

Ecological Importance of Mangrove Trees – the example of *Bruguiera gymnorhiza* (L.) Lamk. (*Rhizophoraceae*)

Mangrove forests known as 'rainforests' by the sea' are one of the most important coastal ecosystems in the world in terms of primary production and coastal protection. Distributed in the tropical and sub-tropical regions, mangroves reach their maximum development and great luxuriance in Southeast Asia. The luxuriance of mangroves in Southeast Asia has let many to believe that it is the birth place for mangroves and from this region, the seeds and seedling of mangroves might have moved on ocean currents to different coastal regions in the tropical latitudes. In effect, the mangroves got established in marine environments of the tropics.

Mangrove trees have special adaptation to live in saline habitats. The specialized seeds of mangroves are tough, float and travel great distances in salt water and take root far from its parent tree. The seeds germinate and grow into seedling right on the parent tree. During this time, they acquire the carbohydrates they need later to grow on their own. The mangrove tree eventually drops its seedlings, where they take root in the mud below or are swept out by the tide. The mangrove trees have unique biological adaptation to survive this marine environment, including reproductive biology, salt tolerance, and growth form. They are well adapted to anoxic sediments. They produce aerial and tap roots which filter out the salt in the brackish water they grow in and support roots which grow directly into the mud to anchor them. Breathing roots allow them to survive in anoxic sediments. Buttresses and above ground roots enable them to grow in unstable mud flats. Their foliage removes excess salt from the sap and conserves water to cope with periods of high salinity.

Mangrove trees take major role in ecological services in mangrove ecosystems. They contribute to the stabilization of the shoreline and prevention of shore erosion. The dense network of support roots, breathing roots and stilt roots give mechanical support to the tree and trap the sediments. The mangrove trees produce litter by shedding their foliage: foliage drop is a mechanism to remove salt crystals accumulated in it. This foliage enters the mangrove water and produces detritus which in turn is colonized by heterotrophic microorganisms, thus enhancing its nutritive value. This detritus is consumed by the juveniles of a variety of bivalves, shrimps and fishes, which migrate into the mangrove environment for better feeding and protection. Mangrove trees

provide nesting sites for many shore birds and serve as home for crab-eating monkeys, proboscis monkeys, fishing cats, lizards, sea turtles, bats, and many more animals. Therefore, mangrove trees are very important to conserve and maintain mangrove ecosystems.

Today mangrove forests are one of the most threatened habitats in the world because of natural and demographic pressures, Mangrove trees act as sinks which concentrate pollutants such as sewage, toxic minerals, pesticide, herbicides, etc. Over time, the stress of the pollutants and reduced light kill large areas of mangrove forests.

Mangrove trees are good sources for firewood for locals, their wood makes a superior kind of charcoal, are sources for tannins, resins, medicines, etc. and many trees are cut down to sustain local interests. In effect, mangrove forests are under stress, turning into more fragile ecosystems. In India, the total area of mangroves was estimated to be 6,740 sq km as per the Status Report of the Government of India (1987) but the Indian Remote Sensing Data have shown that the total mangrove area is 4,474 km only. The available mangrove cover is highly subject to human pressures.

Bruguiera gymnorhiza Is one of the most important and widespread large-leafed mangrove species. It occurs in almost all mangrove ecosystems of the world. It thrives under a broad range of inter-tidal conditions, including salinity levels from near freshwater to full- strength seawater and tolerates a range of flooding and other soil types. It has economic importance: the bark for extracting tannin, the wood for firewood, the leaves and propagules as food for mammals. At root level, it provides good habitat for juvenile fish and other species and supports marine food chains through out-welling of carbon. It is viviparous, meaning that it produces seeds hidden in the mature persistent calyx and the seeds germinate on the parent plant.

In *B. gymnorhiza*, the flowering and fruiting occur continuously throughout the year. The flowers with red sepals and brown petals are quite conspicuous against the foliage. The mature buds which are ready for opening require external tripping by birds and in the absence of bird visits, the buds remain as they are and fall off subsequently. Each petal encloses two stamens and behaves independently, the bird tripping of mature bud does not lead to simultaneous burst of stamens from each petal. This

independent opening of petals is a unique floral device evolved for receiving multiple visits by birds.

This flower-birds relationship is well developed and co-evolved to cause explosion of flowers following tripping by birds. In this floral explosion process, pollen ejects out and adheres to the probing bill of the bird and the bird after tripping the bud collect nectar which occurs in copious amount in the calyx cup enveloped by setose hairs. The birds involved in floral tripping are sunbirds (*Nectarinia asiatica* and *N. zeylonica*) and white-eyes (*Zosterops palpebrosa*) at the Coringa mangrove forest. This indicates that *B.gymnorrhiza* disperses pollen to its neighbouring or distantly spaced trees through floral explosion by using bird species. This type of flower-bird relationship in this tree species is not a local adaptation but a universal adaptation throughout the distribution range of mangrove forests. However, the bird species differ with each geographic region. They include honey eaters in Papua New Guinea and Australasia. Sunbirds in South Africa and sunbirds, white-eyes and bulbuls in Japan. Pollinated flowers produce fruits and the seeds germinate on the parent plant. The seedlings fall off in salt water, float and establish themselves in new areas.

Like *B.gymnorrhiza*, almost all other mangrove trees have some economic and ecological values and contribute to the sustainability of mangrove ecosystem. Therefore, mangrove trees have to be conserved and managed for the perpetuation of mangrove biodiversity which exists under unique ecological and environmental conditions.

Public awareness and education about the mangrove forests help us to protect our mangrove ecosystems. It is also important to involve local communities in managing and protecting their mangroves. Designated conservation areas also save some of these forests. Further, the government at central, state and local level must enforce laws and regulate development and industry to save the mangrove lands.

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