

OCCURRENCE OF LARVAE OF *PSEUDORHOMBUS ELEVATUS* OGILBY (HETEROSOMATA—PISCES) ALONG THE SOUTH-WEST COAST OF INDIA

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ABSTRACT

Larvae of *Pseudorhombus elevatus* Ogilby ranging in standard length from 3.47 to 7.76 mm. are described. These were brought on board R. V. VARUNA in the vertical plankton haul collected during the international Indian Ocean Expedition 1962-65 from two stations off the South-West Coast of India. Larvae slightly less than 8 mm. had developed the full complement of dorsal, anal, caudal and pelvic rays but lacked pectoral rays and a few gill rakers. Metamorphosis must take place at a small size, probably at less than 10 mm. standard length. The most notable character of middle and late stage larvae is the pronounced elongation of the nine anteriormost dorsal fin rays. Adults of *P. elevatus* Ogilby with mature gonads were subsequently collected from the same region. The identification of the larva to species is based mainly on meristic characters.

INTRODUCTION

ALTHOUGH the distribution of the adults of the genus *Pseudorhombus* has been frequently described (Norman, 1928, 1934; Whitley, 1934; Ginsburg, 1936; Herre, 1950; Smith, 1955; Silva, 1956; Kuroda, 1957; Kamohara, 1959; Matsuura, 1962; Smith and Smith, 1963; Abraham, 1963 and Pradhan, 1964) little has been published to date on larvae of *Pseudorhombus*. Gopinath (1946) referred specimens of flat-fish post-larvae to *P. arsius* and *P. triocellatus*; Jones and Pantulu (1958) illustrated a late post-larval specimen of *P. oligodon* (10.56 mm. total length) and illustrated a recently transformed individual of *P. arsius* from a collection of specimens ranging in size from 10.28 to 13.53 mm. total length; while Pertseva-Ostroumova (1965) illustrated an 8.2 mm. specimen of *Pseudorhombus* sp.

MATERIAL AND METHODS

From the processed plankton samples of R. V. VARUNA of the International Indian Ocean Expedition (IOBC, 1968), 19 post-larvae of *Pseudorhombus* species (Table I) were studied. All these were preserved in 5 per cent. neutral formaldehyde. Body proportions were taken using ocular and stage micrometers. Measurements were made from the tip of the lower jaw and are included in *Appendix I* along with meristic characters. Drawings of larvae were made by using Projectina-Optik, Switzerland.

The composition of the catches of the fishing vessels near Quilon (09° 00' N, 76° 22' E) from a depth of 27 to 50 m. showed that *P. elevatus* Ogilby were present in large numbers in September, October and November, 1967. Random samples were preserved in 5 per cent. formaldehyde. Alizarin preparations of the adults were made to ascertain the meristic characters.

TABLE I

Data for the stations from which *Pseudorhombus elevatus* Ogilby larvae were collected

Name of vessel	Cruise No.	Station No.	Year	Month	Day	Latitude N	Longitude E	Local time	Day/night	Depth of haul	Depth at station	Sampler	No. of specimens
R. V. Varuna	104	2004	1963	11	4	09° 00'	76° 22'	0510	Night	45-0	50 m	IOSN	18
"	"	2005	"	"	"	"	76° 16'	0630	Day	54-0	58	IOSN	1

RESULTS

1. Description of Larval Stages

Larva 3.99 mm (Fig. 1).—The thin transparent body of the larva is symmetrical and laterally compressed. Length of the body is about eight times its depth. Eyes are symmetrical and black. Notochord is vacuolated at the caudal end. There are 29 myotomes, of which 10 are pre-anal. Mouth is small and terminal. Jaws carry small conical teeth. Intestine has a single circular coil. Liver is small and is not as massive as in *Arnoglossus* or *Bothus* species. At the postero-lateral aspect of the operculum there are sets of irregularly arranged spinules. Another set of spinules is also present on the head near the dorsal profile, above the level of the eye. The dorsal fin fold commences just behind the level of the spinules. It is continuous and confluent with the caudal and anal fin folds. At its anterior end a tentacular process is seen in which four interneural spines are faintly

marked out. The cleithrum is well differentiated. Embryonic rays are seen in the caudal fin. Pectoral rays are not differentiated. Brown stellate pigment spots are seen in the dorsal and ventral border of each myotome and on the skin covering the tentacular process.

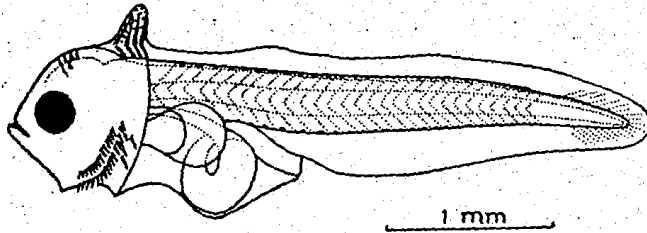


FIG. 1. *Pseudorhombus elevatus* Ogilby—Larva (SL. 3.99 mm).

Larva 4.26 mm (Fig. 2).—The length is more than 5.5 times its depth. Thirty myotomes are countable. Four elongated dorsal rays are differentiated in the place of the tentacular process. The first ray is more flat and club-shaped than the rest. Rudiment of the fifth ray is seen behind the fourth one. The nature and distribution of pigments and spinules are as in the previous stage.

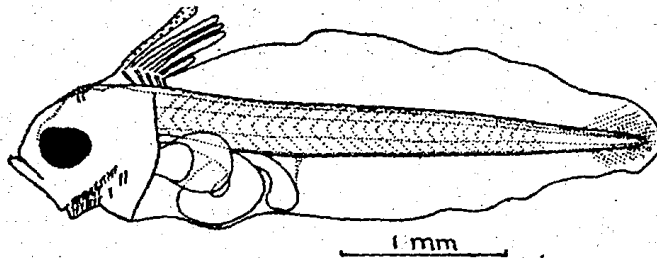


FIG. 2. *Pseudorhombus elevatus* Ogilby—Larva (SL. 4.26 mm).

Larva 4.72 mm.—Length of the body is less than 5.5 times its depth. The lower jaw projects beyond the upper. Anterior five rays are elongated. Rudiment of sixth ray is marked out. Thirty-one vertebral segments are differentiated corresponding to the number of myotomes, except at the posterior end where the notochord still remains vacuolated. Gill buds are present. Brown stellate pigment spots are also found along the middle of each myotome.

Larva 5.48 mm (Fig. 3).—The length of the body is slightly more than four times its depth. Five branchiostegal rays are differentiated. There

are five gill rakers on the lower limb. Thirty-two vertebral segments are differentiated. Anterior seven dorsal rays are elongated. Along the dorsal and ventral body wall interneural and interhaemal complexes are differentiated as in *Cynoglossus semifasciatus* Day (Balakrishnan, 1961). Ventral fin radials are differentiated. Rudiments of ventral fins are also seen. Hypural elements are in the process of formation. The opercular spinules have increased in number. Nature and distribution of pigments are same as in the preceding stages.

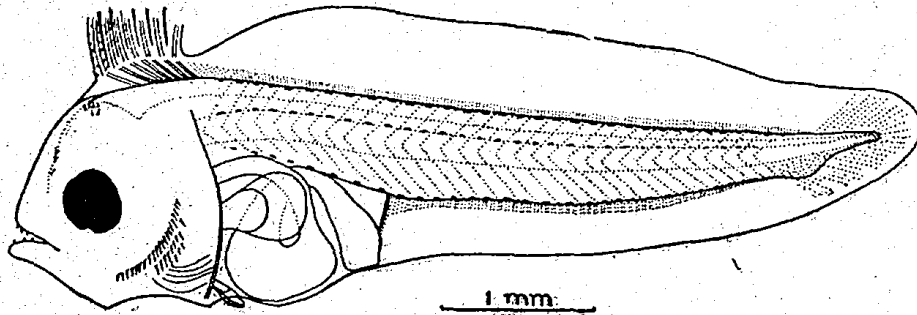


FIG. 3. *Pseudorhombus elevatus* Ogilby—Larva (SL. 5.48 mm).

Larva 6.01 mm.—Six branchiostegal rays and seven gill rakers on the lower limb are developed. Rudiments of 10 caudal rays are seen. Isolated brown pigment spots are found on the abdomen.

Larva 6.37 mm (Fig. 4).—The length of the body is 3.5 times its depth. There are 34 vertebral segments including the urostyle. Anterior eight dorsal rays are elongated and the ninth one is faintly marked. Anteriorly only four interneural spines are differentiated following the first nine ones while 19 of them are differentiated near the caudal end. In the anal fin fold 15 interhaemal spines are differentiated all of them are found near the caudal end. Differentiation of interneural and interhaemal spines near the caudal end earlier than the anterior caudal portion has also been observed in *Cynoglossus monopus* Bleeker (Balakrishnan, 1963). Twelve caudal rays are differentiated. The nature and distribution of pigments and spinules are as in the earlier stages.

Larva 6.86 mm.—The length of the body is nearly thrice its depth. Seven branchiostegal rays and eight gill rakers on the lower limb are present. There are vertebral segments including the urostyle. Sixty-six interneural and 52 interhaemal spines are well marked out, but the rays are not fully formed. The anterior nine dorsal rays are elongated. The

hypural elements are well differentiated and consequently the urostyle gets pushed dorsalwards. There are 17 caudal rays of which the middle one is the longest. Six ventral rays are faintly marked out. The ventral fin radials are symmetrical and short based. The pectoral fin still remains unrayed. In addition to the pigmentation found in the earlier stages, isolated stellate pigments could be seen on the abdomen and between 24th and 27th vertebral segments.

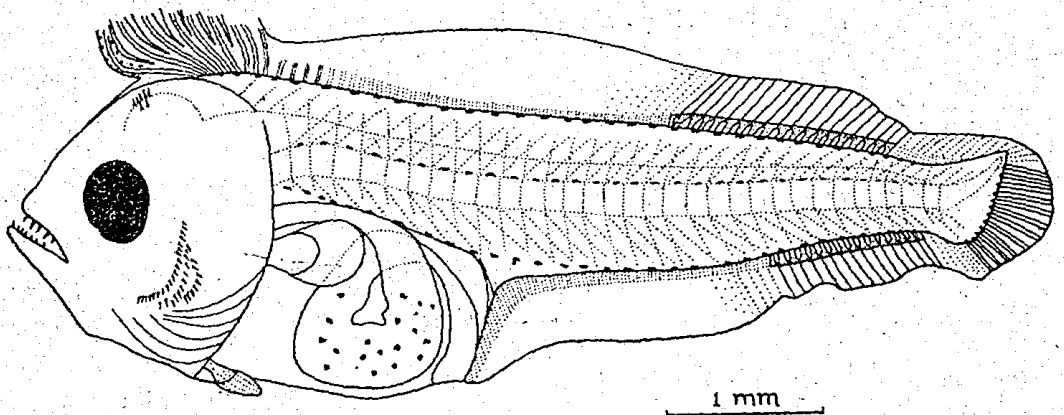


FIG. 4. *Pseudorhombus elevatus* Ogilby—Larva (SL. 6.37 mm).

Larva 7.76 mm (Fig. 5).—The length of the body is less than three times its depth. The eyes are still symmetrical. Seven branchiostegal rays and nine gill rakers on the lower limb are well differentiated. There are 34 vertebral segments including the urostyle. The dorsal fin rays commence from the very extremity of the dorsal fin fold. The anterior nine dorsal rays are elongated. The first dorsal ray is especially flat and leaf-like and is directed obliquely forwards. Sixty-eight interneural and 54 interhaemal spines are well differentiated. The fin rays are faintly marked out. Ventral fins have short bases and bear six rays. The pectorals still remain unrayed. The nature and distribution of the pigments and spinules are the same as in the preceding stage.

2. *Distinctive Characters of Adult P. elevatus* Ogilby.

The adults of *P. elevatus* Ogilby are characterised by the presence of 34 vertebrae including the urostyle, 66–69 dorsal, 50–55 anal, 17 caudal, six ventral rays and 13 gill rakers on the lower limb. These characters agree with those described by Norman (1934).

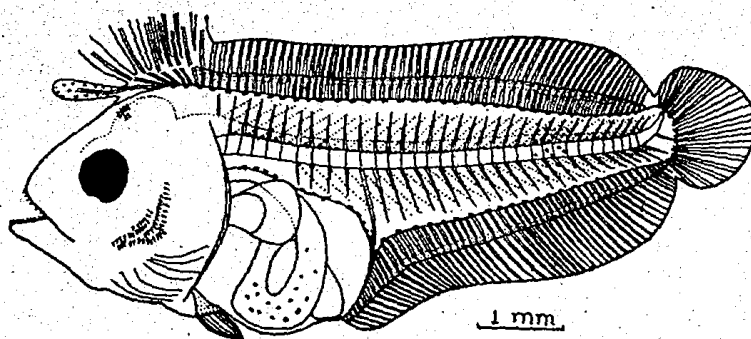


FIG. 5. *Pseudorhombus elevatus* Ogilby—Larva (SL. 7.76 mm).

(The anterior elongated rays of the larvae are broken. Hence their relative lengths are not shown in figures.)

DISCUSSION

The thin, flat body, large numbers of soft continuous fin rays in the dorsal and anal fins, the absence of procurrent rays in the caudal fin, and the relatively few (10) abdominal vertebrae help to distinguish the larvae as those of flat-fish. The presence of precocious elongated anterior rays in the dorsal fin together with symmetrical short-based ventral fins, place this larva in the *Paralichthys-Pseudorhombus* group of bothid flat-fish. Meristic characters support the assignment to *Pseudorhombus elevatus* Ogilby. Gopinath (1946), Jones and Pantulu (1958) and Pertseva-Ostroumova (1965) do not give indication of the presence of a group of elongated anterior dorsal rays on their specimens—although this character is one of the most diagnostic features of *Pseudorhombus* larvae. Larvae of the closely allied genus *Paralichthys*, develop a precocious group of five elongated anterior dorsal rays (Okiyama, 1967). It is probable that the two specimens identified and illustrated as *Samaris macrolepis* Norman by Jones and Pantulu (1958, pp. 131–33, Figs. 22–23) are larvae of *Pseudorhombus*.

The presence of adult *P. elevatus*, with maturing gonads in the locality from where the larvae had been obtained previously, at the same season of the year, strengthens the assignment to this species.

The largest larvae studied, slightly less than 8 mm standard length, possessed a full complement of dorsal, anal, caudal and pelvic fin rays, and lacked only the pectoral rays. The number of gill rakers on the lower limb is also incomplete. This stage of development of flat-fish larvae usually

immediately precedes metamorphosis; hence, metamorphosis probably occurs at a length of 10 mm. or less in this species.

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APPENDIX I
Measurement and meristic counts of Pseudorhombus elevatus Ogilby larvae

Sl. No.	Standard length mm.	Total length mm.	Eye diameter maximum mm.	Eye diameter minimum mm.	Snout length mm.	Head length mm.	Length up to Cleithra mm.	Length up to anus mm.	Depth at caudal peduncle mm.	Vertebrae without urostyle	Branchio-stegals	Dorsal rays	Anal rays	Caudal rays	Gill rakers	Remarks	
1	3.47	3.56	0.26	0.26	0.30	0.79	0.89	1.95	0.50	23	..	..	..	..	..	..	Damaged. 3 inter-neural spines in the tentacular process
2	3.99	4.13	0.26	0.25	0.17	0.76	0.86	1.91	0.50	29	..	..	..	..	..	..
3	4.26	4.39	0.26	0.26	0.20	0.83	0.92	1.85	0.76	20	..	4	..	..	..	..
4	4.72	4.85	0.30	0.26	0.13	0.76	0.92	2.15	0.86	31	..	5	..	..	..	..
5	4.72	4.85	0.30	0.30	0.26	0.92	1.06	2.01	0.89	31	..	5	..	..	..	..
6	4.85	4.98	0.30	0.30	0.26	0.96	1.06	2.18	0.89	31	..	5	..	..	..	..
7	4.98	5.08	0.36	0.33	0.33	1.16	1.22	2.18	1.25	31	..	5	..	..	..	..
8	5.15	5.25	0.36	0.33	0.40	1.12	1.22	2.28	0.99	32	3	6	..	..	5	..	
9	5.31	5.45	0.40	0.33	0.30	0.89	1.19	2.31	1.09	32	4	7	..	..	5	..	
10	5.35	5.51	0.36	0.33	0.36	1.19	1.32	2.38	1.02	32	4	7	..	..	7	..	
11	5.48	5.58	0.40	0.40	0.33	1.02	1.22	2.34	0.83	32	6	7	..	..	5	..	
12	5.61	5.71	0.36	0.33	0.36	1.09	1.29	2.31	1.19	32	5	7	..	8	6	..	
13	5.78	5.87	0.43	0.36	0.36	1.09	1.49	2.54	1.35	32	6	7	..	9	6	..	
14	6.01	6.14	0.46	0.36	0.43	1.39	1.52	2.74	1.49	32	6	7	..	10	7	..	
15	6.04	6.11	0.40	0.40	0.40	1.42	1.49	2.71	1.49	32	6	7	..	10	7	..	Damaged and distorted
16	6.14	6.30	0.40	0.36	0.33	1.22	1.45	2.51	1.35	32	6	7	..	11	7	..	
17	6.37	6.90	0.50	0.40	0.46	1.55	1.58	2.84	1.82	33	7	8	..	12	7	..	
18	6.86	7.90	0.53	0.50	0.46	1.82	2.01	3.23	2.41	33	7	9+57	52	17	8	..	
19	7.76	8.98	0.59	0.50	0.59	2.01	2.31	3.76	2.74	33	7	9+59	54	17	9	..	