

Nursing of Babylon Snail (*Babylonia areolata* Link, 1807) from Veliger Larvae to Early Juveniles Using Different Materials Attached on Edge of Nursing Tanks for Prevention of Crawling Out

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ABSTRACT

Nursing of Babylon snail (*Babylonia areolata* Link, 1807), from veliger larvae to 60 days old early juveniles using different materials attached on the edge of the nursing tank to prevent the juveniles crawling out from the tank was conducted at Rayong Coastal Fisheries Research and Development Center. Five treatments with five replications were set up for the experiment (T1-T5), T1 : control treatment (no material); T2 : thick plastic sheet; T3 : thin plastic sheet; T4 : nylon net sheet and T5 : foam rubber sheet. The average final shell length of Babylon snail in five treatments was 12.16 ± 0.93 , 9.43 ± 0.35 , 9.83 ± 0.47 , 8.47 ± 0.40 and 10.99 ± 0.31 mm, respectively. The average survival rates were 1.22 ± 0.51 , 13.38 ± 0.61 , 10.14 ± 0.60 , 21.58 ± 2.43 and 6.45 ± 1.10 %, respectively. The average final shell length and the average survival rates of all treatments were significantly different at $p < 0.05$. Nylon net sheet is the best material for preventing the juveniles crawling out from the nursing tank.

Key words: *Babylonia areolata*, veliger larvae, early juvenile, attached-edge-material

INTRODUCTION

Babylon snail (*Babylonia areolata* Link, 1807) is an economically important aquatic species due to its popularity for domestic and international consumption and its quite high price at around 300-350 Baht/kg. Commercial culture of this species faced the problem of low survival rate (0.34 - 9.82 %) during the crawling stage, veliger larvae to early juvenile, at the sized of 5-10 mm (Poomtong and Nhongmeesub, 1996; Singhagraiwan, 1996; Siripan and Wongwiwatanawute, 2000; Chaitanawisuti and Kritsanapuntu, 2002; Sriveerachai *et al.*, 2005; Srimukda *et al.*, 2005). This due to its behavior after reaching the juvenile

stage at the shell length less than 5 mm because it will crawl up to the tank wall and cannot move back to the water. Thus a large number of snail juveniles died along the edge of the nursing tank (Chaitanawisuti *et al.*, 2004). This study was aimed to find out the suitable materials to attach at the edge of the nursing tank to reduce the mortality of crawling out from the tanks.

MATERIALS AND METHODS

Duration and location

The study was conducted in a hatchery at Rayong Coastal Fisheries Research and Development Center, Coastal Fisheries Research

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and Development Bureau, Department of Fisheries during April-June 2006.

Experimental design

The completely randomized design was used for the experiment. There were 5 treatments using different materials attached to the edge of the nursing tanks to prevent juveniles crawling out. The 1st treatment (T1) was a control treatment (no material). The 2nd treatment (T2) used the thick plastic sheet, the 3rd treatment (T3) used the thin plastic sheet, the 4th treatment (T4) used the nylon net sheet and the 5th treatment (T5) used the foam rubber sheet. All materials were 5 cm in width. Each treatment consisted of 5 replications.

Methods

Water and tank preparation

Chlorine was applied, 20 g/m³, for water treatment. The water was left for 10 days before use.

Twenty five of 50 l fiber glass tanks with 0.45 m in diameter were used as nursing tanks. Five tanks were assigned to each treatment.

Babylon snail preparation

Hatching basket with 5 days old eggs of Babylon snail was put in a 2 m³ cement tank, sea water, 32 ppt salinity, was filled to 1.5 m³. After hatching, the basket was removed and veliger larvae were nursed further for 5 days.

On the 6th day, veliger larvae were distributed into each tank with a density of 8,000 larvae/tank. All experimental tanks were filled up with 40 l of sea water, 32 ppt salinity, given the final density of 200 larvae/l (Siripan and Wongwiwatanawute, 2000).

Experimental management

Feeding strategies

Five days after hatching, the veligers were fed with *Chaetoceros calsitrans* at a density of 20,000 cell/cc twice daily. Then the veligers were transferred to 50 l experimental tanks and fed with *Chaetoceros calsitrans* and *Tetraselmis*

sp. with a ratio of 1:1 at a density of 20,000 cells/cc twice daily (Sutthinon and Yaemkasem, 2005).

At the crawling juvenile stage, the snails were fed with early hatched frozen artemia for 2 weeks twice daily. Subsequently, their food was changed to adult frozen artemia for 2 weeks twice daily. On the 5th week, the snails were fed with small pieces of fish meat (*Selaroides leptolepis*) once daily. The fish meat was removed when the snails stopped feeding.

Five days before the snail reached the crawling juvenile stage, fine sand, 350 microns in size, was applied on the bottom of the nursing tank, 2 mm in depth, when the snails aged 30 days, sand was added to the depth of 1 cm (Sutthinon *et al.*, 2006).

Water quality management

Water quality was analyzed weekly as follows.

- Water salinity was measured with a Reflectosalino meter Model ATAGO (S-10E).
- Temperature was measured with a thermometer.
- pH was measured with a pH meter Model Denver Strument (50).
- Dissolved oxygen was measured with a DO meter Model YSI (550 DO).
- Alkalinity was analyzed using titration method (APHA, 1980).
- Total ammonia and nitrite-nitrogen were analyzed with a UV-VISIBLE SPECTROPHOTOMETER Model SHIMADZU (UV-1601) (Grasshoff, 1976).

During the veliger stage, the water was replaced 30-50 % daily before feeding. During early juvenile stage, the water was replaced 80-100 % daily after feeding.

Data collection

Velliger larvae and early crawling juveniles were randomly sampled, 10 snails per tank, to measure the initial shell length under the microscope. The 30 days old and 60 days old

snails were randomly sampled at 10 % per tank to determine the body weight, the shell width and the shell length. At the end of the experiment, all juveniles were counted to calculate the survival rate.

Statistical analysis

Data were analyzed by one way ANOVA. Means were compared using the Duncan's New Multiple Range Test at a significant level of $P < 0.05$ (Phupat, 2004).

RESULTS

Growth and survival

After nursing from veliger larvae to early juvenile at age of 60 days, body weight, shell width, shell length, average daily gain (ADG) and survival rate were found significantly difference

among treatments ($P < 0.05$) (Table 1 and Figure 1).

Water quality

Almost average water quality parameters during nursing period were in an acceptable range for snail growth except for total ammonia and nitrite-nitrogen which were rather high. Average salinity and temperature were not significantly different ($P > 0.05$), while average pH, alkalinity, total ammonia and nitrite-nitrogen were significantly different ($P < 0.05$) among treatments as shown in Table 2.

CONCLUSION AND DISCUSSION

Babylon snails, *B. areolata*, were reared from veliger larvae to 60 days juveniles. Four different materials were used to attached on the edged of rearing tanks to prevent the snails from

Table 1 Growth and survival of *Babylonia areolata* from veliger larvae to 60 days old early juveniles nursed in tanks using different materials attached on the edge of tanks.

Parameters	Treatments				
	T1(control)	T2(thick plastic)	T3(thin plastic)	T4(nylon net)	T5(foam rubber)
Final weight(gm)	0.52 ± 0.11^c	0.28 ± 0.02^a	0.29 ± 0.02^a	0.24 ± 0.03^a	0.39 ± 0.03^b
Final width(mm)	6.41 ± 0.52^b	5.02 ± 0.26^a	4.99 ± 0.16^a	4.84 ± 0.41^a	6.01 ± 0.44^b
Initial length(mm)	0.49 ± 0.01^a	0.49 ± 0.01^a	0.49 ± 0.01^a	0.49 ± 0.01^a	0.49 ± 0.01^a
Final length(mm)	12.16 ± 0.93^d	9.43 ± 0.35^b	9.83 ± 0.47^b	8.47 ± 0.40^a	10.99 ± 0.31^c
ADG(mm/day)	0.16 ± 0.01^d	0.12 ± 0.01^b	0.13 ± 0.01^b	0.11 ± 0.01^a	0.14 ± 0.01^c
Survival rate (%)	1.22 ± 0.51^a	13.38 ± 0.61^d	10.14 ± 0.60^c	21.58 ± 2.43^e	6.45 ± 1.10^b

Within each row, means $\pm$ S.D. bearing different superscripts are significantly different ($P < 0.05$).

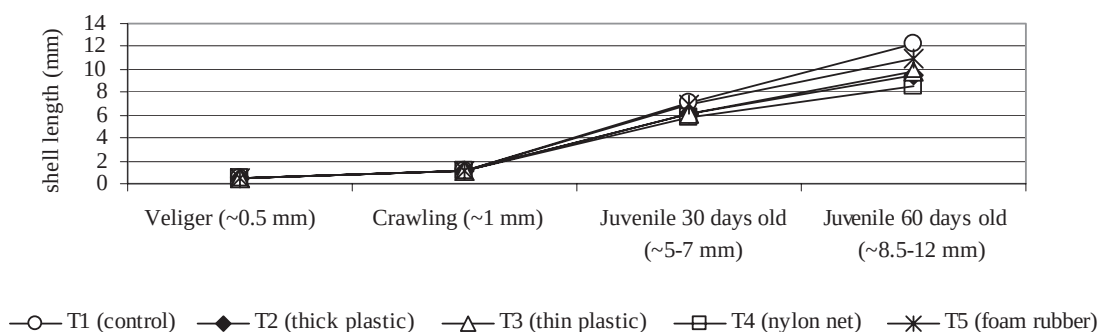


Figure 1 Shell length of *Babylon areolata* from veliger larvae to 60 days old early juveniles nursed in tanks using different materials attached on the edge of tanks.

Table 2 Average water quality during nursing *Babylonia areolata* from veliger larvae to 60 days old early juvenile.

Parameters	Treatments				
	T1 (control)	T2 (thick plastic)	T3 (thin plastic)	T4 (nylon net)	T5 (foam rubber)
Salinity (ppt)	34.21 ± 0.05 ^a	34.17 ± 0.04 ^a	34.13 ± 0.07 ^a	34.16 ± 0.04 ^a	34.18 ± 0.03 ^a
pH	7.99 ± 0.01 ^d	7.85 ± 0.02 ^b	7.83 ± 0.01 ^b	7.80 ± 0.03 ^a	7.88 ± 0.02 ^c
Alkalinity (mg/l as CaCO ₃)	114.57 ± 3.14 ^c	105.53 ± 1.72 ^{ab}	103.98 ± 3.09 ^{ab}	102.08 ± 1.79 ^a	107.43 ± 2.49 ^b
DO (mg/l)	6.09 ± 0.03 ^c	6.05 ± 0.01 ^{ab}	6.03 ± 0.04 ^a	6.07 ± 0.01 ^{bc}	6.08 ± 0.01 ^{bc}
Total ammonia (mg/l)	0.34 ± 0.02 ^a	0.73 ± 0.09 ^{cd}	0.64 ± 0.07 ^c	0.77 ± 0.12 ^d	0.57 ± 0.05 ^b
Nitrite-Nitrogen (mg/l)	0.17 ± 0.03 ^a	0.31 ± 0.02 ^b	0.34 ± 0.02 ^{bc}	0.35 ± 0.03 ^c	0.32 ± 0.04 ^{bc}
Temperature (°C)	28.40 ± 0.82 ^a	28.70 ± 0.76 ^a	28.60 ± 0.74 ^a	28.50 ± 0.79 ^a	28.70 ± 0.57 ^a

Within each row, means ± S.D. bearing different superscripts are significantly different (P<0.05)

crawling out. The snail growth rate was inversely related to the survival rate. The highest survival rate, 21.58 %, was observed in T4 on which the edged nursing tank was attached with nylon net sheet. However, the lowest growth rate was obtained in this treatment during to the highest snail density. The total ammonia and nitrite-nitrogen were rather high in T4. The stress due to poor water quality, in T4, may lead to the reduction in feeding rate.

The higher survival rate of the snails in T4 may come from the rough surface of nylon net sheet which made it difficult for the juveniles to crawl up successfully. On contrary, the juveniles may move faster on smoother surfaces of other materials. Thus, these juveniles become dead because of desiccation upon reaching the top of the nursing tanks. Our results were similar to that of Sutthinon *et al.* (2006) with a survival rate of 21.13 %. Their results showed that nursing *Babylonia areolata*, from veliger larvae to 60 days old early juveniles, in tanks with nylon net attached on the edge of tanks to prevent crawling out and fine sand substrate filled at the bottom of tanks gave higher survival than without sand substrate. Nursing with sand substrate probably reduced the stress because the habitat was similar to the nature (Abbott and Dance, 1989 ; Singhagraiwan, 1996;

Chaitanawisuti and Kritsanapuntu, 1998; Chaitanawisuti and Kritsanapuntu, 2002; Chaitanawisuti *et al.*, 2004) and *Zoothamnium* sp. attaching on the snail shell can be removed easily. They also suggested that filling sand as a natural substrate, five days before the veliger larvae metamorphosed into the crawling juvenile was the most convenient practice to manage and reduced larval stress. In addition, the result of this study also showed higher survival rate than those previously reported by Poomtong and Nhongmeesub (1996), Singhagraiwan (1996), Siripan and Wongwiwatanawute (2000), Chaitanawisuti and Kritsanapuntu (2002), Sriveerachai *et al.* (2005) and Srimukda *et al.* (2005). The survivals were as low as 0.34, 0.84, 2.02, 0.19, 7.18 and 9.82 % respectively. These might due to the different management for example Srimukda *et al.* (2005) nursed veliger larvae to early juvenile at age of 60 days by removing the first crawling juvenile to the square net to prevent them crawling out. Then crawling juveniles were moved to the nursing tank, filled with sand substrate and covered with the transparent plastic to prevent them crawled out but this practice was inconvenient. Almost water quality parameters were in an appropriate condition for snail growth except for total

ammonia and nitrite nitrogen which were rather high, but water exchange was done 30-50 % at the first stage and increased to 80-100 % at the second stage daily. This might reduce effect of those substances on the snail larvae.

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LITERATURE CITED

- Abbott, R. T. and S. P. Dance. 1998. **Compendium of Seashell**. Odyssey Publishing, Hong Kong. 411 p.
- American Public Health Association, American Water Works Association and Water Environment Federation (APHA). 1980. **Standard Methods for the Examination of Water and Wastewater**. 15th ed. American Public Health Association, Washington, D.C. 1,134 p.
- Chaitanawisuti, N. and A. Kritsanapuntu. 1998. Research on Culture Techniques of Spotted Babylon (*Babylonia areolata*) for Commercial Purpose. **Research Report**. 38 p.
- ____ and S. Kritsanapuntu. 2002. **Handbook of Hoy Wan (*Babylonia areolata* Link, 1807) Aquaculture**. 1st ed. Chulalongkorn Press. Bangkok. 114 p.
- ____, S. Kritsanapuntu and Y. Natsukari. 2004. Research and development on commercial land-based aquaculture of spotted Babylon, *Babylonia areolata* in Thailand: Pilot hatchery-based seeding operation. **Aquaculture Asia IX** (3): 16-20.
- Grasshoff, K. 1976. **Method of Seawater Analysis**. Verlag Chemic. Germany. 314 p.
- Phupat, S. 2004. ANOVA, p. 75-79. Extension and Training Office, Kasetsart University. **In Training Course of Using SPSS Program for Analysis of Statistics of High Research 2nd**.
- Poomtong, T. and J. Nhongmeesub. 1996. Spawning, larval and juvenile rearing of Babylon snail (*Babylonia areolata*, L.) under laboratory conditions. **Phuket Marine Biological Centre Special Publication 16** : 137-142.
- Singhagraiwan, T. 1996. Some biological study of Babylon Snail, *Babylonia areolata* Link, 1807 in captivity for seedling and releasing. **Technical paper** no. 57. Eastern Marine Fisheries Department Center, Marine Fisheries Division, Department of Fisheries, Ministry of Agriculture and Cooperatives. Bangkok. 42 p.
- Srimukda, B., S. Chaweepack and V. nupin. 2005. Commercial production of Spotted Babylon (*Babylonia areolata* Link, 1807) seeds. **Technical paper** no. 24/2005. Chanthaburi Coastal Fisheries Research and Development Center, Coastal Fisheries Research and Development Bureau, Department of Fisheries, Ministry of Agriculture and Cooperatives. Bangkok. 34 p.
- Sriripan, N. and C. Wongwiwatanawute. 2000. Breeding and hatching of Babylon (*Babylonia areolata* Link, 1807). **Technical paper** no. 51/2000. Chonburi Coastal Aquaculture Station and Coastal Aquaculture Division and Technical Office, Department of Fisheries, Ministry of Agriculture and Cooperatives. Bangkok. 46 p.
- Sriveerachai, T., C. Wuttimatee and J. Sirisombat. 2005. Advance biological closed system of culturing *Babylonia areolata* Link, 1807 in cement tanks. (CD-ROM). **In The seminar on Fisheries 2005**: 21. Department of Fisheries, Bangkok.
- Sutthinon, P. and S. Yaemkasem. 2006. Nursing of Spotted Babylon (*Babylonia areolata* Link, 1807) from veliger larvae to early juvenile stage using various types of live feed.

Technical paper no. 30/2006. Rayong Coastal Fisheries Research and Development Center, Coastal Fisheries Research and Development Bureau, Department of Fisheries, Ministry of Agriculture and Cooperatives. Bangkok. 17 p.

_____, W. Taparhudee and R. Yashiro. 2006. Nursing of Babylon snail (*Babylonia areolata*

Link, 1807) from veliger larvae to early juveniles with sand substrate application in different periods. p. 19-31. **In Proceeding the Conference on Fisheries 2006**. Department of Fisheries and Southern Asian Fisheries Development Center.