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Early Developmental Stages of the Scorpaenid Fish, *Scorpaena miostoma*, Reared in the Laboratory

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Abstract Embryonic development and morphology of the eggs, egg masses and larvae of the scorpaenid fish, *Scorpaena miostoma* are described on the basis of the laboratory-reared specimens. The gelatinous egg mass is not bilobed but simple, oval and balloon-like in shape. It usually floats at or near the surface. The individual egg is colorless and ovoid in shape, measuring 0.86 × 0.75 mm. Hatching occurs between ca. 34 and 40 hours after spawning at the water temperature of 22–24°C. A newly hatched larva measures 1.55 mm in notochord length and has ca. 25 myomeres. The finfold is balloon-like in shape and almost completely covers the larval body. Minute "cell-like" granules scatter on the findfold.

Scorpaena miostoma Günther is a somewhat common scorpaenid fish inhabiting the sea from central to southern Japan and the southern Korean Peninsula. Among *Scorpaena* species distributed in the coastal areas of the Shima Peninsula, Mie Prefecture, this species is the most abundant and widely used for human consumption. Biological information about this species is very little except for systematic descriptions.

Although the morphology of the eggs, egg masses and larvae of *Scorpaena* species in the NE Pacific and the Mediterranean is well known (Barnhart, 1932; David, 1939; Orton 1955; Sparta, 1956), there are few reports concerning that of Japanese congeners. Mito (1963) described nine types of Japanese scorpaenid eggs and larvae. But these were unfortunately not identified.

We collected some immature adults of *S. miostoma* and reared them in our laboratory. Six or seven months after our collection of the parents, we succeeded in getting their eggs, and reared them until they developed to preflexion larvae. In this report, we described the embryonic development and the morphology of the eggs, egg masses and larvae of this species.

Materials and methods

Three females (85–100 mm in standard length (SL)) and two males (90–122 mm SL) were caught by angling at the mouth of Ago Bay, Mie Prefecture, Japan (34°16′45″N, 136°46′30″E, 12–15 m depth) during the period from October to December, 1985. They were kept in a 2,000 *l* concrete tank until August 1986.

Just after spawning had occurred, the egg masses were transferred into a 30 *l* polycarbonate tank with somewhat strong aeration. Incubating temperature ranged from 22 to 24°C. The hatched larvae were transferred into a 500 *l* black polyethylene tank with weak aeration. The larvae were fed with trochophores of the oyster, *Crassosterea gigas*. The larvae were removed periodically from the larval rearing tank, and anesthetized by 10–50 ppm ethylene glycol monophenyl ether for subsequent morphological observation and measurement.

Results

Spawning. Spawning occurred continuously from June 21 to July 20, 1986. Spawning time was defined from 21: 30 to 22: 30. A female parent discharged a pair of egg masses simultaneously.

Eggs and egg masses. The eggs are embedded irregularly in a single layer in a thin gelatinous matrix. The distance between neighboring eggs in the matrix ranges from ca. 0.07 to 0.25 mm. The gelatinous egg mass is hollow, colorless, and oval in shape (ca. 4 cm in long diameter and ca. 3 cm in short diameter), containing approximately 3,000 to 4,000 eggs (Fig. 1). Egg masses usually float at or near the surface, but sometimes they deposit on the bottom even though the individual eggs are alive. A pair of egg masses is not joined but isolated entirely from each other. Although

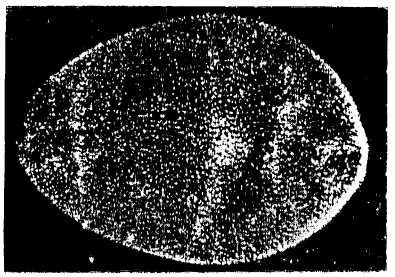

Fig. 1. A gelatinous egg mass of *Scorpaena miostoma*, about an hour after spawning.

the gelatinous matrix recently spawned is tight and elastic, it becomes loose and rends one day after spawning.

The individual egg is buoyant, transparent and ovoid in shape, measuring 0.78–0.96 mm (av. 0.86 mm) in long diameter and 0.65–0.82 (av. 0.75 mm) in short diameter. The yolk is slightly textured and contains no oil globules. The perivitelline space is very narrow and not visible until the embryo is sufficiently developed.

Embryonic development is shown in Table 1 and Fig. 2. Hatching occurs between ca. 34 and 40 hours after spawning.

Larval morphology. Measurements and external morphology of the larvae are shown in Table 2 and Fig. 3, respectively. The larvae were kept alive for 13 days after hatching, but the length growth was recognized for only the first five or six days. The maximum size of the larva obtained here is 2.38 mm in notochord length.

Table 1. Embryonic development of *Scorpaena miostoma*.

Time elapsed after spawning	Developmental stages observed
1 h 30 min	Elevation of blastodisc.
1 h 57 min	2-cell stage (Fig. 2B).
2 h 20 min	4-cell stage.
2 h 38 min	8-cell stage (Fig. 2C).
2 h 57 min	16-cell stage.
10 h 10 min	Blastula stage.
11 h 50 min	Gastrula stage.
15 h 56 min	Beginning of embryo formation (Fig. 2D).
18 h 4 min	Formations of optic and Kupffer's vesicles. 4 myomeres.
19 h 10 min	Closure of blastopore. 7 or 8 myomeres.
22 h 4 min	Formation of otic capsule. 9–11 myomeres (Fig. 2E).
26 h 3 min	Disappearance of Kupffer's vesicle.
26 h 33 min	Formation of olfactory vesicle.
27 h 0 min	Beginning of tail formation.
27 h 35 min	Formation of optic lens.
28 h 35 min	Beginning of embryo moving.
30 h 24 min	Beginning of heart pulse.
34 h 20 min	Beginning of hatching (Fig. 2F).

Body shape: The newly hatched larva is stout-bodied and short-tailed. The body becomes slender and the tail elongates very rapidly. One-

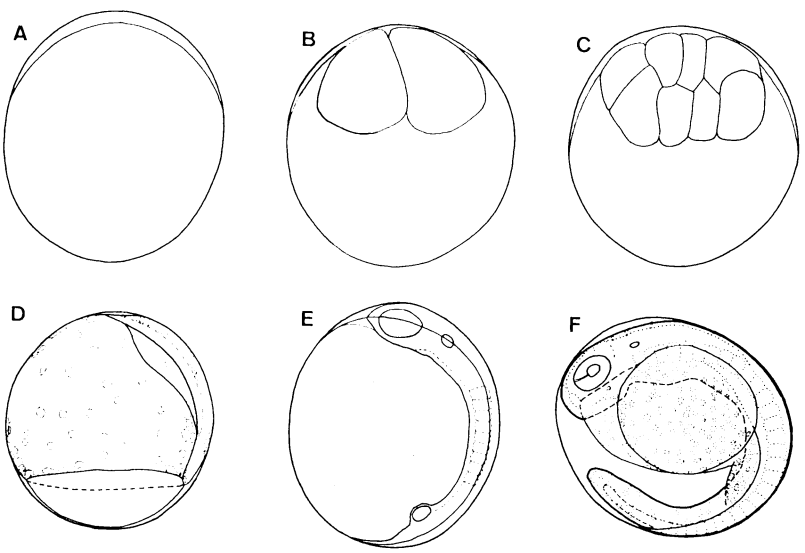

Fig. 2. Development of eggs of *Scorpaena miostoma*. A, just after spawning; B, ca. 2 h, C, ca. 2 h 40 min; D, ca. 16 h; E, ca. 22 h; F, ca. 34 h 20 min.

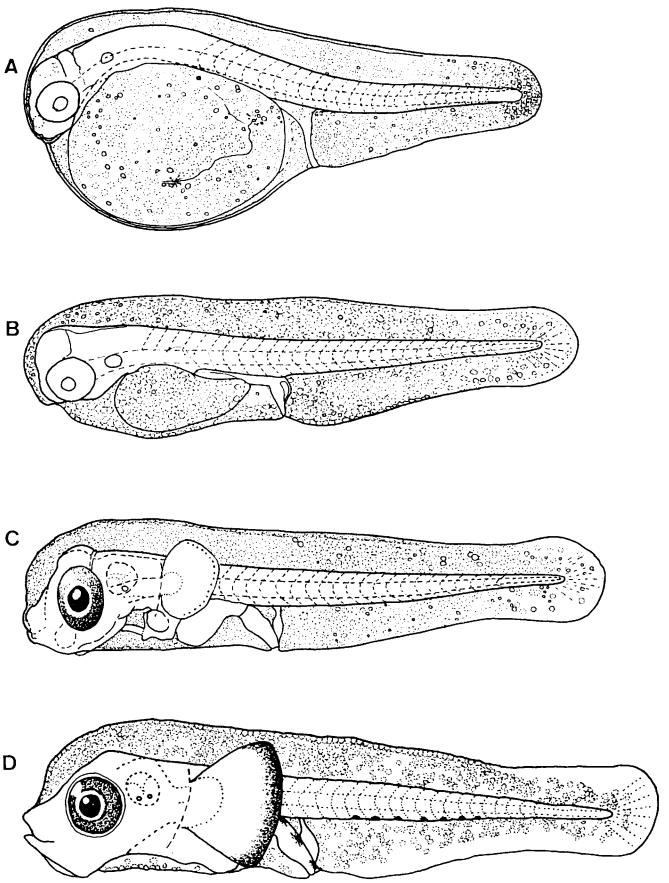

Fig. 3. Development of larvae of *Scorpaena miostoma*. A, yolk-sac larva newly hatched, 1.55 mm in notochord length (NL); B, yolk-sac larva, 1 day after hatching, 2.01 mm NL; C, preflexion larva, 3 days, 2.25 mm NL; D, preflexion larva, 5 days, 2.33 mm NL, two melanophores on the dorsal surface of the alimentary canal are hidden behind the pectoral fin.

Table 2. Measurements of *Scorpaena miostoma* larvae. Figures in parentheses indicate the mean values.

Days after hatching	Total length (mm)	Notochord length (mm)	Pre-anal length (mm)
Newly hatched	1.55–1.65 (1.60)	1.50–1.60 (1.55)	0.87–0.93 (0.90)
1	1.90–2.22 (2.11)	1.80–2.08 (1.97)	0.90–1.05 (0.97)
2	2.05–2.25 (2.15)	1.95–2.15 (2.05)	0.94–1.03 (0.98)
3	2.20–2.40 (2.31)	2.00–2.25 (2.17)	0.97–1.07 (1.03)
4	2.25–2.40 (2.32)	2.13–2.28 (2.21)	1.01–1.08 (1.04)
5	2.28–2.50 (2.35)	2.25–2.38 (2.29)	1.05–1.15 (1.08)

to five-day-old larvae have a somewhat cylindrical body with a rather compressed tail. The number of myomeres ranges from 25 to 27 (9–11 in trunk and 15–18 in tail).

Yolk sac: In the newly hatched larva, the yolk sac is very large and ovoid in shape, but extends forward no further than the anterior tip of the snout. The yolk sac diminishes in size and becomes spheroidal in shape according to larval growth. Absorption of the yolk is completed three days after hatching.

Alimentary canal: The anus is situated slightly posterior to the middle of the body in a newly hatched larva. In one-day-old or older larvae, the anus is located anterior to the middle of the body. The pre-anal length decreases relatively according to the larval growth. The mouth is open three days after hatching. The alimentary canal is straight within the first two days after hatching, and then it becomes convoluted. The food animals in the canal were visible in four-day-old or older larvae.

Finfold: The finfold begins on the anterior tip of the snout and completely covers the larval body. It is much inflated and balloon-like in shape except on the posterior part of the tail where it forms thin and compressed edges. Minute "cell-like" granules are spread densely on almost the entire surface of the finfold. The granules on the dorsal surface of the finfold are piled up and show a narrow polygonally patterned zone along the dorsal contour of the finfold in the lateral observation because the finfold is wide and flattened in this area (Fig. 4). The granules become larger in diameter but decrease in number four days after hatching.

Pectoral fin: The anlage of the pectoral fin appears one day after hatching. The fin develops rapidly and becomes fanshaped.

Pigmentation. The newly hatched larva is transparent with no chromatophores. Pigmentation of the larva begins two days after hatching.

Eye: Iridophores appear two days after hatching, and then melanophores deposit three days after hatching.

Melanophores on the body: Punctate melanophores appear on the dorsal surface of the alimentary canal (3–5 cells) and on the ventral contour of the tail (6–10 cells) four days after hatching. Subsequently, the punctate melanophores change into branched ones one or two days after their first appearance.

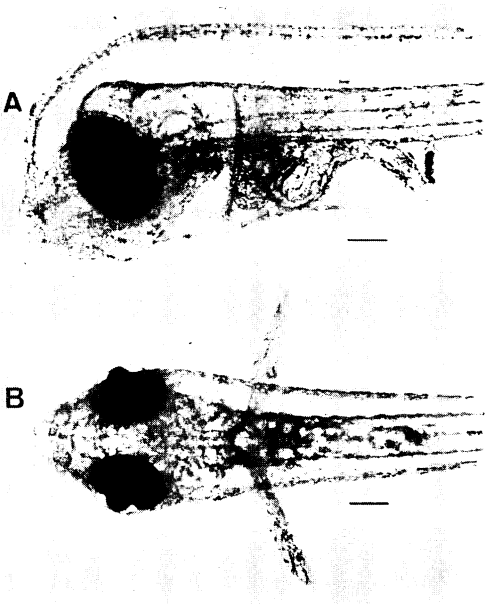

Fig. 4. Photographs of a four-day-old larva (2.20 mm NL) showing minute "cell-like" granules on the finfold. A, lateral view; B, dorsal view. Scales indicate 0.1 mm.

Melanophores on the pectoral fin: A single series of the punctate melanophores appears along the posterior margin of the fin three days after hatching. These melanophores change into branched ones and spread densely on the marginal area of the fin one or two days after their first appearance.

Xanthophores on the finfold: Two days after hatching numerous xanthophores are present on the cephalic, dorsal and caudal areas of the finfold. Subsequently, these xanthophores gradually decrease in number, and they completely disappear seven days after hatching.

Discussion

The eggs and larvae of *Scorpaena* species are hitherto known of only one NE Pacific and three Mediterranean species: *S. guttata* (Barnhart, 1932; David, 1939; Orton, 1955), *S. porcus*, *S. scrofa* and *S. notata* (Sparta, 1956). This paper is the first report on the *Scorpaena* egg and larva from the NW Pacific.

The gelatinous egg mass of *S. miostoma* re-

sembles that of the congeneric species in general structure. *S. miostoma* spawns a pair of egg masses simultaneously as stated before. Each of the masses may be produced by one side of the paired ovary. Although all the egg masses of scorpaenid fishes hitherto known form a bilobed balloon (Barnhart, 1932; Orton, 1955; Pearcy, 1962; Washington et al., 1984), a pair of egg masses of *S. miostoma* obtained here is completely separated from each other and forms two independent oval balloons. In NE Pacific and Mediterranean *Scorpaena* species mentioned above, cell-like spaces or polygonal blocks are present in the gelatinous matrix; whereas in *S. miostoma* no structure is discerned in the matrix between the eggs. The egg mass of *S. miostoma* is rather small in size as compared with that of *S. guttata* (25 cm in long axis).

The individual egg of *S. miostoma* also bears a close resemblance to that of the congeners. The common characteristics of *Scorpaena* eggs are their ovoid shape, lack of oil globules and very narrow perivitelline space. *Scorpaena* eggs could be distinguished by these characters from *Pterois* and *Sebastolobus* eggs (Mito and Uchida, 1958; Pearcy, 1962; Fukataki, 1963; Washington et al., 1984). The egg size of *Scorpaena miostoma* is almost equal to *S. notata* (0.88×0.76 mm), slightly larger than *S. scrofa* (0.88×0.68 mm), and rather smaller than *S. porcus* (0.92×0.84 mm) and *S. guttata* (1.22–1.29×1.16–1.19 mm). The incubating period of *S. miostoma* is equal to *S. porcus* (1–2 days), and shorter than *S. guttata* (3 days), *S. notata* (3–4 days) and *S. scrofa* (4–5 days).

The yolk-sac and preflexion larva of *S. miostoma* closely resemble those of the congeneric species in general. The number of myomeres and the morphology of the finfold are almost common in the genus. A newly hatched larva of *S. miostoma* is smaller in body length than *S. porcus* (1.72 mm in total length (TL)) and *S. guttata* (1.9–2.0 mm TL). The lengths of newly hatched larvae are positively correlated to the diameters of their eggs. The newly hatched larvae of *S. scrofa* and *S. notata* described by Sparta (1956) are so large (2.80 mm TL in both species) that these lengths are to be considered doubtful.

Pigmentations of the five species of the *Scorpaena* larvae are slightly different from one another. *S. miostoma* is less pigmented than the other congeners. Melanophores on the eye of the newly hatched larvae are absent in *S. miostoma* and *S. porcus* which have shorter incubating periods (within 2 days); whereas those melanophores are present in *S. guttata*, *S. scrofa* and *S. notata* which have longer incubating periods (more than 3 days).

As stated above, the morphology of the eggs, egg masses and larvae of *S. miostoma* is different from those of NE Pacific and Mediterranean congeners. But most eggs and larvae of Japanese *Scorpaena* species and other oviparous scorpaenids are unfortunately not described although about ten species of the genus *Scorpaena* and many oviparous scorpaenids are distributed in Japanese waters. Identification of the wild eggs and larvae belonging to the genus or the family is, therefore, still difficult.

The eggs and larvae of *S. miostoma* bear a close resemblance to those of Mito (1963)'s Scorpaenicae-type No. 9 in the following characters: egg diameter, lack of oil globules, lengths of larvae and larval pigmentation. But there is a discrepancy concerning the positions of the hindgut and the anus. The hindgut is in contact with the posterior margin of the yolk sac and the anus is situated just posterior to the yolk sac in Mito's newly hatched larva; whereas both the hindgut and the anus are always located slightly apart from the posterior margin of the yolk sac in the larvae obtained here.

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Literature cited

Barnhart, P. S. 1932. Notes on the habits, eggs and young of some fishes of southern California. Bull. Scripps Inst. Oceanogr. Univ. Calif., 3(4): 87–99.

David, L. R. 1939. Embryonic and early larval stages of the grunion, *Leuresthes tenuis*, and of the sculpin, *Scorpaena guttata*. Copeia, 1939(2): 75–81.

Fukataki, H. 1963. Pelagic egg balloons from the western North Pacific referable to *Sebastolobus macrochir* (Günther). Bull. Japan Sea Reg. Res. Lab., (11): 91–100. (In Japanese with English summary.)

Mito, S. 1963. Pelagic fish eggs from Japanese waters—VIII. Cottina. Japan. J. Ichthyol., 11(3/6): 65–79, pls 19–28. (In Japanese with English summary.)

Mito, S. and K. Uchida. 1958. On the egg development and hatched larvae of a scorpaenoid fish, *Pterois lunulata* Temminck et Schlegel. Sci. Bull. Fac. Agr. Kyushu Univ., 16(3): 381–385. (In Japanese with English summary.)

Orton, G. L. 1955. Early developmental stages of the California scorpionfish, *Scorpaena guttata*. Copeia, 1955(3): 210–214.

Pearcy, W. G. 1962. Egg masses and early developmental stages of the scorpaenid fish, *Sebastolobus*. J. Fish. Res. Bd. Canada, 19(6): 1169–1173.

Sparta, A. 1956. Sottordine: Scleroparie. Famiglia 1: Scorpaenidae. Pages 599–626, pls. 38–39 *in* Uova, larva e stadi giovanili de Teleostei. Fauna Flora Golfo Napoli, Monogr., (38).

Washington, B. B., H. G. Moser, W. A. Laroche and W. J. Richards. 1984. Scorpaeniformes: Development. Pages 405–428 *in* H. G. Moser, W. J. Richards, D. M. Cohen, M. P. Fahay, A. W. Kendall, Jr. and S. L. Richardson, eds. Ontogeny and systematics of fishes. Amer. Soc. Ichthyol. Herpetol., Spec. Publ., (1).

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コクチフサカサゴの卵および仔魚

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水槽内で自然産卵させたコクチフサカサゴ卵を飼育し，卵内発生過程や卵，卵嚢および仔魚の形態を記載した．本種の卵はゼラチン質の卵嚢内に一層に埋没している．卵嚢は中空の扁球形で，通常は水面近くに浮遊する．個々の卵は透明の卵形で，平均直径 0.86×0.75 mm，油球はない．水温 22—24°C で受精約 34—40 時間後に孵化する．孵化仔魚は平均脊索長 1.55 mm で，筋節数 25 前後，色素胞は有していない．膜鰭は袋状で，体全体を覆う．膜鰭上には多数の胞状顆粒物がみられる．孵化 3 日後に卵黄が完全に吸収され，開口し，眼や胸鰭縁辺に黒色素胞が沈着する．消化管背面や尾部腹中線上の黒色素胞は孵化 4 日後に出現する．

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