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Early developmental stages of some marine fishes from India

3. *Liza subviridis* and *L. tade**

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Abstract: Features of the early developmental stages of two species of grey mullets in the marine fish fauna of Porto Novo, India, are given and the pigmentation pattern in the larvae and postlarvae of these and a few other species is commented upon.

1. Introduction

In the earlier two parts of the present series (BENSAM, 1986; 1987), one or more of the early developmental stages of nine Clupeiformes and one Gonorhynchiformes were described after investigations at Porto Novo, India, during 1977-79. In the present and third part of the series, the eggs, larvae, postlarvae and/or juveniles of two species of grey mullets (Family Mugilidae, Order Mugiliformes) are described. The material was collected from the same locality as stated in the first part (BENSAM, 1986) and methods applied here are also the same.

2. Results and discussion

2.1. *Liza subviridis* (Valenciennes)

This species, more commonly called *L. dussumieri* (Valenciennes), is both of capture and culture value in India and is distributed in Persian Gulf, Gulf of Oman, Sri Lanka, China, Queensland and Polynesia. Since little seems to be known on its early development, the eggs, larvae, postlarvae and juveniles collected during September-October 1977 are described here.

a. Eggs (Fig. 1, A-D)

Mature ova of *L. subviridis* vary in diameters from 0.45 to 0.55 mm, with the mean at 0.50 mm (Fig. 1, A). An oilglobule is present, in diameters of 0.145-0.156 mm, with the mean at 0.150 mm. Yolk is clear, neither segmented nor vacuolated and leaves a narrow perivitelline space. Coinciding with occurrence of the spawners of this fish, a large number of eggs resembling the ripe ova in all features are found in the plankton. These measure diameters between 0.53 and 0.57 mm, with the mean at 0.55 mm; and their oilglobules have diameters between 0.154 and 0.165 mm, with the mean at 0.15 mm. In developing eggs the oilglobules occupy an anterior aspect of the embryo. In an earlier stage of development (Fig. 1, B), there are two patches of light yellowish brown pigments in the head and black pigments intermingled with light yellowish brown chromatophores on the trunk and tail. Similar pigmentation is present on the oilglobules also. In a later stage (Fig. 1, C) the embryo is almost fully formed, when an yellowish brown blotch of pigments is seen midway between the hind end of yolksac and tail end. Hatching usually takes place in the afternoon of the day of collection, when the embryo emerges out of the egg capsule (Fig. 1, D).

b. Larvae (Fig. 1, E and F)

The newly hatched larva is 1.3 mm long (Fig. 1, E) with the oilglobule located at the anterior aspect of the yolksac. The pigment blotch in the mid postanal region is conspicuous. There are 7 preanal and 17 postanal myomeres. In a 24 hours old larva which measures 2.0 mm (Fig. 1, F), the eyes have become partly pigmented and the alimentary canal is under progressive development.

c. Postlarvae (Figs. 1, G and H, 2, I and J)

The earliest postlarva is reared in the labo-

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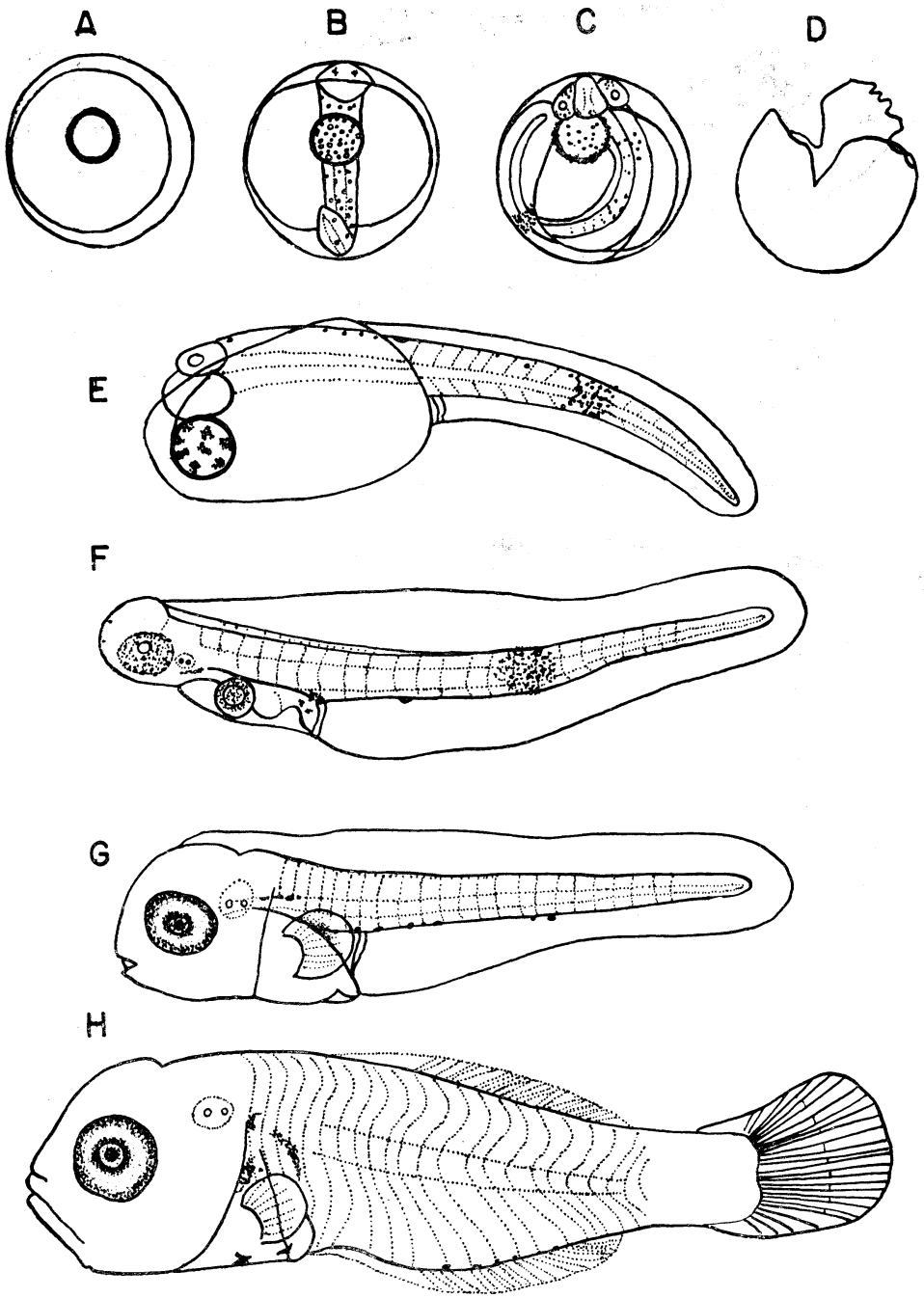

Fig. 1. Eggs, larvae, postlarvae and juveniles of *Liza subviridis* (a). A, Ripe ovum; B and C, planktonic eggs in two stages of development; D, empty egg capsule after hatching of the embryo; E, newly hatched larva of 1.3 mm in total length; F, 24 hours old larva of 2 mm; G, 48 hours old postlarva of 1.9 mm; H, planktonic postlarva of 4 mm. All drawn from preserved specimens, but A–C from live eggs.

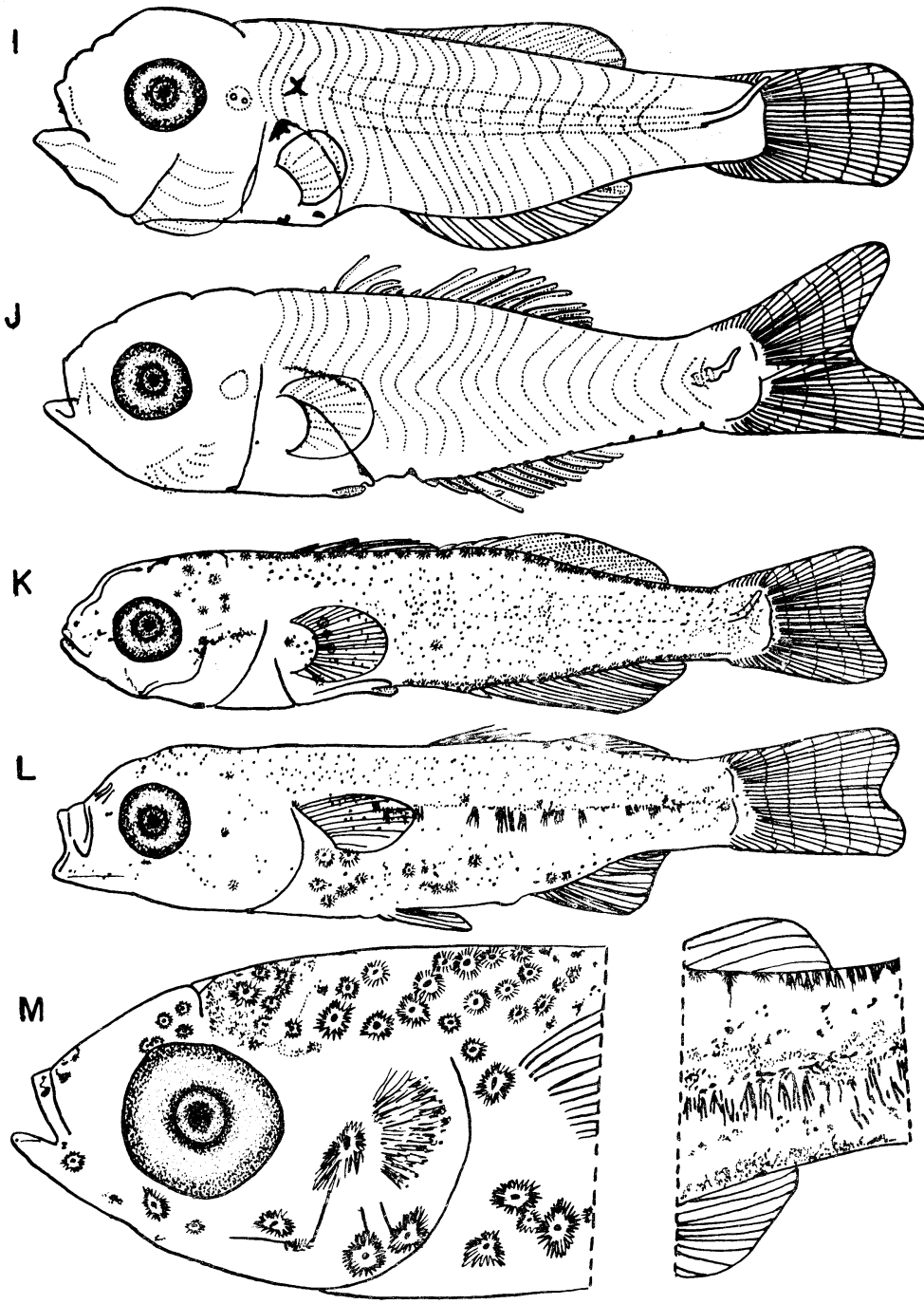

Fig. 2. Eggs, larvae, postlarvae and juveniles of *Liza subviridis* (b). I, planktonic postlarva of 4.5 mm in total length; J, planktonic postlarva of 7.2 mm; K, juvenile of 10.1 mm; L, juvenile of 12.4 mm; M and N, head and caudal peduncular regions respectively of a 14.0 mm juvenile. All drawn from preserved specimens.

ratory from egg stage and the others are collected from the plankton. The former is 48 hours old and measures 1.9 mm (Fig. 1, G). Apart from the postlarval characters such as pigmentation of eyes, development of pectoral fin and opercular cleft, there are black pigment spots on the dorsal aspect of trunk and a few yellowish brown chromatophores along ventral side of the body. Among the postlarvae collected from plankton, a 4.0 mm stage (Fig. 1, H) shows remnants of larval finfold along with rudiments of dorsal, caudal and anal fins. There are about 12 rays in the dorsal fin, 14 in the caudal and 12 in the anal. The number of preanal myomeres has decreased to 6 and that of the postanal myomeres increased to 18. In a slightly longer specimen of 4.5 mm (Fig. 2, I), the larval finfold has disappeared. The cuadal fin has become bifurcated by 7.2 mm (Fig. 2, J) and the pelvic fin as well as the spinuous part of the dorsal fin are formed. There are 6 spines and about 10 rays in dorsal fin, 32 rays in caudal and 12 in ventral fin. Disposition of the myomeres has changed to 7 preanal and 17 postanal.

d. Juveniles (Fig. 2, K–N)

The youngest juvenile collected measures 10.1 mm (Fig. 2, K). All the fins are under progressive development, with about 7 spines and 10 rays in dorsal fin, 34 rays in caudal fin, 12 in the anal, 10 in the pectoral and 3 in the pelvic. Pigmentation has increased considerably, in the form of blackish brown chromatophores in the snout, above and behind eyes, along dorsolateral and ventrolateral profiles and in the form of minute spots all over the body. Disposition of myomeres in this stage is 9 preanal and 15 postanal. Significant changes observed in a 12.4 mm juvenile (Fig. 2, L) are further development of all the fins and increase in pigmentation. Pectoral fin has become almost triangular. The dorsolateral and ventrolateral pigmentation has disappeared but a midlateral series has developed. The myomeres have become 10 preanal and 14 postanal in disposition. In a 14.0 mm stage the juvenile characters have become stabilised, with standard length of 11 mm, head length 3.3 mm, snout to origin of dorsal fin 5.7 mm, snout to pelvic 4.7 mm and snout to origin of anal 7.5 mm. Many chromatophores are present above the eyes, posteriodorsal aspect of head and opercular region (Fig. 2, M). Pigmentation has increased along the dorsolateral, ventrolateral and midlateral aspects of body (Fig. 2, N). It is in this stage that the myomere disposition corresponds to the adult condition of 11 preanal and 13 postanal.

e. Remarks

Although the diameter range of the eggs of *L. subviridis* falls within that of the eggs of *Mugil cephalus* (CHAUDHURI *et al.*, 1978) and of *Liza macrolepis* (NATARAJAN and PATNAIK, 1973) reported from India, the oilglobules in the eggs of *L. subviridis* are distinctly smaller than those of the other two species. The eggs and newly hatched larvae of *L. subviridis* differ from those of *L. macrolepis* in having a postanal blotch of pigments and an anterior location of the oilglobule. It may be noted in this connection that among the early larvae of most grey mullets reported from India, no character appears to be distinct enough to separate them species-wise without difficulty. The number and disposition of myomeres are not of much value because in most species these are the same. Hence, identification of the eggs and early larvae of most Indian grey mullets seems to be possible only by comparing the ripe ova with planktonic eggs.

In the planktonic postlarvae of *L. subviridis*, pigmentation is sparse, unlike those of *M. cephalus* reported by MARTIN and DREWRY (1978) and *Liza haematocheila* described by FUJITA (1979). It is only after the 7.2 mm stage that pigmentation increases in *L. subviridis*, thus reaching the general mullet pigmentation by 10.1 mm. In the early postlarvae of *M. cephalus* and *L. haematocheila* (*loc. cit.*) the midlateral pigmentation is dense, but in those of *Mugil curema* it is feeble (MARTIN and DREWRY, 1978). In *L. subviridis*, the midlateral row is absent in the early postlarvae and appears only in the early juvenile stage. These facts reveal that in the early development of grey mullets there are variations in pigmentation. Similarly, in the development of the anterior and posterior parts of the dorsal fin in *M. cephalus*, *M. curema* and *L. haematocheila* (*loc. cit.*), from the very beginning these parts are located away from each other. But, in *Liza parsia* SAROJINI (1957) has reported that the two parts are located

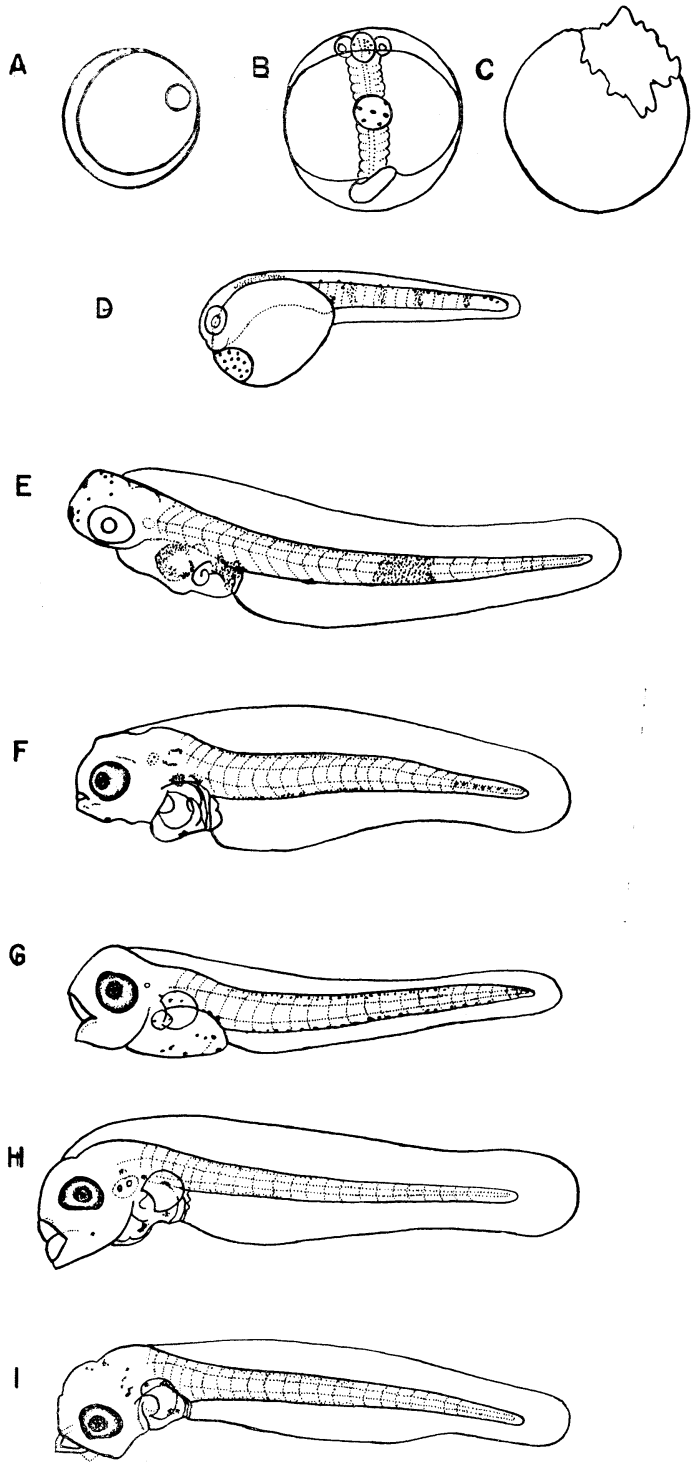

Fig. 3. Eggs, larvae and postlarvae of *Liza tade*. A, Ripe ovum; B, planktonic egg; C, empty egg capsule after hatching of the embryo; D, newly hatched larva of 1.3 mm in total length; E, 21 hours old larva of 1.9 mm; F, 42 hours old postlarva of 1.7 mm; G, 48 hours old postlarva of the same length; H, 66 hours old postlarva of 1.7 mm. All drawn from preserved specimens, but A and B from live eggs.

close to each other to begin with and it is only at a later stage that these are separated from each other. In *L. subviridis* the two parts are situated close to each other from 7.2 to 10.1 mm stages and it is only by 12.4 mm that the two parts get separated from each other.

2.2. *Liza tade* (FORSKÅL)

This is another commercially important grey mullet found in the Red Sea, Persian Gulf, India, Andamans, Penang, Malacca, China, Philippines and Australia. Nothing appears to be known on the early development of this species also so far.

a. Eggs (Fig. 3, A-C)

As judged from the appearance of mature, ripe and spent specimens of *L. tade* off Porto Novo, this species spawns there from January to May during 1977-79. Ripe ova (Fig. 3, A) range in diameters from 0.54 to 0.72 mm, with clear, unsegmented yolk and an oilglobule in the diameter range of 0.126-0.162 mm. Planktonic eggs (Fig. 3, B) have diameters from 0.63 to 0.72 mm, with clear, unsegmented yolk and an oilglobule in the diameter range of 0.126-0.188 mm. A few brownish pigment spots are present on the dorsal side of the head, the body and on the oilglobule. The embryos usually hatch out in the afternoon of the day of collection, leaving behind the egg capsule (Fig. 3, C).

b. Larvae (Fig. 3, D and E)

The newly hatched larva measures 1.3 mm (Fig. 3, D), with the oilglobule occupying an anterior position. In the posterior region of the body there are four vertical, brownish green pigment bands and above the hind end of the yolksac there is a large pigment. Also, minute black pigments are present along the dorsal profile of the head, trunk and tail. In a 21 hours old larva measuring 1.9 mm (Fig. 3, E), a few pigment spots have appeared on the head, one spot above the anal region and another about 4 myomeres behind it. In the mid-postanal region, a vertical blotch of light yellowish green pigments has appeared; but, the four vertical bands noted in the previous stage have disappeared. There are 6 preanal and 18 postanal myomeres.

c. Postlarvae (Fig. 3, F-I)

When 42 hours old, measuring 1.7 mm (Fig. 3, F), the postlarval features are seen. Pigments along the ventral aspect of the postanal region, above the pectoral region and at the ventral aspect of the viscera are more marked than in the larval stages. A few minute spots have appeared midlaterally at the caudal end. In a 48 hours old stage (Fig. 3, G), there is a further increase in pigmentation in the visceral region. By 66 hours (Fig. 3, H), there is a slight decrease in dorsal and ventral pigmentation and by 72 hours (Fig. 3, I), there is a diffusion in visceral pigmentation and a few pigment spots have appeared on the dorsal aspect of the mid brain.

d. Remarks

Similarities between the ripe ova of *L. tade* and the planktonic eggs have aided to identifiy the latter. Eggs of *L. tade* may be distinguished from those of *M. cephalus* reported from India (CHAUDHURI *et al.*, 1978) in that the former has an oilglobule smaller than that of the latter (0.29-0.38 mm). In the larvae and early postlarvae of *M. cephalus* as reviewed by RUSSELL (1976) and MARTIN and DREWRY (1978) and of *L. haematocheila* as described by FUJITA (1979), thick melanophores are present all over the body except posterior part of the tail. But, such a condition is lacking in the larvae of *Liza ramada*, *Chelon labrosus*, as reviewed by RUSSELL (1976), of *M. curema* by MARTIN and DREWRY (1978), of *Mugil corsula* as described by PAKRASI and ALIKUNHI (1953) and of *L. tade* described herein, in all of which pigmentation in the larvae is thin and sparse only. Also, while in *M. cephalus* and *L. haematocheila* a midlateral row of melanophores is present in the larvae and early postlarvae, in *L. ramada*, *C. labrosus*, *L. subviridis* and *L. tade* such a row is not present. In *M. curema* the midlateral row appears only after the 2.47 mm stage (MARTIN and DREWRY, 1978), in *M. corsula* by 6.4 mm (PAKRASI and ALIKUNHI, 1953) and in *L. dussumieri* (present paper) only after 10.1 mm.

From the information avaialble on pigmentation in the larvae and postlarvae of some grey mullets, the following sets of groupings may be formulated. (1) Larvae with sparse pigmentation as in *L. ramada*, *C. labrosus*, *L. subviridis* and *L. tade*; and larvae with dense pigmentation as in *M. cephalus* and *L. haematocheila*. (2) Larvae with an yellowish postanal blotch as in *M. cephalus*, *L. subviridis* and *L. tade*; and larvae

without it as in *C. labrosus* and *L. haematocheila*. (3) Larvae with a midlateral row of pigments as in *M. cephalus* and *L. haematocheila;* and larvae without it as in *C. labrosus, M. curema, M. corsula, L. subviridis* and *L. tade*. In *M. corsula, M. curema* and *L. subviridis* this row develops only in later stages.

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インド産海産魚類の初期発生段階

3. *Liza subviridis* および *L. tade*

Pathrose BENSAM

要旨: インド（マドラス州）ポルト・ノヴォ産ボラ類2種の初期発生にみられる形態的特徴を明らかにし，これら2種および近縁数種の稚仔に認められる色素沈着型の異同を論じた。