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STUDIES ON MANGROVE SWAMPS OF GOA: I. HETEROTROPHIC BACTERIAL FLORA FROM MANGROVE SWAMPS

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ABSTRACT

Heterotrophic bacterial flora from the mangrove swamps of Goa consisted of physiologically active organisms exhibiting cellulolytic, pectinolytic, amylolytic, proteolytic and H_2S forming activities, throughout the year. Coryneform and *Bacillus* were found to be the most dominant among the bacterial isolates. A large number of yeasts were also present.

Mangrove swamps comprising of foliage as a major organic material, support a detrital type of food chain in the tropical marine environment (Odum and Heald, 1975). The mangrove swamps of Goa situated along the Mandovi-Zuari estuary undergo well marked seasonal and regional variations in the physico-chemical parameters which affect the microbial flora. In monsoon, when the salinity is low and leaf content is high, the microbial flora consists of a large fungal population (Matondkar, Mahtani and Mavinkurve, 1980a). All the fungal isolates obtained from these swamps throughout the year, are physiologically active producing enzymes like cellulase, pectinase and amylase (Matondkar, Mahtani and Mavinkurve, 1980b). Such fungal groups are important in initiating the plant litter decomposition leading to the release of simple products which support the growth of bacteria and yeast. The action of these latter microflora influences the further degradation and solubilization of organic matter, leading to the detritus formation (Fell, Cefalu, Master and Tallman, 1975). The present work was undertaken to assess the qualitative nature of heterotrophic bacterial flora from this region, particularly with respect to their physiological activities.

Total viable bacterial counts of sediment and water samples from mangrove swamp, situated in the Zuari estuarine belt were carried out (Matondkar, Mahtani and Mavinkurve, 1980a). Isolates were picked up at random from the plates with 20-200 colonies, purified, examined for their morphological, biochemical and physiological characteristics (Harrigan and McCance, 1973; Rodina, 1972) and identified (Buchanan and Gibbons, 1975).

The viable counts and the distribution of various groups, predominant amongst a total of 146 isolates are shown in Table I. The actinomycetes and yeasts are known to play an important role in such ecosystems where the plant litter decomposition occurs. In

Table I. Distribution of microbial groups in the mangrove swamps.

Sampling Period	May	September	January
	Viable count on nutrient agar		
Sediment (/g)	$1 \cdot 5 \times 10^6$	$1 \cdot 4 \times 10^4$	$4 \cdot 8 \times 10^4$
Water (/ml)	$3 \cdot 3 \times 10^4$	$1 \cdot 4 \times 10^3$	$3 \cdot 3 \times 10^3$
No of isolates	79	10	57
		% Microbial groups	
Coryneform	15·1	20·0	12·3
Bacillus	16·5	40·0	12·3
Planococcus	12·7	—	—
Staphylacoccus	5·1	—	59·7
Streptococcus	2·6	—	—
Micrococcus	1·3	—	8·8
Pseudomonas	10·1	—	—
Unidentified	19·0	—	3·5
Yeast	15·2	40·0	3·5

Table II. Distribution of physiologically active isolates from mangrove swamps.

	Total No. of isolates	Cellulose decomposers	Starch hydrolysers	Pectin degraders	Gelatin liquefiers	H_2S producers	N_2 fixers
Period				*% Positive isolates*			
May	79	46·9	63·3	62·1	68·4	32·9	57·0
September	10	70·0	90·0	30·0	30·0	80·0	30·0
January	57	45.6	50·9	49·1	82·5	42·1	29.8
Groups		*% Positive among predominant groups*					
Coryneform	21	66.7	42·9	61·9	61.9	66·7	57·2
Bacillus	24	45·9	70·9	54·2	62·5	58·4	37.5
Cocci	56	40·0	52·5	57·2	69·7	35·7	32.2
Pseudomonas	8	37·5	62·5	100·0	50·0	12·5	52·5
Yeast	18	55·6	61·1	38·9	72·2	33·4	44.5

the present study although no specific attempt was made to enumerate these groups, a large number of yeasts were isolated from nutrient agar plates reflecting their preponderance throughout the year. Aerobic spore forming organisms and coryneforms were also consistently present in varying proportions. The presence of the same types of organisms belonging to *Bacillus, Corynebacterium, Micrococcus* and *Pseudomonas* has been observed in mangrove swamps of Thailand (Daengshuba, 1979) and in coconut husk ret liquor (Bhat and Nambudiri, 1971). Such a striking similarity in the two environments is perhaps not very surprising as both the ecosystems foster the degradation of the plant material in a damp estuarine marshy land. The significance of these metabolically versatile organisms in plant decomposition (Eklund and Gyllenberg, 1974) has been conclusively established earlier.

The members of each of the taxonomically distinct groups show the presence of an array of enzymes (Table II) implicated in degradative processes. Amongst the heterotrophic microbial population, cellulose decomposers ranged between 45 to 70% being higher during the monsoon. The H_2S formers ranged between 30–80% which

perhaps account for strong H_2S odour emitted from these mangrove swamps throughout the year with an increased intensity in monsoons. It was interesting to note that many of the isolates referred to as N_2 fixers in Table II, when inoculated and subcultured in Norris N_2 free medium (Rodina, 1972) showed persistent luxuriant growth. Starch hydrolysers, pectin degraders, gelatin liquifiers were also present in large numbers throughout the year. The presence of similar physiologically active groups from mangrove swamps of Killai backwaters has been reported by Venkateshan and Ramamurthy (1971).

The role of the cellulolytic, amylolytic and H_2S producing bacteria in the degradative processes is implicated on the basis of their association with detritus. The presence of such organisms in the mangrove swamps reflect the cumulative activities occuring in this specialized ecosystem leading to continuous decomposition of the foliage and the turnover of nutrients.

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