

ON A NEW RECORD OF A MAJID CRAB, *DOCLEA HYBRIDA*
(FABRICIUS) FROM THE MAHARASHTRA WATERS AND ITS
LIFE HISTORY

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ABSTRACT

The crab genus *Doclea* has so far been represented by a single species, *D. gracilipes* Stimpson along the Maharashtra Coast and the present new record of another species *D. hybrida* (?), therefore adds to the list of Brachyuran crabs of Maharashtra. The taxonomic status of the species has been discussed in light of the evidence derived from the examination of abdominal appendages of the males of the allied species.

The life history of *D. hybrida* (?), as reared in the laboratory, consists of two zoeal stages and a megalopa stage.

INTRODUCTION

THE GENUS *Doclea* [Family : Majidae (= Majidae); subfamily : Pisinae] has so far been represented by a single species, *D. gracilipes* Stimpson along the Maharashtra Coast (Chhapgar, 1957) and the present new record of *D. hybrida* (Fabr.), collected from Ratnagiri, adds to the list of Brachyuran crabs of the Maharashtra.

Alcock (1895) considers the crab *D. hybrida* as the adult stage of what is called as *D. muricata* - his conclusions being based on examination of several specimens collected from different parts of India. Alcock's description of *D. hybrida* is, however, rather inadequate and some additional information is given in this paper on the morphology of this species, along with its life history stages, comprising 2 zoeal and one megalopa stages, as reared in the laboratory.

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Doclea hybrida (Fabricius)

The present material agrees in all respects with the description of *D. hybrida* (Fabr.) as given by Alcock (1895) and following is the additional information on the species not included by Alcock:

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1. Colour of carapace and part of the legs covered by mat of hairs, is muddy brown to ash grey, the dactylus and part of propodus of legs are pink.

2. The anterior male abdominal appendage (Fig. 1 a, a₁, b, b₁) is rather straight with a slight bend near the base. The tip part is slightly broadened and is spooned, without any notches on its margin.

D. hybrida can be distinguished from *D. gracilipes* by the following characters:

1. Carapace is globular in *hybrida* whereas it is discoid, non-globose in *gracilipes*.

2. A short row of tubercles on branchial regions, almost parallel to the mid-dorsal row of tubercles in case of *hybrida* but in *gracilipes*, carapace is armed with sharp spines, the one at the external angle of buccal frame being particularly large and prominent.

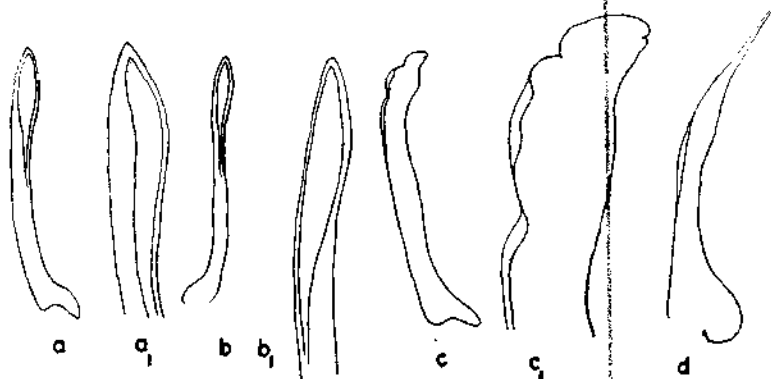


Fig. 1. Anterior male abdominal appendages of *Doclea hybrida*; *D. muricata* and *D. gracilipes*: a. that of *D. hybrida* (Fabri.) of Alcock, a₁. tip part of the 'a' enlarged, b. that of *D. hybrida* of the present material, b₁. tip part of 'b' enlarged, c. that of *D. muricata* of Alcock, c₁. tip part of 'c' enlarged and d. that of *D. gracilipes* Stimpson (after Chhappgar).

3. Second pair of legs hardly twice the length of carapace in *hybrida* but in *gracilipes* the long, slender legs of second pair are more than 3-times the carapace length.

4. The anterior male abdominal appendage, though rather straight in both the species, in *hybrida* (Fig. 1 a, a₁, b, b₁) it has a slight bend at the base and its tip part is spooned without notches whereas in case of *gracilipes* (Fig. 1 d) it has a slight bend in the middle, the distal half is abruptly narrowed with its tip sharply pointed.

Remarks

Alcock (1895) considers *D. hybrida* as the adult of *D. muricata*, his observations, being based on the examination of gross anatomical characters of several specimens of both the species, collected from different parts of India. He, however, does not mention about the anterior male abdominal appendage. Gordon (1931) stresses the importance of male abdominal appendages in the systematics of crabs which has been followed by Chhappgar (1957). We have examined the present material of

hybrida with us in light of this character. Dr. K. K. Tiwari of the Zoological Survey of India was specially requested to examine Alcock's material, deposited in the Indian Museum at Calcutta, of both *hybrida* and *muricata* with reference to the above character and through his courtesy, the sketches of male abdominal appendages of Alcock's material (Fig. 1 a, a₁ and c, c₁) have been incorporated in this paper. Comparison of these sketches with those of our material clearly reveals: (1) The present material agrees with that of *hybrida* of Alcock; (2) Male abdominal appendage of *muricata* (Fig. 1 c, c₁) is distinctly different from that of *hybrida*. It is, therefore, suggested that *D. muricata* and *D. hybrida* have independent species status.

The two species, *muricata* and *hybrida* can also be further distinguished by their carapace armature (as per Alcock's description).—(i) tubercles and not spines on the carapace in *hybrida* and (ii) - spines and not tubercles on the carapace in *muricata*.

Material examined: One ovigerous female-42 mm in carapace width; one male 36 mm in carapace width, both collected from Ratnagiri (Maharashtra) in "Rampan" (shore seine) nets in the month of February 1959.

One ovigerous female-46 mm in carapace width, collected while trawling on a muddy-gravel bottom in a depth of about 50 m off Mirya Bay, Ratnagiri on 11th March 1967.

LIFE HISTORY

Works on larval development in family Majidae are rather scanty. Recently, Yang (1968) describes the complete life history upto the 1st crab stage of *Epialtus dilatatus* A. Milne Edwards, belonging to the subfamily Acanthonychinae, reared in the laboratory. He also gives a review of works done on the larvae of Majidae so far and therefore, the same is not repeated herein. Considering the subfamily Pisinae to which the present species *Doclea hybrida* belongs, practically no information is available except for Kurata's work (1963, 1969). Kurata (1963) deals with 2 zoeal and a megalopa stages of *Chinocetes opilio elongatus* Rathbun and *Hyas coarctatus alutaceus* Brandt (subfamily Pisinae) but no mention is made whether his material was reared in the laboratory or from plankton. In 1969, he gives a brief account of the 1st zoea of *Naxioides histrix* (Miers), the only member of Pisinae in his entire larval material of 15 species, belonging to 13 genera, of the family Majidae all hatched from eggs in the laboratory. Besides this, as far as the authors are aware, there is no other information on the larvae of Pisinae.

Regarding the genus *Doclea*, megalopa and 1st crab instar, collected from plankton, of *D. gracilipes* Stimpson, has been described by Chhapgar (1959) from Bombay waters. The present work, describing the complete life history comprising two zoeal and a megalopa stages, of *Doclea hybrida* as reared in the laboratory, is thus the first of its kind.

Material and Methods: On 11.3. 67, a live berried female was collected in the trawl catch of the Departmental vessel "Surmai," operating on a muddy-gravel bottom at a depth of 48-50 m off Ratnagiri. This specimen was kept in a small aquarium tank provided with soft sticky mud collected specially by releasing extra length of wire rope so as to make the otterboards plough through the sea bottom. The larvae hatched on 21.3.67. About 300 larvae were obtained which

were reared individually in small finger bowls of 250 cc capacity, each with penicillin inoculated filtered sea water, changed once a day. The larvae were fed on freshly hatched *Artemia* nauplii, supplemented by green water containing algal culture of *Palmettococcus* sp. The mortality was high during the intermoult period between the Ist and IInd stages and later on there was hardly any mortality till the megalopa stage, which inspite of several efforts described later, did not moult to the subsequent instars. During the course of this study, the temperature and salinity ranged from 29.0-30.5° C and 33‰ to 34‰ respectively.

The following Table shows the average number of days required for each larval stage:

	Stage		Megalopa
	I	II	
Number of days required for each stage	4	5	10

DESCRIPTION OF LARVAL STAGES

First Zoea (Fig. 2)

Carapace length 0.8 mm; Total length 2.6 mm.

Carapace rounded and minutely punctate. Dorsal spine and rostrum present but lateral spine absent as also in *Epialtus dilatatus* (Yang, 1968) and *Naxioides histrix* (Kurata, 1969). Anterior seta (= 'soie anterieure' of Casanova, 1960), supposed to be a Majid characteristic, present on the antero-ventral margin of carapace as in the other species, followed by a row of 5-6 delicate setae posteriorly. Rostrum very small as in *E. dilatatus* rather than like that of *N. histrix* where it is long and pointed. A small dorsal hump present just behind rostrum. This hump also present in *N. histrix* along with posterior hump. Dorsal spine well developed, longer than eye diameter, as in *N. histrix*; in *E. dilatatus*, dorsal spine very small. Eyes sessile. Abdomen 5-segmented, with a pair of medio-dorsal processes on 2nd segment. Telson forked and with 6 serrated spines on posterior margin.

Antennule (Fig. 2 b): Unsegmented with 4 aesthetascs + 2 setae terminally. In *N. histrix*, 3 aesthetascs + 1 seta and in *E. dilatatus*, only 2 aesthetascs + 1 seta present.

Antenna (Fig. 2 c): Two styliform processes-Protopod and exopod. Protopod elongated, tapering with a small endopod bud basally. Exopod, little shorter than protopod, tapering, with a pair of fairly long spines subterminally.

Except for the exopod not serrated distally the antenna agrees well with that of *N. histrix*. In *E. dilatatus*, both protopod and exopod finely serrated distally.

Mandible (Fig. 2 d): Dorsal cutting edge with 5-7 small teeth whereas ventral cutting edge with a row of 7-8 fine teeth + 1 blunt tooth on right mandible and 5-6 fine + 1 blunt teeth on left mandible respectively.

First maxilla (Fig. 2 e): Basal endite with 3 big serrated teeth + 4 subterminal setae, and coxal endite with 7 setae. Palp appearing unsegmented, with 3 terminal, 2 subterminal and 1 basal setae.

Second maxilla (Fig. 2 f): Two bilobed endites with 5, 4, 5 and 4 setae respectively from proximal to distal lobes. Palp unsegmented, with 5 terminal setae, its outer margin fringed with fine hairs. Well developed scaphognathite with 11 marginal plumose setae.

First maxilliped (Fig. 2 g): Endopod 5-segmented, longer than exopod - the first four segments with 4, 2, 1 and 2 setae respectively while last segment with 4 terminal + 1 outer distal setae. Exopod partially 2-segmented with 4 terminal, plumose setae. Basis with groups of 1, 2, 2 and 3 setae distalwards.

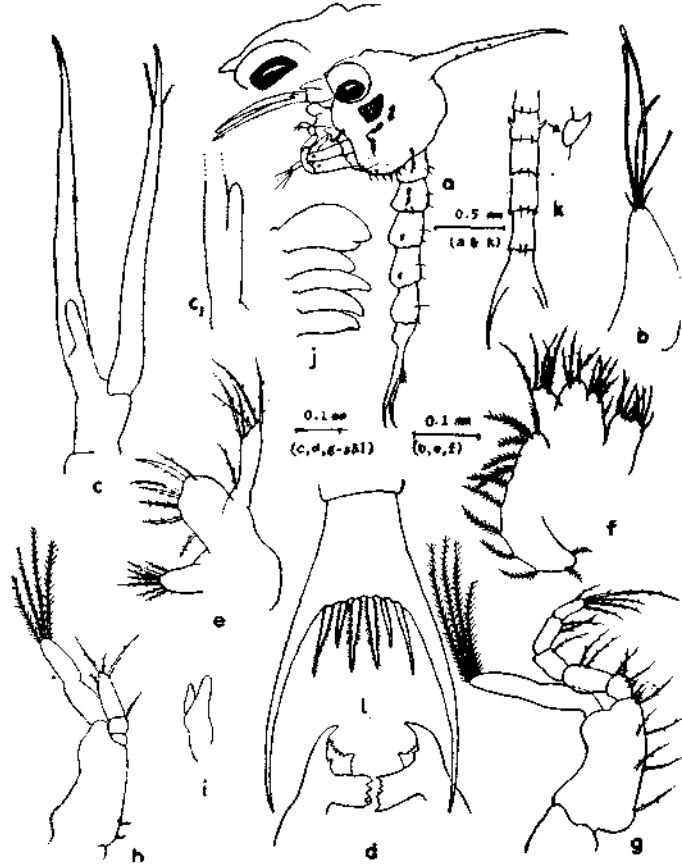


Fig. 2. *Doclea hybrida* (Fabri.): 1st zoea. (For explanation see Fig. 5).

Second maxilliped (Fig. 2 h): Endopod 3-segmented as in other species, slightly more than half the length of exopod, carrying 4 apical setae on the terminal and only 1 distal seta on the subterminal segments. Exopod as in the first maxilliped. Basis with only 2 small setae.

Other appendages: Third maxilliped (Fig. 2 i) and five pairs of pereopods (Fig. 2 j) present as buds, first two biramous and remaining uniramous.

Abdomen (Fig. 2 k): Abdomen 5-segmented, second segment with a pair of medio-dorsal projections pointing upwards like in *N. histrix* (in *E. dilatatus*, these are small conical processes). All segments with a pair of fine medio-dorsal hairs each and also the third to fifth segments with a pair of postero-lateral processes, as in the other two species.

Telson (Fig. 2 l): Forked as in other species. Furca long but smooth and without lateral spines, unlike the serrated ones of other two species. Posterior margin inside furca, with 6 serrated spines as in others.

Chromatophores: Greenish brown, reddish and orange brown are the main components of chromatophores which are distributed as follows: The anterior side of the dorsal spine has a reddish tinge and its posterior side provided with 2-4 minute dark greenish brown chromatophores. Exopod of antenna is tinged with a reddish hue which often gets contracted to 2-3 small stellate chromatophores. Carapace has a large patch of orange brown diffused colouration behind the eyes; a dark greenish brown branched chromatophore deeply embedded in front of the cardiac region and a similar but rather large and much branched chromatophore, on either side of carapace as shown in the Fig. 1 a. A small dark brown one on the distal end of basis of the first two maxillipeds; longitudinal strips on the second to fourth abdominal segments are also present, but that on the second abdominal segment being prominent than the rest which often get reduced to small contracted spots, this happening invariably on killing or preservation of the larvae.

Second Zoea (Fig. 3)

Carapace length 0.9 mm; Total length 2.8 mm.

Eyes stalked and free from carapace. No dorsal setae above the eyes like that of *E. dilatatus* (In *N. histrix*, only the 1st zoea is described; no comparison therefore, could be made of this stage). Pleopod buds present on second to fifth abdominal segments, sixth segment still fused to telson.

Carapace with 2 unequal, mid-dorsal humps between the tip of the rostrum and dorsal spine; 2 similar humps present on anterior half of lateral side; no other change in carapace.

Antennule (Fig. 3 b): Terminally with 8 aesthetascs. A small bud representing the inner ramus present in this stage.

Antenna (Fig. 3 c): No other change except for increase in size. Endopod bud, as in *E. dilatatus*, about 1/5 the length of protopod.

Mandible (Fig. 3 d): A small rudimentary palp developed.

First maxilla (Fig. 3 e): Increase in the number of setae on the endites-8 on the coxal and 9 on the basal. No other change.

Second maxilla (Fig. 3 f): Scaphognathite setae increased to 25-26.

First maxilliped (Fig. 3 g): Exopod now with 6 terminal, plumose setae, as in *E. dilatatus*. A small epipod bud present on coxa.

Second maxilliped (Fig. 3 h): As in the first maxilliped, exopod with 6 setae, but no epipod.

Other appendages: Third maxilliped and pereopod buds still rudimentary.

Abdomen (Fig. 3 a): The 5th segment still fused to telson. Four pairs of biramous pleopod buds each with a small inner ramus; present on the 2nd to 5th segments.

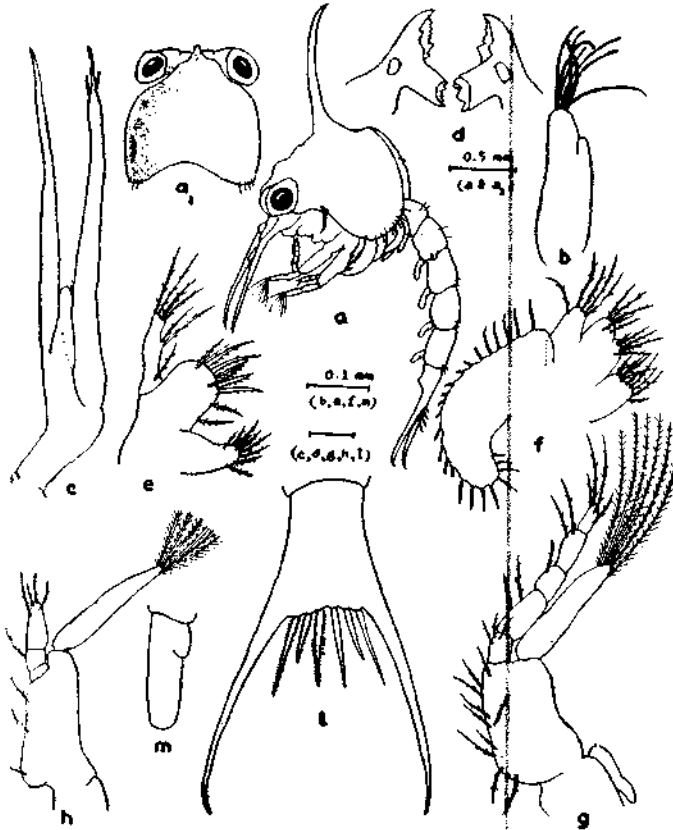


Fig. 3. *Doclea hybrida* (Fabri.): IInd zoea. (For explanation see Fig. 5).

Telson (Fig. 3 i): No change except increase in size.

Chromatophores: No appreciable change but for the greenish brown chromatophores becoming more greenish than brown.

Megalopa (Fig. 4, 5)

Carapace length 1.3 mm.

After 5 days, the IInd zoea moulted to megalopa which showed more tendency to crawl than swim. Small pebbles and stones encrusted with sea-weeds etc., collected from intertidal zone were provided in small glass containers wherein megalopae were introduced. Megalopae were observed to scrape off this encrusted

Antennule (Fig. 4 b) : Peduncle 3-segmented with a simple seta at distal end of the last segment. Inner flagellum 2-segmented with 3 terminal setae on distal segment (in *E. dilatatus*, inner ramus unsegmented). Outer ramus 4-segmented like in *E. dilatatus* with in all about 12 aesthetascs, except on first and last segments. Last segment with one distal seta only.

Antenna (Fig. 4 c) : A 3-segmented peduncle and flagellum of 4 segments. Basal segment of peduncle with inner distal angle produced into a lobed structure in addition to rounded protuberance at outer distal angle. Such protuberance absent in *E. dilatatus*, remaining two segments of peduncle with 2-3 distal setae. Only last segment of flagellum with 4 terminal setae and last but one with 3 distal setae.

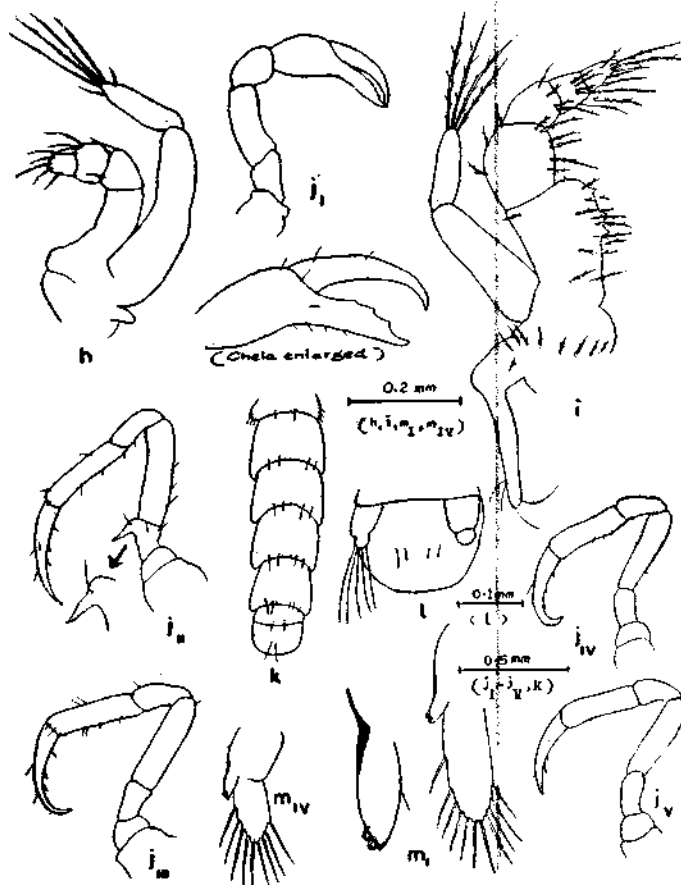


Fig. 5. *Doclea hybrida* (Fabri.) : megalopa.

(a. entire larva, a₁. carapace part enlarged, b. antennule, c. antenna, c₁. basal part of proto-pod of antenna enlarged, d. mandible, e. first maxilla, f. second maxilla, g. first maxilliped, h. (second maxilliped, i. third maxilliped, j. pereopodbuds (Roman suffix indicates the number), k. abdomen, and l. telson).

Mandible (Fig. 4 d) : Palp not distinctly segmented, bearing 4-5 bristle-like setae. No prominent teeth on cutting edges. In *E. dilatatus*, palp is 2-segmented.

material as though to feed. They were also fed on prawn and clam meat which was readily accepted. Though the megalopae survived for 10 days, they failed to moult to the next crab instar stage and died in the laboratory.

Carapace almost sub-globular. Rostrum rather short, pointed as in *E. dilatatus*, unlike the bifid rostrum of the adult. Most of the tubercles of the adult present but in the form of blunt projections occupying almost the same positions as in the adult. Antero-lateral margin of carapace with 3 large tubercles instead of 4 of the adult and between the median row and the lateral row of tubercles, almost on the branchial region on either side, 2 large and 2 small projections in series, also

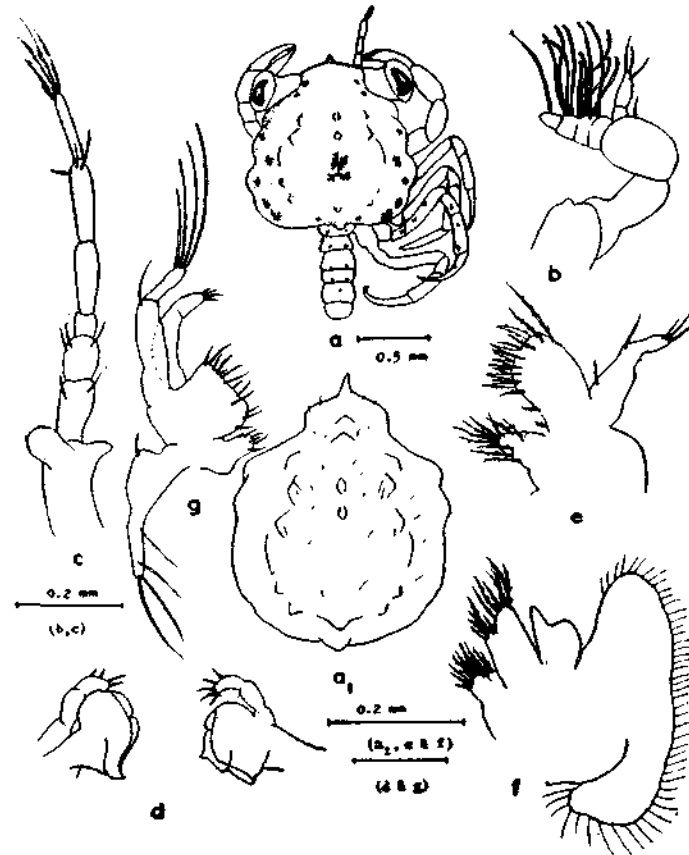


Fig. 4. *Doclea hybrida* (Fabri.) : megalopa. (For explanation see Fig. 5).

present unlike the adult with only 2 tubercles in all 5 series of tubercles. Distinct regions of carapace as in the adult and covered with sparsely plumose setae that are rather short and tough (Fig.4 a₁). In megalopa of *Doclea gracilipes*, described by Chhapgar (1954) carapace with only 4 spines on dorsal surface arranged in the form of a triangle and rostrum not small and pointed but as two horns at antero-lateral angles of carapace.

First maxilla (Fig. 4 e): Palp, as in zoeal stages, unsegmented with 3 terminal and 2 outer setae. Basal endite with 7 serrated teeth and about 10 setae apically and 2 basally. Coxal endite with 5 terminal and 5 subterminal setae.

Second maxilla (Fig. 4 f): Scaphognathite fringed with about 40 plumose setae along entire margin. Palp, as in *E. dilatatus*, bifurcated and unarmed. Two endites with 7, 7, 3 and 7 setae respectively from basal to distal lobes.

First maxilliped (Fig. 4 g): This appendage is greatly modified over the zoeal stages. Protopod bilobed, fringed with marginal setae. Endopod indistinctly 2-segmented with 4 small, apical setae on terminal segment. Exopod 2-segmented, basal segment with a single seta, more than twice length of distal which bears 4 long terminal setae. Epipod somewhat triangular, narrowing downwards with 4 long, distal and a small basal setae.

Third maxilliped (Fig. 5 i): Fully developed in this stage. Endopod 5-segmented, all segments with row of setae and on inner side with distal tufts of setae. A few setae scattered on outer side. Basi-ischial joint of endopod with 4 sharp, tubercle-like teeth in distal half of lower margin (this margin being smooth in *E. dilatatus*.) Exopod 2-segmented, short distal segment with 4 terminal, plumose setae. Coxal joint with a row of 9-10 short bristles. Joint between epipod and coxa not clearly marked as also reported in *E. dilatatus*.

Pereiopods: All pereiopods well developed, long and slender. No feeler in form of long, curved setae on last segment of the Vth leg. No meral spine on legs—this spine distinct on meri of all the pereiopods in *D. gracilipes*.

First pair of chelipeds (Fig. 5 j₁): All segments smooth except for a few scattered setae. Dactylus or movable finger long, unarmed and fixed finger as long as dactylus, with 3-4 blunt tubercles distally on cutting edge. Long filtering setae on coxa mentioned in case of *E. dilatatus*, are absent.

The second to fifth pairs (Fig. 5 j_{ii}-j_v): Structurally similar to each other. Ischium of second pereiopod with a fairly large spine as in *D. gracilipes*. In *E. dilatatus*, this spine present on 3rd pereiopod also. Dactylus of each walking leg claw-like tapering and slightly curved at tip. Two spines present on the posterior margin of dactylus.

Abdomen (Fig. 5 k): Now with 6 segments and a telson. All segments smooth except for small dorso-median setae distributed as 1 pair on first and last segments and 2 pairs each on second to fifth segments. Pleopods present on second to sixth segments (Fig. 5 m_i, m_{iv}). Exopod of each pleopod with 9-11 setae. Endopod much smaller than exopod and with 2-3 minute hooks. The pleopods of sixth segment without endopod and with 5 setae on exopod as in *E. dilatatus*.

Abdomen in *D. gracilipes* differs considerably from that of above two species in having—no setae on any segments although the second and third segments have 2 spinules each on dorsal surface; third and fourth segments each with a pair of lateral hooks. Pleopods of last (6th) segment with 8 setae instead of 5.

Telson (Fig. 5 l): Almost rounded or semicircular in outline, smooth except for 2 pairs of mid-dorsal fine setae.

Gills, unfortunately, could not be studied in the present work.

DISCUSSION

No information is available on the larvae of the genus *Doclea*, except that on the megalopa of *D. gracilipes* Stimpson, described from plankton by Chhapgar (1954). Only comparison that can be made, therefore, is with the available information on the larvae of the subfamily Pisinae—*Naxioides histrix* (Miers), 1st zoea only and of subfamily Acanthonychinae—*Pugettia quadridens* (De Haan) and *P. incisa* (De Hann) (Kurata, 1969) and *Epialtus dilatatus* A. Milne Edwards, also belonging to subfamily Acanthonychinae (Yang, 1968).

In the subfamily Acanthonychinae, larvae of *Pugettia quadridens* and *P. incisa* (Kurata, 1969) and *Epialtus dilatatus* (Yang, 1968), resemble the *D. hybrida* larvae. The rostrum, however, differs from that of *Pugettia* species in not being long and pointed but very small like that of *E. dilatatus*. In the subfamily Pisinae, the larvae of *N. histrix* agree with those of *D. hybrida* in all respects except for the rostral character, in having a long rostrum unlike the small one in *D. hybrida*.

Presence of serrations on the antennal exopod and telson furca appears to be one of the important Majid character as per Kurata (1969). This character is, however, absent in *D. hybrida*. The absence of this character may be a distinctive feature of *D. hybrida*.

As far as megalopa is concerned, the comparison, in the genus *Doclea*, can be made with the megalopa of *D. gracilipes* (Chhapgar, 1954). The megalopa in both the species, however, show more differences than similarities in the following:

1. Rostrum - consisting of two horns at the extremity with a transverse border between them in *gracilipes* but in *hybrida*, it is small, median, acute and deflecting downwards.
2. Carapace with 4 spines arranged in triangular form anteriorly in *gracilipes* but in *hybrida* no spines but a series of tubercles.
3. In *gracilipes*, the merus of the pereopods is subdivided, armed with a prominent spine whereas in *hybrida*, there is no such a spine or the subdivision of merus on any of the pereopods.
4. Abdominal segments 3 and 4 have lateral hooks in *gracilipes* but there are no hooks or spines on any abdominal segments in *hybrida*.
5. The 6th pleopod in *gracilipes* has 8 plumose setae but in *hybrida*, there are only 5.

Also, as far as the authors are aware, the megalopa of *D. hybrida* compares well with that of *E. dilatatus* (Yang, 1968), of the subfamily Acanthonychinae, in the form of rostrum, smooth abdominal segments, telson and the number of setae on the 6th pleopod.

Thus, the megalopa of *D. hybrida*, belonging to the subfamily Pisinae, shows affinities towards the subfamily Acanthonychinae. However, in the absence of more information on the megalopae of Pisinae except for *D. gracilipes* in which also the identification is rather provisional, nothing can be said at this stage about the taxonomic significance of the larval characters of *Doclea*.

Another interesting observation in the present study: Alcock (1895) considers *D. muricata*, perhaps due to its spinose carapace, as the young stage of *D. hybrida* with tubercular carapace, possibly assuming that the spines of the young stage get modified to tubercles in adult. The present study, however, reveals that the tubercular nature of carapace in *D. hybrida* develops as early as the megalopa stage and there appears no possibility of these tubercles changing to spines at any stage of life history. Thus, the above larval evidence also supports our confirmation on the adult taxonomic status that *D. hybrida* and *D. muricata* are at the level of two independent species, contrary to Alcock's observation.

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