A SYSTEMATIC REPORT ON THE FRESH WATER PRAWNS OF THE ATYID GENUS *CARIDINA* H. MILNE-EDWARDS 1837, FROM MADRAS (TAMILNADU : INDIA)[1]

JASMINE RICHARD[2] AND M.R. CHANDRAN[3]

(With six text-figures)

Key words: Atyidae, *Caridina* sp.

The atyid prawns belonging to the genus *Caridina* are widely distributed in the freshwater bodies in and around Madras. Eventhough the first report of an atyid prawn from India was from Madras in the year 1893, no attempt was made thereafter to study the Atyidae of Madras.

The present work is the first systematic report of the *Caridina* sp. of Madras, including a new species. A complete account of synonymy, material examined, type material of the new species, ecology, live coloration, fecundity and larval stages based on laboratory culture, is provided. A key for the identification of the species of *Caridina* in and around Madras is also provided.

INTRODUCTION

The first freshwater prawn to be described from Madras region was an atyid belonging to the genus *Caridina*, a century back by Henderson (1893). This was incidentally the first report of the family Atyidae from India. Since then, except for the brief accounts by Nobili (1903) and Kemp (1915), there have been no other works on this confusing group along the Tamil Nadu coast. Even from the interior Tamil Nadu, whatever little information available on this group is only by the brief accounts of Roux (1931) and Wycliffe (1973). The present work was, therefore, undertaken with a view to systematically study these prawns which are increasingly becoming popular as crustacean bioassay material in experimental biology among the research workers of this area.

During the course of study, following four species could be collected:

1. *Caridina gracilirostris* De Man, 1892.
2. *Caridina gracilipes* De Man, 1892.
3. *Caridina kunnathurensis* sp. nov.
4. *Caridina gurneyi* Jalihal *et al.* 1984.

The studies on morphometrics dealing with various body proportions have been used for easily distinguishing several species of *Caridina* by Bouvier (1925). In the present work, these ratios are given in Table 1 wherein the following abbreviations are used for indicating lengths of corresponding appendages : al - antennular peduncle, ab6 - sixth abdominal segment, c - carapace, ch1 & ch2- chela of first and second pereiopods (i.e. chelipeds), cp1 to cp5 - carpus of first to fifth pereiopods, d1 to d5 - dactylus of first to fifth pereiopods, f1 & f2 - fingers of first and second chelipeds, p1 & p2 - palm of first and second chelipeds, pr 3 & pr 5 - propodus of third and fifth pereiopods. The suffix b indicates breadth of relevant appendage/segment.

The abbreviations ZSI, NMC and RMNH are used for Zoological Survey of India, Calcutta, National Museum of Natural Sciences, Canada and Rijksmuseum Van Natuurlijke Historie, Leiden, The Netherlands, respectively.

[1]Accepted July 1992.

[2]Department of Zoology, Presidency College, Madras 600 005.

[3]Department of Animal Science, Tiruchirapalli 620 024.

TABLE I
VARIOUS BODY PROPORTIONS OF THE FOUR SPECIES OF *CARIDINA* FROM MADRAS

Body proportions	*Caridina gracilirostris*	*Caridina gracilipes*	*Caridina kunnathurensis*	*Caridina gurneyi*
1. r/c	1.40 to 2.20	0.90 to 1.20	0.80 to 1.00	0.40 to 0.70
2. a1/c	0.60 to 0.90	0.75 to 0.90	0.65 to 0.83	0.40 to 0.50
3. ab6/c	0.60 to 0.90	0.75 to 0.90	0.51 to 0.59	0.35 to 0.45
4. pr3/c	0.30 to 0.40	0.35 to 0.36	0.39 to 0.45	0.34 to 0.70
5. pr5/c	0.38 to 0.50	0.45 to 0.52	0.38 to 0.50	0.36 to 0.62
6. cp1/cp1.b	1.48 to 1.80	2.00 to 2.50	2.77 to 3.10	1.66 to 2.00
7. ch1/ch1.b	2.00 to 2.46	2.40 to 2.64	2.35 to 2.72	1.80 to 2.50
8. f1/p1	0.80 to 1.20	1.32 to 1.50	1.10 to 1.60	0.80 to 1.15
9. cp2/cp2.b	3.80 to 5.10	4.57 to 5.10	4.60 to 5.10	5.23 to 6.00
10. ch2/ch2.b	3.12 to 3.20	2.90 to 3.31	2.35 to 2.72	2.75 to 3.40
11. f2/p2	0.90 to 1.30	1.58 to 1.72	1.35 to 1.75	1.10 to 1.70
12. pr3/pr3.b	10.00 to 12.00	6.81 to 10.50	9.60 to 12.11	10.00 to 11.00
13. pr3/d3	4.50 to 5.60	3.41 to 5.10	3.04 to 4.05	4.00 to 5.30
14. d3/d3.b	2.50 to 3.40	3.50 to 4.10	3.00 to 4.50	2.50 to 2.90
15. pr5/pr5.b	12.60 to 14.50	9.45 to 12.22	12.00 to 16.12	10.00 to 14.00
16. pr5/d5	3.80 to 6.00	2.88 to 4.07	3.53 to 4.50	3.00 to 4.50
17. d5/d5.b	3.10 to 4.00	4.28 to 5.15	4.16 to 6.29	3.75 to 4.75

1. **Caridina gracilirostris** De Man, 1892
(Figs. 1 - 2)

Caridina gracilirostris : De Man, 1892, *Max. Weber Zool. Ergeb., 2:*392.

Caridina gracilirostris : Bouvier, 1913, *Bull. Sci. Ent. France,* 177-182.

Caridina gracilirostris: Kemp, 1918, *Mem. Asiat. Soc. Bengal, 6:* 282.

Caridina gracilirostris : Bouvier, 1925, *Encycl. Ent., 4:* 142.

Caridina gracilirostris : Natarajan, 1942, *Curr. Sci., 11:* 245.

Caridina gracilirostris : Johnson, 1961, *Bull. Reffles Mus. Singapore 26:* 124.

Caridina gracilirostris : Arudpragasam and Costa, 1962, *Crustaceana, 4:* 7.

Caridina gracilirostris gracilirostris : Johnson, 1963, *Bull. natn. Mus. St. Singapore, 32:* 20.

Caridina gracilirostris : Pillai, 1964, *J. Mar. biol. Ass. India, 6:* 43.

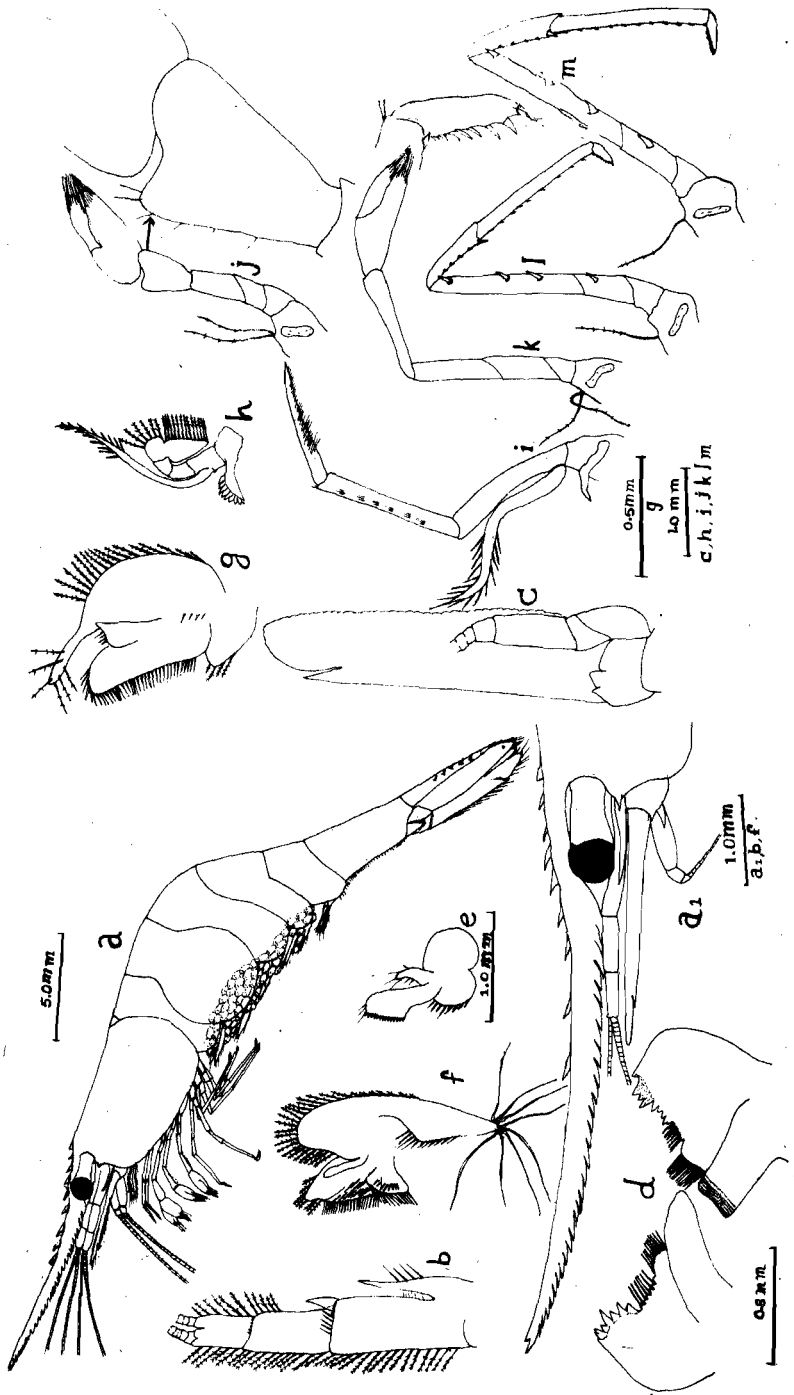

Fig. 1. *Caridina gracilirostris* De Man

a. Entire animal (Lateral view); a1. Anterior part (magnified); b. Antennule; c. Antenna; d. Mandibles; e. First maxilla; f. Second maxilla; g. First maxilliped; h. Second maxilliped; i. Third maxilliped; j. First pereiopod; k. Second pereiopod; l. Third pereiopod; m. Fourth pereiopod.

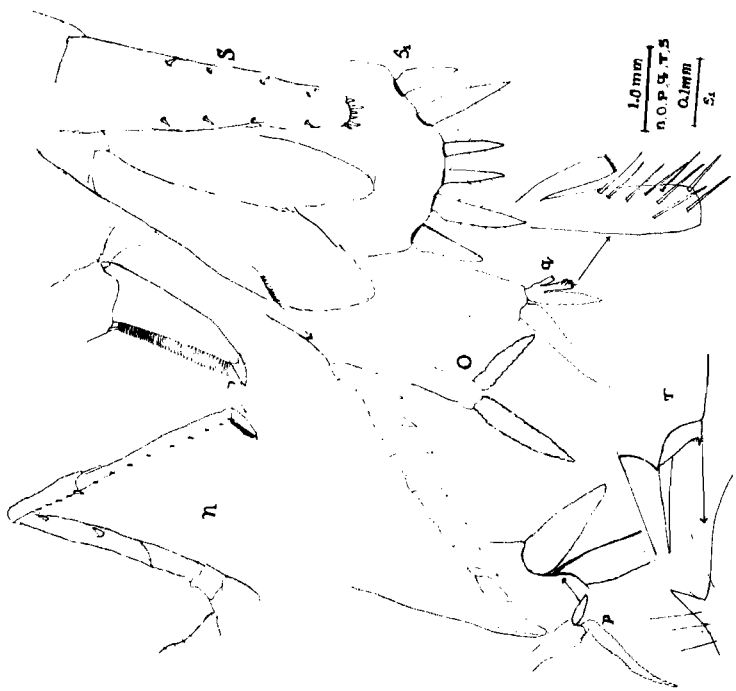

Fig. 1. *Caridina gracilirostris* De Man
n. Fifth pereiopod; o. First pleopod of female; p. First pleopod of male; q. Second pleopod of male; r. Preanal carina; s. Telson with uropod;
s1. Posterior part of telson (magnified).

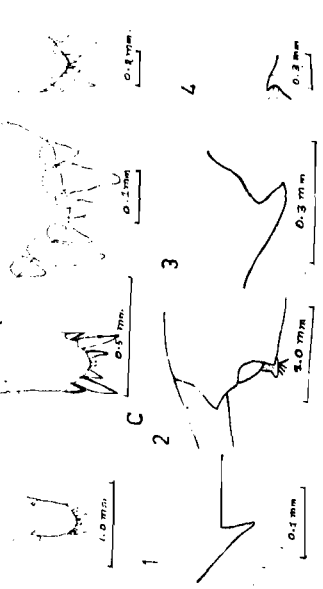

Fig. 2. Comparison of *C. gracilirostris* from various regions
C. pseudogracilirostris
A. First pleopod of male of : 1. Madagascar - as per Holthuis (1965); 2. Madras; 3. Andhra Pradesh - as per Ravindranath (1977); 4. ZSI type locality material; 5. Cochin - as per Thomas *et al.* (1973).
B. Posterior portion of the telson of : 1. Madagascar - as per Holthuis (1965); 2. Madras; 3. Andhra Pradesh - as per Ravindranath (1977); 4. ZSI type locality material; 5. Cochin - as per Thomas *et al.* (1973).
C. Preanal carina of : 1. Madras; 2. Andhra Pradesh - as per Ravindranath (1977); 3. ZSI type locality material; 4. Cochin - as per Thomas *et al.* (1973).

non Caridina gracilirostris : Holthuis, 1965, *Mem. Mus. nat. Hist. Paris, 33:* 23.

Caridina gracilirostris gracilirostris : Tiwari and Pillai, 1971, *Crustaceana 21:* 83.

Caridina gracilirostris : Costa, 1972, *Bull. Fish. Res. Stn. Sri Lanka (Ceylon), 23:* 129.

Caridina pseudogracilirostris : Thomas *et al.* 1973, *J. Mar. biol Ass. India, 15:* 871.

Caridina gracilirostris gracilirostris : Ravindranath, 1977, *Ph.d. thesis* (unpublished).

Material Examined: 120 specimens collected between January, 1979 and January, 1982 in following freshwater bodies: Chetput pond, Chembarambakkam reservoir, Nursery pond of Fisheries Research Station (FRS) at Chembarambakkam, Porur and Kunnathur ponds. Sizes: 30 males (25 to 30 mm), 30 non-berried females (29 to 35 mm) and 60 berried females (30 to 42 mm). Also, following material from ZSI was examined : 2 males (29 mm each) and 1 berried female (33 mm), collected from Celebes (type locality) by Prof. Max Weber and determined by the original author De Man (Reg. No. 3935/7), 3 males (23 to 25 mm) and 3 berried females (31 to 34 mm) collected from Garia river near Calcutta by S. Kemp (Regd. NO. 9653/10); 2 males (24 & 26 mm) and 1 berried female (30 mm) collected from Sanguem-Sanvordem by S. Kemp (Reg. No. 9657/10); 3 males (28 to 32 mm) and 3 berried females (30 to 35 mm) collected from Tambrapani River, Tinnelvelly by J.R. Hill (Reg. No. 9655/10); 3 males (20 to 25 mm) and 3 berried females (34 to 38 mm) collected from Patani River, Siamese Malay State by N. Annandale (Reg. No. 9658/10).

Description: Rostrum long, slender, distally upturned and distinctly overreaching antennal scale. Rostral formula

$$\frac{(1 \text{ or } 2)\ 5 \text{ to } 8 + 1 \text{ or } 2}{26 \text{ to } 29}$$

dorsal teeth occupying proximal 1/3rd region while distal 2/3rd portion unarmed; ventral teeth closely set and arranged almost up to tip. Carapace without pterygostomial spine but with a well developed antennal spine. Cornea well pigmented.

Antennular carina feebly developed, stylocerite long and slender, reaching 3/4th of the basal segment; antero-lateral tooth long and pointed; aesthetasc bearing segments 20 to 25 in females and 38 to 45 in males. Antennal scale long and about 4 times as long as broad.

Mouthparts normal; mandibles asymmetrical and without palp, third maxilliped with an epipod and extending up to 2nd segment of antennular peduncle; exopod reaching middle of the 2nd segment of endopod.

First chelipeds extending up to basal segment of antennular peduncle; carpus only slightly excavated anteriorly. Second chelipeds slender and extending up to antennular peduncle; carpus slender and without anterior excavation. Third pereiopod extending up to 2nd segment of antennular peduncle; dactylus with 8 to 11 (mostly 8 or 9) spines; merus bearing 3 stout spines along its inner border. Fourth pereiopod similar to third, while fifth extending up to basal segment of antennular peduncle; dactylus with 33 to 45 (mostly 33 to 38) comb-like spinules; merus with 2 stout spines along inner margin.

Epipod present on first 4 pereiopods while all 5 pereiopods bear 1 or 2 setobranchs.

Abdomen slender, with a dorsal hump on 3rd segment. Endopod of first pleopod of male 2.90 to 3.30 times as long as broad, 0.18 to 0.27 times exopod and without bearing an appendix interna. Appendix masculina 0.31 to 0.36 times endopod and 1.50 to 2.00 times appendix interna.

Telson with 4 or 5 (mostly 4) pairs of dorsal spines and 3 pairs of posterior processes that are sparsely plumose excepting outermost pair. Uropod diaeresis with 6 to 10 (mostly 6 or 8) spinules.

Eggs and development: Eggs slightly yellowish, small measuring 0.26 to 0.37 × 0.47 to 0.58 mm. Fecundity 150 to 750. Development prolonged with 6 larval stages.

Coloration: Specimens collected from localities rich in vegetation tend to be greenish while those from open waters exhibit pale yellow coloration; original coloration is retained when kept in mud pots and cement containers but turns pale yellowish when kept in glass aquaria.

Remarks: *Caridina gracilirostris* is one of the most common atyids inhabiting Indo - Malayan archipelago (De Man 1892, Kemp 1918, Natarajan 1942, Johnson 1961 & 1963, Arudpragasam and Costa 1962, Pillai 1964, Holthuis 1965, Tiwari and Pillai 1971, Costa 1972, Ravindranath 1977). Holthuis (1965) categorically stated and illustrated that posterior margin of telson in this species is pointed and the endopod of the first pleopod of male possesses a distinct appendix interna. Since these two characteristic features were absent in their specimens, Thomas *et al.* (1973) erected a new species *C. pseudogracilirostris* for their Cochin specimens which had rounded telson and lacked interna on first male pleopod. In all probability, Thomas *et al.* (1973) were not aware of the syntype telson figure of *C. gracilirostris* as given by Bouvier (1925). The figure clearly shows that telson is very much rounded and not pointed in original *gracilirostris*.

As far as the first appendix interna on first pleopod of male is concerned, Ravindranath (1977) draws a rather unacceptable conclusion that it might be present only for a short time during the breeding season in *gracilirostris*. Such a hypothesis can only be confirmed by studying a large series of material collected throughout the year (Gordon 1933). Hence, in the present study special observations were made in this regard and it was confirmed that the relevant appendix interna is totally lacking in the Madras specimens irrespective of seasons or size.

Also, the personal examination of specimens of *C. gracilirostris* collected from type locality as well as different parts of India and Malaysia (ZSI, Calcutta) clearly proved that its telson is always rounded and its male does not possess appendix interna on first pleopod at any stage of its life. This observation further proves that the Madagascar specimens of Holthuis (1965) may altogether belong to different species and that *C. pseudogracilirostris* of Thomas *et al.* (1973) is merely a synonym of *C. gracilirostris*.

2. **Caridina gracilipes** De Man, 1892 (Fig. 3)

Caridina wyckii var. *gracilipes* : De Man, 1892, *Max Weber Zool. Ergeb., 2:* 387. *Caridina wyckii* : Henderson, 1893, *Trans. Linn. Soc. London, 5:* 434. *Caridina wyckii* : Nobili, 1903, *Boll. Mus. Zool. Anant. Comp. Torino 18:* 6. *Caridina nilotica* var. *bengalensis* : De Man, 1908, *Rec. Indian Mus., 2:* 265. *Caridina nilotica* var. *gracilipes* : De Man, 1908, *Rec. Indian Mus., 2:* 270. *Caridina nilotica* var. *bengalensis* : Kemp, 1915, *Mem. Indian Mus.,5:* 307. *Caridina nilotica gracilipes* : Kemp, 1918, *Rec. Indian Mus., 14:* 275. *Caridina nilotica* var. *bengalensis* : Bouvier, 1925, *Encycl. Ent. ser. A., 4:* 154. *Caridina nilotica* (Roux) var. *bengalensis* : Wycliffe, 1973, *J. Madurai Univ. 1:* 161. *Caridina bengalensis* : Ravindranath, 1977, *Ph.D. thesis* (unpublished): 239. *Caridina nilotica* var. *bengalensis* : Anatha Raman *et al.* 1978, *Vignana Bharati, 4(2):* 86.

Material Examined: Prawns were collected from January, 1979 to January 1982 in various freshwater bodies in and around Madras such as Chetput pond, Chembarambakkam reservoir, nursery ponds FRS Chembarambakkam, Kunnathur pond, YWCA pond and Adyar river (near Saidapet).

Size: 30 males (22 to 30 mm); 35 non-berried females (25 to 32 mm) and 80 berried females (30 to 40 mm). Also, the syntype material of *Caridina nilotica* var. *bengalensis*

from ZSI was examined: 1 berried female (19 mm), 1 non berried female (18 mm) and 3 males (16 to 20 mm) (Reg. No. 5615-7/10 wrongly labelled as 5 males).

Description: Rostrum straight, equal to or slightly longer than antennal scale. Rostral formula

$$\frac{(1 \textit{ or } 2)\ 10 \textit{ to } 24 + 0 \textit{ to } 2}{11 \textit{ to } 22} \text{ mostly}$$

$$\frac{(2)\ 17 \textit{ to } 20 + 1 \textit{ or } 2}{14 \textit{ to } 17}$$

dorsal margin with a distal gap which may rarely be interrupted by 1 or 2 intermediate teeth. Carapace without pterygostomial spine but with a prominent antennal spine at orbital expansion. Cornea round and well pigmented.

Antennular carina poorly developed; stylocerite reaching 3/4th of basal segment; anterolateral tooth sharply pointed and reaching proximal 1/3rd of 2nd segment. Aesthetascs - bearing segments 24 to 33 in females while 45 to 50 in males. Antennal scale about 3-4 times as long as broad.

Mouthparts as in figure. Third maxilliped with an epipod and extending up to 2nd segment of antennular peduncle.

First chelipeds extending up to base of antennular peduncle; carpus slightly excavated anteriorly. Second chelipeds slender and extending up to 2nd segment of antennular peduncle; carpus comparatively slender and without anterior excavation; Third perieopod extending up to tip of antennular peduncle; dactylus with 7 to 10 (mostly 8 or 9) spines; merus with 2 to 4 big spines and ischium with a single big spine along inner margin. Fourth pereiopod almost similar to third. Fifth pereiopod extending up to 2nd segment of antennular peduncle; dactylus bearing 50 to 70 spinules on posterior margin giving a comb-like appearance; merus almost double of carpus and with 2 or 3 stout spines but ischium without any spine.

All five pereiopods with 2 setobranchs each while only first four pereiopods possess epipods.

Abdomen with a prominent hump on 3rd segment. Endopod of first pleopod of male 0.25 to 0.30 times exopod, 2.0 to 2.5 times as long as broad and with a distinct appendix interna. Appendix masculina 0.3 to 0.4 times as long as endopod and 1.5 to 1.8 times appendix interna.

Preanal carina with a strong spine and with a few setae.

Telson posteriorly either with a triangular median point flanked by 3 pairs of processes or blunt bearing 3 or 4 + 1+ 3 or 4 processes. Uropod diaeresis with 9 to 12 (mostly 10 or 11) spinules.

Eggs and Development: Eggs yellowish, small, measuring 0.24 to 0.38 × 0.38 to 0.55 mm. Fecundity : 200 to 850. Development prolonged with 7 larval stages before postlarva.

Coloration: Freshly collected specimens are slightly greenish and retain this coloration when kept in mud pots or cement tanks but turn pale yellow when maintained in glass aquaria. Ventral margin of rostrum, front of carapace, junction of abdominal pleura and base of telson with prominent orange-red coloration.

Remarks: The present species has the distinction of being the first reported atyid from India. It was recorded from Madras (Henderson 1893) and Pondichery (Nobili 1903) under the name *Caridina wyckii*. Subsequently De Man (1908) synonymised it with *C. nilotica* var. *bengalensis* and listed its differences from the closely allied form *C. nilotica* var. *gracilipes* as under:

Present material encompasses all the ranges mentioned above for the two varieties in

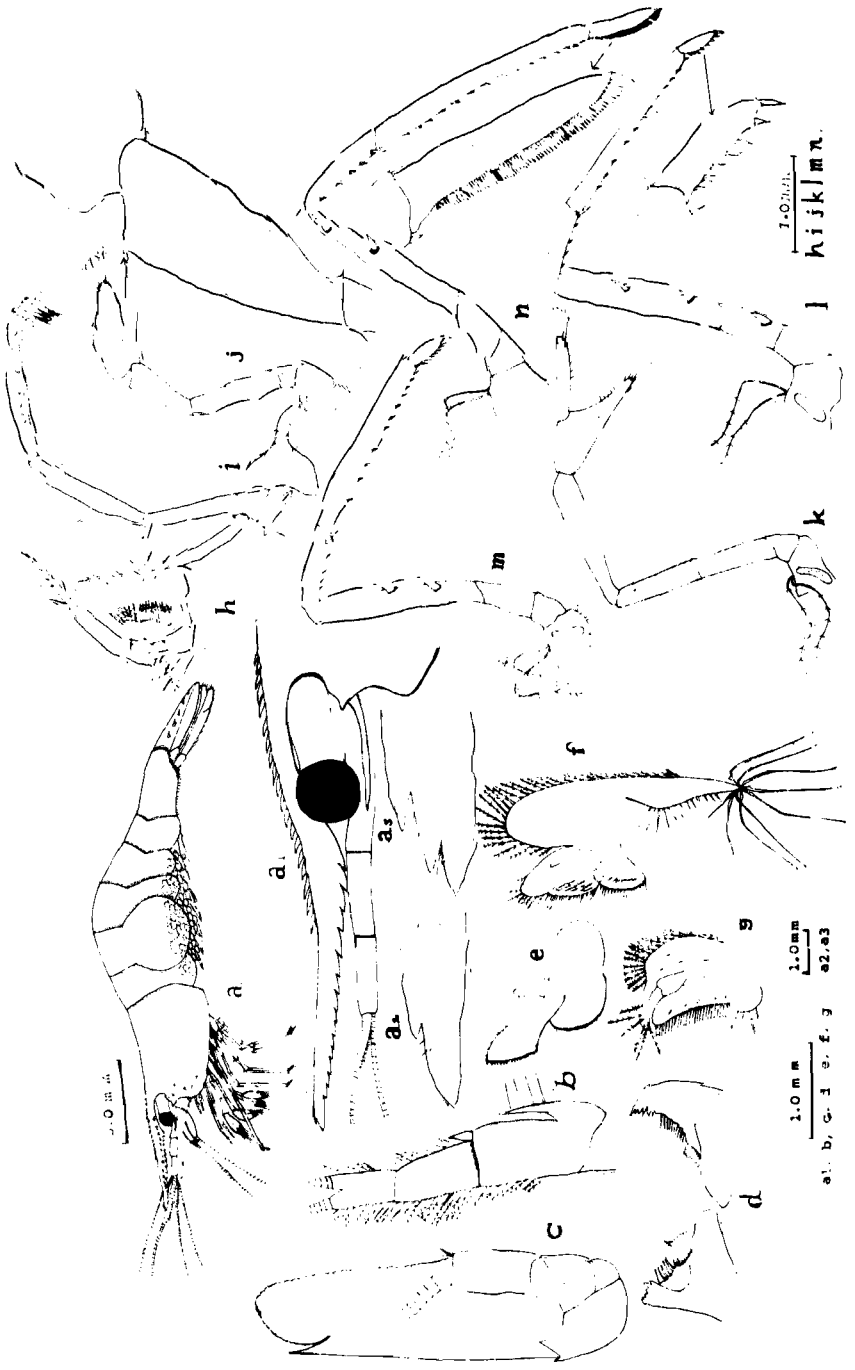

Fig. 3. *Caridina gracilipes* De Man
a. Entire animal (lateral view); a1. Anterior part of specimen; a2, a3. Tip of the rostrum of two different specimens; b. Antennule; c. Antenna; d. Mandibles; e. First maxilla; f. Second maxilla; g. First maxilliped; h. Second maxilliped; i. Third maxilliped; j. First pereiopod; k. Second pereiopod; l. Third pereiopod; m. Fourth pereiopod; n. Fifth pereiopod.

Characters	*C. nilotica* var. *bengalensis*	*C. nilotica* var. *gracilipes*
I. ROSTRUM:		
1. Proximal teeth on upper margin	Mostly 20 to 24	Mostly 12 to 20
2. $\frac{\textit{Armed portion}}{\textit{Unarmed portion}}$	2.0 to 4.50	0.33 to 1.00
3. Subapical teeth	1 to 4 (mostly 1 or 2)	Mostly 1, rarely 2
II. EGGS: 4. Length (mm)	0.42 to 0.49	0.33 to 0.40

possessing following features:

1. Rostral formula: $\frac{12 \textit{ to } 26 + 1 \textit{ to } 4}{11 \textit{ to } 22}$

2. $\frac{\textit{Armed portion of rostrum}}{\textit{Unarmed portion of rostrum}}$: 0.90 to 2.00

3. Egg length (mm): 0.38 to 0.55 mm

It is thus clearly seen that above two varieties merely represent the two extremes of variations exhibited by a single species only. In fact Kemp (1915, 1918), based on his extensive study, stated that separation of the two based only on rostral teeth is untenable and synonymised *bengalensis* with *gracilipes.*

However, Bouvier (1925) once again separated the two on the ground the $\frac{d5}{pr5}$ is less than 0.25 (0.18 to 0.20) in *bengalensis* but more than 0.25 (0.26 to 0.27) in *gracilipes*. This observation apparently is incorrect since based on measurements given for syntype by De Man (1908), these values can be calculated as 0.30 to 0.35 and 0.26 to 0.27 respectively in the two species.

While treating the two as separate forms, Johnson (1963) synonymised Kemp's (1918) *gracilipes* from Shanghai as well as De Man's (1908) and Kemp's (1915) *bengalensis* from India, with the Sri Lankan species *C. simoni* but De Man's (1892 & 1908) original *gracilipes* from Celebes with *C. wyckii.*

However, Ravindranath (1977), rightly pointing out that *bengalensis* can be easily separated from *simoni* in possessing at least one subapical dorsal rostral tooth as against none in the latter species, raised *bengalensis* to species level. Apparently he had failed to appreciate: (1) similarities between *bengalensis* and *gracilipes,* (2) that *wyckii* is distinct from *gracilipes* in possessing only 2 or 3 pairs of dorsal spines on telson and longer dactylus of walking legs. Therefore, the name *gracilipes* gains priority over *bengalensis* as pointed out by Kemp (1915,1918).

Also, it was interesting to find out that in spite of being very similar to the present material, Ravindranath's (1977) Andhra Pradesh specimens are apparently unique in possessing 'blunt' preanal carina. However, personal examination revealed that all the specimens in the syntype series of *Caridina nilotica* var. *bengalensis* possess well developed sharp spine. Thus, Ravindranath's (1977) Andhra Pradesh material differs from Madras material and type material in possessing a blunt preanal carina.

However, it was also observed that all the male specimens in the syntype series lacked appendix interna on first pleopod. This may be

entirely due to their small size (16 to 20 mm only). Nevertheless, it would be worthwhile to study this appendage in the type material of *C. gracilipes* also.

3. **Caridina kunnathurensis** sp. nov.
(Figs. 4-5)

Material Examined: 100 specimens collected from January 1979 to January 1982 in the following localities - Kunnathur pond, Reservoir and FRS nursery ponds at Chembarambakkam: 20 males (15 to 22 mm), 30 non-berried females (20 to 27 mm) and 50 berried females (20 to 30 mm).

Holotype: 1 adult male (19 mm) deposited at NMC (Reg. No. NMC - C 1983 - 447).

Paratypes: 3 males, 5 non-berried females, 9 berried females and 6 juveniles deposited at RMNH (Reg. No. Crust. D. 35564).

Type Locality: Kunnathur pond, Madras, India.

Description: Rostrum equal to or slightly longer than antennal scale. Rostral formula $\frac{(3\ to\ 5)\ 17\ to\ 32}{7\ to\ 14}$ mostly $\frac{(4)\ 20\ to\ 26}{7\ to\ 11}$, dorsal margin of rostrum with a distal gap generally interrupted by 0 to 5 teeth, ventral teeth compactly arranged except distal 1/3rd portion. Carapace without pterygostomial spine but antennal spine distinct and with a small orbital expansion, cornea rounded and well pigmented.

Antennular carina not pronounced; stylocerite slender and reaching 2/3rd of basal segment; antero-lateral tooth reaching basal 1/3rd of second segment; aesthetasc bearing segments 18 to 20 in females and 28 to 33 in males. Antennal scale about 3.5 times as long as broad.

Mouth parts normal, as in figure. Third maxilliped extending up to 2nd segment of antennular peduncle.

First chelipeds extending up to base of antennular peduncle; carpus slightly excavated anteriorly. Second chelipeds extending up to base of antennular peduncle; carpus slender and without anterior excavation. Third pereiopod extending up to second segment of antennular peduncle; dectylus with 8 to 10 (mostly 9 or 10) spines: merus about 1.80 times carpus and bearing 4 or 5 stout spines along its inner margin. Fourth pereiopod similar to third but comparatively slender. Fifth pereiopod extending up to second segment of antennular peduncle; dactylus with 38 to 53 comb-like spinules; merus about 1.5 times carpus and bearing 2 to 4 spines; ischium without any spine.

One or two setobranchs on all five pereiopods while each of first to fourth pereiopods with an epipod.

Abdomen with a characteristic hump on 3rd segment. Endopod of first pleopod of female 0.65 to 0.70 times exopod and without appendix interna while that of male 0.30 to 0.40 times exopod; 2.40 to 2.60 times as long as broad with a distinct appendix interna. Appendix masculina about 0.35 times endopod and 1.20 to 1.40 times appendix interna.

Preanal carina smoothly curved and without any spine but only with a few setae.

Telson with 5 or 6 pairs of dorsal spines and bearing 4 or 5 (mostly 5) pairs of almost same sized plumose processes posteriorly. Uropod diaeresis with 10 to 13 (mostly 11 to 13) spinules.

Eggs and Development: Eggs yellowish, fairly large (0.45 to 0.60 × 0.70 to 1.00 mm) and less in number (40 to 150). Development partially abbreviated with only 3 larval stages before postlarva.

Coloration: Body greenish but lower margin of rostrum, anterior and posterior margins of carapace, junction of abdominal

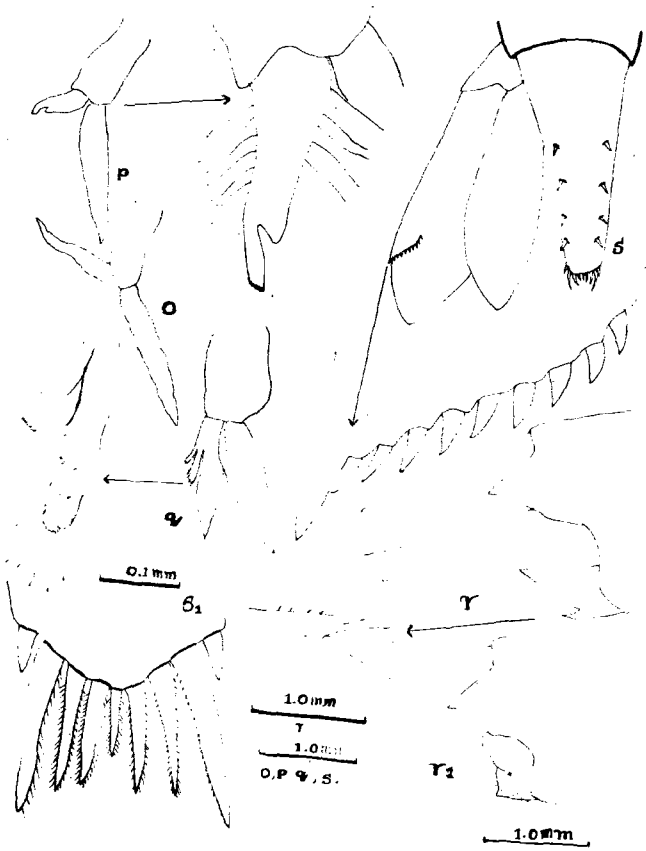

Fig. 3. *Caridina gracilipes* De Man
o. First pleopod of female; p. First pleopod of male; q. Second pleopod of male; r. Preanal carina; r1. Preanal carina (of *C. bengalensis* Andhra Pradesh); s. Telson with uropods; s1. Posterior part of telson.

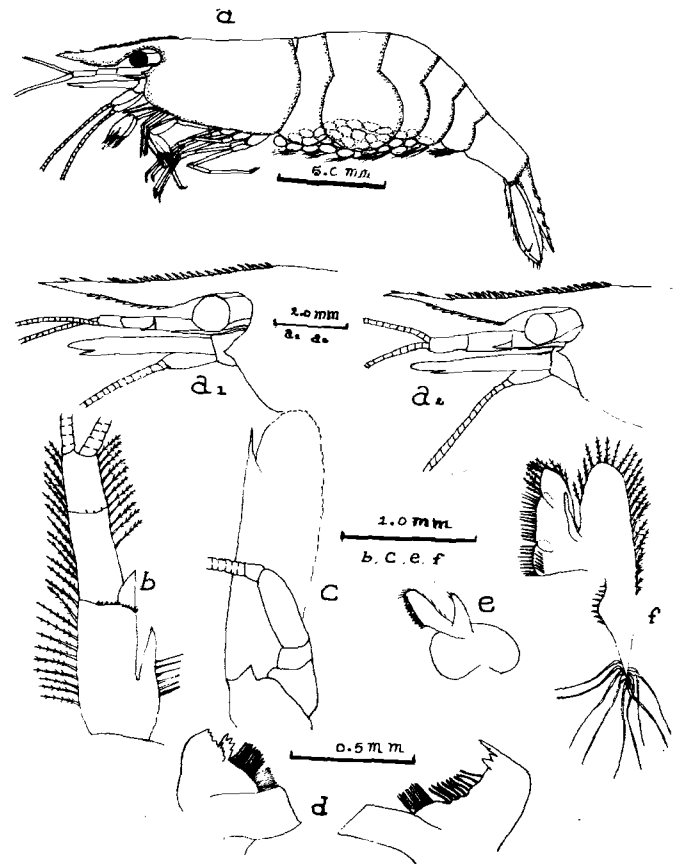

Fig. 4. *Caridina kunnathurensis* sp. nov.
a. Entire animal (lateral view); a1, a2. Anterior part of two different specimens; b. Antennule; c. Antenna; d. Mandibles; e. First maxilla; f. Second maxilla.

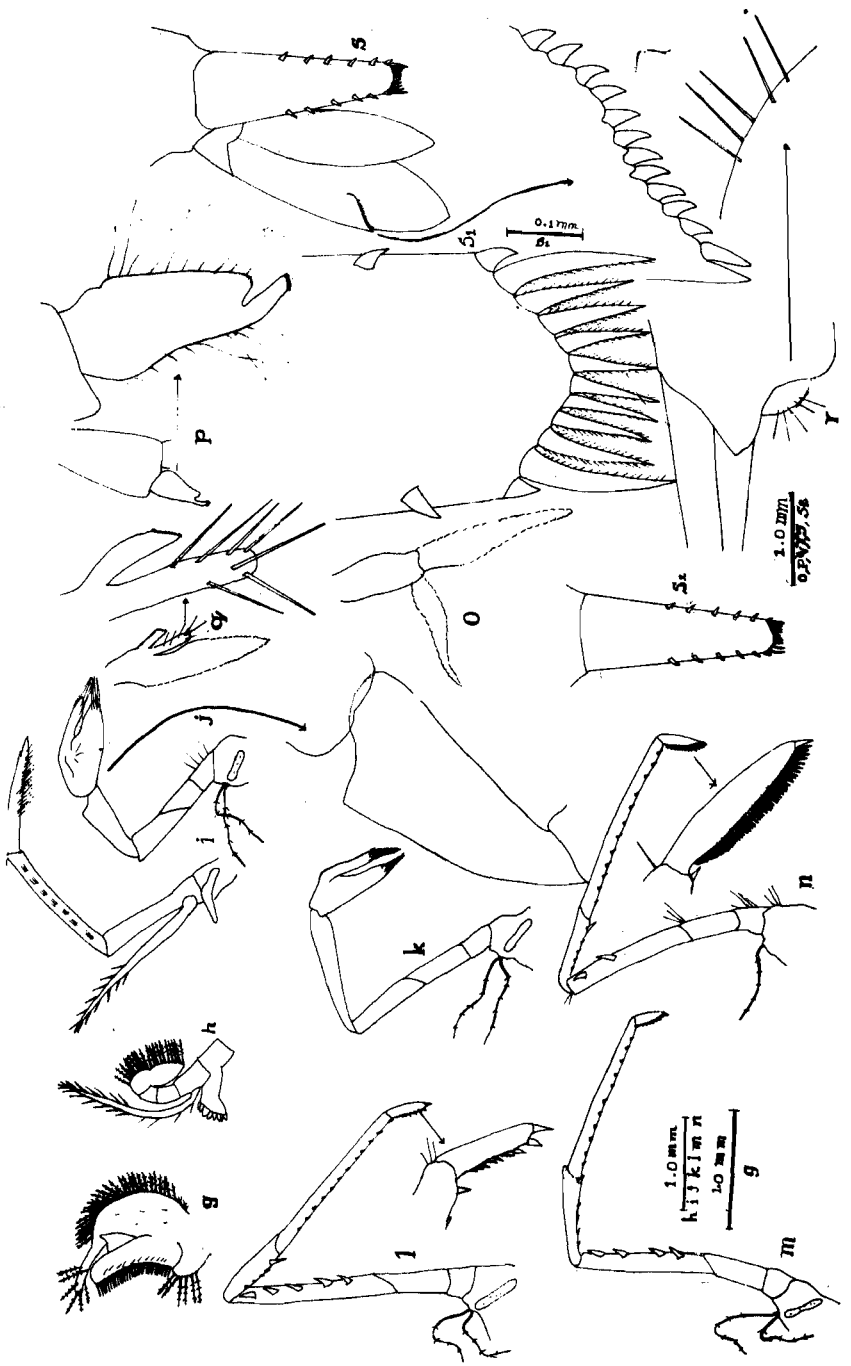

Fig. 4. *Caridina kumathurensis* sp. nov.
g. First maxilliped; h. Second maxilliped; i. Third maxilliped; j. First pereiopod; k. Second pereiopod; l. Third pereiopod; m. Fourth pereiopod; n. Fifth pereiopod; o. First pleopod of female; p. First pleopod of male; q. Second pleopod of male; r. Preanal carina; s. Telson with uropod; s1. Posterior part of telson; s2. Telson.

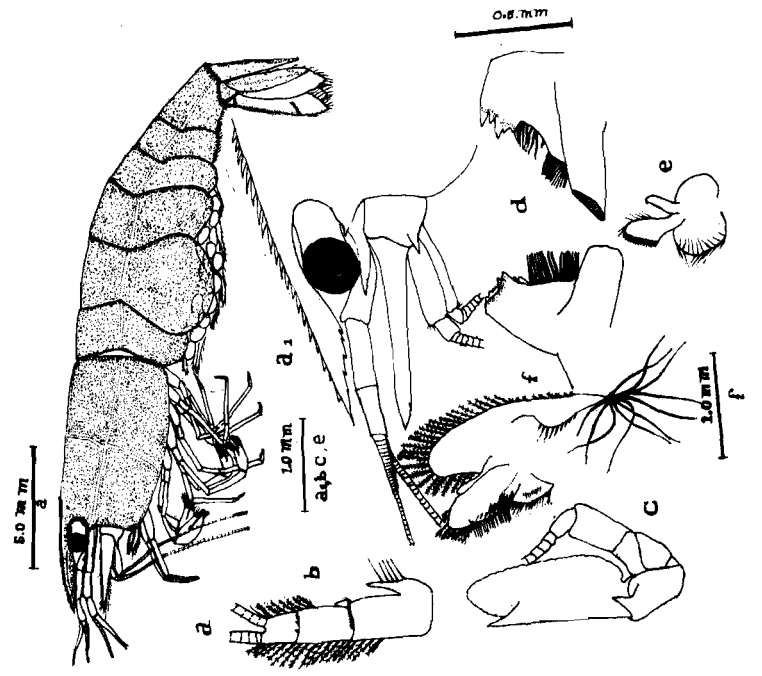

Fig. 6. *Caridina gurneyi* Jalihal *et al.*
a. Entire animal (Lateral view); a1. Anterior part of animal; b. Antennule; c. Antenna; d. Mandible; e. First maxilla; f. Second maxilla; C. First pleopod.

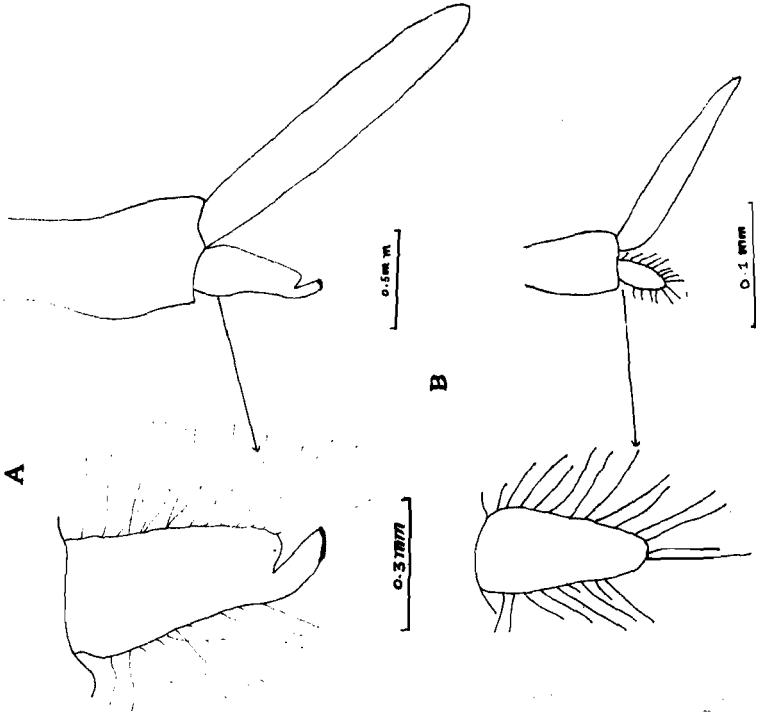

Fig. 5. Comparison of the first pleopod of *C. kunnathurensis* and *C. n. macrophora* male.
First pleopod of: A. *C. kunnathurensis*; B. *C. n. macrophora*.

pleura and base of telson with orange-red coloration.

Remarks: Among the so far known species of *Caridina*, the new species closely resembles *C. nilotica macrophora* described by Kemp (1918) from Lake Tale Sap, Siam (presently Thailand) in (i) general shape of body, (ii) shape of rostrum and arrangement of teeth and (iii) large size of eggs (0.45 to 0.60 × 0.70 to 1.00 mm) in *kunnathurensis* and 0.52 to 0.58 × 0.90 to 0.96 mm in *macrophora*.

However, examination of syntype material of *macrophora* (ZSI Reg. No. 9665/10 - collected in and near the mouth of Patalung river, Tale Sap) revealed the total absence, in that species of appendix interna on first pleopod of males. It also differs from the present new species in the following features:

Range of dorsal teeth	13 to 16	17 to 20	21 to 32
Percentage frequency in *kunnathurensis*	0	20	80
Percentage frequency in *macrophora*	72	28	0

Further, the number of post-orbital teeth is 3 to 5 (mostly 4) in *kunnathurensis* as against only 1 to 3 (mostly 2) of *macrophora*.

Species	No. of examples	Dorsal / Upper Margin				Ventral / Lower Margin			
		Range	Mean	S.E.	S.D.	Range	Mean	S.E.	S.D.
kunnathurensis	100	17-32	22.74	±0.14	1.40	7-14	9.65	±0.17	1.70
macrophora	50	13-20	15.58	±0.13	1.30	6-12	8.60	±0.10	1.00

Rostral formula: Number of dorsal teeth in *macrophora* is lesser (13 to 20, mostly 13 to 16, average : 15.58) than in *kunnathurensis* (17 to 32, most 20 to 26, average 22.74). The break-up percentage frequency distribution of dorsal teeth in the two species into 3 groups is given below:

It is clearly seen that less number of teeth (i.e. 13 to 16) are overwhelmingly frequent in *macrophora* while larger number of teeth (i.e. 21 to 32) are predominant in *kunnathurensis*. Although a similar tendency is exhibited by the ventral teeth also, it is not that well marked. The range, mean, standard deviation (S.D.) and standard error (S.E.) of mean of upper and lower teeth in both the species are as under:

Second chelipeds: Carpus of second chelipeds is comparatively stouter in *kunnathurensis* (4.60 to 5.10 times as long as broad) than in *macrophora* (5.50 to 7.00 times as long as broad).

Telson: Dorsal margin in *kunnathurensis* bears 5 or mostly 6 pairs of spines while in *macrophora* only 3 pairs of spines are present.

Uropod Diaeresis Spinules: *C. kunnathurensis* bears 10 to 13 (mostly 11 to 13) spinules while *macrophora* bears only 5 to 7 spinules.

Etymology: The new species is named after the village Kunnathur (25 km away from Madras), where it is available in plenty.

4. **Caridina gurneyi** Jalihal *et al.*, 1984 (Fig. 6)

Caridina gurneyi Jalihal *et al.*, 1984, *Rec. Zool. Surv. India.* Occ. paper No. 69: 29.

Material Examined: 65 specimens collected from January 1979 to January 1982 in the ponds of Kunnathur and My Lady's Garden - 10 males (19 to 23 mm), 25 non-berried females (21 to 24 mm) and 30 berried females (24 to 30 mm).

Description: Rostrum gradually sloping anteriorly and falling just short of tip of antennular peduncle. Rostral formula $\frac{(3\ to\ 6)\ 14\ to\ 27}{3\ to\ 7}$, post-orbitals mostly 5 or 6; teeth arranged equidistantly up to tip without any gap. Carapace without pterygostomial spine but antennal spine distinct with a small orbital expansion. Cornea rounded and well pigmented.

Antennular carina prominent; stylocerite reaching 3/4th of basal segment; antero-lateral tooth blunt and reaching barely 1/4th of middle segment. Aesthetasc bearing segments 24 to 30 in females and 31 to 46 in males. Antennal scale about 2.5 times as long as broad.

Mouth parts normal; mandibles asymmetrical and without palp. Third maxilliped extending up to tip of antennular peduncle.

First chelipeds extending up to base of antennular peduncle; carpus with a deep anterior excavation. Second chelipeds slender and extending up to antennular peduncle; carpus slender, without anterior excavation. Third pereiopod extending up to tip of antennular peduncle; dactylus with 8 to 10 (mostly 9 to 10) spines; carpus with 1 and merus with 4 stout spines along inner margin. Fourth pereiopod almost similar to third. Fifth pereiopod extending up to base of antennular peduncle; dactylus with 36 to 48 comb-like spinules; merus with 2 large inner spines while ischium without any spines.

All five pereiopods with 3 (occasionally 4) setobranchs each, first four also with an epipod each.

Abdomen rather stout and without a dorsal hump. Endopod of first pleopod of female nearly as long as exopod; that of male about 0.35 times exopod and with a distinct appendix interna. Appendix masculina 0.40 to 0.50 times endopod and 1.60 to 1.80 times as long as appendix interna.

Preanal carina produced into a blunt posterior projection and with a few setae.

Telson 1.10 to 1.20 times as long as sixth abdominal segment and with 4 to 6 (mostly 4 or 5) pairs of dorsal spines; posterior margin almost rounded with 4 or 5 dorsal setae and 4 to 6 (mostly 4 or 5) pairs of plumose processes, outermost pair being totally smooth along outer margin and only sparsely plumose along inner margin; Uropod diaeresis with 15 to 19 (mostly 18 or 19) spinules.

Eggs and Development: Eggs dark brownish, considerably large, measuring 0.51 to 0.59 × 0.81 to 1.00 mm. Fecundity 50 to 105. Development partially abbreviated with 3 larval stages before postlarva.

Coloration: Pitch black in colour with a whitish brown mid-dorsal longitudinal band extending from base of rostrum to base of telson. Each abdominal segment with diffused white transverse bands.

Remarks: The present material agrees well with *Caridina gurneyi* described from Western Ghats in north Karnataka (Jalihal 1978 & Jalihal *et al.* 1984). However, following differences have been noticed in the adults and larvae:

The above differences are quite sufficient to merit a new nomenclature to the present material. However, taking into consideration our rather inadequate knowledge of this highly variable group, especially of those belonging to

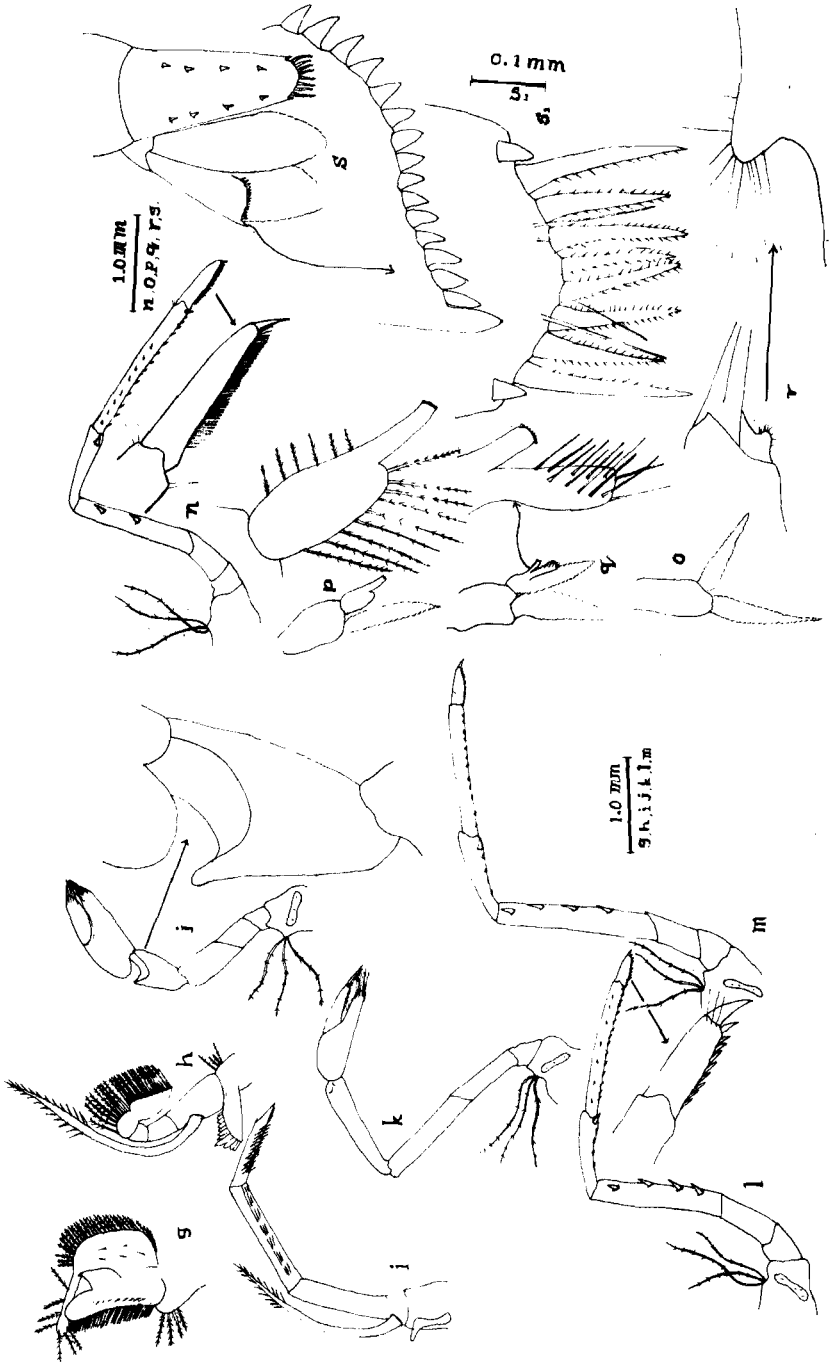

Fig. 6. *Caridina gurneyi* Jalihal *et al.*

f. Second maxilla; g. First maxilliped; h. Second maxilliped; i. Third maxilliped; j. First pereiopod; k. Second pereiopod; l. Third pereiopod; m. Fourth pereiopod; n. Fifth pereiopod; o. First pleopod of *female*; p. First pleopod of male; q. Second pleopod of male; r. Preanal carina; s. Telson with uropod; s1. Posterior part of telson.

Characters	Western Ghats Specimens (Jalihal 1978 and Jalihal *et al.* 1984)	Present Material
I. ADULTS:		
1. Extension of rostrum	Longer; being equal to antennular peduncle.	Shorter, failing to reach tip of antennular peduncle.
2. Dactylus of third pereiopod	With 5 to 8 (mostly 6 or 7) spines.	With 8 to 10 (mostly 9 or 10) spines.
II. LARVAE:		
A) FIRST ZOAEA:		
3. Extension of rostrum	Longer, extending beyond sessile eyes.	Shorter, failing to extend beyond sessile eyes.
4. No. of aesthetascs	2	3
5. Spine at base of antennal flagellum	Smooth.	Serrated.
6. Endopod of second maxilla	Longer than scaphognathite.	Shorter than scaphognathite.
7. First two pereiopods	Exhibits chelate nature.	Do not show chelate nature.
8. Pleopod buds	Biramous.	Uniramous.
B) SECOND ZOAEA:		
9. Antennal scale	With an outer spine.	Outer spine absent.

the '*Caridina weberi sumatrensis*' complex, like the present one, it is decided to designate the material to *C. gurneyi* until more detailed studies are undertaken.

KEY TO SPECIES OF THE GENUS *Caridina* H. MILNE-EDWARDS, 1937, IN AND AROUND MADRAS

1. Abdomen stout and without any dorsal hump. Rostrum shorter than antennal scale; upper margin completely armed without any distal gap. Carpus of first cheliped with a deep anterior excavation. Setobranchs on pereiopods always 3 in number. Uropod diaeresis spinules always more than 14. Eggs large being 0.51 to 0.81 × 0.81 to 1.00 mm and 50 to 105 in number. Larval development partially abbreviated comprising 3 zoaeal stages .... *C. gurneyi* Jalihal *et al.* 1984

- Abdomen slender and with a dorsal hump. Rostrum equal to or longer than antennal scale; upper margin with a distinct distal gap. Carpus of first cheliped with a very feeble anterior excavation. Setobranchs on pereiopods not more than 2 in number. Uropod diaeresis spinules always less than 14 2

2. Rostrum slender and distinctly longer than scale; upper margin with always less than 12 teeth and with an uninterrupted distal gap; lower margin with always more than 20 teeth. Carpus of first cheliped stouter, being always less than twice as long as broad Posterior margin of telson usually with 6 spine - like (non - plumose) processes. First pleopod of male without appendix interna. (Eggs small, being 0.26 to 0.37 × 0.47 to 0.58 mm and 150 to 750 in number. Larval development prolonged, comprising 6 zoaeal stages) ..... *C. gracilirostris* De Man, 1892

- Rostrum stouter and subequal to antennal scale; upper margin always with more than 12 teeth and distal gap may be interrupted by 1 to 5 teeth; lower margin always with less than 20 teeth. Carpus of first cheliped comparatively slender, being always more than twice as long as broad. Posterior margin of telson always with more than 6 setae like (plumose) processes. First pleopod of male with a well developed appendix interna 3

3. Distal gap of rostrum rarely interrupted by 1 or 2 teeth; post-orbitals 1 or 2; teeth on lower margin arranged up to tip; Preanal carina with a distinct posteriorly directed spine. (Eggs small 0.24 to 0.38 × 0.38 to 0.55 mm and more 250 to 850 in number. Larval development prolonged with 7 zoaeal stages) ..... *C. gracilipes* De Man, 1892

- Distal gap of rostrum almost always interrupted by 1 to 5 teeth; post-orbitals 3 to 5; distal 1/3rd of lower margin always unarmed. Preanal carina blunt, without any spine. Eggs large 0.45 to 0.60 × 0.70 to 1.00 mm and less 40 to 150 in number. Larval development partially abbreviated. Consisting of 3 zoaeal stages ..... *C. kumathurensis* sp. nov.

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