

THE LARVAL STAGES OF *PERICLIMENES* (*PERICLIMENES*) *INDICUS* KEMP*

BY M. KRISHNA MENON, M.Sc.

(Central Marine Fisheries Research Station, Madras)

Received December 17, 1948

(Communicated by Dr. H. Srinivasa Rao, F.A.Sc.)

INTRODUCTION

LARVÆ of several species of *Periclimenes* have been described before; but all of them belong to the subgenus *Ancylocaris*. *Periclimenes indicus* Kemp comes under the subgenus *Periclimenes* (Kemp, 1922), and an account of its larvæ should not be without interest, as it would serve to bring out the differences among the larvæ of a genus whose species are so numerous and so diverse in habits. This species was originally described by Kemp (1915) as *Urocaris indica*. Subsequently in his account of the Indian Pontonineæ (1922) the genera *Urocaris* and *Ancylocaris* were merged in the genus *Periclimenes* as it became evident to him that the two former should be regarded as only synonyms of the latter. Evidence derived from larval structure may now be examined to ascertain whether it lends support to this arrangement.

Berried females together with larvæ and immature forms were obtained from the plankton of Adyar backwater in May and the following 3 months. Panikkar and Aiyar (1939) have recorded the occurrence of egg-bearing females in the same locality in April, September and October also. In view of Kemp's records (1915) from Chilka lake and Ennur they remark that "it is not possible to say whether there is any well-marked breeding season for the species".

Larvæ belonging to the first stage were obtained by keeping berried females (carrying eyed eggs) in aquaria. A few of these first stage larvæ moulted in the course of 2 or 3 days, but it was found extremely difficult to get the later stages in the same manner. They were, however, present in townt net collections so that a complete series was available for study.

EGG

Kemp has described the eggs as sage green in colour. Those with fully developed eyed embryos (Fig. 1) are somewhat oval in shape and measure

* Published with the permission of the Chief Research Officer, Central Marine Fisheries Research Station.

0.5 mm. in length and about 0.35 mm. in breadth. The embryonic telson is armed with 6 pairs of spines on its posterior margin.

LARVÆ

Stage I (Fig. 2).—Total length about 1.5 mm. The body, as is usual in the larvæ of *Periclimenes* and related genera, has a conspicuous bent at the third abdominal segment. As in the first stage of all Caridean larvæ the eyes are fused with the carapace and a minute rostrum projects forwards between them. The carapace has no other spines on any other part. The first 3 pairs of maxillipeds are well developed and functional, with exopodites tipped with large plumose setæ.

The larvæ are quite transparent, with numerous maroon chromatophores, some of which are large and branching and have yellow margins. They show the following arrangement:—

1. A pair on the dorsal side just behind the eyes. They are united together.
2. A pair at about the middle of the cephalothorax, one on each side.
3. A somewhat smaller pair on the second abdominal segment, lateral in position.
4. A pair at the middle of the third abdominal segment also placed laterally.
5. A pair at the base of the telson.
6. A pair on the ventral side between the base of the antennæ, into which their branches enter.

Numerous dot-like pigment bodies are also present scattered at the base and endopodites of the maxillipeds, tips of the antennular peduncles and extremity of the telson.

Antennule (Fig. 3).—It consists of a peduncle and the outer flagellum. The latter is unsegmented and carries 4 terminal æsthetes and a short plumose seta. Inner flagellum is represented by a plumose seta.

Antenna (Fig. 4).—It has an unjointed peduncle, flagellum and scale. Flagellum shows no segmentation and is tipped with a small spine and a seta. The tip of the scale is distinctly jointed, 4 joints being distinguishable. Along its inner margin and tip there are 9 long plumose setæ and a short one on the outer margin at the level of the first joint. Anterior to this and external to the outermost terminal seta there is a short hair-like one. Proximally behind the first seta there is a small papilla.

Mandible (Fig. 5).—Between the incisor and molar portions there is a prominent serrated tooth.

Maxilla I (Fig. 6).—It has two endites and a palp. Both the endites have each 5 short setæ, those of the distal being larger. Palp is short, unsegmented and terminated by a small seta.

Maxilla II (Fig. 7).—Only 3 endites are present, the proximal being larger than the other two. First and third have 2 setæ each and the second 1. Palp projects slightly beyond the anterior extremity of the scale, and has a single terminal seta. Scale is fringed with 5-6 plumose setæ, one of which, arising from the posterior extremity is the largest.

Maxilliped I (Fig. 8).—Protopodite is armed with 2 setæ distally. Endopodite is short, unjointed and bears 3 unequal setæ terminally. Exopodite shows a number of constrictions, dividing it indistinctly into 8 or segments. It has 4 plumose swimming setæ at the tip and a hair-like pair at the distal joint.

Maxilliped II (Fig. 9).—Protopodite and exopodite are similar to those of the first. Endopodite has 3 segments, second and third being armed with 2 and 3 setæ respectively.

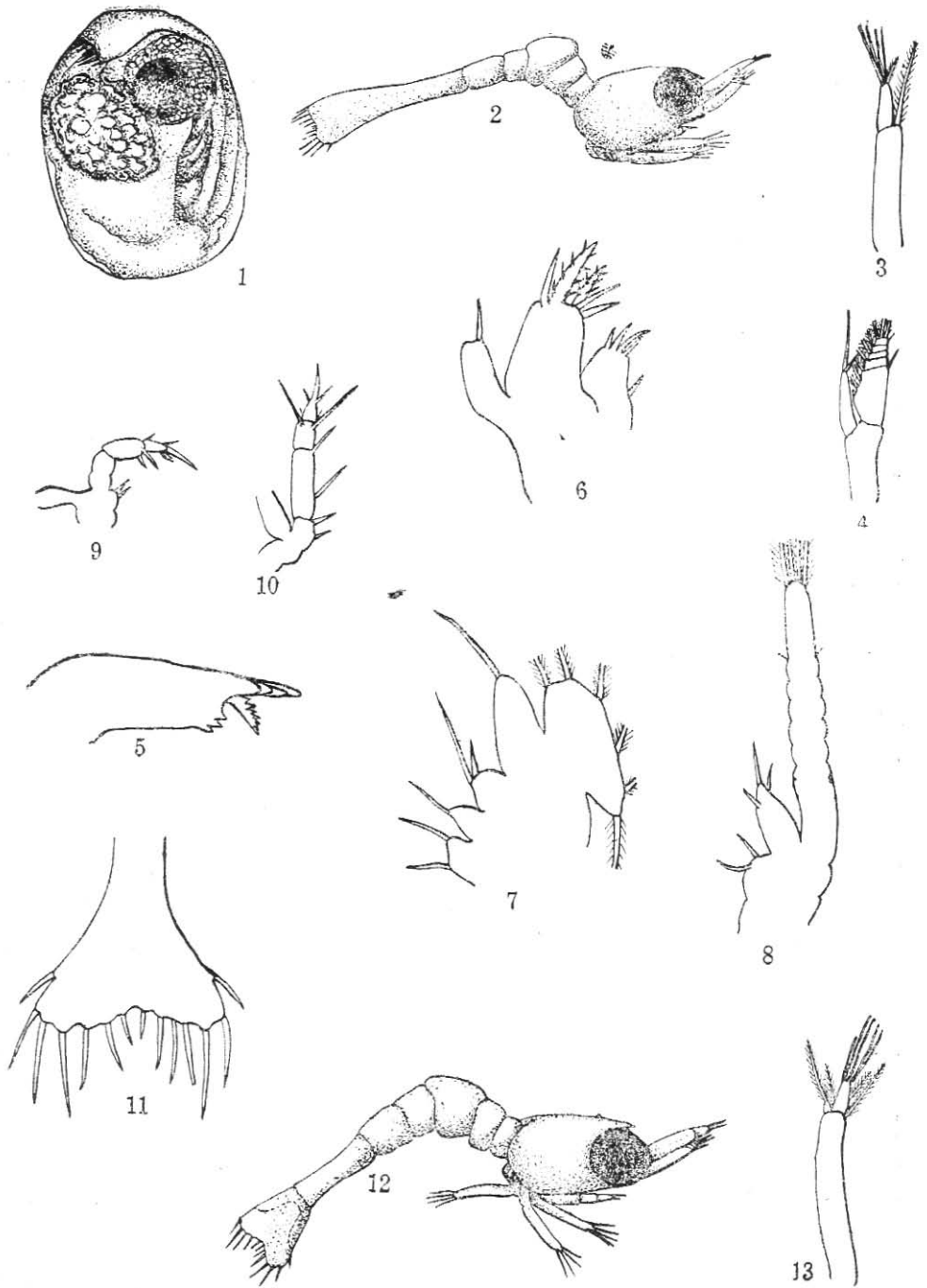
Maxilliped III (Fig. 10).—Protopodite and exopodite are similar to those of the preceding 2 pairs. Endopodite differs from that of the second in having 2 setæ on the proximal segment. Also the pair of setæ of the second are longer and nearly reach to the tip of the terminal seta of the third.

Rudiments of 3 of the remaining pairs of peræopods are present, those of the first being biramous.

Abdomen.—It consists of 5 segments and the telson. The segments are unarmed, the third being much larger than the others, except the last.

Telson (Fig. 11).—It is broadly triangular with a small notch in the middle of its posterior margin. On each side of the notch there are 7 setæ, one being distinctly on the outer margin. The third and fourth from the outside are longer and approximately equal to each other. All, except 1 and 2, are on ciliated on both sides.

Stage II (Fig. 12).—Length about the same as that of Stage I. Eyes are now free from the carapace and stalked. Rostrum is much longer than in Stage I, though it does not reach to the extremity of the eyes. At its base a small knob or papilla has developed. Anterolateral angles of the carapace are produced into very small pterygostomial spines. Peræopods 1 and 2 have become functional.



FIGS. 1-13

Fig. 1. Fully developed egg. $\times 75$.
 Fig. 2. Stage I: Entire animal. $\times 36$.
 Fig. 3. Do. Antennule. $\times 75$.
 Fig. 4. Do. Antenna. $\times 75$.
 Fig. 5. Do. Mandible. $\times 330$.
 Fig. 6. Do. Maxilla I. $\times 330$.
 Fig. 7. Do. Maxilla II. $\times 330$.

Fig. 8. Stage I: Maxilliped I. $\times 198$.
 Fig. 9. Do. Maxilliped II. $\times 75$.
 Fig. 10. Do. Maxilliped III. $\times 75$.
 Fig. 11. Do. Telson. $\times 75$.
 Fig. 12. Stage II: Entire animal. $\times 36$.
 Fig. 13. Do. Antennule. $\times 75$.

Antennule (Fig. 13).—It shows little difference from that of Stage I. Outer flagellum seems to have 5 aesthetes and the distal end of the peduncle carries 4 to 5 setæ. Inner flagellum is in the form of a tiny papilla with a seta at its tip.

Antenna.—It shows hardly any change.

Mandible.—There may be 2 serrated teeth between the incisor and molar processes.

Maxilla I.—Distal endite has a couple more of setæ.

Maxilla II (Fig. 14).—Palp has two unequal terminal setæ. Scale has 7 plumose setæ, 5 of which are anterior in position and 2 posterior.

Maxillipeds I and II.—They are practically as they were in Stage I.

Maxilliped III (Fig. 15).—Protopodite and exopodite are as in Stage I. Endopodite has 4 segments armed with 2, 0, 2 and 5 setæ respectively.

Legs I and II (Fig. 16).—Protopodite is armed with 2 setæ as in maxillipeds. Exopodite has 4 swimming setæ. Endopodite has 4 segments carrying 2, 1, 2 and 3 setæ respectively, that of the second being on the outer side.

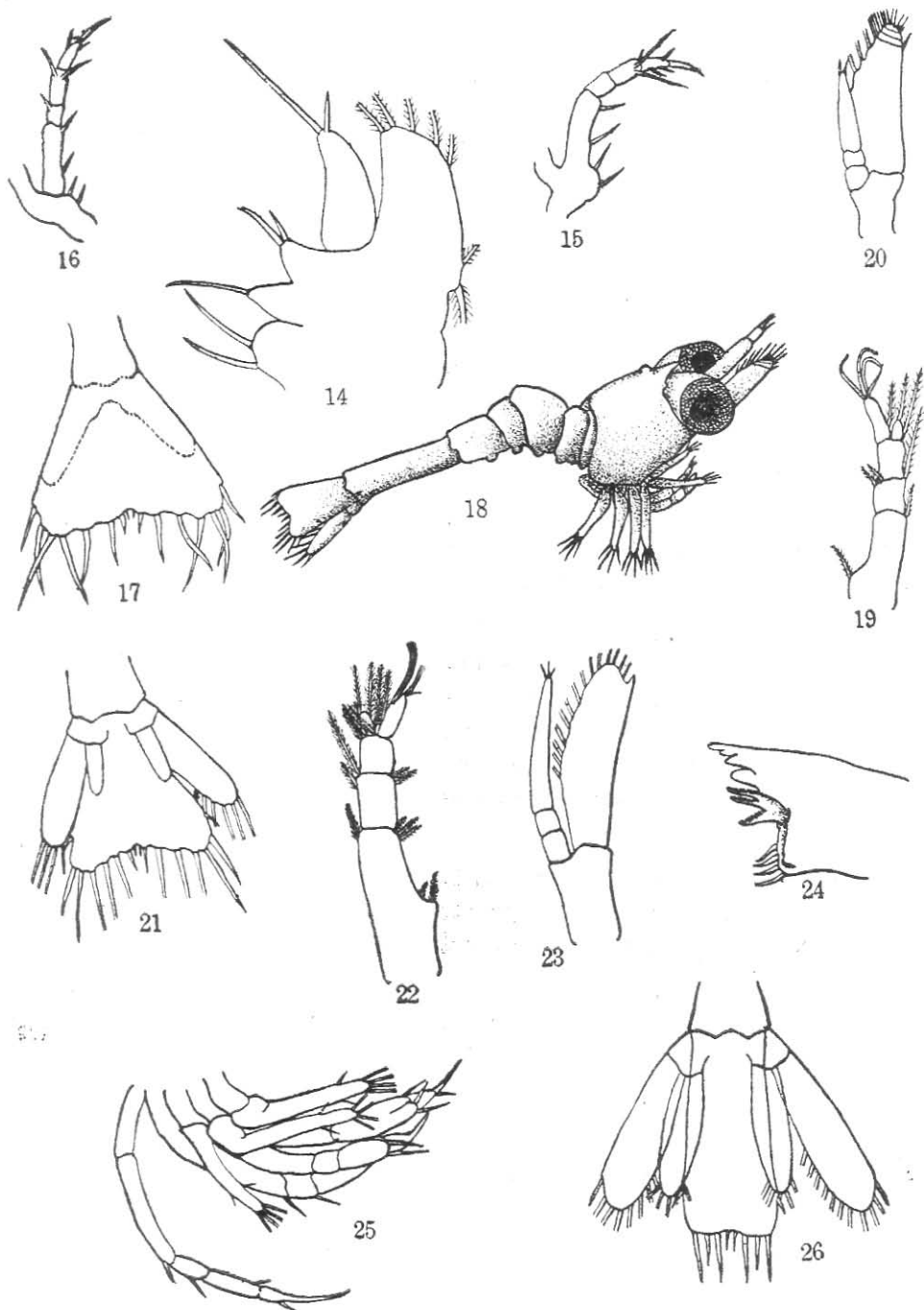
Small rudiments of the remaining 3 pairs are developed, those of the third being biramous and of the fourth much smaller and placed internal to the others.

Abdomen.—It is still composed of only 5 segments; but the sixth and the uropods are developed beneath the cuticle. So also small knob-like rudiments of pleopods, though they hardly project beyond the surface.

Telson (Fig. 17).—It is more or less unaltered except for the appearance of a pair of very small inner spines.

Stage III (Fig. 18).—Slightly larger than the previous stage. Length about 1.7 mm. In addition to the pterygostomial spine a very small supra-orbital also has made its appearance on each side of the carapace. The differentiation of the sixth abdominal somite and the appearance of free uropods are the other important structural advances of this stage.

Antennule (Fig. 19).—Peduncle is three-jointed, though the basal joint is not distinctly marked out. Proximal part of the first segment is distinctly swollen, and carries a seta. Large plumose setæ are borne at the tip of the third joint and a few on the inner margin of all the joints. A pair of quite small setæ are present at the junction of the second and third segments on the outer side. Both flagella are slightly longer, but are otherwise unaltered.



Figs. 14-26

Fig. 14. Stage II: Maxilla II. $\times 330$.
 Fig. 15. Do. Maxilliped III. $\times 75$.
 Fig. 16. Do. Leg I. $\times 75$.
 Fig. 17. Do. Telson. $\times 75$.
 Fig. 18. Stage III: Entire animal. $\times 36$.
 Fig. 19. Do. Antennule. $\times 75$.
 Fig. 20. Do. Antenna. $\times 75$.

Fig. 21. Stage III: Telson and Uropods. $\times 75$.
 Fig. 22. Stage IV: Antennule. $\times 75$.
 Fig. 23. Do. Antenna. $\times 75$.
 Fig. 24. Do. Mandible. $\times 330$.
 Fig. 25. Do. Peræopods. $\times 75$.
 Fig. 26. Do. Telson and Uropods. $\times 75$.

Antenna (Fig. 20).—Two segments are distinctly marked out at the base of the flagellum. Excluding the small hair the scale has 12 setæ along inner margin and tip.

Mandible and the 2 pairs of maxillæ are little altered.

The 3 pairs of maxillipeds also exhibit hardly any change. So too legs 1 and 2.

Rudiments of peræopods 3, 4 and 5 are larger, that of the fourth being still smaller and in the same position.

Abdomen.—The sixth segment has been added. Pleopods are still in the form of round knobs.

Uropods (Fig. 21).—They are developed and functional, each having protopodite, a short unarmed endopodite and a much larger exopodite provided with 6 setæ along inner margin and tip. Telson is unchanged.

Stage IV.—It is slightly less than 2 mm. in length. The tubercle at the base of the rostrum noticed in the 2 previous stages is conspicuous now and anterior to it on the rostrum itself there is a tooth. In addition to the supra-orbital and pterygostomial spines there is an equally small spine which, according to Gurney, is the branchiostegal. All peræopods are now well developed and jointed except the fourth, the last 2 pairs having no exopodites. Pleopods are in the form of uniramous papillæ.

Antennule (Fig. 22).—Both on the outer and inner sides of the peduncle there are numerous plumose setæ. Inner flagellum is still unsegmented; outer seems to be two-jointed, the proximal joint having 3 æsthetes and distal 4, one of which is setiform.

Antenna (Fig. 23).—Flagellum is almost as long as scale, but still shows only the 2 basal joints. At the tip there may be 2 or 3 setæ. A short spine has developed at the extremity of the outer margin of the scale, which has lost all trace of segmentation, its tip and inner margin carrying 14 setæ.

Mandible (Fig. 24).—Three serrated teeth are present between the incisor and molar processes.

Maxillæ and Maxillipeds have not changed much.

Peræopods (Fig. 25).—First 3 pairs are biramous with functional exopods similar to those of the maxillipeds. Endopodites are four-jointed, the first and second being chelate. The fourth and fifth are directed forwards, the fifth lying along the midventral line. All the joints carry setæ. The fourth is still rudimentary, not even half as long as the fifth and bears no setæ.

Uropods (Fig. 26).—Endopodites are also setose in this stage, their tips carrying 5 plumose setæ. Exopodites have 11 setæ along inner margin and tip, the outermost at the tip being spine-like.

Telson.—It has undergone considerable alteration in shape, being now almost rectangular with the sides parallel. The posterior border is straight and carries 4+4 spines, the innermost being quite small. A small tooth is present on the outer margin at about a fourth of its length from the posterior end.

Stage V.—The length slightly exceeds that of Stage IV. This is the last larval stage and the most important advance which it shows over the previous is in respect of the pleopods, which have grown considerably, and consist of a peduncle, a small endopod and much larger exopod, both devoid of setæ.

Antennule.—The enlargement at the base of the first segment of peduncle has grown and projects as a prominent triangular process with a few short setæ at its base and angle. Inner flagellum has grown slightly and is as long as the first segment of the outer flagellum.

Antenna.—Scale has now 15 plumose setæ besides the spines at the extremity of the outer margin. Flagellum is distinctly longer than scale and besides the 2 segments at its base, has 1 at the extremity also. Peduncle is distinctly two-jointed with a minute spine on the inner side of the extremity of the distal segment.

Mandibles, maxillæ and maxillipeds are as they were in the previous stage.

Peræopods.—They are better developed and the endopodites show 5 segments. The fourth leg is now fully developed and jointed. It is only slightly shorter than the fifth. The setæ of the penultimate segment are not larger than those of the other legs.

Uropods.—Endopodite has 9 setæ along inner margin and tip, besides 2-3 hair-like ones arising, not from the edge, but from the inner surface close to it. Exopodite is fringed with 14 setæ.

Telson (Fig. 26).—All the spines of fourth stage are present in this stage also. On the sides, however, 2 very small spines have appeared so that there are 3 pairs of lateral spines, the most proximal pair of which are identical with those of Stage IV.

POST-LARVA

Length is about 2.5 mm. The rostrum (Fig. 29) extends forwards to the middle of the eyes and has the crest dorsally, so prominent in the adult.

It carries 2 teeth in addition to the basal papilla. The pterygostomial, branchiostegal and supraorbital spines of the larvæ have disappeared, and an antennal spine, and behind it a small hepatic spine have developed. The legs are all well developed and the dactyli of the last 3 pairs have the characteristic spine (Fig. 37) producing the biunguiculate appearance peculiar to the subgenus *Periclimenes*. These and other characters make their identification in plankton material comparatively easy.

Antennule (Fig. 30).—Inner flagellum has 3 and outer 4 segments. Second segment of the outer flagellum has a process carrying 3-4 aesthetes, which later develop into one of the 2 branches. The outer triangular process of the basal segment is more prominent and the outer margin anterior to it is convex, but does not project forwards beyond the insertion of the second segment as in the adult animal. The two distal segments of the peduncle together measure about half of the first.

Antenna (Fig. 31).—Spine on outer margin of scale reaches almost to the tip. Flagellum is more than half the body in length.

Mandible (Fig. 32).—Incisor and molar processes are widely separated, the former having 3-4 teeth. Serrated teeth of the larvæ have disappeared and there is no palp.

Maxillæ I and II do not show any change.

Maxilliped I (Fig. 33).—Endopodite is quite small. Masticatory processes of the protopodite are well developed, and closely beset with setæ. A small knob-like epipodite is present.

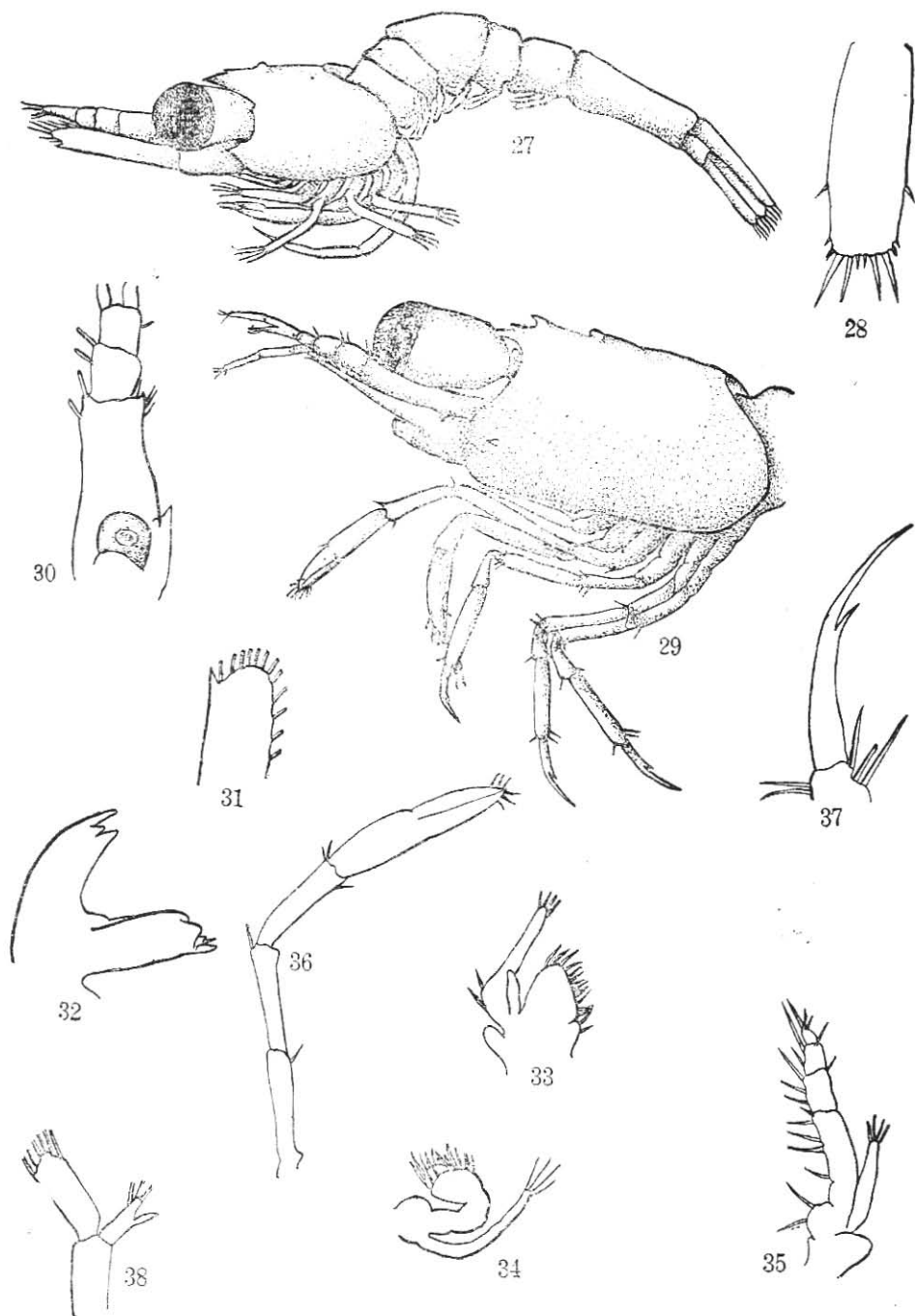
Maxilliped II (Fig. 34).—Endopodite is curved, the last two segments being armed with numerous short setæ on their outer margin. Exopodite has the same number of setæ as in the larvæ.

Maxilliped III (Fig. 35).—Endopodite is still four-jointed. Tip of exopodite reaches the extremity of the first joint of the endopodite.

Peræopods.—Proportionate size of the segments is not that of the adult legs. In both chelipeds the fingers are approximately equal in length to the palm and in the second leg (Fig. 36) the first 3 segments do not differ much in length. Rudiments of all gills are visible.

Pleopods (Fig. 38).—Both rami are provided with swimming setæ. A small appendix interna is carried by each endopodite. Uropods are longer than the telson.

Telson.—The posterior spines of the telson of the only available specimen had been broken off. But in a slightly longer specimen there are 2 pairs



FIGS. 27-38

Fig. 27. Stage V: Entire animal. $\times 36$.
 Fig. 28. Do. Telson. $\times 75$.
 Fig. 29. Post-larva: Anterior part of body. $\times 45$.
 Fig. 30. Do. Antennule. $\times 75$.
 Fig. 31. Do. Antennal scale. $\times 75$.
 Fig. 32. Do. Mandible. $\times 198$.

Fig. 33. Post-larva: Maxilliped I. $\times 75$.
 Fig. 34. Do. Maxilliped II. $\times 75$.
 Fig. 35. Do. Maxilliped III. $\times 75$.
 Fig. 36. Do. Second leg. $\times 75$.
 Fig. 37. Do. Tip of leg 5. $\times 198$.
 Fig. 38. Do. Pleopod. $\times 75$.

of lateral spinules and 3 pairs of posterior spines, the second of which are larger than the others.

DISCUSSION

Our knowledge of the larvæ belonging to the sub-genus *Ancylocaris* is fairly extensive. Gurney has described the complete series of stages of *P. calmani* (1927) and *P. americanus* (1936) and also the first stage of 3 other species, namely, *P. grandis*, *P. agag*, and *P. diversipes* (1938). In addition to these the first stage of *P. brevicarpalis* has been described by Nair (1947). Excluding *P. diversipes* and *P. brevicarpalis* larvæ of other species agree very closely and a summary of the characters of the subgenus based on their characters has been given by him (1938). Regarding *P. diversipes* he has remarked that it differs so much from the others "that one would suppose it should be referred to a distinct genus or subgenus. Such differences are the very well-developed antennal papilla, form of endopod of maxillule, presence of 5 setæ on exopod and absence of basal lobe on endopod of maxilla and terminal spines of maxilliped III." In 3 of these characters, namely presence of antennal papilla, absence of a basal lobe on endopod of maxilla and terminal spines of maxilliped III *P. brevicarpalis* agrees with *P. diversipes*. *P. indicus* agrees with *P. diversipes* in all these characters and thus differs from most of the species of the *Ancylocaris* group. The other more important differences are given below stage by stage.

Stage I.—Antennal scale has only one outer seta; endites of maxilla have much fewer setæ (the number is the same as in *P. brevicarpalis*); exopodites of maxillipeds constricted so as to produce the appearance of segmentation and provided with at least one hair-like pair behind the terminal setæ.

Stage II.—Rudiment of leg 5 does not show any marked difference in size.

Stage III.—Fifth legs are not long and styliform, but only rudiments, hardly larger than those of legs 3.

Stages IV & V.—A branchiostegal spine is present; flagellum of antenna has two basal segments and in Stage V a third segment at the tip so that it is four-jointed; leg 4 is an unarmed rudiment in Stage IV, not reaching to the extremity of the first segment of leg 3; in Stage V the setæ of the last 2 segments are not much different from those of leg 3; 2 extra pairs of minute lateral spines on the telson in Stage V.

Besides the species mentioned above, the first larvæ of the following species belonging to other genera have also been described:—

1. *Pontonia phallusia* (Gourret, 1884)
2. *Pontonia tyrrhena* (Caroli 1926)
3. *Typton spongicola* (Lebour, 1926; Caroli, 1926)
4. *Harpilius beaupresi* (Gurney, 1938)
5. *Harpilius gerlachei* (Gurney, 1938)
6. *Coralliocaris graminea* (Gurney, 1938)

Lebour has remarked that in its segmented antennal scales, the form of its antennules and general build the larva of *Pontonia* resembles that of *Typton*. It may be of interest to note here that the exopodites of the maxillipeds in the latter show indications of 3 segments, agreeing in this respect with the present species, though here the number of segments is more. In regard to the other species Gurney has pointed out that *Harpilius beaupresi* and *Coralliocaris graminea* resemble very closely *P. diversipes*, while *H. gerlachei* agrees with the other species of *Periclimenes*. He thinks therefore that their larval structure indicates quite a different generic grouping of the adults from that which is adopted by Kemp.

Reference has already been made to the similarity between *P. indicus* and *P. diversipes* in those characters in which the latter differs from other *Periclimenes* species. It is therefore hardly necessary to indicate how the former agrees with *H. beaupresi* and *C. graminea*.

The mode of development of the fourth and fifth legs and the arrangement of the setæ on the last 2 segments, especially of leg 4, have to be considered in this context. The retarded development of leg 4 and the precocious development of leg 5 are characters shared in common with the 2 species whose development is completely known. But in those species leg 5 is long and styliform even in Stage III, while it is only in Stage IV that the appendage becomes functional in the present species. Further, in the last stage in which leg 4 is also functional, the pair of setæ carried by the penultimate segment are not so large as in the other species. Such short setæ are shown by another species also, though it has not been definitely ascribed to *Periclimenes* (*Pontoniinæ*, sp. 2, Terra Nova collection, Gurney, 1924). Except these 2, most of the others that have been referred to *Pontoniinæ* show this arrangement of setæ in leg 4.

The structural differences shown by the larvæ of the various species of *Periclimenes* known so far would therefore seem to indicate that the species composing the genus as it is constituted at present, are not so closely related as one would expect. Further, some of the differences which the present species exhibit, that of the fourth leg in particular, seem large enough to render its position within the genus somewhat doubtful.

ADDENDUM

Gurney and Lebour have given a brief description of a single larva in the last stage and the succeeding post-larval stages derived from it (*Jour. Linn. Soc. Lond.*, 1941) and have referred them provisionally to *Periclimenes (Periclimenes) longicaudatus* (Stimpson). Since no reference to it has been made earlier it may be pointed out here that except in size and some minor characters this larva resembles closely that of *P. indicus*.

REFERENCES

- *1. Caroli, E. .. "La Zoa dei Pontiinae," *Bull. Soc. Nat. Napoli*, 1926, 37.
- *2. Gourret, R. .. "Consideration sur la faune pelagique du golfe de Marseille," *Ann. de Musee d'histoire Naturelle de Matseille*, 1884, Zoology, II, mem. 2.
3. Gurney, R. .. "Decapod Larvæ," *British Antarctic (Terra Nova) Expedition*, 1910, 1924, Zool. 8, No. 2, Crustacea, Pt. IX.
4. ————— .. "Larvæ of the Crustacea Decapoda (Cambridge Expedition to the Suez Canal)," *Trans. Zool. Soc. London*, 1927, 22.
5. ————— .. "Notes on some Decapod Crustacea of Bermuda. III. The larvæ of Palæmonidæ," *Proc. Zool. Soc. London*, 1936.
6. ————— .. "The Larvæ of the Decapod Crustacea: Palæmonidæ and Alpheidæ," *Sci. Rep. Great Barrier Reef Expedition*, 1938, 6, No. 1.
7. Kemp, S. W. .. "Notes on Crustacea Decapoda in the Indian Museum. IV, Pontiinae," *Rec. Ind. Mus.*, 1922, 24.
8. ————— .. "Fauna of the Chilka Lake. Crustacea Decapoda," *Mem. Ind. Mus.*, 1915, 5.
9. Lebour, M. V. .. "The eggs and newly hatched larva of *Typton spongicola* O.G. Costa," *Jour. Mar. Biol. Assn. U.K.*, 1924, 13.
10. Nair, S. G. .. "The newly hatched larva of *Periclimenes (Ancylocaris) brevicarpalis* (Schenkel)," *Proc. Ind. Acad. Sci.*, B, 1947, 26.
11. Panikkar, N. K., and Aiyar, R. G. .. "Observations on breeding in brackish water animals of Madras," *ibid.*, 1939, 9.

* These references were not available for consultation.

ADDENDUM

Gurney and Lebour have given a brief description of a single larva in the last stage and the succeeding post-larval stages derived from it (*Jour. Linn. Soc. Lond.*, 1941) and have referred them provisionally to *Periclimenes (Periclimenes) longicaudatus* (Stimpson). Since no reference to it has been made earlier it may be pointed out here that except in size and some minor characters this larva resembles closely that of *P. indicus*.

REFERENCES

- *1. Caroli, E. . . "La Zoea dei Pontoniinæ," *Bull. Soc. Nat. Napoli*, 1926, 37.
- *2. Gourret, R. . . "Consideration sur la faune pelagique du golfe de Marseille," *Ann. de Musee d'histoire Naturelle de Matseille*, 1884, Zoology, II, mem. 2.
3. Gurney, R. . . "Decapod Larvæ," *British Antarctic (Terra Nova) Expedition*, 1910, 1924, Zool. 8, No. 2, Crustacea, Pt. IX.
4. ————— . . "Larvæ of the Crustacea Decapoda (Cambridge Expedition to the Suez Canal)," *Trans. Zool. Soc. London*, 1927, 22.
5. ————— . . "Notes on some Decapod Crustacea of Bermuda. III. The larvæ of Palæmonidæ," *Proc. Zool. Soc. London*, 1936.
6. ————— . . "The Larvæ of the Decapod Crustacea: Palæmonidæ and Alpheidæ," *Sci. Rep. Great Barrier Reef Expedition*, 1938, 6, No. 1.
7. Kemp, S. W. . . "Notes on Crustacea Decapoda in the Indian Museum. IV, Pontoniinæ," *Rec. Ind. Mus.*, 1922, 24.
8. ————— . . "Fauna of the Chilka Lake. Crustacea Decapoda," *Mem. Ind. Mus.*, 1915, 5.
9. Lebour, M. V. . . "The eggs and newly hatched larva of *Typton spongicola* O.G. Costa," *Jour. Mar. Biol. Assn. U.K.*, 1924, 13.
10. Nair, S. G. . . "The newly hatched larva of *Periclimenes (Ancylocaris) brevicarpalis* (Schenkel)," *Proc. Ind. Acad. Sci.*, B, 1947, 26.
11. Panikkar, N. K., and Aiyar, R. G. . . "Observations on breeding in brackish water animals of Madras," *ibid.*, 1939, 9.

* These references were not available for consultation.