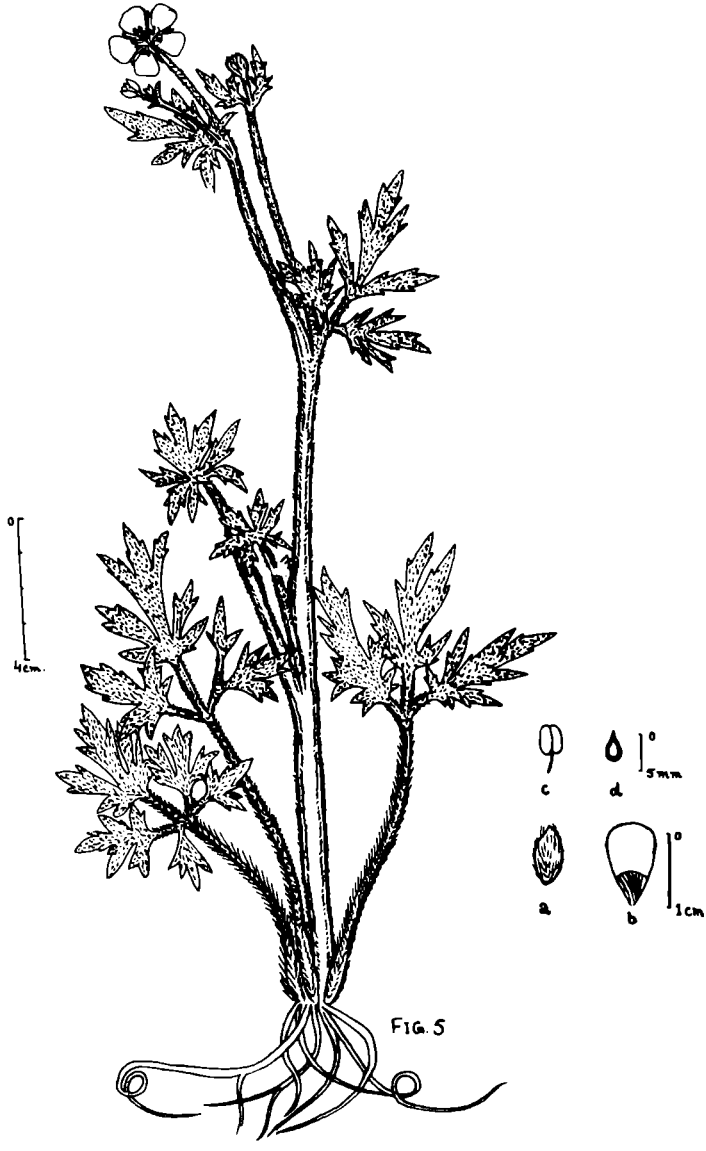


Fig. 5. *Ranunculus cantoniensis* DC. (a flowering shoot)
a. a sepal, b. a petal, c. a stamen, d. an achene

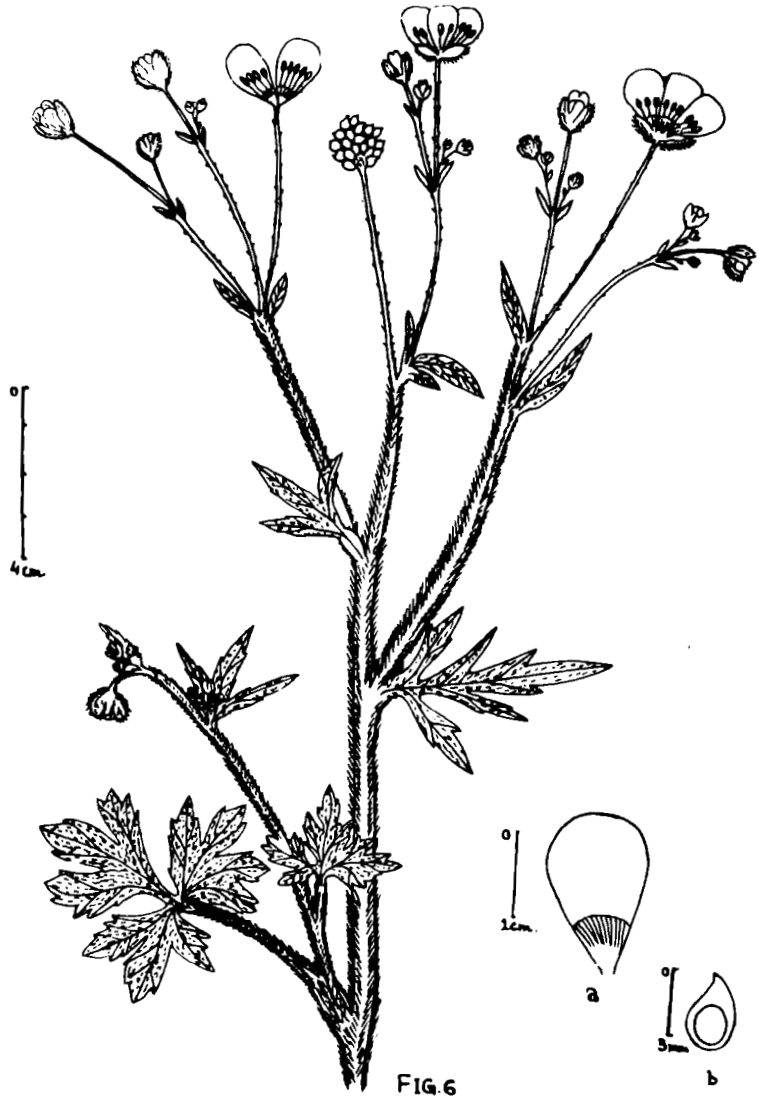


Fig. 6. *Ranunculus laetus* Wall. (a flowering shoot)
a. a petal, b. an achene

Fig. 7. *Ranunculus arvensis* Linn. (a flowering shoot)
a. an achene, b. root system

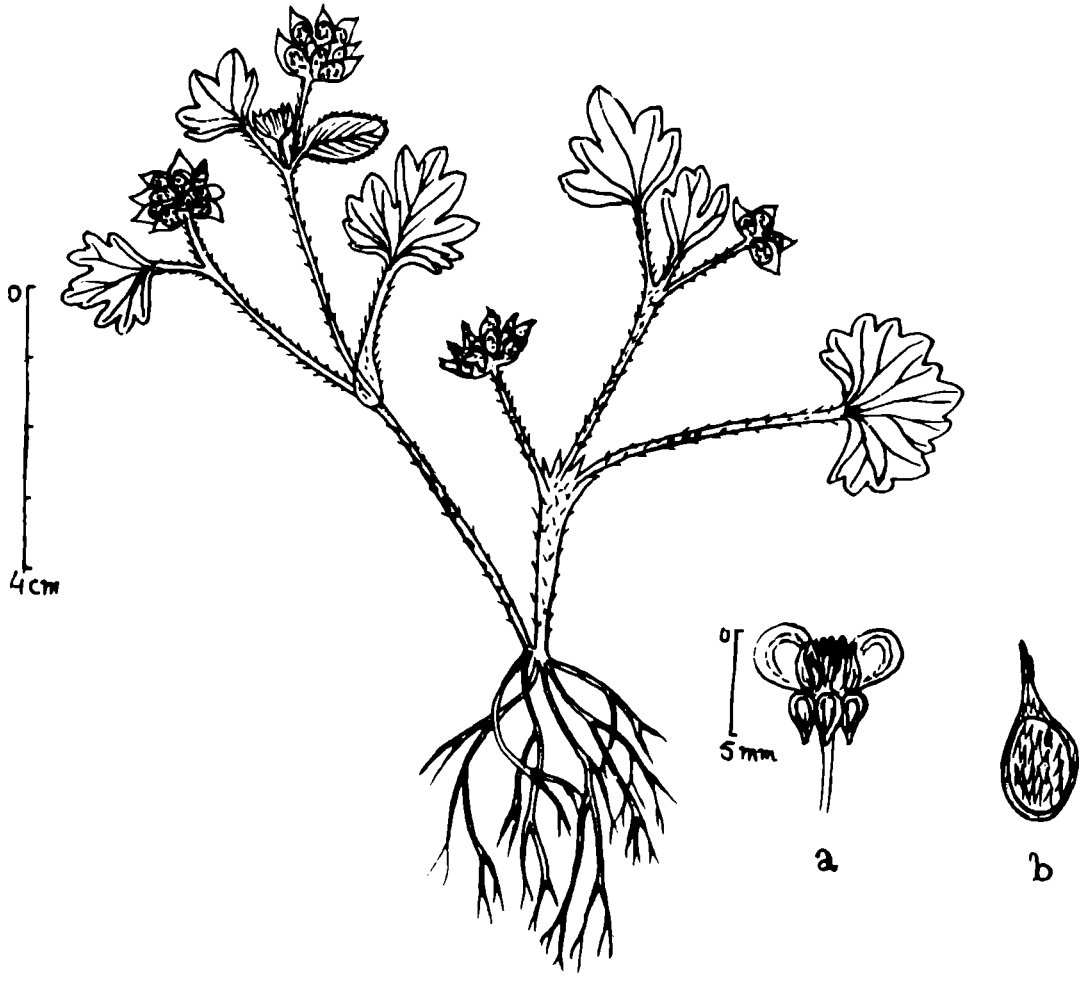


Fig. 8. *Ranunculus muricatus* Linn. (a flowering plant)
a. a flower (parts exposed), b. an achene

Fl. & Fr. : June - August.

Dissemination : The seeds are disseminated by man during ploughing. The weed is rare but forms gregarious colonies.

Habitat : Moist and fertile soil indicators.

Root system : Bunches of rootlets arise from a common rootstock which bind the plants in the soil.

Geographical distribution : North China, North Africa and America; India : Punjab.

Specimens examined : *Duthie* (28-6-1892) Kashmir (DD); *Kaul* 224 (25-6-1970) Badgam orchards (Vegetable cabbage growing fields).

Ranunculus laetus Wallich ex Royle, Illus. Bot. Himal. Mounts. 55, 1834; FBI 1 : 19; Collet 10; Blatter 1 : 16; Hand.- Mazz. 164; Kitamura 130; Stewart 271. **(Fig. 6)**

Biennial or perennial herbs. Rootstock somewhat woody. Stem 20-75 cm erect solid branched, hairy; hairs white appressed towards the base, diminishing towards the apices of the branches; many flowered. Radical leaves 3.0-6.5 cm diam; petiolate; petiole 9.0-16.5 cm appressed hairy, generally 3-partite, segments ovate-oblong or cuneate, 3-5 fid, under surface silky pubescent. Cauline leaves 2.0-9.5 cm diam; petiolate or upper ones sessile; 3-partite as radical ones but the segments sometimes deeply fid, lower surface silky and upper hairy. Flowers up to 3 cm diam, pedicel up to 9.5 cm long, glabrous or minutely pubescent, yellow. Sepals 5, up to 8 mm diam. oval, boat shaped, villous especially on the under surfaee, petaloid when mature, caducous. Petals 5, obovate, to oblong, shining yellow with a nectary at the base. Stamens many. Receptacle slightly raised, glabrous. Achenes 15-25, aggregated in small globose or rounded heads. Each achene up to 3 mm diam. glabrous, beak small but straight.

Germination : The seeds germinate in spring (April).

Fl. & Fr. : June-August.

Dissemination : The seeds are disseminated by water and weed is common along irrigation channels of different fields.

Habitat : The weed prefers moist situations and is common along margins of wheat fields, paddy fields and vegetable fields, in damp grasslands. Damp soil indicator.

Root system : The rootstock is woody, producing long rootlets going deep in the soil.

Geographical distribution : Himalaya, Temperate Kashmir, Afghanistan.

Specimens examined: *Duthie* 13444 (7-8-1893) Kashmir (DD); *Keshavanand* 25348 (27-6-1906) Hawal Srinagar (DD); *Kaul* RRL 5988 (24-5-1970) Barzulla orchards; *Kaul* 279 (4-8-1971) Hyderpora, Paddy fields.

Chromosome report : 2n=28 (Bhat, Bakshi & Kaul, 1972.)

Ranunculus flaccidus Hook. f. & Thoms., Fl. Ind. 38, 1855; FBI 1 : 20.

Perennial herbs in tufted patches, prostrate. No definite stem, small filiform leafy branches arising directly from the ground. Radical leaves 2-7 mm diam, stalked; stalk small, glabrous or slightly hairy, reniform or orbicular, 3-5 segmented, somewhat hairy. Cauline leaves similar but subsessile or sometimes

absent. Flowers 0.2-0.5 cm diam. pedicel short, yellow. Sepals 5, reflexed, caducous, equalling the petals, glabrous. Petals ovate, soon falling off. Fruit a head of 3-8 achenes. Each achene 0.2-0.4 cm diam. echinate, margins with sharp edges, beak generally curved.

Germination : The one seeded achenes start germinating in early April (spring).

Fl. & Fr. : May-July.

Dissemination : The seeds disseminate mainly by rain water.

Habitat : Found mostly in fallow grasslands, forming small patches. It prefers moist and shady situations and compact soils.

Geographical distribution : Temperate Himalaya : Kumaon to Bhutan.

Specimens examined : Kaul 174 (8-5-1970) Ganderbal fallow fields.

Ranunculus arvensis L., Sp. Pl. 555, 1753; FBI 1 : 20; Singh in BOBSI 2 : 352, 1960; Stewart 269. **(Fig. 7)**

Annual herbs. Stem 19-30 cm erect, branched, glabrous or slightly hairy towards the apex, hairs silky, white. Radical leaves 3-partite with narrow elongate or lanceolate segments; segments 2-5 fid, 3-8.5 cm long, stalk short. Cauline leaves similar to radical ones with somewhat winged and hairy petiole, margins glabrous or sometimes slightly hairy. Calyx of 5 free lobes, up to 0.5- 1.5 cm diam. petaloid. Petals oblong, double the length of sepals. Achenes 0.3- 0.8 cm diam 4-10 (generally 6) on a small receptacle, all of the same size or sometimes the size is variable; style or the beak towards one side, away from the centre of the achene, straight or hooked. Achenes clothed with straight or hooked spines.

Germination : The one seeded achenes sprout in late February or early March when snow melts alongwith crop seeds.

Fl. & Fr. : April-June.

Dissemination : The achenes mature with the crop and form impurities with crop seeds.

Habitat : A common weed of orchards, wheat, linseed, pea and Sarson fields and also some fallow lands. It is clay-loam indicator.

Root system : A simple tap root sends profuse branches in the deeper horizons of soil.

Geographical distribution : Europe, Mediterranean region, Central Asia, Iran, Afghanistan, Himalayas, Kashmir to Kumaon.

Specimens examined : *Meebold* 3306 (June, 1905) Uri, Kashmir (CAL); *Keshavanand,* 28513 (11-5-1908) Dobgah, Kashmir (DD); *Kaul* RLL 5994 (26-5-1970) Rawalpora orchards.

Chromosome report : 2n = 32(Bhat, Bakshi & Kaul, 1972).

Ranunculus muricatus L. Sp. Pl. 555, 1753; FBI 1 : 20; Blatter 1 : 17; Polunin 103; Stewart 271. **(Fig. 8)**

Annual herbs. Stem 7-20 cm diffused, prostrate rarely erect, hairy or sometimes glabrous; hairs spreading white, mostly on fresh portions. Radical leaves 2.7 - 7.5 cm diam., generally 3-fid, lobes irregularly cut, base rounded or cordate, glabrous or sometimes slightly hairy; petiolate, petiole 2.0-12. 5 cm. weak, herbaceous, sometimes hairy. Cauline leaves similar but small with shorter stalks. Flowers 0.5- 1. 5 cm diam. generally leaf opposed or sometimes terminal, yellow,

pedicellate; pedical 1.0-3.5 cm. glabrous or hairy. Sepals 1.5- 3. 5 mm diam sometimes triangular, shorter than petals, reflexed back, glabrous, petaloid when mature, caducous. Petals 2.5 - 5 mm diam. ovate or slightly obovate, light yellow, caducous. Stamens numerous in many whorls, anthers small, basifixed, filaments slightly longer than anthers. Achenes 5-12 in a globose head on a small receptacle, Each achene 3-8 mm diam. glabrous or tubercled; tubercles when present 3-many, scattered on flattened sides; sbeak 2-3 mm long, straight but the tip lightly bent.

Germination : The achenes remain dormant for about seven months including winter and sprout when the snow melts in February or early March.

Fl. & Fr. : April-June.

Dissemination : The achenes are disseminated mostly by rain water or irrigation water and also during ploughing operations.

Habitat : A common weed inhabiting drains or irrigation canals, well irrigated wheat fields, places full of dirt and fallow grasslands. It prefers fertile and alkaline soils.

Root system : A bunch of adventitious roots arise from different nodes which enter the upper layers of the soil.

Geographical distribution : Europe, West Asia and North America.

Specimens examined : Meebold 3305 (June 1905), Uri, Kashmir (CAL); *Kaul* RRL 5533 (22-5-1969) Sanat Nagar orchards; *Kaul* 137 (30-3-1970) Sanat Nagar roadsides along drains; *Kaul* 162 (30-4-1970) Naseem Bagh, fallow fields.

Remarks : A most variable plant. Some plants are very small and others large and profuse. Some plants are glabrous whereas others possess white hairs spreading all over. Achenes in certain plants are smooth and in others with a few tubercles.

Chromosome report : 2n = 28 (DCA 25).

CERATOCEPHALUS Moench

1. Achenes with a straight beak **testiculatus**
2. Achenes with a more or less curved beak **falcatus**

Ceratocephalus testiculatus (Crantz) Roth, Enum. 1 : 1014. 1827; Stewart 263.

Ranunculus testiculatus Crantz Stirp. Austr. ed. 1, 2 : 97, 1762.

C. orthoceras DC., Syst. 1 : 231, 1818; Ovez in Fl. URSS 7 : 324, 1939; Kitamura 122.

Annual woolly herbs growing aggregated at a place to form a compact mass of many plants. Leaves radical, 0.5- 3.5 cm long, 3-lobed or pinnately divided, segments linear, entire, flattened, blunt or subacute. The flowering stems 1-5, up to 5 cm long, generally as long or longer than the leaves , woolly all over. Flowers solitary on each scape, yellow. Sepals 5, up to 5 mm diam. ovate to obovate woolly. Petals 5, longer than the sepals. Stamens generally more than 10, filaments very small. Achenes in globular or generally elongated heads, small but thin and straight.

Germination : The achenes readily germinate when snow melts in the month of February.

Fl. & Fr. : March-May. Even the smallest plants are seen in flowers.

Dissemination : Seeds get disseminated either by rains or during ploughing.

Habitat : The weed is common inhabitant of wheat fields, pea fields, orchards, saffron fields and some open meadows. It shows luxuriant growth on fertile well aerated and moist soils.

Geographical distribution : Europe. Middle East, Central Asia, Western Siberia, Iran, Afghanistan and Kashmir.

Remarks : The weed is very variable and on the basis of field observations 3 variants are distinguished by following characters. Further studies are indicated to determine whether these are ecotypes or infraspecific taxa.

Var. 1. Leaves radical as long as the scapes. Scapes up to 5 cm woolly. generally more than one. **(Fig. 9a)**

Specimens examined : *Kaul* 296 (21-3-1972) Rawalpora orchards; *Kaul* 297 (1-4-1972) wheat fields of Chadora.

Var. 2. Leaves radical shorter than the scape. Scape upto 2.5 cm long, woolly, generally one or sometimes more.

(Fig. 9b)

Specimens examined : *Kaul* 296A (21-3-1972) Rawalpora orchards; *Kaul* 297 A (1-4-1972) wheat fields of Chadora.

Var. 3. Leaves very small, soon dying off. Scapes absent, flowers single sessile to subsessile. Mature plants are represented by head of achenes only. **(Fig. 9c)**

Specimens examined : *Falconer* (1-3-1838) Kashmir (DD); *Kaul* 299 (21-4-1972) Rawalpora orchards; *Kaul* 300 (25-4-1972) Natipora fallow fields.

Ceratocephalus falcatus (L.) Pers., Syn. Pl. 1 : 341, 1805; Kitamura 122; Stewart 263.

Ranunculus falcatus L. Sp. Pl. 556, 1753; FBI 1 : 16.

Habit of *Ceratocephalus orthoceras* but can be distinguished from it by its compact heads of achenes, each achene has more or less curved beak.

In fields this species is sometimes associated with the preceding species.

Specimens examined : *Kaul* 119 (23-3-1970) Majid Bagh orchards; *Kaul* 120 (23-3-1970) RRL Campus.

Ceratocephalus falcatus (L.) Pers. var. **minutus** Boiss, Fl. Orient. 1 : 58, 1867; Kitamura 122.

This variety as the name indicates is a minute form of the species. The minute single flowered plants form small colonies and are seen as clumps on moist and well aerated soils.

Geographical distribution : Europe, Mediterranean region, Central Asia, Iran, Afghanistan, Himalaya, Kashmir to Punjab, Peshawar.

Specimens examined : *Kaul* RRL 5949 (3-4-1969) Rawalpora wheat fields.

PAPAVERACEAE

PAPAVER Linnaeus.

Key to the species

1. Leaves 1-2 pinnatifid, lobes larger, blunt or subacute, generally glabrous, capsule or sometimes obovoid elongated :
   2. Stigmatic rays 6-12, forming a somewhat flat disc **dubium**
   2. Stigmatic rays 8-12, forming a hemispherical disc **macrostomum**
1. Leaves 1-2 pinnatifid, lobes finely cut, acute, awned, somewhat hairy. Capsule globose to ovoid **rhoeas**

Papaver dubium L., Sp. Pl. 1196, 1753; FBI 1 : 117 : Collett 23; Blatter 1 : 29; Rao in BOBSI 2 : 395, 1960; Polunin 133; Stewart 287.

Annual herbs. Stem up to 75 cm erect, branched, generally glabrous juice milky. Leaves (a) radical and (b) cauline; (a) up to 20 cm x 2.5 cm forming a rosette, subsessile segments deeply cut, lobes larger, often glabrous; (b) 6.5-15 cm x 0.8-1.5 cm alternate, sessile, lobes blunt, often glabrous or sometimes slightly hairy. Flowers 2.0-10.0 cm diam. stalks up to 6.5 cm long, appressed hispid, solitary or several. Sepals 2, obovate or somewhat rounded, glabrous or slightly hispid, caducous. Petals 4, generally in 2 whorls, those of outer whorls longer and overlapping the inner ones, bases with or without dark brownish spots, size of the spots varies from plant to plant. Capsule 0.8-2 cm oblong or sometimes elongated, gradually tapering towards the apex, glabrous. Stigmatic rays 6-12, generally flat or sometimes with slightly curved ends.

Germination : The seeds germinate in early spring (March).

Fl. & Fr. : Late April to early June.

Dissemination : The seeds are small, somewhat triangular and produced in large quantities from each capsule. These are mostly disseminated by wind or as crop seed impurities.

Habitat : The weed is an inhabitant of wheat fields, pea fields, orchards, wastelands and rubbish heaps. It is nitrogenous often dry loam indicator.

Geographical distribution : Europe, West Asia. Afghanistan, Western Himalaya, from Hazara to Kashmir and Garhwal.

Specimens examined : *Kaul* RRL 16004 (25-4-1970) wheat fields of Srinagar.

Remarks : Highly variable herb.

Chromosome report : 2n = 28 (Kaul & Gohil 1973).

Papaver macrostomum Boiss. & Huest. ex Boiss. in Fl. Orient. 1 : 115, 1867; Stewart 287.

This species differs from *P. dubium* in having slightly hairy stem; leaves with broader lobes; flowers generally larger, (up to 15.5 cm) in diameter; sepals similar but densely hairy; capsule elongated, stigmatic rays 8-12, hemispherical.

The plants can be mistaken in the fields as *P. dubium* and are associated with it. The phenological data is also similar to it.

Specimens examined : *Gommie* s.n. (2-7-1891), Srinagar 5300 ft (DD); *Kaul* RRL 16006 (25-4-1970); RRL fields; *Kaul* RRL 16013 (25-4-1970) Majidbagh orchards.

Geographical distribution : West Asia, Siberia, Kashmir to Garhwal.

Chromosome report : 2n = 14 (Kaul & Gohil 1973).

Papaver rhoeas L., Sp. Pl. 507, 1753; FBI 1 : 117; Collett 23; Blatter 1 : 29; Polunin 113 : pl. 29, Stewart 288.

Annual herbs with stem 8-49 cm erect, branched, covered with generally stiff spreading and small white hairs, sometimes glabrous. Leaves both (a) radical and (b) cauline; (a) withering soon after the plants flower (b) stalked, alternate 1-2 pinnately compound, lobes lanceolate, more or less cut, tips awned, hairy; hairs white and spreading. Flowers 1-many, scarlet red or red, varying in diameter. Sepals 2, ovate or slightly rounded, covered with rough hairs, rarely glabrous, caducous. Petals 4, generally in 2 whorls, sometimes in single whorl, with or without a dark eye at the base. Stamens many, brown with simple filaments. Capsule 0.8 - 10.5 cm globose or sometimes ovoid, variable in shape, glabrous, stalked; stalk hairy. Stigmatic rays 3- 7. Seeds many, somewhat triangular with corrogated margins, brownish.

Germination and other phenological datails similar to *P. dubium* L.

This species is an escape from cultivation and is established as a weed.

Specimens examined : *Kaul* RRL 16010-16012 (25-4-1970) Air field, Srinagar wheat fields.

Remarks : All the species are locally called 'Gulala' and are used as fodder. The flowers yield a red dye.

Chromosome report : 2n = 14 (DCA 34).

FUMARIACEAE

Key to the genera

1. Petals spurred, spur short rounded at the base; fruit a globose nutlet **Fumaria**
1. Petals spurred, spur elongated into a sub-acute base, fruit a flat capsule **Corydalis**

FUMARIA Linnaeus

Fumaria indica Pugsley in J. Linn. Soc. Bot. 44 : 313, 1919.

E. vaillantii auct. auct. non Loisel. (1809); FBI 1 : 128; Hara in Fl. Eastern Himalaya 104, 1966.

Annuals with stem up to 23·5 cm suberect, diffusely branched, branches arising from the base and spreading, light blue in appearance, slender and weak, glabrous. Leaves pinnate compound, leaflets deeply lobed; segments very narrow, lobed or entire, up to 5 mm long, glabrous and glaucous. Flowers up to 8 mm long, pinkish white, in lax or crowded apical racemes; bracteate; bracts small, lanceolate sessile or with small and slender stalks. Sepals 2, caducous. Petals 4; 2 outer dissimilar, upper one broad, produced at the base into a short rounded spur, lower one flat and narrow; 2 inner clawed and keeled. Stamens diadelphous, lower spurred at the base, spur projecting into the petal spur. Fruit globose, 1- seeded nutlet, hard, glabrous.

Germination : The seeds are hard and remain dormant for at least seven months. They sprout in February or March depending upon the temperature conditions of the area.

Fl & Fr. : April-June.

Dissemination : The seeds are mostly dispersed through ploughing and other agricultural operations.

Habitat : An occasional weed of wheat, pea and linseed fields and orchards. Loam indicators.

Root system : A simple tap root with small branches, surface feeders.

Geographical distribution : Europe, West Asia and West Siberia, lower Himalaya & Nilgiri hills, Kashmir.

Specimens examined : *Kaul* RRL 5938 (12-3-1969) Barzulla orchards.

Chromosome report : 2n=28 (DCA 35).

CORYDALIS Ventenat (*nom. cons.*)

Corydalis diphylla Wallich Tent. Fl. Nepal. 54, 1826; Stewart 289.

C. rutaefolia auct. non Sibth. (1806) : FBI 1 : 122; Collett 25; Blatter 1 : 33, pl. 9, t. 6.

Annual herbs with a slender rootstock. Stem up to 15 cm, weak, suberect, somewhat branched, slender, glabrous and glaucous. Leaves pinnate compound with generally 3-leaflets or sometimes even five, apical one largest, ovate-oblong, subsessile, margin entire glabrous, somewhat succulent. Flowers up to 3 cm long including spur, bright purple with dark tips, bracteate; bract leafy, smaller than the pedicel; in 3 flowered racemes. Sepals 2, minute, caducous. Petals 4, 2 outer dissimilar, anterior flat, posterior spurred; 2 inner clawed, tips free and bases cohering. Stamens 6, diadelphous with posterior bundle enclosed in the petal spur, middle anthers of each bundle shorter than the ovary, stigma capitate. Capsule 7 mm x 2-3 mm, seeds many. Seeds rounded, hard.

Germination : The seeds germinate in early March.

Fl. & Fr. : May-July.

Dissemination : The seeds are disseminated generally by rain water.

Habitat : A rare weed of orchards. Indicator of organic matter in soils.

Root system : A simple tap root with few branches.

Geographical distribution : West Asia and Western Himalaya; Kumaon to Mari.

Specimens examined : *Duthie* 10943 (15-5-1892) Verinag (DD); *Kaul* RRL 5962 (10-6-1969) Naseem Bagh orchards.

BRASSICACEAE (CRUCIFERAE)

Key to the genera

1. Leaves, at least the lower ones, pinnatifid to pinnate compound with apical lobes the largest :
   2. Pods linear to oblong, never beaked :
      3. Seeds 1— seriate or irregularly 2—scriate :
         4. Leaves simply pinnatifid with segments oblong :
            5. Sepals erect or spreading; pods many seeded, valves 1-3 nerved, hairs simple or O — **Sisymbrium**
            5. Sepals erect; pods many seeded, valves keeled, hairs appressed and forked — **Erysimum**
         4. Leaves 2-3 pinnatisect with small linear segments — **Descurainia**
         4. Leaves pinnate compound with apical leaflets largest :

6. Flowers yellow. Pod 4-angled. seeds 1-seriate — **Barbaraea**

6. Flowers white. Pods hard nerved, seeds irregularly 2—seriate — **Cardamine**

3. Seeds 2—seriate :

7. Leaves pinnate compound; flowers white and pods linear — **Nasturtium**

7. Leaves pinnatifid, flowers yellow and pods obovate — **Rorippa**

2. Pods never linear or oblong (except in *Eruca* where it is oblong) :

8. Pods 2—celled, triangular or circular. Seeds-1 many in each cell :

9. Leaves pinnatifid; pods triangular, many-seeded — **Capsella**

9. Leaves pinnate compound, segments small and linear, pods somewhat circular, 2—celled, 1 seed in each cell — **Coronopus**

8. Pods 2 or more celled, never triangular. Seeds one in each cell :

10. Pods transversely oblong, valves turgid, wingless — **Cardaria**

10. Pods elliptic or ovoid, valves winged or wingless — **Lepidium**

11. Pods globose with a subulate and small beak, only one seed — **Neslia**

11. Pods oblong prolonged into a long seedless beak, Seeds many — **Eruca**

8. Pods 1-celled, almost circular with a solitary seed — **Thlaspi**

1. Radical as well as cauline leaves simple :

12. Pods sessile, up to 5 cm long, not rigid — **Malcolmia**

12. Pods stalked, less than 5 cm long, not rigid :

13. Pods moniliform, up to 9 mm long, somewhat curved — **Goldbachia**

13. Pods linear, orbicular to elliptic, up to 3.5 cm long, never curved :

14. Hoary herbs, hairs stellate or branched :

15. Stamens appendaged; pods orbicular and petals entire — **Alyssum**

15. Stamens appendaged; pods elliptical and petals deeply bifid — **Erophila**

15. Stamens not appendaged; pods linear :

16. Leaves cordate; pods linear, shorter than their stalks — **Alliaria**

16. Leaves ovate to obovate; pods as long or longer than their stalks :

17. Pods with convex one nerved valves, seeds 1-2 seriate — **Arabidopsis**

17. Pods flat 3-nerved; seeds 1-2 seriate :

18. Scapes O; leaves radical and cauline, hairy — **Turritis**

18. Scapes 1-5; leaves radical, glabrous or hairy — **Drabopsis**

SISYMBRIUM Linnaeus

Key to the species

1. Stem glabrous or slightly hairy towards the apex. Pods up to 5 cm long — irio
1. Stem all over spread with simple and recurved hairs. Pods 3.5 cm long — loeselii

Sisymbrium irio L. Sp. Pl. 659, 1753; FBI 1 : 150; Kitamura 169; Polunin 123; Stewart 327. **(Fig. 10)**

Annual herbs. Stem up to 1 m erect, generally branched from the base, slender, herbaceous glabrous or slightly hairy towards the apices. Radical leaves up to 12 cm x 4.0 cm, petiolate; petiole up to 4.5 cm slender, hairy; pinnatifid to pinnatisect with terminal lobes largest having wavy margins. Cauline leaves 1.5-6.5 cm x 0.5-2.0 cm, petiole 0.3-2.5 cm, alternate, hastate, glabrous or margins slightly hairy. Flowers 2.5 mm diam. yellow, in long branched racemes. Sepals 4, saccate, green, glabrous or slightly hairy, caducous. Petals 4, cruciform, longer than the sepals, clawed Stamens tetradynamous. Pods up to 5 cm x 2 mm linear, horizontal, stalk up to 1.5 cm long, slightly hairy, dehiscing from the base, valves with definite median ridge, glabrous. Seeds 2-seriate, slightly elongated, 0.5-1 mm diam. brown.

Germination : Seeds germinate in early spring (March)

Fl. & Fr. : April to August.

Dissemination : The seeds found in large numbers, are light and easily carried to long distances by wind.

Habitat : A common weed of fallow fields, muddy walls, rubbish heaps and also some vegetable fields. It prefers to grow in moist areas and avoids dry situations. Indicators of dampness in soil.

Root system : A simple tap root with much branched secondary and tertiary roots going into deeper horizons of soil.

Geographical distribution : Europe, North Africa, Western Asia, Central Asia, Afghanistan, Pakistan, China and Kashmir.

Specimens examined : *Kaul* 40(26-5-1969) Barzulla fallow fields.

Chromosome report : 2n=14, 16 (DCA 41).

Sisymbrium loeselii L. Cent. Pl. 1 : 18, 1755; FBI 1 : 151; Kitamura 160; Stewart 327.

Annual herbs resembling *S. irio* L., but differs from it in having simple, recurved hairs spread all over the stem, very rarely glabrous; leaves with terminal hastate lobes; flowers 3-8 mm diam, pods up to 3.5 cm long, glabrous, stalks up to 1 cm.

It has similar habitat conditions and other phenological data as the preceding species.

Specimens examined : *Ahluwalia* 2072 4-10-1951) Srinagar; *Kaul* 58 (15-7-1969) Hari parbat orchards of almond; *Kaul* RRL 19695 (21-5-1971) Natipora orchards; *Kaul* RRL 19733 (30-9-1971) Rawalpora orchards.

Geographical distributton : Europe, Caucasus, Siberia, Turkey, Central Asia, Iran, Afghanistan, Pakistan, Himalaya, Kashmir.

Chromosome report : 2n=14 (DCA 41).

ERYSIMUM Linnaeus

Erysimum altaicum C. A. Mey. in Ledeb. Fl. Alt. 3 : 153, 1830; Hook f. & Thom. in J. Linn. Soc. 5 : 167, 1861; FBI 1 : 154; Stewart 314.

Annual herbs. Stem up to 35 cm erect, branched, slender, rarely branched, somewhat

angled, hoary with appressed simple and forked hairs. Radical leaves 4.5-7.5 cm × 3.5 mm. 8.5 mm linear, petiolate, petiole small and slightly winged; pinnatifid with small lobes, glabrous or appressed hairy. Cauline leaves simillar but smaller alternate, margins rarely entire, commonly sinuate, hairy. Flowers yellow in apical corymbs, pedicels small. Sepals 0.5-0.8 cm linear lanceolate, blunt, glabrous or hoary. Petals clawed. Stamens 6 with simple filaments, anthers elongated. Ovary with a definite style and a bilobed stigma. Pods 2-6 cm long, much longer than the pedicels, glabrous. Seeds 1 - seriate, small with incumbent cotyledons.

Germination : The seeds sprout with thawing of snow from the fields, i.e., late February or early March.

Fl. & Fr. : May-June.

Dissemination : The seeds are disseminated mainly by wind.

Habitat : A rare weed of some orchards and fallow grasslands, preferring dry situations. Compact and hard soil indicator.

Root system : A simple tap root penetrating up to 15 cm deep in the soil.

Geographical distribution : Caucasus, Altai, India : Western Himalaya, Tibet.

Specimen examined : *Gammie s.n.* (28-7-1891) Kashmir (DD); *Kaul* RRL 5956 (8-4-1969) Majid Bagh Orchards; *Kaul* 301 (26-4-1972) Chisma Shahi orchards.

DESCURAINIA Webb & Berthelot (*nom. cons.*)

Differs from *Sisymbrium* in possessing finely segmented leaves hairs simple as well as branched. Valves of fruit 1-veined.

Descurainia sophia (L.) Webb ex Prantl, Pflanzenfam. Ser. 3, 2 : 192, 1891; Kitamura 146; Polunin 123; Stewart 306.

(Fig. 11)

Sisymbrium sophia L., Sp. Pl. 659, 1753; FBI 1 : 150; Collett 35.

Annual herbs. Stem 15-45 cm erect, branched or unbranched, ascending, tomentose or hoary, slightly ribbed, greyish green. Leaves mostly cauline, 2-5 cm long, 2-3 pinnate compound. Segments up to 5 mm linear, hairy with simple and branched hairs or even hoary. Flowers 2-4 cm across, yellowish, ebracteate pedicel 0.5-1.5 cm long, hairy in terminal corymbose racemes. Sepals 4, petaloid, glabrous, or sometimes hairy, as long as the petals. Pods up to 2-5 cm linear, compressed, hairy when young and glabrous at maturity, held on slender small stalks. Seeds many, rounded black and hard.

Germination : The seeds sprout in December before the snowfall and emerge from the snow in spring. Some seeds remain dormant for winter and sprout in early spring (early March).

Fl. & Fr. : March-May.

Dissemination : Once the pods are mature the seeds are disseminated to distances mainly by wind.

Habitat : A common weed inhabiting orchards, wheat fields, pea fields, other spring vegetables, muddy house tops and some fallow fields. Loam indicators.

Root system : A small and branched tap root going into surface horizons of soil.

Geographical distribution : Europe, Asia, N. Africa, Temperate Himalaya from Kashmir to Kumaon.

Specimens examined : *Kaul* RRL 5950 (3-4-1969) Rawalpora orchards; *Kaul* 122 (24-3-1970) Naseem Bagh wheat fields.

Remarks : 'Mazen Gassa'. The seeds are of medicinal value.

Chromosome report : 2n=20, 28, 56 (DCA 40).

BARBAREA R. Brown (*nom. cons.*)

Key to the species

1. Leaves pinnatifid to pinnate compound, segments entire; pods up to 2.2 cm, stalk longer **vulgaris**
1. Leaves pinnate compound, leaflets entire or pinnatifid; pods up to 3 cm, stalk as long or smaller **intermedia**

Barbarea vulgaris R. Br. in Aitch. Hort. Kew. ed. 2, 4 : 109, 1812; FBI 1 : 134; Collett 30; Blatter 1 : 34; Stewart 302.

Annual herbs. Stem 10-50 cm erect or procumbent, generally branched are procumbent, furrowed, ribbed, glabrous, leafy. Radical leaves similar to cauline, 2.0-15.5 cm long; lower cauline leaves petiolate and upper sessile, pinnate compound with apical lobes largest; each leaflet up to 1 cm long, oblanceolate, margins serrate or entire at times, glabrous. Flowers golden yellow, ebracteate, pedicellate, in long dense branched racemes. Sepals 4, caducous. Petals 4, twice as long as sepals, cruciform, limbed. Pods linear up to 2.2 cm, pedicellate; pedicels longer than the pod, glabrous. Seeds 1-seriate, many, somewhat rounded.

Germination : The seeds start germinating in spring (March) after the change in the temperature has set.

Fl. & Fr. : May-July.

Dissemination : The seeds are dispersed mostly by the water of the irrigation canals.

Habitat : A common and abundant weed growing along the water channels and margins of paddy fields. Indicators of moist, fertile, nitrogenous soil.

Root system : Clumps of adventitious roots are formed at certain nodes which keep the plants bound in the tough substratum.

Geographical distribution : Europe, Caucasus, Siberia, Central Asia, Afghanistan, Kashmir, Mongolia.

Specimens examined : *Duthie* 11363 (2-6-1892) Kashmir (DD); *Kaul* 199 (25-5-1970) Chattabal paddy fields.

Remarks : "Threugh" used as a fodder plant. Young shoots used as vegetable by local people.

Chromosome report : 2n=16 (DCA 43).

Barbarea intermedia Boreau. Fl. Centr. Fr. ed. 1, 2 : 48, 1840 ; Polunin 127; Stewart 302.

B. vulgaris Br. var. *sicula* (Presl) Hook. f. & Thoms. in Hook. f., FBI 1 : 134, 1872.

Barbarea sicula Presl. Delic. Prag. 17. 1822.

Simailar to *B. vulgaris* Br. differing in having deeply pinnatifid leaflets. Flowers deep yellow; pods up to 3 cm, stalked, stalk as long or shorter than the pod.

Germination : Seeds sprout in the month of March.

Fl. & Fr. : May-July.

Dissemination : The seeds being light are disseminated by wind and also remain contaminated with wheat or linseed.

Habitat : It is a rare weed of wheat and linseed fields.

Root system : Meagrely developed tap root.

Geographical distribution : Central and Southern Europe; India : Kumaon.

Specimens examined : *Kaul* 38 (25-5-1966) Ganderbal wheat fields; *Kaul* RRL 5557 (19-8-1969) Tangmarg wheat fields.

Chromosome report : 2n = 16 (DCA 43).

CARDAMINE Linnaeus

Cardamine hirsuta L. Sp. Pl. 655, 1753; FBI 1 : 138; Stewart 304. **(Fig. 12)**

Annual with stem decumbent, branched from the base, flaccid, weak, glabrous or slightly pubescent towards the base. Radical leaves 4.5 - 8.5 cm, pinnate compound, petiolate; petiole somewhat winged, glabrous; forming a rosette; leaflets in 3-7 pairs, orbicular to ovate, toothed, apical one generally longer, petiolate; cauline leaves similar but smaller. Flowers white in apical corymbose racemes, ebracteate and pedicellate. Pods linear, 2-3.5 cm stalked, stalk is long or shorter than the pod. Seeds small, rounded, brown when mature; 1-seriate or irregularly 2- seriate.

Germination : The seeds germinate in early spring i.e., February to early March.

Fl. & Fr. : April-May.

Dissemination : The dissemination of seeds mostly takes place by wind and to some extent during farm operations.

Habitat : A common weed of grasslands, lawns, flower beds and also some orchards, prefers shady and moist situations. Indicator of well aerated loamy soils.

Root system : A simple slightly branched tap root remaining in the surface horizons of the soil.

Geographical distribution : Temperate Himalaya.

Specimens examined : *Kaul* 134, 134 a (29-3-1970) RRL Lawn Srinager, Chisma Shahi orchards.

Chromosome report : 2n=16 (Bhat, Bakshi & Kaul 1974).

NASTURTIUM R. Brown (*nom. cons.*)

Nasturtium officinale R. Br. in Ait. Hort. Kew. ed. 2, 4 :111, 1812; FBI 1 : 133; Vassile in Fl. URSS 8 : 143, 1939; Polunin 128; Stewart 323.

Annual or biennial creeping, aquatic, semi-aquatic and terrestrial herbs. Stem weak, branched, often rooting at nodes, glabrous commonly non-green but purplish. Leaves, pinnate compound with 3-7 leaflets or even more; apical leaflet larger, rounded, petiolate and margins sinuate; lateral leaflets sessile, glabrous. Flowers up to 8 mm diam. white, in apical small corymbose racemes. Sepals 4, green, caducous, shorter or even half the petals. Pods 0.5-3 cm linear or obovate; style small, pedicel as long or shorter than the pod. Seeds 2-seriate, small black on maturity.

Germination : The seeds germinate in December or onset of winter and remain under snow for three months, sprouting out of the snow in spring.

Fl. & Fr. : April-July.

Dissemination : The seeds are either contaminated with crop seeds or get disseminated by irrigation or rain water.

Habitat : A common weed of drains and channels along wheat fields, orchards and paddy fields. Indicator of well irrigated alluvial soils.

Root system : A simple branched tap root going into surface horizons of the soil. Slender roots also arise from the nodes.

Geographical distribution : Afghanistan, Temperate Europe and Asia.

Specimens examined : Kaul RRL 5596 (27-7-1970) Barzulla orchards.

Chromosome report : 2n=32 (K. Rahan in Taxon 15 (2) : 120, 1966.

RORIPPA Scopoli

Rorippa islandica (Oeder) Borbas, Balaton. Tav. Pl. 2, 392, 1900; Kitamura 159; Polunin 127; Stewart 326.

Sisymbrium islandicum Oeder. Fl. dan. 3, 7 : 8, t. 409, 1768.

Nasturtium palustre (Leyss.) DC. Syst. 2 : 191, 1821; FBI 1 : 133; Collett 30.

Sisymbrium palustre Leyss., Fl. Hal. 166, 1761.

Annual herbs. Stem up to 30 cm mostly procumbent, branched, rarely unbranched, weak, dull green, glabrous. Radical leaves petiolate; petiole 1.5-3.5 cm winged; glabrous. deeply pinnatifid with apical lobes larger and broader, often sinuate toothed, glabrous. Cauline ones similar but smaller and subsessile. Flowers yellow in branched racemes up to 20 cm long, ebracteate, pedicellate, pedicel up to 1.5 cm glabrous. Sepals green, caducous. Petals generally as long or slightly longer than the sepals, entire; pods 0.3-0.9 cm × 0.2-0.3 cm, stalked; stalks glabrous, as long or shorter than the pods, obovate with a distinct mid-vein, glabrous, seeds 2-seriate, many, crowded, in each cell.

Germination : The seeds germinate in early spring, (February or March).

Fl. & Fr. : May-June.

Dissemination : The seeds get disseminated by irrigation water or rain water. Man and wind help in dispersal.

Habitat : A common weed of water-logged fields, also found in wheat fields, and some orchards preferring damp situations but also invading dried locations. Indicator of water-logged soils.

Root system : A simple tap root goes up to 20 cm deep in soil. The spreading branches of stem form a rosette and turn the weed obnoxious and dangerous.

Geographical distribution : Cosmopolitan.

Specimens examined : Duthie, J.F. 10930 (3-5-1892) near Srinagar (DD); *Kaul* 167 (3-5-1970) Habak vegetable fields; *Kaul* RRL 16020 (21-3-1971) Rawalpora Sarson fields; *Kaul* RRL 16046 (9-6-1971) Hyderpora pea fields,; *Kaul* 282 (4-8-1971) Hyderpora paddy fields.

Chromosome report : 2n = 16, 32 (DCA 43).

Illustration : Geigy weed tables, fig 42.1.

CAPSELLA Medikus (*nom. cons.*)

Capsella bursa-pastoris (L.) Medikus Pflanzen. 85, 1792; Singh in BOBSI 2: 352, 1960; Kitamura 144; Polunin 134; Stewart 304.

Thlaspi bursa-pastoris L., Sp. Pl. 647,1753.

An annual or biennial herb. Stem very. variable in length, 3 - 30 cm erect, branched

or unbranched, glabrous or hairy, hairs white spreading as well as branched. Radical leaves 2.0-10.5 cm oblong lanceolate, usually pinnatifid; terminal lobes larger, broadly triangular, segments entire or toothed, glabrous or slightly hairy; generally subsessile or with small petioles, Cauline leaves sessile or stem clasping, pinnatifid, hairs spreading on the margins. Flowers up to 7 mm diam; white, arranged in corymbose racemes of variable size, ebracteate and pedicellate. Sepals slightly shorter than the petals. Pods up to 7 mm diam. triangular, flattened with a distinct ridge, valves smooth dehiscing along the ridge. Seeds 2-seriate.

Germination : The seeds sprout in October or November and also in March depending up to the temperature conditions. The late autumn temperature i. e. 15-20°C is conducive for germination.

Fl. & Fr. : It has been seen to flower twice a year- in December and April or May.

Dissemination : The seeds are formed in large quantities and disseminate by wind or by certain agricultural operations by man.

Habitat : A common weed of all types of fields including fallow fields, preferring moist situations. Indicator of loamy soils.

Root system : A simple tap root with many branches going into soil.

Geographical distribution : Cosmopolitan in temperate conditions.

Specimens examined : 1004 *Keshavanand* (18-6-1908) Drugmulla, Srinager (DD); *Kaul* RRL 5942 (12-3-1969) Habak orchards; *Kaul* RRL 5953 (6-4-1969) Barzulla cabbage fields; *Kaul* 107 (18-11-1969) Barzulla.

Remarks : " Krala mund ". Taken afresh by local people.

Chromosome report : 2n = 32 (DCA 39)

Illustration : Geigy weed table, Fig. 47.1.

CORONOPUS Zinn (*nom. cons.*)

Coronopus didymus (L.) Smith, Fl. Brit. 2: 691, 1800; Kitamura 146; Rao in BOBSI 2: 395, 1960; Polunin 140; Stewart 306.

Lepidium didymum L., Syst. Nat. ed. 12, 433, 1767.

A spreading annual or biennial herb with a prostrate habit. Stem up to 30 cm branched profusely, branches always prostrate dull green finely grooved, throughout hairy, juice acrid with a strong smell and taste. Leaves mostly cauline 1.5 - 5. 5 cm x 0.5 - 1. 5 cm pinnate compound, segments up to 6 mm lance-shaped, toothed, deeply fid, mostly glabrous, sometimes minutely pubescent. Flowers 1.5 - 2. 5 mm diam. ebracteate, pedicellate pedicels longer than the flowers, hairy or glabrous; in dense apical clusters; sepals 4, caducous. Petals 4, as long or generally smaller than the sepals, falling off. Fruit 3-5 mm, diam comprising of two equal small rounded to reniform lobes, stalked; stalks elongated in fruit, attached near the base like the filament of a stamen, notched, hard, surface, covered with irregular pits.

Germination : The seeds germinate in spring (March or April).

Fl. & Fr. : July - August.

Dissemination : The seeds are produced in large quantities and are disseminated by rain water or man.

Habitat : A common gregarious weed inhabiting lawns grasslands, orchards and also some fallow lands. Dry and compact loam indicator.

Root system : A meagrely developed tap root system.

Geographical distribution : A native of South America naturalized widely in Western and Central Europe, Afghanistan and Kashmir.

Specimens examined : *Kaul* 63 (21-7-1969). Batmaloo fallow fields.

Remarks : 'Taribod' The young shoots are taken as such and used locally as salad.

Chromosome report : 2n= 32 (DCA 39).

Illustration : Polunin, pl. 36.

CARDARIA Desvaux

Cardaria draba (L.) Desv. J. Bot. *l. c.*; Polunin 140; Stewart 304.

Lepidium draba L. Sp. Pl. 645, 1753; FBI 1 : 160.

Annual with stem up to 40 cm erect, branched, or unbranched, slightly ribbed, glabrous, leafy. Radical leaves petiolate; petiole small and glabrous. Cauline leaves 3.0 - 7.5 cm oblanceolate, sessile, bases auricled; auricles sagittate and converging; margins sinuate, glabrous. Flowers up to 3.5 mm diam. white, ebracteate, pedicellate, in branched racemes. Sepals 4, almost equal or smaller than petals, petaloid at maturity, caducous. Stamens 6, small, included. Pods 2.3 mm diam. ovate, slightly broader than long, constricted between the papillose valves; stalk up to 1.5 cm glabrous; style straight, short and persistent; 2-celled with one ovule in each cell. Seeds small, brownish with a deep convex cavity on one side.

Germination : The seeds germinate in early March.

Fl. & Fr. : May - June.

Dissemination : The seeds are mostly disseminated by wind and through farm yard manure in which the seeds are carried to long distances.

Habitat : It grows in orchards and vegetable gardens. Indicator of organic matter in soils.

Root system : A simple branched tap root having a restricted growth and spreading in the surface horizons only.

Geographical distribution : Europe; India Punjab.

Specimens examined : *Kaul* 177 (9-5-1970) Rawalpora orchards.

Chromosome report : 2n = 64 (DCA 39).

Illustration : Polunin pl. 36.

LEPIDIUM Linnaeus

Lepidium latifolium L. Sp. Pl. 644, 1753; FBI 1 : 160; Kitamura 154; Polunin 138; Stewart 319.

Perennial shrubby plants. Stem up to 1.5 m tall, branched from the base, erect, glaucous, pale green. Leaves (a) radical (b) cauline; (a) up to 20 cm long, stalked; (b) 2-9.5 cm x 0.5-2.5 cm, simple, sessile, oblong lanceolate, margins entire or minutely dentate, glaucous and tough, Flowers up to 4 mm diam. white, crowded in apical racemes forming small heads. Sepals up to 2 mm diam. glabrous or very rarely hairy. Petals as long

or longer than sepals. Pods up to 3 mm diam, circular or slightly orbicular, glabrous with a distinct median ridge, dehiscing in two equal parts at maturity setting free 2 enclosed seeds. Seeds small, brown, somewhat elongated.

Germination : The seeds do not germinate under ordinary conditions and the plants propagate through vegetative methods.

Fl. & Fr. : July-August.

Dissemination : The seeds are disseminated mostly by wind

Habitat : A rare weed of orchards and vegetable gardens. Indicator of sandy soils.

Root system : The rootstock is thick and woody with many adventitious roots arising from it which bind the soil.

Geographical distribution : Europe, North Africa, Turkey, Caucasus, Central Asia, Western Siberia, Iran, Afghanistan, Tibet.

Specimens examined : *Kaul* RRL 19604 (6-7-1960) Malkha vegetable fields.

Remarks : It is considered to be dangerous for livestock.

Chromosome report : n=8 (DCA 39).

NESLIA Desvaux (*nom. cons.*)

Neslia apiculata (Fisch. Mey & Ave-Lall) Mey. Index. Sem. Horti. Petrop. 8 : 68, 1842; Kitamura 158; Stewart 323. **(Fig. 13)**

Vogelia apiculata Fisch. Mey & Ave-Lall in Vierh. Oestr. Bot Zietschr. 70:169, 1921.

N. paniculata auct. non Desv. (1814); FBI 1: 164; Sabnis in J. Bombay Nat. Hist. Soc. 42 (1) : 131, 1942.

Annual herbs with stem up to 50 cm erect, branched or very rarely unbranched, hairs branched and spreading. Radical leaves 2.0-4.5 cm x 0.8-1.3 cm sagittate, auricles surrounding the nodes, alternate, midrid prominent on under surface, pubescent. Flowers up to 1.5 cm long, slender and glabrous. Sepals 4, up to 4 mm pubescent. Petals 4, longer than the sepals. Stamens 6, filaments of the same size. Pods up to 1.5 cm diam. slightly globular, a little broader than long, hard, glabrous, style short but persistent, stigma bilobed. Seeds 3, with only one reaching to maturity, hard, rounded and black.

Germination : The seeds remain dormant for the autumn and winter seasons and germinate in early summer.

Fl. & Fr. : April-May.

Dissemination : The seeds are dispersed mostly by wind or to some extent by rain water.

Habitat : An occasional weed of orchards, grasslands and some vegetable fields. Indicator of well aerated loams.

Root system : A simple tap root.

Geographical distribution : Western Asia, Temperate southern Europe, N. Africa, Iran, Caucasus, Central Asia, Afghanistan, Pakistan, Himalaya, Kashmir.

Specimens examined : *Kaul* 160 (27-4-1970) RRL Campus Srinagar.

Chromosome report : 2n=14 (DCA 44).

ERUCA P. Miller

Eruca sativa Mill. Gard. Dict. ed. 8, no. 1, 1768; FBI 1: 158; Stewart 313.

Annuals with stem up to 35 cm erect, branched, glabrous or slightly hairy towards

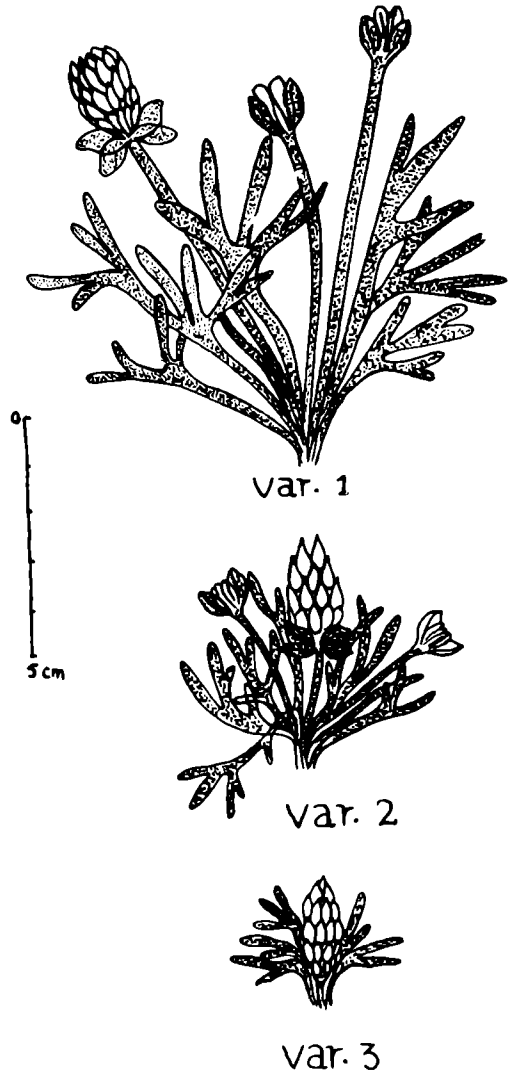


FIG. 9

Fig. 9. *Ceratocephalus testiculatus* (Crantz) Roth
a. var. 1 (flowering plant)
b. var. 2 (flowering plant)
c. var. 3 (flowering plant)

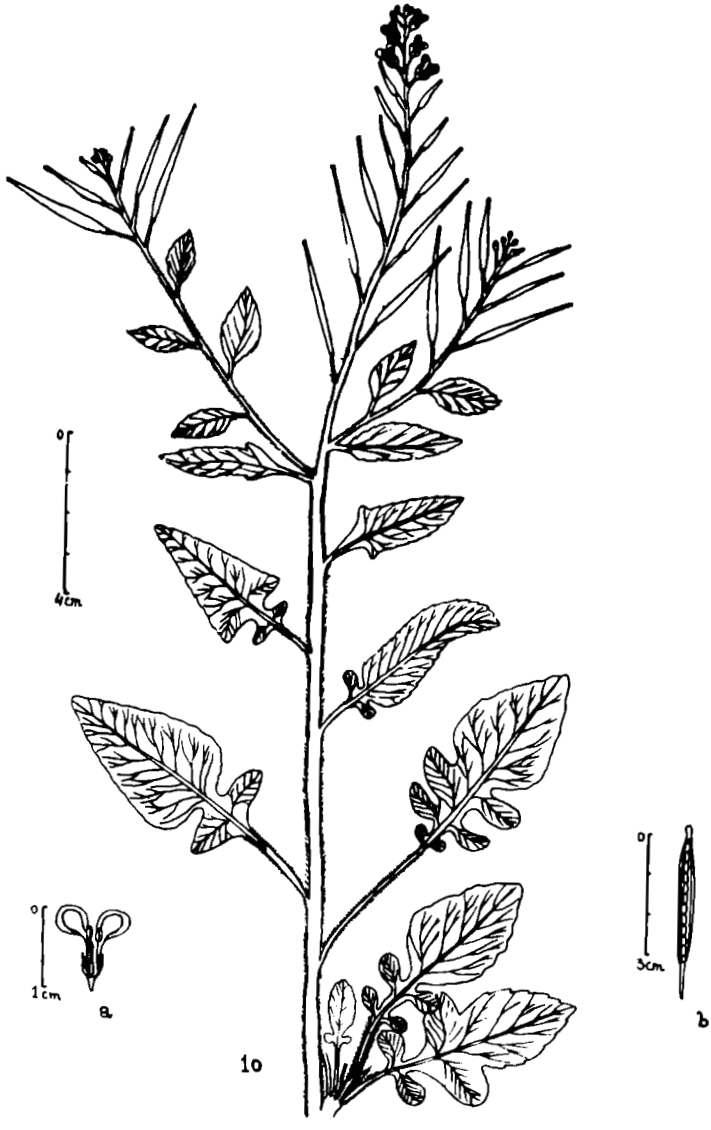


Fig. 10. *Sisymbrium irio* Linn (a flowering shoot)
a. v.s. flower, b fruit (l.s.)

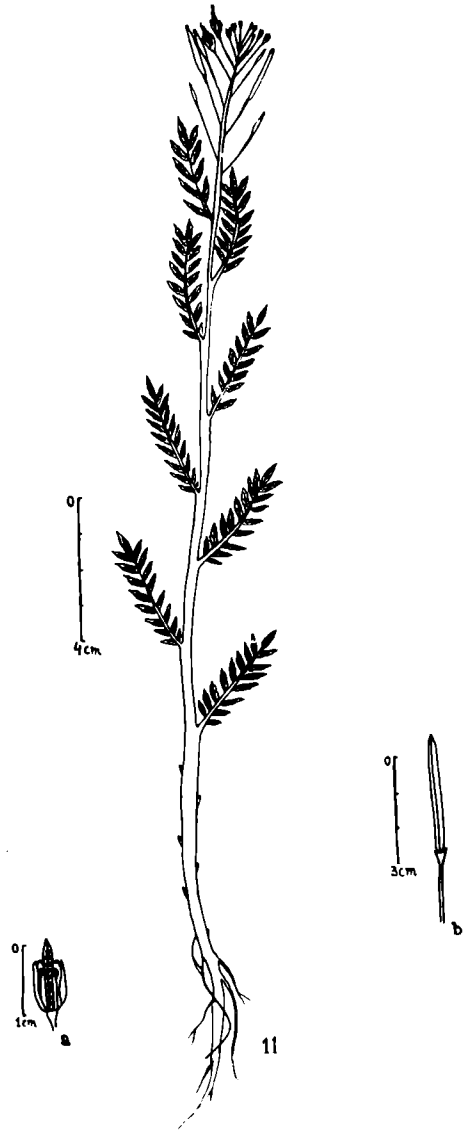


Fig. 11. *Descaurainea sophia* (L.) Webb. (a flowering plant)
a. v.s. mature flower, b. fruit

Fig. 12. *Cardamine hrisuta* Linn. (a flowering plant)
a. a flower, b. a dehiscing fruit

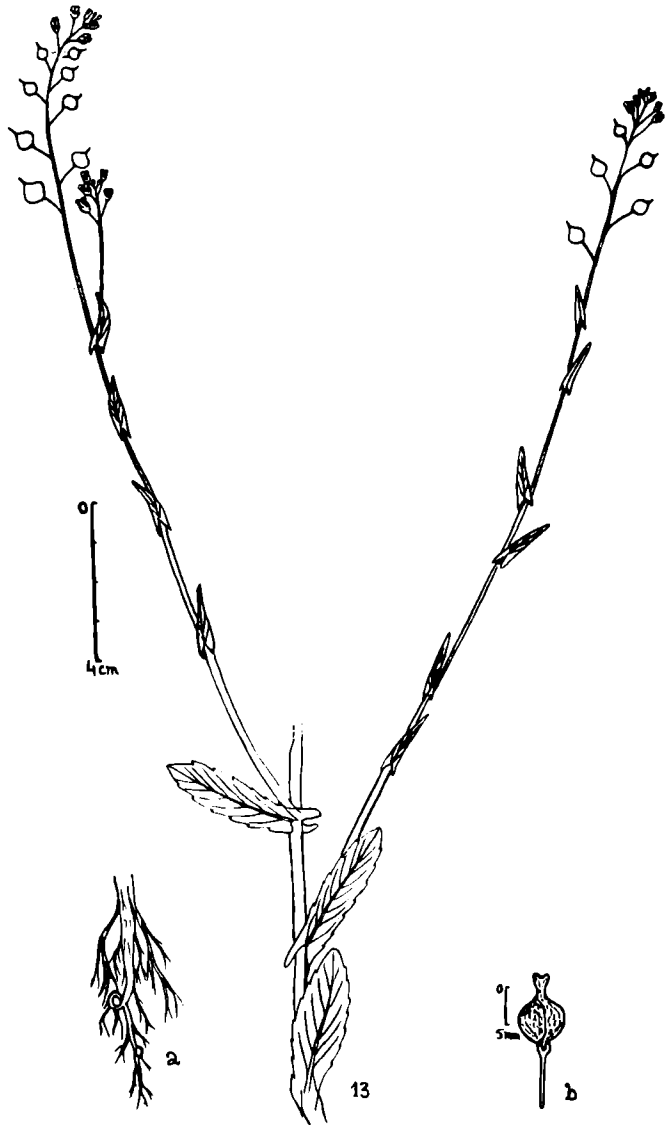


Fig. 13. *Neslia apiculata* (Fisch. Mey & Lall) Mey. (a flowering shoot) a. root system, b. a fruit

Fig. 14. *Malcolmia africana* (L.) R. Br. (a flowering shoot)
a. root system, b. v.s. flower, c. a fruit (l.s.)

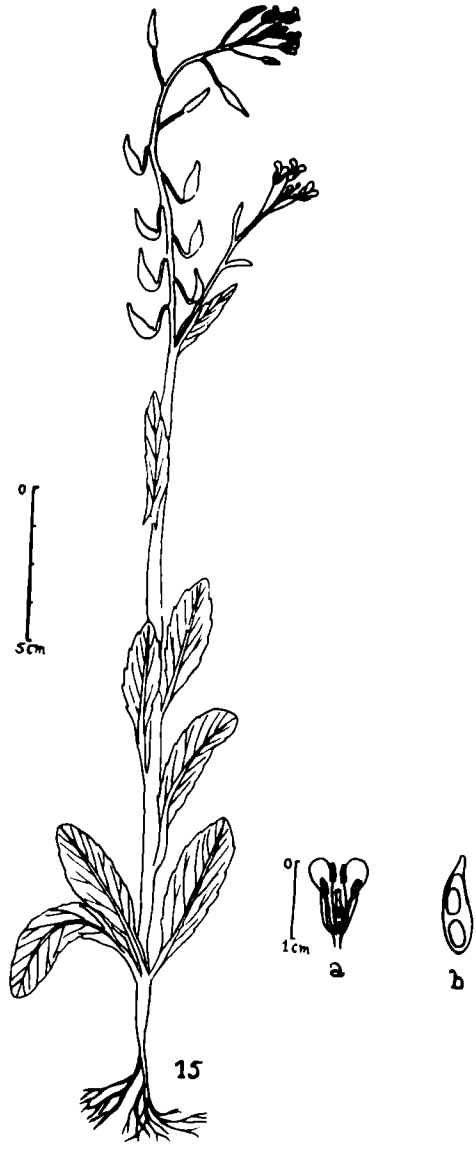


Fig. 15. *Goldbachia laevigata* (M. Bieb.) DC. (a flowering plant)
a. v s. flower, b. a fruit cut longitudinally

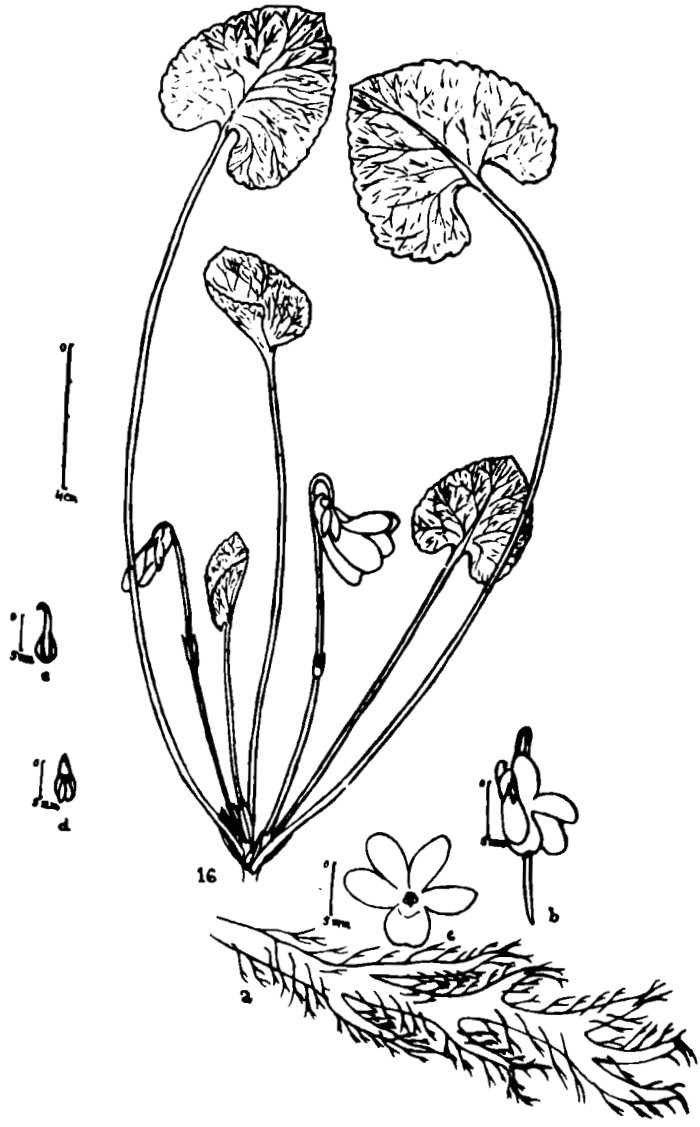


Fig. 16. A variable form of *Viola odorata* Linn. (a flowering shoot)
a. root system, b. a flower, c. a flower (side view), d. a stamen, e. an ovary

the base. Radical leaves 4.0-7.5 cm, petiolate, petiole 0.5-1.5 cm, glabrous, lyrate pinnatifid with apical lobes larger, segments coarsely toothed. Cauline leaves 0.8-3.5 cm, sessile, alternate, oblong, lanceolate, coarsely toothed or sometimes pinnatifid, glabrous; flowers yellowish, ebracteate, pedicels 3.8 mm, glabrous, in small branched racemes. Sepals up to 1 cm, linear and erect, glabrous, slightly saccate. Petals 4, longer than the sepals, unguiculate, veined, veins purplish. Pods up to 4.5 cm oblong, tapering into a seedless narrow beak, appressed to the axis, valves concave, 3-nerved, glabrous. Seeds in two rows, many, globose or slightly rounded, hard and black.

Germination : The seeds germinate in December and remain under snow for winter.

Fl. & Fr. : April-July.

Dissemination : The seeds get contaminated with crop seeds and are thereby disseminated.

Habitat : An occasional weed of wheat fields, *Brassica* fields, pea fields, some orchards and also fallow grasslands. Indicator of dry loams.

Root system : A simple tap root going about 25 cm deep into the soil.

Geographical distribution : Mediterranean region, Caucasus, Iran, Afghanistan, Central Asia.

Specimens examined : *Kapoor* 1086 (9-7-47) Naseem Bagh; *Kaul* 121 (23-3-1970) Airfield wheat fields.

Chromosome report : 2n=22 (Bhat, Bakshi & Kaul 1974).

THLASPI Linnaeus

Thlaspi arvense L. Sp. Pl. 641, 1753; FBI 1 : 162; Polunin 136, pl. 35; Stewart 329.

Annual herbs. Stem erect 10-25 cm, branched from the base, slightly hirsute. Leaves radical and cauline, former falling off soon, simple, lanceolate, 1-3.5 cm x 0.2-0.5 cm, entire, sessile, tapering towards the base. Flowers white in apical leafless clusters, pedicels 0.5-1 cm. Fruit almost circular with an apical notch, 0.3-0.8 cm diam., flattened, with a solitary hard brick-red seed.

Germination : Spring (March).

Fl. & Fr. : May-July.

Dissemination : The seeds are disseminated through wind and man during ploughing.

Habitat : An occasional weed of paddy fields. Sandy or silty clay loams.

Root system : A simple unbranched tap root goes up to 10 cm deep in soil.

Geographical distribution : Europe, Temperate Himalaya.

Specimen examined : *Kaul* 355 (24-5-1973) Badgam wheat fields.

MALCOLMIA R. Brown (*nom. cons*)

Malcolmia africana (L.) R. Br. in Ait. Hort. Kew. *l.c.*; FBI 1 : 146; Sabnis in J. Bombay Nat. Hist. Soc. 42(1) : 129, 1942; Kitamura 155; Stewart 320. **(Fig. 14)**

Hesperis africana L. Sp. Pl. 663, 1753.

Annual or biennial herbs. Stem decumbent up to 35 cm long, branched, leafy, hoary, covered with simple and forked hairs, rough and terete. Leaves 2-9.5 cm x 0.5-2 cm simple petiolate, petiole 0.5-1.5 cm hairy;

margin sinuate, covered with simple and hooked hairs. Flowers 0.5-2 cm long, pinkish white, pedicellate; pedicels small and hairy, arranged in racemes. Sepals 4, 0.3-1 cm linear, hairy. Petals longer than sepals, nearly double, spreading. Stamens tetradynamous. Pods 1.5-5 cm long, erect, stalks up to 3 mm, rough when mature, covered all over with simple and branched hairy growth; valves tapering into a subacute or blunt apex, veins 1-3 with a distinct mid-vein. Seeds 2-seriate, several, somewhat rounded and hard.

Germination : The seeds germinate in late autumn or early winter (November-December) and remain under snow for winter.

Fl. & Fr. : March-May.

Dissemination : The seeds are mo tly disseminated by wind and to some extent by rain water and man.

Habitat : A common weed of orchards, wheat fields, pea fields and Sarson fields. Indicator of fertile, well aerated, alluvial soils.

Root system : A stiff and tough branched tap root going deeper in the soil.

Geographical distribution : East Europe, Caucasus, Mediterranean region, Turkey, Central Asia, Iran, Afghanistan, Pakistan and Kashmir.

Specimens examined : *Gammie* s. n. (4-7-1891), Srinagar 5300 (DD); *Duthie* 10843 (8-5-1892) near Batwara Srinagar (CAL); *Kaul* RRL 5989 (24-5-1970) Chadura wheat fields; *Kaul* 226 (25-6-'70) RRL Campus, Srinagar.

Chromosome report : 2n=28 (Bhat, Bakshi and Kaul 1974).

GOLDBACHIA A.P. de Candolle (*nom cons.*).

Goldbachia laevigata (M. Bieb.) DC., Syst. 2. 577, 1821; FBI 1 : 166; Sabnis in J. Bombay Nat. Hist. Soc. 42 (1) : 131, 194 (Fig. 1

Raphanus laevigatus M. Bieb. Fl. Taur. Cau 2 : 129, 1808.

Annual herbs with stem up to 40 cm. erect branched or unbranched, branches ascending slightly pubescent near the base or glabrous Radical leaves petiolate, soon withering, muc longer than the cauline ones, oblong lanceo late, sinuate. Cauline one similar, 0.9-5.5 cr bases auricled, glabrous. Flowers white wit pinkish or rosy veins, arranged in lax 10-1 cm long racemes. Sepals elongate, glabrous caducous. Petals nearly double the length o sepals, entire. Ovary with a capitate stigma style O. Pods 0.8 - 1.5 cm swollen along a length, protruding into a small beak; thick and glandular when young, horizontal bu forming a V-shape with the pedicel when mature, pedicel as long or slightly shorter than the pod. Seeds 1-seriate, invariably in a pod longer than broad, hard and black.

Germination : The seeds germinate as the winter approaches and the seedlings remain under snow sprouting in early spring.

Fl. & Fr. : April - May.

Dissemination : The seeds are dispersed mainly by water and by man during agricul- tural operations.

Habitat : An occasional weed of orchards, fallow lands, grasslands and wheat fields. Indicator of sandy loams.

Root system : A simple much branched tap root going deeper into the soil.

Geographical distribution : Temperate Himalaya, Kashmir to Punjab, Westwards to S. Russia.

Specimen examined : *Kaul* 157 (20-4-1970) RRL Campus *pyrethrum* plantation.

Chromosome report : 2n=28 (DCA 45).

ALYSSUM Linnaeus

Alyssum desertorum Stapf, Denkschr. Akad. Wien. 51 : 302, 1886; Stewart 297.

A. minimum Willd. Sp. Pl. 3 : 464, 1800 non L. 1753; FBI 1 : 141.

Annual herbs. Stem up to 15 cm above ground, branched; branches slender, spreading from the base, leafy, covered with stellate pubescence. Leaves up to 2.0 x 1.0 cm, petiole small, oblong; apex somewhat rounded tapering towards the base, margins entire all over covered with stellate pubescence, texture rough. Flowers up to 3 mm. diam yellow, ebracteate, pedicels very small, crowded to form small rounded heads near the apex. Sepals persistent, green boat shaped, as long as the petals. Petals minute with notched apices, withering soon. Stamens 6, with or without appendages. Pods up to 3.5 mm diam. slightly broader than long, notched 2-celled. Seeds 3-6, small and brownish.

Germination : The seeds sprout just before the winter approaches i.e. early December and remain under snow during winter,

Fl. & Fr. : March-May.

Dissemination : The seeds are dispersed either by wind or by contamination with crop seeds.

Habitat : An occasional weed of wheat fields, muddy house tops and fallow lands. Indicator of dry clay loams.

Root system : A meagrely developed unbranched tap root.

Geographical distribution : Afghanistan, Europe, Turkey Caucasus, Syria, Iran. Central Asia, Siberia, Mangolia, Himalaya : Kashmir.

Specimen examined : *Kaul* 145 (5-4-1970) Chishma Shahi, orchards and wheat fields.

EROPHILA de Candolle (*nom. cons*).

Erophila verna (L.) E. Meyer var. **cabillonensis** (Jord.) Schulz in Pflanzenreich 89 : 352, 1927; Kitamura in Res. Kyoto Univ. Sci. Exped. 8 : 97, 1966.

E. cabillonensis Jord. Diagn. 226, 1864.

Draba verna L. Sp. Pl. 642, 1753.

E. vulgaris DC. Syst. 2 : 356, 1821; FBI 1 : 145.

Annual herbs up to 15.5 cm. Leaves up to 13.5 cm, all radical forming a rosette at the base, oblong lanceolate, broader at the apex and narrowing towards the base, margins slightly pubescent and finely dentate. Scapes 1-5, generally one with flowers arranged towards the apices in racemes, glabrous or slightly pubescent at the base. Flowers white, ebracteate, pedicellate; pedicels up to 1.5 cm glabrous. Sepals 4, greenish, caducous. Petals 4, each lobe deeply bifid, nearly twice the length of sepals. Pods 4-8 mm long, twice as long as broad, compressed, elliptic and glabrous. Seeds many.

Germination : The seeds are small, produced in large quantities sprouting in early spring (February-March).

Fl. & Fr. : April-May.

margin sinuate, covered with simple and hooked hairs. Flowers 0.5-2 cm long, pinkish white, pedicellate; pedicels small and hairy, arranged in racemes. Sepals 4, 0.3-1 cm linear, hairy. Petals longer than sepals, nearly double, spreading. Stamens tetradynamous. Pods 1.5-5 cm long, erect, stalks up to 3 mm, rough when mature, covered all over with simple and branched hairy growth; valves tapering into a subacute or blunt apex, veins 1-3 with a distinct mid-vein. Seeds 2-seriate, several, somewhat rounded and hard.

Germination : The seeds germinate in late autumn or early winter (November-December) and remain under snow for winter.

Fl. & Fr. : March-May.

Dissemination : The seeds are mo tly disseminated by wind and to some extent by rain water and man.

Habitat : A common weed of orchards, wheat fields, pea fields and Sarson fields. Indicator of fertile, well aerated, alluvial soils.

Root system : A stiff and tough branched tap root going deeper in the soil.

Geographical distribution : East Europe, Caucasus, Mediterranean region, Turkey, Central Asia, Iran, Afghanistan, Pakistan and Kashmir.

Specimens examined : *Gammie* s. n. (4-7-1891), Srinagar 5300 (DD); *Duthie* 10843 (8-5-1892) near Batwara Srinagar (CAL); *Kaul* RRL 5989 (24-5-1970) Chadura wheat fields; *Kaul* 226 (25-6-'70) RRL Campus, Srinagar.

Chromosome report : 2n=28 (Bhat, Bakshi and Kaul 1974).

GOLDBACHIA A.P. de Candolle (*nom cons.*).

Goldbachia laevigata (M. Bieb.) DC., Syst. 2: 577, 1821; **FBI** 1 : 166; Sabnis in J. Bombay Nat. Hist. Soc. 42 (1) : 131, 1942. **(Fig. 15)**

Raphanus laevigatus M. Bieb. Fl. Taur. Cauc. 2 : 129, 1808.

Annual herbs with stem up to 40 cm. erect, branched or unbranched, branches ascending, slightly pubescent near the base or glabrous. Radical leaves petiolate, soon withering, much longer than the cauline ones, oblong lanceolate, sinuate. Cauline one similar, 0.9-5.5 cm bases auricled, glabrous. Flowers white with pinkish or rosy veins, arranged in lax 10 - 18 cm long racemes. Sepals elongate, glabrous, caducous. Petals nearly double the length of sepals, entire. Ovary with a capitate stigma, style O. Pods 0.8 - 1.5 cm swollen along all length, protruding into a small beak; thick and glandular when young, horizontal but forming a V-shape with the pedicel when mature, pedicel as long or slightly shorter than the pod. Seeds 1-seriate, invariably in a pod, longer than broad, hard and black.

Germination : The seeds germinate as the winter approaches and the seedlings remain under snow sprouting in early spring.

Fl. & Fr. : April - May.

Dissemination : The seeds are dispersed mainly by water and by man during agricultural operations.

Habitat : An occasional weed of orchards, fallow lands, grasslands and wheat fields. Indicator of sandy loams.

Root system : A simple much branched tap root going deeper into the soil.

Geographical distribution : Temperate Himalaya, Kashmir to Punjab, Westwards to S. Russia.

Specimen examined : *Kaul* 157 (20-4-1970) RRL Campus *pyrethrum* plantation.

Chromosome report : 2n=28 (DCA 45).

ALYSSUM Linnaeus

Alyssum desertorum Stapf, Denkschr. Akad. Wien. 51 : 302, 1886; Stewart 297.

A. minimum Willd. Sp. Pl. 3 : 464, 1800 non L. 1753; FBI 1 : 141.

Annual herbs. Stem up to 15 cm above ground, branched; branches slender, spreading from the base, leafy, covered with stellate pubescence. Leaves up to 2.0 x 1.0 cm, petiole small, oblong; apex somewhat rounded tapering towards the base, margins entire all over covered with stellate pubescence. texture rough. Flowers up to 3 mm. diam yellow, ebracteate, pedicels very small, crowded to form small rounded heads near the apex. Sepals persistent, green boat shaped, as long as the petals. Petals minute with notched apices, withering soon. Stamens 6, with or without appendages. Pods up to 3.5 mm diam. slightly broader than long, notched 2-celled. Seeds 3-6, small and brownish.

Germination : The seeds sprout just before the winter approaches i.e. early December and remain under snow during winter,

Fl. & Fr. : March-May.

Dissemination : The seeds are dispersed either by wind or by contamination with crop seeds.

Habitat : An occasional weed of wheat fields, muddy house tops and fallow lands. Indicator of dry clay loams.

Root system : A meagrely developed unbranched tap root.

Geographical distribution : Afghanistan, Europe, Turkey Caucasus, Syria, Iran, Central Asia, Siberia, Mangolia, Himalaya : Kashmir.

Specimen examined : *Kaul* 145 (5-4-1970) Chishma Shahi, orchards and wheat fields.

EROPHILA de Candolle (*nom. cons*).

Erophila verna (L.) E. Meyer var. **cabillonensis** (Jord.) Schulz in Pflanzenreich 89 : 352, 1927; Kitamura in Res. Kyoto Univ. Sci. Exped. 8 : 97, 1966.

E. cabillonensis Jord. Diagn. 226, 1864.

Draba verna L. Sp. Pl. 642, 1753.

E. vulgaris DC. Syst. 2 : 356, 1821; FBI 1 : 145.

Annual herbs up to 15.5 cm. Leaves up to 13.5 cm, all radical forming a rosette at the base, oblong lanceolate, broader at the apex and narrowing towards the base, margins slightly pubescent and finely dentate. Scapes 1-5, generally one with flowers arranged towards the apices in racemes, glabrous or slightly pubescent at the base. Flowers white, ebracteate, pedicellate; pedicels up to 1.5 cm glabrous. Sepals 4, greenish, caducous. Petals 4, each lobe deeply bifid, nearly twice the length of sepals. Pods 4-8 mm long, twice as long as broad, compressed, elliptic and glabrous. Seeds many.

Germination : The seeds are small, produced in large quantities sprouting in early spring (February-March).

Fl. & Fr. : April-May.

Dissemination : The seeds are disseminated mostly by wind and to some extent by rain water.

Habitat : A common weed of lawns, flower beds, roadsides, footpaths and orchards preferring moisture and shady situations. Loam indicators.

Root system : A meagrely developed tap root.

Geographical distribution : Europe, Caucasus, Turkey Syria, Iran, Central Asia, Afghanistan, Himalaya, Kashmir.

Specimen examined : *Kaul* 130 (28-3-1970 Rawalpora orchards.

ALLIARIA Heister ex Fabricius

Alliaria petiolate (M. Bieb.) Cav. & Grande Boll. Orto. Bot. Napoli 3 : 418, 1913; Stewart 297.

Arabis petiolata M. Bieb. Fl. Taur. Cauc. 2 : 126, 1808.

Sisymbrium alliaria Scop. Fl. Car. ed. 2, 2 : 26, 1772; FBI 1 : 151.

Mostly biennial herbs. Stem up to 35 cm. erect or procumbent unbranched, rarely branched, weak, glabrous or hairy towards the base. Radical leaves 2.5-4.7 cm diam. petiolate; petiole upto 5.5 cm, glabrous or downy, cordate, glabrous, margins crenate or even serrate. Cauline ones similar but petiole up to 1.5 cm. Flowers white, ebracteate, pedicellate in small corymbose racemes. Sepals 4, petaloid at maturity, nearly half as long as the petals. Pods linear up to 1.5 cm or rarely more glabrous, compressed, stalked, stalk longer than the pod and smooth. Seeds 1-seriate oblong, hard, testa dotted.

Germination : Early March.

Fl. & Fr. : The flowering takes place once in two years; March-May.

Dissemination : The seeds are disseminated mostly by wind.

Habitat : A rare weed of orchards and gardens of public interest. It prefers moist and shady situations.

Root system : A thick tap root with its branches going up to 20 cm. deep into the soil.

Geographical distribution : Western Europe, Western Himalaya; from Kumaon to Kashmir; Afghanistan.

Specimen examined : *Kaul* RRL 5973 (10-4-1969) Harwan near reservoir.

Chromosome report : 2n=36 (DCA 41.).

ARABIDOPSIS Heynhold

Arabidopsis thaliana (L.) Heynhold in Holl. et Heynh. Fl. Sachs. 2 : 538, 1842; Kitamura 141; Polunin 124; Stewart 299.

Arabis thaliana L. Sp. Pl. 665, 1753.

Sisymbrium thalianum J. Gray & Monnard in Ann. Sc. Nat. Bot. Ser. 1, 339, 1926; FBI 1 : 148.

Annual herbs. Stem 8-20 cm, erect, slender, branched, glabrous or slightly pubescent towards the base with scattered, spreading, simple and forked hairs. Radical leaves forming a rosette, withering soon, petiolate; petiole 1.5-4.0 cm glabrous; pubescent covered with simple and stellate hairiness. Cauline leaves 1.5-2.5 cm x 0.5 cm ovate lanceolate, simple and sessile margins entire, slightly pubescent. Flowers white arranged in slender elongated and branched axillary racemes; pedicellate; pedicels 0.5-1.5 cm, slender, glabrous or sometimes hairy. Pods up to 2 cm., stalk some-

what shorter than the pod, narrow and linear, valves convex, 1-nerved.

Germination : The seeds germinate in early spring (late Feb. to early March).

Fl. & Fr. : April-May.

Dissemination : The seeds are small and light, easily disseminated by wind and to some extent by rain water.

Habitat : A common weed of lawns, roadsides, footpaths and some grasslands. Indicator of alluvials or sandy loams.

Root system : A meagrely developed tap root.

Geographical distribution : Eurasia, Afghanistan, Himalaya, Sikkim to Kashmir.

Specimens examined : *Kaul* RRL 5943 (1-4-1969) University campus Srinagar; *Kaul* 129 (28-3-1970) Barzulla lawns.

Chromosome report : 2n=10 (DCA 40).

Illustration : Geigy Weed tables, Fig. 40. 1.

TURRITIS Linnaeus

Turritis glabra L. Sp. Pl. 666, 1753; Rao in BOBSI 2 : 395, 1960.

Arabis glabra Crantz, Stirp. Austr. 36, 1762; FBI 1 : 135.

Annual herbs. Stem 20-50 cm, erect, branched or sometimes unbranched, purplish below, dull green pubescent below, some small branches pubescent all over. Radical leaves 4.0-6.5 cm, simple, oblong lanceolate, sessile, apex obtuse, margins dentate, pubescence stellate on under surface, soon withering. Cauline leaves 2-3.5 cm, oblong, lanceolate, stem clasping bases auricled, margins dentate, slightly hairy; uppermost leaves slightly sagittate with acute apices. Flowers 0.5 cm diam., light yellow, in branched 5-18.5 cm long racemes. Sepals 4, green slightly hairy. Petals as many as sepals but a bit longer. Stamens tetradynamous, filaments as long as petals. Pods up to 3.5 cm, linear, stalks hairy. Seeds 2-seriate and brick red, small but very hard.

Germination : The seeds germinate in early spring (Feb -March).

Fl. & Fr. : April-May.

Dissemination : The seeds are disseminated by wind and to some extent by rain water.

Habitat : A rare weed inhabiting some orchards. Sandy loam indicators.

Root system : A simple tap root.

Geographical distribution : Temperate Europe, Asia, North America, Alps of Australia, Western Himalaya: Kumaon to Kashmir.

Specimens examined : *Duthie* 10866 (13-5-1892) Pirni, Jehlum valley (DD); *Kaul* RRL 5957 (8-4-1969) Majid Bagh orchards; *Kaul* 133 (29-3-1970) Chishma Shahi orchards.

Chromosome report : 2n=16, 32 (DCA 44).

DRABOPSIS K.H.E. Koch

Drabopsis verna K.H.E. Koch in Linnaea 15 : 253, 1841; Stewart 312.

Arabis nuda Belang. ex Boiss. in Ann. Sc. Nat. Ser. 2, 17 : 54, 1842; FBI 1 : 137.

A small annual up to 10 cm high, growing in small colonial tufts. Leaves all radical, 0.5-1.5 cm, generally sessile or subsessile, oblong, broad in the middle, slightly hairy or even glabrous, margin entire. Scapes one to several, leafless, generally glabrous, erect. Flowers small, yellow. Sepals 4, 2-5 mm, glabrous, caducous. Petals 4, cruciform, longer than the

sepals, lobes entire. Pods up to 1.8 cm, linear, stalk very small, glabrous, erect, valves 1-3 veined, midvein distinct, seeds 1-seriate, 0.5-1 mm diam., brownish, not margined.

Germination : The seeds germinate in early spring. (Feb.-March).

Fl. & Fr. : April-May.

Dissemination : The seeds are disseminated by wind or irrigated water.

Habitat : An occasional weed of orchards, grasslands and *Morus* nurseries; growing in colonies under the shade of trees and moist situations. Indicator of alluvials or sandy loams.

Root system : The roots are in the form of slender adventitious roots remaining in the surface horizons.

Geographical distribution : Afghanistan to Turkey, Western Himalaya, Kashmir.

Specimen examined : *Kaul* 124 (25-3-1970) Rawalpora *Morus* stands.

VIOLACEAE

VIOLA Linnaeus

Viola odorata L. Sp. Pl. 934, 1753; FBI I : 182; Stewart 492.

(Fig. 16)

Perennial herbs with a stout, creeping or stoloniferous rootstock. Stem O. Leaves all radical, up to 3 cm diam, petiolate, petiole 3-9 cm, slender, hairy or even glabrous, broadly cordate, tip rounded, crenate, glabrous or margins slightly hairy. Stipules elongated, generally toothed with linear segments. Flowers up to 2.5 cm long including spur, pinkish blue or purplish, bracts O, bracteoles 2, small, linear, pedicellate; pedicels 6-9 cm long, glabrous or hairy. Sepals 5, 2.5-4.5 mm long, apex obtuse, margins glabrous or setose, persistent. Petals 5, lower spurred, spur short and subulate. Stamens 5. Ovary with a small inflated style and decurved stigma, 3-celled. Seeds 3-6 or more, somewhat rounded.

Germination : The seeds are hard and do not germinate easily. The plants mostly reproduce vegetatively. The seedlings are seen in March.

Fl. & Fr. : April-June.

Habitat : A rare weed but having a gregarious habit in some orchards under the shade of trees. Indicator of sandy loams.

Root system : A thick creeping somewhat black rootstock trailing in the surface horizon of the soil producing adventitious roots and shoots.

Geographical distribution : Europe, North Africa, N. and W. Asia, Himalaya, Kashmir.

Specimens examined : *Kaul* RRL 5975 (10-4-1969) Harwan Park; *Kaul* 139 (30-3-1970) Rawalpora orchards.

Chromosome report : 2n=20 (DCA 49).

A variable form of this species is described as under :

Rootstock thick and stoloniferous. Stem up to 45 cm, weak procumbent, glabrous or very rarely hairy towards the base. Leaves mostly radical and some cauline. Radical ones up to 6.5 cm diam, stipulate, stipules up to 1.8 cm, base broad, finally tapering towards the apex, margins dentate, petiolate, petiole up to 21.5 cm long, slender, mostly glabrous, cordate, apex rounded, margins crenate, lobes rounded, glabrous. Cauline ones similar but obovate to cordate and short

petioled. Flowers up to 2.2 cm long, including spur, pure white or sometimes lower part of spur a bit brownish, pedicel up to 7.5 cm long, glabrous. Sepals 5 up to 1 cm long, broader at the base and tapering into a subacute apex, margins glabrous or setose. Petals spurred, small but slightly hooked. Ovary similar to *V. odorata* but the seeds are definitely larger.

A rare weed of orchards of Srinagar.

Kaul 117 (12-3-1970) Sanat Nagar, Srinagar.

CARYOPHYLLACEAE

Key to the genera

1. Sepals united in a 5-toothed calyx :
   2. Calyx cylindric or ovoid and inflated; fruit a membranous capsule — **Silene**
   2. Calyx not so inflated; fruit membranous or not :
      3. Petals pink, margins jagged and scales at throat — **Vaccaria**
      3. Petals without scales or jagged margins, notched or entire. Flowers umbellate 4-7 arising from a point — **Holosteum**
1. Sepals free or rarely fused at the base :
   4. Petals shortly or deeply 2-lobed :
      5. Petals shortly bifid. Fruit longer than the calyx with twice as many teeth as styles — **Cerastium**
      5. Petals bifid, rarely entire. Ovary with 3 styles — **Stellaria**
      5. Petals with diverging lobes. Ovary with 5 styles — **Myosoton**
   4. Petals entire or even absent :
      6. Leaves ovate to obovate or sometimes linear, bases not united. Petals as long or even shorter than sepals — **Arenaria**
      6. Leaves obovate to linear lanceolate, bases united, petals 4-5 or 0 — **Sagina**

SILENE Linnaeus

Silene conoidea L. Sp. Pl. 418, 1753; FBI 1: 218; Sabnis in J. Bombay Nat. Hist. Soc. 42 (1): 135, 1942; Mizushima in Kitamura, Fl. Afghanistan 115, 1960; Stewart 251.

Annuals with stem 15-55 cm, erect, branched or unbranched, ribbed, finely grooved, glandular, pubescent, apical portions sticky. Radical leaves similar to cauline ones but subsessile and soon withering. Cauline leaves 2.5-8.5 cm, oblong to lanceolate, broader towards base and tapering into an acute apex, opposite, stem clasping, veins running somewhat parallel, glandular pubescent. Flowers 2.0-3.5 cm long, in panicled cymes, bracteate, bracts leafy; pedicellate; pedicel as long or shorter than the flowers, pink. Calyx tubular, tube up to 3 cm long, 20-30 veined, finely grooved, sticky, narrowed towards the apex, 5-toothed, teeth linear lanceolate, bases of the tube dilating in fruit; persistent. Petals 5, pink, limb obovate, small, entire, claw long, auricled. Stamens 10, outer five adnate to the petals, anthers elongated, basifixed. Ovary raised on a small gynophore, oblong-ovoid, narrowing into a pointed apex, shining; styles 3, small. Capsule ovoid, enclosed in globosely inflated calyx. Seeds many, brick-red, hard with small tuberculated rows.

Germination : The seeds are produced in large quantities only a few germinate in early spring i.e February—March.

Fl. & Fr. : Ending March-Early May.

Dissemination : The seeds are mostly disseminated by wind and to some extent by man during agricultural operations.

Habitat : A rare weed of some orchards, grasslands and fallow lands. Loam indicators.

Root system : A much branched tap root.

Geographical distribution : Mediterranean region, C. Assa, Iran, Afghanistan, Pakistan, Western Himalaya and Tibet.

Specimens examined : *Kaul* RRL 5995 (26-5-1970) Barzulla orchards; *Kaul* RRL 19748 (24-6-1972) Rawalpora orchards.

Chromosome report : n=10 (Bhat, Bakshi & Kaul. 1972).

VACCARIA Medikus

Vaccaria pyramidata Medik. Philos. Bot. 1 : 96, 1789; Stewart 256,

Saponaria vaccaria L. Sp. Pl. 409, 1753; FBI 1 : 217; Sabnis in J. Bombay Nat. Hist. Soc. 42 (1) : 135, 1942; Mizushima in Kitamura, Fl. Afghanistan 115, 1960.

Tall annuals. Stem up to 75 cm, erect, robust, branched, narrowly grooved, glabrous. Leaves 3.0-8.5 x 1.5-3.5 cm, sessile, linear-oblong, opposite, apex acute, margins entire, glabrous. Flowers in dichotomous cymes, up to 3.5 cm diam., bracteate, pedicellate; pedicels very small. Sepals 5, up to 2 cm long, ovoid or oblong, distinctly nerved, glabrous. Petals 5, with broad, entire or notched, obovate limbs, white with rosy streaks. Stamens many, generally 10-20. Ovary 2-celled with 2 styles. Capsule ovoid to oblong. Seeds many, globose, black and granulate.

Germination : The seeds sprout in spring (March-April).

Fl. & Fr. : July-August.

Dissemination : The seeds are disseminated mostly by man through agricultural operations.

Habitat : An occasional weed of wheat, pea and sarson fields. Indicator of fertile soil conditions.

Root system : The main tap root is about 20 cm long and branches remain in the surface horizons only.

Geographical distribution : Chiefly Mediterranean and West Asiatic regions.

Specimen examined : *Kaul* RRL 19747 (24-6-1972) Rawalpora orchards.

HOLOSTEUM Linnaeus

Holosteum umbellatum L. Sp. Pl. 88, 1753; FBI 1 : 227; Polunin 82, t. 8; Stewart 245.

(Fig. 17)

Annual herbs, 10 to 25 cm long. Stem branched from the base, erect, internodes up to 5 cm, glabrous, slender, slightly glandular. Leaves simple, 1.0-3.5 x 0.3-0.8 cm linear to obovate-lanceolate, opposite, semiamplexicaule, entire. Flowers in terminal umbellate cymes, bracteate; bracts small, membranous, not seen in older plants, pedicellate; pedicels 4-7, arising from a point, glabrous, young stalks deflexed. Sepals 5, up to 0.5 cm long, glabrous, edges scarious, persistent. Petals 5, slightly longer than sepals, notched or entire. Stamens, 4-5, with globular anthers. Ovary 1-celled with 3 styles. Capsule 6-valved, valves with recurving tips in dehisced fruit. Seeds many, rough, concavo-convex, up to 1 mm diam., brick red and hard.

Germination : The seeds sprout in early spring (February-March).

Fl. & Fr. : Ending March-May.

Dissemination : The seeds are disseminated, mostly by man and to some extent by wind.

Habitat : A rare weed of vegetable fields and fallow lands. Indicator of open and aerated soils.

Root system : A meagrely developed adventitious root system never going deep.

Geographical distribution : West Asia, North Africa, Europe, Iran, Afghanistan and Kashmir.

Specimen examined : *Kaul* 123 (25-3-1970) Sanat Nagar orchards.

Chromosome report : 2n = 20 (DCA, 1955).

CERASTIUM Linnaeus

Cerastium glomeratum Thuill. Fl. Paris ed. 2, 266, 1799; Stewart 241. **(Fig. 18)**

C. vulgatum L. var. *glomerata* Thuillier ex Edgew. & Hook. f. in Hook. f. FBI 1 : 228, 1875.

Annual herbs, branching from the base. Stem up to 15 cm, rarely more, suberect or erect, weak, finely ribbed, glandular hairy, fast green, sticky towards the apices of the branches. Leaves up to 2.5 x 1.5 cm, simple, sessile, opposite, ovate or obovate, glandular hairy, margins entire, apex blunt. Flowers white in axillary cymes, towards the apices of the branches, bracteate; bracts small, leafy, glandular hairy; pedicellate; pedicels smaller than the flower, glandular and viscid. Sepals 5, up to 7 mm long, obovate, finely tapering towards the apex, glandular pubescent, persistent, margins membranous. Petals 5, spreading, as long or slightly longer than the sepals, apex bifid. Stamens 10, filaments of variable size. Ovary obovate, styles 5, shorter than the ovary. Capsule protruding out of the persistent calyx, valves 5-7 fid, tubular, dehiscing by an apical pore. Seeds many, small, hard, finely tubercled, brownish.

Germination : The seeds germinate in early spring (February end—Early March).

Fl. & Fr. : April-June.

Dissemination : The seeds are mostly disseminated by rain water or irrigation water.

Habitat : The occasional weed of lawns, flower beds, margins of wheat fields, orchards and even fallow lands, preferring moisture. Indicator of fine alluvials or loam.

Root system : A meagrely developed adventitious root system remaining in the surface layers of soil only.

Geographical distribution : A cosmopolitan weed; probably a native of Europe.

Specimens examined : *Kaul* 150 (9-4-1970) RRL campus lawns; *Kaul* RRL 19749 (24-6-1972) Rawalpora orchards.

ARENARIA Linnaeus

Arenaria serpyllifolia L. Sp. Pl. 423, 1753; FBI 1 : 239; Collett 53; Mizushima in Kitamura, Fl. Afghanistan 110, 1960; Rao in BOBSI 2: 397, 1960; Stewart 239. **(Fig. 19)**

Annual herbs. Stem 15-25 cm long erect or decumbent, branches cymose, arising from the root, all over pubescent, slender. Leaves simple up to 1 cm long, rarely more, ovate to obovate, opposite, acuminate, sessile, 1-3 nerved, ciliate, margins more hairy. Flowers in apical cymes, white, up to 0.5 cm diam. pedicellate; pedicels longer in fruit, pubescent. Calyx 5, persistent, hairs with rounded tips. Petals 5, entire, generally shorter than the

sepals, white. Stamens 5 with globular pinkish anthers. Ovary obovate, styles 3, recurved with a hairy stigmatic portion. Capsule 1-celled, slightly exceeding the persistent calyx, ovoid with small 6 valves, dehiscence by apical pore. Seeds many, globular, brown and hard.

Germination : The seeds are produced in large quantities and germinate in late autumn (November-December).

Fl. & Fr. : April-June.

Dissemination : The seeds get disseminated by wind, irrigation water and through animals and men.

Habitat : An occasional weed of lawns, muddy walls, house tops and wheat fields. It is known to be a lime indicator.

Root system : A meagrely developed tap root system.

Geographical distribution : Temperate Europe, Asia and N. Africa.

Specimens examined : Kaul 30 (21-5-1969) Badgam, along walls; *Kaul* RRL 19750 (24-6-1972) Rawalpora orchards.

Chromosome report : 2 n = 40 (DCA 61).

STELLARIA Linnaeus

Stellaria media (L.) Cyr. Ess. Pl. Char. 36, 1784; FBI 1 : 230; Rao in BOBSI 2 : 397, 1960; Mizushima in Hara, Fl. Eastern Himalayas 82, 1966; Stewart 254.

Alsine media L. Sp. Pl. 272, 1753.

Annual herbs with stem up to 30 cm long, weak, procumbent, glandular, pubescent, branched, rooting at the nodes, flaccid. Leaves 0.5-3.0 cm diam., lower ones petiolate; petiole up to 1.5 cm, slightly winged and pubescent; uppermost sessile, opposite, margins smooth, ovate to ovate-cordate, glabrous or lower surface somewhat pubescent. Flowers up to 6 mm diam, in axillary cymes, bracteate; bracts leafy, pedicellate; pedicels smaller than the leaves, glandular. Sepals 5, free, lanceolate, broader at the base, apex acute, slightly hairy, as long as petals. Petals 5, each 2-fid, white. Stamens 10, some anthers red. Ovary globular, styles 3. Capsule pyramidal, up to 1 cm diam, longer than broad, protruding out of the persistent calyx. Seeds many, brick red, small, tubercled, hard and somewhat circular.

Germination : The seeds germinate in late autumn, i.e. November and sometimes in early March also.

Fl. & Fr. : March-July.

Dissemination : The seeds are mostly disseminated by rain or irrigation water and to some extent by animals, especially hoofed animals.

Habitat : A common abundant weed growing in orchards by the sides of drainage, wastelands and some damp areas. Indicator of damp and alkaline soils.

Root system : The roots are developed profusely on the nodes.

Geographical distribution : All Arctic and north temperate regions.

Specimens examined : *Kashavanand* 26978 (3-6-1908) Srinagar (CAL); *Kaul* RRL 5944 (1-4-1969) University campus; *Kaul* 153 (16-4-1970) Badgam roadsides.

An ecotype of this species is seen to grow in wheat fields under open and dry conditions. It forms small tufts or mats. Stem much smaller turning greenish purple. Leaves all

sessile, ovate, very small. Petals generally shorter than sepals. Capsule included in the calyx.

Specimens examined: *Kaul* 117a (17-3-1970) Barzulla fallow fields; *Kaul* 122b (25-3-1970) Shalimar wheat fields.

Remarks : The plants are fed to the cattle.

MYOSOTON Moench

Myosoton aquaticum (L.) Moench, Meth. *l.c.*; Stewart 249.

Cerastium aquaticum L. Sp. Pl. 439, 1753.

Stellaria aquatica (L.) Scopoli, Fl. Carniol. ed. 2, 1 : 319, 1772; FBI 1 : 229; Mizushima in Hara, Fl. Eastern Himalayas 82, 1966.

Perennial herbs. Stem up to 75 cm long, procumbent or suberect, weak, fistular, branches trailing faintly ribbed with narrow grooves, glandular towards the apices of branches. Leaves 1.0-8.5 x 0.3-2.5 cm, lower ones short petioled, broader at the base and tapering towards the apex, opposite, margins entire or sinuate, glabrous or glandular hairy. Flowers up to 1 cm diam, white in axillary cymes, bracteate, bracts leafy; pedicellate; pedicels slender, up to 2.5 cm, glandular hairy. Sepals 5, ovate lanceolate, glandular, enlarged in fruit. Petals 5, with diverging lobes, slightly longer than sepals. Stamens 10, included. Ovary obovate, styles 5, diverging. Capsule ovoid or globose, up to 1.5 cm diam.; stalks deflexed; dehiscence, valvular, valves 5, acute. Seeds globose, tubercled, brick red and hard.

Germination : The seeds remain dormant in the muddy soil for autumn and winter and sprout in early summer i.e. February-March.

Fl. & Fr. : June-August.

Dissemination : The occasional weed of damp fallow lands, floating islands and some water canals.

Habitat : An occasional weed of floating islands preferring damp situations.

Root system : The nodes are rooting and fix the plants in the muddy soil.

Geographical distribution : North and West Asia, N. Africa and Europe.

Specimens examined : *Gammie* s.n. (18-7-1891) Kashmir (DD); *Kaul* 27 (2-5-1969) Shalimar floating fields.

SAGINA Linnaeus

Sagina saginoides Karst., Deutsche Fl. Pharm. Med. Bot. 539, 1882; Stewart 250.

Spergula saginoides L. Sp. Pl. 441. 1753.

Sagina procumbens auct. non L (1753); FBI 1: 242; Collett 53; Rao in BOBSI 2: 397, 1960.

A small somewhat tufted perennial herb. Stem branching from the base, weak procumbent, spreading, up to 10 cm long. Leaves opposite, united at the base, somewhat linear and acute, glabrous or slightly glandular hairy, hairs small, microscopic. Flowers small, green, arranged in small cymes, 4-merous, rarely 5-merous, pedicellate; pedicels axillary, slender, glabrous or minutely ciliate, erect or curved at the tip. Sepals 4, sometimes 5, obovate, up to 5 mm long, margins membranous, glabrous or very rarely ciliate, persistent, diverging apart as the capsule matures. Petals O. Ovary obovate; styles 4, about o. 1 mm long, white, slender and somewhat plumose. Capsule opening by 4-5 valves, receptacle tentacular, embedded in the tentacles are seeds which are small, black, hard, circular, up to 1 mm diam, numerous.

Germination : The seeds germinate in early spring and remain dormant for summer and winter.

Fl. & Fr. : March-May.

Dissemination : The seeds are dispersed mostly by wind or get contaminated with crop seeds.

Habitat : An occasional weed of lawns, flower beds, roadsides, footpaths and some grasslands, preferring open situations Indicator of sandy loams.

Root system : A meagrely developed branched tap root system.

Geographical distribution : Temperate and alpine Himalaya and Tibet.

Specimen examined : *Kaul* RRL 16030 (31-5-1971) RRL Srinagar lawns.

Chromosome report : 2n=22 (DCA 60).

Illustration : Polunin pl. 13.

PORTULACACEAE

PORTULACA Linnaeus

Portulaca oleracea L. Sp. Pl. 445, 1753; FBI 1 : 246; Geesink in Blumea 17 : 290, 1969, Polunin 76; Stewart 237. **(Fig. 20)**

Annual prostrate herbs. Stem up to 20 cm, thoroughly branched, branches trailing, sometimes rooting at nodes, succulent, glabrous, purplish or non-green at maturity. Leaves up to 2 cm diam., oval or oblong, sub-succulent, subsessile, lower ones opposite, middle alternate and upper whorld, glabrous. Flowers up to 8 mm diam., yellow, arranged in apical small dichotomous cymes, clustered. Sepals 2, up to 5 mm long, imbricate, persistent, subsucculent, glabrous. Petals 5, slightly longer or as long as sepals, each lobe notched. Stamens 5-10 or more, anthers small globular, surrounding the style. Ovary included in the persistent calyx, half inferior, glandular and succulent, styles 3.5. Capsule obovate or triangular, enclosed in 2, persistent sepals. Seeds opening through a transverse lid, many, minute and black.

Germination : The seeds sprout in spring (March-April).

Fl. & Fr. : Summer (June-August).

Dissemination : The seeds are disseminated mostly by water and to some extent by man also.

Habitat : The weed grows commonly in orchards, vegetable fields and fallow lands. Prefers moist and shady situations. Indicator of aerated clay loams.

Root system : Simple adventitious roots are produced at nodes which enter the surface horizons of soil.

Geographical distribution : A cosmopolitan weed.

Specimen examined : *Kaul* 89 (10-9-1969) RRL Srinagar fallow fields.

Local name : 'Nunar'.

Uses : Used as a vegetable by common people. It possesses sour taste.

Chromosome report : 2n=54 (DCA 70).

HYPERICACEAE

HYPERICUM Linnaeus

Hypericum perforatum L. Sp. Pl. 785, 1753; FBI 1 : 255; Forsch. in Fl. URSS 15: 243, t. 12-1, 1949; Rao in BOBSI 2: 397, 1960; Stewart 486.

Perennial herbs with somewhat stoloniferous roots. Stem up to 50 cm erect, angled, branched or unbranched, glabrous, but more

or less black gland dotted, leafy. Leaves oblong, 0.5-2.5 x 0.3-1.5 cm, obtuse, veins radiating, lower surface pale, glabrous, entire, seems to be perforated when seen against light, black dotted. Flowers up to 3 cm diam., yellow, in terminal corymbs, bracteate; bracts leafy and small; pedicels stout, up to 3 cm long, more or less dotted. Sepals 5, up to 8 cm long, acute, green, persistent, gland dotted. Petals 5, obovate, up to 1.5 cm long, gland dotted on the margins. Stamens numerous, triadelphous, anthers globular, sometimes gland dotted. Ovary 3-celled, styles 3, diverging, twice as long as ovary. Capsule up to 1 cm diam., ovate. Seeds small, brownish, hard and numerous.

Germination : The seeds sprout at the onset of summer (May).

Fl. & Fr. : August-September.

Dissemination : The seeds are disseminated by wind and animals including man.

Habitat : An occasional weed of orchards, grasslands and fallow lands. Indicator of nitrogenous dry soil.

Root system : The rootstock is tough and somewhat trailing.

Geographical distribution : Europe, North Africa, Siberia, Central Asia, Turkey, Iran, Afghanistan, Pakistan, Himalaya, Kashmir to Kumaon and China.

Specimens examined : *Ahluwalia* 1298 (4-7-1951) Kukernag; *Kaul* RRL 5574 (3-7-1970) RRL Srinagar campus.

Chromosome report : 2 n = 32 (DCA 114).

MALVACEAE

Key to the species

1. Calyx forming a cupular tube at maturity, never inflated :
   2. Epicalyx absent. Carpels larger in a compact elongated head **Abutilon**
   2. Epicalyx linear or obovate. Carpels smaller in compact circular head **Malva**
1. Calyx inflated and campanulate at maturity **Hibiscus**

ABUTILON P. Miller

Abutilon theophrasti Medik. Malv. 28, 1787; Borssum in Blumea 14 : 166, 1966; Stewart 477.

A. avicennae Gaertn. Carp. 2 : 251, t. 135, f. 1, 1791; FBI 1 : 327.

Annual herbs. Stem up to 1 m erect, cylindrical or ribbed, downy, grey, woody near the base. Leaves cordate, apex acute or acuminate, up to 9.5 cm across, broader than long, petiole longer than the leaf, hairy or downy, raised from the under surface, closely felted with grey downy growth; upper surface usually glabrous, margins crenate to finely dentate. Flowers in terminal axillary cymes, yellow, bracts leafy, bracteoles 0, pedicels shorter than the leaf petioles, hairy or tomentose. Sepals 5, obovate, apex acuminate, blunt, up to 8 mm long, becoming broader in fruit, forming a cupular tube, downy, persistent. Petals 5, longer than sepals, free above but connate below. Stamens forming a tube, anthers 1-2 celled. Carpels exceeding 15, in a compact elongated head. Each carpel densely hairy, hairs white, apex awned; awn straight, persistent and hairy. Seeds 1-many in each carpel, up to 8 mm diam., hard and wrinkled.

Germination : The seeds sprout in early spring (May).

Fl. & Fr. : August-September.

Dissemination : The seeds are disseminated by wind and man.

Habitat : An occasional weed of maize fields and fallow dry lands. Indicator of sandy loams.

Root system : A thick tap root going up to 20 cm deep in the soil.

Geographical distribution : Arabia, Tropical Africa, India & Pakistan.

Specimens examined : *Meebold* 3662 (June, 1905) Sumbal, Kashmir (CAL); *Kaul* RRL 19703 (16-9-1971) Shalteng Maize fields.

Chromosome report : 2n=42 (DCA 122).

MALVA Linnaeus

Key to the species

1. Stem suberect and weak. Petals 3-4 times the length of sepals **sylvestris**
1. Stem decumbent and weak. Petals twice the length of sepals **neglecta**

Malva sylvestris L. var. **eriocarpa** Boiss. Fl. Orient. 1 : 819, 1867; FBI 1 : 320.

Annual, biennial or even perennial herbs with a thick stoloniferous rhizome. Stem up to 50 cm, suberect or even trailing, weak, ribbed and narrowly furrowed, glabrous or more or less hairy. Leaves simple, cordate or rounded, 5-7 lobed, broader than the long, petiole very long, glabrous or minutely pubescent, veins reticulate. Flowers up to 5.5 cm diam. pedicel up to 1-5 cm or rarely more in length, bracts leafy, bracteoles 3, small, linear, smaller than the sepals. Epicalyx constituted of 5 broader lobes. Sepals 5, obtuse or acute, minutely pubescent persistent. Petals 5, purplish to pinkish, dark purple veins running along the length of petals, 3-4 times the lengh of sepals, notched, bases slightly bearded. Stamens forming a tube round the ovary, anthers 1-2 lobed. Ovaries small, many. Fruit enclosed in the persistent calyx.

Germination : The seeds germinate in early summer (May-June).

Fl. & Fr. : August-September.

Dissemination : The seeds are mostly disseminated by irrigation water and by animals also.

Habitat : An occasional weed of vegetable fields. Indicators of moist nitrogenous alluvials.

Root system : The roots are mostly adventitious and remain in the superficial horizon of the soil. The adventitious roots arise from a thick stoloniferous sucker like rootstock.

Geographical distribution : Europe, N. Africa, Caucasus, Central Asia, Afghanistan, Pakistan, Himalaya, Kashmir to Kumaon.

Specimens examined : *Kapoor* 337 (24-7-1945) Gagribal fallow fields; *Kaul* 68 a (2-8-1969) Rawalpora vegetable fields.

Remarks : When young the leaves are relished as a vegetable.

Chromosome report : 2 n = 42 (DCA 122).

Malva neglecta Wallr. in Syll. Ratish. 1 : 140, 1824; Iljin in Fl. URSS 15 : 56, 1949; Kitamura 271; Stewart 481.

M. rotundifolia L. Sp. Pl. 688, 1753 *nom. ambig.* FBI 1 : 320; Collett 59; Rao in BOBSI 2 : 397, 1960.

Annual or biennial herbs. Rootstock stoloniferous, spreading, stem up to 12.5 cm, procumbent, weak, much branched, sparingly villous or downy with simple and stellate

pubescence. Leaves simple, suborbicular or cordate, 2.0-5 5 cm across, lobes crenate, dull green, somewhat rough, pubescent, petiole slender up to 9 cm long, downy or villous. Flowers up to 2 cm across, generally white, rarely pinkish, bracts leafy, bracteoles narrowly oblong, acute, hairy, pedicel up to 3 cm long, pubescent. Epicalyx 3-5 lobed. Sepals 5, oblong, acute, persistent, dull green, villous. Petals 5, about twice the length of sepals, lobes wedge shaped, notched, somewhat bearded at the base. Stamens form a tube round the ovary, anthers 1-2 celled. Carpels 1-seeded, many, hairy; indehiscent, after maturity separating from a short conical torus. Seeds hard, with a somewhat curved micropyle, grey, up to 5 mm diam.

Germination : The seeds germinate in early summer (May).

Fl. & Fr. : July-September.

Dissemination : The seeds are disseminated by wind and during agricultural operations.

Habitat : An occasional weed of orchards and fallow grasslands, preferring dry situations. Indicator of sandy or gravelly soils.

Root system : A tough stoloniferous rootstock with roots arising from the nodes.

Specimens examined : *Keshavanand* 28761 (16-5-1908) near Wular (DD); *Kaul* RRL 19606 (6-7-1969) Hari Parbat fallow fields, almond orchards; *Kaul* 336 (4-8-1972) Pampore maize fields.

Chromosome report : 2 n = 42 (DCA 122).

HIBISCUS Linnaeus (*nom. cons.*)

Hibiscus trionum L. Sp. Pl. 697, 1753; FBI 1 : 334; Blatter 1 : 63, pl. 16, t. 4; Stewart 480.

Annual herbs. Stem 15-45 cm long, hairy, branched. Leaves 1-2 pinnatifid, 2.0-5.5 cm long, lobes inversely egg shaped, blunt, more or less hairy on both the surfaces, petiolate. Flowers pale yellow with a dark purple centre, 1.5 x 2.5 cm; bracteoles many, linear; petiole 1.5-2.5 cm long Calyx campanulate, 5 lobed just above the half-way down, lobes broad and pointed, inflated, with many linear hairy green nerves all round. Capsule elongated, hairy outside. Seeds black dotted with stellate hairiness.

Germination : Early summer (May-June).

Fl. & Fr. : August-October.

Dissemination : The seeds are disseminated by wind and water.

Habitat : An occasional weed of maize fields and orchards. Prefers moist clay loams.

Root system : A branched tap root goes up to 16 cm deep in the soil.

Geographical distribution : S. Europe, Tropics of Old World, Western Himalaya.

Specimen examined : *Kaul* 351 (7-10-1972) Drug farms of Yarikha.

Chromosome report : 2 n = 28, 56 (DCA 123).

ZYGOPHYLLACEAE

1. Perennial bushy herbs. Stem much branched, leafy; flowers large white or creamy **Peganum**

1. Annual or biennial herbs. Stem branched or unbranched, leafy; flowers small, generally yellow **Tribulus**

PEGANUM Linnaeus

Peganum harmala L. Sp. Pl. 444, 1753; FBI 1 : 486; Rao in BOBSI 2 (3-4) : 398, 1960;

Haines in Botany Bihar & Orissa 159, 1925; Stewart 434.

A perennial bushy herb. Stem branched from the base, up to 85 cm tall, branches flattened and spreading, glabrous, leafy. Leaves multifid, segments linear lanceolate, entire, acute, glabrous, up to 1.5 cm long; lower cauline leaves long stalked and upper sessile, glabrous. Flowers solitary in the axils of branches, up to 1. 8 cm diam., green when young and creamy at maturity. Sepals leafy, exceeding the corolla. Corolla 4-5, ovate oblong with a distinct green vein on the back. Stamens many, with many antherless filaments, anthers linear, basifixed. Ovary 3-celled, with a small style and globular stigma. Capsule globose, 3-angled, each cell containing many seeds. Seeds somewhat triangular, brown with a hard testa.

Germination : The seeds germinate in summer (March-April).

Fl. & Fr. : July-September.

Dissemination : The seeds are mostly disseminated by wind.

Habitat : An occasional weed of graveyards and fallow lands, possessing habit. Indicator of fertile, slopy, dry and compact soils.

Root system : A thick trailing rootstock perennating during the unfavourable season. Once established it is difficult to eradicate.

Geographical distribution : Arabia, N. Africa and Westward to Hungary and Spain.

Specimen examined : *Kaul* RRL 19607 (6-7-1969) Hariparbat grave yards.

Remarks : The seeds are used for burning during some religious ceremonies locally.

The seeds also yield a red dye and used in medicine.

Chromosome report : 2 n = 24 (DCA 82).

TRIBULUS Linnaeus

Tribulus terrestris L. Sp. Pl. 387, 1753; FBI 1 : 423; Haines, Bot. Bihar & Orissa 159, 1925; Stewart 435.

An annual herb. Stem up to 70 cm long, slender, decumbent, branches arising from the base, nodes swollen, slightly purplish, throughout white, hairy, hairs prickly. Leaves pinnate compound, petiolate, opposite, leaflets 4-12, each leaflet ovate to obovate, up to 1 cm x 0.4 cm sessile, entire, hispid. Stipules linear, small leafy, generally 4 at a swollen node, 2 longer and 2 shorter, hispid soon falling off. Flowers solitary, axillary in long racemes, petiole up to 1.5 cm long, hispid, yellow. Calyx of 5 lobes, ovate to linear, boat shaped, hispid, white, hairs spreading on the outer surface, falling off in fruit. Petals linear to obovate, as long or slightly longer than the sepals. Stamens 10, outer 5 attached to the base of corolla lobes and 5 inner arising from an annular disc, basifixed. Carpels 5, united, hairy, style O, stigma with 5 distinct hemispherical rays. Fruit of 5 stiff achenes fused together, each achene is somewhat triangular with 2 long and 2 short bristles on the outer concave and rough surface.

Germination : The seeds germinate in spring (April-May).

Fl. & Fr. : July-September.

Dissemination : The fruit segments cling to the animals and birds and are carried to long distances.

Habitat : An occasional weed of orchards and maize fields possessing a gregarious habit. Indicator of dry sandy fertile loams.

Fig. 17. *Holosteum umbellatum* Linn.
a. a flower, b. dehisced fruit, c. stamen and ovary

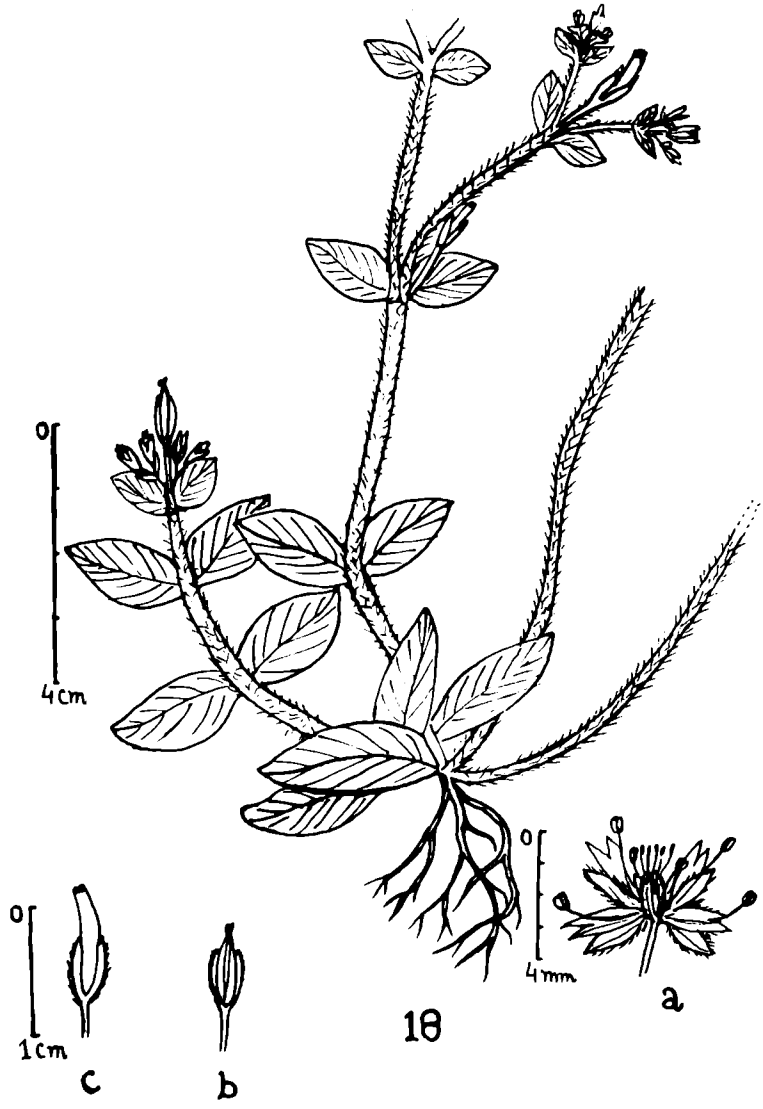


Fig. 18. *Cerastium glomeratum* Thuill. (a flowering plant in part)
a. a flower, b. an ovary, c. a dehisced capsule.

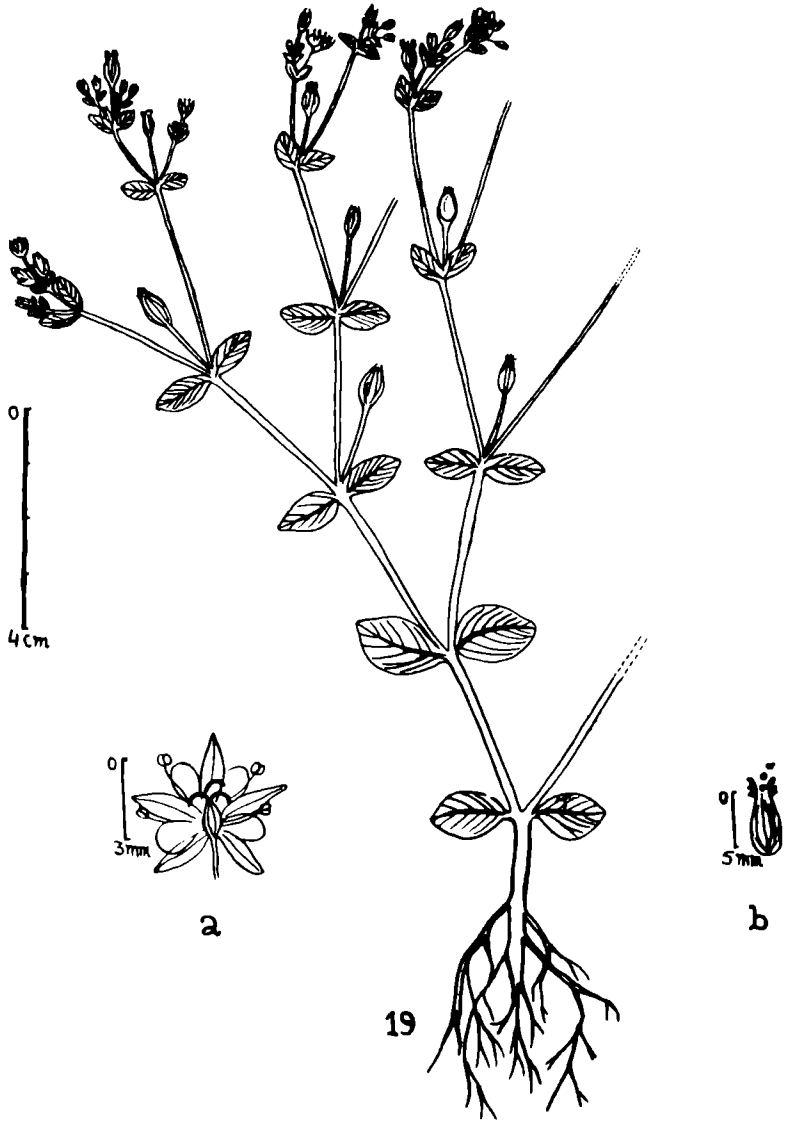


Fig. 19. *Arenaria serpyllifolia* Linn. (a flowering plant in part)
a. a flower, b. a dehisced capsule

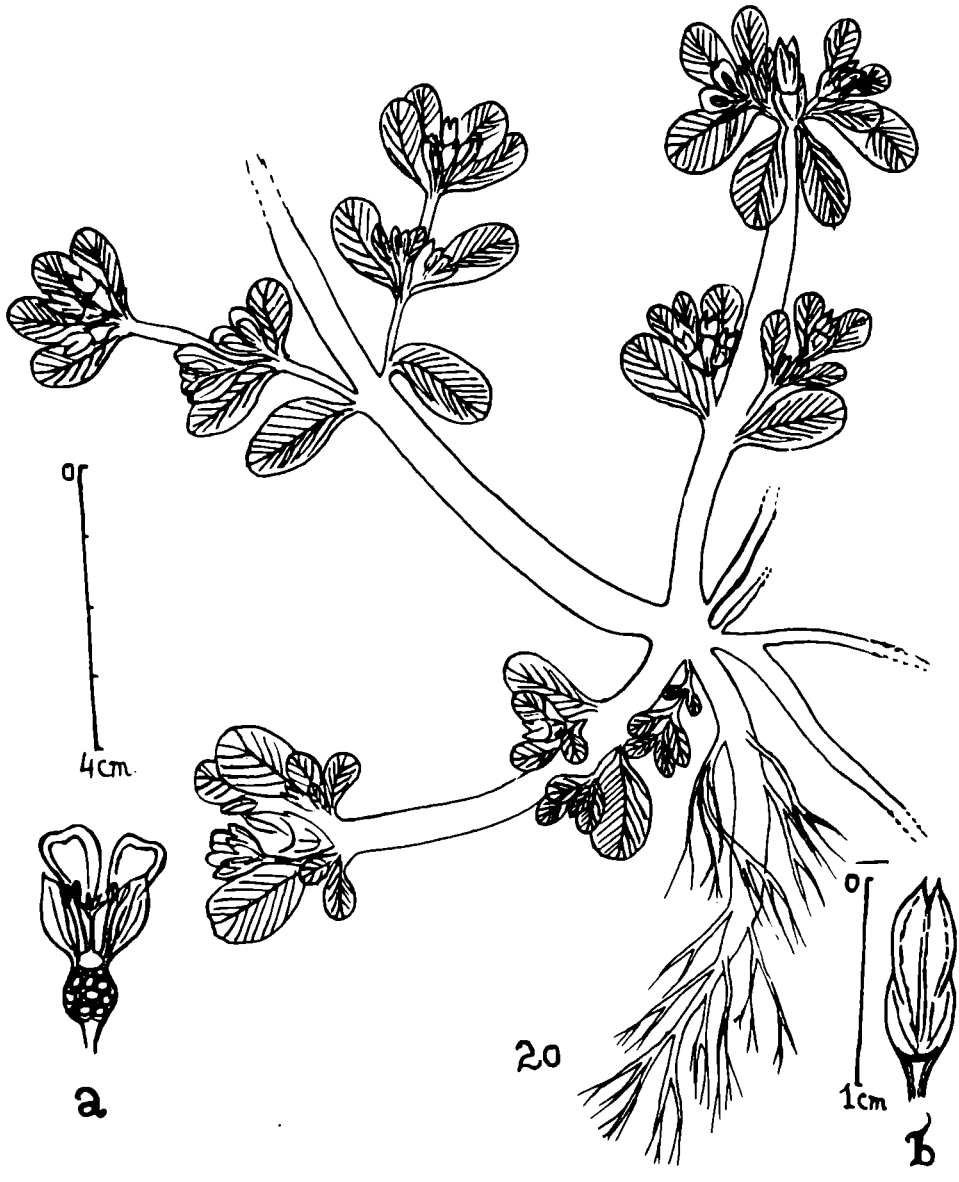


Fig. 20. *Portulaca oleracea* Linn. (a flowering plant in part)
a. v.s. flower, b. a mature capsule

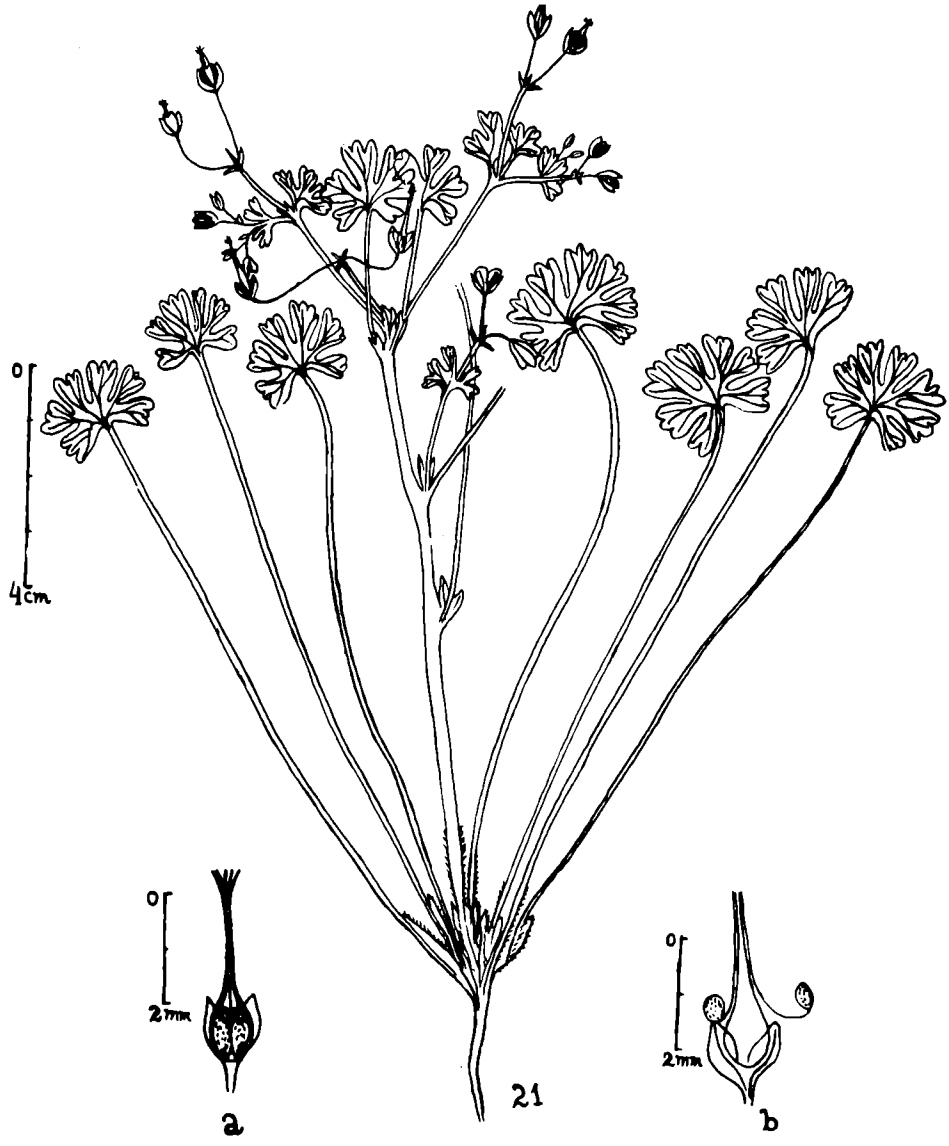


Fig. 21. *Geranium polyanthes* Edgew. (a flowering shoot)
a. a mature fruit, b. a dehiscing fruit

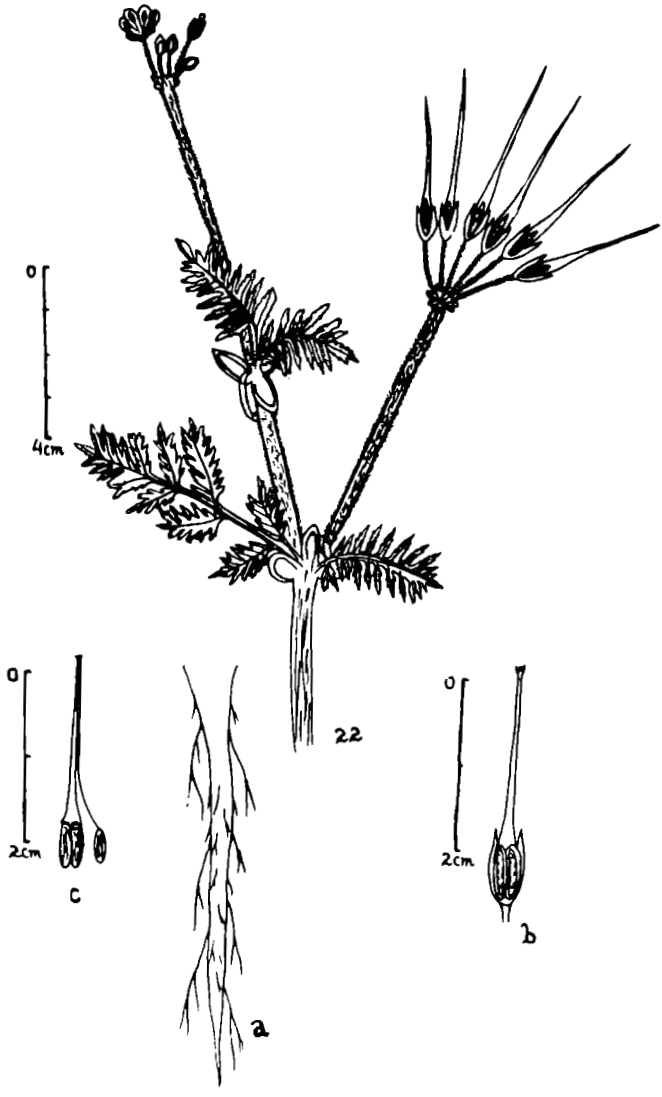


Fig. 22. *Erodium cicutarium* (L.) L'Herit
a. a root system, b. a mature fruit, c. a dehisced fruit.

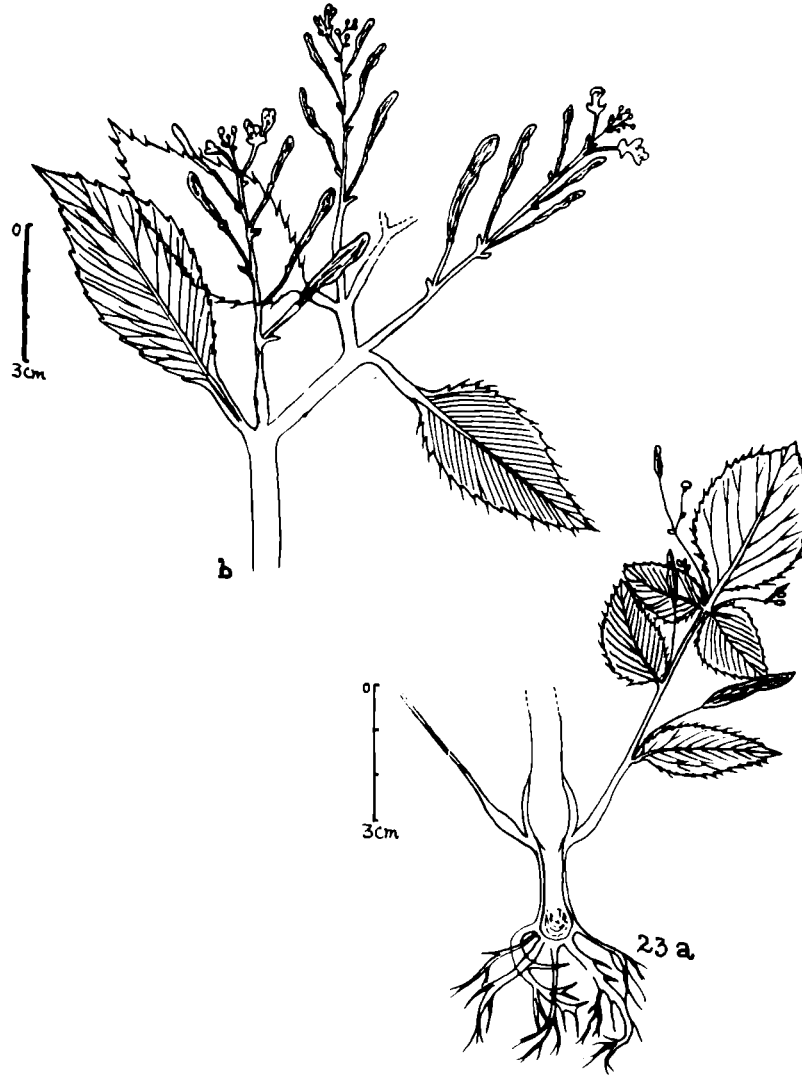


Fig. 23. *Impatiens brachycentra* Kar. et Kir.
a. basal part of the flowering shoot, b. upper flowering shoot

Fig. 24. *Trifolium repens* Linn.
a. v.s. flower, b. pod

Root system : A tap root sending branches into deeper horizons of the soil.

Geographical distribution : Throughout warm regions of the world.

Specimens examined : *Kaul* 286 (10-8-1971) Barzulla maize fields.

Remarks : A weed very difficult to eradicate. The seeds are considered to possess a great medicinal value. Water rendered mucilaginous by it is drunk in diseases of genito-urinary system.

Local name : "Meitcher Kund".

Illustration : Polunin pl. 64.

GERANIACEAE

Key to the genera

1. Leaves simple, deeply lobed. Stamens 10, all anther bearing — **Geranium**
1. Leaves pinnate compound, lobes very small. Stemens 10, only 5 are anther bearing — **Erodium**

GERANIUM Linnaeus

Key to the species

1. Perennial herbs. Flowers up to 4 cm diam. — **wallichianum**
1. Annual or biennial herbs. Stem suberect, procumbent, flowers up to 1.5 cm diam. :
   2. Leaves orbicular-reniform, 3-9 gonal, segment cuneate or obtsuse :
      3. Stem umbellately branched above the middle; flowers up to 8 mm diam. — **polyanthes**
      3. Stem branched, branches procumbent, flowers up to 1.5 cm diam. — **nepalense**
   2. Leaves somewhat rounded, segments large, obtuse, 3-5 fid — **rotundifolium**

Geranium wallichianum D. Don ex Sweet, Geran 1 : t. 90, 1821; FBI 1 : 430; Rao in BOBSI 2 : 397, 1960; Stewart 430.

Perennial herbs with thick somewhat tuberous rootstock. Stem up to 75 cm, erect, weak, terete, much branched, more or less pilose or villous with spreading reflexed hairs. Leaves radical and cauline, former palmately 5-7 lobed, each segment pinnatifid, wedge-shaped, broader than long; stalked, stalk up to 20 cm, hairy, stipules oblong 2-4 fid, non green, glabrous or pilose like the leaves. Cauline ones similar but smaller and alternate. Flowers up to 4 cm diam., bluish purple, peduncles 2-flowered, pedicels 2-2.5 cm long, hairs spreading. Sepals 5, obovate 1-2 cm long, hairy, apex acute and awned. Petals 5, about twice the length of sepals, spreading lobes slightly notched, claw slightly hairy. Stamens 10, obdiplostemonous, filaments with dilated bases. Ovary of 5 distinct, 1-seeded cells hairy, styles 5, adnate to the column, separating at maturity and coiling up with force to eject out seeds. Seeds up to 5 mm diam., elongated glabrous or hairy when young, hard, greyish brown.

Germination : The seeds germinate in early summer (May) or late spring (April) remain dormant for a period of over six months.

Fl. & Fr. : June-August.

Dissemination : The seeds are ejected out of the capsule with force and are disseminated by wind.

Habitat : A rare weed of parks and gardens. Commonly found in forests. Indicator of humus and organic matter.

Root system : A tuberous rootstock going deep in humus sending adventitious roots.

Geographical distribution : East Afghanistan, Temperate Himalaya : Kashmir to Nepal.

Specimens examined : *Gammie s.n.* (28-7-1891) Sind Valley (DD); *Kaul* 34 (23-5-1969) Shalimar Bagh.

Geranium polyanthes Edgew. et Hook. f. in FBI 1 : 431, 1875. **(Fig. 21)**

Annual herbs. Stem up to 25 cm, simple, suberect, umbellately branched above the middle, glabrous, sparingly hairy or pilose towards the apices. Leaves up to 4.5 cm diam., orbicular, reniform, 5-9 partite, segments cuneate, obtuse 3-many fid; radical ones long petioled, many, umbellate, more or less pilose, stipules linear, reddish; cauline ones subsessile to sessile, more pilose, crowded. Peduncles 2-many flowered. Flowers bluish to purple, up to 8 mm diam., pedicels small, pilose. Sepals 5, up to 6 mm long, acute, awned, glandular, hairy, persistent. Petals as long or slightly longer than sepals, tubular, lobes spreading, entire or notched, Stamens 10, anthers small, filaments simple. Ovary 5-celled, with 5 short and slender styles. Seeds smooth, compressed, elongated and hard.

Germination : The seeds germinate in early spring.

Fl. & Fr. : April-June.

Dissemination : The seeds are disseminated mostly by wind.

Habitat : An occasional weed of orchards possessing a gregarious habit. Indicator of clay loams.

Root system : A simple but branched tap root going in the surface horizon of soil.

Geographical distribution : Temperate Himalaya; Kumaon to Sikkim.

Specimens examined : *Kaul* 148 (9-4-1970) Rawalpora orchards (Apple); *Kaul* RRL 5983 (24-5-1970) Barzulla orchards.

Geranium nepalense Sweet, Geran. 1 : t. 12, 1820; FBI 1 : 430; Collett 69, t. 22; Rao in BOBSI 2 (3 & 4) : 397, 1960; Stewart 429.

Annual or biennial herbs. Stem diffuse, slender, much branched, suberect, up to 40 cm, nearly terete, somewhat angular, glabrous or pilose nodes, swollen. Leaves 3-5 gonal, broader than long, segments deeply dentate, glabrous or minutely pubescent, lower ones long stalked, stalk pilose or even glabrous. Flowers up to 1.5 cm diam., bluish white, pedicellate; pedicel up to 4.5 cm, grey covered with pubescence; peduncles 1-2 flowered. Sepals 5, obovate up to 0.5 cm long, slightly hairy, 1-3 nerved, awned, awn small. Petals as long or slightly hairy, longer than the sepals, lobes slightly notched, spreading. Stamens 10, filaments simple, anthers globular, 2-celled. Ovary 5-celled; styles 5, coherent forming a small tubular hairy beak. Seeds ejected by force and lifted by the styles, hairs spreading when seeds are young.

Germination : The seeds germinate in early summer, i.e. April-May.

Fl. & Fr. : June-August

Dissemination : The seeds are ejected out of capsule by force and get disseminated by wind and hoofed animals.

Habitat : An occasional weed of orchards and vegetable fields loving moist conditions. Indicator of fertile clay loams.

Root system : A branched tap root system, the branches are horizontally spread.

Geographical distribution : East Afghanistan, India, Himalaya, Kashmir, and China.

Specimens examined : *Thapliyal* 26364 (31-5-1959) Kashmir (DD); *Kaul* 67 (29-7-1969) Chishma Shahi vegetable fields; *Kaul* RRL 19676 (28-8-1970) Boniyar orchards.

Chromosome report : 2n = 28 (DCA 84).

Geranium rotundifolium L. Sp. Pl. 683, 1753; FBI 1 : 432; Polunin 217; Stewart 430.

Annual herbs. Stem trailing, procumbent, slender, with spreading branches, hairs white sometimes glandular, leaves mostly radical, reniform or rounded, segments 3-5 fid, broad, obtusely lobulate, pubescent, petioles up to 13.5 cm long, weak, hairy, stipules oblong lanceolate; flowers reddish, 1-2 on each peduncle; bracteoles 3, linear, hairy, pedicel up to 3.5 cm, slender. Sepals 5, oblong, acute, up to 5 mm long, pubescent, persistent. Petals 5, generally as long or slightly longer, rarely notched. Stamens 10, filaments small, anthers reddish. Ovary 5-celled, hairy when young, styles up to 8 mm glabrous and slender. Seeds glabrous, deeply pitted.

Germination : The seeds germinate in spring. (Feb.-March).

Fl. & Fr. : April-May.

Dissemination : The seeds are mostly disseminated by rain water and to some extent by wind.

Habitat : An occasional weed of orchards and fallow moist situations. Indicator of sandy or gravelly loams.

Root system : A simple long tap root going up to 15 cm deep in the soil.

Geographical distribution : Western Himalaya, Pakistan, Europe.

Specimens examined : *Duthie, J.F.* 10815 (7-5-1892) Srinagar (DD); *Kaul* 136 (29-3-1970) Chishma Shahi orchards on walls; *Kaul* RRL 19734 (30-9-1971) Rawalpora orchards.

Chromosome report : 2n=26 (DCA 84).

ERODIUM L' Heritier ex Aiton

Erodium cicutarium ((L.) L' Herit. ex Aiton in Hort. Kew. ed. 1, 2 : 414, 1789; FBI 1 : 434; Collett 70; Rao in BOBSI 2 : 397, 1960, Polunin 218; Stewart 427. **(Fig. 22)**
Geranium cicutarium L. Sp. Pl. 680, 1753.

Annual, hairy, more or less viscid glandular. Stem tufted, branches prostrate running up to 50 cm in length, forming a basal rosette, reddish nodes slightly swollen. Leaves mostly radical, pinnate, pinnules pinnatifid, segments oval, narrow, acute, hairy. Stipules scarious, broadly lanceolate and acute. Flowers up to 8 mm diam., purple, axillary; peduncles 2-10 flowered, umbellate. Sepals 5, ovate, up to 1 cm long, margins scarious turning purple, veins 3-5, distinctly minutely pubescent, awned. Petals 5, unequal, entire, alternating with the sepals, slightly longer. Stamens 5, staminodes 5, filaments simple. Ovary 5-celled; styles 5, long coherent, separating at the time of dehiscence, inner surface silky. Seeds hard, grey, compressed, elongated or round.

Germination : The seeds germinate in late autumn and spring (November and early March).

Fl. & Fr. : April-August.

Dissemination : The seeds are generally disseminated by wind and also to some extent by rain water and animals.

Habitat : A common weed of orchards, wheat fields, fallow land and waysides. In open situations the plant possess a restricted growth whereas in shady and moist situation it is profuse. Indicator of fertile clay loams.

Geographical distribution : Europe, Algeria, North Africa, Caucasus, Turkey, Siberia, Central Asia, Iran, Afghanistan, Western Himalaya, Kashmir.

Specimens examined : *Gammie* s.n. (11-7-1891) Srinagar 5300 ft (DD); *Kaul* RRL 5991 (26-5-1970) RRL Campus Srinagar.

Chromosome report : 2 n = 40 (DCA 83).

OXALIDACEAE

OXALIS Linnaeus

Oxalis corniculata L. Sp. Pl. 435, 1753; FBI 1 : 436; Calder in RBSI 6 (8) : 331, 1919; Gorsh. in Fl. URSS 14 : 77, 1949; Kitamura 245; Polunin 214; Stewart 431.

Annual or perennial herbs. Rootstock creeping along long distances and rooting at nodes, densely hairy towards the base. Leaves alternate, up to 3 cm across, leaflets 3, pale green, cordate, notched deeply, petioles long but slender, appressedly hairy. Flowers yellow up to 1.5 cm across, in long stalked umbels generally 3 in an umbel, individual flowers pedicellate, pedicels up to 2.5 cm long. Sepals 5, linear, hairy, persistent, smaller than the petals. Petals 5, lobes obovate, entire. Stamens 10, obdiplostemonous filaments simple. Ovary 5-celled, styles 5, more or less united, stigma capitate. Capsule cylindrical, up to 2 cm long, tomentose. Seeds somewhat rounded, brick red, hard, 2-several in each cell.

Germination : The seeds germinate in early spring remaining dormant during autumn and winter.

Fl. & Fr. : May-August.

Dissemination : Vegetative as well as through seeds. The seeds are mostly disseminated by wind. The seeds have also been seen to be carried by ants to different fields.

Habitat : A common weed of orchards and fallow grasslands. Prefers open situations. Indicator of well aerated alluvial soils.

Root system : The rootstock creeps along the soil and sends nodal roots which penetrate the surface of soil.

Geographical distribution : A cosmopolitan weed.

Specimens examined : *Kaul* RRL 5986 (24-5-1970) Nagin orchards; *Kaul* RRL 19787 (19-8-1972) Majid Bagh, vegetable fields.

Chromosome report : 2n = 24 (DCA 84).

BALSAMINACEAE

IMPATIENS Linnaeus

Impatiens brachycentra Kar. & Kir. in Bull. Soc. Nat. Mosc. 15, 179, 1842; FBI 1 : 481; Collett 75; Rao in BOBSI 2 : 398, 1960; Stewart 464. **(Fig. 23)**

Annual herbs. Stem up to 50 cm, erect, slender, branched or rarely unbranched, quite glabrous, succulent, nodes swollen and transparent, lower nodes rooting. Leaves simple, elliptic oblong, acuminate, 3.5-7.5 cm x 0.8-3.5 cm crenate, crenatures sometimes gland tipped, petiolate; petiole up to 2 cm, slender, glabrous, sometimes winged, alternate, looking like whorled towards the apices, veins distinct and much branched. Flowers white, irregular, up to 8 mm long, in racemes or umbel like clusters, usually in the axils of upper leaves; bracteoles 2-3, small, linear, pedicels up to 1.5 cm long, slender, glabrous. Sepals 2-3, lower

3 forming a boat-shaped lip, non green, caducous. Petals 3, upper one broad and lower 2 combined forming wings, creamy. Stamens 5, anthers cohering round the pistil. Ovary 5-celled, stigma sessile, 5-toothed when mature. Capsule narrowly oblong, up to 1.5 cm nearly terete, glabrous. Seeds 3-8, oblong, compressed, brown.

Germination : The seeds sprout in early summer or late spring (March-April).

Fl. & Fr. : July-September.

Dissemination : Through seeds. The seeds are disseminated by wind and by rain water.

Habitat : An occasional weed of orchards and vegetable fields preferring moist and shady situations. Indicator of organic matter in soils.

Root system : Bunches of long adventitious roots arising from a globular rootstock, enter the surface horizon of well aerated soil.

Geographical distribution : East Afghanistan, Pakistan, Himalaya, Kumaon to Marri, Kashmir.

Specimens examined : *Kaul* RRL 5548 (18-7-1969) Vegetable fields near Hazratbal.

Chromosome report : n = 7 (Bhat, Bakshi & Kaul 1974).

FABACEAE/LEGUMINOSAE

Key to the species

1. Leaves digitately or pinnately 3-foliolate, leaflets usually toothed. Flowers small :
   2. Leaves digitately 3-foliolate, Flowers in terminal heads — **Trifolium**
   2. Leaves pinnately 3-foliolate. Flowers not in heads :
      3. Pods straight or spirally twisted;
         4. Pods straight or nearly so; seeds more than 5 in each pod — **Trigonella**
         4. Pods spirally twisted or strongly curved; seeds up to 5 in each pod — **Medicago**
      3. Pods short, ovoid or oblong :
         5. Pods ovoid or rounded, 1-2 seeded — **Melilotus**
         5. Pods oblong, 1-seeded — **Lespedeza**
1. Leaves pinnate compound, leaflets entire or toothed; flowers generally larger :
   6. Leaflets 5, 2 at the base of the stalk and 3 at the end; flowers umbellate — **Lotus**
   6. Leaflets more than 5; flowers not umbellate :
      7. Stipules leafy, petiole ending in a tendril :
         8. Style cylindrical, nearly glabrous — **Vicia**
         8. Style flattened, bearded along the inner side — **Lathyrus**
      7. Stipules small membranous or absent; petiole not tendrular :
         9. Leaf rachis spinous, calyx not oblique — **Astragalus**
         9. Leaf rachis free from any spine, calyx 2-lipped — **Aeschynomene**

TRIFOLIUM Linnaeus

Key to the species

1. Terminal leaflets sessile. Flowers in compact, globose or ovoid heads; heads up to 2 cm diam :
   2. Flowers white or tinged with pink. Pods 1-4 seeded :
      3. Calyx glabrous, simple with subequal teeth. Pods 3-4 seeded — **repens**
      3. Calyx forming a persistent membranous bladder in fruits. Pods 1-2 seeded — **fragiferum**
   2. Flowers red-purple. Pods generally 4-seeded — **pratense**
1. Terminal leaflets stalked. Flewers very small in small lax heads; heads up to 5 mm diam. — **dubium**

Trifolium repens L. Sp. Pl. 767, 1753; FBI 2 : 86; Bobrov in Fl. URSS 11 : 211, 1945; Rao in BOBSI 2 : 398, 1960; Stewart 422. **(Fig. 24)**

Perennial, creeping, herbs. Stem slender, running along the surface of the soil,branched, generally hairless, rooting at nodes. Leaves long stalked; stalk up to 20 cm. slender, glabrous; digitately 3-foliolate. Leaflets obovate to obcordate with a small depression at the apex, sessile, slightly hairy, margins dentate; stipules membranous, adnate to the base of the leaf stalk, deciduous. Flowers white or slightly pinkish in dense globular heads; peduncles as long or longer than leaf petioles, leafless, directly arising from the creeping stem. Each flower head is up to 2 cm diam., 20-35 flowered, drooping after maturity; each flower up to 1.2 cm long. Calyx 5-toothed, campanulate, teeth triangular, as long as the tube, distinctly veined, non-green, persistent. Corolla double the length of calyx. Pod small, ovate, 1-3 seeded, rarely 4. Seeds rounded blackish and hard.

Germination : The seeds germinate in early spring (March).

Fl. & Fr. : May-July; sometimes the flowering is seen in October-November also.

Dissemination : The weeds spread vegetatively as well as through seed. The seeds get disseminated mainly by rain or irrigation water and also by hoofed animals.

Habitat : A common weed of lawns, footpaths, grasslands, meadows and other moist areas. Indicator of sandy loams.

Associations : The weed is commonly associated with *Cynodon dactylon* and *Medicago lupulina*; at times it overgrows these associates,

Root system : Adventitious roots arise from the nodes of the creeping stem which bind the weeds in soil. Main tap root is branched with small nodules.

Geographical distribution : Europe, Siberia, Turkey. Caucasus, Central Asia, Mongolia, Afghanistan, Himalaya : Kashmir.

Specimens examined : *Thapliyal* 25553 (24-5-1958) Kashmir (DD); *Kaul* 37 (24-5-1969) Naseem Bagh grasslands.

Chromosome report : 2 n = 32 (DCA 160).

Trifolium fragiferum L. Sp. Pl. 772, 1753; FBI 2 : 86; Polunin 207; Stewart 422.

Perennial, creeping herbs generally having a gregarious habit. Stem procumbent or at, times suberect, fistular, up to 25 cm long

branches spreading rooting at nodes, rarely green, glabrous. Leaves trifoliolate, petiole up to 8.5 cm, older petioles longest, slightly hairy or even glabrous. Leaflets obovate or obcordate, slightly longer than broad, glabrous, margins dentate, generally purplish. Stipules broad, 2-3 toothed, teeth linear, glabrous, non-green, deciduous, distinctly longitudinally veined. Flower heads globose, compact on axillary peduncles, drooping at maturity. Calyx 5-toothed, at maturity forming a persistent white bladder around the capsule. Corolla deep pink, slightly longer than the calyx. Stamens diadelphous with very small anther lobes. Seeds rounded with depression on one side, hard.

Germination : The seeds germinate in early spring (March).

Fl. & Fr. : May-August.

Dissemination : The weed propagates vegetatively as well as through seed. The seeds are disseminated by rain water.

Habitat : An occasional weed of lawns and orchards, growing along water channels. Indicator of sandy loams.

Root system : The adventitious roots arise from the running stem and enter the surface horizons of soil.

Geographical distribution : Europe, North Africa, Turkey, Iran, Caucasus, Central Asia, Afghanistan, Kashmir.

Specimens examined : *Kaul* 51 (26-6-1969) Emporium gardens, Srinagar; *Kaul* 227 (1-7-1970) Zewan fallow fields.

Chromosome report : 2n=16 (DCA 160).

Trifolium pratense L. Sp. Pl. 768, 1753; FBI 2 : 86; Rao in BOBSI 2 : 398, 1960; Polunin 208; Stewart 422.

A perennial herb with a thick creeping rootstock. Stem procumbent or suberect up to 18 cm long, spreading branches, slender, somewhat downy or glabrous. Leaves of 3 leaflets; petiole 0 3-3.5 cm, slender, slightly hairy, leaflets elliptic to obovate, slightly longer than broad, margins dentate, lower surface pubescent; stipules up to 2 cm long, tubular, bifid at the top, longitudinally veined, non-green Flower heads terminal, subsessile with 2 leaves closely below it, many flowered; becoming ovoid. Each flower up to 1 cm long, papilionaceous, purplish or sometimes reddish. Pods ovoid with 2-3 seeds but one reaching to maturity. Seeds rounded, hard, surface mottled and blackish.

Germination : The seeds germinate in early spring. (early March).

Fl. & Fr. : May-September.

Dissemination : The weed propagates vegetatively as well as through seed. The seeds are disseminated mainly by irrigation water.

Habitat : An occasional weed of orchards, banks of water channels and moist fallow places. Indicator of sandy loams.

Geographical distribution : Europe, Siberia, Turkey, Caucasus, Central Asia, Himalaya : Kashmir to Garhwal.

Specimens examined : *Kaul* 43 (27-5-1969) University canals along moist channels; *Kaul* 95 (29-9-1969) Habak vegetable fields.

Chromosome report : 2n = 14 (DCA 159).

Trifolium dubium Sibth. Fl. Oxon. 231, 1794; Polunin 204; Stewart 422.

T. minus Smith in Relhan Fl. Cantab. ed. 2, 290, 1802; Collett 116.

Annual herbs. Stem generally suberect or even procumbent, branches spreading up to 35 cm long, minutely pubescent, slender, shorter than the leaves. Leaflets ovate to obovate, up to 8 mm diam., sessile, sometimes apical one stalked, minutely dentate, glabrous. Stipules small, membranous, deciduous. Flowers yellowish, 10-20 in small loose heads, on long axillary peduncles longer than the leaves. Calyx lobes finely toothed, nongreen, persistent. Corolla extruded out of calyx, the yellow colour fades at maturity, papilionaceous. Pods small up to 3 mm diam. with a somewhat curved apex. Seeds generally one or rarely more than one, very minute, grey, shining, p to 1.5 mm diam.

Germination : The seeds germinate in early spring (March).

Fl. & Fr. : May-July.

Dissemination : The seeds are dispersed by wind.

Habitat : A rare weed of lawns, open grasslands and flower beds. Indicator of fertile nitrogenous loams.

Root system : The root system is meagrely developed and the small nodal roots arising from the base of the stem bind the plants in the soil.

Geographical distribution : Europe; India : Simla.

Specimens examined : *Kaul* 195 (22-5-1970) Lawns of Hoakersar.

Chromosome report : 2n=14, 28 (DCA 159).

TRIGONELLA Linnaeus

Key to the species

1.	Flowers 1-4, generally in an umbel. Pods many seeded :	
2.	Flowers on long axillary peduncles. Pods upto 3 cm long	**incisa**
2.	Flowers sessile, paired axillary. Pods up to 11.5 cm long	**foenum-graecum**
1.	Flowers 6-12 in a raceme. Pods small flattened with 3-4 seeds	**emodi**

Trigonella incisa Benth. in Royle, Illus. Bot. Himal. 197, 1835; Camb. in Jacq. Voy. Bot. 36, t. 42, 1844; Stewart 423.

Trigonella polycerata auct. non. L., (1753); FBI 2 : 87.

Annual herbs. Stem weak, procumbent, branched, branches spreading, diffuse, slender, glabrous or slightly hairy. Leaflets cuneate or somewhat triangular, 0.5-2.0 cm x 0.3-1.5 cm, apical one stalked, sharply inciso-dentate glabrous or young leaves with white pubescence. Stipules deeply 2-fid, linear with a somewhat broader base, minutely pubescent. Flowers 2-4, generally 2, umbellate on a common axillary, 0.5-2 cm long stalk; yellow. Calyx 5-toothed, teeth linear as long or shorter than tube, pubescent and persistent. Corolla 1½ times the length of calyx, yellow, papilionaceous. Pods linear up to 3 cm long with a somewhat decurved beak, covered with white

silky pubescence when young. Seeds 5-10, small, black, hard.

Germination : The seeds germinate in late autumn and remain under snow during the winter. The seedlings start growth after the snow melts i.e. in February or March.

Fl. & Fr. : April-May, or sometimes in March also.

Dissemination : The seeds are disseminated through manures and during the agricultural operations.

Habitat : A rare weed of orchards, wheat and pea fields. Indicator of well aerated fertile soils.

Root system : The root system is superficial and adventitious, with very small size and number of nodules.

Geographical distribution : West Siberia, South Europe to Spain, Upper Gangetic Plain, Simla.

Specimens examined : Kaul 141 (30-3-1970) Rawalpora apple orchards.

Chromosome report : 2n=28 (Bir & Sidhu, vide Taxon 15(2) : 118, 1966).

Trigonella foenum-graecum L. Sp. Pl. 777, 1753; FBI 2 : 87; Sabnis in J. Bombay Nat. Hist. Soc. 42(2) : 343, 1942; Gross. in Fl. URSS 11 : 119, t. 9-6, 1945; Polunin 203, pl. 58; Stewart 423.

Annual procumbent herbs. Stem weak, branched, branches up to 20 cm long, spreading, sub-terete, nearly glabrous or ninutely hairy, fresh shoots light green. Leaves of 3-leaflets, alternate; leaflets oblong to obovate, lateral ones sessile and apical ones short stalked, broadly toothed and base entire, glabrous. Stipules laciniate. Flowers white up to 1.5 cm long, stalkless, paired in the axils of upper leaves. Calyx 5-toothed, shorter teeth, linear, lanceolate, slightly hairy, persistent. Corolla nearly double the length of calyx, standard broader and enclosing the wings and keel. Stamens diadelphous. Pod linear up to 11.5 cm long, erect, glabrous, progressively narrowing into a narrow seedless 2-4 cm long beak. Seeds many oval or rounded up to 4 mm diam., mottled when mature.

Germination : The seeds germinate in late autumn i.e. November; the seedlings start growth in early summer.

Fl. & Fr. : April-June.

Dissemination : The seeds get dispersed due to contamination with crops like wheat and pea, and also by wind.

Habitat : A weed of orchards, wheat and pea fields as an escape from cultivation. Indicator of alluvial soils.

Root system : A branched tap root going into the deeper horizons of soil.

Geographical distribution : Mediterranean regions, Afghanistan, Pakistan, India.

Specimens examined : *Kaul* RRL 924 (15-6-1970) Barzulla orchards.

Uses : The seeds are edible and the plants are cultivated for its seeds in some places.

Chromosome report : 2n = 64 (DCA 161).

Trigonella emodi Benth. in Royle, Illus. Bot. Himal. Mounts. 197, 1835; FBI. 2 : 88; Stewart 423.

Trigonella cashmiriana Camb. in Jacq. Voy. Bot. t. 41, 1844.

Perennial trailing herbs. Stem arising from a short thick, straggling rootstock, copiously

branched, up to 20 cm long, suberect or even trailing, solid, somewhat terete, glabrous or slightly downy. Leaves of 3-leaflets, stalks smaller than the leaflets; stipules inciso-dentate, nongreen, persistent, deeply 2-fid, covering the nodes Leaflets ovate to obovate, up to 8 mm diam., apical one subsessile, apex finely dentate and base entire, veins distinct, glabrous. Flowers yellow, 5-12 in a raceme up to 3.5 cm long. Each flower is up to 2 cm long, small stalked, bracteoles small and persistent. Calyx 5-toothed, teeth about half as long as the tube, distinctly veined, persistent. Corolla more than twice the length of calyx, standard broad. Pods up to 2 cm long, flat broader in the middle, glabrous. Seeds 3-4 or more, hard, somewhat rounded and brownish.

Germination : The seeds do not germinate under normal conditions and remain dormant for long time.

Fl. & Fr. : April-August.

Dissemination : The weed spreads mostly vegetatively. The seeds get disseminated by wind or rain water.

Habitat : A rare weed of fallow lands, stone walls and other dry locations Indicator of sandy or gravelly soils.

Root system : A somewhat thicker, straight or creeping rootstock binding the soil as well as the plants.

Geographical distribution : Afghanistan, Iran, India : Kashmir to Nepal.

Specimens examined : *Duthie, J F.* 13606 (17-8-1893) Kashmir (DD); *Keshavanand* 27353 (30-8-1909) Kashmir (DD); *Kaul* 32 (21-5-1969) Shalimar Bagh walls.

Remarks : This weed can be used to check soil erosion on account of its soil binding roots and hardiness.

MEDICAGO Linnaeus

Key to the species

1. Stem suberect Flowers not yellow, arranged in long racemes **sativa**
1. Stem generally procumbent. Flowers yellow, arranged in small heads or clusters:
   2. Peduncles 2-6 flowered. Pods armed with small and slender spines:
      3. Peduncles shorter than leaf pedicels. Pods with 2-4 spirals **polymorpha**
      3. Peduncles as long or longer than leaf pedicels. Pods with 4-5 spirals **minima**
   2. Peduncles long with a compact head of several flowers. Pods unarmed **lupulina**

Medicago sativa L. Sp. Pl. 778, 1753; FBI 2 : 90; Gross. in Fl. URSS 11 : 148, tab. 10-14, 1945; Stewart 413.

Biennial or perennial herbs. Stem erect or suberect, rarely procumbent, copiously branched, glabrous or rarely pubescent, cylindrical but weak. Leaves pinnately trifoliolate, petiolate, petiole smaller than the leaflet. Leaflets oblanceolate, oblong wedge-shaped, 0.5-1.5 cm x 0.3-0.5 cm, terminal one stalked and longest, glabrous or lower surface hairy, margins dentate, apex rounded. Stipules deeply bifid, lobes linear lanceolate, veins distinct running parallel, deciduous, glabrous.

Flowers purple to bluish purple, 15-25 in a somewhat compact 2-4 cm long raceme. Each flower sessile to subsessile, bracteoles very minute. Calyx teeth longer than the tube, setaceous, persistent. Corolla double the length of calyx, standard broadest. Pod forming a double spiral, hairy when young. Seeds solitary, somewhat rounded.

Germination : The seeds remain dormant in winter and sprout in early spring (February-March).

Fl. & Fr. : May-August.

Dissemination : The weeds spread vegetatively as well as through seed also. The seeds are disseminated by wind and during agricultural operations.

Habitat : A common weed of orchards, grasslands and meadows possessing gregarious habit. Indicator of fertile, compact sandy loams.

Associations recorded : The common associates of this weed are *Cynodon dactylon* and *Medicago minima*.

Root system : The adventitious roots developed from the nodes of trailing rootstock enter the deeper horizons of soil and bind the weeds in soil.

Geographical distribution : Europe, North Africa, Turkey, Caucasus, Central Asia, Iran, Afghanistan, Pakistan, West Siberia.

Specimens examined : *Meebold* 1496 (June, 1905) Achabal, Kashmir (CAL); *Kaul* 45 (26-6-1969) RRL Campus grasslands; *Kaul* 49 (26-6-1969) Chattabal vegetable fields.

Chromosome report : 2n = 16, 32, 64 (DCA 161).

Medicago polymorpha L. Sp. Pl. 779, 1753; Shin in Rhodora 58 : 5, 1956; Stewart 413. **(Fig. 25)**

Medicago denticulata Willd. Sp. Pl. 3 : 1414, 1800; FBI 2 : 91; Sabnis in J. Bombay Nat. Hist. Soc. 42 (2) : 344, 1942; Gross. in Fl. URSS 11 : 168, t. 11-14, 1945.

Annual, more or less robust herbs. Stem trailing, rarely suberect, much branched, up to 30 cm long, glabrous or somewhat downy, slender. Leaves pinnately 3-foliolate; leaflets obovate to cuneate, 0.5-1.5 cm diam., apical ones larger, glabrous, margins finely dentate. Peduncles shorter than the leaf pedicels, 2-4 flowered. Each flower is sessile, yellow up to 4 mm long; calyx 5-toothed, teeth linear as long as the tube, minutely pubescent, persistent; corolla exserted out, standard as long as the wings. Pods circular with 2-4 spirals, each spiral is spined, spines slender up to 2 mm long, spirals distinctly veined. Seeds generally solitary, rounded with a concavity in the middle.

Germination : The seeds remain dormant for winter and germinate in early spring (February-March).

Fl. & Fr. : April-June.

Dissemination : A common weed of some grasslands preferring moist situations. Indicato of nitrogenous clay loams.

Root system : The tap root has restricted growth but is thoroughly branched, branches bearing many root nodules.

Associations recorded : The weed forms a pure community in a grassland dominated by *Cynodon dactylon*.

Geographical distribution : Mediterranean region, Turkey, Central Asia, Afghanistan, Western Himalaya : Kashmir.

Specimens examined : *Kaul* RRL 5993 (26-5-1970) University campus orchards; *Kaul* 151 A (12-4-1970) Mansbal wheat fields.

Chromosome report : 2n = 16 (DCA 160).

Medicago minima L. Grupb. in L. Amoen. 4 : 105, 1759; FBI 2 : 91; Sabnis in J. Bombay Nat. Hist. Soc. 42 (2) : 344, 1942; Gross. in Fl. URSS 11 : 174, tab. 11-16, 1945; Stewart 412.

M. polymorpha-minima L. Sp. Pl. 780, 1753.

Annual herbs, sometimes even acting as perennial, branched, branches spreading up to 15.5 cm long, hairy. Leaves petiolate, as long as leaflet, slightly hairy, stipules persistent, leafy, hairy. Peduncles axillary, as long or slightly longer than petioles of leaves, 3-6 flowered; calyx teeth as long as the tube, finely downy, persistent. Corolla double the length of calyx with a broad standard, yellow. Pods up to 8 mm diam. excluding the spines, with a spiral of 4-5 close turns and with a double row of weak hooked spines. Seeds solitary, enclosed in the pod, rounded, brownish, shining.

Germination : The seeds remain dormant for about a year and start germinating in early spring.

Fl. & Fr. May-August.

Dissemination : The weed spreads vegetatively as well as by seeds. The seeds are generally disseminated by the animals feeding on the grass associated with it. The pods are barbed and bristly which cling to the animals and are carried to long distances.

Habitat : A common weed of grasslands, orchards, and even fallow lands preferring open situations. Indicator of dry sandy nitrogenous loams.

Root system : A tap root going into the deeper horizons of soil sending branches which possess small nodules.

Associations recorded : The weed is generally associated with *Cynodon dactylon* and *Bothriochloa ischaemum*, forming a community.

Geographical distribution : Europe, Turkey, Caucasus, Central Asia, Afghanistan, India : Kashmir.

Specimens examined : *Duthie* 10822 (7-5-1892) Srinagar near Dalgate (DD); *Kaul* RRL 916 (16-8-1969) University Campus orchards; *Kaul* 163 (30-4-1970) Naseem Bagh fallow fields.

Chromosome report : 2n= 16 (DCA 160).

Medicago lupulina L. Sp. Pl. 779, 1753; FBI 2 : 90; Gross. in Fl. URSS 11 : 134, t. 10-12, 1945; Rao in BOBSI 2 : 398, 1960; Stewart 412. **(Fig. 26)**

Annual, biennial or even perennial herbs. Stem slender, procumbent, branched from the base, branches spreading more or less downy or even pubescent up to 25 cm long. Leaves pinnately trifoliolate, petiolate; length of petiole varied; in some plants leaves are sessile, in others petiole is shorter than the leaf in still others much longer than the leaf. Leaflets obovate or even ovate, 0.5-2 cm long, glabrous or silky pubescent, stipules leafy, broader than long, acute, shortly toothed at base, slightly pubescent. Flowers bright

yellow, 2-5 mm long, 8-15 in small globular heads, carried on long axillary peduncles, peduncles elongated in fruits. Calyx teeth setaceous as long as the tube, falling off at maturity. Corolla slightly exserted. Pod up to 4 mm diam., sickle-shaped, reniform coiled in almost one complete turn, faintly veined longitudinally, turning black at maturity, Seed solitary enclosed in hard covering, shining.

Germination : The seeds remain dormant in winter and start sprouting in early spring. Sometimes the seeds also germinate in late autumn (November).

Fl. & Fr. : March-September.

Dissemination : Vegetative propagation as well as by seed. The seeds are dispersed by rain water or irrigation water or to some extent by man during harvest of grasses and forbs for fodder.

Habitat : A common and abundant weed of lawns, pastures, orchards, grasslands, wheat fields and also fallow fields. Indicates nitrogeneous sandy loams.

Root system : A long branched or unbranched tap root going up to 20 cm deep into the soil and bearing many nodules.

Geographical distribution : Eurasia, North Africa, Siberia, Europe, Ethiopia, Pakistan, India, Temperate Himalaya : Kashmir.

Specimens examined : *Kaul* RRL 5952 (6-4-1969) Rawalpora wheat fields; *Kaul* 115 (27-2-1970) RRL Campus Srinagar; *Kaul* RRL 19761 (26-7-1972) Naseem Bagh orchards.

Chromosome report : 2n=16,32 (DCA 160).

MELILOTUS P. Miller

Key to the species

1. Annual herbs. Flowers yellow in shorter racemes **indica**

1. Biennial herbs. Flowers white in longer axillary racemes **alba**

Melilotus indica All. Fl. Ped. 1 : 308, 1785; Bobrov in Fl. URSS 11 : 189, Tab. 12-4, 1945; Kitamura 237; Polunin 201.

Melilotus parviflora Desf. Fl. Atl. 2 : 192, 1800; FBI 2 : 89; Sabnis in J. Bombay Nat. Hist. Soc. 344, 1942.

Annual herbs. Stem erect or procumbent, slender, up to 45 cm tall, branched, glabrous or slightly hairy towards the apices, fistular, light green. Leaflets obovate to oblong lanceolate; apical ones petiolate, lateral ones sessile glabrous, margins dentate above and entire below; petiole of the leaf up to 3 cm long, glabrous. Flowers 12-35 in long axillary spikes. Each flower is up to 4 mm long, yellow, tiny, sessile. Calyx tube campanulate, 5-toothed, teeth distinct, nearly equal, lanceolate and acute. Corolla nearly double the length of calyx, standard not clawed, wings and keel shorter than standard. Stamens diadelphous. Pod up to 5 mm diam., almost circular, hairless, surface netted, olive green when ripe. Seed solitary somewhat rounded with an apical depression, yellowish.

Germination : The seeds remain dormant in winter and start sprouting in early spring (March) sometimes in late autumn (November) also.

Fl. & Fr. : May-September.

Dissemination : The seeds are mainly disseminated by wind or during agricultural operations.

Habitat : The weed occurs occasionally in orchards, some grasslands, or fallow waysides. It prefers fertile soil conditions.

Root system : A thick branched tapering taproot with or without nodules.

Geographical distribution : Mediterranean region, Caucasus, Central Asia, Afghanistan, Pakistan, India, Europe.

Specimen examined : *Kaul* RRL 5987 (24-5-1970) Barzulla orchards.

Chromosome report : 2n=16 (DCA 161).

Melilotus alba Medikus ex Desrousseaux in Lamarck, Encycl. Meth. 4 : 63, 1796; FBI 2 : 89; Sabnis in J. Bombay Nat. Hist. Soc. 42(2) : 344, 1942; Ohashi in Hara Fl. Eastern Himal. 158, 1966; Stewart 413.

(Fig. 27)

Biennial tall herbs. Stem up to 1 m tall, somewhat woody below, branched from the base, minutely pubescent or glabrous, angular narrowly grooved; leaves of 3-leaflets, petiole as long or longer than the leaf, glabrous, apical leaflet longest up to 2 cm x 0.8 cm stalked, lateral ones nearly sessile, oblong to obovate, upper part toothed and base entire, veins running parallel into sharp teeth, stipules narrowly lanceolate, deeply bifid, deciduous. Flowers in long axillary racemes, white; each flower up to 5 mm long, pedicel very slender and short; bracteoles very small, deciduous. Calyx and corolla similar to *M. indica* described earlier Stamens diadelphous. Style of the ovary glabrous, incurved, stigma minute. Pod indehiscent up to 5 mm coming out of persistent calyx. Seed 1-2 small, ovoid, hard.

Germination : The seeds germinate in early spring (March) after remaining dormant for about a year.

Fl. & Fr. : July-September.

Dissemination : The weed propagates vegetatively as well as by seed. The seeds are dispersed by wind water or even by animals.

Habitat : An occasional weed of orchards and grasslands. It grows in open and compact soils and indicates loamy nitrogenous soils.

Root system : The rootstock is thick and remains dormant in the soil for at least two years. The branches arising from the rootstock penetrate the deeper horizons of soils and possess many small nodules.

Geographical distribution : Europe, North Asia & Siberia, Himalaya.

Specimen examined : *Kaul* RRL 19601 (21-6-1969) Barzulla orchards.

Chromosome report : 2n = 16, 24, (DCA 161).

LESPEDEZA A. Michaux

Key to the species

1. Stem slightly pubescent or tomentose. Flowers in racemes or umbels on peduncles up to 2.5 cm long:
   2. Leaves cuneate to obovate. Flowers 3-7 in compact umbels or racemes:
      3. Leaflets up to 2 cm long. Flowers light purplish or very rarely pale yellow — **cuneata**
      3. Leaflets up to 1.5 cm long. Flowers light purple — **juncea**
   2. Leaflets oblong or elliptic. Flowers 3-9 generally in sessile umbels — **elegans**
1. Stem densely pubescent. Flowers in long racemes, peduncles up to 10 cm long — **tomentosa**

Lespedeza cuneata G. Don. Gen. Syst. 2 : 307, 1832; Kitamura 235. **(Fig. 28)**

Lespedeza sericea (Thunb.) Miquel in Ann. Mus. Lugd. Bot. 3 : 49, 1867 *nom. illegit.*; FBI 2 : 142; Rao in BOBSI 2 : 399, 1960.

Hedysarum sericeum Thunb. Fl. Jap. 287, 1784, non Mill. 1768.

Annual or biennial undershrubs. Stem erect, sometimes procumbent, up to 1.5 mm long, unbranched or with small axillary branches, finely ribbed throughout its length, pubescent, greyish, sometimes woody towards the base. Leaves pinnately trifoliate, nearly sessile, crowded or overlapping; leaflets cuneate to obovate, up to 2.5 cm x 1.0 cm terminal subsessile, lateral ones sessile, apex rounded, awned, lower surface white; silky. Stipules small and deciduous. Peduncles 3-7 flowered, up to 2.5 cm long, silky or greyish. Each flower subsessile, white or purplish, rarely yellowish, bracteoles linear and filiform. Calyx 5-fid, segments linear, slightly pubescent, persistent. Corolla nearly double the length of calyx, standard broad. Pods oval up to 5 mm diam. glabrous or sometimes silky, seed solitary, somewhat rounded. black.

Germination : The seeds remain dormant for a year or even more and sprout in spring (March-April).

Fl. & Fr. : July-September.

Dissemination : The weeds propagate vegetatively as well as by seed. The seeds are dispersed by wind and animals which eat the twigs.

Habitat : An occasional weed of orchards, grasslands and fallow roadsides; possessing a gregarious habit. Prefers to grow in dry compact loams.

Root system : Trailing root with enough branches penetrating into the surface horizons of soil.

Geographical distribution : China, Japan, North Australia, Pakistan, Himalaya from Kashmir to Assam.

Specimen examined : *Kaul* 82 (25-8-1969) Sanat Nagar apple orchards, seen also at Pampore fallow fields.

Chromosome report : 2n=18 (DCA 157).

Lespedeza juncea (L. f.) Pers Syn. Pl. 2 : 318, 1807; FBI 2 : 318, Collett 127; Stewart 411.

Hedysarum junceum L. f. Decas Prima Pl. t. 4, 1762.

Annual or biennial herbs. Stem generally decumbent or even trailing, slender, up to 75 cm long, branched, branches terete, slightly pubescent or grey. Leaves trifoliate, petioles small, not much crowded; leaflets obovate, up to 1.5 cm x 0.8 cm, apex rounded and awned, lower surface silky. Stipules small and deciduous. Peduncles very short, axillary, 3-5 flowered. Each flower is sessile, pale purple, up to 1 cm long with a broad standard. Calyx and corolla similar to *L. sericea*. Pod oval, up to 3.5 cm diam. silky. Seed solitary.

Germination : The seeds remain dormant for at least one year and germinate in spring (March).

Fl. & Fr. : July-September.

Dissemination : The seeds are mainly disseminated by wind.

Habitat : An occasional weed of orchards and some grasslands. Indicator of sandy or gravelly soils.

Root system : Tough root trailing on the surface of soil sending slender branches which bind the plants in the soil.

Geographical distribution : Afghanistan, India, Himalaya : Kashmir to Kumaon; Siberia, China.

Specimen examined : *Kaul* 74 (10-8-1969) Chishma Shahi orchards.

Chromosome report : 2n = 18 (DCA 157, confirmed).

Lespedeza elegans Camb. in Jacquem. Voy. Bot. 43, t. 52, 1844; FBI 2 : 143; Stewart 410.

Biennial or perennial herbs. Stem erect, up to 1 m tall, rarely branched, terete, somewhat tomentose, hard and woody towards the base. Leaves pinnately trifoliate, alternate, short petioled or even sessile towards the apex; leaflets elliptic or even oblong, 0.5-2.8 cm x 0.3-1.2 cm apical one small stalked, grey or white silky on the undersurface, margins entire. Flowers 5-9 in sessile umbels, sometimes in small compact racemes. Each flower is sessile; bracteoles linear, small, deciduous; 1.5 cm long. Calyx deeply 5-fid, segments linear-subulate, densely pubescent. Corolla as long or slightly longer than calyx. Pods oblong coming out of the persistent calyx, hard, glabrous, 1-seeded. Seeds rounded, hard, black up to 5 mm diam.

Germination : The seeds germinate in spring (March-April), remaining dormant for the rest of the year.

Fl. & Fr. : July-September.

Dissemination : The weeds propagate vegetatively as well as by seed. The seeds are dispersed by rain water or irrigation water.

Habitat : A rare weed of vegetable fields along the water canals and some orchards. It possesses a gregarious habit. Indicator of nitrogenous soils.

Root system : A thick tapering rootstock penetrates the deeper horizons of soil bearing small nodules on finer branches.

Geographical distribution : Temperate regions of world.

Specimens examined : *Kaul* RRL 19684-19685 (30-9-1970) Majid Bagh vegetable field.

Lespedeza tomentosa (Thunb.) Siebold ex Maxim. in Act. Hort. Petrop. 2 : 376, 1873; FBI 2 : 143.

Hedysarum tomentosum Thunb. Fl. Jap. 286, 1784.

Perennial undershrubs up to 1 m or more tall. Stem erect, branched, terete, densely pubescent. Leaves trifoliate, distant; leaflets oblong to obovate, obtuse, thick, subcoriaceous; young leaves densely silky beneath, veins thickly raised beneath, margins entire lower ones petiolate and upper sessile; stipules subulate and persistent, densely hairy. Flowers in long axillary distinctly peduncled 4.5-10 cm long racemes. Each flower is up to 1.5 cm long, subsessile to sessile; bracteole 1, brownish, deciduous. Calyx 5-fid, lobes lanceolate, densely pubescent, persistent. Corolla white or with purplish tinge, extruded out of the calyx tube, standard as long as the wings, keel shorter. Pod enclosed in persistent calyx, oblong densely pubescent when young. Seed small, solitary.

Germination : Compared to the number of seeds borne by the plants, the percentage of seedlings seen is very low. (March-April).

Fl. & Fr. : July-September.

Dissemination : The weed spreads mostly through vegetative means. The seeds are disseminated by irrigation water.

Habitat : A rare weed of parks and gardens of public interest. Indicator of sandy loams.

Root system : A thick top root system perennating in the unfavourable season.

Geographical distribution : China, Japan, Korea, Western Himalaya: Temperate regions.

Specimens examined : *Keshavanand* 26335 (4-9-1906) Sadhuganga on margins of river (DD); *Lambert* 44691 (15-5-1927) Srinager near Harwan reservoir (DD); *Kaul* RRL 918 (27-8-1969) Shalimar garden.

Chromosome report : 2n = 20 (DCA 158).

LOTUS Linnaeus

Lotus corniculatus L. var. **japonicus** Regel, Index Sem. Horti. Petrop. 23, 1864; Kitamura 235.

Lotus corniculatus sensu Baker in FBI 2 : 91, 1879. *p. p.*

Perennial herbs with stem generally decumbent, rarely suberect, slender, branches spreading from the base, glabrous or minutely silky towards the apices. Leaves compound; leaflets 5, two lowest stipule like, oblanceolate, obovate to oblong, 0.3-1 cm x 0.1, end ones sessile and apical one stalked, generally glabrous, rarely minutely hairy, margins entire, apex acute or sometimes awned. Flowers 3-6 in a close umbel subtended by a trifoliate leaf, carried on a long leafless peduncle. Each flower is yellow with a reddish standard and keel up to 1.5 cm x 0.8 cm, sessile. Calyx campanulate, teeth subequal as long or longer than the tube, silky pubescent or even glabrous, persistent or falling at a late stage. Corolla up to 1.5 cm with a broad standard, Pod cylindrical, up to 3 cm long, glabrous, awn stiff and spiny; septate between the seeds, valves opening longitudinally. Seeds many, small, brick red and hard.

I follow S. Kitamura (1960) in placing it under *var. japonicus* as the leaflets are glabrous.

Germination : The seeds remain dormant for at least one year and sprout in late spring (April) if enough of moisture is available.

Fl. & Fr. : June-September.

Dissemination : The seeds are carried by wind and irrigation water to long distances.

Habitat : It is a common weed of orchards, grasslands and fallow lands; requiring moisture during the early stage and once established can resist drought conditions. Indicator of sandy alluvial soils.

Root system : The adventitious root system goes into deeper horizons of the soil and binds the soil.

Geographical distribution : East Afghanistan, Japan, westwards to Europe, Western Himalaya : Kashmir.

Specimens examined : *Kaul* RRL 5589 (27-7-1970) Barzulla, fallow fields; *Kaul* RRL 19760 (26-7-1972), Naseem Bagh orchards.

Illustration : Blatter pl. 18, fig. 4.

VICIA Linnaeus

Key to the species

1. Flowers solitary or 2, sessile, axillary, not racemed — **sativa**

1, Flowers 3-7 in small close axillary racemes — **sepium**

Vicia sativa L. Sp. Pl. 736, 1753; FBI 2 : 178; Stewart 425.

Annual or biennial herbs. Stem slender, weak; branched up to 35 cm long, glabrous, fistular or sometimes solid, slightly angular, climbing by means of tendrils. Leaves compound, alternate; leaflets 8-20, upper ones modified into tendrils. Each leaflet is sessile or subsessile, oblong to oblong lanceolate, margins entire, apex rounded or with cup-shaped depression, glabrous. Stipules small, deeply toothed, persistent. Flowers generally two, axillary, sessile up to 2.5 cm long, purplish. Calyx 5-toothed, teeth linear nearly as long as the calyx-tube, glabrous, distinctly veined, persistent. Corolla double the length of calyx, snowy, standard largest concealing the wings and keel. Stamens diadelphous. Pods up to 4.5 x 0.5 cm flat, glabrous, tapering into a beak. Seeds rounded, 1-seriate, black.

Germination : The seeds germinate in spring (April).

Fl. & Fr. : June - August.

Dissemination : The seeds are disseminated mostly by man during grass harvesting. The seeds also get associated with the crop.

Habitat : A weed commonly occurring in grasslands and orchards. Indicator of fertile moist alluvials.

Root system : A branched taproot system remaining confined to the suface of the soil, nodules small and numerous.

Geographical distribution : Mediterranean region, Western Asia, widely naturalized in many parts of world.

Specimen examined : *Kaul* 48 (11-6-1969) University campus orchards and grasslands.

Remarks : Locally known as "Hemba gassa". The seeds of pods are collected and taken as a vegetable. The stem and leaves are fed to cattle. In Europe it is cultivated for fodder.

Illustration : Ciba Geigy weed tables, f.55.3.

Chromosome report : 2n=12 (Bir & Sidhu, Taxon 15(2) : 119, 1966).

Vicia sepium L. Sp. Pl. 737, 1753; FBI 2 : 179; Rao in BOBSI 2 : 399, 1960; Stewart 425.

Perennial herbs. Stem trailing or climbing up to 1 m, slender, week, fistular or even solid, branched, glabrous or finely downy. Leaves pinnate compound with no apical leaflet, alternate; stipules small, persistent. Leaflets 8-15, ovate to obovate, up to 3 cm diam. margins entire, apex rounded with a small depression. Flowers 3-7, in small close axillary racemes, mostly towards the apices, purplish. Calyx 5- toothed, teeth unequal shorter than the campanulate tube, glabrous or somewhat downy, persistent. Corolla always double the length of calyx, somewhat similar to that of earlier species. Stamens diadelphous. Ovary with a small style and a knobbed hairy stigma. Pods up to 4 cm linear, glabrescent, somewhat flat. Seeds 5-10, rounded with a small depression below the apex.

Germination : The seeds sprout in spring (April).

Fl. & Fr. : June-September.

Dissemination : The seeds are disseminated by irrigation water.

Habitat : A rare weed of vegetable fields preferring moist situations. Indicator of fertile, well aerated loams.

Root system : A meagrely developed tap root system with shrivelled and small nodules.

Geographical distribution : Europe, Siberia, India : Kashmir.

Specimens examined : *Thapliyal* 26340 (29-5-1958) Harwan (DD); *Kaul* 81 (25-8-1969) Pampore, vegetable fields.

Chromosome report : 2n = 14 (DCA 155).

LATHYRUS Linnaeus

Key to the species

1. Rachis ending in a long tendril, stipules large :
   2. Stipules leaf like, leaflets O. Flowers yellow — **aphaca**
   2. Stipules not leaf-like, leaflets present :
      3. Leaflets 2
         4. Flowers reddish, solitary axillary — **sphaericus**
         4. Flowers yellowish, in 6-10 flowered racemes — **pratensis**
      3. Leaflets 6-8, racemes 3-6 flowered — **altaicus**
1. Rachis ending in a small bristle like tendril, stipules small — **erectus**

Lathyrus aphaca L. Sp. Pl. 729, 1753; Benth. in Royle Illus. Bot. Himal. 200, 1835; FBI 2 : 179; Fedchenko in Fl. URSS 13 : 480, 1948; Polunin 196; Stewart 409.

Annual herbs. Stem weak, up to 25 cm, erect or procumbent, branched, wingless but slightly angular. Leaves modified into tendrils. Stipules leafy, hastate, in pairs at a node adpressed to the stem, glabrous as well as glaucous, margins entire. Peduncles axillary, 2.5-4.5 cm about 3 times the length of the stipule, glabrous generally 1-flowered. Flowers yellow up to 1.5 cm long. Calyx 5-toothed, teeth linear, longer than the tube, persistent. Corolla exserted, nearly double the length of calyx, papilionaceous. Pods linear up to 3 cm long, glabrous, slightly curved. Seeds 4-5, testa wrinkled.

Germination : The seeds germinate in late autumn, (November) and the seedlings remain under snow till the onset of spring.

Fl. & Fr. : April-May.

Dissemination : The seeds are disseminated by wind and water.

Habitat : An occasional weed of orchards and public gardens, possessing a gregarious habit and preferring moist situations. Indicator of moist alluvial soils.

Root system : A meagrely developed adventitious root system bearing nodules.

Geographical distribution : Europe, North Africa, Iran, Afghanistan, Pakistan, India : Kashmir to Kumaon.

Chromosome report : 2n = 14 (Bir & Sidhu in Taxon 15 (2) 119, 1966).

Illustration : Polunin pl. 55.

Lathyrus sphaericus Retz. Obs. 3 : 39, 1783; FBI 2 : 180; Fedchenko in Fl. URSS 13 : 497, 1948; Stewart 410.

Annual herbs. Stem procumbent, weak, generally copiously branched; branches up to 1 m long, angular, glabrous, wingless. Leaves of 2-leaflets; petiole distinct, rigid, angular up to 1.5 cm tendrillar, glabrous. Leaflets linear up to 10.5 cm long, gradually tapering into an acute apex, veins distinct running parallel and converging at both ends, opposite, glabrous. Stipules small, arrow-shaped or nearly cordate, with 2 linear basal auricles, persistent. Flowers reddish, solitary axillary up to 1.2 cm long, pedicels as long or shorter than the leaf petiole. Calyx 5-toothed, teeth linear, equal, a bit longer than the tube, glabrous and persistent. Corolla about twice the length of calyx, papilionaceous. Pods up to 7 cm long, tapering into a narrow angular beak. Seeds 10-14, rounded to reniform, hard, whitish or greyish, spotted.

Germination : The seeds germinate in late autumn and remain under snow during the winter; or sometimes also sprout in early spring, if all the favourable conditions are available.

Fl. & Fr. : April-June.

Dissemination : The seeds are disseminated by water and animals.

Habitat : An occasional weed of cultivated fields growing wheat and sarson. Indicator of nitrogenous sandy loams.

Root system : meagrely developed tap root.

Geographical distribution : Europe, Caucasus, Turkey, Iran, Afghanistan, Pakistan, Central Asia, Himalaya : eastwards to Kumaon.

Specimen examined : *Kaul* RRL 909 (15-4-1969) Chadura, wheat fields.

Chromosome report : 2n = 14 (DCA 156).

Lathyrus pratensis L. Sp. Pl. 733, 1753; FBI 2 : 180; Rao in BOBSI 2 : 399, 1960; Stewart 410.

A stoloniferous perennial climbing herb. Stem slender, branched or unbranched up to 1 m tall, branches angular, dull green, glabrous. Leaves of 2-leaflets, petiolate, petiole as long or shorter than the leaflet, tendrular. Leaflets lance shaped, up to 3.5 cm long, opposite, glabrous, apex acute, entire veins distinct running parallel and converging at both the ends; stipules sagittate or hastate, as long or longer than the leaflets, adpressed to the stem, glabrous. Peduncles axillary, stout up to 7.5 cm long, mostly apical 6-10 flowered; each flower is up to 2 cm long, light yellow with a pedicel up to 4 mm long, hairy and slender; bracteoles small and persistent. Calyx 5-toothed, linear, teeth as long as or longer than the campanulate tube. Corolla almost 3 times the length of calyx, papilionaceous. Pod linear, up to 3 cm glabrous or slightly hairy when young, tapering into a small linear beak. Seeds 5-8, rounded, hard with a wrinkled testa.

Germination : The seeds germinate in spring (April), remaining dormant for at least 1 year.

Fl. & Fr. : August-October.

Dissemination : The seeds are disseminated by animals or man during agricultural operations.

Habitat : A rare weed of vegetable fields, preferring moist situations.

Root system : A meagrely developed tap root.

Geographical distribution : Europe, North Africa, Turkey, Iran, Afghanistan, Pakistan, Western Himalaya, Siberia and Mongolia.

Specimens examined : *Meebold* 1459 (June, 1905) Pindabal, Kashmir (CAL); *Kaul* 94 (29-9-1969) Habak, Vegetable fields.

Chromosome report : 2 n = 14, 28 (DCA 156).

Lathyrus altaicus Led. Ic. Pl. Fl. Ross. 1 : 13, t. 53, 1829; Rao in BOBSI 2 : 399, 1960; Stewart 409.

Stem sub-erect or procumbent up to 75 cm branched or unbranched, glabrous or sometimes edges slightly pubescent, climbing by means of tendrils, leaves compound, leaflets 6-8, in pairs, oblong, 1.5-3.5 x 0.5-1 cm, sessile, entire, glabrous or minutely pubescent margins, the main rachis ending into long branched and coiled tendrils. Racemes on axillary long peduncles, laxly 3-6 flowered. Each flower is reddish, subsessile. Calyx tube longer than the teeth, sometimes hairy. Corolla with a broad standard, about twice as long as calyx. Pods linear up to 4.5 cm, glabrous, 5-8 seeded. Seeds small, hard, testa mottled.

A rare weed, growing in orchards and public gardens, possessing a gregarious habit.

Specimens examined : *Inayat* 25561 (26-5-1970) Kashmir (CAL); *Kaul* RRL 19767 (29-7-1972) Shalimar Bagh.

Geographical distribution : Siberia, Western Himalaya : Temperate regions.

Illustration : Blatter pl. 20, f. 1.

Lathyrus erectus Lagasca, Gen. et Sp. Nov. 22, 1816; Stewart 409.

Lathyrus inconspicutus auct. non L., (1753); FBI 2 : 180; Fedstch in Fl. URSS 13 : 498, 1948.

This plant is closely allied to *L. sphaericus* in habit and appearance but differs from it in :

1. Smaller height up to 25 cm. branched from the base
2. Leaflets linear, up to 5 cm, long in mature plants
3. Petioles very slender and much shorter
4. Tendrils very small, bristle-like
5. Stipules smaller and sagittate
6. Calyx-teeth subequal and a bit longer than the tube, and
7. Pods smaller and with less number of seeds.

Germination : Ths seeds sprout in late autumn (November) and remain under snow or the soil for the winter. Seedlings come out at the onset of spring (February-March).

Fl. & Fr. : May-June.

Dissemination : The seeds are disseminated by irrigation water and also remain contaminated with the crop.

Habitat : An occasional weed of wheat and linum fields preferring open and dry situations. Indicator of fertile well aerated dry nitrogenous loams.

Root system : A much branched tap root system with healthy nodules.

Geographical distribution : Afghanistan, Pakistan to Turkey, Himalaya : Kashmir.

Specimens examined : *Kaul* RRL 16057, 16057a (12-6-1971) Sanat Nagar wheat fields, University campus wheat fields.

Chromosome report : 2n = 14 (Bhat, Bakshi & Kaul, 1974).

ASTRAGALUS Linnaeus

Key to the species

1. Small annual prostrate herbs densely hairy **leucocephalus**
1. A branched perennial undershrub armed with spinous structures **grahamianus**

Astragalus leucocephalus Grah. ex Benth. in Royle Illus. Bot. Himal. Mounts. 198, t. 32, f. 2, 1835; FBI 2 : 128; Rao in BOBSI 2 : 399, 1960; Stewart 392.

Annual prostrate herbs. Stem trailing, branched from the base, ascending up to 18 cm, slender, densely clothed with persistent loose white hairs. Leaves up to 7.5 cm long, compound; leaflets 15-27, oblong or slightly rounded, up to 8 cm diam. sessile, lower surface grey, covered with dense silky hairs, upper surface greenish, slightly, hairy, thick glaucous. Flowers in small, oblong, dense heads, carried on long peduncles, 10-20 in a head. Each flower is up to 8 mm long, sessile bracteate, bracts lanceolate; densely tomentose, exceeding the buds, persistent. Calyx teeth as long as the tube, shaggy with white hairs. Corolla extruded, slightly yellowish with pinkish dots, standard longest. Stamens with minute anthers. Pod small, slightly rounded, included in the persistent calyx, finely downy. Seeds 3-4, minute, black.

Germination : The seeds do not germinate under normal conditions because of a tough testa. The testa is removed in nature by some enzyme action and seeds start sprouting in early spring (February-March).

Fl. & Fr. : May-July.

Dissemination : The seeds are disseminated by wind or irrigation water.

Habitat : An occasional weed of fallow fields, saffron fields and other dry locations. Indicator of compact dry nitrogenous loams.

Root system : A thick tapering tap root with small branches going deep into the soil.

Geographical distribution : Afghanistan, India : Punjab, Simla, Garhwal, Kumaon, Western Himalaya : Kashmir.

Specimens examined : *Duthie* 10827 (7-5-1892) near Srinagar (CAL); *Kaul* RRL 5999 (26-5-1970) Barzulla fallow fields.

Illustration : Blatter pl. 19, fig. 1.

Astragalus grahamianus Benth. in Royle Illus. Bot. Himal. Mounts. 199, t. 36, f. 2, 1835; Kitamura 200; Stewart 390.

A copiously branched, perennial undershrub. Stem branched from the base, spreading or suberect up to 20 cm, armed with crowded ascending spinous old leaf rachises which are up to 4.5 cm long, thick and tough. Leaflets 7-15, oblong or somewhat oval, sessile, glabrous or sometimes silky pubescent, margins entire, apex awned. Flowers up to 3 cm long, short stalked, yellow, axillary, crowded. Calyx tubular up to 1.3 cm long, light green, glabrous or thinly silky, mouth slightly oblique, teeth linear but much shorter than the tube. Corolla up to 3 cm, standard enclosing the wings and the keel, showy. Pod linear, covered with silky pubescent when young, oblong to linear oblong up to 1.3 cm long, turgid, bilocular.

Seeds 2-seriate, somewhat rounded, hard, not germinating easily.

Germination : The seeds are very hard and do not germinate ordinarily. They remain dormant for about a year and germinate in late autumn (November), within a temperature range of 20-25°C.

Fl. & Fr. : March-May.

Dissemination : The seeds are mostly disseminated by irrigation or rain water.

Habitat : An occasional weed of fallow lands, hilly areas and drier locations. Indicator of sandy or gravelly nitrogenous soil.

Root system : Thick creeping rootstock with bunches of adventitious roots binding the plants in the soil. Once established it is difficult to eradicate the weed.

Geographical distribution : Afghanistan, India: Kumaon to Garhwal and Kashmir.

Specimen examined : *Kaul* RRL 5969 (10-4-1969) Rawalpora fallow fields; *Kaul* 12 (12-4-1969) Airport wheat fields.

Remarks : It can be used to check soil erosion on account of of its tufted habit and soil binding roots.

AESCHYNOMENE Linnaeus

Aeschynomene indica L. Sp. Pl. 713, 1753; Wight Ic. t. 405, 1840; **FBI** 2 : 151; Collett 129; Rao in RBSI 18 (2) : 25, 1960; Stewart 383. **(Fig. 29)**

Annual herbs. Stem dull green, branched or unbranched, glabrous, slender, terete, fistular up to 1 m tall. Leaves compound, alternate, petiolate; petiole up to 1.5 cm, glabrous and gland dotted. Stipules lanceolate, bifid, deciduous, membranous, slightly auricled. Leaflets 40-70, sometimes apical leaflet is also present, 0.5-1.5 cm x 0.5-1 cm oval, apex obtuse, margins entire, glabrous, sessile. Flowers creamy white up to 2 cm in length, in axillary racemes, peduncles gland-dotted; bracteate, bracts linear, small, glandular. Sepals 5, 2 smaller than the other 3. Corolla double or 3 times the length of calyx, creamy. Stamens in 2 groups of 5 each, anthers small. Pods 5-11 cm long, straight or curved, 7-12 jointed, glandular dotted all over. Seeds reniform up to 5 mm diam. grey with black dots, glabrous, hard.

Germination : The seeds germinate in spring (March-April).

Fl. & Fr. : July-August.

Dissemination : The seeds get contaminated with the crop during harvesting or fall on the substrate and is carried by irrigation water to long distances.

Habitat : A common weed of paddy fields remaining associated with it nearly up to maturity. Indicator of damp fertile loams.

Root system : A creeping rootstock with bunches of long adventitious roots arising from the nodes and bind the plants in the loose muddy soil.

Geographical distribution : Japan, Tropics of Old World.

Specimens examined : *Kaul* 76 (11-8-1969) Shalimar paddy fields.

Remarks : A good plant for fodder.

Local name : "Muthege Gassa".

Chromosome report : 2n=40 (Bir & Sidhu 1966).

ROSACEAE

Key to the genera

1. Carpels superior: Fruit never enclosed in calyx-tube :
   2. Fruit dry consisting of a numerous small achenes :
      3. Achenes hairy. style terminal, long — **Geum**
      3. Achenes glabrous or very rarely hairy. Style lateral, very short — **Potentilla**
   2. Fruit succulent, consisting of the enlarged receptacle bearing the minute, glabrous achenes — **Fragaria**
1. Carpels inferior. Fruit enclosed in the calyx-tube — **Agrimonia**

GEUM Linnaeus

Geum urbanum L., Sp. Pl. 501, 1753; FBI 2 : 343; Yuzepchuk in Fl. URSS 10 : 260, 1941; Rao in BOBSI 2 : 400, 1960; Stewart 352. **(Fig. 30)**

A slender herb with a woody, perennial, rootstock. Stem erect, branches many arising independently from the base, sparsely and softly hairy. Radical leaves with long petioles, compound; leaflets 9-11, terminal up to 6 cm diam. orbicular, lobed, crenate; lateral leaflets much smaller up to 1.2 cm diam. sessile, lobed. Cauline leaves short stalked or the upper most ones sessile, variously cut and lobed, terminal leaflets largest, lateral pairs of unequal size. Stipules leafy, lobed and toothed. Flowers arranged in apical cymes, yellow, pedicels up to 6.5 cm long, slender, hairy. Calyx 5-lobed, lobes obovate, apex acute, finely hairy, reflexed in mature flowers, persistent. Petals 5, slightly longer or at times as long as sepals, soon falling off. Stamens and carpels numerous. Each carpel is small, hairy with a style sharply incurved and jointed just above the middle, lower portion is glabrous and persistent; terminal portion hairy, ultimately breaking off. Achenes small, spreading and recurved up to 4 mm long; with long awns; awns 3 times the length of achene; on a small dry domb-shaped and villous receptacle.

Germination : The seeds do not germinate under ordinary conditions, about fifty percent do not germinate at all; others germinate in early spring (April-March), if necessary conditions as moisture etc. is available. Chilling induces germination.

Fl. & Fr. : May-July.

Dissemination : The seeds are generally disseminated by irrigation water.

Habitat : A rare weed of fallow fields growing along moist ground. Indicator of organic matter in soils.

Root system : The rootstock is thick sending long branched rootlets deep into the soil to bind the plants.

Specimens examined : *Kaul* 44 (30-5-1969) Harwan reservoir.

Geographical distribution : Europe, North Africa, Turkey, Iran, Afghanistan, Western Siberia, Central Asia, Himalaya : Kashmir to Kumaon.

Chromosome report : 2n = 42 (DCA 141).

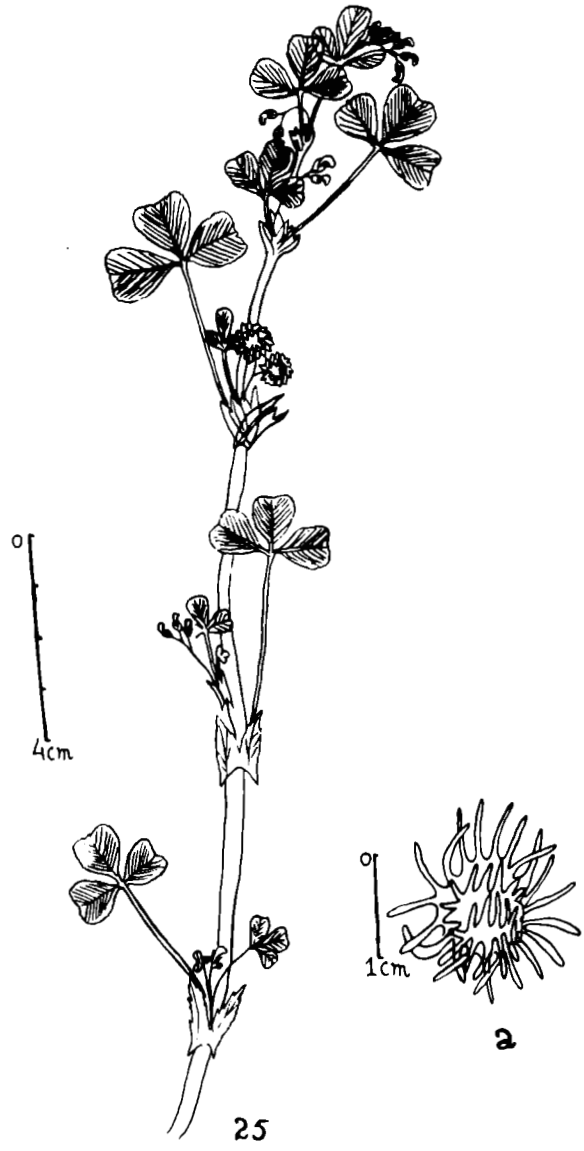


Fig. 25. *Medicago polymorpha* Linn. (a flowering shoot)
a fruit

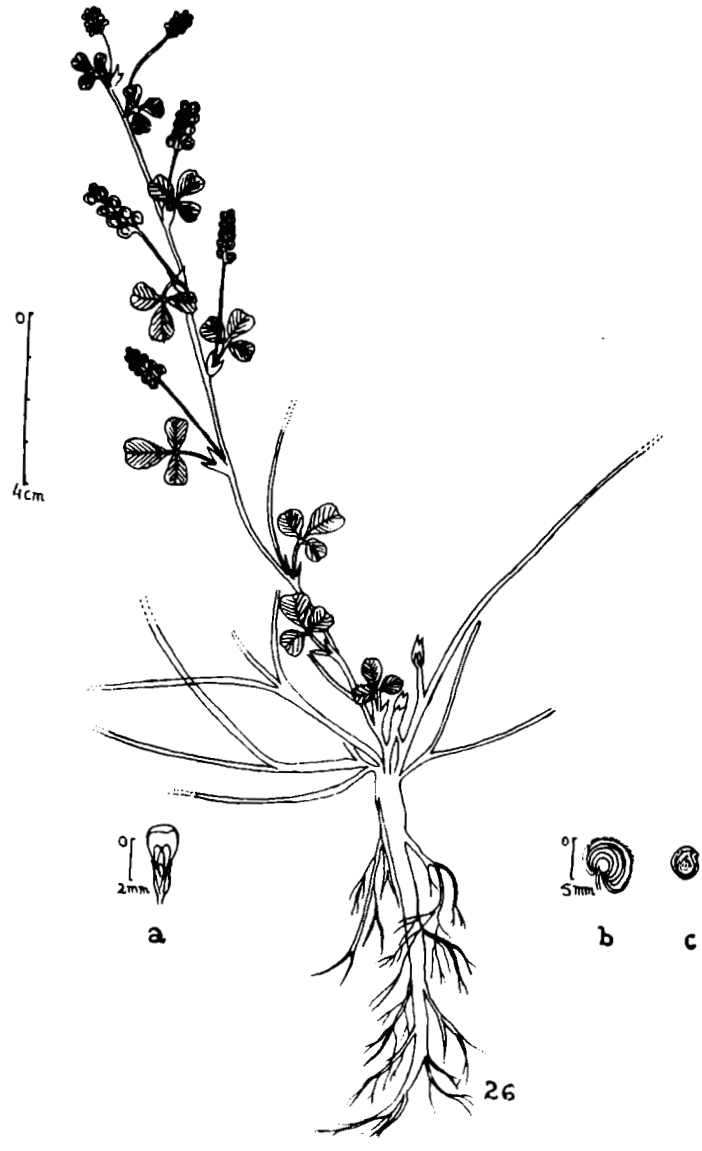


Fig. 26. *Medicago lupulina* Linn (a flowering plant, in part)
a. a flower, b. a fruit, c. a seed

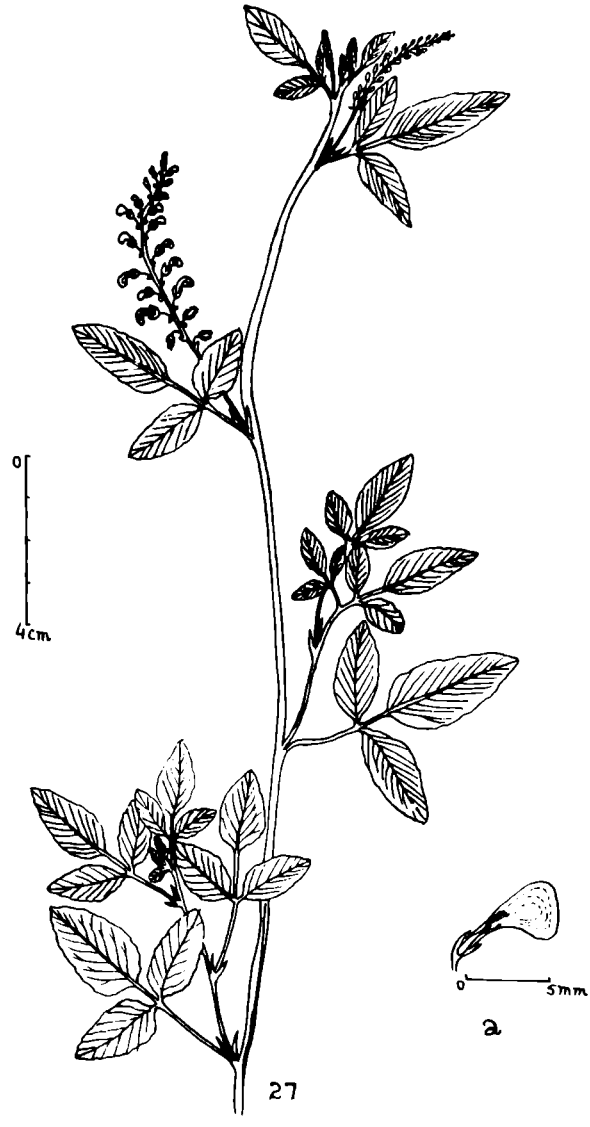


Fig. 27. *Melilotus alba* Medicus ex Desr. (a flowering shoot)
a. a flower

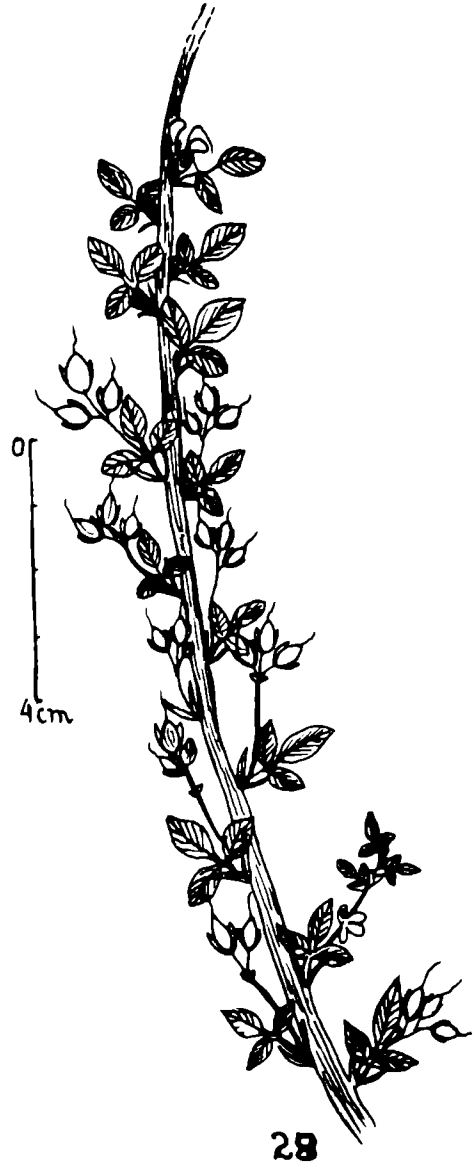


Fig. 28. *Lespedeza cuneata* G. Don (a flowering shoot)

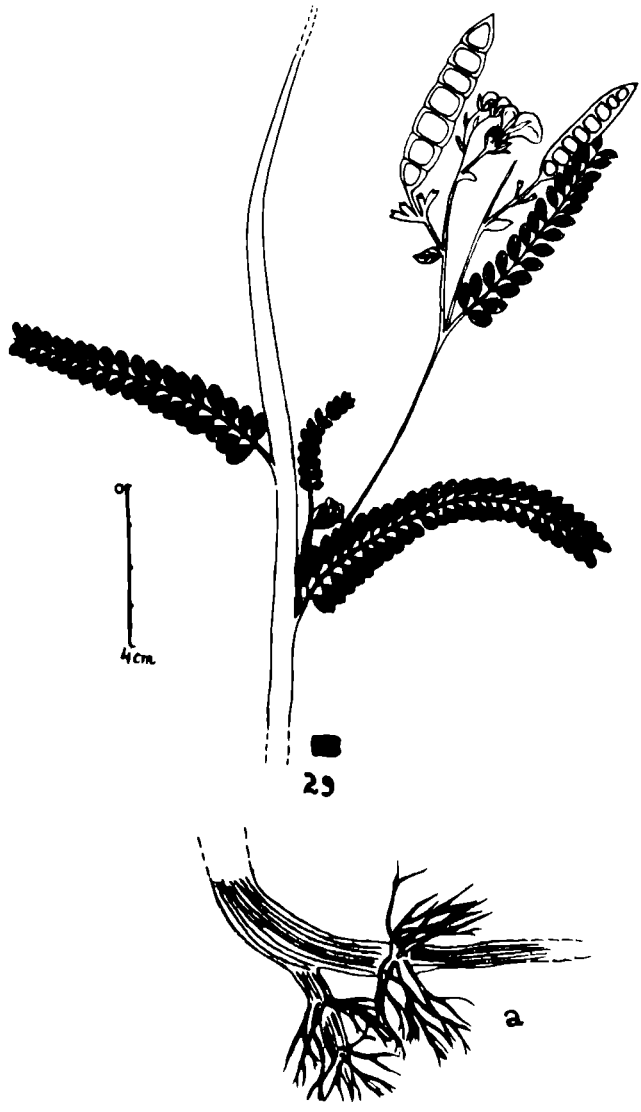


Fig. 29. *Aeschynomene indica* Linn. (a flowering shoot, in part)
a. root system, in part

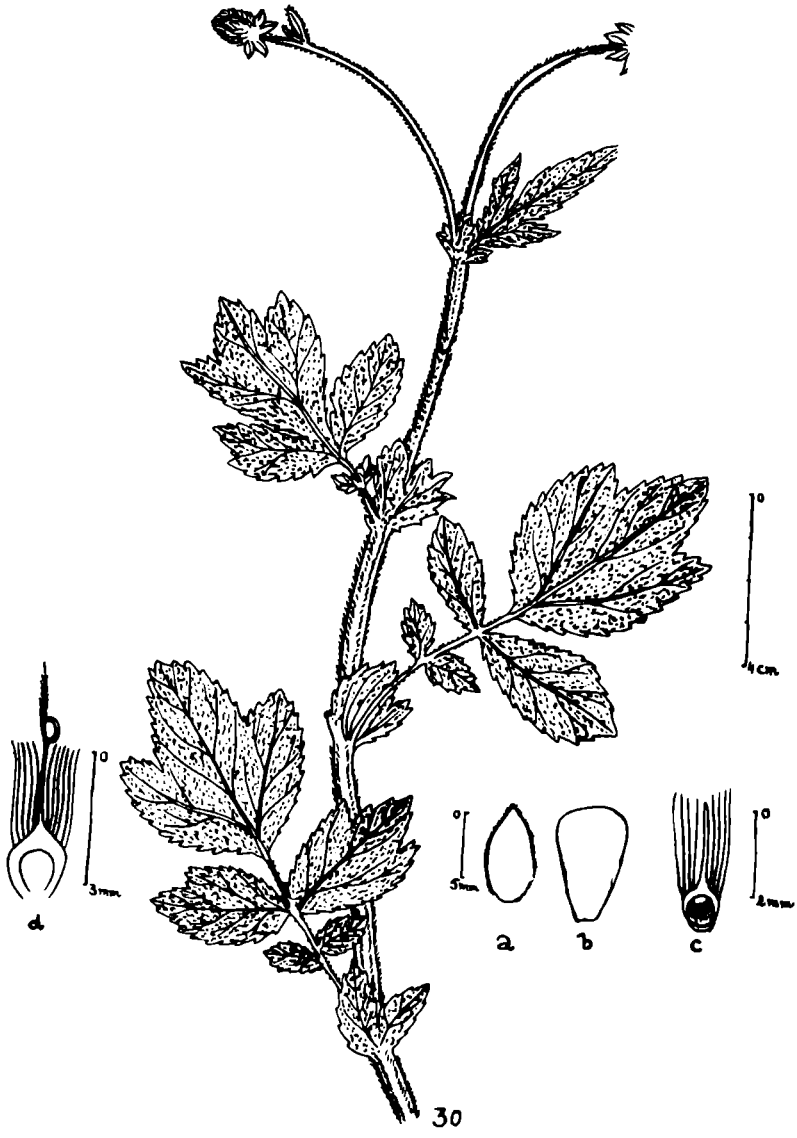


Fig. 30. *Geum urbanum* Linn. (a flowering shoot)
a. a sepal, b. a petal, c. an ovary, d. a mature achene

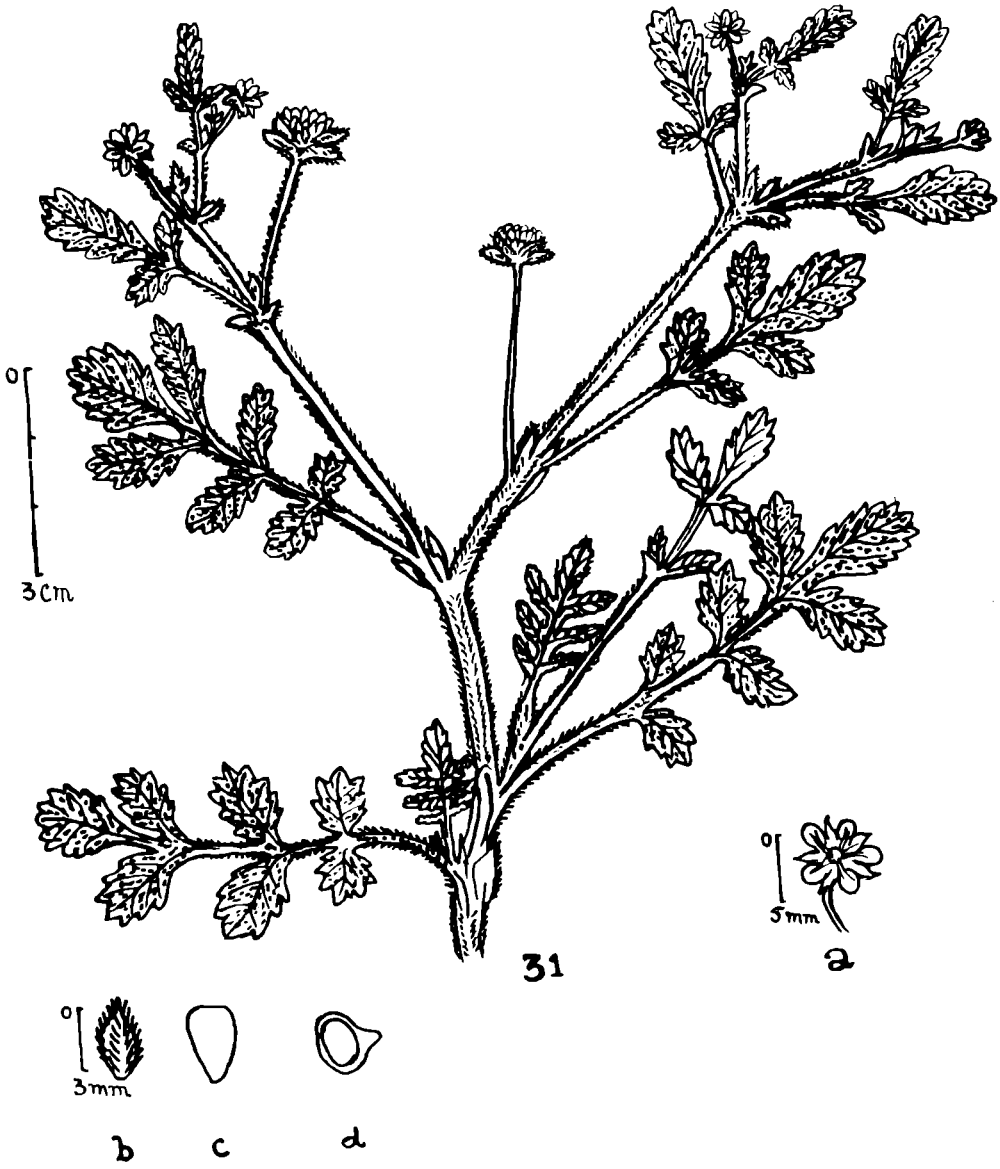


Fig. 31. *Potentilla supina* Linn. (a flowering shoot)
a. a flower, b. a sepal, c. a petal, d. an achene

Fig. 32. *Agrimonia eupatoria* Linn. (a flowering shoot)
a. a fruit, b. v.s. flower, c. a stamen

POTENTILLA Linnaeus

Key to the species

1. Perennial herbs; stem erect or decumbent :
   2. Stems many from the root, no runners; leaves hoary with white tomentum on undersurface **argentea**
   2. Stem branched, branches arising from long runners; leaves slightly hairy or even glabrous **reptans**
1. Annual herb; stem generally decumbent. Stem spreading, leafy, leaflets 3-9 **supina**

Potentilla argentea L. Sp. Pl. 497, 1753; FBI 2 : 356; Blatter 1 : 109; Stewart 353.

Perennial herbs with a thick woody rootstock. Stem many from the root, up to 30 cm erect, branched, branches small; hoary with appressed white, woolly and silvery hairs. Leaves digitately divided; petiolate or upper ones sessile, petiole woolly; alternate. Leaflets 5, up to 3.8 cm x 0.8 cm, sessile, wedge-shaped, stiff, lobes pointing upwards, margins deeply cut, glabrous above and white or downy below; stipules leafy, deeply bifid, hairy, lanceolate, acuminate. Inflorescence broad, much branched in corymbose cymes, leafy. Flowers up to 0.8 cm diam., yellow, pedicellate; pedicel up to 3 cm long woolly. Calyx 5, ovate to obovate, apex acute, densely hairy, persistent. Corolla slightly longer than calyx, of 5 inversely egg shaped petals. Achenes many, small, smooth on a hairy elevated receptacle.

Germination : The seeds germinate in early spring (February-March).

Fl. & Fr. : June-August.

Dissemination : The seeds are mostly disseminated by wind.

Habitat : A rare weed of fallow lands but commonly encountered at high altitudes. Indicator of organic matter in soils.

Root system : A thick rootstock bears bunches of adventitious roots binding the plants to the soil.

Geographical distribution : North Asia, Turkey, Europe.

Specimens examined : *Kaul* 925 (15-6-1970) Qazi guard maize fields.

Chromosome report : 2n = 14, 28, 35, 42, 56 (DCA 1955).

Potentilla reptans L. Sp. Pl. 499, 1753; FBI 2 : 356; Blatter 1 : 115; Rao in BOBSI 2 : 400, 1960; Stewart 358.

Perennial creeping herbs with a woody rootstock from which arise the runners up to 40 cm long; runners are slender and leafy at nodes. There is no definite stem other than some branches arising from runners. Stipules are at the base of the petioles, reddish, oblong, entire, glabrous or rarely hairy, soon falling off. Leaves digitately divided into 3-5 leaflets, petiolate, petioles up to 8.5 cm long, slender, hairy. Leaflets up to 3 cm x 1.5 cm ovate to obovate, apex obtuse or rounded, margins dentate hairy; hairs slightly more on midrib. Flowers up to 2.5 cm diam. yellow, pedicellate; pedicel up to 8 cm long, hairy, slender, growing in the axils of leaves or directly from the runners. Epicalyx 5, each

lobe, obovate, 3-5 dented, hairy persistent. Calyx 5, oblanceolate, apex acute, margins entire, alternating the lobes of epicalyx, persistent. Petals 5, obcordate, as long or shorter than the epicalyx. Stamens many. Achenes small, many, dark brown.

Germination : The seeds germinate in early spring (February-March).

Fl. & Fr. : May-July.

Dissemination : The seeds are disseminated by wind and rain water.

Habitat : A common weed of some orchards and vegetable fields preferring moist or even damp situations. Indicator of damp alluvial soil.

Root system : A creeping rootstock bearing long adventitious roots at nodes which bind the plants in soil.

Geographical distribution : Europe, North Africa, Caucasus, Siberia, Central Asia, Afghanistan, Japan, Ethiopia.

Specimens examined : *Gammie* s.n. (13-7-1981) Nishat Bagh, 53000 (CAL); *Thapliyal* 26323 (28-5-1951) Harwan, Srinagar 5300 ft. (DD); *Kaul* 39 (25-5-1969) Rawalpora wheat fields; *Kaul* RRL 5578 (25-7-1970) Barzulla orchards, Srinagar.

Chromosome report : 2n = 28 (DCA 139).

Potentilla supina L. Sp. Pl. 497, 1753; FBI 2 : 359; Blatter 1 : 116; Yuzepchuk in Fl. URSS 10 : 165, 1941;Stewart 359.

(Fig. 31)

Annual herbs with many stems arising from the root. Stem spreading decumbent, up to 50 cm long, branched, leafy, generally slender and hairy, hairs spreading. Leaves up to 8 cm long, petiolate; petiole slender and hairy; alternate, compound. Leaflets 3-9, sometimes even 11, usually obovate, irregularly cut, crenate incised or serrate, slightly hairy. Stipules at the base of the petiole, ovate with a fine tip, slightly hairy, entire, persistent, Flowers up to 7 mm diam. pedicellate, pedicel shorter than the leaf, axillary, slender but hairy. Epicalyx 5, ovate acute or obtuse, broader than the inner calyx lobes and alternating with them, persistent. Petals 5, obcordate, up to 7 mm diam. slightly longer or as long as calyx lobes, yellow. Achenes up to 1.5 mm diam., smooth on a very hairy receptacle.

The plants are common in well irrigated fields of Srinagar. They form small tufts because of its prostrate and spreading habit. It is an obnoxious weed and spreads fast. The var. 1 given by Hooker conforms with our plant for its stems are excessively branched, flowers 6-7 mm diam. and achenes smooth. This variety has been reported by Hooker from plains of India and var. 2 which has been reported from Kashmir does not conform with the plant under this study.

Germination : The seeds germinate in early spring (February-March).

Fl. & Fr. : May-September.

Dissemination : The seeds are disseminated by wind and rain or irrigation water.

Habitat : A common weed of orchards, vegetable fields and other moist places. Indicator of fertile well aerated loams.

Root system : A branched tap root system with branches penetrating deep into the soil.

Geographical distribution : Europe, North Africa, Caucasus, Siberia, Central Asia, India, Himalaya, China.

Specimens examined : *Meebold* 2887 (June, 1905) Sumbal (CAL); *Kaul* 235 (4-9-1970) RRL Campus Srinagar; *Kaul* 165 (3-5-1970) Habak pea fields.

FRAGARIA Linnaeus

Fragaria. vesca L. Sp. Pl. 494, 1753; FBI 2 : 344; Yuzepchuk Fl. URSS 10: 59, 1941; Polunin 68.

A perennial herb with many spreading above ground stolons up to 25 cm long, rooting at nodes. Leaves trifoliate with leaflets oval, coarsely toothed, 2 - 3. 5 cm diam., silky on under surface, bright green and hairy above. Leaf petiole up to 10.5 cm long, covered with spreading hairs. Flowers white forming a lax cluster towards the apex of the peduncle up to 2 cm diam. showy; peduncles apressedly hairy. Calyx 5-lobed, with 5 bracteoles at the base, generally entire, hairy, persistent. Corolla nearly double the length of calyx. Stamens numerous. Carpels many, small on a convex receptacle, ovule one, ascending. Fruit globular up to 2.5 cm diam. red with a succulent receptacle. Seed minute, black.

Germination : The seeds remain dormant for more than a year and sprout in early spring if enough humus and moisture is available.

Fl. & Fr. : May-July.

Dissemination : The seeds dispersed by animals including birds which eat the fruits. Rain water also helps in dissemination.

Habitat : A rare weed of fields but common in forests. Once the weed comes into the fields it spreads fast vegetatively under well irrigated conditions. Indicator of organic matter in soils.

Root system : Adventitious roots arise from different nodes of stoloniferous stem which bind the plants in the soil.

Geographical distribution : Temperate Himalaya; from Murree & Kashmir to Sikkim; Europe, Caucasus, Iran, Afghanistan, Java, Siberia (introduced in Japan).

Specimens examined : *Kaul* RRL 5532 (22-5-1969) Sarband garden near Harwan.

Chromosome report : 2n = 14 (DCA 138).

AGRIMONIA Linnaeus

Agrimonia eupatoria L. Sp. Pl. 448, 1753; FBI 2 : 361; Collett 169; Rao in BOBSI 2 : 401, 1960; Stewart 346. **(Fig. 32)**

Perennial hairy herb with an erect, branched, ribbed and non green stem up to 50 cm in height. Leaves pinnate compound, up to 20 cm long; sessile with a leafy, deeply crenate persistent stipule adnate to the base of the leaf; leaflets coarsely toothed, very unequal, larger ones 5-9, intermixed with a number of smaller ones, ovate to obovate. Flowers yellow, in terminal spike like racemes; each flower in the axil of a small 3-cleft bract and with 2 smaller, 3-toothed bracteoles at the top of its small stalk. Calyx tube cup-shaped, 7-9 grooved, bearing outside itr mouth a ring of small, hooked bristles, limb, 5-toothed. Petals 5, small, oblong. Stamens 15. Carpels 2, free enclosed within the calyx-tube; style threadlike protruding, stigmas terminal, dilated. Achenes 1 or 2, enclosed in the hardened, bristly calyx, crowned with a ring of hooked bristles.

Germination : The seeds germinate in spring (March), only when enough of moisture is available.

Fl. & Fr. : July-September.

Dissemination : The seeds get disseminated by wind and irrigation water.

Habitat : A rare weed found along the margins of paddy fields. Indicator of sandy loams.

Root system : A thick rootstock sending smaller branches deep into the soil.

Geographical distribution : Iran to Atlantic, Siberia to Java, America, India : Sikkim, Western Himalaya, Kashmir.

Specimens examined : *Gammie* s. n. (26-7-1891) Gund, Sind valley (CAL); *Kaul* RRL 16075 (29-7-1971) Harwan, paddy fields.

Chromosome report : 2n = 28 (DCA 141).

CRASSULACEAE

SEDUM Linnaeus

Sedum adenotrichum Wallich ex Edgew. in Trans. Linn.Soc.20 : 48, 1846; FBI 2 : 420; Collett 186, t. 54; Blatter 1 : 127; Rao in BOBSI 2 : 401, 1960; Stewart 333.

Annual herbs. Stem many from the base, erect up to 20 cm, glandular hairy, succulent, non green, generally leafy or sometimes without any leaves. Radical leaves rosulate, simple, entire or finely crenate, succulent, glabrous or finely glandular hairy. Cauline leaves smaller than the radical ones, generally alternate. Flowers white striped with pink, up to 0.8 cm diam. in loose apical cymes, pedicels slender up to 1.5 cm long. Calyx 5 lobed, each lobe obovate with acute apex, glandular hairy, persistent. Petals 5, a bit longer than the sepals. Stamens 8-10 with a slender filament and rounded anther. Carpels 4-5, style slender, stigma knobbed. Follicles thin walled, erect, glabrous or hairy when young. Seeds ellipsoid, brick-red, longitudinally striate.

Germination : The seeds germinate in early spring, (February-March).

Fl. & Fr. : May-July.

Dissemination : The seeds get disseminated by wind and rain water.

Habitat : An occasional weed of damp and marshy situations. Indicator of rocky substratum.

Association recorded : The plants are often associated with mosses.

Root system : The adventitous root system penetrates hard substrata sometimes even rocks and help in weathering.

Geographical distribution : East Afghanistan, Pakistan, Himalaya : Kashmir.

Specimen examined : *Duthie* 10896 (7-5-1892) Near Srinagar (CAL); *Kaul* RRL 5529 (4-5-1969) Barzulla around tubewell.

Illustration : Blatter pl. 24, f. 1.

LYTHRACEAE

Key to the genera

1. Erect perennial rarely annual undershrubs, stem 4-angled. Flowers large and showy — **Lythrum**
1. Weak decumbent annual herbs. Flowers small in axillary spikes or cymes :
   2. Flowers solitary or in sessile spikes; capsule septicidal — **Rotala**
   2. Flowers whorled in cymes or clusters; capsule indehiscent or bursting irregularly — **Ammannia**

LYTHRUM Linnaeus

Lythrum salicaria L. Sp. Pl. 446, 1753; Rao in BOBSI 2 : 402, 1960; Polunin 263; Stewart 500.

A perennial undershrub, rarely pubescent. Stem erect, up to 1.5 m tall, branched, ribbed, generally branches are tetrangular. Leaves simple, oblong lanceolate, base broader tapering towards the acute apex, 1.5- 6.8 x 0.3-1.0 cm, glabrous, margin entire, upper cauline leaves sessile. smaller and narrowly lanceolate, 2-3 crowded at a place. Flowers in interrupted whorls, each whorl of 5-8 flowers, showy. Each flower up to 1 cm long, with a small pedicel and 2-3 bracteoles. Calyx tubular, 0.5-0.9 cm, green, or reddish green, 6-toothed, short, alternating with six minute accessory teeth, persistent. Petals 6, reddish protruding out of calyx tube and inserted on the top of the tube, spreading. Stamens 12 or even lesser, inserted below the middle of the calyx tube, filaments of variable length, reddish. Ovary at the base of the calyx-tube, free, sessile, oblong 2-celled. Style filiform far protruding, stigma bilobed. Ovules many on axile placenta. Capsule enclosed in the calyx-tube. Seeds brownish, elongated, flattened on one side.

Germination : The seeds remain dormant for more than a year and plant propagates mostly through vegetative means. The young shoots appear in spring (March-April).

Fl. & Fr. : July-August.

Dissemination : Though the seeds are disseminated by irrigation water, they do not germinate even after remaining dormant for a year, the plant possesses a gregarious habit and is not common.

Habitat : A weed of paddy fields and floating islands in lakes. Indicator of marshes.

Root system : A thick rootstock creeps in the substratum and binds the plants in the soil.

Geographical distribution : All Europe, Temperate Himalaya : Kashmir.

Specimens examined : *Rao* 7732 (1-8-1956) Srinagar (CAL); *Kaul* 235 (21-7-1970) Paddy fields near Majid Bagh.

Chromosome report : 2n = 30, 50, 60 (DCA 1955).

Illustration : Polunin pl. 79.

ROTALA Linnaeus

Key to the species

1. Flowers in numerous sessile spikes, axillary. Calyx 4-toothed **indica**
1. Flowers never in distinct spikes, solitary axillary. Calyx 5 toothed **densiflora**

Rotala indica (Willd.) Koehne in Engler Bot. Jahrb. 1 : 172, 1880; Blatter & Hallberg in J. Bombay Nat. Hist. Soc. 25 : 117, 1918; Raizada in Indian For. Rec. (N.S) Bot. 5 (1) : 12, 1958; Van Leeuwen in Blumea 19 : 54, 1971; Stewart 500.

Peplis indica Willd. Sp. Pl. 2 : 244, 1799.

Ammannia peploides Spreng. Syst. 1 : 444, 1825; FBI 2 : 566.

Annual weak herbs. Stem decumbent up to 30 cm long, branched, glabrous rooting at lower nodes never solid, with distinct ridges and wrinkled appearance. Leaves simple, opposite, up to 2 cm long, elliptic or lanceolate, narrowed towards the base and apex,

entire, glabrous with a distinct mid-vein, upper-most leaves serving as bracts. Flowers numerous in sessile, solitary, axillary spikes, densely crowded; spikes up to 1.5 cm long. Calyx-tube campanulate, scarcely striate, teeth 4, often pink, acute and triangular in fruit. Petals small, soon falling off. Stamens 4, with slender filaments and small anthers. Capsule ellipsoid longer than broad. Seeds somewhat angular and elongated.

Germination : The seeds germinate after the fields are flooded with water in April-May.

Fl. & Fr. : August-November.

Dissemination : The seeds are produced in large number and are disseminated by wind and irrigation water.

Habitat : An occasional weed of paddy fields. Indicator of damp well aerated loams.

Root system : Bunches of adventitious roots bind the plants in muddy soils.

Geographical distribution : Iran, China, Japan, Malaysia, India : Himalaya.

Specimen examined : *Kaul* RRL 19713 (22-9-1971) Narakura, Srinagar paddy fields.

Rotala densiflora (Roth ex Roem. & Schult.) Koehne in Engler Bot. Jahrb. 1 : 164, 1880; Kitamura 278; Van Leeuwen in Blumea 19 : 55, 1971; Stewart 500.

Ammannia densiflora Roth ex Roem. & Schult., Syst. 3 : 304, 1818.

R. roxburghiana R. Wight Ic. 1, t. 2608, 1840 excl. Syn. *Ammannia pentandra* Roxb.

Annual herbs. Stem weak, decumbent, rooting at nodes, up to 50 cm or sometimes more in length, often with many opposite branches, divergent at right angles, glabrous, leafy. Cauline leaves up to 3 cm long, upper floral leaves small, oblong, with a broader base, bractiform, entire opposite, glabrous. Flowers generally in each axil, sessile and never in axillary spikes; bracteoles as long as the calyx. Calyx-teeth 5, lanceolate, very acuminate; accessory teeth 5, subulate, often as long as the primary teeth. Petals narrow ovate, small or sometimes even absent. Stamens 5. Carpels spherical or globose, depressed. Seeds many, hemispherical, yellowish or grey, very small.

Germination : The seeds germinate in spring (April) only when the fields are flooded.

Fl. & Fr. : August-November.

Dissemination : The seeds are disseminated by irrigation water and during the ploughing of the fields.

Habitat : An occasional weed of paddy fields. Indicator of damp fertile muddy loams.

Root system : Adventitious roots spread in the surface horizons of the soil.

Geographical distribution : Africa, Iran, Afghanistan, Southern China, Malaya, Australia, India.

Specimen examined : *Kaul* RRL 19711 (19-9-1971) Hyderpora paddy fields; *Kaul* RRL 19722 (29-9-1971) Majid Bagh, Srinagar paddy fields.

AMMANNIA Linnaeus

Key to the species

1. Leaves elliptic narrowed at the base, flowers in dense or a bit loose axillary clusters **baccifera**

1. Leaves elongate oblong, subauriculate, flowers in long axillary cymes **auriculata**

Ammannia baccifera L. Sp. Pl. 120, 1753; FBI 2 : 569; Stewart 499.

Annual herbs with an erect, glabrous, branched or unbranched, quadrangular stem. Leaves opposite, oblong narrowly elliptic, up to 2.5 cm long, entire, glabrous. Flowers in dense clusters forming knots on the stem or in looser but vry short axillary cymes. Calyx-tube hemispherical, 4-toothed, accessory teeth small. Petals small, just protruding out of calyx-tube, falling off soon. Stamens 4 or at times 8. Capsule depressed, inside the persistent calyx-tube. Seeds many black.

Field notes : The weeds of paddy fields growing in the damp as well as dry situations. The plants that inhabit the damp conditions are taller and more slender than those found in drier conditions. The fruit is reddish when young and turns blackish on maturity.

Fl. & Fr. : Aug.-Oct.

Geographical distribution : Tropical Africa, Europe, India, Eastwards to China and S. Japan, Malaysia and Australia.

Specimens examined : *Kaul* RRL 922 (21-10-1969) Hyderpora paddy fields; *Kaul* RRL 16125 (25-8-1971) Dhara, Harwan.

Ammannia auriculata Willd. Hort. Berol. 1 : 7, t. 7, 1806; H. Hara in Fl. Eastern Himalayas 217, 1966; Stewart 499.

A. senegalensis sensu Clarke in FBI 2 : 570, 1879.

Annual glabrous herbs. Stem glabrous, quadrangular, generally unbranched, up to 55 cm long, suberect or even procumbent. Leaves opposite, elongate-oblong, up to 5.5 cm long, sessile, subauriculate at the base, glabrous, crowded towards the apex. Flowers in axillary, peduncled, compound cymes. Bracteoles on the cyme branches, minute and linear. Calyx campanulate, tube 4-8 veined, veins outside, becoming indistinct in fruit; teeth 4, broad triangular. Petals 4, soon falling off or sometimes absent. Stamens 6-8. Capsule becoming red ultimately, exceeding the calyx tube. Seeds black, many, triangular or a bit elongated.

Germination : The seeds germinate in spring (April), remaining dormant for autumn and winter.

Fl. & Fr. : August-November.

Dissemination : The seeds are disseminated by wind and during the crop harvesting by man.

Habitat : A common weed of paddy fields. Indicator of damp fertile muddy soils.

Root system : Adventitious roots bind the plants in muddy soil.

Geographical distribution : Tropical Africa, Caucasus, Iran, China, Philippines, Australia, and America, India.

Specimens examined : *Meebold* 370 (June, 1905) Baramulla (CAL); *Kaul* RRL 923 (21-10-1969) Hyderpora paddy fields; *Kaul* RRL 19721 (29-9-1971) Majid Bagh, Paddy fields.

ONAGRACEAE

Key to the genera

1. Petals usually yellow; seeds without plume of hairs — **Oenothera**
1. Petals pink, rarely white, seeds with a plume of hairs — **Epilobium**

OENOTHERA Linnaeus

Key to the species

1. Flowers large and yellow. Fruit elongated **drummondii**

1. Flowers smaller and pink. Fruit ellipsoid **rosea**

Oenothera drummondii Hk. Bot. Mag. 8 : t. 3361, 1834; Rao in RBSI 18(2) : 31, 1960.

Biennial herbs. Stem erect up to 35 cm, branched or unbranched, sticky. Leaves simple and sessile; flowers large, showy, yellow; sepals and petals 4, forming a long tube below. Stamens will large elongated anthers arising from the mouth of the tube. Style long with a stellate 4-lobed stigma. Capsule with many seeds. Locules elongated.

Germination : The seeds germinate in spring, (March-April), but the seedlings develop only if the moist conditions are available.

Fl. & Fr. : July-September.

Dissemination : The seeds are produced in large numbers and are disseminated by wind.

Habitat : A rare weed of some orchards preferring to grow on moist slopes and possessing a gregarious habit. Indicator of acidic soils.

Geographical distribution : Introduced from America into some temperate Asian countries including India.

Specimens examined : *Gammie* s.n. (9-7-1891) Srinagar, 5300 (DD); *Kaul* RRL 19675 (28-8-1970) Boniyar fallow fields and orchards.

Chromosome report : 2n = 14 (DCA, 1955 and confirmed *Kaul* 1970).

Oenothera rosea Soland in Aiton, Hort, Kew. ed. 1, 2 : 3, 1789; H. Hara in Fl. Eastern Himalayas 225, 1966; Polunin 267; Stewart 508. **(Fig. 33)**

Annual herbs. Stem erect or sub-erect up to 40 cm long, branched, or unbranched, hairy; hairs small and simple; slender and weak. Leaves simple, alternate obovate, 1.5-4.5 cm x 0.5-2 cm, petiolate, petiole much smaller than the leaf; glabrous, margins broadly toothed, apex acute to acuminate. Flowers pink, bracteate; bract leafy; pedicellate; pedicel small, hairy. Calyx 4, petaloid, glabrous temporarily fused, caducous. Petals 4, pink to rosy, veins prominent, obovate, free. Stamens 8, size of filaments variable, base broad arising from the rounded mouth of tube; anthers linear, dorsifixed or versatile. Style long, coming out of the tube, stigma club shaped, rosy, separable easily in to 4 branches; ovary inferior 4-locular, linear-oblong. Capsule ellipsoid, distinctly 4-ridged, ridges somewhat winged with four more intermediate ridges, all over hairy, rounded apex tapering towards the base. seeds many.

Germination : The seeds sprout in early spring (February-March) as the snow melts.

Fl. & Fr. : May-July.

Dissemination : The seeds are small and light, easily carried over to long distances by wind; irrigation water also helps in the dissemination.

Habitat : An occasional weed of orchards preferring moist and shady situations Indicator of sandy loams.

Root system : A simple tap root going up to 20 cm deep in well aerated and loose soils.

Geographical distribution : Native of Peru; naturalized in other countries including India.

Remarks : In Kashmir the plants have been seen as weeds and never cultivated though reported to be cultivated in Europe and America (Hooker 1879 & Polunin 1969). Moreover it never exceeds 40 cm in height in Srinager, whereas it is reported to grow up to 1 m in European countries.

Specimens examined : *Kaul* 31 (21-5-1969) Shalimar Bagh; *Kaul* 184 (16-5-1970) Rawalpora orchards.

Chromosome report : 2n=14 (DCA 87 & confirmed *Kaul* 1970).

EPILOBIUM Linnacus

Key to the species

1. Stigma distinctly 4-cleft with spreading lobes **hirsutum**
1. Stigma combined and not with spreading lobes **royleanum**

Epilobium hirsutum L. Sp. Pl. 347, 1753; FBI 2 : 583; Rao in RBSI 18(2) : 31, 1960. **(Fig. 34)**

Annual herbs with a slightly trailing rootstock. Stem erect up to 35 cm, generally unbranched, tetrangular or sometimes even rounded, hairy, hairs white more thick towards the centre, leafy. Leaves simple, sessile, obovate, 3-6.5 cm x 0.5-2 cm, finely serrate, middle leaves opposite with semiamplexicaule bases, lower ones slightly alternate tending to be opposite, softly pubescent on both surfaces. Flowers axillary towards the apices, pinkish to purplish, regular. Sepals 4, lobes oblong, acute, slightly hairy, caducous. Petals slightly longer than sepals, lobes obovate to oblong. Stamens arising from the circular disc of the tube, 4 shorter; anthers linear, dorsifixed or versatile. Stigmas 4, distinct, spreading. Capsule linear up to 7 5 cm stalked; stalk up to 1 cm hairy; dehiscing along the length. Seeds ellipsoid or obovoid, narrowed at the base, brownish crowned with long silky hairs.

Germination : The seeds germinate in spring (March-April) only when considerable amount of moisture is present in soil.

Fl. & Fr. : July-August.

Dissemination : The seeds are mainly disseminated by wind because of presence of tuft of silky hairs on seeds and also by irrigation water as seen by the growth of plants along the canals.

Habitat : An occasional weed of orchards and also vegetable fields. Indicator of compact sandy loams.

Root system : A branched somewhat creeping tap root with branches spread deep in the soil.

Geographical distribution : Europe, Africa, Asia, Himalaya.

Specimens examined : *Kaul* RRL 5600 (31-7-1970) Barzulla orchards; RRL 10758 (25-7-1972) Barzulla vegetable fields.

Chromosome report : 2n=36 (DCA 88).

Epilobium royleanum Hausskn. in Oesterr. Bot. Zeitshr. 29 : 55, 1879; Stewart 507. **(Fig. 35)**

Epilobium roseum Schreb. var. *indicum* in FBI 2 : 584, 1879; Rao in RBSI 18(2) : 31, 1960.

Annual herbs. Stem erect but weak, generally branched, rarely 4-angular, hairy, hairs

small and inconspicuous. Leaves simple,ovate to lanceolate, alternate on the main stem and opposite on small branches, minutely dentate, hairy on midribs and main veins on under surface, sessile or lower ones subsessile. Flowers in long axillary racemes, slightly pinkish. Calyx and corolla similar to preceding species. Stigmas 4, but never spreading, club-shaped. Capsule up to 9 cm long, minutely pubescent, stalk very small. Seeds light brown up to 2.1 mm long with long silky hairs at the apex.

Germination : The seeds germinate in late spring (April-May).

Fl. & Fr. : July-September.

Dissemination : Wind and water.

Habitat : A rare weed of orchards preferring moist situations.

Geographical distribution : Europe, West Asia, Himalaya.

Specimens examined : *Meebold* 292 (Sept. 1905) Gorai, Kashmir (CAL); *Kaul* 69 (2-8-1969) Chattabal orchard.

UMBELLIFERAE

Key to the genera

1. Leaves undivided, narrowly lanceolate — **Bupleurum**
1. Leaves divided :
   2. Leaves not pinnately divided :
      3. Leaves 3-partite, segments 1-2 fid — **Apium**
      3. Leaves 3-5 partite, segments spinous — **Eryngium**
   2. Leaves pinnately divided :
      4. Fruit bristly. bristles curved or straight :
         5. Fruit up to 3 mm x 1.5 mm with 4 spiny ribs alternating with hairy ribs — **Daucus**
         5. Fruit up to 6.5 mm diam. bristles small — **Torilis**
         5. Fruit up to 1.5 cm diam. bristles rough and stout — **Turgenia**
      4. Fruits never bristly
         6. Leaf segments ovate to lanceolate. nodes rooting — **Oenanthe**
         6. Leaf segments much divided, nodes free :
            7. Fruit prolonged into a beak — **Scandix**
            7. Fruit never beaked — **Vicatia**
               8. Fruit cylindrical or ellipsoidal, distinctly ridged :
                  9. Fruit cylindrical and scabrid — **Anthriscus**
                  9. Fruit cylindrical but not scabrid — **Chaerophyllum**
               8. Fruit ellipsoid, outer coat hard and ridged — **Bunium**
                  10. Leaf segments filiform or obtuse :
                     11. Fruit viscid — **Carum**
                     11. Fruit not viscid, with a deep narrow longitudinal groove — **Conium**
                  10. Leaf segments ovate or pinnatifid — **Pimpinella**
                  10. Leaf segments ovate lanceolate — **Sium**

BUPLEURUM Linnaeus

Key to the species

Fruit up to 5 mm diam. ridges obscure, furrows with 3-vittae **lanceolatum**

Fruit up to 2 mm diam distinctly ridged, with 1-6 vittae **marginatum**

Bupleurum lanceolatum Wallich. ex DC. Prodr. 4 : 131, 1830; FBI 2 : 674; Stewart 513.

Perennial erect herbs. Stem branched, glabrous, up to 25 cm or more tall, leafy. Leaves simple, overlapping towards the base, narrowly lanceolate, entire, with 5-7 prominent nerves. Flowers in small and simple umbels, generally yellowish and small; rays 3-6 in an umbel. Calyx O; corolla lobes 5, spreading but small with 5 small stamens having globular anthers. Fruit 3 5 mm. diam, ridges not distinct.

Germination : The seeds germinate in late spring (April-May).

Fl. & Fr. : July-August.

Dissemination : The seeds are disseminated by wind and irrigation water.

Habitat : A rare weed of orchards possessing a gregarious habit. Indicator of dry gravelly slopes.

Root system : A thick tap root going up to 20 cm deep in search of water.

Geographical distribution : North West Himalaya.

Specimens examined : *Mackinson* s.n. (August, 1912) North west Himalaya (CAL); *Kaul* RRL 5543 (16-7-1969) Shopian orchards.

Bupleurum marginatum Wallich ex DC. Prodr. 4 : 132, 1830; Nasir in Fl. West Pakistan 20 : 60. 1972.

Bupleurum falcatum L. var *marginata* (Wallich ex DC.) Clarke in Hook. f., FBI 2 : 676, 1879.

Annual or biennial herbs. Stem erect, herbaceous, up to 50 cm, glabrous, branches slender and fast green. Leaves linear up to 9 cm x 1 cm with 5-7 prominent nerves running parallel, margins entire, apex acuminate glabrous and glaucous. Flowers in small umbels, bracteate; bracts 2-5, linear-lanceolate, acute, bracteoles 4-5 shorter than the umbels; yellow, pedicels short. Fruits obovate up to 5 mm long, ridges with distinct furrow.

Germination : The seeds sprout in spring as the snow melts (February-March).

Fl. & Fr. : June-August.

Dissemination : The seeds are disseminated by wind.

Habitat : A rare weed of fallow lands. Indicator of compact, dry and hard soils.

Root system : The tap root enters deep into the soils in search of water.

Geographical distribution : South Europe, West and Central Asia, Temperate Himalaya, East Asia to Japan.

Specimen examined : *Kaul* 302 (1-5-1972) Harwan, near Rakh.

Chromosome report : 2n=28 (DCA 205).

APIUM Linnaeus.

Apium graveolens L. Sp. Pl. 264. 1753; DC. Prodr. 4 : 101, 1830; FBI 2: 679; Buwalda in Blumea 2 : 179, 1936; Polunin 285; Stewart 510.

Annual or biennial herbs with erect, branched, glabrous and leafy stem. Leaves

3-partite, segments once or twice trifid, coarsely toothed; pedicellate; pedicels becoming shorter towards the apices and apical leaves are sometimes even sessile, glabrous. Flowers white in simple and small umbels. Calyx-teeth insignificant. Petals 5 with small spreading lobes. Fruit ovoid or orbicular, ridges narrow, vittae broad, glabrous.

Germination : The seeds sprout, if enough moisture is available in late autumn (November) or summer (March).

Fl. & Fr. : June-July.

Distribution : The seeds are produced in large numbers and disseminated mostly by irrigation water. The crop seeds get contaminated with seeds of this species.

Habitat : An occasional weed of vegetable fields preferring moist and shady situations. Indicator of well aerated loams.

Root system : A thick tap root with branches spread in surface horizons.

Geographical distribution : West and Central Asia, Europe, North Africa, Caucasus, Afghanistan.

Specimens examined : *Kaul* 187 (22-5-1970) Majid Bagh, fallow fields; *Kaul* 222 (25-6-1970) Majid Bagh, Cabbage fields.

Chromosome report : 2n=22 (DCA 206).

ERYNGIUM Linnaeus

Eryngium billardieri Delaroche Eryng. 25, t. 2, 1808; FBI 2 : 670; Blatter 1 : 141; Rao in BOBSI 2 : 402, 1960; Stewart 517.

Stem up to 40 cm, erect, branching from the base. Basal leaves long stalked, sagments 3-fid or pinnatifid, spinous-toothed. Bracts 5-7, no spines on margin, bracteoles slightly spiny. Fruit up to 3 mm diam.

Germination : The seeds germinate in summer (March-April).

Fl. & Fr. : June-August.

Dissemination : The seeds are disseminted by wind.

Habitat : A common weed of orchards and maize fields, growing in moist as well as dry situations. Indicator of compact gravelly soils.

Root system : A thick unbranched tap root going deeper into the soil.

Geographical distribution : West Asian countries.

Specimens examined : *Meebold* 3387 (June, 1905) Uri, Kashmir (CAL); *Kaul* RRL 5595 (27-7-1970) Barzulla orchards; *Dutt* 7733 (27-8-1962) Lal mundi, Srinagar.

DAUCUS Linnaeus

Daucus carota L. Sp. Pl. 242, 1753; Polunin 292; Stewart 516.

Biennial herbs. Stem erect up to 1 m, generally branched, hairy; hairs white. Leaves 3-pinnate; segments pinnately lobed, hairy, ultimate segments ovate to lanceolate, up to 5 mm long; petiole up to 15 cm long in lower leaves, hairy. Flowers white in compound umbels. Bracts 7-15, conspicuous deeply divided into narrow linear lobes with membranous margins; bracteoles several smaller and linear, pointed. Primary rays 18-35, up to 4 cm long, hairy, secondary rays 8-15, up to 1 cm long. Fruit oblong-ovoid, up to 3 mm × 1.5 mm with 4 spiny ribs alternating with hairy ribs.

Germination : Spring (March).

Fl. & Fr. : July-October.

Dissemination : The seeds get disseminated by wind, water and animals.

Habitat : An occasional weed of orchards and vegetable fields preferring moist situations. Sandy or silty clay loams.

Root system : A tap root goes up to 20 cm deep in soil, branches less developed.

Geographical distribution : A cosmopolitan weed.

Specimens examined : *Kaul* RRL 5549 (18-7-1969) Hazratbal orchards Srinagar; *Kaul* 345 (15-9-1972) Mansbal Cabbage fields.

Local name : "Wild Gajar".

Illustration : Polunin pl. 87.

TORILIS Adanson

Key to the species

1. Stem rough scabrid. Fruit densely bristly. **leptophylla**
1. Stem glabrous or adpressedly hairy. Fruit hispid. **japonica**

Torilis leptophylla (L.) Reichb. f. in Icones Fl. Germ. 21, t. 2010, 1866; Stewart 527.

Caucalis leptophylla L. Sp. Pl. 347, 1753; FBI 2 : 719.

Stem erect, up to 40 cm, rough, scabrid or hispid, branched. Leaves 2-3 pinnate, finely cut, hispid, margins densely hispid. Peduncles carrying the umbels very short, or even absent. Flowers white, sessile or subsessile with 2-3 bracteoles. Fruit up to 5 mm x 3 mm, densely hispid, bristles straight or curved.

Germination : The seeds sprout in late autumn or early spring.

Fl. & Fr. : May-June.

Dissemination : The seeds are generally disseminated by animals including man because of its densely hispid fruits.

Habitat : A rare weed of cultivated orchards and medicinal plants. Indicator of well aerated loams.

Root system : A meagrely developed branched tap root.

Geographical distribution : West Asia, South Europe and North Africa.

Specimen examined : *Kaul* 188 (22-5-1970) Mansbal Pyrethrum plantation.

Chromosome report : 2n = 12 (DCA 207).

Torilis japonica (Houtt.) DC. Prodr. 4 : 219, 1830; Raizada in Indian Forester 92(5) : 299, 1968; Kanai in Hara Fl. Eastern Himalaya, 231, 1966; Stewart 527.

Caucalis japonica Houtt. Nat. Hist. 26 : 42, 1777.

Caucalis anthriscus sensu Clarke in Hook. f., FBI 2 : 718, 1879.

Flowers purplish when young, bracts absent, bracteoles 3-4 narrow, filiform; umbels compound. Fruit up to 5 mm diam., bristly, green or sometimes purplish or deep red.

Germination : The seeds germinate in spring (March-April).

Fl. & Fr. : May-August.

Dissemination : The seeds are disseminated by wind and by animals including man.

Habitat : An occasional weed of orchards and maize fields at higher altitudes. Indicator of dry, gravelly and loose soils.

Root system : A deep tap root with branches spread in all directions.

Geographical distribution : Himalaya, Burma, South east Asia, Japan.

Specimens examined : *Kaul* RRL 5544 (16-7-1969) Barzulla orchards; *Kaul* 231 (18-7-1970) Barzulla; *Kaul* RRL 19707 (16-9-1971) Majid Bagh Srinagar.

Chromosome report : 2n=16 (DCA 207).

TURGENIA Hoffmann

Turgenia latifolia (L) Hoffm. Gen. Umbell. 59, 1814; Kitamura 291; Stewart 528.

Caucalis latifolia L., Syst. Nat. ed. 12, 1205, 1768; 2 : 719.

Annual herbs with stem up to 15 cm tall, slender, branched or unbranched, generally with red spots, slightly hairy. Leaves pinnate with oblong pinnae, hairy on under surface Bracts absent, bracteoles linear. Rays 2-4 in each umbel. Carpels with two lateral ridges in the form of commissures. Fruit oblong to ovoid, bristly, bristles stout and scattered.

Germination : The seeds are large and germinate in early spring (Feb.-March), if enough moisture is present in fields.

Fl. & Fr. : May-July.

Dissemination : The seeds are covered all over with hooked bristles which stick to birds and animals and thereby disseminated.

Habitat : An occasional weed of wheat fields and orchards. Indicator of well aerated sandy loams.

Root system : A meagrely developed tap root with slender branches.

Geographical distribution : Europe, North Africa, Caucasus, Central Asia, Turkey, Iran and Afghanistan.

Specimens examined : *Mcebold* 3376 (June, 1905) Baramulla (CAL); *Kaul* 189 (22-5-1970) Mansbal wheat fields.

Chromosome report : 2n=32 (DCA 207 and confirmed).

OENANTHE Linnaeus

Oenanthe javanica (Blume) DC. Prodr. 4 : 133, 1830; Maheshwari in Fl. Delhi, 178, t. 95, 1963; Stewart 521.

Sium javanicum Blume Bijdr. Fl. Ned. Ind. 15 : 881, 1826.

O. stolonifera Wallich ex DC. Prodr. 4 : 138, 1830; FBI 2 : 696; Collett 212.

Annual herbs with stoloniferous rootstock, up to 50 cm long branches arising from the nodes and growing erect. Leaves pinnate compound, glabrous. Flowers in compound umbels, rays 6-10. Bracts absent, bracteoles 3-5. Fruit compressed, ridged with all the ridges equal in size.

Germination : The seeds germinate in spring (March-April) only if water is available in good quantity.

Fl. & Fr. : July-September.

Dissemination : The seeds are shed in water and get disseminated by currents.

Habitat : A rare weed of shallow waters or floating fields in lakes, with a gregarious habit. Indicator of damp compact soils full of organic matter.

Root system : Clumps of long adventitious roots arise from the nodes of a stoloniferous rootstock which help the binding of plants in the substrate.

Geographical distribution : Java, China, Japan.

Specimen examined : *Kaul* 75 (10-8-1969) Chishma Shahi floating islands.

Chromosome report : 2n=22 (Bhat, Bakshi & Kaul, 1971).

SCANDIX Linnaeus

Scandix pecten-veneris L. Sp. Pl. 256, 1753; FBI 2 : 692; Polunin 279; Rao in BOBSI 2 : 403, 1960; Stewart 526.

Annual herbs with stem 15-30 cm long, glabrous. Leaves pinnately decompound, segments small and narrow. Flowers small, pedicel up to 1.5 cm, slender and glabrous; calyx teeth minute, petals emarginate. Fruit with a long beak, tapering into a point.

Germination : The seeds germinate in late autumn or early spring with the melting snow.

Fl. & Fr. : Early May-July.

Dissemination : The seeds are disseminated by agricultural operations and by irrigation water.

Habitat : A common weed of wheat and pea fields and also some orchards. Indicator of fertile well aerated loams.

Root system : A meagrely developed tap root in the surface horizon of soil.

Geographical distribution : Afghanistan to Western Europe, Iran, Central Asia.

Specimens examined : *Kaul* RRL 5945 (2-4-1969) Rajora orchards; *Kaul* 131 (28-3-1970) Rawalpora orchards.

Remarks : Its abundance is considered deleterious to crop. The young plants are used as salad.

Chromosome report : 2n = 16 (DCA 208).

VICATIA A.P. de Candolle

Vicatia coniifolia DC. Prodr. 4 : 243, FBI 2 : 671; Collett 207; Rao in RBSI 18 (2) : 32, 1960; Hara in Fl. Eastern Himal. 232, 1966; Stewart 528.

Annual herbs Stem 15-35 cm long, glabrous. Leaves compound, ultimate segments small. Bracteoles linear. Flowers reddish when young. Fruit up to 0.8 cm long, tapering towards base and apex, somewhat broader in the middle, ridges distinct, not winged.

The weeds though common in forests are very rare in Srinagar fields. I have seen the plants growing in one place only though it has been reported from University Campus, Srinagar by Kaul & Zutshi (1963).

Fl. & Fr. : June-July.

Specimens examined : *Kaul* RRL 19728 (30-9-1971) Badgam fallow fields; *Kaul* 321 (15-7-1972) Rawalpora, Srinagar : orchards of apple.

Chromosome report : n = 11 (Bhat, Bakshi and Kaul; 1974).

ANTHRISCUS Persoon

Anthriscus nemorosa (M. Bieb.) Spreng. Pl. Umb. Prodr. 27. 1813; FBI 2 : 692; Collett 212; Stewart 510.

Chaerophyllum nemorosum M. Bieb. Fl. Taur. Cauc. 1 : 232, 1808.

Leaflets linear pinnatifid, slightly pubescent on undersurface more on mid-vein & lateral veins. Bracts none, bracteoles several. Fruit up to 1.7 cm long, cylindrical, narrowed towards the apex, scabrid, ridges obscure.

These plants are also of rare occurrence in Srinagar fields, though found in fields at

higher altitudes. In Babarishi, Gulmarg, the plants were seen in potato fields. In Srinagar the plants were seen growing near Harwan reservoir and no other place.

Fl. & Fr. : June-August.

Geographical distribution : North Asia to Europe; Himalaya : Kashmir.

Specimens examined : *Clarke, C. B.* 28765 (6-7-1876) Kashmir (CAL); *Kaul* 61a (15-7-1969) Harwan.

CHAEROPHYLLUM Linnaeus

Chaerophyllum villosum Wallich ex DC. Prodr. 4: 225, 1830; FBI 2: 690; Collett 211; Rao in RBSI 18 (2) :32, 1960; Stewart 515.

Bracts absent, bracteoles 3-6, linear with membranous margins; flowers white in compound umbels. Fruit up to 2.7 cm long, somewhat broader in the middle, narrowed at both ends,

Germination : The seeds germinate in spring (March-April).

Fl. & Fr. : May-July.

Dissemination : The seeds are disseminated by wind,

Habitat : A rare weed growing in fallow lands and on the borders of maize fields. Indicator of compact soils and slopes

Root system : The main tap root is thick and branches are more in the superficial layers of the soil.

Geographical distribution : Temperate Himalaya.

Specimens examined : *Meebold* 3393 (August, 1905) Shah Pila, Kashmir (CAL); *Kaul* 66(29-7-1969) Chishmashahi, orchards.

Chromosome report : n=11 (Bhat, Bakshi & kaul, 1974).

BUNIUM Linnaeus

Bunium persicum (Boiss.) B. Fedtsch. in Rastit. Turkert. 612, 1915; Kitamura 283; Stewart 511.

Carum persicum Boiss. in Ann. Sci. Nat. Ser. 3 138, 1844.

Carum bulbocastanum auct non Koch. (1825); FBI 2: 681; Rao in BOBSI 2: 402, 1960.

Annual herbs. Stem about 50 cm, long, simple, branched or unbranched, glabrous. Leaves deeply divided into linear filiform segments. Bracts linear, segments divided; bracteoles absent. Flowers small, in small but compound umbels, with small pedicels. Fruit viscid, distinctly ridged, vitta one.

Germination : The seeds germinate readily as these fall on the soil but the seedlings do not grow further unless the favourable season continues.

Fl. & Fr. : June-September.

Dissemination : The seeds are disseminated by wind and rain water.

Habitat : An occasional weed in maize fields of higher altitudes and also grows in wheat fields. Indicatar of dry compact and gravelly soils.

Root system : An unbranched tap root going deep into the soil.

Geographical distribution : Temperate Himalaya, Afghanistan.

Specimens examined : *Kaul* 48 a (11-6-1969) Mansbal fields Pyrethrum plantation; *Kaul* RRL 19736 (30-9-1971) Barzulla orchards.

Chromosome report : 2n=22 (DCA 205).

CARUM Linnaeus

Carum carvi L. Sp. Pl. 263, 1753; FBI 2 : 680; Rao in RBSI 18(2) : 32, 1960.

Stem procumbent or erect. Leaves much divided, ultimate segments lanceolate, glabrous. Bracts 1-3, bracteoles O. Fruit up to 2.5 mm diam, elliptic, oblong, almost viscid, oily with smelling oil glands.

Field notes : Very rare in Srinagar fields. Probably migrated from higher altitudes like Gulmarg.

Fl. & Fr. : May-July.

Specimens examined : *Duthie* 11558 (27-6-1892) Sind! valley, Kash. (CAL); *Kaul* 231 a (18-7-1970) Chishmashahi.

Geographical distribution : West and north Asia, Europe.

Chromosome report : 2n=20 (DCA 205).

CONIUM Linnaeus

Conium maculatum L. Sp. Pl. 243, 1753; Rao in BOBSI 2 (3 & 4) : 403, 1960; Stewart 516.

A smooth, purple spotted, hollow-stemmed, biennial, 1-2 m tall plants. Leaves large, glabrous, 2-3 pinnate with segments blunt. Flowers white appearing in large showy umbels. Fruit prominently ridged and has on its inner face a narrow, longitudinal groove.

Germination : The seeds germinate in spring (March-April).

Fl. & Fr. : June-August.

Dissemination : The seeds are disseminated by wind and rain water.

Habitat : A common weed of fallow lands and orchards as well as vegetable fields. Indicator of compact alluvial soils.

Root system : A thick rootstock perennates the unfavourable season; branches arising from the rootstock bind the soil.

Geographical distribution : Europe, Afghanistan.

Specimens examined : *Gammie* s.n. (13-7-1891) Srinagar. (DD); *Kaul* RRL 5577 a (12-7-1970) Srinagar fallow fields; *Kaul* RRL 19704 (16-9-1971) Hyderpora, fallow fields.

Chromosome report : 2n=22 (DCA 210).

Illustration : Polunin pl. 55.

PIMPINELLA Linnaeus

Pimpinella diversifolia Wallich ex DC. Prodr. 4 : 122, 1830; FBI 2 : 688; Collett 210, Stewart 522.

Biennial herbs with erect, slender and glabrous stem. Leaves 1-pinnate, generally 3-foliate, sessile, or lower ones petiolate. Leaflets oblong to obovate, sessile, glabrous, margins dentate, apex acuminate. Flowers white in simple or compound umbels, bracts none; bracteoles 3-5, linear. Fruit narrow, hispidulous, ridges not prominent.

Field notes : The plants prefer moist and shady situations and are found very rarely in Srinagar fields.

Specimens examined : *Kapoor* 1068 (29-6-1947) Shankeracharya, Srinagar; *Kaul* 212A (12-6-1970) Harwan.

Fl. & Fr. : June-July.

Geographical distribution : China, Afghanistan, Pakistan, India : Himalaya, Japan.

Chromosome report : n=9 (Bhat, Bakshi & Kaul 1974).

SIUM Linnaeus

Sium latijugum Clarke in Hook. f. FBI 2 : 683, 1879; Rao in BOBSI 2 : 403, 1960.

Annual herbs. Stem erect up to 75 cm long, glabrous, fistular. Leaves pinnate com-

pound, leaflets obovate in earlier stages but lanceolate in mature plants, apical leaflets stalked. Flowers in long umbels, white, rays 10-17. Bracts linear 2-3 or sometimes absent. Fruit triangular, corky, furrows 2-3 vittae.

Germination : The seeds sprout in spring (March-April).

Fl. & Fr. : June-August.

Dissemination : The seeds are produced in large numbers and water is the main disseminating source.

Habitat : A common weed of paddy fields, growing by the sides of canals and in damp shallow waters. Indicator of fertile muddy soils.

Root system : Bunches of adventitious roots arise from the nodes of thick stoloniferous rootstock which bind the plants in muddy substratum.

Geographic distribution : Kashmir to Baltistan.

Specimens examined : *Gammie* s.n. (10-7-1991) Srinagar, 5300 ft. (DD); *Kaul* RRL 19668 (27-10-1969) Chishma Shahi paddy fields.

Chromosome report : n=6 (Bhat, Bakshi & Kaul 1974).

RUBIACEAE

Key to the genera

1. Leaves whorled, cordate-ovate, long pointed; corolla 5-lobed; fruit succulent — **Rubia**
1. Leaves whorled, obovate-linear lanceolate; corolla 4-lobed; fruit dry — **Galium**

RUBIA Linnaeus

Rubia cordifolia L. var. **cordifolia** f. **strigosa** Deb & Malick in J. Bombay Nat. Hist. Soc. 63 : 782, 1066 et BOBSI 10 : 9, 1968.

Perennial climbing herbs. Stem slender, up to 2.5 m long, winding itself around shrubs, tetrangular, scabrid more along the angles, branched. Leaves 7, less frequently 5, rarely 9 and very rarely 3 at a node, petiolate; petiole up to 6.5 cm long retrorsely scabrid; cordate to obovate with acute apex, up to 4.5 cm x 1.8 cm, strigose on both surfaces, more along the veins on the lower surface. Flowers minute, generally 5-merous, rarely 4-merous, in axillary branched panicled cymes, bracteate; bracts small but leafy. Calyx lobes very small and insignificant. Corolla 5-lobed, white or creamy, lanceolate, tips incurved. Stamens with very small anthers. Fruit globose, seed 4-5, with a membranous testa, adhering, hard at maturity

There is a controversy as to whether the Indian plant is *R. cordifolia* L. or *R. munjista* Roxb. Recently Deb & Malick (1968) in their revision of the genus have merged the two. According to them the pentamerous & tetramerous flowers occur on the same plants. The plants observed by me had pentamerous flowers.

Germination : The seeds are hard and germinate in summer (March-April).

Fl. & Fr. : June-August.

Dissemination : The seeds are disseminated by wind and rain water.

Habitat : An occasional weed creeping around the shrubs and some tall herbs. Indicator of sandy loams.

Root system : A thick tap root with long branches perennating the unfavourable season.

Geographical distribution : Tropical Africa, Afghanistan, India, : Himalaya, East and South east Asia.

Specimen examined : *Kaul* RRL 19790 (21-8-1972) Harwan orchards.

Chromosome report : 2n = 22 (DCA 238).

GALIUM Linnaeus

Key to the species

1. Fruit covered with hooked bristles :
   2. Stem almost smooth, leaves scabrid on margins — **asperuloides**
   2. Stem scabrid, with reflexed hairs or prickles, leaves scabrid — **aparine**
1. Fruit without hooked hairs, scabrid, tubercled, glandular or smooth :
   3. Fruit scrabrous, granulate :
      4. Leaves 6-8, linear to oblanceolate — **tricorne**
      4. Leaves 6-8, small filiform — **setaceum**
   3. Fruit glabrous, granulate or smooth :
      5. Leaves subsessile 4-6, oblong to obovate, fruit glabrous and smooth — **spurium**
      5. Leaves linear, deflexed, 6-8, fruit glabrous and granular — **verum**

Galium asperuloides Edgew. in Trans. Linn. Society 20 : 61, 1846; Kitamura in Fauna & Flora of Nepal Himalayas 230, 1955; Stewart 685.

Galium triflorum sensu Hook. f. FBI 3 : 205, 1881.

Annual herbs. Stem erect or decumbent, branched or unbranched, slender and weak, angled, nearly glabrous or minutely scabrid. Leaves 6-8, whorled, oblong to lanceolate, sessile, up to 3.5 x 0.6 cm, prickly on the margins and midrib, obtuse. Flowers in axillary and branched cymes, minute, white. Calyx lobes insignificant; corolla 4-lobed, lobes acute. Stamens with protruding anthers. Fruit globular, covered with white hooked bristles. Seeds small, one in each cell.

Germination : The seeds readily germinate in summer (March-April).

Fl. & Fr. : June-August.

Dissemination : The seeds are disseminated by wind and birds which carry the seeds on the feathers,

Hobitat : An occasional weed of orchards preferring to grow under the shade of trees. Indicator of fertile well aerated loams.

Root system : A meagrely developed tap root with slender branches in the surface horizons of the soil.

Geographical distribution : Afghanistan, Malaya, China.

Specimen examined : *Kaul* RRL 19792 (25-8-1972) Chishma shahi orchards.

Galium aparine L. Sp. Pl. 108, 1753; FBI 3: 205; Collett 235; Stewart 684.

A tall annual herb up to 50 cm or more in height, branched, slender and weak, angled, scabrid and prickly along the ridges

or angles. Leaves 6-8, whorled, obovate to linear, up to 4 cm or 5 cm, scabrid on margins and both surfaces, nerves obsolete. Peduncles axillary, generally in 3-flowered cymes. Flowers minute, white, pedicellate. Fruit clothed with spreading hooked bristles

Germination : The seeds sprout in summer (March-April).

Fl. & Fr. : July-August.

Dissemination : The seeds are disseminated by wind and rain water.

Habitat : An occasional weed of orchards and parks of public interest. Indicator of well aerated moist loams.

Root system : A superficial meagrely developed tap root system.

Geographical distribution : Europe, North Africa, Turkey Iran, Afghanistan, Siberia Pakistan.

Specimens examined : *Kapoor* 1005 (21-7-1970) Harwen parks; *Kaul* RRL 5992 (26-5-1970) RRL campus, Srinagar.

Chromosome report : 2n=22. 44 (DCA 236).

Galium tricorne With. Bot. Arr. Brit. Pl. ed. 2, 1: 153; 1787, FBI 3: 206; Aitch. in J. L. Soc. 19:167 1882; Probed in Fl. URSS 23 : 304, 1958; Stewart 686.

An annual erect or decumbent herb. Stem up to 40 cm tall or spreading, branched from the base, tetrangular, rotrorsely scabrid, more along the margins. Leaves oblanceolate, cuspidate, or linear, sessile, up to 4.5 cm x 7 cm obtuse to subacute, 6-8 at a node. Peduncles stout, axillary, 1-3 flowered. Flowers minute, white, with smal lpedicels, scabrous, granulate, black when mature with a seed in each cell. Seed rounded, pale yellow, up to 0.5 cm diam.

Germination : The seeds germinate in late autumn (November) and remain under snow, sprouting only in early summer (Feb.-March).

Fl. & Fr. : May-June.

Dissemination : The seeds are disseminated by wind and rain water.

Habitat : A common weed of wheat fields and orchards forming small patches and preferring to grow near moist situations. Indicator of fertile, well aerated loams.

Root system : Meagrely developed adventitious roots penetrating the superficial layers of the soils.

Geographical distribution : Europe, N. Africa, Turkey, Caucasus, Iran, Central Asia, Afghanistan, Western Himalaya.

Specimen examined : *Kaul* 36 (24-5-1969) Rawalpora orchards; *Kaul* 149 (9-4-1970) Barzulla orchards; *Kaul* RRL 16051 (11 6-1971) RRL campus Srinagar.

Chromosome report : 2n=44 (DCA 236 & confirmed).

Galium setaceum Lamk. Encycl. 2 : 584, 1786; FBI 3 : 208; Stewart 686.

Annual, stems small, erect or decumbent, up to 15 cm, terete, branched from the base, slender, weak, angular, scabrid. Leaves 6-8 in a whorl, filiform, acute, setaceous; lower leaves somewhat broader than the upper ones. Flowers minute, in terminal axillary few flowered cymes, pedicellate; pedicels very thin and slender, scabrid. Fruit very small, rounded, granulate or with a few short hooked hairs.

Germination : The seeds germinate readily in summer (March-April).

Fl. & Fr. : August-October.

Dissemination : The seeds are disseminated mostly by irrigation water or to some extent by animals.

Hahitat : An occasional weed growing in orchards and fallow lands preferring moisture but tolerating dry situations as well. Indicator of sandy loams.

Root system : Slender adventitious roots go into superficial layers of soil.

Geographical distribution : Baluchistan, Afghanistan, Turkey and Greece; Western Himalaya.

Specimen examined : *Kaul* RRL 19735 (30-9-1971) Barazulla orchards.

Chromosome report : 2n=22, 44 (DCA 236).

Galium spurium L. Sp Pl. 106, 1753; FBI 3 : 208; Stewart 686.

Annual herbs Stem up to 35 cm long decumbent, rambling, flaccid, glabrous or margins somewhat scaberulous. Leaves generally 4 in a whorl, subsessile, elliptic to lanceolate or oblong, nerves obsolete, scabrid on the margins. Flowers in long branched divaricate cymes, white, pedicellate; pedicel thin and slender, scabrid. Corolla segments ovate to acuminate. Fruit globular, didymous, sometimes one cell only developing, glabrous and smooth. Seeds solitary in each cell, rounded.

Germination : The seeds germinate in early spring or sometimes in late autumn (November), when enough water is available.

Fl. & Fr. : July-August.

Dissemination : The seeds are disseminated by irrigation water.

Habitat : An occasional weed of paddy fields and floating islands possessing a gregarious habit. Indicator of fertile muddy soils.

Root system : Adventitious roots arise from the nodes and bind the plants in soil.

Geographicol distribution : Europe, South West Asia, Temperate Himalaya : Kashmir.

Specimens examined : *Kaul* 193 (22-5-1970) Hoakersar floating islands; *Kaul* RRL 16076 (29-7-1971) Harwan, Paddy fields; *Kaul* RRL 19793 (25-8-1972) Shalimar Paddy fields.

Chromosome report : 2n=20, 44 (DCA 236)

Galium verum L. Sp. Pl. 107, 1753; FBI 3 : 208; Rao in BOBSi 2, 494, 1960; Stewart 686.

Annuals or even perennials. Stem erect or procumbent up to 65 cm, terete, angular, smooth or somewhat pubescent towords the apices of the branches, leafy. Leaves 8-10 in a whorl, linear, cuspidate, glabrous or margins scaberulous, up to 7 cm long, sessile, usually deflexed. Flowers in long, axillary, branched cymes, minute, yellow, pedicel very short and slender. Fruit small, glabrous but granular. Seeds solitary, small.

Germination : The seeds germinate in early spring (February-March).

Fl. & Fr. : June-July.

Dissemination : The seeds are disseminated by wind and rain water.

Habitat : A rare weed of some orchards especially on moist slopes. Indicator of sandy to gravelly soils.

Root system : A thick tough rootstock with many branches penetrating deep into the soil.

Geographical distribution : Eurasia, North Africa, Afghanistan, North and West Asia.

Specimens examined : *Sarin* 6611 (28-6-1960) Yarikha fields.

Chromosome report : 2n=22, 46 (DCA 236).

VALERIANACEAE

VALERIANELLA Moench

Key to the species

1. Fruit up to 4 mm long, hairy on one side, hair short and microscopic, glistening **szovitziana**
1. Fruit up to 2 mm long, rarely hairy or pubescent **dentata**

Valerianella szovitziana Fisher et Mey. Ind. Sem. Horti. Petrop. 3 : 48, 1837; FBI 3 : 214; Linez in Fl. URSS 23 : 660, Tab. 33-11, 1958; Kitamura 374; Stewart 700. **(Fig. 36)**

Small annual dichotomously branched herbs; stem longitudinally ribbed, glabrous. Leaves oblong linear, up to 4.5 cm x 6 cm opposite, sessile, entire or sparingly irregularly toothed, glabrous. Flowers pinkish white in small corymbose cymes, bracts linear. Calyx inconspicuous when young, but at maturity reticulately veined with one long horizontal linear tooth. Corolla with 5-small spreading lobes. Stamens with white globular anthers. Fruit up to 4 mm, hairy especially on one side, hairs microscopic.

Germination : The seeds sprout in early summer (February).

Fl. &. Fr. : Mid April-Mid June.

Dissemination : The seeds are disseminated mostly by wind.

Habitat : An occasional weed of orchards and wheat fields possessing a gregarious habit. Indicator of moist loams.

Root system : A tap root sending branches in the surface horizons of soil.

Geographical distribution : Turkey, Arabia, Caucasus, Iran, Afghanistan, Central Asia, Kashmir.

Specimens examined : *Kaul* 24 (21-4-1969) Badgam orchards; *Kaul* 171 (8-5-1970) Rawalpora fallow fields; *Kaul* RRL 16031 (31-5-1971) RRL campus fields.

Chromosome report : 2n = 32 (DCA 243).

Valerianella dentata (L.) Poll. Hist. Pl. Palat. 1 : 30, 1776; FBI 3 : 214; Stewart 699.

Valeriana locusta-dentat L., Sp .Pl. 33, 1753.

Annual herbs with more slender stem than the preceding species. Leaves oblong, opposite, entire or regularly sparingly toothed, glabrous. Flowers similar. Calyx-limb obliquely truncate and toothed. Corolla with 5-spreading lobes and a short tube. Fruit up to 2 mm diam. ovoid or subconical, with two filiform cells forming a rim round an ovate oblong slight depression.

A rare weed growing in orchards preferring moist situations.

Fl. & Fr. : April-May.

Geographical distribution : Europe.

Specimen examined : *Kaul* 168 (3-5-1970) Habak orchards.

Chromosome report : 2n = 14 (DCA 243).

ASTERACEAE/(COMPOSITAE)

Key to the genera

1. Flower heads simple and radiate i.e. ray florets ligulate and disc florets tubular :
   2. Rootstock swollen and tuber like; flower heads up to 7.5 cm diam. **Helianthus**
   2. Rootstock never tuber-like; flower heads up to 4 cm diam :
      3. Pappus hairy :
         4. Involucral bracts 1-2 seriate, equal, with a few smaller at the base **Senecio**
            5. Ray florets 1-2 seriate **Aster**
            5. Ray florets more than 2-seriate or even absent :
               6. Ray florets very slender tubular or with very short ligules **Conyza**
               6. Ray florets all fertile, ligulate **Erigeron**
         4. Involucral bracts many seriate, unequal. Leaves sessile **Inula**
      3. Pappus of bristles or scales :
            7. Receptacle with broad and narrow scales :
               8. Receptacle with flat narrow scales. Pappus of 2-3 stiff barbed bristles **Bidens**
               8. Receptacle with linear hirsute scales, each scale enclosing several flowers; pappus of 2-5 minute teeth **Eclipta**
            7. Receptacle covered with small 3-toothed scales. Pappus of several fringed scales **Galinsoga**
            7. Receptacle naked or with fimbriate pits :
               9. Heads large, rayed. Achenes 3-5 ribbed **Matricaria**
               9. Heads small, disciform with or without rays. Achenes small minutely ribbed **Cotula**
      3. Pappus absent :
               10. Stem bearing flowers, or scapes, stout and leafy :
                  11. Leaves ovate to lanceolate :
                     12. Involucral bracts long, leafy, glandular **Siegesbeckia**
                     12. Involucral bracts small, never glandular **Myriactis**
                  11. Leaves pinnatisect, segments linear **Achillea**
               10. Stem bearing flowers, or scapes, slender and leafless **Bellis**

1. Flower heads simple and discoid i.e. flowers all tubular :
   13. Pappus of silky hairs, or palaeceous and bristly :
      14. Leaves never spinous or prickly. Invovucral bracts not spiny. Pappus feathery **Saussurea**
      14. Leaves spinous or prickly. Involucral bracts spiny :

15. Stem winged :
    16. Stem wings broad white grey; receptacle like a honey comb — **Onopordum**
    16. Stem wings narrow, interrupted, green. Receptacle somewhat smooth — **Carduus**
15. Stem never winged :
    17. Involucre not bracteate at the base. Achenes compressed or 4-angled; pappus very short, bristly — **Centaurea**
    17. Involucre bracteate at the base by spinous leaves. Achenes smooth with paleceous pappus — **Carthamus**
    18. Involucral bracts with straight, stout or slender hooked bristles :
        19. Pappus feathery — **Cirsium**
        19. Bracts with slender hooked bristles at the apex. Pappns not feathery — **Tricholepis**
    18. Involucral bracts scarious, not bristly :
        20. Clusters of heads enclosed by leaf-like bracts — **Filago**
        20. Clusters of heads not enclosed by bracts — **Gnaphalium**

13. Pappus absent :
    21. Leaves pinnately lobed :
        22. Flower heads very small, shining, numerous in large terminal panicles — **Artemisia**
        22. Flower heads large, long peduncled, narrow but never in panicle — **Chrysanthemum**
    21. Leaves usually lanceolate, never pinnately lobed :
        23. Flower heads bisexual. Achenes long ending in a short glandular beak — **Carpesium**
        23. Flower heads unisexual. Achenes never beaked, enclosed in hardened involucral bracts — **Xanthium**

1. Flower heads simple and ligulate i e. flowers all ligulate :
    24. Pappus heads simple hairs :
        25. Achens beaked :
            26. Leaves radical and cauline. Beak of the achenes as long or longer than achene, dilated at the tip — **Lactuca**
            26. Leaves radical & cauline, generally entire. Beak of the achenes shorter than achene — **Ixeris**
            26. Leaves all radical. Beak of the achenes not dilated at the tip — **Taraxacum**
        25. Achenes not beaked (rarely beaked in *Crepis*) :
            27. Stem leaves none or few and stalked; flower heads up to 2.5 cm long; achenes narrowed at both ends — **Crepis**
            27. Stem leaves a few and sessile; flower heads up to 1 cm long; achenes flattened — **Youngia**
            27. Stem leaves numerous and stem clasping — **Sonchus**
        25. Achenes truncate or elongate :
            28. Flower heads large, sessile; achenes truncate — **Cichorium**
            28. Flower heads small, stalk up to 2 cm long; achenes elongate — **Garhadiolus**
            28. Flower heads small, stalk up to 5 cm long: achenes curved inwards to form a birds claw — **Koelpinia**
    24. Pappus of feathery hairs — **Tragopogon**

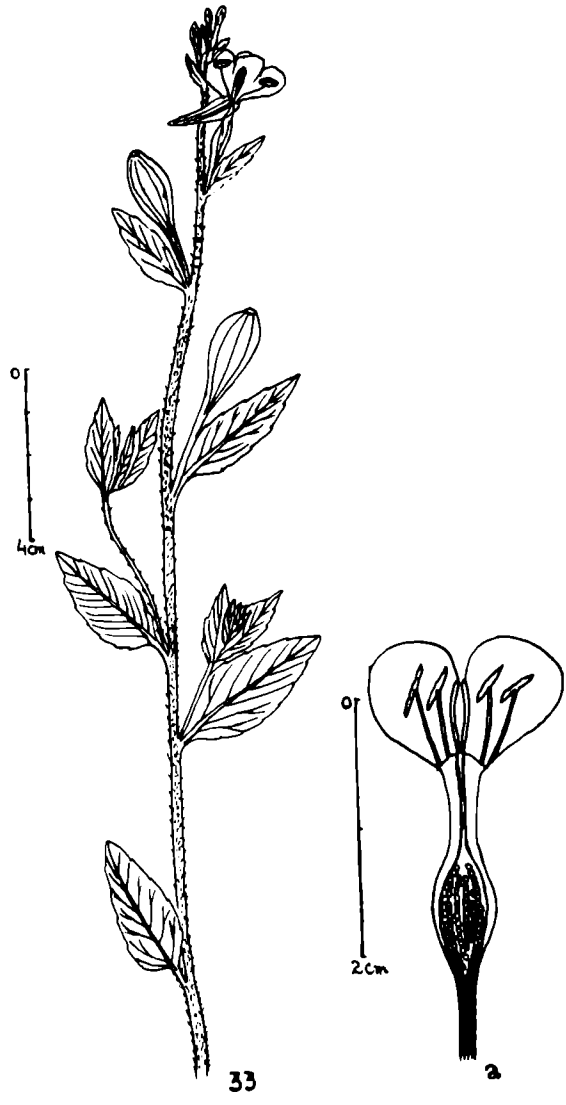


Fig. 33. *Oenothera rosea* Soland. (a flowering shoot)
a. v. s. flower

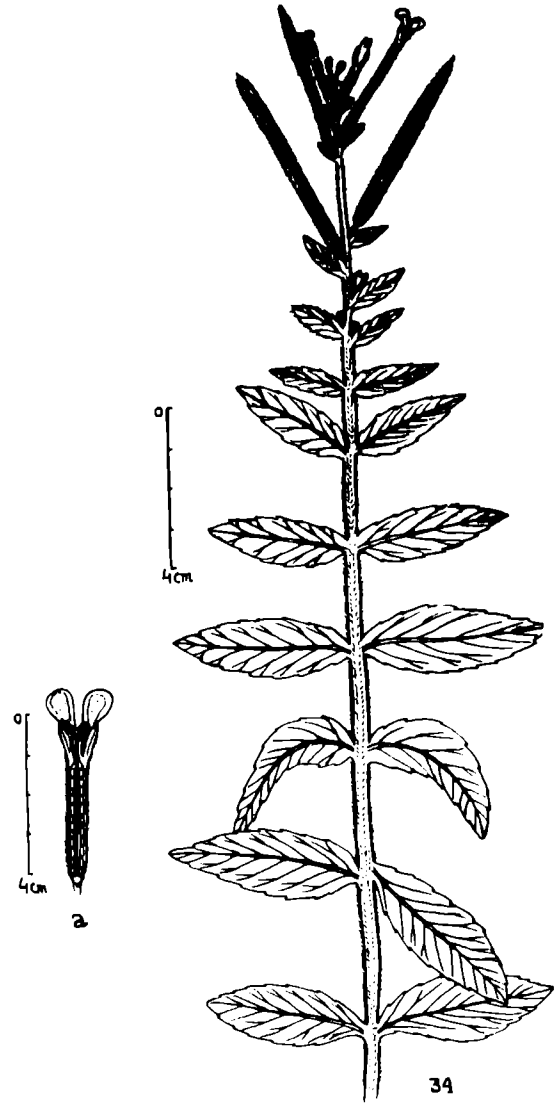


Fig. 34. *Epilobium hirsutum* Linn. (a flowering shoot)
a. v.s. flower

Fig. 35. *Epilobium royleanum* Hausskn. (a flowering shoot)
a. v.s. flower, b. a seed

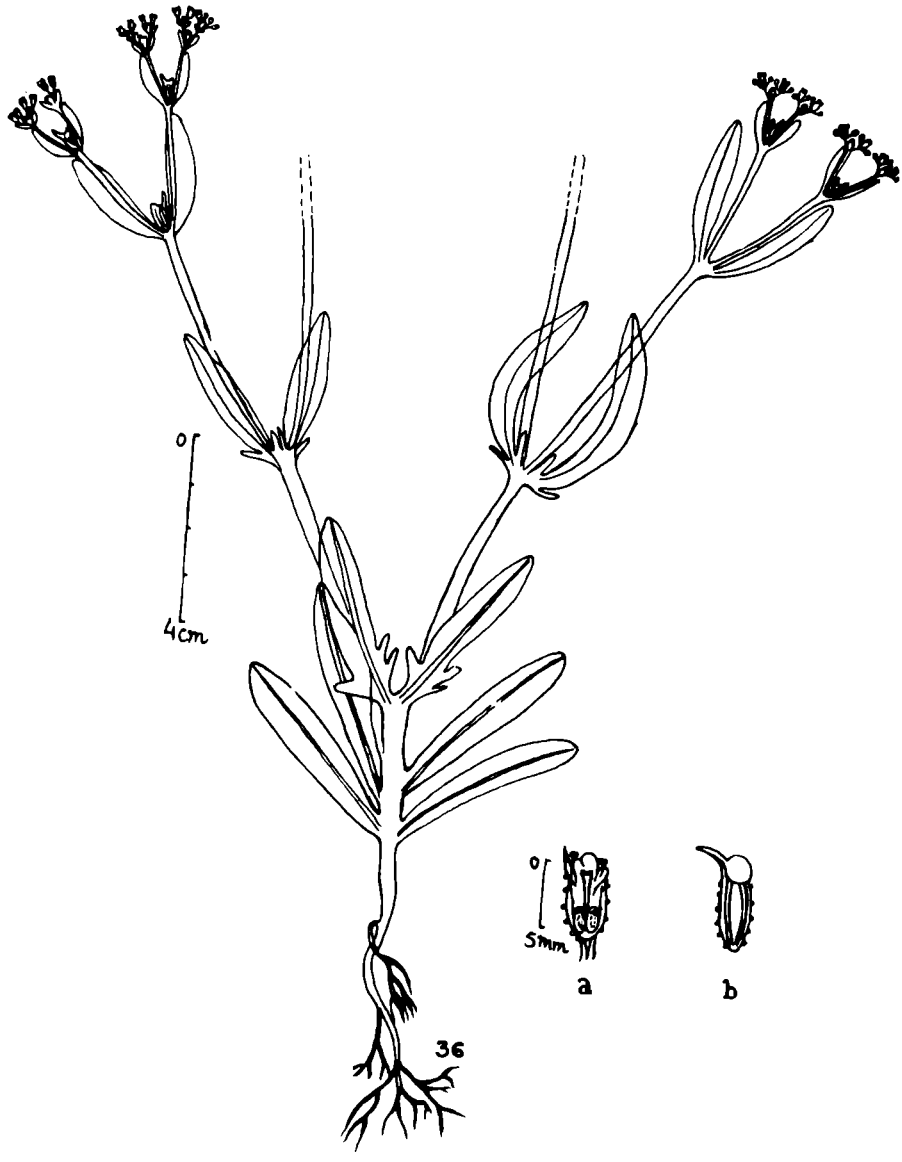


Fig. 36. *Valerianella szovitziana* Fisch. et Mey. (a flowering plant, in part)
a. v.s. flower, b. a fruit

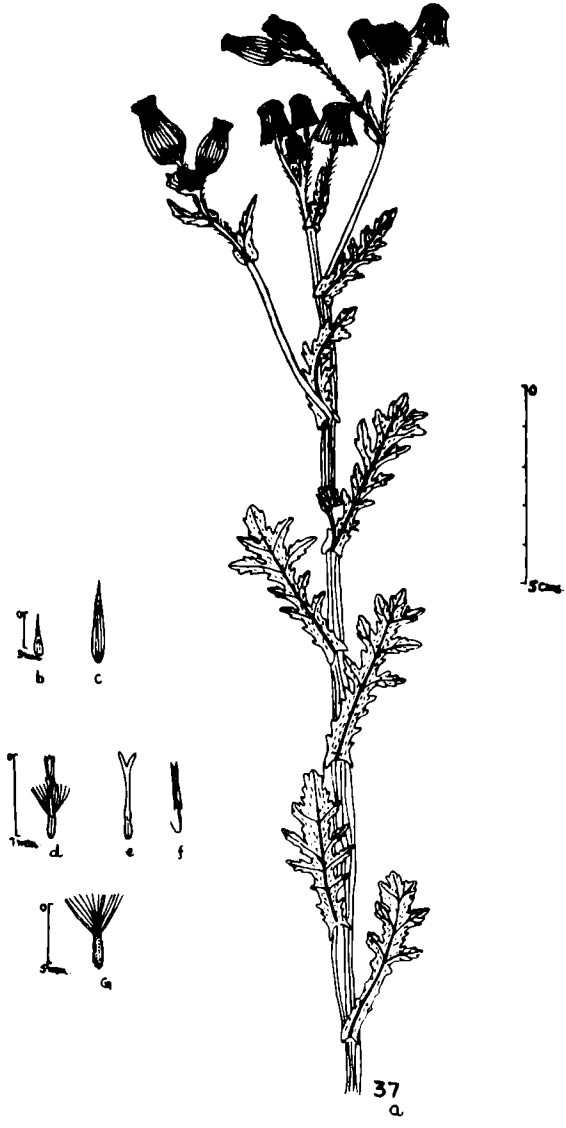


Fig. 37. *Senecio vulgaris* Linn.
a. a flowering shoot, b. outer involucral bract, c. inner involucral bract, d. a floret, e. ovary with style, f. a stamen, g. an achene

Fig. 38. *Aster pilosus* Willd. var. *demotus* Blake
a. an involucral bract, b. a disc floret, c. a ray floret, d. an achene

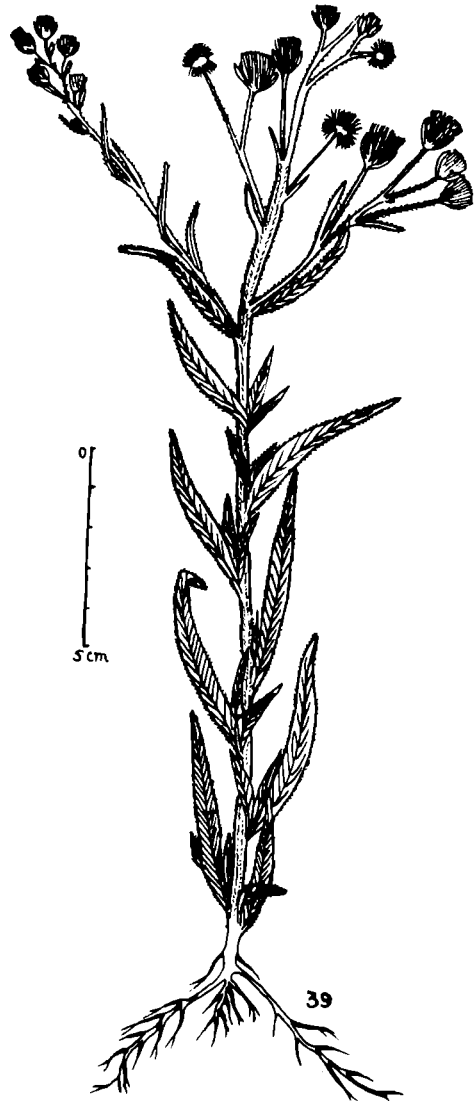


Fig. 39. *Conyza bonariensis* (L.) Cronquist (a flowering plant)

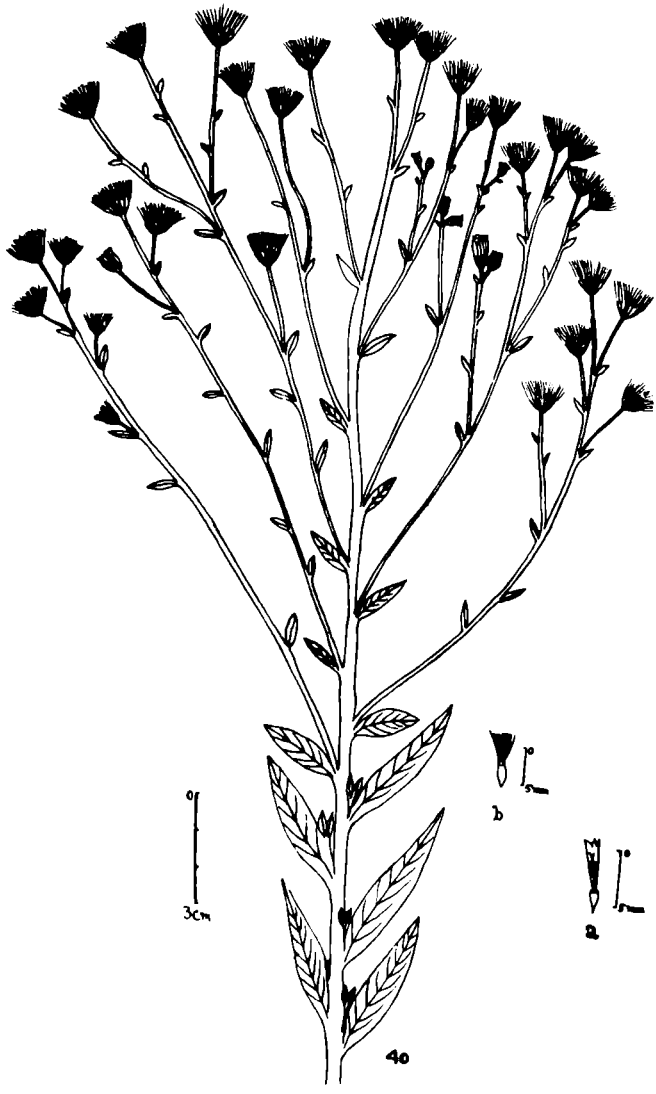


Fig. 40. *Erigeron annuus* Pers. (a flowering plant)
a. a floret, b. an achene

HELIANTHUS Linnaeus

Helianthus tuberosus L. Sp. Pl. 905, 1753; Polunin 437; Stewart 750.

Perennial herbs. Rootstock swollen, consisting of branched potato-like tubers. Stem up to 1 m long, hairy, woody below branched. Leaves simple, ovate to oblong, lanceolate, long pointed apex, opposite, narrowed to a winged stalk. Flower heads yellow, 5-7.5 cm diam., carried on a long peduncle. Ray florets yellow 1-seriate, female or neuter. Disc florets yellowish or brown, compact, bisexual, fertile. Seed oblong, black to brown.

Germination : Spring (March-April).

Fl. & Fr. : July-October.

Dissemination : The plants spread fast vegetatively through tuber-like rootstock. Seeds are dispersed by wind and animals.

Habitat : A rare weed of orchards and vegetable fields possessing a gregarious habit. Well aerated fertile clay loam indicators.

Root system : The rootstock is tuberous and branched, adventitious roots arise from the nodes.

Geographical distribution : Native of North America and naturalized elsewhere.

Local name : "Farm gogej".

Specimen examined : *Kaul* 264 (19-7-1971) Rawalpora orchards; *Kaul* 352 (8-10-1972) Majid Bagh orchards.

Remarks : The tubers are sweet and edible containing inulin—a source of fructose for diabetic patients.

Chromosome report : 2n = 102 (DCA 255).

SENECIO Linnaeus

Senecio vulgaris L. Sp. Pl. 867, 1753; Lewis in Brit. Wild Fls. 234, t. 110. 1958; Polunin 449. **(Fig. 37)**

Annual or biennial herbs up to 30 cm in height. Stem erect branched sometimes angled sparingly hairy with cottony long hairs towards the apices of the branches. Leaves mostly cauline, alternate, 2 - 4. 5 cm long pinnatifid, irregularly and deeply cut into somewhat oblong lobes; lobes toothed somewhat thick, bases auricled, mostly glabrous or sometimes hairy. Flower heads corymbose, yellow up to 1. 5 cm long, slightly broader at the base and tapering at the apex; peduncles 0.5-4.5 cm long somewhat cottony. Involucral bracts 2-seriate; outer ones 4-10, up to 4 mm long, black tipped; inner ones 15-20, up to 1 cm long, narrowly lanceolate, margins membranous, glabrous, acute, persistent, recurving after dehiscence. Flowers homogamous, ligules O. Disc florets hermaphrodite with 3-5 fid corolla tube, anthers syngenesious and sagittate, inside the corolla tube, style truncate, protruding out of the tube. Achenes up to 5 mm ribbed along the length, slightly hairy on ribs, pappus white longer than the achenes.

Germination : The seeds germinate as and when they fall on a suitable substrate.

Fl. & Fr. : The plants flower all the year round excepting one or two winter months but the profuse flowering occurs in summer (June - August).

Dissemination : The seeds are disseminated mostly by wind and to some axtent by water.

Habitat : A common weed of orchards, crop fields, grasslands and even fallow fields. Indicator of sandy loams.

Root system : A much branched tap root with most of the branches near the apex.

Geographical distribution : Native of Europe, Spreading in all continents.

Specimens examined : *Kaul* 29 (21-5-1969) Barzulla orchards; *Kaul* 161 (30-4-1970) RRL campus Srinagar; 220 *Kaul* (22-6-1970) Badgam orchards.

Chromosome report : 2n = 40 (DCA 263).

S. chrysanthemoides DC. Prodr. 6 : 365, 1838; FBI 3 : 339; Collett 269; Blatter 1 : 176, Rao in BOBSI 2 (3 & 4): 406, 1960; Stewart 781.

An annual herb. Stem erect up to 75 cm, woody at the base, branched, ribbed and finely grooved, glabrous or nearly so towards the base pubescent upwards. Leaves radical and cauline, former soon withering off, lower cauline ones 13.5-21 cm x 5-7.5 cm, pinnately divided into broad and toothed lobes; apical lobe the largest, irregularly toothed; basal stem clasping, upper leaves smaller with numerous lobes. Flower heads golden yellow up to 1.8 cm diam. showy, long-stalked, forming large apical corymbs. Involucral bracts oblong to lanceolate, 10-15 in 2-series, persistent. Flowers heterogamous; ray florets ligulate, 8-12, conspicuous, ligules elongated 3-toothed; disc florets many, tubular, corolla 3-5 fid, anthers linear, tailed surrounding a truncate style. Achene up to 2.5 mm long, slightly hairy or even glabrous, minutely ribbed, pappus white silky.

Germination : The seeds sprout in spring (March).

Fl. & Fr. : June-September.

Dissemination : The seeds are disseminated by wind and irrigation water.

Habitat : An occasional weed of paddy fields, growing towards the margins only. Indicator of moist slopes and compact soils.

Root system : Tap root going deep, branches mostly towards the surface horizons of soil.

Geographical distribution : Temperate and alpine Himalaya : Kashmir to Sikkim, Khasia Hills.

Specimens examined : *Kaul* RRL 19610 (19-7-1969) Magam Paddy fields; *Kaul* 270 (30-7-1971) Harwan Paddy fields; *Kaul* RRL 19731 (30-9-1970) Hyderpora, Paddy fields; *Kaul* RRL 19791 (25-8-1972) Chishma Shahi, orchards.

ASTER Linnaeus

Aster pilosus Willd. var. **demotus** Blake in Rhodora 32 : 139, 1930. **(Fig. 38)**

Annual herbs. Stem suberect to decumbent up to 75 cm long branched, leafy, slightly angled towards the base, downy or greyish tomentose towards the apices. Leaves simple, linear,filiform, up to 3.7 cm long, tips acute; crowded towards the apices, alternate, light green, somewhat downy or tomentose. Flower heads white with purplish tinge, generally solitary on a short leafy branch, panicled. Involucral bracts 2-3 seriate, outer ones a bit smaller up to 5 mm long; inner ones up to 7 mm, obovate to linear, margins membranous, slightly downy, persistent. Flowers heterogamous; ray florets 2-4 seriate, ligule

up to 1 cm long, entire or 2-fid near the apex, female, fertile style half as long as ligule with two small lanceolate arms near the apex; disc florets purplish, many-seriate; corolla tube 4-5 fid, stamens with 5-anthers, obtuse bases, coming out of the tube at maturity, style similar to that of ray florets. Receptacle small, simple and naked. Achenes elongated up to 0.1 cm long, whitish, tapering towards the base, finely hirsute; pappus white almost 4-times the length of achenes.

Germination : The seeds sprout in summer (June).

Fl. & Fr. : September-November.

Dissemination : The seeds are disseminated mostly by wind.

Habitat : A rare weed of orchards. Indicator of dry sandy loams.

Root system : A somewhat creeping tap root with small branches in the surface horizons of the soil.

Geographical distribution : Probably native of America.

Specimen examined : *Kaul* RRL 19727A (29-9-1971) Badgam orchards.

CONYZA Lessing

Key to the species

1. Outer ray florets 1-3 seriate :
   2. Outer ray florets 1-seriate or sometimes O. Flower heads generally on short peduncles **bonariensis**
   2. Outer ray florets 1-3 seriate. Flowers heads generally on long peduncles and numerous **canadensis**
1. Outer ray florets many seriate **aegyptiaca**

Conyza bonariensis (L.) Cronquist in Bull. Torrey Bot. Club 70(6) : 632, 1943; Stewart 734. **(Fig. 39)**

Erigeron bonariensis L. Sp. Pl. 863, 1753; Kitamura 421.

E. linifolius Willd. Sp. Pl. 3 : 1955, 1803; FBI 3 : 254; Singh in BOBSI 2 : 355, 1960.

Annual herbs. Stem up to 50 cm, erect, slightly woody towards the base, fast green branches longitudinally ribbed, pubescent. Leaves oblong lanceolate to linear, up to 8.5 cm x 0.3 cm, entire or serrated here and there, alternate, hirsute on both the surfaces and more on margins. Flower heads up to 5 mm diam on small or long stalks forming sub-corymbose structures. Involucral bracts 2-seriate, linear, filiform, slightly hairy on margins, persistent. Flowers yellowish, up to 8 mm long, heterogamous. Ray floret small, 1-seriate or even absent; inner disc florets bisexual and fertile. Achenes are elongated, up to 3 mm long, slender; pappus silky, many seriate, about double the length of achene. Receptacle flat and naked.

Germination : The seeds readily germinate as they fall on a suitable substrate. Seedlings are common in early summer (May).

Fl. & Fr. : July-December.

Dissemination : The seeds are mainly disseminated by wind.

Habitat : A common weed of orchards, grasslands, vegetable fields, margins of paddy

fields and fallow lands. Indicator of well aerated fertile loams.

Root system : A thick and much branched tap root, the main root goes up to 25 cm deep in the soil.

Geographical distribution : A cosmopolitan temperate weed.

Specimen examined : *Kaul* 108 (22-11-1969) RRL Campus, Srinagar.

Chromosome report : 2n=54 (DCA 257).

Conyza canadensis (L.) Cronquist in Bull. Torrey Bot. Club 70 (6): 632, 1943; Stewart 734.

Erigeron canadensis L. Sp. Pl. 863, 1753; FBI 3: 254; Singh in BOBSI 2 : 256, 1960.

Annual herbs. Stem erect, up to 1 m tall, or even more, branched towards the top, solid, fast green, glabrous or slightly hairy near the base. Leaves simple, narrowly lanceolate up to 5 cm long, alternate but crowded, margins covered with small white bristly hairs. Flower heads numerous, up to 8 mm diam. slightly longer than broad, on small peduncles, subcorymbose to corymbose. Involucral bracts thin, 1-seriate, filiform green with black or purplish tips, almost as long as flowers, glabrous or hairy, persistent. Flowers heterogamous, ray florets slightly smaller or as long as the involucral bracts, white, 1-3 seriate, rarely absent. Disc florets heterogamous, fertile. Achenes up to 4 mm long, creamy or slightly brownish; pappus white, double the length of achenes. Receptacle naked.

Germination : Early summer (May).

Fl. & Fr. : July-December.

Dissemination : The seeds are mainly disseminated by wind.

Habitat : A common weed of grasslands, orchards and vegetable fields preferring open situations. Indicator of sandy alluviums.

Root system : A branched tap root with main roots going up to 25 cm deep in the soil.

Geographical distribution : A native of America and naturalized throughout the world.

Specimens examined : *Gammie* s. n. (25-7-1891) Ganderbal, Kashmir, (DD); *Kaul* 104 (2-11-1969) RRL Campus.

Chromosome report : 2n=18 (DCA 257).

Conyza aegyptiaca Ait. Hort. Kew. ed. 1, 3 : 113, 1789;Stewart 734.

Erigeron asteroides Roxb. Fl. Ind. 3:432, 1832; FBI 3 : 254.

Annual or biennial herbs with a thick and stout rootstock. Stem woody below, branches from the base, branches up to 25 cm long, slender pubescent and leafy. Radical leaves obovate to linear lenceolate, simple, 2.0-4.5 cm. x 0.3-0.8 cm, broader at the apex and narrowing towards the base, margins hairy. Cauline leaves sessile and smaller. Flower heads up to 1.5 cm x 0.5 cm, long peduncled, sub-corymbose. Involucral bracts 2-3 seriate, outer small and inner longest, up to 6 mm long, linear lanceolate; green or slightly purplish,hairy and persistent. Each flower head heterogamous; outer florets many seriate, ligulate; ligules reddish; female with shrinked achenes; inner disc florets yellowish, hermaphrodite, anthers linear, style bifid at the tip. Achenes linear, pointed, hairy; pappus many seriate.

Field notes : A rare weed of orchards preferring semi-dry situations.

Geographical distribution : Tropical Himalaya. Nepal to Sikkim; Bengal and Western Peninsula.

Specimen examined : *Kaul* 256 (4-9-1970) Majid Bagh orchards.

ERIGERON Linnaeus

Erigeron annuus Pers. Syn. Pl. 2 : 431, 1807. **(Fig. 40)**

Annual herbs. Stem erect up to 65 cm, branched, longitudinally ribbed and finely grooved, leaf below, glabrous or minutely pubescent, pubescence appressed. Leaves simple, oblong lanceolate, up to 6.5 cm x 1.0 cm, sessile, alternate entire or sinuate toothed, apex obtuse or sub-acute, minutely pubescent. Flowers heads somewhat rounded, carried on long branched peduncles, corymbose to sub-corymbose. Involucral bracts 2-3 seriate; outer ones smaller and inner lanceolate, margins membranous, hairy, persistent. Flowers homogamous, bisexual, fertile; corolla tubular 3-5 fid; stamens elongated, surrounding the truncate style. Achenes very small up to 0.5 mm or 1 mm long, finely ribbed; pappus white, much longer than the achene.

Field notes : A rare weed preferring moist situations found on the margins of paddy fields. It possesses a small but stout and branched tap root system. The seeds are disseminated by wind and irrigation canals.

Specimen examined : *Kaul* 267 (24-7-1971) Rawalpora paddy fields.

Chromosome report : 2n=27 (DCA 257).

INULA Linnaeus

Inula indica L. Sp. Pl. 1236, 1763; Stewart 754.

Vicoa auriculata Cass. in Ann. Sc. Nat. Ser. 1, 12 : 418, 1829; FBI 3 : 297.

Annual herbs. Stem erect, up to 75 cm, branched or rarely unbranched, ribbed, glabrous or somewhat pubescent towards the apex. Radical leaves oblong to obovate, petiolate; petiole slightly winged and pubescent, base broadened, silky hairiness at the leaf base; cauline leaves similar with acute apex, alternate, semiamplexicaule, margins dentate. Flower heads arranged corymbosely towards the apex of the branches carried on peduncles 1.5-6.5 cm long; pubescent leaf opposed or arising in the axils of leaves. Involucral bracts many-seriate recurved, linear lanceolate, margins hirsute and membranous; outer ones broader than the inner. Flowers heterogamous; ray florets 2-3 seriate, female, yellow, linear ligules generally 3-fid, style arms divergent, fertile; disc florets hermaphrodite, circular disc yellow, with 5-libed corolla tube; stamens with syngenesious anthers having long tails. Achenes 0.5-1.5 mm long, ribbed and hirsute; pappus 3-5 seriate, silky.

Germination : The seeds germinate in spring (March-April).

Fl. & Fr. : July-August.

Dissemination : The seeds are disseminated by wind.

Habitat : A rare weed of orchards possessing a gregarious habit. Indicator of dry sandy loams.

Root system : A simple tap root with small branches.

Geographical distribution : Burma, Shri Lanka, Western Himalaya.

Specimens examined : *Kaul* 87 (6-9-1969) Barzulla orchards; *Kaul* 232 (20-7-1970) Srinagar near airport fallow fields.

BIDENS Linnaeus

Key to the species

1. Achenes with 2-3 rigid, hispid awns **tripartita**
1. Achenes with 3-5 rigid awns **biternata**

Bidens tripartita L. Sp. Pl. 831, 1753; FBI 3 : 309; Collett 264; Stewart 725. **(Fig. 41)**

Annual herbs. Stem erect or decumbent near the base, up to 60 cm long slender, glabrous, sometimes even fistular, rooting at the lowermost nodes. Leaves pinnatifid, 2-3 partite with apical lobes largest, petiolate or upper ones sessile, opposite. Flower heads up to 2 cm diam., in axillary or terminal peduncles, yellowish. Involucral bracts many-seriate; inner ones ovate to obovate with a definite mid-rib and scarious margins, persistent. Flowers many, heterogamous; ray florets small, female, ligule spreading; disc florets tubular, 5-fid, style coming out of the tube. Achenes small angled, brown, glabrous with 2-3 small awns.

Germination : The achenes germinate readily as they fall on suitable substrates. The majority of seedlings are seen in early summer (June).

Fl. & Fr. August-October.

Dissemination : The achenes are disseminated by rain water and also some animals.

Habitat : An occasional weed of orchards, vegetable fields and margins of paddy fields growing along water channels. Indicator of fertile compact moist soils.

Root system : Bunches of adventitious roots arise from a common rootstock and act as soil binders.

Geographical distribution : North Asia, Japan, Western Europe and North America.

Specimens examined : *Kaul* 258 (21-9-1970). Majid Bagh vegetable fields; *Kaul* RRL 19710 (18-9-1971) Barzulla orchards.

Chromosome report : 2n=48 (Mangal & Davidson in Taxon 16 (1) : 66, 1967).

Bidens biternata (Lour.) Merr. & Scherff. in Bot, Gaz. 88 : 293, 1929; Santapau in BOBSI 3 : 12, 1961.

Coreopsis biternata Lour. Fl. Cochin. 508, 1870.

Bidens pilosa auct. non L. (1753); FBI 3 : 309.

Annual herbs. Stem erect up to 50 cm, slender above, branched or unbranched, ribbed all along the length, slightly grooved or angled, glabrous. Leaves compound, apical leaflet largest, lateral ones unequal, deeply cuneate; petiolate, opposite, glabrous or with scattered hairiness. Flower heads on slender, axillary, branched peduncles. Involucral bracts 2-3 seriate, outer ones glandular hairy with hairs on the margins, inner ones larger than the outer, obovate and fine tipped. Flowers with both ray and disc florets yellow. Ray florets a few, female or neuter. Disc florets many, hermaphrodite. Achenes black, much exceeding the involucre, angled, up to 2 cm long, glabrous or hispid with 3-5 commonly 3 barbed, small, angular, sticky awns.

Germination : The achenes sprout in summer (June-July),

Fl. & Fr. : September-November.

Dissemination : The seeds are disseminated by birds and animals.

Habitat : An occasional weed of some orchards. Indicator of well aerated alluvial soils.

Root system : A simple branched tap root.

Geographical distribution : All warm countries of the world.

Specimens examined : *Kaul* 86 (6-9-1969) Barzulla orchards.

Remarks : This species was confused by some authors as **B. pilosa** L. but Santapau (1961) clearly distinguishes the two species.

ECLIPTA Linnaeus

Eclipta prostrata (L.) L. Mant. 2 : 286, 1771; Santapau in J. Bombay Nat. Hist. Soc. 54: 457, 1959, & BOBSI 3: 16, 1961; Stewart 743. **(Fig. 42)**

Verbesina prostrata L. Sp. Pl. 902, 1753.

Verbesina alba L. Sp. Pl. 903, 1753.

Eclipta alba (L.) Hass. Pl. Jav. Rar. 526, 1824; FBI 8: 304.

Annuals with stem prostrate or suberect and branches spreading from the base, purplish green, up to 50 cm long, roughly pubescent or glandular at apices, sometimes fistular towards the base. Leaves simple, narrowly lanceolate to oblong, up to 7.5 cm x 1.5 cm opposite, sessile to subsessile, toothed or nearly entire, apex obtuse, surfaces roughly pubescent. Flower heads up to 1 cm diam. axillary or terminal, peduncled; peduncles much shorter than the leaves, pubescent. Involucral bracts 1-2 seriate, outer ones ovate to obovate, leafy, generally exceeding the flowers, pubescent more on edges, persistent. Flowers heterogamous; ray florets female, 1-2 seriate, white, ligules erect or spreading, entire or 2-fid, fertile or even sterile; disc florets whitish, corolla tube 4-5 fid, hermaphrodite, stamens with purplish anthers surrounding a truncate style. Receptacle flat or somewhat concave with narrow linear setaceous palae as long as the flowers enclosing 1-3 flowers. Achene flat or triangular, tapering towards the base,apex black, toothed, tipped with small teeth.

Germination : The seeds germinate readily in middle spring (April-May).

Fl. & Fr. : July-September.

Dissemination : The seeds are shed in autumn and remain dormant in the soil, disseminated mostly by irrigation water.

Habitat : An occasional weed of rice fields. Indicator of muddy or moist fertile soils.

Root system : Bunches of adventitious roots arise from the base of the stem and bind the plants in muddy soil.

Geographical : South America, Australia; it is a cosmopolitan tropical weed.

Specimen examined : *Kaul* RRL 16127 (26-8-1971) Hyderpora paddy fields.

Chromosome report : 2n = 22 (DCA 253).

GALINSOGA Ruiz et Pavon

Galinsoga parviflora Cav. Icon. 3: 41, t. 281, 1795; FBI 3: 311; Collett 264; Rao in BOBSI 2: 405, 1960; Stewart 747.

Annual herbs. stem weak, erect or subdecumbent up to 50 cm, glabrous or sometimes hairy towards the apex, generally branched. Leaves simple, ovate to obovate, 1.5-5.0 cm x 1-3.0 cm, tapering towards the apex, petiole as long or shorter than the leaf, surfaces slightly hairy, margins dentate. Flower heads small, globular, up to 1 cm diam. subterminal or axillary with definite peduncles. Involucral bracts obovate, 2- seriate up to 5 mm diam, persistent,membranous when mature. Flowers heterogamous; outer ray florets 1- seriate,

ligulate; ligules very small, 5-10 in a head, yellowish white, oval, female, 2-4 fid. Inner disc florets bisexual, fertile, tubular, limb 5-fid. Achenes small, black to brown, somewhat hispid and a concave centre, pappus as long as achene, consisting of elongated strap like structures or palae with hairy margins.

Germination : The achenes germinate readily in moist and fertile situations. The seedlings sprout in spring (March-April).

Fl. & Fr. : June-August.

Dissemination : The seeds are produced in large numbers and are disseminated by wind and water.

Habitat : An occasional weed of orchards, vegetable fields and margins of paddy fields preferring moist and shady situations. Indicator of fertile well aerated moist loams.

Root system : Adventitious roots arise from the nodes and bind the soil.

Geographical distribution : A native of America, now widely naturalized in other parts of globe.

Specimens examined : *Kaul* 206 (1-6-1970) Rawalpora orchards; *Kaul* RRL 19799 (31-8-1972) Harwan paddy fields.

Chromosome report : 2n = 16 (Subramanyam & Kamble in Taxon 16 : 343, 1967).

MATRICARIA Linnaeus

Matricaria chamomilla L. Sp. Pl. 891, 1753; FBI 3 : 315; Stewart 766. **(Fig. 43)**

Annual sweet smelling herbs. Stem erect or decumbent near the base, thoroughly branched, weak light geen, ribbed, glabrous. Leaves 2-3 pinnatifid, segments narrow, linear up to 1.5 cm long, glabrous or minutely pubescent. Flower heads up to 2.5 cm diam. corymbose towards the apices of the branches. Involucral bracts 1-2 seriate, ovate to lanceolate, yellowish green with membranous margins. Ray florets 1-seriate, 10-15 or even more, longer than the involucral bracts, 4-5 fid, white, female. Disc florets many-seriate, yellow, forming an elevated or conical disc, tubular corolla, 5-fid, hermaphrodite. Achenes small, grey with slender ribs; white, without oil glands. Receptaecl conical in mature flowers, glabrous.

Germination : The seeds are produced in large numbers and germinate readily when favourable conditions are available. The young seedlings sprout in spring (March).

Fl. & Fr. : June-August.

Dissemination : The seeds are disseminated by wind. The plants are more efficiently propagated through underground runners.

Habitat : A common weed of orchards, parks, roadsides and some fallow lands possessing a gregarious habit. Indicator of moist gravelly soils.

Root system : The rootstock is thin but very stiff running to long distances, rootlets arise from the rootstock and bind the soil.

Geographical distribution : Europe, Siberia, Caucasus, Iran, Afghanistan Pakistan, India.

Specimen examined : *Kaul* RRL 5998 (28-5-1970) Barzulla orchards.

Remarks : The weed is very difficult to control because of its efficient mode of dissemination. The flowers are showy.

Chromosome report : 2n=18 (DCA 268).

COTULA Linnaeus

Cotula anthemoides L. Sp. Pl. 891, 1753; FBI 3 : 316; Stewart 735.

Annual weak harbs. Stem generally decumbent, diffused, branched thoroughly up to 20 cm long branches. glabrous or minutely hairy. Leaves 1-2 pinnatifid or pinnatisect, segments decurrent lobed, lobes small lanceolate, up to 6 mm long petioles of the leaves semi-amplexicaule, glabrous. Flower heads yellow, small, globular up to 7 mm diam, solitary terminal or axillary. Involucral bracts 1-2 seriate, small with scarious or membranous margins. Ray florets small up to 3 mm, ovate, white, sometimes even absent, when present female and fertile. Disc florets forming a globular yellow disc on a nearly flat and tubercled receptacle; corolla tube 4-5 fid, stamens with syngenesious anthers, anther bases, obtuse. Achenes ovate, thick, narrow slightly winged, produced in enormous quantities.

Germination : Seeds remain dormant during winter and sprout in early spring (February-March). Sometimes seeds also germinate in late autumn (Oct -Nov.).

Fl. & Fr. : May-June.

Dissemination : The seeds are disseminated by wind and water. The weeds spread vegetatively as well.

Habitat : A rare weed of orchards and vegetable fields preferring moist situations.

Root system : A running stoloniferous slender rootstock with small branches restricted in the surface horizons of the soil.

Geographical distribution : North and South Africa, China.

Specimen examined : *Kapoor* 2240 (23-5-1952) Srinagar orchards.

SIEGESBECKIA Linnaeus

Siegesbeckia orientalis L. Sp. Pl. 900, 1753; FBI 3 : 304; Collett 262; Rao in BOBSI 2 : 405, 1960; Stewart 784.

Annual herbs. Stem erect, up to 50 cm; somewhat woody near the base, pubescent with crisped hairs, branches dichotomous. Leaves simple, ovate to obovate triangular, 5.5-13.5 cm x 3.0-10 cm, variable in shape, opposite, sessile, toothed or crenate, pubescent. Flower heads in leafy panicles. Involucral bracts 2-seriate; the outer ones spathulate, up to 2.5 cm long, narrow, spreading, glandular pubescent; inner ones generally shorter and erect, glandular. Flowers yellow, heterogamous; ray florets 1-seriate, fertile, ligule 2-3 fid; disc florets bisexual, fertile or innermost sterile, tubular, limb campanulate, 3-5 fid; anthers syngenesious, bases entire. Achenes obovoid-oblong, not compressed, often incurved, obtuse, black, angled with no pappus.

Germination : The seeds sprout in early summer (May-June).

Fl. & Fr. : August-October.

Dissemination : The achenes stick to the fur of the animals and are disseminated to long distances.

Habitat : An occasional weed of orchards Indicator of dry gravelly soils.

Root system : A thoroughly branched tap root entering the deeper horizons of the soil.

Geographical distribution : Africa, Caucasus, Iran, Afghanistan, India, Indo-China, Japan, Philippines and Australia.

Specimens examined : *Kaul* 257 (8-9-1970) Churpora, Srinagar orchards.

Chromosome report : 2n=24 (Subramanyam & Kamble in Taxon 16 : 345, 1967).

MYRIACTIS Lessing

Myriactis wallichii Less. in Linnaea 6 : 129, 1831; FBI 3 : 247; Stewart 766. **(Fig. 44)**

Annual herbs. Stem erect, up to 50 cm tall, finely ribbed, ribs pubescent, branched. Leaves simple ovate to obovate lanceolate, 1.5-6.5 cm x 0.5-2.5 cm, alternate, teeth coarse and irregular, distant; petiolate, petiole slender aud slightly winged, surfaces slightly pubescent or hirsute, apex acute to acuminate. Flower heads hemispherical up to 1.2 cm diam, radiate, paniculate on long axillary stalks. Involucral bracts 2-4 seriate, elongate to obovate with white membranous margins, pubescent and persistent. Flowers heterogamous; ray florets white, 1-4 seriate, small, with entire ligules, female and fertile; disc florets yellow turning slightly purplish in fruit, bisexual, corolla tube 5-fid. Achenes flat, elongated and smooth, pointed towards the base, glabrous.

Germination : The seeds germinate readily in moist situations in early summer.

Fl. & Fr. : August-September.

Dissemination : Seeds are mainly disseminated by irrigation or rain water.

Habitat : An occasional weed of orchards and vegetable fields growing by the side of water. Indicator of fertile sandy loams.

Root system : A much branched tap root with the main root penetrating deep into the soil.

Geographical distribution : Central Asia, Sri Lanka, Western Himalaya.

Specimens examined : *Dutt* 9036 (25-9-1962) Emporium Gardens., Srinagar; *Kaul* 259 (23-9-1970) near Badgam orchards.

ACHILLEA Linnaeus

Achillea millefolium L. Sp. Pl. 899, 1753; FBI 3 : 312; Collett 265; Rao in RBSI 18 (2) : 37, 1960; Polunin 440; Stewart 711.

Biennial or perennial herbs. Rootstock stoloniferous. Stem erect 20-100 cm, branched or unbranched, ribbed, narrowly furrowed, villous; hairs fine, spreading. Leaves radical and cauline, crowded towards the base; former stalked, 3-pinnatisect 3.0-15.0 cm long, segments linear up to 5 mm long, acute. Involucral bracts 2-3 seriate, more or less appressed, margins often scarious, villous, inner bracts hyaline. Heads 3-7 mm diam. in compound corymbs, heterogamous; ray florets female, rarely neuter, 5-9 in a head, 2-4.5 mm long, ligule short, rounded, 3-5 toothed, whitish, style arms truncate but small. Disc florets smaller, included, creamy, hermaphrodite, 8-19 in a head. Receptacle palaeceous with small hyaline and membranous scales. Achenes shining, flattened, slightly elongated, black, no pappus.

Germination : Seedlings are seen sprouting in early summer (May-June).

Fl. & Fr. : August-October.

Dissemination : The seeds are disseminated by irrigation water. The plants also reproduce vegetatively.

Habitat : An occasional weed of paddy fields possessing a gregarious habit. Indicator of moist stony compact soils.

Root system : A deeply running slender rootstock with bunches of roots arising from the nodes and binding the plants in soil.

Geographical distribution : Europe.

Specimens examined : *Kaul* RRL 5547 (18-7-1969) Margins of paddy fields near Harwan; *Kaul* RRL 16073 (29-7-1971) Harwan Paddy fields.

Local name : "Pahale Katch".

Remarks : The flower heads are used in perfumery. The leaves are crushed and locally used against toothaches and swellings.

Chromosome report : 2n=18, 36, 56 (DCA 268).

BELLIS Linnaeus.

Bellis perennis L. Sp. Pl. 886, 1753; Bailey in Standard Cycl. Horti. 1 : 486, 1900; Stewart 724. **(Fig. 45)**

Perennial tufted herbs. Rootstock thick, slightly trailing or going deep. Leaves all radical clustered near the root, simple, spathulate or obovate, rounded at the apex and tapering towards the base, 2.5 cm x 0.5-1.5 cm, petiole slightly winged, pubescent. Scapes 1-5, 5-15 cm long, slender hairy, carrying a single capitulum. Flower heads white or pinkish white 1-3 cm diam. Involucral bracts 1-2 seriate, ovate to obovate, slightly hairy, persistent. Flowers heterogamous; ray florets white, ligule 3-5 fid generally neuter; disc florets yellowish; corolla tube 5-fid. Stamens 5 with sagittate, syngenesious anthers. Achenes obovate without any pappus.

Germination : The seeds germinate in early summer (February-March).

Fl. & Fr. : May-June.

Dissemination : The weeds reproduce vegetatively as well as by seed. The seeds are disseminated by wind.

Hobitat : An occasional weed of lawns and public gardens possessing a gregarious habit. Indicator of compact fertile sandy loams.

Root system : A perennial branched somewhat trailing rootstock.

Geographical distribution : Temperate countries of the world.

Specimen examined : *Kaul* 175 (8-5-1970) Naseem Bagh.

Remarks : A weed difficult to eradicate once established. The flowers are showy and of horticultural importance.

Chromosome report : 2n = 18 (DCA 257).

SAUSSUREA A.P. de Candolle

Saussurea heteromalla (D.Don) Hand. Mazz. Symb. Sin Pt. 7, 1152, 1936; Raizada in Indian Forester 92 : 322, 1966; Stewart 775.

Carduus heteromalla D. Don, Prodr. 166, 1825.

Saussurea candicans (DC.) Clarke in Comp. Indica 232, 1876; FBI 3: 365.

Aplotaxis candicans DC. Prodr. 6: 540, 1838.

Perennial herbs with a somewhat woody tapering root. Stem up to 1 metre tall, often branching near the top, glabrous or somewhat cottony, longitudinally ridged. Radical leaves simple, pinnatisect with apical lobe largest up to 17.5 cm long, petiole slender and cottony; upper surface light green, lower surface white tomentose; cauline leaves similar to radical ones but with small petioles or even sessile, alternate. Flower heads are globose, broader than long, carried on white

tomentose peduncles. Involucral bracts 2-3 seriate, outer ones smaller up to 1.2 cm long, obovate, pubescent or tomentose, acute or spine tipped: inner ones double the length of outer, similar. Flowers white with reddish tinge or sometimes purplish, homogamous, hermaphrodite. Corolla tube longer than the inner involucral bracts, 5-lobed. Stamens 5, with long connate anthers. Achenes elongated brown, 4-5 angled, rough, never smooth with a rounded umbo at the apex on which arise the pappus. Pappus is longer than achene, feathery and silky, deciduous.

Field notes : Rarely in fallow fields of Srinagar preferring dry and compact soils.

Fl. & Fr. : June-August.

Specimen examined : *Kaul* 60 (15-7-1969) Dalgate fallow fields.

Distribution : Subtropical and Temperate India, Bhutan, Afghanistan, Western Himalaya.

ONOPORDUM Linnaeus

Onopordum acanthium L. Sp. Pl. 827, 1753; Aitch. in J. Linn. Soc. 18 : 73, 1880; Kitamura 428; Rao in BOBSI 2 : 406, 1960; Stewart 967.

A tall and robust biennial or perennial herb. Stem up to 1.5 m tall, erect, branched winged; wings broad, white-felted leafy and spinescent. Leaves elliptic to oblong, pinnatifid with shallow, angular and strongly spiny lobes, white felted, blade running down into a broad spiny wing of the stem. Flowers in more or less globular heads, 3-5 cm diam broader than long, on a small white, tomentose peduncle. Involucral bracts 2-many seriate, outer ones smaller than the inner ones, spinescent, persistent, Flowers homogamous, yellowish to purplish. ligule sometimes present in the form of small spreading lobe. Achenes elongated up to 5 mm long, tapering towards the base, ridges small transverse in a row; pappus whitish, feathery. Receptacle broad like honey comb.

Germination : The seeds are hard and possess long term dormancy; seedlings sprout in spring (March-April).

Fl. & Fr. : July-August.

Dissemination : The seeds are disseminated mainly by wind.

Habitat : An occasional weed of fallow lands, waste heaps and vegetable fields. Indicator of organic matter in soil

Root system : A thick rootstock with branches going deep in the dry soils in search of water.

Geographical distribution : Europe, Afghanistan, Westrn Himalaya; Kashmir to Kumaon.

Specimen examined : *Kaul* RRL 19612 (27-7-1969) Pampore fallow fields.

Chromosome report : 2n=34 (DCA 262).

CARDUUS Linnaeus

Carduus edelbergii Rech. f. Symb. Afghan. 2 : 175, 1955; Kazmi in Mitt. Bot. Staats. Munchen 5 : 346, 1964; Stewart 724.

Carduus nutana Hook. f. FBI 3 : 361 (non. L.)

Carduus onopordioides Fisch. et Bieb. Fl. Taur. Cauc. 3 : 552, 1819; Kitamura 394.

Erect biennial to perennial herbs. Stem rough up to 1 m tall, grooved, winged; wings interrupted, spinous, somewhat rough or

cobwebby, branched. Leaves alternate, 1-2 pinnatifid, lobes and segments spinous 5-20 cm, most variable in length, sessile and green or greyish. Flower heads small peduncled, globose up to 4 cm diam, peduncles cottony or tomentose. Involucral bracts many seriate, 0.5-1.5 cm long, narrowly lanceolate or broader at the base, spine-tipped, spine erect or recurved persistent. Flowers crimson or purplish, may, homogamous, bisexual. Corolla tube 5-lobed at the apex; stamens with pubescent or glabrous filaments, anther bases sagittate, auricles connate. Achenes oblong ribbed with pappus copious. Receptacle broad and hairy.

Germination : The seedlings sprout in early spring (February-March) as the snow melts from the soil.

Fl. & Fr. : May-July.

Dissemination : The seeds are efficiently disseminated by wind.

Habitat : A common weed of orchards roadsides, left over places and even some vegetable fields. Indicator of sandy loams.

Root system : A stout much branched tap root sending branches to deep horizons of the soil.

Geographical distribution : Europe.

Specimens examined : *Kaul* 42 (27-5-1969) Barzulla roadsides; *Kaul* 211-212 (12-6-1970) Barzulla orchards.

Remarks : This Himalayan plant is most variable as described by Hooker (1881).

Chromosome report : 2n=16 (Confirmed Bhat, Bakshi & Kaul 1973).

CENTAUREA Linnaeus

Centaurea iberica Trev. ex Spreng. Syst. 3 : 406, 1826; FBI 3 : 385; Stewart 729.

Annual or biennial herbs. Stem erect, up to 45 cm, light green branched, angular, finely pubescent. Radical leaves forming a rosette, pinnatifid to pinnate with spreading lobes, pubescent, withering away in older plants; cauline leaves pinnate or linear with 3 toothed lobes, upper ones entire, sessile. Flower heads ovoid, sessile or peduncled. Involucral bracts 1-many seriate, ovoid with narrow membranous margins, terminating in a long but strong spreading spine with short lateral ones at the base. Flowers pinkish, homogamous, hermaphrodite; corolla tube 5-fid, style truncate. Achenes small white with a very short pappus.

Germination : The seeds sprout in early spring (March).

Fl. & Fr. : July-September.

Dissemination : The seeds are disseminated mostly by wind.

Habitat : A common weed of fallow lands, orchards, roadsides and grasslands. Indicator of sandy loams.

Root system : A branched tap root enters deeper horizons of the soil.

Geographical distribution : Greece, Turkey Transcaucasia, Iraq Iran, Afghanistan, Central Asia, Pakistan.

Specimens examined : *Kaul* 93 (11-9-1969) Barzulla roadsides; *Kaul* RRL 19692 (15-6-1971) Hari Parbat fallow fields.

Remarks : The weed is initially seen with a rosette of radical leaves and a spinous sessile involucre in the centre. At this stage it

is used as a vegetable and is given especially to ladies after child birth.

Local name : "Kretch".

Chromosome report : 2n=16 (DCA 260).

CARTHAMUS Linnaeus

Carthamus lanatus L. Sp. Pl. 830, 1753; FBI 3 : 386; Stewart 728.

Perennial herbs. Stem erect up to 130 cm tall, stout, branched, ribbed, greenish white, not winged, slightly woolly. Leaves simple, pinnatifid, radical ones lyrate, up to 5 cm x 1.5 cm, cauline ones ovate, semi-amplexicaule with an auricled toothed strongly 3-nerved base, spinescent; spines hard and stiff. Involucral bracts longer than the flower head, leafy, spinescent, outer ones largest up to 5.5 cm long, persistent. Flowers in apical compact heads, pale yellow, homogamous, hermaphrodite; corolla 5-fid, tube long; stamens with long anthers. Receptacle bristly; bristles white, long. Achenes small ovoid to elongated, glabrous, shining with pappus of narrow, acute, linear, shining, elastic pales longer than the achenes.

Germination : The seeds are hard and germinate in spring (March).

Fl. & Fr. : May-August.

Dissemination : The seeds are mostly disseminated by water and to some extent by wind.

Habitat : An occasional weed of fallow fields and vegetable fields. Indicator of dry compact sandy soils.

Root system : A thick and branched root-stock bearing long rootlets which bind the plants in soil.

Geographical distribution : Mediterranean region, Iran, Afghanistan, Westwards to Atlantic.

Specimens examined : *Meebold* 935 (June, 1905) Markhand, Kashmir (CAL); *Kaul* RRL 19613 (27-7-1969) Pampore fallow fields; *Kaul* 210 (12-6-1970) RRL fields, Srinagar.

Illustration : Polunin, pl. 157.

Chromosome report : 2n=64 (DCA 262).

CIRSIUM P. Miller

Cirsium argyracanthum DC. Prodr. 6 : 640, 1838; Stewart 733.

Cnicus argyracanthus (DC.) Clarke Comp. Indica 218, 1876; FBI 3 : 362; Collett 273; Rao in RBSI 18(2) : 39, 1960.

Biennial or perennial herbs. Stem erect up to 75 cm, 1-2.5 cm diam, branched, ribbed, finely grooved, tomentose or slightly cottony, not winged. Leaves pinnatifid up to 25 cm long, lobes divided hairy above and white tomentose beneath, spinescent; spines strong up to 2 cm long; alternate and semi amplexicaule. Flower heads fascicled, corymbose, sessile or on small peduncles. Involucral bracts many seriate, ovate lanceolate with spreading and spinous tip, spines long, recurved. Flowers purplish or white, homogamous, bisexual, corolla tube 2-3 cm long, 5-fid, stamens 5 with long anthers, filaments free. Achenes small, glossy, brownish white; pappus feathery, many seriate. Receptacle densely bristly.

Germination : The seeds sprout in early spring (February-March).

Fl. & Fr. : June-August.

Dissemination : The seeds are disseminated by wind & water.

Habitat : A common weed of roadsides and margins of paddy fields mostly along moist situations. Indicator of compact alluvial soils.

Root system : A thick rootstock with branches going into deep horizons of the soil.

Geographical distribution : Temperate Himalaya.

Specimens examined : *Kaul* 41 (27-5-1969) Barzulla Srinagar; *Kaul* 209 (1-6-1970) RRL Srinagar; *Kaul* 216 (22-6-1970) Hyderapora paddy fields; *Kaul* 255 (4-9-1970) Hyderpora.

TRICHOLEPIS A.P. de Candolle

Tricholepis elongata DC. Prodr. 6: 563, 1838; FBI 3 : 380; Collett 276; Stewart 797.

Perennial herbs with stem up to 75 cm tall, branched, stout, ribbed, ribs slightly tomentose or pubescent. Leaves simple, oblong lanceolate to obovate, variable in shape and size, sessile to subsessile, acute, margins toothed and slightly spiny, lower surface somewhat tomentose. Heads solitary on long naked peduncles, flowers enclosed in the involucral bracts up to maturity. Involucralbracts many seriate, narrow with hair like tips. Flowers yellowish, homogamous, hermaphrodite; corolla tube with 5 lobes; stamens-5 with long anthers. Achenes small, oblong, slightly broader upwards, smooth, pappus copious, ridged, minutely barbed, longer than the achene.

Field notes : The weed is found to be very rare in Parks and gardens and has not been seen in fields. It prefers moist and shady situations.

Fl. & Fr. : August-September.

Geographical distribution : Western Himalaya : Kashmir to Kumaon.

Specimens examined : *Meebold* 1177 (Oct., 1905) Kashmir, (CAL); *Kaul* 83 (29-8-1969) Shalimar Bagh, Srinagar.

FILAGO Linnaeus

Filago pyramidata L. Sp. Pl. 119, 1753; Stewart 747.

Filago germanica auct. non L. (1753); FBI 3 : 277, p. p.; Rao in RBSI 18 (2) : 36, 1960.

Filago spathulata Presl. Delic. Prag. 99, 1822; Kitamura 423.

Small annual woody herbs. Stem weak, branched, up to 20 cm long, branching dichotomously from the base, prostrate or suberect, all over woolly. Leaves obovate to lanceolate, 0.5-2. 5 cm long, simple, sessile, alternate, entire with woolly surfaces. Flower heads small, oblong, 5-8 mm diam, sessile crowded in terminal or axillary clusters; each cluster of 5 - 12 heads surrounded by leafy bracts. Involucral bracts small, obovate, apiculate, woolly, awned, multi-seriate, persistent. Flowers heterogamous, disciform; outer florets female, fertile, multi-seriate, flliform with a small corolla tube and two truncate style arms protruding out. The central flowers are hermaphrodite, few fertile with corolla tube 3-5 fid. Stamens 5 with small tailed anthers. Achenes minute, tip rounded, slender; pappus small, silky.

Germination : Seeds are small and the seedlings sprout in early spring (Feb.-March); forming small clusters.

Fl. & Fr. : June-August.

Dissemination : The seeds are disseminated mostly by wind.

Habitat : A common weed of orchards, fallow lands and maize fields. Indicator of well aerated, dry and sandy loams.

Root system : A meagrely developed tap root with small branche.

Geographical distribution : Mediterranean region, Caucasus, Turkistan, Iran, India, Himalaya : eastwards to Kumaon.

Specimens examined : *Gammie* s. n. (14-7-1891) Srinagar, 5300 ft. (DD); *Meebold* 1017 (June. 1905) Sumbal, Kashmir (CAL); *Kaul* 207 (1-6-1970) RRL fields, Srinagar.

Chromosome report : 2n=28 (DCA 259).

GNAPHALIUM Linnaeus

Gnaphalium luteo-album L. Sp. Pl. 851, 1753; FBI 3 : 288; Singh in BOBSI 2 : 356, 1960. **(Fig. 46)**

Annual herbs. Stem weak, branched from the base or sometimes unbranched, 10-25 cm in height, woolly with a dense thick covering at the apex. Leaves simple, oblanceolate, narrow, 3-5.5 cm long sessile, semi-amplexicaule, woolly on both the surfaces, alternate, margins entire. Flower heads compact, corymbose; many capitula combined in a head. Involucral bracts up to 0.5 cm diam, many-seriate, faint yellow, scarious and transparent. Flowers heterogamous; outer florets female and inner bisexual. Achenes small, simple or tubercled, small, brown; pappus much longer than the achenes. Receptacle naked.

Germination : The seeds are produced in large numbers and produce seedlings as the snow melts from the surface of the soil.

Fl. & Fr. : June-September.

Dissemination : The seeds are disseminated by wind & water.

Habitat : A common weed of wheat fields, linseed fields and orchards growing vegetables, forming small tufts. Indicator of well aerated, fertile loams.

Root system : A meagrely developed tap root.

Geographical distribution : Middle and South Europe, Africa, Turkey, Caucasus, Turkestan, Iran and Afghanistan.

Specimens examined : *Meebold* 1026 (June, 1905) Pampore, Kashmir (CAL); *Kaul* 155 (16-4-1970) Badgam orchards; *Kaul* RRL 16068 (11-7-1971) Hyderpora paddy fields on margins.

Chromosome report : 2n=14 (DCA 259).

ARTEMISIA Linnaeus

Key to the species

1. Flower heads heterogamous; outer florets female and fertile, disc florets bisexual and sterile :
   2. Radical leaves with 3-5 palmately spreading lobes — **parviflora**
   2. Radical leaves much divided into spreading linear lobes — **scoparia**
1. Flower heads heterogamous; outer florets female and disc florets bisexual, all fertile :
   3. Receptacle naked; sweet smelling or smell-less herbs :

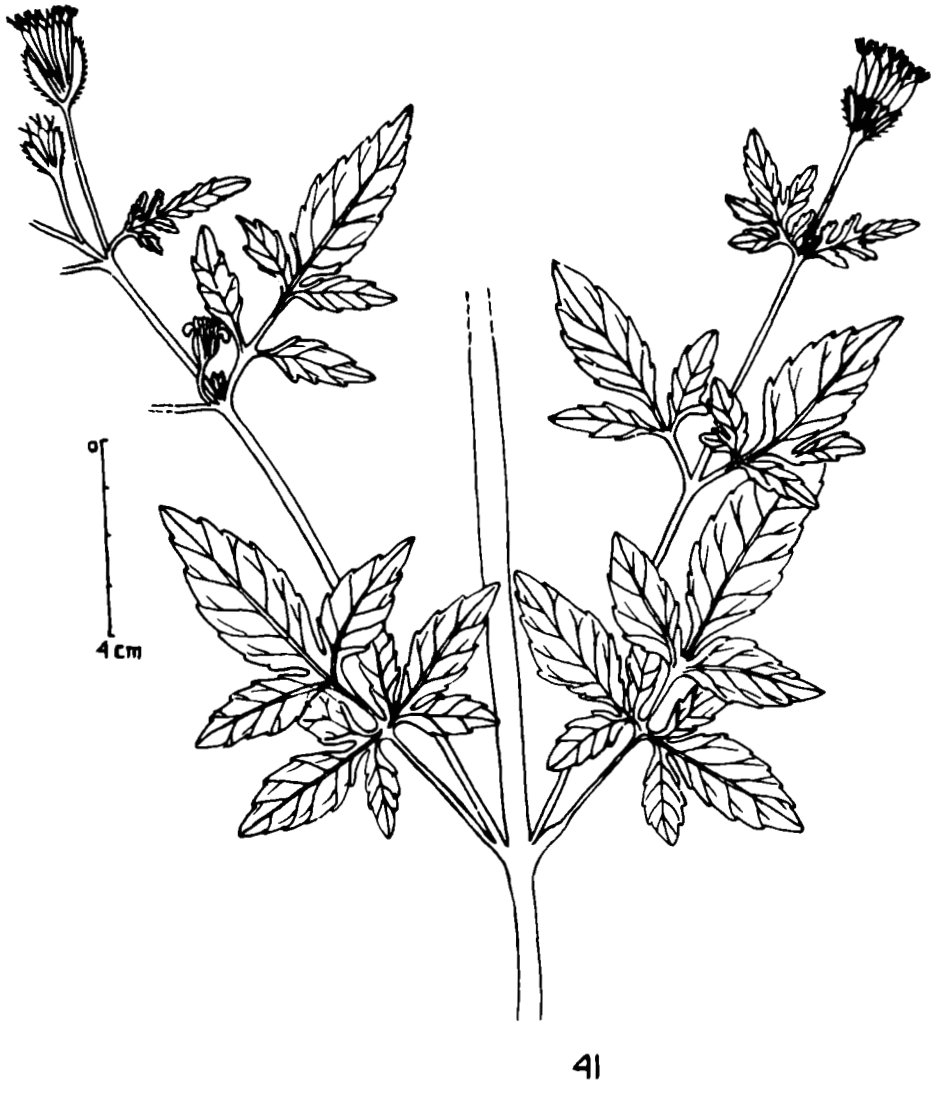


Fig. 41. *Bidens tripartita* Linn. (a flowering shoot)

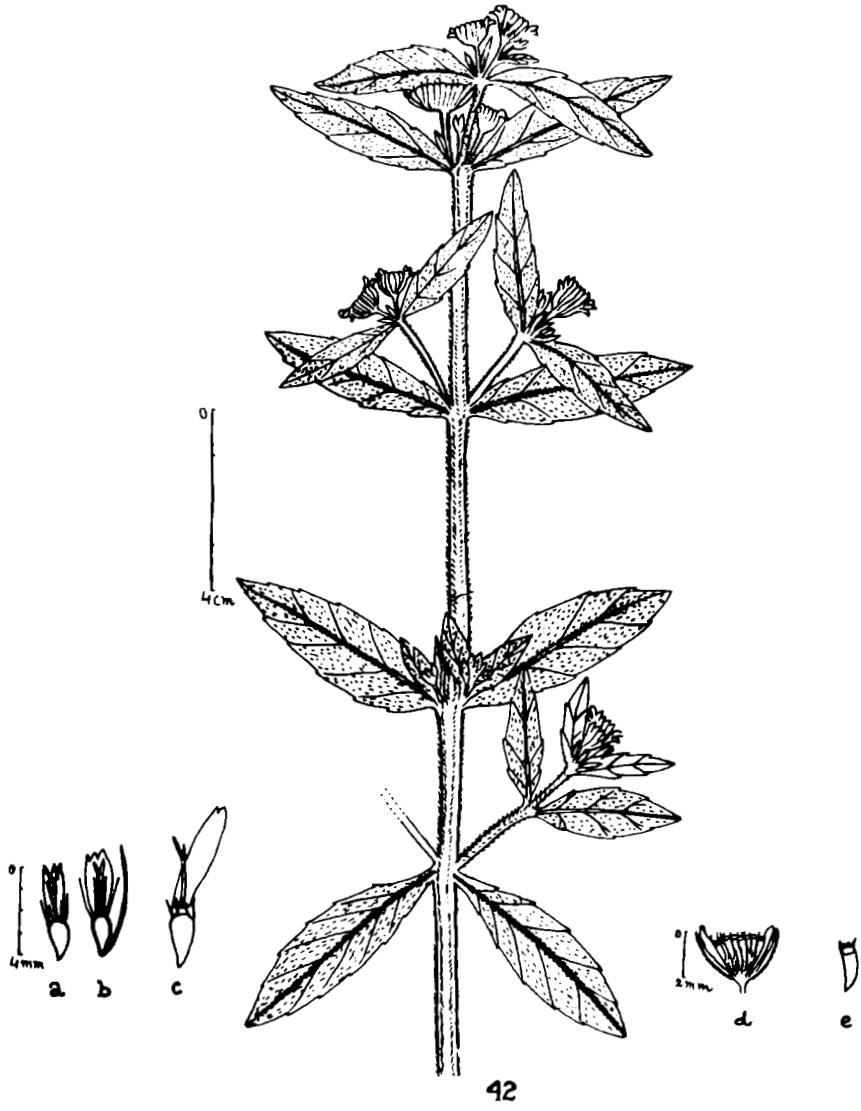


Fig. 42. *Eclipta prostrata* (L.) L. (a flowering shoot)
a. a disc floret, b. a disc floret with a palea, c. a ray floret,
d. an involucre, e. an achene

Fig. 43. *Matricaria chamomilla* L. (a flowering shoot)

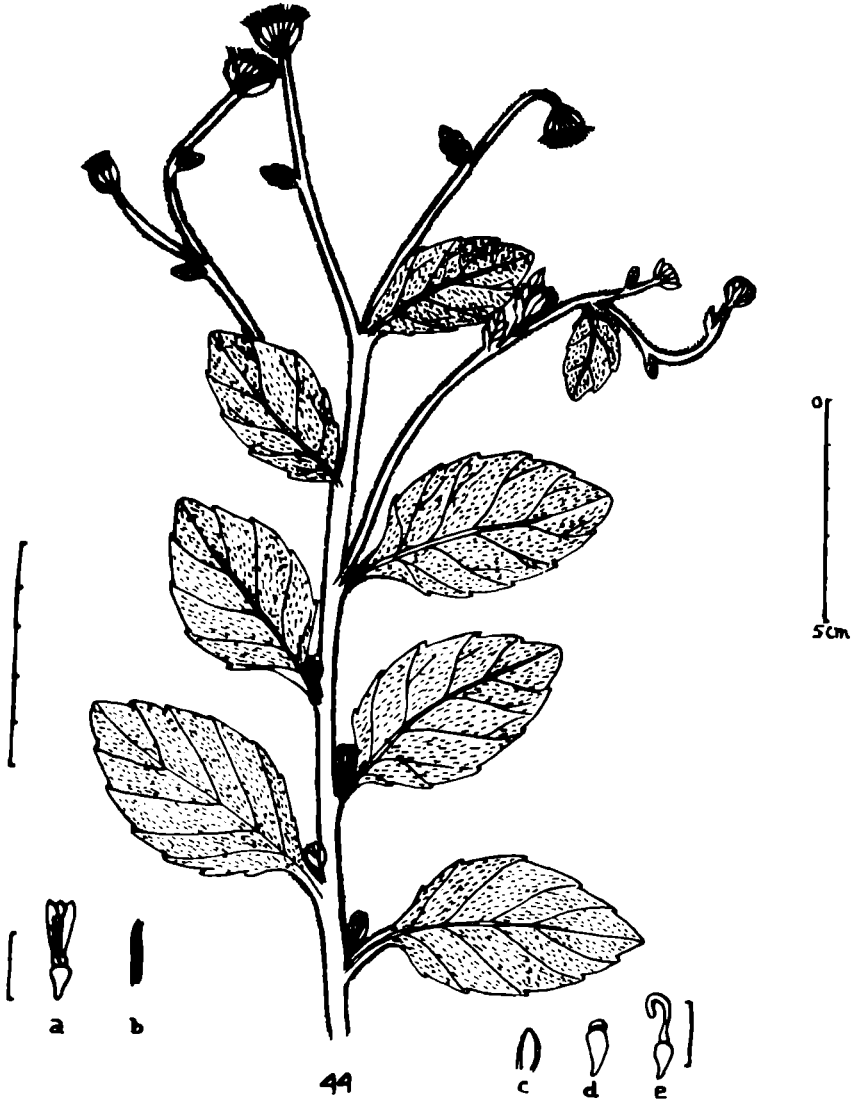


Fig. 44. *Myriactis wallichii* Less. (a flowering shoot)
a. a disc floret, b. an anther, c. an involucral bract,
d. an achene, e. ovary with style

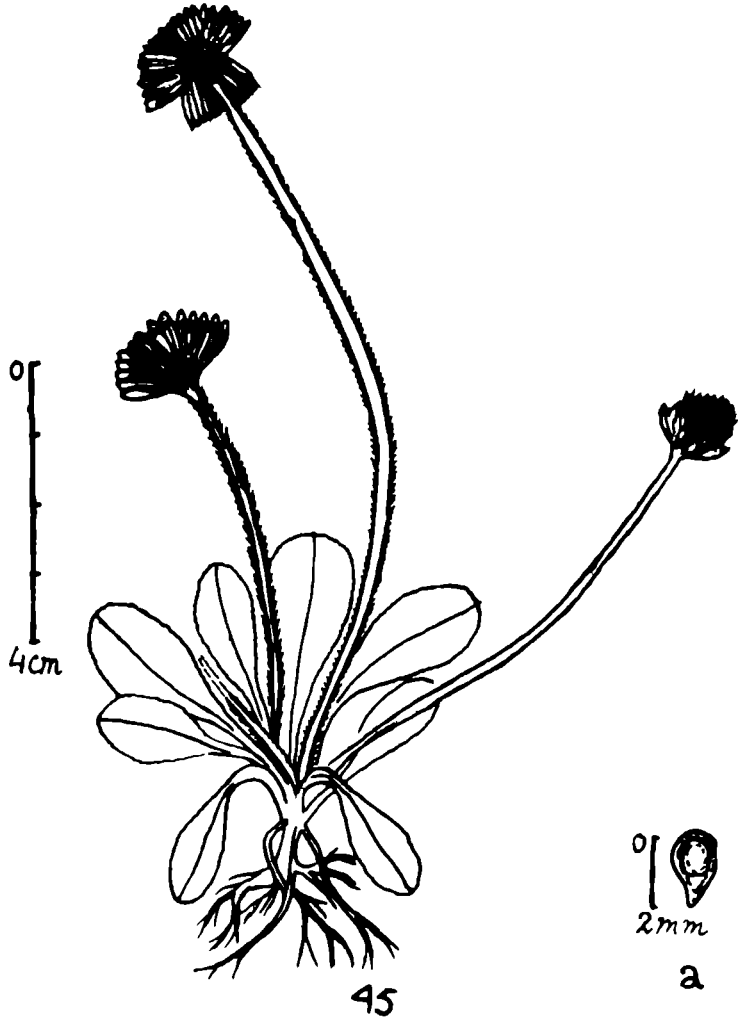


Fig. 45. *Bellis perennis* Linn.
a. an achene

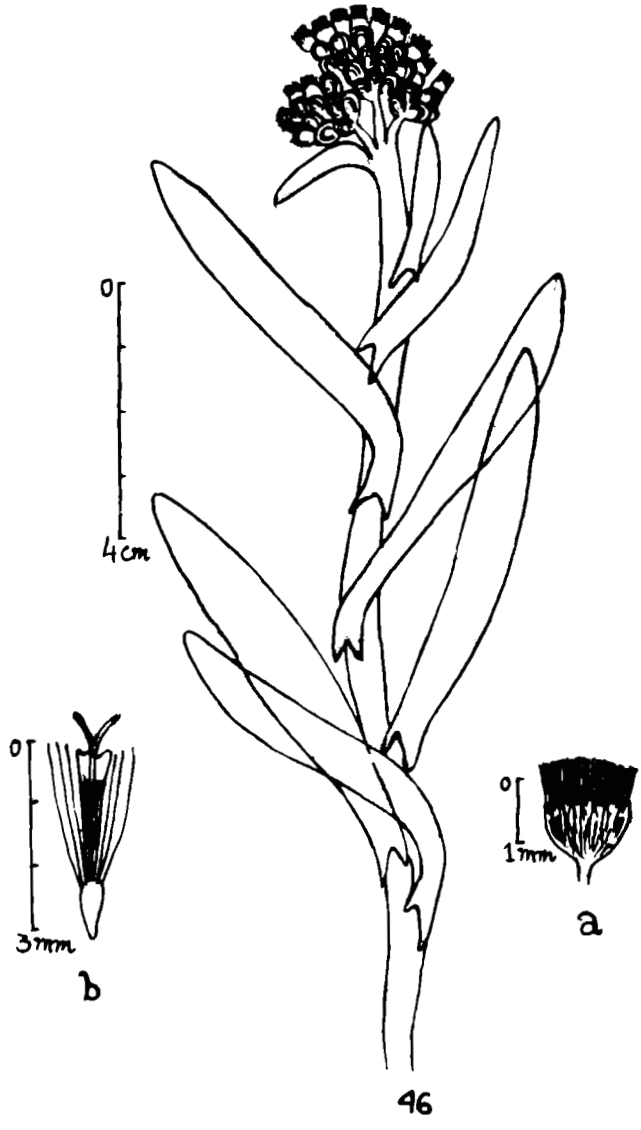
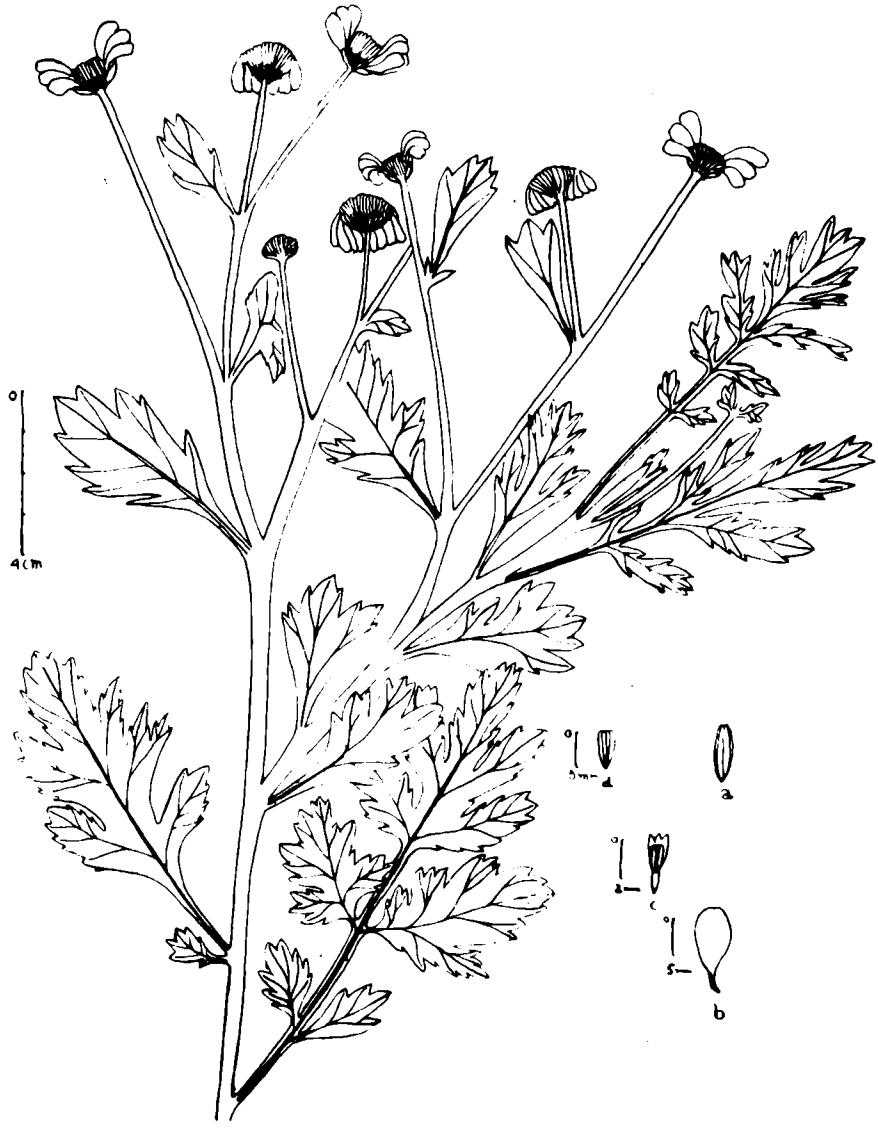


Fig. 46. *Gnaphalium luteoalbum* Linn. (a flowering plant)
a. a flower head, b. a floret



47. *Chrysanthemum parthenium* (L.) Bernh. (a flowering shoot) an involucral bract, b. a ray floret, c. a disc floret, d. an achene

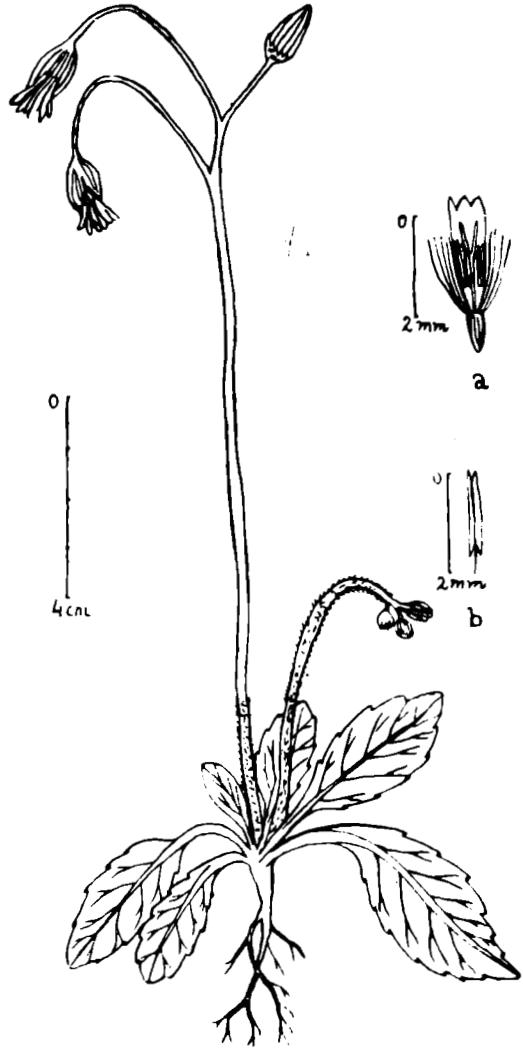


Fig. 48. *Crepis sancta* (L.) Babcock (a flowering plant)
a. a floret, b. a stamen

4. Annual herbs; leaves ovate, pinnatisect, segments oblong toothed, laciniate. Flower heads in dense, axillary, erect, sessile and compound panicles **tournefortiana**
4. Perennial herbs; leaves ovate, lobed, 1-2 pinnatipartite, glabrous or white tomentose beneath. Flower heads in short or long, snb-erect or horizontal panicled racemes **vulgaris**
4. Perennial herbs; leaves ovate, pinnatisect, green above and tomentose beneath. Flower heads in short or long compound hoary racemes; sweetly smelling **vestita**

3. Receptacle covered with long hairs; strongly smelling herbs **absinthium**

Artemisia parviflora Roxb. Fl. Ind. 420, 1832; FBI 3 : 322; Stewart 718.

Perennial herbaceous plants. Stem erect, ascending from a decumbent base, slightly woody at the base, up to 65 cm long, ribbed, paniculateiy branched, glabrous or villous, young branches are more villous and white, inodorous. Leaves very variable, radical ones sessile, somewhat glabrous with spreading pinnatifid 3-5 lobes; middle ones 1-2 pinnatifid with narrow serrate lobes, villous, up to 7.0 cm long and sessile; upper ones are smaller up to 3.5 cm, obovate to linear lanceolate having two small stipule like lobes at the base. Flower heads are heterogamous, somewhat spherical, peduncles up to 3 mm or more in length. Involucral bracts 2-seriate, outer ones smaller than the inner, obovate with membranous margins, scarious with a distinct mid-vein. Flowers 9-15 in a head; outer ones female and fertile; inner ones bisexual with corolla tube 3-5 fid, style truncate, producing non-viable achenes. Achenes of outer florets up to 1.5 mm long, tapering towards the base, brownish and glabrous.

Germination : The seeds germinate readily in spring, (March-April).

Fl. & Fr. : July-September.

Dissemination : The seeds are disseminated mostly by wind. The weeds reproduee vegetatively also.

Habitat : An occasional weed of orchards. cultivated fields, growing mostly in higher altitudes. Indicator of sandy or gravelly soils.

Root system : A stout branched rootstock with branches in the deeper horizons of soil.

Geographical distribution : Temperate Himalaya.

Specimens examined : *Duthie* 13690 (22-8-1893) Kashmir, 10,000 ft. (DD); *Kaul* RRL 16228 (6-9-1972) Rawalpora orchards.

Chromosome report : 2n = 18 (Bhat, Bakshi & Kaul, 1974).

A common variant of this taxon is found associated with it in the cultivated fields which does not grow on higher altitudes. It is allied to *A. parviflora* but differs in the following points :

1. More tufted near the base.
2. Stem up to 1.27 m in height.
3. Stem light purple to green, all over covered with cottony hairy growth.
4. Leaves densely hairy, segments ovate to obovate or cuneate. Germination and time of flowering similar to the preceding species.

Specimens examined : *Kaul* 16226 (31-7-1972) Rawalpora orchards.

Remarks : This seems to be a new species of *Artemisia* allied to *A. parviflora*. Cytologically also it is different because it contains a chromosome with a satellite which is not found in *A. parviflora*. (Bakshi, un published).

Chromosome report : 2n=18 (Bakshi, 1971).

Artemisia scoparia Waldst. et. Kit. Pl. Rar. Hungar 1 : 66, t. 65, 1802; Aitch. in J. Linn. Soc. 18 : 70, 1880; FBI 3 : 323; Stewart 719.

Perennial herbs with thick woody rootstock. Stem erect up to 75 cm in height, branched, branchlets slender, glabrous or slightly hairy, purplish green, faintly ribbed. Radical leaves 3 - 9.5 cm. long, petiole white or grey; pinnatisect with distant spreading linear segments. Cauline leaves smaller, lanceolate and filiform, glabrous, lower ones much divided and upper ones undivided and setaceous. Flower heads small up to 4 mm diam, in crowded racemes arranged alternately on branchlets, sessile or with small stalks. Involucral bracts shining, oblong, obtuse, margins scarious; inner ones smaller than the middle ones, 2-3 mm diam. Flowers 8-15 in a heterogamous head; outer ones mostly female and fertile and inner ones hermaphrodite. Corolla tube 3-5 fid, anthers elongated surrounding a small shrivelled style, achenes shrinked. Viable achenes 1-2 mm diam. pointed at both ends and slightly broader in the middle, brownish black. Receptacle naked.

Field notes : The plant is common in some orchards and specially in fallow grasslands of Srinagar. It yields an oil. The stem completely dies off and new shoots start apearing at the approach of spring.

Fl. & Fr. : July-October.

Specimens examined : *Kaul* 19683 (27-9-1970) Pampore fallow fields.

Geographical distribution : Eurasia.

Chromosome report : 2n=18 (Bhat, Bakshi & Kaul, 1974).

Artemisia tournefortiana Reichenb. Icones Exot. 1 : 16, t. 5, 1824; Aitch. in J. Linn. Soc. 18 : 70, 1880; FBI 3 : 324; Stewart 720.

Annual herbs. Stem up to 1.5 m tall, fast green or sometimes with purplish tinge, solid, ribbed along the length, narrowly furrowed, somewhat woody towards the base, quite glabrous. Leaves compound or pinnatisect with segments oblong, toothed, laciniate or pinnatifid; up to 15.5 cm long, petiole up to 5 cm, glabrous. Flower heads in clustered spiciform racemes on small branches; each head up to 5 cm diam. sessile to subsessile in the axils of small leafy bracts. Involucral bracts obovate to oblong with acute apices, glabrous, concealing the flowers up to maturity. Outer flowers female and inner bisexual, fertile. Achenes up to 3 mm long, slightly ribbed, broadened in the centre.

Germination : The seed possess a high germinating capacity and sprout readily in spring (March-April).

Fl. & Fr. : August-September.

Dissemination : The seeds are produced in large numbers and are mainly disseminated by wind.

Habitat : A common gregarious weed of orchards, maize fields, vegetable fields and also some fallow lands. Indicator of fertile well aerated loams.

Remarks : A weed difficult to control because of its seed output and ready germination.

Geographical distribution : Armenia, Iran, Afghanistan, Western Himalaya.

Specimens examined : *Kaul* 78 (11-8-1869) Rainawari Vegetable fields.

Chromosome report : 2n=18 (Bhat, Bakshi & Kaul 1974).

Artemisia vulgaris L. Sp. Pl. 848, 1753; FBI 3 : 325; Stewart 720.

Perennial tall shrub-like herbs. Stem up to 2.5 m tall, and 5 cm diam. near the base, paniculately branched, branches also thick and robust, solid, hoary pubescent or tomentose, rarely glabrous, at times ribbed, angled or sometimes flattened, furrows never deep. Leaves both radical and cauline, large up to 20 cm long, 1-2 pinnatipartite with large ovate, obovate to linear acute or obtuse lobes, white tomentose beneath, rarely hoary or green on both surfaces, sometimes surfaces cottony; radical ones petiolate; petiole slightly winged and downy: upper cauline ones sessile with stipule like basal lobes. Flower heads up to 5 mm diam. ovoid subglobose or somewhat elongated, clustered or laxly arranged on short or long suberect or horizontal panicled racemes. Involucral bracts 2-4 seriate, woolly or glabrate, inner ones scarious, persistent. Flowers small, heterogamous, varying in number, 6-22 in each head, tubular, outer ones female and fertile producing viable achenes. Corolla tube white or generally purplish, 3-5 fid, style truncate coming out of the corolla tube. Receptacle naked. Achenes produced in large numbers, slightly elongated, finely ribbed, tapering towards the base.

Germination : Seedlings sprout in spring (March-April).

Fl. & Fr. : July-September.

Dissemination : The seeds are disseminated by wind and water.

Habitat : An occasional weed of forests coming into the fields. Indicator of stony and gravelly soils.

Root system : A tufted much branched thick rootstock with some branches going up to 25 cm deep in the soil. The main rootstock possesses many growing buds and remain viable for long time even if all other portions are removed.

Geographical distribution : Temperate Europe, Asia, Thailand and Java.

Specimens examined : *Kaul* RRL 16149 (27-9-1971) Chishma Shahi; *Kaul* RRL 16150 (27-9-1971) Sonamarg Kashmir.

Remarks : This is a complex species, mostly growing in forests. Cytologically it has diploids and hexaploids in nature. There is much variation in height, structure of leaves, flower heads, number of flowers in each head etc. According to Pampanini there is no true *A. vulgaris* in our region and he distributes the specimens referred by Hooker to *A. dubia*, *A. incisa*, *A. elegantissima* etc. while Dr. Jarret at Kew refers them to *A. indica* (Stewart 1972).

Chromosome report : 2n=18, 36, 54 (Bhat, Bakshi & Kaul 1974).

Artemisia vestita Wallich ex DC. Prodr. 6 : 106, 1838; FBI 3 : 326; Rao in **RBSI** 18 (2) : 38, 1960; Stewart 720.

Perennial shrubby herbs. Stem woody below, up to 1 m tall, generally bushy below,

ribbed, narrowly grooved, somewhat hoary and with tomentose branches. Leaves ovate, pinnatisect, segments pectinately pinnatifid, green above and greyish white below, lobes small and obtuse; petiole slightly winged, downy or tomentose. Flower heads in short or long compound racemes, with small pedicels. Involucral bracts 1-2 seriate, obovate to linear, tomentose, margins hairy. Flowers 6-10 in each head, heterogamous; outer ones female and inner bisexual, all fertile producing viable achenes. Achenes 0.5-1.5 mm diam. elongated tapering towards the base, brown or slightly blackish.

Germination : All the seeds produced by the plant are viable and germinate in spring (March-April).

Fl. & Fr. : July-September.

Dissemination : It reproduces vegetatively as well as through seed. The seeds are disseminated by wind and rain water.

Habitat : A rare weed of orchards growing on mounds and dry situations; possessing a gregarious habit. Indicator of dry alluvial and gravelly soils.

Root system : A thick perennial rootstock with branches going up to 25 cm deep in soil.

Geographical distribution : North China, Pakistan, India : Kashmir to Kumaon.

Specimens examined : *Gollan* 9085 (13-10-1889) near Srinagar (DD); *Kaul* RRL 19673 (28-8-1970) Chishma Shahi orchards.

Chromosome report : 2n =18 (Bhat, Bakshi & Kaul, 1974).

Artemisia absinthium L. Sp. Pl. 848, 1753; Aitch. in J. Linn. Soc. 18 : 70, 1880; FBI 3 : 328; Stewart 714.

Perennial herbs. Stem erect up to 70 cm, branched, somewhat tufted near the base, ribbed, narrowly grooved, hoary-pubescent, sometimes even angular. Leaves ovate or obovate, 2-3 pinnatifid, cut into linear lanceolate segments, hairy or downy on both the surfaces; upper cauline leaves much less divided, entire or sometimes pinnatifid. Flower heads subspherical, up to 8 cm diam. pedicel up to 2 cm long, arranged in long panicled branched racemes, yellowish. Involucral bracts 1-2 seriate, upper ones oblong, hoary, scarious; inner ones greyish or white tomentose with membranous margins, persistent. Flowers heterogamous, all fertile; outer ones female and inner bisexual. Achenes elliptic oblong, up to 2 mm long, produced in large numbers, slightly brownish and glabrous. Receptacle rounded, hairy, hairs long and dense, white.

Germination : The seeds germinate readily as they fall on suitable substrate. The seedlings get established in spring (March-April).

Fl. & Fr. : July-September.

Dissemination : Mostly by wind.

Habitat : A common weed of meadows, orchards and maize fields. Indicator of sandy loams.

Root system : The rootstock is tapering and branched, main root goes up to 25 cm deep in soil.

Geographical distribution : Europe. Turkey, Siberia, Armenia, Iran, Caucasus, Afghanistan, India : Kashmir.

Specimens examined : *Meebold* 868 (July, 1905), Sumbal *Lambert* (CAL): 44654 (18-8-1927) Awantipora near Srinagar (DD); *Kaul* 19682 (25-9-1970). Chishma Shahi orchards.

Remarks : A common herb locally used to kill intestinal worms and also used for liver disorders. The leaves possess an acrid principle.

Locally used to protect garments from insects.

Local name : "Tathe vena".

Illustration : Polunin pl. 149.

Chromosome report : 2n=18 (Bhat, Bakshi & Kaul, 1974).

CHRYSANTHEMUM Linnaeus

Key to the species

1. Flower heads up to 5 mm diam., yellow **vulgare**
1. Flower heads up to 2 cm diam., white ligules **parthenium**

Chrysanthemum vulgare (L.) Bernh. Syst. Verz. Erf. 145, 1800; Aitch. in Trans. Linn. Soc. 18 : 69, 1800; Polunin 442.

Tanacetum vulgare L. Sp. Pl. 844, 1753.

Biennial or even perennial herbs. Stem tufted, erect, up to 75 cm, dull green, somewhat tomentose, woolly at the swollen nodes, branched or unbranched. Leaves up to 25 cm long, pinnatisect lobes again divided, sessile or lower ones petiolate, many at a node, alternate, glabrous or minutely pubescent. Flower heads yellow, small, rounded, forming compound corymbose racemes or panicled towards the apices, showy. Involucral bracts 1-2 seriate, small, hairy or glabrous, persistent. Ray florets absent; disc florets forming a definite cupular disc comprising of many small golden yellow flowers. Each disc floret is hermaphrodite, with corolla tube 1.5 mm, ribbed, pappus absent.

Germination : The seeds sprout in spring (March-April).

Fl & Fr. : June-August.

Dissemination : It reproduces vegetatively as well as by seed. The seeds are disseminated by wind,

Habitat : A rare weed of fallow fields and orchards possessing a gregarious habit. Indicator of dry compact alluvials.

Root system : A thick somewhat creeping rootstock binding the plants in soil. The weed is difficult to control once it gets established in soil.

Geographical distribution : A common European plant.

Specimens examined : *Kaul* 52 (3-7-1969) Sanat nagar fallow fields.

Chromosome report : 2n = 18 (DCA 267).

Illustration : Polunin pl. 147.

Chrysanthemum parthenium (L.) Bernh. Syst. veiz. Erf. 145, 1800; Aitch. in J Linn. Soc. 18 : 69, 1800; Kitamura 402; Polunin 443; Stewart 732. **(Fig. 47)**

Matricaria parthenium L. Sp. Pl. 890, 1753.

Perennial branched herbs with a somewhat creeping rootstock. Stem woody below, erect up to 60 cm branched, light green, ribbed, finely tomentose towards the apex. Leaves pinnate up to 8 cm long, with 3-7 oval leaflets, each further divided into narrow, oval, toothed or lobed segments; lower cauline leaves stalked; stalk slender as long as the leaf; upper ones sessile or short-stalked, glabrous or minutely pubescent, aromatic. Flower heads long stalked forming subcorymbose heads. Involucral bracts ovate, 1-2 seriate, downy with membranous margins. Ray florets in a single outer row, ligules

white, 3-5 fid, female, fertile or even sterile. Disc florets many, yellowish compact in the centre, corolla tube 3-5 fid; stamens with linear anthers, style truncate. Achenes whitish, somewhat cuneate, tapering towards the base, glabrous or minutely hispidulous. Receptacle naked.

Germination : Late spring (April-May),

Fl. & Fr. : July-October.

Dissemination : The plant reproduces efficiently through vegetative means. The rootstock spreads underground and sends aerial branches. The seed produced are also viable but take 2-3 years to get established as mature plants and till then are easily removed from the fields.

Habitat : A rare weed of orchards preferring moist situations and of gregarious habit.

Geographical distribution : Europe, Transcaucasia, Caucasus, Turkey, Afghanistan.

Specimens examined : *Kaul* 266 (24-7-1971) Fallow fields near Barzulla; *Kaul* RRL 19706 A (16-9-1971) Majid Bagh Barzulla orchards.

CARPESIUM Linnaeus

Key to the species

1. Heads up to 2.3 cm diam. terminal, solitary and long stalked **cernuum**

1. Heads up to 0.5 cm diam. numerous, axillary; sessile or small stalked **abrotanoides**

Carpesium cernuum L. Sp. Pl. 859, 1753 FBI 3 : 301; Stewart 728.

Annual herbs. Stem erect up to 70 cm. branched, pubescent. Leaves simple, elliptic-lanceolate, obtuse, subsessile, alternate, glabrous or at times pubescent. sinuate toothed. Flowers yellowish in somewhat circular or globular heads, solitary on a long leafy, pubescent, axillary peduncle. Involucral bracts 2-3 seriate, outermost leafy, ovate lanceolate, light green pubescent and persistent; inner ones about half as long as the outer ones, ovate with scarious margins, glabrous, minutely pubescent. Disc florets greenish yellow forming a large circular disc, bisexual; corolla tube small, 5-fid near the apex Achenes elongated brownish, ribbed & glandular.

Germination : The seeds readily germinate in soils rich in humus; sprouting takes place in spring (March-April).

Fl. & Fr. : July-September.

Dissemination : The achenes are produced in large quantities and are glandular and sticky; getting disseminated by birds & irrigation water.

Habitat : A rare weed of orchards. Indicator of organic matter in soils.

Root system : A simple branched tap root; main root going up to 15 cm deep but the branches spread laterally.

Geographical distribution : Himalaya, China and Taiwan.

Specimen examined : Kaul 326 (20-7-1972) Magam orchards, Kashmir.

Carpesium abrotanoides L. Sp. Pl. 860, 1753 : FBI 3 : 301; Collett 260; Rao in BOBSI 2 : 405, 1960; Stewart 727.

Annual or biennial herbs. Stem up to 1 m in height, stout, branched, suberect, slightly pubescent. Leaves simple, lanceolate, narrowed at both ends, up to 21.5 cm x 3 cm, glabrous, subsessile or even sessile, margins

entire or slightly dentate, apex acute or acuminate. Flower heads globular or rounded up to 7 mm long and 5 mm diam, subsessile, racemosely secund on small and leafy branches. Involucral bracts broadly oblong or ovate, up to 5 mm long, many seriate, scarious and papery light green, outer one shorter than the inner ones, persistent. Flowers yellowish, homogamous bisexual, longer than the surrounding bracts. Corolla tube 4-5 fid, stamens with linear syngenesious anthers surrounding a truncate style. Achenes small with flattened surfaces, sticky very light in weight and oily to touch.

Germination : Seeds sprout in late spring (April-May).

Fl. & Fr. : August-October.

Dissemination : The seeds are disseminated by wind and irrigation water.

Habitat : An occasional weed of orchards and vegetable fields. Indicator of fertile sandy loams.

Root system : A simple but thick tap root going up to 20 cm deep in soil in search of water.

Geographical distribution : Europe, Caucasus, Turkey, Iran, India, Vietnam, China, Korea and Japan.

Specimens examined : *Kaul* 88 (9-9-1969) Badgam vegeatble fields; *Kaul* RRL 19705 (16-9-1971) Hypderpora paddy fields.

Remarks : The seeds yield an oil. The flowers were used to dye Kashmir silk but are no longer used for this purpose.

XANTHIUM Linnaeus

Xanthium strumarium L. Sp. Pl. 987. 1753; FBI 3 : 303; Collett 261; Polunin 436; Rao in BOBSI 2 : 405, 1960; Stewart 801.

Annual herbs. Stem erect up to 75 cm, coarse, rough, branched, slightly downy or tomentose. Leaves cordate, up to 5.5 x 3 cm or orbicular, lobed and toothed, petioles downy or tomentose, rough. Flower heads unisexual, monoecious, combined in axillary and terminal clusters. Male heads near the apices, globose up to 1 cm diam. involucral bracts few, short, narrow, in one series; flowers numerous, crowded, each enclosed in a small scale; corolla white or greenish, tubular, 5-toothed; filaments of stamens united and anthers free; ovary and style rudimentary or wanting. Female heads ovoid up to 1.5 cm diam. outer involucral bracts few, short; inner many, narrow, united covered with hooked bristles and terminating in two strong hooked beaks; flowers 2, style branches thread-like, protruding from between the beaks. Achenes obovoid, thick, enclosed in hardened involucral bracts.

Germination : The seeds are hard and germinate in spring (March).

Fl. & Fr. : July-September.

Dissemination : The seeds are disseminated by wind and also animals. The small spines covering the seeds help the dispersal by animals.

Habitat : An occasional weed of vegetable fields along the water channels. Indicator of sandy loams.

Root system : A thick tap root, main root restricted but branches going deep into the soil.

Geographical distribution : Eurasia, N. Africa, Afghanistan, India, Pakistan.

Specimens examined : *Kapoor* 2125 (21-8-1951)Yarikha fields; *Kaul* 324(18-7-1972) Naseem Bagh, Srinagar.

Chromosome report : 2n=36 (DCA 253)

Illustration : Polumin pl. 146.

LACTUCA Linnaeus

Key to the species

1. Flowers yellow; stem leafy, leaves pinnatifid **serriola**
1. Flowers blue or blue-purple; radical leaves forming a rosette **dissecta**

Lactuca serriola L. Cent. Pl. 2 : 29, 1756; Stewart 760.

L. scariola L Sp Pl. 1119, 1763; FBI 3 : 404; Collett 284.

Annual or biennial herbs. Stem 40-75 cm tall, erect, glabrous or slightly hairy or tubercled near the base, hairs small, quite distinct; paniculately branched above, ribbed, dull green. Leaves radical and cauline, former soon falling off and latter ones runcinate pinnatifid with a broad hastate terminal lobe, 3 - 9.5 cm long, coarsely toothed, teeth somewhat hard and spinous; petioles 0.5-1.5 cm, distinctly winged, leaf bases auricled; auricles stem clasping or semiamplexicaule, alternate, crowded and glabrous. Flower heads 0.5 - 1.8 cm. long, slender, on small branched peduncles, 6-10 flowered. Involucral bracts 2-seriate, outer smaller, ovate lanceolate, up to 8 mm long, apex blunt, glabrous or slightly hairy; inner ones up to 1.8 cm, blunt or acute, sometimes glandular, Achenes 3-6 mm long, pointed towards the base and broader at the apex, compressed, ribbed, ribs 5, beak slender capillary, 5-8 mm. (longer than the achene) with silky white pappus.

Germination : seeds sprout in spring (March-April).

Fl. & Fr. : July-August,

Dissemination : The seeds are mostly disseminated by wind and to some extent by insects visiting flowers.

Habitat : An occasional weed of some orchards preferring to grow along canals. Indicator of sandy loams.

Root system : Rootstock is thick and sends branches up to 30 cm deep in soil.

Geographical distribution : West Asia and Europe.

Specimen examined : *Kaul* 229 (7-7-1970) Harwan reservoir.

Chromosome report : 2n=18 (Kaul & Gohil 1973).

Lactuca dissecta D. Don Prod. Fl. Nep. 164, 1825; FBI 3 : 405; Collett 284; Stewart 758.

Annual herbs. Stem erect, very variable in length. 15-50 cm dichotomously branched towards the apices, branches slender, nongreen, somewhat purplish. leafy, glabrous or slightly hairy towards the base; hairs white, simple or branched and spreading. Leaves, radical and cauline, former soon withering; cauline ones entire or pinnatifid, up to 5 cm long, tapering tawards the apax, glabrous, greenish purple, bases auricled and semiamplexicaule; alternate. Flower heads up to 1.5 cm long, narrowly cylindric; peduncles up to 2 cm forming terminal corymbs. involucral bracts 2-seriate or rarely 3-seriate, innermost largest narrowly lanceolate; outer ones ovate and few. Flowers ligulate, pale blue or purplish, 10 - 15 in a head.

Ligule up to 1.5 cm long, minutely 5-fid, style with diverging arms. Achenes oblanceolate, 0.1 - 0.5 cm long, flattened on both sides, distinctly 3-ribbeds; beak slender, nearly twice the length of achene; pappus silky white.

Germination : Seeds germinate in early spring (February-March).

Fl. & Fr. : May-August.

Dissemination : The seeds get disseminated by wind to long distances.

Habitat : A common weed of orchards, maize fields and vegetable fields. Indicator of thick compact sandy or gravelly soils.

Root system : A simple tap root, main root going up to 20 cm deep in the soil.

Geographical distribution : Himalaya, Tibet, Afghanistan, Europe.

Specimens examined : *Kaul* 70 (6-8-1969) Sanat Nagar orchards; *Kaul* 92 (11-9-1969) Pampore vegetable fields; *Kaul* 201 (25-5-1970) Barzulla maize fields.

Chromosome report : 2n=16 (Shetty in Taxon 16 : 569. 1967).

IXERIS Cassini

Ixeris polycephala Cass. in Dict. Sc. Nat. 24 : 50 1822; Stewart 756.

Lactuca polycephala Benth. in Benth. & Hook. f., Gen. Pl. 2 : 526, 1873; FBI 3 : 410; Blatter 2 : 6.

Annual herb. Stem up to 50 cm long, erect, generally unbranched, slender, glabrous. Radical leaves forming a rosette near the base, petiolate. Cauline leaves linear lanceolate, 4.5-11 cm x 0.5-1.0 cm, fine pointed sessile, bases auricled, glabrous. Flower heads elongated up to 1.5 cm long, forming terminal corymbs or panicles. Involucral bracts 2-seriate, outer shorter inner 5-10, linear, persistent. Flowers yellow 8-10 in each head, homogamous. Achenes reddish brown, up to 3 mm long, narrowed into a slender shor tbeak; pappus silk, longer than the achene.

Germination : Early summer (May-June).

Fl. & Fr. : August-October.

Dissemination : Mostly by wind.

Habitat : A rare weed of orchards preferring open situations. Indicator of gravelly soils.

Root system : A tap root going up to 20 cm deep in the soil.

Geographical distribution : Afghanistan, Himalaya : from Kashmir to Sikkim, Upper Burma.

Specimens examined : *Kaul* 353 (8-10-1972) Majid Bagh orchards.

TARAXACUM G.H. Weber

Taraxacum officinale Weber in Wigg. Prim. Fl. Holsat. 56. 1780; FBI 3 : 401; Rao in BOBSI 2 : 406, 1960.

Perennial herbs. Rootstock thick tapering deep into the soil. Leaves oblanceolate or linear, entire, pinnatifid or runcinate, lobes acute, more or less denticulate; sessile, forming a rosette at the ground level, glabrous. Flower heads solitary on long leafless, hollow and glabrous non green scapes. Involucral bracts 1-2 seriate, linear, ovate, often thickened and clawed at the tip, recurving at maturity. Flowers all ligulate, yellow, homogamous. Achenes narrowly obovoid, ribbed; ribs muricate or echinate

suddenly contracted into a very slender beak, equalling or exceeding the body, pappus white forming a typical parachute.

Germination : seeds are produced in large numbers and readily germinate on suitable moist substrata. Majority of seeds sprout in early March and October depending upon the temperature conditions. The optimum temperature required for germination is 15-20° C.

Fl. & Fr. : May-June or sometimes in November.

Dissemination : The seeds are primarily disseminated by wind and to some extent by animals including man. Indicator of clay loams.

Root system : A simple tap root generally unbranched going up to 20 cm deep in the soil.

Geographical distribution : Temperate and cold regions of north and south hemisphere.

Specimens examined : *Kaul* RRL 5939 (12-3-1969) Barzulla orchards.

Local name : "Hundh".

Ramarks : It is a highly variable weed. The plant is used locally as vegetable. It is supposed to contain iron and is given to ladies after child birth, generally mixed with *Centaurea iberica* another common weed.

Illustration : Polunin pl. 159.

CREPIS Linnaeus

Key to the species

1. Small herbs, stem decumbent, hairy or glandular **thomsoni**

1. Taller herbs; stem erect, pubescent near the base. **sancta**

Crepis thomsoni Babcock in J. Bot. Lond. 76 : 208. 1938 & Univ. Calif. Publ. Bot. 22 (2) : 713, 1947; Stewart 744.

Crepis foetida auct. non L., (1753) : FBI 3 : 393.

Annual or biennial herbs. Stem decumbent or even prostrate, up to 25 cm long branched, hairy, glandular, stout towards the base and slightly angular towards apices, Radical leaves linear, obovate, up to 7.5 x 1.5 cm sessile to subsessile, deeplv dentate or even pinnatifid, tomentose or hairy; cauline leaves up to 5.5 cm x 1.5 cm, sessile or stem clasping, sometimes auricled, deeply dentate, margins glandular hairy, surfaces greyish. Flower heads on long axillary peduncles, solitary or somewhat paniculate. Involucral bracts 3-4 seriate ; outer ones smaller inner ones up to 1.2 cm long, margins hispid or glandular hairy, persistent. Flowers homogamous, all ligulate; ligules 3-5 fid; stamens with linear tailed anthers. Achenes linear, silvery, tapering in to a beak; beak slender nearly as long as the achene; pappus silvery white as long or even longer than the achene. Receptacle naked.

Germination : Early spring (March).

Fl. & Fr. : July-August.

Dissemination : The seeds get disseminated by wind.

Habitat : A rare weed of orchards and grasslands. Indicator of alluvial soils.

Root system : A simple branched tap root system.

Geographical distribution : Atlantic, Afghanistan, Western Himalaya.

Specimens examined : *Kaul* 228 (4-7-1970) Rawalpora orchards, Srinagar.

Chromosome report : 2n=10 (Babcock 1947).

Crepis sancta (L.) Babcock ssp. **bifida** (Vis.) Thell ex Babcock in Univ. Calif. Publ. Bot. 22 : 731, 1947; Stewart 740. (**Fig. 48**)

Pterotheca falconeri Hook. f., FBI 3 : 399, 1881.

Annual herbs. Stem up to 50 cm tall, 1-many from the base, mostly erect sometimes semi-decumbent, slender and corymbosely or paniculately branched above, hairy towards the base, branches spreading usually nodding. Leaves all radical forming a rosette at the base, petioled; petiole winged; 2.0-12.5 cm long (including petiole) pinnatisect with apical lobe largest, hairy hairiness more on midrib and petiole, margins toothed. Flowers in linear long capitula up to 2.5 cm long when mature, all ligulate and yellow. Involucral bracts 2-3 seriate, outer bracts small, oval, apiculate, few, tips blackened, slightly hairy; inner ones up to 2 cm long, narrowly lanceolate, margins membranous, slightly hairy, recurving or spreading apart at maturity persistent. Ligules of flowers come out of involucral bracts, spreading and entire, anthers syngenesious and sagittate, style simple brownish with two diverging arms near the apex. Achenes slender narrowed at both ends; pappus white, silky, branched.

Germination : The seeds readily germinate as they fall on suitable substrata. The seedlings can be seen in early spring (Feb.-March).

Fl. & Fr. : The weeds flower twice a year; in spring (March-April) and in late autumn.

Dissemination : The seeds are mainly disseminated by wind and to some extent by water.

Habitat : A common weed of orchards, grasslands, vegetable fields, wheat fields, and also fallow lands. Indicator of clay loams.

Root system : A simple branched tap root.

Geographical distribution : Balkan States, Aegean archipelago, Southern Russia, Transcaucasia, Syria, Arabia, Pakistan, Afghanistan, Turkestan and North West Himalaya.

Specimens examined : *Kaul* 112 (5-12-1969) Rawalpora orchards; *Kaul* 164 (3-5-1970) Naseem Bagh orchards; *Kaul* RRL 19693 (15-5-1971) Barzulla wheat fields.

Chromosome report : 2n=10 (Babcock, 1947 & confirmed Kaul, 1970).

YOUNGIA Cassini

Youngia japonica (L.) DC. Prodr. 7 : 194, 1938; Babcock et Stebbins in Carnegie Inst. Wash. Publ. No : 484, 95, 1937; Kitamura in Act. Phytotax. Geobot. 11 : 129, 1942; Stewart 801.

Prenanthes japonica L. Mant. 107, 1767.

Crepis japonica Benth. in Fl. Hongk. 194, 1861; FBI 3 : 395.

Annual or biennial herbs. Stem erect up to 50 cm, branched, many stems arising from the base, minutely pubescent towards the base and glabrous upwards, juice milky. Radical leaves obovate, 9-19.5 cm long, sinuate toothed or runcinate, pinnatifid, petiole small, winged and pubescent; forming a rosette at the base. Cauline leaves few, smaller, pinnatifid with apical lobe largest, alternate, sessile. Inflorescence panicled or corymbose towards the ends of the branches. Flower heads small, with a long or small stalk. Involucral bracts

simple, linear to obovate, 1-seriate, glabrous or minutely hairy with a distinct midrib and hyaline margins, persistent. Flowers 8-16 in a head, yellow, ligulate, homogamous, bisexual. Achenes brown, elongated, tapering at both ends, slightly flattened, ribs minute sometimes echinate; pappus much dense, as long as the achene, white.

Germination : Early spring (February-March).

Fl. & Fr. : May-July.

Dissemination : The seeds are mainly disseminated by wind.

Habitat : An occasional weed of orchards and wheat fields preferring moist situations. Indicator of sandy loams.

Root system : A meagrely developed branched tap root.

Geographical distribution : Malaya Peninsula, China, Japan, Afghanistan, Mauritius, Polynesia, Nova-Guinea, Philippines, Vietnam, Thailand and India.

Specimens examined : *Kaul* 197 (22-5-1970) Vowosa orchards, Srinagar.

Chromosome report : 2n=16 (Babcock 1937).

SONCHUS Linnaeus

Key to the species

1. Leeves deeply toothed; teeth long, unequal and spinous. **asper**
1. Leaves toothed; teeth nearly equal, never spinous.
   2. Stem leaves with acute hasal lobes. **oleraceus**
   2. Stem leaves with rounded basa lobes. **wightianus**

Sonchus asper (L.) Hill. Herb. Brit 1 : 47, 1756; FBI 3 : 414; Collett 287; Jeffrey in Kew Bull. 18 : 481, 1966; Stewart 784. **(Fig. 49)**

Sonchus oleraceus var. asper L. Sp. Pl. 794, 1753.

Annual herbs. Stem erect, weak, fistular, branched or unbranched, glabrous or sparsely glandular towards the apices of the branches, light green. Leaves lanceolate or pinnatifid, upto 15.0 x 6.0 cm, margins toothed, teeth numerous, long, unequal, divergent, spinous; half-amplexicaule, basal lobes recurved, rounded or slightly obtuse, glabrous. Flower heads generally in terminal umbels or rarely panicled, yellowish. Involucral bracts many, ovoid to obovoid, many seriate, overlapping with outer ones smaller, glandular. Flowers homogamous, bisexual; corolla tube 5-fid; stamens with syngenesious long anthers. Achenes many, brownish, tapering towards the base, flattened, faces 3-ribbed, muricate between the ribs; pappus white, silky, profuse. Receptacle naked.

Germination : Seeds remain dormant for at least nine months and sprout in early autumn, (August-September).

Fl. & Fr. : October-December.

Dissemination : The seeds are mainly disseminated by wind and to some extent by water.

Habitat : A common weed of orchards of Srinagar preferring moist situations. Indicator of fertile well aerated sandy loams.

Root system : A deep tap root with branches in the surface horizons of the soil.

Geographical distribution : A cosmopolitan weed.

Specimens examined : *Kaul* 100 (12-10-1969) Chattabal vegetable fields; *Kaul* 102 28-10-1969) Barzulla orchards.

Chromosome report : 2n=18 (DCA 248).

Sonchus oleraceus L. Sp Pl. 764, 1753; FBI 3 : 414; Collett 287; Singh in BOBSI 2 : 356, 1960; Stewart 785.

This species differs from the preceding species in possessing larger leaves, amplexicaule with basal lobes completely surrounding the stem and somewhat acute, spines of leaves prickly, termir a' lobes largest and lateral lobes small, pointing downwards.

Remarks : This weed is more dangerous as compared to the preceding species because of its prolific growth and more seeds out-put. The roots are also more stout and go deeper in the soil.

Geographical distribution : A cosmopolitan weed.

Specimens examined : Kaul RRL 5958 (8-4-1969) Majid Bagh, orchards; *Kaul* 109 (30-11-1969) Barzulla orchards.

Sonchus wightianus DC. Prodr. 7 : 187, 1838; Boulos in Bot. Notis. 126 : 186, f. 22, 1973.

Sonchus arvensis auct. non L., (1753); FBI 3 : 414; Collett 288.

Annual herbs with a creeping rootstock, juice milky, Stem erect, leafy, fistular, glabrous, ribbed or finely grooved, purplish green. Leaves mostly radical, pinnatifid, spinous-toothed, teeth small; cauline ones semiamplexicaule with appressed rounded auricles, upper cauline leaves linear lanceolate, narrowing towards the apex, glabrous, mid-vein distinct on under surface. Flower heads terminal, irregularly sub-corymbose, umbellate or sometimes panicled, peduncles up to 5 cm long, glabrous. Involucral bracts many seriate, outer ones smaller, ovate and inner ones lanceolate, 1-2 cm long, turning back at maturity. Achenes narrow, sub-compressed with 2-3 thick ribs on each side; pappus white, silky and profuse.

Habitat : An occasional weed of orchards prefering moist situations. Indicator of sandy loams.

Geographical distribution : A cosmopolitan weed.

Specimens examined : *Kaul* 110 (1-2-1969) RRL Campus, Srinagar; *Kaul* 213-214 (22-6-1970) Rawalpora orchards.

Remarks : It is similar to other species of *Sonchus* so far as the germination and period of flowering is concerned. Locally the weed is called "Dadhege" and is fed to cattle only after drying, since It oozes latex in fresh state. Boulos (1973) points out that the commonly known *S. arvensis* L. in Eastern Asia should be correctly called *S. wightianus* DC. True *S. arvensis* is restricted mainly to Europe and N. America.

Chromosome report : 2n=64 (DCA 248).

CICHORIUM Linnaeus

Cichorium intybus L. Sp. Pl. 814, 1753; FBI 3 : 391; Collett 279; Singh in BOBSI 2 : 355, 1960; Stewart 732.

Perennial herbs. Stem erect up to 65 cm, rough, woody at the base and more or less glandular, angled and grooved, branches spreading. Radical leaves up to 11.5 cm long, lanceolate, pinnatifid, lobes toothed, pointing downwards; cauline leaves alternate pinnatifid with long entire apical lobes, glabrous or slightly glandular pubescent. Flower heads sky-blue, showy, terminal and solitary or axillary and clustered, sessile or on short

thick stalks. Involucral bracts 1-2 seriate, outer smaller ones a few, inner 6-10, leafy. Ray florets only present; ligules long spreading, 5-toothed, style arms long and recurving. Achenes smooth, angled, crowned with a ring of pappus scales or palae.

Germination : Seeds sprout in spring, (March-April).

Fl. & Fr. : June-August.

Dissemination : The seeds are disseminated by animals and man during ploughing etc.

Habitat : A common weed of orchards, margins of paddy fields and some grasslands preferring moist sltuations. Indicator of compact moist hard soils.

Root system : A thick tap root perennating the unfavourable season; the main root enters up to 25 cm into the soil.

Geographical distribution : Europe. Iran, Afghanistan, Pakistan, India : Kumaon to Kashmir.

Specimens examined : *Kaul* RRL 19611 (20-7-1969) Barzulla orchards; *Kaul* 283 (4-8-1971) Hyderpora, paddy field margins.

Remarks : This plant is cultivated in Gujarat and southern parts of India but in Kashmir it is seen to grow wild.

Illustration : Polunin pl. 158.

Chromosome report : 2n=18 (DCA 250).

GARHADIOLUS Jaubert ex Spach

Garhadiolus minutissimus (Bunge) Kitamura in Acta Phytotax. Geobot. 17 : 35, 1957 & in Fl. Afghanistan 423, 1960; Stewart 747. **(Fig. 50)**

Hedypnois minutissima Bunge in Mem. Sav. Etrang. 7 : 372, 1847.

Rhagadiolus hedypnois Fischer et. Mey. Index. Sem. Horti. Petrop. 4 : 48, 1837. non All. 1785; FBI 3 : 392.

Annual herbs. Stem spreading from the base, branches arising from the root and diverging, 5-15 cm long, glabrous or hairy below, slender and weak. Leaves simple, mostly radical, petiolate, 0.8-4.8 cm long including petiole. broader at the apex and tapering towords the base, margins toothed, glabrous; stem leaves small and sessile, oblong to obovate. Flowers yellow all ligulate in heads up to 1 cm diam. Involucral bracts narrow, glabrous, persistent in fruit. Achenes 6-12, slightly exceeding the bracts, tips incurved; pappus of some small hairs, minute, white.

Germination : Early spring (February-March).

Fl. & Fr. : April-July.

Dissemination : The seeds are mainly disseminated by irrigation water and animals. Wind also helps to disperse the seed to some extent.

Habitat : An occasional weed of orchards and wheat fields. Indicator of well aerated clay loams.

Root system : A tap root with branches in the surface horizons of the soil.

Geographical distribution : Turkey , Caucasus, Syria, Iraq, Iran, Afghanistan and Pakistan.

Specimens examined : *Kaul* 46 (3-6-1969) RRL campus, Srinagar; *Kaul* 158 (22-4-1970) Pampore orchards; *Kaul* RRL 16049 (11-6-1971) RRL campus.

Chromosome report : 2n=10 (Bhat, Bakshi & Kaul, 1972).

KOELPINIA Pallas

Koelpinia linearis Pall. Reise, 3 : 755, 1776; FBI 3 : 392; Blatter 2 : 7; Stewart 757.

Annual herbs. Stem decumbent ar suberect, 15-25 cm long, branched from the base, slender, glabrous or slightly pubescent. Leaves radical and cauline, simple, linear lanceolate, gradually narrowed at both the ends, 5-15.5 cm x 0.3-0.7 cm, margins entire, slightly pubescent. Flower heads small, yellow, carried on a slender up to 5 cm long pedicel. Involucral bracts 3-7, linear; outer 1-3, 0.8-1.5 cm long. Achenes curved inwards to form a birds claw, longer than the bracts, slightly hairy, dorsal ribs with 2 rows of purplish spines.

Germination : Spring (March).

Fl. & Fr. : May-June.

Dissemination : The achenes cling to the animals or even man while passing through the fields and therby get disseminated.

Habitat : A rare weed of wheat fields with a gregarious habitat. Dry sandy to silty clay loams.

Root system : An unbranched tap root goes up to 12 cm deep in the soil,

Geographical distribution : N. Africa, S, Russia, Siberia, Afghanistan, N. Himalaya-Tibet.

Sepecimens examined : *Kaul* 356 (24-5-1973) Badgam wheat fields.

Illustration : Blatter pl. 35, t. 2,

TRAGOPOGON Linnaeus

Tragopogon dubius Scop., Fl. Carn. ed. 2, 2 : 95, 1772; Stewart 797.

Tragopogon pratense auct. non L.. 1753; FBI 3 : 418; Blatter 2 : 8; Rao in BOBSI 2 : 407, 1960.

Annual or biennial herbs. Stem up to 50 cm in height, erect, branched, leafy, glabrous, bluish green, with milky juice. Leaves linear lanceolate, gradually narrowing into a long point from a broad sheathing base, waxy, glabrous, but full of milky latex. Flower heads yellow, on hardy thickened peduncles towards the apices of the branches. Involucral bracts 6-8, linear, broader at base and tapering towards the apex, more or less glandular, at times even longer than the flowers. Ray florets with long spreading ligules, 3-5 fid coming out of the bracts; styles with diverging arms at the apex. Achenes up to 2.5 cm long tapering into an equally long or somewhat shorter beak, ribbed with muricated margins. Pappus long, feathery, connate at the base into a circular ring.

Germination : The seeds sprout in early spring (Feb.-March).

Fl. & Fr. : May-July.

Dissemination : The seeds are disseminated mainly by wind.

Habitat : A common weed of branches and grasslands forming small tufts and preferring moist situations. Indicator of moist sandy loams.

Root system : A deep and thick tap root, perennating during the unfavourable seasons.

Geographical distribution : Western Himalaya, Western Tibet and Europe.

Specimens examined : *Kaul* RRL 5535 (22-5-1969) RRL campus fields, Srinagar.

Remarks : The milky juice or the latex exuding from all parts of plant after injury, is used locally to heal wounds or blisters.

Chromosome report : The chromosome number of this plant is reported to be 2n=12 (*vide* Darlington & Wylie, 1955). I have found the Kashmir plants to be a natural tetraploid having 2n=24.

CAMPANULACEAE

CAMPANULA Linnaeus

Campanula colorata Wall. in Roxb. Fl. Ind. 98, 1824; FBI 3 : 440; Collett 291; Blatter 2 : 13; Sabnis in J. Bombay Nat. Hist. Soc. 42(2) : 376, 1942; Stewart 708.

Annual herbs. Stem erect 35 cm or even suberect, branched or rarely unbranched, roughly hairy or tomentose. Leaves simple, ovate to obovate, or broadly lanceolate, up to 4.5 cm x 1.5 cm sessile, alternate, hairy, crenate or toothed, apex acuminate to obtuse. Flowers pale liliac or even white in clusters or panicles, pedicels smaller than the leaves. Calyx-teeth 5, lanceolate or somewhat triangular, spreading up to 7 mm long, entire or even toothed. tube cupular persistent. Corolla 5-lobed, lobes ovate, short divided up to the middle, shorter than the calyx-teeth, hairy outside. Fruit a capsule up to 7 mm diam. obconic, inferior enclosed in the calyx-tube. Seeds ellipsoid, very small, pale yellow.

Germination : Spring (March-April).

Fl. & Fr. : June-August.

Dissemination : The seeds get disseminated by ploughing and other soil operations and also by water.

Habitat : A rare weed of vegetable fields. Indicator of sandy loams.

Root system : A simple branched tap root.

Geographical distribution : Afghanistan, India : Kashmir to Kumaon.

Specimens examined : *Meebold* 573 (June, 1905) Baramulla (CAL); *Kaul* RRL 1973 (26-7-1972) Majid Bagh, vegetable fields.

Illustration : Collett f. 87.

PRIMULACEAE

Key to the genera

1. Flowers in heads, umbels or whorls. Corolla tube shorter than the calyx. **Androsace**

1. Flowers in axillary racemes. Corolla lobes equal or even longer than the calyx. **Anagallis**

ANDROSACE Linnaeus

Androsace rotundifolia Hardw. in As. Res. 4 : 350, 1799; FBI 3 : 496; Collett 300; Stewart 534. **(Fig. 51)**

Perennial or biennial tufted herbs without any definite stem. Leaves mostly radical, rounded to cordate, lobulate; lobes 5-7 and each 3-crenate, densely hairy; petiolate; petiole slender up to 6 cm long or more hairy with spreading white hairs. Scapes many from the base, erect but slender, up to 15 cm long, leafless. Flowers umbellate, 8-15 in an umbel; with a 3-5 crenate, hairy leafy involucral bract. Each flower is pedicellate; pedicel up to 3 cm long, hairy; pinkish with white centre. Calyx 5-lobed, lobes oval with acute tip, divided nearly up to the base, glabrous or hairy when young, persistent. Corolla lobes notched in the middle, nearly as long as calyx lobes or shorter, tube very short. Stamens 5, sessile inside the corolla tube, anthers linear, filaments small. Ovary with a small style, stigma cupular, somewhat 5-fid. Capsule much shorter than the calyx lobes,

glabrous included in small depression. Seeds minute, rounded, brick red and granulate.

Germination : Early spring (February-March).

Fl. & Fr. : May-July.

Dissemintion : The seeds get contaminated with flower seeds of horticultural importance and also get disseminated by wind.

Habitat : A rare weed of some parks and gardens of public interest. Indicator of well aerated loams.

Root system : A simple but branched tap root.

Geographical distribution : Temperate Himalaya and Western Tibet.

Specimens examined : *Kaul* 196 (22-5-1970) Hoakersar parks, Srinagar.

ANAGALLIS Linnaeus

Anagallis arvensis L. Sp. Pl. 148, 1753; FBI 3 : 506; 1881; Collett 302; Kunth. in Engler, Pflanzenreich 22 : 322, 1905; Rao in RBSI 18(2) : 43, 1960; Stewart 532.

(Fig. 52)

Glabrous annual herbs. Stem generally decumbent with many branches, up to 42 cm arising from the base, slender, 4-angled, gland dotted, dots black and small. Leaves broadly ovate up to 3 cm, generally lesser in diameter, acute, entire, sessile, opposite, glabrous and black dotted. Flowers generally deep crimson, small, solitary axillary, on slender and long pedicels, showy, closing in dull weathers. Calyx 5-parted, rotate, up to 5 mm diam , lobes obovate entire or slightly wavy at the apex, twisted in the bud. Stamens 5, inserted at the base of the corolla, filaments hairy. Ovary globose with a slender style, stigma terminal and simple Capsule small, globose, 5-striped from outside, opening by circular fissure round the middle. Seeds many, small, somewhat, convex, brick-red.

Germination : Seeds remain dormant under snow and sprout as the snow starts melting from the fields in early spring (Feb.-March).

Fl. & Fr. : April-June.

Dissemination : The seeds are disseminated by man during crop harvesting and some agricultural operations.

Habitat : A common weed of wheat fields, pea fields, orchards, and sometimes fallow lands, preferring open situations. Indicator of well aerated sandy loams.

Root system : A branched tap root with branches restricted in the surface horizons of the soil.

Geographical distribution : Europe, West Asia. Introduced to many temperate regions.

Specimens examined : *Kaul* RRL 5937 (12-3-1969) RRL campus in *Pyrthrum* plantation; *Kaul* RRL 5594 (27-7-1970) Barzulla orchards.

Local name : "Chari saben".

Chromosome report : 2n=40 (DCA 280).

GENTIANACEAE

Key to the genera

1. Terrestrial herbs; leaves opposite rarely alternate :
   2. Corolla tube shorter than the lobes, lobes glandular near the base **Swertia**
   2. Corolla tube longer than the lobes, lobes spreading never glandular :

3. Flowers irregular, stigmas 2 — **Canscora**
3. Flowers regular panicled or terminal subcapitate — **Centaurium**

1. Aquatic or marshy herbs; leaves radical or alternate :
4. Leaves 3-foliolate — **Menyanthes**
4. Leaves simple, cauline deeply cordate — **Nymphoides**

SWERTIA Linnaeus

Swertia paniculata Wallich Pl. As. Rar. 3 : 3. t. 205, 1831; FBI 4 : 122; Collett 326; Blatter 2 : 47.

Annual herbs. Stem up to 65 cm, erect, terete, light green or even nongreen, somewhat lignified at the base, branches slender and axillary, glabrous, finely grooved. Leaves oblong to lanceolate, 3-7.5 cm x 1.2 cm opposite, sessile, margins wavy, apex obtuse, glabrous, with 1-3 distinct veins. Flowers whitish with purple spots at the base, axillary in corymbose cymes. Sepals 5, linear to oblong, up to 6 mm long, glabrous, caducous or at times persistent. Petals 5, oblong, obtuse, slightly longer than sepals. Stamens as many as corolla lobes, filaments linear, arising from the glandular base of the petals, anthers oblong. Ovary obovoid with a linear long style, stigma 2-fid with unequal arms. Capsule elliptic or obovate, smooth. Seeds globose, smooth, light yellow.

Germination : Spring (March-April).

Fl. & Fr. : June-August.

Dissemination : Seeds are disseminated by water & wind.

Habitat : A rare weed of some orchards growing by the side of water channels. Indicator of moist compact gravelly soils.

Root system : A much branched tap root going up to 18 cm deep in the soil.

Geographical distribution : Temperate west Himalaya.

Specimens examined : *Kaul* 61 (15-7-1969 Shalimar gardens; *Kaul* 325 (19-7-1972) Naseem Bagh orchards. **(Fig. 53)**

CANSCORA Lamarck

Canscora decussata Roem & Shultes, Syst. Veg. Mant. 1 : 229, 1822; FBI 4 : 104; Collett 323.

Annual herbs. Stem up to 15 cm long, dichotomously branched, glabrous, quadrangular, slightly grooved or winged, leafy. Leaves opposite, oblanceolate, simple, 0.5-2.5 cm long, glabrous, margins entire, apex acuminate, 1-nerved. Flowers in cymes, white, pedicel small or even absent. Calyx 4-toothed teeth linear, somewhat adnate to the corolla tube, glabrous. Corolla tube up to 2 cm long with 4-5 ovate or obovate spreading lobes, closing in darkness. Stamens 4, generally 1 or 2 perfect, others sterile; filaments arising from the corolla tube. Seeds small, slightly brownish, many.

Germination : Early spring (Feb.-March).

Fl. & Fr. : May-June.

Dissemiaation : The seeds get disseminated by wind & water.

Habitat : An occasional weed of lawns and wheat fields. Indicator of sandy loams.

Root system : A meagrely developed tap root with branches restricted to the surface layers of soil.

Geographical distribution : Madagascar, Tropical Africa, Himalaya to Burma and southwards to Sri Lanka.

Specimens examined : *Kaul* 53 (3-7-1969) Lawns of Barzulla; *Kaul* 182 (12-5-1970) RRL lawns, Srinagar.

CENTAURIUM J. Hill

Centaurium pulchellum (Sw.) Druce, Fl. Oxf. 342, 1897; Stewart 552.

Gentiana pulchella Sw. in Vet. Acad. Handl. Stock. 84, t. 3, 1783.

Erythraea ramosissima Pers. var. *pulchella* C.B. Clarke in J. Linn. Soc. 14 : 428, 1875 and in FBI 4 : 101, 1883.

Annual herbs. Stem erect up to 25 cm, generally quadrangular and winged, dichotomously, branched, glabrous. Leaves oblong, to elliptic oblong, up to 3.5 cm x 1.1 cm sessile, bases stem-clasping, acute, margins entire, glabrous. Flowers in corymbose cymes, rosy. Calyx 5, teeth linear, winged, persistent. Corolla tube slightly longer than the calyx; lobes 5, spreading, ovate to obovate, acute closing in darkness. Stamens 5 with small filaments, arising from base of the corolla lobes. Ovary 1-celled with 2 oblong stigmas.

Germination : Early spring (Late Feb.-March).

Fl. & Fr. : May-July.

Dissemination : The seeds get disseminated by rain water and wind.

Habitat : A rare weed of wheat fields. Indicator of well aerated loams.

Root system : A meagrely developed tap root.

Geographical distribution : Central and West Asia.

Specimens examined : *Clarke* 29134/c (16-7-1876) Syedpore, Kashmir (CAL); *Kaul* 182 A (12-5-1970) Mansbal wheat fields.

MENYANTHES Linnaeus

Menyanthes trifoliata L. Sp. Pl. 145, 1753; FBI 4 : 130; Rao in BOBSI 2 : 408, 1960; Polunin 318; Stewart 563.

Stem creeping and rooting at nodes, up to 35 cm long, slender, fistular, glabrous, unbranched or rarely branched, upper portions covered by lax sheathing of petioles. Leaves 3-foliolate, petiole up to 10 cm long with broad and sheathing bases; leaflets subsessile or even sessile, oblong or obovate, up to 8.5 cm x 4.9 cm, margins entire, apex obtuse. Flowers on long leafless scapes, arranged in racemes towards the apical portion, pinkish white. Sepals 5, up to 5 mm long; petals 5 with acute spreading lobes having white hairy growth on upper surface, longer than the sepals. Ovary 1-celled with a slender style. Capsule globose sometimes deeply 2-fid. Seeds many.

Germination : The weeds spread vegetatively as well as through seed and seedlings are seen in early spring (March).

Fl. & Fr. : June-July.

Dissemination : Mainly by water.

Habitat : An occasional weed of marshes and some floating islands of lakes. Indicator of acidic compact marshes.

Root system : A creeping rootstock with bunches of adventitious roots at nodes, binding the plants.

Geographical distribution : Europe, North Asia, N. America, Caucasus, Amurland and Japan.

Specimens examined : ***Kaul*** 204 (1-6-1970) Hoakersar; *Kaul* 327 (24-7-1972) Hoakersar floating islands.

Chromosome report ; 2 n=54 (DCA 276).

Illustration : Polunin pl. 98.

NYMPHOIDES J. Hill

Nymphoides peltatum (Gmel.) Kuntze, Rev. Gen. 429, 1891; Rao in BOBSI 2 : 408, 1960; Polunin 318; Stewart 563.

Limnanthemum peltatum Gmel. in Nov. Comm. Acad. Petrop. 14 : 527, 1770.

Limnanthemum nymphaeoides (L.) Link ex Clarke in FBI 4:131, 1883: Blatter 2 : 49.

Menyanthes nymphaeoides L. Sp. Pl. 145, 1753.

Aquatic perennial herbs. Stem up to 2 cm long, creeping, floating, rooting at nodes, fistular or solid, fast green, sometimes mucilaginous by growth of algal flora on it. Leaves rounded or cordate, up to 5.5 cm diam., stalked, subalternate, glabrous, margins entire, surfaces thick. Flowers in axillary umbels, yellow, pedicels up to 7.5 cm long. Sepals 5, green or light yellow, up to 1.3 x 0.2 cm. Petals rotate, deeply 4-5 fid, tube sparingly ciliate inside forming sort of guiding ridges for the insects. Stamens as many as corolla lobes, epipetalous, anthers versatile. Capsule up to 2 cm long ellipsoid, sharp pointed, glabrous, 1-celled. Seeds many, winged.

Germination : The stoloniferous rootstock remains dormant in mud and sprouts in spring (April or May) when the fields are irrigated. The seeds are produced in fruits above the surface of water and germinate in spring.

Fl. & Fr. : June - July.

Dissemination : By irrigation water.

Habitat : A common weed of a few paddy fields growing in shallow water only. The plants die as the water dries up or is removed from the fields. The rootstock remains dormant under mud. Indicator of shallow waters and muddy soils.

Root system : A stoloniferous rootstock growing at a fast rate and producing long adventitious roots which bind the plants in mud.

Geographical distribution : West and Central Europe to China.

Specimens examined : *Kaul* 217 (22-6-1970) Badgam Paddy fields; *Kaul* RRL 16069 (15-7-1971) Chattabal paddy fields; *Kaul* RRL 19796 (28-8-1972) Hyderpora paddy fields.

Local nome "Khor"

Remarks : A fodder crop, relished by horses.

Chromosome report : 2n=54 (DCA 276).

HYDROPHYLLACEAE

PHACELIA A.L. Jussieu

Phacelia tanacetifolia Benth. in Trans. Linn. Soc. 17 : 280, 1737; Munz & Keck in Fl. Californica 529-30, 1959; Kaul in J. Bombay Nat. Hist. Soc. 69 (1) : 229, 1972. **(Fig. 54)**

Annual herb. Stem up to 75 cm erect, somewhat woody towards the base, bran-

ched, slightly greenish purple, grooved, silky pubescent especially towards the apices of the branches. Leaves 9-19.5 cm long, 2-pinnatisect, lobes up to 5 mm long, ovate lanceolate; alternate, exstipulate, lower petiolate; petiole 1.0-2.5 cm long, pulvinate, slightly silky pubescent; upper sessile, rachis more pubescent. Flowers in long scorpioid, compact cymes, initially looking like small heads, 25-40 in each cyme; ebracteate, subsessile to sessile, peduncle hairy. Sepals 5, 0.3-0.7 cm long, linear to obovate, acute, sparsely hairy; hairs white; green, persistent. Petals 5, up to 1 cm long, united at the base but free above the middle, broadly campanulate, lobes ovate, purplish, distinctly veined. Stamens 5, filaments filiform as long as the styles of the ovary, glabrous, arising from the base of the corolla tube; anthers globular, dorsifixed, dehiscing early. Ovary on a hairy receptacle, superior, slightly pubescent, pointed towards the apex, 2-celled with 1-2 ovules in each cell. Styles 2, up to 1.3 cm long, hairy up to the middle divergent, saffron-coloured. Seeds usually 2, greyish-brown.

Geographical distribution : Indigenous in California, U.S.A.

Specimen examined : *Kaul* 26 (1-5-1969) Barzulla Lab. campus.

BORAGINACEAE

Key to the genera

1.	Mouth of corolla tube with scales. Style simple and bifid arising from between the ovary lobes :		
	2.	Nutlets bristly or glochidiate :	
		3. Nutlets with bases produced downwards and slightly bristly	**Cynoglossum**
		3. Nutlets connate forming a pyramidal fruit and slightly glochidiate	**Heterocaryum**
2.	Nutlets never bristly, at times glochidiate :		
	4.	Nutlets attached to a somewhat conical receptacle :	
		5. Flowers axillary, subsessile, fruiting calyx enlarged	**Asperugo**
		5. Flowers axillary, pedicellate; fruiting calyx simple	**Bothriospermum**
	4.	Nutlets attached to flat or nearly flat receptacle :	
		6. Corolla tube curved; nutlets somewhat rounded	**Anchusa**
		6. Corolla tube never curved; nutlets ovoid to oblong	**Myosotis**
1.	Mouth or corolla tube without scales. Style terminal on the entire ovary		**Heliotropium**
1.	Mouth of corolla tube naked or with small scales. Style never terminal		**Lithospermum**

CYNOGLOSSUM Linnaeus

Key to the species

1.	Stem minutely hairy, hairs simple. Racemes much longer	**lanceolatum**
1.	Stem profusely hairy, hairs springing from tubercles. Racemes very small	**glochidiatum**

Cynoglossum lanceolatum Forsk. Fl. Aegypt. Arab. 41, 1775; Stewart 584.

Cynoglossum micranthum Desf. Bat. Hort. Par. 220, 1804; FBI 4 : 156.

Annual or biennial herbs. Stem up to 75 cm tall, somewhat woody at the base, branched, hirsute or sometimes finely tomentose, somewhat rough and dull green. Radical leaves soon withering off; cauline ones lanceolate, acute at both ends, up to 6.5 cm x 1.5 cm, crenate, densely hirsute, sessile. Flowers in long one-sided, divaricately forked racemes, bluish. Each flower is small up to 5 mm diam. with a small or even no pedicel. Calyx lobes up to 3 mm long, obtuse, persistent. Corolla tube as long or longer than the calyx lobes. throat with dark blue-black rounded scales. Ovary 4-celled, style up to 2 mm long arising from the base. Nutlets 4, all over covered with small spiny structures.

Germination : Late spring or early summer (May-June).

Fl. & Fr. : August - October.

Dissemination : The seeds are disseminated by animals and birds.

Habitat : An occasional weed of orchards and vegetable fields. Indicator of fertile well aerated gravelly soils.

Root system : A branched tap root, the main root goes up to 25 cm in the soil.

Geographical distribution : Temperate Himalaya.

Specimens examined : *Meebold* 4191 (June, 1905) Baramulla, Kashmir (CAL); *Kaul* RRL 5552 (25-7-1969) Rawalpora orchards; *Kaul* RRL 19716 (26-9-1971) Chishma Shahi orchards; *Kaul* RRL 19723 (29-9-1971) Majid Bagh, paddy fields (Crop harvested).

Cynoglossum glochidiatum Wallich ex Benth. in Royle Ill. Him. Mount. 306, 1836; FBI 4 : 157; Blatter 2 : 50; Stewart 584.

Annual herbs. Stem up to 50 cm erect, branches arising from the base and ascending, sparsely hairy with hairs arising from small tubercles, slender. Radical leaves larger but soon withering; cauline ones obovate lanceolate, simple, 1.5-4.5 cm x 0.5-1 cm, apex obtuse or rounded, margins entire, sessile or lower leaves with small stalks, surfaces some what hispid. Flowers blue, shortly pedicelled arranged on small racemes. Calyx lobes 5, oval, fused below, persistent. Corolla of 5 petal lobes, finely veined, longer than the sepals, with distinct square or rectangular scales on the mouth of corolla tube. Stamens 5 with globular bluish anthers. Style of the ovary included in the tube, stigma capitte. Ovary 4-celled. Nuts slightly glochidiate, not spiny.

Germination ; Early summer (February-March).

Fl. & Fr. : May-August.

Dissemination : The seeds are disseminated by man & animals.

Habitat : A rare weed of some orchards. Indicator of well aerated moist sandy loams.

Root system : A simple, tap root going up to 15 cm deep in soil.

Geographical distribution : Afghanistan, Pakistan, Turkestan, India : Himalaya, Khasia, & China.

Specimens examined : *Kaul* 168A (3-5-1970) Habak orchards, *Kaul* Srinagar 268; 24-7-1971) Rawalpora paddy field margins.

HETEROCARYUM A.P. de Candolle

Heterocaryum rigidum DC. Prodr. 10 : 145, 1886; Stewart 592.

Echinospermum minimum sensu Clarke in Hook. f., FBI 4 : 162, 1883.

Annual or biennial plants. Stem up to 25 cm tall, rough towards the base, branched, coarsely hispid, with large and showy flowers. Leaves obovate or lower ones spathulate, up to 3.5 cm x 0.8 cm, petiolate or sessile, alternate, entire or finely crenate, hispid. Flowers in long racemes, pedicellate or subsessile, pedicel often thickened, bracts leafy continued, up to the top of racemes, Calyx 5-lobed, up to 8 mm long; corolla tube overtopping the calyx with 5 rectangular blue scales at its mouth. Nutlets 4, generally 1 or 2 abortive, up to 8 mm diam. margins thickened with a single row of strong glochidia, smooth or scarcely granular, cofluent near the base and tops free.

Germinations : Spring (March-April).

Fl. & Fr. : July-September.

Dissemination : The seeds get disseminated by animals and irrigation water.

Habitat : An occasional weed of orchards and wheat fields preferring moist situations and possessing a gregarious habit. Indicator of compact sandy soils.

Root system : A thick and long tap root going up to 25 cm deep in the soil.

Geographical distribution : Central Asia to Temperate Himalaya.

Specimens examined : *Meebold* 4197 (June, 1905) Sumbal, Kashmir (CAL) : *Kaul* 328 (24-7-1972) Habak orchards, Srinagar.

ASPERUGO Linnaeus

Asperugo procumbens L. Sp. Pl. 138, 1753; FBI 4 : 167; Pop. in Fl. URSS 19 : 182, 1953; Kazmi in J. Arn. Arb. 52 : 118, 1971; Stewart 583. **(Fig. 55)**

Annuals with stem up to 50 cm long, creeping, slender, scabrous hispid, tetrangular, branches curling around other plants, very sticky. Leaves oblanceolate, spathulate, 3-8 cm x 0 5-1.5 cm, apex obtuse; petiole small, winged and sticky, margins entire and hispid. Flowers small, pedicels small and somewhat curved, axillary, congested towards the apices. Calyx small, narrowly lanceolate when young, enlarging towards the maturity, forming somewhat hastate plates round the nutlets, each plate 5-8 lobed, veins distinct and light green, persistent, Corolla 5-lobed, tube small, dense blue with 5 reniform scales at the mouth, lobes somewhat rounded and spreading, Stamens 5, included in the tube. Style very small up to 1.5 mm long, arising from between the 4 lobes of the ovary. Fruit of 4 glabrous, hard nutlets, generally 1 or 2 abortive; each nutlet is ovoid with a small blunt beak, up to 8 mm diam, laterally compressed, glabrous and glaucous.

Germination : The seeds sprout in early spring (Fabruary-March).

Fl. & Fr. : May-June.

Dissemination : The seeds are disseminated by animals and man during agricultural operations.

Habitat : A rare weed of some orchards possessing a gregarious habit and spreading very fast. Indicator of organic matter in soils.

Root system : A branched tap root going up to 15 cm deep in the soil.

Geographical distribution : From Egypt to Iran, Afghanistan, Pakistan and India.

Specimens examined : *Kaul* 170 (8-5-1970) Rawalpora orchards and pea fields.

Chromosome report : 2n=48 (DCA 295).

Remarks : It is the only species of the genus reported from India.

BOTHRIOSPERMUM Bunge

Bothriospermum tenellum (Hornem.) Fisch. & Mey. Index Sem. Horti. Petrop. 1 : 23, 1855; FBI 4 : 167; Kazmi in J. Arnold Arb. 51 : 182, 1970; Stewart 583. **(Fig. 56)**

Anchesta tenella Hornem. Hort. Hafn. 1 : 176, 1815.

Annual prostrate herbs. Stem spreading, never erect, branches arising from the base and forming small patches; weak, all over hispid. Radical leaves 4-6.5 cm long, petiolate, hispid; cauline leaves ovate to obovate, 1-4.5 cm long and 1 cm broad in the middle, sessile, hispid margins slightly dentate, alternate. Flowers small in long racemes, bracteate, pedicel small or absent, white. Calyx 5-lobes ovate lanceolate, hispid up to 5 mm long, persistent. Corolla 5-lobed with a small tube, mouth with 5 white scales. Stamens 5, included in the corolla tube, anthers basifixed with small epipetalous filaments. Ovary with a small style arising from between the lobes; stigma capitate. Fruit of 4 small nutlets, each nutlet is slightly glochidiate, hard with a concave inner surface.

Germination : The seeds germinate in late autumn (Nov.) or early spring (Feb.-March).

Fl. & Fr. : May-June.

Dissemination : The seeds are disseminated mainly by irrigation water and to some extent by wind.

Habitat : A common weed of wheat fields, pea fields, some orchards and grasslands. Indicator of compact nitrogeneous and sandy or clayey loams.

Root system : A tap root going up to 20 cm deep in the soil, generally unbranched.

Geographical distribution : Amurland, Japan, China, Afghanistan, Manchuria, Phillipines, Mascarene and Hawailan Islands.

Specimen examined : *Kaul* 167A (3-5-1970) Habak wheat fields; *Kaul* RRL 16017 (18-3-1971) Magam wheat fields.

ANCHUSA Linnaeus

Anchusa ovata Lehm. A sperif. 1 : 222, 1818; Stewart 581. **(Fig. 57)**

Lycopsis orientalis L. Sp. Pl. 139, 1753; Pop. in Fl. URSS 19 : 313, 1953; Kitamura 319.

Lycopsis arvensis Aitch. J. Linn., Soc. 19 : 178, 1882 (non L.); FBI 4 : 169.

Annual herbs. Stem up to 50 cm erect or procumbent, simple or tufted, branches arising from the base, slightly angular, densely hispid and hirsute. Leaves simple, narrowly lanceolate or oblanceolate, up to 4.5 x 1 cm, margins slightly dentate, apex rounded or obtuse, hairy; hairs with bulbous bases. Flowers in racemes up to 25 cm long, bracteate, subsessile, dark blue. Calyx 5, oblong lanceolate, hairs purplish outside and

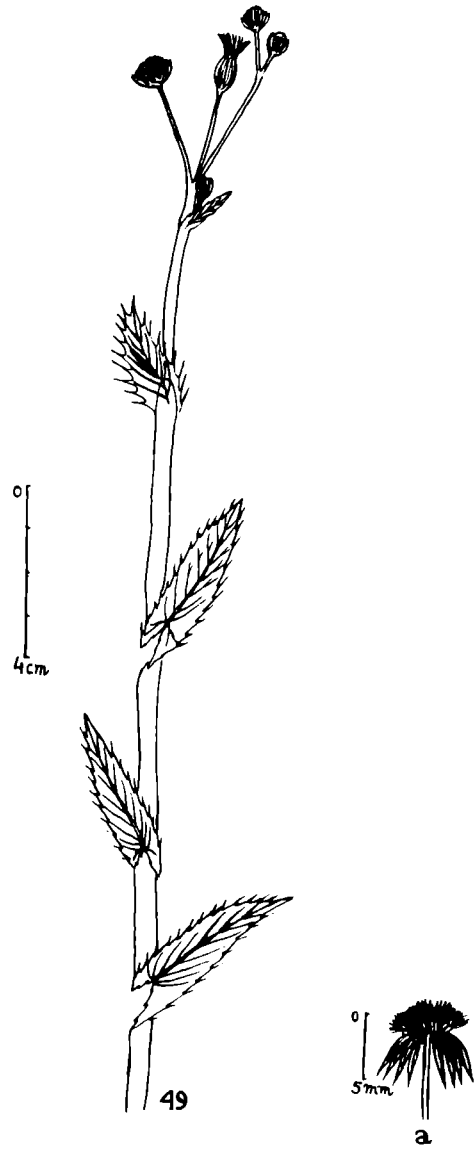
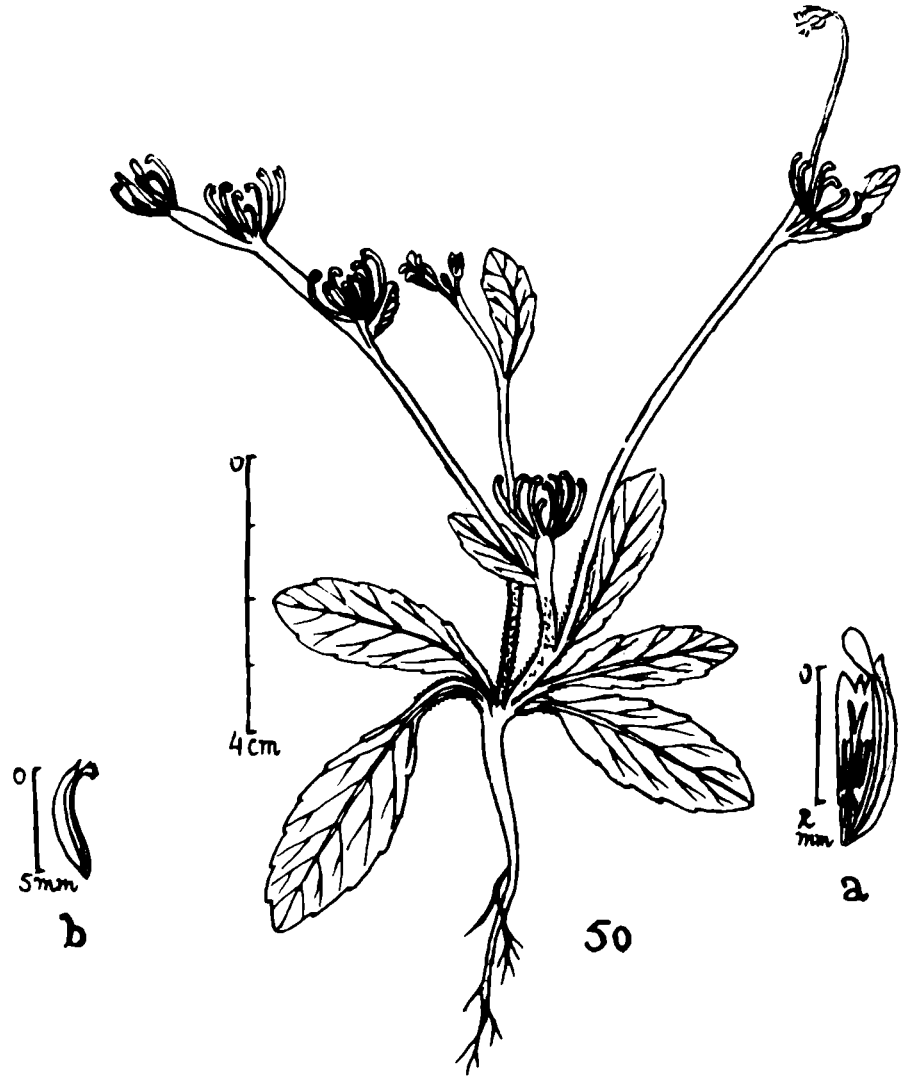


Fig. 49. *Sonchus asper* (L.) Hill. (a flowering shoot)
a. a mature flower head



50. *Garhadiolus minutissimus* (Bunge) Kitamura (a flowering plant)
a. a floret with bract, b. an achene

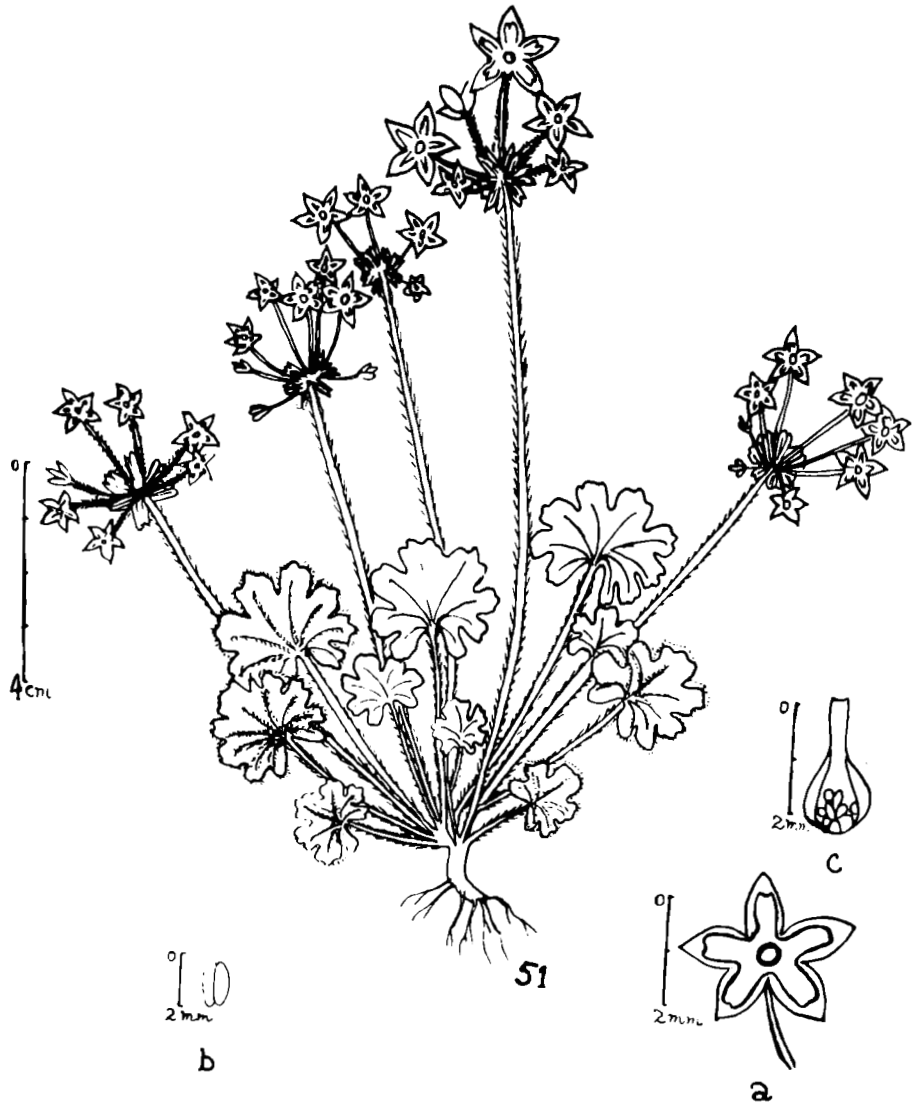


Fig. 51. *Androsace rotundifolia* Hardw. (a flowering plant)
a. a flower, b. an anther, c. a dehiscing capsule

Fig. 52. *Anagallis arvensis* Linn. (a flowering plant)
a. a flower, b. a capsule

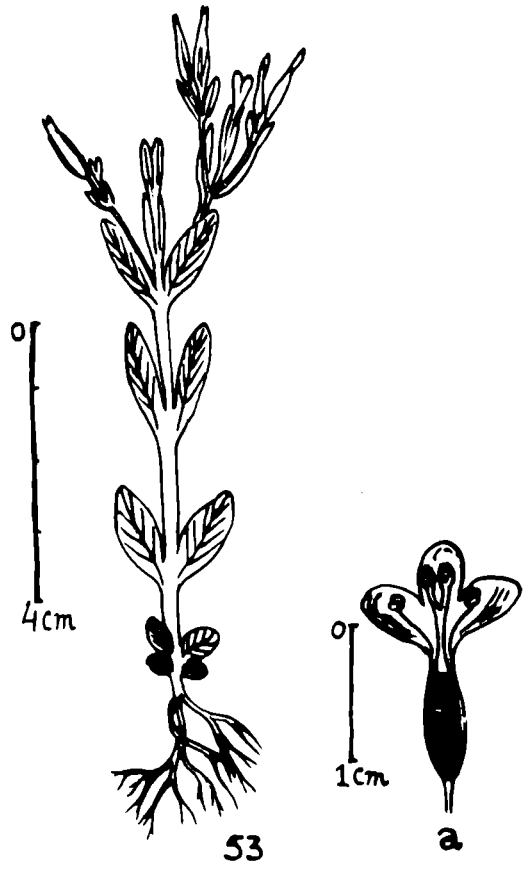


Fig. 53. *Canscora decussata* Roem. et Schultes
a. v.s. flower

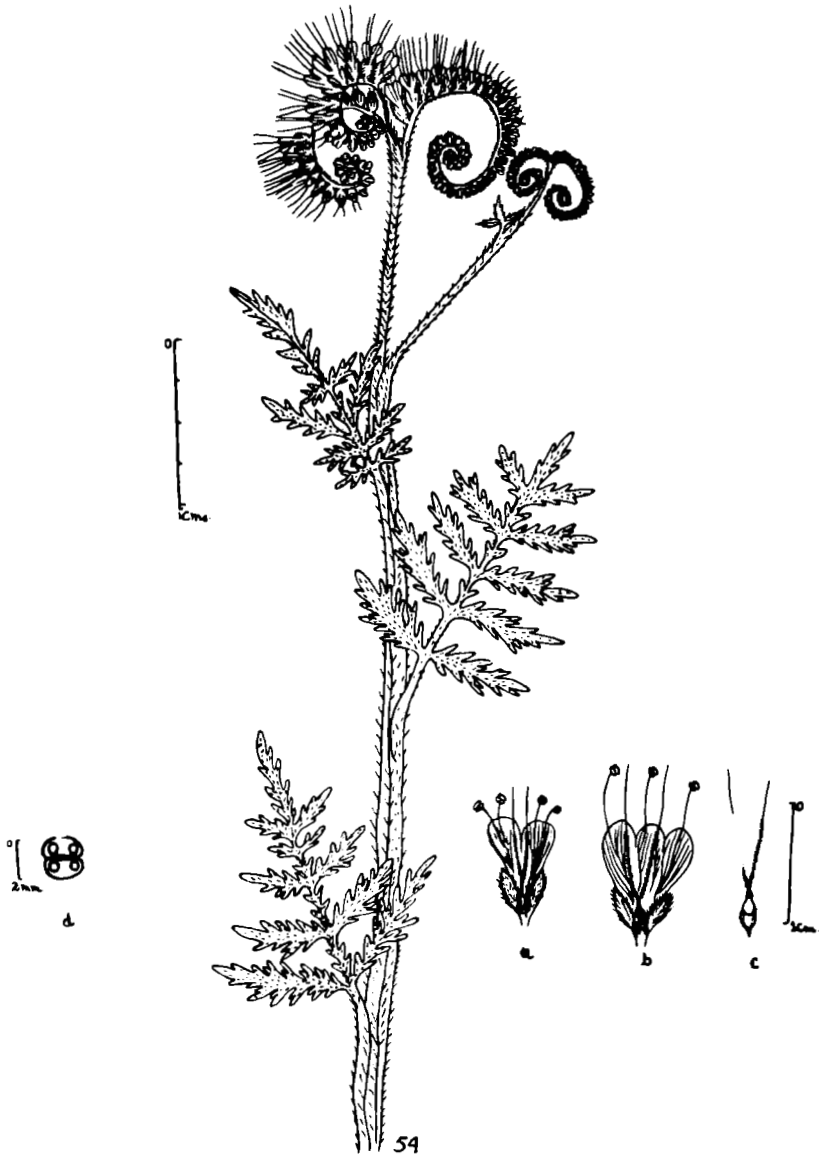


Fig. 54. *Phacelia tanacetifolia* Benth. (a flowering shoot)
a. a flower, b. v.s. flower, c. an ovary with styles, d. t.s. ovary

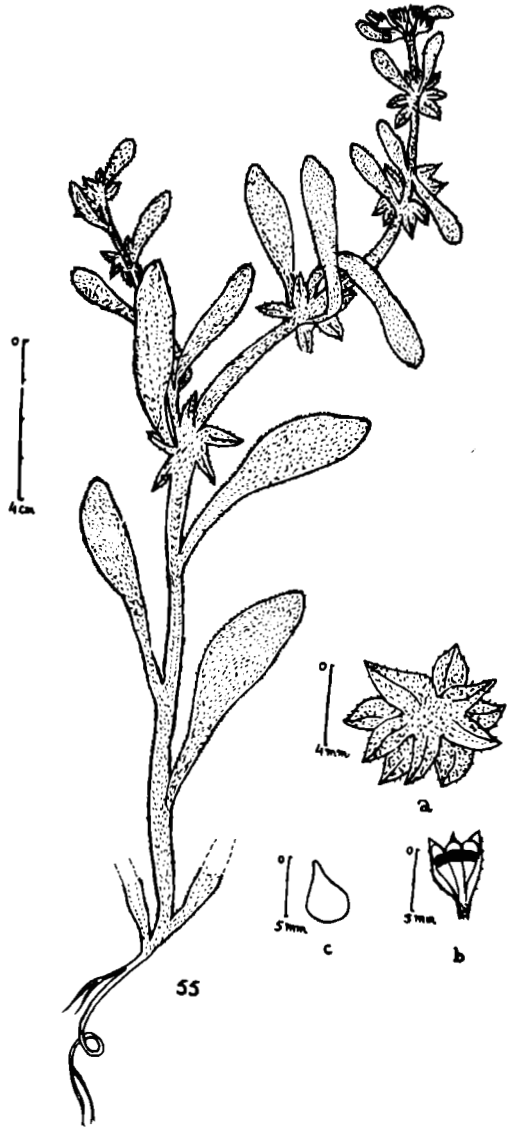


Fig. 55. *Asperugo procumbens* Linn. (a flowering shoot)
a. a fruiting calyx, b. a flower, c. a nutlet

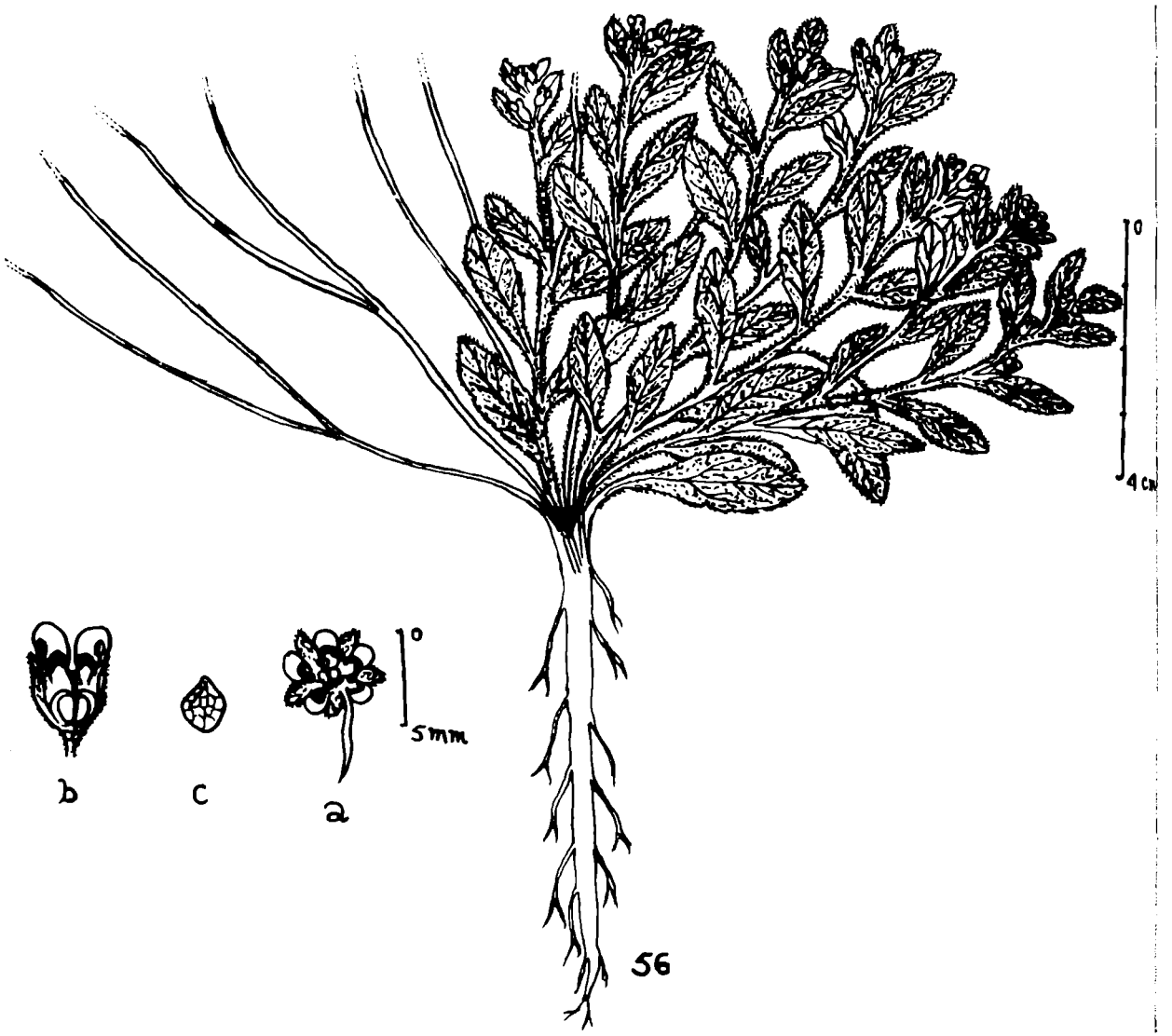


Fig. 56. *Bothriospermum tenellum* (Hornem.) Fisch. & Mey.
(a flowering shoot, in part)
a. a flower, b. v.s. flower, c. a nutlet

glandular from inside with a distinct median ridge, persistent. Corolla with a curved tube as long as the sepals and lobes spreading, protruding out. Scales 5, somewhat rounded, closing the mouth. Stamens inside the corolla tube near the base, filaments very short and absent, epipetalous. Ovary 4-celled with a small gynobasic style, stigma capitate and bilobed. Fruit with an elongated stalk, 4 small rounded nutlets rugose and with a small protuberance.

Germination : The seeds sprout in late autumn (November) or in early spring (Feb.-March).

Fl. & Fr. : April-June.

Dissemination : The seeds are disseminated by wind, through manure and also by water.

Habitat : An occasional weed of orchards, wheat fields, pea fields and grasslands. Indicator of fertile well aerated loams.

Root system : A branched tap root, main root restricted to 5 cm depth and branches going up to 20 cm deep.

Geographical distribution : Eastern Europe, Turkey, Armenia, Iran, Afghanistan, Pakistan.

Specimens examined : *Duthie* 10836 (8-5-1892) Near Srinagar (CAL); *Kaul* 146 (9-4-1970) Rawalpora pea fields; *Kaul* RRL 16055 (12-6-1971) RRL campus; *Kaul* RRL 19732 (30-9-1971) Rawalpora orchards.

Remarks : The plants are variable. In some cases :

(i) Plants are never tufted, up to 25 cm erect and never branched from the base,

(ii) Hairs are simple without bulbous base,

(iii) Flowers are exclusively white and

(iv) Nutlets are somewhat smooth.

Kaul 156 (19-4-1970) Rawalpora orchards.

Chromosome report : 2n=16 (Bhat, *et al.* 1974).

MYOSOTIS Linnaeus

Myosotis caespitosa Schultz Prod. Fl. Starg. Suppl. 1 : 11, 1819; FBI 4 : 173; Collett 234; Kazmi in J. Arn. Arb. 52(4) : 680, 1971.

Annual herbs. Stem 10-40 cm generally erect, branched or unbranched, slender, hairs appressed to the stem. Leaves simple oblanceolate, 1.5-6 cm x 0.5-1.5 cm, apex rounded and obtuse, tapering towards the base, lower ones petiolate, upper sessile, alternate, hairs appressed to the surface. Flowers in long and branched racemes, ebracteate, pedicel 0.5-1.5 cm minutely hispid; bluish. Calyx 5-fid, divided up to the middle, lobes triangular, minutely hispid, persistent. Corolla lobes 5, tube shorter than the calyx, bluish with yellowish rectangular or squarish scales at the mouth. Stamens 5, inside the corolla tube. Ovary 4-celled with a short gynobasic style, stigma bilobed. Nutlets 4, ovoid, slightly longer than broad, smooth on a flat receptacle.

Germination : Spring (March).

Fl. & Fr. : June-August.

Dissemination : The seeds get disseminated by irrigation water.

Habitat : An occasional weed of moist and marshy situations including rice fields & floating islands. Indicator of moist fertile marshy soils.

Root system : A simple branched tap root with branches in the surface horizons.

Geographical distribution : Afghanistan to Siberia, Europe and North America.

Specimens examined : *Kaul* 278 (4-8-1971) Hyderpora, paddy fields; *Kaul* RRL 19789 (21-8-1972) Shalimar paddy field borders.

Chromosome report : 2n=80 (DCA 295).

HELIOTROPIUM Linnaeus

Heliotropium europaeum L. var. *lasiocarpum* (Fisch. & Mey.) Kazmi in J. Arnold Arboretum 51(2) : 176, 1970; Stewart 590.

H. lasiocarpum Fisch. & Mey. Index Sem. Petrop. 4 : 38, 1837.

H. eichwaldii Steud. var. *lasiocarpum* (Fisch. & Mey) Clarke in Hook. f., FBI 4 : 150, 1883.

Annual herbs. Stem erect up to 30 cm, branched from the base, slender, tomentose or downy, cylindrical. Leaves simple, ovate to obovate, 2-6.5 cm long and up to 5 cm broad, petiolate, petiole as long or longer than the leaf, white tomentose; margins entire or sinuate, surfaces downy, fine. Flowers small in long branched curling scorpioid cymes, white, sessile, to subsessile, bracts O. Calyx 5-fid up to the middle, or sometimes even below the middle, lobes linear narrow, minutely hispid, persistent. Corolla with a small tube and spreading lobes as long as the calyx, scales absent. Stamens five with very small or no filaments, anthers somewhat triangular. Ovary 2-4 celled with a terminal style as long or shorter than the ovary and clothed with a sheath all along its length and looking thick. Nutlets 2-4, not easily separable and closed in a persistent calyx tube.

Germination : Spring (March-April).

Fl. & Fr. : June-August.

Dissemination : The seeds get disseminated by wind and man during agricultural operations.

Habitat : An occasional weed of maize fields, saffron fields and rarely occurs in vegetable fields. Indicator of well aerated sandy loams.

Root system : A much branched tap root with branches going up to 30 cm deep in soil.

Geographical distribution : Jordan, Syria, Iraq, Iran, Afghanistan, Russia, Centjal Asia and Kashmir.

Specimens examined : *Meebold* 4216 (Sept. 1905) Sumbal (CAL); *Kaul* 218 (22-6-1970) Majid Bagh, vegetable fields.

Chromosome report : 2n=24 (DCA 296),

LITHOSPERMUM Linnaeus

Lithospermum arvense L. Sp. Pl. 132, 1753; Aitch. in J. Linn. Soc. 18 : 81, 1881; FBI 4 : 174; Popov in Fl. URSS 19 : 165, 1953; Stewart 595.

Annual herbs. Stem up to 50 cm erect, cylindrical or slightly angular, rough and scabrid or hirsute with hairs having tuberculate bases; branched or unbranched, dull green. Leaves radical and cauline, former soon withering and not seen in adult plants; cauline ones obovate lanceolate, up to 3.5 cm x 0.5 cm, margins entire, apex obtuse, sessile or petiolate; petiole when present up to 5 mm long and somewhat winged; hairs strigose and with tuberculate bases. Racemes up to 15.5 cm long or even longer in fruit. Flowers brac-

teate; bracts leafy; pedicels shorter than flowers; white, blue or reddish. Calyx 5-fid, divided nearly up to the base, linear up to 7 mm long, hirsute and persistent. Corolla tube as long or shorter than the calyx lobes, lobes spreading coming out of the calyx tube, scales absent or very minute. Stamens included, epipetalous. Nutlets 4, obovate, generally narrowed upwards, rough or strigose.

Germination : Early spring (Feb.-March).

Fl. & Fr. : April-June.

Dissemination : The seeds get disseminated by wind & man.

Habitat : A common weed of orchards, wheat fields, grasslands and fallow lands. Indicator of well aerated clay loams.

Root system : A much branched tap root, main root goes up to 25 cm deep in the soil.

Geographical distribution : Eurasia, England to Japan.

Specimens examined : *Kaul* RRL 5954 (8-4-1969) Rajpora orchards; *Kaul* 47 (3-9-1969) RRL Campus Srinagar; *Kaul* 147 (9-4-1970) Vovosa orchards.

Chromosome report : 2n = 28 (DCA 295).

CONVOLVULACEAE

Key to the genera

1. Style branching near the top in 2 short linear stigma **Convolvulus**
1. Style not branching near the top, stigma capitate **Ipomoea**

CONVOLVULUS Linnaeus

Convolvulus arvensis L. Sp. Pl. 153, 1753; FBI 4:219; Popov in Fl. URSS 19 : 182, 1953; Rao in BOBSI 2 : 409, 1960; Stewart 572. **(Fig. 58)**

Perennial creeping herbs. Stem slender, creeping and twining around the stems of other plants, glabrous or somewhat pubescent, running to long distances up to 75 cm. Leaves hastate or auriculate, up to 5.5 cm x 1.5 cm with a long apical lobe and 2 lateral auricles, rarely ovate to cordate, petiolate, petiole smaller than the leaves, alternate and glabrous. Flowers purplish white or sometimes pure white, 1-2 on axillary peduncles, bracteoles 2, small, linear, distinct and persistent. Sepals 5, elliptic obtuse, sometimes hairy and persistent. Corolla wide, infundibuliform, 5-plaited, margins wavy, glabrous, white with purplish tinge. Stamens included to the tube surrounding the style, anthers elongated, whitish. Ovary half the size of sepals with a long style coming nearly up to the mouth of the corolla tube; stigma 2-lobed, lobes globular but small. Capsule enclosed in the calyx, 4-valved, with triangular or oblong 4 seeds, one seed in each loculus.

Germination : The seeds sprout in spring (March-April).

Fl. & Fr. : May-July.

Dissemination : The seeds are disseminated by wind & man.

Habitat : A common weed of wheat fields, orchards, pea fields and also some grasslands. Indicator of well aerated sandy loams.

Root system : The main tap root is generally unbranched but goes up to 30 cm deep in the soil.

Geographical distribution : A cosmopolitan weed.

Specimens examined : *Kaul* RRL 5536 (28-5-1969) RRL campus; *Kaul* RRL 5590

(27-7-1970) Barzulla; *Kaul* RRL 16053 (12-6-1971) Rewalpora orchards.

Local name : "Threir".

Remarks : A fast spreading weed, difficult to eradicate; once it gets established in a field. The leaves are used as sheep fodder.

Chromosome report : 2n=48 (Kaul & Gohil 1973).

IPOMOEA Linnaeus

Ipomoea eriocarpa R. Br. Prodr. 484, 1810; FBI 4 : 204; Collett 337; Van Ooststroom in Fl. Males. 1, 4(4) : 462, 1953. **(Fig. 59)**

I. hispida (Vahl) Roem. & Schult. 4 : 238, 1891, non Zucc. 1809; Stewart 576.

Convolvulus hispidus Vahl, Symb. Bot. 3 : 29, 1794.

Perennial procumbent and twining herbs. Stem stiff, up to 50 cm long, branched or unbranched, cylindrical, minutely pubescent throughout. Leaves simple, cordate or sometimes hastate, lanceolate, up to 9.5 cm x 6.0 cm, petiolate; petiole slender, as long or longer than the leaf, hairy; alternate, entire with long pointed apex, surfaces somewhat glabrous or hairy. Flowers small, pinkish in small, axillary, sessile heads. Sepals 5, obovate to lanceolate, long pointed, densely hairy, persistent. Petals campanulate, tube as long or shorter than the sepals, limb 5-lobed, folding at the angles. Stamens 5, filaments unequal, arising from the corolla tube, anthers basifixed, white. Ovary 3-celled, densely hairy, style as long as the corolla tube; stigmas 2, globular. Capsule ovate to obovate, dehiscing from the top by 4-valves, releasing seeds. Seeds 4, somewhat angular with one convex surface, hard, black and glabrous.

Germination : Late spring (May-June).

Fl. & Fr. : July-September.

Dissemination : The seeds are disseminated by wind and man during agricultural operations.

Habitat : An occasional weed of maize fields. Indicator of dry clay loams.

Root system : A strong tap root going up to 25 cm deep in the soil and binding the weed.

Geographical distribution : Tropical regions of Old World.

Specimens examined : *Meebold* 4035 (June, 1905) Sumbal (CAL); *Kaul* 293 (25-9-1971) Badgam maize fields.

SOLANACEAE

Key to the genera

1. Flowers stalked :
   2. Inflorescence cymose or racemose, stamens with coherent anthers — **Solanum**
   2. Inflorescence solitary axillary, stamens never with coherent anthers — **Datura**
1. Flowers sessile, crowded in a leafy spike; corolla purple veined — **Hyoscyamus**

SOLANUM Linnaeus

Solanum nigrum L. Sp. Pl. 186, 1753; FBI 4 : 229; Santapau in J. Bombay Nat. Hist. Soc. 47 : 652, 1948. Pojark in Fl. URSS 22 : 251, 1955; Rao in BOBSI 2 : 409, 1960. **(Fig. 60)**

Annual erect herbs. Stem up to 75 cm tall, glabrous or sparingly hairy, angled or longitudinally ribbed, dark green. Leaves ovate or oblong-obovate, up to 8.5 x 6.0 cm with coarse angular teeth, petiole much shorter than the leaf, alternate, glabrous or pubescent on the midribs. Flowers white on slender and up to 4.5 cm long drooping stalks, forming irregular umbel like clusters, Calyx teeth linear, obovate, glabrous up to 3 mm long, sometimes persistent, generally caducous Corolla 5-lobed with a small tube, twice as long as sepals, glabrous. Stamens with connate anthers surrounding the style. Berry up to 7 mm diam, rounded with a small beak, green, red, yellow or finally black. Seeds many, small, brownish or black.

Germination : Spring (March-April).

Fl. & Fr. : September-November.

Dissemination : The seeds are disseminated by birds, animals and to some extent by wind. The berries are carried to long distances by birds.

Habitat : An occasional weed of orchards and vegetable fields preferring moist situations. Indicato r of well aerared clay loams.

Root system : A thick branched tap root up to 30 cm long, branches mostly in the surface layers of the soil.

Geographical distribution : A cosmopolitan weed.

Specimens examined : *Gammie* s.n. (3-7-1891) Gegribal, Srinagar (DD); *Dutt* 9050 (3-10-1962) Batwara, Srinagar; *Kaul* RRL 5968 (10-4-1969) Majid Bagh.

Local name : "Kambai".

Chromosome report : 2n=56 (Kaul & Gohil 1973).

DATURA Linnaeus

Datura stramonium L. Sp. Pl. 179, 1753; FBI 4 : 242; Collett 344; Stewart 640.

Erect annual herbs. Stem up to 1.5 m tall, sometimes fistular but generally solid with 3 cm diam near the base, glabrous, light green, smooth and shining. Leaves ovate to oblong, up to 15.5 cm x 8 cm coarsely aud irregularly lobed and toothed, lobes long obovate and acute, glabrous, midvein and side veins distinct from the lower surface. Flowers white, solitary axillary, stalks very short. Calyx tubular, tube up to 4.5 cm long 5-toothed, 5-ribbed, light green, caducous. Corolla tube infundibuliform, twice or more than the length of calyx tube, 5-lobed, folding at the angles, lobes ending in long narrow points. Stamens 5, included, filaments linear long, arising from the base of the corolla tube, anthers long white. Ovary 2-celled, 4-lobed, covered with short soft protuberances; style linear, stigma 2-lobed, distinct and oblong. Capsule ovoid, up to 4 x 2.5 cm, covered with rigid, sharp prickles and surrounded at the base by lower part of the calyx tube. Seeds up to 3 mm diam. flattened, yellowish brown, wrinkled, produced in large numbers.

Germination : Spring or early summer (May-June).

Fl. & Fr. : July-October.

Dissemination : The weeds are disseminated by wind and animals including man.

Habitat : An occasional weed of orchards, waste heaps, fallow lands and maize fields. Indicator of compact nitrogenous soils.

Root system : A thick rootstock going up to 50 cm deep in the soil, branching in the lower horizons.

Geographical distribution : A cosmopolitan weed.

Specimens examined : *Dutt* 7412 (19-7-1961) Barzulla, Srinagar; *Kaul* RRL 921 (20-10-1969) wastelands near exhibition, Srinagar.

Local name : "Datur".

Uses : The plants especially leaves and seeds are used as narcotics.

Illustration : Polunin pl. 118.

Chromosome report : 2n=24, 48 (DCA 303).

HYOSCYAMUS Linnaeus

Hyoscyamus niger L. Sp. Pl. 179. 1753; FBI 4 : 244; Pojark in Fl. URSS 22 : 93, 1955; Rao in BOBSI 2 : 409, 1960; Stewart 640.

Annual herbs. Stem erect up to 50 cm tall, leafy, more or less hairy and viscid with a somewhat disagreeable odour. Radical leaves oblong, obovate tc ovate, up to 15.5 cm long, coarsely sinuate toothed, tomentose or hairy. Cauline leaves similar but smaller, ovate, irregularly pinnatifid, crowded, alternate, passing into bracts, finely hairy or tomentose. Flowers pale yellow-green, purple-veined, darker in the centre, nearly sessile, solitary axillary forming one-sided spikes, bracts leafy, rolled back at the top before flowering. Calyx tube ovoid, limb 5-toothed, infundibuliform. Corolla tube funnel shaped, limb spreading; lobes 5, broad short, slightly unequal. Stamens protruding, filaments unequal. Ovary 2-celled. style longer than the stamens. Capsule up to 1.5 cm diam enclosed in globose tube of enlarged calyx, opening transversely between the two plates. Seeds many, black, small.

Germination : Early summer (June). The seeds germinate readily at 20°C.

Fl. & Fr. : September-November.

Dissemination : Wind and irrigation water.

Habitat : An occasional weed of higher altitudes but spreading in the fields of Srinagar. Indicator of sandy to gravelly soils.

Root system : A much branched stout tap root going up to 15 cm deep in the soil.

Geographical distribution : Eurasia, Afghanistan and Pakistan.

Specimens examined : *Abrol* 2853 (20-9-1953) Srinagar fields; *Kaul* RRL 906 (15-4-1969) RRL fields, Srinagar.

Remarks : It is medicinally important for its poisonous alkaloids.

Chromosome report : 2n=34 (Sometimes 33); (DCA 307).

SCROPHULARIACEAE

Key of the genera

1. Somewhat woolly herbs; flowers with rotate corolla and 5 stamens — **Verbascum**
1. Herbs never woolly; flowers never with rotate corolla, stamens 4 :
   2. Corolla distinctly 2-lipped; leaves simple, entire or serrate :
      3. Flowers never spurred :

4.	Sepals distinct or united half length, lobes spreading or ascending	**Lindernia**
4.	Sepals united above half length, tube funneliform, lobes acute	**Mazus**
3.	Flowers spurred :	
5.	Flowers large, spur 15-20 mm long	**Linaria**
5.	Flowers small, spur 2-5 mm long	**Kickxia**
2.	Corolla never 2-lipped, leaves pinnatifid	**Leptorhabdos**
1.	Glabrous or glandular pubescent herbs; flowers with 2 stamens; calyx 4-lobed	**Veronica**

VERBASCUM Linnaeus

Verbascum thapsus L. Sp. Pl. 177, 1753; FBI 4 : 250; Collett 347; Pennell in Acad. Nat. Sci. Philad. Monog 5, 40. 1943; Rao in BOBSI 2 : 409, 1960; Stewart 663.

Biennial or perennial herbs. Rootstock thick and going deep in the soil. Stem erect, densely clothed with soft yellowish, grey, stellate hairs especially towards the apices, robust, generally unbranched, winged with the prolonged leaf bases. Leaves radical and cauline, former ovate to oblong or oblong lanceolate, up to 25.5 cm x 6.5 cm thick, somewhat tough and leathery, yellowish grey covered with soft hairs, stalked; cauline ones similar but sessile and somewhat smaller. Flowers yellow, nearly sessile, crowded in terminal spikes forming a thick rod-like unbranched inflorescence. Calyx 5-lobed, obovate, acute, covered with white hairy growth, persistent. Corolla 5-lobed, concave, spreading, nearly equal to sepals, broad and obtuse. Stamens 5; 3 filaments short and hairy, 2 longer and glabrous. Ovary ovoid, style small, stigma capitate. Capsule ovoid or oblong, inside the persistent calyx, woolly, hard, opening by valves. Seeds many, h rd, rugose or rough, brown.

Germination : Early summer (May). The seeds germinate readily at 25-30° C

Fl. & Fr. : The flowering time of the weed varies as is evident from different collections of Duthie & Gammie. The flowering starts from July and profuse flowering occurs in months of September to November.

Dissemination : The seeds are disseminated by water and to some extent by wind.

Habitat : A common weed of orchards, some maize fields, fallow fields and some waste heaps. Indicator of well aerated sandy fertile loams.

Root system : A thick tap root going up to 25 cm deep in soil, branches short.

Geographical distribution : It is widely distributed as a weed in the northern hemisphere.

Specimens examined : *Gammie* s. n. (18-7-1891) Kashmir, 9000ft. (DD); *Duthie* 10817 (7-5-1892) Srinagar, (DD); *Kaul* RRL 19715 (26-9-1971) Chishma Shahi orchards.

Remarks : A medicinal plant used especially in pulmonary complaints. Crocetin and some saponins have been isolated (Saldanha, 1963).

Chromosome report : 2n =34, 36 (DCA 315).

LINDERNIA Allioni

Lindernia procumbens (Krock.) Philcox in Taxon 14 : 30, 1965 & Kew Bull. 22 : 29, 1968.

Anagalloides procumbens Krock. Fl. Siles. 2(1) : 398, t. 26, 1790.

Lindernia pyxidaria L. Mant. 2 : 252. 1771, *nom. illegit*. Pennell in Acad. Nat. Sci. Philad. Monog. 5, 29, 1943; Mukerjee in J. Indian Bot. Soc. 24 : 131,'1945; Stewart 653.

Vandellia erecta Benth. Scrop. Ind. 36, 1835; FBI 4 : 281.

Annual herbs. Stem up to 13.5 cm high. slender, branched from the base, branches divaricate, generally erect, glabrous light green or purplish green. Leaves elliptic or oblong, obtuse up to 3.5 cm x 1.5 cm, 3-5 nerved, entire or obscurely serrate or crenate, sessile, opposite, glabrous. Flowers purplish or pinkish, pedicels very slender, twice as long as the leaves, axillary; sepals 5, up to 5 mm long, linear, persistent, corolla tube cylindric; upper lip erect, broad, concave, notched or bifid; lower lip, broad, 3-fid, Stamens 4, 2 posterior included and other two with appendaged filaments. Capsule ovoid to orbicular, somewhat shorter than the persistent calyx. Seeds many, small and greyish yellow.

Germination : The seeds are very small and require enough water for germination. Seedlings are seen in late spring or early summer (May).

Fl. & Fr. : July - August.

Dissemination : The seeds are disseminated by water and to some extent by wind.

Habitat : An occasional weed of paddy fields. Indicator of moist soft clay loams.

Root system : A weakly developed tap root with branches in the surface layers.

Geographical distribution : Thailand, China, Japan, Malaya, France and Polynesian Islands.

Specimens examined : *Kaul* 246 (12-8-1970) Harwan and Shalimar paddy fields.

MAZUS Lourierо

Key to the species

1. Plant densely hirsute; racemes small and leafy **del vayi**
2. Plants hirsute; racemes long, generally leafless **pumilus**

Mazus delevayi Bonati in Bull. Herb. Boiss. Ser. 2, 8 : 530, 1908; Pennell in Acda. Nat. Sci. Philadelphia Mon. 5 : 34. 1943. **(Fig. 61)**

Annual tufted herbs. Stem procumbent or even prostrate up to 25 cm long, many from the base, branched, slender, densely hirsutulous, looking rough. Leaves radical and cauline, oblancolate, broader at the apex and tapering towards the base, 0.5-5.5 cm long, sessile or petiolate; petiole somewhat winged, margins dentate forming small acute lobes, densely hirsute, dull green. Flowers in short racemes, pedicellate; pedicels up to 0.5 cm long or even absent, bracteoles 1-2, very minute. Calyx 5-fid, lobes oval, tube small, campanulate with 3-5 distinct veins on the outer surface, dull green, densely hirsute, persistent. Corolla white protruding out of the calyx, upper lip 2-lobed, lower much larger 3-fid, upper lip with some purplish dots. Stamens 4, didynamous, anthers small globular,

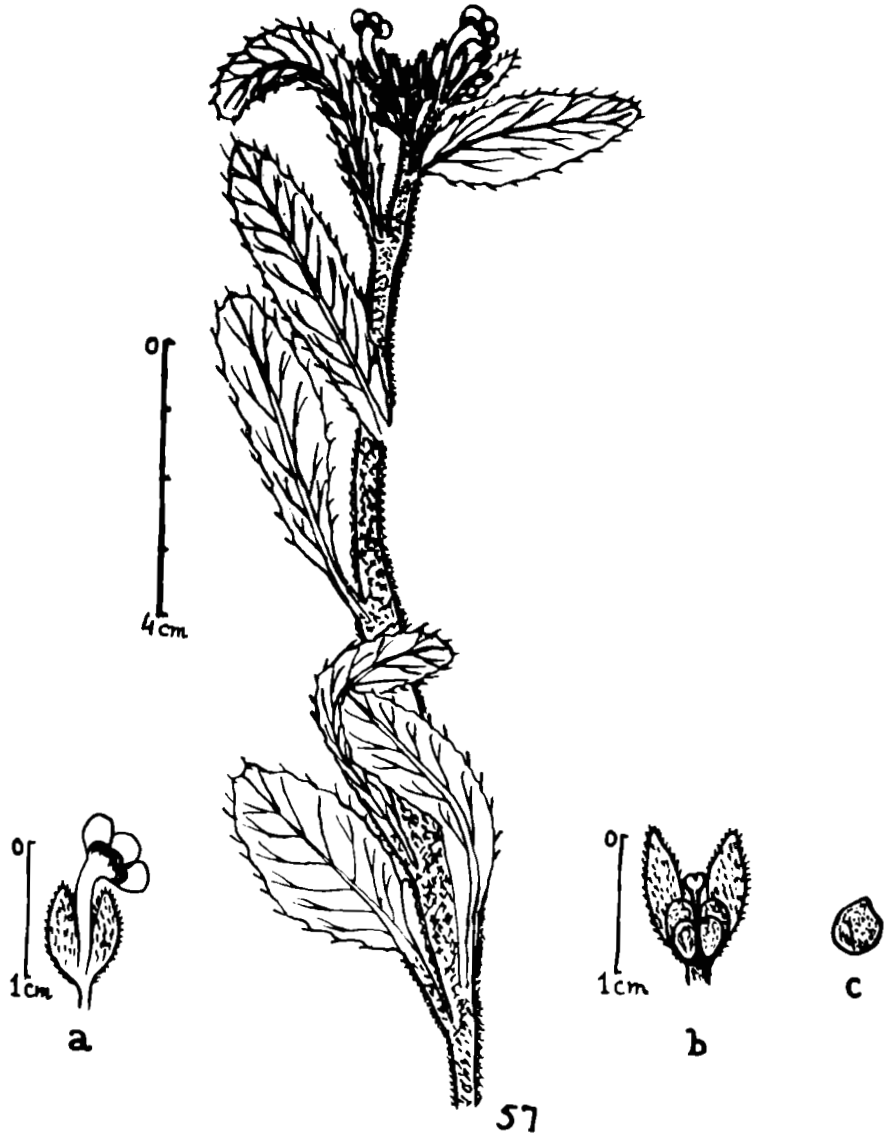


Fig. 57. *Anchusa ovata* Lehm. (a flowering shoot)
a. a flower, b. a mature fruit, c. a nutlet

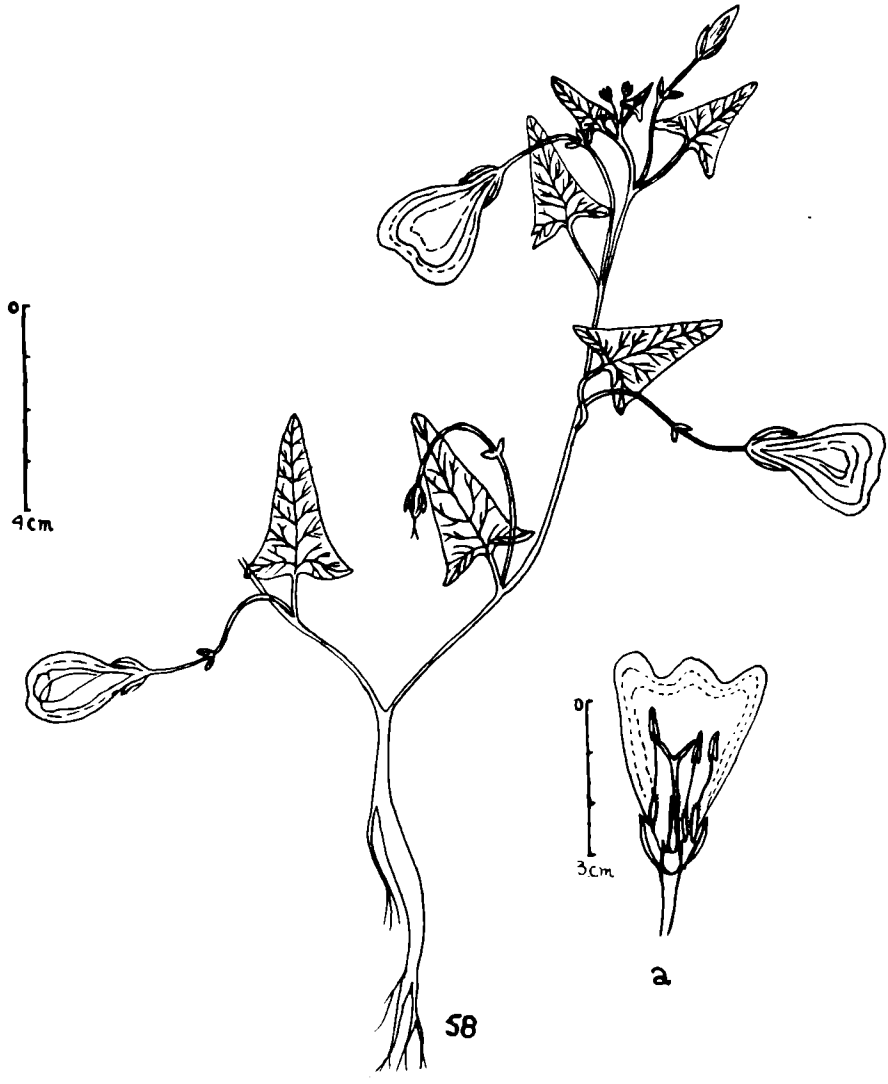


Fig. 58. *Convolvulus arvensis* Linn. (a flowering plant, in part)
a. v.s. flower

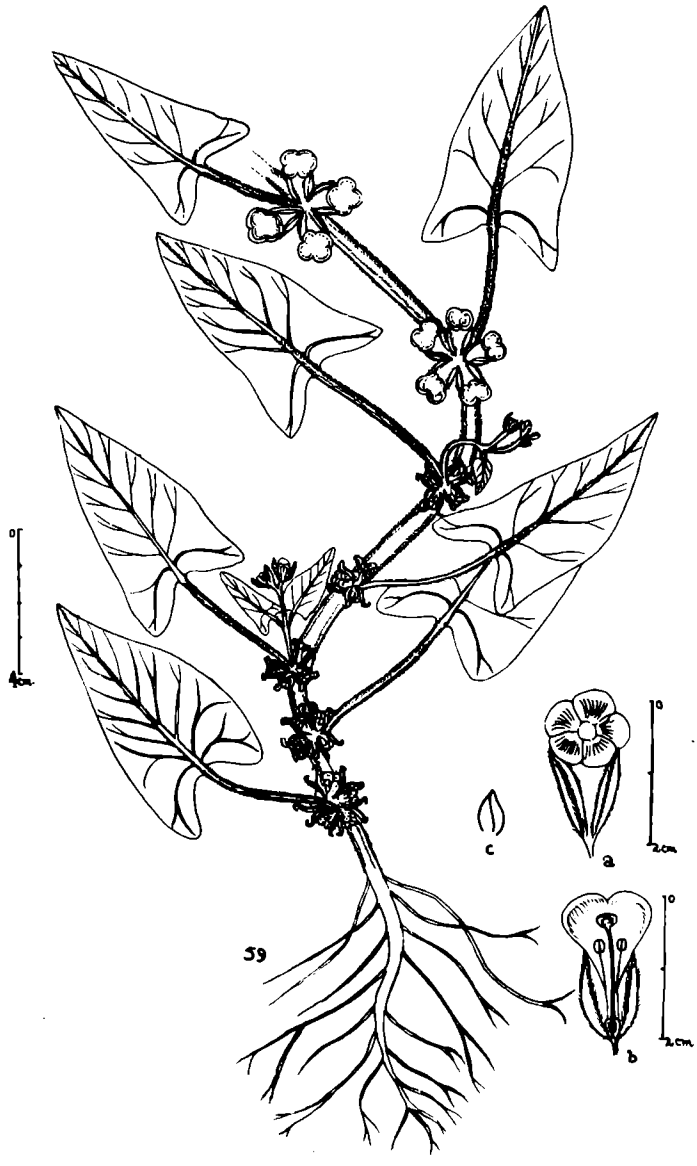


Fig. 59. *Ipomoea eriocarpa* R. Br. (a flowering plant, in part)
a. a flower, b. v.s. flower, c. a seed

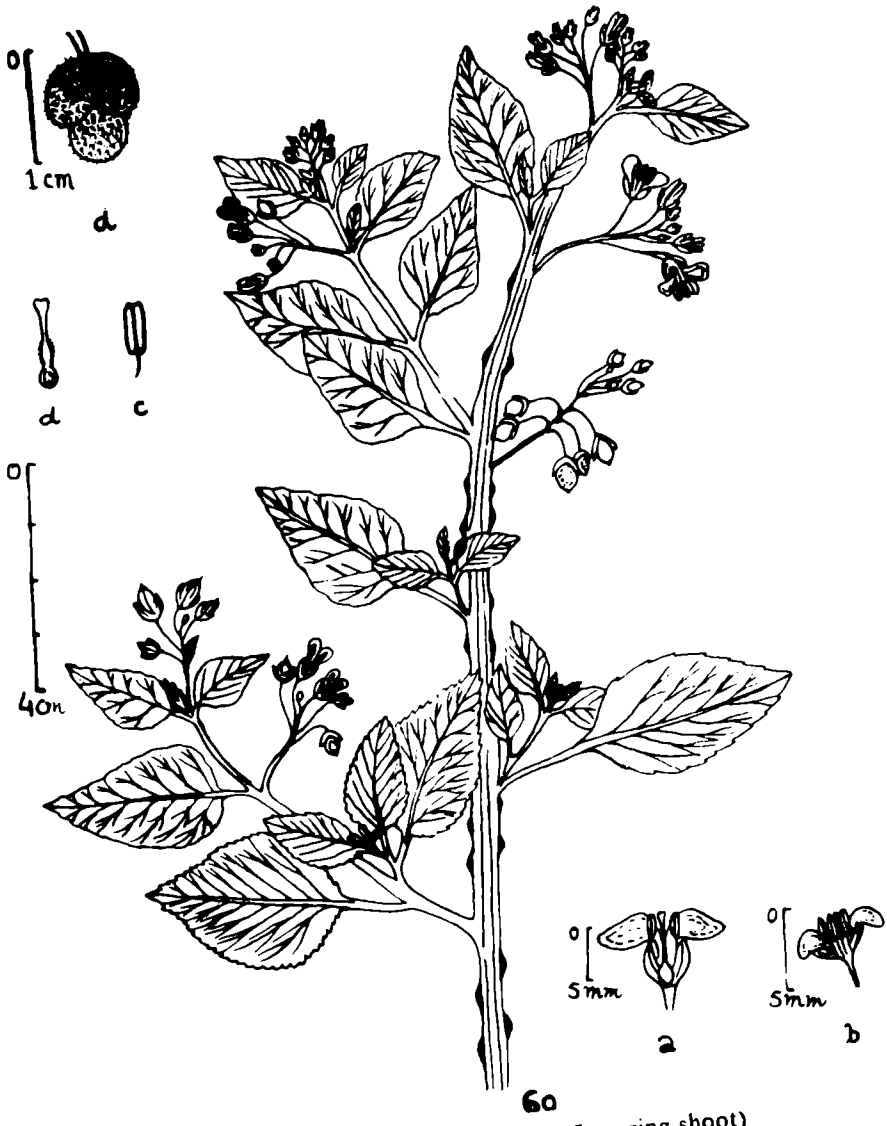


Fig. 60. *Solanum nigrum* Linn. (a flowering shoot)
a. a flower (opened), b. flower (from above), c. a stamen, d. an ovary with style

Fig. 61. *Mazus delevayi* Bonati (a flowering plant)
a. v.s. flower

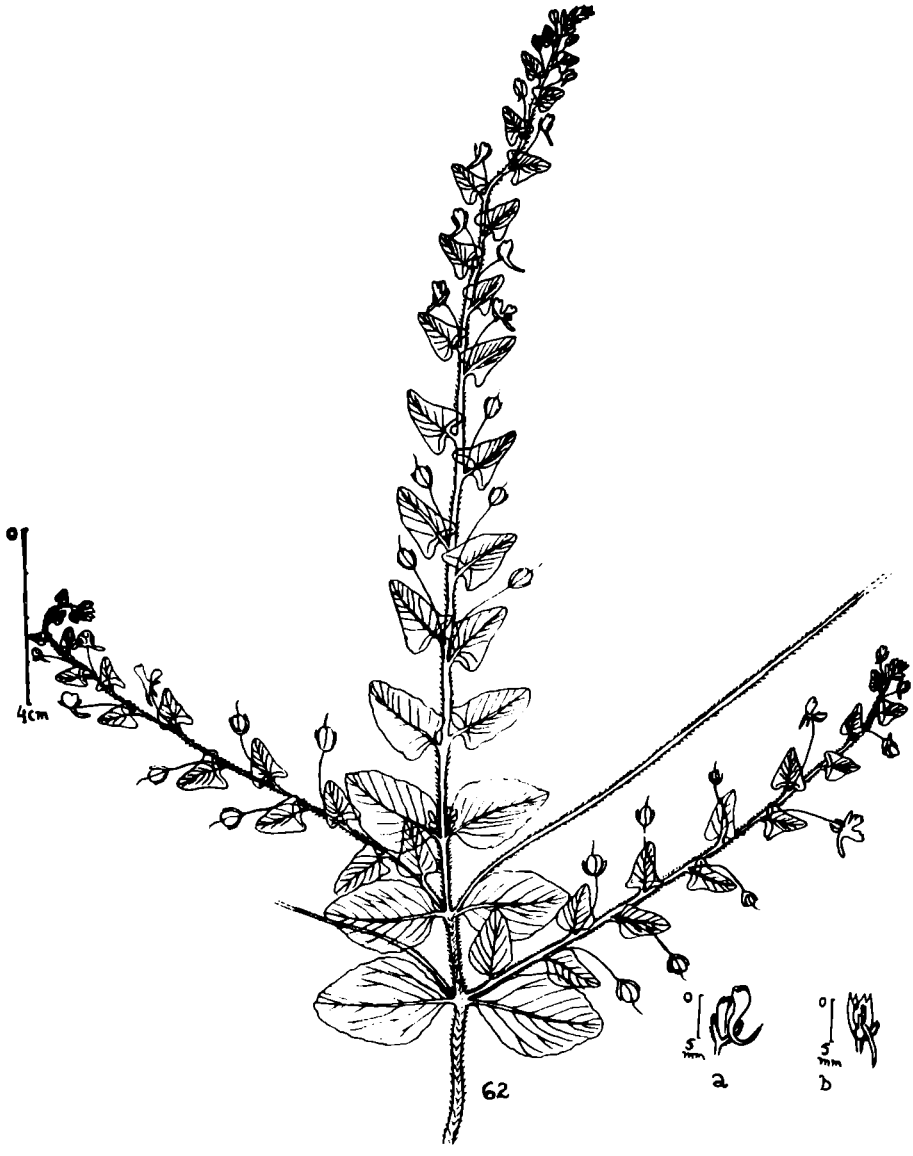


Fig. 62. *Kickxia subsessilis* Pennell (a flowering shoot)
a. a flower, b. v.s. flower

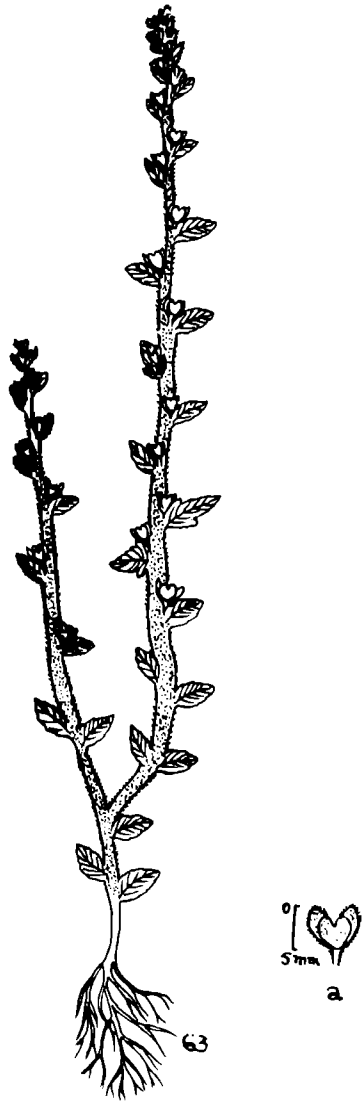


Fig. 63. *Veronica verna* Linn. (a flowering plant)
a. a capsule

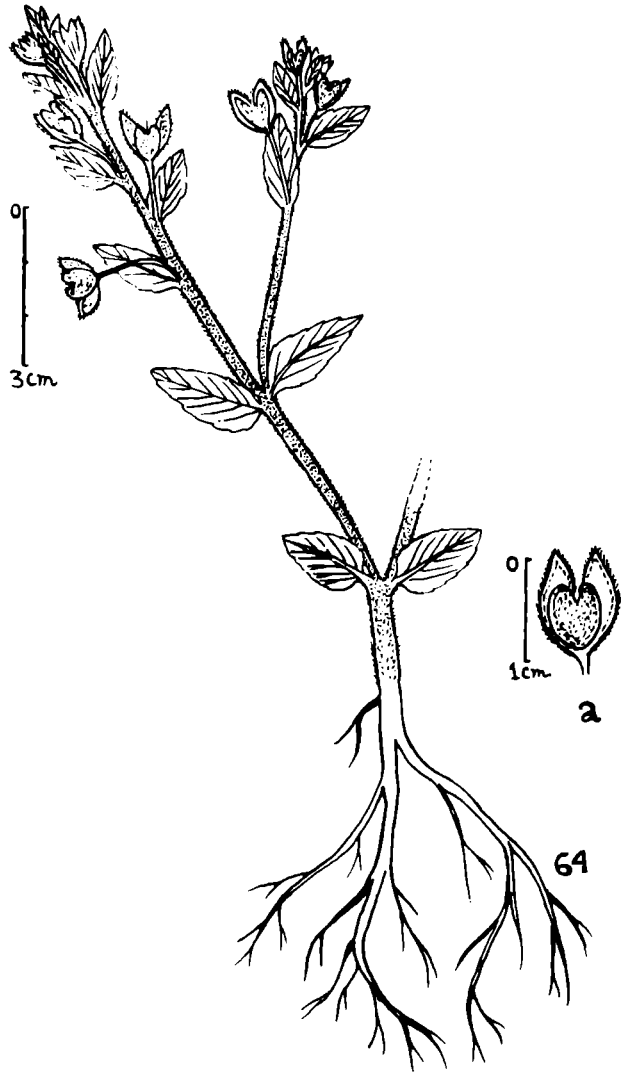


Fig. 64. *Veronica biloba* Linn. (a flowering plant, in part)
a. a capsule

contiguous. Ovary globular, included in the calyx tube, style long, stigma lyrate. Capsule included in persistent calyx, glabrous, 2-celled, ovules arranged on a rounded placenta. Seeds small, yellowish numerous.

Germination : Early spring (February-March).

Fl. & Fr. : May - June.

Dissemination : The seeds are disseminated by wind, animals and water.

Habitat : An occasional weed of wheat and pea fields. Indicator of moist clay loams.

Root system : A thick tap root going up to 15 cm deep in the soil.

Geographical distribution : Temperate Himalaya.

Specimens examined : *Kaul* 166 (3-5-1970) Habak pea fields; *Kaul* 181A (11-5-1970) Hyderpora wheat fields.

Chromosome report : 2 n=40 (Confirmed Bhat, Bakshi & Kaul 1972).

Muzus pumilus (Burm. f.) Steenis in Nova Guinea, n. s. 9:31, 1958.

Lobelia pumila Burm. f. Fl. Ind. 168, t. 60. f. 3, 1768.

Mazus japonicus (Thunb.) O. Kuntze in Rev. Gen. Pl. 2 : 462, 1891; Pennell in Acad. Nat. Sci. Phil. Mon. 1, 137, 1935; Santapau in J. Bombay Nat. Hist. Soc. 49 : 48, 1950.

Lindernia japonica Thunb. Fl. Jap. 253, 1784.

Mazus rugosus Lour. Fl. Cochinch. 385, 1790; FBI 4 : 258.

Annual herbs. Stem somewhat tufted, branched from the base, slender, pubescent or even glabrous. Leaves mostly radical obovate-spathulate, crenate narrowed into a short petiole, slightly hairy on the margins. Flowers on long racemes, pedieellate; pedicels up to 8 mm long, glabrous or sometimes slightly pubescent; ebracteate, or with small bracteoles, white with purplish spots. Calyx 5-fid nearly up to the middle, lobes narrow and acute, tube small glabrous, green, veined, persistent. Corolla protruding out of the calyx; upper lip smaller 2-fid, lower lip spreading and 3-fid. Stamens 4, didynamous included in the corolla tube, anthers contiguous at maturity, very small bluish. Ovary small included in the calyx tube, style as long as the filaments, stigma lyrate. Capsule globular included in the persistent calyx, seeds many.

Germination : Spring (March-April).

Fl. & Fr. : May-July.

Dissemination : The seeds are disseminated mainly by irrigation water and to some extent by animals.

Habitat : An occasional weed of wheat fields. Indicator of moist clay loams.

Root system : A tap root with branches in the surface layers.

Geographical distribution : Afghanistan, Java, China, Japan, Philippine islands.

Specimens examined : *Gammie* s.n. (11-7-1891) Srinagar, 5300 ft. (DD); *Kaul* 179 A (11-5-1970) Hazratbal wheat fields; *Kaul* RRL 16018 (18-3-1971) Magam wheat fields.

Chromosome report : 2n=40 (Verma & Dhillon in Taxon 16 : 220, 1967).

LINARIA Miller

Linaria dalmatica (L.) Miller Gard. Dict. ed. 4, no. 13. 1754. Pennell in Acad. Nat. Sci. Phil. Monog. 5 : 33, 1943; Rao in RBSI 18(2) : 47, 1960; Stewart 651.

Antirrhinum dalmaticum L. Sp. Pl. 616, 1753.

Perennial herbs. Root-stock thick, trailing or even stoloniferous. Stem erect up to 75 cm or more, somewhat woody towards the base, cylindrical or somewhat ribbed towards the apices, glabrous and glaucous. Leaves simple, oval to broadly lanceolate, up to 5.5 cm x 3.0 cm, bases stem clasping, alternate margins entire, apex acute, glabrous or smooth and shining. Flowers up to 3.5 cm or even more in length including the spur which is mostly straight and as long as the corolla, yellow with somewhat brownish throat-boss; bracteate, pedicellate; pedicel glabrous as long or slightly longer than the bract. Calyx lobes 5, divided nearly up to the base, each lobe obovate with a broad base and tapering acute apex, glabrous, persistent. Corolla tube spurred upper lip 2-lobed, lower lip with 3 spreading lobes, throat or mouth clothed with plumose brownish or white covering. Stamens 4, included in the corolla tube, didynamous, anthers distinct. Ovary included in the persistent calyx, glabrous or minutely hairy, style long and stigma 2-fid. Capsule somewhat elongated, slightly pubescent. Seeds many, small, somewhat winged.

Germination : The vegetative suckers as well as weeds sprout in spring (March).

Fl. & Fr. : May-August.

Dissemination : The seeds are disseminated by wind.

Habitat : An occasional weed of orchards, mounds and follow fields. Indicator of dry gravelly soils.

Root system : A thick trailing rootstock with long suckers going up to 30 cm deep in soil.

Geographical distribution : Balkan peninsula, Europe, India : Temperate Himalaya.

Specimen examined : *Kaul* RRL 5531 a (22-5-1969) Rawalpora orchards.

Chromosome report : 2 n=12 (DCA 309).

KICKXIA Dumortier

Kickxia subsessilis Pennell in Acad. Nat. Sci. Phild. Mong. 5 : 59, 1943; Stewart 649.

(Fig. 62)

Stem much branched, prostrate, diffusely spreading up to 60 cm long, villose throughout with white hairs, light green. Leaves simple, ovate, acute to broadly rounded, slightly dentate to hastate, lobed at and above the base, up to 2 cm long and as broad, sessile to subsessile, alternate; nearly all the leaves act as bracts as the stem is floriferous throughout. Flowers up to 1.5 cm long; pedicel 2 cm usually equalling or longer than the bracts, slender, villous, somewhat upcurved near the apex. Sepals ovate-lanceolate, attenuate, up to 3.5 cm long, green, hairy, persistent. Corolla up to 1.5 cm including the spur which is up to 6 mm long, dark yellow, tip of the lower lip deep crimson, externally pubescent, internally hirsute to pubescent. Stamens 4, filaments and anthers ciliate. Capsule up to 3 mm long, depressed, globose, dehiscing by the abscission as a plate. Seeds small, ovoid, brown, irregular, reticulate alveolate.

Germination : Spring (March-April) also sometimes in late autumn (Nov.).

Fl. & Fr. : July - September.

Dissemination : Wind and animals.

Habitat : An occasional weed of orchards, maize fields and pulse fields. Indicator of moist sandy or clayey loams.

Root system : A much branched tap root, the main root going up to 20 cm deep in the soil.

Geographical distribution : Western Himalaya to Eastern Afghanistan.

Specimen examined : *Kaul* RRL 5593 (27-7-1970) Barzulla orchards.

Chromosome report 2n=18 (Bhat, Bakshi & Kaul, 1972).

LEPTORHABDOS Schrenk.

Leptorhabdos parviflora (Bentham) Bentham in DC. Prodr. 10 : 510, 1846; Pennell in Acad. Nat. Sci. Philad. Monog. 5 : 92, 1943.

Gerardia parviflora Benth. Scrop. India 48. 1835.

Leptorhabdos benthamiana Walp. Rep. Bot. Syst. 3 : 387, 1845; FBI 4 : 303; Collett 360.

Erect, annual herbs. Stem up to 75 cm, branched, finely ribbed or sometimes angular, glabrous or slightly pubescent towards the apices, light green. Leaves obovate, pinnatisect, up to 8 cm long, segments linear, toothed or entire; sessile, lower leaves opposite or clustered, upper alternate, glabrous or slightly pubescent. Corolla tube short, limb 5-lobed, spreading, lobes nearly equal. Stamens 4, in unequal pairs, anther cells perfect. Ovary small, included in the calyx tube, style small with a minute stigma. Capsule, oblong, flattened, enclosed in the calyx; seeds 2-3 seriate, small, apiculate, greyish, glabrous and shining.

Germination : Summer (June - July).

Fl. & Fr : September - October.

Dissemination : The seeds are disseminated mainly by wind.

Habitat : A rare weed of some orchards, common at higher altitudes i.e 7-9000 ft. Indicator of compact gravelly soils.

Geographical distribution : Afghanistan, Iran, Temperate Western Himalya.

Specimen examined : *Kapoor* 2823 (5-10-1952) Harwan public gardens.

VERONICA Linnaeus

Key to the species

1. Inflorescence terminal, upper bracts alternate :
   2. Plants perennial from a subterranean rhizome; only the upper leaf axils flower bearing **serpyllifolia**
   2. Plants annual; most of the leaf axils flower bearing :
      3. Leaf-blades oval to lanceolate, dentate to entire; sepals ovate to lanceolate, shortly or not ciliate :
         4. Pedicels shorter than the sepals, seeds many :
            5. Capsule 3.5 mm long, yellowish or reddish, much wider than long **verna**

5. Capsule 2.5-3 mm wide, deeply notched. greenish yellow, scarcely wider than long — **arvensis**

4. Pedicels (as long as) or longer than sepals, seeds few — **persica**

6. Capsule notched in the centre, glandular hairy; sepals usually as long or smaller than the capsule — **didyma**

6. Capsule hemispheric or narrower, slightly flaring, pubescent

7. Capsule with soft glandular hairs; style up to 0.5 mm long; sepals ovate, pedicels spreading — **biloba**

7. Capsule pubescent with longer hairs, some are usually gland tipped, style 1-1.5 mm long; sepals lanceolate, pedicels recurving — **campylopoda**

3. Leaf blades wider than long, shallowly 3-lobed, the lobes rounded; sepals ovate, long ciliate — **stewartii**

1. Main stem not terminating in an inflorescence, flowers in axillary cymes or sometimes racemes :

8. Leaves all petiolate, oblong-oval, obscurely crenate; stem decumbent — **beccabunga**

8. Leaves at least upper ones sessile and stem clasping :

9. Pedicels ascending, making racemes less than 1 cm wide. Capsule acutish or obtuse. Leaf blades serrate :

10. Rachis, pedicels, sepals and capsules glabrous or nearly so; capsule strongly flattened, equalling or slightly exceeding the sepals — **anagallis-aquatica**

10. Rachis, pedicels, sepals and capsule glandular-pubescent, capsule about one and half times the length of sepals — **secunda**

9. Pedicels spreading, usually distally upcurved, making racemes over 1 cm wide. Leaf blades serrulate or entire — **salina**

Veronica serpyllifolia L. var. **humifusa** (Dickson) Vahl Enum. Plant. 1 : 65, 1805; Pennell in Acad. Nat. Sc. Philadelphia Monog. No. 5, 77, 1943; Stewart 666.

Veronica humifusa Dickson in Trans. Linn. Soc. 2 : 281, 1794.

Perennial herbs. Stem arising from stoloniferous branched rootstock, ascending up to 15.5 cm, slender, glabrous or pubescent, often glandular. Leaves simple, oblong-ovate to obscurely crenate or sometimes entire, up to 1.1 cm diam., shortly petioled, opposite or uppermost sessile and alternate, glabrous and glandular. Flowers white or somewhat purplish, stalked; stalk always shorter than or as long as the bract; forming terminal racemes. Calyx 4-lobed, as long or longer than the capsule, glandular and persistent, Corolla as long or slightly longer, pubescent within and veined, soon falling off. Stamens 2 with simple bluish, rounded, anthers. Capsule obviously wider than long, notched slightly, style shorter in length than the capsule. Seeds many, pale yellow or greenish, up to 1.5 mm diam.

Germination : Early spring (February - March).

Fl. & Fr. : May - June.

Dissemination : The seeds are disseminated by irrigation water and to some extent by animals.

Habitat : A common weed of field crops and pastures at higher altitudes, rarely below 7000 ft. Indicator of moist and muddy loams.

Root system : The rootstock is creeping and the adventitious roots arise from it.

Geographical distribution : Temperate Asia, North Africa, Britain and America.

Specimens examined : *Gammie* s. n. (18 7-1891) Srinagar (DD); *Kaul* RRL 910 (20-5-1969)Ganderbal fallow pastures.

Veronica verna L. Sp. Pl. 14, 1753;FBI 4 : 296; Pennell in Acad Nat. Sci. Philadelphia Monog. 5 : 78, 1943; Stewart 667. **(Fig 63)**

Annual small herbs. Stem 6-12 cm generally many branches arise from or near the base, slender, somewhat erect, leafy all over, slightly hairy, sometimes glandular towards the apices, throughout floriferous. Leaves ovate to obovate, crenate, sometimes 3-cleft, up to 8 mm wide and as long or slightly longer, sessile, slightly hairy, nearly all acting as bracts excepting 1 or 2 at the base. Flowers small up to 4 mm diam, axillary with a small pedicel, looking sessile, blue, never longer than the bract. Calyx 4-lobed, lobes obovate, hirsute as long or longer than the capsule, persistent. Corolla lobes slightly shorter than the calyx lobes. Capsule 3.5-4.5 mm long, yellowish, style exserted but small. Seeds many, brick red, small.

Germination : Early spring (February-March).

Fl. & Fr. : Mid April-May.

Dissemination : The seeds are disseminated by wind and irrigation water.

Habitat : A common weed of lawns, parks, roadsides rootpaths and cultivated fields. Indicator of sandy loams.

Root system : A meagrely developed tap root.

Geographical distribution ; Europe, North Asia, Temperate Western Himalaya.

Specimens examined : *Thapliyal* 26380 (1-6-1958) Dorus, Kashmir (DD); *Kaul* RRL 5526A (25-4-1969) RRL lawns and fields; *Kaul* 181 (11-5-1970) Hyderpora, wheat fields.

Chromosome report : 2n=16 (DCA 310, Confirmed).

Remarks : A fast spreading weed eradicates the common lawn grasses as *Cynodon dactylon* and *Poa annua* at many places.

Veronica arvensis L. Sp. Pl. 13, 1753; FBI 4 : 296; Collett 358; Pennell in Acad. Nat. Sci. Phil. Monog. 5 : 78, 1943.

Annual procumbent herbs. Stem generally suberect or ascending up to 30 cm long, branching from the base, slender, pubescent, hairy or glandular hairy. Leaves simple, ovate to obovate, sessile, up to 1 cm wide and as long, upper leaves floriferous. Flowers small, blue, pedicel very small forming lax racemes. Calyx and corolla similar to preceding species, Capsule somewhat deeply notched, up to 3 mm wide and as long. Seeds many.

Germination : Early spring (February-March).

Fl. & Fr. : Mid April-May.

Dissemination : Mostly by wind.

Habitat : A rare weed of orchards and pastures. Indicator of dry sandy loams.

Root system : A meagrely developed tap root.

Geographical distribution : Europe, N. Asia, and N. Africa.

Specimen examined : *Kaul* RRL 16034 (5-6-1971) Naseem Bagh orchards.

Chromosome report : 2n=14, 16 (DCA 310).

Remarks : I follow Pennell (1943) in treating it as a distinct species. It can be a variety of *V. verna.*

Veronica persica Poir. Encyc Meth. Bot. 8 : 542, 1808; FBI 4 : 294; Pennell in Acad. Nat. Sci. Phila. Monog. 5 : 78, 1943; Rao in RBSI 18(2) : 48, 1960; Stewart 666.

Annual herbs Stem generally procumbent, branched from the base, up to 30 cm long, hairy; hairs somewhat spreading; slender with tips of the branches ascending. Leaves simple, ovate, coarsely serrate, base rounded or cordate; petiolate; petiole smaller than the leaf, hairy; opposite or alternate towards the apex, hairy on both surfaces. Flowers up to 9 mm diam., deep blue, pedicel generally longer than the leafy bract but slender and recurved in fruit. Calyx 4-lobed, lobes obovate, generally longer than the capsule, hairy, persistent. Corolla lobes slightly longer than the calyx. Capsule 6-7 mm diam., slightly ciliate, hairy with raised reticulations, style up to 2 mm long. Seeds 5-12 in each cell, small up to 3 mm. diam., boat-shaped with a central concavity, hard.

Germination : The seeds germinate in early spring (February-March) and also sometimes in late autumn (October-November).

Fl. & Fr. : March-April or sometimes in December.

Dissemination : The seeds are disseminated by wind & water.

Habitat : A common weed of orchards and wheat fields. Indicator of sandy loams.

Root system : A much branched slender tap root.

Geographical distribution : Europe, West & Central Asia, North Africa.

Specimen examined : *Kaul* RRL 5990 (6-5-1970) RRL campus fields, Srinagar.

Chromosome report : 2n=28 (DCA 310, Confirmed).

Veronica didyma Tenore, Prodr. Fl. Nap. 6, 1811; Stewart 664.

Veronica agrestis auct. non L (1753); FBI 4 : 294; Collett 357; Rao in RBSI 18 (2) : 48, 1960.

Annual herbs. Stem generally procumbent, spreading up to 30 cm long branches, pubescent and slender. Leaves ovate to broadly ovate, up to 2 cm wide near the base and as long, short stalked, opposite below and alternate above, slightly pubescent. Flowers whitish or with violet tinge, arranged in apical axillary racemes, pedicels as long or shorter than the leaves. Sepals 4, generally shorter than the capsule, narrowing towards the apex, persistent, Corolla as long or generally shorter than the calyx, soon falling off. Capsule biglobose, notched, style 1.5 mm long. Seeds small, hard, boat-shaped, deeply pitted, 8-10 in each cell.

This species is found associated with *V. persica* Poir. in fields and easily distin-

guished by small and somewhat thick leaves and small white or pinkish flowers.

Specimens examined : *Kaul* RRL 5947 (3-4-1969) RRL Campus; Srinagar.

Geographical distribution : Europe, North & West Asia to Japan China, and North Africa.

Chromosome report : 2n=14, 28 (DCA 310).

Veronica biloba L. Mant. Pl. 172, 1771; FBI 4 : 294; Blatter 2 : 82; Pennell in Acad. Nat. Sci. Philad. Monog. 5 : 80, 1943; Stewart 664. **(Fig. 64)**

Small annual herbs. Stem generally erect or ascending up to 20 cm diffusely branched from the base, pubescent or sometimes glabrous, slender. Leaves simple, oblong to ovate lanceolate, up to 2 cm x 0.5 cm, sessile to subsessile, lower ones opposite and running into upper alternate ones, glabrous or hairy. Flowers bluish, axillary; pedicels as long or generally longer than the leafy bracts, slender with a solitary flower. Sepals 4, spreading, generally longer that the capsule glabrous or puberulous, persistent. Corolla 4, always shorter than the calyx, soon falling off. Stamens 2. Capsule deeply lobed with soft glandular hairs, much broader than long, flattened, cells 2-4 seeded, style small. Seeds oblong, boat-shaped, more or less deeply pitted.

Germination : Early spring (February-March).

Fl. & Fr. : April-May.

Dissemination : Wind and rain or irrigation water.

Habitat : An occasional weed of wheat fields, pea fields, orchards and pastures. Indicator of well aerated clayey loams.

Root system : A meagrely developed tap root.

Geographical distribution : Western Himalaya : Kashmir to Kumaon, Turkey, Afghanistan.

Specimens examined : *Kaul* RRL 5941 (12-3-1969) Habak orchards; *Kaul* RRL 5948 (3-4-1969) Barzulla orchards.

Chromosome report : 2n=28 (DCA 310, Confirmed).

Veronica campylopoda Boiss. Diagn. 1(4) : 80, 1844; Pennell in Acad. Nat. Sci. Philad. Monog. 5 : 81, 1943; Stewart 664.

Veronica hallbergi Blatter in Beau. Fls. Kashmir 2 : 82, 1929.

The species can be easily distinguished from *V. biloba* by the following differences :

1. Plants annual, generally small up to 10 cm.
2. Calyx lobes smaller in the fruit.
3. Corolla much smaller and bluish.
4. Capsule divided nearly up to the base, pubescent with long hairs, some being gland-tipped.
5. Pedicels recurving in the fruit, and
6. Seeds transversely rugose, pale brown with a groove on one side.

This species can be easily mistaken for *V. biloba* because of minor differences. Hooker, J.D.(1884) does not even consider it as a variety of *V. biloba* Linn. I follow Pennell (1943) in considering it as a distinct species described by Boissier (1844) and afterwards mistaken

as a new species (*V. hallbergi*) by Blatter (1929). It flowers alongwith *V. biloba* in March-April.

Specimen examined : *Kaul* RRL 5948a (3-4-1969) Rawalpora orchards, Srinagar.

Geographical distribution : Baluchistan, Afghanistan.

Chromosome report : 2n=42 (DCA 310).

Veronica stewartii Pennell in Acad. Nat. Sci. Philadelphia Monog. 5 : 81, 1943; Stewart 666.

Veronica hederifolia (non L.) of FBI 4 : 294, 1884.

Annual herbs. Stem generally prostrate, elongated up to 20 cm long, pilose or finely villose with spreading or reflex hairs, usually with a few long branches. Leaves oval or subrotund, rounded with one pair of short-obtuse lobes, 3-fid or even 5-fid, glabrate, or slightly pubescent, petioles up to 1.5 cm long. Flowers axillary, pedicels up to 4 mm long, spreading finely villose, shorter than the petioles of leafy bracts. Sepals 4, equal, ovate, acuminate, rounded or slightly cuneate at the base, ciliate with long white hairs. Corolla shorter than the sepals, whitish. Capsule 2-2.5 mm long, glabrous, slightly notched, lobes semicircular to rounded. Seeds one in each cell, brown.

Stewart has collected type specimen of Pennell from Srinagar, but I have not been able to collect this plant from this region.

Veronica beccabunga L. Sp. Pl. 1 2, 1753; FBI 4 : 293; Blatter 2 : 79; Pennell in Acad. Nat. Sci. Philad. Monog. 5 : 88, 1943; Stewart 663.

Annual or biennial herbs. Stem prostrate, somewhat succulent, branched, reddish, slightly hairy generally hairless, spreading to form mats. Leaves oval or inversely egg-shaped, blunt or coarsely toothed, sessile to subsessile, opposite, fleshy, glabrous. Flowers few or many forming axillary racemes up to 8 cm long, bluish purple, pedicels commonly longer or as long as the leafy bracts. Calyx lobes egg-shaped to oblong, shorter than the corolla lobes Corolla lobes oval and unequal. Capsule rounded, flattened, as long as or longer than the persistent calyx lobes, slightly notched at the tip; style as long as the capsule or slightly shorter. Seeds many, flattened and smooth.

Germination : The seeds require water for germination and survival of seedlings. The sprouting occurs in March-April.

Fl. & Fr. : May-July.

Dissemination : Mainly by water and to some extent by wind.

Habitat : A common weed of paddy fields, irrigated wheat fields, vegetable fields and along canals of orchards, preferring moist situations. Indicator of fertile clayey loams,

Root system : A creeping rootstock with bunches of nodal roots. The rootstock creeps along the surface of soil and forms thick dense mats.

Geographical distribution : Extends through most of the Palaeoarctic regions of Eurasia.

Specimens examined : *Kaul* 176 (9-5-1970) Habak vegetable fields; *Kaul* RRL 16082 (14-8-1971) Majid Bagh paddy fields.

Chromosome report : 2n=18 (DCA 311).

Veronica anagallis-aquatica L. Sp. Pl. 12, 1753; Pennell in Acad. Nat. Sci. Phild. Monog. 5 : 88, 1943; Yamazaski in Kitamura's Fl. Afghanistan 359, 1960; Stewart 663.

Annual herbs with a stoloniferous rootstock rooting at nodes in the mud. Stem ascending up to 35 cm, slender, sometimes fistular below, glabrous or glandular pubescent. Leaves simple, obovate to lanceolate, broader in the middle, up to 4.5 cm x 0.7 cm, margins dentate, apex obtuse to acuminate, opposite, sessile, stem clasping. Flowers small in long axillary racemes towards the apices of branches, violet or purple white; bracts small linear lanceolate, generally as long or even shorter than the slender pedicels. Calyx 4-lobed, up to 2 mm long and slightly less broad, persistent. Corolla longer than the calyx lobes. Capsules oval, in contour, strongly flattened, equalling or shorter than the calyx lobes, Seeds up to 0.5 mm long, dull brown, 1-3 in each cell.

Germination : Early spring (Feb.-March); the seeds germinate under water.

Fl. & Fr. : May-July.

Dissemination : Mostly by irrigation water.

Habitat : An occasional weed of well irrigated paddy fields, ditches, margins of left over ponds and some marshes. Indicator of muddy fertile loams.

Root system : A stoloniferous rootstock running along the ground level in the muddy soil and producing bunches of adventitious roots at the nodes.

Geographical distribution : A wide spread Palaeo-arctic plant. Naturalized in North & South America.

Specimens examined : *Kaul* 192 (22-5-1970) Hyderpora, paddy fields; *Kaul* RRL 5599 (27-7-1970) Barzulla orchards

Chromosome report : 2n=36 (DCA 311).

Veronica secunda Pennell in Acad. Nat. Sci. Philad. Monog. 5 : 89, 1943; Stewart 666. **(Fig. 65)**

Annual or biennial herbs forming stoloniferous rhizome as in *V. anagallis-aquatica* Linn. Stem simple or branched, erect up to 90 cm tall, glabrous below and glandular pilose especially towards the apex. Leaves elliptic oblong to oblong-lanceolate, acute, up to 6.0 cm x 2.5 cm, more or less serrate closely with low teeth, glandular pubescent on both the surfaces or glabrous; lower surface, sessile, generally opposite. Racemes up to 20 cm long, densely pilose throughout, secund. Flowers slightly violet or lavander coloured, bracteate; bracts linear lanceolate, usually all but lower exceeded by the pedicels. Sepals oblong lanceolate, acute, shorter than the capsule. Corolla lobes ovate, acutish, unequal, violet-veined. Stamens shorter than the corolla lobes. Capsule 3-3.5 mm long, pyramidal to ovoid, finely glandular pubscent. Seeds oval, turgid smooth and brown.

Germination : Seeds germinate in moist and shady situations in spring (March-April).

Fl. & Fr. : May-September.

Dissemination : The seeds are disseminated by irrigation water and to some extent by wind.

Habitat : An occasional weed of ditches, water channels and paddy fields. Indicator of muddy and fertile loams.

Root system : Rootstock creeping and producing rootlets at nodes.

Geographical distribution : Western Himalaya.

Specimens examined : *Kaul* 172 (8-5-1970) Habak, pea fields; *Kaul* 179 (11-5-1970) Hyderpora, wheat fields; *Kaul* 290 (23-9-1971) Shalimar paddy fields.

Veronica salina Schur. Enum. Pl. Transsylv. 492, 1866; Pennell in Acad. Nat. Sci. Philad. Monog. 5 : 90, 1943; Stewart 666.

Annual or biennial herbs. Stem erect up to 50 cm, somewhat fistular towards the base, unbranched or branched, glabrous or glabrous pubescent at the apices. Leaves simple, obovate lanceolate, obscurely crenate, to serrate, up to 9.5 cm x 2.5 cm, opposite sessile or lowest ones shortly petiolate, glabrous or sometimes glandular pubescent. Flowers in long axillary racemes; mostly towards the apices, whitish; bracts linear lanceolate, as long or smaller than the pedicels which are usually distally upcurved. Sepals 4, lobes slightly shorter than the capsule, glandular and persistent. Capsule slightly longer than broad, slightly notched, sometimes pilose or even glabrous; style usually half as long as the capsule. Seeds many, small, brownish with a concavity.

Fl. & Fr. : June - August.

Habitat : A semiaquatic weed found in ditches and well irrigated cultivated fields.

Geographical distribution : Europe, Asia, North & South Africa and N. America.

Specimens examined : *Kaul* RRL 19651 (26-8-1969) Rawalpora vegetable fields.

LENTIBULARIACEAE

UTRICULARIA Linnaeus

Utricularia aurea Lour. Fl. Cochinch. 26, 1790; Subramanyam & Kamble in Proc. Ind. Acad Sci. 32(5) : 222, 1968; Stewart 673.

Utricularia flexuosa Vahl, Enum. Pl. 1 : 198, 1905; FBI 4 : 329; Blatter 2 : 75.

A perennial aquatic floating herb. Stem with long, much branched stolons, slender, floating in water, sometimes rooting at nodes, glabrous. Leaves usually in whorls of 4, pinnately divided into many filiform comb-like segments; each leaflet bearing a small almost globose long pointed bladder in the axil. Flowers yellow, up to 1.5 cm diam., pedicellate, calyx segments enlarged in fruit.

Field notes : The plants occur as weeds in the rice fields where the water level is up to 5 cm or even low. It is generally associated with algae like *Chara* sp. and other microscopic algal members. The plants form a complete mesh work in shallow waters and are very difficult to eradicate. The stem is soapy and slips because of algal covering over it. The plants have not been seen to flower in paddy fields, as at the time of their flowering the water gets dried up and plants do not remain in healthy state to produce flowers. The flowers are however formed in these plants when growing in lakes and ditches. The bladders are found in large numbers and the plant mostly reproduces vegetatively by fragmentation as most of the aquatics do.

Specimens examined : *Kaul* RRL 19603 (21-61969) Badgam paddy fields; *Kaul* 277 (4-8-1971) Hyderpora paddy fields.

Geographical distribution : South east Asia, and North Australia.

Chromosome report : 2 n = 42 (Subramanyam & Kamble, 1968).

VERBENACEAE

VERBENA Linnaeus

Verbena officinalis L. Sp. Pl. 20, 1753; FBI 4 : 565; Gorsh in Fl. URSS 19 : 694, 1953; Rao in RBSI 18(2) : 50, 1960; Stewart 608. **(Fig. 66)**

Annual herbs. Stem erect up to 65 cm, sometimes bases are decumbent and ascending, tetrangular, glabrous or downy and puberulous, branched. Leaves simple to pinnatifid, lower ones lobed and petiolate, up to 9.5 x 2.5 cm, upper ones obovate lanceolate, deeply crenate, opposite, more or less pubescent or hoary on the midrib and nerves form under surface. Flowers slightly pinkish, in long apical branched spikes, dense, bracteate; bract narrow, filiform, hoary and persistent even after the fruit has fallen. Calyx 5-toothed, teeth very minute, united into a tube below, persistent. Corolla 5-lobed, tube slightly oblique, coming out of the calyx tube, throat slightly hairy. Pyrenes oblong, tapering towards the base, 3-ribbed smooth or margins somewhat scabrid.

Germination : Spring (March-April).

Fl. & Fr. : July-October.

Dissemination : Wind and animals.

Habitat : An occasional weed of orchards and vegetable fields preferring moist situations. Indicator of dry sandy or clayey loams.

Root system : A thick tap root going up to 25 cm deep, the branches spread along the sides.

Geographical distribution : Kashmir to Bhutan, Bengal plains to Sunderbans; Temperate and subtropical regions of world; naturalized in America.

Specimens examined : *Kaul* RRL 5546 (18-7-1969) Barzulla orchards; *Kaul* RRL 5597 (27-7-1970) Barzulla; *Kaul* RRL 19712 (19-9-1971) Hyderpora, paddy fields.

Chromosome report : 2n=14 (DCA 323).

LAMIACEAE/LABIATAE

Key of the genera

1. Corolla regular or nearly so, not bilipped :
   2. Stamens 2, leaves glabrous — **Lycopus**
   2. Stamens 4, leaves glabrous or hairy :
      3. Flowers white, purple or yellow; stamens in unequal pairs — **Elsholtzia**
      3. Flowers liliac; stamens all equal — **Mentha**
1. Corolla irregular, limb bilipped :
   4. Stamens 2, anther cells widely separated — **Salvia**
   4. Stamens 4, anther-cells never widely separated :
      5. Lower lip of the corolla distinctly 3-lobed, lobes unequal :
         6. Leaves obovate-ovate, calyx lobes 5 ,spiny tipped — **Sideritis**

6. Leaves oblong lanceolate, calyx lobes 5-10, sometimes spiny — **Marrubium**
   7. Calyx not bilipped, teeth equal or nearly so :
      8. Upper lip of the corolla flat nr nearly so; flowers in short spikes — **Origanum**
      8. Upper lip of corolla concave or hood-like; flowers in short or long spikes :
         9. Upper pairs of stamens longer than the lower — **Nepeta**
         9. Lower pair of stamens longer than the upper :
            10. Calyx 10-toothed — **Lencas**
            10. Calyx 5-toothed — **Stachys**
7. Calyx bilipped, teeth unequal :
   11. Calyx mouth remaining open after flowering; throat hairy :
      12. Plants generally procumbent and scented; calyx tube bilipped — **Thymus**
      12. Plants erect and never scented; calyx tube curved and flowers in dense clusters — **Calamintha**
   11. Calyx mouth closing after flowering :
      13. Fruiting calyx 2-partite, lips entire, upper with a broad plate — ***Scutellaria***
      13. Fruiting calyx tubular upper lip 3-toothed — **Prunella**
5. Lower lip of corolla 3-lobed, lateral lobes very small or wanting — **Lamium**
1. Corolla irregular, limb 1-lipped, upper lip wanting — **Teucrium**

LYCOPUS Linnaeus

Lycopus europaeus L. Sp. Pl. 21, 1753; FBI 4 : 648; Mukerji in RBSI 14 : 102, 1940, Bolk. Fl. URSS 21 : 395, 1954; Stewart 616. **(Fig. 67)**

Perennial herbs with a creeping or stoloniferous rootstock. Stem up to 65 cm tall, branched, woody towards the base, generally angular, ribbed and finely grooved, glabrous. Leaves obovate lanceolate, up to 7.5 cm x 1.8 cm, opposite, sessile, margins deeply dentate, rarely pinnatifid, teeth long and pointed, nerves prominent from the undersurface, glabrous. Flowers small, white in dense axillary clusters forming small compact heads at nodes. Calyx deeply 5-fid, as long or slightly longer than the corolla, glabrous and persistent. Corolla 4-5 fid, lobes small, white, sometimes with hairy throat. Stamens 2 with small anthers having parallel cells. Ovary small, style protruding out of corolla tube, 2-fid with flattened arms. Nutlets obovate, up to 0.8 mm long, smooth, within the persistent calyx.

Germination : Late spring (July-August).

Fl. & Fr. : September-November.

Dissemination : Wind and water.

Habitat : An occasional weed of orchards growing by the side of canals and possessing a gregarious habitat. Indicator of moist fertile loams.

Root system : A thick somewhat creeping rootstock with stoloniferous branches perennating the unfavourable weather.

Geographical distribution : West Asia, Iran and Afghanistan.

Specimens examined : *Gollan* 9077 (12-10-1889) Near Srinagar (DD); *Meebold* 2669

(Sept. 1905) Sumbal (CAL); *Kaul* 68 (2-8-1969) Barzulla orchards.

Chromosome report : 2n=22 (DCA 329).

ELSHOLTZIA Willdenow

Elsholtzia strobilifera Benth. in Lab. Gen. & Sp. 163, 1835 and DC. Prodr. 12 : 162, 1852; FBI 4 : 645; Collett 389; Blatter 2 : 123; Stewart 612.

Annual herbs. Stem erect, 10-40 cm in height, simple or branched, hairy; hairs white, spreading and in a line; slender. Leaves ovate to obovate, simple, 2-5.5 cm x 1-2.5 cm, opposite, subsessile petiole up to 5 mm long, hairy; coarsely serrate, hairy. Flowers small, rosy in compact cone like spikes which are cylindrical and 2-5 cm x 0.3-0.8 mm at maturity; bracts membranous, somewhat longer and concealing the flowers, persistent. Calyx teeth lanceolate, tube slender and hairy. Corolla tube longer than the calyx, hairy; lobes small and hairless. Ovary 4-celled, style long with a bifid stigma. Nutlets 4, oblong, glabrous and glaucous.

Germination : Spring (March-April).

Fl. & Fr. : May-September.

Dissemination : The seeds get disseminated mainly by wind.

Habitat : A rare weed of fields at lower altitudes. Indicator of moist fertile acidic or humic soils.

Root system : A much branched tap root system.

Geographical distribution : Temperate and alpine Himalaya.

Specimens examined : *Kaul* 200 (25-5-1970) RRL campus, Srinagar.

Remarks : The plants are sweet smelling and occur commonly in the fields of Simla (Collett, 1902).

Illustration : Blatter pl. 53, fig. 1.

MENTHA Linnaeus

Mentha longifolia (L.) Huds. Fl. Angl. 221, 1762; Boriss. in Fl. URSS 21 : 611, 1954; Rao in BOBSI 2 (3 & 4) : 411, 1960; Stewart 617.

Mentha spicata-longifolia L. Sp. Pl. 576, 1753.

Mentha sylvestris L. Sp. Pl. 804, 1763; FBI 4 : 647; Mukerji in RBSI 14 : 86, 1940.

A perennial herb with creeping rootstock. Stem erect, up to 60 cm in height, branched from the base, somewhat angled, finely tomentose or hoary. Leaves ovate, oblong to lanceolate, opposite, up to 7.5 cm x 2.3 cm, nearly sessile, sharply toothed acute; upper surface hoary pubescent, lower white tomentose. Flowers small, liliac in large whorls, crowded in axillary and terminal, cylindric, tapering spikes. Calyx 5-toothed, tube campanulate, hairy and persistent. Corolla tube included in the calyx; limb erect, 4-lobed, lobes nearly equal. Stamens 4, equal, protruding, filaments naked. Ovary 4-celled, style protruding out of the corolla tube, arms unequal. Nutlets 4, small, glabrous, somewhat rounded, black-brownish.

Germination : Spring (March-April).

Fl. & Fr. : July-September.

Dissemination : The weed mostly spreads through under ground suckers though it spreads by seeds also. The seeds are disseminated by wind, and water and animals.

Habitat : A common and abundant weed of orchards, margins of paddy fields, grasslands and also fallow places preferring moist situations. Indicator of moist, compact clay loams.

Root system : The rootstock produces suckers which creep under the surface of the plants over long distances.

Geographical distribution : Europe, Iran, Afghanistan, West & Central Asia, Himalaya, Tibet.

Specimens examined : *Kaul* RRL 19697 (12-7-1971) Srinagar orchards; *Kaul* 274 (3-8-1971) Paddy fields of Shalimar.

Local name : Vena.

Remarks : A good smelling plant used in religious ceremonies.

Illustration : Polunin pl. 116.

Chromosome report : 2n=18, 24, 48 (DCA 326).

SALVIA Linnaeus

Salvia moorcroftiana Wallich ex Benth. in Wallich Pl. As. Rar. 1 : 67, 1830; FBI 4 : 654; Mukerji in RBSI 14 : 110, 1940; Rao in RBSI 18(2) : 51, 1960; Stewart 631.

Perennial herbs. Stem erect, up to 50 cm tall and up to 2 cm diam near the base, branched, clothed, with white hairs, ribbed and narrowly grooved. Leaves ovate to oblong, up to 11.5 cm x 6.5 cm, thick and rugose, sinuate and irregularly lobed, crenate or sharply toothed; radical ones petiolate; petiole up to 6.5 cm long, woolly or tomentose; cauline leaves generally sessile and smaller, nearly glabrous to tomentose, wrinkled, lower surface white tomentose. Flowers pale blue to purplish white, up to 3 cm long in many distant whrols; bracts large up to 2 cm broad, orbicular, abruptly pointed, green veined, somewhat tomentose, persistent. Calyx teeth spinous, upper lip 3-toothed, tube campanulate, somewhat bristly. Corolla tube much longer than the calyx, upper lip long curved, flattened, concave. Stamens 2, filaments short, anther cells one at each end of a slender curved connective. Ovary 4-celled, style long, stigma minute. Nutlets subglobose, smooth, dark brown.

Germination : Spring (March-April).

Fl. & Fr. : May-August.

Dissemination : The seeds get disseminated mainly by wind.

Habitat : An occasional weed of some orchards, wheat and maize fields. Indicator of sand or gravelly soils.

Root system : A thick somewhat creeping branched rootstock perennating the unfavourable seasons.

Geographical distribution : Afghanistan, India : Kashmir-Kumon, Pakistan.

Specimens examined : *Thapliyal* 26304 (27-5-1958) Srinagar (DD); *Kapoor* 7883 (11-5-1962) Srinagar orchards; *Kaul* RRL 19783 (18-8-1972) Tangmarg maize fields.

SIDERITIS Linnaeus

Sideritis montana L. Sp. Pl. 575, 1753; Polunin 351; Kaul in J. Bombay Nat. Hist. Soc. 69(1) : 230, 1972; Stewart 634.

(Fig. 68)

Annual herbs. Stem up to 20 cm erect, branched from the base, angular, woolly all over, jointed, leaves, 1.5-4.0 cm x 0.3-0.8 cm, simple, opposite, oblong-lanceolate, sessile, hairy all over, more on the margins; lower

leaves blunt and upper mucronate. Flowers bracteate; bracts leafy, longer than the flowers, in verticils, on long, lax and leafy spikes, each whorl usually six-flowered. Calyx gamosepalous, cupular with five spiny-tipped lobes, three upper forming the upper lip; tube up to 0.8 cm somewhat longer than the lobes, base swollen, distinctly ribbed, hairy. Corolla gamopetalous, bilipped, generally as long as the calyx or slightly, exerted, yellowish with brown dots, turning brown on maturity. Corolla tube up to 4 mm long, hairy outside. Upper lip with three conspicuous lobes, hairy and lower lip with two small lobes, dotted. Stamens 4, included in the corolla tube, didynamous, anthers small, globular. Ovary on a raised, rectangular and glabrous receptacle. Style included in the corolla tube, gynobasic. Capsule with 4-nutlets, each nutlet 2-4 mm diam. tapering towards the apex with a definite median ridge, mottled, slightly brownish.

Geographical distribution : Europe.

Specimens examined : *Kaul* 11 (3-12-1968) Barzulla; *Kaul* 25 (21-4-1969) Rawalpora.

MARRUBIUM Linnaeus

Marrubium vulgare L. Sp. Pl. 583, 1753; FBI 4 : 671; Rao in RBSI 18(2) : 52, 1960; Stewart 617. **(Fig. 69)**

Perennial herbs. Stem erect, up to 60 cm, robust, tufted, branched from the base, faintly ribbed, tomentose or even woolly. Leaves simple, ovate, base rounded or cordate, up to 3.5 cm diam, leathery, wrinkled, margins crenate, lower surface woolly, petiolate; petiole small and tomentose, opposite. Flowers whitish, small in axillary dense whorls, up to 25 flowers in a whorl forming small heads. Calyx tube campanulate, up to 7 mm long, 10-nerved, tomentose, teeth 10 or even more, spreading and curved near the tip, slightly spiny, persistent. Corolla tube small and slender, upper lip long and 2-fid. Stamens 4, included in the corolla tube, anthers with cells divergent. Ovary 4-celled. Nutlets 4, grey, smooth.

Germination : The seedlings sprout in early spring i.e. March either from the rootstock or seed.

Fl. & Fr. : July-September.

Dissemination : The plant spreads vegetatively as well as through seed.

Habitat : A common weed of fallow lands, roadsides, waste heaps and also orchards, preferring dry situations. Indicator of sandy or gravelly loams.

Root system : A thick rootstock with somewhat creeping branches, the branches are restricted in the surface horizons of the soil.

Geographical distribution : Afghanistan, Europe, North Africa. Introduced to America.

Specimens examined : *Meebold* 2670 (June, 1905) Baramulla, Kashmir, (CAL); *Kaul* RRL 19605 (6-7-1969) Srinagar roadside; *Kaul* RRL 5588 (27-7-1970) Barzulla fallow fields.

Local name : Ganda Soi.

Chromosome report : 2n=34, 36 (DCA 329).

ORIGANUM Linnaeus

Origanum vulgare L. Sp. Pl. 590, 1753; FBI 4 : 648; Mukerji in RBSI 14 : 50, 1940; Stewart 627.

Perennial herbs with somewhat stoloniferous rootstock. Stem up to 65 cm, erect or somewhat procumbent, slightly tufted near the base, branched, tomentose or villous, leafy. Leaves simple, broadly ovate to obovate, up to 5 cm x 2 cm margins generally entire or sometimes finely toothed, hairy on both the surfaces, petiole up to 5 mm, villous as the stem opposite. Flowers white with purplish dots; bracts green or purple, ovate, obtuse to acute; arranged in corymbose cymes. Each cyme is carried on a long axillary peduncle, up to 3 cm diam consisting of dimorphic flowers; larger ones are bisexual and smaller ones are female. Calyx-teeth short, tube villous. Corolla protruding out of the calyx, 2-lipped; upper lip notched or 2-fid, lower one spreading and 3-fid. Stamens 4, unequal, anthers small with distinct and spreading cells. Ovary small included in the calyx-tube, style just protruding out of the corolla tube, style arms unequal and acute. Nutlets obovate to slightly rounded, smooth.

Germination : Spring (March-April).

Fl. & Fr. : July-September.

Dissemination : The seeds are disseminated mainly by wind.

Habitat : A rare weed of some orchards preferring moist humic situations. Indicator of acidic soils.

Root system : A much branched rootstock perennating the unfavourable season.

Geographical distribution : Himalaya, Afghanistan, West and North Asia, North Africa.

Specimens examined : *Gammie* s.n. (20-8-1891) Kashmir (DD); *Duthie* 13500 (16-8-1969) Lidderwat, Kashmir (DD); *Kaul* RRL 915 (16-8-1969) Chishma-Shahi orchards.

Remarks : A sweet scented herb, scent used in perfumery.

Chromosome report : 2n=30, 32 (DCA 328).

NEPETA Linnaeus

Key to the species

1. Leaves distinctly petioled, entire or crenate :
   2. Rootstock bulbous; spikes compact upto 2 cm long — **raphanorhiza**
   2. Rootstock never bulbous; spikes up to 16.5 cm long. Flowers lax — **cataria**
1. Leaves simple and sessile, entire, or crenate :
   3. Spikes up to 4.5 cm., flowers compact — **connata**
   3. Spikes small, axillary; flowers small up to 1.5 cm long — **linearis**

Nepeta raphanorhiza Benth. Lab. Gen. & Sp. 734, 1835; FBI 4 : 659; Mukerji in RBSI 14 : 126, 1940; Rao in BOBSI 2 (3 & 4) : 412, 1960; Stewart 625.

Perennial herbs. Stem many arising from a small globose rootstock, slender, procumbent, diffuse or ascending, up to 20 cm long branches, slightly angular, villous with white hairs. Leaves simple, broadly ovate or ovate-cordate, up to 2 cm x 1.2 cm, petiolate; petiole smaller than the leaf, hairy; opposite, margins crenate, apex obtuse or sub-obtuse, both

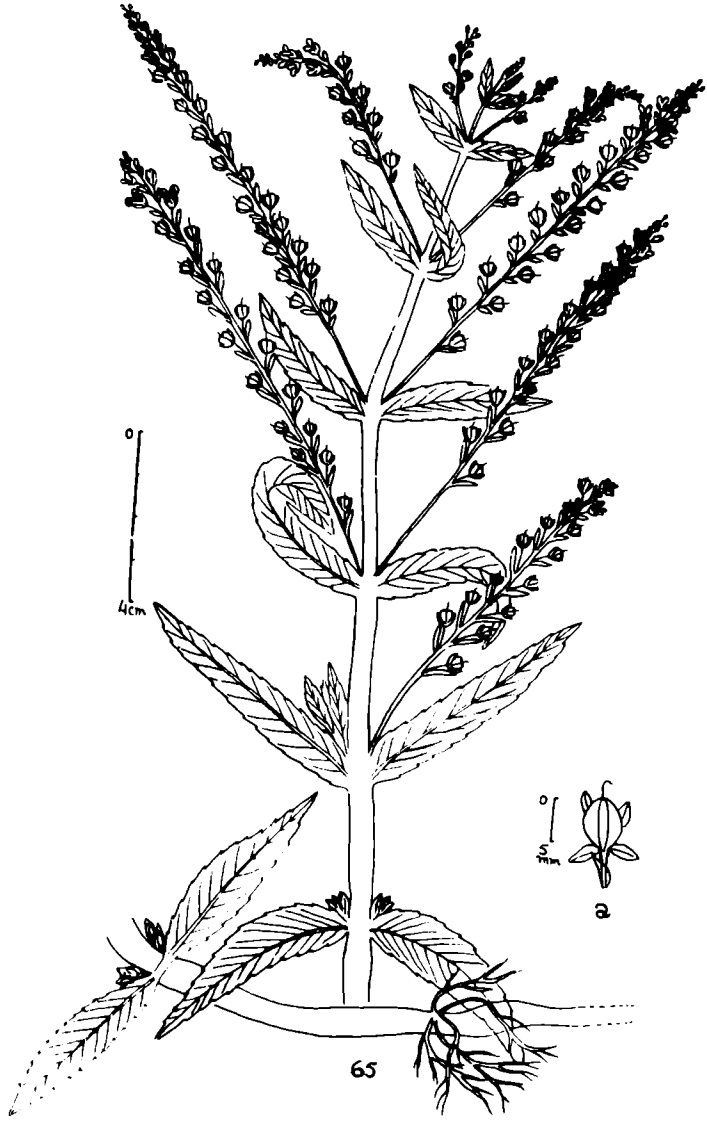


Fig. 65. *Veronica secunda* Pennell (a flowerings shoot)
a a capsule

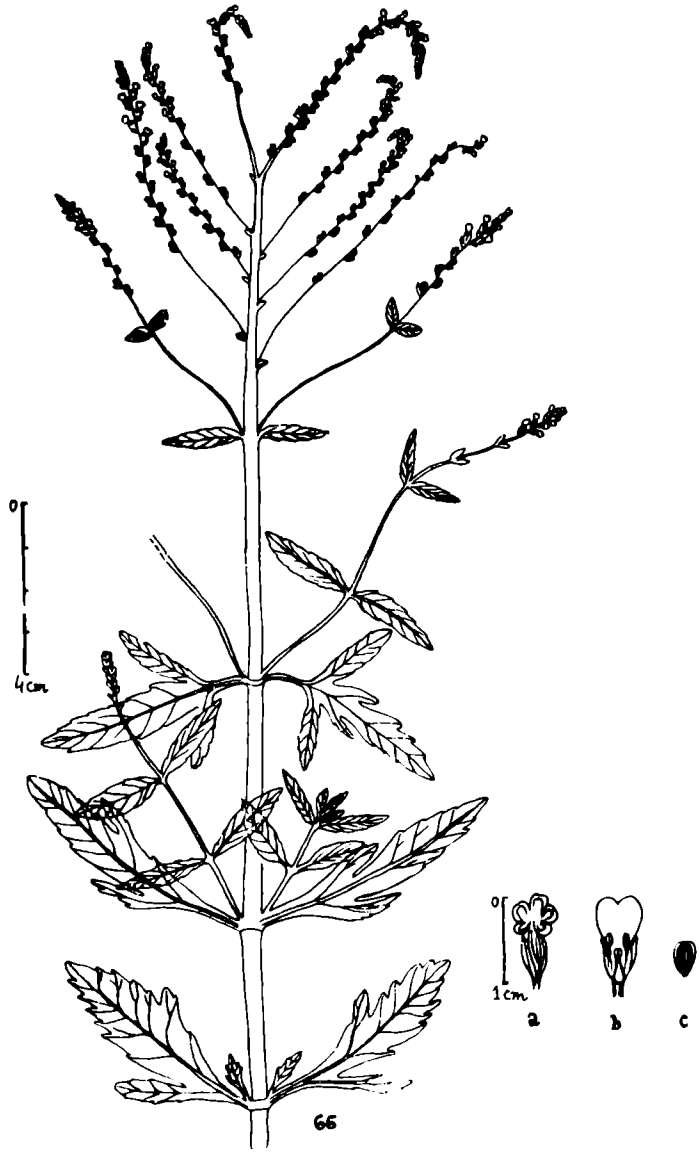


Fig. 66. *Verbena officinalis* Linn. (a flowering shoot)
a. a flower, b. v.s. flower, c. a nutlet

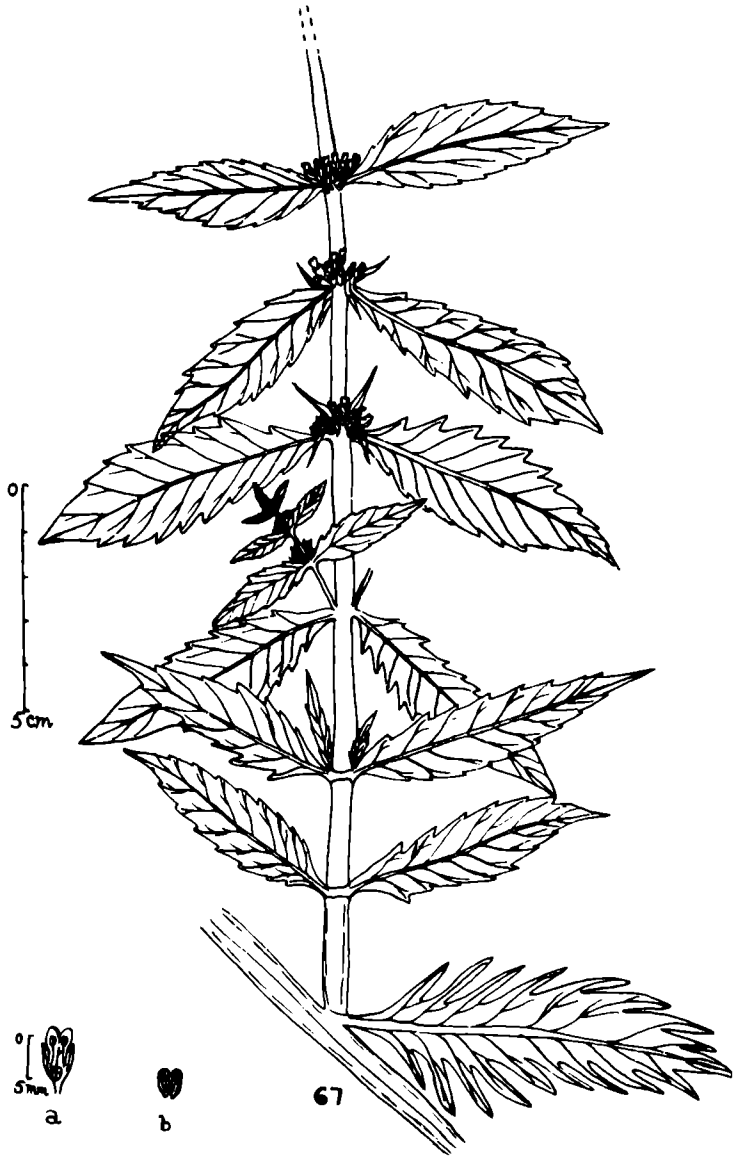


Fig. 67. *Lycopus europaeus* Linn. (a flowering shoot, in part)
a. v.s. flower, b. a fruit (4 nutlets)

Fig. 6... *Sideritis montana* Linn. (a flowering plant)
a. a flower, b. corolla tube (dorsal view), c. ovary with gynophore, d. a nutlet

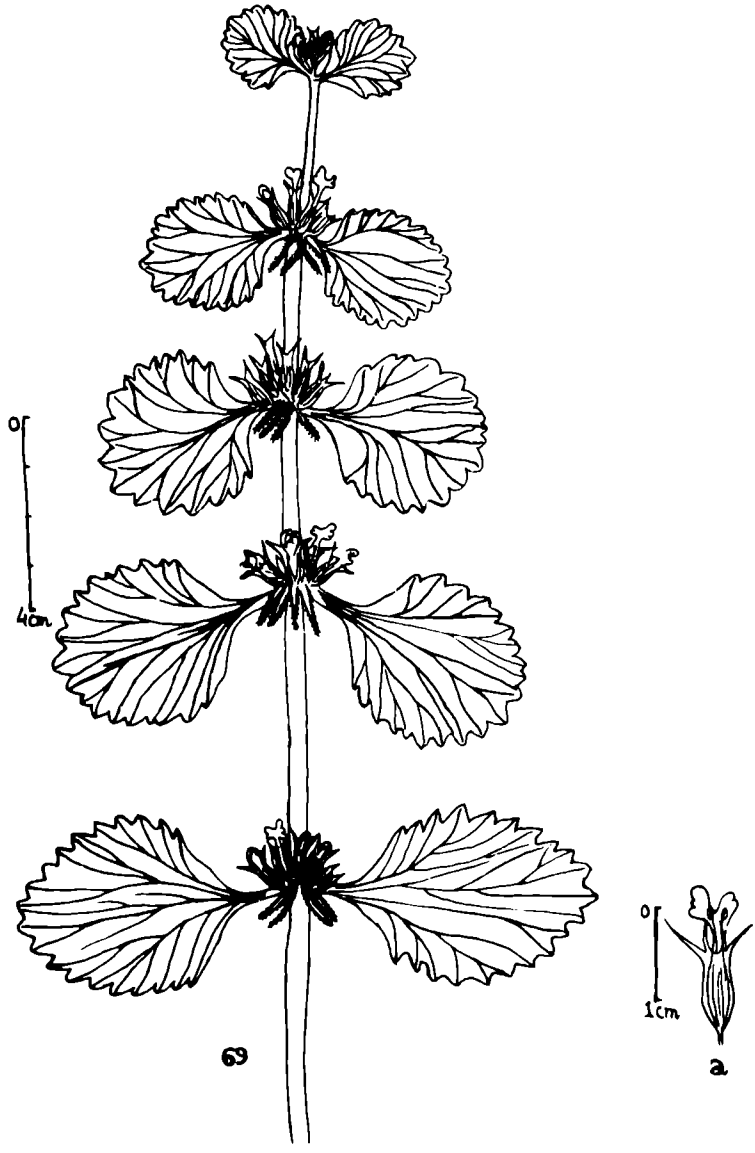


Fig. 69. *Marrubium vulgare* Linn. (a flowering shoot)
a. a flower (dorsal view)

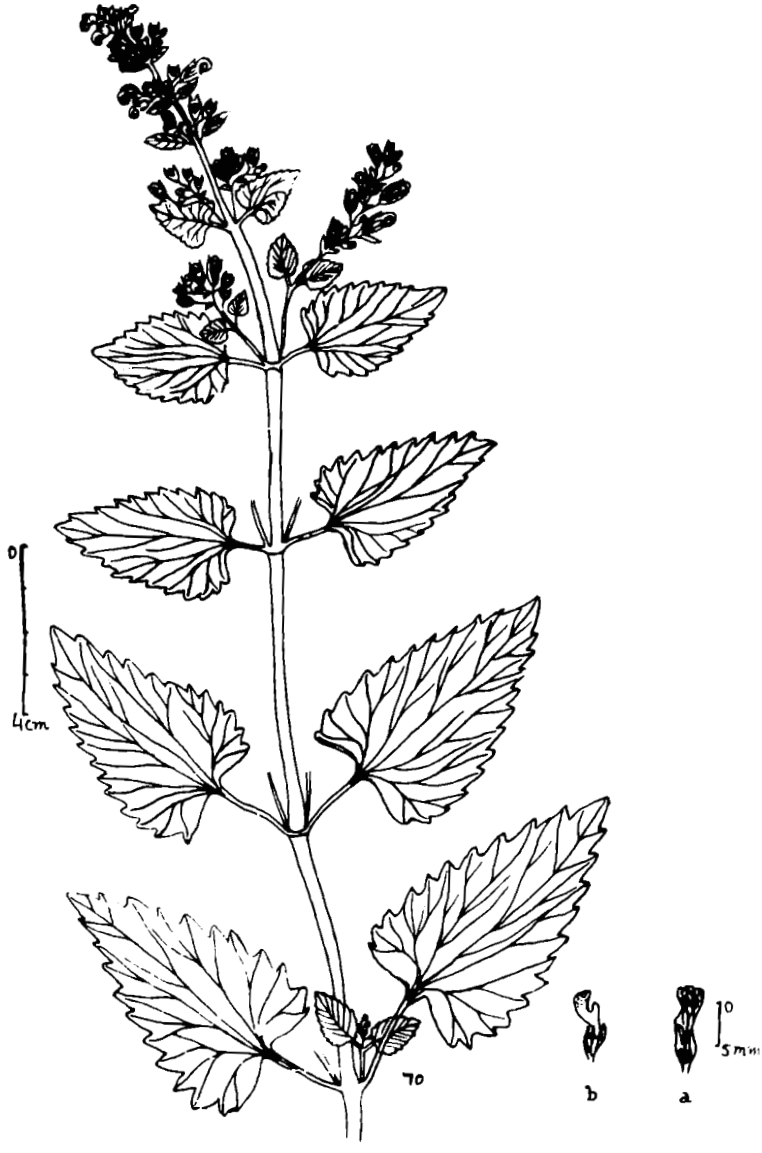


Fig. 70. *Nepeta cataria* Linn. (a flowering shoot)
a. a flower, b. corolla tube

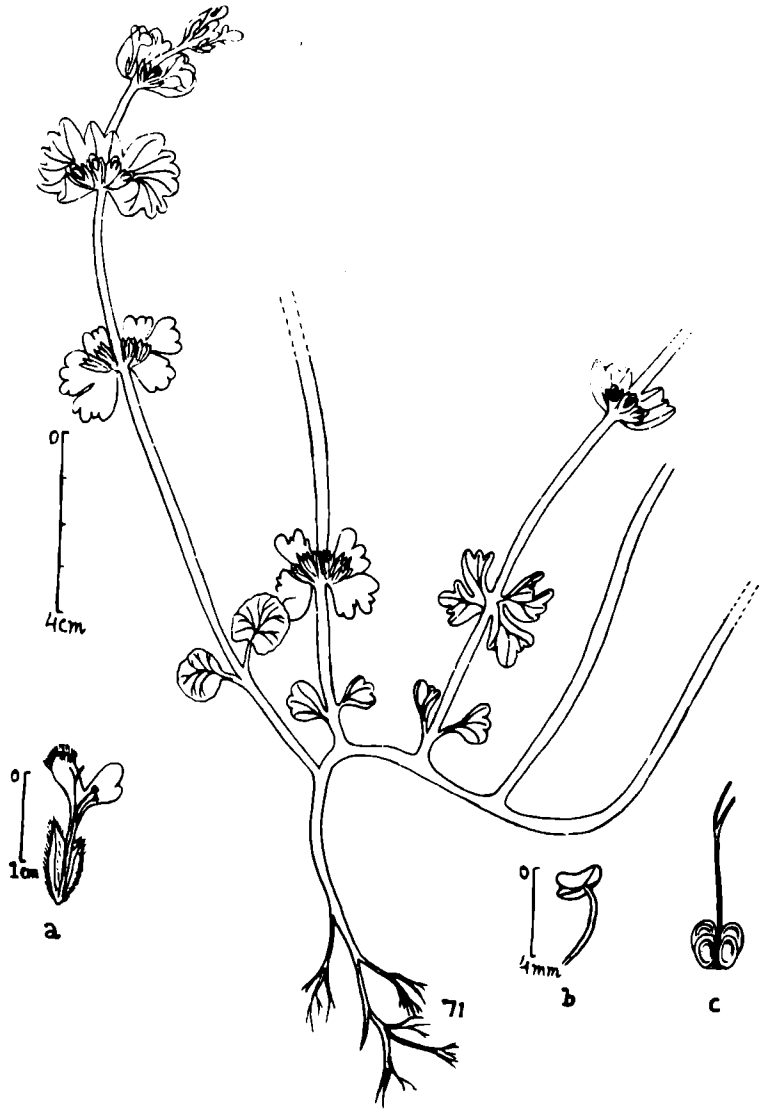


Fig. 71. *Lamium amplexicaule* Linn. (a flowering plant)
a. a flower, b. a stamen, c. an ovary

Fig. 72. *Acroglochin persicarioides* (Poir) Miq. (a flowering shoot)
a an inflorescence

surfaces slightly hairy. Flowers blue in compact up to 2 cm long spikes. Calyx-tube campanulate, 5-toothed, teeth narrowly linear, hirsute. Corolla tube twice the length of calyx, upper lip erect and lower spreading, 3- lobed with a broad central lobe. Stamens 4 in unequal pairs, anthers small, whitish. Ovary with a small style. Nutlets very small and glabrous.

Germination: Spring (March-June).

Fl. & Fr. : May-June.

Dissemination: The seeds get disseminated by wind and rain water.

Habitat: An occasional weed of some orchards preferring drys ituations. Indicator of dry gravelly soils.

Root system : A tuberous rootstock which perennates for 1-2 years till new tubers are formed.

Geographical distribution : Afghanistan, India : Kashmir.

Specimens examined : *Kaul* 6000 a (31-5-1970) Chishma Shahi orchards.

Chromosome report : 2n=16 (Gill, 1969 in Taxon 18 (3) : 314.)

Nepeta cataria L. Sp. Pl. 570, 1753; FBI 4 : 662; Mukerjii in RBSI 14 : 132, 1940; Pojark in Fl. URSS 20 : 349, 1954; Stewart 619. **(Fig. 70)**

Perennial herbs, Stem erect up to 75 cm, branched, angled, generally tetrangular near the base, hoary tomentose or even pubescent, dull green. Leaves ovate to oblong, up to 6.5 cm x 3.0 cm (excluding the petiole), opposite, margins dentate, segments slightly triangular, petiole half as long as the leaf finely tomentose. Flowers small, pinkish with purplish spots, bracteate; bracts almost equalling the calyx, tomentose, forming small 3-11 flowered whorls or cymes and in turn arranged on long branched, compact or lax spikes. Calyx up to 0.6 cm. long, teeth linear, unequal, finely tomentose, persistent. Corolla double the length of calyx, upper lip notched, lower 3- lobed and with purplish spots within. Stamens 4, anthers small 2- celled, dorsifixed. Ovary 4-celled, style long; nutlets 4, shining, black to brown with a white circular ring near one end.

Germination : Late spring (May-June).

Fl. & Fl. : July-August.

Dissemination : Vegetative propagation and by seed. The seeds are disseminated by wind and irrigation water.

Habitat : An occasional weed of orchards and some vegetable fields preferring moist and shady situations. Indicator of sandy loams.

Root system : The rootstock is somewhat creeping and stoloniferous producing many secondary branches.

Geographical distribution : West Himalaya, Afghanistan to Europe, Central Asia, China.

Specimens examined : *Gammie* s.n. (23-7-1891) Srinagar (DD); *Kaul* RRL 5550 (25-7-1969) Barzulla orchards.

Remarks : Locally this is also called "Ganda Soi" (the same given to *Marrubiun vulgare* L.)

Chromosome report : 2n=36 (DCA 329, confirmed),

Nepeta connata Royle ex Benth. in Hook. Bot. Misc. 3: 378, 1833 & in lab. Gen. & Sp. 469, 1835; FBI 4:657; Stewart 620.

Perennial herbs. Stem erect, up to 65 cm, branched from near the base, tetrangular glabrous or slightly pubescent on the edges, Leaves simple, sessile, narrowly linear lanceolate, mostly crowded near the base and much distant on the main stem, up to 12.5 cm x 0.6 mm, apex acute, margins entire or sinuate-toothed, glabrous or minutely pubescent, sessile, opposite. Flowers in apical compact, up to 4.5 cm long spikes, somewhat woolly. Calyx tube campanulate, 5- toothed teeth unequal, sometimes purplish and longer than the tube, densely hairy, persistent.

Germination : Spring (March-April).

Fl. & Fr. : July-September.

Dissemination : Mostly by wind.

Habitat : A rare weed of maize fields. Indicator of gravelly soils.

Root system : A thick rootstock perennating the unfavourable season, branches spread in the surface horizons of dry fields.

Geographical distribution : Western temperate Himalaya.

Specimens examined : *Kaul* RRL 19617 a (9-8-19969) Magam maize fields; *Kaul* 78 a (11-8-1969) Rainawari vegetable fields; *Kaul* RRL 19785 (18-8-1972) Tangmarg maize fields.

Nepeta linearis Royle ex Benth. in Hook. Bot. Misc. 3; 377, 1833; FBI 4: 657; Blatter 2: 120; Rao in BOBSI 2: 411, 1960; Stewart 623.

Perennial herbs with a thick rootstock. Stem erect or suberect up to 50 cm in height, ascending, stout, branched, cylindrical or terete, sparsely leafy towards the base, glabrous or slightly hairy. Leaves oblanceolate up to 6.5 cm x 0.5 cm tapering towards both ends, opposite, sessile, entire, glabrous or minutely pubescent, crowded near the base. Flowers up to 1.5 cm long, purplish blue sessile, crowded in small axillary whorls or heads mostly apical. Calyx tube elongated up to 5 mm long, 5-toothed; teeth shorter than the tube, linear sometimes even spinous. Corolla tube twice as long as the calyx, throat dilated, upper lip 2-lobed, broad, lower lip 3- celled with lateral lobes longer than the middle one. Ovary 4- celled, style long, with unequal lobes. Nutlets 4, rounded, and smooth.

Germination : Spring (March-April).

Fl. & Fr. : July-September.

Dissemination : The seeds are disseminated by wind and animals including man.

Habitat : An occasional weed of maize fields and fallow dry fields. Indicator of dry gravelly and stony soils.

Root system : A thick rootstock with branches going up to 30 cm deep in soil in search of water.

Geographical distribution : West Temperate Himalaya.

Specimens examined : *Meebold* 2680 (June, 1905) Pindabal Kashmir (CAL); *Thapliyal* 26445(5-6-1958) Gulmarg (DD); *Kaul* RRL 19778 (11-8-1972) Tangmarg maize fields.

LEUCAS R. Brown

Leucas lanata Benth. in wall. Pl. As. Rar. 1 : 61, 1830; FBI 4 : 681; Collett 405; Stewart 615.

Perennial herbs. Stem up to 75 cm, erect, branched, angular, softly clothed with white and woolly tomentum. Leaves simple, ovate to oblong, up to 4.5 cm x 2.5 cm, lower ones petiolate; petiole up to 2 cm, long, slender, villous; upper ones sessile, opposite, margins dentate, both surfaces covered with white woolly tomentum, apex acuminate. Flowers 10-15 in axillary compact whorls, purplish or liliac. Calyx 5-8 toothed, teeth sometimes slightly spinous, tube up to 0.8 mm long, 5-10 nerved, villous, persistent, corolla protruding out and about double the length of calyx, upper lip broader and entire, lower lip 3-fid, spotted inside. Stamens 4, filaments unequal, anthers small. Nutlet 4, oblong, black, flattered on one side, glabrous and glaucous.

Germination : Spring (March-April).

Fl. & Fr. : July-September.

Dissemination : Main seeds disseminating agent is wind.

Habitat : An occasional weed of apple orchards preferring open dry situations. Indicator of well aerated sandy loams.

Root system : A thick tap root going up to 25 cm deep in the soil.

Specimens examined : *Kaul* RRL 5551 (25-7-1969) Rawalpora orchards; *Kaul* 80 (25-8-1969) Barzulla orchards, Srinagar.

STACHYS Linnaeus

Stachys sericea Wallich ex Benth. in Pl. As. Rar. 1 : 64, 1830; FBI 4 : 675; Mukerji in RBSI 14 : 187, 1940; Stewart 635.

Annual herbs. Stem erect, up to 70 cm, branched, tetrangular covered with long silky hairs. Leaves simple, ovate or oblong to oblong lanceolate, up to 6.5 cm x 0.3 cm petiolate; petiole slender, about as long as the leaves; upper leaves sessile, crenate, apex obtuse, both surfaces silky pubescent. Flowers whorled in the axils, sessile to subsessile forming small compact heads purplish. Calyx tube campanulate, up to 1.2 cm long, silky pubescent, 5-toothed, teeth unequal, ovate spiny tipped, persistent. Corolla nearly double the length of calyx, tube cylindric, hairy within and without; upper lip, erect, hood like, entire; lower spreading, 3-lobed; midlobe broad. Stamens 4 in unequal pairs, ascending up to the base of upper lip, outer pair longer than the inner. Nutlets 4, oblong, brownish, smooth.

Germination : Spring (March-April).

Fl. & Fr. : June-August.

Dissemination : The seeds get disseminated by wind and animals including man.

Habitat : A rare weed of fallow lands and waste heaps. Indicator of organic matter in soils.

Geographical distribution : Afghanistan, Nepal, India : Kashmir to Kumaon.

Specimens examined : *Kaul* 57 (10-7-1969) Habak fallow lands Srinagar.

THYMUS Linnaeus

Thymus serphyllum L. ssp. **quinquecostatus** (Celak.) Kitamura in Fauna and Flora of Nepal Himalayas 216,t. 27, 1955 & in Fl. Afghanistan 350, 1960; Stewart 638.

Thymus quinquecostatus Celak. in Oster. Bot. Zeitschi. 39 : 263, 1889.

Thymus serphyllum sensu Hook. f. FBI 4: 649, 1885.

Perennial herbs. Stem generally procumbent, much branched, up to 75 cm or even more in length, thin but stiff, rooting at nodes sometimes woody near the base, hairy, densely pubescent towards the apices of the branches, leafy. Leaves simple, oblong to ovate, up to 0.75 cm x 0.3 cm, subsessile, dense or small young branches, glabrous or slightly hairy, gland dotted, entire. Flowers small, purplish, showy, crowded in apical spikes. Calyx tubular, tube up to 5 mm long, 5-10 nerved, hairy; hairs white and spreading; gland.dotted; 2- lipped, upper lip broad 3- toothed and lower one 2- toothed, segments linear, sometimes petaloid, persistent. Corolla tube as long as the calyx; limb protruding out, purplish 2- lipped, upper lip nearly erect, flat and notched, lower spreading and 3-lobed. Stamens 4, filaments generally coming to the same level and protruding out of the corolla tube; anthers small and purplish. Ovary 4-celled, style arms unequal; nutlets smooth, r ounded black to brown.

Germination : Spring (March-April).

Fl. & Fr. : May-July

Dissemination : Both vegetatively as well as through seed. The seeds are disseminated by wind and water.

Habitat : An occasional weed of some meadows and fallow fields growing on mounds and slopy areas. Indicator of gravelly soils.

Root system : A creeping branched rootstock restricted in the surface horizons of soils.

Geographical distribution : Afghanistan, China, Manchuria, Japan and Himalaya.

Specimens examined : *Gammie* s.n. (14-7-1891) Srinagar, Kashmir (CAL); *Kaul* RRL 5579 (25-7-1970) Barzulla vegetable fields.

Chromosome report : 2n=24 (DCA 325).

Remarks : Gammie's specimen collected on 14-7-1891 from Srinagar seen at DD, identified as *Satureia hortense* Linn., is *T. serphyllum* ssp. *quinquecostatus.*

CALAMINTHA Lamarck

Key to the species

1. Flowers in dense mostly, apical whorls — **vulgaris**
1'. Flowers in lax apical and axillary whorls — **umhrosa**

Calamintha vulgaris (L.) Druce in Ann. Scot. Nat. Hist. Soc. 60: 224, 1906; Stewart 609.

Clinopodium vulgare L. Sp. Pl. 587, 1753.

Calamintha clinopodium Benth. in DC. Prodr. 12: 233, 1852; FBI 4: 650; Mukerji in RBSI 14: 98, 1940.

Annual or biennial herbs with a somewhat branched stoloniferous rootstock. Stem erect or suberect, generally branched, slightly woody towards the base, tetrangular, sparsely hairy, hairy white. Leaves simple, obovate to oblong, 2-6 cm x 1.5-3 cm, petiolate; petiole slender, smaller than the leaves, hairy; upper ones sessile, apex acuminate, margins entire or minutely crenate, lower surface more hoary as compared to upper one. Flowers many in dense whorls mostly towards the apices of the main stem or branches, subsessile, pink to purplish, bracteoles linear. Calyx 5-toothed, teeth linear as long as the tube, densely hairy with spreading hairs, some hairs glandular,

tube, 10-15 nerved, persistent. Corolla tube as long or longer than the calyx tube, 2-lipped; upper lip 2-lobed, lobes spreading, lower 3-lobed with middle lobe the largest. Stamens 4, didynamous, anthers small, dehiscing before the corolla tube opens. Ovary 4-celled with a long style and lyrate spreading stigma. Nutlets 4, oblong and glabrous.

Germination : Early spring (Late February-March).

Fl. & Fr. : May-July.

Dissemination : The seeds are disseminated by wind and irrigation water.

Habitat : An occasional weed of orchards and vegetable fields preferring moist situations. Indicator of well aerated sandy loams.

Geographical distribution : Europe, North Africa, Afghanistan, Iran, Caucasus, Assam, Burma, Himalaya.

Specimens examined : *Thapliyal* 26386 (1-6-1958) Dorus, Kashmir (DD); *Kaul* 190 (22-5-1970) Mansbal fields, Srinagar; *Kaul* 269 (30-7-1971) Harwan paddy fields.

Chromosome report : 2n= 20 (DCA 329).

Calamintha umbrosa (M. Bieb.) Fisch. et Mey. Ind. Sem. 6: 6, 1840; FBI 4: 650; Mukerji in RBSI 14: 98, 1940; Stewart 609.

Melissa umbrosa M. Bieb. Fl. Taur. Cauc. 2 : 63, 1808.

Clinopodium umbrosum Koch. in Linnaea 21: 673, 1848; Boriss. in Fl. URSS. 21: 439, 1954; Kitamura 328.

Annual herbs. Stem generally procumbent or sometimes suberect, branched, up to 25 cm or more long, tetrangular, laxly hairy. Leaves simple, ovate to obovate, 1.5-3.5 cm x 1-2 cm petiole up to 1 cm long, hairy, margins entire or slightly dentate, opposite, apex obtuse. Flowers in lax or sometimes dense axillary and apical whorls, rosy. Calyx teeth somewhat smaller than the tube, hirsute, persistent. Corolla similar to that of *C. vulgaris*. Stamens 4, or rarely only 2. Ovary with 4 nutlets. Each nutlet is oblong, smooth and hard.

Field notes : It is more common than *C. vulgaris* (Linn.) Druce. It can be distinguished by its lax verticillasters which are axillary as well as terminal.

Fl. & Fr. : May-July.

Specimens examined : *Gammie* s.n. (4-7-1891) Srinagar, 5300 ft. (DD); *Kaul* 59 (15-7-1969) Badgam fallow fields.

Geographical distribution : Afghanistan, Caucasus, China, Japan, Java, Himalaya : Kashmir to Bhutan.

SCUTELLARIA Linnaeus

Key to the species

1.	Flowers in short leafy terminal spikes	**prostrata**
1.	Flowers in axillary pairs	**galericulata**

Scutellaria prostrata Jacquem. ex Benth. in Lab, Gen. & Sp. 733, 1835; FBI 4 : 667; Rao in BOBSI 2 : 412, 1960; Stewart 633.

Perennial herbs with a stout rootstock. Stem erect, suberect or even procumbent, up to 50 cm long, much branched, tetrangular, somewhat tomentose especially towords the apices. Leaves simple, cordate to obovate, up to 2.5 cm x 1.8 cm petiolate; petiole as long or longer than the leaf; crenate, slightly pubescent, crowded on small branches. Flowers in terminal small

axillary spikes, sessile to subsessile, yellowish. Calyx much enlarged in fruit, upper lip forming a small lid-like structure on lower deciduous pouch shaped lip. Corolla tube up to 2 cm long, 2-lipped, yellow tipped with violet tinge, slightly hairy within. Stamens 4, anthers conniving. Nutlets 4, small, oblong and hispidulous.

Germination : Spring (March-April).

Fl. & Fr. : June-August.

Dissemination : Mostly by wind.

Habitat : A rare weed of maize fields and left over places. Indicator of dry gravelly soils.

Root system : A tough somewhat creeping stout rootstock, branches restricted in the surface horizons.

Geographical distribution : Kashmir to Kumaon.

Specimen examined : *Kapoor* 594 (13-7-1941) Kamri village.

Scutellaria galericulata L. Sp. Pl. 599, 1753; FBI 4 : 670; Stewart 633.

Annual or biennial herbs. Stem erect, branched, up to 40 cm tetrangular, angles rough and scabrid. Leaves simple, obovate to oblong lanceolate, up to 3.5 cm x 0.8 cm, sessile to subsessile, opposite, glabrous, margins dentate, apex, acuminate, veins and midrib raised from the undersurface. Flowers up to 1.5 cm long, bracteate; bract leafy; pedicel up to 4 mm, bluish, two at a node. Calyx cupular, slightly glandular, enlarged in fruit forming a small trap or bladder for the nutlets within, consisting of 2 flaps; lower one simple and flattened, upper one hat-like with a depression inside. Petals forming a big tube, 2- lipped; upper lip broad and entire. lower lip 3- fid with 3 equal small lobes, hairy within and outside. Stamens 4, didynamous, two longer with longer filaments arising from the base of the corolla tube, two shorter ones surrounding the style, anthers 2- celled or multicelled with white hairs spreading throughout the cells. Pollen elongated with a central elongated germ pore. Ovary 4-celled, style long arising from the base of the rounded and somewhat elongated disc, rarely protruding out of the tube. Each nutlet is somewhat rounded, pale yellow with rough testa.

Germination : Spring (March-April).

Fl. & Fr. : June-August.

Dissemination ; Vegetative propagation as by seed. The seeds are disseminated mainly by irrigation water.

Habitat : An occasional weed of paddy fields and small irrigation canals of some orchards. Indicator of moist compact alluvials.

Root system : The main root goes uo to 50 cm deep in the compact soil and the branches arising from it are somewhat stoloniferous.

Geographical distribution : Europe, Caucasus, North Africa, Central & North Asia, North America.

Specimens examined : *Kaul* 265 (19-7-1971) Rawalpora paddy fields; *Kaul* RRL 19797 (28-8-1972) Rawalpora paddy fields.

Chromosome report : 2n=32 (DCA 328).

PRUNELLA Linnaeus

Prunella vulgaris L. Sp Pl. 600, 1753; FBI 4 : 670; Mukerji in RBSI 14 : 149, 1940;

Boriss in Fl. URSS 20 : 495, 1954; Rao in RBSI 18(2) : 51, 1960; Stewart 630.

Perennial herbs. Stem suberect or procumbent, rooting at lower nodes, up to 50 cm long, purplish, tetrangular, slightly hispid or glabrous near the angles, branched or unbranched. Leaves simple, ovate to oblong lanceolate, 4-7.5 cm x 1.5-3 cm, petiolate; petiole slender, up to 1.5 cm long, glabrous; margins dentate, apex acuminate, glabrous. Flowers purplish, in compact apical heads or spikes which are cylindrical and up to 5.5 cm x 2.0 cm, bracts ovate to cordate, ciliate, edges purplish, larger flowers are bisexual and female in the same spike. Calyx 2-lipped, teeth, variable and unequal, tube 5-10 nerved, somewhat purplish and persistent. Corolla tube protruding out of the calyx tube, annulate within, upper lip erect and concave, lower spreading, side lobes deflexed and midlobe concave. Stamens 4, exserted, anthers small, purplish and conniving. Ovary 4-celled, style long with subulate lobes. Nutlets oblong and smooth.

Germination : The suckers as well as seeds sprout in spring (March-April).

Fl. & Fr. : July-August,

Dissemination : The weeds propagate vegetatively through sucker-like structures as well as by seed. The seeds are disseminated by water.

Habitat : A common weed of orchards, grasslands, meadows and damp situations.

Root system : Underground suckers bind the plants tightly in damp situations. These suckers also help in its propagation.

Geographical distribution : Himalaya, Central Asia, Siberia, Turkey, Pakistan, Afghanistan, Iran, Europe, and North Africa.

Specimens examined : *Gammie* s.n. (14-7-1891) Srinagar, Kashmir (CAL); *Kapoor* 1125 (28-7-1949) Vicharnag, Srinagar; *Kaul* 273 (1-8-1971) Shalimar near paddy fields; *Kaul* RRL 16126 (25-8-1971) Dhara, Paddy fields.

Local name : Kalaveuth.

Remarks : The flowers are used in ayurvedic medicines.

Chromosome report : 2n=28 (Nelson vide Taxon 15(4) : 156, 1966).

LAMIUM Linnaeus

Key to the species

1. Annual herbs; flowers pink or reddish **amplexicaule**
1. Perennial herbs; flowers white **album**

Lamium amplexicaule L. Sp. Pl. 579, 1753; FBI 4 : 679; Collett 403; Stewart 614.

(Fig. 71)

Annual herbs. Stem decumbent, up to 35 cm long, branches arising from the base, slender, finely ribbed, glabrous or slightly hirsute. Leaves orbicular to obovate, lower ones stalked and upper ones amplexicaule, lobed and glabrous. Flowers purple red, showy in axillary, compact spikes. Calyx 5-toothed, teeth as long as the tube, densely hirsute and persistent. Corolla tube up to 2.5 cm long, narrow near the base and widening at mouth, hairy within and without; upper lip broad, rounded, entire and densely hairy; lower lip 3-fid. Stamens 4, filaments coming up to the mouth of the corolla tube, anthers purplish and small. Ovary 4-celled, style long with unequal arms; nutlets oblong, 3-angled, smooth and brownish.

Germination : Early spring (Feb.-March) or sometimes late autumn (November).

Fl. & Fr. : April-June.

Dissemination : Wind as well as water.

Habitat : A common weed of orchards, vegetable fields and gardens preferring moist situations. Indicator of well aerated & fertile clay loams.

Root system : A meagrely developed tap root system.

Geographical distribution : Asia, Europe, and North Africa; India : Simla.

Specimens examined : *Thapliyal* 26499 (10-6-1958) Kashmir, (DD); *Kaul* RRL 5982 (2-4-1970) Barzulla orchards, Srinagar.

Chromosome report : 2n=18 (DCA 329).

Lamium album L. Sp. Pl. 579, 1753; FBI 4 : 679; Mukerji in RBSI 14 : 161, 1940; Gorsch in Fl. URSS 11 : 134, 1954; Rao in BOBSI 2 : 412, 1960; Stewart 614.

Perennial herbs. Stem erect or decumbent, up to 55 cm long, ribbed, branched or unbranched, glabrous or slightly hairy. Leaves obovate, ovate or cordate, up to 7.5 cm x 4.0 cm, petiole slender up to 1 cm long, opposite, coarsely or sharply toothed, apex acute to acuminate, glabrous. Flowers in dense axillary whorls, white and showy. Calyx 5-toothed, teeth linear and filamentous, as long or longer than the tube, unequal, margins hispid, spreading and enlarging in fruit. Corolla tube up to 2 cm long, mouth wider than the tube, 2-lipped; upper lip rounded, entire and largest; lower lip with a larger central lobe, slightly hairy within. Stamens 4, equal in length, anthers black. Ovary 4-celled with a long style. Nutlets rounded to oblong, pale to dark brown and smooth.

Field notes : A rare weed of fields but common and abundant in forest meadows. The plant produces a creeping thick rootstock which is capable of producing new plants vegetatively. It prefers moist situations and produces large, white, showy flowers.

Fl. & Fr. : June-July.

Specimen examined : *Kaul* 65 (26-7-1969) Chishma shahi fields.

Geographical distribution : Europe, Africa N.W. Asia, Iran, Afghanistan, Central Asia and Himalaya.

Chromosome report : 2n=18 (DCA 329).

TEUCRIUM Linnaeus

Key to the species

1. Flower in terminal racemes; racemes many flowered **royleanum**
1. Flowers in axillary racemes; 2-6 in an axil **scordium**

Teucrium royleanum Wallich ex Benth. in Wallich Pl. As. Rar. 1 : 58, 1830; FBI 4 : 700; Collett 406; Mukerji in RBSI 14 : 218, 1940; Stewart 635.

Annual or biennial herbs. Stem erect or generally procumbent and ascending, branched, up to 75 cm long, tetrangular, slightly grooved, angles minutely pubescent or glabrous. Leaves simple, ovate to oblong or cordate, up to 6.5 cm x 4.5 cm, petiole slender, up to 1.5 cm or even absent in upper most ones, opposite, apex acute, margins serrate, surfaces slightly hairy. Flowers pink in many flowered lax racemes; bracts linear, longer than the slender pedicels. Calyx tube campanulate, petaloid at maturity, 5-toothed, teeth linear; densely hirsute and persistent. Corolla about twice the length of calyx,

lobes exserted. Stamens 4, filaments small. Ovary 4-celled, nutlets 4, small, brownish and rough.

Germination : Late spring (May-June).

Fl. & Fr. : August-September.

Dissemination : Mainly by wind.

Habitat : An occasional weed of orchards, vegetable fields and grasslands. Indicator of aerated & fertile clay loams.

Root system : A stoloniferous rootstock going upto 50 cm deep in soil, the branches are also creeping.

Geographical distribution : Afghanistan, Himalaya : Kashmir to Kumaon.

Specimens examined : *Kaul* 79 (15-8-1969) University campus; *Kaul* RRL 19667 (27-10-1969) Chishma Shahi orchards; *Kaul* RRL 19786 (19-8-1972) Habak orchards.

Teucrium scordium L. Sp. Pl. 565, 1753; FBI 4 : 702; Mukerji in RBSI 14 : 216, 1940; Juz in Fl. URSS 20 : 46, 1954; Stewart 636.

Annual or biennial herbs. Stem erect or suberect, usually unbranched, up to 20 cm long, somewhat angled, leafy from the base, covered with white spreading hairs, some hairs are glandular. Leaves oblong to oblanceolate, 1.5-3.0 cm x 0.7-1.0 cm, sessile, opposite, both surfaces hairy, margins serrate; lower leaves wither soon. Flowers in axillary racemes, generally 4 at a node, pedicels small or even absent. Calyx 5-toothed or lobed, lobes triangular and spreading, tube campanulate, 5-10 nerved, glandular hairy and persistent. Corolla nearly double the length of calyx, upper lip insignificant; the larger limb is 5-lobed with central lobe much longer than the lateral ones. Stamens 4, didynamous, nearly extruded out of the corolla tube, anthers reddish and reniform. Ovary with a long style, apex 2-fid, lobes unequal. Nutlets 4, oval on a raised receptacle, smooth.

Germination : Early spring (February-March).

Fl. & Fr. : May-June.

Dissemination : The seeds are disseminated by wind and animals.

Habitat : The weed of lawns, parks and gardens. Indicator of fertile sandy loams.

Root system : A simple tap root restricted in the surface horizons of soil.

Geographical distribution : Afghanistan, North and West Asia, Europe, North Africa, Western Himalaya.

Specimens examined : *Kaul* 192A (22-5-1970) Hoakersar lawns.

PLANTAGINACEAE

PLANTAGO Linnaeus

Key of the species

1. Spikes cylindrical up to 25 cm in length **major**
1. Spikes ovoid or shortly cylindrical up to 3 cm long **lanceolata**

Plantago major L. Sp. Pl. 112, 1753; FBI 4 : 705; Collett 407; Rao in RBSI 18(2) : 52, 1960; Stewart 682.

Perennial herbs with a small rootstock and fibrous bunch of adventitious roots. Leaves all radical, broadly ovate or oblong-ovate, up to 11.5 cm x 5.0 cm, distinctly stalked; stalk slightly winged, as long or shorter than the leaf, veins running parallel and convergent at the top; margins entire or

sinuate, apex obtuse, glabrous. Scapes 1-many, up to 45 cm long, erect, slender, arising from the base, sometimes angled carrying a longer cylindrical, up to 25 cm long spike. Flowers hermaphrodite, up to 5 mm diam., lax at the base and dense towards the apex. Calyx 4-parted, lobed, ovate with membranous margins, persistent or falling at a mature stage. Corolla 4-lobed, hypogynous, scarious, as long or slightly longer than the calyx. Stamens 4, anthers very small. Ovary oblong with a small persistent style. Capsule pyramidal with a tapering apex. Seeds 8-16, minute, rounded and pale brown.

Germination : Spring (April-May).

Fl. & Fr. : July-Septmber.

Dissemination : The seeds get disseminated by wind and animals including man, birds and cattle.

Habitat : A common weed of orchards, vegetable fields, lawns, kitchen gardens, grasslands, and margins of paddy fields preferring moist situations. Indicator of fertile, moist and compact loams.

Root system : A thick rootstock with bunches of long adventitious roots binding the plants.

Geographical distribution : Europe, Siberia, Turkey, Iran, Afghanistan, and Pakistan.

Specimen examined : *Kaul* RRL 19670 (11-8-1970) Chishmashahi grassland.

Local name : Veuth Gulla.

Remarks : The plants are variable. The leaves are broad and relished by animals. The seeds are used in medicines.

Chromosome report : 2n=12 (Spicer in Taxon 17 : 202, 1968; canfirmed).

Plantago lanceolata L. Sp. Pl. 113, 1753; FBI 4 : 706; Grig. in Fl. URSS 23 : 156, 1958; Rao in RBSI 18(2) : 52, 1960; Stewart 681.

Perennial herbs with a thick underground rootstock producing long adventitious roots. Leaves all radical, linear lanceolate, up to 25.5 cm x 1.1 cm, shortly petioled, entire or rarely sinuate, tapering into an acute apex, glabrous, veins running parallel Scapes 3-many (up to 18, seen in Kashmir plants).

Germination : Spring (March-April).

Fl. & Fr. : July-September.

Dissemination : The seeds are mainly disseminated by animals including man.

Habitat : A common weed of orchards, grasslands, and fallow fields. Indicator of compact, fertile & moist soils.

Root system : A thick branched or unbranched rootstock with long adventitious roots going up to 30 cm deep in soil.

Geographical distribution : Europe, North Asia, Eurasia, Western Himalaya : Kashmir to Simla.

Specimens examined : *Kaul* 244 (10-8-1970) Hyderpora paddy fields.

Local name : Gulla.

Remarks : The young leaves are used locally as vegetable and seeds are used as purgative.

Chromosome report : 2n=12 (Kaul & Gohil 1973).

ILLECEBRACEAE

HERNIARIA Linnaeus

Herniaria cinerea DC., Fl. Fr. Suppl. 6 : 375, 1815; Stewart 244.

Herniaria hirsuta L. var. *incana* Hook.f.,

FBI 4 : 712, 1885; Rao in RBSI 18(2) : 53, 1960.

Perennial, prostrate herbs. Stem thoroughly branched, branches up to 15 cm long but spreading along all sides, slender but tough, slightly hirsute, dark green. Leaves simple, ovate to obovate, about 0.5-1 cm or even smaller, alternate, sessile, entire, acute; stipules small and scarious. Flowers minute, bisexual, in axillary clustered spikes, 5-12 in each spike, bracteate; bracts hyaline and toothed. Calyx 5-parted, adnate below, lobes slightly oval, hirsute, persistent, closed even up to maturity. Petals absent. Stamens 3-5, filaments small, anthers globular, included, reddish at maturity. Ovary small, superior with minute style and 2-lobed stigma. Capsule included in the persistent calyx, indehiscent with a single subglobose seed. Seeds brown at maturity.

Germination : Early spring (February-March).

Fl. & Fr. : April-June.

Dissemination : The seeds are disseminated by animals including man.

Habitat : An occasional weed of fallow fields, vegetable fields, flower beds and orchards preferring drier places. Indicator of well aerated, dry and fertile clay loams.

Root system : A thin but tough and branched tap root system restricted in surface horizons of soil.

Geographical distribution : West and Central Asia, N. Africa and Europe.

Specimen examined : *Kaul* 186 (22-5-1970) Mansbal Drug farms.

Remarks : The prostrate habit of weeds covers the ground like a mat.

AMARANTHACEAE

Key of the genera

1. Leaves opposite and alternate; anthers 2-celled :
   2. Flowers unisexual. Sepals simple and persistent — **Amaranthus**
   2. Flowers bisexual. Sepals spinescent — **Achyranthes**
1. Leaves opposite; anthers 1-celled — **Alternanthera**

AMARANTHUS Linnaeus

Key to the species

1. Flowers in terminal long compact spikes. Stamens 3-5 — **hybridus**
1. Flowers in axillary small compact spikes. Stamens 2 or 3 — **graecizans**

Amaranthus hybridus L. ssp. **cruentus** (L.) Thell. var *paniculatus* in Asch. & Gr. Syn. 5(1): 247, 1914; Rao in RBSI 18(2): 53, 1963.

Amaranthus paniculatus L. Sp. Pl. 1406, 1763; FBI 4:719.

Annual herbs. Stem erect or suberect up to 1 m in height, branched or unbranched, ribbed, narrowly grooved, glabrous or puberulous, somewhat thickened at nodes. Leaves elliptic or ovate-lanceolate, up to 13.5 cm x 0.5 cm, base cuneate, petiole as long or shorter than the leaf, glabrous, margins entire or sinuate, apex acute or acuminate. Flowers in erect apical compact spikes, green bracts

linear long, recurved Calyx 5-lobed, each lobe ovate, up to 0.6 cm diam, persistent. Petals 0. Male flowers with 5 stamens and a rudimentary ovary; female ones sometimes with staminodes. Ovary 1-celled, with a small style and capitate bilobed stigma. Seeds are yellow green when young and black or brown at maturity, up to 0.2 cm diam., shining.

Germination : The seeds are hard and germinate only in summer

Fl. & Fr. : August—October.

Dissemination : The seeds are disseminated by wind and animals especially man.

Habitat : A common weed of maize fields, orchards vegetable fields and even fallow lands. Indicator of sandy or clay loams.

Root system : A much branched tap root. the main root enters up to 40 cm deep in the soil.

Geographical distribution : East and West Asia, Africa, Himalaya.

Specimens examined : *Gammie* s. n. (23-7-1891) Srinagar (DD); *Kaul* 96 (11-10-1969) Barzulla orchards and vegetable fields.

Chromosome report : 2n=32 (DCA 78).

Amaranthus graecizans L. Sp. Pl. 900, 1753; Stewart 230.

Annual herbs. Stem generally decumbent or sometimes suberect, branched from the base, ribbed or terete, glabrous or minutely pubescent, generally purplish below. Leaves simple ovate, up to 4.5 cm x 2.3 cm, petiole generally as long as the leaf, alternate, base truncate or cuneate, apex rounded or notched, margins sinuate. Flowers small, sessile, clustered in a rounded axillary spike, green, bracts ovate. Perianth 3-5, green, persistent. Stamens 3, filaments small, anthers 2-celled, coming out in mature flowers. Ovary 1-celled Utricle small, discoid, flattened; nuts solitary, shining, circular and dark brown.

Germination : Summer (July—August).

Fl. & Fr. : September—November.

Dissemination : Wind, rain and man.

Habitat : A common weed of orchards, vegetable fields and fallow lands. Indicator of dry clayey loams.

Root system : A branched tap root, the main root goes up to 25 cm deep in the soil.

Geographical distribution : Europe.

Specimens examined : *Kaul* 98(12-10-1969) Chattabal vegetable fields; *Kaul* RRL 19717 (26-9-1971) majid Bagh fallow fields. The specimen was identified by Mr. P. Aellen.

ACHYRANTHES Linnaeus

Achyranthes aspera L. Sp Pl. 204, 1753; FBI 4 : 730; Collett 414; Stewart 228.

Stem up to 75 cm, erect, branched from the base, ribbed, finely hirsute, hairs appressed. Leaves orbicular to ovate or obovate, up to 7.5 cm x 3.0 cm, subsessile, opposite, entire, apex acute or acuminate, pubescent, somewhat tough. Flowers greenish, up to 7 mm long, arranged laxly in long axillary spikes; bracts as long or longer than the flowers, remaining on the rachis even after the flowers have fallen. Perianth 5-lobed, each lobe obovate, spinescent, green, shining when dry. Stamens with small anthers soon falling off, staminodes as many as the stamens but much shorter. Ovary oblong, compressed, style small and a capitate stigma. Utricle ovoid or oblong, shining when dry with a solitary seed.

Field notes : A rare weed possessing a gregarious habit. It prefers to grow in dry situations. It can resist forest. Germination is very poor.

Fl. & Fr. : August-November.

Geographical distribution : Tropical Asia, Africa, Australia and America.

Specimens examined : *Kaul* 337 a (13-8-1972) Boniyar maize fields.

ALTERNANTHERA Forsskal

Alternanthera sessilis (L.) DC. Cat. Hort. Monsp. 77, 1813; FBI 4 : 731; Collett 415; Rao in BOBSI 2 : 413, 1960; Stewart 229.

Gomphrena sessilis L. Sp. Pl. 225, 1753.

Annual herbs. Stem 15-65 cm long, branched, rooting at the nodes, prostrate, sometimes terminal branches ascending, glabrous below and hairy towards the apices, nodes villous, reddish, somewhat succulent. Leaves simple, narrow obovate lanceolate to elliptic, 0.5-2.5 cm long, opposite, nearly sessile, obscurely dentate, glabrous or petiole slightly hairy. Flowers greenish white, minute, crowded in axillary, sessile, somewhat globular spikes. Perianth 5-parted, scarious; segments ovate, membranous, acute. Stamens 5, filaments slender, longer than the ovary, connate at the base forming a tube round the ovary; anthers 1-celled, dorsifixed. Ovary orbicular with 1-ovule, slightly notched at the top, style very short, stigma capitate; utricle flattened, enclosed in the persistent perianth containing a single seed.

Germination : Spring (March-April).

Fl. & Fr. : July-September.

Dissemination : The seeds are dispersed by wind, water and animals.

Habitat : An occasional weed of fallow lands, waste heaps and seen growing around rice fields. It prefers moist situations.

Root system : The main tap root goes about 20 cm deep in soil; nodal roots also anchor the plant in soil.

Geographical distribution : All warm countries of the world.

Specimens examined : *Kaul* 360 (3-7-1973) Batmaloo fallow fields.

CHENOPODIACEAE

Key to the genera

1, Inflorescence somewhat spiny: fruits exposed **Acroglochin**

1. Inflorescence never spiny but smooth: fruits enclosed in persistent perianth **Chenopodium**

ACROGLOCHIN Schrader

Acroglochin persicarioides (Poir.) Miq., DC. Prodr. 13(2) : 254, 1849; Stewart 216. **(Fig. 72)**

Amaranthns parsicarioides Poir. in Lamk. Encycl. Suppl. 1 : 311, 1810.

Acroglochin chenopodioides Schrad. Cat. Gott. 1824; FBI 5 : 3; Collett 415.

Annual herbs. Stem erect, robust up to 60 cm long, branched from the base, ribbed and narrowly grooved, glabrous or rarely pubescent towards the tips. Leaves simple, alternate or sometimes opposite, ovate or slightly obovate, 3-6.5 cm x 1.5-4 cm, petiolate; petioles slender up to 3 cm long, glabrous, margins with distinct and distant small teeth. Flowers in axillary branched cymes, minute, often subtended by small prickly sterile

branchlets up to 2 mm long. The flowering cymes are 2.5-6.0 cm long and almost as broad, forming axillary bunches. Perianth lobes 5, small, insignificant, acute and persistent, connate at the base, deeply divided, Stamens generally 3 represented by small with flattened bases. Ovary small, stigmas 2. Utricle exposed, opening transversely. Seeds black, up to 1.5 mm diam, discoid, shining with a blunt beak on one side.

Field notes : The weed is seen associated with ornamentals in gardens and in maize fields. It prefers moist situations.

Fl. & Fr. : September-November.

Specimens examined : *Kaul* RRL 19657 (8-10-1969) RRL Srinagar flower beds as, a weed.

Geographical distribution : Himalaya : from Kashmir to Kumaon and Khasia mountains.

CHENOPODIUM Linnaeus

Key to the species

1. Scentless herbs. Flower clusters in spikes :
   2. Leaves ovate or oblong, upper ones entire — **album**
   2. Leaves triangular hastate and cordate, deply acutely unequally toothed — **foliosum**
1. Scented herbs. Flower clusters in panicles :
   3. Aromatic herbs, cymes short axillary — **botrys**
   3. Herbs with unpleasant, camphoraceous odour; cymes long, branched and panicled — **ambrosoides**

Chenopodium album L. Sp. Pl. 219, 1753; FBI 5 : 3; Collett 416; Blatter 2 : 138; Backer in Fl. Males. 4(2) : 102, 1949; Rao in BOBSI 2 (3 & 4) : 413, 1960; Stewart 220.

Annual or biennial herbs. Stem erect, up to 75 cm, branched or unbranched, somewhat angled, pale green to purplish green, mealy white especially towards the apices. Leaves simple, scentless, extremely variable; lower oblong to obovate, up to 5.5 cm x 2 cm, stalked; margins irregularly more or less sinuate, sometimes toothed; upper leaves ovate, up to 2.5 cm x 1.1 cm, sessile or subsessile, alternate, margins entire or sinuate, lower surface mealy and upper pale green. Flower clusters in axillary spikes, each cluster with 5-10 small flowers, pale green often tinged with purple. Perianth 5-segmented, each segment is up to 3 mm diam mealy and persistent. Stamens 3, filaments small and slender, anther lobes rounded and white Ovary small, styles 2, stigmas 2-fid, globose. Utricle enclosed in the perianth segments. Seeds solitary, brownish, crustaceous, shining.

Germination : Summer (June-July). The seeds possess a hard outer covering.

Fl. & Fr. : September-November.

Dissemination : The seeds get disseminated by wind and animals including man.

Habitat : A common weed of orchards and vegetable fields especially cabbage fields, preferring dry situations. Indicator of well aerated and fertile clay loams.

Root system : A thoroughly branched taproot, the mainroot goes up to 35 cm deep in the soil.

Geographical distribution : A cosmopolitan weed.

Specimen examined : *Kaul* 90 (10-9-1969) RRL Campus, Srinagar; *Kaul* 101a (15-10-1969) Naseem Bagh orchards.

Illustration : Polunin pl. 10.

Chromosome report : 2n=36, 54 (DCA 76).

Chenopodium foliosum (Moench.) Aschers. Prodr. Fl. Brand. 1 : 572. 1864; Iljin in Fl. URSS 6 : 48 Tab. 111-3, 1936; Kitamura 95; Rao in BOBSI 2 : 413, 1960; Stewart 221.

Monocarpus foliosum Moench. Meth. 342, 1794.

Chenopodium blitum Hook.f. in Gen. Pl. 52, 1876; FBI 5 : 5; Blatter 2 : 136.

Perennial herbs sometimes acting as annual. Stem up to 65 cm long, generally suberect and ascending, branched somewhat thick and stout towards the base, glabrous, ribbed, finely grooved, pale green to whitish, leafy. Leaves without scent, triangular or hastate and cordate, tapering into a long point, alternate, up to 8.5 cm x 2.5 cm, stalked; stalk slender, about half as long as the leaf or even shorter, margins deeply cut and unequally toothed, sometimes even lobed, glabrous. Flowers in small axillary clusters, each cluster is somewhat rounded up to 8 mm diam consisting of 6-12 small and sessile flowers, forming long leafy spikes. Perianth 3-lobed, never enclosing the fruit, turning red at maturity. Stamens 1, filament small, anther reddish. Fruit conspicuously scarlet red with one opaque, reddish to brownish, somewhat rounded seed.

Germination : Spring (March-April),

Fl. & Fr. : May-August.

Dissemination : The seeds are disseminated by water and animals especially hoofed animals.

Habitat : A common weed of woods and spread into fields of lower altitudes by cattle. Indicator of compact gravelly, stony or sandy soil.

Root system : A thick somewhat creeping and branched rootstock.

Geographical distribution : Europe, North & West Asia, North Africa.

Specimen examined : *Duthie* 13650 (19-8-1893) Below Baltal in fallow fields (DD); *Kaul* RRL 16045 (7-6-1971) Chrari Sharif on muddy walls.

Remarks : The plants are readily distinguished by its mulberry like red fruits.

Illustration : Polunin pl. 10.

Chenopodium botrys L. Sp. Pl. 219, 1753; FBI 5: 4, Collett 416: Blatter 2: 137; Rao in BOBSI 2 (3 & 4) 413, 1960; Stewart 220.

Annual or biennial herbs. Stem up to 45 cm long, erect or suberect ascending, much branched, glandular pubescent, cylindrical, or finely ribbed, pale or whitish green. Leaves oblong, up to 6.5 cm x 2.5 cm, lower ones lobed and upper ones generally entire, glandular hairy, aromatic, falling off at maturity so that the mature plants seem to be leafless. Flower clusters in numerous, shorter, axillary, branched panicles. Perianth segments trian-

gular, glandular and persistent. Stamens 3, filaments small and slender; anthers whitish and globular. Ovary small with two style branches. Utricle enclosed in persistent perianth. Seed solitary and shining.

Germination : Spring (March-April) and also in autumn (September).

Fl. & Fr. : July-November.

Dissemination : The seeds are disseminated by wind, water and cattle.

Habitat : An occasional weed of some orchards and hilly areas including maize fields. Indicator of gravelly & stony soils.

Root system : A branched tap root system, the main root going up to 20 cm deep in soil.

Geographical distribution : Kashmir to Sikkim, North & West Asia, North Africa and Europe.

Specimens examined : *Gammie* s. n. (4-7-1891) Srinagar, 5300 ft. (DD); *Kaul* 105 (8-11-1969) Shalimar carrot fields.

Remarks : The plants are easily identified by strong pleasant.

Chromosome report : 2n=16 (DCA 76).

Chenopodium ambrosoides L. Sp. Pl. ed. 1, 1: 219, 1753; FBI 5 : 4; Blatter 2: 137; Rao in BOBSI 2 (3 & 4) 413, 1960; Stewart 220.

Perennial much branched bushy herbs. Stem somewhat woody near the base, much branched, glabrous or covered with glandular hairiness, ribbed and finely grooved. Leaves simple, oblong-lanceolate, up to 7.5 cm. x 2.0 cm. blunt or sharply pointed, sinuately toothed or upper leaves almost entire, sessile or bases tapering into a short stalk, glabrous and minutely hairy, having a camphoraceous odour. Flowers small, 3-7 in each clusters, forming slender, axillary and terminal, simple or paniculate leafy spikes. Perianth 5-segmented, each segment oval or rounded, up to 2 mm diam. blunt and persistent. Stamens 5, having very short filaments and rounded anthers Ovary small with a small style and 5-lobed stigma. Seed solitary in the utricle, rounded up to 2 mm diam., black or brownish.

Germination : Summer (May-June).

Fl. & Fr : September-November.

Dissemination : The seeds are produced in large numbers and disseminated by wind, animals & men.

Habitat : An occasional weed of fallow lands, waste heaps and orchards preferring dry situations. Indicator of compact sandy loams to gravels.

Root system : A much branched thick tap root penetrating up to 50 cm deep in the soil.

Geographical distribution : A cosmopolitan weed.

Specimens examined : *Kaul* RRL 920 (20-10-1969) Exhibition grounds; *Kaul* RRL 19714 (22-9-1971) Narakura, Badgam fallow fields.

Chromosome report : 2n=32, 36, 64 (DCA 76).

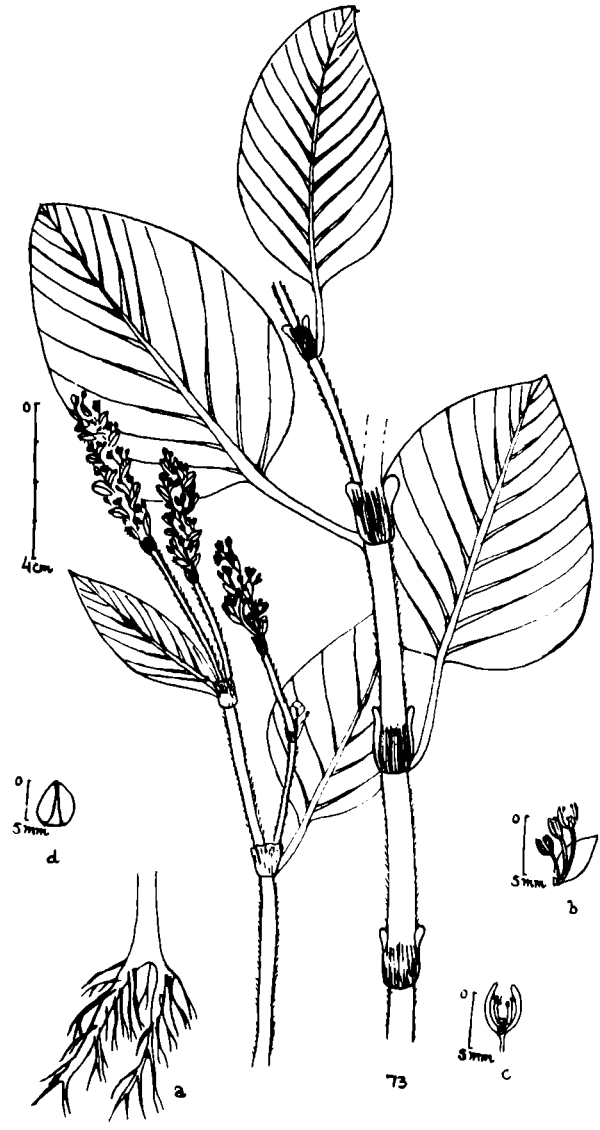


Fig. 73. *Polygonum orientale* Linn. (a flowering shoot)
a. root system, b. a bract with 3 flowers, c. v.s. flower, d. a nut

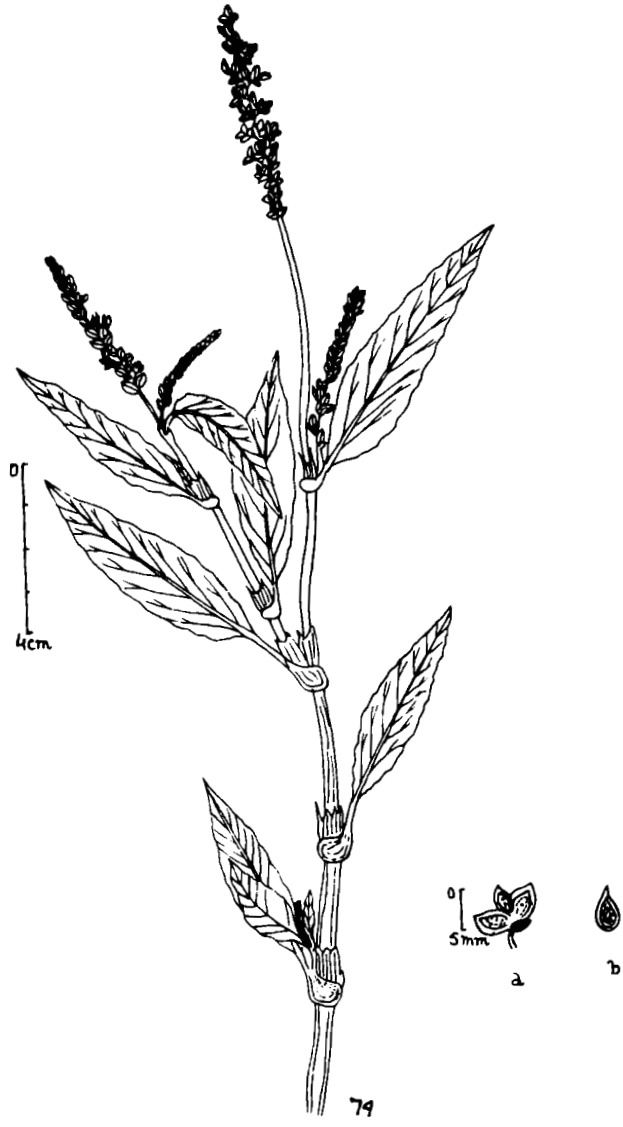


Fig. 74. *Polygonum persicaria* Linn. (a flowering shoot) a. a bract with 3 fls., b. a nut.

Fig. 75. *Polygonum nepalense* Meissn. (a flowering shoot)
a. a part of root system, b. flowers with bracts, c. a nut.

Fig. 76. *Thymelaea passerina* (Linn) Cass. (a flowering shoot) a. a flower, b. v.s. flower, c. a fruit.

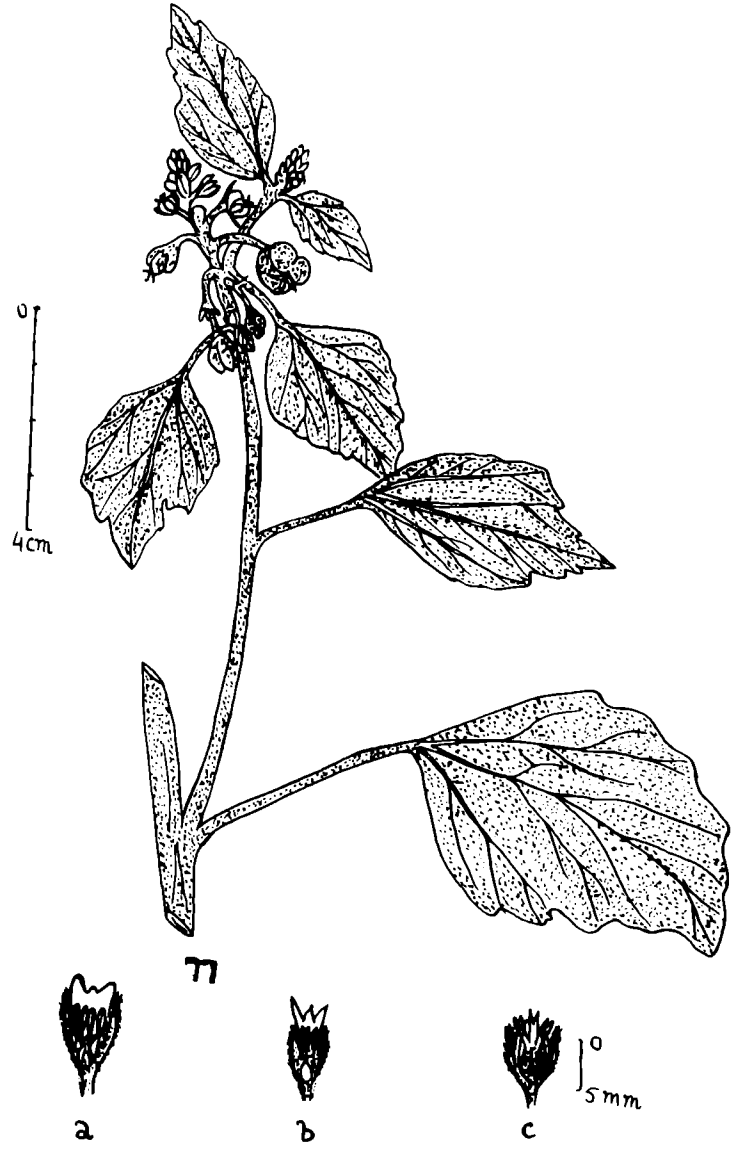


Fig. 77. *Chrozophora obliqua* (Vahl) Juss. (a flowering shoot)
a. male flower, b. female flower, c. male flower with rudimentary ovary,
d. a fruit.

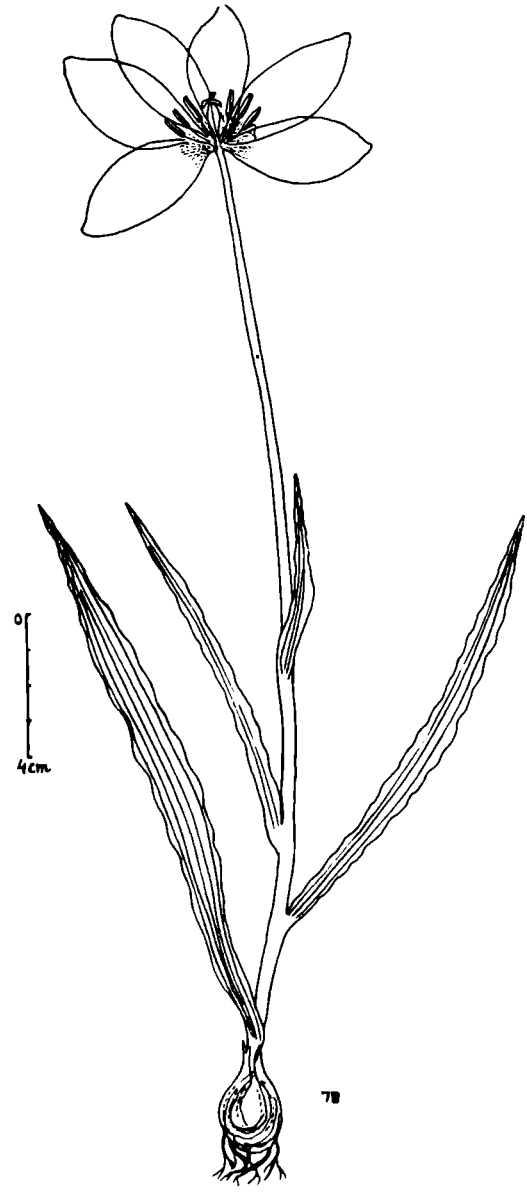


Fig. 78. *Tulipa stellata* Hook. f. (a flowering plant)

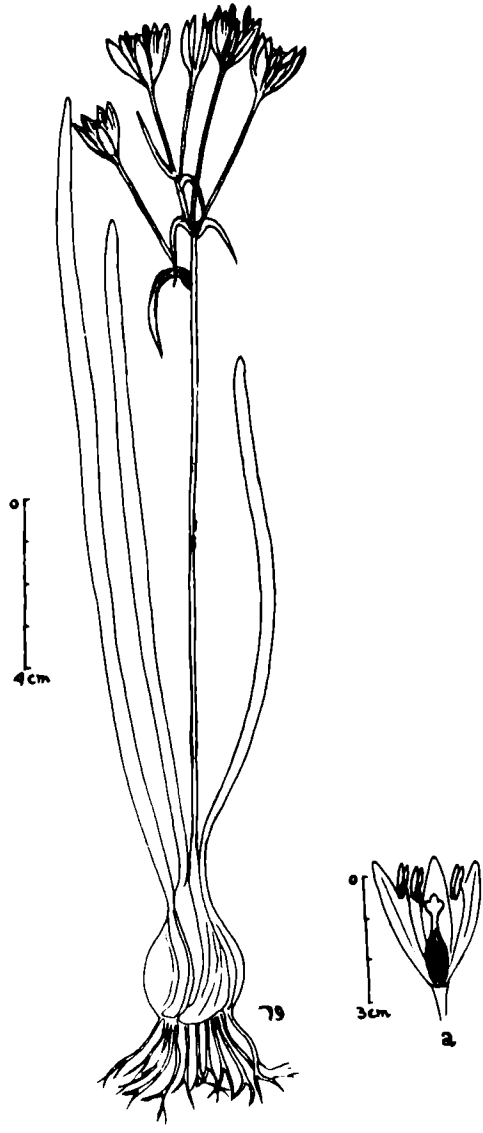


Fig. 79. *Ornithogalum umbellatum* Linn. (a flowering plant)
a. a flower

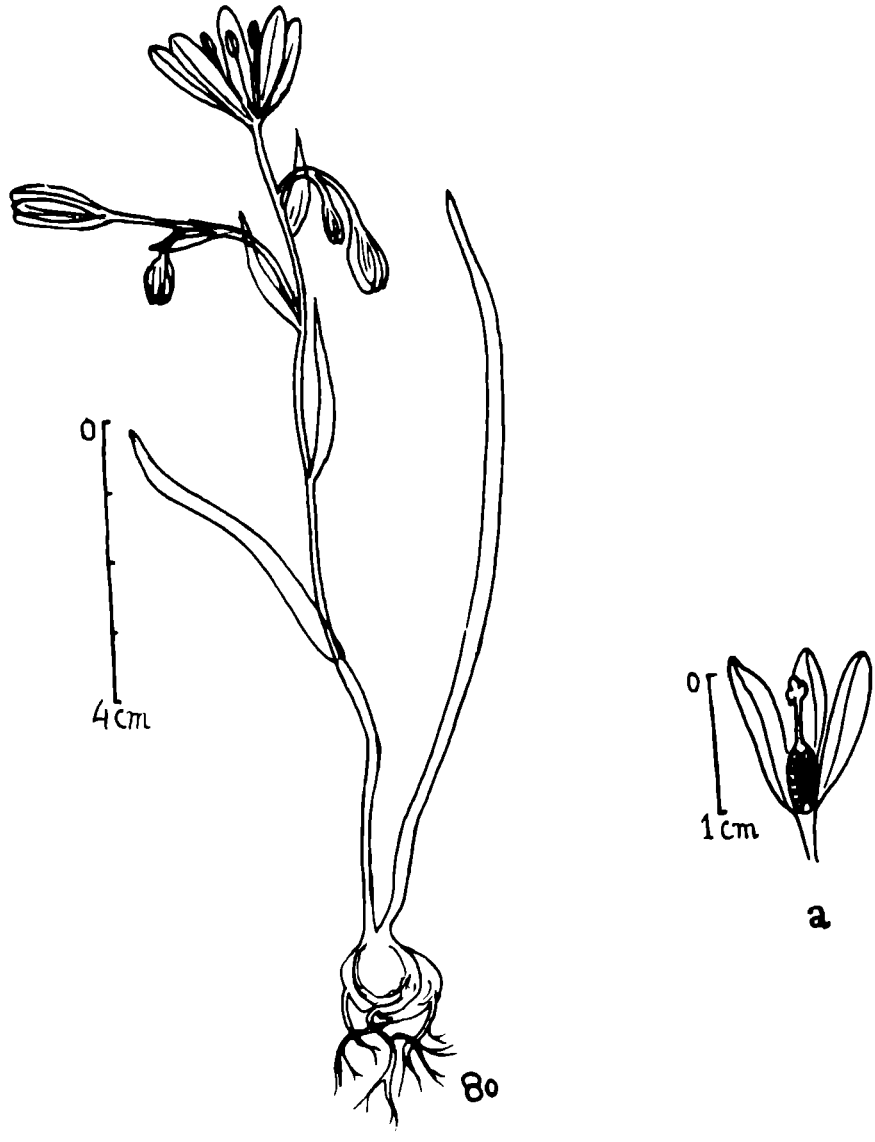


Fig. 80. *Gagea dschungarica* Regel (a flowering plant)
a. a flower

POLYGONACEAE

Key of the genera

1. Perianth 4-5 eleft, stigma capitate :
   2. Nuts enclosed in the perianth segments — **Polygonum**
   2. Nuts enclosed in the perianth segments — **Fagopyrum**
1. Perianth 6-parted or cleft. Stigma fringed — **Rumex**

POLYGONUM Linnaeus

Key to the species

1, Flowers axillary :
   2. Nerves of the stipules prominent — **aviculare**
   2. Nerves of the stipules none or very faint :
      3. Perianth shortly toothed — **rottboellioides**
      3. Perianth deeply toothed — **plebelum**
1. Flowers in terminal racemes :
   4. Stipules slightly hairy on the nerves :
      5. Bracts hairy; styles 2; nuts flattened — **orientale**
      5. Bracts glabrous; styles 3; nuts 3-angled — **amplexicaule**
   4. Stipules glabrous on the nerves :
      6. Marshy or aquatic plants, rooting at nodes — **amphibium**
      6. Plant growing in non-marshy situations, (dry for part of the year) :
         7. Flowers in narrow, elongated, interrupted spikes — **hydropiper**
         7. Flowers in dense spikes :
            8. Flowers bright or pale pink, stalks of the inflorescence i.e. peduncles not glandular — **persicaria**
            8. Flowers greenish-white or dull pink, stalks of the inflorescence with yellow glands — **lapathifolium**
1. Flowers in heads or short spikes — **nepalense**

Polygonum aviculare L. Sp. Pl. 362, 1753; FBI 5 : 26; Collett 420; Blatter 2 : 144; Rao in BOBSI 2 : 413, 1960; Kitamura 89; Webb & Chater in Fl. Europaea 1 : 78, 1964; Stewart 203.

Annual herbs. Stem generally prostrate, widely spreading, up to 50 cm long branches, slender, finely grooved, smooth, jointed stem with swollen joints, leafy and generally flowering throughout its length, sometimes also barren near the base, glabrous, twining, tough as well as flexible near the base. Leaves simple, obovate to lanceolate, up to 3 cm x 0.8 cm. generally sessile or sometimes base tapering into a small stalk, entire, sometimes gland dotted. Stipules tubular, up to 0.5 cm long, nerves several and strong, tips of nerves somewhat projecting, membranous, persistent. Flowers small, in axillary clusters, each cluster of 3-7 small greenish white or reddish flowers, sessile or with small stalks in the persistent stipules. Perianth 4 or 5 parted,

cleft nearly to the base, segments oval up to 3 mm diam falling off after maturity. Stamens as many as perianth segments, filaments slender, anthers rounded. Ovary small embedded in the perianth; styles 3, small. Nuts triangular solitary enclosed in perianth segments, smooth and shining surfaces.

Germination : Early spring (Late February-March) and autumn (September-October).

Fl. & Fr. : May-June and November.

Dissemination : The seeds are disseminated by man, animals, wind and rain water.

Habitat : A common prostrate weed of fields crops (wheat), waste places, particularly footpaths and roadsides preferring moist situations. Indicator of compact, moist, sandy or clayey loams.

Root system : A creeping rootstock, rooting at nodes and binding the soils.

Geographical distribution : Arctic and Temperate Europe, introduced into America, North & West Asia including Kashmir.

Specimens examined : *Kaul* 33 (23-5-1969) RRL fields, roadsides; *Kaul* RRL 16050 (11-6-1971) Srinagar fields.

Remarks : A fast spreading moist variable weed, forming mats at places; moderately competitive with field crops.

Chromosome report : 2n=40, 60, (DCA 27).

Polygonum rottboellioides Jaub. & Spach, Ill. Pl. Or. 2: 32, 1845; Stewart 210.

Polygonnm tubulosum Boiss., Fl. Orient. 4; 1032, 1867; FBI 5 : 27; Collett 420; Blatter 2: 152; Rao in BOBSI 2: 413, 1960.

An annual herb. Stem always prostrate or decumbent, thoroughly branched, branches up to 20 cm long forming a basal rosette, somewhat angular or terete, dull green, leafy, looking like runners along the ground level. Leaves linear, up to 1.5 cm x 0.3 cm, sessile or base tapering into a small stalk, alternate but looking like crowded, margins entire, bent back, glabrous. Stipules white, transparent, conspicuous, tubular, almost entire or fringed, nerves absent or sometimes very faint. persistent. Flowers very small, white or pinkish, sessile, in axillary clusters. Perianth 4 or 5 cleft, lobes small, oval glabrous, persistent. Stamens small as many as perianth lobes, filaments slender coming out of the perianth lobes, anthers globular. Ovary small with 3 free styles, glabrous. Nutlets solitary, triangular, smooth, brownish.

Germination : Spring (March-April).

Fl. & Fr. : July-August.

Dissemination : The seeds are disseminated by man, animals and rain water.

Habitat : An occasional weed of orchards, grasslands, maize fields and roadsides preferring dry situations.

Root system : A creeping slender but tough rootstock with bunches of adventitious roots at nodes.

Geographical distribution : Afghanistan, Iran, North Western Himalaya, Kumaon to Western Tibet.

Specimens examined : *Gammie* s.n. (17-7-1891) Jhelum valley, 4000 ft. (DD); *Kaul* 54 (3-7-1969) Barzulla orchards, Srinagar.

Polygonum plebeium R. Brown in Prodr. Fl. Nov. Holl. 420, 1810; FBI 5 : 27; Collett 421; Blatter 2 : 150; Danser in Bull. Jard. Bot. Buitz. 3, 8 : 140, 1922; H. Hara in

Fl. Eastern Himalayas 75, 1966; Stewart 208.

Annual herbs. Stem prostrate, branched, sometimes ascending, up to 45 cm long, terete, finely grooved, smooth, tough, glabrous, flowering throughout their length. Leaves oblong or linear or narrowly obovate, up to 1.5 cm long, sessile to subserslle, alternate but erowded towards the apices of the branches, entire glabrous; stipules tubular, short up to 4 mm long, torn up to the middle, white, membranous and transparent, nerves absent or faint. Flowers small in axillary clusters, similar to that of *P. aviculare*, concealed among the stipules. Perianth 5 parted, deeply fid (nearly up to the base), small and persistent. Stamen 5; ovary with 3 minute and free styles. Nut triangular to rhomboid, smooth and shining, brownish to black, never protruding out of the persistent perianth lobes.

Germination : Spring (March-April).

Fl. & Fr. : July-August.

Dissemination : Mostly by animals and rain water.

Habitat : An occasional weed of wheat fields, roadsides, grasslands & fallow lands, perferring moist situations. Indicator of moist compact & sandy loams.

Root system : A simple somewhat creeping rootstock, rooting at nodes.

Geographical distribution : Africa, Afghanistan, Eastward to China and Bhutan to Kashmir.

Specimens examined : *Kaul* 63A (21-7-1969) University campus orchards, Srinagar.

Remarks : It is allied to *Polygonum aviculare* and can be readily distinguished by faint nerved stipules and rhomboid nuts. Hooker (1885) has given 11 forms of which our plant, can be placed under form *indica*.

Polygonum orientale L. Sp. Pl. 362, 1753; FBI 5 : 30; Collett 421; Blatter 2 : 142; Danser in Bull. Jard. Bot. Buitz 3, 8 : 168, 1927; Stewart 207. **(Fig. 73)**

Annual or biennial herbs. Stem erect up to 1 m, branched from the base, somewhat woody towards the base, but the branches are fistular, softly hairy or tomentose, swollen at the nodes, somewhat angled and grooved. Leaves simple, obovate, tapering into an acute apex, up to 13.5 cm x 7.5 cm petioles up to 2.5 cm long, alternate, margins smooth or minutely crisped or dented, veins much prominent from the undersurface, midrib raised and softly hairy, stipules tubular embracing the nodes more than 1 cm in length, truncate, margins often green, nerves distinct and pubescent. Flowers red in dense erect or drooping racemes, up to 6.5 cm long and forming terminal panicles; bract, ovate, purplish, tubular, densely hairy containing 3-5 flowers. Perianth 5-lobed or rarely 4-lobed; stamens 6-8, filaments slender included in the perianth. Ovary small, style small with a 2-lobed stigma. Nutlets rounded, flattened edges and rather convex faces, black, shining.

Field notes : A rare annual plant found in orchards and vegetable fields preferring moist situations. The racemes or the panicles are showy.

Fl. & Fr. : July-August.

Geographical distribution : Thailand Java, Borneo, China, Japan, Turkestan, Himalaya : Kashmir, Eastwards to Bengal, Assam.

Specimens examined : *Kaul* 71 (6-8-1969) Badgam orchards.

Remarks : It can be placed under var. *glabrata* of Hooker (1885) which has been reported from Kashmir by Thomson.

Chromosome report : 2n=22 (DCA 73.)

Polygonum amplexicaule D. Don, Prodr. Fl. Nepal. 70, 1825; FBI 5 : 32; Collett 421; Blatter 2 : 142; Rao in BOBSI 2 : 413, 1960. Webb. & Chater in Fl. Europaea 1 : 80; Stewart 203.

Perennial herbs. Rootstock thick and woody, branched and tufted. Stem tufted near the base, many arising Independently from the same rootstock, up to 70 cm tall, branched or rarely unbranched, terete, narrowly grooved, glabrous or minutely pubescent. Lower leaves ovate to cordate, petiolate, upper leaves similar but amplexicaule, acuminate, margins crenulate, glabrous or softly pubescent on the under surface; stipules tubular, finely veined, mouth truncate, glabrous, tips torn. Flowers pink or deep red, rarely white, small up to 5 mm diam., sessile; bracts ovate sharp pointed, membranous; racemes up to 9.5 cm long, perianth 5-parted, persistent. Stamens 8, filaments small, included in the perianth and anthers rounded and protruding out. Ovary trigonous, styles 3, small and free from the base. Nutlets triangular up to 0.4 cm diam, smooth and shining.

Germination : Spring (March-April).

Fl. & Fr. : July-September.

Dissemination : The seeds are disseminated by wind and rain water.

Habitat : A common weed of forests. Rare in maize fields and some orchards. Indicator of organic matter in soils.

Root system : A thick and stout, rootstock, branched, spreading in the surface horizons of the soil and perennating the unfavourable season.

Geographical distribution : Temperate Himalaya : Kashmir to Sikkim.

Specimens examined : *Kaul* RRL 19609 (19-7-1969) Tangmarg maize fields; *Kaul* 19755 (28-6-1972) Tangmarg, fallow fields.

Local name : Meichren.

Illustration : Blatter pl. 55, fig. 4 & 5.

Polygonum amphibium L. Sp. Pl. 361, 1753; FBI 5 : 35; Blatter 2 : 141; Rao in BOBSI 2 : 413, 1960; Webb & Chater in Fl. Europaea 80, 1964, Stewart 203.

A perennial marshy or aquatic herb. Rootstock creeping and fibrous with bunches or roots growing from the nodes. Stem prostrate, weak up to 50 cm long. fistular, ribbed and finely grooved. Leaves simple, obovate to cordate or lanceolate with a long pointed apex, up to 9.5 cm, petiole up to 3 cm long, glabrous or hairy, margins entire or serrate, alternate, floating in aquatic plants but spreading or drooping in marshy plants, green or reddish sometimes spotted; stipules appressed to the stem, membranous, generally glabrous or sometimes hispid. Flowers bright pink, in solitary terminal, stout and up to 3.5 cm long racemes, peduncles long and stout, glabrous or hairy; bracteate; bracts acute, obtuse or cuspidate. Perianth 5-partite, segments oval, blunt, reddish, glabrous, persistent, much longer than the enclosed nut. Stamens 5, anthers small, globulor. Ovary

small, included with 2 styles. Nuts shining, up to 3 mm long with 2 flat surfaces, black.

Germination : Spring (March-April).

Fl. & Fr. : July-October.

Dissemination : The plants reproduce vegetatively as well as by seed. The seeds are disseminated by water and man.

Habitat : A common weed of floating islands and sometimes paddy fields.

Root system : A slender rootstock creeps in the surface horizons of muddy soils. Bunches of adventitious roots arise from the nodes of the rootstock and bind the soil.

Geographical distribution : North Eurasia, N. America, Westwards to Atlantic; Western Himalaya : Kashmir to Kumaon.

Specimens examineand: *Keshavanand* 28766 (July, 1909) Wular Lake (DD); *Kaul* RRL 19719 (26-9-1972) Dal Lake floating islands.

Illustration : Polunin pl. 8.

Chromosome report : 2n=66 (DCA 73).

Polygonum hydropiper L. Sp. Pl. 361, 1753; FBI 5 : 39; Collett 423; Blatter 2 : 147; Polunin 62; Stewart 206.

Annual herbs. Stem erect, up to 45 cm, branched, somewhat tough and woody near the base, branches slender, swollen at joints, glandular, lower nodes rooting, glabrous, generally reddish green. Leaves lanceolate, up to 6 cm x 1.8 cm, sessile to subsessile, usually covered with impressed glands, margins entire, apex acuminate to obtuse, glabrous; stipules almost tubular, reddish, membranous, almost deeply cut, ciliate. Flowers in drooping, filiform, lax, up to 6 cm long racemes, bracts tubular shortly fringed, sometimes red spotted. Perianth 5-partite, glandular, glabrous, persistent, enclosing the nuts completly. Stamens 5 or 6, filaments slender as long as the perianth lobes, anther lobes globular. Ovary small glabrous; styles 2 or 3, free nearly up to the base. Nuts rounded or triangular, shining and glabrous.

Germination : Spring (March-April).

Fl. & Fr. : July-September.

Dissemination : The seeds are disseminated by water.

Habitat : A common weed of marshlands, ditches, floating islands & damp fallow places.

Root system : A much branched tap root goes up to 20 cm deep in the mud.

Geographical distribution : Temperate and subtropical Asia, Java, North America, Australia, Assam and Bengal to N.W. India.

Specimens examined : *Kaul* 77 (11-8-1969) Nishat, around paddy fields and marshy places; *Kaul* 280 (4-8-1971) Hyderpora, paddy fields.

Local name : Marchwangen Gassa.

Remarks : The leaves have an acrid taste like that of pepper. Considered to be poisonous for livestock.

Illustration : Polunin pl. 8.

Chromosome report : 2 n=20 (DCA 73).

Polygonum persicaria L. Sp. Pl. 361, 1753; FBI 5 : 35; Blatter 2 : 150; Polunin 52; Stewart 208. (Fig. 74)

Annual herbs. Stem erect up to 75 cm, branched or unbranched, greenish with reddish spots, nodes slightly swollen, solid or

smaller branches may be fistular, glabrous, finely ribbed and grooved, Leaves simple, ovate lanceolate, tapering at both the ends, up to 8.5 cm x 1.5 cm, more or less stalkless, alternate, dotted below, margins entire or sometimes finely crenate, glabrous or fringed with hairs on the margins; stipules tubular, up to 1.2 cm long. membranous. nerved, loose but coherent when young, persistent. Flowers white or with a reddish tinge, in dense racemes or spikes which are branched, terminal up to 10 cm long; bracts small with 2-3 subsessile to sessile flowers in the axil. Perianth generally 4-cleft, segments small but persistent. Stamens 6-8, filaments small. Ovary with 2-styles, united below. Nuts brownish, triangular, up to 3 mm long, glabrous and shining with 2 flat surfaces.

Germination : Late spring (April-May).

Fl. & Fr. : August-October.

Dissemination : The seeds are mainly disseminated by wind and water.

Habitat : A common weed of damp places, floating islands and margins of paddy fields. Fertile, rather acidic, moist, peaty and loamy soils.

Root system : A somewhat creeping or stoloniferous rootstock penetrating up to 40 cm deep in the peat.

Geographical distribution : North and West Asia, Africa, Europe, N. America, Western Himalaya : Kashmir to Tibet.

Specimens examined : Kaul 85 (3-9-1969) Barzulla vegetable fields towards water channels.

Chromosome report : 2n=44 (DCA 73).

Polygonum lapathifolium L. var. **nodosa** (Pers.) Hook. f., FBI 5:35, 1885; Blatter 2 : 148; Polunin 63.

Polygonum nodosum Pers. Syn. Pl. 1 : 440, 1805.

This species is quite similar to *P. persicaria* but can be distinguished by its larger leaves, white downy undersurface, inflorescence consisting of greenish-white flowers, peduncles with small yellowish glands (sometimes even absent) and nuts are comparatively smaller. It possesses same habitat conditions.

Specimens examined : *Kaul* RRL 19757 (25-7-1972) Barzulla vegetable fields.

Geographical distribution : N.W. Asia, Europe, Africa and America.

Chromosome report : 2 n=22, 44 (DCA 73).
Illustration : Geigy weed tables, fig. 18.4.

Polygonum nepalense Meissn. Monogr. 84, t. 7. f. 2. 1826; Kitamura 91; Stewart 207).

Polygonum alatum Sprengel, Syst. 4, 2 : 154, 1827; FBI 5 : 41; Collett 423; Blatter 2 : 143, **(Fig. 75)**

Annual or biennial herbs. Stem generally procumbent, ascending, rarely erect, up to 50 cm long branched thoroughly, rooting at nodes, cylindrical, finely ribbed, glabrous or at times hairy. Leaves ovate, to cordate, up to 3.5 cm x 2 cm, petiole winged, sometimes auricled at base, alternate, sharp pointed or blunt, entire margins, glabrous, very rarely hairy; stipules small, tubular, membranous, deeply 2-fid, hairy or glandular towards the base, persistent, turning somewhat reddish at maturity. Flowers white or sometimes even reddish, in axillary heads up to 1.8 cm diam., stalks of the inflorescence glandular hairy near the top;

bracts flat, membranous and glabrous. Perianth 4-5 parted, up to 4 mm long, green or reddish, persistent. Stamens 6-8, filaments slender and small, anthers glabrous. Ovary with 2-3 styles, fused nearly up to the top. Nut triangular, minutely dotted, shining black, enclosed in the persistent perianth.

Germination : Early summer (June).

Fl. & Fr. : July—September.

Dissemination : The seeds are disseminated mainly by rain water.

Habitat : An occasional weed of damp situations, margins of floating islands and some maize fields possessing a gregarious habit. Indicator of acidic, fertile soils.

Root system : A somewhat creeping rootstock bearing adventitious roots at nodes.

Geographical distribution : Ethiopia, Afghanistan, Himalaya : Kashmir to Sikkim; Khasia mountains, China, Japan, Malaya.

Specimens examined : Kaul RRL 16072 (29-7-1971) Harwan paddy fields; *Kaul* 334 (4-8-1972) Pampore maize fields.

FAGOPYRUM Miller

Fagopyrum cymosum (Trev.) Meissn. in Wallich Pl. Asia. Rar. 3 : 63, 1832; FBI 5 : 55; Collett 426; Rao in BOBSI 2 : 413, 1960; Stewart 210.

Polygonum cymosum Trev. in Nov. Act. Acad. Caes. Leop. Carol. Nat. Cur. 13 : 177, 1826.

Annual herbs. Stem erect up to 70 cm branched or rarely unbranched, cylindrical, sparsely pubescent, sometimes angled. Leaves cordate, hastate or broadly triangular, up to 9.5 cm x 6.5 cm, entire, acutely pointed, stalks about half the length of leaves; uppermost leaves sessile with bases stem clasping; stipules membranous and tubular, falling off at maturity. Flowers white or with red tinge, small stalked, forming branched panicles up to 10 cm long, flower stalks jointed near the middle. Perianth 5-parted, segments nearly equal and blunt, hairy, persistent. Stamens 8, filaments up to 5 mm long, alternating with the honey secreting glands. Ovary small, styles 3, long and free, stigma capitate. Nuts triangular, ovate, more than twice as long as the perianth at maturity, blackish brown, smooth and shining.

Germination : Spring (March-April).

Fl. & Fr. : July-September.

Dissemination : The seeds are disseminated by wind water and animals.

Habitat : A rare weed of paddy fields and moist damp situations. Indicator of fertile clayey loams.

Root system : A much branched tap root, the main root does not go beyond 10 cm deep.

Geographical distribution : Himalaya, Kashmir to Sikkim, Khasia, Tibet, Thailand, Malaya & China.

Specimens examined : Kaul RRL 16124 (25-8-1971) Harwan paddy fields; *Kaul* 294 (18-11-1971) Chrari Sharif, fallow fields.

Remarks : The rootstock is reported to be perennial but I don't find it so in the specimens observed in the field.

Chromosome report : 2 n=16 (DCA 72).

RUMEX Linnaeus

Key to the species

1. Leaves ovate to obovate. Inner fruiting perianth lobes with broad much toothed wings. **chalepensis**

1. Leaves hastate. Inner fruiting perianth lobes much enlarged, membranous, entire. **hastatus**

Rumex chalepensis Mill. Gard. Dict. ed. 8, no. 11, 1768; Stewart 213.

Rumex dentatus sensu Hook.f., FBI 5:59.1885, p.p.

Annual herbs. Stem erect, up to 50 cm or sometimes more branched from the base, finely ribbed and also narrowly grooved, glabrous main stem thick and fistular, branches solid. Leaves oblong obtuse with a somewhat cordate base, up to 6.5 x 4.5 cm, petiole up to 2.5 cm long or even absent in uppermost leaves, margins crisped, glabrous; stipules tubular, fringed, torn off at maturity or even falling off. Flowers in distinct whorls, greenish or turning reddish at maturity, drooping downwards forming small bunches at nodes. Perianth 6; outer unchanged; inner 3, oblong-ovate with an oblong smooth tubercle and broad densely reticulated wings which are irregularly toothed, teeth stout and straight. Stamens 6, filaments small, anthers reddish. Ovary small, trigonous with 3 free linear, filiform styles, glabrous. Nuts included in the enlarged perianth lobes, globular but angular, glabrous, smooth and shining.

Germination : Late spring (April-May).

Fl. & Fr. : June-August.

Dissemination : The seeds ara disseminated by wind, rain water and animals.

Habitat : An occasional weed of vegetable fields and orchards preferring moist situations. Indicator of sandy or clay loams.

Root system : A tap root going up to 25 cm deep in the soil, less branched.

Geographical distribution : China, Afghanistan, Pakistan, India : Himalaya, Kashmir to Assam.

Specimens examined : *Gammie* s.n. (2-7-1891) Srinagar, 5300 ft. (DD); *Thapliyal* 25418 (3-8-1956) Dorus, Kashmir; *Kaul* RRL 19756 (28-6-1972) Tangmarg fields.

Chromosome report : 2n = 40 (DCA 72).

Rumex hastatus D. Don, Prodr. Fl. Nep. 74, 1825; FBI 5: 95; Collett 421; Rao in BOBSI 2:414. 1960; Stewart 214.

Perennial herbs, Stem tufted, much branched from the base, robust up to 75 cm long, branches stiff and spreading, glabrous, cylindrical and sometimes grooved towards the base. Leaves rhombic deltoid or hastately 3-lobed, lobes narrow, up to 5.5 cm x 2.5 cm, petiole slender as long or even sometimes longer than the leaf, alternate, entire; stipules small, tubular, mouth fringed, faintly ribbed, membranous, turning purplish at maturity. Flowers in small whorls, racemed or forming panicles often dense in fruit. Perianth lobes usually enlarged in fruit, often pink, delicately veined, resembling valves which enclose the reproductive parts. Stamens 6, anthers on slender filaments, reddish. Ovary small with 3 free styles arising from the angles of the ovary, stigma or the upper portion of styles somewhat feathery. Nuts included in so called

persistent, coloured valves; globular, glabrous, pointed towards one end, shining.

Field notes : The plant is found generally in dry locations with a thick tufted rootstock going into the hard and dry substratum. It occasionally invades orchards and is found in fallow fields also.

Fl. & Fr. : June-August.

Specimens examined : *Thapliyal* 26276 (27-5-1958) Shankeracharya hill, Srinagar (DD); *Kaul* RRL 5575 (3-7-1970) Dalgate fallow fields.

Geographical distribution : Afghanistan, Pakistan and through Himalaya to China.

Chromosome report : 2n=18 (DCA 72).

THYMELAECEAE

THYMELAEA P. Milier

Thymelaea passerina (L.) Coss. & Germ. Synops. Analit. 360, 1859; Stewart 497. **(Fig. 76)**

Stellera passerina L. Sp. Pl. 559, 1753.

Thymelaea arvensis Lamk. Fl. Franc. 3 : 218, 1795; FBI 5: 194.

Annual herbs with a simple generally unbranched tap root penetrating the surface horizon of the soil. Stem erect, up to 55 cm branched or unbranched, cylindrical, slightly appressed hairy above the middle, leafy. Leaves simple, narrowly lanceolate, up to 2.1 x 0.5 cm, alternate, sessile, apex obtuse, margins entire and glabrous. Flowers up to 5 mm. long, generally 3 at a node, axillary, middle one longer than the lateral ones, subtended by small stipular bracts. Perianth tube 4-fid near the apex, segments small, all over covered with small white appressed hairs, more dense near the base. Stamens 8, linear, filaments slender arising from the middle of the perianth tube; anthers basifixed, maturing in the youngest flowers. Ovary small, globular with a small slender style and a somewhat capitate, stigma. Fruit pear-shaped, rounded at the base, protruding into a blunt apex, glabrous and black.

Germination : The seeds germinate in early spring.

Fl. & Fr. : May-August.

Dissemination : The seeds are disseminated mostly by wind.

Habitat : An occasional weed of wheat fields, orchards and grasslands. Indicator of dry sandy loams.

Root system : The weed produces a simple branched or unbranched tap root going up to 15 cm deep in the soil.

Geographical distribution : Afghanistan, France, North Africa and mostly in plains of India.

Specimens examined : *Kaul* 56 (10-7-1969) Srinagar wheat fields; *Kaul* RRL 16176 (23-6-1972) RRL campus fields.

EUPHORBIACEAE

Key to the genera

1. Trees, herbs or shrubs with milky juice. Stem and leaves glabrous or hairy — **Euphorbia**
1. Herbs without milky juice. Stem and leaves stellately tomentose — **Chrozophora**

EUPHORBIA Linnaeus

Key to the species

1. Erect or sometimes even suberect; glabrous herbs :
   2. Stem erect up to 75 cm, leaves simple, ovate lanceolate, crowded throughout the stem — **peplus**
   2. Stem suberect or even procumbent. Leaves never crowded throughout the stem :
      3. Leaves obovate-oblong, often crowded towards the inflorescence — **helioscopia**
      3. Leaves oblong or rounded, opposite — **hypericifolia**
1. Ganerally procumbent or rarely suberect, hispid or hirsute herbs — **hispida**

Euphorbia peplus L. Sp. Pl. 456, 1753; FBI 5 : 266; Polunin 225; Stewart 451.

Annual herbs. Stem erect up to 75 cm, solid or sometimes fistular, generally unbranched or many branches arise from the base, longitudinally ribbed, narrowly grooved and purplish or yellow at maturity, glabrous, leafy throughout, juice milky. Leaves simple oblanceolate, up to 8.5 x 1.5 cm, sessile, alternate, margins entire, apex obtuse or blunt, mid-rib prominent from the under surface, veins running parallel, yellow or greenish yellow when young, looking fresh, smooth and shining, glabrous. Flowers in small monoecious inflorescence which is surrounded by cordate, yellow involucrate leafy lobed concealing the flowers up to maturity. The smaller flower heads are carried on slender stalks, umbellate arising in the axils of small ovate yellow leafy bracts, so that the entire compound inflorescence forms a head. Each small head is cupular, 5-lobed, lobes concealed by 5 glands placed in their angles; glands smooth, fleshy, flattened, usually yellow green on purple having dentate margins and projecting apex. Male flowers inside the cup consisting of 8-10 or more stamens arising from the base, filaments small. Female flowers consisting of a long stalked ovary, stalk slender coming out of the involucre or the cup; ovary 3-celled, styles 3, tips spreading. Capsule globose, 3-lobed, glabrous, up to 0.6 cm diam. splitting into 3 two-valved one seeded cocci.

Germination : Late spring (April-May).

Fl. & Fr. : June-August.

Dissemination : The seeds are disseminated by wind, rain water and animals.

Habitat : An occasional weed of orchards and fallow grasslands, preferring moist and shady situations. Indicator of fertile, moist sandy loams.

Root system : A thoroughly branched tap root, the main root goes up to 30 cm deep into the soil and branches are restricted in the surface horizons.

Geographical distribution : Europe excepting Iceland.

Specimens examined : Kaul RRL 917 (16-8-1969) Uuiversity campus Srinagar.

Remarks : The plant is considered to be poisonous.

Chromosome report : 2n = 16 (DCA 127).

Euphorbia helioscopia L., Sp. Pl. 459, 1753; FBI 5 : 262; Collett 446; Polunin 224; Stewart 449.

Annual glabrous herbs. Stem procumbent when young and erect at maturity; usually much branched near the top, up to 3.5 cm tall when mature, smooth, shining and succulent, full of milky latex, weak. Leaves obovate to spathulate, up to 5.5 x 3.5 cm alternate, often short stalked; lower cauline ones shorter than the upper, finely toothed at the apex and entire towards the base, glabrous, generally yellowish green or at times reddish. Inflorescence umbellate, umbels with 5 rays which are longer than the subtending involucral bracts; secondary rays 2-3, much shorter each carrying 2-3 flowers, also subtended by golden yellowish green, small, ovate bracts. Involucre 4-toothed, glands yellow rounded and entire. Stamens many, anthers small with jointed filaments. Ovary carried on a long slender stalk, coming out of the involucre; styles 3, free up to the base. Fruit up to 3.5 mm diam. smooth; seeds minutely net veined.

Germination : Early spring (February-March) and late autumn (November).

Fl. & Fr. : Early May-August.

Dissemination : The seeds are mostly disseminated by wind and to some extent by rain water and animals.

Habitat : A common weed of cultivation, also grows in fallow lands and waste heaps preferring moisture. Indicator of well aerated and fertile clay loams.

Root system : A simple branched tap root, the main root going up to 25 cm deep in loose soils.

Geographical distribution: W. Asia, Europe, Western Himalaya : Kashmir to Punjab, introduced into Nilghiris; Afghanistan, Japan.

Specimens examined : Thapliyal 26555 (8-6-1958) Kashmir in fields (DD); *Kaul* RRL 5592 (27-7-1970) Srinagar orchards; *Kaul* 19752 (24-6-1972) Rawalpora orchards.

Remarks : In autumn the seeds germinate and the seedlings are prostrate and reddish stem and leaves, remaining under snow for winter and maturing in summer. The mature plants are erect.

Local name : Gursocheel.

Local uses : The plants are poisonous; latex being used locally against ringworm and other skin diseases.

Chromosome report : 2n=42 (DCA 127).

Euphorbia hypericifolia L., Sp. Pl. 454. 1753; FBI 5:249; Hadidi in Bull. Jard. Bot. Nat. Belag. 43:87, 1973.

Euphorbia indica Lamk. Dict. Bot. 2:423 1786; Stewart 450.

Annual herbs. Stem 15-25 cm long, slender, branched, glabrous, generally decumbent. Leaves oblong, 1.5 - 2.5 cm x 0.5-1 cm, rounded at the base, blunt at the tip, short stalked, opposite, margins slightly toothed. Flowers in small involucres forming terminal or axillary cymes, glands green bordered. Capsule hairy; styles 3, shorter than the capsule. Seeds small and smooth.

Field notes : A rare weed growing along moist situations preferring rubbish heaps.

Fl. & Fr. : May-September.

Geographical distribution : Tropical regions of world except Australia and Pacific isles.

Specimens examined : *Sobti* RRL 913(5-7-1970) Srinagar, along Batwara; *Kaul* 354 (8-10-1972) Wazir Bagh fallow fields.

Euphorbia hispida Boiss. Cent, Euphorb. 8, 1856 and DC. Prodr. 15(2) : 27, 1862; FBI 5 : 265; Stewart 449.

Annual herbs. Stem branched from the base, branches somewhat trailing or procumbent along the ground level, up to 25 cm long or rarely more, slender, sparsely hairy, generally hairy, minutely ribbed and finely grooved. Leaves small, ovate, or obovate, up to 1.5. x 0.8 cm, opposite, shortly stalked to sessile, margins finely dentate to crenate, apex obtuse, surfaces glabrous or sometimes hairy, green or purplish; stipules small, fimbriate, falling off at maturity. Involucre up to 2 mm diam. with a slender pedicel. axillary, campanulate, generally purplish slightly hairy or glabrous; glands purplish with white spots. Stamens very small, dehiscing early. Ovary with a small slender stalk, style small 3-fid, divided up to the base. Capsule up to 2 mm diam, shortly stalked, glabrous. Seeds small and netted.

Germination : Late summer (July-August).

Fl. & Fr. : September-November.

Dissemination : The seeds are mainly disseminated by irrigation water and to some extent by wind and animals.

Habitat : A common weed of lawns, orchards, grasslands, fallow lands roadsides and even kitchen gardens. It possess a gregarious habit, preferring moist situations. Indicator of well aerated sandy or clay loams.

Root system : A thoroughly branched tap root, the main root goes up to 12 cm deep in soil and the secondary branches are longer than main root.

Geographical distribution : Afghanistan, introduced into other temperate regions of the world.

Specimens examined : *Kaul* RRL 19754 (24-6-1972) RRL campus, Srinagar; *Kaul* 350 5-10-1972) Rawalpora orchards.

Remarks : A fast spreading obnoxious weed and a good competitor. The specimen quoted above was identified by Kew authorities as *E. hispida* Boiss. which has been considered as a doubtful species by Hooker.

CHROZOPHORA A.H.L. Jussieu

Chrozophora obliqua (Vahl) Juss. Euph. Gen. Tent. 27, 1824; FBI 5:409; Stewart 446. **(Fig. 77)**

Croton obliquum Vahl, Symb Bot. 1:78, 1790.

Annual undershrubs or herbs. Stem erect, up to 65 cm, branched thoroughly, woody towards the base, somewhat angled, densely tomentose. hairs stellate. Leaves ovate to obovate, up to 5.5 cm x 3.5 cm petiole up to 7.5 cm long, tomentose; margins sinuate toothed, surfaces leathery covered with grey stellate tomentum, apex obtuse. Flowers in sessile axillary bracteate racemes, yellowish and monoecious. Male flowers consisting of 5 linear perianth lobes which are persistent and densely tomentose. Stamens 5-15, filaments slender and small, anther lobes yellowish, pistil rudimentary, Female flowers mostly towards the base, perianth 5-lobed; ovary small with 3 free spreading styles, style bifid near the apex, yellowish; ovules one in each cell. Capsule subglobose, carried on a long slender stalk, 3-angled,

stellately tomentose and with silvery scales, hard. Seeds angular, hard and greyish brown.

Germination : The seeds possess a hard outer covering and remain dormant till the testa is disintegrated in soil. The sprouting takes place in spring (March-April).

Fl. & Fr. : July-September.

Dissemination : The seeds are disseminated by wind and animals including man.

Habitat : An occasional weed of orchards and fallow lands preferring dry situations. Indicator of well aerated fertile clayey loams or Karewas.

Root system : A thick branched tap root going up to 30 cm deep in the soil, the branches are spread laterally.

Geographical distribution : Arabia and North Africa.

Specimens examined : *Kaul* RRL 19753 (24-6-1972) RRL campus, Srinagar.

URTICACEAE

URTICA Linnaeus

Urtica dioica L. Sp. Pl. 984, 1753; FBI 5:548; Collett 462; Jarmolinka in Fl. URSS 5:392, 1936; Rao in BOBSI 2:414, 1960; Stewart 197.

Biennial or perennial herbs. Stem erect up to 1 m, branched from the base, the main stem generally unbranched, solid, slightly angular and grooved, ribbed, conspicuously clothed all over with stinging hairs. Leaves simple, ovate to obovate lanceolate, up to 7.5 x 2.5 cm, petiole up to 2 cm, covered with stinging hairs, margins dentate to serrate or crenate, apex acute, surfaces covered with stinging hairs; stipules small, narrowly lanceolate, up to 1 cm long, free up to the base. Flowers unisexual, monoecious or dioecious, green clustered on long or short branches forming catkins; generally 4 branches at a node, Male flowers sometimes with a rudimentary ovary and female flowers with staminodes. Fruit a small yellowish nut enclosed in the persistent perianth.

Germination : The seeds sprout in summer (June-July).

Fl. & Fr. : August-November.

Dissemination : Wind, water and animals.

Habitat : A common weed of cultivated fields especially fallow fields and waste places growing in moist as well as dry situations. Indicator of fertile soils.

Root system : A perennial much branched rootstock perennating during the unfavourable seasou.

Geographical distribution : Europe, North Africa, Turkey, Caucasus, Siberia, Iran, Afghanistan, Himalaya and Tibet.

Specimens examined : *Kaul* 101 (15-10-1969) Chishma Shahi orchards.

Local name : Soi.

Remarks : A most undesirable but fast spreading weed. The stinging hairs all over the plant produce blisters if they touch the human skin.

Chromosome report : 2n=52, 48 (DCA 186).

The plants are variable. A typical variant collected in the same locality showed the following differences :

1. Stem up to 2 m tall, generally unbranched, woody near the base.

2. Stinging hairs dense on leaf petioles.
3. Leaves much variable in length and petioles up to 1.5 cm long.
4. Flowering catkins longer.
5. Ovary with a sessile feathery stigma and
6. Flowering earlier than the typical *U. dioica.*

Specimens examined : *Kaul* 72 (7-8-1969) Chishma Shahi orchards.

CANNABACEAE

CANNABIS Linnaeus

Cannabis sativa L. Sp. Pl. 1027, 1753; FBI 5 : 487; Collett 456; Stewart 195.

Annual herbs. Stem erect up to 3 m tall, ribbed minutely and distinctly grooved, branched or unbranched, finely tomentose, branches slender. Leaves 3-10 partite; stalks up to 3 cm, slender and downy; generally opposite, sometimes lower ones alternate, leaflets narrowly lanceolate and broader in the middle and tapering towards both ends, middle leaflet the longest, deeply serrate, surfaces minutely pubescent. Flowers pale yellow or green, dioecious. Male flowers pale yellow green, small, clustered in short, axillary clustered panicles pedicels small; perianth 5-parted, yellowish green, boat-shaped, segments imbricate, membranous margined; stamens 5, no flaments, anthers erect in bud. Female flowers axillary, sessile, erect, clustered; perianth in the form of a single entire leaf enclosing the ovary; ovary with two long, spreading, hairy, brown, filiform style arms. Fruit an achene; about 5 mm diam. enclosed in the persistent perianth.

Germination : The seeds readily germinate as these fall from the plants but the seedling survive in spring or at the most up to early summer. The seedlings formed in November die during the winter.

Fl. & Fr. : May-September.

Dissemination : The seeds are disseminated by wind and animals including man.

Habitat : A common and obnoxious weed of orchards, vegetable fields and fallow lands preferring dry locations. Indicator of gravelly soils.

Root system : A much branched and thick tap root going up to 50 cm deep in the soil.

Geographical distribution : Central Asia, also cultivated in temperate and tropical regions.

Specimens examined : *Kaul* 302 (25-5-1970) Rawalpora orchards.

Local name : Hashish, Banghe.

Remarks : Stem is fibrous, and ropes are made out of it, leaves are narcotic and flower tops yield "Hashish". The seeds are fed to cage birds.

Illustration : Polunin pl. 6.

Chromosome report : 2n=20, 40 (DCA 185).

MONOCOTYLEDONS

ORCHIDACEAE

Key to the genera

1. Roots tuberous; spikes simple with larger flowers **Dactylorhiza**
1. Roots fibrous; spikes spirally twisted with small flowers **Spiranthes**

DACTYLORHIZA Necker ex Neveski

Dactylorhiza hatagirea (D. Don) Soo' Annales Univ. Sc. Buda, Sect. Biol. 3:341, 1960; Stewart 67.

Orchis hatagirea D. Don, Prodr. Fl. Nep. 23, 1125.

Orchis latifolia auct. plur. non L. (1753); FBI 6: 127, 1887; Collett 499; Rao in BOBSI 2: 415, 1960.

Perennial herbs with tuberous rootstock, tubers slightly flattened and divided into 2 or 3 finger like lobes. Stem solitary up to 55 cm, erect, leafy throughout or the lower portion bearing a few sheathing scales, glabrous. Flowers in dense cylindrical cluster, reddish purple to red, bracteate; bracts leafy, lower longer and upper slightly shorter. Perianth with outer 2 and inner 3 converging segments; lip almost as long as broad, shallowly 3-lobed, mid lobe triangular, pointed and slightly longer; spur straight, cylindric, as long as the ovary. Stamens sessile, anthers adnate to the base of the column, cells diverging; pollinia 2, caudicles attached to 2 small, globose and viscid glands, overhanging the broad 2-lobed stigma. Ovary small.

Field notes : An orchid very rarely present in the fields as weed. It prefers meadows, shady and moist situations. The tubers are lobed, each lobe can regenerate into a fresh plant. The plants are very showy and insect pollinated.

Specimens examined : Kaul 55 (10-7-1969) Pampore Crocus fields; *Kaul* RRL 19759(25-7-1972) Barzulla orchards.

Fl. & Fr. : June-August.

Distribution : Europe, possibly introduced into Kashmir.

SPIRANTHES L.C. Richard

Spiranthes sinensis (Persoon)Ames Orch.2:53, 1908; Rao in BOBSI 2 : 415, 1960; Rathakrishanan in Indian Forester 98:31, 1972.

Neottia sinensis Persoon, Syn. Pl. 2: 511, 1807.

Spiranthes australis Lindley in Bot. Reg. 10: t. 823, 1824; FBI 6 : 102; Collett 495; Blatter 2 : 157.

Spiranthes lancea auct. non Backer, Brink & V. Steenis (1950); Stewart 73.

Annual herbs. Rootstock consisting of thick and fleshy root fibres. Stem up to 40 cm, erect, solitary or many arising from the base, slender but stout, leafy near the base, glabrous finely ribbed, narrowly grooved, sometimes fistular. Leaves linear or inversely lance-shaped, shortly sheathing, clustered near the base, alternate above, smooth, somewhat channelled, glabrous, margins entire. Flowers small, pink or slightly whitish, crowded in a spiral, slender, spike up to 8.5 cm long. bracts ovate, larger than the ovary. Sepals lance-shaped, the lateral ones spreading the upper one combined with the petals to form a 3-lobed hood enclosing the column, tips recurved. Lip oblong, adnate to the foot of the column, concave, having 2 small glands within, spur none. Column short, prolonged upwards in a flat, pointed process over-hanging the circular, green stigma, the anthers lying above it; pollinia 4, united in pairs, sessile on a single, minute, linear gland embedded in the viscid process. Capsule about 0.8 cm long, ridged and slightly pubescent.

Field notes : An occasional orchid found as a weed around rice fields, on floating islands and moist places. The roots are fibrous and run along the ground level. The spikes of the plants are typical in possessing a twist in the centre, the flowers are very small but showy.

Fl. & Fr. : August - September.

Specimens examined : *Kaul* 337 (13-8-1972) Shalteng rice field on margins in mud.

Geographical distribution : Afghanistan, Temperate and Sub-tropical Himalaya : Nepal to Bhutan; India, South-east Asia, Australia, New Zealand China, Korea, Japan, Mongolia and Siberia.

Illustration : Blatter pl. 56, fig. 5.

Chromosome report : 2n=20 (DCA 408).

IRIDACEAE

IRIS Linnaeus

Key to the species

1. Outer segments of the perianth bearded with multicellular hairs **germanica**
1. Outer segments of the perianth without a beard or crest, sometimes pubescent :
   2. Leaves linear, generally less than 1 cm broad; rhizomes compact **ensata**
   2. Leaves linear, generally much more than 1 cm broad, rhizomes never compact :
      3. Stem bearing 1-3 flowers below the terminal one, flowers generallygolden yellow **crocea**
      3. Stem bearing several lateral spicate heads below the terminal one, flowers blue, purple or even white **spuria**

Iris germanica L. Sp. Pl. 38, 1753; Bailey in Stand. Cycl. Horti. 2 : 1672, 1958; Stewart 63.

Rootstock tuberous, thick; perennial herbs. Stem up to 75 cm erect, glabrous, leafy with sheathing leaf bases covering the stem. Leaves up to 33 cm long, linear, tapering into an acute apex, veins running parallel, green with purplish margins and tips, glabrous and shining when fresh. Flowers purplish or liliac, generally 2 near the apex and one each on short and long lateral branches. Perianth 6 segmented in 2 whorls, outer segments bearded, veined and much showy. Stamens and the ovary resembling common *Iris*.

Field notes : The "graveyard iris" is cultivated for its horticultural importance. The plants escape as weeds and mostly reproduce vegetatively through rhizomes. It is a variable species and possibly has several hybrids in nature. It prefers to grow on mounds and raised areas including graveyards.

Fl. & Fr. : May-July.

Specimens examined : *Kaul* RRL 5576-5577 (12-7-1970) Sanat Nagar graveyards and roadsides.

Geographical distribution : Temperate parts of the world.

Chromosome report : 2n=44 (DCA 386).

Iris ensata Thunb. in Trans. Linn. Soc. 2: 328, 1794; FBI 6 : 272; Blatter 2 : 167; Bailey in Stand. Cycl. Hort. 2 : 1076, 1958; Rao in BOBSI 2 : 416, 1960; Stewart 63.

Perennial herbs with a compact, stout, tufted and creeping rootstock. Stem tufted, up to 50 cm high, slender. Leaves all radical up to 40 cm or more long and 1 cm broad, linear, ridged, greenish blue, veins running parallel. Spathes 1-3 flowered. Flowers bluish white or with purplish veins,

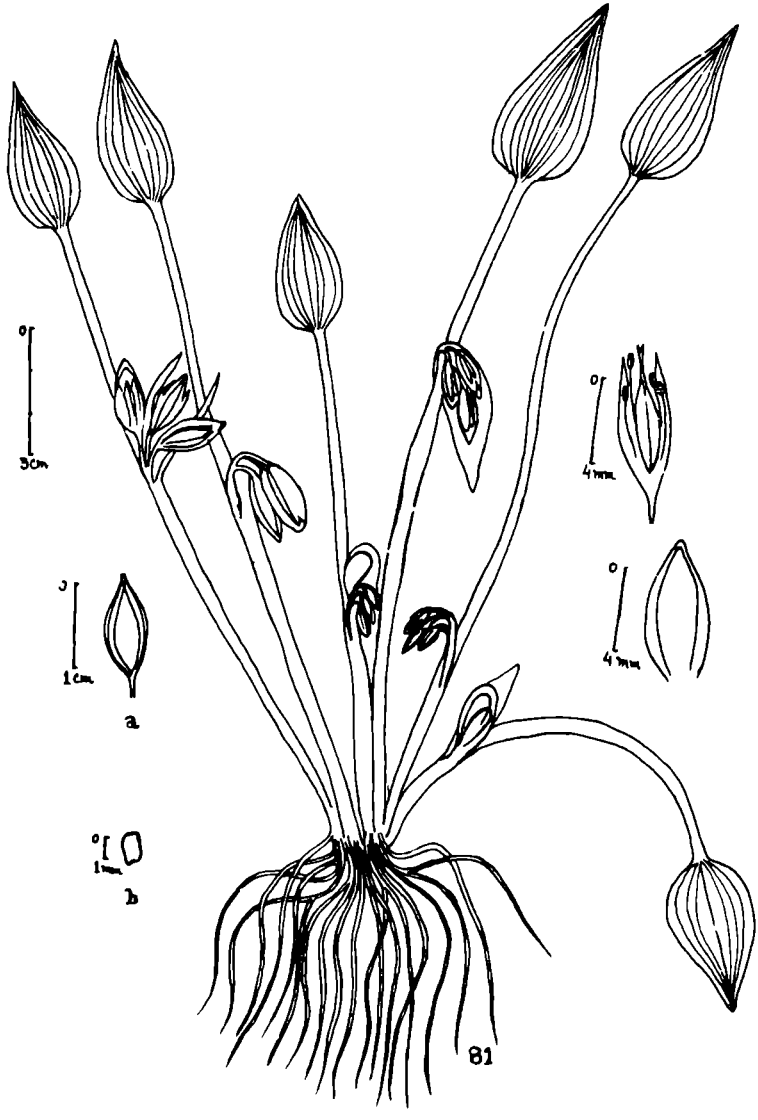


Fig. 81. *Monochoria vaginalis* (Linn.) Presl
a. a flower enclosed in bract, b a seed, c. a flower opened, d. a bract.

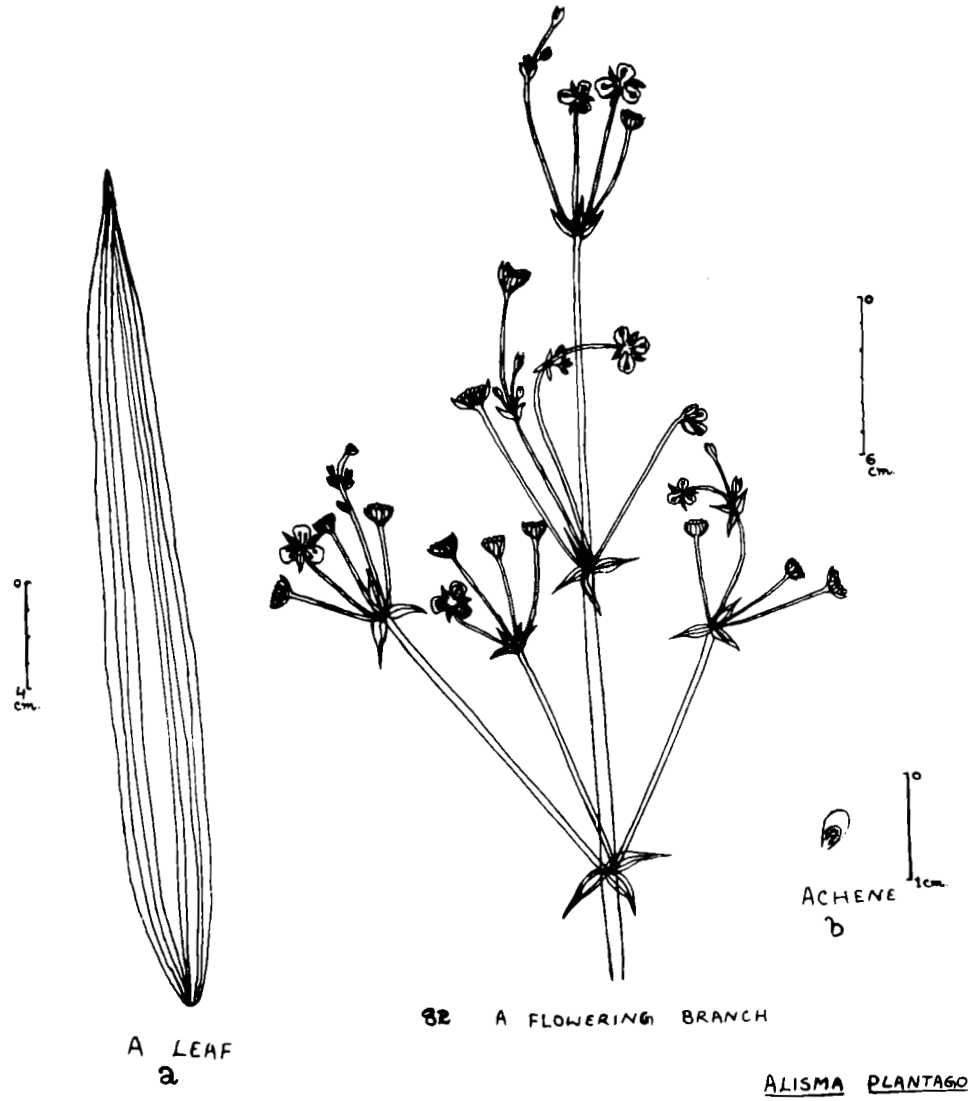


Fig. 82. *Alisma plantago-oquatica* Linn. (a flowering shoot)
a. a leaf, b. an achene

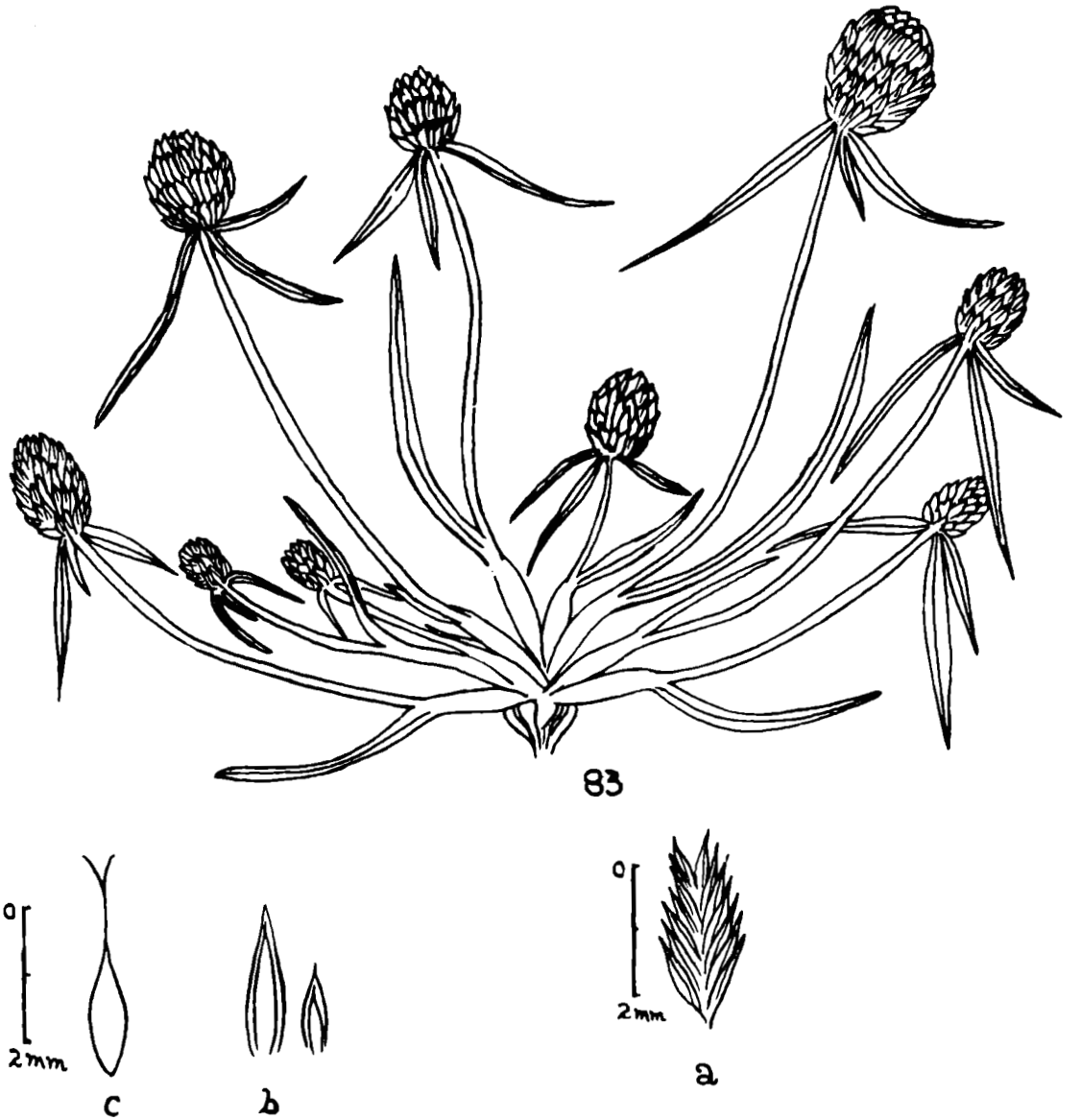


Fig. 83. *Cyperus michelianus* (Linn.) Link (a flowering shoot)
a. a spikelet, b. glumes, c. ovary with style.

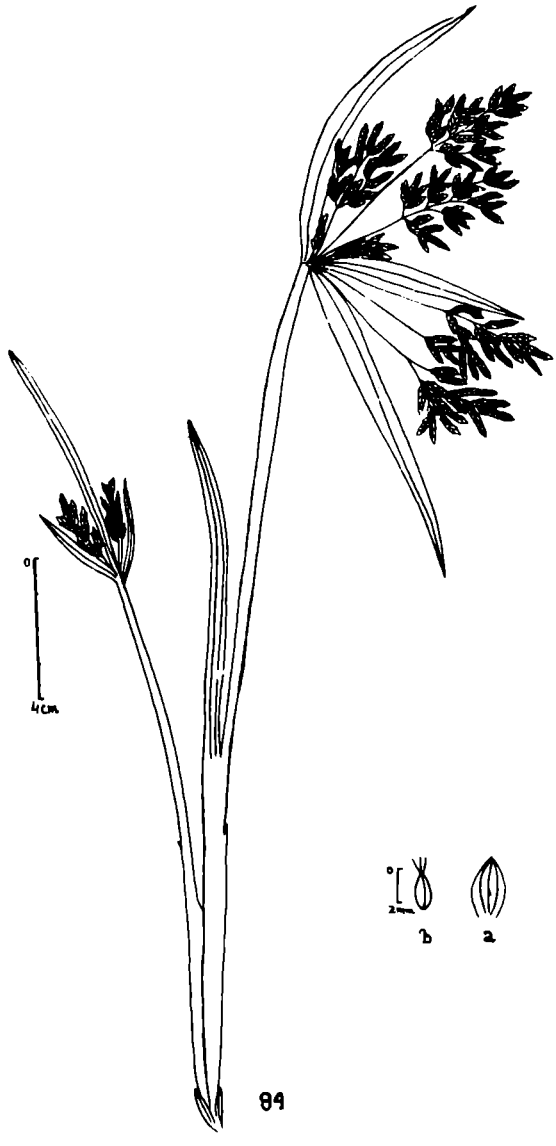


Fig. 84. *Cyperus iria* Linn.
a. glume, b. ovary with style.

stalked. Perianth 6-segmented, in 2 whorls, tube absent; outer longer than the inner ones, neither crested nor bearded, blunt, entire. Stamens 3, at the base of the outer perianth segments, filaments linear; anthers rod like, erect. Ovary 3-celled up to 2.5 cm long, style linear; arms 3, linear, tip sharply bifid. Capsule obovate, taperitg on both ends, up to 7 x 1.3 cm, 6-ribbed. Seeds long hard rounded resembling pea.

Field notes : A common weed of fields of Kashmir growing in dry as well as marshy places. It reproduces very fast both vegetatively as well as through seed. Sometimes it is even cultivated as its leaves are considered to have great fodder value for sheep. One can easily distinguish it by its compact habit forming large patches in all kinds of fields.

Fl. & Fr. : April - June.

Local name : Krishm

Geographical distribution : Temperate Asia, Western Himalaya and West Tibet.

Specimens examined : *Kaul* RRL 5591 (27-7-1970) Burzulla orchards. Common.

Iris crocea Jacq. ex R. C. Foster in Contrib. Gray Herb. 114: 41, 1936; Stewart 63.

Iris aurea Lindley in Bot. Reg. 33: t. 59, 1847; non Raf. & Link. 1827; FBI 6: 273; Blatter 2: 168; Rao in BOBSI 2: 416, 1960.

Perennial herbs Rootstock stout and prostrate, Stem up to 85 cm tall, fistular, glabrous, leafy below covered with sheathing leaf bases. Leaves up to 25 cm x 3 cm sword shaped, nerves running parallel, convergent towards the apex, glabrous, margins entire. Flowers yellow, carried on long stalks, 1-3 towards the apex. Perianth 6, in two whorls, outer segments oblong, broad and tapering into a claw, inner segments somewhat smaller with shorter claw, net veined, veins yellow or liliac. Ovary as long, as the perianth tube, style arms up to 3.5 cm long, crested. Capsule oblong, 6-angled, beaked. Seeds rounded or sub-globose, hard, brownish.

Field notes : An occasional weed but gregarious in habit forming colonies wherever present. The weeds reproduce both sexually as well as asexually. The beautiful golden yellow flowers have lent some horticultural importance and brought it into cultivation. It is found mostly on graveyards,

Fl. & Fr. : May - July.

Specimens examined : *Kaul* RRL 5587 (27-7-1970) Barzulla graveyard.

Geographical distribution : Western Himalaya.

Chromosome report : 2n=40 (DCA 385).

Iris spuria L. Sp. Pl. 39, 1753; FBI 6 : 272; Blatter 2: 167; Bailey in Stand. Cycl. Hort. 2: 1678, 1958; Rao in BOBSI 2: 116, 1960; Stewart 65.

Similar to *I. crocea* Jacq. but differing from it in :

1 Stem up to 1 m tall.

2 Leaves up to 35.0 cm x 3.5 cm,

3 Flowers forming brancned, lateral, spicate heads in addition to terminal ones and are commonly bluish.

Field Notes : A rare *Iris* sp. probably introduced. It is seen growing at certain graveyards. The flowers are showy.

Fl. & Fr. : May - July.

Specimens examined : *Kaul* 35 (24-5-1969) Rawalpora graveyards

Geographical distribution : Kashmir, Eastwards to Russia.

Chromosome report : 2n=22 (DCA 386).

AMARYLLIDACEAE

1. Radical leaves forming a tuft, many, up to 2.2 cm broad
   2. Corola with a crown like projection or corona
   2. Corona without a corona **Sternbergia**
1. Radical leaves 4-6, very long, up to 0.5 cm broad **Ixiolirion**

STERNBERGIA Waldstein et Kitaibel

Sternbergia fisheriana Rupr. in Regel, Gartenflorn 100, t. 576, 1868; Stewart 61.

Perennial bulbous herbs. Leaves linear lanceolate, succulent, dark green, coming out after flowering is over. Flowers solitary with equal perianth segments, tube 2.0-3.5 cm long, golden yellow. No fruits are seen.

Field notes : It is common on the graveyards, roadsides, fallow fields and orchards where the soil is porous. The weed is one of the first plants to flower in the valley and has been seen to flower at the approach of winter and even December, if there is no snowfall. The flowers are very beautiful and have horticultural value though not feen in cultivation.

Specimens examined : *Kaul* 262 (1-6-1971) Barzulla orchards.

Geographical distribution : Balkan Mountains, Europe and also introduced into temperate regions of the world.

Chromosome report : 2n=22 (Kaul and Khan, 1971).

IXIOLIRION Herbert

Ixiolirion montanum (Labill.) Herb. App 37, 1821; Blatter 2:169; Stewart 61.

Amaryllis montana Labill. Ic. Pl. Syr. Dec. 2:5, 1791.

This species has been reported as a weed from Srinagar by Blatter 1929. I have not been able to collect it.

LILIACEAE

Key to the genera

1. Rootstock creeping or many branched, often tuberous or fleshy
   2. Pseudoleaves tufted to form cladodes **Asparagus**
   2. Leaves simple never tufted at a node **Polygonatum**
1. Rootstock bulbous
   3. Flowers umbellate or capitate, at first enclosed in a spathaceous involucre **Allium**
   3. Flowers sub umbellate or in racemes or spikes
      4. Flowers large up to 5.5 cm diam.
         5. Flowers solitary or few, erect or sub-erect **Tulipa**
         5. Flowers many in sub-umbellate racemes. **Ornithogalum**
      4. Flowers small up to 2.5 cm diam.
         6. Flowers urn-shaped, in bunches, blue **Muscari**
         6. Flowers never urn-shaped, sub-umbellate, yellow or green **Gagea**
   3. Flowers solitary terminal, stalk surrounded by leaf sheaths **Colchicum**

ASPARAGUS Linnaeus

Asparagus officinalis L. Sp. Pl. 313, 1753; Kitamura 69; Rao in BOBSI 2 : 416, 1960; Polunin 502; Stewart 49.

Perennial herbs. Stem erect up to 125 cm long, much branched above and with numerous needle-like branchlets in clusters of 3-8, giving the plant a feathery appearance, solid, glabrous, slightly swollen at the nodes. Leaves absent, scales whitish and membranous on the main stem at joints and slightly swollen nodes falling off at maturity. Flowers green or creamy, axillary, solitary or paired, on slender filaments arising from near the base of the perianth tube. Berry globular, green when unripe. Seeds semispherical, 2-6 in a berry, hard, brown to black.

Field notes : An occasional weed having somewhat tuberous roots occurring in orchards, vegetable and fallow fields. It prefers to grow in well aerated but drier situations. Locally the fresh roots are used as a vegetable and for making jams.

Local name : Paragloss.

Fl. & Fr. : July - September.

Specimens examined : *Gammie* s.n. (9-7-1891) Srinagar, 5300 ft. *Kaul* 5581 (25-7-1970) Barzulla orchards Srinagar.

Geographical distribution : Europe, N. Africa, Caucasus, West Siberia.

Chromosome report : 2n=20 (DCA 359).

POLYGONATUM Adanson

Polygonatum verticillatum Allioni Fl. Pedem. 1: 131, 1785; FBI 6 : 321; Stewart 57.

Perennial herbs with a creeping rootstock. Many stems arise directly from the root stock, branched or unbranched, terete, glabrous. Leaves oblong, up to 9.5 x 4.0 cm, sessile to sub-sessile, margins entire, apex acute, surface smooth and glaucous, veins running parallel converging at both the ends, generally alternate. Flowers 1-5, on slender axillary peduncles, greenish or creamy, veined, veins slightly pubescent. Stamens 6, filaments very short, anthers small, somewhat globular. Berry blue-black, sub-globose containing 2-6 somewhat rounded black coloured seeds.

Field notes : It is a weed usually found in forests but occasionally invading fields. It has been seen in maize fields where the soil is somewhat moist and stony. The rootstock is thick and runs to long distances producing abundant fibrous roots which bind the soil.

Fl. & Fr. : June - July.

Specimens examined : *Keshavanand* 2865O (22-5-1908) Khuihama ; *Sarin* 6489 (23-6-1960 Tangmarg maize fields.

Geographical distribution : Europe, North Asia, Japan, Western Himalaya : Kashmir to Kumaon.

Chromosome report : 2n=18 (DCA 367).

ALLIUM Linnaeus

Key to the species

1. Leaves flat; stamens as long or longer than the perianth
   2. Bulbs solitary or clustered upon an erect or creeping rootstock; stamens longer than the perianth lobes **thomsoni**
   2. Bulbs not seated upon a rootstock; stamens generally as long as the perianth lobes **robustum**
1. Leaves linear; stamens generally shorter than the perianth tube **griffithianum**

Allium thomsoni Baker in J. Bot. 12: 294, 1874; FBI 6: 340; Blatter 2 : 176; Stewart 46.

Perennial bulbous herbs; bulbs tufted, narrowly egg-shaped, outer scales hard and brown. Stem up to 75 cm, somewhat erect, glabrous,covered by sheathing leaf bases,thick and fistular. Leaves 4-5, linear up to 7.5 cm x 1·1 cm excluding the sheath which is with membranous margins, alternate, flat fleshy and blunt, glabrous. Flowers in large rounded heads, heads up to 3.5 cm diam, enclosed at first in short deltoid membranous apathes; scapes fistular. Flowers red to purple, stalks as long or shorter than the perianth, showy. Perianth segments oblong lanceolate, up to 0.7 cm long, sharp pointed, veined. Stamens as many as perianth lobes; filaments extruding out of the campanulate perianth tube, anthers reddish, small, globular. Ovary globose, 3-celled. style much protruding, stigma 3-lobed. Seeds 2-6, minute and black.

Germination : The seedlings are seen in spring (March-April).

Fl. & Fr. : July - August.

Dissemination : The weeds propagate vegetatively as well as by seed. The seeds are mostly disseminated by man and wind. The forest soil or humus containing the seeds is carried to cultivated fields as manure.

Habitat : A common weed of fields of higher altitudes seen growing along the roadsides of Srinagar rather rarely. Indicator of organic matter in soils.

Root system : A cluster of bulblets on an old bulb, and adventitious roots in clusters from the bases of the bulbs.

Specimens examined : Kapoor 661 (20-7-1946) Kamri village, along roadsides.

Chromosome report : 2n=32 (Kaul and Gohil 1973).

Allium robustum Kar. et Kir. in Bull. Soc. Nat. Mosc. 14: 853, 1841; Vvedensky in Fl. URSS 4: 265, 1934; Kitamura 67: Stewart 45.

Allium atropurpureum sensu Boiss. Fl. Orient. 5: 757, 1857, p.p.; FBI 6 : 344; Blatter 2: 172.

Perennial herbs, bulbous, bulb rounded or ovate, covered all over with brown scales. Stem up to 55 cm, fistular, glabrous, dull green, covered with sheathing leaf bases, sheaths sometimes slightly hairy. Flowers in hemispherical heads up to 5 cm diam., dense flowered, carried on long fistular scapes; spathes 2-4, membranous, covering the flower heads when young. Each flower rosy or purplish, stalk much langer than the stellate flowers. Perianth segments 6, oblong, linear up to 1.2 cm long, veined. Stamens nearly as long as the perianth of segments, filaments awl-shaped, anthers minute. Ovary almost globose, Capsule many-seeded, seeds small, somewhat rounded.

Field notes : The weed propagates both vegetatively as well as by seeds as the preceding species. The bulbs sprout as the snow melts from the surface of the soil in early spring or March.

Fl. & Fr. : June - July.

Dissemination : The bulbs regenerate in the soils and are carried from on place to another through ploughing and the seeds are disseminated by wind.

Habitat : A common weed of muddy house tops, vegetable fields, and some

orchards preferring moist situations. Indicator of clay loams.

Root system : The adventitious roots arise from the bases of the bulbs and go up to 15 cm deep in soil.

Geographical distribution : Central Asia, Afghanistan, Kashmir.

Specimens examined : *Kaul* 208 (1-6-1970) RRL Srinagar; *Kaul* 252 a (1-6-1971) Rainawari muddy house tops.

Chromosome report : 2n=16 (Kaul and Gohil 1973).

Allium griffithianum Boiss. Diagn. Ser. 2, 4: 117, 1859; Kitamura in Fl. Afghanistan 65, 1960; Stewart 43.

Allium rubellum M. Bieb. var. *grandiflorum* Boiss. Fl. Orient. 5: 253, 1867; FBI 6: 339; Collett 525; Blatter 2: 175.

Perennial herbs with small bulbs, outer coating striate and inner membranous with a fresh bulblet just above it. Stem ascending, up to 45 cm, weak, glabrous. Leaves nearly as long as the scapes, linear, filiform or sometimes flattish, sheaths elongate, margins erose, glabrous. Flower heads hemispherical, up to 3.5 cm diam, carried on long slender unbranched scapes, spathese entire or 2-4 fid. Perianth lobes obovate up to 1.3 cm long, purplish with a distinct dark median streak, veined. Stamens arising from the base of the perianth lobes filaments short, sometimes even shorter than the erect whitish anthers. Ovary small, globose with a short style. Capsule sub-globose, glabrous, 3-celled, each cell with 1 or generally 2 rounded seeds.

Germination : The seedlings are seen in early spring (February-March).

Fl. & Fr. : April - June.

Dissemination : Vegetatively through bulbs.

Habitat : An occasional weed of orchards and wheat fields preferring moist situations. Indicator of sandy loams.

Root system : A cluster of small elongated bulbs bearing bunches of adventitious roots on basal discs.

Geographical distribution : Kashmir, Westwards to Iran, Afghanistan.

Specimens examined : *Kaul* RRL 16054 (12-6-1971) Rawalpora orchards.

Chromosome report : 2n=16, 24, 32 (Kaul & Gohil 1973).

TULIPA Linnaeus

Key to the species

1. Flowers up to 7 cm across, perianth scarlet, base purplish black with yellow margins **lanata**
1. Flowers up to 5.5 cm across, perianth white within, base yellow and greenish without **stellata**

Tulipa lanata Regel in Act. Hort. Petrop. 6 507, 1879; Stewart 58.

Tulipa praecox Tenore Fl. Nep. 1: 170, 1881; Blatter 2: 178.

Perennial herbs with bulb covered by brownish covering. Stem up to 50 cm long, erect, light green, glabrous and glaucous, fistular. Leaves 3-5, lance-shaped, acute with wavy margins, broad in the middle, alternate and glabrous. Perianth 6-segmented in two whorls, companulate; each segment up to 6 cm x 4 cm, oblong, basal blotch oblong or lance-shaped, purplish black with yellow margin, finely hairy at the tip. Stamens 6, filaments long, purple, hairless; anthers

elongated yellow. Ovary prismatic or triangular, style absent, stigma hairy and reddish. Capsule many-seeded.

Germination : The bulbs sprout as soon as the snow melts from the soil surface i. e. spring (Feb.-March).

Fl. & Fr. : March - May.

Dissemination : Vegetatively through bulbs.

Habitat : A rare weed of orchards, wheat fields and saffron fields. Indicator of clayey loams.

Root system : A somewhat spherical or pear-shaped bulb with long adventitious roots going up to 35 cm deep in the soil.

Geographical distribution : Italy, South France, Greece, Algeria, Syria, Israel and Iran.

Specimens examined : *Kaul* 261 a (12-4-19-71) Paempore Crocus fields.

Remarks : Blatter (1929) reports it to be very common weed but it seems to have been replaced by another species *T. stellata* closely related to it. It can be easily distinguished by its broader leaves and large purplish to scarlet red flowers.

Tulipa stellata Hook. f. Bot. Mag. t. 2762, 1827; FBI 6: 355; Collett 528; Blatter 2: 178; Rao in BOBSI 2: 416, 1950; Stewart 59. **(Fig. 78)**

Perennial bulbous herbs. Stem suberect to erect, up to 45 cm, glabrous, fistular, unbranched. Leaves 4-6, linear, up to 23.5 cm long channelled and sheathing towards the base, alternate towards the lower part, spreading along the ground, glabrous, milky green, smooth. Flowers on long scapes, usually only one. Perianth segments 6, oblanceolate, distinct, spreading when fully extended, white tinged with red, the bases yellow inside. Stamens 6, filaments small than the perianth segments, anthers oblong; basifixed· Ovary oblong 3-celled, style short, stigma 3-lobed; ovules many in each cell. Capsule 2.5 cm long; seeds numerous, small, flat.

Field notes : A very common weed of orchards, meadowlands, wheat fields, vegetable fields occurring also on muddy walls or house-top. It prefers moist situations. It mostly regenerates by vegetative means. In fields it forms large mats, generally only a single radical leaf comes out of the ground. It flowers once in two years.

Fl. & Fr. : April·May.

Geographical distribution : W. Himalaya; Kashmir-Kumaon; Afghanistan.

Specimen examined : *Kaul* 151 (12-4-1970) wheat filds near Air field.

ORNITHOGALUM Linnaeus

Ornithogalum umbellatum L. Sp. Pl. 306, 1753; Bailey in Stand, Cycl. Hort. 2: 2408. 1958; Polunin 500. **(Fig. 79)**

Bulbs tufted, membranous, subglobose up to 5 cm diam, bearing numerous bulblets. Leaves linear, narrow, 10-25 cm long, succulent, deeply channelled, 3-6, all radical, entire, glabrous. Scapes 10-20 cm. long, quadrangular in outline, succulent. Flowers large, white and stellate. Perianth segments obovate or elliptic up to 2 5 cm long, spreading in sunlight and nearly closing in dark. Capsule elongated, with 6-stigmatic rays. Seeds numerous, crowded inside the capsule.

Germination : The bulbs sprout in early spring (Feb.-March).

Fl. & Fr. : April-May.

Dissemination : Vegetatively through bulbs.

Habitat : A weed of orchards preferring moist situations. Indicator of well fertile humic soils.

Root system : The bulblets are produced out of old bulbs and adventitious roots arise from the basal discs.

Geographical distribution : Europe.

Specimens examined : *Kaul* 178 (10-5-1970) Rawalpora orchards; *Kaul* RRL 16052 (12-6-1971) Rawalpora fallow fields.

Chromosome report : 2 n = 18 (DCA 351).

MUSCARI P. Miller

Muscari botryoides Mill. Gard. Dict. ed. 8, 1768; Bailey in Stand. Cycl. Hort. 2: 2080, t. 2405, 1958; Polunin 502.

Perennial bulbous and colonial herbs. Stem up to 30 cm erect, glabrous, succulent, leafless. Radical leaves narrowly lanceolate, 5.0 - 15 x 2.0 - 5.0 cm, succulent, many arising from the base. Flowers in apical somewhat compact racemes hanging like bunch of grapes succulent, blue and scentless. Perianth urn-shaped, 6-segmented, segments small up to 5 mm long. Flowers towards the apices are sterile and basal ones are fertile. Stamens 6, having small epiphyllous white anthers. Ovary 3-celled with a linear filiform style as long as the ovary and a 3-lobed stigma. Capsule globular, glabrous with many seeds. Seeds rounded, up to 0.5 mm diam. black and glaucous.

Field notes : A rare weed, probably an escape from cultivation. It has been seen to invade some orchards, the bulbs form small bulblets and regenerate giving rise to new plants. The weeds produce small showy flowers and are of horticultural importance. It prefers moist conditions.

Fl. & Fr. : Mid March-Mid May.

Specimens examined : *Kaul* 144(3-4-1970) Rawalpora orchards.

Geographical distribution : Europe, introduced into Kashmir and other temperate regions of the world.

Chromosome report : 2n = 36, 48, 63 (DCA 354).

GAGEA R.A. Salisbury

Key to the species

1. Inflorescence subumbellate, leaves radical and cauline, broader in the middle and tapering towards the apices **elegans**
1. Inflorescence cymose, leaves radical and cauline, generally filiform.
   2. Radical leaf solitary and glabrous **dschungarica**
   2. Radical leaves 2, margins white and ciliate **kashmirensis**

Gagea elegans Wallich ex Royle Illus. Bot. Himal. 387, t. 95, f. 2, 1839; Stewart 53.

Gagea lutea auct. non Schultz. f. (1822); FBI 6 : 355; Collett 529; Blatter 2 : 170; Rao in BOBSI 2:416, 1960.

Perennial herbs with a small bulb. Stem erect up to 15.5 cm long, slender, unbranched and glabrous. Radical leaf solitary, linear lance-shaped, broader in the middle and tapering towards the apex, generally longer than the stem or shorter, glabrous, margins

entire. Inflorescence subumbellate to umbellate. Flowers yellow, bracteate; bracts 2, leafy, broader at the base and tapering towards the apex, unequal, nearly opposite, glabrous; pedicels up to 6.5 cm long, slender. Perianth 6-segmented, linear oblong, blunt or sharp-pointed, up to 1.5 cm long, stellate. Stamens 6, filaments starting from the base of the perianth lobes, shorter, anthers oblong basifixed. Ovary 3-angular, 3-celled, up to 0.5 cm long, style straight. Capsule broader than long, 3-grooved, Seeds many flat, greyish, glaucous and hard.

Germination : The bulbs as well as seeds sprout in early spring (February-March.

Fl. & Fr. : March-May.

Dissemination : The seeds are disseminated by wlnd and man.

Habitat : A common weed of wheat fields, orchards, forest floors and some fallow places preferring moist and shady situations. Indicator of fertile sandy or clayey loams.

Root system : The bulbs are small and somewhat spherical perennating during the unfavourable season.

Geographical distribution : Western Himalaya : Kashmir to Kumaon, Europe and North Asia.

Specimens examined : *Dabadghao* 368 (5-5-1956) Kashmir (DD) ; *Thapliyal* 26447 (5-6-1958) Kashmir (DD); *Kaul* 128 (28-3-1970) Rawalpora orchards; *Kaul* RRL 16037 (June. 1971) Barzulla wheat fields.

Chromosome report : 2n=72, 96, 132 (Kaul & Gohil 1973).

Gagea dschungarica Regel, Acta Hort. Petrop. 6 : 513, 1879; Stewart 53.

Gagea persica auct. non Boiss. (1869) : FBI 6: 355; Collett 529; Blatter 2:171;Rao in BOBSI 2 : 416, 1960. **(Fig. 80)**

Perennial herbs with small bulbs. Stem erect up to 17.5 cm long, light green or membranous towards the base, glabrous and cylindrical Radical leaf solitary up to 15 cm long, linear lanceolate or filiform, green and glabrous. Flowers in elongated cymes, many, bracteate; bracts linear, short, each bearing a flower in its axil; pedicel longer than the bract. slender and glabrous. Perianth 6-segmented, linear up to 1.5 cm, blunt, white or greenish outside. Stamens as many as perianth lobes, filaments nearly as long, anthers small and basifixed. Capsule enclosed in persistent perianth, angled, glabrous. Seeds compressed, many, rounded or slightly angular.

Field notes : A common weed of orchards, wheat fields, fallow fields and also vegetable fields. The bulbs are small and regenerate freely. It prefers to grow in open situations.

Fl. & Fr. : May-July.

Specimens examined : *Kaul* RRL 5955 (April, 1969) Barzulla fallow fields; *Kaul* 118 (17-3-1970) Barzulla, fallow fields.

Geogrophical distribution : Iran and Turkestan.

Chromosome report : 2n=48, 60 (Kaul & Gohil 1973).

Gagea kashmirensis Turrill in Kew. Bull. 77, 1928; Blatter 2 : 171; Stewart 53.

Perennial small herbs with 2 small unequal bulbs, covered by brownish scales, rooting from the base. Stem up to 10 cm long, more or less covered with white hairs, slender and

unbranched. Leaves radical, 2, narrowly lanceolate, filiform, up to 9 cm long; cauline ones alternate, unequal, somewhat broader at the base and tapering towards the apex, margins more or less white ciliate, surfaces glabrous or sometimes pubescent. Inflorescence 3-6 flowered, stalks small; glabrous or pubescent; bracts linear. Perianth 6-segmented, segments narrowly elliptical or elliptic lanceolate, up to 1.0 x 0.3 cm, 5-7 nerved, outer ones sharp pointed and inner ones blunt, 3-4 nerved. Stamens smaller than the perianth lobes, anthers basifixed. Ovary inversely egg-shaped slightly pubescent, style up to 5 mm long. Capsule egg-shaped, or obovate, somewhat angled; seeds many, small and black.

Field notes : An occasional weed very distinct from other species in having a short size, two long and filiform radical leaves, and smaller yellow flowers. This plant prefers to grow in dry and gravelly soils unlike other two species. It is probably endemic in Kashmir.

Fl. & Fr. : February-Early March.

Specimens examined : *Kaul* RRL 5963 (10-4-1969) Fallow dry fields near Shankracharya.

Chromosome report : 2n=24 (Kaul & Gohil 1973).

COLCHICUM Linnaeus

Colchicum luteum Baker in Gard. Chron. 34, 1874; FBI 6 : 356; Blatter 2 : 168; Stewart 50.

Perennial herbs with an oblong-ovate corm. Leaves arising from the corm, linear lanceolate, up to 20 cm long, glabrous, linear lanceolate, the maximum size attained at the fruiting stage. Flowers yellow, stalk short amongst the leaf sheaths. Perianth 6-segmented, somewhat tubular, segments oblong, blunt, many nerved. Stamens 6, included in the tube. Ovary sessile, 3-celled, styles 3, longer than the perianth. Seeds light brown, rounded.

Germination : Late autumn i.e. November or early spring - February.

Fl. & Fr. : Spring, March - April.

Dissemination : Spreads fast vegetatively. Seeds get disseminated by water and hoofed cattle.

Habitat : An occasional weed of meadows and fallow areas preferring to grow on mounds.

Geographical distribution : Afghanistan, Turkestan, Temperate Himalaya, Chamba.

Specimens examined : *Kaul* RRL 5959 (8-4-1969) Dalgate, fallow fields, Srinagar.

Local name : Virkim Posh, Suranjan.

Remarks : This herb grows commonly on hills and is one of the first plants to flower in Kashmir. The corms contain Colchicine, a valuable alkaloid.

PONTEDERIACEAE

MONOCHORIA K.B. Presl

Monochoria vaginalis Presl. Rel Haenk. 1 : 128, 1830; Bentham in Fl. Hongk. 374, 1861; FBI 6 : 353; Rao in BOBSI 2 : 417, 1960; Stewart 38. **(Fig. 81)**

Pontederia vaginalis L. Mant. Pl. 228, 1767.

Annual herbs with a short but somewhat thick rootstock. Stem O. Leaves radical,

petiole 7.5 cm - 22 cm long or rarely longer, ovate or somewhat cordate, apex acute and fine, margins entire, nerves many running parallel, smooth ad light green, glabrate. Flowers generally drooping, subspicate, 3-5 in an inflorescence; bracts sheathing and covering the young flowers; pedicels up to 5 mm long, flattened. Perianth 6-segmented, segments oblong, margins membranous, glabrous, bluish with red spots, persistent. Stamens 6, epiphyllous, filaments slender and variable size, one longest generally shorter than the perianth; anthers oblong, small, white and basifixed. Ovary as long as the perianth, oblong, 3-celled, style up to 3.5 mm long, stigma somewhat capitate, ovules many in each cell. Capsule enclosed in the persistent perianth, generally 3-ridged and glabrous. Seeds brick red when mature, longer than broad, up to 1 mm diam. with a basal depression, testa hard.

Germination : Early June.

Fl. & Fr. : August-September.

Dissemination : Water is the main seed dispersing agent. Man also helps in the dispersal during crop harvesting as the capsule matures with the crop.

Habitat : An occasional weed of paddy fields, marshy lands and floating islands growing vegetables. It prefers well irrigated, fertile and well aerated soils.

Root system : The roots are slender, long and fibrous which go up to 20 cm deep in muddy and porous soils.

Geographical distribution : Throughout India : From Kashmir to Assam, Malayan islands, China, Japan and tropical Africa.

Specimen examined : *Kaul* 284 (5-8-1971) Shalimar paddy fields.

Local name : Aahi.

Remarks : A bad weed of paddy crop in certain areas.

Chromosome report : 2n=52 (DCA 372).

JUNCACEAE

JUNCUS Linnaeus

Key to the species

1. Stamens shorter than the perianth. Stem leafy, leaves cylindrical **articulatus**
1. Stamens longer than the perianth. Leaves channelled or flattened above; cyme a solitary sessile head **membranaceous**

Juncus articulatus L. Sp. Pl. 327, 1753; Stewart 38.

Juncus lampocarpus Ehrh. ex Davies in Trans. Linn. Soc. 10 : 13, 1810; FBI 6: 395; Collett 436; Rao in BOBSI 2 : 417, 1960.

Perennial marshy herbs with simple or creeping rootstock. Stem tufted, many arising from the base, erect or ascending, terete, unbranched, hollow and glabrous. Leaves mostly radical, linear, tubular, cylindrical, up to 21.5 cm long, glabrous, tapering into an acute apex. Flowers in cymes with strict divaricate branches up to 4.5 cm long, bearing small heads at the forks and tips; involucral bracts leafy, linear, mucronate; each flower head up to 6 mm diam, hemispheric. Perianth 6-segmented, outer ones slightly longer than the inner ones, up to 5 mm long, margins membranous. Stamens 6, anthers globular or generally elongated, equalling or shorter than the slender filaments. Ovary small, inside the persistent perianth lobes, styles 3, as long as

the ovary, spreading, purplish, feathery; 3-celled, ovules many in each cell. Capsule obovate, green when young, turning purplish or brown. Seeds many, small flattened, testa greyish.

Germination : The dormant seeds or the underground rootstock sprouts in early spring (Feb.-March).

Fl. & Fr. : May-July.

Dissemination : The seeds are disseminated by wind, water and man.

Habitat : A common weed of floating islands, margins of paddy fields and some marsh lands.

Root system : A thick hollow creeping rootstock running in surface horizon of the muddy soils.

Geographical distribution : North temperate regions of the world.

Specimens examined : *Kapoor* 399 (29-5-1969) Dal Lake floating islands; *Kaul* 198 (25-5-1970) Floating islands growing cucurbits in Dal Lake.

Chromosome report : n=40 (Bhat, Bakshi & Kaul 1974).

Juncus membranaceous Royle ex D. Don in Trans. Linn. Soc. 18 : 317; 1840; FBI 6 : 397; Rao in BOBSI 2 : 417, 1960; Stewart 39.

Perennial herbs with a stoloniferous rootstock. Stem tufted many arising from the base, up to 50 cm erect or ascending unbranched, slightly brownish near the base and covered by leaf sheaths, fistular and glabrous. Leaves linear, flattish, up to 15.5 cm long, tapering towards the apex, somewhat tubular or channelled, glabrous. Flowers small in cymes forming a hemispherical 8-24 flowered head. Involucral bracts leafy, ovate-lanceolate, hyaline and glabrous. Perianth 6-segmented in two series, outer somewhat longer than the inner, up to 0.7 cm long. Stamens 6, filaments slender protruding out of the persistent perianth, anthers linear about half as long as the filaments Ovary small included, style short, stigmas 3, feathery. Capsule obovate up to 3 mm long, 1-3 celled; seeds up to 1 mm long, elongated, black to brown.

Field notes : Occurs in marshy and moist places. The rootstock is somewhat trailing from which arise long slender bunches of adventitious roots anchoring the plants in the mud. The flowers are small and form cymose heads at the apices.

Fl. & Fr. : June-July.

Specimens examined : *Kapoor* 914 (27-7-1964) Tarshing, Kashmir floating islands; *Kaul* 191 (22-5-1970) Malroo near Shalteng, marshes.

Geographical distribution : Temperate and subalpine Himalaya from Kashmir to Sikkim.

SPARGANIACEAE

SPARGANIUM Linnaeus

Sparganium ramosum Huds. Fl. Angl. ed. 2, 401, 1778; FBI 6 : 490; Rao in BOBSI 2 : 417, 1960; Stewart 28.

Perennial herbs up to 1.5 m in height. Stem branched, leaf, fistular, thick towards the base surrounded by sheathing leaf bases, glabrous. Leaves up to 50 cm long, stiff up to 1.5 cm wide, triangular in cross section, keeled, parallel veined and glabrous. Infloresc-

ence of many globular, greenish or yellowish clusters. Flowers unisexual and monoecious. Male flowers in yellow globular clusters, numerous towards the lateral and terminal branches; Stamens 3, filaments small, anthers globular and yellowish. Female flower clusters fewer and much larger, up to 2 cm diam., lower ones stalked and upper ones stalkless in the axiis of long leafy bracts. Perianth segments black-tipped; ovary somewhat angled, style and stigma linear. Fruit abruptly narrowed above; seeds longitudinally ribbed, black to brown.

Germination : The seedling can be seen in spring (March), in moist places.

Fl. & Fr. : May-July.

Dissemination : The seeds are disseminated mainly by water.

Habitat : An occasional weed of shallow irrigation drains, paddy fields, marshy floating islands and shallow ponds. Indicator of marshes.

Root system : A creeping underground rhizome with bunches of long adventitious roots arising from the nodes and anchoring the plants in mud.

Geographical distribution : Europe, North temperate regions and Burma.

Specimens examined : *Kaul* 194 (22-5-1970) Shalteng rice fields.

Associations recorded : The weed has been generally seen associated with *Typha latifolia*, *T. angustata* and *Butomus umbellatus*.

Illustration : Polunin pl. 184.

Chromosome report : 2n=30 (Bhat, Bakshi & Kaul 1974).

TYPHACEAE

TYPHA Linnaeus

Key to the species

1. Flowers unisexual, male and female spikes generally contiguous **latifolia**
1. Flowers unisexual, male and female spikes generally interrupted by a naked portion **angustata**

Typha latifolia L. Sp Pl. 971, 1753; Saha in Bull. Bot. Soc. Bengal 22(1) : 12, 1969; Polunin 559.

Perennial herbs with a long, thick and creeping rhizome. Stem up to 2.5 m tall, generally unbranched, hollow, all over covered with membranous sheathing leaf bases, smooth. Leaves as long or longer than the stem, flat, light green, parallel veined, 1-2 cm broad. Male and female spikes contiguous. Male spike generally towards the apex, narrower than the female spikes, yellowish; each flower consisting of a hair like creamy bract and 2-3 stamens, anthers elongated and yellow; at maturity all flowers fall off and leaves a slender and naked terminal axis. Female spikes generally as long or longer than the male spike but much broader, brown at maturity; each flower is naked constituting a naked ovary and long brownish style; bracts and bracteoles are absent. At maturity the female spikes burst, disseminating enormous quantity of woolly seeds which are light and easily carried by wind.

Field notes : A common plant of shallow waters, marshes and lakes. It has been seen to invade paddy fields at certain places. When the plants grow in marshes these are shorter and the rhizomes creep along consi-

derable distances binding the soil. The weed is not of much importance so far as paddy cultivation is concerned, for it grows along the marshy margins of such fields. The plants are locally used by the local people a) in weaving mats b) flowering spikes are cut when the plants reach maturity and the woolly substance obtained is used in mud plasters and filling pillows.

Local name : Pechi gassa.

Geographical distribution : Throughout Europe.

Specimens examined : Kaul RRL 912 (1-8-1969) Shalteng paddy fields.

Chromosome report : 2n=30 (DCA 377)

Typha angustata Bory & Chaub. Exped. Sci. Mores 2, 1 : 338, 1832 : Rao in BOBSI 2 (3 & 4) : 417, 1960; Subramanyam, Aquatic Angios. 74, 1961; Saha in Bull. Bot. Soc. Bengal 22(1) : 13, 1968; Stewart 28.

The plants are similar to *T. latifolia* L., but for following characters : a) Leaves shorter and narrower up to 1.2 cm broad, convex beneath. b) Male and female spikes separated by a naked section of stem up to 6 cm long. c) Female spikes with subspathulate bracts and long hairs.

Field notes : This plant is found under similar habitat conditions and also associated with *T. latifolia* L. and *Sparganium ramosum* Huds. It is not as common as the preceding species.

Geographical distribution : Throughout Europe and other temperate parts of the world.

Specimen examined : *Kaul* RRL 913 (16-8-1969) Dal Lake floating islands.

Chromosome report : 2n=30 (DCA 377).

ARACEAE

ACORUS Linnaeus

Acorus calamus L. Sp. Pl. 324, 1753; FBI 6 : 555; Collett 544; Polunin 555; Stewart 34.

Perennial aromatic herbe with creeping rhizomes. Stem up to 40 cm, erect, leafy all over, glabrous and fistular. Leaves mostly radical, tufted up to 60 cm x 2.5 cm, flat generally tapering into an acute apex, parallel veined and glabrous. Spathe leaf like, not enclosing the spadix completely. Spadix up to 7.5 cm on flat leaf like stem, cylindrical, tapering with numerous yellowish, bisexual flowers. Perianth segments 6, free but persistent Stamens 6, arising from the base of the segments. Ovary free, oblong, 3-celled, each cell with many ovules. Berries yellow green, 1-3 seeded. Seeds round black or brownish.

Fl. & Fr. : July-September

Geographical distribution : Temperate and warm regions of northern hemisphere.

Specimen examined : *Abrol* 1956 (15-7-1948) Shalteng marshes.

Local name : Vai Gunder.

Remarks : The reclamation of marshlands for the purpose of agriculture is gradually denuding the areas under this species. The plant is of considerable importance in local medicines. (Chopra 1956).

Illustration : Polunin pl. 183.

LEMNACEAE

Key to the genera

1. Root fibre single. Frond circular or hemispherical — Lemna
1. Root fibres several. Frond circular — Spirodela

LEMNA Linnaeus

Lemna minor L. Sp. Pl. 970. 1753; FBI 6 : 556; Collett 544; McCann in J. Bombay Nat. Hist. Soc. 43 : 153, 1942: Hartog & Plas in Blumea 18(2) : 362, 1970; Stewart 36.

Minute aquatic plants forming colonies, frond somewhat circular or hemispherical up to 5 mm diam. younger one attached to the old and detaching soon, green above and white membranous on undersurface. Root fibre single, sheath not appendaged, Spathe 2-lipped; stamens 2, each representing a male flower. Ovary small, style long, ovule one.

Field notes : A common and abundant weed of still waters and has been seen invading paddy fields. As soon as water dries, the plants are also seen to decay. The weed reproduces vegetatively and forms a dense cover over the surface of water not allowing any light to pass below. It is sieved out to avoid any danger to the crop. It is generally associated with water fern *Salvinia*.

Fl. & Fr. : Generally in August.

Specimens examined : *Kaul* 276 (4-8-1971) Rice fields near Hyderpora observatory.

Local name : Mongola.

Geographical distribution : A cosmopolitan weed.

Chromosome report : 2n=40 (DCA 377).

SPIRODELA Linnaeus

Spirodela polyrhiza (L.) Schleid in Linnaea 8 : 392, 1839; Stewart 36.

Lemna polyrhiza L. Sp. Pl. 970. 1753; FBI 6 : 557; Collett 544.

This species is similar in appearance to *Lemna minor* L. but differs from it in possessing several clustered roots, up to 3 cm long which arise from the lower surface of each frond. The fronds are somewhat longer and thicker, shining green above and purplish with faintly marked veins beneath.

This plant occurs in association with *L. minor* in rice fields.

ALISMATACEAE

Key to the genera

1. Flowers bisexual, stamens 6-9. receptacle flat **Alisma**

1. Flowers unisexual, stamens many, receptacle globose **Sagittaria**

ALISMA Linnaeus

Alisma plantago-aquatica L. Sp. Pl. 342, 1753; FBI 6 : 559; Kitamura 25; Polunin 478; Stewart 32. **(Fig. 82)**

A scapose biennial or perennial herb. Rootstock fibrous and swollen, Stem or scape branched from the base, swollen, 28-70 cm in height or rarely more. Leaves radical, ovate lanceolate, undivided, tapering towards the apex, 9.0 cm - 32.0 cm x 1.0 - 3.5 cm., 5-9 nerved, glabrous, generally spreading, sometimes erect, entire; petiole 2.5-6.0 cm long. Flowers small, bisexual, on long slender stalks in bracteate whorls, forming a large terminal panicle. Perianth 6-segmented, in 2 whorls, free; outer smaller and greenish persistent; inner larger, white or pinkish, claw yellowish. Stamens 6. Ovaries many, small, arranged in a ring on a small receptacle,stigmas small and terminal; ovule single. Fruit a ring of achenes, surrounded by outer persistent perianth segments.

Germination : The seeds are produced in large numbers and germinate in late spring (May) only when soil is fully moist.

Fl. & Fr. : July-September.

Dissemination : The seeds are disseminated by water.

Habitat : A common weed of paddy fields, floating islands and marshlands possessing a gregarious habit. Marsh or peat indicators.

Root system : Many long and thick adventitious roots arise from the thickened underground basal portion of the stem and bind the weeds tightly in soil.

Geographical distribution : Eurasia, N. America, Australia, Afghanistan, Europe and Temperate Himalaya.

Specimens examined : *Kaul* 242 (1-8-1970) Hyderpora paddy fields; *Kaul* RRL 19686 (3-10-1970) Nishat paddy fields.

Chromosome report : 2n=10, 14, 16, 28 (DCA 336).

SAGITTARIA Linnaeus

Sagittaria sagittifolia L. Sp. Pl. 993, 1753; FBI 6 : 561; Rao in BOBSI 2 : 417, 1960; Polunin 478; Stewart 32.

Perennial herbs with a thick creeping and tuberous rootstock. Leaves all radical, usually 3 forms are present on the same plant; submerged form of leaf is entire and transluscent; floating form is oval or ovate-lanceolate and the aerial forms are arrow-like and with sagittate bases; petiole is smallest in the first form and longest in emerged or aerial forms, looking hollow inside, veins running parallel, glabrous. Flowers unisexual on long scapes up to 60 cm in 3-5 whorls of 3-5 flowers each. Lower whorls constitute female flowers, sessile or subsessile. Upper whorls consist of male flowers with longer pedicels, bracts short and obtuse but persistent. Sepals 3. persistent. Petals 3, oblong, white and deciduous. Stamens 6, filaments linear compressed anthers basifixed and white. Carpels many on a globose receptacle. Fruit in globose or hemispherical heads. up to 1.5 cm diam., consisting of numerous obliquely obovate achenes; sides flattened with broad and entire wings.

Germination : Seedlings are seen in late spring, (April-May).

Fl. & Fr. : July-September.

Dissemination : The weeds reproduce efficiently through vegetative means. The thick creeping rhizomes produces corm like small dormant buds at the onset of unfavourable weather which perennate and produce new plants in the growing season, The weeds also spread through seeds.

Habitat : A common weed of paddy fields, floating islands, especially marshlands possessing a gregarious habit. Marsh indicators.

Root system : A creeping underground thick rhizome with bunches of adventitious roots arising from nodes.

Geographical distribution : Caucasus, Iran, Afghanistan, Central Asia, Japan and China.

Specimens examined : *Kaul* RRL 19671 (11-8-1970) Paddy fields of Chishma Shahi; RRL *Kaul* 16071 (29-7-1971) Shalimar paddy fields.

Chromosome report : 2n=20, 22 (DCA 336).

BUTOMACEAE

BUTOMUS Linnaeus

Butomus umbellatus L. Sp. Pl. 372, 1753; FBI 6 : 562; Rao in BOBSI 2 : 417, 1960; Polunin 479; Stewart 32.

Perennial herbs. Stem up to 80 cm, unbranched, fistular, leafless, up to 3 cm wide, terete and glabrous. Leaves linear, acute, triangular in cross section, sheathing at the base, up to 75 cm long. Flowers up to 3 cm across, usually in an umbel; involucral bracts generally 3, ovate lanceolate, persistent; pedicels up to 11.5 cm long, slender, glabrous, unequal. Perianth 6-segmented, pink with dark veins on outside, falling off at maturity. Stamens 6-9, filaments filiform, anthers linear pinkish. Carpels generally 6, rarely 9 with erect and persistent styles. Fruit forming a bunch of 6-9 shrivelled achenes.

Germination : Late spring (April-May).

Fl. & Fr. : July-September.

Dissemination : Mainly by water and to some extent by wind. Seeds are mostly non-viable.

Habitat : An occasional weed of paddy fields, shallow water ponds and marshes. Peat or marsh indicator.

Root system : Bunches of adventitious roots arise from the base of the stem and go up to 15 cm deep in the mud.

Geographical distribution : Europe, Caucasus, Turkey, Central Asia, Iran, Afghanistan, North China and Kashmir.

Specimens examined : *Kaul* 243 (1-8-1970) Badgam paddy fields; *Kaul* RRL 19678 (28-8-1970) Boniyar marshy places.

Illustration : Polunin pl. 161.

Chromosome report : 2n=26 (DCA 335).

ERIOCAULACEAE

ERIOCAULON Linnaeus

Eriocaulon sieboldianum Sieb. & Zucc. ex Steud. Syn. Pl, Cyp. 272, 1855; FBI 6 : 577, 1894; Collett 550; Fyson in J. Indian Bot. Soc. 3 : 15, 1922; Rao in BOBSI 2 (3 & 4) : 418, 1960; Stewart 36.

Annual scapigerous herbs with a creeping and fibrous rootstock Stem absent. Leaves chiefly radical, diverging from a common point, linear lanceolate up to 6.5 cm long, opaque or transluscent, 3-5 nerved or some times uninerved, hollow within, tapering into a fine tip, glabrous. Scapes many, slender, longer than the leaves, glabrous, terminating into a small globose head of minute flowers. The flower heads are unisexual, up to 2.5 mm diam., outermost generally female and central ones are male. Involucral bracts oblong, obtuse with a reddish margin, floral bracts oblong lanceolate and glabrous. Male flowers with 1-3 sepals and generally one stamen, filament as long or shorter than the bract, anthers elongated, versatile. Female flowers with 1-2 or no sepals, petals 1-3. Ovary on a small stalk with a style branched into 2 near the middle, staminodes 2 or even absent. Seeds 1-3 in a capsule, red brown, small, numerous in the head.

Germination : The seeds are very small and produced in large numbers germinating under water in spring (April-May).

Fl. & Fr. : July-August.

Dissemination : The seeds are disseminated by water, wind and also contaminate the crop seeds.

Habitat : A common weed of paddy fields. Indicator of fertile muddy soils.

Root system : Bunches of slender adventitious roots arise from the base of the scapes and go up to 10 cm deep in the soil.

Geographical distribution : China, Japan, Philippines, India : from Kashmir to Assam, and Burma.

Specimens examined : *Kaul* 237 (21-7-1970) Harwan paddy fields; *Kaul* 260 (1-4-1971) Majid Bagh, fields left for paddy cultivation.

Illustration : Collett, fig. 180.

CYPERACEAE

Key to the genera

1. Spikelets of few or many glumes; lower 1-2 glumes always empty; uppermost male, empty or imperfect, intermediate ones bisexual :
   2. Flowering glumes usually many, all distichous, no hypogynous bristles — **Cyperus**
   2. Flowering glumes usually many in a spiral, hypogynous bristles or scale often present
      3. Style bases persistent or completely deciduous, no hypogynous bristles, leafy plants — **Fimbristylis**
      3. Style bases not articulate, passing into nut gradually, hypogynous bristles 0-6, undivided, linear, rarely oblong — **Scirpus**
      3. Style-bases somewhat swollen, hypogynous bristles 6-9, undivided — **Eleocharis**
1. Spikelets of male or female flowers, or both; nuts enclosed in utricle — **Carex**

CYPERUS Linnaeus

Key to the species

1. Style trifid, nuts smooth and somewhat angular :
   2. Annual herbs; stem slender; spikes linear much branched — **iria**
   2. Perennial herbs; stem somewhat robust; spikes linear and long :
      3. Rootstock somewhat stoloniferous or creeping — **rotundus**
      3. Rootstock thick and woody, never creeping — **eleusinoides**
1. Style bifid, nuts dorsally compressed — **michelianus**
   4. Stem decumbent, leafy all over, stamens generally 3 — **sanguinolentus**
   4. Stem erect, leafy only at the base, stamens usually one — **nitens**

Cyperus iria L. Sp. Pl. 45, 1753; FBI 6 : 606; Collett 556; Rao in BOBSI 2 : 418, 1960; Kern in Reinwardtia 6 : 55, 1961; Stewart 90. **(Fig. 84)**

Annual herbs with much branched root system. Stem somewhat tufted at the base, up to 70 cm, generally erect but weak, glabrous, triangular, base covered with leaf sheaths. Leaves nearly as long as the stem or even absent, up to 5 mm in breadth,

tapering into an acute apex, margins sharp, glabrous. Inflorescence umbellate, small irregular umbels varying much in size; primary rays 3-7, up to 11.5 cm long, again umbelled near the apex. Spikelets 5-20 obliquely erect yellowish brown at maturity, loosely arranged in linear branched or unbranched up to 4.5 cm long spikes, rachis persistent. Glumes 10-20, ovate to obovate, up to 2.5 mm diam, 3-5 nerved on the back, persistent. Stamens 2 or 3, anthers oblong, muticous. Nut triquetrous, nearly as long as the glume, palea brown, style much shorter than the nut, 3-branched, branches linear shortly exserted.

Germination : Late spring or early summer (ending May—early June).

Fl. & Fr. : July-September.

Dissemination : The nuts are mostly disseminated by irrigation water and also man during harvesting of grass for fodder.

Habitat : An occasional weed of paddy fields, floating islands and other marshy places. Soils are generally waterlogged. Marsh indicators.

Root system : The adventitious roots arising from the base of the stem and bind the plants in mud.

Geographical distribution : Warm regions of the Old World.

Specimens examined : *Kaul* 248 (12-8-1970) Harwan paddy fields; *Kaul* RRL 16129 (26-8-1971) Hyderpora paddy fields.

Cyperus rotundus L. Sp. Pl. 67, 1753; FBI 6 : 614; Collett 557; Kern in Reinwardtia 6 : 53, 1961; Stewart 91. **(Fig. 85)**

Perennial herbs with somewhat stoloniferous rootstock having small tuber like structures at the base from which arise long adventitious roots. Stem up to 65 cm, erect, generally unbranched, leafy near the base only, triquetrous near the apex, glabrous. Leaves linear lanceolate, tapering into an acute apex bases sheathing the stem, up to 50 cm long, rarely as long as the stem, glabrous, mid-vein much prominent. Bracts leafy, 2-3, generally 3, unequal in size. Inflorescence umbellate, umbels simple or compound, primary rays up to 11.5 cm long with compact spikelets arranged alternately or in opposite manner. Spikelets elongated up to 2.5 cm long, red-brown in short spikes. Glumes 11-39 compactly arranged on a persistent rachis, oblong with an acute apex, margins minutely scarious; lower glumes empty and middle ones bisexual. Stamens 2-3, anthers linear or oblong with much shorter stamens. Nuts small, about half the length of glumes, triquetrous with somewhat flat surfaces, style branches very minute.

Germination : Ending spring or early summer (May-June).

Fl. & Fr. : July-November.

Dissemination : Through stolons and seeds. The seeds are dispersed mainly by wind and water and to some extent by animals.

Habitat : A common weed of orchards, paddy fields, lawns, marshy places, and floating islands. Indicator of compact, fertile and moist loams.

Root system : The adventitious roots are produced from the base of stem. At the

onset of winter stoloniferous slender rootstock arise from the base of stem and perennate the unfavourable season.

Geographical distribution : All temperate and subtropical regions of Old World.

Specimens examined : *Clarke, C B.* s.n. (June, 1883) Himalaya, Kashmir (CAL); *Kaul* 247 (12-8-1970) Harwan paddy fields; *Kaul* 252 (17-8-1970) Batmaloo fallow fields; *Kaul* RRL 16130 (2-9-1971) RRL Campus fields, Srinagar.

Remarks : A fast spreading dangerous weed in Srinagar fields.

Cyperus eleusinoides Kunth, Enum. Pl. 2 : 39, 1837; FBI 6 : 608; Stewart 88.

Perennial herbs with a thick and somewhat fibrous rootstock. Stem erect up to 1 m, generally unbranched, leafy towards the base and triquetrous towards the apex, glabrous. Leaves broader at the base sheathing the thick stem and tapering into an acute apex, up to 11.5 cm x 2.0 cm, margins wavy, parallel veined, glabrous. Inflorescence of large compound umbel, subtended by long stiff leafy or stem like bracts. Spikelets densely spicate, linear 20-40 flowered, up to 1.6 cm long, pale and becoming red or chestnut brown. Glumes up to 1.5 mm diam, compact on a persistent rachis; lower ones empty, middle ones bisexual and uppermost male or empty. Stemens 2 or rarely 3, anthers oblong, small and inconspicuous. Nuts smaller than or as long as glumes, ellipsoid, often curved.

Field notes : A rare weed found in marshy places including floating islands and margins of lakes. The rootstock is very thick, never producing stolons but producing thick roots which bind the plant in the thick muddy soil. The stem is also thick and produces compact umbels at its top concealed by long stiff and erect bracts. It cannot resist dry conditions.

Fl. & Fr. : September-November.

Specimens examined : *Ahluwalia* (Nov. 1951) Srinagar around the lake on the margins; *Kaul* 288 (23-9-1971) Shalimar paddy fields.

Geographical distribution : Asia, Africa and Australia; in India it extends from Punjab to Ceylon and Naga hills.

Cyperus michelianus (L.) Link, Hort. Berol. 1 : 303, 1827, Stewart 90. **(Fig. 83)**

Scirpus michelianus L. Sp. Pl. 52, 1753.

Cyperus pygmaeus Rottb. Desert. Ic. 20, t. 14, f. 4 & 5, 1773.

Annual herbs. Stem up to 17. 5 cm. long, many from the base glabrous, slender, angular with flat surfaces, leafy near the base forming a tuft. Leaves mostly radical, linear lanceolate, tapering into an acute apex, margins sharp, glabrous. Involucral bracts subtending the inflorescence, leafy, up to 11 cm long, generally 3 or more, glabrous. Inflorescence a compound spikelet; each head up to 2 cm diam., compact, consisting of 65-100 spikelets. Each spikelet somewhat elongated, up to 5 mm x 1.5 mm, greenish white or finally pale brown, 6-20 flowered (generally 12-16 flowered). Glumes 4-6, generally 6, lowermost 2 empty, boatshaped, succeeding 2 bisexual and uppermost male and sterile. Stamens 1-3, anthers elongated, filaments very small and slender. Ovary with a long style, 2 branched near the apex. Nut solitary in

each flower, ellipsoid, somewhat flattened surfaces with a persistent style,

Germination : Early summer (June). The nuts germinate only when enough moisture is present in soil.

Fl. & Fr. : August-October.

Dissemination : The nuts get contaminated with the crop seeds and also disseminated by irrigation water.

Habitat : An occasional weed of maize fields and 'moong' (*Phaseolus aureus*) fields preferring moisture and forming small prostrate patches in the fields. Indicator of nitrogenous, fertile soils.

Root system : Bunches of long, slender adventitious roots arise from the base of the stem and spread in surface layers of soil.

Geographical distribution : All warm regions excluding Europe; extending from Kashmir to Burma and Ceylon.

Specimens examined : *Clarke* s.n. (May. 1883) Himalaya (CAL); *Meebold* 2542 (Sept. 1905) Sumbal, Kashmir (CAL); *Kaul* RRL 19700 (16-9-1971) Mansbal pulse fields.

Cyperus sanguinolentus Vahl, Enum. 2 : 351, 1806; Kern in Reinwardtia 6 : 61, 1961.

Pycreus sanguinolentus (Vahl) Nees in Linnaea 9 : 283, 1834; FBI 6 : 590; Collett 552.

Perennial herbs with a creeping rootstock. Stem up to 65 cm in height, decumbent near the base, ascending, weak, leafy, leaf sheaths covering the stem much above the base, glabrous, triquetrous towards the apex. Leaves linear up to 40 cm long, tapering towards the apex, margins smooth, mid-vein quite prominent, glabrous. Spikelets clustered, 4-12 at a note, up to 1.2 cm long, reddish brown 8-24 flowered; flowers arranged in opposite rows on a persistent rachis, Glumes obtuse, boat-shaped, up to 4 mm long and as broad, margins and tips red, 3 green nerves on the back. Lowermost 2 glumes of the spikelet empty middle ones bisexual and upper 1-3 male. Stamens 3, filaments slender but nearly as long as the glume, anthers protruding out and soon falling off. Ovary small tapering into a long 2-branched style. Nut slightly compressed, hardly half the length of the glume, ashy brown, hard and glabrous.

Germination : The seedlings sprout in late spring (ending May).

Fl. & Fr. : July - September.

Dissemination : It reproduces vegetatively through creeping rhizomes. The seeds are disseminated by irrigation water.

Habitat : An occasional weed of borders of paddy fields and floating islands. Marsh indicators.

Root system : A thin creeping rootstock running up to 25 cm along the surface of the soil, the adventitious roots arise from the nodes and bind the plants. The rootstock perennates during the unfavourable season.

Geographical distribution : Throughout warm regions of the Old World.

Specimens examined : *Kaul* 236 (21-7-1970) Hyderopora paddy fields: *Kaul* 329 (24-7-1972) Hyderpora.

Cyperus pumilus L. Cent. 2 : 6, 1756; Kern in Reinwardtia 6 : 62, 1961; Stewart 91.

Pycreus nitens (Retz.) Nees in Linnaea 9 : 283, 1834; FBI 6 : 591; Collett 552.

Cyperus nitens Retz. Obs. 6 : 13, 1789.

Annual glabrous herbs. Stem somewhat tufted, erect up to 35 cm., leafy at the base only, weak. Leaves linear, up to 25 cm long, slender, spreading, nearly all radical or some cauline, glabrous. Inflorescence umbellate or spicate; bracts spreading leafy, much longer than the umbels. Spikelets linear up to 2 cm long, clustered around a single node, straw coloured or dusky, 8-24 in a spike or a cluster, 20-44 flowered, flowers arranged in a compact opposite manner or a slender and persistent rachilla. Glumes oblong, boat-shaped, 3-5 nerved on the back, sides pale nerveless, light yellowish brown. Stamens generally one or rarely 2 in certain plants, filaments slender. Ovary small near the base of the glume, styles as long or even longer than the ovary, Nut compressed, about half as long as the glume, brown.

Germination : Late spring (ending May).

Fl. & Fr. : July - September.

Dissemination : The seeds are disseminated by water and also man during crop harvesting.

Habitat : A common weed of paddy fields, marshy places and floating islands preferring moist situations where superfluous water is drained off. Indicator of compact, moist and fertile loams.

Root system : Bunches of slender adventitious roots arise from the base of the stem and go up to 10 cm deep in soil.

Geographical distribution : Warm regions of the world.

Specimens examined : *Kaul*, 331 (2-8-1972) Badgam, Srinagar, paddy fields.

FIMBRISTYLIS Vahl

Fimbristylis bisumbellata (Forsk) Bub. Dodec. 30, 1850; Koyama in J. Fac. Sci. Univ. Tokyo 3, 8 : 13, 1961; Kern in Reinwardtia 6 : 47, 1961; Stewart 95. **(Fig. 86)**

Scirpus bisumbellatus Forsk. Fl. Aeg-Arb. 1 : 15, 1775.

Fimbristylis dichotoma sensu Clarke in Hook. f., FBI 6 : 635, 1893.

An annual herb. Stem up to 25 cm, tufted near the base, somewhat grooved and triangular towards the apex, glabrous, base covered with leaf sheaths. Leaves linear lanceolate, nearly as long as the stem, surfaces rough and slightly pubescent. Umbels compound, up to 9.5 cm diam., terminal, subtended by long, leafy, spreading and unequal bracts. Spikelets 5.5 mm x 2.5 mm obovate or ovate, tapering towards the apex, reddish brown at maturity while as green when young. Glumes boat-shaped, acute, ferruginous, keel green 1-3 nerved; lowest glume more or less bract like, often pubescent. Stamens 2 or 1. Ovary small, style 2-branched, flattened, often villous nearly to the base. Nut small up to 2 mm diam., biconvex, each face longitudinally stripped.

Germination : Late spring (ending May-early June).

Fl. & Fr. : August - September.

Dissemination : The seeds are disseminated by wind and irrigation water.

Habitat : A common weed of rice fields of Kashmir and also some floating islands. Indicator of fertile, compact and moist soils.

Geographical distribution : Warm regions of the Old World.

Specimens examined : *Kaul* RRL 16131 (5-9-1971) Badgam rice fields.

Remarks : A common weed generally associated with *Echinochloa crus-galli*, *Medicago lupulina* and *Rotala densiflora* and restricted to margins of paddy fields. A weed survey of rice fields of Kashmir by the author reveals that this species ranks second so far as the dominance and frequency of weeds of rice fields is concerned, *Echinochloa crus-galli* being the first one. The observation is based on random quadrat sampling method. This weed possesses an adventitious root system which is produced in bunches and does not go beyond 15 cm deep in the soil. Because of its tufted habit, the basal area covered by it is also appreciable and hence it is an obnoxious weed.

SCIRPUS Linnaeus

Key to the species

1. Nut marked with transverse wavy lines; hypogynous bristles present or even absent
   2. Spikelets in compact heads. heads closely umbelled — **lateriflorus**
   2. Spikelets in a single lateral or terminal compact head :
      3. Stem elongate, terete and leafy at the base, tufted — **juncoides**
      3. Stem robust, triquetrous, nearly leafless, never tufted — **mucronatus**
1. Nut not marked with transverse wavy lines hypogynous bristles present :
   4. Stem cylindrical; rhizomes thick — **lacustris**
   4. Stem trigonous; rhizomes with tuber like swellings — **affinis**

Scirpus lateriflorus Gmel. Syst. Veg. 1 : 27, 1791; Kern in Reinwardtia 6 : 34, 1961; Stewart 102.

Scirpus supinus L. var. *uninodis* (Del.) Clarke in Hook. f., FBI 6 : 656, 1893, excl. basionym *Isolepis uninodis* Del.

Annual glabrous herbs. Stem somewhat tufted, erect, terete. leafy only at the base, never going beyond 35 cm in height. Leaves mostly radical, sheathing the base of the stem, small portion spreading in the form of blade. Bracts elongated, spreading, 2-3, the lowest one looking like a continuation of the stem. Spikelets in small, rounded up to 1 cm diam. and compact heads. Inflorescence umbellate. umbels simple, terminal. Rays up to 2.5 cm long, certain heads are sessile. Each spikelet up to 9 mm long, many-flowered flowers arranged alternately on a persistent rhachilla. Glumes ovate, with a definite median greenish vein, margins are red-tinged, apex acute or mucronate, hypogynous bristles 2 or even absent. Nut slightly shorter than the glume, triquetrous, with 3 small styles which soon fall off.

Germination : Late spring i e. May.

Fl. & Fr. : July - September.

Dissemination : The seeds are disseminated by wind and water.

Habitat : An occasional weed of floating islands and swampy fields. Indicator of swampy soil conditions.

Root system : Fibrous adventitious roots arise from the base of the stem and remain in surface layers of soil.

Geographical distribution : India and Sri Lanka, Old World and America; Tropical Africa, Java and Australia.

Specimens examined : *Meebold* 2574 (June, 1905) Srinagar (CAL); *Kaul* 339 (16-8-1972) Chishmashahi floating islands.

Remarks : Many plants are binded together and give a tufted appearance to the plants. This variety is distinct from *S. supinus* in possessing longer leaves and nuts which are slightly shorter than the glumes.

Scirpus juncoides Roxb. Fl Ind. 216, 1820; Stewart 101.

Scirpus erectus auct. non Poir. (1805); FBI 6 : 656.

Annual or biennial glabrous herbs. Stem tufted very often many individual stems coming together, elongate up to 40 cm in height, sometimes leafy at the base. Spikelets in a single lateral head, bract generally a continuation of the stem. Each spikelet up to 1.2 cm long and slightly less broad, flowers many, compactly arranged on a persistent rhachilla. Glumes ovate, concave, mucronate with membranous and scaly margins, incurved; hypogynous bristles 2-4, brownish, as long or slightly shorter than the glumes. Nut broadly obovoid, triquetrous, with plane 3-surfaces shining, style 2-3 branched, small, soon falling off.

Germination : Late spring (May).

Fl. & Fr. : July - September.

Dissemination : The seeds are disseminated by irrigation water.

Habitat : An occasional weed of marshes and floating islands growing vegetables. A marsh indicator.

Root system : A meagrely developed fibrous adventitious root system.

Geographical distribution : Temperate Asia, North America and Australia.

Specimens examined : *Meebold* 2573 (June, 1905) Sumbal, Kashmir (CAL); *Kaul* 341 (1-9-1972) Chishma Shahi floating islands.

Scirpus mucronatus L. ssp. **robustus** (Miq.) Koyama in Quart. J. Taiwan Mus. 14 : 194, 1961; Stewart 102. **(Fig. 87)**

Scirpus mucronatus auct. non Linn. (1753) : FBI 6 : 656; Collett 564.

Perennial herbs with a short thick horizontal rhizome and fibrous rootlets. Stem upto 75 cm., generally erect, triquetrous with somewhat flattened edges, glabrous. Leaf in the form of a basal tubular non-green sheath or even absent. Bracts spreading, the lowest up to 9.5 cm long, as though a continuation of stem, trigonous. Spikelets 6-10, in a single, sessile, lateral and dense head. Each spikelets up to 1.2 cm long, somewhat broader at the base and tappering towards the apex forming a small cone like structure, 20-60 flowered, flowers pale greenish, compactly arranged on a persistent rhachilla. Glumes ovate or obovate, up to 6 mm diam., with a thick median ridge, mucronate, not notched at the top, margins glabrous or rarely minutely scabrous-hairy; hypogynous bristles generally 6, sometimes 5, unequal, two longer ones as long as the nut. Nut obovoid, nearly half as long as the glume, trigonous, shining, black, smooth or sometimes transversely wavy.

Germination : Young seedlings are seen in late spring (ending May).

Fl. & Fr. : August - October.

Dissemination : The plants propagate vegetatively and through seed. The seeds are dispersed by irrigation water.

Habitat : An occasional weed of marshes, floating islands and vegetable fields. Indicator of compact moist and thick soils.

Root system : Fibrous adventitious roots arise from the horizontal rhizomes and bind the plants in mud.

Geographical distribution : Europe, Madagascar, Warmer Asia, Australia.

Specimens examined : *Meebold* 56 (Sept., 1905) Sumbal, Kashmir (CAL); *Kaul* RRL 19701 (16-9-1971) Mansbal marshes.

Scirpus lacustris L. Sp. Pl. 48, 1753; FBI 6 : 658; Caius in J. Bombay Nat. Hist. Soc. 8 : 170, 1936; Rao in BOBSI 2 : 418, 1960; Stewart 101.

Perennial herbs with a thick and long horizontal rhizomes. Stem up to 1 m tall, stout, terete or sometimes trigonous, covered nearly all over by a membranous sheath, glabrous. Leaves if present mostly towards the base, broader at the base and tapering towards the apex, up to 12.5 cm long, floating in shallow water. Umbels usually once or twice divided; spikelets many, some pedicellate and others sessile, oblong, up to 1.2 cm long, broader at the base and tapering towards the apex. Glumes ovate, notched at the top with a small mucro in the notch, margins membranous pilose. Bristles as long as the nut, sometimes even absent. Stamens 3, filaments slender and small, anthers linear or oblong, crested. Nut trigonous, about half as long as the glume.

Germination : Late spring (May).

Fl. & Fr. : July - September.

Dissemination : By irrigation water.

Habitat : An occasional weed of paddy fields and floating islands. Indicator of moist, fertile and soft alluvials.

Root system : Adventitious rootlets arise from the horizontal rhizomes and remain in the surface layers of soil.

Geographical distribution : Europe, Africa, Australia and North America.

Specimens examined : *Meebold* 2572 (June, 1905) Srinagar, Kashmir (CAL); *Kaul* 238 (21-7-1970) Harwan; *Kaul* 340 (16-8-1972) Chishma Shahi paddy fields.

Remarks : The rootstock is astringent and diuretic.

Scirpus affinis Roth in Roem. & Schult., Syst. Veg. 2 : 140, 1817; Kern in Reinwardtia 6 : 33, 1961; Stewart 100.

Scirpus maritimus L. var. *affinis* (Roth) Clarke in Hook. f., FBI 6 : 659, 1893.

Stem up to 65 cm arising from a creeping and thick rhizome. slender, trigonous, basal portions covered by leaf sheaths, glabrous. Leaves slender, all near the base with long grass like blades. Umbels small reduced to 3 or at times one spikelet; bracts unequal. lower one very long and looks like a continuation of the stem, glabrous. Spikelets capitate, large ovoid or lanceolate up to 1.3 cm long, many flowered. Glumes obovate to ovate lanceolate, up to 5 mm diam., slightly longer than broad, sparingly hairy with a distinct

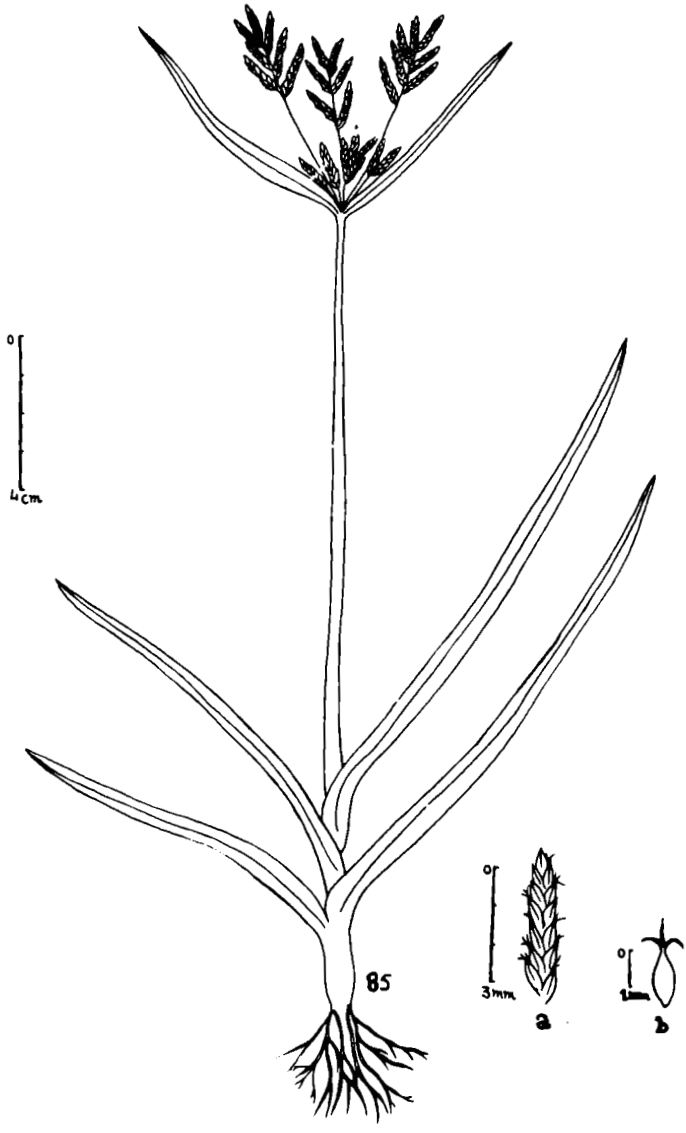


Fig. 85. *Cyperus rotundus* Linn. (a flowering plant)
a. a spikelet, b. ovary with style

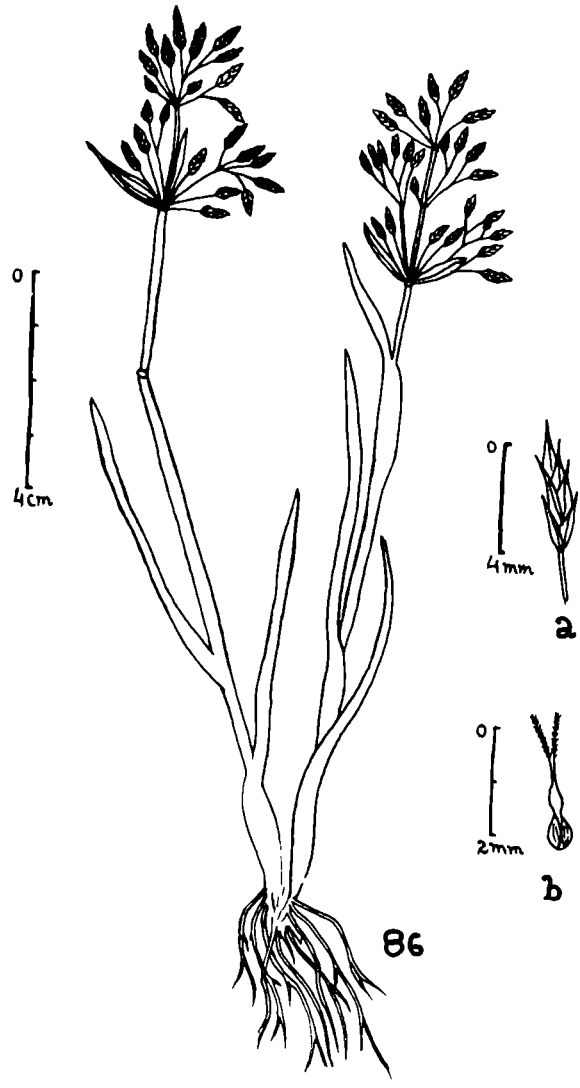


Fig. 86. *Fimbristylis bisumbellata* (Forsk.) Bub. (a flowering plant) a. a spikelet, b. ovary with style

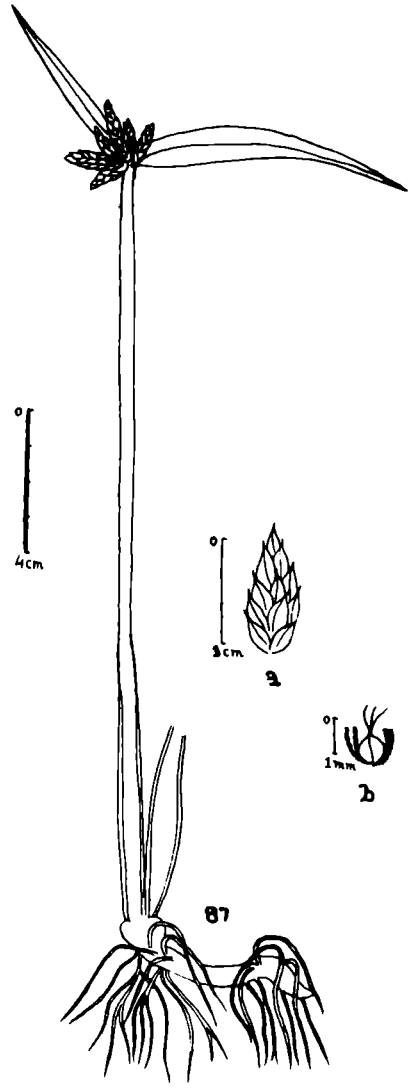


Fig. 87. *Scirpus mucronatus* Linn. ssp. *robustus* (Miq.) Koyama
(a flowering plant)
a. a spikelet. b. ovary with style

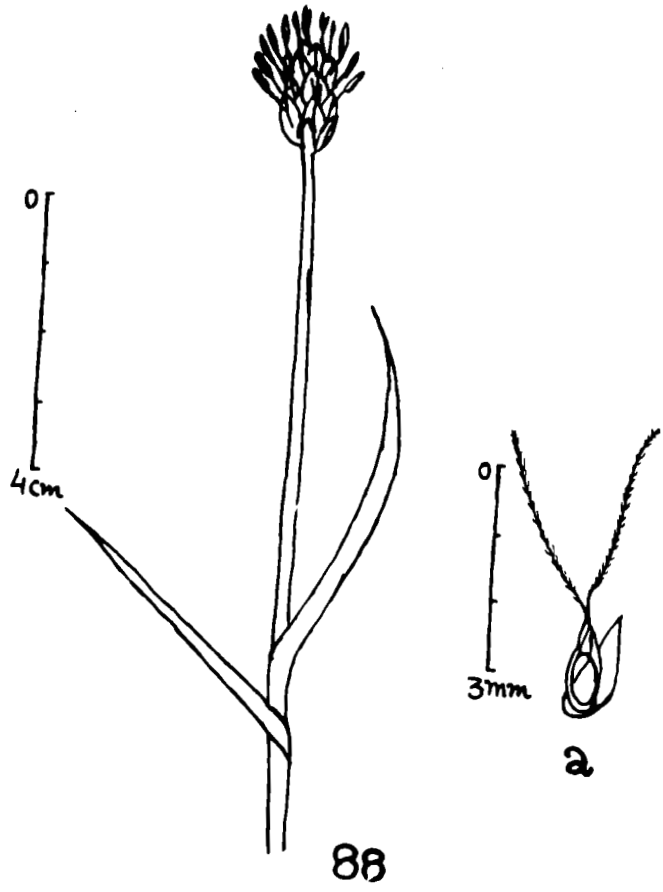


Fig. 88. *Carex stenophylla* Wahl. (a flowering shoot)
a. ovary with style

vein, apex acute and slightly notched. Nut small with a long 2-fid style, hypogynous bristles 2-4, generally 4, as long as the nut, white or straw coloured.

Germination : Seedling sprout in late spring (early June),

Fl. & Fr. : August - October.

Dissemination : The seeds reproduce vegetatively by the production of dormant buds from the nodes of tuberous rhizome and also seed. The seeds are dispersed by water.

Habitat : An occasional weed of paddy fields, marsh lands and floating islands. Marsh indicators.

Root system : Bunches of adventitious roots arise from the nodes of the creeping rhizomes and bind the plants to soil.

Geographical distribution : North India, Turkestan and N. China.

Specimen examined : *Kaul* 245 (12-8-1970) Harwan paddy fields.

ELEOCHARIS R. Brown

Eleocharis dulcis (Burm. f.) Henschel, Vita Rump. 188, 1833; Kern in Reinwardtia 6 : 36, 1961; Stewart 93.

Andropogon dulce Burm. f. Fl. Ind. 219, 1768.

Eleocharis plantaginea (Retz.) Roem. & Schult. Syst. Veg. 2 : 152, 1817; FBI 6 : 625.

Scirpus plantagineus Retz. Obs. 5 : 14, 1789.

Eleocharis equisetina Presl, Rel. Haenk. 1 : 195, 1828; FBI 6 : 626.

Perennial stoloniferous herbs, stolons long, slender, running to long distances, rooting at intervals. Stem erect up to 65 cm, robust, somewhat tufted, transversely septate when dry, covered with membranous sheaths which are soon torn. Spikelets up to 2 cm long, hardly wider than the stem, terminal, many flowered, flowers densely packed. Glumes ovate or obovate, up to 5 mm long with black striation on the back; lowest 1-3 stouter appearing as the continuation of the stem, generally empty. Bristles 7, stout with barbed margins, equalling or exceeding the nut, yellowish-brown. Nut slightly larger than half of the glume, biconvex or obscurely trigonous; style bases persistent, depressed, conic, brown-black.

Germination : Early spring (March). The stoloniferous rhizomes remain dormant for the winter and sprout at the onset of spring.

Fl. & Fr. : April-May.

Dissemination : Vegetative as well as through seed. The seeds are light and easily carried by wind and water,

Habitat : A rare weed preferring to grow in slums, marshlands and sometimes paddy fields. It possesses a gregarious habit. Indicator of fertile, well irrigated alluvials.

Root system : Adventitious roots arise from the nodes of stoloniferous rootstock and penetrate in the muddy soils.

Geographical distribution : Tropics of Old World, Assam to Sri Lanka and Malayan Peninsula.

Specimens examined : *Kapoor* 2637 (15-6-1952) Yarikha fields; *Kaul* 304 (4-5-1972) Shopian paddy fields.

Remarks : The stem of the plants is practically leafless and looks like *Equisetum* when dry.

CAREX Linnaeus

Key to the species

1. Terminal spike female at the base and male at top :
   2. Style 2-branched. flattened :
      3. Spike ovoid or oblong, sessile or nearly so; inflorescence a dense or interrupted compound spike :
         4. Spike ovoid androgynous, male at the top forming one ovoid or oblong compound spike. **stenophylla**
         4. Spike small dense forming a linear interrupted compound spike :
            5. Nerves of utricle many, prominent **nubigena**
            5. Nerves of utricle none or few and obscure **foliosa**
      3. Spike linear-cylindric, peduncled, inflorescence loose **brunnea**
1. Terminal spike male, the others female **notha**
   2. Style 3-branched, nut triquetrous
      6. Spikes 3-6, approximate, terminal one male, lower female, short cylindric, dense : **philocrena**
      6. Spikes 3-7, moderately together, terminal male and lower female, dense nodding
         7. Flowering stem leafy at least up to 1/3rd of the stem :
            8. Utricle glabrous **pseudocyperus**
            8. Utricle hairy or minutely setulose **kashmirensis**
         7. Flowering stem naked **fedia**

Carex stenophylla Wahl. in Kong. Vet. Acad. Handl. Stockh. 24 : 142, 1803; FBI 6 : 701; Stewart 84. **(Fig. 88)**

Annual herbs with a descending rhizome. Stem erect, up to 20 cm, slender, 1-many arising from the same rhizome, glabrous, unbranched, leafy near the base. Leaves with a small sheath and a long blade, linear lanceolate, alternate, glabrous. Spikes ovoid, up to 2 cm diam., 5-8 forming a dense and compact compound terminal spike. Each spikelets 3-10 flowered, dark brown; basal glume the largest and empty, strongly scarious margined; outer glumes female and inner male. Male flowers with 3-6 stamens with slender filaments and linnear long anthers which extrude out at maturity. Female flower with somewhat triangular ovary and a long bifid style; style branches somewhat barbed throughout the length. Nut triquetrous black or blackish brown, crustaceous enclosed in an ellipsoid acuminate obscurely nerved and short beaked utricle.

Field notes : A rare weed found mostly in lawns and roadsides generally associated with *Poa annua* and *Cynodon dactylon*. The root system is meagrely developed and the weed mostly propagates by its seeds. The nuts are black and shining, germinating with great difficulty.

Fl. & Fr. : April-May.

Geographical distribution : North West Himalaya : from W. Tibet and Spiti to Karakorum mountains and cold northern regions.

Specimens examined : *C.B. Clarke* s.n.

August. (1884) Himalaya (CAL); *Kaul* 152 (14-4-1970) Roadsides along Badgam.

Carex nubigena D. Don in Trans. Linn. Soc. 14 : 326, 1825; FBI 6 : 702; Collett 567; Stewart 80.

Perennial herbs with a short but thick rhizome. Stem many branched from the base, slender, densely leafy at the base, glabrous, up to 60 cm in length. Leaves linear, narrow, crowded at the base with definite many-nerved sheaths; blades incurved when dry, margins somewhat hirsute. Inflorescence constituting of many greenish to brownish interrupted spikes; bracts generally at the basal spike, overtopping the inflorescence. Spikes up to 5 mm diam., dense, ovoid, androgynous. Female glumes ovate scarcely apiculate and generally shorter than the utricle. Male glumes towards the apices of the spikes, shorter; stamens 3-6, anthers linear-oblong, very shortly apiculate, Ovary completely enclosed in the utricle, style coming out, 2 or sometimes 3-fid. Utricle small, of thin texture, green or pale brown, many-nerved, nerves very prominent along all surfaces; small red-glands spread all over the surface between the nerves; beak of utricle hard pointed, not winged, smooth or minutely scabrid. Nut much shorter than the utricle, brown, compressed, surfaces plane.

Germination : Spring (March-April).

Fl. & Fr. : May - July.

Dissemination : Vegetatively as well as through seed. The seeds are dispersed by wind, water & animals.

Habitat : A common weed of orchards along the drainage and water channels. Indicator of moist, compact loams.

Root system : The adventitious roots are developed from the underground rhizome and generally remain in surface layers of the soil.

Geographical distribution : Afghanistan, Malaya, China, Japan, South India, Sri Lanka and Himalaya.

Specimen examined : *Kapoor* 2648 (15-6-1962) Yarikha orchards.

Illustration : Collett fig. 184.

Carex foliosa D. Don in Trans. Linn. Soc. 14: 327, 1825; Stewart 76.

Carex muricata L. var. *foliosa* (D. Don) Clarke in Hook. f., FBI 6: 703, 1894; Rao in BOBSI 2: 418, 1960.

Perennial herbs with short rhizome. Stem up to 75 cm, erect or ascending, slender, rough towards the top, glabrous, sometimes fistular. Leaves linear lanceolate, up to 60 cm long and 7 mm broad in the middle, tapering into an acute apex, margins entire, glabrous. Spikes ovoid, male at the top, brownish forming a linear interrupted spike up to 5 cm long. Stamens with long obovate crested anthers. Female glumes ovate, usually long pointed; midrib prominent, margins white and transparent. Utricle ovoid, glabrous; nerves none or few and obscure; beak linear rough on the margins. Ovary small and a simple 2 branched style. Nut flattened half the length of the glume.

Field notes : A rare weed preferring moist situations sometimes growing in swamps and marshes, with a small but thick rhizome.

Fl. & Fr. : May - June.

Geographical distribution : Himalaya; Pulney and Nilghiri hills.

Specimens examined : *Kapoor* 2608 (28-6-1952) Near Verinag fields.

Carex brunnea Thunb. Fl. Japon. 38, 1784; FBI 6: 705; Collett 568; Stewart 74.

Perennial herbs with long and oblique rhizomes. Stem erect up to 75 cm, slender, branched from the base, branches as long as the leaf, glabrous Leaves linear, up to 3 mm broad, glabrous. Spikes up to 5 cm long, linear, stalked. nodding, red-brown, forming a long and lax panicle. Male glumes triangular, reddish brown; stamens with linear-oblong anthers. Female glumes ovate, apex acute or subacute. Utricles suddenly narrowed into a long beak which is shortly bifid with erect lobes. Nut much flattened, ovoid, suddenly narrowed at top, nearly filling the utricle except beak. Style about as long as beak, slightly swollen, contracted at the base, branches long and brown.

Field notes : An occasional weed having a tufted habit and growing in open bnt moist situations. The stem is branched from the base and the leaves are as long as the stem. It looks like a grass and is considered poisonous for the cattle.

Fl. & Fr. : March - May.

Geographical distribution : The Mascarene Isles, Australia, Japan, Sandwisch-Islands, North West Himalaya and Sri Lanka.

Specimens examined : Kapoor 1330 (9-3-1952) near Banihall open fields.

Carex notha Kunth, Enum. Pl. 2 : 421, 1837; FBI 6 : 709.

Annual or biennial herbs with much branched root system. Stem up to 55 cm, erect or sub-erect, generally unbranched, slender, glabrous, densely leafy at the base. Leaves linear lanceolate, grasslike, much crowded at the base, cauline ones much longer than the stem, veins running parallel, distinct, margins entire, glabrous, protruding into an acute point. Spikes 3-7, linear, cylindrical, lower on slender peduncle; lowest bract hardly as long as the inflorescence. Male spikes 3-5, terminal, peduncled, linear up to 4.5 cm long, greenish when young and brown at maturity. Glumes compact on the spikes, green, obscurely 3-nerved on the back, often muticous, mucronate. Female spikes 2-3, below the male spikes, linear, up to 5 cm long. Utricle exceeding the glume with round or linear, yellow or brown, scattered and sunk glands; beak slightly notched, minutely granular. Nut small enclosed in the utricle.

Germination : Summer (June).

Fl. & Fr. : July - September.

Dissemination : Wind and animals including man.

Habitat : A common weed of marshy areas, floating islands, some lawns and roadsides. Indicator of moist, compact, fertile soils.

Root system : A somewhat trailing slender rootstock with many long adventitious roots going up to 20 cm deep in soil.

Geographical distribution : Himalaya; from China and Garhwal to Bhutan.

Specimens examined : *Kaul* RRL 15132 (8-9-1971) Sanat Nagar lawns.

Carex philocrena V. Krecz in Fl. URSS 3: 393, 1935; Stewart 82.

Carex flava auct. non L. (1753): FBI 6 : 739; Polunin 566.

Perennial glabrons and tufted herbs. Stem up to 50 cm erect or suberect, slender. Leaves linear lanceoiate, very narrow up to 20 cm long. Spikes generally all approximate forming a terminal cluster comprising of single, pale, linear male, spike and 2-4 erect, oval to globular, stalkless and overlapping female spikes up to 1 cm diam. Bracts leafy, lowest, longer than inflorescence. Female glumes ovate, shorter than the utricle, pale, often yellowish, muticous or rarely mucronate. Utricle with 8 or 9 thick ribs, about half as long as the utricle; beak hard, shortly notched. Nut obovoid, trigynous, nearly filling the utricle.

Germination : Spring (March-April).

Fl. & Fr. : May - June.

Dissemination : The seeds are disseminated by water.

Habitat : An occasional weed of floating islands, marshy and swampy rice fields. Marsh indicators.

Root system : A meagrely developed adventitious root system. The roots remain in the surface layers of soil.

Geographical distribution : North temperate regions and Europe.

Specimens examined : *Kaul* 203 (29-5-1970) Hoakersar floating islands.

Carex pseudocyperus L. Sp. Pl. 978. 1753; FBI 6 : 740; Polunin 566; Stewart 83.

Perennial, tufted herbs. Stem erect, up to 75 cm, rough, sharply triangular up to 5 mm diam., glabrous, generally unbranched, but 1-many arising from the same rootstock. Leaves linear up to 60 cm long (along with the sheath) blade up to 1.5 cm broad in the middle and tapering into an acute apex, yellowish green in colour. Spikes 3-7, moderately approximate, terminal one male, pale and lower female, cylindric, dense and nodding. Bracts 3-5, leafy, much longer than the inflorescence. Male spike up to 6 cm long with many flowers arranged on a persistent rhachilla. Female spikes 3-5, cylindrical up to 5 cm long. Male glumes up to 6 mm diam., greenish with white membranous margins or light brown. Female glumes up to 4.5 cm diam., apex toothed. Utricle ellipsoid-lanceolate, subinflated, thin, pale, smooth, strongly ribbed. Nut ovoid, narrower than the utricle, about half as long, brown.

Germination : Spring (March).

Fl. & Fr. : May - July.

Dissemination : The seeds are disseminated mainly by water.

Habitat : An occasional sedge of floating islands growing in association with *Typha latifolia*, *Juncus articulatus* and *Ranunculus lingua*. Marsh indicators.

Root system : A thick, much branched somewhat creeping rootstock with bunches of adventitious roots arising from it.

Geographical distribution : Cool northern regions of the world.

Specimens examined : *Kaul* 358 (2-6-1973) Dal Lake floating islands; *Kapoor* 855 (May, 1946) Field around Dal Lake.

Illustration : Polunin pl. 115.

Carex kashmirensis C.B. Clarke in Hook. f. FBI 6 : 743, 1894; Stewart 78.

A perennial small herb with short, creeping and much divided rhizome. Stem up to 30 cm long, erect or ascending, slender, unbranched, more leafy near the base. Leaves linear lanceolate, up to 20 cm long including basal sheath, the upper cauline leaves are more longer than the basal ones, up to 3 mm broad, flat, protruding into an acute apex, glabrous. Inflorescence up to 5 cm long consisting of separate male and female spikes. Bracts leafy, scarcely overtopping the inflorescence. Male spikes linear up to 2 cm long, pedicelled or nearly sessile; female spikes just below the male, up to 1.5 cm distant from each other. Glumes of female spike ovate up to 5 mm long, muticous. Utricle ellipsoid, lanceolate, muticous, trigonous, greenish 8-ribbed, minutely hispid, acuminated into oblong deeply bifid beak. Nut filling the utricle, dark brown.

Field notes : An occasional weed found in lawns and borders of floating islands, It prefers to grow in moist and shady situations. The rhizome is short but creeping and produces thin roots which are mostly absorptive and do not bind the stem in the soil. The stem is extremely weak.

Fl. & Fr. : April - June.

Geographical distribution : Temperate Himalaya : Kashmir.

Specimens examined : *Kaul* 160A (27-4-1970) Sanat nagar lawns.

Carex fedia Nees in Wight's Contrib. 129, 1834; Stewart 76.

Carex wallichiana Prescott ex Clarke in Hook. f., FBI 6 : 747, 1894; Collett 570; Rao in BOBSI 2 : 418, 1960.

Perennial herbs with long running underground stolons. Stem up to 75 cm erect, stout, unbranched, many arising from the base, glabrous. Leaves mostly basal, also cauline, sheaths often fimbriate, up to 32.5 cm long and 6 mm broad in the middle, margins entire, apex acute. Spikes 4-8, distant, long cylindric, dense; 1-3 male spikes terminal, pale rather thick, stamens with slender filaments, anthers linear, protruding out at maturity; female 3-5, the lowest longest up to 10.5 mm long and 6.5 mm broad, distant on erect peduncles; bracts usually overtopping the inflorescence. Female glumes ovate, acute, often mucronate, fuscous, shorter than the utricles. Utricle up to 4 mm long including the beak, 8-10 nerved, surface densely hairy all over. Nut slightly shorter than the utricle, triquetrous with black or pale brown shining surfaces.

Germination : Spring (March-April).

Fl. & Fr. : May - June.

Dissemination : The plants reproduce vegetatively by stolons and also by seeds. The seeds disperse by water.

Habitat : An occasional weed of floating islands and swampy areas. Marsh indicators.

Root system : Adventitious roots arising from the nodes of the underground rhizome, remain in the surface layers of soil.

Geographical distribution : Afghanistan.

Specimens examined : *Kapoor* 2903 (15-5-1952) Srinagar around Dal Lake; *Kaul* 308A (1-6-1972) Dal Lake floating islands.

GRAMINEAE (POACEAE)

Broadly the family is divided into two sub-divisions viz. *Panicoideae* and *Pooideae* (*Poaceae*) on the basis of following characters :

Panicoideae : Spikelets all bisexual, or with male or barren and bisexual spikelets mixed in the same inflorescence and so arranged that a male or barren spikelet is near a bisexual spikelet or if unisexual then the lemma of fertile floret indurated. Stalk of the spikelet jointed below the empty glume.

Pooideae : Stalk of the spikelet not jointed below the empty glumes. Rhachilla often jointed above the persistent lower glumes, produced beyond the fertile flowers in the form of a stalk or bearing empty glumes or imperfect flowers.

The names of the genera, tribes and number of species of grasses under the respective tribes, as occurring in Srinagar fields as weeds are represented in tabular form :

GROUP	TRIBE	GENERA
PANICOIDEAE	Andropogoneae	*Bothriochloa, Cymbopogon, Chrysopogon, Imperata, Sorghum,*
	Paniceae	*Brachiaria, Digitaria, Echinochloa, Panicum, Paspalum, Pennisetum, Setaria.*
POOIDEAE	Agrostideae	*Agrostis, Alopecurus, Phleum, Polypogon, Stipa.*
	Avenae	*Avena, Helictotrichon.*
	Chlorideae	*Cynodon, Eleusine.*
	Festuceae	*Bromus, Dactylis, Eragrostis, Phragmites, Poa, Sclerochloa, Vulpia.*
	Hordeae	*Agropyron, Hordeum, Lolium.*

PANICOIDEAE

Key to the genera

1. Spikelets usually 2-flowered; terminal flower bisexual, fertile; lower male or rudimentary; rarely bo h fertile :
   2. Spikelets awnless, not surrounded by involucre of bristles :
      3. The back of the upper lemma turned away from the rachis and lower glume turned towards it i.e. spikelets adaxial. **Brachiaria**
      3. The back of the upper lemma facing the rachis and lower glume (if present) turned away from it i e. spikelets abaxial **Paspalum**
         4. Lower empty glume minute or wanting; lower flowering glume empty or sometimes containing a rudimentary flower :
         4. Lower empty glume shorter than the upper, but obvious; lower flowering glume containing a rudimentary or male flower or empty **Panicum**

2. Spikelets awnless and surrounded by an involucre of bristles

5. Spikelets in spikes or in a cylindric tapering panicle; stalks bearing an involucre of long bristles and not jointed at the base **Setaria**

5. Spikelets in a dense raceme; stalks bearing an involucre of long, sometimes fringed bristles and jointed at the base **Pennisetum**

2. Spikelets awned or rarely awnless, in several spikelike clusters **Echinochloa**

1. Spikelets in spikes. panicles or racemes; hairy, rarely glabrous; usually in pairs :

6. Spikelets in pairs, both sessile and pedicelled ones hermaphrodite :

7. Spikes not jointed; spikelets 1-flowered, partially enveloped in a tuft of long yellow hairs

7. Panicles contracted silvery; spikelets surrounded by long white tuft of hairs **Imperata**

6. Spikelets in each pair dissimilar, the sessile hermaphrodite, the pedicelled male or sterile or absent :

8. Spikelets long stalked in a branched inflorescence; spikelets with 1 fertile floret :

9. Leaves narrow, spikelets in clusters with a tuft of russet hairs present below each spike **Chrysopogon**

9. Leaves broad; spikelets in lax clusters without a tuft of hairs below each spike **Sorghum**

8. Spikelets in panicles of racemes interrupted by spathes or the espathulate racemes digitate :

10. Lemma awned :

11. All pairs of spikelets heterogamous, rarely one pair homogamous; upper lemma of the sessile spikelet not cleft, often stipitate **Bothriochloa**

11. Racemes in pairs supported by spathes; one pair of spikelet in each raceme homogamous, male or neuter, all other pairs homogamous; upper lemma of the sesile spikelet 2-cleft **Cymbopogon**

10. Lemma awnless **Digitaria**

POOIDEAE

Key to the genera

1. Spikelets stalkless or nearly so, in a solitary spike-like cluster, florets 1-many :

2. Tall erect perennials; inflorescence quadrangular in section; spikelets up to 2 cm long, arranged uniformly on 2 sides of the axis **Agropyron**

2. Annual or perennial herbs. Spikelets never arranged uniformly on the two sides of axis

3. Spikelets solitary at the nodes of the spike, 3-many flowered; floral glumes coriaceous, 5-many nerved **Lolium**

3. Spikelets in groups of 3 at the nodes forming a dense spike, floral glumes 5-nerved **Hordeum**

1. Spikelets in dense, spike-like or more or less spreading panicles, 1-flowered or occasionally 2-flowered :

4. Spikelets in dense, ovoid or cylindric, spike-like panicles; flowering glumes thin and transparent :

5. Empty glumes equal, awned or unawned :

6. Empty glumes never united at the base, their keels terminating in short points, awnless — **Phleum**

6. Empty glumes united at the base, awn of the lemma bent — **Alopecurus**

5. Empty glumes equal or unequal, generally awned :

7. Empty glumes awned on the back below the top — **Polypogon**

7. Empty glumes with a short dorsal awn (awn sometimes absent), tip mucronate — **Agrostis**

4. Spikelets in more or lass spreading, loose panicles. Fruiting glumes narrow, acuminate, tip produced in an awn — **Stipa**

8. Spikelets up to 3 cm long, in panicles, narrow, terete; flowering glume long awned :

9. Spikelets drooping, shorter — **Avena**

9. Spikelets erect and long — **Helictotrichon**

8. Spikelets small or minute, sessile in 2 rows along one side of the usually digitate arranged spikes :

10. Spikelets with usually 1-6 florets; spike like clusters long and narrow :

11. Spikes 2-3 in a cluster; spikelets 1-flowered; empty glumes nearly equal — **Cynodon**

11. Spikes 4-7 in a cluster; spikelets 3-6 flowered; empty glumes unequal — **Eleusine**

10. Spikelets with 3-8 florets, inflorescence oval — **Sclerochloa**

8. Spikelets in spreading or contracted panicles, rarely in spikes; tip of the rhachilla naked or bearing 1-3 rudimentary glumes :

12. Stem up to 3 m tall. Leaves flat and broad. Spikelets 3-8 flowered, forming large, dense, erect, shining and silky panicles — **Phragmites**

12. Stem up to 2 m tall, spikelets glabrous or nearly 80, in panicles or spicate :

13. Spikelets awned :

14. Spikelets not conspicuously 2 ranked :

15. Spikelets up to 6 mm long, 3-5 flowered, in one sided ovoid cluster. Flowering glumes rigid, 5-nerved, shortly awned; ovary glabrous — **Dactylis**

15. Spikelets up to 3 mm long, 7-14 flowered, tip of the flowering glumes notched, awned. Ovary densely hairy on the top — **Bromus**

14. Spikelets 2-ranked or not, keeled on the back, lemma awned — **Vulpia**

13. Spikelets generally awnless :

16. Flowering glumes 3-nerved; rhachilla not prolonged — **Eragrostis**

16. Flowering glumes more than 2-nerved; rhachilla often prolonged — **Poa**

BRACHIARIA (Trinius) Grisebach

Brachiaria eruciformis (J. E. Sm.) Griseb. in Ledeb., Fl. Ross 4 : 469, 1853; Bor 283; Rajagopal and Panigrahi in Proc. Nat. Acad. Sci. 37 (1) : 26, t. 3, 1967; Stewart 115.

Panicum eruciforme J. E. Sm., Fl. Graeca 1 : 44, t. 59, 1806.

Panicum isachne Roth ex Roem. et Schult., Syst. Veg. 2 : 458, 1817, FBI 7 : 28.

Annual herbs. Stem generally spreading, branched and tufted nearby the base, branches ascending carrying the inflorescence, solid at the nodes, slender, glabrous or sometimes hairy at nodes. Leaves simple with blade as long as the sheath, aggregated mostly near the base and distant on the main stem, sheath densely hairy with distinct and raised parallel striations, margins of the blade sharp, apex acuminate. Inflorescence a panicle with erect closely crowded racemes, internodes shorter than the racemes. Spikelets up to 2.5 mm long, green or tinged with purple, rachis hairy. Lower glume much shorter than the upper glume, generally 3-nerved, densely hairy. Upper lemma fertile, as long as the spikelet and enclosing a granulate palea; stamens 3 with anthers longer than the filaments; ovary small, styles 2 with bushy stigmas. Grain obovate oblong up to 1.5 mm long.

Germination : Late spring (April-May).

Fl. & Fr. : August-November.

Dissemination : The seeds are dispersed by wind, water and animals which feed on it.

Habitat : An occasional weed of flower beds, lawns and some orchards preferring moist situations. Indicator of silty, clayey loams.

Root system : Bunches of slender, adventitious roots are formed near the base of the stem and go up to 8 cm deep in the soil.

Geographical distribution : India, Westwards to Spain and North Africa.

Specimens examined : *Kaul* 230 (18-7-1970) Barzulla orchards; *Kaul* RRL 19718 (26-9-1971) RRL Campus lawns.

Chromosome report : 2 n = 18 (DCA 424).

PASPALUM Linnaeus

Paspalum scrobiculatum L. Mant. Pl. 1 : 29, 1767; FBI 7 : 11; Bor in Indian For. Rec. 2 (1) : 174, pl. 45, 1941; Bor 340; Stewart 123.

An annual grass. Stem erect or decumbent, 30-70 cm long, glabrous, rarely hairy, leafy, nodes rooting. Leaves almost erect and spreading, linear lanceolate, 7-12.5 cm x 0.5 cm, flat, glabrous, sheath somewhat hairy at the mouth near ligule, leaf blade sharp-margined, acuminate. Inflorescence a panicle consisting of false spikes, distant, erect or spreading. 2-5.5 cm long and up to 3.5 mm broad, rachis flattened, scaberulous Spikelets secund, 2-4 mm long, in two rows imbricate, orbicular or sub-ovoid glabrous. Lower glume absent, upper 2-4 mm long, concave, membranous, glabrous, 3-nerved, two nerves submarginal and one central quite distinct. Lower floret neuter; lemma equal to and resembling upper glume, 5-7 nerved. Upper floret hermaphrodite; lemma 2-4 mm orbicular or sub-ovate, thick, coriaceous, shining palae eqalling the lemma in length. Stamens 3 with large anthers up to 4 mm long. Ovary

with two styles and bushy brownish stigma coming out of the floret for pollination. Caryopsis pale, biconvex.

Germination : Seedling sprout in late spring (April-May).

Fl. & Fr. : June - September.

Dissemination : The plants propagate vegetatively as well as through seed. The seeds disperse by wind and man during agricultural operations.

Habitat : A common weed of lawns, fallow lands and margins of paddy fields preferring moist situations. Indicator of fertile silty clayey loams.

Root system : The creeping stem roots at nodes, the adventitious roots being slender enter the surface horizons of soils.

Associations recorded : The plants are generally associated with *Cynodon dactylon* and *Poa annua.*

Geographical distribution : All warm countries of world; India : Uttar Pradesh.

Specimens examined : *Kaul* 234 (21-7-1970) Majid Bagh, paddy field margins; *Kaul* 250 (17-8-1970) Batmaloo lawns and fallow fields.

Remarks : Bor (1941) reports it to be a poisonous grass.

PANICUM Linnaeus

Panicum miliaceum L. Sp. Pl. 58, 1753; FBI 7 : 45; Bor 327; Stewart 121.

Annual herbs with fibrous root system. Stem branched or unbranched, erect, up to 1.2 m tufted at the base, pubescent near the base and the nodes, leafy up to the panicle. Leaves slightly rounded at the base, linear lanceolate, 20-45 cm long and up to 3 cm broad in the middle, margins scaberulous with a few long cilia having swollen bases; leaf sheath split, lax covered with spreading tubercle based hairs; ligule long and hairy. Panicle 10-20 cm long and as broad, branched copiously, branches filiform, fascicled and scabrid. Spikelets turgid, green 4-5 mm diam, glabrous. Lower glume 2-3 mm long, clasping, broadly ovate, nerved; upper glume 4-5 mm long, 7-11 nerved. Lower floret barren, lemma like the upper glume, palea absent; upper floret hermaphrodite, sessile, lemma as long as the spikelet, smooth, shining, crustaceous, yellow, lemma and palea of the same structure and texture. Caryopsis almost orbicular, white or creamy, plano-convex.

Field notes : The plants are cultivated in the hilly regions for its grain and the long culms and the leaves are used as fodder. Duthie (1888) states that in India it is cultivated for grain used by man. It has been seen to infest certain fields as a weed, the probable reason being mixture of seeds with other crops.

Fl. & Fr. : June - August.

Specimens examined : *Kapoor* 910 (24-7-1946) Astore, Shopian fallow fields.

Geographical distribution : Africa, India and other hotter parts of the world.

Illustration : Polunin pl. 182.

Chromosome report : 2n=36 (DCA 423).

SETARIA Palisot de Beauvois

Key to the species

1. Spikelets in a narrow, spike-like panicle :
2. Fruiting lemma conspicuously transversely wrinkled **glauca**
   2. Fruiting lemma smooth **viridis**

1. Spikelets in a loose, cylindric panicle :
   3. Panicle cylindric, very dense. Fertile lemma smooth, barbs of the bristles pointing upwards **italica**
   3. Panicle cylindric, not very dense; barb of the bristles pointing downwards **verticillata**

Setaria glauca (L.) P. Beauv., Essai Agrost., 51, 1812; FBI 7 : 78; Collett 587; Bor 360; Stewart 124.

Panicum glaucum L. Sp. Pl. 56, 1753.

Annual grass, stem suberect to erect, up to 45 cm, branched or rarely unbranched, glabrous, nodes slightly purplish brown. Leaves narrow or broad in the middle, lanceolate, up to 15.5 cm x 1.2 cm acute, flat, generally glabrous or with hairy margins. Panicles spiciform, solitary at the top of each branch, up to 3.5 cm x 0.5 cm, dense flowered, cylindrical, yellow or slightly purplish. Spikelets nearly sessile, ovoid, 6-12 bristles arising from the base of each spikelet, bristles unequal and 2-4 times as long as the spikelet. Glumes generally unequal, lower one much shorter than the upper one, former ovoid, shorter than the upper lemma, generally 5-nerved. Lower floret generally male with 3-distinct stamens; upper floret bisexual and fertile with lemma as long as spikelet. Grain ovoid, shining.

Germination : Early spring (February - March).

Fl. & Fr. : May - September.

Dissemination : Wind and animals including man.

Habitat : An occasional weed of lawns, fallow fields and some orchards. Indicator of fertile sandy clayey loams.

Root system : Many slender fibrous adventitious roots arise from the base of the stem and go up to 10 cm deep in soil.

Geographical distribution : Throughout India and all warm, temperate and tropical regions of the world.

Specimens examined : *Kaul* RRL 16074 (29-7-1971) Harwan, margin of paddy fields; *Kaul* 309 (12-6-1972) University campus, Srinagar orchards.

Illustration : Geigy weed Tables, fig. 4.1

Chromosome report : 2n=18, 36 (Bor 1960)

Setaria viridis (L.) P. Beauv. Essai Agrost., 51, 1812; FBI 7 : 80; Collett 587; Bor 365; Rao in BOBSI 2 (3 & 4) : 418, 1960; Stewart 125.

Panicum viride L. Syst. Nat. ed. 10, 2 : 870, 1759.

The plants are similar to S. *glauca* (L.) P. Beauv. but differ from it in the following characters : 1) the spikes are narrower and longer; 2) the fruiting lemma is smooth and not wrinkled as in the preceding species; and 3) the bristles are slightly longer and tinged with redness at the time of maturity of the spikelet.

Field notes : This weed is similar in habit and habitat to the preceding species and cannot be easily distinguished when young. The spikelets when mature can be readily differentiated on the basis of size and colour of the bristles. In general it could be seen that *S. viridis* P. Beauv. is taller as compared to *S. glauca* (L.) P. Beauv. in Kashmir fields. Both the weeds are sometimes growing side by side associated with common lawn grass. It is said to be of good fodder value, the

grains are eaten by human beings at certain places.

Local name : Shaol gassa.

Fl. & Fr. : June - September.

Specimens examined : *Kaul* 342 (1-9-1972) Hazratbal orchards, Srinagar.

Geographical distribution : Temperate Himalaya to Western Tibet.

Chromosome report : 2 n = 18 (Bor 1960).

Setaria italica (L.) P. Beauv, Essai Agrost., 51, t. 13, fig. 3, 1812; FBI 7 : 78; Collett 587; Bor 362; Stewart 124.

Panicum italicum L. Sp. Pl. 56, 1753.

Annual tufted grasses. Stem erect up to 1 m tall, base sometimes decumbent and tops ascending, branched or unbranched, rooting at lower joints, glabrous. Leaves somewhat crowded at the base, linear up to 40.5 cm long and 2.5 cm broad in the middle, tapering into a fine tip, margins retrorsely hispid, sheaths long, hairy; ligule short, comprising of white bearded hairiness. Spiciform panicle up to 10.5 cm long and 0.3-1.2 cm broad; spikelets crowded with many bristles, variable in size. The fertile lemma as long as the spikelet, containing a bisexual flower. Grain oblong, greenish white.

Germination : Spring (March).

Fl. & Fr. : June - September.

Dissemination : Mainly by wind and animals.

Habitat : A weed of fallow lands, margins of paddy fields and orchards preferring moist situations. Indicator of fertile and well aerated sandy loams.

Root system : The rootstock is small but stout from which arise long slender adventitious roots which go up to 15 cm deep in soil.

Geographical distribution : Most warm, temperate and tropical countries of the world.

Specimens examined : *Kapoor* 1488 (5-7-1951) Yarikha fields; *Kaul* 332 (2-8-1972) Shalteng fallow lands.

Local use : The tall grass is used as a fodder crop.

Chromosome report : 2n = 18 (DCA 425).

Setaria verticillata (L.) P. Beauv., Essai Agrost 51, 1812; FBI 7 : 80; Collett 587; Bor 365; Stewart 125.

Panicum verticillatum L. Sp. Pl. 82, 1762.

Annual herbs. Stem erect, up to 55 cm, generally branched, many stems arising from the base; glabrous, leafy. Leaves linear, up to 15 5 cm x 1.1 cm (in the middle), tapering in to an acute apex, margins wavy, retrorsely hispid; sheaths sometimes as long as the blade, glabrous or hairy. Inflorescence a spiciform panicle, cylindrical, rod-shaped, up to 12.5 cm x 1.0 cm; spikelets densely crowded, subtended by many long bristles with reversed barbs. Lower glume shorter than the upper glume which is as long as the upper lemma, Lower lemma empty and upper hermaphrodite, palae transparent as long as the upper lemma, completely enclosing the grain. Grain oblong, shining up to 2 mm diam.

Germination : The seeds are produced in large numbers and germinate readily on falling on suitable substrate. Late spring (April-May).

Fl. & Fl. : July-November.

Dissemination : Wind and grazing animals.

Habitat : An occasional weed of paddy fields, lawns and orchards preferring moist and shady situations. Indicator of nitrogenous sandy loams.

Root system : Slender nodal roots go up to 10 cm deep in soil.

Associations recorded : It is generally seen associated with legumes as *Medicago lupulina* and *Trifolium repens.*

Geographical distribution : Widely distributed in tropical and temperate regions of the Old World introduced into America (Bor 1960).

Specimens examined : *Kaul* 344 (7-9-1972) Barzulla orchards.

Chromosome report 2n=18, 36 (Bor 1960).

PENNISETUM L.C. Richard ex Persoon

Key to the species

1. Spikelets only one on a stalk; bristles not fringed **flaccidum**
1. Spikelets 1-5 on a stalk, bristles fringed **orientale**

Pennisetum flaccidum Griseb. in Goett. Nachr. 86, 1868; FBI 7 : 84; Collett 589; Bor 344; Rao in BOBSI 2 (3 & 4) : 419. 1960; Stewart 123.

Perennial tufted grass with a creeping rootstock. Stem up to 70 cm erect, many arising from the base, generally unbranched, stout below and slender above, glabrous. Leaves linear lanceolate, up to 29.5 cm long and 5 mm broad in the middle, flat, glabrous or margins somewhat hispid. Inflorescence a dense spike-like raceme, up to 20 cm long. Spikelets generally one on a stalk, densely arranged all over the rachis, stalk small surrounded at the base by numerous bristles 0.7 - 2.2 cm long, greenish white or reddish, naked or covered by very minute silky hairs near the base. The upper glume and lemma of the upper floret almost of similar size, 3-5 nerved and mucronate; lemma of the lower floret generally male. Ovary small with 2 long feathery styles coming out of the spikelet to receive foreign pollen. Grain oblong but very small, pale and smooth.

Field notes : Two forms of this species collected from different habitat conditions in Srinagar fields can be observed.

Form No. 1 is commonly more tufted, with thick rootstock and grows in dry locations in stones and gravelly soil. Stems many arising from the base, up to 50 cm in height. Spikelets up to 3.5 mm long, surrounded by bristles up to 0.9 cm long and generally white and naked.

Fl. & Fr. : September - October.

Specimens examined : *Kaul* 289 (23-9-1971) Shalimar; *Kaul* RRL 19739 (30-9-1971) near Dalgate and Shankeracharya hill, dry fallow fields.

Form No. 2 is little or not tufted, rootstock thin and generally occurs in moist and shady situations and fertile soils; stem solitary, arising from the base, generally unbranched, up to 70 cm tall or at times 1 metre tall; spikelets up to 7 mm long surrounded by bristles up to 2.2 cm long, generally reddish in colour, naked or covered with silky hair near the base.

Specimen examined : *Kaul* 271 (30-7-1971) Harwan paddy fields.

Pennisetum orientale L.C. Rich in Pers., Syn. Pl. 1 : 72, 1805; FBI 7 : 86; Collett 589;

Bor 345; Rao in BOBSI 2 (3 & 4) : 419, 1960; Stewart 123.

Perennial grasses with a thick and stout creeping rootstock. Stem erect or decumbent below and ascending, many arising from the base, up to 50 cm, densely leafy near the base, glabrous. Leaves linear, lanceolate, up to 17.5 cm x 5 mm tapering into a spike-like raceme, up to 12.5 cm long; spikelets usually 2-5 on a small stalk or rarely one, lax on the rachis, surrounded by numerous long unbranched bristles fringed with white silky hairs on either side, inner bristles much longer than the spikelet, tips tinged with reddish or pinkish colour. Lower glume much shorter than the upper glume as in the preceding species. Lower lemma generally with a male flower and upper lemma bisexual. Upper glume and upper lemma of the same size, 5-nerved and mucronate. Grain oblong, smooth and shining.

Germination : The seedlings are seen in spring (April - May).

Fl. & Fr. : August - October.

Dissemination : The plants propagate vegetatively and by seed. The seeds are disseminated by wind.

Habitat : An occasional weed of dry locations, almond orchards and some moundy slopy fallow fields. Indicator of dry compact gravelly soils.

Root system : A short and thick perennial rootstock covered with coriaceous scales and adventitious roots arising from it.

Geographical distribution : Western Himalaya, Concan, Bihar, Westwards to Arabia, Iraq, Iran and North Africa.

Specimens examined : *Kaul* RRL 19740 (30-9-1971) near Shankaracharya Hill, Srinagar; *Kaul* 333 (3-8-1972) Shopian almond orchards.

Chromosome report : 2n = 36 (Bor 1960).

ECHINOCHLOA Palisot de Beauvois

Key to the genera

1. Spikelets crowded in 3-7 rows on the spike, generally awned **crus-galli**
1. Spikelets in clusters of 3 on the spike, generally unawned **colonum**

Echinochloa crus-galli (L.) P. Beauv. Ess. Agrost. 161, 1812; Bor 310; Polunin 551; Stewart 120.

Panicum crus-galli L. Sp. Pl. ed. 1, 56, 1753; FBI 7 : 30; Collett 581.

Annual grasses. Stem erect or sometimes decumbent, branched or unbranched, glabrous, up to 75 cm tall, ribbed and finely grooved. Leaves linear, up to 30 cm long and 3 cm broad at the base, tapering towards the apex, flat, midrib, definite and slightly raised from the under sarface, margins smooth and very sharp sometimes giving a cut to hand, surfaces generally glabrous but at times minutely hairy; ligule absent. Spikes arranged on simple or compound racemes; racemes 10.5 cm - 20.5 cm long. Spikes sessile - subsessile, upper becoming shorter, nodes are bearded and rhachilla is villous; in some forms nodes are glabrous or slightly pubescent. Spikelets densely packed on the spikes in 3-7 rows or even more; each spikelet obovate to oblong, 3-5 mm diam., sessile or subsessile. Outer glume very small cup-shaped, glabrous or hairy; inner glume as long as the spikelets 3-5 nerved, generally hairy. Lemma of upper and lower floret of

almost equal size, 5-7 nerved generally awned, when awned, awn is 2 - 4.5 cm long and scabrid, lower spikelets in the spikes somewhat short awned. Palea coriaceous short but shining white. The grain is in obovoid so called utricle, rounded or flattened on both sides.

Germination : Late spring (May).

Fl. & Fr. : July - September.

Dissemination : The seeds contaminate paddy while harvesting and are also disseminated by irrigation water and wind.

Habitat : A common weed of paddy fields. Indicator of fertile clay loams.

Root system : A thoroughly branched adventitious root system going up to 25 cm deep in the soil. The roots remain interwoven with the roots of crop (paddy).

Geographical distribution : Very common throughout India, Burma, Malaya, Sri Lanka and South-east Asia. Generally extended to the sub-tropics of Africa.

Specimens examined : *Kaul* RRL 16070 (29-7-1971) Shalimar Paddy fields; *Kaul* 338 (16-8-1972) Pampore vegetable fields.

Local name : Hama.

Remarks : The seeds are eaten during food scarcity. The culms and the leaves are fed to cattle. A weed survey of paddy fields reveal that this weed ranks first in dominance and frequency. It is very difficult to control this weed as it germinates and matures with the crop. It is a variable weed.

Echinochloa colonum (L.) Link, Hort. Berol. 2 : 209, 1833; Bor 308; Stewart 119.

Panicum colonum L. Syst. Nat. ed. 10, 2 : 870, 1759; FBI 7 : 32; Collett 582.

Annual herbs. Stem about 60 cm long, branches arising from the base, erect or ascending, glabrous, leafy. Leaves linear lanceolote, blades 15-25 cm x 0.3-0.7 cm, glabrous, margins scaberulous and sharp, ligule white membranous. Spikelets in clusters of 3, crowded on 1.5-3 cm long branches of an apical erect panicle. Glumes 2, lower, empty and one third the length of upper. Lemma 2, hard, unawned, slightly hairy near the base, brownish. Grain enclosed within the shining pale.

Germination : Early summer (early June).

Fl. & Fr. : August-October.

Dissemination : The seeds are disseminated by irrigation water and animals that feed upon it.

Habitat : A common weed of orchards, vegetable fields and well irrigated maize fields.

Root system : Adventitious roots arise from the base of the stem and go up to 15 cm deep in soil.

Geographical distribution : All warm countries of the world.

Specimens examined : *Kaul* RRL 19702 (16-9-1971) Shalteng maize fields; *Kaul* 319 (7-7-1972) Raj Bagh, Srinagar, fallow fields; *Kaul* 349 (4-10-1972) Barzulla Srinagar, near paddy fields.

Local name : Hama.

Remarks : A good fodder plant.

Chromosome report : 2n = 36, 48, 54, 72 (Bor 1960).

IMPERATA Cyrillo

Imperata cylindrica (L.) P. Beauv. Essai Agrost. 165, 1812; Bor 169; Komarov in Fl. URSS 2 : 6, 1963; Polunin 551.

Langrus cylindricus L. Syst. Nat. ed. 10, 878, 1759.

Imperata arundinacea Cyrill. Pl. Rar. Neap. 2 : 26, 1792. FBI 7 : 106.

Perennial herbs with a thin but tough and creeping, much branched rootstock. Stem erect, 10-35 cm, rarely branched, culms glabrous, shining and fistular but slightly bearded at the nodes, purplish at maturity towards the base. Leaves linear, flat and spreading with a small blade ending into a fine point, sheath slightly longer than the blade, glabrous or slightly hairy; leaves crowded at the base. Spikelets in spiciform or thyrsiform panicles almost hidden in the silky white hairs which are twice as long as the spikelets. Panicles dense up to 20 cm long (generally 11 cm long). Glumes 2, similar or one shorter than the other, overlapping, membranous, hardly up to 5 mm long, hairy, awnless. Lemma 2, inside the glumes, awnless, fringed at the apex; palea transparent, small, enclosing the ovary. Stamens 2 with brown long anthers extruded out of the glumes. Ovary with a long style and two linear stigmas coming out of the flower; anthers clung to the stigma as the flowers mature. Grain small oblong, free, The ovary is surrounded by long dense silky hairs spread out which help in dispersal of the grain.

Germination : Early spring (Feb - early March).

Fl. & Fl. : May-July.

Dissemination : The plants propagate vegetatively and by seed. The seeds are small and light and easily carried by wind.

Habitat : A common weed of orchards and margins of paddy lands preferring moist places. Indicator of moist, compact alluvials.

Root system : A stout creeping rootstock lies in the surface layers of soil and sends slender adventitious roots up to 10 cm deep in the soil.

Geographical distribution : Warm and temperate parts of Asia, extending to Australia and S. Africa.

Specimens examined : *Kaul* 215 (22-6-1970) Badgam paddy fields; *Kaul* RRL 16016 (19-3-1971) Rawalpora, fallow fields; *Kaul* 306 (12-5-1972) Barzulla orchards.

Remarks : The plants form pure association whenever present due to its active mode of vegetative reproduction.

CHRYSOPOGON Trinius

Chrysopogon gryllus (L.) Trin. Fund. Agrost. 188. 1820; Bor 117; Stewart 107.

Andropogon gryllus L. Cent. Pl. 2 : 33, 1756; FBI 7 : 188; Collett 603.

Tall perennial tufted grass with a creeping deep and stout rootstock. Stem up to 1 m tall, simple, terete or compressed, culm thick and hollow, glabrous. Leaves mostly towards the base, 20-60 cm long and up to 5 mm broad in the middle, tapering into an acute apex, glabrous or mostly hirsute, margins scabrid, midrib and other veins distinct; ligule narrow, ciliate. Panicle 6-20 cm long, branches in a whorl, 3-8 cm long, usually many, tip of the branches truncate, densely bearded, axils hairy or glabrous. At the tip of the branches the spikelets are in threes', very often brownish or purplish, one sessile in the centre and two pedicelled side-ways. Sessile spikelets linear, up to 1.2 cm long; glumes 2 more or less equal, involute; lemma hyaline lanceolate, margins ciliate, awn

generally shorter than the spikelet. Pedicellate spikelets with stalks more than half of the spikelet, linear lanceolate. Glumes similar, acuminate or aristulate, 3-8 nerved, margins ciliate; lemma and palea hyaline. Stamens 3, with linear long anthers.

Field notes : An occasional weed of orchards. The perennial tufted rootstock perennates while the aerial portion dies soon after maturity. The rootstock forms new dormant buds which are capable of producing new plants when favourable season commences. Grains are also produced in good quantity

Fl. & Fr. : May - July.

Specimens examined : *Kaul* RRL 19738 (30-9-1971) Dalgate, fallow fields; *Kapoor* 2635 (15-6-1962) Yarikha grasslands.

Geographical distribution : Temperate Himalaya : Simla to Khasi and Naga hills.

Remarks : It is considered to be a good fodder in Australia (Bor, 1941).

Illustration : Collett fig. 191.

Chromosome report : 2n=40 (Bor 1960).

SORGHUM Moench

Key to the species

1. Stem up to 1 m tall, nodes generally bearded **nitidum**
1. Stem up to 2 m tall, nodes pubescent **halepense**

Sorghum nitidum (Vahl) Pers. Syn. Pl. 1 : 101, 1805; Bor 245; Stewart 114.

Holcus nitidus Vahl, Symb. Bot. 2 : 102, 1791.

Andropogon serratus Thunb. Fl. Jap. 41, 1784; FBI 7 : 185.

Perennial tall grasses. Stem erect, up to 1 m, culms hollow or solid near the apex, nodes hairy or bearded, glabrous, purplish towards the base. Leaves simple, linear, narrow, tapering towards the apex, glabrous on margins, sometimes setose, sheath slightly shorter than blade, often glabrous or more or less hairy; ligules very short, truncate. Panicles branching 10-30 cm long, glabrous, reddish at maturity. Spikelets both sessile and pedicellate. Sessile spikelets obovoid, 0.3-0.8 cm long, outer glume brownish, polished with pale tips; inner somewhat longer and hirsute. Lemmas shorter than the glumes, unawned, palea membranous. Pedicellate spikelets with slender, terete pedicels, 0.5 - 1.5 cm long; outer glume 3-5 nerved, inner 3-nerved; lemmas transparent.

Field notes : A common weed found in orchards, wheat and maize fields. The rootstock is thin but much branched and creeping. The weeds start appearing in spring and remain in fields up to autumn. It is considered to be an obnoxious plant as it spreads very fast.

Fr. & Fl. : August-November.

Specimens examined : *Dutt* 9070 (3-10-1962) Batwara fallow fields; *Kaul* RRL 19742 (30-9-1971) Dalgate fallow fields.

Geographical distribution : Throughout India, Asia, Australia.

Chromosome report : 2n=20 (DCA 418).

Sorghum halepense (L.) Pers. Syn. Pl. 1 : 101, 1805; Bor 222; Polunin 554; Stewart 113 **(Fig. 89)**

Holcus halepense L. Sp. Pl. 1047, 1753.

Andropogon halepensis (L.) Brot. var. *genuinus* (Hack.) Stapf in Hook. f., FBI 7 : 183, 1896.

Perennial grass with long creeping and somewhat stoloniferous roots. Stem up to 2 m tall, erect, branched or unbranched, culm hollow or even solid, rachis of spikes fragile, nodes slightly pubescent. Leaves simple, up to 75 cm long including the sheath and 1.5 cm broad in the middle, tapering into an acute apex, glabrous or villous at the base, sheaths terete, margins scabrid; ligules rounded and membranous. Panicles up to 50 cm long, very variable, ramified, suberect and whorled branches, bases of branches often pubescent. Spikes with 3-7 pairs of spikelets, often pedicellate ones are male and sessile ones are fertile. Sessile spikelet is 0.3-0.8 cm long, purplish green, callus sparsely bearded, hairs silky. Glumes 2, outer with involute margins embracing the other, 3-7 veined, veins running parallel; inner glume shorter with ciliate margins. Lemmas much shorter than glumes, glabrous or rarely hirsute, hyaline, 1-3 veined, often awned, sometimes awn is absent, when present longer than the spikelet and scabrib; palea linear oblong with ciliolate margins. Stamens 3 with linear purplish anthers. Ovary small with 2 diverging styles; stigma feathery, purplish protruding out. Grain oblong, as long as the inner glume, glabrous and shining. pedicellate spikelets with a stalk half the length of the sessile spikelet or shorter. Glumes 2, shorter and narrower than that of the sessile spikelet, margins hirsute but surfaces are glabrous, membranous. Lemmas shorter, glabrous awned or not. These spikelets are generally male or rudimentary.

Germination : The seed germinate in early spring (February) and also in autumn.

Fl. & Fr. : July-December.

Dissemination : The plants propagate vegetatively and by seed. The seeds are disseminated by wind and man during agricultural operations.

Habitat : A common weed of orchards, maize fields growing in moist as well as dry situations. Indicator of well aerated silty loams.

Root system : A perennating somewhat thick rootstock producing larger adventitious roots at nodes.

Geographical distribution : According to Snowden (1955) this weed is indigenous to India, but introduced from Mediterranean region, Europe and also warm places of world.

Specimens examined : *Kaul* 241 (1-8-1970) Hyderpora maize fields; *Kaul* 314 (15-6-1972) wheat fields, Barzulla; *Kaul* 346 (1-10-1972) Maize fields, Badgam.

Local name : Durham.

Remarks : A fast spreading noxious weed.

Chromosome report : 2n= 40 (Bor 1960).

BOTHRIOCHLOA O. Kuntze

Bothriochloa ischaemum (L.) Keng in Contr. Biol. Lab. Sci. Soc. China, Bot. Ser. 10 : 201, 1936; Rao in BOBSI 2 : 419, 1960; Bor 108; Polunin 552; Stewart 106.

Andropogon ischaemum L. Sp. Pl. 1047, 1753.

Perennial tufted herbs. Stem erect or decumbent, up to 55 cm, slender, generally unbranched, glabrous or slightly hairy at the joints. Leaves generally aggregated near the base, linear lanceolate, up to 20 cm long including the sheath, and up to 5 mm broad at the base tapering into a fine point, margins fringed with hairs; ligule in the form of a small row of hairs. Inflorescence of 2-10

narrow, spike-like clusters each up to 6 cm long, arising from the apex of the stem. Spikelets paired, somewhat compact on the primary axis. Sessile spikelet generally fertile and awned. Pedicelled spikelet similar with a stalk nearly half as long as the glume and densely covered with spreading hairs. Glumes similar and awnless. Caryopsis small, oblong, glabrous.

Germination : Seedlings sprout in spring (March).

Fl. & Fr. : April - November.

Dissemination : The plants propagate vegetatively and by seed. The seeds are dispersed mainly by wind.

Habitat : A common weed of orchards and vegetable fields, generally associated with *Cynodon dactylon* and *Poa annua*. Indicator of sandy or silty clayey loams.

Root system : A creeping slender rootstock with nodal roots.

Geographical distribution : Tropical Africa, Australia and Pacific isles.

Specimens examined : *Kaul* 219 (22-6-1970) Badgam orchards.

Illustration : Polunin, pl. 182.

CYMBOPOGON K.P.J. Sprengel

Key to the species

1. Spikes woolly with long silky white hairs — **jwarancusa**
1. Spikes thinly or shortly hairy — **olivieri**

Cymbopogon jwarancusa (Jones) Schult. Syst. Veg. 2 : 458, 1824; Bor 128; Stewart 108.

Andropogon jwarancusa Jones in Asia. Res. 4 : 109, 1795; FBI 7 : 203; Collett 604.

Tufted perennial grass with creeping rootstock. Stem erect, up to 1 m tall, firm branched or unbranched, glabrous. Leaves linear lanceolate up to 50 cm long; blades flat, ending into a fine tip, sheaths more or less inflated below, glabrous or sometimes hairy, ligules shortly oblong, membranous, ciliolate. Panicles long, usually interrupted in between by joints, with distant or crowded branches. Spathe leaf-like, purplish, enclosing the spathioles and the branched racemes. Racemes unequal, 0.5 - 2.0 cm long, spikelets 3-4 paired, sessile spikelets up to 5 mm long, lowest pair of the sessile racemes homogamous, those of the peduncled racemes heterogamous. Outer glume obovate, 3-4 nerved, nerves not distinct, somewhat hairy but the base is villous with silky hairy; inner glume somewhat shorter. Lemma narrow, 2-3 mm long, membranous, hyaline, cleft at the top, lobes subulate and ciliate, awn up to 5 mm long. Pedicelled spikelets with a pedicel half its size. Upper and lower glumes similar in size texture and shape but former 5-7 nerved, and the latter 3-nerved. Lemma hyaline. Grain oblong.

Field notes : The plant possesses a tufted habitat and mostly prefers to grow in drier situations. It has been seen to grow in fallow lands, on mounds and even on stone walls. The rootstock is perennial and tufted and produces dormant buds. These buds produce new plants at the outset of favourable season.

Fl. & Fr. : June-October.

Geographical distribution : Temperate Himalaya : from Simla east-wards to Khasi and Naga hills.

Specimens examined : *Kaul* RRL 19741 (30-9-1971) near Dalgate on stone walls; *Kapoor* 2662 (22-7-1941) Shankeracharya Hill, Srinagar.

Remarks : It yields an essential oil.

Chromosome report : 2n =40 (Bor 1960).

Cymbopogon olivieri (Boiss.) Bor in Notes Roy. Bot. Gard. Edinb. 25 : 62, 1963; Stewart 108.

Andropogon olivieri Boiss. Diagn. Ser. 1, 5 : 76, 16S4.

Cymbopogon schoenanthus auct non L. (1753); Spreng., Pugill. 2 : 15, 1815; Bor 131.

Andropogon schoenanthus L Sp. Pl. 1046, 1753; FBI 7 : 204; Collett 604.

Perennial herbs with an aromatic rootstock. Stem 50-75 cm long, erect, many branches arising from a common rootstock, glabrous, leafy. Leaves linear lanceolate, 7-16.5 cm x 0.5-1.5 cm, sheath loose, blade, fine-tipped, slightly hairy near the margins. Spikelets sheathed in a spathe-like bract up to 1.7 cm long; 3-6 pairs on a spike; the spikes are crowded on an erect branched panicle 12-30.5 cm long, joints fringed with short white hairs. Sessile spikelets with a male or rudimentary flower; flowering glume narrow, bifid with a rather thick awn. Grain oblong, yellowish brown.

Germination : Late spring (April-May).

Fl. & Fr. : July - September.

Dissemination : Seeds dissemination by animals and wind, vegetative propagation is also efficient.

Habitat : A rare weed of fallow fields preferring dry situations and gravelly soils.

Root system : The adventitious roots arise from the underground perennial rootstock and go up to 25 cm deep in the soil.

Geographical distribution : West Asia, Tropical Africa.

Specimens examined : *Kaul* 362 (3-7-1973) Shalteng fallow fields.

Remarks : It yields an essential oil. It can be used for checking erosion.

DIGITARIA Haller

Key to the species

1. Racemes digitate or sub-digitate. Leaves with sparsely pubescent sheaths and slightly pubescent blades **longiflora**
1. Racemes digitate, denerally corymbose. Leaves glabrous or with slightly pabescent sheaths
   2. Racemes corymbose, pubescent in the lower axils. Lower glumes absent, upper 3-5 nerved. **setigera**
   2. Racemes never corymbose, less pubescent **sanguinalis**

Digitaria longiflora (Retz.) Pers. Syn. Plan. 1 : 85, 1805; Bor 302; Rajagopal and Panigrahi in Proc. Nat. Acad. Sci. Sec. B, 37(1) : 33, t. 12, 1967; Stewart 118.

Paspalum longiflorum Retz. in Obs. Bot. 4 : 15, 1786; FBI 7 : 17.

Annual tufted grasses. Stem generally procumbent, branches ascending up to 25 cm long, slender, tufted at the base, slightly hairy at nodes, leafy. Leaves simple, more towards the base, blade as long as the sheath, flat, margins sharp, surface covered with white irregular hairs, the sheath is sparsely pubescent. Racemes 2-3, often 2, up to 6 cm long, rachis flattened and somewhat

winged. Spikelets oblong-ovate, up to 1.2 mm long, hairy, hairs verrucose, 2-flowered. Upper glume up to 1.1 mm long, 3-nerved, lower glume very small. Lower floret sterile, lemma up to 1.2 mm long, membranous, hairy between the nerves. Lower floret hermaphrodite with a lemma and small palea enclosin the grain. Grain plano-convex, up to 2 mm long, glabrous and shining.

Germination : Late spring (May).

Fl. & Fr. : July - October.

Dissemination : Wind and irrigation water.

Habitat : An occasional tufted weed of kitchen gardens, flower beds preferring moist situations. Indicator of fertile and well aerated alluvials.

Root system : The roots are fibrous and arise in bunches from the base of the tufted stem entering the superficial layers of the soil.

Geographical distribution : Tropics of the Old World. Probably a spontaneous introduction in Kashmir fields.

Specimens examined : *Kaul* 249 (17-8-1970) RRL Campus, Srinagar.

Chromosome report : 2n = 18 (Bor 1960).

Digitaria setigera Roth ex Roem. & Schult. Syst. Veg. 2 : 474, 1817; Bor 305; Stewart 119.

Paspalum sanguinale Lamk. var. *extensum* Hook. f. FBI 7 : 15, 1897.

Annual grasses. Stem erect procumbent, slender, generally unbranched, up to 35 cm long, glabrous, fast green, leafy. Leaves linear lanceolate, blades up to 10.5 cm long, broader at the base and narrowing into an acute, apex, sheath shorter than the blade, generally glabrous; ligule small turning brownish at maturity. Inflorescence in the form of several digitate to corymbose racemes, generally coming out from the axil of involucral leaf. Each raceme slender, erect up to 7.5 cm long with a winged and flattened, glabrous or slightly hairy rachis. Spikelets oblong to obovate, 2-nate, lower with a very small pedicel and upper with a pedicel half as long as the spikelet. Spikelets 2-flowered, lower flower is reduced; glume one, lower one lacking, up to 4 mm long, 3-5 nerved, slightly pubescent, hairs white. Lower floret neuter, lemma up to 3-5 mm long, membranous and hyaline, many nerved, nerves not distinct, palea very small. Upper floret bisexual, lemma 3-nerved, nerves distinct, enclosing the bisexual flower. Stamens 3 with yellowish or brownish linear anthers, filaments very small and slender. Ovary small with long styles exserting the brownish stigma. Caryopsis enclosed in the fertile lemma and palea up to dehiscence.

Germination : Late spring (April-May).

Fl. & Fr. : August-September.

Dissemination : The seeds are disseminated by wind, grazing animals and man.

Habitat : A common weed of orchards, kitchen gardens, *Crocus* fields preferring moist shady situations. Indicator of clayey loams.

Root system : A somewhat creeping stem rooting at nodes, the fibrous nodal roots remain in the surface layers of soil.

Associations recorded : It is generally associated with *Cynodon dactylon*, *Poa annua* and *Eleusine indica*.

Geographical distribution : India, Burma, and Thailand.

Specimens examined : *Kaul* 343 (2-9-1972) Shalteng fallow fields, Srinagar.

Digitaria sanguinalis (L.) Scop. Flor. Carn. ed. 2, 1 : 52, 1772; Bor 304, Stewart 118.

Panicum sanguinale L. Sp. Pl. 57, 1753.

Paspalum sanguinale (L.) Lamk. Tab. Encycl. Meth. Bot. 1 : 176, 1791; FBI 7 : 13.

Annual grass. Stem erect, ascending from a creeping, geniculate base, up to 40 cm, glabrous, smooth, terete; nodes puberulous, lower rooting. Leaf blades spreading, lanceolate-acuminate, slightly contracted at the base, 3.0-15.5 cm x 3-7 mm, sheaths open, glabrous or slightly hairy near the ligule; ligule truncate and membranous. Inflorescence made of several false spikes or racemes, lower spreading, 5-8 cm long, often flexuous, almost panicled. Racemes slender with a somewhat winged rachis, margins of which are scaberulous. Spikelets 2-nate, with small pedicels, pedicel of lower spikelet smaller than that of upper, giving an idea of a sessile and pedicellate spikelet. Each spikelet is ovate-oblong, up to 4 mm long, greenish or violet, acute, rather laxly imbricate, pubescent. Lower glume very small, silky, upper up to 4 mm long, 3-nerved, margins silky. Lower floret sterile, lemma up to 3 mm long, 5-7 nerved, margins often scantily hairy. Upper floret hermaphrodite, lemma 3-3.5 mm long, rather turgid. Stamens 3 with purplish linear anthers. Ovary with 2 long styles and feathery violet stigma. Caryopsis oblong, up to 1.5 mm long.

Germination : Late spring (May).

Fl. & Fr. : August-September.

Dissemination : Mostly by wind and water and to a certain extent by man during crop harvesting.

Habitat : An occasional weed of orchards, fallow lands and margins of paddy lands preferring moist situations. Indicator of compact fertile soils.

Root system : The adventitious roots arise in bunches from the base of the main stem.

Geographical distribution : Himalaya; from Iskardo to Kashmir; Sikkim and Manipur

Specimens examined : *Kaul* 251 (17-8-1970) Batmallo fallow fields.

AGROPYRON J. Gaertner

Key to the species

1. Flowering glumes 3-5 nerved **canaliculatum**
1. Flowering glumes 7-many nerved **striatum**

Agropyron canaliculatum Nevski in Bull. Jard. Bot. Acad. Sci. URSS 30 : 509, 1932; Bor 659. **(Fig. 90)**

Agropyron longearistatum Boiss. Fl. Orient. 5 : 660, 1884; FBI 7 : 368; Collett 632.

Perennial tufted grass. Stem erect up to 75 cm, ascending from a decumbent base, glabrous, fistular, leafy. Leaves narrowly lanceolate, blade up to 25 cm long, convolute, sheaths generally shorter than blades, glabrous; ligule short and membranous. Spikes up to 20 cm long, nodding with decurved tops; spikeletes arranged alternately on zig-zag rachis, obovate 2 - 3.2 cm long including the awn, 6-flowered. Glumes 2 at the base, of variable size, lower shorter than the upper, distinctly nerved, mucronate Lemmas up to 3 cm long along with the awn, palea thin and membranous enclosing the flower. Stamens 3, anthers linear, yellow. Ovary small hairy with long styles. Caryopsis narrowly oblong, with hairy tip.

Field notes : A tufted perennial grass very uncommon in fields preferring drier locations, growing in stones on walls and on mounds

Fl & Fr. : July - September.

Specimens examined : *Kaul*, 318 A (1-7-1972) Baramulla on mounds; *Kapoor* 3141 (9-8-1951) Sonamarg fallow dry, gravelly fields.

Geographical distribution : Afghanistan, Iran, Ethiopia and Tibet.

Agropyron striatum Nees ex Steud., Syn. Pl. Gram. 1 : 346, 1854; FBI 7 : 369; Bor 666. **(Fig. 91)**

Perennial tall and robust grass. Stem tufted at the base, more than 1 m tall, fistular, nodes distinct, glabrous, leafy. Leaves linear up to 40 cm, flat, involute, margins slightly dentate, ending in a long point, ligule small or even absent. Spikes up to 15 cm long, rachis stout and glabrous, zig-zag with spikelets arranged alternately. Spikelets long, 7-9 flowered; glumes 2, empty, subequal, 5-7 nerved, nerves strong when dry, deeply channelled. Lemmas up to 2.5 cm long, awned; awn sometimes as long as the lemma; palea thin and membranous, margins ciliolate. Ovary small, concealed in the palea. Grain oblong.

Field notes : In habit the plant is similar to the preceding species and occurs occasionally in cultivated fields.

Fl. & Fr. : May - July.

Specimens examined : *Kapoor* (June, 1961) Yarkha fields. Rare.

Geographical distribution : Temperate Himalaya.

LOLIUM Linnaeus

Lolium temulentum L. Sp. Pl. 83, 1753; FBI 7 : 364; Collett 632; Polunin 539; Stewart 154. **(Fig. 92)**

Perennial tufted grass. Stem erect up to 50 cm. generally unbranched, many arising from a common rootstock, glabrous, fast green. Leaves linear, blades much longer than the sheath, flat glabrous, margins sharp and smooth; ligules short. Spikes up to 17.5 cm long, erect; spikelets sessile, arranged on alternating distichous hollows of the rachis, up to 3 cm long, 5-7 or rarely many flowered. Glume single, empty, linear up to 2.8 cm long, tapering into an acute apex, generally 5-7 nerved, glabrous with somewhat membranous margins. Each flower with an awned lemma which is up to 1 cm long (excluding the awn); palea membranous, serrulate with an adherent ovary; lodicules very small, fleshy. Stamens 3 with linear anthers up to 3 mm long and small, slender filaments. Ovary small with 2 feathery styles. Grain ovate to oblong or obovate, surfaces smooth and shining.

Germination : Early spring (Late Feb. - March).

Fl. & Fr. : May - June.

Dissemination : The seeds are disseminated mainly by animals feeding on it and to some extent by man during mowing and weeding.

Habitat : A common weed of orchards, vegetable fields and also margins of paddy fields preferring moist conditions. Indicator of compact sandy or silty loams.

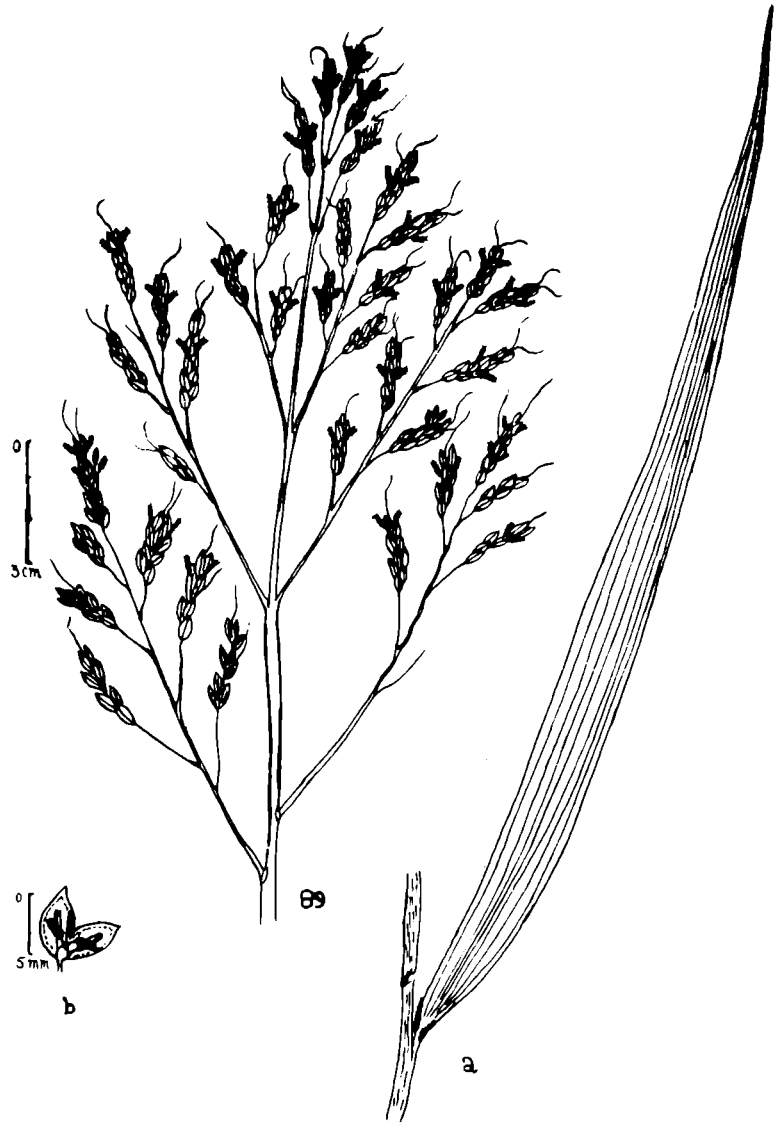


Fig. 89. *Sorghum halepense* (Linn.) Pers. (an inflorescence)
a. a leaf b. a flower

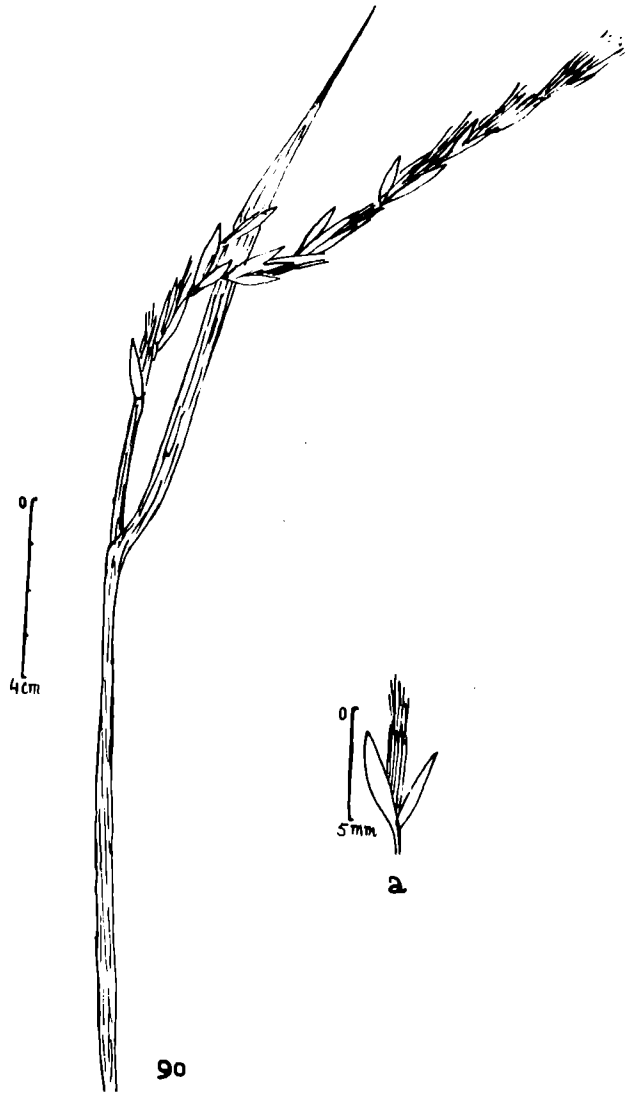


Fig. 90. *Agropyron canaliculatum* Nevski (a flowering shoot)
a. a spikelet

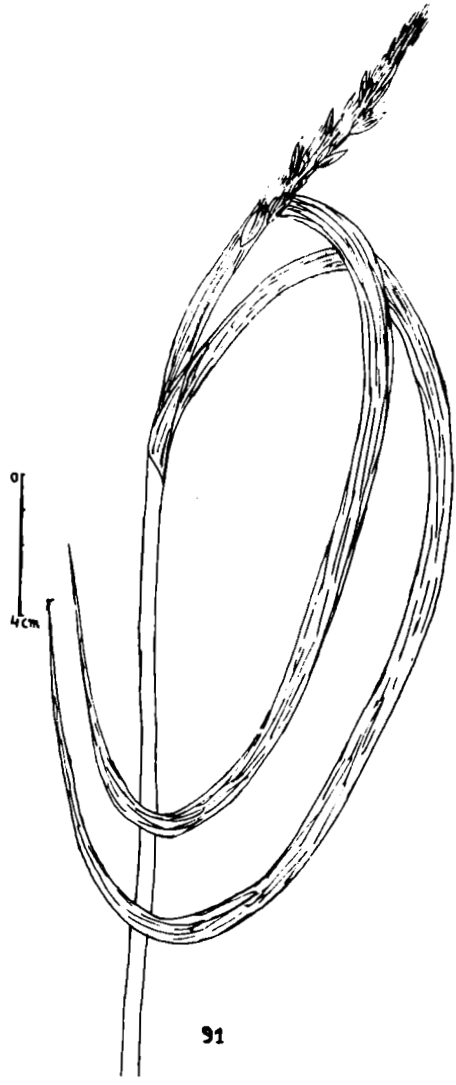


Fig. 91. *Agropyron striatum* Nees ex Steud. (a flowering shoot)

Fig. 92. *Lolium temulentum* Linn. (a flowering shoot)
a. a spikelet, b. ovary with lemma

Root system : Adventitious roots are produced in bunches from the base of stem which are aggregated to form tufts.

Associations recorded : This grass is commonly associated with *Cynodon dactylon, Hordeum murinum, Senecio vulgaris* etc.

Geographical distribution : Europe, North Asia, and western Himalaya.

Specimens examined : *Kapoor* 2638 (16-6-1952) Yarikha orchards; *Kaul* 315 (27-6-1972) University Campus, Srinagar.

Chromosome report : 2n=14 (Bor 1960).

HORDEUM Linnaeus

Hordeum murinum L. Sp. Pl. 85, 1753; FBI 7 : 377; Rao in BOBSI 2 : 420, 1960; Bor 676; Polunin 531. **(Fig. 93)**

A tufted annual grass. Stem up to 50 cm, erect or ascending from a descending base, glabrous, jointed, light green, leafy. Leaves linear, blades up to 11.5 cm long, protruding into an acute apex, margins slightly hairy; sheaths shorter than the blades, slightly hairy, ligule short and membranous. Inflorescence spikelike, terminal, up to 12 cm long, awned. Spikeletes 3-nate, central spikelet of the trio fertile and lateral ones male or sterile. Glumes of the central spikelet lanceolate, with ciliate margins, long awned; lemma membranous, 3-5 nerved, awn up to 5 cm long; palea small adherent to the ovary. Glumes of the lateral spikelet bristle like, margins scabrid, long-awned; lemmas lanceolate with an awn 2-4 cm long. Stamens 3 with linear protruding anthers. Ovary with 2 short feathery brown styles. Grain small, grooved on one side and slightly hairy at the apex.

Germination : Spring (March).

Fl. & Fr. : May - July.

Dissemination : Mostly by man and animals.

Habitat : A common weed of orchards, wheat fields, fallow places. In some orchards it forms a pure community. Indicator of well aerated clay loams.

Root system : Adventitious root system and slender fibrous roots going up to 8 cm deep in soil.

Geographical distribution : Kashmir, west wards to Atlantic.

Specimens examined : *Kaul* 308 (1-6-1972) Barzulla wheat fields.

Local uses : A good fodder plant.

Chromosome report : 2n=14, 28 (DCA 451).

PHLEUM Linnaeus

Phleum paniculatum Huds. Fl. Angl. 33, 1762; Bor 403; Stewart 130.

Phleum asperum Jacq. Collectan. 1 : 110, 1786; FBI 7 : 237; Collett 610.

Annual grasses. Stem tufted, many arising from the decumbent base, jointed, stout, glabrous, leafy. Leaves linear, blades up to 11.5 cm long, broad at the base and tapering into an acute apex, sheaths loose, veins distinct and running parallel, margins scabrid, fast green; ligules very short and membranous, sometimes lacking in mature plants. Inflorescence panicled, spikelets densely arranged, panicle up to 12.5 cm, long, cylindric rodshaped. Spikelets up to 3 mm long, green flattened, 1-flowered, rhachilla prolonged beyond the flower. Glumes 2, ovate, acute

ending into a strong point, rigid, empty. Lemma obovate to oblong much shorter than the glumes, transparent, margins membranous, parallel veined, veins faint, fertile, enclosing a bisexual flower. Stamens 3, anthers linear, filaments slender, longer than the anthers. Ovary small, styles 2, short and feathery. Grain up to 1.5 mm diam, ending into a strong point, glabrous and shining.

Germination : Spring (March),

Fl. & Fr. : May-August.

Dissemination : The seeds are dispersed by wind and irrigation water and to some extent by man.

Habitat : A common tufted weed of orchards vegetable fields, margins of paddy fields and also wheat fields. Indicator of fertile clay loams.

Root system : The root system is adventitious and profuse, penetrating up to 13 cm deep in the soil.

Geographical distribution : Western Himalaya; West Asia and Europe.

Specimens examined : *Kapoor* 2614 (25-5-1952) Srinagar; *Kaul* 316 (27-6-1972) Barzulla orchards.

Remarks : The plants are used as fodder for animals. The seed are very small and produced in large numbers.

Chromosome report : 2 n = 28 (DCA 436).

ALOPECURUS Linnaeus

Key to the species

1. Perennial grasses with creeping rootstock and stout stem with ovoid to oblong panicles **arundinaceus**
1. Annual grasses with stout or slender stem and cylindrical panicles **geniculatus**

Alopecurus arundinaceus Poir. in Lamk., Encycl. Meth. Bot. 8 : 776, 1808; FBI 7 : 238; Bor 393; Rao in BOBSI 2 : 419, 1960; Polunin 545; Stewart 127.

Perennial herbs with stem stout, creeping at the base, ascending up to 75 cm tall, glabrous, jointed, hollow between the joints, leafy. Leaves linear with blades up to 21.5 cm long, sheaths much shorter than the blade, inflated, glabrous or slightly hairy, crowded at the base, margin of the blade slightly dented. Ligule short, rounded and membranous. Panicle ovoid or oblong, generally oblong up to 5 cm long, solitary on an unbranched peduncle, fast green. Spikelets ovate, subsilky, soft, densely arranged on the rachis forming a compact panicle. Glumes 2, ovate to lanceolate up to 6 mm long, acuminate, subequal, more or less connate at the base, margins membranous, veins green not very distinct. Lemma up to 4.5 mm long, transparent, tip scaberulous, awn inserted at or above the middle, slender, generally as long or longer than the lemma. Ovary small with 2 short feathery styles. Grain oblong, glabrous.

Field notes : A tall weed with a creeping rootstock, growing in dry locations in orchards and fallow lands. The rootstock is thick and perennates, producing new culms every year. Seeds are produced in good quantity. It is an occasional weed but possesses a gregarious habit. The culms are cut and are fed to the cattle. It is supposed to be relished by goat.

Fl. & Fr. : May-July.

Specimens examined : *Kapoor* 2619 (15-6-1952) Yarikha orchards and grasslands.

Geographical distribution : Western Himalaya : Kashmir to Garhwal; Westwards to Europe and N. Asia.

Alopecurus geniculatus L. Sp. Pl. 60, 1753; FBI 7 : 239; Collett 610; Bor 393; Rao in BOBSI 2 : 419, 1960; Polunin 545; Stewart 127.

Annual grasses with stem erect up to 55 cm with a decumbent base, jointed, tufted, densely leafy throughout its length, glabrous. Leaves linear, blades lanceolate up to 11.5 cm x 0.5 cm, tapering into an acute apex, margins sharp, glabrous with spreading small white hairs; sheaths generally shorter than the blade, upper ones inflated, dull green; ligule short, rounded and membranous. Inflorescence a spike-like panicle, cylindrical up to 6.5 cm long, spikelets oblong-flattened, up to 4 mm long, 1-flowered, pubescent, yellowish, densely arranged on the rachis. Glumes 2, nearly equal, boat-shaped, empty, keels fringed, more or less united near the base. Lemma as long as the glumes, margins membranous, awn inserted on the back near the base. Stamens 2 or at times 3, anthers linear, exserting at maturity. Ovary small with 2 long, distinct and feathery styles. Grain ovate, flattened loosely enclosed in glumes.

Field notes : An occasional weed growing in moist, marshy and water-logged soils. The bunches of adventitious roots arise from the base of each plant which fix the weed tightly in moist soils. The stem is branched from the base and gives the tufted habit. The plant is being fed to cattle and makes good fodder.

Fl. & Fr. : May-July.

Specimens examined : *Kaul* RRL 16026 (29-5-1971) Awantipore fallow fields; *Kapoor* 3125 (21-8-1953) Kangan fields along streams.

Geographical distribution : Nearly all temperate regions of the world.

Chromosome report : 2 n = 28 (DCA 437).

POLYPOGON Desfontaines

Polypogon monspeliensis (L.) Desf. Fl. Atlan. 1 : 67, 1798; FBI 7 : 245; Collett 612; Bor 403; Polunin 544; Stewart 131.

Alopecurus monspeliensis L. Sp. Pl. 61, 1753.

Annual tufted grasses. Stem erect or decumbent near the base, up to 35 cm, purplish when mature, unbranched but many stems arise independently from the base, glabrous, leafy. Leaves crowded at the base, blades linear up to 9.5 cm x 0.8 cm, tapering into an acute apex, margins sharp; sheaths very small inflated towards the basal portion of the stem, glabrous, ligule short and membranous. Spikelets ovate, nearly sessile, 1-flowered, aggregated in a dense cylindrical spike-like panicle. Glumes 2, connate at the base, ovate, margins fringed, pubescent, green, veined, persistent. Lemma slightly shorter than the glume, margins membracous, enclosing a floret. Stamens 1-3 with minute anthers. Style short, inconspicuous. Grain oblong, shining and glabrous.

Germination : Spring (March).

Fl. & Fr. : May - August.

Dissemination : The seeds are light, produced in large numbers and are carried by wind.

Habitat : An occasional weed of orchards, fallow lands and some wheat fields possessing a gregarious habit. Indicator of silty clay loams.

Root system : Many slender adventitious roots arise from the base of the stem and enter the surface horizons of the soil.

Geographical distribution : Tropical and some temperate regions including Europe.

Specimens examined : *Kaul* 317 (1-7-1972) Barzulla wheat fields.

Chromosome report : 2n=28 (Bor 1960).

AGROSTIS Linnaeus

Agrostis stolonifera L. Sp. Pl. 62, 1753; Bor 390; Stewart 127.

Agrostis alba auct. non L. (1753); FBI 7 : 254; Collett 613.

Perennial tufted grasses. Stem erect, generally weak up to 65 cm, unbranched, many stems arising independently from the rootstock, jointed, glabrous, leafy. Leaves linear, blades flat with margins sometimes in rolled, up to 21.5 cm x 0.5 cm, tapering into an acute apex, margins smooth, surfaces somewhat rough covered with short spreading hairs; sheaths loose, much shorter than the blade, glabrous, ligule small and membranous. Inflorescence a compound, branched and spreading panicle; spikelets narrowly ovoid to obovate, green or purple tinged, shining and glabrous. Glumes 2, nearly equal, lower up to 3.5 mm. and upper 2.5 - 3 mm. long, boat shaped, mucronate, persistent, glabrous, lower rough, shining. Lemma slightly shorter than the glumes, membranous, veins faint glabrous, falling off with the seed; palea nearly half as long as glume, membranous, enclosing seed. Stamens 3, extruded at maturity, anthers linear on slender filaments. Ovary small with 2 small feathery styles, grain oval, enclosed in the palea and lemma, shining.

Field notes : An occasional weed of fallow lands preferring to grow on muddy and stony walls and mounds. The weed has a tufted habit and produces profusely branched bunches of roots which anchor the plants in the soil. This plant can be used to check soil erosion because of its tufted habit and profuse root system. The seeds are very small and light, produced in large quantities, taken by birds. It has got a hard pericarp which can not be easily digested by birds and is thrown with faeces, thus helping the dispersal of plants. It does not reproduce vegetatively but mostly by its seed.

Fl. & Fr. : June - September.

Specimens examined : *Kapoor* 2678 (9-7-1952) Yarikha fields; *Kaul* 330 (1-8-1972) Magam fallow fields.

Geographical distribution : Temperate Himalaya and Europe.

Chromosome report : 2n=28 (Bor 1960).

STIPA Linnaeus

Key to the species

1. Spikelets oblong-lanceolate up to 1.2 cm long, green; awn about twice as long as the spikelet, stout, twisted and hairy towards the base only **sibirica**

1. Spikelets oblong-lanceolate up to 0.8 cm long, green or purplish; awn as long or shorter than the spikelet, slender, erect, not twisted, glabrous **splendens**

Stipa sibirica (L.) Lamk. Tab. Encycl. Bot. 1 : 158, 1791; FBI 7 : 231; Collett 609; Bor 646; Rao in BOBSI 2 : 419, 1960; Stewart 169. **(Fig. 94)**

Avena sibirica L. Sp. Pl. 79, 1753.

Perennial grasses. Stem tufted, arising from a thick rootstock, stout, erect up to 95 cm, jointed, hollow, smooth, simple,

branched, leafy. Leaves linear, blades lanceolate, up to 50 cm long, more open sheaths in mature plants, glabrous, veins distinct, running parallel. Inflorescence a loose spreading much branched panicle, up to 31.5 cm long, branches terete, scaberulous. Spikelets oblong lanceolate, terete, pedicels as long or shorter than the spikelets, 1-flowered. Glumes 2, equal, lanceolate, sub-hyaline, 3-7 nerved, margins membranous and slightly scabrid, glabrous persistent. Lemma oblong, nearly as long as the glume, membranous, hairy, awn nearly as long as lemma or often more, twisted scabrid, erect, slightly hairy at the base enclosing a bisexual flower; palea as long, quite adherent to the ovary, dorsally hairy. Ovary oblong with 2 short feathery deciduous styles. Grain oblong, pointed towards the apex, smooth and shining, slightly grooved near the base on the dorsal surface.

Germination : Late spring (May).

Fl. & Fr. : August - November.

Dissemination : The plants reproduce vegetatively and by seed. The seeds are disseminated by wind.

Habitat : A common weed of fallow lands, pastures and more common in forest. Indicator of organic matter in soils.

Root system : A much tufted rootstock sending adventitious roots up to 20 cm deep in the soil.

Geographical distribution : Western temperate Himalaya : from Kashmir to Kumaon Afghanistan, Siberia to Korea.

Specimens examined : *Inayat* 20361 (23-7-1896) Kangan, Kashmir (CAL); *Meebold* 1953 (Sept., 1900) Baramulla, Kashmir (CAL); *Kaul* 295 (18-11-1971) Chari-Sharif fallow fields.

Remarks : A common weed said to be poisonous. It does not allow its associates to grow in competition.

Local name : Gumai.

Chromosome report : 2n=24 (Bor 1960).

Stipa splendens Trin. in Spreng. Neve Entdeck 2 : 54, 1821; FBI 7 : 233; Stewart 170.

Perennial tufted grasses. Stem erect, many arising from the thick, stout and creeping rootstock, up to 75 cm, smooth and shining, culms thicker towards the base, leafy. Leaves with linear lanceolate and convolute blades up to 25.5 cm long; sheaths as long, loose, smooth or scaberulous, light green or yellow green Inflorescence a loose, spreading and much branched panicle, up to 35 cm long, pyramidal when open, branches semi-verticillate, capillary, smooth. Spikelets oblong lanceolate, 1-flowered pedicellate; pedicel as long or shorter than the spikelet, slender and glabrous; green or generally purplish. Glumes 2, oblong, apex acute, up to 8 mm long, 1-nerved, margins membranous, glabrous, empty and persistent. Lemma as long as the shorter glume, membranous, faintly veined, enclosing a bisexual flower and palea, awn slender as lond as or shorter than the spikelet; palea villous adherent to the ovary. Stamens with bearded anthers-tips. Ovary small with 2 small white feathery styles. Grain oblong, pointed towards both the ends with a small depression an one side, glabrous.

Field notes : A rare weed of fallow fields-having a tufted habit with thick and stout

creeping perennating rootstock. The plant prefers to grow in dry localities in stones and is seen to grow on walls of cement and concrete.

Fl. & Fr. : August-October.

Specimens examined : *Kaul* RRL 19742 A (30-9-1971) near Shankeracharya hill, a muddy wall.

Geographical distribution : Western Tibet and Siberia.

Chromosome report : 2n = 48 (DCA 455).

AVENA Linnaeus

Avena fatua L. Sp. Pl. 80, 1753; FBI 7 : 274; Collett 617; Bor 434; Polunin 540.

Annual grasses. Stem erect up to 75 cm, many culms arising from the base, fistular, unbranched, smooth and shining, leafy. Leaves linear lanceolate, blades many-veined, rough with scabrid margins, long pointed; sheaths smooth; ligule oblong, truncate or jagged, membranous. Panicle pyramidal much-branched, up to 30 cm long, loose with spreading smooth and terete branches. Spikelets oblong-lanceolate, stalked, stalks slender and unequal rough; 2-3 flowered, pendulous. Glumes 2, oblong, mucronate, up to 2.2 cm long, equal, 7-9 nerved; nerves distinct, margins membranous, empty and persistent. Lemma oblong up to 1.8 cm long, finely hairy, thin and membranous apex acute, 2-lobed; awn three times the length of glume, tough and twisted, arising below the middle of lemma; palea membranous and small with a tuft of bristle-like hairs at the base. Stamens with long anthers coming out of the diverging glumes, filaments slender, shorter than the anthers. Ovary small with 2 distinct diverging feathery styles. Grain oblong furrowed on one side, slightly hairy at the top.

Germination : Late spring (May).

Fl. & Fr. : August - November.

Dissemination : The seeds get disseminated by wind, water and to some extent by man.

Habitat : An occasional weed of fallow roadsides, and wheat fields inhabiting dry locations. Indicator of gravelly soils.

Root system : A bunch of adventitious roots arise from the base of the stem and go up to 10 cm deep.

Geographical distribution : A common weed of tropical cultivated fields. North west Himalaya, Europe, N. Africa and N. Asia.

Illustration : Geigy Weed Tables fig. 10.1.

Specimens examined : *Kaul* 347 (1-10-1972) Qazigund on roadsides.

HELICTOTRICHON Besser ex J.A. et J.H. Scbultes

Helictotrichon pratense (L.) Pilger in Fedde, Rep. Sp. Nov. 45 : 6, 1938; Bor 439; Polunin 541.

Avena pratensis L. Sp. Pl. 80, 1753; FBI 7 : 276.

Perennial grasses. Stem tufted, erect, up to 75 cm unbranched, fistular, glabrous or slightly hairy near the base, smooth and shining towards the middle and apex. Leaves mostly radical, linear lanceolate, blades 5 cm - 13.5 cm x 0.3 - 0. 5 cm, tapering into an acute apex; sheaths slightly hairy; cauline leaves a few with longer sheaths than blades, margins of blades sharp and slightly scabrid; ligule oblong, membranous and small. Panicles up to 15 cm long, drooping; spike-

lets generally 5-11 in a panicle, generally 3 arising from a node, pedicels slender, terete, glabrous or scabrid, unequal, longer or shorter than the spikelets, 2-flowered. Glumes 2, oblong lanceolate, up to 3.5 cm long, one slightly longer than the other, distinctly green-veined and white membranous margined, persistent. Lemma slightly shorter than the glumes, hairy below the middle; hairs silky and spreading, awned, awn up to 5 cm long, starting below the middle of lemma, sticky, geniculate, twisted near the base. Palea membranous and transparent, hairy at the base, keeled, nearly adherent to grain. Grain up to 6 mm long with a distinct median ridge or furrow.

Field notes : An occasional tufted weed of orchards and wheat fields. It prefers to grow in moist, shady and humic conditions. The spikelets are long, green and shining with long brown awns protruding out of the glumes. It mostly reproduces by its seed.

Fl. & Fr. : May-July.

Specimens examined : *Kaul* 169 (8-5-1970) Rawalpora orchards (wheat growing).

Geographical distribution : Western Himalaya : Kashmir to Garhwal. Widespread in Europe and Turkey.

Chromosome report : 2n = 14, 28, 42 (DCA 448).

CYNODON L.C. Richard

Cynodon dactylon (L.) Pers. Syn. Pl. 1 : 85, 1805; FBI 7 : 288; Collett 620; Bor in Indian For. Rec. 2 (1) : 110, pl. 22, 1941; Bor 469.

Panicum dactylon L. Sp. Pl. 58, 1753.

Perennial grass with long running and spreading runners. Stem often decumbent with ascending culms, leafy. Leaf blades flat, up to 9.5 cm long, linear, acuminate, subulate, glabrous smooth, rough on the margins; sheaths shorter than the blades, elongate above, glabrous; ligule represented by a short and narrow ciliate rim. Inflorescence consisting of 2-8 digitate, diverging and spreading green or purplish spikes up to 7 cm long. Spikelets ovate, acuminate, laterally compressed sessile in 2 rows on one side of a slender, compressed or angular, scaberulous, continuous rachis and appressed to it; rhachilla jointed above the glumes, sometimes with a rudimentary lemma. Glumes 2, subequal up to 0.8 cm long, narrow, acuminate, 1-nerved, persistent or falling off. Lemma up to 3 mm long oblong, obliquely oblong to ovate, membranous, awnless, strongly compressed, 3-nerved, pubescent on the keel, containing a hermaphrodite floret; palea linear-oblong, very minute. Lodicules 2. Stamens 3, anthers pale purple, linear up to 1.5 mm long, extruded; stigmas feathery and purple. Grain oblong flattened, up to 1 mm long, enclosed in the palea.

Germination : The grass starts sprouting at the onset of spring (early March).

Fl. & Fr. : July-October.

Dissemination : The grass propagates vegetatively and also by seed. The seeds are disseminated by wind and water.

Habitat : A common weed of orchards, margins of paddy fields, vegetable fields, fallow fields and practically all fields of cultivation. Indicator of fertile silty clayey loams.

Root system : Nodal roots are slender and arising from long creeping runners binding the grass tightly in soil.

Specimens examined : *Kaul* 233 (20-7-1970) Srinagar lawns.

Geographical distribution : Throughout India and tropical countries of the world.

Remarks : The grass forms the turf of the lawns and public gardens. As a weed it efficiently overpowers other plants like *Poa annua*, *Medicago lupulina* etc. in competition.

Local name : Dramun.

Chromosome report : 2n=30, 36, 40 (Bor 1960)

ELEUSINE Gaertner

Eleusine indica (L.) Gaertn. Fruct. 1 : 8, 1789; FBI 7 : 293; Bor 493; Stewart 145.

Cynosurus indicus L. Sp. Pl. 72, 1753.

An annual grass. Stem creeping, culms up to 60 cm long, arising from a decumbent base, glabrous, smooth, leafy. Leaves linear with flat blades up to 21.5 cm long, acuminate, flaccid, glabrous or with a few hairs near the base; sheaths flattened open near the base of the stem, slightly hairy, ligule narrow and membranous, ciliate. Spikes 3-7, digitate, radiating from the top a slender glabrous peduncle. Spikes up to 10.5 cm long, erect or slightly decurved; rachis slender, flat scabrid on margins, ending in a terminal spikelet. Each spikelet ovate up to 4 mm long, acuminate, 3-6 flowered. Glumes 2, lower up to 2.5 mm long and upper 3.5 mm or more in length, boat shaped, 3-7 nerved, shortly apiculate, scabrid on the keels. Lemmas ovate or oblong, slightly longer than glumes, thin and membranous, margins broadly hyaline; palea shorter 2-nerved somewhat adherent to the ovary. Lodicules small and cuneate. Grain oblong, up to 2 mm long, obscurely trigonous, tip obtuse or rounded.

Germination : Early spring (late Feb.-early March).

Fl. & Fr. : May-August.

Dissemination : The plants propagate vegetatively and by seed. The seeds are disseminated by wind, water and animals which graze on it.

Habitat : An occasional weed of lawns, orchards, margins of paddy fields and kitchen gardens preferring moist situations. Indicator of clayey loams.

Root system : A somewhat creeping stem, rooting at nodes. The nodal roots are slender.

Geographical distribution : Throughout India and Tropical regions of Old World.

Specimens examined : *Kaul* 318 (1-7-1972) Batmaloo kitchen gardens.

Remarks : A weed generally associated with *Cynodon dactylon* but easily distinguishable. It is also used as a fodder plant.

Cnromosome report : 2n=18, 36 (DCA 429).

SCLEROCHLOA Palisot de Beauvois

Sclerochloa dura (L.) P. Beauv. Essai Agrost. 97, t. 19, f. 4, 1812; FBI 7 : 335; Bor 563; Polunin 536; Stewart 159.

Cynosurus durus L. Sp. Pl. 72, 1753.

Annual herbs. Stem prostrate, spreading, branched from the base, up to 15 cm long branches, slender, flattend, leafy. Leaves with linear blades up to 5.5 cm long and 0.3 cm wide, sheaths very small, open, glabrous, rough, green when young and turning yellow at maturity; lower leaves soon falling off; ligules membranous, short and torn. Inflorescence a spiciform dense, oval, 2-4 cm long panicle. Spikelets ovate or obovate, 0.6-1 cm long and slightly less broad, greenish white,

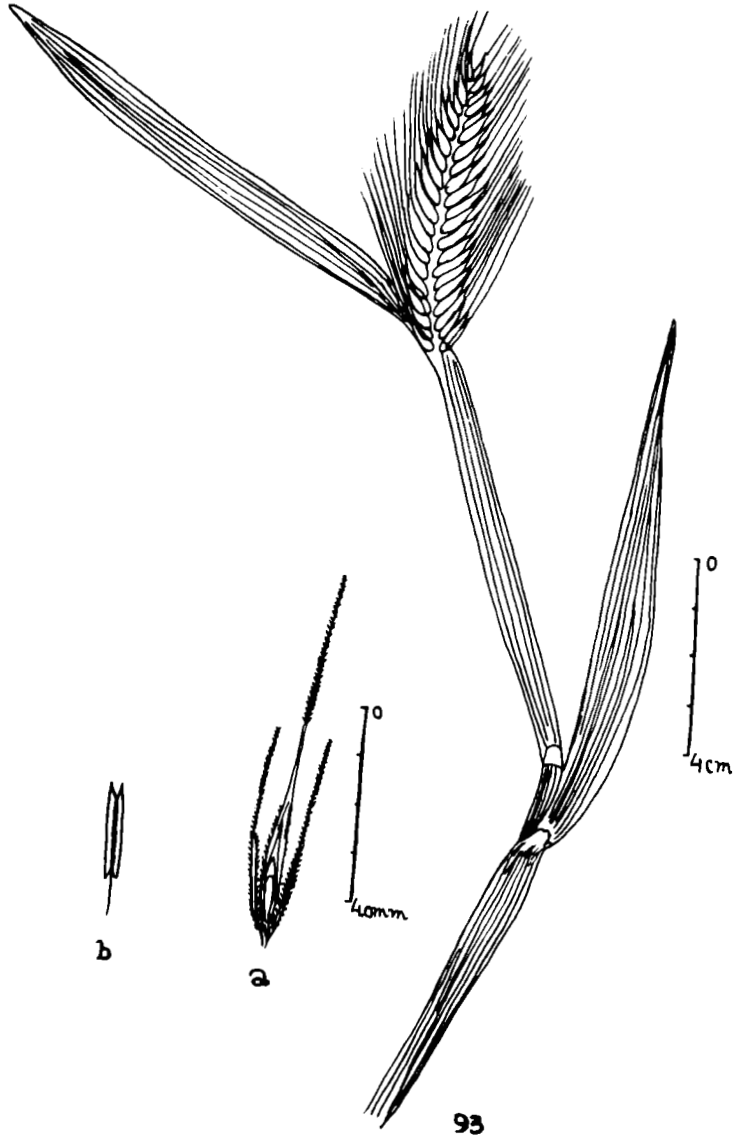


Fig. 93. *Hordeum murinum* Linn. (a flowering shoot)
a. a flower, b. a stamen

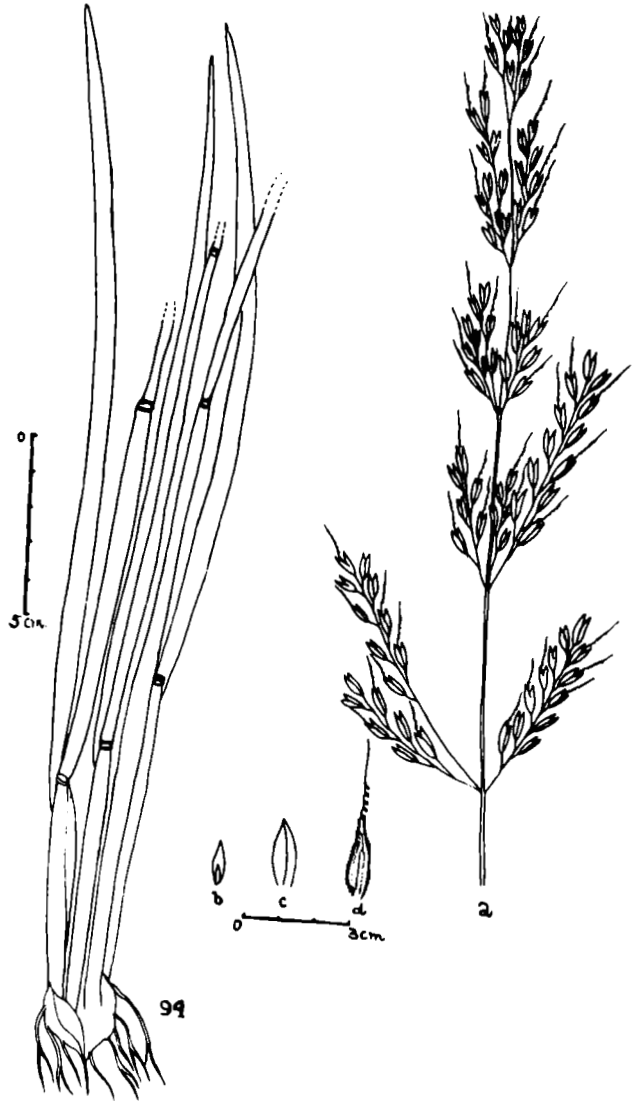


Fig. 94. *Stipa sibirica* (Linn.) Lamk. (a flowering shoot)
a. an inflorescence, b. outer glume, c. inner glume, d, twisted awned glume

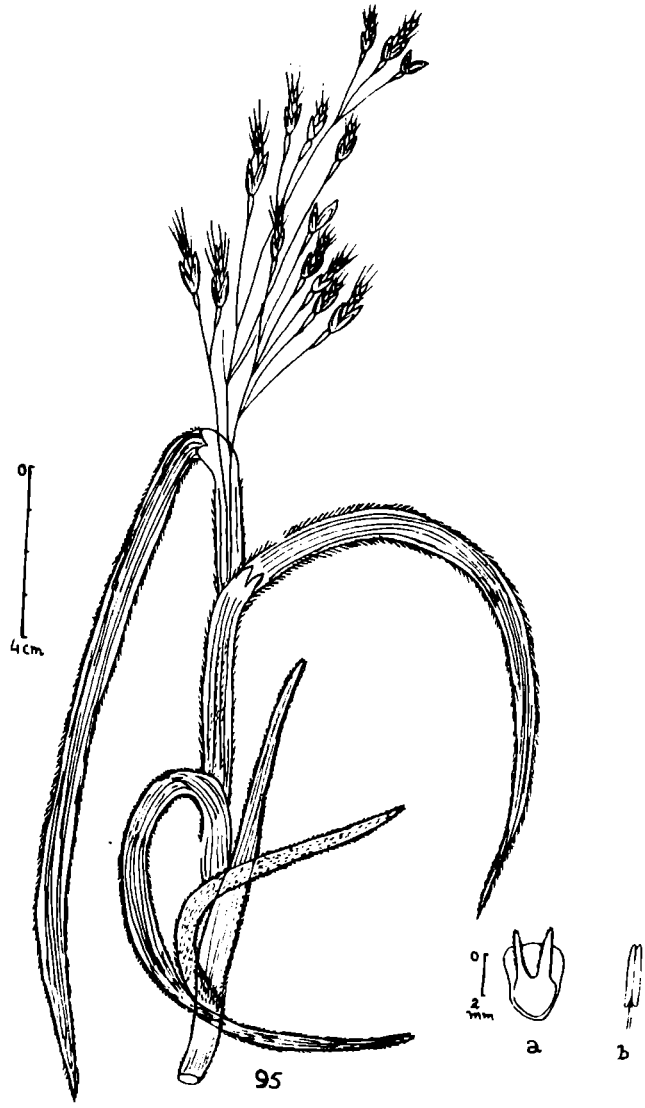


Fig. 95. *Bromus inermis* Leyss. (a flowering shoot)
a. ovary with styles, b. a stamen

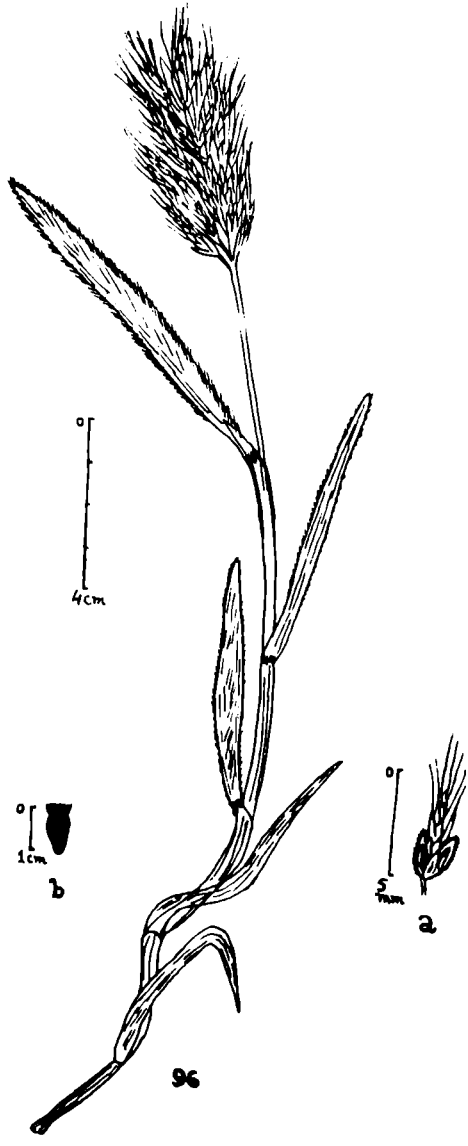


Fig. 96. *Bromus scoparius* Linn. (a flowering shoot)
a. a spikelet, b. a grain

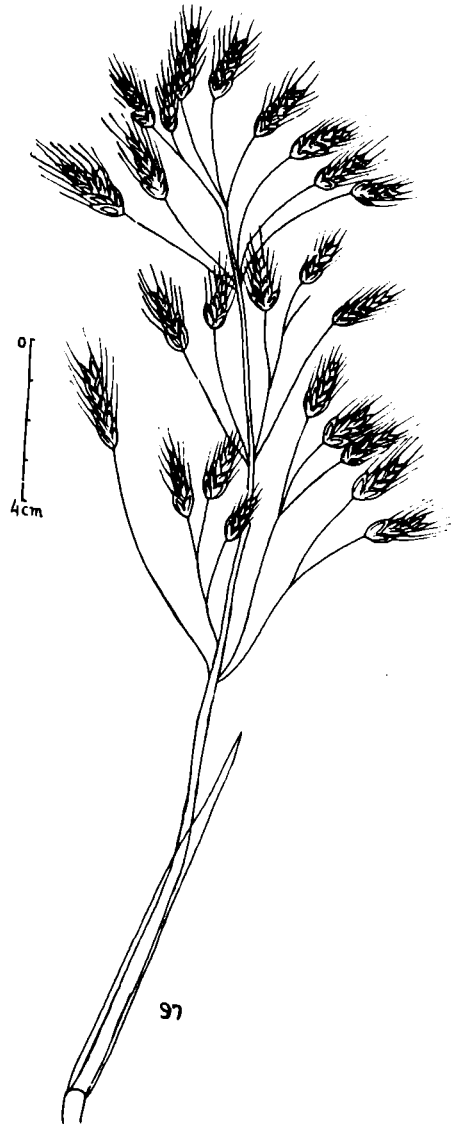


Fig. 97. *Bromus lanceolatus* Roth (a flowering shoot)

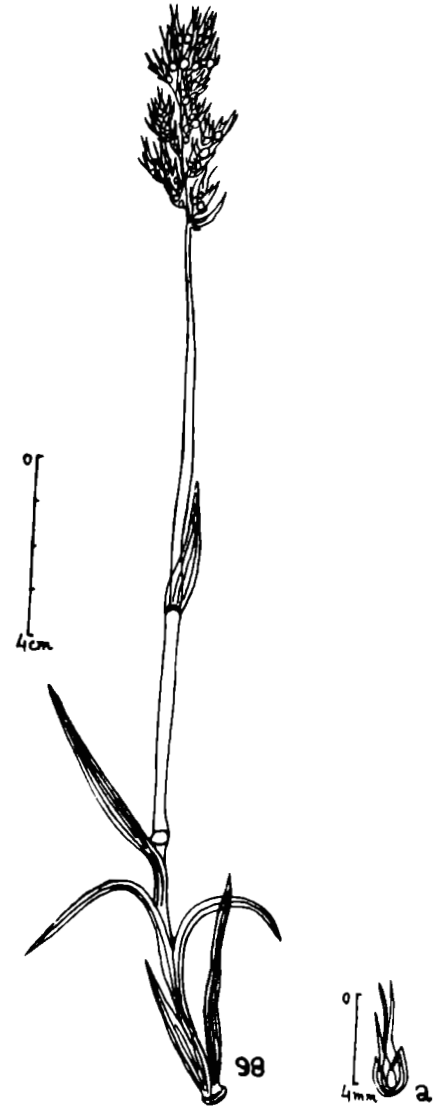


Fig. 98. *Poa bulbosa* Linn. (a flowering shoot)
a. a spikelet

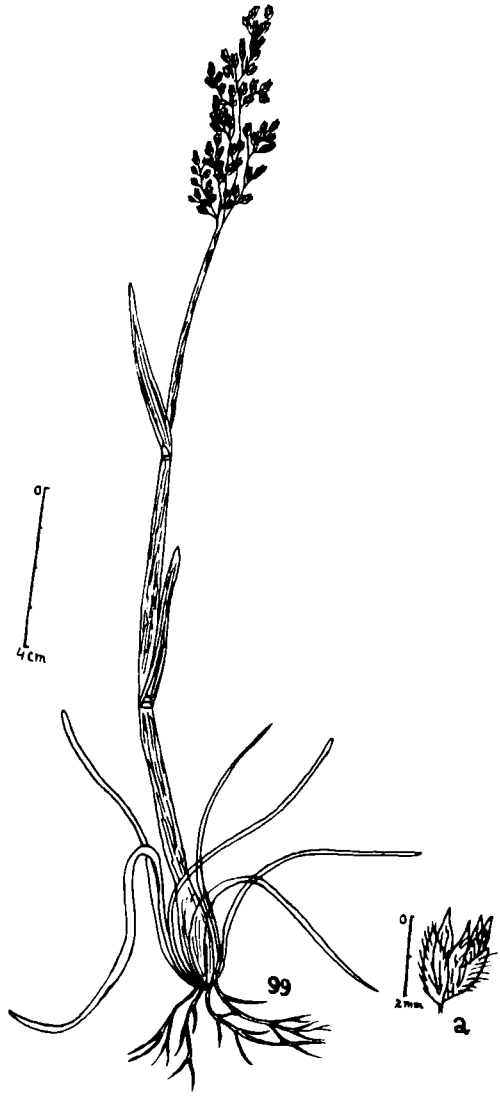


Fig. 99. *Poa angustifolia* Linn. (a flowering shoot)
a. a spikelet

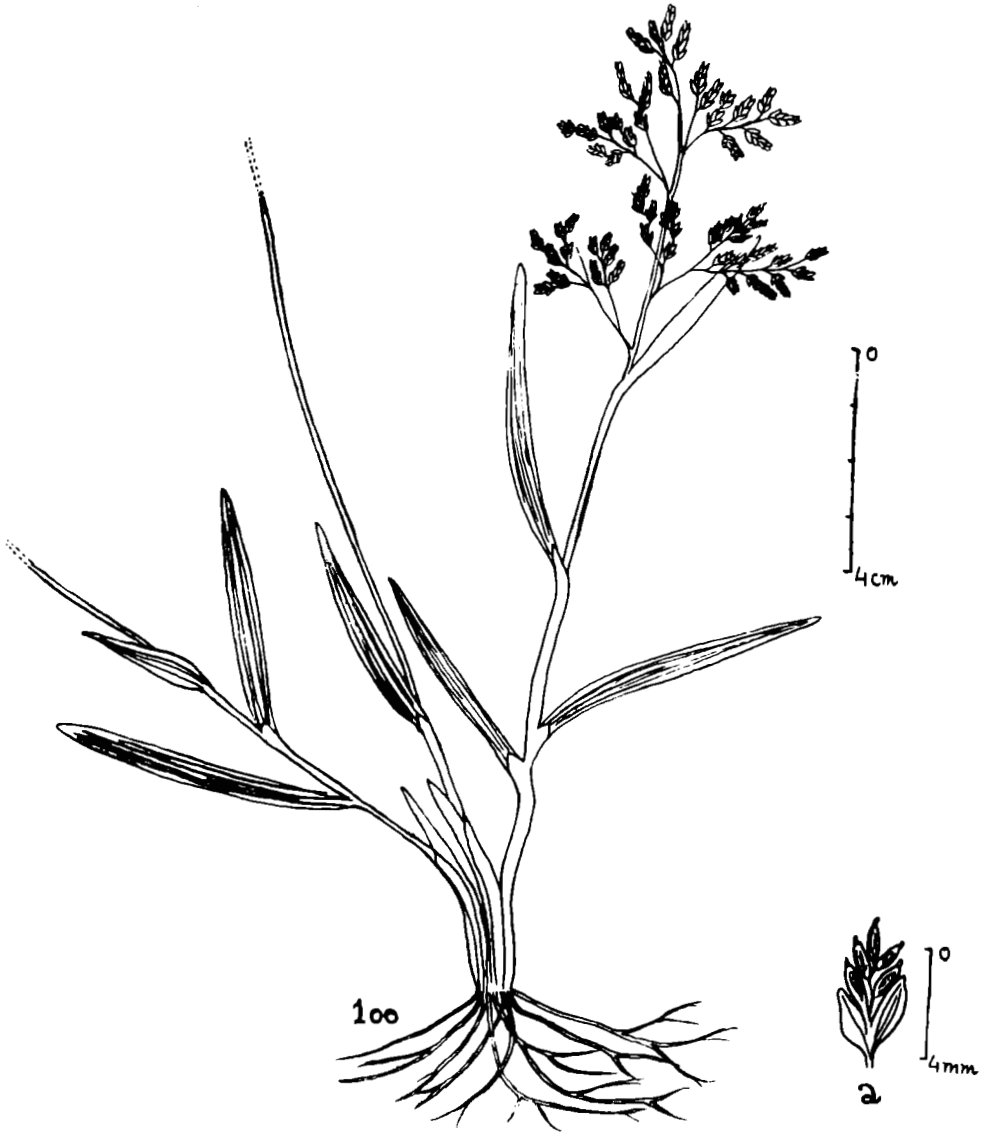


Fig. 100 *Poa annua* Linn. (a flowering plant, in part)
a. a spikelet

dense on one side of the rachis, sessile. Glumes 2, unequal, lower one oval up to 2 mm long, upper up to 3.5 mm, apex blunt, margins membranous, 3-5 veined, glabrous. Lemmas obovate, slightly longer than the glumes, blunt, with papery margin, fine-veined, each enclosing a floret. Palea small, slightly enclosing the grain. Lodicules 2, ovate, apex toothed. Grain minute, oblong, completely enclosed in the lemma and palea with slightly cleft tip.

Germination : Early spring (Feb.-March).

Fl. & Fr. : May-July.

Dissemination : A common weed propagating vegetatively as well as by seed. The seeds are dispersed by wind and water.

Habitat : It is generally invading lawns and lands preferring moist situations. Indicator of silty clayey loams.

Root system : A somewhat creeping stem rooting at nodes.

Geographical distribution : Western Himalaya and the most European countries.

Specimens examined : *Meebold* 1932 (June, 1905) Srinagar (CAL); *Kapoor* 2619 (26-5-1952) Srinagar; *Koul* 263 (2-6-1971) RRL campus, Srinagar.

Chromosome report : 2n=14 (DCA 441).

PHRAGMITES Adansoa

Phragmites australis (Cav.) Trin. ex Steud. Nom. Bot. ed. 2, 2 : 324, 1841; Stewart 134.

Arundo australis Cav. ex Roem. & Schult. Syst. 2 : 511, 1817.

Phragmites communis Trin. Fund. Agrost. 134, 1820; Bor 416.

Stem erect, up to 3 m tall, unbranched along its length, many arising independently from a creeping rootstock, fistular, leafy throughout. Leaves with blades up to 75 cm long, linear broader at the base and tapering in to a sharp point, flat, fast green, parallel veined, shining, margins scaberulous and sharp; sheaths much shorter than the blades; ligule represented by a short hemispherical hairy ring. Spikelets narrow up to 1.2 cm long, flattened; pedicels slender, longer than the spikelets terete, glabrous; crowded on more or less drooping branches of a dense, erect, shining compound panicle which is up to 21.5 cm x 6.5 cm and brownish purple; the lowest floret of the spikelet male or neuter, others bisexual and upper rudimentary; rhachilla jointed above the glumes and silky. Glumes 2, much shorter than the spikelet, lower linear lanceolate, up to 6 mm long, acute, 3-nerved, glabrous, empty, upper similar up to 1.1 cm long; persistent. Lowermost lemma oblong lanceolate, 3-5 nerved, margins hyaline; lemmas of fertile florets similar with hyaline margius and narrowed in to an awn like point. Stamens 3 or sometimes only 1 in the lower-most male floret, anthers linear, purplish, extruded out for pollination. Ovary small with 2 distinct diverging styles and plumose stigmas. Grain small, free within the persistent glumes, smooth and shining.

Germination : Late spring (May).

Fl. & Fr. : September-November.

Dissemination : It spreads efficiently through underground rootstock. The growing buds are produced on the rootstock at the onset of favourable season.

Habitat : A common weed of marshlands, floating islands preferring to grow in shallow water. Indicator of marshes.

Root system : A tough trailing rootstock bearing long branched adventitious roots.

Geographical distribution : North and South temperate regions.

Associations recorded : It has been seen generally associated with *Typha latifolia*, *T. angustata* and *Alisma plantago*. Sometimes it forms a pure community and eradicates other plants in competition.

Specimens examined : *Sarin* (4-10-1968) Floating islands near Dal Lake; *Kaul* RRL 16227 (5-9-1972) Floating islands in Dal lake.

Local name : Nur gassa.

Remarks : The grass is considered to be a good sheep fodder. It is sometimes cultivated for this purpose.

Illustration : Polunin pl. 179.

Chromosome report : 2n=48, 96 (Bor 1960).

DACTYLIS Linnaeus

Dactylis glomerata L. Sp. Pl. 71, 1753; FBI 7 : 334; Collett 626; Bor 530; Rao in BOBSI 2 : 420. 1960; Polunin 536; Stewart 150.

Perennial grass. Stem erect, somewhat tufted near the base, rough, up to 1 m tall, generally fistular, glabrous, more leafy at the base. Leaves up to 21 5 cm x 0.8 cm, lanceolate, acuminate, parallel veined, margins scabrid, sheaths shorter than blades, lower ones loose, glabrous; ligule short rounded, membranous and torn or jagged. Spikelets up to 1 cm long, green or purple tinged, shortly stalked, flattened 3-5 flowered crowded in one sided, ovoid clusters in an erect panicle up to 15 cm long. Glumes 2, lanceolate, boat-shaped, keeled, empty, slightly unequal, long pointed and persistent. Lemmas slightly longer than glumes, stiff, margins hyaline, 5-nerved, tip shortly awned, keel rough. Stamens 3, anthers linear, purplish, exserted at maturity. Ovary small, glabrous; styles 2, distant and feathery. Grain triquetrous, grooved, brownish or pale up to 2.5 mm diam.

Field notes : An occasional weed growing in pastures cherry and plum orchards and fallow lands. The rootstock is thin but creeping, perennating at the onset of winter. It prefers to grow in moist situations. The culms produce shining compact panicles at the apices and many long leaves. It is relished by cattle grazing in the pastures.

Fl. & Fr. : May-August.

Specimens examined : *Kapoor* 2640 (15-6-1952) Yarikha orchards.

Geographical distribution : Europe, North Africa, Temperate Asia, introduced in other temperate regions of the world.

Chromosome report : 2n=28 (Bor 1960).

BROMUS Linnaeus

Key to the species

1. Perennial herbs; glumes 2, outer 1-nerved and inner 3-nerved: lemmas 5-7 nerved with a long awn — **inermis**
1. Annual or biennial herbs; glumes, 2, outer 3-5 nerved, inner 5-9 nerved; lemmas 7-9 nerved ;
   2. All lemma 1-awned; panicle compact, rarely loose — **scoparius**
   2. All lemma not 1-awned, some 3-awned: panicle open and loose — **lanceolatus**

Bromus inermis Leyss. Fl Hal. ed. 1, 16, 1761; FBI 7 : 357; Bor 454; Polunin 528; Stewart 139. **(Fig 95)**

Perennial grasses. Stem somewhat tufted arising from a thin creeping rootstock, 22-75 cm tall, glabrous. Leaves linear, finely acuminate, 7.5-30.5 cm x 0.2-0.6 cm, 5-9 parallel veins converging at the apex, pubescent, margins of blades more hairy than surfaces; sheaths shorter, hairy all over; ligule membranous up to 1 cm diam, bilobed and toothed margins. Spikelets oblong lunceolate, 5-9 flowered, carried on long glabrous and terete stalks, rhachilla not prolonged, loosely arranged to form a panicle 12-25 cm long. Glumes 2, lower 0.3-0.9 cm long, oblong, lanceolate, acuminate, upper 0.8-1.3 cm long, empty, glabrous, margins, membranous, persistent. Lemmas 0.5-1.5 cm long, similar to glumes, slightly hirsute, apex bifid with an awn up to 0.2 cm arising from the cleft. Palea membranous, bifid, slightly hairy; lodicules very small. Stamens 3, anthers linear longer than the filaments, bisifixed. Ovary with an enlarged crown, 2 styles inserted ventrally below the tip of the ovary. Grain oblong, glabrous and shining.

Germination : Early spring (Feb.-March).

Fl. & Fr. : April-July.

Dissemination : Wind and man during grass mowing.

Habitat : A common weed of orchards, wheat fields, pea fields, cabbage fields and also fallow lands preferring moist situations. Indicator of sandy or silty clay loams.

Root system : A tuft of small slender adventitious roots arising from the base of the stem.

Geographical distribution : Western Himalaya, Kashmir to Kumaon, North Europe, Caucasus and North Asia.

Specimens examined : *Kapoor* 2621 (26-5-1952) Srinagar fields; *Kaul* RRL 19694 (18-6-1971) Majid Bagh Srinagar; *Kaul* 313 (12-6-1972) Burzulla pea fields.

Local name : Shoal.

Remarks : A good fodder grass. The seeds are given to cage birds.

Bromus scoparius L. Cant. Pl. 1 : 6, 1755; FBI 7 : 360; Bor 456; Stewart 141. **(Fig. 96)**

Annual grasses. Stem erect, 20-50 cm commonly unbranched, many culms arising from the base giving it a somewhat tufted appearance, glabrous, ribbed minutely. Leaves linear, 3-8.5 cm x 0.1-0.7 cm, covered with dense stiff hairs; sheaths compact and longitudinally veined; ligule truncate, very short, toothed or torn. Panicles erect, compact 4.0-7.5 cm long and 1-4.5 cm wide, rachis smooth, branched; spikelets linear 1.5-3 cm long, stalk up to 0.5 cm long, flattened, 9-13 flowered. Glumes 2, nearly equal, outer 3-nerved, inner 5-7 nerved, boat-shaped, acute, covered with stiff hairs. Lemmas 0.5-1.5 cm long, 5-9 nerved margins membranous, covered with stiff hairs, apex acute, bifid with an awn as long or longer than the lemma; palea transparent, loosely ciliate; lodicules absent. Stamens 3 with linear anthers longer than the slender filaments, basifixed. Grain oblong lanceolate, slightly furrowed on one side, glabrous.

Germination : Spring (March).

Fl. & Fr. : May-July.

Dissemination : The seeds are disseminated by wind.

Habitat : An occasional weed of orchards, wheat fields and some fallow pastures, preferring to grow in moist and shady situations. Indicator of clay loams.

Root system : Long slender fibrous roots go up to 15 cm deep in the soil.

Geographical distribution : Mediterranean region.

Specimens examined : *Meebold* (June, 1905) Baramulla (CAL); *Kapoor* 2628 (27-5-1952) Srinagar fields; *Kaul* 322 (19-7-1972) Rawalpora orchards.

Bromus lanceolatus Roth Catalecta Bot. 1 : 18, 1797; Stewart 140. **(Fig. 97)**

Bromus macrostachys Desf., Fl. Atl. 1 : 96, t. 19, f. 2, 1798; FBI 7 : 361.

Annual or biennial grasses. Stem erect, 20 cm-1 m, bases decumbent, branched near the base, glabrous or slightly pubescent, light green, fistular. Leaves narrowly lanceolate 7-20 cm x 0.2-0.8 cm, acute or subacute, margins slightly hairy or velvety, nerves distinct from the under surfaces; young sheaths villous and older ones turning glabrous, ligule ovate, laccerate, membranous. Panicled much branched up to 25 cm or more long, loose; rachis glabrous or pubescent, branches unequal up to 4.5 cm long, erect, 1-2 spiculate, strict, scabrid. Spikelets up to 3 cm long, 6-18 flowered, pale green, rhachilla pubescent. Glumes 2, broad, pubescent, tips and margins scarious; lower up to 1 cm long. 3-5 nerved; upper up to 1.3 cm long, lanceolate, 5-7 nerved, margins membranous, scarious. Lemmas up to 2 cm long, obovate to oblong, 7-9 or rarely more nerved, acute or sometimes 2-toothed with 1 or 3 long scabrid awns. Palea membranous completely adherent to the ovary, keel long ciliate. Ovary small with 2 feather styles. Grain linear-oblong, up to 3 mm glabrous and shining, adherent to the palea.

Field notes : An occasional weed possessing a gregarious habit and preferring to grow in well irrigated fields. In fallow dry lands the plants were seen to be comparatively shorter and less numerous. The spikelets are oblong lanceolate on long stalks, loosely arranged on a drooping panicle and are characterised by 1-awned or 3-awned lemma. The weed is mostly annual but sometimes acts as biennial.

Fl. & Fr. : June-July.

Specimens examined : *Kapoor* 2987 (28-6-1953) Kheer Bhawani, Ganderbal, commonly found in fallow fields.

Geographical distribution : Afghanistan, to Mediterranean region, India : Murree.

Chromosome report : 2n=14, 28 (DCA 441).

VULPIA C.C. Gmelin

Vulpia myuros (L.) Gmel, Fl. Bad. 1 : 8, 1806; Bor 564; Stewart 160.

Festuca myuros L. Sp. Pl. 74, 1753; FBI 7 : 356; Collett 630.

Annual tufted grass. Stem branched from the base, suberect, to erect, 10-30 cm in height, slender, glabrous, leafy. Leaves linear lanceolate, blades sometimes longer than the stem, convolute, distinctly 5-9 nerved, glabrous with setaceous margins; sheaths tight

with the stem, glabrous; ligule short, membranous, biauricled. Spikelets dense, 3-5 flowered, pedicel very short arranged on 5-15 cm long panicle. Glumes 2, shorter one inconspicuous, longer one 0.3-0.6 cm long, margins hyaline, mucronate. Lemmas much longer than the glumes margins membranous and scaberulous, tough awn as long as the lemma itself, palea ciliate. Stamens 1 or rarely 2, anthers short on slender filaments. Ovary glabrous. Grain linear, concave with a small groove on one side, adherent to the palea.

Germination : Early spring (February-March).

Fl. & Fr. : May - July.

Dissemination : The seeds get disseminated by wind, water and animals including man.

Habitat : A common weed of orchards, wheat fields and fallow lands preferring open and semidry situations. Indicator of sandy clay loams.

Root system : A tuft of adventitious roots arise from the base of the stem and bind the plants in soil.

Geographical distribution : Europe, generally penetrating into temperate parts of Asia.

Specimens examined : *Meebold* 1902 (June, 1905) Baramulla (CAL); *Kapoor* 2613 (26-6-1952) Sheopora, Srinagar fields; *Kaul* RRL 19696 (21-6-1971) Srinagar orchards.

Chromosome report : 2n = 14 (Bor 1960).

ERAGROSTIS Wolf

Key to the species

1. Spikelets light green or purple tinged. 5-12 flowered **pilosa**
1. Spikelets dark olive-coloured, usually fewer, scattered, 3-9 flowered **nigra**

Eragrostis pilosa (L.) P. Beauv, Ess. Agrost. 71, 1812; FBI 7 : 323; Collett 625; Bor 512; Stewart 147.

Poa pilosa L. Sp. Pl. 68, 1753.

Annual herbs. Stem suberect or spreading tufted near the base, usually slender and simple, branched from the base. Leaves with narrowly lanceolate blades flat or flaccid, up to 7.5 cm long, margins smooth, glabrous; sheath shorter than the blade, hairy at the mouth; ligule oblong membranous. Panicle up to 10.5 cm long, erect, inclined or nodding, branches filiform or capillary, fascicled or subwhorled, simple below. Spikelets oblong or linear, flattened, 5-12 flowered, green with a purple tinge, generally on pedicels shorter than its length. Glumes 2, unequal, lower nerved and upper faintly 1-nerved, margins membranous, apex acute persistent and empty. Lemmas slightly longer than the glumes, ovate, acute, paleas subpersistent with scaberulous keels. Stamens 3, anthers small with slender filaments, extruded at maturity, violet. Ovary small glabrous with 2 short feathery styles. Grain up to 1.5 mm long, finely grooved on one side, glabrous and shining.

Germination : Late summer (August).

Fl. & Fr. : September-November.

Dissemination : The seeds get dispersed by wind and water.

Habitat : A common weed of lawns, vegetable fields and kitchen gardens preferring moist situations. Indicator of silty clayey loams.

Root system : A simple adventitious root system with slender nodal roots going into the surface horizons of soil.

Geographical distribution : Throughout India and Burma ascending to Himalaya. Europe and moist warm countries of the world.

Associations recorded : It is generally associated with grasses like *Cynodon dactylon*, *Poa annua* and *Bothriochloa ischaemum*.

Specimens examined : *Kapoor* 2724 (7-10-1952) Barzulla orchards; *Kaul* 348 (1-10-1972) Barzulla orchards.

Chromosome report : 2n=40 (Bor 1960).

Eragrostis nigra Nees ex Steud. Syn. Pl. Glum. 1 : 267, 1854; FBI 7 : 324; Collett 625; Bor 511; Stewart 147.

Annual herbs with tufted, erect stem; branches decumbent near the base, ascending, spreading, up to 25 cm long, glabrous, densely leafy at the base. Leaves linear lanceolate, acuminate, glabrous; sheaths narrow terete or obscurely compressed, sometimes hairy; ligule oblong, membranous. Panicle oblong to ovate, large open lax flowered, branches usually in whorls or panicles up to 12.5 cm long. Spikelets linear to oblong or pyramidal, up to 0.8 cm long, pedicel as long or shorter than the spikelet, 3-9 flowered. Glumes subequal, membranous, acuminate, strongly 1-nerved, empty, persistent, keels scabrid. Lemmas ovate, acute, up to 2.5 cm long, membranous, awnless enclosing a bisexual floret. Stamens 3, anthers linear, purplish on slender filaments. Grain oblong-ovoid, dorsally slightly grooved, shining.

Germination : Spring (March-April).

Fl. & Fr. : May-August.

Dissemination : Wind and water.

Habitat : An occasional weed of orchards and fallow lands preferring to grow in dry and compact situations. Indicator of sandy loams.

Root system : A tuft of adventitious roots arising from the base of the stem goes up to 15 cm deep in the soil.

Geographical distribution : Temperate and tropical Himalaya; Sri Lanka and extending to China.

Specimens examined : *Kapoor* 2991 (30-6-1953) Srinagar fallow fields, *Kaul* 312 (12-6-1972) Rawalpora orchards.

POA Linnaeus

Key to the species

1. Stems tufted, robust, usually up to 55 cm tall; leaves rather broad; panicles somewhat compact :
   2. Spikelets 3-6 flowered, flowers slightly purplish, generally viviparous **bulbosa**
   2. Spikelets 2-5 flowered, flowers green, never viviparous **angustifolia**
1. Stem slender, somewhat tufted near the base, usually up to 25 cm tall; leaves narrow linear, panicles loose **annua**

Poa bulbosa L. Sp. Pl. 70, 1753; FBI 7 : 338; Bor 556; Rao in BOBSI 2 : 420, 1960; Polunin 537; Stewart 155. **(Fig. 98)**

Annual tufted grasses. Stems many from the base, erect, slender, up to 35 cm, terete, smooth, nodes and lower internodes purplish; leaves with narrowly lanceolate, 3-7.5 cm long, flat and acute blades; mostly crowded at the base, margins smooth; sheaths small, loose or adpressed to the stem, glabrous; ligule

short, thin, papery and white. Panicles oblong, terminal, 3-8 cm long, branches short and linate; spikelets subsessile or sessile, ovate-oblong, 3-6 flowered, pale green with purplish small bulbs, flowers crowded and viviparous. Glumes 2, outer shorter, acute, 3-nerved up to 3 mm long, slightly hairy, margins dentate, persistent and empty, upper up to 5 mm long and similar. Lemma oblong, acute or mucronulate, hyaline; palea short and membranous. Stamens when present possessing very small anthers. No seed is produced because of vivipary.

Germination : Spring (March).

Fl. & Fr. : June-September.

Dissemination : The plants are disseminated mostly by wind and water. Also by man during mowing.

Habitat : A common weed of orchards, wheat fields, pastures and fallow fields preferring shady situations. Indicator of fertile nitrogenous clay loams.

Root system : A bunch of adventitious roots arise from the base of the stem and does not grow beyond 10 cm deep in soil.

Geographical distribution : Widespread in Northern Hemisphere including temperate Europe and Asia.

Associations recorded : The common associates of this plant are *Cynodon dactylon*, *Veronica didyma*, *Capsella bursa-pastoris* etc.

Specimens examined : *Kaul* RRL 19737 (30-9-1971) Dalgate fallow fields; *Kaul* 307 (21-5-1972) Rawalpora orchards.

Remarks : The weed spreads fast. The panicles appear in summer and the flowers get transformed into small bulbils which germinate readily after falling on a suitable substrate.

Chromosome report : 2n = 14, 28, 45 (Bor 1960).

Poa angustifolia L. Sp. Pl. 67, 1753; Bor 555; Stewart 155. **(Fig. 99)**

Poa pratensis L. var. *angustifolia* Wahl. Fl. Lapp. 41, 1812; FBI 7 : 340; Collett 627.

Perennial tufted herbs. Stems many arising from the base, erect, smooth, terete, up to 55 cm long. Leaves narrowly lanceolate, flat, acute, 5-21 cm long; sheaths short, lower adpressed to the stem and upper loose, margins setaceous; ligule small, white, membranous. Panicles erect, up to 9 cm, laxly branched, spreading, lower branched with 2-5 spikelets. Each spikelets 2-5 or generally 3-flowered, lower pedicels short and upper longer, glabrous, Glumes equal, sometimes lower one slightly smaller, membranous, boat-shaped, 0.3-0.5 cm long, 3-7 nerved. Lemmas longer than the glumes, up to 0.8 cm long, membranous acute, 5-7 nerved, enclosing a small, thin, transparent pale. Stamens with linear extruded anthers. Grain oblong, glabrous.

Field notes : An occasional weed of orchards, pastures, fallow lands with a creeping stoloniferous rootstock. The stems are tufted at base and with crowded leaves. It reproduces both vegetatively as well as by seed. The seeds are produced in large numbers and germinate readily on suitable substrates. The weed prefers moist situations but grows very well in open dry situations and is seen to be associated with *Descaurainea*

sophia, Capsella bursa-pastoris, Cynodon dactylon and other weeds like *Convolvulus arvensis*.

Fl. & Fr. : April-July.

Specimens examined : *Kaul* 310 (12-6-1972) Barzulla orchards; *Kaul* 323 (16-7-1972) Badgam paddy fields on margins.

Geographical distribution : Wide spread in Europe, penetrating into Asia via high mountain ranges.

Chromosome report : 2 n = 51, 66 (Bor 1960).

Poa annua L. Sp. Pl. 68, 1753; FBI 7 : 345; Collett 628; Bor 555; Rao in BOBSI 2 : 420, 1960; Stewart 155. **(Fig. 100)**

Perennial tufted grasses. Stem erect from a decumbent base, up to 20 cm tall, branched, glabrous; slender, more or less flattened, leafy. Leaves with narrow, spreading blades, 3-6.5 cm long, subacute, margins sharp, glabrous; sheaths appresed to the stem, longer than blades, glabrous or more or less with spreading hairs; ligules truncate, membranous. Panicles 3-7 cm long, spreading. Spikelets oblong. up to 1 cm long stalks as long or longer than the spikelets, minutely hairy; rhachilla terete, pubescent; 3-5 flowered. Glumes 2, shorter one up to 3 mm long, 1-nerved. villous, persistent, empty. Lemmas longer than the glumes, apex purplish, sometimes bifid, membranous covered with woolly hairs; palea shorter and membranous. Lodicules 2, small. Stamens with globular or oblong extruded anthers, Ovary small with 2 plumose slender styles. Grain oblong, glabrous and shining.

Germination : Early spring (Feb.-March.)

Fl. & Fr. : April-July.

Dissemination : The seeds are disseminated by wind and more efficiently by irrigation water.

Habitat : A common weed of lawns, roadsides, footpaths. fallow lands, orchards and margins of paddy fields preferring moist situations. Indicator of sandy clayey loams.

Root system : Slender long adventitious roots arise from the base of the stem and go up to 13 cm deep in soil.

Geographical distribution : Cosmopolitan.

Specimens examined : *Kaul* 303 (4-5-1972) Chishma Shahi, fallow lands.

Remarks : A fast spreading weed reproducing both vegetatively as well as through seed. It is commonly associated with *Cynodon dactylon* and at certain places overgrows it and forms large patches. It flowers commonly in summer and remains in vegetative state all the year round barring the winter.

Chromosome report : 2n=28 (Bor 1960).

PTERIDOPHYTES

EQUISETACEAE

EQUISETUM Linnaeus

Equisetum arvense L. Sp. Pl. 1061, 1753; Valentine in Fl. Europaea 1 : 8, 1964; Stewart 2.

Perennials with long creeping stiff rhizomes up to 15 cm long, penetrating the soil to a great depth. Stem procumbent or generally ascending, up to 25 cm long, branched, branches arranged in whorls at the node, jointed, longitudinally striated, scabrid, never smooth. Leaves in the form of small scales at the nodes fused to form a toothed

sheath, generally membranous. Cones apical, oblong, up to 2.5 cm long. tapering on both the ends, green and compact when young and greyish or greenish-white at maturity. Spores small, microscopic, forming a powdery mass, mostly dispersing through wind.

Germination : The spores start germinating in March (early spring).

Maturity of spores : The cones mature in May-June (late spring).

Dissemination : The spores are mostly dispersed by wind, occasionally by water and animals

Habitat : It is a strong and fast spreading weed of fields, woods, fallow places and lawns etc. Very difficult to eradicate.

It occurs in a variety soil conditions :—

Poor, nitrogenous, open, loose, aerated, dry to fresh and moist, stony, sandy loamy and clayey soils.

Geographical distribution : Europe and Asia, North America including Arctic regions. Mediterranean regions, South Africa.

Specimens examined : *Kaul* RRL 5970 (10-4-1969) Harwan fields (Lawns), Maize fields.

Illustration : Fig. 1.1, Geigy weed Tables, 1968.

MARSILEACEAE

MARSILEA Linnaeus

Marsilea quadrifolia L. Sp. Pl. 1099, 1753; Valentine in Fl. Europaea 1 : 24, 1964; Gupta, Marsilea 22, 91, 1962; Stewart 21.

Perennial fern with black creeping or stoloniferous rhizome up to 65 cm long, thin but tough, branched, rooting at nodes which keep the rhizomes bound in the muddy soils. Leaves quadrifoliate, leaflets obovate to cuneate, attached near the tip of the petiole, glabrous, slender, petioles slender arising directly from the rhizome, glabrous slender, somewhat grooved. Sporocarps rounded up to 1 cm diam, black, attached by a small slender, stalk, arising from the rhizome and remaining underground up to maturity. At maturity the sporocarps protrude out of the soil to give spores.

Germination : The spores germinate in spring (March-April).

Maturity of spores : When the spores are mature, the sporocarps turn brownish black and protrude out of the soil or water. Sporocarps mature in late summer (August).

Dissemination : The spores are disseminated through water.

Habitat : A common weed of paddy fields, marshlands growing vegetables and some floating islands. The weed sprouts fast by long creeping stoloniferous rhizomes.

Geographical distribution : Distributed over temperate parts of the world.

Specimens examined : *Kaul* 272 (1-8-1971) Badgam paddy fields; *Kaul* 292 (25-9-1971) Chishma Shahi marsh.

SALVINIACEAE

SALVINIA Adanson

Salvinia natans (L.) All., Fl. Pedem. 2 : 289, 1785; Rao in BOBSI 2 (3 & 4) : 431, 1960; Valentine in Fl. Europaea 1 : 24, 1964; Stewart 21.

Marsilea natans L. Sp. Pl. 1099, 1753.

A free floating water fern. The main rachis is 3.5-8 cm long, slender, concealed by

ovate to obovate leaflets. Sporocarps are aggregated on the undersurface of the leaflets, formed at maturity. These produce large number of spores which float on water and germinate only when favourable conditions prevail

Germination : The spores start germinating in late spring (May-June).

Maturity of spores : Sporocarps mature in early autumn (August-September).

Dissemination : The spores, produced in large quantities, float on water and are carried to long distances.

Habitat : It is a fast spreading weed of paddy fields and is very difficult to control.

Geographical distribution : Temperate region of the world.

Specimens examined : *Kaul* 275 (4-8-1971) Hyderpora paddy fields.

Chromosome report : 2n=18 (D' Avanzi IOPB 1957).

APPENDIX I

STUDIES ON THE DISSEMINATION, AVERAGE SEED OUT-PUT AND PERCENTAGE VIABILITY OF 177 COMMON WEEDS OF KASHMIR

Mode of dissemination, seed out-put and viability are the three highly significant factors for the spread of a weed and consequently for the extent of damage caused by the weed to the infected crop. In order to get an indication of the extent of potential damage to the crop 177 commoner weeds have been studied for these factors. It is hoped that the information can also be used for control of the weeds. These weeds are treated under the following heads :

(1) Weeds of spring crops.

(2) Weeds of lawns, public gardens, roadsides, turfs and grasslands.

(3) Weeds of fruit crops (orchards).

(4) Weeds of fallow and waste lands.

(5) Weeds of Maize fields.

(6) Weeds of Saffron fields.

(7) Weeds of Paddy fields.

(i) The weeds, in general, disseminate through seeds. A few spread vegetatively as well, and cause damage to cultivated crops. Many weeds are omnipresent and may invade more than one kind of crop. A few are restricted to certain crops.

(ii) Seed out put is the potential capacity of a species to reproduce itself. Large variations are found in the seed output of different species. The seed output was measured by following method (Pandeya, 1967).

Average number of seeds per fruit $=X$

Average number of fruits per plant $=Y$

Average seed output $=X \times Y$

The seed output was based on an average of 10 plants of a particular species collected at random from an area.

(iii) The seed viability percentage has been determined by 2, 3, 5 triphenyl tetrazolium chloride test. (Salisbury, 1942; Misra, 1968).

1. Weeds of Spring crops (Wheat, Linum, Brassica and Pea fields)

In Kashmir, crops like Wheat, Pea, *Linum* and *Brassica campestris* grow under similar bioclimatic conditions. The crop sown in late autumn, remains under snow in winter and starts flowering and fruiting in late spring or even summer. The weeds occurring in these types of fields are mostly winter annuals; some are biennial and a few are perennial.

Name of the weed	Dissemination	Average seed output	Average seed viability
Adonis aestivalis	Through seed	11	86%
Anagallis arvensis	Through seed	390	74%
Arenaria serpyllifolia	Through seed	215	82%
Bothriospermum tenellum	Vegetative propagation and seed	160	73%

Name of the weed	Dissemination	Average seed output	Average seed viability
Bothriochloa ischaemum	Vegetative propagation and seed	112	63%
Ceratocephalus falcatus	Through seed	84	65%
Capsella bursa-pastoris	Through seed	135	75%
Convolvulus arvensis	Vegetative propagation and seed	55	55%
Descaurainea sophia	Through seed	360	92%
Digitaria setigera	Vegetative propagation	73	81%
Erodium cicutarium	Through seed	40	95%
Eruca sativa	Through seed	78	80%
Euphorbia hispida	Through seed	2555	90%
Fumaria indica	Through seed	23	70%
Gagea dshungarica	Through bulbs	21	Seeds not viable
Galium tricorne	Seed	140	35%
Geranium nepalense	Seed	65	72%
Gnaphalium luteoalbum	Seed	1053	60%
Hordeum murinum	Seed	255	69%
Lamium amplexicaule	Seed	260	60%
Lathyrus erectus	Seed	165	65%
Lithospermum arvense	Seed	32	55%
Lolium temulentum	Seed	221	70%
Lotus corniculatus	Vegetatively and seed	250	52%
Malcolmia africana	Seed	208	62%
Mazus pumilus	Seed	120	72%
Medicago sativa	Vegetatively and seed	165	45%
Nepeta cataria	Vegetatively and seed	212	30%
Papaver dubium	Seed	1113	40%
Phleum paniculatum	Vegetatively and seed	2117	70%
Plantago lanceolata	Vegetatively and seed	918	65%
Polygonum aviculare	Vegetatively and seed	63	72%
P. plebeium	Vegetatively and seed	113	61%
P. rottboellioides	Vegetatively and seed	97	55%
Ranunculus arvensis	Seed	32	90%
R. laetus	Vegetatively and seed	315	80%

Name of the weed	Dissemination	Average seed output	Average seed viabliity
Scandix pecten-veneris	Seed	35	93%
Senecio vulgaris	Seed	1566	100%
Setaria glauca	Seed	2111	75%
S. viridis	Seed	1650	82%
Sonchus asper	Seed	275	69%
Thymelaea passerina	Seed	115	72%
Tragopogon dubius	Seed	55	85%
Tulipa stellata	Through bulbs		Seeds not seen

2. Weeds of lawns, public gardens, roadsides, turfs and gardens

The common lawn and turf grass in Kashmir is *Cynodon dactylon* which harbours many weeds. At times these weeds crowd out the lawn grass in competition. The common cause of infestation of these weeds is the irrigation water which carries weed seeds with it.

Name of the weed	Dissemination	Seed output per plant	Seed viability.
Arabidiopsis thaliana	Seed	43	95%
Arenaria serpyllifolia	Seed	215	82%
Bellis perennia	Vegetativelyand seed	211	41%
Bothriochloa ischaemum	Vegetatively and seed	212	63%
Brachiaria eruciformis	Vegetatively and seed	33	75%
Carex notha	Seed	88	63%
C. stenophylla	Seed	12	75%
Cerastium glomeratum	Seed	171	66%
Coronopus didymus	Vegetatively and seed	111	40%
Eleusine indica	Vegetatively and seed	111	72%
Erodium cicutarium	Seed	40	95%
Erophila verna	Seed	35	80%
Euphorbia hispida	Seed	2555	90%
Galium tricorne	Seed	140	35%
Lespedeza juncea	Vegetatively and seed	165	41%
Lotus corniculatus	Do	250	52%
Medicago lupulina	Do	240	88%
Oxalis corniculatus	Do	30	76%

Name of the weed	Dissemination	Seed output per Plant	Seed viability
Paspalum scrobiculatum	Do	211	62%
Plantago lanceolata	Do	918	65%
Plantago major	Do	172	65%
Poa annua	Do	103	61%
Poa pratensis	Do	161	70%
Polygonum aviculare	Do	63	72%
Potentilla reptans	Do	240	42%
Sagina saginoides	Seed	156	65%
Senecio vulgaris	Seed	1566	100%
Setaria viridis	Seed	1650	82%
Taraxacum officinale	Vegetatively and seed	33	100%
Trifolium fragiferum	Do	65	55%
Trifolium pratense	Do	113	40%
Trifolium repens	Do	92	60%
Veronica didyma	Do	168	96%
V. persica	Seed	72	100%
V. verna	Seed	98	80%

From the data given above, it is evident that the majority of weeds in these cultivations reproduces both vegetatively as well as through seed. That is why these weeds are difficult to control and pose a serious problem to the agriculturists as well as horticulturists.

3. Weeds of orchards

Kashmir is the valley of orchards where fruit production is of considerable importance. **Nearly** half of the cultivable land is under orchards growing apples, almonds, apricots, cherries, peaches, pears, walnuts and such other fruits. The soils of these orchards are fertile, well aerated and suitable for invasion of weeds. The most common weeds of these orchards are listed below :

Name of the weed	Dissemination	Seed output	Seed viability.
Artemesia absinthium	Vegetatively and seed	851	92%
A. parviflora	Do	135	90%
A. scoparia	Do	396	85%

Name of the weed	Dissemination	Seed output	Seed viability.
A. tournefortiana	Do	1313	92%
A. vestita	Do	1165	88%
Bothriochloa ischaemum	Vegetatively and seed	112	63%
Cannabis sativa	Seed	196	100%
Chenopodium album	Seed	103	60%
Cichorium intybus	Vegetatively and seed	—	—
Calamintha vulgaris	Seed	240	45%
Convolvulus arvensis	Vegetatively and seed	55	55%
Conyza bonariensis	Seed	4788	64%
C. canadensis	Seed	1325	60%
Crepis sancta	Seed	155	100%
Cynodon dactylon	Vegetatively and seed	73	70%
Erodium cicutarium	Seed	40	95%
Eryngium billardieri	Seed	182	65%
Filago pyramidata	Seed	269	75%
Geranium nepalense	Seed	65	72%
Hordeum murinum	Seed	85	69%
Imperata cylindrica	Vegetatively, seeds are non-viable		
Lathyrus aphaca	Seed	65	62%
Linaria damatica	Vegetatively and seed	165	50%
Lolium temulentum	Seed	221	70%
Lotus corniculatus	Vegetatively and seed	250	52%
Medicago lupulina	Do	240	88%
Medicago sativa	Do	165	45%
Melilotus alba	Seed	73	62%
Mentha longifolia	Vegetatively and seed	280	73%
Nepeta cataria	Do	212	30%
Pennisetum orientale	Vegetatively and seed	120	40%
Poa angustifolia	Do	763	45%
Poa bulbosa	Vegetative propagation and vivipary		
Portulaca oleracea	Seed	4560	80%
Prunella vulgaris	Vegetatively and seed	365	45%
Ranunculus laetus	Do	315	80%

Name of the weed	Dissemination	Seed output	Seed viability.
Rumex chalepensis	Seed	511	32%
Salvia moorcroftiana	Seed	316	46%
Senecio vulgaris	Seed	1566	100%
Setaria viridis	Seed	1650	82%
Sonchus asper	Seed	275	68%
Sonchus oleraceus	Seed	369	44%
Sorghum halepense	Vegetatively and seed	290	82%
Stellaria media	Do	671	52%
Tragopogon dubius	Do	55	85%
Tulipa stellata	(Seed not seen)		
Vulpia myuros	Seed	592	62%

(4) Weeds of fallow lands and waste lands

Certain fields are left fallow and not cultivated due to one reason or the other. Weeds infest such fields and remain there even if the land is put to cultivation. Weeds are also seen to infest wastelands, fallow land and dumping areas. The common weeds of such areas are :

Name of the weed	Dissemination	Seed output	Seed viability
Amaranthus graecizans	Seed	253	40%
Astragalus grahamianus	Vegetatively and seed	712	16%
A. leucocephalus	Do	Seed not collected	
Cannabis sativa	Seed	196	100%
Capsella bursa-pastoris	Seed	135	75%
Carduus edelbergii	Seed	355	45%
Carthamus lanatus	Seed	267	62%
Centaurea iberica	Vegetatively and seed	Seeds not collected	
Cirsium argyracantham	Seed	125	62%
Contum maculatum	Vegetatively and seed	4186	75%
Conyza bonariensis	Seed	4788	64%
Cynodon dactylon	Do	73	70%
Cyperus rotundus	Do	375	82%

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Name of the weed	Dissemination	Seed output	Seed viability
Datura stramonium	Seed	1269	65%
Drabopsis nuda	Do	27	96%
Eragrostis pilosa	Vegetatively and seed	655	49%
E. nigra	Do	582	58%
Erodium cicatarium	Seed	40	95%
Euphorbia helioscopia	Do	917	65%
Herniaria cinerea	Vegetatively and seed	4275	78%
Hyoscyamus niger	Seed	2301	22%
Lepidium latifolium	Do	1729	15%
Malva neglecta	Do	314	94%
Marrubium vulgare	Vegetatively and seed	424	72%
Medicago lupulina	Do	240	88%
Onopordum acanthium	Seed	375	60%
Oxalis corniculata	Vegetatively and seed	30	76%
Plantago lanceolata	Do	918	65%
Plantago major	Do	172	65%
Ranunculus muricatus	Seed	65	92%
R. sceleratus	Vegetatively and seed	315	65%
Senecio vulgaris	Seed	1566	100%
Sisymbrium irio	Seed	2999	60%
Solanum nigrum	Do	1635	53%
Taraxacum officinale	Vegetatively and seed	33	100%
Trifolium repens	Do	92	60%
Urtica dioica	Do	5215	96%
Verbascum thapsus	Seed	1183	92%

5. Weeds of maize fields

Maize is one of the important cereals and is grown commonly in Kashmir. The crop is sown in early summer (April-May) and harvested in late summer or early autumn (August-September). There are certain weeds restricted to such fields. The common weeds of maize fields growing in the region under study are given below :

Name of the weed	Dissemination	Seed output	Seed viability
Abutilon theophrasti	Seed	173	54%
Amaranthus hybridus	Do	203	56%
Artemisia tournefortiana	Do	1313	92%
Cannabis sativa	Do	196	100%
Chrysopogon gryllus	Vegetatively and seed	321	51%
Centaurea iberica	(Seed not collected)		
Cirsium argyracantham	Seed	125	62%
Convolvulus arvensis	Vegetatively and seed	55	55%
Eryngium billardieri	Seed	128	65%
Equisetum arvense	Vegetatively and seeds	(not countable)	
Euphorbia hispida	Seed	255	29%
Heliotropium europaeum var, lasiocarpum	Do	808	36%
Kickxia subsessilis	Do	722	70%
Pennisetum orientale	Vegetatively and seed	311	61%
Poa angustifolia	Seed	363	45%
Rumex chalepensis	Vegetatively and seed	511	32%
Salvia moorcroftiana	Seed	316	46%
Senecio vulgaris	Do	1566	100%
Sorghum halepense	Vegetatively and seed	290	82%
Tragopogon dubius	Do	55	85%
Tribulus terrestris	Seed	155	50%
Verbascum thapsus	Do	1183	92%

6. Weeds of saffron fields

Saffron fields have a great importance in Kashmir because of their restricted cultivation in India. Saffron forms an important item of commerce. The characteristic feature of these fields is that no other crop is grown on that land throughout year and the bulbs once sown perennate for 2-3 years. The flowering is synchronous in early autumn (September to October) and that is why the fields look very beautiful. Different weeds thriving in different seasons invade these fields. The common weeds are :

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Name of the weed	Dissemination	Seed output	Seed viability
Alyssum desertorum	Seed	113	40%
Arenaria serpyllifolia	Do	215	82%
Artemisia parviflora	Vegetatively and seed	135	90%
Capsella bursa-pastoris	Seed	135	75%
Chrozophora obliqua	Do	45	50%
Convolvulus arvensis	Vegetatively and seed	55	55%
Crepis sancta	Seed	155	100%
Eragrostis nigra	Vegetatively and seed	582	58%
Erodium cicutarium	Seed	40	95%
Eruca sativa	Do	78	80%
Euphorbia hispida	Do	255	90%
Gagea dshungarica	Through bulbs	21	Seeds not viable
Gagea elegans	Through bulbs		(Seeds not viable)
Heliotropium europaeum var. lasiocarpum	Seed	808	36%
Lactuca dissecta	Do	511	65%
Lespedeza cuneata	Vegetatively and seed	201	33%
Lithospermum arvense	Do	32	55%
Poa angustifolia	Vegetatively and seed	763	45%
P. annua	Do	103	61%
Polygonum aviculare	Do	63	72%
P. plebeium	Do	113	61%
P. rottboellioides	Do	97	55%
Senecio vulgaris	Seed	1566	100%
Setaria viridis	Do	1650	82%
Sorghum halepense	Vegetatively and seed	290	82%
Taraxacum officinale	Do	33	100%
Tulipa stellata	Vegetatively through bulbs		
T. lanata	Vegetatively through bulbs		

7. Weeds of paddy fields

Paddy fields form an important place for study of weeds. The plants which occur in water, marshlands, floating lands and other moist places invade these fields. The sources of these weeds may be seeds in the soil of the seed bed, impurities in the rice seed, seeds brought in by irrigation water or wind blown seeds of the plants growing in irrigation ditches or marshy places. The common weeds occurring in these fields can be cited under 3 main headings :

(i) Weeds present when the fields stagnate with water.

(ii) Weeds present when water drains off the fields.

(iii) Weeds present mainly towards borders of fields.

Name of the weed	Dissemination	Seed output	Seed viability
(i) Weeds present when the rice fields stagnate with water :			
Aeschynomene indica	Vegetatively and seed	729	33%
Agrimonia eupatoria	Do	525	44%
Alisma plantago-aquatica	Do	1323	52%
Ammannia auriculata	Do	2678	40%
Ammannia baccifera	Do	3253	32%
Butomus umbellatus	Do	(Seeds not seen)	
Eriocaulon sieboldianum	Seed	1225	55%
Juncus articulatus	Vegetatively and seed	175	37%
Lemna minor	Do	(Seed not seen)	
Lemna polyrhiza	Do	(Seed not seen)	
Lythrum salicaria	Do	763	41%
Marsilea quadrifolia	Vegetatively and sporocarp	18	100%
Rotala densiflora	Vegetatively and seed	3250	50%
R. indica	Do	2567	35%
Sagittaria sagittifolia	Do	2163	45%
Salvia natans	Vegetatively and spores	(innumerable spores produced)	
Sium latijugum	Do	1173	55%
Sparganium ramosum	Vegetatively and seed	—	—
Spiranthes lancea	Do	97	60%
Utricularia aurea	Do	(Seeds not seen)	
(ii) Weeds present when water drains off the fields :			
Aeschynomene indica	Vegetatively and seed	729	33%
Ammannia auriculata	Do	2678	40%
A. baccifera	Do	3253	32%
Cyperus elusinoides	Do	2172	45%

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Name of the weed	Dissemination	Seed output	Seed viability
C. michelianus	Do	364	52%
Echinochloa crus-galli	Do	3057	63%
Lindernia procumbens	Seed	1050	41%
Monochoria vaginalis	Vegetatively and seed	2167	55%
Rotala densiflora	Do	3250	50%
R. indica	Do	2567	35%
Scirpus juncoides	Do	327	33%
(iii) **Weeds present mainly towards the borders of the rice fields**			
Achillea millifolium	Vegetatively and seed	2211	72%
Bidens biternata	Do	112	85%
Bothriochloa ischaemum	Do	112	63%
Carduus edelbergii	Seed	355	45%
Carex foliosa	Vegetatively and seed	371	35%
Carex notha	Seed	568	42%
Carex nubigena	Do	711	50%
Carex fedia	Do	211	65%
Cichorium intybus	Vegetatively and seed	—	—
Cirsium argyracanthum	Seed	125	62%
Cyperus pumilus	Do	97	65%
Digitaria bifasciculata	Vegetatively and seed	—	—
Eclipta erecta	Do	950	72%
Epilobium hirsutum	Seed	715	40%
Erigeron annuus	Seed	1913	55%
Euphorbia hispida	Do	255	90%
Fimbristylis bisumbellata	Vegetatively and seed	522	45%
Galinsoga parviflora	Do	3157	56%
Hordeum murinum	Seed	85	69%
Imperata cylindrica	Vegetatively and seed	—	—
Lotus corniculatus	Do	260	52%
Medicago lupulina	Do	240	88%
Oxalis corniculatus	Do	307	76%
Pennisetum flaccidum	Do	1011	22%
Phleum paniculatum	Do	2117	70%
Plantago lanceolata	Do	918	65%
P. major	Do	172	65%

Name of the weeds	Dissemination	Seed output	Seed viability
Poa angustifolia	Do	763	45%
P. annua	Do	103	61%
Polgonum hydropiper	Do	275	72%
P. lapathifolium	Do	511	80%
P. persicaria	Do	470	82%
Scirpus juncoides	Do	567	70%
S. mucronatus	Do	Seed small many	
Scutellaria galericulata	Do	416	62%
Setaria italica	Do	927	80%
S. verticillata	Do	717	53%
Trifolium pratense	Do	133	40%
T. repens	Do	92	60%
Verbena officinalis	Seed	1211	72%
Veronica secunda	Vegetatively and seed	2007	81%

From the table given above it is evident that the weeds invading paddy fields possess a capacity of reproducing both vegetatively as well as through seeds. The availability of good moisture and fertile soils help these weeds to survive and develop better than in their normal habitat.

APPENDIX II

CONTRIBUTION TO THE NEW RECORDS FOR KASHMIR

Following is a list of weed species which have been reported by the author for the first time from Kashmir :

1. *Barbarea intermedia* Boreau.
2. *Bromus lanceolatus* Roth
3. *Cardaria draba* (L.) Desv.
4. *Chrysanthemum vulgare* (L.) Bernh.
5. *Conyza aegyptiaca* Ait.
6. *Crepis thomsoni* Babcock
7. *Cyperus pumilus* L.
8. *Cyperus sanguinolentus* Vahl
9. *Eleocharis dulcis* (Burm.f.) Henschel
10. *Erigeron annuus* Pers.
11. *Galium setaceum* Lamk.
12. *Geranium polyanthes* Edgew. et Hook.f.
13. *Helianthus tuberosus* L.
14. *Lamium amplexicaule* L.
15. *Muscari botryoides* Mill.
16. *Oenothera rosea* Soland
17. *Paspalum scrobiculatum* L.
18. *Ranunculus cantoniensis* DC.
19. *Ranunculus flaccidus* Hook.f. & Thoms.
20. *Scirpus lateriflorus* Gmel.
21. *Trigonella incisa* Benth.
22. *Trifolium dubium* Sibth.
23. *Youngia japonica* (L.) DC.

APPENDIX III

CONTRIBUTION TO THE NEW RECORDS FOR INDIA FROM KASHMIR

Certain weed species have not been reported from Indian subcontinent. These may either be recent introductions or have escaped the notice of earlier collectors. The species collected and observed by the author are enumerated below :

1. *Amaranthus graecizans* L.
2. *Aster pilosus* L. var. *demotus* Blake
3. *Chrysanthemum parthenium* (L.) Bernh.
4. *Ornithogalum umbellatum* L.
5. *Phacelia tanacetifolia* Bentham
6. *Senecio vulgaris* L.
7. *Sideritis montana* L.

APPENDIX IV(I)

Germination studies on common weeds of Kashmir.....I. *Senecio vulgaris* L.

INTRODUCTION

Generally weeds are highly adaptive. They can grow alongwith the crop seeds and reach maturity with the crop or mature even if uprooted at the flowering stage (Muenscher, 1955). Though the weeds germinate quickly, some have been seen to retain their viability up to forty years (Muenscher *l.c.*). Seed dormancy is an adaptive mechanism of growth cessation which often confers upon some species a selective advantage in distribution and abundance.

With a view to knowing the germinating behaviour of a weed common to different crops of Srinagar, *Senecio vulgaris* L. was selected as a representative weed of orchards and cereal crops. It is seen flowering practically all the year round except in the winter (December-February), and it was thought worthwhile to study the germinating pattern of its seeds under variable conditions of habitat.

The preliminary effects of storage, scarification, burial under mud and photoperiod were observed with the help of appropriate experiments.

MATERIALS & METHODS

Mature seeds were obtained from plants growing wild and stored in dry glass containers under normal room conditions. Five replicates of 50 seeds each were used in each experiment and these were germinated in petri dishes using Whatman's No. 1 filter paper.

Seed scarification was done mechanically by giving a sharp cut at the micropylar end.

The light treatment was given using white light of 880 lumens/hour intensity. Dark treatment was given by wrapping the patri dishes with black paper and keeping them in a dark room.

All the above techniques are adapted from Misra's workbook in Ecology (1968).

OBSERVATIONS & RESULTS

Experiment No. 1 :

Effect of dry storage on germination

Freshly harvested seeds (August, 1971) did not show any germination. The percentage of germination showed a considerable increase with the increase in storage period. Thus the

seeds stored for 12 months showed 96% germination.

Experiment No. 2 :

Effect of scarification on germination

A prick was given by a sharp pin on the pericarp towards the micropylar end of each 'seed' and the 'seeds' were allowed to germinate. Scarification was seen to have a considerable effect in breaking the dormancy of freshly collected seeds. The results are tabulated in Table 1, below :

TABLE 1

Date	*Total No. of seeds*	*No of seeds germinated (Mean of 5 replicates)*	
		Unscarified	*Scarified*
21.8.1971		—	—
22.8.1971		—	—
23.8.1971		—	—
24.8.1971		—	—
25.8.1971		1	4
26.8.1971		—	5
27.8.1971		—	9
28.8.1971		—	7
29.8.1971		—	3
30.8.1971		—	7
31.8.1971		—	—
1.9.1971		—	—
2.9.1971		—	—
3.9.1971		—	—
	50 each	1	35

Only 2% unscarified seeds germinated while the germination of scarified seeds was 70%. No seeds germinated after one week.

Experiment No. 3 :

Effect of burial in mud

The freshly collected one year old seeds were wrapped in muslin cloth and buried in mud at a depth of 25 cm for varying periods i.e. 15 days, 30 days and 45 days. After a thorough wash these were allowed to germinate. The results are set in Table 2.

TABLE 2

Burial duration	*Percentage germination*	
No. of days	*Fresh seeds*	*1 year old seeds*
15	48	9
30	15	2
45	9	2

Fresh 'seeds' when buried for about a fortnight in mud showed 48% germination, the old 'seeds' showed a decaying tendency. When the fresh 'seeds' were buried for a month or more the germination percentage was considerably lowered.

Experiment No. 4 :

Effect of photoperiod on germination.

'Seeds' stored for one month and one year were subject to different photoperiod treatments. One year old 'seeds' showed a maximum of 89% germination when subjected to 12 hours of light and 12 hours of darkness; whereas one month old 'seeds' showed a maximum of 25% germination when subjected to 20 hours of light and 4 hours of darkness. It shows that age of seeds and photoperiod influence the germination ability of this weed.

DISCUSSION

Sapru and Kaul (1968) have shown similar results in germination studies of *Euphorbia peplus* L. and concluded that the inhibitive effects of the outer coating are lost in nature under dry storage conditions.

If the apex of the achene is cut artificially, germination is preponed. It appears that if the seed reaches a physiological state in which it is not dormant but still has an intact pericarp, it is still unable to germinate. Mechanical pressure in perhaps the main factor responsible for this phenomenon. It is also suggested that an inhibitor may be present which must be leached out or overcome in nature before germination can occur. Timson (1966) reports such type of dormancy in *Polygonum convolvulus.*

In nature, the plants grow luxuriantly near moist habitat conditions; the 'seeds' are shed at maturity and remain buried. It was found that the 'seeds' lose their viability by prolonged burial in mud.

The duration of light is of great significance as some seeds germinate in continuous light or continuous darkness and some require diurnal variation for the germination to set in. In the plant under study, one year old 'seeds' when subjected to 12 hours of light followed by 12 hours of darkness show maximum germination whereas one month 'seeds' show minimum germination. The germination was negligible when 'seeds' were subjected to complete light or darkness.

APPENDIX IV(2)

Germination studies on common weeds of Kashmir.....II

Correlation of temperature and germination in *Veronica didyma* Tenore.

INTRODUCTION

This weed is seen to flower in spring (April) generally but it has been observed in flowers at times during late autumn (November). Accordingly, it is observed to germinate generally in autumn (November), these seedlings remain dormant during winter and develop further during the spring. The plants flowering in autumn germinate during the spring. The flowering and fruiting during spring and autumn produce normal seeds and seedlings.

This study is designed to assess the effect of temperature and storage on germination of seeds in this species.

EXPERIMENTAL PROCEDURE & RESULTS

The seeds were collected at random from campus fields of Regional Research Laboratory, Srinagar, and stored in dry glass containers. The germination was studied under conditions of temperature control in incubators. Five replicates of 100 seeds each were put in patri dishes using Whatmann (No. 42) filter paper. In each case germination was checked every day for about 3 weeks.

TABLE NO. 1

Effect of temperature on germination on *Veronica didyma* Tenore

Temperature	Germination percentation	
	Fresh seeds	*1 year old seeds*
10°C	Nil	6
20°C	10	69
30°C	Nil	46
35°C	Nil	15

From the table given above it is evident that fresh seeds show 10% germination at 20°C and at other temperatures there is no germination. One year old seeds have a tendency to germinate faster and they showed better tolerance to higher temperatures. The study reveals that 20°C is the optimum temperature for its germination. There is a decline in the germination as the temperature goes up.

According to Newman (1963), (in most species investigated where there is a change in ability to germinate as the seed ages) after a period of storage the seeds give a higher total germination and/or a faster rate than do fresh seeds under same conditions. Mostly this change in germination ability is related to physiological changes in the seed (after ripening), but in some Leguminosae it is due to the softening of a hard seed coat. In *Bromus tectorum* the total germination of fresh seed as reported by Hulbert (1955) was 53% at 10°C and 1% at 20°C; after 7 weeks storage, germination was about 95% at either temperature, but faster at 20°C.

From the above discussion it seems that germination ability of *Veronica didyma* is related to physiological changes in the seed in time, for it does not have a hard seed coat.

APPENDIX IV(3)

Germination studies on common weeds of Kashmir - .....III.

A comparison of the germination character of 4 species of Chenopodiaceae.

INTRODUCTION

The family Chenopodiaceae is represented by 5 weed species in Kashmir—*Acroglochin persicarioides* Schrad., *Chenopodium album* L. *Chenopodium ambrosoides* L., *Chenopodium botrys* L. and *Chenopodium foliosum* (Moench.) Asch.

A comparative study of the germination behaviour of 4 species of *Chenopodium* was made.

Experimental procedure and results :

The seeds of the 4 species of *Chenopodium* under study were collected and stored in dry glass containers. The germination was studied under uniform conditions in patri dishes using Whatmann (No. 42) filter paper.

Experiment No. 1 :

Effect of storage on germination :

The germination of fresh and one year old seeds studied at 25°C in an oven. The comparative data is tabulated as below :

Species	Percentage germination	
	Fresh seeds	1 year old seeds
Chenopodium album	—	16
Chenopodium ambrosoides	—	24
Chenopodium botrys	—	14
Chenopodium foliosum	10	96

From the above table it is evident that fresh seeds of these species do not germinate, whereas storage has definitely some effect on germination ability. In the case of *Chenopodium foliosum* 10% of fresh seeds germinated whereas the percentage rose to 96% in the case of seeds stored for a year.

Experiment No. 2.

Effect of chilling on germination

Fresh and one year old seeds were moistened and put at 5°C in an incubator for a fortnight. After this treatment the seeds were moved at 25°C and germination studied. The results are tabulated as follows :

Species	Percentage germination	
	Fresh seeds	1 year old seeds
C. album L.	22	40
C. ambrosoides L.	7	11
C. botrys L.	55	96
C. foliosum (Moench.) Asch.	94	98

It is evident that chilling enhances the germination ability of all the four species. The germination of *Chenopodium ambrosoides* in general is seen to be poor. It is a perennial herb and in nature also it has not been seen to be as common as the other species.

From the foregoing experiments it can be concluded that the germination percentage of *C. foliosum* is the highest with or without chilling. In nature *C. album*, *C. ambrosoides* and *C. botrys* flower in autumn and shed seeds in late autumn or in early winter which undergo chilling, whereas *C. foliosum* flowers in summer and shed seeds in early autumn.

The increase in germination ability with storage has been reported in many plant species; as in certain legumes like *Trifolium glomeratum*, *T reflexum*, *T. resupinatum* (Toole and Hollowell, 1939).

APPENDIX V

COMPARISON OF COMPETITIVE ABILITY OF TWO COMMON WEED SPECIES

Weeds compete with crop plant for water, nutrients and light, subsequently reducing its quality and quantity. One of the methods to evaluate this loss is by assessing the "competitive ability" or "competitive efficiency" of the weeds in relation to a crop plant. The competitive ability of a plant according to Welbank (1963) and Tripathi (1968) means its ability to depress the growth of other plants. Welbank (1963) measures the effect of different species on a common indicator plant (crop) by taking fresh and dry weight of the indicator or the relevant part thereof.

MATERIALS & METHODS

All the experiments were performed under field conditions. *Descurainea sophia* (L.) Webb. and *Papaver dubium* L., the most common weeds of wheat fields of Srinagar, were selected for this study. The selected area near the campus of Regional Research Laboratory, Srinagar, was sub-divided into one square metre plots in which uniform crop-weed levels were maintained. In each plot 100 plants of wheat and 100 plants of weed were allowed to grow. In one plot *Descurainea sophia* was used as a weed and no other weed was allowed to grow. In another plot *Papaver dubium* was the competing weed. The crop as well as weed were sown at the onset of winter i.e. 2nd week of December, 1971 and in spring the seedlings of the two weeds were transplanted to keep uniform crop-weed level. In the control only wheat seedlings were allowed to grow. The experiment was replicated three times. At the end of April, 1972, the crop was harvested. The fresh and the dry weights of roots, shoots (excluding spikes) and spikes of wheat (indicator plant) were determined and taken at the index of competitive ability. The fresh

weight was taken in the field and dry weights were taken after drying the plants in oven at 100°C for twentyfour hours.

RESULTS & DISCUSSION

The results obtained are tabulated as under :

Table : Effects of weeds on fresh weight and dry weight of root, shoot (excluding spike) and spike of wheat (indicator plant).

TREATMENT	Average Root wt./plant		Average shoot wt./plant		Average spike wt./plant	
	Fresh (g)	Dry (g)	Fresh (g)	Dry (g)	Fresh (g)	Dry (g)
CONTROL	0.50 ± .07	0.30 ± .05	3.16 ± .17	2.66 ± .35	4.27 ± .17	2.77 ± .16
Wheat grown with *Descurainea sophia*	0.27 ± .04	0.15 ± .01	2.16 ± .13	1.66 ± .10	3.04 ± .15	2.15 ± .13
Percentage loss	46	50	31.3	37.6	28.8	22.3
Wheat grown with *Papaver dubium*	0.21 ± .02	0.11 ± .06	1.62 ± .19	1.07 ± .15	2.16 ± .30	1.40 ± .14
Percentage loss	58	63.3	48.7	59.7	49.4	49.4

From the table above it is evident that, of the two weeds, *P. dubium* ranks higher in competitive ability as measured by its effects on roots, shoot and spike of wheat. The data indicate that *D. sophia* is much less a troublesome weed. The common field poppy has been observed to reduce the dry weight of wheat spike to nearly fifty per cent hence ranking much higher in competitive ability than the other weed.

Thus it is evident that effect of a plant species on its associates (its competitive ability) greatly depends on the species involved in competition. This effect, to a considerable extent, depends upon the relative success of the individual in utilizing the nutrients and other things needed for growth. The plants of *P. dubium* produce much branched roots which go to longer distances to get the nutrients and moreover it produces a basal rosette of leaves and spreads its branches cutting off part of sunlight to the crop plants; whereas in *D. sophia* the roots are simple, branched or unbranched and the leaves are small and much divided which do not stop any sunlight to the crop plants.

APPENDIX VI

COMPOSITION OF WEED FLORA IN WHEAT FIELDS OF KASHMIR

This study is an account of the composition of weeds in wheat fields of Kashmir, broadly speaking; the spring cereal crops.

The wheat crop is grown in all districts of Kashmir. Out of the total cultivable land, this crop was grown on 1.79 lakh hectares in 1971-72 and 1.82 lakh hectares in 1972-73.

Sixteen localities were selected for this study, For convenience, this first eight localities were studied in the year 1973 and others in 1974 (from early March to middle May of each year). The localities are enumerated in Table 1. Each locality was visited at least twice a month. The data was taken from five sub-locations selected in each locality.

TABLE 1

Localities surveyed in 1973 and 1974.

S. No.	*Locality*	
1.	Awantipora	**Year 1973**
2.	Baramulla	
3.	Charari-sharif	
4.	Ganderbal	
5.	Magam	
6.	Manasbal	
7.	Patan	
8.	Sopore	
9.	Badgam	**Year 1974**
10.	Barzulla	
11.	Harwan	
12.	Nasim	
13.	Natipora	
14.	Nishat	
15.	Pampore	
16.	Shalteng	

Sampling units

The random quadrat sampling method was used for finding the percentage frequency of weed species. One square metre quadrat was used throughout the study (Misra 1968).

Distribution of weed taxa

The total number of species listed from all the localities during the years 1973 & 74 was 112. The number of species in the localities varied considerably (Tab. 3).

The most common species and their average percentage frequencies are given in Table 2.

TABLE 2

Average percentage frequencies of common and weed taxa.

Name of the weed	Av. percentage frequency
ANNUALS	
Papaver dubium L.	65
Descurainea sophia (L.) Webb	62
Ranunculus arvensis L.	40
Arenaria serpyllifolia L.	39
Malcolmia africana (L.) R. Br.	36
Anagallis arvensis L.	33
Alyssum desertorum Stapf	33
Eruca sativa Mill.	32
Ceratocephalus falcatus (L.) Pers.	31
PERENNIALS	
Convolvulus arvensis L.	47
Polygonum rottboellioides Jaub. & Spach.	35
Equisetum arvense L.	33
Plantago lanceolata L.	32
Sorghum halepense (L.) Pers.	31

On an average the annuals were more frequent than perennials.

A detailed account of the distribution and frequencies of 14 weed taxa which seem to be of considerable importance, is given hereunder. There annuals and three perennials which are more damaging for the crop have been represented graphically.

Papaver dubium L.

Annual polymorphic herb; easily distinguished by its large showy, scarlet red flowers. Common in all wheat fields throughout the valley. It was found to be more common in (Baramulla, Magam, Sopore and Natipora) north-western parts of Kashmir.

Descurainea sophia (L.) Webb.

Annual herb found commonly in wheat fields, orchards, and occasionally in vegetable fields.

It was found to be more frequent in (Charari-sharif, Magam, Natipora, Nishat and Pampore) South and S. eastern parts of Kashmir, on the basis of survey conducted during 1973 and 1974.

Ranunculus arvensis L.

Annual herb with small yellow flowers found to be common in wheat fields and occasional in orchards and vegetable fields.

The weed was found to be common towards South-West of Kashmir.

Arenaria serpyllifolia L.

Annual herb, procumbent with small white flowers; common in wheat fields and occasional in orchards and vegetable fields.

The weed was found to be more common in Sopore and Nasim as compared to other ocations surveyed during 1973 and 1974.

Malcolmia africana (L.) R. Br.

Annual herb with small pinkish white flowers and somewhat tufted habit, common in wheat fields and orchards.

The weed was found to be more common in Awantipora, Badgam and Pampore as compared to other locations surveyed.

Anagallis arvensis L.

Annual procumbent herb with generally crimson flowers common in wheat fields and occasional in orchards, vegetable fields, grasslands and even fallow lands.

The weed has been recorded from all the localities, though it is more common in Nasim, in the north of Srinagar.

Alyssum desertorum Stapf

Annual small herb with small yellow flowers, forming colonies in wheat fields and orchards.

The weed was found to be common in Ganderbal, Magam, Badgam and Barzulla on the basis of survey conducted during 1973 and 1974.

Eruca sativa Mill.

Annual herb with yellowish flowers, found to be common in wheat fields and Sarson fields.

It was more common in Mansbal, Barzulla and Harwan as compared to other localities.

Ceratocephalus falcatus (L.) Pers.

Annual small herbs with yellow flowers, forming small colonies in the fields. It is common in wheat fields, vegetable fields and orchards; occasional in grasslands, fallow lands and roadsides.

It wes found to be common in Patan and Badgam as compared to other localities.

Convolvulus arvensis L.

Perennial creeping herb, rootstock spreading to long distances; common in wheat fields and occasional in orchards and maize fields.

It was found to be more common in Nasim and Nishat as compared to other localities.

Polygonum rottboelloides Jaub & Spach

Perennial decumbent herb, branches spreading along all directions; common in wheat fields and occasional in orchards and vegetable fields.

It was found to be more common in Ganderbal and Magam as compared to other localities.

Equisetum arvense L.

Perennial decumbent herb, found mostly in vegetative state as a weed; common in wheat fields and maize fields, occasional in grasslands and orchards.

The weed was found to be common in Barzulla and Shalteng as compared to other localities surveyed.

Plantago lanceolata L.

Perennial herb; common in wheat fields and orchards, occasional in grasslands, fallow lands and roadides.

In Harwan, Nasim and Natipora this weed was found to be more dangerous than other localities.

Sorghum halepense (L.) Pers.

Perennial herb with more than 1 m tall culm; commonly in vegetative state in wheat fields and flowering in maize fields.

In Harwan it was found to be more common as compared to other localities.

TABLE 3

Percentage frequencies of weed taxa found on wheat fields

Sr. No.	Taxon	Year 1973 Locality	1	2	3	4	5	6	7	8	Average P.F. 1973
1.	*Aaonis aestivalis* L.		—	—	33	—	—	—	—	30	8
2.	*Alyssum desertorum* Stapf		37	27	—	80	80	—	20	—	31
3.	*Anagallis arvensis* L.		25	40	32	33	15	40	20	40	31
4.	*Anchusa ovata* Lehm.		—	45	—	—	—	—	—	33	10
5.	*Arenaria serpyllifolia* L.		27	43	43	43	37	37	30	55	39
6.	*Artemisia absinthium* L.		—	—	—	—	—	—	—	—	—
7.	*A. parviflora* Roxb.		—	—	—	—	—	—	—	—	—
8.	*Avena fatua* L.		—	—	—	10	—	—	—	—	—
9.	*Barbarea intermedia* Boreau.		—	—	—	—	—	10	—	—	1
10.	*Bothriochloa ischaemum* (L.) Keng		—	—	30	—	45	—	—	—	9
11.	*Bothriospermum tenellum* (Hornem) Fisch. et Mey.		—	—	—	—	—	—	—	—	—
12.	*Bromus inermis* Leyss.		—	—	—	20	—	—	—	—	3
13	*B. lanceolatus* Roth		—	—	—	20	—	—	—	—	3
14.	*Bunium persicum* (Boiss) B. Fedtsch.		—	—	—	10	—	15	—	—	3
15.	*Canscora decussata* Roem. & Schultes		—	—	—	—	20	—	—	—	—
16.	*Capsella bursa-pastoris* (L.) Medikus		27	—	10	—	—	—	—	30	8
17.	*Carduus edelbergii* Reich. f.		20	—	—	—	—	—	—	—	3
18.	*Centaurea ibericea* Trev.		10	—	—	—	—	—	—	35	6
19.	*Cerastium viscosum* Thuill.		—	10	—	—	—	—	—	—	1
20.	*Ceratocephalus falcatus* (L.) Pers.		60	—	25	55	45	50	90	—	41
21.	*Chenopodium album* L.		—	—	10	—	—	—	—	—	1
22.	*Cichorium intybus* L.		15	20	10	—	—	20	20	—	11
23.	*Cirsium argyracanthum* DC.		—	10	—	—	—	—	20	—	4
24.	*Convolvulus arvensis* L.		50	50	53	—	37	47	43	52	42
25.	*Conyza canadensis* (L.) Cronq.		15	25	15	15	—	35	20	10	17
26.	*Coronopus didymus* (L.) Smith		10	20	10	15	25	10	—	40	16
27.	*Crepis sancta* (L.) Babcock		—	15	10	—	—	—	30	—	7
28.	*Cynodon dactylon* (L.) Pers.		—	—	—	—	—	—	—	—	—
29.	*Descurainea sophia* (L.) Webb.		40	45	90	60	80	45	57	73	61
30.	*Equisetum arvense* L.		40	40	20	30	20	37	45	30	33
31.	*Erodium cicutarium* (L.) L'Herit		17	—	—	—	—	10	—	70	12

9	10	11	12	13	14	15	16	Average P.F. 1974	Average P.F. 73-74
30	25	—	50	—	—	—	—	13	11
70	80	25	—	40	27	27	—	34	33
30	37	45	60	20	30	27	37	35	33
50	25	17	30	20	20	—	35	25	18
34	35	43	55	30	40	40	34	39	39
—	—	—	10	—	—	—	—	1	1
10	—	—	—	—	—	—	—	1	1
10	—	—	—	—	—	—	—	1	1
—	—	—	—	—	—	—	—	—	1
—	—	—	—	—	—	—	—	—	5
—	—	—	—	45	—	—	—	6	3
20	10	—	—	—	—	10	—	5	4
—	—	—	—	—	—	—	—	—	2
30	—	—	—	10	—	—	20	8	6
—	—	—	—	—	—	—	—	—	2
20	—	30	—	20	10	15	20	14	11
—	—	—	30	20	—	10	20	10	7
10	30	50	—	10	-	10	30	18	12
—	20	—	—	—	—	—	—	3	2
80	—	—	50	—	—	40	—	21	31
—	—	—	—	—	—	—	—	4	3
—	—	—	—	10	—	—	10	3	7
—	40	—	—	20	30	—	—	11	8
57	64	57	60	30	60	15	55	51	47
—	30	—	17	33	35	10	20	18	18
—	—	—	30	—	—	30	23	10	13
—	—	—	10	20	20	23	—	9	8
27	50	—	20	—	—	—	—	12	6
70	—	63	63	80	90	85	50	63	62
—	55	30	—	45	50	50	50	33	33
20	—	35	40	—	—	10	—	13	13

Sr. No.	Taxon	Year 1973 Locality	1	2	3	4	5	6	7	8	Average P.F. 1973
32.	*Eruca sativa* Mill.		40	30	30	45	37	60	—	—	30
33.	*Euphorbia helioscopia* L.		10	10	—	—	—	—	20	23	8
34.	*E. hispida* Boiss.		—	—	—	—	—	—	—	—	—
35.	*Filaga pyramidata* L.		—	40	—	30	—	—	50	—	15
36.	*Fumaria indica* Pugsley		—	—	—	—	—	—	—	40	5
37.	*Gagea dschungarica* Regel.		—	—	—	10	10	—	—	—	3
38.	*Gagea elegans* Wall.		20	35	—	15	15	35	—	—	15
39.	*Galinsoga parviflora* Cav.		—	10	—	—	—	—	45	—	7
40.	*Galium tricorne* With.		—	30	—	—	25	—	30	30	14
41.	*Garhadiolus minutissimus* (Bunge) Kitamura		—	10	—	—	—	25	—	—	4
42.	*Geranium nepalense* Sw.		—	—	—	—	—	—	—	20	3
43.	*Gnaphalium luteo-album* L.		—	15	—	—	—	—	45	—	8
44.	*Goldbachia laevigata* (M. Bieb.) DC.		15	20	—	—	—	—	—	10	6
45.	*Heliotropium europaeum* L. var. *lasiocarpum* (Fisch. et Mey.) Kazmi		—	—	—	—	—	—	—	—	—
46.	*Herniaria hirsuta* L.		—	—	—	—	—	—	—	—	—
47.	*Hordeum murinum* L.		—	—	—	—	—	—	—	—	—
48.	*Iris ensata* Thunb.		10	10	—	—	—	—	—	—	3
49.	*Kickxia subessilis* Pennell		—	—	—	—	—	—	—	—	—
50.	*Koelpinia linearis* Pall.		—	—	—	—	20	—	—	—	3
51.	*Lactuca serriola* L.		20	—	—	10	10	—	—	—	5
52.	*Lamium amplexicaule* L.		10	20	—	—	—	—	60	40	16
53.	*Lathyrus aphaca* L.		—	—	—	10	10	—	10	—	4
54.	*L. sphaericus* Retz.		—	—	—	—	—	—	—	—	—
55.	*Lespedeza juncea* Pers.		—	—	—	—	—	—	—	—	—
56.	*Lithospermum arvense* L.		—	—	—	—	45	—	—	50	12
57.	*Lolium temulentum* L.		—	30	25	30	—	—	—	10	12
58.	*Lotus corniculatus* L.		—	—	—	—	—	—	—	—	—
59.	*Macolmia africana* (L.) R. Br.		65	40	40	—	45	40	30	50	39
60.	*Malva neglecta* Wallr.		—	—	—	—	—	—	20	—	3
61.	*M. sylvestris* L.		—	—	—	—	—	—	—	—	—
62.	*Mazus pumilus* (Burm.f.) Steenis		—	—	—	—	60	—	25	—	11
63.	*M. tomentosa* (Roxb.) Saldanha		—	—	—	—	40	—	—	50	11
64.	*Medicago lupulina* L.		10	40	35	40	—	30	23	15	24
65.	*M. minima* (L.) Grupb.		—	—	—	20	—	—	40	20	10

9	10	11	12	13	14	15	16	Average P.F. 1974	Average P.F. 73-74
45	57	65	—	—	40	33	35	34	32
—	—	40	—	—	—	—	—	5	7
—	—	—	—	—	30	—	—	4	2
40	30	—	—	30	—	—	—	13	14
15	57	—	50	—	—	—	—	15	10
—	—	—	—	—	—	—	—	—	2
—	—	—	—	—	—	20	—	3	9
—	—	43	10	—	30	—	10	12	10
50	57	—	—	—	20	—	30	20	17
10	20	10	20	10	—	—	—	9	7
—	—	—	—	—	—	—	—	—	2
—	—	43	10	—	30	—	10	12	10
15	25	—	30	20	14	—	15	15	11
—	—	—	—	—	—	25	—	3	2
15	30	—	30	30	—	—	—	13	7
10	—	—	20	—	—	—	—	4	2
—	15	20	10	10	—	10	15	10	7
—	—	—	10	20	10	—	—	5	3
20	—	10	—	—	—	—	—	4	4
—	—	—	—	—	—	10	—	1	3
—	—	20	—	—	30	20	—	9	13
—	20	—	—	—	20	—	20	8	6
30	—	—	—	—	—	10	—	5	3
—	—	—	—	—	—	—	10	1	1
30	20	—	—	—	—	—	30	10	11
10	20	—	30	—	10	—	—	9	11
—	—	—	—	—	—	—	16	2	1
60	40	27	51	—	3	66	—	35	37
—	—	—	—	—	—	—	30	4	4
—	30	—	—	—	—	—	—	4	2
—	—	—	20	—	—	—	25	6	9
—	—	—	60	—	—	—	40	13	12
42	50	50	55	40	20	20	10	36	30
—	—	10	50	—	—	—	—	8	9

Sr. No.	Taxon	Year 1973 Locality	1	2	3	4	5	6	7	8	Averag P.F.
66.	*M. sativa* L.		—	10	—	—	—	—	—	—	1
67.	*Neslia apiculata* (Fisch. & Mey.) Mey.		20	10	—	—	20	30	20	—	13
68.	*Onopordum acanthium* L.		—	—	—	—	—	—	—	—	—
69.	*Papaver dubium* L		62	90	62	52	80	47	57	80	66
70.	*P. macrostomum* Boiss. & Heust.		30	—	20	—	—	—	30	10	11
71.	*P. rhoeas* L.		—	—	—	—	—	—	—	40	5
72.	*Phleum paniculatum* Huds.		—	—	—	—	—	—	—	—	—
73.	*Plantago lanceolata* L.		—	50	35	50	40	37	25	23	33
74.	*Plantago major* L.		30	—	20	—	—	30	10	—	11
75.	*Poa annua* L.		—	10	15	—	—	10	—	20	7
76.	*Poa bulbosa* L.		10	—	—	—	25	—	—	10	6
77.	*Polygonum aviculare* L.		—	35	—	20	—	27	—	—	10
78.	*Polygonum hydropiper* L.		—	—	—	—	—	—	—	—	—
79.	*P. rottboelloides* Jaub. & Spach.		—	10	—	70	70	40	20	40	31
80.	*Potentilla reptans* L.		—	—	—	10	—	—	—	—	1
81.	*P. supina* L.		10	30	—	15	20	—	—	30	13
82.	*Ranunculus arvensis* L.		52	40	40	50	33	43	57	60	47
83.	*R. laetus* Wall.		—	30	15	20	—	—	—	20	11
84.	*R. muricatus* L.		—	—	35	43	—	40	20	17	19
85.	*Rorippa islandica* (Oeder) Borbas.		—	—	—	—	—	—	15	70	11
86.	*Salvia moorcroftiana* Wall.		15	30	—	35	50	—	—	—	16
87.	*Scandix pecten-veneris* L.		27	46	30	—	30	—	30	45	26
88.	*Senecio vulgaris* L.		15	20	—	—	—	—	50	40	16
89.	*Sisymbrium irio* L.		—	—	—	—	—	—	—	—	—
90.	*S. loeselii* L.		—	—	—	—	—	—	—	—	—
91.	*Solanum nigrum* L.		—	—	—	10	10	—	—	—	3
92.	*Sonchus asper* (L.) Hill		—	—	—	20	20	—	—	—	5
93.	*Sorghum halepense* (L.) Pers.		20	40	40	40	40	43	50	—	34
94.	*Silene conoidea* L.		10	—	—	—	—	—	—	—	1
95.	*Taraxacum officinale* Wigg.		15	—	10	10	10	10	—	50	13
96.	*Thlaspi arvense* L.		—	—	10	—	—	—	—	10	3
97.	*Thymelaea passerina* (L.) Coss.		—	—	—	—	—	—	—	—	—
98.	*Torilis leptophylla* (L.) Reich.f.		—	—	—	—	—	20	—	—	3
99.	*Tribulus terrestris* L.		—	20	—	—	10	—	—	—	4
100.	*Trifolium dubium* Sibth.		—	—	—	—	—	20	—	—	3

9	10	11	12	13		15	16	Average P.F. 1974	Average P.F. 73-74
20	—	—	10	—	—	—	10	5	3
30	20	—	20	20	20	—	23	17	15
—	—	—	20	—	—	—	—	3	2
66	65	62	57	87	40	67	67	64	65
—	—	—	—	—	30	20	—	6	9
60	—	—	—	—	—	—	—	8	7
—	—	—	10	—	—	—	—	1	1
20	30	50	60	50	20	—	10	30	32
—	—	—	20	—	—	—	20	5	8
10	10	—	13	—	20	20	10	10	9
23	—	—	20	20	30	—	10	13	10
40	60	—	10	30	40	20	30	29	20
—	—	—	30	—	—	—	—	4	2
47	55	35	30	45	—	40	30	38	35
—	—	—	20	—	—	—	—	3	2
—	—	—	40	—	—	—	—	5	9
70	25	37	40	—	33	50	—	33	40
—	35	15	—	—	—	—	—	6	9
40	—	—	70	—	—	—	40	19	19
—	—	20	40	—	—	—	37	12	12
—	—	—	—	—	—	35	50	11	14
47	40	35	50	20	20	40	20	34	30
—	—	15	—	—	—	—	10	3	10
30	—	—	60	15	—	—	—	13	7
—	—	—	60	—	—	—	—	8	4
—	—	—	—	—	—	—	—	—	2
—	30	—	—	30	—	—	—	6	6
—	35	80	—	28	43	—	35	28	31
—	50	—	—	—	—	—	—	6	4
—	10	35	—	10	—	10	—	8	11
20	—	—	—	—	—	—	—	3	3
—	—	—	20	10	—	—	—	4	2
—	—	—	—	—	—	—	—	—	2
—	—	—	—	—	—	—	—	—	2
—	—	—	—	—	—	...	—	—	2

Sr. No.	Taxon	Year 1973 Locality	1	2	3	4	5	6	7	8	Average P.F. 1973
101.	*Trifolium pratense* L.		—	15	—	30	—	—	6	—	6
102.	*T. repense* L.		—	—	—	20	—	—	26	—	2
103.	*Trigonella emodi* Benth.		—	—	—	—	—	—	—	10	1
104.	*T. incisa* Benth.		—	—	—	—	—	—	20	—	3
105.	*Tulipa stellata* Hook.f.		37	40	—	—	—	—	—	—	10
106.	*Turgenia latifolia* Hoffm.		—	—	—	15	35	—	—	—	6
107.	*Vacaria pyramidata* Medik.		—	60	40	20	30	35	—	30	27
108.	*Valerianella szovitziana* Fisch. et Mey.		—	25	—	37	25	20	—	—	13
109.	*Verbasum thapsus* L.		30	—	—	—	—	—	—	—	4
110.	*Veronica biloba* L.		—	15	17	20	—	40	20	40	19
111.	*Veronica didyma* Tenore		—	—	30	—	—	—	20	27	10
112.	*Vicia sativa* L.		—	10	—	20	—	—	15	—	6

9	10	11	12	13	14	15	16	Average P.F. 1974	Average P.F. 73-74
—	10	—	15	—	—	—	10	4	5
—	—	—	20	—	—	—	—	3	5
—	—	—	—	—	—	—	—	—	1
—	—	10	—	—	—	—	—	1	2
10	—	—	—	—	—	35	—	6	8
23	20	—	20	—	20	25	25	17	12
50	45	25	40	—	50	30	20	33	30
37	22	30	30	30	15	10	23	25	19
—	—	—	—	—	—	—	—	—	2
30	25	—	20	—	—	—	—	9	14
32	47	20	10	—	10	20	35	22	16
30	25	—	—	—	20	—	—	9	8

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Family names in CAPITALS, names accepted for the flora are in **bold**, synonyms in *italics* and others in roman. An asterisk (*) with page number indicates figure and bold page number indicates the main description of the taxon.