CULTURE OF *BABYLONIA SPIRATA* (L.) (NEOGASTROPODA: BUCCINIDAE)

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ABSTRACT

Adult *Babylonia spirata* were collected from Parangipettai coastal waters (Tamil Nadu, India) and kept in the laboratory. Spawning occurred from January to August. Each female laid 12 to 65 transparent vasiform egg capsules. From 178 to 676 larvae hatched per capsule after 6-8 d. Metamorphosis was completed in 16-19 d. Larvae were fed on *Chaetoceros* sp. and *Skeletonema* sp. Juveniles were fed on bivalve meat (*Meretrix meretrix*). Shell length was 10.5 mm after 60 d and 25.4 mm after 125 d. Feeding rates were 3.5 % (50 days old) and 5.07 % (100 days old) of the total body weight d^{-1}. Survival rate of veligers from hatching to settlement was 28.8 %, and 4.4 % for juveniles up to 60 d. There was no mortality after 60 d until the culture was terminated after 200 d.

sive basal disc (Fig. 1a). The peduncle helps the capsule to stand straight above the sandy substratum. The capsule above the peduncle is inverted triangular in shape, with a gradual increase in width towards the top. Each egg capsule measured 24 to 35 mm in length and 4 to 9 mm in width. The peduncle was 10 to 14 mm long. Eggs were immersed in albuminous fluid inside the capsules. Spawners took 16 to 38 minutes to lay a single egg capsule. The number of egg capsules per spawner was 178 and 676, with an average of 611 eggs per capsule. Highest fecundity was 43,112 eggs counted in 65 capsules deposited by one spawner.

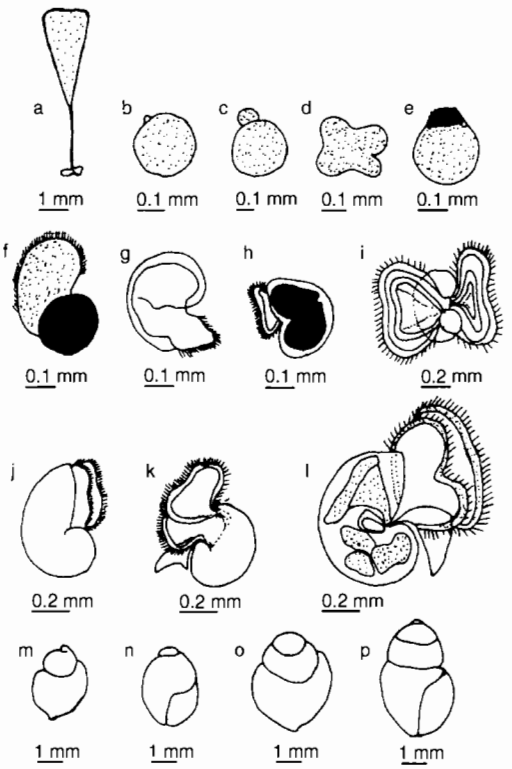

Figure 1. Developmental stages of B. spirata. (a). Egg capsule. (b). Fertilised egg. (c), (d), (e). Cleavage stages. (f), (g), (h). Early embryonic stages. (i). Newly hatched larva. (j). Three days old larvae. (k), (l). 8 and 15 days old larva. (m), (n). Dorsal and ventral view of newly metamorphosed juvenile. (o), (p). Dorsal and ventral view of 10 days old juvenile.

Table 1. Diameter of egg and embryo during intracapsular development of *Babylonia spirata*.

Age (hrs or days)	Diameter of egg and embryos (mm)
1-3 hrs.	0.33- 0.40
48 hrs.	0.36- 0.42
3 days	0.34- 0.44
4 days	0.36- 0.40
5 days	0.38- 0.40

Intracapsular development

The fertilised eggs were spherical, 0.330 to 0.400 mm in diameter. Tab. 1 shows the size of developing embryos. The first and second polar bodies were formed and the cleavage stage lasted up to 24 hours (Fig. 1 c, d, e, f). An outline of the shell, though not coiled was observed after 48 hours. The intermediate phase of intracapsular veligers was characterised by a globose shell, which was slightly coiled and had a pale yellow tinge. After that, velar ciliation was observed and the shell coiling was more pronounced (Fig. 1 f, g, h). After 5 days, the bilobed velum bordered with cilia, foot and two eye spots were evident in embryos which were very active inside the capsule.

Larvae

Larvae hatched between 6 and 8 days after spawning. Newly hatched larvae measured 0.380 to 0.400 mm in diameter. The number of larvae was related to length of the egg capsule. On average 684.5 larvae hatched from 34 to 35 mm capsules and 344.9 larvae from egg capsules of 24 to 32 mm length. Newly hatched veliger larvae had a colourless, transparent, thin shell, and bilobed velum bordered with cilia (Fig. 1 j, k, l). Larvae were positively phototactic and planktotrophic. Velar lobes disintegrated after 16 to 19 days and larvae settled on the bottom of the tank. Growth of larvae is shown in Tab. 2.

Juveniles

Newly settled juveniles were pale yellowish

Table 2. *Babylonia spirata*. Growth of larvae to juvenile stage.

Age (days after hatching)	Developmental stage	Shell length (mm)
1.	Veliger	0.38-0.40
3.	Veliger	0.40-0.42
6.	Veliger	0.44-0.50
9.	Veliger	0.55-0.83
11.	Veliger	0.95-1.04
13.	Veliger	1.10-1.25
15.	Late Veliger	1.24-1.36
16.	Metamorphosis	1.34-1.42
18.	Early Juvenile	1.44-1.68
19	Early Juvenile	1.76-1.86
25.	Juvenile	1.84-1.93

Table 3. Growth of *Babylonia spirata* juveniles reared in the laboratory.

Age (days)	Length (mm) (mean ± SD)	Width (mm) (mean ± SD)	Total weight (g) (mean ± SD)
1	1.58 ± 0.14	0.96 ± 0.12	0.009 ± 0.002
10	2.84 ± 0.18	1.24 ± 0.13	0.012 ± 0.008
25	4.65 ± 0.23	2.66 ± 0.20	0.033 ± 0.012
50	8.11 ± 0.79	4.77 ± 0.91	0.177 ± 0.031
60	10.46 ± 0.23	6.58 ± 0.26	0.385 ± 0.022
75	13.33 ± 1.24	10.22 ± 0.91	0.606 ± 0.182
85	18.21 ± 1.93	13.88 ± 0.87	1.222 ± 0.252
100	21.88 ± 1.03	15.37 ± 1.08	2.584 ± 0.419
125	25.42 ± 1.30	16.41 ± 1.03	3.421 ± 0.586
150	29.1 ± 0.73	19.08 ± 0.21	5.897 ± 0.091
175	31.5 ± 0.14	20.10 ± 0.14	7.726 ± 0.038
200	34.3 ± 0.12	22.41 ± 0.16	9.137 ± 0.043

in colour having one protoconch and one teleoconch whorl and a broad aperture (Fig. 1 m, n, o, p). One more whorl was evident in the teleoconch after four days, and the shell became brown in colour. After 70 days, the shell had 3 whorls of the teleoconch, increasing to 4 (after 98 days) and 5 whorls (after 200 days).

Growth rate

Growth of juveniles is listed in Tab. 3. Juveniles reached half the size of adult animals after 150 days. The growth in terms of shell length, shell width and total weight in 200 days were 34.3 mm, 22.4 mm and 9.137 g, respectively.

Feeding

The rates of food consumption of 50, 75, and 100 days old juveniles were calculated as 4.5, 6.4, and 5.1 % of their total body weight per day. In 150 days old juveniles the rate was 4.62 % of their own body weight per day.

Survival rate

Survival rate of veligers was 28.8 % from hatching to settlement. From settlement to 20 days of age survival was 6.8 %, and 4.5 % after 60 days. No mortality was observed from 60 to 200 days of age.

DISCUSSION

The whelk family Buccinidae is probably one of the largest and most diversified families of marine snails. Larval development of *B. spirata* is indirect with planktotrophic pelagic larvae. The presence of large numbers of small eggs, absence of nurse eggs, and the small sized larvae support this mode of larval development. In tropical species of Buccinidae, indirect larval development is the dominant pattern (Shanmugaraj *et al.* 1994; Poomtong & Nhongmeesub 1996), whereas temperate species, *e.g.*, *Buccinum undatum*, exhibits a direct mode of larval development (Thorson 1935). This species deposits 500-2,000 eggs per capsule, out of which only 10 young emerge. The other eggs serve as nurse eggs.

The spawning behaviour and hatching were the same for both *B. spirata* and *B. areolata* but the time to settlement varied between these species. The larvae of *B. spirata* settled 16 to 19 days after hatching while *B. areolata* larvae settle after 25 days (Poomtong & Nhongmeesub 1996). The difference in settlement time may be due to the local environmental conditions. Spawning was observed in *B. spirata* from January to

August. Poomtong & Nhongmeesub (1996) observed that spawning occurred throughout the year in *B. areolata* with the exception of November and December and the highest spawning frequency was attained in March and July. Other differences were noted between the two species. Growth rate was higher in *B. spirata* compared to *B. areolata* (Poomtong & Nhongmeesub 1996). The feeding rate of juveniles varied within different age groups. In 75, 100, and 150 days the consumption rate of old juveniles was 6.4, 5.1 and 4.6 % of total body weight per day. This rate is comparable to other carnivore snails. The consumption rate of *Hemifusus pugilinus* (Melongenidae) was 4.5 % (Benny *et al.* 1996); Morton (1986) reported (4 %) in *Hemifusus tuba*. Broom (1982) found a consumption rate of 7 % of its body weight per day in *Natica maculosa*. Edwards & Huebner (1977) stated that *Polinices duplicatus* consumed more than 5 - 6 % of its body weight per day.

In the present study 28 % survival rate was observed from hatching to settlement. The high rate of mortality at this stage may be due to overcrowding of the larvae and lack of proper food. The survival rate from settlement to the 20th day was even lower. The main reasons for the low survival were cannibalism and the crawling behaviour of the juveniles. Most of the juveniles crept on the walls of the tank and came out of water, which caused death.

REFERENCES

Benny, A., B.A. Venmathimaran & K. Ayyakkannu. 1996. Food and feeding habits of *Hemifusus pugilinus* (Gastropoda: Melongenidae). - Phuket Marine Biological Center Special Publication **16**: 273-278.

Broom, M.J. 1982. Size selection consumption rates and growth of the gastropod *Natica maculosa* (L). - Journal of Experimental Marine Biology and Ecology **56**: 213-233.

Edwards, D.C. & J.D. Huebner. 1977. Feeding and growth rates of *Polinices duplicatus* preying on *Mya arenaria* at Barnstable harbour, Massachusetts. - Ecology **58**: 1218-1236.

Morton, B. 1986. Reproduction, juvenile growth, consumption and the effect of starvation upon the South China Whelk *Hemifusus tuba* (Gmelin) (Prosobranchia: Melongenidae) - Journal of Experimental Marine Biology and Ecology **102**: 257-280.

Poomtong, T & J. Nhongmeesub. 1996. Spawning, larval and juvenile rearing of babylon snail (*Babylonia areolata*, L.) under laboratory conditions. - Phuket Marine Biological Center Special Publication **16**: 137-142.

Raghunathan, C., J.K. Patterson Edward & K. Ayyakkannu. 1994. Long term study on food consumption and growth rate of *Babylonia spirata* (Neogastropoda: Buccinidae). - Phuket Marine Biological Center Special Publication **13**: 207-210.

Shanmugaraj, T., A. Murugan & K. Ayyakkannu. 1994. Laboratory spawning and larval development of *Babylonia spirata* (L.) (Neogastropoda: Buccinidae). - Phuket Marine Biological Center Special Publication **13**: 95-97.

Thorson, G. 1935. Studies on the egg-capsules and development of Arctic marine prosobranchs. - Meddelelser om Grønland **100**: 1-71.

ISSN 0858-3633