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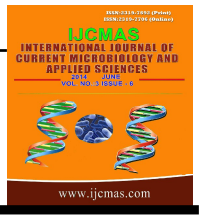

Original Research Article

Sediment characteristics of mangroves from Bhatey and Kalabadevi Estuary (Maharashtra), India

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A B S T R A C T

Mangroves constitute an important ecosystem because of their global extent and high productivity. In this investigation soil physico-chemical conditions were analysed for better understanding of habitats of mangroves from western coast of Maharashtra. In the present study the physico-chemical parameters such as soil granulometry, temperature, pH, salinity of soil as well as water and vegetation from the study region were analysed during 2005-2013. It was observed that mangroves occur on course to fine sandy and muddy substratum. Sensitivity and adaptability of the species in the critical ecosystem become important to assess the vulnerability of a species.

Keywords

Western coast, physico-chemical, mangroves

Introduction

Mangrove trees are the most prominent salt tolerant forest trees of the intertidal areas (Kathiresan and Bingham, 2001). Mangrove forests are one of the most productive and bio diverse wetlands on earth. Growing in the inter-tidal areas and estuary mouths between land and sea, mangroves provide critical habitat for a diverse marine and terrestrial flora and fauna. They normally grow poorly in stagnant waters and have luxuriant growth in the alluvial soil substrates with fine - textured loose mud or silt, rich in humus and sulphides.

They can also be found in substrates other than muddy soil such as coastal reefs and oceanic islands. In such areas, the mangrove plants grow on peat, which is derived from decayed vegetation. They find it difficult to colonize the coastal zone with waves of high energy and hence they normally establish themselves in sheltered shorelines (Kathiresan & Bingham, 2001). The mangrove vegetation of West coast is sparse, less extended, and confined to patches due to scanty upstream freshwater supply, excessive amount of silt-clay deposition, low average rainfall and relatively low tidal fluctuation (Blasco & Aizpuru 1997; Naskar & Guha Bakshi 1987; Untawale 1984). Therefore in the

present work, the main aim was to study of mangroves sediment with respect to physicochemical studies of the different sites from the study region.

Materials and Methods

Study Area

The present study is carried out from the coastal Maharashtra which is situated along the central west coast of India. The study region lies between 15^{O} 44' to 20^{O} 08' N latitude. This region is well known as "Konkan". The region is a part of Deccan plateau. The estuaries Bhatye and Kalabadevi are drowned valleys (Wagle, 1982). In the present investigation more attention was given to South-Western Maharashtra.

Methods

Substrate collections and Soil analysis

Soil samples were randomly collected, at a depth of 10–20 cm. They were brought to laboratory and air-dried, followed by sieving through 2 mm sieve and stored prior to analysis. Measurement of pH was made on pH meter (APX 175E) as 1:5 (weight/volume) suspension of soil in distilled water. The soil conductivity was measured using electrical conductivity (EC) meter (Systronics 304) and the soil organic matter by the method of Walkley and Black (1935) with some modifications. Soil moisture content was determined gravimetrically at 105°C (Parent and Caron, 1993).

Soil density was calculated using a plastic cylinder to take a sample of known volume that was then oven-dried at least 65°C for 72 hours and dry mass was determined.

Results and Discussion

Present study reveals that the occurrence of mangroves on coarse to fine sandy and muddy substratum, but no mangroves are recorded on rocky and more gravelly substratum. Walsh (1974) has reported occurrence of mangroves in cracks and crevices of rocky shores. It is however observed that mangroves themselves may influence the sediments by promoting siltation (Davies, 1977). The soils studied during present work show swampy – muddy nature at many locations of different estuaries. The depth of mud is variable and general range of mud depth is from 10 cm to 120 cm. However, at the certain places dry as well as still deep muddy swamps are recorded.

The range of soil pH recorded during the study is from 3.4 to 8.6 in case of Bhatye estuary while in case of Are and Kalabadevi estuary, the range i from 6.4 to 7.9 and 4.4 to 8.1 respectively. The pH of soil shows wide range from acidic to alkaline. According to Chaudhary and Bhattacharya (1984), the mangrove areas of Sunderbans show low pH in monsoon. The pH of sediments in the mangrove environment is subjected to change into addition of organic substances by mangrove flora and fauna, levels of carbonates and bicarbonates (Williams, 1987) and it is going to change due to location of estuary (Bhosale, 1990). In the present investigation lower values of pH are recorded from Karla and Bhatye estuary. The pH at these sites is hampered by addition of domestic waste along with fresh water influx in rainy season which might have resulted lowering the pH. Nair *et al*., (1984) and Hossain *et al*., (1988) analysed that the lowering of pH caused by waste loads including distillery and agricultural wastes.

Table No.1 Mangrove species along Bhatey and Kalabadevi estuaries of South Western Maharashtra

S.No.	Species	Family	Bhatye	Kalabadevi
1.	*Rhizophora mucronata* Poir.	Rhizophoraceae	+	+
2.	*R. apiculata* Blume		+	+
3.	*B. parviflora* (Roxb.) Wight		+	-
4.	*Ceriops tagal* (Perr.) C. B. Rob		+	+
5.	*Kandelia candel* (L.) Druce		+	-
6.	*Avicennia marina* (Forsk.) Vierh	Avicenniaceae	+	+
7.	*A. officinalis* Blume		+	+
8.	*Sonneratia alba* Smith	Sonneratiaceae	+	+
9.	*Aegiceras corniculatum* (L) Blanco	Myrcinaceae	+	+
10.	*Acanthus ilicifolius* L.	Acanthaceae	+	+
11.	*Excoecaria agallocha* L.	Euphorbiaceae	+	+
12.	*Lumnitzera racemosa* Willd.	Combrataceae	+	+
13.	*Clerodendrum inerme* (L.) Gaertn	Verbenaceae	+	+
14.	*Premna integrifolia* L.		-	+
15.	*Salvadora persica* L.	Salvadoraceae	+	+
16.	*Derris heterophylla* (Willd.) Back	Fabaceae	+	+
17.	*Pongammia pinnata* Vent.		+	-
18.	*Caesalpinia nuda* L.	Caesalpiniaceae	+	+
19.	*Thespesia populnea* (L.) Soland	Malvaceae	+	+
20.	*Aleuropus lagopoides* (L.) Trin	Gramineae	+	+
21.	*Halophila beccarii* Aschers	Hydrocharitaceae	+	-
22.	*Ipomea pescarpe* Sweet.	Convolvulaceae	-	+

The higher values are recorded from south bank of Bhatye estuary. This may be due to shallow water levels which causes more salinity and more pH, consequently during dry seasons. The pH does not show any gradient from mouth to upstream of the estuary. The different pH values for the soil under different species may be due to different addition of litter and microbial activities in the soil underneath.

The electrical conductivity (EC) shows

wide range of values according to vegetation dominated by the site. The EC ranges from 2.9 to 13.1 mS/cm. Blasco (1975) has recorded EC for Indian mangrove soil while Sah *et al*., (1886) has given range from 2.7 to 11.4 mS/cm for mangrove soils of Sunderbans.

Soil organic matter serves as an indispensable source of plant nutrients and enhances soil biological, chemical and physical properties (Mokwunye *et al*., 1996). At study site the organic matter ranges from 6.81 to 10.22%. Naidoo and Raiman (1982) observed that mangrove soil were higher in organic matter than the non-mangrove soil. According to Rasmussen and Collins (1991), soils in lowlands have higher soil organic matter than soils on upland positions. There is slight change in the soil density at various localities. The growth responses of species at different localities are observed to be different. Almost all soil nitrogen and other important soil properties such as moisture retention, cation exchange capacity (CEC) and stabilization of soil aggregates are related to soil organic matter (De Ridder and Van Keulen, 1990; Rowell, 1994). Bhatye estuary has high soil organic matter (10.22%) while, at Kalabadevi it is much less as compared to other localities. Most soil organic matter values are derived from organic carbon (C) because the quantitative determination of soil organic matter has high variability and questionable accuracy (Nelson and Sommers, 1982). In case of water holding capacity (WHC) Bhatye estuary show highest value with higher percent of moisture content (53.23%).

The study area occupies more than 22 mangroves and their associates (Table:1). The dominance of the species changing at different sites. It is evident from foregoing discussions that the dominance of mangroves from the study region is governed by different conditions like soil and water salinity, tidal inundations, exposure to high energy tidal waves etc.

Sensitivity and adaptability of the mangrove species in the critical ecosystem become important to assess the vulnerability of a species. Adaptive capacity of some of them can be improved by management intervention, especially by planting them in suitable areas after assessing the trend and rate of environmental changes with special reference to substratum. Therefore, these studies will help in the management and conservation of mangrove ecosystems from the Maharashtra.

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