

ON SOME OPHICHTHYID LARVÆ FROM THE INDIAN COASTAL WATERS

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SINCE describing some leptocephali and elvers collected from the estuaries of Bengal and Orissa (Jones and Pantulu, 1952 and Pantulu and Jones, 1954), larval forms of certain ophichthyid eels, not hitherto recorded, have been obtained from the coasts of Madras, Orissa, and Travancore. These larvæ form the subject-matter of this account.

1. PROLARVÆ AND LEPTOCEPHALI FROM THE MADRAS COAST

This collection from the University Zoological Laboratory, Madras, consists of 3 prolarvæ and 5 leptocephali. The prolarvæ were hatched out from large sized pelagic eggs collected from the coastal waters off Madras City on 1-12-1952. The hatchlings emerged on 3-12-1952 and were subsequently fixed on the 1st, 2nd and 3rd day after hatching and mounted in balsam by Shri Vijayaraghavan who kindly passed on the material to us. Unfortunately no detailed information about the nature and character of the eggs was available. The only other record of eel eggs from the Madras coast is a brief note by Aiyar, Unny and Varkey (1944).

1st day larva (Fig. 1 A), (7.29 mm.).—The larva is transparent with rounded cephalic and caudal ends. Mouth and gill openings have not yet formed. Eyes are devoid of pigmentation. The heart is distinct with a large pericardial space. At the broad anterior portion of the yolkmass is a group of large oil globules. Portions of the incompletely formed alimentary canal are seen above the yolk. Pectoral fins are not formed, but a callous area, one on either side above the yolk, indicates their position. The vent, which is situated in the 64th myotome, is still closed. Post-anal myotomes are very indistinct. The dorsal fin arises from the nape and is continuous with the caudal and anal fins.

2nd day larva (Fig. 1 B), (8.64 mm.).—The transparent larva has a conspicuous head with a wide open mouth and a rounded caudal end. There are four teeth on either side of each jaw, the anterior of which are larger than the posterior. Eyes are well pigmented and black. Gill openings have appeared with the pectoral fins immediately behind them. The yolk has

been absorbed except in the region of the liver and below the gut. The anal opening, which has not yet formed, is indicated in the 65th myotome. Myotomes in the caudal region are still indistinct. The median fins are broader than in the previous stage.

3rd day larva (Fig. 1 C), (9.99 mm.).—The transparent larva has a pointed snout and a rounded caudal end. The head is contained about 6.6 times in the body and the eye 4.7 and 1.7 times in the head and snout respectively. There are fine teeth on either side of the upper and lower jaws and those at the anterior end, especially in the upper jaw, are large and conspicuous. Eyes are black. There is a large prominent chromatophore at the tip of the lower jaw. The well formed alimentary canal is seen as a wide tube. There is still a trace of unabsorbed yolk close to the liver. The vent is opposite the 72nd myotome.

The chromatophores are very characteristic. In addition to one at the tip of the lower jaw there are 13 on the body, of which 10 are pre-anal in position. Of these the first one is immediately below the pectoral fin where the gut is constricted. Among the trunk chromatophores seven are large and three comparatively small. The posterior of the three caudal chromatophores is conspicuously branched. In between the anterior pairs of chromatophores in the trunk faint streaks of black pigment are seen.

TABLE I
Measurements of Prolarvæ

	1st day larva	2nd day larva	3rd day larva
Total length (in mm.) ..	7.29	8.64	9.99
Length of head (in mm.) ..	..	1.056	1.488
Length of snout (in mm.) ..	..	0.32	0.56
Eye diameter (in mm.) ..	..	0.32	0.32
Snout to vent (in mm.) ..	5.49	6.84	8.01
Maximum depth (in mm.) ..	0.896	0.992	1.17
Total No. of myotomes ..	..	..	133
Pre-anal myotomes ..	63	64	71

There is no conclusive evidence to show that the larvæ described above are hatched out from eggs of the same type and belong to the same species, apart from the fact of their occurrence at the same time and in the same

place. A careful scrutiny of the points of similarity and dissimilarity between the three larvæ is essential to establish that they belong to the same species.

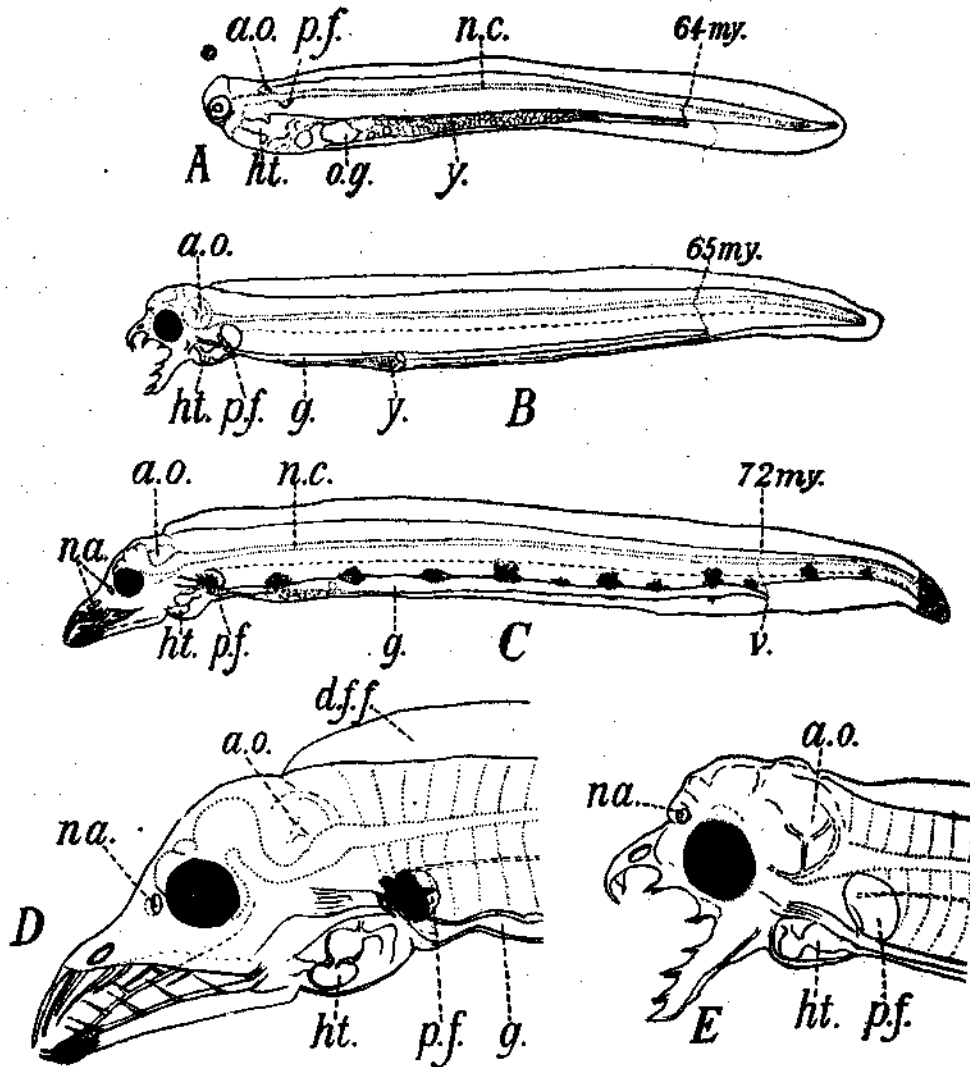


FIG. 1. Pro-larvæ of ophichthyid eel from Madras Coast.

A. 'First day' larva, $\times 11.6$. B. 'Second day' larva, $\times 11.6$. C. 'Third day' larva, $\times 11.6$. D. Head of 'Third day' larva, $\times 30$. E. Head of 'Second day' larva, $\times 30$. a.o., auditory organ; d.f.f., dorsal fin fold; g., gut; ht., heart; my., myotome; na., naris, n.c., nerve cord; o.g., oil globule; p.f., pectoral fin; v., vent., y., yolk.

The first and second day larvæ are so identical in characters that the conclusion that they belong to the same species is almost indisputable. The

observed differences are minor, brought about presumably by the normal changes in the course of the growth of a newly hatched larva. In the third day larva, however, the position of the vent is shifted to the 72nd myotome from the 64th and 65th in the first and second day larvæ, and chromatophores begin to appear. A study of the existing literature on early leptocephali has revealed that the observable differences could possibly be attributed to the changes that normally take place during development. Instances are on record (Delsman, 1933) where, in eel larvæ hatched out from a single type of egg, the vent has shifted from the 74th to the 77th myotome in the first day and to the 80th in the second. Similarly, in another type of egg, a backward shifting of the vent by 5 myotomes has taken place in two days. Hence the difference in the position of the vent of the third day larva could be explained as being due to a backward shifting of the vent. Likewise, the rapid development of chromatophores is also a common feature in all the eel larvæ described by Delsman from the Java sea. The distribution and nature of chromatophores in the third day larva under discussion are very similar to that of a 2-day-old larva figured by him.

It is, therefore, reasonable to conclude that all the three larvæ belong to the same species and are hatched from the same type of egg, as these were collected at the same time and at the same place. As regards the identity of the larvæ, it could only be said, in the present state of knowledge, that they belong to the *Ophichthyidae*. The origin of the dorsal finfold from the nape, the continuation of the notochord almost to the caudal end and the nature and distribution of the chromatophores are similar to those of the ophichthyid larvæ described by Delsman (1933). In the absence of later stages it is difficult to fix their generic or specific identity, particularly in view of the fact that several species belonging to this family occur on the Madras Coast.

Though several leptocephali have been recorded from Indian waters descriptions of the very early developmental stages of eel larvæ are scarce. Nair and Bhimachar (1951) described two early eel larvæ of which one, with prominent groups of ramifying chromatophores opposite notch-like constructions on the alimentary canal, appears to belong to the *Ophichthyidae*.

LEPTOCEPHALUS (Fig. 2) (105.0 mm.)

Five examples of Ophichthyid leptocephali, 87 to 105 mm. long, collected from the Bay of Bengal off Madras City between 28-8-1938 and 31-8-1938 were given to us by Prof. C. P. Gnanamuthu, Director, University Zoological Laboratory, Madras. With 223 myotomes in the body in all five

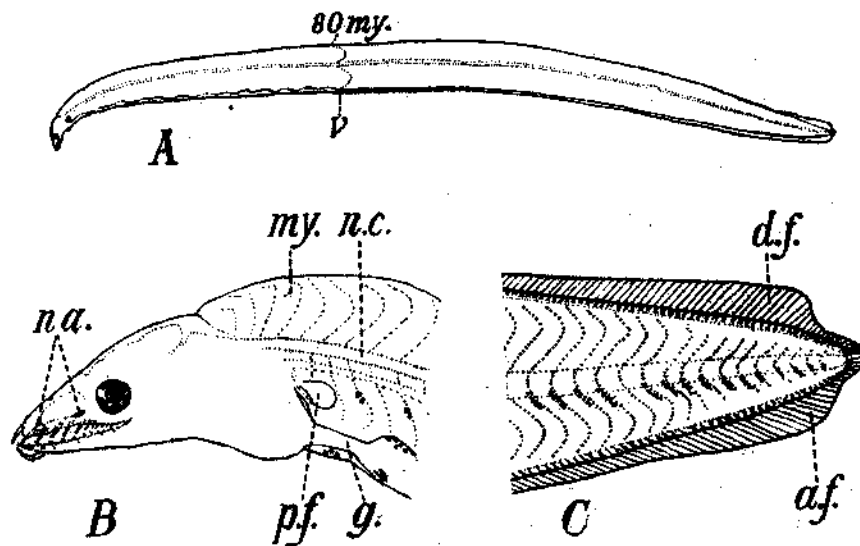


FIG. 2. *Leptocephalus* from Madras Coast.

A. Outline drawing of the leptocephalus, $\times 1$. B. Head of the leptocephalus, $\times 9$. C. Caudal end of the leptocephalus, $\times 9$. *a.f.*, anal fin; *d.f.*, dorsal fin; *g.*, gut; *my.*, myotome; *n.c.*, nerve cord; *p.f.*, pectoral fin; *v.*, vent.

specimens, they seem to belong to the same species and more or less to the same stage of development. One of these is described here. The morphometric details of this specimen are given in Table II.

TABLE II

Measurements of Leptocephali

	<i>Leptocephalus</i> from Madras	<i>Leptocephalus</i> I from Travancore	<i>Leptocephalus</i> II from Travancore	<i>Leptocephalus</i> of <i>P. hijala</i> from Orissa
Total Length (in mm.) ..	105.00	82.00	103.50	68.00
Length of head (in mm.) ..	4.05	2.88	3.825	3.42
Length of snout (in mm.) ..	1.26	1.035	1.53	0.976
Eye diameter (in mm.) ..	0.52	0.624	0.784	0.496
Snout to vent (in mm.) ..	40.00	54.00	52.5	28.00
Snout to dorsal (in mm.) ..	97.80	77.00	97.11	61.25
Maximum depth (in mm.) ..	6.30	6.39	7.29	5.13
Total myotomes ..	223	174	141	155
Pre-anal myotomes ..	80	107	66	60

The leptocephalus is long, narrow and pointed at both the extremities. Head is about 26 and height 16.6 in total length. Eye is about 7.8 in head and 2.4 in snout. Cleft of the mouth extends up to the posterior border of the orbit. The anterior nares are situated on the lateral side, a little behind the tip of the snout and immediately above the margin of the upper jaw. The laterally situated posterior nares are at a distance of about $\frac{1}{2}$ the orbit diameter in front of the eyes, almost in a line with their ventral margin. In the upper jaw there are 12 larval teeth on each side, of which the 4 posterior ones are relatively very small. Similarly, in the lower jaw there are 10 teeth on each side of which the 6 anterior ones are more prominent than the rest. Pectoral fins are present. The gut shows at intervals 12 hump-like thickenings, over which are discernible dense groups of chromatophores. The vent is anterior in position to the middle of the body. The dorsal fin originates far behind at a distance of about 8 mm. from the tip of the tail. The caudal end is bluntly pointed and, though there is no well-developed caudal fin, a few very short, almost vestigial, rays could be seen covering the blunt tip. There are 223 myotomes, of which 80 are pre-anal. Elongate streak-like chromatophores are present near the tip of the lower jaw and on the lateral margins of the upper and lower jaws. From the 6th myocomma onwards prominent dendritic chromatophores arranged in a line are present immediately below the midlateral line along most of the myocommas. At the base of the anal fin regularly arranged chromatophores are present. The general shape of the body, the nature of the caudal end and the distribution of chromatophores, show that this leptocephalus belongs to the family *Ophichthyidae*.

2. LEPTOCEPHALI FROM THE TRAVANCORE COAST

Six leptocephali, belonging to various genera, were collected from the shore seines of Kovalam beach (7 miles south of Trivandrum) in the month of January 1953. Of these 2 were leptocephali of *Congrellus anago*, 2 of ophichthyids, and the remaining two of murænids. Since these two ophichthyid leptocephali are different from those recorded hitherto, they are briefly described here.

Leptocephalus 1 (82.0 mm.) *Fig. 3 A, B and C.*—The leptocephalus is thin and moderately broad. The head is about 28 and height 13 in total length. The eye is about 4.6 in head and 1.7 in snout. Cleft of the mouth extends nearly up to the posterior margin of the orbit.

An olfactory pit with one opening is discernible immediately before the eye. In addition to the prominent tooth situated a little above the tip of the upper jaw, there are 14 teeth on each side, of which the 5 anterior ones

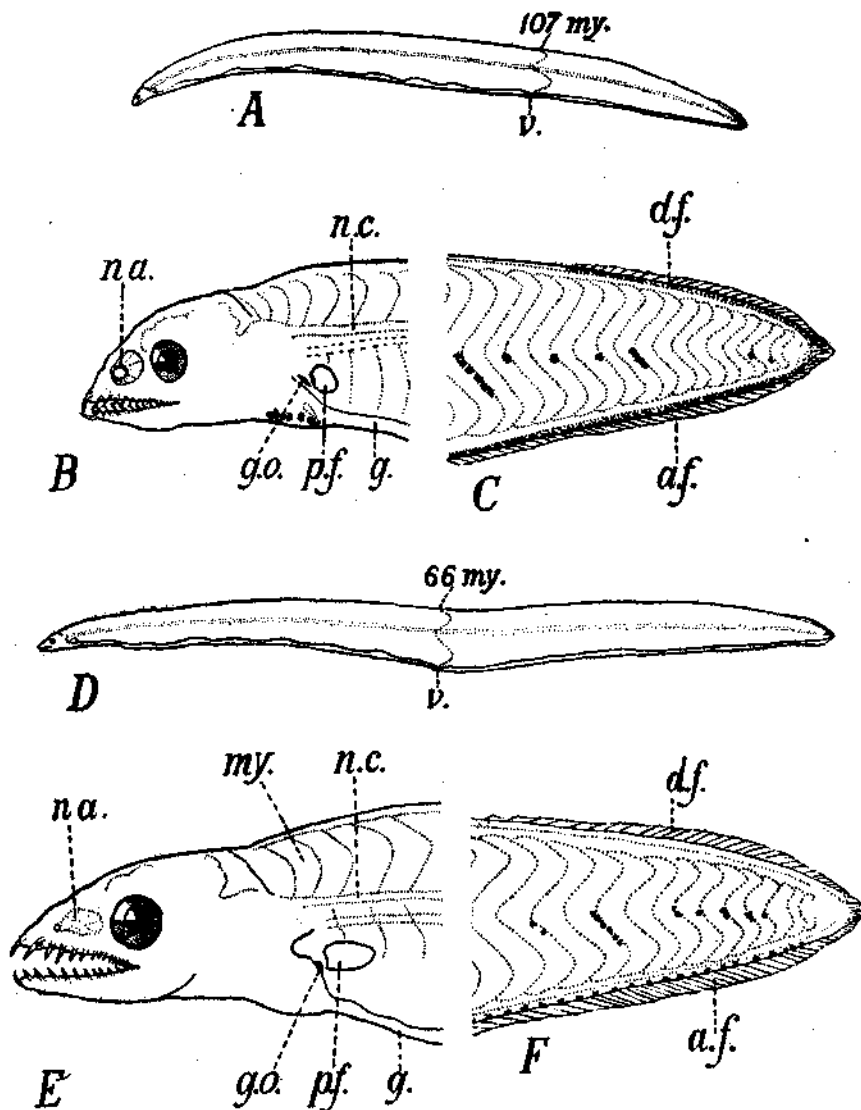


FIG. 3. Leptocephali from Travancore Coast.

A. Outline drawing of leptocephalus, I, $\times 1$. B. Head of leptocephalus I, $\times 10$. C. Caudal end of leptocephalus I, $\times 10$. D. Leptocephalus II, $\times 1$. E. Head of leptocephalus II, $\times 9$. F. Caudal end of leptocephalus II, $\times 9$. *a.f.*, anal fin; *d.f.*, dorsal fin; *g.*, gut; *g.o.*, gill opening; *my.*, myotome; *na.*, naris; *p.f.*, pectoral fin; *v.*, vent.

are relatively larger. Similarly in the lower jaw there are ten teeth on either side in addition to two big ones arising a little below the tip of the jaw. Pectoral fins are present. The dorsal originates far behind at a distance of

nearly 5 mm. from the caudal end. The caudal fin is vestigial and its rays indistinct. In the gut are seen alternate constrictions and distensions very much like those described in the leptocephali from the Madras Coast. The body has 174 myotomes of which 107 are pre-anal.

The head is devoid of any chromatophores, while the region of the heart has five conspicuous and highly dendritic chromatophores. Along the dorsal and ventral margins of the first four hump-shaped distensions in the gut, 5 to 8 dendritic chromatophores are discernible. Along the dorsal margin of the 5th and 6th humps and on the portion of the gut immediately preceding the vent, minute, closely set, dendritic chromatophores, forming a dark streak are present. A line of closely arranged chromatophores is present immediately below the mid-lateral line along the myocomma after the 32nd myotome. Regularly arranged chromatophores are present along the base of the anal fin.

Leptocephalus II (103.5 mm.) Fig. 3 D, E, F.—This is relatively broader and longer than *Leptocephalus I* though it has only 141 myotomes. The vent is situated in the 67th myotome. Head is about 27 and height 14 in total length. Snout is twice as long as the orbit and the head nearly 5 times. Cleft of the mouth extends up to or a little beyond the middle of the orbit. An olfactory pit with a small anterior opening is present immediately in front of the orbit. In addition to the prominent median tooth originating a little above the tip of the upper jaw there are 15 pointed teeth on each side directed forwards of which the five anterior are bigger than the rest. In the lower jaw there are in all 11 teeth of which the two anteriormost originate a little below the tip of the lower jaw. The vent is situated in the middle of the body. Pectorals are present. The dorsal fin originates far behind in the caudal region at a distance of 6 mm. from the tip of the tail, while the caudal is absent. While only two rather indistinct chromatophores are present on the outer side of the upper jaw at the base of the 2nd and 3rd teeth, a few are present on the gut, at the dorsal and ventral margins of the humps as well as in the intermediate region. Most of the chromatophores present on the top margins of the humps are small, closely set, and linear in character, whereas those on the humps and at their lower margins are conspicuous, isolated and dendritic in nature. Congregations of pigment spots, forming thin streaks in between the adjacent rays, are present along the entire length of the base of the anal fin. No chromatophores are discernible at the base of the dorsal. Closely set pigment spots forming conspicuous lines are present along most of the myocommas, immediately below the mid-lateral line from the fifteenth myotome onwards.

3. LEPTOCEPHALI OF *Pisoodonophis hijala* (HAMILTON)
FROM THE ORISSA COAST

Two leptocephali 68.0 and 73.1 mm. long, in the same stage of development and belonging to the same species, were collected between 19.00 and 23.00 hrs. on 17-1-1953, in a sub-surface tow-net haul in the coastal waters of the Bay of Bengal off the Mahanadi estuary in Orissa on board the 'I.N.S. Investigator'.

The smaller of the two specimens is described below. The details of body measurements are given in Table II.

This (Fig. 4) is a transparent, rather narrow and short leptocephalus with the head 20 and depth of body 13 in total length. The eye is about 7 in head and 2 in snout. The anterior nares are situated on the (lateral) side immediately above the margin of the upper jaw at a little distance behind

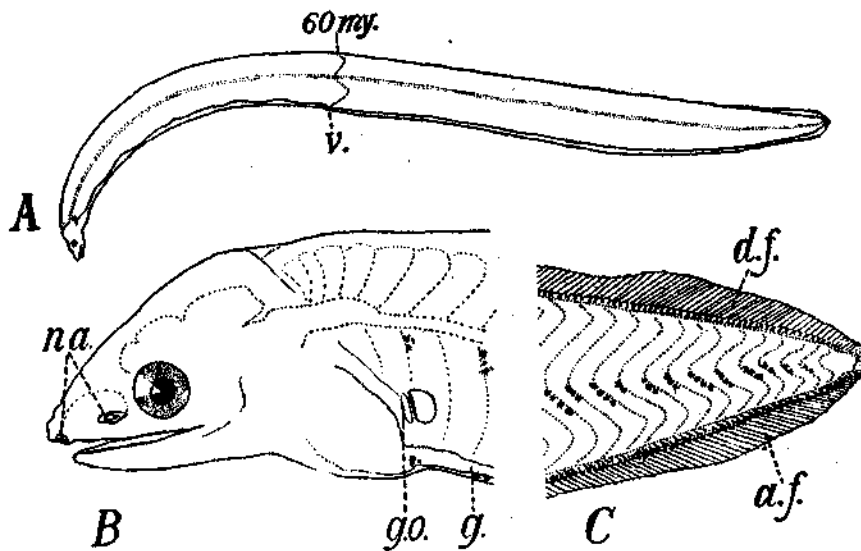


FIG. 4. Leptocephalus of *Pisoodonophis hijala*.

A. Outline drawing of leptocephalus, $\times 1.6$. B. Head of leptocephalus, $\times 16$. C. Caudal end of leptocephalus, $\times 16$. a.f., anal fin; d.f., dorsal fin; g., gut; g.o., gill opening; my., myotome; na., naris; v., vent.

the tip of the snout and the posterior ones, also lateral, some distance above the margin of the upper jaw, almost in a line with the lower margin of the orbit, at a distance of $\frac{1}{3}$ the diameter of the orbit, anterior to the front border of the eye. Cleft of the mouth extends up to the posterior border of the orbit and is edentulous. Pectoral fins are present. The gut has six humps like those found in the leptocephali described earlier.

The body has 155 myotomes of which 60 are pre-anal. The dorsal fin originates rather far behind in the body and extends only up to a short distance before the tip of the tail. The caudal end is blunt without a fin.

Head is devoid of chromatophores. Three small chromatophores are present on the gut immediately below the gill openings. Three small rows of chromatophores are present in the region of the distensions on the alimentary canal, along the dorsal and ventral margins and in between them. The central row is absent in the region of the two posterior humps. Chromatophores, present along the dorsal surface of the gut immediately before the vent, are linear. Conspicuous, dendritic chromatophores, varying in number from 1 to 11, are present on most of the myocommas immediately below the mid-lateral line. Regularly arranged pigment spots are found along the base of the anal fin.

The identification of this leptocephalus is based on the number of myotomes (155) which is almost equal to the number of vertebræ (156) in the elvers of the same species, and on the fact that *P. hijala* is the only species of *Pisoodonophis* recorded to be present in these waters.

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