

**FLORA**  
**OF THE**  
**PUNJAB PLAINS**

**RECORDS**  
OF THE  
**BOTANICAL SURVEY OF INDIA**

VOLUME XXI, No. 1, 1978

**FLORA**  
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N. C. NAIR



BOTANICAL SURVEY OF INDIA  
INDIAN BOTANIC GARDEN, HOWRAH-711103

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Price : Rs. 50.20 or \$ 11.60 or £ 5.00

PUBLISHED BY THE DIRECTOR, BOTANICAL SURVEY OF INDIA, INDIAN BOTANIC  
GARDEN, HOWRAH-711103 AND PRINTED BY N. K. GOSSAIN & CO. PRIVATE LTD.,  
13/7, ARIFF ROAD, CALCUTTA-700067

## FOREWORD

*Flora of the Punjab Plains* is based on intensive floristic studies made by Dr. N. C. Nair during 1961-66 when he worked as Systematic Botanist in the Northern Circle, Botanical Survey of India, Dehra Dun.

The Botanical Survey of India is now involved in a major programme of preparing the Flora of India. It is proposed to bring it out in four series namely Ser. I. The National Flora (Flora of India). Ser. II. State Flora Analysis. Ser. III. District or Small Regional Flora. Ser. IV. Miscellaneous — not falling under the above three series. The present Flora of the Punjab Plains could rightly be one such volume under Ser. III. At the time when Dr. Nair completed the work and prepared the manuscript on the present flora, the details of publication of Flora of India series had not been finalised and hence it was decided to publish his work as Records of the Botanical Survey of India.

Botanical Survey of India is happy to release the present work as it should adequately serve the needs of a regional flora for the area covered by it.

Botanical Survey of India  
P. O. Botanic Garden  
Howrah-711103  
March, 1978

S. K. JAIN  
*Director*

## PREFACE

This Flora of the Punjab Plains is the outcome of an interest born ever since I joined the Botanical Survey of India. The main object of the work is to provide the means of determining the various taxa which comprise the flora of Haryana and Punjab States, to supply the currently accepted nomenclature of the taxa, their important synonyms (names mentioned in Indian works) and any other information which may prove useful to those interested in the study of the plants of the area.

No flora can be claimed to be perfect; at most "it will represent the best summary of information available to its author". The larger the number of specimens studied the more reliable should be the work; it is necessary, therefore, to give information about the methods employed and materials examined by me.

The present work is based on field studies and collections made by me during 1961-1966 from all over the Punjab plains, except parts of Hoshiarpur and Gurdaspur Districts, and on the relevant materials housed in the herbaria of the Forest Research Institute, Dehra Dun (DD), and Botanical Survey of India, Dehra Dun (BSD). The specimens I have examined are cited under each taxon. This will facilitate any verification, if this becomes necessary. Plants, which I have not seen but reported from the area by earlier works, are also included giving the authority. Ethnobotanical notes given are mostly from literature. The main part of the work was completed at Dehra Dun; the concluding part was carried out at Calcutta.

I am thankful to the authorities of the Forest Research Institute, Dehra Dun, for giving me permission to examine the herbarium materials housed there. I owe my gratitude to late Rev. Fr. H. Santapau, Dr. S. K. Mukherjee, Dr. K. Subramanyam, former Directors, Botanical Survey of India and Dr. M. A. Rau, former Deputy Director, Botanical Survey of India, Dehra Dun, for their interest and encouragement, without which the completion of the present work would not have been possible. From the very beginning of my explorations I was fortunate in having the constant company and assistance of Dr. V. J. Nair, Botanical Survey of India, Dehra Dun. I am deeply thankful to him.

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## INTRODUCTION

### PHYSICAL FEATURES

The area covered in this flora extends roughly from 28°50' to 32°50' N Lat. and from 73°80' to 78°E Long. and is bounded on the west by Pakistan, on the north by Jammu and Kashmir and Himachal Pradesh, on the east by Uttar Pradesh and Delhi and on the south-west by Rajasthan. It includes two states, Haryana and Punjab, and comprises 16 districts, namely Hissar, Rohtak, Gurgaon, Karnal, Ambala, Hoshiarpur, Jullundur, Ludhiana, Ferozepore, Amritsar, Bhatinda, Kapurthala, Mahendragarh, Patiala, Gurdaspur and Sangrur.

The area can be divided into two regions: The vast alluvial plain extending from the Ravi to the Jamuna with a gradual slope towards the south-west which hardly exceeds 66 cm per kilometre. The Plain ranks with the best lands in India in fertility. The westerly portion of it is drained by the Sutlej, the Beas, and the Ravi which between themselves form two river-locked tracts, viz. the Bist Doab, lying between the Beas and the Sutlej and the Bari, contained between the Beas and the Ravi. From Ludhiana to Jamuna valley the country is a portion of the Gangetic Plain.

The Ghaggar and its tributary (known as Chitang in east Punjab), relics of a gigantic system, have their source in the south-western Himalayan region and flow through the entire length of the Punjab plains and disappear in the Great Indian Desert. There is evidence to show that these two rivers, which are responsible for the annual flood in Hissar district during the rainy season, are the ancient Saraswati and Drishadavati mentioned in the Rig Veda; in the east Punjab region they carry some water and by the time they reach the border of Rajasthan their beds are dry. Only narrow belts of land on either side of Ghaggar can, therefore, be irrigated.

In the districts of Ferozepore, Hissar and Mahendragarh, due to their close proximity to the Rajasthan desert, a desertic topography prevails. Sand dunes and rippled sandy areas are abundant; these are unproductive.

The Aravalli ranges of Rajasthan, the oldest mountain system of India, which came into existence towards the close of Dharwar era and was once a lofty mountain system and is now represented only by small hills, have a north-westerly branch. This branch passes through Hissar district as isolated hillocks.

The sub-montane region comprises parts of Hoshiarpur, Gurdaspur and Ambala districts. A refreshing break in the stereotyped configuration of

the plains is given by the Siwalik Hills running parallel to the mountain wall of the Himalayas.

*Climate:* The climate is very hot in summer and markedly cold in winter. The summer season is from April to the end of June. The temperature rises to 43.3°C-48.9°C in May and June. The intensity of heat is relieved by dust and thunderstorms which are often followed by rain. Towards the close of the summer the south-west monsoon clouds coming from the Bay of Bengal and striking the eastern Himalayas, are deflected to the west. The rain clouds are forced up the plains by the south-eastern winds. The lower Himalayan ranges in this way receive heavy rainfall. The monsoon exhausts itself in its journey through the plains and dies away towards the south and the west. A part of the Bombay branch of the monsoon is sucked into the Bay currents from time to time and this results in wide-spread rain. The heat during the monsoon season, though mild on rainy days, is still intense. It comes down from the middle of September. October and November, when the weather is dry and cool, are the most pleasant months of the year.

January is the coldest month and the mercury often falls down to freezing point or below. Table I shows the temperature variation in three principal places of the area.

Table I: Showing temperature variation in the Punjab Plains

Station	Mean Max. (°C)		Mean Min. (°C)		Temperature	
	May	June	Dec.	Jan.	Highest	Lowest
Hissar	41.4	41.6	6.0	5.9	49.5	-1.7
Ambala	39.8	39.3	6.2	6.3	47.6	-0.7
Ludhiana	39.9	40.4	6.9	6.9	48.3	-4.4

The winter or north-east monsoon does not get into the Punjab plains. The rains, that are received during this season, are due to land storms which originate beyond the western frontier. Table II shows the rainfall of the principal districts.

Table II: Showing rainfall of the Punjab Plains

District	June-September (cm)	December-March (cm)	Annual Rains
Hissar	31.01	4.75	38.76
Rohtak	42.67	5.26	50.19
Gurgaon	47.98	4.70	56.08
Karnal	46.84	6.96	57.58
Ambala	70.80	11.05	87.06
Hoshiarpur	61.63	13.54	79.96
Jullundur	49.68	10.46	64.44
Ferozepore	28.50	5.69	36.98
Ludhiana	49.48	9.01	62.81
Amritsar	41.52	9.78	55.29
Gurdaspur	68.43	17.02	90.93

Relative humidity is lowest in April-May and highest in August ; in the rainy season it is 78-80% in the morning and 60% in the afternoon. During December to February it is generally 60-70% in the morning and 30-36% in the afternoon ; the air is very dry in April and May and in the afternoon hours the relative humidity falls to nearly 10%. The variation of relative humidity during the day is 28-38% in winter, 18-28% in Summer, and 19-31% in rainy season.

Winds are generally stronger over the western and south-western arid and semiarid regions than over the areas further east. Winds are strongest in June and lightest in November. During the cold weather periods winds are generally light and variable, but north-westerly and northerly winds are more frequent than those from other directions. In the hot season and during the monsoon, winds blow between south-west and west. Hot and dust raising winds are present throughout the area during summer. In the arid tracts they are sometimes violent when the maximum velocity is about 136 km per hour.

Thunder-storms occur more frequently in the eastern and northern part of the area particularly in Ambala and Gurdaspur districts. Hail-storms are frequent in the eastern and north-eastern parts during March-April and they do much damage to crops and vegetation. Dust-storms are most frequent in the arid tracts, decreasing progressively towards the north-east and east. Fog is common during the cold season in the morning and in the evening. Ground frost is also common during winter and it has adverse effect on the vegetation.

*Geology and Soil :* The plains consist of Indo-gangetic alluvium. They also contain beds of sedimentary rocks of a transition age, which form a series of outliers of the Aravalli rocks of the Delhi system. They are composed of an upper thicker group of quartzites, limestones and a lower group of slates.

Except a major portion of Gurdaspur district, the area has alluvial soils. In Gurdaspur district the soils are loamy with a clay content below 10% ; they contain small quantities of lime, but the magnesia content is high. The soils of Hoshiarpur are loamy, fairly rich in total phosphoric acid, potash and nitrogen. Sandy loam and silt loam occur in Jullundur district. The soils of Ferozepore district are sandy loam and alkaline. The soils of Ambala district are mostly of a loamy nature ; they are slightly alkaline and contain enough total potash and phosphoric acid, but nitrogen content is low. Sandy to sandy loam soils occur in Karnal district ; they are highly alkaline and show deficiency of available phosphoric acid ; surface soils are supplied with enough nitrogen. Soils of Rohtak district are loamy on the surface and the clay content increases with depth ; these soils are neutral or slightly alkaline and deficient in phosphoric acid and nitrogen. The soils of



Hissar district are loamy, the fine fractions increasing with depth. On the whole the soil of the plains consists of a crust of varying depth on a sandy substratum ; the crust has 10-15% clay ; sodium salts are usually present and in some localities are abundant and appear like effervescence during summer months. Though the soils contain plenty of mineral matter, they are deficient in organic matter and nitrogen.

*Irrigation :* Before the partition of 1947, Punjab had one of the best canal systems in the world ; only about one third of the area served by these canals came to India. At present there are five main canals in the region: (1) the Upper Bari Doab canal which takes off from the Ravi at Madhopur ; (2) the Sirhind canal which starts from the Sutlej at Rupar ; (3) the western Jamuna canal which takes off from the Jamuna at Tajewala ; (4) the group of inundation canals called the grey canals in Ferozepore district ; (5) the Bhakra canal system.

#### PREVIOUS WORK

Royle (1833-1840) mentions a little more than 3 score plants of the Punjab plains. J. L. Stewart (1868, 1869) gave the botanical and vernacular names and uses of economically important trees, shrubs and herbs. Powel (1868) also gave the economic importance and vernacular names of some Punjab plants. Aitchison (1868) published a list of the plants of Hoshiarpur district and his collections are housed in the herbarium of Forest Research Institute, Dehra Dun. He also (1869) catalogued the plants of the Punjab, but this account mostly deals with plants of the area now in Pakistan. A few sheets of J. R. Drummond are preserved in the herbarium of the Forest Research Institute, Dehra Dun. Stewart and Brandis (1874) made reference to the plants of the Punjab in their flora. Coldstream (1889) gave photolithographs of some of the principal grasses of Hissar district. The extensive collections from Hissar made by J. F. Duthie in the latter half of the last century are preserved in the herbarium of the Forest Research Institute, Dehra Dun. A catalogue of the principal trees and shrubs of the Punjab was given by Coventry (1901). Gamble gave an account of several timber-yielding trees and shrubs and the nature of their bark and wood in 1902. Bamber's (1916) work covered the Punjab and North West Frontier Provinces of the former undivided India and Kashmir ; this work does not include Cyperaceae and Gramineae. Parker's (1918 ; 2nd ed. 1924 ; 3rd ed. 1956) flora includes only the trees and shrubs of the erstwhile Punjab, Hazara and Delhi. Sabnis (1940-1941) gave a list of plants of the Punjab plains and adjoining hilly areas.

Among recent collectors are M. B. Raizada (Hissar), O. P. Sharma (E. Punjab), M. A. Rau (Hissar), T. A. Rao (Gurgaon, Patiala, Chandigarh

and Hoshiarpur), J. N. Vohra (Karnal, Ambala, Amritsar and Kapurthala) and V. J. Nair (Rohtak and Hissar). The specimens of Raizada and Sharma are preserved in the herbarium of the Forest Research Institute, Dehra Dun ; the specimens of the rest are in the herbarium of the Botanical Survey of India, Northern Circle, Dehra Dun.

Occasional collections of Harsukh (Hissar), Ganga Singh (Patiala), Gupta (Ambala Siwaliks), T. S. Bakshi (Laroha, Jullundur Dist.) and P. N. Mehra (Chandigarh) are housed in the herbarium of the Forest Research Institute, Dehra Dun. Nair (1961, 1967) and Nair and Nair (1963, 1964a, b, 1966) published a number of new records for the Punjab plains. Sharma and Sharma (1974, 1975) gave floristic account of Ludhiana District. Other significant papers in which plants of the Punjab plains are referred to include those of Anonymous (1880, 1896), Cleghorn (1864), Duthie (1881, 1883, 1885, 1886, 1888), Duthie and Fuller (1882-1883), Edgeworth (1838, 1842), Luthra (1937), Maheshwari (1963), Mohan (1940, 1955), Parker (1935), Ribbentrop (1873), Sharma and Sharma (1966-1968) and R. R. Stewart (1945).

## VEGETATION

### Vegetation of the sandy tract

Sandy tracts occur in the regions adjoining the desert of Rajasthan. Due to extreme aridity, the vegetation here is very sparse and exhibits a striking uniformity. Only those plants, which are drought resistant, constitute the permanent structural framework of the vegetation. They are xeromorphic in character. The vegetation can be divided into three categories—(a) vegetation of loose sand dunes, (b) vegetation of stabilized dunes and (c) vegetation of spreadout sand.

(a) *Vegetation of loose sand dunes*: Sand is piled up into dunes in a definite direction, depending on the direction of the wind. The great speed of the wind sorts out sand particles into wind ripples which show a forward motion ; as a result of this, hardly any plant can obtain a footing. During the rainy season the sand gets set, and stray seeds carried by wind and lodged in the sand germinate. The early pioneers are *Calotropis procera* R. Br., *Zizyphus nummularia* (Burm. f.) Wt. et Arn., *Crotalaria burhia* Buch.-Ham., *Aerua persica* (Burm. f.) Merr., *Leptadenia pyrotechnica* (Forsk.) Decne., *Farsetia hamiltonii* Royle, *Calligonum polygonoides* Linn., *Cenchrus biflorus* Roxb., *C. ciliaris* Linn., *Eragrostis ciliaris* R. Br., *Arnebia hispidissima* DC. etc. Of these *Crotalaria*, *Leptadenia*, *Calligonum* and *Arnebia* are typical psammophytes and are not found in stabilized soil. Large shrubs of *Calligonum* and *Leptadenia* are sometimes found on the very crest of the dunes. Another plant which

at times occurs on loose sand dunes is *Citrullus colocynthis* (Linn.) Schrad.; this plant has long trailing branches, which remain green throughout the year. Trees are rare in these sand dune areas, and, when present, are widely spaced. The characteristic trees are *Prosopis cineraria* (Linn.) Druce, *Balanites aegyptiaca* (Linn.) Del., *Acacia nilotica* (Linn.) Del. and *Tecomella undulata* (Sm.) Seem.

(b) *Vegetation of stabilized dunes*: Due to encroachment of vegetation, sand dunes get stabilized and support a comparatively good vegetation. At times trees of considerable size, like *Prosopis cineraria* (Linn.) Druce, *Tecomella undulata* (Sm.) Seem. and *Acacia nilotica* (Linn.) Del. are found on them. These trees have very slow rate of growth. Seemingly, therefore, these dunes were stabilized a considerable time ago. The common elements of these stabilized dunes include *Calotropis procera* R. Br., *Leptadenia pyrotechnica* (Forsk.) Decne., *Zizyphus nummularia* (Burm. f.) Wt. & Arn., *Boerhavia diffusa* Linn., *Capparis decidua* (Forsk.) Edgew., *Pupalia lappacea* Juss., *Clerodendrum phlomidis* Linn. f., *Calligonum polygonoides* Linn., *Lycium europaeum* Linn., *Salvadora oleoides* Decne., *Maytenus emarginatus* (Willd.) Ding. and *Acacia jacquemontii* Benth.

(c) *Vegetation of spreadout sand*: When loose sand is spread out, it is easily colonized by *Zizyphus nummularia* (Burm. f.) Wt. & Arn., *Aerua persica* (Burm. f.) Merr., *A. pseudotomentosa* Blatt. & Hallb., *Blepharis linearifolia* Pers., *Crotalaria burhia* Buch.-Ham., *Farsetia jacquemontii* Hook. f. et Thoms., *Citrullus colocynthis* (Linn.) Schrad., *Arnebia hispidissima* DC., *Sericostoma pauciflorum* Stocks and species of *Cenchrus*, *Cyperus*, etc. during the rainy season. From December to July all these disappear except *Citrullus*. Sometimes large tracts show pure stands of *Calligonum*, *Leptadenia* and *Acacia*.

Due to prolonged weathering and by the admixture and accumulation of organic matter, the sand becomes stabilized. In such places often an open thorny scrub vegetation is seen comprising of *Prosopis cineraria* (Linn.) Druce, *Capparis decidua* (Forsk.) Edgew., *Maytenus emarginatus* (Willd.) Ding., *Acacia nilotica* (Linn.) Del., *A. jacquemontii* Benth., *Mimosa hamata* Willd., *Balanites aegyptiaca* (Linn.) Del., *Zizyphus nummularia* (Burm. f.) Wt. & Arn., *Calotropis procera* R. Br., *Securinega leucopyrus* Muell.-Arg., *Salvadora oleoides* Decne., etc. Sometimes pure stands of *Salvadora* are seen for long distances. Pure stands of *Balanites* are also often met with. This tree regenerates itself in dense shady clumps by producing root suckers. *Anogeissus* and *Acacia* trees, when growing near temporary ponds, at times, reach a height of more than 20 m.<sup>c</sup>

During the rainy season the stabilized soil puts on a thick green carpet of herbaceous vegetation consisting of species of *Trianthema*, *Zaleya*, *Tribulus*, *Cenchrus*, *Fagonia*, *Eragrostis*, *Boerhavia*, *Heliotropium*,

*Tephrosia*, *Panicum*, *Tridax*, *Indigofera*, *Digera*, *Mollugo*, *Achyranthes*, *Aerva*, *Phyllanthus*, etc. Most of these plants die away in winter, and new plants such as *Solanum nigrum* Linn., *Justicia* sp., *Echinops echinatus* Roxb., *Psammogeton canescens* (DC.) Vatke, *Argemone mexicana* Linn., *Carthamus oxyacantha* Bieb., *Heliotropium ellipticum* Ldb., *Gastrocotyle hispida* (Forsk.) Bunge, etc. come up. The ground is barren in summer except for plants like *solanum surattense* Burm. f., *Boerhavia diffusa* Linn., etc.

Climbers are in large numbers among the bushes and they are mostly perennial such as *Pergularia daemia* Bl. & Mac., *Coccinia grandis* (Linn.) Voigt., *Ephedra foliata* Boiss., *Cocculus pendulus* Diels, *C. hirsutus* Diels, *Maerua oblongifolia* A. Rich., *Momordica balsamina* Linn., *Rhynchosia minima* DC., *Pentatropis spiralis* Decne., etc.

Wherever subsoil water is present, cultivation is carried on. The chief plants grown are *Pennisetum typhoides* Stapf & Hubb., *Zea mays* Linn. and cucurbits.

Exotic plants such as *Albizia lebbek* Benth., *Prosopis juliflora* DC., *Melia azedarach* Linn., *Azadirachta indica* A. Juss., *Ficus religiosa* Linn., *Zizyphus mauritiana* Lamk., etc. thrive well in these localities.

### **Vegetation of the isolated hills**

There are a few isolated rocky hills in Rohtak, Hissar, Gurgaon and Patiala. The vegetation on these is open scrub; the bulk of the vegetation consists of spinous trees and hardy shrubs. The tree species characteristic of this habitat are *Acacia senegal* Willd., *Wrightia tinctoria* R. Br., *Cordia dichotoma* Forst. f., *Anogeissus pendula* Edgew., *Boswellia serrata* Roxb. and *Balanites aegyptiaca* (Linn.) Del. The thorny shrubby vegetation consists of *Euphorbia nivulia* Buch.-Ham., *Capparis sepiaria* Linn., *C. decidua* (Forsk.) Edgew., *Mimosa hamata* Willd., *Grewia tenax* Fiori, *Maytenus emarginatus* (Willd.) Ding., *Maerua oblongifolia* A. Rich., *Hibiscus micranthus* Linn. f., *Abutilon indicum* Sweet, etc. *Corbichonia decumbens* (Forsk.) Exell is found only on the hills and is a typical lithophyte.

During the rains these hills are completely covered with a green blanket of herbaceous vegetation consisting of species of *Tribulus*, *Vernonia*, *Euphorbia*, *Corchorus*, *Cenchrus*, *Oropetium*, *Aristida*, *Melanocenchrus*, etc. *Rhynchosia*, *Melothria*, *Pergularia* and *Ipomoea* are the chief climbers.

### **Vegetation of the fertile and irrigated region**

The rest of the Punjab plains is irrigated by a network of canals and is extensively cultivated. There is very little or no natural vegetation.

Where the area is not cultivated it is worked for fire wood. The agricultural year includes two seasons, the Kharif (rainy season) and the Rabi (cold season).

The Kharif crops include *Pennisetum typhoides* Stapf & Hubb. (Indian millet, *Bajra*), *Sorghum vulgare* Pers. (Great millet, *Jowar*), *Oryza sativa* Linn. (Rice, *Chawal*), *Zea mays* Linn. (Corn, *Bhutta*), *Gossypium* (Cotton, *Rui*), *Hibiscus cannabinus* Linn. (Roselle hemp, *San*), *Crotalaria juncea* Linn. (San hemp, *San*), *Cyamopsis tetragonolobus* Taub. (*Gaur*), *Sesamum indicum* Linn. (Sesame, *Till*), *Vigna unguiculata* (Linn.) Walp. (Cowpea, *Lobia*), *Cajanus cajan* Mill. (Pigeon pea, *Thur*) etc.

The Rabi crops include *Triticum aestivum* Linn. (Wheat, *Gahum*), *Hordeum vulgare* Linn. (Barley, *Jow*), *Brassica campestris* var. *sarson* Prain (Mustard, *Sarsum*), *Linum usitatissimum* Linn. (Linseed, *Alsi*), *Cicer arietinum* Linn. (Gram, *Chena*), *Lens culinaris* Medik (Lentil, *Masur*), *Pisum sativum* Linn. (Pea, *Mattar*), *Trigonella foenum-graecum* Linn. (Fenugreek, *Methi*), etc. *Saccharum officinarum* Linn. (Sugarcane, *Ganna*) is planted from January to April and harvested during the following cold season.

A number of garden crops are grown during the cold season as well as during summer. The chief cold season crops are *Allium sativum* Linn. (Garlic, *Lasum*), *A. cepa* Linn. (Onion, *Piaj*), *Beta vulgaris* Linn. (Beet root, *Chikundari*), *Daucus carota* Linn. (Carrot, *Gajar*), *Brassica oleracea* var. *botrytis* Linn. (Cauliflower, *Phoolgobi*), *B. oleracea* var. *capitata* Linn. (Cabbage, *Bandhgobi*), *Raphanus sativus* Linn. (Radish, *Mooli*), *Coriandrum sativum* Linn. (Coriander, *Dhaniya*), *Brassica juncea* Czern & Coss. (Leaf mustard, *Sarsum*), *Spinacia oleracea* Linn. (Spinach, *Palak*), etc.

During the summer months a number of cucurbits are grown. These include *Citrullus lanatus* (Thunb.) Matsumara (Water melon, *Kharbuza*), *Momordica charantia* Linn. (Bitter gourd, *Karela*), *Luffa acutangula* Roxb., (*Tori*), *L. aegyptiaca* Mill. (*Giatori*), *Cucumis melo* Linn. (Melon, *Karbuza*), *Cucumis melo* var. *momordica* Duthie & Fuller (*Phunt*), *C. melo* var. *utilissimus* Duthie & Fuller (*Kakri*), *Trichosanthes dioica* Roxb. (*Parwal*) etc.

The most common weeds associated with the rainy season crops are species of *Cleome*, *Corchorus*, *Polycarpaea*, *Justicia*, *Digera*, *Celosia*, *Crotalaria*, *Trianthema*, *Aeschynomene*, *Gisekia*, *Euphorbia*, *Artemesia*, *Heliotropium*, *Leucas*, *Desmostachya*, etc.

The weeds of the winter season are *Vicoa indica* DC., *Oxalis corniculata* Linn., *Fumaria indica* Pugsley, *Coronopus didymus* Sm., and species of *Potentilla*, *Cotula*, *Anagallis*, *Sisymbrium*, *Spergula*, *Spergularia*, *Lathyrus*, *Orobanche*, *Sonchus*, *Antirrhinum*, *Asphodelus*, *Polypogon*, *Lolium*, *Melilotus*, *Vicia*, *Medicago*, *Trigonella*, *Cirsium*, etc.

### Vegetation of the river sides

The riverine tracts are lowlying and during the monsoon they are subjected to inundation. The silt accumulated in the floods is colonized by *Tamarix dioica* Roxb., and *Alhagi pseudalhagi* Desv.; and these pioneers pave the way for other plants such as *Vetiveria zizanioides* Nash., *Sporobolus marginatus* Hochst. ex A. Rich., *Polygonum plebium* R. Br., etc.

As the water recedes, water-loving herbs develop on the muddy flats; the commoner species are *Marsilea minuta* Linn., *Ranunculus sceleratus* Linn., *Anagallis arvensis* Linn., *Juncus bufonius* Linn., *Potentilla supina* Linn., *Gnaphalium indicum* Linn., *Veronica anagallis-aquatica* Linn., *V. agrestis* Linn., *Verbascum chinense* (Linn.) Santap., *Pulicaria angustifolia* DC., *Salvia plebia* R. Br., etc. *Acacia farnesiana* Willd. has become naturalized along the river sides at many places.

### Vegetation of ponds, lakes and canals

A number of algae, mostly filamentous, are collected soon after the rains. In still-water they decay as the climate becomes hotter. Species of *Chara* and *Nitella* are common. Submerged phanerogamic hydrophytes include species of *Vallisneria*, *Zannichellia*, *Ceratophyllum*, *Hydrilla*, *Potamogeton* and *Najas*. Plants rooted in the mud with floating parts include *Potamogeton nodosus* Poir., *Ipomoea reptans* Poir., *Lophotocarpus guyanensis* (Kunth) Morong, *Sagittaria sagittifolia* Linn., *Nymphaea nouchali* Burm. f. and *Marsilea minuta* Linn.

Free floating vegetation consists of *Aponogeton natans* (Linn.) Engl. & Krause, *Lemna paucicostata* Hegel., *L. trisulca* Linn., *Spirodela polyrrhiza* (Linn.) Schleid., *Utricularia inflexa* var. *stellaris* (Linn. f.) Tayl., *Wolffia microscopica* Kurz, *Trapa natans* Linn. var. *bispinosa* (Roxb.) Makino., *Eichhornia crassipes* Solms. and *Azolla pinnata* R. Br.

The margins of canals, lakes and ponds have a rich vegetation consisting of amphibious plants; this reed swamp flora comprises *Typha elephantina* Roxb., *T. angustata* Bory & Chaub., *Echinochloa crusgalli* Beauv., *Scirpus* spp., *Fimbristylis dichotoma* Vahl, species of *Cyperus*, *Hemarthria*, *Cynodon*, *Verbascum*, *Phyla*, *Alternanthera*, *Glinus* etc.

On the canal banks and slightly away from the water margin are *Alhagi pseudalhagi* Desv., *Equisetum* sp., *Grangea maderaspatana* Poir., *Sporobolus marginatus* Hochst. ex A. Rich., *Cynodon dactylon* Pers., *Vetiveria zizanioides* Nash, *Corchorus capsularis* Linn., *Eclipta prostrata* Linn., *Achyranthes aspera* Linn., *Polygonum barbatum* Linn., *P. plebium* R. Br., *Nicotiana plumbaginifolia* Viv., *Chenopodium ambrosioides* Linn., *Centella asiatica* Urb., *Rorippa indica* Hiern, *Ageratum conyzoides* Linn., *Paspalidium flavidum* A. Camus etc. Trees such as *Tamarix*, *Acacia*, *Prosopis*, *Ficus* and *Dalbergia* are often planted along the canal banks, where they thrive very well.

### Vegetation of marshes

The marshy vegetation consists of *Týpha angustata* Bory & Chaub., *T. elephantina* Roxb., *Monochoria vaginalis* Presl, *Sagittaria sagittifolia* Linn., *Lophotocarpus guayanensis* (Kunth) Morong, *Bacopa monnieri* (Linn.) Pennell, *Veronica anagallis-aquatica* Linn., *Hemarthria compressa* R. Br. and *Fimbristylis dichotoma* Vahl. The trees found near marshy localities are *Phoenix sylvestris* Roxb., *Acacia nilotica* (Linn.) Del., *Butea monosperma* Taub. and *Tamarix aphylla* (Linn.) Karst.

### Vegetation of saline areas

The saline localities may be very small or may cover large areas ; these are water-logged during the rainy season, the soil being impervious to water. In the dry season they are desertic in character and often show crusts of salt shining in the sun. The vegetation is very sparse comprising of *Sporobolus marginatus* Hochst., *Sueda fruticosa* Forsk., *Salsola baryosma* Dandy, *Chenopodium album* Linn., *Cressa cretica* Linn., *Polygonum plebeium* R. Br., *Solanum surattense* Burm. f., *Alhagi pseudalhagi* Desv., *Kochia indica* Wt., *Scirpus maritimus* Linn., and *Tamarix aphylla* (Linn.) Karst., *Acacia nilotica* (Linn.) Del. and *Butea monosperma* Taub. appear to stand extreme saline conditions.

### Fruit trees

Orchards are common ; the following plants are cultivated: *Mangifera indica* Linn. (*Am*), *Morus alba* Linn. (*Sethud*), *Eriobotrya japonica* Lindl. (*Loquat*), *Manilkara hexandra* (Roxb.) Durb. (*Kirni*), *Psidium guajava* Linn. (*Amruth*), *Grewia asiatica* Linn. (*Phalsa*), *Syzygium cumini* Skeels (*Jamun*), *Prunus persica* Stokes (*Adu*), *Embllica officinalis* Gaertn. (*Amla*), *Zizyphus mauritiana* Lamk. (*Baer*), *Carica papaya* Linn. (*Papitha*), *Tamarindus indica* Linn. (*Imli*), *Cordia rothii* Roem. & Schult. (*Gondi*), *Ficus racemosa* Linn. (*Gular*), *F. carica* Linn. (*Anjir*), *Punica granatum* Linn. (*Anar*), and *Musa paradisiaca* Linn. (*Kela*).

### Wayside trees

The common wayside and avenue trees are: *Delonix regia* (Bog.) Raf., *Albizia lebbek* Benth., *Syzygium cumini* Skeels, *Azadirachta indica* Juss., *Kigelia pinnata* DC., *Tamarindus indica* Linn., *Polyalthia longifolia* Thw., *Mimusops elengi* Linn., *Millingtonia hortensis* Linn., *Cassia fistula* Linn., *Ficus religiosa* Linn., *Ailanthus excelsa* Roxb., *Dalbergia sissoo* Roxb., *Acacia leucophloea* Willd., *A. farnesiana* Willd., *Mangifera indica* Linn., *Terminalia arjuna* (Roxb.) Wt. et Arn., and *Melia azedarach* Linn. These trees are also planted in parks of cities and towns.

### Ruderal flora

A characteristic ruderal vegetation develops in places which are subjected to change from time to time, such as waste places around villages, towns, old garden sites, along railway lines and roads and in fallow fields. *Xanthium strumarium* Linn., *Solanum surattense* Burm. f., *Cannabis sativa* Linn., *Amaranthus spinosus* Linn., *Erigeron bonariensis* Linn., *Cassia obtusifolia* Linn., *Argemone mexicana* Linn. and *Croton bonplandianum* Baill. are the common plants of these places. Sometimes escapes of cultivation, like *Ricinus communis* Linn., *Lycopersicon lycopersicum* (Linn.) Karstén, *Coriandrum sativum* Linn., and *Sesamum indicum* Linn., are found growing on rubbish heaps.

### Vegetation of sub-Himalayan region

Parts of Hoshiarpur, Gurdaspur and Ambala districts, though part of the Punjab plains, have a sub-Himalayan flora. The vegetation is very rich. The chief tree species are *Shorea robusta* Gaertn., *Anogeissus latifolia* Wall. ex Brand., *Terminalia tomentosa* Wt. et Arn., *Bauhinia variegata* Linn., *Emblica officinalis* Gaertn., *Ougeinia oojenensis* (Roxb.) Hochr., *Cassia fistula* Linn., *Xylosma longifolium* Clos., and *Pinus roxburghii* Sarg. *Woodfordia fruticosa* (Linn.) Kurz, *Caryopteris wallichiana* Schau., *Clerodendrum fragrans* Vent., *C. indicum* (Linn.) Kuntze, *Colebrookea oppositifolia* Sm. etc. are the common shrubs.

### Recent introductions

*Oxalis corymbosa* DC., *O. pes-caprae* Linn., *Moschosma polystachyum* (Linn.) Wall., *Merremia emarginata* (Burm. f.) Hall., *Galium aparine* Linn., *Dactyliandra welwitschii* Hook., *Cuscuta capitata* Roxb., *C. hyalina* Roth, *Aerva pseudotomentosa* Blatt. et Hallb., *Alternanthera pungens* H. B.K., *A. paronychioides* St. Hil., *Anogeissus sericea* Brand., *Argemone ochroleuca* Sweet, *Chenopodium ambrosioides* Linn., *Euphorbia prostrata* Ait., *Gomphrena celosioides* Mart., *Phyllanthus maderaspatensis* Linn., *Polygala irregularis* Boiss., *Ruellia tuberosa* Linn., *Zaleya govindia* var. *flava* (Blatt. et Hallb.) N. C. Nair, *Euphorbia geniculata* Ort., *E. heyneana* Spr., *Ipomoea sinensis* (Desv.) Choisy, *Merremia aegyptia* (Linn.) Urb., *Heliotropium curassavicum* Linn., *Physalis longifolia* Nutt., *Tephrosia uniflora* subsp. *petrosa* (Blatt. et Hallb.) Gill. et Ali, *Trifolium fragiferum* Linn., *Trigonella occulta* Del., *Cyperus bulbosus* Vahl and *Enneapogon persicus* Boiss. have been recently reported from the area (cf. Nair, 1967 ; Nair & Nair, 1963, 1964a, 1964b, 1966).



## NOTES ON THE FLORA

Out of 1064 taxa representing 574 genera and 127 families treated in this work, 807 taxa of 460 genera and 110 families are either indigenous or naturalized. The ratio of genera to species is 1: 1.75. This shows the small proportion of species to the number of genera and families. In the adjoining Delhi State, Upper Gangetic Plain and Rajasthan the ratio of genera to species is 1: 1.63, 1:2.2 and 1: 1.99 respectively. The prevailing arid and semi-arid conditions probably are responsible for the low proportion of genera to species in these when compared with the rest of India where the ratio is 1: 7.

Table III: Showing the percentage composition of the flora

	Dicotyledons		Monocotyledons		Total
	No.	%	No.	%	
Families	89	80.99	21	19.01	110
Genera	369	80.22	91	19.78	460
Species	630	78.19	177	21.81	807

Except for Gramineae and Cyperaceae, the Monocotyledons are poorly represented. Of the 177 species of monocotyledons, 103 belong to Gramineae and 35 to Cyperaceae, while the remaining 39 belong to 19 families, none of which has more than 5 species. The ratio of monocotyledons to dicotyledons is 1: 4.24 of families, 1: 4.05 of genera and 1: 3.56 of species.

The genera which have 6 or more species are *Abutilon* (6), *Sida* (6), *Corchorus* (7), *Acacia* (9), *Cassia* (7), *Crotalaria* (7), *Indigofera* (15), *Heliotropium* (9), *Ipomoea* (8), *Euphorbia* (11), *Cyperus* (17), *Scirpus* (7), *Eragrostis* (11) and *Panicum* (6).

The Punjab plains border the arid districts of Rajasthan, the drier parts of Uttar Pradesh, Delhi State and Himachal Pradesh. Therefore, one would expect common features with the flora of these adjoining places. Himachal Pradesh has a predominantly temperate and alpine vegetation and the elements constituting this type of vegetation are lacking in the plains except for a few taxa found on the Siwalik ranges. Comparison should, therefore, be made only with Delhi, Upper Gangetic plain and Rajasthan. The ten dominant families of these regions and the Punjab plains are given in Table IV.

Table IV *Principal families of the Punjab plains and adjoining regions*

Punjab plains	Gangetic plain (Hooker, 1907)	Rajputana (Blatter & Hallberg, 1920)	Delhi (Maheshwari, 1963)	India (Hooker, 1907),
Gramineae	Gramineae	Gramineae	Gramineae	Orchidaceae
Papilionaceae	Leguminosae	Leguminosae	Leguminosae	Leguminosae
Compositae	Cyperaceae	Compositae	Compositae	Gramineae
Cyperaceae	Compositae	Cyperaceae	Cyperaceae	Rubiaceae
Malvaceae	Scrophulariaceae	Convolvulaceae	Acanthaceae	Euphorbiaceae
Acanthaceae	Malvaceae	Amaranthaceae	Euphorbiaceae	Acanthaceae
Euphorbiaceae	Acanthaceae	Boraginaceae	Convolvulaceae	Compositae
Convolvulaceae	Euphorbiaceae	Cucurbitaceae	Malvaceae	Cyperaceae
Scrophulariaceae	Convolvulaceae	Euphorbiaceae	Amaranthaceae	Labiatae
Amaranthaceae	Labiatae	Malvaceae	Scrophulariaceae	Urticaceae

The flora of the region is composed of the following elements.

Table V: *Showing elements comprising the flora*

Elements	No.	%
Tropical (cosmopolitan) element	282	34.94
Indian element	168	20.81
N. African, Indian desert element	68	8.42
Indo-Malayan-African element	56	6.93
Tropical African element	52	6.45
Tropical African, N. African desert element	15	1.87
Indo-Malayan-E. Asiatic element	40	4.95
W. Asian-African element	38	4.70
Mediterranean element	22	2.71
Temperate element	18	2.21
New World element	18	2.21

The elements mentioned in Table V can be classified under three broad heads. The general element comprising the widespread elements of the tropical countries and Indian elements, the eastern elements comprising of the Indo-Malayan elements, and the western elements comprising of the African, West Asian and Mediterranean elements. The western elements comprise 225 species and the eastern elements comprise 56 species. The eastern elements are only  $\frac{1}{4}$  of the western elements. In the adjoining Rajasthan they are  $\frac{1}{7}$  and in Delhi they are  $\frac{1}{3}$ .

The type of vegetation on the eastern part of the Punjab plains bears a striking resemblance to that of the Upper Gangetic Plains ; the southern and the south-western parts are similar to the dry thorny scrub of Rajasthan desert. The density of vegetation thins out from south-east to north-west.

Of the taxa mentioned in the present work 92 are not given by Duthie (1960), 150 by Puri *et al.* (1964) and 87 by Maheshwari (1963).

#### ABBREVIATIONS

For economy of space the conventional abbreviations of some of the well-known works have been condensed as follows:

Bamber	...	<i>Plants of the Punjab</i> by C. J. Bamber. 1916, Lahore.
FBI	...	<i>The Flora of British India</i> by J. D. Hooker <i>et al.</i> 1872-1897, London.
Bor	...	<i>The Grasses of Burma, Ceylon, India and Pakistan (excluding Bambuseae)</i> by N. L. Bor. 1960, London.
Duthie	...	<i>Flora of the Upper Gangetic Plain and of the Adjacent Siwalik and Sub-Himalayan Tracts</i> by J. F. Duthie (Rep. Ed.), 1960, Calcutta.
JBNHS	...	<i>Journal of the Bombay Natural History Society.</i> Bombay.
Maheshw.	...	<i>Flora of Delhi</i> by J. K. Maheshwari. 1963, New Delhi.
Parker	...	<i>A Forest Flora of the Punjab</i> by R. N. Parker. 3rd Ed. 1956, Lahore.
Puri	...	<i>Flora of Rajasthan</i> by G. S. Puri, S. K. Jain, S. K. Mukerjee, S. Sarup and N. N. Kotwal. <i>Records of the Botanical Survey of India</i> 19(1) 1964.
RBSI	...	<i>Records of the Botanical Survey of India, Calcutta.</i>
Sabnis	...	<i>Flora of the Punjab and associated hill regions</i> by T. S. Sabnis 1940-1941 in <i>Journal of the Bombay Natural History Society.</i> vol. 42.



## KEY TO THE FAMILIES

27. Stamens monadelphous; pollen rough; leaves simple 22. MALVACEAE
27. Stamens polyadelphous; pollen smooth:
28. Leaves compound; spiny trees 23. BOMBACACEAE
28. Leaves simple; unarmed shrubs or undershrubs 20. HYPERICACEAE
26. Stamens few, 15 or less united in a column with 5 sterile prolongations opposite the petals; anthers 2-celled 24. STERCULIACEAE
25. Stamens free:
29. Stamens with prolonged connectives 21. DIPTEROCARPACEAE
29. Stamens without prolonged connectives 25. TILIACEAE
6. Stamens not arising directly from the receptacle:
30. A conspicuous hypogynous disc present; stamens attached either to the outer or to the inner surface of the disc:
31. Flowers polygamous or unisexual:
32. Fruits drupe; ovary 1-celled 40. ANACARDIACEAE
32. Fruits capsule; ovary 3-celled 39. SAPINDACEAE
31. Flowers bisexual:
33. All stamens antipetalous; petals valvate:
34. Spinescent shrubs 37. RHAMNACEAE
34. Unarmed tendril climbers; fruit berry 38. VITACEAE
33. All stamens not antipetalous; petals usually imbricate:
35. Leaves simple:
36. Stamens in two whorls, all fertile 27. MALPIGHIACEAE
36. Stamens only in one whorl, antisepalous:
37. Stamens alternating with staminodes; herbs or small shrubs 26. LINACEAE
37. Staminodes absent; large shrubs or small trees 36. CELASTRACEAE
35. Leaves compound (some times unifoliolate):
38. Leaves pellucidly gland-dotted 30. RUTACEAE
38. Leaves not pellucidly gland-dotted:
39. Herbs or very small undershrubs (trees in *Averrhoa* but then fruit berry); leaves stipulate:
40. Leaves opposite (alternate and multifid in *Peganum*); stamens free 28. ZYGOPHYLLACEAE
40. Leaves alternate; stamens slightly united at the base 29. OXALIDACEAE
39. Large shrubs or trees:
41. Corolla irregular; petals 5, the upper 2 small, the lowest largest; ovary 1-celled; fruits cylindrical capsule 41. MORINGACEAE
41. Corolla regular; ovary multilocular; fruits various:
42. Filaments united to form a tube (filaments free in *Toona*) 34. MELIACEAE
42. Filaments free:
43. Ovary deeply lobed or carpels free at the base; ovules solitary in each carpel; fruits samaroid; leaves foetid 32. SIMAROUBACEAE
43. Ovary entire:
44. Trees armed with sharp spines; leaves 2-foliolate; fruits a 1-seeded fleshy drupe 31. BALANITACEAE
44. Trees unarmed:
45. Leaves many-foliolate; ovules 2 in each carpel; fruits 3-seeded drupe 33. BURSERACEAE
45. Leaves simple; fruits 1-seeded drupe 35. OLACACEAE

30. Outer zone of torus elongated to form a tube;  
ovary often included in the tube or inferior:
46. Gynoecium usually monocarpellary; when more than  
one carpel present apocarpous or enclosed within the  
hypanthium:
47. Corolla papilionaceous; stamens monadelphous  
or diadelphous 44. PAPILIONACEAE
47. Corolla not papilionaceous; stamens free:
48. Stamens many 45. ROSACEAE
48. Stamens few:
49. Flowers zygomorphic; petals imbricate, the  
posterior most petal innermost and  
smallest; or flowers apetalous 43. CAESALPINIACEAE
49. Flowers actinomorphic; petals valvate or  
imbricate, all equal:
50. Carpel 1; petals not persistent 42. MIMOSACEAE
50. Carpels as many as persistent petals 46. CRASSULACEAE
46. Gynoecium not monocarpellary and usually syncarpous;  
when apocarpous not enclosed within the hypanthium:
51. Ovary free from the hypanthium:
52. Petals present, some times absent in  
*Ammannia*; style 1, stigma capitate;  
embryos not curved 49. LYTHRACEAE
52. Petals absent; styles as many as carpels;  
embryos curved; seeds reniform 57. AIZOACEAE
51. Ovary partly or completely fused with the  
hypanthium:
53. Leafless looking succulent plants: stems flat and  
articulated, usually often prickly 55. CACTACEAE
53. Non succulent plants:
54. Locules of ovary superposed 50. PUNICACEAE
54. Locules of ovary not superposed:
55. Tendril climbers; flowers unisexual 53. CUCURBITACEAE
55. Plants without tendril; flowers unisexual:
56. Flowers in simple or compound umbels:
57. Fruit a cremocarp 58. UMBELLIFERAE
57. Fruit a berry, 5-celled 59. ARALIACEAE
56. Flowers not in umbels:
58. Stamens many; ovary many celled; leaves  
gland-dotted; erect shrubs or trees 48. MYRTACEAE
58. Stamens few; leaves not gland-dotted:
59. Trees or climbing shrubs; ovary  
unilocular 47. COMBRETACEAE
59. Herbs; ovary more than 1-celled:
60. Fruit with lateral horns; aquatic  
plants 52. TRAPACEAE
60. Fruit without horns 51. ONAGRACEAE
5. Petals united; carpels as many as the petals or fewer:
61. Ovary inferior:
62. Ovary unilocular 62. COMPOSITAE
62. Ovary with two or more locules:
63. Calyx unrolling in fruit into 5-15 feathery  
bristles united into a short tube at the base 61. VALERIANACEAE
63. Calyx not as above:
64. Leaves opposite or whorled 60. RUBIACEAE
64. Leaves alternate 63. CAMPANULACEAE
61. Ovary not inferior:
65. Ovary unilocular:
66. Ovule solitary:
67. Styles elongated, 3-fid; fruits capsule 64. PLUMBAGINACEAE
67. Styles very short or absent; fruits drupe 70. SALVADORACEAE
66. Ovules 2-many; styles undivided:
68. Flowers actinomorphic:
69. Stamens twice as many as the corolla:
70. Trees; leaves pinnatifid; petiole hollow;  
fruit a large berry 56. CARICACEAE

70. Succulent herbs; leaves with adventitious buds; fruits follicle 46. CRASSULACEAE
69. Stamens as many as the corolla :
71. Trees or large shrubs; flowers in axillary fascicles 66. MYRSINACEAE
71. Flowers solitary, axillary or in small cymes or umbels; herbs :
72. Flowers solitary axillary or when in umbels heterostylous 65. PRIMULACEAE
72. Flowers in dichotomous cymes; not heterostylous 74. GENTIANACEAE
68. Flowers zygomorphic; stamens 2; alternating with 3 anterior petals; aquatic herbs 81. LENTIBULARIACEAE
65. Ovary with 2-many locules; corolla lobes few or many:
73. Corolla lobes 18-24 in 2 or 3 series 67. SAPOTACEAE
73. Corolla lobes unlike the above:
74. Flowers dioecious; trees or large shrubs; stamens free; seeds arillate 68. EBENACEAE
74. Flowers bisexual; stamens united to the corolla :
75. Carpels free, united by the styles; fruit a pair of follicles:
76. Anthers forming a column with the style and stigma; pollen form 1 or 2 waxy or rarely granular masses (pollinia) in each anther lobe 72. ASCLEPIADACEAE
76. Anthers often conniving and some times adhering by a point on the connective to the swollen top of the style but not forming a column; pollen granular 71. APOCYNACEAE
75. Carpels and styles united:
77. Corolla irregular:
78. Ovary unilocular with parietal placentation and many ovules; leafless parasites 80. OROBANCHACEAE
78. Ovary bilocular; not leafless parasites:
79. Seeds winged; trees or large shrubs; anther cells divaricate; fruit elongated 82. BIGNONIACEAE
79. Seeds not winged:
80. Seeds supported by hard upwardly curved retinacula (retinacula, absent in *Elytraria*) 86. ACANTHACEAE
80. Seeds not supported by retinacula:
81. Locules of ovary many ovuled:
82. Ovary bilocular; ovules uniseriate in each locule:
83. Fruit with 2 large hooks 84. MARTYNIACEAE
83. Fruit without hooks angular 83. PEDALIACEAE
82. Ovary bilocular; ovules many in each locule 79. SCROPHULARIACEAE
81. Seeds 1 or 2 in each locule:
84. Ovary deeply 4-lobed or partite; style gynobasic; each locule uniovulate; fruits carcerulus 88. LABIATAE
84. Ovary not deeply 4-lobed; style not gynobasic; each locule 2-ovuled:
85. Calyx reduced, annular or of fimbriate hairs 85. THUNBURGIACEAE
85. Calyx not reduced 87. VERBENACEAE
77. Corolla regular:
86. Stamens 2 69. OLEACEAE
86. Stamens 4 or 5:
87. Ovules many:
88. Corolla not plicate; placenta not swollen 73. LOGANIACEAE

88. Corolla usually plicate; placenta swollen 78. SOLANACEAE
87. Ovules few, 2-8 in each carpel :
89. Flowers tetramerous, in spikes; scapigerous herbs; leaves radical 89. PLANTAGINACEAE
89. Flowers pentamerous :
90. Fruit a drupe or nut :
91. Herbs or small undershrubs; inflorescence dichotomous scorpoid syme 75. BORAGINACEAE
91. Shrubs or trees; inflorescence lax cyme 76. EHRETIACEAE
90. Fruit a capsule; corolla campanulate or infundibuliform, lobes plicate or contorted in bud; mostly climbing herbs 77. CONVULVACEAE
4. Flowers with only one whorl of tepals:
92. Ovary inferior:
93. Tepals zygomorphic; fruits capsule; climbing herbs 97. ARISTOLOCHIACEAE
93. Tepals actinomorphic; fruits berry; parasitic herbs 96. LORANTHACEAE
92. Ovary superior:
94. Lower portion of the coloured tepal persisting and covering the ovary to form an anthocarp; fruits 1-seeded 90. NYCTAGINACEAE
94. Fruits not an anthocarp:
95. Flowers always unisexual:
96. Aquatic herbs, dichotomously branched, branches filiform; flowers monoecious 103. CERATOPHYLLACEAE
96. Land plants:
97. Ovary 2-3-locular; ovules 1-2 in each locule 98. EUPHORBIACEAE
97. Ovary unilocular:
98. Fruits many seeded; stamens many 14. FLACOURTIACEAE
98. Fruits 1-seeded:
99. Leaves simple; anthers reversed; filaments inflexed in bud:
100. Trees or large shrubs; style simple or stylar branches 2; stipules deciduous:
101. Inflorescence cyme (male), female flowers solitary or 2-4 together 101. ULMACEAE
101. Inflorescence spikate or hypanthodium 100. MORACEAE
100. Herbs; style single:
102. Inflorescence spike 95. PIPERACEAE
102. Inflorescence cyme 99. URTICACEAE
99. Leaves palmately compound and opposite at least in the lower part; anthers not reversed; filaments not inflexed in bud 102. CANNABACEAE
95. Flowers bisexual or polygamous:
103. Trees or large shrubs; seeds arillate, aril red 54. SAMYDACEAE
103. Herbs or small shrubs; seeds not arillate:
104. Leaves stipulate:
105. Stipule connate to form a tube around the node; tepals coloured; leaves alternate 94. POLYGONACEAE
105. Stipules not like above; tepals greenish; leaves opposite; prostrate herbs 91. ILLECEBRACEAE
104. Leaves exstipulate:
106. Tepals scarious and dry; flowers with scarious or hyaline bracts 92. AMARANTHACEAE
106. Tepals not scarious often fleshy and green; flowers usually ebracteate:
107. Flowers hypogynous 93. CHENOPODIACEAE
107. Flowers perigynous 57. AIZOACEAE



3. Cotyledon single; stems usually without a central pith; stem without secondary thickening, bundles scattered:
108. Flowers without perianth or perianth of hairs or scales:
109. Flowers in spikelets composed of bracts (glumes); ovary 1-celled, 1-ovuled:
110. Seed coat adhering to the pericarp (caryopsis); stems usually hollow; leaves 2-ranked; sheath ligulate 127. GRAMINEAE
110. Seeds free within the pericarp, a trigonous nut; stems 3-angled, usually solid; leaves 3-ranked 126. CYPERACEAE
109. Flowers not in spikelets:
111. Free floating minute plants with 1 or more roots 119. LEMNACEAE
111. Large rooted plants:
112. Flowers in cylindric spikes:
113. Perianth of slender hairs; rhizomatous plants 117. TYPHACEAE
113. Perianth of green scales 120. SPARGANIACEAE
112. Flowers in spadix 118. ARACEAE
108. Flowers with distinct perianth:
114. Perianth petaloid:
115. Flowers irregular:
116. Stamens and gynoecium united to form a column; ovary unilocular 105. ORCHIDACEAE
116. Stamens free; ovary 3-locular:
117. Stamens petaloid with only a half anther attached to one of them 110. CANNACEAE
117. Stamens not petaloid, anthers 6:
118. Plants tree-like; fruit berry 109. MUSACEAE
118. Prostrate herbs 114. COMMELINACEAE
115. Flowers regular:
119. Trees 116. PALMAE
119. Plants not arborescent:
120. Inflorescence subtended by spathe-like leaf sheath 113. PONTEDERIACEAE
120. Inflorescence not as above:
121. Carpels free, uniovulate: 121. ALISMATACEAE
122. Perianth of calyx and corolla 122. PERIANTH PETALOID IN A SINGLE WHORL 123. APINOGETONACEAE
121. Carpels united, ovary 3-locular with 2 ovules in each locule:
123. Ovary superior:
124. Petioles with cirrhi at the top of the sheath 107. SMILACACEAE
124. Petioles without cirrhi 106. LILIACEAE
123. Ovary inferior:
125. Climbing herbs 108. DIOSCOREACEAE
125. Plants not climbing:
126. Flowers on large panicles more than 2 m long; leaf large and fibrous 112. AGAVACEAE
126. Flowers on small umbels; leaves not fibrous 111. AMARYLLIDACEAE
114. Perianth not petaloid:
127. Ovary inferior; flowers unisexual 104. HYDROCHARITACEAE
127. Ovary superior:
128. Gynoecium monocarpellary, 1-ovuled; flowers axillary: 122. NAJADACEAE
129. Stigma 2-4 125. ZANNICHELLIACEAE
129. Stigma single
128. Gynoecium of more than 1 carpel:
130. Carpels free, uniovulate; submerged aquatic herbs 124. POTAMOGETONACEAE
130. Carpels united; perianth rigid; fruits 3-valved capsule; grass-like herbs 115. JUNCACEAE

## GYMNOSPERMAE

### 1. PINACEAE

#### PINUS Linn.

*P. roxburghii* Sargent, *Silv. North Amer.* 11: 9, 1897. *P. longifolia* Roxb. *Fl. Ind.* 3: 651, 1832; FBI 5: 652; Bamber 569; Parker 536 (non Salisb.); Duthie 259.

Large trees with fissured bark. Leaves needle-like in bundles of threes. On Siwalik hills.

*Flowers*: March-April.

Hoshiarpur, *Aitchison* 292 (DD)\*.

### 2. EPHEDRACEAE

#### EPHEDRA Linn.

*E. foliata* Boiss. var. *ciliata* Stapf in *Denkschr. Math.-Natur. Kl. Akad. Wiss. Wien* 1889: 49, 1889; FBI 5: 863. *E. foliata* Boiss. *Fl. Or.* 5: 716, 1881; Parker 535; Puri 152. *E. peduncularis* Boiss. *Fl. Or.* 5: 717, 1881; FBI 5: 641.

A climbing shrub. Leaves only on young branches. Male cones 2-3 together. Female flowers in pairs enclosed by bracts which become fleshy at maturity. Common in sandy places.

*Local name*: Phog.

*Flowers*: Feb.-May.

Loharu, \*\*20095, 20097; Bhiwani, 20063; Siwani, 26566.

## ANGIOSPERMAE

### 3. RANUNCULACEAE

1. Carpels with more than one ovule; flowers spurred  
1. Carpels uniovulate; flowers not spurred

1. *Delphinium*  
2. *Ranunculus*

#### 1. DELPHINIUM Linn.

*D. ajacis* Linn. *Sp. Pl.* 531, 1753; Mukerjee in *Bull. bot. Surv. India* 2: 293, 1960. *D. pauciflorum* D. Don, *Prodr. Fl. Nep.* 196, 1825.

Erect herbs with deeply lobed leaves. Flowers irregular on racemes,

\* The specimens cited are from the Herbarium of the Botanical Survey of India, Dehra Dun unless otherwise specified by (DD) for specimens from the Herbarium of the Forest Research Institute, Dehra Dun.

\*\*The herbarium numbers given in this work refer to N. C. Nair unless a name is cited before the number.

bluish-white to purple. Grown in gardens.

*Local name* : Delphinium.

*Flowers* : Cold season and spring.

Muktesar, 36520; Hissar, *V. J. Nair* 19981.

## 2. RANUNCULUS Linn.

1. Aquatic herbs; leaves much divided, segments thread-like, submerged; flowers white; achenes wrinkled 1. *R. trichophyllus* subsp. *trichophyllus*
1. Semiaquatic or moisture-loving herbs; leaf segments not thread-like; flowers yellow; achenes smooth or tubercled not wrinkled:
  2. Achenes spinous 2. *R. arvensis*
  2. Achenes not spinous:
    3. Achenes with an intramarginal rib:
      4. Leaves ternatisect, hairy; achenes very smooth, receptacle pilose 4. *R. cantonensis*
      4. Leaves trifid, usually glabrous; achenes with tubercles (sometimes absent); receptacle not pilose 5. *R. muricatus*
    3. Achenes without an intramarginal rib, smooth 3. *R. sceleratus*

1. *R. trichophyllus* Chaix in Vill. Hist. Pl. Dauph. 1 : 335, 1786 subsp. *trichophyllus*; Cook in Mitteil. Bot. Staatss. Munch. 6 : 126, 1966. *R. aquatilis* Linn. var. *trichophyllus* Hook. f. et Thoms. FBI 1 : 16, 1872; Sabnis 125; Bamber 633; Mukherjee in Bull. bot. Surv. India 2 : 102, 1960; Maheshw. 50; Duthie 21.

Leaf segments up to 6 cm long; stipules auricled. Flowers shortly pedicelled, up to 2 cm long. Achenes in globular head.

*Flowers and fruits* : March.

Subhanpur, *J. N. Vohra* 11332.

2. *R. arvensis* Linn. Sp. Pl. 555, 1753; FBI 1 : 20.

Radical leaves wedge-shaped; stem-leaves shortly stalked and deeply divided into 2-3 narrow segments. Flowers up to 2 cm across, pale yellow. Achenes flat in globose head.

*Flowers and fruits* : March-April.

Pinjaur, *Drummond* 1169 (DD).

3. *R. sceleratus* Linn. Sp. Pl. 776, 1753; DC. Syst. 1 : 268, 1818; Royle Ill. 53, 1839; FBI 1 : 19; Bamber 349; Sabnis 125; Mukerjee 105; Maheshw. 50; Duthie 21.

Annual glabrous and succulent herbs, very variable in height, usually 30-75 cm, sometimes as small as 10-12 cm. Leaves 3-partite, cuneately segmented; radical leaves long stalked, cauline sessile. Sepals reflexed. Corolla yellow. Achenes many in oblong head. Receptacle hairy.

Common in moist places and canal banks.

*Flowers and fruits* : Feb.-March.

Binjhol (Panipat), 25827; Hissar, *V. J. Nair* 19372, 19920; Laroha (Jullunder), *T. S. Bakshi* s. n. (DD); Kapurthala, 36314.

4. *R. cantonensis* DC. Prodr. 1: 43, 1824; Mukerjee 102. *R. pennsylvanicus* Hook. f. et Thoms. FBI 1: 19, (non Linn. f.); Sabnis 125; Duthie 22.

Erect hairy herbs. Radical leaves long petioled, cauline shorter, gradually becoming nearly sessile, ternatisect. Flowers yellow; sepals reflexed; stamens many; receptacle pilose. Achenes flattened with an intramarginal rib, glabrous, beak almost straight.

Common in marshy places and near edges of canals and ponds.

*Flowers and fruits*: Hot season.

Yamunanagar, 26398.

5. *R. muricatus* Linn. Sp. Pl. 780, 1753; DC. Syst. 1: 298, 1818 et Prodr. 1: 42, 1824, FBI 1: 20; Bamber 502; Sabnis 125; Mukherjee 104.

Glabrous or sparsely hairy herb. Leaves 3-fid, lobes irregularly cut. Flowers yellow on terminal panicles. Sepals shorter than petals. Achenes muricate, closely punctate, with a straight beak and intramarginal rib.

In moist places.

*Flowers and fruits*: March.

Beas, *J. N. Vohra* 11318; Hoshiarpur, *Aitchison* 569 (DD); Laroha, *T. S. Bakshi* s. n. (DD).

#### 4. MAGNOLIACEAE

##### MICHELIA Linn.

*M. champaca* Linn. Sp. Pl. 563, 1753; FBI 1: 42; Sabnis 126; Parker 5. Maheshw. 51.

Trees. Flowers yellow or orange, fragrant.

Cultivated.

*Local name*: Champa.

Hoshiarpur, *Aitchison* 555 (DD).

#### 5. ANNONACEAE

- |  |                      |
|--|----------------------|
| 1. Carpels free; fruit a cluster of drupelets or berries; sepals 3, petals 6 in two whorls:  |                      |
| 2. Flowers solitary or paired, very fragrant, yellow; climbing shrubs with hooked peduncles; fruit aggregate of 2-seeded berries                             | 2. <i>Artabotrys</i> |
| 2. Flowers in fascicles or umbels, yellowish green; fruit aggregate of drupelets; large shrubs or trees  | 3. <i>Polyalthia</i> |
| 1. Carpels subconnate; fruit compact, formed by the fusion of carpels and receptacle; sepals 3, petals 6 in 2 whorls of which the inner is minute or wanting | 1. <i>Annona</i>     |

## 1. ANNONA Linn.

**A. squamosa** Linn. Sp. Pl. 537, 1753; Bamber 110; Parker 6; Mukerjee in Bull. bot. Surv. India 5(1): 45, 1963; Maheshw. 51; Puri 17; Duthie 25.

Shrubs or small trees. Leaves elliptic or oblong-lanceolate, pellucid dotted, glabrous. Flowers greenish yellow on leaf-opposed peduncles. Fruit globose.

Cultivated occasionally for its fruits.

*Local name* : Sitaphal.

*Flowers* : Hot season.

Hoshiarpur, *Aitchison* s. n. (DD); without precise locality *Anonymous* (DD).

## 2. ARTABOTRYS R. Br.

**A. hexapetalus** (Linn. f.) Bhandari in Bailey 12 : 147, 1964. *Annona hexapetala* Linn. f. Suppl. 270, 1781. *Artabotrys odoratissimus* R. Br. ex Ker in Bot. Reg. 5 : t. 423, 1820; FBI 1 : 54; Parker 7. *Uvaria odoratissima* Roxb. Fl. Ind. 2 : 666, 1824. *Artabotrys uncinatus* (Lamk.) Merr. in Phil. Jour. Sc. (Bot.) 7 : 234, 1912; Mukerjee 40.

A large scandent shrub. Leaves oblong-lanceolate, shortly acuminate, glabrous. Flowers yellow with a characteristic fragrans. Bases of petals thick and conniving over the stamens and carpels, limb spreading. Fruit glabrous, yellow.

Cultivated in gardens.

*Flowers* : Apr.-Sept.

This plant is mentioned on the authority of Parker. I have not seen any specimen from the area.

## 3. POLYALTHIA Blume

**P. longifolia** (Sonn.) Thw. Enum. 398, 1864; FBI 1 : 62 ; Parker 7; Sabnis 126; Mukherjee 42; Maheshw. 52; Duthie 25. *Uvaria longifolia* Sonn. Voy. Ind. Or. 2 : 233, t. 131. 1782.

Evergreen trees. Leaves lanceolate with undulate margin. Flowers in umbellate fascicles. Fruit 1-seeded.

Cultivated as an ornamental tree in avenues and gardens.

*Flowers* : Hot season.

Hoshiarpur, *Aitchison* 552 (DD); *Parker* 14383 (DD).

## 6. MENISPERMACEAE

1. Carpels solitary; stamens united in column; leaves peltate
1. Carpels more than one; stamens free; leaves not peltate:
2. Flowers appearing when the plant is leafless; leaves ovate or ovate-cordate, glabrous
2. Plants not deciduous; leaves ovate-oblong, villous

1. *Cissampelos*

3. *Tinospora*  
2. *Cocculus*

## 1. CISSAMPELOS Linn.

*C. pareira* Linn. Sp. Pl. 1031, 1753; FBI 1 : 103; Bamber 606; Parker 10; Sabnis 127; Maheshw. 52; Puri 18; Duthie 31.

Softly pubescent perennial shrub. Branches wiry. Leaves pubescent when young, ultimately glabrous. Male flowers in axillary branched peduncles, females 1-3 in the axils of orbicular bracts arranged to form dense racemes.

Common in hedges of parks and gardens and climbing on trees or shrubs.

*Flowers and fruits* : Aug.-Oct.

Karnal, *Drummond* 1219, 1220 B, C, D, 1221A (all DD); Panipat, 24683, 24700, *Drummond* 1222 (DD).

## 2. COCCULUS DC.

- |  |                       |
|--|-----------------------|
| 1. Woody climber; leaves subglabrous; male flowers in sessile axillary clusters; sepals glabrous | 2. <i>C. pendulus</i> |
| 1. Bushy climber; leaves pubescent; male flowers in axillary panicles; sepals pubescent          | 1. <i>C. hirsutus</i> |

1. *C. hirsutus* (Linn.) Diels in Pflanzenr. 46 : 236, 1910; Parker 551; Maheshw. 52; Puri 17. *Menispermum hirsutum* Linn. Sp. Pl. 341, 1753. *Cocculus villosus* DC. Syst. 1 : 525, 1818; FBI 1 : 101; Bamber 605; Sabnis 125; Parker 8; Duthie 29.

Branches pendulous. Young stem, leaves and inflorescence clothed with greyish hairs. Leaves short petioled ovate to lanceolate, mucronate. Female flowers 1-3, axillary, green. Drupelets dark purple.

Common climber on shrubs and trees in jungles.

*Local name* : Karta ki bel.

*Flowers* : Feb.-April. *Fruits* : Sept.

Ambala, *Parker* 21041 (DD); Karnal, *Drummond* 1647 (DD); *Rambuksh & Sham Singh* 4747 (DD); Jind, 18687, 25861; Ludwa, 26434; Panipat, 18607, 18682; Patiala, *T. A. Rao* 10944; Sohna, *T. A. Rao* 11073.

2. *C. pendulus* (Forst.) Diels in Pflanzenr. 46; 237, 1910; Parker 551; Puri 17. *Epibaterium pendulum* Forst. f. Char. Gen. 108, 1776. *Cocculus laeba* DC. Syst. 1 : 529, 1818; FBI 1 : 102; Bamber 605; Parker 8; Sabnis 127; Duthie 30.

Stem woody up to 10 cm diam.; bark corky. Branches puberulous when young. Leaves variable in shape, lobed, sub-orbicular or linear oblong, base truncate. Petiole hairy. Flowers minute. Drupelets black.

Common woody climber in jungles.

*Flowers* : Throughout the year.

Bhiwani, 16336; Chakkajheel (Sirsa), 18996; Hansi, 25877; Hissar,

18804, 18996, 19916, 21535; *Raizada* 20978 (DD). 21019 (DD); *Rau* 3546; Karnal, *Drummond* 1214 a (DD); Ludhiana, *Drummond* 4826 (DD); Sidrauli (Near Sirsa), 20806.

### 3. TINOSPORA Miers

**T. cordifolia** (Willd.) Hook. f. et Thoms. Fl. Ind. 184, 1855; FBI 1: 97; Sabnis 127; Parker 9; Maheshw. 53; Puri 17; Duthie 27.

Glabrous climbing shrub. Leaves cordate, petioled, deciduous when flowering. Flowers small, yellow; female flowers solitary, males in fascicles.

Cultivated in gardens. The stem is used in Ayurvedic medicine.

*Local name* : Gulael.

Hissar, 34532; Karnal, *Drummond* 6291 (DD).

### 7. NYMPHAEACEAE

1. Carpels sunk in fleshy torus  
1. Carpels united into a many-celled ovary

2. *Nelumbo*  
1. *Nymphaea*

#### 1. NYMPHAEA Linn.

1. Leaves blotched with purple beneath, entire; anthers with appendages  
1. Leaves not blotched with purple beneath, pubescent beneath, sharply toothed on the margin; anthers without appendage

2. *N. stellata*  
1. *N. nouchali*

1. **N. nouchali** Burm. f. Fl. Ind. 120, 1768; Merr. in Phil. Jour. Sci. (Bot.) 19 : 350, 1921 & Enum. 2 : 140, 1923 ; Maheshw. 54. *N. pubescens* Willd. Sp. Pl. 2 : 1154, 1799; Puri 18. *N. lotus* auct. plur. (non Linn.).

Aquatic herbs with floating leaves. Flowers variable in colour and size. Berries globose; stigmatic rays with appendages. Seeds broadly ellipsoid.

*Local name* : Chota Kamal.

*Flowers* : Sept.-Oct.

Karnal, *J. N. Vohra* 9908; Bahmanwas (Rohtak Dist.), *V. J. Nair* 23161; Rohtak, *V. J. Nair* 23273.

2. **N. stellata** Willd. Sp. Pl. 2 : 1153, 1799; FBI 1 : 114; Sabnis 128; Bamber 629; Maheshw. 54; Puri 18; Duthie 34.

Large aquatic herb. Leaves peltate, orbicular, dentate. Flowers white, mildly fragrant. Peduncle long. Fruit globose.

*Local name* : Chota Kamal.

*Flowers and fruits* : July-Nov.

Between Jind and Hansi, 24787; Hansi, 18779, 24841; Hoshiarpur, *Aitchison* 289 (DD).

## 2. NELUMBO Adans.

*N. nucifera* Gaertn. Fruct. 1 : 73, t. 19, f. 2, 1788; Santapau in RBSI. 16 (1) : 7, 1953; Maheshw. 54; Puri 18. *Nymphaea nelumbo* Linn. Sp. Pl. 511, 1753. *Nelumbium speciosum* Willd. Sp. Pl. 2 : 1258, 1799; FBI 1 : 116; Sabnis 128; Bamber 630; Duthie 35.

Aquatic herbs with creeping rhizome and orbicular, centrally peltate leaves. Flowers white or light pink, solitary, mildly fragrant. Anthers yellow or orange.

The plant is reported to be cultivated in several localities. I have seen no specimen. Its rhizomes are sold in market.

*Local name* : Kamal.

## 8. PAPAVERACEAE

- |  |                         |
|--|-------------------------|
| 1. Vegetative parts sepals and carpels spinous | 1. <i>Argemone</i>      |
| 1. No part spinous:                            |                         |
| 2. Leaves multifid into linear segments        | 2. <i>Eschscholtzia</i> |
| 2. Leaves not multifid into linear segments    | 3. <i>Papaver</i>       |

## 1. ARGEMONE Linn.

- |   |                         |
|---|-------------------------|
| 1. Flower buds sub-spherical; petals bright yellow; stigmatic lobes broad, closely crowded and adpressed to the style | 1. <i>A. mexicana</i>   |
| 1. Flower buds oblong, petals white or light yellow, stigmatic lobes narrow, spreading                                | 2. <i>A. ochroleuca</i> |

1. *A. mexicana* Linn. Sp. Pl. 503, 1753; FBI 1 : 117; Bamber 354; Maheshw. 55; Puri 19; Duthie 37.

Robust herb. Leaves pinnatifid, ash green. Sepals with a tail each at the top. Stamens many. Stigmas red. Capsule dehiscent by short valves. Seeds many, black.

Common everywhere during the cold season. Stray plants are found throughout the year. The seed is said to be an emetic and narcotic similar to opium.

*Local name* : Satyanashi.

*Flowers and fruits* : Oct.-April.

Bhiwani, 19003, 20048, 20049; Choudriwas (Hissar), V. J. Nair 19221; Fatehbad, 24917; Hansi, 16161; Rewari, 20762; Rohtak, 20043.

2. *A. ochroleuca* Sweet in Britt. Fl. Gard. 3 : t. 242, 1828; Venkatesh in Curr. Sci. 31 : 250, 1962; Nair & Nair in Bull. bot. Surv. India 5: 219, 1963; Maheshw. 55.



Similar to the above taxon but easily distinguished by its ash coloured and non-stem clasping leaves, white flowers and narrow spreading stigmas.

*Local name* : Satyanashi.

*Flowers and fruits* : Feb.-April.

Bhatinda, 26258; Bhiwani, 20047; Mahendragarh, 20605.

## 2. ESCHSCHOLTZIA Cham.

**E. californica** Cham. in Nees, Hor. Phys. Berol. 74, 1826; Fedde in Engler Pflanzenr. 40: 154, 1909; Sabnis 128.

Glaucous herbs, glabrous or nearly so. Leaves ternately dissected into very narrow segments. Sepals 2, united into a calyptra which is pushed off by the expanding petals. Petals yellow.

Californian poppy. Cultivated in gardens, often runs wild.

*Flowers and fruits* : March-April.

Barnala, 36587.

## 3. PAPAVER Linn.

1. Capsule setulose

1. Capsule glabrous:

2. Stigmatic rays up to 12

2. Stigmatic rays 12-30

1. *P. somniferum*

2. *P. rhoeas*

3. *P. hookeri*

1. **P. somniferum** Linn. Sp. Pl. 508, 1753; Fedde in Engler Pflanzenr. 40: 338, 1909; FBI 1: 117; Bamber 353; Maheshw. 56; Duthie 36.

Erect glabrous herb with stem-clasping leaves.

Flowers variously coloured. Capsule globose.

Cultivated.

*Local name* : Afim.

This species is mentioned on the authority of Bamber although I have not seen any specimen.

2. **P. rhoeas** Linn. Sp. Pl. 507, 1753; Fedde in Engler Pflanzenr. 40: 293, 1909.

Slender herb with spreading hairs and irregularly pinnatifid non stem-clasping leaves. Flowers variously coloured.

Cultivated ornamental.

*Flowers* : Feb.-March.

Khanna, 35980.

3. **P. hookeri** Baker ex Hook. Bot. Mag. t. 6729, 1883; Sabnis 128. *P. rhoeas* L. var. *hookeri* (Baker ex Hook.) Fedde in Adh. Bot. Ver. Prov. Brandenb. 45: 230, 1903 et Engler Pflanzenr. 40: 301, 1909.

Like the last species but differs in its more robust habit, double the number of stigmatic rays and larger seeds.

*Flowers*: March.

Karnal, *Drummond* 6293 (DD).

## 9. FUMARIACEAE

### FUMARIA Linn.

*F. indica* Pugsl. in Jour. Linn. Soc. Bot. 44 : 313, 1919; Duthie 37; Maheshw. 56; Puri 19. *F. parviflora* Wt. et Arn. Prodr. 18, 1834 (non Lamk.): FBI 1 : 128; Bamber 355; Sabnis 128.

Weak herbs with much dissected leaves. Bracts shorter than the fruit stalk. Flowers purplish pink.

Weed of cultivated fields, gardens and orchards in moist soil.

A substitute for fumitory, used in stomach derangements, afflictions of the liver and skin infections.

*Local name*: Pitpapra.

*Flowers and fruits*: Nov.-April.

Barwala, *V. J. Nair* 19285; Badopal, *V. J. Nair* 19821; Bhinjol, 25821; Hissar, 25918; *V. J. Nair* 19215, 19331; Lambi, 26210; Mahendragarh, 20643; Narnaul, 20666; Rewari, 20732; Sarsudh, *V. J. Nair* 19321; Taran Taran, 36361.

## 10. CRUCIFERAE

- |   |                       |
|---|-----------------------|
| 1. Pods indehiscent, cylindric and elongated with tapering beaks; more than 2-seeded, seeds separated by pith | 8. <i>Raphanus</i>    |
| 1. Pods dehiscent, seeds not separated by pith:   |                       |
| 2. Pods flattened:  |                       |
| 3. Pods 2-seeded, deeply notched  | 6. <i>Lepidium</i>    |
| 3. Pods many seeded   | 5. <i>Farsetia</i>    |
| 2. Pods not flattened:  |                       |
| 4. Pods globose or nearly so:   |                       |
| 5. Pods 2-seeded  | 3. <i>Coronopus</i>   |
| 5. Pods many-seeded   | 2. <i>Cochlearia</i>  |
| 4. Pods elongated:  |                       |
| 6. Pods prolonged into a short horn; flowers purple   | 7. <i>Malcomia</i>    |
| 6. Pods without horn; flowers not purple:   |                       |
| 7. Pods with a seedless indehiscent beak:   |                       |
| 8. Flowers yellow   | 1. <i>Brassica</i>    |
| 8. Flowers lilac or yellowish with purple veins   | 4. <i>Eruca</i>       |
| 7. Pods without seedless beak, dehiscent and bearing seeds completely:  |                       |
| 9. Seeds 1-seriate; valves 3-nerved   | 10. <i>Sisymbrium</i> |
| 9. Seeds 2-seriate; valves faintly 1-nerved   | 9. <i>Rorippa</i>     |

### 1. BRASSICA Linn.

- |   |                   |
|---|-------------------|
| 1. Cauline leaves stem clasping or amplexicaul; sepals erect: |                   |
| 2. Tap roots tuberous   | 5. <i>B. rapa</i> |
| 2. Tap roots not tuberous:                                    |                   |

- 3. Radical leaves in rosettes 6. *B. tournefortii*
- 3. Radical leaves not in rosettes:
- 4. Lower leaves lyrate pinnatifid 1. *B. campestris*
- 4. Leaves not pinnatifid, fleshy:
- 5. Stems short, enlarged into a spherical edible portion  
with large leaf scars 4c. *B. oleracea* var. *gongloides*
- 5. Stems not enlarged:
- 6. Leaves not packed into a head, inflorescence thick and  
fleshy; flowers aggregated to form a head 4a. *B. oleracea* var. *botrytis*
- 6. Leaves packed into a head 4b. *B. oleracea* var. *capitata*
- 1. Cauline leaves not stem clasping; sepals spreading:
- 7. Pods adpressed to the axis, angular, torulose 3. *B. nigra*
- 7. Pods spreading, terete, torulose 2. *B. juncea*

1. ***B. campestris*** Linn. Sp. Pl. 666, 1753.

- 1. Stems compressed; leaves large bristly and hairy in rosette;  
seed coats with a mucilagenous epidermis var. *dichotoma*
- 1. Stems not compressed; leaves not bristly and not in  
rosette; seeds not mucilagenous:
- 2. Petals overlapping along lateral margins; pod some  
what torulose var. *toria*
- 2. Petals narrow not overlapping; pods plumpy, not torulose var. *sarson*

var. ***dichotoma*** (Roxb.) Watt Dict. Econ. Prod. 1 : 523, 1889; Duthie  
45. *Sinapis dichotoma* Roxb. Fl. Ind. 3 : 117, 1832.

Erect herbs with dichotomous branches. Flowers yellow. Seeds  
brown.

Cultivated for the oil bearing seeds.

*Local name* : Kali sarson.

*Flowering time* : Feb.-April.

Barnala, 36582.

var. ***toria*** Duthie et Fuller, Field Gard. Crop. N. W. Prov. Oudh 2 :  
29, 1882; Watt 525; Duthie 45.

Erect herbs with open habit and dichotomous branches. Flowers  
yellow. Seeds bluish brown, rugose with distinct circular marks on the  
testa.

Cultivated in irrigated fields for the seeds. The fatty oil from the  
seed is edible and the oil cake used as cattle feed and manure.

*Local name* : Tori, Toria.

*Flowers* : Feb.-March.

Barnala, 36580.

var. ***sarson*** Prain in Dept. Land Rec. Agric. Beng. Bull. No. 4 : 24,  
tt. 5-7, 1898; Maheshw. 61; Duthie 44.

Erect herbs up to 1.5 m. Lower leaves large-lyrate pinnatifid, stem  
clasping, upper leaves gradually become small. Flowers bright yellow.  
Fruits stout, beaked, long pedicelled. Seeds yellowish white to brown  
smooth.

Extensively cultivated in the area. Sown during the cold months and harvested in April-May. The leaves and young parts are a favourite vegetable of the people. An edible oil is extracted from the seeds. The dried stem is collected and used as fuel.

*Local name* : Sarsom.

*Flowers and fruits* : Jan.-April.

Binjhol (Panipat), 25823; Fatehbad, 24917, 25963 ; Ferozapore, 363666; Hissar, 24917, 25912.

2. **B. juncea** (Linn.) Czern. et Coss. in Czern. Consp. Pl. Chark. 8, n. 5, 1859 et Coss. in Bull. Soc. Bot. France 6 : 609, 1859 ; FBI 1 : 157 (pro parte): Bamber 357; Maheshw. 61; Duthie 43. *Sinapis juncea* Linn. Sp. Pl. 668, 1753 (excl. Syn. Herm.).

Erect tall annual. Stems tinted red. Leaves petioled, lyrate, pinnatifid or entire, gradually decreasing in size upwards. Flowers yellow. Sepals spreading. Pod narrow, torulose with a conical beak.

Widely cultivated for its seeds during the cold season.

*Local name* : Asl Rai, Chotiya-lai.

*Flowers and fruits* : Dec.-March.

Binjhol (Panipat), 25828; Fatehbad, 25953, 25954; Lambi, 26224.

3. **B. nigra** Koch in Roehl. Deutschl. Fl. 4 : 713, 1833; FBI 1 : 156; Bamber 356; Maheshw. 62; Duthie 43.

An erect branched annual up to 1 m high. Leaves petioled, lyrate becoming entire upwards. Flowers yellow. Racemes naked. Pods somewhat 4-angular, adpressed to the stem, torulose. seeds somewhat oblong.

Cultivated throughout the area for the seeds which are known as black mustard.

*Local name* : Rai, Poorbirai.

*Flowers and fruits* : Feb.-April.

Mahendragarh, 20639.

4a. **B. oleracea** Linn. var. **botrytis** Linn. Sp. Pl. 667, 1753; Maheshw. 60.

Cultivated during cold season. Cauliflower.

*Local name* : Phoolgobi.

Ferozapore, 36380.

4b. **B. oleracea** Linn. var. **capitata** Linn. Sp. Pl. 667, 1753; Maheshw. 60.

Cultivated during cold season. Cabbage.

*Local name* : Bandhgobi.

4c. **B. oleracea** Linn. var. **gongloides** Linn. Sp. Pl. 667, 1753.

Cultivated during the cold season. Knol-kol.

*Local name* : Ghandgobi.

5. **B. rapa** Linn. Sp. Pl. 666, 1753; Maheshw. 60.

Erect herbs. Tap roots tuberous, napiform. Stems with reddish tint. Leaves lyrate pinnatifid, becoming smaller upwards. Flowers pale yellow.

Cultivated during the cold season for the roots which are cooked as vegetable. Also used as forage. The turnip.

*Local name* : Shaljam.

Ratia, 25996.

6. **B. tournefortii** Gouan III. 44, t. 20 A, 1773; FBI 1: 156; Bamber 357; Maheshw. 61; Duthie 45.

Erect, branching, hispid, herbs. Radical leaves form a rosette, pinnately divided with backwardly pointed lobes. Stem leaves linear lanceolate mostly entire. Flowers pale yellow. Pods erect.

According to Zafar Alam in Ind. Jour. Agric. Sci. 15: 173-181, 1945, this plant is commonly grown in the Punjab on borders of fields. I have not seen any specimen.

## 2. COCHLEARIA Linn.

**C. cochlearioides** (Roth) Santapau et Maheshwari in JBNHS. 54: 804, 1957; Maheshw. 59. *Alyssum cochlearioides* Roth, Nov. Pl. Sp. 322, 1821. *Cochlearia flava* Buch.-Ham. ex Roxb. Hort. Beng. 48, 1814 (nomen nud.); FBI 1: 145; Bamber 355; Duthie 41.

Erect branched herbs, glabrous. Leaves radical and cauline, pinnatifid, lobes sinuate toothed. Racemes axillary towards the end of branches. Flowers yellow. Common along canal banks and marshy places.

*Flowers* : Cold season.

Ratia, 26005; Chakka Jheel, 26022.

## 3. CORONOPUS Boehm.

**C. didymus** (Linn.) Smith Fl. Brit. 2: 691, 1800; Maheshw. 57; Puri 21. *Lepidium didymum* Linn. Mant. 1: 92, 1767. *Senebiera didyma* Pers. Syn. 2: 185, 1807. *S. pinnatifida* DC. in Mem. Soc. Hist. Nat. Par. 144, t. 9, 1799; Duthie 46.

A hispid herb with finely divided pinnatifid leaves. Flowers minute, yellowish green, apetalous (rarely petals are seen). Stamens 2. Fruits dehiscent into 2 indehiscent parts. Seeds brown or brownish black.

A weed of cultivation during the cold season.

*Flowers and fruits* : Jan.-May.

Bhatinda, 27762; Hissar, 25907; *V. J. Nair* 14763, 19806; Lambi, 26239; Sampla, 20021.

#### 4. ERUCA Adans.

*E. sativa* Mill. Gard. Dict. n. 1, 1768; FBI 1 : 158; Bamber 358; Maheshw. 62; Puri 20; Duthie 45.

Erect branching herbs. Leaves lyrate pinnatifid, petiole slightly winged. Flowers yellow with purple veins. Pods erect, adpressed against the stem.

Cultivated as a cold season crop. An oil is obtained from the seeds which is often mixed with mustard oil.

*Local name* : Taramira.

*Flowers and fruits* : Feb.-March.

Fatehbad, 25964; Taran Taran, 36335a; Kapurthala, 36308.

#### 5. FARSETIA Desv.

- |   |                           |
|---|---------------------------|
| 1. Flowers 3 mm across; petals short, slightly exceeding the sepals | 1. <i>F. hamiltonii</i>   |
| 1. Flowers 5-10 mm across; petals long, much exceeding the sepals   | 2. <i>F. jacquemontii</i> |

1. *F. hamiltonii* Royle, Ill. 71, 1834; Hook. f. et Thoms. in Jour. Linn. Soc. Bot. 5 : 148, 1861; FBI 1 : 140; Bamber 111; Jafri in notes Roy. Bot. Gard. Edinb. 22(3) : 212, 1957; Maheshw. 59; Puri 20; Duthie 40.

Erect undershrubs. Branches many. Leaves linear. Flowers small 2.5-3 mm across. Petals slightly exceeding the sepals, pink or pinkish white. Pod linear oblong, pointed. Common in sandy places.

*Local name* : Aridbuti.

*Flowers and fruits* : Feb.-Nov. Stray flowers throughout the year.

Bhatinda, 26291; Dabwali, 26125; Fatehbad, 18842, 25980; Jhabua, 20730; Khansala, *V. J. Nair* 23253; Lambi, 26184, 27843; Mojukheda, 26110; Ottu bridge (Sirsa), 18943; Rohtak, *V. J. Nair* 23187; Talwandi, 16217; Taoru, *T. A. Rao* 11089; Tosham, 25061.

2. *F. jacquemontii* Hook. f. et Thoms. in Jour. Linn. Soc. Bot. 5 : 148, 1861; Boiss. Fl. Or. 1 : 158, 1867; FBI 1 : 140; Bamber 110; Sabnis 129; Jafri *ibid.* 213, 1957, subsp. *jacquemontii*.

Undershrubs. Branches many hairy. Leaves linear oblong. Flowers large, 6-12 mm across. Petals 2-3 times longer than the sepals, pink. Siliqua 2-4.5 cm long, 0.3-0.5 cm broad.

Frequently met with in sandy areas. Sabnis (loc. cit.) remarks that the plant is eaten as tonic, small branches eaten raw and chutney is made.

*Flowers and fruits* : Apr.-Dec.

Badopal, 16229; Bhatinda, 262263; Dadri, 16269; Fatehbad, 26578; Hissar, *Duthie* 38331 (DD); *Raizada* 20973 (DD); Sirsa, 18912.

#### 6. LEPIDIUM Linn.

**L. sativum** Linn. Sp. Pl. 644, 1753; FBI 1 : 159; Bamber 359; Sabnis 130; Maheshw. 62; Puri 21; *Duthie* 47.

Glabrous annuals up to 1 m high. Basal leaves long petioled, bipinnatisect, stem leaves sessile often entire. Flowers small, white in long racemes. Siliqua winged, orbicular, deeply notched, 2-seeded.

A weed of cultivation during the cold season.

*Local name* : Alsa, Hala.

*Flowers and fruits* : Feb.-May.

Badopal, 34537; Barnala, 36591; Binjhol (Panipat), 25812, 25818; Fatehbad, 25974; Hissar, *M. A. Rau* 3593; Jind, 25868; Rohtak, 26367; *V. J. Nair* 29716.

#### 7. MALCOMIA R. Br.

**M. africana** R. Br. in Ait. Hort. Kew 3(4): 121, 1812; FBI 1 : 146; Bamber 319; Sabnis 129.

Erect leafy annuals up to 50 cm high, rough with forked and simple hairs. Leaves petioled, oblong or lanceolate, toothed. Flowers in terminal racemes; pink to purple. Pods linear, elongate, clothed with forked hairs, subsessile.

Common weed during the cold season and spring.

Considered to be a very good fodder for sheep and cattle.

Bhatinda, 26280; Dabwali, 26138, 26144, 26156.

#### 8. RAPHANUS Linn.

**R. sativus** Linn. Sp. Pl. 669, 1753; FBI 1 : 166; Bamber 504; Maheshw. 57; Puri 21; *Duthie* 47.

Annual herbs up to 1.5 m high, rough or smooth, hairy. Tap roots fusiform, tuberous. Leaves pinnately divided, end lobe largest. Flowers large, white with purple veins. Pod terete, indehiscent. Seed globose, brownish black.

Cultivated during the cold season for the edible roots; young leaves and tender fruits used as vegetables.

*Local name* : Muli.

*Flowers and fruits* : Dec.-June.

Badopal, 25922; Ratia, 25993; Taran Taran, 36335.

### 9. RORIPPA Scap.

1. Flowers white

1. Flowers yellow:

2. Leaves pinnatifid or not, entire

2. Leaves pinnatifid, lobes toothed

3. *R. nasturtium-aquaticum*

2. *R. montana*

1. *R. indica*

1. *R. indica* (Linn.) Hiern, Cat. Afr. Pl. Welw. pt. 1, 26, Addit. & Corr. 1896. *Sisymbrium indicum* Linn. Mant. 1 : 93, 1767. *Nasturtium indicum* (Linn.) DC. Prodr. 1 : 139, 1824; FBI 1 : 134; Bamber 638; Puri 19; Duthie 39.

An erect almost hairy annual. Radical leaves pinnatifid; upper leaves lyrate, margin toothed. Racemes long. Flowers yellow, small. Pods cylindrical.

A garden weed.

*Flowers and fruits* : Feb.-March.

There are a few sheets in DD without precise locality:

2. *R. montana* (Wall. ex Hook. f. et Thoms.) Small, Fl. S. E. U. S. 1336, 1913; Maheshw. 58. *Nasturtium montanum* Wall. ex Hook. f. et Thoms. in Jour. Linn. Soc. 5 : 139, 1861; FBI 1 : 134; Bamber 638; Duthie 39.

Erect herbs up to 1 m. Flowers yellow. Pods cylindrical, narrow. Common in moist places.

*Flowers* : March-April.

Hissar, V. J. Nair 21505.

3. *R. nasturtium-aquaticum* (Linn.) Hayek, Sched Fl. Stir. Exs. 3-4 : 22, 1905. *Sisymbrium nasturtium-aquaticum* Linn. Sp. Pl. 657, 1753. *Nasturtium officinale* R. Br. in Ait. f. Hort. Kew 4 : 111, 1812; FBI 1 : 133; Bamber 638; Duthie 39.

A semi-aquatic herb with creeping stem; leaves pinnate, leaflets entire or wavy. Flowers white in short racemes. Pods cylindrical, stalked. Water cress.

*Local name* : Halim.

*Flowers and fruits* : Feb.-March.

Hoshiarpur, Aitchison s. n. (DD), Anonymous s. n. (DD).



## 10. SISYMBRIUM Linn.

*S. irio* Linn. Sp. Pl. 659, 1753; Hook. f. et Thoms. in Jour. Linn. Soc. 5 : 157, 1861; FBI 1 : 150; Bamber 504; Sabnis 130; Maheshw. 58; Puri 20; Duthie 42.

Erect herbs up to 1 m or more high, smooth. Leaves pinnately divided, end lobe large and often arrow-headed. Flowers yellow. Pods erect.

Common in waste places and as a weed in gardens during the cold season.

*Local name* : Jungli-sarson.

*Flowers and fruits* : Feb.-April.

Badopal, *V. J. Nair* 19826; Bhatinda, 27813; Binjhol (Panipat), 25831; Dabwali, 26137, 26146; Fatehbad, 25969; Hissar, 25908; *V. J. Nair* 19353; Jhabua, 20707; Mahendragarh, 20599, 20627; Sampla, 20014; Taran Taran, 36355.

## 11. CAPPARACEAE

- |  |                    |
|--|--------------------|
| 1. Herbs with usually digitate leaves; fruit an elongated capsule with a persistent replum   | 3. <i>Cleome</i>   |
| 1. Shrubs or trees usually with simple (trifoliate in <i>Crataeva</i> ) leaves; fruits berry or rarely dehiscent, then without a replum: |                    |
| 2. Androphore elongated, longer than the sepals; fruits narrowly cylindrical, slightly torulose  | 1. <i>Cadaba</i>   |
| 2. Androphore short, not as long as the sepals; fruits various:  |                    |
| 3. Branches spiny  | 2. <i>Capparis</i> |
| 3. Branches not spiny:   |                    |
| 4. Leaves simple   | 5. <i>Maerua</i>   |
| 4. Leaves trifoliate   | 4. <i>Crataeva</i> |

## 1. CADABA Forsk.

*C. fruticosa* (Linn.) Druce in Rep. Bot. Exch. Cl. Brit. Isles 1913 (3) : 415, 1914; Santapau et Wagh in Bull. Bot. Surv. Ind. 5(2) : 105, 1963; Puri 23. *Cleome fruticosa* Linn. Sp. Pl. 671, 1753. *Cadaba farinosa* Forsk. Fl. Aegypt. Arab. 68, 1775; FBI 1 : 173; Bamber 51; Parker 17. *C. indica* Lamk. Encycl. 1 : 544, 1783; FBI 1 : 173; Sabnis 132.

A straggling pubescent shrub, becoming glabrescent. Leaves simple, elliptic-oblong, entire, mealy when young. Stipules minute. Flowers yellowish white. Petals clawed. Stamens 4 or rarely 5. Fruit cylindrical, irregularly torulose; seed striate, clothed by a red aril.

Common on the walls of ruins and deserted buildings.

*Flowers and fruits* : Nov.-Jan.

Hissar, *V. J. Nair* 14770.

## 2. CAPPARIS Linn.

- |  |                        |
|--|------------------------|
| 1. Erect shrubs or small trees; branches leafless; flowers deep or light scarlet | 1. <i>C. decidua</i>   |
| 1. Climbing shrubs; branches leafy; flowers white:                               |                        |
| 2. Flowers supra-axillary; fruits reddish brown                                  | 3. <i>C. zeylanica</i> |
| 2. Flowers solitary axillary; fruits black                                       | 2. <i>C. sepiaria</i>  |

1. *C. decidua* (Forsk.) Edgew. in Jour. Linn. Soc. Lond. Bot. 6 : 184, 1862; Pax in Engl. & Prant. Pflanzenfam. 3(2) : 231, f. 139, 1891; Jacobs in Blumea 12(3) : 424, 1965; Maheshw. 65; Puri 23. *Sodada decidua* Forsk. Fl. Aegypt. Arab. 81, 1775. *Capparis aphylla* Roth, Nov. Sp. Pl. Ind. Or. 238, 1821; FBI 1 : 174; Bamber 73; Sabnis 132; Parker 19; Duthie 51.

A large shrub or small tree with rough grey and corky bark. Tender branches with waxy bloom. Leaves caducous. Stipular spines straight up to 3 mm, often wanting. Gynophore 1.5-2 cm long. Berry 2 cm across, globose, red or pink.

This plant with *Prosopis cineraria*, *Acacia nilotica* var. *tomentosa*, *Salvadora oleoides*, *Maerua oblongifolia* and *Cocculus pendulus* constitute the bulk of the scrubby vegetation. The flower buds and fruits are used for pickles.

*Local name* : Kair, Karil.

*Flowers and fruits* : March-April. Stray flowers are found throughout the year.

Bhatinda, 27808; Choudriwas, *V. J. Nair* 21520; Faridkot, 36536; Hansi, 25040; Hissar, 18791; *Duthie* 3842 (DD), 4512 (DD); *V. J. Nair* 19207; Jind, 16118; Kurukshetra, *J. N. Vohra* 9883; Loharu, 16325, 20094; Mahendragarh, 20603; Mohra (Rohtak), *V. J. Nair* 23101; Patiala, *T. A. Rao* 10953; Sirsa, *V. J. Nair* 21561; Sohna, *T. A. Rao* 11066.

2. *C. sepiaria* Linn. Syst. Nat. 10 ed. 2 : 1071, 1759; Sp. Pl. 2 ed. 720, 1762; FBI 1 : 177; Bamber 73; Sabnis 132; Parkar 20; Duthie 51; Maheshw. 65; Puri 23. Jacobs 489.

A much-branched shrub often climbing. Branches stout, zig-zag. Spines stout and recurved. Leaves coriaceous. Flowers white in terminal umbellate clusters. Gynophore 5-10 mm long. Stamens many. Fruit 8 mm in diameter.

Common along road sides, in scrubs and jungles, and near canals. Often gregarious. Sheds leaves during the hot season.

*Local name* : Hingarna, Hins.

*Flowers and fruits* : April-Aug.

Daber, 15872; Fatehbad, 16241; Gohana, *V. J. Nair* 23152; Hissar, 24878; *Duthie* 3841 (DD), 3843 (DD); *V. J. Nair* 19946, 21636; Karnal, *Parker* 1254 (DD); Ludwa, 26427; Ottobridge, *V. J. Nair* 21606.

3. *C. zeylanica* Linn. Sp. Pl. 2 ed. 720, 1762 (non Hook. et Thoms.); *C. horrida* Linn. f. Suppl. 264, 1781; FBI 1 : 178; Bamber 590; Sabnis 132; Parker 20; Puri 23; Duthie 52.

Climbing shrubs. Spines recurved. Leaves subcoriaceous. Flowers white developing along young branches before the leaves. Stamens many, white, turning reddish. Gynophore 2-6 cm long, glabrous. Fruit globular to ellipsoid, woody.

Frequent in jungles.

*Local name* : Hins.

*Flowers and fruits* : April-May.

Hoshiarpur, *Aitchison* 565 (DD); Ludwa, 26430.

### 3. CLEOME Linn.

- |  |                          |
|--|--------------------------|
| 1. Stamens more than six   | 4. <i>C. viscosa</i>     |
| 1. Stamens six only:   |                          |
| 2. Gynophore present   | 2. <i>C. gynandra</i>    |
| 2. Gynophore absent:   |                          |
| 3. Leaves simple; fruits more than 2 cm long                             | 3. <i>C. scaposa</i>     |
| 3. Leaves usually 3 or sometimes 5-foliolate; fruits less than 2 cm long | 1. <i>C. brachycarpa</i> |

1. *C. brachycarpa* Vahl ex DC. Prodr. 1 : 240, 1824; FBI 1 : 169; Bamber 389; Sabnis 131; Maheshw. 63; Puri 22; Duthie 48.

Erect strongly scented herbs with woody base. Leaves and stem covered with glandular hairs. Flowers pale yellow. Capsules oblong, beaked. Styles persistent. Seeds minute, smooth.

Common in hard soil.

*Flowers and fruits* : Aug.-Jan.

Barwala, *V. J. Nair* 19295; Hissar, *Duthie* 3837 (DD); *Raizada* 20970 (DD); Tosham, 23079.

2. *C. gynandra* Linn. Sp. Pl. 671, 1753; Iltis in *Brittonia* 12; 284, 1960; Puri 22. *Gynandropsis pentaphylla* (Linn.) DC. Prodr. 1 : 238, 1824; FBI 1 : 171; Bamber 390; Sabnis 131, *Duthie* 49. *G. gynandra* (Linn.) Briq. in *Ann. Cons. Jard. Bot. Genève* 17 : 382, 1914; Maheshw. 64.

A glandular pubescent annual up to 95 cm tall and with repelling odour. Leaves 5-foliolate. Flowers purplish white, viscid. Stamens at about the middle of the gynandrophore. Stigma sessile. Fruit up to 7.5 cm. Seeds reniform, black.

Common in waste lands and cultivated places during the rainy season.

*Local name* : Kathal, Hullul.

*Flowers and fruits* : July-Sept. Stray fruits even up to Jan.

Badopal, 24939; Fatehbad, 16240, 18874; Hissar, *Duthie* 3839 (DD); Kurukshetra, *J. N. Vohra* 9889; Loharu, 16323; Mahendragarh, 16280; Narnaul 18874, 25204.

3. *C. scaposa* DC. Prodr. 1 : 239, 1824. *C. papillosa* Steud. Nomen. Bot. ed. 2, 1 : 382, 1840; FBI 1 : 168; Bamber 275; Sabnis 131.

A strongly scented glandular pubescent herb. Leaves ovate, or ovate cordate, papillose. Flowers small, pinkish becoming yellow. Capsule subsessile, up to 5 cm long, slender. Seeds granulate.

Common in hilly places. A lithophyte.

*Flowers and fruits* : Aug.-Sept.

Khanak, 16256, 16259; Tosham, 25082.

4. *C. viscosa* Linn. Sp. Pl. 672, 1753; FBI 1 : 170; Bamber 389; Sabnis 131; Maheshw. 63; Puri 22; Duthie 48.

A glandular pubescent herb up to 1 m high. Leaves 3-5-foliolate. Petals yellow, clawed. Stamens 12-24. Capsules up to 9 cm long, glandular pubescent. Seeds smooth, black.

A weed of cultivated areas.

*Local name* : Higur, Bugra.

*Flowers and fruits* : July.-Oct.

Badopal, 24940; Bhiwani, 16333; Hissar, 16195; Raizada 21024 (DD).

#### 4. CRATAEVA Linn.

*C. odora* Buch.-Ham. Trans. Linn. Soc. 15 : 118, 1827; Jacobs Fl. Mal. Ser. 1, 6 : 66, 1960. *C. religiosa* Forst. f. Prodr. 35, 1786; FBI 1 : 172; Bamber 40; Sabnis, 132; Parker 20; Duthie 50.

A small tree (planted ?). Leaves deciduous, appearing with the flowers. Leaflets 3, subcoriaceous, red brownish when dry. Flowers yellowish white becoming purplish. Stamens many, longer than the petals. Fruits 4-5 cm long, red-brownish when dry.

*Local name* : Barna.

*Flowers* : April-May. *Fruits* : August.

Hissar, V. J. Nair 19947; Jind, 26513; Sonpet, V. J. Nair 23363; Yamunanagar, 27596.

#### 5. MAERUA Forsk.

- 1. Branches and leaves glabrous
- 1. Branches and leaves pubescent

- 1. *M. oblongifolia* var. *glabra*
- 2. *M. oblongifolia* var. *scabra*

1. *M. oblongifolia* (Forsk.) A. Rich var. **glabra** (Hook. f. et Thoms.) N. C. Nair comb. nov. *M. arenaria* Hook. f. et Thoms. var. *glabra* in Hook. f. Fl. Brit. Ind. 1 : 171, 1872; Duthie 50.

Woody climber with smooth grey bark. Flowers corymbose, greenish white. Calyx tube funnel-shaped, lobes 4, valvate, hairy on the margin. Petals 4, smaller than calyx lobes. Stamens many. Fruits moniliform, twisted and knotty, berry up to 8 cm long, each knot 1-seeded.

A common climber in jungles and waste places.

*Flowers and fruits* : Aug.-March.

Hissar, 18780, *M. A. Rau* 3506, *V. J. Nair* 14785; Sirsa, 18911.

2. *M. oblongifolia* (Forsk.) A. Rich. var. *scabra* (Hook. f. et Thoms.) N. C. Nair comb. nov. *M. arenaria* Hook. f. et Thoms. var. *scabra* Hook. f. et Thoms. in FBI 1 : 171, 1872; Duthie 50.

Like the last taxon but young branches, pedicels and calyx pubescent throughout.

*Flowers and fruits* : Aug.-March.

Between Bhiwani and Loharu, 20072; Hansi, 18723; Hissar, *Duthie* 3840 (DD); *Raizada* 20965 (DD); *M. A. Rau* 3527.

## 12. RESEDACEAE

### OLIGOMERIS Camb.

*O. linifolia* (Vahl) Macbride in Contr. Gray Herb. (n.s.) 53 : 13, 1918; Cufodontis in Bull. Jard. Bot. Brux. Suppl. 24: 161, 1954; Maheshw. 66. *Reseda linifolia* Vahl in Hornemann, Hort. Hafn. 2 : 501, 1814. *Oligomeris glaucescens* Camb. in Jacq. Voy. Bot. 24, t. 25, 1844; FBI 1 : 181; Bamber 223; Sabnis 132; Duthie 53.

Branched glabrous annual with linear leaves. Spike dense-flowered, elongate. Flowers bracteate, greenish yellow. Capsules 4-lobed. Seeds shining.

Common in waste places.

*Local name* : Bui.

*Flowers and fruits* : Sept.-March.

Bhatinda, 26285; Choudhriwas, *V. J. Nair* 19379; Hoshiarpur, *Aitchison* 697 (DD); Mahendragarh, 20574, 20615; Sirsa, *M. A. Rau* 3599; Talwandi, *V. J. Nair* 19357.

## 13. VIOLACEAE

### VIOLA Linn.

*V. serpens* Wall. in Roxb. Fl. Ind. 2 : 449, 1824; FBI 1 : 184; Bamber 456; Sabnis 133.

Herbs with scattered hairs. Stem short with runners. Leaves ovate or cordate, toothed. Stipules fringed. Flowers lilac.

*Local name* : Banafsha.

*Flowers* : Cold months.

Hoshiarpur, *Aitchison* 541 (DD).

## 14. FLACOURTIACEAE

1. Style one, ovary 1-celled  
 1. Styles more than 1; ovary 2 or more celled

2. *Xylosma*  
 1. *Flacourtia*

## 1. FLACOURTIA Comm.

**F. indica** (Burm. f.) Merr. Interp. Herb. Amb. 377, 1917; Maheshw. 67.  
*Gmelina indica* Burm. f. Fl. Ind. 132, t. 39, f. 5, 1768. *F. ramontchi*  
 L'Herit. Stirp. Nov. 59, t. 30, 1786; FBI 1 : 193; Bamber 35; Sabins 133;  
 Parker 22; Duthie 57.

Thorny shrubs. Leaves simple, alternate, glabrous, puberulous on the  
 veins. Flowers yellow. Petals absent.

*Local name* : Kukai, Kako, Khatai.

*Flowers* : Hot months.

Hoshiarpur, *Aitchison* 504 (DD).

## 2. XYLOSMA Forst.

**X. longifolium** Clos in Ann. Sc. Nat. Ser. 4, 8 : 231, 1857; FBI 1 : 194;  
 Bamber 35; Sabnis 133; Parker 22; Duthie 57.

Small trees. Leaves alternate, exstipulate, simple, shining.

Flowers yellow in short racemes. Petals absent.

*Local name* : Chirunda.

*Flowers* : Nov.-Jan.

Hoshiarpur, *Aitchison* 597 (DD).

## 15. POLYGALACEAE

## POLYGALA Linn.

1. Seeds with a strophiole  
 1. Seeds without a strophiole

1. *P. erioptera*  
 2. *P. irregularis*

1. **P. erioptera** DC. Prodr. 1 : 326, 1824; FBI 1 : 203; Bamber 284;  
 Sabnis 134; Maheshw. 68; Puri 24; Duthie 60.

An erect or decumbent annual, variable in habit. Leaves variable,  
 obovate to linear. Flowers pinkish yellow. Wings petaloid.

Common in Sandy places.

*Flowers* : Aug.-Oct.

Bakra-Nangal, *T. A. Rao* 10818; Bharian, 18814; Bhiwani, 16353; Dadri,  
 16265; Fatehbad, 16239, 18858; Hissar, *Raizada* 21005 (DD); Hoshiarpur,  
*T. A. Rao* 10747; Ludhiana, *Drummond* 1276 (DD); Narnaul, 25218; Otto-  
 bridge (Sirsa), 18963; Rohtak, *V. J. Nair* 23218, 29724; Sirsa, 18963;  
 Talwandi, 18755, 18774; Tosham (Hissar), *Drummond* 1288 (DD).

2. ***P. irregularis*** Boiss. Diagn. Ser. 1. 1, fasc. 1, 8, 1842 & Fl. Or. 1 : 469, 1867; Cooke, Fl. Bomb. Pres. 1 : 61, 1901; Mukherj. in Bull. bot. Soc. Beng. 12 : 42, 1958; Nair & Nair in Bull. bot. Surv. India 5 : 222, 1963; Puri 25.

Prostrate plants. Leaves variable, obovate-lanceolate. Racemes terminal often divaricate; persistent wing sepals with rounded apex, veins green. Corolla purple.

Not common. Found in sandy places.

*Flowers and fruits* : Oct.-Nov.; Feb.-May.

Kanana (Dadri), 20545; Loharu, 20086; Rohtak, *V. J. Nair* 23188; Siwani, 26567.

## 16. CARYOPHYLLACEAE

1. Stipules present, scarious:

2. Capsules 3-valved:

3. Style 1, tip 3-toothed; erect greyish herbs

3. Styles 3; weak herbs

2. Capsules 5-valved; styles 5, free

4. *Polycarphaea*

7. *Spergularia*

6. *Spergula*

1. Stipules absent:

4. Calyx gamosepalous:

5. Petals clawed with an appendage near the base of the blade:

6. Styles 3(4); capsules dehiscent by apical teeth

6. Styles 2; capsules 4-valved

5. *Silene*

9. *Vaccaria*

5. Petals clawed but without appendage near the base:

7. Calyx teeth long and leaf-like

7. Calyx teeth not long and leaf-like, epicalyx present

2. *Agrostemma*

3. *Dianthus*

4. Calyx polysepalous; petals not clawed:

8. Petals deeply lobed

8. Petals entire

8. *Stellaria*

1. *Arenaria*

### 1. ARENARIA Linn.

***A. serpyllifolia*** Linn. Sp. Pl. 423, 1753; FBI 1 : 239; Bamber 530; Sabnis 136; Maheshw. 69; Duthie 63.

A small decumbent annual, glandular throughout. Leaves ovate or ovate-elliptic. Flowers white. Seeds black, tubercled.

Common in moist sandy places and in gardens during cold season.

*Flowers* : Feb.-March.

Badopal, 25925; Bhatinda, 26277; Kapurthala, 36311; Malerkotla, 36712.

### 2. AGROSTEMMA Linn.

***A. githago*** Linn. Sp. Pl. ed. 2; 435, 1762. *Lychmis githago* (Linn.) Scop. Fl. Carn. (ed. 2) 1 : 310, 1772. *Githago segetum* Link. Diss. Bot. Suerin 62, 1795.

Annual herbs with simple or sparsely branched flowering stem 10-100 cm long, covered with adpressed white hairs. Leaves 3-12.5 cm long, linear lanceolate, acute with adpressed hairs. Flowers 3-5 cm diameter, usually solitary at the ends of branches. Pedicels hairy. Calyx tube

cylindrical, ovoid, coriaceous, hairy, 10-ribbed with long linear acute leaf-like teeth equalling the petals or longer. Petals pale reddish purple, long clawed, slightly notched with no coronal scales. Capsules ovoid, exceeding the calyx tube, opening by 5  $\pm$  erect teeth. Seeds black, tubercled.

In wheat fields. Seeds said to be poisonous. In all probability a new introduction to this country.

*Flowers and fruits* : Jan.-April.

Barnala, 36597 A, B.

### 3. DIANTHUS Linn.

**D. caryophyllus** Linn. Sp. Pl. 410, 1753.

Cultivated in gardens from Dec.-April.

### 4. POLYCARPAEA Lamk.

**P. corymbosa** (Linn.) Lamk. Ill. 12 : 129, 1800; FBI 1 : 245; Bamber 133; Maheshw. 70; Puri 25; Duthie 65. *Achyranthes corymbosa* Linn. Sp. Pl. 203, 1753.

Erect annual herbs with dichotomous purplish-white branches and linear leaves. Bracts and calyx silvery.

Common in sandy places; one of the early pioneers on sand dunes.

*Flowers and fruits* : July-Dec.

Bankhandi, T. A. Rao 10774; Choudriwas, 25123; Gurgaon, 25245; Kanana, 20542; Narnaul, 25184; Panipat, 24711; Rewari, 20769; T. A. Rao 11140; Tosham, 25054.

### 5. SILENE Linn.

**S. conoides** Linn. Sp. Pl. 418, 1753; Royle, Ill. 79. 1834; FBI 1 : 218; Bamber 143; Sabnis 135; Puri 25; Duthie 62.

Annual, glandular pubescent herbs. Leaves lanceolate. Calyx conic ovoid. Petals pink or pinkish white, ornamental. Seeds tuberculate.

In wheat fields.

*Flowers* : Feb.-April.

Bhatinda, 26282; Dabwali, 26145; Hoshiarpur, Aitchison s. n. (DD); Lambi, 26217; Talwandi, 34519; Taran Taran, 36331.

### 6. SPERGULA Linn.

**S. arvensis** Linn. Sp. Pl. 440, 1753; FBI 1 : 243; Bamber 132; Sabnis 136; Duthie 63; Maheshw. 69; Puri 25.

Weak herbs. Branches slightly glandular. Leaves linear, grooved beneath, whorled. Stipules thin, dry, small. Flowers in dichasial umbellate cymes. Sepals 5, blunt. Petals 5, white, blunt. Stamens 10. Capsule longer than calyx. 5-valved. Seeds many narrowly winged.



Common in gardens and moist places during the cold season.

*Flowers and fruits* : Dec.-April.

Badopal, 25930; Binjhol (Panipat), 25832; Fatehbad, *M. A. Rau* 3567; Hoshiarpur, *Aitchison* 338 (DD); Karnal, 25293; Lambi, 26177; Mahendragarh, 20638; Narnaul, 20023.

#### 7. SPERGULARIA (Pers.) J. et C. Presl

1. Petals sharply pointed; seeds winged

1. *S. fallax*

1. Petals broad-tipped; seeds not winged

2. *S. rubra*

1. ***S. fallax*** Lowe in Hook. Kew Jour. Bot. 8 : 289, 1856. *Spergula fallax* (Lowe) E. H. Krause in Sturm. Fl. Deutsch. (ed. 2) 5 : 19, 1901; Milne-Redhead in Kew Bull. 1950 : 338, 1950; Burt & Lewis in Kew Bull. 1952 : 349, 1952.

Weak herbs. Leaves linear, not grooved beneath. Flowers white. Seeds flattened, smooth, broadly winged, black.

Common in gardens during cold season.

*Flowers and fruits* : Dec.-April.

Hissar, 25906; Hoshiarpur, *Aitchison* 577 (DD); Jhabua (Rewari), 20733; Khanna, 35983; Sangrur, 36706.

2. ***S. rubra*** (Linn.) Presl, Fl. Cech. 94, 1819. *Arenaria rubra* Linn. Sp. Pl. 423, 1753. *Spergula rubra* (Linn.) Dietr. Syn. Pl. 2 : 1958, 1840; FBI 1 : 244; Bamber 132; Duthie 64.

Small annual herbs. Stem up to 20 cm long. Leaves linear, fleshy, stipules split silvery. Flowers pinkish white. Petals shorter than sepals. Capsule ovoid, longer than calyx. Seeds many, brown, not winged.

Rare on field borders.

*Flowers and fruits* : Feb.

Karnal, 15801.

#### 8. STELLARIA Linn.

***S. media*** (Linn.) Villars, Hist. Pl. Dauph. 3 : 615, 1789; Willd. in Fl. Zamb. 1(2) : 349; Turrill in Fl. Trop. East Afr. Caryophyll. 24, 1956; FBI 1 : 230; Bamber 529; Sabnis 135; Maheshw. 68; Duthie 62.

Prostrate herbs. Lower leaves petioled, upper sessile. Flowers in axillary and terminal dichasia. Sepals 5, free to the base. Petals 5, white, some times absent. Stamens 3, 5 or 10. Capsules longer than sepals.

Common in gardens and shady places during the cold months.

*Flowers and fruits* : Dec.-March.

Hissar, *M. A. Rau* 3507; *V. J. Nair* 14767, 19368; Jind, 25871; Ludhiana, 35986.

## 9. VACCARIA Medik.

**V. pyramidata** Medik. Phil. Bot. 1: 96, 1789; Cuffodontis in Bull. Jard. Bot. Brux. Suppl. 23: 104, 1953; Maheshw. 68. *Saponaria vaccaria* Linn. Sp. Pl. 409, 1753; FBI 1: 217; Bamber 133; Sabnis 135; Puri 25; Duthie 62.

Erect sparingly branched herbs up to 1 m high. Flowers in corymbs. Petals light pink. Seeds granulate.

Common in wheat fields.

*Flowers and fruits*: March-April.

Amritsar, *Vohra* 11272; Barnala, 36589; Binjhol, 25813; Chakka Jheel (Sirsa), *V. J. Nair* 21579; Dabwali, 26139; Jind, 25869; Ludwa, 26458; Taran Taran, 36330.

## 17. PORTULACACEAE

## PORTULACA Linn.

- |  |                          |
|--|--------------------------|
| 1. Flowers more than 2 cm across             | 1. <i>P. grandiflora</i> |
| 1. Flowers less than 2 cm across:            |                          |
| 2. Plants densely hairy, flowers red         | 3. <i>P. pilosa</i>      |
| 2. Plants not densely hairy, flowers yellow: |                          |
| 3. Flowers solitary, terminal                | 4. <i>P. quadrifida</i>  |
| 3. Flowers in terminal clusters              | 2. <i>P. oleracea</i>    |

1. **P. grandiflora** Hook. in Bot. Mag. t. 2885, 1829; Maheshw. 71.

A succulent prostrate herb. Leaves linear borne all round the stem. Flowers of various shades, yellow, pink and purple. Cultivated for its attractive flowers during the rainy season.

*Local name*: Lonja.

Hoshiarpur, Anonymous s. n. (DD).

2. **P. oleracea** Linn. Sp. Pl. 445, 1753; Roxb. Fl. Ind. 2: 463, 1832; FBI 1: 246; Bamber 544; Sabnis 136; Maheshw. 70; Puri 26; Duthie 66.

Glabrous annual herbs with succulent, alternate leaves. Stipules minute. Flowers sessile. Sepals persistent. Petals yellow. Stamens 8-12. Styles 3-fid. Seeds several.

Common weed in cultivated places and gardens. Cooked as vegetable and used as a cooling, demulcent and diuretic medicine.

*Local name*: Kulfa, Choulai.

*Flowers*: July-Nov.; March-April.

Barwala, *V. J. Nair* 19262; Chakka Jheel, 21594; Fatehbad, 18853; Hissar, 24846; Jhabua, 20712; Karnal, *J. N. Vohra*, 8867; Khansala, *V. J. Nair* 23248; Loharu 16320; Ludwa, 26453; Mahendragarh, 20604, 20634; Rewari, 20789; Talwandi, 16213.