

ON THE LARVAL DEVELOPMENT OF THE INDIAN TRANSPARENT GOBY,
GOBIOPTERUS CHUNO (HAMILTON) WITH OBSERVATIONS ON
 ITS BIONOMICS.

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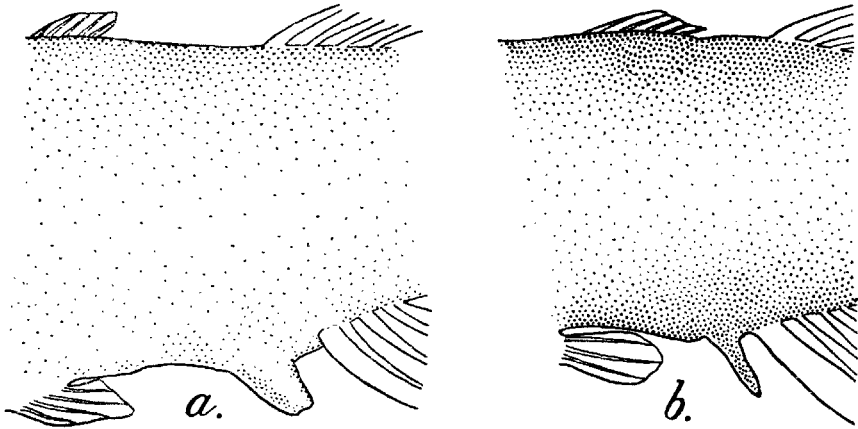
INTRODUCTION.

The larval development of the European Transparent Gobies, *Aphya pellucidus* Nardo, and *Crystallogobius nilsoni* V. Dub & Kor, has been described by Lebour (1919), but nothing was so far known about the breeding and development of the Indian form, *Gobiopterus chuno* (Hamilton). During regular collections of mullet fry, the larvae of this fish were secured in the plankton net from a brackish water-pool in Baguranjalpai, a coastal village in Contai (W. Bengal), during the months of October and November. This pool is situated near the farthest end of a narrow creek. During the spring tides the pool gets connected with the main creek, but otherwise remains isolated. At the time of the collections referred to above, the pool had thus been cut off, for over a week. The collections contained numerous mature 'Chuno', many of which were in the oozing condition.

BREEDING SEASON AND FECUNDITY.

Adult 'Chuno' were observed to be present in the collections from this area, from June onwards. A few mature specimens were obtained in August, but they occurred in appreciable numbers only from September to December. The larvae were collected during October and November, and it may be inferred that they breed in the locality at least from October to December. Mature females have the abdomens greatly distended with eggs, which are quite visible through the body wall. The adults of the species exhibit marked sexual dimorphism. The genital papilla which is present in both the sexes, is stouter and more prominent in the female (Text-fig. 1a) than in the male (Text-fig. 1b). The ripe female has the

conical teeth on the jaws considerably larger than the minute ones found in the male as already described by Hora (1923). In the ovary of a specimen 23 mm. long there were only 276 eggs. All the eggs were nearly of the same size and stage of maturity suggesting that all of them were meant for one spawning. The mature specimens varied from 22 mm. to 24 mm. in length, and in our collections which consisted of more than 900 specimens, there were no mature ones below this size range.



TEXT-FIG. 1. (a) The genital papilla of a female $\times 35$.
(b) The genital papilla of a male $\times 35$.

OVARY AND OVARIAN EGGS.

The two lobes of the ovary are of the same size and shape, and as maturity is attained they swell considerably with the result that they come to lie in close apposition, the whole ovary appearing as a single oval mass. A ripe ovarian egg (Text-fig. 2a) is nearly spherical in shape, and measures 0.425 mm. to 0.5 mm. in diameter. When examined under the microscope, numerous unbranched adhesive threads can be seen radiating from a point on the egg membrane, presumably for attachment to vegetation or other objects in the water. There is a single large oil globule besides several small ones distributed in the yolk.

LARVAL DEVELOPMENT.*

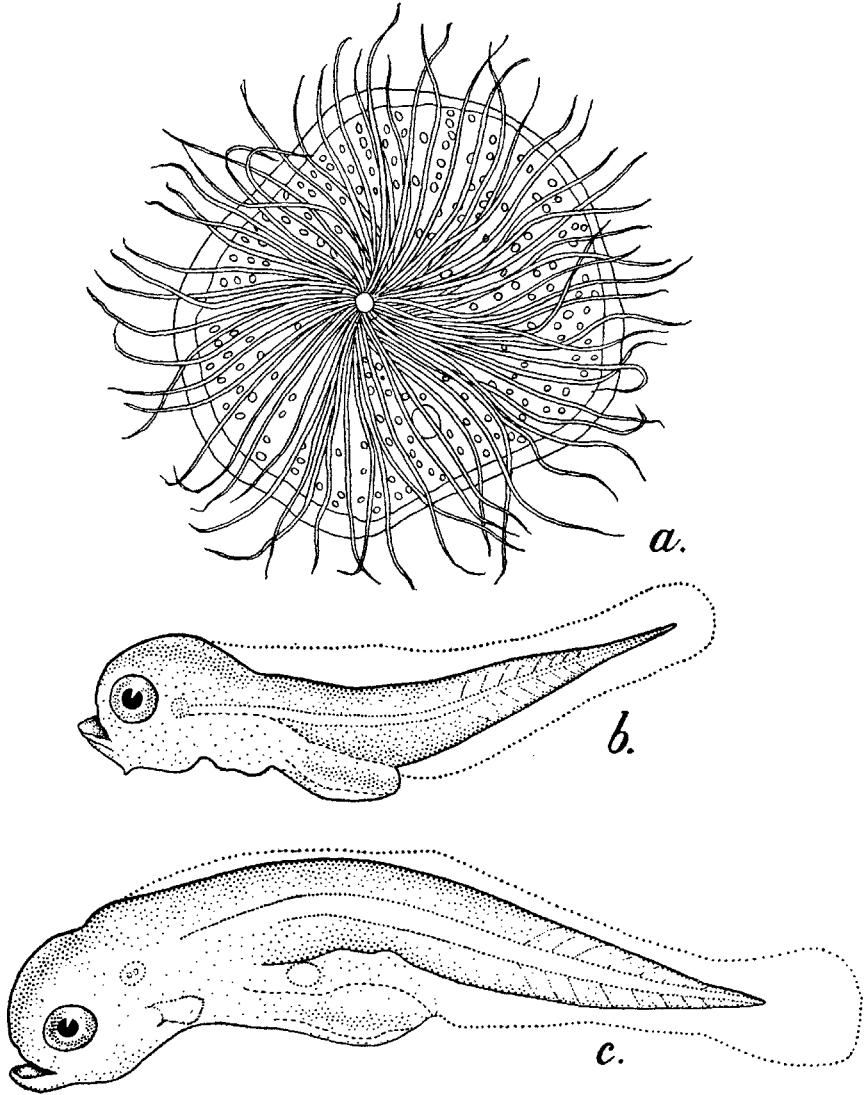
Specimen 1.7 mm. long.—(Text-fig. 2b). This is the earliest stage in our collections. The yolk mass at this stage appears to have been fully absorbed. The mouth is inferior and the alimentary canal is a straight tube. The vent is situated at about the midbody length below the 9th myotome. The eyes are fully pigmented and the auditory capsule is recognizable. The median finfold is continuous and extends dorsally to the head.

Specimen 2.7 mm. long.—(Text-fig. 2c). The body of the larva at this stage has essentially the same shape as the 1.7 mm. larva. The median finfold has become narrow dorsally and the caudal lobe has been demarcated. The pectoral fin is visible at this stage as a transparent membrane. The intestine shows a slight bend. The vent has shifted slightly backwards and is situated below the 11th myotome. The air bladder is conspicuous.

Specimen 3.4 mm. long.—(Text-fig. 3a). At this stage the body appears slightly compressed. The mouth is still inferior in position. The air bladder has become longer and is clearly visible. There is a large pigment spot above the air bladder

* The descriptions and measurements are based on permanent mounts of specimens.

which is characteristic of the gobiid larvae. Dorsally the finfold stops short of the trunk region above the 11th myotome. The soft dorsal and the anal fins are more or less demarcated. The caudal fin has a nearly straight posterior margin.

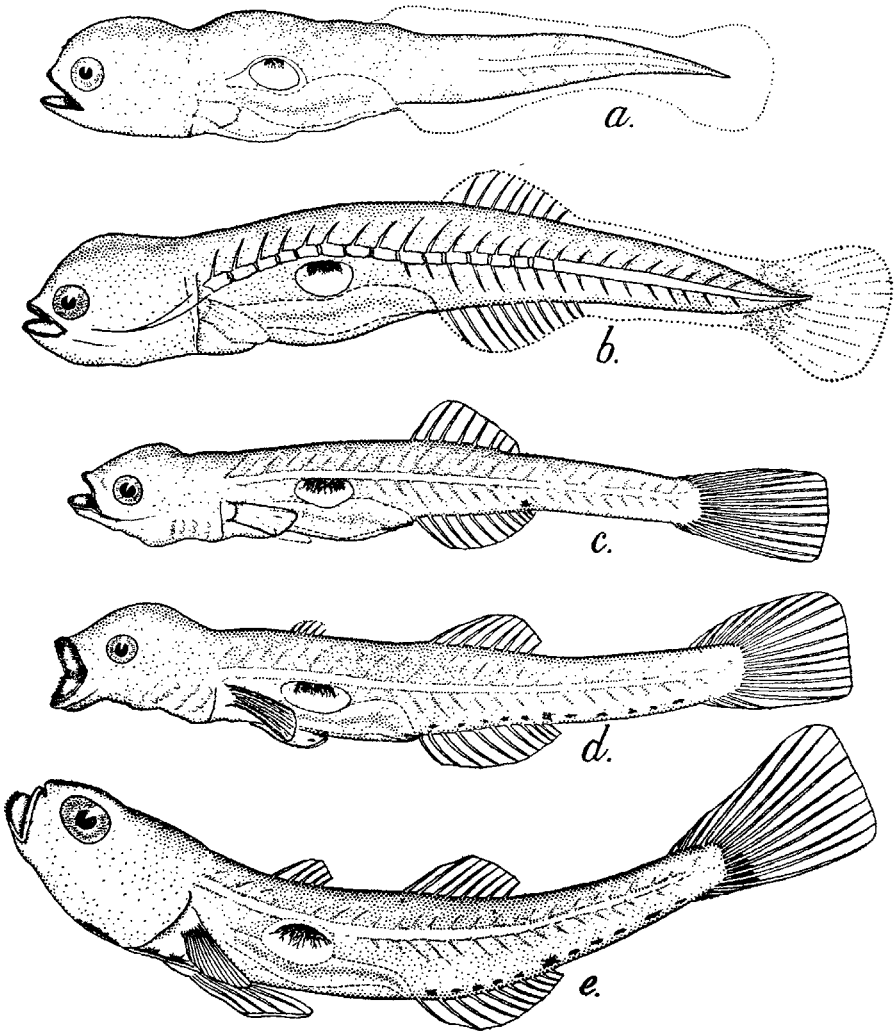


TEXT-FIG. 2. (a) Ovarian egg $\times 150$.
 (b) A 1.7 mm. long specimen $\times 55$.
 (c) A 2.7 mm. long specimen $\times 55$.

Specimen 4.3 mm. long.—(Text-fig. 3b). The body of the larva of this size is well compressed. The mouth is now terminal in position and the dorsal profile of the head is more prominently arched. The pigment spot is very prominent now. The pectorals show indications of rays on them. The notochord shows a slight bend upwards at its tip. In alizarin stained specimens, 10 pre-anal and 15

post-anal vertebral segments can be clearly counted. The soft dorsal and anal fins have their rays fully differentiated. There are indications of rays on the caudal. The spinous dorsal is not yet evident.

Specimen 5.4 mm. long.—(Text-fig. 3c). The body has grown slender, and the caudal peduncle is somewhat constricted and in this region the dorsal and ventral profiles are almost straight and parallel. The tip of the peduncle is no more pointed, but is broad and truncate. The mouth is now slightly superior and oblique. The gill rudiments can be seen through the opercular fold. There is a single chromatophore on either side of the body, situated above the posterior end of the anal fin. The soft dorsal, caudal and anal fins have been separated and are



TEXT-FIG. 3. (a) A 3.4 mm. long specimen $\times 55$.
 (b) A 4.3 mm. long specimen (Alizarin stained) $\times 50$.
 (c) A 5.4 mm. long specimen $\times 35$.
 (d) A 6.3 mm. long specimen $\times 35$.
 (e) A 7.5 mm. long specimen $\times 35$.

fully developed. The pectoral and pelvic fins can be seen as transparent membranes without any rays. There is still no indication of the spinous dorsal. The caudal has assumed the truncate shape of the adult, and all the thirteen rays besides some incomplete ones have been formed.

Specimen 6.3 mm.—(Text-fig. 3d). The body shape is essentially the same as of the 5.4 mm. stage. The mouth is more superior and oblique. Teeth are visible on the jaws. A ventral row of black chromatophores is seen on either side of the body extending from above the anal fin to the tip of the caudal peduncle. Of these the sixth from the anterior end, which was visible in the previous stage is the largest. The spinous dorsal has been formed. The pectorals show indications of rays on them. The pelvics have partially united and begun to develop rays.

Specimen 7.5 mm. long. (Text-fig. 3e). Specimens of this length have almost all the adult characters, except for the absence of scales. The mouth is definitely superior and oblique; and the eyes are situated on the sides. There are two long chromatophores below the chin and a few pigment spots at the base of the caudal.

SIGNIFICANCE OF THE DEVELOPMENTAL FEATURES.

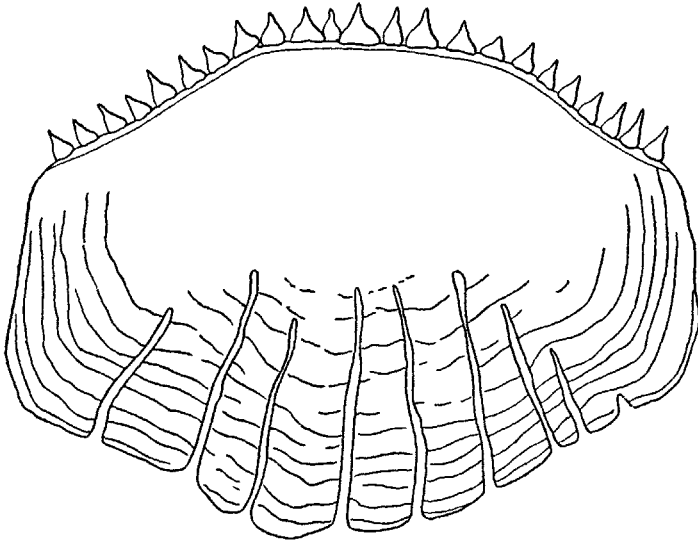
The larval development of the 'Chuno' is remarkably different from that of the common gobiids. Hildebrand and Cable (1938) have stated that generally in gobiid larvae, at hatching 'the mouth tends to be horizontal and inferior, but very soon becomes rather oblique'; and as the adult stage is reached the mouth in at least several species assumes again nearly the position occupied at hatching. The caudal fin when formed has either a straight or a slightly rounded margin and as the development of the fish progresses this becomes more or less concave. In some species the caudal fin becomes round only after virtually all the adult characters are developed. Lebour (1919) has observed that the eyes which are situated on the sides of the head in the post-larval stage of gobiids, shift to the dorsal surface as the fish change their mode of life—the pelagic larvae descending to the bottom where the adult lives. An examination of the features of the larval development of the 'Chuno' shows that as in the European Transparent Goby, *Aphya pellucidus* (Lebour *op. cit.*), the development of this fish gets arrested at the post-larval stage. The body remains transparent throughout its life as in the post-larvae. The mouth which has become oblique in the post-larval stage remains so in the adult. The caudal fin does not get rounded in the adult and the eyes continue to remain on the sides. The fish is truly pelagic all through its life, and does not change to bottom living as is the case with most of the gobies.

BIONOMICS.

General.—*G. chuno* is an inhabitant of brackish water areas. It has been recorded from the estuary below Calcutta (Hamilton, 1822) and the Chilka Lake and the Salt Lakes of Calcutta (Hora, 1923). Koumans (1941) gives India, Singapore and Siam as the habitat of this species. Hora (1934) recorded the specific gravity of the water of its habitat in Chilka, and remarked that the salinity of the other pieces of water in which *Gobiopterus* lives is not known. Our observations are mainly based on collections made from the creeks of Baguranjalpai. The chlorinity of the water at the times of collection from June to December ranged from 0.06% to 0.97%, and the temperature varied from 80.6°F. to 89°F. The hydrogen ion concentration showed a range of 8.2 to 8.6. 'Chuno' has been collected by us from the enclosed mullet farms near Calcutta and the river Hooghly also; which shows that they thrive in standing as well as running waters. The fact that the young and adults were always collected in surface tow nets proves that they are truly pelagic in their habits. As already pointed out by Hora (*op. cit.*) the pelvic fins are united only half-way forming a funnel like tube which does not serve

as an adhesive organ, as is generally the case in other gobies. Our observations on live specimens in the laboratory confirm this.

Hora (1923) stated that he could not make out any definite striae in the central portion of the scales of 'chuno'. Though the sculptural details are not recognizable normally, when stained with alizarin the scales show clearly rows of circuli extending along the basal and lateral regions. Text-fig. 4 shows the scale of a mature specimen 24 mm. long. The nucleus is not visible, but 12 circuli which stop short of the apical margin can be seen. The scales do not show any sort of annuli formations. Colett (1878) and Lebour (1919) suggested that the European Transparent Goby, *Aphya*, dies after spawning and is probably an annual fish. Though further observations are necessary to say whether this is so in *G. chuno*, the absence of annuli formations on the scales and the fact that all the eggs in the ovary are of the same stage of maturity, seem to point to a similar condition.



TEXT-FIG. 4. The scale of a 24 mm. long specimen $\times 150$.

Food and Feeding.—Hora (1934) stated that the 'chuno' feeds on copepods and other planktonic crustacea. Analysis of the gut contents of 50 specimens ranging from 9 mm. to 24 mm. collected from Baguranjalpai, Hooghly and Ghutiari-Sharif showed that planktonic copepods formed the chief constituent of the diet. Occasionally nauplius larvae and in one specimen *Zoea Macrura*, were found. The gut contents of the young as well as the adult specimens were similar, indicating that no dietary change takes place during the growth of the fish. No noticeable local variations in the menu was observed. The stomachs of ripe females were invariably found to be empty, indicating cessation of feeding during breeding since the gonads occupy so much room that very little space is left for the alimentary canal to function. The upturned mouth, and the nature of the food taken, show that it is a surface feeder.

SUMMARY.

Gobiopterus chuno breeds during October to December in the Contai area. Generally there are 230-300 eggs in the ovary, and all of them are meant for a single spawning. Adult females can be distinguished from the males by the presence of stouter and more prominent genital papillae, and larger conical teeth on the jaws. The development of larvae from 1.7 mm. stage to the juvenile stage is described. It is inferred that the development of the fish is arrested at

the post-larval stage. The fish remains pelagic all through its life. Though the scales do not show any annulii formations striae can be made out in scales stained in alizarin. From the analysis of the gut contents, it is inferred that (1) it feeds at the surface on zooplankton, (2) the food of young as well as adults is the same, and (3) there are no appreciable local variations in the menu.

ACKNOWLEDGMENTS.

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