

FLORA OF BANSWARA RAJASTHAN

V. SINGH

BOTANICAL SURVEY OF INDIA
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FLORA OF BANSWARA
RAJASTHAN

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Series 3

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V. Singh



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FOREWORD

The Botanical Survey of India has started publishing the Flora of India under four series.

Series 1 is the National Flora of India, which is being brought out in form of fascicles dealing with various families, tribes or large genera. Eleven fascicles had been brought out till the end of 1982. The work is being intensified and many manuscripts are in press and under editing or preparation.

Series 2 will deal with census of plants of different States or large regions.

Series 3 will deal with floras of districts or such other smaller regions.

Series 4 will have special publications, such as monographs on cryptogams or works which would not be covered under series 1-3.

This Flora of Banswara District, therefore, is a volume in Series 3.

The district of Banswara is situated in southern part of Rajasthan in Western India and borders the States of Madhya Pradesh and Gujarat. The flora has elements of the desert, Deccan peninsula as also of the semi-arid tracts of Gujarat; it is phyto-geographically interesting.

There are two recent large floras available now on western and eastern parts of the State of Rajasthan, but, hardly any detailed work exists on a district or smaller region. The flora of Banswara by Dr. Singh, therefore, should not only serve the purpose of identification and other applications of a local flora for the district of Banswara, but for several other districts in Rajasthan and neighbouring States.

The Botanical Survey has been undertaking work on district or local floras in a small manner for last several years; it has recently been intensified and in addition to the scientists of the Botanical Survey of India, a number of botanists in educational institutions of the country have been involved.

It is hoped that a number of district floras will appear during the current year, and the years to come. They should be useful for students and teachers of botany and officials of the forest and agriculture departments, and also for persons concerned with utilisation and conservation of plant resources.

Dr. Singh will welcome useful suggestions on this flora and will try to incorporate them in future editions.

Howrah
19-9-1983

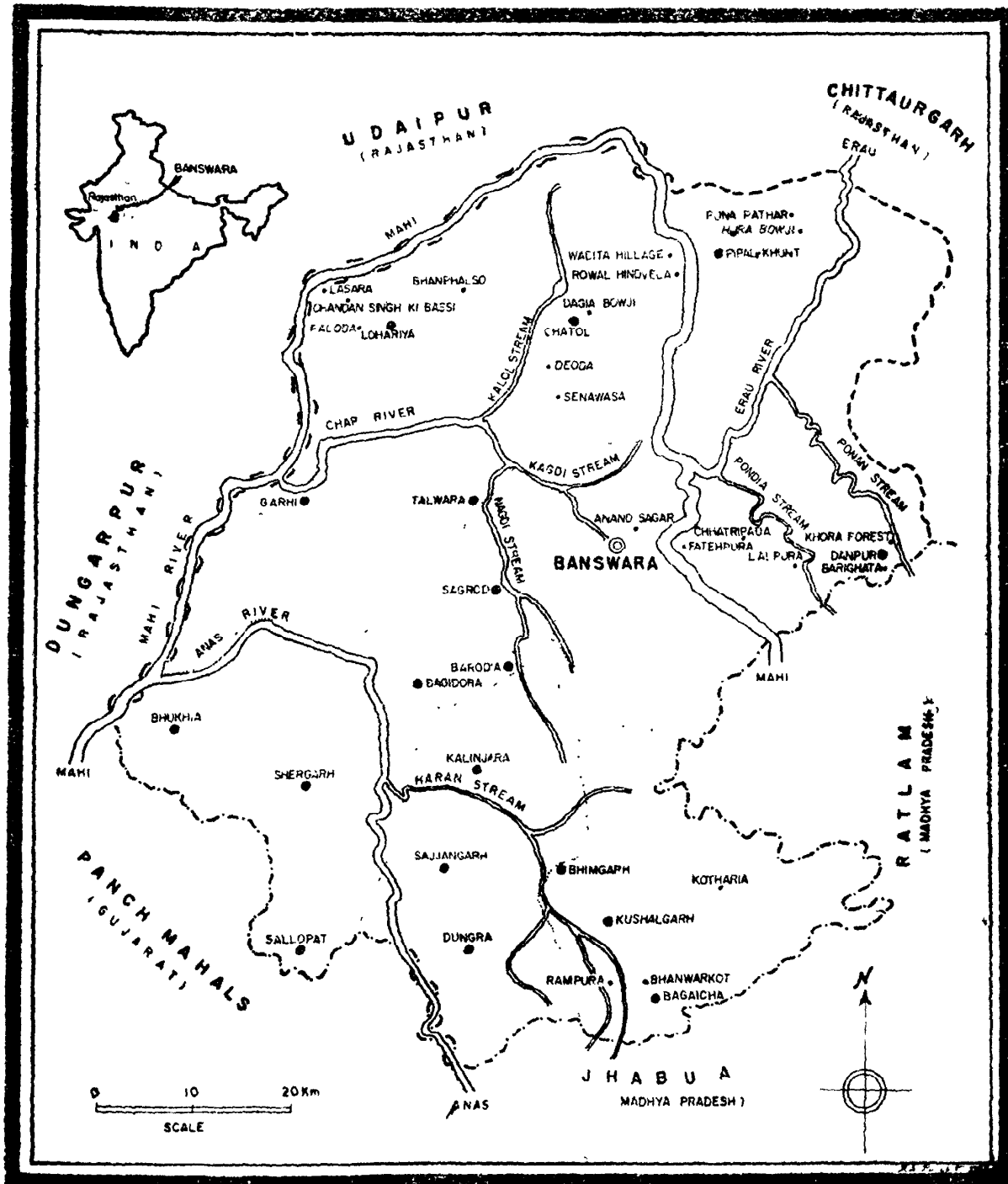
S. K. Jain
Director
Botanical Survey of India

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BANSWARA DISTRICT



INTRODUCTION

Rajasthan is the third largest State of India, occupying an area of about 348861 sq. km. i.e. nearly 11 per cent of the total area of India. It forms the eastern extremity of the great arid and semi-arid belt of the world. A striking geological feature of Rajasthan is the presence of Aravalli range which divides the State into eastern and western regions. The western two-third part of the State is unproductive, barren and desert, while the eastern one-third is rich in vegetation and is more fertile. Since the publication of King's (1878) "Sketch of the flora of Rajputana" and Blatter and Hallberg's (1918-21) "The Flora of the Indian Desert", the aridity and other factors influencing the vegetation have attracted the attention of the whole nation and also of the UNESCO. As a result of this, in the last 25 years a large number of lists of plants and accounts on the vegetation of desertic zone have been published (Das and Sarup, 1951; Sarup, 1952, 54, 57, 58a, 58b; Joshi, 1956; Sarup & Vyas, 1957, 58; Tandon, 1958; Sarup & Puri, 1960; Rolla & Kanodia, 1962 etc.) Many symposia (1952, 1964, 1968, 1973, 1976, 1978) have also been organised to discuss the problems of desert and its floral elements. More recently, Puri *et al.* (1964) and Bhandari (1978) have further contributed to our knowledge of the flora of the Rajasthan desert.

The second place which attracted the attention of our botanists after Macadam's (1890) work, is Mount Abu—the highest peak of Aravalli (Sutaria, 1941; Raizada, 1954; Jain, 1962, 67; Gupta & Saxena, 1968 etc.). Since the publication of Duthie's (1903-29) "Flora of Upper Gangetic Plain", the eastern and south-eastern parts of the State have also attracted the attention of some workers during recent years (Vyas, 1967; Ramdeo, 1969; Majumdar, 1973, 79a, 79b; Sharma & Tiagi, 1979; Maheshwari and Singh, 1974, 79 etc.). But, the southern part of the State has been neglected and the only publication available is Kanodia's (1963) account on the vegetation of Banswara district. The southern part of Rajasthan is an extensive plateau and is important geographically since it is close to Madhya Pradesh and Gujarat. Considering the paucity of botanical literature on the vegetation of southern part of the State, the Banswara district has been selected to conduct an intensive botanical exploration with a view to study the floristics and plant-life and prepare a modern flora of the district for the purpose of elucidating the present status of the flora and floral composition. Besides providing the taxonomic data in the present work, local names and economic uses of the plants have also been given with the hope that the present work will not only be useful to the workers engaged in the economic development of the rural areas, but also the industrialists and layman to look more critically

into the plant-wealth of the district.

Banswara district is situated in the southern part of Rajasthan between 23°11' and 23°56' N. latitudes and 70°00' and 74°47' E. longitudes. The district comprises the territories of the former Banswara State and chiefship of Kushalgarh. It is 93 km in length from north to south and 83 km in breadth from east to west, occupying an area of about 5041 sq. km at the height of about 350 metres above mean sea level. It is bounded by Udaipur and Chittorgarh districts in the north and north-east respectively, by Dungarpur district in the west, by Madhya Pradesh in the east and south-east and by Gujarat State in the south-west. The administrative units of the district are connected by roads. There is no railway line in the district. The population is predominantly (94 per cent) rural and tribal. The principal local language is Bagdi—a dialect of Rajasthan. There are no large scale industries and important trade centres. The economy is mainly agriculture and pastoral. The absence of infra-structure facilities, skilled workers and poor demand of industrial products are mainly responsible for backwardness of the district.

PREVIOUS WORK AND PRESENT STUDY

The earliest recorded information on botanical exploration of Rajasthan is about Jacquemont's journey in 1832 from Delhi to Bombay, via Ajmer and Neemuch. Since then, the vegetation, ecological features and geographical position of the State have attracted the attention of the whole nation and also of the UNESCO. The studies on the flora of Rajasthan have been recently reviewed in detail by Jain (1972), Bhandari (1978), Majumdar (1979b), Shetty and Pandey (1979). A perusal of literature revealed that out of twenty-six districts of Rajasthan eleven viz. Banswara, Bharatpur, Bhilwara, Chittorgarh, Dungarpur, Jalour, Nagaur, Pali, Sawaimadhopur, Sikar and Tonk have not been fully explored. The Arid Zone Circle of Botanical Survey of India, which has recently been established (1972) at Jodhpur, is engaged in the botanical exploration of the under explored and unexplored areas of the State. The present work is a part of the same and it is hoped that it will prove a valuable contribution to our knowledge of plants of Banswara district after Kanodia's brief vegetational account published in 1963.

MATERIAL AND METHODS

The results presented in this flora are based on intensive and extensive explorations and exhaustive study of the plants of Banswara district by the author spread over more than three years (1976-1980) and on the study of the specimens of earlier collectors (Kanodia, Majumdar and Verma)

deposited in the herbaria of Western Circle (BSI) and Central Circle (BSA) of Botanical Survey of India located at Pune and Allahabad respectively. This project was started by the author in early 1976. Many excursions were undertaken to cover the entire region in different seasons so as to collect most of the plants in flowering and fruiting stages and also to note the seasonal changes in vegetation. During the field work, observations on habit, habitat, abundance, ecological features and macroscopic characters of the species such as height, colour of the flower etc., were recorded. The underground parts of some plants, particularly the herbaceous ones, were carefully uprooted, and studied. Further, the local names and local uses of the plants were also ascertained. To present a full account of the vegetation of the district, well established cultivated plants were also studied and included in the present flora.

The specimens were identified with the help of available literature and comparison with authentic specimens. The nomenclature of all the taxa are brought up-to-date in accordance with the International Code of Botanical Nomenclature (ed. 1978). Two herbarium sheets of each taxon, collected by the author, have been deposited in the herbarium of Arid Zone Circle, BSI, Jodhpur (BSJO) and one sheet in the Central National Herbarium, Howrah (CAL).

TOPOGRAPHY AND GENERAL FEATURES

Banswara district is quadrangular in shape with a number of natural and artificial features such as hills, rivers, tanks, ponds, undulating plain etc. The hills, scattered in the north-east and southern part of the district, belong to Aravalli system. Their elevation hardly exceeds 610 m above m.s.l. and they are composed of quartzite-schists formations. The top of the hills is usually flat. The gentle slopes show better soil formation in comparison to the steep slopes which bear conspicuous boulders of rocks and seem dry and bare of soil. The hilly plateau in the eastern and southern parts of the district are rather unproductive, rocky, having river bluffs, interfluvies and ravines. The central and western portions of the district are undulating in nature varying in altitude from 140 to 200 m above m.s.l. They represent a rather homogenous topography characterized by hard rocks covered with upper thick fertile layer of soil which is used for cultivation.

The district has five rivers viz. Mahi, Anas, Haran, Eru and Chap. The first two rivers are perennial, but due to high banks and stony beds their water cannot be easily used for irrigation. The river Mahi flows through the district from east at first in northerly direction and then in westerly and south-westerly direction forming a natural boundary between Dungarpur and Banswara districts. The Anas, entering the district from Madhya Pradesh, flows first towards north and then towards west till it falls into the Mahi. Its

principal affluent is the Haran stream. The Eru enters in district in the north-east near Semlia village from Chittorgarh district. After receiving all the drainage of the hills and following a south-westerly course, it joins the Mahi. Its main tributaries are Ponan and Pundia. The Chap, originating in the hills near Kalingera village, flows in the north and then in the west, eventually falling into Mahi, not far from Garhi village. It is fed by Nagli, Kagdi and Kalol streams.

The district is also rich in tanks. Out of more than two hundred fifty tanks, scattered all over the district, about fifty are under the Irrigation Department and are being utilized for irrigation purposes. Patela, Surwania, Makanpura, Mimkhor, Bhatiya, Delwara, Arai, Bhagora, Metwala, Asan and Ramore tanks are the larger ones having capacity of more than one thousand cubic metres. These tanks are periodically subjected to cleaning by way of weed removal and maintain only sparse vegetation. The other deep water tanks, which are important from vegetation point of view, are located near Lamero, Loharia, Karonia, Kalingera, Lasara, Talwara etc. There is no natural lake in the district.

In addition to the vast stretches of fresh water in the shape of permanent tanks, the area abounds in large number of temporary ponds, ditches and low-lying areas which are located along the roads and near habitations. At certain places, the marshes turn into lagoons due to deep stationary water. Such habitats are characterised by the growth of some members of Cyperaceae in association with *Typha angustata* Bory & Chaub.

GEOLOGY AND SOILS

The geological antiquity of the district belongs to (i) Archaean age, representing granite gneiss complex, (ii) Aravalli system, consisting of quartzite-schists formation and (iii) the Deccan trap of the Eocene period which compares the complex series of metamorphosed sedimentary and igneous rocks. The Deccan trap is generally massive, fine-grained and almost non-vesicular. It weathers into rounded dark boulders and gravels and yields a black, highly fertile soil. The higher slopes and hilly plateau in most cases are lateritic.

The Aravalli series of rocks are met with in the tracts occupied by Garhi, Shergarh and parts of Ghatol. This system is represented by a basal quartzite formation often conglomeratic, an impure carbonate unit and an argillaceous formation consisting of slaty, phyllitic and micaceous schistose types. Lime-stones are nowhere extensively developed.

The composite gneissic complex of the Archaean era represents the oldest formation of the area. Granites are more common in this area than the acid gneisses. Massive homogenous granites occur in the Mahi valley in the eastern part of the district, while near the town of Banswara gneissic

forms prevail.

The soils of Banswara district are mainly of two types. In the west, north-west and north-eastern parts of the district, particularly in the Mahi catchment area, the soils are mainly red loam (Bhuri). These soils are reddish coloured, medium-textured, non-calcareous and well drained. They sometimes degenerate into a kind of gravel and are not much fertile. In the south-west, southern and eastern parts of the district, formed particularly over Deccan trap, are black soils (Kali). These are medium to heavy textured, grey to dark greyish brown in colour and moderately drained. They are extremely fertile and best soils of the area. In the eastern forest-clad tract, both types of soils, i.e. black and red are found much intermingled in varying proportions (Berangi). The soils on the top and slopes of the hills are shallow, with gravelly material very near to the surface. They are light-textured, fairly drained, poor in carbonate and chlorides and rich in nitrates. The river beds and flood plains are characterized by well drained soils which are sandy loam to clay-loam in texture, rich in carbonates and chlorides and poor in nitrate contents, humus and porosity. Humus content is maximum in winter season. Chloride contents does not show any marked difference at different depths and seasons. Water soluble salts increase with the depth and are maximum in rainy season. pH value varies from 6.5—7.5 and does not show any marked change in different seasons and depths, hence, the soils in general are alkaline in nature. The presence of exchangeable bases in profusion is a redeeming feature in almost all the soil types.

CLIMATE

The climate of the district, which lies in subtropical region, is almost semi-arid but milder than that in the desert regions further north and north-west. It is markedly periodic and is characterized by a dry and increasing hot season from March to June with high temperatures, low humidity and low-rainfall, a dry and cold winter season from October to March with low-rainfall, low humidity and low temperatures, and a warm monsoon period from Mid-June to September with high humidity, low temperature and high rainfall.

Temperature :

The mean annual maximum temperature is about 33°C; however, the maximum temperature sometimes reaches upto 42°C in the month of May and June which is the hottest period of the year. Generally, the temperature starts rising by middle of March, reaches the climax by the middle of June and then drops slightly during the rainy season. Further fall in the temperature starts from October and comes to the lowest in the month of January i.e. as low as 4°C. The mean minimum annual temperature is about 15°C.

There are much fluctuations in the temperatures from January to December of a year and between maximum and minimum temperatures. However, the variations in mean annual minimum and maximum temperatures, individually, are not considerable.

Rainfall :

The rainfall is generally low, erratic and monsoonic type. The variations in annual rainfall and number of rainy days from year to year are appreciable. The average annual rainfall for the last ten years is about 922 mm, of which 95 per cent occurs from June to September. The month of July is the rainiest. The remaining five per cent of annual rainfall occurs in the form of local showers during winter season. The months of April, November and December are almost dry. On an average, there are about 40 rainy days in a year.

Relative Humidity :

The relative humidity is minimum in summer season, particularly in April and May (26-30%). The maximum humidity is noted during rainy season, particularly from middle of July to mid August (90%). During the coldest months of winter season, i.e. mid December to January, the relative humidity varies from 75 to 80 per cent. It is interesting to note that the variations in relative humidity during winter and rainy seasons are negligible.

Wind:

The winds are generally light in the post monsoon and winter months, i.e. about 1.5 km/minute. They are moderate and sometimes strong (10 km/minute) during summer and rainy seasons. The annual mean wind velocity is about 5 km/minute. Thunder storms, squalls and dust storms are common between March and June. From April to September, the winds are predominantly from south-west to west. Light easterly or north easterly winds begin to blow from October and continue in the winter months. Westerly winds appear by April and easterlies and north-easterlies become less frequent.

Hail storms are very rare and they generally occur from January to March. Fogs are comparatively more frequent, usually occurring between December to February. In October and to a lesser extent in the monsoon months, the area is affected by depressions and cyclonic storms causing widespread rain.

GENERAL ASPECTS OF VEGETATION

The vegetation presents a very open appearance excepting the forests. The permanent vegetation, occurring throughout the year, is xerophytic in

character. The onset of winter results in the defoliation of most of the trees. As the days warm up, new foliage appears and is followed by flowering and fruiting. The temporary vegetation, consisting of annuals and biennials, on the other hand, shows an abrupt change with change of season. In the following pages biota of forests, wastelands, grasslands, weed and aliens, aquatic and marshland habitats and exotic flora are discussed in details.

1. Forests:

The forests, occupying about 15 per cent of the total area of the district, are mostly confined to the Aravalli hills and undulating terrain, particularly in the eastern and sothern parts of the district. They have been divided into six forest ranges and to facilitate docking, the ranges have been further divided into forest blocks and compartments as under:

1. Banswara range: The important forest blocks under this range are Anand Sagar, Chhatripada, Lalpura, Fatehpura, Naya Gaon, Bhapor, Khora, Bari Ghata and Sarwan Devi.

2. Dungra range: Dungra, Sajjangarh and Kalingra are the important forest blocks under this range.

3. Ghatol range: Ghatol, Dagia Bowji, Wadita hillage, Rowal hindwela, Puna pathar and Hura bowji are the important forest blocks under this range.

4. Garhi range: Lohariya is the main forest block under this range.

5. Kushalgarh range: Kotharia, Galdhar, Bagaycha, Bhanwarkot are the chief forest blocks.

6. Bagidora range : Shergarh and Sallopat forest blocks fall under this range.

Further, it is interesting to note that 59 per cent of the forests come under Ghatol range, 20 per cent in Kushalgarh range, 10.5 per cent in Banswara range and the remaining 10.5 per cent forms Bagidora, Dungra and Garhi ranges.

The forests are mainly of dry deciduous type, falling under the category 4-B type E-1 in the Champion's classification of Indian forest types (1968). The crop consists mainly of *Tectona grandis* (Teak). The vegetation in most of the forest blocks is almost similar due to identical topography, soil moisture, soil nature, exposure etc. The altitude also does not have much effect on the zonation of vegetation except that on higher slopes teak is generally replaced by miscellaneous species like *Bauhinia racemosa*, *Boswellia serrata*, *Dalbergia latifolia*, *Lannea coromandelica*, *Phyllanthus emblica*, *Sterculia urens* etc.

The vegetation is more rich on the gentle slopes of the hills and in flat terrain due to better soil formation and water holding capacity. The common trees associates of *Tectona grandis* are *Adina cordifolia*, *Aegle marmelos*, *Albizia odoratissima*, *Anogeissus latifolius*, *Bauhinia racemosa*, *Boswellia*

serrata, *Cassia fistula*, *Dalbergia latifolia*, *Diospyros melanoxylon*, *Flacourtia indica*, *Hymenodictyon excelsum*, *Legerstroemia parviflora*, *Lannea coromandelica*, *Madhuca longifolia*, *Mitragyna parvifolia*, *Phyllanthus emblica*, *Sterculia urens*, *Terminalia arjuna*, *T. bellirica*, *Wrightia tinctoria* etc., which are scattered in an indefinite complex. *Dendrocalamus strictus* is also common. *Aerides crispum* is the only epiphyte found in this district.

The steep slopes which are excessively stony with conspicuous boulders of rocks, support mainly *Euphorbia neriifolia* and *E. nivulia*.

On the outskirts of forests, the vegetation is greatly disturbed. The dry teak forests have been reduced to dry deciduous scrubs with many stemmed crooked branchy teak stocks amidst *Acacia chundra*, *A. leucophloea*, *Butea monosperma*, *Holarrhena antidysenterica*, *Salvadora persica* etc. At certain places, as in Sarwan Devi block, *Boswallia serrata* dominates the vegetation and teak, wherever it occurs in association, is generally stunted. *Dendrocalamus strictus* is usually absent in such blocks. Along the rivers, particularly Mahi and Anas, the dry deciduous riverian forests dominated by *Terminalia crenulata* are also noted. Further, *Dendrocalamus strictus* does not form dense brakes in any forest block and no association of *Anogeissus pendula* and *Acacia leucophloea* could be observed in this district as mentioned by Champion (1936) and Champion and Seth (1968).

The tree canopy in the forests is considerably open and provides sufficient space for the growth of shrubby and herbaceous flora. The common shrubs and undershrubs met with in the forests are *Azanza lampas*, *Barleria cristata*, *B. prattensis*, *B. prionitis*, *Grewia flavescens*, *G. tiliifolia*, *Helicteres isora*, *Hibiscus caesius*, *H. vitifolius*, *Lantana indica*, *Leea edgeworthii*, *Malhania futteyporensis* and *Nyctanthes arbor-tristis*. The last mentioned species is so abundant at certain places (Lohariya, Anand Sagar forest blocks) that even movement becomes very difficult.

On the outskirts of the forests, where the tree canopy is more open, a large number of shrubs and undershrubs like *Adhatoda zeylanica*, *Abutilon indicum*, *Capparis sepiaria*, *Cassia auriculata*, *C. occidentalis*, *Lantana camara*, *Sida alba*, *S. ovata*, *Triumfetta pentandra*, *T. rotundifolia* etc. grow in abundance.

The notable climbers in the forests are *Aristolochia indica*, *Asparagus racemosus*, *Cryptolepis buchananii*, *Dioscorea bulbifera*, *D. hispida*, *Gloriosa superba*, *Gymnema sylvestre*, *Holostemma annulare*, *Tylophora hirsuta*, *Wattakaka volubilis* etc. The species like *Abrus precatorius*, *Cissampelos pareira*, *Ipomoea sepiaria*, *Mucuna pruriens* etc. are more common towards the outskirts of the forests.

The herbaceous vegetation (ground cover) is fairly dense during rainy season. The common species are *Acanthospermum hispidum*, *Achyranthes aspera*, *Bidens biternata*, *Blainvillea acmella*, *Borreria pusilla*, *Cassia absus*, *C. pumila*, *C. tora*, *Clitoria biflora*, *Curculigo orchoides*, *Curcuma pseudo-*

montana, *Desmodium dichotomum*, *D. gangeticum*, *D. procumbens*, *D. velutinum*, *Hibiscus lobatus*, *Neuracanthus sphaerostachyus*, *Polygala arvensis*, *Phyllanthus virgatus*, *Sclerocarpus africanus*, *Uraria picta*, *Zornia gibbosa* and grasses like *Arthraxon lancifolius*, *Chrysopogon hackelii*, *Dichanthium caricosum*, *Eragrostis unioides*, *Heteropogon contortus*, *Oplismenus compositus*, *Panicum walense*, *Pennisetum hordeoides* etc. The details regarding the grasses have been discussed in the chapter on "Grasslands".

During winter and summer season, only few shade loving herbaceous species like *Ageratum conyzoides*, *Biophytum sensitivum*, *Blumea eriantha*, *Canscora diffusa*, *Hoppea dichotoma*, *Lindernia ciliata*, *Oxalis corniculata* etc. may be noted along the water courses in the forests.

2. Wasteland Vegetation :

The area falling outside the range of the forests and cultivated land has been termed as "wasteland" in the present work. This occupies 45 per cent of the total area and presents a very characteristic dry deciduous scrub vegetation containing sparse and discontinuous tree layer with plenty of vacant spaces between them. The most common tree species are: *Acacia leucophloea*, *A. nilotica* subsp. *indica*, *Aegle marmelos*, *Azadirachta indica*, *Balanites aegyptiaca*, *Butea monosperma*, *Cordia dichotoma*, *Dolichandrone falcata*, *Ficus benghalensis*, *F. religiosa*, *Madhuca longifolia*, *Mangifera indica*, *Phoenix sylvestris*, *Pithecellobium dulce*, *Prosopis chilensis*, *P. cineraria*, *Salvadora persica*, *Ziziphus mauritiana* etc.

It is interesting to note that the progressive regeneration of most of the trees, both by seeds and coppice, is negligible due to great biotic pressure on them. *Prosopis chilensis* is the only species which shows highest survival percentage under adverse climatic and biotic conditions and, thus, suggests the possibility of it being used for afforestation in this area. The wasteland habitats are more favourable for shrubs and undershrubs which form a comparatively dense layer in this area. The most common shrubs growing in clumps with trees and in vacant spaces are: *Abutilon indicum*, *Acacia farne-siana*, *A. jacquemontii*, *Adhatoda zeylanica*, *Calotropis procera*, *Capparis decidua*, *C. sepiaria*, *C. zeylanica*, *Clerodendrum phlomidis*, *Dichrostachys cinerea*, *Ficus palmata*, *Kirganelia reticulata*, *Lantana camara*, *Leptadenia pyrotechnica*, *Mimosa hamata*, *Opuntia elatior*, *Solanum incanum* and *Ziziphus nummularia* which is very gregarious at certain places.

A large number of undershrubs also grow in the wastelands ; the most common ones are : *Cassia auriculata*, *C. occidentalis*, *Desmodium gangeticum*, *Malvastrum coromandelianum*, *Pavonia zeylanica*, *Pupalia lappacea*, *Sida alba*, *S. cordifolia*, *S. ovata*, *Triumfetta pentandra*, *T. rotundifolia*, *Urena lobata*, *Xanthium strumarium* etc. There are no epiphytes here. However, some climbers like *Abrus precatorius*, *Argyreia sericea*, *Cissampelos pareira*, *Cocculus hirsutus*, *Cryptostegia grandiflora*, *Leptadenia reticulata*, *Marsdenia tenacissima*,

Mucuna pruriens, *Pergularia daemia*, *Rivea hypocrateriformis*, *Teramnus labialis*, *Wattakaka volubilis* etc. do occur among the trees and shrubs.

Besides these, a large number of annual and perennials ranging from psammophytic and semi-xerophytic to aquatic and amphibious herbs are encountered in the wastelands. With the advent of winter season, a considerable number of compositaceous meadow herbs, in association with *Acalypha ciliata*, *Achyranthes aspera*, *Argemone mexicana*, *Leucas cephalotus*, *Nepeta hindostana*, *Solanum nigrum* etc. come into bloom. The most common compositaceous herbs are : *Ageratum conyzoides*, *Echinops echinatus*, *Eclipta alba*, *Gnaphalium polycaulon*, *Lagascea mollis*, *Launaea procumbens*, *Pulicaria angustifolia*, *Sonchus oleraceus* and *Sphaeranthus indicus* which forms dense mats in black cotton soils at certain places.

The decreasing moisture contents, increasing temperature and high velocity winds during March and April result in the disappearance of most meadow herbs excepting those growing in somewhat moist habitats. The dry meadow herbs appearing during the summer months are very few e.g. *Alhagi pseudalhagi*, *Chrozophora rottleri*, *Solanum surattense*, *Tridax procumbens* and *Dipcadi serotinum* which possesses underground bulbs and becomes visible above the ground only during the summers.

During rainy season, the area gives glorious appearance of a green carpet of semi-xerophytic and meadow herbs which help in increasing humus content of the soil and extend the vegetation to the barren areas. The life cycle of most of the herbs comes to a close before the winter sets in. The rainy season herbs are dominated by leguminous plants like *Alysicarpus monilifer*, *A. tetragonolobus*, *Cassia pumila*, *C. tora*, *Crotalaria linifolia*, *C. medicaginea*, *C. prostrata*, *Indigofera cordifolia*, *I. linifolia*, *I. linnaei*, *I. trita*, *Psoralea corylifolia*, *Tephrosia villosa*, *Vigna trilobata* etc. The other common associated species include *Aristolochia bracteolata*, *Borreria articularis*, *Cleome simplicifolia*, *C. viscosa*, *Convolvulus prostratus*, *Evolvulus alisnoides*, *Glossocardia bosvallea*, *Merremia tridentata*, *Polygala erioptera*, *Tridax procumbens* and several grasses among which the species of *Aristida*, *Cenchrus*, *Chloris*, *Eragrostis*, *Tragus*, *Urochloa* etc. are more common.

On the boundaries of fields, gardens and orchards *Antigonon leptopus*, *Canavalia ensiformis*, *Cardiospermum halicacabum*, *Coccinia grandis*, *Delonix elata*, *Dioscorea bulbifera*, *Euphorbia nerifolia*, *E. nivulia*, *Jatropha curcas*, *Momordica dioica*, *Mukia maderaspatana* etc., besides providing protection, beauty and reducing wind velocity also act as an obstacle in the path of moving sand particles and trap them.

A few sciophytic, humus and shade-loving herbs fairly distributed in the gardens, orchards and other similar habitats are : *Baliospermum montanum*, *Biophytum sensitivum*, *Chenopodium album*, *Corchorus olitorius*, *Euphorbia hirta*, *Heliotropium strigosum*, *Hybanthus enneaspermus*, *Lindernia crustacea*, *Oldenlandia corymbosa*, *Oxalis corniculata*, *Phyllanthus fraternus*, *Physalis*

minima, *Solanum nigrum*, *Trianthema portulacastrum* etc.

The parks and play grounds are the most suitable localities for many grasses which form dense mantle and act as an efficient soil-binder. The chief components are *Bothriochloa pertusa*, *Cynodon dactylon*, *Dichanthium annulatum*, *Imperata cylindrica*, *Iseilema laxum*, *Tragus roxburghii* etc. These habitats are frequently subjected to moving and except for some procumbent, spreading herbs, nothing is allowed to come up.

The unproductive corners of cultivated fields, which escape ploughing and have lower percentage of nitrates, humus and low water holding capacity, are most suitable for the growth of lime-loving species like *Chenopodium album*, *Desmostachya bipinnata*, *Echinop echinatus*, *Euphorbia hirta*, *Perotis indica*, *Saccharum spontaneum*, *Vetiveria zizanioides* etc.

Inhabiting semi-demolished walls of ancient buildings and monuments, there are well recognizable associations of meadow herbs like *Bidens biternata*, *Euphorbia hirta*, *Glossocardia bosvallea*, *Haplanthodes verticillata*, *Indoneesiella echinoides*, *Lindenbergia indica*, *Tridax procumbens* etc. The seedlings of *Ficus benghalensis* and *F. religiosa* cause damage to the buildings by sending their roots deep down into the walls. *Aerides crispum* is the only epiphyte in this area and *Utricularia exoleta* and *U. stellaris* are the only representatives of insectivorous plants. *Buchnera hispida*, *Dendrophthoe falcata* and *Striga gesnerioides* are the common parasites of the area.

The floristic composition of wastelands i.e. the presence of sparse ground cover during winter and summer, the presence of an abundant ground cover during rainy season, distantly scattered deciduous trees and comparatively dense growth of xerophytic shrubs suggest semi-arid climate in the area.

3. Grasslands :

The grasslands, managed for grass production and subsequent grazing and to check the exposure of soil to the action of rain and high velocity winds, are few. They are usually managed on the outskirts of the forests, more or less naked hillocks and in the degraded forests. The grasslands of such habitats are dominated by tall grasses like *Aristida adscensionis*, *Bothriochloa pertusa*, *Cenchrus ciliaris*, *Chloris barbata*, *Cymbopogon martinii*, *Dichanthium caricosum*, *Digitaria adscendens*, *Dinebra retroflexa*, *Eragrostis unioides*, *Heteropogon contortus*, *Iseilema laxum*, *Pennisetum hordeoides*, *Sehima nervosum*, *Themeda quadrivalvis*, *Tripogon jacquemontii* etc.

Besides, many-stemmed crooked branchy *Bauhinia racemosa*, *Dichrostachys cinerea*, *Mimosa hamata*, *Tectona grandis*, *Ziziphus mauritiana* etc. which are sparsely distributed in the grasslands, some weed species like *Alysicarpus tetragonolobus*, *Celosia argentea*, *Cleome simplicifolia*, *Crotalaria hirsuta*, *Ipomoea sindica*, *Cyperus rotundus* etc. also compete with grasses in several ways and are harmful to the grasslands.

Another category of grasslands occupy large, open, undulating rocky terrain (wastelands). These grasslands have deteriorated for want of protection against grazing and also due to the spread of undesirable thorny bushes and a number of weeds. The most common grass species are : *Alloteropsis cimicina*, species of *Aristida*, *Cenchrus ciliaris*, *Chloris montana*, *Cynodon dactylon*, *Dactyloctenium aegyptium*, species of *Eragrostis*, *Hackelochloa granularis*, *Melanocenchris jacquemontii*, *Setaria tomentosa*, *Sporobolus tenuissimus*, *Tetrapogon villosus*, *Tragus roxburghii*, *Tripogon purpurascens*, *Urochloa panicoides* etc. which grow on rather thin layer of soil.

Besides these, many characteristic long-stemmed species of first category also form distant patches. The study revealed that the scope for the development of good pasture lands along the suitable gentle slopes of hills, on the outskirts of forests and in the wastelands is very bright if the work is done under proper scientific management.

4. Weeds and aliens :

About forty five per cent of the total area of the district is under cultivation and a number of weeds grow with the crops. Most of the weed species are well equipped for dissemination by wind, water, man and animals. The phenological observations revealed that the seedlings of winter weeds come up in the fields a few days later than the crop seedlings and the vegetative phase in most of the weeds extends upto mid-December, after which plants are seen in flowering which is quickly followed by fruiting and by the end of March seed-setting is completed in most of the weed species. The highest weed density may be noted during the months of January and February. The typical weeds associated with the winter season (Rabi) crops are : *Ageratum conyzoides*, *Anagallis arvensis*, *Asphodelus tenuifolius*, *Chenopodium album*, *Cynodon dactylon*, *Euphorbia dracunculoides*, *Fumaria indica*, *Lepidium sativum*, *Lathyrus aphaca*, *Melilotus alba*, *M. indicus*, *Oxalis corniculata*, *Polypogon monspeliensis*, *Striga angustifolia* etc.

The Rabi crop weeds are usually not represented in the weed flora of 'Zayad' crops because the conditions favouring seed-germination are not available during summer months. This indicates that weeds have certain periodicity in germination which seems to be responsible for the occurrence of a particular weed community during a crop season. The typical weeds associated with the summer (Zayad) crops are *Alhagi pseudalhagi*, *Gomphrena celosioides*, *Solanum nigrum*, *S. surattense*, *Tribulus terrestris*, *Ziziphus nummularia* etc.

The paucity in the number of summer weeds is due to unfavourable climate and soil conditions. Some winter season weeds like *Euphorbia dracunculoides*, *Cynodon dactylon*, *Cyperus rotundus* which have lower susceptibility to receding soil moisture and to the rise of temperature, give

considerable cover during early summers.

The density and frequency of rainy season weeds is higher as compared to winter and summer season weeds due to high moisture contents during this period. The common weeds of rainy season (Kharif) are : *Aerva lanata*, *Alysicarpus longifolius*, *Ammannia baccifera*, *Caesulia axillaris*, *Celosia argentea*, *Commelina benghalensis*, *Corchorus aestuans*, *C. olitorius*, *C. trilocularis*, *Cyperus rotundus*, *Digera muricata*, *Eclipta alba*, *Euphorbia hirta*, *Launaea procumbens*, *Leucas cephalotus*, *L. nutans*, *Oldenlandia corymbosa*, *Oxalis corniculata*, *Trianthema portulacastrum*, *Vernonia cinerea*, *Vicoa indica* etc.

It is interesting to note that majority of weeds are annual and therophytes excepting *Cynodon dactylon*, *Cyperus rotundus*, *Oxalis corniculata*, *Ziziphus nummularia*, which propagate by means of seeds as well as root-stocks. Some weeds like *Ageratum conyzoides*, *Eclipta alba*, *Oxalis corniculata* etc. show wide range of adaptability.

5. Aquatic and Marshland Vegetation :

The area maintains variable habitats for the growth of aquatic and marshland plants. The rivers like Mahi, Anas, Haran, Eru and Chap, passing through hilly and tectonic terrain, are characterised by their rocky bottom and banks. The hydrophytes grow only where a considerable amount of sand accumulates. The artificial tanks, which are used for irrigation, are under great biotic pressure and maintain a very sparse vegetation. The natural deep water tanks like Lamero, Loharia, Karonia, Kalingera, Lasara, Talwara tank etc. and shallow ponds and low-lying areas, including paddy-fields, represent a variable emporium for many aquatic and amphibious plants.

On the basis of their contact with soil, water and air, the hydrophytes of the area may be grouped into following life-forms :

A. FREE-FLOATING : The species like *Pistia stratiotes*, *Utricularia stellaris* etc. come in this group.

B. ATTACHED WITH FLOATING LEAVES AND/OR SHOOTS : The species like *Ipomoea aquatica*, *Nymphaea nouchali*, *N. pubescens*, *Nymphoides cristata*, *Potamogeton nodosus* fall in this category.

C. SUSPENDED SUBMERGED : The species like *Hydrilla verticillata*, *Najas minor*, *Nechamandra alternifolia*, *Potamogeton pectinatus*, *Zannichellia palustris* etc. come in this category.

D. ATTACHED SUBMERGED : The species like *Ottelia alismoides*, *Potamogeton crispus*, *Vallisneria spiralis* etc. fall in the group.

E. AQUATIC AND/OR AMPHIBIOUS EMERGENT : The species like *Aeschynomene indica*, *Hydrolea zeylanica*, *Limnophila indica*, *Polygonum glabrum*, *Sagittaria sagittifolia*, *Typha angustata* etc. constitute to this group of hydrophytes.

F. MARSHLAND : The species like *Ammannia baccifera*, *Caesulia axillaris*, *Hygrophila auriculata*, *Phyla nodiflora*, most of the sedges and few grasses

like *Coix lacryma-jobi*, *Hemarthria compressa*, *Paspalidium flavidum* etc. are the chief components of this life-form.

The area, apparently unsuitable for the growth of luxurient vegetation, is rich in marshland species. The paucity of aquatic species may be due to the rocky bottom and wide amplitude of water level in puddles and reservoirs. Most of the aquatic and marshland species grow in a number of associations excepting *Pistia stratiotes* and *Typha angustata* which often form pure stands at certain places.

6. Exotic flora/Cultivated plants :

A. CULTIVATED CROPS : About 45 per cent of the total area of the district is under cultivation. Three main seasonal crops, namely Rabi crop-during winter season, Zayad crop-during summer season and Kharif crop-during rainy season, are cultivated on commercial scale.

The food crops of winter season include the cereales, mainly *Triticum aestivum* and few pulses like *Cicer arietinum* and *Pisum sativum*. The important vegetables of winter season are *Brassica campestris* var. *rapa*, *B. oleracea* var. *botrytis*, *B. oleracea* var. *capitata*, *Daucus carota*, *Lycopersicon esculentum*, *Solanum tuberosum*, *Trigonella foenum-graecum* etc. The condimental crops mainly include *Coriandrum sativum* and *Foeniculum vulgare*.

Besides these, the main oil yielding crop cultivated during winter season is *Brassica campestris* var. *sarson*. *Saccharum officinarum* and *Nicotiana tabacum* are the cash crops of winter season. *Medicago sativa* and *Trifolium alexandrinum* are the important fodder crops of winter season.

During summer season, when the soil and climate are dry, a few members of Cucurbitaceae are cultivated for their fruits and for vegetables. The most common ones are : *Citrullus fistulosus*, *C. lanatus*, *Cucumis melo*, *C. sativus*, *Cucurbita moschata*, *Lagenaria siceraria*, *Luffa cylindrica*, *Momordica charantia* etc.

The food crops of rainy season include the cereals like *Echinochloa frumentacea*, *Oryza sativa*, *Pennisetum typhoides*, *Setaria italica*, *Sorghum saccharatum*, *Zea mays* etc. and pulses like *Cajanus cajan* and *Vigna radiata*.

The important vegetables of rainy season are : *Abelmoschus esculentus*, *Capsicum annuum*, *Lablab purpureus*, *Cucumis melo* var. *cultus*, *Solanum melongena* etc. *Cyamopsis tetragonoloba*, besides providing edible pods, is the main fodder crop of the season.

The oil-yielding plants of rainy season are : *Arachis hypogaea*, *Gossypium herbaceum* var. *acerifolium* and *Sesamum indicum*. The fibre-yielding plants include : *Crotalaria juncea*, *Gossypium herbaceum* var. *acerifolium* and *Hibiscus cannabinus*.

B. ORCHARDS AND GARDENS : Orchards and gardens are scattered throughout the area, particularly near Banswara, Kushalgarh and Ghatol. Most of the orchards produce summer and rainy season fruits ; the common

ones are : *Aegle marmelos*, *Annona reticulata*, *A. squamosa*, *Citrus medica*, *Mangifera indica*, *Psidium guajava*, *Syzygium cumini* etc.

The fruits produced during winter season are few, like *Manilkara achras*, *M. hexandra*, *Mimusops elengi*, *Phyllanthus emblica* and *Ziziphus mauritiana* etc.

C. ORNAMENTAL AND AVENUE PLANTS : Much of the greenary of the area is provided by a large number of avenue and ornamental trees, shrubs and climbers which have been planted along the roads, canals and in the gardens and parks. The common trees of this type are : *Acacia pinnata*, *Adansonia digitata*, *Ailanthus excelsa*, *Albizia lebbeck*, *Bombax ceiba*, *Cassia fistula*, *C. siamea*, *Crateva nurvala*, *Delonix regia*, *Eucalyptus tereticornis*, *Gardenia resinifera*, *Melia azedarach*, *Morinda tomentosa*, *Moringa oleifera*, *Pithecellobium dulce*, *Polyalthia longifolia*, *Sapindus laurifolius* etc.

The common shrubs planted/cultivated for ornamental effect and as a screen for privacy are : *Clerodendrum inerme*, *Dodonaea viscosa*, *Euphorbia pulcherima*, *Hibiscus rosa-sinensis*, *H. schizopetalus*, *Lagerstroemia indica*, *Lowsonia inermis*, *Murraya paniculata*, *Nerium indicum*, *Tabernaemontana divericata*, *Thevetia peruviana* etc.

The common climbers, grown in the gardens, along the walls and pergolas or as twiners around pillars are : *Antigonon leptopus*, *Bougainvillea spectabilis*, *Clitoria ternatea*, *Combretum ovalifolium*, *Jasminum grandiflorum* etc.

Besides these, a large number of seasonal herbs, particularly compositaceous, are cultivated in the gardens and parks for their decorative flowers. It is interesting to note that most of the cultigens are introductions from Madagascar, South Africa, South America, Java, Malaya, Burma, China, Japan, Australia, Brazil etc.

ECONOMIC AND MEDICINAL PLANTS

The flora and plant life of Rajasthan have been studied in greater details in the present century, yet, there is no comprehensive up-to-date published work on the useful and medicinal plants of the State. Recently, in October, 1968 and November 1976, the University Grants Commission, New Delhi organised a symposium in the University of Jodhpur on "Natural Resources of Rajasthan", wherein Gupta and Saxena (1977), Khalsa and Chatterji (1977), Rao and Shiva (1977) and Srivastava (1977) made a preliminary attempt to deal with this aspect. The other notable contributions in the field of economic plants of Rajasthan are those of King (1869-70), Singh (1964), Bhandari (1974) and Singh and Shetty (1977). The present author undertook the botanical exploration of Banswara district with special reference to the economic and medicinal plants to find out the scope for new industries which could be encouraged in the area on the basis of available plant resources.

The results obtained are summarized below :

Tannin :

The chief source of tannin is outer bark; the notable tannin yielding species are : *Acacia chundra*, *A. leucophloea*, *A. nilotica* subsp. *indica*, *Albizia lebbek*, *A. odoratissima*, *Cassia auriculata*, *C. fistula*, *Ficus religiosa*, *Hymenodictyon excelsum*, *Lannea coromandelica*, *Madhuca longifolia*, *Tamarindus indica*, *Terminalia arjuna* and *Ziziphus mauritiana*. A considerably high percentage of tannin is also found in the endodermis, phloem paranchyma and in the walls, lumina and pit cavities of dead cells of the wood of *Acacia chundra* and *Tamarindus indica*. The young fruits of *Acacia nilotica* subsp. *indica*, *Aegle marmelos* and *Ziziphus mauritiana* bear tannin in the epidermal cells and fleshy tissues. The epidermal and hypodermal cells of the leaves of *Acacia nilotica* subsp. *indica*, *Adhatoda zeylanica*, *Anogeissus latifolius* and *Wrightia tinctoria* contain high percentage of tannin.

Dye :

The most common dye-yielding species are : *Abrus precatorius* (superficial layers of seed coat), *Achyranthes aspera* (ash of the plant), *Butea monosperma* (flowers), *Kirganelia reticulata* (mature fruits) *Phyllanthus fraternus* (stem and leaves).

Gum and resin :

The species containing gum of commercial value are : *Acacia chundra*, *A. nilotica* subsp. *indica*, *Aegle marmelos*, *Ailanthus excelsa*, *Anogeissus latifolius*, *Boswellia serrata*, *Butea monosperma*, *Lannea coromandelica*, *Moringa concanensis* and *Sterculia urens*. Further, the gum of *Prosopis cineraria* is edible and used in the preparation of sweet meats.

Resin, the oxidation products of various essential oils, are found in the resin-ducts of *Boswellia serrata*. They normally ooze out through the bark alone or in combination with gum and harden on exposure to air.

Fibre :

The floss fibre or lint, which are the hairy outgrowths of seeds etc., may be obtained from *Bombax ceiba*, *Calotropis procera*, *Cryptolepis buchananii*, *Cryptostegia grandiflora* etc.

The common bast fibre yielding species are : *Abutilon indicum*, *Acacia leucophloea*, *A. nilotica* subsp. *indica*, *Aeschynomene indica*, *Annona squamosa*, *Bauhinia racemosa*, *Butea monosperma*, *Cassia auriculata*, *Corchorus olitorius*, *Cordia dichotoma*, *C. macleodii*, *Purgularia daemia*, *Ficus benghalensis*, *F. religiosa*, *Leptadenia pyrotechnica*, *Luffa acutangula*, *Melochia corchorifolia*, *Moringa oleifera*, *Pavonia zeylanica*, *Phoenix sylvestris*, *Sida rhombifolia* and *S. ovata*.

Besides these, the grasses like *Desmostachya bipinnata* and *Saccharum spontaneum* are also used by the local people for making ropes.

Timber :

The area is rich in tree species and the exploitation of local timber would be comparatively more cheaper and helpful in economic development of the area. The most common tree species are : *Acacia leucophloea*, *A. nilotica* subsp. *indica*, *Adina cordifolia*, *Aegle marmelos*, *Albizia lebbek*, *A. odoratissima*, *Anogeissus latifolius*, *Azadirachta indica*, *Bambusa* sp., *Bauhinia racemosa*, *Boswellia serrata*, *Butea monosperma*, *Cassia fistula*, *Cordia dichotoma*, *Dalbergia latifolia*, *D. sissoo*, *Dendrocalamus strictus*, *Diospyros malanoxylon*, *Ficus benghalensis*, *Lannea coromandelica*, *Lagerstroemia parviflora*, *Madhuca longifolia*, *Mangifera indica*, *Mitragyna parvifolia*, *Phoenix sylvestris*, *Sterculia urens*, *Tamarindus indica*, *Tectona grandis*, *Terminalia arjuna*, *T. bellirica*, *Wrightia tinctoria* etc.

Besides these, *Ailanthus excelsa*, *Bombax ceiba*, *Ficus religiosa*, *Hymenodictyon excelsum* and *Sterculia urens* are the plants which may be used in soft wood industries.

Non edible oil :

The indigenous species, which possess considerably high percentage of non edible oil are : *Argemone mexicana*, *Azadirachta indica*, *Cleome viscosa*, *Dalbergia latifolia*, *Euphorbia dracunculoides*, *Jatropha curcas*, *Moringa concanensis*, *Ricinus communis*, *Tamarindus indica*, *Tectona grandis* etc.

The volatile or essential oils of a strong aromatic odor may be distilled or extracted from *Ageratum conyzoides*, *Cyperus rotundus*, *Vetiveria zizanioides*, *Vitex negundo* etc. They are extensively used in perfumery and soap industries.

Spirit, country liquor and other beverages :

The alcoholic distillation is prohibited in the area. However, the local people distill the spirituous liquors on large scale from the fleshy corolla of *Madhuca longifolia*, which is locally called as 'Mahuri'. This tree is so fairly distributed in the forests and wastelands that a small industry may run independently in this area. Beside this, *Acacia nilotica* subsp. *indica* (Bark), *Cordia dichotoma* (Fruits), *Imperata cylindrica* (rhizome and roots), *Phoenix sylvestris* (fruits) and *Ziziphus nummularia* (root-bark) may provide enough raw material for the industry. The root-bark of *Acacia leucophloea* and *A. nilotica* subsp. *indica* is used to flavour the local spirits. The stem-bark of *A. leucophloea* and fruits of *Phyllanthus emblica* are commonly used to increase the narcotic properties of spirits by arresting the secondary fermentation.

The seeds of *Cassia obtusifolia*, *C. tora* and *C. occidentalis* may be used

as a substitute for Coffee (non alcoholic beverage) on commercial scale like in Africa, Abyssinia, England, Malaysia and some parts of India as Bombay, Assam and Goa. The leaves of *Diospyros melanoxylon* are used for making 'Biris' on commercial scale.

Paper :

The cellulose is the basic constituent for the paper. The various raw-materials present in the district are rich in lignin and other non-cellulose components. Besides *Bambusa* species, the pulp obtained from the wood of *Adina cordifolia*, *Anogeissus latifolius*, *Bombax ceiba*, *Boswellia serrata*, *Cordia dichotoma*, *Dalbergia sissoo*, *Diospyros melanoxylon*, *Ficus benghalensis*, *Lagerstroemia parviflora*, *Lannea coromandelica*, *Phoenix sylvestris*, *Phyllanthus emblica*, *Ziziphus xylopyrus* etc. may also be used as raw material in paper industry.

Among the grasses, *Imperata cylindrica*, *Saccharum spontaneum*, *Erianthus benghalensis* etc. are more common which may provide enough raw material to the industry.

Rubber :

The latex from the lower parts of the stem of *Cryptostegia grandiflora* and *Wrightia tinctoria* may be used for manufacturing rubber.

Mucilage :

The mucilagenous substances are chiefly used in the medicines. The chief source of the mucilage are the algae which are abundant in the area. Among the angiosperms, the seeds of *Abutilon indicum*, *Lepidium sativum*, *Orthosiphon pallidus*, *Ocimum americanum* and fruits of the species of *Corchorus* and *Ziziphus mauritiana* contain considerable amount of mucilage and are used by the local vaidas to obtain the mucilage.

Detergent and soap substitutes :

Due to their cheapness and reputed properties, the fruits of *Acacia nilotica* subsp. *indica*, *Balanites aegyptiaca*, *Phyllanthus emblica* and *Sapindus laurifolius* are commonly used for washing the clothes and hairs by the local people.

Cement :

The seeds of *Tamarindus indica* and fruits of *Typha angustata* are locally used as cement for uniting two bodies.

Medicinal and poisonous plants :

Due to the constant association with the forest environment, the tribals have accrued considerable knowledge of plants and their utility, especially

for medicinal purposes. The uses of many of the medicinal plants employed by the tribal people are, however, not known outside their restricted community. In the following account, the information on the medicinal uses which was obtained from the local inhabitants, vairs and forest officials are dealt.

1. ABDOMINAL PAIN AND DISORDER/CONSTIPATION : *Aegle marmelos* (pulp of fruits), *Annona squamosa* (root), *Cassia fistula* (pulp of fruits), *Helicteres isora* (fruit), *Plumbago zeylanica* (root), *Terminalia bellirica* (fruit) etc.
2. ANTIDOTE AGAINST SNAKE AND SCORPION : *Calotropis procera* (latex), *Cassia fistula* (fruit), *Cucurbita moschata* (pedicel and thalamus of fruit), *Enicostema hyssopifolium* (decoction of plant), *Ficus benghalensis* (bark), *Hoppea dichotoma* (plant), *Melochia corchorifolia* (plant), *Polycarpaea corymbosa* (plant) etc.
3. ASTHMA : *Abelmoschus ficulneus* (seed), *Acacia nilotica* (bark), *Achyranthes aspera* (seed), *Calotropis procera* (root), *Cassia auriculata* (seed), *Evolvulus alsinoides* (plant smoked), *Helicteres isora* (root), *Sida rhombifolia* (root), *Solanum surattense* (boiled fruit), *Tribulus terrestris* (fruit) etc.
4. COUGH AND COLD : *Adhatoda zeylanica* (leaf and root), *Barleria prionitis* (decoction of plant), *Cassia occidentalis* (root and seed), *Datura metel* (seed), *Ocimum americanum* (root and leaf), *Sphaeranthus indicus* (plant) etc.
5. CUTS AND WOUNDS : *Cissampelos pareira* (leaf), *Desmodium triflorum* (leaf), *Sida cordata* (leaf), *Terminalia arjuna* (bark), *Tridax procumbens* (paste of plant) etc.
6. DIARRHOEA AND DYSENTERY : *Acacia nilotica* (flower, pod and gum-resin), *Aegle marmelos* (fruit), *Bauhinia racemosa* (bark), *Celosia argentea* (seed), *Cyperus rotundus* (rhizome), *Desmodium triflorum* (leaf), *Holarrhena antidysenterica* (bark and seed), *Limnophila indica* (plant), *Mukia maderaspatana* (seed), *Woodfordia fruticosa* (flower and fruit) etc.
7. FEVER : *Ammannia baccifera* (plant), *Cardiospermum halicacabum* (plant), *Cissampelos pareira* (root), *Enicostema hyssopifolium* (plant), *Oldenlandia corymbosa* (plant), *Oxalis corniculata* (plant), *Phylla nodiflora* (plant), *Polygonum glabrum* (plant), *Solanum nigrum* (plant) etc.
8. HEART AND BLOOD DISEASES : *Aerva lanata* (plant), *Alangium salvifolium* (bark), *Celosia argentea* (seed), *Portulaca quadrifida* (leaf), *Sida rhombifolia* (root), *Tephrosia purpurea* (plant), *Terminalia arjuna* (bark) etc.
9. JAUNDICE AND LIVER DISEASES : *Cyperus triceps* (root), *Eclipta alba* (plant), *Hygrophila auriculata* (root, stem & leaf), *Oldenlandia corymbosa* (plant), *Solanum nigrum* (plant) etc.
10. NERVOUS DISEASES : *Cardiospermum halicacabum* (plant), *Grangea maderaspatana* (leaf), *Ipomoea aquatica* plant etc.

Some plants, including many medicinal ones, contain poisonous principles like alkaloids, glucosides, toxalbumins etc. which are useful and beneficial in small amounts, may cause serious disorders and even death of man and live-

stock if taken in higher dose. It is, therefore, suggested that nobody should, of his own self, try to use any plant mentioned here or elsewhere. The notable poisonous or otherwise harmful plant species from Banswara district are: *Argemone mexicana*, *Abrus precatorius*, *Calotropis procera*, *Cynodon dactylon*, *Datura* sp., *Dioscorea hispida*, *Diospyros montana*, *Jatropha curcas*, *Lantana camara*, *Mucuna pruriens*, *Mukia maderaspatana*, *Nerium indicum*, *Prosopis chilensis*, *Ricinus communis*, *Sorghum helepense*, *Tribulus terrestris*, *Trichosanthes bracteata* etc.

Plants of horticultural importance :

Few indigenous plants were noted which bear beautiful flowers and/or foliage and may be introduced in the gardens for horticultural purposes. Such notable species are : *Cassia auriculata*, *Centratherum phyllolaenum*, *Crinum defixum*, *Curcuma pseudomontana*, *Dioscorea hispida*, *Erythrina suberosa*, *Gloriosa superba*, *Lantana camara*, *Leonotis nepetifolia*, *Nymphaea* species, *Nymphoides* species, *Plesmonium margaritifera*, *Sopubia delphinifolia* and *Woodfordia fruticosa*.

Plants of botanical value :

The following eighteen species collected from Banswara are new records for Rajasthan, since they are not collected/reported so far from other districts. These species are: *Abutilon crinitus*, *Anagallis pumila*, *Canscora decussata*, *Chrysopogon hackelii*, *Combretum ovalifolium*, *Cyperus meeboldii*, *Dioscorea pentaphylla*, *Eriocaulon polycephalum*, *Euphorbia acaulis*, *Knoxia sumatrensis*, *Leea edgeworthii*, *Mitriola petiolata*, *Neodistimon indicum*, *Rungia elegans* and *R. linifolia*. Further, it is interesting to note that most of them are natives of penninsular India.

Bambusa arundinacea and *Dendrocalamus strictus*, which once grew in abundance in the district, are under great biotic pressure and have disappeared considerably from the forest biota. There are no other endangered, rare or endemic species in the district.

FLORISTIC ANALYSIS

From Banswara district of Rajasthan a total number of 619 indigenous species belonging to 368 genera and 106 families are enumerated in the percentage and ratio tabulated below :

TABLE I

	No.	Dicotyledons % of total	No.	Monocotyledons % of total	Grand total
Families	88	83.0	18	17.0	106
Genera	281	76.3	87	23.7	368
Species	452	73.0	167	27.0	619

The ratio of species belonging to Monocotyledons to Dicotyledons is 1:2.7, of genera 1:3.2 and of families 1:4.3. It is interesting to note that the proportion of genera to species in the whole of India is 1:7, in the Gangetic Plain it is 1:2.2, while in the area of present study it is 1:1.6. This shows the small proportion of species to the number of genera in this area. Further, it conforms to the general rule that, within the same floral region, the smaller the flora the smaller the species—genus ratio.

The monocotyledons are very poorly represented in this area. Of the 167 species, 127 species belong to Cyperaceae (30) and Gramineae (97), while the remaining 40 species belong to 16 other families. The families represented by one genus and single species are : Alismataceae, Amaryllidaceae, Arecaceae, Hypoxidaceae, Najadaceae, Typhaceae and Zannichelliaceae.

Among the Dicotyledons, the class Polypetalae is dominant and is represented by 210 species belonging to 122 genera and 49 families. The families represented by single genus and single species are : Aizoaceae, Alangiaceae, Annonaceae, Balanitaceae, Balsaminaceae, Bombacaceae, Burseraceae, Cactaceae, Celastraceae, Elatinaceae, Flacourtiaceae, Fumariaceae, Meliaceae, Moringaceae, Myrtaceae, Onagraceae, Papaveraceae, Rosaceae, Rutaceae, Sapindaceae, Simaroubaceae, Tamaricaceae, Trapaceae, Violaceae and Zygophyllaceae. The largest family of this group is Papilionaceae which is represented by 68 species belonging to 31 genera.

The class Gamopetalae finds the second place and it is represented by 28 families containing 129 genera and 181 species. The families represented by single genus and single species are: Bignoniaceae, Cuscutaceae, Hydrophyllaceae, Martyniaceae, Oleaceae, Plumbaginaceae, Salvadoraceae and Spigeliaceae. The largest family of this group is Asteraceae containing 25 genera and 30 species.

Monochlamydeae is represented by 11 families, 30 genera and 61 species. The families represented by single genus and single species are : Casuarinaceae, Loranthaceae, Nyctaginaceae, Ulmaceae and Urticaceae. The largest family of this group is Euphorbiaceae containing 25 species belonging to 10 genera.

Out of 619 species, 81 species are trees, 90 species shrubs or shrubby climbers and 448 species are herbs or herbaceous climbers. About 75 species are cultivated in the area for various purposes. The flora is characterized by the complete absence of Guttiferales, Olacales, Ericales, Multiovulatae aquaticae, Micrembrayae and Dephnales.

PHYTOGEOGRAPHICAL ANALYSIS

The vegetation of Banswara district consists mainly seven elements, namely (i) Perso-Arabian (Western), (ii) Indo-Malayam (Eastern), (iii) Indian

element, (iv) General element consisting of pantropical and pleuriregional species, (v) European, (vi) American and (vii) Australian in the following percentage and ratio.

TABLE-II

Phytogeographical regions	Number of species	Percentage %	Ratio of Eastern to Western element
Perso-Arabian (Western)	79	12.7	1:2
Indo-Malayan (Eastern)	40	6.4	—
Indian	198	31.9	—
General (Cosmopolitan)	250	40.3	—
American	32	5.1	—
European	13	2.1	—
Australian	7	1.1	—

The analysis revealed that the General element predominates over other elements (40.3%) and the Indian element find the second place (31.9%). The Australian (1.1%), European (2.1%) and American element (5.1%) are very poorly represented in comparison to Perso-Arabian (12.7%) and Indo-Malayan elements (6.4%).

A comparison of the flora of this district with other hilly regions of Eastern Rajasthan (Vyas, 1967; Ramdeo, 1969; Singh, 1973, 76, 77, 79; Majumdar, 1973, 79a; Sharma and Taigi, 1979) shows striking resemblances, as the Perso-Arabian element dominates the Indo-Malayan, altitude does not have any effect on the zonation of vegetation. A comparison with the flora of Western Rajasthan (Blatter & Hallberg, 1918-21; Bhandari, 1978) revealed that mostly those species which have wide distribution in India from sea level to about 1000 m are common in both regions.

PLAN OF THE FLORA

In the present work, the vascular plants, particularly angiosperms of Banswara district have been included. The families are arranged according to Bentham and Hooker's classification (1862-83) except in a few cases in which Hutchinson's (1959) concept regarding splitting of the families is followed. The names of the families are without the names of the authors and description. In case of genera, the names are followed by the names of authors, but without description.

Keys :

Dichotomous keys, based mostly on macroscopic characters, for the

identification of the indigenous taxa from the rank of family to infra-specific level are given.

Nomenclature :

Attempts have been made to adopt the latest correct name according to ICBN (ed. 1978). The references to the latest monographs and taxonomic revisions, if any, follow the adopted name. The basionym, if any, is given to indicate the source of valid combination as an indirect reference. The important synonyms are given to connect the valid name with the names accepted in the "Flora of British India" and "Flora of Upper Gangetic Plains". No references, synonyms, basionym, description etc. are given to the generic names, which bear authors names alone. However, the conserved generic names have been marked as "*nom. cons*".

Local names :

The local names in Bagdi, a dialect of Rajasthan, have been given in inverted commas after citation. In cases where the local people call the same plant by different names, at the most three authentic local names have been given.

Description :

Brief descriptions of the species and infra-specific taxa, based on the specimens studies, have been given. The characters used in the keys do not reflect in the descriptions. For the plants recorded in the literature but some how could not be collected or seen in any herbarium by the author, the descriptions are based on the regional floras cited or on some other authentic literature.

Flowering and fruiting time :

Special efforts were made to record the correct flowering and fruiting time for the plants growing in this district. When flowering and fruiting stages are quite distinguishable in the life-cycle of a taxon, they are given independently.

Illustrations :

To render easy determination of the plants, references to good illustrations published in standard literature have been given. A district map showing forest ranges and other important localities surveyed has been included.

Distribution :

The data about frequency, relative abundance, habitat, associations, variations depending on altitude or habitat etc. and the exact locality of occurrence, interspaced from the above by a semicolon, have been mention-

ed. The field numbers of the specimens deposited in other herbaria and incorporated in this flora are indicated along with the collector's name and abbreviated name of herbarium in parantheses at the end of distributional data. The author has not cited the field numbers collected by him. However, the first and second localities mentioned in this work belong to the authors collections.

Notes :

In the end, remarks on taxonomic affinities, identity of taxa and nomenclatural notes, wherever necessary, have been given.

Cultigens :

The well established cultivated species, along with their valid names, important synonyms, primary diagnostic characters, local names and usefulness, have been alphabetically arranged at the end of respective families. The cultigens are not included in the keys and floristic analysis of the flora.

Abbreviations :

The abbreviations of serials and floras used are in conformity with the common useage in botanical taxonomy, and are cited in accordance with the recommendations made by the International Code of the Botanical Nomenclature (ed. 1978). The abbreviations of various herbaria are adopted from Index Herbariorum (ed. 1974).

KEY TO THE FAMILIES

- 1a. Vascular bundles of the stem open and arranged in rings.
Leaves with reticulate venation. Seeds with 2 cotyledons:
 - 2a. Perianth biseriate or multiseriate, differentiated into calyx and corolla :
 - 3a. Petals free, polypetalous :
 - 4a. Flowers unisexual or polygamous :
 - 5a. Ovary inferior. COMBRETACEAE 39
 - 5b. Ovary superior:
 - 6a. Gynoecium with 1-many, unilocular ovaries:
 - 7a. Leaves scale like, appressed and reduced. Carpels 3-5, syncarpous. Fruit a capsule. TAMARICACEAE 14
 - 7b. Leaves normal, well developed. Carpels 1-many, apocarpous. Fruit never a capsule:
 - 8a. Fruit drupaceous:
 - 9a. Scandent or twining shrubs. Flowers unisexual. MENISPERMACEAE 2
 - 9b. Trees. Flowers polygamous. ANACARDIACEAE 33
 - 8b. Fruit never drupaceous:
 - 10a. Carpel 1. Fruit a legume. MIMOSACEAE 37
 - 10b. Carpels 4-6. Fruit a follicle. STERCULIACEAE 18
 - 6b. Gynoecium with 1, two-many locular ovary:
 - 11a. Stamens 1-5:
 - 12a. Stamens inserted on the margins of disk. Style one, thick. CELASTRACEAE 28
 - 12b. Stamens alternating with the lobes of disk (Disk intrastaminal). Style 3, entire or branched. EUPHORBIACEAE 84
 - 11b. Stamens 6-many:
 - 13a. Leaves pinnately 2-many foliolate:
 - 14a. Trees or shrubs. Disk annular, basal, 10-lobed. Fruit an indehiscent drupe or samara:
 - 15a. Leaflets more than 2. Ovary deeply divided. Fruit samaroid. SIMAROUBACEAE 24
 - 15b. Leaflets 2. Ovary entire. Fruit a drupe. BALANITACEAE 25
 - 14b. Twining herbs. Disk unilateral, of 2 glands opposite the lower petals. Fruit an inflated, membranous, 3-valved, dehiscent capsule. SAPINDACEAE 32
 - 13b. Leaves simple, entire or palmately lobed. EUPHORBIACEAE 84
 - 4b. Flowers bisexual:
 - 16a. Carpels 1-many, apocarpous:
 - 17a. Stamens 1 or 2-adelphous:
 - 18a. Flowers actinomorphic. Calyx and corolla valvate in bud. Corolla not papilionaceous:
 - 19a. Fruit a legume. MIMOSACEAE 37
 - 19b. Fruit a capsule. STERCULIACEAE 18
 - 18b. Flowers zygomorphic. Calyx and corolla imbricate in bud. Corolla papilionaceous. FABACEAE 35
 - 17b. Stamens free:
 - 20a. Corolla zygomorphic, caesalpinaceous. CAESALPINIACEAE 36

- 20b. Corolla actinomorphic, not caesalpinaceous:
- 21a. Petals imbricate:
- 22a. Trees, with resin passages in the stem. Gynoecium of 1 carpel. Fruit a drupe. ANACARDIACEAE 33
- 22b. Herbs, without resin passages. Gynoecium of many free carpels. Fruit an achene. ROSACEAE 38
- 21b. Petals valvate:
- 23a. Ovary superior, Fruit a legume. MIMOSACEAE 37
- 23b. Ovary inferior. Fruit coriaceous or drupaceous, not a legume. COMBRETACEAE 39
- 16b. Carpels 2-many, syncarpous:
- 24a. Ovary 1-celled:
- 25a. Placentation parietal:
- 26a. Stamens 2-6:
- 27a. Trees. Inflorescence a panicle. MORINGACEAE 34
- 27b. Herbs. Inflorescence racemose (raceme or corymb) or the flowers are axillary solitary:
- 28a. Flowers irregular, with gibbous or spurred outer petals:
- 29a. Sepals 2. Stamens 6, in two bundles. FUMARIACEAE 5
- 29b. Sepals 5. Stamens 5, free. VIOLACEAE 9
- 28b. Flowers regular. Petals normal, cruciform. BRASSICACEAE 6
- 26b. Stamens more than 6:
- 30a. Stem spiny, succulent, flattened, jointed (modified into phylloclades). Ovary inferior. CACTACEAE 45
- 30b. Stem normal, not phylloclade, however, may have stipular spines. Ovary superior:
- 31a. Stipular spines present. Fruit an indehiscent berry. CAPPARACEAE 8
- 31b. Stipules, if any, not spiny. Fruit a dehiscent capsule:
- 32a. Capsules 2 valved. CLEOMACEAE 7
- 32b. Capsules 3 to 5-valved:
- 33a. Herbs. Leaves simple, spinous-dentate. Sepals 2-3. Capsules oblong to elliptic, upto 7 cm long, prickly. PAPAVERACEAE 4
- 33b. Trees. Leaves 2 to 3-pinnate, glabrous. Sepals 5. Capsules smooth, cylindric, 15-50 cm long. MORINGACEAE 34
- 25b. Placentation free central, axile, basal or apical, never parietal:
- 34a. Succulent herbs. Sepals or calyx-lobes 2. PORTULACACEAE 13
- 34b. Plants, even if herbs, not succulent. Sepals or calyx-lobes more than two:
- 35a. Ovary superior. Placentation free central at least in upper region of the ovary; in lower region it may be axile due to the formation of septa:
- 36a. Corolla caryophyllaceous. Stamens arising directly from the receptacle. Styles 2-5. Embryo curved. CARYOPHYLLACEAE 12
- 36b. Corolla not caryophyllaceous. Stamens

- arising from the calyx-tube. Style 1.
Embryo straight. LYTHRACEAE 41
- 35b. Ovary inferior. Placentation basal or apical:
 - 37a. Calyx-lobes 4. Placentation basal. MYRTACEAE 40
 - 37b. Calyx-lobes 5-10. Placentation apical. ALANGIACEAE 49
- 24b. Ovary 2 to many-celled:
 - 38a. Pods dehiscent, liberating the seeds:
 - 39a. Flowers zygomorphic:
 - 40a. Capsules 2-celled, 2-valved and 2-seeded.
Seeds strophiolate. POLYGALACEAE 11
 - 40b. Capsules 5-celled, 5-valved, many-seeded.
Seeds estrophiolate. BALSAMINACEAE 22
 - 39b. Flowers actinomorphic:
 - 41a. Ovary inferior or semi-inferior. ONAGRACEAE 42
 - 41b. Ovary superior:
 - 42a. Corolla cruciform. Placentation parietal. BRASSICACEAE 6
 - 42b. Corolla not cruciform. Placentation axile,
basal or apical:
 - 43a. Stamens free, distinct:
 - 44a. Leaves alternate:
 - 45a. Leaves simple. Sepals valvate. TILIACEAE 19
 - 45b. Leaves compound. Sepals imbricate:
 - 46a. Styles 5, distinct from the base. OXALIDACEAE 21
 - 46b. Style 1, often branched at apex or
with lobed stigma:
 - 47a. Ovules 2 in each cell of the ovary. BURSERACEAE 26
 - 47b. Ovule 1 in each cell of the ovary. SAPINDACEAE 32
 - 44b. Leaves opposite or whorled:
 - 48a. Leaves simple:
 - 49a. Stipules present. Sepals imbricate. ELATINACEAE 15
 - 49b. Stipules absent. Sepals valvate. LYTHRACEAE 41
 - 48b. Leaves pinnately or digitately com-
pound. OXALIDACEAE 21
 - 43b. Stamens united, at least at the base:
 - 50a. Anthers 1-celled:
 - 51a. Trunk or stem unarmed. Stamens
1-adelphous. Pollens rough. Pericarp
of fruits normal, not as below. MALVACEAE 16
 - 51b. Trunk armed with spines. Stamens
poly-adelphous. Pollens smooth.
Pericarp of fruits pithy or woolly. BOMBACACEAE 17
 - 50b. Anthers 2-celled:
 - 52a. Stamens distinctly 1-adelphous. STERCULIACEAE 18
 - 52b. Stamens slightly connate at the base
only. TILIACEAE 19
 - 38b. Pods indehiscent, not liberating the seeds, often
separating into mericarps, cocci or carpels:
 - 53a. Ovary inferior or semi-inferior:
 - 54a. Fruit 1-seeded:
 - 55a. Aquatic herbs. Fruits with 2 spines. TRAPACEAE 43
 - 55b. Terrestrial trees. Fruits smooth. MYRTACEAE 40
 - 54b. Fruit 2 to many-seeded. APIACEAE 48

- 53b. Ovary superior:
- 56a. Aquatic herbs, with peltate leaves. Carpels embedded in the torus and forming a compound, many-celled ball resembling a syncarpous ovary. NYMPHAEACEAE 3
- 56b. Plants terrestrial. Leaves not peltate. Carpels truly syncarpous or very close to one another resembling syncarpous ovary, never embedded in the torus:
- 57a. Stamens 1-adelphous:
- 58a. Anthers 1-celled. MALVACEAE 16
- 58b. Anthers 2-celled:
- 59a. Leaves pinnately compound. Hypogynous disk present. MELIACEAE 27
- 59b. Leaves simple. Hypogynous disk absent. STERCULIACEAE 18
- 57b. Stamens free, distinct:
- 60a. Placentation parietal. CAPPARACEAE 8
- 60b. Placentation axile or basal:
- 61a. Leaves simple:
- 62a. Leaves exstipulate. Petals 6, in two series of 3 each. ANNONACEAE 1
- 62b. Leaves stipulate. Petals 4 or 5, in one series:
- 63a. Tendril bearing plants. Fruits a berry. VITACEAE 30
- 63b. Tendrils absent. Fruit not berry:
- 64a. Stipules normal or absent. Stamens arising directly from the receptacle. True hypogynous disk absent. TILIACEAE 19
- 64b. Stipules modified into spines. Stamens arising from the hypogynous disk, not directly from receptacle. RHAMNACEAE 29
- 61b. Leaves compound:
- 65a. Leaves opposite. ZYGOPHYLLACEAE 20
- 65b. Leaves alternate:
- 66a. Leaflets 3, gland-dotted. RUTACEAE 23
- 66b. Leaflets 2 or more than 3, not gland-dotted:
- 67a. Stamens as many as and opposite the petals. VITACEAE 30
- 67b. Stamens twice as many as petals or as many as and alternate with petals or lesser than the number of petals:
- 68a. Styles 2-5, free throughout or atleast at the base or connate by stigmas only:
- 69a. Leaflets more than 2. Fruit samaroid. SIMAROUBACEAE 24

- 69b. Leaflets 2. Fruit a drupe. BALANITACEAE 25
- 68b. Style 1, simple or branched at apex. SAPINDACEAE 32
- 3b. Petals united variously, usually forming a short or long tube:
 - 70a. Ovary inferior:
 - 71a. Plants climbing with the help of tendrils. Stem with bicollateral vascular bundles. CUCURBITACEAE 44
 - 71b. Plants not climbers, or if climbers than without tendrils. Stem with collateral vascular bundles:
 - 72a. Stem flattened, phylloclade. Leaves reduced to spines. CACTACEAE 45
 - 72b. Stem normal, with well developed, normal leaves:
 - 73a. Leaves exstipulate. Calyx modified into pappus. Anthers connate. Ovary 1-celled. Achene 1-seeded. ASTERACEAE 51
 - 73b. Leaves stipulate. Calyx normal, not modified into pappus etc. Anthers free. Ovary 2 to 10-celled. Fruit berry, capsule, drupe or of dehiscent or indehiscent cocci, always more than 1-seeded. RUBIACEAE 50
 - 70b. Ovary superior:
 - 74a. Gynoecium consists 2, distinct (apocarpous) ovaries, 2 distinct or united styles and a united stigma:
 - 75a. Pollens in pollinia. Styles 2, distinct in lower region, united in stigmatic region and bearing a single stigma. Anthers united with stigma to form a gynostegium:
 - 76a. Pollen masses granular. Pollen carrier spathulate. PERIPLOCACEAE 60
 - 76b. Pollen masses waxy. Pollen carrier slender. ASCLEPIADACEAE 59
 - 75b. Pollens distinct, not in pollinia. Styles 2, united from the base and bearing a single stigma. Gynostegium absent. APOCYNACEAE 58
 - 74b. Gynoecium consists 1, apocarpous or syncarpous ovary, united or distinct or branched styles and entire or lobed stigma(s):
 - 77a. Ovary 1-celled:
 - 78a. Flowers unisexual. MENISPERMACEAE 2
 - 78b. Flowers 2-sexual:
 - 79a. Style solitary, with entire or lobed stigma:
 - 80a. Fruits woody, bottle-shaped, 2-horned. MARTYNIACEAE 74
 - 80b. Fruits not as above:
 - 81a. Corolla papilionaceous, with descending imbricate aestivation. Fruit a legume. FABACEAE 35
 - 81b. Corolla not papilionaceous. Aestivation if imbricate then ascending. Fruit not a legume:
 - 82a. Plants insectivorous. Leaf-segments modified into bladders. Stamens 2. LENTIBULARIACEAE 71
 - 82b. Plants not insectivorous, Leaves normal. Stamens more than 2:
 - 83a. Fruit 1-seeded. SALVADORACEAE 57
 - 83b. Fruit usually many-seeded:

- 84a. Stamens opposite the corolla-lobes. Placentation free-central. PRIMULACEAE 53
- 84b. Stamens alternating with the corolla-lobes. Placentation parietal:
 - 85a. Aquatic herbs, with floating, alternate leaves. Corolla-lobes induplicate-valvate in bud. MENYANTHACEAE 63
 - 85b. Terrestrial herbs, with opposite leaves. Corolla-lobes contorted in bud. GENTIANACEAE 62
- 79b. Styles 5, distinct. Stigmas simple, as many as styles. PLUMBAGINACEAE 52
- 77b. Ovary more than 1-celled:
 - 86a. Corolla uniseriate. Stamens less than the corolla-lobes:
 - 87a. Corolla actinomorphic. OLEACEAE 56
 - 87b. Corolla zygomorphic:
 - 88a. Mature ovary separating into 1-seeded nutlets. Style gynobasic. LAMIACEAE 77
 - 88b. Mature ovary not separating into nutlets, dehiscing variously or indehiscent. Style terminal:
 - 89a. Seeds prominently winged. BIGNONIACEAE 72
 - 89b. Seeds not winged:
 - 90a. Seeds attached on upcurved processes (retinaculae). ACANTHACEAE 75
 - 90b. Seeds without retinaculae:
 - 91a. Flowers with extra-floral glands at the base of pedicels. PEDALIACEAE 73
 - 91b. Flowers without extra-floral glands:
 - 92a. Each cell of ovary 1 to 2-ovuled. Fruits indehiscent. VERBENACEAE 76
 - 92b. Each cell of ovary more than 2-ovuled. Fruits dehiscent. SCROPHULARIACEAE 70
 - 86b. Corolla uniseriate with stamens as many as corolla-lobes or more, or multiseriate with stamens as many as the petals of one series or more:
 - 93a. Flowers unisexual. EBENACEAE 55
 - 93b. Flowers bisexual:
 - 94a. Stamens free from petals. OXALIDACEAE 21
 - 94b. Stamens epipetalous:
 - 95a. Plants stem-parasites, with yellow leafless, much-branched, climbing stem. CUSCUTACEAE 68
 - 95b. Plants usually autophytes or root-parasites, in latter case, the stem is normal, not as above:
 - 96a. Carpels placed obliquely. Placenta swollen. SOLANACEAE 69
 - 96b. Carpels not placed obliquely. Placenta not swollen:
 - 97a. Fruit a capsule, dehiscing in various

- ways:
- 98a. Leaves alternate:
 - 99a. Plants climbers, twiners or creepers, rarely erect shrubs. Vascular bundles in stem bicollateral. Seeds 1-4 in each cell. CONVOLVULACEAE 67
 - 99b. Plants erect or decumbent herbs. Vascular bundles in stem collateral. Seeds more than 4 in each cell. HYDROPHYLLACEAE 64
 - 98b. Leaves opposite:
 - 100a. Capsules compressed contrary to the septum. Carpels first separating and then dehiscing along the inner face. SPIGELIACEAE 61
 - 100b. Capsules globose, not compressed, septicidally 2-valved. GENTIANACEAE 62
 - 97b. Fruit a fleshy or dry and hard berry, drupe or nut dividing into 2-4 nutlets:
 - 101a. Plants with milky juice. Stamens opposite the petals. SAPOTACEAE 54
 - 101b. Plants with watery juice. Stamens alternating with petals:
 - 102a. Stamens free, distinct:
 - 103a. Trees. Fruit a drupe. EHRETIACEAE 66
 - 103b. Erect, prostrate or twining herbs or shrubs. Fruit a nut of 2-4 nutlets or a dry hard berry:
 - 104a. Ovary 4-lobed outside. Style usually gynobasic or rarely subterminal. Fruit a nut of 2-4 nutlets. BORAGINACEAE 65
 - 104b. Ovary not lobed outside. Style terminal. Fruit a dry, hard berry. CONVOLVULACEAE 67
 - 102b. Stamens united at the base into a 5-lobed staminal tube. LEEACEAE 31
 - 2b. Perianth uniseriate or absent, not differentiated into calyx and corolla:
 - 105a. Ovary 1-celled at maturity:
 - 106a. Ovary inferior:
 - 107a. Plants facultative stem-parasites. Seeds without seed-coat. LORANTHACEAE 83
 - 107b. Plants autophytes. Seeds with a distinct seed-coat. COMBRETACEAE 39
 - 106b. Ovary superior:
 - 108a. Stipules ochreate. POLYGONACEAE 81
 - 108b. Stipules absent, if present then not ochreate:
 - 109a. Fruits prominently winged. ULMACEAE 85
 - 109b. Fruits not winged:
 - 110a. Placentation basal or free-central by abortion of septa:~
 - 111a. Ovary 1-carpelled:

- 112a. Flowers 2-sexual. NYCTAGINACEAE 78
 112b. Flowers 1-sexual. URTICACEAE 87
 111b. Ovary 2 to 5-carpelled:
 113a. Fruit dehiscing irregularly, by valves or
 circumscissile:
 114a. Tepals green, herbaceous:
 115a. Prostrate terrestrial herbs. Leaves sub-
 equal in each pair. Petiole dilated at
 base into stipuliform margins. AIZOACEAE 46
 115b. Erect herbs in wet and marshy habitats.
 Leaves equal sized in each pair. Petiole
 not detailed as above. LYTHRACEAE 41
 114b. Tepals scarious. AMARANTHACEAE 79
 113b. Fruit an indehiscent nut or utricle:
 116a. Bracts and tepals scarious. AMARANTHACEAE 79
 116b. Bracts absent, if present then herbaceous.
 Tepals green, not scarious. CHENOPODIACEAE 80
 110b. Placentation apical or parietal:
 117a. Leaves reduced, scale-like. Perianth absent.
 Ovary 2-carpelled. CASUARINACEAE 88
 117b. Leaves well developed. Perianth present. Ovary
 1-carpelled or so due to the abortion of second
 carpel. MORACEAE 86
 105b. Ovary 2 to many-celled at maturity:
 118a. Carpels subdistinct (semi-apocarpous). Fruit a follicle. STERCULIACEAE 18
 118b. Carpels completely united (syncarpous). Fruit not
 follicular:
 119a. Perianth zygomorphic. Ovary inferior. ARISTOLOCHIACEAE 82
 119b. Perianth actinomorphic. Ovary superior:
 120a. Fruit indehiscent, drupe or berry, neither separat-
 ing into cocci nor liberating the seeds:
 121a. Stipules small. Styles 3, entire or divided. EUPHORBIACEAE 84
 121b. Stipules absent. Styles 5, entire. FLACOURTIACEAE 10
 120b. Fruit a dehiscent capsule liberating the seeds or
 regma separating into cocci:
 122a. Flowers unisexual. EUPHORBIACEAE 84
 122b. Flowers bisexual:
 123a. Perianth gamophyllous. Stamens inserted on
 the calyx-tube:
 124a. Leaves subequal at each node. Flowers con-
 cealed in petiolar pouch. Capsules truncate
 or slightly concave at the tip with 2 spread-
 ing teeth. AIZOACEAE 46
 124b. Leaves equal-sized at each node. Petiole not
 forming the pouch. Capsules rounded at the
 tip, without teeth. LYTHRACEAE 41
 123a. Perianth polyphyllous. Stamens hypogynous. MOLLUGINACEAE 47
 1b. Vascular bundles of stem scattered and closed. Leaves with
 parallel venation. Seeds with 1 cotyledon:
 125a. Perianth absent or modified into hairs, bristles or scales:
 126a. Inflorescence a fleshy spadix. ARACEAE 99
 126b. Inflorescence not spadix:

- 127a. Flowers not enclosed or subtended by glumes, but surrounded by thread-like or spathulate forked scales, arranged in spikes. TYPHACEAE 98
- 127b. Flowers in the axils of glumes or between two glumes, united in spikelets and latter arranged variously:
- 128a. Leaf-sheaths not splitting (closed). Fruit an achene. CYPERACEAE 105
- 128b. Leaf-sheaths splitting (open). Fruit a caryopsis. POACEAE 106
- 125b. Perianth present in bisexual flowers and also atleast in one sex when flowers are unisexual, differentiated into calyx and corolla or not:
- 129a. Ovary inferior:
- 130a. Ovary 1-celled:
- 131a. Stamens 1 or 2. ORCHIDACEAE 90
- 131b. Stamens 3-15. HYDROCHARITACEAE 89
- 130b. Ovary more than 1-celled, usually 3-celled:
- 132a. Fertile stamen 1. ZINGIBERACEAE 91
- 132b. Fertile stamens more than 1:
- 133a. Dioecious twiners, with cauline leaves. Flowers unisexual. DIOSCOREACEAE 94
- 133b. Plants not twiners, with basal or radical leaves. Flowers bisexual:
- 134a. Flowers in umbels which are sometimes reduced to a single flower, subtended by 1 or more spathaceous bracts. AMARYLLIDACEAE 92
- 134b. Flowers in cymes, racemes or panicles. Bracts, if any, not spathaceous. HYPOXIDACEAE 93
- 129b. Ovary superior:
- 135a. Carpels distinct, forming apocarpous gynoecium:
- 136a. Flowers bisexual. POTAMOGETONACEAE 101
- 136b. Flowers unisexual:
- 137a. Stamen solitary:
- 138a. Male flowers without perianth. Female flowers with a cupular hyaline perianth. ZANNICHELLIACEAE 102
- 138b. Male flowers with double perianth, the outer tubular or inflated, the inner hyaline. Female flowers without perianth. NAJADACEAE 103
- 137b. Stamens more than 1, usually 6 to many:
- 139a. Trees or shrubs, with pinnately or palmately divided to compound leaves. Inflorescence a spadix. ARECACEAE 97
- 139b. Aquatic or marshy herbs, with simple, entire leaves. Flowers in umbellate or paniculate whorls. ALISMATACEAE 100
- 135b. Carpels united, forming a syncarpous gynoecium:
- 140a. Flowers unisexual. ERIOCAULACEAE 104
- 140b. Flowers bisexual:
- 141a. Perianth-segments all alike. LILIACEAE 95
- 141b. Perianth distinguished into an outer calyx and inner corolla. COMMELINACEAE 96

1. ANNONACEAE

ANNONA L.

Annona squamosa L. Sp. Pl. 537. 1753; Hook. f. & Thoms. in Hook. f. Fl. Brit. India 1 : 78. 1872; Duthie, Fl. Gangetic Plain 1 : 23. 1903. '*Sitaphal*' (Hindi).

Large shrubs or small trees. Leaves oblong, elliptic or ovate-lanceolate, 7-15 × 2-4 cm. Flowers greenish-yellow, solitary, leaf-opposed or on short branchlets. Petals thick, 3-angular, valvate. Stamens many. Syncarps fleshy, globose or cordate-ovoid, 5-10 cm in diam., tubercled, greenish-yellow when ripe. Seeds oblong, brown, smooth, with a swelling at the hilum.

Fl. : March-May; *Fr.* : June-October.

Native of Tropical America and West Indies; naturalized in the forests and cultivated in the gardens for its edible fruits; Shergarh, Banswara (Verma 210, BSA).

A. reticulata L.—Small trees, with oblong-lanceolate leaves and cordate, subglobose, smooth fruits. Native of tropical America; cultivated in the gardens for its edible fruits. '*Ramphal*' (Hindi).

Polyalthia longifolia (Sonnerat) Thw. (*Uvaria longifolia* Sonnerat)—Evergreen avenue tree, with slender stem, lanceolate leaves, yellowish-green flowers and ovoid fruits. Planted in the gardens and along the roads. '*Ashok*' (Hindi).

2. MENISPERMACEAE

1a. Petals 4 in male flowers, 1 in female flowers. Pistil solitary.

Cissampelos 1

1b. Petals 6 in the flowers of both sexes. Pistils 3-6:

2a. Seeds horse shoe-shaped.

Cocculus 2

2b. Seeds oblong or globose.

Tinospora 3

1. CISSAMPELOS L.

Cissampelos pareira L. var. **hirsuta** (Ham. ex DC.) Forman in Kew Bull. 22 : 356. 1968. *C. hirsuta* Ham. ex DC. Syst. Nat. 1 : 535. 1817. *C. pareira* auct. non L. 1753; *sensu* Hook. f. & Thoms. in Hook. f. Fl. Brit. India 1 : 103. 1872; Duthie, Fl. Gangetic Plain 1 : 30. 1903; Mahesh. Illus. Fl. Delhi f. 2. 1966. '*Heir*' (Hindi).

Twining, dioecious shrubs, with hirsute or tomentose branches. Leaves suborbicular-reniform, peltate, 3-8 × 4-9 cm, truncate or cordate-based, 5 to 6-nerved. Male flowers in axillary, pedunculate cymes. Bracts linear-subulate. Sepals 4, obovate-spathulate. Petals connate at base. Stamens connate.

Female flowers in pendulous, 6-15 cm long racemes, with leaf-like bracts. Drupes subglobose, about 5 mm in diam., hirsute, red when ripe.

Fl. & Fr. : June to November.

Common in wastelands and on the fringes of forests. Pendulous, bracteate female racemes make the plant more elegant; Kotharia forest.

2. COCCULUS DC. *nom. cons.*

Cocculus hirsutus (L.) Diels in Engl. Pfreich. 46 : 236. 1910. *Menispermum hirsutum* L. Sp. Pl. 341. 1753. *Cocculus villosus* DC. Syst. Nat. 1 : 525. 1817; Hook. f. & Thoms. in Hook. f. Fl. Brit. India 1 : 101. 1872; Duthie, Fl. Gangetic Plain 1 : 28. 1903. *C. macrocarpus* Wt. & Arn. Prodr. 13. 1834; Hook. f. & Thoms. *l.c.* 1 : 101. 1872. 'Bajar-bel' (Hindi).

Twining, hirsute, dioecious undershrubs. Leaves ovate-oblong, lanceolate or deltoid, villous. Male flowers in axillary cymose panicles. Stamens free. Female flowers in axillary clusters or racemes. Sepals 6, 2-seriate. Petals obovate, emarginate, embracing the stamens in males. Fruits globose, dark purple, about 2 cm in diameter, rugose.

Fl. & Fr. : September-January.

Common on the fringes of forests and in wastelands; Bari-ghata forest, Kushalgarh (Kanodia 75727, BSI).

3. TINOSPORA Miers

Tinospora cordifolia (Willd.) Miers in Ann. & Mag. nat. Hist. ser. 2. 7 : 38. 1851; Hook. f. & Thoms. in Hook. f. Fl. Brit. India 1 : 97. 1872; Duthie, Fl. Gangetic Plain 1 : 26. 1903. *Menispermum cordifolium* Willd. Sp. Pl. 4 : 826. 1806. 'Neem-Gilol' (Hindi).

Succulent, trailing shrubs, with lenticelled stem, papery, easily separable bark and many aerial roots. Leaves ovate-cordate, 6-10 × 7-10 cm, acuminate, glabrous, 5 to 7-nerved at the base. Male flowers fascicled in the axils of lanceolate bracts. Sepals 6, 2-seriate. Filaments free. Female flowers solitary. Berries globose. Seeds oblong or globose.

Fl. & Fr. : July-March.

Rare, along boundaries of fields and gardens; Talwara.

Notes : Leaves are very short lived, appear during the rainy season and fall in October. The aphyllous stem bears aerial roots and flowers.

3. NYMPHAEACEAE

NYMPHAEA L. *nom. cons.*

- 1a. Leaves sharply sinuate-dentate. Anthers not appendaged.
Stigmatic rays with clavate appendages.

N. pubescens 2

- 1b. Leaves entire or bluntly dentate. Anthers appendaged. Stigmatic rays without appendages.

N. nouchali 1

1. *Nymphaea nouchali* Burm. f. Fl. Ind. 120. 1768. *N. stellata* Willd. Sp. Pl. 2 : 1153. 1799; Hook. f. & Thoms. in Hook. f. Fl. Brit. India 1 : 114. 1872; Duthie, Fl. Gangetic Plain 1 : 34. 1903; Subram. Aquatic Ang. 6. f. 1. 1962. 'Pappaphool' (Hindi).

Aquatic herbs, with short, ovoid root-stocks. Leaves orbicular, or when young elliptic-sagittate, peltate, 10-15 cm in diam., glabrous; sinus 5-7 cm deep. Flowers white or violet, 8-15 cm in diam., solitary. Sepals not ribbed. Stigmatic rays 10-30. Seeds longitudinally striated.

Fl. & Fr. : August-February.

Native of South-East Asia. Rare, in tanks and ponds in association with *N. pubescens* Willd. It is a day-flowering species; 22 km from Banswara on Kushalgarh road, Lodha tank (Kanodia 51129, BSI).

2. *N. pubescens* Willd. Sp. Pl. 2 : 1154. 1799. *N. lotus* non L. var. *pubescens* (Willd.) Hook. f. & Thoms. Fl. Ind. 241. 1855. *N. lotus auct. plur.* non L. 1753; Hook. f. & Thoms. in Hook. f. Fl. Brit. India 1 : 114. 1872; Duthie, Fl. Gangetic Plain 1 : 33. 1903. *N. nouchali auct. plur.* non Burm. f. 1768; Subram. Aquatic Ang. 6. f. 2. 1962. 'Kamal' (Hindi).

Aquatic herbs, with erect root-stocks. Leaves hairy beneath. Flowers white or red, 8-15 cm in diam., solitary. Sepals 5 to 10-ribbed. Stigmatic rays 10-20. Fruits fleshy, globose, about 3 cm in diam. Seeds ovoid, with white aril.

Fl. & Fr. : August-March.

Native of Central Africa; common in ponds, tanks, ditches and rivers. It is a night flowering species; 22 km from Banswara on Kushalgarh road.

4. PAPAVERACEAE

ARGEMONE L.

Argemone mexicana L. Sp. Pl. 508. 1753; Hook. f. & Thoms. in Hook. f. Fl. Brit. India 1 : 117. 1872; Duthie, Fl. Gangetic Plain 1 : 36. 1903, *pro parte*; Ownbey in Mem. Torr. Bot. Club 21 : 29. 1958. 'Pili-dhaturi' (Hindi).

Erect, prickly herbs, upto 1 m high, with yellow or white latex. Leaves sinuate-pinnatifid, 4-18 × 2.5-6.0 cm, inciso-dentate, spiny on the margins. Flowers bright yellow, terminal, solitary. Stigma disc-like. Capsules oblong, 3 to 6-valved, loculicidal, prickly. Seeds black, scrobiculate.

Fl. & Fr. : Almost throughout the year, profuse from September to January.

Native of West Indies, Central Africa and Florida; naturalized in wastelands, on the edge of drying ponds and in cultivated fields; **Sunni**,

Banswara (*Kanodia* 51141, BSI).

5. FUMARIACEAE

FUMARIA L.

Fumaria indica (Haussk). Pugsley in Journ. Linn. Soc. 44 : 313. 1919; Mahesh. Illus. Fl. Delhi f. 4. 1966. *F. vaillantii* Loisel. var. *indica* Haussk. in Flora 56 : 443. 1873. *F. parviflora* Lam. subsp. *vaillantii* Hook. f. & Thoms. Fl. Ind. 1 : 258. 1855 & in Hook. f. Fl. Brit. India 1 : 128. 1872, non *F. vaillantii* Loisel. 1809; Duthie, Fl. Gangetic Plain 1 : 37. 1903. 'Pitpapra' (Hindi).

Annual herbs, upto 60 cm high. Leaves 2 to 3-pinnatisect; segments linear-oblongate, apiculate. Flowers purplish-red, spurred, in terminal or leaf-opposed, bracteate racemes. Sepals incised-dentate. Nuts subglobose, 2-3 mm in diam., indehiscent, rugose when dry.

Fl. & Fr. : January-April.

Common weed of cultivated fields and garden-beds; Kushalgarh.

6. BRASSICACEAE (CRUCIFERAE *nom. alt.*)

1a. Fruit a siliqua. Seeds 1 to 2-seriate in each cell.

Rorippa 2

1b. Fruit a silicula. Seeds solitary in each cell.

Lepidium 1

1. LEPIDIUM L.

Lepidium sativum L. Sp. Pl. 644. 1753; Hook. f. & Anders. in Hook. f. Fl. Brit. India 1 : 159. 1872; Duthie, Fl. Gangetic Plain 1 : 48. 1903; Thell. Die Gatt. Lepidium 12. 1906.

Erect, annual, glabrous herbs, upto 60 cm high. Lower leaves 1 to 2-pinnate, long-petioled; upper ones sessile, pinnatifid or entire, 2-4 x 0.2-0.8 cm. Flowers white, in terminal and axillary, 10-50 cm long racemes. Stamens 6. Silique ovate, oblong or suborbicular, 4-6 x 3-5 mm, retuse at the apex, laterally compressed; valves boat-shaped, winged at the top; cotyledons incumbent.

Fl. & Fr. : January-March.

Native of Mediterranean region; common weed in the crops of winter season; Loharia.

2. RORIPPA Scop.

Rorippa indica (L.) Hiern, Cat. Afr. Pl. Welw. 26. 1896; Bailey in Rhodora 18 : 155. 1916. *Sisymbrium indicum* L. Mant. 1 : 93. 1767. *Nasturtium*

indicum (L.) DC. Syst. Nat. 2 : 199. 1818; Hook. f. & Anders. in Hook. f. Fl. Brit. India 1 : 134. 1872, *pro parte*; Duthie, Fl. Gangetic Plain 1 : 39. 1903. *N. montanum* Wall. ex Hook. f. & Th. in Journ. Linn. Soc. 5 : 139. 1861; Hook. f. & Anders. *l.c.* 1 : 134. 1872; Duthie, *l.c.* 1 : 40. 1903.

Erect, hairy or glabrous herbs, upto 50 cm high. Lower leaves petiolate, lyrate-pinnatifid; upper ones ovate-lanceolate, sessile, sinuate-dentate, acute. Flowers white or yellow, in axillary racemes. Sepals upto 3 mm long, outer larger than the inner, obtuse. Petals oblanceolate-cuneate, not clawed. Silique turgid, not beaked. Seeds turgid, subreniform, granulate.

Fl. & Fr. : July-October.

Rare, weed of cultivated fields and nearby localities; Ghatol (*Majumdar* 10217, BSA).

***Brassica campestris* L. var. *rapa* (L.) Hartm. (*B. rapa* L.).**—Annual herbs, with napiform roots, dull yellow or white flowers and beaked silique. Cultivated during winter season for its edible fleshy roots. ‘*Shalgam*’ (Hindi).

***B. campestris* L. var. *sarson* Prain**—Annual herbs, with tap root and yellow flowers. Cultivated throughout the area for the oil obtained from the seeds. ‘*Sarso*’ (Hindi).

***B. oleracea* L. var. *botrytis* L.**—Rachis of young inflorescence and pedicels thickened into a dense, fleshy, white, edible mass. Native of W. Europe; cultivated during winter season. ‘*Phool gobhi*’ (Hindi).

***B. oleracea* L. var. *capitata* L.**—Leaves congested into a subglobose or ellipsoid bud which is cooked as vegetable. Native of Europe and Asia; cultivated during winter season. ‘*Karamkulla, Pat-gobhi*’ (Hindi).

***Raphanus sativus* L.**—Roots fusiform. Flowers white or pinkish, in corymbs elongating into racemes. Native of Europe and Temperate Asia; cultivated for its edible roots during winter season. ‘*Mooli*’ (Hindi).

7. CLEOMACEAE

CLEOME L.

1a. Leaves simple. Fruits glabrous.

C. simplicifolia 1

1b. Leaves 3 to 7-foliolate. Fruits glandular pubescent.

C. viscosa 2

1. ***Cleome simplicifolia* (Camb.) Hook. f. & Thoms.** in Hook. f. Fl. Brit. India 1 : 169. 1872; Duthie, Fl. Gangetic Plain 1 : 49. 1903. *Polanisia simplicifolia* Camb. in Jacq. Voy. Inde 20. t. 20. 1841. *P. burtporensis* Munro in Wight, Icon. 3(4) : 5. t. 1072. 1846.

Annual herbs, 20-60 cm high, clothed with white, stiff, glandular-based hairs. Leaves obovate-oblong or lanceolate, 3-8 x 0.5-2.5 cm, strigose. Flowers violate or purple, axillary, solitary, passing into racemes. Stamens

10-12. Ovary sessile. Silique 1.5-5.0 cm long, many-ribbed, beaked, slightly torulose. Seeds yellowish brown, smooth.

Fl. & Fr. : July-October.

Rare, a wasteland ruderal, often abundant in the grasslands; Kotharia forest, Lodha (*Kanodia* 75317, BSI), Kushalgarh (*Kanodia* 75679, BSI).

2. *C. viscosa* L. Sp. Pl. 672. 1753; Hook. f. & Thoms. in Hook. f. Fl. Brit. India 1: 170. 1872; Duthie, Fl. Gangetic Plain 1: 50. 1903; Iltis in Brittonia 12: 281. 1960; Jacobs in Fl. Males. 6: 103. 1960; Mahesh. Illus. Fl. Delhi f. 9. 1966. *C. icosandra* L. l.c. 672. 1753. 'Pili-Hulhul, Jangli-Ashar' (Hindi).

Annual herbs, upto 1 m high, clothed with viscid-glandular hairs. Leaflets 3-7, elliptic, oblong or obovate. Flowers yellow, axillary, solitary, passing upwards into lax, bracteate corymbose racemes. Stamens 20-25. Ovary sessile. Silique cylindric, 4-6 cm long, viscid, many-ribbed, beaked. Seeds subglobose, pitted in the centre, transversely ribbed, brown.

Fl. & Fr. : June-September.

Common weed in wastelands and open forests; Deoda, Banswara (*Majumdar* 10253, BSA), Anand Sagar (*Kanodia* 75257, BSI).

8. CAPPARACEAE (CAPPARIDACEAE)

CAPPARIS L.

- | | |
|---|-----------------------|
| 1a. Leaves absent or on the young shoots only, deciduous. | <i>C. decidua</i> 1 |
| 1b. Leaves normal, persistent: | |
| 2a. Leaves without a callus tip. Flowers greenish-yellow, in umbels. | <i>C. sepiaria</i> 2 |
| 2b. Leaves with recurved callus tip. Flowers white or pink, solitary, supra-axillary. | <i>C. zeylanica</i> 3 |

1. *Capparis decidua* (Forsk.) Edgew. in Journ. Linn. Soc. Bot. 6: 184. 1862; Jacobs in Blumea 12: 424. 1965; Mahesh. Illus. Fl. Delhi f. 12. 1966. *Sodada decidua* Forsk. Fl. Aegypt.-Arab. 81. 1775. *Capparis aphylla* Roth, Nov. Sp. Pl. Ind. Or. 238. 1821; Hook. f. & Thoms. in Hook. f. Fl. Brit. India 1: 174. 1872; Duthie, Fl. Gangetic Plain 1: 53. 1903. 'Kair' (Hindi).

Much-branched, leafless shrubs, upto 2 m high. Stipular spines straight. Flowers red, in corymbs. Gynophore 1.5-2.0 cm long. Berries globose, 1-2 cm in diam., glabrous, with white latex, reddish when ripe.

Fl. & Fr. : November-March.

Occasional, in dry wastelands; Banswara.

2. *C. sepiaria* L. Syst. Nat. ed. 10. 2: 1071. 1759 & Sp. Pl. ed. 2. 720. 1762; Hook. f. & Thoms. in Hook. f. Fl. Brit. India 1: 177. 1872; Duthie, Fl. Gangetic Plain 1: 53. 1903; Jacobs in Blumea 12: 489. 1965; Mahesh. Illus.

Fl. Delhi f. 13. 1966. *C. incanescens* DC. Prodr. 1: 247. 1824. *C. sepiaria* L. var. *incanescens* (DC.) Hook. f. & Thoms. l.c. 1: 177. 1872. *C. glauca* Wall. ex Hook. f. & Thoms. l.c. 1: 180. 1872. 'Jal, Chhail' (Hindi).

var. *sepiaria*.

Woody, straggling shrubs, 1-2 m high. Leaves ovate, elliptic, 3-5 x 2-3 cm, entire, retuse. Stipular spines hooked. Umbels axillary and terminal. Berries globose, smooth, black when ripe. Gynophore upto 8 mm long.

Fl. & Fr.: November-May.

Common on the edges of fields, in wastelands and forests; Loharia forest, Banswara (*Kanodia* 51092, BSI).

3. *C. zeylanica* L. Sp. Pl. ed. 2. 720. 1762; Jacobs in Blumea 12: 505. 1965; Hook. f. & Thoms. Fl. Brit. India 1: 174. 1872. *C. horrida* L. f. Suppl. Pl. 264. 1781; Wight, Icon. 1: t. 173. 1839; Hook. f. & Thoms. in Hook. f. l.c. 1: 178. 1872; Duthie, Fl. Gangetic Plain 1: 53. 1903. 'Gitoran, Kantan' (Hindi).

Climbing shrubs, 2-4 m high. Leaves ovate or oblong, 3-5 x 2-3 cm, entire. Stipular spines hooked. Flowers 2-6 serial. Sepals 1.0-1.5 cm long, tomentose. Petals densely hairy inside. Berries subglobose, 4-5 x 3-4 cm, reddish-brown, with fatty pulp and woody pericarp. Seeds subglobose.

Fl. & Fr.: November-April.

Common among bushes and shrubs in wastelands; Banswara.

Crateva nurvala Buch.-Ham. (*C. religiosa* non Forst. var. *nurvala* (Buch.-Ham.) Hook. f. & Thoms.—Trees, with 3-foliolate leaves, yellow flowers and globose, obovoid or ovoid, brown-tomentose berries. Planted in the gardens. 'Barna' (Hindi).

9. VIOLACEAE

HYBANTHUS Jacq. *nom. cons.*

Hybanthus enneaspermus (L.) Muell. Fragm. 10: 81. 1876 & Census Austr. Pl. 1: 11. 1882 & 1889; Tannant in Kew Bull. 16(3): 431. 1963. *Viola enneasperma* L. Sp. Pl. 937. 1753. *V. suffruticosa* L. l.c. 937. 1753. *Ionidium heterophyllum* Vent. Jard. Malm. t. 27. 1803; Duthie, Fl. Gangetic Plain 1: 56. 1903. *I. suffruticosum* (L.) Roem. & Schult. Syst. Veg. 5: 394. 1819; Wight Icon. 1: t. 308. 1840; Hook. f. & Thoms. in Hook. f. Fl. Brit. India 1: 185. 1872. 'Ratanpurus' (Hindi).

Erect, annual herbs, 15-30 cm high. Leaves subsessile, linear-lanceolate, 2-5 x 0.2-1.0 cm, serrulate. Stipules subulate, gland-tipped. Flowers pinkish-purple, solitary, axillary. Sepals not produced below their insertion. Lower petal spurred at the base. Two anthers spurred on the back. Capsules subglobose, smooth. Seeds striated.

Fl. & Fr.: August-November.

Sparsely distributed in the wastelands in wet habitats; Paloda.

10. FLACOURTIACEAE

FLACOURTIA Commers. ex L' Herit.

Flacourtia indica (Burm.f.) Merr. Inter. Rump. Herb. Amb. 377. 1917. *Gmelina indica* Burm. f. Fl. Ind. 132. t. 39. f. 5. 1768. *Flacourtia ramontchi* L' Herit. Stirp. Nov. 3: 59. t. 30 & 30 B. 1785; Hook. f. & Thoms. in Hook. f. Fl. Brit. India 1 : 193. 1872, incl. vars.; Duthie, Fl. Gangetic Plain 1: 59. 1903, incl. vars. *F. sepiaria* Roxb. Cor. Pl. 1: 48. t. 68. 1796; Hook. f. & Thoms. *l.c.* 1: 194. 1872; Duthie, *l.c.* 1 : 59. 1903. 'Kankair' (Hindi).

Dioecious trees, 4-8 m high. armed with spines. Leaves elliptic, ovate or oblong. 1.5-8.5 x 1.5-6.0 cm, crenate-serrate; midrib glabrous. Flowers unisexual, greenish-yellow, clustered in short, axillary racemes. Tepals 4, united below. Stigmas 5-11. Berries globose, reddish-purple when ripe.

Fl. & Fr. : January-June.

Frequent in the forests; Kotharia forest, Banswara (*Kanodia* 75356, BSI).

11. POLYGALACEAE

POLYGALA L.

1a. Wing sepals about 5 mm broad, acute or acuminate. Capsules narrowly margined.

P. arvensis 1

1b. Wing sepals about 2 mm wide, obtuse. Capsules not margined.

P. erioptera 2

1. *Polygala arvensis* Willd. Sp. Pl. ed. 3. 2 : 876. 1802; Burt in Notes Roy. Bot. Gard. Edinb. 32: 404. 1973. *P. chinensis* auct. plur. non L. 1753; Bennett in Hook. f. Fl. Brit. India 1: 204. 1872, excl. var. *brachystachya* (Bl.) Bennett; Duthie, Fl. Gangetic Plain 1 : 62. 1903; Mahesh. Illus. Fl. Delhi f. 16. 1966. 'Golbel' (Hindi).

Erect or prostrate herbs. Leaves obovate, oblanceolate or elliptic, 1.0-4.5 x 0.6-1.5 cm, ciliate, mucronate. Flowers greenish-yellow, axillary, solitary or in racemes shorter than leaves. Sepals persistent. Lower petal largest, keeled, with a dorsal crest of few subulate teeth. Capsules broadly oblong, ciliate, emarginate. Seeds pubescent. strophiolate, with three basal appendages.

Fl. & Fr. : August-October.

Common weed in wastelands, gardens, lawns, parks and often on the hills. This is a polymorphic taxon; Pipalkhunt.

2. **P. erioptera** DC. Prodr. 1 : 326. 1824; Bennett in Hook. f. Fl. Brit. India 1 : 203. 1872; Duthie, Fl. Gangetic Plain 1 : 62. 1903; Mukerj. in Bull. Bot. Soc. Beng. 12: 47. 1960. '*Sarbhagolia*' (Hindi).

var. **erioptera**

Erect herbs, 10-50 cm high. Leaves linear to elliptic-oblong, 1-4 x 0.3-1.0 cm, entire. Flowers yellow, in axillary or extra-axillary racemas shorter than leaves. Lower petal falcate, 3-angular, keeled. Capsules oblong, emarginate at the apex, glabrous or pubescent. Seeds 2, oblong, hairy, strophiolate with three basal appendages.

Fl. & Fr. : July to January.

Common weed in wastelands and forests; Ghatol, Jolana (*Kanodia* 75616, BSI), Anand Sagar (*Kanodia* 75255, BSI).

12. CARYOPHYLLACEAE

1a. Stipules fimbriate. Stamens 5. Style solitary, 3-fid at the apex.

Polycarpaea 1

1b. Stipules not fimbriate. Stamens 8-10. Styles 3 or 5, free to the base.

Spergula 2

1. POLYCARPAEA Lam. *nom. cons.*

Polycarpaea corymbosa (L.) Lam. Tabl. Encycl. 2: 129. 1797; Wight, Icon. 2(4): 6. t. 712. 1843; Edgew. & Hook. f. in Fl. Brit. India 1: 245. 1874; Duthie, Fl. Gangetic Plain 1 : 68. 1903. *Achyranthes corymbosa* L. Sp. Pl. 205. 1753. '*Dholphuli*' (Hindi).

Hoary-pubescent, annual herbs, 15-30 cm high. Leaves in pseudo-whorls, linear-lanceolate, 1.2-3.0 cm long. Stipules scarious, lanceolate, 2-6 mm long. Flowers white, crowded in much branched cymes, forming flat-topped silvery heads. Sepals scarious, not keeled. Petals enclosed in the calyx. Capsules ovoid, 3-valved, many-seeded.

Fl. & Fr. : August- November.

Common weed in cultivated fields and wastelands; Lasara, Jolana (*Kanodia* 75582, BSI).

2. SPERGULA L.

Spergula fallax (Lowe) Krause in Sturm, Deutschl. Fl. ed 2. 2: 19. 1901; Milne-Redhead in Kew Bull. 1950: 338. 1950; Burtt & Lewis in Kew Bull. 1952 : 349. 1952. *Spergularia fallax* Lowe in Hook. f. Kew Journ. Bot. 8 : 289. 1856. *Spergula pentandra sensu* Edgew. & Hook. f. in Fl. Brit. India 1 : 243. 1874, *pro parte*, non L. 1753; Duthie, Fl. Gangetic Plain 1 : 67. 1903. '*Khandidal*' (Hindi).

Diffuse herbs, upto 40 cm high. Leaves in pseudo-whorls, linear-subulate, 2.0-3.5 cm long, fleshy, not channelled beneath. Stipules scarious, entire.