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PENAEID LARVAL REARING IN THE CENTRE OCEANOLOGIQUE DU PACIFIQUE

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CONTENTS

The Centre Océanologique du Pacifique (COP), a branch of the Centre National pour l'Exploitation des Oceans (CNEXO), already described in other chapters of this handbook, has been working since 1973 on the culture of penaeid shrimp.

This chapter describes the larval rearing technique perfected at the COP and used for seven years on 8 species: P. aztecus, P. japonicus, M. ensis, P. merguiensis, P. indicus, P. monodon, P. vannamei and P. stylirostris.

I. MATERIAL AND METHODS

The COP has two hatcheries. The first one is used mainly for experimental purposes and is equipped with eight 500 liter tanks and three 2 m^3 tanks. Two 500 liter tanks more can be operated on a closed system with biological filtration. The second hatchery is used for production and has four 800 liter tanks, three 2 m^3 tanks and one 10 m^3 tank.

A. Larval Rearing Tanks

All larval rearing tanks are made of fiberglass and polyester resin.

1. 500 liter tanks (Figure 1)

In these cylindroconical tanks, the water renewal is

made through a lateral overflow connected by a flexible hose to an immersed filter. Emptying the tank is done with a siphon. The aeration is ensured by a central aerator. These tanks are located within a concrete tank with running sea-water as a temperature regulator.

2. 800 liter and 2 m^3 tanks (Figure 2)

These cylindroconical tanks have a 45^o slope at the bottom. The drain is centrally located and operated by an exterior valve. A vertical PVC pipe is screwed on the central drain and has a quarter turn opening system half-way up. For water changes, a filter fitted with a mesh adapted to the size of the larvae (205, 335, 500μ) is slipped on this pipe and the opening system operated so as to empty half of the tank.

3. 10 m^3 tank

A 10 m^3 tank, elongated and U-shaped, has been tried and is presently in use in the production hatchery. This tank uses the same principle as the 2 m^3 tanks; the center filter being connected to the drain by a flexible hose and immersed horizontally in the tank.

B. Sea-water and Air Networks

1. Sea water

The sea water is pumped from the lagoon in front of the COP at a depth of 5 meters and has oceanic characteristics: temperature from 25° to 29° C, salinity of 35 ppt and a pH of 8.2. This water is filtered through 5 µ and 0.5 µ cartridges and distributed to the larva rearing tanks without any other treatment. Heating is not necessary but could be useful in the cold months to shorten the larval period.

2. Air

The general air system of the COP is fed by a blower with a 600 m^3/hour capacity. The air is delivered to the larval rearing tanks through air-stones at 0.2 bar pressure.

C. Algae

The algae culture methods used at the COP have been described in another chapter of this handbook. For penaeid larvae, three species of algae are used: Isochrysis sp., Chaetoceros gracilis and Platymonas sp. These algae are distributed to the rearing tanks through a 25 µ mesh sieve to eliminate algal clumping that sometimes occurs in culture.

D. Artemia

A special room with five 150 liter tanks is used for Artemia nauplii production. The hatching tanks have a conical translucent bottom equipped with a valve. To recover the nauplii, aeration is stopped and the tank covered with a black top. The

valve is opened and the nauplii, which are concentrated at the bottom, are washed through a 207μ-sieve that holds back the remaining unhatched cysts.

E. Treatments

1. Fungicide

Contamination of larvae by fungi (Sirolpidium sp. and Lagenidium sp.) is frequent and a continuous preventive treatment is necessary[1]. Treflan(R), diluted to 5 ppm solution, is distributed constantly.

2. Antibiotics

Antibiotic treatments are used to control bacterial contamination, which result in necrosis of the larvae and often heavy mortalities[1]. P. monodon is particularly sensitive to bacterial necrosis. Many drugs have been tested but Chloramphenicol, the most effective, is used either preventively with doses of 2 to 6 ppm every two days according to the larval stages or curatively with doses of 2 to 10 ppm.

F. Daily Observations

Morning and afternoon, the following observations are made: counting of the larvae in a one liter sample; observation of color, behaviour and appearance of larvae; determination of larval stage; determination of presence of moults; determination of presence of weak and dead larvae; determination of necrosis and fungi; feeding counts of algae and artemia nauplii.

II. LARVAL REARING

A. Technique

The technique presently in use is derived and adapted from the Galveston method [2-5]. Larvae are reared at high density (100 to 120 larvae/l) until P_4 (4th day after the first post-larva appear).

The normal larval culture sequence, i.e. without any pathological problem or incident, does not vary significantly from one species to another. This sequence is illustrated in Table 1, which should be used as the primary guideline for treatment and care of larval shrimp.

B. Results

The survival between nauplius stage and the post-larvae P_4 is from 65 to 80 % for P. merguiensis, P. indicus, P. vannamei, and P. stylirostris. For P. monodon, the survival is lower, around 45 %, because of their susceptibility to bacterial attacks. The pathological mortalities are mainly from fungal attacks, bacterial necrosis and the presence of bad-shaped nauplii[1]. Other diseases have been observed, especially those related to the nutrition of the larvae i.e.:

1. Larvae that don't feed at stage Zoea 1;
2. Larvae with a black stomach: a black plug is present in the stomach at the Z_1 or Z_2 stage and obstructs the digestive tract;
3. Larvae with a grey stomach: the algae ingested look

like they are not digested.

For all these diseases, the therapy consists of antibiotic treatments and from the Zoea 3 stage onward complete draining of the tanks can be done. Larvae are retained on a sieve and put in a bowl where separation between live and dead larvae is done more easily.

The COP is also experimenting with the substitution of inert particles (microgranules and yeasts) for live food (algae and artemia).

All the results described in this paper concern larvae coming from broodstock completely reared in captivity through successive generations. In hatcheries which are working with broodstocks constituted from adults caught in the wild, the survival is higher, around 80 %. It seems the quality of the eggs obtained from captive broodstock is not as good as that of eggs obtained from wild animals, probably due to some deficiency in the feed.

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TABLE 1. Larval culture sequence.

			Feeding			Treatments	
Day	Stage	Isochrysis	Chaetoceros	Artemia	Water exchange	Triflan	Antibiotic
			cells/ml	Nauplii /ml		ml/m^3	ppm
D0	W-N	-	-	-	NO	20	-
D1	N	-	-	-	NO	2 x 20	-
D2	N.Z_1	50,000	-	-	NO	2 x 30	-
D3	Z_1	80,000	20,000	-	NO	2 x 30	2
D4	Z_1-Z_2	80,000	20,000	-	NO	2 x 30	-
D5	Z_2	50,000	50,000	-	NO	2 x 30	2
D6	Z_3	50,000	50,000	-	NO	2 x 40	-
D7	Z_3-M_1	-	80,000	-	TOTAL	2 x 40	-
D8	M_1	-	50,000	0.2	1/2	2 x 40	-
D9	M_2	-	50,000	0.2	2/3	2 x 50	4
D10	M_3	-	30,000	0.5	2/3	2 x 50	-
D11	M_3-P_1	-	30,000	1	2/3	2 x 50	6
D12	P_1	-	-	1	2/3	2 x 50	-
D13	P_2	-	-	2	2/3	2 x 50	-
D14	P_3	-	-	5	TOTAL	2 x 50	10
D15	P_4		HARVESTING				

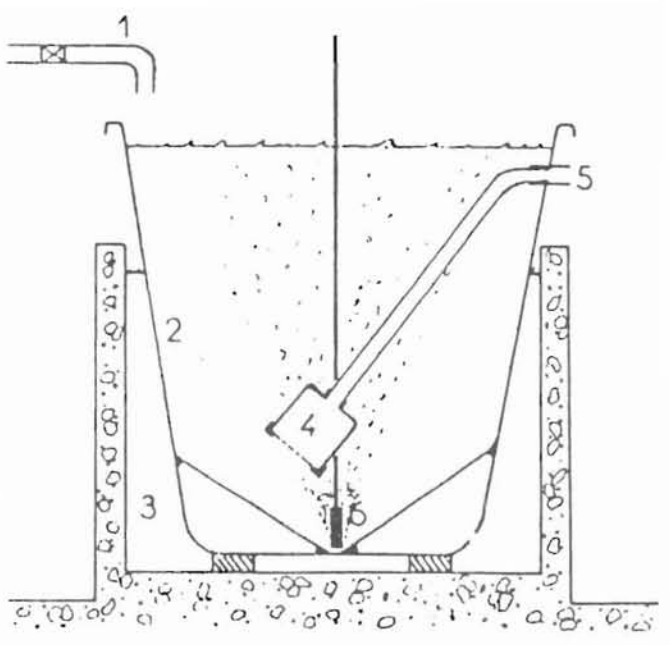

Figure 1. 500 liter larval rearing tank

1. Filtered sea-water inlet
2. Larval rearing tank
3. Concrete tank
4. Immersed filter
5. Lateral overflow
6. Air-stone

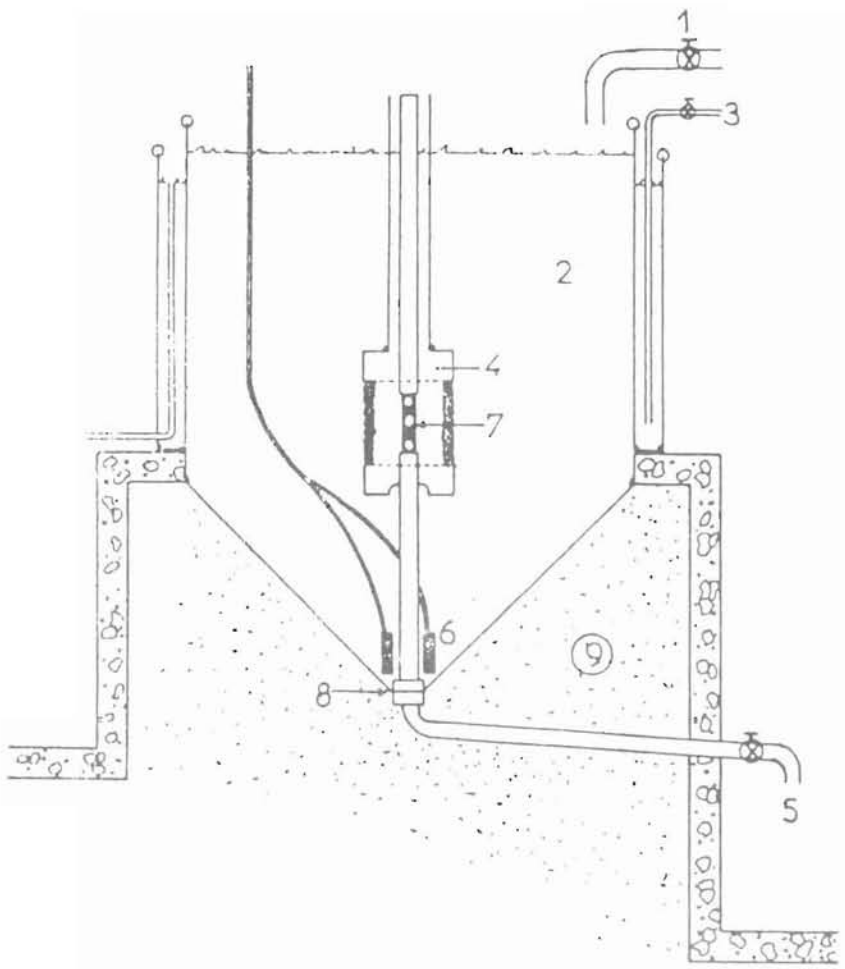

Figure 2. 2 m^3 tank

1. Filtered sea-water inlet
2. Larval rearing tank
3. Constant temperature bath water inlet
4. Central filter
5. Water outlet
6. Air-stones
7. Quarter turn opening system
8. Drain

DAY	STAGE	FEEDING			WATER EXCHANGE	TREATMENTS	
		Isochrysis cells/ml	Chaetoceros cells/ml	Artemia nauplii/ml	per day	Treflan ml/m3	Antibiotics ppm
D_o	E.N	--	--	--	--	20	--
D_1	N	--	--	--	--	2X20	--
D_2	$N-Z_1$	50,000	--	--	--	2X30	--
D_3	Z_1	80,000	20,000	--	--	2X30	2
D_4	Z_1-Z_2	80,000	20,000	--	--	2X30	--
D_5	Z_2	50,000	50,000	--	--	2X30	2
D_6	Z_3	50,000	50,000	--	--	2X40	--
D_7	Z_3-M_1	--	80,000	--	TOTAL	2X40	--
D_8	M_1	--	50,000	0.2	1/2	2X40	--
D_9	M_2	--	50,000	0.2	2/3	2X50	4
D_{10}	M_3	--	30,000	0.5	2/3	2X50	--
D_{11}	M_3-P_1	--	30,000	1	2/3	2X50	6
D_{12}	P_1	--	--	1	2/3	2X50	--
D_{13}	P_2	--	--	2	2/3	2X50	--
D_{14}	P_3	--	--	5	TOTAL	2X50	10
D_{15}	P_4	HARVESTING					