



## Short Communication

# Density distribution of fungi in the surface waters of Visakhapatnam fishing harbour, east coast of India

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### Abstract

The fungal density distribution in the surface waters of Visakhapatnam fishing harbour was studied from April 2008 to January 2009 at fortnightly intervals from five sampling points using Sabouraud Dextrose Agar (SDA) and Potato Dextrose Agar (PDA) media. The mean density of fungi grown on SDA and PDA media were  $26.92 \times 10^5$  cfu/ml and  $25.85 \times 10^5$  cfu/ml respectively. The study suggests that SDA is relatively preferable for culture of coastal water fungi than PDA. The density distribution is discussed in relation to physico-chemical parameters.

**Keywords:** Fungi, density, coastal waters

### Introduction

Fungi survive in the marine environment as heterotrophs obtaining nourishment from decaying materials, dead organisms and dissolved organic matter. The action of fungi promotes organic degradation and mineralization processes in sediments and in overlying waters; and releases dissolved organic and inorganic substances, which are useful to autotrophic organisms in primary production. Marine fungi form an ecological rather than a taxonomical group. Obligate marine fungi are those that grow and sporulate exclusively in a marine or estuarine habitat whereas facultative marine fungi are those from freshwater and terrestrial milieus and are able to grow and sporulate in the marine environment.

Studies on marine fungi from Indian waters are mainly on species composition and culture (Sridhar and Prasannarai, 2001; Vittal and Sharma, 2006; Damare and Raghukumar, 2006; Sridhar and Maria, 2006; Suetrong and Jones, 2006) and there is paucity of data on the density distribution of fungi. Hence an attempt was made to study the surface waters of Visakhapatnam fishing harbour.

### Material and Methods

Surface water samples were collected from Visakhapatnam fishing harbour ( $17^\circ 42'$  N lat;  $83^\circ 18'$  E long.), east coast of India at fortnightly intervals from April 2008 to January 2009 from 5 sampling points. Data on physico-chemical parameters (temperature, salinity, dissolved oxygen and pH) of marine fungi were collected from surface water samples. Surface water temperature was recorded using  $0.1^\circ\text{C}$  sensitive hand-held thermometer. Salinity and dissolved oxygen were measured using Knudsen's method and Winkler's method, respectively (Strickland and Parsons, 1972). pH of water samples was measured with a digital pH meter (Elico). Water samples obtained for culture of marine fungi were aseptically inoculated, using 5-fold dilution, in two standard media *i.e.* Sabouraud Dextrose Agar (Hi-media, code no. 063) (SDA) and Potato Dextrose Agar (Hi-media, code no. 096) (PDA).

The inoculated samples were incubated at  $36^\circ\text{C}$  for 3 to 7 days. The colonies on the culture plates were counted using a colony counter and the pigmentation, if any, in the culture plates was recorded. The mean densities of fungi were expressed as: number  $\times 10^5$  cfu/ml. Pearson product

Table 1. Mean values and standard deviations of temperature (°C), salinity (ppt), dissolved oxygen (mg/l) and pH of Visakhapatnam fishing harbour surface waters from April 2008 to January 2009 (I: first fortnight; II: second fortnight)

Period	Temperature		Salinity		Dissolved oxygen		pH	
	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D
Apr I	29.02	0.16	30.88	0.50	4.56	0.68	7.34	0.21
Apr II	32.94	0.21	33.02	0.16	5.09	1.27	7.58	0.23
May I	32.90	0.25	30.68	0.53	4.39	0.85	7.52	0.04
May II	30.94	0.21	33.00	0.29	5.70	1.21	7.64	0.15
Jun I	30.04	0.24	33.02	0.26	4.60	1.23	7.56	0.19
Jun II	30.96	0.18	32.98	0.36	4.42	1.27	7.40	0.10
Jul I	30.90	0.29	32.08	0.22	4.96	2.33	7.46	0.17
Jul II	30.02	0.26	31.00	0.29	3.13	0.83	7.42	0.18
Aug I	32.06	0.21	32.98	0.22	4.02	1.68	7.46	0.22
Aug II	30.06	0.21	31.04	0.30	4.37	1.33	7.72	0.13
Sep I	30.00	0.20	28.22	0.45	4.62	1.50	7.30	0.19
Sep II	31.06	0.21	24.24	0.44	5.41	0.11	7.60	0.14
Oct I	29.04	0.18	25.98	0.26	6.27	1.17	7.46	0.31
Oct II	31.04	0.27	25.76	0.44	5.86	1.58	7.60	0.12
Nov I	30.96	0.24	31.04	0.21	4.00	0.42	7.56	0.11
Nov II	30.02	0.26	31.94	0.21	3.80	0.24	7.40	0.32
Dec I	28.98	0.19	29.94	0.19	4.22	0.42	7.82	0.08
Dec II	27.98	0.15	30.96	0.18	4.50	0.90	7.74	0.11
Jan I	29.96	0.21	32.92	0.16	4.09	0.78	7.26	0.19
Jan II	32.04	0.21	30.00	0.16	6.56	2.08	7.48	0.36

Table 2. Mean densities (number $\times 10^5$  cfu/ml) and standard deviations of surface water fungi grown on Sabouraud Dextrose Agar (SDA) in the study area from April 2008 to January 2009 (I: first fortnight; II: Second fortnight) (S.P: sampling point)

Period	S.P 1	S.P 2	S.P 3	S.P 4	S.P 5	Mean	S.D
Apr I	14	17	15	18	27	18.2	5.2
Apr II	58	04	11	01	04	15.6	24.0
May I	02	11	38	36	20	21.4	15.6
May II	06	22	13	07	06	10.8	6.9
Jun I	11	22	41	34	36	28.8	12.2
Jun II	44	43	44	53	47	46.2	4.1
Jul I	12	22	07	29	12	16.4	8.9
Jul II	02	05	04	03	04	3.6	1.1
Aug I	01	00	04	01	03	1.8	1.6
Aug II	17	10	03	05	04	7.8	5.8
Sep I	01	04	02	39	05	10.2	16.2
Sep II	02	02	05	00	01	02.0	1.9
Oct I	192	266	166	212	219	211.0	37.0
Oct II	72	04	17	90	03	37.2	40.9
Nov I	22	14	18	11	13	15.6	4.4
Nov II	31	42	03	08	12	19.2	16.6
Dec I	07	09	19	15	18	13.6	5.4
Dec II	06	02	02	03	18	6.2	6.8
Jan I	09	42	39	49	69	41.6	21.7
Jan II	03	05	34	10	04	11.2	13.0
Mean	25.60	27.30	24.25	31.20	26.25	26.92	

moment correlation coefficients ( $r$ ) were calculated to correlate mean fungal densities with environmental parameters. Significance tests (' $t$ ' test) were performed to find out whether the calculated correlation values are significant (Ostle, 1954).

### Results and Discussion

The mean distribution of surface water temperature, salinity, dissolved oxygen and pH of fishing harbour during the study period are given in Table 1.

The mean density distribution of fungi in SDA medium was lower than  $50 \times 10^5$  cfu/ml except during Oct I when the density increased to  $211 \times 10^5$  cfu/ml (Table 2). The density distribution of fungi during Apr II, May I, Sep I, Oct II, Nov II, Jan I and Jan II showed variations between sampling points. The mean density distribution

between sampling points varied slightly from  $24.25 \times 10^5$  cfu/ml (Sampling Point 3) to  $31.2 \times 10^5$  cfu/ml (Sampling Point 4).

The mean density distribution of fungi in PDA medium was lower than  $55 \times 10^5$  cfu/ml except during Oct I when the density increased to  $138.4 \times 10^5$  cfu/ml (Table 3). The density distribution during Apr I, Apr II, May I, Jul I, Oct II, Nov I, Nov II and Jan I showed marked variations between sampling points. The mean density distribution between sampling points showed variations with low value at Sampling Point 4 ( $18.1 \times 10^5$  cfu/ml) and high value at Sampling Point 1 ( $35.15 \times 10^5$  cfu/ml).

In the present study density distribution of fungi exhibited specific relationship with the physico-chemical parameters. The density showed inverse relations with temperature and salinity while

Table 3. Mean densities (number  $\times 10^5$  cfu/ml) and standard deviations of surface water fungi grown on Potato Dextrose Agar (PDA) in the study area from April 2008 to January 2009 (I: first fortnight; II: Second fortnight)

Period	S.P 1	S.P 2	S.P 3	S.P 4	S.P 5	Mean	S.D
Apr I	71	22	11	12	158	54.8	62.7
Apr II	19	40	09	09	03	16.0	14.6
May I	49	13	18	18	17	23.0	14.7
May II	03	03	04	04	02	3.2	0.8
Jun I	06	16	11	11	11	11.0	3.5
Jun II	47	44	33	33	40	39.4	6.3
Jul I	22	46	59	59	36	44.4	15.8
Jul II	04	05	11	11	18	9.8	5.6
Aug I	02	05	02	02	10	4.2	3.5
Aug II	12	05	03	03	17	8.0	6.2
Sep I	03	03	11	11	04	6.4	4.2
Sep II	07	02	04	04	02	3.8	2.0
Oct I	165	147	127	127	126	138.4	17.3
Oct II	154	04	04	04	02	33.6	67.3
Nov I	43	21	13	13	40	26.0	14.6
Nov II	24	51	15	15	08	22.6	16.9
Dec I	11	14	11	09	16	12.2	2.8
Dec II	06	07	08	04	09	6.8	1.9
Jan I	50	54	34	03	81	44.4	28.7
Jan II	05	06	21	10	03	9.0	7.2
Mean	35.15	25.40	20.45	18.10	30.15	25.85	

Table 4. Pearson correlations between physico-chemical parameters and fungal densities during the study period ( $N = 2$ ) ( $p = 0.05$ )

Medium	Temperature	Salinity	Dissolved oxygen	pH
Sabouraud Dextrose Agar	- 0.27	- 0.34	0.41	0.14
Potato Dextrose Agar	- 0.30	- 0.27	0.32	- 0.26

dissolved oxygen exhibited positive relationship (Table 4). The maximum density was during Oct I on both media, which may be attributed to the availability of a congenial environment (highly oxygenated water, 6.27 mg/l; ideal salinity, 25.98 ‰; optimal temperature, 29.04 °C and pH, 7.46) for the fungi. It is also interesting to note that the densities of fungi were the lowest during Sep I and highest in Oct I, *i.e.* in adjacent fortnights. Even though correlations were statistically insignificant ( $p = 0.05$ ), temperature and salinity showed negative correlations with density on both media, while dissolved oxygen showed positive correlation.

The study indicates that both the agars *i.e.* SDA and PDA are ideal for the culture of fungi, but SDA can be preferred in view of its similarities of the values of fungi between grand mean density of fishing harbour and the mean densities of 5 different sampling points.

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