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Original Research Article

Mangroves and Associated Flora of Vashista Godavari Estuary from Darbharevu to Biyyaputippa, West Godavari District, AP, India

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Abstract

Mangrove ecosystem is one of the productive ecosystems in aquatic environment. Mangrove populations occurring along the Vashista branch of Godavari River were studied using line transect with 16 m² quadrates and the quadrate samples were analyzed. In the present investigation a total of 16 mangrove species were reported, out of which four are true mangrove species, six associated mangroves and six halophytes were reported. Transect studies revealed that mangroves were distributed up to 10 to 20 meters in Darbharevu and 30 to 40 meters in Biyyaputippa region. Most of the forest in Darbharevu is in form of long strip and in Biyyaputippa forest extends and density of species was higher than Darbharevu. In both study sites (Darbharevu and Biyyaputippa) the species with the highest density was *Suaeda monoica* whereas the species with lowest density was *Sonneratia caseolaris.* The maximum height in these two stations varied from 5 to 10 meters only. Percentage frequencies of DBH (Density at Breast Height) classes were estimated. In the present study only two diameter classes in Darbharevu and 4 classes in Biyyaputippa were reported. This is an indicative of the small and bushy mangrove vegetation in station 1 and little bit larger canopy was reported in station 2. Anthropogenic and aqua industry play a critical impact on the survival of this mangrove ecosystems.

Keywords: Mangrove species, Distribution and density, Vashista Godavari, Andhra Pradesh, India.

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INTRODUCTION

Mangroves are coastal tropical formations between intertidal regions of estuarine zones which salt tolerant and diversified ecosystems found. These ecosystem occurs in the tropical and subtropical regions of the world. These estuarine forests are inundated regularly by the high tides of the sea. Rich organic matter present in this region is source for formation of abundant phytoplankton and ultimately growth and development of more and more fishery products (Narasimha Rao and Lohitasyudu, 2023). This ecosystem provides livelihood for the local inhabitants. In India, the total area of mangroves was estimated to be 6740 sq.km (MOEF, 1987), which is about 7% of the world's mangrove area. Godavari mangroves are second largest mangroves in India which spreading from Chollangi near Kakinada to Pandi and Pora regions of East Godavari district covering an area 316.21KM² (Umamaheswara Rao and Narasimha Rao, 1988). Mangroves species of the estuarine habitats of Godavari estuary was studied by several investigators such as Rao (1959); Sidhu (1963); Raju (1968); Blasco (1975); Chapman (1976); Umamaheswara Rao and Narasimha Rao (1988); Bhaskara Rao *et al.*, (1992). Several authors (Narasimha Rao and Dora, 2009; Narasimha Rao and Subba Rangaiah,2010; Narasimha Rao and Murty, 2010a; Narasimha Rao, 2012; Narasimha Rao *et al.*, 2012; Narasimha Rao, 2014 and Narasimha Rao, 2015) studied the distribution pattern, composition and importance of mangroves in Godavari estuary and its distributaries. Narasimha Rao (2018) studied distribution and conservation of halophytes in estuarine habitats of Godavari River. In this present investigation, a quantitative study on the mangrove distribution was undertaken on the west side of the Vashista Godavari estuary from Darbharevu to Biyyaputippa where river Vashista Godavari merges into Bay of Bengal.

Study Sites

Godavari River is the largest among the rivers of the Andhra Pradesh and it empties the $240x10^5$ cusecs of water each year into the Bay of Bengal. River Godavari branches into Gautami and Vashista and

Vashista branch of Godavari flows into southwest and divided into two branches namely, Vainateyam and Vashista and opens into Bay of Bengal at Karawaka and Anthervadi respectively. The west side of the Vashista branch meets Bay of Bengal at Biyyaputippa village. Mangroves populations were reported from Darbharevu to Biyyaputippa village, long strip like formations were observed from Darbharevu and lengthy forest was observed at Biyyaputippa. In this study, two study sites were selected, one was at Darbharevu (longitudes and latitudes are 16.39º N 81. 69º) second station at Biyyaputippa (16.33º N 81.70ºE).

MATERIALS AND METHODS

Two stations (Darbharevu and Biyyaputippa) were selected in the Vashista branch of Godavari estuary on its west side for collection of data on distribution and density of mangrove populations from January 2023 to December 2023. Data were collected by placing the transect from the edge of the creek/canal to the interior of the forest and extending transect up to the barren region of the forest to obtain the real status of the forest canopy. A transect of 0 to 50 Meters length was used in this study. Belt quadrate of 4mX4m laid down at 5 m interval of the transect. Plant populations present in each quadrate were identified and counted. At Darbharevu station 10 transects and Biyyaputippa 15 were taken randomly. Transects were taken in January, April, August and December months in 2023. In each station density was calculated based on the plant species present in all quadrates during the period of the study. DBH of all plants present in all quadrates were measured to estimate relative abundance of different diameter classes of mangroves in all stations (Narasimha Rao and Umamaheswara Rao, 1988 and Narasimha Rao, 2012).

RESULTS

Information on the distribution of the mangrove species in two stations of west side of Vashista Godavari estuary was collected from January, 2023 to December 2023. Table 1 shows the mangrove species present in two study sites of the estuary. A total of 16 mangrove species were reported through quadrate samples collected from the mangrove habitats. Out of these, four are true mangrove species such as *Avicennia marina, Avicennia officinalis, Sonneratia apetala and Sonneratia caseolaris,* six associated mangrove flora such as *Acanthus ilicifolius, Clerodendron inerme, Excoecaria agallocha, Derris trifoliata, Prosophis chilensis and Solanum tribatum,* and remaining six species such as *Arthrocnemum indicum, Heliotropium curussavicum, Sesuvium porstulacastrum, Suaeda maritima, Suaeda monoica* and *Suaeda nudiflora* were halophytes.

Density of different mangrove species in two stations (Darbharevu and Biyyaputippa) was presented in Table 1. In Darbharevu higher density value was reported for *Suaeda monoica* (2486 pl/ha.) followed by *Suaeda maritima* (2248 pl/ha.) and minimum density was reported for the species *Sonneratia caseolaris* (126 pl/ha.) followed by *Sonneratia apetala* (428 plants/ha.). In Biyyaputippa maximum density was reported for the species *Suaeda maritima* (2846 pl/ha.) followed by *Prosophis* chilensis (2682 pl/ha.) and minimum density was reported for the species *Sonneratia caseolaris* (248 pl/ha.) followed by *Derris trifoliata* (842plants/ha.). Based on the observations on distribution and density of the mangrove flora in two stations of the Vashista estuary, it was evident that the plants like *Acanthus ilicifolius, Suaeda maritima, Suaeda monoica, Suaeda nudiflora, Clerodendron inerme* and *Excoecaria agallocha* were dominant species which form forest canopy as mixed nature of populations along with true mangroves like few *Avicennia* and *Sonneratia* sps. Table 2 shows the DBH classes for mangrove species in two stations of the estuary. Observations on the relative abundance of different diameter classes of the mangrove flora reveled that approximately 57% of plants growing in two stations were under 0-10 cm diameter class. Seven species such as *Avicennia marina, Avicennia officinalis, Sonneratia apetala, Sonneratia caseolaris, Clerodendron inerme* and *Excoecaria agallocha* are under four diameter classes up to 31-40 cm. In Darbharevu station, only two diameter classes were observed while in Biyyaputippa four diameter classes (0-10;11-20;21-30 and 31-40) were reported which indicated that forest of moderate height and average canopy.

Table 1: Density of Mangrove species in Darbharevu and Biyyaputippa regions at west side of Vashista Godavari estuary (Density/Individual/hectare[1])

S. No	Name of the Species	Darbharevu	Biyyaputippa
1.	*Acanthus ilicifolius* L.	1284	1896
2.	*Arthrocnemum indicum* (Willd.)Moq.	1028	1472
3.	*Avicennia marina* (Forsk)Vierh	486	1048
4.	*Avicennia officinalis* L	562	1174
5.	*Clerodendron inerme* (L.) Gaertn.	1148	1576
6.	*Derris trifoliata* Lour	624	842
7.	*Excoecaria agallocha* L.	972	1284
8.	*Heliotropium curussavicum* L.	1026	1486
9.	*Prosophis chilensis* (Molina) Stuntz	2068	2682
10	*Solanum tribatum*	862	1084
11	*Sonneratia apetala* Buch. Ham	428	896

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S. No	Name of the Species	Darbharevu	Biyyaputippa
12	*Sonneratia caseolaris* Engl.	126	248
13	*Sesuvium porstulacastrum* (L) L.	1262	1878
14	*Suaeda maritima* (L.) Dumm.	2486	2846
15	*Suaeda monoica* Forsk.ex. Gmel	2248	2562
16	*Suaeda nudiflora* Thwaites	1474	2048

Table 2: Percentage frequency of DBH classes for mangrove species in two stations

No	Name of the Species	Plant diameters (cm)					
		Station 1 (Darbharevu)		Station 2 (Biyyaputippa)			
		0-10	11-20	0-10	11-20	21-30	31-40
1	*Acanthus ilicifolius*	100	--	100	--	--	--
2	*Arthrocnemum indicum* (Willd.)Moq	100	--	100	--	--	--
3	*Avicennia marina* (Forsk)Vierh	54	46	36	32	22	10
4	*Avicennia officinalis* L	48	52	38	28	18	16
5	*Clerodendron inerme* (L.) Gaertn.	72	28	68	22	--	--
6	*Derris trifoliata* Lour	100	--	100	--	--	--
7	*Excoecaria agallocha* L.	46	54	34	36	18	12
8	*Heliotropium curussavicum* L.	100	--	100	--	--	--
9	*Prosophis chilensis* (Molina) Stuntz	90	10	65	35	--	--
10	*Solanum tribatum*	100	---	100	--	--	--
11	*Sonneratia apetala* Buch. Ham	56	44	36	32	18	12
12	*Sonneratia caseolaris* Engl.	62	38	42	28	16	14
13	*Sesuvium porstulacastrum* (L) L.	100	--	100	---	--	--
14	*Suaeda maritima* (L.) Dumm.	100	--	100	--	--	--
15	*Suaeda monoica* Forsk.ex. Gmel	100	--	100	--	--	--
16	*Suaeda nudiflora* Thwaites	100	--	100	--	--	--

DISCUSSION

In the present investigation, field studies were conducted along the estuarine and mangrove habitats of Vashista Godavari (west side) from Darbharevu to Biyyaputippa on composition and density of mangrove flora and reported 16 mangroves with four diameter classes. Earlier investigators studied the composition and distribution of mangrove populations in different parts of Andhra Pradesh (Mangrove of Gauthami Godavari estuary by Mathuda, 1959; Rao, 1959; Sidhu, 1963; Raju, 1968; Blasco,1975; Umamaheswara Rao and Narsimha Rao, 1988; Narasimha Rao and Subba Rangaiah, 2010; mangroves of Krishna estuary by Venkanna and Narasimha Rao, 1993; mangroves of Sarada and Varaha estuarine complex and Visakhapatnam by Narasimha Rao,2008; Vamsadhara estuary by Narasimha Rao and Murthy, (2010a). Narasimha Rao and Murthy, (2010b) studied the mangroves and associated flora of Vashista and Vainateyam branches of Godavari estuary. Maximum density was observed for the species of halophytes such as *Suaeda maritima, Suaeda monoica* and *Sesuvium portulacastrum* and minimum density for *Avicennia officinalis Cressa cretica* and *Derris horrida*. In this present study on mangroves of Vashista estuary (west side) also reported that maximum density was observed for halophytes.

Rao and Rao (1988) reported that nearly 40% of the total individuals belonging to species like *Suaeda maritima* and *Suaeda monoica*. Excoecaria agallocha were found to be the dominant species in the Godavari estuary and its density was nearly 22% of the total density. The other mangrove accounted for 38% of the total density. Narasimha Rao and Murty, (2010b) reported that the mangrove vegetation of Vainateyam and Vashista comprises with the populations of *Suaeda maritima, Suaeda monoica* and *Excoecaria agallocha.* More than 75% of the forest composed with halophytic flora only. In this present study maximum density reported for halophytes and 57% of populations under 0-10 diameter class which indicated the most of the forest is bushy and minimum height plants.

CONCLUSIONS

This ecosystem provides the livelihood for local inhabitants due to presence of rich organic matter and nutrients present in these areas which is the sources for the growth of more fishery products. But due to urbanization and other developmental activities, structure and composition of the mangrove species are depleting slowly without notice of the scientific community. Most of the halophytic zone along with transitional part of the mangrove forest was converted into aqua culture and other agricultural purposes. These are all responsible for further degradation of the mangrove ecosystem. Public awareness is essential for protecting and safe guarding these estuarine tidal forests.

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