J. mar. biol. Ass. India, **42** (1&2) 2000 : 200 - 204

Structure and species distribution of mangrove forest at Uran

S. G. Yeragi, K. N. Babu and S. S. Yeragi

K. J. Somaiya college of Science, Vidyavihar, Mumbai - 400 077

Abstract

The present investigation was conducted in the mangrove mudflats of Raigad district in Uran creek (lat.20° 29'N, long. 77°32'E). The mangrove of Uran creek is well-developed, much more productive and forms the base of the food chain. No other plant community in the world has perhaps attracted more scientific attention than the mangroves. They grow on a highly stressed habitat due to high amount of dissolved salts in its substratum and water which periodically covers the soil surface.

A survey of the global status of mangroves may show that vast areas are being destroyed for various purposes in which fishfarming and fuels are the dominant ones. The mangrove of India is also not exception to such uncontrolled exploitation. The mangrove vegetation of India have an area of approximately 3,56,500 ha of which Krishna-Godavari mangrove complex comprises an area of approximately 12,800 ha (Sidhu, 1963). Information is available on the extent of mangrove forests from certain regions along the west coast and the estimated area is about 70,400 ha (Blatter, 1905, Patil, 1959, Untawale *et al.* 1982, 1984)

The mangrove forest itself reaches its maximum development in South - East Asia, both in number of species and exuberance of individual growth. From the ecological point of view, mangrove plant species are salinity tolerant if not low right halophytes. Salinity tolerance is achieved by different morphological and physiological features and mechanisms that can be grouped into three main categories like penetration of NaCl and other salts at root level, secreting excess salts through salt glands and accumulating salts of tissue level.

Material and methods

The present study was carried out in Uran creek. A series of quadrats of 5 x 5m were laid at an interval of 1 km along the 10 km long canal. The number of trees in each quadrate was counted and the data were tabulated. Using. certain indices of species structure in community, data on the index of dominance, species diversity, richness of species were calculated. In addition to these, data on the relative density and relative frequency was calculated. The three measures are computed as follows:

$$\text{Relative density} = \frac{\text{number of individuals of species}}{\text{total number of individuals}} \times 100$$

$$\text{Relative frequency} = \frac{\text{frequency of a species}}{\text{sum-frequency of all species}} \times 100$$

Frequency is the percentage of plots in which a given species is present

Results

The number of plants recorded in 10 quadrate along the distance of 10 km is given in Table 1. The vegetation in the mangrove swamp consisted of seven species of mangrove plants. The distributions of these plants were varied in a distinct pattern from the mouth of the creek towards the inland water.

The distribution of *Avicennia officinalis* was restricted towards inland water whereas *Excoecaria agallocha* and *A. marina* were found along the entire region of Uran creek. *E. agallocha* was more dense towards the mouth of the creek. The zone of mangrove can be divided into two areas. First, the *Avicennia* area that is located near the inland water and the second region dominated by *E. agallocha*. This region was found more towards the sea. *A. officinalis* was not dense towards U_3 region, because this species may prefer an inland habitat with lesser magniture of salinity variation. A non-mangrove species *Ipomaea tuba* that was closely associated with mangroves showed a discontinuous distribution.

Almost all the species are present with variable numbers in all the quadrate except a few like *Acanthus ilicifolius, Bruguiera gymnorrhiza,* and *Derris heterophylla.* The quadrats 1 to 4 are near the high salinity region and 5 to 7 are in variable salinity but 8 to 10 are located in the inland area where freshwater condition existed during the monsoon season and brackish water regime found during the post monsoon and summer seasons.

Table 1 : *Structure of Uran Mangrove Community*

Sl. No.	Species	Quadrate number 1	2	3	4	5	6	7	8	9	10	Total number of individuals	Frequency	Relative density (%)	Relative frequency (%)
		Number of individuals													
1	*Rhizophora mucronata*	21	12	18	20	17	12	9	14	12	21	156	100	28.20	13.39
2	*Avicennia officinalis*	7	9	15	11	13	7	8	10	9	12	101	100	18.26	13.89
3	*Avicennia marina*	8	12	11	7	8	5	-	-	3	4	58	80	10.48	11.11
4	*Sonneratia alba*	-	-	4	6	4	2	-	2	4	3	25	70	4.52	9.72
5	*Sonneratia caseolaris*	2	-	-	5	6	3	2	4	6	-	28	70	5.06	9.72
6	*Excoecaria agallocha*	10	8	12	9	3	4	7	11	13	12	89	100	16.09	13.89
7	*Acanthus ilicifolius*	-	-	4	5	8	9	3	8	7	5				
9	*Derris heterophylla*	-	-	2	-	-	4	3	5	16	50	2.89	6.95		
	Total	48	41	69	67	68	42	31	60	62	65	553	720		

Rhizophora mucronata and *Avicennia officinalis* distributed in all the quadrates with 100% frequency, 13.89% relative frequency and 28.20% relative density. The relative frequency of *R. mucronata, A. officinalis,* and *E. agallocha* were highest amongst all. While *D. heterophylla* was lowest (6.95%).

Phenological characteristics of mangrove species were related to different environmental factors, especially, rainfall, temperature, soil and water condition. In the mangrove species along this regions, flowering was noticed during January to April and extensive fruiting during April to May. An extensive flowering during January to April due to higher temperature and larger duration of photoperiod and extensive fruiting during nearer the period of monsoon due to heavy rains have been observed. Extensive fall in the establishment of mangrove seedlings, especially in *Rhizophora* sp. during monsoon period when salinity is low also have been noticed. Excess salt in the soil delays the fall of seedlings in the mangroves. The production number of seedling and size amplitude plays an important role in the zonation of the mangroves (Untawale *et al.* 1980).

In Uran areas the following types of mangroves are recognised, each with its characteristic flora. Riverine mangroves are found in the estuary in which *Sonneratia, Bruguiera* and *Rhizophora* communities are characteristic. Fringing mangroves with *Rhizophora, Bruguiera, Avicennia,* and *Excoecaria* communities are found along shallow lagoons. Basin mangroves with *Rhizophora, Excoecaria* communities, scrub mangroves, which are stunted and degraded, with *Avicennia, Excoecaria* are found bordering the lagoons and finally overwash mangroves with *Rhizophora, Bruguiera* and *Avicennia* are found in small island. Common throughout the study site were *Rhizophora mucronata, Avicennia marina, A. officinalis,* and *Excoecaria agallocha.*

Discussion

The species structure in the mangroves of Uran appears to vary from site to site. Rao *et al.* (1963) and Venkatesan (1966) reported the occurrence of 26 species in the neighbourhood of Kakinada. In the Coringa forest, Blasco (1975) recorded the occurrence of *Excoecaria agallocha, Avicennia officinalis, and Derris* sp. Sidhu (1963) recognised three major forest communities. They are tidal ever green, semi-evergreen and tidal deciduous. He recognised pure *Avicennia* community, mixed *Avicennia* community, and *Aegiceras* mixed community. He also recognised a total of 20 species in his studies. In this area of study, *Rhizophora* and *Avicennia* were the dominant species, recorded throughout the areas. Another feature of difference is the association of *Avicennia* with *Excoecaria.*

Along the Maharashtra coast there are about 14 genera and 20 species representing the mangrove flora. Of these about 16 species are the mangroves, while others are associate species. The dominant mangrove flora species are *Rhizophora* spp., *Avicennia* sp., *Sonneratia* spp. *Bruguiera* spp., *Acanthus* sp. etc. The most virgin and luxurient mangrove areas can be

totally preserved as protected areas, sanctuaries, reserves, etc. where no management practice, modification, alterations would be allowed. A high-density plantation programme can be developed in smaller plots of less than 25 ha. For fodder crop and fuel wood uses 'High density plantation Techniques' has to be developed. Protection of the luxuriant mangrove areas from illegal felling, poaching and the large-scale mangrove afforestation programmes in the marshy areas with the help of local communities on incentive basis warrant attention. For any successful plantation programme techniques of nursery development are very important.

Most of the fringing habitats, especially those in Puttalam lagoon are occupied by a single species, frequently by *A. marina.* According to Cintron *et al.* (1985), the most constant conditions of salinity and nutrients as well as the exposure to expectedly higher kinetic energy regimes which are relatively unfavourable to support a large number of species may restrict the number of species occurring in fringing habitats. Moreover, during periods of flood, considerable tidal and water flow energies may be dissipated in the riverine sites. Although such periods are relatively short, they may favour mangrove establishment more than the constant tidal motion in the fringing habitats, especially in a low-tidal environment. Thus as a result of the oscillating conditions and more favourable nutrient balances, estuarine mangals may be able to support more species than fringing mangals.

The length of the propagule may determine the zoning of species, with *Rhizophora mucronata,* that has longer propagules growing where tidal amplitude is greater. The morphology of the propagules is also well adapted for setting the seedlings in the correct upright position with the budding end up, because of the rooting end is heavier, therefore the propagule shoots down, well directed by gravity. Salinity as high as 90 ppm in ground water is known to be tolerated by *Avicennia marina* roots, although the plants are dwarfed by salinity stress. *R. mucronata* can withstand upto 45-50 ppm, but tolerance of surface water salinity is significantly lower.

Under extreme unfavourable conditions, when stress is at its maximum, specimens of ecologically prevalent species are able to survive under stress conditions spending most of their energy just to keep alive without much being left for growth. In many places of Uran creek such "Dwarf mangrove trees" reduced to shrub size and growing sparsely are found due to excess of toxic elements in the soil. Pollution over-exploitation by removing the plants for firewood or fodder may produce the same type of deformed dwarfs. Species of the genus *Avicennia* especially. *A. marina* is probably the ones that can take the maximum number of environmental insults and still survive.

In conclusion, the structure and species composition of the mangrove forest varies as a function of geographical, geophysical, geological, hydrographic, climatic and edaphic factors, and man's activities. There have been several attempts to classify mangrove forests into different types, however each one has only

limited value. The structure and dynamics of mangrove forests must be well known before deciding on the most suitable management practices.

References

Blasco. F, 1975. Mangroves of India. Inst. Fr. Pondicherry. *Tran. Sect. Sc.; Tech. 15.* 175 pp.

Blatter E. 1905. *J. Bom. Nat. His. Soc.* **16.** 644-656.

Cintron G. A. *et al.* 1985. Structural and functional properties of mangrove forests. St. Louis. MO USA : 53-56.

Navalkar. B. S. 1952. *J. Bom. Nat. Hist. Soc.* **50** : 157-166.

Patil R. P. 1959. In : *Proc. Mangrove Symposium* Calcutta; 16-19 Oct. 1957.

Rao. *et. al.* 1963. *Bull. Bot. Surv. India.* **5** : 301-323.

Sidhu S. S. 1963. *Forestar.* **89** : 337-351.

Untawale A. G. *et al.* 1980. *Mahasagar* Bull. No. 10. **13**:73-76.

----- *et al.* 1982. In : *Proc. First Wet land Conf;* 51-67.

----- 1984. Mangroves of India. Present status and multiple use. Status report submitted to the UNDP/UNESCO. Regional mangrove project for Asia and the Pacific.

Venkatesan, K. R. (1966). *Forestar,* **92** : 27-34.