BREEDING HABITS, DEVELOPMENT AND LIFE-HISTORY OF BLENNIUS STEINDACHNERI DAY FROM WALTAIR COAST

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ABSTRACT

The breeding habits, development and life-history stages of Blennius steindachneri are described for the first time. The female lays its eggs in the empty shells of Balanus tintinnabulum tintinnabulum, in oyster shells and rock crevices and the male guards over the eggs. Hatching of the eggs takes place on 6th or 7th day of incubation and mechanical stimulus helps hatching process. Maturity is reached when they attain a length of about 70-00 mm.

INTRODUCTION

The breeding habits, development and life-histories of blennids of India are very poorly known. The earliest account of the larvae of the Blennidae is that of Bhattacharya (1916) on the larval stages of Petroscirtes bhattacharyae (3·25-9·00 mm) from Chilka Lake. Jones (1937) described the breeding habits and development of Petroscirtes bhattacharyae from the brackish waters of Adayar (Madras). Rao and Hora (1938) gave an account of the breeding habits and development of another blennid, Andamia heteroptera, from Andaman Islands. Bal and Pradhan (1951) reported the postlarval stages of P. punctatus (1·5-48 mm) and P. bhattacharyae (1·5-41·0 mm) from Bombay waters. Recently Dutt and Viswsalar Rao (1960) described the breeding habits and development of P. bipunctatus from Godavari estuary.

Blennius steindachneri Day (1878) is a very common blenny inhabiting the rock and tide pools and shingle beds of Waltair. The adults attain

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a length of 10–12 cm. Both sexes possess a row of 8–10 cirrhi on the head by the presence of which they can be easily distinguished from other blennids.

**Material and Methods**

The egg masses were collected from the crevices in rocks and from the dead shells of the rock barnacle, *Balanus tintinnabulum tintinnabulum*. The eggs were carefully scraped off the rocks and barnacles with a thin knife and brought to the laboratory. The eggs in the advanced stage often hatched while they were being brought to the laboratory aided perhaps by the shaking of the container. The algal filaments and other organisms adhering to the egg mass were carefully removed and the eggs were kept in clean sea-water that was previously filtered through No. 41 Whatman filter-paper to eliminate ciliate infestation.

Large glass troughs having a capacity of about 3 litres were used to keep the eggs at room temperature (28–30º C). To reduce the mortality rate, the eggs were carefully separated from the egg mass and not more than 20–30 were kept in each jar. The dead eggs and empty egg membranes of hatched eggs were removed at frequent intervals to prevent multiplication of the ciliates, which attack the eggs and the larvae. The eggs remained viable even if exposed for nearly two to three hours in air. The water film between the eggs of the egg mass was sufficient to keep them moist and prevent desiccation. The water in the troughs was kept stirring often and aerated. The larvae were alive for four days by which time the yolk was completely absorbed. During this period unsuccessful attempts were made to feed the pro-larvae with the nauplii of the brine shrimp (*Artemia salina*) and other microscopic planktonic organisms. The larvae died due to starvation on the fourth day after hatching. However, the post-larvae readily accepted the nauplii of the brine shrimp as well as other planktonic organisms and even chopped bits of the fish muscle.

Post-larvae and juveniles (14–30 mm) were collected from the rock pools by a hand net and were reared in the laboratory on natural and artificial diet.

Measurements were taken using an ocular micrometer and drawings were made with the aid of a camera lucida. Description was made on the living and preserved material.

*Breeding habits.*—Gravid females and barnacle shells containing the eggs were usually obtained from December to May. The female lays
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its eggs in the empty shells of the rock barnacle in a single layer. Very rarely empty oyster shells and rock holes are chosen for depositing the eggs. Large and clean shells only are preferred while those infested with serpulid tubes, algae, etc., are usually not chosen. Fishelson (1963 a) described in detail the reproductive behaviour of Blennius pavo from the Mediterranean coast of Israel. The female of B. pavo applies its urinogenital papilla to the glass of the aquarium tank and the lips of the papilla contract and expand alternately. A small number of eggs are extruded singly and adhere to the glass. The male gets excited and his whole body quivers. The male then drives away the female and fertilizes the eggs.

Parental Care.—The parental care of the Blennidae is well known (Brown, 1929; Jones, 1937; Hildebrand and Cable, 1938; Quasim, 1957; Smith, 1961; Fishelson, 1961, 1963 a, 1963 b). Only on two occasions the male was found guarding the eggs in a crevice that was full of eggs.

Spawn mass (Fig. 19).—The spawn mass contains usually 300–400 dome-shaped eggs arranged closely in a single layer. They were attached to the rock or shell by a sticky disc-like portion of the egg. The colour of the spawn varies from brown to pink depending upon the stage of development. A number of living micro-organisms like ciliates, nematodes, copepods, polychaetes, turbellarians and algal filaments are found associated with it. The eggs in the shells are usually in different stages of development.

DEVELOPMENT OF THE EMBRYO

One day old embryo (Fig. 1).—The eggs are more or less dome-shaped measuring 0.75 mm along the horizontal axis and 0.60 mm in the vertical axis. The egg membrane is very thick and slightly brown in colour. The perivitelline space is narrow. The yolk is granular and pink in colour containing a few white bodies. The blastomeres are found in the form of a cap. An oil globule is absent. The age of the eggs at this stage is not known but the approximate age can be estimated at 24 hours by comparing this stage with those of B. pavo (Fishelson, 1963 b).

Two days old embryo (Fig. 2).—The embryo is completely formed and occupies about half the circumference of the yolk. The head is clearly formed with its optic vesicles. But the lenses are not yet formed. Twelve myotomes are formed and minute dot-like melanophores appear on the yolk. The eggs are still pink in colour.
Plts. 1-18. Early Development and life-history of *Blennius steindachneri* Day. Fig. 1. One day old embryo. Fig. 2. Two days old embryo. Fig. 3. Three days old embryo. Fig. 4. Four days old embryo. Fig. 5. Five days old embryo. Fig. 6. Six days old embryo. Fig. 7. Seven days old embryo. Fig. 8. Hatchling. Fig. 9. One day old larva. Fig. 10. Four days larva. Fig. 11. 14 mm post-larva. Fig. 12. 14 mm post-larva after three days. Fig. 13. 16 mm post-larva after 15 days. Fig. 14. 18 mm post-larval after 2 months. Fig. 15. 21 mm Juvenile. Fig. 16. Nasal cirrus. Fig. 17. Orbital cirrus. Fig. 18. Head cirrus.

(HC, Head cirrus; HT, Heart; NC, Nasal cirrus; OC, Orbital cirrus; RP, Red patch; UV, Urinary vesicle; WB, White bodies.)
Three days old embryo (Fig. 3).—The embryo has grown considerably and begins to make slight movements. The head and eyes have become prominent. The eye develops some black pigment on the anterior part. The number of melanophores on the yolk has increased. The amount of yolk, and the size of the white bodies have decreased. A functional heart is formed but the rate of beating is very slow.

Four days old embryo (Fig. 4).—The embryo takes a curve either to the right or left. The eyes have become completely black and can be seen as two small beads with the naked eye. The yolk retains the pinkish colour in some while it turned brown in the majority of the eggs. The number of white bodies is reduced to one or two and in some eggs they have completely disappeared. The rate of heart-beat is increased. The main blood vessels with circulating blood are formed.

Five days old embryo (Fig. 5).—The embryo changes its position very frequently. The yolk assumes a crescentic shape due to its absorption in the central region. The heart lies in the groove-like part of the yolk. Occasionally the embryo moves its eyes to the sides as in the adult.

Six days old embryo (Fig. 6).—The embryo has grown further in length. The melanophores which lie scattered on the yolk begin to accumulate in the gut region and the branches of the melanophores become very short.

Seven days old embryo (Fig. 7).—The embryos are ready to hatch out as indicated by the increased movements inside the egg. The height of the egg is reduced due to the absorption of the yolk. The head develops a few melanophores between the eyes.

Hatching and Development of the Larvae

Eggs are usually hatched on the sixth or seventh day. Mechanical stimulus such as stirring or aeration always helped the process of hatching. As the eggs are subjected to wave action in the natural habitat and well aerated, similar conditions in the laboratory also are probably required for hatching. In the absence of mechanical stimulus and aeration the number of the hatchlings is remarkably reduced and hatching is delayed. Quasim (1957) also observed that mechanical stimulus was necessary in the hatching of the eggs of Blennius pholis. Larvae of Blennius pavo develop special hatching glands on the anterior part of the head which, according to Eggert (1932), secrete a proteolytic substance that acts upon the egg membrane and partly dissolves it. The chemical action of the enzyme
and the mechanical action of the embryo inside break the egg membrane and the larvae escape the eggs with the head first. In this study no attention was paid to the hatching enzymes. But it was observed that the hatching of the first one or two eggs appear to stimulate the hatching of the rest of the eggs in the container as the hatching of most of the eggs follows the initial hatching.

**Hatchling (Fig. 8).—**The hatchling measures about 3.00 mm and the yolk is still present in considerable quantity. There are 9 pre-anal and 21 post-anal myotomes. The mouth is not formed in some while it is formed in others. Blood circulation is clearly visible on the yolk and the body. The pectoral fin develops dot-like melanophores. The larvae are very active and positively phototropic.

**One day old larva (Fig. 9).—**The larvae have grown in length and measure about 3.5 mm. A small quantity of yolk is still present and the mouth is formed in all the larvae but they did not feed on any of the items of food supplied.

**Three days old larvae.**—The larvae do not differ much from the previous stage except that they have increased in size. About 20 dot-like melanophores appear at the base of the ventral fin-fold and those on the pectoral fin begin to branch. Many larvae died on the third day due to starvation.

**Four days old larva (Fig. 10).—**A few larvae survived till the fourth day. They measure 4.00 mm in length. The ventral dot-like melanophores and the branched melanophores on the pectoral fin become more prominent. A green oval body is seen in the region of the gut. All the larvae died on the fourth day after hatching.

**POST-LARVAE AND JUVENILES**

**Post-larva of 14.00 mm (Fig. 11).—**D XII + 15. P 14. V 3. A II + 16. C 11.

The larva is highly transparent at this stage. Bright red patches of chromatophores are present on the head and pectoral fins. A light red pigment is present along the length of the vertebral column. Silvery spots are found on the pectoral fins. A simple nasal cirrhus and a branched orbital cirrhus are developed. Minute teeth are present on both the jaws.

After three days the red patches of chromatophores disappeared completely except the one on the head. A few melanophores make their
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appearance on the head and the pectoral fins. Four vertical rows of melanophores begin to appear on the dorsal and the lateral sides of the larva (Fig. 12).

Post-larva of 16.00 mm (Fig. 13).—The larva has grown to a length of 16.00 mm, during the course of 15 days after collection. During this period there is gradual loss of transparency of the body with the progressive increase of the melanophore pigmentation. Greenish-yellow pigmentation also appears on the dorsal and lateral sides of the body. Many silvery patches are developed on the body. A light red patch still persists on the head. A number of melanophores concentrate at the first dorsal fin-ray where the future ocellus of the dorsal fin develops.

Post-larva of 18.00–20.00 mm (Fig. 14).—Five to six vertical bands are clearly formed on the body. Many larvae developed one to three head-cirri. The ocellus of the dorsal fin is clearly formed. The anal fin develops a black line at its margin. Red dot-like pigment cells develop on the dorsal fin.

Juveniles of 21.00–30.00 mm (Fig. 15).—It is observed that the monthly rate of growth of the larvae is 1.5–2.00 mm in length under laboratory conditions. There is a gradual addition of the number of head-cirri in the course of development. The new cirri are formed one behind the other. The number of branches of the orbital and nasal cirri increases. Circular black patches appear on the lateral sides of the body.

Adults of 30.00–70.00 mm—Maturity is reached when they grow to a length of about 70 mm. The mature females have a very well-developed and distended abdomen. The vertical pigment bands become ill-defined in the full-grown adults while they are well marked in the younger stages. The circular black and silvery patches become more prominent. The adults possess a row of 8–10 cirri on the head, a nasal cirrhus of 6–7 branches and an orbital cirrhus of 6–10 branches (Figs. 16–18).

Remarks

The eggs of blennids were first described by Guitel (1893) and later by several workers (Eggert, 1932; Hildebrand and Cable, 1938; Quasim, 1956; Wickler, 1957a, 1957b; Fishelson, 1963b). They are usually dome-shaped with a sticky disc pink or brown in colour. The two large eyes of the embryos can be seen with the naked eye in well-developed embryos. The pattern of pigmentation of the embryos and the larvae varies consider-
ably. The larvae are usually characterised by large black eyes, a series of melanophores at the base of the anal fin-fold pigmentation on the pectoral fin and on the dorsal aspect of the gut.

The time taken for hatching of the eggs varies from a period of two months to one week depending on the temperature. The eggs of *Blennius pholis* take 61 days at a temperature of 9.5-114°C (Quasim, 1956); *Pseudoblennius percoides* 17 days at a temperature of 17°C (Fujita, 1957); *Blennius pavo* 9-10 days at a temperature of about 24°C (Fishelson, 1963 b) and *Hypleurochilus geminatus* 6-7 days at a temperature of 26–28°C (Hildebrand and Cable, 1938).

Day (1878) recorded *Blennius steindachneri* from Indian waters and mentioned Waltair as one of the localities of its occurrence. Smith (1961) synonymised *B. steindachneri* with *B. cristatus*. But Dr. Springer of Smithsonian Institution, Washington D.C., expressed that the name "cristatus" be restricted to the Atlantic species.

The present work is only of a preliminary nature and further investigations will greatly elucidate the biology of this species.

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