

## REPRODUCTIVE BIOLOGY OF *PLEUROPLOCA TRAPEZIUM* LINNAEUS (NEOGASTROPODA : FASCIOLARIIDAE)

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### ABSTRACT

The marine prosobranch gastropod *Pleuroploca trapezium* was collected randomly in Gulf of Mannar, southeast coast of India over a period of 12 months. The sex ratio was 1:1 (M:F) during April, June & November while females were slightly higher in number in all other months. The maximum gonad length in males (15.7 cm) and females (16.2 cm) were observed in March whereas the minimum was 6.0 cm in males and 7.2 cm in females and they were found in June. The calculated gonad indices were maximum in males (2.80%) and females (3.20%) during March and minimum (males, 0.68%; females, 0.78%) in July. Though spawning was noticed from January to February, peak spawning was in March. The egg capsules were collected between January and April. The morphology of capsules is described.

### INTRODUCTION

Reproductive biology of prosobranch gastropods is more varied than that of any other groups (Fretter and Graham, 1964). *Pleuroploca trapezium* is gonochoristic and shows great diversity in breeding strategies. It has a single gonad which discharge by way of a glandular, pallial genital duct parallel to the rectum. The gonad with the digestive gland occupies the visceral coils, the former mainly on the columellar side. The testis spreads anteriorly as it develops and appears as a crescentic mass in the mantle skirt between the rectum and the prostate (von Rohrbach, 1937; Berry, 1974). The male carries a penis behind the right tentacle. Fertilization is internal through copulation. The embryos develop within an egg capsule (D' Asaro, 1970b).

The reproductive biology of fasciolarids has till now received scant attention. Johnson (1929) studied the egg capsules of *Fasciolaria gigantea*. D' Asaro (1970a and 1970b) observed the egg capsules of *Fasciolaria salmo* from the Pacific coast of Panama and *Fasciolaria tulipa* and *Pleuroploca gigantea* from the South Florida and Bahamas respectively. D' Asaro (1986) also studied egg capsules of *Fasciolaria lilium hunteria* from Northeast Florida. There is no detailed study of the reproductive biology

of the economically important horse conch *Pleuroploca trapezium* Linnaeus, which is the subject of the present study.

### MATERIALS AND METHODS

Adult snails of *P. trapezium* (18.4-22.3 cm length, 490-890 g total weight) were randomly collected every month for a period of 12 months from October 1992 to September 1993 from the continental shelf region of the coral beds of the Gulf of Mannar, on the southeastern coast of India. The total length, total weight, gonad length and gonad weight of all the collected specimens were measured. Sex was determined by removing the soft parts from the shell. The colour of the gonad was observed to identify the different stages of gonad maturation. Fresh gonad smears were also examined under binocular microscope to ascertain the maturity stages of both the males and females. The size in males and females at first sexual maturity was determined by observing the presence of mature eggs and sperms in the smears of the gonad from groups of the minimum to the maximum size.

Sex ratio was calculated every month and the Chi-square applied to test whether the populations were in accordance with the ratio of 1:1.

Gonad indices (GI) were calculated every month separately for males and females using the formula.

$$GI = (\text{Gonad weight} / \text{Animal weight (excluding shell)}) \times 100$$

The number of egg capsules per cluster were counted and the capsules from different clusters were examined under microscope to count the average number of eggs per capsule.

## RESULTS

### Sex ratio

A total of 411 specimens of *P. trapezium* were collected during the study period. This comprised 191 males and 220 females. The sex ratio was 1:1.15. During the months April, June and November the ratio of males to females was 1:1. Sex ratio fluctuated every month with the predominance of females throughout the year except in the above month. No significant deviation from 1:1 was observed (Chi square).

### Size at first sexual maturity

The distinction between immature and mature snails was made on the basis of the appearance of the necessary sexual glands like the albumen and cap-

sule glands. Males were scored as mature if penis was well developed and the penial glands turgid. Females with large and turgid capsule glands were scored as mature. Smear examination of the gonads showed that the first indications of gonad maturation appeared at a shell size of 14.3 cm in males and 15.2 cm in females. Mature male and female gonads were dark brown in colour. Gonads were pale brown in the maturing stage.

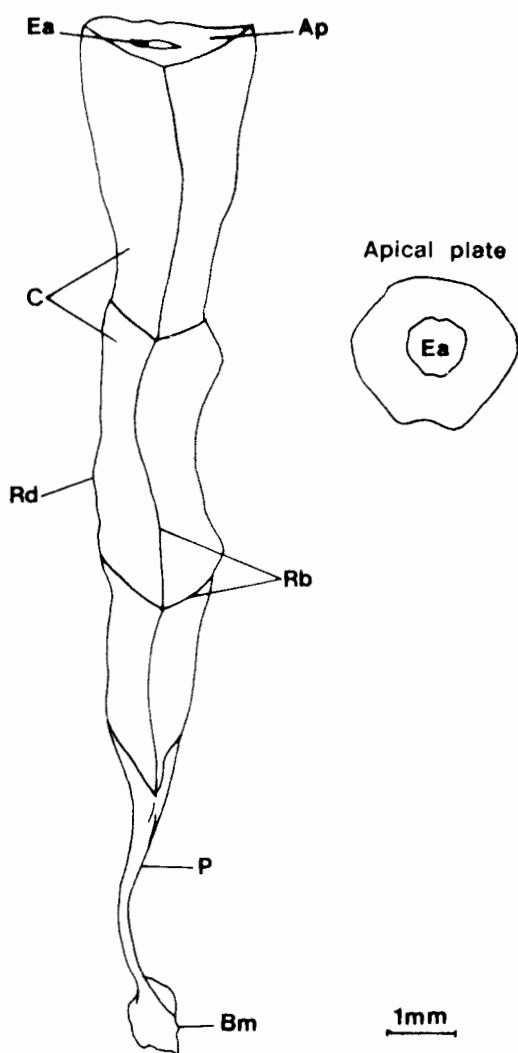
### Gonad index

Table 1 shows monthly variations in gonad length, gonad weight, animal weight and gonad index. The gonad length and weight varied from month to month while the digestive gland section remained fairly constant. Gonad length of both males and females increased from June to a maximum in March, and gonad weight from June. The increase in gonad weight had a direct bearing on animal weight, which increased correspondingly.

Gonad index was calculated for every month and the highest values were recorded in the months January to April with the peak in March in both males and females. Gradual increment of the gonad index in both males and females was observed between June and March.

Table 1. Gonad characteristics of *Pleuroploca trapezium*.

Year & Month	Gonad length (cm)		Gonad weight (g)		Animal weight (g)		Gonad index (%)	
	Male	Female	Male	Female	Male	Female	Male	Female
<b>1992</b>								
October	10.4	10.6	1.3	1.5	113	137	1.15	1.09
November	11.7	12.2	2.0	2.2	127	158	1.57	1.39
December	12.3	13.4	2.3	3.7	133	160	1.73	2.31
<b>1993</b>								
January	13.5	14.4	3.5	4.4	145	179	2.41	2.46
February	14.2	15.3	4.2	4.7	160	190	2.63	2.47
March	15.7	16.2	4.8	6.4	170	200	2.82	3.20
April	14.4	15.7	4.5	4.8	165	185	2.73	2.59
May	8.8	13.5	1.2	1.7	83	110	1.45	1.55
June	6.0	7.2	0.5	0.7	74	90	0.68	0.78
July	7.8	8.0	0.6	0.9	80	100	0.75	0.90
August	8.3	8.7	0.9	1.2	95	120	0.95	1.00
September	9.1	9.3	1.1	1.3	102	128	1.08	1.02



**Figure 1.** Egg capsule of *Pleuroploca trapezium*. Ea = Escape-aperture, Ap = Apical plate, C = compartment, Rb = Rib, Rd = Ridge, P = Peduncle, Bm = Basal membrane.

### Spawning

Egg capsules of *P. trapezium* were collected from the study area during the 4 months from January to April. The maximum numbers were collected in March. The gonad index indicated that spawning in *P. trapezium* was from January to April. After spawning, the gonad size reduced markedly, and became a dull greenish-brown in colour.

### Egg capsules

Egg capsules of *P. trapezium* were found in clusters of 105-130 egg capsules. The capsules are vasiform, opaque and pale violet in colour. The apical region of the capsule is broad and tapers distally. Three sharp rib lines run longitudinally on the lateral side of the capsule to the peduncle. The peduncle is solid with supportive ribs and terminates in an adhesive basal membrane. Capsules have three compartments and a thick rib running transversely differentiate the two adjacent compartments. The apical plate is concave and triangular in shape surrounded by a thick rib with a sharp edge. An oval shaped escape-aperture is situated in the central region of the apical plate and is covered by an opaque membrane. Each egg capsule contains 90-110 eggs floating in dense albumen. The average capsular dimensions are; height 29 mm; width 5 mm; peduncle height 12 mm; diameter of escape-aperture 1 mm (Fig. 1).

### DISCUSSION

The predominance of females found during most of the sampling period in the present study is common in gonochoristic mollusc. Female predominance increases with age (Fretter and Graham, 1962; Pelseneer, 1926). The early death of stenoglossan males (Fretter and Graham, 1964) may be the reason for the predominance of females observed in the course of the present study. However, the sex ratio was 1:1 during the months of April, June and November, indicates that communal spawning (D'Asaro, 1970b) could be the explanation for the predominance of females observed in the months of spawning.

The present investigation revealed that the males matured earlier than the females. It may be the reproductive strategy adopted by males as a consequence of the competition for mates (Sewell, 1924). Or, as suggested by Moore (1937), growth rate has been greater in females, and hence they are larger in size. However, the time of sexual maturity may be the same for both the sexes. Only long-term growth studies in the laboratory can confirm the reasons for the observed larger size of females.

The gonad index denotes that the spent or immature gonad is small and the ripe one is large and the absolute size of the gonad is proportional to the animal's size (Hahn, 1989). The gonad index as well as animal weight increased in *P. trapezium* and attained maximum during March. The gonad index confirms maturation of the gonads from June to January in both males and females.

Spawning in *P. trapezium* lasts 4 months with a peak in March (post-monsoon) during which numerous clusters of egg capsule were collected. D' Asaro (1970b) collected egg capsules of *Fasciolaria tulipa* from January through August and they were most abundant in April from the Biscayne Bay, Florida. He also collected egg capsules of *Pleuroploca gigantea* from March through May, and *Fasciolaria liliium hunteria* (D' Asaro, 1986) in late April at the same locality. A major spawning in the post monsoon period (March) is in accordance with peak breeding of other molluscs on the southeastern coast of India (George, 1980; Rajagopal, 1982).

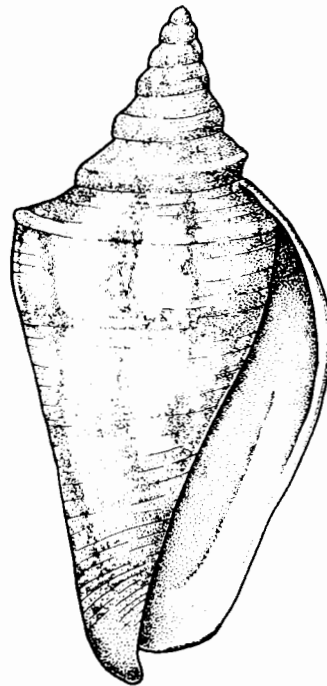
The egg capsules of *P. trapezium* were found in clusters of 105-130 capsules which is a common cluster size in fascioliariids. *Fasciolaria salmo* deposited a maximum of 150 capsules (Keen, 1958). *Fasciolaria tulipa* from 20 to 115 (D' Asaro, 1970b) and *Pleuroploca gigantea* from 35 to 140, and up to 400 capsules (Johnson, 1929) *Fasciolaria liliium hunteria* 16-27 capsules (D' Asaro, 1986).

In *P. trapezium* egg capsules are vasiform and opaque with a triangular apical plate, oval shaped escape-aperture and are compartmented. D' Asaro (1986) suggested that typical fascioliariid capsules are broadly vasiform with expanded apical collars and attached to a common basal membrane. The capsules of *P. trapezium* have been easily recognized as typical of fascioliariids, but larger in size and distinct from *Fasciolaria liliium hunteria* (D' Asaro, 1986), *Fasciolaria tulipa* and *Pleuroploca gigantea* (D' Asaro, 1970a).

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*Strombus marginatus septimus* Duclos, 1844.  
Drawing by Patairat Singdam.