

## Project Lifescape 2. Flowering Plants

**Project Lifescape aims to make available user-friendly accounts of a set of about 1500 species and higher taxonomic categories of target taxa to nurture the study of living organisms as a part of teaching biology and other related subjects in India. These accounts would be in a standardised format to promote studies whose results would be comparable and could eventually feed into a nationwide programme of monitoring a range of taxa of conservation and economic significance. This part includes two such accounts, one for a family of conservation significance, and the other for a species of economic significance. It also includes the standardised format for flowering plants. These accounts are expected to be as non-technical as possible, the technical terms unavoidably used would be in bold letters and all of these are explained in an illustrated glossary. Some examples of such terms are provided in the margins.**

### **Nutmeg Family**

#### *Myristicaceae*

**Series:** Unisexuales

Myristicaceae members are all evergreen trees of tropical forests notable for blood-red exudation on injury to bark, **unisexual** flowers, **arillate** seeds and wrinkled endosperm.

With many primitive and archaic characters Myristicaceae has been termed a family of 'living fossils'. Taxonomists place it along with other families of primitive dicots like Magnoliaceae, Annonaceae and Chloranthaceae. Its members have very restricted distribution and are invaluable relics of early stages of the angiosperm evolution. With worldwide decline of tropical rainforest, this family faces a bleak future.

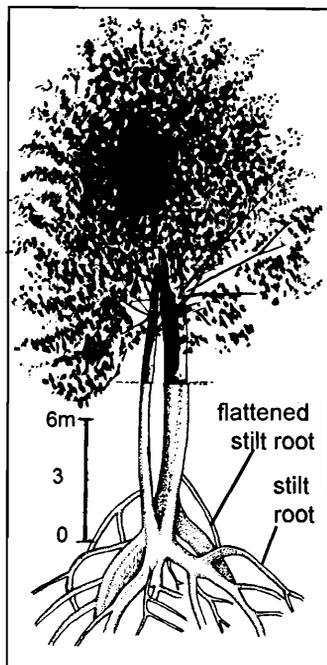
**Morphological Characters:** All members of this family are medium sized to lofty evergreen trees (18 – 30 m) with pyramid

M D Subash Chandran combines teaching botany to under-graduate students and active research on forest ecology and history.

V V Sivan works at Centre for Ecological Sciences in the Indian Institute of Science and his areas of interest are plant taxonomy and ecology.

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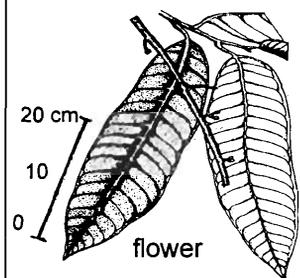


*Myristica fatua* var. *magnifica*

Twig of *Myristica fatua* showing oblong-lanceolate leaves

**Lanceolate** – Tapering at both ends and broader near the base.

**Oblong** – Longer than broad with nearly parallel margin.



shaped crown; often faintly aromatic. Whorls of branches spring at intervals from the main stem. Some species have aerial stilt roots arising from the base of the stem. Old stilt roots often flatten into aerial buttresses in the swamp dwelling *Myristica fatua*. *Gymnacranthera canarica* has loop-like breathing roots protruding into the air from its swampy habitat. All such aerial roots of the swampy species are useful in gathering oxygen as well as sending out toxic by-products of anaerobic respiration which accumulate in them. Bark is usually thin; a reddish resinous sap oozes out from inner bark on injury. Wood is soft but heavy and easily perishable. Leaves are leathery textured, simple, with entire margin and arranged alternately on the stem. Size of the **oblong-lanceolate** leaves varies from 10-55cm; upper side mostly greenish and lower paler, sometimes with rusty hair.

Flowers are **unisexual**. Male and female flowers are found on separate plants, rarely on the same plant. Small flowers with regular symmetry are in compressed clusters. **Perianth** consists of 3 united **sepals**, rarely 2 or 4, with rusty hairs outside. **Stamens** are 3 to many, their **filaments** are united to form a central column in male flowers with **anthers** towards the top of the column. Female flower has a single carpel with a single chambered and single ovuled ovary.

Fruit is usually fleshy; but the wall splits into two halves on maturity exposing the seed.

Seed is single, large, oval, covered with a bright yellow to orange or red coloured **aril**. The **endosperm** inside the seed is wrinkled as in arecanut and is rich in fat and starch. The major fatty acids of the seed fat are myristic acid, palmitic acid, oleic acid and lauric acid.

**Pollination:** The scented flowers have no nectar. Beetles are reported as pollinators.

**Dispersal:** The brightly coloured arillate seeds attract many birds. Pigeons, hornbills, birds of paradise, toucans and guans

disperse the seed. in many parts of the world. Monkeys, malabar squirrels and rodents which feed on fleshy fruits also disperse the seeds. Lion-tailed macaque feeds on the fruits of *Myristica* spp.

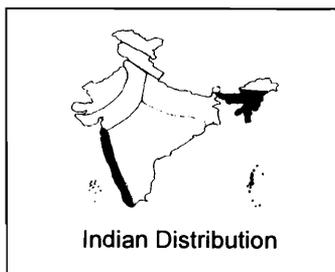
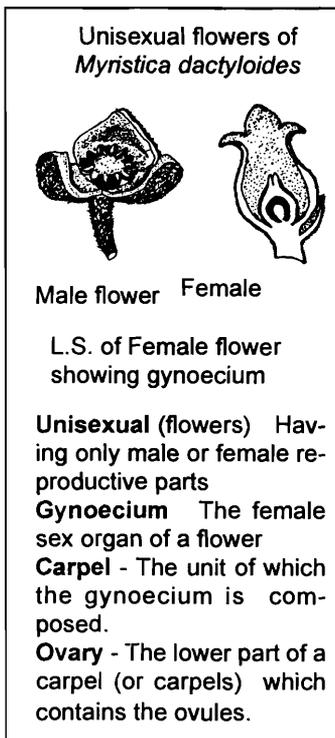
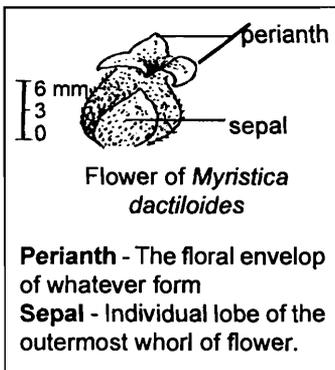
**Seed Germination:** The seeds germinate readily on falling on moist ground. Seeds have a poor dormancy period. The large seeds, well stocked with fats and starch have an advantage in the deeply shaded forests, producing seedlings which survive under reduced light intensity until they grow large enough to support themselves with their own photosynthetic machinery.

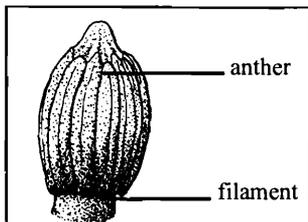
**Diversity:** The family has 17 genera and 370 species of which 4 genera and 15 species are found in India. *Myristica* is the largest genus with 120 spp. with Malayan region as its centre. Despite great distances separating the members of the family, which are found in the humid tropics of different continents and oceanic islands, there is a striking similarity between them.

**Distribution:** Pantropical (Oriental, Neotropical, Afro-tropical and Australian); mainly found in the rainforests of Malaysia, Borneo, Polynesia, India, Madagascar, Africa, Amazon basin and Sri Lanka. The species found in India are mainly distributed in the North-eastern states, Western Ghats and the Andamans. The Western Ghats have 3 genera (*Myristica*, *Knema* and *Gymnacranthera*) and 5 species. Of these, *Myristica malabarica* and *Myristica fatua* var. *magnifica*, *Knema attenuata* and *Gymnacranthera canarica* are endemic to the Western Ghats. *Myristica dactyloides* is found in the Western Ghats and Sri Lanka.

**Habitat:** The members of the family occur in the evergreen-semievergreen forests from sea level to 1000m. Some are adapted to swamps within evergreen forests. Members are shade tolerant canopy or sub-canopy trees.

**Human Significance:** The cultivated species *Myristica fragrans* is the most economically and medicinally significant plant among Myristicaceae serving as the source of spices such as 'mace' and





*Myristica* sp. stamen

**Stamen** The male sex organs, usually consisting of anther, connective and filament

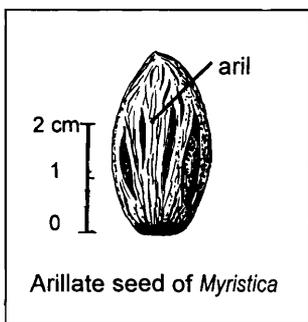
**Anther** The part of the stamen that produces pollen.

**Filament** - A thread, particularly the stalk of an anther

'nutmeg' obtained from the aril and seed, respectively. The fleshy outer part of the fruit is used to make pickle and a jelly preserve. Seed is used in Ayurveda in different ways as a remedy for various diseases.

**Conservation Status:** It seems the conditions which favoured the Myristicaceae members, like the dense evergreen forests with swamps are fast giving way to secondary forests and savannas due to ever increasing human pressure. Myristicaceae could be one of the prime casualties. In the Western Ghats, for instance, most of the myristica swamps have disappeared due to their conversion into rice fields, rubber estates, arecanut orchards, forest monoculture and submersion under reservoirs. The most threatened species today, due to the decline of the swamps are *Myristica fatua* var. *magnifica* and *Gymnacranthera canarica*.

**Survey method:** A transect-quadrat method would be appropriate for an effective sampling of flowering plants.



Arillate seed of *Myristica*

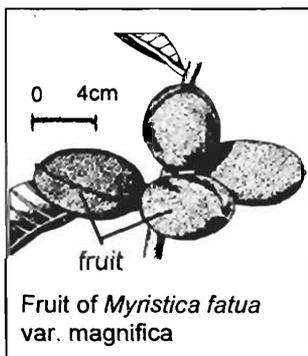
### Water Hyacinth

*Eichhornia crassipes*: Pontederiaceae

**Series:** Coronarieae

A free-floating, freshwater plant with smooth and glossy leaves and spongy leaf-stalk. The plant has lilac to violet flowers and numerous spreading roots, which balance the plant.

A dreaded waterweed, the hyacinth is known by several names such as 'blue devil', 'bengal terror', 'curse of bengal' etc. In fact it is a very pretty plant too, one of disregarded beauty, aptly called 'cinderella of the plant world'. This exotic beauty has conquered huge expanses of water bodies in India, nearly choking the rest of the plant and animal life. Efforts are being made since the last few decades to free the waters from this dreaded weed.



Fruit of *Myristica fatua* var. *magnifica*

**Morphological Characters:** Water hyacinth forms a sprawling expanse of green, decorated with lilac to violet flowers, on the water bodies. It multiplies vegetatively by special short, thick branches called **stolons**. It has been reported that two plants of



Water hyacinth is undoubtedly one of the most troublesome weeds of the tropics costing much energy and money in controlling it.

in almost all states of the country and has been proclaimed as the number one water weed.

**Habitat:** Freshwater bodies ranging from small ponds and ditches to large lakes and reservoirs and mighty rivers. The plant also infests rice fields. The weed flourishes in the temperature range of 27°–30°C. It ceases to grow when water temperature is below 10°C or above 40°C. Adult plants are free-floating whereas the younger ones are submerged.

**Human Significance:** Water hyacinth is undoubtedly one of the most troublesome weeds of the tropics costing much energy and money in controlling it. Today man is making every effort, even using remote sensing to survey and monitor the weed. Waterways are blocked and navigation is hindered when the weed growth is prolific. It interferes with hydroelectric power generation. Irrigation projects are rendered useless by this weed. In eastern India the paddy farmers face enormous problems when flood waters flush in tons of water hyacinth per ha. The choked water bodies increase the risk of water borne diseases and become breeding grounds especially for mosquitoes, which spread malaria and encephalitis. The flood risk increases when drainage is impaired. Needless to say the fish and other animal life perish when water bodies are choked with weeds and dissolved oxygen is depleted. The phytoplankton and the submerged plant species underneath the dense mat of weeds die due to want of light. The huge quantity of the weed with trapped silt and dust make the water bodies shallow, even forming small islands where reeds and even woody plants invade.

The weed is being used for production of biogas in India and USA.

Of late, man is befriending this devil of a plant. He has become successful in converting the seemingly useless biomass of the water hyacinth into many useful products. Paper can be produced from the plant. Dried hyacinth is being used as a fuel as well as fodder for cows and buffaloes. The weed is being used for production of biogas in India and USA. It can also be used for production of power alcohol. The plant is good for mulching and effective in conserving soil moisture.

The plant has good potential for pollution control. From sewage and industrial wastes discharged into water bodies, the hyacinth absorbs substances deleterious to human health, such as nitrogen, fecal coliform bacteria, organic carbon and many heavy metals such as copper, cadmium, nickel, lead, mercury, etc.

**Illustrations by:**  
Sanjeeva Nayaka and  
Revathi R.

**Survey Method:** Water hyacinth may be surveyed at two scales. At a larger scale, estimates may be made of the proportion of the water bodies and the overall area in m<sup>2</sup> or hectare covered by the plant; this may be supplemented by estimates of numbers and fresh and dry weight of plants per square meter.

**Ecological Adaptations:** The whole plant is highly adapted to an aquatic mode of life. The spongy plant body full of air sacs, especially leaf-stalk provides buoyancy. Numerous hairy fibrous roots with a small pocket at the tip is a special adaptation to balance in the water and also to absorb maximum nutrients.

**Suggested Student Projects:** Study the various problems posed by water hyacinth in the locality and local uses of the plant. Document the local control measures; also try your own control measures to eliminate the plant.

**Local names:** Kachuripana (Bengali), Kulavazha (Malayalam), Akasathamarai (Tamil), Antharathamara and Pisachthamarai (Telugu).

*(Lajjaluh syat samipatra samanga jalakarika  
raktapadi namaskari namna khadiraketyapi  
lajjalu sitala tikta kasaya kaphapittajit  
raktapittam atisaram yonirogan vinasayet*

*Samipatra, samanga,  
jalakarika, raktapadi,  
namaskari, khadiraka are  
synonyms of Lajjaluh. Lajjaluh is  
cold, bitter, astringent and  
pacifying pitta and kapha. It is  
good for bleeding disorders,  
diarrhoea, vaginal disorders.*

*(Bhavaprakasa nighantu, Guducyadhi varga, 272)*

Further enquiries and offers of help relating to Project Lifescape may be directed to Madhav Gadgil  
Centre for Ecological Sciences  
Indian Institute of Science  
Bangalore 560 012, India.  
email : madhav@ces.iisc.ernet.in.

## Format for Writing Plant Accounts

1. Common English name
2. Scientific name along with taxonomic category as appropriate (series, order, family).
3. A poem or a verse preferably from Indian sources including Ayurvedic texts along with translation and citation.
4. Succinct statement of what the organism is (a large, deciduous tree, notable for its thick fissured bark).
5. Interesting facts, popular beliefs, folklore and myths.
6. Derivation of the scientific and popular names, if interesting.
7. History of the taxon, time of introduction and its spread if exotic; (attracted by its beautiful flowers, water hyacinth was introduced to India in 1890 as an ornamental plant. It escaped from cultivation and is now the most pernicious of water weeds); time course of shrinkage of its range if now rare, etc.
8. Morphological characters of particular significance for field identification [Provide sketches with an arrow pointing to their diagnostic features]. These may include vegetative characters such as size of the organism, growth form, root, stem, bark, branching pattern and shape of the crown and characters of leaf and leaf-stalk. Any special characters such as presence of spur, glands, modification of plant parts, etc. can be highlighted. Floral characters include significant features of inflorescence, like the type, position and nature. Flower characters such as colour, size, odour, position and features of the floral parts, fruit and seed characters.
9. Mechanism of pollination
10. Mechanism of seed dispersal
11. Seed germination and dormancy
12. Related taxa with which appearance may be confused (*Mimosa pudica* resembles *Mimosa hamata*, but the latter can be distinguished by the presence of more than two pairs of pinnae and large fruit with hooked bristles).
13. Levels of diversity within the taxon at global and Indian level (family Myristicaceae includes worldwide 17 genera and 370 species of which 15 species of 4 genera are found in India), any interesting aspect of evolutionary history, especially in case of higher taxonomic categories.
14. Distribution: a. Global in 6 biogeographic zones [Oriental, Australian, Palearctic, Ethiopian, Nearctic, Neotropical]. b. Indian in 10 biogeographic provinces [as per Rodgers and Panwar]. c. In terms of bioclimate. d. In terms of altitudinal zone. e. In terms of specific locality, if the distribution is rather restricted (*Trichopus zeylanicus* distribution is restricted to Agasthyamala).
15. Habitat preference: Ranging from macro to micro habitat.
16. Seasonal changes: Phenology; leaf shedding, flowering and fruiting, fruit ripening.
17. Long term fluctuations (Talipalm flowers once in its life time, the fruits take one year to mature;

*Strobilanthes kunthianus* flowers once in twelve years).

18. Human significance: Source of food, medicine, timber, other economic products, religious feelings, source of harm as weeds.
19. Extent of range and levels of population abundance [whether the population is increasing or decreasing over a period of time], sources of change in range and population levels such as habitat destruction or enhancement, overharvest, etc.
20. Conservation status: Listing in red data books, any legal protection such as listing in Wildlife Protection Acts or CITES, ongoing attempts at conservation, propagation or eradication (*Myristica fatua* is considered as infrequent by IUCN).
21. Succinct statement of ecological survey methods appropriate to population assessment of the concerned taxon.
22. Notable ecological adaptations (breathing roots of *Rhizophora* and *Avicennia* is an adaptation to live in marshy habitat), occurrence in different successional stages, status as an indicator plant (occurrence of *Heteropogon contortus* is an indication of heavy grazing); relevance to ecosystem service (Ficus trees are keystone species as they provide fruit to many animals and birds); ecological role and significance, special features. Notable interactions with other species (parasitism, mutualism, etc). [Such information may be highlighted with a view to promote special student projects].
23. Suggested student projects: Any special adaptation that merits study. Major gaps in available information on the taxon that merit investigations (the importance of Mahua trees in the lives of tribal and non-tribal communities; the pollination mechanism in *Amorphophallus* and the agents involved).
24. Local names in as many Indian languages and dialects as possible.
25. Full addresses of experts and centers of important research on the taxon.
26. Significant publications on the taxon. These may be provided alphabetically in a standard form as in the *Journal of Biosciences*, Indian Academy of Sciences, Bangalore.
27. Full addresses of significant repositories of collections of specimens of the taxon.
28. List of technical terms used in the account.
29. Names and addresses of contributors.

## Suggested Reading

- [1] D K Christopher Cook, *Aquatic and wetland plants of India*, Delhi Oxford University Press, 1996.
- [2] E J H Corner, *The Seeds of Dicotyledons* (Cambridge: Cambridge University Press), 1976.
- [3] K Kubitzki, *The Families and Genera of Vascular Plants*, vol II, K Kubitzki, J G Rohwer, V Bittrich (eds.), Berlin Springer-Verlag.
- [4] A K Mondal and S Parui, Devil turned-friend, *Science Reporter*, Vol. 3, 52-54, 1997.
- [5] B R Ramesh and J P Pascal, *Atlas of Endemics of the Western Ghats* (Pondicherry: French Institute), 1997.
- [6] C Tadulingam and G Venkatanarayana, *A handbook of South Indian weeds* (Madras: Govt. Press), 1932.
- [7] A Takhtajan, *Flowering plants: Origin and dispersal* (Edinburgh: Oliver & Boyd), 1969.