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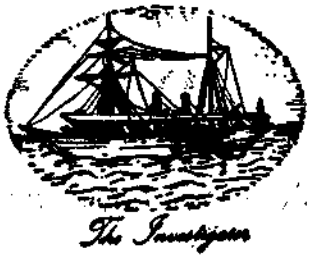

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ON THE OCCURRENCE OF SHELL BORING POLYCHAETES AND SPONGES ON PEARL OYSTER *PINCTADA FUCATA* AND CONTROL OF BORING ORGANISMS

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ABSTRACT

Boring organisms, particularly polychaetes and sponges cause considerable damage to the pearl oyster *Pinctada fucata* reared in the farm. The most serious pests are the polychaete *Polydora ciliata* and the boring sponge *Cliona vastifica*. The incidence of attacks by the boring organisms on oysters from the pearl culture farm at Veppalodai and Tuticorin Harbour and from the natural beds have been studied and the oysters from Veppalodai were found to be the most affected.

Of the several methods tried to control boring organisms, immersion of the oysters in fresh water was found to be most effective in controlling the polychaetes. Brushing the external surface of the shells with 1% formalin was found to be effective in controlling the boring sponge.

INTRODUCTION

THE FOULING and boring organisms in the pearl culture farm always pose problems. Nishii (1961), Mizumoto (1964, 1966, 1968) and Yamamura *et al.* (1969) have reported in detail the fouling and boring organisms encountered in the pearl culture farms in Japan. Alagarswami and Chellam (1976) have made a comprehensive study on the fouling and boring organisms in the pearl culture farm at Veppalodai. Shirai (1970) discusses the use of saturated salt solution for the removal of the polychaetes from the pearl oyster shells. Korringa (1952) reports some of the parasites and diseases of the oysters and the control measures. De Laubenfel (1930) has reported the use of fresh water for killing the boring sponges from the oysters. In Indian waters, no work appears to have been done on the control of boring organisms on the oysters. The experiments carried out during 1978-79 to control boring organisms on pearl oysters and the possibilities for making use of the results of the work on the farm oysters are discussed in the present paper.

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MATERIAL AND METHODS

In the Veppalodai pearl culture farm, pearl oysters were reared at a depth of 3 to 4 metres by

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raft culture method. In the Tuticorin Harbour basin rafts were moored at a depth of 8 to 10 metres. The farm oysters as well as freshly collected oysters from the pearl banks in the Gulf of Mannar were examined for the presence of shell boring organisms from January 1978 to September 1979.

Treatment with 1% formalin on the shells

After noting the presence of boring polychaetes, sponges and *Martesia* sp. on 225 oysters, experiments were conducted in five batches. The oysters were arranged in a frame net of 45 × 65 cm with equally divided horizontal compartments. Dilute 1% formalin was brushed on the right and left valves of the oysters. The oysters were kept in air for 15 minutes to 2 hours and, after washing in fresh water, transferred to normal sea water. The effect of the formalin on *Martesia* sp. and sponge was noted after keeping them in the farm for one week.

Immersion in brine solution

The oysters affected by boring polychaetes were selected and were immersed in brine solution ranging in salinity from 42.3 to 78‰ in containers of 5 litres capacity. The time of immersion was from 4 hours to 21 hours. A total of eleven experiments was conducted with 160 oysters. On immersion in a particular concentration, the tentacular movements of the polychaetes were observed. After counting the number of polychaetes in each oyster, they were transferred to normal sea water and kept in the laboratory. The oysters were examined for results after two days.

Immersion in fresh water

Two hundred oysters affected by the borers were selected and were immersed in fresh water. The immersion time ranged from 1 hour 15 minutes to 10 hours. Later they were transferred to normal sea water. The oysters were kept in the laboratory for a week for obervations.

Observations

The spionid polychaete worms *Polydora ciliata* Johnston and *Polydora* sp. and the clionid sponge *Cliona celata* and *Cliona vastifica* were the main borers on the pearl oyster *P. fucata* from the farm as well as the natural beds. Other boring polychaetes recorded were of the families Sylidae, Nereidae, Terebellidae and Cirratulidae. The pholad mollusc *Martesia* sp. made large holes in the oyster shells. The isopod *Sphaeroma* made shallow grooves superficially on the oyster shells.

In 1978, 205 oysters from the pearl banks Devi Paar, Kodamuthu Paar, Vaipar Periya Paar and Tholayiram Paar were examined. *Polydora* infestation ranged from 1-16 worms per 10 oysters. Of the 290 oysters examined during January to April, 1979, 64 (22.1%) were affected with an average of 4 worms per 10 oysters for the whole period.

In 1978, a total of 606 oysters were examined from the natural beds for sponge 6 oysters (0.99%) showed sponge boring. In the year 1979, out of 630 oysters, 0.95% were infested by sponge.

The data on the percentage of oysters affected by boring by *Polydora* and *Cliona* and the worm load on oysters from the farms at Veppalodai and Tuticorin Harbour are presented in Fig. 1. *P. ciliata* and *Cirratulus cirratus* caused considerable damage to the pearl oyster shells (Plate I).

Experimental Results on Control of Boring Organisms

Treatment with 1% formalin

The exposure for 15 minutes after brushing with 1% formalin was found effective in killing the sponges and *Martesia* sp. completely and *Polydora* suffered a mortality of 87.7% (Table 1).

Immersion in brine solution

In a salt solution of 78‰ all the polychaete worms were dead and the minimum time required was 7 hours and 40 minutes. In the lower concentrations the mortality of the oysters increased when the duration of immersion of oysters was prolonged (Table 1).

size range of 40 to 55 mm in DVM during August, 1979. 573 oysters were treated with fresh water and 148 oysters were brushed with 1% formalin. In the next month when examined 0.1% of the oysters were dead. In October and November 2.3% and 0.8% mortality was noted. The empty oyster shells were

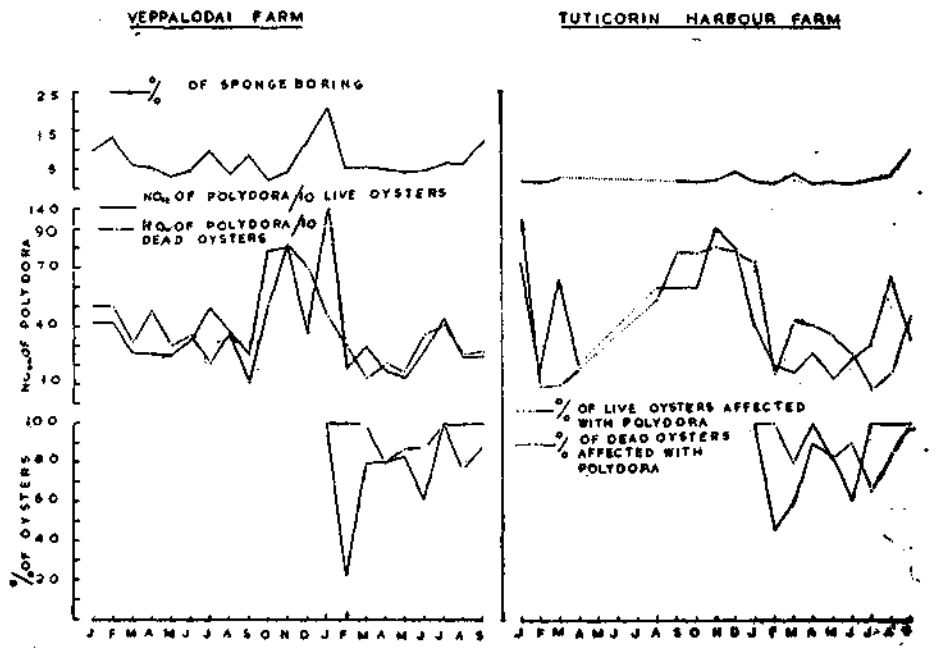

Fig. 1. Polychaete (*Polydora* sp.) and sponge boring on pearl oysters of Veppalodai and Harbour farms.

Immersion in fresh water

The oysters immersed in tap water for 1 hour and 15 minutes to 10 hours were all in good condition (Table 1). In about 6 to 10 hours all the *Polydora* as well as *Cirratulus* were killed. Feeble and decaying worms could be seen in between the shell layers and inside the blisters after four hours of immersion. Worms found on the peripheral sides of the shells and in small blisters were affected more than others by this treatment.

Application of control measures on farm oysters

A total of 721 oysters were selected for the control of borers from Harbour farm with the

examined and were without worms in the case of fresh water treated oysters. The incidence of boring by sponges ranged from 1.4 to 4.3% in the fresh water treated oysters. In the formalin treated oysters no fresh sponge attack was noticed. In both cases, the oysters were found in good condition as other healthy oysters in the farm.

Discussion

Nelson and Stauber (1940) recorded that *Polydora lingi* copiously secreted strands of thick mucus in the form of net work, which caught sediment, detritus, oyster faeces and

TABLE 1. *Experiments on the control of boring organisms on pearl oysters*

No. of oysters used	Duration Hrs	Duration Min	Treated with	Mortality of oysters (percentage)	Percentage of mortality/removal of *Polydora*	*Syllis*	*Terebellid*	*Martesia*	Cirratulid	Sponge
4	2	0	1% Formalin	100	100	X	X	X	X	X
10	1	0	Do.	100	100	X	100	X	X	100
10	0	30	Do.	10	100	X	X	100	X	100
85	0	30	Do.	12.5	46.42	X	X	100	X	X
30	0	30	Do.	10	X	X	X	X	X	100
56	0	15	Do.	Nil	87.71	X	X	X	X	X
30	0	15	Do.	Nil	X	X	X	100	X	100
225										
			Brine Solution							
18	19	0	42.3‰	Nil	100	X	X	X	100	X
25	21	0	42.3 ,,	Nil	100	100	X	X	X	X
10	9	0	55.0 ,,	Nil	100	X	X	X	X	X
10	9	30	55.0 ,,	Nil	60	X	X	X	X	X
37	4	0	60.0 ,,	Nil	90.6	X	X	X	X	X
10	8	30	60.0 ,,	Nil	100	X	X	X	X	X
10	8	15	60.0 ,,	Nil	100	X	X	X	X	X
10	8	0	71.6 ,,	Nil	50	X	X	X	X	X
10	8	0	71.6 ,,	Nil	100	X	X	X	X	X
10	7	40	78.0 ,,	Nil	100	X	X	X	X	X
10	7	50	78.0 ,,	Nil	100	X	X	X	X	X
160										
			Fresh water							
86	1	15	,,	Nil	34	X	X	X	X	X
97	3	30	,,	Nil	57.07	X	X	X	X	X
4	4	00	,,	Nil	75	X	X	X	100	X
4	6	00	,,	Nil	100	X	X	X	100	X
5	8	00	,,	Nil	100	X	X	X	100	X
4	10	00	,,	Nil	100	X	X	X	100	X
200										

X — Not present before and after the experiment.

rejected material. The decomposition of the mass covering the oysters was said to have produced so much hydrogen sulphide that it finally led in early spring to an oyster mortality sweeping over acres of Delaware beds. Korringa (1952) found in the South Carolina waters that about 54% of the edible oysters below the low water mark had mud blisters, while only 20% of the oysters above the low water mark were infected. The percentage of blisters change with the size of the oysters. It was noticed that the pearl oysters of 40 mm in DVM and less in size from the farms and natural beds had few instances of boring by *Polydora* and sponge. Mohammad (1972) indicated that a total of 4.68% of *Pinctada margaritifera* were infected with *Polydora vulgaris* in Kuwait, Arabian Gulf. The infestation was higher in older oysters (14.77%), in those with pearls (19.43%) and highest in old pearl carriers (41.2%), Mizumoto (1964) noted 7 species of polychaetes, of which *Polydora ciliata* formed 88% single and 11.4% double wormed blisters in the pearl oyster (*P. martensii*). Herdman (1905) found from the South Cheval Paar (Sri Lanka Pearl Banks) that more than 75% of the oysters were affected by *Cliona margaritiferae*. Alagarswami and Chellam (1976) observed from Veppalodai farm that a total of 93 shells (20.07%), out of 450 shells examined, were infected with the boring sponge *Cliona celata*. In January 1979, 21.05% of oysters were affected by boring sponge in the Veppalodai farm.

In Holland, a satisfactory treatment against *Polydora* was to expose the oysters either for 16 hours to fresh water or 3 hours to 0.5‰ solution of ammonium salt of dinitro orthocresol in sea water (Korringa, 1951). In the Australian waters, the *Polydora* infection in the edible oysters was checked by exposing the oysters to air and sun when the worms were quickly killed (Yonge, 1960). It was noticed in the present experiment that fresh water treatment for about 6 to 8 hours killed all the polychaete worms, *Martesia* sp. and other organisms found on pearl oysters. Funakoshi (1964) and Shirai (1970) reported the use of saturated salt solution to kill polychaetes from the pearl oysters. Immersion of the affected oysters in a saturated solution of ordinary table salt for 40 minutes was hundred per cent effective in destroying the worms. The experiments using different salinities revealed that when the concentration of the brine was lowered the time required for killing the worms was more and mortality of the oysters also set in. Since the usage of fresh water to kill the borers was cheaper and safe this process was successfully applied to the affected oysters of the harbour farm. Brushing the affected parts of the shells with 1% formalin exposing for 15 minutes to air, washing in fresh water and returning to the farm was found to be very effective.

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