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Phytosociological analysis of Mangroves at Kannur District, Kerala

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ABSTRACT

Investigation on floristic diversity of mangroves of Kannur indicated that the study area constituted 12 species under nine genera belonging to seven families. Rhizophoraceae represented maximum genera of four species. Phytosociological analysis revealed that *Acanthus illicifolius* registered highest density and relative density followed by *Avicennia officinalis.* Whereas relative frequency was highest recorded for *Avicennia officinalsi* followed by *Acanthus illicifolius.* Maximum relative basal area was represented by *Aviennia marina* followed by *Avicennia officinalis.* Structural analysis of the mangroves of Kannur unveiled the domination of *Avicennia officinalis* which, registered highest Importance value index (IVI) and relative importance value index (RIVI) among the 12 mangroves species distributed all over. Though this species constituted relatively lesser density and frequency, it registered highest IVI and RIVI due to its relatively higher basal area. The lowest IVI and RIVI was registered for *Luminitzera racemosa.* Diversity indices for six mangrove sites and for whole Kannur district indicated that mangroves at Pappinisseri constituted highest Shannon Weiner index and equitability (H' 9.706, 3.75). Highest Simpson's index was reported for Madakkara (0.847) and Kavayi registered lowest value for Shannon Weiner index and H max (H' 5.72, 2.585).

Keywords: Mangroves- Phytosociology – Floristic - Diversity index

1. Introduction

Mangroves are salt-tolerant plants of tropical and subtropical intertidal regions of the world. Mangroves have many peculiar features than the other terrestrial plants. The word 'mangrove' can also be used to describe the habitat as well as the species of trees and shrubs that grow in that habitat. Plants in mangals are diverse but all are able to exploit their habitat that lives at or near the water's edge in protected marine habitats. Mangroves were found in more than 120 countries and territories around the world. The mangrove ecosystem covers only 0.037 per cent of the world's surface or 0.12 per cent of the Earth's land area (Ong, 2004). Mangroves in India account for about 5 per cent of the world's mangrove vegetation and are spread over an area of about 4,500 km^2 along the coastal States/UTs of the country. Sunderbans in West Bengal accounts for a little less than half of the total area under mangroves in India. In Kerala, only Kannur has good natural patches than that in the other districts. There was approximately 755 hectare of mangrove forest in Kannur. However, it has declined to 17 km^2 (Basha, 1991). Extention of mangrove ecosystem in Kerala as 70,000 ha Various studies showed that mangrove vegetation cover only 1,095 ha in Kerala (Kurien, *et al.,* 1994). Forest Survey of India (FSI, 2003) further showed that mangrove vegetation in Kerala is now restrained largely to river mouths and tidal creeks and that there has been no significant mangrove cover south of Cochin in Kerala coast.

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Phytosociology is the study of vegetation and its internal "social" relationships, not only classifications of plant communities but also analysis of their structure, composition, successional relations, relationship with environmental factors, as well as comparison of different communities (Fujiwara, 1987). Apart from the details on the extent, there has no attempt to assess the status of mangrove areas in the State. Only few studies on the floral and faunal components and physical parameters of the ecosystem were initiated or completed. Almost 90 per cent of the area comes under this category. Anthropogenic activities like heavy sand mining from the rivers, pose problems for the natural regeneration of mangroves (Sunil Kumar, 2002). Hence an attempt is made here to study the floristic composition and phytosociological parameters of the mangroves of Kannur.

Study area

Figure 1: Map of Kannur district showing study sites

The study was constituted in Valapattanam-Madakkara, Akkarakkad, Thazhekkavu, Dal region, Pappinisseri and Kavvayi region of Kannur district. All trees of mangroves found to be varied in their girth at breast height (GBH) were enumerated by measuring the GBH and height using Tape and Clinometer respectively. Phytosociological analysis in six sites was carried out by quadrate method (species area curve method). The different sites were Valapattanam-Madakkara, Akkarakkad, Thazhekkavu, Dal region, Pappinisseri, Kavvayi. Fifteen quadrates of each 5x5 m size were laid each in six mangrove sites. On the basis of data obtained from quadrates, the structural parameters like density, relative density, abundance ,% frequency, relative frequency, basal area, relative basal area, importance value index (IVI), relative IVI, were calculated by using standard formula Diversity indices like Simpson's index, equitability, and Shannon-wiener's index (Shannon and Wiener, 1963) function were also found out using the following formulas.

Density = No. of individuals/ha

Relative Density = $\frac{\text{No. of individuals}}{\text{Total no. of individuals}} \times 100$

Basal area = $G^2/4\pi$

Relative Basal area = $\frac{\text{Basal area}}{\text{Total Basal area}} \times 100$

Frequency (%) = $\frac{\text{No. of quadrates in which a species occurs}}{} \times 100$

$$\text{Relative Frequency} = \frac{\text{No. of occurrence of a species} \times 100}{\text{Total no. of quadrates}}$$

$$\text{Abundance} = \frac{\text{Total no. of individuals of a species in all quadrates}}{\text{No. of occurrence of all species.}}$$

$$\text{Total no. of quadrates in which the species occur}$$

IVI=RD+RF+RBA

RIVI = IVI/3

Simpson's Index = $1-\sum(n_i/N)^2$

Shannon Weiner Index, $H' = 3.3219 (\log N - \frac{1}{N}) \sum n_i \log n_i$

$Hmax = 3.3219 \log_{10} S$

Equitability, E=H'/Hmax

- N-Total number of all individuals of all the species.
- n_i-No. Of individuals of a species.
- S-Total no. of species

3. Result and Discussions

1.1 Species composition

Distribution of true mangroves at various sites indicated that, *Acanthus illicifolius, Avicennia marina, Avicennia officinalis* were noticed in all the study sites. *Bruguiera cylindrica, Avicennia officinalis*, *Rhizophora mucronata* were found in four sites whereas *Aegiceraas corniculatum Sonneratia alba* and *Sonneratia caseolaris* were noticed in three sites. *Excoecaria agallocha* and *Kandelia candel* were in two sites whereas *Luminitzera racemosa* is a rare species, which was confined to Kavayi. Floristic study revealed that the occurrence of a total 12 species belonging to seven families. Rhizophoraceae represented maximum genera of four species. Rao (1986) made comparative studies from mangrove area along the northern and western coasts and stated that the species composition and the agents causing maximum destruction differed with localities. Krishnamurthy *et a*l. (1981) reported 110 species belonging to 60 genera and 35 families from Pitchavarum mangroves of Tamil Nadu.

1.2. Phytosociological analysis

Structural analysis encompasses not only the study of vegetation and its internal "social" relationships, but also provides information on classifications of plant communities and their structure, composition, and successional relations. Phytosociological analysis of mangroves of Kannur revealed that the highest density for *Acanthus illicifolius* (279.3) followed by *Avicennia officinalis* (117.3). The relative density for *A. illicifolius* was found to be maximum (35.00). The minimum was represented by *Luminitzera racemosa*, which recorded lowest relative density of (3.0). The frequency was 300 individuals per hectare and showed an erratic distribution. Relative frequency of *A. illicifolius* was high in Pappinisseri area only while in other areas relative frequency was highest for *A. officinalis* (18.06). Relative basal area was recorded highest for *A.marina (*16.56). Importance value index was estimated using the values of relative density, relative frequency and relative basal area. It was found that the

highest IVI and RIVI were recorded for *A.officinalis* followed by *A. illicifolius*. The lowest IVI and RIVI were recorded for *L. racemosa*. Structural analysis of the mangroves of Kannur unveiled the domination of *a* shrub *Acanthus illicifolius.* Though this species constituted lowest basal area, it registered 2nd highest IVI and RIVI due to its gregarious occurrence in the most of the study sites. Among the 12 mangroves species studied from different locations of Kannur, *A. illicifolius* represented the species with maximum density. Detailed investigation on structural features of mangroves in Kerala and elsewhere were studied and reported by various workers. Sureshkumar (1993) studied Phytosociological analysis of Puduvyppu, Kerala and reported that importance value index was highest for *Avicennia officinalis* followed by *Bruguiera sexangula* without much zonal variations.

Jose, (2003) studied structural features of the mangroves at Kunnimangalam, Valapatanam and Dharmadam areas of Kannur. He found that *Avicennia officinalis* represented highest IVI (141.86) followed by *Excoecaria agallocha* (112.14). *Avicennia marina* is tolerant of a very wide salinity range, which appears to account for its sporadic distribution from the outer seaward margin in some areas to the inner landward fringe in others, and even in hypersaline patches where the plants are stunted or shrubby. Sindhumathi (2009) reported the domination of *Rhizophora mucronata* in the mangroves of Chetuwai of Thrissur district, Kerala. The IVI reported for *Rhizophora mucronata* was highest (149.5) when compared to *Bruguiera cylindrica,* which registered next highest IVI (114.94). In the present study, *Avicennia officinalis* constituted maximum IVI followed by *Acanthus illicifolius* which represented next highest IVI as the whole Kannur is concerned. Structural analysis of the mangrove communities at different estuarine formations revealed that there was site specific domination of species which in turn supported by the adaptability of these species to specific site conditions. Ecosystem evaluation with respect to adaptation of a species to the specific site may be attributed by physical, biological and edaphic factors. Tolerance to salinity levels, organic content in the soil, morphological adaptations, power to resist physical pressure exerted by the turbulent water, duration of fresh water inundation etc. might be influential factors for the species dominance at different sites (Ewel and Bourgeois, 1998).

Table 1: Structural analysis of mangroves of Kannur

No.	Name of the species	Rel.Density	Rel . Frequency	Rel. Basal area	IVI	Rel. IVI
1	*Acanthus illicifolius*	35.00	13.66	0.49	49.15	16.38
2	*Aegiceras corniculatum*	5.93	9.25	1.40	16.58	5.53
3	*Avicennia marina*	6.43	12.33	16.94	35.71	11.90
4	*Avicennia officinalis*	14.70	18.06	16.79	49.56	16.52
5	*Bruguiera cylindrica*	8.35	2.64	6.39	17.39	5.80
6	*Exceocaria agollocha*	2.17	3.96	8.63	14.76	4.92
7	*Kandelia candel*	3.64	4.85	9.45	17.64	5.88
8	*Luminitzera racemosa*	3.00	0.44	1.16	1.85	0.62
9	*Rhizophora apiculata*	2.79	6.17	5.80	15.23	5.08
10	*Rhizophora*	4.92	11.45	5.78	27.93	9.31

	mucronata					
11	*Sonneratia alba*	2.08	5.29	11.09	18.47	6.16
12	*Sonneratia caseolaris*	3.44	11.89	16.08	35.75	11.92

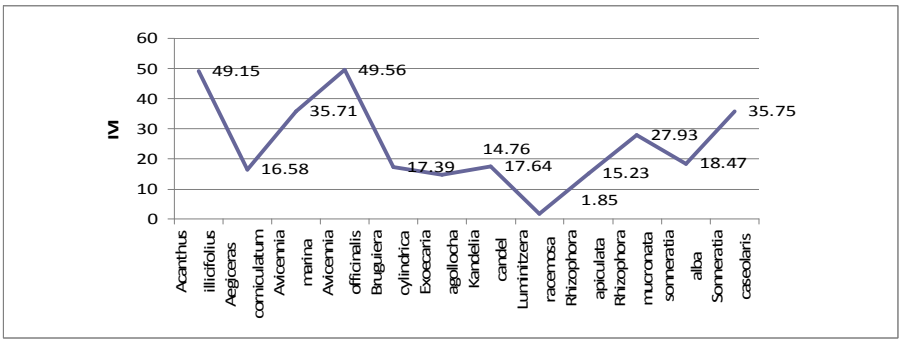

Figure 1: Importance value index of different mangrove species of Kannur

Diversity indices of mangroves at different sites

Plant diversity indices in 6 mangrove sites and indices for whole Kannur showed that Pappinisseri constituted highest Shannon Weiner index and equitability (H' 9.706, 3.75). Highest Simpson's index in Valapattanam-Madakkara (0.847) and Kavvayi registered lowest value for Shannon Weiner index and H max (H' 5.72, 2.585). Simpson index of diversity for concentration of dominance (cd) represent the chance of two successively randomly chosen individuals belonging to same species (Simpson, 1949). The present study indicated, Simpson index of diversity of mangroves for whole Kannur was 0.821. Jose (2003) reported almost similar values for Kannur (0.854). Sureshkumar (1993) reported very less value for Simpson index of diversity (0.144) for mangroves in Puduvyppu, Kerala. Shannon Weiner index of diversity (H max) in the present study was ranged from 2.53 to 4.22 at different sites. Sureshkumar (1993) reported this value changed from 3.8 to 4.3 in the mangroves of Puduvyppu, Kerala. Shannon Weiner index of 2.0 -3.2 in Honkong (Steve, 1993), 1.4 in China (Licun Li, et al., 1993) 1.0 to 2.27 in Maharashtra (Kurlapkar and Bhosale, 1993) was reported by various workers.

Table 2: Diversity indices of different mangrove sites of Kannur

Sl.No.	Name of the Locality	Shannon weiner index (H)	H max	Equitability	Simpson's index
1	Kannur	8.137	4.219	3.585	0.821
2	Madakkara	6.608	3.170	2.085	0.847
3	Akkarakkad	8.020	3.000	2.673	0.822
4	Dal	6.501	3.170	2.051	0.778
5	Kavvayi	5.718	2.585	2.212	0.493
6	Pappinisseri	9.706	2.585	3.755	0.432
7	Thazhekkavu	7.432	2.807	2.647	0.751

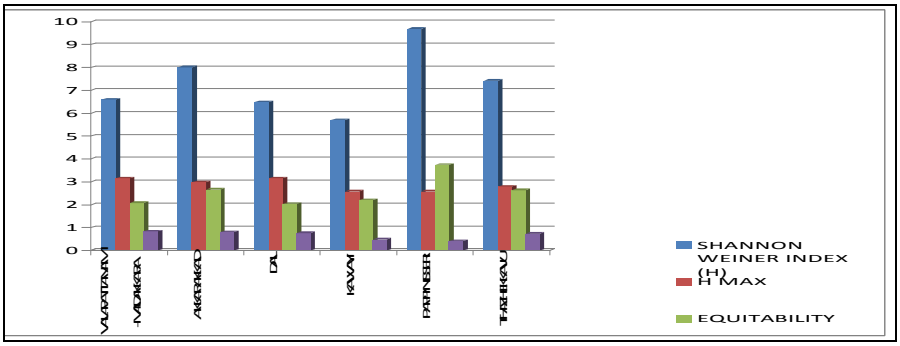

Figure 2: Diversity indices of Mangroves at Kanuur

4. Summery

Floristic diversity indicated that the study area constituted 12 species under 9 genera belonging to 7 families. Rhizophoraceae is the family which comprised of 3 genera in which Rhizophora is the major genera constituted 2 species. Structural analysis of the mangroves of Kannur unveiled the domination of *Avicennia officinalis* which, registered highest Importance value index (IVI) and relative importance value index (RIVI) among the 12 mangroves species distributed all over. Diversity indices for 6 mangrove sites studied and indices for whole Kannur indicated that Mangroves at Pappinisseri constituted highest Shannon Weiner index and equitability (H' 9.706, 3.75). Highest Simpson's index was reported for Madakkara (0.847) and Kavayi registered lowest value for Shannon Weiner index and H max (H' 5.72, 2.585).

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