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Research Article

Seasonal tetraspores shedding and diurnal periodicity in *Padina tetrastromatica Hauck*. (Phaeophyceae) along the Visakhapatnam coast, East coast of India

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Abstract: Studies on the tetraspores shedding were made for a period of one and half year from August 1993 to January 1995 in *Padina tetrastromatica Hauck* growing along the Visakhapatnam coast. Experiments were conducted on the seasonal spore producing capacities and diurnal aspects of tetraspores shedding. The spore shedding in this brown alga with peak shedding of tetraspores in the month of February. Diurnal periodicity was observed with peak output of tetraspores between 06:00 and 10:00 hours in all eight months of the year of its occurrence on the coast without any shift in the peak shedding.
Keywords: *Padina tetrastromatica Hauck*, seasonal tetraspores shedding, Diurnal periodicity, Jodugullapalem of Visakhapatnam coast.

INTRODUCTION

Padina tetrastromatica Hauck is one of the most important members of the algae in Visakhapatnam Coast with respect to their relative size, abundance and its distribution on the rocky shores. The importance of Indian marine algae as food lies in their essential amino acids, vitamins and minerals [1]. This alga is considered to be a potentially useful seaweed having food (salad vegetable), Pharmaceutical and fertilizer value. In order to gain an insight of tetraspores shedding capacities. Although *Padina tetrastromatica* is common on the Visakhapatnam Cost, the quantity is inadequate for this commercial use. The above studies are very essential before undertaking cultivation of any alga. The purpose of the present study is to ascertain optimal level for most important in influencing liberation of tetraspores in *Padina tetrastromatica*. The results obtained on these aspects are presented and discussed in this paper. Several authors studied the spore shedding and other aspects on brown algal members in different geographical regions of the world [2-8]. Studies on sporulation play a vital role in the field of mariculture to generate the algal populations in the natural habitats. In the present investigation studies were made on the tetraspores shedding from *Padina tetrastromatica* at in Jodugullapalem along the Visakhapatnam coast was made for a period of one and half years from August 1993 to January 1995, is presented in this paper.

MATERIAL AND METHODS

Visakhapatnam is situated on the east coast of India between the latitude 17˚ 40’ 30’’ and 17˚ 45’ N longitudes 83˚ 16’ 25” and 83˚ 21’ 30”E. The coastline is sandy with outcrops of rocky boulders in different regions. Depending upon the physical nature of the substratum four stations were selected in an earlier investigation [9]. Materials for this study were collected during the spring tide periods from Jodugullapalem region where large accessible boulders occur with dense growth of algae. *Padina tetrastromatica* was collected for carrying out the laboratory experiments during the years August 1993 to January 1995.Tetraspores liberation experiments were carried out with the fertile material, washed with sterilized sea water and placed in the petriplates filled with sea water. The tetraspores liberation experiments were conducted for 24 hours at room temperature (32 ± 2^0C) and Petri-dishes were illuminated by fluorescent lamps at 1000 lux for 8 hours during the day time from 10 to 18 hours. The tetraspores liberated daily counted and after 24 hours were transferred to a measuring cylinder with a pipette. The tetraspores suspension was then diluted to a known volume depending upon the Quantity of tetraspores liberated in the Petri-dishes. Taking a subsample of 1c.c tetraspores suspension into a plankton counting chamber, the tetraspores were counted. Average values of three counts were used for computing the tetraspores output in each experiment. Fresh weight of the thalli was taken and the tetraspores output was expressed as

tetraspores / gr. fr. wt. /day. Data on the diurnal changes in tetraspores shedding were collected by changing the material kept in the Petri-dishes at four hours intervals. The tetraspores liberated at 4 hours intervals i.e. at 22h, 02h, and 06h. 10h, 14h and 18h, were counted as described above. Ten experiments (replicates) were conducted with *Padina tetrastrornatica* to study the diurnal changes in tetraspores shedding experiments were conducted. In all above experiments, the data collected were expressed as tetraspores per gr.fr.wt/day, to observe the quantity of tetraspores liberation under diverse environmental conditions.

RESULTS

The results obtained on the tetraspores shedding, seasonal tetraspores shedding, diurnal periodicity and seasonal diurnal periodicity in the liberation of *Padina tetrastromatica* is presented in this paper.

Tetraspores shedding:

Daily liberation of tetraspores of *Padina tetrastromatica* is shown in Figure 2. In this alga maximum liberation of tetraspores was seen on the first day and the tetraspores output decreased rapidly from 2nd day onwards and the tetraspores shedding lasts for 3 to 4 days only (Fig. 2).

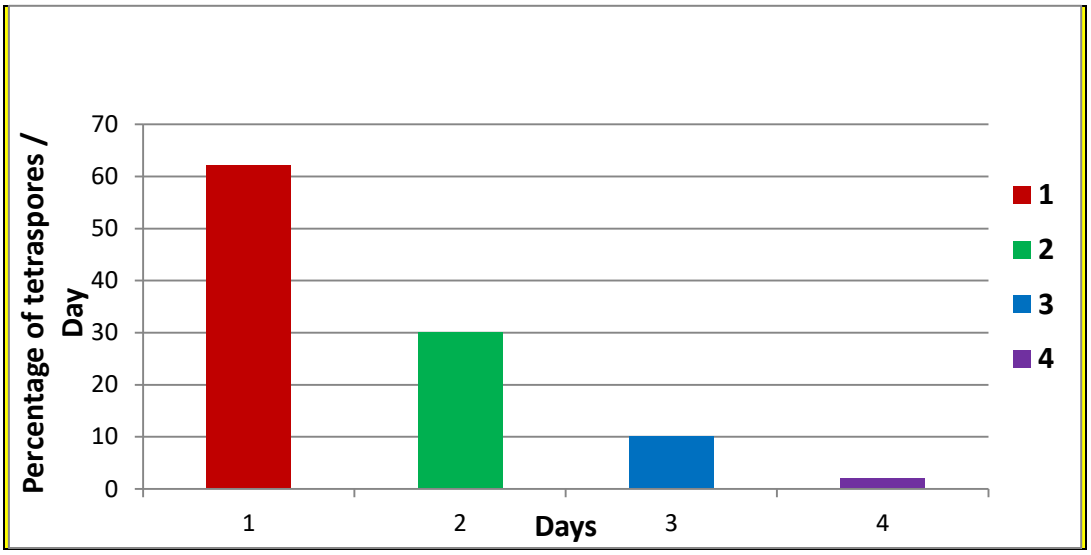

Fig-2: Daily liberation of tetraspores shedding of *Padina tetrastromatica*.

Seasonal changes in tetraspores shedding:

Seasonal changes in tetraspores shedding were observed from November, 1993 to June, 1994 plotted in fig.3. The present study observed peak tetraspores shedding in the month of February.

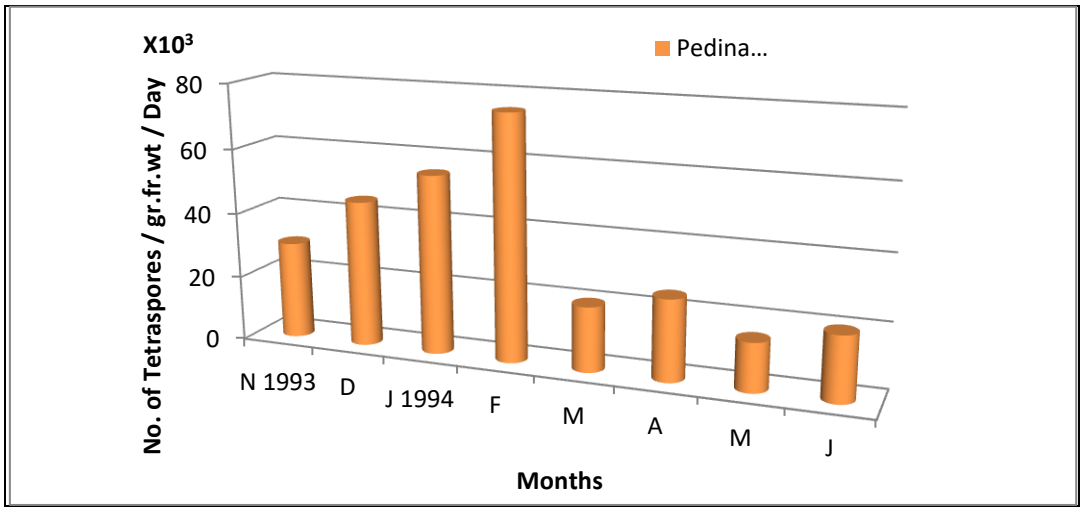

Fig-3: Seasonal variation in the tetraspores shedding of *Padina tetrastromatica*.

Diurnal periodicity:

The Quantity of spores liberated at different times of the day varied in *Padina tetrastromatica*. Data collected on the diurnal periodicity of tetraspores shedding are shown in Fig.4. Maximum number of tetraspores liberation was seen between 06 to 10 hours and from 10

hours onwards gradual decrease in the liberation of tetraspores was noticed. Information collected on monthly tetraspores shedding in diurnal periodicity is presented in Fig.5. Data collected from November to June on diurnal periodicity in tetraspores liberation of *Padina tetrastromatica* didn't alter the peak shedding time (6 to 10h.).

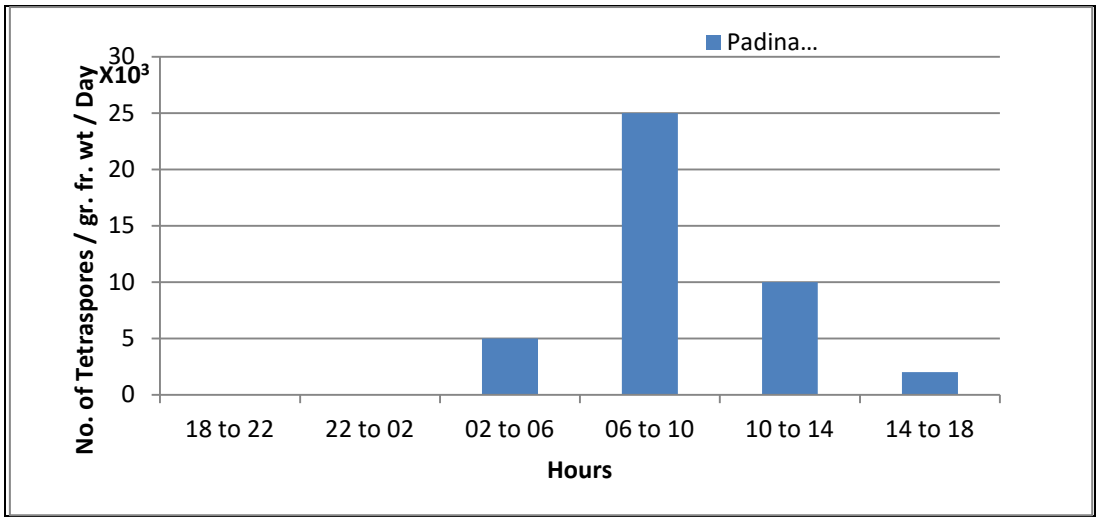

Fig-4: Diurnal periodicity in the shedding of Tetraspores of *Padina tetrastromatica*

***Seasonal diurnal periodicity*:**

The quantities of tetraspores liberated in different months were varied. Maximum number of tetraspores were liberated in February and minimum in June.

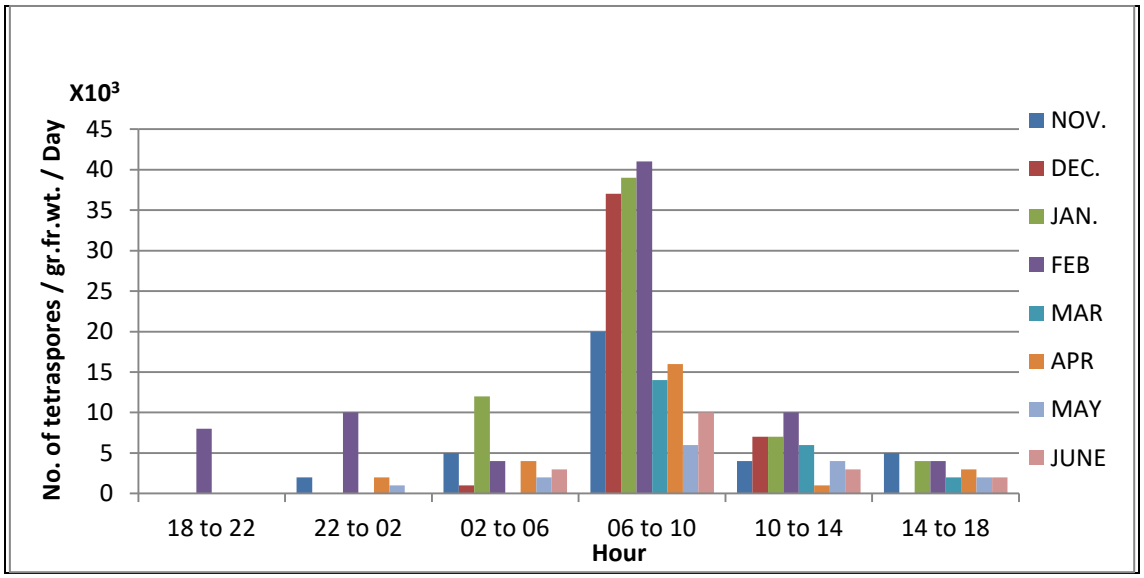

Fig-5: Seasonal diurnal periodicity in the shedding of tetraspores of *Padina tetrastromatica*

DISCUSSION

In the present study, information was gathered on tetraspores shedding of *Padina tetrastromatica* growing in the infra littoral fringe zone of the intertidal region of Visakhapatnam coast. The variations of spore production in different months of the year and diurnal periodicity were studied by conducting the experiments under laboratory conditions. The data obtained in the present study shows that the spore producing capacity of the brown alga is very low when compared to the other members of red and green algae of the Visakhapatnam coast [10, 11-19]. In *Padina tetrastromatica* maximum shedding of spores was seen on the first day (fig .2). Similar trend was noticed in the spore shedding of *Gracilaria corticata* [20], *Gracilaria edulis* [23], *Gracilaria textorii* [11], *GraciIariopsis sjoestedtii* [12], *Hypnea valentiae* [10], *Gelidiopsis variabilis* [15], *Pterocladia heteroplatos* ([16], *Gelidium pusillum* [17], *Wrangelia argus*, *Centroceras clavulatum* and *Polysiphonia platycarpa* [19]. From the seasonal data obtained on spore shedding (Fig.3), it is evident that maximum liberation of tetraspores occurs in the month of February, which coincides with a single peak period observed in *Polysiphonia platicarpa* [19].

But most of the members of Rhodophyceae had two peak periods in a year i.e. *Gracilaria eduIis* [23], *G. corticata* [20], *Hypnae valentiae* [10]. Detailed studies have not been made on the daily liberation of the spores in the members of Phaeophyceae. Several workers described periodicity in the daily liberation of spores of Gelidiales [24-28]; Gigartinales [29-31, 10, 20, 21, 14]; Ceramiales [13, 19]; Ulotrichales [18]; Bangiales [32]. The quantity of spore liberated at different times of the day varied in many algae, with peak shedding of spores in forenoon (6 to 10h.), in G*elidiopsis variabilis* [28], in the afternoon between 14 and 18 in *Gelidiella acerosa* [27]. *Wrangelia argus* [19] and *Gracilaria textorii* [22] and in the noon time between 10 and 14 in *Ectocarpus mitchellae* [33]. Data collected in the present study on diurnal periodicity in the liberation of spores from *Padina tetrastromatica* showed that peak shedding occurred during the forenoon (6 to 10) as reported by [28] on *Gelidiopsis variabilis*, *Ulva fasciata* and *Enteromorpha compressa* [18].

CONCLUSION

Studies on the tetraspores shedding in *Padina tetrastromatica* (phaeophyceae) growing along the Visakhapatnam coast. Experiments were conducted on the seasonal spore producing capacities and diurnal aspects of spore shedding were studied under laboratory conditions. The results obtained on the above aspects were presented in this paper. The spore shedding varied seasonally in this brown alga with peak shedding of spores in the month of February. Diurnal periodicity was observed with peak output of spores between 06 and 10 hours in all eight months of the year of its occurrence on the coast without any shift in the peak shedding. These experimental findings closely agree with the environmental conditions existing in the intertidal habitat at Jodugullapalem of the Visakhapatnam coast.

It is interesting to note that the quantity of tetraspores liberated in *Padina tetrastromatica* of the present study is almost less than half when compared to the studies made by [20]. This change may be due to increase in the temperature (2-3^{o}C) in the nature, and indiscriminate discharge of industrial effluents in to the sea. If this process continues, we do hope that in future there will be a drastic change in the seaweeds of Visakhapatnam coast towards decrease in the vegetation as well as in spore shedding capacities.

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