Composition, Structure of Mangroves in Gamui Estuary, Chudamani, Orissa, India

G. M. Narasimha Rao and P. Prayaga Murty

Department of Botany, Andhra University, Visakhapatnam-530003, Andhra Pradesh, India.

pragada007@gmail.com, Fax 08912526143

ABSTRACT…

Mangroves and halophytic vegetation of Chudamani region and Dhamara mouth region of Gamui estuary, Orissa was studied by using the transect with 4x4m quadrate. In each station, 5 transect samples were collected and total samples analyzed for getting relative density, relative dominance and relative frequency of individual species in the studied area. Maximum Important Value Index (IVI) was obtained for the species *Suaeda maritima* and minimum value for *Sonneratia apetala*. A total of 11 plant species were reported, out of them 3 were true mangroves species, remaining 8 were halophytes. Along with data on plant populations hydrographical and sediment analysis was gathered to correlate with distribution and abundance of mangrove species. Maximum density was reported *Suaeda maritima* and minimum density for *Prosophis juliflora*. Maximum height of forest is only 2 to

2.5 meters with diameter of plant species is not more than 26cm. Sediment analysis and low input of fresh water may be responsible for degraded mangroves with stunted growth.

KEY WORDS: True mangroves, halophytes, Chudamani and Dhamara mouth of
Gamui estuary, Orissa, India

INTRODUCTION

Mangroves of Mahanadi, Bhitarkanika in Orissa were studied by several authors (Banerjee and Rao, 1985; Banerjee, 1984; 1986; 1987). Banerjee and Rao (1990) have published a book entitled" Mangroves of Orissa Coast and their ecology, they presented the information regarding the distributions, ecology and utilization of mangroves along the coastal regions of Orissa. And they studied the mangrove vegetation of Dhamara mouth region of Orissa. In the present study, phytosociological studies were carried out to collect the information on structure, composition and distribution of mangroves in Chudamani region.

MATERIAL AND METHODS

Gamui is one of the seasonal rivers in Orissa. It empties the plenty of water during the monsoon season. Remaining seasons minimum amount of water is present in the river. The Gamui divided into many distributaries near Chudamani, one of the major distibutaries flows through Chudamani and merges with Bay of Bengal at Dhamara mouth region (Latitude 21^0 13 and Longitude 86^0 11). In this region mangrove forest is homogeneous with stunted growth. Mangrove forest spreads 25 to 28 Km^2. In the present study two stations were selected one was near Chudamani port area another one at Dhamara mouth region. Hydrographical parameters such as water temperature, salinity, P^H, D.O and water transparency were collected at study sites from January 2010 to December 2010.

Water temperature, P^H, salinity were measured with a thermometer, salinometer and P^H meter. Water transparency was measured by a Secchi disc. D.O was estimated by the method followed by Strickland and Parsons (1972). Sediment analysis of the soil sample in mangrove swamp was estimated by pipette method (Craver, 1971) Quantitative data were collected by placing the transect from water front to interior of the forest and extending transect up to the barren zone to get the present status of the mangrove populations. Quadrat of (4x4m) was marked along the transect line at 5 m intervals from water front to end of the forest. A total of 10

transects (5 in each stations) were collected and plants present in each quadrat were counted. Quadrat samples collected from different stations were analyzed and densities of different species were estimated. Mean standard diameters, relative density and relative dominance of available plant species was estimated.

RESULTS

Hydrographical conditions:

Seasonal data collected on hydrographical parameters of main distributary of Gamui estaury was presented in table -1. During the period investigation water

Table-1 Seasonal changes in the hydrographical parameters of Gamui estuary

S.No	Parameters	Summer	Monsoon	Winter
1	Water temperature(O ^{0} C)	30	25	19
2	Salinity (‰)	25	16	21
3	P^H	7.4	7.2	6.9
4	Transparency (cm)	30	12	18
5	D.O (ml/L)	6.4	5.9	5.7

Temp erature of the surface water varies from 19^0C (in winter season) to 30^0C (maximum in summer) maximum salinity of the surface water was recorded in summer months (25ppt) and minimum salinity (16ppt) was observed in rainy season. P^H of the surface waters varies from 6.9 to 7.4. Minimum P^H values were reported in winter and maximum in summer season. Dissolved oxygen of the study areas varies from 5.7 to 6.4. Transparency of Secchi disc values varies from 12 to 30cm. Maximum turbidity and minimum secchi disc values were reported in rainy season, while maximum Secchi disc values and minimum turbidity was observed in summer months (Table-1).

Structure and composition of mangroves:

Mangrove forest of the studied area is a homogeneous type and only two species belongs to one genus dominates the entire mangrove zone. Halophytic zone in the mangrove forest was

dominated by the species of Suaeda. Density of individual plant species was estimated by using the total number of quadrats and calculated the number of plant species per hectare (Table-2). Density of plant populations based on quadrat analysis reveals that *Suaeda maritima* is a dominant species with a density of 2540 plants per hectare followed by *Suaeda monoica* 2465 plants per hectare minimum density for *Prosophis juliflora* (36 plants per hectare). Density of plant populations in station 2 shows the same trend.

Table-2: Density of plant populations' estimated at Chudamani estuary.

S.No	Name of the species	Family	Density individual/hectare	
			St_1	St_2
1	*Avecennia marina*	Verbenaceae	578	493
2	*Avecennia officinalis*	Verbenaceae	540	523
3	*Excoecaria agallocha*	Euphorbiaceae	178	132
4	*Heliotropium curassavicum*	Boraginaceae	687	563
5	*Prosophis chinensis*	Mimosaceae	84	76
6	*Prosphis juliflora*	Mimosaceae	36	24
7	*Sesuvium portulacastrum*	Aizoaceae	1940	1760
8	*Sonneratia apetala*	Sonneratiaceae	74	52
9	*Suaeda maritima*	Chenopodiaceae	2540	2230
10	*Suaeda monoica*	Chenopodiaceae	2465	2160
11	*Suaeda nodiflora*	Chenopodiaceae	2350	2090

Height of the mangrove species ranged from 2.0 to 2.5 meters only but here and there few plants are found with maximum height of 3 meters, diameters of mangrove species is not more than 26cm.

Table-3 Relative density, Relative abundance, and Relative frequency of Mangrove species of Chudamani.

S.No	Species name	T-1	T-2	T-3	T-4	T-5	T-6	T-7	T-8	T-9	T-10	TNI	TOI	F %	Den	Dom	R. F	R.Den	R.Dom	IVI
1	*Avecennia marina*	15	13	12	16	11	10	9	13	14	15	**128**	10	100	12.8	12.8	10	24.95	24.36	**59.308**
2	*Avecennia officinalis*	9	7	8	7	6	8	4	5	6	7	**67**	10	100	6.7	6.7	10	13.06	12.75	**35.809**
3	*Excoecaria agallocha*	1	2	2	2	1	3	2	1	2	3	**19**	10	100	1.9	1.9	10	3.703	3.615	**17.318**
4	*Heliotropium curassavicum*	2	1	2	1	2	0	2	1	1	2	**14**	9	90	1.4	1.55	9	2.729	2.949	**14.678**
5	*Prosophis chinensis*	2	1	0	2	1	2	0	0	1	0	**9**	6	60	0.9	1.5	6	1.754	2.854	**10.608**
6	*Prosphis juliflora*	1	2	1	2	1	1	1	2	1	1	**13**	10	100	1.3	1.3	10	2.534	2.473	**15.007**
7	*Sesuvium portulacastrum*	1	3	2	4	2	1	3	2	2	1	**21**	10	100	2.1	2.1	10	4.093	3.996	**18.089**
8	*Sonneratia apetala*	1	0	1	0	1	0	1	0	0	1	**5**	5	50	0.5	1	5	0.974	1.902	**7.876**
9	*Suaeda maritima*	12	13	13	15	16	13	14	15	16	17	**144**	10	100	14.4	14.4	10	28.07	27.4	**65.472**
10	*Suaeda monoica*	8	9	7	3	8	6	4	5	6	8	**64**	10	100	6.4	6.4	10	12.48	12.18	**34.653**
11	*Suaeda nodiflora*	3	2	4	5	2	3	4	2	1	3	**29**	10	100	2.9	2.9	10	2.653	5.518	**18.171**
														1000	51.3	52.55				

A = Abundance **D** = Density   **F** = Frequency **TNI:** Total Number of Individuals   **TOI:** Total Occurrence of Individuals. **RDom** = Relative Abundance **RD** = Relative Density RF = Relative Frequency **IVI** = Important Value Index

Quantitative Analysis of Mangroves

Abundance, Density, Frequency and their relative values for determining the distribution pattern and Importance Value Index (IVI) of the mangroves encountered in field was presented in Table-3 *Avecennia marina and Suaeda maritima* are most abundant mangrove tree species and halophyte species respectively followed by *Avecennia officinalis* and Suaeda monoica. The Important Value Index calculated for the individual mangrove species encountered in the field revealed interesting results. *Avecennia marina* is the most important species followed by the *Suaeda maritime, Avecennia officinalis, Suaeda monoica , Sesuvium portulacastrum* and *Suaeda nodiflora.* From the results obtained, it is clearly established that most of the mangrove species encountered in the field fall under C,D and E frequency classes and hence the mangrove vegetation is relatively homogeneous.

Information collected on various parameters in phytosociological studies was presented in Table-3. Maximum relative density was (27.4) reported for the species *Suaeda maritima* followed by *Avicennia marina* (24.3), *Avicennia officinalis* (12.7), *Suaeda monoica* (12.1) and minimum values were reported for the species *Sonneratia apetala* (1.9)

Sediment analysis of mangrove soils

In the present study, sediment analysis shows that the high percentage of sand (34% to 40%) low percentage of silt(16% to 22%) and clay (18% to 28%) But silt content is more than 50% reported in the abundant mangrove zone.

DISCUSSION

Among the various parameters in climatic, hydrographical and chemical features, salinity plays vital role for the growth, development and composition of mangroves in any estuarine habitat. Hydrographical features of the present investigation shows the moderate conditions of Gamui estuary which are agree with the earlier studies of Godavari estuary (Narasimha Rao, 1989), Visakhapatnam and Sarada and Varaha estuarine complex, (Narasimha Rao, 2008), Vashista and vainateyam estuaries (Narasimha Rao and Prayaga Murty, 2010).

In the Chudamani region, mangrove forest spreads upto 300 to 350 meter from water front zone. Most of the forest was dominated by 2 or 3 species only. In the mangrove forest

intertidal zone is approximately in between 2.0 to 2.5 Km. Transect studies reveals that mangrove species spread upto100 to 150 meters from water front, while halophytic vegetation extends from 150 to 300 or 350 meters. Abundant barren zone is present,some part of it converted to aquaforms. Banerjee and Rao (1990) reported the presence of *Avicennia marina*, A.*alba, Sonneratia alba* and *Phoenix paludosa* in the mangroves of Dhamara mouth region. But in our present study Avicennia and Sonneratia were observed without reports of genus phoenix. Distribution, structure such as height, diameter of mangroves and composition of mangroves depend on climatic factors, organic matter, salinity and sediment types in mangrove habitats of the different estuarine system reported by several authors (Mukherjee and Mukherjee, 1970; Blasco, 1975; Banerjee and Rao 1990; Bhaskara Rao *et al.,* 1992; Narasimha Rao and Dora, 2009; Narasimha Rao and Prayaga Murty, 2010).

Sediment studies in the present investigation shows the higher values of sand, lower value of silt and clay. In Sundarbans, Blasco, (1977) reported the 40-60% silt; In Godavari estuary Bhaskara Rao *et al.,* (1972) observed that the silt content is more than 50% in the mangrove of Godavari estuary, where the growth of mangrove is luxurious and abundant. But in the study high percentage of sand and low percentage of silt and clay may be responsible for the homogeneous and stunted growth of the mangroves in Chudamani and Dhamara mangrove forest and agrees with the earlier reports of Narasimha Rao and Prayaga Murty (2010) on mangroves of Vashista and Vainateyam estuary.

REFERENCES

Banerjee, L.K.and Rao, T.A. (1985). Mangals of Mahanadi delta, Cuttack dist., Orissa.   All India Symposium Marine Plants Dora Paula. Goa, India. 137-152.

Banerjee, L.K. (1984). Vegetation of the Bhitarkanika sanctuary in Cuttack dist.,   Orissa. Journal of Economic and Taxonomic Botany 5 (5): 1065-1079.

Banerjee, L.K. (1986). New distributional records of some mangrove species from   Orissa coast. Journal of Bombay Natural History Society 83(1): 271-273.

Banerjee, L.K.(1987). Ecological studies on the Mahanadi estuarine Delta in Orissa. Tropical Ecology 28: 117-125.

Banerjee, L.K. and Rao, T.A. (1990) Mangroves of Orissa coast and their ecology. Bishen Singh Mahendra Palsingh, Dehradun, India pp118.

Blasco, F.(1975). The Mangroves of India, Pondicherry, French Institute, French Sectariat Science and Technology: 14, 1-175 pp.

Bhaskara Rao, V., Narasimha Nao, G.M. Sarma, G.V. S. and Krishna Rao, B. (1992). Mangrove and its sediment characters in Godavari estuary, east Coast of India. Indian Journal Marine Science: 21, 64-66.

Craver, R.E. (1971). Sedimentary petrology. (John Wiley and Sons Inc, London) 1- 653 pp.

Mukherjee, B.B. and Mukherjee,J.(1970).Magrove of Sunderbans, India. Phytomorphology 28(2): 217-192.

Narasimha Rao, G.M.(1989). Ecological studies on some estuarine and marine algae, Ph.D. Thesis, Andhra University. Andhra Pradesh 1-129.

Narasimha Rao, G.M. (2008). Mangrove populations of Visakhapatnam and Sarada and Varaha estuarine complex, India. International Journal of Plant Sciences: 3 (2), 686-687.

Narasimha Rao, G.M and Prayaga Murty, P. (2010).Mangroves and Associated Flora of Vashista and Vainateyam Estuaries, A.P. India. Journal of Notulae Scientia Biologicae 2(4) 2010, 40-43.

Narasimha Rao, G.M. and Dora, S.V.V.S.N. (2009). An experimental approach to Mangroves of Godavari estuary. Indian Journal of Forestry 32(3), 263-265.

Strickland, J.D.H. and Parsons, T.R.A. (1972). Practical handbook of seawater analysis. Journal of Fisheries Research Board of Canada, 167: 1-311.