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Seasonal Studies on Marine Algae at Revupolavaram, Visakhapatnam District, East Coast of India

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Abstract **Original Research Article**

Marine macro algae occurring along the coastal line of Revupolavaram beach was investigated for a period of one year from May 2018 to April 2019. A total of 22 species were identified in three seasons during this investigation period. Chlorophyceae members were dominant throughout the year while Phaeophyceae algal members and some of the Rhodophyceae were reported during the winter season only. Maximum number of algal species was reported in the winter season. Biomass values were measured for all the species collected during the study period. Maximum biomass value was obtained for the species *Gracilaria corticata* and minimum value for *Ectocarpus mitchellae*.

Keywords: Marine algae, seasonal studies, Revupolavaram, Visakhapatnam district, East Coast of India.

INTRODUCTION

Marine algal populations of Visakhapatnam and nearby coastal regions were studied by various investigators (Umamaheswara Rao and Sreeramulu 1964; Umamaheswara Rao and Sree Ramulu 1970; Umamaheswara Rao, 1972; Narasimha Rao, 1984, Narasimha Rao and Umamahewara Rao, 1986; Narasimha Rao, 1989, 1991 and 1992, Prasanna Lakshmi and Narasimha Rao, 2009, Narasimha Rao, 2010, Satyarao *et al*., 2011, Narasimha Rao *et al*., 2012, Narasimha Rao, 2014, Narasimha Rao and Srinivasa Rao, 2016 and Narasimha Rao, 2017). Similarly several investigations were carried out on the seasonal distribution of marine macro algae along the east coast of India (Kalimuthu *et al.*, 1995; Rath and Adhikary, 2006; Sulekha and Panikkar, 2007). So far there is no exploration or investigative report on the marine algae of Revupolavaram coastal regions of the Visakhapatnam district, Andhra Pradesh. So the present investigation was aimed to study the distribution and density of macro algae present in this coastal zone in relation to the environmental fluctuations.

MATERIALS AND METHODS

Revupolavaram is a coastal village panchayat located in the Visakhapatnam district of Andhra-Pradesh and it is located 30 KM away from the Tuni town and 75 KM away from the Visakhapatnam city. It lies between the latitudes 17.43 N and longitudes is 82.73E on the east coast of India. Rocky boulders along the shoreline of the study site provides the platform for growth and development of marine macro algal populations.

Hydrographical features such as air temperature, water temperature, salinity and pH were collected monthly from the study site during May 2018 to April 2019. Temperature, pH and salinity of the surface water were measured by using thermometer, portable pH meter and salinometer respectively. For estimation of biomass, quadrates of 0.50X0.50 M were used (Narasimha Rao and Umamaheswara Rao, 1986). Plants present in the quadrates were collected carefully with help of scalpel and brought to the laboratory at Visakhapatnam. They were carefully separated and allow to sun dried. After that again dried to a constant weight in an oven at 60º C temperature. Each month 4 to 5 quadrate samples were collected randomly and average monthly values of biomass collected during May 2018 to April 2019 were expressed as gram dry weight/m².

RESULTS AND DISCUSSION

Table I shows the collected information on the physico-chemical features at coastal line of Revupolavarm. Environmental features such as air temperature, water temperature varied seasonally shows its maximum temperature of air and water were recorded in April and May months and minimum values were observed during the months of December and January (Table 1). Salinity of the surface water at the study site

varied from 31.0 to 32.5 ppt with higher salinity in the month of April. pH of the seawaters at this coastal area varied from 7.5 to 7.8 with maximum in February and minimum in the month of June. Dissolved oxygen content varied seasonally with maximum value of 7.2ml/L (Table 1). Present observations on hydrographical features of surface waters at Revupolavaram agrees with the results of Satyarao *et al*., (2011) and Narasimha Rao and Srinivasa Rao (2016).

Data collected on the distribution of the marine macro algae at Revupolavaram beach was presented in the Table 2. A total of 22 marine macro algal forms were observed and out of these 9 species belongs to Chlorophyceae, 6 species belongs to Phaeophyceae and remaining 7 species belongs to the Rhodophyceae. Seasonal variations in biomass of the different marine algal forms from May 2018 to April 2019 was presented in the Table 3. Seasonally the presence of these marine algal forms was varied. Members of the chlorophyceae occurred throughout the year while members of the phaeophyceae occurred certain months of the year. Species such as *Ectocarpus mitchellae, Lophophora variegata* and *Padina tetrastromata* were available at the coastal regions of the study site from November to March months. Species of *Sargassum vulgare* and *S. ilicifolium* present from November to May months. *Rosenvengea nhatrangensis* occurs three months from December to February months only. In case of Rhodophyceae members except *Gracilaria textorii* remaining six species occurs throughout the year at study site along the coastal belt and *Gracilaria textorii* occurs from November to March months only (Table 3). Biomass values of these forms varied seasonally with higher biomass values for the species of *Ulva fasciata, Cladophora socialis, Spongomorpha indica, Gracilaria corticata* and *Amphiroa fragilissima.* Minimum biomass values were reported for the species of *Ectocarpus mitchellae* and *Rosenvengea nhatrangensis* (Table 3).

Table 1: Physico chemical features of the surface water at Revupolavaram beach

Month	Air temperature (ºC)	Water temperature (ºC)	Salinity (‰)	pH	DO ml/L
May,2018	31.0	26.5	31.5	7.7	7.0
June	30.0	25.5	32.0	7.5	6.9
July	28.5	25.0	31.0	7.6	7.1
August	27.5	24.5	31.5	7.6	7.2
September	27.0	24.0	32.0	7.7	7.2
October	26.0	23.5	31.0	7.6	6.9
November	24.5	22.5	31.0	7.5	7.1
December	23.5	21.0	31.5	7.7	7.2
January 2019	23.5	21.5	32.0	7.6	7.0
February	26.5	23.5	31.5	7.8	6.9
March	28.0	25.0	32.0	7.7	7.2
April	30.5	25.5	32.5	7.5	7.1

Table 2: List of the marine macro algae at Revupolavaram coast, Visakhapatnam district

S. No	Name of the speccies	Family
1	*Ulva fasiata* Delile	Chlorophyceae
2	*Enteromorpha compressa (L) Greville*	Chlorophyceae
3	*Chaetomorpha antennina (Bory) Kutzing*	Chlorophyceae
4	*Cladophora socialis Kutzing*	Chlorophyceae
5	*Spongomorpha indica* Thiviy at Visalakshmi	Chlorophyceae
6	*Caulerpa fastigiata* J.Ag.	Chlorophyceae
7	*Caulerpa racemosa* J.Ag.	Chlorophyceae
8	*Caulerpa taxifolia* C.Ag.	Chlorophyceae
9	*Bryopsis pennata Lmouroux*	Chloraphyceae
10	*Ectocarpus mitchellae* Hamel	Phaeophyceae
11	*Lobhophora variegata*	Phaeophyceae
12	*Rosenvengea nhatrangensis*	Phaeophyceae
13	*Sargassum vulgare*	Phaeophyceae
14	*Sargassum ilicifolium C.Ag.*	Phaeophyceae
15	*Padina tetrastomatica* Hauck	Phaephyceae
16	*Gracilaria corticata* J. Ag	Rhodophyceae
17	*Gracilaria textorii* J.Ag.	Rhodophyceae
18	*Gratilophia filicina* J.Ag.	Rhodophyceae
19	*Amphiroa fragilissama* Camouroux	Rhodophyceae
20	*Jania rubens*	Rhodophyceae
21	*Gelidium pusillum* LeJolis	Rhodophyceae
22	*Gelidiopsis vaiabilis* Schmitz	Rhodophyceae

Table 3: Seasonal changes in the biomass (gram dry wt./m²) of marine algae of Revupolavaram coast, Visakhapatnam district

S. No	Name of the species	M 2018	J	J	A	S	0	N	D	J 2019	F	M	A
1	*Ulva fasiata*	6.5	6.8	6.3	6.4	6.4	6.7	6.9	7.8	7.5	7.2	6.7	6.4
2	*Enteromorpha compressa*	2.9	2.8	2.8	3.0	3.2	3.4	3.7	3.9	3.7	3.5	3.1	3.0
3	*Chaetomorpha antennina*	1.8	2.5	2.7	2.6	2.9	3.1	3.3	3.5	2.7	1.8	1.5	1.0
4	*Cladophora socialis*	5.5	5.1	5.8	6.1	6.6	6.9	7.2	7.5	7.1	6.7	6.0	5.7
5	*Spongomorpha indica*	5.5	5.3	5.0	5.1	5.3	5.7	6.0	6.5	6.5	6.2	5.9	5.7
6	*Caulerpa fastigiata*	2.3	2.0	1.8	2.4	2.7	3.1	3.2	3.4	3.7	3.3	2.9	2.5
7	*Caulerpa racemosa*	1.6	1.8	2.1	2.3	2.3	2.6	2.7	2.9	2.6	2.4	2.0	1.8
8	*Caulerpa taxifolia*	1.8	1.9	1.9	2.1	2.4	2.6	2.9	3.1	3.6	3.3	2.7	2.3
9	*Bryopsis pennata*	2.0	2.3	2.2	2.5	2.4	2.6	2.6	2.7	2.5	2.2	2.3	2.1
10	*Ectocarpus mitchellae*	--	--	--	--	--	--	0.3	0.5	0.9	0.6	0.5	--
11	*Lobhophora variegata*	--	--	--	--	--	--	2.9	3.6	3.9	2.7	2.4	--
12	*Rosenvengea nhatrangensis*	--	--	--	--	--	--	--	0.8	0.9	0.6	--	--
13	*Sargassum vulgare*	3.6	--	--	--	--	--	3.8	4.0	5.4	6.7	4.5	4.0
14	*Sargassum ilicifolium*	4.1	--	--	--	--	--	3.4	4.2	6.1	7.2	5.9	4.7
15	*Padina tetrastrimatica*	--	--	--	--	--	--	2.8	3.2	3.9	3.5	3.2	--
16	*Gracilaria corticata*	10.3	10.8	11.2	11.5	11.8	12.3	12.9	14.2	13.7	12.6	11.8	9.5
17	*Gracilaria textorii*	--	--	--	--	--	--	7.4	8.5	9.0	7.7	7.3	6.2
18	*Gratilophia filicina*	2.0	1.8	2.2	2.5	2.3	2.6	2.8	3.2	3.2	3.0	2.4	2.2
19	*Amphiroa fragilissama*	10.2	9.5	9.8	10.2	11.4	11.8	12.4	12.8	13.0	13.5	12.2	11.3
20	*Jania rubens*	2.8	3.2	3.2	3.5	3.2	3.4	3.2	3.1	3.5	3.2	2.7	2.5
21	*Gelidium pusillum*	1.9	2.1	2.3	2.4	2.6	2.5	2.7	2.8	2.6	2.3	2.2	2.0
22	*Gelidiopsis vaiabilis*	2.4	2.8	2.7	3.5	3.8	3.7	3.3	3.1	2.7	2.6	2.9	2.6

Results of this present investigation agrees with the earlier reports on marine macro algae of Visakhapatnam coast (Umamaheswara Rao and Sreeramulu, 1964; Narasimha Rao, 1984; Narasimha Rao and Umamaheswara Rao, 1986; Prasanna Lakshmi and Narasimha Rao, 2009; Narasimha Rao, 2017) and marine algae growing along the coastal regions of nearby areas such as Bhimili coastal region (Satyarao *et al*., 2011), Mutyalammapalem coast (Narasimha Rao and Srinivasa Rao, 2016). Narasimha Rao (1991) studied the seasonal growth of *Ectocartpus mitchellae* and observed its presence from November to May months at Visakhapatnam coast and Narasimha Rao and Srinivasa Rao (2016) observed the growth of *Ectocarpus mitchellae* at Mutyalamma palem beach for the period of four months only from the November to February months with maximum biomass in the month of January. In the present study, *Ectocartpus mitchellae* occurs from November to February months only supporting the earlier studies of Narasimha Rao (1991); Narasimha Rao and Srinivasa Rao (2016). Present observations at Revupolavaram coast agrees with the investigations of west coast of India (Untawale *et al*., 1989 and Oza *et al*., 1991). At Visakhapatnam coast, Umamaheswara Rao and Sreeramulu (1964) reported more than 85 species, Narasimha Rao (1984) reported 45 species. At Mutyalammapalem coast, Narasimha Rao and Srinivasa Rao (2016) reported the presence of 28 species. In the present study at Revupolavaram coast a total of 22 species were reported with much reduced biomass when comparing with the earlier studies at Visakhapatnam and nearby coastal regions. The reduction in biomass of algal forms as well as gradual reduction of number of species along the coastal regions of Visakhapatnam and nearby areas may be due to anthropogenic activities and Climatic changes.

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