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SEASONAL INFESTATION OF THE COMMENSALIC CILIATES OF THE SHIPWORM, *NAUSITORA HEDLEYI* AND *TEREDO FURCIFERA*

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ABSTRACT

A study was made of the endocommensalic ciliates of the shipworm *Nausitora hedleyi* and *Teredo furcifera* from the south west coast of India. Fortnightly and monthly collections were made from Ernakulam channel and Neendakara barmouth respectively. Five species of ciliates viz,, *Boveria teredinidi, Trichodina balakrishnia. Thigmonzoon fencheli* and *Nyctotherus marina* were selected for seasonal infestation studies. In general, all these species showed their abundance during low saline periods than high saline periods. It was also found that the occurrence of the host species. *N. hedleyi* harbours a richer fauna than *T. furcifera.*

INTRODUCTION

THE population cycles of the commensalic ciliates occurring in their shipworm "hosts" *Nausitora hedleyi* Schepman and *Teredo furcifera* Von Martens, were studied with a view to understanding the nature of infestation and related aspects of their occurrence during the seasonal cycles. There is a paucity of information on these aspects as well as their ecology. The study has also a bearing on the organisms that could be effectively employed in any programme for the biological control of these pests.

The ciliate species *Boveria teredinidi* Nelson, *Trichodina balakrishnia* Santhakumari and Nair, *Nuclecorubula adherens* Santhakumari and Nair, *Thigmozoon fencheli* Santhakumari and Nair and *Nyctotherus marina* Santhakumari and Nair discussed in this paper occur in the mantle cavity of the host. Their taxonomy and behaviour have been reported elsewhere (Santhakumari and Nair, 1970, 1973.). Of these species *Nyctotherus marina* and *Boveria teredinidi* may occasionally be found also within the caecum of the host. The nature of infestation and the relative month-wise abundance of the different species in the hosts have been studied with reference to also the fluctuations in environmental condition of the habitat of their hosts.

Cochin Backwater is an open estuary and the details of which is described by Nair (1965). The hydrography of this region has been described by Ramamirtham and Jayaraman (1963), tidal cycle and environmental features by Qasim and Gopinathan (1969) and nutrients by Sankaranarayanan and Qasim (1969).

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MATERIAL AND METHOD

The material consists of two series of samples, (i) regular fortnightly collections of *Nausitora hedleyi* at the Ernakulam channel part of the Cochin Backwater where the depth is 2.5 m (Vembanad Lake) and (2) monthly samples of *Teredo furcifera* were collected at Neendakara barmouth (Ashtamudi Lake) where the depth is 2 m during 1965 June to 1965 May. Sampling from ten such areas was necessary since in the Ernakulam channel, the population of *T. furcifera* is completely displaced during the low saline period of the monsoon. However, at Neendakara, it was possible to collect the species throughout the year. Almost reverse is the case with *N. hedleyi* which occurs throughout the year in Ernakulam channel but does not occur regularly at Neendakara. In order to study the seasonal infestation and relative abundance of commensalic ciliates throughout the year, observation were carried out on samples of *T. furcifera* from Neendakara and *N. hedleyi* from Ernakulam channel. The shipworms were carefully removed from the burrows of submerged timber structures. A fixed quantity of sample was taken with a graduated pipette from the mantle cavity and counted. Ten shipworms were examined from each collection and the data given here represent average values. Surface temperature and samples for salinity were taken from the stations.

RESULTS

The salinity of the Ernakulam channel varies from very low values to practically that of sea water during the course of the year. In general, June to November is the period of low salinity and in 1965 August (1.7‰) the lowest value was observed. The maximum salinity value was observed in April 33.4‰ (Fig.1). Neendakara barmouth area is less influenced by the influx of flow water during the monsoon, and consequently the salinity values are not so low during the period. The minimum recorded value is 7.3‰ (Fig. 3).

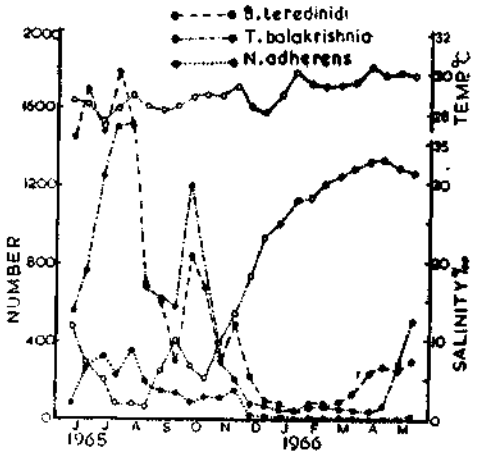

Fig. 1. Seasonal infestation and relative abundance of *Boveria teredinidi, Trichodina balakrishnia* and *Nucleocorbula adherens* from *Nausitora hedleyi.*

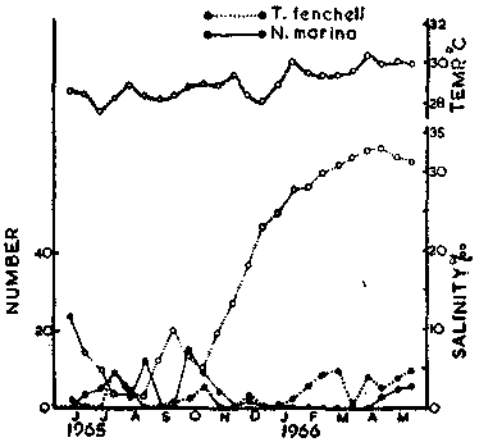

Fig. 2. Seasonal infestation and relative abundance of *Thigmozoon fenchelli* and *Nyctotherusmarina from Nausitora hedleyi.*

Surface temperature at both the stations showed only slight variations throughout the year (Fig. 1 and 3).

The seasonal infestation and the relative abundance of the 5 species of ciliates are illustrated in Figs. 1 to 4. The data show that *Nausitora hedleyi* harbours a relatively greater number of commensals than *Teredo furcifera*. The reason for this difference is difficult to explain. *N. hedleyi* may attain a considerably larger size than *T. furcifera* in these localities and the former is a typical brackish water species with a restricted breeding season during the periods of medium salinity. *T. furcifera* on the other hand, is a smaller marine species showing little tolerance to lower salinity. Experiments conducted on the salinity tolerance of the ciliates revealed the fact that they do not prefer high salinities.

The seasonal occurrence of the 5 species in the two hosts showed noticeable fluctuations during the different seasons. The period of peak incidence of *Boveria teredinidi* in *N. hedleyi* was June, July and August. A secondary peak was however, discernible during October. Thereafter the trend indicated a fall in its number to reach the minimum in the second half of January. A trend towards an increase in their number was evident from February onwards with a steep rise during June through the early half of July (Fig. 1). The occurrence of this species in *T. furcifera* (Fig. 3) presents a slightly different pattern, the range of fluctuations in its number being not so great. The maximum number recorded in this host was 695 and this was in June and the minimum in January. From February they showed a fairly steady increase to reach the maximum in June. The values for July, August and September were also fairly high. From September they steadily decreased until December and disappeared from the host altogether in January. In both the species the period of abundance approximately coincided with low or medium salinities (Figs. 1 and 3).

Trichodina balakrishnia also showed (Fig. 1) a trend which was similar to that of *Boveria teredinidi* in the host *N. hedleyi*. The months of peak occurrence were July and August with a secondary peak in October. The months of low or medium salinities recording comparatively greater numbers than months of high salinities. This species showed a rather erratic pattern of occurrence in *T. furcifera*, the peak occurring in November. None was noticed during January. The trends in the seasonal occurrence do not, however, give any correlation between the incidence in the host and hydrographical conditions (Figs 1 and 3).

The incidence of *Nucleocorbula adherens* in *N. hedleyi* (Fig. 1) suggests that low or medium salinities are distinctly favourable for it. Its peak occurrence in this host was during the second half of August. From December to the first half of June they were present only in negligible numbers. From the second half of December to the first half of May they were absent. This suggests that higher salinity is a limiting factor for this species. A perusal of Figs. 1 and 3 show that their flutcuations in number in *T. furcifera* did not follow the changes in the hydrographical conditions. Nevertheless, January, February and March gave comparatively low values.

The occurrence of *Thiomozoon fencheli* (Figs 2 and 4) is noteworthy as more specimens were recorded during some months from *T. furcifera* than from N. *hedleyi*. In *N. hedleyi* during the premonsoon period of higher salinity they predominate their number though during the low saline periods also they occasionally showed a spurt in their number as in July and October. In *T. furcifera, Thigmozoon fencheli* was present in fair numbers from August, to Novembet and during February being rare in other months. *Nyctotherus marina* (Figs. 2 and 4) from *N. hedleyi* showed considerable variations, occurring in greater numbers in July, August, October

and March, and being poorly represented during the remaining months. In general, this species seemed to prefer low or medium salinities. In *T. furcifera, Nyctotherus marina* occurred in relatively greater numbers from August to November and during February.

DISCUSSION

The occurrence of ciliates is numerically greater in *N. hedleyi*. If we assume that the sampling errors are not significant, the reason for the greater number in *N. hedleyi* may be the result of better conditions offered by the body of the host. Moreover, *N. hedleyi* is a larger form than *T. furcifera*. Fenchel (1965) also observed that the ciliates were more in a larger host. There is probably no species of commensalic ciliates or their hosts in this locality that does not exhibit a marked seasonal variation in abundance. But such fluctuations may be more marked in some species. It is interesting to note that in *N. hedleyi*, the period of abundant

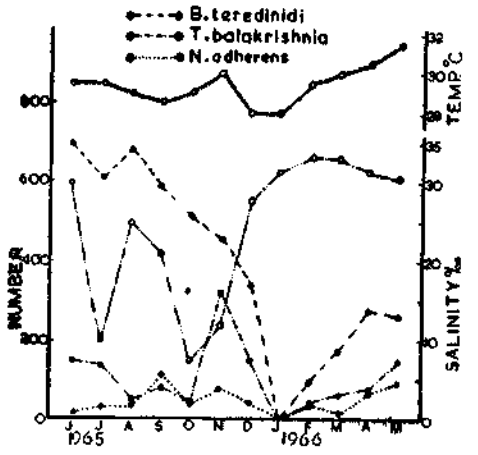

Fig. 3. Seasonal infestation and relative abundance of *Boveria teredinidi, Trichodina balakrishnia* and *Nucleocorbula adherns* from *Teredo furcifera*.

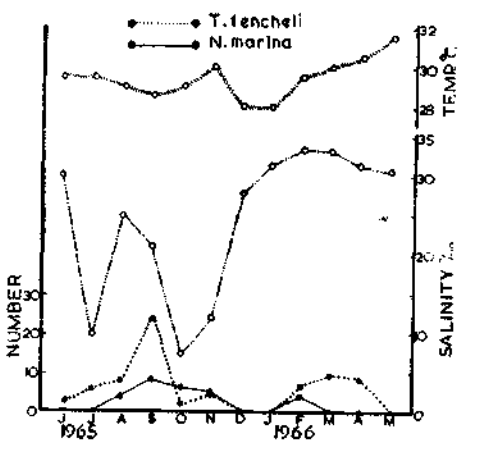

Fig. 4. Seasonal infestation and relative abundance of *Thigmozoon fenc heli* and *Nyctotherus marina* from *Teredo furcifera*.

occurrence of the ciliates corresponds with the period of active growth and reproduction of the host in this locality (Saraswathy, 1967). This estuarine species is most active during the period July to December when the salinity of the ambient water is not very high. This observation is in conformity with the statement of Fenchel (1965) that the genus *Trichodina* probably evolved in fresh water or brackish water where it is most rich in species. It would appears that a relatively few ciliates are able to survive the unfavourable periods and re-establish a large population by vigorous sexual and asexual reproduction on the recurrence of suitable conditions. It is also probable that some of the ciliates may undergo a period of encystment when conditions become unfavourable as has been reported from time to time in Protozoa.

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