

## **M.S.41. CHANDRIKA, V.—Studies on the Ecophysiology of some heterotrophic and Indicator bacteria in the marine environments of Kerala—1984—Dr. P.V. Ramachandran Nair.**

The thesis entitled "Studies on the eco-physiology of heterotrophic and indicator bacteria in the marine environments of Kerala" embodies the results of an investigation carried out by the candidate at the Central Marine Fisheries Research Institute, Cochin. It is presented under 4 chapters in two parts (Parts A & B) and includes 6 sections. The material for the study was collected in the Cochin backwater during April 1972 to February 1973, March 1974 to February 1975, July 1975 to June 1976 and in the inshore area during January to October, 1978 and an account of the heterotrophic and indicator bacteria are given with intensity charts and tables.

Samples from all the stations contained significant quantities of heterotrophs (Part A, Section I) and faecal pollution indicators (Section II). Maximum number of heterotrophic bacteria was observed during the postmonsoon period. The total counts between one station and the other did not vary as much as the counts between months did. The distribution was characterised by overdispersion. During 1972-73 in all the stations except the fourth the minimum heterotrophs (Total counts) were recorded during the monsoon period. Minimum counts were observed during the premonsoon period, with an increasing trend from the premonsoon to postmonsoon seasons. Maximum counts were recorded during monsoon months during 1974-75. No significant difference was noted in the total plate count between stations, months and regions. Seasonal variations in sea water was meagre during 1975-76, whereas in sediments variations were prominent during monsoon in Station I - near the mouth of the sewage effluent of Cochin City and in postmonsoon at Station II in the Mattancherry Channel and Station III near barmouth.

In total 8 genera namely *Alcaligenes*, *Pseudomonas*, *Vibrio*, *Aeromonas*, *Photobacterium*, *Flavobacterium*, *Micrococci* and *Bacillus* were the main constituent of bacterioplankton in the surface water as well as sediments. *Micrococci* and *Bacillus* were encountered more in sediment than in water. Bacterial species varied seasonally but proteolytic, lipolytic and amylolytic activity appeared independent of the season. Eemzymatic activity was not a reflection of the bacterial genera.

Estimation of numerical abundance of four indicators of bacterial pollution and their variation in seasonal occurrence with environmental parameters showed that the coliform counts differed significantly between stations, between months and between regions. The presence of coliform was more in sediment than in water. *E. coli* counts showed significant difference between stations and between months. Faecal streptococci showed significant difference between stations, months and regions. The count was significantly high in backwater than in offshore samples. Faecal index showed significant difference between stations and between months. Station near the sewage outlet was having significantly higher faecal index to other stations both in sea water and sediment indicating predominance of animal waste in mixed pollution in this area.

The third section includes studies on zymogenous heterotrophic microbes (amylolytic, gelatinolytic, lipolytic, chitinolytic, caseinolytic ureolytic population) association with *Salvinia molesta* in water and sediment from 10, 20 and 30 metres in the inshore environment of Cochin during 1978. Sediment/water ratio of zymogenous microbes were constructed and increased rate of *Salvinia* deposits resulted in a decline in the sediment/water ratio of all the zymogenous micro-organisms. The depth range of 10 to 20 m appeared to be more dynamic and productive investigated in the inshore region.

A comparative study of 43 marine bacteria isolated from 3 beaches near Trivandrum and 60 human bacteria from clinical specimens fromed the 1st section under Part B. Glucose fermentation was very high in human strains whereas citrate utilisation was very high in marine bacteria.  $H_2S$  production was very low in marine isolates as well as in human bacteria but Indole production was high in strains isolated from marine environment than in human isolates.

*In vitro* study of antibiotic sensitivity of the marine bacteria (Part B - Section II) and human strains isolated from clinical specimens showed multiple drug resistance than resistance to one or two drugs among marine bacteria. 100% Penicillin resistance was encountered in isolates from marine environment whereas isolates from human source showed 100% resistance to 3 antibiotics like Penicillin, Erythromycin and Cepharon. A higher percentage of resistant organisms were notedd among human pathogens ranging from 50% to 60% while the resistant rate was only 34% among marine bacteria. Out of 3 concentrations of 10 different antibiotics used, the lower concentration showed higher rate of resistance with most of the Gram-negative bacteria from clinical specimens though much differentiation in sensitivity was not noted between middle and higher concentration.

About 230 *E. coli* (Type I) isolated from the samples during 1975-76 were subjected to preliminary serological determination and seven *E. coli* 'O' serotypes were encountered and serotypes 026, 055, 086, 0111, 0119, 0127 and 0128 were identified as enteropathic *E. coli* (Part B, Section III). 75% of the 0111 *E. coli* serotype was in agglutenable in 'O' antiserum unless first heated at 100°C. Except 'O' serotype 026 all the other serotypes were isolated also from sea

water. Faecal index was constructed with the ratio of faecal coliform and faecal streptococci and the relationship between total bacterial population and faecal index was found significant.

Most of the isolates encountered in the three beaches near Trivandrum, (Shankumugham, Kovalam and Vizhinjam) belong to *Pseudomonas* sp. All the isolates were non-pigment producers except 2 species of *Pseudomonas*. Maximum isolates including enterobacteria were isolated from Shankumugham beach water. Based on *E. coli* distribution the Vizhinjam beach was considered to be most polluted of all the beaches studied. Eventhough Vizhinjam beach possessed more *E. coli* than Shankumugham and Kovalam, the Shankumugham beach possesd more antibiotic resistant microbes distinct from that of other sites. The high rate of incidence of multiple drug resistant organisms in the littoral waters of Trivandrum indicated the possibility of R-factor mediated drug-resistant bacteria also in this environment, which could transfer their resistance to other gram-negative pathogens. Such transfer would create a pathogen with formidable capabilities possessing enhanced infectivity and virulence. All these results suggest that the marine environments of Kerala can also be identified as potential reservoir of multiple drug resistant isolates harbouring R-Plasmid which are involved in inactivating the lethal action of drugs on bacterial strains.