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[Note]

Spore Shedding in *Catenella impudica* from the Godavari Estuary at Bhiravapalem, India

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Catenella impudica (Mont.) J.Ag is an important species for human consumption from estuarine regions of Asia. Seasonal shedding of carpospores and tetraspores was quantified between January and December 2004 for natural populations of *C. impudica*. Vegetative and tetrasporophytic plants were available throughout the year but gametophytic plants were observed only from September to May. Tetraspore shedding was observed throughout the year and carpospores shedding was noticed only during the months when material was available. Hydrographical conditions of the estuary such as low water temperature and low salinity are correlated to the formation and release of carpospores and tetraspores in *C.impudica*

Key Words: carpospores shedding, *Catenella impudica*, Godavari estuary, tetraspore

INTRODUCTION

Estuarine algae can tolerate a variety of salinity regimes and occur on prop roots and pneumatophores of the Mangrove plants. These algal forms are important for human consumption. *Bostrychia* and *Catenella* are sold, for example, in the markets of Rangoon and used in salads after being rehydrated (Chapman and Chapman 1980), and as a source for valuable chemicals (Khan 1970). Data on estuarine red algae is relatively few (Kapraun 1974; Yarish and Edwards 1982; Davey and Woelkerling 1985; Liv, 1990; Tanaka 1991; West 1991; Mosisch 1993). Information on the estuarine algae in India is scarce (Jagtap 1985; Mal *et al*. 1987; Narasimha Rao and Umamaheswara Rao 1991; Narasimha Rao 1995; Narasimha Rao and Venkanna 1996). The present study investigates seasonal release of tetraspore and carpospores and relative abundance of different populations of *Catenella impudica* in the mangrove habitats of Gautami Godavari estuary. The information obtained in this study would be useful for proper maintenance of the estuarine algae beds in their natural habitats, thus augmenting the natural resources.

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MATERIALS AND METHODS

The River Godavari is the largest in South India and is held in reference as Dakshina Ganga. The Gautami branch of Godavari is a typical estuary situated between 82° 12′ and 82° 21′ E and 16° 31′ and 16° 54′ N. Water samples were collected from a small boat with a bucket near Bhiravapalem of the Gautami Godavari estuary. These surface samples were obtained from the centre of the creek or channel, where macro algal material was collected. The air and water temperature, pH and salinity were measured by a thermometer, portable pH and salino-meters respectively in the estuary. Dissolved oxygen was estimated by the method given by Strickland and Parsons (1972).

Algae occur on the pneumatophores and stilt roots of *Avicennia* and *Rhizophora* plants along the banks of an estuary near Bhiravapalem. Every month fifteen to twenty clumps of *Catenella impudica* was collected from these mangrove plants and relative abundances of gametophytic and sporophytic generations were quantified. Male and female vegetative plants were sorted out by examining them under a microscope, and the relative abundance of the fruiting and vegetative plants in the populations was estimated. Seasonal spore output was estimated using tetrasporophytic and cystocarpic plants of *Catenella impudica*. These mangrove macro algal speci-

Table 1. Table shows the hydrographical conditions of the Gautami Godavari estuary near Bhiravapalem during January to December 2004

Month	Water Temperature	Air Temperature.		D.O	Salinity (ppt)	pH
		Min.	Max.			
January	25.5	20	28	7.2	22	6.8
February	26.0	21	29	7.5	23	6.8
March	26.5	22	32	6.7	24	6.9
April	27.5	23	35	6.8	30	7.0
May	28.5	26	37	7.1	31	7.1
June	29.0	26	36	7.2	30	7.1
July	27.0	25	34	7.1	29	7.0
August	26.5	25	32	6.8	26	6.8
September	25.0	24	30	6.9	23	6.7
October	26.0	23	29	6.6	22	6.5
November	25.5	21	27	6.7	20	6.5
December	25 .5	21	26	6.8	21	6.6

mens were collected monthly and brought to the laboratory in polyethylene bags filled with estuarine water. Stichidia and cystocarps were separated and washed carefully with sterile water and placed in cavity slides with a few drops of filtered water collected from the same area. To prevent the evaporation, these cavity slides were kept in Petri dishes and the bottom of the Petri dishes was lined with moist filter paper. These experiments were started at 1800 h and Petri dishes were kept near fluorescent lamp providing 9 μmoles m^{-2} s^{-1} light intensity for 8h during 0900 to 1700h. After 24h the tetraspores or carpospores from stichidia or cystocarps, released in the cavities were counted with a microscope. These experiments were conducted every month with this alga and average values were expressed as tetraspores/stichidium/day or carpospores/cystocarp/day.

RESULTS AND DISCUSSION

Data on climatic conditions and hydrographical parameters of the estuary obtained for twelve months are presented in Table 1. Minimum air temperature was recorded in the months of December and January. From February onwards air temperature increased and maximum temperatures were recorded in the months of April, May and June. From July onwards temperatures decreased (Table 1). Minimum water temperature was observed in the months of August and September, and maximum was recorded in the months of May and June. Surface water salinity was minimum in the months of the November, December and January. From February onwards salinity increased and reached maximum levels in the months of April, May and June. pH of surface waters also varied seasonally and shows a positive relationship with seasonal changes in salinity. There was no significant seasonal trend for dissolved oxygen content of the Bhiravapalem of Godavari esturary (Table 1).

Seasonal data on gametophytic, tetrasporophytic and vegetative populations of the *Catenella impudica are* presented in the Table 2. Tetrasporic and vegetative plants of *C. impudica* occurred throughout the year with maximum relative abundance in the months of May, June and July. Gametophytic populations (i.e. cystocarpic and spermatangial plants) were found from November to April made up 11% to 17% of the total population. The relative abundance of tetrasporophytic plants was more than the gametophytic plants in the populations of *C. impudica*.

Monthly data collected for 2004 on the seasonal spore shedding are shown in Table 3. Corresponding to the availability of reproductive plants, tetraspore output was observed throughout the year while carpospore output was only observed in winter and spring. Maximum number of tetraspore and carpospores shedding was noticed in the months of December, January and February. Tetraspore release was lowest during July and August. Carpospores were not observed from May to October.

Salinity plays a vital role in the occurrence and distribution of algae in the estuarine regions (Jagtap and Untawale 1981; Yarish and Edwards 1982; Nair *et al*.

Table 2. Relative abundance of different generations of *Catenella impudica* growing in Bhiravapalem mangroves of Godavari estuary

Month	Tetrasporophytic	Cystocarpic	Spermatangial	Vegetative
January	47	17	15	21
February	51	14	12	23
March	45	14	12	29
April	50	10	12	28
May	54	0	0	46
June	51	0	0	49
July	56	0	0	44
August	58	0	0	42
September	52	0	0	48
October	51	0	0	49
November	48	12	11	29
December	52	14	12	22

Table 3. Seasonal variation in tetraspore and carpospores liberation from *C.impudica* at Bhiravapalem mangroves of Godavari estuary

Month	No. of Tetraspores/ Stichidium	No. of carpospores/ stichidium
January 2004	43	78
February	41	71
March	38	67
April	27	53
May	24	-
June	25	-
July	22	-
August	29	-
September	35	-
October	37	-
November	44	65
December	46	74

1982; Mal *et al.* 1987; Narsimha Rao 1989; Mosisch 1993). Jagtap and Untawale (1981) observed that *C. leprieurii* prefers diffused light, high temperature and optimum salinity of 10-20 ppt in the mangrove habitats of Goa. In Ashtamudi estuary (Nair *et al*. 1982) and Sunderbans (Mal *et al*. 1987) reported that *Catenella* occurred in salinities ranging from 18-25 ppt. In the present study, it is evident that salinity ranging from 19 to 29 ppt is one of the favorable conditions for occurrence and distribution of alga in the head of the Godavari estuary.

Kapraun (1974) described seasonal patterns in the occurrence of reproductive plants in the populations of *C. leprieurii* collected from Louisiana. He observed tetrasporophytes only for July and August. No sexual plants were reported. Yarish and Edwards (1982) observed tetrasporophytes and carposporophytes of *C. leprieurii* between May and September and male plants of this alga was reported to be rare. In the present study tetrasporophytes were seen in all months of the year along with vegetative plants, while carposporophytes and male plants only occurred from November to April.

From the data presented in the Table 1, it is evident that low air and water temperatures, moderate salinity and pH are favorable conditions for the growth and release of tetraspores and carpospores of this alga *C. impudica*.

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