INNOVATE SEAFOOD PRODUCTION: MARICULTURE OF JUVENILE MURICID SNAIL, *CHICOREUS RAMOSUS*

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ABSTRACT

The marine snail *Chicoreus ramosus* (L.) was mass produced in fibre-glass and concrete tanks with running, filtered sea water, and tree oysters, *Isognomon* sp., as food throughout the culture period. Snails grew to 6-7 cm shell length in *ca.* half a year. The juveniles cook easily, and can be served in-the-shell. A test panel found the juveniles delicious, with tender, slightly sweet flesh, and a high potential as seafood for human consumption. Production cost was 50 baht (= 2 US dollars) per kg juvenile snail. The flesh yield was 25-30 % of the total weight. Feasibility of the production is discussed.

INTRODUCTION

Culture of the giant muricid snail *Chicoreus ramosus* has been successfully conducted in Thailand in the past few years (Steenfeldt & Bussarawit 1992; Nugranad 1992; Nugranad *et al.* 1994). Hatchery-produced juveniles were raised in culture tanks up to marketable adult size. Survival and growth rate were good and the culture method simple. Juveniles reached 6-7 cm shell length within half a year. That is, the same size as other gastropods being utilized for human food, such as *Babylonia* spp.

Marketable size (shell length) of snails harvested in nature is 20 cm or more, and the age is about 2-3 years. Mariculture to this size is not attractive. It takes too long time before harvest is possible. In addition, the flesh is very tough unless specially cooked (Hylleberg 1992; Patterson *et al.* 1994). The aim of this study is to show the prospects of tank production of juvenile *Chicoreus ramosus*.

MATERIALS AND METHODS

Egg collection and larval rearing

Egg capsules were naturally deposited by *Chicoreus ramosus* in an outdoor broodstock holding tank; a 5 tons concrete raceway. Collected capsules were cleaned and transferred into hatching tanks as described by Nugranad *et al.* (1994). Hatched veligers were reared in 300-1000 litre fibre-glass tanks with 32-34 ppt sea water filtered through 1 µm filters, provided with gentle aeration and mixed phytoplankton, *Isochrysis galbana*, *Chaetoceros calcitrans* and *Tetraselmis* sp. at concentrations of 2-2.5 x 10^3 cells/ml. Sea water was changed in the rearing tanks every second day. Temperature ranged from 27-29 °C.

Juvenile culture

When *Chicoreus* began to settle, bivalve spat and small barnacles were provided as food. A sea water flow of 1-2 l/min was established when no swimming veligers were observed in the rearing tank. Juveniles > 2 mm shell length were transferred for rearing in a flow-through system in concrete raceways or rectangular fibre-glass tanks. The bivalve *Isognomon* sp. (tree oyster; Fig. 1) was used as food. Eaten bivalves were checked and removed every morning, along with siphoning debris and faeces out of the culture tanks. Stocking density was 7-10 juveniles/100 cm^2 for lengths < 1 cm., and 3-5 juveniles/100 cm^2 for lengths > 1 cm. Cannibalism was reduced by sorting of snails according to size. It was previously observed that the smaller snails often preyed on the larger ones. Shelters made of PVC were put in the tanks to provide hiding space for the snails.

Food and total consumption

Tree oysters were obtained from the oyster growing area in Prachuap Khiri Khan. Total weight and soft body weight of the *Isognomon* were determined. Shell diameter was measured from the hinge to the opposite

shell margin. The number of the bivalves eaten by the juveniles was checked daily. The total amount of food ingested was estimated from the relationships between total weight and soft body weight of the bivalves. Individual feeding experiments were not carried out.

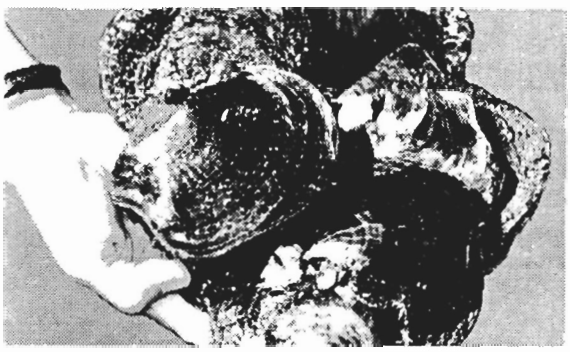

Figure 1. The bivalve *Isognomon* sp. used for feeding *Chicoreus ramosus*.

RESULTS AND DISCUSSION

Growth and Survival

The veligers grew from 750 µm mean shell length (newly hatched larvae) to about 2 mm in 1 month. Survival rate from hatching to settlement was 30-40 %. Provided with enough food, juveniles grew very fast, and reached a length of 6-7 cm in 6-7 months. After a year, the length was 8-10 cm. Growth of the cultured snails is shown in Fig. 2.

Juveniles had very high survival when abundant food was provided. Over-feeding was necessary to prevent cannibalism which otherwise was common. In addition, frequent sorting of the juveniles according to size was necessary for a high survival (Table 1).

Food Consumption Rates

Three size classes (large, medium and small) of *Isognomon* were used for feeding the juveniles. The soft bodies constituted between 15.18-15.85 % of the total weight (Table 2).

Table 3 shows the consumption estimated from the average daily feeding in culture tanks. The amount of live food needed by 10,000 juveniles per day is calculated assuming 15 % bivalve flesh of the total bivalve weight.

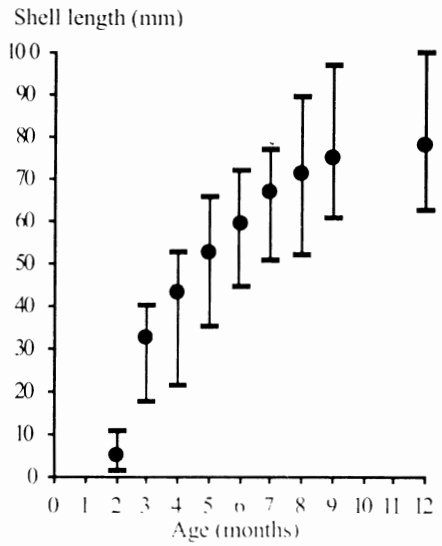

Figure 2. Growth of juvenile *Chicoreus ramosus* in tank culture; vertical bars show the maximum and minimum sizes.

Table 1. Survival rate of the juveniles *Chicoreus ramosus* in mass culture.

Shell length (cm)	Survival %
< 0.6	94.84
0.6 - 2.4	96.35
2.5 - 4.5	99.57
> 4.5	100.00

Table 2. *Isognomon* sp. Length and weight relationships for the three size classes.

Isognomon	Number	Shell length (cm)			Total Weight	Flesh	Flesh
Size Group	per kg	Min	Max	Mean	(g)	(g)	(%)
Large	10-35	7.7	11.6	8.85 ± 0.8	45.1 ±12.1	6.88	15.25
Medium	60-190	4.9	7.2	5.99 ± 0.6	11.5 ± 2.9	1.83	15.85
Small	200-1000	2.5	4.4	3.51 ± 0.4	2.2 ± 0.8	0.34	15.18

Table 3. Consumption of different sized *Chicoreus ramosus* feeding on *Isognomon* sp.

Chicoreus Shell length (cm)	Age (months)	Weight (g)	Food consumed (g bivalve flesh needed/snail/day)	*Isognomon* soft body needed per 10,000 juv. *Chicoreus* (kg/day)
1.5-3.0	2-3	no data	0.02	1.3
3.4-5.5	4-5	no data	0.57	38.0
5.8-7.3	6-7	16-40	1.88	125.4
9.1-17.0	<24	50-500	2.39	159.4
16.6-26.0	>24	700-2,050	6.46	430.9

Feasibility

The shell length increases from 1.5 cm to 6-7 cm length in about 6 months. Assuming 100 % survival, about 6,000 kg of live food is needed to produce 10,000 juveniles of marketable size. The food cost is 9000 baht at present price level of *Isognomon* (1.5 baht/kg = 4 US cents/kg). The total weight of 10,000 juveniles is 250 kg, which gives a food cost of 36 baht per kg juvenile snail. Other costs are roughly estimated at 14 baht per kg. In total about 50 baht/kg.

If the product has a high market value it appears profitable to grow juveniles in tank culture in spite of the high cost of food. However, it remains to be shown if this is the case. Considering the good taste of young snails, it appears likely that the product may be able to enter the seafood market at a price similar to that of *Babylonia areolata* which costs between 80-150 baht/kg. Yet, before a final conclusion can be reached, it is necessary to investigate other factors influencing the feasibility. For this study, live food could be purchased from oyster farmers in Prachuap Khiri Khan. But, large scale production may lead to problems of finding enough food since the muricids only will eat live food.

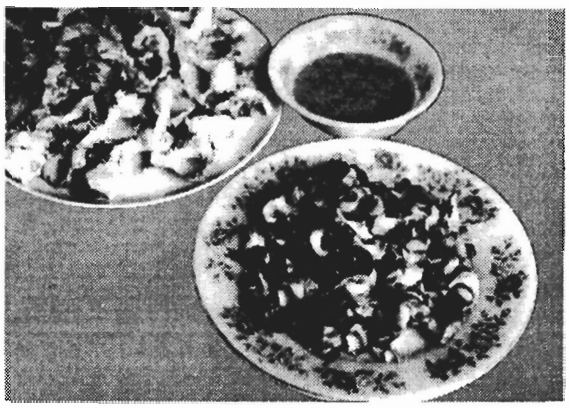

Figure 3. *Chicoreus ramosus*, 6-7 months old, steamed, and served as appetizing dish with Thai-style chilli sauce.

ACKNOWLEDGEMENTS

The mollusc hatchery staff of the Prachuap Khiri Khan is gratefully acknowledged for their help in taking care of the broodstocks, veligers, and juveniles. The study was supported by DANIDA through the TMMP project.

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