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A Review of Reproductive Ecology of Mangroves: Conservation and Management

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Abstract

Mangrove forests are special ecosystems, common in tropical and subtropical coastal environments. They are one of the most productive and bio-diverse wetlands. Mangrove forests are important in protecting coasts from erosion by fierce tides, in promoting the diversity of marine organisms and fisheries by contributing a quantity of food and providing favorable habitats for animals. They yield timber, fuel wood, poles, thatching material, grass, honey, wax and industrial raw material. These various uses of mangrove forests suggest that they play an important role in the lives and economies of the coastal regions of the world. The sustainability of the mangrove flora is intimately linked to the success of their reproductive biology which in turn is associated with local insects. Further, the survival and population buildup of flower-visiting insects in this ecosystem is essentially dependent on the mangrove flora which vary with each salinity zone within the mangrove forest. It is in this context, the interactions between mangrove plants and insects leading to the benefit of both partners, the former for reproductive success and the latter for food and breeding, will be explained. True viviparous plant species include *Bruguiera gymnorrhiza, B. cylindrica, Ceriops decandra, C. tagal, Rhizophora apiculata* and *R. mucronata*, all belong to a single family Rhizophoraceae. Crypto-viviparous plant species include *Avicennia alba, A. officinalis, A. marina, Aegialitis rotundifolia* and *Aegiceras corniculatum*. Non-viviparous plant species include *Sonneratia alba, S. apetala, Lumnitzera racemosa, Scyphiphora hydrophyllacea* and *Excoecaria agallocha*. Mangrove associate plants are *Acanthus ilicifolius, Caesalpinia crista, Clerodendrum inerme, Derris trifoliata, Ipomoea pes-caprae, I. tuba, Malachra capitata, Suaeda maritima, S. monoica* and *S. nudiflora*. *Rhizophora* species do not produce nectar and offer only pollen as floral reward to the foraging insects; small bees utilize their pollen as chief pollen source. *Acanthus, Aegialitis, Aegiceras, Avicennia, Bruguiera, Ceriops, Derris, Excoecaria, Lumnitzera, Caesalpinia, Ipomoea pes-caprae, Malachra, Scyphiphora* and *Suaeda* are associated with bees, wasps, thrips, flies and butterflies. All these plant species utilize these insects for sexual reproduction while the insects utilise them as pollen and/or nectar during daytime. In case of *Ipomoea pes-caprae*, its pollen is the chief source of protein for the snail, *Euplecta decussata* which while collecting pollen contributes to out-crossing. *Ipomoea tuba* is an important source of nectar for the hawk moths which visit the flowers during dawn and dusk hours. The bees, *Xylocopa* and *Anthophora* are robbers of nectar from *Clerodendrum* flowers but their nectar robbing behavior promotes foraging activity by butterflies which in turn promote outcrossing. *Suaeda* species are sources of alkaloids, triterpenoids, sterols and various other chemicals. Nymphalid, lycaenid and hesperiid butterflies use them prior to flowering and after fruiting. They use alkaloids for protection against their predators. The propagules of true-viviparous species are essential food sources for edible crab species. The production of propagules is exclusively dependent on the extent of insect interactions with the flowers of these plants. Therefore, plant-insect interactions in mangrove forests are important for the structural and functional integrity of mangrove forests. Further, this knowledge enables to understand the relationships between mangrove flora and insect fauna and to take effective measures for the conservation and management of the mangroves and also for the reforestation of denuded mangrove forest.

Keywords: Reproductive ecology, Mangroves, Nectar robbery, Alkaloids, Conservation