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RESEARCH ARTICLE

Distribution and Composition of True Mangroves Species in three major Coastal Regions of Tamilnadu, India

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Abstract

Mangroves are a part of marine ecosystem. They occur within the inter-tidal zone of the river estuaries. Mangrove formation depend on terrestrial and tidal water for their nourishment, and silt deposits from upland erosion as substrate for support. Mangroves are one of the most productive ecosystem and a natural renewable resource. However, across the globe, the world's mangroves are threatened. The Mangroves are distributed globally, occurring in over 112 countries. The present study observed the mangrove diversity in three major regions of Tamilnadu mangrove forest: namely Pichavaram, Muthupet, and Gulf of Mannar. The mangrove species diversity varies from one place to another, due to the factors such as climate, tidal factors and anthropogenic pressures. Pichavaram region has a maximum of 12 true mangrove species, whereas only 9 species are represented in Gulf of Mannar region. In Muthupet region only 8 species were recorded. In all the three places, 14 taxa of mangrove species were recorded from Tamilnadu region.

Introduction

Mangroves form the interface ecosystem that occur at the confluence of river and sea in tropical and subtropical areas (Lugo & Snedaker 1974). The term 'mangrove' describes both the ecosystem and the plant families that are adapted to live in the tidal saline environment (Tomlinson 1986). They provide a vast array of ecological and socio-economic services like coastal protection (Dahdouh-Guebas *et al.* 2005; Walters *et al.* 2008), soil conservation (Furukawa *et al.* 1997), nurseries for commercially important fishes, crabs and prawns (Manson et al. 2005; Nagelkerken *et al.* 2008), carbon cycling (Kristensen *et al.* 2008); fuel wood and fodder (Dahdouh-Guebas *et al.* 2006), a variety of traditional non-wood forest products (Bandaranayake 1998 & 2002). Mangroves are natural occurring in water logged and saline soil of sheltered tropical and subtropical shores. They are subjected to diurnal and seasonal (neap/spring) tides. They thrive in intertidal zone up to the high-tide mark. The Mangrove forests comprises 46 genera having about 60 species of true and associated mangrove species. In General the, flora of mangrove wetlands could be divided into two groups namely, True or exclusive mangrove and associate mangrove species (Tomlinson 1986).

By reconciling common features from Banerjee and Rao (1990), Duke (1992) and Kathiresan and Bingham (2001), 69 species in 27 genera, belonging to 20 families can be considered as true mangrove species. True mangroves are grown only in mangrove environment and do not extend among terrestrial plant communities play a major role in determining the structure of plant community.

Global Scenario

Mangroves occupy less than 1 percent of the world's surface (Saenger, 2002) and are mainly found between the Tropic of Cancer and the Tropic of Capricorn on all continents covering an estimated 75 percent of the tropical coastline worldwide. There are more than 18 million ha of global mangroves inhabiting in 112 countries. Around 34 major and 20 minor mangrove species belonging to about 20 genera in over 11 families have been recorded worldwide (Tomlinson, 1986). Mangroves of South and Southeast Asia form the world's most extensive and diverse mangrove systems comprising 41.4 percent of global mangroves.

Indian Scenario

India with a long coastline of about 7516.6 km, including the island territories (Anonymous, 1984), has a two mangrove covers of about 6,749 km , the fourth largest mangrove area in the world (Naskar & Mandal, 1999). These mangrove habitats (69°E-89.5°E longitude and 7°N-23°N latitude) comprise three distinct zones: East river deltas of Ganges, Brahmaputra, Mahanadi, Godavari, Krishna and Cauvery which have nutritional rich alluvial soil. 60 species of mangroves are known to grow abundantly (Untawale, 1986). Sundarbans (east coast) form a major portion of mangrove forests in India, covering about 9,600 sq. km of mangrove forest and water. The Sundarban with the most dominant flora comprises numerous island formed by the sediments deposited by three major rivers, the Ganga, Brahmaputra, Meghna, and a dense network of smaller rivers, channels and creeks. Indian mangroves make up 3.1 percent of the total global cover and are distributed all along the maritime states, except the union territory of Lakshadweep, with an area of about 4461 km along the 7,500 km long. Mangroves are the most dominant flora in Sundarbans and 30 true mangroves occur in the Indian Sundarban.Debnath and Naskar (1999) identified 36 species as true mangroves. The east coast is endowed with the world's largest forest, the gigantic Sundarbans in West Bengal.

The mangrove area in Orissa is nearly 200 km in extent and its degradation was placed at 20 km over ten years, as percent estimates. Andhra Pradesh possesses about 5822 km of mangrove area. Tami Nadu is one of the nine maritime states of India endowed with the second longest coastline of 1076 km. The major mangrove wetlands in Tamil Nadu are Pichavaram mangroves, Muthupet mangroves and Gulf of Mannar for which river Cauvery is the main supplier of freshwater. The area of mangrove ecosystem in Tamil Nadu is about 225 km of which the largest and most unspoiled mangrove forests are found in Pichavaram, Cuddalore District, extending over an area of 1100 km. (Venkataraman, 2007). Right from the ancient times, Gujarat has an extensive and diverse mangrove ecosystem. Goa with seven major micro tidal estuary swamps comprising of laterite, loamy and alluvial soils. Out of 130 km coastal wetland in the state 67.30 km is contributed by mudflats and mangroves. These mangroves are present in the narrow intertidal mudflats along the estuary banks and are of fringing nature which is considered to be raising the topography of the coast and these habitats have been reclaimed for urbanization. The state of Orissa has a geographical area of 1, 55707 km with an actual forest cover of 47107 km (30.3 %). Total area of sanctuary is 672 km of which mangrove forests constitute to 130 km which receive water from three rivers, known to be rich in species diversity with dense trees tall like those of Sunderbans (Selvam, 2003). The mangrove ecosystem is basically of three types, the first being the deltaic mangroves located along the mouth of major estuaries on east coast and Gulf of Kachh and Khambhat Gulf on the west coast. These cover up to 53% of the total Indian mangroves out of which Sunderbans cover about 78%. The Second type forms the coastal mangroves found along the intertidal coastlines, minor river mouths, sheltered bays, and backwater areas of the west coast. This constitute 12% of the mangrove area of India. The third type of island mangroves are found along shallow protected intertidal zones of bay islands such as Lakshadweep and Andamans which are approximately 16% of the total mangrove area (Ingole, 2005).

Materials and Method

Study area:

The coast line of Tamil Nadu extends about 950 km, within the latitude 8 ^{o} 13’ N - 10 ^{o} 15’ N and longitude 77^{o} 15 E - 80^{o} 20’ E. with about 46 big and small rivers. All the rivers carry freshwater and silt particles from the upper reaches and discharge them to the coastal zone. Mangroves in Tamil Nadu comprises of Pichavaram, Muthupet and Gulf of Mannar area. The common dominant mangroves are *Rhizophora apiculata, Rhizophora mucronata*,

Sonneratia apetala, Avicennia marina, Avicennia officinalis, Bruguiera cylindrica, Ceriops decandra, Aegiceras corniculatum, Lumnitzera racemosa.

Pichavaram

Geographical location

Latitude: 11^{o} 27'N

Longitude: 79^{o} 47' E,

Pichavaram is situated about 250 km south of the city of Chennai, on the south east coast of India. It is located in the Vellar-Coleroon estuarine complex and has many islands separated by intricate water ways. It covers an area of about 400 hectares and is traversed by a large number of channels and creeks which connect the coleroon estuary in the south and Vellar estuary in the north. It is an estuarine mangrove situated at the confluence of Uppanar, a tributary of the coleroon river. The Pichavaram mangrove wetland has 51 islets and the total area of the vellar-pichavaram-coleroon estuarine complex is 2335.5 ha of which only 241 ha is occupied by dense mangrove vegetation.

Flora

The common dominant mangroves are *Rhizophora apiculata, R. mucronata*, which attain 5-7 m height and the occasional mangroves are *Sonneratia apetala, Avicennia marina, A, officinalis, Bruguiera cylindrica, Ceriops decandra, Aegiceras corniculatum.*

Muthupet:

Geographical location

Latitude: 10.4°N

Longitude: 79.5°E

Muthupet mangrove forest is located at the southern end of the Cauvery delta, covering an area of approximately 6,803.01 ha of which only 4% is occupied by well-grown mangroves. The river of Paminiyar, Koraiyar, Kilaithankiyar, Marakkakoraiyar and other tributaries of the river Cauvery flow through Muthupet and adjacent villages. At the tail end, they form a lagoon before meeting the sea. The northern and western borders of the lagoon are occupied by muddy silt ground which is devoid of mangroves. The total area of the Muthupet mangrove wetland is about 12,000 ha and for administrative purpose it is divided into six Reserve Forests such as Palanjur, Thamarankottai, Maravakkadu, Vadakadu, Thuraikadu and Muthupet reserve forests. Presence of two large lagoons, which are contiguous and about 1,700 ha in area, is one of the characteristic features of the Muthupet mangrove wetlands.

Flora

A recent botanical survey indicates a total number of 8 true mangrove species are present in the Muthupet mangroves like *Excocaeria agallocha, Aegiceras corniculatum, Lumnitzera racemosa, Acanthus ilicifolius, Ceriops decandra, Rhizophora apiculata Rhizophora mucronata, Avicennia marina* and *Avicennia marina* is the conqueror of the forest which is found as a single dominant species. Among these *Ceriops decandra, Rhizophora apiculata* and *Rhizophora mucronata* might have been introduced recently.

Gulf of Mannar

Geographical location

Latitude: 8° 35' - 9° 25' N

Longitude: 78° 8' - 79° 30' E

This marine Biosphere Reserve along the coast of Tamilnadu is the first of its kind in India and Southeast Asia. It is situated in the Indian part of the Gulf between India and Sri Lanka covering an area of about 10,500 sq.km in the southeast and parallel to the main coastline to a distance of about 170 nautical miles. It is an area of about 21 islands from the northern most Pamban to Tuticorin. The total island area is about 555 ha. The Gulf is influenced by both south west (from April to July) and north east (October to December) monsoonal rains

Flora

The Gulf of Mannar and the islands possess unique mangrove vegetation along with other flora and fauna. The vegetation consists of species belonging to *Rhizophora*, *Avicennia*, *Bruguiera*, *Ceriops*, and *Lumnitzera* etc. Although the mangroves are reported from majority of the islands, the vegetation of Manalli is striking for its luxuriance and diversity. They are not so tall, perhaps the height is reduced due to strong winds lashing there perennially with great velocity during the monsoons, periodical cyclone etc. The species include plants of *Avicennia officinalis, Excoecaria agallocha, Bruguiera cylindrica, Ceriops tagal, Lumnitzera racemosa*.

Data collection

Consequent surveys were made along the beaches, deltaic regions, river channels and the mouth of estuaries to explore the successful establishment of the true mangroves. The nomenclature of the specimens were followed by Gamble (1957) and Mathew (1983). Collected Herbarium specimens are stored for future references.

Result and Discussion

The results after the intensive survey, made from the Pichavaram, Muthupet and Gulf of Mannar areas of Tamilnadu coastal regions showed the formation or group of plants including the Rhizophora, which was introduced by the Department of Forest, Government of Tamilnadu, India. The other species found were *Acanthus ilicifolius, Bruguiera cylindrica, Avicennia (Avicennia marina* and *Avicennia officinalis*), *Rhizophora* (*Rhizophora apiculata* and *Rhizophora mucronata*), However, *Excoecaria agallocha* was seen sporadically growing along the riversides, instead of forming a community or clump. The mangrove diversity observed is presented in Table 1

The taxa Avicennia marina are found represented in all the study sites, whereas Ceriops tagal is recorded only in Muthupet region and Acanthus ilicifolius present only in Gulf of Mannar river sides. Kathiresan (2000) According to Selvam et al (2004) *Buruguiera cylindrica* is noted in Muthupet region. *Pemphis acidula* is noted only in Gulf of Mannar region. *Avicennia officinalis, Rhizophora lamarkii* and *Xylocarpus mekongensis* are reported in Pichavaram region. *Aegiceras corniculatum, Avicennia marina, Ceriops decandra, Excoecaria agallocha, Lumnitzera racemosa, Rhizophora apiculata* and *Rhizophora mucronata* are growing in all study areas. *Avicennia marina* is the most abundant in all places. *Rhizophora annamalayana* is a new hybrid between *Rhizophora apiculata* and *Rhizophora stylosa* from Pichavaram mangroves (Kathiresan 1995). Previously this species was called as *R. lamarkii*, a hybrid between *Rhizophora stylosa* and *Rhizophora apiculata* (Lakshmanan and Rajeswari 1983). Since *Rhizophora stylosa* does not exist in Pichavaram (Kathiresan 1995). *Buruguiera cylindrica* (Rhizophoraceae) has been recorded for the first time from the west coast, while it is common on the east coast (Bhat and Untawale 1987). The Palynological studies carried out in the Muthupet mangroves by Tissot (1987) proved with strong evidence that the species belonging to the genera Rhizophora and Sonneratia which occurred there might have disappeared since 200 years. Pichavaram region has a maximum of 12 true mangrove species, whereas only 9

species are represented in Gulf of Mannar region. Only 8 species are represented at Muthupet region. To our Interest, 14 taxa of mangrove species are recorded from Tamilnadu region.

Earlier reports suggested that the East Coast of India was covered with thick mangrove vegetation and their remnants could be seen in the estuaries and in river beds of the backwater areas along the Bay of Bengal. All three regions of Tamilnadu are of estuarine riverine type K Jerfe (1984). In Tamilnadu region, the brackish water, with less salinity and the addition of freshwater from various rivers, channels and canals, favour the growth and development of the vegetation. Saenger et al (1983) have summarized the role of fresh water on the mangrove ecosystem. Blasco (1984) suggested that both temperature and rainfall are the two essential bioclimatic factors for mangrove and other terrestrial ecosystems. The edaphic factor with the micronutrients, rainfall, temperature, humidity and pH of water also favour the growth and development of mangroves.

Conclusion

The vegetation and plantation of mangroves are found to be successful and well preserved in the region Pichavaram, Muthupet and Gulf of Mannar. The Tamilnadu region in South India is a breeding ground for aquafauna and avifauna and the region has the potentials to develop ecotourism, and to make a wind-breaking zone along the coast of India. This study confirms the establishment of a true mangrove vegetation and its diversity in major mangrove areas in South India. In all the three regions some species are found extinct in condition.

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Table1. The Distribution of true mangroves from the three major coastal areas of Tamilnadu.

(PV-Pichavaram, MP-Muthupet, GM-Gulf of Mannar)

S.No	Family name	Plant name	PV	MP	GM
1.	Acanthaceae	*Acanthus ilicifolius*	+	+	+
2.	Myrsinaceae	*Aegiceras corniculatum*	+	+	+
3.	Avicenniaceae	*Avicennia marina*	+	+	+
4.	Avicenniaceae	*Avicennia officinalis*	+	-	-
5.	Euphorbiaceae	*Excoecaria agallocha*	+	+	+
6.	Meliaceae	*Xylocarpus mekongensis*	+	-	-
7.	Combretaceae	*Lumnitzera racemosa*	+	+	+
8.	Lythraceae	*Pemphis acidula*	-	-	+
9.	Rhizophoraceae	*Rhizophora apiculata*	+	+	+
10.	Rhizophoraceae	*Ceriops tagal*	-	-	+
11.	Rhizophoraceae	*Ceriops decandra*	+	+	+
12.	Rhizophoraceae	*Rhizophora lamarkii*	+	-	-
13.	Rhizophoraceae	*Bruguiera cylindrica*	+	-	+
14.	Rhizophoraceae	*Rhizophora mucronata*	+	+	+

(+ = Present, - = Absent)