

Floristic Diversity of Udaipur Wildlife Sanctuary West Champaran District of Bihar



Submitted to

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FOREWORD

Till 1912, the state of Bihar was a part of Bengal. During 1948 and 1956 certain areas were transferred from Orissa to Bihar and from Bihar to West Bengal. In 2000, Bihar was divided into two separate states, Bihar proper and Jharkhand. Present Bihar offers a great opportunity of studying biodiversity for the Botanists and Foresters. Prior to 1863, very little attention was paid towards conservation of Forests. Historically, documentation of a rich floral assemblage of old Bihar and Orissa are available in literature. Sir J.D. Hooker (1848) was the first Botanist to study the flora of Parasnath hills, Bihar. It was in 1921-1925, when Mr. H. H. Haines did a pioneering work by publishing monumental work entitled “The Botany of Bihar and Orissa”. Forest Research Institute is fortunate that Mr. Haines served as a Forest Botanist during 1906-1907 in the then Imperial Forest Research Institute, Dehra Dun. After Haines’ work no comprehensive work has been published on flora of present Bihar State.

Udaipur Wild Life Sanctuary (UWLS) is one of the smallest wildlife sanctuaries in India, located in the Bariya Anchal of West Champaran district of Bihar state with rich floristic diversity. Till date no work has been carried out for the assessment of quantitative status of different plant species in the region. It is first time in the district that quantitative assessment of vegetation is done. Authentic identification and latest nomenclature of species for biodiversity assessment of the area have been provided. Photographs have also been provided for each species for easy identification. Medicinal plant wealth of the district has also been explored and illustrated in the report. It gives me immense pleasure in writing the foreword of this study. The authors deserve accolades for bringing out this comprehensive report.

The study will be extremely useful for the Officers and Field Staff of Bihar Forest Department for easy identification of plant species and assessing their quantitative status in the state. It may also be an important document for preparation of future working plan for the forest division as well as formulating strategies for conservation and judicious utilization of the floristic resources.

Dr. Arun Singh Rawat

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ABSTRACT

ABSTRACT

Inventorization and monitoring of biodiversity is prerequisite for conservation and sustainable use of biodiversity and its components. In the present study, floristic diversity of the Udaipur Wildlife Sanctuary of West Champaran district of Bihar was explored. Appropriate coordinating points were provided by the GIS cell of the Forest Research Institute, Dehradun for collection of vegetative data. Qualitative and quantitative data was collected sites on the basis of crown density i.e. very dense, moderately and open forest. Survey for vegetative study of forest area was carried out in pre and post monsoon period. Quantitative analysis of vegetation for frequency, density and dominance were carried out at different district following Mishra (1968). Quadrature size of 10 x 10m, 3x3m and 1x1m was kept for trees, shrubs and herbs respectively. Plant specimens were collected along with their local names from the study area and were processed and identified using taxonomic expertise. Survey of tree species growing outside the forest area viz., parks, either side of road, homestead etc was carried out. List of all the trees species alongwith their local names growing outside forest (TOF) was prepared. To know the medicinal plant wealth of the state, list of species of medicinal was prepared.

Quantitative and qualitative study was carried out to assess the floral wealth of the forest area of Udaipur Wildlife Sanctuary. It has been found that there are 258 species of flowering plants including Tree Outside Forest in the surveyed sites. Taxonomic cum pictorial description of all the flowering plants occurring in the area was done. In addition to angiosperm, enumeration of pteridophyte and gymnosperm were also carried out. With aim to easy and correct identification of species, species are arranged according to their habit viz. tree, shrub, climber and grasses alongwith their photographs. Under each habit category, species are further arranged as per Bentham and Hooker system of classifications of plants.

The status of a species is an important indicator for its conservation and sustainable utilization. Importance Value Index (IVI) is a measure of how dominant a species is in a given forest area. It is a standard tool used to inventory a forest. IVI is estimated for tree, shrubby and herbaceous layers. A high importance value indicates that species is well represented in the area. With a view to provide information of dominant species of Forest area of Nalanda district, IVI of randomly selected sites were estimated.

A total of 258 species were reported from the forest sites of Udaipur Wildlife Sanctuary. It includes 57 Dicotyledons families (170 genus, 202 species), 11 monocotyledons families (45 genus, 54 species), 1 gymnosperm (1 genus, 1 species) and 1 pteridophyte (1 genus, 1 species). Largest family reported from the area is Poaceae (27 genus, 30 species)

followed by Fabaceae (15 genus, 17 species), Caesalpiniaceae (9 genus, 12 species), Mimosaceae (6 genus, 10 species), Moraceae (4 genus, 9 species), Lamiaceae (7 genus, 8 species) Combretaceae (3 genus, 8 species), Apocynaceae (7 genus, 7 species), Euphorbiaceae (7 genus, 7 species), Cyperaceae (3 genus, 7 species) etc. Five genera viz. *Acacia*, *Bauhinia*, *Terminalia*, *Ficus* and *Cyperus* are dominant with 5 species each in the area. These are followed by *Ipomoea* and *Solanum* with 4 species each.

With aim to compare different regions and taxa, different diversity indices viz., Shannon-Wiener diversity index (H), Concentration of dominance (cd), evenness (E) and species richness (SR) for different growth forms at different sites of Udaipur Wildlife Sanctuary were estimated. In the tree layer, highest species richness was observed at near Permanent Nursery and Majharia Jungles – I (Both 21 spp.), followed by Jal Bharia (12 spp.), Majharia Jungles – II (11 spp.) and lowest was found at Balwa Rampurwa (07spp). In case of shrubby layer, highest value was found at Near Permanent Nursery (21spp.), followed by Majharia Jungles – II (18 spp.), Majharia Jungles – I (14 spp.) and lowest was found at Jal Bharia (08 spp.). Herbaceous layer had highest species richness at Near Permanent Nursery (23spp.), followed by Majharia Jungles – II (15 spp.), Balwa Rampurwa and Jal Bharia (14 spp.) and lowest value was found in Majharia Jungles – I (10 spp.).

In the tree layer, highest diversity index was estimated for Near Permanent Nursery (2.5657), followed by Majharia Jungles – I (1.9547), Jal Bharia (1.9086) and lowest at Balwa Rampurwa (1.1274). In the shrubby layer, highest diversity index value was estimated for near Permanent Nursery (2.4276), followed by Majharia Jungles – I (1.7291), Balwa Rampurwa (1.7136) and lowest at Majharia Jungles – II (1.3390). In the herbaceous layer, highest diversity index was estimated for Jal Bharia (2.4840), followed by Majharia Jungles – II (1.9551), near Permanent Nursery (1.9365) and lowest for Balwa Rampurwa (0.9420).

In the tree layer, concentration of dominance was highest in case of Balwa Rampurwa (0.4908) followed by Majharia Jungles - II (0.3799), Jal Bharia (0.2261) and lowest in case of near Permanent Nursery(0.1137). Shrubby layer had highest value of concentration of dominance at Majharia Jungle – II (0.5036), followed by Jal Bharia(0.3338), Majharia Jungles – I (0.3171) and lowest at near Permanent Nursery(0.1205). In the herbaceous layer, highest value of concentration of dominance (cd) was estimated for Balwa Rampurwa (0.6698), followed by near Permanent Nursery (0.2583), Majharia Jungles – I(0.2377) and lowest at Jal Bharia (0.0944).

In case of tree layer highest evenness value was estimated for Majharia Jungles – I (0.8896), followed by near Permanent Nursery (0.8427), Jal Bharia (0.7681) and lowest at Balwa Rampurwa (0.5784). In case of shrubby layer, highest value was observed for near Permanent Nursery (0.7974), followed by Balwa Rampurwa (0.7146), Jal Bharia (0.6931) and lowest was at Majharia Jungles – II (0.0162). In the herbaceous layer, highest value of evenness was estimated for Jal Bharia (0.9412) followed by Majharia Jungles - II(0.7219), Majharia Jungles – I(0.6893) and lowest at Balwa Rampurwa (0.3569).

A total of 17 species of medicinal plants along with their uses and vernacular names have been found in the division. Some of the medicinal plants are *Tinospora cordifolia*, *Aegle marmelos*, *Azadirachta indica*, *Phyllanthus emblica*, *T. arjuna*, *Syzygium cumini* etc. A total of 63 tree species outside forest area (TOF) alongwith their local names were reported from the district. Some of the TOF species occurring in the district are *Acacia auriculiformis*, *Albizia lebbek*, *Anthocephalus chinensis*, *Dalbergia sissoo*, *Terminalia catappa*, *Thuja orientalis* etc.

Earlier no work has been carried out for the assessment of quantitative status of different species in the region. In the present study efforts have been made to quantify the status of different species in the forest area of the division. Again it is for the first time, when floristic wealth of Udaipur Wildlife Sanctuary is carried out on the basis of quantification. The study will be extremely useful for the preparation of future working plan of the forest division.

INTRODUCTION

INTRODUCTION

Udaipur Wild Life Sanctuary (UWLS) is one of the smallest wildlife sanctuaries in India. It is located in the Bariya Anchal of West Champaran district of Bihar state, situated at a distance of about 15 km west from the district headquarter-Bettiah. Geographically it is situated within the coordinates $26^{\circ} 48' 47.1''$ and $26^{\circ} 47' 16.2''$ latitude and $84^{\circ} 25' 8.8''$ and $84^{\circ} 24' 24''$ E longitude. It has a total area of 548.75 ha. out of which 222.5 ha has been converted into plantation.

The unique feature of Udaipur Wild Life Sanctuary is its being forested wetland. There exist on ox-bow shaped lake-named Sareyaman amidst the sanctuary, surrounded by forests. This lake is believed to have been created by the meandering river Gandak, which now flows at a distance of about 3 km west of the sanctuary. The forest and the lake area were together declared as Udaipur Wildlife Sanctuary vide Environment and Forest Department, Government of Bihar notification no. S. O.-670 dated 05.05.1978 under section 18(1) of Wildlife (Protection) Act, 1972 and the final notification under section 26A of the Act were issued specifying the limits of the sanctuary vide notification no. Wildlife-20/2008-216(E) dated 17.06.2010. The terrain is almost plain with gentle slopes towards west. About 75 per cent area of sanctuary is situated around horse shoe shaped natural lake 'Sareyaman' which forms the main catchment area.

As the Sanctuary lies close to Bettiah township and is the only place for recreation nearby, it attracts a large number of visitors, specially on holidays. Some of them also visit the sanctuary for the purpose of bird watching, mainly during the migratory season in winter, i.e. from November to mid March and some for recreation throughout the year. School and college students visit the Sanctuary for collecting different information on tree species and wild animals and to study the ecosystem as a whole. They also wish to boat in the lake.

This lake is recharged by underground water of Gandak river which flows at a distance of about 6 km west of the lake. The notified sanctuary area does not have any drain falling directly into the lake. However, the rains the forested area and the adjoining agricultural fields do drain into lake recharging it to some extent during the rainy season.

The entry to the Sanctuary is from three sides-one from the eastern side near the village-Bhatwaliya through Gate No. 1. The second and third entry is from the Patarkha Naurangiya village situated on the northern side. There also exists an entry across the Saraiyaman lake near the village Majharia on the southern side.

Wetlands are characteristic assemblages of species that interact with each other and the environment. These interactions within and between the biotic and abiotic components of wetland ecosystems lead to a flow of ecological functions that provide ecosystem services to the human society. Some of the ecological functions provide direct economic benefits whereas others provide indirect support and protection to an economic activity.

UWLS is providing significant ecosystem services in terms of-

- groundwater recharge,
- erosion control,
- recreational values,
- educational value and
- aesthetic values

It performs important functions of a wetland besides being the wintering sites for few migratory birds. It is recognized as an important bird area and a centre for conservation education and recreation in the State.

Scientist of Zoological Survey of India, As per the inventory made by Dr. R.K.Sinha, Head of Department, Deptt. of Zoology, Patna University and Sri Arbind Mishra, founder of Mandar Hill Nature Club, Munger more than 100 species of birds (out of which 6 are migrants), 29 species of fish belonging to 12 families, 14 benthic, 43 zooplanktones, 9 macrophytes and more than 35 tree species are present in this small area of Sanctuary rich in bio-diversity. The area, thus, has great ecological values.

UWLS is one of the few respites from the urban conglomeration of Bettiah. The Sanctuary serves as the educational centre for the surrounding schools and colleges, important sites for the bird watching, especially during migratory season. Because of its location in the urban landscape, it attracts tourist for its recreational and aesthetic values. Visitors love boating in the Sareyaman lake.

As the lake is surrounded by forested area, no evidence of flooding has ever been recorded by the lake. Though the water level of the lake do increases by more than 60 cm during the rainy season which is mainly due to accumulation of rain water in its catchment areas and the adjoining agricultural fields. In seasons of heavy rain only, the water from the nearby Gandak river overflowing its bank reaches the lake. Hence, embankments have been constructed along the riverbank to prevent the river water from spilling over to the inhabited areas. To limit the movement to the meandering Gandak and for attracting or deflecting the flow of the river towards or away from the riverbank, several spurs have also been constructed at right angles to the riverbank, projected into the river.

Ground water is a vital resource for agriculture, domestic water supply and industry. It is also single largest and most productive source of irrigation water and plays a critical role in maintaining agricultural production during droughts. Due to fast urbanization and reduction of agricultural zone, which could have acted as the percolation zone, the replenishing of this ground water is getting difficult and the consequence of which is evident as the scarcity of water in different areas. Sprawling urbanization has already resulted in fall in ground water levels to the tune of about 3 to 5 m in some part of adjoining villages. Floodplains in the Sanctuary recharge the ground water. As a result, the mean depth of water table becomes high in the post-monsoon season. Thus, good amount of water gets trapped in the lake which ultimately helps agriculture.

A total of 29 fish species belonging to 12 families are found in the lake. Fishing is now prohibited in the Sanctuary. However, before its notification as a Sanctuary in 1978, the lake (with surrounding water bodies) were given on lease by the Forest Department for fishing which contributed significantly to the income of local people.

The villagers from the nearby areas of Sanctuary are dependent on for livestock grazing, small wood and grass extraction. A large number of livestock especially buffaloes and cows exclusively depend and get their fodder from the open areas in and around the Sanctuary throughout the year. Different plant species, which grow in Sanctuary like, *Saccharum spontaneum*, *Typha angustifolia*, are used by the local peoples for various purposes. However, no such rights have been admitted and that grazing and collection of small wood have been banned from the Sanctuary area.

The Sanctuary is surrounded by roads connecting the adjoining villages to the Block and District headquarter. The green cover of the Sanctuary helps to reduce the air pollution of the surrounding environment and traps atmospheric carbon. It also acts as a green muffler to reduce the noise pollution. The toxic pollutants of the water which enter it through the domestic and agricultural effluents are trapped by the aquatic vegetation of the Sanctuary, thus reducing the toxic load of the water.

The soil is of immature riverain type. It consists of mostly sandy loam with the depth of top soil varying from 0.3 to 2m. Below this is found pure sand which appears to be the abandoned bed of the Gandak river or its tributaries.

Climate of the area is hot during summer and pleasant in winter. The hot weather begins from the middle of March and is at its height in May when westerly winds prevail. The cold weather is ushered in November by a chilly wind, blowing from the hills and persists till January. The average annual temperature for the year 1962 has been recorded as

26°C. The rainfall is heavy, the total annual rainfall being 168 cm for the year 1962. During June, July and August maximum rain has been recorded.

Four distinct categories of vegetation are found in the area. These are 1. Deciduous forests 2. Evergreen forests 3. Vegetation in plantation and open areas and 4. Aquatic vegetation. There is no wild forest species of economic importance in the plantation and open area sites, therefore, nearly 212.5 ha. land was cleared for raising species of economic value such as Teak (*Tectona grandis*), Sal (*Shorea robusta*) and *Eucalyptus* sp.. Aquatic vegetation is found in plenty in the extensive lake, Sareyaman in the sanctuary. Common species occurring in the are *Nyphoides hydrophylla*, *Ipomoea aquatica*, *Hydrilla verticillata*, *Veronica anagallis –aquatica*, *Alternanthera sessilis*, *Polygonum barbatum*, *Ceratophyllum demersum*, *Nechamandra alternifolia*, *Ottelia alismoides*, *Calamus tenuis*, *Cyperus alopecuroides*, *Cyperus platystylis*, *Hydrorhiza aristata*, *Phragmites karka*, *Potamogeton pectinatus*, *P. nodosus*, *Najas marina*, *Typha angustifolia* etc. Details of quantification of deciduous and evergreen forest are carried out in the present study. Systematic survey on species richness and their quantification in the area are not carried out earlier. With view above, present work is carried out to assess the status of floristic wealth with emphasis on quantification of Udaipur Wildlife Sanctuary.

MATERIAL AND METHODS

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Study site

Study was conducted at the Udaipur Wildlife Sanctuary, West Champaran district of Bihar. Map of Bihar state is given in Fig.2.1. West Champaran is one of the thirty-eight districts of Bihar state, India. Udaipur Wild Life Sanctuary (UWLS) is one of the smallest wildlife sanctuaries in India. It is located in the Bariya Anchal of West Champaran district of Bihar state, situated at a distance of about 15 kms. from the district headquarter-Bettiah. Geographically it is situated within the coordinates $26^{\circ} 48' 47.1''$ and $26^{\circ} 47' 16.2''$ latitude and $84^{\circ} 25' 8.8''$ and $84^{\circ} 24' 24''$ E Longitude.



Fig.2.1 Location map of study area

Survey and vegetative data

The whole is divided into different forest types. Further, each forest type is subdivided into open, moderately dense and dense forest. Appropriate coordinating points were provided by the GIS cell of the Forest Research Institute, Dehradun for collection of vegetative data.

Qualitative and Quantitative study

Survey for vegetative study of forest area was carried out in pre and post monsoon period. Quadrate size of 10 x 10m, 3x3m and 1x1m was kept for trees, shrubs and herbs respectively. In each quadrat, g.b.h. (girth at breast height at 1.37m above ground level) of each tree was measured and recoded individually. In case of herb and shrub, diameter was measured 2.5 cm above ground level. Quantitative analysis of vegetation for frequency, density and dominance was calculated following Mishra (1968). Values of Relative frequency, density and dominance were summed to get Importance Value Index (IVI). Different biodiversity indices were estimated as given below:

S= Species Richness

Total number of species

Shannon-Wiener information function (Shannon & Wiener, 1963) was calculated using the formula:

$$H = - \sum p_i \ln p_i$$

Where p_i is (N_i/N) , N_i = Number of individuals of species i and N = Total number of individuals of all the species.

Concentration of dominance (cd) was measured by Simpson Index (Simpson, 1949).

$$Cd = \sum (p_i)^2$$

Pielou's evenness index (Pielou, 1966) was calculated using formula:

$$J = H' / \ln(S)$$

Where H' is Shannon Weiner diversity and S is the total number of species

- Plant specimens were collected along with their local names from the study area and were properly processed and identified using taxonomic expertise.
- Survey of tree species growing outside the forest area such as park, either side of road, homestead etc was carried out. List of all the trees species alongwith their local names growing outside forest (TOF) was prepared.
- To know the medicinal plant wealth of the state, list of species of medicinal importance was prepared.

SYSTEMATIC ENUMERATION OF SPECIES

TREES

SYSTEMATIC ENUMERATION OF SPECIES

Species identification is the prerequisite for the assessment of the biodiversity of any region. In the present study, plants species of forest area and tree out side forest (TOF) area were systematic enumerated through extensive survey of the area. For easy identification, firstly species were arranged on the basis of habit i.e. Trees, Shrubs, Climbers, Herbs and Grasses. It was later classified by as per the Bentham and Hooker Sytem of Classification. Systematic enumeration of species occurring in forest area of Nalanda district alongwith their phoographs is given hereunder:

TREES

DICOTYLEDONS

ANNONACEAE

MILIUSA Lesch. ex DC.

Miliusa velutina (Dunal) Hook.f. & Thoms., Fl. Ind. 151. 1855 & in Hook. f., Fl. Brit. India 1:87. 1872; Bedd., Fl. Sylv.t. 37. 1870; Bedd., Icon.t. 87. 1874; King in Ann. Roy. Bot. Gard. (Calcutta) 4: 158.t. 206. 1893; Haines, Bot. Bihar & Orissa 1:13(14).1921.

Vern. *Hiran*, *Karmota*, *Karandho*, *Karyota*

Deciduous tree; bark grey, rather cracked, often fluted; all young parts densely or villously fulvous-tomentose. *Leaves* large, broadly ellipsoid or ovate, 14-25 x 10-15 cm, more or less permanently tomentose beneath. *Flowers* green on very long drooping pedicles in few-flowered extra-axillary scorpioid cymes. *Sepals* lanceolate, 3-5 mm, scarcely hairy. Outer petals 7.5 mm; inner petals yellowish, ovate to orbicular-ovate, 10-12.5 mm. *Anther* cells contiguous connective hardly apiculate. *Ovaries* many and villous, ovules 2. *Ripe* carpels purple, ellipsoid, 1.5-2 cm, downy; fruiting peduncle woody, over 3.75 cm, often 7.5-12.5 cm.

Distribution: Uttarakhand, Bihar, Orissa, Madhya Pradesh, Malabar, Pegu.



POLYALTHIA Bl.

Polyalthia longifolia (Sonn.) Thw. Enum. 398.1864; Bedd. Fl. Sylv. t. 38. 1870; Hook.f. & Thoms. in Hook.f., Fl. Brit. India 1:62.1872; King, Ann. Roy. Bot. Gard. (Calcutta) 4:72.t.99.1893; Haines, Bot. Bihar & Orissa 1:12(12).1921; Sinclair, Gard. Bull. Straits Settle. 14:322.1955. *Uvaria longifolia* Sonn. Voy. Ind. 2:223.t.131.1782; Bedd. Icon. t.38.1868-1874. *Guatteria longifolia* Wall. Cat. 6442.1832; Wight, Icon. t.1. 1838.

Tall evergreen tree; young branches slender glabrous. *Leaves* narrowly lanceolate, 7.5-22 x 1.8-3.75 cm,



shining, glabrous, margin undulate, apex long-acuminate; petiole ca 6 mm. *Flowers* yellowish-green, 2-3 across, fascicled or in shortly peduncled umbels; sometimes racemed on short special lateral branches or elongated tubercles, pedicels slender, 2.5-3.75 cm long with small, pubescent, deciduous bract about the middle. *Sepals* triangular, acuminate, spreading, subequal, 0.75-1.25 cm long. *Ripe* carpels ovoid, 1.8-2 cm long, 8-10 or more in a cluster, stalked, glabrous; stalk 1-1.25 cm long stout, glabrous. *Seeds* smooth, shining.

Distribution: Cultivated throughout India. Native of Sri Lanka.

COCHLOSPERMACEAE

COCHLOSPERMUM Kunth ex DC.

Cochlospermum religiosum (L.) Alston, Handb. Fl. Ceyl. 6: 14. 1931; Balakrishnan in Fl. India 2:380. 1993. *Bombax religiosum* L., Sp. Pl. 552. 1753. *C. gossypium* DC., Prodr. 1: 527. 1824; Hook.f. & Thom. in Hook.f., Fl. Brit. India 1: 190. 1872; Haines, Bot. Bih. & Or. 34. 1921.

Vern. *Atigalgal*, *Galgol*, *Galgalla*, *Konar*

Shrubs or trees, up to 10 m tall, often with crooked branches, more or less deciduous. *Leaves* orbicular in outline, 7 – 20 cm in diam., 3 – 5-lobed to more than half-way down, cordate and 5 – 7-nerved at base, pubescent to subtomentose beneath; lobes undulate or obscurely crenate along margins, acuminate at apex; mid lobed 5 – 11 x 1 – 9 cm; petioles articulate, 8 – 25 cm long; stipules linear-subulate, 5 – 10 mm long, hairy, caducous. *Flowers* greenish yellow, up to 8 cm across, in terminal racemes or loosely arranged panicles, short hairy, one flower opening at a time on each branch; pedicels 2 – 3 cm long; bracts triangular, acute, 4 – 5 mm broad at base, caducous. *Sepals* deltoid-ovate, acute, 2 – 2.5 x 1 – 2 cm, hairy, partly puplish, caducous. *Petals* obovate, notched at apex, 3 – 6 x 2 – 3 cm, yellow, with distinct odour, thickened at base. *Stamens* slightly S-curved, unequal; filaments ca 1 cm long, yellow; anthers orange, linear, falcate, ca 5 x 5 – 10 cm long, 2.5 – 8 cm broad; valves 5, striate-ribbed. *Seeds* reniform to cochleate, 5 – 6 mm across, brown, woolly.



Distribution: India: Uttarakhand, Uttar Pradesh, Madhya Pradesh, Bihar, Orissa, Maharashtra. Sri Lanka, Vietnam, Cambodia, Thailand, Malaysia, Indonesia and Philippines.

FLACORTIACEAE

CASEARIA Jacq.

Casearia graveolens Dalz. in Hooker's J. Bot. Kew Gard. Misc. 4:107. 1852; Clarke in Hook.f., Fl. Brit. India 2:592. 1879; Haines, Bot. Bihar & Orissa 1:39(40).1921.

Vern. *Dair*

Large shrub or small tree; twigs glabrous. *Leaves* elliptic, elliptic-oblong or ovate, 5-20 x 3-8.5 cm, round or obtuse at base, more or less crenate-serrate (or entire), acute, shortly acuminate or sometimes obtuse or rounded



at apex, glabrous, prominently reticulate; petiole 0.6-1.6 cm. *Flowers* greenish, small, in dense clusters, villous. *Capsule* yellow, smooth, shining, broadly ellipsoid to broadly oblong, 0.8-2.5 cm. *Seeds* ovoid, compressed, with a scarlet aril.

Distribution: Himalayas, upto 1500 m; Deccan Peninsula, Myanmar.

Casearia tomentosa Roxb., Fl. Ind. 2:421. 1832; Clarke in Hook.f., Fl. Brit. India 2:593. 1879; Haines, Bot. Bihar & Orissa 1:39(40). 1921; Anon. Drawing Ind. Pl. (Icon.Roxb.No.147)7:t. 25. 1976. *C. elliptica* Willd., Sp. Pl. 2:628. 1799; Wight, Icon. t. 1849. 1852.

Vern. *Bari, Churchu, Kanair, Kanal, Kanali, Kanar*

Shrubs or small trees, up to 8 m tall; younger parts sometimes velutinous tomentose. *Leaves* ovate-lanceolate, usually rounded, rarely cuneate or subtruncate and always somewhat oblique at base, obtuse or obtusely short acuminate at apex, coarsely but distantly serrate or crenate to subentire, 5 – 22 x 2.5 – 8.5 cm, subcoriaceous when mature, sparsely but softly pubescent to velvety tomentose (usually more dense along midrib and beneath) or glossy and glabrescent. *Flowers* greenish white, few or numerous in dense axillary glomerules. *Calyx* broadly elliptic, densely to sparsely so inside. *Stamens* 8. *Ovary* ovoid, ca 1 mm long, glabrous; style short; stigma discoid. *Capsules* 1.5 – 2.8 cm long, ellipsoid.



Distribution: Throughout India, ascending to 1200 m. Sri Lanka, Malaysia Islands and N. Australia.

FLACOURTIA L'Herit.

Flacourtia indica (Burm.f.) Merr., Interpr. Ramph. Herb. Amb. 377. 1917; Sleumer in Steenis, Fl. Males. I. 5: 76.1954. *Gmelina indica* Burm.f., Fl. Ind. 132.t.39.f.5.1768. *Flacourtia ramontchi* L' Herit., Strip. Nov. 3.59.t.30. 1785; Wight, Icon.t. 85. 1838; Hook.f. & Thoms. in Hook.f., Fl. Brit. India 1:193.1872; Haines, Bot. Bihar & Orissa 1:36(38). 1921. *F. sapida* Roxb., Pl. Corom.t.69.1796. *F. sepiaria* Roxb., Pl. Corom.t. 68. 1796 & Fl. Ind. 3:835. 1832; Hook.f. & Thoms.in Hook.f., Fl. Brit. India. 1:94. 1872; Haines, Bot. Bihar & Orissa. 1:36(37). 1921.

Vern. *Bahicha, Bhaincha, Katai*

Deciduous (or evergreen), polymorphous shrub or small tree with straight sharp thorns, 1.5-5 cm long or the older branches often unarmed; thorns sometimes branched; twigs pubescent. *Leaves* alternate or clustered, variable in form, size, texture and indumentum, mostly obovate or ovate to elliptic, rarely oblong or oblanceolate, 1.25-8 x 0.7-5 cm, coarsely crenate, especially towards apex, apex obtuse, rounded or subacute, glabrous on both sides. *Flowers* yellowish, 5 mm across, solitary or in short, often pubescent, few-flowered racemes, axillary or terminating short lateral, 3-4-leaved twigs which are sometimes transformed into woody thorns; pedicels pubescent or sometimes glabrous or puberulous, 3-



5(-7) mm. *Sepals* ovate, 1.5 mm, obtuse, mostly nearly glabrous on their back, densely hairy at the margin and inside. *Male flowers*: Discs slightly lobulate or crenate. *Female flowers*: Disc entire or nearly so. ovary globular with 4-7, almost free styles; stigmas slightly bilobed. *Fruit* globose to ellipsoid, 0.7-1 cm diam, ripening dull to blackish red. *Seeds* 5-8.

Distribution: Throughout India upto 1350m. Africa, S.E. Asia, Polynesia.

DIPTEROCARPACEAE

SHOREA Roxb. ex Gaertn.

Shorea robusta Gaertn.f., Fruct.3:48 t. 186. 1805; Roxb., Pl. Corom. t. 212. 1811; Bedd., Fl. Sylv. t. 4. 1869; Dyer in Hook. f., Fl. Brit. India 1:306. 1874; Haines, Bot. Bihar & Orissa 1:56(58). 1921.

Vern. *Sakhua*, *Sal*

Trees, 10-25 m or sometimes upto 45 m; bark dark brown to greyish-brown, conspicuously vertically fissured. *Leaves* ovate or ovate-oblong, mostly 10-25 x 5-15 cm, entire or somewhat undulate, acute to shortly bluntly acuminate, coriaceous, shining, glabrous, lateral veins 11-16 pairs, base rounded or sub-cordate; petiole 1.2-2.5 cm, pubescent or puberulous; stipules falcate, 6-12 mm, covering the young buds, pubescent. *Panicles* upto 20 cm long, pubescent or tomentose; racemes 4-6-flowered; bracts about 1 cm long, deciduous. *Flowers* white to cream ca. 1.5 cm across, shortly pedicelled; pedicels 2-5 mm long; bracteoles minute or 0. *Sepals* ovate, 2-3 mm long, acute to obtuse, pubescent outside, glabrous within. *Petals* lanceolate to acuminate 1-1.3 cm long, the acumen twisted. *Stamens* 30-32 (50); anthers hairy at the tip, appendages bearded; filaments broadened at base. *Fruit* ovoid, 1.3 cm, beaked with the style; wings linear-oblong or spatulate, 5-10 cm, subequal, three larger, usually obtuse, pubescent.



Distribution: Western Himalaya, Assam, Eastern districts of Central India, Uttar Pradesh, West Bengal. Orissa, Andhra Pradesh.

BOMBACACEAE

BOMBAX L.

Bombax ceiba L., Sp. Pl. 511. 1753, pro parte, quoad plantas asiaticas, excl. syn.; Nicolson in Taxon 28:367-73. 1979; Robyns in Dassan & Fosberg, Rev. Handb. Fl. Ceylon 1:64. 1980. *Salimalia malabarica* (DC.) Schott & Endl., Melet. Bot. 35. 1832. *Bombax malabarica* DC., Prod. 1:479. 1824; Master in Hook. f., Fl. Brit. India 1:349. 1974; Haines, Bot. Bihar & Orissa 1:74(77). 1921.

Vern. *Semal*



Tree with prickly trunk and branches when young; branchlets warty. *Leaves* 5-7-foliolate; petiole 7.5-17 cm; leaflets elliptic, 5.5-12 x 1.5-4.5 cm, the terminal one largest, entire, acuminate, base subacute or cuneate, glabrous to tufted-puberulous especially along the nerves; petiolule 0.8-2.5 cm. *Flowers* bright red or yellow, 10-12 cm across, on leaflets branchlets; pedicel stout, 1-1.5 cm, calyx thick, cupuliform, more or less 2-5-lobed, 2.2-5.2 cm across, glabrescent without, densely sericeous within; lobes 3-5, broadly ovate. *Petals* oblong or obovate, 4.7-11 x 7-4.5 cm, round-obtuse, stellate-pubescent without, puberulous within. *Receptacle* glandular. *Capsule* oblong to ovoid, 12-16 x 6-7 cm. *Seeds* more or less pyriform, ca.5 mm long.

Distribution: Throughout India, ascending to 1800 m. Tropical Asia, extending eastwards to New Guinea.

CEIBA Mill

Ceiba pentandra (L.) Gaertn., Fruct. Sem, 2:224.t. 133. 1791; Robyns in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 1:70.1980. *Bombax pentandra* L., Sp. Pl. 511.1753. *Eriodendron pentandrum* (L.) Kurz. J. Asiat. Soc. Bengal pt. 2.Nat.Hist. 43:113. 1874. *E.anfractuosum* DC., Prod. 1:479. 1824; Wight, Icon. t.400. 1840; Bedd. Fl. Sylv.t.4.f.2. 1871; Master in Hook.f., Fl. Brit. India 1:350.1874.

Leaves 5-9-foliolate; petiole 6-20 cm; leaflets mostly oblanceolate, elliptic or oblong, 4.5-15 x 1-5 cm, entire, subacute to acuminate, base obtuse-cuneate; petiolule 0.5-1 cm. *Flowers* white; pedicels 2.5-4 cm. *Calyx* green, campanulate, 1-1.2 cm long, glabrous without, softly sericeous within. *Petals* obovate. *Capsule* ellipsoid to fusiform, 12 x 4 cm, narrowed at both ends, valves with silky fibres. *Seeds* brown to blackish, subglobose, 5-7 mm diam. glabrous.



Distribution: Throughout the hotter parts of India. Pantropical.

MALVACEAE

KYDIA Roxb.

Kydia calycina Roxb., Pl. Corom.t.215. 1811; Wight, Icon.t. 879-80. 1844-45, pro parte; Bedd., Fl. Sylv.t.3.f. 5.1869; Master in Hook.f., Fl. Brit. India 1: 348. 1874; Haines, Bot.Bihar & Orissa 1:73(76). 1921; Anon., Draw.Ind.Pl. (Icon.Roxb. No.673). t.6. 1968; Paul & Nayar, Fasc. Fl. India 19:160. 1988. *K.roxburghiana* Wight, Icon.t. 881. 1844-45. *K.fraterna* Roxb., Pl. Corom.t.216.1811.

Vern. *Banpatua*

Moderate-sized tree. *Leaves* suborbicular or ovate-rounded, 10-15 cm diam., sinuate-angled or somewhat lobed, rounded or subcordate at base, entire or irregularly serrate,



acute or obtuse or more or less trior penta-cuspidate, stellate-hispid above, greyish stellate pubescent beneath, 5-7-nerved at base, with a large gland on 1-3 of the nerves beneath; petiole 2.7 cm, densely stellate pubescent; stipules subulate. *Pedice* 0.5-1/5 cm, densely stellate pubescent. *Epicalyx* segments 4-6, connate below, oblong or oblong-spathulate, 5-7 mm long, stellate pubescent, persistent. *Corolla* white, 1.7 cm across; longer than calyx but shorter than epicalyx. Staminal column ca. 3 mm long; pistillode absent in male flower. *Capsule* subglobose, ca. 5-6 mm across, hard, covered with stellate hairs. *Seeds* brown, reniform-ellipsoid, 2-3 mm across, glabrous, glandular striate.

Distribution: Throughout India. Pakistan, Myanmar, China.

STERCULIACEAE

ERIOILAENA DC.

Eriolaena hookeriana Wight & Arn. Prod. 70.1834; Bedd. Fl. Sylv. t. 5. f. 2.1871; Mast. in Hook.f., Fl. Brit. India 1:370. 1874; Haines, Bot. Bihar & Orissa 1:81(84). 1921.

Shrub or small tree, upto 4 m; young shoots densely stellately scaly. *Leaves* broadly ovate, 10-15 cm across cordate, crenate or dentate, acuminate, stellate tomentose beneath, glabrescent above base 5-7-nerved; petiole 2.5-6.5 cm, rather stout. *Flowers* yellow, 3.7-5 cm across, 1-few on axillary or extra-axillary long peduncle; bracteoles lancinate, pinnatisect, 0.75-1.25 cm, usually deciduous. *Buds* ovoid, beaked by the tips of valvate, tomentose sepals. *Sepals* linear-lanceolate, 1.5-2 cm, pubescent outside, stellate tomentose and with pairs of basal glands inside. *Petals* obovate, claw densely pubescent within. *Capsule* ovoid, 2.5-3 cm long, corrugate or tubercled; 8-10-valved.



Distribution: Peninsular India, Bihar, Uttar Pradesh, West Bengal and Assam.

HELECTERES L.

Helicteres isora L., Sp. Pl. 963. 1753; Master in Hook.f., Fl. Brit. India 1: 365. 1874; Haines, Bot. Bihar & Orissa 78. 1921; Malick in Fl. India 3:426. 1993.

Vern. *Aintha*

Large shrubs or small trees, 3 – 8 m tall. *Leaves* 10 – 23 x 11 – 17 cm, broadly elliptic, elliptic-obovate, ovate-cordate, rounded-cordate or suborbicular, slightly obliquely cordate at base, shortly acuminate at apex, often 3-lobed. *Flowers* axillary, solitary or in clusters, often supra-axillary. *Calyx* gibbous, laterally compressed, somewhat 2-lipped. *Petals* crimson, reflexed, 2 lower shorter and broader than the 3 upper ones, claws winged. *Staminal* tube slightly bent on one side at the tip, exserted; stamens 10, surrounding ovary and alternating in pairs with 5 minute scaly staminodes attached to the stamina tube. *Ovary* 5-lobed;



styles united, as long as the ovary, deflexed. *Follicles* 4-8 x 0.5-1 cm. cylindrical, spirally twisted with an apical beak, up to 1 cm long on 2.5 cm long and androgynophore. *Seeds* many, 2 mm long, angular, wrinkled, tomentose.

Distribution: Widely distributed in India, Malaysia, Sri Lanka, Java, Australia.

STERCULIA L.

Sterculia urens Roxb., Pl. Coram. 1:25.t.24.1795; Master in Hook.f., Fl. Brit. India 1:355.1874; Haines, Bot.Bihar & Orissa 1:76(79). 1921.

Vern. *Kainji, Kaunj, Koni, Koniya, Konjia, Pirojee, Sakrai*

Moderate-sized tree; bark papery. *Leaves* orbicular-cordate, palmately 5-lobed, 15-40 cm diam., glabrous above when mature, tomentose beneath; lobes entire, caudate; petiole 12-30 cm long. *Panicles* axillary and terminal, 10-18 cm, densely viscid-pubescent. *Flowers* reddish-brown, 4mm across. Male flowers; *Calyx* 5-lobed, tomentose outside, greenish inside. Gynandrophore included within the calyx. *Stamens* 10. *Ovary* globose. *Follicles* 4-5, ovoid-oblong, 2-5 cm long, densely hairy. *Seeds* dark, oblong.



Distribution: Warmer parts of India. Myanmar, Malay Peninsula, Philippines.

TILIACEAE

GREWIA L.

Grewia asiatica L., Mant. Pl. 122. 1767; Master in Hook.f., Fl. Brit. India 1: 386. 1874 excl. var. *vestita*; Daniel & Chandrabose in Fl. india 3:494. 1993. *G. subinaequalis* DC., Prodr. 1: 511. 1824. *G. hainesiana* Hole in Ind. For. 43: 126. 1917; Haines, Bot. Bih. & Or. 94. 1921. Vern. *Phalsa*

Small trees or shrubs. *Leaves* 5 – 19 x 4 – 15 cm, broadly ovate or suborbicular, obliquely cordate or rounded at base, acute or acuminate at apex, crenate, scabrous above, tomentose beneath, 5 – 7-nerved; petioles up to 1.8 cm long. *Flowers* in axillary, umbellate cymes; peduncles up to 1 cm long. *Sepals* 6 -12 x 2 – 3 mm, oblong-lanceolate or oblanceolate, tomentose. *Petals* yellow, 3 – 7 x 1.5 – 3 mm, oblong-obovate or linear-oblong, obtuse; glands ca 1 x 0.7 mm, obovoid. *Stamens* numerous; filaments 4 – 6 mm long. *Ovary* 1.5 – 2.5 x 1 – 1.5 mm, ovoid, villous; stigma 4-lobed. *Drupe*s 7 – 12 mm across, subglobose, obscurely lobed, red or purple, pilose.



Distribution: Throughout India: also cultivated. Bangladesh and Sri Lanka.

RUTACEAE

AEGLE Corr.

Aegle marmelos (L.) Corr. in Trans. Linn. Soc. London 5:223. 1800; Hook.f., Fl. Brit.India 1:516.1875; Haines, Bot. Bihar & Orissa 1:167(173). 1921; Stone in Dassan & Fosberg, Rev. Handb.Fl. Ceylon 5:414.1985. *Crateva marmelos* L., Sp. Pl. 444, 1753.

Vern. *Bel*

Small or medium-sized tree; spines 1-2, axillary, strong; leaflets ovate, ovate-lanceolate or elliptic, 5-10 x 2.5-3.5 cm, terminal one larger, entire or crenulate, acuminate or obtuse, glabrous, base cuneate or rounded. *Petiole* 2.5-6.5 cm. *Flowers* white or greenish-white, 2-5 cm across, in very numerous lateral and subterminal simple panicles, 3.7-7.5 cm long, appearing with the new leaves. *Berry* globose or ovoid, woody, 5-7.5 cm diam. (larger in cultivated forms). *Seeds* embedded in a clear mucilage and yellow, sweetly aromatic pulp.



Distribution: Throughout the greater part of India, wild or cultivated. Sri Lanka, Myanmar, Indo-China. Cultivated in S.E. Asia, Malaysia and a few other tropical countries.

MURRAYA Koenig ex L.

Murraya paniculata (L.) Jack, Malayan Misc. 1(5):31. 1820; Stone in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 5:459.1985. *Chalcas paniculata* L., Mant. Pl. 168. 1767. t. 96. 1838; Bedd., Fl.Sylv.t. 7.f.2.1870; Hook.f., Fl. Brit. India 1:502.1875; Haines, Bot.Bihar & Orissa 1:164(170). 1921.

Vern. *Pitjhi*

Shrub or small tree. Leaves 10-12.5 cm long; leaflets 3-9, alternate, ovate, ovate-elliptic, or rhomboid, 1.8-5 x 1-2.5 cm; terminal one the largest, entire or sometimes obscurely crenulate, acute, acuminate or obtuse, glabrous, shining, dark-green, symmetrical or subsymmetrical. *Flowers* white, fragrant, in few-flowered axillary or terminal cymes. *Petals* oblong-lanceolate or elliptic, 1.2-1.5 cm long, subobtus. *Ovary* 2-celled. *Berry* red or yellow, ellipsoid, 1.2-1.8 cm long, apiculate, 1-2-seeded, seated on the persistent calyx.



Distribution: Outer Himalaya, upto 1350m; Bihar; S. India; cultivated throughout India. Sri Lanka, SE. Asia, Australia.

NARINGI Adanson

Naringi crenulata (Roxb.) Nicolson in C.J. Saldanha & Nicolson, Fl. Hassan Dist. 387. 1976; Nair & Nayar in Fl. India 4: 302. 1997. *Limonia crenulata* Roxb., Pl. Coromandel 1: 60, t. 86. 1798. *Hesperuthusa crenulata* (Roxb.) M. Roemer, Syn. Mon. Hesper. 1: 38. 1846. *Limonia acidissima* auct. non L. 1762: Hook.f., Fl. Brit. India 1: 507. 1875; Haines, Bot. Bihar & Orissa 1:163.1921.

Vern. *Gaira*

Small trees, up to 10 m high, spines solitary or in pairs, bark corky, rugose, grey-brownish. *Leaves* alternate, imparipinnate, to 15 cm long; petioles and rachis marginate or narrowly winged; leaflets usually 5 or 7, rarely also 3 on the same branchlets, opposite, sessile, ovate, elliptic or oblanceolate, oblique and acute at base, obtuse and emarginated at apex, crenulate or irregularly serrulate along margins, 1 – 5 x 1 – 2 cm, profusely pellucid-gland-dotted; glands dimorphic, often raised and prominent on both surfaces. *Inflorescences* axillary or sometimes terminal on short leafy branchlets, subumbellate racemes. *Flowers* bisexual. *Sepals* 4, ovate-orbicular or deltate, glandular. *Petals* 4, elliptic or oblong, obtuse, profusely glandular, white. *Stamens* 8, subequal or alternately shorter and longer. *Ovary* subovoid, 4-locular; each locule with a single ovule. *Berries* semidry, globose, bluish-black when ripe, to 1 cm across, glandular, 1-4-seeded; seeds oblong, 3 – 5 mm across, brownish, shiny.



Distribution: India: Moist deciduous forests of peninsular India and sub – Himalayan tracts of N.W. India, up to 1200 m. Sri Lanka, Pakistan, Myanmar, Bhutan, Bangladesh, S.W. China, Indochina, Thailand and Java.

SIMARUBIACEAE

AILANTHUS Desf.

Ailanthus excelsa Roxb., Pl. Corom.t.23.1795 & Fl. Ind. 2:450.1832; Wight, Ill.t. 67. 1840; Bennett in Hook. f., Fl. Brit. India 1:518.1875; Haines, Bot.Bihar & Orissa 1:169(174). 1921; Nooteb.in Steenis, Fl. Males.I. 6:219.1962; Basak, Fasc. Fl. India 4:4.1980.

Large tree; bark light-coloured; branchlets hoary tomentose, with large leaf-scars. *Leaves* large, pinnate, 60-90 cm long; rachis hoary tomentose; leaflets 10-13 pairs, variable in shape, often ovate, 8.5-15 x 5-7.5 cm, very coarsely toothed, acute or acuminate, densely pubescent beneath and pubescent above when young, secondary nerves 12-20, base very oblique; petiolule 1.5-5 cm, with two hairy glands near the base, and sometimes in place of the lowest leaflets also. *Flowers* yellowish in large panicles. *Ovary* hairy. *Samaras* often solitary, linear-oblong to lanceolate, 4-5(6) x 1-1.5 cm, strongly nerves, once or twice twisted at base.



Distribution: Widely distributed in India, both as wild and cultivated. Sri Lanka, Pakistan.

ANTHOCEPHALUS A.Rich.

Anthocephalus chinensis (Lamk.) A.Rich. ex Walp., Rep. 2:461. 1843. *Cephalanthus chinensis* Lamk., Encycl. Meth. Bot. 1:678. 1785. *Anthocephalus indicus* A. Rich. in Mem. Soc. Hist. Nat. Park 5:238. 1834. *A. cadamba* (Roxb.) Miq., Fl. Ind. Bat. 2:135. 1856; Hook.f., Fl. Brit. India 3:23. 1880. *Neolamarckia cadamba* (Roxb.) Boisser in Bull. Mus. Nat. B. Adansonia ser. t. 6. 1984. N. 1:247. 1984. *Nauclea cadamba* Roxb., Fl. Ind. ed. 1(2): 121. 1824.

A large deciduous tree of rapid growth; bark grey, smooth in young trees, becoming darker and fissured with age, exfoliating in small rectangular plates; blaze yellowish-brown. *Leaves* broadly ovate, decussate, 7.5-18 x 4.5-11 cm, acute or shortly acuminate, rounded or sometimes subcordate at the base, shining above, pubescent beneath; lateral nerves 10 pairs; petioles 1-2.5 cm; stipules linear, early caducous. *Flowers* yellow, in solitary, terminal heads, 3.5-5 cm across. Calyx-lobes 5 mm, erect, linear, obtuse, hairy outside about the middle, persistent. Corolla-lobes lanceolate, acute, erect imbricate in bud; tube 1 cm, slender, dilated upwards. *Stamens* 5. Styles and stigmas white; ovaries not confluent. *Fruit* a fleshy, globose, orange receptacle, on which inserted numerous closely packed, compressed, angular, few-seeded capsules with the persistent calyx-lobes. *Seeds* not winged, mucinate.



Distribution: Throughout India, often cultivated. Sri Lanka, Sumatra, Borneo.

BURSERACEAE

BOSWELLIA Roxb. ex Colebr.

Boswellia serrata Roxb. ex Colebr. in Asiat. Res. 9: 379. t.5.1807; Bennett in Hook.f., Fl. Brit. India 1: 528. 1875; Haines, Bot. Bihar & Orissa 170. 1921; Chitra & Henry in Fl. India 4:432. 1997. *B. serrata* Roxb. ex Colebr. var. *glabra* (Roxb.) Bennett in Hook.f., Fl. Brit. India 1: 528. 1875. *B. glabra* Roxb., Pl. Coromandel 3: t. 207. 1811.

Vern. *Salai* or *Salaia*.

Trees; 6-20 m high; branchlets with annular swelling at intervals. *Leaves* 15.5-44 cm long; leaflets 8-23, variable in size, shape and degree of pubescence (sometimes the lowermost pair much smaller than the others, ovate-lanceolate, oblong-ovate or elliptic, 0.8 – 9.4 x 0.4 – 3.5 cm, coriaceous, oblique, cuneate, rounded at base, crenate-serrate, sometimes entire or repand along margins, acute, obtuse or retuse, mucronate at apex. *Panicles* axillary, up to 21 cm long. *Flowers* pink, or white with pinkish tinge, fragrant. *Calyx* tube broadly campanulate; calyx-lobes triangular-ovate, pubescent, persistent. *Petals* ovate-oblong, shortly clawed, obtuse, inflexed at apex. glabrous, pubescent or puberulous; anther lobes oblong. *Stigma* capitate. *Capsules* 3-gonous, 1.2 – 2.4 x 1 – 1.4 cm.



Distribution: India: On dry hills and slopes, on gravelly soils at altitudes 274 – 900 m. Punjab, Uttar Pradesh, Madhya Pradesh, Rajasthan, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu. Endemic.

GARUGA Roxb.

Garuga pinnata Roxb., Pl. Corom.t. 208.1811 & Fl. Ind. 2:400.1832; Bennett in Hook.f., Fl. Brit.India 1:528. 1875; Haines, Bot.Bihar & Orissa 1:170(176). 1921; Kalkman in Blumea 7:468. 1953.

Vern. *Jingra*, *Kanaikar*, *Nimiti*

Tree; bark grey, smooth or flaky. *Leaves* 30-45 cm; leaflets 8-16 pairs, sessile or shortly petiolulate, ovate-lanceolate or oblong, 3-12x2.5-4.5 cm, crenate or crenate-serrate, acuminate or caudate, hairy both sides, secondary nerves 12-16; lowest pair of leaflets usually very short and reflexed. *Panicles* 10-15 cm long, tomentose, from the leaf-scars at the tips of the branches, borne when the tree is leafless. *Flowers* yellow, campanulate, 5-6 mm long. *Calyx-tube* hairy, sepals half as long as the petals. *Petals* linear-oblong. *Filaments* hairy. *Drupe* globose, 1.7 cm diam., yellowish-green, with 2-4, rarely 5 pyrenes.



Distribution: Throughout India. SE. Continental Asia, Bangladesh, Myanmar, S.China, Thailand, Indo-China.

MELIACEAE

AZADIRACHTA A. Juss.

Azadirachta indica A Juss., Mem. Mus.Hist. Nat. 19:221.t.2.f. 5. 1832; Haines, Bot. Bihar & Orissa 1:176(182). 1921. *Melia azadirachta* L., Sp. Pl. 385.1753; Hiern in Hook. f., Fl. Brit. India 1:544. 1875.

Vern. *Neem*

Tree. *Leaves* pinnate, 20-38 cm; leaflets 5-9 pairs, obliquely lanceolate, 2.5-7.5 x 1.2-3.7 cm, inequilateral, sometimes falcate, serrate, acuminate, glabrous, base cuneate, oblique; petiolules 2 mm. *Flowers* white, fragrant, 7.5 mm across, branched, glabrous, axillary panicles shorter than leaves. *Staminal-tube* 5 mm long, little shorter than petals, toothed at apex; anthers. *Drupe* ellipsoid, 1.2-1.8 cm long, yellow, glabrous, 1-celled, 1-seeded.



Distribution: Cultivated and naturalized throughout India and many other tropical countries. Native of India, Myanmar.

MELIA L.

Melia azedarach L., Sp. Pl. 384. 1753; Wight, Icon t. 160. 1839; Bedd., Fl. Sylv. t. 13. 1869; Hiern in Hook. f., Fl. Brit. India 1.544. 1875; Haines, Bot. Bihar & Orissa 1:177(183). 1921.

Vern. *Bakain*

Small or medium-sized tree; bark thick and deeply fluted in old trees, smooth in young. *Leaves* mostly 3-pinnate, upto 60 cm long; pinnae upto 30 cm long; secondary pinnae 1-3-foliolate; leaflets 1-5 pairs, opposite ovate-lanceolate to lanceolate, 1.5-6.5 x 1.5-3.5 cm, serrate or gashed, acuminate, glabrescent. *Flowers* lilac, 6-8 mm long. Staminal tube, purple. *Drupe* yellowish, ellipsoid, 1.2-1.8 x 1-1.3 cm, with very hard endocarp.



Distribution: Commonly cultivated in India; wild in sub-Himalayan tract, upto 900 m Myanmar, Pakistan, China, Iran, Turkey.

SOYMIDA A.Juss.

Soymida febrifuga (Roxb.) A. Juss. in Mem. Mus. Hist. Nat. 19: 251. 1830; Hiern in Hook. f., Fl. Brit. India 1: 567. 1875; Haines, Bot. Bihar & Orissa 175. 1921; Jain & Bennet in Fl. India 4:501. 1997. *Swietenia febrifuga* Roxb., Pl. Coromandel t. 17. 1795.

Vern. *Ractrohan*, *Rohna*, *Rohina*

Large tree with tall, straight trunk and thick bluish grey or brown bark; branches with leaf scars. *Leaves* paripinnate, 25-50 cm long; rachis 6-12 cm long; leaflets 3-6 pairs, subopposite or alternate, ovate-oblong, rounded, inequilateral at base, entire or coarsely crenate-serrate along margins, obtuse at apex, 6 – 20 x 4 – 12 cm, coriaceous; secondary nerves 8 – 20 on each side; petiolules to 1 cm long, sometimes leaflets almost sessile. *Flowers* ca 1 cm across, greenish white. *Calyx* 5-lobed; lobes ovate, pubescent, imbricate. *Petals* 5, obovate, notched at apex, ca 5 mm long, pubescent outside. *Staminal* tube cup-shaped, less than half as long as petal; anthers 10. *Ovary* glabrous. *Capsules* smooth, 2.5 – 6.5 cm long, black when ripe; seeds to 5 cm long including wings.

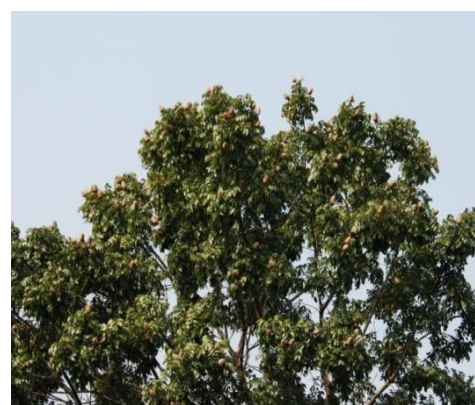


Distribution: India: Uttar Pradesh, Bihar, Orissa, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Andhra Pradesh, Karnatka, Tamil Nadu and Kerala. Sri Lanka.

SWIETENIA Jacq.

Swietenia macrophylla King in Hook. Icon. Pl. t. 1550. 1886; Haines, Bot. Bihar & Orissa 1:175(180).1921; Panig. & Mishra, Indian J. For 11:139.1988.

Large tree; bark brown. *Leaves* ca 20 cm long; leaflets usually 4 pairs, lanceolate or ovate-lanceolate, 6-15 x 3-5 cm, subfalcate, acuminate or abruptly, inequilateral, glabrous, secondary nerves 8-12, base



oblique; petiolate to 1 cm. *Flowers* greenish, 0.7-1 cm across, sweet scented, in narrow, supracillary panicles, ca 8.5-12.5 cm long. *Petals* oblong, 3.7 mm. Staminal-tube cream. *Disc* red. *Capsule* inverted, club-shaped, erect, 10-15 cm long. *Seeds* to 6 cm, winged.

Distribution: Native of Honduras, now widely cultivated in the tropics.

CELASTRACEAE

CASSINE L.

Cassine glauca (Rottb.) Kuntze, Rev. Gen. Pl. 1:114. 1891; Ding Hou in Steenis, Fl. Males. I. 6. 286. 1962. *Mangifera glauca* Rottb., Nye Saml. Kongel. Danske Vidensk. Selsk. Skr. 2:534.f. 4.6.1783. *Elaeodendron glaucum* (Rottl.) Pers., Syn. Pl. 1:241. 1805; Lawson in Hook.f., Fl. Brit. India 1:623, pro parte; Haines, Bot. Bihar & Orissa 1:189(196). 1921. *E. roxburghii* Wight & Arn., Prod. 157. 1834; Wight, Ill.t.71. 1840; Bedd., Fl. Sylv.t.148. 1871.

Vern. *Khaura*, *Thanki*

Small tree; bark grey, nearly smooth. *Leaves* ovate to obovate, 5-15 x 2.5-7.5 cm, crenate or serrulate, acute, acuminate or obtuse, glabrous; petiole 0.5-2.5 cm. *Cymes* lateral, corymbose, 5-10 cm diam., peduncle long. *Flowers* greenish-white or brownish, small. Sepals orbicular, un-equal. *Petals* oblong, 3.7 mm long, dorsally pubescent. *Stamens* on the lobes of the disc, straight, ascending, finally spreading and recurved. *Drupe* oblong or obovoid, 1.2 cm long.



Distribution: Throughout India, ascending to 1800 m. Sri Lanka, Indo-China, Thailand, Indonesia, Malaya, Philippines.

RHAMNACEAE

ZIZIPHUS Tourn. ex Mill.

Ziziphus mauritiana Lam., Encycl. 3:319. 1989 var. **mauritiana**; Bhandari & Bhans. in Fasc. Fl. India 20:100. 1990. *Z. jujuba* (L.) Gaertn., Fruct. 1:203. 1788, non Mill. 1768; Lawson in Hook. f., Fl. Brit. India 1:632. 1875; Haines, Bot. Bihar & Orissa 1:195(201). 1921. *Rhamnus jujuba* L., Sp. Pl. 194. 1753.

Vern. *Bair*

Small, armed, much branched tree; branchlets tomentose with germinate prickles or often unarmed in old trees. *Leaves* oblong, oblong-orbicular, or ovate, 3.5-7.5 x 2-3.7 cm, usually minutely serrulate, apex obtuse or rounded, glabrous above, white or brownish tomentose beneath, base oblique 3-nerved; petiole 5-8 mm. *Cymes* of fascicles dense, axillary, tomentose, 1.2-1.8 cm long, sometimes with a short peduncle under 6.5 mm long. *Flowers* 5-6 mm diam; pedicels spatulate, white, concave. *Ovary* 2-celled; style mostly 2, connate to middle. *Drupe* yellow, orange or red, globose or ellipsoid or oblong, 1.2-1.8 cm diam., stone 2-celled.



Distribution: Throughout India. Sri Lanka; now in cultivation in most parts of the world.

Ziziphus xylopyra (Retz.) Willd., Sp. Pl. 1: 1104. 1797; Lawson in Hook.f., Fl. Brit. India 1: 634. 1875 ('*Xylopyrus*'); Haines, Bot. Bihar & Orissa 196.1921; Bhandari & Bhans. in Fl. India 5:243. 2000. *Rhamnus xylopyrus* Retz., Obs. Bot. 2: 11. 1781.

Vern. *Ghoot, Ghoot, Kakor*

Large, straggling shrubs or small trees, 7.5-12 m tall, spines in pairs on younger branches, one straight, the other curved. *Leaves* broadly elliptic or orbicular, rarely ovate, 2.5-7.5 x 1.5-6.5 cm, obliquely subcordate, obtuse with mucro at apex, serrate, each serration marked by a deciduous glandular mucro, basally 3-4 nerved. *Inflorescence* dense, axillary, dichotomous cymes. *Flowers* yellowish green. *Calyx* lobes keeled up to the middle, thickened at apex. *Petals* 1.5-2 mm long. *Stamens* equal to petals. *Disc* 10-lobed, pitted or grooved, rarely 5-lobed. *Ovary* 3-celled, rarely 2 or 4-celled, globose. *Drupes* globose, 1.8-2.5 cm in diam., woody, slightly rugose; stone thin and hard. *Seeds* 3, 1-2 x 1-1.5 mm, compressed, black.



Distribution: India : In dry deciduous forests, but sometimes also found in Sal forests. Throughout, except E. India. Nepal and Sri Lanka.

SAPINDACEAE

LITCHI Sonner.

Litchi chinensis Sonner. Voy. Ind. Or. Chine 2:230.t. 129.1782. *Nephelium litchi* Camb. Mem. Mus. Natl. Hist. Nat. 18:30.1829; Wight, Icon.t. 43.1838; Hiern in Hook.f.Fl. Brit. India 1:687.1875; Haines, Bot. Bihar & Orissa 1:214(222).1921.

Small evergreen tree. *Leaves* paripinnate; leaflets 2-6 pairs, subopposite, oblong-lanceolate or ovate-lanceolate, 5-15 cm long, entire, acuminate, glabrous, shining. *Flowers* small, greenish-white or yellowish, regular, polygamous, in pyramidal panicles. *Calyx* cupular, shallowly toothed. *Petals* 0. *Disc* annular. *Stamens* 6-8. *Ovary* 2-lobed, silky, only one lobe usually developing into fruit. *Fruit* globose or ovoid, reddish when ripe; pericarp dry, thin tuberculate. *Seed* one with large fleshy aril.



Distribution: Widely cultivated in India. Introduced from S.China.

SCHLEICHERA Willd.

Schleichera oleosa (Lour.) Oken, Allg. Naturgesch. 3(2):1341.1841. *Pistacia oleosa* Lour., Fl. Cochinch. 2:615.1790. *Schleichera trijuga* Willd., Sp. Pl. 4:1096. 1805; Bedd., Fl. Sylv. t. 119. 1871; Heirn in Hook.f., Fl. Brit. India 1:681. 1875; Haines, Bot. Bihar & Orissa 1:213(221). 1921.

Vern. *Aimshree, Athiyar, Kusum*



Tree with dense foliage; bark thin. *Leaves* paripinnate, 20-40 cm long; leaflets 2-4 pairs, opposite or subopposite, sessile or very shortly petiolate, elliptic or oblong, 7-25 cm long, entire, rarely repand, obtuse, acuminate or acute, glabrous. The racemes 5-15 cm, axillary or below the leaves and often on special abbreviated branchlets. *Flowers* yellowish, small. *Stamens* 4-8; filaments glabrous or slightly hairy. *Ovary* 3-celled; ovule 1 per cell on basal placentae. *Drupe* ovoid, 2-2.5 x 1.5 cm, sharply pointed. *Seed* compressed brown, 1-1.5 cm long.

Distribution: Throughout India, Myanmar, Sri Lanka, Java.

ANACARDIACEAE

BUCHANANIA Spreng.

Buchanania lanzan Spreng. in J. Bot. (Schrader) 2:234.1800. *B. latifolia* Roxb., Fl. Ind. 2:385. 1832; Hook. f., Fl. Brit. India 2:23. 1876; Haines, Bot. Bihar & Orissa 1:221.1921.

Vern. *Pyal*, *Pyar*

Small tree; bark rough, dark grey or black. *Leaves* alternate, simple, petioled, oblong or obovate-oblong, 12-20 cm long, entire, rounded, pubescent beneath, strongly nerved; petiole 6-8 mm, stout, pubescent. *Panicle* axillary and terminal, dense, pyramidal, densely pubescent. *Flowers* greenish-white, 5-7 mm across. *Sepals* 5, nearly free. *Petals* 4-5, triangular or oblong. *Stamens* 10, inserted at the base of the disc, erect, as long as the spreading petals. *Carpels* hairy. *Drupe*s globose, black.



Distribution: Throughout the hotter parts of India, Myanmar.

LANNEA A. Rich.

Lannea coromandelica (Houtt.) Merr. in J. Arn. Arbor. 19:353. 1938; Ding Hou in Steenis, Fl. Males. I. 8:478. 1978. *Dialium coromandelicum* Houtt. in Nat. Hist. II. 2:39.t.5.f.2. 1774. *Odina wodier* Roxb., Fl. Ind. 2:293. 1832; Hook. f., Fl. Brit. India. 2:29. 1876; Haines, Bot. Bihar & Orissa 1:223 (231). 1922.

Vern. *Dhoka*, *Jhingna*, *Jigna*, *Kasamber*, *Parmi*

Small to moderate-sized tree; bark light-coloured and smooth in young trees. *Leaves* 10-25 cm long, clustered at the ends of thick branchlets; leaflets 5-9 or more, ovate or ovate-oblong, 6-14 x 2.5-4.5 cm, entire, acuminate; oblique at base, puberulous beneath; lower smaller leaflets shortly petiolate, upper pairs sometimes sessile, terminal with 2.5-5 cm long petiolule. *Flowers* small, yellowish green, dioecious, fascicled on the rachis of numerous racemes crowded towards the ends of leafless branchlets; inflorescence appearing before the leaves; racemes 7-20 cm long, elongating in fruit. *Sepals* ovate, ciliate. *Male flowers*: Petals oblong, acute, pistillode deeply 4-lobed. *Female*



flowers: Petals larger, obtuse. *Staminodes* 8. *Ovary* 4-6-lobed, usually 1-celled. *Drupe*s red, curved, oblong, compressed, 1-1.2 cm long.

Distribution: Throughout the hotter parts of India, Sri Lanka, Thailand, Myanmar, Indo-China, China (Hainan).

MANGIFERA L.

Mangifera indica L., Sp. Pl. 200. 1753; Bedd., Fl. Sylv. 1.162.1871; Hook. f., Fl. Brit. India 2:13. 1876; Haines, Bot. Bihar & Orissa 1:220 (228). 1922; Ding Hou in Steenis, Fl. Males. I. 8:427. 1978.

Vern. *Aam*

Large tree. *Leaves* lanceolate, elliptic to narrowly elliptic, 10-20 x 2-8 cm, entire, acute to acuminate, glabrous, base acute or cuneate. *Panicles* terminal or sometimes also in the upper most leaf axil, often crowded at the ends of the twigs. *Flowers* greenish-yellow, polygamous, small. *Calyx* 5-lobed, lobes. *Petals* 5, spreading, elliptic or ovate-oblong. *Disc* short-cupular. *Stamens* 5, usually 1 or 2 fertile. *Ovary* 1-celled; style excentric. *Drupe* very variable in size, shape and colour, usually ovoid, 2.5-10 cm, usually yellow when ripe, with large stone. *Seed* with testa free from the endocarp.



Distribution: Throughout tropical India. Widely cultivated throughout the tropics of both hemispheres. Probably a native of Indo-Burma region.

SEMECARPUS L.f.

Semecarpus anacardium L.f., Suppl. Pl.: 182. 1781; Hook.f., Fl. Brit. India 2: 30. 1876; Haines, Bot. Bihar & Orissa 222.1921; Chandra & Mukherjee in Fl. India 5:500. 2000.

Hin. *Bhilwala, Bhilaw, Bhelewa, Vhella*

Trees, 6-12 m tall. *Leaves* obovate-oblong or elliptic-oblong, 6.5-40 x 3.5-21 cm, apex rounded, base cuneate or rounded, sometimes contracted below the middle, pubescent beneath; petioles 2-5 cm long. *Panicles* 15-40 cm long, pubescent. *Male flowers* 2.5 mm in diam., sessile. *Calyx* pubescent outside. *Petals* 2 x 1 mm. *Stamens* 2 mm long. *Disc* 1 mm in diam. *Female flowers* 3 mm in diam. *Ovary* 1.5 mm in diam.; styles densely hairy. *Drupe*s obliquely ovoid or oblong, 1.5-3.5 x 1-1.8 cm, glabrous, glossy, black; hypocarp fleshy, turbinate, 1-2 x 1-1.5 cm, pubescent.

Distribution: India : Tropical outer Himalaya and Shiwaliks, Gangetic Plain, Deccan, Konkan, in deciduous forests, ascending up to 1000 m.



SPONDIAS L.

Spondias pinnata (L.f.) Kurz, Prelim, Rep. For. & Veg. Pegu Append. A. 44 & B.42. 1875; Ding Hou in Steenis, Fl. Males. I. 8:483. 1978. *Mangifera pinnata* L.f., Suppl. Pl. 156. 1781. *Spondias mangifera* Willd., Sp. Pl.2:751. 1799; Wight, Ill. t. 76. 1840; Hook.f., Fl. Brit.India 2:42. 1876; Haines, Bot. Bihar & Orissa 1:224 (232). 1922.

Vern. *Amara*, *Ambara*

Large or medium-sized tree; bark smooth, white, very thick and soft; branchlets stout. *Leaves* mango smelling, long petiolate, rachis 5-22 cm; leaflets 4-6 pairs, oblong, 5-23 x 2.5-10 cm, entire, acuminate, secondary nerves 10-30, horizontal, joined by a strong intramarginal one; petiole short. *Panicle* 30-60 cm long when the tree is leafless. *Flowers* white, 8-9 mm across, sessile. *Calyx* salver-shaped with 5-6 ovate, acute lobes. *Petals* ovate-oblong. *Filaments* short, subulate. *Drupes* yellowish, large, ellipsoid, 3.7 cm long, with a hard, somewhat fibrous and slightly grooved 2-6-celled stone, usually 1-3-seeded, the other cells abortive.



Distribution: Throughout India, wild and cultivated. Tropical Asia.

MORINGACEAE

MORINGA Juss.

Moringa oleifera Lam., Encycl. 1:398. 1785; Bedd., Fl.Sylv.t.80.1871; Haines, Bot.Bihar & Orissa 1: 225(235). 1922; Steenis Fl. Males.I. 4:45.f.1. 1949. *M.pteridosperma* Gaertn., Fruct. 2:314. 1791; Hook.f., Fl. Brit. India 2:45.1876.

Small deciduous tree; bark grey or whitish, corky; twigs lenticellate. *Leaves* 2-4-pinnate, 25-50 cm long; rachis slender, thickened and articulated at the base; pinnae and pinnules opposite, their stalks articulated and with a gland at the articulations; leaflets elliptic, ovate or obovate, 5-22mm long, entire, apex rounded, pale beneath, pubescent when young. Panicle-branches 15-22 cm long. *Flowers* white, ca. 1.5 cm long. *Sepals* linear-lanceolate, puberulous outside. *Petals* spatulate or oblanceolate. *Capsule* pendulous, 22-45 cm long.



Distribution: Indigenous in NW. India and cultivated elsewhere throughout India. Widely cultivated in tropical countries.

FABACEAE (PAPILIONACEAE)

BUTEA Roxb. ex Willd.

Butea monosperma (Lam.) Taub.in Engl. & Pantl. Pflanzenf. 3(3):366. 1894; Anon., Draw.Ind.Pl. (Icon.Roxb. 67) 5:t. 25.1971. *Erythrina monoperma* Lam., Encycl. 1:391.1785. *Butea frondosa* Koen. ex Roxb. in Asiat.Res. 3:369. 1792 & Pl. Corom. t. 21. 1795; Bedd., Fl.Sylv.t.176.1872; Baker in Hook.f., Fl. Brit.India 2:194. 1876; Haines, Bot.Bihar & Orissa 2:270(292). 1922; Mooney,Suppl. Bot.Bihar & Orissa 51.1950.

Vern. *Dhak, Palas, Paras, Tasu*

Small or medium-sized tree; trunk crooked, and branches nodose; bark rough, bluish-grey or dark-brown; exuding from wood a light red gum. *Leaves* rarely 1-foliate; petiole 10-15 cm; stipules linear-lanceolate, deciduous; leaflets rigidly coriaceous, 10-20 cm long and broad, glabrous above, grey tomentose or pubescent beneath, terminal rhomboid or obovate, rounded at apex or emarginate, base cuneate, lateral ones obliquely ovate or elliptic and smaller; petiolules 5-10 mm long, stout; stipules subulate, deciduous. *Racemes* axillary, crowded towards the extremities of leafless branchlets, 4-6 cm long, rigid; pedicels 1.2-3 cm long, the stout rachis, bracts and calyx covered with brown velvety tomentum. Flowers bright orange-red or rarely yellow, 3.7-5 cm long. *Calyx* campanulate, upper lip sub emarginate, lower with three deltoid teeth. *Petals* silvery-tomentose outside; keel incurved. *Pods* stalked, ca. 15 cm long, velvety brown. *Seeds* oval, compressed, brown, 3.7 cm long.



Distribution: Throughout India, ascending to 1200 m. SE. Asia.

DALBERGIA L.f.

Dalbergia lanceolaria L. f., Suppl. 316. 1781; Baker in Hook.f, Fl. Brit India 2:235. 1876; Haines, Bot. Bihar & Orissa 296.1922.

Vern. *Bansisham, Sagaldri*

A middle-sized or large deciduous tree with nearly smooth pale brown or grey bark, sometimes buttressed at the base. *Leaves* 10-25 cm long with 7-17 leaflets; *leaflets* 2.5-8 x 1.5-2.5 cm oblong or obovate-oblong, usually notched and rounded at the apex, base broadly cuneate or rounded. *Flowers* pinkish-white or dull purplish, about 2 cm long, often second on the branches of lax, axillary and terminal, pubescent panicles 5-10 cm long. *Calyx* adpressed hairy; teeth shorter than the tube. *Corolla* much exserted. *Pod* 5-10 x 1.2-2 cm, flexible, 1-3-seeded narrowed at both ends, base with a stipe 7-15 mm long, sometimes sinuate between the seeds.



Distribution: India (Throughout from tropical Himalaya southwards). Sri Lanka, Myanmar.

Dalbergia latifolia Roxb., Pl. Corom. t. 113. 1799; Baker in Hook. f., Fl. Brit. India 2:231. 1876; Parin in Ann. Roy. Bot. Gard. (Calcutta) 10:t.62.1904; Haines, Bot. Bihar & Orissa 2:294(307). 1922; Thoth. Tax. Rev. Dalbergieae Indian Subcont. 46. 1987.

Vern. *Banjhi, Kalasisham*



Small or medium-sized tree; bark light coloured. *Leaves* imparipinnate; leaflets 5-7, very unequal –sized on the same rachis, suborbicular, 2.5-10 cm long, rounded or emarginate at apex, glabrous, pale beneath; petiolule 6-10 mm long. *Flowers* white, in numerous lax panicles, 5-10 cm long, axillary and from the leaf-scars; pedicels 3-3.5 mm long. *Calyx* glabrous; teeth oblong obtuse or subacute. *Corolla* exserted. *Stamens* 9. *Pod* 3-8 x 1.5-2 cm, abruptly narrowed to a stipe, glabrous, sometimes constricted between the seeds, flat. *Seeds* 1-3.

Distribution: India (Throughout from tropical Himalaya southwards). Sri Lanka, Myanmar. ***Dalbergia sissoo*** Roxb., Fl.Ind. 3:223. 1832; Baker in Hook. f., Fl. Brit. India 2:237.1876; Haines, Bot. Bihar & Orissa 2:293(307). 1922; Thoth. Tax.Rev. Dalbergieae India Subcont.37. 1987.

Vern. *Sisham*

Medium-sized tree; bark grey or pale brown, thick, exfoliating in narrow longitudinal strips. *Leaves* imparipinnate; *leaflets* 3-5, broadly elliptic, ovate, obovate or orbicular, 2.5-7.5 cm long, cuspidate or acuminate, narrowed to rounded at base, distal leaflets larger. *Flowers* yellowish, 7-9 mm long, subsessile, secund on the branches of dense, densely pubescent axillary panicles, 5-7.5 cm long. *Calyx* campanulate, 4.5-6 mm long, puberulous to pubescent without, lobes oblong. *Corolla* ca. twice the calyx, standard orbicular, long-clawed. *Stamens* 9, monadelphous. *Ovary* long-stipitate, pubescent with very short style. *Pods* linear-oblong, 2.5-7.5 cm long, glabrous, base cuneate, 1-3- rarely 4-seeded.



Distribution: Throughout India, ascending to 1200 m on the Himalaya, Bangladesh, Myanmar, Baluchistan, Afghanistan and Malaysia (cultivated).

ERYTHRINA L.

Erythrina variegata L., Herb. Amb. 10. 1754; Bullock in Kew Bull. 20:294. 1966; Krukoff in J.Arnold Arbor. 53:132. 1972. var *orientalis* (L.) Merr. Interp. Herb. Amb. 276. 1917; Mahesw. in Bull.Bot.Surv.India 3:46. 1961. *E.orientalis* L., Sp. Pl. 706. 1753. *E.indica* Lam., Encycl. 2:391. 1786; Wight, Icon.t.58. 1838; Baker in Hook.f., Fl. Brit.India 2:188. 1876; Haines, Bot.Bihar & Orissa 2:284 (297). 1922.

Vern. *Fareda, Farhad, Felala*

Prickly tree; prickles small and black; shoots at first densely tomentose, bark smooth and greenish after the papery exfoliation. *Leaflets* rhomboid-ovate, 5-15 cm x 5.5-17 cm, acute or acuminate, more or less stellate pubescent when young, glabrescent with age; stipels short thick, reflexed, finally hard. Racemes very elongate, usually 15 cm, excluding the ca. 10 cm long peduncle. *Flowers* scarlet, 7 cm long. *Calyx* split, spathaceous with



very oblique mouth, persistent and ultimately recurved, 5-toothed at the narrow tip. Standard ca. 4 times as long as the wings. *Pods* many, subcylindric, 15-25 cm long, beaked, somewhat curved, narrowed into a seedless base and a stout stipe, 1.8-2.5 cm long, torulose, 6-12-seeded, somewhat stellate-pubescent. *Seeds* 1.5-1.8 cm, dark purple.

Distribution: Wild in coastal region in India; also planted and naturalized. Africa, Madagascar, Sri Lanka, Myanmar, Thailand, Cambodia, Laos, Vietnam, China, Malesia.

OUGEINIA

Ougeinia oojeinensis (Roxb.) Hochr. in Bull.Soc.Bot.Geneve 13 & 14:51. 1909. *Dalbergia oojeinensis* Roxb. in Miq. Pl. Jungle 216. 1852; Baker in Hook.f., Fl. Brit.India 2:161. 1876; Haines, Bot. Bihar & Orissa 2:259 (271) 1922. *Desmodium oojeinensis* (Roxb.) Ohashi in Ginkgoana 1:117. 1973.

Vern. *Pandam*, *Pannam*

Tree, usually small and crooked; bark dark brown, deeply cracked; branches slender, grey. *Leaves* pinnately 3-foliolate, stepellate; petiole 3.7-5 cm long; stipules lanceolate, 6 mm long, acute, caducous; leaflets rigidly coriaceous, the terminal ovate, orbicular, obovate or trapezoidal, 7.5-15 x 5-10 cm, obtuse, entire or crenate, secondary nerves 5-10, strong, lateral leaflets opposite, obliquely ovate, cordate, 7.5-10 x 3.7-7.5 cm, leaflets glabrous above, glabrous or sub-tomentose beneath; petiolules 3 mm long. *Flowers* white or pink, small, mostly 3-nate, in the axils of bracts in dense fascicled racemes from the leaf-axils and the old wood; pedicels slender. *Calyx* campanulate, pubescent, teeth short, triangular. *Corolla* exserted; standard orbicular; wings spurred, slightly adnate to the obtuse keel. *Stamens* 9+1. *Ovary* many-ovuled; style incurved, subulate; stigma capitate. *Pod* linear or linear oblong, 5-7.5 cm long, 2.5-jointed; joints flat, large, oblong or joints obscure. *Seeds* 1-5, compressed, reniform.



Distribution: Sub-Himalayan tract from the Sutlej to Sikkim, ascending to 1250 m; Bihar; Madhya Pradesh, South of Godavari and N. Kanara.

PITHECELLOBIUM Martius

Pithecellobium dulce (Roxb.) Benth. in Hook.Lond.J.Bot.3:199.1844; Bedd., Fl.Sylv.t.188.1872; Baker in Hook. f., Fl. Brit. India 2:302. 1878; Haines, Bot.Bihar & Orissa 2:335(349). 1922; Kosterm. Monog. Pithecellobium 8.1954 & Dassan. & Fosberg, Rev. Handb.Fl. Ceylon 1:495.1980. *Mimosa dulcis* Roxb., Corom.t.99.1798. *Inga dulcis* (Roxb.) Willd., Sp. Pl. 4:4:1005.1806; Wight, Icon.t. 198.1839.

Vern. *Jungal jalabee*

Tree with small stipular spines, persistent on the



trunk. *Petiole* 1-1.5 cm; with a solitary concave gland; *pinnae* 1(-2) pair; *leaflets* 1 pair, oblong-oblongate, oblique, 1.5-5 x 0.5-1.6 cm, entire, subacute to obtuse, glabrous above, puberulous beneath; *petiolule* 3-5 mm; *stipels* linear, 1 mm. *Heads* white or yellowish, 1.2 cm diam. in narrow panicles. *Pods* strap-shaped, 8.1-1.5 cm, circinate. *Seeds* 6-8, orbicular, shining black in white pulpy aril.

Distribution: Cultivated throughout the plains of India. Native of tropical America; cultivated in the tropics.

PONGAMIA Vent.

Pongamia pinnata (L.) Pierre, Fl. Cochinch.t. 385. 1899; Thoth. in Bull. Bot.Surv. India 3:418.t.1.1961. Thoth. & Nair, Taxon.30:44.1981. *Cytisus pinnatus* L., Sp. Pl. 741. 1753. *Pongamia glabra* Vent., Jard. Mal.t.28.1803; Wight, Icon.t.59. 1838; Baker in Hook.f., Fl. Brit. India 2:240. 1876; Haines, Bot.Bihar & Orissa 2:299(313). 1922. *Derris indica* (Lam.) Bennet in J.Bombay Nat.Hist.Soc. 68:303. 1971. *Galedupa indica* Lam., Encycl. 2; 594. 1788. *Millettia pinnata* (L.) Panigrahi, Fl. Bilaspur Madhya Pradesh 1:210.1989.

Vern. *Karanj*

Moderate- to large-sized tree; sometimes flowering in shrub by form on the sea-coasts; bark smooth; thin grey. *Leaves* 20-35 cm long; *petiole* 4-5 cm; *stipules* oblong, 2 mm; *leaflets* 5-7, ovate or oblong, 4.5-12.5 (20) cm long, entire, acuminate or cuspidate, glabrous, glossy above. *Flowers* purplish-white or pinkish-white, 1 cm across, axillary racemes, 7-18 cm long; *pedicels* 0.6-1.5 cm. *Calyx* 2-3(4) mm long, puberulous, truncate with obsolete teeth. *Corolla* 1.2 cm; standard silky. *Pods* woody, 3.7-5 x 1.7-3.2 cm with a short decurved point. *Seed* reddish-brown.



Distribution: Widely distributed in India. Sri Lanka, Myanmar, Pakistan, Malaya, N.Australia, Polynesia, Mascarene.

PTEROCARPUS L.

Pterocarpus marsupium Roxb., Pl. Corom. 2: t. 116. 1799; Baker in Hook.f., Fl. Brit. India 2:239. 1876; Haines, Bot. Bihar & Orissa 297. 1922; Sanjappa, Legume India 232. 1992; Kumar & Sane, Legume South Asia 179.2003.

Vern. *Paisar*

A large, nearly evergreen tree with longitudinally fissured, dark-grey, rough bark; young parts brown pubescent. *Leaves* imparipinnate, 15-30 cm long; *rachis* glabrous; *leaflets* 5-10 x 2-7 cm, sometimes larger, oblong or ovate-lanceolate, usually acute or shortly acuminate, often cuspidate, coriaceous. *Flowers* yellow, about 1.5 cm long, in large, much branched terminal panicles up to 25 cm long. *Calyx* campanulate, densely brown hairy. *Pod* indehiscent, 3-5.5 cm in diameter, orbicular, compressed, with a broad wing-like rigid and veined rim, the apex displaced to near the base.

Distribution: India (Peninsula, Bihar, Uttar Pradesh,



Uttarakhand). Sri Lanka.

CAESALPINIACEAE

BAUHINIA L.

Bauhinia malabarica Roxb., Fl. Ind. 2:321. 1832; Baker in Hook.f., Fl. Brit.India 2:277.1878; Haines, Bot.Bihar & Orissa 2:308(322).1922.

Vern. *Shahul*

Small tree; bark light brown-grey, nearly smooth or with linear-oblong flakes when old; branchlets pubescent or tomentose. *Leaves* broader than long, 2.5-10 cm diam. lobed one-eighth to one-quarter way down, glaucous and glabrescent or sometimes minutely pubescent beneath, base cordate, 7-11-nerved; petiole 2.5-5 cm long. *Flowers* whitish subregular in tomentose, sub-corymbose, mostly paniced racemes, 5-7.5 cm long; pedicels slender. *Calyx* 6-12 mm long, limb shortly 5-lobed. *Petals* slightly exsert, oblong-spathulate. *Pods* 17-30 x ca. 2 cm, flattened, mostly curved, rostrate, reticulate venose when dry.



Distribution: Outer Himalayas at lower elevations; Assam; Bihar; Cantral and S. India, Myanmar, Malay Islands and Java.

Bauhinia purpurea L., Sp. 375.1753; Baker in Hook.f., Fl. Brit.India 2:284. 1878; Haines, Bot. Bihar & Orissa 2:310(323). 1922. *Phanera purpurea* (L.) Benth. in Miq. Pl. Jungh. 262. 1852.

Moderate-sized tree; bark ashy or dark brown; branchlets glabrous. *Leaves* often oblong, 5-18 cm x 6-16 cm, deeply lobed from one third way down to nearly to the base, scarcely overlapping, 9-11-nerved, glabrous or minutely puberulous on the nerves beneath, scarcely glaucous, lobes obtuse to subacute; petiole 2.5-3.7 cm long. *Flowers* purple, large in terminal paniced racemes 0; flower-buds acutely 5-angled. *Calyx* spathaceous, limb 1.8 cm, tube turbinate 0.6-0.7 cm. *Petals* oblanceolate, 3.5 cm long, often variegated, long-clawed. *Stamens* 3-2 perfect; staminod filamentous. *Pods* 15-30 x 1.8.25 cm long, narrow below, somewhat broadening upwards, flat, dehiscent when ripe with thin coriaceous twisted valves.



Distribution: Foothills of Himalayas to Tamil Nadu; cultivated throughout India S.E. Asia.

Bauhinia racemosa Lam., Encycl. 1:390. 1785; Hook.Icon.Pl. t. 141. 1840; Baker in Hook. f., Fl. Brit. India 2:276. 1878; Haines, Bot.Bihar & Orissa 2:308(322). 1922. *Piliostigma racemosa* (Lam.) Benth.in Miq.Pl. Jungh. 262.1852.

Vern. *Kathul, Katmohlee, Konnar*

Smaller tree; branches pubescent; bark grey, rough. *Leaves* broader than long, 2.5-6.5 x 3.5-7 cm, lobed one-third way down, lobes obtuse or rounded, glaucous and glabrous or minutely puberulous on the nerves (or tomentose or pubescent) beneath; base shallowly cordate. *Racemes* simple, 5-8 cm long, sparsely pubescent (or tomentose). *Flowers* whitish. *Calyx* sphaeaceous, sparsely pubescent. *Petals* linear-oblongate, 8-12mm long. *Stamens* 10, connate below; anthers villous. *Pods* 10-18(25) x 1.8-3.2 cm, thick, glabrous, turgid (sometimes slightly torulose), septate, not beaked or with very short beak under 5 mm. *Seeds* 10-15, broadly oblong, 3 mm.

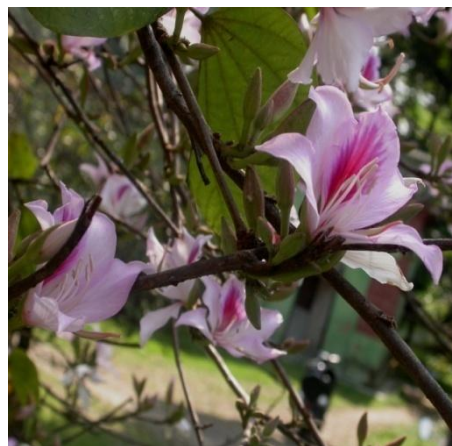


Distribution: Subtropical outer Himalaya, Punjab, Uttar Pradesh, Bihar, Peninsular India, Sri Lanka, China, Malay Islands.

Bauhinia variegata L., Sp. Pl. 375. 1753; Baker in Hook. f., Fl. Brit. India 2:284. 1878; Haines, Bot. Bihar & Orissa 2:309 (323). 1922. *Phanera variegata* (L.) Benth. in Miq. Pl. Jungh. 262. 1852.

Vern. *Koirala*

Moderate-sized tree; branchlets glabrescent; bark grey. Longitudinally cracked. *Leaves* 6.2-15 x 7.5-16.5 cm, lobed about one-fourth to one-third way down, lobes rounded, overlapping, grey glaucous and pubescent especially on the nerves beneath, 11-15-nerved; petiole (1.5) 2.3-4.5 cm, pubescent, stout. *Flowers* white or purple with one petal variegated yellow, in short racemes, mostly from the leaflets axils; flower-buds terete. *Calyx* saphaceous, tube 2.5-3 cm, limb broadly ovate. *Petals* obovate, 5-6.2 cm long. Perfect stamens 5; staminodes 0. *Pods* 15-25(30) x 1.8-2.5 cm, glabrous, very flat, venose when dry; stipe 2.5 cm long. *Seeds* suborbicular.



Distribution: Throughout India, ascending to 1200 m, Myanmar; cultivated in other parts of tropical Asia; possibly a native of China.

CASSIA L.

Cassia fistula L., Sp. Pl. 377.1753; Baker in Hook. f., Fl. Brit. India 2:261. 1878; Haines, Bot. Bihar & Orissa 2:302 (315). 1922. *C. rhombifolia* Roxb., Fl. Ind. 3:334. 1832.

Vern. *Ahirgoa, Amaltash, Banarlori*

Small or medium-sized sub deciduous tree; bark smooth, pale or whitish. *Petiole* and rachis eglandular;



leaflets 4-8 pairs, ovate, ovate-lanceolate or ovate-oblong, 5-19 x 2-7.5 cm, acute or acuminate, glabrous, with close strong secondary nerves. *Flowers* yellow, 5 cm across, in lax drooping axillary racemes, 30-60 cm long. *Fertile stamens* 10. *Pods* short-stipitate, long cylindric, drooping, 30-60 x 2.2.5 cm, black when mature, indehiscent. *Seeds* many, flat, transverse.

Distribution: Throughout India.

DELONIX Raf.

Delonix regia (Boj. ex Hook.) Raf., Fl. Tell 2:92. 1836. *Poinciana regia* Boj. ex Hook. in Curtis Bot. Mag. t. 2884. 1829; Baker in Hook. f., Fl. Brit. India 2:260. 1878; Haines, Bot. Bihar & Orissa 2:313(327). 1922.

Vern. *Gulmohar*

Tree. *Leaves* feathery, upto 60 cm long; stipules pectinate with finely linear segments; pinnae 11-18 pairs; opposite; leaflets many, small. *Flowers* orange or red, more than 10 cm across. *Calyx-lobes* deltoid. *Petals* 5 cm long or more, very long-clawed, uppermost dissimilar, lined with red or orange. *Stamens* nearly equal to or shorter than petals. *Pods* 30-60 cm long. *Seeds* narrowly oblong, with bony testa.



Distribution: Planted throughout India, Native of Madagascar, now cultivated throughout the tropics.

HARDWICKIA Roxb.

Hardwickia binata Roxb., Pl. Corom. 3:6.t. 209. 1811; Baker in Hook.f., Fl. Brit. India 2:270. 1878; Haines, Bot. Bihar Orissa 307.1922.

Vern. *Anjan*

A medium or large deciduous ornamental tree. *Branches* drooping slender; crown conical in early life, becoming broader later. *Bark* of saplings almost silvery white and smooth, gradually changing as the tree gets older to dark grey and rough with irregular vertical cracks, exfoliating in narrow flakes. *Leaves* small, 2-6 cm long by 2-3 cm wide, alternate, pinnate, almost kidney shaped and greyish-green. *Flowers* small, pale yellowish-green in axillary and terminal lax paniced racemes. *Pod* flat, samaroid, 5-7.6 x 1-1.5 cm, oblong lanceolate, coriaceous, narrowed at both ends, with parallel longitudinal veins. *Seed* solitary.



Distribution: Bihar, Orissa, Central in South India.

PELTOPHORUM (Vogel.) Benth.

Peltophorum pterocarpum (Candolle) Backer ex K. Heyne, Nutt. Pl. Ned.-Ind., ed. 2. 2: 755. 1927. *Inga pterocarpa* Candolle, Prodr. 2: 441. 1825. *Caesalpinia ferruginea* Decaisne. *C. inermis* Roxb. *Peltophorum ferrugineum* (Decaisne) Benth. *P. inerme* (Roxb.) Naves ex Fernández-Villar. *P. roxburghii* (G. Don) O. Degener. *Poinciana roxburghii* G. Don

Trees, 4-15 m tall. Young shoots, petioles, and inflorescences ferruginous hairy; old branches with yellowish, small lenticels. Leaves 30-42 cm; petiole robust; rachis 25-35 cm; pinnae 7-15 pairs, opposite, 8-12 cm; leaflets (7-)10-21 pairs, crowded together, oblong-obovate, 1.2-1.7 cm × 5-7 mm, leathery, abaxially pale green, adaxially deep green, base oblique, margin entire, apex rounded, mucronate. Panicles terminal or axillary, densely ferruginous puberulent; bracts caducous, 5-8 mm. Pedicels ca. 5 mm, ca. as long as flower buds, 5-7 mm from one another. Flower buds globose, 5-8 mm in diam. Sepals ovate, 5-8 × 4-7 mm, outside ferruginous tomentose. Petals obovate, 1.5-1.7 cm × 8-10 mm, densely ferruginous pubescent at middle of both surfaces, long clawed. Filaments ca. 1.2 cm, hirsute at base; anthers ca. 3 mm, sagittate at base. Ovary stalked, hairy, 3- or 4-ovuled; style filiform, much longer than ovary, smooth; stigma discoid, 3-lobed. Legume winged, compressed, fusiform, narrowed to both ends, longitudinally veined at middle part; wings 4-5 mm wide. Seeds 2-4.



Distribution: Cultivated in Guangdong (Guangzhou), Guangxi, Yunnan [Bhutan (cultivated), India, Indonesia, Malaysia, Sri Lanka, Thailand, Vietnam; Australia, N Oceania; introduced in E Africa and many other tropical countries].

TAMARINDUS L.

Tamarindus indica L., Sp. Pl. 34.1753; Baker in Hook.f., Fl.Brit.India 2:273. 1878; Haines, Bot. Bihar & Orissa 2:311 (325). 1922.

Vern. *Imli*

Large tree to medium sized tree; bark dark grey, roughish, exfoliating in regular hard scales; *leaflets* 10-20 pairs, small, close, linear oblong, ca. 1.2 cm long, base and apex obtuse. *Flowers* pale-yellow triped with red, ca. 1 cm across, in lax racemes. *Calyx-lobes* subequal, 2 lowest connate. *Petals* yellow dotted with red. *Anthers* large. *Pods* 7.5-15 x 1.5-2.5 cm. *Seeds* 3-10, reddish-brown, ca. 1 cm long irregularly shaped, embedded in dark brown pulp.



Distribution: Throughout India, cultivated and self sown. Native in tropical Africa; widespread in the tropics.

MIMOSACEAE

ACACIA Mill.

Acacia auriculiformis A.Cunn. ex Benth. in Hook.J.Bot. Kew Gard. Misc. 1:377.1842; Haines, Bot. Bihar & Orissa 2:330(345).1922.

Small or moderate-sized tree; bark white; branchlets glabrous and glaucous, slightly angular. The place of leaves is sometimes taken by large, laterally compressed, falcate-oblong phyllodes, 10-17.5 x 1.2-3.7 cm, narrowed both ends, with 4-6 principal subparallel nerves, sometimes confluent near the base and finer parallel intermediates occasionally anastomosing. *Flowers* small, yellow (or white); in slender axillary spikes 3.7-6.2 cm long. *Calyx* broadly campanulate, 0.5 mm long, minutely, toothed. *Petals* spreading, as long as the calyx. *Pods* hard, almost woody, much coiled in an irregular spire with the outer edge often sinuate.



Distribution: Widely planted throughout India. Native of Australia.

Acacia catechu (L.f.) Willd., Sp. Pl. 4 :1079. 1806; Baker in Hook. f., Fl. Brit. India 2:295. 1878; Haines, Bot.Bihar & Orissa 2:329(343). 1922. *Mimosa catechu* L.f., Suppl. Pl. 439.1781; Roxb.Pl. Corom.t.175.1802.

Vern. *Karee, Khair*

Small tree; bark dark brown, pending off in thin vertical strips; branches slender, armed with germinate (stipularly) hooked spines; branchlets generally glabrous. Leaf-rachis 5-15 cm, rarely 20 cm, with a gland below the pinnae and one between the upper 1-6-pinnae; pinnae 7-24 pairs, their rachis 1.2-3.7 cm long; *leaflets* 6-35 but mostly 12-20 pairs, sessile, 2.5-5 mm long, subacute or obtuse, pubescent or ciliolate. *Flowers* white or yellowish, 2-2.5 mm long, crowded in pubescent spikes, 5-8.7 cm long, axillary on the young shoots. *Corolla* longer than calyx, pubescent or densely hairy. *Stamens* in 5 bundles. *Ovary* glabrous, stipitate. *Pods* 5-12.5 x 1.5-2 cm, often irregularly constricted, 4-7, rarely only 2-seeded, obtuse, mucronate or beaked, stipulate.



Distribution: Throughout N. India, ascending to 1500 m, Central and S.India, Bihar, Sikkim, Myanmar.

Acacia nilotica (L.) Delile subsp. **indica** (Benth.) Brenan in Kew Bull. 12:84. 1957; Kosterm.in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 1:488. 1980. *A.nilotica* (L.) Delile var.*indica* (Benth.) Hill, Bot.Mus.Leafl.Harvard Univ.8:99.1940. *A.arabica* var.*indica* Benth.in Hook.Lond.J.Bot. 1:500.1842. *A.arabica* auct.non (Lam.)Willd.: Bedd., Fl. Sylv.t.

47. 1870; Baker in Hook.f., Fl. Brit. India 2:293. 1878; Haines, Bot.Bihar & Orissa 2:324 (338). 1922.

Vern. *Babool*

Tree, but often flowering as a shrub; bark, deep brown or black, deeply cracked; branches with long, straight, white, stipular spins, 0.6-5 cm long. Leaf-rachis with a cup-shaped gland at the base of the lowest and generally also the uppermost pair of pinnae 3-6(9) pairs, 1.2-5 cm long; leaflets 10-20 pairs, sessile or subsessile, linear 3-6.2 mm long, subobtuse, glabrous or nearly so. Flower-heads yellow, 1.2 cm across, on short axillary, slender, fascicled peduncles with 2 bracts a little above the middle. *Pods* grey-downy, 7.5-22 x 1.5-1.8 cm long, moniliform, indehiscent.



Distribution: Throughout the greater part of India. Paleotropics; native of India.

ALBIZIA Durazz.

Albizia lebbek (L.) Benth.in Hook.Lond.J. 3:87. 1844; Baker in Hook. f., Fl. Brit. India 2:298.1878; Haines, Bot.Bihar & Orissa 2:332(346).1922; Kosterm.in Dassan. & Fosberg, Rev. Hanb.Fl.Ceylon 1:502.1980. *Mimosa lebbeck* L., Sp.Pl. 516.1753.

Vern. *Khour, Siris*

Large or moderate-sized tree; bark rather rough and rugosa, cinereous. *Pinnae* 2-4, rarely 5 pairs; rachis with a gland below the uppermost pair of pinnae and at the base; pinnae with a gland below the 2-5 upper pairs of leaflets; *leaflets* 5-8 pairs, rarely up to 13 pairs, shortly petioluled, oblong or obovate-oblong, 1.8-5.6 x 0.8-2.5 cm, rounded or obtuse, base rounded. Flower-heads ca. 3 cm across; peduncles 1-3 together in the axils of the leaves of young shoots, rarely subpanicled due to the late development of subtending leaves. *Flowers* white, fragrant. *Calyx* pubescent. *Corolla* tubular-ventricose. *Pods* yellow, oblong, 15-30 x 2.5-5.5 cm, glabrous. *Seeds* 5-10, oval.



Distribution: Throughout India, ascending to 1200 m.Tropical Asia and Africa, usually planted.

Albizia odoratissima (L. f.) Benth. in Hook. Lond. J. Bot. 3: 88. 1844; Bedd., Fl.Sylv.t.54.1879; Baker in Hook.f., Fl. Brit. India 2: 299. 1878; Haines, Bot. Bihar & Orissa 2:333(347). 1922; Kosterm. in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 1:499. 1980. *Mimosa odoratissima* L.f., Suppl. Pl. 437.1781;Roxb. Pl.Corom. 2:12.t.120.1798.

Vern. *Gobrarri*

Large or small tree; bark grey; branchlets and panicle densely pubescent or tomentose. Leaf-rachis pubescent, with a gland below the uppermost pair of pinnae and at the base or glands abortive; pinnae 2-5 pairs; rachis of pinnae 7.5-25 cm long, a gland between the upper 1-2 pairs of the leaflets, rarely 0; leaflets 6-24 pairs, sessile or subsessile; oblong to narrowly oblong, sometimes subfalcate, 1.5-3.2 x 0.6-1.2 cm, obtuse finely appressed silky both sides or glabrescent except the margin and midrib, basal nerves 5-6, mid-nerve towards the distal margin. *Peduncles* 1.8-3 cm long, 1-3 together in usually ample terminal panicles. *Flowers* sessile. *Calyx* campanulate, 1-1.5 mm, pubescent, scarcely toothed. *Corolla* whitish, hairy all over, funnel-shaped, tube exserted, lobes one-third to as long as tube. *Filaments* 1.5-1.8 cm long. Pods purplish-green to brown or red when mature, 13.7-30 x 2.5-5 cm. *Seeds* 10-12, ovoid.



Distribution: Sub-Himalayan tract, West to Indus, Bengal, Central and S.india. Sri Lanka, Myanmar, Thailand, Indo-China and West Malaysia.

DICHROSTACHYS (DC.) Wight & Arn.

***Dichrostachys cinerea* (L.) Wight & Arn. subsp. *cinerea* var. *cinerea*;** Brenan & Brummitt, Bot. Soc. Brot. (ser. 2) 39:110.1965; Kosterm. in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 1:466.1980. *D. cinerea* (L.) Wight & Arn. Prod. 271. 1834; Wight, Icon. t. 357. 1840; Bedd. Fl. Sylv. t. 185. 1872; Baker in Hook. f. Fl. Brit. India 2:288.1878; Haines, Bot. Bihar & Orissa 2:320(334).1922. *Mimosa cinerea* L. Sp. Pl. 521. 1753; Roxb. Pl. Corom. t. 174.1802.

Large branched shrub or small tree; bark grey; the numerous branches armed with short lateral and terminal straight thorns. *Leaves* borne on the thorns and small nodes tubercles which are covered with apparently the bases of persistent stipules. *Leaf-rachis* 3.7-7.5 cm long, pubescent, with stipitate glands between the pinnae; pinnae 3-12 pairs, short, 1-1.2 cm long; leaflets numerous, sessile, linear, 1.2-2.5 mm long, acute, pubescent beneath. *Spikes* tassel-like, stalked; the lower 2.5-5 cm portion with pink, sterile flowers with pink rose, 1.2 cm long staminodes; the upper usually shorter portion with yellow, bisexual flowers with shortly exserted stamens. *Pods* linear, curled and twisted, 7.5-10 cm long, in clusters. *Seeds* 6-10.



Distribution: Central & S.India to Sri Lanka. Asia, Africa, Australia (species).

PROSOPIS L.

Prosopis juliflora (Sw.) DC. Prod. 2:447. 1825; Johnston, Brittonia 14:83. 1962; Towns in Kew Bull. 21:436. 1968; Burkart, J. Arnold Arbor. 57:499. 1976; Kosterm. in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 1:468. 1980.

Armed, spreading shrub (or tree); branchlets glabrous; spines axillary 1-1.5 cm, straight. *Leaves* alternate or clustered; petiole 2.5-3 cm, eglandular; stipules spinescent; rachis with a solitary gland; pinnae 1 or 2 pairs, to 8 cm; leaflets 15-20 pairs, oblong, 0.8-1.8 x 0.25-0.3 cm, inequilateral, entire, base and apex obtuse, glabrous, petiolule 0; stipels 0. *Spikes* axillary, solitary or 2-4 in a cluster; peduncle 1.5-2.5 cm; bracteoles linear, to 1.5 mm; pedicel to 0.5 mm. *Flowers* cream, 1.5 mm across, 5-merous. *Pods* 12.5-20 x 0.7-0.9 cm, straight or slightly curved, compressed, septate, mesocarp pulpy. *Seeds* ovoid.



Distribution: Planted and naturalized in hotter parts of India. Native of S.America and West Indies. Pantropic.

COMBRETACEAE

ANOGEISSUS (DC.) Gill., Perr. & A.Rich.

Anogeissus latifolia (Roxb. ex DC.) Wall. ex Guill. & Perr., Fl. Seneg. Tent. 7:280.1832; incl. var. *villosa* Clarke; Wight., Icon.t. 994. 1845; Clarke in Hook. f., Fl. Brit.India 2:450. 1878; Haines, Bot.Bihar & Orissa 2:355(370). 1922.

Vern. *Banjhi, Doh, Sawa*

Large or medium-sized tree; bark whitish, smooth. *Leaves* alternate to opposite, broadly elliptic or oblong-elliptic, rarely orbicular, 5-10 x 3-5 cm., rounded, obtuse, rarely acute or emarginate, mostly glabrous with age, with pellucid dots; petiole 6-8 mm. *Flowers* heads 5-10 mm in diameter, peduncles usually in racemes or fascicled, or sometimes solitary. *Calyx* pubescent, teeth. *Fruit* yellowish-brown, 5-6 mm long excluding the beak and about as broad, beak equalling or shorter than the main fruit; beak as long as, or longer than the fruit wing with entire margin.



Distribution: Himalaya to Sri Lanka, ascending to 900 m. Pakistan.

Anogeissus pendula Edgew. in J.Asiat.Soc.Bengal 21:171. 1853; Clarke in Hook.f., Fl. Brit. India 2:451. 1878.

Vern. *Doh*

A small tree, bark smooth grey often silvery, twigs slender pendulous. *Leaves* 0.8-2.5 x 1-1.5 cm, elliptic or obovate, obtuse or acute, usually mucronate, base narrowed, glabrous or more or less adpressed silky hairy on both sides; petiole 2 mm long. *Flower-heads* 5 mm in diameter, on slender axillary unbranched peduncles. *Fruit* about 5 mm long, excluding the bark which is about half as long as the nucleus.



Distribution: Drier parts of India.

TERMINALIA L.

Terminalia alata Heyne ex Roth, Nov. Pl. Sp. 379. 1821. *T.tomentosa* (Roxb. ex DC.) Wight & Arn., Prod. 314.1834; Haines, Bot. Bihar & Orissa 2:352(369). 1922. *T.tomentosa* Wight & Arn. var. *tomentosa*; Clarke in Hook. f., Fl. Brit. India 2:447.1878. *Pentaptera tomentosa* Roxb. ex DC.Prod.3:14. 1828. *T.elliptica* Willd., Sp. Pl. 4(2):969.1806.

Vern. *Asan*

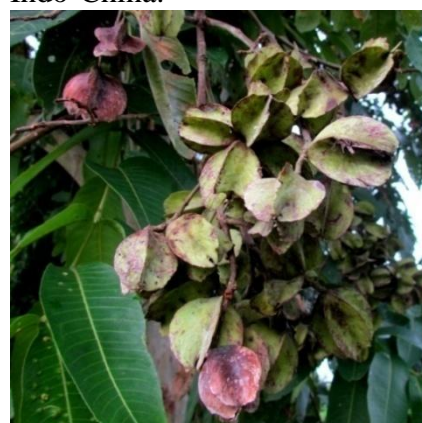
Large tree; bark dark, rough, cracked into oblong segments. *Leaves* opposite or subopposite, subsessile or petioled, elliptic-oblong, ovate-oblong or obovate-oblong, 8-23 x 5-8 cm, entire or nerves excurrent as teeth, with distinct tertiary nerves, pubescent, tomentose or glabrescent beneath; with two large glands at the base of the lamina beneath or on the petiole. *Flowers* ca. 5 mm across, in panicle spikes. *Fruit* 3.5-5(7.5) x 2.5 cm, 5-winged; wings over 1.2 cm wide, coriaceous, glabrous, with horizontal striations.



Distribution: Throughout India. Sri Lanka, Myanmar, Thailand, Indo-China.

Terminalia arjuna (Roxb. ex DC.) Wight. & Arn., Prod. 314. 1834; Clarke in Hook. f., Fl. Brit. India 2:447.1878; Haines, Bot.Bihar & Orissa 2:353 (368). 1922. *Pentaptera arjuna* Roxb. ex DC., Prod. 3:14.1828.

Vern. *Kahua*



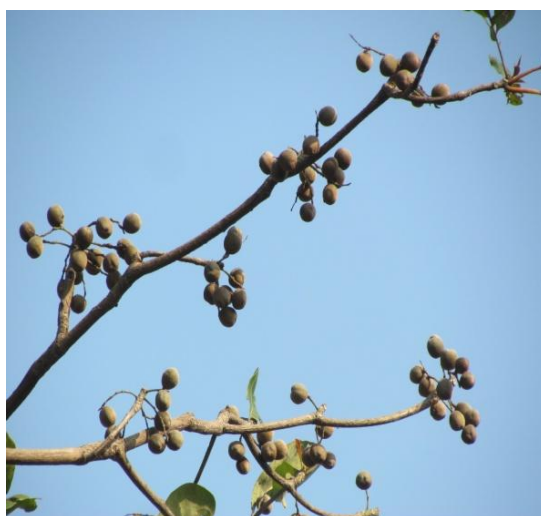
Large tree; bark grey or pale green, smooth. *Leaves* opposite or subopposite, subsessile or shortly petiolate, oblong or elliptic-oblong, 10-15 x 4-6.5 cm., entire or crenate, obtuse or subacute, glabrous, with two glands near the base of the lamina beneath or on the petiole; petiole 1.2 cm. *Flowers* white, 5 mm across, in shortly paniced spikes. *Fruit* 2.5-3.7 cm long, 5-winged; wings 1.2 cm wide, fibrous-woody, glabrous, with much ascending striations.

Distribution: Widely distributed in India. Sri Lanka.

Terminalia bellirica (Gaertn.) Roxb., Pl. Corom.t. 190. 1805 ('*bellerica*'); Wight, Icon.t.91. 1838; Clarke in Hook.f., Fl. Brit. India 2:445. 1878; Haines, Bot.Bihar & Orissa 2:352(367). 1922; Exell in Steenis, Fl. Males. I. 4:569. 1954.

Vern. *Bahera*

Tree; bark dark grey. *Leaves* clustered towards the ends of the branchlets, alternate, broadly elliptic or obovate, 7.5-20 x 7-15 cm, entire, rounded, obtusely-cuspidate or subacute at apex, cuneate at base, puberulous when young. *Flowers* greenish –white or greenish-yellow, 5-6.2 mm across, in solitary axillary or extra-axillary spikes, 7.5-15 cm long. *Calyx-tube* copular densely villous inside, lobes triangular. *Drupes* subglobose or pyriform, 1.8 cm across, grey-tomentose.



Distribution: Throughout India, upto 1100 m, except in the dry and arid regions of Rajasthan. Myanmar, Sri Lanka, Malaya.

Terminalia catappa L. Syst. Nat. ed . 12.2:674. 1767; Wight, Icon.t. 172. 1839; C.B.Clarke in Hook.f., Fl. Brit. India 2:444.1878; Haines, Bot. Bihar & Orissa 2:352(367). 1922;Exell in Steenis, Fl. Males. I.4:566.f. 17, 18.1954.

Tree with spreading crown; trunk buttressed. *Bark* cracked. *Leaves* clustered towards the ends of the branchlets, alternate, obovate, 15-28 x 10-18 cm, entire, obtuse, glabrous, base long cuneate but often narrowly cordate; petiole 1-2 cm. *Spikes* axillary, 8-16 cm long. *Flowers* yellowish, 6-8 mm across. *Fruit* ellipsoid, somewhat laterally compressed, 4-5 cm long, glabrous, with a very hard and fibrous endocarp.

Distribution: Tropical Asia, N.Australia, Malesia, Polynesia; Widely planted in tropics.

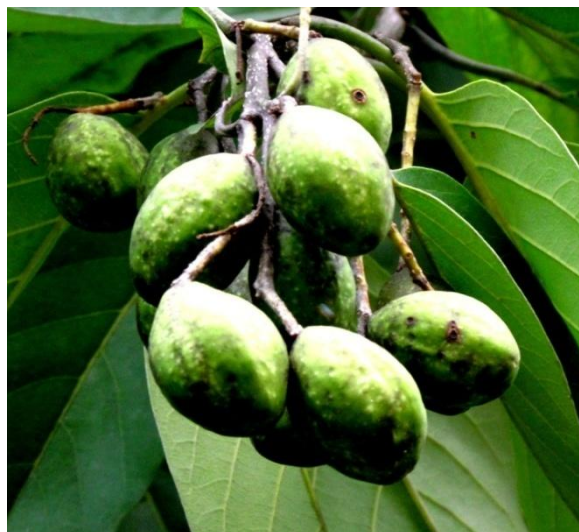


Terminalia chebula Retz., Obs.Bot. 5:31. 1789, incl.forma *tomentosa*; Clarke in Hook.f., Fl. Brit.

India 2:446. 1878, pro parte; Haines, Bot.Bihar & Orissa 2:352(368). 1922.

Vern. *Hara*

Tree; bark grey or dark grey; craked in old trees. *Leaves* usually subopposite, ovate or elliptic, 10-19 x 5-10 cm, entire, acute or obtuse, base rounded or rarely acute, silky hairy when young, glabrous or nearly so when mature; petiole 1.2-2.5 cm with usually 2 glands near the top. *Spikes* 5-9 cm, pubescent or tomentose, from the upper new leaf-axils and forming a small terminal panicles; bracts linear, as long as the buds, caducuous. *Flowers* whitish, very densely white villous within. *Drupes* ellipsoid, 2.5-3 cm long, glabrous, often 5-ribbed, when dry due to the 5-ribbed endocarp.



Distribution: Northern India, from Uttarakhand to Bengal and southwards to the Deccan. Sri Lanka, Myanmar, Nepal.

MYRTACEAE

CALLISTEMON R.Br.

Callistemon viminalis (Sol. ex Gaertn.) G.Don ex Loud. Hort. Brit. 197.1863.

A small evergreen tree; young shoots and inflorescence loosely hairy. *Leaves* alternate, 5-8 cm long, 5-8 mm broad, linear-lanceolate, narrowed at both ends, sharply pointed, not rigid, gland dotted. *Flowers* crimson in terminal spikes, 7-14 cm long. *Calyxtube* campanulate, 5-lobed. *Petals* 5, sub-orbicular. *Stamens* numerous; filaments crimson. *Fruit* a woody cup shaped capsule, 6 mm long.



Distribution: Native of Australia.

EUCALYPTUS L'Herit.

Eucalyptus camaldulensis Dehnhardt, Cat. Pl. Hort. Camald., ed. 2. 6, 20. 1832.

Trees, to 25 m tall. Bark dark gray, white, brown, or red, smooth, exfoliating. Branches sometimes pendulous, terete, youngest parts ridged. Young leaves opposite; leaf blade broadly lanceolate, 6-9 x 2.5-4 cm. Mature leaves with a slender 1.5-2.5 cm petiole;

leaf blade narrowly lanceolate to lanceolate, 6-30 × 1-2 cm, slightly twisted, thinly leathery, both surfaces with small black glands, secondary veins at an angle of ca. 45° from midvein, intramarginal veins ca. 0.7 mm from margin. Inflorescences axillary, simple, umbels 5-11-flowered; peduncle 1-1.5 cm, slender, terete. Flower buds ovoid, 5-8 mm. Hypanthium semiglobose, ca. 3 mm; stipe 3-12 mm; calyptra hemispheric, rostrate to obtusely conic, 5-7 mm, apically constricted, apex obtuse, acute, or acuminate and beaked or not. Stamens 5-7 mm; anthers elliptic, dehiscing longitudinally. Capsule subglobose, 5-6 mm in diam.; disk broad; valves (3 or)4(or 5), exserted from hypanthium. Fl. Dec-Aug.



Distributed: Cultivated in Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hunan, Jiangxi, Sichuan, Taiwan, Yunnan, and Zhejiang [native to Australia, where widespread.

PSIDIUM L.

Psidium guajava L. Sp. Pl. 490. 1753; Duthie in Hook.f. Fl. Brit. India 2:468.1878 (*guyava*’); Haines, Bot. Bihar & Orissa 2:364(380).1922.

Small tree; bark smooth, pinkish brown, exfoliating in small flakes. *Leaves* opposite, oblong or elliptic oblong, 10-15 cm long, entire, glabrous above, pubescent beneath, secondary nerves 15-20, prominent; petiole 7-9 mm long. *Flowers* white, 2.5-3.7 cm across on 1-3-flowered, axillary peduncles. *Calyx* urceolate, lower portion adnate to the ovary, upper portion free and irregularly lobed. *Petals* free. *Ovary* 4-5-celled; ovules many. *Berry* globose or pyriform varying in size and shape, generally over 6 cm long, many-seeded; seeds embedded in pleasantly flavoured sweet pulp.



Distribution: Cultivated and naturalized throughout India and Tropics of the World. Native of Tropical America.

SYZYGIUM Gaertn.

Syzygium cumini (L.) Skeels in U.S.D.A. Bur.Pl. Industr. Bull. 348:2.1912; Mooney, Suppl.Bot.Bihar & Orissa 65.1950. *Myrtus cumini* L., Sp. Pl. 471.1753. *Eugenia jambolana* Lam., Encycl. 3:198.1789; Duthie in Hook. f., Fl. Brit. India 2:499.1879, pro parte. *Syzygium jambolanum* (Lam.) DC., Prod. 3:259. 1828; Haines, Bot. Bihar & Orissa 2:360(376). 1922.



Vern. *Jamun*

Large glabrous tree; bark grey-brown or nearly black, often pitted more or less cracked when old. *Leaves* oblong or elliptic-oblong, mostly 6-12 x 3.5-5.3 cm, acute or acuminate, shining secondary nerves numerous, close, meeting near the margin in an intramarginal nerve, reticulations numerous between the main nerves, base slightly narrowed. *Flowers* white, sessile, mostly in 3-chotomous panicles with terete branches. *Calyx-tube* turbinate, with truncate or very obscurely lobed limb. *Petals* calyptrate. *Berry* ellipsoid or oblong, variable in size and shape, usually upto 2.5 cm long, black, shining and juicy when fully ripe, usually crowned with the cup-like limb of the calyx-tube, purple inside. *Seed* nearly always one.

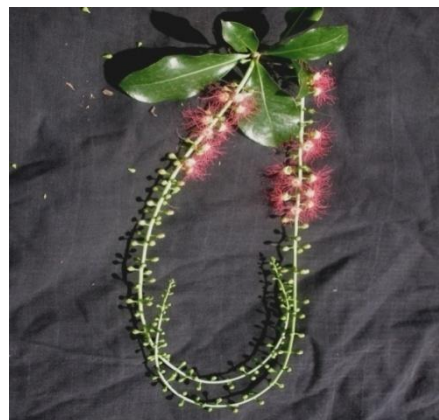
Distribution: Throughout India. Sri Lanka, Malesia, Asutralia.

BARRINGTONIACEAE (LECYTHIDACEAE)

Barringtonia acutangula (L.) Gaertn. Fruct. 2:97. t. 101. 1790; Bedd., Fl. Sylv. t. 204. 1872; Clarke in Hook.f., Fl. Brit. India 2:508. 1879; Haines, Bot. Bihar & Orissa 2:368(384). 1922; Payens in Blumea 15:1067. 1967. *Eugenia acutangula* L., Sp. Pl. 471. 1753.

Vern. *Ijjar*

Small or medium-sized tree; bark thick, dark grey, furrowed on old trees. *Leaves* obovate or oblanceolate, 7-13x4-10 cm, crenulate, rounded or subacute at apex, glabrous, base narrowed; petiole 5-15 mm. *Racemes* lax, drooping, 15-45(60) cm long; pedicels 5-7 mm long. *Flowers* red, 1-1.2 cm across, fragrant. *Hypanthium* acutely 4-angled, obpyramidal; calyx-lobes 2.5 mm, denticulate. *Petals* cadulous, 5 mm. *stamens* bright red. *Fruit* oblong quadrangular truncate, ca 2.5 cm long.



Distribution: Throughout India. Wide spread from Afghanistan to N. Australia.

LYTHRACEAE

LAGERSTROEMIA L.

Lagerstroemia parviflora Roxb., Pl. Corom.t.66. 1795; Clarke in Hook. f., Fl. Brit. India 2:575. 1879; Haines, Bot. Bihar & Orissa 2:375(392). 1922.

Vern. *Asidh*, *Seedha*, *Siddha*

Tree or sometimes large shrub; bark grey or reddish, smooth, stripping off in long narrow flake in old trees. *Leaves* narrowly elliptic or oblong or ovate-lanceolate, 5-8.5x2.5-3.7 cm, acute or acuminate. *Flowers* white, 7.5-12 mm across, in lax, axillary and terminal downy panicles of 2-5-flowered cymes. *Calyx-tube* copular, smooth, woody in fruit and embricating the capsule; lobes 6, triangular or lanceolate, acute. *Petals* 6, membranous, ovate-oblong, ca. 6 mm long, margin undulate. *Capsule* ellipsoid, 1.8-2.5 cm long, polished, 3-sometimes 4-valved. *Seeds* with a terminal wing which is thickened and somewhat curved on the back, 1.5-1.8 cm long, including the wing.



Distribution: Tropical Himalaya; Deccan plateau. Myanmar.

RUBIACEAE

ADINA Salisb.

Adina cordifolia (Roxb.) Hook.f. ex Brandis, For.Fl. N.W. India 263.t. 33. 1874, Hook.f., Fl. Brit. India 3:24.1880; Haines, Bot. Bihar & Orissa 2:421(441). 1922. *Nauclea cordifolia* Roxb., Pl. Corom.t. 53. 1796. *Haldinia cordifolia* (Roxb.) Ridsd. in Blumea 24:361. 1978.

Vern. *Karam, Karma, Kurum*

Large tree; bark smooth, light-coloured, exfoliating in patches. *Leaves* broadly ovate, 10-20 x 10-18 cm, shortly abruptly acuminate, glabrescent to minutely pubescent above, pubescent to tomentose beneath; stipules suborbicular, enclosing the terminal bud. *Heads* 1.8-2.5 cm diam., yellow, axillary, usually in vertical rows of three; peduncles 2.5-7.5 cm, with 2 small caducous bracts towards the end; bracteoles filiform, hairy and somewhat expanded upward. *Calyx-lobes* linear. *Corolla* 6.2 mm, tube pubescent. *Fruiting* heads dry, 1-1.2 cm diam.



Distribution: Outer ranges of Himalaya, upto 900 m, extending eastwards to Sikkim, Bhutan and Myanmar, southwards through Central India and South India to Sri Lanka. China, Vietnam, Thailand.

CATUNAREGAM Wolf

Catunaregam spinosa (Thunb.) Tirveng. in Bull. Mus. Hist. Nat (Paris) Ser. 3.35:13. 1978. *Gardenia spinosa* Thunb., Diss. Gard. 7:16.t.2.f.4.1780. *Randia dumetorium* (Retz.) Poir. in Lam., Encycl. Suppl. 2:829. 1811; Hook. f., Fl. Brit. India 3:110.1880; Haines, Bot. Bihar &

Orissa 2:432(453). 1922. *Gardenia dumetorum* Retz., Obs. Bot. 2:14.1781. *Randia dumetorum* (Retz) Poir.var. *floribunda* (DC.) Gamble, Fl. Madras 2:615(616). 1921. *R.floribunda* DC., Prod. 4:386. 1830. *R.longispina* (Roxb.) DC., Prod. 4:386.1830. *Posoqueria longispina* Roxb., Fl. Ind. 2:566. 1824. *Randia brandisii* Gamble, Fl. Madras 3:616(434). 1921. *Xeromphis spinosa* (Thunb.) Keay in Bull. Jard.Bot.Etat. Brux. 28:37. 38.1958.

Vern. Karhar, Kathari, Maun, Mon

Small tree or large shrub usually armed with straight axillary spines; bark grey nearly smooth but fissured with fine lines. *Leaves* mostly clustered on short branchlets, obovate to oblanceolate, 2.5-7.5 x 2-4 cm, obtuse or shortly acuminate, base narrowed into a short slender petiole 5-10 mm long. *Flowers* white turning yellow, 1.2-3 cm across, solitary, terminal on new shoots or in 3-4-flowered, sessile cymes, subsessile or with pedicels 1.2 cm. *Calyx*-tube strigose; lobes ovate or obovate-lanceolate or oblong. *Corolla* tube campanulate, 6-10 mm long, lobes ultimately reflexed, obovate, oblong oblanceolate. *Berry* yellow when ripe, globose or ovoid, 2.5-3.7 cm diam., crowned by the calyx, glabrous.



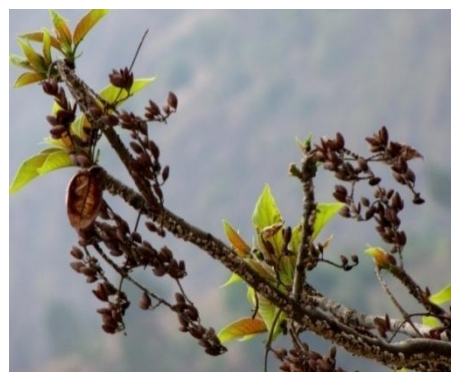
Distribution: Throughout India. Sri Lanka, Java, Sumatra, S.China, E. tropical Africa.

HYMENODICTYON Wall.

Hymenodictyon orixense (Roxb.) Mabb. in Taxon 31:66. 1982. *Cinchona orixensis* Roxb., Bot. Descr. Swietenia 21. 1793. *Hymenodictyon excelsum* (Roxb.) Wall. in Roxb., Fl. Ind. 2:149. 1824; Hook. f., Fl. Brit. India 3:35. 1880; Haines, Bot. Bihar & Orissa 2:425 (446). 1922. *Cinchona excelsa* Roxb., Pl. Corom.t. 106. 1799. *Hymenodictyon obovatum* Wight, Icon.t. 80. 1838; *non* Wall.

Vern. Bhurkul, Papratua, Papritua

Large or medium-sized tree; bark dark-grey, thick, rugged. *Leaves* at the ends of the branches, ovate to broadly elliptic, 10-25 x 3.5-15 cm, acuminate, pubescent, base acute; petiole 2.5-10 cm. *Flowers* whitish or yellowish green, crowded on the abbreviated branches of thyrsoid suberect or drooping tomentose panicles, 7.5-15 cm long or more, subtended by long-petioled leaf-like bracts which become dry in fruit. *Capsule* oblong-elliptic, ovoid or elliptic, 1.8-2 x 0.7-0.8 cm, finally reflexed (or on reflexed rachis).



Distribution: Along the base of the Himalaya, west to Ravi, ascending to 1500 m; southwards to Central and S.India. Myanmar, Nepal, Java.

WENDLANDIA Bartl.ex DC.

Wendlandia heynei (Roem. & Schult.) Sant. & Merch. in Bull.Bot.Surv. India 3:110.1961. *Rondeletia heynei* Roem. & Schult., Syst. 5:234.1820. *Wendlandia exserta* (Roxb.) DC., Prod. 4:11.1830; Hook. f., Fl. Brit. India 3:37.1880; Haines, Bot.Bihar & Orissa 2:426.1922.



Vern. *Thilka*

Small tree, hoary-pubescent all over; bark light brown. *Leaves* elliptic, elliptic-oblong, ovate-lanceolate or oblong, 10-20 x 2.5-6.5 cm, acuminate, hoary-pubescent, secondary nerves 12-16, prominent, base acute; petiole 1-2 cm; stipules broadly oblong or ovate, recurved, persistent or subpersistent. *Panicles* pyramidal, 7.5-15 cm, lower branches sometimes axillary; bracts rhomboid-lanceolate, 3.5 mm long, hairy. *Flowers* white, ca. 2 mm long. Corolla-tube; lobes 2.5 mm long. *Capsule* 1.5-1.7 mm diam., hoary-pubescent, crowned by the erect lanceolate hairy calyx-lobes.

Distribution: Tropical and Subtropical Himalaya from Chenab eastwards to Nepal and Sikkim, upto 1500 m; Orissa, Central India, Maharashtra, Deccan, Konkan, N. Circars.

SAPOTACEAE

MADHUCA Buch-Ham.

Madhuca longifolia (Koenig) Macbr. var. **latifolia** A. Chev. Rev. Int. Bot. Appl. Agric. Trop. 23:149. 1943; P.Royen in Blumea 10:55.1960. *Madhuca indica* Gmel., Syst.Nat. 2:799.1791. *Bassia latifolia* Roxb., Pl. Corom.t.19.1795. Clarke in Hook. f., Fl. Brit. India 3:544.1882; Haines, Bot. Bihar & Orissa 2:511(536). 1922.

Vern. *Mahua*

Large or moderate-sized tree; bark brown, nearly smooth; branchlets pubescent or tomentose. *Leaves* clustered near the ends of the branches, elliptic, elliptic-oblong or ovate, 12-20 x 6-10 cm, acuminate, pubescent or rusty tomentose beneath when young. *Flowers* cream, fleshy, on rusty tomentose pedicels; clustered at the ends of the usually leafless branches,



from the leaf-scars. *Calyx-lobes* ovate, rusty tomentose. *Corolla-tube* ovoid, erect in flower, 7-14, often 8 in two series with the outer series twisted, the inner imbricate, elliptic or narrowly elliptic. *Stamens* subsessile. *Berry* ovoid, 2.5-5 cm long, tomentose. *Seed* ellipsoid, 1 double convex, or 2-4 more or less flattened on one or two sides, pale-brown, 3-3.7 cm long; testa soft, with milky juice.

Distribution: Widely distributed in India. Myanmar.

MIMUSOPS L.

Mimusops elengi Linn., Sp. Pl. 349. 1753; Clarke in Hook. f., Fl. Brit. India 3:548. 1882; Haines, Bot. Bihar & Orissa 513.1922.

Large or often small tree. *Leaves* elliptic or elliptic-oblong, 6.2-10 cm long, margins often wavy, acute or acuminate, shining, glabrous. *Flowers* white, fascicled, ca 2 cm across; pedicels pubescent, about as long as the petioles. *Calyx-lobes* usually 4+4, but rarely 3+3 on the same tree. *Corolla-lobes* lanceolate and subsimilar. *Stamens* 8 and an inner series of petaloid, rather membranous, villous, usually toothed staminodes. *Berry* rather variable, usually narrowly ovoid or ellipsoid 2.5 x 1.8 cm, orange, 1-seeded.



Distribution: Deccan Peninsula. India to Hawaii, N.Australia, New Caledonia; commonly cultivated in the tropics.

APOCYNACEAE

ALSTONIA R.Br.

Alstonia scholaris (L.) R.Br. Mem. Wern. Nat. Hist. Soc. 1:76. 1811; Hook.f., Fl. Brit. India 3:642. 1882; Haines, Bot. Bihar & Orissa 532.1922. *Echites scholaris* Linn., Mant. Pl. 53. 1767.

Vern. *Chatwan*

Large tree with milky latex; branches often towards whorled; bark dark grey, nearly smooth, lenticellate. *Leaves* 3-7, usually 6 in a whorl, obovate-oblong, oblanceolate to obovate, 7-20 x 2-6.5 cm, obtuse or retuse, glabrous, secondary nerves many, parallel, base narrowed; petiole 6-12 mm. *Inflorescence* umbellately branched cymose panicle, puberulous, peduncled or sessile. *Flowers* greenish-white or cream, subcapitate at the ends of the panicle branches. *Disc* 0. *Corolla* 0.8-1.5 cm across. *Ovary* hirsute. *Follicles* pendulous, terete, narrow, 30-60 cm long. *Seeds* ca 7.5 mm long.



Distribution: Widely distributed in India; often planted. Sri Lanka, SE. Asia from Myanmar and S.China through Malesia to New Guinea and Queensland, also Africa.

ERVATAMIA (A.DC.)Stapf

Ervatamia divaricata (Linn.) Burkill, Rec. Bot. Surv. India 10:320. 1925; Huber in Dassan. & Fosberg, Rev.Handb. Fl. Ceylon 4:27. 1983. *Nerium divaricatum* Linn., Sp. Pl. 209. 1753. *Nerium coronarium* Jacq. Coll. Bot. 1:138. 1786. *Tabernaemontana coronaria* (Jacq.) Willd.Enum.Bort.Berol 275. 1809; Hook.f., Fl. Brit. India 3:646. 1882; Haines, Bot. Bihar &

Orissa 537.1922. *T.divaricata* (Linn.) R.Br. ex Roem. & Schult. Syst. 4. 427. 1819. *Ervatamia coronaria* (Jacq.) Stapf in Oliver, Fl. Trop. Africa 4:127. 1902.

Shrub or small tree. *Leaves* oblong-ob lanceolate, or elliptic-oblong rarely obovate, mostly unequal 3-5 cm, acute, acuminate or caudate, glabrous, shining, base acute; petiole 6.2-10 mm; axils glandular. *Flowers* white, 3.7-4.5 cm across. *Calyx* 2.5 mm long, lobes obtuse or rounded. *Corolla-tube* 2-2.5 cm, slender; lobes obliquely obovate or ovate-oblong, obtuse, rounded or acute. *Follicles* 4-5 cm long, spreading and recurved, coriaceous, sessile or stipitate, turgidly oblong, 3-7-ribbed, inside orange or red. *Seeds* with a fleshy, red aril.



Distribution: Cultivated throughout India. Throughout the tropics.

HOLARRHENA R.Br.

Holarrhena pubescens (Buch.-Ham.) Wall.ex.G.Don, Gen.Syst. 4:78. 1837. *Echites pubescens* Buch.-Ham. in Trans. Linn. Soc. London 13:521. 1821. *Nerium antidysentericum* L., Sp. Pl. 209. 1753. nom. ambig. *Echites antidysenterica* Roxb.ex Fleming, Asiat.Res. 2:166. 1810. *Holarrhena antidysenterica* Wall.ex. A.DC.in DC., Prod. 8:413.1844; Hook. f., Fl. Brit. India 3:644. 1882; Haines, Bot. Bihar & Orissa 2:538(564). 1922. *Chonemorpha antidysenterica* (Roth) G. Don, Gen. Hist. 4:76. 1837. *Holarrhena cadaga* G. Don, Gen. Hist. 4:78. 1837. *H.maleccensis* Wight, Icon.t. 1298. 1848.

Vern. *Dudhkorla*

Large shrub or small tree; bark thick smooth. *Leaves* elliptic, ovate or elliptic-oblong, 6-30 x 3.5-12.5 cm, acute to acuminate, glabrous or pubescent (or tomentose), base acute to obtuse or rounded; petiole 5-8 mm. *Cymes* 7.5-15 cm wide. *Flowers* white, 1.8-3.7 cm diam. *Calyx-lobes* 2.5 mm. *Corolla-tube* 1 cm, pubescent, lobes 1.2-1.5 cm. *Follicles* slender, divaricate, 15-25 cm long. *Seeds* linear-oblong, 1.2 cm long with a long coma.



Distribution: More or less throughout India, ascending to 1200 m. Myanmar, Indo-China, Malaya.

PLUMERIA L.

Plumeria rubra L.Sp.Pl. 209. 1753; Haines, Bot. Bihar & Orissa 2:537 (563).1922; Huber in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 4:29.1983. *P.acuminata* R.Br. in Ait. Hort. Kew. 2:70.1789; Hook. in Curtis Bot. Mag.t. 3952.1842. *P.acutifolia* Poir. in Lam. Encycl. Suppl. 2:667. 1812; Wight, Icon. t. 471. 1841; Hook. f. in Fl. Brit. India 3:641. 1882; Haines, Bot. Bihar & Orissa 2:536(563). 1922.

Small tree. *Leaves* oblanceolate, obovate-oblong or oblong, 20-30 x 7-8 cm, acute or obtuse, mid-rib thick, secondary nerves parallel, base tapering; petiole upto 8 cm. *Flowers* red or white with a yellow centre, fragrant, in short umbellately divided on a long peduncle. *Corolla* lobes obovate-elliptic, 3.7 cm long; tube 1.2-1.8 cm, hairy within.

Distribution: Cultivated throughout India. Native of tropical America; widely naturalized in the tropics.



BORAGINACEAE

EHRETIA R. Br.

Ehretia acuminata R.Br. var. **serrata** (Roxb.) Johnston, J. Arnold Arbor. 32:23. 1951. *E. serrata* Roxb., Fl. Ind. 2:340. 1824., Wight, Ill. t. 170. 1850. *E. acuminata* sensu Clarke in Hook. f., Fl. Brit. India 4:141. 1883; Haines, Bot. Bihar & Orissa 576. 1922. Vern. *Kanair, Khaura, Purain, Ratangaroor*

Small or medium-sized tree; bark pale-grey, flaking. *Leaves* elliptic or elliptic-oblong, 7.5-13.7 cm long, acute or acuminate, sharply serrate, glabrous or minutely hispidulous above; petiole 1.8-3.7 cm. *Flowers* 3.7 mm across, clustered on the branches of dense pyramidal pubescent panicles, 7.5-15 cm long. *Calyx* 1.2 mm long, ciliate. *Corolla-lobes* very short, lobes broadly oblong, soon reflexed style shortly 2-fid. drupe ellipsoid, 3-4.3 mm diam., with 2-pyrenes, 4-seeded.

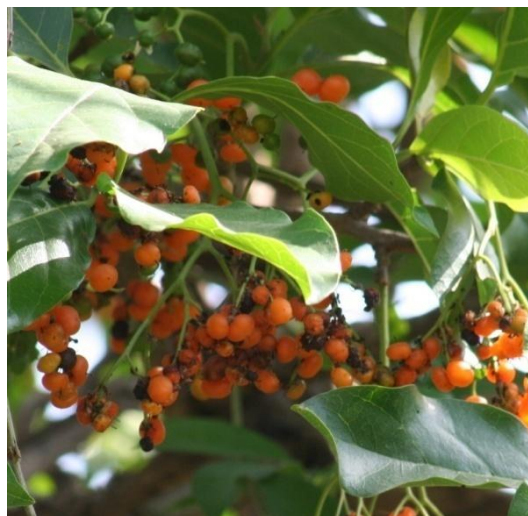
Distribution: Subtropical Himalaya; Meghalaya; N. Circars. Myanmar.



Ehretia laevis Roxb., Pl. Corom. t. 56. 1796; Clarke in Hook. f., Fl. Brit. India 4:141. 1883; Haines, Bot. Bihar & Orissa 576. 1922.

Vern. *Datrang, Khairkhota, Koura, Panapati*

Small or medium-sized tree; bark white or pale grey. *Leaves* ovate or ovate-oblong, broadly or narrowly elliptic or rarely obovate, 7.5-15 x 3-7.5 cm, often larger when mature, often inequilateral, entire, acute or shortly acuminate, rarely, obtuse. *Flowers* white, 7.5-10 mm across, sessile or pedicelled, in dichotomous scorpioid cymes 5-10 cm diam., usually borne laterally on the bare branches, more rarely terminal on the young shoots; cyme branches pubescent. *Calyx* usually pubescent, lobes lanceolate or oblong-lanceolate, scarcely accrescent. *Corolla-lobes* acuminate. *Style* 2-fid. *Drupe* orange to black, subglobose or 2-lobed, 4-6.2 mm diam., with 1-4 pyrenes.



Distribution: Throughout India, upto 1100 m. Tropical and subtropical regions of the Old World.

BIGNONIACEAE

HAPLOPHRAGMA Dop

Haplophragma adenophyllum (DC.) Dop in Bull. Soc. Bot. France 72:890. 1925. *Spathodea adenophylla* DC., Prodr. 9:206. 1845; Wight, Ill.2:t. 160. 1850. *Heterophragma adenophyllum* (DC.) Steem. ex Benth. in Benth. & Hook.f., Gen. Pl. 2:1047. 1876; Clarke in Hook.f., Fl. Brit. India 4:381. 1884.

Vern. *Kathsaigon*

A medium-sized deciduous tree. *Leaves* opposite, imparipinnate 30-60 cm long. *Leaflets* 5-7, with often a pair of small auricle-like leaflets at the base of the petiole, very variable in size 8-25 x 5-18 cm, the terminal usually much the largest, elliptic or elliptic-oblong, apex rounded or acuminate, entire or undulate, more or less pubescent beneath, the lateral sessile. *Flowers* 6-8 cm across, yellowish-brown, in erect terminal brown-tomentose panicles. *Calyx* campanulate, brown-tomentose outside, irregularly 3-5-lobed. *Corolla* densely brown-tomentose outside, tube. *Stamens* 4; anthers-cells divergent. *Capsule* 30-90 cm long, cylindric, ribbed, twisted, loculicidally 2-valved, densely brown-tomentose.



Distribution: Indigenous to Burma and the Andamans. Cultivated throughout India.

JACARANDA Juss.

Jacaranda mimosifolia D.Don, Bot. Reg. 8:t. 631. 1822; Haines, Bot. Bihar & Orissa 2:659(691); Steenis in Steenis, Fl. Males. I. 8:183. 1977. *J.ovalifolia* R.Br. in Curtis, Bot. Mag. t. 2:327.1822.

Large tree. *Leaves* opposite, twice imparipinnate; rachis slightly winged; leaflets numerous, oblong, more or less trapezoid or rhombic, 7-15 x 2.5-4 mm, terminal largest, acute or obtuse, apiculate, glabrous. *Flowers* blue, showy, in long, loose terminal panicles. *Calyx* small. *Corolla* tubular-campanulate with moderately long, narrow basal tube. *Stamens* included; anthers glabrous with divaricate cells; the staminode very long and clavate at the end with a short 2-lobed hairy tip. *Capsule* elliptic or almost



orbicular, 6 cm diam., woody, compressed at right angles to the septum, loculicidal, each valve carrying with it half the septum.

Distribution: Common in Indian hill gardens. Tropical America, Bolivia to NW. Argentina.

VERBENACEAE

GMELINA L.

Gmelina arborea Roxb., Pl. Corom.t. 246. 1815; Clarke in Hook.f., Fl. Brit. India 4:581. 1885; Haines, Bot. Bihar & Orissa 719. 1922; Rajendran & Daniel, Indian Verbenaceae. 155. 2002.

Vern. *Gambhar*, *Gamhar*

Large or moderate-sized tree; bark light grey, exfoliating in lighter coloured patches when old. *Leaves* broadly ovate, 10-18 (22.5) x 6-12.5(20) cm, entire, acuminate or caudate, glabrous above, white- or grey-stellate-tomentose beneath, base cordate or subcordate, strongly 3-5-nerved and usually shortly cuneate on the petiole, mostly with one or several large glands at the base between the primary nerves; petioles 5- 15 cm long, often unequal in a pair.

Flowers yellow, or yellow-brown, 2.5-3.7 cm long in lateral or terminal panicles, 7.5-20 cm long, caducous.

Calyx campanulate, 5-6.2 mm, tomentose. *Corolla*

tomentosely hairy outside up to 5 cm across, upper lip much shorter than the lower, anterior lobe shovel-shaped. *Drupe* obovoid, 1.8-2.5 cm diam., usually 2-1- celled and seeded.

Distribution: Throughout India, Pakistan, Bhutan, Bangladesh, Myanmar, Sri Lanka, Thailand, Indo-China, Malaya, Indonesia, S. China; introduced in many parts of tropical Africa, S. Africa and elsewhere.



TECTONA L.f.

Tectona grandis L.f., Suppl. Pl. 151. 1781; Clarke in Hook.f., Fl. Brit. India 4:570. 1885; Mold. & A.L. Mold. In Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 4:304. 1983; Rajendran & Daniel, Indian Verbenaceae. 320. 2002.

Large deciduous tree; branches 4-sided and channeled, lawny stellate-tomentose; bark light brown or grey. *Leaves* large, elliptic or obovate, 30-60 cm long, scabrid above, stellate-tomentose beneath. *Panicle* large, erect, terminal, brachiate, stellate-tomentose, 30-60 or sometimes 90 cm long; bracts short, lanceolate. *Flowers* white, short-pedicelled. *Calyx* 3-4.3 mm in flower, large, inflated, 2.5-3.7 cm diam. in fruit. *Corolla* 5-6.2 mm long, throat glabrous. *Drupe* subglobose, 1.2 cm diam., somewhat 4-lobed, with a thick spongy covering of matted hairy exocarp; endocarp bony with 1-4, usually 1-2 seeds.

Distribution: W. Deccan Peninsula; Central India to Orissa; also widely planted. Tropical Asia; native to



India, Myanmar, through Thailand and Malaya to Java; Widely cultivated in tropical Asia and Africa.

LAURACEAE

LITSEA Lam.

Litsea glutinosa (Lour.) Robins in Philipp. J. Sci. 6:321. 1911; Kosterm. in Reinwardtia 7:505. 1969. *Sebifera glutinosa* Lour., Fl. Cochinch. 638. 1790. *Litsea chinensis* Lam., Encycl. 3:574. 1792. *L. sebifera* (Willd.) Pers. Syn. Pl. 2:4. 1806; Hook.f., Fl. Brit. India 5:157. 1886; Haines, Bot. Bihar & Orissa 3:793 (832). 1924. *Tetranthera apetala* Roxb., Pl. Corom. t. 147. 1800.

Vern. *Dardmaida*, *Men*

Small or medium-sized tree; bark grey, smooth or dark grey and slightly rough in old trees. *Leaves* very variable in size and shape, elliptic, elliptic-lanceolate, oblong or lanceolate, 5-16 (27.5) x 2.5-6.5 (7.5) cm, obtuse to acuminate or rounded, glabrous or pubescent, base obtuse or acute; petiole 1.8-3.5 cm. *Flowers* white or yellowish, in corymbose or racemose, few-flowered umbels; peduncles pubescent or glabrescent, 0.7-2 cm long, axillary or from the axils of caduceous bracts on the new shoots below the leaves; pedicels very short; bracts concave orbicular. Perianth-tube minute in flower, thickened and disc-like in continuation with the pedicel, 3.7-4.4 mm diam. in fruit; lobes 0 or incomplete. *Stamens* 9-20, with long villous filaments; glands fleshy on villous stalks. *Fruit* black, globose, 0.8-1 cm diam.



Distribution: Throughout the hotter parts of India. Sri Lanka, Myanmar, China, Indo-China, Malesia.

Litsea monopetala (Roxb.) Pers., Syn. Pl. 2:4. 1801. *Tetranthera monopetala* Roxb., Pl. Corom. 2:26. 1800. *Litsea polyantha* Juss., Ann. Mus. Hist. Nat. 6:211. 1805; Hook.f., Fl. Brit. India 5:162. 1886; Haines, Bot. Bihar & Orissa 3:794 (833). 1924; Mooney, Suppl. Bot. Bihar & Orissa 132. 1950.

Vern. *Mathwa*

Small tree; bark dark grey, smooth; branchlets brown-pubescent. *Leaves* alternate, elliptic, oblanceolate-oblong or orbicular-oval, 5-22.5 x 3-10 cm, obtusely acute, obtuse or subacute, strongly nerved, pubescent and glaucous or tomentose beneath, base rounded; petiole 1-1.8 cm. *Umbels* tomentose, stout-pedicelled clustered along the branchlets and axillary, 2-several in a cluster, sometimes on a very short common peduncle, 5-6-flowered. Fruiting pedicel 6.2-18 mm. Perianth-lobes usually 5, linear-oblong, nearly free. *Stamens* 9-13; filaments hairy, reduced to 2-glandular staminodes in female flower. *Fruit* ellipsoid or ovoid, 6.2-10 mm long, seated on the shallow, saucer-shaped



perianth-tube.

Distribution: Foot-hills of Himalaya; Assam; Satpura Range; Bihar. Myanmar, Java, China.

EUPHORBIACEAE

BRIDELIA Willd.

Bridelia retusa (L.) Spreng., Syst. Veg. 3:48. 1826; Hook.f., Fl. Brit. India 5:268. 1887, pro parte; Haines, Bot. Bihar & Orissa 1:119 (123). 1921. *Cluytia retusa* L., Sp.Pl. 1042. 1753.

Vern. *Bherra, Kaj, Kalajiri, Khujji*

Small or moderate-sized tree, usually with long conical thorns on the trunk when young; bark grey, flaky. *Leaves* oblong or elliptic-oblong, sometimes somewhat obovate, 7-25 x 3.5-10 cm, acute, obtuse or rounded or even retuse, grey or glaucous beneath. *Flowers* small, green, monoecious, in axillary clusters towards the ends of the branchlets, later when the leaves fall off these appear to be spicate. *Male flowers* pedicelled, female subsessile. *Sepals* lanceolate. *Petals* in male broad, angular or coarsely toothed, in female oblong, entire, persistent. *Drupe* black when fully mature, globose, 6-7.5 mm diam., pyrenes furrowed.



Distribution: Throughout the hotter parts of India. Sri Lanka, Malacca, Myanmar.

MALLOTUS Lour.

Mallotus philippensis (Lam.) Muell.-Arg. in Linnaea 34:196. 1865; Bedd., Fl. Sylv.t. 289. 1873 (*'philippinensis'*); Hook.f., Fl. Brit. India 5:442. 1887; Haines, Bot. Bihar & Orissa 1:104 (110). 1921. *Croton philippense* Lam., Encycl. 2:206. 1786. *Rottlera tinctoria* Roxb., Pl. Corom.t. 168. 1802.

Vern. *Abeer, Amshahri, Rohna, Rori*

Tree, often small; bark nearly smooth, grey; branchlets and young leaves covered with greenish yellow, glandular pubescence. *Leaves* alternate, ovate, rhomboid, ovate-oblong, or ovate-lanceolate, 6-22.5 x 3-12.5 cm, entire or sometimes serrate or toothed, acute or acuminate glabrescent above, grayish pubescent to fulvous tomentose and red-glandular beneath, base rounded 3-nerved secondary nerves 3-4; petiole 2.5-8.7cm. *Tepals* tomentose outside, glabrous within. *Male flowers* clustered in racemes, 11-25cm long, axillary and densely paniced at the ends of the branchlets. *Flowers* whitish-yellow, 3mm diam. anther-cells longitudinally dehiscent, sometimes with a few red glands. Female racemes 5-7.5cm long, flowers



distant, rarely 2 together. *Perianth* 4-fid. *Ovary* tomentose and red-glandular; stigmas 3, spreading, yellow. *Capsule* globose, 7.5-12.5 mm diam., smooth, densely covered with red glands, 3-valved. *Seeds* globose, smooth black.

Distribution : Throughout India, up to 1450 m on the Himalaya. Sri Lanka, Formosa, Malesia, Australia and Melanesia.

PUTRANJIVA Wall.

Putranjiva roxburghii Wall. Tent. Fl. Nep. 61. 1826; Wight, Icon. t. 1876. 1852; Bedd., Fl. Sylv. t. 275. 1872; Hook. f., Fl. Brit. India 5:336. 1887; Haines, Bot. Bihar & Orissa 1:136 (140). 1921. *Drypetes roxburghii* (Wall.) Hurusawa in J. Fac. Sci. Univ. Tokyo Sect. 3. Bot. 6:335. 1954; Airy Shaw in Kew Bull. 26:257. 1972.

Vern. *Jurpiti*, *Putranjeeva*

Large or moderate-sized tree, often with drooping branches; branchlets pubescent or tomentose; bark dark grey. *Leaves* bifarious, oblong, broadly lanceolate or oblong-lanceolate, 2.5-10.5 x 1.2-5 cm, margin wavy, serrulate or shallowly distantly crenulate, obtuse or rounded (or shortly acuminate), glabrous or puberulous, shining above, secondary nerves ca. 12, very fine, base obtuse or rounded; petiole 5-12 mm, pubescent or tomentose; stipules minute, caducous. *Flowers* monoecious or dioecious, males numerous, clustered axillary or on leafless axillary shoots and on previous years wood, females long-peduncled, usually solitary axillary; pedicels pubescent. Male flowers yellow, 2.5 mm across. *Tepals* 3-6, lanceolate or linear-oblong, ciliate. *Stamens* 2-4, central; filaments more or less connate below. *Disc* 0. Female flowers green, 4 mm across. *Tepals* oblong, wider upwards and toothed, 1.2-1.8 mm long. *Ovary* 2-3-celled; styles 2-3, stigmatiferous, dilated, papillose. *Drupe* obovoid or ellipsoid, 1.5-1.8 cm long, hoary-tomentose, apiculate, with hard 1-celled and 1-seeded endocarp.



Distribution: Throughout tropical India, wild and cultivated. Sri Lanka, Myanmar, Indo-China, Java, Moluccas, Lesser Sunda Isls., E. New Guinea.

PHYLLANTHACEAE

PHYLLANTHUS L.

Phyllanthus emblica L., Sp. Pl. 982. 1753; Bedd., Fl. Sylv. t. 258. 1872; Hook. f., Fl. Brit. India 5:289. 1887; Webster in J. Arnold Arbor. 38:76. 1957; Airy Shaw, Euphorb. Borneo 183. 1975. *Emblica officinalis* Gaertn., Fruct. 2:122. t. 108. f. 2. 1790; Wight, Icon. t. 1896. 1852; Haines, Bot. Bihar & Orissa 1:128 (132). 1921.

Vern. *Amla*

Small or moderate-sized deciduous tree; bark light grey, exfoliating; branchlets hairy, 7.5- 20 cm long with close-set distichous leaves. *Cataphylls* small with 2 stipules. *Leaves* linear or linear-oblong, 7.5-18 x 1.8-2.5 mm, margined, apiculate, glabrous; petiole 1-2 mm; stipules minute, fimbriate or with hair tip. *Flowers* monoecious, yellowish, minute, in axillary fascicles, males and females mixed or frequently female in the lower and males in upper axils of present or fallen leaves. *Tepals* 6(-5). *Disc* 0 or of distinct glands in male, copular in female. *Male flowers* : Pedicels slender. *Stamens* 3; filaments connate into a slender column; anthers free but broad connectives connivent back to back, the cells dehiscing vertically. *Female flowers* subsessile or with short pedicel. *Ovary* 3-celled; ovules 2, collateral in each cell; styles more or less connate below, twice 2-fid above. *Drupe* globose, 1.8-2.5 cm diam., succulent, yellow or tinged with pink when ripe, with a 6-ridged putamen which is tardily dehiscent at the ridges.



Distribution: Throughout India, up to 1400 m on the Himalaya; Assam, Sri Lanka, Myanmar, S. China, Indo-China, Malesia.

TREWIA L.

Trewia nudiflora L., Sp. Pl. 1193. 175; Wight, Icon. t. 1870. 1852; Hook. f., Fl. Brit. India 5:423. 1887; Haines, Bot. Bihar & Orissa 1:105 (109). 1921; Mooney, Suppl. Bot. Bihar & Orissa 29. 1950; Airy Shaw in Kew Bull. 26:343. 1972.

Vern. *Pania*, *Vilor*

Deciduous tree, superficially much resembling Gmelina; bark smooth, grey, old flaking in thin patches; branches and young stems with thin raised stipular lines; young parts hispid. *Leaves* large, broadly ovate or ovate-oblong, 6-20 x 3.5-12 cm, acuminate, glabrous above, tomentose, hispid-pubescent or glabrescent, or sometime villosely stellate beneath, 5-7-nerved at base and with 4-6 strong secondary nerves, base rounded or usually cordate, usually with two large glandular areas on the blade above either side of the top of the petiole; petioles long, 2.5-10 cm long; stipules minute, caducous. *Flowers* yellow. *Male racemes* drooping, 10-20 cm long with flowers usually in threes on slender, bracteolate, articulate pedicels. *Tepals* finally reflexed. *Female flowers* solitary or 2-3 terminal, closely invested by the urceolate, 5-toothed perianth, which splits longitudinally; peduncle short, very stout, bracteate, upto 5-8.7 cm in fruit. *Drupe* globose ellipsoid or ovoid, 3-3.7 cm diam., tomentose when young.



Distribution: Hotter parts of India. Sri Lanka, Myanmar, Indo-China, S. China, W. Malesia.

ULMACEAE

CELTIS L.

Celtis tetrandra Roxb., Fl. Ind. 2:63. 1832; Hook.f., Fl. Brit. India 5:482. 1888; Haines, Bot. Bihar & Orissa 3:808 (848). 1924; Mooney, Suppl. Bot. Bihar & Orissa 133. 1950; Soep. in Steenis, Fl. Madras I. 8:66. 1977. *C.serotina* Planch., Ann. Sci. Nat. Bot. (ser.3). 10:301. 1848; Wight, Icon.t. 1970. 1853.

Vern. *Bajkarai*

Large or medium-sized tree; bark white, pale or grey. *Leaves* obliquely ovate or ovate-lanceolate, 3-12 x 1.7-4.2 cm, subentire, serrate or crenate, usually serrate above middle, acuminate or caudate, stiff, glabrous or with tufts of hairs in the axils of the secondary nerves, secondary nerves 2-3, fine but strong, one each side nearly reaching the apex; petiole slender, 2.5-5 mm. *Flowers* 4-merous. *Fruiting* peduncles simple, nearly always solitary, 7.5-10 mm; *Drupe* globose, broadly ellipsoid or ovoid, 6-7.5 mm long, orange when ripe, glabrous, with ovoid, ridged otherwise smooth putamen.



Distribution: Lower outer Himalaya; Sikkim; Meghalaya; Bihar; Deccan Peninsula. Bangladesh, Myanmar, Indo-China, Malesia, Thailand.

HOLOPTELEA Planch.

Holoptelea integrifolia (Roxb.) Planch., Ann. Sci. Nat. Bot. (ser.3) 10:266. 1848; Hook.f., Fl. Brit. India 5:481. 1833; Haines, Bot. Bihar & Orissa 3:807(847). 1924. *Ulmus integrifolia* Roxb., Pl. Corom. t. 78. 1798.

Vern. *Chilbil*, *Chiriata*

Large or small tree; bark light-coloured, becoming thick and fleshy in very old trees; branches white. *Leaves* elliptic or ovate, sometimes somewhat obovate, 5-15 x 3.7-8.5 cm, mature usually entire or coarsely crenate or serrate, obtuse or often shortly acuminate, translucent-punctate when green, with minute raised dots beneath when dry, usually glabrescent or pubescent on the nerves beneath, base rounded, oblique or somewhat cordate. *Flowers* green, in very numerous fascicles or abbreviated racemes on the leafless branches; male and female flowers in same clusters, 4-8 usually 5-6-merous. *Tepals* linear, pubescent. *Samara* broadly elliptic or suborbicular, 2.5-3.5 cm long, notched between the two.



Distribution : Sub-Himlayan region; Uttar Pradesh; Rajsthan; Bihar; Madhya Pradesh; W.Peninsula. Sri Lanka, Myanmar, Indo-China.

TREMA Lour.

Trema orientalis (L.) Blume, Mus. Bot. 2:61. 1856; Hook.f., Fl. Brit. India 5:484. 1888; Haines, Bot. Bihar & Orissa 3:809 (848). 1924; Soep. in Steenis, Fl. Males I. 8:51. T. 13. 1977. *Celtis orientalis* L., Sp.Pl. 1044. 1753; Wight, Icon.t. 602 & 603. 1842. *Sponia wightii* Planch., Ann. Sci. Nat. Bot. (Ser.3). 10:32. 1848; Wight, Icon.t. 1971, 1853; Bedd., Fl. Sylv. t. 311. 1873.

Small trees, up to 12 m; trunk ringed with stipular scars; branchlets with dense silky pubescence; bark smooth, white or pale. *Leaves* oblong, ovate-oblong, ovate-lanceolate, 3-15 x 1.5-5.8 cm, serrulate, acuminate, more or less white or silvery beneath with fine silky hairs, scabrid or nearly smooth above, base obtuse or rounded, mostly oblique, usually three principal nerves, midrib with 2-5 strong, oblique secondary nerves; petiole 3-12 mm. Dioecious, cymes bracteates. Male cymes usually dense, 7.7-18 mm long but sometimes lax and branched and up to 3 cm long. *Tepals* narrow, oblong, concave; torus usually woolly. *Pistillode* obovoid. Female cymes about as long as the males but laxer. *Tepals* flat. *Stigma* remote, tongue-shaped, papillose. *Drupe* yellow, 4.3mm long.

Distribution : More or less throughout India. Tropical Africa, SE. Asia, through Malesia to Queensland, Melanesia, Micronesia and Polynesia.



MORACEAE

ARTOCARPUS J.R. Forst. & G. Forst.

Artocarpus heterophyllus Lam. Encycl. 3:209. 1789; Jarett, J. Arnold Arbor. 40:334. 1959; Corner in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 3:217. 1981. *A. integrifolius* auct. non L.f.: Roxb. Pl. Corom.t. 250. 1815; Wight, Icon. t. 678. 1840; King in Hook.f. Fl. Brit. India 5:541. 1888; Haines, Bot. Bihar & Orissa 3:825(865). 1924; Mooney, Suppl. Bot. Bihar & Orissa 137. 1950.

Large, evergreen tree with dense crown; bark black, mottled green, smooth (deeply cleft when old); branchlets glabrous. *Leaves* elliptic, obovate or obovate-oblong, 10-20 x 4.5-8.7 cm, entire (of young plants occasionally 3-lobed), obtuse to shortly acute, dark shining green above, glabrous, lateral nerves 7-8, base acute; petiole 1.2-2.5 cm; stipules spathaceous, 5-7.5 cm long, glabrous, leaving an annular scar after falling. *Receptacles* lateral on the trunks and branches, but on special branchlets. *Inflorescence* at first enclosed in 2 large leathery yellowish bract like stipules of the leaf (often small) on special branchlets. Male receptacles cylindric, 5-15 cm, without bracteoles. *Tepals* 2. Syncarp very large, oblong cylindric, 30-75 cm long, tubercled.

Distribution: Widely cultivated throughout the warmer parts of India; said to be indigenous in Western Ghats. Widely cultivated throughout the tropics.



Artocarpus lacucha Roxb.ex Buch.-Ham., Mem. Wern. Nat. Hist. soc. 5:333.1826; Wight, Icon.t. 681. 1840 ('lakoocha'); King in Hook. f., Fl. Brit. India 5:543.1888, pro parte ('lakoocha'); Haines, Bot. Bihar & Orissa 3:824(865).1924; Mooney, Suppl.Bot.Bihar and Orissa 137. 1950; Mabb. in Taxon 26:529.1977.

Moderate-sized tree with dense crown; branchlets villously-tomentose; bark grey, flaky in small scales. *Leaves* elliptic or ovate, 10-25 x 5-12 cm, entire, obtuse or shortly acuminate, pubescent or tomentose on the nerve above, pubescent and tomentose beneath, secondary nerves 8-13, strong, nearly reaching the margin, base obtuse or rounded; petiole 1.2-2.5 cm tomentose; stipules lanceolate, 1.2 cm long, villous, caducous, leaving a scar. Receptacles axillary, males subsessile from previous years axils, females shortly peduncled from current years axils. Male receptacles orange yellow, spongy, ovoid, 1.8-2.5 cm across, closely covered with minute, peltate bracts, *Perianth* and scarcely exserted *Stamens*, deciduous. Syncarps (female receptacles) irregularly subglobose, 7.5-10 cm diam., yellow when ripe, nearly smooth.



Distribution: Tropical and subtropical Himalaya, up to 1200 m; widely cultivated in India. Myanmar.

FICUS L.

Ficus benghalensis L., Sp. Pl. 1059. 1753; King in Ann. Roy. Bot. Gard. (Calcutta) 1:t.13. 1887 & in Hook.f., Fl. Brit.India 5:499.1888; Haines, Bot. Bihar & Orissa 3:834 (874).1924; Corner in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 3:251. 1981. *Urostigma benghalense* (L.) Gasp., Nov. Gen. Fic. 7. 1844; Wight, Icon. t. 1989 . 1853.

Vern. *Bargad*

Large tree, epiphytic when young; branches sending down roots which form into accessory trunks; bark grey. *Leaves* approximate near the ends of the branchlets, ovate to elliptic, 10- 17 x 7-12 cm, coriaceous, old glabrous or slightly pubescent beneath, young softly pubescent and often reddish, base rounded or subcordate, 3-5-nerved. *Figs* sessile, in pairs,globose or subglobose, 0.2-1.8 cm diam., scarlet when ripe, puberulous, with 2-4, more or less onnate, broad, obtuse bracts at the base.



Distribution: Throughout the plains of India and Sub-Himalayan tract. Sri Lanka, Pakistan; widely cultivated.

Ficus hispida L.f., Suppl. Pl. 442. 1781; King in Ann. Roy. Bot.Gard. (Calcutta) 1:tt. 154 & 155. 1888 & in Hook.f., Fl. Brit. India 5:522.1888; Haines, Bot.Bihar & Orissa 3:836(878).1924; Corner in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 3:277. 1981. *F. oppositifolia* Roxb., Pl. Corom.t. 124. 1799; Wight, Icon.t.638. 1840. *F. daemonia* Koenig ex Vahl, Enum. Pl. 2:198. 1806; Wight, Icon.t. 641.1840.

Vern. *Damgular*, *Domar*



Small tree; branches hispid with hollow or sometimes solid inter-nodes. *Leaves* mostly opposite, obovate, obovate-oblong or ovate-oblong, 10-37 x 5-22 cm, toothed, rarely entire, obtuse or obtusely acuminate, scabrous above, hispid, especially on the nerves beneath, base obtuse, rounded or cordate, mostly 5-nerved, secondary nerves 5-7, strong and raised beneath, looping close to the margin; petiole 1.2-8 cm. *Figs* numerous, fascicled on both the trunk and branches, often on leafless drooping branches, also sometimes axillary, globose, 2-2.5 cm diam., yellowish when ripe, tomentose or closely shortly hairy, umbo prominent, base narrowed to a slender or very short stalk with scattered bracts. *Style* hispid; *Stigma* tubular. Male *Flowers* very few.

Distribution : Throughout India. Sri Lanka, S. China to New Guinea and Queensland.

***Ficus racemosa* L.**, Sp. Pl. 1060. 1753; Corner in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 3:266. 1981. *F. glomerata* Roxb., Pl. Corom. t. 123.1799; King in Ann. Roy. Bot. Gard. Calcutta 2:t. 218A. 1888 & in Hook.f., Fl. Brit. India 5:535. 1888; Haines, Bot. Bihar & Orissa 3:838(880). 1924.

Vern. *Gular*

Large or moderate-sized tree with few short aerial roots; bark grey to rusty. *Leaves* ovate, ovate-lanceolate or elliptic, 7-20 x 3.5-9 cm, entire, obtuse, acute or subacute, dark green above, paler beneath, glabrous above, glabrous or pubescent on the nerves beneath, base obtuse or rounded, rarely acute, 3-nerved, secondary nerves 4-8; petiole 1.5-5 cm long; stipules ovate-lanceolate, 1.2-5 cm long. *Figs* on short or sometimes up to 60 cm long leafless, scariously bractolate, tubercled and warted branchlets from the main trunk or larger branches, figs occasionally axillary. *Globose* to pyriform, 2.5-5 cm diam., red when ripe pubescent or tomentose; peduncle up to 1.8 cm long. Male, female and gall flowers in the same fig. *Male flowers* near the mouth; tepals 3-4; inflated. *Perianth* of gall and female flowers toothed. *Stigma* clavate. *Achene* granulate.



Distribution : Throughout India. Sri Lanka, Pakistan, S. China to New Guinea and Queensland.

***Ficus religiosa* L.**, Sp. Pl. 1059. 1753; Bedd., Fl. Sylv. t. 314. 1873, pro parte; King in Ann. Roy. Bot. Gard. (Calcutta) 1:t. 67A. 1887 & in Hook.f. Fl. Brit. India 5:513. 1888; Haines, Bot. Bihar & Orissa 3:838(874). 1924. *Urostigma religiosum* (L.) Gasp., Ric. Caprifico 82:t. 7. ff. 1-5. 1845; Wight, Icon. t. 1967. 1853.

Vern. *Pipal*

Large tree, epiphytic when young; all parts except the bracts glabrous; *Bark* grey, smooth, irregularly pitted when old. *Leaves* more or less pendulous, broadly ovate, 12-27 x 8-16.5 cm, margin often repand, very truncate with 3 strong principal nerves and shining above, 2-4 weaker, secondary above, base cordate, long-caudate, coriaceous, dark green and shining above, base cordate or truncate with 3 strong principal nerves and 2-4 weaker, secondary nerves 8-10, looped within the margin, acumen many nerved; slender, 4-10 cm long; stipules linear subulate, 4.3-7.5 cm long, axillary, geminate, sessile, depressed-globose, 1-1.5 cm diam., smooth, glabrous, dark purple when ripe, basal bracts 3, broad, rounded, spreading, ciliate or pubescent, 3.7-6.2 mm long.



Distribution : Sub-Himalayan forests; Bengal; Orissa; the Circars and Central India; planted or run wild in other parts of India. Myanmar, Sri Lanka, Yunnan, Cochinchina, N. Thailand, Malaya.

Ficus virens Ait., Hort. Kew. (ed. 1) 3:451. 1789 var. *virens*; Corner in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 3:238. 1981. *F. infectoria* Roxb., Fl. Ind. 3:551. 1832, non Willd. 1806; Wight, Icon. t. 75. 1887; King in Ann. Roy. Bot. Gard. (Calcutta) 1:t. 75. 1887 & in Hook. f., Fl. Brit. India 5:515. 1888; Haines, Bot. Bihar & Orissa 3:830(871). 1924.

Vern. *Pilkhen*

Medium-sized or large, very variable tree, epiphytic when young; bark greenish-grey, smooth; buds usually pubescent. *Leaves* oblong, 10-15 cm long, margin often repand, abruptly acuminate, glabrous, often distinctly pellucid punctate, base slightly cordate, secondary nerves few, looping within the margin; petiole slender, 3.7-8.7 cm long; stipules ca. 2 cm long, caducous. Figs sessile, in axillary pairs, globose or subglobose but without broad base, 6.2-7.5 mm diam., glabrous or pubescent, whitish or flushed with red and dotted when ripe, basal bracts free, ovate or orbicular, spreading, 1.8 mm long. *Tepals* 3 or often 4 or 5, linear or lanceolate. Filament and anther short and broad.



Distribution : Throughout India. Sri Lanka, Myanmar, Malay Peninsula, China, Solomon Is.

MORUS L.

Morus australis Poir., Encycl. 4:38. 1797; Nakai in J. Arnold Arbor. 8:236. 1927; Rehder in J. Arnold Arbor. 10:123. 1929. *M. indica* auct. non L.: Roxb., Fl. Ind. 3:396. 1832; Hook. f., Fl. Brit. India 5:492. 1888; Haines, Bot. Bihar & Orissa 3: 821(861). 1929.

Vern. *Shatoot*

Shrub or small tree; bark light grey; buds peculate. *Leaves* ovate or ovate-oblong, 4-10 x 2.8-5.5 cm, serrate or sharply serrate, often deeply lobed, acuminate or caudate, glabrous, basal nerves 3, secondary nerves 3-4, base subcordate; petiole 1.2-3.7 cm long. Male spike rather lax-flowered, broadly cylindric or ovoid, 1.2-3.7 cm long, hairy all over; peduncle short. *Tepals* elliptic, 2-2.5 mm long. *Stamens* twice as long. Female spikes short, ovoid, on slender peduncles about half *Tepals* obovate with white margin. *Style* long connate below hairy. *Fruit* ovoid or subglobose, red, turning black.



Distribution: Himalaya, up to 2100 m; Sikkim; widely cultivated throughout India. Myanmar, W. China.

STREBLUS Lour.

Streblus asper Lour., Fl. Cochinch. 615. 1790; Hook.f., Fl. Brit. India 5:489. 1888; Haines, Bot.Bihar & Orissa 3:820 (860). 1924; Corner in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 3:281. 1981. *Epicarporus orientalis* Blume, Bijdr.488.1825.

Vern. *Shahora*, *Shihor*

Rigid, much branched shrub or small tree; bark rough, stringy, light grey. *Leaves* very shortly petioled, obovate or rhombic-elliptic, 1.2-10 x 0.6-5.5 cm, obscurely toothed, acute, subacute or acuminate, stiff, scabrid on both sides, secondary nerves 7-9, nervules raised beneath. Male heads 6.2-7.5 mm diam., on 1-3-nate peduncles, nearly as long, or up to 1.2 cm; bracts very small, ovate, under 1.2 mm long, outer involucrate. *Flowers* 6-8. *Perianth* ca. 2.5 mm long. *Tepals* connate below, one sometimes smaller than the others. *Stamens* exceeding the perianth. *Female peduncles* 7.5-10 mm; bracts 2- 3, 1.8-2 mm long at the top supporting the flower. *Tepals* free but closely wrapping round the *Ovary* 2-2.5 mm. *Style* 1.8 mm, excluding the 7.5 mm long arms. *Fruit* yellow, succulent, globose, 3.7 mm diam.



Distribution : Widely distributed throughout the drier parts of India. Sri Lanka, Myanmar, S. China, Hainan, Indo-China, Thailand, Malesia.

MONOCOTYLEDONS

ARECACEAE

BORASSUS L.

Borassus flabellifer L., Sp. Pl.: 1187. 1753; Hook.f., Fl. Brit. India 6:482. 1892; Haines, Bot. Bihar & Orissa 887. 1924. *Lontarus domestica* Gaertn., Fruct. Sem. Pl. 1:21. 1788. *Borassus tunicatus* Lour., Fl. Cochinch. 2:618. 1790. *Pholidocarpus tunicatus* (Lour.) H. Wendl. in O.C.E. de Kerchove de Denterghem, Palmiers: 253. 1878. *Borassus sundaicus* Becc. in Webbia 4:321. 1914.

Large tree, 20-30 cm; stem grayish-black, often swollen about the middle, when young covered with dry leaves and bases of petioles, old trunks naked and marked with the sheath scars. *Leaves* almost circular, 0.6-1.5 m diam., margins split into 60-80 linear-lanceolate (not drooping), acuminate segments, folded along the midrib; petiole 0.6-1.2 mm long, stout, semiterete, the edges armed with hard, horny, spinescent serratures. Male spadix simply branched, female simple. *Branches* of male spadix clustered, ca 30 cm long and 2.5 cm diam., including the closely imbricate broad truncate bracts; flowers seated on the inner upper side of the cavities. *Petals* spreading 2.5 mm long. Female flowers 2.5 cm diam. *Fruit* 15 cm diam., seated on the greatly enlarged perianth.



Distribution: Cultivated throughout the plains of India and widely naturalized. Africa, Madagascar, Sri Lanka, India to Indo-China and Siam, E.Java, Lesser Sunda Isls., New Guinea, Queensland. All parts of the plant are used for various purposes. The spadices are tapped for today or boiled into jiggery.

CARYOTA L.

Caryota urens L., Sp. Pl. 1189. 1753; Mart., Hist. Nat. Palm. 3, 193. Pl. 107, 108, 162 1823-1853; Griff., Calcutta. J.Nat.Hist. 5, 479. 1845 and Palms Brit. E. Ind. 159. 1850; Becc. & Hook.f., in Hook.f., Fl. Brit. India 6:422. 1892; Moore & Dransfield in Taxon 28:70. 1979. Rheede, Hort. Malab. I:Pl. 11. 1678.

Solitary, hapaxanthic, monoecious palm. *Stem* 16-20 m high and to 60 cm in diameter, leaf scars annular. *Leaves* 3-4 m long, induplicate bipinnate; sheath triangular, eroding opposite the petiole into a mass of strong black fibres, leaflets very numerous. *Inflorescence* 3-4 m long; bracts about 45 cm long, produced in basipetal sequence, infrafoliar, pendulous, peduncle densely scaly, curved, stout, rachillae simple, very long, pendulous, level topped resembling a huge docked horse tail; staminate flowers elongate, symmetrical. *Fruit* globose, 1.8-2 cm in diameter, red at maturity, mesocarp fleshy, with irritant needle like crystals, endocarp not differentiated; seeds hemispherical, smooth, endosperm ruminant.

Distribution: India, Myanmar, Sri Lanka, Malaysia.



PHOENIX L.

Phoenix loureiroi Kunth, Enum. Pl. 3:257. 1841. *P. humilis* Royle, Ill. Bot. Himal.; Becc. & Hook.f., Fl. Brit. India 6:427.1892; Haines, Bot. Bihar & Orissa 882.1924; Blatter, Palms Brit.Ind.20.1926.

Stem well developed, up to 3 m high and ca. 22 cm diam., densely covered with the petiole-bases. *Leaves* 1.2-2.4 m long; leaflets 20-50 x 0.7-1.8 cm, pliable, fascicled, more or less 4-farious, not or hardly pulvinate at the insertion, a number of lowest forming channeled spines, 2.5-7.5 cm long. *Spathes* 20 cm long, fringed on the margins. *Spadix* much branched in fruit, 0.9-1.2 m long; peduncle elongating to 1.25 m in fruit. *Female flowers* 5-6.2 mm long. *Fruit* 1.2-1.5 cm long, at the first orange, turning to black when ripe.

Distribution: Assam; Meghalaya; Manipur; South India; Western Ghats. Myanmar, Cochinchina.



Phoenix sylvestris (L.) Roxb., Hort. Bengal.: 73(1814) Griff., Palms Brit. E. Ind.: 141, t. 228 (1850); Becc. & Hook. f., Fl. Brit. India 6:425(1892); Haines, Bot. Bihar & Orissa 881. 1924; Blatt., Palms Brit. Ind.: 3, pl. 2,3, (1926); H.E. Moore, Principes 7(4): 157 (1963); H.E. Moore & J.Dransf., Taxon 28(1,2/3); 67 (1979); Katou-Indel Rheede, Hort. Malab. 3:15-16, pl. 22-25 (1682) vide Mart., Hist. Nat. Palm. 3:270-273, t.136 (1849).

Tall palm, 8-16 m high, rarely branched; stem densely covered with the petiole-bases. *Leaves* greyish-green, 2.1-4.5 m long; leaflets much fascicled, with the fascicles upto 7.5 cm apart, 2-4-farious, 15-45 x 1.8-2.5 cm, rigid, the lowest modified into long spines upto 10 cm long. *Spathes* 30-40 cm long, thick, almost woody, scurfy, separating into 2 boat-shaped valves. *Male inflorescence* white, scented, compact on a short peduncle. *Male flowers* 6.2-8.7 mm long, dense. *Female flowers* smaller, distant. Fruiting peduncle finally drooping, 60-75 cm long, terminating in large bunches of spikes bearing fruits. *Drupes* orange to reddish-brown, oblong-ellipsoid, 2.5-3 cm long, flesh sweet but very scanty; stone ca 1.8 cm long and nearly half as broad as long.



Distribution: India (Throughout the hotter parts), Pakistan.

ROYSTONEA O.F.Cook

Roystonea regia (Kunth) O.F. Cook, Science (ser. 2) 12:479. 1900. *Oxeodoxa regia* Kunth in H.B.K. Nov. Gen. Sp. 1:244.1816.

Stem up to 40 m tall, usually displaying a distinct thickening towards the middle, greyish white, smooth. Crown roundish, leaves up to 4 m long, drooping, divided into numerous leaflets, pinnae in two rows on either side of rachis, lower pinnae 60-71 x 2-2.5 cm, middle pinnae 70-90 x 3.5-5.0 cm, reduplicate from the base, rachis



tapering towards the apex; petiole glabrous, unarmed, smooth, elongated into a leaf sheath forming a shining greenish elongated crown shaft, crown shaft reaching up to 120 cm. Inflorescence profusely branched. Male flower much larger than the female, calyx and corolla 3-lobed, corolla thin, larger than the calyx, petals 0.5 x c. 0.2 mm, valvate, joined at the base; stamens 9, exserted, filaments subulate, 0.5 mm long, joined at the base beneath the pistillode; pistillode smaller, anthers dorsifixed, large. Female flowers 3-4 mm long, white; stigma triangular and surrounded by 6 scale-like staminodes. Fruit globose, fleshy 1-1.2 cm long, scar near the base of the fruit.

Distribution: Native of Cuba.

SHRUBS

SHRUBS

DICOTYLEDONS

MENISPERMACEAE

COCCULUS DC.

Cocculus pendulus (J.R. & G. Frost.) Diels in Engler, Pflanzen. 46: 237. 1910. *Epibatium pendulum* J.R. & G. Forst., Char. Gen. Pl. 108, t. 54. 1776. *Cocculus leaeba* DC., Syst. Nat. 1: 529. 1817; Hook.f. & Thom., in Fl. Brit. India 1: 102. 1872.

Twining shrubs, much branched; stems up to 15 cm thick; branches slender, puberulous, 5 – 6 m long. *Leaves* oblong-lanceolate to oblong-ovate, truncate, cuneate, rounded or trilobed-hastate at base, obtuse, mucronate or emarginated at apex, 1.6 – 5 x 0.5 – 3 cm, generally glabrous or slightly puberulous; basal nerves 3 – 5. *Male flowers* minute, sessile or subsessile in axillary 5 – 20 mm long fascicles on ca 1.5 cm long peduncles; *sepals* ovate-elliptic, fleshy or membranous; outer 3 smaller, 1 – 1.5 x 0.4 – 0.7 mm, sparsely puberulous; inner 3 larger, puberulous to glabrous, shiny; petals ovate to obovate, 0.8 – 2 x 0.5 – 1 mm; *stamens* 0.8 – 1.5 mm long. *Female flowers* axillary, solitary or rarely in pairs, on 0.7 – 1.3 cm long peduncles; sepals and petals as in male; carpels ca 1 mm long. *Drupes* ovoid to obovoid or reniform, compressed, 4 – 7 x 4 – 5 mm, reddish, black on drying; endocarp ribbed on lateral faces, without crest, not perforated at centre.



Distribution: India: In semi-desert scrubs and deciduous bushland and wastelands, up to 700 m.

CAPPARACEAE

CAPPARIS L.

Capparis sepiaria L., Syst.Nat.ed. 10.2:1071. 1759; Hook.f. & Thoms. in Hook.f., Fl.Brit.India 1:177.1872; Haines, Bot. Bihar & Orissa 32.1921; Jacobs in Steenis, Fl. Males.I.6:79. 1960 & in Blumea 12:489.1965.

Branched shrubs, ca 2 m sometimes climbing; young branches grey-tomentose or grey puberulous, sooner or later glabrescent; twigs stout, zigzag, terete, thorns generally vigorous, recurved, 3-5 mm long. *Leaves* elliptic, lanceolate or oblong-lanceolate or ovate-oblong, 1.5-4x1-2.5 cm, base obtuse, round, apex rounded, obtuse acute, blunt or often notched, lower surface glabrescent, nerves not very distinct; petiole 2-4 mm. Subumbels few-20-flowered at the end of small lateral twigs, rarely terminal; bracts small, hairy, early caducous. *Flowers* white or with greenish and yellowish tinge, to 1 cm across; pedicels mostly 1-1.2 cm, glabrous; buds globular, 4 mm diam. *Sepals* ovate or orbicular, 4-6 mm long. *Petals* obovate, 4.5-6 x 1.2-3 mm, very thin,



margin ciliate. *Stamens* many, 5-8 mm. *Gynophore* ca 8 mm, glabrous; ovary ovoid, glabrous. *Fruit* globose, 0.5-1 cm diam., 1-2-celled, smooth, black. *Seeds* 3 mm.

Distribution: Throughout India, S.E.China, Africa, Sri Lanka, Myanmar to Hainan, Indo-China, Malaysia, Australia.

MALVACEAE

URENA L.

Urena lobata L., Sp.Pl.692.1753; Master in Hook. f., Fl. Brit. India 1:329.1874; Haines, Bot. Bihar & Orissa 1:62(65).1921; Borassum in Blumea 14:140.1966; Paul & Nayar, Fasc.Fl. India 19:228.t.59.1988.

Annual or perennial erect undershrub, 0.5-1.5 m. *Leaves* ovate to orbicular, angular or shallowly palmilobed, 2-12 cm diam., base shallowly cordate, apex obtuse to acute or rounded, upper leaves ovate, ovate-oblong, oblong or occasionally rhomboid, at base subcordate, acute, obtuse or rounded, penninerved; leaves serrate to crenate, occasionally entire, at base 3-9-nerved, with a linear nectar on midrib beneath near base. *Epicalyx* copular in fruit 8 mm across, stiff, appressed to the mericarps, segments long triangular, acute, outside with minute stellate hairs. *Calyx* 5-parted, lobes lanceolate-oblong, acute. *Corolla* pink with purple centre, rotate, petals obovate. *Schizocarp* globose, 5-8 mm across, glochidiate; mericarps 4-5 mm high, radially ca. 4 mm, dorsally and laterally stellate hairy and reticulately veined. *Seeds* reniform, 2-3 mm across, minutely hairy to glabrous.



Distribution: Throughout India, Pantropical.

TELIACEAE

GREWIA L.

Grewia hirsuta Vahl, Symb.Bot. 1:34.1790; Wight, Icon.t. 76. 1838; Master in Hook.f., Fl. Brit.India 1:391.1874; Haines, Bot. Bihar & Orissa 1:90(93). 1921, pro parte.

Shrub branchlets stellate-tomentose. *Leaves* lanceolate to ovate-lanceolate, 8-15 x 2-5 cm, serrate, acute, densely stellate-hairy beneath, base little oblique, 4-5-nerved. *Peduncle* few or clustered, equal to petiole; pedicels as long. *Flowers* white or yellowish, polygamous or dioecious. *Buds* ovoid, under 3 mm. *Sepals* 3-4.5 mm. *Petals* oblong, 2.5-3.5 mm, entire, black not much longer than the gland. *Stamens* 40-45 or more, much longer than the hairs in male flowers; hairs exceeding the stamens in bisexual flowers. *Ovary* hirsute. *Drupes* 3-10 mm across, deeply 2-lobed, each



lobe slightly lobed, pilose with long deciduous hairs.

Distribution: Widely distributed in India. Sri Lanka, Myanmar.

Grewia sclerophylla Roxb. ex G.Don, Gen. Hist. 1: 550. 1831; Daniel & Chandrobose in Fl. India 3:509. 1993; Haines, Bot. Bihar & Orissa 89.1921. *G. scabrophylla* Roxb., Fl. Ind. 2: 584. 1832; Master in Hook.f., Fl. Brit. India 1: 387. 1874.

Vern. *Bendu, Dapher*

Shrubs. *Leaves* 7 – 19 x 5 – 12.5 cm, totund-ovate, obovate or obcordate, rounded or subacute at base, rounded, emarginate or acuminate at apex, serrate, tomentose, 3 – 5-nerved; petioles ca 1.2 cm long. *Flowers* in axillary cymes; peduncles 2 – 8 mm long; buds 1 – 1.3 cm long, ovoid-oblong, ribbed, tomentose; pedicels 0.5 – 1.2 cm long. Sepals 1.2 – 1.5 cm long, lanceolate, densely pubescent outside. *Petals* white, ca 6 x 2.2 mm, oblong-obovate, obtuse, notched at apex. *Receptacle* short, hispid. Androgynophore ca 4 mm long, glabrous excepting at apex. *Ovary* ca 2 x 4 mm, depressed-globose, hirsute; stigma 2-lobed. *Drupes* 1.2 – 1.8 cm across, globose, stellate-tomentose.



Distribution: India: Common in deciduous and evergreen forests. Himachal Pradesh, Uttar Pradesh, Bihar, West Bengal, Sikkim, Assam and Orissa. Bangladesh and Myanmar.

BALANITACEAE

BALANITES Del.

Balanites roxburghii Planch. in Ann. Sc. Nat. Bot. ser. 4. 2: 258. 1854; Benett in Hook.f., Fl. Brit. India 1: 522. 1875; Haines, Bot. Bih. & Or. 154. 1921. *B. aegyptiaca* auct. non (L.) Del. 1813; Basak, Fasc. Fl. India 4: 20. 1980.

Vern. *Emun*

Bushy shrubs or small trees, armed, deciduous, 3 – 5 m high; bark whitish, bitter; thorns up to 6 cm long, simple or forked or with smaller spines, often bearing leaves and flowers. *Leaflets* 2, elliptic-oblong or obovate-oblong or oblanceolate, rounded or cuneate at base, obtuse or acute or rarely mucronate at apex, 1 – 5 x 1 – 3 cm, glaucous green, pubescent. *Flowers* pale-greenish yellow, fragrant, 4 – 12, in axillary fascicled cymes. *Sepals* 5, elliptic-ovate, densely pubescent outside, long silky hairy inside. *Petals* 5, elliptic-oblong, glabrous outside. *Stamens* 10, 2 – 3 mm long. *Ovary* globose. *Drupes* ovoid or subspherical, 5-grooved, 3-6 x 2-4 cm, puberulous, yellow when ripe with foetid smelling pulp; seeds solitary, stony with fibrous testa.



Distribution: Throughout India in scrub forests, deciduous forests and sandy coasts. Pakistan and Myanmar.

FABACEAE (PAPILIONACEAE)

DESMODIUM Desv.

Desmodium pulchellum (L.) Benth., Fl. Hong. 83. 1861; Baker in Hook.f., Fl. Brit. India 2:162. 1876; Haines, Bot. Bihar & Orissa 2:261(273). 1922. *Hedysarum pulchellum* L., Sp. Pl. 747. 1753. *Dicerma pulchellum* (L.) DC., Ann. Sci. Nat. (Paris) 4:236. 1825 & Prod. 2:339. 1825; Wight, Icon. t. 418. 1841. *Phyllodium pulchellum* (L.) Desv. in J. de Bot. II. 1:124. t. 5. f. 24. 1813; Ohashi in Ginkgoana 1:276. 1973.

Undershrub or shrub, 0.6-1.2 m; branches terete, grey-downy. *Leaves* 3-foliolate; petiole 1-1.5 cm long, channelled above, densely downy; stipules ovate, 5 mm long-long acuminate; leaflets elliptic or ovate-oblong, obtuse or subacute, often sinuate, coriaceous, glabrescent and subrugose above, finely downy and pale beneath, secondary nerves 7-10 with parallel tertiaries, terminal one 7.5-12.5 cm long, lateral ones about half as long; petiolules 2.5-3 mm; stipules subulate. *Flowers* in terminal or axillary racemes, 7.5-25 cm long, composed of solitary, fascicled or umbellate flowers in the axils of 12-40 compound leafy bracts; bracts 2-foliolate, their leaflets stipellate, orbicular, 1.2 cm across, glabrous on the upperside, finely downy on the inner side, strongly nerved, coriaceous, placed back to back. *Calyx* 2 mm long puberulous, teeth lanceolate. *Corolla* white or yellow, 6 mm long. *Pods* 4-6 mm long, indented on both sutures; joints usually 2, slightly longer than broad, pubescent.



Distribution: Throughout India. Sri Lanka, Myanmar, Thailand, Indo-China, Malaysia, China, Taiwan, Ryukyu and N. Australia.

FLEMINGIA Roxb. ex Ait.

Flemingia macrophylla (Willd.) Prain ex Merr. in Philip. J. Sci. 5:13. 1910. *Crotalaria macrophylla* Willd., Sp. Pl. 3:982. 1802. *Flemingia congesta* Roxb. ex Ait., Hort. Kew. ed. 2. 4:349. 1812; Baker in Hook. f., Fl. Brit. India 2:228. 1876; Haines, Bot. Bihar & Orissa 2:269 (281). 1922. *Maughania macrophylla* (Willd.) Kuntze, Rev. Gen. Pl. 1:199. 1891; Mukh. in Bull. Bot. Soc. Bengal 6:16. 1952; Nooteb. in Reinwardtia 5:434. 1960, pro parte; Anon., Draw. Ind. Pl. (Icon. Roxb. No. 1278) 6:t. 4. 1973 ('*Moghania*'). *Flemingia semialata* Roxb., Fl. Ind. 3:340. 1832; Wight, Icon. t. 326. 1840; Haines, Bot. Bihar & Orissa 2:269(282). 1922. *F. congesta* Roxb. var. *semialata* (Roxb.) Baker in Hook. f., Fl. Brit. India 2:229. 1876, pro parte. *Maughania semialata* (Roxb.) Mukh. in Bull. Bot. Soc. Bengal 6:16. 1952; Anon., Draw. Ind. Pl. (Icon. Roxb. No. 1623) 6:t. 5. 1973 ('*Moghania*').

Vern. *Bhatwar*

Erect shrub, 1-2 m; branches densely pubescent, or glabrescent; young shoots densely silky. *Leaves* 3-foliolate; petiole angled or narrowly winged, 3.7-10 cm; leaflets



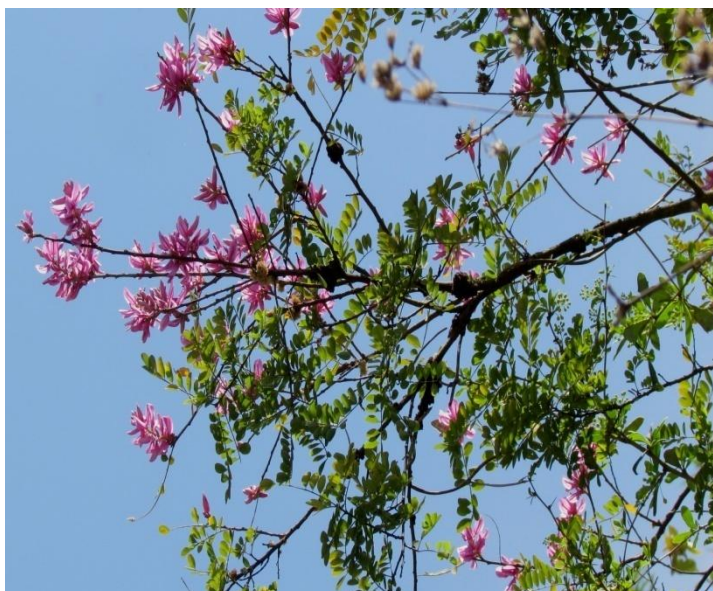
rhomboidly lanceolate or elliptic, 7-16(21) x 2.7-12 cm, acute or acuminate, glabrous, glabrescent or pubescent especially on the nerves beneath, gland-dotted or not, glands, evanescent or persistent. *Racemes* axillary, 2-4-nate or branched, villous, 2.5-12.5 cm, longer or shorter than the petiole; bracts 6.2 mm. *Flower* purplish, 7.5-10 cm long. *Calyx* densely white silky, with or without black glands, teeth 2-3-times as long as the tube, lowest as long as the corolla. *Pods* ca. 1 cm, without black glands. *Seeds* 2, black, shining.

Distribution: Throughout India, upto 1500 m. Bhutan, Sri Lanka, Myanmar, China, Malaysia.

INDIGOFERA L.

Indigofera cassioides Rottl. ex DC., Prod.2:225. 1825; Ali in Bot. Not. 111:569. 1958. *I. pulchella* auct. non Roxb.: Baker in Hook.f., Fl. Brit.India 2:101. 1876; Haines, Bot. Bihar & Orissa 2:240(251). 1922; Anon., Draw.Ind.Pl. (Icon.Roxb.No. 389) 4:t.12.1970.
Vern. *Bihul*, *Jirkul*

Much branched shrub, 1-3 m; stems angled or terete, more or less hairy or rarely quite glabrescent. *Leaves* imparipinnate, 7.5-20 cm long; leaflet 6-15 pairs, opposite or subopposite, elliptic-oblong or oblong-obovate, often somewhat obovate or ovate, 1.2-3.7 cm long, rounded both ends, often emarginate or apiculate, appressed hairy both sides. *Flowers* pink or rose, 1.2-1.5 cm long, in numerous dense 8-15 cm long racemes, axillary and from the axils of fallen leaves; bracts long, boat-shaped, acuminate, with long setaceous tip and far exceeding the buds or without long tip and not exceeding the buds, deciduous. *Calyx* very oblique, often petaloid, broadly campanulate; teeth lanceolate, acuminate, usually hairy. Standard elliptic-oblong, 12 x 7.5 mm, neither clawed nor spurred, often with a white patch at the base. *Pods* straight, slender, 2.5-5 cm long, usually reflexed.



Distribution: Throughout the hills of India, upto 2700 m. Myanmar, China, Thailand, Indo China.

TEPHROSIA Pers.

Tephrosia purpurea (L.) Pers., Syn. Pl. 2:329. 1807; Baker in Hook. f., Fl. Brit. India 2:112. 1876, pro parte; Haines, Bot. Bihar & Orissa 2:244(255). 1922; Mooney, Suppl. Bot. Bihar & Orissa 48.1950. *Cracca purpurea* L., Sp. Pl. 752. 1753. *Tephrosia hamiltonii* Drumm. in Gamble, Fl. Madras 1:320(226). 1918; Haines, Bot. Bihar & Orissa 2:243(254). 1922; Mooney, Suppl. Bot. Bihar & Orissa 250. 1950.

Undershrub, ca. 60 cm or suberect; branches angled or rounded, glabrous or sericeous. Leaf-rachis 5-6.2 cm; stipules filiform-subulate, 7.5-9 mm long; leaflets 5-8 pairs, oblanceolate to obovate or oblong-cuneate, 1.5-3.2 cm long, rounded, truncate or slightly retuse, mucronate, glabrous or appressed hairy, sometimes closely sericeous beneath. *Racemes* terminal, elongate, lax, upto 12.5 cm long, with 3 or more nodes, each bearing 1-3 flowers in the axils of setaceous bracts about as long as or shorter than the slender, 2.5-4 mm long pedicels. *Flowers* purple. *Calyx* teeth subulate or narrow-lanceolate, finely acuminate, longer than the tube. *Standard* scarcely emarginate. *Pods* 3.2-4 cm long, slightly curved, with short appressed hairs, 6-10-seeded. *Seeds* ovoid, strophiole in the middle of the seed.



Distribution: W.Himalaya, upto 1200m and from Bengal to Sri Lanka. Myanmar, Malesia.

MIMOSACEAE

MIMOSA L.

Mimosa himalayana Gamble in Kew Bull.1920:4. 1920; Haines, Bot. Bihar & Orissa 2: 322 (336). 1922. *M.rubicaulis* auct. non Lam.; Baker in Hook.f., Fl. Brit. India 2:291.1878, pro parte.

Vern. *Arhar*

Erect or suberect very prickly weak shrub, 2-3.5 m with many stems; branches angular, with close scattered slightly curved prickles. *Leaf-rachis* 12-20 cm, very prickly; *pinnae* 7-12 pairs, 1.8-4 cm long; *leaflets* 14-20 pairs or only 10 on the basal pinnae; oblong, 5-7 x 1.75 mm, obtuse or subacute, often somewhat, mucronate, base semierectangular. *Flowers* pink, in heads, ca 1.2 cm diam.; peduncle 2-4-nate axillary and in long thyrsiform racemes in the axils of undeveloped leaves with filiform stipules, 5-6.2 mm long. *Calyx* campanulate, 1mm long, glabrous. *Corolla* funnel-shaped, lobes 4, oblong, as long as the tube. *Stamens* 8, long exserted. *Ovary* glabrous. *Pods* linear-oblong, 8-10x1-1.2 cm, 4-10-joined and 1-seeded, glabrous, base attenuate, apex apiculate, tipped by the long style; sutures slightly aculeate or unarmed; stipe 1-1.5 cm.



Distribution: Outer Himalaya from Kashmir to Assam; Central India; Bengal; Meghalaya; Sikkim southwards to Andhra Pradesh, Nepal, Bhutan.

LYTHRACEAE

WOODFORDIA Salisb.

Woodfordia fruticosa (L.) Kurz in J.Asiat.Soc. Beng. 40:56. 1871; Haines, Bot.Bihar & Orissa 2:374(390). 1922; Mooney, Suppl. Bot. Bihar & Orissa 67.1950. *Lythrum fruticosum* L., Syst.ed. 10. 1045. 1759. *Grislea tomentosa* Roxb., Pl. Corom. t. 31. 1796. *Woodfordia floribunda* Salisb., Parad. Lond. t.42. 1806; Clarke in Hook.f., Fl. Brit. India 2:572. 1879, pro parte.

Vern. *Dhodhakki, Dhodki, Fuldhavai*

Large spreading shrub; bark reddish brown, peeling off in thin strips young parts hairy; leaves and branches covered with black dots. *Leaves* sessile or subsessile, lanceolate, ovate-lanceolate or linear-lanceolate, 3.7-10 x 1.5-3.7 cm, acuminate, finely pubescent and dotted beneath. *Flowers* scarlet, 1.2-1.8 cm long, in fascicled cymes, axillary and form the old wood, often completely covering the branches. *Calyx* scarlet, 1-1.5 cm long persistent. *Capsule* ellipsoid, 1 cm long, included within the persistent calyx-tube.



Distribution: Throughout the greater part of India, ascending to 1500 on the Himalaya. China, Baluchistan, tropical Africa, Madagascar.

ASTERACEAE (COMPOSITAE)

EUPATORIUM L.

Eupatorium odoratum L., Syst. Nat.ed. 10.1205. 1759; Hook. f., Fl. Brit. India 3:244. 1881; Grierson in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 1:143. 1980. *Chromolaena odorata* (L.) R.King & Robins. in Phytologia 20:204.1970.

Vern. *Basain, Patpati, Tuntunwa*

Erect shrub, 1-2.5 m; stems terete. *Leaves* petiolate, deltoid-ovate, 5-10 x 3-6 cm, coarsely toothed, acuminate, pubescent on both sides, base cuneate; petiole upto 6 cm. *Heads* bluish, cylindrical, 3 mm diam., in dense terminal corymbs. *Involucre* 4-5-seriate, outer involucre bracts ovate, shorter, inner



linear, acute, whitish with 3 distinct green lines on each; florets 20-35 per head. *Corolla* tubular campanulate, 5-lobed. *Achenes* slender, ca 2 mm long, angular, with 4-5 slightly scabid ribs; pappus whitish, 5 mm long.

Distribution: Indigenous to tropical S. America, naturalized in India, Nepal, Myanmar, Malaya and Thailand.

APOCYNACEAE

CALOTROPIS R.Br.

Calotropis gigantea R.Br. in Ait.f., Hort. Kew. (ed.2). 2:78. 1811; Wight, Ill.t.L. 155 & 156. 1850; Hook.f., Fl. Brit. India 4:17.1883; Haines, Bot. Bihar & Orissa 4:550(577). 1922; Huber in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 4:78.1983.

Vern. *Aak*

Stout hoary-tomentose shrub. *Leaves* subsessile or shortly petioles obovate or obovate-oblong, 7-20 x 4-9 cm, obtuse, rounded (or acute), base cordate often amplexicaul. *Calyx-lobes* short, spreading. *Corolla* bluish-purple, 3-4.5 cm across; lobes spreading, ovate-lanceolate, revolute and twisted when old. *Corona* processes with their bases elegantly curved, dorsally pubescent, their apices with two little broad spurs or tubercles. Top of columns 5-angled, corpuscles small black at the angles. *Follicles* 7.5-10 x 3.7 cm, recurved, obtuse.



Distribution: Throughout the hotter part of India. Pakistan, Nepal to Sri Lanka, the Maldives Islands, S.China and Malesia.

NERIUM L.

Nerium oleander L. Sp. Pl. 209.1753; Haines, Bot. Bihar & Orissa 2:541(567). 1922; Grant et al., Smithsonian Contr. Bot., 17:53.1974; Huber in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 4:28.1983. *N.indicum* Mill. Gard. Dict. (ed.8). n.2.1768. *N.odorum* Soland.in Ait. Hort. Kew. 1:297.1789; Hook.f. in Hook.f., Fl. Brit. India 3:655.1882; Haines, Bot. Bihar & Orissa 2:541(567). 1922.

Shrub with usually erect, rod-like branches. *Leaves* linear, 6.5-14 x 1-1.5 cm, acute at both ends, glabrous, secondary nerves many, close, regularly parallel. *Flowers* white or usually rose, 2.5-3.7 cm diam, in terminal cymes. *Follicles* long, cylindric, 12-18 x 0.8 cm. *Seeds* with brown coma.



Distribution: Cultivated throughout India.

CONVOLVULACEAE

IPOMOEA L.

Ipomoea carnea Jacq., Enum. Syst. Pl. 1760; Haines, Bot. Bihar & Orissa 600.1922. subsp. **fistulosa** (Mart. ex Choisy) Austin in Taxon 26:237. 1977. *I.fistulosa* Mart. ex Choisy in DC., Prod. 9:349. 1845; Ooststr. in Steenis. Fl. Males. I. 4:485. 1953. *Batatas* ? *crassicaulis* Benth., Voy. Sulphur. 5:134. 1845. *Ipomoea crassicaulis* (Benth.) Robinson in Proc. Amer. Acad. Arts 51:530. 1916.

Vern. *Lattar*

Shrub, 1-2.5 m, erect or ascending; branches thick, fistulose or solid with milky sap; younger parts glabrescent or puberulous. *Leaves* ovate or ovate-oblong, 15-25 x 10-15 cm, acuminate, glabrous or puberulous, with a gland beneath on each side of the midrib at the base of the lamina, base cordate petiole 5-12.5 cm. cymes several-flowered, axillary and terminal, minutely pubescent, conspicuously marked with caducous bracts-scars; bracts oblong-ovate, 3 mm long; peduncles stout, 5-15 cm; pedicels 1.2-2 cm. *Calyx* with 5 nectaries between the sepal-base; sepals subequal, broadly ovate-oblong or rounded, 6 x 4.5 mm, puberulous. *Corolla* purple, dark purple towards the base, funnel-shaped or broadly campanulate, 5-7.5 cm long, tube puberulous. *Stamens* unequal; filaments ciliate below; anthers oblong. *Ovary* 4-celled. Fruit not seen.



Distribution: Widely naturalized throughout India. Originally from American tropics, now circumtropical.

SOLANACEAE

SOLANUM L.

Solanum erianthum D.Don, Prod. 96.1825; Roe in Taxon 17:1968 & in Brittonia 24:251.1972; Hepper in Dassan. Fosberg, Rev. Handb. Fl. Ceylon 6:370.1987. *S.verbascofolium* auct. non L.: Wight, Icon.t. 1398. 1848; Clarke in Hook.f., Fl. Brit. India 4:230. 1883; Haines, Bot. Bihar, & Orissa 2:611(641).1922.

Large unarmed shrub, 1.8-6 m; branchlets densely stellate-tomentose. *Leaves* ovate, elliptic, ovate-lanceolate or lanceolate, 10-30 x 5-15 cm, entire, acuminate, densely stellate-tomentose beneath and less so above; petiole 2.5-5 cm. *Flowers* white, 1.8 cm across in long-peduncled tomentose cymes, 5-12.5 cm broad; cymes terminal, becoming lateral in fruit; peduncles 2.5-10 cm in flower and 7.5-10 cm in fruit. *Calyx* campanulate, 5-7.5 mm long, densely stellate-tomentose; teeth ovate, lanceolate or deltoid, 1.5 mm. *Corolla* 1 cm long; tube short; lobes stellate-pubescent. *Stamens* on the throat; anthers oblong, short, 3 mm long, scarcely exceeding the flattened filaments, not



attenuate, opening by a short apical slit, longitudinally dehiscent. *Berries* yellow or orange, globose, 8 mm diam., stellate when young.

Distribution: Throughout India, upto 1500 m. Originally from S.America, now introduced throughout the tropics.

Solanum violaceum Orteg., Hort. Matr. Dec. 56. 1798; Gandhi in Saldanha & Nicolson, Fl. Hassan Dist. 462. 1976; Hepper in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 6:378.f.3. 1987. *S. indicum* auct. non L.: Wight, Icon.t. 346. 1840; Clarke in Hook. f., Fl. Brit. India 4:234. 1883; Haines, Bot. Bihar & Orissa 2:612 (642).1922; Mooney, Suppl. Bot. Bihar & Orissa 94. 1950.

Shrub or undershrub, 0.6-1(1.8) m, stellate-tomentose; stems and branches with yellowish, compressed, often curved, short prickles. *Leaves* ovate or oblong, 1.5-15 x 1.5-10 cm, sinuate or lobed, acuminate, lobes obtuse or rounded, grey-or white-stellate- tomentose beneath, sparsely stellate above, always more or less prickly on the nerves beneath, base acute or oblique; petiole 1-3.7 cm.

Flowers blue, 1.2-1.8 cm across, lanceolate. 3-11 in lateral (or at first terminal) simple, scorpioid cymes; cymes with very short peduncle or sessile, sometimes prickly, tomentose; pedicels erecto-patent, finally 1.2-1.8 cm long, thickened upwards. *Calyx* often prickly, stellate-tomentose, tube very short, lobes lanceolate, 3.7 mm long, spreading but not enlarged in fruit. *Corolla* tomentose outside, lobes lanceolate. *Filaments* hardly any; anthers 3 mm long, attenuate from about halfway up. *Berry* orange or yellow, shining, globose, 0.8-1.2 cm diam.

Distribution: Throughout India. Sri Lanka.



VERBENACEAE

CLERODENDRUM L.

Clerodendrum viscosum Vent., Jard. Malm. 1:t. 25. 1803; Sant. in Bull. Bot. Surv. India 3:14. 1961; Mold. & A.L. Mold, in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 4:473. 1983. *C. infortunatum* auct. non L.: Wight, Icon.t. 1471. 1849 (*'infortunata'*); Clarke in Hook.f., Fl. Brit. India 4:594. 1885; Haines, Bot. Bihar & Orissa 2:721(756). 1922.

Vern. Kalabhant, Titbhant, Titbhanti

Shrub or undershrub, 1-1.8 m; branches hairy. *Leaves* ovate or broadly ovate, 10-24 x 5-18 cm, entire or dentate, acuminate or caudate, thinly hairy on both sides, glandular beneath, base cordate or rounded. *Flowers* white with



pink centre or pink-spotted, in large often leafy below. *Calyx* 1-1.2 cm long in flower, 5-fid; lobes acuminate; calyx accrescent, red in fruit. *Corolla-tube* 1.8 cm long, rather slender, pubescent; lobes one posterior and the other 4 declinate or obliquely spreading. *Stamens* far exserted. *Drupe* bluish-black, usually of a single globose drupe, 6-7.5 mm diam., at first enclosed by the calyx which opens widely on maturity.

Distribution: Throughout India, up to 950 m. Pakistan, Nepal, Myanmar, Sri Lanka, Thailand, S. China, Hainan, Philippine Islands, Sumatra, Java and Sarawak; naturalized in Brazil; often cultivated.

LIPPIA L.

Lippia javanica (Burm.f.) Spreng., Syst. Veg. 2:752. 1824; Meeuse in Blumea 5:68. 1942. *Verbena javanica* Burm.f., Fl. Ind. 12.t.6.f.2. 1768. *Lippia geminata* H.B.K., Nov. Gen. Sp. 2:266. 1818; Clarke in Hook.f., Fl. Brit. India 4:563. 1885; Haines, Bot. Bihar & Orissa 2:705(740). 1922; Mooney, Suppl. Bot. Bihar & Orissa 120.1950. *L. alba* (Mill.) N.E.Br. ex Britton & Wilson in Britton, Sci. Surv. Puerto Rico & Virgin Isles 6:141. 1925. *Lantana alba* Mill., Gard.Dict. (ed.8) n.8.1768. *Lippia unica* Ramakr. in J.Bombay Nat. Hist.Soc. 54:925. 1957.

Aromatic shrub or undershrub; branches several, erect or procumbent, 0.9-1.5 m, angled, with numerous minute glands and spreading hairs. *Leaves* lanceolate, oblong or ovate, 3-11 x 2-4.5 cm, closely crenulate or crenate-serrate, acute, thinly hairy and punctuate above, somewhat hoary beneath, usually with gradually tapering or cuneate base; petiole 5-10 mm. *Flowers* pink, scented, in capitate spikes, 7.5 mm long, elongating to 1.8 cm, on axillary peduncles 7.5-12.5 mm, very rarely 25 mm long; bracts ovate, lowest 5-7.5 mm long, acuminate, hairy. *Calyx* of 2 oblong, obtuse, concave, silky, lateral lobes, free on the anterior face, slightly concave at base above. *Corolla* hairy, tube 5 mm, throat yellow, upper lip with 2 small rounded lobes much shorter than the lower lip which has a shovel-shaped blade. *Fruit* globose, 2 mm diam., with sub-succulent green pericarp when unripe, ultimately dry and splitting into 2 pyrenes.



Distribution: West Bengal; Assam, Bihar; Peninsular India; Andamans. Native of tropical America and West Indies, now wide-spread.

LAMIACEAE

COLEBROOKEA Sm. ('Colebrookia')

Colebrookea oppositifolia Sm., Exot. Bot. 2:111.t.115.1805 ('Colebrookia'); Hook.f., Fl. Brit. India 4:642. 1885; Haines, Bot. Bihar & Orissa 2:741 (777). 1924; Mukerjee in Rec. Bot. Surv. India 14:84. 1940; Mooney, Suppl. Bot. Bihar & Orissa 125. 1950. *C. ternifolia* Roxb., Pl. Corom. t. 245. 1815.

Vern. *Ujalabhant*



Large spreading, softly woolly shrub, 1.5-3 m, with stout, softly white-tomentose branches. *Leaves* large, elliptic or elliptic-oblong, 9-20 x 3.5-8.7 cm, crenate or crenulate, acute or acuminate, softly pubescent or white-tomentose, base acute; petiole 1.2-5 cm. *Flowers* very small, white, in paniced spikes, 4-10 cm long. *Calyx* in fruit villous, deeply furrowed with plumose teeth 3 mm long. *Nutlets* often solitary.

Distribution: Throughout India in the hills. Myanmar, SW. China, Indo-China.

POGOSTEMON Desf.

Pogostemon benghalensis (Burm.f.) Kuntze, Rev. Gen. Pl. 2:517. 1891. *Origanum benghalense* Burm.f., Fl. Ind. 128. t. 38. F. 3. 1768. *Pogostemon plectranthoides* Desf., Mem. Mus. Hist. Nat. 2:155. t. 6. 1815; Hook.f., Fl. Brit. India 4:632. 1885; Haines, Bot. Bihar & Orissa 2:737 (773). 1924; Mukerjee in Rec. Bot. Surv. India 14:69. 1940; Mooney, Suppl. Bot. Bihar & Orissa 124. 1950.

Erect, suffruticose herb or shrub, 1-1.8 m; stems 4-angled, glabrous or hairy, branches often purple, hoary-pubescent. *Leaves* ovate, rarely lanceolate, 5-14 x 2.5-8 cm, serrate or coarsely doubly serrate, acute to acuminate, glabrous or pubescent, base straight, obtuse or cuneate; petiole 2.5-5 cm. *Flowers* bluish, purple, in capitate, secund bracteate spikes, arranged in dense secund paniced villous or hoary-pubescent racemes; bracts ovate, elliptic-ovate, or oblong-rhomboid, 5-6.2 mm long. *Calyx* tubular-ovoid, 3.7-4.3 mm long, sub-2-lipped, two teeth rather broader than the other three, half-to two-thirds as long as tube, villous-pubescent and minutely glandular. Upper corolla-lip with 3 rounded lobes, lower entire, lanceolate, acute. *Filaments* bearded. *Nutlets* minute, broadly ellipsoid, smooth and shining.



Distribution: W. Himalaya, up to 1500 m; Bihar; West Bengal; South India; Maharashtra. Myanmar.

EUPHORBIACEAE

BREYNIA J.R.Forst. & G.Forst.

Breynia vitis-idaea (Burm.f.) Fischer in Bull. Misc.Inform. 1932:65. 1932. *Rhamnus vitis-idaea* Burm.f., Fl. Ind. 61. 1768. *Breynia rhamnoides* (Retz.) Muell.-Arg. in DC. Prod. 15:440. 1866; Hook.f., Fl. Brit. India 5:330. 1887; Haines, Bot. Bihar & Orissa 1:133 (138). 1921. *Phyllanthus rhamnoides* Retz., Obs. Bot. 5:330. 1788. *Melanthesa rhamnoides* (Retz.) Bl., Bijdr. 591. 1826; Wight, Icon.t. 1898.f. 1. 1852.

Shrub, 1-3 m; branchlets spreading, often 2-edged but without raised angles from the stipular lines; bark light coloured. *Leaves* close-set, distichous, elliptic, elliptic-ovate or broadly oblong, 0.7-5.5 x 0.7-3.5 cm, obtuse, rounded or somewhat retuse, glabrous, pale beneath, base obtuse or cuneate, rarely rounded; petiole 2-5 mm; stipules very short, triangular or ovate-acuminate. *Flowers* monoecious or rarely dioecious, green, yellow or pinkish, axillary, solitary or in few-flowered clusters; male and female often on separate branchlets. *Male flowers* turbinate, 2 mm across, pedicels 2.5 mm. Female flowers solitary, green, campanulate;



perianth 6-lobed, lobes triangular-ovate. *Ovary* exceeding the perianth, with a fleshy raised rim, more or less 5-6-lobed; style half-sunken with 3 infected stigmas or rarely 5. *Fruit* red, globose or globose-ovoid, 5-6 mm diam., obscurely 5-6-lobed, seated on enlarged spreading perianth which is not as broad as the diam. of the fruit.

Distribution: Throughout tropical India. Sri Lanka, Nepal, SE. Asia, China, Malesia, Ryu Kyu Isls.

MALLOTUS Lour.

Mallotus repandus (Willd.) Muell.-Arg. in Linnaea 34:197. 1865; Hook.f., Fl. Brit. India 5:442. 1887; Haines, Bot. Bihar & Orissa 1:105(111).1921. *Croton repandus* Willd., Ges. Naturf. Freunde Berlin Neue Schriften 4:206. 1803.

Large shrub, sometimes scandent or subscandent with thorns on the trunk; branchlets stellate-pubescent or tomentose. *Leaves* ovate or ovate-deltoid, 5-10 x 4.3-8.7 cm, entire or somewhat sinuate-toothed, acute or acuminate, glabrescent above, densely stellate-pubescent and closely covered with small glands beneath, secondary nerves 2-3 above the 3-nerved, cordate, subtruncate, retuse, rarely obtuse or rhomboid base; petiole 2.5-6 cm long; stipules minute, tomentose. *Inflorescence* densely pubescent. Male flowers in terminal paniced racemes. *Tepals* 3-5, yellow, suborbicular or lanceolate, 3 mm long, concave, tomentose, glandular within. *Anthers* with 2 oblong cells, slightly produced beyond the connectivity. Female flowers green, in simple racemes. *Tepals* linear, caducous. *Ovary* tomentose, 2-lobed and -celled; stigma plumose, sessile. *Capsule* 2-valved, 1.2 cm diam., densely fulvous-tomentose, glandular. *Seeds* subglobose, black.



Distribution : Throughout India. Sri Lanka, Myanmar, China, Malay Isls., New Caledonia.

PHYLLANTHACEAE

PHYLLANTHUS L.

Phyllanthus reticulatus Poir. in Lam. Encycl. 5:298. 1804; Hook.f., Fl. Brit. India 5:288. 1887; Airy Shaw, Euphorb. Borneo 185. 1975. *Kirganella reticulata* (Poir.) Baill., Etude Euphorb. 613. 1874; Haines, Bot. Bihar & Orissa 1:129 (134). 1921. *Anisonema multiflora* Wight, Icon.t. 1899. 1852.

Vern. *Siket, Titori*

Sarmentose shrub, 2-12 m; branches slender, glabrous or pubescent; branchlets slender, with pinnately arranged leaves; bracts (cataphylls) present. *Leaves* elliptic or oblong, 1-4.3 (7.5) x 0.5-2 cm, apex obtuse or rounded, dark green above, pale beneath, secondary nerves 6-8, slender, base rounded or subacute; petiole 1-3.7 mm; stipules basifixed, lanceolate, entire shorter than or equalling the petiole, occasionally hardening and reflexed.



Flowers green or purple, campanulate, male and female subsimilar on slender pedicels, 3.7-6.2 mm long, usually 1 male and 1 female in each axil, sometimes racemed. *Tepals* 5 imbricate, inner tepals elliptic, 1.2-1.5 mm long, rather broader and often orbicular in female, up to 1.8 mm in fruit. *Disc* of 5 fleshy glands. Male flowers: stamens 4-7 or usually 5, free or inner 2-3 with connate filaments; anther-cells longitudinally dehiscent. Female flowers: *Ovary* 5-12-celled, with as many minute sessile fleshy stigmas or half as many 2-lobed stigmas; ovules 2, superposed in each cell. *Fruit* a fleshy, 5-12-celled berry, black, globose, 5-7 mm diam., usually 8-10-seeded. *Seeds* trigonous.

Distribution: Throughout tropical India. SE. Asia, tropical Africa, S. China, Sri Lanka, Myanmar, Malesia.

SECURINEGA Comm. ex Juss.

Securinega virosa (Roxb. ex Willd.) Baill. in Adansonia 6:334. 1866, quod syn. Tantum, emend. Pax & Hoffm. in Engl. & Prantl. Pflanzenfam. (ed.2) 19C: 60. 1931; Airy Shaw in Kew Bull. 26:340. 1972. *Phyllanthus virosus* Roxb. ex Willd., Sp. Pl. 4:578. 1805. *Fluggea virosa* (Willd.) Baill., Etude Gen. Euphorb. 593. 1858. *F. microcarpa* Blume, Bijdr. 580. 1826; Hook.f., Fl. Brit. India 5:328. 1887. *F. obovata* Baill., Etude. Gen. Euphorb. 593. 1858; Haines, Bot. Bihar & Orissa 1:123 (127). 1921. *Chorisandra pinnata* Wight, Icon.t. 1994. 1853.

Vern. *Sikhet*

Small unarmed glabrous tree or large shrub, sometimes straggling (rarely thorny); bark smooth, thin, reddish-brown. *Leaves* very variable in size and shape, elliptic, obovate or orbicular, 1.8-7.5 x 1.2-3.7 cm, beneath, secondary nerves 5-8; petiole 3-8 mm. *Flowers* greenish; ca. 2 mm across, clustered on filiform, 4-12.5 mm long pedicels. *Tepals* thin, rounded. *Fruit* pretty white, globose, 7.5 mm diam., with fleshy pericarp, rarely dry and only 3-4.3 mm diam.



Distribution: Tropical Africa, Sri Lanka, S. Asia, Japan, Malesia, Australia, Polynesia.

MONOCOTYLEDONS

TYPHACEAE

TYPHA L.

Typha angustifolia L., Sp. Pl. 971.1753; Backer in Steenis, Fl. Males. 4: 243. F. 9. 1951.

T.angustata Bor & Chaubard, Exped. Sci. Moree Bot.2: 338. 1832; Hook. f., Fl. Brit. India 6:489. 1849; Haines, Bot. Bihar & Orissa 876.1924.

Vern. *Pater*

Erect, marshy, undershrubs to 2.5 m tall, with rhizomatous base. *Leaves* semicylindrical, blade above sheath, 100-150x2-2.5cm, usually longer than flowering stem. *Spikes* cylindrical, the male and female flowers separated by long interval. *Stamen* usually 1. *Female* flowers with 1 carpel; ovary minute, on a long capillary stipe. *Fruits* minute, 1-seeded.



Distribution: Northern and Central-South India, to 1000m; N. Asia, Africa and S. Europe.

CLIMBERS

CLIMBERS

DICOTYLEDONS

RANUNCULACEAE

CLEMATIS L.

Clematis gouriana Roxb. ex DC., Syst. 1:138. 1817; Wight, Icon. t.933 & 934. 1845; Hook.f. & Thoms.in Hook.f., Fl. Brit. India 1:4.1872; Haines, Bot. Bihar & Orissa 1:4(4). 1921; Mooney, Suppl. Bot. Bihar & Orissa 19. 1950; Gupta in Bull. Natl. Bot. Gard. Lucknow 54: t.9 1961; Kapoor in Bull. Natl. Bot. Gard. Lucknow 78:22. 1962; Anon., Draw Ind. Pl. (Icon. Roxb. No. 1453) 1: t.1. 1964.

Large evergreen climber; branches sulcate glabrous to villous-pubescent. *Leaves* generally pinnate, bipinnate or biternate but generally bipinnate; leaflets oblong, ovate-lanceolate, 2.5-9 x 1-3 cm, chartaceous, glabrous or pubescent below, 3-5-nerved, base obtuse or cordate, margin entire or coarsely toothed, apex acute or acuminate; petiole 6 cm or more; petiolule 1 cm. *Panicles* dense, to 15 cm, sparsely pubescent; peduncles 3-6 cm; pedicel to 1.5 cm. *Flowers* fragrant, 0.8-1.5 cm across. *Sepals* white or cream, oblong or obovate, 4-8 mm long, revolute, puberulous. *Filaments* linear, 3-6 mm, flattened, glabrous; connective not produced above anthers. *Carpels* 10-15, oblong or linear; style to 2.5 mm, persistent; stigma clavate. *Achenes* sessile, narrowly or broadly oblong or ovoid, to 3 mm long, with 3-5 cm long persistent feathery style.

Distribution: Himalaya to Sri Lanka and the Eastern Peninsula. Myanmar, China, Java, Philippines.



MENISPERMACEAE

CISSAMPELOS L.

Cissampelos pareira L.var.**hirsuta** (Buch.-Ham.ex DC.) Forman in Kew Bull. 22:356.1968. *C.hirsuta* Buch. Ham.ex DC. Syst.Nat.1:535.1817. *C. pareira* L., Sp.Pl. 1031. 1753, pro parte; Hook.f. & Thoms. in Hook.f., Fl. Brit. India 1:103.1872; Haines, Bot. Bihar & Orissa 1: 16 (17).1921.

Ver. *Gairguj*

Slender climber with perennial root-stock. *Leaves* broadly ovate or orbicular, 4.5-11x4.5-12 cm, base rounded, truncate or cordate, apex obtuse or retuse, mucronate, margin entire, palmately 5-7-nerved, lower surface tomentose to pubescent or puberulous, somewhat glaucous, upper surface sparsely pubescent or puberulous; petiole 2-9 cm long. *Male inflorescence* 2-4 cm long, pubescent. *Male flowers*: Green to yellow on pedicels 1-2 mm. *Sepals* 1.25-1.5 mm long, pilose outside. *Corolla* ca. 0.5 mm long, puberulous outside. *Synardrium* ca 0.5 mm long. *Female inflorescence* upto 18 cm, bract upto 1.5 cm long, puberulous. *Female flowers* on pedicels 1-1.5 mm. *Sepals*



broadly obovate, 1.5 mm long. *Petals* broadly cuneate obovate, 0.75 mm long. *Ovary* pilose; style thick, glabrous; stigma divaricately 3-lobed. *Drupe* orange or red, pubescent, with endocarp obovate in outline, 5 mm long.

Distribution: Tropical and subtropical India. Pantropical.

COCULUS DC.

Cocculus hirsutus (L.) Diels in Engl. Pflanzenr. 46:236. 1910; Haines, Bot. Bihar & Orissa 1:19(20).1921. *Menispermum hirsutum* L., Sp. Pl. 341. 1753. *Cocculus villosus* DC., Prod. 1:98. 1824; Hook.f., Thoms.in Hook.f., Fl. Brit. India 1:101.1872.

Vern. *Dudhlat*

Straggling climber to 6 m, more or less villous. *Leaves* triangular to ovate, 2.5-7.5 x 2-3.5 cm, base rounded, truncate or cordate, margin entire, apex obtuse, rounded or emarginate, mucronate, undersurface densely villous, pubescent to glabrescent above. *Male flowers* in axillary, short-peduced small capitate cymes, much shorter than the leaves. *Sepals* free, outer ones obovate, inner ones oblanceolate. *Petals* free, greenish, obovate, glabrous. *Stamens* enclosed by petals; anthers dehiscing vertically. *Female flowers* 1-3 from short axillary peduncles. *Sepals* as in male. *Petals* hairy. *Carpels* 3. *Drupe* purple, compressed, 4-8 mm across, tomentose.

Distribution: Tropical and subtropical India. Tropical Africa, Asia from C. Arabia to S. China.



TILIACORA Colebr.

Tiliacora acuminata (Lam.) Miers, Ann. Mag. Nat. Hist. II. 7:39. 1851; Haines, Bot. Bihar & Orissa 1:19(19). 1921; Forman in Kew Bull. 30:90.1975. *Menispermum acuminatum* Lam., Encyl. 4:101. 1797. *Tiliacora racemosa* Colebr. in Trans. Linn. Soc. 13:67. 1821; Hook.f. & Thoms. in Hook.f., Fl. Brit. India 1:99.1972.

Vern. *Karwanth*, *Kaurabaint*

Large woody climber. *Leaves* ovate, sometimes oblong-lanceolate, 8-12 x 3.5-8cm, glabrous, with 3-5 subpalmate basal nerves and 2-3 pairs of lateral nerves, base truncate to subcordate, margin entire, apex acuminate; petiole 2-3 cm, articulate at the base. *Inflorescence* tomentose or pubescent, male inflorescence 6-7 cm long, with peduncle 1 cm long female inflorescence 2.5-5 cm long. *Male flowers*; Sepals 3+3, free, outer ones ovate, hairy without, glabrous within, petaloid, oblong. *Petals* 6, bright yellow, free, obovate, glabrous, apex retuse. *Stamens* 6, pistillode short. *Female flowers*: *Carpels* 6(-9). *Drupe* red, 1.0-1.5 x 0.6 cm; endocarp obscurely reticulate.



Distribution: Tropical India from North India and Bengal to Konkan. Sri Lanka, Nepal, Upper Myanmar.

TINOSPORA Miers

Tinospora cordifolia (Willd.) Hook.f. & Thoms., Fl. Ind. 184.1855 & in Hook.f., Fl. Brit. India 1:97.1872; Haines, Bot. Bihar & Orissa 1:18 (18). 1921; Forman in Kew Bull. 36:403. 1981. *Menispermum cordifolium* Willd., Sp. Pl. 4:826. 1806.

Vern. *Giloh*

Woody climber; branchlets glabrous, often sending down slender pendulous, fleshy roots. *Leaves* cordate, 4-10 x 4.5-10 cm, glabrous, 5-7(-9)-nerved, often with glandular papillose patches in the basal nerve-axils on lower surface, margin entire, apex acuminate; petiole 2.5-10 cm. *Pseudoracemes* axillary or on leafless branchlets, shorter or ultimately often longer than the leaves. *Male flower*: Clustered in the axils of minute bracts; pedicels filiform. Outer sepals ovate, inner ones elliptic. *Petals* 6, green, free, obovate, reflexed. *Stamens* enclosed by petals; filaments clavate; anthers longitudinally dehiscent. *Female flowers*: Usually solitary in the racemes. Outer sepals lanceolate, inner ones obovate. *Petals* broadly spatulate. *Carpels* 3; styles stout. *Drupe*s red, globose to subglobose, 6-8 mm across, radiating from a 2-3-branched carpophore; style-scar subterminal.



Distribution: Tropical India, Bangladesh, Sri Lanka.

OLEACEAE

OLAX L.

Olax scandens Roxb., Pl. Corom.t.102. 1799 & Fl. Ind. 1:163.1820; Master in Hook. f., Fl. Brit. India 1:575. 1875; Haines, Bot. Bihar & Orissa 1:183(189).1921; Sleumer in Blumea 26:157.1980 & in Steenis, Fl. Males.1.10:7. 1984.

Vern. *Katihari*

Shrub or small or scandent (rarely spinous); branches pubescent. *Leaves* ovate, oblong-elliptic to suborbicular, 3-12 x 1.8-6 cm, obtuse, rounded or subacute, subglabrous, pubescent or hairy, base rounded; petiole 7.5-12 mm, pubescent. *Flowers* white, 6.7.5 mm long, in short racemes; pedicels short. *Calyx* ciliate narrow, 5-7 mm. *Petals* narrow, 5-7 mm. *Disc* thin, copular. *Stamens* 7-10, 3-5 fertile, staminodes 2-fid. *Fruit* yellow, or orange fleshy, subglobose, 0.8-1.5 cm diam., more than half enclosed in the accrescent calyx.



Distribution: Throughout tropical India. Sri Lanka, Myanmar, Indo-China, Thailand, Malaysia.

CELASTRACEAE

CELASTRUS L.

Celastrus paniculatus Willd., Sp. Pl. 1:1125.1798; Wight, Icon.t.158.1839 & Ill.t.72. 1842; Lawson in Hook. f., Fl. Brit. India 1:617.1875; Haines, Bot. Bihar & Orissa 1:188(195). 1921; Ding Hou in Steenis, Fl. Males. I. 6:235. 1962.

Vern. *Kujree, Malkangni*

Scrambling or climbing shrub; branches long, lenticellate. *Leaves* obovate, elliptic or oblong, 3.5-15 x 2.5-8 cm, serrulate, shortly abruptly acuminate, glabrous or puberulous above, pubescent beneath especially along the nerves, base acute to rounded; petiole 0.6-1.2 cm; stipules minute, deciduous. *Panicles* 5-15 cm; bracts minute. *Flowers* yellowish or greenish, 3 mm across; pedicels 1.5-2 mm long. *Sepals* orbicular, erose. *Petals* ovate-oblong, obtuse. *Capsule* yellow, globose or obovoid, 7-8 mm across, 3-valved, 3-6-seede. *Seed* red arilled.



Distribution: Throughout India, Myanmar, Thailand, Indo-China, S.China, Malaysia to Australia, New Caledonia.

RHAMNACEAE

VENTILAGO Gaertn.

Ventilago denticulata Willd., Ges. Naturf. Fr. Neue Schriften. 3:417. 1801; Benerjee & Mukherjee in Indian For. 96:209.1970; Bhandari & Bhans. in Fasc. Fl. India 20:82.1990. *V. calyculata* Tul. in Ann. Sci. Nat. Bot. IV. 8:124. 1857; Lawson in Hook.f., Fl. Brit. India 1:631. 1875; Haines, Bot. Bihar & Orissa 1:193(200).1921.

Vern. *Dasriya, Dhersain, Gahumanmaltee, Rapain, Ropain*

Large woody climber; branchlets pubescent. *Leaves* ovate-oblong to elliptic-oblong, 5-15 x 2.5-7.5 cm, irregularly crenate-serrate or entire, acute, acuminate or subacute, glabrous or pubescent above, pubescent beneath, secondary nerves often 4-5; petiole 8-10 mm. *Flowers* pale-yellowish-green in terminal pubescent panicles upto 25 cm long. *Disc* villous. *Fruit* samaroid, the basal globose nut ca.6 mm diam., pubescent girt to the middle by the calyx tube; wing oblong, 4 x 8.8 cm, pubescent.



Distribution: Throughout India, Cochin China, Myanmar, Malaysia.

ZIZIPHUS Tourn. ex Mill.

Ziziphus oenoplia (L.) Mill., Gard. Dict.ed.8.n. 3. 1768; Lowson in Hook. f., Fl. Brit. India 1:634.1875; Haines, Bot.Bihar & Orissa 1:196(203). 1921; Bhandari & Bhans. in Fasc. Fl. India 20:103.1990. *Rhamnus oenoplia* L., Sp. Pl.194. 1753.

Vern. *Dithor*, *Makahi*, *Sitaber*

Straggling thorny shrub sometimes climbing over trees; trunk armed with large conical spine-tipped woody bosses; branchlets brown-tomentose; thorns usually solitary, small and hooked or with one nearly straight. *Leaves* obliquely ovate-lanceolate or oblong-ovate, 2-6.5 x 1.5-3.7 cm, entire or faintly crenate, acute or acuminate, glabrous or pubescent above, silky pubescent or tomentose beneath, base oblique, 3-5-nerved; petiole 3-8 mm long. *Cymes* axillary, under 1.2 cm long, brown-tomentose. *Flower* sometimes 4-merous. *Petals* cucullate. *Ovary* 2-celled. *Drupe* black, globose, 6-8 mm diam., stone rugose, compressed, 1-, rarely 2-seeded.



Distribution: Throughout the hotter parts of India. Tropical Asia and Australia.

VITACEAE (AMPELIDACEAE)

AMPELOCISSUS Planch.

Ampelocissus tomentosa (Roth) Planch. Vigne Amer. Vitic. Eur. 375. 1884 & in DC. Monog. Phan. 5:376. 1887; Mooney, Suppl. Bot. Bihar & Orissa 43. 1950. *Vitis tomentosa* Heyne ex Roth, Nov. Pl. Spec. 157. 1821; Wight, Ill.t. 57. 1840; Lawson in Hook.f., Fl. Brit. India 1:650. 1875; Haines, Bot. Bihar & Orissa 1:203(210). 1921.

Large climber, densely often ferruginous tomentose; branchlets cottony tomentose when young. *Leaves* simple orbicular, 8-25 cm diam., angled or 3-5-lobed, serrate, serrulate or spinulose dentate, palminerved, pubescent above, tomentose to glabrescent beneath, base deeply cordate; petiole 7-15 cm long. *Flowers* red, sessile, in divaricate cymes on a peduncle under 2.5 cm long, borne again together with a tendril on a common branchlet 7-15 cm long. *Petals* spreading. *Berry* black, 8-10 mm diam. *Seeds* obcordate, furrowed and keeled on the inner and pitted on the outer face.



Distribution: Peninsular India. Sri Lanka.

TETRASTIGMA (Miq.) Planch.

Tetragstigma thomsonianum Planch.in A. & C.DC., Monogr. Phan. 5:438.1887. *Cissus angustifolius* Roxb., Fl. Ind. (Carey & Wall. ed.) 1:408.1820. *Vitis angustifolia* (Roxb.) Wight, Icon. Pl. Ind. Orient. 1:9.t. 176. 1839; Lawson in Hook.f., Fl. Brit. India 1:654.1875; Haines, Bot. Bihar Orissa 200.1921 (Repr. Ed., 1:212. 1961).

Vern. *Gunah*

A herbaceous climber with dark-coloured usually flattened stem. *Leaves* 3-foliolate; common petiole 5-8 cm long, glabrous; stipules ovate-oblong, coriaceous. *Leaflets* 8-18 x 2.5-4 cm, lanceolate or elliptic-lanceolate, distantly serrate, acuminate, glabrous or puberulous on the mid-rib; main lateral nerves 5-7 on either half, slender. *Tendrils* simple, leaf-opposed, very slender. *Cymes* axillary, short-shorter than the common petiole, dense, usually very shortly peduncled pubescent. *Flowers* 4-merous, dioecious, green. *Petals* free. *Style* 0; stigma large, flat, scarcely lobed. *Berry* globose, about 5 mm across, not juicy, 2-4 seeded. *Seeds* furrowed on each face and transversely rugose on the sides.

Distribution: Bihar, North-east India.

FABACEAE (PAPILIONACEAE)

ABRUS Adans.

Abrus precatorious L., Syst.Nat.ed.12.2:472. 1767; Baker in Hook.f., Fl. Brit. India 2:175. 1876; Haines, Bot.Bihar & Orissa 2:247(259). 1922; Breteler in Blumea 10:917.1960.

Vern. *Katkaraji, Ratti*

Twining slender shrub. *Leaves* 5-8.7 cm long, paripinnate; leaflet 10-20 pairs, opposite, oblong, 7.5-18 mm long, entire, obtuse, glabrous or silky beneath. *Flowers* pinkish-white or white, 7-10 mm long in crowded racemes, 2.5-7.5 cm long. *Pods* oblong, 25-3.5 cm long, turgid, 3-5-seeded. *Seeds* subglobose, 5-7 mm, polished, usually scarlet with a black eye but sometimes white.

Distribution: Throughout the greater part of India. Pantropical.



ATYLOSIA Wight & Arn.

Atylosia scarabaeoides (L.) Benth.in Miq.Pl. Jungh. 243. 1852; Baker in Hook.f., Fl. Brit. India 2:215. 1876; Haines, Bot. Bihar & Orissa 2:274(287). 1922. *Dolichos scarabaeoides* L., Sp. Pl. 1020. 1753. *Catharospermum scarabaeoides* (L.) Baill. in Bull.Soc. Linn. Paris 1:384. 1883; Mooney, Suppl. Bot. Bihar & Orissa 52.1950.

Vern. *Bankulthi*

Herbaceous, perennial pubescent climber; *leaflets* elliptic, obovate-oblong or



oblong 1.2-4.5 cm long, subacute or obtuse, pubescent above, densely pubescent below, the glands in some specimens almost evanescent, lateral leaflets somewhat smaller and oblique petiolules very short. *Flowers* yellow or tinged with reddish-brown, 2-6 on short, densely pubescent axillary peduncles. *Calyx* densely grey or fulvous-pubescent; lobes linear. *Pods* oblong, 1.8-2.5 cm, straight, covered with long soft brownish hairs, with deep transverse or obliquely transverse depressed lines between the seeds, apex obtuse, tipped with the base of the style. *Seeds* 4-6, grey-brown, oblong-rounded, under 5 mm.

Dsitribution: Throughout India, ascending to 1800 m. Tropical Asia, Madagascar, Mauritius, Australia.

BUTEA Roxb. ex Willd.

Butea parviflora Roxb., Fl. Ind. 3:248.1832; Haines, Bot. Bihar & Orissa 2:280(293). 1922. *Spatholobus roxburghii* Benth. in Miq, Pl. Jungh. 238.1852; Baker in Hook. f., Fl. Brit. India 2:193.1876. *S. parviflorus* (Roxb.) Kuntze, Rev. Gen. Pl. 1:205 1981.

Vern. *Chihut, Dhorni, Dhorsain, Ghursain, Mahai*

Gigantic evergreen climber with smooth grey bark, exuding a reddish gum when cut. *Petiole* 7.5-10 cm long, glabrescent; leaflets 12-25 cm long, scarcely coriaceous, shortly densely silky or glabrescent beneath, terminal elliptic, sub-rhomboid or somewhat obovate, shortly cuspidate, lateral leaflets oblique. *Panicles* tomentose; pedicels under 2.5 mm. *Flowers* cream or white. *Calyx* narrowly campanulate, pale tomentose, lower teeth linear-lanceolate, sometimes exceeding the tube. *Pods* 7.5-10 cm long, ferruginous-tomentose, sometimes constricted below the seed, base narrowed suddenly into a stalk, ca 12 mm long, dehiscing only at the apex.



Distribution: From the foot of the Himalaya to S. India. Myanmar, Sri Lanka.

CAESALPINIACEAE

BAUHINIA L.

Bauhinia vahlii Wight & Arn. in Wight, Cat. 38. 1833; Baker in Hook. f., Fl. Brit. India 2:279. 1878; Haines, Bot. Bihar & Orissa 2:310(324). 1922. *Phenera vahlii* (Wight & Arn.) Benth. in Miq. Pl. Jungh. 263. 1853.

Vern. *Chahar, Chihar, Mahulang, Moulan, Patai*

Gigantic climber; shoots and young parts tomentose; stem attaining 0.6-1.2 m girth; bark nearly smooth, brown; tendrils circinate, leaf-opposed. *Leaves* 8-10 x 8-25 cm, or more, deeply lobed with rounded lobes, with a very stout point from the sinus, glabrous above, tomentose beneath, 11-13-nerved, base deeply cordate; petiole 3.5-10.5 cm long. *Flowers* white or cream, large; in tomentose often paniced corymbs; pedicels 3-4 cm long, tomentose; flower-buds tomentose. *Calyx* densely tomentose, limb into 2 broadly ovate lobes. *Petals* 2.5-3.7 cm, densely villous on the back. *Pods* woody, oblong, flat, 15-30 x 3.7-6.5 cm, velvety rusty. *Seeds* 6-12 cm oblong-ellipsoid, ca. 3 x 2 cm, compressed, polished.



Distribution: Throughout India.

MIMOSACEAE

ACACIA Mill.

Acacia pennata (L.) Willd., Sp. Pl. 4: 1090. 1806; Baker in Hook. f., Fl. Brit. India 2:292. 1878, pro parte; Haines, Bot. Bihar & Orissa 2:327(341). 1922. *Mimosa pennata* L., Sp. Pl. 522. 1753. *Acacia pennata* (L.) Willd. var. *heyneana* Benth. in Hook. Lond. J. Bot. 4:515-16. 1842. *A. ceaesia* Wall. Cat. 5253A. 1831-32 (*nom. nud.*); non Willd. *A. canescens* Grah ex Gamble, Fl. Madras 1:429(304). 1919; Haines, Bot. Bihar & Orissa 2:327(341). 1922. *A. pennata* (L.) Willd. var. *canescens* Baker in Hook. f., Fl. Brit. India 2:298. 1879.

Vern. *Arhar*

Large woody climber; bark-light coloured; branches usually more or less 5-angled with lines of small prickles on the angles. *Stipular* thorns 0; rachis with a gland near the base or middle of petiole and between 2-3 uppermost pairs of pinnae; pinnae 8-20 pairs, 3.7-8 cm long; leaflets 40-80 pairs, sessile, linear, 3-5-8.5 mm long, apex acute to rounded, base rounded rectangular with about 4 small nerves. Flower-heads ca. 1.5 cm across, in terminal or axillary racemes; peduncle often 4-nate, thinly pubescent or nearly glabrous; bracts 1-2 linear, tip sometimes dilated. *Flowers* cream, pedicelled. *Pods* thin, flat, 10-



18 x 1.8-3 cm, brown or purple, glabrous, sutures strong. *Seeds* upto 12, black, oblong, 1-1.2 x 0.7 cm.

Distribution: Throughout India, ascending to 1500 m. SE. Asia, Tropical Africa.

Acacia sinuata (Lour.) Merr. in Trans.Amer.Philos.Soc. 24:186.1935; Gandhi in Saldanha & Nicolson, Fl.Hassan 228.1976. *M.rugata* Lam., Encycl.1:20. 1783. *M.concinna* Willd.Sp. Pl. 4:1039.1806. *Acacia concinna* (Willd.) DC., Prod. 2:464. 1825; Baker in Hook.f., Fl. Brit. India 2:296.1878; Haines, Bot. Bihar & Orissa 2:328(343). 1922; Verdc. in Kew.Bull. 32:471.1978; Nielson in Adansonia 19:348.1980. *Acacia rugata* (Lam.) Voigt,Hort.Suburb.Calc.263. 1845, non Benth. 1842; Merr. in Philipp.J.Sci.Bot.5:28. 1910. *A.concinna* (Willd.) DC. var.*rugata* (Lam.) Baker in Hook. f., Fl. Brit. India 2:297.1878.

Vern. *Shikakai*

Large, very prickly climbing shrub with pale-grey twigs, copiously armed with hooked prickles; branchlets often white; pubescent. *Stipules* ovate, thorns 0; leaf-rachis 7.5-14 cm long, pubescent, prickled, glands between 2 uppermost pinnae; pinnae 3-6(8) pairs, 1.2-2.5 cm apart, the median one ca. 6.2 cm long; leaflets 9-15 pairs, sessile, linear, 6-15 x 1-2 mm, obtuse, apiculate, glabrous or slightly pubescent beneath, base truncate, mid-nerve near the distal margin. Flower-heads 1-2-4-nate in leaf-axils and below, 1-1.2 cm across; bracts ovate, to 5 mm. *Flowers* cream (or pink), 2.5-3 mm long, sessile. *Calyx* ca.2 mm, minutely thinly pubescent. *Ovary* usually glabrous or nearly so. *Pods* 6.2-10 x 1.8-2.6 cm, thick, fleshy, much wrinkled when dry, sutures indented between seeds.



Distribution: Punjab, Bihar, Bengal, Madhya Pradesh, Maharashtra and Tamil Nadu, Nepal, Sri Lanka, S.China, Malaysia, New Guinea.

COMBRETACEAE

COMBRETUM Loefl.

Combretum roxburghii Spreng., Syst.2:331. 1825; Exell in Steenis, Fl. Males. I. 4:544. 1951. *C.decandrum* Roxb., Pl. Corom.t. 59. 1798; Clarke in Hook. f., Fl. Brit. India 2:452. 1878; Haines, Bot. Bihar & Orissa 2:357(373). 1922.

Vern. *Madhulatti*, *Ratair*

Large sarmentose or scandent rusty-pubescent shrub. *Leaves* oblong or obovate-oblong, 7-18 x 3-7.5 cm, shortly suddenly acuminate, coriaceous, glabrous or somewhat appressed hairy or with tufts of hairs in the axils of the strong secondary nerves beneath. *Spikes* rusty villous, 1.5-3(5) cm in large axillary and terminal panicles with conspicuous large white



bracts. *Flowers* 5-merous. *Calyx-tube* urceolate, densely villous-pubescent; lobes sub-aristate, acuminate. *Petals* ovate, acuminate, hairy, not much longer than calyx-lobes. *Fruits* oblong or elliptic, 2.5-3 cm long.

Distribution: Throughout the greater part of India. Myanmar.

PASSIFLORACEAE

PASSIFLORA L.

***Passiflora suberosa* L., Sp. Pl. 958. 1753.**

Perennial climbers; stem subangular. *Leaves* ovate or suborbicular, 3-lobed, 4-10 x 6-8 cm; lobes ovate-lanceolate, acute, base semi-lunar with two lateral lobes; petioles 1.5-3 cm long, with two glands near the middle; stipules lanceolate-linear; tendrils arising from the axils of leaves, unbranched. *Flowers* solitary, rarely in 2; pedicel 1-1.5 cm long. *Calyx* segments, lanceolate-oblong. *Coronal* threads 3-seriate; outer ones green recurved; inner ones shorter, clavate. *Fruits* ellipsoid, globose, about 1 cm across; seeds pitted.

Distribution: Sub Himalayan tracts, to 1000 m.



TRICHOSANTHES L.

***Trichosanthes tricuspidata* Lour., Fl. Cocohinch. 589. 1790; Hara & Sutton, Enum.Fl. Pl. Nepal 2:180. 1979. *T.bracteata* (Lam.) Voigt, Hort. Sub. Calc. 58. 1845; Chakrav., Fasc. Fl. India 11:109. 1982. *Modecca bracteata* Lam., Encycl. 4:210. 1797. *Trichosanthes palmata* Roxb., Fl. Ind. 3:704. 1832; Wight, Ill. 2.104. 1850; Clarke in Hook.f., Fl. Brit. India 2:606. 1879; Haines, Bot. Bihar & Orissa 2:387(405). 1922. *T.lepiniana* (Naud.) Cogn. in DC. Monog. Phan. 3:377. 1881; Chakrav., Fasc. Fl. India 11:116. 1982. *Involucraria lepiniana* Naud. in Huber, Cat. 11.1868.**

Vern. *Patalkohra*

Large climber; stem suffrutescent, branches long pendent. *Leaves* broadly ovate, upto 15 x 12.5 cm, simple or deeply palmately 3-5-lobed, cordate, denticulate, sometimes with large green glands near base, upper surface smooth and bright green when fresh but very scabrous when old, lower surface paler with cystoliths on the nerves when dry, primary nerves 3-5(-7); petiole 2.5-5 cm; tendril 2-5-fid, robust. *Flowers* white, 5-7.5 mm across, dioecious. *Male racemes* 5-10 cm; peduncle to 9 cm; bract obovate, 1-1.5 cm long, with large deep green circular glands and sharply dentate or lacinate; pedicel to 5 mm. *Calyx-tube* 3-6 cm long, glabrous; lobes lanceolate, 1.5 cm long. *Petals* ovate, long lacinate. *Calyx-tube* 1.5 cm; lobes lanceolate, lacinate. *Ovary* globose, puberulous. *Fruit* bright scarlet, globose 5-6.5 cm diam., on axillary short stout peduncle.



Seeds embedded in dark green pulp, oblong, flattened, slightly narrowed at base, 1-1.2 cm long.

Distribution: Throughout India, ascending to 1500 m on the Himalaya. Sri Lanka, Myanmar, Malesia, China, Japan, N.Australia.

APOCYNACEAE

ICHNOCARPUS R.Br.

Ichnocarpus frutescens (L.) R.Br., Mem. Wern. Nat.Hist.Soc. 1:62. 1811 (pre print 1810) & in Ait. f., Hort. Kew 2:69. 1811; Hook. f., Fl. Brit. India 3:669.1882; Haines, Bot. Bihar & Orissa 2:546(573). 1922; Huber in Dassan. & Fosberg, Rev. Handb.Fl.Ceylon 4:71.1973.

Vern. *Dudhlar*

Large climbing shrub, woody below; branches rusty-pubescent or rusty-tomentose. *Leaves* lanceolate-oblong, oblong, elliptic or broadly oblong, 10-13 x 1-5 cm, acute to acuminate, glabrous, base acute or rounded; petiole 4-6.5 mm. *Panicle* narrowed, usually leafy, with short branches. *Flowers* white, small, 7.5 mm diam. *Calyx* with linear glands within. *Corolla-tube* swollen in the middle, usually pubescent, mouth villous, lobes narrow, lobes narrow, twisted, bearded. *Follicles* linear, 7.5-16 x 0.3 cm, divaricate, slightly flattened. *Seeds* brown, linear, 1.2 cm, grooved, with a coma about 6.2 mm.



Distribution: Throughout the greater part of India, ascending to 1200 m. Sri Lanka, SE. Asia to Australia.

PERIPLOCACEAE

CRYPTOLEPIS R.Br.

Cryptolepis buchanani Roem. & Schult., Syst. Veg. 4:409. 1819; Wigh, Icon.t.494. 1841 & Ill.t. 182.f.8.1850; Hook.f., Fl. Brit. India 4:5.1883; Haines, Bot. Bihar & Orissa 2:549(576). 1922; Huber in Dassan. & Fosberg, Rev.Handb. Fl. Ceylon 4:183. 1983.

Vern. *Matka dudhiya latra*

Large twining glabrous shrub with copious milky juice; bark brown on old stems, peeling



off in large, very thin strips. *Leaves* oblong or elliptic, 7-15 x 3.7-6.2 cm, obtuse rounded, often apiculate at apex, glabrous, shining above, pale-glaucous beneath, secondary nerves numerous, slender, nearly parallel, united in an intramarginal ring, base rounded or subacute; petiole 7.5-15 mm long. *Flowers* yellow, 1.8 cm across, in lax, often panicled cymes with opposite, divaricate, fleshy branches, constricted at the nodes; cymes usually 2.5-5 cm long and broad; pedicels 3 mm long. *Calyx-lobes* ovate, acute, 2.5 mm. *Corolla-tube* 2.5-3 mm; lobes linear, linear-lanceolate, 7.5 mm. *Coronal-scales* clavate, fleshy. *Pollinia* very minute, linear. *Follicles* poniard-shaped, 5-10 cm long, 1.2-1.8 cm diam in the middle.

Distribution: Throughout India, ascending to 1200 m. Sri Lanka, Myanmar, China, Indo-China, Pakistan.

CONVOLVULACEAE

IPOMOEA L.

Ipomoea aquatica Forssk., Fl. Aegypt. -Arab. 44. 1775; Clarke in Hook.f., Fl. Brit. India 4:210. 1883; Ooststr. in Steenis, Fl. Males. I.4:473. 1953; Austin in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 1:318. 1980. *I. reptans* Poir. in Lam. Encycl. Suppl. 3:460. 1814; Haines, Bot. Bihar & Orissa 2:597(626). 1922; Mooney, Suppl. Bot. Bihar & Orissa 93. 1950.

Herb; stems mostly thick, fistular or spongy, rooting at the nodes trailing on moist soil or mud, or floating on water. *Leaves* variable in shape and size, ovate-triangular, ovate-oblong, lanceolate, elliptic-oblong or ovate, 3.7-15 x 1.5-9 cm, acute or obtuse, glabrous, base truncate, hastate or cordate; petiole 3-10(21) cm. *Flowers* purple or rarely white, 2.5-5 cm long and 3.7 cm across, axillary, solitary or in 2-3-flowered peduncled cymes; peduncle 1.2-17.5 cm long; pedicels 2-3.5(6.5) cm. *Calyx* 1 cm long; sepals subequal, ovate or ovate-oblong, obtuse, one or two mucronate, gland-dotted within.



Filaments thickened at the base and densely papillose. *Capsule* ovoid, 7.5 mm long, glabrous, 4-2-seeded. *Seeds* glabrous or microscopically hairy.

Distribution: Naturalized throughout India. Native of the Old World tropics, now widely naturalized.

Ipomoea nil (L.) Roth, Catal. Bot. 1:36. 1797; Ooststr. in Steenis, Fl. Males. I. 4:465. 1953; Austin in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 1:332. 1980. *Convolvulus nil* L., Sp. Pl. (ed.2) 1:219. 1762. *Ipomoea hederacea* auct. non (L.) Jacq.: Clarke in Hook.f., Fl. Brit. India 4:199. 1883; Haines, Bot. Bihar & Orissa 2:602(631). 1922; Mooney, Suppl. Bot. Bihar & Orissa 93. 1950.

Hairy twiner; stems retrorsely hirsute. *Leaves* ovate, 3-lobed, 5.5- 12.5 x 5.5-10 cm, pubescent or thinly hairy, base cordate; lobes broadly ovate or oblong, very acuminate; petiole 3-10 cm, retrorsely hirsute. *Flowers* bluish-purple or pinkish-purple, 3.7-5.5 cm long, subumbellate on 1-5-flowered, axillary peduncles; peduncles 2.5-7.5(10) cm long, hirsute with reflexed hairs; bracts linear. *Sepals* very long, linear-lanceolate, 1.6-2.5 cm long, pubescent and hirsute, especially at the base, not enlarged in fruit. *Corolla* funnel-shaped. *Anthers* not twisted. *Capsule* subglobose, 7.5 mm long, glabrous.

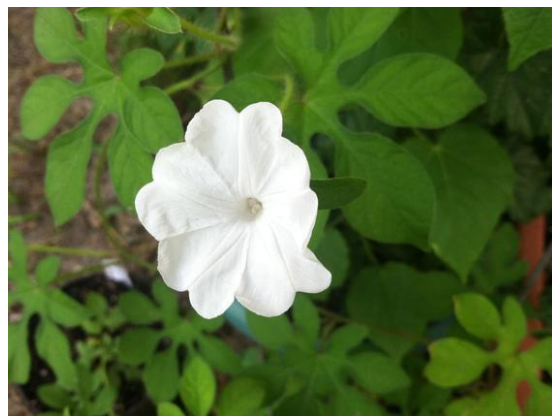


Distribution: Throughout India, both cultivated and naturalized. N. American in origin; widely introduced in the tropics.

Ipomoea pes-tigridis L., Sp. Pl. 162. 1753; Wight, Icon. t. 836. 1844-45; Clarke in Hook.f., Fl. Brit. India 4:204. 1883; Haines, Bot. Bihar & Orissa 2:595(624). 1922; Ooststr. in Steenis, Fl. Males. I. 4:467. 1953; Austin in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 1:336. 1980.

Herbaceous twiner, fulvous hairy or hirsute with patent hairs all over. *Leaves* orbicular, 3-12.5 cm across, hairy with appressed or patent hairs, deeply 5-9-lobed; lobes lanceolate or elliptic, acute or acuminate, contracted at base; petiole 2.5-5 cm. *Flowers* 2.5-3.2 cm long, in long peduncled heads, involucrate with large persistent bracts; peduncles 5-10 (11.2) cm long, hairy; heads dense, few-flowered; outer bracts ovate to elliptic, 1.8-2.5 cm long, inner smaller, narrower, acute. *Corolla* pink, funnel-shaped with spreading limb. *Sepals* lanceolate, 7.5-12.5 mm long, hairy. *Capsule* ovoid, 6.2 mm long, papery, glabrous. *Seeds* 4, minutely velvety or nearly glabrous, 4 mm long.

Distribution: More or less throughout India. Tropical East Africa, tropical Asia.



PORANA Burm.f.

Porana paniculata Roxb., Pl. Corom. t. 235. 1815; Clarke in Hook. f., Fl. Brit. India 4:222, 1883; Haines, Bot. Bihar & Orissa 590. 1921.

Vern. *Burilatti*, *Fulhar*

Large woody climber with grayish-tomentose shoots. *Leaves* ovate-cordate, 2.5 – 12.5 x 1.2-7.5 cm, rarely the lower ones up to 15 cm broad, acute or acuminate, softly white-tomentose, palmately 5-6-nerved from base. Petiole 1.2-2.5 cm. *Flowers* small, white, in numerous, large, lateral or terminal panicles. *Sepals* linear, 1.2 mm long in flower, densely tomentellous; fruiting sepals all equally enlarged or sometimes three 1.8 x 0.6 cm and the other two linear, 6.2 mm long. *Corolla* tubular-funnel-shaped, 6.2-7.5 mm long. *Capsule* globose, 5 mm diam., hairy tomentose.



Distribution: Throughout India, up to 950 m. Myanmar; cultivated as an ornamental in the tropics.

EUPHORBIACEAE

BRIDELIA Willd.

Bridelia stipularis Bl., Bijdr. 2:597. 1825; Hook.f., Fl. Brit. India 5:270. 1887, pro parte; Haines, Bot. Bihar & Orissa 1:121 (125). 1921.

Large woody climber or sometimes large erect shrub; branches pendent, rusty-pubescent. *Leaves* elliptic, elliptic-oblong, elliptic-ovate or obovate, 4.5-15 x 2.3-9 cm, those on the flowering branches much smaller, acute, shortly acuminate or sometimes obtuse, glabrous above, fulvous-tomentose beneath, especially on the nerves,



secondary nerves 7-12, strong, joining the marginal nerve, base obtuse, rounded or subcordate. *Flowers* monoecious, 3.7 mm long, green, densely hairy outside, numerous axillary or spicate and in panicle spikes; rachis zig-zag. *Calyx* enlarged in fruit. *Petals* obovate or orbicular, alike in both sexes or toothed in male. *Disc* prominent, in female flower densely hirsute at base within. *Drupe* black, oblong, 1-1.2 x 0.8 cm, pyrenes smooth.

Distribution: Throughout the hotter parts of India. Sri Lanka, Malesia, tropical Africa.

MONOCOTYLEDONS

DIOSCOREACEAE

DIOSCOREA L.

Dioscorea bulbifera L., Sp. Pl. 1033. 1733; Wight, Icon. t. 878. 1844; Haines, Bot. Bihar & Orissa 3:1122 (1172). 1924; Prain & Burkill in Ann. Roy. Bot. Gard. (Calcutta) 14(1): 1936; Burkill in Steenis, Fl. Males. 1.4:311. 1951. *D. sativa* Thunb., Fl. Jap. 15. 1784, non L. 1753; Hook. f., Fl. Brit. India 6:295. 1892.

Stem twining to the left, smooth, sometimes subulate; tuber not deep, usually single, subglobose, without defined stalk. Bulbils common, axillary, roundish, up to 3 cm across, warted. Leaves alternate, rarely opposite, suborbicular or broadly ovate, 5-25 x 3-20 cm, acuminate or caudate, 7-11-ribbed, with very distinct scalariform cross-nervules, usually deeply cordate, sinus usually very wide; petiole as long as or usually much shorter than the blade. Male flowers green or purplish, 1.5-2.5 mm long or more pendulous, in numerous long, very slender axillary and paniced spikes, 5.5-10 cm long; bracts half to three-fourths as long as the flower with filiform acumen. Perianth-lobes linear, inner narrower than the outer. Stamens very small, 6 perfect, not one-fourth as long as the inner Perianth. Female spikes slender, drooping, several fascicled at each axil. Perianth as in male. Capsule quadrately oblong, 1.5-2 x 1-1.2 cm, reflexed. Seeds with an oblong wing above.



Distribution: Throughout India. Tropics of the old world. Tubers are very acrid, eaten only in times of famine after boiling and much preparation.

ARECACEAE

CALAMUS L.

Calamus tenuis Roxb., Fl. Ind. ed. 1832, 3:780. 1832; Becc. & Hook. f., Fl. Brit. India 6:447. 1892; Becc. in Ann. Roy. Bot. Gard. (Calcutta). 11.262. 1908, & Appendix Pl. 94. 1913; Haines, Bot. Bihar & Orissa 886. 1924; Basu, Rattans in India Monogr. Rev. 84. 1992. *Palmijuncus tenuis* (Roxb.) Kuntze, Revis. Gen. Pl. 2:734. 1891. *Calamus amarus* Lour., Fl. Cochinch.: 210. 1790., provisional synonym. *Calamus heliotropium* Buch.-Ham. ex Kunth, Enum. Pl. 3:210. 1841. *Calamus royleanus* Griff., Calcutta J. Nat. Hist. 5:40. 1845. *Calamus horrens* Blume, Rumphia 3:43. 1847. *Calamus stoloniferus* Teijsm. & Binn., Cat. Hort. Bot. Bogor.: 75. 1866, nom. inval. *Palmijuncus amarus* (Lour.) Kuntze, Revis. Gen. Pl. 2:733. 1891. *Palmijuncus heliotropium* (Buch.-Ham. ex Kunth) Kuntze, Revis. Gen. Pl. 2:733. 1891. *Palmijuncus horrens* (Blume) Kuntze, Revis. Gen. Pl. 2:733. 1891. *Palmijuncus royleanus* (Griff.) Kuntze, Revis. Gen. Pl. 2:732. 1891. *Rotang royleanus* (Griff.) Baill., Hist. Pl. 13:299. 1895.



Cluster forming medium diameter rattan. *Stem* with sheaths 2.5 cm in diameter, without sheaths 1.5 cm in diameter. *Leaves* ecirrate; sheath flagelliferous, green, with oblique white patches sparingly armed with spines; spines black, basal portion unpraised, concave beneath, solitary or grouped, if in groups one just below the other, knee prominent; ocrea present; petiole well developed, armed at the sides and below with solitary spines black, 2 cm long; rachis armed at the sides and below with a row of spines, spines 1 cm long, those at the lower side recurved; leaflets regular, 25-1.5 cm, linear, margins and veins bristly, terminal leaflets free. Male inflorescence slender, rachilla 2-3 cm long; male flower 4 m long; female inflorescence slender, long flagellate, primary sheath tightly sheathing, first primary sheath armed at the margins and on one side; partial inflorescence to 21 cm long; secondary sheath tightly sheathing; rachilla to 5 cm long, decrease in length distally; involucrophorum pedicelliform; involucre disc shaped. *Fruit* broadly ovoid, 1.4 x 1 cm; scales in 15 vertical rows, grey white on ripening, with a dark brown border towards the apex; channeled at the middle; endosperm not ruminant.

Distribution: India; Myanmar, Bangladesh, South Vietnam. Common at moist damp areas and paddy fields at Tripura and North Bengal.

ARACEAE

SCINDAPSUS Schott

Scindapsus officinalis (Roxb.) Schott in Schott & Endl., Meletem. Bot. 21. 1832; Hook. f., Fl. Brit. India 6: 541. 1893; Haines, Bot. Bihar & Orissa 3:859(900). 1924. *Pothos officinalis* Roxb., Fl. Indica 1: 452. 1820.

Perennial, climbers or scramblers; branches wrinkled when dry, rooting from nodes. *Leaves* broadly ovate-elliptic or orbicular, 10-25x6-15cm, base cordate or rounded, apex acuminate, entire, glabrous; petioles 5-15 cm long, broadly winged. *Peduncle* solitary, terminal, shorter than petiole; *spathe* 10-15cm long, green without yellow within, with slender beak; *spadix* almost equal to the spathe, elongating in fruit, greenish-yellow. *Berries* fleshy, only few ripening.



Distribution: Submontane Himalaya, Uttarakhand eastward to Sikkim, Myanmar and Andaman Islands.

HERBS

HERBS

DICOTYLEDONS

MALVACEAE

SIDA L.

Sida acuta Burm.f., Fl. Ind. 147. 1768, emend.K.Schum.in C. Martius, Fl. Bras. 12.3:326. 1891; Haines, Bot. Bihar & Orissa 1:61(63).1921; Borassum in Blumea 14:187.1966; Paul & Nayar, Fasc.Fl. India 19:202.t.49.1988. *S. carpinifolia* sensu Master in Hook.f., Fl. Brit. India 1:323. 1874, non L. f. 1781.

Erect herb or undershrub, 0.3-1 m; stem rigid, sparsely covered with minute stellate and often few simple hairs or glabrous. *Leaves* lanceolate, obovate-lanceolate, oblong or ovate-oblong, 1-9x0.5-2.5 cm, base acute rarely obtuse or rounded, margin serrate or coarsely serrate, apex acute, 3-nerved at base. *Flowers* solitary, axillary or in clusters or 2-3. *Calyx* campanulate, 5-lobed;lobes. *Corolla* yellow, petals obliquely obovate, as long as the calyx or slightly longer. *Staminal column* 4 mm long, with simple and glandular hairs, antheriferous towards the apex. *Ovary* ovoid; styles 6-10. *Mericarps* 6-10, tetrahedral, ca. 4 mm long, at apex usually with 2-awns, glabrous, reticulately striate. *Seeds* triangularly ovoid, ca. 2 mm long, glabrous except for the short hairy hilum, dark brown.

Distribution: Throughout India, Pantropical.



Sida cordata (Burm.f.) Borassum in Blumea 14:182. 1966; Paul & Nayar, Fasc. Fl. India 19:206.t.50.1988. *Melochia cordata* Burm.f.,Fl. Ind. 143.1768. *Sida veronicaefolia* Lam., Encycl.1:5.1783; Haines, Bot.Bihar & Orissa 1:59(61).1921. *S.humilis* Cav., Diss. 5:277.t. 134. f. 2. 1788; Master in Hook.f., Fl. Brit. India 1:322.1874. *S.humilis* Cav. var. *veronicaefolia* (Lam.) Master in Hook. f., Fl. Brit. India 1:322.1874.

Procumbent herb, 30-90 cm; stems, petioles and pedicel hairy with scattered, long patent simple hairs and minute stellate hairs but without gland-hairs. *Leaves* ovate or suborbicular, 0.5-9 x0.3-5.5 cm, cordate, crenate-dentate or serrate, acute to acuminate, 5-7-nerved at base. *Flowers* axillary, initially solitary, afterwards in short, few-flowered racemes by development of an accessory bud or sometimes in loose panicles by abortion of the upper leaves. *Calyx* widely campanulate 5-fid; segments triangular, one prominent nerve in the middle. *Corolla* yellow; petals obovate, ciliate at base. *Staminal column* ca. 3 mm long, glabrous or with patent simple hairs, basal part wide, conical, tubular part short. *Schizocarp* globose, ca. 4 mm across, enclosed within the persistent calyx; mericarps 5, tetrahedral with rounded angles, 4 mm long, glabrous or at apex short-hairy, awnless. *Seeds* ovoid, ca 2 mm long, glabrous.



Distribution: Throughout India, Pantropical.

STERCULIACEAE

BYTTNERIA Loef.

Byttneria herbacea Roxb., Pl. Corom.t. 29. 1795; Wight, Icon.t. 488. 1841; Master in Hook.f., Fl. Brit. India 1:376. 1874; Haines, Bot. Bihar & Orissa 1:83(86). 1924.

Vern. *Tinpatia*

Perennial branched herb, 40-90 cm with ascending branches. *Leaves* ovate-lanceolate, 1.5-4(8) x 1-2(3) cm, denate, acuminate, glabrous or glabrescent, basally 3-nerved, with a linear gland at the base on lower side of midrib; petiole ca. 1 cm. *Flowers* deep purple, 8 mm across. *Sepals* oblong, lanceolate 4 mm long, basally connate. *Petalobuteals* upto 8 mm long, with long, slender tips and 2-fid appendages. *Capsule* globose, ca. 6 mm diam., echinate. *Seeds* ovoid, angular, 5 mm, muricate.



Distribution: Bihar, Peninsular India.

TILIACEAE

TRIUMFETTA L.

Triumfetta rhomboidea Jacq., Enum.Syst.Pl. 22.1760; Master in Hook.f., Fl. Brit.India 1:395. 1874; Haines, Bot.Bihar & Orissa 1:85(89). 1921. *T.bartramia* L., Syst. Nat.ed.10.2:1044.1759.nom, illegit. *T.angulata* Lam., Encycl. 3:421.1789; Wight, Icon.t. 320. 1840.

Vern. *Chirchiria*

Herb or undershrub, 30-90 cm; branches pubescent. *Leaves* broadly ovate to suborbicular or rhomboid, 3-8 x 1.5-5 cm, lower 3-5-lobed, upper ones often narrow lanceolate or elliptic and smaller, coarsely serrate or dentate, stellate-pubescent above, hairy or tomentose beneath, 5-7-nerved; petiole upto 10 cm long. *Flowers* yellow, fascicled, axillary or leaf-opposed, often running into interrupted racemes or spike by reduction of leaves. *Sepals* linear, 3.7-5 mm. *Petals* oblong or spatulate, slightly shorter than sepals. *Capsule* ellipsoid or subglobose, 5-6 mm across including bristles, pubescent; bristles glabrous.

Distribution: Throughout tropical and subtropical India. Pantropic.



OLACACEAE

OLAX L.

Olax nana Wall. ex Benth. in Proc. Linn. Soc. 1: 88. 1840. Master in Hook.f., Fl. Brit. India 1: 576. 1875; Haines, Bot. Bihar & Orissa 183.1921.

Low undershrubs; rootstock woody. *Leaves* oblong-lanceolate, up to 6 x 1.5 cm, entire, glabrous, deep green above, glaucous beneath, recurved at the margin, subsessile. *Flowers* axillary, solitary, creamy or whitish; pedicels slender, up to 1.2 cm long. *Calyx* minute, cupular, accrescent in fruit. *Petals* 3, oblong-obovate, rounded at tip, cohering about half way. *Stamens* 3. *Staminodes* 6. *Ovary* ovoid; style shorter than the stamens. *Drupes* globose, ca 6 mm across, apiculate, nearly covered by the accrescent calyx, deep yellow when mature.

Distribution: India: In drier places, ascending to 1600 m in to Himalaya and Shiwaliks. Punjab, Uttar Pradesh, Bihar, West Bengal, Assam, Arunchal Pradesh, Meghalaya, Gujarat and Andhra Pradesh. Pakistan, Nepal and Thailand.



FABACEAE (PAPILIONACEAE)

DESMODIUM Desv.

Desmodium gangeticum (L.) DC., Prod. 2: 327. 1825; Baker in Hook. f., Fl. Brit. India 2:168.1876, incl. var. *maculatum*; Haines, Bot. Bihar & Orissa 2:256(268). 1922; Meeuw. in Reinwardtia 6:249. 1962; Ohashi in Ginkgoana 1:184.1973. *Hedysarum gangeticum* L., Sp. Pl. 746. 1753. *Desmodium collinum* Wight, Icon.t. 272.1840.

Diffuse or suberect herb or undershrub, 15-120 cm; stems somewhat angled, appressed hairy. *Leaves* 1-foliolate, lanceolate, oblong or ovate-oblong, (1.5) 7.5-15 x (1) 3-6.5 cm, acute or slightly acuminate, grey silky or nearly glabrous and glaucous or paler beneath, base rounded. *Flowers* purple or white, 3-5 mm, 2-several-nate in ascending, lax, elongate, slender axillary and terminal, usually paniced racemes, 15-30 cm long; pedicels, 2.5-3.5 mm; bracts subulate, minute or as long as the pedicel. *Calyx* 2 mm; teeth as long as tube, lanceolate or deltoid, hairy. *Pod* subfalcate, 1.2-2.3 cm, 6-8-jointed, deeply indented on the lower suture, upper suture slightly indented, usually with minute hooked hairs on the faces.



Distribution: Throughout India, ascending to 1500 m. SE. Asia, tropical Africa, Australia.

CAESALPINIACEAE

CASSIA L.

Cassia tora L., Sp. Pl. 376. 1753; Baker in Hook. f., Fl. Brit India 2:203. 1878, pro parte; Haines, Bot. Bihar & Orissa 2:304(318). 1922.

Vern. *Chakora*

Herb or undershrub, 0.3-1 m. *Petiole* eglandular; stipule linear; leaflets 3 pairs, subsessile or shortly petioluled, obovate, 2.5-6 cm long, obtuse, rounded or retuse, increasing in size upwards, glabrous or thinly hairy; rachis with linear glands between two lower pairs of leaflets. *Flowers* yellow, 1.2 cm across, usually 2 on a very short axillary peduncle but one often abortive. *Calyx* lobes 5, ovate. *Fertile stamens* 7; all anthers rounded at apex, nerve beaked. *Pods* short-stipitate, subterete, 15-30 cm long, incompletely septate. *Seeds* many, brown, oblong, 3 mm long; areole broad, 1.5-2 mm wide.



Distribution: Throughout India, Africa, Arabia, Pakistan, Eastwards to Polynesia, Native of America.

LOGANIACEAE

MITREOLA L.

Mitreola petiolata (Gmel.) Torr. & A. Gray, Fl. N. Amer. 2:45. 1841; Mooney, Suppl. Bot. Bihar & Orissa 88. 1950. *Cynoctonum petiolatum* Gmel., Syst. 2:443. 1791. *Ophiorhiza mitreola* L., Sp. Pl. 150. 1753. *Mitreola oldenlandioides* G.Don, Gard. Dict. 4:172. 1837, nom. illeg.; Clarke in Hook.f., Fl. Brit. India 4:79. 1883; Haines, Bot. Bihar & Orissa 2:565(593). 1922. *Cynoctonum mitreola* (L.) Britt. in Mem. Torrey Bot. Club. 5:258. 1894; Leenh. in Steenis, Fl. Males. I. 6:375. 1962.

Slender, erect herb, 10-25(45) cm. *Leaves* ovate or ovate-oblong, 2-7.5 x 1.2-3 cm, acute (or acuminate), pubescent or puberulous, base rounded, subtruncate or tapering; petiole 0.7-1.2 cm long. *Flowers* minute, white, sessile or subsessile in 2-3-chotomous, terminal or axillary peduncled cymes, unilateral on the cyme branches. *Capsule* laterally compressed, obcordate, 2-horned, 3-3.7 mm long and broad, horns short incurved.

Distribution: Uttarakhand; Sikkim; Meghalaya and Nagaland; Bihar; Central Provinces, W. Peninsula. SE. United States, Central and tropical South America, SE. Asia, Malaysia.



APIACEAE

CENTELLA L.

Centella asiatica (L.) Urban in Mart. Fl. Bras. 11:287.t. 78.f.1.1879; Buw. in Steenis, Fl. Males. I. 4:117. 1949; Krahulik & Theob. in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 3:384. 1981. *Hydrocotyle asiatica* L., Sp. Pl. 234. 1753; Wight, Icon.t. 565. 1842; Clarke in Hook.f., Fl. Brit. India 2:669. 1879; Haines, Bot. Bihar & Orissa 2:405(423). 1922; Mooney, Suppl. Bot. Bihar & Orissa 68. 1950.

Vern. *Bhrami*

Herbs with long creeping stems rooting at the nodes. Young leaves and petioles pubescent villous. Leaves several from the rootstick, orbicular-reniform, 1.2-3.7 cm across, shallowly crenate, coarsely dentate or subentire, glabrous, with several slender nerves from cordate base; petiole 1.2-12 cm long. Umbels usually several at a node each with a pair of ovate subamplexicaul bracts, 2.5-3.7 mm long; peduncle short, pubescent or glabrous. Flowers 3-5, rarely 6 in an umbel, subsessile. Sepals 0. Petals red, ovate, acute or obtuse, imbricate. Stamens red. Fruit orbicular to ellipsoid 2-3 mm across, broader than long, mericarps with 5 primary ridges strong, sometimes with 2 or 4 secondary ridges or the intermediate space venose; thinly pilose; epicarp very thick, corky; endocarp thin. Seed much compressed laterally.



Distribution: Throughout India, ascending to 2000 m. Pantropic

GENTIANACEAE

CENTAURIUM Hill.

Centaurium centaurioides (Roxb.) Rao & Hemadri in J. Bombay Nat. Hist. Soc. 67:357. 1970. *Chironia centaurioides* Roxb., Fl. Ind. 1:584. 1820. *Erythraea roxburghii* D.Don, Lond. & Edinb. Phil. Mag. & J. Sci. 8:77. 1836; Wight, Icon. t. 1325. 1848; Clarke in Hook. f., Fl. Brit. India 4:102. 1883, incl. var. *saxatilis* Clarke; Haines, Bot. Bihar & Orissa 2:568(596). 1922. *Centaurium roxburghii* (D.Don) Druce, Rep. Bot. Exch. Club Brit. Isles 4:614. 1916; Mooney, Suppl. Bot. Bihar & Orissa 89. 1950.

Small herb, 4-20 cm. Radical leaves obovate or elliptic 2.5 cm long, usually obtuse; cauline leaves smaller and narrower. Flowers pink, long-pedicelled, 1-1.2 cm long, in repeatedly branched dichasial cymes; bracts small; pedicels in the forks of the cymes 0.6-1.2 cm. Calyx 5 mm long. Corolla-tube slender, 6.5-7.5 mm long; lobes spreading, very small.

Distribution: Throughout India, upto 600 m.

MENYANTHACEAE

NYMPHOIDES Seguiet

Nymphoides hydrophylla (Lour.) Kuntze, Rev. Gen. Pl. 429. 1891; Cramer in Dassan. & Fosberg, Rev.



Handb. Fl. Ceylon 3:208. 1981. *Menyanthes hydrophylla* Lour., Fl. Cochinch. 1 :129. 1790. *Nymphoides cristata* (Roxb.) Kuntze, Rev. Gen. Pl. 2:429. 1891. *Menyanthes cristata* Roxb., Pl. Corom. t. 105. 1799. *Limnanthemum cristatum* (Roxb.) Griseb., Gen.Sp. Gent. 342.1839; Wight, Ill. t. 157. bis. f. 4. 1850; Clarke in Hook. f., Fl. Brit. India 4:131. 1883; Haines, Bot. Bihar & Orissa 2:571(599). 1922.

Perennial, aquatic herb; petioloid stems long, filiform. *Leaves* floating, elliptic to orbicular, 4-11 cm diam., faintly crenate, pale green above, purplish glandless and prominently nerved beneath, base deeply cordate; petioles 1-3.5 cm long. *Flowers* on slender pedicels rising one by one above the water to open; pedicels 2.5-6 cm long, recurved after flowering. *Calyx-lobes* linear-oblong, 3-5 mm, subacute. *Corolla* white, yellow in the centre, 1.2-1.8 cm across, lobes not hairy but with a median longitudinal undulate crest along centre on upper surface, the margins undulate; throat with a ring of hairs. *Style* homostylous. *Seeds* 5-10, glabrous, tuberculate.

Distribution: Throughout India. Malaysia, S. China, Sri Lanka.

BORAGINACEAE

ARNEBIA Forsk.

Arnebia hispidissima (Sieb ex Lehm.) DC., Prodr. 10:94.1846; Clarke in Hook.f., Fl. Brit. India 4:176. 1883; Thothari *et al.* in Bull. Bot. Surv. India 8(2):137.1966. *Lithospermum hispidissimum* Sieb. ex Lehm., Icon. 1:23.t. 39. 1822. *Arnebia asperima* (Del.) Hutch. & Dalz., Fl. W.Trop. Arf. 2:201.1931.

A much branched, annual, clothed all over by bristly, white hairs. *Roots* drying purple or violet. *Leaves* 1.5-5 cm long, 2.5-6 mm broad, linear, lanceolate, sub-obtuse, clothed with stiff, white hairs with bulbous bases. *Flowers* yellow, in dense, many-flowered spikes, which are finally elongated. *Nutlets* 4, more than 1 mm long, acute, tubercled.

Distribution: Persia, Sudan, Arabia, W.Asia, Egypt, Nubia, Pakistan (Sind), India.



BOTHRIOSPERMUM Bunge

Bothriospermum tenellum (Hornem.) Fischer & E.Meyer, Index Sem. Hort Petrop 1:23.1835; Clarke in Hook.f., Fl. Brit. India 4:167.1883; Haines, Bot. Bihar & Orissa 582. 1922. *Anchusa tenella* Hornem., Hort.Hafn.1:176.1815.

Annual, prostrate or diffused, appressedly hispid, 10-30 cm long herbs. *Leaves* alternate, ovate-oblong to elliptic, 2-3 cm long, with bulbous hairs, entire, subacute or mucronate. *Flowers* white, in distant bracteate racemes. *Calyx* 5-partite; lobes narrow. *Corolla* tube short, throat with 5-scales; lobes reflexed. *Stamens* 5, included. *Ovary* deeply 4-lobed; style short; stigma capitate. *Nutlets* 4, ellipsoid, tuberculate.

Distribution: Submontane Himalaya, Garhwal to Bhutan, C. & W. India; China, Japan, Indo-China, Philippines.



CYNOGLOSSUM L.

Cynoglossum zeylanicum (Vahl ex Hornem) Thunb. ex Lehm. Neue Schriften Naturf. Ges. Halle 3:20.1817; Kazmi in J. Arnold Arbor. 52:344. 1971. *Anchusa zeylanica* Vahl ex Hornem., Enum. Pl. Hort. Hafn. 3. 1807. *Cynoglossum denticulatum* A.DC. var. *zeylanicum* (Hornem.) Clarke in Hook.f., Fl. Brit. India 4:157.1883. *C. furcatum* Wall. in Roxb., Fl. Ind. 2:6. 1824; Wight, Icon. t. 1395. 1850; Clarke in Hook.f., Fl. Brit. India 4:155. 1883; Mooney, Suppl. Bot. Bihar & Orissa 256. 1950. *C.denticulatum* sensu Haines, Bot. Bihar & Orissa 2:581 (610). 1922; Mooney, Suppl. Bot. Bihar & Orissa 9. 1950.

Erect herb; stem much forked with the alternate fork ending in a raceme, appressed hairy with white-bulbous based hairs. *Radical* leaves elliptic, 7.5-16 x 4.3-8 cm, acute, base cuneate; petiole 7.5-15 cm long, evanescent at the time of flowering; cauline leaves oblong-lanceolate or elliptic-lanceolate, 4-12 x 2-4 cm, often minutely denticulate, appressed hairy above with white bulbous-based hairs, paler and shortly hairy beneath without tubercles. *Racemes* strigose, branches usually equal, attaining 15-20 cm in fruit.



Flowers pedicelled or upper subsessile; pedicels 2.5-5 mm in fruit. *Calyx* 2.5 mm long, campanulate in flower, 3.7 mm in fruit; lobes ovate-oblong, spreading in fruit. *Corolla* blue or white with deep blue centre, 5-6.2 mm across, lobes suborbicular. *Nutlets* 2.5-3.7 mm across, margined or not, glochidiate on outer face.

Distribution: Throughout India; Himalaya. Afghanistan, Sri Lanka, east to China, Japan, Malesia.

HELIOTROPIUM L.

Heliotropium strigosum Willd. subsp. **brevifolium** Kazmi in J. Arnold Arbor. 51:153. 1970. *H. brevifolium* Wall. in Roxb., Fl. Ind. 2:2. 1824. *H. strigosum* Willd. var. *brevifolium* (Wall.) Clarke in Hook.f., Fl. Brit. India 4:151. 1883. *H. strigosum* sensu Haines, Bot. Bihar & Orissa 2:579 (608).1922; Mooney, Suppl. Bot. Bihar & Orissa 90. 1950.

Small erect or spreading strigose herb. *Leaves* linear or linear-lanceolate, 0.5-1.8 cm, margin-recurved. *Flowers* white, 2.5-4.3 mm long, sessile or lower pedicelled, 2-ranked in mostly simple spikes, 2.5-5 cm long; bracts narrow, small. *Calyx* 1.5-2 mm long, strigose, one lobe broadly lanceolate, others narrow-lanceolate. *Corolla* strigose, tube about as long as calyx; lobes ovate, short, plicate in the sinuses. *Anthers* minute, ovate; connective produced into a long acumen. *Style* minute, swelling large with bluntly conical stigma about as long as the style. *Nutlets* dark grey-brown, ovoid, 1.5 mm long, acute, hispid above.

Distribution: Throughout India; subtropical Himalaya. Afghanistan, Myanmar, Thailand, S. China.



CONVOLVULACEAE

EVOLVULUS L.

Evolvulus nummularius (L.) L., Sp. Pl. (ed.2) 391. 1762. *Convolvulus nummularius* L., Sp. Pl. 157. 1753. *Volvulopsis nummularius* (L.) Roberty in Candollea 14:28. 1952.

Prostrate or procumbent herb with trailing, puberulous branches, 15-30 cm long, often rooting. *Leaves* orbicular or broadly ovate, 0.5-1.5 cm diam., rounded at apex, glabrous, gland-punctate beneath, base cordate. *Flowers* white, solitary, axillary. *Calyx* of 5, linear-oblong, imbricating lobes, 2.5-3.7 mm long, ciliate on the margins towards apex. *Corolla* funnel-shaped, very thinly pubescent outside; tube very narrow, about as long as the sepals. *Ovary* 1-celled. *Capsule* subglobose, 3 mm diam, 1-celled, 2-seeded.

Distribution: Widely naturalized in India. New World tropics, tropical Africa, Madagascar.



SOLANACEAE

SOLANUM L.

Solanum nigrum L., Sp.Pl. 186. 1753; Clarke in Hook.f., Fl. Brit. India 4:229. 1883; Haines, Bot. Bihar & Orissa 2:610(640).1922; Mooney, Suppl. Bot. Bihar & Orissa 94.1950; Deb in J. Econ. Taxon Bot. 1:49. 1980. *S. rubrum* Mill., Gard. Dict. (ed.8) no.4. 1768, non L. 1767; Wight, Icon.t. 344. 1840.

Erect branched herb; branches often with raised lines. *Leaves* ovate, lanceolate-ovate or oblong, 1.2-10 x 0.5-5 cm, entire, sinuate, sometimes toothed or lobed, acute, glabrous or puberulous, base decurrent on petiole; petiole 1.2-2.5 cm. *Flowers* small, white, 5-7.5 mm across, few subumbelled on extra axillary peduncles; pedicels deflexed in fruit, ca. 1.2 cm long. *Calyx* 6.2 mm across, pubescent or glabrous; lobes broad, rounded, 1.5 mm long. *Anthers* short, not attenuate. *Berry* black or sometimes yellow or red, globose, 6-8 mm diam.



Distribution: Throughout India. Cosmopolitan.

Solanum virginianum L., Sp.Pl. 187. 1753; Hepper & Jaeger in Kew Bull. 41:434. 1986; Hepper in Dassan. & Fosberg, Rev. Handb.Fl. Ceylon 6:375. 1987. *S. surattense* Burm.f., Fl. Ind. 57. 1768. *S. xanthocarpum* Schard. & Wendl., Sert. Hannov. 1:8.t.2. 1795; Clarke in Hook.f., Fl. Brit. India 4:236. 1883; Haines, Bot. Bihar & Orissa 2:613(643). 1922. *S. jacquini* Willd., Sp. Pl. 1:1041. 1798; Wight, Icon.t. 1401. 1848.

Diffuse herb or undershrub, very copiously armed all over with straight, yellow, very sharp prickles, upto 1.8 cm long; young parts sometimes stellate-tomentose. *Leaves* ovate, oblong or elliptic, 2.5-8 x 1-4 cm, glabrescent or sparsely stellate-pubescent, lacerate with the lobes or segments mostly again lobed or dentate. *Flowers* deep blue, 2.5-3(4.2) cm across, in extra-axillary, few-flowered cymes. *Calyx* 3.7-5 mm long in flower, usually prickly, glabrescent or sparsely stellate-pubescent, with small, linear lobes and usually very broad sinuses in between, scarcely accrescent in fruit. *Corolla-lobes* broadly ovate-triangular. *Berry* yellow or white, blotched with green, globose, 1.2-2.5 cm diam.



Distribution: Throughout India. Myanmar, Sri Lanka.

SCROPHULARIACEAE

LIMNOPHILA R.Br.

Limnophila indica (L.) Druce, Bot. Exch. Club Soc. Brit. Isles. 3: 420. 1914; Philcox in Kew Bull. 24:115. 1970; Cramer in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 3:432. 1981. *Hottonia indica* L., Syst. Nat. (ed.10) 919. 1759. *Limnophila gratioloides* R.Br., Prod. 442. 1810; Hook.f., Fl. Brit India 4:271. 1884; Haines, Bot. Bihar & Orissa 2:628 (658). 1922.

Small marsh herb, puberulous and glandular-pubescent all over or glabrous. *Leaves* pinnatifid, whorled, upper ones 3-fid, uppermost rarely undivided, lower capillary multifid, submerged ones much longer, multifid. *Flowers* white or pale purple, 8-12 mm long, pedicelled, axillary; pedicels 4-8 mm long, elongating to 1.8-2.5 cm in fruit; bracteoles linear, 2-3 mm long. *Calyx* glabrous or somewhat pubescent, lobes linear, 3-5 mm in fruit, acuminate, midrib prominent. *Capsule* subovoid, 4-5(12) mm long.

Distribution : Throughout India. From SE. Africa through Iraq, Sri Lanka and SE. Asia eastwards to Malesia and China, and southwards to Australia.



LINDERNIA All.

Lindernia ciliata (Colsm.) Pennell in Brittonia 2:182. 1936; Mukerjee in J. Indian Bot. Soc. 24:133. 1945; Mooney, Suppl. Bot. Bihar & Orissa 99. 1950; Philcox in Kew Bull. 22:51. 1968; Cramer in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 3:412. 1981. *Gratiola ciliata* Colsm., Prod. Descr. Gratiol. 14. 1793. *Ilysanthes serrata* (Roxb.) Urb., Ber. Deutsch. Bot. Ges. 2:436. 1884. *Bonnaya brachiata* Link & Otto, Icon. Pl. Select. 25. t. 11. 1820; Hook.f., Fl. Brit. India 4:284. 1884.

Erect, glabrous or puberulous herb, 7-12(25); stem, branches and peduncles 4-angled. *Leaves* sessile or subsessile, oblong or broadly oblong, 12-3.7 x 0.4-1.2 cm, sharply and closely aristate serrate, obtuse or subacute, glabrous or sometimes minutely hirtellous beneath. *Flowers* purple, pink or white, 6.2-8 mm long, in lax, terminal racemes; pedicels rigid, 3-6.2 mm long; bracts linear subulate, 3-4.3 mm long. *Calyx* 5 mm long, lobed almost to the base; lobes linear-subulate, finely aristate. Perfect stamens 2. *Capsule* linear-oblong, 1-1.2 cm long. *Seeds* usually truncate both ends.

Distribution: Throughout India, up to 1600 m in the Himalaya. SE. Asia, N. Australia.



SCOPARIA L.

Scoparia dulcis L., Sp. Pl. 1: 116. 1753; Hook. f., Fl. Brit. India 4:289.1884; Haines, Bot. Bihar & Orissa 637.1922.

Herbs or suffrutescent subshrub, erect, to 1 m tall. *Branches* ribbed to narrowly winged, puberulent at nodes. *Leaves* petiolate; leaf blade rhomboid-ovate to rhomboid-lanceolate, to 3.6 X 1.5 cm, glandular punctate, base cuneate, margin toothed above middle, sometimes slightly double serrate, or subentire, apex obtuse. *Flowers* usually axillary, (1 or)2 per node. *Calyx* lobed to base; lobes 4, ovate-oblong, margin ciliate, apex obtuse. *Corolla* white, tube densely hairy at throat; lobes margin erose-denticulate, apex obtuse. *Stamens* exserted. *Style* erect; stigma truncate to 2-parted. *Capsule* 2-3 cm in diam., columella persistent.



Distribution: Native of tropical America, naturalized.

VERBASCUM L.

Verbascum chinense (L.) Sant., Fl. Purandhar 90. 1958; Cramer in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 3:390. 1981. *Scrophularia chinensis* L., Mant. Pl. 250. 1771. *Celsia corormandeliana* Vahl, Symb. Bot. 3:79.1794; Wight, Icon. t. 1406. 1849; Hook.f., Fl. Brit. India 4:251. 1883; Haines, Bot. Bihar & Orissa 2:619(649). 1922; Mooney, Suppl. Bot. Bihar & Orissa 94. 1953.

Erect, hairy-pubescent herb, 68-90 cm, branched at summit. Radical leaves lyrate-pinnatifid, cauline sessile, ovate or oblong-ovate, toothed, passing into bracts upwards; lower leaves 5-10 cm long with a large terminal, usually oblong, obtuse, toothed lobe. *Flowers* yellow, 12 cm across, in simple or paniced racemes, 15-25 cm long; pedicels 6-7.5 mm long; bracts ovate, very small at top of raceme. *Calyx-lobes* oblong obovate, 3.5 mm, acute. *Filaments* hairy. *Capsule* subglobose, 6-8 mm. long, glabrous, glandular. *Seeds* very small, oblong, grey, longitudinally grooved and rugose between the grooves.



Distribution: Throughout India, up to 1500 m. Myanmar, Afghanistan, China, Ava.

VERONICA L.

Veronica anagallis-aquatica L., Sp. Pl. 12.1753. *V. anagallis* L., Hook.f. in Hook.f., Fl. Brit. India 4:293.1984.

Annual, erect or suberect or decumbent, pubescent or glabrous herbs, 10-30(-50) cm high; stem hollow, creeping, stoloniferous. *Leaves* sessile, oblong-lanceolate or linear-oblong, 5-10 x 1-2 cm, base semiamplexicaule, subentire-crenate, subobtuse. *Flowers* pale-purple or white, in lax axillary or terminal, bracteate racemes, forming 15-20 cm long, leafy panicles. *Calyx* glandular hairy; lobes 4, oblong-lanceolate. *Corolla* 1.5-2 mm long; lobes 4, rounded.



Stamens 2, exserted. *Capsules* broadly ovate to globose, flattened with hairs, emarginate.

Distribution: N.W. plains and Himalaya, to 2500 m; Europe, Asia, Africa, America.

ACANTHACEAE

HEMIGRAPHIS Nees emend. T. Anders.

Hemigraphis hirta (Vahl) T. Anders. in J. Linn. Soc.Bot. 9:462. 1867; Clarke in Hook.f., Fl. Brit. India 4:422.1884; Haines, Bot. Bihar & Orissa 2:672 (704). 1922; Mooney, Suppl. Bot. Bihar & Orissa 108. 1950. *Ruellia hirta* Vahl, Symb. Bot. 3:84. T. 67. 1794.

Small prostrate herb, softly white-hirsute or villous. *Leaves* sessile, subsessile or shortly petioled, 1.2-3 x 0.8-1.8 cm, crenate, obtuse to acute, hirsute. Heads small, few-flowered; bracts oblong or oblanceolate, 1-1.2 cm. *Calyx*-lobes linear or spatulate in fruit. *Corolla* purplish, pale-blue or white, 1-1.2 cm diam., ventricose portion nearly as long as the cylindrical. Longer filaments laxly hairy below. *Capsule* 7.5-10 mm long, ca. 12-seeded.



Distribution: West Bengal; Upper Gangetic Plain.

PERISTROPHE Nees

Peristrophe paniculata (Forssk.) Brummit in Kew Bull. 38:451. 1983. *Dianthera paniculata* Forssk., Fl. Aegypt.-Arab. 7. 1775. *Peristrophe bicalyculata* (Retz.) Nees in Wall. Pl. As. Rar. 3:113. 1832; Clarke in Hook.f., Fl. Brit. India 4:554. 1885; Haines, Bot. Bihar & Orissa 2:696 (730). 1922. *Dianthera bicalyculata* Retz., Acta Holm. 1775:279.1776.

Laxly paniculately branched herb. *Stems* sharply 6-angled, hispid or hairy. *Leaves* ovate, 2-10 x 1.5-4 cm, lower larger, acute to acuminate, base somewhat decurrent; upper leaves gradually passing into spreading, setaceous bracts. *Flowers* small, pinkish, in copiously branched, lax panicles, final branches bearing cymules of 2 sessile flowers, of which one is usually abortive. *Calyx* segments subaristate or setaceous upwards, one segment larger, 1 cm long, others 7 mm long, linear with setaceous tip. *Corolla*-tube 5-6.2 mm, lips oblong. *Capsule* oblong, 7.5 mm, compressed, with short solid stipe, beaked, glandular and puberulous.



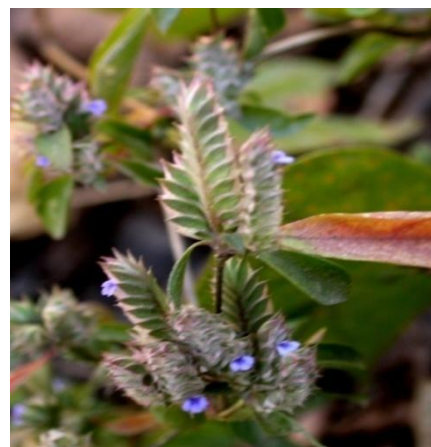
Distribution: Throughout the warmer parts of India; subtropical Himalaya. Tropical Africa, Afghanistan, Myanmar, Indo-China, Malaya.

RUNGIA Nees

Rungia pectinata (L.) Nees in DC., Prod. 11:469. 1847, pro parte. *Justicia pectinata* L., Amoen. Acad. 4:299. 1759. *Rungia parviflora* (Retz.) Nees var. *pectinata* (L.) Clarke in Hook.f., Fl. Brit. India 4:550. 1885; Haines, Bot. Bihar & Orissa 2:690 (723). 1922.

Diffuse or erect herb. *Leaves* ovate-lanceolate, linear or narrowly lanceolate to narrowly elliptic, 2-8.5 x 0.4-2.5 cm, acute, lineolate, base narrowed. *Flowers* very small, ca. 3.7 mm long, blue, in clustered second spikes, 0.5-3 cm long with two rows of imbricate, barren, ovate to lanceolate, mucronate or cuspidate bracts and two ventral rows of suborbicular, broadly ovate or obovate, hairy flowering bracts, 3 mm broad including the wide scarious margins. *Capsule* 2 mm, compressed.

Distribution: Throughout India, upto 1300 m. Myanmar, China, Malaya, Philippines.



LAMIACEAE

ANISOMELES R.Br.

Anisomeles indica (L.) Kuntze, Rev. Gen. Pl. 2:512. 1891; Haines, Bot. Bihar & Orissa 2:745 (782). 1924; Mukerjee in Rec. Bot. Surv. India 14:152. 1940; Keng in Steenis, Fl. Males. I. 8:329. 1978; Cramer in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 3:176. 1981. *Nepeta indica* L., Sp. Pl. 571. 1753. *Anisomeles ovata* Ait.f., Hort. Kew. 3:364. 1811; Wight, Icon. t. 865. 1844-45; Hook.f., Fl. Brit. India 4:672. 1885.

Softly pubescent herb or undershrub, 0.6-1.5 m. Leaves ovate, 2.5-8 cm long, coarsely crenate, acute to acuminate, sometimes obtuse, softly pubescent to hairy on both sides, base cuneate to subtruncate; petiole 1-4 cm long. Flowers purplish. Calyx 7.5 cm long, hirsute within and without, teeth acuminate. Corolla with pale or greenish upper lip and purple, spreading, 3-lobed lower lip with the mid-lobe laterally compressed and notched. Filaments hirsute. Nutlets ovoid, 1.8-2 mm long, black, polished, smooth.



Distribution: Throughout India, ascending to 1500 m. in the Himalaya. Sri Lanka, China, Malesia, Japan.

LEONOTIS (Pers.) R.Br.

Leonotis nepetifolia (L.) R.Br., Prod. 504. 1810 ('*nepetaefolia*'); Wight, Icon.t. 867. 1844-45 & III.t. 176. 1850; Hook.f., Fl. Brit. India 4:691. 1885; Haines, Bot. Bihar & Orissa 2:752 (789). 1924; Mukerjee in Rec. Bot. Surv. India 14:185. 1940; Keng in Steenis, Fl. Males. I. 8:335. 1978; Cramer in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 3:180. 1981. *Phlomis nepetifolia* L., Sp. Pl. 586. 1753 ('*nepetaefolia*').

Tall herb, 1.2-2.1 m; stems thick, 4-angled and grooved, puberulous. *Leaves* large, ovate, 5-10(20) x 3-6(8) cm below, smaller, more lanceolate and deflexed under the



whorls, coarsely crenate-serrate or crenate, acute to acuminate, pubescent, base rounded to truncate, abruptly narrowed; petiole, 2.5-7.5 cm long. *Flowers* orange; whorls distant, large, globose, 4-7.5 cm diam., bracts linear spinescent. *Calyx* 1.8 cm, pubescent outside, throat glabrous, mouth oblique, teeth spinescent, unequal, uppermost tooth longest. *Corolla* 2.5 cm long, tube slender, exserted, villous. *Nutlets* linear-oblong, widened upwards, truncate.

Distribution: Hotter parts of northern and southern India. Tropical Africa and Asia.

LEUCAS R.Br.

Leucas cephalotes (Roth) Spreng., Syst. Veg. 2:743. 1825; Wight, Icon.t. 337. 1840; Hook.f., Fl. Brit. India 4:689. 1885; Haines, Bot. Bihar & Orissa 2:750 (787). 1924; Mukerjee in Rec. Bot. Surv. India 14:168. 1940. *Phlomis cephalotes* Roth, Nov. Pl. Sp. 262. 1821.

Erect herb, 15-40 (70) cm; stems 4-grooved, patently hairy. *Leaves* lanceolate-oblong or elliptic-oblong, 3.7-10 x 1-3.7 cm, remotely serrate or crenate-serrate acute, shortly densely pubescent on both sides and with longer hairs beneath and punctulate; petiole 2.5-12.5 mm long. *Whorls* dense, globose, 2.5-5 cm diam., terminal or subterminal, being usually surmounted by a pair of leaves; bracts closely imbricating, large, lanceolate or elliptic, 1.2-1.8 cm long, acuminate, aristate; rather membranous, ciliate, strongly nerved. *Calyx* tubular, 1.5-1.8 cm long, hairy above, mouth oblique and hairy within, ribs 10, ending in 10 subaristate, hispidulous teeth, 1-1.5 mm long. *Corolla* white, ca. 2.5 cm long, tube shortly exserted, lower lip shortly longer than the densely bearded upper. *Nutlets* 3 mm long, smooth, brown.



Distribution: Throughout India.

Leucas indica (L.) R.Br. ex Vatke, Desterr. Bot. Zeits. 25:95. 1875. *Leonurus indicus* L., Syst. Nat. (ed.10) 1101.1760. *Leucas lavandulifolia* Sm. in Rees, Cyclop. 20. n. 2. 1812; Mukerjee in Rec. Bot. Surv. India 14:167. 1940; Keng in Steenis, Fl. Males. I. 8:338. 1978. *L. linifolia* (Roth) Spreng., Syst. Veg. 2:743. 1824; Hook.f., Fl. Brit. India 4:690. 1885; Haines, Bot. Bihar & Orissa 2:751 (788). 1924. *Phlomis linifolia* Roth, Nov. Pl. Spec. 260. 1821.

Erect herb, 30-40 (90) cm; stems usually much branched, pubescent. *Leaves* linear or linear-lanceolate, 5-10 x 0.3-0.8 cm, entire or remotely shallowly crenate-serrate, acute or obtuse minutely pubescent both sides or somewhat scabrous above, base attenuate; petiole 0-7.5 mm. *Whorls* dense, axillary and terminal, 1.2-1.8 cm diam.; flowers white; bracts linear setaceous, smaller than calyx. *Calyx* somewhat obovoid, 5-6.2 mm, glabrous or puberulous, mouth very oblique, glabrous within, the upper project far beyond the lower, teeth 7-10, very small, sometimes



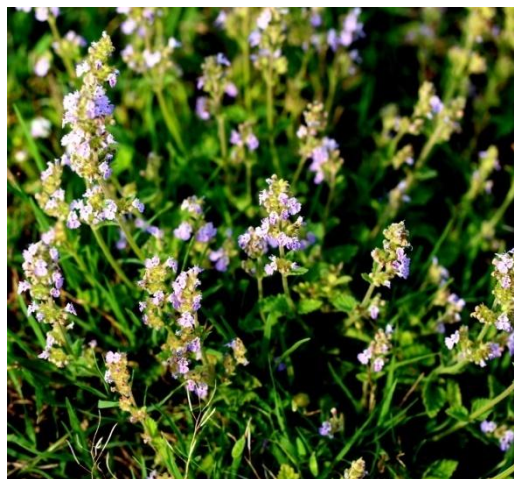
spinescent; tube not or only faintly ribbed. *Corolla-tube* included. *Nutlets* dark brown, oblong, 2 mm long, somewhat triquetrous.

Distribution: South India; Bihar; Uttarakhand West Bengal; Assam. Continental Asia.

NEPETA L.

Nepeta hindostana (Roth) Haines, Bot. Bihar & Orissa 744 (781). 1924; Mukerjee in Rec. Bot. Surv. India 14:133. 1940. *Glechoma hindostana* Roth, Nov. Pl. Sp. 259. 1821. *Nepeta ruderalis* Buch.-Ham. ex Benth. in Wall. Pl. As. Rar. 1:64. 1830; Hook.f., Fl. Brit. India 4:661. 1885; Haines, Bot. Bihar & Orissa 2:744 (781). 1924.

Erect or ascending, aromatic herb, 15-45 cm; stems one or many from the root, pubescent. *Leaves* petioled, ovate or broadly ovate, 1.2-5 cm long, coarsely crenate-serrate, usually obtuse, hairy or hoary-pubescent, base sometimes cordate; petiole 1.2-1.8 cm. *Flowers* blue-purple, hairy, pedicelled, 6.2 mm long, in stalked, axillary, dense cymes, aggregated at the top of the stem into dense spiciform thyrses, about 2 cm diam; peduncles of lower cymes often 7.5 mm; bracts setaceous. Fruiting calyx 6.2 mm long, ribbed, slightly curved, mouth oblique, teeth subulate, 2 lower rather smaller and narrower than the 3 upper. *Corolla* shortly exserted; lower lip 5 mm with a large shovel-shaped, emarginate and slightly obtusely crenate mid-lobe and narrower, paler, 2-fid side-lobes; upper lip flat, pale, 2-fid, oblong, hairy; throat purple spotted. *Nutlets* oblong, light brown with white dots, basal scar small.



Distribution: West Bengal; Bihar; NW. India; Uttar Pradesh; Uttarakhand; Rajasthan; Afghanistan.

SALVIA L.

Salvia plebeia R. Br., Prod. 501. 1810; Hook.f., Fl. Brit. India 4:655. 1885; Haines, Bot. Bihar & Orissa 2:744 (780). 1924; Mukerjee in Rec. Bot. Surv. India 14:111. 1940; Mooney, Suppl. Bot. Bihar & Orissa 125. 1950; Keng in Steenis, Fl. Males.I. 8:358. 1978.

Erect, copiously branched herb, 30-60 cm; stems grooved on the sides, pubescent with short reflexed hairs. *Leaves* wrinkled, ovate, oblong or ovate-lanceolate, 2.5-7.5 cm long, crenate, lower obtuse, upper acute, base narrowed into long petiole. *Racemes* 5-10 cm long, glandular, terminal, often paniced; whorls 6-flowered; bracts oblong or lanceolate. *Flowers* small or minute, white or lilac. *Calyx* 3 mm in fruit, upper lip entire, obtuse, decurrent on the tube, lower lip longer, obtusely 2-toothed. *Corolla* 3-5 mm long. *Stamens* ascending under the upper lip; anthers-cells widely separated by the lever-like connective, one imperfect.



Nutlets minute, ovoid, brown, mucilaginous when wetted.

Distribution: Throughout India, up to 1700 m. Continental SE. Asia to Australia.

AMARANTHACEAE

ALTERNANTHERA Forssk.

Alternanthera sessilis (L.) R.Br. ex DC., Cat. Pl. Hort. Monsp. 4:77. 1813; Wight, Icon.t. 727. 1843; Hook.f., Fl. Brit. India 4:731. 1885; Haines, Bot. Bihar & Orissa 2:768 (806). 1924; Backer in Steenis, Fl. Males.I. 4:92. 1949; Mooney, Suppl. Bot. Bihar & Orissa 129. 1950; Melville in Kew Bull. 13:172. 1958; Towns. in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 1:49. 1980. *Gomphrena sessilis* L., Sp. Pl. 225. 1753. *Alternanthera triandra* Lam., Encycl. 1:95. 1783.

Annual or perennial prostrate or ascending herb; younger branches with 2 lines of pubescence; nodes hairy. *Leaves* sessile or subsessile, variable, linear, elliptic-oblong, oblanceolate, obovate-oblong, narrowly elliptic, linear-oblong or oblong-lanceolate, 1-5 (7.5) x 0.3-1.2 cm, sometimes denticulate, obtuse acute or subacute, glabrous or slightly hairy both sides, base narrowed. *Cluster* of flowers or spikes axillary, solitary or few in a cluster, subglobose or slightly elongate in fruit, ca. 5-7.5 mm diam., white or pinkish; bracts scarious white, ovate, mucronate, glabrous; bracteoles similar. *Tepals* elliptic, 1.5-2.5 mm, acuminate or acute, mucronate, glabrous or nearly so. *Stamens* 5, of which usually only 2-3 anther bearing. *Utricle* compressed, obcordate 2.5-3 mm diam., with thickened margin. *Seeds* discoid.



Distribution: Throughout India. Widespread in tropics and subtropics of the world.

DIGERA Forssk.

Digera muricata (L.) Mart., Beitr. Amarantac. 77. 1825; Backer in Steenis, Fl. Males.I. 4:80. 1949; Towns. in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 1:23. 1980. *Achyranthes muricata* L., Sp.Pl.(ed. 2) 295. 1762. *Digera arvensis* Forssk., Fl. Aegypt. Arab. 65. 1775; Hook.f., Fl. Brit. India 4:717. 1885. *Desmochaeta muricata* (L.) DC. Cat. Pl. Hort. Monsp. 103. 1813; Wight, Icon.t. 732. 1840. *Digera alternifolia* Asch. in Schweinf., Beitr. Fl. Aethiop. 180. 1867; Haines, Bot. Bihar & Orissa 760. 1924.

Slender herb with ascending or prostrate, glabrous branches. *Leaves* variable, ovate, elliptic or lanceolate. 1.8-7.5 x 1.2-5 cm, acute or obtuse, glabrous; petiole slender, often upto 2.5 cm long. *Bracts* and bracteoles ovate-lanceolate, acute. *Perianth* pink. *Nutlets* hard, verrucose.

Distribution: N.W. India; West Bengal; South Deccan. Asia; South, Central and East tropical Africa; Madagascar.



POLYGONACEAE

POLYGONUM L.

Polygonum barbatum L., Sp. Pl. 362. 1753; Hook.f., Fl. Brit. India 5:37. 1886; Haines, Bot. Bihar & Orissa 2:777 (816). 1924; Mooney, Suppl. Bot. Bihar & Orissa 130. 1950.

Erect or spreading herb, 60-90 cm; branches glabrous or nearly so. *Leaves* sessile or subsessile, linear-oblong or linear-lanceolate, 4-17.5 x 0.7-2 cm, acuminate or acute, strigose on both sides or only on nerves beneath with few scattered hairs in between, base acute; stipules with excurrent bristles longer than the tube. *Racemes* spiciform, terminal, slender, 3-10 cm long, paniced; peduncles glabrous or nearly so; bracts short, glabrous, setose on margins. *Flowers* white-pinkish. *Styles* mostly 3. *Nut* trigonous.



Distribution: Throughout the hotter parts of India. Tropical Africa, W. Asia, Himalaya, China, S. Japan, Malesia, Australia.

Polygonum plebeium R. Br., Prod. 420. 1810 (*'plebejum'*); Hook.f., Fl. Brit. India 5:27. 1886; Haines, Bot. Bihar & Orissa 2:775 (813). 1924; Mooney, Suppl. Bot. Bihar & Orissa 129. 1950. *P. indicum* Heyne in Roth, Nov. Pl. Spec. 208. 1821; Wight, Icon.t. 1808. 1852.

Prostrate herb; stems many from the root, 5-30 cm long; stems and branches grooved, smooth or scabrous. *Leaves* linear, linear-oblong or obovate-oblong, 2.5-18 mm long, acute or obtuse, often with revolute margins; stipules short or longer than the leaves, fimbriate, with excurrent nerves. *Flowers* small, green to pink with green midrib, under 2.5 mm long, subsessile, 3-4 or crowded in the leaf-axils, sunk among the stipules or exsert. *Perianth* lobes acute or obtuse. *Nut* somewhat spindle-shaped, 1.5-1.8 mm long, triquetrous, brown, shining.



Distribution: Throughout India, up to 1500 m. Africa, W. Asia, Himalaya, east to China and Rysukyu, Malesia, Australia.

PIPERACEAE

PEPEROMIA Ruiz & Pav.

Peperomia pellucida (L.) Kunth, Nov. Gen. Sp. 1:64. 1816; Haines, Bot. Bihar & Orissa 3:791(829). 1924; Mooney, Suppl. Bot. Bihar & Orissa 131. 1950; Huber in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 6:299. 1987. *Piper pellucidum* L., Sp. 30. 1753.

Succulent, glabrous herb, 7.5-15(25) cm, becoming very membranous when dry. *Leaves* alternate and opposite, ovate or broadly ovate, 1-3.5 x 1-2.2 cm, acute, subacute or obtuse, glabrous, 7-nerved, nerves clear, base often slightly cordate; petiole 0.5-1cm. *Spikes* slender, leaf-opposed, 2.5-5 cm long and 0.7 cm diam., glabrous; peduncle hardly any; flowers distant, sunk in the rachis with minute peltate bracts. *Fruit* globose, 0.5 mm diam., marked with 10 vertical ridges and minute transverse very fine raised lines inbetween.



Distribution: Naturalized in many parts of India. Pantropic; native of S.America.

EUPHORBIACEAE

ACALYPHA L.

Acalypha indica L., Sp. Pl. 1003. 1753; Wight, Icon.t. 877. 1844-45; Hook.f., Fl. Brit. India 5:416. 1887; Haines, Bot. Bihar & Orissa 1:113 (117). 1921; Mooney, Suppl. Bot. Bihar & Orissa 31. 1950.

Erect herb, 30-60 cm; stems puberulous. *Leaves* long-petioled, ovate or rhomboid-ovoid 1.2-6.2 x 0.9-3.8 cm, serrate, acute or obtuse, surface minutely dotted, base 5-nerved, subacute, entire; petiole 1.5-5.5 cm, pubescent. *Spikes* numerous, axillary, 2.5-6.2 cm long, female flowers below, 9 or more, lax, males above; female bracts foliaceous, concave, suborbicular-cuneiform, 3-7 mm long, many-nerved, toothed. *Male flowers* ebracteate, very minute, clustered. *Capsule* concealed by the bract, hispid, usually 1-seeded.



Distribution: Throughout India. Tropical Africa, eastwards to Sri Lanka, Myanmar, Timor, Philippines.

MONOCOTYLEDON

CERATOPHYLLACEAE

CERATOPHYLLUM L.

Ceratophyllum demersum L., Sp. Pl. 992. 1753; Hook.f., Fl. Brit. India 5:639. 1888; Haines, Bot. Bihar & Orissa 3:841(883). 1924; Steenis in Steenis, Fl. Males. I. 4:41.t.1.1949; Wilmot-Dear in Kew Bull. 40(2):257.1954; Subram., Aquat. Angios. 52.t.36.1962.

Submerged aquatic herb, 15-90 cm long, densely leafy. *Leaves* once or twice bifurcate, 1.2-2.5 cm long, segments 0.2-0.7 mm broad, with transverse partitions visible under magnification, outer edges toothed. *Male flowers* in separate axils from the female. *Perianth* irregularly 10-12 fid. *Stamens* 10-30; anthers large, white, with white watery pollen. *Ovule* visible through the translucent ovary. *Nut*, pedicelled, ellipsoid, 3.7 mm long, often dotted, furnished with one terminal (style) and 2 sub-basal appendages, much longer than the nut, some small accessory spines also sometimes present.

Distribution: Throughout India in stagnant waters. Cosmopolitan.



HYDROCHARITACEAE

HYDRILLA Rich.

Hydrilla verticillata (L.f.) Royle, III. Bot. Himal.t. 376. 1839; Hook.f., Fl. Brit. India 5:659.1888; Haines, Bot. Bihar & Orissa 3:853 (893). 1924; Hartog in Steenis, Fl. Males.I. 5:385.t. 1. 1957; Subram., Aquat. Angios. 55.t. 37.1962. *Serpicula verticillata* L.f., Suppl. Pl. 416. 1781; Roxb., Pl. Corom.t. 164. 1802.

Weak aquatic herb forming large masses suspended under water; stems slender, branched, upto 45 cm long; roots fibrous. *Leaves* 4-8 in a whorl, linear or rarely narrowly elliptic, 6-12 mm long, usually spinulose-serrate, spreading with recurved tips. *Male flowers* sessile at the base of each leaf, escaping from the muricate sheath when mature and swimming on the water-surface. *Female flowers* above the male, if monoecious or in separate terminal branchlets and usually solitary in the whorls or opposite. *Stigma* pink.

Distribution: Throughout India. Widely distributed in the Old World from S. and E.Europe, Africa S. and E.Asia to Australia; throughout Malesia.



NECHAMANDRA Planch.

Nechamandra alternifolia (Roxb.) Thw., Enum. Pl. Zeyl. 332.1864; Subram. & Balak. in Bull. Bot. Surv. India 3:23.1962; Subram., Aquat. Angios. 56.t.38.1962. *Vallisneria alternifolia* Roxb., Fl. Ind. 3:750.1832; Wight, Ill.t. 11. 1840. *Lagarosiphon roxburghii* (Planch.) Benth. in Benth. & Hook.f., Gen. Pl. 3:451.1880; Hook.f., Fl. Brit. India 5:659.1888. *L.alternifolia* (Roxb.) Druce, Bot. Excl. Club. Soc. Brit. Isles 1916; 630. 1917; Haines, Bot. Bihar & Orissa 3:853(894). 1924; Mooney Suppl. Bot. Bihar & Orissa 141.1950.

Submerged aquatic herb; stems elongated, rather filiform, ascending through the water to various lengths. *Leaves* distant, sessile, linear or linear-lanceolate, 2.5 cm or more, acute and often twisted. *Males spathes* on opening setting free minute male florets seen as specks floating on water surface in close gregarious manner. *Tepals* reflexed. *Anthers* dehiscing transversely. *Female flowers* solitary, axillary, sessile. *Perianth-lobes* spreading, orbicular, concave. *Ovary* long; stigmas papillose on the receptive surface.

Distribution: Throughout India. Sri Lanka, Nepal.



OTTELIA Pers.

Ottelia alismoides (L.) Pers., Syn. Pl. 1:400.1805; Hook.f., Fl. Brit. India 5:662.1888; Haines, Bot. Bihar & Orissa 3:855(897). 1924; Mooney, Suppl. Bot. Bihar & Orissa 141.1950; Hartog in Steenis, Fl. Males. I. 5:398. 1947; Subram., Aquat. Angios. 61.t.43.1962.

Flaccid aquatic herb, varying in height with the depth of the water. Submerged leaves shortly petioled, usually narrow or oblong with tapering base or oblong-lanceolate and ca 30 cm long; floating leaves oblong, broadly ovate, or orbicular, upto 17.5 cm diam., margin undulate, apex obtuse or rounded, 7-11-nerved, base cordate or rounded and then narrowed into an angled or 2-edged petiole. *Spathe* on long axillary peduncles, tubular, 2.5-3.7 cm long and 1.8 cm broad, with about 6 waxy crisped wings, sharply 5-6-toothed or segments, obtuse and cuspidate. *Petals* white, obovate or orbicular with fleshy basal appendages. *Stamens* 6, in three pairs; pollen-grain densely set with numerous minute tubercles. *Fruit* oblong, upto 5.5 x 2.5 cm, crowded with withered perianth, 6-grooved. *Seeds* oblong with pulpy testa.

Distribution: Throughout India at low attitudes. NE. Africa, Nepal, SE. Asia, China, Japan, Australia, Solomon Isls.



COMMELINACEAE

MURDANNIA Royle

Murdannia nudiflora (L.) Brenan in Kew Bull. 7:189. 1952. *Commelina nudiflora* L., Sp.Pl. 41. 1753, pro Parte. *Aneilema nudiflorum* (L.) R.Br., Prod. 271. 1810; Hook.f., Fl. Brit. India 6:378. 1892; Haines, Bot. Bihar & Orissa 3:1080 (1128).1924; Mooney, Suppl. Bot. Bihar & Orissa 200. 1950.

Glabrous or sometimes hairy herb with many slender branches decumbent and rooting or ascending; roots fibrous. *Leaves* linear or linear-lanceolate, 3.7-12.5 x 0.3-1.2 cm, acute, acuminate or subobtuse, base narrowed, rounded or cordate; sheaths open, margin ciliate. *Flowers* small, blue or purplish, in terminal or leaf-opposed, few-flowered cymes; cymes becoming paniculate with elongate peduncles marked with scars of fallen bracts at the cyme; *Pedicels* 2.5-5 mm long. *Stamens* 3 fertile with bearded filaments; *Staminodes* 3 with filaments bearded or not.



Ovary with cells 2-ovuled. *Capsule* broadly oblong-ellipsoid, 2.5-3.7 mm long, mucronate, 3-celled. *Seeds* 2 per cell, 1-seriate, very rugose and pitted, truncate at their common end, rounded or obtuse at the other end.

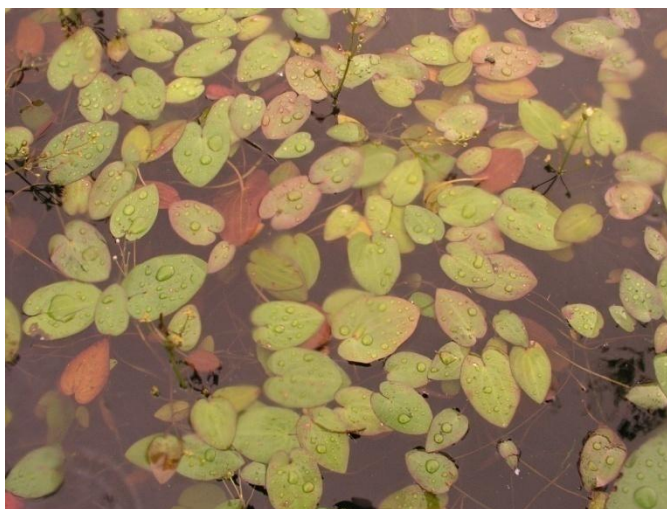
Distribution: Throughout India, up to 1800 m. Africa, Myanmar, China, S. Japan, Malesia.

ALISMATACEAE

CALDESIA Parl.

Caldesia parnassifolia (L.) Parl., Fl. Ital. 3:599. 1858; Hartog in Steenis, Fl. Males.I. 5:319.1857; Subram., Aquat. Angios. 84.t.51.1962. *Alisma parnassifolia* Bassi ex L., Syst. Nat.(ed.12) 3 (App.):230. 1768. *A.reniforme* D.Don, Prod. 22.1825; Wight, Icon.t.322.1840; Hook.f., Fl. Brit. India 6:560.1893; Haines, Bot. Bihar & Orissa 3:843(884). 1924.

Large glabrous herb with an annual stem. *Leaves* orbicular-ovate, 6.2-1.2 x 5-16.2 cm, apex rounded or retuse, 13-15-nerved, base cordate. *Flowering* stems 30-75 cm, branches 3-4 or usually 6 in a whorl with bracts upto 1.2 cm long in the lowest whorl. *Flowers* white or pink-purple, 1.2 cm diam. *Sepals* persistent in fruit. *Achenes* 5-8, not whorled, turgid, obovoid, 2 mm long, beaked with style, dorsally ribbed.



Distribution: Throughout the plains of India. From N. & C.Africa and Madagascar to S. and C.Europe, through SE. Asia to China, Japan and N.Australia.

NAJADACEAE

NAJAS L.

Najas marina L., Sp. Pl. 1015. 1753; Wilde in Steenis, Fl. Males.I.6:162.1962. *N.major* All., Fl. Pedem 2:221.1781; Hook.f., Fl. Brit. India 6:569.1883; Haines, Bot. Bihar & Orissa 3:850(892).1924.

Stouter plant with the internodes sometimes dentate. *Leaves* 0.5-4.5 cm long and 2.5-3.7 mm broad, with 4-8 spiny almost triangular teeth on each side; sheath with rounded entire sides; auricles almost absent; intravaginal scales fleshy. *Flowers* dioecious, solitary. Neck of the spathe of male flowers upto twice as long as broad, the margin without or with a few minute spines. *Anthers* 4-celled. *Spathe* of female flowers 0.

Distribution: Throughout India. Widely distributed throughout the World.



POTAMOGETONACEAE

POTAMOGETON L.

Potamogeton nodosus Poir. in Lam. Encycl. (suppl.4):535. 1816 Subram., Aquat. Angios. 95.1962. *P.indicus* Roxb., Fl. Ind. 1:471. 1820, non Roth ex Roem. & Schult. 1818; Hook.f., Fl. Brit. India 6:565. 1893; Haines, Bot. Bihar & Orissa 3:847(888). 1924.

Aquatic, submerged, rooted herb; stem slender, terete, branched. *Leaves* all petioled, nearly all floating in shallow water, or upper ones only floating in deep water; floating leaves sometimes opposite, elliptic, elliptic-lanceolate or oblong, (4-) 6-10 x 2.5-4.5 cm, acute, obtuse or rounded both ends, thinly coriaceous, shining, with strong midrib and 13-15 parallel nerves mostly from near the base; petiole 2.5-10 cm; stipules free, 2.5-3.7 cm; submerged leaves membranous, lanceolate or elliptic-lanceolate, upto 20 x 2.5 cm, acute, often undulate. *Spike* 1.8-3.7 cm long, dense-flowered, on axillary or leaf-opposed peduncle, 2.5-15 cm; spikes raised just above water surface. *Perianth* segments 2.5 mm long, including the claw, limb orbicular, concave, 2 mm diam. *Drupelets* 3 mm long, obliquely truncate, shortly beaked.



Distribution: Common in fresh-water throughout the plains of India ascending to 2700 m in Sikkim Himalayas; S.Andamans. Warm temperate and tropical regions of Europe, Africa, Asia and America.

Potamogeton pectinatus L., Sp. Pl. 127.1753; Hook.f., Fl. Brit. India 6:567. 1893; Haines, Bot. Bihar & Orissa 3:848(890). 1924; Mooney, Suppl.Bot.Bihar & Orissa 140.1950; Subram., Aquat.Angios. 95.t. 55.f.1-3.1962.

Submerged aquatic herb; stem filiform, profusely branched. *Leaves* all submerged, alternate, sessile, filiform, 2.5-15 cm long and 0.5-2.5 (-5) mm wide, margins slightly thickened or inrolled, 1-3-nerved; sheaths upto 7-nerved; stipules adnate to the leaf-sheath with free tips only. *Flowers* white, interruptedly whorled on a spike, 0.5-2.5 cm long; peduncle axillary, slender, elongate. *Perianth* segments suborbicular. *Drupelets* dimidiate-obovoid, 2.5-3.2 mm long, slightly convex ventrally, with strong lateral ridges and when dry sometimes obscurely keeled dorsally, very shortly beaked.



Distribution: Common in fresh-water and low land water throughout the plains of India, sometimes ascending to higher altitudes; also common in brackish water of Chilika lake. Temperate and tropical regions of Europe, Africa, Asia, America and Australia.

SEDGES

SEDGES

CYPERACEAE

CYPERUS L.

Cyperus alopecuroides Rottb., Descr. Pl. Rar. 20.1772; Kern in Steenis, Fl. Mals. I. 7:603. 1974; T.Koyama in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 5:123. 1985. *Juncellus alopecuroides* (Rottb.) Clarke in Hook.f., Fl. Brit. India 6:595. 1893.

Perennial; rhizome very short; stem stout, tufted, trigonous, smooth, leafy at the much thickened base, upto 1.25 m. *Leaves* 6-16 mm wide, scabrous on the margins and nerves, midrib prominent beneath and 2 lateral nerves strongly marked above; lower sheaths spongy. *Inflorescence* compound or decompound, upto 30 cm long; involucral bracts 4-7, much overtopping the inflorescence, upto 65 x 1 cm; primary rays 5-10, unequal, smooth, suberect, rigid, upto 20 cm, secondary ones usually very short, up to 6 cm. *Spikes* digitately arranged, oblong-cylindrical to cylindrical, divergent, very dense, 2-5 x 0.8-1 (-1.5) cm; rachis hidden spicately arranged, somewhat turgid, ovate to oblong-lanceolate, 12-30-flowered, ca .5 mm long; rachilla straight, strongly compressed, persistent, very narrowly winged. *Glumes* very densely imbricate, yellowish, ovate or elliptic-ovate, 1.5-2.25 x 1-1.25 mm, obtuse, apiculate or minutely mucronulate, membranous, concave, not keeled, 5-7-nerved with finally inrolled margins. *Stamens* 2(-3). *Stigmas* mostly 2. *Nut* yellow or stramineous, dorsiventrally compressed, planoconvex or with a raised dorsal angle, broadly elliptic (or slightly obovate), ca 0.9 mm long, shortly apiculate.



Distribution: Widely distributed in India. Africa from the Mediterranean to the tropics, Madagascar; India to Queensland; West Indies.

Cyperus corymbosus Rottb., Descr. Icon. Rar. 42.t. 7. f.4. 1773; Clarke in Hook.f., Fl. Brit. India 6:612. 1893; Haines, Bot. Bihar & Orissa 3:899(942). 1924; Subram., Aquat. Angios. 105.t.158.1962; T.Koyama in Dassan. & Fosberg, Rev. Handb.Fl. Ceylon 5:175. 1985.

Rhizome creeping, stout, woody; stems bluntly trigonous above, spongy below, septate not or hardly visible when dry, upto 1.8 m. *Leaves* reduced to sheaths or sometimes with a blade upto 15 cm long. *Inflorescence* compound; primary rays 6-15, slender, upto 15 cm long, secondary rays terminated by spikes or corymbs of 4-16 spikelets; involucral bracts 3-5, linear-ensiform, shorter than the inflorescence, upto 7.5 cm long and 5 mm wide. *Spikelets* linear, 0.6-2.5 cm long; rachilla distinctly narrowly 2-winged, wings usually pale. *Glumes* ovate-oblong when unfolded, 2.5 mm long, obtuse or subacute, straw-coloured, pale reddish-brown. *Nut* narrowly elliptic-oblong, trigonous, 1.5 mm long black.



Distribution: More or less throughout India. Pantropical.

Cyperus flavidus Retz., Obs. Bot. 5:13.1788; Kern in Steenis, Fl. Males.I. 7:648.1974. *C.capillaris* Koenig ex Roxb., Fl. Ind. 1:198.1820. *Pycneus capillaris* Nees, Linnaea 9:283.1834; Clarke in Hook.f., Fl. Brit. India 6:591.1893, incl. var. *nilagiricus*. *P.globosus* Reichb., Fl. Germ. Excurs.1:140(10).1830; Haines, Bot.Bihar & Orissa 3:936(948).1924.*Cyperus globosus* All., Auctur.Fl. Pedem. 49.1789; Mooney, Suppl.Bot. Bihar & Orissa 146.1950. *Pycneus flavidus* (Retz.) T. Koyama in J. Jap. Bot. 51:313.f.1976 & in Dassan. & Fosberg, Rev. Handb.Fl.Ceylon 5:222.1985.

Very slender annual; stems tufted, 5-60 cm, trigonous, smooth. *Leaves* very slender, almost setaceous, 10-30 cm, very gradually acuminate, smooth or slightly scabrid at the top. *Inflorescence* simple or often compound with several short rays and a central sessile subglobose spike; involucre bracts 4-8, lower much overtopping the inflorescence. *Spike* ovoid to broadly ovoid; rachis short. *Spikelet* pale brown to deep brown, spreading, linear, 7.5-17 x 2.5 mm, compressed; rachilla straight, wingless, persistent. *Glumes* closely imbricate, ovate-oblong, 1.5-2.5 mm long, obtuse, muticous. *Keel* green, 3-nerved, sides brown, nerveless, margins whitish hyaline especially towards the top. *Stamens* 2. *Stigmas* 2. *Nut* ellipsoid, ca 8 mm long, biconvex, laterally compressed, apiculate, chestnut brown to dark castaneous; epidermal cells isodiametric.



Distribution: Widely distributed in India upto 1800 m. S.Europe, Africa, W. & C. Asia, China, Japan, Malesia.

Cyperus platystylis R.Br., Prod. 214. 1810; Clarke in Hook. f., Fl. Brit. India 6:598.1893; Haines, Bot. Bihar & Orissa 3:893(935). 1924; Mooney, Suppl. Bot. Bihar & Orissa 144. 1950; Subram., Aquat. Angios. 105. 1962; Kern in Steenis, Fl. Males. I. 7:618. 1974; T.Koyama in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 5:198.t. 12. 1985.

Stout perennial upto 1 m; stoloniferous (or stolons 0); roots thick stems solitary or subcaespitose, stout, flattened below, trigonous upwards, 1.2-1.8 cm thick at base, smooth (or scaberulous) on the angles above. *Leaves* basal, as long as or longer than the stem, septate (cross-nerves)-nodulose,, very scabrous (cutting) on the margins and midrib, 8-12 mm wide; lower sheaths bladeless, strongly keeled, cinnamomeous to purplish. *Inflorescence* compound, often with very



numerous spikelets, depressed corymbose or semiglobose, very dense to rather loose, upto 30 cm across; involucre bracts 5-8, leaf-like, 5-45 cm long. *Spikelets* bright brown, often very numerous, digitately arranged in clusters of 3-8, linear-lanceolate, 5-12.5 mm long, acute, compressed but somewhat turgid, upto 60-flowered; rachilla straight, wingless, persistent, with strong transverse ledges but not deeply excavated after fall of glumes. *Glumes* ovate or ovate-oblong, 2-2.5 mm long, obtusish, mucronulate, with rounded, strongly 3-nerved, green

back, sides thinner, yellowish or brownish streaked with red, margins whitish hyaline. *Stamens* 3; filaments ligulate; anthers linear-oblong with a small red mucro. *Style* flattened, ciliate; stigmas 3. *Nut* unequally trigonous, dorsally compressed, ellipsoid, 1.75-2 x 1 mm, with corky, much thickened angles, shining grayish brown to blackish.

Distribution:. From India and Sri Lanka, Myanmar to Taiwan and through Malesia eastwards to northern and eastern Australia.

Cyperus rotundus L., Sp.Pl. 45. 1753; Clarke in Hook.f., Fl. Brit. India 6:614. 1893; Haines, Bot. Bihar & Orissa 3:903 (946). 1924; T.Koyama in Dassan,. & Fosberg, Rev. Handb.Fl. Ceylon 5:181. 1985.

Perennials; rhizome emitting long, slender, wiry stolons ending in tubers; tubers fragrant, black, subglobose, ovoid or ellipsoid, ca 1.2 cm diam. scales of rhizome soon disintegrating and usually not present on last years growth; stems slender, triquetrous, smooth, tuberous at base, 10-60 cm. *Leaves* several, mostly radical, 2-3(-6) mm wide, generally shorter than the stems, acuminate, scabrid on the margins in the upper part; lower sheaths reddish-brown, soon disintegrating. *Inflorescence* simple or compound, usually small; involucre bracts mostly 3, as long as or overtopping the inflorescence, upto 30 cm long; primary rays 3-9, very unequal; spikes ovoid, loose to rather dense with glabrous rachis; spikelets spicately arranged, linear, 0.6-1.8 (-2.5) cm long, acute, strongly compressed, 10-40 (-100)- flowered; rachilla flexuous, broadly winged, persistent. *Glumes* imbricate, linear-oblong, 3-3.5 mm long, membranous, keeled, subobtusate, midrib mucronulate, rubiginous to deep brown, with narrow hyaline margins 3-7 nerves. *Stamens* 3. *Stigmas* 3. *Nut* trigonous, oblong-obovoid, 1.5 mm long, apiculate, brownish to black, rarely maturing.



Distribution: Throughout India, ascending to 1800 m. Cosmopolitan.

ELEOCHARIS R.Br.

Eleocharis congesta D.Don, Prod. 41.1825; Clarke in Hook.f., Fl. Brit. India 6:630.1893; Haines, Bot. Bihar & Orissa 3:911(957). 1924; Mooney, Suppl. Bot. Bihar & Orissa 148.1950; Kern in Steenis, Fl. Males.I. 7:532.1974; T.Koyama in Dassan. & Fosberg, Rev.Handb.Fl.Ceylon 5:263.1985.

Annual or perennial caespitose herb, 20-30 cm; stems; stolons 0; stems slender, terete, 8-10-angular or striate, smooth, sheaths appressed often reddish, uppermost with a short subulate or lanceolate appendage. *Spikelet* ovoid or conical, 5-10 mm long and upto 4 mm wide, terete, often proliferous at the base. *Glumes* elliptic-oblong (or oblong-ovate to lanceolate), 1.5-2 mm long, membranous, appressed, scarcely keeled, 1-nerved, hyaline in the centre and with often



coloured margins or a coloured band between centre and margins. *Bristles* 6, little longer than the nut. *Stamens* 2(-3). *Style* 3-fid. *Nut* obscurely trigonus, obovoid or pyriform, 0.8-1.2 mm long, smooth or obscurely longitudinally striolate, straw-coloured; epidermal cells longitudinally oblong; style base shortly pyramidal, triangular, as long as or slightly longer than wide, and as broad as the nut.

Distribution: Throughout India. Nepal, Indo-China, China, Japan.

SCIRPUS L.

Scirpus lateriflorus Gmel., Syst.Nat.2, 1:127.1791; Kern in Backer & Bakh.f., Fl. Java 3:459.1968 & in Steenis, Fl. Males.I. 7:514.1974. *S.supinus* var. *uninodis* Clarke in Hook.f., Fl. Brit. India 6:656.1893; non *Isolepis uninodis* Del. 1813. *S.supinus* auct. non L.: Haines, Bot. Bihar & Orissa 3:925(969). 1924; Mooney, Suppl. Bot. Bihar & Orissa 150.1950. *Schoenoplectus lateriflorus* (Gmel.) Lye in Bot. Not.124.290.1971; Saldanha & Nicolson, Fl. Hassan 698.1976. *S.supinus* subsp. *lateriflorus* (Gmel.) T.Koyama in Hara, Stearn & Williams, Enum.Fl. Pl. Nepal 1:119.1978 & in Dassan. & Fosberg, Rev. Handb.Fl. Ceylon 5:158.1985.

Diffuse annual herb, 5-45 cm; stems slender weak, densely tufted, terete or subterete. *Leaves* reduced to 2-3 sheaths, obliquely truncate at the apex, rarely with an elongate blade under 2.5 cm. *Inflorescence* pseudolateral, with 4-10(-15) spikelets in cluster, sometimes with 1-3 rays developed in addition to the sessile head; involucre bracts 1-2, the lower erect, similar to and continuous with the stem, always distinctly shorter than the latter, upto 15 cm long, the second when present patent, much shorter. *Spikelets* brownish, oblong-ovoid, 3.5-8 x 2-3 mm, terete or angular, acutish, densely 15-20-flowered. *Glumes* ovate, 1.5-2.5 mm long, keeled, keel ending in a minute usually black or dark coloured mucro, sides nerveless, brown, scarious. *Bristles* 0. *Stamens* 3; connective produced, papillose-bristly at the top. *Stigmas* 3. *Nut* more or less trigonous, obovate, 1-1.2 mm long, minutely apiculate, conspicuously transversely wavy-ridged, black.

Distribution: More or less throughout India. SE. Asia, Australia.

GRASS

GRASS

POACEAE (GRAMINEAE)

BAMBUSA Schreb.

Bambusa balcooa Roxb., [Hort. Bengal. 25. 1814, nom. nud.] Fl. Ind. 2:196. 1832; Munro in Trans. Linn. Soc. London 26(1): 100. 1868; Haines, Bot. Bihar & Orissa 949.1924. *Dendrocalamus balcooa* (Roxb.) Voigt, Hort. Suburb. Calcutta. 718. 1845.

Vern. *Haroti bans*

A tall, stout, caespitose bamboo. *Young shoots* blackish and green, tip acute; *Culms* dull grayish-green, 12-20 m tall, 5-10 cm in diameter at the base; *nodes* swollen, with a white ring above each node, hairy below; *internodes* 6th & 8th generally longest, length varying from 18-30 cm, sometimes slightly sulcate, silvery-brown pubescent, wall thick; branches from all nodes from base to upwards, sometimes branches of the lower nodes smaller and recurved like spine; branch buds 4-5 cm broad, 2-3 cm wide, triquetrous, slightly 2 keeled towards the top, ciliate along the keels. *Culm sheaths* green when young,



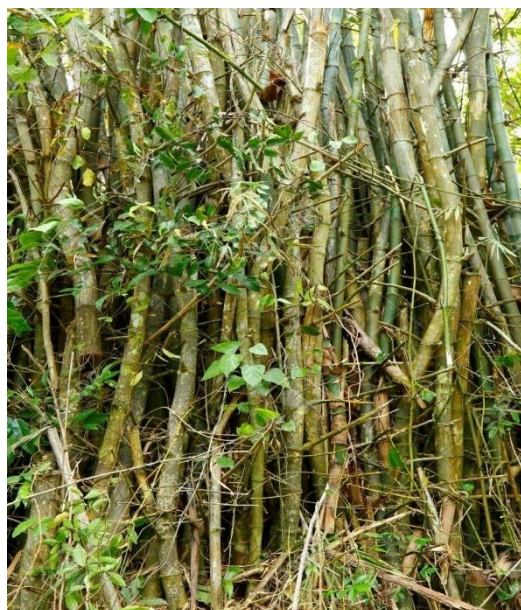
deciduous, falling off at the time of branch emergence, sheaths dimorphic, those of lower nodes much shorter and broader than upper ones, 16-35 cm long, 14-20 cm broad at base, densely appressed hairy on the upper surface, ciliate on the edges and on the rounded top, sheath proper 14-25 cm long, oblong-elongated; *imperfect blade* short, triangular, decurrent into short, fringed auricles, upper one 25-35 x 20-25 cm, glabrous, striate, truncate above, ciliate on the edges; lower imperfect blade 15-20 x 7-10 cm, sharp at apex and with recurved margin, hairy below, striate above, rounded at the base, and then again decurrent on the sheath to form a narrow band bearing a few long ciliate hairs; *ligule* 5-8 mm, denticulate. *Leaves* oblong-lanceolate, 9-30 x 2-5 cm, base rounded, tip acuminate, hairy in young stage, both the surface, glabrous in old stage; veins scabrous, secondary veins 7-9 pairs, intermediate 6-7, many pellucid glands which often give the appearance of prominent transverse veinlets are found on the lower surface; *sheath* striate, appressed-white hairy, truncate above with a narrow callus and sometimes furnished with few stiff, wavy deciduous bristles; *ligule* membranous, triangular.

Distribution: Eastern Uttar Pradesh, Bihar, Orissa, plains of West Bengal, Arunachal Pradesh, Assam, Manipur, Meghalaya, Nagaland, Tripura. Nepal, Bangladesh, Annam. Cultivated at Forest Research Institute, Dehradun, Botanic Garden, Calcutta, Kerala, Java, Australia and South Africa.

Bambusa bambos (L.) Voss, Vilm. Blumen gaert (ed.3) 1:1189. 1895. *Bambusa arundinacea* (Retz.) Willd. Sp. Pl. 2:245. 1799; Bedd., Fl. Sylv.t. 321. 1872; Haines, Bot. Bihar & Orissa 3:950 (995). 1924. *Bambos arundinacea* Retz. Obs. Bot. 5:24. 1788; Roxb., Pl. Corom.t. 79. 1798.

Vern. *Kanta bans*

Large densely caespitose thorny bamboo with curving branches from a thick rootstock; culms bright green, shining, up to 24 to 30 m high and 15-18 cm diam. branches from the base, the lower joints giving out long horizontal shoots armed at the 73 nodes with 2-3 recurved thorns and with few *Leaves*; culm-sheaths up to 30-38 x 22-30 cm striate, somewhat rounded at the top and and plaited on the edges, densely yellow-hairy when young otherwise glabrous, blade triangular, up to 10 cm long, sharply pointed, concave with involute margins, greenish yellow when young, glabrous without, densely clothed within with a thick purple or brown or black felt of bristly hairs, the margins decurrent on the sheath, wavy, plaited, long and thickly ciliate, hardly auricled; ligule narrow, entire, or fringed with whitish hairs. *Leaves* linear-lanceolate or linear, 12-20 x 1.2-1.8 (2.5) cm, rounded at the base into a short, 2.5 mm petiole, glabrous above except for long hairs near the base, glabrous or puberulous beneath, scabrous on one or both margins and ciliate towards the base; leaf-sheath striate, glabrous or slightly pubescent, ending in a thick, often ciliate callus and a short auricle furnished with a few stiff, curved, white, deciduous bristles, edges ciliate; ligule short. *Panicle* often occupying the whole plant. *Spikelets* 1.2-2.5 cm long, sessile in close dense clusters along the twigs or 7.5-18 mm in much laxer clusters (var. *spinosa*). *Glumes* 0-2, ovate or ovate-lanceolate, acute or mucronate, many-nerved. *Lemmas* 3-7, lower 2-sexual, upper male with 2-3 uppermost imperfect. Keel of *Palea* ciliate. *Anthers* yellow, obtuse, 5 mm long.



Distribution: Throughout India, except Himalaya and Indo-Gangetic Plain. Myanmar, Sri Lanka; introduced into West Indies.

BOTHRIOCHLOA A.Kuntze

Bothriochloa bladhii (Retz.) S. T. Blake in Proc. Royal Soc. Queensland 80:62.1969; Cope, Fl. W. Pak. 143: 284.1982. *Bothriochloa intermedia* (R. Br.) A. Camus, Ann.Soc. Linn. Lyon n.s. 76:164. 1931; Bor, Grasses Burma Ceyl. Ind. Pak. 108. 1960. *Andropogon bladhii* Retz. in Hook. f., Fl. Brit. Ind. 7: 175. 1896. *Bothriochloa intermedia* (R. Br.) A. Camus in Ann. Soc. Linn. Lyon, 1930, n.s. 76, 164 (1931); *Andropogon intermedius* R. Br., Prod. 202 (1810); *A.intermedius* var. *genuinus* Hackel in DC., Monogr. Phan. 6, 485 (1889); *Amphilophis intermedius* (R. Br.) Stapf in Agric. News, W. Ind. 15, 179 (1916). *Amphilophis glabra* (Roxb.) Stapf in Prain, Fl. Trop. Afr. 9:172.1917; Haines, Bot. Bihar & Orissa 1028.1924.

Perennial. *Culms* tufted with short rhizome, 30-90 mm tall. *Leaves* linear, acuminate, hairy at base, margins scabrid; sheath glabrous; *ligule* a shallow membrane. *Inflorescence* a panicle, hairy, lower branches shorter. *Spikelets* in pairs, sessile and pedicelled; pedicels and rachis joints flattened and longitudinally grooved, long ciliate. *Sessile spikelet* 2-3 mm long; callus short, hairy.



Lower glume 7-nerved, pitted on back, 3.2 mm long. *Upper glume* 3-nerved 3.5 long. *Lower lemma* neuter. *Upper lemma* hyaline, 1-nerved with scaberulous awn, keeled at centre, 1.2 mm plus awn, 1.2 cm long. *Anthers* 2, Yellow, 1.2-1.4 mm long. *Pedicelled spikelet* neuter. *Caryopsis* 1.2 mm long, without callus.

Distribution: Northwest submontane to montane Himalaya and adjacent plains, C. & S. India, Sri Lanka, China, Indomalaysia.

CYMBOPOGON Spreng.

Cymbopogon jwarancusa (Jones) Schult. in Mant. 2:458. 1824; Haines, Bot. Bihar & Orissa 1045.1924; Bor, Grasses Burma Ceyl. Ind. Pak. 128. 1960; Cope, Fl. W. Pak. 143: 328.1982. *Andropogon jwarancusa* Jones in Asiatic Res. 4, 109.1795; Hook. f., Fl. Brit. Ind. 7: 203.1896. *A. himalayensis* Gandoger in Bull. Soc. Bot. Fr. 46, 421 (1899).

Perennial; *Culms* erect or geniculately ascending, up to 150 cm high. *Leaf-blades* up to 30 cm long and 5 mm wide, whitish, narrowed at the base, attenuate to a filiform tip; basal sheaths glabrous, flat or coiled; *ligule* 0.5-4 mm long. False reddish, 1.5-40 cm long, erect; spatheoles lanceolate to narrowly elliptic, becoming reddish, 1.5-2.5 cm long. *Racemes* 13-22 mm long, lowest pedicel not swollen; internodes and pedicels densely ciliate along the margins and on the back. *Sessile spikelet* lanceolate, 4.5-5.5 mm long; *lower glume* shallowly concave on the back; *upper lemma* deeply bifid, with an *awn* 7-10 mm long.



Distribution: Submontane and montane of Northwest Himalaya and adjacent plains, S. Tibet and N. Africa.

CYNODON Rich.

Cynodon dactylon (L.) Pers., Syn. Pl. 1:85. 1805; Hook. f., Fl. Brit. Ind. 7:288. 1896; Haines, Bot. Bihar & Orissa 966. 1924; Bor, Grasses Burma Ceyl. Ind. Pak. 469. 1960. *Panicum dactylon* L., Sp. Pl. ed. 1, 58.1753.

A perennial grass. *Culms* slender, decumbent-ascending, widely creeping and rooting at nodes at base. *Leaves* 4-10 x 0.2-0.4 cm, linear-subulate, acuminate, flat, scaberulous on upper surface and margins, glaucous; sheaths compressed, glabrous except hairy throat; *ligule* a 3 mm long, ciliate, scarious, erose rim. *Inflorescence* of 2-6, 1.8-4 cm long, green or



purplish green spikelets 2-2.4 mm long, narrowly ovate, sessile, imbricate in two rows on one side of slender, scaberulous rachis and appressed to it. *Rachilla* produced as a minute bristle. *Glumes* subequal, shorter than lemma, lanceolate, 1-nerved, keeled; lower glume 1.2 mm long, acute; upper glume 1.3 mm long. *Lemma* 2 mm long, boat shaped, subacute, bidentate, 3-nerved, silky pubescent on keel. *Palea* nearly as long as lemma, linear-oblong, obtuse, 2-nerved, scaberulous on keel. *Lodicules* 2. *Grains* ellipsoid, usually turgid or scarcely laterally compressed.

Distribution: Throughout India. Tropical and warm temperate regions of the World.

CYRTOCOCCUM Stapf

Cyrtococcum patens (L.) A. Camus, Bull. Mus. Hist. Nat. (Paris) 27:118.1921; Mooney, Suppl. Bot. Bihar & Orissa 175.1950; Bor, Grass. Burma Ceylon India Pakistan 292. 1960. *Panicum patens* L., Sp. Pl. 58.1753; Hook.f. in Hook.f., Fl. Brit. India 7:57. 1896, pro parte. *Cyrtococcum radicans* (Retz.) Stapf in Hook. Icon. Pl. sub.t. 3096. 1922. *Panicum radicans* Retz. Obs. Bot. 4:18. 1786.

Culms slender, erect, 20-45 cm, from a creeping, much branched rooting base; nodes glabrous. *Leaves* ovate to linear-lanceolate, 2.5-12.5 x 0.6-1.2 cm, finely acuminate, thin, ciliate below, with tubercle-based hairs; sheath-margin and mouth ciliate; ligule rounded. *Panicle* 5-10 cm long, with spreading, glabrous or puberulous branches, naked below; rachis, branches and pedicels capillary; pedicels longer than the spikelets. *Spikelets* almost round, green, reddish or brown, 1.8-2.5 mm long. *Glumes* herbaceous, membranous; lower glume 0.5-1.2 mm long, one-third to two-third, the lemma, cordate, ovate, obtuse (or acute), 3-5-nerved; upper glume 0.75-1.5 mm long, helmet-shaped, elliptic-oblong, 3-nerved, glabrous or ciliate at apex; palea short. *Upper floret* bisexual. *Lemma* 1.8 mm long, coriaceous, cartilaginous, whitish, cordate, semi rounded, acute, mucronulate, subcompressed, finely punctuate, scarcely 3-nerved; palea 1.8 mm long, 2-nerved, mucronulate. *Lodicules* quadrangular, shorter than the ovary. *Caryopsis* obovoid, small.

Distribution: Throughout India upto 900 m. S.E. Asia.



DACTYLOCTENIUM Willd.

Dactyloctenium aegyptium (L.) Willd., Enum. Hort. Berol. 1029. 1809; Bor, Grasses Burma Ceyl. Ind. Pak. 489. 1960. *Eleusine aegyptiaca* (L.) Desf. Fl. Atlant. 1: 85.1798; Hook. f., Fl. Brit. Ind. 7: 296.1896; Haines, Bot. Bihar & Orissa 970. 1924.

An annual grass. *Culms* 20-70 cm high, erect, geniculately ascending or prostrate, branching at thickened nodes. *Leaves* linear, acute 2.5-20 cm long



2.5 mm wide, flat, distichous, linear, acute or acuminate, scabrid on margins; sheaths compressed, glabrous; *ligule* a ciliate rim. *Spikes* 1.5-4.5 cm long, 2-6, digitately spreading, grayish-green, densely covered with spikelets to the base. *Spikelets* 3-3.5 mm long, disposed off at right angles to the rachis. *Glumes* subequal, broadly ovate; lower 1.9 mm long, long-cuspidate; upper 2 mm long, obliquely cuspidate, subcoriaceous with 1.5-2 mm long awn. *Lemma* 3-3.5 mm long, broadly ovate, mucronate. *Palea* broad, 2-keeled, ciliate on keels. Lodicules 2. *Anthers* 0.5 mm long. *Grains* 0.8 mm long, obovoid-globose, rugose.

Distribution: Throughout India at lower elevations. Widely distributed in tropical and warm temperate region of the Old World; introduced in America.

DENDROCALAMUS Nees

Dendrocalamus strictus (Roxb.) Nees in Linnaea 9:476. 1834; Munro in Trans. Linn. Soc. London 26(1):147. 1868; Hook.f., Fl. Brit. India 7:404. 1896; Haines, Bot. Bihar & Orissa 609.1924 *Bambusa stricta* Roxb., Pl. Corom 1:58. t. 80. 1798.

Vern. *Bans*

A deciduous densely tufted bamboo. *Culms* 6-15 m tall, 2.5-7 cm in diameter, hollow in wet, solid in dry climates, glaucous green when young, dull-green or yellowish when old; *nodes* somewhat swollen; *internodes* 30-40 cm long. *Branches* from base to mid culm; branch buds oval, tip raised like a horn. *Culm sheaths* variable, deciduous at the time of branch emergence, 7.5-30 x 10-17 cm, covered on the back with golden brown-stiff hairs, sometimes glabrous in dry climate, striate, rounded at the top, ciliate at the margins, slightly auricled; *imperfect blade* conical, 3.5-6.5 cm long, hairy; *ligule* narrow, sometimes ciliate. *Leaves* linear-lanceolate, 2.5-25 x 1.5-3 cm, rounded at the base into a short petiole, terminating above in a sharply acuminate, twisted tip, upper surface rough of often hairy, lower surface softly hairy, margins scabrous; *sheath* striate, hairy, ending in a prominent callus or short auricles with a few, wavy, deciduous cilia; *ligule* narrow, serrate.



Distribution: Throughout India. In North East India it is generally cultivated. Nepal, Bangladesh, Myanmar, Sri Lanka.

DESMOSTACHYA (Stapf) Stapf

Desmostachya bipinnata (L.) Stapf in Thiselt.-Dyer, Fl. Cap. 7:632. 1900; Bor. Grass, Burma, Ceylon, India. Pakistan 104. 1960. *Briza bipinnata* L., Syst. Nat. ed. 10, 2, 875 (1759). *Eragrostis cynosuroides* (Retz.) Beauv. Hook.f., Fl. Brit. Ind. 7: 324. 1896. *D. cynosuroides* Stapf ex Haines, Bot. Bihar & Orissa 2:962. 1924.

A perennial grass with a stout underground rhizomatous stem. *Culms* upto 1 m high, tufted, branching from the base, smooth, leafy; stolons



stout, covered with shining sheaths. *Leaves* linear-lanceolate, acuminate, tapering to a filiform tip, 15-40 cm long, by 4-10 mm wide, rigid, flat, margins scarcely thickened, hispid towards the base; sheaths leathery, glabrous, hairy at the mouth; ligule a ciliolate ridge. *Inflorescence* coarse panicle, 15-45 cm long, 1.3-3.8 cm broad, narrowly pyramidal or columnar often interrupted, common axis puberulous; branches many, short, about 2 cm long, crowded from the base with sessile imbricating spikelets; branchlets rigid, spreading, glabrous or hispidulous. *Spikelets* sessile, second, 2-striate and crowded, deflexed, pale-brown, rather shining, 13 mm long, upto 30-flowered; rhachilla tough, internode very short. *Glumes* very unequal; *Glume* I 0.5 mm long; *Glume* II 1.6 mm, obtuse. *Lemmas* 1.6-2 mm long, ovate, acute, coriaceous; *palea* shorter than its *lemma*, subcoriaceous with minutely scabrid keels. *Stamens* 3; *anthers* .8 mm long. *Caryopsis* .5-.6 mm long, obliquely ovoid, laterally compressed, obscurely trigonous.

Distribution: Throughout India, Persia, Arabia, North Africa to tropical Africa.

DICHANTHIUM Willemet

Dichanthium annulatum (Forssk.) Stapf in Praia, Fl. Trop. Afr. 9:178. 1917; Haines, Bot. Bihar & Orissa 1039. 1924; Bor, Grasses Burma Ceyl. Ind. Pak. 133. 1960. *Andropogon annulatus* Forssk., Aegypt.-Arab. 173.1775; Hook.f., Fl. Brit. India 7:196. 1896. *A.comosus* Link, Hort. Berol. 1, 239.1827. *A.garipensis* Steud., Syn. Pl. Glum. 1, 379.1854. *A.ischaemum* Roxb. ex Wight, Cat. (1834) nomen. *A.obtusum* Nees in Hook. et Arn., Bot. Beech. Voy. 243.1838. *A.scandens* Roxb., Fl. Ind. 1, 262.1820. *Lepeocercis annulata* (Forssk.) Nees, Fl. Afr. Austr. 98 (1841).

Perennial. *Culms* 20-80 m tall, decumbent- ascending, rooting at nodes; nodes purple-tinged. *Leaves* 10-40 x 0.3-1.2 cm, linear acuminate, margins scabrid; sheaths flattened, keeled; *ligule* 4-9 mm long, acute, membranous, torn. *Panicle* 4-20 cm long, branches close, together & spikelet like. *Sessile spikelets* 3-4 mm long, oblong truncate. *Lower glume* truncate, 5-nerved, 2-keeled, villous in the middle. *Upper glume* 3-5 mm long, 3-nerved, acute or obtuse, multicous, glabrous. *Lower lemma* \pm 3 mm long, linear-oblong, empty. *Upper lemma* 3-3.5 mm long, hermaphrodite, awned; callus bearded. *Pedicelled spikelets* oblanceolate-spathulate. *Upper lemma* multicous. *Grain* oblong, 3-sided, grooved, loosely enclosed within the persistent glumes.



Distribution: Wildspread in India and Myanmar, tropical and North Africa.

DIGITARIA Hall.

Digitaria stricta Roth. ex Roem et. Schult Syst. Veg. 2:474. 1817; Bor, Grasses Burma, Ceylon, India and Pak. 306. 1960; Cope in Nasir and Ali, Fl. Pak. 143:222. 1982. *Paspalum royleanum* Nees ex Thw., Enum. Plant. Zeyl. 358 (1864) nomen et in Hook. f., Fl. Brit. Ind. 7, 18 (1896) descr. *Agrostis pilosa* Retz., Obs. Bot. 6, 22.1791. *D. puberula* Link, Hort. Berol. 1, 223.1827. *D. denudata* Link, loc. cit. 222; *Setaria stricta* Kunth, Rev. Gram. 1, 47.1829. *Panicum denudatum* (Link) Kunth, loc. cit. 32. *Digitaria royleana* (Nees) Prain, Beng. Plants, 1182.1903; Haines, Bot. Bihar & Orissa 1008.1924. *Syntherisma royleana* (Nees) Newbold in Torreyia 24, 9.1924. *Panicum pseudosetaria* Steud., Syn. Pl. Glum. 1, 39 (1854).

An annual grass, often delicate. *Culms* 12-45 cm high, erect, tufted, simple or branched below. Terete, striate, smooth and glabrous, very slender to almost robust, glabrous at the nodes. *Leaves* 1.5-5 mm broad, linear, long, acute, scabrid on margins and both surfaces but more so towards apex; sheaths glabrous or hairy on throat; *ligule* 1 mm long, membranous, lacerate at apex. *Inflorescence* of 2-8, 4-10 cm long, subdigitate racemes or racemes arranged on a very short axis, racemes straight up to 18 cm long, erect at the first then spreadin and nodding; rachis 3 mm broad, flat, winged, scabrid on wings, carrying spikelets in threes on the central angle; pedicels scabrid, slightly dilated at the tip. *Spikelets* 1-2 mm long, elliptic-obtuse, obovate-elliptic-obtuse or oblong-obtuse. *Glume I* absent, *gl. II* absent or varying from a minute with clavate hairs. *Lower lemma* empty; shape and size of the spikelets. *Palea* not seen. *Upper lemma* hermaphrodite, chartaceous elliptic or oblong in shape, acute or apiculate, turning almost back or purple at maturity; *palea* same colour and texture; *stamens* 3; *anthers* 0.3 mm long; *styles* 2; *stigmas* plumose.

Distribution: Kashmir to Manipur, S.India; Sri Lanka and tropical Asia.

ECHINOCHLOA Beauv

Echinochloa colona (L.) Link., Enum. Hort. Berol. 2: 209. 1833; Haines, Bot. Bihar & Orissa 997.1924; Cope, Fl. W. Pak. 143: 196.1982. *Echinochloa colonum* (L.) Link, Hort. Berol. 2: 209. 1833; Bor, Grasses Burma, Ceylon, India and Pak. 308. 1960. *Panicum colonum* L., Syst. Nat. ed. 10, 2, 870.1759; Collett. Fl. Sim., 582, 1921. *Milium colonum* (L.) Moench, Method. Pl. 202.1794. *Oplismenus colonum* (L.) H.B.K., Nov. Gen. et Sp. 1, 108.1816. *Panicum zonale* Guss., Fl. Sic. Prodr. 1, 82.1827. *P. incertum* Bosc ex Steud., Nom. Bot. ed. 2, 2, 258 (1841) nomen. *Oplismenus repens* J.S. Presl. ex C. B. Presl., Rel. Haenk. 1, 321.1830. *Echinochloa zonalis* (Guss.) Parl., Fl. Panorm. 1, 119.1845. *Panicum prorepens* Steud., Syn. Pl. Glum. 1, 46.1854. *Echinochloa crusgalli* Subsp. *colonus* Honda in Bot. Mag. Tokyo 37, 122.1923. *Panicum crusgalli* subsp. *colonus* Makino et Nemoto, Fl. Jap. 1470 (1925).

An annual, growing in small tufts upto 60 cm high. *Culms* slender, erect or geniculately ascending, branched mostly in the lower part only, glabrous or smooth. Nodes glabrous. *Leaves* glabrous rarely with some minute hairs on the blades, linear from a scarcely contracted base, tapering to a slender acute point, flat, glabrous, flaccid; sheaths compressed. *Inflorescence* of an erect panicle, 5-12.5 cm long, very narrow; branches from 6 to many, solitary rarely 2-nate, erect and often appressed to the axis, or sometimes obliquely spreading, rather distant on the rhachis, lower 2.5-3.1 cm long, upper decreasing gradually in length, forming dense simple, moderately stout, sub-secund, sessile false spikes; pedicels 2-nate or fascicled lower down, very short, scaberulous, tips sub-discoid. *Spikelets*



crowded, usually approximately 4-ranked, ovate to ovate-elliptic in outline, acute or cuspidate, 3.1-3.7 mm long. *Glume* I membranous, very broadly ovate and clasping at the base acute to cupidate 1.25 mm long, scaberulous; *gl.* II sub-herbaceous, membranous, elliptic ovate in outline, very concave, acute or cuspidate, 5-7-nerved, minutely pubescent between the scaberulous nerves. *Lower lemma* male, similar to the *gl.* II but flat or depressed on the back; *palea* oblong, acute, almost as long as the lemma, keels scaberulous upwards; *upper lemma* hermaphrodite elliptic-ovate or sub-ovate, cuspidate, from less than 2.5 mm to over 2.5 mm long, yellowish or whitish, polished, subcoriaceous. *Anthers* 9 mm long. *Grain*, broadly elliptic in outline, plano-convex, 1.9 mm long.

Distribution: Widely spread in tropical Asia and Africa.

Echinochloa stagnina (Retz.) P. Beauv. in Ess. Agrost. 53, 161, 171. 1812; Bor, Grasses Burma Ceyl. Ind. Pak. 311.1960; Cope in Nasir and Ali, Fl. Pak. 198. 1982. *Panicum stagninum* Retz., Obs. Bot. 5:17. 1789.

Aquatic perennial, sometimes behaving as an annual or a biennial; *culms* spongy, 40-150 cm high, decumbent and rooting at the nodes. *Leaf-blades* 8-50 cm long, 6-10 mm wide; *ligule* a line of hairs; sheaths glabrous. *Inflorescence* narrowly lanceolate, rarely narrowly ovate, 7-20 cm long, typically \pm open with the racemes secund and usually ascending; *racemes* simple, 2-6.5 cm long, coarsely spiculate. *Spikelets* ovate to broadly ovate or rounded, 3.5-5 mm long, pubescent to hispid, often from tubercles; *lower lemma* tapering to an awn up to 10 mm long; *upper lemma* 34 mm long.



Distribution: More or less throughout India. Tropical Asia and Africa.

ERAGROSTIS Wolf

Eragrostis tenella (L.) P. Beauv. ex Roem. & Schult., Syst. Veg. 2:576. 1817; Hook.f., Fl. Brit. Ind. 7:315. 1896; Haines, Bot. Bihar & Orissa 956. 1924; Bor, Grasses Burma Ceyl. Ind. Pak. 513. 1960. *Poa tenella* L., Sp. Pl. ed. 1, 69, 1753. *Eragrostis tenella* var. *plumosa* Hook.f., Fl. Brit. Ind. 7, 315 (1896). *Eragrostis amabilis* (L.) Wight et Arn. ex Hook. et Arn., Bot. Beechey Voy. 251 (1838).

Annual. Culms 10-50 cm high, erect or geniculately ascending, loosely tufted. Leaves 3-12 x 0.2-0.4 cm, linear, flat, tapering to a fine point, glabrous; sheaths usually glabrous, sometimes hairy, ligule a short scarious rim. Panicles 3-12 x 1.3-3.5 cm, oblong or ovate, contracted or loose and open, green or purplish; branches 0.5-4 cm long, more or less spreading. Spikelets 3-9-flowered, 1-3 x 0.9-1.8 mm, ovate-oblong. Pedicels 0.5-2 mm long, scabrid. Glumes subequal, lanceolate, subacute, 1-nerved; lower 0.8-1 mm long, upper 1-1.2 mm long. Lemmas 1-1.1 mm long, ovate-oblong, obtuse, scabrid on keel, membranous. Paleas 0.9-1 mm long, oblong-ovate. Anthers 0.2 mm long. Grains oblanceolate-oblong.



Distribution: Widely distributed in India. Widely spread in the tropics of the old World; introduced into America.

HYGRORYZA Nees

Hygroryza aristata (Retz.) Nees ex Wt. & Arn. in Edinb. New Phil. J. 15:380, 1833; Hook.f., Fl. Brit. India 7.95.1896; Haines, Bot. Bihar & Orissa 981. 1924. *Pharus aristatus* Retz. Obs. Bot. 5:23, 1789.

The floating culms measure 30 cm or more and the erect branches are 5-20 cm high. Leaves are subcoriaceous, ovate to narrowly ovate-oblong, base cordate, with inflated sheaths, 2.5-7.8 cm long and 0.5-1.7 cm wide. Panicles are 2.5-5 cm long with few hermaphrodite, long-pedicelled spikelets. Glumes are absent and there is a single floret. Lemma is narrowly lanceolate, 0.6-0.7 mm long, strongly 5-nerved and awned which in turn is 0.7-1.4 cm long and scabrid.



Distribution: Common along shallow ponds and ditches. India, Sri Lanka, Myanmar.

IMPERATA Cyrillo

Imperata cylindrica (L.) Raeusch., Nom. Bot. ed. 3. 10. 1797; Hook. f., Fl. Brit. Ind. 7: 106.1896; Bor, Grasses Burma Ceyl. Ind. Pak. 169.1960. *Lagurus cylindricus* L., Syst. Nat. ed. 10, 878.1759. *Saccharum cylindricus* L., Syst. Nat. ed. 10, 878.1759; *S. laguroides* Pourr. in Mem. Acad. Toulouse 3, 326.1788; *Imperata arundinacea* Cyr., Pl. Rar. Neap. 2, 26.1792; Haines, Bot. Bihar & Orissa 1015. 1924. *Calamagrostis lagurus* Koel., Descr. Gram. 112 (1802).

Perennial, Rhizome scaly. *Culms* 30-70 cm tall, erect, unbranched; nodes bearded. *Leaf blade* 3-4 cm long, linear, scabrid at base, sheath glabrous; *ligule* a scarious, erose rim. *Panicle* 4-6 cm long, cylindric, pedicel 1.5 – 2 mm long. *Spikelets* 2.5 – 6 mm long lanceolate to oblong, terete enuveloped in long silky hairs from callus and glumes; *glumes* 2.5- 2.7 cm long, lanceolate, acuminate, hairy on back, membranous. *Lower lemma* ovate, toothed, hyaline, nerveless, bisexual. *Lower palea* linear, retuse. *Lemma* lanceolate to oblong, shorter than spikelets, hyaline, awnless. Callus bearded with soft, white, silky hairs. *Anthers* 1-1.3 mm long. *Style* \pm 2 mm long, hairy, 2- branched; stigmas purple, hairy.

Distribution: Mediterranean region, extending Iran, Iraq, Afghanistan, USSR.



MNESITHEA Kunth

Mnesithea granularis (L.) Koning & Sosef in Blumea 31:295. 1986. *Hackelochloa granularis* (L.) O. Ktze. in Rev. gen. Pl. 2:776. 1891; Hook. f., Fl. Brit. Ind. 7: 159.1896; Bor, Grasses Burma Ceyl. Ind. Pak. 159.1960; Cope, Fl. W. Pak. 143: 345.1982. *Manisuris granularis* L., f., Nov. Gram, Gen. 40.1779; Haines, Bot. Bihar & Orissa 1057.1924. *Cenchrus granularis* L., Mant. 2, App. 575.1771; *M. polystachya* P. Beauv., Fl. Owar. et. Benin 1, 24 (1805), t. 14; *Ryttilix granularis* Skeels, U.S. Dept. Agr. Bur. Pl. Indus. 282, 20 (1913).

Annual, *Culms* 60-90 cm tall, erect, hirsute with tubercle based hairs. *Leaves* 5-10 cm long, hirsute with cordate base; sheath loose, hispid; *ligule* membranous, tip hairy. *Inflorescence* a terminal, axillary racemes; peduncle 1.5- 2.0 cm long; joints flattened, fused with pedicels. *Sessile spikelet* globose, \pm 1.3 mm long. *Lower glume* rounded-orbicular, pitted and tubercled. *Upper glume* 1.0-1.2 mm long, obtuse, membranous. *Lower lemma* empty, 1 mm long. *Caryopsis* \pm 0.5 mm long, ovoid, shining.

Distribution: Throughout the warmer parts of India.



OPLISMENUS P.Beauv.

Oplismenus burmannii (Retz.) P. Beauv. in Ess. Agrost. 54, 168, 169. 1812; Hook. f., Fl. Brit. Ind. 7: 68. 1896; Haines, Bot. Bihar & Orissa 999. 1924; Bor, Grasses Burma, Ceylon, India and Pak. 315. 1960. *P. burmannii* Retz., Obs. Bot. 3, 10.1783.

Annual. *Culms* slender, creeping stoloniferous, erect portions 10-30 cm. tall; leaf-sheaths up to 1.5 cm. long, usually loose, soft-hairy especially on the margins; blades narrowly lanceolate-acuminate, up to 4 cm. long by 7 mm. wide, narrowed to an asymmetric base, apex acuminate, soft-hairy and often with stiff bulbous based hairs up to 2 mm. long, margin scaberulous and often undulate; *ligule* a membrane 1 mm. deep with stiff marginal hairs. *Inflorescence* of 3-4-5 one sided racemes alternately on the axis, to 10 cm. long, racemes 1.0 to 1.5 cm. long, spike like, with the *spikelets* arranged in pairs on either side of the midrib of a flattened rachis, furnished especially on the back with stiff bulbous-based hairs; spikelets often dark tipped, 2.4 mm. long, awned from the glumes; *lower glume* 1.4 mm. with stiff hairs on the back, with an awn 2.4 mm. hyaline, 3-nerved, lanceolate, notched at the tip; *upper glume* similar, broader, 7-nerved, 1.6 mm. long plus awn 2.6 mm.; *lower lemma* boat shaped, 7-nerved, the upper half stiff hairy on the back and margin, notched with a small awn, all awns scaberulous, 2.3 mm. long plus awn 0.2 mm., palea nil.; *upper lemma* of different texture though scarcely indurated, boat-shaped and very pointed, nerves 3, obscure, smooth, 1.8 mm. long; *palea* similar in texture, 2-nerved, the margins inrolled, 1.7 mm. long; grain tightly enclosed by lemma and palea, oblong, hilum to half length of grain.



Distribution: Widespread in the tropics of both hemispheres.

Oplismenus compositus (L.) P. Beauv., Ess. Agrost. 54, ?168, ?169. 1812. Hook. f., Fl. Brit. Ind. 7:66. 1896; Haines, Bot. Bihar & Orissa 999. 1924; Bor, Grasses Burma Ceyl. Ind. Pak. 317. 1960. *Panicum compositum* L., Sp. Pl. ed. 1, 57.1753.

Vern. *Basarighas*

A perennial grass. *Culms* slender, upto 0.2-1.5 m long, base decumbent, rooting, terete, nodes many, glabrous or frequently hairy along a line adaxial to the supporting leaf. *Leaves* 3-12 x 0.8-2.5 cm, narrowly lanceolate to ovate-lanceolate, thin, flat, thin flaccid or rigid, green, hairy below, sometimes sparsely hairy above; sheaths striate, densely ciliate along the margin; nodes pubescent, elsewhere glabrous; *ligule* a line of hairs. *Panicle* upto 18 cm long; rachis trigonous, glabrous or hairy all over, racemes second or subsecund, very short and stout, tip



truncate with a few bristles. *Spikelets* lanceolate or lanceolate-oblong, acuminate, 3.8-5 mm long, greenish, tips purple or tinged with red. *Glumes* subequal, 3.1 mm long, thinly herbaceous, lanceolate to lanceolate-oblong, prolonged into slender filiform, more or less viscous purple awns, sparingly hairy, rarely quite glabrous. *Glume I* 5-nerved, awn upto 13 mm long; *gl. II* 7-9-nerved, awn 2.5-3 mm long; *Lower lemma* equaling the spikelet, similar to the Inflorescence 10-25 cm. long, racemes 2.5-7.5 cm long, rachis glabrous, spikelet pairs distant. Spikelets 2.5-4 mm long, glabrous. *Glumes* with smooth viscid awns 0.4-1 cm long. *Stamens* 3, *styles* 2, free to the base. *Grain* free within the hardened glume and pale.

Distribution: Throughout India. Tropical regions of the Old and new Worlds.

ORYZA L.

Oryza rufipogon Griff., Not.Pl. Asiat. 3:5.1851; Bor, Grass. Burma Ceylon India Pakistan 605.1960; Duist. in Blumea 32:170.1987. *O.sativa* sensu Hook.f., Fl. Brit. India 7:92.1896, pro parte; non L. 1753. *O.fatua* Koenig ex Trin., Mem. Acad.St.-Petersbourg 5:177.1839. *O.sativa* L. var. *fatua* Prain, Beng. Pl. 1184. 1903.

Perennial, tufted grass; culms white or purplish, erect or ascending, 60-90 cm, usually rooting in the basal part, glabrous, smooth; internodes strongly ribbed; nodes glabrous; lower sheaths slightly inflated, the upper ones tight, auricles sometimes present. *Leaves* linear, 20-60 x 0.7-1.8 (-2.5) cm, glabrous, smooth on both sides, margins scabrous, midrib below protruding, transverse veinlets 0; ligule triangular to narrowly triangular 8-15 mm long, glabrous. *Panicles* loosely contracted, 12-30 cm long; peduncle and axis terete, ribbed, smooth, scabrous upwards; branches ascendingly patent to erect, glabrous, 1-9-spikelet; pedicels clavate, glabrous or minutely pubescent. *Spikelets* caducuous, oblong, 7.5-10 mm long. *Glumes* ca. 0.3 mm long. *Sterile* lemmas lanceolate to linear lanceolate, 1.25-3 (-7.5) mm long, margin serrate upwards, apex acute to finely acuminate, glabrous or hairy on the midrib and margins. *Fertile* lemma obovate-lanceolate to lanceolate, 7-9 mm long, margins curled inwards, apex acuminate, slightly sulcate, finely reticulate, covered with glassy hairs, bony, sometimes purplish at the apex; awn very variable, 1.5-8 cm, antrorsely scaberulous, stout callose at base. *Palea* as the lemma, margin narrowly scarious, not incurved, not sulcate; awn 0.3-2.3 mm long. *Lodicules* obovate to obovate-lanceolate, oblong, truncate. *Anthers* (3.5-) 4-6.2 mm long. *Stigmas* blackish purple or brown. *Caryopsis* oblong, lanceolate to obovate-lanceolate, cylindrical, 5-7 mm long, red-brown.

Distribution: Eastern India; Maharasthra; Uttar Pradesh; Madras. Bangladesh, Myanmar, Thailand, Cambodia, S.Vietnam, China, Taiwan, Malesia, Australia, S.America.



PANICUM L.

Panicum repens L., Sp. Pl. ed. 2, 87 (1762); Haines, Bot. Bihar & Orissa 994.1924; Bor, Grasses Burma Ceyl. Ind. Pak. 330(1960). *P.ischaemoides* Retz., Obs. Bot. 4, 17(1786). *P.arenarium* Brot., Fl. Lusit.1, 82(1804). *P.leiogonum* Delile, Fl. Aegypt. III.51 (1812). *P.convolutum* P.Beauv. ex Spreng., Syst. Veg.1, 319 (1825).

A Perennial with creeping, stoloniferous rootstock and culms upto 1 m tall. *Leaf-blades* linear-lanceolate, acuminate, upto 25 cm long. *Leaf-sheaths* glabrous, striate. *Ligule* a coriaceous ridge. *Inflorescence* an erect, contracted, irregularly branched panicle, upto 30 cm long. *Spikelets* ovate-lanceolate, acute, glabrous 3 mm long, solitary or in pairs. *Lower glume* orbicular, 5-7 mm long, nerveless or 3-nerved. *Upper glume* ovate, acute, 5-7-nerved, sometimes 9-nerved. *Lower floret* male or neuter, its lemma ovate, acute, convex 7-9-nerved. *Palea* short, ovate, thin. *Upper floret* hermaphrodite, its lemma ovate-oblong, acute, 7-nerved. *Palea* as long as lemma.

Distribution: Tropic and sub-tropic of both hemispheres.



PASPALIDIUM Stapf

Paspalidium flavidum (Retz.) A. Camusin, Lecomte, Fl. Gen. Indo-Chine. 7:419. 1922; Bor, Grasses Burma, Ceylon, India and Pak. 333.1960; Cope, Fl. W. Pak. 143: 190.1982; Haines, Bot. Bihar & Orissa 1001.1924. *Panicum flavidum* Retz., Obs. Bot. 4, 15.1786. *P. floridum* Royle, Ill. Bot. Himal. 420.1840; *P. granulare* Lamk., Tab. Encycl. Meth. Bot. 1, 170.1791.

Annual-perennial. *Culms* 0.1-1 m high, erect or ascending from a short decumbent base, glabrous. *Nodes* glabrous. *Leaves* 8.5-25 x 0.45-1.2 cm linear-lanceolate, flat or folded, somewhat contracted at base, obtuse-acute at apex, somewhat rigid, obscurely scaberulous on margins; sheaths compressed, hairy on throat; *ligule* a ciliate rim. *Inflorescence* 10-35 cm long; of 5-9, 1.2-2.2 cm long, sessile, erect or falcoform racemes distanced by 2-4 times their own length, spaced along common axis and nearly appressed to shallow hollow in it. *Rachis* narrowly winged, glabrous or minutely ciliate. *Spikelets* 2.4-3 mm long, pale greenish. *Lower glume* 1-1.4 mm long, suborbicular-truncate, 5-nerved, membranous. *Upper glume* 1.5-2.5 mm long, rounded-ovate, membranous. *Lower lemma* 2.5 mm long, ovate, subacute, 5-nerved, subcoriaceous. *Lower palea* ovate-oblong, membranous. *Upper lemma* 2.5 mm long, broadly ovate, acute, mucronate. *Palea* ovate-oblong, coriaceous. *Lodicules* quadrangular. *Grains* elliptic.



Distribution: Almost throughout India, tropical Asia and Africa.

PASPALUM L.

Paspalum scorbiculatum L., Mant. Pl. 1: 29.1767; Haines, Bot. Bihar & Orissa 1000. 1924; Bor, Grasses Burma, Ceylon, India and Pak. 340.1960. *P. kora* Willd., Sp. Pl. 1, 332.1798.

Culms tufted, erect or nearly so, sometimes basally prostrate and rooting at the lower nodes, but never long-creeping, erect shoots 20-100 cm. tall. Leaf-sheaths to 5 cm. long, lowest ones hairy, upper ones hairy near the base of the blade, hairs fine, white to 3 mm. long; blade 6-18 cm. long by 5-15 mm. wide, erect, long acuminate, glabrous except near the base, margin rough or with very short close stiff hairs; *ligule* glabrous, 1 mm. deep. *Inflorescence* of 2-12 racemes, fairly closely spaced together; racemes 2.5-9 cm. long with a flattened rachis 2-2.5 mm. wide bearing 1 or 2 rows of spikelets on either side of the median ridge; *Spikelets* very slightly overlapping, 2 mm. long, elliptic, ovate or nearly round, on broad flattened pedicels; *lower glume* absent; *upper glume* thin, the shape of the spikelet, glabrous or very shortly hairy, 3-5 nerved; *lower lemma* similar to the upper glume; upper floret hermaphrodite, lemma nearly round with slightly inflexed edges folding over the edges of the palea, olivaceous, stiff, shining, palea similar; stigmata purple or white; *anthers* cream coloured.



Distribution: Almost throughout India; pantropical.

PEROTIS Ait.

Perotis indica (L.) O. Ktze. in Revis. Gen. Pl. 2: 787. 1891; Hook. f., Fl. Brit. Ind. 7: 98. 1896; Bor Grass. Burma, Ceylon, India, Pakistan 611. 1960; Cope, Fl. W. Pak. 143: 148.1982. *Anthoxanthus indicum* L., Sp. Fl. ed. 1, 28 (1753). *Perotis latifolia* Ait., Hert. Kew. 1: 85. 1789; Hook.f., Fl. Brit. India 7:98. 1896; Haines, Bot. Bihar & Orissa 978.1924.

A tufted annual or sometimes perennial grass. *Culms* upto 45 cm tall erect from a geniculate base smooth and glabrous. *Leaves* flat, ovate or lanceolate, base cordate, tapering to an acute tip, surface smooth and glabrous, margins spinulose, 1-2.5 cm long, 4 mm to 1 cm broad. *Sheaths* short, loose, striate, smooth and glabrous, margins scarious. *Ligule* a very minute, membranous, ridge, upper margins erose or ciliate. *Inflorescence*, cylindrical, spike-like terminal; rachis simple, scabrid. *Spikelets*, shortly pedicelled, 2.5-4 mm long; callus conical. *Glumes* subequal,



2.5-4 mm long, linear, narrow scabrid or hispid, tapering into a scabrid, purple awn upto 1.5 cm long. *Lemma* hyaline. *Stamens* 3. *Styles* 2. *Lodicules* 2. *Caryopsis* linear, terete, nearly as long as the glumes and free within them.

Distribution: North west India ascending 800 m, Southeast Asia, China.

PENNISETUM Rich.ex Pers.

Pennisetum glaucum (L.) R. Br., Prodr. 1:195. 1810. Stuntz in U.S. Dept. Agric., Bur. Pl. Ind., Inv. 31:84. 1914. *Panicum glaucum* L., Sp. Pl. 1:56. 1753; *Setaria glauca* (L.) P. Beauv., Ess. Agrost. 51, 178. 1812; Haines, Bot. Bihar & Orissa 988. 1922.

An annual grass. *Culms* loosely tufted 25-100 cm. tall; leaf-sheaths 3-8 cm. long, glabrous; blades flaccid up to 12 x 0.4 cm. tall; *ligule* a shallow membrane topped with stiff bristles about 1.5 mm. long. *Inflorescence* a spike with a hairy axis bearing successive short clusters of 2-3 spikelets 2.4 mm. long; *lower glume* hyaline, 1-(3) nerved, acute, 1.4 mm. long; *upper glume* 5-nerved, the nerves anastomosing towards the tip, hyaline, 1.6 mm. long, ovate-acute; lower floret male or neuter, *lemma* hyaline, ovate-acute, 5-nerved, the nerves anastomosing 2.3 mm. long; *palea* 2-nerved, hyaline, 2 mm. long, minutely scaberulous on back of nerves; *stamens* 3, *anthers* 0.6 mm. long; upper floret, lemma boat-shaped, pointed, indurated, transversely rugose on the back, 2.2 cm. long; *palea* 1.8 mm., similarly indurated, pointed, with two flanges on the lower one third clasping the grain; *stamens* 3, *anthers* 0.8 mm. long; *stigmata* 2, white; grain dark, hilum punctiform, 1.4 mm. long.



Distribution: Throughout India.

PHRAGMITES Trin.

Phragmites karka (Retz.) Trin. ex Steud. Nom. Bot., ed. 2, 2:324. 1841; Hook. f., Fl. Brit. Ind. 6:304. 1896; Haines, Bot. Bihar & Orissa 952. 1924; Bor, Grass Burma, Ceylon, India, Pakistan 416. 1960; Cope, Fl. W. Pak. 143: 26.1982. *Arundo karka* Retz. Obs. Bot. 4. 21. 1786; *P. maxima* (Forsk.) Blatter & McCann Bomb. Grass. 205. 1935.

A tall perennial grass up to 7.5 m high. *Culms* jointed, hollow, spreading widely by means of stolons. *Leaves* distichous, linear to lanceolate, tip subulate, *Ligule* aridge of short stiff-hairs. *Inflorescence* a large decompounds panicle up to 60 cm long, 10-40 cm broad, very silky-hairy at the base; branches filiform, distinctly scaberulous; pedicels glabrous or



long villous. *Spikelets* several-flowered, 1.1-1.8 cm long; rhachilla above the lowest lemma penicillate with long hairs. *Glume* I oblong-lanceolate, membranous 3-5 nerved; glume II 5 mm long, 3-nerved, oblong-lanceolate, membranous. *Lowest lemma* up to 12.5 mm long narrowly oblong-lanceolate, acute, convolute, 3-nerved, male or neuter persistent. Upper lemma subulate-lanceolate, subaristate, successively a little shorter than the lower. *Paleas* much shorter than the lemmas up to 3 mm long, faintly 2-nerved, glabrous, ending in two short horns or tip obtuse. Stamens 1-3. Styles 2, terminal, free; stigmas plumose. Lodicules 2, horns or tip obtuse. Stamens 1-3. Styles 2, faintly 2-nerved, glabrous, ending in two short horns or tip obtuse. *Stamens* 1-3. *Styles* 2, terminal, free; stigmas plumose. *Lodicules* 2, obtuse.

Distribution: India, Myanmar, Sri Lanka, extending to Southeast Asia and Australia.

SACCHARUM L.

Saccharum spontaneum L., in Mant. 2:183. 1771. Hook.f., Fl. Brit. Ind. 7: 118.1896; Haines, Bot. Bihar & Orissa 1011.1924; Bor, Grasses Burma Ceyl. Ind. Pak. 214.1960; Cope, Fl. W. Pak. 143: 263.1982. *Imperata spontaneum* (L.) P. Beauv., Ess. Agrost. 8.1812. *Saccharum semidecumbens* Roxb., Fl. Ind. 1, 241.1820. *S. canaliculatum* Roxb., loc. cit. 251. *S. insulare* Brongn. in Duperr., Voy. Coq. Bot. 99.1831. *S. propinquum* Steud., Syn. Pl. Glum. 1, 406 (1855).

Strong perennial with extensive rhizomes. *Culms* 1-2 m tall, glabrous, nodes hairy. *Leaves* 20-50 cm long, filiform, margins scabrid; sheaths auriculate, glabrous, throat hairy; *ligule* hairy. *Inflorescence* a lax panicle, silvery white. *Spikelets* 3-6 mm long, lanceolate, sessile and pedicelled similar, 1-flowered, bisexual. *Sessile spikelet* 3.5-4.0 mm long. *Lower glume* 3.5 mm long, sharply acute, margin ciliate, 2-nerved. *Upper glume* 4 mm long, 1-keeled. *Lower lemma* 3 mm long, oblong, ciliate, epaleate. *Upper lemma* bisexual, 3 mm long, linear-elliptic. *Anthers* 3, purple, ± 1 mm long. *Caryopsis* ± 3 mm long, narrowly lanceolate.

Distribution: Throughout the warmer parts of India. Sri Lanka, South Europe, Australia.



SCHIZACHYRIUM Nees

Schizachyrium brevifolium (Sw.) Nees ex Buse in Mi-quel, Pl. Jungh. 3: 359. 1854; 1896; Haines, Bot. Bihar & Orissa 1042. 1924; Bor, Grasses Burma Ceyl. Ind. Pak. 215.1960. *Andropogon brevifolius* Sw., Prodr. Veg. Ind. Occ. 26.1788. *Pollinia brevifolia* (Sw.) Spreng., Syst. Neg. 1, 288.1825. *Andropogon obtusifolius* Poir in Lamk., Encycl. Meth. Bot. Suppl. 1, 583.1810. *A. parviflorus* Roxb., Fl. Ind. 1, 277.1820. *A. floridus* Trin. in Mem. Acad. Sci. Petersb. ser. 6, 2, 265.1832. *A. debilis* Kunth., Enum. Pl. 1, 488.1833. *Pollinia vaginata* Spreng., Pugill. 2, 11.1815.

Annual. *Culms* delicate, erect or trailing, 10-70 cm long, copiously branched, glabrous. *Leaves* cauline; leaf sheaths keeled, glabrous; leaf blades yellowish green becoming

reddish brown, oblong-linear, flat or folded, $1.5-4 \times (0.1-0.2-0.7)$ cm, glabrous, base subrounded, apex obtuse; ligule 0.5–0.8 mm, lacerate. *Raceme* slender, 1–2 cm, enclosed at base by spatheole, borne along most of culm length, usually several flexuous peduncles arising from each leaf axil; rachis internodes and pedicels inflated upward, ca. $3/4$ length of sessile spikelet, glabrous to villous. *Sessile spikelet* 2.5–4 mm; *lower glume* linear-lanceolate, subleathery, back flat, glabrous to thinly pilose, indistinctly 4–5-veined, flanks keeled toward apex, keels wingless, apex minutely 2-toothed; *upper lemma* 2-lobed to near base; awn 0.7–1 cm. *Pedicelled spikelet* reduced to 1 or 2 glumes, up to 0.5 mm, *lower glume* with 3–5 mm awn.

Fl. & Fr.: July–Sept.

Distribution: Widespread in India; tropics of the old World.

SPOROBOLUS R.Br.

Sporobolus indicus (L.) R. Br. var. **diander** (Retz.) Jovet. & Guedes in *Taxon* 22: 163 1973. *Sporobolus diander* (Retz.) P. Beauv. Ess. Agrost. 26, 147, 178.1812; FBI. 7: 247. 1896; Haines, Bot. Bihar & Orissa 974. 1924; Bor, Grasses Burma Ceyl. Ind. Pak. 627.1960. *Agrostis diandra* Retz., Obs. Bot. 5, 19 (1789). *Vilfa erosa* Trin. in Mem. Acad. Sci. Petersb., ser. 6, 5, 2, 86 (1839). *V. retzii* Steud., Nom. Bot. ed. 2, 2, 768.1841.

Perennial. *Culms* 20–80 cm high, erect, tufted, slender. Nodes glabrous. *Leaves* 15–20 x 0.2–0.3 cm, flat or convolute, narrowed towards apex, margins entire; sheaths glabrous. *Panicles* 8–20 cm long, erect, contracted, green or slaty grey; branches up to 3 cm long, solitary or fascicled, capillary, suberect or spreading. *Spikelets* spindle-shaped, acute, hermaphrodite. *Lower glume* ovate, glabrous. Upper glume 0.6–0.8 mm long, broadly ovate, subacute, obscurely 1-nerved. *Lemma* 1.2–1.4 mm long, ovate, acute. *Palea* as long as lemma. *Grains* 0.6 mm long, subtruncate, quadrangular, compressed, reddish-brown.



Distribution: Throughout India upto 1650 m. Myanmar, Sri Lanka, Pakistan, extending to Australia.

VETIVERIA Bory

Vetiveria zizanioides (L.) Nash. in Small, Fl. Southeast U.S. 67. 1903; Haines, Bot. Bihar & Orissa 1032. 1924; Bor, Grasses Burma Ceyl. Ind. Pak. 258.1960; Cope, Fl. W. Pak. 143: 306.1982. *Phalaris zizanioides* L., Mant. 2:183. 1771. *Andropogon muricatus* Retz., Obs. Bot. 3, 43.1783. *Agrostis verticillata* Lamk., Encycl. Meth. Bot. 1, 59 (1783) non Vill.1779. *Anatherum muricatum* (Retz.) P. Beauv., Ess. Agrost. 150 (1812) t. 22, f. 10. *Vetiveria odoratissima* Lem.-Lisanc. in Bull. Soc. Philom. (Paris) 43.1882. *V. odorata* Virey, J. Pharm. 13, 501.1827. *V. muricata* (Retz.) Griseb., Fl. Brit. West Ind. 560.1864. *V. arundinacea*

Griseb., loc. cit. 559. *Sorghum zizanoides* (L.) O. Ktze., Rev. Gen. Pl. 2, 791.189. *Andropogon zizanoides* (L.) Urban, Symb. Antill. 4, 79.1903. *Holcus zizanioides* (L.) O. Ktze. ex Stuck. in Ann. Mus. Nac. Buenos Aires 11, 48.1904. *Anatherum zizanioides* (L.) Hitchc. et Chase in U.S. Natl. Herb. Contrib. 18, 285.1917. *Andropogon festucoides* J.S. Presl ex C.B. Presl, Rel. Haenk. 1, 340 (1830).

Perennial, rhizome woody, culms 25-170 cm tall, base leafy, tufted, erect. Leaves linear, up to 50 cm long, glabrous or bristly; sheath compressed, keeled; ligule membranous, minute. Inflorescence a whorled panicle made of several racemes; rachis smooth; callus bearded. Sessile spikelet + 6 mm long, linear-lanceolate, polished, awned. Lower glume + 5 mm long, linear, glabrous, muriculate. Upper glume equaling the lower, boat-shaped, with 9-10 mm long arista. Lower floret empty. Upper floret hermaphrodite. Lemma 4.0-4.5 mm long, 2-lobed; awn 25-29 mm long. Palea hyaline, nerveless. Anthers 3, yellow, + 3 mm long. Caryopsis + 4 mm long, broader towards base. Pedicelled spikelets similar.



Distribution: India, Indo-China, Malaya. Introduced in trop. Africa and America.

GYMNOSPERM

GYMNOSPERM

CUPRESSACEAE

THUJA L.

Thuja orientalis L., Sp. Pl. 1002. 1753

A small tree 6 m or more tall with compact conical or columnar habit. Branches and branchlets ascending, closely appressed. Foliage dark green. *Leaves* borne in flattened frond-like branchlets; scale-like, opposite decussate. *Male cones* terminal on the branchlets; microsporophylls 6-10 opposite decussate. *Female cones* green, woody and brown when ripe subglobose; *Scales* 8-12, each with a curved process. Seeds ovoid, not winged.

Distribution: It is native to eastern Canada and much of the north, central and upper Northeastern United States.



PTERIDOPHYTA

PTERIDOPHYTA

ACHYRIACEAE

DIPLAZIUM Sw.

Diplazium esculentum (Retz.) Sw.J.Bot. (Schrader) 1801:312; Haines, Bot. Bihar & Orissa 3:1197(1250).1924; Mooney, Suppl. Bot. Bihar & Orissa 220.1950; Sledge, Bull. Brit. Mus. (Nat. Hist) Bot. 2:310.1962. *Hemionitis esculenta* Retz. Obs. Bot. 6:38. 1791. *Anisogonium esculentum* (Retz.) Presl, Tent. Pterid. 116.1836; Bedd. Handb. Ferns Brit. India 192. 1883. *Callipteris esculenta* (Retz.) J.Sm. apud. Houlst. & Moore, Gard. Mag. Bot. 3:265.1851; Bedd. Ferns South India 54.t. 164. 1864. *Athyrium esculentum* (Retz.) Copel. Philipp.J.Sci. 111:295. 1908; Holttum Fl. Malaya 2:562. 1954.

Large fern with an erect stout caudex and a terminal tuft of fronds. Fronds mostly bipinnate, 0.9-1.5 m long (including the stipe), more or less puberulous and papillose beneath, sometimes pubescent on the costae, slightly scented, the hairs apparently slightly glandular; stipes pale, slightly scaly, more or less 4-angled and grooved; scales dense near the rhizome, lanceolate-acuminate, ciliate with papillae, moderately thin walled. Sterile fronds almost dimorphic, either simply pinnate with the pinnae 5-8.7 cm long or very broad and 2-pinnate (on some plant) with the pinnae 15-30 cm long, alternate and rather distant; fertile fronds similar to the second from; secondary pinnae 2.5-10 cm long, 1-1.8 cm wide in middle, lobed one-fourth to one-third way down or only notched, basal lobes often much longer than others, margin crenate-serrate; vein (one to each lobe) with 5-6 oblique veinlets, of which 2-3 meet in an included intermediate vein; occasionally also there is a little anastomosis near the edge of the lobes. Sori linear, 1.2-3 mm long, one to each venule except the 1-2 terminal.

Distribution: Throughout India. China, Formosa, Malaysia east to Phillipines, New Guinea, Samoa.



VEGETATIONAL ANALYSIS

VEGETATIONAL ANALYSIS

Plant species vary in their responses to environmental factors. A given species will have a unique set of tolerances to environmental variables, such as light, temperature, moisture, and nutrients. The status of a species is an important indicator for its conservation and sustainable utilization. Importance Value Index (IVI) is a measure of how dominant a species is in a given forest area. It is a standard tool used to inventory a forest. IVI is estimated for tree, shrubby and herbaceous layers. A high importance value indicates that species is well represented in the area. With a view to provide information of dominant species of Forest area of Udaipur Wildlife Sanctuary IVI of randomly selected sites were estimated. Site-wise vegetative analysis of Udaipur Wildlife Sanctuary is given below:

Balwa Rampurwa, Sub beat-, Tower No. 2

Quantitative analysis of Trees, Shrubs and herb layers of Sub beat-Balwa Rampurwa Tower No. II, Udaipur Forest Division (N 26° 47' 41.5" E 84° 25' 23.2" Alt. 130 m) is presented in Table 4.1. A total of seven tree species were recorded from the site with total density (T ha⁻¹) of 410. Maximum density (T ha⁻¹) of 280 was observed in *Putranjiva roxburghii*. Highest frequency was also recorded for *Putranjiva roxburghii* (100%). Total basal area (TBA) (m² ha⁻¹) was found to be 14.68. Maximum IVI was estimated for *Putranjiva roxburghii* (123.15), followed *Syzygium cumini* by (114.18), *Streblus asper* (26.92), *Trewia nudiflora* (14.12) etc and minimum for *Ficus hispida* (6.87).

A total of 11 species were reported in shrubby layer with total density (S ha⁻¹) of 14111. *Putranjiva roxburghii* was the most abundant species with density (S ha⁻¹) of 4444 followed by *Calamus tenuis* (4333), *Mallotus philippensis* (2333), *Syzygium cumini* (1222), *Colebrookea oppositifolia* (667) etc. Highest frequency of 100% was observed for *Mallotus philippensis*. Total basal area (TBA) (m² ha⁻¹) was found to be 6.71. On the basis of Important value index (IVI), *Putranjiva roxburghii* (98.60) was the most dominant species in the area followed by *Mallotus philippensis* (69.39), *Calamus tenuis* (61.54), *Syzygium cumini* (24.57) etc and least was *Capparis zeylanica* (3.19).

A total 14 species were reported in herbaceous layer with total density (H ha⁻¹) 198000. Maximum density (H ha⁻¹) was observed in *Tetrastigma thomsonianum* (159000) followed by *Tiliacora acuminata* (9000), *Putranjiva roxburghii* (6000), *Acacia sinuata* (5000), *Diplazium esculentum* (5000) etc. The total basal area (TBA) (m² ha⁻¹) was found to

be 1.06. Highest IVI was found in *Tetrastigma thomsonianum* (185.67) and lowest in *Streblus asper* (3.68).

Table: 4.1. Quantitative analysis of trees, shrub and herb layers in Sub beat-Balwa Rampurwa Tower No.2

S.N.	Tree	Density (T ha ⁻¹)	Frequency %	TBA (m ² ha ⁻¹)	IVI
1.	<i>Putranjiva roxburghii</i>	280	100	1.67	123.15
2.	<i>Syzygium cumini</i>	50	50	11.78	114.18
3.	<i>Streblus asper</i>	30	30	0.96	26.92
4.	<i>Trewia nudiflora</i>	20	20	0.08	14.12
5.	<i>Gmelina arborea</i>	10	10	0.16	7.85
6.	<i>Acacia sinuata</i>	10	10	0.02	6.91
7.	<i>Ficus hispida</i>	10	10	0.01	6.87
		410	230	14.68	300.00

S.N.	Shrub	Density (S ha ⁻¹)	Frequency %	TBA (m ² ha ⁻¹)	IVI
1.	<i>Putranjiva roxburghii</i>	4444	80	3.22	98.60
2.	<i>Mallotus philippensis</i>	2333	100	1.95	69.39
3.	<i>Calamus tenuis</i>	4333	90	0.63	61.54
4.	<i>Syzygium cumini</i>	1222	50	0.27	24.57
5.	<i>Colebrookea oppositifolia</i>	667	20	0.17	12.07
6.	<i>Murraya koenigii</i>	333	20	0.09	8.45
7.	<i>Tetrastigma thomsonianum</i>	222	10	0.26	7.84
8.	<i>Acacia sinuata</i>	222	20	0.03	6.83
9.	<i>Ficus hispida</i>	111	10	0.04	3.80
10.	<i>Ehretia laevis</i>	111	10	0.04	3.71
11.	<i>Capparis zeylanica</i>	111	10	0.002	3.19
		14111		6.71	300.00

S.N.	Herbs	Density (H ha ⁻¹)	Frequency %	TBA (m ² ha ⁻¹)	IVI
1.	<i>Tetrastigma thomsonianum</i>	159000	100	0.793	185.67
2.	<i>Tiliacora acuminata</i>	9000	50	0.127	31.72
3.	<i>Acacia sinuata</i>	5000	30	0.024	13.88
4.	<i>Putranjiva roxburghii</i>	6000	20	0.025	11.48
5.	<i>Diplazium esculentum</i>	5000	20	0.011	9.60
6.	<i>Syzygium cumini</i>	3000	20	0.015	8.96
7.	<i>Murraya koenigii</i>	3000	20	0.003	7.87

8.	<i>Colebrookea oppositifolia</i>	1000	10	0.030	6.38
9.	<i>Litsea monopetala</i>	2000	10	0.015	5.48
10.	<i>Ficus hispida</i>	1000	10	0.004	3.91
11.	<i>Litsea glutinosa</i>	1000	10	0.004	3.89
12.	<i>Calamus tenuis</i>	1000	10	0.002	3.74
13.	<i>Grewia sclerophylla</i>	1000	10	0.002	3.73
14.	<i>Streblus asper</i>	1000	10	0.001	3.68
		198000		1.06	300.0

Jal Bharia

Quantitative analysis of Trees, shrub and herb layers of Jal Bharia, (N 26° 48' 32.7" E 84° 25' 25.0") is presented in Table 4.2. In tree layer, 12 trees species were observed with total density ($T\ ha^{-1}$) of 670. Maximum density ($T\ ha^{-1}$) of 280 was recorded for *Miliusa velutina*. Highest frequency was also recorded for *Miliusa velutina* (90%). Total basal area (TBA) ($m^2\ ha^{-1}$) was found to be 6.54. Maximum IVI was estimated for *Holoptelea integrifolia* (98.11) followed by *Miliusa velutina* (73.43), *Mallotus philippensis* (33.71), *Streblus asper* (25.44) etc and minimum for *Aegle marmelos* (4.59).

A total of 8 species were recorded in shrubby layer with total density ($S\ ha^{-1}$) of 8778. *Mallotus philippensis* was the most abundant species with density ($S\ ha^{-1}$) of 4667 followed by *Putranjiva roxburghii* (1333), *Ehretia laevis* (1111), *Colebrookea oppositifolia* (667), *Murraya koenigii* (667) etc. Highest frequency (100%) was observed in *Mallotus philippensis*. Total basal area TBA ($m^2\ ha^{-1}$) was found to be 6.30. On the basis of Important Value Index (IVI) *Mallotus philippensis* (145.54) was the most dominant species in the area followed by *Ehretia laevis* (46.37), *Putranjiva roxburghii* (44.26), *Murraya koenigii* (24.15) etc. least was *Holoptelea integrifolia* (4.85).

A total 14 species were observed in herbaceous layers with total density ($H\ ha^{-1}$) 28000. Maximum density ($H\ ha^{-1}$) was found in *Oplismenus burmannii* and *Rungia pectinata* (4000 each). Total basal area TBA ($m^2\ ha^{-1}$) was found to be 0.10. Highest IVI value was estimated for *Tiliacora acuminata* (50.35) and lowest for *Murraya koenigii* (9.83).

Table: 4.2. Quantitative analysis of trees, shrub and herb layers of Jal Bharia

S.N.	Tree	Density ($T\ ha^{-1}$)	Frequency %	TBA ($m^2\ ha^{-1}$)	IVI
1.	<i>Holoptelea integrifolia</i>	60	50	4.92	98.11
2.	<i>Miliusa velutina</i>	280	90	0.43	73.43
3.	<i>Mallotus philippensis</i>	110	50	0.22	33.71
4.	<i>Streblus asper</i>	60	40	0.35	25.44

5.	<i>Adina cordifolia</i>	20	20	0.25	12.39
6.	<i>Litsea glutinosa</i>	30	20	0.13	11.96
7.	<i>Ehretia laevis</i>	30	20	0.05	10.75
8.	<i>Holarrhena pubescens</i>	30	20	0.02	10.36
9.	<i>Syzygium cumini</i>	20	20	0.07	9.57
10.	<i>Putranjiva roxburghii</i>	10	10	0.05	4.98
11.	<i>Lannea coromandelica</i>	10	10	0.03	4.70
12.	<i>Aegle marmelos</i>	10	10	0.02	4.59
		670		6.54	300.00

S.N.	Shrub	Density (S ha ⁻¹)	Frequency %	TBA (m ² ha ⁻¹)	IVI
1.	<i>Mallotus philippensis</i>	4667	100	3.85	145.54
2.	<i>Ehretia laevis</i>	1111	50	1.14	46.37
3.	<i>Putranjiva roxburghii</i>	1333	60	0.65	44.26
4.	<i>Murraya koenigii</i>	667	40	0.26	24.15
5.	<i>Colebrookea oppositifolia</i>	667	40	0.13	22.11
6.	<i>Miliusa velutina</i>	111	10	0.18	7.30
7.	<i>Litsea glutinosa</i>	111	10	0.08	5.62
8.	<i>Holoptelea integrifolia</i>	111	10	0.02	4.65
		8778		6.30	300.00

S.N.	Herbs	Density (H ha ⁻¹)	Frequency %	TBA (m ² ha ⁻¹)	IVI
1.	<i>Tiliacora acuminata</i>	3000	30	0.022	50.35
2.	<i>Tetrastigma thomsonianum</i>	3000	10	0.022	38.94
3.	<i>Rungia pectinata</i>	4000	20	0.003	29.10
4.	<i>Putranjiva roxburghii</i>	2000	10	0.014	26.69
5.	<i>Streblus asper</i>	1000	10	0.014	23.64
6.	<i>Oplismenus burmannii</i>	4000	10	0.003	23.40
7.	<i>Clerodendrum viscosum</i>	2000	10	0.007	20.12
8.	<i>Colebrookea oppositifolia</i>	3000	10	0.001	17.50
9.	<i>Holoptelea integrifolia</i>	1000	10	0.005	14.14
10.	<i>Ehretia laevis</i>	1000	10	0.004	13.61
11.	<i>Ageratum conyzoides</i>	1000	10	0.003	12.75
12.	<i>Albizia lebbek</i>	1000	10	0.001	10.26
13.	<i>Dioscorea bulbifera</i>	1000	10	0.001	10.01
14.	<i>Murraya koenigii</i>	1000	10	0.0004	9.83
		28000		0.10	300.00

Near Permanent Nursery

Quantitative analysis of trees, shrub and herb layers Near Permanent Nursery (N 26° 48' 46.7" E 84° 25' 48.5" Alt. 102 m) is presented in Table 4.3. 21 trees species were

observed in the tree layer with total density ($T\ ha^{-1}$) of 610. Maximum density ($T\ ha^{-1}$) of 140 was estimated for *Mallotus philippensis*. Highest frequency was also recorded for *Mallotus philippensis* (60%). Total basal area (TBA) ($m^2\ ha^{-1}$) was found to be 15.48. Maximum IVI was estimated for *Syzygium cumini* (111.90) followed by *Mallotus philippensis* (39.36), *Pongamia pinnata* (21.32), *Miliusa velutina* (16.42) etc. and minimum for *Ficus hispida* (4.10).

A total 21 species were recorded in shrubby layer with total density ($S\ ha^{-1}$) 11222. *Murraya koenigii* was most abundant species in the area with density ($S\ ha^{-1}$) of 2444 followed by *Colebrookea oppositifolia* (1889), *Syzygium cumini* (1333), *Mallotus philippensis* (1222) etc. Highest frequency of 50% was observed for both of *Murraya koenigii* and *Mallotus philippensis*. Total basal area TBA ($m^2\ ha^{-1}$) was found to be 73.26. On the basis of Important Value Index (IVI) *Murraya koenigii* (41.49) was the most dominant species in the area followed by *Pongamia pinnata* (41.20), *Mallotus philippensis* (38.71), *Colebrookea oppositifolia* (34.09) etc and least was for *Tinospora cordifolia* (3.45).

In herbaceous layer, 23 species with total density ($H\ ha^{-1}$) of 234000 were reported. Maximum density ($H\ ha^{-1}$) was observed in case of *Oplismenus burmannii* (108000) followed by *Diplazium esculentum* (36000), *Rungia pectinata* (28000), *Eragrostis tenella* (14000). The total basal area (TBA) ($m^2\ ha^{-1}$) was found to be 0.37. Highest IVI value found in grass *Oplismenus burmannii* (80.18) and lowest in *Pongamia pinnata* (2.97).

Table: 4.3. Quantitative analysis of trees, shrub and herb layers in Near Permanent Nursery

S.N.	Tree	Density ($T\ ha^{-1}$)	Frequency %	TBA ($m^2\ ha^{-1}$)	IVI
1.	<i>Syzygium cumini</i>	110	50	12.65	111.90
2.	<i>Mallotus philippensis</i>	140	60	0.27	39.36
3.	<i>Pongamia pinnata</i>	60	30	0.65	21.32
4.	<i>Miliusa velutina</i>	50	30	0.14	16.42
5.	<i>Albizia lebbek</i>	30	30	0.21	13.59
6.	<i>Cassia fistula</i>	30	30	0.18	13.40
7.	<i>Holoptelea integrifolia</i>	20	20	0.39	10.67
8.	<i>Barringtonia acutangula</i>	20	20	0.12	8.93
9.	<i>Acacia sinuata</i>	20	20	0.02	8.28
10.	<i>Ehretia laevis</i>	20	10	0.08	6.25
11.	<i>Aegle marmelos</i>	10	10	0.21	5.45
12.	<i>Bombax ceiba</i>	10	10	0.14	4.99
13.	<i>Streblus asper</i>	10	10	0.10	4.75
14.	<i>Trewia nudiflora</i>	10	10	0.09	4.68

15.	<i>Bauhinia malabarica</i>	10	10	0.07	4.51
16.	<i>Hymenodictyon orixense</i>	10	10	0.05	4.43
17.	<i>Tectona grandis</i>	10	10	0.05	4.39
18.	<i>Grewia sclerophylla</i>	10	10	0.04	4.33
19.	<i>Litsea glutinosa</i>	10	10	0.01	4.13
20.	<i>Litsea monopetala</i>	10	10	0.01	4.12
21.	<i>Ficus hispida</i>	10	10	0.00	4.10
		610		15.48	300.00

S.N.	Shrub	Density (S ha ⁻¹)	Frequency %	TBA (m ² ha ⁻¹)	IVI
1.	<i>Murraya koenigii</i>	2444	50	0.55	41.49
2.	<i>Pongamia pinnata</i>	889	40	1.72	41.20
3.	<i>Mallotus philippensis</i>	1222	50	1.14	38.71
4.	<i>Colebrookea oppositifolia</i>	1889	40	0.55	34.09
5.	<i>Syzygium cumini</i>	1333	30	0.95	32.23
6.	<i>Calamus tenuis</i>	1000	30	0.16	18.37
7.	<i>Acacia sinuata</i>	333	30	0.41	15.93
8.	<i>Miliusa velutina</i>	444	10	0.44	12.44
9.	<i>Holoptelea integrifolia</i>	111	10	0.41	9.08
10.	<i>Hymenodictyon orixense</i>	111	10	0.31	7.63
11.	<i>Streblus asper</i>	333	10	0.10	6.80
12.	<i>Ehretia laevis</i>	111	10	0.15	5.41
13.	<i>Albizia lebbek</i>	111	10	0.13	5.20
14.	<i>Litsea glutinosa</i>	111	10	0.08	4.55
15.	<i>Ziziphus oenoplia</i>	111	10	0.08	4.48
16.	<i>Ficus hispida</i>	111	10	0.04	4.01
17.	<i>Bridelia stipularis</i>	111	10	0.03	3.83
18.	<i>Catunaregam spinosa</i>	111	10	0.03	3.79
19.	<i>Securinega virosa</i>	111	10	0.02	3.68
20.	<i>Cassia fistula</i>	111	10	0.01	3.63
21.	<i>Tinospora cordifolia</i>	111	10	0.002	3.45
		11222		7.33	300.00

S.N.	Herbs	Density (H ha ⁻¹)	Frequency %	TBA (m ² ha ⁻¹)	IVI
1.	<i>Oplismenus burmannii</i>	108000	60	0.0725	80.18
2.	<i>Tiliacora acuminata</i>	8000	50	0.0916	40.12
3.	<i>Diplazium esculentum</i>	36000	40	0.0224	31.13
4.	<i>Clerodendrum viscosum</i>	5000	30	0.0405	20.28
5.	<i>Rungia pectinata</i>	28000	10	0.0164	18.80
6.	<i>Peristrophe paniculata</i>	5000	10	0.0343	13.74
7.	<i>Eragrostis tenella</i>	14000	20	0.0049	12.18
8.	<i>Albizia lebbek</i>	2000	20	0.0155	9.87
9.	<i>Oplismenus compositus</i>	7000	10	0.0074	7.41

10.	<i>Murraya koenigii</i>	3000	20	0.0011	6.46
11.	<i>Holoptelea integrifolia</i>	2000	20	0.0012	6.05
12.	<i>Urena lobata</i>	1000	10	0.0119	6.04
13.	<i>Ageratum conyzoides</i>	3000	10	0.0063	5.41
14.	<i>Miliusa velutina</i>	1000	10	0.0090	5.28
15.	<i>Cassia occidentalis</i>	1000	10	0.0090	5.28
16.	<i>Eupatorium odoratum</i>	1000	10	0.0090	5.26
17.	<i>Desmodium gangeticum</i>	2000	10	0.0069	5.14
18.	<i>Sida acuta</i>	2000	10	0.0028	4.05
19.	<i>Litsea glutinosa</i>	1000	10	0.0037	3.85
20.	<i>Scoparia dulcis</i>	1000	10	0.0036	3.82
21.	<i>Catunaregam spinosa</i>	1000	10	0.0028	3.62
22.	<i>Porana paniculata</i>	1000	10	0.0008	3.07
23.	<i>Pongamia pinnata</i>	1000	10	0.0004	2.97
		234000		0.37	300.0

Majharia Jungles – I

Quantitative analysis of Vegetational Trees, shrubs and herbs of Majharia Jungles – I (N 26° 48' 39.2" E 84° 26' 9.2") is presented in table 4.4. In the tree layer, 9 species were observed with total density (T ha⁻¹) of 680. Maximum density (T ha⁻¹) of 200 was found in case of *Wendlandia heynei*. Highest frequency (60%) was recorded by three species viz. *Wendlandia heynei*, *Terminalia arjuna* and *Mallotus philippensis*. Total basal area (TBA) (m² ha⁻¹) was found to be 1.56. Maximum IVI was recorded in *Wendlandia heynei* (65.53) followed by *Syzygium cumini* (57.53), *Terminalia arjuna* (54.12), *Dalbergia sissoo* (32.08) etc and minimum in *Celtis tetrandra* (8.86).

A total of 14 species were recorded in shrubby layer with total density (S ha⁻¹) of 8111. *Pogostemon benghalensis* was the most abundant species with density (T ha⁻¹) of 4333 followed by *Syzygium cumini* (1111), *Mallotus philippensis* (556), *Clerodendrum viscosum* (444) etc. Highest frequency of 100% was observed for *Pogostemon benghalensis*. Total basal cover (TBA) (m² ha⁻¹) was found to be 2.03. On the basis of Importance Value Index (IVI), *Pogostemon benghalensis* (100.60) was the most dominant species in the area followed by *Syzygium cumini* (43.59), *Woodfordia fruticosa* (20.48), *Mallotus philippensis* (19.25) etc and least was *Albizia lebbek* (6.05).

In the herbaceous layer, 10 species with total density (H ha⁻¹) 23000 were reported. Maximum density (H ha⁻¹) was observed in grass *Cyrtococcum patens* (76000) followed by *Saccharum spontaneum* (52000), *Olax nana* (48000), *Diplazium esculentum* (42000). Total

basal area (TBA) ($\text{m}^2 \text{ha}^{-1}$) was found to be 2.71. Highest IVI was estimated for *Saccharum spontaneum* (121.30) and lowest for *Ichnocarpus frutescens* (7.63).

Table: 4.4. Quantitative analysis of trees, shrub and herb layers in Majharia Jungles

S.N.	Tree	Density (T ha^{-1})	Frequency %	TBA ($\text{m}^2 \text{ha}^{-1}$)	IVI
1.	<i>Wendlandia heynei</i>	200	60	0.33	65.53
2.	<i>Syzygium cumini</i>	100	60	0.44	57.53
3.	<i>Terminalia arjuna</i>	120	60	0.34	54.12
4.	<i>Dalbergia sissoo</i>	60	40	0.21	32.08
5.	<i>Mallotus philippensis</i>	80	60	0.08	32.03
6.	<i>Bombax ceiba</i>	40	40	0.09	21.53
7.	<i>Litsea glutinosa</i>	40	40	0.03	17.50
8.	<i>Ficus hispida</i>	20	20	0.04	10.81
9.	<i>Celtis tetrandra</i>	20	20	0.01	8.86
		680		1.56	300.00

S.N.	Shrub	Density (S ha^{-1})	Frequency %	TBA ($\text{m}^2 \text{ha}^{-1}$)	IVI
1.	<i>Pogostemon benghalensis</i>	4333	100	0.52	100.60
2.	<i>Syzygium cumini</i>	1111	40	0.43	43.59
3.	<i>Woodfordia fruticosa</i>	111	20	0.30	20.48
4.	<i>Mallotus philippensis</i>	556	40	0.08	19.25
5.	<i>Putranjiva roxburghii</i>	222	40	0.13	18.03
6.	<i>Colebrookea oppositifolia</i>	333	20	0.16	16.21
7.	<i>Bombax ceiba</i>	222	40	0.09	15.84
8.	<i>Albizia procera</i>	111	20	0.14	12.67
9.	<i>Litsea glutinosa</i>	222	40	0.02	12.61
10.	<i>Clerodendrum viscosum</i>	444	20	0.03	11.34
11.	<i>Trema orientalis</i>	111	20	0.08	9.85
12.	<i>Ficus hispida</i>	111	20	0.03	7.41
13.	<i>Ventilago denticulata</i>	111	20	0.01	6.06
14.	<i>Albizia lebbek</i>	111	20	0.01	6.05
		8111		2.03	300.00

S.N.	Herbs	Density (H ha^{-1})	Frequency %	TBA ($\text{m}^2 \text{ha}^{-1}$)	IVI
1.	<i>Saccharum spontaneum</i>	52000	20	2.493	121.30
2.	<i>Cyrtococcum patens</i>	76000	40	0.023	47.21
3.	<i>Diplazium esculentum</i>	42000	80	0.034	46.17

4.	<i>Olex nana</i>	48000	40	0.114	38.41
5.	<i>Ficus hispida</i>	2000	20	0.018	8.18
6.	<i>Clematis gauriana</i>	2000	20	0.009	7.87
7.	<i>Cryptolepis buchanani</i>	2000	20	0.007	7.80
8.	<i>Dioscorea bulbifera</i>	2000	20	0.006	7.77
9.	<i>Passiflora suberosa</i>	2000	20	0.003	7.65
10.	<i>Ichnocarpus frutescens</i>	2000	20	0.002	7.63
		230000	300	2.71	300.0

Majharia Jungles - II

Quantitative analysis of Vegetational Trees, shrub and herbs of Majharia Jungles - II (N 26° 48' 39.2" E 84° 26' 9.2") in table 4.5. 11 trees species contributed total density (T ha⁻¹) of 830 with maximum density (T ha⁻¹) of 490 for *Syzygium cumini*. Highest frequency was recorded by *Syzygium cumini* (100%). Total basal are (TBA) (m² ha⁻¹) was recorded to be 2.46. Maximum IVI was estimated for *Syzygium cumini* (155.17) followed by *Dalbergia sissoo* (42.25), *Terminalia arjuna* (37.64), *Celtis tetrandra* (15.32) etc and minimum for *Barringtonia acutangula* (4.85).

In the shrubby layer, 18 species with total density (S ha⁻¹) 18667 were recorded. *Syzygium cumini* was the most abundant species with density (S ha⁻¹) of 13111 followed by *Clerodendrum viscosum* (1333), *Litsea glutinosa* (667), *Celtis tetrandra* (667) etc. Highest frequency of 90% was observed for *Syzygium cumini*. Total basal area (TBA) (m² ha⁻¹) was found to be 8.30. On the basis of Important Value Index (IVI) *Syzygium cumini* (168.76) was the most dominant species in the area by *Celtis tetrandra* (22.01), *Phoenix loureiroi* (12.97), *Tinospora cordifolia* (11.21) etc and least was *Clematis gauriana* (3.58).

A total 15 species were reported in herbaceous layer with total density (H ha⁻¹) 114000. Maximum density (H ha⁻¹) was observed in *Diplazium esculentum* (39000), followed by *Saccharum spontaneum* (25000), *Syzygium cumini* (20000), *Oplismenus burmannii* (6000) etc. The total basal area TBA (m² ha⁻¹) was found to 0.72. Highest IVI value was found in *Saccharum spontaneum* (92.42) and lowest in *Cryptolepis buchanani* (4.23).

Table: 4.5. Quantitative analysis of trees, shrub and herb layers of Majharia Jungles - II

S.N.	Tree	Density (T ha ⁻¹)	Frequency %	TBA (m ² ha ⁻¹)	IVI
1.	<i>Syzygium cumini</i>	490	100	1.57	155.17
2.	<i>Dalbergia sissoo</i>	90	40	0.45	42.25
3.	<i>Terminalia arjuna</i>	100	40	0.31	37.64

4.	<i>Celtis tetrandra</i>	40	30	0.02	15.32
5.	<i>Mallotus repandus</i>	20	20	0.01	9.43
6.	<i>Putranjiva roxburghii</i>	20	20	0.01	9.40
7.	<i>Ehretia acuminata</i>	20	20	0.01	9.34
8.	<i>Ficus hispida</i>	20	10	0.02	6.43
9.	<i>Mangifera indica</i>	10	10	0.02	5.11
10.	<i>Streblus asper</i>	10	10	0.02	5.06
11.	<i>Barringtonia acutangula</i>	10	10	0.01	4.85
		830		2.46	300.00

S.N.	Shrub	Density (S ha ⁻¹)	Frequency %	TBA (m ² ha ⁻¹)	IVI
1.	<i>Syzygium cumini</i>	13111	90	5.980	168.76
2.	<i>Celtis tetrandra</i>	667	20	1.042	22.01
3.	<i>Phoenix loureiroi</i>	222	20	0.490	12.97
4.	<i>Tinospora cordifolia</i>	333	30	0.050	11.21
5.	<i>Clerodendrum viscosum</i>	1333	10	0.092	11.19
6.	<i>Litsea glutinosa</i>	667	20	0.057	10.14
7.	<i>Calamus tenuis</i>	556	20	0.083	9.86
8.	<i>Mallotus philippensis</i>	444	20	0.109	9.58
9.	<i>Ficus hispida</i>	333	20	0.052	8.29
10.	<i>Litsea monopetala</i>	111	10	0.086	4.58
11.	<i>Streblus asper</i>	111	10	0.070	4.38
12.	<i>Terminalia arjuna</i>	111	10	0.052	4.16
13.	<i>Flemingia macrophylla</i>	111	10	0.045	4.07
14.	<i>Tiliacora acuminata</i>	111	10	0.037	3.99
15.	<i>Putranjiva roxburghii</i>	111	10	0.030	3.90
16.	<i>Azadirachta indica</i>	111	10	0.016	3.73
17.	<i>Phyllanthus reticulatus</i>	111	10	0.004	3.59
18.	<i>Clematis gauriana</i>	111	10	0.004	3.58
		18667		8.30	300.00

S.N.	Herbs	Density (H ha ⁻¹)	Frequency %	TBA (m ² ha ⁻¹)	IVI
1.	<i>Saccharum spontaneum</i>	25000	20	0.468	92.42
2.	<i>Diplazium esculentum</i>	39000	90	0.031	64.20
3.	<i>Syzygium cumini</i>	20000	50	0.038	37.15
4.	<i>Clerodendrum viscosum</i>	5000	30	0.033	17.49
5.	<i>Trichosanthes tricuspidata</i>	2000	20	0.033	12.02
6.	<i>Oplismenus burmannii</i>	6000	20	0.004	11.53
7.	<i>Celtis tetrandra</i>	2000	20	0.024	10.72
8.	<i>Litsea glutinosa</i>	2000	20	0.008	8.52

9.	<i>Passiflora suberosa</i>	2000	20	0.005	8.20
10.	<i>Tiliacora acuminata</i>	1000	10	0.029	7.75
11.	<i>Centella asiatica</i>	5000	10	0.002	7.49
12.	<i>Mallotus philippensis</i>	2000	10	0.015	6.62
13.	<i>Calamus tenuis</i>	1000	10	0.018	6.26
14.	<i>Terminalia arjuna</i>	1000	10	0.012	5.41
15.	<i>Cryptolepis buchanani</i>	1000	10	0.004	4.23
		114000		0.72	300.0

A total of 258 species were reported from the forest sites of Udaipur Wildlife Sanctuary. It includes 57 Dicotyledons families (170 genus, 202 species), 11 monocotyledons families (45 genus, 54 species), 1 gymnosperm (1 genus, 1 species) and 1 pteridophyte (1 genus, 1 species). Largest family reported from the area is Poaceae (27 genus, 30 species) followed by Fabaceae (15 genus, 17 species), Caesalpiniaceae (9 genus, 12 species), Mimosaceae (6 genus, 10 species), Moraceae (4 genus, 9 species), Lamiaceae (7 genus, 8 species) Combretaceae (3 genus, 8 species), Apocynaceae (7 genus, 7 species), Euphorbiaceae (7 genus, 7 species), Cyperaceae (3 genus, 7 species) etc. Five genera viz. *Acacia*, *Bauhinia*, *Terminalia*, *Ficus* and *Cyperus* are dominant with 5 species each in the area. These are followed by *Ipomoea* and *Solanum* with 4 species each.

Shannon-Wiener diversity index (H), Concentration of dominance (cd), evenness (E) and species richness (SR)

Diversity indices aim to describe general properties of communities that allow us to compare different regions and taxa. Diversity indices viz., Shannon-Wiener diversity index (H), Concentration of dominance (cd), evenness (E) and species richness (SR) for different growth forms at different sites of Udaipur Wildlife Sanctuary is presented in Table No.4.6. Higher value of species richness indicates higher diversity of species. In the tree layer, highest species richness was observed at near Permanent Nursery and Majharia Jungles – I (Both 21 spp.), followed by Jal Bharia (12 spp.), Majharia Jungles – II (11 spp.) and lowest was found at Balwa Rampurwa (07spp). In case of shrubby layer, highest value was found at Near Permanent Nursery (21spp.), followed by Majharia Jungles – II (18 spp.), Majharia Jungles – I (14 spp.) and lowest was found at Jal Bharia (08 spp.). Herbaceous layer had highest species richness at Near Permanent Nursery (23spp.), followed by Majharia Jungles – II (15 spp.), Balwa Rampurwa and Jal Bharia (14 spp.) and lowest value was found in Majharia Jungles – I (10 spp.).

The higher value of diversity index indicates the variability in the type of species and heterogeneity in communities whereas lesser value points to homogeneity in the community. In the tree layer, highest diversity index was estimated for Near Permanent Nursery (2.5657), followed by Majharia Jungles – I (1.9547), Jal Bharia (1.9086) and lowest at Balwa Rampurwa (1.1274). In the shrubby layer, highest diversity index value was estimated for near Permanent Nursery (2.4276), followed by Majharia Jungles – I (1.7291), Balwa Rampurwa (1.7136) and lowest at Majharia Jungles – II (1.3390). In the herbaceous layer, highest diversity index was estimated for Jal Bharia (2.4840), followed by Majharia Jungles – II (1.9551), near Permanent Nursery (1.9365) and lowest for Balwa Rampurwa (0.9420).

Table 4.6: Diversity indices for different growth forms at different sites of Udaipur District of Bihar:

Site	Stand	Trees				Shrubs				Herbs			
		SR	H	cd	E	SR	H	cd	E	SR	H	cd	E
I.	Balwa Rampurwa	07	1.1274	0.4908	0.5784	11	1.7136	0.2318	0.7146	14	0.9420	0.6498	0.3569
II.	Jal Bharia	12	1.9086	0.2261	0.7681	08	1.4412	0.3338	0.6931	14	2.4840	0.0944	0.9412
III.	Near Permanent Nursery	21	2.5657	0.1137	0.8427	21	2.4276	0.1205	0.7974	23	1.9365	0.2583	0.6176
IV.	Majharia Jungles – I	21	1.9547	0.1696	0.8896	14	1.7291	0.3171	0.6552	10	1.5871	0.2377	0.6893
V.	Majharia Jungles - II	11	1.4720	0.3799	0.6139	18	1.3390	0.5036	0.0162	15	1.9551	0.2044	0.7219

(SR=species richness; H=Diversity index; cd=Concentration of dominance; E=Evenness)

The higher value of concentration of dominance (cd), the greater is the homogenous nature of community and vice-versa. In other words, such communities are dominant by single species (Kohli *et al.* 2004). The lower value of concentration of dominance indicates that dominance of plant is shared by many species. In the tree layer, concentration of dominance was highest in case of Balwa Rampurwa (0.4908) followed by Majharia Jungles - II (0.3799), Jal Bharia (0.2261) and lowest in case of near Permanent Nursery (0.1137). Shrubby layer had highest value of concentration of dominance at Majharia Jungle – II (0.5036), followed by Jal Bharia (0.3338), Majharia Jungles – I (0.3171) and lowest at near Permanent Nursery (0.1205). In the herbaceous layer, highest value of concentration of dominance (cd) was estimated for Balwa Rampurwa (0.6698), followed by near Permanent Nursery (0.2583), Majharia Jungles – I (0.2377) and lowest at Jal Bharia (0.0944).

Higher value of evenness indicates that species are evenly distributed and vice-versa. In case of tree layer highest evenness value was estimated for Majharia Jungles – I (0.8896), followed by near Permanent Nursery (0.8427), Jal Bharia (0.7681) and lowest at Balwa Rampurwa (0.5784). In case of shrubby layer, highest value was observed for near Permanent Nursery (0.7974), followed by Balwa Rampurwa (0.7146), Jal Bharia (0.6931) and lowest was at Majharia Jungles – II (0.0162). In the herbaceous layer, highest value of evenness was estimated for Jal Bharia (0.9412) followed by Majharia Jungles - II (0.7219), Majharia Jungles – I (0.6893) and lowest at Balwa Rampurwa (0.3569).

TREE OUTSIDE FOREST

TREE OUTSIDE FOREST (TOF)

For conservation and suitable utilization of trees, it is essential to have accurate tree resources of the state. Trees not only exist in forest area but also extensively outside the forest area. These are termed as ‘Trees Outside Forests’ (TOF), they form of small woodlots and block plantations, trees along linear features, such as roads, canals bunds, etc. and scattered trees on farmlands, homesteads, community lands and urban areas. Traditionally, these were not inventoried and little quantitative information existed about TOF. However, for accurate assessment of tree resources, it is essential that Trees Outside Forest (TOF) must be carried out. Keeping in mind the importance of trees resources existing outside the traditional forest, an inventory was made of trees which were occurring in the outside forest. The details of such tree species are given hereunder:

Sl. No.	Name of Plant	Family	Local name/English name
1.	<i>Acacia nilotica</i> ssp. <i>indica</i>	Mimosaceae	Babul, Gum-arabic Tree, Keekar
2.	<i>Acacia auriculiformis</i>	Mimosaceae	Ear Pod Wattle
3.	<i>Aegle marmelos</i>	Rutaceae	Bel, Stone Apple
4.	<i>Ailanthus excelsa</i>	Simaroubaceae	Mahanimb, Tree of Heaven
5.	<i>Albizia lebbek</i>	Mimosaceae	Siris , Woman's tongue
6.	<i>Alstonia scholaris</i>	Apocynaceae	Saptaparni, Devil's tree
7.	<i>Anthocephalus chinensis</i>	Rubiaceae	Kadamb
8.	<i>Artocarpus lakoocha</i>	Moraceae	Daho, Dehu
9.	<i>Artocarpus heterophyllus</i>	Moraceae	Kathal, Jackfruit
10.	<i>Azadirachta indica</i>	Meliaceae	Neem
11.	<i>Bambusa bambos</i>	Poaceae	Kata bans
12.	<i>Bambusa balcooa</i>	Poaceae	Ropi Bans
13.	<i>Bauhinia purpurea</i>	Caesalpiniaceae	Purple Bauhinia,
14.	<i>Bauhinia variegata</i>	Caesalpiniaceae	Kachnar, Orchid Tree
15.	<i>Bombax ceiba</i>	Bombacaceae	Semal, Silk cotton tree
16.	<i>Borassus flabellifer</i>	Arecaceae	Tad
17.	<i>Butea monosperma</i>	Fabaceae	Palash, Dhak, Fire of the forest
18.	<i>Callistemon viminalis</i>	Myrtaceae	Bottle brush
19.	<i>Calotropis gigantea</i>	Apocynaceae	Madar

20.	<i>Caryota urens</i>	<i>Arecaceae</i>	Mari, Fishtail Palm
21.	<i>Cassia fistula</i>	<i>Caesalpiniaceae</i>	Amaltash, Golden shower tree
22.	<i>Ceiba pentandra</i>	<i>Bombacaceae</i>	Kapok, Safed semal
23.	<i>Dalbergia sissoo</i>	<i>Fabaceae</i>	Sheesham
24.	<i>Delonix regia</i>	<i>Caesalpiniaceae</i>	Gulmohar
25.	<i>Dendrocalamus strictus</i>	<i>Poaceae</i>	Lathi bans
26.	<i>Dichrostachys cinerea</i>	<i>Mimosaceae</i>	Kunali
27.	<i>Ehretia laevis</i>	<i>Boraginaceae</i>	Chamaror
28.	<i>Eucalyptus camaldulensis</i>	<i>Myrtaceae</i>	Liptus
29.	<i>Ficus benghalensis</i>	<i>Moraceae</i>	Bargad, Bad
30.	<i>Ficus racemosa</i>	<i>Moraceae</i>	Goolar
31.	<i>Ficus religiosa</i>	<i>Moraceae</i>	Peepal
32.	<i>Ficus virens</i>	<i>Moraceae</i>	Pilkhan
33.	<i>Gmelina arborea</i>	<i>Verbenaceae</i>	Gamhar
34.	<i>Heterophragma adenophyllum</i>	<i>Bignoniaceae</i>	Katsagon
35.	<i>Jacaranda mimosaeifolia</i>	<i>Bignoniaceae</i>	Nili Gulmohar
36.	<i>Lagerstroemia speciosa</i>	<i>Lythraceae</i>	Pride of India, Jarul
37.	<i>Litchi chinensis</i>	<i>Sapindaceae</i>	Litchi
38.	<i>Madhuca indica</i>	<i>Sapotaceae</i>	Mahua
39.	<i>Mangifera indica</i>	<i>Anacardiaceae</i>	Aam
40.	<i>Melia azedarach</i>	<i>Meliaceae</i>	Bakain
41.	<i>Mimusops elengi</i>	<i>Sapotaceae.</i>	Maulshri
42.	<i>Moringa oleifera</i>	<i>Moringaceae</i>	Shajana
43.	<i>Morus australis</i>	<i>Moraceae</i>	Mulberry, Sahtoot
44.	<i>Nerium indicum</i>	<i>Apocynaceae</i>	Lal Kaner
45.	<i>Peltophorum ferrugineum</i>	<i>Caesalpiniaceae</i>	Copper Pod Tree
46.	<i>Phoenix sylvestris</i>	<i>Arecaceae</i>	Sugar Date Palm
47.	<i>Phyllanthus emblica</i>	<i>Euphorbiaceae</i>	Amala
48.	<i>Pithecellobium dulce</i>	<i>Mimosaceae</i>	Jungle Jalebi
49.	<i>Plumeria acuminata</i>	<i>Apocynaceae</i>	Perungalli, Frangipani
50.	<i>Polyalthia longifolia</i>	<i>Annonaceae</i>	Ashok
51.	<i>Pongamia pinnata</i>	<i>Fabaceae</i>	Karanj

52.	<i>Psidium guajava</i>	<i>Myrtaceae</i>	Amrud
53.	<i>Drypetes roxburghii</i>	Putranjivaceae	Jivanputr
54.	<i>Roystonea regia</i>	Arecaceae	Royal palm
55.	<i>Spondias pinnata</i>	Anacardiaceae	Amara
56.	<i>Streblus asper</i>	<i>Moraceae</i>	Dahia, Sihor
57.	<i>Swietenia macrophylla</i>	<i>Meliaceae</i>	Mahogany
58.	<i>Syzygium cumini</i>	<i>Myrtaceae</i>	Jamun
59.	<i>Tabernaemontana divaricata</i>	<i>Apocynaceae</i>	Chandni
60.	<i>Tamarindus indica</i>	<i>Caesalpiniaceae</i>	Imali
61.	<i>Terminalia arjuna</i>	Combretaceae	Arjun
62.	<i>Terminalia catappa</i>	Combretaceae	Baddam
63.	<i>Thuja orientalis</i>	Cupressaceae	Morpankhi

MEDICINAL PLANTS

MEDICINAL PLANTS

Nearly all plants, may they be trees, shrubs or herbs, have some medicinal value to the animals and human. If the word medicinal is taken in its category, as all of them give oxygen and have curative and preventive properties. Beside oxygen, their aesthetic value has a lot of psychological effects on human. The world Medicinal Herb often lead to the thought of some miraculos and supernatural cures. Our ancient literature has reference not only the plants reputed to cure difficult and incurable diseases, but also of plants related with many magical properties. For example certain seeds ‘treated’ with oracles (**Mantras**) and thrown on somebody to entice him, certain roots chewed to increase longevity of life, or a few drop of juice of a plant put in the mouth of the dead to bring him back to life. In olden days, a medicine prescribed by a hermit (**Faqir**) earned more favour and reputation than the one based on some tests and experience. It is possible such beliefs suited the conditions and mental altitudes of those time.

Plants are vital for the existence of life in the Universe. Out of about 200,000 plant species known, 300 species were cultivated for food production. About 99% world food production is derived from only a few crops viz. wheat, rice, maize, potatoes, beans, coconut and bananas. India has 16 Agro-climatic zones, 45,000 different plant species and 15,000 medicinal plants that include 7000 plants used in Ayurveda and over 700 in Unani medicines. This makes India as one of the 12 mega bio-diversity countries of the world, which despite having only 2.5 % of total land area of the world contains over 8 % of the recorded species of the world. The World Health Organization has forecast that 80% of the population of developing countries depend on traditional medicines derived from plants. The present international market of medicinal plant is valued at over US\$60 billion per year. India at present exports herbal material and medicine to the tune of Rs. 446 crores, which is expected to rise to Rs. 3,000 crores by 2005. Majority of plants used for medicinal purposes grow in forests and very few of them are cultivated. The forest wealth with regards of plants of medicinal importance has not yet fully been tapped. It is estimated that between 60% to 70% of raw material used in drug industry comprise of shoots, tubers, rhizomes, bark, wood, flower and fruits.

About 200 traditional drugs comes from animal origin and a similar number are of mineral origin. Considering animal products as Musk, Horns of Rhino, Tiger bones and Bear liver is considered as aphrodisiac in Chinese system of medicine. Keeping of Rhino

horn below the cot of an expectant mother is supposed to help in easy delivery. Nails and teeth of panther and tiger is considered as talisman to ward off evil spirits.

The traditional system of medicine in India prescribing plants extractives in therapy dates back to the early of **Rig Veda** (4500-1600 BC) wild medicinal plants and their products has been the only mean of medicines. 'Ayurved' (study of this science (**Veda**) enables one to ensure longevity, since it imparts knowledge of life (**Ayus**), the sages named it as Ayurveda or science of life and longevity), the system based on these medicinal plants and their products, prevailed in India administrated by '**Vaids**'. The surgery of these '**Vaids**' appears to be very skillful, they had a very wide range of knowledge of natural chre. In mediaeval period the '**Unani**' system of medicine was introduced in India and was supported by the Muslim rulers. The physicians of this system were known as 'Hakims'. Allopathic system of medicines has been introduced in India by the Britishers who brought it specially for their civil and military officers. With the advancement in science technology this system gained popularity in the nineteen century. As a result of which "Ayurved and 'Unani' system lost ground and gradually people lost knowledge of medicinal plants, their products and natural cure.

According to the Ayurveda, health is an indication of normal biological process which would help to maintain mental and physical alertness and happiness. Diseases could develop from body and mind. The treatment of diseases means use of drug, control of diet and also involves practices for recovery of health. **Charka Samhita**, the first treatise on Ayurveda, was followed by **Sushruta Samhita**, both compiled a century apart, believed to be not later than 900 BC. According to Ayurveda, the entire biological process of the living organism is governed by three essential factor viz. **Vayu, Pitta** and **Kapha**.

Vayu: It explains all the biological phenomena which are controlled by the functions of central and autonomic nervous system. The function of **Vayu** is the major factor in developing diseases either by itself or coupled with other functional disorders due to **Pitta** and **Kapha**.

Pitta: It is manifestation of energy in the living organism that helps digestion, assimilation tissue building, heat production, blood-pigmentation, activities are thermogenic and metabolic.

Kapha: It implies the function of thermotaxis or heat regulation and also formation of various preservative fluids e.g. mucus, synovia etc.

A large number of people are perhaps skeptical or apprehensive about conventional drug have now turned to alternative treatment, and in particular treatment that make use of

medicinal plants. They are quite well to place their trust in the competence of herbalists. In their attempt to achieve good health “natural means”, they are tempted by expensive little packets of attractively wrapped and cleverly advertised herbs claiming to cure every type of complaints. The advantage of plant remedies is that they are harmless, provided they are selected carefully and taken under medical guidance.

List of the medicinal plants of Udaipur Wildlife Sanctuary, West Champaran district is given hereunder:

Table 6.1: List of Medicinal Plants of Udaipur Wildlife Sanctuary

Sl. No.	Botanical Name	Family	Trade Name	Local Name	Uses
1.	<i>Aegle marmelos</i> (Linn.) Corr.	Rutaceae	Bel	Bel	Fruits contain marmesin and root bark contains umbelliferone and conmerin as active principal. Leaves have essential oil (0.6%), consisting of a and b-phellandrene. Pulp of the ripe fruits is aromatic, cooling, laxative used in chronic dysentery, Diarrhea, appetite and digestion. Unripe or half ripe fruit is astringent. Locally, the bark decoction is taken thrice a day for one week in intermittent fever. Root bark decoction is given in hypochondriasis, melancholia etc. The root of one of the ingredients of the 'Dasamool' of 'Ayurveda'
2.	<i>Ageratum conyzoides</i> Linn.	Asteraceae	Goat Weed	Nilam, Bhakumbhar	Used as nervine tonic; juice of the herb is useful in prolapsus ani. Decoction or infusion used in Diarrhea, dysentery, colic with flatulence and other gastrointestinal ailments.
3.	<i>Azadirachta indica</i> A. Juss.	Meliaceae	Margosa Tree	Neem	Bark used in skin troubles. Leaves considered antiseptic, applied to boils in the form of poultice, decoction given for ulcers and eczema. Flowers tonic and stomachache. Berries anthelmintic, purgative, emollient. Seeds yield a non-drying oil used for skin affections. Fresh tender twigs used to clean teeth particularly in pyorrhea.
4.	<i>Centella asiatica</i> (Linn.) Urb. (<i>Hydrocotyle asiatica</i> Linn.)	Apiaceae	Indian Rennywort	Brahmi	Fresh leaves contain a bitter substance glucoside asiaticoside. The whole plant is a alterative and used against diseases of skin. It is used in the treatment of leprosy, ulceration of womb, eczema, elephantiasis and nerve tonic and blood purifier. Leaves are taken as tonic and for improvement memory, useful in syphilitic skin diseases both internally and externally. Leaves juice is useful in cataract and other eye troubles.

Sl. No.	Botanical Name	Family	Trade Name	Local Name	Uses
5.	<i>Desmodium gangeticum</i> (L.) DC.	Fabaceae	Sal Leaved Desmodium	Dhruva, Dirghamuli	A decoction of the leaves is used against stones in the gall bladder, kidneys or bladder. The leaves are applied as a poultice to the head as a treatment for headache. The roots are considered to be alterative, astringent, bitter tonic, diuretic, expectorant and febrifuge. A decoction of the root is employed to treat kidney problems, oedema, swellings, chronic fever, coughs, biliousness, diarrhoea and dysentery; or as a sedative for children. The roots are applied to the gums as a treatment for toothache. A decoction is used externally to clean wounds and ulcers
6.	<i>Phyllanthus emblica</i> Gaertn. (<i>Phyllanthus emblica</i> Linn.)	Euphorbiaceae	Emblic Myrobalan	Aonla	There are many cultivars/forms viz. <i>Banarasi</i> , <i>Chakaiya</i> , <i>Francis</i> , <i>Kanchan</i> , <i>Krishna</i> , <i>Balwant</i> , NA-6, NA-7, NA-9, <i>Anand-2</i> and <i>BS-1</i> known under <i>E. officinalis</i> . It is a chief ingredient of Chayavanprash, a tonic and restorative in Indian medicine. The fresh fruits are acrid, cooling, diuretic, refrigerant and laxative. Raw fruits are aperient, dried fruits are useful in haemorrhage, diarrhoea and dysentery; in combination with iron used in anaemia, jaundice and dyspepsia. Fermented liquor prepared from the fruit is used in jaundice, dyspepsia and cough. Squash of aonla with lemon juice is taken for arresting acute bacillary dysentery. Exudate for incision of the fruit is used as external application for the inflammation of the eye. Flowers are cooling refrigerant. Seeds are used to cure of asthma, bronchitis and biliousness. Fruits are rich in Vitamin C and are successfully used in the treatment of scurvy. Fruit juice mixed with turmeric powder and honey is said to cure diabetes. Fruits of the species along with the fruit of <i>Terminalia chebula</i> (Harra). and <i>T. bellerica</i> (Bahera) forms myrobalan or <i>Triphala</i> , which is used in constipation. Decoction of pericarp of the fruit cures chronic peptic ulcer. Fruits are mixed in oil to strengthen hairs. Large size fruits (4cm and above) from blemishes are used for preserve, candy and

Sl. No.	Botanical Name	Family	Trade Name	Local Name	Uses
					pickle; small size used for <i>Chayawanprash</i> making and defective fruits are sued for <i>Triphala</i> making.
7.	<i>Gmelina arborea</i> <i>Roxb.</i>	Verbenaceae	Gamhar	Gamhar	The juice of the fruit is applied to eczema of the feet. It is also used as a leech repellent. The fruit, pounded with lime, is applied as a poultice to the throat as a remedy for coughs. The extract of the roots is used internally as a stimulant, resolvent, and in treating diseases of the joints and nerves. The juice of the roots is used as a purgative and in treating fatigue. An extract of the leaves is used externally as a stimulant, resolvent, and in treating diseases of the joints and nerves
8.	<i>Ichnocarpus</i> <i>frutescens</i> R.Br.	Apocynaceae	Black Creeper	Kalidudhi, Shyamalata	The plant has a large number of traditional medicinal uses, including treatment for rheumatism, asthma, cholera, and fever. Some <i>in vitro</i> and rodent studies have suggested that extracts of the plant inhibit tumors, protect liver cells from damage in acetaminophen overdose, and reduces complications of hyperlipidemia in diabetic rats. There have been no published studies testing any of these effects in humans.
9.	<i>Litsea glutinosa</i> <i>(Lour.) Pers</i>	Lauraceae	Indian Laurel	Medh, Chandna, Maidalakri	The root bark and leaves are used medicinally to reduce fever, reduce swelling, and treat diarrhoea. They also may be used for treating furunculosis. The leaves, and the mucilage in the gum from the bark, have been used for making poultices. The bark also acts as a demulcent and mild astringent in the treatment of diarrhoea and dysentery. The pounded seeds are applied externally against boils
10.	<i>Mallotus</i> <i>philippensis</i> <i>(Laur.) Muell. -</i>	Euphorbiaceae	Kamala Tree, Monkey face tree	Rohni	Kamala powder, obtained from the skins of the fruits, is used as Anthelmintic. The active compound is rottlerin. All parts of the tree can be applied externally to treat parasitic infections of the skin. The fruits and bark have been reported to be used medicinally to treat stomach ulcers and tapeworm. A decoction of the leaves is used in

Sl. No.	Botanical Name	Family	Trade Name	Local Name	Uses
	<i>Arg.</i>				the treatment of diarrhoea
11.	<i>Murraya koenigii</i> (Linn.) Sprag.	Rutaceae	Curry Leaf Tree	Maitha Neem	Leaves yield an essential oil and glucoside-koeinigin. Leaves, root and bark tonic, stomachic diarrhoea and dysentery and for checking vomiting. Juice of roots taken for relief from renal pain. Leaves are frequently used in curries.
12.	<i>Pongamia pinnata</i> Pierre (<i>Derris indica</i> (Lamk.) Bennet)	Papilionaceae	Pongam oil tree, Karanj, Indian Beech	Karanj	Seed contain a bitter fatty oil (17-36%) and trace of an essential oil and three crystalline substances karanjin, pongamol and glabrin. Medicinally it is applied in scabies, herpes, leucoderma and other cutaneous diseases. Juice of the leaves prescribed in bleeding pile, flatulence, dyspepsia, diarrhoea and whooping cough; also used in leprosy and gonorrhoea. Juice of the roots used for cleansing foul ulcers and fistulous sores and for cleaning teeth and strengthening gums. Fresh bark given in piles. Decoction of bark used in beri-beri. Herb refrigerant, vulnerary, antiscorbutic, aperient, and diuretic; the diuretic action being due to the presence of high percentage of potassium salts. Used in scurvy and diseases of liver, spleen, kidney and bladder; also employed in cardio-vascular diseases, sore nipples, and ulceration of the mouth. In homeopathy the herb is employed to stimulate gastric secretion.
13.	<i>Putranjiva roxburghii</i> Wall. (<i>Drypetes roxburghii</i> (Wall.) Hurus.)	Euphorbiaceae	Putranjiva	Jayapot, Putranjiva	The leaves and stone contain glucoputranjivin, glucocoelearin, glucojiaputen, gluco-cleomin, minnitol, saponin, glucosides and fatty oils. It's decoction is used for cold and cough, rheumatism. It is reported to have the properties to effect conception in sterile women and attributed with the birth of male child, hence the name <i>Putranjiva</i> or 'Jayapot'.

Sl. No.	Botanical Name	Family	Trade Name	Local Name	Uses
14.	<i>Streblus asper</i> Lour.	Moraceae	Siamese, Rough Bush	Choriya	Poultice of leaves applied to swelling and bafoes. Poultice of roots applied ulcers, sinuses, swelling and boils. Pulverized roots given in dysentery. Decoction of bark used in fever, diarrhoea, and dysentery. Latex astringent and antiseptic and applied to sore heals, chapped hands and glandular swellings. Seeds used in epistaxis, piles and diarrhoea, externally their past used in leucoderma. The 'filacid' capsules and pills the marketable drug form the bark is effective in control of filareases.
15.	<i>Syzygium cuminii</i> (Linn.) Skeels	Myrtaceae	Black Plum, Java Plum	Jaman	Bark is used in gargles and mouth wash also blood purifier. Fresh bark juice mixed with goat milk used in diarrhoea. The seed powder about 15 gm is administered orally thrice a day of 3-4 months in diabetes. The bark is used in sore throats, bronchitis, asthma, ulcers and dysentery. The fruit juice has the same properties, but the effect of preparations from seed is more marked.
16.	<i>Terminalia arjuna</i> W.&A.	Combretaceae	Arjun	Arjun	The bark contain a crystalline compound arjunin, a lactone-arjunetin, essential oil and tannin. It is used as tonic, astringent, febrifuge and deobstruent. It also used in bilious affections and for sores. It is reported as cardiac tonic and useful in blood dysentery, blood pressure, fractures of bone, heart diseases, leucorrhoea and earache and act as an antidote to poison.
17.	<i>Tinospora cordifolia</i> (Willd.) Miers. ex Hook. f. & Thom.	Menispermaceae	Gulancha, Tinospora	Giloe, Gulel	Stem contains tinosporin and a furanoid diterpine, giloin, giloinin, berberine and waxy substrate. Stem is a constituent of several Ayurvedic preparations used in general debility, dyspepsia, fevers and urinary diseases and to heal fractures (in Bihar); dry twigs with bark intact, constitute the drug. Bitter principles present in the drug show antispasmodic, antipyretic and anti-inflammatory properties. The drug possess one fifth of the analgesic effect of sodium. Salicylate. A kind of starch called <i>Giloe-ka-sat</i> prepared from aqueous extract of dry stem, is used as a tonic. Decoction of leaves

Sl. No.	Botanical Name	Family	Trade Name	Local Name	Uses
					is given in gout. Root is a powerful emetic and used for visceral obstruction; its watery extract is used in leprosy. Pulverized fruit is used as a tonic and also for jaundice and rheumatism. Antiviral properties against Ranikhet disease in poultry have been reported. Dried stem powder with water, mixed with honey is used to treat cough.

CONCLUSION

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Study reveals that there are a total of 258 species in the forest area of the Udaipur Wildlife Sanctuary. It includes 57 Dicotyledons families (170 genus, 202 species), 11 monocotyledons families (45 genus, 54 species), 1 gymnosperm under TOF (1 genus, 1 species) and 1 pteridophyte (1 genus, 1 species). Largest family reported from the area is Poaceae (27 genus, 30 species) followed by Fabaceae (15 genus, 17 species), Caesalpiniaceae (9 genus, 12 species), Mimosaceae (6 genus, 10 species), Moraceae (4 genus, 9 species), Lamiaceae (7 genus, 8 species), Combretaceae (3 genus, 8 species), Apocynaceae (7 genus, 7 species), Euphorbiaceae (7 genus, 7 species), Cyperaceae (3 genus, 7 species) etc. Five genera viz. *Acacia*, *Bauhinia*, *Terminalia*, *Ficus* and *Cyperus* are dominant with 5 species each in the area. These are followed by *Ipomoea* and *Solanum* with 4 species each.

Different diversity indices viz., Shannon-Wiener diversity index (H), Concentration of dominance (cd), evenness (E) and species richness (SR) for different growth forms at different sites of Udaipur Wildlife Sanctuary were estimated. In the tree layer, highest species richness was observed at near Permanent Nursery and Majharia Jungles – I (Both 21 spp.), followed by Jal Bharia (12 spp.), Majharia Jungles – II (11 spp.) and lowest was found at Balwa Rampurwa (07spp). In case of shrubby layer, highest value was found at Near Permanent Nursery (21spp.), followed by Majharia Jungles – II (18 spp.), Majharia Jungles – I (14 spp.) and lowest was found at Jal Bharia (08 spp.). Herbaceous layer had highest species richness at Near Permanent Nursery (23spp.), followed by Majharia Jungles – II (15 spp.), Balwa Rampurwa and Jal Bharia (14 spp.) and lowest value was found in Majharia Jungles – I (10 spp.).

In the tree layer, highest diversity index was estimated for Near Permanent Nursery (2.5657), followed by Majharia Jungles – I (1.9547), Jal Bharia (1.9086) and lowest at Balwa Rampurwa (1.1274). In the shrubby layer, highest diversity index value was estimated for near Permanent Nursery (2.4276), followed by Majharia Jungles – I (1.7291), Balwa Rampurwa (1.7136) and lowest at Majharia Jungles – II (1.3390). In the herbaceous layer, highest diversity index was estimated for Jal Bharia (2.4840), followed by Majharia Jungles – II (1.9551), near Permanent Nursery (1.9365) and lowest for Balwa Rampurwa (0.9420).

In the tree layer, concentration of dominance was highest in case of Balwa Rampurwa (0.4908) followed by Majharia Jungles - II (0.3799), Jal Bharia (0.2261) and lowest in case of near Permanent Nursery(0.1137). Shrubby layer had highest value of concentration of dominance at Majharia Jungle – II (0.5036), followed by Jal Bharia(0.3338), Majharia Jungles – I (0.3171) and lowest at near Permanent Nursery(0.1205). In the herbaceous layer, highest value of concentration of dominance (cd) was estimated for Balwa Rampurwa (0.6698), followed by near Permanent Nursery (0.2583), Majharia Jungles – I(0.2377) and lowest at Jal Bharia (0.0944).

In case of tree layer highest evenness value was estimated for Majharia Jungles – I (0.8896), followed by near Permanent Nursery (0.8427), Jal Bharia (0.7681) and lowest at Balwa Rampurwa (0.5784). In case of shrubby layer, highest value was observed for near Permanent Nursery (0.7974), followed by Balwa Rampurwa (0.7146), Jal Bharia (0.6931) and lowest was at Majharia Jungles – II (0.0162). In the herbaceous layer, highest value of evenness was estimated for Jal Bharia (0.9412) followed by Majharia Jungles - II(0.7219), Majharia Jungles – I(0.6893) and lowest at Balwa Rampurwa (0.3569).

A total of 17 species of medicinal plants along with their uses and vernacular names have been found in the division. Some of the medicinal plants are *Tinospora cordifolia*, *Aegle marmelos*, *Azadirachta indica*, *Phyllanthus emblica*, *T. arjuna*, *Syzygium cumini* etc. A total of 63 tree species outside forest area (TOF) alongwith their local names were reported from the district. Some of the TOF species occurring in the district are *Acacia auriculiformis*, *Albizia lebbek*, *Anthocephalus chinensis*, *Dalbergia sissoo*, *Terminalia catappa*, *Thuja orientalis* etc.

Earlier no work has been carried out for the assessment of quantitative status of different species in the region. In the present study efforts have been made to quantify the status of different species in the forest area of the division. Again it is for the first time, when floristic wealth of Udaipur Wildlife Sanctuary is carried out on the basis of quantification. The study will be extremely useful for the preparation of future working plan of the forest division.
