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Early developmental stages of some marine fishes from India

2. *Ilisha melastoma, I. megaloptera, Thryssa dussumieri, T. mystax* and *Chanos chanos**

Pathrose BENSAM**

Abstract: Four Clupeiform species and one Gonorhynchiform species in the important marine fish fauna of Porto Novo, India, are described in stages of egg, larva, postlarva and juvenile, along with their diagnostic characters.

1. Introduction

In the first part of the present series (BENSAM, 1986), the early developmental stages of five Clupeiformes were described after investigations during 1977-79 at Porto Novo, India. In the present and second part of the series, the early stages of five more marine fishes are dealt with. Of these, four species belong to Clupeiformes and one to Gonorhynchiformes. The material is collected from the same locality as shown in the preceding report (BENSAM, 1986) and methods applied here are also the same.

2. Results and discussion

2.1. *Ilisha melastoma* (Schneider)

Although this species is widely distributed in the Indo-Pacific and contributes to fisheries in various localities, nothing may be known so far on its early development. In the present study four postlarvae are described, based on the collection during the periods of August 1977, and January-February 1978.

a Postlarvae (Fig. 1, A-D)

The smallest postlarva measuring 5.6 mm in body length (Fig. 1, A) has the larval finfold. Pigmentation is in the form of a few spots in the foregut, one in the midgut and one behind the vent. There are 36 preanal and 8 postanal myomeres. In an 8.6 mm stage (Fig. 1, B) the finfold has disappeared and dorsal and anal fins are indicated. A series of pigment spots appears above the alimentary canal. Only 7 myomeres can be counted in the postanal region. Significant changes noted in a 12.7 mm postlarva (Fig. 1, C) are progressive development of all the fins, disappearance of midgut pigmentation and appearance of a few pigments along anal fin base. In the dorsal, caudal and anal fins, about 16, 24 and 9 rays respectively can be counted. Preanal myomeres decrease to 31 and postanal ones increase to 12. In a longer specimen of 14.7 mm (Fig. 1, D), pelvic fin develops below 16th-18th preanal myomeres. Pattern of pigmentation remains almost the same as seen in the previous stage; disposition of myomeres is also the same.

b Remarks

The number of vertebrae in *I. melastoma* is 20 preanal and 20-24 postanal in the adults, with total mean value at 43, as observed by RAMAIYAN (1977). In the present specimens of postlarvae, there are 43 total myomeres, tallying with adult vertebral number. The structure of anal fin in advanced postlarvae with a base longer than that of other Clupeiformes and foreshadowing the condition in adult *Ilisha* serves to strengthen the identification. This is further confirmed by differences in the disposition of myomeres and allied aspects in species with similar myomeres. The 12.7 and 14.7 mm postlarvae of *I. melastoma*, compared to the 13.1 mm stage of *Sardinella clupeoides* described in the previous report (BENSAM, 1986), have only 31 preanal myomeres as against 35 in *S. clupeoides*. Similarly, the 13.4 and 14.1 mm postlarvae of

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Sardinella sirm (with only 42 total myomeres), show the position of vent below the 28th myomere. This appears to be related to the pace in the forward movement of the vent in these three species, quickest in *S. sirm*, lesser so in *I. melastoma* and slowest in *S. clupeoides*. Postlarvae of *I. melastoma* can be easily distinguished from those of *I. megaloptera* (see section 2.2 in the present report), in having only 43 myomeres as against 50–51 in the latter. In the case of *I. elongata* described by DELSMAN (1930) from Java and UCHIDA (1958a) from Japan, the forward movement of vent to attain the adult condition of 20–23 preanal myomeres appears to be delayed much more when compared to the other clupeid species. DELSMAN (1930) assigns certain eggs and their larvae to *Pellona ditchoa* (=*I. melastoma*, WHITEHEAD, 1972). But, along with *P. ditchoa*, DELSMAN (1930) finds also two other species, namely *Pellona ditchela* and *Ilisha kampeni*, thus throwing a doubt on the diagnosis. Referring to the characteristics of the eggs and larvae, it appears that they belong to *P. ditchela* (=*P. hoeveni*; WHITEHEAD, 1972) and not to *P. ditchoa* (=*I. melastoma*), as suggested earlier by WHITEHEAD (1972), who includes the above-mentioned two species described by DELSMAN (1930) under the name of *P. ditchela*.

2.2. *Ilisha megaloptera* (Swainson)

This species has been synonimised with *I. filigera* (Valenciennes), as noted by WHITEHEAD (1972). It is also widely distributed in the Indo-Pacific, supporting artisanal fisheries wherever it occurs. Since little is known on its early life history, two postlarvae collected during February 1978 may be of interest herein.

a Postlarvae (Fig. 2, A and B)

In the younger stage of 9.1 mm length (Fig. 2, A), the body is elongated and the dorsal as well as anal fins are indicated. Dorsal fin appears above the 28th through 32nd preanal myomeres, with a few rays. Pigmentation is sparse, in the form of a few spots laterally on the foregut area and dorsally on the hindgut area; a few spots of pigmentation also on the caudal fin. There are 40 preanal and about 10 postanal myomeres. The significant changes in the older stage of 14.4 mm length (Fig. 2, B) are: (i) an increase of spots in pigmentation, (ii) progressive development of all fins, and (iii) a change in the dis-

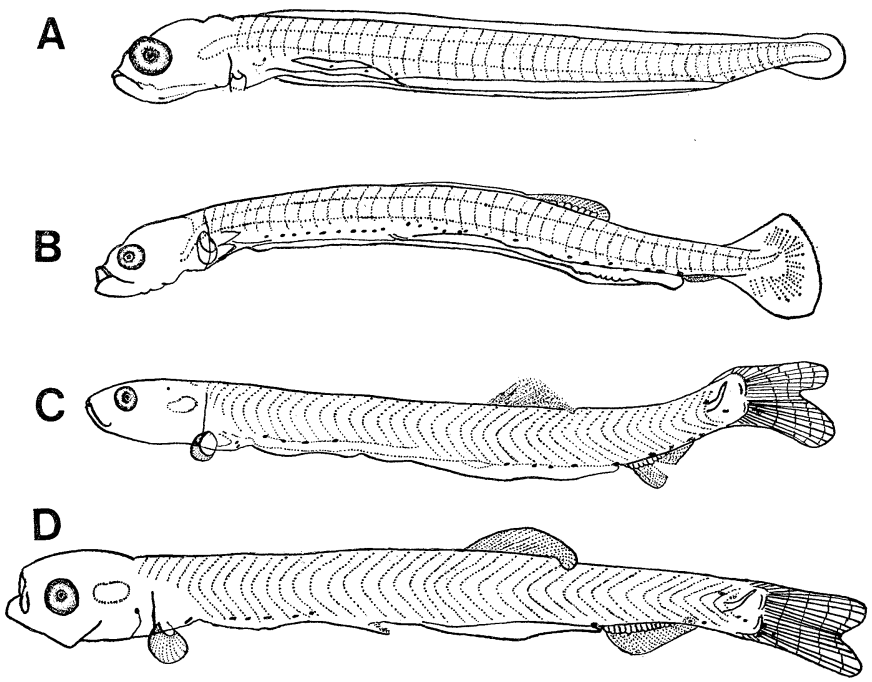

Fig. 1. Postlarvae of *Ilisha melastoma*. A, 5.6 mm in total length; B, 8.6 mm; C, 12.7 mm; D, 14.7 mm. All drawn from preserved specimens.

position of myomeres. Pigmentation is in the form of: a few spots at the posteriodorsal aspect of head; one each in auditory region and behind isthmus; a series along ventral aspect of the fore- and hind-guts; a few especially above mid-gut, above anal region and on the caudal fin. There are 37 preanal and 14 postanal myomeres; it is noted here that the anal fin moves forward to a level just behind the hinder end of the dorsal fin base.

b Remarks

In Porto Novo waters the number of vertebrae in adult *I. megaloptera* is found in the range of 47–52, as earlier observed by RAMAIYAN (1977). Interesting fact noticeable here is that from some other Indian waters the number concerned has been reported to range from 43 to 52 (DUTT, 1967; RAO, 1976). It suggests that more than one subspecies may occur in Indian waters. The postlarvae dealt with here are provided 50–51 myomeres, within the range observed already by authors. Among allied species of Clupeiformes occurring in Porto Novo waters, only *Opisthopterus tardoore* may have 50 vertebrae in adults. It must be noted here an evidence (BENSAM, 1968) showing that this species is provided 30 preanal and 20 postanal myomeres even in an early postlarval stage measuring 3.7 mm. The older postlarvae with 37–40 preanal myomeres, mentioned here, cannot be identified to *O. tardoore*.

In this connection, some other species with a similar number of vertebrae, especially *Ilisha elongata*, should be mentioned here. This species, however, has not been recorded in India, as pointed out already ky WHITEHEAD (1972), but in southeast and far-eastern Asian areas, including Japan. In the species, as described by UCHIDA (1958a), the movement of the vent to attain the adult vertebral disposition is in a later postlarval stage of development. A similar case is in *Hilsa ilisha* (JONES and MENON, 1951a), where the adult vertebral disposition is not observed but in a late stage.

Evidence referable here is a developmental difference in vertebral number which may occur in *I. elongata*. This fish from Java coasts (DELSMAN, 1930) is of 50–51 in vertebral number, while its larvae and postlarvae from Japan (UCHIDA, 1958a) may be provided 55–56 myomeres. Concerning such an evidence, interesting indications (BLAXTER, 1957; HEMPEL and BLAXTER, 1961) have been presented of this species; according to them, the myomeres could be upto 9 more in larvae and early postlarvae than in adults. In spite of such indications, the existence of subspecies cannot be ruled cut, when the myomeres of the species in late postlarval stages are so different in number as 50–51 in Japanese waters and 55–56 in the far-eastern waters. Therefore, in relation to the *I. megaloptera* of India, with vertebrae in a wide range so reported, the question needs further extensive and intensive investigations.

2.3. *Thryssa dussumieri* (Valenciennes)

No reliable description nor figures of this species have been provided yet, while this economically important anchovy from India was

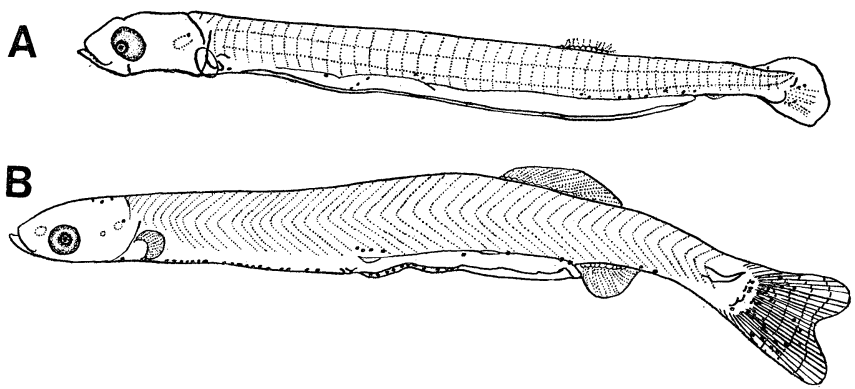

Fig. 2. Postlarvae of *Ilisha megaloptera*. A, 9.1 mm in total length; B, 14.4 mm. Both drawn from preserved specimens.

reported on eggs and larvae occurring there by authors (BAL and PRADHAN, 1947, 1951; CHACKO, 1950).

a Eggs (Fig. 3, A-C)

Based on the collections during September 1977, of which three phases in the embryonic stage are shown here, eggs are pelagic and spherical, measuring 0.90-0.98 mm diameter in living condition; oil globule is absent, yolk is vacuolated and perivitelline space is quite narrow.

b Larvae (Fig. 3, D)

An egg among reared samples is found to hatch out in the following morning. It measures 3.9 mm in body length; mouth is not formed yet; eyes are not pigmented; 28 preanal and about 14 postanal myomeres are counted.

c Postlarva (Fig. 3, E)

A single postlarva measuring 4.6 mm is collected during the survey. The larval flnfold is in a reduced condition; mouth already formed; eyes pigmented; pectoral fin developed. Pigmentation arranged somewhat in the foregut, midgut and hindgut. It has 29 preanal and 13 postanal myomeres.

d Remarks

Identiflcation of the eggs to this species is allowable by the similarity in diameter of the planktonic eggs to fully mature ova (0.7-0.8 mm in diameter) of the species, which have been examined at Porto Novo. In the Clupeiform eggs with a narrow perivitelline space, planktonic eggs are known to be slightly larger in diameter than mature ova. It is reasonable, then, to expect for the eggs concerned to be of *T. dussumieri* with eggs of 0.8-0.9 mm diameter as usual.

As for the peculiarities of myomeres, this species is known to have about 42 myomeres in early larval stage, which tallies with the adult vertebral condition. It is noteworthy here that CHACKO (1950) gives this species a remarkably small number (17) of preanal myomeres in his brief note on eggs and early larvae assigned to this species, although his note on egg size is apparently acceptable even for the present material. Such a small number of preanal myomeres is not allowed for a Clupeiform character in an early larval stage. In this connexion, it is referred here to the works by DELSMAN (1929a) and VIJAYARAGHAVAN (1957); the eggs assigned by them to a related species, *Thryssa hamiltoni* (=*Engraulis grayi*; WHITEHEAD, 1972), provide

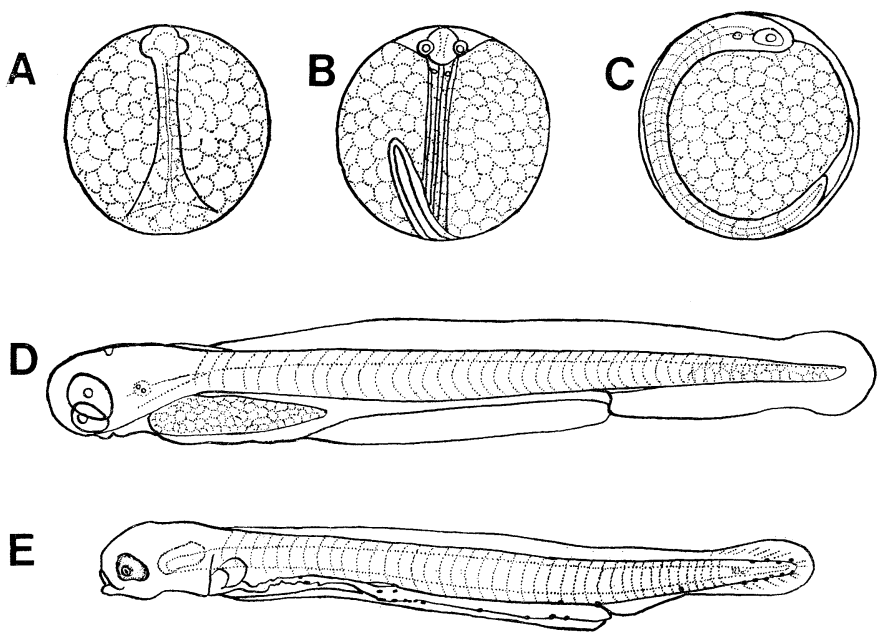

Fig. 3. Eggs, larva and postlarva of *Thryssa dussumieri*. A, B and C, eggs in three stages of development. All drawn in live condition. D, larva of 3.9 mm in total length; E, postlarva of 4.6 mm. Both drawn from preserved speciments.

larvae with at least 45 myomeres, in contrast to a small number (42–43) of myomeres in the species treated herewith. Another referable work is made by RAO and GIRIJAVALLABHAN (1973); eggs identified by them as of *Thryssa mystax* are 0.92–1.26 mm in diameter, and they provide three-days-old larva with 43 myomeres. As pointed out by DELSMAN (1929a), however, eggs of this species are different in size from the above-mentioned range; such a size suggests that they are of *Thryssa purava* in ripe ova, as given by PALEKAR and KARANDIKAR (1952). Besides, the total number of vertebrae in *T. mystax* is not known as 43, but 45 (DELSMAN 1929a). These facts suggest that the above-mentioned assignment of eggs and larvae to *T. mystax* is not reliable, and some relationships to *T. dussumieri* may be pursued by further scrutinies.

2.4. *Thryssa mystax* (Schneider)

This is another anchovy supporting coastal fisheries in the Indian waters and in southeast Asia. DELSMAN (1929a) describes the occurrence from Javanese coast of eggs of this species. As referred to above (section 2.3), the assignment of eggs and larvae to this species by RAO and GIRIJAVALLANBHAN (1973) is very doubtful.

a Postlarvae (Fig. 4, A–C) and Juveniles (Fig. 4, D)

Three postlarvae and one juvenile are at my disposal by the collection made during October 1977. The smallest sample of 18.8 mm length (Fig. 4, A) is furnished with many engraulid characteristics; dorsal, pelvic, anal and caudal rays are 15, 6, 30 and 24 in number respectively; pigmentation is sparse, even if with typical presentation as in engraulid postlarvae; 27 pre-anal and 18 postanal myomeres. In a 23 mm stage of postlarva (Fig. 4, B), snout becomes more prominent; maxillary extends behind eye region; dorsal fin origin is well in front of the middle of the body. Twelve pectoral, 15 dorsal, 40 anal and 40 caudal rays. Indications of future scales (Fig. 4, C) are on the body skin. Myomeres are changed in disposition to 24 preanal and 21 postanal. In a largest specimen of

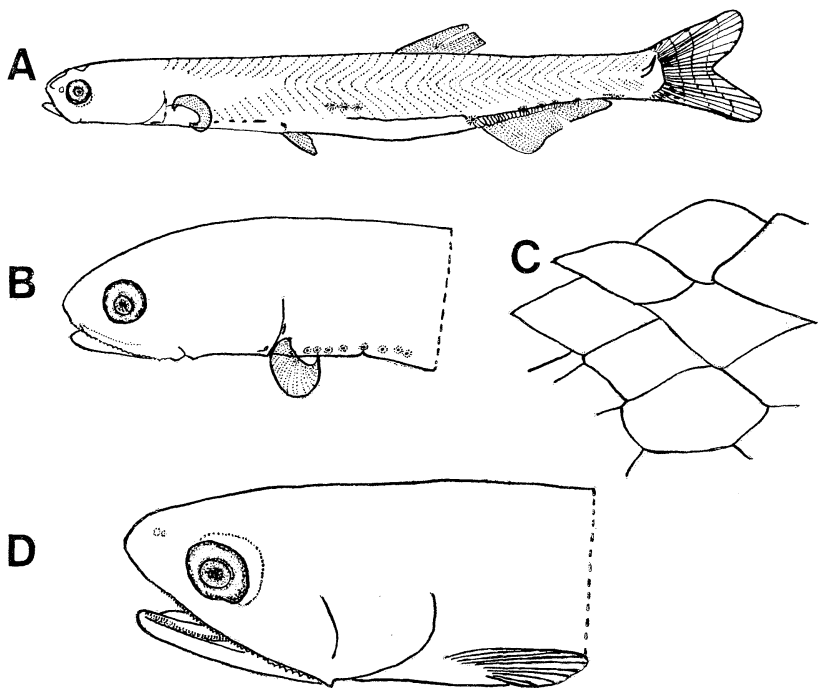

Fig. 4. Postlarvae and a juvenile of *Thryssa mystax*. A, postlarva of 18.8 mm in total length; B, cephalic region of a postlarva of 23 mm; C, markings on the skin of the same specimen; D, cephalic region of a juvenile of 26.5 mm. All drawn from preserved specimens.

juvenile (Fig. 4, D), pectoral fin assumes a triangular shape; dorsal and anal fin rays are mostly furnished with 3–5 segments and caudal ones with 5–11 segments. Pigmentation is in the form of a series of spots along the anal base. Myomeres are the same in number and disposition as seen in the previous stage.

b Remarks

Concerning the various species of *Thryssa* occurring at Porto Novo, mature and spent fish are observed only in *T. mystax* and *T. dussumieri*, during the years of 1977–1979, from July–August season through October-November season. Between these two species, the number of myomeres may be a diagnostic character for differentiating the early developmental stages, as *T. dussumieri* is furnished with 40–43 vertebrae, while *T. mystax* with 50. Based on the present work as well as UCHIDA (1958b), the gradual formation of the snout in engraulids would be

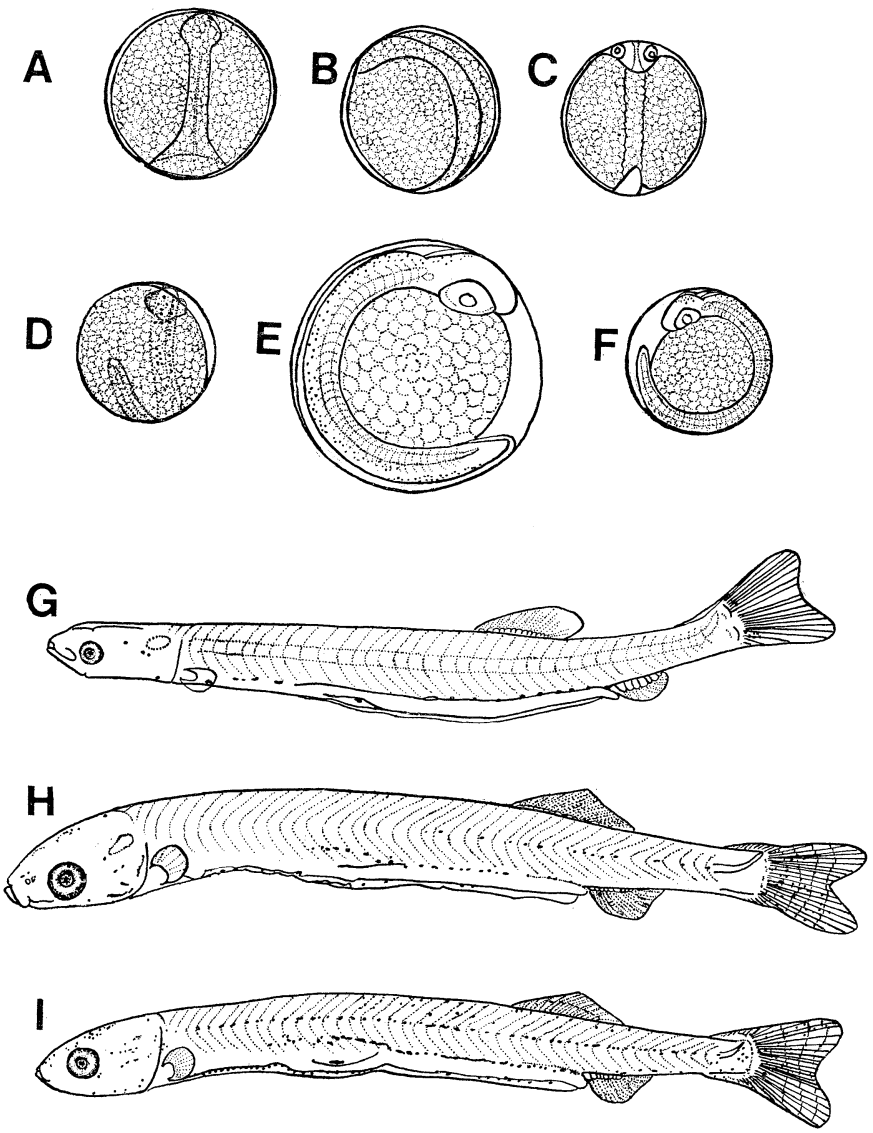

Fig. 5. Eggs, postlarvae and juveniles of *Chanos chanos* (a). A–F, eggs in various stages of development; G, postlarva of 10.5 mm in total length; H, 14.6 mm; I, 14.0 mm. All drawn from preserved specimens, but A–C from live eggs.

obvious. The adult disposition of the vent is noticeable here. In the specimens described here, it would be attained after their reaching a body size of 26.5 mm. According to NAIR (1940) and JONES and MENON (1951b), in the development of another engraulid species, *Setipinna phasa*, the vent shifts forward to the adult disposition of myomeres in 50 mm long stage.

2.5. *Chanos chanos* (Forskal)

A large number of the fry of this species occurs usually in Indian waters (TAMPI, 1968). As far as my knowledge goes, however, no author has given any collection report on its eggs, but CHACKO (1950), even if he provides simply a report on their occurrence, without any necessary descriptions nor figures. Hence the

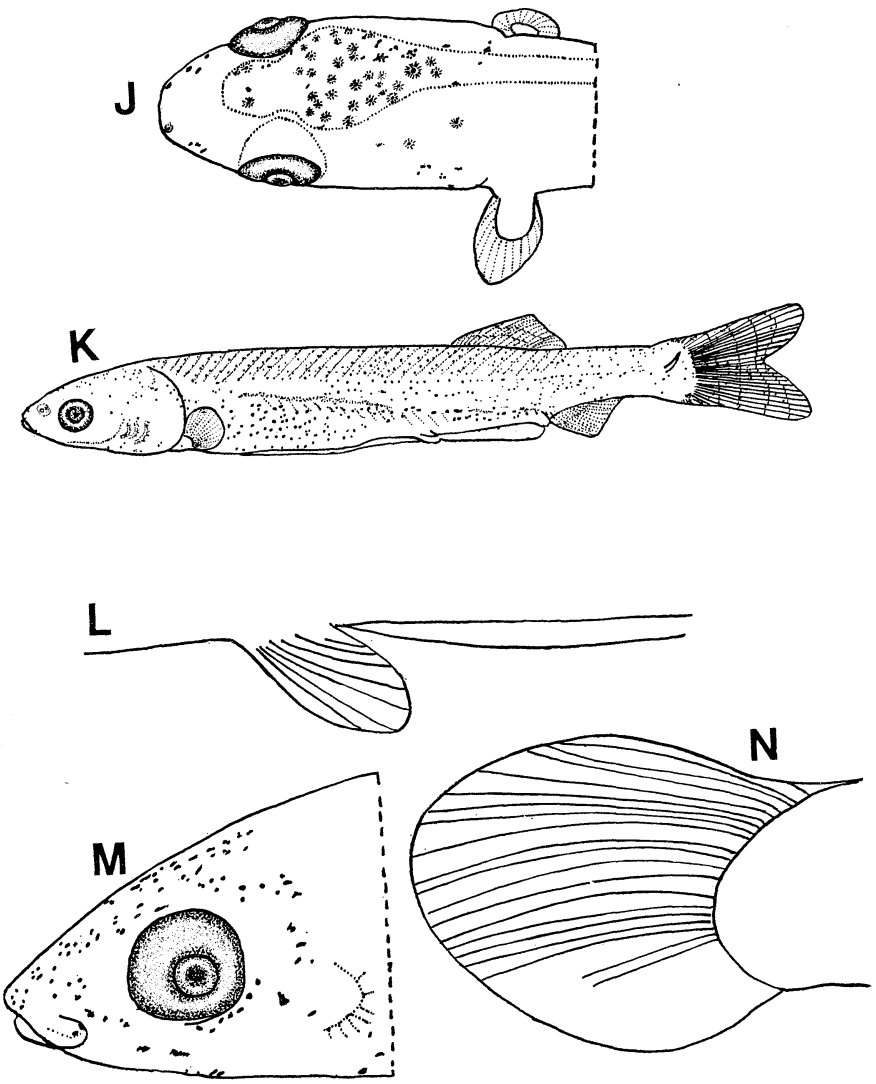

Fig. 6. Eggs, postlarvae and juveniles of *Chanos chanos* (b). J, dorsal view of a cephalic region of the specimen shown in Fig. 5, I; K, juvenile of 16.2 mm; L, developing pelvic fin in a 16.5 mm-long specimen; M, cephalic region in a juvenile of 18.5 mm; N, developing pectoral fin in the same specimen. All drawn from preserved specimens.

present account on the eggs, postlarvae and early juveniles may be of interest. All the specimens are collected through stages during January-April 1978.

a Eggs (Fig. 5, A-F)

The eggs are pelagic, spherical, without oil globule and furnished with finely vacuolad light-yellowish yolk. Perivitelline space is quite narrow and imperceptible in live and healthy eggs. They range from 1.12 to 1.2 mm in diameter. Pigment spots are observed on the embryo in late developmental stages. None of the eggs which are reared in the laboratory has survived to rise to larvae.

b Postlarvae (Fig. 5, G-I, Fig. 6, J)

In a 10.5 mm stage is the youngest postlarva collected (Fig. 5, G). The body is elongated and the snout is slightly flattened dorsoventrally. Dorsal, anal and caudal fins have 14, 7 and 18 rays respectively. Pigmentation is found in the form of a few spots on the head, the gut in all range and the caudal fin. Muscle fibres show a parallel arrangement and not a crossed one as seen in Clupeiformes. There are 32 preanal and 11 postanal myomeres, the total tallying with the number of vertebrae in adults. Notable changes in a 14.6 mm-long postlarva (Fig. 5, H) are progressive development of fins and an increase in pigmentation. In another postlarva of 14.0 mm long (Fig. 5, I) much more intensive pigmentation is observed, particularly at the ventral aspect of alimentary canal, along lateral line, at the dorsal aspect of mid- and hind-guts, on the caudal fin and on dorsal side of the head (Fig. 6, J).

c Juveniles (Fig. 6, K-N)

In a 16.2 mm-long juvenile (Fig. 6, K), most of the postlarval features have disappeared. Origin of pelvic fins may be seen as a small bud below the level of dorsal fin origin. Dorsal, anal and caudal fins contain about 16, 12 and 28 rays respectively. Pigmentation becomes intensified, extending almost all over the body. The vent moves forward further, reducing the number of preanal myomeres down to 31 and making the number of postanal ones to 12. In a slightly longer specimen of 16.5 mm, the pelvic fins develop further, with about 7 rays (Fig. 6, L). In a further longer specimen of 18.5 mm long, the snout overgrows the lower jaw (Fig. 6, M), approaching the condition in adults; and pectoral fins are more developed, with about 10 rays (Fig. 6, N). Dorsal fin has approximately 16 rays, and about 10, 14 and 34 rays in pelvics, anal and caudal respectively. Pigmentation is much more intensified than in the others, almost all over the body.

c Remarks

The characteristics described here for the eggs may more confirm the specific identification in comparison with the case where it depends on evidence given by authors (DELSMAN, 1929b; CHAUDHURI *et al.*, 1987; LIAO *et al.*, 1979). According to the latter two works, certain markings are observed on capsule of artificially fertilized eggs in the Philippines, while the present material is without such markings. As referred to above, the postlarvae are identical easily by characteristics such as parallel arrangement of muscle fibres and number and disposition of myomeres. It is noted here that the 10.5 mm long postlarva described here resembles the material of 10 mm long stage dealt with by DELSMAN (1926) in all essential features, and that it is identical with the same-sized postlarva articially bred by LIAO *et al.* (1979) except of much more dense pigmentation in the latter.

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インド産海産魚類の初期発生段階

2. *Ilisha melastoma, I. megaloptera, Thryssa dussumieri, T. mystax* および *Chanos chanos*

Pathrose BANSAM

要旨: インド（マドラス州）ポルト・ノヴォ産重要魚種のうち，イワシ目魚類4種，ネズミギス目魚類1種について，卵，仔魚，後期仔魚および稚魚の4発生段階の形態を記載し，それらの分類学的特徴を論じた。