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Embryonic Development and Prolarva of the Atherinid Fish, *Atherion elymus*

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Among atherinid fishes only *Atherion elymus* Jordan et Starks have been known to spawn adhesive eggs without chorionic filaments (Breder and Rosen, 1966). The description is based on Nakamura (1936). Recently we succeeded in making the fish spawn in captivity and found quite a different result from what has been previously reported for this species.

Materials and method

We operated a seine on June 12, 1985 at a sandy beach in Nomo, Nagasaki (32°35′N, 129°45′E) and caught about 120 adult *A. elymus* of about 4 cm in standard length. Two-thirds of the specimens were kept in a concrete indoor holding tank, 147×70 cm square and 67 cm deep at the nearby Fisheries Experimental Station of the Faculty of Fisheries, Nagasaki University. Sea water flowed into and out of the tank continuously (about 140 liters an hour). Frozen mysis were fed everyday. The rest of the specimens were fixed in formalin solution for identification of species and examination of ovarian eggs.

A rectangular plastic net, 100×60 cm with a mesh size of 1.3 mm and set on a wooden frame was placed at the tank bottom and some smaller nets were hung in the water column. The eggs spawned on the net were removed and kept in a small rectangular plastic tank, 9×20 cm and 6 cm deep with controlled water temperature to observe embryonic development and prolarva.

Results

Eggs. On June 14, 20 eggs were found entangled on the net set on the bottom. Five additional eggs were found the next day on the same net but no eggs were found on subsequent days, although the fish appeared healthy, taking food everyday. No eggs were spawned on the net hung in the water. The eggs were laid on the net separately, not forming an egg mass.

The eggs (Fig. 1) are demersal, almost spherical in shape, measuring 0.87–1.02 mm in diameter, with a colorless transparent chorion and slightly yellowish yolk. There are 3 to 7 comparatively large oil globules measuring 0.05–0.12 mm in diameter, and numerous tiny ones in the yolk. The perivitelline space is narrow.

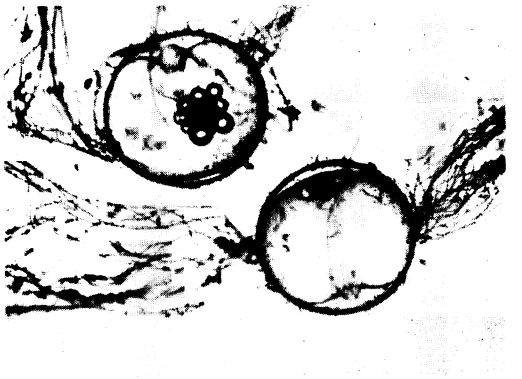

Fig. 1. Eggs of developing *Atherion elymus* showing chorionic filaments at opposite sides.

The egg has numerous chorionic filaments gathering at two tufts located at the opposite sides of the chorion. Most filaments measuring 4–6 mm long and 30–50 in number were found in each tuft; 2 or 3 filaments are located a little bit apart from the tufts. Measurements and counts of filaments should be considered preliminary, because some filaments may have been cut or lost when eggs were removed from the net, although the eggs were rather easy to remove and the fragments of the filaments did not seem to remain on the net. Each filament is slightly thickened at the base.

Embryonic development. Out of 25 eggs collected, only 6 developed to hatching. Embryonic development of these eggs is shown in Table 1 and Fig. 2. During embryonic development, no change in number and size of oil globules was seen. The most distinguished feature of the embryo was the numerous large xanthophores thickly borne on the body. We found the pectoral fins formed within 5 days and 3 hours after the morula stage, although we failed to note the exact time of the formation. The vitelline circulation common in atherinid fishes was observed in well-grown embryos. Hatching took place at 21.5 to 22.3°C 12 days from the morula stage when we had collected them.

Prolarva. One newly hatched larva (Fig. 2) measured 4.4 mm in total length. Some yolk was present anteriorly and oil globules also re-

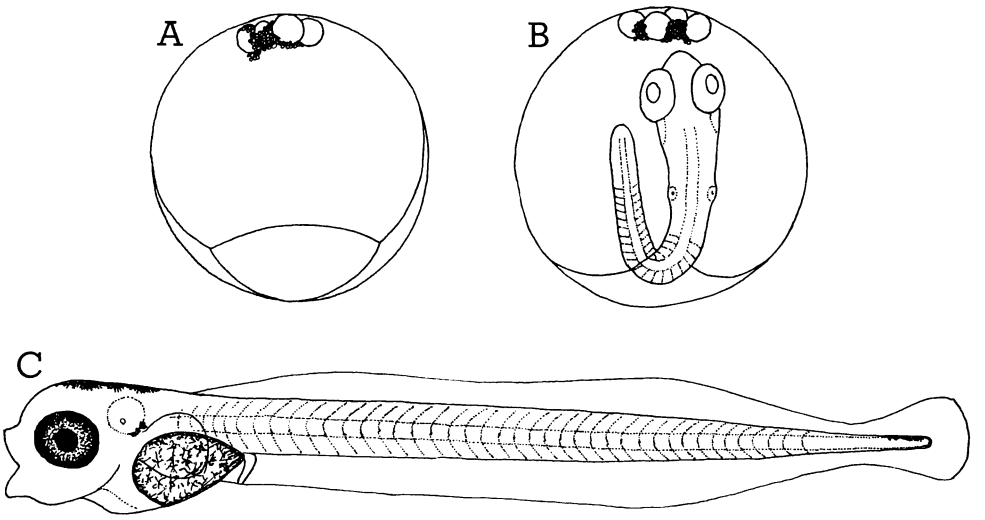

Fig. 2. Eggs 3 hr (A) and 2 days 20 hr (B) after the collection (after morula stage) and a larva half a day after hatching (C). The filaments on chorion are eliminated from the drawings.

mained anteriorly in the yolk. The mouth was fully developed and the larva possessed 41 (7+34) myomeres. The anus was located anteriorly just behind the yolk sac and the tail was elongated as seen in most of the atherinid larvae (White *et al.*, 1984).

Melanophores were found on top of the head, sides of the head behind the otocysts, the yolk sac and the posterior notochord tip. Three large conspicuous melanophores were lined up in a longitudinal row on top of the head. This melanophore row is typically seen in the larvae of *Hypoatherina tsurugae* (see Uchida, 1927), *H. bleekeri* (see Takita and Nakamura, 1986) and *Atherinomorus insularum* (see Miller *et al.*, 1979). Of the six larvae obtained, five had lined melanophores located dorsally on the notochord tip as shown in Fig. 2. Three out of the five larvae

Table 1. Embryonic development of *Atherion elymus*.

Time elapsed from morula stage			Water temp. (°C)	Developmental stages observed
day	hr	min		
0	2	55	21.9	Blastula stage.
0	10	0	21.9	Early gastrula stage.
1	0	30	21.8	Beginning of embryo formation.
1	6	30	21.8	Blastopore nearly closed.
1	13	40	21.7	Eye vesicle formation.
2	4	0	21.9	Myomere formation.
2	5	30	21.9	Optic lens formation.
2	9	0	21.8	Otocyst formation.
2	20	0	21.8	Beginning of tail formation.
2	21	30	21.9	Appearance of xanthophores on embryo.
3	0	30	21.8	Beginning of heartbeat.
3	3	30	21.9	Appearance of xanthophores on the yolk sac.
8	21	0	22.1	Appearance of black pigments in the eyes.
11	20	0	22.3	Appearance of the three large melanophores on the top of head.
12	9	0	22.1	Hatching.

had a small melanophore at the ventral side of the notochord tip, but the two other larvae lacked this melanophore. One larva had no melanophore either dorsally or ventrally on the notochord tip.

Xanthophores were present on the head and posterior part of tail. Only a few or no xanthophores were seen on the trunk with yolk sac, and anterior one-third and the end of the tail.

The larvae remained motionless at the tank bottom throughout the day and would not move, unless disturbed. Since they lived only for two days, this behavior may be abnormal.

Discussion

The eggs we observed were typical of the atherinid fishes, whereas Nakamura (1936) reported small size, adhesion of chorion and lack of chorionic filament for *A. elymus* eggs which are uncommon in atherinid fishes. Moreover, he has not noted the formation of pectoral fins and mouth as well as the development of vitelline circulation in embryos, which have been known in many atherinid fishes.

Not only the egg morphology, but also some conspicuous differences in prolarva are seen between ours and the description by Nakamura (1936). Nakamura's newly hatched larvae have fewer myomeres, a large amount of yolk with one large oil globule and no mouth or pectoral fin. Moreover, there are no lined melanophores on top of the head in his specimens.

Some points should be discussed in relation to the different results of this study from Nakamura's (1936). First, the species could be different. Our specimens were examined referring to the original description by Jordan and Starks (1901) and confirmed the species. Second, a different fish could be mixed in our holding tank or Nakamura's and spawned. When our specimens were examined we noted the ovarian eggs and recognized the filaments curling up onto the chorion.

Nakamura (1936) described the postlarvae and juveniles using specimens collected from the sea. They have typical atherinid characters and apparently differ from those of *H. bleekeri* (see Takita and Kondo, 1984) and *H. tsurugae* (see Uchida, 1927) which can be expected to occur with *A. elymus*. Moreover, the youngest of his postlarvae from the sea resembles ours. The postlarvae and juveniles in Nakamura (1936) can be the same species as ours.

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(Note: Title in parentheses is originally given in Japanese, and put into English by the authors.)

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ムギイワシの卵内発生と前期仔魚

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ムギイワシの水槽内産卵で，本種の卵は多くのトウゴロウイワシ科魚類と同様，てん絡卵であることを確認した．その卵は直径 0.87–1.02 mm で，卵膜の両端に長さ 4–6 mm のてん絡糸が各，30–50 本，束状に生えている．胚体は口，胸鰭と卵黄血管が発達し，頭頂に 3 つの大型の星状黒色素胞を持つ．ふ化直後の仔魚は全長 4.4 mm で，典型的なトウゴロウイワシ科仔魚の体型を有する．これらの特徴のいずれも，本種の卵は粘着卵であるとした Nakamura (1936) では認められていない．

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