

NOTES ON EGGS, LARVAE AND JUVENILES OF FISHES FROM
INDIAN WATERS

XV. *PEGASUS VOLITANS LINNAEUS*, XVI. *DACTYLOPTENA ORIENTALIS* (CUVIER AND VALENCIENNES) AND XVII. *DACTYLOPTENA MACRACANTHUS* (BLEEKER)

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XV. *PEGASUS VOLITANS LINNAEUS*

Three species of pegasids viz., *Pegasus volitans* Linnaeus, *P. laternarius* Cuvier and *P. draconis* Linnaeus have been recorded from the seas around India. Of these, *Pegasus draconis* is distinct from the other two by the presence of 8 tail rings and 2 pits on occiput. *P. volitans* differs from *P. laternarius* mainly in having 12 tail rings as against 11 tail rings in the latter. *P. natans* is considered synonym of *P. volitans* (*vide* De Beaufort, 1962) and hence the larval and juvenile specimens collected from the Orissa coast (Jones and Pantulu, 1958) and the postlarva collected from Porto Novo (Krishnamurthy, 1962) should be known under *P. volitans*.

Larval specimens of *Pegasus volitans* Linnaeus smaller than those described by Jones and Pantulu (*op. cit.*) and Krishnamurthy (*op. cit.*) were obtained from the plankton collections from the Gulf of Mannar and Park Bay near Mandapam Camp and three of the typical stages from these are described here. There are seven early postlarval specimens measuring from 2.83 mm. to 5.38 mm. in total length which could be definitely identified as those of *P. volitans* by the presence of 12 tail segments and the detailed measurements of these are given in Table I.

TABLE I
Measurements of larval Pegasus volitans in mm.

S.No.	Locality and date of collection	T.L.	S.L.	Head	Snout	Eye	Snout to dorsal	Snout to ventral
*1	Mandapam Camp, Palk Bay. 25-8-58.	2.83	2.73	1.09	0.31	0.31	1.62	1.41
2	Do.	2.87	2.77	1.15	0.36	0.36	1.67	1.46
*3	Mandapam Camp, Gulf of Mannar. 26-12-58.	4.39	3.77	1.41	0.41	0.38	2.51	1.98

*Denotes specimens described.

TABLE I—contd.

S. No.	Locality and date of collection	T.L.	S.L.	Head	Snout	Eye	Snout to dorsal	Snout to ventral
4	Mandapam Camp, Palk Bay. 29-11-57.	4.50	3.97	1.51	0.47	0.38	2.56	2.19
5	Do. 6-12-57.	4.92	4.31	1.51	0.52	0.44	2.77	2.55
*6	Mandapam Camp, Gulf of Mannar. 26-12-58.	5.23	4.42	1.69	0.52	0.47	2.98	2.35
7	Mandapam Camp, Palk Bay. 25-8-58.	5.38	4.86	1.78	0.60	0.50	3.19	2.51

*Denotes specimens described.

2.83 mm. stage (Figs. 1 and 2).—This is an early postlarva and there is no indication of any yolk at this stage. The head is conspicuously large and the body behind the pectorals is somewhat abruptly compressed and tapering. The snout is equal to the diameter of the eye, about 11% of standard length. Seventeen myotomes could be made out since those anteriorly are not clear. There is a supraorbital ridge above the eye on each side followed by another behind and a long median supracapital crest. On the dorsal and ventral aspects of the body up to the base of the dorsal and anal, five prominent ridges are visible on either side which ultimately develop as segments. The median finfold is continuous and fin rays are faintly visible in the region of the dorsal and anal, but the caudal fin is devoid of distinct fin rays. Pelvic fin rudiments could be distinguished merely as thickenings just anterior to the vent. The specimen is dull white in formalin. A patch of pigment is visible over the region of the hind-brain. Dendritic chromatophores are present ventrolateral to the eye, on the dorsal aspect of the abdominal sac, above the base of the anal and also on the sides anterior to the caudal peduncle. Three faint pigments are present on the ventral aspect of the caudal fin. Dorsal aspect of the trunk is slightly pigmented. Pectoral fin excepting the outer margin is densely pigmented.

4.39 mm. stage.—The beginning of formation of 12 tail rings is indicated. The caudal is heterocercal. The medium fins are separate and fin rays could be made out. The pectorals have 11 rays. The ventral fins are seen as two curved structures, but rays could not be made out. Scattered chromatophores

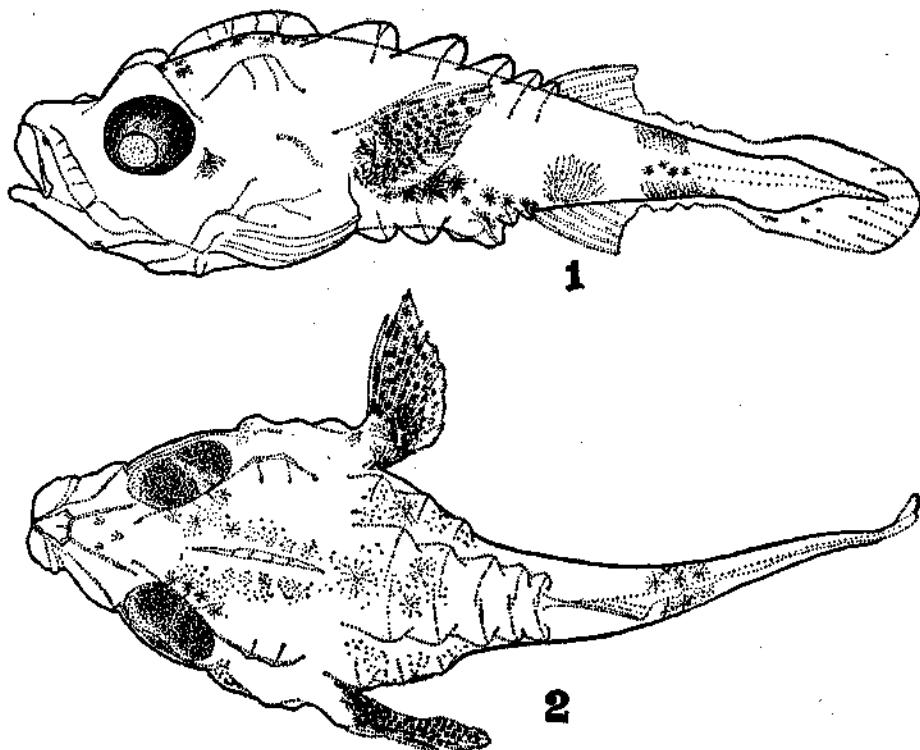


FIG. 1. *Pegasus volitans*. 2.83 mm stage. FIG. 2. Dorsal view of the above

are present on the dorsal side of head and anterior part of body. There is a dark brown cluster of chromatophores extending from the second to the seventh ray of pectoral.

5.23 mm. stage (Fig. 3).—The noticeable changes in this stage are the slight elongation of the snout in comparison to the eye, the narrowness of the trunk and tail when viewed from above, the lengthening of the pectorals and the clear demarcation of all the segments. The eye is proportionately smaller. The temporal ridges and the supraoccipital crest are more prominent. The 3 body segments and 12 tail segments are clearly distinguishable. Adult complement of rays are developed in the median and paired fins. The pectorals have lengthened considerably, being more than the length of snout and eye together. General colouration is dull white in formalin with dark pigments on head and body. Scattered pigments are present on the ventral side of head and body. The upper seven rays of the pectoral are densely pigmented and a few pigments are present at the distal third of lower rays. The other fins are devoid of pigments.

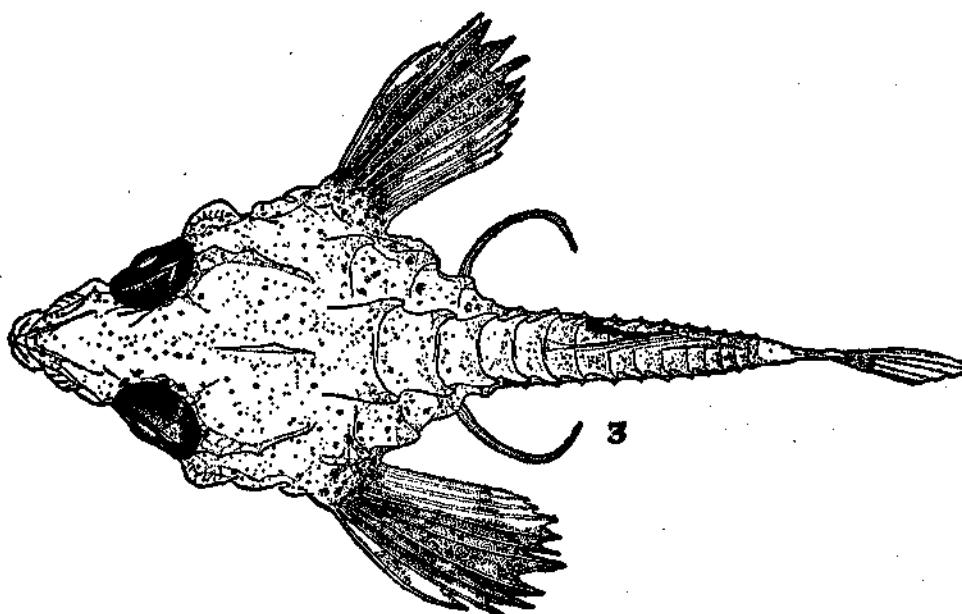


FIG. 3. *Pegasus volitans*. 5.23 mm stage.

The specimen measuring 5.38 mm. shows considerable overall resemblance to the 6.00 mm. specimen of Krishnamurthy (*op. cit.*) even though the latter is slightly longer. Incidentally it may be stated here that the length of snout and the diameter of eye given by him *viz.*, 0.32 mm. and 0.13 mm. respectively are considerably less than what they should be and do not in the least correspond to his figure.

XV. DACTYLOPTENA ORIENTALIS (CUVIER AND VALENCIENNES)

De Beaufort (*op. cit.*) recognises only the genus *Dactyloptena* for all the three generally accepted valid species of flying gurnards found in the Indo-Pacific and this classification is followed here. *Dactyloptena orientalis* (Cuvier and Valenciennes) and *D. macracanthus* (Bleeker) have already been reported from the seas around India, while *D. peterseni* (Nyström) which was formerly known only from the Pacific and off South Africa has recently been collected from the west coast of India by Dr. E. G. Silas (Jones, MS.).

The larval stage of dactylopterids characterised by the spiny armature on the head and short pectorals differs very much from the adult and has been described by some of the early workers under the genus *Cephalacanthus*. After the identity of the above has been known such larval stage was referred to as *Cephalacanthus* stage. Thirty three postlarval specimens measuring 3.76 mm. to 17.35 mm. in total length determined as of *D. orientalis* have been collected

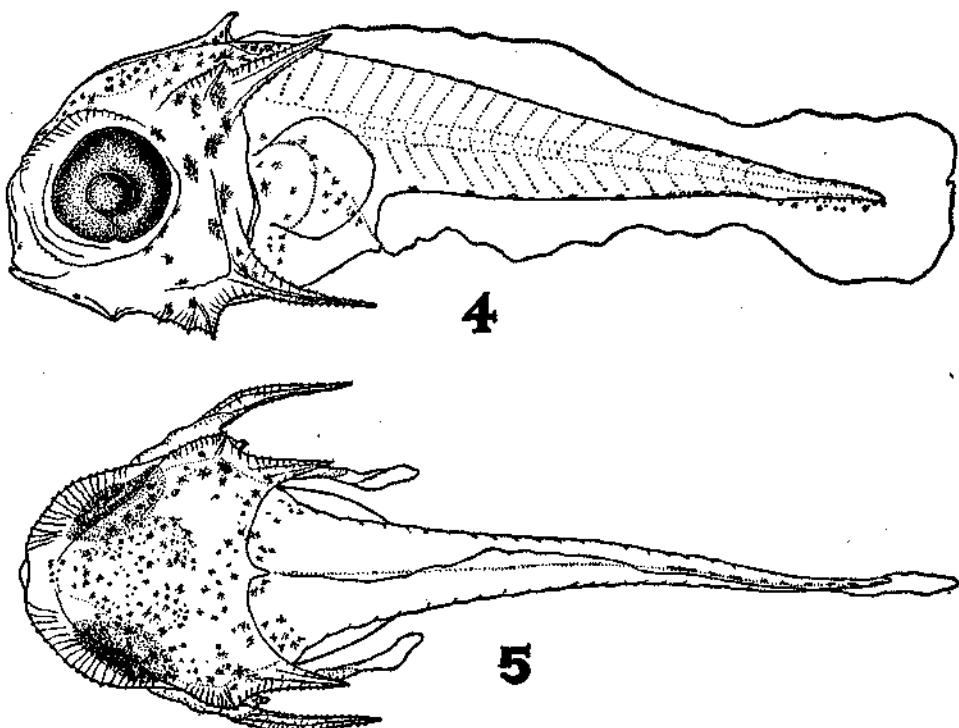


FIG. 4. *Dactyloptena* sp. 3.76 mm stage. FIG. 5. Dorsal view of the above.

from several areas off the west coast of India. All except two specimens were collected from plankton samples on board R. V. Varuna, while one specimen each was collected on board R.V. Kalava and from Vizhingam near Trivandrum. The localities of collection and measurements of 25 formalin preserved specimens in good condition are given in Table II. Five stages from these are described below.

3.76 mm. stage (Figs. 4 and 5).—The head is broad and blunt anteriorly, the body is slender and tapering. The head excluding spinous projections is about 28.7% and eye about 12.6%, both in standard length. The vent is far anterior to the mid point of total length. The angle of preoperculum is produced into a feebly serrated spine measuring 18.9% of standard length. Anteroventral to this is an obtuse projection which is also serrated. The post-temporal spine which is slightly shorter (15%) than the preopercular spine is feebly serrated. The armature giving rise to the supraoccipital and post-temporal projections seems to be continuous. Twenty one myotomes could be counted at this stage. The median finfold is continuous and has no rudiments of rays. The specimen is more or less cream coloured in formalin. Dendritic chromatophores are present

on the dorsal side of head, on the preopercle and at the base of preopercular spines, post-temporal spines and supraoccipital projection. Pigments are present on the abdominal sac, along the ventral midline and posterior third of the dorsal midline of body and below the urostyle.

5.38 mm. stage (Fig. 6).—The head is 34.7% of standard length and the body is stouter. The eye is very prominent and its diameter is 16.2% of standard length. Preanal portion has elongated considerably and the vent is midway between tip of snout and posterior end of caudal. The preopercular spine and the post-temporal spine are 32.6% and 25.9% respectively of standard length. The caudal fin is heterocercal and separate from the dorsal and anal. Only the first four spines are discernible in the region of the dorsal. Rays could be distinguished with difficulty in the second dorsal, anal, and caudal. The ventrals which are thoracic in position are seen as small thickenings below the base of pectorals. Dorsal side of head, preoperculum and sides of body up to below the origin of second dorsal are densely pigmented. A few chromatophores are present on the dorsal midline of caudal peduncle, ventral midline of body and on the caudal fin.

7.47 mm. stage (Fig. 7 and 8).—The head, the preopercular spine and the post-temporal spine are longer than in the preceding stage. The mouth is inferior and very fine granular teeth are visible in two irregular rows in the jaws. The adult complement of spines and rays could be distinguished in the median fins and the pectoral which is longer than the eye diameter has 16 rays. All the 7 dorsal spines and the stumpy spine immediately behind them are connected by membrane; the first spine just behind the occiput is about 38.8% of head length and the second spine is about 1/3 of the former and the third (which actually is the first spine of the continuous first dorsal in the adult) is slightly longer than the second spine. The ventrals are seen as small stumps. Body up to the caudal peduncle is densely pigmented. Three pigments are seen at the tip of the occipital spine.

9.46 mm stage (Fig. 9).—The head is 37.2% and the eye 17.1% in standard length. The preopercular spine and the post-temporal spine are 37.9% and 35% respectively of standard length. The pectorals and the ventrals have elongated and 18 rays could be counted in the former. Bony ridges have formed below the occipital spine which is now about 86.4% of head length. The second spine is about 1/5 and the third is slightly more than 1/3 of the occipital spine. The stumpy immovable spine before the soft dorsal is clearly visible. Scales have begun to develop on the body. Pigmentation on head and body is more dense. Distal 2/3 of the occipital spine is densely pigmented. A few pigments are present distally on the membrane between the first three dorsal spines and at the base of the preopercular and the post-temporal spines.

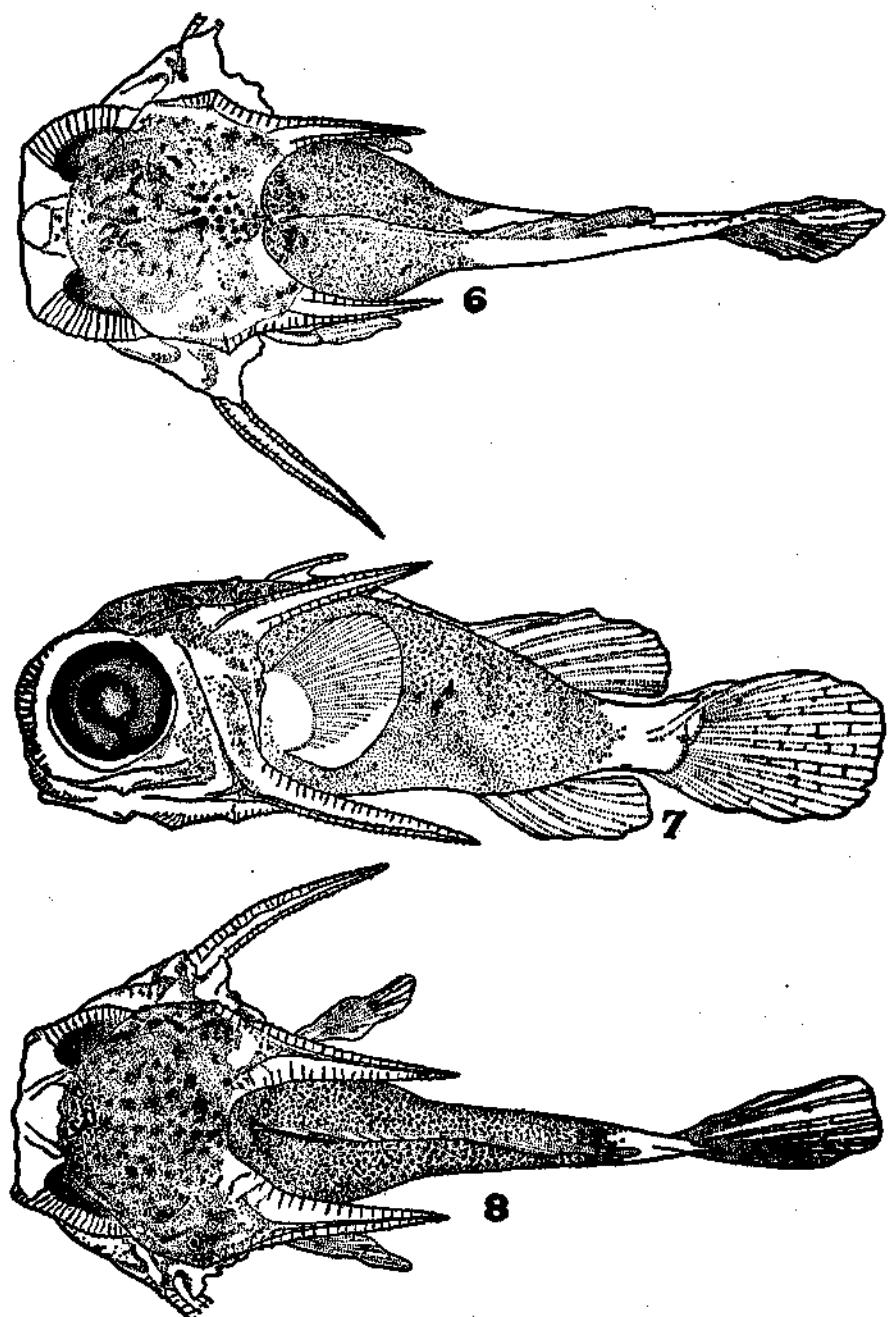


FIG. 6. *Dactyloptena orientalis*. Dorsal view of 5.38 mm stage (preopercular spine of one side not drawn) FIG. 7. 7.47 mm stage. FIG. 8. Dorsal view of the above preopercular spine of one side not drawn).

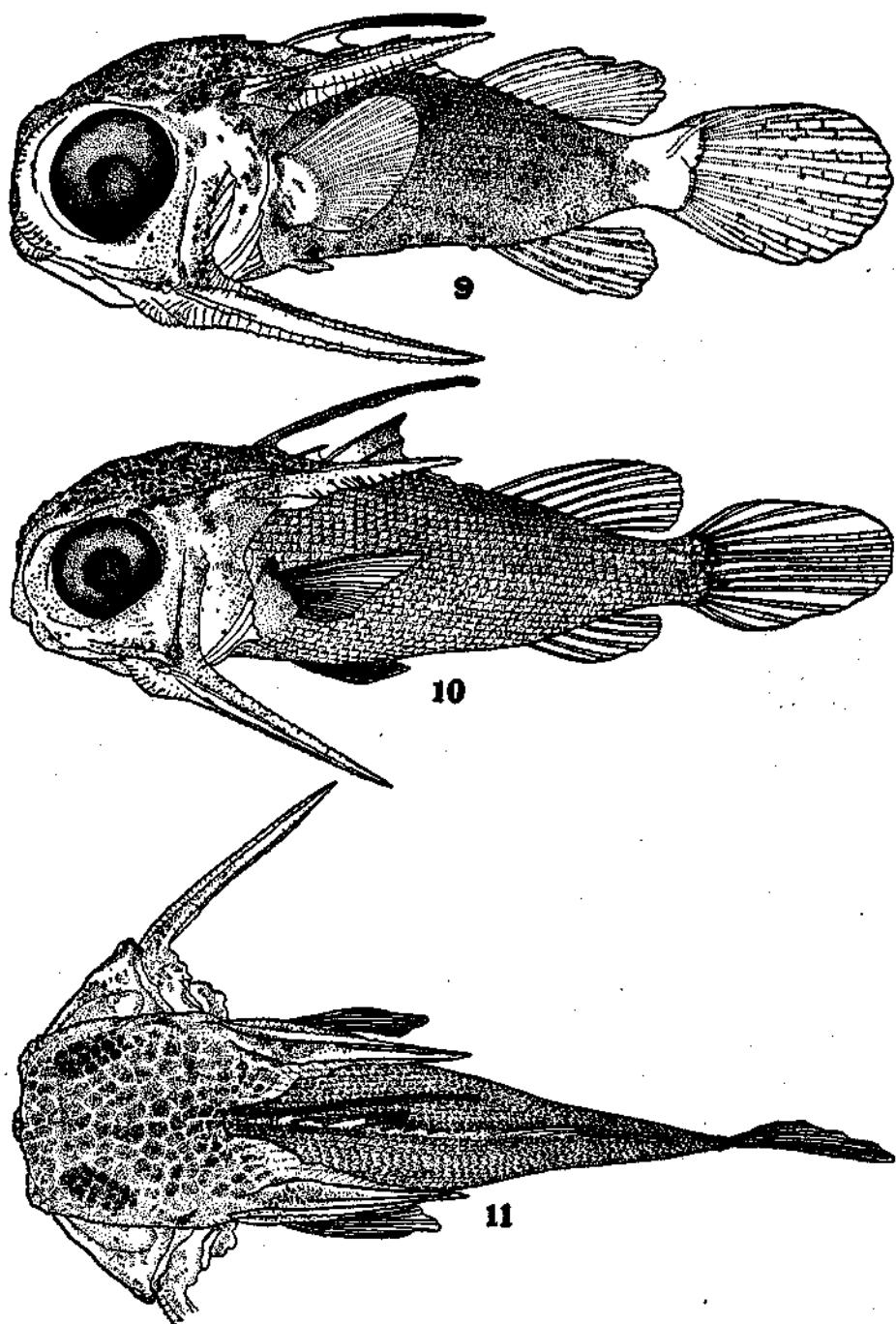


FIG. 9. *Dactyloptena orientalis*. 9.46 mm stage. FIG. 10. 17.35 mm stage. FIG. 11.
Dorsal view of the above (preopercular spine of one side not drawn).

TABLE II
Measurements of larval Dactyloptena orientalis in mm.

S.No.	Locality	Date	T.L.	St.L.	Head	Snout	Eye	Preop. spine	P.t. spine	Occ. spine	Sn. to D ₂	Sn. to D ₂	Sn. to A	Pecto-ral fin.
* 1	8°21' N, 76°56' E	. . .	15-2-1957	3.76	3.45	0.99	0.18	0.44	0.63	0.52	..	0.99	..	1.44 0.57
2	11°15' N, 75°20' E	. . .	4-1-1963	4.18	3.97	1.25	0.21	0.55	0.78	0.65	..	1.09	..	1.78 0.68
3	16°00' N, 72°43' E	. . .	6-1-1963	4.50	4.24	1.15	0.21	0.52	1.04	0.83	..	1.20	..	1.83 0.68
4	Do.		Do.	4.60	4.24	1.41	0.26	0.62	1.04	0.83	..	1.30	..	1.93 0.73
5	Do.		Do.	4.81	4.50	1.36	0.26	0.62	1.20	0.99	..	1.36	..	2.30 0.73
6	16°00' N, 73°05' E	. . .	Do.	4.92	4.60	1.62	0.29	0.68	1.15	1.04	..	1.57	2.61	2.67 0.78
7	16°00' N, 72°43' E	. . .	Do.	5.18	4.65	1.62	0.29	0.73	1.41	1.30	..	1.51	2.67	2.67 0.83
8	14°00' N, 73°20' E	. . .	13-12-1962	5.28	4.71	1.62	0.29	0.73	1.51	1.15	..	1.41	2.67	2.67 0.83
*9	16°00' N, 73°05' F	. . .	6-1-1963	5.38	4.81	1.67	0.31	0.78	1.57	1.25	0.15	1.62	2.72	2.77 0.83
10	14°49' N, 73°20' E	. . .	16-12-1962	5.42	4.86	1.67	0.29	0.73	1.41	1.15	0.15	1.62	2.67	2.67 0.83
11	16°00' N, 72°43' E	. . .	6-1-1963	6.27	5.13	1.88	0.31	0.89	1.72	1.57	0.26	1.88	3.14	3.19 0.99
12	Do.		Do.	6.37	5.13	1.93	0.31	0.83	1.62	1.41	0.28	1.83	3.14	3.19 0.99
13	Do.		Do.	6.43	5.07	1.93	0.31	0.89	1.78	1.51	0.36	1.83	3.29	3.29 0.99
14	10°02' N, 73°40' E	. . .	7-4-1959	6.64	5.18	2.04	0.34	0.94	1.93	1.62	0.68	1.98	3.45	3.56 1.10
15	16°00' N, 73°05' E	. . .	6-1-1963	6.84	5.38	2.14	0.31	0.94	2.09	1.93	0.78	2.04	3.45	3.56 1.15

21—1 DCM(FRI)67	16	16°00' N, 72°43' E	.	.	Do.	7·06	5·64	2·19	0·31	0·94	1·98	1·78	0·73	2·09	3·76	3·82	1·10
	*17	Do.	.	.	Do.	7·47	5·85	2·14	0·34	0·89	2·14	2·04	0·83	2·09	3·86	3·97	1·15
	18	15°58' N, 72°03' E	.	.	6-1-1963	8·21	6·27	2·61	0·39	1·15	2·56	2·19	1·57	2·56	4·34	4·34	1·46
	19	16°00' N, 73°05' E	.	.	6-1-1963	8·78	6·85	2·61	0·39	1·20	2·72	2·25	2·40	2·57	4·65	4·76	1·51
	20	Do.	.	.	Do.	9·15	7·21	2·82	0·41	1·36	3·03	2·51	2·61	2·57	4·71	4·92	1·46
	*21	Do.	.	.	Do.	9·46	7·31	2·72	0·41	1·25	2·77	2·56	2·35	2·72	4·76	4·92	1·56
	22	Do.	.	.	Do.	11·50	8·84	2·65	0·52	1·41	3·87	3·20	3·79	2·72	5·85	5·96	1·98
	23	15°58' N, 72°03' E	.	.	7-1-1963	12·02	9·41	3·29	0·57	1·46	4·13	3·76	3·56	3·03	6·46	6·64	2·14
	24	Do.	.	.	Do.	14·95	11·97	4·45	0·81	2·04	4·65	4·03	5·13	4·03	8·45	8·84	2·98
	*25	Do.	.	.	Do.	17·35	13·64	4·92	0·94	2·14	5·38	4·71	5·91	4·34	9·47	9·83	3·45

*Denotes specimens described.

T.L. = Total length ; St. L. = Standard Length ; Preop. spine = Preopercular spine ; P.t. spine = Post-temporal spine ; Occ. spine = Occipital spine ; Sn. to D₁ = Snout to origin of occipital ray ; Sn. to D₂ = Snout to origin of second dorsal ; Sn. to A. = Snout to origin of anal fin.

TABLE III
Measurements of larval Dactyloptena macracanthus in mm.

S.No.	Locality	Date	T.L.	St.L.	Head	Snout	Eye	Preop. spine	P.t. spine	Occ. spine	Sn to D ₁	Sn to D ₃	Sn to A	Pectoral fin
1	08°00'N, 74°40'E	14-11-62	5.33	4.81	1.51	0.26	0.68	1.51	1.20	..	1.57	2.67	2.67	0.68
2	Do.	Do.	8.79	6.69	2.67	0.31	1.30	2.72	2.46	0.36	2.51	4.45	4.39	1.62

17.35 mm. stage (Figs. 10 and 11).—Considerable progress in development is noticed in this specimen over the previous one. The length of the head and diameter of the eye are 36% and 15.7% respectively of standard length. The preopercular spine and the post-temporal spine are 39.4% and 34.5% respectively of standard length. The post-temporal spine is broad basally and some bony ridges have developed on the dorsal side of head. The ventrals have elongated and one spine and four rays could be distinguished. Keeled scales have developed, 44 could be counted in longitudinal series and two elongate and somewhat oblique keels are distinguishable at the base of the caudal fin. The occipital spine is longer than the head and is not connected to the spine behind; second ray is about 1/6 of the former and not completely separate from the first spine of spinous dorsal proper which is less than 1/2 the length of occipital spine. Pigmentation on the head and the body is more dense. The occipital spine is completely pigmented and the membrane between the first four spines of dorsal is pigmented distally.

The only information we have on the development of the species of the genus *Dactyloptena* is from the description of a specimen measuring about 10 mm. presumed to be of *D. orientalis* by Weber (1913), another specimen of *D. orientalis* measuring 17 mm. described by Kaumans (1953) and the larval stages of *D. peterseni* described by Senta (1958). In the larva collected by the Siboga Expedition from Manipa Strait ($3^{\circ} 20' S$, $127^{\circ} 22.9' E$) and described by Weber (*op. cit.*) the adult complement of fin rays have developed and the occipital spine is equal to the length of the head and this larva is considered as that of *D. orientalis* for reasons given elsewhere. The above specimen is comparable to the 9.46 mm. larva in our collections but the former differs slightly in being a little more stout and in having a broader interorbital space. The specific identity of the larvae described here as of *Dactyoptena orientalis* is based on the presence in juveniles of a long isolated occipital spine much longer than the head, and the short, almost free spine immediately posterior to it and the close similarity of 17.35 mm. stage to the specimen measuring 17 mm. collected by the Snellius expedition from Lembeh Strait and described by Kaumans (*op. cit.*). According to him (Kaumans, *op. cit.*) "the detached finlet of one spine, between the elongate spine at the occiput and the spinous dorsal fin" is omitted in Weber's figure. This statement does not appear to be correct as the spine which ought to develop in the adult as the detached spine behind the occipital spine is clearly visible in the figure even though attached by membrane to the first spine of the continuous spinous dorsal fin which is much longer than the former. This is in conformity with the progress in development of the spines in the early stages of the larvae described in this paper.

Sanzo (1934 and 1939) and Padoa (1956) have described the larval stages of *Dactylopterus volitans* (Linnaeus) which is distributed in Atlantic and

Mediterranean. The larval specimen measuring 7.4 mm. of the above species differs considerably from the specimen of the same size of *D. orientalis* obtained by us. In the former there are three somewhat recurved spines at the ventral edge of the distal third of the preopercular spine.

XVII. *DACTYLOPTENA MACRACANTHUS* (BLEEKER)

Two specimens measuring 5.33 mm. and 8.79 mm. collected from off the west coast of India which differ appreciably from the larval stages identified as of *D. orientalis* and provisionally determined as of *D. macracanthus* are described here. The detailed measurements of the specimens are given in Table III.

5.33 mm. stage (Fig. 12).—The head is large, about 31.4% in standard length and the body is slender and tapering. The eye is 14.1% of standard length. The vent is slightly posterior to the mid point of total length. The serrated preopercular spine and the post-temporal spine are 31.4% and 25.9% respectively of standard length. The caudal fin is separate from the dorsal and anal. Seven rays could be distinguished in the caudal. Rays have not yet developed in the dorsal, anal and pectoral fins. Dorsal side of head and anterior part of body up to the level of origin of anal is densely pigmented. A few chromatophores are present on the dorsal and ventral midline of caudal peduncle and on the caudal fin.

8.79 mm. stage (Figs. 13 and 14).—The head and body are broad and deep. The head is 39.9% of standard length. The eye is darker and is 19.4% of standard length. The preopercular spine and the post-temporal spine measure 40.7% and 36.7% respectively of standard length. The origin of anal fin is slightly posterior to the mid point of total length. Only four spines could be distinguished in the dorsal and the adult complement of rays could be made out in the second dorsal, anal and caudal. The first spine which eventually become the detached occipital spine in the adult is 13.5% of head length, the second spine is about 2/3 of first spine and the third one is almost equal to the first spine. Eighteen rays could be counted in the pectoral. The ventrals appear as small projections. Two or three irregular rows of small granular teeth have formed in the jaws. Head, body, basal third of the post-temporal spine and basal half of the preopercular spine are densely pigmented. A few pigments are seen on the caudal fin.

The specific identity of the larvae described above is only provisional in the absence of a connected series of specimens. The length of the head and the diameter of the eye in 8.79 mm. specimen are considerably more than in specimens of comparable size of *D. orientalis*. Moreover, the dorsal spines are very much shorter; the occipital spine in the specimen measuring 8.79 mm.

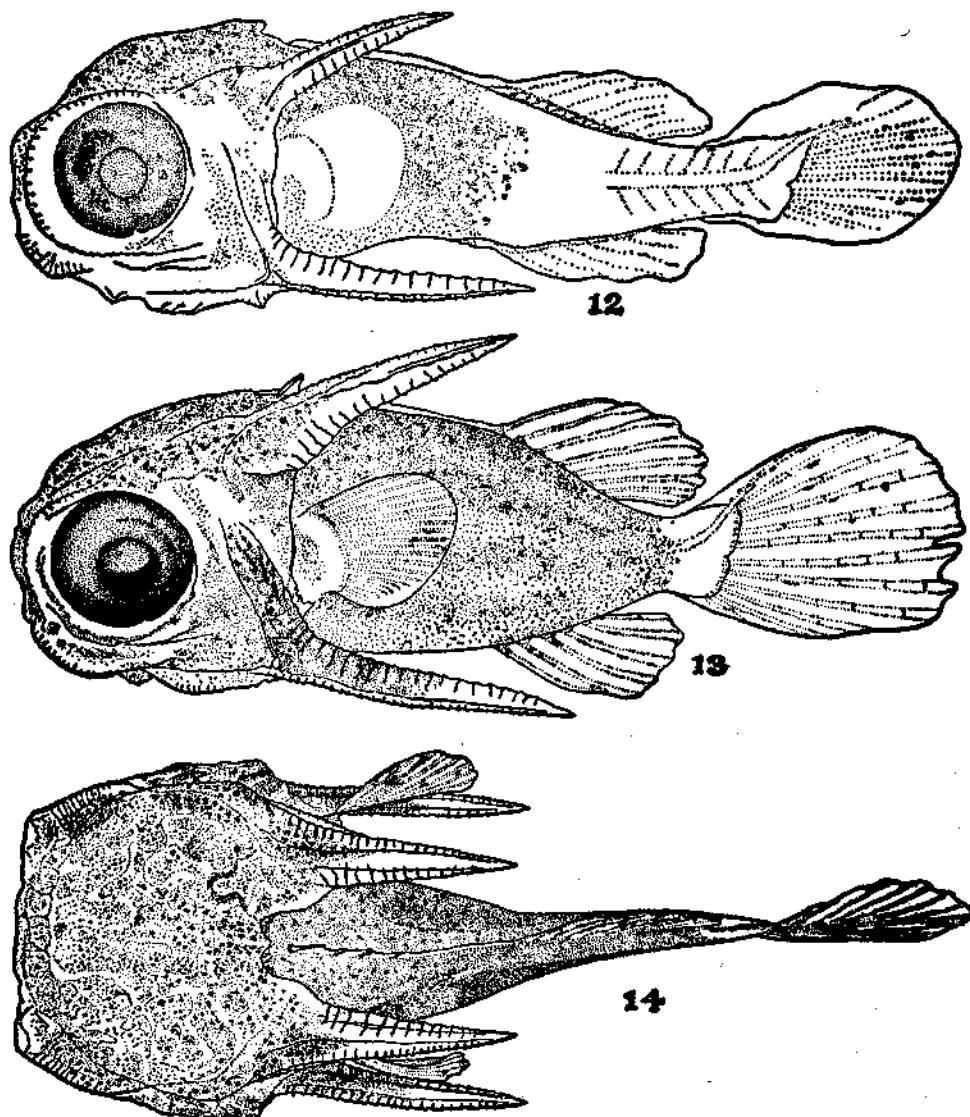


FIG. 12. *Dactyloptena macracanthus*. 5.33 mm stage. FIG. 13. 8.79 mm stage. FIG. 14. Dorsal view of the above.

supposed to be of *D. macracanthus* is only about 14% of head length, whereas, in a specimen of same size of *D. orientalis* it will be at least 85% of head length. There is considerable overall similarity in general features between the early stages of *D. peterseni* described by Senta (*op. cit.*) and the two specimens described above. However, *D. peterseni* is characterised by the absence of second free spine between the occipital spine and the first dorsal fin. In the 8.79 mm. specimen four spines could be made out, of which the first one representing

the occipital spine in the adult even though short, is longer than the second spine and the third is almost equal to the first spine and judging by the length of base between these spines and the length up to the origin of soft dorsal proper, one could see that there is sufficient space for the further development of four spines posteriorly and due to the presence of a second spine in the process of development unlike in *D. peterseni* we feel that these two larvae could belong to *D. macracanthus*. In the side view of a specimen measuring 4.7 mm. (Senta, *op. cit.*, Pl. 86, Fig. 2) the dorsal fin is shown as originating from the dorsal side of the middle of body, whereas, the dorsal view of the same specimen (Pl. 86, Fig. 3) shows the dorsal fin originating just behind the supraoccipital projection. It is evident that the anterior part of the fin has been left out in the former.

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