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Effect of the environmental pollution on marine macro-algae of Visakhapatnam coast, India

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SUMMARY

To asses the impact of different industrial effluents and sewage on some important marine algal species was studied during 2007. Six species which are economically important for extraction chemicals and biogas were selected for this study. Apices of these species were cultured in different concentrations of industrial effluents and sewage. Spore liberation experiments and spore germination studies were conducted with above algal species. Growth of the apices of different plants was reduced from control to 20% concentration of industrial effluents. At 30% concentration of effluents growth was completely inhibited and malformation of the fragments was also noticed. Similarly spore liberation and spore germination results coincidence with the growth data of the above algal forms.

Key words : Marine macro algae, Industrial effluents, Sewage, Growth and spore germination, Pollution

Visakhapatnam is a well known coastal industrial city with a natural harbor located in the northern part of Andhra Pradesh. Industrial wastes from the nearby major factories such as Hindustan Polymers, HPCL and Coromandal fertilizers release their effluents at different places into a stream known as Meghadrigedda which in turn opens into the inner harbour. Besides, untreated sewage from the Visakhapatnam city enters into the inner harbour. All these pollutants enter into the coastal waters of Visakhapatnam and ultimately play a vital role on the life of the aquatic organisms in the offshore waters of the Visakhapatnam coast. Several authors emphasized the intensity of pollution at the inner harbour and coastal waters of Visakhapatnam (Ganapathi and Raman, 1973; Sarma *et al.*, 1982; Venkateswara Rao, 1990; Jagannadha Rao, 1991 and Narasimha Rao, 1994).Algae constitute a major part of the primary producers in an aquatic ecosystem and their survival is of much ecological and economical value (Rachlin *et al.*, 1982). Marine algae forms used as biological indicators for the assessment of aquatic pollution Bharati *et al.*, 1980; Trivedy, 1986). In the present study apical growth of some economically important seaweeds and sporulation, spore germination experiments were conducted in different concentrations of industrial effluents and city sewage.

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MATERIALS AND METHODS

Visakhapatnam lies (Lat.17^0 40' 30" and 17^0 45' N and Long. 83^0 10' and 83^0 21' E) on the east coast of India. Industrial effluents from HPCL, Coromandal fertilizer were collected at the discharge points and sewage was collected at old post office region near inner harbour. Different concentrations were prepared with these effluents. Treating the effluent as 100% of concentration and dilutions from 10 to 100 % was prepared adding sterile seawater. Growth of apical fragments, sporulation and spore germination experiments were conducted using the marine algae such as *Gracilaria corticata, Hypnea valentiae, Gigartina acicularis, Gelidiopsis variabilis, Bostrychia tenella* and *Pterocladia heteroplatos*. Apical fragments measuring 5 cms from the healthy plants were used for growth experiments. Growth of the apices was measured at 10 days intervals. The Petriplates with algal thalli were maintained at photon flux density of 9µE m^2 s^1 provided by white fluorescent light in the culture chamber with continuous illumination with 8:16 light and dark cycle. Sporulation and spore germination experiments were conducted using the tetrasporophtic and cystocarpic populations of the different species with different concentration of industrial effluents and sewage. Methodology for these experiments was followed by Narasimha Rao (1989).

RESULTS AND DISCUSSION

Table 1 shows the growth of the apical fragments of different algal species cultured in different concentrations of HPCL effluent along with control. Maximum growth

Table 1 : Growth in length (cms) of apices of some marine algal species in different concentrations (%) of HPCL effluent

	Control	10	20	30	40	50
Gracilaria corticata	12.2	12.0	11.8	7.9	6.9	5.3
Hypnea valentiae	13.4	12.5	12.1	10.2	6.8	5.6
Gigartina acicularis	10.2	10.1	9.5	9.1	6.9	5.1
Gelidiopsis variabilis	11.8	10.9	9.6	8.7	6.2	5.0
Bostrychia tenella	7.4	6.9	6.3	5.8	5.2	5.1
Pterocladia heteroplatos	8,4	7.9	6.8	6.2	5.7	5.0

of these apices was reported in control only. Among these species maximum growth (13.4 cms) was reported in *Hypnea valentiae* and minimum growth (7.4 cms) in *Bostrychia tenella*. Growth of the apices was decreased from control to 50% concentration of the effluent. There was no growth at 50% in *Gelidiopsis, Pterocladia* and negligible growth was reported in *Gigartina, Gracilaria* and *Bostrychia*. Significant growth was in *Hypnea* at 50% concentration of HPCL effluent but at 60% concentration apices were completely deteriorated. Table 2 shows the growth of the apices in different concentration of Coromandal fertilizer factory effluent. Maximum growth of apical fragments was reported in control conditions. Growth of the fragment decreased gradually from control and no growth was reported in 50% concentration. Maximum growth reported in control for *Gracilaua* and minimum growth was reported in *Bostrychia tenella*.

Table 3 shows the growth of the apices of different marine algal species in different sewage concentrations. Contrary to the results of the growth in industrial effluents, maximum growth was reported in 10% sewage concentration. Growth of the fragments in control and 20% concentrations showed the similar results. Growth of the fragments decreased from 20% concentration onwards with minimum in 50% sewage concentration. No growth was reported in 60% concentration.

Spore shedding and spore germination of these algae in different concentrations of industrial effluents and sewage was studied. Liberation of spores was noticed in all concentrations (0-50%) of HPCL, Coromandal fertilizer factory effluents and concentrations of city sewage. Maximum liberation of the spores from different marine algae such as algae used for growth studies was noticed at 10% concentration of HPCL and Coromandal factory effluent. Spore discharge of these marine algae was decreased from 20% concentration onwards with a minimum no. of spores were reported at 50%. Spores liberated at control were also little bit lower than 10% concentrations of the effluents. But spores liberated from the different concentrations of sewage were higher than the concentrations of industrial effluents. Maximum spore output was reported at 20% concentration of sewage. From 20% concentration onwards spore liberation was

Table 2: Growth in length (cms) of apices of some marine algal species in different concentrations (%) of Coromandal fertilizer factor effluent

	Control	10	20	30	40	50
Gracilaria corticata	12.8	12.1	10.7	7.2	6.9	5.2
Hypnea valentiae	12.2	11.9	10.9	9.7	6.5	5.1
Gigartina acicularis	9.8	9.6	9.2	8.7	6.3	5.0
Gelidiopsis variabilis	11.2	10.4	8.9	8.2	5.9	5.0
Bostrychia tenella	6.7	6.2	6.1	5.5	5.1	5.0
Pterocladia heteroplatos	7.8	6.9	6.4	6.2	5.3	5.0

Table 3 : Growth in length (cms) of apices of some marine algal species in different concentrations (%) of sewage

	Control	10	20	30	40	50
Gracilaria corticata	12.4	12.8	12.4	10.2	7.1	5.8
Hypnea valentiae	13.3	13.8	12.6	10.4	7.5	6.0
Gigartina acicularis	10.4	10.7	9.7	9.3	7.2	5.8
Gelidiopsis variabilis	11.9	12.5	11.8	10.5	8.4	6.2
Bostrychia tenella	7.6	7.9	7.2	6.9	6.3	5.3
Pterocladia heteroplatos	8.2	8.6	8.3	7.6	6.7	5.5

decreased with minimum number of spores at 50 % concentration of sewage. Liberation of spores was higher than the control at 10 and 20% concentration of sewage. Results regarding spore germination reveal that there was spore germination at 20% to 50% concentrations of industrial effluents and sewage. Only 25-30% of spore germination was noticed at 10% concentration.

Very little information was available on the effect of industrial effluents on the growth and sporulation of Indian marine algae (Tewari and Joshi, 1988, Narasimha Rao, 1994). In the coastal waters of Gujarat, Tewri and Joshi (1988) observed that *Ulva lactuca* and *Rhizoclonium kochianum* are most resistant form to chloralkali industry effluent. In the present study species such as *Hypnea valentiae*, *Gracilaria corticata*, and *Gelidiopsis variabilis* are highly resistant than the other algal forms in the industrial effluent at Visakhapatnam coast. Narasimha Rao (1994) reported that the depletion of more number of marine algal forms at Visakhapatnam coast is due to impact of pollution. The present study indicates that the growth of the marine algal forms was deteriorated and spore germination also ceased in the polluted waters. By these reasons most of these algal species are migrating from this region to safer regions where there is no pollution.

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