

FECUNDITY, SIZE OF EGG CAPSULES, AND HATCHED VELIGERS OF *CHICOREUS RAMOSUS* IN CAPTIVITY BROODSTOCKS

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ABSTRACT

Adult *Chicoreus ramosus* obtained from nature and hatchery reared specimens were used as broodstock. The hatchery-reared snails began spawning at the age of 2 years, when they were 14-16 cm in shell length. The newly mature snails had significantly lower fecundity than the older ones. The number of egg capsules laid by each females ranged from 150 to 1595 in the newly mature, hatchery-reared group, and from 2035 to 4438 in the wild group. The mean number of hatched veligers from each female ranged from 281 to 636 veligers per capsule. The mean size of hatched veligers ranged from 685 to 754 microns, which was not highly related to either the capsule or spawner size, though it showed a trend of increasing number of veligers with increasing capsule sizes.

INTRODUCTION

Chicoreus ramosus has been successfully cultured in the Prachuap Khiri Khan Coastal Aquaculture Development Center during the past few years. The adult snails collected from nature and the ones raised from eggs since 1991 have been maintained as the broodstock in a concrete raceway provided with flowing filtered sea water and adequate amounts of food. The hatchery-produced snails from the first success of laboratory rearing in 1991 started spawning in 1993 when they reached 2 years of age, and a size of 14-16 cm in shell length. Egg capsules laid by these young spawners were smaller than the ones laid by the older or larger spawners obtained from natural habitat. Data on deviation of egg capsule sizes from different females, the relationships between capsules and the spawner sizes, fecundity, and variation in sizes of the newly hatched veligers obtained from September 1993 - March 1994 will be discussed.

MATERIALS AND METHODS

Maintenance of the broodstocks

A total of 23 *Chicoreus ramosus* collected from the sea since 1992, referred to as the wild snails, and 17 hatchery reared *Chicoreus ramosus*, referred to as the hatchery snails, were held in a concrete raceway tank of 5 tons capacity, 0.7 m (width) x 15.0 m (length) x 0.6 m (depth). The raceway was filled with flowing

filtered sea water at the rate of 10-15 liters per minute. Adequate amounts of live bivalves (*Isognomon* sp.) were provided as food for the snails. The dead or eaten bivalves were checked and removed from the tank every day.

Prior to the natural spawning season, which was found to start around September, the snails were cleaned to remove fouling organisms attached on the shell surface. Each snail was measured and numbered with plastic tags glued on the shell. The broodstock holding tank was cleaned and filled with filtered sea water.

Spawning records and egg collections

The broodstock holding tank was inspected daily. Once spawning was observed, each spawner was recorded by the number. Egg capsules were taken out as soon as possible, when the spawner had moved away from the mass. Number of capsules was counted. Collected capsules were cleaned in filtered sea water and shortly soaked in freshwater to get rid of microorganisms contaminating the capsule surface, then transferred into the hatching tanks.

Capsule sizes, veliger sizes and number of veligers per capsule

Approximately 30 capsules were sampled from each spawner. The capsule length and width were measured to the nearest 0.1 mm (vernier caliper). Another 10-20 capsules were sampled from each spawner. The

samples from different spawners were put in separate hatching trays to determine the number of veligers hatched per capsule. Newly hatched veligers, 30-40 individuals from each spawner, were measured under the microscope.

Fecundity

Instead of counting the number of eggs, the fecundity was estimated from the mean number of veligers hatching from one capsule of each snail.

RESULTS AND DISCUSSION

Spawning and Fecundity

Spawning of *Chicoreus ramosus* occurred from Sept. to March, in both wild and hatchery-reared broodstock. Egg clusters were attached to the wall of the holding tank. Similar to the observation of Ruangchoy and Tantichodok (1992), no egg capsules were found attached to the shell of the snails, unlike in nature where egg masses often are found attached on shells.

Totally 16 snails or 40 % of the broodstock were laying eggs during the study period. Among the spawners, there were 10 females or 43.5 % of the wild group, and 6 females or 35.5 % of the hatchery group. The proportion of spawning females, was lower than the remainders, which could be either males or unspawned females, in both wild and hatchery groups.

Spawners in the wild group were older and larger, and laid more egg capsules than the younger and smaller ones from the hatchery group. The number of capsules spawned by each female in the wild group ranged from 2,035 to 4,438 with the average of 3,412 capsules, while the number obtained from the newly mature hatchery group ranged from 150 to 1,595 with the average of 697 capsules per spawner. Duration of the spawning period of the wild snails ranged from 52 to 117 days with the average of 79 days, while the hatchery snails took only 3-57 days with the average of 22 days (Table 1). There was no significant difference between the average number of capsules spawned per day by the two groups.

Table 1. Spawning of wild and hatchery-reared *Chicoreus ramosus*.

a. Spawners from the wild group:

Spawner No.	Length (cm)	Weight (g)	Spawning period (initiated - ended)	Duration (days)	No. of capsules	Average (caps./day)
A1	21.5	1,140	21/09/93 - 12/03/94	117	4,438	37.9
A6	21.5	1,130	6/10/93 - 12/03/94	85	4,087	48.1
A2	26.0	2,050	22/10/93 - 16/03/94	83	2,984	36.0
A15	27.2	1,950	29/10/93 - 4/03/94	81	3,265	40.3
A12	22.2	1,150	2/11/93 - 23/02/94	79	3,059	38.7
A21	22.5	1,150	5/11/93 - 15/03/94	91	3,815	41.9
A19	18.9	890	7/11/93 - 16/03/94	60	2,035	33.9
A9	19.5	965	18/11/93 - 12/03/94	52	2,097	40.3
A23	18.0	610	18/11/93 - 3/03/94	63	2,373	37.7
A14	25.4	1,400	1/12/93 - 12/03/94	77	3,273	42.5
Average				78.8	3,412.6	39.7

b. Spawners from the hatchery group:

Spawner No.	Length (cm)	Weight (g)	Spawning period (initiate - ended)	Duration (days)	No. of capsules	Average (caps./day)
B1	15.3	480	29/09/93 - 1/03/94	57	1,595	28.0
B2	15.6	480	10/10/93 - 21/11/93	5	167	33.4
B6	14.6	410	31/10/93 - 9/12/93	27	745	27.6
B9	14.4	390	13/11/93 - 23/02/94	35	1,273	36.4
B16	14.0	330	18/11/93 - 22/11/93	5	150	30.0
B4	14.4	360	9/12/93 - 9/03/94	3	250	83.3
Average				22	696.7	39.8

The snails held in captivity in the Prachuap Khiri Khan mollusc hatchery had very high fecundity (Table 2), especially the wild group, compared with data obtained from previous observations at Phuket, where the number of capsules spawned per female ranged from 205 to 1,214 from snails of 400 - 2,300 g weight (Ruang-choy & Tantichodok 1992). Figure 1 shows the relationship between the number of egg capsules and the size of the spawners.

Table 2. Fecundity of *Chicoreus ramosus* in captivity, estimated by number of veligers. A= No. of capsules; B = Mean No. of Veligers/Capsule; C = Fecundity (no. of veligers).

Spawner No.	Length (cm)	Weight (g)	A	B	C x 1000
A1	21.5	1,140	4,438	431.3	1,914
A6	21.5	1,130	4,087	318.2	1,300
A2	26.0	2,050	2,984	464.2	1,385
A15	27.2	1,950	3,265	453.2	1,480
A12	22.2	1,150	3,059	280.9	859
A21	22.5	1,150	3,815	329.0	1,255
A19	18.9	890	2,035	636.4	1,295
A9	19.5	965	2,097	365.0	765
A23	18.0	610	2,373	320.4	760
A14	25.4	1,400	3,273	364.7	1,193
B1	15.3	480	1,595	340.6	543
B2	15.6	480	167	366.8	61
B6	14.6	410	745	319.4	238
B9	14.4	390	1,273	595.4	758
B16	14.0	330	150	140.3	21
B4	14.4	360	250	281.3	70

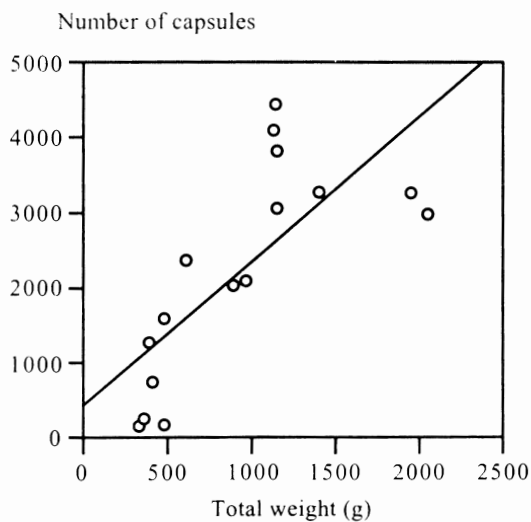


Figure 1. Relationship between total weight of *Chicoreus ramosus* and the number of egg capsules spawned in captivity; $Y = 1.92954 X + 430.2996$; $r^2 = 0.55$.

The relationship between size in terms of total body weight and fecundity, revealed that the reproductive output increased with increasing size (Fig. 2).

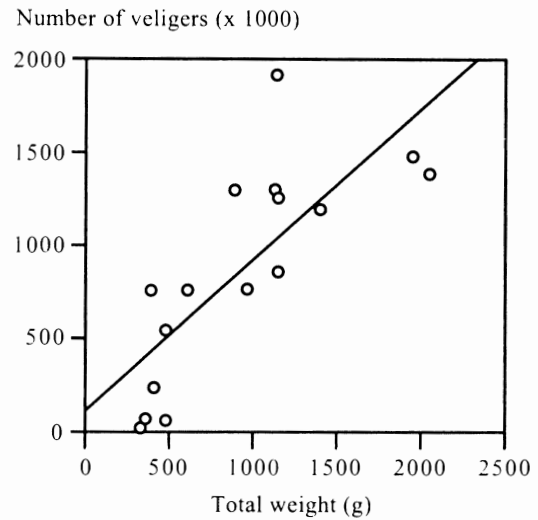


Figure 2. Relationship between total weight and fecundity of *Chicoreus ramosus*; $Y = 0.8125 X + 112.50$; $r^2 = 0.59$.

Sizes of egg capsules and hatching veligers

Egg capsules laid by different females varied in shape and size. Capsules laid by each female had specific characteristics of shape, especially the apical plate was different. There was a little variation in length and width of the capsules from the same spawner, but a great variation among different snails. The average capsule size from each of 8 females in the wild group ranged from 17.3 to 25.0 mm in length and 5.3 to 7.9 mm in width. From 6 females in the hatchery group, the capsule size ranged from 13.1 to 21.3 mm in length and 5.3 to 7.3 mm in width. One female *Chicoreus* from the hatchery-reared group, (No. B-16), produced a cluster of tiny capsules obviously different from capsules of other females (Fig. 3).

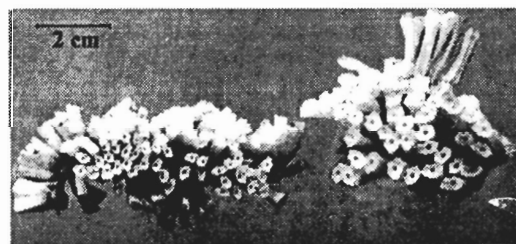


Figure 3. Egg capsules of *Chicoreus ramosus*. The capsules of spawner No. B-16 (left) are compared with normal sized egg capsules (right).

The mean sizes of egg capsules and hatching veligers from each female are shown in Table 3. Although the size and shape of egg capsules varied much among different spawners, data on size of hatching veligers were similar.

The relationships between total weight of the spawners and capsule size, total weight and veliger size, capsule

size and veliger size, the number of veligers/capsule and capsule size, are shown in Figures 4, 5, 6 and 7, respectively. The capsule sizes and veliger sizes showed an increasing trend with spawner weight (Figs. 4 & 5). The number of veligers per capsule also increased with increasing capsule sizes, but with a very poor correlation ($r^2 = 0.16$) (Fig. 7).

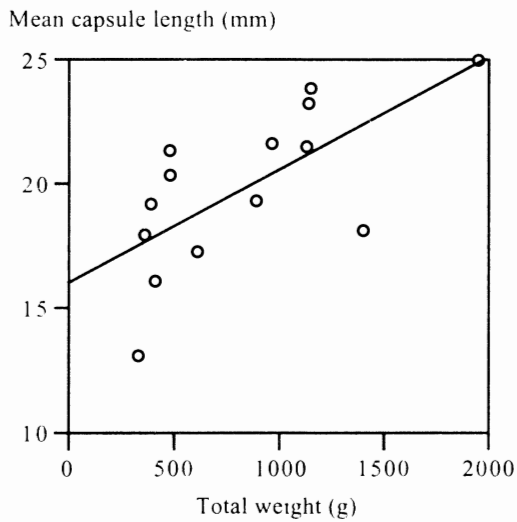


Figure 4. Relationship between capsule sizes and total weight of *Chicoreus ramosus*; $Y = 0.00457 X + 16.022$, $r^2 = 0.46$.

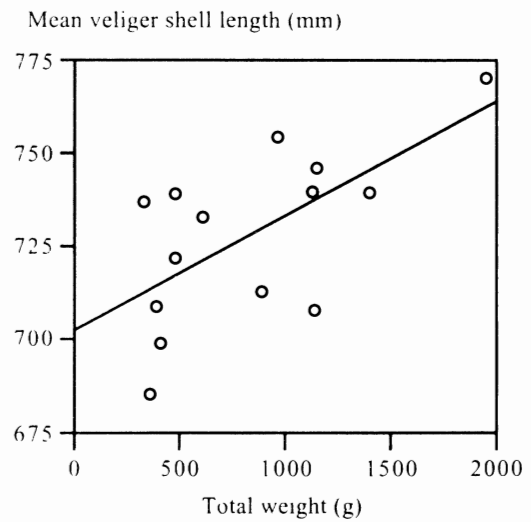


Figure 5. Relationship between veliger sizes and total weight of *Chicoreus ramosus*; $Y = 0.03076 X + 702.42$; $r^2 = 0.41$.

Table 3. Variations of capsule and veliger sizes.

Spawner No.	Capsule length (mm)			Capsule width (mm)			Veliger length (μm)		
	min	max	mean	min	max	mean	min	max	mean
A1	20.6	25.3	23.23	6.9	8.5	7.28	630	750	707.8
A6	20.6	22.2	21.49	5.1	6.6	5.89	620	800	739.6
A15	22.8	26.3	24.98	6.0	7.0	6.66	735	820	770.2
A21	22.5	24.9	23.84	7.2	8.6	7.86	700	830	746.0
A19	16.7	21.3	19.31	6.1	7.6	6.91	630	770	712.8
A9	20.3	22.4	21.61	6.8	7.9	7.45	700	805	754.3
A23	16.3	18.8	17.26	6.0	6.8	6.37	670	800	732.8
A14	15.3	20.6	18.12	4.8	5.9	5.28	670	880	739.4
B1	18.9	24.6	20.34	6.8	7.7	7.30	640	780	721.8
B2	18.4	23.0	21.33	4.8	6.7	5.97	670	780	739.0
B6	13.1	17.9	16.08	5.2	6.7	5.83	640	750	698.8
B9	18.2	20.5	19.18	5.9	7.3	6.80	670	735	708.8
B16	11.3	14.4	13.06	3.1	6.4	5.31	650	780	736.9
B4	16.7	18.6	17.94	6.0	6.8	6.36	600	770	685.2

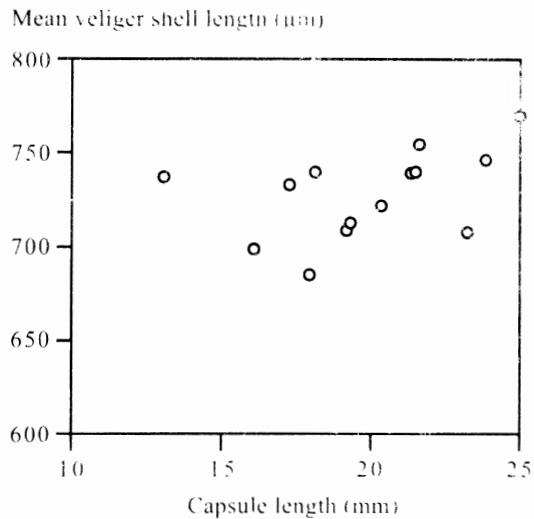


Figure 6. Relationship between egg capsule sizes and veliger sizes of *Chicoreus ramosus*

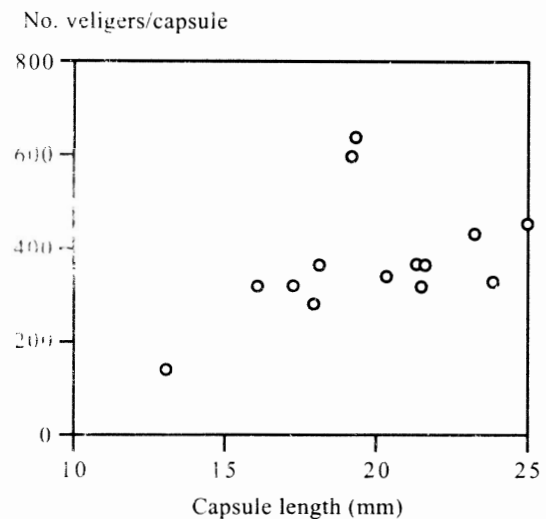


Figure 7. Relationship between capsule sizes and number of veligers per capsule of *Chicoreus ramosus*.

CONCLUSIONS

Our results lead to the following conclusions.

- The newly mature hatchery reared *Chicoreus ramosus* had significantly lower fecundity than the wild ones, which were older.
- The egg capsules spawned by the newly mature females were mostly smaller in sizes than the ones produced by the older wild snails, but the capsule sizes were not highly related to the spawner sizes.
- There was no obvious relationship between sizes of

capsules and hatching veligers, as well as between number of veligers per capsule and sizes in total weight of the spawners.

ACKNOWLEDGMENTS

The authors wish to thank the mollusc hatchery staff of the Prachuap Khiri Khan Coastal Aquaculture Development Center for their heartfelt help. We acknowledge DANIDA for supporting this study under the TMMP project.

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