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HOST - PARASITE RELATION BETWEEN *BUCEPHALOPSIS HAEMEANAS* AND *CRASSOSTREA MADRASENSIS* IN THE PULICAT LAKE

R. THANGAVELU AND P. J. SANJEEVARAJ

Zoology Department, Madras Christian College, Tambaram, Madras-600 059

ABSTRACT

A digenic trematode *Bucephalopsis haemeanas* was observed in the gonads of the backwater oyster *Crassostrea madrasensis* of the Pulicat Lake. Maximum percentage of infection was 17.7 during December. Highest incidence of infection was observed in the size groups of 60-69 mm and 100-109 mm. Initially the infection was noticed in the gonads of the oyster and later it was found to invade the other tissues such as mantle, gill and digestive gland. Infection was found to be more in the partly spent and spent individuals than in the fully ripe and individuals with gametogenic activity. As a result of infection, gametes are resorbed quickly and thus oysters are castrated leading to indeterminate stage. In the majority of parasitised oysters, feeding was noted to be very poor. The infection seems to be seasonal and starts when the salinity and temperature in lake decline considerably after the heavy rains of North-East Monsoon. The parasites were observed to die at the salinity below 2.3‰.

INTRODUCTION

MASS mortalities of oysters have been reported at Kanasawa Bay (Takeuchi *et al.*, 1956), Miura Peninsula (Fujita *et al.*, 1953), Hiroshima Bay (Ogasware *et al.*, 1962), Matsushima Bay (Sindermann, 1966), Australia (Roughley, 1926) and New Zealan (Howell, 1966). While conducting breeding experiments in the laboratory, Miller (1963) observed the mortality of *Ostrea edulis* and attributed it to the infection of larval trematodes. Sindermann and Rosenfield (1967) found the Pacific oysters from Taiwan infected with larval *Bucephalus*. Except the report of trematode parasite *Bucephalopsis haemeanas* in the edible oyster *Crassostrea madrasensis* by Samuel (1976) and Stephen (1977), no other information is available in India. In the present paper, the extent of infection of oysters by *Bucephalopsis haemeanas*, areas of infection in the visceral mass, effect on the host, seasonal occurrence, size of infected oysters, effect of low salinity on the occurrence of parasites and the preventive measures are discussed.

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MATERIAL AND METHODS

Samples of oysters were collected fortnightly from the natural bed. After taking the linear measurements, they were shucked properly and the gonads were examined under the microscope by preparing a smear in the live condition. Soon after ascertaining the presence of parasites in the gonad, the other body components also examined carefully.

OBSERVATIONS

Host preference

Size of oysters infected : Almost all sizes of oysters were found to be infected, but the extent of infection varied in different size groups (Fig. 1). Oysters ranging from 50-59 mm to 100-109 mm size groups were found

to be more infected than the other size groups. This may be due to the smaller size of the gonad in the oysters below 50 mm size and higher immune capacity in the oysters above 110 mm. Highest percentage of infection (15.8%) was observed in the size group of 60-69 mm and the same was true in the 100-109 mm size groups. The percentage of infection was also less in the oysters of the size group above 110 mm. Oyster spat below the size range of 10-19 mm were totally devoid of parasitic infection.

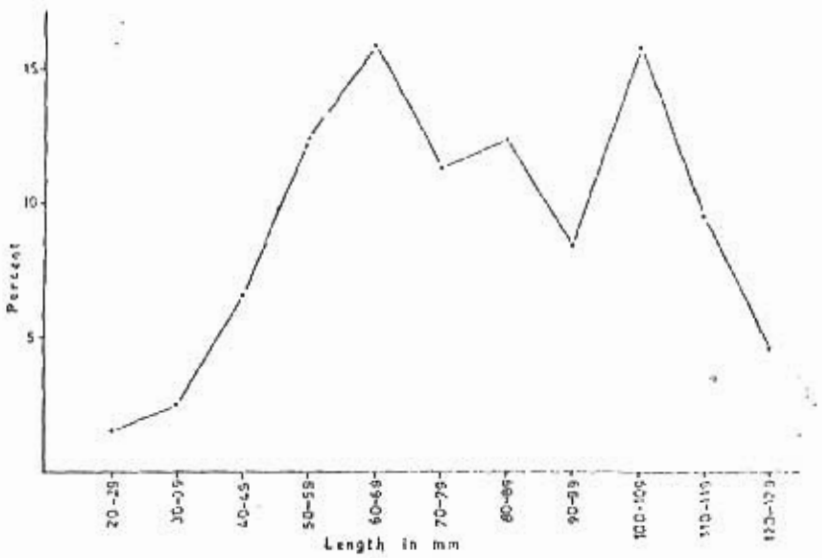

Fig. 1. Extent of infection of *Bucephalopsis haemeanas* on the different size groups of the oyster *Crassostrea madrasensis*.

Stages of gonad

Females : The gonadal stages of the oysters during the period of parasitism is given in Table 1. The onset of parasitism was found during the ripe condition of gonad. Majority of infected oysters were found in the spent condition with a few ova to represent the sex of oysters and the percentage of spent individuals was 81.8, 70.8, 76.9 and 35.7 during December 1980, January, February and March 1981 respectively. During December 1981 and February 1982, 100% of the infected females were in the spent condition. In March 1982, 50% oysters were in the ripe condition and 50% in the spent condition.

Males : The maximum percentage of infected male oysters were in the spent condition, which seems to be higher than the ripe or partly spent ones throughout the period of study except for the month of November 1981 and March 1982. Ripe males were few and their percentages were 22.2, 30.0 and 16.7 for January, February and March 1981 respectively. In March 1982, the percentage of infected ripe oysters was 57.1%. The percentages of partly spent males infected during December and January immediately after spawning were 50 and 33.3 respectively. The highest incidence of infection (83.3%) among the infected males was found in the spent condition of oysters during March 1981.

Sex ratio of oysters infected : Both males and females were usually found to be harbouring the trematode parasites. The percentage of males, females and indeterminates infected with the parasites has been given in Fig. 2. Infection was found to be very high in the case

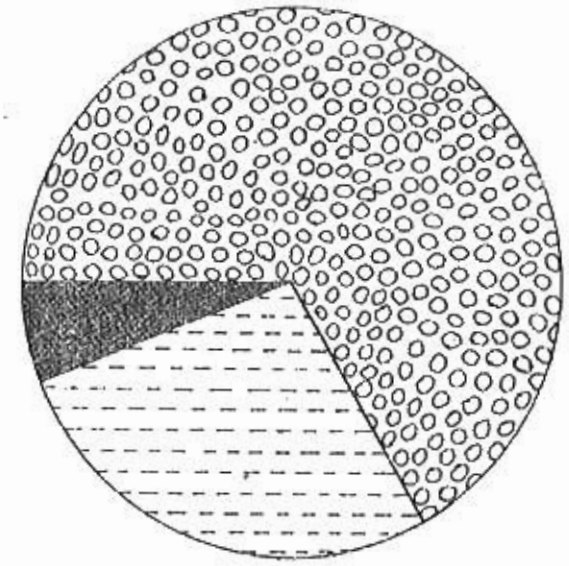

Fig. 2. Percentage of female, male and indeterminate oysters infected by *Bucephalopsis haimeanus*.

of females and very low in males during most of the months observed. The percentage of infected females during December 1980, January, February and March 1981 was observed to be 78.6, 70.6, 86.7 and 70.0 respectively and the incidence of parasitism was considerably low

TABLE 1. *Percentage of gonadal stages of infected oysters*

Sex and stage	Dec. 1980	Jan. 1981	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan. 1982	Feb.	Mar.
Female																
Ripe	9.09	12.50	11.54	21.43	—	—	—	100	—	—	—	14.29	—	10.00	—	50.00
Spent	81.82	70.83	76.92	35.71	—	—	100	—	—	—	—	85.71	100.00	60.00	100	50.00
P. Spent	9.09	16.67	11.54	42.86	—	—	—	—	—	—	—	—	—	30.00	—	—
Male																
Ripe	—	22.22	50.00	16.67	—	—	—	—	—	—	—	14.29	10.00	14.29	33.33	57.14
Spent	50.00	44.44	50.00	83.33	—	—	—	—	—	—	—	14.29	70.00	35.71	66.67	28.57
P. Spent	50.00	33.33	—	—	—	—	—	—	—	—	—	71.42	20.00	50.00	—	14.29

in the males during the corresponding period of the same year. Though there was a secondary peak of spawning of oysters during April and May, the incidence of parasitic infection was very negligible.

Seasonal infection

During the period of gametogenic activity no infection was observed. The infection starts when the gonad is full with ripe ova or in the partly spent condition. In the year 1980, infection was found to occur just after the spawning of oysters and the percentage of infected oysters during the month of December was 6.9 and it was found to increase upto 16.8% in January 1981. The infection was found to decrease through February and March. No infection was found during April and May. In June and July, the infection was very low. Occurrence of trematode larvae was recorded during November and during this period oysters were found to be at the onset of spawning. The percentage of infection was at maximum (17.7%) during December and decreased to 11.8, 5.4 and 3.5 in January, February and March 1982 respectively.

The spawning of oysters was triggered as a result of heavy monsoon rains on the Pulicat Lake during November 1980 which brought down the salinity to very low levels. The same factor has favoured the adult parasites to liberate eggs and the resulting miracidia invade the gonad of the oyster. Infection started just after the release of the ova during which period the follicular tissue became dilated to a certain extent favouring the attachment of these sporocysts.

Effect of low salinity on infection

Oysters collected from the natural bed during the first fortnight of November 1981 were found to be infected with the trematodes and the salinity in the oyster-bed was observed to be 8.94‰. 713 oysters were collected and put into six small synthetic wire bags with the mesh size of 2 cm. They were suspended into the water opposite to the Estuarine Biological Station, where the salinity was considerably lower (4.52‰) than the natural bed due to heavy influx of freshwater. After a fortnight, 119 oysters from the bags were examined and in the meantime the salinity declined further to 2.3‰ due to heavy rains in the lake. The percentage of gonad infection was reduced from 12.7 to 0.84, after a fortnight. The same sample was retained further and examined after another fortnight and found that the oysters were completely devoid of infection and average salinity was observed to be 3.92‰ and the oysters in the natural bed for the same period have registered 10% infection when the salinity in the natural bed was 9.62‰.

Effect on the host

Usually sporocysts are harboured in the gonad of the host - oysters, but in an advanced infection they may invade the other parts of the body. As a result of parasitism, the ripe oysters fail to reproduce, owing to partial or complete destruction of the gonads caused by the parasitic infection. Heavy infection found to occur during January or December and most of the oysters infected during this period were observed to be lean watery, transparent and less in consistency. During this period, the parasite seems to invade from the gonad to the mantle, gill and hepatopancreas. They are not considered as palatable during this period. Totally 36 infected oysters were analysed for a study of the gut contents in different months. Among them, 20 oysters were found with poor feeding and 16 oysters had moderate quantities of food in their gut. Feeding was found to be very poor at the time of infection.

Discussion

In the present study at Pulicat Lake, among the various size groups of oysters examined, the highest percentage of infection upto 15.8% was found in the oysters of the size 60-69 mm

and 100-109 mm, and in all other groups infection was very low. Usually the young oysters were devoid of parasitic infection. The incidence of infection was found to be higher in females. Majority of infected female oysters were found in the partly spent and spent stages. Some of the observations on the infection in the Pulicat Lake oysters revealed that the mortality of oysters was not noted as it was reported in other countries, however, as a result of heavy infection, ova or sperms were resorbed and thus castrating the gonad to an indeterminate stage. As a result, the infected oysters were found to be lean, watery, transparent and less in consistency.

Usually, the maximum percentage of infection was observed during December-January and February-March. No infection was found between August and October 1981. The sporocysts are harboured in the gonad of the oyster at first and in advanced condition they may invade to the other parts of the visceral mass such as mantle, gill and hepatopancreas. As a result of parasitism, the ripe oysters fail to reproduce and hence complete destruction of the gonad was caused by the parasitic infection. Hoshina and Ogina (1951) found that as a result of parasitism the physiology of the host is impaired, growth is retarded and reproduction is inhibited. Burton (1956) has concluded that the ova in the parasitised oysters are resorbed and become sterile.

Hoshina and Ogina (1951) reported that 10% of oysters in the Hiroshima Bay were infected with larval trematode in the gonadal tissues. Miller (1963) reported the percentage of parasitism 82.3%. Boyden (1971) has reported the trematode parasitic infection in cockles upto 13.1% and 0.41% in *Cerastoderma edule* and *C. glaucum* respectively. According to Samuel (1976) the infection at Karapad was 1%. Stephen (1977) observed 0.61% of oysters in the natural bed infected with parasites at Mulki Estuary. In the present study, the maximum percentage of infection was 17.7 during December 1981 and in all the other months the incidence of infection was very low.

The infection starts when the salinity and temperature of the lake decline considerably after the heavy North-East Monsoon. In the present study, it was also observed that the salinity lower than 2.3‰ has its effect in killing the parasitic trematodes in oysters and this agrees with the views of Galtsoff (1964) and also mentioned that the gastropods, flatworms and starfishes which are highly destructive to oysters are killed by the influx of freshwater into the estuary. Ray (1954) also observed that low salinity retarded the development of terminal infection in the laboratory population of oysters.

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