

**LARVAL DEVELOPMENT OF A DROMIID CRAB, *CONCHOECETES ARTIFICIOSUS* (FABR.) (DECAPODA, CRUSTACEA) IN THE LABORATORY**

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THE systematic position of the Dromiidea, which includes the primitive sponge-crabs, is highly controversial, and relatively very little is known about the larvae of its members. Published descriptions of identified larvae are available for only the genera *Dromia* and *Dromidia* (see Lebour, 1934; Pike and Williamson, 1960 and Rice and Provenzano, 1966). As far as the genus *Conchoecetes* is concerned, no information is available on its larvae. The present paper deals with the life-history of *Conchoecetes artificiosus* (Fabr.), of which four stages, the pre-zoea, two zoeal stages and the megalopa, were reared in the laboratory.

**MATERIAL AND METHODS**

Ten ovigerous specimens were obtained on 2nd July, 1965, from the trawl catches of the departmental survey vessel *SAVITRI* operating on muddy bottom in 12-20 fathoms (21-35 m.) off Sassoon Docks, Bombay. The crabs were kept in sea water aquaria, provided with soft mud on the bottom and shells of the bivalves, *Arca* and *Meretrix*, which were readily taken up as covers. Within three days, in 2 or 3 specimens the eggs hatched out into pre-zoeae which struggled at the bottom for 5 to 10 minutes and then started swimming as zoeae. In other specimens, pre-zoeae were not observed; zoeae were released in batches of 10-15 and this process continued for half an hour to 1 hour until all the eggs were hatched. The larvae, in groups of 10 each, were reared in a series of small finger bowls (250 cc. capacity) filled with penicillin inoculated sea water, which was renewed once a day and the bowl was examined for the presence of exuviae or dead larvae. The larvae were fed upon freshly hatched *Artemia* nauplii.

**OBSERVATIONS**

Early in development the eggs were orange-red changing to pale pinkish-red as the embryos became advanced.

There were generally a pre-zoea, two zoeal stages and one megalopa in the life-history and the duration of each stage is given in the table below; the temperature during the experiment varying between 28-30°C.

Stage	Pre-zoea	Ist zoea	IInd zoea	Megalopa
Duration	5-10 minutes	5-7 days	9-15 days	—

The zoeae were fairly active. The megalopae occasionally swam about, but showed a greater tendency to crawl. Tiny empty shell-valves were introduced into the rearing bowls, but the megalopae did not care for them. They were fed on finely chopped prawn and clam meat, but none of them survived for more than 3 days in the laboratory.

#### DESCRIPTION OF LARVAL STAGES

##### *Pre-zoea*

(Fig. 1)

Carapace length=0.8 mm., abdomen length=1.2 mm.

The larva is very similar to that of *Dromia personatus* (=vulgaris) (Lebour, 1934), in all respects.

*Antennule* (Fig. 1, b): The inner ramus has 4 terminal spines and outer ramus is represented by a single lateral spine which is an Anomuran character, as also seen in the pre-zoeae of the porcellanid crabs.

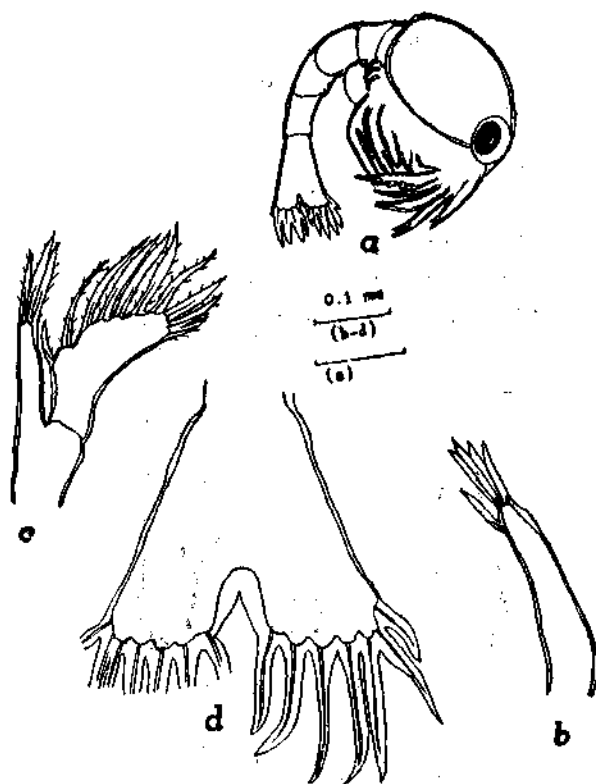


FIG. 1. *Conchoecetes artificiosus*: Prezoea. a—entire larva; b—antennule; c—antenna; d—telson.

*Antenna* (Fig. 1, c): The scale has 10 processes and the endopod has 3 - a character differing from the Galatheidae and Porcellanidae.

*Telson* (Fig. 1, d): It is similar to that of *Munida* and *Galathea* and its process-formula is 7+7. In porcellanids, the formula is 6+6.

*First zoea*

(Figs. 2 & 3)

Carapace length=1.5 mm., abdomen length=1.8 mm.

Rostrum is fairly long, acute reaching almost to the tip of the antenna and antennule. Just behind the rostrum, on the mid-dorsal line is a small hump-like projection which in turn is followed by another bulge extending from the posterior margin of the orbits to the mid-posterior half of the carapace. A similar bulge is also present on either side just above the orbits. The carapace is devoid of any spines and its posterior margin is rounded and smooth. The eyes are stalked but not completely free from the carapace.

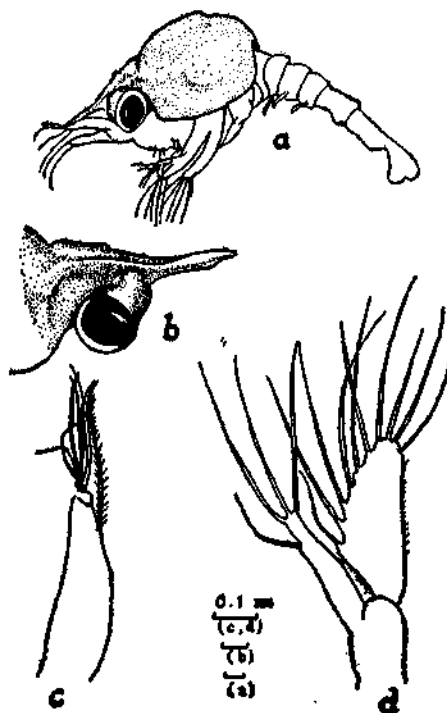


FIG. 2. *Conchoecetes artificiosus*: First zoea. a—entire larva; b—anterior part of carapace; c—antennule; d—antenna.

*Antennule* (Fig. 2, c): The outer ramus has terminally 3 delicate setae and 3 aesthetascs. The inner ramus is represented by a single long plumose seta.

*Antenna* (Fig. 2, d): The scale is distinctly articulated to the basal segment and bears 10 plumose setae along the inner margin. There is no terminal spine. The entire outer margin and the proximal part of the inner margin are fringed with fine short hairs. The endopod terminates in 3 plumose setae, bearing a smaller sub-terminal seta on the inner margin.

**Mandible** (Fig. 3, a) : It is provided with fairly well developed teeth but there is no palp.

**First maxilla** (Fig. 3, b) : The endopod is 2-segmented, the basal segment armed with 3 bristle-like setae and the terminal with 6 setae in 3 groups of 2 each. The distal endite has 4 unequal serrated teeth and 3 short bristle-like setae whereas the proximal endite has 12 bristle-like setae.

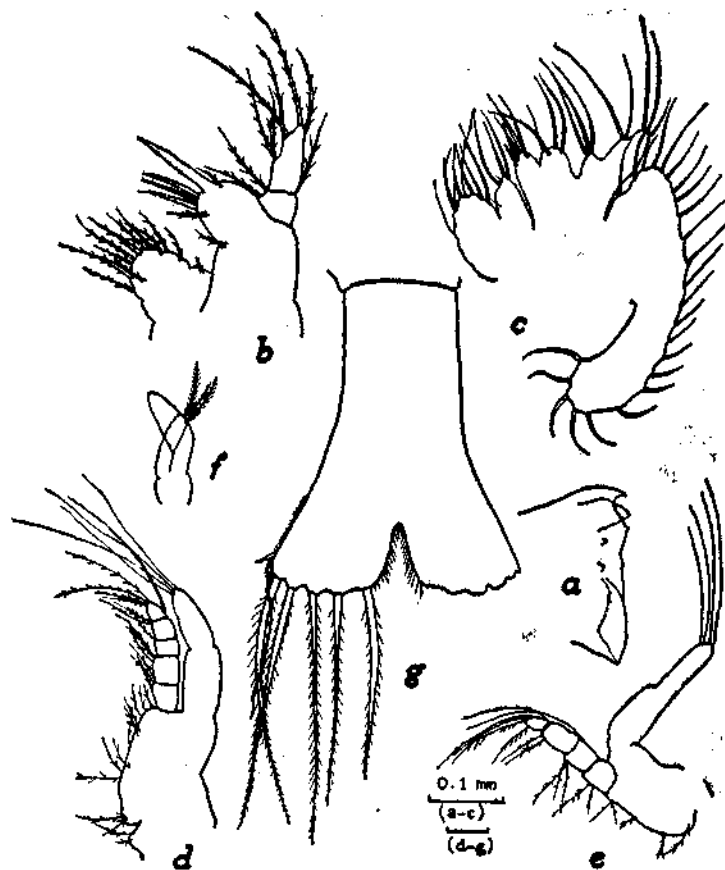


FIG. 3. *Conchoecetes artificiosus*: First zoea. a—mandible; b—Ist maxilla; c—IInd maxilla; d—Ist maxilliped; e—IInd maxilliped; f—IIIrd maxilliped; g—telson.

**Second maxilla** (Fig. 3, c) : It consists of 2 bilobed endites, an unsegmented endopod and a long narrow scaphognathite. The two lobes of the proximal endite have 8 and 3 setae respectively and those of the distal have 5 and 4 setae respectively. The endopod bears setae in 3 groups—3 proximal, 2 distal and 3 terminal. The scaphognathite has about 24 marginal plumose setae.

**First maxilliped** (Fig. 3, d) : It consists of a 5-segmented endopod and partially 2-segmented exopod which bears 4 natatory setae. The distribution of setae on the first to fourth segments of the endopod is 3, 3, 1 and 2 on the inner margin. The last segment has 4 terminal and one outer proximal setae. The basipod of the protopod is armed with 11 setae on its inner margin.

*Second maxilliped* (Fig. 3, e): The endopod is 4-segmented with 2, 3 and 2 setae on the inner margin from the first to third segments. The last segment has 4 terminal and 1 outer plumose setae; the basipod has 5 setae. The exopod is as in the first maxilliped.

*Third maxilliped* (Fig. 3, f): It is biramous and rudimentary, with a non-functional exopod and an unsegmented, rather basally situated endopod which has 3 terminal plumose setae.

*Pereiopods* (Fig. 2, a): 4 pairs present as rudimentary uniramous buds.

*Abdomen* (Fig. 2, a): It is 5-segmented, the sixth segment being fused to the telson. The second to fourth segments bear pleopod buds, whereas the fifth, which is the longest segment, bears a tubercle-like projection. There are a few microscopic hairs which are discernible mainly on the third and fourth segments.

*Telson* (Fig. 3, g): It is longer than broad with a deep cleft in the middle of its posterior margin. The posterior third of the lateral margin and the whole of the central cleft is fringed with fine short hairs. The telson process-formula is 7+7. The first process is a simple spine, situated slightly anterior to the postero-lateral angle; the 2nd is a reduced anomuran hair which is sparsely plumose. The third to seventh processes are long, plumose setae. All the processes are distinctly articulated to the telson and the posterior margin inbetween the processes is smooth. There is no anal spine.

*Colour*: The larva has many orange-red stellate chromatophores so thickly set as to give diffused reddish appearance at low magnification. These chromatophores are more clearly seen in the ventral view of the larva and extend from the buccal region to almost the base of the first maxillipeds. In front of the cardiac region there is, on either side, a rather elongated patch of diffuse green. A few minute orange-red spots are also present on either side in the posterior part of the carapace.

#### *Second zoea*

(Fig. 4 & 5)

Carapace length=2.0 mm., abdomen length=2.2 mm.

There is a considerable increase in the size of the larva. The carapace now shows a more complicated pattern (Fig. 4, a & b). The eyes are stalked and free from carapace. The number of setae on the exopods of the first three maxillipeds increases to 9-10, 10 and 7 each. The pereiopod buds are now more developed showing partial segmentation (Fig. 4, c) and gills are distinctly formed. The abdomen becomes 6-segmented and the pleopods, though increased in size, are still in bud form. The telson process formula is 8+8.

*Antennule* (Fig. 5, a): The outer ramus is 2-segmented with 3 aesthetascs and 5 unequal setae on the terminal segment. The inner ramus is represented by a small elongated bud whose articulation with the peduncle is not distinct. The peduncle bears 3 plumose setae on the inner margin and 2 unequal knob-like structures on the outside as shown in the figure.

*Antenna* (Fig. 6, b): The scale now bears 23 setae all over the margin. The endopod is now partially 2-segmented but has lost its setae.

*Mandible* (Fig. 5, c): As in the first stage, except for the increase in size.

*First maxilla* (Fig. 5, d): There is no appreciable change from that of the first stage.

*Second maxilla* (Fig. 5, e): The number of setae on the endites is increased, the proximal endite with 13 and 9 setae and the distal with 5 and 7 setae. The

palp now carries setae in groups of 3, 2, 2 and 2 each from base to tip and the scaphognathite is fringed with 46 plumose setae.

**First maxilliped (Fig. 5, f) :** The number of setae on the endopod segments is increased, 3 on the inner and 1 on the outer margin on the first and second segments, 1 each on the inner and outer margins of the third ; 2 on the inner margin only of the fourth. The last segment has 2 inner, 2 terminal and 1 outer setae. The basipod shows a characteristic laminiform appearance, carrying 12 setae on the inner margin. The coxa bears a hatched-shaped epipod and a rather pointed inner lobe with 5 setae. The exopod carries 9-10 plumose setae and is still partially 2-segmented.

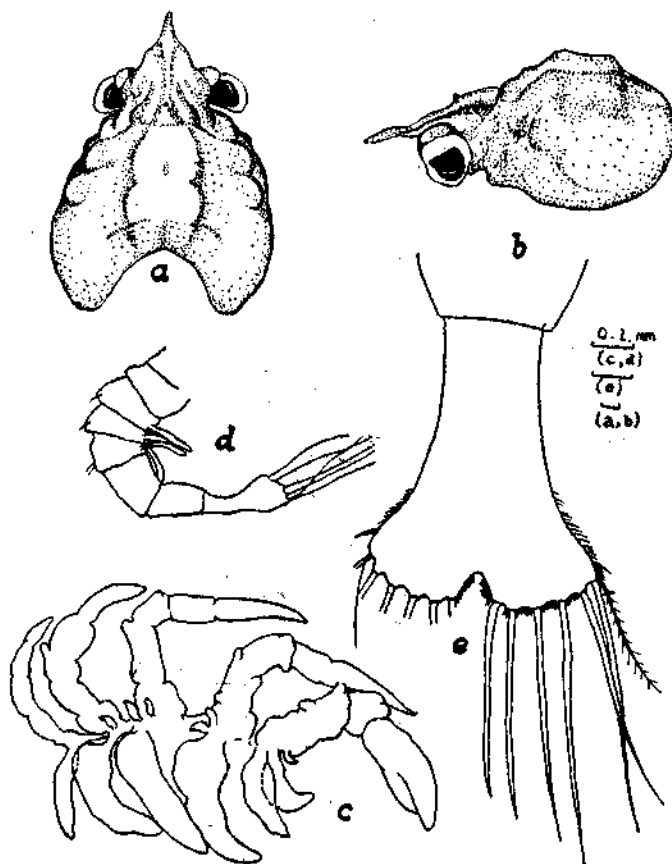


FIG. 4. *Conchoecetes artificiosus* : Second zoea. a—carapace (dorsal view) ; b—carapace (lateral view) ; c—pereopods and gills ; d—abdomen ; e—telson.

**Second maxilliped (Fig. 5, g) :** The endopod bears on the inner margin 3, 3 and 2 setae on the first, second and third segments respectively and the last segment bears 4 terminal setae. All these segments have one outer seta each. The basipod has in all 5 setae distributed on 4 small projections. Similarly, 3 setae are present on the coxopod which also bears a small epipodite.

**Third maxilliped (Fig. 5, h) :** The endopod arises from the proximal part of the

basis and is indistinctly 5-jointed. The second and fourth segments bear on the inner margin one seta each. The last segment bears 4 setae of which 2 are terminal. The basipod is characteristic as shown in the figure and the coxopod has a small,

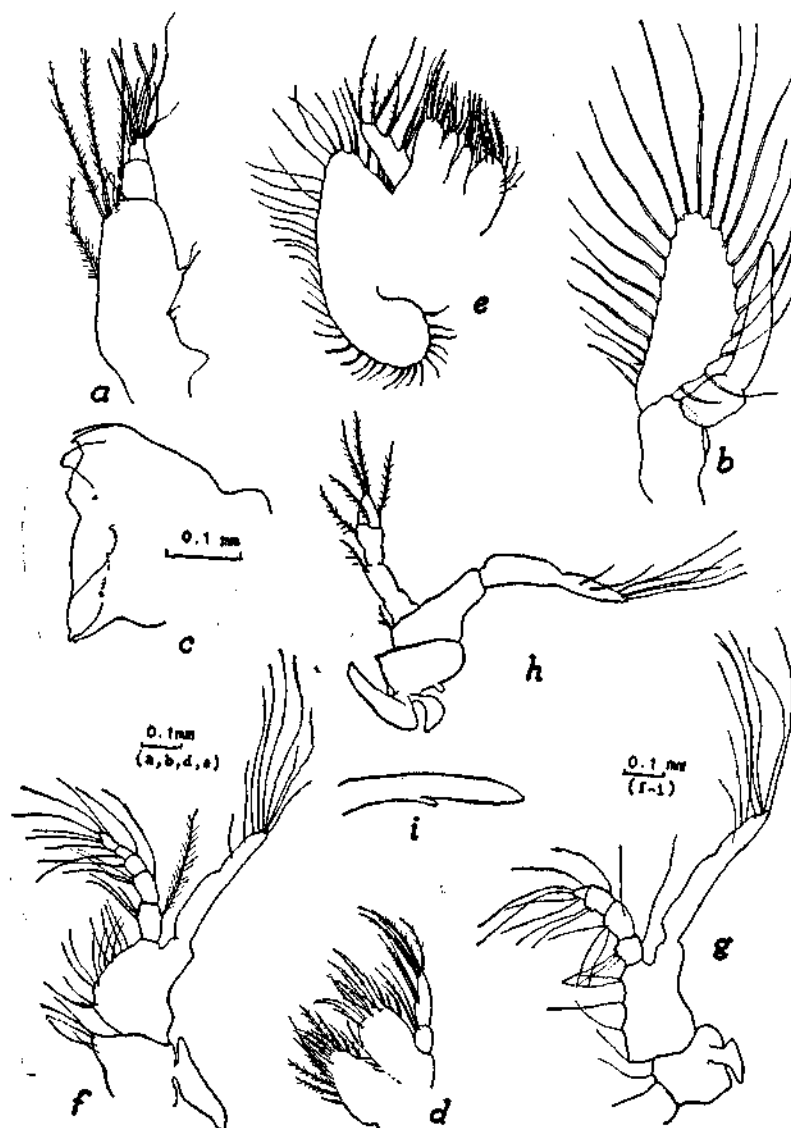


FIG. 5. *Conchoecetes artificiosus*: Second zoea. a—antennule; b—antenna; c—mandible; d—1st maxilla; e—IIInd maxilla; f—1st maxilliped; g—IIInd maxilliped; h—IIIrd maxilliped; i—pleopod.

vestigial epipodite and 2 gills which are arthrobranchs. The exopod is partially segmented bearing 7 plumose setae.

*Pereopods* (Fig. 4, c) : All the 5 pairs are rather well developed showing indistinct segmentation. The first pair shows its chelate nature clearly. There are no exopods on any of the legs and the branchial formula is as follows :

<i>Appendages</i>	<i>Epipodite</i>	<i>Arthrobranchs</i>	<i>Pleurobranchs</i>
Ist maxilliped	1	—	—
IIInd maxilliped	1	—	—
	(rudimentary)		
IIIrd maxilliped	1	2	—
Ist leg	1	2	—
IIInd leg	—	2	1
IIIrd leg	—	2	1
IVth leg	—	1	1
Vth leg	—	—	1

*Abdomen* (Fig. 4, d) : It is 6-segmented. The second and third segments each bears proximally on the mid-dorsal line a very fine hair (seen only under high magnification) and similarly the fifth segment has 2 such hairs. There are now 4 pairs of elongated biramous pleopod buds (Fig. 5, i) on the second to fifth segments. The inner ramus of each is very small.

*Telson* (Fig. 4, e) : Telson process-formula is 8+8. The median cleft has now become shallower than in the first stage. There are no other differences except that the posterior margin, in between the processes, is fringed with hairs.

*Colour* : Here again, the orange-red chromatophores are so compactly arranged that they give a diffuse orange-red colouration to the larva ; the chromatophores in the carapace region extend from the base of the antennules, rostrum and eye-stalks to the protopodite of the maxillipeds and almost the entire abdominal region. The proximal two-thirds of the telson is also similarly filled with orange-red chromatophores. The chromatophores are fairly big and stellate.

### *Megalopa*

(Fig. 6-9)

The carapace, though longer than broad, shows a tendency towards the pentagonal shape of the adult and the regions are fairly well represented by grooves, especially the cervical and branchial grooves. Except for the posterior margin, the borders of the carapace are armed with small granules.

In contrast to the adult condition, the median lobe of the front is slightly longer than the lateral lobes and is on a much lower plane. The median lobe bears distinct 3-4 granules. The carapace is covered with several granules and microscopic hairs on the front, hepatic, branchial and lateral margins. The abdominal segments are strongly convex dorsally as in the adult.



**Antennule (Fig. 7, a):** The peduncle is 3-segmented. The basal segment has 2 conical processes and the antennular gland is clearly seen. The 2nd segment is armed with a round tubercle distally and a conical one sub-distally, and bears 5 setae. The last segment bears on the outer border a long, plumose seta distally and a simple seta on the inner. The inner flagellum is 3-segmented, the segments carrying 3, 1 and 4 setae respectively from base to tip. The outer flagellum consists of about 5 segments, the 2nd to last but one segments bearing a row of 21 or more aesthetascs. The last segment is elongated and carries 2 terminal and 1 sub-terminal setae.

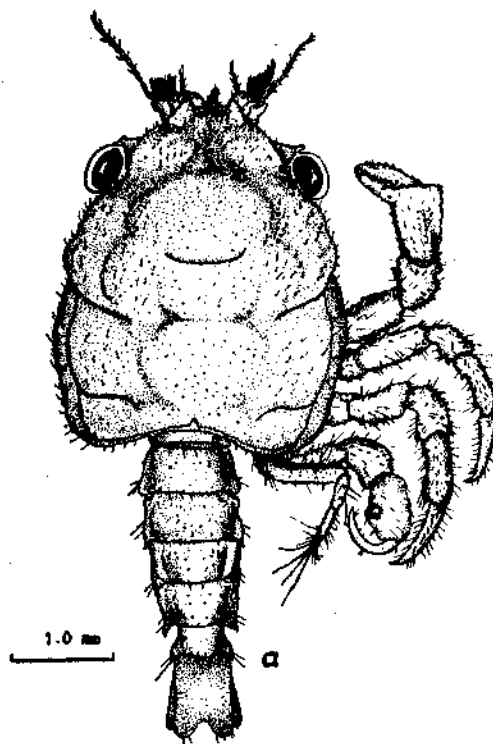


FIG. 6. *Conchoecetes artificiosus*: Megalopa, a—Dorsal view.

**Antenna (Fig. 7, b):** The second segment bears a scale on the outer-upper border which terminates in a tubercle-like projection, bearing 3 teeth-like structures on the inner border. The distal outer margin near the scale is armed with about 4 tubercles and its surface is provided with setae and a few tubercles. The 3rd segment is twice as broad as long and is less than one-half the length of the fourth segment. The flagellum consists of about 8 segments, each with setae as shown in the figure.

**Mandible (Fig. 7, c):** It is well developed with a distinct palp which appears to be 3-jointed, though the segmentation of its basal joint is not clearly seen and its distal segment bears 4 terminal setae.

**First maxilla (Fig. 7, d):** It is very similar to that of the second zoeal stage, though its endopod is much longer, carrying 2 terminal and 2 marginal setae on its distal segment. The basal segment bears 2 marginal and one distal setae. The distal endite is now armed with 6-serrated teeth and 8 setae; the proximal endite with 18 bristle-like and about 2 simple setae.

**Second maxilla** (Fig. 7, e) : The endopod which is still unsegmented bears setae in 4 groups of 3, 2, 2 and 2 each and 1 short basal seta on the outer margin. The number of setae on both the endites is now increased. The scaphognathite is increased in size with a triangular lobed posterior part and is provided with 98-100 marginal setae.

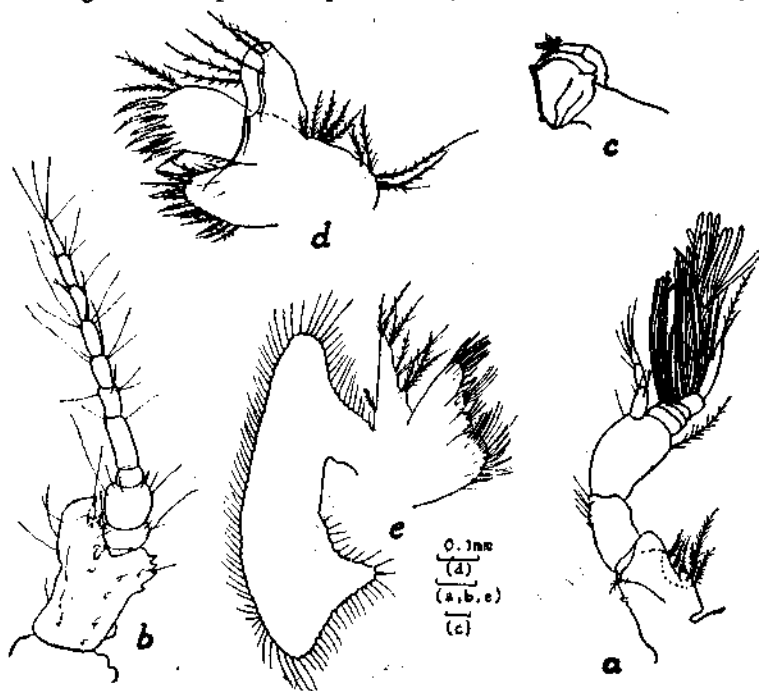


FIG. 7. *Conchoecetes artificiosus*: Megalopa. a—antennule; b—antenna; c—mandible; d—1st maxilla; e—IInd maxilla.

**First maxilliped** (Fig. 8, a) : The endopod does not show any segmentation; it bears about 7 setae on the inner margin and 4 at the distal end, 2-3 on the outer margin. The exopod is partially 2-segmented, the basal segment carrying 4-5 plumose marginal setae and the second segment with 4 long and 1 short terminal setae. The protopodite is bilobed and armed with several setae. There is a large foliaceous epipod provided with many setae.

**Second maxilliped** (Fig. 8, b) : The endopod is 5-segmented whereas the exopod is 2-segmented with no flagellum.

**Third maxilliped** (Fig. 8, c) : The endopod is 5-segmented and armed with numerous setae; the ischium and merus are armed with a row of tubercles both on the inner and outer margins. The exopod is 2-jointed, the terminal joint being further segmented to form a flagellum. There are about 7 plumose setae on the terminal segment of the flagellum and one seta on the last but one segment.

#### *Pereiopods*

**First pair** (Fig. 9, a) : It is chaelate, both the legs being equal, similar and heavier than the remaining legs.

The basipod and ischium each bear a row of granules and their surfaces are setose. The merus is elongated and carries about 9 spines on the outer border, 5

spines on the upper-inner border and about 2 on the lower inner border. The carpus has its outer border spinose, with a big distal tooth. On the outer surface, there is an elevated portion which is edged with granules, a little away from its distal end. The inner margin shows a sub-distal tooth. The outer and inner borders of the propodus are spinose and there is an oblique denticulate ridge on the outer surface, as in the adult.

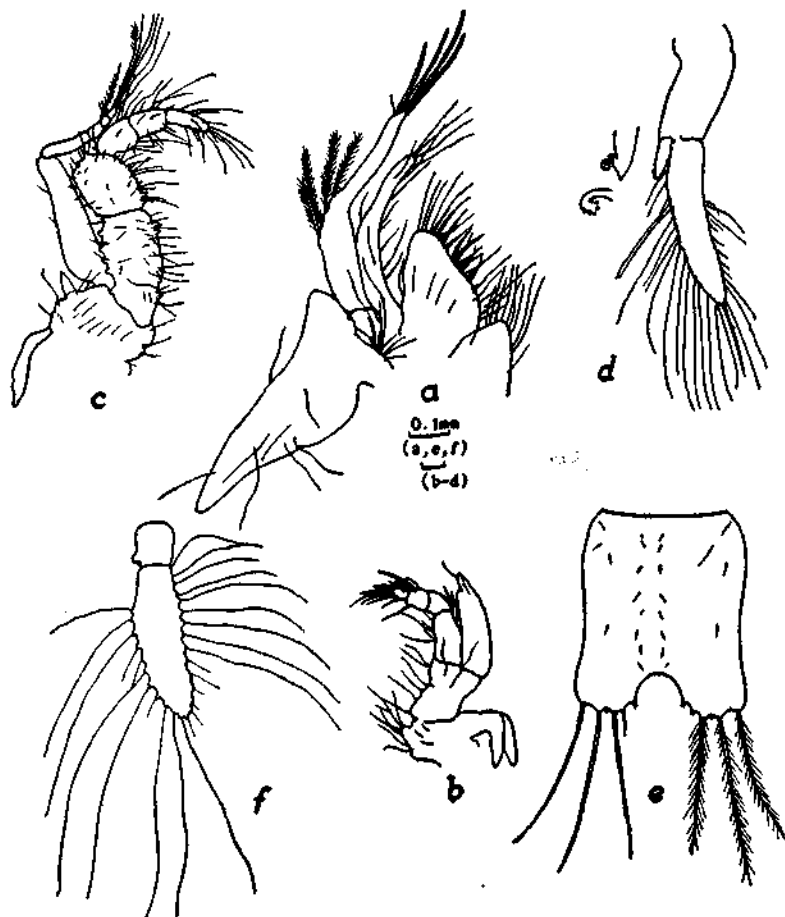


FIG. 8. *Conchoecetes artificiosus*: Megalopa. a—1st maxilliped; b—2nd maxilliped; c—3rd maxilliped; d—pleopod; e—telson; f—uropod.

Near and parallel to this ridge, the dorsal surface has 2 rows of teeth. The upper outer border is raised near the articulation with the dactylus and is armed with several teeth of which 2 are much longer than the rest. The dactylus has its outer margin denticulate. The cutting edge of the fixed finger shows about 5 unequal teeth-like projections and that of the movable finger has about 3 small teeth. *Second pair* (Fig. 9, b): Both the margins of the coxopod and the inner border of the basi-ischial joint are denticulate. The outer border of merus is armed with about 9 teeth and the inner with about 5. The carpus has its outer border dentate, with a row of several teeth on the upper half of the outer surface. There is also a

sub-distal tubercle-like tooth on the dorsal surface. The outer margin of the propodus bears a number of denticles of varying sizes and the inner margin has 2 proximal and 2 distal denticles. The posterior or inner margin of the dactylus is with about 9 teeth-like spines.

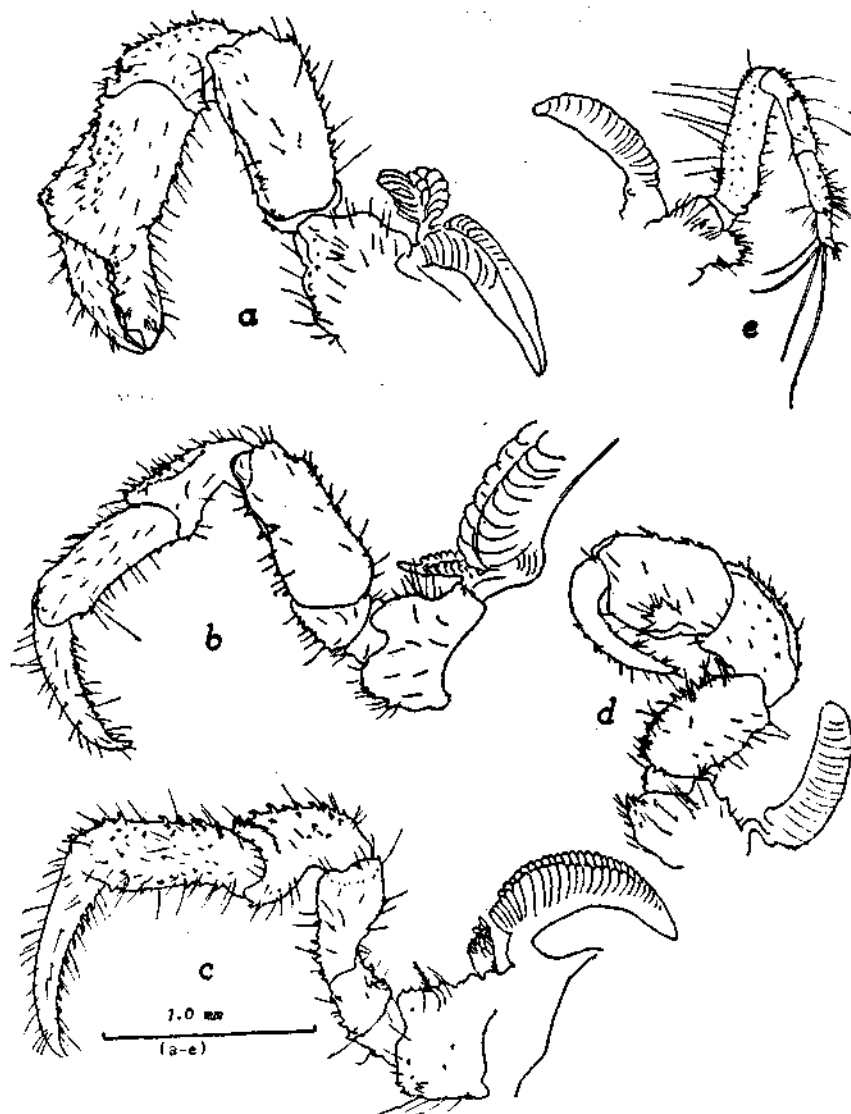


FIG. 9. *Conchoecetes artificiosus*: Megalopa. a—cheliped; b—IInd leg; c—IIIRD leg; d—IVth leg; e—Vth leg.

*Third pair* (Fig. 9, c): Almost similar to that of the second except that its merus is much shorter. The coxopod has both its margins denticulate and also a few tubercles and teeth on its dorsal surface. The basi-ischial joint has about 3 teeth

on the outer margin and about 5 on the inner. The merus has 2 teeth on the outer and about 6 on the inner margins. The outer margin of the carpus has several denticles and the inner margin has two. The distal part is slightly raised, foreshadowing the formation of a nodule on the carpal joint as in the adult, and it is edged with 3-4 tubercle-like teeth. There are also some tubercles on its dorsal surface. The outer and inner borders of the propodus are denticulate and its dorsal surface is covered with tubercles and teeth, which are scarce in the middle. The dactylus has about 10 teeth on its posterior border and a few tubercles on its dorsal surface.

*Fourth pair* (Fig. 9 d): The coxopod bears 3 distal spines along the inner margin and 1 or 2 blunt projections on the outer margin. The ischium is very short. The merus is armed with about 15 unequal teeth along the inner and 3 along the outer margins. The outer margin of the carpus is provided with about 10 teeth and near this margin a row of 7 teeth is present on the dorsal surface. Also there are about 4 smaller teeth on the upper half of the dorsal surface. The propodus has on its outer margin about 5, blunt to sharp teeth. In the middle of the posterior half of the dorsal surface there is a claw-like projection edged with about 4 unequal teeth, as in the adult. The dactylus is claw-like, curved inwards as in the adult and armed with about 6 tubercle-like projections on the outer margin and 5 on the inner.

*Fifth leg* (Fig. 9, e): It is much smaller than the other legs. Its coxopod has a lobe-like projection edged with 5-6 unequal teeth. The merus has 4 teeth on the inner margin and 3 proximal and 2 distal teeth on its outer margin; there are also several tubercles arranged in 2 rows (sometimes 3 rows) on the dorsal surface. There are 10-11 denticles on the outer margin of the carpus and 1-3 such teeth on the dorsal surface also. The outer margin of the propodus has 2-3 teeth and about 5 teeth scattered on its surface. The dactylus is small, with its distal part turned upwards, and it bears 4 long stiff setae.

*Abdomen* (Fig. 6, a): It consists of 6 segments and a telson. The 2nd to 5th segments bear four pairs of pleopods which decrease in size posteriorly. Each pleopod consists of a large setose exopod and a small endopod (Fig. 8, d). The exopod has about 31 plumose setae and the endopod is armed with peculiar hooks as shown in the figure. There are 5 hooks on each of the 1st 3 pairs and 4 on the last.

*Telson* (Fig. 8, e): It is longer than broad with a fairly deep rounded notch on its posterior margin. The telson process formula is 6+6 with the 3rd process on each side reduced to a short tubercle. There are 2 rows of minute setae medio-dorsally and a few setae scattered.

*Uropods* (Fig. 8, f): These are more or less ventrally situated. Only the exopod is functional, bearing about 26 marginal plumose setae, each seta being situated on a tubercle-like base. The endopod is represented by a rudimentary bud not separated from the protopod.

*Colour*: As in the larval phase, the chromatophores are densely placed giving orange-red colouration to the megalopa.

#### DISCUSSION

Previously, the knowledge of the larvae of the Dromiidea has been based almost entirely on *Dromia*; now *Dromidia* (Rice and Provenzano, 1966) and *Conchoecetes* must also be taken into account.

A comparison of larval characters of *Conchoecetes* and *Dromia* reveal resemblances in respect of distinctive carapace humps, antennal endopod with 4 setae in stage I, outer marginal setae of the antennal scale—the most distinctive dromiid character—, exopod of third maxilliped, spiny megalopa having a typical

brachyuran carapace, peculiar fourth legs and gills. The differences are: reduction in number of larval stages, absence of postero-lateral carapace spines, absence of exopods on legs, dactylus of leg four markedly different from those of legs two and three, long setae on last leg of megalopa, delayed appearance of pleopod on somite 5 compared with those on somites 2-4, uropods practically uniramous.

The larvae of *Dromia* and *Dromidia* resemble each other very closely (Rice and Provenzano, 1966). Also the larvae of *Conchoecetes* resemble those of *Dromidia* in all the characters discussed above for *Dromia*, but also possess additional similarities i.e., absence of postero-lateral carapace spines in zoeal stages and presence of long setae on last leg of megalopa. The differences are almost the same as listed for *Dromia*.

It is doubtful which is more primitive form of carapace, but all other differences mark *Conchoecetes* as more advanced than *Dromia* and *Dromidia*.

The later appearance of posterior pleopods in *Conchoecetes* suggests a link with hermit-crabs *Diogenes* and *Anapagurus* (Paguroidea) in which these pleopods do not appear in the zoeal stages. In one or two specimens of IVth zoea of *Dromidia*, the posterior two pleopods were either very small or entirely missing, whereas the four pairs were generally present in all the larvae of this stage (Rice and Provenzano, 1966). Uniramous uropods are found also in Hippidae—*Emerita emerita* (Menon, 1933); *E. talpoida* (Rees, 1959), *E. holthuisi* (Sankolli, 1965), Raninidae and Lithodidae.

*Conchoecetes* differs from Brachyura in respect of prezoal characters and later in shape and spines of carapace, antennule, antenna, exopod of 3rd maxilliped, absence of lateral knobs on abdominal segments, telson and gills. On the other hand, it resembles Thalassinidea, especially *Upogebia* and *Thalassina* (Webb, 1919, Hart, 1937; Sankolli, 1965, Shenoy, 1965) in the antennal endopod (except for the presence of a sub-terminal plumose seta), exopod of third maxilliped, and telson which has the first process situated more laterally than posteriorly. *Conchoecetes* however, differs from *U. setellata*, *U. deltura* (Webb, 1919) *U. pugettensis* (Hart, 1937) and *U. kempfi* (Shenoy, 1965) in not possessing exopods on legs. Comparison in this respect cannot be made with *T. anomala* (Sankolli, 1965) since information is available only on the first 3 stages. The gills of *Conchoecetes* however, differ much from those of *Upogebia*.

The characters resembling Anomura are: carapace, basal position of endopod of third maxilliped, exopods being absent on legs, and telson. The gills are similar to those of Galatheoidea. Thus *Conchoecetes* shows distinct affinity towards Anomura.

Lebour (1934) and Gurney (1942) lay stress on the character-absence of exopods on legs—as an essentially one of the main characters of Anomura and suggest further the removal altogether of Dromiacea from Brachyura. In *D. personatus* (= *D. vulgaris*), the first three legs have exopods, whereas in *Conchoecetes*, the exopods are totally absent. The absence of exopods on legs and the above mentioned other anomuran characters indicate that *Conchoecetes* may have an Anomuran origin rather than the so-called Anomuran section of the Thalassinidea. Surely *Conchoecetes* and *Dromia* must have the same origin, although *Conchoecetes* is more anomuran than *Dromia*, but the long setae on the dactylus of the last leg of the megalopa may be homologous with those found in many Brachyura in the same

stage. If so, this is the first truly brachyuran larval character to be noted in a dromiid.

It is, however, too early, as rightly put by Gurney (1942) to say anything definite about the phylogeny of the Dromiacea as a whole, since our knowledge of the larvae of its members is too inadequate.

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#### REFERENCES

- GURNEY, R. 1942. *Larvae of Decapod Crustacea*. London : Ray Society.
- HART, J. F. L. 1937. Larvae and adult stages of British Columbia Anomura, *Canada J. Res. Ottawa*, DXY (10) : 179-220.
- LEBOUR, M. V. 1934. The life-history of *Dromia vulgaris*. *Proc. zool. Soc. Lond.* : 241-249.
- MENON, M. K. 1933. The life histories of four species of decapod Crustacea from Madras. *Bull. Madras Govt. Mus., (n. ser.) (Nat. Hist.)*, 3 (3) : 17-45.
- PIKE, R. B. AND WILLIAMSON, D. I. 1960. Larvae of decapod Crustacea of the families Dromiidae and Homolidae from the Bay of Naples. *Pubbl. Staz. zool. Napoli*, 31 : 553-563.
- REES, G. H. 1959. Larval development of the Sand Crab, *Emerita talpoida* (Say) in the laboratory. *Biol. Bull.*, 117 (2) : 356-370.
- RICE, ANTHONY L. AND PROVENZANO, JR. ANTHONY J. 1966. Larval development of the West Indian sponge crab *Dromidia antillensis* (Decapoda : Dromiidae) *J. Zool., Lond.*, 149 : 297-319.
- SANKOLLI, K. N. 1965. Studies on larval development in Anomura (Crustacea, Decapoda). I. *Symposium on Crustacea, Pt. II. Mar. biol. Ass. India*,
- SHENOY, SHAKUNTALA. 1965. Studies on larval development in Anomura (Crustacea, Decapoda). II, *Ibid.* : 777-804.
- WEBB, G. E. 1919. The development of the species of *Upogebia* from Plymouth Sound. *J. mar. biol. Ass. U. K.*, 12 : 81-134.