REPRODUCTIVE BIOLOGY OF PLEUROPLOCA TRAPEZIUM LINNAEUS
(NEOGASTROPODA: FASCICULARIDAE)

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ABSTRACT

The marine prosobranch gastropod Pleuroploca trapezium was collected randomly in Gulf of Mannar, southeastern 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 index were maximum in males (2.80%) and females (3.26%) 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 gonochoric 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 its digestive gland occupies the visceral coils, the former mainly on the columnellar side. The testis spread unevenly as it develops and appears in a crescentic mass in the mantle skirt between the rectum and the prostate (von Rohrbach, 1937; Berrn, 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 Fascicularia and Fasciolariinae has till now received scant attention. Johnson (1926) studied the egg capsules of Fasciolariina gymnoea. D’Asaro (1970a and 1970b) observed the egg capsules of Fasciolariina sima from the Pacific coast of Panama and Fasciolariina subita and Pleuroploca goniota from the South Florida and Bahamian respectively. D’ Asaro (1986) also studied egg capsules of Fasciolariina lenticulata nuttica 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 (18.4-22.5 cm length, 400-800 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 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 test 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 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:

\[ GI = \left( \frac{\text{Gonad weight}}{\text{Animal weight (excluding shells + 100)}} \right) \]

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. tropicarium* were collected during the study period. This comprised 291 males and 220 females. The sex ratio was 1:1.5. 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 deviations from 1:1 were observed (Chi square).

**Size at first sexual maturity**

The distinction between immature and mature specimens 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 gonad 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>
<thead>
<tr>
<th>Year &amp; Month</th>
<th>Gonad length Male (cm)</th>
<th>Female</th>
<th>Gonad weight Male (g)</th>
<th>Female</th>
<th>Animal weight Male (g)</th>
<th>Female</th>
<th>Gonad index Male (%)</th>
<th>Female</th>
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<td>1992</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>October</td>
<td>10.4</td>
<td>11.6</td>
<td>1.3</td>
<td>1.5</td>
<td>113</td>
<td>137</td>
<td>1.15</td>
<td>1.09</td>
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<tr>
<td>November</td>
<td>11.7</td>
<td>12.2</td>
<td>2.0</td>
<td>2.2</td>
<td>127</td>
<td>154</td>
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<td>12.3</td>
<td>13.4</td>
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<td>3.7</td>
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<td>150</td>
<td>1.73</td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>January</td>
<td>13.5</td>
<td>14.4</td>
<td>3.5</td>
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<td>145</td>
<td>179</td>
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<td>15.3</td>
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<td>190</td>
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<td>16.2</td>
<td>4.8</td>
<td>6.4</td>
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<td>200</td>
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<td>15.7</td>
<td>4.3</td>
<td>4.8</td>
<td>165</td>
<td>185</td>
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<td>May</td>
<td>8.8</td>
<td>13.5</td>
<td>1.2</td>
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<td>83</td>
<td>110</td>
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<tr>
<td>June</td>
<td>6.0</td>
<td>7.2</td>
<td>0.5</td>
<td>0.7</td>
<td>74</td>
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<td>July</td>
<td>7.8</td>
<td>8.6</td>
<td>0.6</td>
<td>0.9</td>
<td>80</td>
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<td>0.9</td>
<td>1.2</td>
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<td>9.3</td>
<td>1.1</td>
<td>1.3</td>
<td>102</td>
<td>128</td>
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Egg capsules

Egg capsules of *P. trapezium* were found in clusters of 105-130 egg capsules. The capsules are vaseform, opaque and pale violet in color. 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 differentiates 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 capsule 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 gasterochorial molluscs. Female predominance increases with age (Fretter and Graham, 1962, Pelseneer, 1926). The early death of sternoglossan 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 reason for the observed larger size of females.

**Figure 1. Egg capsule of *P. trapezium*.**

- **Es** = Escape aperture
- **Ap** = Apical plate
- **C** = compartment
- **Rb** = Rib
- **Rd** = Ridge
- **P** = Peduncle
- **Bm** = Basal membrane
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 is 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 Pleurolopa gigantea from March through May, and Fasciolaria lilium hortensis (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 fasciolariids. Fasciolaria salmo deposited a maximum of 150 capsules (Kee, 1958). Fasciolaria tulipa from 20 to 115 (D'Asaro, 1970b) and Pleurolopa gigantea from 35 to 140, and up to 400 capsules (Johnson, 1929) Fasciolaria lilium hortensis 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 fasciolariid capsules are broadly vasiform with expanded apical collars and attached to a common bursal membrane. The capsules of P. trapezium have been easily recognized as typical of fasciolariids, not larger in size and distinct from Fasciolaria lilium hortensis (D'Asaro, 1986), Fasciolaria tulipa and Pleurolopa gigantea (D'Asaro, 1970a).

REFERENCES


Sewell, R.B.S. 1924. Observation on growth in certain molluscs and on changes correlated with growth in the radula of Pyreneus palustris (with a note on the radula by the late N. Annandale) Proc. Indian. 26: 529-548.


*Strombus marginatus septimus* Dueñas, 1844.

Drawing by Patairat Singsam.