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P. B. No. 2704, E. R. G. Road, Cochin-682 031, India

64. INDUCED MATURATION AND SPAWNING OF *CRASSOSTREA MADRASENSIS*

K. Nagappan Nayar, K. Satyanarayana Rao, M. E. Rajapandian and A. D. Gandhi
Central Marine Fisheries Research Institute, Cochin-682 031

ABSTRACT

One of the constraints in the development of hatchery techniques for the production of the seed of oysters on a year round basis is the difficulty in getting spawners from the natural stock throughout the year. In order to overcome this, attempts were made for induction of maturation of gonads of *Crassostrea madrasensis* and to make them spawn. After conditioning the oysters in laboratory, gonads matured within fifteen to twenty days. Spawning was effected by administering thermal stimulation. The conditioning *C. madrasensis* for maturation of gonads and effective spawning are described.

INTRODUCTION

One of the problems experienced in the operation of oyster hatchery is the difficulty in obtaining sexually ripe oysters from natural beds throughout the year for the production of viable gametes required to run the hatchery. Hence, this study was undertaken to evolve laboratory techniques for conditioning and spawning the oyster *C. madrasensis* in this region.

Similar studies were carried out by Loosanoff (1945), Loosanoff and Davis (1963), Don Maurer and Price (1968) and Dupuy et al (1977) in the American oyster *Crassostrea virginica*. These authors succeeded in inducing the precocious development of the gonads of oysters by subjecting them to higher temperature medium. They were also able to withhold the spawning of ripe oysters by lowering the temperature medium. Don Maurer and Price (op. cited) were able to hold the oyster in healthy ripe condition for 248 days.

Loosanoff and Davis (op. cited) conditioned the oysters and turned them into potent spawners within a period of 2 to 3 weeks. In our present studies the oysters have been conditioned by keeping them at water temperature below the normal sea water temperature and by intensively feeding them with mixed phytoplankters and corn meal which enabled the oysters to become sexually mature within a period of 10 to 20 days. Various techniques involved in this process and the

laboratory facilities required for these experiments have been presented in this paper.

MATERIAL AND METHODS

Oysters which appeared healthy and comprised of different age groups were collected from Tuticorin bay and used as broodstock. The physical factors such as salinity, pH and temperature of the water in the natural bed were comparable to those in the hatchery. This feature eliminates the need for acclimatising the oysters before conditioning in the hatchery. The ambient water temperature of the Tuticorin bay has been taken as the basis for the manipulation of the temperature protocol for conditioning and spawning of oysters.

Around 750 oysters of the size ranging from 60 - 110 mm, representing "0" to "2" year old oysters were selected as brood stock for conducting 3 sets of experiments at a time. It has been observed that males are dominant, among the oysters of "0" age group and females around 60% in 2 year old oysters. The brood-stock was so selected that it included atleast 30% "0" and one year age groups.

Oysters thus selected were cleaned and placed in sea water in 100 l fibre glass tanks (75 x 50 x 25 cm) on nylon knitted P. V. C. frames. Six to eight such tanks were used and in each tank 25 oysters were held. The water temperature was maintained at 22 to 24°C by using 2 units of 1.5 ton air conditioners in a 20' x 24' room. The tanks were adequately

and continuously aerated by using an air compressor. Air stones were provided to air tubes placed in each tank to filter the air. The required filtered sea water was drawn from the main filtered sea water supply system of the hatchery (25,000 l overhead tank). A storage tank (1000 l) was kept in the air conditioned room with filtered sea water for preconditioning the water temperature before use in the experiments.

The oysters were fed with mixed phytoplankters viz. the diatoms, *Chaetoceros affinis*, *Skeletonema costatum*, *Thalassiosira subtilis* and *Nitzschia closterium* and phytoflagellates, *Isochrysis galbana* and *Pavlova* spp at the rate of 3 l per oyster per day. The cell concentration of the algal diet was on an average one million cells per ml. Some batches of oysters were fed exclusively with the microgreen algae *Chlorella salina* in similar quantity with a cell concentration of 1 to 1.2 million cells per ml. Artificial feed such as corn flour suspension was provided for some batches of oysters. The corn flour was dissolved in water,

boiled and cooled and preconditioned to the temperature of the conditioning room before feeding the oysters. 400 mg of corn flour was provided as feed per oyster per day.

The tanks in which the oysters were reared were cleaned daily to remove dirt and faeces and filled with fresh sea water before commencing the feeding. At the start of the experiments a sample of 5 to 10 oysters were opened and the stages of maturation determined by smear studies. After a period of ten days a few oysters were opened to determine the maturity stage. If the gonads of oysters did not reach desired mature stage the conditioning process was continued.

When the oysters were found to be sufficiently mature they were transferred to a 100 l perspex tank (spawning module - Fig 1) containing filtered sea water with the temperature maintained at 2 - 4° C above the ambient level viz. 4 - 8°C above the temperature maintained during conditioning process. The water temperature in the spawning tank was regulated

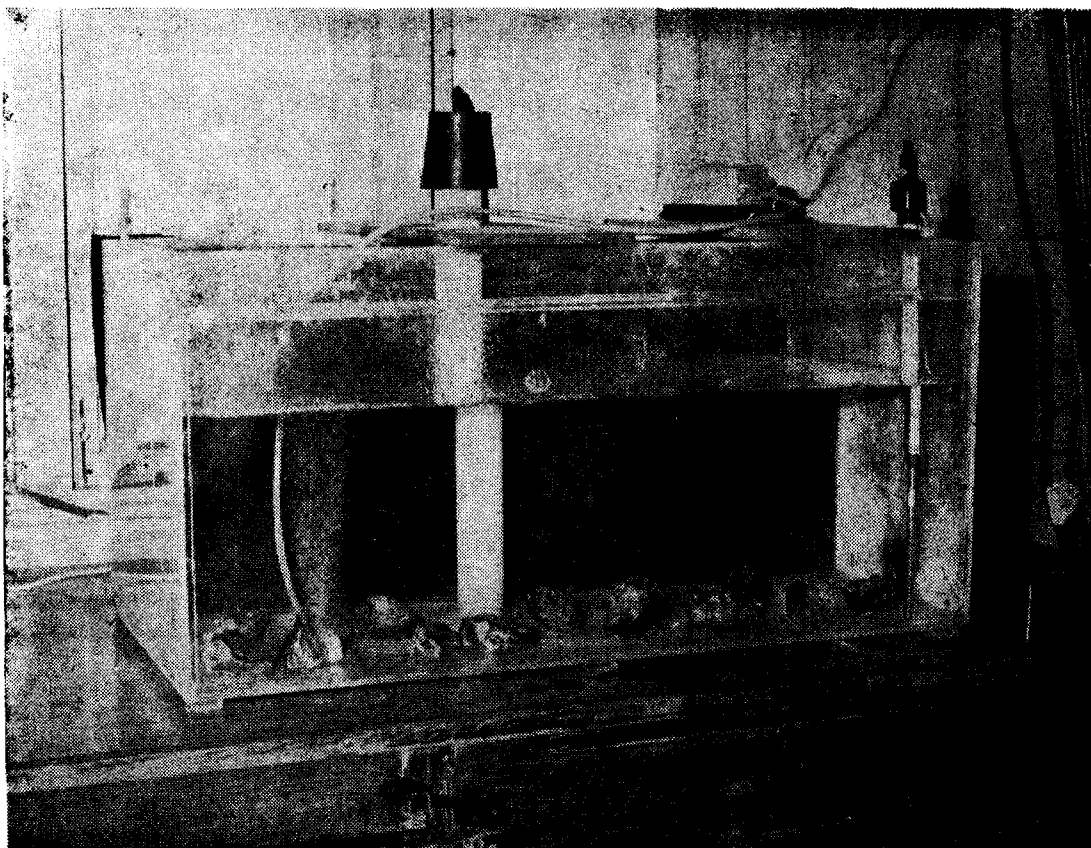


Fig. 1 Spawning module

to the desired higher level with the help of an insulated electrical heater controlled by a thermostat. The tank was also well aerated. In less than one hour stimulated by the sudden rise in temperature the oysters spawn. Other methods for inducing spawning oysters like manipulating the pH of water adjusted from 4.5 to 5.0 or at higher levels from 9 to 10 did not produce desirable results. However, introduction of sperm suspension obtained from a ripe male oyster into the tank helped to induce spawning in 20 to 30% oysters.

RESULTS AND DISCUSSION

Seven hundred and fifty oysters in maturing and spent stages were utilised for these studies. On conditioning for 10 to 20 days the oysters showed matured gonads. Three sets of experiments involving 10 batches for each set, were conducted between April 1986 to September 1986. The different sets of experiments were carried out in order to assess the relative efficiency of the diets in conditioning the oysters. Tables 1, 2 & 3 show the incidence of spawning in the conditioned oysters during these experiments.

TABLE 1. *Spawning of Crassostrea madrasensis conditioned by feeding with mixed phytoplankton*

Sl. No. of expt.	Period of conditioning in days	No. of oysters tested	No. of oysters spawned		% of oysters spawned
			Male	Female	
1	20	25	8	3	44
2	15	25	4	2	24
3	17	25	5	2	28
4	12	25	7	4	44
5	16	25	3	0	12
6	11	25	9	3	48
7	10	25	8	5	52
8	16	25	9	4	52
9	10	25	7	4	44
10	18	25	9	5	56
Average value	14.5	25	6.9	3.2	40.4

TABLE 2. *Spawning of Crassostrea madrasensis conditioned by feeding with microgreen algae Chlorella salina*

Sl. No. of expt.	Period of conditioning in days	No. of oysters tested	No. of oysters spawned		% of oysters spawned
			Male	Female	
1	17	25	3	0	12
2	13	25	4	0	16
3	18	25	8	3	44
4	17	25	0	0	0
5	10	25	3	1	16
6	13	25	4	1	20
7	16	25	0	0	0
8	13	25	2	0	8
9	11	25	0	0	0
10	15	25	2	3	20
Average value	13.3	25	2.6	0.8	13.6

TABLE 3. *Spawning of Crassostrea madrasensis conditioned by feeding with corn flour*

Sl. No. of expt.	Period of conditioning in days	No. of oysters tested	No. of oysters spawned		% of oysters spawned
			Male	Female	
1	10	25	0	0	0
2	15	25	3	5	32
3	12	25	0	0	0
4	17	25	4	2	24
5	20	25	7	4	44
6	10	25	0	0	0
7	20	25	5	2	28
8	10	25	2	0	8
9	15	25	2	1	12
10	17	25	5	2	28
Average value	14.6	25	2.8	1.6	17.6

Among the conditioned oysters the ones which were fed with mixed phytoplankton registered high percentage of spawning (40.47%). The oysters which were fed with the microgreen algae *Chlorella salina* and corn flour have registered very low percentage of spawning when compared to the former. It

looks advisable to resort to mixed phytoplankton feeding of oysters while conditioning.

Stimulating the conditioned oysters to spawn appears to be best done by thermal stimulation process. As is universally known and practised, introduction of sperm suspension in holding tank containing ripe females will activate the squirting of matured eggs.

REFERENCES

- DON MAUSER AND K. S. 1968. Holding and spawning Delaware Bay oysters (*Crassostrea virginica*) out of season. 1. Laboratory facilities for retarding spawning. *Proc. Natl. Shellfish.* 58 : 71-77.
- LOOSANOFF, V. L. 1945. Precocious gonad development in oysters induced in midwater by high temperature. *Science.* 102 : 124-125.
- LOOSANOFF, V. L. AND H. C. DAVIS. Rearing of bivalve molluscs. *In Advances in Marine Biology* 1 : 1-136. Russel, F. S (ED), Academic press, INC; London.
- DUPUY, L. J., N. J. WINDSOR AND C. E. SUTTON. 1977. Manual for design and operation of an oyster seed hatchery for the American Oyster *Crassostrea virginica*. *Virginia Inst. Mar. Sci. Spl. Rep.*, 142 : 1-104.