

KEY WORKS TO THE TAXONOMY OF
**FLOWERING PLANTS
OF
INDIA**

M. P. NAYAR

VOLUME 4

BOTANICAL SURVEY OF INDIA

Key Works to the Taxonomy of Flowering Plants of India by Dr. M. P. Nayar. M. Sc., Ph. D. (London), FLS, with up-to-date references, annotations, systematic position of the families is under publication in series of volumes. The author has prepared these series from his collections of bibliography and nomenclature reference systems of over 30,000 entries. The First Volume (Acanthaceae to Crypteroniaceae) is published in early 1984.

The Fourth volume deals with families in alphabetical sequence from Magnoliaceae to Orchidaceae. Data on the circumscription of families, modern classificatory systems and data on the families and genera are presented and they are arranged in alphabetical sequence. Under each family there is main data source dealing with monographic work on the family or particular subfamily or tribe with additional information on cytotaxonomy, palynology and chemotaxonomy. This source book of reference will be useful in the study of taxonomy, plant genetic resources and conservation of flora. Wherever useful plants are cited, the taxonomy of such taxa are more or less comprehensively covered as this may serve as a data source for genetic resources, plant variations and genotypic variations.

FLORA OF INDIA (Series IV)

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VOLUME 4

MAGNOLIACEAE TO ORCHIDACEAE

M. P. Nayar

**BOTANICAL SURVEY OF INDIA
DEPARTMENT OF ENVIRONMENT**

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Price :

**Published by the Director, Botanical Survey of India, P. O. Botanic Garden,
Howrah-711 103 and Printed by Robi Kar, Prabartak Printing & Halftone Ltd.,
52/3 Bepin Behari Ganguly Street, Calcutta-700 012.**

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INTRODUCTION

All the families of flowering plants occurring in India are arranged in alphabetical order from A to Z (Acanthaceae to Zygophyllaceae). Gymnosperms and Pteridophytes are treated separately and the families are arranged in alphabetical sequence. The families are delimited as per modern concept and for families segregated from the main family there are cross references and annotations. A brief synoptical account of the families is given with references. Under each family the genera occurring in India are enumerated in alphabetical sequence. A separate list of genera which are cultivated in India is also included. Under each family there is main data source dealing with monographic work on the family, or particular sub-family or tribe with additional informations as are available on cytology, palynology and chemotaxonomy. Monographs which are basic to the family are cited in order to get a holistic view of the family. Pre-1900 references are quoted only for critical and monographic citations. Since this book deals with key reference for taxonomic literature, distributional records of local or narrow geographical range are excluded in the citations. Wherever cytological, palynological and other data which may help in the synthesis of taxonomic concepts of a taxon are available, such references are included. But purely morphological, embryological or anatomical data which are not readily relevant to taxonomy are not considered in this book.

As mentioned earlier under each family and under each genus citations are arranged authorwise alphabetically. Where more than one reference is cited for the same author, they are indexed chronologically. Where references to joint authors are cited they are arranged first alphabetically and followed by their datewise sequence. In the references where the actual date of publication is different from the accredited date of publication, the date of effective publication is the date of the actual publication as per Art 30 & 32 of International Code of Botanical Nomenclature (1978). The accredited date is given in parenthesis before the actual date of publication. The abbreviation *ibid.* for denoting the same journal repeated in separate citations, is avoided in order to help computer scanning of journals.

In the same way each author name is repeated without giving the usual *ditto* sign. Each citation is complete on its own with standard abbreviations with a code number. Brief annotations wherever relevant are given. In the annotations abbreviations are used : *descr.* for description, *distr.* for distribution, *spp.* for species, *enum.* for enumeration. For references to the publication of the classifications of Airy-Shaw, Bentham & Hooker, Cronquist, Dahlgren, Engler, Hutchinson, Takhtajan and Thorne, the reference is not repeated. A common reference to their classification system is given below. All the citations are coded as per family code devised by Weber (Taxon 31 : 74-88. 1982). In a subject where such vast information system is assembled there may be some omissions and the author considers it useful if additional information or data are brought to his attention.

Acknowledgements

I am grateful to Dr. T. N. Khoshoo, Secretary to the Government of India, Department of Environment for giving the idea of the preparation of a familywise and genuswise taxonomic data index. I wish to thank Dr. S. K. Jain, Director, Botanical Survey of India for facilities. I am grateful to Prof. A. K. Sharma, Chairman, SPAC of Botanical Survey of India for encouragements.

HOWRAH-3.

M. P. NAYAR

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MAGNOLIACEAE

(Refer also Schisandraceae)

The family Magnoliaceae, named after the genus *Magnolia* (commemorating Pierre Magnol 1638-1715), is one of the primitive families of angiosperms consisting of about 12 genera and 230 species, commonly termed as "living fossils".

The family Magnoliaceae is included in the order Magnoliales by Cronquist, Dahlgren, Engler, Hutchinson and Takhtajan, whereas Thorne considered this family in the order Annonales. Bentham & Hooker however included it in the order Ranales.

According to Dandy (1927) the family Magnoliaceae is classified as follows and it is supported by the epidermal studies of Baranova (1972) : (i) Magnoliaceae : having introrse or latrose anthers, capsular fruits, testa free from the endocarp and externally ariloid ; (ii) Liriodendraceae : having extrorse anthers, samaroid fruits, testa adherent to the endocarp and not ariloid.

The species of the family Magnoliaceae is characterised by their arborescent habit with simple alternate stipulate leaves. The characteristic large stipules enclosing the vegetative growth leaving prominent annular scar indicate the protective role of stipules, a transition from leaf to floral parts protecting the reproductive parts. The wood of different species of *Magnolia* show transitions from primitive vessels. The nodes are tri- or multilacunar (Canright, 1955). The flowers are large, terminal or axillary and indicate bennettitalean strobili distantly. According to Corner (1972) "primitive flowers and primitive ways can hardly be expected now, but the *Magnolia* flower is a relic comparable with *Cycas* and *Ginkgo* in showing primitive construction; in other ways the family has grown into large leptocaul vying with the tallest in the tropical trees yet still with its generalized flower".

The perianth ranges from 12 to 18 and usually there is no distinction between calyx and corolla (excepting the species of the genera *Magnolia* and *Michelia*). The stamens are many and spirally arranged,

more or less laminar and sometimes produced over the microsporangia. According to Cronquist (1968) "the laminar stamen with embedded pollen sacs as seen in *Degeneria* and some other Magnolialean genus is a primitive type." The uniaperturate pollen in Magnoliaceae is considered as a primitive type and it is generally accepted that triaperturate pollen type is later derived from it. However this adaptive significance is controversial. Baranova (1972) after critical study noted that the thick-walled epidermal cells with pores in the outer wall are found in many Magnoliales and Cycadales. It is also seen that paracytic stomata which is a primitive type is also seen in the Magnoliales. The presence of small embryos and possession of endosperm are primitive attributes. The fruit is multifollicular and there is a tendency of range of fruit characters in the genera *Aromadendron*, *Manglietia* and *Talauma* (Keng, 1978). Raju & Nayar (1980) supporting the views of Keng (1978) relegated the genus *Talauma* to the genus *Magnolia* and indicated that the concrescent carpels becoming fleshy in the genus *Talauma* is an evolutionary *cul-de-sac* of missed opportunities for bird pollination due to the presence of alkaloids in the fruits.

According to Janaki Ammal (1952), the genus *Magnolia* shows distant polyploid series which is a result of evolutionary stress for survival in cold hostile Himalayan region.

The classical view of *Magnolia* type of flower as the ancient one based on the morphological studies by Bailey, Nast and Swamy, led the earlier phylogenists to consider the family Magnoliaceae as the direct connecting link. Recent work of Leroy (1983), proposing the importance of the genus *Hedyosmum* (a chloranthaceous genus of tropical America) as the ancestral prototype of angiosperm evolution deserves critical attention.

Dahlgren (1983) indicated that "flowers in different groups of angiosperms need not necessarily represent homologous structures and "the homology between a magnoliaceous flower and a chloranthaceous inflorescence cannot yet be wholly dismissed". It is interesting to note that the spicate inflorescence of the Saururaceae (*Houttuynia*) with its white sepal like bracts may superficially represent *Magnolia* flower.

Though the family Magnoliaceae and its allies have several combination of primitive characters like beetle pollination (associated with the absence of nectary glands), laminar stamens with embedded microsporangia and free carpels, the present day Magnoliales as a group is a plexus which are remnants of an ancient flora, a vast floristic complex bursting into angiosperm flora due to the necessity of the insect evolution. Production of closed seeds with triploid endosperm and the female sporangium invested with integuments to make the seed coat, are evolutionary necessities to avoid wastage and help dispersal of seeds.

In India the following genera constitute the magnoliaceous flora : *Alcimandra*, *Magnolia*, *Manglietia*, *Michelia*, *Pachylarnax*, *Paramichelia*, *Talauma*.

The genus *Liriodendron* (*L. tulipifera* Linn.), a native of America is introduced and cultivated in some hill stations.

For taxonomic studies, refer Dandy (1927, 1928, 1950), Keng (1978), Raju & Nayar (1980); for palynology refer Agababin (1973); for comparative morphology refer Canright (1952, 1953, 1955); for chemotaxonomy refer Johnson & Fairbrothers (1956); for chromosome numbers and phylogeny refer Janaki Ammal (1952, 1960), Whitaker (1933).

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MALPIGHIACEAE

The family Malpighiaceae consists of about 60 genera and 800 species mainly occurring as important shrubs or shrubby climbers with main centre of distribution in tropical America, and few genera in the Old World tropics and subtropics.

The family Malpighiaceae is included in the order Polygalales by Cronquist and Dahlgren, in the order Malpighiales by Hutchinson, in the order Geraniales by Bentham & Hooker, Thorne and Takhtajan. Engler, however, considered it in the order Rurales.

The family Malpighiaceae is distinguished by its usually opposite leaves racemose inflorescence with 5-merous floral parts. The clawed petals with imbricate arrangement give a zygomorphic appearance and androecium (5 + 5) usually forms a ring at the base. The ovary is 3-loculed with axile placentation, usually one pendulous ovule in each locule. The fruit is a schizocarp with 3 mericarps, but more often other mericarps abort and mericarps are usually winged.

According to the classification of Niedenzu (1928) the family is classified as follows : (i) *Pyramidoterae* having pyramidal torus and usually winged mericarps, (ii) *Planitorae* having flat concave torus with nonwinged mericarps.

The studies of seed coat (Corner, 1976) indicates the family Malpighiaceae is not as closely allied to Polygalaceae as generally considered. Its systematic position may be appropriately in the order Geraniales as mentioned by Takhtajan and Thorne. On the basis of pollen ultrastructure (Simpson & Skvarla, 1981), the families Polygalaceae, Malpighiaceae and Krameriaceae might have evolved convergently.

Several species of the family are cultivated in gardens as ornamentals : *Banisteria laevifolia*, a climbing shrub with yellow flowers ; *Acrocarpus alternifolius* with subcorymbose inflorescence ; *Heteropteris leona* from West tropical Africa with yellow flowers in panicles and reddish samaras ; *Tristellateia australasiae*, native of Malaysian region with star-shaped yellow flowers ; *Malpighia glabra* from tropical America

with scarlet edible fruits used in pickles ; *Malpighia urens* and *Malpighia puniceifolia* fruits are edible. Hallucinogenic drugs are derived from the leaves of *Banisteria caapi*, a tropical American plant ; *Hiptage benghalensis* leaves have insecticidal properties.

The following genera occur in India : *Aspidopterys*, *Hiptage*.

The cultivated genera in India are *Banisteria*, *Byrsonima*, *Malpighia*, *Stigmaphyllon*, *Thryallis*.

For taxonomic revisions refer Niedenzu (1928) ; pollen morphology refer Lobreau (1967).

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MALVACEAE

(Refer also Bombacaceae)

The Malvaceae is mainly a pantropical family with about 75 genera and 1500 species. A family of fibre yielding plants and ornamental herbs, the Malvaceae is of great economic importance in the tropics.

The family Malvaceae is included in the order Malvales by Bentham & Hooker, Cronquist, Dahlgren, Engler, Hutchinson, Takhtajan and Thorne.

A family of mainly herbs and shrubs and often trees with usually simple or palmately lobed and stipulate leaves, the family Malvaceae has usually 5-merous flowers, often there is the presence of epicalyx which is probably considered as an aggregation of bracteoles. The stamens are usually numerous, all united into a tube forming staminal tube which is jointed to the petals and the anthers are monothecous. It is considered that the monothecal stamens of the Mal-

vaceae represent longitudinal halves of dithecal stamens which is an ancestral type. It is also hypothesised that the increase of the number of stamens is derived from pentamerous condition by some botanists, while others especially Cronquist considers that the high numbers are ancestral and inherited from a thealean ancestry. According to Cronquist (1968) the spines in the pollen of the family Malvaceae and the tendency in the family to form connate filaments might relate to the type of pollinators. It is considered by the author that the monothecous condition of stamens might be due to the necessity of space occupancy of a prolonged staminal tube formation in the family Malvaceae from the Thealean ancestry so that the same androecial output is spread out for attracting insect pollinators. The fruit is typically septicidally dehiscent or seldom loculicidally dehiscent.

The family Malvaceae is different from the family Bombacaceae in having spiny pollen and mostly multiporate. While in the Bombacaceae the pollen is smooth and triporate.

According to Schuman (1890), the family Malvaceae is divided into the following tribes : Malopeae, Malveae, Ureneae and Hibisceae. Kearney (1951) considered the following tribes : Malopeae, Hibisceae, Malveae, Abutilae and Ureneae. Hutchinson (1967) followed Kearney in the classification.

Dahlgren (1983) including the Malvaceae in the order Malvales considered that the general tendency is for the presumably originally diplostemonous flower to lose one staminal whorl, while the other becomes multistaminate generally with centrifugal developmental succession and frequently fasciculate stamens or stamens fused to a column.

Cotton of commerce is derived from the fluffy seeds of the genus *Gossypium*. Cotton fibre has been traced to the Indus Valley civilization of about 3000 B.C. and Greeks met this crop during Alexander the Great's Indian campaign. The long staple cotton (*Gossypium hirsutum*) is cultivated mainly in USA, while short staple cotton (*G. arboreum* & *G. herbaceum*) is cultivated in Asia. Cotton seeds are an important source of edible vegetable oil. Other well-known fibre yielding

plants are species of *Abutilon*, *Decaschistia* and *Malachra capitata*. The genus *Hibiscus* is of ornamental importance with about 200 species and number of cultivars. The most widely known species is Rose-of-China (*Hibiscus rosa-sinensis*) with large number of cultivars. The Blue mahoe (*Hibiscus elatus*) is the national flower of Jamaica. The Rose-of-Sharon (*Hibiscus syriacus*) growing in eastern Mediterranean has large flowers with pinkish colour. *Hibiscus schizopetalus* with divided petals and pendant flowers is cultivated in gardens. Bimli Jute (*Hibiscus cannabinus*) is cultivated for centuries for fibre. Rozale (*Hibiscus subdarifa*) yields edible fruits, used for making pickles. Bendi (*Abelmoschus esculentus*) fruits are used as vegetable. The root *Radix Althaea* is used in medicine (*Althaea officinalis*).

The malvaceous flora of India consists of *Abelmoschus*, *Abutilon*, *Althaea*, *Bombyx*, *Decaschistia*, *Dicellostyles*, *Gossypium*, *Hibiscus*, *Kydia*, *Lavatera*, *Malachra*, *Malva*, *Malvastrum*, *Pavonia*, *Sida*, *Thespesia*, *Urena*.

Important cultivated genera are *Anoda*, *Malvaviscus*, *Modiola*, *Wissadula*.

For recent taxonomic studies refer Borssum Waalkes (1966), Hu (1955), Riedl (1976) ; for morphology refer Corner (1946), Heel (1966) ; for palynology refer Chaudhuri (1965), Chaudhuri & Mallick (1965), Nair (1962), Prasad (1963), Radulescu & Tarnavschi (1979) ; for cytotaxonomy refer Bates (1966, 1976), Bates & Balanchard (1970), Bhatt & Dasgupta (1976), Hazra & Sharma (1971).

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- MLV 116 Fernald, M. L. 1942
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The segregation of *Radyera* from *Hibiscus* (Malvaceae).
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The cytotaxonomy of some species of *Hibiscus*. *Kew*
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- MLV 123 Menzel, M. Y. & Wilson, F. D. 1963
Cytotaxonomy of 12 species of *Hibiscus*, section *Furcaria*.
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- MLV 124 Merrill, E. D. 1920
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- MLV 126 Nair, P. K. K. 1961
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Revision of the Indian species of *Hibiscus* (Malvaceae). *Bull. Bot. Surv. India* 12 : 151-175, 1 fig. 32 spp. Keyed out.
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Preliminary account of the results of some species crosses in *Hibiscus*. *Genetica* 24 : 90-92.
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Studies on pollen morphology, production and viability in different varieties of shoe flower (*Hibiscus rosa-sinensis* L.). *Agr. Res. Journ. Kerala* 4(2) : 7-24.
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Notes taxonomiques sur le genre *Lavatera* L. *Feddes Rep.* 74 : 18-28.
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Contribucoes para o conhecimento do Genero *Lavatera* L., *Collectanea Botanica a Barcinomensi Botanico Instituto edita* 7(1) : 393-447.

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Althaea, *Abelmoschus* and *Malva* from Pakistan, Afghanistan and Iran. *Res. Kyoto Univ. Sci. Exped. Karak. Hinduk.* I, 1955 : 284-286.

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Dimorphic spines in the pollen grains of *Malva parviflora*
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- MLV 142 Bates, D. M. 1978
Typification of *Malvastrum* A. Gray, one last time ?
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- MLV 143 Borssum Waalkes, J. van 1960
The typification of the genus *Malvastrum*. *Taxon* 9 : 212-
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On the typification of *Malvastrum*. *Taxon* 15 : 311-315.
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- MLV 147 Kearney, T. H. 1955
Malvastrum A. Gray—a redefinition of the genus. *Leafl.*
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- MLV 150 Abedin, Sultanul 1979
Revision of *Pavonia* Cav. (Malvaceae) from Pakistan.
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Sida Linn.

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Revision of *Sida* Linn. (Malvaceae) from Pakistan.
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- MLV 152 Adhikary, A. K. 1963
Cytotaxonomical studies in some species of *Sida*. *Trans. Bose Res. Inst.* 26 : 59.
- MLV 153 Bhandari, M. M. 1977
A new species of *Sida* (Malvaceae) from the Indian desert.
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- MLV 154 Clement, I. D. 1957
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- MLV 155 Gagnepain, F. 1909
Essai d'une classification des Sida asiatiques. Notulae Systematicae Phanerogamiae Herbarii du Museum d' Histoire Naturelle, Paris, 1 : 27-32. 10 spp. recognised.
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Le genre *Sida* (Malvacees). *Bull. Soc. Bot. France* 71 : 627-633. Key to spp.
- MLV 157 Hazra, R. & Sharma, A. 1971
Chromosome studies in different species and varieties of *Sida* with special reference to accessory chromosomes.
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MLV 158 Fosberg, F. R. & Sachet, M. -H. 1972

Thespesia populnea (L.) Solander *ex* Correa and *Thespesia populneoides* (Roxb.) Kosteletsky. *Smithsonian Contrib. Bot.* No. 7 : 1-13.

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Atkinsia gen. nov., *Thespesia* and related West Indian genera of the Malvaceae. *Bull. Torrey Bot. Club.* 67 : 89-100.

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MLV 160 Gupta, R. C. & Roy, S. K. 1970

Studies on the pollen grains of *Urena lobata* Linn. *Curr. Sci.* 39: 264-268.

MLV 161 Hochreutiner, B. P. G. 1901

Le genre *Urena* L. *Ann. Cons. Jard. Geneve* 5 : 131-146, *U. lobata* L. is subdivided into about 15 varieties and forms with a key.

ADDITIONS : GENERAL

MLV 162 Dahlgren, R. 1983

General aspects of angiosperm evolution and macrosystematics. *Nord. Journ. Bot.* 3 : 119-149.

MLV 163 Hutchinson, J. 1967

Malvaceae. *The Genera of Flowering Plants* 2 : 536-567.

MLV 164 Kearney, T. H. 1951

The American genera of Malvaceae. *Amer. Midl. Nat.* 46 : 93.

MLV 165 Schuman, K. 1890

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Decaschistia cuddaphensis T. K. Paul et Nayar—a new species from India. *Geobios New Report* 2 : 156-157.
- MLV 168 Rao, A. V. N. & Pandey, D. S. (1982) 1983
Decaschistia crotonifolia Wight & Arn.—a new and promising fibre yielding plant. *Journ. Econ. Tax. Bot.* 4 : 215-222.

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- MLV 169 Paul, T. K. & Nayar, M. P. (1983) 1984
Hibiscus hoshiarpurensis Paul et Nayar (Malvaceae). *Bull. Bot. Surv. India* 25 : 188-189.
- MLV 170 Prendergaast, H. D. V. 1982
 Pollination of *Hibiscus rosa-sinensis*. *Biotropica* 14(4) : 287.

Sida Linn.

- MLV 171 Mathew, Philip & Sivarajan, V. V. 1983
Sida elongata Blume and *Sida javensis* Cav. (Malvaceae), new records for India. *Journ. Econ. Tax. Bot.* 4(2) : 617-619.

Thespesia Soland. ex Correa

- MLV 172 Paul, T. K. & Nayar, M. P. 1982
Thespesia danis Oliver (Malvaceae)—a new record for India. *Journ. Econ. Tax. Bot.* 3 : 655.

MARANTACEAE

A family of about 30 genera and 400 species, mainly herbaceous perennials occurring mainly in the tropics, the Marantaceae is included in the order Zingiberales by Cronquist, Dahlgren, Hutchinson, Takhtajan and Thorne, While Engler considered the family in the order Scitamineae, Bentham & Hooker did not consider this as a separate family, but included it in the order Epigynae.

The family Marantaceae is distinguished from the family Zingiberaceae in having swollen joint or pulvinous at the junction of petiole and leaf blade. The flowers are zygomorphic, bisexual, pentacyclic and 3-merous. As in the family Cannaceae the androecium is united with the corolla and there is one fertile stamen which is often petaloid. Other stamens are represented by staminodes. The ovary is inferior, 3-loculed and 3-ovuled, solitary in each locule. The fruit is usually a loculicidal capsule. The pollination mechanism is interesting as the fertile petaloid stamen deposits the pollen in its style. The insects attracted by the honey secreted from the junction of the septa of the ovary, force their way and as they do this movement, insects set free the style which descends and touches the back of insects and thus deposits pollen on the insects. This helps in the cross pollination of flowers.

The family Marantaceae has stems without mucilage canals, seeds are mostly arillate and ovules are solitary in each locule. Whereas in the family Cannaceae, the stems are provided with mucilage canals, seeds are not arillate and ovules are numerous in each locule.

Dahlgren (1983) mentions that the least specialized members of the Zingiberales (Musaceae, Heliconiaceae, Strelitziaceae and Lowiaceae) have oxalate raphides, 5 functional stamens, septal nectaries and seeds with copious starchy endosperm. In the other Zingiberales (Zingiberaceae, Costaceae, Cannaceae and Marantaceae) they generally lack oxalate raphides, several stamens are transferred into petaloid fertile stamen or showy petaloid staminodia, usually absence of septal nectaries and endosperm is often replaced by copious perisperm.

The family yields edible rhizomes (*Maranta arundinacea*). Some of the attractive indoor foliage plants belonging to this family are : *Maranta bicolor*, *Calathea zebrina*, *Calathea makoyana*.

The native genera of India are *Phacelophrynium*, *Phrynium*, *Schumannianthus*, *Stachyphrynium*.

Some of the genera cultivated in India are : *Calathea*, *Maranta*.

For recent taxonomy refer Holttum (1951), Wu & Chen (1981) ; for morphology refer Dahlgren (1983), Tilak & Pai (1966), Tomlinson (1961).

GENERAL

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The synflorescence of the Marantaceae. Organization and descriptive terminology. *Bot. Notiser* 129 : 39-48.
The inflorescence component is interpreted as a more or less complex aggregate of monochasial cymes.
- MRN 2 Eichler, A. W. (1883) 1884
Beitrag zur Morphologie und Systematik der Marantaceen. *Abh. K. Preuss. Akad. Wiss. Berl.* 1-99, tab. 1-7.
- MRN 3 Gagnepain, F. 1903 & 1904
Zingiberaceae et Marantaceae nouvelles de l'herbier du Museum. *Bull. Soc. Bot. Fr.* 50 : 586-590. 1903 ; *ibid.*, 51 : 164-182. 1904.
- MRN 4 Holttum, R. E. 1951
The Marantaceae of Malaya. *Gard. Bull. Singapore* 13 : 254-296.
- MRN 5 Rao, A. S. & Verma, D. M. (1972) 1975
Materials towards a monocot flora of Assam II. (Zingiberaceae & Marantaceae). *Bull. Bot. Surv. India* 14 : 114-143.

- MRN 6 Schumann, K. M. 1902
Marantaceae. *In*: Engler, *Pflanzenr.* II (IV. 48): 1-184,
tab. 1-23.
- MRN 7 Tomlinson, P. B. 1961
Morphological and anatomical characteristics of the
Marantaceae. *Journ. Linn. Soc. Bot.* 58 : 55-78.
- MRN 8 Wu, Te-lin & Chen, Sen-Jen 1981
Marantaceae. *Fl. Reipubl. Pop. Sinicae* 16(2) : 158-169,
4 fig. In Chinese ; key to 4 genera.

Phrynium Willd. emend. K. Schum.

- MRN 9 Balakrishnan, N. P. 1978
A new *Phrynium* (Marantaceae) from Great Nicobar
island, India. *Blumea* 24 : 185-187, 1 fig. *P. paniculatum*
Balakr. allied to *P. tristachyum* Ridley.

ADDITIONS : GENERAL

- MRN 10 Dahlgren, R. 1983
General aspects of angiosperm evolution and macrosys-
tematics. *Nord. Journ. Bot.* 3 : 119-149.
- MRN 11 Tilak, V. D. & Pai, R. M. 1966
Studies in the floral morphology of the Marantaceae
1. Vascular anatomy of the flower of *Schumannianthus*
virgatus Rolfe, with special reference to the labellum.
Can. Journ. Bot. 44 : 1365-1370.
- MRN 12 Tomlinson, B. 1962
Phylogeny of the Scitamineae—morphological and
anatomical consideration. *Evolution* 16 : 192-213.

MARTYNIACEAE

(Refer also Pedaliaceae)

The family Martyniaceae consists of 3 genera and 13 species, occurring mainly in tropical and subtropical America.

The family Martyniaceae is recognised by Dahlgren and Takhtajan and included it under the order Scrophulariales. Hutchinson and Thorne however included the family in the order Bignoniales. Engler considered it in the order Tubiflorae. Cronquist however did not recognise it in the family status and included it in the family Pedaliaceae in the order Scrophulariales. Bentham & Hooker considered it in the family Pedaliaceae.

The family is characterised by 5-merous zygomorphic flowers and androecium with four epipetalous and didynamous stamens, superior ovary with 1-2 loculicidal capsule with parietal placentation. It is closely allied to the family Pedaliaceae and Bignoniaceae.

The family is represented in India by the genus *Martynia* (*M. arva* L., native of Mexico and naturalized in India).

GENERAL

MAR 1 Nafday, U. R. 1963

Studies in the Tubiflorae of Nagpur-5. Martyniaceae. *Bull. Bot. Soc. Coll. Sci. Nagpur* 4 : 58-71. Descr. of family, genus & sp. (1) ; synonymy, phenology and taxonomic discussion.

MAR 2 Theobald, W. L. & Grupe, D. A. 1973

Martyniaceae. *Revised Fl. Ceylon* 1 : 107-109, 1 fig.

MASTIXIACEAE—refer CORNACEAE**MELASTOMATACEAE**

(Refer also Memecylaceae)

The family Melastomataceae consists of about 250 genera and 4000 species, occurring in tropical and subtropical regions of the world.

The sub-family Memecyloideae is considered as a separate family in this work.

The family Melastomataceae is included in the order Myrtales by Bentham & Hooker, Cronquist, Dahlgren, Hutchinson, Takhtajan and Thorne. Engler considered it in the order Myrtiflorae. According to Krasser (1898) the family is divided into the following sub-families : Melastomatoideae, Astronoideae and Memecyloideae. Airy-Shaw and Dahlgren considered the sub-family Memecyloideae to the family status which is supported by the author.

The family Melastomataceae is a natural family with herbs, lianes, epiphytes and they constitute the typical elements of humid tropic flora. The flowers are actinomorphic, bisexual, rarely unisexual and they range from 3-6-merous condition. The number of stamens varies from 3 to 65 and the flowers show a number of evolutionary trends from hypogyny to perigyny and epigyny, from numerous to few ovules and from axial to basal placentation. The stamens vary considerably in number and they range from 3 to 65. But usually the stamens are twice the number of petals. However the genus *Sonerila* usually has three stamens, while at the other extreme *Astrocalyx* has 65 stamens. The most important feature of the family Melastomataceae is the presence of prominent connective in various taxa. The staminal appendages, the vascularisation of the connective and the appendages were studied by Wilson (1950) and according to him the stamens of the family Melastomataceae are the evolutionary remnants of an ancient branch system which bore terminal sporangia. It is considered that staminal appendages have arisen secondarily for pollination purposes. The stamens usually dehisce by single pore situated apically or sub-apically. It is considered that the brightly coloured staminal appendages act as landing strips for pollinating insects and while the insects land the apical porose anthers shed their pollen on the insects. According to Mathews & Maclachlan (1929) the porose dehiscence is evolved from slit dehiscence by shortening of the longitudinal slits.

It is seen that anatomically the most outstanding feature of the family Melastomataceae is the universal occurrence of cortical and medullary bundles.

Some of the well-known ornamental plants are : *Medinilla magnifica*, *Bertolonia* and *Sonerila*, *Tibouchina*.

In India the melastomataceous flora consists of the following genera : *Allomorpha*, *Blastus*, *Clidemia*, *Kendrickia*, *Medinilla*, *Melastoma*, *Osbeckia*, *Otanthera*, *Oxyspora*, *Phyllagathis*, *Pseudodissochaeta*, *Pternandra*, *Sarcopyramis*, *Sonerila*.

For recent studies on taxonomy refer Bakhuizen van den Brink Jr. (1943), Hansen (1972), Maxwell (1978), Nayar (1965, 1966, 1969, 1975, 1978) ; for wood anatomy and phylogeny refer Vliet, Kock-Noorman & Welle (1981).

GENERAL

- MLS 1 Bass, P. 1981
A note on stomatal types and crystals in the leaves of Melastomataceae. *Blumea* 27 : 475-479.
- MLS 2 Bakhuizen van den Brink Jr. R. C. 1943
A contribution to the knowledge of the Melastomataceae occurring in the Malay archipelago especially in the Netherlands East Indies. *Meded. Bot. Mus. & Herb. Rijks. Univ.* 91 : 1-391.
- MLS 3 Candolle, A. P. de 1828
Melastomataceae. *In* : DC., *Prodr.* 3 : 99-202.
- MLS 4 Cogniaux, A. 1891
Melastomataceae. *In* : DC., *Monogr. Phan.* 7 : 1-1256. Monographic.
- MLS 5 Diels, L. 1932
Beitragc sur Kenntnis der Melastomataceen Ostasiens. *Bot. Jahrb.* 65 : 97-119. Revision of Oxysporeae and Sonerileae.
- MLS 6 Guillaumin, A. 1913
Contribution a'l'etude des Melastomacees d' Extreme-orient. *Lecomte Not. Syst.* 2 : 301-323.

- MLS 7 Guillaumin, A. 1913
Contribution a' l'etude des Melastomacees d' Extreme-Orient. *Bull. Soc. Bot. France* 60 : 86-92, 273-276, 337-345, 362-371, 401-406.
- MLS 8 Keng, Hsuan 1955
The Melastomataceae of Taiwan. *Quart. Journ. Taiwan Mus.* 8 : 17-36, pl. 1-11.
- MLS 9 King, G. 1900
Materials for a flora of the Malayan Peninsula—Melastomataceae. *Journ. Asiat. Soc. Beng.* 69 : 1-87.
- MLS 10 Korthals, P. W. 1840-1844
Bijdrage tot de Kenntis der Inische Melastomataceae. *Temminck Verh. Nat. Gesch. Bot.* 218-255.
- MLS 11 Kranzlin, F. 1931
Beitrage Zur kenntnis der Melastomataceae. *Vierteljahrs. Nat. Ges. Zurich* 76 : 147-159.
- MLS 12 Krasser, F. 1898
Melastomataceae. *In* : Engler & Prantl, *Pflanzenf.* III (7) : 130-199.
- MLS 13 Li, H. L. 1944
Studies in the Melastomataceae of China. *Journ. Arn. Arb.* 25 : 1-42. Taxonomic revision.
- MLS 14 Li, H. L. 1950
Geographical distribution of the Melastomataceae in eastern Asia. *Taiwania* 1 : 129-139. A critical discussion.
- MLS 15 Maxwell, J. F. 1978
A revision of *Medinilla*, *Pachycentria* and *Pogonanthera* (Melastomataceae) from the Malay Peninsula. *Gard. Bull. Singapore* (Part II) : 139-216.
- MLS 16 Naudin, C. 1849-52
Melastomacearum quae in Musaco Parisiensi Continentur monographicae descriptionis et secundum affinitates dis-

- tributionis tentamen. *Ann. Sci. Nat. III. Bot.* 12 : 196-284. 1849; 13 : 25-39, 126-159, 273-303, 347-362. pl. 5-8, 1849; 14 : 53-76, pl. 4-7, 118-165. 1850; 15 : 43-79, pl. 3, 4. 216-345, pl. 12-15, 1851; 16 : 83-246, pl. 18, 24, 25. 1851; 17 : 305-382. 1852; 18 : 85-154, pl. 3-6, 257-294. 1852. Monographic.
- MLS 17 Nayar, M. P. 1965
Contributions to the knowledge of India-Malaysian and other Asiatic Melastomataceae. *Kew Bull.* 19:501-506.
- MLS 18 Nayar, M. P. 1966
Contributions to the knowledge of Indo-Malaysian and other Asiatic Melastomataceae. *Kew Bull.* 20: 155-161, 235-244.
- MLS 19 Nayar, M. P. 1966
Taxonomic studies in Asian genera of the family Melastomataceae (Unpublished) Thesis. University of London 1966.
- MLS 20 Nayar, M. P. (1972) 1975
Centres of development and patterns of distribution of the family Melastomataceae. *Bull. Bot. Surv. India* 14 : 1-12.
- MLS 21 Stapf, O. 1892
On the Sonerileae of Asia. *Ann. Bot.* 6 : 291-320, pl. 17. Revision.
- MLS 22 Triana, J. 1866
Dispositio Melastomaccarum. *Bull. Congr. Internat. Bot. Hort. Amsterdam* 1865 : 457-461. A synopsis of the Melastomataceae.
- MLS 23 Triana, J. 1871
Les Melastomacees. *Trans. Linn. Soc.* 28: 1-188, pl. 1-7. Monographic.
- MLS 24 Vliet, G. J. C. M. van 1981
Wood anatomy of the palaeotropical Melastomataceae. *Blumea* 27: 395-462. 10 pl. 9 tab., 6 fig. Crypteroniaceae

is considered as a separate subfamily. On the basis of wood anatomy three subfamilies are recognised: Memecyloideae, Melastomatoideae and Crypteronioideae.

- MLS 25 Vliet, G. J. C. M. van, Kock-Noorman, J. & Welle, B. J. H. ter 1981
Wood anatomy, classification and phylogeny of the Melastomataceae. *Blumea* 27 : 463-473, 2 fig.
- MLS 26 Wilson, C. L. 1950
Vasculature of the stamens in the Melastomataceae with phyletic implications. *Amer. Journ. Bot.* 37 : 431-444.

Astronia Bl.

- MLS 27 Nair, N. G. 1974
A new record of *Astronia macrophylla* Bl. (Melastomataceae) from Great Nicobars and its phytogeographical significance. *Curr. Sci.* 43 : 665-666. Descr. & phytogeography.

Blastus Lour.

- MLS 28 Metcalf, F. P. 1933
Bredia, *Barthea* and *Blastus* (Melastomataceae). *Lingnan Sci. Journ.* 12 : Suppl. 153-156. A synopsis with keys to genera.
- MLS 29 Nayar, M. P. 1968
Taxonomic notes on some species of *Blastus* Lour. (Melastomataceae). *Curr. Sci.* 37 : 413-414.

Clidemia D. Don

- MLS 30 Nayar, M. P. 1966
Contributions to the knowledge of Indo-Malaysian and other Asiatic Melastomataceae. *Kew Bull.* 20 : 155-161. *Clidemia hirta* (L.) D. Don, new record for India from Kerala.

Medinilla Gaud.

- MLS 31 Lindley, J. 1850
The magnificent medinilla (*Medinilla magnifica*). An evergreen stove shrub from Java, belonging to the natural order of melastomads. *Paxt. Fl. Gard.* 1 : 55, 56, t. 12.
- MLS 32 Shetty, B. V. & Karthikeyan, S. 1976
Medinilla fuchsoides Gardn. (Melastomataceae)—a new record for India. *Bull. Bot. Surv. India* 18(1-4) : 215. Key.

Ochthocharis Bl.

- MLS 33 Hansen, C. & Wickens, G. E. 1981
A revision of *Ochthocharis* (Melastomataceae) including *Phaeoneuron* of Africa. *Kew Bull.* 36 : 13-29.

Osbeckia Linn.

- MLS 34 Clark, J. J. 1913
Osbeckia stellata. *Curtis's Bot. Mag.* 139. pl. 8500.
- MLS 35 Fyson, P. F. 1932
Notes on four species of flowering plants from the South Indian highlands. *Journ. Indian Bot. Soc.* 11: 48-50. 2 new spp., *Osbeckia rosea* Fyson & *Notonia shevarayensis* Fyson.
- MLS 36 Hansen, C. 1972
Osbeckia chinensis L. and *O. zeylanica* L. f. *Taxon* 21 : 653-657. Tabulated differences between the two spp.
- MLS 37 Hansen, C. 1977
The Asiatic species of *Osbeckia* (Melastomataceae). *Ginkgoana* No. 4 : 1-150, 20 pl.
- MLS 38 Nayar, M. P. 1968
Nomenclatural notes on the genus *Osbeckia* Linn. of India and Burma. *Sci. Cult.* 34 : 488-489. *O. cupularis* Don = *O. rosea* Fyson.

Oxyspora DC.

- MLS 39 Subramanyam, K. & Nayar, M. P. 1969
A new species of *Oxyspora* DC. (Melastomataceae) from Assam, India. *Journ. Bengal Bot. Soc.* (Sen Memorial Vol.) : 411-413.

Pseudodissochaeta Nayar

- MLS 40 Nayar, M. P. 1969
Pseudodissochaeta, a new genus of Melastomataceae. *Journ. Bombay Nat. Hist. Soc.* 65 : 557-568.

Pternandra Jack

- MLS 41 Maxwell, J. F. 1981
A revision of the genus *Pternandra* (Melastomataceae). *Gard. Bull. Singapore* 34 : 1-90, 8 pl. 18 fig.
- MLS 42 Nayar, M. P. (1975) 1978
A new species, new combinations and notes on the genus *Pternandra* Jack (Melastomataceae). *Bull. Bot. Surv. India* 17 : 51-54.

Sarcopyramis Wall.

- MLS 43 Nayar, M. P. 1967
A new species of *Sarcopyramis* Wall. (Melastomataceae) from North East India. *Proc. Indian Acad. Sci. B.* 66 : 279-291.
- MLS 44 Nayar, M. P. 1974
A noteworthy *Sarcopyramis* from Eastern Himalayas. *Journ. Bombay Nat. Hist. Soc.* 71 : 170-172.
- MLS 45 Hansen, C. 1978
A revision of the genus *Sarcopyramis* Wall. (Melastomataceae). *Bot. Tidssk.* 73(3-4) : 177-183. All the taxa reduced to *S. nepalensis* Mem.

Sonerila Roxb.

- MLS 46 Lauener, L. A. & Mckean, D. 1972
A note on *Sonerila* (Melastomataceae). *Notes Roy. Bot. Gard. Edinb.* 31 : 437-440.
- MLS 47 Nayar, M. P. 1969
A new species of *Sonerila* Roxb. (Melastomataceae) from South India. *Proc. Indian Acad. Sci.* 69 B : 256-258, fig. 1. *S. sadasivanii*, descr., from Tamil Nadu & Kerala.
- MLS 48 Nayar, M. P. 1969
Nomenclature notes on the genus *Sonerila* Roxb. (Melastomataceae). *Journ. Bombay Nat. Hist. Soc.* 65 : 805-807.
- MLS 49 Nayar, M. P. (1969) 1970
New species and notes on the genus *Sonerila* Roxb. (Melastomataceae). *Journ. Indian Bot. Soc.* 48 : 321-325. *S. wynaadensis* from Kerala, descr., notes on 3 spp.
- MLS 50 Nayar, M. P. (1974) 1976
A new species of *Sonerila* (Melastomataceae) from Kerala, S. India. *Journ. Bombay Nat. Hist. Soc.* 71 : 632-633, 1 pl. *S. devicolamensis*, descr.

ADDITIONS : GENERAL

- MLS 51 Clarke, C. B. 1879
Melastomataceae. *In* : Hooker, J. D., ed., *Fl. Brit. India* 2 : 512-565.
- MLS 52 Fernandes, A. & Fernandes, R. 1954
Contribution to the knowledge of the Melastomataceae of Mocambique. *Bol. Soc. Broter. ser. 2, A.* 28: 205-214.
- MLS 53 Mathews, J. R. & Maclachlan, C. M. 1929
The structure of certain poricidal anthers. *Trans. & Proc. Bot. Soc. Edinb.* 30 : 104-122.
- MLS 54 Wilson, C. L. 1948
The telome theory and the origin of the stamens. *Amer. Journ. Bot.* 29 : 759-764.

Blastus Lour.

- MLS 55 Hansen, C. 1982
A revision of *Blastus* Lour. (Melastomataceae). *Adansonia* 4(1-2) : 43-77.

Catanthera F. v. Muell.

- MLS 56 Nayar, M. P. 1969
The status of the genus *Catanthera* F. v. Muell. (Melastomataceae). *Gard. Bull. Singapore* 24 : 351-354.
- MLS 57 Nayar, M. P. 1982
Revision of the genus *Catanthera* F. v. Muell. (Melastomataceae). *Reinwardtia* 10 : 35-61.

Creaghiella Ridl.

- MLS 58 Nayar, M. P. 1973
A review of the genus *Creaghiella* Stapf. *Gard. Bull. Singapore* 26 : 259-261.

Neodriessenia Nayar

- MLS 59 Nayar, M. P. 1974
Neodriessenia Nayar : a new genus of Melastomataceae. *Bull. Bot. Surv. India* 16 : 21-26.

Plethiandra Hook. f.

- MLS 60 Nayar, M. P. 1974
Revision of genus *Plethiandra*. *Reinwardtia* 9 : 143-151.

Phyllagathis Bl.

- MLS 61 Nayar, M. P. 1976
Notes on Asian Melastomataceae (I). Notes on the genus *Phyllagathis* Bl. *Journ. Jap. Bot.* 51(8) : 230-234.

Sonerila Roxb.

- MLS 62 Lundin, Roger 1983
Taxonomy of *Sonerila* (Melastomataceae) of Ceylon.

Nord. Journ. Bot. 3 : 633-656. All Ceylon species are considered as endemic.

MLS 63 Nayar, M. P. 1969

Two new species of *Sonerila*. *Dansk. Bot. Arkiv.* 27: 61-66.

Tayloriophyton Nayar

MLS 64 Nayar, M. P. 1968

Tayloriophyton : a new malaysian genus of Melastomataceae. *Bull. Bot. Surv. India* 10 : 90-93.

MELIACEAE

The family Meliaceae consists of about 50 genera and 1400 species, mainly trees and shrubs occurring in the pantropical belt. The family gets its name from the well-known species *Melia azedarach* "Pride of India" or Persian lilac.

The Meliaceae is included in the order Sapindales by Cronquist, in the order Rurales by Dahlgren, Engler, Takhtajan and Thorne, in the order Meliales by Hutchinson and in the order Geraniales by Bentham & Hooker.

The family is characterised by alternate exstipulate pinnate or simple leaves without gland dots. The flowers are 3-5 merous and the stamens are usually united into a tube called staminal tube. Ovary is 2-5 locular (rarely 1-locular) superior ovary with one to more ovules, usually pendulous, anatropous.

According to Engler the family is classified into the following sub-families: Cedreloideae (stamens free, capsular and seeds winged); Swietenioideae (stamens form a tube, capsular with winged seeds); Melioideae (stamens form a tube, capsular, berry or drupe and seeds not winged).

According to Styles & Vosa (1971) that unlike other tropical woody groups the family Meliaceae is "interesting because of the considerable range of chromosome numbers they exhibit". The sub-family Melio-

ideae is heterogenous karyologically, but morphologically similar. It is also seen that differences in chromosome numbers in closely related species of economically important timber genera *Swietenia*, *Cedrela* and *Toona*. According to Styles & Khosla (1976) the diversity of chromosome number in the family is unequalled and chromosomes vary from $2n=12$ to $2n=c. 360$. According to Mehra (1972) the chromosome number of most hardwoods are small and the same applies to the family (0.5 to 3.5μ in length). The basic average haploid number for the family is $n=27$. Whereas Grant (1963) noted that the average haploid number for tropical dicotyledons is $n=15.99$. It is hypothesised by Styles & Khosla (1976) that "the small size and high chromosome number are almost certainly correlated with the longevity of trees. High numbers will increase recombination potential and compensate for decrease in chromosome size".

The family includes some of the high grade timbers of economic importance. It includes timber yielding species of *Entandrophragma*, *Guarea* and *Khaya*, which are huge emergent timber trees of 70 m high and about 15 m girth. They are among the world's tallest woody trees (Styles & Khosla, 1976). Some of the well-known timber trees cultivated are : *Swietenia mahagoni*, *S. macrophylla*, *Entandrophragma cylindricum*, *Khaya senegalensis*, *Cedrela odorata*. The neem tree of India, *Azadirachta indica* is cultivated throughout India as a cosmopolitan avenue and economically important tree.

The Meliaceae flora of India includes : *Aglaia*, *Amoora*, *Aphanaxis*, *Azadirachta*, *Chisocheton*, *Chukrasia*, *Cipadessa*, *Dysoxylum*, *Epicharis*, *Melia*, *Munronia*, *Naregamia*, *Soymida*, *Toona*, *Turraea*, *Walsura*, *Xylocarpus*.

The genera cultivated in India are *Khaya*, *Sandoricum*, *Swietenia*.

For recent taxonomic studies refer Chaudhuri (1965), How & Chen (1955), Mabberley (1977), Pennington & Styles (1975) ; for cytology refer Datta & Samanta (1977), Khosla & Styles (1975), Minfray (1963), Mehra, Sareen & Khosla (1972), Minfray (1963), Styles & Khosla (1976), Styles & Vosa (1971) ; for palynology refer Chang & Wang (1956).

GENERAL

- MEL 1 Candolle, C. de 1878
Meliaceae. *In* : DC., *Monogr. Phan.* 1 : 399-752, pl. 6-9.
Monographic.
- MEL 2 Candolle, C. de 1878
On the geographical distribution of the Meliaceae.
Trans. Linn. Soc. II, Bot. 1, 233-236.
- MEL 3 Chang, K. T. & Wang, F. H. 1956
Morphology of pollen grains of Meliaceae. *Acta Bot. Sinica* 5(2) : 253-265.
- MEL 4 Chaudhuri, A. B. 1965
A study of the Meliaceae of India with special reference to West Bengal. *Indian Forester* 91 : 454-461, tab. 2.
- MEL 5 Chaudhuri, A. B. 1967
Studies on the Meliaceae of India and neighbouring countries. *Bull. Bot. Soc. Bengal* 21 : 1-24. Enum. 111 spp. & 21 genera, endemism.
- MEL 6 Datta, P. C. & Samanta, P. 1977
Cytotaxonomy of Meliaceae. *Cytologia* 42(1) : 197-208.
Chrom. nos.
- MEL 7 How, F. C. & Chen, T. C. 1955
Meliaceae of China. *Acta Phytotax. Sin.* 4 : 1-45, pl. 1-4.
A systematic treatment.
- MEL 8 Juliano, J. B. 1934
Studies on the morphology of the Meliaceae. *Philippine Journ. Agr.* 23 : 253-266.
- MEL 9 Khosla, P. K. & Styles, B. T. 1975
Karyological studies and chromosomal evolution in Meliaceae. *Silvae Genet.* 24(2-3) : 73-83.

- MEL 10 Mabberley, D. J. 1977
Francis Hamilton's commentaries with particular reference to Meliaceae. *Taxon* 26(5-6) : 523-540.
- MEL 11 Mehra, P. N. 1972
Cytogenetical evolution of hardwoods. *Nucleus. Calcutta* 14(1) : 64-83.
- MEL 12 Mehra, P. N. & Bawa, K. S. 1969
Chromosomal evolution in tropical hardwoods. *Evolution* 23 : 466-481.
- MEL 13 Mehra, P. N., Sareen, T. S. & Khosla, P. K. 1972
Cytological studies on Himalayan Meliaceae. *Journ. Arn. Arb.* 53(4) : 558-568. Chrom. nos.
- MEL 14 Minfray, E. 1963
Contribution a l'etude caryo-taxinomique des Meliacees. *Bull. Soc. Bot. France* 110 : 180-192.
- MEL 15 Minfray, E. 1963
Le noyau et les chromosomes somatiques de deux Meliacees. *Bull. Mus. Hist. Nat. Paris* 35(5) : 527-531.
- MEL 16 Miquel, F. A. W. 1868
Monographia meliacearum Archipelagi indici. In : Miquel, *Ann. Mus. Bot. Lugd.-Bat.* 4 : 1-64. Notes on the distribution of the Meliaceae in E. Asia ; keys to the larger genera.
- MEL 17 Panshin, A. J. 1933
Comparative anatomy of the woods of the Meliaceae, sub-family Swietenioideae. *Amer. Journ. Bot.* 20 : 638-668, pl. 37-48.
- MEL 18 Pennington, T. D. & Styles, B. T. 1975
A generic monograph of the Meliaceae. *Blumea* 22(3) : 419-540.
- MEL 19 Rehder, A. & Wilson, E. H. 1914
Meliaceae. In : Sarg., *Pl. Wils.* 2 : 156-159.

- MEL 20 Styles, B. T. 1972
The flower biology of the Meliaceae and its bearing on tree breeding. *Silvae Genet.* 21(5) : 175-182.
- MEL 21 Styles, B. T. & Khosla, P. K. 1976
Cytology and reproductive biology of Meliaceae. *In* : Burley J. & Styles, B. T., eds., *Tropical trees, variation breeding and conservation*. *Linnean Soc. Symp. Series No. 2*, 61-67. The state of our knowledge at present.
- MEL 22 Styles, B. T. & Vosa, C. G. 1971
Chromosome numbers in the Meliaceae. *Taxon* 20(4) : 485-499. Chromosome study of 58 spp. in 30 genera.

Aglaia Lour.

- MEL 23 Kostermans, A. J. G. H. 1966
A monograph of *Aglaia* sect. *Lansium* Kosterm. (Meliaceae). *Reinwardtia* 7 : 221-282. *Aglaia anamallayana* (Bedd.) Kosterm., based on *Lansium anamallayana* Bedd.
- MEL 24 Nair, K. K. N. 1981
A reassessment of the taxonomic position and status of *Aglaia bourdillonii* Gamble (Meliaceae) with notes on the nomenclature of related taxa. *Journ. Bombay Nat. Hist. Soc.* 78 : 425-426. Reduced to a variety of *A. elaeagnoides*.
- MEL 25 Pellegrin, F. 1909-1911
Sur les genres *Aglaia*, *Amoora* et *Lansium*. *Not. Syst.* 1 : 284-290. Generic distinctions.
- MEL 26 Sundara Raghavan, R. (1969) 1971
A note on *Aglaia littoralis* Talb. non Miq. (Meliaceae). *Bull. Bot. Surv. India* 11 : 183-184. *A. talbotii* Sundara Raghavan, nom. nov., notes.

Amoora Roxb.

- MEL 27 Pellegrin, F. 1909-1911
Sur les genres *Aglaia*, *Amoora* et *Lansium*. *Not. Syst.* 1 : 284-290.

Azadirachta A. Juss.

- MEL 28 Deshmukh, N. Y. 1957
Chromosome number in Neem. *Indian Oil Seeds Journ.*
3(1) : 45.
- MEL 29 Jacobs, M. 1961
The generic identity of *Melia excelsa* Jack. *Gard. Bull.*
Singapore 18 : 71-75, 5 fig. Transferred to *Azadirachta*
excelsa (Jack.) Jacob, key to 2 spp.
- MEL 30 Mukherjee, S. K. 1952
Meiosis in *Azadirachta indica* A. Juss. *Curr. Sci.* 21(10):
287.

Cedrela Linn.

(Old World spp. reduced to *Toona*)

- MEL 31 Candolle, C. de 1908
A revision of the Indo-Malayan species of *Cedrela*. *Rec.*
Bot. Surv. India 3 : 357-376.
- MEL 32 Chatterjee, A., Chakraborty, T. & Chandrasekharan, S.
1971
Chemical Investigation of *Cedrela toona*. *Phytochemistry*
10 : 2533-2535.
- MEL 33 Cunliff, K. M. 1973
Trees for tomorrow : *Trees S. Afr.* 24(4) : 107-111.
Cedrela toona.
- MEL 34 Holdridge, L. R. 1943
Comments on the silviculture of *Cedrela*. *Caribbean Forester*
4 : 77-80.
- MEL 35 Lamb, A. F. A. 1968
Cedrela odorata, Fast growing timber trees of the low land tropics,
No. 2, 46 pp. Commonwealth Forestry Institute, Oxford.

- MEL 36 Li, H. L. 1944
The genus *Cedrela* in China. *Trop. Woods* 79 : 16-24. A revision.

- MEL 37 Smith, C. E. 1960
A revision of *Cedrela*. *Fieldiana Bot.* 29 : 295-341. Old World spp. belong to *Toona*.

Chisocheton Bl.

- MEL 38 Mabberley, D. J. 1979
The species of *Chisocheton* (Meliaceae). *Bull. Brit. Mus. (Nat. Hist.)* 6(4) : 1-386. Key, maps, chrom. nos., a monograph.

Chukrasia A. Juss.

- MEL 39 Livera, E. J. 1925
The genus *Chukrasia*. *Ann. Roy. Bot. Gard. Peradeniya* 9 : 307-308.

Heynea Roxb. ex Sims.

(Refer *Trichilia* P. Br.)

Khaya A. Juss.

- MEL 40 Dutt, A. K. 1961
A comment on the record of *Khaya senegalensis* A. Juss. from Pondicherry. *Journ. Bombay Nat. Hist. Soc.* 58 : 542-543. Notes on distr.

- MEL 41 Shankaranarayan, K. A. 1959
Khaya senegalensis A. Juss.—a new plant record from Pondicherry, South India. *Journ. Bombay Nat. Hist. Soc.* 56 : 270-373, 1 fig.

Lansium Rumph.

(Refer *Aglaia*)

- MEL 42 Sahni, K. C. & Bennet, S. S. R. 1974
Correct botanical name of "Langsat". *Indian Forester*

100(3) : 202. *Lansium parasiticum* (Osbeck) Sahni & Bennet. = *L. domesticum* Corr.

Melia Linn.

- MEL 43 Jacobs, M. 1961
The generic identity of *Melia excelsa* Jack. *Gard. Bull. Singapore* 18 : 71-75, 2 fig. Key to *Melia* & *Azadirachta*.
- MEL 44 Zerpa, D. M. de 1953
Los cromosomas to *Melia azedarach*. *Agron. Trop. (Macaray)* 20(4) : 257.

Munronia Wt.

- MEL 45 Harms, H. 1917
Über die asiatische Meliaceen Gattung *Munronia* Wight und eine Verwandte sud afrikanische Gattung. *Bericht. Deutsch. Bot. Ges.* 35 : 74-82, 1 fig. Recognises 13 spp. of *Munronia*.
- MEL 46 Rao, A. S. (1963) 1964
Nomenclatural notes in *Munronia* Wt.—a Meliaceae genus. *Bull. Bot. Surv. India* 5 : 225-256. *M. pinnata* (Wall.) A. S. Rao = *M. wallichii* Wt. (*Turraea pinnata* Wall.).

Sandoricum Cav.

- MEL 47 Tixier, P. 1958
Sur le faux Mangoustan : *Sandoricum indicum* Cav. *Journ. Agr. Trop. et. Bot. Appl.* 5(8-9) : 596-597.

Soymida A. Juss.

- MEL 48 Chaudhuri, Rai H. N. 1961
Pharmacognostic study of the stem bark of *Soymida febrifuga* A. Juss. *Journ. Sci. & Industr. Res.* 20 : 345-347.
- MEL 49 Meijer, W. 1970
Botanical notes on Ceylon trees. 1. *Soymida febrifuga* (Roxb.) Juss. indigenous in Ceylon. *Ceylon For.* 9 : 95-97.

Swietenia Jacq.

- MEL 50 Lee, H. Y. 1967
 Studies in *Swietenia* (Meliaceae). Observations on the sexuality of the flowers. *Journ. Arn. Arb.* 48 : 101-104. Flowers of *Swietenia* are unisexual.
- MEL 51 Lee, H. Y. 1970
 Morphological variations of seedlings in *Swietenia* raised from open-pollinated seeds. *Taiwania* 15(2) : 1-7.
- MEL 52 Melville, R. 1936
 A list of tree and false mahoganies. *Kew Bull. Misc. Inf.* 1936 : 193-210.

Toona M. Roem.(Refer also *Cedrela*)

- MEL 53 Grijpma, P. 1976
 Resistance of Meliaceae against the shoot borer *Hypsipyla* with particular reference to *Toona ciliata* M. J. Roem. var. *australis* (F. v. Muell.) C. DC. In : Burley, J. & Styles, B. T., eds., *Tropical trees, Variation, Breeding and Conservation. Linnean Soc. Symp. Ser. No. 2* : 69-78. 1 pl. Academic Press, London.
- MEL 54 Panigrahi, G. 1974
 A note on the nomenclature of certain species of *Toona* M. Roem. from Asia. *Bangladesh Journ. Bot.* 3(1) : 51-55. *Toona ciliata* M. Roem. subsp. *nepalensis* (C. DC.) Panigrahi.

Trichilia P. Br.

- MEL 55 Bentvelzen, P. A. J. 1962
 Reduction of the genus *Heynea* Roxb. ex Sims. to *Trichilia* P. Br. (Meliaceae). *Acta Bot. Neerl.* 11: 11-20, 1 fig. *Trichilia connaroides* (Wt. & Arn.) Bentvelzen f. *glabra* Bentvelzen = *H. trijuga* Roxb. ex Sim.

- MEL 56 De Wilde, J. J. F. E. 1968
A revision of the species of Trichilia P. Browne (Meliaceae)
on the African continent. 200 pp.

Xylocarpus Koen.

- MEL 57 Parkinson, C. E. 1934
 The Indian species of *Xylocarpus*. *Indian Forester* 60 :
 136-143, tab. 15-17.

Walsura Roxb.

- MEL 58 Ghosh, R. B. 1968
 Studies on the morphology of somatic chromosomes in
Walsura piscida Roxb. *Caryologia* 21(2) : 111-114.

ADDITIONS : GENERAL

- MEL 59 Grant, V. 1963
 The *Origin of adaptations*, New York & London, Colum-
 bia Univ. Press.
- MEL 60 Hiern, W. P. 1875
 Meliaceae. *In* : Hooker, J. D., ed., *Fl. Brit. India*
 1 : 540-569.
- MEL 61 Lowry, J. B. 1976
 Anthocyanins of the Melastomataceae, Myrtaceae and
 some allied families. *Phytochemistry* 15 : 513-556.

MELIOSMACEAE—refer **SABIACEAE**

MEMECYLACEAE

(Refer also Melastomataceae)

A family of 4 genera and about 360 species mainly trees and shrubs, occurring in the tropical regions, the Memecylaceae, a segregate of the family Melastomataceae includes the following genera : *Memecylon* (300 spp.) occurring in Asia and Africa ; *Votomita* (5 spp.)

of S. America ; *Mouriri* (50 spp.) of central and tropical S. America and *Avinandra* (5 spp.) from Sri Lanka, Malay Peninsula and Borneo.

The family Memecylaceae is considered as a separate family by Airy-Shaw and Dahlgren (1983) and considered it in the order Myrtales. However, Bentham & Hooker, Cronquist, Hutchinson, Takhtajan and Thorne included it as a part of the family Melastomataceae in the order Myrtales. While Engler also included it in the family Melastomataceae under the order Myrtiflorae.

The family Memecylaceae is characterised by opposite, entire exstipulate leaves, 4-5-merous flowers, inflorescence usually axillary, one to multilocular inferior ovary with 2-3 ascending axile ovule per locule and 1-5 seeded berry with leafy cotyledons and large embryo.

The family is allied to the Myrtaceae and Melastomataceae. The family is represented in India by the following genera : *Memecylon*.

GENERAL

- MMC 1 Dahlgren, R. 1983
General aspects of angiosperm evolution and macro-systematics. *Nord. Journ. Bot.* 3 : 119-149.
- MMC 2 Vliet, G. J. C. M. van, Kock-Noorman, J. & Welle, B. J. H. ter 1981
Wood anatomy, classification and phylogeny of the Melastomataceae. *Blumea* 27 : 463-473, 2 fig.

Memecylon Linn.

- MMC 3 Bremer, K. 1979
Taxonomy of *Memecylon* (Melastomataceae) in Ceylon. *Opera Botanica* No. 50 : 1-32, 12 fig., 3 photo ; key to 30 spp.
- MMC 4 Henry, A. N. (1980) 1981
A new *Memecylon* L. (Melastomataceae) from Tamil Nadu, India. *Journ. Bombay Nat. Hist. Soc.* 77(3) : 492-493. *M. subramanii* described from Kannikatti.

- MMC 5 Jacques-Felix, H. 1978
Les subdivisions du genre *Memecylon* (Melastomataceae) en Afrique. *Adansonia* ser. 2. 17(4) : 415-424.
- MMC 6 Jacques—Felix, H., Moutan, J. A. & Chalopin, M. 1978
Nervation et types foliaires chez les *Memecylon* (Melast.) africains. *Adansonia* 18(1) : 67-81.
- MMC 7 Maxwell, J. F. 1980
Revision of *Memecylon* L. (Melastomataceae) from the Malay Peninsula. *Gard. Bull. Singapore* 33 : 31-150. A complete revision of 28 spp., 22 taxa reduced.

MENISPERMACEAE

A family of about 70 genera and 400 species of mostly twining shrubs and trees, mainly pantropical, derives its name from moon-shaped seeds (*mene*, moon ; *sperma*, seed).

The family Menispermaceae is included in the order Ranunculales by Cronquist, Dahlgren, Engler and Takhtajan. While Hutchinson and Thorne included it in the order Berberidales. Bentham & Hooker included it in the order Ranales.

The Menispermaceae is characterised by alternate usually simple exstipulate leaves, unisexual, dioecious flowers which are inconspicuous and arranged in racemose or cymose inflorescence, flowers 3-merous and seeds mostly with large embryo and scanty endosperm.

According to Dahlgren (1983) the Ranunculales and Papaverales share with many Magnoliiflorae in the spiral insertion of the floral parts, which become trimerous, the common presence of benzylisoquinoline alkaloids and the occasional presence of cyanogenic compounds.

While establishing South East Asia as the cradle of flowering plants Takhtajan (1969) indicated that the most primitive genera

Tinomiscium and *Fibraurea* of the tribe Fibrauraceae occur in S. E. Asia while genus *Pycnarrhena* of the tribe Triclisiae ranges from Eastern Himalaya to Queensland. The allied genera *Macrococculus* and *Haematocarpus* occur in East Himalaya and West Malesia.

It is seen complex types of benzyloisoquinoline alkaloids, many of which are restricted to one family (i.e.) hausubanan alkaloids to the Menispermaceae (Thornber, 1970) and spirobenzyloisoquinoline alkaloids to the Fumariaceae have helped in the placement of the systematic groupings. However it is also seen sesquiterpene lactones known as picrotoxins are found in the families Euphorbiaceae, Menispermaceae, Orchidaceae and Coriariaceae which are taxonomically distant (Seigler, 1981).

The menispermaceous flora of India is represented by the following genera : *Albertisia*, *Anamitra*, *Aspidocarya*, *Cissampelos*, *Cocculus*, *Coscinium*, *Cyclea*, *Diploclisia*, *Eleutharrhena*, *Fibraurea*, *Haematocarpus*, *Hypserpa*, *Pachygone*, *Parapaena*, *Pericampylus*, *Pycnarrhena*, *Stephania*, *Tiliacora*, *Tinomiscium*, *Tinospora*.

The genus *Jateorhiza* [*J. palmata* (Lamk.) Miers] is cultivated.

For recent taxonomic revisions refer Forman (1955, 1956, 1960, 1968, 1972, 1975, 1982) ; for pollen morphology refer Thanikaimoni (1968), Harley & Ferguson (1982) ; for chemotaxonomy refer Thornber (1970).

GENERAL

- MNS 1 Baillon, H. 1871
 Monographie des Menispermacees et des Berberidacees.
Hist. Pl. 3 : 1-76. Includes Lardizabalaceae.
- MNS 2 Bentham, G. 1861
 Notes on Menispermaceae. *Journ. Linn. Soc. Bot.* 5
 (Suppl. 2) : 45-52. General comments.
- MNS 3 Candolle, A. P. de 1824
 Menispermaceae. *In* : DC., *Prodr.* 1 : 95-104.

- MNS 4 Diels, L. 1910
Menispermaceae. *In* : Engler, *Pflanzenr.* 46 : (IV. 94) : 1-345. fig. 1-93.
- MNS 5 Ernst, Wallace R. 1964
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A preliminary study of menispermaceous medicinal plants in China. *Acta Phytotax. Sin.* 13 : 32-55, 2 fig. Synopsis ; new species from China.
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A revision of the tribe Coscinieae Hook. f. & Thoms. (Menispermaceae). The Menispermaceae of Malesia and adjacent areas IX. *Kew Bull.* 32 : 323-338. Revision of *Anamirta* and *Coscinium*.

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Coscinium Colebr.

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Wight. *Kew Bull.* 14 : 68-78.

Eleutharrhena Forman

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The tribe Triclisieae Diels in Asia, the Pacific and
Australia. The Menispermaceae of Malesia and adjacent
areas VIII. *Kew Bull.* 30 : 77-100.

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Pollen morphology and taxonomy of the tribe Menispermaceae (Menispermaceae). *Kew Bull.* 37(3) : 353-366.
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Menispermaceae. In : Hooker, J. D., ed., *Fl. Brit. India* 1 : 94-107.
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Terpenes and plant phylogeny. In : Young, D. A. & Seigler, D. S., eds., *Phytochemistry and angiosperm phylogeny*. Praeger, New York, 117-148.
- MNS 49 Thornber, C. W. 1970
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The tribe Triclisieae Diels in Asia, the Pacific and Australia. The Menispermaceae of Malesia and adjacent areas VII. *Kew Bull.* 30(1) : 77-100. *Pycnarrhena mecistophylla* Miers is transferred to the genus *Albertisia mecistophylla* (Miers) Forman from Assam.

MENYANTHACEAE

(Refer also Gentianaceae)

The family Menyanthaceae consists of 5 genera and 33 species of aquatic or marsh plants and it is closely allied to the family Gentianaceae but differs in having alternate leaves and valvate petaled flowers. Whereas in the Gentianaceae the leaves are opposite and petals are convolute.

The Menyanthaceae is included in the order Polemoniales by Cronquist. While Engler, Dahlgren, Hutchinson, Takhtajan and Thorne considered it in the order Gentianales. Bentham & Hooker however considered it as a part of the family Gentianaceae.

The family is characterised by alternate simple or rarely peltate or 3-foliolate exstipulate leaves, bisexual 5-merous flowers having valvate petals with usually fimbriate margin. The ovary is superior, 2-carpelled, 1-locular with two parietal placenta and fruit is either 2-4 valved capsule or fleshy indehiscent.

According to Dahlgren (1983) the family Menyanthaceae differs from the Gentianaceae in lacking internal phloem, in the presence of alternate leaves and in the cellular endosperm formation (it is usually nuclear in other Gentianales). Cronquist (1981) indicated that the family Menyanthaceae is not satisfactorily placed either in the Gentianales or Solanales and a detailed study is needed. Cronquist treats Menyanthaceae outside the order Gentianales which differ from the rest of the Gentianales in the presence of fructose oligosaccharides (Pollard & Amuti, 1981).

In India the family Menyanthaceae is represented by the following genera : *Menyanthes*, *Nymphoides*, *Villarsia*.

For taxonomic revisions refer Qaiser (1977) ; for palynology refer Nilsson & Ornduff (1973) ; for morphology refer Nair (1976), Ornduff (1966) ; for chemotaxonomy refer Pollard & Amuti (1981).

GENERAL

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thaceae Dum. Stockholm, Almqvist & Wiksell, 1-20.
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Genera et Species Gentianearum. 336-348. Stuttgartiae.
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The origin of dioecism from heterostyly in *Nymphoides* (Menyanthaceae). *Evolution* 20 : 309-314.
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Cytogeography of *Nymphoides* (Menyanthaceae). *Taxon* 19 : 1150.
- MNY 7 Raynal, Aline 1974
- Le genre *Nymphoides* (Menyanthaceae) en Afrique et a Madagascar. *Adansonia ser.* 2. 14(3) : 405-458. Distinct groups recognised within *N. indica s. l.*
- MNY 8 Vasudevan, R. 1968
A new species of *Nymphoides* (Menyanthaceae) from South India. *Kew Bull.* 22 : 101-106. *N. macrospermum* from Kerala.

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General aspects of angiosperm evolution and macro-systematics. *Nord. Journ. Bot.* 3 : 119-149.
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MESEMBRYANTHEMACEAE—refer AIZOACEAE

MIMOSACEAE

(Refer also Leguminosae)

The segregate of the family Leguminosae, the family Mimosaceae comprises about 1500 species which are predominantly tropical and subtropical.

The family Mimosaceae is regarded as a separate family by Takhtajan and included in the Rosales ; while Hutchinson and Dahlgren (1983) considered the family Mimosaceae in the order Leguminales and Fabales respectively. However Bentham & Hooker, Cronquist, Engler & Thorne considered it under the family Leguminosae in the order Rosales.

The family is characterised by having often bipinnate leaves, regular flowers and valvate sepals [rarely imbricate sepals (i.e.) tribe Parkieae] 4 to 10 or numerous stamens with usually compound pollen. The following tribes are recognised : Ingeae, Acaciae, Mimoseae, Adenanthereae, Piptadenieae and Parkieae.

Among the economically important trees, the following species are well known. Black wattle (*Acacia decurrens*) ; Golden wattle (*Acacia pycnantha*) ; Black wood (*Acacia melanoxylon*). Some of the fast growing trees are *Acacia auriculiformis*, *Albizia lebbek*, *A. falcataria*, *A. chinensis*, *A. procera*, *Calliandra calothyrsus*, *Mimosa scabrella* *Enterolobium cyclocarpum*, Ipil-Ipil (*Leucaena leucocephala*), Rain tree (*Samanea saman*).

Dahlgren (1983) treated the order Fabales in the order Fabiflorae showing its relationships with Sapindales (i.e.) Sapindaceae and Connaraceae. El Gazzar & El-Feti (1977) on the basis of seed morphology, flavonoid and canavanine distribution indicated that the sub-families Caesalpinoideae and Mimosoideae are closer to each other than either of them is to Faboideae.

The family is represented in India by the following genera : *Abarema* (reduced to *Pithecellobium*), *Acacia*, *Adenantha*, *Calliandra*, *Indopiptadenia*, *Inga*, *Mimosa*, *Neptunia*, *Parkia*, *Pithecellobium*, *Prosopis*, *Xylia*.

The following genera are introduced and cultivated in India : *Desmanthus*, *Leucaena*, *Samanea*.

For recent taxonomic revisions refer Ali (1973), Brenan (1959), Elias (1978), Kostermans (1954) ; for palynology refer Guinet (1969, 1978), Sorsa (1969) ; for chromosome and evolution refer Bandel (1974).

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Studies on extra floral nectaries of the Leguminales. 3. Mimosaceae. *Journ. Indian Bot. Soc.* 52(3-4) : 267-298.
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An overview of Mimosoideae. *Bull. Groupe Int. Etude Mimos.* 6 : 38-39. Summary of papers presented at International Leguminosae Conference.
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Birds as possible pollinators of *Acacia pycnantha*. *Austral. Journ. Bot.* 24(6) : 793-795.
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Donnees nouvelles sur le role de la morphologie du pollen dans la classification du genre, *Acacia*, C. R. *Acad. Sci. Paris* 258(19) : 4823-4825.
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Parallelisme entre les caracteres du pollen dans les groupes Piptadeniees et Acaciees des Mimosacees. *Rev. Palaebot. Palynol.* 3(1-4) : 151-153.
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A note on *Acacia auriculiformis* A. Cunn ex Benth. in Sabah. *Malayan Forester* 28(3) : 243-244.
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Indian climbing Acacias of the *Caesia* group. *Indian Forester* 55: 325-333. refer *Kew Bull.* 1915 : 407.
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Revision of the extra-Australian species of *Acacia* subgen. *Heterophyllum*. *Contrib. Queensl. Herb.* No. 18 : 1-24. Key to 18 spp.
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A revision of *Acacia* Mill. in Queensland. *Austrobaileya* 1(2) : 1-234. Key.
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A survey of some of the pre-Linnean history of the genus *Acacia*. *Bothalia* 13 : 95-110, 17 fig.
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MITRASTEMONACEAE—refer **RAFFLESACEAE****MOLLUGINACEAE**

(Refer also Aizoaceae)

The family Molluginaceae is a segregate of the family Aizoaceae. The family Molluginaceae is included in the order Caryophyllales by Cronquist, Hutchinson and Takhtajan in the order Centrospermae by Engler; whereas Bentham & Hooker and Thorne included Molluginaceae as part of the family Aizoaceae.

It is interesting to note that within the order Caryophyllales, betalains occur in all excepting the family Caryophyllaceae and the

Molluginaceae. Mabry & Behnke (1976) noted though the Caryophyllaceae and the Molluginaceae are anthocyanin—pigmented families, they are closely united with the rest of the Caryophyllales by a well-matched mesh of palynological, anatomical and embryological characters. Cronquist (1981), Dahlgren (1980, 1983) treat the Caryophyllaceae and Molluginaceae near each other. While Takhtajan (1980) considered it a separate suborder, Thorne (1981) has gone to the extreme of keeping betalain producing Aizoaceae and anthocyanin producing Molluginaceae together. Richardson (1981) after flavonoid study indicated that separation is possible in many members of Molluginaceae and Aizoaceae on the basis of the presence or absence of C-glycosylflavonoids. According to Ehrendorfer (1976) some protocaryophylloids which are pigment free developed betalains which are attractive pigments for vecting pollinators due to selection pressures brought out by sudden evolution of insect population. Whereas the proto Phytolaccaceae—Molluginaceae—Aizoaceae has anthocyanins or no pigments.

The family is represented in India by the genus *Mollugo*.

For taxonomic studies refer Eckardt (1964) ; for palynology refer Sharma (1963) ; for chemotaxonomy refer Richardson (1981), Mabry & Behnke (1976).

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MONOTROPACEAE

(Refer also Ericaceae and Pyrolaceae)

A family of parasitic fleshy herbs, it includes about 12 genera and 21 species. The family Monotropaceae is included in the order Ericales by Bentham & Hooker, Cronquist, Dahlgren, Hutchinson and Takhtajan. Whereas Engler considered it under the family Pyrolaceae Thorne treated it under the family Ericaceae.

Due to parasitic nature the herbs are devoid of chlorophyll and leaves are reduced to scales. The family has bisexual regular flowers

usually arranged in racemes or capitate or sometimes solitary with 2-6 calyx lobes, 3-6 petals and 6-12 stamens, filaments connating at the base and anthers opening by slits. The ovary is 1-6 locular superior with many ovules on axile or parietal placentas. The seeds are small with copious endosperm.

The family is represented in India by the genera *Cheilothea*, *Monotropa* and *Monotropastrum*.

For recent taxonomic revisions refer Copeland (1931) ; for palynology and classification refer Nowicke (1966) and Wallace (1976).

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Inter relationships of the subfamilies of the Ericaceae and derivation of the Monotropeoideae. *Bot. Notiser* 128(3) : 286-298.
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MORACEAE

(Refer also Cannabidaceae & Urticaceae)

The family Moraceae consists of about 53 genera and 1400 species of mostly trees and shrubs.

The family Moraceae is included in the tribe Urticales by Cronquist, Dahlgren, Engler, Hutchinson, Takhtajan and Thorne.

As an order, Urticales, it is considered better placed near Euphorbiales (Berg, 1977 ; Dahlgren, 1980, 1983 ; Thorne, 1976) than to the wind pollinated groups Fagales, Betulales and Juglandales as proposed by Cronquist (1981) and Takhtajan (1980).

The family is characterised by stipulate leaves with latex and flowers mostly unisexual arranged in racemes, spikes or umbels. The stamens in male flowers are opposite to the perianth lobes bent mostly inwards or rarely straight and anthers not exploding as in Urticaceae. Ovary in female flowers are 2-carpelled usually one abortive, 1-locular with one pendulous ovule. Fruits are achenes or drupe, all being united, usually becoming fleshy by aggregation with fleshy receptacle.

Berg (1978) proposed the family Cecropiaceae, a segregate of the family Urticaceae. According to Corner (1962) the family is divided into the following tribes : Ficeae, Dorsteniaceae, Brosimeae, Moraceae, Olmedieae, Artocarpeae based on the nature of flowers, exserted or inserted styles, straight or inflexed stamens and nature of fruits.

A family of economic importance, some of the trees yielding edible fruits are : Bread fruit (*Artocarpus communis* J. R. & G. Forst.) ; Jackfruit (*Artocarpus heterophyllus* Lamk.) ; Fig (*Ficus carica* Linn.) ; Mulberry tree (*Morus alba* Linn. ; *M. australis* Poir.).

The following genera represent the family Moraceae in India : *Antiaris*, *Artocarpus*, *Broussonetia*, *Cudrania*, *Dorstenia*, *Ficus*, *Morus*, *Plecospermum*, *Pseudostreblus*, *Streblus*.

The introduced and cultivated genera are as follows : *Castilla*, *Chlorophora*, *Fatoua*, *Maclura*.

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- MOR 22 Kaastra, R. C. 1972
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- MOR 27 Condit, I. J. 1958
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- MOR 33 Corner, E. J. H. 1960
Taxonomic notes on *Ficus* Linn., Asia and Australasia VI. Subgen. *Ficus* sect. *Sycocarpus* Miq. *Gard. Bull. Singapore* 18 : 36-69.
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Taxonomic notes on *Ficus* Linn., Asia and Australasia—Addendum. *Gard. Bull. Singapore* 18 : 83-97.
- MOR 35 Corner, E. J. H. 1962
The classification of Moraceae. *Gard. Bull. Singapore* 19 : 187-252. Synonymy ; key to tribes & genera.
- MOR 36 Corner, E. J. H. 1962
Taxonomic notes on *Ficus* Linn., Asia and Australasia—Addendum II. *Gard. Bull. Singapore* 19 : 385-401.
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The species of *Ficus* of the Indo-Malayan and Chinese countries. *Ann. Roy. Bot. Gard. Calcutta* 1 : i-xii, 1-185, tab. 1-225. Monographic.
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The creeping species of *Ficus*. *Gard. Chron.* III, 22 : 205.

Morus Linn.

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Taxonomical studies on the Morus plants and their distri-

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Prodromus di una monografia delle specie del genere *Morus*. *Giorn. Ist. Lombardo Sci.* 1 : 85-102. A critical discussion and synopsis of 16 spp. without description.

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Presence in Indochina. De *Streblus indicus* (Bur.) Corner. *Adansonia* 7 : 365-369. 1 pl., 1 map.

Taxotrophis Bl.

(Reduced to *Streblus*)

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Taxotrophis and *Balanostrebulus*. *Kew Bull.* 1918 : 147-153.

ADDITIONS : GENERAL

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Urticales, their differentiation and systematic position. *Plant Syst. Evol. Suppl.* I : 349-374.
- MOR 62 Berg, C. C. 1978
Cecropiaceae, a new family of the Urticales. *Taxon* 27 : 39-44.

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An integrated system of classification of flowering plants.
Columbia University Press, New York.
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A revised system of classification of the angiosperms.
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A phylogenetic classification of the Angiospermae.
Evol. Biol. 9 : 35-106.

MORINACEAE

(Refer also Dipsacaceae)

A family of one genus and 17 species, Morinaceae occurs in temperate regions of Europe and Asia. Airy Shaw proposed the family status to the tribe Morineae, formerly assigned to the family Dipsacaceae. While Cronquist, Engler, Thorne and Takhtajan included it in the family Dipsacaceae in the order Dipsacales, Dahlgren (1983) supported the family rank to the Morinaceae in the order Dipsacales.

The family Morinaceae consists of perennial herbs with opposite or verticillate leaves and zygomorphic flowers in axillary whorls. The zygomorphy is due to the presence of bilabiate calyx and corolla. The stamens are 2 or 4, didynamous and ovary is inferior, 1 locular with one pendulous ovule. The fruit is an achene.

According to Dahlgren (1983), Ericales, Cornales and Dipsacales are closely bound by several morphological, anatomical and chemical characters.

The family is represented in India by the genus *Morina*.

MORINGACEAE

The family Moringaceae is represented by the genus *Moringa* (one genus) and 12 species occurring in India and Africa.

The Moringaceae is included in the order Capparales by Cronquist, Dahlgren and Takhtajan, in the order Capparidales by Hutchinson and Thorne, in the order Papaverales by Engler. Bentham & Hooker kept this as an "anomalous family".

The species of the family Moringaceae are trees with myrosin cells, a universal character of the order Capparales. The leaves are pinnate to tripinnate and flowers are bisexual zygomorphic with 5-merous floral parts. The ovary is superior on a short gynophore, 3-carpelled, 1-locular with many biseriate pendulous ovules on 3 parietal placentas. Fruit is an elongated 3-valved, 1 locular capsule and seeds are usually 3 winged.

The zygomorphy of flowers may be due to particular pollinators and in this it shows alliance with the family Caesalpiniaceae.

Kolbe's (1973, 1978) serological studies do not support affinities between the Moringaceae or Trapaeclaceae with the other families of Capparaceae, Brassicaceae, Tovariaceae and Resedaceae. According to Gershenzon & Mabry (1983) glucosinolates are ubiquitous in the Brassicaceae, Capparaceae, Moringaceae, Resedaceae and Tovariceae. Formerly the family Papaveraceae is included in the order Rhodales (old ordinal name for the order Capparales). But the absence of glucosinolates and the presence of benzylisoquinoline alkaloids in the Papaveraceae led to the separation of the Papaveraceae from the order Rhodales (Hegnauer, 1969).

The family is represented in India by the genus *Moringa*. The leaves and spongy tissue and seeds are edible. (*Moringa oleifera* Lamk.)

For recent taxonomy refer Chatterjee (1948), Datta & Mitra (1947), van Steenis (1949) ; for chemotaxonomy refer Gershenzon & Mabry (1983) ; for palynology refer Rao & Ling (1947).

GENERAL

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Notes on the affinities of Moringaceae. *Sci. Cult.* 14 : 253-254. Discussion.

- MRG 2 Datta, R. M. & Mitra, J. N. 1947
The systematic position of the family Moringaceae based on a study of *Moringa pterygosperma* Gaertn. (*M. oleifera* Lam.). *Journ. Bombay Nat. Hist. Soc.* 47 : 355-357. Assigns *Moringa* near Violaceae.
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Contribution a' l'etude des Moringees. *Revue Gen. Bot.* 25 : 449-471, pls. 2, 3 p.
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The genera of Capparaceae and Moringaceae in the South Eastern United States. *Journ. Arn. Arb.* 44 : 89-95. *Moringa oleifera* (Moringaceae), 93-95 p.
- MRG 5 Khan, M. S. & Huq, A. M. 1975
Flora of Bangladesh : 2. Moringaceae, Polemoniaceae, Basellaceae and Butomaceae. *Bangladesh Agricultural Research Council* 1-13.
- MRG 6 Pax, F. 1936
Moringaceae. In : Engler & Prantl, *Pflanzenf.* ed. 2. 17b : 693-698.
- MRG 7 Steenis, C. G. G. J. van 1949
Moringaceae. In : *Fl. Males.* I, 4 : 45-46.
- Moringa** Adans.
- MRG 8 Bullock, A. A. 1960
Nomenclatural notes XII. The types of some generic names. *Kew Bull.* 14 : 40-45. *M. oleifera* Lamarck is the correct name for *M. pterygosperma*.
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The horse radish tree (*Moringa oleifera* Lam.). *Fair Child Tropical Garden. Am. Eagle* 42(21) : 3.
- MRG 10 Puri, V. 1941
The life history of *Moringa oleifera* Lamk. *Journ. Indian Bot. Soc.* 20 : 263-284.

- MRG 11 Rao, A. N. & Ling, L. F. 1974
Pollen morphology of certain tropical plants. *Reinwardtia* 9 : 153-176. *Moringa oleifera*. p. 160.
- MRG 12 Verdcourt, B. 1959
Moringa—a correction. *Kew Bull.* 13 : 384-386.

ADDITIONS : GENERAL

- MRG 13 Gershenzon, J. & Mabry, T. J. 1983
Secondary metabolites and the higher classification of angiosperms. *Nord. Journ. Bot.* 3 : 5-34.
- MRG 14 Hegnauer, R. 1969
Chemical evidence for the classification of some plant taxa. *In* : Harborne, J. B. & Swain, T. eds., *Perspectives in Phytochemistry*, Academic, London 121-138.
- MRG 15 Kjaer, A. 1973
The natural distribution of glucosinolates, a uniform group of sulfur containing glycosides. *In* : Bendz, G. & Santesson, J., eds., *Chemistry in botanical classification*, Nobel Foundation, Stockholm, 229-234.
- MRG 16 Kolbe, K.- P. 1973
Serologischer Beitrag Zur Systematik der Capparales unter besonderer Berucksichtigung der inneren Gliederung der Brassicaceae, Dis, kiel.
- MRG 17 Kolbe, K.- P. 1978
Serologischer Beitrag Zur Systematik der Capparales. *Bot. Jahrb. Syst.* 99 : 468-489.

MUSACEAE

(Refer also Zingiberaceae)

The family Musaceae consists of *Musa* and *Ensete* with about 42 species occurring in tropical Asia, Africa and Australia with large number of cultivars.

The Musaceae is included in the order Zingiberales by Cronquist, Dahlgren, Hutchinson, Takhtajan and Thorne. While Engler considered it in the order Scitamineae and Bentham & Hooker included it in the order Epigynae (as Scitamineae). The family is herbaceous with branching rhizomes having leafy sheaths arranged spirally, closely packed shooting up as pseudo aerial stems. The flowers are arranged in racemes with brightly coloured spathes. The flowers are zygomorphic with male, female and bisexual flowers and they are 3-merous. The perianth 3+3 (5 united and 1 free) and petaloid. Stamens are 3-merous (3+3) the posterior stamen represents as a staminode. Ovary is 3-carpelled, 3-loculed, one to many ovule in each locule. The seeds are not arillate and the flowers produce honey as an aid for insect pollination.

According to Dahlgren (1983) "the least specialized members of Zingiberales (i.e.) Musaceae, Heliconiaceae, Strelitziaceae (a single if applying a wider concept) and Lowiaceae have oxalate raphides, 5 functional stamens (and lack of petaloid staminodia), septal nectaries and seeds with copious starchy endosperm". The other Zingiberales (Zingiberaceae, Costaceae, Cannaceae and Marantaceae), generally lack oxalate raphides, most of the stamens are usually petaloid staminodia, septal nectaries are usually absent and the endosperm is replaced by copious perisperm.

The family is represented in India by the genera *Ensete* and *Musa*.

For recent taxonomy refer Cheesman (1947-50), Simmonds (1960, 1962, 1966) ; Simmonds & Shepherd (1955) ; for chromosome studies refer Cheesman & Larter (1935), Dodds (1943) ; Pancho & Capirpin (1959) ; for phylogeny refer Dahlgren (1983).

GENERAL

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Variation of chromosome numbers in Musaceae. *Curr. Sci.* 3 : 615-617.
- MUS 2 Baker, J. G. 1893
A synopsis of the genera and species of Musae. *Ann.*

Bot. 7 : 189-222. Key with an enumeration & descr. of all known spp.

- MUS 3 Brewbaker, J. L. & Umali, D. L. 1956
Classification of Philippine *Musae* 1. The genera *Musa* L. and *Ensete* Horan. *Philipp. Agric.* 40 : 231-241.
- MUS 4 Chakravorti, A. K. 1951
Origin of the cultivated bananas of South East Asia. *Indian Journ. Genet.* 11 : 34-46.
- MUS 5 Champion, J. 1963
Le bananier Paris, Maisonneuve Larose 1-258.
- MUS 6 Chandraratna, M. F. 1951
The origin of cultivated races of banana. *Indian Journ. Genet.* 11 : 29-33.
- MUS 7 Cheesman, E. E. 1947-50
The classification of the bananas. *Kew Bull.* 2 : 97-117 ; 3 : 11-28 ; 4 : 23-28, 133-137, 265-272, 445-452 ; 5 : 27-31, 151-155.
- MUS 8 Cheesman, E. E. & Larter, L. N. H. 1935
Genetic and cytological studies of *Musa* 3. Chromosome numbers in the Musaceae. *Journ. Genet.* 30 : 31-52.
- MUS 9 Hill, A. W. 1926
The original home of the banana. *Nature, Lond.* 117 : 757.
- MUS 10 Krishnamurthy, S. & Seshadri, V. S. 1958
Origin and evolution of cultivated bananas. *Indian Journ. Hort.* 15 : 135-145.
- MUS 11 Kuprianova, L. A. 1955
Donnees palynologiques sur la systematique des Musaceae. *Dokl. Akad. Nauk. S. S. S. R.* 101(6) : 1131-1133.
- MUS 12 Kurz, S. 1865
Note on the plantains of the Indian Archipelago. *Journ. Agri.-hort. Soc. W. India* 14 : 295-301.

- MUS 13 Lane, I. E. 1955
Genera and generic relationships in Musaceae. *Mitt. Bot. Staatssaml. Munchen* 13 : 114-131.
- MUS 14 Li, H. W., Wu, Te-lin, Chen, Senjen 1981
Musaceae. *Fl. Reipubl. Pop. Sinicae* 16(2) : 1-19, 5 pl.
In Chinese. Key to 3 genera ; 9 species of *Musa*.
- MUS 15 Nur, N. 1976
Studies on pollination in Musaceae. *Ann. Bot. (U. K.)* 40(166) : 167-177.
- MUS 16 Roy, R. S. & Sharma, C. 1951
Chromosome studies of Bihar bananas. *Indian Journ. Genet.* 11 : 34-46.
- MUS 17 Schumann, K. 1900
Musaceae. In : Engler, *Pflanzenr.* 1 : (IV 45) 1-45, fig. 1-10.
- MUS 18 Simmonds, N. W. 1960
Notes on banana taxonomy. *Kew Bull.* 14 : 198-212.
- MUS 19 Simmonds, N. W. 1962
The evolution of the bananas. London, Longmans Green 1-165.
- MUS 20 Simmonds, N. W. 1966
Bananas 2nd ed., London, Longmans Green 1-512.
- MUS 21 Simmonds, N. W. & Shepherd, K. 1955
The taxonomy and origins of the cultivated bananas. *Journ. Linn. Soc. Bot.* 55 : 302-312.
- MUS 22 Tomlinson, P. B. 1959
An anatomical approach to the classification of the Musaceae. *Journ. Linn. Soc. Bot.* 55 : 779-809.
- MUS 23 Tomlinson, P. B. 1962
Phylogeny of the Scitamineae—morphological and anatomical considerations. *Evolution* 16 : 192-213.

- MUS 24 Venkataramani, K. S. 1946
Studies on Indian Bananas : 1. A descriptive study of
twenty varieties. *Proc. Indian Acad. Sci.* 23 B : 113-128.
- MUS 25 Venkataramani, K. S. 1950
Classification of the bananas—a resume. *Madras Agric.
Journ.* 37 : 439-447.
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Musaceae. *In* : Engler & Prantl, *Pflanzenf.* 15a : 505-
541.

Ensete Horan

- MUS 27 Chaudhuri, A. B. 1959
A note on *Ensete edule*, Ethiopian banana. *Indian Forester*
85 : 422.
- MUS 28 Cheesman, E. E. 1947
Classification of the bananas I. The genus *Ensete* Horan.
Kew Bull. 1947 : 97-105.
- MUS 29 Moore, H. E. Jr. 1957
Musa and *Ensete*. The cultivated bananas. *Baileya*
5 167-194, fig. 48-58. A historical and botanical
review.
- MUS 30 Rao, A. S. & Hazra, P. K. (1976) 1979
Ensete glaucum (Roxb.) Cheesm. in the Khasi hills,
Meghalaya, India. *Bull. Bot. Surv. India* 18(1-4) : 207-
210. *Musa agharkarii* Chakrav. reduced.
- MUS 31 Subba Rao, G. V. & Kumari, G. R. (1972) 1975
Ensete glaucum (Roxb.) E. E. Cheesm., a relict species in
the Eastern Ghats. *Bull. Bot. Surv. India* 14 : 164-166,
10 fig. Synonymy, descr., distr.

Musa Linn.

- MUS 32 Baker, J. G. 1894
Species and principal varieties of *Musa*. *Kew Bull.
Misc. Inf.* 1894 : 229-314.

- MUS 33 Chakravorti, A. K. 1949
A preliminary note on the occurrence of the genus *Musa* L. in India and the features of its distribution. *Journ. Indian Bot. Soc.* 27 : 84-90, tab. 1-3.
- MUS 34 Chakravorti, A. K. 1948
On the occurrence of nonstoloniferous species of *Musc.* *M. agharkarii* sp. nov. in the Chittagong hill tracts (Bengal). *Journ. Indian Bot. Soc.* 27 : 90-96. Refer MUS 30.
- MUS 35 Champion, J. 1947-49
Classification, origine et repartition, géographique des espèces et variétés du genre *Musa*. *Fruits Outre Mer.* 2 : 73-79, 251-254. 1947 ; 3 : 173-180. 1948 ; 4 : 16-24, 2 maps, 1949. A review of classification.
- MUS 36 Champion, J. 1949
Classification origine et repartition géographique des espèces du genre *Musa*. *Fruits Outre Mer.* 4 : 133-140. An enumeration of species in alphabetical sequence.
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- MUS 38 Cheesman, E. E. 1948
Classification of the banana—3. Critical notes on species. *Kew Bull.* 1948 : 11-17, 2 pl. *Musa balbisiana* Colla from Tamil Nadu & Kerala.
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Genetical and cytological studies of *Musa*—5. Certain edible diploids. *Journ. Genet.* 45 : 113-138.
- MUS 40 Dodds, K. S. & Pittendrigh, C. S. 1946
Genetical and cytological studies of *Musa*—7. Certain aspects of polyploidy. *Journ. Genet.* 47 : 162-177.

- MUS 41 Dodds, K. S. & Simmonds, N. W. 1948
Genetical and cytological studies of *Musa*-9. The origin of an edible diploid and the significance of interspecific hybridization in the banana complex. *Journ. Genet.* 48 : 285-296.
- MUS 42 Jacob, K. C. 1934
South Indian bananas. *Madras Agric. Journ.* 27 : 41-57.
- MUS 43 Jacob, K. C. 1952
Madras bananas : a monograph.
- MUS 44 Pancho, J. V. & Capinpin, J. M. 1959
Cytotaxonomic study of the fiber producing *Musa* in the philippines. 1. Chromosome numbers in the Philippines. 1. Chromosome numbers in the section *Australimusa*. *Philipp. Agric.* 43 : 397-403.
- MUS 45 Raman, V. S., Alikhan, W. M., Manimekalai, G. & Bhakthavathsalu, C. M. 1971
A study of the cytomorphology of some banana hybrids. *Madras Agric. Journ.* 58(2) : 55-62.
- MUS 46 Shepherd, K. 1964
A new species of banana. *Kew Bull.* 17 : 461-463, 11 fig. *Musa ochracea*, probably from W. Ghats ; locality not indicated.
- MUS 47 Sundararaj, D. D. & Balasubramanyam, G. 1971
Occurrence of *Musa ornata* Roxb. from South India (E. Ghats). *Kew Bull.* 25 : 331-333. Describ.
- MUS 48 Wildeman, E. de 1912
Les bananiers, culture, exploitation, commerce systematique due genre *Musa*. *Ann. Colon. Mus. Marseille* II, 10 : 286-362. Monographic.

MYRICACEAE

The family Myricaceae consists of 4 genera (*Myrica*, *Gale*, *Comptonia*, *Canacomyrica*) and about 40 species which is a cosmopolitan family.

The family Myricaceae is included in the order Myricales by Cronquist, Hutchinson, Takhtajan and Thorne. It is included in the order Juglandales by Engler. However Bentham & Hooker treated the family in the order Unisexuales.

The family consists of aromatic shrubs and trees. The flowers are monoecious or dioecious or bisexual and achylamydous and they are borne in catkin like spikes. The male flowers are with 2 bracteoles and 2(4)-16 stamens and filaments sometimes connate below. The female flowers are 2-4 bracteolate and the ovary is 2 carpelled, 1 locular with one ovule. Fruit is a waxy warted drupe.

The Myricales form as separate order with a single family Myricaceae and its systematic position requires further study. However it is seen that it is closely related to the family Betulaceae.

According to Cronquist (1968) the peltate resinous glands of the leaves of Myricaceae which give its characteristic odour, are similar to the peltate glands seen in the Juglandales and Fagales. Meeuse (1975) has given the reasons for considering wind pollinated flowers (Fagales, Myricales, Juglandales and Casuarinales) as relatively ancestral. Petersen & Fairbrothers (1979) on serological evidence justifies the placing of Myricales and Juglandales with Fagales. As mentioned earlier, wind pollinated flowers have arisen polyphyletically from several ancient stocks of insect pollinated groups. The course of evolution has taken place from one group to another depending on the ecological and environmental factors and availability of insect pollinators in space and time.

GENERAL

- MYR 1 Backer, C. A. 1951
Myricaceae. *In* : van Steenis, *ed.*, *Fl. Males.* I, 4: 276-279,
fig. 1.

- MYR 2 Candolle, C. de 1864
Myricaceae. *In* : DC., *Prodr.* 16(2) : 147-155.
- MYR 3 Chevalier, A. 1901-1902
Monographie des Myricacees ; anatomie et histologie, organographie, classification et description des especes, distribution géographique. *Mem. Soc. Sci. Nat. Cherbourg* 32 : 85-340, pl. 1-8, fig. 1-20, 1 map.

Myrica Linn.

- MYR 4 Chevalier, A. 1922
Les myricas asiatiques a' fruits comestibles. *Rev. Bot. Appl.* 2 : 633-636. Edible species of *Myrica*.
- MYR 5 Sladkov, A. N. 1956
Pollen de certaines especes vivantes et fossiles du genre *Myrica* L. *Dokl. Akad. Nauk. S.S.S.R.* 109 : 213-216. In Russian.

ADDITIONS : GENERAL

- MYR 6 Meeusc, A. D. J. 1975
Floral evolution in the Hamamelidae II, Interpretative floral morphology of the Amentiferae. *Acta Bot. Neerl.* 24 : 165-179.
- MYR 7 Petersen, F. P. & Fairbrothers, D. E. 1979
Serological investigations of selected amentiferous taxa. *Syst. Bot.* 4 : 230-241.

MYRISTICACEAE

The family Myristicaceae consists of about 18 genera and 300 species occurring mainly in the tropics.

The family Myristicaceae is included in the order Magnoliales by Cronquist, Engler and Takhtajan. It is included in the order Annonales by Dahlgren and Thorne. The family is considered in the order

Laurales by Hutchinson. While Bentham & Hooker treated it in the order Micrembryae.

The species of the family Myristicaceae are mainly trees with simple exstipulate leaves with oil cells. The flowers are usually 3-merous, sometimes (2-3-5) merous, simple and valvate. Stamens are 3-30, filaments united into a column. Ovary is superior, 1-locular with one basal ovule. Fruit is fleshy, arillate and seeds with ruminant endosperm.

According to Takhtajan (1969) "the Myristicaceae are noticeably more primitive than the Annonaceae in their wood structure, but more advanced florally". The family Myristicaceae have trilacunar nodes and uniaperturate pollen as in the magnoliaceous group. The floral structures are more advanced in Myristicaceae as the filaments of the numerous stamens in the male flowers are united, features quite uncommon in the primitive groups. The gynoecium is interpreted as monomerous. In earlier classification, the Myristicaceae is closely associated in Laurales which is apparently due to the inconspicuous sepals and petals, apparently unicarpellate ovary which is considered a derived feature. Though the presence of benzyloquinoline alkaloids are primitive features mainly seen in the Magnoliflorae, it is lacking in the primitive family Myristicaceae, Winteraceae and Lactoridaceae.

The family Myristicaceae is represented in India by the following genera : *Gymnacranthera*, *Horsfieldia*, *Knema*, *Myristica*.

Myristica fragrans Houtt., the Nutmeg of commerce, native of E. Moluccas is cultivated, as kernel and aril are used as spice and for perfume.

For taxonomy revisions refer Sinclair (1958, 1968) ; for palynology refer Canright & Paden (1962), Joshi (1946) ; floral morphology refer Nair (1972) ; for wood anatomy refer Garratt (1933).

GENERAL

- MYS 1 Canright, J. E. & Paden, M. P. 1962
Contributions of pollen morphology to the phylogeny of

the Annonaceae, Eupomatiaceae and Myristicaceae.
Amer. Journ. Bot. 49(6) : 674.

- MYS 2 Garratt, G. A. 1933
Bearing of wood anatomy on the relationships of the
Myristicaceae. *Trop. Woods* 36 : 20-44.
- MYS 3 Joshi, A. C. 1946
A note on the development of pollen of *Myristica fragrans*
and the affinities of the family Myristicaceae. *Journ.*
Indian Bot. Soc. 25 : 139-143.
- MYS 4 Nair N. C. 1972
Floral morphology and embryology of *Myristica malabarica*
Lamk. with a discussion on certain aspects of the syste-
matic of Myristicaceae. *Adv. Plant Morph.* 1972 :
264-277.
- MYS 5 Sinclair, J. 1958
A revision of Malayan Myristicaceae. *Gard. Bull. Singapore*
16 : 205-466.
- MYS 6 Uphof, J. C. T. 1959
Myristicaceae. In : Engler & Prantl, *Pflanzenf.* 17a(2) :
177-220.
- MYS 7 Warburg, O. 1897
Monographie der Myristicaceen. *Nov. Act. Acad. Natur-*
forsch 1-680, t. 1-25.

Gymnacranthera Warb.

- MYS 8 Sinclair, J. 1958
Florae Malesianae praecursorum 30. The genus *Gymna-*
cranthera (Myristicaceae) in Malaysia. *Gard. Bull. Singapore*
17 : 96-120, 3 fig.

Horsfieldia Willd.

- MYS 9 Sinclair, J. 1975
The genus *Horsfieldia* (Myrist.) in and outside Malesia

II. *Gard. Bull. Singapore* 28 : 1-181. Species names arranged alphabetically ; keys with critical notes.

Knema Lour.

- MYS 10 Sinclair, J. 1961
Florae Malesianae Precursores-31. The genus *Knema* in Malaysia and outside Malaysia (Myrist.). *Gard. Bull. Singapore* 18 : 102-327, 26 fig., 18 map.
- MYS 11 Wilde, W. J. J. O de 1979
 New account of the genus *Knema* (Myristicaceae). *Blumea* 25 : 321-478, 18 fig. Precursor to *Flora Males.* 83 spp., key, critical notes.

Myristica Gronov.

- MYS 12 King, G. 1891
 The species of *Myristica* of British India. *Ann. Roy. Bot. Gard. Calcutta* 3 : 275-331, tab. 106-174.
- MYS 13 Sinclair, J. 1968
Florae Malesianae Precursores-42. The genus *Myristica* in Malesia and outside Malesia. *Gard. Bull. Singapore* 23 : 1-540, 86 fig., 22 map. Key to sections, series & spp., synonymy of genus ; descr. & distr. of spp.

ADDITIONS : GENERAL

- MYS 14 Takhtajan, A. 1969
Flowering plants, origin and dispersal i-x, 1-310, Oliver & Boyd, Edinburgh.
- MYS 15 Tsiang, Y., Li, P.-T. eds.
Calycanthaceae, Annonaceae, Myristicaceae. Flora Republic Popularis Sinicae 30(2) : i-vii, 1-218. In chinese, keys.

MYRSINACEAE

(includes Aegicerataceae)

The family Myrsinaceae consists of about 35 genera and 1000 species of trees and shrubs.

The family Myrsinaceae is included in the order Primulales by Bentham & Hooker, Cronquist, Dahlgren, Engler, Takhtajan and Thorne. However Hutchinson considered it as a separate order Myrsinales. Hutchinson and Dahlgren considered Aegicerataceae as a separate family.

The family is characterised by its alternate exstipulate gland dotted leaves and schizogenous secretory systems, bisexual or unisexual regular 5-4 epipetalous oppositipetalous stamens. Ovary is semi-inferior, 1-loculed with basal or free central with usually many or rarely few ovules. The fruit is a berry or drupe and seeds are endospermous. The family is allied to the Theophrastaceae, but differs in having fertile stamens while in the Theophrastaceae, staminodes are also present and leaves are not gland dotted. It is considered as allied to Primulaceae because of the stamens opposite to petals. But in the family Primulaceae the fruit is capsular and plants are herbaceous.

The myrsinaceous flora is represented by the following genera : *Amblyanthopsis*, *Amblyanthus*, *Antistrophe*, *Ardisia*, *Embelia*, *Hymenandra*, *Maesa*, *Myrsine*, *Rapanea*, *Sadiria*.

For taxonomic revisions refer Mez (1902, 1906), Walker (1940), Nayar & Giri (1976, 1977, 1979).

GENERAL

- MRS 1 Candolle, A. de 1834
A review of the natural order Myrsineae. *Trans. Linn. Soc.* 17 : 95-138, pl. 4-8.
- MRS 2 Candolle, A. de 1841
Seconde memoire sur la famille des Myrsinacees. *Ann. Sci. Nat. II. Bot.* 16 : 65-97, pl. 1-3.

- MRS 3 Candolle, A. de 1841
Trosieme memoire sur la famille des Myrsineacees.
Ann. Sci. Nat. II. Bot. 16 : 65-97, pl. 1-3.
- MRS 4 Candolle, A. de 1844
Myrsinaceae. *In* : DC., *Prodr.* 8 : 75-140.
- MRS 5 Jafri, S. M. H. & Qaiser, S. 1975
Myrsinaceae. *Fl. W. Pakistan* 80 : 1-8, 2 fig.
- MRS 6 Mez, C. 1902
Myrsinaceae. *In* : Engler, *Pflanzenr.* 9 (IV. 238) : 1-437,
fig. 1-61.
- MRS 7 Mez, C. 1906
Additamenta monographica III. Myrsinaceae. *Fedde
Repert* 3 : 97-104.
- MRS 8 Mez, C. 1919-1920
Additamenta monographica III. Myrsinaceae. *Fedde
Repert* 16 : 309-312, 410-425.
- MRS 9 Walker, E. H. 1937
New species and nomenclatural changes in eastern
Asiatic Myrsinaceae. *Journ. Washington Acad. Sci.* 27 :
198-203, fig. 1-4.
- MRS 10 Walker, E. H. 1940
A revision of the eastern Asiatic Myrsinaceae. *Philip.
Journ. Sci.* 73 : 1-258, fig. 1-37.
- MRS 11 Walker, E. H. 1942
New and critical Chinese and Indo-Chinese Myrsinaceae.
Journ. Arn. Arb. 23 : 344-355, fig. 1-2.

Amblyanthopsis Mez.

- MRS 12 Sikdar, J. K. (1976) 1979
A note on *Amblyanthopsis bhotanica* (Myrsinaceae) from
India. *Bull. Bot. Surv. India* 18 : 244-246, fig. 1.

Antistrophe A. DC.

- MRS 13 Nayar, M. P. & Giri, G. S. (1976) 1976
Revision of the genus *Antistrophe* A. DC. (Myrsinaceae).
Bull. Bot. Surv. India 18(1-4) : 80-84. Key & descr.

Ardisia Sw.

- MRS 14 Feng, W. Z. & Yao, K. 1979
Materials on the genus *Ardisia* Sw. (Myrsinaceae). *Acta
Phytotax. Sin.* 17(4) : 99-100. In Chinese, critical notes.
- MRS 15 Giri, G. S. & Nayar, M. P. 1981
New Indian record of *Ardisia perdalina* Mez. (Myrsina-
ceae). *Journ. Bombay Nat. Hist. Soc.* 78(3) : 633-635.
- MRS 16 Nayar, M. P. & Giri, G. S. (1975) 1976
A new species of *Ardisia* (Myrsinaceae) from N. E.
India. *Journ. Bombay Nat. Hist. Soc.* 72(3) : 825-826,
pl. 1. *Ardisia meghalayensis* descr. from Jaintia hills.
- MRS 17 Nayar, M. P. & Giri, G. S. 1982
Taxonomic studies of Asian Myrsinaceae. 1. Two new
species of *Ardisia* from Burma. *Journ. Econ. Tax. Bot.*
3 : 281-283.
- MRS 18 Walker, E. H. 1939
Concerning *Ardisia crispa* (Thunb.) A. DC. and *A. crenata*
Sims., confused species of Myrsinaceae from Eastern
Asia. *Journ. Washington Acad. Sci.* 29 : 256-261.

Embelia Burm.

- MRS 19 Mez, C. 1901
Zwei neue Arten der Gattung *Embelia* Burm. aus China.
Notizbl. Bot. Gart. Berlin 3 : 107-108.
- MRS 20 Walker, E. H. 1931
Embelia scandens (Lour.) Mez and its eastern Asiatic
allies. *Lingnan Sci. Journ.* 10 : 475-480.

Hymenandra A. DC.

- MRS 21 Nayar, M. P. & Giri, G. S. (1975) 1976
 A synopsis of the genus *Hymenandra* A. DC. (Myrsinaceae) and a new species from Burma. *Journ. Bombay Nat. Hist. Soc.* 72(3) : 818-821. A short review ; *Hymenandra narayanaswamii* from Burma is described ; 3 spp., key.

Maesa Forsk.

- MRS 22 Mazumdar, N. C. & Giri, G. S. 1981
 A new species of *Maesa* Forsk. (Myrsinaceae) from Meghalaya. *Journ. Bombay Nat. Hist. Soc.* 78 : 149-151, 1 pl.
- MRS 23 Nayar, M. P. & Das, Debika 1969
 A new variety of *Maesa macrophylla* Wall. (Myrsinaceae) from Naga hills. *Indian Forester* 95 : 400-401. *M. macrophylla* var. *magnidentata* from Naga hills.
- MRS 24 Nayar, M. P. & Giri, G. S. (1975) 1978
 A new species of *Maesa* (Myrsinaceae) from Nagaland (India). *Bull. Bot. Surv. India* 17(1-4) : 182-184.
- MRS 25 Nayar, M. P. & Giri, G. S. 1978
 Lectotypification of *Maesa castaneifolia* Mez. (Myrsinaceae) and new addition to the Indian flora. *Journ. Bombay Nat. Hist. Soc.* 75(1) : 252-254.

Sadiria Mez.

- MRS 26 Nayar, M. P. & Giri, G. S. (1974) 1977
 Taxonomic studies on Myrsinaceae of India. 1. A new species and review of genus *Sadiria* Mez. *Bull. Bot. Surv. India* 16(1-4) : 144-147. Key to 6 spp.

ADDITIONS : GENERAL

- MRS 27 Chen, Cheih 1978
 New species and varieties of Myrsinaceae from China.

Acta Phytotax. Sin. 16(3) : 79-81. New spp. in *Maesa*,
Ardisia & *Embelia*.

MRS 28 Clarke, C. B. 1882

Myrsineae. *In* : Hooker, J. D., *ed.*, *Fl. Brit. India* 3: 507-533.

MRS 29 Rao, K. S. 1972

Studies in Myrsinaceae I *Proc. Ind. Acad. Sci. B.* 75 : 160-166. Morphology and embryology.

MYRTACEAE

The family Myrtaceae consists of about 100 genera and 3000 species with the main centre of distribution in tropical America and secondary centre in Australia.

The family consists of giant trees and shrubs. *Eucalyptus regnans* from Australia is considered as one of the tallest angiosperms second only to Redwoods of California. The leaves are alternate or opposite, gland-dotted. The flowers are regular, bisexual, perigynous to epigynous, 4-5 merous. Stamens are many, free or in bundles and bent inwards in bud. Ovary is generally inferior, many to 1-loculed, 2 to many ovules in each locule. The fruit is a berry, drupe or capsule or sometimes a nut.

The family is classified into the following subfamilies: (i) Myrtoideae (berry or drupe, leaves usually opposite ; (ii) Leptospermoideae (dry fruit, leaves opposite or alternate).

The family is included in the order Myrtales by Bentham & Hooker, Cronquist, Engler, Dahlgren, Hutchinson, Takhtajan and Thorne.

The order Myrtales have characteristic features such as the presence of bicollateral vascular strands, nuclear endosperm formation and the presence of ellagi tanins.

Within the order Myrtales, Myrtaceae and Onagraceae do not have pseudocolpi whereas in the other members of the Myrtales (Melastomataceae, Memecylaceae, Crypteroniaceae, Penaeaceae,

Combretaceae and Olinaceae) have heterocolpate pollen grains (pollen grains where the tissue apertures alternate with colpus like grooves).

For recent taxonomic revisions refer Ashton (1981), Merrill & Perry (1938) ; for phylogeny refer Andrews (1913), Briggs & Johnson (1979) ; for chromosome numbers refer Atchison (1947), Bowden (1945), Mehra & Khosla (1972) ; for palynology refer Deb & Chakraborty (1959).

The following genera occur in India : *Acmena*, *Cleistocalyx*, *Decaspermum*, *Meteoromyrtus*, *Rhodamnia*, *Rhodomyrtus*, *Syzygium*, *Tristania*.

The following genera are cultivated in India : *Callistemon*, *Eucalyptus*, *Eugenia*, *Feijoa*, *Melaleuca*, *Metrosideros*, *Myrtus*, *Pimenta*, *Psidium*.

GENERAL

- MRT 1 Andrews, E. C. 1913
 The development of the natural order *Myrtaceae*. *Proc. Linn. Soc. New South Wales* 38 : 529-568.
- MRT 2 Atchison, E. 1947
 Chromosome numbers in the Myrtaceae. *Amer. Journ. Bot.* 34 : 159-164.
- MRT 3 Ashton, P. S. 1981
 Myrtaceae. *Rev. Handb. Fl. Ceylon, New Delhi* ed. 403-472.
- MRT 4 Berry, E. W. 1915
 The origin and distribution of the family Myrtaceae. *Bot. Gaz.* 59 : 484-490.
- MRT 5 Bowden, W. M. 1945
 A list of chromosome numbers in higher plants 1. Acanthaceae to Myrtaceae. *Amer. Journ. Bot.* 32 : 82-92.
- MRT 6 Briggs, B. G. & Johnson, L. A. S. 1979
 Evolution in the Myrtaceae—evidence from inflorescence structure. *Proc. Linn. Soc. New South Wales* 102(4) : 157-256.

- MRT 7 Candolle, A. P. de 1828
Myrtaceae. *In* : DC., *Prodr.* 3 : 207-296.
- MRT 8 Candolle, A. P. de 1841
Memoire sur la famille des Myrtacees. *Mem. Soc. Phys. & Hist. Nat. Geneve* 9 : 301-361, t. 1-22.
- MRT 9 Deb, D. B. & Chakraborty, N. K. 1959
Studies on the pollen grains of certain Myrtaceae. *Bull. Bot. Soc. Bengal* 13 : 66-69.
- MRT 10 Diels, L. 1920-1922
Myrtaceae. *Engl. Bot. Jahrb.* 57 : 356-426.
- MRT 11 Mehra, P. N. & Khosla, P. K. 1972
Cytogenetical studies of East Himalayan Hamamelidaceae, Combretaceae and Myrtaceae. *Silvae Genet.* 21(5) : 186-190.
- MRT 12 Merrill, E. D. & Perry, L. M. 1938 & 1939
The Myrtaceae of China. *Journ. Arn. Arb.* 19 : 191-247.
1938. A revision. Additional notes on Chinese Myrtaceae. *Journ. Arn. Arb.* 20 : 102-103.
- MRT 13 Moussel, B. 1965
Contribution a' l'etude cytotaxinomique des Myrtacees. *Mem. Mus. Nat. Hist. Nat. Ser. B.* 16 : 91-125.
- MRT 14 Niedenzu, F. 1898
Myrtaceae. *In* : Engler & Prantl, *Pflanzenf.* III (7) : 57-105.
- MRT 15 Wilson, K. 1960
The genera of Myrtaceae in the South Eastern United States. *Journ. Arn. Arb.* 41 : 270-278.

Acmena DC.

- MRT 16 Merrill, E. D. & Perry, L. M. 1938
A synopsis of *Acmena* DC., a valid genus of the Myrtaceae.

Journ. Arn. Arb. 19 : 1-20. Includes *A. acuminatissima* (Bl.) Merr. & Perry.

Callistemon R. Br.

- MRT 17 Byrnes, N. B. 1980
Callistemon and *Melaleuca*. *Austral. Syst. Bot. Soc. Newsletter* 22 : 8. Discussion.
- MRT 18 Lebler, B. A. 1974
 Bottlebrushes of South-Eastern Queensland. *Queensland Agric. Journ.* 100(11) : 539-550.

Cleistocalyx Bl.

- MRT 19 Merrill, E. D. & Perry, L. M. 1937
 Reinstatement and revision of *Cleistocalyx* Blume (including *Aciealyptus* A. Gray), a valid genus of the Myrtaceae. *Journ. Arn. Arb.* 18 : 322-343, pl. 215.

Decaspermum J. R. & G. Forst.

- MRT 20 Scott, A. J. 1980
 A synopsis of *Decaspermum* (Myrtaceae) in South-East Asia and China. *Kew Bull.* 35 : 403-411. Key & descr. 9 spp.

Eucalyptus L'Herit

- MRT 21 Blakely, W. F. 1934
 A key to the eucalypts, with descriptions of 500 species and 138 varieties, 1-339. Sydney.
- MRT 22 Carr, S. G. M. 1972
 Problems of the geography of tropical eucalypts. *In* : Walker, D., ed., *Bridge and barrier : the natural and cultural history of Torres Strait* : 153-181. Canberra.
- MRT 23 Johnson, L. A. S. 1976
 Problems of species and genera in *Eucalyptus* (Myrtaceae). *Pl. Syst. Evol.* 125(3) : 155-167.

- MRT 24 Johnston, R. D. & Marryatt, R. 1965
Taxonomy and nomenclature of Eucalypts. *Dep. Nat. Development For. & Timber Bureau Leaflet*. 92 : 1-24.
Critical evolution of names.
- MRT 25 Maheshwari, J. K. 1975
Exomorphological features and convergence in eucalypts. *In* : Mohan Ram, H. Y., Shah, J. J. and Shah, C. K., eds., *Form, structure and function in plants* 330-340.
- MRT 26 Mouden, J. H. 1903-1929
A critical revision of the genus *Eucalyptus*. 8 vols. Sidney.
- MRT 27 Mueller, F. von 1879-1884
Eucalyptographia, a descriptive Atlas of the Eucalypts of Australia and the adjoining islands. 10 vols. Melbourne.
- MRT 28 Pryor, L. D. & Johnson, L. A. S. 1971
A classification of the Eucalypts. The Australian National University, Canberra, 1-102.

Eugenia Linn.

- MRT 29 Gagnepain, F. 1917
Classification des *Eugenia*. *Bull. Soc. Bot. France* 64 : 94-103.
- MRT 30 Gill, B. S. 1975
Polyploidy in the woody genus *Eugenia* (Myrtaceae). *In*: P. Kachroo, ed., *Advancing frontiers in cytogenetics in evolution and improvement of plants* 348-356.
- MRT 31 Henderson, M. R. 1949
The genus *Eugenia* (Myrtaceae) in Malaya. *Gard. Bull. Singapore* 12(1) : 1-293. Opposes transfer of species from *Eugenia* to *Syzygium*.

- MRT 32 Schmid, R. 1972
A resolution of the *Eugenia-Syzygium* controversy (Myrtaceae). *Amer. Journ. Bot.* 59 : 423-436.
- Psidium** Linn.
- MRT 33 Fosberg, F. R. 1971
Psidium L. in Ceylon. *Ceyl. Journ. Sci. Biol. Sci.* 9 : 58-60.
Key to 4 spp.
- MRT 34 Nair, P. K. K. *et al.* 1964
Palynological investigations of some guava varieties.
Indian Journ. Hort. 21 : 79-84.
- MRT 35 Sree Rangasamy, S. R. & Das, L. D. V. 1973
Seedlessness in triploid guava (*Psidium guajava* L.) :
embryological studies. *Canad. Journ. Genet. Cytol.* 15(2) :
331-334. Chrom. nos.

Rhodamnia Jack.

- MRT 36 Scott, A. J. 1979
A revision of *Rhodamnia* (Myrtaceae). *Kew Bull.* 33 :
429-459, 1 fig., 3 maps. 23 spp. descr., 8 new spp., 1
species from Nicobar, *R. triplinervia* Bl.

Rhodomyrtus Reichb.

- MRT 37 Scott, A. J. 1978
A revision of *Rhodomyrtus* (Myrtaceae). *Kew Bull.*
33 : 311-329, 1 fig., 3 maps. 11 spp. descr., key, 24
varieties descr.

Syzygium Gaertn.

- MRT 38 Chandrabose, M. & Chandrasekaran, V. 1981
A new species of *Syzygium* Gaertn. (Myrtaceae) from
South India. *Journ. Bombay Nat. Hist. Soc.* 78 : 354-356,
1 pl. *S. chandrasekharanii* from Anamalai, Tamil Nadu,
allied to *S. lanceolatum*.

- MRT 39 Henry, A. N., Chandrabose, M. & Nair, N. C. 1980
 "Belluta Kanneli" of Hortus Malabaricus : *Syzygium zeylanicum* (Linn.) DC. and its varieties (Myrtaceae) in South India. *In* : Manilal, K.S., ed., *Botany & History of Hortus Malabaricus* 159-162, 1 fig.
- MRT 40 Merrill, E. D. & Perry, L. M. 1938
 On the Indo-Chinese species of *Syzygium* Gaertner. *Journ. Arn. Arb.* 19 : 99-116. 51 spp. enumerated.
- MRT 41 Mitra, S. N. 1973
 Some new combinations in Indian plants. *Indian Forester* 99 : 100-101.
- MRT 42 Rathakrishnan, N. C. & Nair, N. C. 1983
 Nomenclatural changes in some Myrtaceous plants. *Journ. Econ. Tax. Bot.* 4 : 287-288. 9 new comb. in *Syzygium*.
- MRT 43 Sastry, T. C. S. & Kashyapa, K. (1975) 1976
Syzygium cumini (Linn.) Skeels var. *axillare* comb. nov. *Journ. Bombay Nat. Hist. Soc.* 72(3) : 882-883. The correct name for *Syzygium jambolanum* DC. var. *axillare* Gamblc.
- MRT 44 Schmid, R. 1972
 A resolution of the *Eugenia-Syzygium* controversy. *Amer. Journ. Bot.* 59 : 423-436, 24 fig. Lists 26 characters segregating *Eugenia* (mostly New World spp.) from *Syzygium* (strictly Old World spp).

ADDITIONS : GENERAL

- MRT 45 Duthie, J. F. 1878 & 1879
 Myrtaceae. *In* : Hooker, J. D., ed., *Fl. Brit. India* 2 : 462-496. 1878 ; 497-512. 1879.

Eugenia Linn.

- MRT 46 Kostermans, A. J. G. H. 1981
Eugenia, *Syzygium* and *Cleistocolyx* (Myrtaceae) in

Ceylon—A monographical revision. *Quart. Journ. Taiwan Mus.* 34 : 117-188.

- MRT 47 Schmid, R. 1972
Floral anatomy of Myrtaceae 1. *Syzygium*. *Bot. Jb.* 92 : 433-489.
- MRT 48 Schmid, R. 1972
Floral anatomy of Myrtaceae II. *Eugenia*. *Journ. Arn. Arb.* 53 : 336-363.

Eucalyptus L'Herit.

- MRT 49 Barber, H. N. 1954
A sterile eucalypt. *Pap. Proc. Roy. Soc. Tasm.* 88 : 285-287.
- MRT 50 Barber, H. N. 1965
Selection in natural populations. *Heredity* 20 : 551-572.
- MRT 51 Krug, C. A. & Alves, A. S. 1949
Eucalyptus improvement. *Journ. Hered.* 40 : 133-139.
- MRT 52 Pryor, L. D. 1951
Controlled pollination of *Eucalyptus*. *Proc. Linn. Soc. N. S. W.* 76 : 135-139.
- MRT 53 Stern, K. & Hattmer, H. H. 1964
Problems involved in some models of selection in forest tree breeding. *Silvae Genet.* 13 : 27-32.

Meteoromyrtus Gamble

- MRT 54 Ramchandran, V. S., Nair, N. C. & Nair, V. J. (1982)
1983
Rediscovery of *Meteoromyrtus wynaadensis* (Bedd.) Gamble (Myrtaceae), more than a century after its earlier collection. *Journ. Bombay Nat. Hist. Soc.* 79 : 461-462.

NAJADACEAE

The family consists of one genus (*Najas*) and about 50 species, fresh water annuals.

They are submerged aquatic plants with linear leaves having sheathing base. The flowers are unisexual. The male flower is represented by a single anther with 1-4 loculed anther enclosed in a 2-lipped perianth. The female flower represents 1-carpelled ovary which is naked or sometimes covered with membranous perianth. The ovule is anatrophous and basal and the ovary is with 2-4 stigmatic lobes. The fruit is an indehiscent nut. The pollination is under water.

The family Najadaceae is included in the order Najadales by Cronquist, Hutchinson, Takhtajan and Thorne. It is included in the order Helobiae by Engler and in the order Apocarpiae by Bentham & Hooker. Dahlgren included it in the order Zosterales.

The Najadaceae though isolated is closely related to the core families Potamogetonaceae, Ruppiaceae, Zosteraceae and Zannichelliaceae. The Najadaceae is different from the above mentioned families in having basal erect ovules, whereas in the former families the ovule is apiculate, lateral or pendulous. The Zosteraceae are marine plants, whereas the Najadaceae, Ruppiaceae and Zannichelliaceae are fresh water or brackish water plants.

The reduction of the flowers is due to the aquatic habit with the loss of insect pollination syndrome due to aquatic habitat.

The family is represented in India by the genus *Najas*.

For studies in morphology refer Swamy & Lakshmanan (1962), Wilde (1961); for taxonomy refer Rendle (1899), Wilde (1961).

GENERAL

NAJ 1 Campbell, D. H. 1897

A morphological study of *Najas* and *Zannichellia*.
Proc. Calif. Acad. Sci. Ser. 3. Bot. 1 : 1-61.

- NAJ 2 Rendle, A. B. 1901
Najadaceae. *In* : Engler, *Pflanzenr.* 2(IV. 12) : 1-21.

Najas Linn.

- NAJ 3 Braun, A. 1864
Revision of genus *Najas* of Linnaeus. *Journ. Bot.* 2 : 274-279.
- NAJ 4 Miki, Shigeru 1937
The origin of *Najas* and *Potamogeton*. *Bot. Mag. Tokyo* 51 : 472-480. Phylogeny ; bibliography.
- NAJ 5 Rendle, A. B. 1899
A systematic revision of the genus *Najas*. *Trans. Linn. Soc. Bot.* II, 5 : 379-436, pl. 39-42. Introduction, systematic account ; keys and list of synonyms.
- NAJ 6 Swamy, B. G. L. & Lakshmanan, K. K. 1962
Contributions to the embryology of the Najadaceae. *Journ. Indian Bot. Soc.* 41 : 247-267.
- NAJ 7 Wilde, W. J. J. O. de 1960
Redescription of the type of *Caulinia indica* Willd. = *Najas indica* (Willd.) Cham. (Najadaceae). *Willdenowia* 2 : 595-597.
- NAJ 8 Wilde, W. J. J. O. de 1961
The morphological evaluation and taxonomic value of the spathe in *Najas* with descriptions of three new Asiatic-Malaysian taxa. *Acta Bot. Neerl.* 10 : 164-170. 9 fig. Spathe is considered as homologous with leaf (bract).

NANDINACEAE

(Refer also Berberidaceae)

The family Nandinaceae is a monogeneric family (*Nandina domestica*), a segregate of the family Berberidaceae.

The family is shrubby with bi- or tripartite exstipulate leaves. The flowers are regular and nectary is absent. Calyx consists of numerous spirally arranged sepals which give a strobiloid appearance. Corolla consists of 6 lobes and stamens are 6, oppositi-petalous ; anthers are sessile with broad connective. The ovary is superior, 1-locular with 1-lateral pendant ovule. Fruit is a globose berry and seeds are copiously endospermous.

The family Nandianaceae is recognised by Ainy-Shaw, Hutchinson and Takhtajan. It is included in the order Berberidales by Hutchinson. While Takhtajan included it in the order Ranunculales, Cronquist, Dahlgren, Engler and Thorne did not recognise this at the family status and considered Nandinaceae as a part of the family Berberidaceae.

Recently Meacham (1980) segregated Nandinaceae as a separate family based on the palynological studies of Nowicke and Skvarla (1981).

According to Takhtajan (1969) "in the most ancient angiosperms there was very probably no corolla, the perianth consisting of modified bracts as in the Bennettitales.....In the Magnoliales as well as in the Illiciales, *Nymphaea*, *Victoria*, *Nandina*, *Paeonia* all the perianth parts (even though differentiated into calyx and corolla) are morphologically equivalent and of bract origin".

The family is represented in India by the genus *Nandina*.

For recent taxonomy and phylogeny studies refer Meacham (1980), Shen (1954) ; for palynology refer Nowicke & Skvarla (1981).

GENERAL

- NAN 1 Hiepko, P. 1965
Vergleichend-morphologische und entwicklungs geschichtliche Untersuchungen über das Perianth bei den Polycarpiceae I. Teil. *Bot. Jb.* 84 : 359-426.
- NAN 2 Meacham, C.A. 1980
Phylogeny of the Berberidaceae with an evaluation of classification. *Syst. Bot.* 5 : 149-172.

- NAN 3 Nowicke, J. W. & Skvarla, J. J. 1981
Pollen morphology and phylogenetic relationships of
the Berberidaceae. *Smithsonian Contr. Bot.* 50 : 1-83.
- NAN 4 Takhtajan, A. 1969
Flowering Plants : Origin and dispersal. i-x, 1-310. Oliver
& Boyd, Edinburgh.

Nandina Thunb.

- NAN 5 Creasy, L. B. 1937
Nandina domestica. *Gard. Chron.* 101 : 11.
- NAN 6 Durand, J. 1923
Nandina domestica Thunb. *Revue Hort.* 28 : 340, 341, 1 pl.
- NAN 7 Shen, Y-F. 1954
Phylogeny and wood anatomy of *Nandina*. *Taiwania* 5 :
85-91. Considers *Nandina* is remotely allied to *Mahonia*
& *Berberis*.

NAUCLEACEAE—refer RUBIACEAE

NELUMBONACEAE

(Refer also Nymphaeaceae)

The family Nelumbonaceae derives its name from the genus *Nelumbo* (a monogeneric family) with two species *Nelumbo nucifera* and *Nelumbo pentapetala* (*N. lutea*, yellow water lily). *Nelumbo nucifera* is the sacred lotus of India and it was introduced to Egypt and other Asian countries as a part of Hindu and Buddhist religious lore by about 1000-500 B.C.

They are large aquatic perennial herbs and unlike the Nymphaeaceae, the leaves and flowers raise above water level. The first perianth leaves are 4-lobed which appear as calyx lobes; followed by numerous petals and stamens arranged acyclically. The central portion is protruded above and it is spongy and bears large number of free carpels embedded in the spongy tissue. Each carpel has 1

pendulous ovule. The spongy receptacles dry up and float about in water until they are disintegrated releasing the seeds for germination. The seeds are non-endospermous and there is no perisperm.

The family Nelumbonaceae is included in the order Nymphaeales by Cronquist and Dahlgren. Takhtajan considered the Nelumbonaceae in a separate order Nelumbonales. Bentham & Hooker, Engler, Hutchinson and Thorne did not recognise this at the family status and included it as a part of the family Nymphaeaceae.

According to Corner (1972) "the flowers of water lilies have a combination that places them low, also in the scale of floral evolution. They are comparable with *Magnolia* flowers, but the floral axis is shortened and the ovary may become syncarpous and inferior. *Nelumbium* shows uniquely how this tendency to sink the ovary in the stem tissue has happened even with the primitive apocarpous flower".

The family Nelumbonaceae is taxonomically isolated (Li, 1958; Takhtajan, 1966). The triaperturate pollen of *Nelumbo* against the rest of the order Nymphaeales which are uniaperturate or uniaperturate-derived is cited as an example for separation. In the Nelumbonaceae the seeds have large embryo and no endosperm or perisperm. Whereas in the Nymphaeaceae, the seeds have small embryo with some endosperm and copious perisperm.

The Nelumbonales have tricolpate pollen and vessels. Takhtajan (1969) states that the absence of vessels is a feature of independent origin and need not be due to aquatic habitat as vessels are present in the aquatic families like Pontederiaceae and Potamogetonaceae. Whereas in the order Nymphaeales, there is the presence of primitive metaxylem of long tracheids.

Chemical characters also support the segregation of Nelumbonaceae from the Nymphaeaceae and allied families. Benzyloisoquinoline alkaloids are seen in the family Nelumbonaceae whereas in the Nymphaeaceae and its allied families Benzyloisoquinoline alkaloids are lacking (Gershenzon & Mabry, 1983).

The family is represented in India by the genus *Nelumbo*.

For recent classification and phylogeny refer Li (1956); for taxonomy refer Fernald (1934), Gleason (1947); for serology and chemotaxonomy Simon (1970, 1972), Gershenzon & Mabry (1983).

GENERAL

- NEL 1 Li, Hui-lin 1955
Classification and phylogeny of Nymphaeaceae and allied families. *Amer. Midl. Nat.* 54 : 33-41.
- NEL 2 Maheshwari, J. K. 1980
Lotuses and water lilies in Hortus Malabaricus. *In* : Manilal, ed., *Botany and History of Hortus Malabaricus* 121-127.

Nelumbo Adans.

- NEL 3 Fernald, M. L. 1934
The name of the American lotus. *Rhodora* 36 : 23-24.
- NEL 4 Flynn, J. J. & Rowley, J. R. 1971
The primexine of *Nelumbo nucifera*. *Experientia* 27(2) : 227-228.
- NEL 5 Gleason, H. A. 1947
The preservation of well-known binomials *Nelumbo lutea* vice *N. pentaphylla*. *Phytologia* 2 : 201-212.
- NEL 6 Irvine, F. R. & Trickett, R. S. 1953
Water lilies as food. *Kew Bull.* 1953 : 363-370. Includes data on *Nymphaea lotus* and *Nelumbo nucifera*.
- NEL 7 Mackawa, F. 1944
On the utilization of lotus and devil lotus. *Journ. Jap. Bot.* 20 : 62-63. Note in Japanese on *Nelumbo* and *Euryale*.
- NEL 8 Ohga, I. 1923
On the longevity of fruits of *Nelumbo nucifera*. *Bot. Mag.*

(*Tokyo*) 37 : 87-95, fig. 1-7. In English; germination of *Nelumbo nucifera*.

- NEL 9 Ohga, I. 1926
On the structure of some ancient, but still viable fruits of Indian lotus with special reference to their prolonged dormancy. *Journ. Jap. Bot.* 3 : 1-20, pl. 1., fig. 1-3.
- NEL 10 Ohga, I. 1927
On the age of the ancient fruit of the Indian lotus which is kept in the peat bed in south Manchuria. *Bot. Mag. Tokyo* 41 : 1-6, fig. 1.
- NEL 11 Ohga, I. 1929
[Two interesting things in Manchuria]. *Amoeba* 1(1) : 59-62, pl. 10-11. Notes in Japanese on semi fossil seeds of lotus (*Nelumbo nucifera*).
- NEL 12 Porterfield, W. M. 1941
Lotus plants for ornaments, food and medicine. *Journ. New York Bot. Gard.* 42 : 280-286.
- NEL 13 Simon, J. P. 1970
Comparative serology of the order Nymphaeales I. Preliminary survey of the relationships of *Nelumbo*. *Aliso* 7 : 243-261.
- NEL 14 Simon, J. P. 1971
Comparative serology of the order Nymphaeales 2. Relationships of Nymphaeaceae and Nelumbonaceae. *Aliso* 7(3) : 325-350. Chrom. nos.
- NEL 15 Snigirevskaya, N. S. 1964
Contributions to the morphology and systematics of the genus *Nelumbo* Adans. *Trudy Bot. Inst. Akad. Nauk. SSSR ser. 1*, 13 : 104-172. In Russian.
- NEL 16 Sohmer, S. H. 1975
The name of the American *Nelumbo*. *Taxon* 24 : 491-493.

- NEL 17 Taylor, H. J. 1927
The history and distribution of yellow *Netumbo*, water
Chinquapin or American lotus. *Proc. Iowa Acad. Sci.*
34 : 119-124.
- NEL 18 Venkateswarlu, J. & Seshavatham, V. 1964
Germination of pollen in *Nelumbium speciosum* Willd.
Curr. Sci. 33(4) : 117.
- NEL 19 Ward, Daniel B. 1977
Nelumbo lutea, the correct name for the American lotus.
Taxon 26(2-3) : 227-234. Nomenclature stability is best
served by the relation of *Nelumbo lutea* (Willd.) Pers. for
the American lotus.
- NEL 20 Watson, W. 1893
The Egyptian lotus (with a coloured plate of *Nelumbium*
speciosum). *Garden* 43 : 462-464, pl. 912.

ADDITIONS : GENERAL

- NEL 21 Corner, E. J. H. 1964
The Life of Plants 1-305. Weidenfeld and Nicolson,
London W 1.
- NEL 22 Gershenzon, J. & Mabry, T. J. 1983
Secondary metabolites and the higher classification of
angiosperms. *Nord. Journ. Bot.* 3 : 5-34.
- NEL 23 Takhtajan, A. 1969
Flowering Plants, Origin and dispersal i-ix, 1-310, Oliver &
Boyd, Edinburgh.

NEPENTHACEAE

The family Nepenthaceae consists of about 2 genera (*Nepenthes*,
Anuroperma) with about 68 species, occurring in Indo-malaysia,
tropical Australia and New Caledonia. The family occurs in tropical
rain fed areas having nutrient-poor soils.

The family Nepenthaceae is included in the order Sarraceniales by Cronquist, Engler and in the order Aristolochiales by Takhtajan and Thorne. Bentham & Hooker included it in the order Multiovulatae terrestriac. Dahlgren however considered it in the order Theales.

The family consists of woody herbs with alternate exstipulate leaves, the midrib of leaves ending in a tendril which bears a pitcher, an insect trapping mechanism. The edges of pitchers have numerous inward producing brightly coloured honey glands and insects get trapped by the inward glands. The trapped insects finally drown in the water collected in the pitchers. The flowers are dioecious arranged in racemes. The perianth 2+2 and stamens are 4-16 arranged in a column. The female flower consists of 4-loculed ovary with numerous ovules. The fruit is a loculicidal capsule. The seeds are minute endospermous and provided with long hair like processes.

According to Cronquist who included the families Droseraceae, Sarraceniaceae and Nepenthaceae in the order Sarraceniales indicates that they represent three distinct lines. Markgraf (1955) considered that the insect catching leaves of all the three families are homologous. It is also seen that the Droseraceae and Nepenthaceae have very common type of pollen.

The family is represented in India by the genus *Nepenthes*.

For recent studies refer Mellichamp (1979), Kondo, *et al.* (1975); for palynology refer Basak & Subramanyam (1966).

GENERAL

- NEP 1 Beccari, O. 1886
 Revista delle specie del Genere. *Nepenthes*. *Malesia* 3 : 1-15, tab. 1-3. Enumeration.
- NEP 2 Danser, B. H. 1928
 The Nepenthaceae of the Netherlands Indies. *Bull. Jard. Bot. Buitenzorg* III, 9 : 249-438, fig. 1-36.
- NEP 3 Harms, H. 1936
 Nepenthaceae. *In* : Engler & Prantl, *Pflanzenf. ed.* 2. *Bd.* 17b : 728-765.

- NEP 4 Hooker, J. D. 1873
Nepenthaceae. *In* : DC., *Prodr.* 17 : 90-105.
- NEP 5 Macfarlane, J. M. 1908
Nepenthaceae. *In* : Engler, *Pflanzenr.* 36(IV. III) : 1-92,
fig. 1-19. Monographic.

Nepenthes Linn.

- NEP 6 Basak, R. K. & Subramanyam, K. 1966
Pollen grains of some species of *Nepenthes*. *Phytomorphology*
16(3) : 334-338.
- NEP 7 Hemsley, W. B. 1905
Historical notes on *Nepenthes*. *Garden* 67 : 250, 269.
- NEP 8 Kondo, K., Kondo, T. & Bogner, J. 1975
Nepenthes : Ornamental Asiatic pitcher plants. *Amer.*
Horticulturist 54(3) : 14-17.
- NEP 9 Kuhl, R. 1933
Nepenthes. *Beih. Bot. Zbl.* 51 : 311-334.
- NEP 10 Mellichamp, L. 1979
Botanical history of carnivorous plants 3 : *Nepenthes*.
Carniv. Pl. Newsl. 8(1) : 30-33.
- NEP 11 Pant, D. D. & Bhatnagar, S. 1977
Morphological studies in *Nepenthes* (Nepenthaceae).
Phytomorphology 27(1) : 13-34.
- NEP 12 Veitch, H. J. 1979
An abridged history of *Nepenthes*. *Carniv. Pl. Newsl.* 8(1):
20-23.

ADDITIONS : GENERAL

- NEP 13 Fisher, L. 1971
Nepenthes blooms again. *Missouri Bot. Gard. Bull.* 59 (6):
13-15.

NEP 14 Markgraf, F. 1955

Über Laubblatt Homologien und Verwandtschaftliche Zusammenhänge bei Sarraceniales. *Planta* 46 : 414-446.

NEURADACEAE

(Refer also Rosaceae)

The family consists of about 3 genera (*Neurada*, *Neuradopsis*, *Grielum*) with about 10 species occurring from Mediterranean region to India.

The Neuradaceae is included in the order Rosales by Cronquist, Dahlgren, Engler and Takhtajan. Bentham & Hooker, Hutchinson, Thorne did not recognise the family status and included this family in the Rosaceae.

They are prostrate tomentose herbs with woody base. The leaves are alternate and pinnately-lobed. The flowers are regular and 5-merous. The stamens 5+5 and ovary is 3-10 loculed adnate to the calyx-tube. The ovule is one per locule and pendulous. The fruit is laterally winged with spinescent styles.

The systematic position of the family is doubtful. A segregate of the family Rosaceae, its alliance with Malvaceae requires study.

The family is represented in India by the genus *Neurada*.

For palynology refer Demchenko (1966); for taxonomy refer Purohit & Panigrahi (1983).

NRD 1 Demchenko, N. I. 1966

The morphology of pollen in Neuradaceae. *Bot. Zh. Moscow* 51(4) : 559-562.

NRD 2 Purohit, K. M. & Panigrahi, G. 1983

The Neuradaceae. J. G. Agardh (Rosales) in India. *Journ. Econ. Tax. Bot.* 4(3) : 1033-1037. The taxonomy and nomenclature of *Neurada procumbens* L., the sole representative in India is studied.

NUPHARACEAE—refer NYMPHAEACEAE

NYCTAGINACEAE

The family Nyctaginaceae includes about 30 genera and 290 species, mostly pantropical.

Cronquist, Dahlgren and Takhtajan placed the family Nyctaginaceae in the order Caryophyllales. Thorne assigned the family in the order Chenopodiales. Engler considered it in the order Centrospermae. Hutchinson treated it in the order Thymelaeales. Whereas Bentham & Hooker assigned the family to Curembryae.

The family is characterised by having flowers in cymes, unisexual or bisexual. The bracts are prominent and coloured as in *Bougainvillea* which has three large petaloid bracts enclosing 3 flowers in a cluster. The sepals usually form a tube which resembles a sympetalous corolla. The perianth is usually petaloid and persistent. The stamens are usually 5, and rarely may range from 8 to 30 by branching. The ovary is superior, 1-loculed with one basal erect ovule. The seeds are provided with perisperm.

The family Nyctaginaceae is one of the core families of Caryophyllales which have betalains. These nitrogenous red and yellow pigments are found only in this order and in a few species of the basidiomycetes (Mabry, 1980).

The family is represented in India by the following genera : *Boerhavia*, *Oxybaphus*, *Pisonia*.

The following genera are cultivated in India : *Bougainvillea*, *Mirabilis*.

For recent taxonomic revisions refer Nasir (1977), Stemmerik (1964); for palynology refer Norwicke (1970), Norwicke & Luikart (1971); for cytology refer Sharma & Bhattacharya (1961).

GENERAL

NYC 1 Choisy, J. D. 1849

Nyctaginaceae. *In* : DC., *Prodr.* 13(2) : 425-458.

- NYC 2 Heimerl, A. 1932
Nyctaginaceen-Studien. *Notizbl. Bot. Gart. Berlin* 11 :
450-470.
- NYC 3 Heimerl, A. 1934
Nyctaginaceae. In : Engler & Prantl, *Pflanzenf. ed. 2.*
Bd. 16C : 86-134.
- NYC 4 Nair, N. C. & Nair, V. J. 1961
Studies on the morphology of some members of the
Nyctaginaceae. *Proc. Indian Acad. Sci. B.* 54 : 281-294.
- NYC 5 Nair, P. K. K. & Khan, H. A. 1965
Pollen grains of Indian plants VII. Nyctaginaceae.
Bull. Nat. Bot. Gard. Lucknow 111 : 1-13.
- NYC 6 Nasir, Y. J. 1977
Nyctaginaceae. *Fl. W. Pak.* No. 115 : 1-16, 4 fig.
- NYC 7 Norwicke, J. W. 1970
Pollen morphology in the Nyctaginaceae. *Grana* 10 :
79-88.
- NYC 8 Norwicke, J. W. & Luikart, T. J. 1971
Pollen morphology of the Nyctaginaceae. II. Coligono-
nieae, Boldoeae and Leucastereae. *Grana* 11 : 145-150.
- NYC 9 Sharma, A. K. & Bhattacharya, U.C. 1961
Further investigations on the cytology of some members
of the Nyctaginaceae. *Indian Agric.* 5 : 9-29.
- NYC 10 Sharma, H. P. 1963
Studies in the order Centrospermales IV. Pollen
morphology of some species of families Ficoidaceae,
Molluginaceae, Nyctaginaceae and Portulacaceae. *Journ.*
Indian Bot. Soc. 42 : 637-647.
- NYC 11 Stemmerik, J. F. 1964
Nyctaginaceae. In : van Steenis, *Fl. Males.* I, 6 : 450-
468, 14 fig.

Boerhavia Linn.

- NYC 12 Almeida, M. R. 1968
Notes on *Boerhavia*. *Journ. Bombay Nat. Hist. Soc.* 65 : 266-268. Key based on fruit & vegetative and floral characters for 5 spp.; **B. erecta** L. = *B. punarnava* Saha & Krishnamurthy.
- NYC 13 Codd, L. E. N. 1966
Notes on *Boerhavia* in southern Africa. *Bothalia* 9(1) : 113-121.
- NYC 14 Fosberg, F. R. 1978
Studies in the genus *Boerhavia* L. (Nyctaginaceae) 1-5. *Smithsonian Contrib. Bot.* No. 39 : 1-20. Key to subgenera, classification of *B. diffusa* L., *B. repens* L.
- NYC 15 Kannabiran, B. 1973
Pollen morphology in *Boerhavia punarnava* Saha & Krish. *Sci. & Cult.* 39 : 280-281.
- NYC 16 Nair, N. C. (1967) 1968
On the identity of *Boerhavia punarnava* Saha & Krishnamurthy. *Bull. Bot. Surv. India* 9 : 283. Correct name is *B. erecta* L.
- NYC 17 Rao, A. N. & Ling L. F. 1974
Pollen morphology of certain tropical plants. *Reinwardtia* 9 : 153-176. *Boerhavia diffusa* L. P. 158.
- NYC 18 Rao, R. S. & Hemadri, K. 1968
Boerhavia punarnava Saha & Krish. *M. V. M. Patrika* 3 : 84. Criticism of the publication of the "new species".
- NYC 19 Rao, R. S. & Hemadri, K. 1970
Boerhavia punarnava Saha & Krish. *Sci. & Cult.* 36 : 218-219.
- NYC 20 Saha, J. C. & Krishnamurthy, K. H. 1962
Identity of the "Sweta Punarnava", *Boerhavia punarnava*

spec. nov. of the Ayurveda. *Journ. Sci. Indust. Res.* 21C : 249-255, pl. 4. Described from Pondicherry; discussion.

Bougainvillea Comm. ex Juss.

- NYC 21 Gillis, W. T. 1976
Bougainvilleas of cultivation (Nyctaginaceae). *Baileya* 20(1) : 34-41. Key.
- NYC 22 Nair, P. K. K. 1961
Pollen grains of cultivated plants II. *Bougainvillea* Comm., *Hibiscus* Medik., *Euphorbia pulcherrima* Willd. *Journ. Ind. Bot. Soc.* 40 : 365-381.
- NYC 23 Pal, B. P. & Vishnu Swarup, 1974
Bougainvilleas. New Delhi—Indian Council of Agricultural Research.
- NYC 24 Sharma, A. K. & Bhattacharyya, U. C. 1960
Cytological investigations on *Bougainvillea*. *Nucleus*, Calcutta 3 : 19.
- NYC 25 Srinivas, Meenakshi & Bhat, R. N. 1982
Cytological studies in some variegated *Bougainvilleas*. *The Nucleus* 25(3) : 130-135.
- NYC 26 Zadoo, S. N., Roy, R. P. & Khoshoo, T. N. 1978
Cytogenetics of cultivated Bougainvilleas—V. Induced tetraploidy and restoration of fertility in sterile cultivars. *Euphytica* 24 : 517.
- NYC 27 Vishnu Swarup & Singh, B. 1964
Pollen morphology and leaf hairs in classification of *Bougainvillea*. *Indian Journ. Hort.* 21(2) : 155-164.

Mirabilis Linn.

- NYC 28 Cruden, R. W. 1973
Reproductive biology of weedy and cultivated *Mirabilis*. (Nyctaginaceae). *Amer. Journ. Bot.* 60 : 802-809.

- NYC 29 Heimerl, A. 1932
Nyctaginaceen Studien. *Notizbl. Bot. Gart. Berlin* 11 :
450-470. Includes *Mirabilis himalaica* var. *chinensis* n. var.
- NYC 30 Pilz, G. E. 1978
Systematics of *Mirabilis* subgenus *Quamoclidion* (Nyctaginaceae). *Madrono* 25(3) : 113-132. Chrom. nos., key, maps.

Pisonia Linn.

- NYC 31 Airy-Shaw, H. K. 1952
On the distribution of *Pisonia grandis* R. Br. with special reference to Malaysia. *Kew Bull.* 1 : 87-97.
- NYC 32 Stemmerik, J. F. 1964
Florae Malesianae Praecursores-38. Notes on *Pisonia* L. in the Old World (Nyctaginaceae). *Blumea* 12 : 275-284. Synonymy of the genus & spp., 2 spp., key to spp.
- NYC 33 St. John, H. 1951
The distribution of *Pisonia grandis* (Nyctaginaceae). *Webbia* 8 : 225-228, 1 fig. Discussion with map.

ADDITIONS : GENERAL

- NYC 34 Mabry, T. J. 1980
Betalains.—In : Bell, E. A. & Charlwood, B. V., eds., *Encyclopaedia of plant physiology*, 8, *Secondary Plant Products*, Springer, Berlin 513-533.

Bougainvillea Comm. ex Juss.

- NYC 35 Aller, O. E. 1982
What's in a name? *Bougainvillea*. *Garden (New York)* 6 (6) : 17-19

Commicarpus Standley

- NYC 36 Meikle, R. D. 1978
A key to *Commicarpus*. *Notes Roy. Bot. Gard. Edinburgh* 36 : 235-249.

NYCTANTHACEAE—refer OLEACEAE

NYMPHAEACEAE

(includes Euryalaceae)

The family Nymphaeaceae includes about 55 aquatic species in the genera *Euryale*, *Nuphar*, *Nymphaea*, *Victoria*. They are with short rhizomes and leaves are large and floating. Calyx consists of 4 sepals. Petals are numerous and stamens are many and subpetaloid. Ovary is superior or semi-inferior and ovules are many and parietal. Fruit is a berry and many seeded. The seeds are endospermous or perispermous.

The family is included in the order Nymphaeales by Cronquist, Dahlgren, Takhtajan and Thorne. Engler considered it in the order Ranunculales while Hutchinson, Bentham & Hooker included it in the order Ranales. The families Cabombaceae and Barclayaceae are considered here as separate families.

The phylogeny of Nymphaeaceae *sensu lato* has been variously interpreted. Hallier (1905) suggested that the Nymphaeaceae were "the ancestors of Helobiac and of the whole division of monocotyledons". According to Agnes Arber (1925), the family Nymphaeaceae descended from ancient stock which gave rise to monocotyledons. In Takhtajan's system (1969) Nymphaeales is indicated as a branch of the monocotyledonous stock. Haines & Lyc (1975) proposed that Nymphaeales should be placed among the monocotyledons, closely allied to Helobiac.

Takhtajan (1969) mentions that the primitive monocots and the order Nymphaeales have the same ancestry. The families Butomaceae, Limnocharitaceae resemble Cabombaceae in the nature of the apocarpous gynocia and in the laminar placentation. It is generally agreed that the discontinuation between monocotyledons and dicotyledons are not distinct (Huber, 1977).

The presence or absence of benzyloquinoline alkaloids are good taxonomic markers. The presence of benzyloquinoline alkaloids in Nelumbonaceae conclusively led the separation of the family Nelum-

bonaceae from the Nymphaeales (Nymphaeaceae and allied families) which lack benzyloquinoline alkaloids. Burger (1977) considers Piperales as descendants of monocotyledonous ancestors, whereas Dahlgren (1983) aligns the Piperales and Nymphaeales as they resemble monocotyledons. Huber (1977) mentions a continuous gradation of characters from advanced monocotyledons through dicotyledons like monocotyledons (Dioscoreales), monocotyledon like dicotyledons (Aristolochiales) to dicotyledons. It is seen that the absence of secondary thickening (lack of cambium in vascular strands) is seen in the Nymphaeales, many Piperales and also many Ranunculiflorae, besides typical monocotyledons.

It is generally accepted that the Cabomba type of flower (in the Nymphaeales), a small trimerous flower, represents the primitive type. The genus *Cabomba* exhibits scattered vascular bundles, lack of vessels in the stem, a short-lived radicle, a short-lived root cap, monosulcate pollen grains, apocarpy, laminar placentation and helobial endosperm as seen in monocotyledonous genera such as *Butomus*. It is seen in the family Nymphaeaceae there are a number of floral parts and development of floral receptacle from the Cabomba type of flower.

Subrahmanyam & Khoshoo (1984) mention that the genus *Nymphaea* supports a wide range of ploidy level from $2x=28$ to $16x=224$, both at inter and intraspecific levels based on $x=14$. It is seen that the diploids are mostly seen in India and Africa, while the polyploidy taxa occupy areas of extreme climatic stresses.

For taxonomy refer Conard (1905); for phylogeny refer Hallier (1905), Agnes Arber (1920), Takhtajan (1969), Dahlgren (1983); for palynology refer Meyer (1965, 1966).

GENERAL

- NYM 1 Baillon, H. 1871
 Monographie des Nymphaeacees. *Histoire des Plantes*
 3 : 77-104.
- NYM 2 Candolle, A. P. de 1824
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- NYM 3 Caspary, R. 1866
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2 : 241-256, pl. 7-8.
- NYM 4 Cheadle, V. I. 1953
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and dicotyledons. *Bot. Gaz.* 98 : 535-555.
- NYM 5 Conard, H. S. 1905
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history, structure, physiology and taxonomy & distribu-
tion.
- NYM 6 Conard, H. S. 1936
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- NYM 7 Conard, H. S. & Hus, H. 1907
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- NYM 8 Hallier, H. 1905
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- NYM 9 Hallier, H. 1912
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- NYM 10 Irvine, F. R. & Trickett, R. S. 1953
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Nymphaea lotus and *Nelumbo nucifera*.
- NYM 11 Khan, M. S. & Halim, M. 1979
Nymphaeaceae. *Fl. Bangladesh* No. 9 : 1-12, p. 4. Key
to 5 genera and *Nymphaea* (4 spp.), 2 cultivated.

- NYM 12 Kuan, Ke-Chian, Hsiao, P. K., Pan, K. Y., Wang, W. T. & Wang, S. H. 1979
Nymphaeaceae, Ceratophyllaceae, Eupteleaceae, Trochodendraceae, Cercidiphyllaceae, Ranunculaceae. *Flora Reipubl. Pop. Sinicae* 27 : 1-664.
- NYM 13 Lawson, G. 1889
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- NYM 14 Li, Hui-lin 1955
Classification and phylogeny of Nymphaeaceae and allied families. *Amer. Midl. Nat.* 54 : 33-41. Nymphaeaceae (s. l.) split into 5 families & placed in 3 orders.
- NYM 15 Meyer, N. R. 1964
Recherches palynologiques sur la famille des Nymphaeaceae actuelles et fossiles. *Bot. Zh.* 49(11) : 1421-1429. In Russian.
- NYM 16 Meyer, N. R. 1965
Palynological researches on the family Nymphaeaceae. *Bot. Zh.* 49 : 1422-1430. In Russian.
- NYM 17 Meyer, N. R. 1966
On the development of the pollen grains of the *Helobiae* and their connection with Nymphaeaceae. *Bot. Zh.* 51 : 1736-1740. In Russian.
- NYM 18 Meyer, N. R. 1966
Investigation of the morphology of pollen grain of Nymphaeaceae and Helobiae for its classification and phylogeny. In : *The Importance of palynological analysis for the stratigraphic and paleofloristic investigations.* *Acad. Sci. USSR, Moscow* 30-35.
- NYM 19 Moseley, F. M. 1958
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- NYM 20 Parkin, J. 1923
The strobilus theory of angiospermous descent. *Proc. Linn. Soc. London Bot.* 153 : 51-64.
- NYM 21 Planchon, J. E. 1853
Etudes sur les Nymphaeacees. *Ann. Sci. Nat. III, Bot.* 19 : 17-63.
- NYM 22 Planchon, J. E. 1853
Enumeration succincte des especes de la famille des Nymphaeacees. *Rev. Hort. (Paris) IV. 2* : 62-68.
- NYM 23 Royen, P. van 1962
Sertulum Papuanum 5. Nymphaeaceae. *Nova Guinea. Bot. No. 8.* 103-126, 7 fig.
- NYM 24 Schaffner, J. H. 1904
Some morphological peculiarities of the Nymphaeaceae and Helobiae. *Ohio Nat.* 4 : 83-92. Attempts to show that the Nymphaeaceae are monocotyledons.
- NYM 25 Sohmer, S. H. 1975
The name of the American *Nelumbo*. *Taxon* 24(4) : 491-493.
- NYM 26 Ueno, J. & Kitaguchi, S. 1961
On the fine structure of the pollen walls of Angiospermae. 2. Nymphaeaceae. *Journ. Biol. Osaka City Univ.* 12 : 83-89.
- NYM 27 Wood, Carroll E. Jr. 1959
The genera of the Nymphaeaceae and Ceratophyllaceae in the South-Eastern United States. *Journ. Arn. Arb.* 40 : 94-112.

Euryale Salisb.

- NYM 28 Gupta, P. P. & Roy, S. K. 1973
Karyotype of *Euryale ferox* Salisb. *Curr. Sci.* 42(3) : 106.

- NYM 29 Okada, Yonosuke. 1926
[On the northern limit of the distribution of *Euryale ferox*]. *Bot. Mag. Tokyo* 40 : 423-424. In Japanese.
- NYM 30 Okada, Yonosuke. 1926
[On the rhizome of *Euryale ferox* Salisb.]. *Journ. Jap. Bot.* 3 : 257-260, 2 fig.
- NYM 31 Okada, Yonosuke. 1935
Study of *Euryale ferox* Salisb. VIII Miscellany *Sci. Rep. Tohoku Univ.* 9 : 455-459, pl. 2. Distribution of fossil and living specimens in Japan.
- NYM 32 Voroshilov, V. N. & Nekrasov, A. A. 1954
Dal nevostochnaia evriale (The Far Eastern *Euryale*) *Priroda* 43(10) : 108-109, 2 fig. A general description of *Euryale ferox* occurring in E. China, Japan and Vladivostock region of Russia.

Nymphaea Linn.

- NYM 33 Deitrich, A. 1853
Aufzählung der *Nymphaea*-Arten. *Allg. Gartenz.* 21 : 353-355, 364, 370-372, 379-380, 386-388, 395-396, 406-407. 64 spp., descr.
- NYM 34 Gaudet, J. J. 1960
The submerged leaves of *Nymphaea pubescens* Willd. *Journ. Bombay Nat. Hist. Soc.* 57 : 234-236, tab. 1, pl. I.
- NYM 35 Gupta, P. O. 1978
Cytogenetics of aquatic ornamentals : 2. Cytology of Nymphaeas. *Cytologia (Japan)* 43(3-4) : 477-484. Chrom. nos.
- NYM 36 Landon, K. C. 1978
Infraspecific classification of *Nymphaea gigantea* (Nymphaeaceae). *Phytologia* 40(5) : 437-455.

- NYM 37 Moseley, F. M. 1961
Morphological studies of the Nymphaeaceae. II. The
flower of *Nymphaea*. *Bot. Gaz.* 122 : 233-259.
- NYM 38 Schuster, J. 1907
Zur Systematik von *Castalia* und *Nymphaea*. *Bull. Herb.*
Boiss. II, 7 : 853-868.

Victoria Schomb.

- NYM 39 Prance, G. T. 1974
Victoria amazonica or *Victoria regia*? *Acta Amazonica*
4(3) : 5-8.
- NYM 40 Prance, G. T. & Prance, A. E. 1976
The beetle and the water lily. *Gard. Journ.* 26(4) : 118-
121. *Victoria amazonica*.
- NYM 41 Ueno, J. 1962
On the fine structure of the pollen walls of Angiospermae-
II. *Victoria*. *Journ. Biol. Osaka City Univ.* 13 : 99-104.

ADDITIONS : GENERAL

- NYM 42 Arber, A. 1925
Monocotyledons : a morphological study. Cambridge.
- NYM 43 Burber, W. C. 1977
The Piperales and the monocots : alternate hypotheses
for the origin of monocotyledonous flowers. *Bot. Rev.*
4 : 345-393.
- NYM 44 Haines, R. W. & Lye, K. A. 1975
Seedlings of Nymphaeaceae. *Bot. Journ. Linn. Soc.*
70 : 255-265.
- NYM 45 Huber, H. 1977
The treatment of the monocotyledons in an
evolutionary system of classification. *Plant Syst. Evol.*
Suppl. 1 : 285-298.

- NYM 46 Simons, J.-P. 1971
Comparative serology of the order Nymphaeales.
2. Relationships of Nymphaeaceae and Nelumbonaceae.
Aliso 7(3) : 325-350.

Nymphaea Linn.

- NYM 47 Subrahmanyam, G. V. & Khoshoo, T. N. 1984
Evolution of garden Nymphaeas. *Curr. Sci.* 53(1) : 360-363.

Victoria Schomb.

- NYM 48 Basu, S. K. 1967
Victoria amazonica—its cultivation in Indian Botanic
Garden. *Hort. Bull.* 3(1) : 17-19.

NYPACEAE—refer **PALMAE**

NYSSACEAE

The family Nyssaceae includes two genera (*Nyssa*, *Camptotheca*) of trees and shrubs, occurring mostly in E. Asia and N. America.

The family Nyssaceae is included in the order Cornales by Cronquist, Dahlgren, Takhtajan and Thorne. Engler considered it in the order Umbelliferae, while Hutchinson in the order Araliales. Bentham & Hooker did not recognise at the family status and considered it as part of the family Cornaceae.

The family is characterised by exstipulate leaves, polygamodioecious, often unisexual regular flowers in heads and racemes. The calyx is 5-dentate or sometimes absent. The petals are 4-5(8) and anthers are 8-10(16) and ovary is 1-2 carpelled, 1-loculed with one apical pendulous ovule. Fruit is drupaceous and sometimes samaroid, 1-seeded. The seeds have large embryo and endospermous.

The Nyssaceae is allied to the Davidiaceae, which has however 6-9 locular ovary. The family is allied to the Cornaceae (stamens as many as petals, opposite leaves, small embryo) but in the Nyssaceae the stamens are more than the petals and seeds have large embryo.

For recent taxonomic revisions refer Fang & Soong (1975), Wasscher (1948); for palynology refer Schna (1963, 1968), for wood anatomy refer Titman (1949).

GENERAL

- NYS 1 Eyde, R. H. 1963
Morphological and palaeobotanical studies of the Nyssaceae I. A survey of the modern species and their fruits. *Journ. Arn. Arb.* 44(1) : 1-60. The living species of the genus *Nyssa* are disjunct in their distribution pattern, occurring in eastern N. America and eastern Asia.
- NYS 2 Eyde, R. H. & Barghooran, E. S. 1963
Morphological and palaeobotanical studies of the Nyssaceae II. The Fossil Record. *Journ. Arn. Arb.* 44 : 328-370. Fossil history traced.
- NYS 3 Fairbrothers, D. E. & Johnson, M. A. 1964
Comparative serological studies within the families Cornaceae (dogwood) and Nyssaceae (sour Gum) 305-318. *In: Leone, C. A., ed., Taxonomic biochemistry and serology*, New York.
- NYS 4 Fang, W. P. & Soong, T. P. 1975
Praecursores Florae Nyssacearum sinensium. *Acta Phytotax. Sin.* 13(2) : 83-89, 2 pl. In Chinese ; key.
- NYS 5 Goldblatt, P. (1978) 1979
A contribution to cytology in Cornales. *Ann. Missouri Bot. Gard.* 65(2) : 650-655. Chrom. nos. *Nyssa*, *Mastixia*, *Cornus*.
- NYS 6 Harms, H. 1898
Cornaceae. *In: Engler & Prantl, Pflanzenf.* III, 8 : 250-270. Includes Nyssaceae.
- NYS 7 Hohn, M. E. & Meinschein, W. G. 1976
Seed oil fatty acids : evolutionary significance in the

- Nyssaceae and Cornaceae. *Biochem. Syst. Ecol.* 4(3) : 193-199.
- NYS 8 Miki, S. 1956
Endocarp remains of Alangiaceae, Cornaceae and Nyssaceae in Japan. *Journ. Inst. Polytech. Osaka Univ.* 7 : 275-297.
- NYS 9 Mohan Rao, P. R. (1972) 1973
Embryology of *Nyssa sylvatica* and systematic consideration of the family Nyssaceae. *Phytomorphology* 22(1) : 8-21.
- NYS 10 Sohma, K. 1963
Pollen morphology of the Nyssaceae I. *Nyssa* and *Camptotheca*. *Sci. Rep. Tohoku Univ. Biol. Ser.* 4 : 29(3-4) : 389-392.
- NYS 11 Sohma, K. 1968
Pollen morphology of the Nyssaceae II. *Nyssa* and *Davidia*. *Sci. Rep. Tohoku Univ. Biol. Ser.* 4 : 23(3-4) : 527-532.
- NYS 12 Tardieu-Blot, M. L. 1968
Nyssaceae. *Fl. Camb. Laos & Vietn. Fasc.* 8 : 3-10, 1 pl.
- NYS 13 Thiergart, F. & Frantz, U. (1962) 1963
Some spores and pollen grains from the Tertiary brown coal of Neyveli. *Palaeobotanist* 11 : 43-45. Includes photographs of new spp. of Tertiary pollen *Lucknowia sahnii* of south India –suggested affinities to Nyssaceae.¹
- NYS 14 Titman, P. W. 1949
Studies in the wood anatomy of the family Nyssaceae. *Journ. Elisha Mitchell Sci. Soc.* 65 : 245-261.
- NYS 15 Wangerin, W. 1910
Nyssaceae. In : Engler, *Pflanzenr.* 41(IV. 220a) : 1-20, fig. 1-4.
- NYS 16 Wasscher, J. 1948
Nyssaceae. In : van Steenis, *Fl. Males.* I, 4 : 29-31. 1 fig.

Nyssa Linn.

- NYS 17 Eyde, R. H. 1959
The discovery and naming of the genus *Nyssa*. *Rhodora* 61 : 209-218.
- NYS 18 Eyde, R. H. 1964
Typification of *Nyssa aquatica* L. *Taxon* 13 : 129-132.
- NYS 19 Oliver, D. 1891
Nyssa sinensis Oliv. *Hook. Icon. Pl.* 20 : pl. 1964. A new species from Hupeh (China).
- NYS 20 Parker, R. N. 1929
The Indian species of *Nyssa* Linn. *Indian Forester* 55 : 642-645.
- NYS 21 Wasscher, J. 1935
The genus *Nyssa* in the Netherlands Indies. *Blumea* 1 : 344-350.

OCHNACEAE

The family Ochnaceae consists of about 40 genera and 600 species mostly trees and shrubs. The family is included in the order Theales by Cronquist, Dahlgren, Takhtajan and Thorne. While Engler considered it in the order Guttiferales, Hutchinson treated it in the order Ochnales and Bentham & Hooker considered it in the order Geraniales.

The flowers are usually 5-merous and calyx consists of 5 free sepals or sometimes sepals are united at the base. The petals are 5, rarely 10-12 and stamens 5 to 10 or many. Ovary is superior 2-5 carpelled, rarely 10-15 and style is usually gynobasic. The ovules are 1-2 in each locule and they are erect or rarely pendulous.

The order Theales is a heterogeneous group and taxa of the order Theales are generally woody plants usually with primitive wood and generally it is seen in the order an increase in the number of stamens. There is syncarpy and some species of the families have winged fruiting calyx which have adaptive significance.

Some of the ornamental species cultivated in gardens are *Ochna atropurpurea* and *Ochna multiflora*. African Oak (*Lophira lenceolata*) from tropical W. Africa, yields good timber and it grows to a height of 200-250 ft.

The ochraceous flora in India consists of the following genera : *Brackenridgea*, *Gomphia*, *Ochna*.

For recent taxonomic studies refer Kanis (1968, 1971) ; for palynology refer Mitra, Saha et Mondal (1979), Muller (1969).

GENERAL

- OCH 1 Bartelletti, V. 1901
Studio monografico intorno alle famiglia della Ochnaceae e specialmente delle specie Malesi. *Malpighia* 15 : 105-174, tab. 5-11. Monograph, without key.
- OCH 2 Kanis, A. 1968
A revision of the Ochnaceae of the Indo-Pacific area. *Blumea* 16: 1-83. Synonymy, descr. of the family, genus, spp., distr., ecol. notes ; key to genera & spp., *Brackenridgea*, *Ochna* & *Gomphia*.
- OCH 3 Kanis, A. 1968
A revision of the Ochnaceae of the Indo-Pacific area. Corrigenda. *Blumea* 16 : 83.
- OCH 4 Kanis, A. 1971
Ochnaceae. In : van Steenis, ed., *Fl. Males.* I. 7: 97-119, 10 fig.
- OCH 5 Kanis, A. 1971
A revision of the Ochnaceae of the Indo-Pacific area. Additional notes and corrigenda. *Blumea* 19 : 16.
- OCH 6 Kanis, A. 1973
Ochnaceae. *Fl. Camb., Laos & Vietn.* 14 : 3-16, 2 pl. 4 genera each with one spp.

- OCH 7 Khan, M. S. & Huq, A. M. 1975
Ochnaceae, Turneraceae, Fumariaceae, Tropaeolaceae,
Flagellariaceae. *Flora of Bangladesh* 3 : 1-13.
- OCH 8 Mitra, Krishna, Saha, Sandhya & Mondal, M. 1979
Pollen morphology of Ochnaceae. *Geophytology* 9 : 83-87.
- OCH 9 Muller, J. 1969
Pollen morphological notes on Ochnaceae. *Rev. Palaeobot. Palynol.* 9 : 149-173.
- OCH 10 Planchon, J. E. 1846-1847
Sur le genre *Godoya* et ses analogues, avec des Observations sur les limites des Ochnacees et une revue des genres et especes de ce groupe. *Hook. Journ. Bot.* 5 : 584-600, 644-656, pl. 19-22. 1846 ; *Ibid.* 6 : 1-31. 1847.
Treatment without keys.
- OCH 11 Tieghem, P. van 1902
Sur les Ochnacees. *Ann. Sci. Nat. VIII, Bot.* 16 : 161-416. Description of genera—no key ; divided *Ouratea s. l.* into 34 poorly defined genera.

Gomphia Schreb.

- OCH 12 Kanis, A. 1967
The typification of *Walkera* Schreb. (1789) and *Gomphia* Schreb. (1789). *Taxon* 16 : 418-423. *Gomphia serrata* (Gaertn.) Kanis = *Ouratea angustifolia* Baill. ex Lanese = *Gomphia angustifolia* Vahl.

Ochna Linn.

- OCH 13 Du Toit, P. G. V. 1975
Notes on African plants : Ochnaceae. The identity of *Ochna atropurpurea*. *Bothalia* 11(4) : 517. *Ochna gamostigmata* du Toit nom. nov. for *Ochna atropurpurea* var. *angustifolia* Phil.

OCH 14 Robson, N. K. B. 1962

The author and typification of the genus *Ochna*. *Taxon* 11: 48-52. *Ochna obtusata* DC. = *O. squairosa* L.; *Ouratea serrata* (Gaertn.) Robson = *O. angustifolia* (Vahl) Baill. ex Lanese.

Ouratea auct. non Aubl.

(Refer *Gomphia*)

OCH 15 Dwyer, J. D. 1965

The history and nomenclatural problem of the genus *Ouratea* (Ochnaceae). *Taxon* 14 : 275-277. Discussion.

OCH 16 Farron, C. 1963

Contribution a la taxonomie des *Ourateae* Engl. (Ochnaceae). *Bull. Soc. Bot. Suisse* 73 : 196-217, 20 fig. Recognised 3 different African genera, *Campylospermum* V. Tiegh., and *Idertia* Farr.; correctly reserved the name *Ouratea* Aubl. to the American species.

OLACACEAE

(Refer also Erythropalaceae & Opiliaceae)

The family Olacaceae includes about 25 genera and 250 species and they are mainly shrubs or trees. The family is included in the order Santalales by Cronquist, Dahlgren, Engler, Takhtajan and Thorne. However Hutchinson and Bentham & Hooker treated the family in a separate order Olacales. Takhtajan considered the subfamily Schoepfioidae as a separate family Schoepfiaceae.

The flowers are regular, bisexual or rarely unisexual. The calyx is often reduced which resembles the calyculus. Petals are 3-6 and stamens are as many, twice or thrice the number of petals. Ovary is superior to inferior and often sunk into the well-developed disk, 2-5 loculed with one ovule per locule.

The family is divided into the following subfamilies by Engler : Anacolosoidae, Olacoideae and Schoepfioidae.

In the allied family Opiliaceae the ovary is 1-loculed with 1 apical or basal ovule.

According to Cronquist (1968) "the Santalales are a group characterized by progressive adaptation to parasitism. This is accompanied by simplification of the ovules culminating in the condition in the Loranthaceae, in which the ovules are scarcely differentiated from the massive placenta". It is seen that the Olacaceae have many autotrophics and hemiparasites with haustorial connection to the roots of host plants.

Bohlmann *et al.* (1973) stated that the presence of polyacetylenes in the five families (i.e. Olacaceae, Opiliaceae, Santalaceae, Loranthaceae and Viscaceae) of the order Santalales indicate their close relationships.

The following genera represent the Olacaceous flora of India : *Anacolosia*, *Olax*, *Schoepfia*, *Strombosia*, *Ximenia*.

For recent taxonomic revisions refer Exell & Mendonca (1951), Lucas (1968), Sleumer (1980).

GENERAL

- OLC 1 Cavaco, A. & Mlle M. Keraudren, 1955
Sur les *Ximenia* (Olacaceae) de Madagascar. Une espece nouvelle d'olax. *Bull. Soc. Bot. France* 102 : 117-119.
- OLC 2 Exell, A. & Mendonca, F. 1951
Olacaceae. *In : Conspectus Florae Angolensis* 1(2) : 331-338.
- OLC 3 Fagerlind, F. 1947
Gynoceum morphologische und embryologische Studien in der Familie Olacaceae. *Bot. Notiser* 1947 : 207-230.
- OLC 4 Lucas, G. 1968
Olacaceae. *In : Fl. Trop. East Africa* 1-15.
- OLC 5 Reed, C. 1955
The comparative morphology of the Olacaceae, Opiliaceae and Octoknemaceae. *Mem. Soc. Brot.* 10 : 29-79.

- OLC 6 Schneider, C. K. 1916
Olacaceae. *In* : Sarg., *Pl. Wils.* 3 : 321-322.
- OLC 7 Sleumer, H. 1935
Olacaceae. *In* : Engler & Prantl, *Pflanzenf.* 16b : 5-32.
- OLC 8 Sleumer, H. 1980
A taxonomic account of the Olacaceae of Asia, Malesia and the adjacent areas. *Blumea* 26 : 145-168. Key ; includes account of *Anacolosia* Bl., *Erythropalum* Bl., *Olax* L., *Schoepfia* Schreb., *Strombosia* Bl. & *Ximenia* L.

Anacolosia Bl.

- OLC 9 Chakrabarti, Anjali (1972) 1975
Identity of *Anacolosia griffithii* Mart. from Andamans. *Bull. Bot. Surv. India* 14 : 171-172.
- OLC 10 Sleumer, H. 1980
A taxonomic account of the Olacaceae of Asia, Malesia and the adjacent areas—An account of the genus *Anacolosia* Bl. in Asia, Malesia and the Pacific. *Blumea* 26 : 146-151.

Olax L.

- OLC 11 Biswas, M. C. 1971
A note on the occurrence of *Olax nana* Wall. ex Benth. (Olacaceae) in West Bengal. *Indian Forester* 97 : 508.
- OLC 12 Sleumer, H. 1980
A taxonomic account of the Olacaceae of Asia, Malesia and the adjacent areas—An account of the genus *Olax* L. in Asia, Malesia, Australia and the Pacific. *Blumea* 26 : 154-160.

Schoepfia Schreb.

- OLC 13 Sleumer, H. 1980
A taxonomic account of the Olacaceae of Asia, Malesia

and the adjacent areas. The genus *Schoepfia* Schreb., in Asia and Malesia. *Blumea* 26 : 161-163.

- OLC 14 Steenis, C. G. G. J. van 1951
Miscellaneous botanical notes IV. *Reinwardtia* 1 : 467-481, fig. 1-2. Includes notes on Asiatic species of *Schoepfia*.

Strombosia Bl.

- OLC 15 Sleumer, H. 1980
A taxonomic account of the Olacaceae of Asia, Malesia and the adjacent areas. The genus *Strombosia* Bl. in Asia and Malesia. *Blumea* 26 : 163-166.

Ximenia Linn.

- OLC 16 De Filipps, R. 1968
A revision of *Ximenia* [Plum.] L. (Olacaceae). Unpublished Dissertation. Southern Illinois University.
- OLC 17 De Filipps, R. 1969
Ximenia americana (Olacaceae) in Angola and South West Africa. *Bol. Soc. Broteriana* 43 : 193-200.
- OLC 18 De Filipps, R. 1969
Parasitism in *Ximenia* (Olacaceae). *Rhodora* 71 : 439-443.
Parasitism in *Ximenia* is confirmed.
- OLC 19 De Filipps, R. 1970
A taxonomic study of *Ximenia caffra* Sonder (Olacaceae). *Bol. Soc. Broteriana* 44 : 67-79. *Ximenia caffra* and *Ximenia americana* discussed.
- OLC 20 Sleumer, H. 1980
A taxonomic account of the Olacaceae of Asia, Malesia and the adjacent areas. The genus *Ximenia* L. in Asia, Malesia, Australia and the Pacific. *Blumea* 26 : 166-168.

ADDITIONS : GENERAL

- OLC 21 Bohlmann, F., Burkhardt, T. & Zdero, C. 1973.
Naturally occurring acetylenes. Academic Press, London.
- OLC 22 Lobreau-Callen, D. 1980
 Caracteres compares du pollen des Icacinaceae et des
 Olacaceae. *Adansonia ser.* 2, 20(1) : 29-89. Paris.

OLEACEAE

(Includes Nyctanthaceae)

The family Oléaceae includes about 29 genera and 600 species. The family is included in the order Scrophulariales by Cronquist. However Dahlgren, Engler, Takhtajan and Thorne treated it in the order Oleales. Hutchinson considered it in the order Loganiales and Bentham & Hooker included in the order Gentianales.

They are usually shrubs or trees with opposite exstipulate leaves. The flowers are in racemes or cymes, regular, 2-6 merous. The calyx consists of 4 lobes and stamens are 2 and epipetalous. The ovary is superior, 2-loculed with 2 ovules in each locule.

Cronquist (1968) on morphological data placed the Buddlejaceae in the order Scrophulariales and in this process included the Oleaceae also in the order Scrophulariales with doubt. Dahlgren (1983) considered the Oleaceae as representing the monofamilial order Oleales. The family Oleaceae has a number of characters in common with Loganiaceae and Gentianales. There is close serological affinities of the taxa of Oleales and Gentianales. However the Buddlejaceae has affinities with Scrophulariaceae in the nature of embryology and iridoid chemistry. The presence of iridoid compounds (i.e.) seco-iridoids, a chemically derived type of iridoid compound lacking carbocyclic ring, keeps the cluster of families Gentianaceae, Loganiaceae, Apocynaceae, Asclepiadaceae, Rubiaceae, Menyanthaceae and the Oleaceae together.

The family includes ornamental and economically important plants : Several species of *Jasminum* are cultivated in gardens for their

fine scented flowers eg. : *J. grandiflorum*, *J. officinale*, *J. polyanthum*, *J. revolutum*, *J. sambac* ; the Golden bells are early blooming winter garden plants in temperate climates eg. *Forsythia europaea*, *F. ovata* ; the lilacs with about 30 species are cultivated in gardens : Common lilac (*Syringa vulgaris*), Persian lilac (*S. persica*), Himalayan lilac (*S. emodii*) ; the well known Olive tree (*Olea europaea*) is a source of olive oil.

The following genera represent the family in India : *Fraxinus*, *Jasminum*, *Olea*, *Osmanthus*, *Schrebera*, *Syringa*.

For taxonomic studies refer Johnson (1957), Green (1965, 1972), Rehder (1916), Kiew (1979) ; for cytotaxonomy refer Taylor (1945), Maekawa (1962) ; for chemotaxonomy refer Harborne & Green (1980), Picchura & Fairbrothers (1979) ; for chromosome studies refer Das Gupta & Sharma (1975), Krishnaswamy & Raman (1948).

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ONAGRACEAE

The family Onagraceae consists of about 21 genera and 640 species, occurring in temperate and tropical regions. The family is included in the order Myrtales by Bentham & Hooker, Cronquist, Dahlgren, Takhtajan and Thorne. Whereas Hutchinson considered it in the order Lythrales.

The family represents mostly herbs and shrubs. The flowers are bisexual, often protandrous, regular 4-merous, rarely 2-5-merous. The calyx tube is prominent with 4 valvate calyx lobes. The petals are 4, rarely absent. Stamens are 4-merous and pollen grains are 3-aperturate. Ovary is 4-locular, semi-inferior, rarely 2-locular with axile placentation.

Some of the well-known ornamental herbs cultivated in gardens belong to the family Onagraceae : Evening prim-rose (*Oenothera biennis*, *O. grandiflora*) ; Dancing girl (*Fuchsia splendens*, *F. corymbosa*, *F. magellanica*) from Central & S. America ; Farewell-to-Spring (*Godetia grandiflora*) native of California ; Enchanter's night shade (*Circaea lutetiana*) ; *Clarkia elegans*.

The family is represented in India by the following genera : *Circaea*, *Epilobium*, *Ludwigia*. The following genera are cultivated in India : *Clarkia*, *Fuchsia*, *Oenothera*.

For recent taxonomic studies refer Raven (1964, 1968, 1977), Raven & Lewis (1961) ; for palynology refer Banerjee (1967), Brown (1967), Ting (1966) ; for wood anatomy refer Carlquist (1977) ; for chromosome study refer Johansen (1929).

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OPILIACEAE

(Refer also Olacaceae)

The family Opiliaceae consists of trees and shrubs, sometimes scandent and mostly root parasitic. There are about 8 genera and 60 species. The family is included in the order Santalales by Cronquist, Dahlgren, Engler, Takhtajan and Thorne. It is included in the Olacales by Hutchinson. Bentham & Hooker did not recognise it as a family and considered it under the family Olacaceae.

The family is characterised by simple exstipulate leaves. The flowers are regular, bisexual, rarely male and female flowers are present. Calyx is 4-merous or obsolete, petals are 4-5 merous and stamens are 4-5 merous, oppositipetalous or rarely alterni-petalous and disk is 4-5 lobed. Ovary is superior, 1-locular with one basal or apical ovule and immersed in the prominent disk. Fruit is a drupe with endospermous seed, but without testa. The family is allied to the Olacaceae, but differs in having 1-loculed ovary, suppressed calyx and in the nature of the disk.

The presence of polyacetylenes in the families Loranthaceae, Olacaceae, Opiliaceae, Santalaceae and Viscaceae all belonging to the order Santalales distinguish this cluster of families.

The family is represented in India by the following genera : *Cansjera*, *Champereia*, *Lepionurus*, *Opilia*.

For recent taxonomic studies refer Hiepko (1972, 1978), Sleumer (1935).

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ORCHIDACEAE

(Refer also Apostasiaceae)

The family Orchidaceae named after the genus *Orchis* consists of about 735 genera and 17,000 species, the largest group of flowering plants, occurring mainly in the humid tropics and subtropical regions and rarely in the temperate regions. In India there are about 1000 species. They exhibit a variety of floral forms, shapes and adaptations for attracting insects for pollination. The family is included in the order Orchidales by Cronquist, Dahlgren, Hutchinson and Takhtajan.

While Bentham & Hooker and Engler treated it in the order Microspermae, Thorne considered it under the Liliales.

The Orchids are biologically specialised and they exist as terrestrials, epiphytes and saprophytes. Most of the tropical species have epiphytic habit, while the temperate species usually have terrestrial habit. Orchids as a whole are not parasitic. Epiphytism is for support and for exposure to sunlight. Symbiotic association of mycorrhiza is important for the orchid seed germination. According to Crenquist (1968) "the combination of mycotrophy and numerous tiny seeds offer certain evolutionary opportunities as well as imposing some limitations". The epiphytes are attached to the host by negatively geotropic roots. The epiphytes absorb water and nutrients through absorbing roots which are provided with a green tissue surrounded by velamen and epidermis which act as sponge or jacket. Some of the epiphytes are provided with fleshy pseudobulbs which hibernate during dry seasons.

The inflorescence is usually racemose or spicate. The flowers are usually zygomorphic excepting in the subfamily Apostasioideae. The family Apostasiaceae is recognised by Dahlgren and Hutchinson.

The orchid flowers range from microscopic (*Taeniophyllum khasianum*) to large one ranging upto 18 cm across in Lady's Slipper orchids. They exhibit a 3-merous pattern of the Liliales, but for vecting insects for pollination, they adapt attractive display of floral parts i.e. androecium and gynoecium each adapting different forms and shapes. The perianth consists of 3+3 lobes in two rows and the posterior inner petal called lip or labellum shows the maximum range of display and adaptation as it serves as landing strip for insects. The labellums of some orchids develop co-evolutionary adaptation of shapes of insects for attracting insects of opposite sex and also serve as landing parlour with different visual and sensual schemes. In the centre, the style, stigma and stamens fuse to form a column. It is considered the column is an outgrowth of the axis bearing anthers and stigma at appropriate orientations and they assume different shapes and forms just like the labellum in helping cross pollination.

In monandrous forms the column bears one anther and two fertile

stigmas which are usually confluent and the third stigma in the form of rostellum. The resupination or twisting of the ovary through 180° results in the positioning of the labellum which represents the posterior inner perianth lobe into the anterior position for serving as attractive landing strips. The anther has two lobes and each is called a pollinium which is a mass of pollen tied together in elastic threads and they constitute at the base to form a cord, the caudicle. The single anther with 2 pollinia represents the anterior one of the outer whorl of the typical 3-merous flowers. In fact, the position and structure of the column, anther locule in the column are of taxonomic importance.

While in the diandrous forms like the genus *Cypripedium*, the column has 2 anthers, without any rostellum and a simple stigma encompassing 3 carpellary stigmas. The stigma is not sticky and there is no pollinia.

The ovary is inferior, unilocular with 3 parietal placentas with numerous ovules. The fruit is a capsule with large number of minute seeds, dispersed through winds.

The family is classified into the following subfamilies and tribes :

- (i) Cyperipedioideae : (deeply saccate labellum, 2 anthers, pollen in tetrads in a sticky fluid).
- (ii) Orchidioideae : (1 anther, no staminode, pollen in pollinia).

The sub-family Orchidioideae is classified into the following tribes:
 1. Orchideae : having granular pollen, caudicle, base of anther firmly attached to column; 2. Neottieae: having mealy pollinia, anther deciduous; 3. Epidendreae : waxy pollinia, anther deciduous, attached by apex; 4. Vandaeae : horny or waxy pollinia, anther deciduous, attached by apex.

The sub-family Apostasioideae having regular flowers, 2-3 anthers and pollens as separate grains (not in pollinia) is considered by the author as a separate family Apostasiaceae, bridging the order Lilales and Orchidales.

The evolutionary opportunity is fully used by the family Orchidaceae in developing plastic adaptability in the form and shape of its

floral parts as per changing environmental scene. The shape of labellum in the species *Cottonia peduncularis* from Peninsular India & Ceylon in the form of an insect is noteworthy. In the species *Coryanthes speciosa* from Brazil, two glands above the lip near the base of the column secrete watery liquid which gets collected in the open lip. Attracted by the scent, male bees crawl in the lip and slip into watery bottom and in the process of escaping the bees pass beneath the gynandrium where they come in contact with the sticky pollinia. This helps in the transfer of pollen from one flower to another. In the genus *Catasetum* from America, the male and female flowers produce odours to attract male insects and a release mechanism releases the pollinium as soon as insects touch two proboscis like outgrowth of the column. In the genus *Cymbidium*, the erectile lips curve forward and narrow the path of the insects as soon as the insects land on the lips. In the genus *Pterostylis*, insects have to crawl out of the tube backwards, and while doing so, they get into contact with stigma and anther.

Orchids because of ornamental importance is of great favourite in horticultural trade. The Slipper orchids are of great horticultural value and some have become rare because of over collection and loss of habitat : Venus Slipper orchid (*Paphiopedilum vnustum*) ; Villose Slipper orchid (*Paphiopedilum villosum*) ; Drury's Slipper orchid (*Paphiopedilum druryi*) ; Spicer's Slipper orchid (*Paphiopedilum spicerianum*) ; Lost orchid (*Paphiopedilum fairieanum*) ; Himalayan Cypripedium (*Cypripedium himalaicum*).

Some of the orchids which have been chosen as national flowers are given below : *Cattleya trianae* is the national flower of Columbia. The Turrialba orchid (*Cattleya turrialba*) is the national flower of Costa Rica. *Cattleya skinneri*, commonly known as "White nun" is the national flower of Guatemala. The Holy Ghost or the Dove flower (*Peristeria elata*) is the national flower of Panama.

The orchidaceous flora of India consists of as follows : *Accmpe*, *Acar.thephippium*, *Acriopsis*, *Aerides*, *Agrostophyllum*, *Androcorys*, *Angraecum*, *Ania*, *Anoectochilus*, *Anthogonium*, *Aphyllorchis*, *Appendicula*, *Armadorum*, *Arundina*, *Biermannia*, *Brachycorythis*, *Bulbophyllum*, *Bulleyia*, *Calanthe*, *Camarotis*, *Cephalanthera*, *Ceratostylis*, *Cheirostylis*, *Chiloschista*, *Chrysoglossum*,

Chusua, Cirrhopetalum, Cleisocentron, Coelogyne, Corallorhiza, Corybas, Corymborkis, Cottonia, Cremastra, Cryptochilus, Cryptostylis, Cymbidium, Cyperorchis, Cypripedium, Dendrobium, Didiciea, Didymoplexis, Diglyphosa, Diphyllax, Diplocentrum, Diplomeris, Diplophora, Disperis, Doritis, Ephemerantha, Epipactis, Epipogium, Eria, Erythrodes, Esmeralda, Galearis, Galeola, Gastrochilus, Gastrodia, Geodorum, Goodyera, Gymnadenia, Habenaria, Hemipilia, Herminium, Herpysma, Hetaeria, Ione, Ipsea, Katherinea, Kingiella, Liparis, Listera, Loxoma, Luisia, Malleola, Mischobulbum, Micropera, Microstylis, Monomeria, Neogyna, Neottia, Neottianthe, Nephelaphyllum, Nervilia, Oberonia, Orchis, Oreorchis, Ornithochilus, Otochilus, Pachystoma, Parisea, Pantlingia, Paphiopedilum, Pelatantheria, Pennilabium, Peristylus, Phaius, Phalaenopsis, Pholidota, Phreatia, Pleione, Podochilus, Polystachya, Pomato-calpa, Porpax, Proteroceras, Pteroceras, Renanthera, Rhynchostylis, Risleya, Robiquetia, Saccolabium, Sarcanthus, Satyrium, Schoenorchis, Sigmatogyne, Sirhookera, Smithsonia, Spathoglottis, Spiranthes, Stigmatodactylus, Sunipia, Taeniophyllum, Tainia, Tainiopsis, Thelasis, Thrixspermum, Thunia, Tipularia, Trias, Trichoglottis, Trichotosia, Tropidia, Uncifera, Vanda, Vandopsis, Vanilla, Vrydazynea, Yoonia, Zeuxine.

The Madagascan orchid *Angraecum sesquipedale* has a foot long spur for very long tongued lepidoptera. E. J. H. Corner (1964) summarized the evolution of floral parts as follows : "Large flowers become bilaterally symmetrical or as botany has it zygomorphic. They develop an upper lip which serves as a hood for the stamens and stigma and a lower lip where the insects alight. With one entrance, the numerous stamens of radial symmetry, projecting in all directions, are uneconomical and the stamens reduce to two or one placed where their open anthers contact the insect's back and the stigma is put where it will rub against it. Then the large symmetrical flowers of lilies lead to precise flowers of orchids, in which one stamen survives with its pollen agglomerated into one or two masses in certainty of success. Around this construction are ranged some of ten thousand species of orchids, every one of which by colour, size, shape, scent and time and season of opening attracts its own kind of insect and achieves its own postal service". According to Cronquist (1968) "the adaptations of different orchids to such pollinators are numerous, highly diverse and often even comical."

It is seen that the Orchidales are derived from the Liliales and the evolutionary advances are towards specialized adaptations to potential pollinators so that pollen can be transferred enmass. The allied families Burmanniaceae, Corsiaceae and Geosiridaceae have failed to seize the opportunity of adaptations. Though in the Orchidaceae, the seed production is voluminous and the light seeds are carried by wind, the physiological dependence on fungal symbionts for germination is a limiting factor. Hence there are many taxonomic categories where abundance of one species is limited and hence their restricted distribution. Due to large scale habitat destruction and trade of wild orchid plants, many species of orchids are on the verge of extinction and some of them have become rare. The family Orchidaceae as a whole is included in the Appendix II of CITES (Convention on International Trade of Endangered Species). Some of the rare and endangered species are as follows :

<i>Acanthephippium sylhetense</i> Lindley	Arunachal Pradesh, Assam, Meghalaya, Sikkim
<i>Anoectochilus tetrapterus</i> Hook. f.	Manipur
<i>Aphyllorchis golloni</i> Duthie	Uttar Pradesh
<i>Aphyllorchis vaginata</i> Hook. f.	Meghalaya
<i>Archineottia microglottis</i> (Duthie)	
S. C. Chen	Uttar Pradesh
<i>Bulbophyllum albidum</i> (Wight) Hook. f.	Tamil Nadu
<i>Bulbophyllum cariniflorum</i> Reichb. f.	Bhutan, Uttar Pradesh
<i>Bulbophyllum fusco-purpureum</i> Wight	Tamil Nadu
<i>Bulbophyllum hookeri</i> (Duthie)	Nepal, Arunachal Pradesh, Assam, Sikkim, Uttar Pradesh
J. J. Smith	
<i>Bulbophyllum mysorensis</i> J. J. Smith	Karnataka
<i>Bulbophyllum raui</i> Arora	Uttar Pradesh
<i>Calanthe herbacea</i> Lindley	Sikkim
<i>Calanthe whiteana</i> King & Pantl.	Sikkim
<i>Coelogyne angustifolia</i> Wight	Tamil Nadu
<i>Coelogyne mossiae</i> Rolfe	Tamil Nadu
<i>Corybas purpureus</i> Joseph & Yoganarasimhan	Meghalaya
<i>Cymbidium mackinnonii</i> Duthie	Uttar Pradesh

<i>Cymbidium munronianum</i> King & Pantl.	Meghalaya, Nagaland, Sikkim
<i>Cymbidium whiteae</i> King & Pantl.	Sikkim
<i>Dendrobium gamblei</i> King & Pantl.	Uttar Pradesh
<i>Dendrobium normale</i> Falc.	Uttar Pradesh
<i>Dendrobium pauciflorum</i> King & Pantl.	Sikkim, West Bengal
<i>Didickea cunninghamii</i> King & Prain ex King & Pantl.	Sikkim, Uttar Pradesh
<i>Diglyphosa macrophylla</i> King & Pantl.	Sikkim
<i>Diplomeris hirsuta</i> (Lindley) Lindley	West Bengal
<i>Diplomeris pulchella</i> D. Don	Meghalaya
<i>Disperis monophylla</i> Blatter ex C. Fischer	Tamil Nadu
<i>Eria albiflora</i> Rolie	Tamil Nadu
<i>Esmeralda clarkei</i> Reichb. f.	Bhutan, Arunachal Pradesh
<i>Eulophia candida</i> (Lindley) Reichb. f.	Assam, Sikkim
<i>Eulophia cullenii</i> (Wight) C. Fischer	Kerala, Tamil Nadu
<i>Eulophia ramentacea</i> Lindley ex Wight	India (W. Ghats & Deccan)
<i>Flickingeria hesperis</i> Seidenf.	Uttar Pradesh
<i>Galeola cathcartii</i> Hook. f.	Sikkim
<i>Gastrodia dyeriana</i> King & Pantl.	Sikkim
<i>Gastrodia exilis</i> Hook. f.	Meghalaya
<i>Habenaria barnesii</i> Summerh. ex C. Fischer	Kerala, Tamil Nadu
<i>Habenaria denticulata</i> Reichb. f.	Tamil Nadu
<i>Habenaria fimbriata</i> Wight	Tamil Nadu
<i>Herminium duthei</i> Hook. f.	Nepal, Uttar Pradesh
<i>Hetaeria ovalifolia</i> (Wight) Benth.	Tamil Nadu
<i>Liparis distans</i> C. B. Clarke	Nagaland
<i>Liparis duthiei</i> Hook. f.	Tamil Nadu
<i>Liparis pulchello</i> Hook. f.	Meghalaya, Nagaland
<i>Nervilia biflora</i> (Roxb.) Schltr.	Kerala
<i>Nervilia mackinnonii</i> (Duthie) Schltr.	Uttar Pradesh
<i>Nervilia scottii</i> (Reichb. f.) Schltr.	Meghalaya, Sikkim
<i>Oreorchis indica</i> (Lindley) Hook. f.	Himachal Pradesh, Uttar Pradesh
<i>Oreorchis rolfei</i> Duthie	Uttar Pradesh

<i>Paphiopedilum druryi</i> (Beddome) Stein	Kerala
<i>Paphiopedilum fairrieanum</i> (Lindley) Stein	Bhutan, Arunachal Pradesh, Sikkim
<i>Paphiopedilum spicerianum</i> (Reichb. f.) Pfitzer	Assam
<i>Paphiopedilum venustum</i> (Wallich ex Sims.) Pfitzer	Nepal, Meghalaya, Sikkim
<i>Peristylus brachyphyllus</i> A. Rich.	Karnataka, Tamil Nadu
<i>Peristylus secundus</i> (Lindley) Rathakr.	Karnataka, Kerala, Tamil Nadu
<i>Pholidota calceata</i> Reichb. f.	Meghalaya
<i>Pleione lagenaria</i> Lindley	Meghalaya
<i>Renanthera imschootiana</i> Rolfe	Burma, Manipur, Nagaland
<i>Rhynchostylis latifolia</i> C. Fischer	Karnataka
<i>Risleya atropurpurea</i> King & Pantl.	Sikkim
<i>Vanda coerulea</i> Griffith ex Lindley	Burma, Thailand
<i>Vanilla walkeriae</i> Wight	Kerala, Tamil Nadu
<i>Vanilla wightiana</i> Lindley ex Hook. f.	Kerala

Some of the species of *Dendrobium* and *Orchis latifolia* are medicinal. The genus *Vanilla* yields the essence vanillin.

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ORC 446 Kerr, A. D. 1975

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ORC 447 Seidenfaden, G. 1971

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Malaxis Soland. ex Sw.

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- ORC 452 Seidenfaden, G. 1978
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Orchis Linn.

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Polystachya Hook.

- ORC 557 Garay, L. A. & Sweet, H. R. 1974
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- ORC 569 Holttum, R. E. 1963
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- ORC 570 Kennedy, G. C. 1979
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- ORC 572 Holttum, R. E. 1962
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Sarcanthus Lindl.

- ORC 573 Balakrishnan, N. P. & Chowdhury, S. 1967
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