Flora of India
Series 3

FLORA OF AGRA DISTRICT

A.K. SHARMA

&

J.S. DHAKRE

BOTANICAL SURVEY OF INDIA

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FOREWORD

Agra district with its historically famous city of Agra as its capital, occupies a geographically significant position in the state of Uttar Pradesh. With varied soil types and situated in between the Aravalli and the Vindhya Hill ranges, the district shows an intermingling of floristic elements and presents an interesting floristic study. Such a detailed study on the vegetation and flora of the district assumes more importance in drawing up of plans to check the problem of massive soil erosion and consequent denundation in the ravines of the Chambal river, by revegetating and greening with suitable species of flora, the details of which are now made available in the present work.

The 'flora' deals with the description of natural plant communities and their diversity in different ecological habitats, besides weeds, and escapes from cultivation; earlier botanical explorations in the district, and allied aspects on the flora. In all 609 species under 384 genera belonging to 103 families of flowering plants have been described with taxonomic Keys to the families, genera and species. Correct botanical names, relevant synonyms, short descriptions with ecological notes have been provided for each species.

It is hoped that this publication will be of interest and use to students of botany, nature lovers, tourists, foresters and environmentalists in closely knowing the plants of the district.

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Director

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Dated January 31, 1994

PREFACE

It was felt, long ago that there is a necessity for the revision of Hooker's Flora of British India. Therefore, Santapau (1952, 1962) and Janaki Amal (1954) suggested a way out - the revision of the regional floras by different workers working in Research Institutions, Colleges and Universities and publication of their works. Several districts of floristic significance in different states have been intensively and extensively botanized for writing district floras and to prepare revisions of different plant families.

The present work on the Flora of Agra District, Uttar Pradesh is one such study to assess the plant diversity in the area. The location of Agra district has been, since long, very significant from geographical, historical and strategic points of view. The flora deals with the description of the vegetation and its associated factors, taxonomic treatment of 609 taxa, each with notes on distribution, frequency, phenology, collector's names, field numbers, uses etc. Efforts have been made to bring the nomenclature uptodate as per the present Botanical code.

I am deeply indebted to Dr. J.S. Dhakre, Principal, R.B.S. College, Agra for his able guidance and help. It was very kind of him to have accompanied me in visits for plant collection. I am also grateful to Mrs. Kamla Dhakre for her constant encouragement.

Sincere thanks are also due to Dr. Bahadur Singh, Dr. S.N. Chaturvedi, Dr. S.V.S. Chauhan, Dr. R.K.S. Rathore and Dr. N.R. smith, R.B.S. College, Agra for their valuable suggestions. I am also thankful to Dr. M.S. Tayal, Principal, M.M. College, Modinagar.

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I am also thankful to Mr. Vipin Kumar for his nice type setting of this manuscript.

I acknowledge with gratitude the patient help rendered by my wife Mrs. Suman Sharma throughout the preparation and publication of the book.

Last but not the least, thanks are also due to Shri Ravi Jain, M/s Deep Printers, New Delhi for nice processing of the materials and release of this work.

A. K. Sharma

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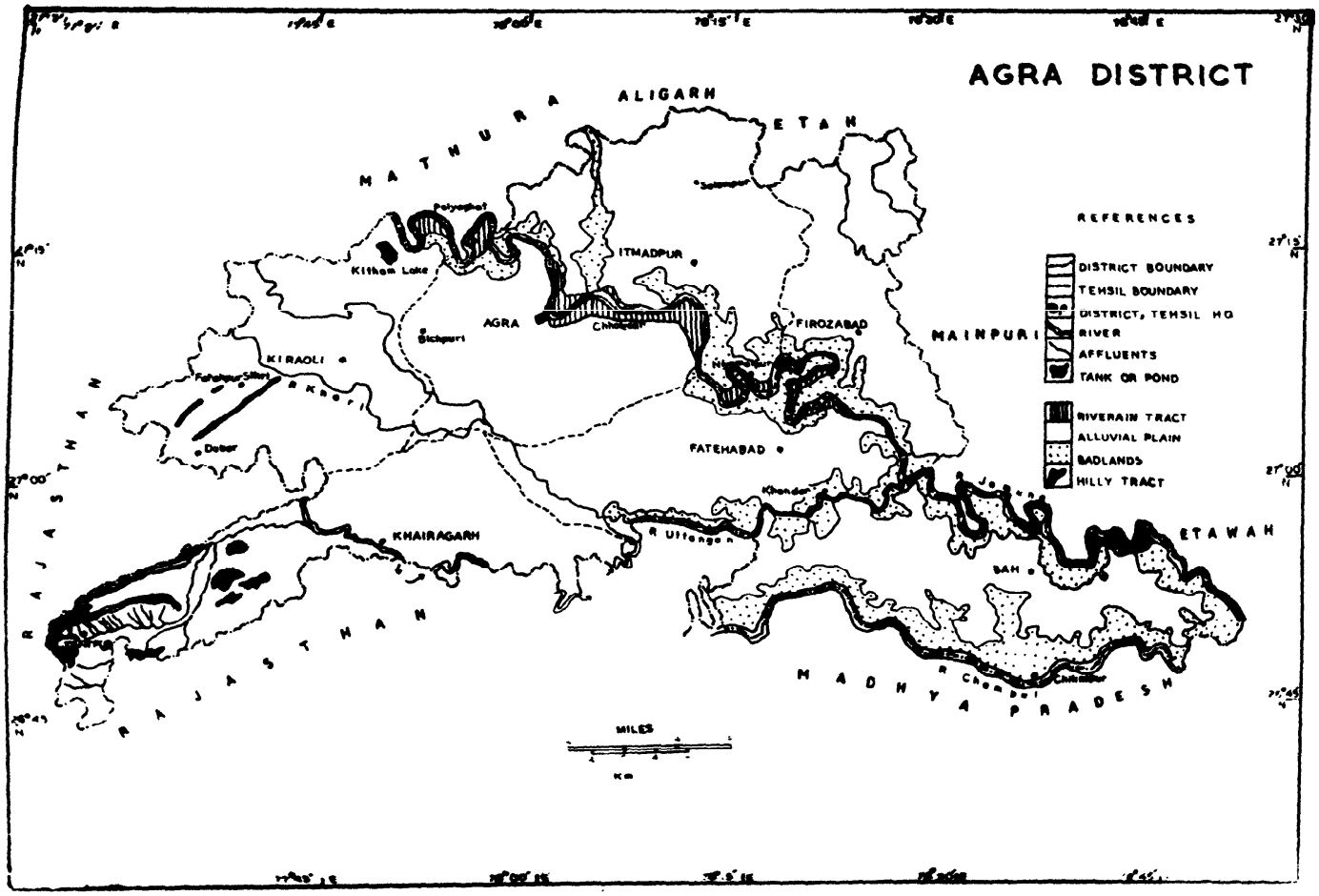
AGRA DISTRICT
MATHURA
ALIGARH
ETAH
MAINPURI
ETAWAH
RAJASTHAN
RAJASTHAN
MADHYA PRADESH
REFERENCES
DISTRICT BOUNDARY
TEHSIL BOUNDARY
DISTRICT, TEHSIL HQ
RIVER
AFFLUENTS
TANK OR POND
RIVERAIN TRACT
ALLUVIAL PLAIN
BADLANDS
HILLY TRACT
AGRA
ITMADPUR
FIROZABAD
FATEHABAD
KIRAOLI
KHAIRAGARH
Kitham Lake
Dober
Khandauli
Chambal
MILES
Km

INTRODUCTION

Agra District is situated between 26°44' and 77°55' N and 77°26' and 78°32' E on the south - west corner of Uttar Pradesh. The location of the subdivision has been, since long, very significant from the geographical, historical and strategic point of view. In recognition of this locational importance, Agra, the capital town of the district, had the privilege of being the royal seat of Mughal Kingdom for nearly the whole length of their reign in India. Of the two important rivers of Northern India, the Ganga and the Jamuna, it is the Jamuna which passes through the district for a distance of nearly 71 km. On one side of the river Jamuna, in the north - east, are Etmadpur and Firozabad subdivision of the district, while the other five subdivisions Agra, Kiraloi, Fatehpur Sikri, Fatehabad, and Bah are in the south - west. In the south, the Chambal gives the district a natural boundry with the districts of Bhind and Morena of Madhya Pradesh. The total area is 4836.5 sq. km.

GEOLOGY

Geologically, the district is generally covered by a thick layer of Indo-Gangetic alluvium of pleistocene to sub-recent periods. This is more so in the southern part which has alluvial deposits of peninsular block, carried by the rivers of the Vindhyan foreland. The alluvium owes its origin to a continuous and conformable series of fluviatile and sub-aerial deposits, composed of interbedded layers of sand, silt and clay (Joshi, 1965). As revealed by the basic data report on tubewells, the depth of the alluvium varies from 153 metres near Basai Kalan, a village (27°9'30" N. Lat. and 78°4' E. Long) at a distance of nearly 5 km. east of Agra, to 251 metres near Arzi Round village (27°8'55" N. lat. and 78°24' E. Long) 3 km. NNE of Firozabad. As one moves south the thickness of the alluvium decreases, ending with no deposit on the rocky surface of peninsular block, which emerges at places in the form of hills in the Kiraoli and Kheragarh tahsils.

The 'Khadar', the 'Bhangar' and the gravels found in abundance in the district are really the variants of the alluvium. Calcareous concretions, locally known as 'Kankar' are found throughout the district, both in the block and nodular forms. Extensive deposits of kankar are found in the Chambal ravines in Bah tahsil. They are locally known as 'Dant' and the material is extensively used for construction work.

In the south - western parts of the district remnants of the Vindhyan mountains are found and can be traced subterraneously even beyond the district boundaries

under the thick coating of alluvium. Tubewell borings show that the layers of these rocks steeply dip towards the N.E., because near Agra they were struck at a depth of 153 metres, while near Firozabad they were reached at 251 metres. The Vindhyan rocks are flagstones and freestones, homegenous and soft and thus eminently suited for elaborate carving (Joshi, 1965). It is for this reason that the Great Mughals used them for their grand buildings.

Another important geological feature of the district is the Great Boundary fault that separates the Aravallis in the West from the Vindhayas in the East. Though not visible on the surface, it may be traced to within the boundaries of district below the alluvium (Singh, 1971).

TOPOGRAPHY

The district is divisible into four well defined, natural, physiographic divisions, namely :

I. Inter fluvial land (the Bhangar)

II. Riverain tract (the Khadar)

III. Bad lands (the Ravine belt)

IV. Hilly tracts (the outcrops of Vindhyan sandstones)

1. *INTER FLUVIAL LAND* (the Bhangar) : This is the interstream area above the general flood level accounting for more than three - fourths of the total area of the district. Almost flat throughout and showing little tendency to elevation, this tract stretches out uniformly for miles in the Jamuna-Chambal Doab and in the trans - Jamuna area. Genetically, the tract may be divided into the Trans - Jamuna Plain and Doab.

(a) *The Trans-Jamuna Plain* : Stretching north of the Jamuna towards the Etmadpur and Firozabad tahsils, it includes a narrow belt running parallel to the Jamuna, up to the easternmost boundary of Agra tahsil in the south. It is an expanse of reliefless plain, sloping gently from the north to the south and is composed of alluvium of Indo-Gangetic origin, made up mainly of sand, silt and clay. Light loam, locally known as "Dumat" where it assumes a yellow colour, characterises most of the area and accounts for nearly 77% of the cultivated land. However, the soil is not fine but full of gravel and is locally called 'Pakhar'.

In the north-west tip of this plain there is a narrow and low-lying belt where water-logging frequently occurs during the monsoon months.

(b) *The Jamuna-Chambal Doab* : This is the vast stretch of alluvial plains watered by the Utangan, Chambal and Jamuna rivers and is located south of the Trans-Jamuna Plain. It is different from its northern counterpart in two respects : (1) It contains both Indo-Gangetic and peninsular alluvium and its general gradient is oriented towards the east, unlike the southernly inclination of Trans-Jamuna plains. Towards the far east, beyond the town of Bah, its slope is realtively steeper, (2) There are Kankar pans at various depths of the sub-stratum, a feature missing in tract (a). The central part of this tract is characterised by fine loam which becomes sand towards the north and clay towards the south as the tract approaches the Jamuna and Chambal respectively.

2. *RIVERAIN TRACT* : In terms of expanse this is an insignificant unit. It is found in narrow strips on both sides of the Jamuna and the Chambal. Annual deposits of sand, silt and clay renew its fertility and make it an economically significant unit. Genetically, it is made up of recent deposits of alluvium.

3. *BAD LANDS* : Appropriatelly called the bad-lands, this tract is marked by deep cuts and incisions on the earth, caused by the wrath of fierce torrents rushing through soft surface. The ravines covering an area of 823 sq. km. contain a large variety of fluvial forms and may well be called Nature's stockyard of these forms.

4. *HILLY TRACT* : Running north-west to north-east, this tract comprises two belts of the Vindhyan sand-stones. The first, found in the Kiraoli tahsil may be called Bhandrauli Fatehpur Sikri Hill and the second, found in the Kheragarh tahsil, Jagnair Tantpur Hill, after the names of the major settlements of the area. Geologically, both belong to the upper Vindhyan system. The Bhandrauli-Fatehpur Sikri spurs have mild elevation, approximately 46 metres above the sorrounding plain. The ridges of Jagnair-Tantpur are higher and more well defined than the former, the highest point 247 metres above mean sea level, lying in the ursa hills. Geologically, these ridges are relics of residual relief.

SOILS

The soil of the district is alluvial except for residual soils which occur in a narrow strip in the south and south-west. The alluvium north of the river Jamuna belongs to the Indo-Ganegetic system, while south of the river, it is the legacy of the rivers of Peninsular India, the Chambal and the Utangan. The soils of the district are divisible into the following types :

1. Recent Alluvium (Khadirs)
2. Uplands

3. Flats

4. Low lands

5. Black clayey soils

6. Residual soils

1. *RECENT ALLUVIUM :* These soils are found in the riverain tract (Khadir) of the Jamuna with a ribbon-like pattern emerging in the tahsils of Agra, Fatehabad, Bah and to some extent in Etmadpur and Firozabad also. Every year the fertility of the soil is renewed through periodic flooding and silting. The colour is grey to ashy, the texture coarse and sandy, occasionally mixed with silty deposits. Soluble salts vary from average to high.

2. *UPLANDS* : These soils spread over a big area are so called as they are found above the general level of floods. Marked alluviation is a noteworthy feature of these soils, due to which the lower horizons have become heavier with the accumulation of clay content. In texture, they are loamy sand and brownish yellow in colour. Few calcareous nodules are also present. The soils are poor in organic matter and other plant nutrients.

3. *FLATS* : These soils occupy most of the Utangan basin in the tahsils of Kiraoli and Kheragarh and to some extent in Agra and Fathehabad. They are loamy in texture but in low-lying tracts, their texture becomes clayey-loam and in colour they vary from brownish grey to greyish brown. The clay content increases from the surface towards the sub-surface, making the lower strate progressively heavier and ultimately forming a zone of compaction and 'Kankar' pans. The soils are rich in plant nutrients and fairly fertile.

4. *LOW LANDS* : These soils are found in a crescent shaped area in the north-east of Firozabad tahsil and also in isolated patches in the Etmadpur tahsil. In texture, they are fine and in colour, grey to dark grey due to severe humid conditions. There appears to be a fairly high degree of salinity in these soils. The lower levels have a 'Kankar' layer in general.

5. *BLACK CLAYEY SOILS* : This type is common in the south-western part of Bah tahsil, north of the ravine belt of the river Chambal. Genetically, they are different from other soils in that they are derived from basaltic material of Central India. They are very fine in texture and black in colour and rich in mineral food. Cracks and fissures develop in these soils in the dry season.

6. *RESIDUAL SOILS* : These soils are found around the hillocks of the district in Kheragarh and Kiraoli tahsils. They have been formed by the detritus material brought down from these hillocks. They consist of rock fragments, pebbles,

boulders near the hillocks and sand at far off distances. These soils are calcareous in nature and neutral to alkaline in reaction.

CLIMATE

The climate is markedly periodic and of a semi-arid nature due to marked diurnal differences of temperature, high saturation deficit and moderately low rainfall. The climate is characterized by a dry and increasingly hot season from March to June, a warm monsoon period from July to September and dry and cold winter from October to February. Corresponding to these, there are three distinct vegetational seasons.

TEMPERATURE

Being far from the soothing effect of the sea, the district has to suffer from extremes of temperature, i.e. very low temperatures, sometimes below freezing point (as 1°C on December 29, 1961) in winter and extremely high (as 48.6°C on June 8, 1968) in summer.

The maximum monthly temperature of January ranges from 21.4°C to 23.1°C. It increases regularly in the subsequent months upto May where it is recorded between 39°C to 42.5°C. There is a decline afterwards with minor fluctuation in the month of August, September and October. The minimum monthly temperature show a similar rise from January (5°C to 7.1°C) to May (20.1°C to 26.6°C) and steady decline in subsequent months.

RAINFALL

Heavy precipitation of rainfall occurs in the second half of July and the first half of August. The average annual rainfall of the district is 607.1 mm., 90% of which is received during the monsoon season and nearly the half of the remaining 10% during winter.

RELATIVE HUMIDITY

Relative humidity in the district remains fairly high during summer months when the lowest range averaging 41% at 08.30 hours and 30% at 17.30 hours in the month of May has been recorded. From the month of June relative humidity

starts rising steeply touching the highest point of 85% at 08.30 hours and 73% at 17.30 hours. During the monsoon season commencing from the month of July and continuing upto the first week of October, it remains constantly high.

WIND

Wind is an important climatic factor for Agra. For most of the year, the wind is mild with a mean velocity of 5.3 kmph. Winds are strongest in June and lightest in October. In the summer months, hot and dust-raising winds, popularly known as 'Loo' are commonly experienced and may result in thunderstorms (andhi).

Towards the end of June a cooler breeze comes up from the south-west at mid-day heralding the advent of the monsoon. From July to September, the rainy season, the wind generally accompanies the rainfall and as such is cool and refreshing. In the winter months, winds blowing from the north are cold and icy. This is particularly so in late December, and early January, when the winds being what is called a cold-wave.

PREVIOUS BOTANICAL EXPLORATIONS

Royle (1799-1858), an English armyman, was the first man who explored the plants of Northern India and Himalayan mountains. The results of Royle's work published after his retirement in "Illustrations of the Botany and other branches of natural History of Himalayan mountains". This came out in eleven parts between 1833 and 1840. The work was based on the collections of Hardwick, Govan and Wallich and the personal collection of Royle in the Jamuna Gangetic Doab, the upper Gangetic plain and the mountains of Garhwal, Sirmur and Kanawar. A large part of his collection is said to have gone to England but a substantial quantity is still in the Herbarium of Forest Research Institute, Dehra Dun. Then came the "Flora of British India" by Hooker (1872-1897) in seven volumes. This was the first comprehensive flora of the sub-continent. Hooker made an extensive use of the plants collected by Anderson, Hamilton, Brandis, Madden, Falconer, Thomson, Clarke, Royle, Wallich, Vicary, Duthie and others.

Other worth mentioning floras are "Notes on the Flora of Lucknow with catalogues of the cultivated and indigenous plants" by Anderson (1859), "Flora of Upper-Gangetic Plain and of Adjacent Siwalik and Sub-Himalayan tract" by Duthie (1903 - 1922) and "Hortus Agrensis" by Munro (1944). Duthie carried out intensive and laborious investigations at Dehra Dun and Saharanpur for many years and brought out this flora. He published his work in five parts, which included the families Ranunculaceae to Juncaceae. But he could not finish his plan and died in

1922. By that time he had completed the families Palmae to Aroideae and Alismataceae. These families and the remaining ones upto Cyperaceae were completed by R.N. Parker at Dehra Dun and W.B. Turrill at Kew, and finally published in 1929. Recently the Botanical Survey of India reprinted Duthie's work in two volumes. Constant use of Duthie's flora has been made during the course of the present study. From this study it appears that no special attention has so far been given to this Western district of Uttar Pradesh.

Raizada (1935, 36, 39, 50, 51, 54, 58, 62, 76) has published some publications to Duthie's flora adding some new noteworthy and recently introduced plants. Watts (1953) published a list of plants which were reported in the vast area of Agra district in the form of "Flora of Agra". Paliwal (1935) and Watts (1953) reported 37 and 39 species of grasses respectively. Bharadwaja (1956) on the other hand, described the grasses of Agra district and reported 89 species and varieties. There is no herbarium record of all these works. From the facts mentioned above it will be seen that the flora of Agra has not been studied thoroughly by anybody, so far.

PRESENT INVESTIGATION

The present work is the result of 3 years' intensive study of plants of the Agra district. For the purpose of obtaining a record of the plants of Agra as well as seasonal changes in its vegetation, excursions atleast once a month were made regularly during these years.

Twigs of the plants with flowering and possibly with fruiting were collected during a day's outing usually in sets of four. Herbaceous plants were collected with roots and radical or basal leaves as far as possible. The field notes of specimens collected were entered in the field book on the spot with regard to habit, habitat, abundance, local name, local uses, colour, smell of flowers etc. which can not be deduced from the examination of dried specimen. A particular species found growing in different habitats was collected from all such localities in order to study any change induced by different environmental conditions. For complete and full description of collected specimens, the material consisting of flowers and fruits of the same was preserved in F.A.A. or formalin solution in small tubes.

In the camp the specimens were pressed and dired in blotting papers. Poisoning was done with saturated solution of Mercuric Chloride in rectified spirit. The flowers of preserved material were studied under microscope. The structure and morphological peculiarities so observed were compared with the description given in Duthie's flora and other recent monographs. All the plants were identified to the species or variety level mainly with the help of Duthie's flora and comparison with specimens in Forest Research Institute, Dehra Dun. Constant use of every recent monograph and other available literature on the subject was made. Any

change in nomenclature or identification of plant was introduced on the authority of the monographer.

The poisoned and dried specimens were mounted on thick 39 X 26 cm. herbarium sheets and labelled. These herbarium sheets cited in this work are preserved in the Department of Botany, R.B.S. College, Agra.

PLAN FOLLOWED IN THE WORK

In the beginning a comprehensive key to the families of dicotylednous and monocotylednous plants has been given. The sequence of families followed is that of Bentham and Hooker (1862-83). In each family keys to the genera and species are given. Throughout this work the metric system has been used. In the treatment of individual species the following details are listed :

1. *NOMENCLATURE* : An attempt has been made to check the nomenclature and bring it up-to-date, as far as possible, according to the requirements of the International code of Nomenclature (1972 ed.). For this purpose various recent monographic revisionary works on different taxa, viz. families, genera and species have been consulted.

The name considered as the correct one has been placed first followed by its basionym. Of the synonyms, mention has been made especially of the adjoining areas and of the Hooker's 'Flora of British India' and Duthie's Flora of Upper Gangetic Plain.

2. *DESCRIPTION* : The description of the species has been shortened to the more important characters which help in the identification. The measurements of plant parts are according to the size of the specimens of my collection.

3. *LOCAL NAME* : The local name of all those plants which could be gathered from the forest guards and other knowledgeable people of the area, have been given.

4. *FLOWERING AND FRUITING* : The period of flowering and fruiting given for the species is based on my personal observations.

5. *FIELD NOTES* : These comprise the notes on the habits of the plants, habitat(s) in which these were observed, their relative abundance, etc., and some of the important localities from where a species can be collected have been given.

6. *USES* : In some cases the uses to which a plant is employed locally as well as elsewhere have been recorded. This information was gathered from the inhabitants of the area.

Cultivated species have not been included in the keys, unless they have been found totally naturalized but a list of the cultivated species has been added in the last.

ABBREVIATIONS

For economy of space, certain abbreviations have been used under citations for each species, they are as follows :

AKS	A.K. Sharma
Bor, Gr. Ind.	The grasses of Burma, Ceylon, India and Pakistan (excluding Bambuseae) by N.L. Bor, 1960. London.
Duthie, Fl. U. Gang. Pl.	Flora of Upper Gangetic Plain and of the Adjacent Siwalik and Sub-Himalyan Tracts by J. F. Duthie, 3 vols., 1903-29, Reprinted Edition. 1960. Calcutta.
Fls.	Flowers
Frts.	Fruits
Hook. f. Fl. Brit. Ind.	The Flora of British India by J. D. Hooker, 7 vols., 1872 97. London.
J. Asiat. Soc. Beng.	Journal of the Asiatic Society of Bengal. Calcutta.
J. Bombay Nat. Hist. Soc.	Journal of the Bombay Natural History Society. Bombay.
J. Ind. Bot. Soc.	Journal of the Indian Botanical Society. Madras.
J. Linn. Soc.	Journal of the Linnean Society (Botany)
Merr. Enum.	An Enumeration of Philippine Flowering plants Merrill, 4 vols., 1923-26. Manila.
nom. cons.	nomina conservanda
Pflanzenr.	Das pflazenreich Regni Vegetabilis conspectus, etc. by A. Engler, Heft 1 102, 1900-37. Leipzig.

P.P.	Pro parte
Rec. Bot. Surv. Ind.	Records of the Botanical Survey of India. Calcutta.
Trans. Linn. Soc.	Transactions of the Linnean Society of London (Bombay). London.
Vern.	Vernacular name.
Wt. Ic.	Icones Plantarum Indiae Orientalis or figures of Indian Plants, by Wight, R., 6 vols., 1938-53. Madras.

THE VEGETATION

Generally the vegetation of the area surveyed, is classified as the 'scrub jungle'. The vegetation presents a very open appearance so that the trees and shrubs are widely spaced. Mostly the annual vegetation is noticed during the rains, as this along is favourable for germination of seed and further growth of seedling. These are annuals which are mostly ephemerals and some are perennials which throw their aerial shoots during the favourable season alone.

For the sake of convenience of study, the vegetation can be classified as follows :

1. Seasonal Vegetation.
2. Weeds and Escapes of cultivation.
3. Vegetation of Hilly Tracts.
4. Vegetation of Aquatic habitats.

1. Seasonal Vegetation :

At the commencement of the spring most of the trees come in flower. Among the herbs, the earliest to flower are *Alternanthera pungens* H.B. & K., *A. sessilis* DC., *Veronica agrestis* L., *V. anagallis-aquatica* L., *Sisymbrium irio* L., *Scoparia dulcis* L., *Centaurium pulchellum* Druce, *Heliotropium eichwaldi* Steud., *Phyla nodiflora* Greene, *Euphorbia prostrata* Ait., *E. clarkeana* Hook., *E. hirta* L., *Justicia diffusa* Wild., *Convolvulus microphyllus* Sieb. etc.

From April as summer advances the temperature gradually rises till towards the end of June. These months are generally dry and the plants show various xeromorphic features such as thorns, woolly tomentum, thick cuticle etc. Such common herbs are *Citrullus colocynthis* Schrad., *Glinus lotoides* L., *Pluchea lanceolata* Cl., *Volutarella ramosa* Santapau, *Echinops echinatus* Roxb., *Laggera aurita* Sch.-Bip., *Euphorbia dracunculoides* Lamk., *Phyla nodiflora* Greene, *Alternanthera pungens* H.B. & K., *Erigeron bonariensis* L., *Alhagi pseudalhagi* Desv., *Arnebia hispidissma* DC., *Gomphrena celosioides* Mart., *Heliotropium aichwaldi* Steud. etc.

The commencement of rainy season in late June is the signal for the appearance of a very vigorous and luxuriant growth of plants, the seeds and rootstocks of which have been lying dormant in the soil awaiting the advent of heavy rain. In this season numerous species of *Fabaceae, Rubiaceae, Lamiaceae, Cucurbitaceae, Commelinaceae, Amaranthaceae, Euphorbiaceae, Tiliaceae, Aizoaceae, Convolvulaceae* and a great many grasses and sedges occur. Other plants occurring in this season are *Polycarpaea corymbosa* Lamk., *Polygala erioptera* DC., *Cassia occidentalis* L., *C. obtusifolia* L., *C. tora* L., *Polygonum plebeium* R. Br., *Pergularia daemia* Blatt. & McC., *Cardiospermum helicacabum* L., *Cayratia trifolia* Domin, *Dentella repens* Forst., *Chenopodium ambrosioides* L., *Blainvillea rhomboidea* Cass., *Lantana indica* Roxb., *Cocculus hirsutus* Diels etc.

With the commencement of winter (mid. Oct.) the vegetation of rainy season starts disappearing. In this season due to the prevailing dry conditions and low temperature, species of colder regions make their apprearance. The common ones are *Coronopus didymus* Sm., *Argemone mexicana* L., *Stellaria media* Vill., *Silene conoidea* L., *Spergula arvensis* L., *Vicia hirsuta* Gray, *V. sativa* L., *Cirsium arvense* Scop., *Vernonia cinerea* Less., *Vicia indica* DC., *Cotula anthemoides* L., *Cichorium intybus* L., *Malva parviflora* L., *Oxalis corniculata* L., *O. corymbosa* DC., *Anagallis arvensis* L., *Rungia pectinate* Nees, *Launaea procumbens* R. & R., *Mazus pumillus* Steen., *Lathyrus aphaca* L., *L. sativus* L., *Rumex dentatus* L., *Barleria prionitis* L., *Adhatoda zeylanica* Medic. *Medicago lupulina* L., *M. denticulata* Willd., *Potentila supina* L., *Melilotus indica* All., *M. alba* Desr., *Fumaria indica* Pugsley etc.

2. Weeds and Escapes of Cultivation :

Amongst the weeds occur in the winter session crop, the most common ones are prostrate herbs, viz. *Fumaria indica* Pugsley, *Coronopus didymus* Sm., *Veronica agrestis* L., *Malva parviflora* L.. Of the tiny and slender herbs, the most common ones are, *Stellaria media* Vill., *Spergula arvensis* L., *Melilotus indica* All. *M. alba* Desr., *Oldenlandia corymbosa* L., *Anagallis arvensis* L. Some of the herbs are prominent because of their size and the following are worth mentioning : *Vaccaria pyramidata* Medik., *Silene conoidea* L., *Lathyrus sativus* L., *Trigonella polycerata*

L., *Sonchus brachyotes* DC., *S. oleraceus* L., *Trichodesma amplexicaule* Roth, *Solanum nigrum* L., *Leucas aspera* Spreng., *Amaranthus* spp., *Chenopodium* spp., *Polypogon monspeliensis* Desf., *Diger muricata* Mart., *Asphodelus tenuifolius* Cav. Some of the climbers and twinners that occur as weeds are represented by *Vicia hirsuta* Gray, *Ipomoea pes-tigridis* L., *Lathyrus aphaca* L.

Some of the species are common for both rainy and winter season crops viz., *Digera muricata* Mart., *Impomoea pes-tigridis* L., *Amaranthus* spp. while there are some which occur exclusively in the rainy season, viz. *Cleome gynandra* L., *Tribulus terrestris* L., *Gisekia pharnaceoides* L., *Trianthema portulacastrum* L., *Zaleya govindia* Nair, *Leucas cephalotes* Spreng., *Crotalaria medicagenia* Lamk., *Portulaca oleracea* L., *Corchorus aestuans* L., *C. trilocularis* L., *Heliotropium strigosum* Willd., *Phyllanthus fraternus* Webster, *Euphorbia parviflora* L.

Setaria intermedia R. & S., S. *glauca* Beauv., *Cenchrus ciliaris* L., *Brachiaria ramosa* Stapf, *Digitaria sanquinalis* Scop., *Saccaharum spontaneum* L., *Sorghum halepense* Pers., *Cynodon dactylon* Pers., *Acrachne racemosa* Ohwi, *Echinochloa crusgalli* Beauv., *Aristida adscensioinis* L., *Dactyloctenium aegyptium* Beauv., *D. sindicum* Boiss, *Bothriochloa pertusa* A. Camus and *Dichanthium annulatum* Stapf are grasses that occur commonly as weeds in rainy season.

3. Vegetation of Hilly Tracts :

The hills mostly comprise of denuded rocks and only a small amount of soil fills the crevices between the rocks. Some grasses like *Aristida* spp., *Oropetium thomaeum* Trin., *Tetrapogon tenellus* Chiov., *Melanocenchris jacquemontii* Jaub and Spach. grow and cover these hills during rainy season.

The trees mainly restricted to the hills are : *Flacourtia indica* Merr., *Helicteres isora* L., *Anogeissus pendula* Edgew., *Wrightia tinctoria* R.Br. Some other species like *Grewia tenax* Fiori, *G. flavescens* Juss., *Butea monosperma* Taub., *Acacia arabica* L., are restricted to the bases of the hills. Species like *Balanites aegyptiaca* Delile, *Maytenus emarginata* Ding-Hou, *Acacia leucophloea* Willd, *Dichrostachys cinerea* W. & A. occur in plains but only in vicinity of the hills. The same holds true for lianas like *Cocculus* spp., *Rivea ornata* Choisy.

The herbaceous flora of the general surface of hills is rich during rains and is composed mainly of small erect and prostrate herbs. Some of the prostrate herbs growing during the period are *Boerhavia diffusa* L., *B. chinensis* A. & S., *Elytaria acualis* Lindau, *Evolvulus alsinoides* L., *Glossocardia bosvallea* DC., *Indigofera linifolia* Retz., *I. cordifolia* Heyne, *Lepidagathis hamiltoniana* Wall. and *Zornia gibbosa* Span. These plants form carpet flora and grow either intermixed with the erect forms or sometimes these alone cover the entire area. Some of the erect forms

are *Tephrosia hamiltoniana* Drumm., *Triumfetta rhomboidea* Jacq., *Barleria cristata* L., *Dipteracanthus patulus* Nees, *Vernonia cinerea* Less., *Echinops echinatus* Roxb., *Bidens biternata* M. & S., *Dicoma tomentosa* Cass., *Solanum indicum* L., *Achyranthus aspera* L., *Pupalia lappacea* Juss., *Euphorbia parviflora* L., *Acalypha ciliata* Forsk., *Urginea indica* Kunth is a common geophyte which can be identified by its leaves during rainy season and by its copper coloured scapes and flowers during the spring season.

The grasses are commmon during the rains. Some of the common ones are: *Cymbopogon parkeri* Stapf, *Dichanthium annulatum* Stapf., *Bothriochloa pertusa* A. Camus, *Digitaria stricta* Roth, *Alloteropsis cimicina* Stapf, *Chloris virgata* Sw., *Tragus roxburghii* Panigrahi, *Aristida adscensioinis* L., *A. funiculata* Trin., *Oropetium thomaeum* Trin., *Tetrapogon tenellus* Choiv. and *Melanocenchris jacquemontii* J. & S.

4. Vegetation of Aquatic Habitats :

Free floating and submerged vegetation consist of members of family Onagraceae, Gentianaceae, Hydrocharitaceae and Potamogetonaceae viz. *Ludwigia adscendens* Hara, *Nymphoides cristata* Kuntze, *N. indica* Kuntze, *Hydrilla verticillata* Royle, *Nechamandra alternifolia* Thw., *Vallisneria spiralis* L., *Potamogeton crispus* L., *P. pectinatus* L. respectively. Species of *Lemna, Wolffia* and *Spirodela* often form a scum on water and in places devoid of nitrogenous matter *Utricularia aurea* Lour, *U. stellaris* L. are seen occuring. These are the sole representatives of insectivorous plants in the area. *Ceratophyllum demersum* L. and *Zannichellia palustris* L. are the common rootless submerged aquatics.

Amongst rooted water plants, *Sagittaria guayanensis* H.B. & K., *Limnophyton obtusifolium* Miq. are the common ones. *Eichhornia crassipes* Solms., an introduced plant is a troublesome weed in the area. *Ipomoea aquatica* Forsk. and *Nymphaea pubescens* Willd. are also seen occurring frequently.

Plants growing on marshy banks are often submerged under water. The common ones of these are : *Aeschynomene indica* L., *Caesulia axillaris* Roxb., *Polygonum glabrum* Willd., *P. plebieum* R. Br., *Typha angustata* Bory & Chaub., *Ludwigia perenis* Brenan, *Sphenoclea zeylanica* Gaertn., *Paspalum paspaloides* Scrib., *Echinochloa colonum* Link., *Hemarthria compressa* R. Br., *Eriochloa procera* C. E. Hubb., *Imperata cylindrica* Beauv., *Eleocharis acutangula* Schult., *Scirpus miliacea* Vahl.

Plants of dry phase appear at the margins of canals and rivers as water recedes due to evaporation or its being used for some purposes. Some of the common species are prostrate plants like *Bergia ammannioides* Roxb., *Potentilla supina* L., *Dentella repens* Forst., *Eclipta alba* Hassk., *Phyla nodiflora* Greene, *Bacopa monnieri*

Pennell, *Alternanthera paronychioides* St., *A. pungens* Humb., *Polygonum plebeium* R. Br., and *Juncus bufonius* L. Some species of dry phase are erect herbs, viz. *Ammannia senegalensis* Lamk., *A. baccifera* L., *Ludwigia perennis* L., *Verbascum chinense* Santapau, *Veronica anagallis-aquatica* L. and some members of family Cyperaceae.

STATISTICAL SYNOPSIS OF THE INDIGENOUS FLORA

Except for *Ceperaceae* and *Poaceae,* the Monocotyledones are very poorly represented. Of the 140 species of Monocotyledones, 112 species belong to the two families mentioned above, while the remaining 28 species belong to 15 different families. The ratio of species belonging to Monocots and Dicots is 1 : 3.35, of genera 1 : 3.98 and of families 1 : 5.05 (Table 1).

Table 1 : Statistical Synopsis of the Flora.

	Dicots		Monocots		Total
	No.	%	No.	%	
Families	86	83.49	17	16.51	103
Genera	307	79.94	77	20.06	384
Species	469	77.01	140	22.99	609

DOMINANCE OF FAMILIES

Unlike in the rest of the country, (Hooker, 1907), Gramineae (Poaceae) tops the list of families in this area and the neighbouring areas (Table 2). The family Leguminosae occupies the second position; Compositae (Asteraceae) the third, followed by Cyperaceae.

With slight changes in position, the families occupying fifth to tenth positions are Acanthaceae, Convolvulaceae, Euphorbiaceae, Amaranthaceae, Scrophulariaceae, Malvaceae, Boraginaceae and Lamiaceae (Labiatae).

The main difference in the floristic position is with the Upper Gangetic plain (Hooker, 1907). Compared to this area, Cyperaceae and Comopsitae exchange their positions in the Upper Gangetic Plain ; Scrophulariaceae, which occupy fifth position in the list for the Upper Gangetic Plain are the eighth for Agra District.

Table 2 : A comparative statement of first ten predominant families in Agra District.

Sl. No.	Name of the Family	Agra district (present studies)	India (Hooker, 1907)	Upper Gangetic Plain (Hooker, 1907)	Delhi (Maheshwari, 1963)	Rajasthan desert (Blatt. & Hallb., 1918)
1.	Poaceae (Gramineae)	1	3	1	1	1
2.	Leguminosae	2	2	2	2	2
3.	Asteraceae (Compositae)	3	7	4	3	3
4.	Cyperaceae	4	8	3	4	4
5.	Acanthaceae	5	6	7	5	
6.	Convolvulaceae	6		9	7	5
7.	Euphorbiaceae	7	5	8	6	9
8.	Amaranthaceae	8			9	6
9.	Scrophulariaceae	8		5	10	
10.	Malvaceae	9		6	8	10
11.	Boraginaceae	10				7
12.	Lamiaceae (Labiatae)	10	9	10		
13.	Orchidaceae		1			
14.	Rubiaceae		4			
15.	Cucurbitaceae					8
16.	Urticaceae		10			

RELATIVE OCCURRENCE OF THE TAXA

Themonocots due to the family Gramineae, predominate in the area and have 140 species, 77 genera and 17 families. The Bicarpellatae come next with 129 species, 85 genera and 19 families. The Calyciflorae have 116 species, 70 genera and 13 families. Considering the number of species per family, the ratio shown by the Inferae is the highest : 53 species in four families, Rubiaceae, Compositae, Campanulaceae and Sphenoleaceae.

As regards the number of species per family the Gramineae occupy the first position (80 species); Papilionaceae, the next (52 species); and the third in the sequence are the Compositae (41 species).

Families that are represented in the area under survey by a single species are: Fumariaceae, Violaceae, Flacourtiaceae, Elatinaceae, Bombacaceae, Linaceae, Celastraceae, Vitaceae, Anacardiaceae, Moringaceae, Rosaceae, Myrtaceae,

Trapaceae, Cactaceae, Sphenocleaceae, Primulaceae, Ebenaceae, Loganiaceae, Hydrophyllaceae, Orobanchaceae, Bignoniaceae, Martyniaceae, Phytolaccaceae, Aristolochiaceae, Piperaceae, Proteaceae, Urticaceae, Ulmaceae, Cannabinaceae, Casuarinaceae, Ceratophyllaceae, Amaryllidaceae, Agavaceae, Juncaceae, Arecaceae, Typhaceae, Butomaceae, Eriocaulaceae and Zannichelliaceae. Of these 39 families, 31 belong to dicots and the remaining eight to monocots.

Families with more than one species in the single genus are : Ranunculaceae (2), Nymphaeaceae (2), Papaveraceae (2), Polygalaceae (2), Portulacaceae (2), Tamaricaceae (3), Rhamnaceae (2), Onagraceae (3), Oleaceae (3), Salvadoraceae (2) Lentibulariaceae (2), Nyctaginaceae (3). All these 12 families belong to dicots.

Leaving aside first three families, there are three families in which the number of species is more than 20: Convolvulaceae (21), Acanthaceae (25), Cyperaceae (33).

There are ten families, with the number of species ranging between 10 and 20. These constitute 9.07% of the total number of families represented in the area. These are : Malvaceae (16), Tiliaceae (10), Caesalpiniaceae (16), Mimosaceae (10), Cucurbitaceae (12), Boraginaceae (12), Scrophulariaceae (18), Labiatae (12), Amaranthaceae (18), Euphorbiaceae (19).

There are 10 families in which the number of species is between six to nine. These are Brassicaceae (7), Capparidaceae (7), Caryophyllaceae (7), Tiliaceae (8), Aizoaceae (8), Rubiaceae (8), Asclepiadaceae (8), Solanaceae (8), Polygonaceae (6), Moraceae (7).

Thirty - six families have the number of species between two and five. Those with five species are Rutaceae, Lythraceae, Verbenaceae, Chenopodiaceae, Commelinaceae, those with four species are Menispermaceae, Sterculiaceae, Oxalidaceae, Gentianaceae, those with three species are Tamaricaceae, Meliaceae, Combretaceae, Onagraceae, Oleaceae, Nyctaginaceae, Hydrocharitaceae, Liliaceae, Lemnaceae. Twenty families are with two species each.

It can be observed, that out of the 103 families, 60 families are with one or two species each and this is the reason for a small number of species in spite of the representation of a fairly large number of families in the area.

The present study records 73 trees belonging to 35 families. Of these 37 are mesophanerophytes i.e. they attain a height of eight to 30 metres ; the rest are all small trees, microphanerophytes reaching a height of eight metres. There is not a single tall tree or megaphanerophyte in this area. Nineteen families are represented by trees exclusively viz. Flacourtiaceae, Tamaricaceae, Simaroubaceae, Bombacaceae, Meliaceae, Celastraceae, Anacardiaceae, Moringaceae, Myrtaceae, Sapotaceae, Ebenaceae, Salvadoraceae, Bignoniaceae, Proteaceae, Ulmaceae, Moraceae, Casuarinaceae, Salicaceae, Palmae.

Forty-six species, distributed over 10 families occur as climbers. Of these *Cuscuta reflexa* Roxb. is a total parasite, while the rest are all woody climbers, either twining over the plants or climbing with the help of spiny outgrowths e.g. *Asparagus racemosus* Willd.

Families showing all the habit forms viz. trees, shrubs, climbers and herbs are just two in number, namely, Capparidaceae and Papilionaceae. Those which are represented by herbs, shrubs and trees are Capparidaceae, Malvaceae, Rutaceae, Papilionaceae, Caesalpiniaceae, Mimosaceae, Verbenaceae.

Some of the families that altogether lack trees and are represented in this area by more than 10 species are Cucurbitaceae, Compositae, Convolvulaceae, Scrophulariaceae, Acanthaceae, Labiatae, Amaranthaceae, Euphorbiaceae, Cyperaceae, Gramineae. There are 40 families that are exclusively represented by herbs, but the total number of species in each of them is under 10.

Twenty-four hydrophytic species are distributed over 14 families, eleven of which are represented exclusively by Hydrophytes viz. Nymphaeaceae, Trapaceae, Lentibulariaceae, Ceratophyllaceae, Hydrocharitaceae, Pontederiaceae, Lemnaceae, Alismataceae, Butomaceae, Potamogetonaceae, Zannichelliaceae. Lentibulariaceae is an insectivorous family.

KEY TO THE FAMILIES

1a. Leaves net-veined ; stem with open bundles ; taproot usually present ; cotyledons two :

2a. Flowers with two whorls of perianth, outer calycine, inner petaline :

3a. Inner whorl of perianth polyphyllous :

4a. Ovary apocarpous :

5a. Perianth and stamens perigynous — 35. ROSACEAE

5b. Perianth and stamens hypogynous :

6a. Herbs; stamens spirally arranged — 1. RANUNCULACEAE

6b. Climbers; stamens cyclic — 2. MENISPERMACEAE

4b. Ovary syncarpous :

7a. Plants aquatic with peltate leaves and many perianth lobes — 3. NYMPHAEACEAE

7b. Plants terrestrial or if aquatic then not with peltate leaves and many perianth lobes :

8a. Sepals free ; ovary superior :

9a. Disc not conspicuous ; stamens borne below the ovary, rarely inserted on the disc :

10a. Ovary 1-locular :

11a. Placentation parietal:

12a. Placenta reduced to the base; leaves scale like — 13. TAMARICACEAE

12b. Placenta on the entire length of the ovary ; leaves not scale like :

13a. Ovary usually on a gynophore — 7. CAPPARACEAE

13b. Ovary not on a gynophore :

14a. Corolla regular; stamens many — 4. PAPAVERACEAE

14b. Corolla zygomorphic, spurred : stamens 5 6 :

15a. Spur of the corolla on the anterior petal; stamens 5; sepals 5 — 8. VIOLACEAE

15b. Spur of the corolla on a lateral petal; stamens 6; sepals 2 — 5. FUMARIACEAE

11b. Placentation free central :

16a. Plants succulent ; sepals 2 ; fruit a circumscissile capsule — 12. PORTULACACEAE

16b. Plants not succulent ; sepals 5 ; fruit a capsule opening by valves. — 11. CARYOPHYLLACEAE

10b. Ovary 2 many locular :

17a. Placentation parietal :

18a. Stamens 6, tetradynamous ; fruit a sliqua or silicula; ovary 2-locular due to spurious septeum — 6. BRASSICACEAE (Cruciferae)

18b. Stamens many ; fruit a berry hard when dry ; ovary many locular due to involutions — 9. FLACOURTIACEAE

17b. Placentation axile :

19a. Placentation on apical portion of ovary ; anthers opening by pores — 10. POLYGALACEAE

19b. Placentation on the entire length of ovary ; anthers opening by slits :

20a. Stamens monadelphous :

21a. Anthers 2 celled — 17. STERCULIACEAE

21b. Anthers 1-celled :

22a. Carpels 5 to many ; pollen rough — 15. MALVACEAE

22b. Carpels 2 5 ; pollen smooth — 16. BOMBACACEAE

20b. Stamens free or in 5 bundles :

23a. Stamens many, free or in 5 bundles ; plants terrestrial — 18. TILIACEAE

23b. Stamens less than 10 in two whorls ; plants usually hydrophytes — 14. ELATINACEAE

9b. Disc a ring, cushion or gland ; spread over bases of calyx tube; stamens borne on the outer or inner edges of the disc or in between it when broken into glands

24a. Stamens more in number than the corolla lobes :

25a. Ovary on a stipe ; seeds winged — 31. MORINGACEAE

25b. Ovary not on a stipe ; seeds not winged :

26a. Stamens diplostemonous, united below in a tube :

27a. Stamens of outer whorl reduced to staminodes ; fruit capsule ; overy more than 1 locular — 19. LINACEAE

27b. Stamens all fertile ; fruit drupe ; ovary 1 locular — 25. MELIACEAE

26b. Stamens obdiplostemonous, not united in a tube :

28a. Disc present below the ovary ; leaves dotted with glands — 23. RUTACEAE

28b. Disc present between stamens and ovary, ring like; leaves not dotted with glands :

29a. Trees ; fruit a drupe or a samara — 24. SIMAROUBACEAE

29b. Herbs; fruit otherwise :

30a. Fruit capsular ; plants acidic — 22. OXALIDACEAE

30b. Fruit schizocarpic ; plants not acidic :

31a. Leaves simple ; fruit a regma — 21. GERANIACEAE

31b. Leaves pinnately compound ; fruit breaking into 3-5 (spiny) hard pericarps — 20. ZYGOPHYLLACEAE

24b. Stamens equal in number to or less than the corolla lobes :

32a. Flowers unisexual, irregular

33a. Ovary 1-celled ; fruit a drupe — 30. ANACARDIACEAE

33b. Ovary 3-celled ; fruit winged or lobed — 29. SAPINDACEAE

32b. Flowers bisexual, regular :

34a. Stamens alternate with the petals ; ovary partly sunk in the disc — 26. CELASTRACEAE

34b. Stamens opposite the petals : ovary not sunk in the disc

35a. Plants usually shrubs or trees ; fruit dry or a drupe — 27. RHAMNACEAE

35b. Plants usually climbers ; fruit baccate — 28. VITACEAE

8b. Sepals united ; ovary often inferior or perigynous :

36a. Carpel one ; fruit a legume or lomentum ;

37a. Corolla actinomorphic, valvate ; stamens usually many — 34. MIMOSACEAE

37b. Corolla zygomorphic, imbricate ; stamens definite:

38a. Corolla descendingly imbricate, papilionaceous ; stamens united — 32. FABACEAE (Papilionaceae)

38b. Corolla ascendingly imbricate, not papilionaceous ; stamens free. — 33. CAESALPINIACEAE

36b. Carpels more than one ; fruit otherwise

39a. Plants succulent, phylloclades bearing spines or 'aereoles'; leaves usualy much reduced or 0 — 42. CACTACEAE (*Opuntia*)

39b. Plants otherwise ; leaves well developed

40a. Leaves glandular punctate — 37. MYRTACEAE

40b. Leaves not glandular punctate :

41a. Aquatic herbs — 40. TRAPACEAE

41b. Terrestrial :

42a. Flowers in simple or compound umbels; foliage aromatic — 44. APIACEAE

42b. Flowers solitary, axillary or in racemes, spikes or cymes :

43a. Placentation parietal ; leaves usually incised — 41. CUCURBITACEAE

43b. Placetation axile ; leaves entire :

44a. Flowers epigynous :

45a. Leaves opposite ; fruit winged — 36. COMBRETACEAE

45b. Leaves alternatre; fruit not winged — 39. ONAGRACEAE

44b. Flowers perigynous or hypogynous :

46a. Perianth uniseriate, consisting of tepals — 43. AIZOACEAE

46b. Perianth biseriate, petals sometimes small — 38. LYTHRACEAE

3b. Inner whorl of perianth gamophyllous

47a. Ovary inferior :

48a. Ovary 1-locular, ovule one in each locule; anthers connate ; sepals of pappus — 46. ASTERACEAE (Compositae)

48b. Ovary more than 1-locular, ovules more than one in each locule ; anthers not connate; sepals sepaline :

49a. Leaves opposite with interpetiolar stipules — 45. RUBIACEAE

49b. Leaves alternate, exstipulate :

50a. Amphibious herbs ; flowers in dense spikes — 48. SPHENOCLEACEAE

50b. Terrestrial herbs; flowers solitary, axillary or in panicled clusters — 47. CAMPANULACEAE

47b. Ovary superior :

51a. Stamens more than the corolla lobes usually double; carpels more than two :

52a. Ovary two or more locular ; stamens more than corolla lobes :

53a. Flowers unisexual ; stamens inserted on the receptacle — 52. EBENACEAE

53b. Flowers bisexual; stamens inserted on the corolla — 51. SAPOTACEAE

52b. Ovary 1-locular ; stamens equal to corolla lobes :

54a. Leaves usually opposite, dotted ; placentation free central — 50. PRIMULACEAE

54b. Leaves alternate, glandular ; placentation basal — 49. PLUMBAGINACEAE

51b. Stamens equal to or fewer than the corolla lobes; carpels two :

55a. Stamens equal to corolla lobes :

56a. Leaves opposite :

57a. Plants with milky latex ; fruit a pair of follicles :

58a. Style one ; corona absent ; filament of stamen free — 55. APOCYNACEAE

58b. Styles two ; corona present ; filaments fused with stigma to form gynostegium — 56. ASCLEPIADACEAE

57b. Plants without milky latex ; fruits otherwise :

59a. Herbs ; placentation parietal — 58. GENTIANACEAE

59b. Trees ; placentation basal or axile :

60a. Ovary usually 1-celled ; placentation basal, ovules 1 2 — 54. SALVADORACEAE

60b. Ovary usually 2- celled; placentation axile, ovules many in each cell — 57. LOGANIACEAE

56b. Leaves alternate

61a. Mature ovary 4-locular due to spurious partition ; fruit schizocarpic, breaking into four one seeded nutlets ; style gynobasic — 60. BORAGINANACEAE

61b. Mature ovary 2-locular ; fruit not schizocarpic ; style terminal :

62a. Ovules 2 in each locule — 61. CONVOLVULACEAE

62b. Ovules numerous in each locule

63a. Placentation parietal — 59. HYDROPHYLLACEAE

63b. Placentation axile — 62. SOLANACEAE

55b. Stamens less than the corolla lobes :

64a. Flowers actinomorphic ; stamens 2 — 53. OLEACEAE

64b. Flowers zygomorphic ; stamens 2 4 :

65a. Placentation parietal :

66a. Root parasites ; flowers in spikes — 64. OROBANCHACEAE

66b. Autophytes ; flowers not in spikes :

67a. Fruit elongatd ; seeds winged — 66. BIGNONIACEAE

67b. Fruit small, woody with hooked prongs; seeds not winged — 68. MARTYNIACEAE

65b. Placentation axile :

68a. Rootless ; carnivorous aquatics ; leaf segments modified into bladders ; stamens 2 — 65. LENTIBULARIACEAE

68b. Plants terrestrial ; stamens 2 4 :

69a. Placenta enlarged ; ovules many in each locule — 63. SCROPHULARIACEAE

69b. Placenta not enlarged ; ovules in one linear row in each locule

70a. Fruit capsular :

71a. Pedicels without swollen glands at the base; capsule opening elastically, seeds usually on hooked funicles — 69. ACANTHACEAE

71b. Pedicels with swollen glands at the base; capsule not elastic ; seeds not on hooked funicles — 67. PEDALIACEAE

70b. Fruit a drupe or schizocarpic dividing into 4-nutlets :

72a. Style terminal ; fruit a drupe — 70. VERBENACEAE

72b. Style gynobasic ; fruit with 4-nutlets — 71. LAMIACEAE (Labiatae)

2b. Flowers with perianth 0 or in one whorl (except Polygonaceae) usually sepaline :

73a. Perianth 0 ; stamens in two whorls — 78. PIPERACEAE

73b. Perianth present ; stamens in one whorl :

74a. Flowers bixexual :

75a. Ovary inferior ; ovules many — 77. ARISTOLOCHIACEAE

75b. Ovary superior ; ovules solitary

76a. Perianth bract like :

77a. Leaves not succulent ; filaments of anthers connate at the base ; bracts scarious — 73. AMARANTHACEAE

77b. Leaves succulent; filaments of anthers not connate; bracts not scarious — 74. CHENOPODIACEAE

76b. Perianth petaloid :

78a. Leaves with ocreate stipules ; ovary trigonous — 76. POLYGONACEAE

78b. Leaves exstipulate ; ovary never trigonous :

79a. Trees — 79. PROTEACEAE

79b. Herbs or shrubs :

80a. Perianth united ; fruit an achene — 72. NYCTAGINACEAE

80b. Perianth free ; fruit a berry — 75. PHYTOLACACEAE

74b. Flowers unisexual :

81a. Male and female flowers in catkins or spikes :

82a. Stems jointed ; leaves reduced to whorls of scales — 85. CASUARINACEAE

82b. Stems not jointed ; leaves expanded :

83a. Plants with milky sap ; seeds few, glabrous — 83. MORACEAE

83b. Plants without milky sap; seeds many, wooly — 86. SALICACEAE

81b. Flowers not in catkins or spikes :

84a. Aquatic herbs ; leaves with setaceous segments — 87. CERATOPHYLLACEAE

84b. Terrestrial plants ; leaves not as above :

85a. Seed with a straight embryo ; stinging hairs present ; often with cystoliths — 81. URTICACEAE

85b. Seed with a curved embryo ; stinging hairs absent ; cystoliths absent :

86a. Fruit many seeded (capsule or regma) ; plants with milky latex ; ovary 3-locular ; styles 3 — 80. EUPHORBIACEAE

86b. Fruit single seeded (achene or samara) ; plants without milky latex ; ovary 1-locular ; styles 2 :

87a. Trees ; flowers tetramerous ; fruit samara — 82. ULMACEAE

87b. Herbs ; flowers pentamerous ; fruit achene — 84. CANNABINACEAE

1b. Leaves parallel veined ; stem with closed bundles ; taproot usually absent ; cotyledon one :

88a. Perianth absent or rudimentary ; represented by hairs or scales :

89a. Flowers subtended by glumes (chaffy scales) ; perianth reduced to scales or hypogynous setae or absent in Cyperaceae and represented by lodicules in Poaceae :

90a. Inflorescence a solitary head on spirally ribbed peduncle — 103. ERIOCAULACEAE

90b. Inflorescence various but not as above :

91a. Culms usually solid, triquetrous ; leaf sheaths not split; perianth represented by hypogynous bristles or absent ; ovary trigonous or lenticular ; fruit an achene — 104. CYPERACEAE

91b. Culms hollow, cylindrical or compressed ; leaf sheaths split ; perianth represented by lodicules ; ovary usually not trigonous ; fruit a caryopsis — 105. POACEAE (Gramineae)

89b. Flowers not subtended by glumes ; perianth absent or represented by hairs :

92a. Flowers in cylindrical spadix :

93a. Inflorescence a simple fleshy spike (spadix) of inconspicuous flowers subtended by a usually large bract like spathe ; aquatic plants — 97. ARACEAE

93b. Flowers in 2 cylindrical, superposed spikes, male and female flowers subtended by caducous bract like spathe ; marshy plants — 96. TYPHACEAE

92b. Flowers not in cylindrical spadix :

94a. Plant body thallus like, not differentiated into stem and leaf — 98. LEMNACEAE

94b. Plant body differentiated into stem and leaf :

95a. Flowers bisexual ; carpels 4, free, not with dilated stigma — 101. POTAMOGETONACEAE

95b. Flowers unisexual ; carpels 1 - 9, free, each with a dilated stigma — 102. ZANNICHELLIACEAE

88b. Perianth well developed usually of 2-series, atleast the inner petaloid

96a. Ovary apocarpus :

97a. Carpels with diffuse parietal placentation — 100. BUTOMACEAE

97b. Carpels with basal placentation — 99. ALISMATACEAE

96b. Ovary syncarpous :

98a. Ovary superior :

99a. Perianth sepaloid :

100a. Perennial herbs ; placentation parietal; fruit a capsule — 94. JUNCACEAE

100b. Shrubs or trees ; placentation basal or axile ; fruit a berry or drupe — 95. ARECACEAE (Palmae)

99b. Perianth petaloid

101a. Aquatic plants ; leaves with floats in petiolar region — 92. PONTEDERIACEAE

101b. Terrestrial plants ; leaves otherwise :

102a. Flowers subtended by a cymbiform (boat-shaped) green spathe except *Murdannia* — 93. COMMELINACEAE

102b. Flowers not subtended by such a bract — 91. LILIACEAE

98b. Ovary inferior

103a. Flowers zygomorphic, bisexual — 90. AGAVACEAE

103b. Flowers actinomorphic, unisexual or bisexual

104a. Plants aquatic, submerged or floating — 88. HYDROCHARITACEAE

104b. Plants terrestrial — 89. AMARYLLIDACEAE

DICOTYLEDONES

1. RANUNCULACEAE

RANUNCULUS L.

1a. Heads globose; achenes tubercled	1. *R. muricatus*
1b. Heads oblong; achenes tubercled	2. *R. sceleratus*

1. **Ranunculus muricatus** L. Sp. Pl. 555. 1753; Hook. f., fl. Brit. Ind. 1:20, 1872.

Erect or diffuse, glabrous, annual herbs, 10-30 cm high. Leaves petiolate, 2.5-4.0 cm across, 3-partite, lobes irregularly cut, base rounded or nearly cordate. Flowers 7-8 mm across, yellow, solitary, axillary. Sepals reflexed, shorter than the petals. Achenes in a large globose head, tubercles scattered over the flattened sides.

Fls. : Jan.-Mar.; *Frts.* : Mar.-Apr.; AKS 650, RBS College garden.

2. **Ranunculus sceleratus** L. Sp. Pl. 551. 1753; Hook. f., Fl. Brit. Ind. 1 : 19. 1872 ; Duthie, Fl. U. Gang. Pl. 1 : 21. Repr. ed. 1960.

Erect, branched, glabrous, annual herbs, 30-60 cm high. Stems fistular, ribbed. Radical leaves long-petiolate, deeply 3-lobed, each lobe further dissected; segments obovate, cuneate; cauline leaves shortly petiolate, 3-partite, segments linear, lobed and toothed. Flowers about 6 mm in diam. Calyx reflexed. Petals yellow. Achenes many, in oblong heads, obliquely obovate, turgid.

Fls. : Jan.-May ; *Frts.* : May-June ; *Vern.* : *Jaldhania* ; AKS 91, Poiya ghat.

Common, particularly near water and in sandy soil on the banks of Jamuna and Utangan.

2. MENISPERMACEAE

1a. Woody climber	3. *Tinospora*
1b. Herbaceous climber :	

2a.	Stamens free	2. *Cocculus*
2b.	Stamens connate	1. *Cissampelos*

1. CISSAMPELOS L.

Cissampelos pareira L. Sp. Pl. 1031. 1753 ; Hook., f. Fl. Brit. Ind. 1:103. 1872; Duthie, Fl. U. Gang. Pl. 1 : 31. Repr. ed. 1960.

A twining, more or less tomentose, perennial shrub. Leaves long petiolate, 3.5 - 7.5 X 4.0 - 8.5 cm, hemispherical or suborbicular, usually peltate, base cordate. Flowers minute, pale green. Male flowers in pedunculate, branched cymes, clustered in the leaf axils, densely tomentose. Female flowers 1-2, in the axils of conspicuous bracts. Drupes subglobose, red when ripe.

Fls. : Sept. - Oct. ; *Frts.* : Oct. Nov. ; *Vern.* : *Patat Ki bel* ; AKS 538, 802, Chiknipur.

Found on the ridge and hilly tracts twining around shrubs.

2. COCCULUS DC. nom. cons.

1a.	Leaves ovate - oblong ; male flowers in axillary panicles	1. *C. hirsutus*
1b.	Leaves narrowly lanceolate; male flowers in sessile, axillary clusters	2. *C. pendulus*

1. Cocculus hirsutus (L.) Diels in Engl. Pflanzenr. 46 : 236. 1910 ; Santapau in Rec. Bot. Surv. Ind. 16(1) : 5. 1953. *Menispermum hirsutum* L. Sp. Pl. 341. 1753. *Cocculus villosus* DC. Syst. 1 : 525. 1818; Hook. f., Fl. Brit. Ind. 1 : 101. 1872 ; Duthie, Fl. U. Gang. Pl. 1 : 29. Repr. ed. 1960

An extensive, climbing shrub. Leaves petiolate, 2.5 - 6.0 x 1.5 - 5.5 cm, ovate or ovate - oblong, obtuse or mucronate, usually subauriculate at the base. Flowers minute, greenish yellow. Male flowers in short axillary panicles. Female flowers 1 - 3, on axillary pedicels ; bracts small, linear. Drupes dark purple.

Fls. : Oct. - Jan. ; *Frts.* : Jan. Feb. ; *Vern.* : *Khareta Ki bel* ; AKS 72, 222, Chhalesar ; 323, Sikandra.

Common on the ridge climbing on shrubs and trees.

2. **Cocculus pendulus** (Forst.) Diels in Engl. Pflanzenr. 46 : 237, f. 78. 1910; Fl. Saur. 1 : 5. 1962; *Epibaterium pendulum* Forst. Char. Gen. 108, t. 54. 1776 ; Hook.f., Fl. Brit. Ind. 1 : 102. 1872; Duthie, Fl. U. Gang. Pl. 1 : 30. Repr. ed. 1960.

A climbing shrub. Leaves petiolate, 1.5 3.5 x 0.9 2 cm, linear, narrowly lanceolate, entire, obtuse. Flowers minute, greenish yellow. Male flowers short pedicelled, in axillary panicles. Female flowers solitary on axillary peduncles. Drupes reniform, dark purple.

Fls. : Feb. Apr. ; *Frts.* : Apr. May; AKS 871, Tantpur.

Occurs on the slopes of the ridge and hilly tracts.

3. Tinospora Miers

Tinospora cordifolia (Willd.) Miers in Ann. & Mag. nat. Hist. ser. 2, 7 : 38. 1851 ; Hook. f., Fl. Brit. Ind. 1 : 97. 1872 ; Duthie, Fl. U. Gang. Pl. 1 : 27. Repr. ed. 1960. *Menispermum cordifolium* Willd. Sp. Pl. 4 : 826. 1806.

A large, succulent, glabrous, climbing shrub. Leaves petiolate, 7 12.5 x 6 8.5 cm, broad cordate, acute or acuminate. Flowers small, yellow ; male ones in fascicles, females usually solitary.

Fls. & frts. : Mar. May ; *Vern.* : *Giloya*; AKS 891, Paliwal Park.

Grown in the gardens and lawns.

3. NYMPHAEACEAE

Nymphaea L. nom. cons.

1a.	Leaves glabrous on the lower sides; anthers with appendages	1. *N.nouchali*
1b.	Leaves pubescent on the lower sides; anthers without appendages	2. *N.pubescence*

1. **Nymphaea nouchali** Burm. f. Fl. Ind. 120. 1768 ; Subram. Aq. Ang. 8, t. I, f, 2. 1962. *N.stellata* Willd. Sp. Pl.2 : 1153. 1799: Hook. f., Fl. Brit. Ind. 1 : 114. 1872 ; Duthie, Fl. U. Gang. Pl. 1 : 34, Repr. ed. 1960.

An aquatic, floating herb. Leaves orbicular or elliptic, cleft at base, blotched with purple beneath. Flowers large, solitary on long radical scapes, white, blue,

rose or purple, mildly scented. Sepals 4. Petals in many series. Anthers with long appendages. Fruits globular.

Fls. & frts. : July - Nov. ; *Vern.* : *Chhota Kamal* ; AKS 745 Shahjahan Garden ; 836, Salempur

Common in ponds and in water reservoirs of the low lying area.

2. **Nymphaea pubescens** Willd. Sp. Pl. 2 : 1154. 1799 ; Baker & Bakh. f. in Fl. Java 1 : 148. 1963. *N.lotus* auct. non L. ; Hook f., Fl. Brit. Ind. 1 : 114. 1872, p.p.

A floating herb. Leaves sagittate when young, orbicular or reniform, sharply toothed, pubescent beneath. Flowers solitary, on long radical scapes, variable in size and colour. Anthers without appendages. Fruits globose, fleshy; stigmatic rays with clubbed appendages. Seeds broadly ellipsoid, rough.

Fls. & frts. : Sept. Nov. ; *Vern.* : *Kamal Kakri* ; AKS 882, Kiraoli.

Occurs in the temporary ponds and in water streams.

4. PAPAVERACEAE

ARGEMONE L.

1a. Flowers bright yellow ; stigma - lobes more or less appressed — 1. *A.mexicana*

1b. Flowers pale yellow or white; stigma - lobes spreading — 2. *A.ochroleuca*

1. **Argemone mexicana** L. Sp. Pl. 508. 1753 ; Hook. f., Fl. Brit. Ind. 1 : 117. 1872 ; Duthie, Fl. U. Gang. Pl. 1 : 37. Repr. ed. 1960.

A robust, branched, prickly herb, 30 100 cm high. Lower leaves crowded in a rosette, petiolate ; higher ones half amplexicaul, sinuately - pinnatifid, glaucous, prickly. Flowers 2.5 3.5 cm across, terminal, sessile or on very short peduncles. Sepals 3, green with an acute horn at the apex. Petals 6, bright yellow. Stigmas red. Capsules elliptic or oblong, erect, prickly, dehiscing by valves. Seeds black.

Fls. : Oct. Apr. ; *Frts.* : Apr. May ; *Vern.* : *Satyanasi* ; AKS 748, Bypass Road.

Common along the roadsides and in open waste places.

2. **Argemone ochroleuca** Sweet, Brit. Fl. Gard. 3 : t. 242. 1828 ; Ownb. in Mem. Torrey Bot. Cl. 21: 29 31. 1958. *Argemone mexicana* L. var. *ochroleuca* (Sweet) Lindl. Bot. Reg. 1343. 1830.

An erect, prickly, glaucous, annual herb, 20 100 cm high. Lower leaves in a rosette ; upper ones half amplexicaul, sinuately pinnatifid, prickly. Flowers sessile. Sepals 3. Petals 6, pale yellow or white. Stigmas dark red. Capsules ovate - lanceolate or lanceolate, clothed with spines.

Fls. : Oct. Mar. ; *Frts.* : Mar. Apr. ; *Vern.* : *Satyanasi*; AKS 943, Bypass Road.

Common in open waste lands and along roadsides.

5. FUMARIACEAE

FUMARIA L.

Fumaria indica (Hassk.) Pugsley in J. Linn. Soc. Bot. 44 : 313. 1919 ; *F. vaillantii* var. *indica* Hassk. in Flora 56 : 443. 1873. *F. parviflora* Wt. & Arn. Prodr. 18. 1834 (non Lamk.). *F. parviflora* subsp. *vaillantii* sensu Hook. f. in Fl. Brit. Ind. 1 : 128. 1872 ; Duthie, Fl. U. Gang. Pl. 1 : 37. Repr. ed. 1960.

A diffuse, much - branched, annual herb. Leaves finely divided into narrow flat segments. Flowers small, in terminal or leaf - opposed racemes. Sepals 2, much smaller than the corolla. Petals rosy purplish, two outer dissimilar, posterior produced at the base into a short spur, anterior one flat, narrow ; two inner narrow, cohering by their tips, keeled at the base. Fruits globose, 2 2.5 mm in diam., 1 seeded, indehiscent.

Fls. : Nov. Jan. ; *Frts.* : Jan. Feb.; *Vern.* : *Gajri* ; AKS 10, Dayalbagh.

Common in moist places of the gardens and cultivated fields.

6. BRASSICACEAE

(Cruciferae)

1a. Fruits indehiscent ..... 3. *Coronopus*

1b. Fruits dehiscent

2a. Fruits terete or compressed dorsally, many seeded:

3a. Fruits short and broad :

4a. Flowers white ; seeds winged — 4. *Farsetia*

4b. Flowers yellow ; seeds not winged — 2. *Cochlearia*

3b. Fruits long and narrow :

5a. Seeds in 2 rows — 6. *Rorippa*

5b. Seeds in 1 row — 7. *Sisymbrium*

2b. Fruits compressed laterally, 1 - 2 seeded :

6a. Fruits 2 - seeded, compressed laterally — 5. *Lepidium*

6b. Fruits 1 - seeded, orbicular - ellipsoid — 1. *Alyssum*

1. ALYSSUM L.

Alyssum maritimum (L.) Lamk. Encycl. 1 : 98. 1783. *Clypeola maritima* L. Sp. Pl. 652. 1753.

An erect or diffuse, pubescent herb, 10 - 25 cm high. Leaves petiolate, 1.9-3.0 x 0.3 - 0.6 cm, linear - oblanceolate, entire, acute. Flowers small, white, in dense terminal racemes. Fruits orbicular ellipsoid, cells 1 seeded, 3 4 x 2 cm.

Fls. : Jan. Feb. ; *Frts.* : Feb. Mar. ; AKS 667, Taj nursery.

Found as an escape in Taj nursery.

2. COCHLEARIA L.

Cochlearia cochlearioides (Roth) Santapau & Mahesh. in J. Bombay Nat. Hist. Soc. 54 : 804. 1957. *Alyssum cochlearioides* Roth, Nov. Pl. Sp. 322. 1821. *Cochlearia flava* Buch. - Ham. ex Roxb. Hort. Beng. 48. 1814, nom. nud. ; Hook. f., Fl. Brit. Ind. 1 : 145. 1872 ; Duthie, Fl. U. Gang. Pl. 1 : 41. Repr. ed. 1960.

An erect, glabrous, diffusely branced, annual herb. Leaves shortly petiolate, 8 - 12.5 x 2 2.5 cm, pinnatifid ; lobes sinuate toothed. Flowers yellow, small, in elongated racemes. Sepals spreading. Fruits globose, smooth. Seeds rugose, compressed.

Fls. : Nov. Dec. ; *Frts.* : Dec. Jan. ; AKS 894, Fatehpur Sikri.

Found near the ponds, canals and in moist places.

3. CORONOPUS L. nom. cons.

Coronopus didymus (L.) Sm. Fl. Brit. 2 : 691. 1800. *Lepidium didymum* L. Syst. 2 : 433 & Mant. 92. 1767. *Senebiera pinnatifida* DC. in Mem. Soc. Hist. Nat. Par. 144, t. 9. 1799 ; Duthie, Fl. U. Gang. Pl. 1 : 46. Repr. ed. 1960.

A prostrate or diffuse, branched, annual herb often forming a rosette. Leaves finely 1 to 2 - pinnatifid. Flowers minute, white, in leaf - opposed racemes. Fruits didymous, 2 - 2.5 mm broad consisting of two reticulate, indehiscent lobes which separate on falling. Seed one in each lobe, reniform, brown.

Fls. : Nov. - Mar. ; *Frts.* : Mar. - Apr.; *Vern.* : *Jengli hala*; AKS 274, Shahjahan garden.

Abundant in moist places of the gardens, fields and along roadsides.

4. FARSETIA Turra.

Farsetia hamiltonii Royle, Ill. 71. 1839 ; Hook. f. Fl. Brit. Ind. 1 : 140. 1872 ; Duthie, Fl. U. Gang. Pl. 1 : 40. Repr. ed. 1960.

An erect, much branched herb, 30 - 75 cm high, covered with dense appressed hairs. Leaves alternate, 2.5 - 7.5 x 0.2 - 0.5 cm, linear, very narrow, acute. Flowers whitish, small in spicate racemes. Fruits 1.2 2 x 0.4 0.5 cm, sessile, linear oblong, pointed, much compressed. Seeds orbicular, broadly winged, deep brown.

Fls. : May Aug. ;. *Frts.* : Aug. Sept. ; AKS 162, Poiya ghat.

Common in sandy soil of cultivated fields and unused grounds.

5. LEPIDIUM L.

Lepidium sativum L. Sp. Pl. 644. 1753 ; Hook. f. Fl. Brit. Ind. 1 : 159. 1872; Duthie, Fl. U. Gang. Pl. 1 : 46. Repr. ed. 1960.

An erect, glabrous, annual herb, 20 45 cm high. Radical leaves petiolate, 2 pinnatisect ; cauline ones sessile, often entire. Flowers small, white or pinkish in elongating racemes. Fruits oblong - orbicular, laterally compressed, notched at the tips, 2 seeded, 5 6 mm long ; valves winged.

Fls. : Feb. Mar. ; *Frts.* : Mar. Apr. ; *Vern.* : *Hala* ; AKS 95, Poiya ghat.

Occurs in moist places of gardens and fields.

6. RORIPPA Scop.

Rorippa indica (L.) Hiern, Cat. Afr. Pl. Welw. Pt. 1, 26, Addit. & Corr. 1896. *Sisymbrium indicum* L. Mant. 1 : 93. 1767. *Nasturtium indicum* DC. Prodr. 1 : 139. 1824 ; Hook. f. Fl. Brit. Ind. 1 : 134. 1872 ; Duthie, Fl. U. Gang. Pl. 1 : 39. Repr. ed. 1960.

An erect, branching herb, 30 60 cm high. Leaves sinuately pinnatifid ; lobes entire. Flowers small, yellow, in many flowered, long racemes. Petals as long as the sepals. Fruits 2 4 x 0.1 cm, narrow, cylindrical.

Fls. : Jan. Feb. ; *Frts.* : Feb. Mar. ; AKS 669, Shahjahan garden.

Found in moist places of gardens and open waste fields.

7. SISYMBRIUM L.

Sisymbrium irio L. Sp. Pl. 659. 1753; Hook f. Fl. Brit. Ind. 1 : 150. 1872; Duthie, Fl. U. Gang. Pl. 1 : 42. Repr. ed. 1960.

An erect, annual herb, 15 60 cm high. Leaves shortly petiolate, pinnatifid, lobes distant, spreading, toothed. Flowers small, yellow in lax racemes. Fruits erect, subtorulose, glabrous, 2 4.5 x 0.1 0.15 cm.

Fls. : Jan. Feb. ; *Frts.* : Feb. Mar. ; AKS 353, Rambagh ; 645, Poiya ghat.

Common in moist places of cultivated fields, gardens and along roadsides.

List of cultivated Taxa:

Brassica rapa L. Sp. Pl. 666. 1753 ; Bailey, Man. Cult. pl. 436. 1949. *Verm.: Shalgam.*

Brassica oleracea L. var. ***capitata*** L. Sp. Pl. 667. 1753; Blatt. in J. Bombay Nat. Hist. Soc. 34 : 297. 1930. *Vern.* : *Bandhagobhi.*

Brassica oleracea L. var. **botrytis** L. Sp. Pl. 667. 1753, Bailey, Man. Cult. Pl. 436. 1949. *Vern.* : *Phoolgobhi.*

Brassica campestris L. var. ***sarson*** Prain in Dept. Land Rec. & Agric. Bengal, Bull. No. 4 : 24, tt. 5 7. 1898 ; Duthie, Fl. U. Gang. Pl. 1 : 44. Repr. ed. 1960.

Brassica juncea (L.) Czern. & Coss.; Czern. Consp. Pl. Chark. 8, n.5. 1859 ; Coss. in Bull. Soc. Bot. France 6 : 609. 1859 ; Hook. f & T. Anders. in Fl. Brit.

Ind. 1 : 157. (in part). *Sinapis juncea* L. Sp. Pl. 668. 1753, excl. Syn. Herm. *Brassica juncea* Hook. f. & Thoms. in J. Linn. Soc. 5 : 170. 1861, in part ;Duthie, Fl. U. Gang. Pl. 1 : 43. Repr. ed. 1960.

Brassica nigra Kock in Roehl. Deutschl. Fl. 4 : 713. 1833; Hook. f. Fl. Brit. Ind. 1 : 156, 1872 ; Duthie, Fl. U. Gang. Pl. 1 : 43. Repr. ed. 1960., Vern. : Poorbirai.

Raphanus sativus L. Sp. Pl. 669, 1753 ; Hook. f. Fl. Brit. Ind. 1 : 166, 1872; Duthie, Fl. U. Gang. Pl. 1 : 47. Repr. ed. 1960. *Vern.* : *Muli.*

7. CAPPARACEAE

(Capparidaceae)

1a. Herbs ; fruits capsular — 3. *Cleome*

1b. Shrubs or trees ; fruit a berry

2a. Leaves trifoliate — 4. *Crataeva*

2b. Leaves simple :

3a. Petals clawed ; stamens 4 - 6 — 1. *Cadaba*

3b. Petals not clawed ; stamens numerous :

4a. Armed shrub or small tree; berry not moniliform — 2. *Capparis*

4b. Unarmed woody climber; berry moniliform — 5. *Maerua*

1. CADABA L.

Cadaba fruticosa (L.) Druce in Rep. Bot. Exch. Cl. Brit. Isles 1913, 3 : 415. 1914 ; Raizada in Ind. For. 5 : 303. 1966. *Cleome fruticosa* L. Sp. Pl. 671. 1753. *Cadaba farinosa* Forsk. Fl. Aegypt. - Arab. 68. 1775. ; Raizada in Ind. For. 8 : 469. 1958. *Cadaba indica* Lamk. Encycl. 1 : 544. 1785. Hook. f. Fl. Brit. Ind. 1 : 172. 1872 ; Haines, Bot. Bih. & Or. 317. Repr. ed. 1961.

A straggling, much branched shrub, 2 - 2.5 high. Leaves shortly petiolate, 2.2 - 5.3 x 0.9 - 2.1 cm, elliptic or oblong, retuse, glaucous, glabrous. Flowers pale white, in terminal corymbs. Sepals 4, 1.2 cm. long, subequal, ovate-oblong. Petals 4, 1.3 cm long, spathulate. Fruits subterete or slightly torulose seated on a gynophore.

Fls. : Oct. Dec. ; *Frts.* : Dec. Jan. ; AKS 575, Niyamatpur.

First record from the area ; found on the ridge in ravine tract.

2. CAPPARIS L.

1a. Older branches leafless ; flowers red — 1. *C. decidua*

1b. All the branches leafy ; flowers white — 2. *C. sepiaria*

1. **Capparis decidua** (Forsk.) Edgew. in J. Linn. Soc. 6 : 184. 1862; Pax in Engl. & Prantl, Pflanzenf. 3 (2) : 230, 231, f. 139. 1891. *Sodada decidua* Forsk. Fl. Aegypt. - Arab. 81. 1775. *Capparis aphylla* Roth, Nov. Pl. Sp. 238. 1821 ; Hook. f. Fl. Brit. Ind. 1 : 174, 1872 ; Duthie, Fl. U. Gang. Pl. 1 : 51. Repr. ed. 1960.

A leafless, much branched, straggling shrub or small tree. Thorns in pairs, short, straight or recurved. Leaves on young shoots only, linear, oblong, acute, caducous. Flowers red or scarlet, in many flowered corymbs on short lateral branches. Sepals unequal, pubescent. Petals narrow oblong, longer than the sepals. Ovary stipitate. Fruits 1.5 - 2 cm in diam., globose or ovoid, red when ripe.

Fls. : Mar. - June ; *Frts.* : June - July ; *Vern.* : *Karil* ; AKS 748, Bypass Road.

Common in open waste places, along roadsides and on the ridge.

2. **Capparis sepiaria** L. Syst. Nat. ed. 10, 2 : 1017. 1759 ; Hook. f. Fl. Brit. Ind. 1 : 177. 1872 ; Duthie, Fl. U. Gang. Pl. 1 : 52. Repr. ed. 1960.

An evergreen, branched, climbing shrub. Thorns paired, recurved. Leaves shortly petiolate, 2 - 5.5 x 1.2 - 3 cm, ovate - elliptic or elliptic-lanceolate, subacute or retuse. Flowers 1.2 1.5 cm across, white, in many flowered, terminal umbels. Petals oblong, unequal. Ovary stipitate. Berries 0.8 - 1 cm in diam., globose, deep purple when ripe.

Fls. : Apr. - June ; *Frts.* : June - July ; *Vern.* : *Heens* ; AKS 409, Delhi gate.

Common on the ridge and along roadsides, also planted for hedges.

3. CLEOME L.

1a. Gynophore present — 2. *C. gynandra*

1b. Gynophore absent

2a. Stamens 6 ; capsules less than 1.5 cm long — 1. *C. brachycarpa*

2b. Stamens 12 or more ; capsules more than 2.5 cm long — 3. *C. viscosa*

1. **Cleome brachycarpa** Vahl ex DC. Prodr. 1 : 240. 1824 : Hook. f. Fl. Brit. Ind. 1 : 169. 1872 ; Duthie, Fl. U.Gang. Pl. 1 : 48. Repr. ed. 1960.

A strongly scented, glandular, scabrous herb, 15 cm high branching from the base. Leaves 3 foliate ; leaflets obovate or oblong. Flowers yellow. Stamens 6. Capsules about 1 cm long, oblong, rough. Seeds minute, smooth.

This plant is included on the authority of Jacquemont (in Duthie, Fl. U. Gang. Pl. 1 : 48).

2. **Cleome gynandra** L. Sp. Pl. 671. 1753 ; Jacobs in Fl. Males. 6 : 101. 1960. *Gynandropsis pentaphylla* (L.) DC. Prodr. 1 : 238. 1824; Hook. f. Fl. Brit. Ind. 1 : 171. 1872 ; Duthie, Fl. U. Gang. Pl. 1 : 49. Repr. ed. 1960. *G. gynandra* (L.) Briq. Ann. Cons. Jard. Bot. Geneve 17 : 382. 1914. *Cleome pentaphylla* L. Sp. Pl. ed. 2.983. 1762.

An erect, brancing, glandular pubescent, annual herb, 30 60 cm high. Leaves digitately 5 goliolate ; leaflets sessile, 3.5 6 x 1.5 2.5 cm, broadly obovate, acute or obtuse. Flowers white, cream - coloured or pinkish, in corymbose racemes. Capsules elongate, viscid pubescent, striate, 3.5 8.5 cm long.

Fls. : July Aug. ; *Frts.* : Aug. Sept. ; *Vern.* : *Hulhul*; AKS 139, Bichpuri campus.

Common along the roadsides and in cultivated and waste fields.

3. **Cleome viscosa** L. Sp. Pl. 672. 1753 ; Hook. f. Fl. Brit. Ind. 1 : 170. 1872 ; Duthie, Fl. U. Gang. Pl. 1 : 48. Repr. ed. 1960.

An erect, branched annual herb, 30 - 60 cm high, viscid and stinking. Leaves 3 - 5 - foliolate ; leaflets 2 - 5 x 1 - 2.5 cm , ovate or oblanceolate. Flowers yellow, solitary, axillary or in leaf - bearing terminal racemes. Capsules linear, cylindric, short - beaked, 3 10 cm long, glandular - pubescent, longitudinally striate. Seeds reniform, bark brown.

Fls.: July - Sept. ; *Frts.* : Sept. - Oct. ; *Vern.* : *Hulhul* ; AKS 127, Paliwal Park; 134, 140, Bichpuri campus.

Common in cultivated and fallow fields and along the roadsides.

4. Crataeva L.

Crataeva adansonii DC. subsp. *odora* (Buch. Ham.) Jacobs in Blumea 12: 198. 1964. *C.odora* Buch. Ham. in Trans. Linn. Soc. 15 : 118. 1827.

A moderate sized, erect, unarmed, deciduous tree. Bark ash coloured. Leaves long petiolate, 3 folialate ; leaflets 5 12 x 2.5 4 cm, ovate or ovate lanceolate, acuminate. Flowers 5 6 cm across, greenish yellow, in terminal corymbs. Stamens longer than the petals ; gynophore short. Berries many seeded, globose, foetid smelling.

Fls. : Apr. May ; *Frts.* : May June ; *Vern.* : *Barna* ; AKS 406, College campus.

Planted in the gardens and roadsides.

5. MAERUA Forsk.

Maerua oblongifolia (Forsk.) A. Rich in Guill & Perr. Fl. Seneg. Tent. 1 : 32. t. 5. 1831 ; Keay in Hutch & Dalz. Fl. West Trop. Afr. ed. 2.1.89. 1974. *Capparis oblongifolia* Forsk. Fl. Aegypt. Arab. 99. 1775. *Maerua arenaria* (DC.) Hook. f. & Thoms. in Hook. f. Fl. Brit. Ind. 1 : 171. 1872. *Niebuhvia arenaria* DC. Prodr. 1 : 244. 1824.

A large, pubescent, woody climber or liana. Leaves shortly petiolate, 2 4 x 1.4 - 2.3 cm, broadly ovate - elliptic, retuse. Flowers greenish - yellow, in corymbs on terminal or lateral shoots. Calyx tube dilated above, softly pubescent. Stamens many. Berries moniliform, and deeply constricted between the seeds.

Fls. : Mar. - Apr. ; *Frts.* : Apr. - May ; AKS 375, St. John's College campus.

Found climbing on *Capparis sepiaria* L.

8. VIOLACEAE

HYBANTHUS Jacq.

Hybanthus enneaspermus (L.) F. v. Muell. Fragm. Phyt. Austr. 10 : 81. 1876. *Viola enneasperma* L. sp. Pl. 937. 1753. *Ionidium suffruticosum* (L.) Ging. in DC. Prodr. 1 : 311. 1824 ; Hook. f. Fl. Brit. Ind. 1 : 185. 1872. *V.suffruticora* L. Sp. Pl. 937. 1753. *I. heterophyllum* Vent. Jard. Malm. 27. 1803; Duthie, Fl. U. Gang. Pl. 1 : 54. Repr. ed. 1960.

A diffuse or ascending, glabrous or pubescent herb, 20 - 45 cm long. Leaves subsessile, 1.2 4.5 x 0.3 0.6 cm, linear or lanceolate, serrate, acute ; stipules subulate. Flowers red, solitary, axillary, irregular. Petals 5, spreading, the lowest

one largest with a long claw and a large oval or orbicular limb. Stigma globose. Capsules subglobose, 3 valved. Seeds striate.

Fls. : Sept. Dec.; *Frts.* : Dec. - Jan. ; *Vern.* : *Ratanpurus ;* AKS 385, 766, Poiya ghat ; 860, Kitham.

Occurs in sandy soil of cultivated and fallow fields and in unused grounds.

9. FLACOURTIACEAE

FLACOURTIA Commers.

Flacourtia indica (Burm.f.) Merr. Interpret. Herb. Amb. 377. 1917. *Gmelina indica* Burm. f. Fl. Ind. 132, t. 39, f. 5. 1768. *F. sepiaria* Roxb. Pl. Cor. 1 : 48, t. 68. 1795 ; Duthie, Fl. U. Gang. Pl. 1 : 57. Repr. ed. 1960; Hook. f. Fl. Brit. Ind. 1 : 194. 1872.

A much branched, thorny shrub or small tree. Leaves alternate, petiolate, 2 6.5 x 1.5 4.5 cm, ovate or suborbicular, crenate-serrate, often cuneate at the base, glabrous, coriaceous, pubescent especially on the veins. Flowers small, greenish - yellow, dioecious, solitary or few, in axillary racemose clusters. Sepals 5, rusty. Petals none. Stamens numerous. Styles 4 5, short. Drupes globose, 7 9 mm in diam., purple.

Fls. : Feb. Apr. ; *Frts.* : Apr. May ; *Vern.* : *Khatai* ; AKS 877, Tantpur; 883, Niyamatpur.

Found on the slopes of the ridge and hilly tracts on gravelly soil.

10. POLYGALACEAE

POLYGALA L.

1a. Flowers pink ; caruncle 3 - lobed — 1. *P. chinensis*

1b. Flowers yellow or mauve ; caruncle appendages absent — 2. *P. crioptera*

1. **Polygala chinensis** L. Sp. Pl. 104. 1753 ; Hook. f. Fl. Brit. Ind. 1 : 204. 1872; Duthie, Fl. U. Gang. Pl. 1 : 60. Repr. ed. 1960. *P. glomerata* Lour. Fl. Cochinch. 426. 1790 ; Hook. f. Fl. Brit. Ind. 1 : 206. 1872.