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Case study: Mangroves

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Abstract
This study deals with mangroves which is a group of plants and shrubs that have developed to live in tidal zones along tropical coasts. Mangroves have been decimated by aquaculture, coastal development, changed hydrology, sea-level rise, and nutrient overload. Mangroves differ structurally and functionally. For the most part, ecosystems have only been described using a hierarchical structure. climate, geomorphology, topography, and hydrology are all included in this classification system for the intertidal zone. In this case, we'll be using the termnumerous levels of emergent features in a hierarchical structure how specialized adaptations and generalized adaptations intertwine Because of the considerable phenotypic plasticity that is characteristic of mangroves and intertidal habitats, mangrove ecosystems are very complex. What makes mangroves so resilient in the face of extremes in salinity and floods ecological processes and eventually the environment are influenced by the availability of nutrients. Its products and services we find that an integrated research strategy that incorporates the use of multiple methods is the most effective. Empirical and theoretical studies of emergent characteristics provide a comprehensive an approach to the study and management of mangroves.

Keywords: Mangroves, plants and shrubs, tropical coasts

Introduction
Coastal wetlands with varied latitudes (30°N–37°S), tide heights (1m–4m), geomorphology, sedimentary environments, temperatures, and nutrients available. This is why mangrove environments are vital to the preservation of biodiversity as well as the various direct and indirect benefits they bring to human activities. As a result, mangrove forests have lost at least 35% of their global coverage in the last two decades, affecting ecosystem services including fish, shrimp, and crab habitat (Aburto Oropeza *et al*. 2008). As a result of the loss of biological function caused by the degraded mangrove forests, millions of people live at danger. Understanding the interplay of processes that define and maintain mangrove biodiversity and production is difficult.

Literature Review
Oceanic islands to riverine systems, peat to alluvial ecosystems, temperatures (from warm temperate to desert and rainy tropics), and nutrients available (oligotrophic to eutrophic). In order to preserve biodiversity and the many direct and indirect advantages they provide to humans, mangrove habitats are crucial (Walters *et al*. 2008, Koch *et al*. 2009). The loss of mangrove trees has harmed ecosystem services such as fish, shrimp, and crab habitat (Aburto Oropeza *et al*. 2008). Millions of people are at danger due to degraded mangrove forests. Determining how systems interact to define and preserve mangrove biodiversity is difficult.

Methodology
Study area
Mangrove plants from the Sundarban estuary in India and Bangladesh, including *Ceriops decandra*, *Xylocarpus moluccensis*, *Excoecaria agallocha*, *Sarcolobus globosus* and *Sonneratia caseolaris*, are discussed in this article.

Decandra C.
Decandra ding hou (Rhizophoraceae) is a tiny evergreen tree in the Indian Sundarbans, growing to a height of 5 metres. To treat ulcers, hepatitis, and discomfort, the plant is an astringent.

Although *C. decandra* from other parts of India and the world contains diterpenoids, triterpenoids, and lignins, few investigations have been done on the chemistry or biology of the species from the Indian or Bangladeshi Sundarbans. The Indian Sundarban region's *C. decandra* leaves were studied by Ghosh *et al*., who discovered lipids, sterols, and triterpenes. The triterpene and sterol composition of the species' leaves was also revealed by the experiment. The hydrocarbon and wax ester profiles of this and six other mangrove species from the Indian Sundarbans were examined by Misra *et al*. Uddin *et al*. found that ethanol extracts of the species' leaves and pneumatophore have antinociceptive properties. According to a study on Bangladeshi leaf, bark, and pneumatophore, there was significant broad spectrum action against Gram-positive and Gram-negative pathogens. There is a significant antioxidant activity in the *C. decandra* (Perr.) Robinson stem bark extract, with an Ascorbic acid equivalent of 13.04 mg/g of *C. decandra* and an IC_{50} of 0.65 mg/ml for diphenyl picryl hydrazyl [DPPH]. Bark from Bangladeshi Sundarbans species has been shown to have antioxidant effects most recently by Hossein *et al*., who concur with Banerjee *et al*. Anti-inflammatory effects are also found in the species.

Moluccensis

Tidal inundation is not an issue for the Meliaceae plant *X. moluccensis* (Lamk.). In addition to being an aphrodisiac, elephantiasis and breast growth can be treated with the fruit. The antidiarrheal and antibacterial activities of the plant were studied by Uddin *et al*. In mice fed on castor oil and magnesium sulphate. CNS depressant activity has been found in mice by Alamgir and colleagues from the Sundarbans of Bangladesh. *X. moluccensis* Uddin *et al*. discovered no antibacterial activity in the leaves, while Haque *et al*. showed strong antimicrobial activity in crude stem bark extracts and three extracted pure compounds (structures unknown) called XM-1, XM-2, and XM-3. Bangladeshi X. moluccensis crude extract was discovered to be cytotoxic to brine shrimp nuclei as well. On the other hand, Mondal *et al*. found that it had antibacterial properties. MDA-MB-453S breast cancer cells and MDA-MB-453S human gastric adenocarcinoma cells were treated with these extracts and found to be moderately hazardous (AGS cell line). The bark of this shrub in Bangladesh's Sundarban was recently reported to contain procyanidins by Wangensteen *et al*. Research in this area uncovered numerous procyanidins, such as procyanidin B1, B3, trimer, pentam, and hexam, as well as decamer, undecamer, and undecamer, all of which were implicated in a variety of health conditions. There are antibacterial and DPPH radical scavenging properties in the plant-derived procyanidins.

Euphorbiaceae family tree Agallocha Geo or Gneoa (Euphorbiaceae) is a medium dioecious tree with a height of 15-20 m. There are a number of ailments for which the herb is effective, including epilepsy, conjunctivitis, dermatitis, hemoturia, leprosy, and toothache.

Neuropharmacological effects have been observed in mice when higher doses of the Bangladeshi Sundarban species are administered.

A significant amount of antinociceptive and gastroprotective activity was seen in crude ethanolic extracts of *E. agallocha* bark from Bangladesh's Sundarbans. A Bangladeshi plant bark ethanolic extract exhibits neuropharmacological, antimicrobial, and cytotoxic properties, according to Subhan *et al*. The extract demonstrated a high antibacterial and cytotoxic impact on brine shrimps, however it was not hazardous to mice, as previously reported. Tissue extracts of this plant from the Bangladesh Sundarbans were discovered to have antioxidant activity by Subhan *et al*. Various solvent extracts from Bangladeshi species bark were shown to have antioxidative and antiallergic activities by Hossain *et al*. In terms of antioxidant and histamine release inhibitory effects, the water and ethanol fractions were the most powerful. Root exudates from Indian Sundarbans species were the subject of a preliminary GC-MS research by Kumar *et al*.

Sarcolobus globosus

The Sundarban mangrove forest is home to the Asclepiadaceae shrub *Sarcolobus globosus*, which can grow as a prostrate or ascending tree. A traditional cure for rheumatism, dengue fever, and fevers. In Bangladeshi Sundarban species, Wangensteen *et al*. found a new sarcolobin and an isoflavone sarbone. Additionally, the examination identified tephrosin, 12a-hydroxyrotenone, 12a-hydroxydeguelin, 11-hydroxytephrosin, 12a-hydroxyrotenone, 6a, 12a-12a-hydroxyelliptone, 6a, 12a-dehydrodeguelin, 13-homo-13-oxa-6a, 12a-dehydrodeguelin. The 6,7-dimethoxy-2,3-dihydrochromone was discovered as a brand-new natural compound by the research team. Wangensteen *et al*. detected four phenolic glycosides, including vanillic acid 4-O-D-glucoside, glucosyringic acid, tachioside, and isotachioside, in later experiments. They also discovered two rotenoids, villosinol and 6-O-xo-6a, 12a-dehydrodeguelin. A mechanism other than antioxidative activity may have been responsible for the observed suppression of 15-LO because they inhibited it but did not scavenge DPPH. Wangensteen et alfindings.'s were corroborated by this investigation. The high quantity of tephrosin and other rotenoids in lipophilic extracts was also demonstrated to be cytotoxic and fatal to brine shrimp. When tested on mice, Alamgir *et al*. Discovered that S. globosus had no effect. Bark extract from Bangladeshi species demonstrated significant cytotoxic, membrane stabilising, and thrombolytic properties when tested on mice erythrocytes in hypotonic solution, according to Kuddus *et al*.

Caseolaris

If you're looking for a medium-to-tall tree that's evergreen, go no further than *Caseolaris* (*S. caseolaris* (L) Engl.). Poultices prepared from the fruits of the species are used to treat sprains and wound. Both luteolin and luteolin 7-O-glucoside were found in dried powdered leaves of the species from Bangladesh's Sundarban mangroves that have antioxidant activity (DPPH radical scavenging on TLC). According to Ahmed *et al*., the dried leaf powder of this species has a significant influence on the serum glucose and lipid profiles of rats. Blood sugar, triglyceride and total cholesterol levels were significantly lower after the injection compared to controls. Serum HDL cholesterol rose significantly after the meals were supplemented with leaf powder. Anti-diabetic and anti-cardiac medicines could be made from the *S. caseolaris* leaf, according to the study. An ethanolic leaf extract of *S. caseolaris* was reported to be effective against *F. oxysporum* by Chaudhuri and Guha. Species from Bangladesh's Sundarban have been shown to have a powerful antioxidant and lowering capacity, according to Mubassara and colleagues. Histamine and

leukotriene B4 inhibition was also observed in the organism, indicating that it might be exploited to create allergy medications.

Result

This study's findings reveal that mangrove species from the Sundarban estuary can extract pharmacologically essential compounds. These plants contain phytochemicals such flavonoids, limonoids, rotenoids, phenolic glycosides, and others. These compounds may aid in drug discovery. Ensuring that natural products are discovered and that activity-structure correlations are understood has been neglected despite the obvious biological activities. The active compounds responsible for these biological activities in *C. decandra*, *E. agallocha*, and *A. ilicifolius* are unknown. *X. granatum* received the most attention in the Sundarban estuary, whereas *S. caseolaris* received the least. Linking activity to structure may identify synergistic compounds. Two extracts from *C. decandra* that demonstrated high antibacterial activity in the disc-diffusion experiment had low activity in bioautography after TLC separation [21]. Maybe the separation of materials that have synergistic effects. It is possible to isolate bioactive compounds based on their activity. There is also a lack of research on the biological and chemical activity of Indian Sundarban mangroves. In Bangladesh's Sundarban estuary, plants are mostly studied. Ongoing research should identify new bioactive compounds that could help in drug discovery.

Discussion

Seven mangrove species were found in Malappuram and Kozhikode districts. Many *Avicennia officinalis* and *Rhizophora mucronata* species were found. Mangroves are found in Ashtamudi estuary in Kollam district. Surveys were conducted on the remaining mangroves in Kerala's 10 coastal districts. Mangrove species were found in 15 genera and 9 families. This group comprises 8 species. These included Malvaceae (one species), Pteridaceae (one species), Euphorbiaceae, Lythraceae, and Arecaceae (3 species). The paper promotes widespread reforestation to safeguard the ecosystem's worth and advantages. Plant diversity and phytosociology were studied in six Kollam district mangroves. These included Rhizophoraceae and Avicenniaceae. The most common species was Avicennia officinalis. In 2015-16, Vaiga and Sincy studied mangroves in Kannur. Vellikkeel has seven true mangrove species, four semi-mangrove species, and seven mangrove-associated species. Twelve mangrove species and three semi-mangrove species are found near Ezhome. The investigation found substantial public pressure on the district's mangrove property.

Conclusion

When the researchers combed through existing research on mangroves in Kerala, they found that most studies were either incomplete or out of date, which is supported by the data they gleaned from that research. It will also be helpful in the long-term monitoring of mangrove species and in the construction of species-specific conservation plans for each species because of the complete information provided here.

Recommendation

Lessening the impact of climate change on wildlife and genetic diversity. In addition, they will preserve the coastline and help spawn fish and shellfish. Mangrove reserves should be created. Schools should be positioned near population and transit centres. Definitive genetic diversity and seed stock protection is necessary for mangrove regeneration in Thailand. Long-term timber yield management with low environmental impact. Also, increase regeneration pace and timber tree proportion. All while protecting the shoreline and providing habitat for marine life. Aquatic life in the mangroves and nearby estuaries, lagoons and seas can be gathered. These areas will continue to preserve coasts and provide spawning and breeding grounds for fish and shellfish. In practise, this should be achievable. Mangroves can be used for aquaculture (fish and shrimp ponds), agricultural, urban and industrial development. All of these require mangrove removal. Due to the devastation caused by this land use, zoning should be restricted. Due to the destruction of larvae breeding habitats, coastal zone planning should try to locate such operations inland. Mangroves should be protected for their numerous uses. Abandonment Dredging and mining waste should not be dumped in mangroves. After mining, the mangrove vegetation and natural drainage should be restored. Forestry. Mangroves should be replanted where garbage dumping has badly destroyed them. Thailand has proved mangrove reforestation.

Charge fees or charges to deter conversion of mangroves into ponds, salt farms or trash dumps. The funding should be used to reforest abandoned mangrove regions. Decentralization reduces development expenses and discourages construction for single-use purposes. Laws and regulations should be enforced by trained officers with adequate support equipment, including vehicles and boats.

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