

**DESCRIPTIONS OF TEN NEW SPECIES OF FRESHWATER CRABS
(CRUSTACEA: BRACHYURA: PARATHELPHUSIDAE:
CEYLONTHELPHUSA, MAHATHA, PERBRINCKIA) FROM SRI LANKA**

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ABSTRACT. – Ten new species of freshwater crabs are described from Sri Lanka: *Ceylonthelphusa alpina*, *C. durrelli*, *C. diva*, *C. savitriae*, *Mahatha helaya*, *M. lacuna*, *M. regina*, *Perbrinckia fenestra*, *P. gabadagei* and *P. rosae*. *Ceylonthelphusa scansor* Ng, 1995, is transferred to the genus *Perbrinckia* Bott, 1969. With the present additions to the fauna, 45 freshwater crab species of parathelphusid crabs are now recognized from the island, all of them endemic.

KEY WORDS. - Sri Lanka, Crustacea, Brachyura, freshwater crabs, new species, taxonomy.

INTRODUCTION

Interest in the taxonomy of freshwater carcinology of the island of Sri Lanka (formerly Ceylon) goes back more than a century, to Kingsley (1880), who described the first two species, both unfortunately from female specimens. Three further species were added by Müller (1887), Zehntner (1894) and Bott (1970a), bringing the total number of freshwater crab species-group taxa recorded from the island to eight by the time of Bott's (1970b) review of this fauna. In 1993, collaborations began between the second author and the Wildlife Heritage Trust of Sri Lanka, aimed at making a more thorough investigation of the crab fauna of Sri Lanka. This led to extensive collections throughout the island, resulting in a series of new discoveries (Ng, 1994, 1995a, b; Bahir, 1998, 1999). Finally, Ng & Tay (2001), having reviewed all extant type material of Sri Lankan parathelphusids, brought the total species-count to 35.

Targeted sampling of habitats, both disturbed and relatively pristine, has continued to lead to the discovery of hitherto undescribed taxa, showing that the island has a remarkably high diversity and richness within this until recently neglected fauna. The restricted range of many of these taxa is cause for concern with regard to their conservation status. Assessment against the IUCN's Red List criteria (IUCN, 2001) shows all but 14 of the

51 species presently recognized (including the ones in the present paper and Bahir & Yeo, 2005: present volume) to be threatened (Bahir et al., 2005) in most cases because of restricted endemism, usually in fragmented habitats that are subject to degradation. Urgent conservation actions based on sound data on the biology of these species are therefore necessary, for which the first step is the formal description of the fauna so as to make names available. On-going survey activity will undoubtedly serve to uncover even more species from poorly-sampled parts of Sri Lanka. Available population and distribution data, however, taken together with the fact that ~95% of Sri Lanka's rainforests (the primary habitat of many freshwater crab species) have been lost, suggest widespread extinctions must certainly have occurred already. It is intended, once the richness and diversity of this fauna is better understood, to publish a comprehensive guide, together with keys enabling field identification of the taxa, as an aid to conservation.

The endemic Sri Lankan freshwater crab genera *Ceylonthelphusa* Bott, 1969; *Mahatha* Ng & Tay, 2001; and *Perbrinckia* Bott, 1969, are currently represented by 13, 3 and 11 species, respectively (Ng & Tay, 2001). In the present study four new species of *Ceylonthelphusa*, three *Mahatha* and three *Perbrinckia* are added, bringing the island's carcinofauna to 51 species, together with the six new *Oziothelphusa* species described by Bahir & Yeo, 2005.

MATERIAL AND METHODS

Methods of measurements and anatomical terminology follow Ng (1988) and Ng & Tay (2001). Specimen size refers to carapace width and length respectively, in millimetres. The male first and second pleopods are referred to as G1 and G2 respectively. Ambulatory legs are measured from the proximal edge of merus to the distal end of dactylus, from the dorsal aspect. Anatomical characters used here are illustrated in Ng & Tay (2001: figs. 1–8). The specimens referred in this paper, all from Sri Lanka, are deposited in the following repositories: Academy of Natural Sciences Philadelphia (ANSP); Naturhistorisches Museum Basel (NHMB); Muséum d'Histoire Naturelle, Genève (MHNG); National Museum of Sri Lanka (NMSL); Wildlife Heritage Trust of Sri Lanka, Colombo (WHT); and the Zoological Reference Collection of the Raffles Museum of Biodiversity Research (ZRC), Department of Biological Sciences, National University of Singapore (NUS). A set of voucher specimens has also been deposited in the Department of Wildlife Conservation, Colombo, Sri Lanka (DWC). Altitudes are given in metres above mean sea level. Colour photographs are of living specimens unless otherwise stated. Most of the recent specimens were hand collected by the staff of the Wildlife Heritage Trust of Sri Lanka for the purpose of the present study; they are preserved in 70% alcohol.

TAXONOMIC ACCOUNT

Ceylonthelphusa alpina, new species (Figs. 1–4)

Material examined. – Holotype - male, 20.8 by 15.2 mm, WHT 10916; from under stones in wet soil, Peradeniya University garden, Peradeniya, Kandy District, 07°17'N, 080°35'E, altitude 650 m; coll. M. M. Bahir & M. Meegaskumbura, 7 Oct.2003.

Paratypes - male, 21.3 by 15.8 mm, ZRC 2003.0260; male, 18.8 by 13.9 mm, NMSL (formerly WHT 10199); male, 16.6 by 12.6 mm, WHT 10201; male, 15.5 by 11.7 mm, DWC 1 (formerly WHT 10200); female, 23.8 by 17.3 mm, ZRC 2003.261; female, 15.1 by 12.0 mm, WHT 10198, Gannoruwa Forest Reserve, 07°17'00" N, 080°35'30"E, altitude 620 m coll. M. M. Bahir & M. Meegaskumbura, 29 Jul.1999. Female, 18.6 by 13.8, WHT 10786, Hantane Forest, near Peradeniya, Kandy District, 07°16'00"N, 080°37'30"E, altitude 1000 m, coll. M. M. Bahir & M. Meegaskumbura, 26 Apr.1999.

Diagnosis. – *Ceylonthelphusa alpina* differs from congeners by a combination of following characters: carapace broader than long, surfaces smooth; anterior dorsal surface of carapace convex in frontal and dorsal aspects (Figs. 1A, B, 3A, C); anterolateral border of carapace distinctly convex in frontal and dorsal aspects (Figs. 1A, B, 3A–C); epibranchial tooth poorly visible, blunt, cleft separating it from external orbital tooth; postorbital and epigastric crests smooth, not developed; epigastric area slightly rugose, raised in dorsal and frontal aspects (Figs. 1B, 3A–C); frontal median triangle distinct, cristate, its dorsal margin almost fused with or not fused with lateral margins (Fig. 3E); ischium of third maxilliped

rectangular (length 1.3 times width) (Fig. 3F); inner margin of chelipedal carpus with 1 broad, large tooth and 1 or 2 sub-basal granules (Fig. 3K); suture between thoracic sternites 2 and 3 visible as a deep, broad groove; suture between thoracic sternites 3 and 4 indistinct (Figs. 1C, 3G, H); male abdomen T-shaped, its sixth segment squarish, broader than long, distinctly longer than telson (Figs. 2J, I, 4C); G1 almost straight; terminal segment 0.55–0.66 times length of subterminal segment (Fig. 4L–O); G2 with long distal segment ~0.04 times length of basal segment (Fig. 3P).

Colour. – In life, carapace orangish brown; chelipeds orange (Fig. 2).

Etymology. – The species epithet *alpina* (a feminized adjective derived from 'alpinus', meaning 'of high mountains'), is a reference to the montane habitat of this species.

Remarks. – Although both the G1 and G2 characters of *C. alpina* and *C. armata* (Ng, 1995a) are almost identical (see Figs. 3L–P), their carapace characters are very different. *Ceylonthelphusa alpina* differs from *C. armata* by having a distinctly convex carapace in frontal aspect (Figs. 1B, 3B, C, 4B) (vs. flat or very slightly convex medially); anterolateral margin of carapace distinctly convex in dorsal aspect (Figs. 1A, 3A, 4A) (vs. slightly convex); suture between thoracic sternites 2 and 3 comparatively deep (Figs. 1C, 3G, H) (vs. very shallow); epibranchial tooth poorly developed, blunt, cleft barely visible (Figs. 1A, 3A, 4A) (vs. comparatively well developed, sharp, distinct); comparatively larger size —males

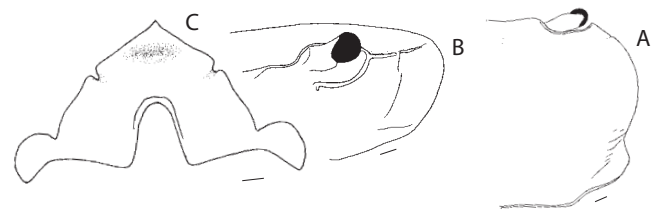


Fig. 1. *Ceylonthelphusa alpina*, holotype male, 20.8 by 15.2 mm, WHT 10916: (A) right dorsal surface of carapace; (B) left frontal surfaces of carapace; (C) anterior part of sternum. Scale bar = 1.0 mm.



Fig. 2. Coloration in life of *Ceylonthelphusa alpina*, holotype male, 20.8 by 15.2 mm, WHT 10916: ventral aspect.

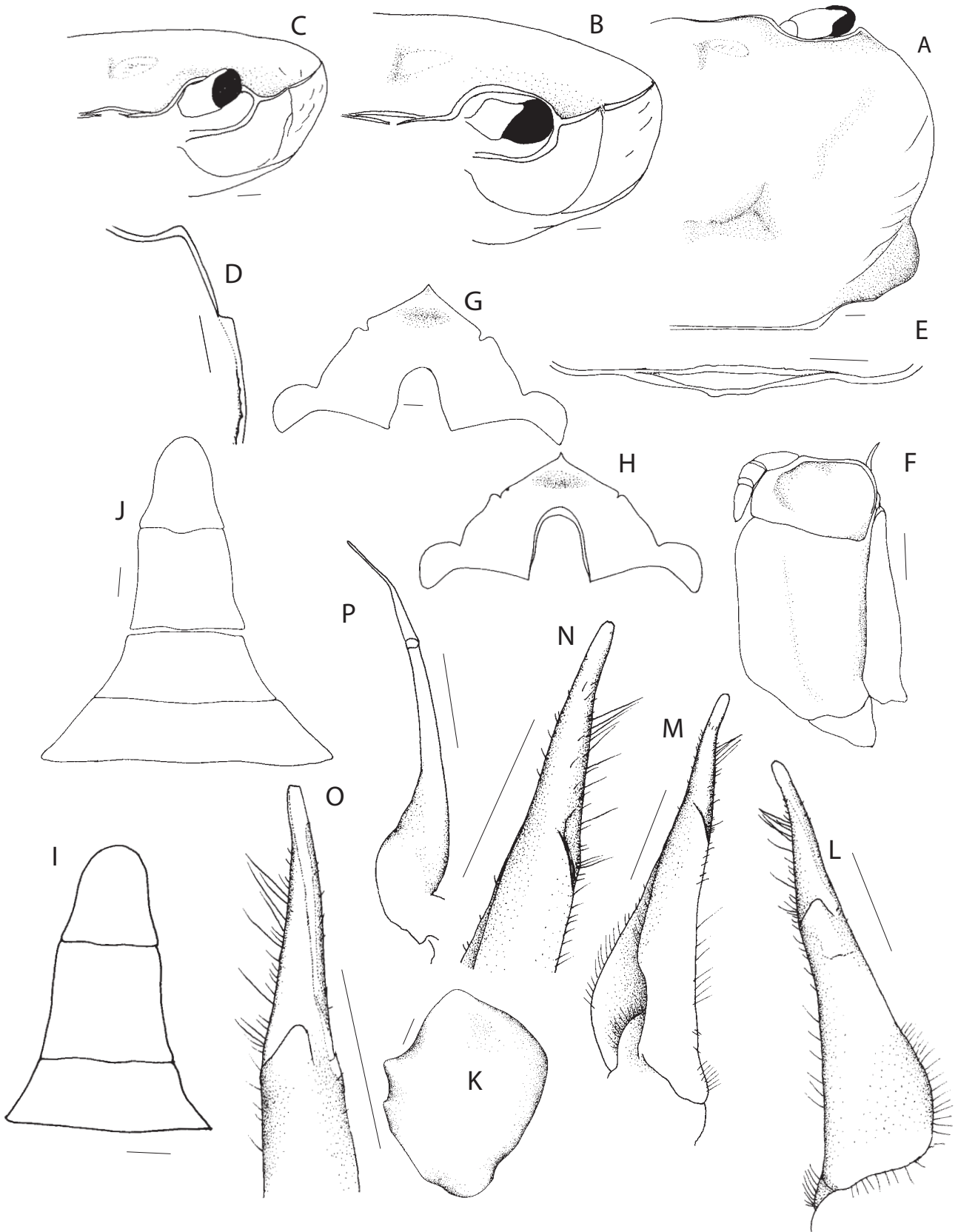


Fig. 3. *Ceylonthelphusa alpina*, paratype male, 21.3 by 15.9 mm, ZRC 2003.260 (except where stated otherwise): (A) right dorsal surface of carapace; (B) left frontal surfaces of carapace; (C) left frontal aspect of paratype male, 18.8, 13.9 by 8.2 mm, WHT 10199; (D) epibranchial tooth of WHT 10199; (E) frontal median triangle; (F) left third maxilliped; (G) anterior part of sternum; (H) anterior part of sternum, paratype male, 15.5, 11.7 by 6.5 mm, WHT 10200; (I) male abdomen of WHT 10200 (J) male abdomen; (K) right chelipedal carpus; (L) left G1 dorsal aspect; (M) left G1 ventral aspect; (N); terminal segment of left G1 ventral aspect; (O) terminal segment of left G1 dorsal aspect; (P) left G2 ventral aspect. Scale bar = 1.0 mm.

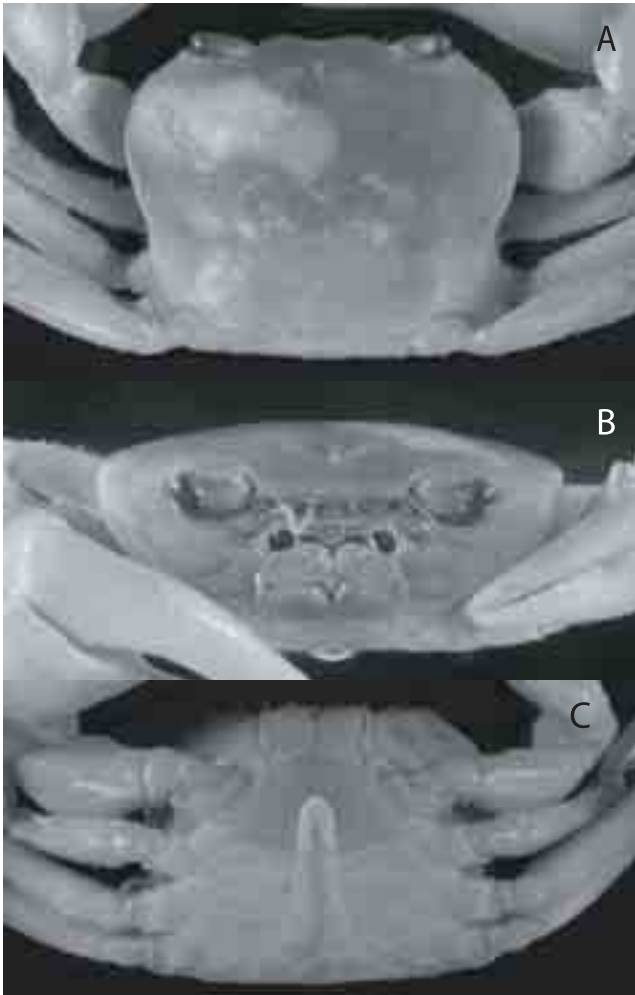


Fig. 4. *Ceylonthelphusa alpina*, paratype male, 21.3 by 15.9 mm, ZRC 2003.0260 (formerly in WHT): (A) dorsal aspect; (B) frontal aspect; (C) ventral aspect.

grow up to 21.3 mm (vs. small, 18.8 mm). The range of *C. alpina* and *C. armata*, although not contiguous, are not widely separated but belong to different river basins (the Mahaveli and Maha-Oya, respectively), the distance between the type localities being about 10 km.

Ecological notes. – *Ceylonthelphusa alpina* was found to occur in wet soil (< 5 cm deep), under rocks on stream margins, and on moist soil adjacent to streams. Most specimens were found on the margins of a slow-flowing stream, in heavy shade, in Gannoruwa Forest. The specimens from Hantane Forest and the Peradeniya University garden were also collected from beside streams (Fig. 5).

Distribution. – *Ceylonthelphusa alpina* was recorded only from three closely-spaced localities, Gannoruwa Forest, Peradeniya and Hantane Forest in the Kandy District of Sri Lanka. As presently understood, its range is ~ 10 km².

***Ceylonthelphusa diva*, new species**
(Figs. 6–9)

Material examined. – Holotype - male, 17.3 by 13.6 mm, ZRC 2003.258, from under stones in wet soil, adjacent to a stream running



Fig. 5. (A) Type locality of *Ceylonthelphusa alpina*: Peradeniya University; (B) microhabitat of *C. alpina*.

through a small marshy area near tea garden, Ranjini Estate, near Gammaduwa, Knuckles mountains, 07°34'36.6"N, 080°41'44.1"E, altitude 755 m, coll. M. M. Bahir, 9 Jan.2001.

Paratypes - Male, 18.4 by 14.4 mm, NMSL (formerly WHT 10466); male, 16.8 by 13.1 mm, WHT 10471; male, 14.5 by 11.3 mm, WHT 10470; male, 14.1 by 11.0 mm, DWC 2 (formerly WHT 10469); female, 19.0 by 14.8 mm, DWC 3 (formerly WHT 10467); male, 17.5 by 13.7 mm, WHT 10465; same collection data as holotype. Male, 18.2 by 14.4 mm, WHT 10435; male, 16.5 by 12.7 mm, WHT 10436; male, 17.3 by 13.1 mm, WHT 10457; male, 14.2 by 11.0 mm, WHT 10458; male, 12.3 by 9.7 mm, WHT 10459; same locality as holotype; coll. M. M. Bahir, 29 Oct.2000. Male 18.7 by 14.3 mm, WHT 10892; Knuckles Mountains, 07°34'36.6"N, 080°41'44.1"E, altitude 950 m; coll. M. M. Bahir & M. Meegaskumbura 19 Oct.2003.

Diagnosis. – *Ceylonthelphusa diva* differs from congeners by a combination of following characters: carapace broader than long, surfaces smooth (Figs. 9A, 6A); carapace convex, dorsal surface of carapace convex in both frontal and dorsal aspects (Figs. 6A,B, 9A,B); lateral border of carapace distinctly convex in frontal aspect (Figs. 6B, 9B); epibranchial tooth poorly to distinctly visible, blunt, cleft separating it from external orbital tooth visible (Fig. 9A); postorbital and epigastric crests slightly rugose, not developed; epigastric area slightly raised in dorsal and frontal aspects (Figs. 9A,B); frontal median triangle distinct, cristate, dorsal margin almost fused to not fused with lateral margins (Fig. 9C); ischium of third maxilliped rectangular (length 1.6 times width) (Fig. 9D); major chela not gaping when fingers closed (Fig. 9H); inner

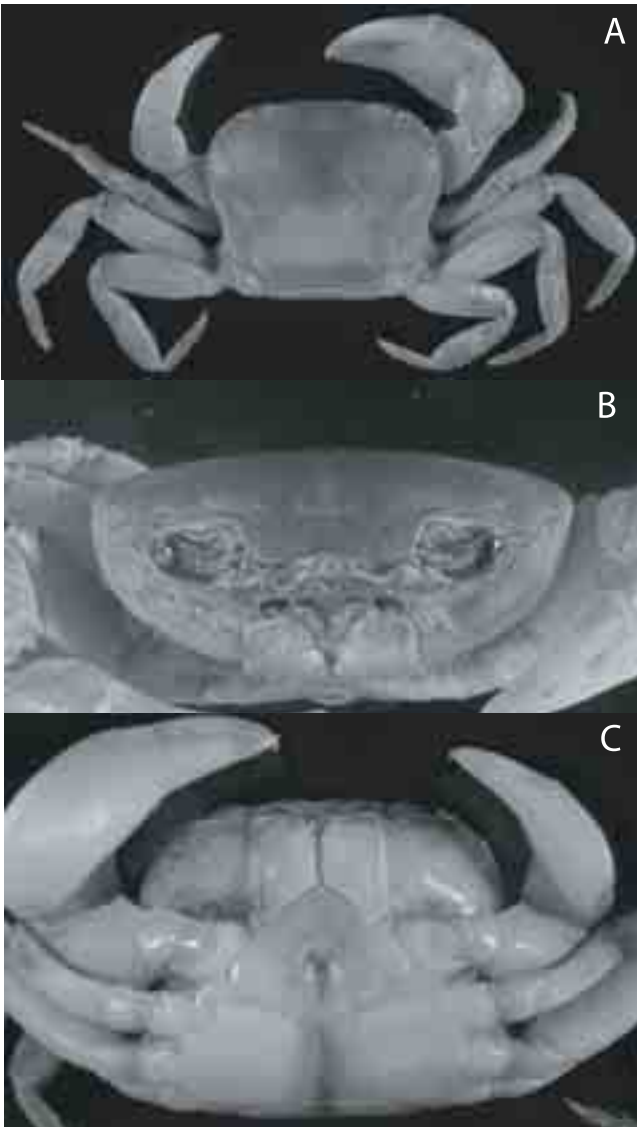


Fig. 6. *Ceylonthelphusa diva*, holotype male, 17.3 by 13.6 mm, ZRC 2003.0258 (formerly WHT 10468): (A) dorsal aspect; (B) frontal aspect; (C) ventral aspect.

margin of chelipedal carpus with 1 broad, large tooth and 1–3 sub-basal granules (Fig. 9G); suture between thoracic sternites 2 and 3, and 3 and 4 indistinct (Fig. 9E); male abdomen T-shaped, its sixth segment squarish, length and width almost equal, distinctly longer than telson (Figs. 9F, 6C); G1 slightly curved outwards from just below juncture between terminal and subterminal segments (Fig. 9I, J); terminal segment 0.55–0.60 times length of subterminal segment (Figs. 9I–K); G2 with long distal segment ~ 0.6 times length of basal segment (Fig. 9L).

Colour. – In life, rusty brown with orange chelipeds (Fig. 7).

Etymology. – The name *diva* means goddess in Latin, an allusion to the beauty of this species; applied here as a noun in apposition.

Remarks. – Although *Ceylonthelphusa diva* resembles *C. alpina* in carapace and gonopod morphology, it differs from



Fig. 7. Coloration in life of *Ceylonthelphusa diva*: (A) dorsal aspect; (B) frontal aspect.



Fig. 8. Habitat of *Ceylonthelphusa diva*, near Midlands Estate in Knuckles mountains.

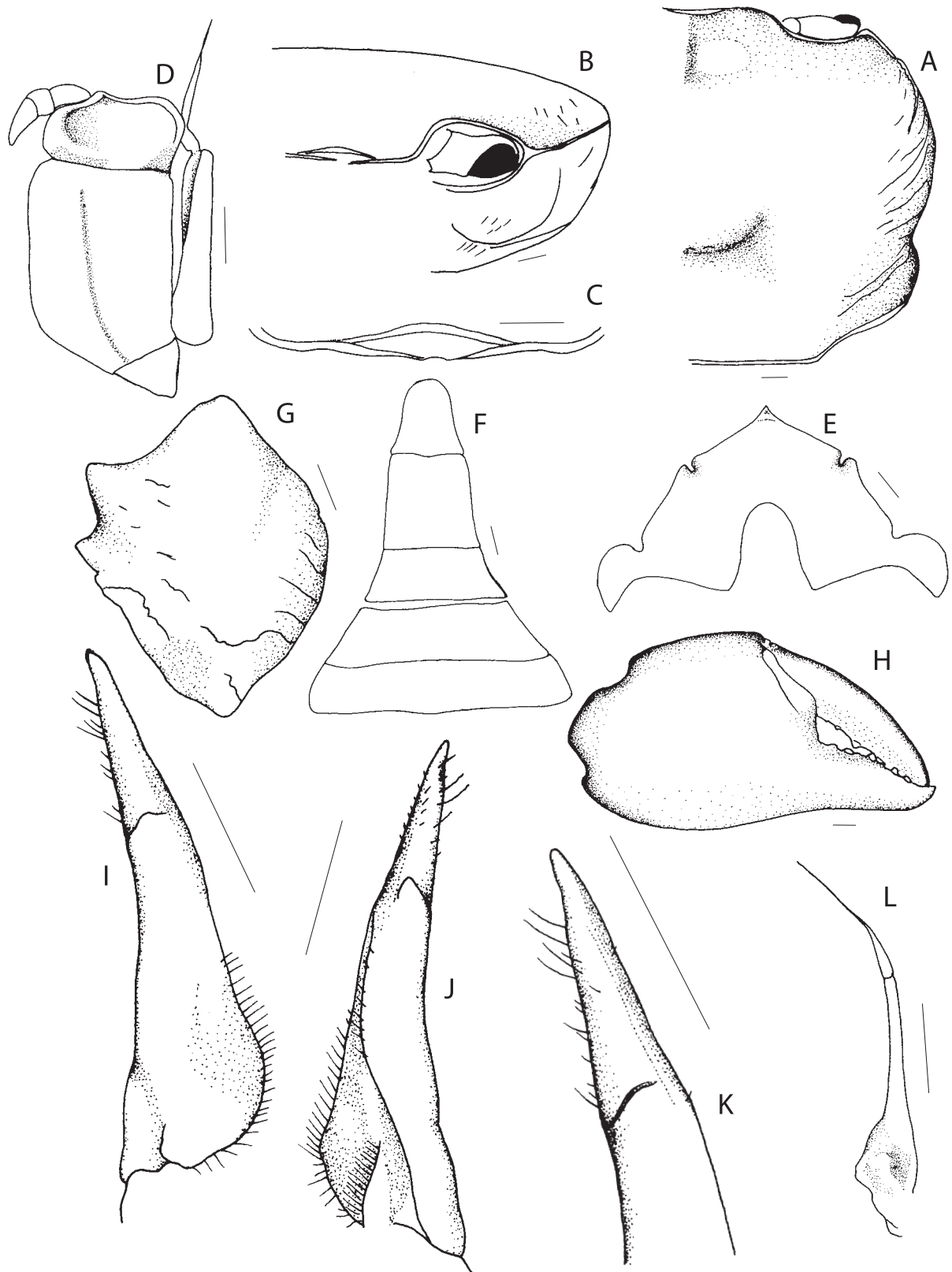


Fig. 9. *Ceylonthelphusa diva*, holotype male, 17.3 by 13.6 mm, ZRC 2003.0258 (formerly WHT 10468): (A) right dorsal surface of carapace; (B) left frontal surfaces of carapace; (C) frontal median triangle; (D) left third maxilliped; (E) anterior part of sternum; (F) male abdomen; (G) right chelipedal carpus; (H) major chela; (I) left G1 dorsal aspect; (J) left G1 ventral aspect; (K) terminal segment of left G1 dorsal aspect; (L) left G2 dorsal aspect. Scale bar = 1.0 mm.

the latter species in the following characters: lateral margins of carapace with more striae (Figs. 9A, 6A) (vs. striae on lateral margin fewer, weaker (Figs. 1A, 3A)); ischium of third maxilliped relatively broader, ~ 1.6 times longer than wide (Fig. 9D) (vs. ischium of third maxilliped narrower ~ 1.3 times longer than wide (Fig. 3F)); suture between male thoracic sternites 2 and 3 not visible (Fig. 9E) (vs. suture between male thoracic sternites 2 and 3 visible (Figs. 1C, 3G, H)); G1 slightly bent (Figs. 9I–K) (vs. straight (Figs. 3L–O)); G1 terminal segment acutely cone-shaped (Fig. 9K) (vs. distal part of G1 terminal segment more slender (Figs. 3N, O)). Furthermore, the two species occur in two well-separated mountain ranges: *C. diva* is known only from the Knuckles mountains, whereas *C. alpina* has been recorded only from the Kandy hills.

Ecological notes. – *Ceylonthelphusa diva* was found to occur in wet soil in small marshy patches, under rocks on stream margins, in wet soil (< 5 cm deep) and adjacent to small streams. Most specimens were found in a small marsh adjacent to a stream (Fig. 8).

Distribution. – *Ceylonthelphusa diva* was recorded only from two localities in the northern part of the Knuckles Mountains: Rangini Estate, near Gammaduwa and near Midlands Estate. As presently understood, its range is ~ 10 km².

***Ceylonthelphusa durrelli*, new species**
(Figs. 10–13)

Material examined. – Holotype - male, 22.6 by 16.6 mm, ZRC 2003.259; from under submersed stones under approx. 10 cm of water in a slow-flowing streamlet at Corbett's Gap, Knuckles mountains, 07°22'N, 080°50'E, altitude 1000 m, coll. M. M. Bahir, M. Meegaskumbura & S. V. Nanayakkara, 28 May 1998.

Paratypes - male, 22.0 by 16.0 mm, NMSL (formerly WHT 10209); male, 18.0 by 13.2 mm, WHT 10213; male, 16.7 by 12.4 mm, WHT 10210; female, 21.2 by 15.5 mm, WHT 10211; immature female, 18.9 by 13.9 mm, WHT 10866; same data as holotype. Male, 21.0 by 15.2 mm, WHT 10862; female, 20.8 by 15.1 mm, DWC 4 (formerly WHT 10863); juv. male, 14.2 by 10.7 mm, DWC 5 (formerly WHT 10864); juv. female, 15.5 by 10.1 mm, WHT 10865, same locality as holotype, coll. M. M. Bahir, 27 May 2003.

Diagnosis. – *Ceylonthelphusa durrelli* differs from congeners by a combination of following characters: carapace broader than long, surfaces smooth (Figs. 10A, 12A); carapace convex, its anterior dorsal surface convex in frontal and dorsal aspects (Figs. 10A, B, 12A, B); anterio-lateral border of carapace distinctly convex in frontal and dorsal aspects (Figs. 12A, B 10A–B); epibranchial tooth poorly visible, blunt, cleft separating it from external orbital tooth indistinct (Fig. 12A); postorbital area and epigastric crests smooth, not developed, slightly raised in dorsal and frontal aspects (Figs. 12A, B, 10A, B); frontal median triangle distinct, cristate, dorsal margin almost fused or not fused with lateral margins (Figs. 12C, 13A, D, G, H); ischium of third maxilliped rectangular (length 1.5 times width) (Fig. 12D); inner margin of chelipedal carpus with 1 low, large tooth and 2–4 sub-basal granules (Fig. 12G); suture between thoracic sternites 2 and 3, and 3 and 4 distinct

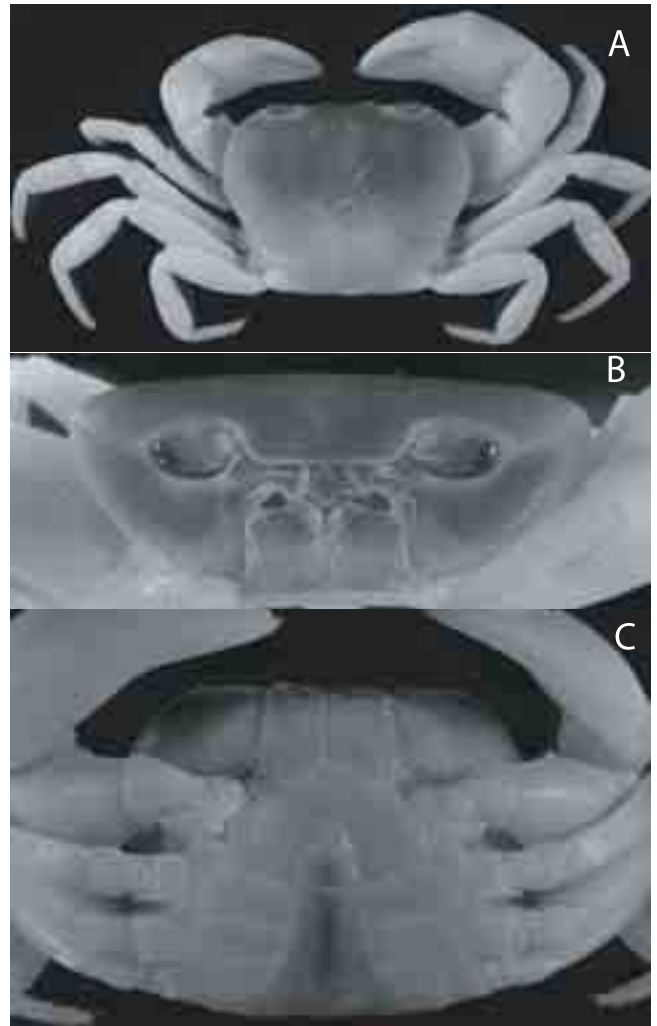


Fig. 10. *Ceylonthelphusa durrelli*, holotype male, 22.6 by 16.6 mm, ZRC 2003.0259: (A) dorsal aspect; (B) frontal aspect; (C) ventral aspect.



Fig. 11. Coloration in life of *Ceylonthelphusa durrelli*, paratype male, 21 by 15.2 mm, WHT 10862: (A) dorsal aspect; (B) frontal aspect.

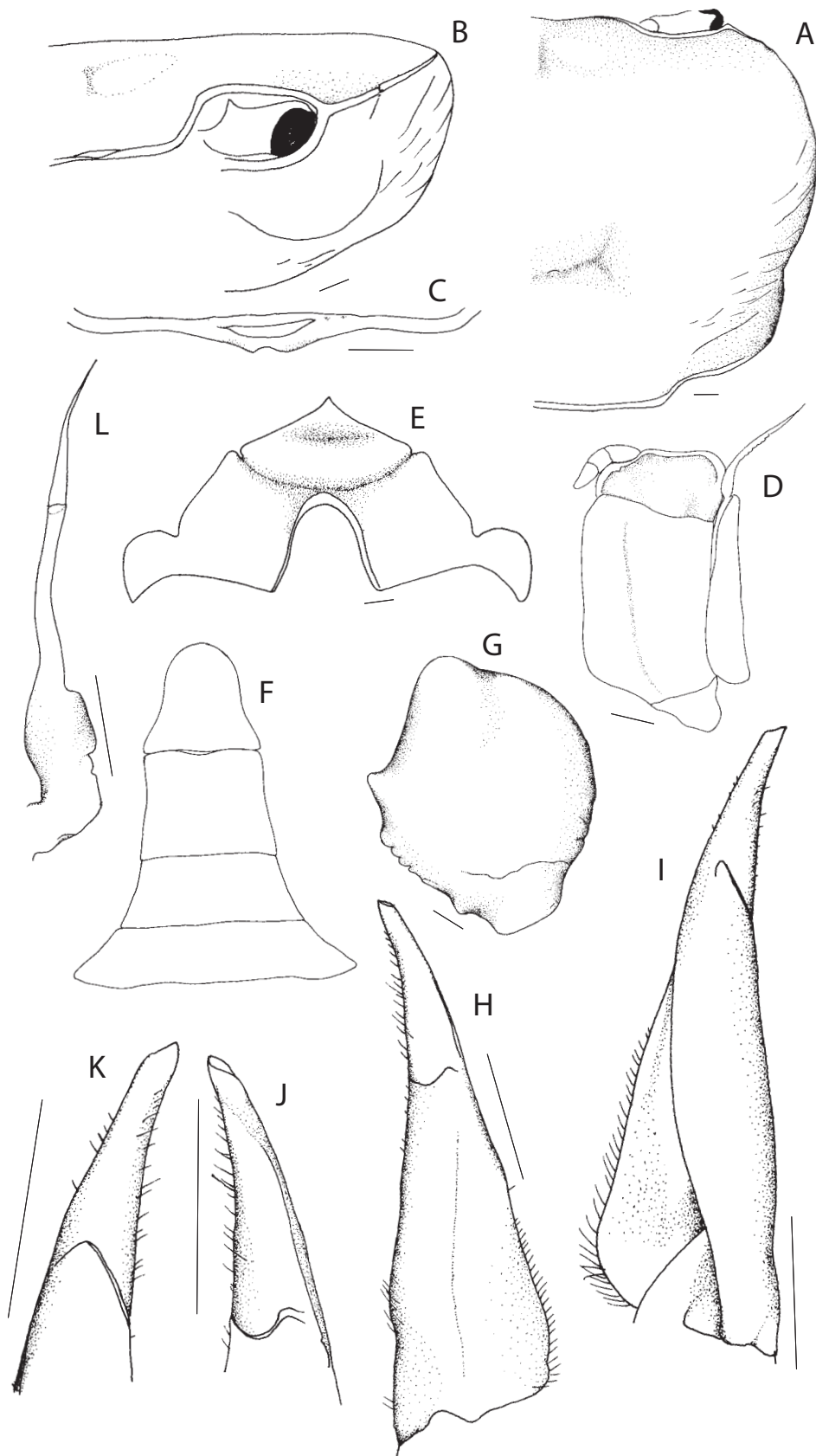


Fig. 12. *Ceylonthelphusa durrelli*, holotype male, 22.7 by 16.6 mm, ZRC 2003.0259 (except where mentioned otherwise): (A) right dorsal surface of carapace; (B) left frontal surfaces of carapace; (C) frontal median triangle; (D) left third maxilliped; (E) anterior part of sternum; (F) male abdomen; (G) right chelipedal carpus; (H) left G1 dorsal aspect; (I) left G1 ventral aspect; (J) terminal segment of left G1 dorsal aspect; (K) terminal segment of left G1 ventral aspect; (L) left G2 ventral aspect. Scale bar = 1.0 mm.

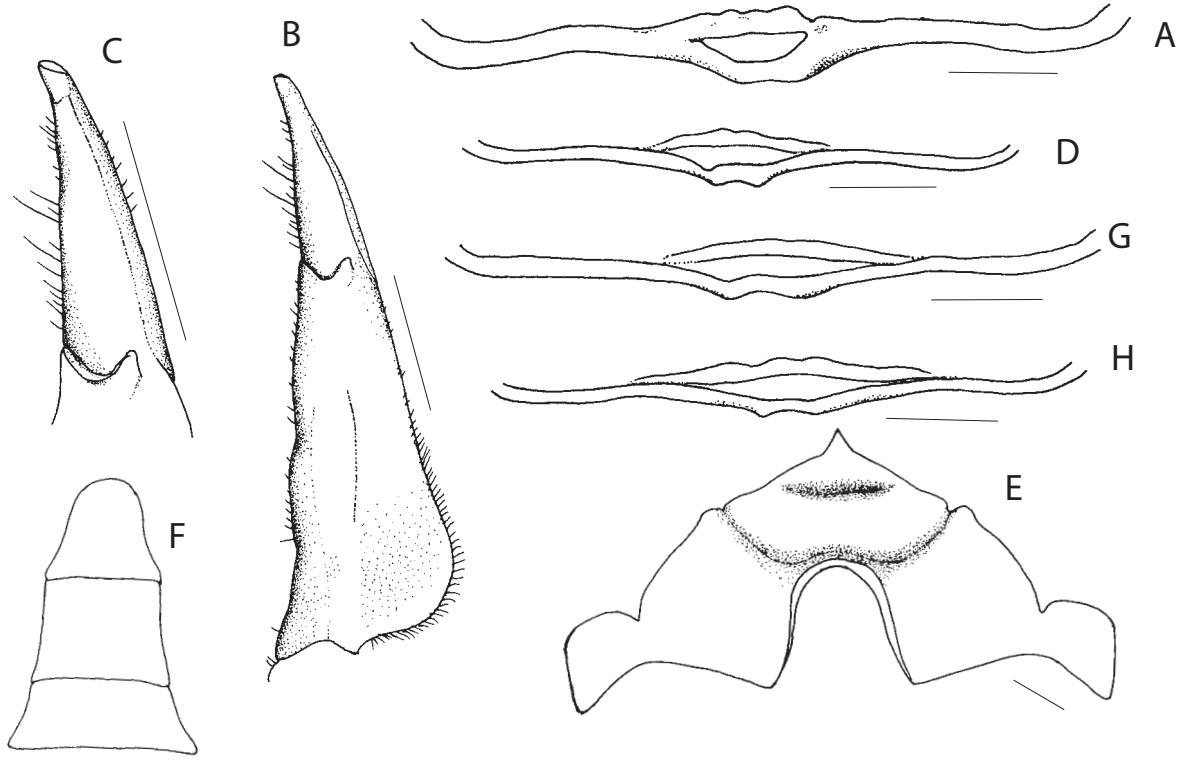


Fig. 13. *Ceylonthelphusa durrelli*, paratype male, 22.1 by 16.0 mm, WHT 10209 (except where mentioned otherwise): (A) frontal median triangle; (B) left G1 dorsal aspect of paratype (C) G1 terminal segment; (D) frontal median triangle of *C. durrelli*, paratype, 16.8 by 12.9 mm, WHT 10210; (E) anterior thoracic sternites of paratype male, 16.7, 12.4 by 6.8 mm, WHT 10210; (F) anterior segments of male abdomen, WHT 10210; (G) frontal median triangle of paratype female, 21.2 by 15.6 mm, WHT 10211; (H) frontal median triangle of paratype male, 18.0 by 13.2 mm, WHT 10213. Scale bar = 1.0 mm.



Fig. 14. (A) Type locality of *Ceylonthelphusa durrelli*, Corbett's Gap, Knuckles mountains; (B) microhabitat of *C. durrelli*.

(Figs. 12E, 13E); male abdomen broadly T-shaped, sixth segment squarish to trapezoidal, wider than long, about same length as telson (Figs. 12F, 13F); G1 curves slightly outwards (Figs. 12H, I, 13B), the terminal segment long 0.5–0.55 times length of subterminal segment (Figs. 12H–K, 13B, C); G2 with long distal segment ~ 0.5 times length of basal segment (Fig. 12L).

Colour. – In life, anterior half of dorsal surface of carapace, suborbital region and third maxilliped merus coffee brown; dactyli of ambulatory leg coffee brown in some specimens, with the rest of body and legs creamy-white (Fig. 11).

Etymology. – The species name is a patronym honouring Gerald Durrell (1925–1995), founder of the Durrell Wildlife Conservation Trust, applied here as a noun in the genitive case.

Remarks. – *Ceylonthelphusa durrelli* resembles *C. sanguinea* (Ng, 1995a) in carapace physiognomy but the G1 of the former species is straighter (Figs. 12H, I, 13B) (vs. slightly but distinctly curved outwards in *C. sanguinea* (see Ng, 1995a: fig. 6A, E)). The species also differ in their living coloration: *C. durrelli* has the carapace coffee brown anteriorly, creamy-white posteriorly with creamy-white chelipeds and ambulatory legs (Fig. 11) (vs. dorsal surfaces of carapace, chelipeds, and legs reddish brown-pinkish brown to almost red in *C. sanguinea* (see Ng, 1995a: fig. 2)).

Ecological notes. – The species was found to occur in very shallow (< 15 cm deep), slow-flowing water in a stream flowing

through montane cloud forest, and under rocks on stream margins, in wet soil adjacent to the stream and among wet leaf litter in and adjacent to water in a cardamom plantation, always in shaded areas.

Distribution. – *Ceylonthelphusa durrelli* was recorded only from the type locality, Corbett's Gap, 07°22'N, 080°50'E, at 1000 m altitude, in the Knuckles range of mountains. As presently understood, its range is ~ 1 km².

***Ceylonthelphusa savitriae*, new species**

(Figs. 15–17)

Material examined. – Holotype - male, 44.8 by 33.9 mm, ZRC 2003.272 (formerly WHT 10829); from under stones in water approx. 10 cm deep in a stream flowing through Morningside Estate, 06°24'N, 080°38'E, altitude 1060 m, coll. S. H. K. Wewelwala and M. M. Bahir, 20 Nov.2002.

Paratypes - male, 42.5 by 31.5 mm WHT 10304; from under stones in water approx. 10 cm deep in a slow-flowing stream at Morningside Estate, 06°24'N, 080°38'E, altitude 1060 m, coll. M. M. Bahir & S. V. Nanayakkara, 12 Jan.1999.

Diagnosis. – *Ceylonthelphusa savitriae* differs from congeners by a combination of the following characters: carapace broader than long, dorsal surface smooth except for postorbital crest, epigastric crest and lateral borders (Figs. 16A, B, 15A, B); dorsal surface of carapace slightly convex in frontal aspect (Figs. 15B, 16B); epibranchial tooth prominent, blunt, cleft separating it from external orbital tooth prominent (Figs. 16A, B, 15A); postorbital crest sharp, strong (Fig. 16A, B); epigastric crests rugose and fused with postorbital crest, epigastric area slightly raised in frontal aspect (15A, B); frontal median triangle distinct, cristate, dorsal margin strongly fused with lateral margins (Fig. 16C); ischium of third maxilliped rectangular (length 1.6 times width) (Fig. 16D); inner margin of chelipedal carpus with major tooth broad, large, with 1 or 2 sub-basal granules, granule on outer margin large, broad, rounded (Fig. 16G, H); suture between thoracic sternites 2 and 3 visible as a very narrow groove, not reaching lateral borders; suture between thoracic sternites 3 and 4 only visible on sides as a series of broad, shallow depressions (Fig. 16E); male abdomen T-shaped, sixth segment squarish, lateral margins straight, slightly longer than broad, longer than telson (Fig. 16F); G1 straight with long terminal segment, gently curving outwards, ~ 0.4 times length of subterminal segment (Fig. 16I–L); G2 with long distal segment ~ 0.6 times length of basal segment (Fig. 16M).

Colour. – In life, reddish-brown (Fig. 17).

Etymology. – The species name *savitriae*, which honours Professor Savitri Gunatilleke, is here applied as a noun in the genitive case, gender feminine; 'savitri' in Sanskrit is also a verse or a prayer addressed to the sun.

Remarks. – Although *Ceylonthelphusa savitriae* resembles *C. rugosa* (Kingsley, 1880) in carapace physiognomy, its G1 morphology is more akin to that of *C. soror* (Zehntner, 1894).

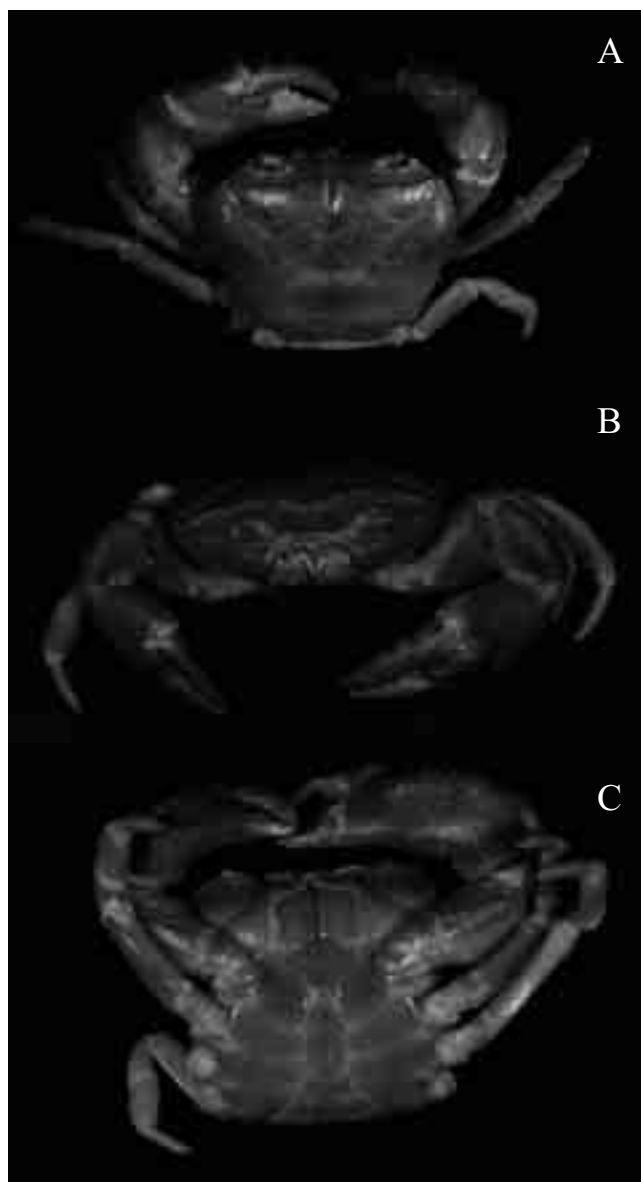


Fig. 15. *Ceylonthelphusa savitriae*, holotype male, 44.8 by 33.9 mm, ZRC 2003.0272 (formerly WHT 10829): (A) dorsal aspect; (B) frontal aspect; (C) ventral aspect.

Although *C. rugosa* is considered to be a highly variable species (Ng & Tay, 2001), *C. savitriae* is clearly distinguishable from *C. rugosa* by having confluent postorbital and epigastric crests (Fig. 16A–B) (vs. separated, see Ng & Tay, 2001: fig. 35A; and even when confluent, both crests are relatively weaker: see Ng & Tay, 2001: fig. 36); outer margin of inner distal tooth of chelipedal carpus with a broad, rounded tooth (Fig. 16G, H) (vs. outer margin distinctly serrated with 1–2 small granules: see Ng & Tay, 2001, Figs. 35E, 38D); male sixth abdominal segment with straight outer margins (Fig. 16F) (vs. outer margins concave: see Ng & Tay, 2001: fig. 35F); the distal end of the G1 subterminal segment is relatively broader (Fig. 16I–J) (vs. comparatively narrower: see Ng & Tay, 2001: fig. 35I); and the G1 terminal segment is gently curved outwards (Fig. 16I–J) (vs. only the tip turned outwards: see Ng & Tay, 2001: fig. 35I). Ng & Tay (2001) discussed the variation of the postorbital and epigastric crest in *C. rugosa*, finding specimens of *C. rugosa* from Walandura, near Kuruwita with confluent postorbital and epigastric crests.

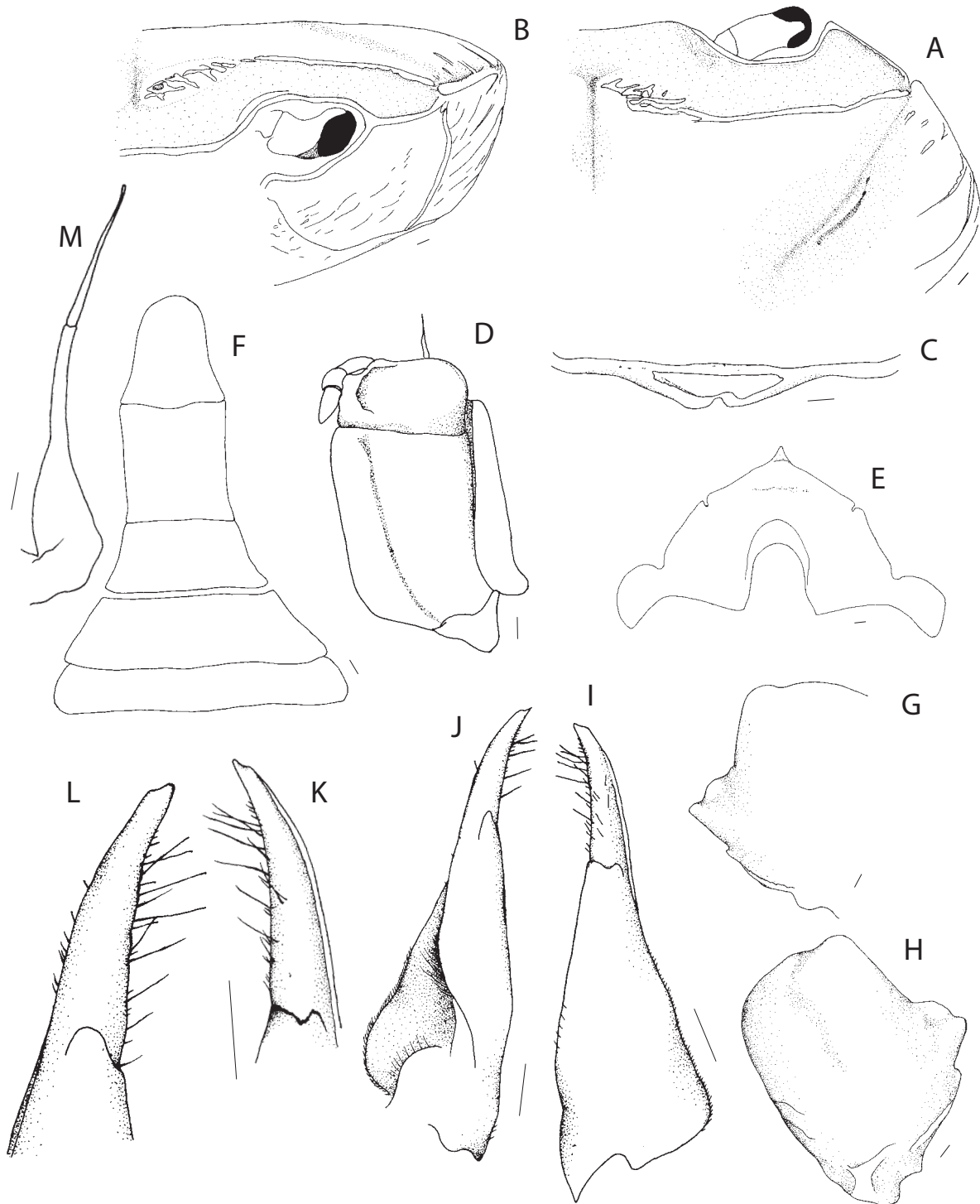


Fig. 16. *Ceylonthelphusa savitriae*, holotype male, 44.8 by 33.9 mm, ZRC 2003.0272 (formerly WHT 10829); (A) right dorsal surface of carapace; (B) left frontal surfaces of carapace; (C) frontal median triangle; (D) left third maxilliped; (E) anterior part of sternum; (F) abdomen; (G) right chelipedal carpus; (H) left chelipedal carpus; (I) left G1 dorsal aspect; (J) left G1 ventral aspect; (K) terminal segment of left G1 dorsal aspect; (L) terminal segment of left G1 ventral aspect; (M) left G2 ventral aspect. Scale bar = 1.0 mm.



Fig. 17. Coloration in life of *Ceylonthelphusa savitriae*, paratype male, 42.5 by 31.5 mm, WHT 10304: (A) dorsal aspect; (B) frontal aspect; (C) ventral aspect.

Ceylonthelphusa rugosa, as presently understood, has the widest distribution among the freshwater crabs of Sri Lanka but we are presently investigating the possibility that this taxon may comprise more than a single species.

Ceylonthelphusa savitriae resembles *C. soror* in gonopod morphology (see Figs. 16I–J vs. Ng & Tay, 2001: figs. 41G, I). They may be distinguished immediately, however, by their carapace characters. The postorbital crest in *C. savitriae* is strong and sharp (Figs. 15A, B, 16A, B), weak, blunt and never as prominent in *C. soror* (see Ng & Tay, 2001: figs. 41A, 42A); the outer margin of the inner distal tooth of the chelipedal carpus in *C. savitriae* bears a distinct broad granule (Fig. 16G, H), a character absent in *C. soror* (see Ng & Tay, 2001: figs. 41E, 42D); the male abdomen is distinctly T-shaped, with an elongate sixth segment in *C. savitriae* (Fig. 16F), whereas the male abdomen is acutely triangular with the sixth segment broader than long in *C. soror* (see Ng & Tay, 2001: fig. 41F). Furthermore, the G1 morphology of these two species is subtly but consistently different: in *C. savitriae* the terminal segment of G1 gently curves outwards (Figs. 16I, J) whereas in *C. soror* the terminal segment is straight, with only the tip directed outwards (see Ng & Tay, 2001: figs. 41G, I); the base

of subterminal segment is stouter (Figs. 16I, J) (vs. comparatively less stout (see Ng & Tay, 2001: figs. 41G, I)); and the base of the G1 outer margin is gently concave in dorsal and ventral aspects (vs. distinctly concave (see Ng & Tay, 2001: figs. 41G, I)). These differences clearly separate *C. savitriae* from *C. rugosa* and *C. soror*.

Ecological notes. – *Ceylonthelphusa savitriae* was found to occur under boulders in flowing streams < 1 m deep. The diversity of freshwater crabs in Morningside, a lower montane cloud-forest reserve, is higher than any other site in Sri Lanka: six species have so far been recorded from this locality (Eastern Sinharaja), three (*Perbrinckia quadrata* Ng & Tay, 2001, *P. rosae*, new species, and *C. savitriae*, new species) of which with are endemic to Morningside.

Distribution. – *Ceylonthelphusa savitriae* was recorded only from the type locality, Morningside Estate, 06°24'N, 080°38'E, at 1060 m altitude. As presently understood, its range is ~ 5 km².

Mahatha helaya, new species (Figs. 18–20)

Material examined. – Holotype - male, 34.6 by 27.0 mm, ZRC 2003.265, from beside the main Road (Colombo–Haputale Road), at Kalupahana, near Haldumulla, 06°50'45"N, 080°50'E, altitude 950 m, coll. M. M. Bahir, 28 May 1996.

Paratypes - male, 37 by 29 mm, WHT 10867; female, 27.3 by 21.7 mm, NMSL (formerly WHT 10868); juv. male, 14.2 by 11.6 mm, NMSL (formerly WHT 10869); male, 32.5 by 26.6, NMSL (formerly WHT 10880); male, 29.9 by 23.8, DWC 6 (formerly WHT 10881); male, 31.8 by 24.6 mm, WHT 10882; male, 28.3 by 22.6, WHT 10883; male, 22.6 by 17.6 mm, WHT 10884; female, 32.2 by 26 mm, DWC 7 (formerly WHT 10885); female, 28.7 by 23.5 mm, WHT 10886; female 29.5 mm by 23.3, WHT 10887; male, 24.2 by 19.5 mm, WHT 10888; juv. female, 21.8 by 17.3 mm WHT 10889, same locality as holotype, coll. M. M. Bahir, 19 Jul.2003.

Diagnosis. – *Mahatha helaya* differs from congeners by a combination of following characters: carapace dorsal surface strongly convex, anterolateral regions distinctly arched in frontal aspect (Figs. 18B, 20B); branchial regions distinctly inflated (Figs. 20A, B); branchial and mid-dorsal surface of carapace distinctly raised in frontal and dorsal aspects (Figs. 18B, 20A, B); cervical groove broad, deep, distinct (Figs. 18A, 20A); epigastric cristae rugose, distinct, elevated, confluent with postorbital cristae; postorbital crest distinctly curved in dorsal aspect (Figs. 18A, 20A). Frontal median triangle distinct, dorsal margin about half as wide as frontal margin, dorsal margin fused or partially separated from lateral margins (Fig. 18C). Inner distal margin of chelipedal carpus serrate with 1 or 2 granules (Fig. 18F). Suture between anterior male thoracic sternites 2 and 3 deep, distinct, barely discernible towards lateral border of sternites (Figs. 18D, 20C); suture between male thoracic sternites 3 and 4 narrow, distinct, reaching lateral borders (Figs. 18D, 20C); male abdomen T-shaped; sixth abdominal segment distinctly broader than long, longer than telson (Figs. 18E, 20C). G1 slender with long terminal segment,

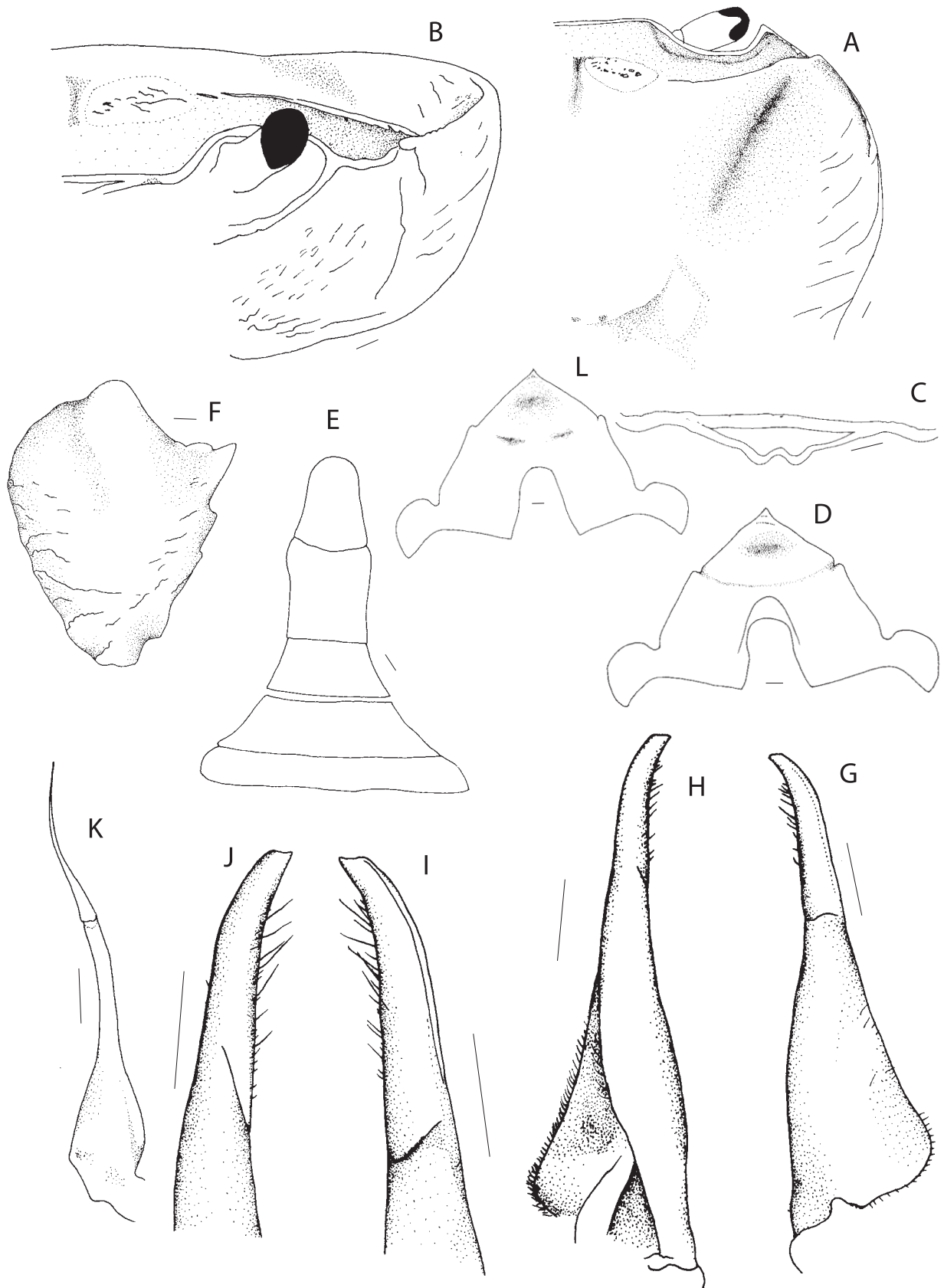


Fig. 18. *Mahatha helaya*, holotype, male, 34.6 by 27.0 ZRC 2003.0265 (formerly WHT): (A) right dorsal surface of carapace; (B) left frontal surfaces of carapace; (C) frontal median triangle; (D) anterior part of sternum; (E) male abdomen; (F) left chelipedal carpus; (G) left G1 dorsal aspect; (H) left G1 ventral aspect; (I) terminal segment of left G1 dorsal aspect; (J) terminal segment of left G1 ventral aspect; (K) left G2 ventral aspect; (L) anterior thoracic sternites of *M. ornatipes* male, 45 by 34.7 mm, ZRC1997.0818. Scale bar = 1.0 mm.



Fig. 19. Coloration in life of *Mahatha helaya*, holotype male, 34.6 by 27.0 mm, ZRC 2003.0265 (formerly WHT): (A) dorsal aspect; (B) coloration in life of paratype male, 37 by 29 mm, WHT 10867, dorsal aspect; (C) frontal aspect; (D) ventral aspect.



Fig. 20. *Mahatha helaya*, holotype male, 34.6 by 27.0, ZRC 2003.0265 (formerly WHT): (A) dorsal aspect; (B) frontal aspect; (C) ventral aspect.

~ 0.5 times length of subterminal segment; short tip of G1 gently curved outwards (Fig. 18G–J); G2 with long distal segment ~ 0.6 times length of basal segment (Fig. 20K).

Colour. – In life, body colour rusty brown (Fig. 19).

Etymology. – In Sinhala, ‘hela’ means mountain, while ‘helaya’ is the classical name for an inhabitant of the island. The name is applied as a noun in apposition.

Remarks. – The carapace and gonopod physiognomy of *Mahatha helaya* resembles those of *M. ornatipes* (Roux, 1915), from which however, several other features easily distinguish it. The anterolateral regions of the carapace of *M. helaya* are distinctly arched in the frontal aspect (Figs. 18B, 20B) (vs. not arched in *M. ornatipes*: see Ng & Tay, 2001, Fig. 124B); the postorbital crest forms a curve in the dorsal aspect in *M. helaya* (Figs. 18A, 20A) (vs. almost straight: see Ng & Tay, 2001: fig. 124A); the suture between male anterior thoracic



Fig. 21. (A) Type locality of *Mahatha helaya*, at Kalupahana, on Colombo-Haputale road; (B) microhabitat of *Mahatha helaya*.

sternites 3 and 4 is a distinct narrow shallow groove, reaching the lateral margins in *M. helaya* (Fig. 18D) (vs. not distinct or, when it is distinct, only visible as two shallow depressions, not reaching lateral margins (Fig. 18L); the distal part of the G1 is gently curved outwards (Figs. 18G–J) (vs. G1 tip distinctly bent: see Ng & Tay, 2001: fig. 122J); and adults are comparatively smaller, with males reaching to 37 mm in carapace width (vs. a larger species with males reaching up to 45 mm carapace width). The differences between *M. helaya* and *M. ornatipes* are subtle but consistent, and we feel comfortable in recognizing them as good species. The G1 morphology of *M. helaya* is similar to *M. lacuna*, new species, but its tip is more distinctly curved (Figs. 18G–J) (vs. almost straight: Figs. 22H–K); postorbital and epigastric crests confluent, the latter distinctly rugose (Figs. 20A, B) (vs. separate and epigastric crests sharp (Figs. 22A, B); postorbital crest curved in dorsal aspect (Figs. 18A, B) (vs. straight in dorsal aspect: Figs. 22A, B); and the suture between anterior male thoracic sternites 3 and 4 distinct (Fig. 18D) (vs. indistinct: Fig. 22D).

A lectotype of *M. ornatipes* (NHMB 540Ia, juvenile, 17.8 by 14.9 mm) was chosen by Ng & Tay (2001) from among the three syntypes. Ng & Tay (2001) also recorded juveniles identical to the lectotype (in addition to adults) from the vicinity of Batadomba cave. In the present study, we critically compared *M. helaya* with similar-sized specimens of *M.*

ornatipes, including the lectotype and the large male illustrated by Ng & Tay (2001).

Distribution. – The species was recorded only from shallow burrows (< 20 cm deep) along the margins of a roadside stream at Kalupahana, on the Colombo–Haputale road (the type locality, at Kalupahana, 06°50'45"N, 080°50'E, 950 m altitude). As presently understood, its range is ~ 5 km².

***Mahatha lacuna*, new species**
(Figs. 22, 23)

Material examined. – Holotype - Male, 42.3 by 33.6 mm, ZRC 2003.267; from a muddy bank of a small muddy pool, Walpola, near Imaduwa, Galle, 06°02'N, 080°23'E, altitude 30 m; coll. S. Batuwita, D. Kandamby & M. M. Bahir, 10 Feb. 1999.

Diagnosis. – *Mahatha lacuna* differs from congeners by a combination of following characters: carapace dorsal surface strongly convex, anterolateral regions of carapace gently arched in frontal aspect (Figs. 22A, 23B); postorbital region short (Fig. 22A); brachial region distinctly inflated in frontal and dorsal aspects; cervical groove broad, short, not straight (Figs. 22A, 23A); epibranchial tooth sharp (Figs. 22A, 23A); epigastric cristae distinct, raised, sharp, anterior of postorbital cristae, slightly but distinctly separated from postorbital crest (Figs. 22A, B); postorbital crest straight in dorsal aspect (Figs. 22A, B); frontal median triangle distinct, width greater than half width of frontal margin; dorsal margin completely fused with lateral margins (Fig. 22C); inner margin of chelipedal carpus major tooth serrate with 1 granule (Figs. 22F, G); suture between anterior male thoracic sternites 2 and 3 very shallow and hardly visible, not discernible towards lateral border of sternites (Fig. 22D); suture between male thoracic sternites 3 and 4 indistinct (Fig. 22D); male abdomen T-shaped; sixth abdominal segment distinctly longer than broad, longer than telson (Fig. 22E); G1 straight, slender, with long terminal segment ~ 0.6 times length of subterminal segment; tip of G1 short, narrow, almost straight (Figs. 22H–K); G2 with a long distal segment, ~ 0.6 times length of basal segment (Fig. 22L).

Colour. – In life and in freshly-preserved specimens, dorsally brown.

Etymology. – The species name is Latin for a hole, a reference to the specimens being found in a deep burrow. Applied as a noun in apposition.

Remarks. – The gonopod morphology of *M. lacuna* resembles that of *M. helaya*; differences are discussed in the remarks under *M. helaya*.

Ecological notes. – The type series was obtained from a deep burrow in a muddy bank of a small pool near Walpola, near Imaduwa, Galle. Three subsequent attempts to recollect this species, from 2000 to 2003, proved unsuccessful.

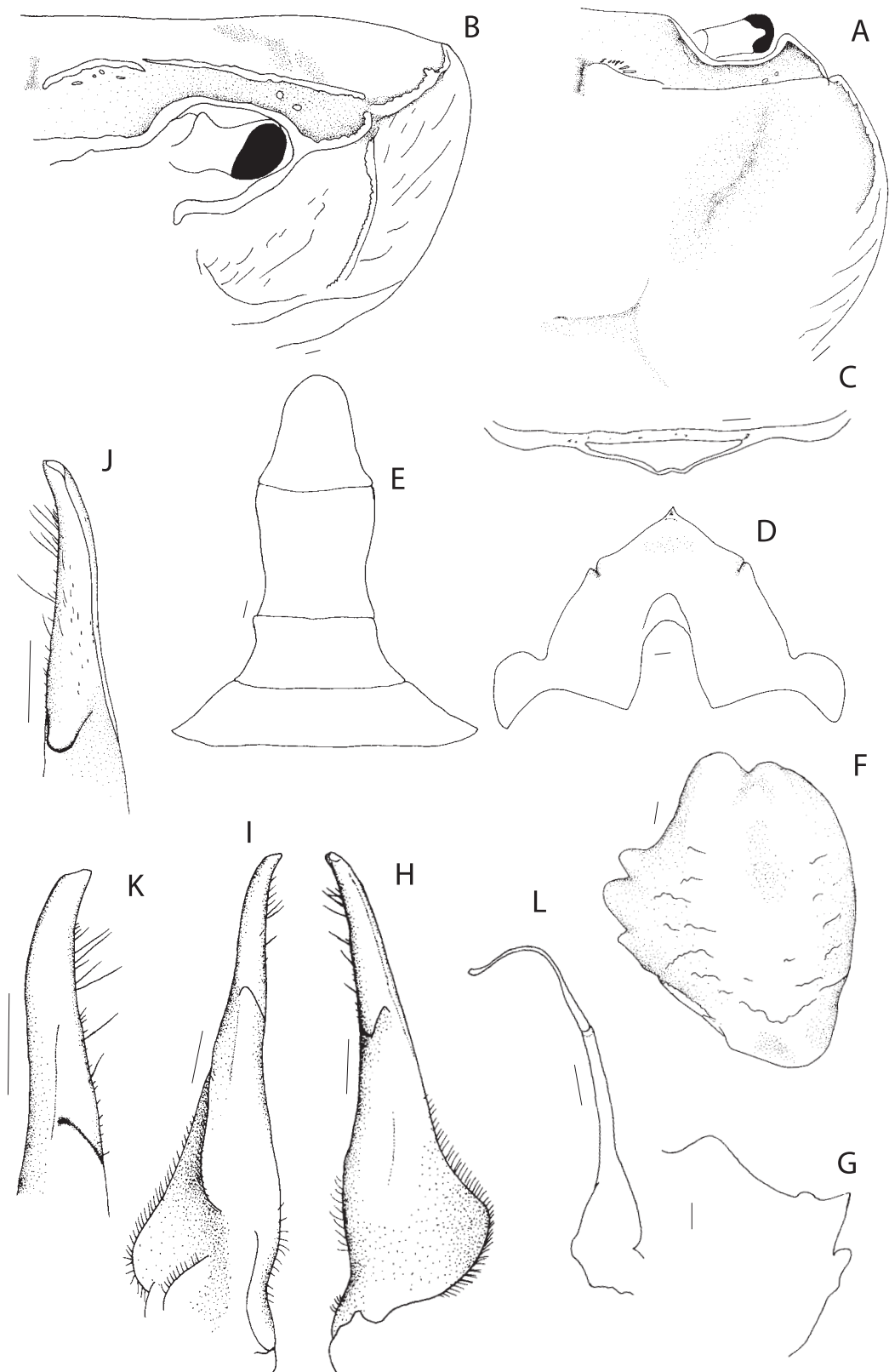


Fig. 22. *Mahatha lacuna*, holotype male, 42.3 by 33.6 mm, ZRC 2003.0267 (formerly WHT): (A) right dorsal surface of carapace; (B) left frontal surfaces of carapace; (C) frontal median triangle; (D) anterior part of sternum; (E) male abdomen; (F) right chelipedal carpus; (G) left chelipedal carpus, major tooth (H) left G1 dorsal aspect; (I) left G1 ventral aspect; (J) terminal segment of left G1 dorsal aspect; (K) terminal segment of left G1 ventral aspect; (L) left G2 ventral aspect. Scale bar = 1.0 mm.

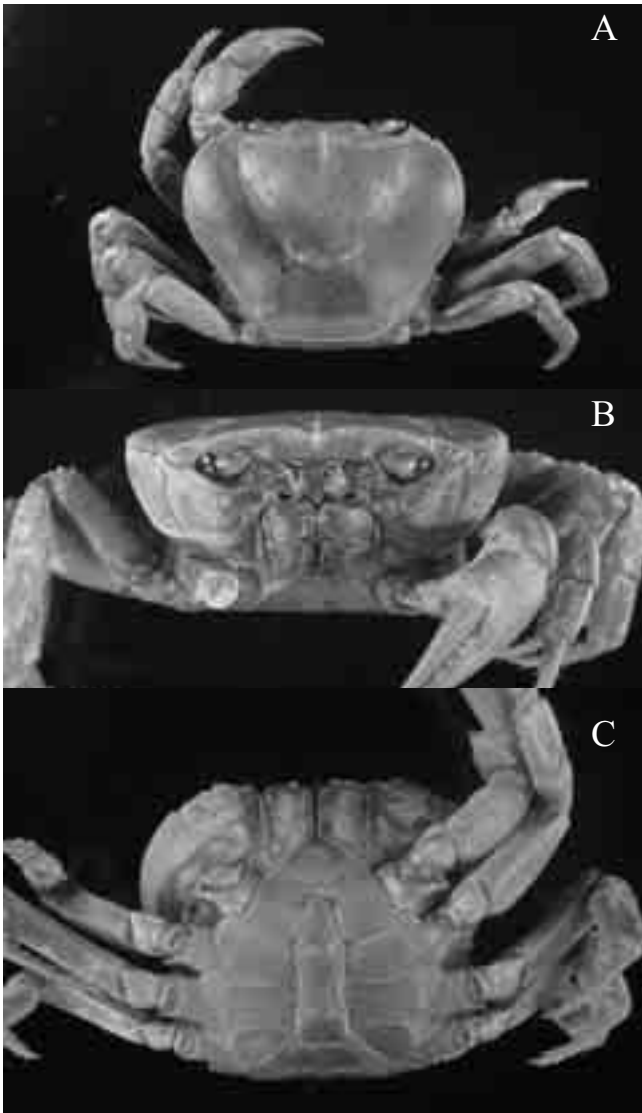


Fig. 23. *Mahatha lacuna*, holotype male, 42.3 by 33.6 mm, ZRC 2003.0267 (formerly WHT): (A) dorsal aspect; (B) frontal aspect; (C) ventral aspect.

Distribution. – *Mahatha lacuna* was recorded only from the type locality, Imaduwa, Galle, 06°02'N, 080°23'E, at 30 m altitude. As presently understood, its range is ~ 5 km².

***Mahatha regina*, new species**
(Figs. 24–26)

Material examined. – Holotype - male, 30.3 by 24.0 mm, WHT 10915; from a moist area next to Pundalu Oya at Kadadarapitiya near Pundaluoya, 07°01'19.04"N, 080°39'59.4"E, altitude 1100 m, coll. M. M. Bahir & S. Batuwita, 10 Dec.2003.

Paratypes - female, 36.6 by 28.7 mm, WHT 10916; same collection data as holotype; male, 25.7 by 20.3 mm, WHT 10917; female, 34.2 by 21.6 mm, NMSL (formerly WHT 10918), same locality data as holotype, coll. M. M. Bahir & S. V. Nanayakkara, 29 Sep.2004.

Diagnosis. – *Mahatha regina* differs from congeners by a combination of following characters: carapace dorsal surface

strongly convex in frontal and dorsal aspects (Figs. 24B, 25A, B); brachial region distinctly inflated in frontal and dorsal aspects; cervical groove broad, short, distinct (Fig. 24B, 25A); postorbital region of moderate length (Fig. 24A); epigastric and postorbital cristae distinct, raised, former rugose and latter comparatively smooth; postorbital crest straight (Figs. 24A, 25A); frontal median triangle distinct, almost as broad as frontal margin, dorsal margin fused or partially separated from lateral margin by an incomplete or indistinct suture; inner margin of chelipedal carpus major tooth serrate with 1 or 2 granules (Fig. 24E). Suture between anterior male thoracic sternites 2 and 3 shallow and distinct, not reaching lateral border of sternites (Figs. 24C, 25C); suture between male thoracic sternites 3 and 4 indistinct (Fig. 24C); male abdomen T-shaped (Fig. 24D); sixth abdominal segment distinctly longer than broad, longer than telson (Fig. 24D). G1 slender with long terminal segment, ~ 0.5 times length of subterminal segment; tip of G1 short, sharply bent outwards, (Fig. 24F–I); G2 with long distal segment ~ 0.6 times length of basal segment (Fig. 24J).

Colour. – In life, dorsal carapace coffee brown with orangish H-groove and lighter ambulatory legs (Fig. 26).

Etymology. – The species-epithet means queen, in Latin; a reference to the regal appearance of the species. The name is used as a noun in apposition, gender feminine.

Remarks. – Although the carapace and gonopod physiognomy of *M. regina* resembles those of *M. ornatipes* (Roux, 1915), there are consistent differences in G1 that allow them clearly to be assigned to distinct species. The G1 tip of *M. regina* is distinctly and sharply bent laterally outwards while the G1 tip of *M. ornatipes* curves laterally outward (see Figs. 24F, G vs. Figs. 122H, J in Ng & Tay, 2001). In addition to their G1 characters, carapace morphology of these two species are significantly different: the branchial region of *M. regina* is distinctly arched in frontal view while in *M. ornatipes* it is not arched (see Fig 25B vs. 124B in Ng & Tay, 2001).

Ecological notes. – *Mahatha regina* was found living within deep burrows in moist areas beside a stream at Pundalu Oya (Fig. 27).

Distribution. – *Mahatha regina* was recorded only from the type locality, from a moist area next to Pundalu Oya at Kadadarapitiya near Pundaluoya, 07°01'19.04"N, 080°39'59.4"E, altitude 1100 m. As presently understood, its range is ~ 5 km².

***Perbrinckia fenestra*, new species**
(Figs. 28–30)

Material examined. – Holotype - male, 18.2 by 14 mm, ZRC 2003.273 (formerly WHT 10066); from under leaf litter, just above entrance to the Batadomba Cave, near Kuruwita, 06°47'N, 080°23'E, altitude 480 m, coll. M. M. Bahir & K. Manamendra-Arachchi, 05 Jan.1998.

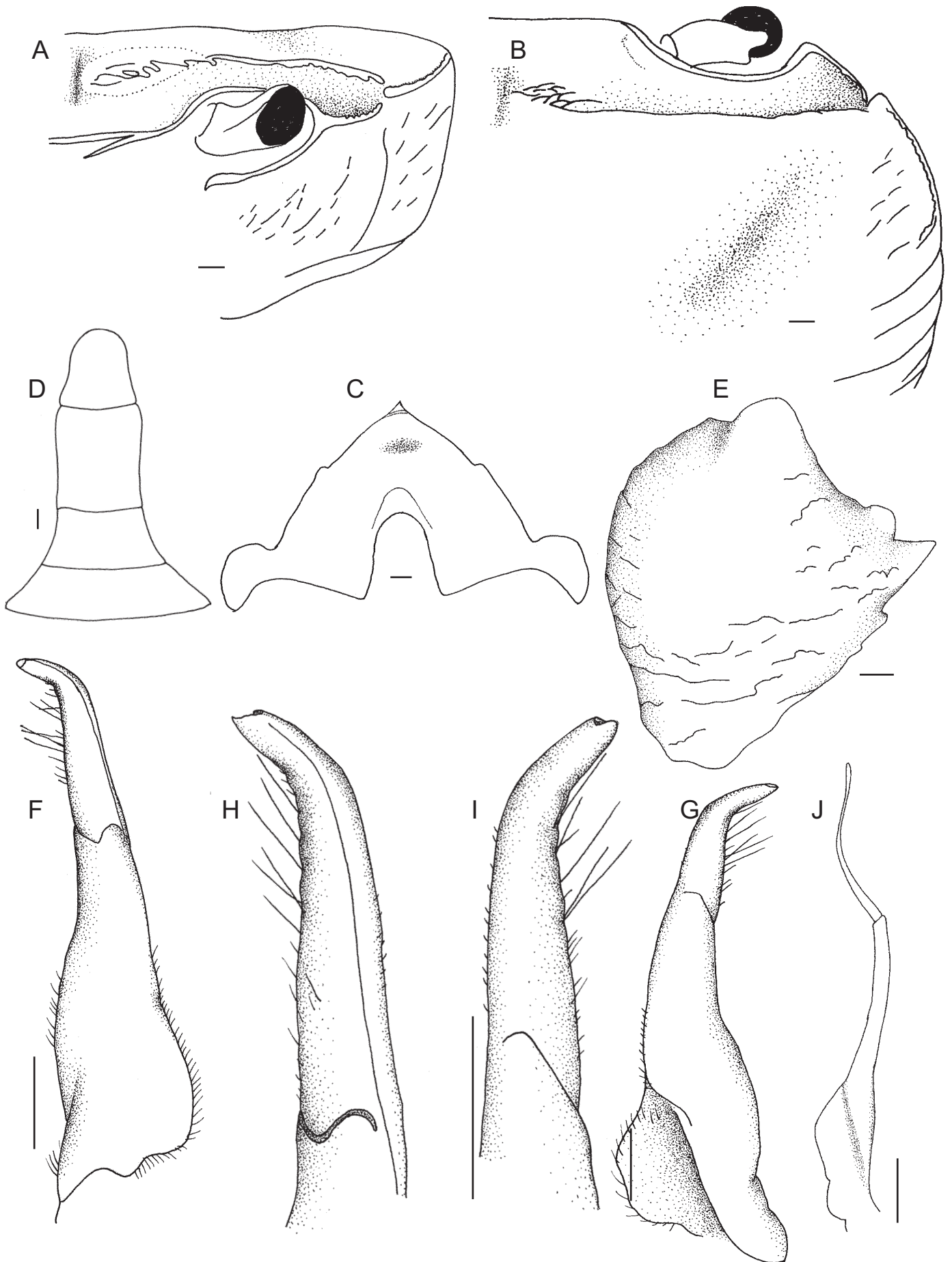


Fig. 24. *Mahatha regina*, holotype male, 30.3 by 24.0 mm, WHT 10915: (A) right dorsal surface of carapace; (B) frontal surfaces of left carapace; (C) anterior part of sternum; (D) male abdomen; (E) right chelipedal carpus; (F) left G1 dorsal aspect; (G) left G1 ventral aspect; (H) terminal segment of left G1 dorsal aspect; (I) terminal segment of left G1 ventral aspect; (J) left G2 ventral aspect. Scale bar = 1.0 mm.

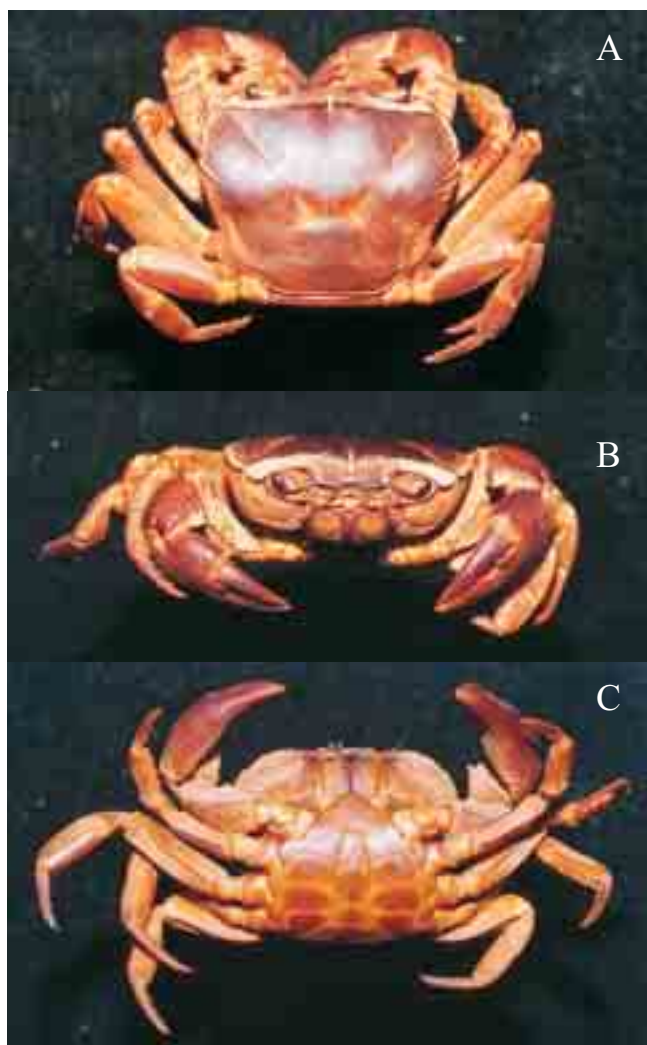


Fig. 25. *Mahatha regina*, holotype male, 30.3 by 24.0 mm, WHT 10915: (A) dorsal aspect; (B) frontal aspect; (C) ventral aspect.

Paratypes - male, 13.5 by 10.8 mm, WHT 10244; female with 26 crablets, 21.2 by 16.1 mm, WHT 10245; from under stones in moist soil, immediately beside entrance to the Batadomba Cave, near Kuruwita 06°47'N, 080°23'E, altitude 460 m, coll. M.M. Bahir & S.V. Nanayakkara, 17 Aug. 1999.

Diagnosis. – *Perbrinckia fenestra* differs from congeners by a combination of following characters: carapace broader than long, surface smooth except for postorbital crest, epigastric area and lateral regions (Figs. 28A, 29A, 30A); anterior dorsal surface of carapace slightly convex in frontal and dorsal aspects (Figs. 28A, B, 29A, B); epibranchial tooth distinct, blunt, cleft separating it from external orbital tooth distinct (Figs. 28A, 29A); postorbital and epigastric crests well developed, clearly separate (Figs. 28A, 29A); epigastric crest rugose, slightly raised in dorsal and frontal aspects (Figs. 28B, 29B); frontal median triangle complete, cristate dorsal margin, strongly fused with lateral margins (Fig. 29C); ischium of third maxilliped rectangular (length 1.6 times width) (Fig. 29D); inner margin of chelipedal carpus with a single large, sharp tooth and sub-basal granules, outer margin with or without a granule (Fig. 29G); ambulatory legs long, the second pair longest, 1.9–2.4 times carapace length (Fig. 29L); suture between thoracic sternites 2 and 3 visible as a shallow



Fig. 26. Coloration in life of *M. regina*, paratype male, 25.7 by 20.3 mm, WHT 10917; (A) dorsal aspect; (B) frontal aspect; (C) coloration in life of paratype female, 34.2 by 21.6 mm, WHT 10918, frontal aspect.

depression, suture between sternites 3 and 4 indistinct (Fig. 29E); male abdomen T-shaped, sixth segment squarish, longer than broad, about same length as telson (Figs. 28C, 29F); G1 slightly curved outwards (Fig. 29H), terminal segment curved outwards from juncture between terminal and subterminal segments (Figs. 29H–J); terminal segment ~ 0.5 times length of subterminal segment (Fig. 29H); G2 with a short distal segment ~ 0.2 times length of basal segment (Fig. 29K).

Colour. – In life, dorsal surfaces orangish or reddish brown (Fig. 30).

Etymology. – The species epithet (Latin, fenestra = window) alludes to this species being found at the mouth of a cave.

Remarks. – The carapace and gonopod physiognomy of *P. fenestra* is similar to *P. nana*, but their differences are significant. *Perbrinckia fenestra* is differentiated from *P. nana* by having the anterior dorsal surface of carapace gently convex in frontal aspect (Figs. 28B, 29B) (vs. flat in frontal aspect, Bahir, 1999: fig. 22); the dorsal margin of the frontal median triangle completely fused with the lateral margins (Fig. 29C) (vs. not fused, Bahir, 1999: fig. 20B); the external orbital



Fig. 27. (A) Type locality of *Mahatha regina*, at Pundalu Oya; (B) microhabitat of *M. regina*.

tooth has a rounded outer margin (Figs. 29A, 28A) (vs. outer margin almost straight, Bahir, 1999: fig. 20A); the G1 terminal segment is comparatively stouter and is bent at the juncture between the terminal and subterminal segments (Fig. 29H) (~ comparatively stout, not bent as in *P. nana*, Bahir, 1999: fig. 20I, J); base of G1 not broad (Fig. 29H) (vs. base of G1 distinctly broader in *P. nana*, Bahir, 1999: fig. 20H).

Both *P. fenestra* and *P. nana* have semi-terrestrial behaviour. Despite their long ambulatory legs (~ 1.9–2.4 length of carapace), they were nowhere observed climbing trees as does the longest-legged Sri Lankan rainforest crab, *C. scansor*. At the vicinity of Batadomba cave, *P. fenestra* and *C. scansor* occur in sympatry.

Ecological notes. – *Perbrinckia fenestra* was found to occur mainly among leaf litter beside small streams, though specimens were also found under stones in moist soil, up to 5 m from the stream margin. Two other species of freshwater crabs were recorded from type locality of *P. fenestra*, in addition to *C. scansor* Ng, 1995b, namely, *C. rugosa* (Kingsley, 1880) and *Mahatha ornatipes* (Roux, 1915).

Distribution. – *Perbrinckia fenestra* is known only from the vicinity of Batadomba cave, near Kuruwita 06°47'N, 080°23'E, at around 460 m altitude. As presently understood, its range is ~ 5 km².

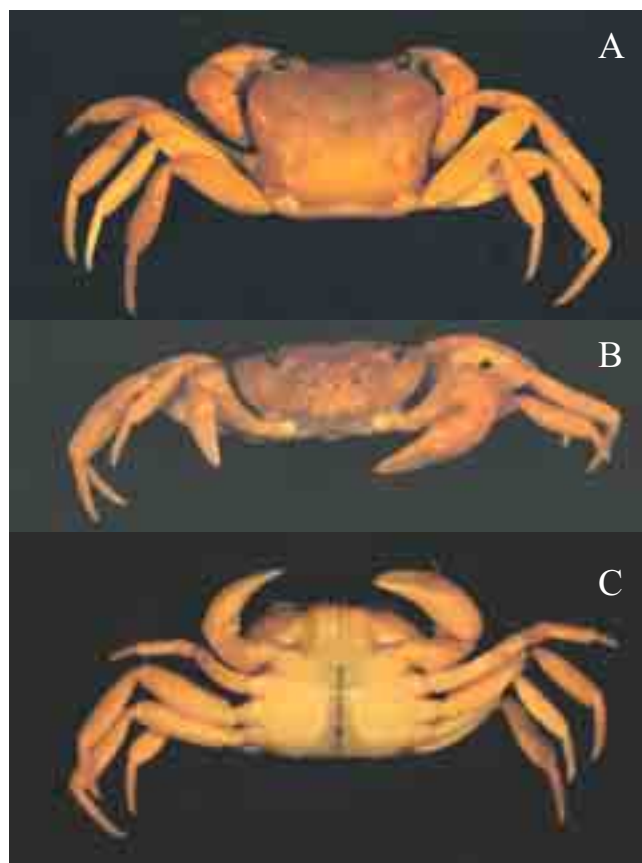


Fig. 28. *Perbrinckia fenestra*, holotype male, 18.2 by 14 mm, ZRC 2003.0273 (formerly WHT 10066): (A) dorsal aspect; (B) frontal aspect; (C) ventral aspect.

***Perbrinckia gabadagei*, new species**
(Figs. 31, 32)

Material examined. – Holotype - male, 12.2 by 9.4 mm, ZRC 2003.263; collected from under stones in wet soil between Thunmodera and Warnagalla, en route to Adam's Peak, Peak Wilderness Sanctuary, 06°24'N, 080°38'E, altitude 1060 m; coll. D. Gabadagé, 27 Jul.1996.

Paratype - male, 9.4 by 7.3 mm, WHT 10890; same collection data as holotype.

Diagnosis. – *Perbrinckia gabadagei* differs from congeners by a combination of following characters: carapace broader than long, surface smooth except distal half of postorbital region, epigastric crest and lateral regions (Figs. 31A, 32A); postorbital crest interrupted (Figs. 31A, B); carapace somewhat convex, anterior dorsal surface convex in frontal and dorsal aspects (Figs. 31A, B, 32A, B); anterolateral border of carapace convex in dorsal aspect (Figs. 31A, 32A); epibranchial tooth distinct, blunt, cleft separating it from external orbital tooth distinct (Fig. 32A); epigastric crest visible, somewhat rugose, slightly raised in dorsal and frontal aspects (Fig. 31A); frontal median triangle distinct, cristate dorsal margin not fused with lateral margins (Fig. 31D); ischium of third maxilliped rectangular (1.5 times as long as wide) (Fig. 31E); inner margin of chelipedal carpus with a single large tooth and 3 sub-basal granules, outer margin serrated with 2

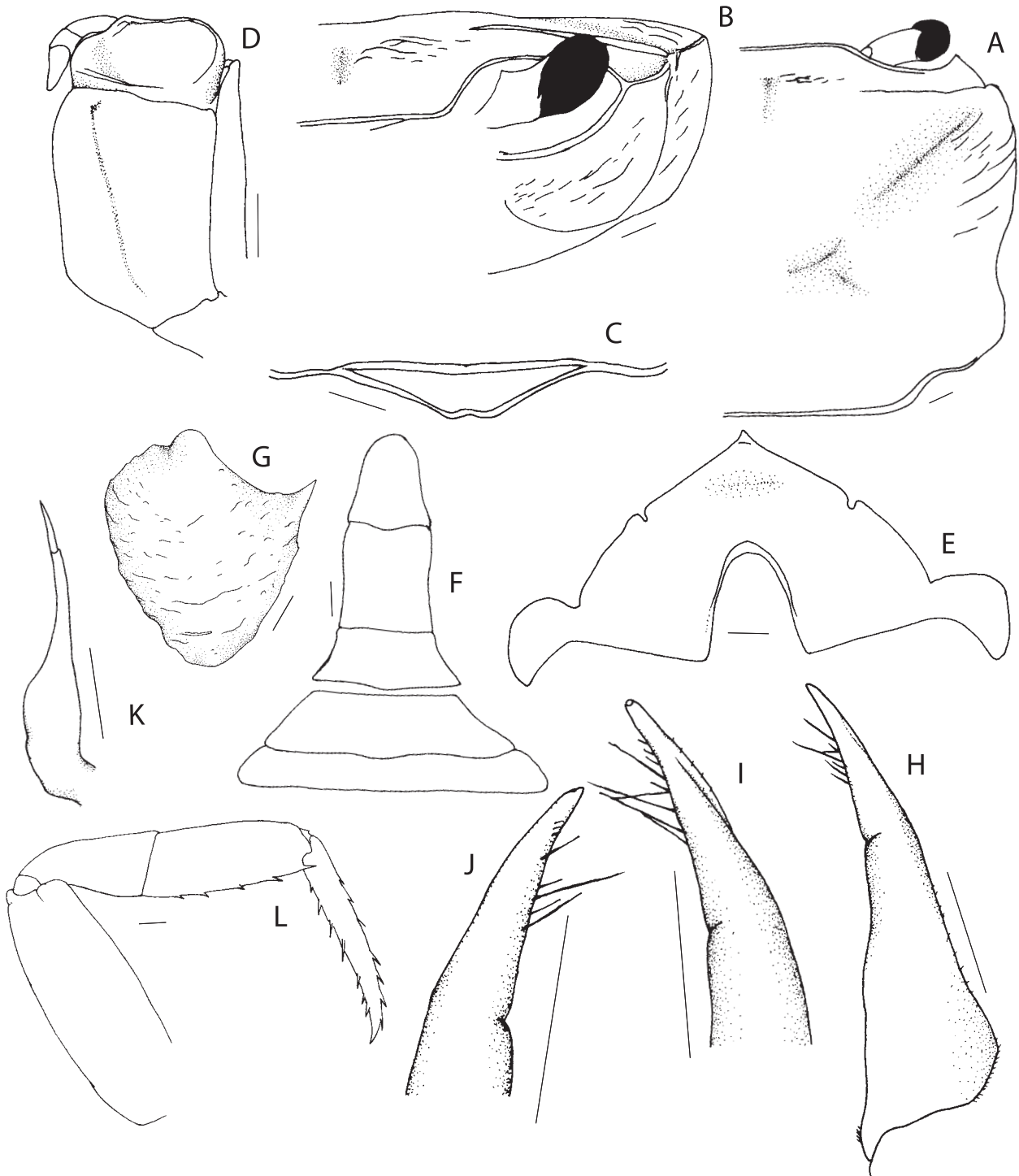


Fig. 29. *Perbrinckia fenestra*, holotype male, 18.2 by 14 mm, ZRC 2003.0273 (formerly WHT 10066) (except where mentioned otherwise): (A) right dorsal surface of carapace; (B) left frontal surfaces of carapace; (C) frontal median triangle; (D) left third maxilliped; (E) anterior part of sternum; (F) male abdomen; (G) left chelipedal carpus; (H) left G1 dorsal aspect; (I) terminal segment of left G1 dorsal aspect; (J) terminal segment of left G1 ventral aspect; (K) left G2 ventral aspect; (L). ambulatory leg III pair. Scale bar = 1.0 mm.



Fig. 30. Coloration in life of *Perbrinckia fenestra*, holotype male, 18.2 by 14 mm, ZRC 2003.0273 (formerly WHT 10066), dorsal aspect.

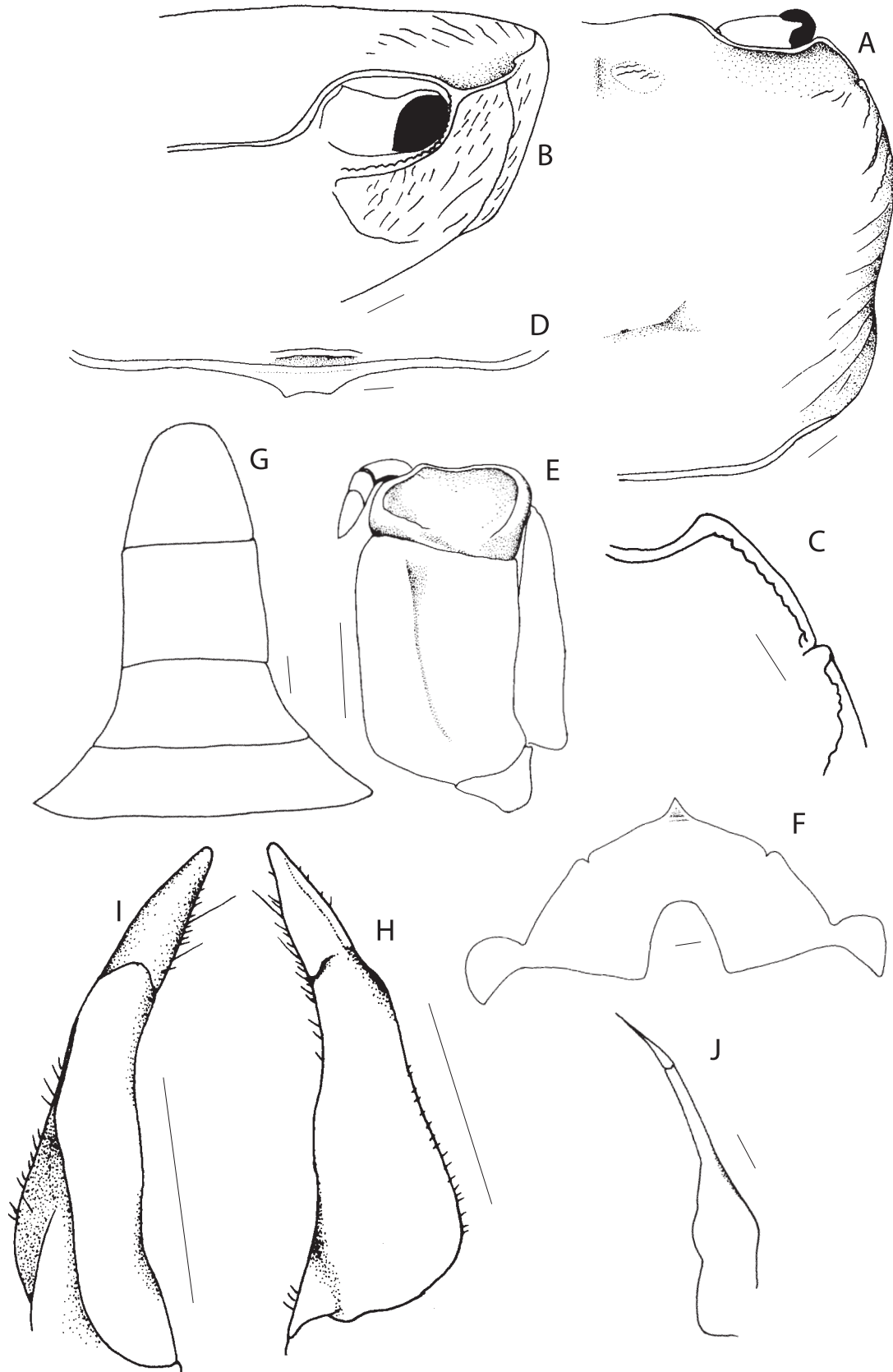


Fig. 31. *Perbrinckia gabadagei*, holotype male, 12.2 by 9.4 mm, ZRC 2003.0263: (A) right dorsal surface of carapace; (B) left frontal surfaces of carapace; (C) right epibranchial tooth; (D) frontal median triangle; (E) left third maxilliped; (F) anterior part of sternum; (G) male abdomen; (H) left G1 dorsal aspect; (I) left G1 ventral aspect; (J) left G2 ventral aspect. Scale bar = 1.0 mm.

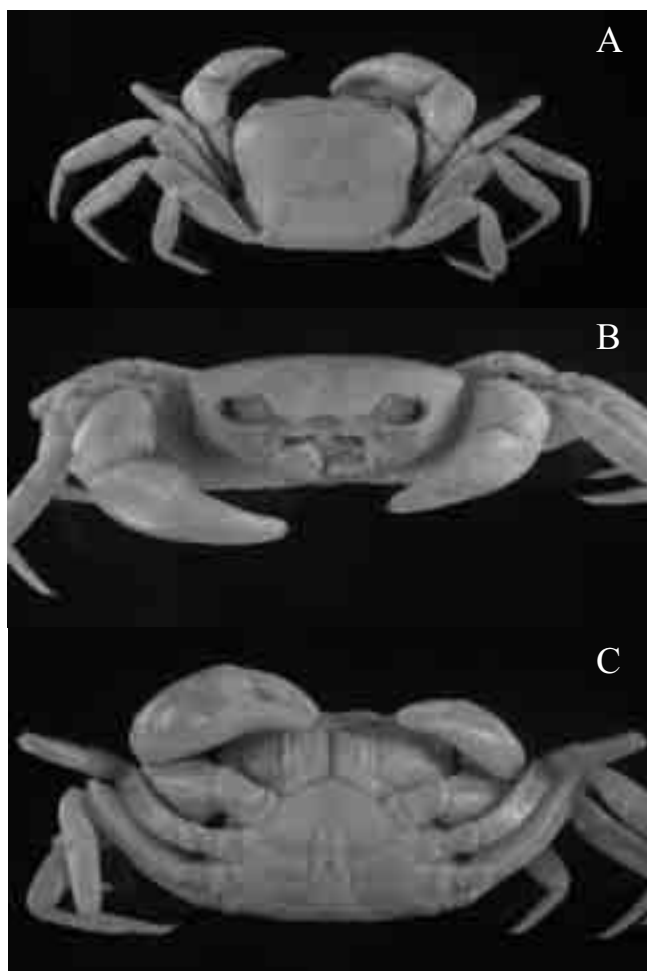


Fig. 32. *Perbrinckia gabadagei*, holotype male, 12.2 by 9.4 mm, ZRC 2003.0263: (A) dorsal aspect; (B) frontal aspect; (C) ventral aspect.

granules (in the holotype); anterior male thoracic sternites broad, sutures between thoracic sternites 2 and 3, and 3 and 4, indistinct (Fig. 31F); male abdomen T-shaped, sixth segment squarish, broader than long, same length as telson (Figs. 31G, 32C); G1 stout, distinctly curved outwards from just below juncture between terminal and subterminal segments (Figs. 31H, I); G1 terminal segment stout, ~ 0.4 times length of subterminal segment (Figs. 31H, I); G2 with short distal segment ~ 0.3 times length of basal segment (Fig. 31J).

Colour. – In life, unknown.

Etymology. – The species-name honours Dinesh Gabadagé, the collector of the type series, who contributed extensively to the initial phase of our survey of the freshwater crabs of Sri Lanka. Applied here as a noun in the genitive case.

Remarks. – The carapace and gonopod physiognomy of *P. gabadagei* resembles *P. enodis* (Kingsley, 1880) more than that of any of its congeners (they are both apparently restricted to the Peak Wilderness Sanctuary). The two species however, are clearly distinct: the sub-orbital region of *P. gabadagei* is more rugose (Figs. 31B, 32B) (vs. comparatively less rugose in *P. enodis*: see Ng & Tay, 2001: fig. 84B); a distinctly rugose postorbital crest present (Figs. 31A, B) (vs. postorbital crest

absent, postorbital region smooth: see Ng & Tay, 2001: fig. 84A); the suture between male anterior thoracic sternites 2 and 3 and 3 and 4 are not visible (Fig. 31F) (vs. grooves between anterior male thoracic sternites visible; outer margin of chelipedal carpus major tooth serrated (vs. smooth); the G1 terminal segment is stout, long (~ 0.4 times length of basal segment), and is clearly angled just below the juncture between the terminal and subterminal segments (Figs. 31H, I) (vs. G1 slender, its terminal segment short (~ 0.3 times length of basal segment) and not as strongly angled as in *P. gabadagei*: see Ng & Tay, 2001: figs. 82J, K); the G2 has a relatively longer distal segment, ~ 0.3 times length of basal segment (Fig. 31J) (vs. G2 distal segment short, ~ 0.2 times length of basal segment: see Ng & Tay, 2001: fig. 86M).

Ecological notes. – The species was found to occur in wet soil under stones in a small stream. It has not been recorded since its original collection by D. Gabadage in 1996.

Distribution. – *Perbrinckia gabadagei* was recorded only from the type locality, between Thunmodera and Warnagalla, on a footpath to Adam's Peak, Peak Wilderness, 06°24'N, 080°38'E, altitude 1060 m. As presently understood, range is ~ 1 km². Several attempts to recollect this species have proved fruitless.

Perbrinckia rosae, new species (Figs. 33–36)

Material examined. – Holotype - male, 27.3 by 21.0 mm, ZRC 2003.262 (formerly WHT 10300); from under stones in wet soil at Morningside, Eastern Sinharaja, 06°24'N, 080°38'E, altitude 1060 m, coll. M. M. Bahir, M. Meegaskumbura & S. V. Nanayakkara, 12 Jan. 1999.

Paratypes - male, 24.9 by 19.5 mm, WHT 10297; male, 22.7 by 17.9 mm, NMSL (formerly WHT 10298); male, 24.9 by 19.2 mm, WHT 10295; male 22.2 by 17.2 mm, DWC 10 (formerly WHT 10296); male, 20.8 by 19.4 mm, WHT 10299; female, 21.8 by 17.3 mm, WHT 10301; female, 21.2 by 16.5 mm, WHT 10302; female, 19.5 by 15.2 mm, NMSL (formerly WHT 10303), same collection data as holotype.

Diagnosis. – *Perbrinckia rosae* differs from congeners by a combination of following characters: larger size of mature individuals (carapace width of large males 22.2–27.3 mm); carapace broader than long, surface smooth except for postorbital crest, epigastric area and lateral regions (Figs. 33A, 34A, B, 36A, B); carapace slightly convex, anterior dorsal surface convex in frontal and dorsal aspects (Figs. 33A, 34A, B); anterolateral border of carapace distinctly convex in dorsal aspect (Figs. 33A, 34A, 36A); epibranchial tooth distinct, blunt, cleft separating it from external orbital tooth distinct (Figs. 33A, 34A); postorbital and epigastric crests well developed, reaching each other but well separated (Figs. 33A, 34A, 36A); epigastric crest rugose, slightly raised in dorsal and frontal aspects (Figs. 33A, 34A, B, 36A, B); frontal median triangle distinct, cristate, dorsal margin strongly or barely fused with lateral margins (Figs. 33B, 34B, C); ischium of third maxilliped rectangular, length 1.7–1.9 times width (Fig. 33C); inner margin of chelipedal carpus with a single large tooth

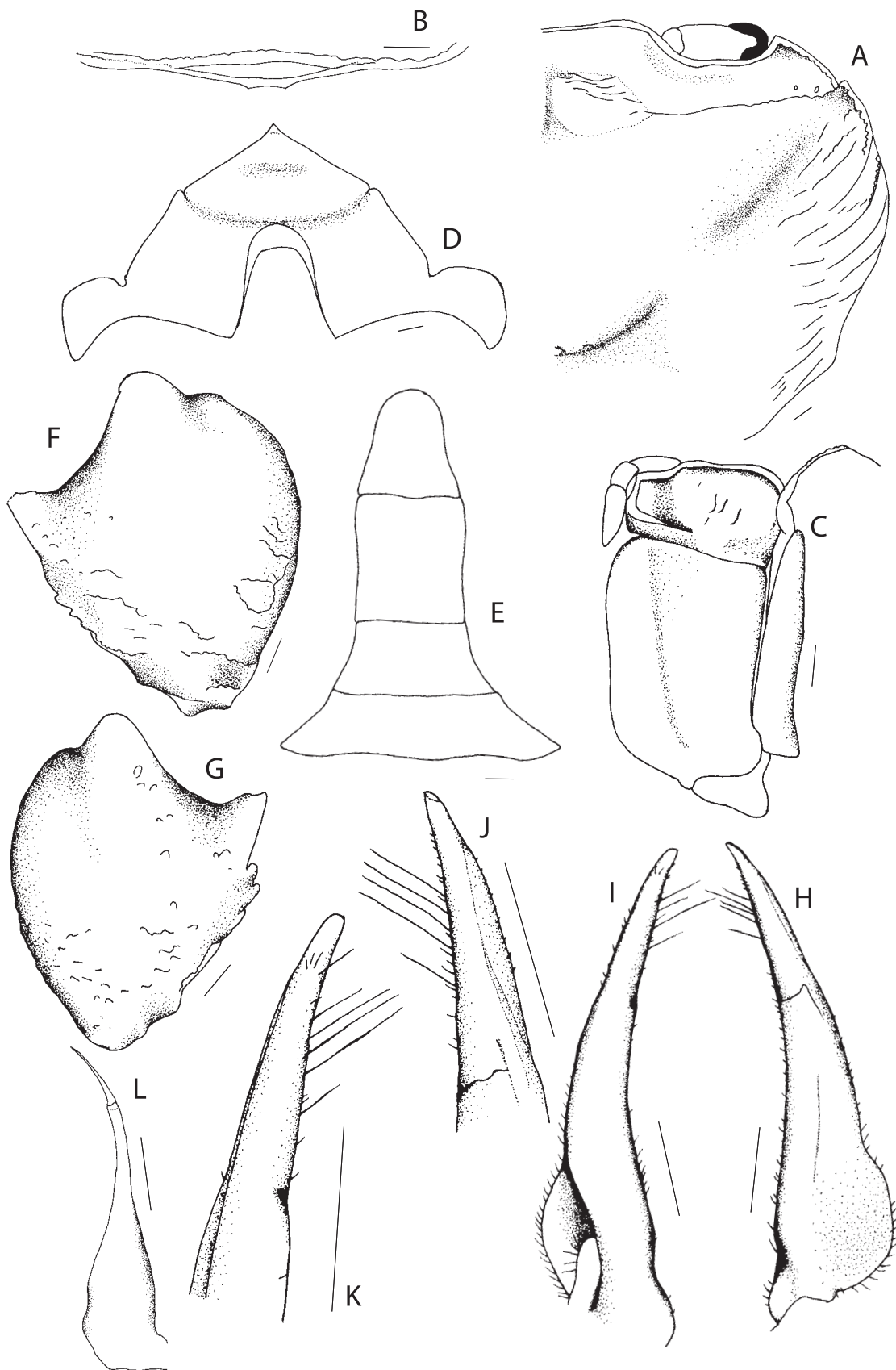


Fig. 33. *Perbrinckia rosae*, holotype male, 27.3 by 21 mm, ZRC 2003.0262: (A) right dorsal surface of carapace; (B) frontal median triangle; (C) left third maxilliped; (D) anterior part of sternum; (E) male abdomen; (F) right chelipedal carpus; (G) left chelipedal carpus; (H) left G1 dorsal aspect; (I) left G1 ventral aspect; (J) terminal segment of left G1 dorsal aspect; (K) terminal segment of left G1 ventral aspect; (L) left G2 ventral aspect. Scale bar = 1.0 mm.



Fig. 34. *Perbrinckia rosae*, paratype male, 24.9 by 19.5 mm, WHT 10297: (A) right dorsal surface of carapace; (B) left frontal surfaces of carapace; (C) frontal median triangle; (D) anterior part of sternum; (E) male abdomen; (F) right chelipedal carpus; (G) major chela; (H) left G1 dorsal aspect; (I) left G1 ventral aspect; (J) terminal segment of left G1 dorsal aspect; (K) terminal segment of left G1 ventral aspect; (L) left G2 ventral aspect. Scale bar = 1.0 mm.



Fig. 35. Coloration in life of *P. rosae*, paratype male, 24.9 by 19.2 mm, WHT 10295: (A) dorsal aspect, *P. rosae*, paratype male, 22.2 by 17.2 mm, WHT 10296; (B) dorsal aspect, (C) ventral aspect, (D) coloration in life of a juvenile, possibly *P. rosae* from the same location as that from which adults were obtained (specimen not preserved).

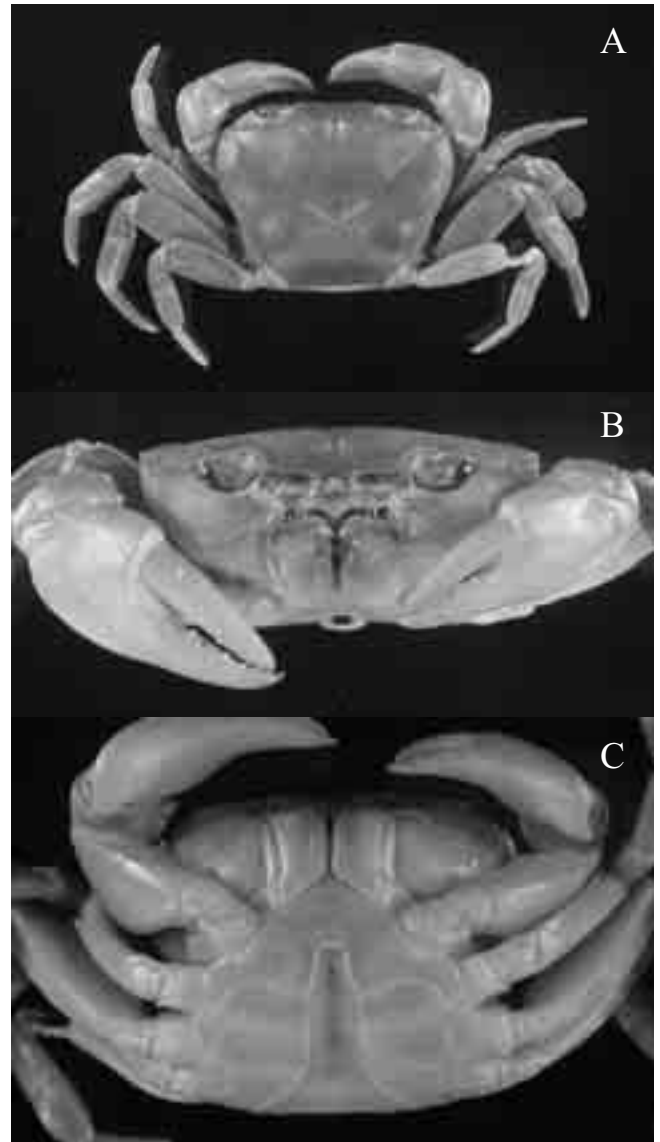


Fig. 36. *Perbrinckia rosae*, holotype male, 27.3 by 21 mm, ZRC 2003.0262 (formerly WHT 1300): (A) dorsal aspect; (B) frontal aspect; (C) ventral aspect.

and 1–3 sub-basal granules, outer margin serrated, with 1–2 granules (Figs. 33F, G, 34F); ambulatory legs short, second pair the longest, 1.6–1.7 times carapace length; suture between thoracic sternites 2 and 3, and 3 and 4 distinct (Figs. 33D, 34D, 36C); male abdomen T-shaped, sixth segment squarish, longer than broad and longer than telson (Figs. 33E, 34E, 36C); G1 slightly curved outwards (Figs. 33H, I, 34H, I), terminal segment ~ 0.4–0.5 times length of subterminal segment (Figs. 33H–K, 36H–K); G2 with short distal segment ~ 0.3 times length of basal segment (Figs. 33L, 34L).

Colour. – In life, all dorsal surfaces reddish brown (Fig. 35).

Etymology. – The species name is an allusion to its overall rose colour (Latin, *rosa* = rose), applied here as a Latinized adjective, gender feminine.

Remarks. – The carapace and G1 morphology of *P. rosae* resembles those of *P. nana* (Bahir, 1999) and *P. fenestra*, but

can easily be distinguished by other features. The ambulatory legs of *P. rosae* are relatively short, the second pair longest ~ 1.6–1.7 of carapace length (vs. longer in *P. nana* and *P. fenestra*, ~ 1.9–2.4 times of carapace length); the suture between the anterior male thoracic sternites are distinct (Figs. 33D, 34D) (vs. not visible: Figs. 29E; see Bahir, 1999: fig. 20D); the base of the G1 subterminal segment is narrower (Figs. 33H, 34H) (vs. broader: Fig. 29H; see Bahir, 1999: figs. 20H–I); and the G1 terminal segment is straight (Figs. 33H, 34H) (vs. gently angled at juncture between terminal and subterminal segments: Fig. 29H; see Bahir, 1999: figs. 20H, I).

Ecological notes. – The species was found to occur under stones in wet soil (< 15 cm deep) in shade within a cardamom plantation at Morningside, adjacent to the Sinharaja World Heritage Site.

Distribution. – *Perbrinckia rosae* was recorded only from the type locality, Morningside, Eastern Sinharaja, 06°24'N, 080°38'E, at 1060 m altitude. As presently understood, its range is ~ 5 km².

COMPARATIVE MATERIAL

Ceylonthelphusa rugosa (Kingsley, 1880), holotype: female, 33.1 by 26.7 mm, ANSP3175. Presumed topotypes: male 51.2 mm by 41.2 mm, WHT 10135; male 47.3 by 37.0 mm, WHT 10136; male 49.9 by 38.9 mm, WHT 10137; female, 48.6 by 39.5 mm, WHT 10138. — *Ceylonthelphusa soror* (Zehntner, 1894), lectotype: female 35.5 mm by 27.3 mm; paralectotype, 35.5 by 27 mm, MHNG. Male 32.6 by 24.9 mm, WHT 115; Roehampton Estate, Haputale, 06 47 N, 80 58 E, alt. 1677 m. Female, 40.8 by 31.4 mm, WHT 164; Agra Arboretum, Torrington Estate near Agarapatana, 06°51'N, 80°41'E, alt. 1555 m. — *Ceylonthelphusa scansor* Ng, 1995b, holotype: male, 27.0 by 21.2 mm, ZRC1994.4287, under fallen log, Mulawella near Kudawa, Sinharaja World Heritage Site, 06°23'N, 80°26'E, alt. 460 m. — *Ceylonthelphusa sanguinea* (Ng, 1995a), holotype: male, 26.7 by 20 mm, ZRC 1994.4427, small waterfall near Kirimetiya Kanda telecoms tower, Laggala, near Rattota, 07°32'N, 80°44'E, alt. 1220 m. — *Ceylonthelphusa callista* (Ng, 1995a), holotype: male, 15.3 by 11.8 mm, ZRC 1994.4430, Mousakanda, near Gammaduwa, 07°33'N, 80°43'E, alt. 915 m. — *Ceylonthelphusa armata* (Ng, 1995a), holotype: male, 16.5 by 12.2 mm, ZRC 1994. 4445, Galawidaputhena, Hingula, Kadugannawa Pahala, Kadugannawa, 07°15'N, 80°28'E, alt. 305 m. — *Ceylonthelphusa venusta* (Ng, 1995a), holotype: female, 13.4 by 10.4 mm, ZRC 1994.4444, Kanneliya Forest Reserve, 06°15'N, 80°20'E, alt. 165 m. Male, 11.2 by 8.8 mm, ZRC 1997.828, same locality data as holotype. — *Ceylonthelphusa cavatrix* (Bahir, 1998), holotype: male, 17.0 by 12.4 mm, ZRC 1998.800, Pathanegala near Puwakpitiya, Knuckles mountains, 07°33'N, 80°44'E, alt. 1100 m. — *Ceylonthelphusa kotagama* (Bahir, 1998), holotype: male, 26.0 by 18.2 mm, ZRC 1998.799, Halgran Oya, Rupaha, Ragala, Nuwara Eliya, 07°01'N, 80°53'E, alt. 1370 m. — *Ceylonthelphusa kandambyi* Bahir, 1999, holotype: male, 33.0 by 26.1 mm, ZRC 1999.0094, near Pituwala waterfall at Elpitiya, 06°15'N, 80°12'E, alt. 80 m. — *Ceylonthelphusa sentosa* Bahir, 1999, holotype: male, 46.1 by 37.6 mm, ZRC 1999.0092, Kottawa Forest Reserve, Galle, 06°06'N, 80°18'E, alt. 50 m. — *Ceylonthelphusa nata* Ng & Tay, 2001, holotype: male, 19.8 by 15.5 mm, ZRC 1998.740, Panagula between Thunmodera and Puwakpitiya, 06°52'N, 80°10'E, alt. 275 m. — *Ceylonthelphusa orthos* Ng & Tay, 2001, holotype: male,

23.7 by 17.2 mm, ZRC 1998.745, Ramboda, 07°04'N, 81°42'E, alt. 1310 m. — *Mahatha adonis* Ng & Tay, 2001, holotype: male, 36.9 by 28.5 mm, ZRC 1997.819, 25 km from Rattota, on Pallegama Road, Mahaveli Basin. — *Mahatha ornatipes* Roux, 1915, lectotype: juv. female, 17.8 by 14.9 mm, MBA5401a, Sri Lanka. Male, 45 by 34.7 mm, ZRC 1997.818, vicinity of Batadomba cave, near Kuruwita. — *Mahatha iora* Ng & Tay, 2001, holotype: male, 24.8 by 19.8 mm, ZRC 1997.821, near Dunhinda Falls, 07°01'N, 81°04'E, alt. 610 m. — *Perbrinckia enodis* Kingsley, 1880, lectotype: female, 14.4 by 11.0 mm, PANS3098, Sri Lanka. Male, 15.4 by 1.7 mm, ZRC 1998.732, Adams Peak. — *Perbrinckia glabra* Ng, 1995a, holotype: male, 23.7 by 18.5 mm, ZRC 1994.4432, Horton Plains, under stones on pathway, 06°48'N, 80°48'E, alt. 2140 m. — *Perbrinckia punctata* Ng, 1995a, holotype: male, 14.4 by 11.4 mm, ZRC 1994.4437, between Pattipola and Horton Plains, 06°51'N, 80°49'E, alt. 1800 m. — *Perbrinckia integra* Ng, 1995a, holotype: male, 14.1 by 11.0 mm, ZRC 1994.4440, between Heramitipana and Linihela, Peak Wilderness, 06°48'N, 80°29'E, alt. 2140 m. — *Perbrinckia scitula* Ng, 1995a, holotype: male, 16.5 by 12.8 mm, ZRC 1994.4442, St. Clair Falls, near Talawakelle, on Kotmale Oya, 06°57'N, 80°38'E, alt. 1160 m. — *Perbrinckia cracens* Ng, 1995a, holotype: male, 16.9 by 12.8 mm, ZRC 1994.4443, vicinity of Avissawella. — *Perbrinckia uva* Bahir, 1998, holotype: male, 16.7 by 12.0 mm, ZRC 1998.803, Tea Estate bordering Namunukula Forest Reserve, Namunukula, 06°56'N, 81°07'E, alt. 1900 m. — *Perbrinckia nana* (Bahir, 1999), holotype: male, 16.9 by 12.8 mm, ZRC 1999.0098, Amugoda near Elpitiya, 06°19'N, 80°13'E, alt. 100 m. — *Perbrinckia fido* (Ng & Tay, 2001), holotype: male, 14.8 by 11.2 mm, ZRC 1998.742, Mousakanda, Gammaduwa, 07°34'N, 80°42'E, alt. 915 m. — *Perbrinckia morayensis* (Ng & Tay, 2001), holotype: male, 17.4 by 14.1 mm, ZRC 1998.724, Moray Estate near Rajamally, near Mousakelle, 06°48'N, 80°31'E, alt. 1370 m. — *Perbrinckia quadratus* (Ng & Tay, 2001), holotype: male, 12.3 by 10.1 mm, ZRC 1998.737, Morningside Estate, near Rakwana, 06°24'N, 80°38'E, alt. 1060 m.

DISCUSSION

The present study brings the total number of species in the genus *Ceylonthelphusa* to 15. The genus, however, appears to contain two distinct species groups —

***Ceylonthelphusa* Group 1.** The *C. rugosa* group, characterized primarily by a rough carapace. The group contains five species: *C. rugosa*, *C. soror*, *C. kandambyi*, *C. sentosa* and *C. savitriae*, to which the following suite of characters applies: postorbital and epigastric crests sharp and distinct; ambulatory legs relatively short, their length 1.4–1.6 times carapace length; G1 terminal segment angled; G2 distal segment long, 0.4–0.6 times of basal segment

***Ceylonthelphusa* Group 2.** The *C. sanguinea* group, characterized primarily by a smooth carapace. The group contains 11 species: *C. sanguinea*, *C. callista*, *C. venusta*, *C. armata*, *C. cavatrix*, *C. kotagama*, *C. nata*, *C. orthos*, *C. alpina*, *C. durrelli* and *C. diva*, to which the following suite of characters applies: postorbital and epigastric crests poorly developed or absent, and even when present (e.g. in *C. cavatrix* and *C. orthos*), not very sharp, discontinuous and poorly developed; ambulatory legs moderately long, their length 1.6–2.1 of carapace length; G1 terminal segment straight; G2 distal segment long, 0.4–0.6 times of basal segment

Species in the *C. sanguinea* group are highly localized in comparison with members of the *C. rugosa* group. Five species (*C. sanguinea*, *C. callista*, *C. cavatrix*, *C. durrelli* and *C. diva*) are restricted to Knuckles mountains, the catchments of which drain into the Mahaveli River basin. A further three species (*C. kotagama*, *C. orthos* and *C. alpina*) are restricted to the Mahaveli (which is the island's largest river basin), but from drainages within the central hills. Only three species, *C. armata* (Maha-Oya Basin), *C. venusta* (Gin River basin) and *C. nata* (Kelani River basin) are known from other river basins.

Of the six species of *Mahatha* known thus far, two (*M. adonis* and *M. iora*) are restricted to the north-eastern and eastern slopes of the central hills and Knuckles mountains. These species share a combination of characters: outer margin of chelipedal carpus major tooth smooth; posterolateral margin of carapace and chelipeds lighter coloured (orangish-white). The other four species, *M. ornatipes*, *M. helaya*, *M. lacuna* and *M. regina* are known from the south-eastern, western and south-western slopes of the central hills. All of them have the outer margin of the chelipedal carpus major tooth serrated, together with a brownish carapace colour.

In view of its relatively short G2 distal segment (~0.3 times length of basal segment), we here transfer *C. scansor* to *Perbrinckia*, a short G2 distal segment being a key diagnostic character of *Perbrinckia* (Ng, 1995a; Ng & Tay, 2001). There are two other long-legged *Perbrinckia* species, viz. *P. fenestra* and *P. nana*. Interestingly, their G1 morphology too, resembles that of *P. scansor* (Ng, 1995). With the three new species described in this study and *P. scansor*, the genus *Perbrinckia* now comprises 15 species, all of them restricted to Sri Lanka's wet zone (rainfall > 2,000 mm yr⁻¹). Within *Perbrinckia* too, there appears to be two distinct species groups:

***Perbrinckia* Group 1.** The *P. enodis* group, characterized primarily by a smooth carapace. This group contains 11 species (*P. enodis*, *P. glabra*, *P. punctata*, *P. itegra*, *P. scitula*, *P. cracens*, *P. uva*, *P. fido*, *P. morayensis*, *P. quadratus* and *P. gabadagei*), characterized by having the carapace smooth; distinct postorbital and epigastric crests absent, or even when present (e.g. *P. gabadagei*), interrupted and not cristate; a similar G1 physiognomy (especially its stout distal segment).

***Perbrinckia* Group 2.** The *P. scansor* group, characterized primarily by a rough carapace. This group contains four species (*P. scansor*, *P. nana*, *P. fenestra* and *P. rosae*), characterized by having the carapace rough; postorbital and epigastric crests sharp and distinct; a similar G1 physiognomy (especially its slender distal segment).

Based on the present knowledge of freshwater crabs of Sri Lanka, all 51 species are endemic to the island (Bahir et al., 2005). By comparison, the southern Indian states of Tamil Nadu and Kerala, which involve a much larger area have

just 14 species in two families (Gecarcinucidae eight species and Parathelphusidae six species: see Bott, 1970b; Ng & Tay, 2001; Bahir & Yeo, 2005). However, these two Indian states have yet to be fully explored, and we can still expect to find more species.

Bossuyt et al. (2004) showed from a molecular investigation of six faunal groups (*Philautus* tree frogs, atyid shrimps, *Puntius* freshwater fish, uropeltid snakes, caecilians and freshwater crabs) that there has been relatively little biotic exchange between India and Sri Lanka despite extensive periods of terrestrial connection, especially recently, during Pleistocene sea-level low stands. They showed also that the crabs presently assigned to the genera treated in this paper, *Ceylonthelphusa*, *Perbrinckia* and *Mahatha*, are in fact part of an endemic insular radiation, confirming their endemism. They also show that these groups form a lineage well separated from the *Oziothelphusa-Spiralothelphusa* clade. Their results suggest, however, that genera defined on the basis of external morphology alone may not in fact be well supported: a reconciliation between the molecular and morphological approaches is called for. A total of 18 (35 %) of Sri Lanka's 51 freshwater crab species are restricted to the south-western rainforests, and 24 (47 %) to montane habitats above 500 m elevation. Roelants et al. (2004) have shown that for ranid frogs, the mountains of Sri Lanka and southern India harbour ancient relict lineages. The same may indeed be true for the crabs—a conjecture worthy of investigation.

The conservation of the freshwater crabs of Sri Lanka is discussed in Bahir et al. (2005).

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