

Occurrence of Fungi in the Primary Film on Glass Slides Submerged in Cochin Backwaters

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Occurrence of fungal mycelia was observed on the glass slides after 48 h of submersion in the Cochin backwaters. The fungus *Curvularia lunata* (Wakker) Boedijn was found throughout the year while *Aspergillus terreus* Thom., *Trichoderma pseudokoningii* Rifas and *Phomopsis* spp. were found only during the low saline period prevailing in the monsoon season. The presence of fungi in the primary film is of importance in the context of its probable role in the biochemistry of the slime film and also in promoting corrosion of metal substrates.

Any substrate immersed in the sea gets rapidly coated with a slime film or primary film. The chief constituents of the primary film are bacteria, algae and protozoa enmeshed in a thick layer of bacterial polymer (Mitchell & Kirchman, 1984). Dead cells and other debris accumulate in the matrix providing a continuous nutrient source.

The fouling community comprises of a large assemblage of more than 2,000 species of animals and plants (WHOI, 1952). This number has doubled since then (Crisp, 1973). Mitchell & Kirchman (1984) report that a fully developed microbial population is characterized by the presence of a large number of stalked and filamentous bacteria, diatoms and algae enmeshed in the polymeric film, fungi and actinomycetes being rare.

While working on the microbial succession of the primary film from the Cochin backwaters, fungal mycelia were observed on the submerged glass panels after 48 h of submersion. This paper reports on the different fungi isolated and their ecology.

Materials and Methods

The fungi were collected by exposing panels from the North Oil Tanker Berth of Cochin Harbour (Fig. 1.). The settlement was observed on the sterilized glass slides (7.5 x 2.5 cm) for 12 months by submerging them at 1 m below low tide level. These

slides were sterilized in the hot air oven at 120°C for 8h, a day prior to submersion.

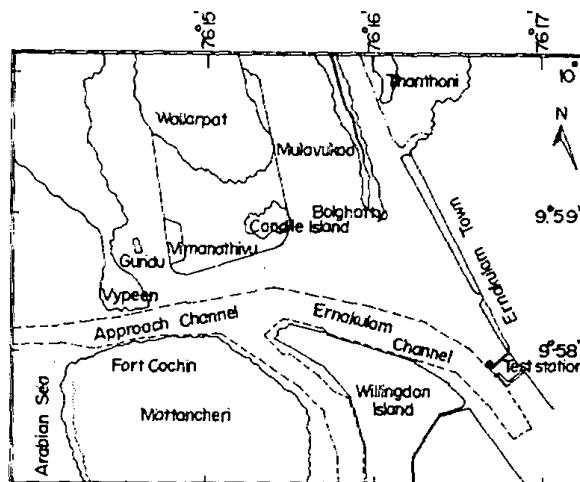


Fig. 1. Location of test site

The experiment was carried out in triplicate. Slides were taken out at 6 hourly intervals from 12 to 72 h after immersion and transported to the laboratory in sea water in a closed container which was also previously sterilized. In the laboratory these slides were taken out aseptically and lightly washed with sterilized distilled water to remove loosely adhering microorganisms, and then placed aseptically in plates on

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Fig. 2. Photomicrograph of *Curvularia lunata*

Yps's agar medium (Kohlmeyer & Kohlmeyer, 1979) and incubated at $28 \pm 2^\circ\text{C}$. After 48 h of incubation fungal growth appeared under and at the edges of the slides. These colonies were isolated on Yps's slants and identified. The study was carried out during the pre-monsoon, monsoon and post-monsoon periods. Hydrography of the test sites was also studied simultaneously (Strickland & Parsons, 1968).

Results and Discussion

There is characteristic change in salinity of the estuarine water during pre-monsoon, monsoon and post-monsoon, at the test site. At the pre-monsoon period (February to

Table 1. Hydrographical parameters at the test site

Month	Air temp, $^\circ\text{C}$	Surf. water temp, $^\circ\text{C}$	Salinity ‰	Dissolved O_2 ml l^{-1}	pH
January	27.0	29.0	26.2	3.6	7.8
February	30.0	28.0	26.0	3.4	7.4
March	28.9	30.3	28.5	4.2	7.7
April	31.3	31.1	19.9	3.7	7.4
May	31.2	30.6	19.9	3.6	7.1
June	29.2	29.7	2.9	4.2	7.1
July	29.7	28.0	1.1	4.1	7.0
August	28.4	29.5	0.8	3.7	6.6
September	29.0	29.7	16.7	3.9	7.2
October	30.6	29.8	17.5	3.8	6.4
November	28.6	29.9	14.5	4.0	7.4
December	28.0	29.3	29.0	3.7	7.8

May) the salinity of the water reaches a maximum of 31.3‰ which gets reduced to almost fresh water at the monsoon period (June-August) (Table 1). Then again the salinity gradually rises to higher values during the post-monsoon period (September to January). This is mainly due to the influence of southwest and northeast monsoons prevalent in the region (Nair, 1965).

Curvularia lunata (Fig.2) showed its settlement on the slides throughout the year, at all the three periods irrespective of the salinity levels. The fungi *Aspergillus terreus* (Fig.3), *Trichoderma pseudokoningii* (Fig.4) and *Phomopsis* spp. were isolated from the glass slides during the monsoon period only, when the salinity fluctuated between 19.00 to 0.8‰, and appear to be euryhaline. All these fungi are terrestrial forms known



Fig. 3. Photomicrograph of *Aspergillus terreus*



Fig. 4. Photomicrograph of *Trichoderma pseudokoningii*

for their cellulolytic activity. *C. lunata* was the predominant fungus appearing throughout the year exhibiting its high adaptability to wide salinity fluctuations. Similar ecological succession were reported by Menon & Nair (1971) and Nair (1973) with respect to certain fouling bryozoans from Cochin harbour waters. They observed *Victoria pavida* (Kent) and *Electra crustulenta* (Pallas), typical euryhaline forms, to be settling during the low saline period of monsoon, tolerating salinity fluctuations between 2.2‰ to 23.1‰. However, *Schizoporella cochinchensis* was found settling only during the high saline conditions (salinity 24.5‰ to 32‰) and are typically marine.

The primary population of the primary film from the test site were observed to be bacterial rods and cocci, diatoms and microalgae such as *Ulothrix*, *Spirogyra*, *Oscillatoria* etc. Bacteria produces polymeric fibrils which attach them firmly to the material surface and these microbial polymers appear to be polysaccharides or glycoproteins (Marshall, 1976). In the present study fungal mycelia were observed only after 48 h of submersion of the glass slides. The bacterial polymers and the microalgae present on the glass slides themselves or extra-cellular materials released by these microalgae may act as food for these cellulolytic fungi (Mitchell & Kirchman, 1984). However, this aspect of the study has to be pursued further.

Appearance of fungi in the primary film is a relatively rare phenomenon and opens up fresh avenues for research on the process of possible attraction and settlement of fungi in the substratum and its role in biofouling. Terrestrial fungi like *Cladosporium resinae* and *Aspergillus fumigatus* have been reported (Hazard, 1961; Prince, 1951; Thomas & Hill, 1976) to promote corrosion of aluminium alloys used in aircraft. Dayal *et al.* (1987) reported on 25 soil fungi that could bring about corrosion of mild steel, galvanised iron and structural

aluminium alloys in soil burial tests. They belong to the genera *Aspergillus*, *Penicillium*, *Stemphylium* and *Scopulariopsis*. The fungi isolated from primary film in this study are facultatively marine and their possible role in material destruction under marine conditions need to be investigated.

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References

- Crisp, D.J. (1973) in *Proc. 3rd International Congress on Marine Corrosion and Fouling*, p.88, Evabston IL, North Western University Press
- Dayal, H.M., Tewari, K.C., Kamalesh Mehta & Chandrasekhar (1987) *A study of some metal corroding fungi from India*, mimeo, p.8
- Hazard, G.F. (1961) *Fungal growth in aviation fuel system-I*, Rept. 252, Defence Standard Laboratory, Victoria, Australia
- Kohlmeyer, J. & Kohlmeyer, E. (1979) in *Marine Mycology-Higher Fungi*, p.20, Academic Press, New York
- Marshall, K.C. (1976) in *Interfaces in Microbial Ecology*, p.59, Harvard University Press, Cambridge
- Menon, N.R. & Nair, N.B. (1971) *Mar. Biol.* 8, 280
- Mitchel, R. & Kirchman, D. (1984) in *Marine Biodeterioration: An Interdisciplinary Study* (Costlow J.D. Tipper, R.C., Eds) p.49, Naval Institute Press, Annapolis, USA
- Nair, N.B. (1965) *Hydrobiol.* 50, 411
- Nair, N.U. (1973) *Fish. Technol.* 10, 61
- Prince, A.E. (1951) *Dev. Ind. Microbiol.* 2, 297
- Strickland, J.D.H. & Parsons, T.R. (1968) *Bull. Fish. Res. Bd. Can.* 167
- Thomas, A. R. & Hill, E.C. (1976) *Internat. Biodeter. Bull.* 12, 116
- WHOI (1952) *Marine Fouling and its Prevention*. U.S. Naval Institute, Annapolis, Maryland, USA.