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### Atyid shrimps (Crustacea: Decapoda: Caridea) of the Ryukyu Islands, southern Japan, with descriptions of two new species

Y. Cai <sup>a</sup> & S. Shokita <sup>b</sup>

<sup>a</sup> Tropical Marine Science Institute, National University of Singapore, 14 Kent Ridge, Singapore 119223

<sup>b</sup> Department of Chemistry, Biology and Marine Science, Faculty of Science, University of the Ryukyus, Nishihara, Okinawa 903-0213, Japan

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# Atyid shrimps (Crustacea: Decapoda: Caridea) of the Ryukyu Islands, southern Japan, with descriptions of two new species

Y. CAI<sup>1</sup> & S. SHOKITA<sup>2</sup>

<sup>1</sup>Tropical Marine Science Institute, National University of Singapore, 14 Kent Ridge, Singapore 119223 and <sup>2</sup>Department of Chemistry, Biology and Marine Science, Faculty of Science, University of the Ryukyus, Nishihara, Okinawa 903-0213, Japan

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## Abstract

The freshwater atyid shrimps of Ryukyu Islands, southern Japan, are documented and discussed. A total of 21 species of freshwater shrimps, belonging to seven genera is reported. Two new species are here described and illustrated in detail. *Caridina sakishimensis* Fujino and Shokita, 1975, is synonymized with *Caridina prashadi* Tiwari and Pillai, 1971. Some previous records are revised, viz. *Caridina weberi* De Man, 1892a is referred to *C. laoagensis* Blanco, 1939; *Neocaridina brevis* reported from Ishigaki Island by Kubo (1941) is most probably an undescribed species. *Caridina hainanensis* Liang and Yan, 1983, from China and *Caridina blancoi* Chace, 1997, from Philippines are also synonymized with *Caridina propinqua* in the present study.

**Keywords:** Decapoda, freshwater shrimps, Atyidae, Japan, Ryukyus, Taxonomy, review

## Introduction

Although the freshwater shrimp fauna of the Ryukyu Islands has been relatively well studied in recent decades (Stimpson 1860; Kubo 1938, 1941; Fujino and Shokita 1975; Shokita 1975, 1979, 1982, 1990, 1996, 1997, 2002, 2003; Shokita and Nishijima 1976, 1977; Suzuki 1980; Hayashi 1989a–d; Naruse et al. 2003, 2006), no taxonomic review has been carried out. The present study serves to revise the taxonomy of the freshwater shrimp of the family Atyidae of the Ryukyu Islands. It is mainly based on a recent joint investigation by the National University of Singapore and the University of the Ryukyus. Previous collections kept in the National Museum of Natural History, Smithsonian Institution, Washington, DC (USNM); Senckenberg Museum, Frankfurt; Germany (SMF); National Science Museum, Tokyo, Japan (NSMT); the Zoological Reference Collection, Raffles Museum of Biodiversity Research, National University of Singapore, Singapore (ZRC); National Museum of Marine Biology and Aquarium,

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Correspondence: Y. Cai, Biodiversity Centre, National Parks Board, 1 Cluny Road, Singapore 259569. Email: caiyixiong@yahoo.com

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Taiwan (NMMBA); Zoological Museum of Amsterdam, Amsterdam, The Netherlands (ZMA); National Museum of Natural History, Leiden, The Netherlands (RMNH); Shanghai Fisheries University, Shanghai, China (SFU); Department of Chemistry, Biology and Marine Science, Faculty of Science, University of the Ryukyus, Okinawa, Japan (URB) were also examined. The abbreviation cl is used for carapace length, measured from the postorbital margin to the posterior dorsal margin of the carapace.

## Taxonomy

### Family ATYIDAE De Haan, 1849

#### Genus *Antecaridina* Edmondson, 1954

#### *Antecaridina lauensis* (Edmondson, 1935)

*Mesocaris lauensis* Edmondson, 1935a, p 13, fig. 4 [type locality: Namuka and Wangava Island, Lau Archipelago, Fiji]; Edmondson 1935b, p 4.

*Antecaridina lauensis*: Edmondson 1954, p 368.

*Antecaridina lauensis*: Holthuis 1955, p 25, fig. 8d–f; 1956, p 51; 1963, p 267; 1965, p 4, figs. 2a–r; 1973, p 19; Shokita 1975, p 118; 1979, p 201; 2003, p 249, fig. 17B; 2005a, p 193; 2006a, p 50, pl. 2 (low, right); Shokita and Nishijima 1976, p 71; Suzuki, 1980, p 47; Smith and Williams 1981, p 49; Hayashi 1989d, p 378, fig. 172; Sket, 1997, p 62; Leberer and Cai 2003, p 356; Yoshigou et al. 2003, p 8.

#### *Material examined*

One female, cl 3.4 mm, URB, Doline No. 19 (Cave), Minami Daito Island, coll. K. Kinjo, 18 March 2000; 1 specimen, cl 3.5 mm, ZRC 2004.0562, Cave Gushiken-Dou, Minami Daito Island, Ryukyu Islands, coll. T. Naruse et al., 3 November 2002; 1 male, cl 3.9 mm, ZRC 2004.0563, Cave Mizuana, Minami Daito Island, Ryukyu Islands, coll. T. Naruse et al., 3 November 2002.

#### *Diagnosis*

Rostrum sharp, unarmed, reaching to middle of second segment of antennular peduncle. Antennal spine fused with inferior orbital angle. Pterygostomian margin with a spine. Telson normally with two pairs of dorsal spines and its distal margin rounded, with no posteromedian projection. Eyes with cornea strongly reduced, with a small spot of pigment. Posterior end of caridean lobe of first maxilliped truncated, with no long curved setae. Exopods present on all pereopods, epipods on first four pereopods. First pereopod with carpus excavated deeply anteriorly, twice as long as high, slightly longer than merus but shorter than chela; finger as long as palm. Second pereopod with carpus excavated anteriorly, four times as long as high, longer than merus and chela, finger longer than palm. Third pereopod with propodus more than 2.5 times as long as dactylus, dactylus ending in two claws, flexor margin with three spines. Fifth pereopod with propodus more than twice as long as dactylus. Endopod of male first pleopod with an appendix interna at its anterior margin. Appendix interna of male second pereopod longer than appendix masculina. Uropodal diaeresis with one long spine.

*Habitat*

Anchialine caves.

*Remarks*

*Antecaridina lauensis* is an anchialine species with a wide but disjunct distribution. It has been reported from Lau Islands, (Edmondson 1935a,b), Europa Island, Madagascar (Holthuis 1965), Sinai Peninsula, Red Sea (Holthuis 1963), Hawaii Island (Holthuis 1973), Solomon Islands (Smith and Williams, 1981), Philippines (Sket 1997) and Guam (Leberer and Cai 2003). In the Ryukyu Islands, it has been recorded from Minami Daito Island (Shokita 1975, 1979) and Kuroshima Island, Yaeyama Group (Suzuki 1980).

*Distribution*

Disjunct distribution in Indo-West Pacific.

**Genus *Paratya* Miers, 1882*****Paratya compressa* (De Haan, 1849)**

(Figures 1–3)

?*Ephyra compressa* De Haan, 1844, p 186, pl. 46 [type locality: Japan].

*Miersia compressa*: Kingsley 1879, p 416.

*Xiphocaris compressa*: Doflein 1902, p 631; Rathbun 1902, p 49; Bouvier 1904, p 29 (part); 1905, p 61(part)

*Xiphocaridina compressa*: Bouvier 1909a, p 330 (part); 1909b, p 328 (part); Balss 1914, p 23 (part).

*Paratya compressa*: Roux 1926a, p 238; 1926b, p 187; Kubo 1938, p 68, figs. 2A, 3A–E; 1941, p 127; Lee 1958a, p 25; 1958b, p 1; Kamita 1958, p 13; 1961, p 11; 1963, p 4, fig. 2; Kim and Park 1973, p 119; Kim 1976, p 137; Shokita and Nishijima 1977, p 187; Nishino 1981, p 201; Shokita et al. 2003b, p 117.

*Paratya compressa compressa*: Shokita 1975, p 119; 1990, p 311; Hayashi 1989e, p 498, figs. a–f; Yamaguchi and Baba 1993, p 215, fig. 36; Ikeda et al. 1992, p 819; 1994a, p 37; 1994b, p 679; 1995a, p 69; 1995b, p 1; 1996, p 37; Shokita 2003, p 249, figs. 17A, 19E, 19H, 20E–G; Ikeda 1999, p 43; Page et al. 2005, p 584; Shokita et al. 2002b, p 76.

Not *Paratya compressa*: Kemp 1917, p 294, fig.1; 1918 p 293.

*Material examined*

One male, cl 5.4 mm, 1 female, cl 7.3 mm, ZRC 2004.0564, upper stream of Tima River, about 4 km from river mouth, Okinawa Island, Ryukyu Islands, coll. Y. Cai, N. K. Ng, T. Naruse and S. Islam, 11 June 2000; 1 male, cl 5.6 mm, 1 female, cl 7.5 mm, 2 ovigerous females, cl 6.6–6.8 mm, URB, Henan River, Okinawa Island, Ryukyu Islands, 17 April 1999; 12 females, cl 3.5–6.8 mm, 3 males, cl 3.8–4.6 mm, Yakukachi River, Amami-ohshima, Ryukyu Islands, 29 July 1992; 5 males, cl 5.0–5.6 mm, 2 females, cl 5.3–7.1 mm, 5 juveniles, ZRC 2004.0565, fast flowing water, upper part of Omija River, Iriomote Island, Ryukyu Islands, coll. Y. Cai and T. Naruse, 15 June 2000; 3 females, cl 7.2–7.9 mm, ZRC 2004.0566, Okuma River, Okinawa Island, Ryukyu Islands, 31 May 1998.

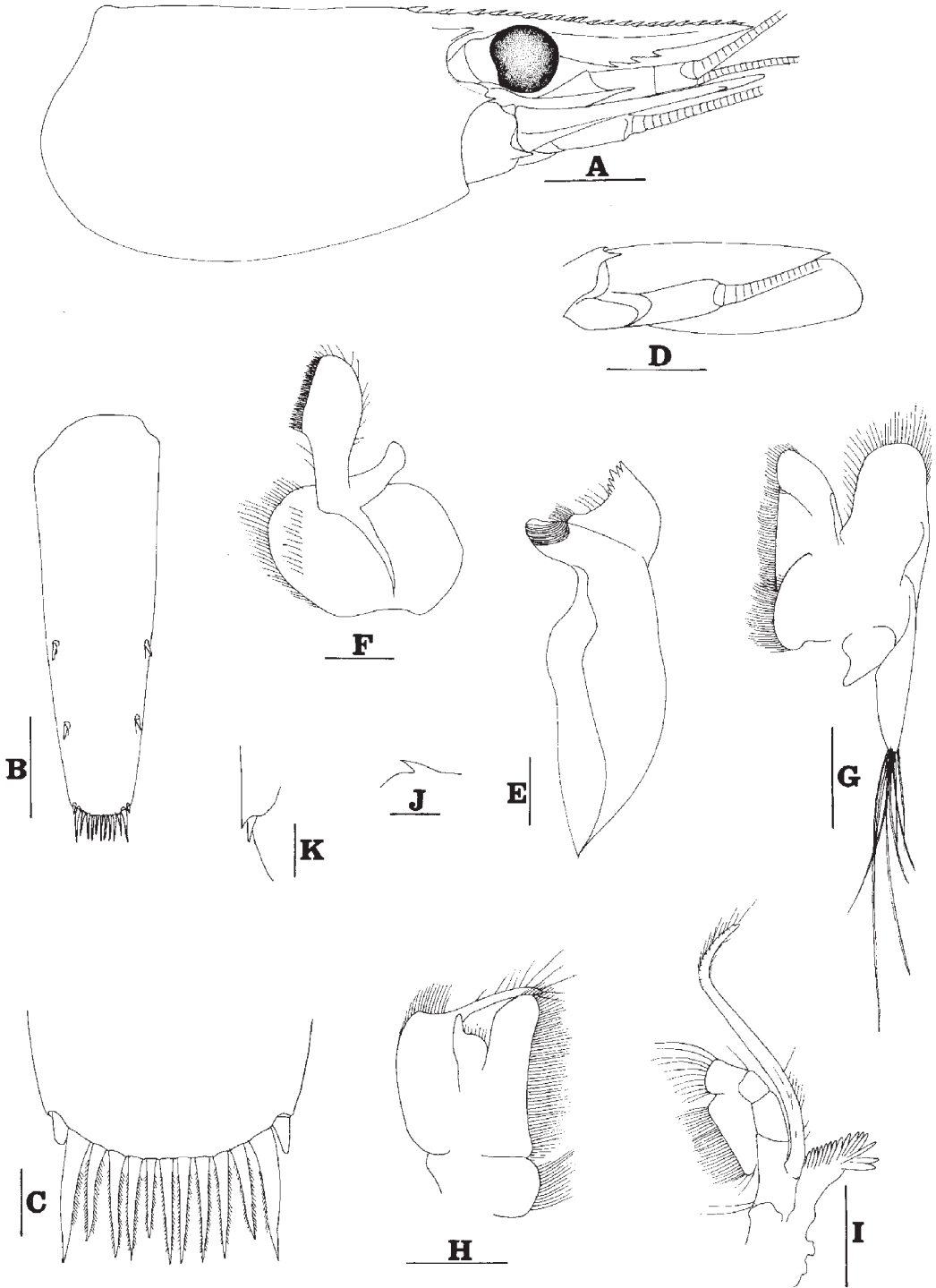


Figure 1. *Paratyia compressa*. A, cephalothorax and cephalic appendages, lateral view; B, telson; C, distal portion of telson; D, scaphocerite; E, mandible; F, maxillula; G, maxilla; H, first maxilliped; I, second maxilliped; J, Preanal carina; K, diaeresis. Scales: A, D=2 mm; B, G, H, I=1 mm; E, F, J, K=0.5 mm; C=0.2 mm (female, cl 7.1 mm, ZRC 2004.0565).

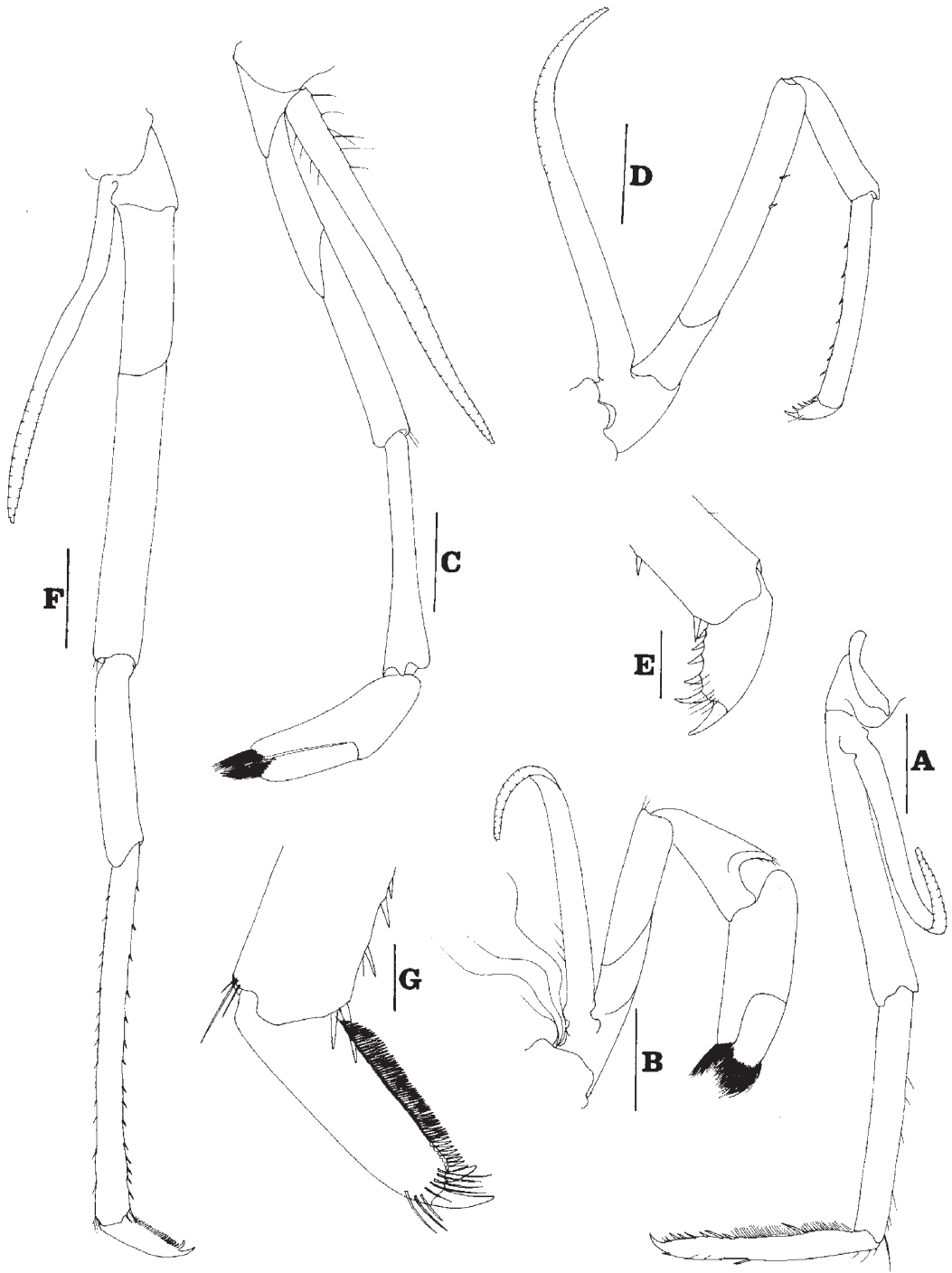


Figure 2. *Paratya compressa*. A, third maxilliped; B, first pereiopod; C, second pereiopod; D, third pereiopod; E, dactylus of third pereiopod; F, fifth pereiopod; G, dactylus of fifth pereiopod. Scales: A–D, F=1 mm; E, G=0.2 mm (female, cl 7.1 mm, ZRC 2004.0565).

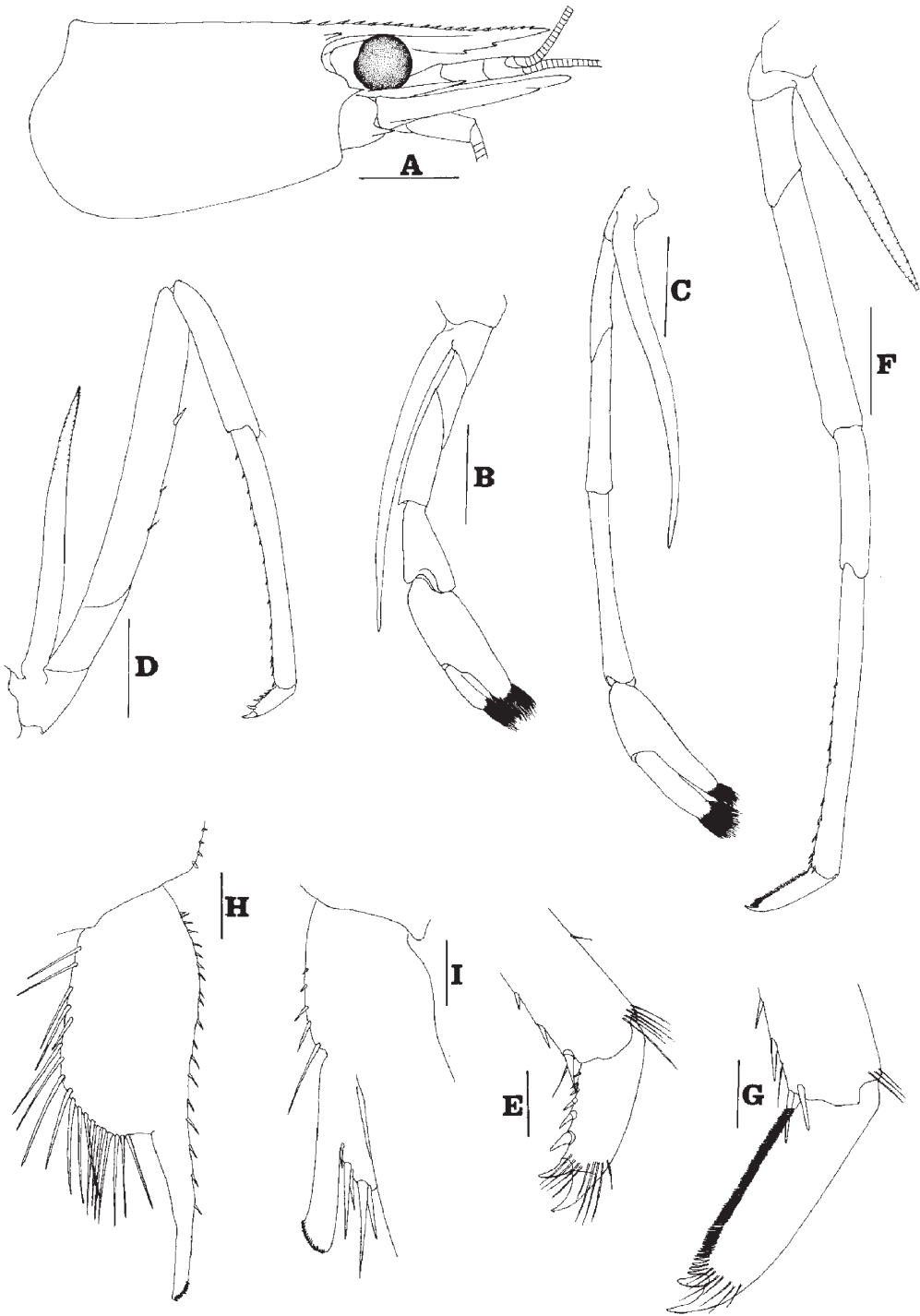


Figure 3. *Paratya compressa*. A, cephalothorax and cephalic appendages, lateral view; B, first pereiopod; C, second pereiopod; D, third pereiopod; E, dactylus of third pereiopod; F, fifth pereiopod; G, dactylus of fifth pereiopod; H, endopod of male first pleopod; I, appendix masculina and appendix interna of male second pleopod. Scales: A=2 mm; B–D, F=1 mm; E, G, H, I=0.2 mm (male, cl 5.2 mm, ZRC 2004.0565).



*Comparative material examined*

*Paratya improvisa* Kemp, 1917: two males, cl 5.5 mm, 1 female, cl 4.0 mm, NMST1222, Natori-gawa River basin, Miyagi Prefecture, Japan, 27 July 1974; 1 male, cl 5.2 mm, NMST1688, Natori-gawa River, Miyagi Prefecture, coll. M. Nakamura 27 July 1974; 1 ovigerous female, cl 6.9 mm, NMST1540, the junction of Natori-gawa River and Goishigawa River, northeast of Honshu, Japan, 27 July 1974.

*Description*

Rostrum (Figures 1A and 3A) reaching to or slightly beyond end of scaphocerite, dorsal margin nearly horizontal, or slightly sigmoid, armed with 16–25 (mode 17–24) teeth throughout dorsal margin, two or three of them situated on carapace posterior to orbital margin, armed ventrally with one to six (mode one to three) teeth. Antennal spine slightly lower than inferior orbital angle; pterygostomial margin subrectangular.

Sixth abdominal somite 0.65 times length of carapace, 1.6 times as long as fifth somite, subequal to length of telson. Telson (Figure 1B,C) 3.2 times as long as wide, not terminating in a posteromedian projection, with two pairs of dorsal spinules and one pair of dorsolateral spinules; dorsal pairs situated near edges; distal end broadly rounded, with about 11 setae, lateral pair slightly longer than intermediates. Preanal (Figure 1J) carina with a spine.

Eyes well developed, anterior end reaching to 0.8 times length of basal segment of antennular peduncle. Antennular peduncle 0.70 times as long as carapace; basal segment of antennular peduncle distinctly longer than sum of second and third segment lengths, anterolateral angle reaching 0.30 times length of the second segment, second segment distinctly longer than third segment. Stylocerite reaching to 0.7 times length of second segment of antennular peduncle. Scaphocerite (Figure 1D) 3.0 times as long as wide.

Incisor process of mandible (Figure 1E) ending in irregular teeth, molar process truncated. Lower lacinia of maxillula (Figure 1F) broadly rounded, upper lacinia elongate, with a number of distinct teeth on inner margin, palp slender. Upper endites of maxilla (Figure 1G) subdivided, palp short, scaphognathite tapering posteriorly with numerous long, curved setae at posterior end. Palp of first maxilliped (Figure 1H) ending in a finger-like projection. Second maxilliped (Figure 1I) typical. Third maxilliped (Figure 2A) reaching to end of antennular peduncle, with ultimate segment slightly shorter than penultimate segment.

Epipods on first four pereopods. Exopod on all pereopods. First pereopod (Figures 2B and 3B) reaching to distal end of eyes; merus 3.2 times as long as broad, as long as carpus; carpus excavated anteriorly, shorter than chela, 1.6 times as long as high; chela 1.6 times as long as broad; fingers shorter than palm. Second pereopod (Figures 2C and 3C) reaching to end of second segment of antennular peduncle; merus shorter than carpus, 5.0 times as long as broad; carpus longer than chela, 5.0 times as long as high; chela 3.0 times as long as broad; fingers slightly longer than palm. Third pereopod (Figures 2D,E and 3D,E) reaching to end of scaphocerite, propodus 11 times as long as broad, 4.2 times as long as dactylus; dactylus 2.1 times as long as wide (spines included), terminating in one claw, with five to seven accessory spines on flexor margin. Fifth pereopod (Figures 2F,G and 3F,G) reaching slightly beyond end of second segment of antennular peduncle, propodus 11 times as long as broad, 4.3 times as long as dactylus, dactylus 2.7 times as long as wide (spinules included), terminating in two claws, with 61 spinules on flexor margin.

Endopod of male first pleopod (Figure 3H) elliptical, 2.2 times as long as wide, one quarter length of exopod; appendix interna elongated, with most of its length reaching beyond distal end of endopod. Appendix masculina of male second pleopod (Figure 3I) very small, appendix interna much longer than appendix masculina.

Uropodal diaeresis (Figure 1K) with 1 movable spinule.

Eggs  $0.35\text{--}0.45 \times 0.24\text{--}0.30$  mm in diameter.

#### *Habitat*

Lower reaches of rivers and streams which discharge to the sea.

#### *Remarks*

De Haan (1849) described *Paratya compressa* under the name of *Ephyra*, from Japan with no specific locality being mentioned. Nishino (1981) showed the distributions of two forms of *P. compressa*, one with a large egg, in central Honshu and the other, with a small egg, in southern Japan. Specimens reported by Kemp (1917) as *Paratya compressa* are most probably an undescribed species. According to Kemp (1917, p 296), his material was from Komatsu Lake near the eastern shore of Lake Biwa and from the Ogura and Yodo ponds near Kyoto, Honshu. "The dactylar spines (of third pereopod) vary in number from 19 to 22, very rarely 18. In the fifth pereopods (text figs. Ie, f) the propodus is also from 2.1 to 2.5 times as long as dactylus." This description, however, is very different from the type material of *P. compressa*. Dr. C. Fransen, curator of the Leiden Museum, checked the syntypes on the request of the first author, as they are all too fragile to be posted. Result of his examination revealed that of the eight syntypes of *Paratya compressa* (RMNH D1007), "only two specimens have a third pereopod attached. In one specimen the ratio propodus/dactylus (of third pereopod) is 4.7, the number of spines on the carpus of the dactylus (of third pereopod) seven. In the other (smaller) specimen, the ratio propodus/dactylus is 4.0 and the number of spines on the carpus of the dactylus five" (C. Fransen, pers. commun.). A review study on the basis of specimens from the whole distribution range is necessary to clarify their identities.

Kemp (1917) proposed a subspecies *Paratya compressa improvisa* (Figure 4) for the specimens from Lake Haruna, Honshu Island, Japan. It differs from the nominal subspecies mainly on the basis of the rostral teeth arrangement. It has no teeth on the carapace while those of *P. compressa* have two to three. But as shown in Figures 1–4, the propodus and dactylus of the male third pereopods are very different in the two subspecies and very easy to separate from each other, we hereby recognize both as distinct species.

#### *Distribution*

Southern Japan.

### **Genus *Halocaridinides* Fujino and Shokita, 1975**

#### ***Halocaridinides trigonophthalma* (Fujino and Shokita, 1975)**

*Halocaridina* (*Halocaridinides*) *trigonophthama* Fujino and Shokita, 1975, p 106, figs. 7, 8 [type locality: several wells in Okinawa Island, Ryukyus, Japan].

*Halocaridina* (*Halocaridinides*) *trigonophthama*: Shokita and Nishijima 1976, p 71; Shokita 1979, p 201.

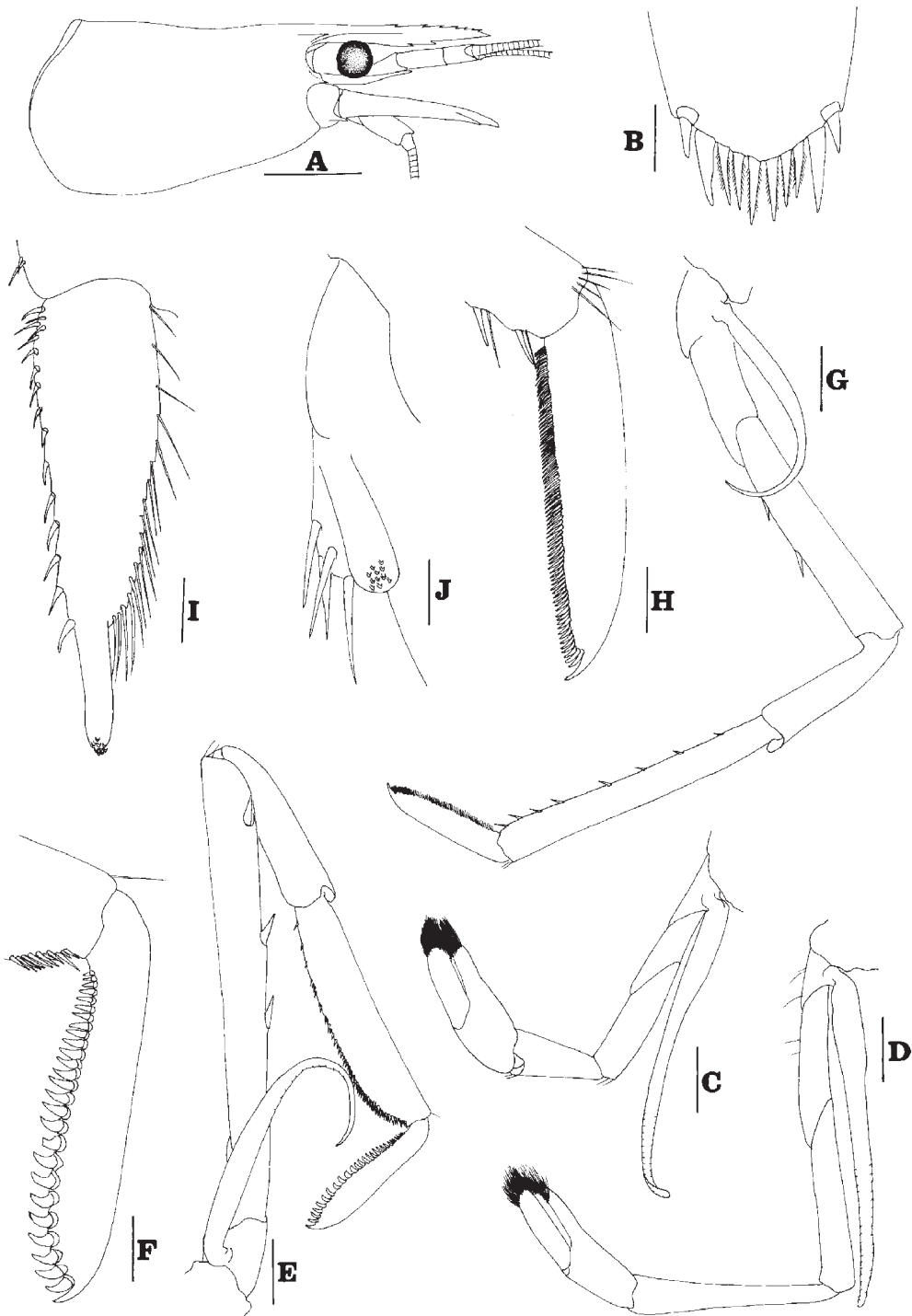


Figure 4. *Paratya improvisa*. A, cephalothorax and cephalic appendages, lateral view; B, distal portion of telson; C, first pereiopod; D, second pereiopod; E, third pereiopod; F, dactylus of third pereiopod; G, fifth pereiopod; H, dactylus of fifth pereiopod; I, endopod of male first pleopod; J, appendix masculina and appendix interna of male second pleopod. Scales: A=2 mm; C-E, G=0.5 mm; B, F, H-J=0.2 mm (male, cl 5.0 mm, NSMT-Cr.1222).

*Palauatya dasyomma* Hart, 1980, p 481, figs.1–31 [type locality: Anguar Island, Palau, Caroline Islands].

*Halocaridinides trigonophthalma*: Holthuis 1982, p 31, fig. 3a–u; Gurney 1984, p 591; Hayashi 1989e, p 497, fig.177; Shokita 2002, p 164; 2003, p 249, fig. 17C; 2006b, p 62; Naruse et al. 2003, p 1; Yoshigou et al. 2003, p 9; Fujita and Shokita 2005a, p 194.

#### *Material examined*

Holotype: male, cl 2.4 mm, URB-497, well near Kaneshi, Okinawa Island, Ryukyu Islands, coll S. Shokita, November 1971. Allotype: 1 female, cl 2.8 mm, URB-498, well near Kaneshi, Okinawa Island, Ryukyu Islands, coll S. Shokita, November 1971. Paratypes: 2 males, cl 2.0–2.4 mm, URB-499, well near Kaneshi, Okinawa Island, Ryukyu Islands, coll S. Shokita, November 1971. Others: 1 specimen, URB, Shiokawa, Okinawa Island, Ryukyu Islands, coll T. Nagai, March 1997; 4 female cl 3.0–3.6 mm (RUB-ZC-78-81), 1 male cl 2.6 mm (RUB-ZC-82), Hatoma Island, Yaeyama Group, Ryukyu Islands, coll. M. Toda, 18 October 2002.

#### *Diagnosis*

Rostrum short, not reaching beyond end of eyestalk; unarmed. Antennal spine fused fully with inferior orbital angle. Pterygostomial margin broadly rounded. Telson not terminating in a projection, with only two pairs of dorsal spinules on distal two-thirds of telson; with two pairs of distal spines, lateral pair of distal spines distinctly longer than intermediates. Antennular peduncle 0.55 times as long as carapace, stylocerite not reaching to end of basal segment of antennular peduncle. Epipods on first three pereopods. Merus of first pereopod as long as ischium; carpus of first pereopod deeply excavated, subequal to chela in length, 3.3 times as long as high, chela 2.3 times as long as broad, fingers distinctly longer than palm. Merus of second pereopod as long as ischium; carpus of second pereopod excavated anteriorly, very slender, seven times as long as high, more than twice longer than chela; chela 2.5 times as long as broad, fingers 1.6 times as long as palm. Propodus of third pereopod three times as long as dactylus, dactylus 2.5 times as long as wide, with eight spines on flexor margin. Propodus of fifth pereopods three times as long as dactylus, dactylus 3.5 times as long as broad, with 18–19 spinules on flexor margin. Endopod of male first pleopod subrectangular, no appendix interna, slightly shorter than exopod. Appendix masculina of male second pleopod slender. Uropodal diaeresis with four movable spinules.

#### *Habitat*

Anchialine caves.

#### *Remarks*

*Halocaridinides* Fujino and Shokita 1975, was originally established as a subgenus of *Halocaridina*. *Palauatya* was established based on Palau material by Hart (1980). Based on a collection from Palau, Holthuis (1982) synonymized *Palauatya* with *Halocaridinides* and raised the latter to full generic rank. *Halocaridinides trigonophthalma* has been found from

Okinawa Island, and Hatoma Island of the Ryukyu Islands (Fujiino and Shokita 1975; Shokita 1975, 1979; Naruse et al. 2003), Palau Islands (Hart 1980; Holthuis 1982) and Guam (Maciolek 1983). Gordon (1968, in Gordon and Monod 1968) described a new species from a subterranean lake in Kufile, Zanzibar, and doubtfully placed it in the genus *Parisia* Holthuis 1956. Gurney (1984) moved it to *Halocaridinides* and redescribed it in detail as *H. fowleri* after re-examining the types. *Halocaridinides trigonophthalma* could be easily distinguished from *H. fowleri* by the relative position of the distal end of the antennal carpus (reaching as far as the distal end of the antennular peduncle in *H. trigonophthalma* vs. reaching as far as the distal end of the antennal scale in *H. fowleri*). Naruse et al. (2003) used the relative length of the exopod of the third pereopod against the endopod as one of two characters to differentiate *H. trigonophthalma* from *H. fowleri*. However this character is too slight to separate two species (see Hart 1980, Fig. 15; Gurney 1984, Fig. 2B). The disjunct localities in the West Pacific may reflect a possible passive dispersal path by ocean current as suggested by Smith and William (1981) and Maciolek (1983).

#### *Distribution*

Known from the Ryukyu Islands, Japan, Palau, and Guam.

#### **Genus *Atyoida* Randall, 1840**

#### ***Atyoida pilipes* (Newport, 1847)**

*Atya pilipes* Newport, 1847, p 160 [type locality: Apia, Upoln, Navigator or Samoan group (see Chace 1983)]

*Atyoida pilipes*: Smith and Williams 1982, p 345 (part); Chace 1983, p 10, figs.3–8; Shokita 2003, p 249, fig. 17D; 2006c, p 61; Cai et al. 2006, p 392, figs. 1–3. (For synonym, see Chace (1983) and Cai et al. (2006).

#### *Material examined*

Neotype of *Caridina brevisrostris*: 1 male, cl 6.8 mm, NSMT, River Aritsu, Kume-Jima Island, Ryukyu Islands, coll. A. Kawakami, 8 December 1995. Others: 2 males, cl 6.2–7.1 mm, URB, Omija River, Iriomote Island, Ryukyu Islands, coll. T. Naruse, 1 August 1999.

#### *Habitat*

Lower reaches of rivers and streams which discharge to the sea.

#### *Remarks*

Cai et al. (2006) recently designated neotypes for *C. acuminata* Stimpson 1860 from the Ogasawara (Bonin) Islands and *Caridina brevisrostris* Stimpson 1860 from Kume Island, Ryukyus, and synonymized both species with *Atyoida pilipes*. *Atyoida pilipes* has been reported from the Philippines and eastern Lesser Sunda Islands at about 120 east longitude eastward through the Pacific high island (Chace 1983). In Japan, it has been reported from Kume Island, Ishigaki Island (Shokita 1979) Iriomote Island of the Ryukyu Islands (Shokita 1997).

*Distribution*

West Pacific.

**Genus *Atyopsis* Chace, 1983**

***Atyopsis spinipes* (Newport, 1847)**

*Atya spinipes* Newport, 1847, p 159 [type locality: Philippine Islands]

*Atya moluccensis*: De Man 1902, p 893; Fujino 1972, p 6, fig. 3.

*Atyopsis spinipes*: Chace 1983, p 35, figs. 20–22; Cai and Ng 2001, p 665, fig. 2a–d; Shokita 2003, p 249, figs. 17E, 19A, 20D; Cai and Anker 2004, p 236; Shokita et al. 2003a, p 101; 2003b, p 117.

*Material examined*

Seven males, cl 10–15 mm, 4 females, cl 15–18 mm, 2 ovigerous females, cl 14–15 mm, ZRC 2004.0567, 124°15.26'E 24°30.11'N, Gaburumata River, Ishigaki Island, Ryukyu Islands, pH 7.3, coll. Y. Cai and T. Naruse, 13 June 2000; 1 female, cl 7.1 mm, ZRC, 124°14.80'E 24°22.76'N, Gaburumata River, Ishigaki Island, Ryukyu Islands, pH 7.3, coll. Y. Cai and T. Naruse, 13 June 2000; 1 male, cl 12 mm, 1 female, cl 15 mm, 1 ovigerous female, cl 16 mm, ZRC 2004.0568, 124°14.52'E 24°26.05'N, stream to Tsuru River, Ishigaki Island, Ryukyu Islands, coll. Y. Cai, N. K. Ng and T. Naruse, 17 June 2000; 1 ovigerous female, cl 14.8 mm, Aira River, Iriomote Island, Ryukyu Islands, 8 August 1969; 1 female, cl 7.1 mm, ZRC 2004.0569, Inoda River, Ishigaki Island, coll. N. K. Ng et al., 13 June 2000.

*Habitat*

Lower reaches of rivers and streams which discharge to the sea.

*Remarks*

Compared to the material of Chace (1983), the number of ventral rostral teeth for this species is more variable in our specimens. It ranges from one to seven. *Atyopsis spinipes* occurs from Philippines and eastern Lesser Sunda Islands (ca.120°00'E) northwards to Taiwan and as far as Tokuno-shima in the Ryukyus, and eastwards as far as Samoa (Chace 1983).

*Distribution*

West Pacific.

**Genus *Caridina* H. Milne-Edwards, 1837**

***Caridina typus* H. Milne Edwards, 1837**

*Caridina typus* H. Milne Edwards, 1837, p 363, Pl. 25, figs. 4, 5 [type locality: unknown].

*Caridina typus*: Kamita 1963, p 5, fig. 5; Shokita and Nishijima 1977, p 187; Hayashi, 1989c, p 310, fig. 168; Shokita 2002, p 164; 2003, p 249, figs. 18G, 19C, 20L; Shokita et al. 2002b, p 76; Shokita et al. 2003a, p 101; 2003b, p 117; Cai and Anker 2004, p 236; Cai et al. 2006, p 412, figs. 13–15.

*Caridina exilirostris* Stimpson, 1860, p 98 [type locality: Okinawa (Loo Choo) Island, Ryukyu Islands, Japan].

*Material examined*

Syntypes: 3 females, cl 7.0–8.4 mm, MNHN-Na 930, no date. Neotype of *Caridina exilirostris*: ovigerous female, cl 7.4 mm, NSMT, Okuma River, Okinawa Island, Ryukyu Islands, coll. P. K. L. Ng et al., 31 May 1998. Others: 3 females, cl 3.0–3.2 mm, 4 males, cl 4.4–4.7 mm, upstream of Nakama river, Iriomote Island, Ryukyu Islands, coll. M. Tomokuni, 3 November 1985; 1 female, cl 7.7 mm, upper of Kawauchi-gawa River, Amami-oshima Island, Ryukyu Islands, coll. M. Takeda, 15 July 1988; 1 female, cl 54 mm, URB1230, Sumiyoh-gawa River, Amami-ohshima Island, Ryukyu Islands, coll. M. Takeda, 17 July 1988; 1 male, cl 4.8 mm, 1 ovigerous female, cl 6.9 mm, URB1112, Shino-kawa River, Amami-oshima Island, Ryukyu Islands, coll. M. Takeda, 17 July 1988; 4 females, cl 5.4–6.8 mm, URB1182, Kawauchi-gawa River, Amami-ohshima Island, Ryukyu Islands, coll. M. Takeda, 15 July 1988; 3 males, 4.9–5.9 mm, 4 females, cl 6.5–7.5 mm, 2 ovigerous females, cl 6.1–6.5 mm, URB1218, Kawauchi-gawa River, Amami-ohshima Island, Ryukyu Islands, coll. Takeda, 18 July 1988; 1 male, cl 4.2 mm, 2 females, cl 4.8–5.2 mm, 2 ovigerous females, cl 5.2–5.6 mm, URB1135, Kanyu-gawa River, Amami-ohshima Island, Ryukyu Islands, coll. M. Takeda, 16 July 1988.

*Habitat*

Rivers and streams which discharge to the sea.

*Remarks*

Cai et al. (2006) recently designated a neotype for *C. exilirostris* Stimpson, 1860 from Okinawa Island, Ryukyu Islands, and synonymized it with *Caridina typus*. This is the most common species found from the Ryukyu Islands.

*Distribution*

Indo-West Pacific.

***Caridina gracilirostris* De Man, 1892**

*Caridina gracilirostris* De Man, 1892, p 399 (part), pl 25, fig. 31a–c [type locality: river near Maros, Sulawesi (Celebes), Indonesia].

*Caridina gracilirostris*: Shokita 2003, p 249, fig. 18A.

*Material examined*

None.

*Habitat*

Lower reaches of rivers and streams which discharge to the sea.

*Remarks*

This species was recently reported by Shokita (2003). The single specimen on which Shokita's (2003) record was based could not be located in the present study.

*Distribution*

Indo-West Pacific.

***Caridina grandirostris* Stimpson, 1860**

*Caridina grandirostris* Stimpson, 1860, p 97 [type locality: Okinawa (Loo Choo) Island, Ruykyu Islands, Japan].

*Caridina grandirostris*: Hayashi 1989c, p 312, fig. 169e; Shokita 2003, p 249, figs. 18B, 19F, 20K; Shokita et al. 2003a, p 101; Cai et al. 2006, p 397, figs. 4–6.

*Material examined*

Neotype: 1 male, cl 4.9 mm, NSMT, upper stream of Tima River, about 4 km from river mouth, Okinawa Island, Ryukyu Islands, coll. Y. Cai, N. K. Ng, T. Naruse and S. Islam, 11 June 2000. Others: 3 males, cl 3.2–3.8 mm, 1 female, cl 4.3 mm, 6 ovigerous females, cl 4.2–5.3 mm, ZRC, 128°02.48'E 26°33.48'N, freshwater stream draining to a small patch of mangrove, Oura River, Okinawa Island, Ryukyu Islands, coll. Y. Cai, N. K. Ng, T. Naruse and S. Islam, 11 June 2000; 13 ovigerous females, cl 4.6–5.6 mm, 4 females, cl 3.6–4.6 mm, 10 males, cl 3.1–3.8 mm, ZRC 2004.0519, 128°04.60'E 26°33.42'N, upstream of Tima River, about 1–2 km from river mouth, Okinawa Island, Ryukyu Islands, pH 7.4, coll. Y. Cai, N. K. Ng, T. Naruse and S. Islam, 11 June 2000; 46 males, cl 3.6–4.6 mm, 12 females, cl 3.6–4.9 mm, 1 ovigerous female, cl 4.7 mm, ZRC 2004.0520, 128°05.52'E 26°33.63'N, upstream of Tima River, about 3 km from the river mouth, Okinawa Island, Ryukyu Islands, pH 7.4, coll. N. K. Ng and S. Islam, 11 June 2000; 6 males, cl 3.8–5.1 mm, 12 females, cl 4.7–6.5 mm, 4 ovigerous females, cl 5.8–6.5 mm, ZRC 2004.0521, upper stream of Tima River, about 4 km from river mouth, Okinawa Island, Ryukyu Islands, coll. Y. Cai, N. K. Ng, T. Naruse and S. Islam, 11 June 2000; 20 males, cl 3.5–4.4 mm, 1 female, cl 5.2 mm, 25 ovigerous females, cl 5.7–6.1 mm, ZRC 2004.0522, 128°07.04'E 26°36.61'N, Arume River, Okinawa Island, Ryukyu Islands, coll. Y. Cai, N. K. Ng, T. Naruse and S. Islam, 11 June 2000; 8 males, cl 2.9–4.0 mm, 10 females, cl 5.0–5.6 mm, 15 ovigerous females, cl 5.0–5.6 mm, ZRC 2004.0523, 124°15.26'E 24°30.11'N, Gaburumata River, Ishigaki Island, Ryukyu Islands, pH 7.3, coll. Y. Cai and T. Naruse, 13 June 2000; 2 males, cl 3.6–4.1 mm, 1 female, cl 6.8 mm, 1 ovigerous female, cl 6.1 mm, ZRC 2004.0524, 124°09.80'E 24°24.42'N, fast flowing stream, with pH 7.6 at one of the tributary of Nagura River, below reservoir, Ishigaki Island, Ryukyu Islands, coll. Y. Cai and T. Naruse, 13 June 2000; 2 males, cl 3.9–4.0 mm, 1 female, cl 5.6 mm, 1 ovigerous female, cl 5.3 mm, ZRC 2004.0525, 124°09.86'E 24°25.00'N, fast flowing tributary of Nagura River, below a reservoir, Ishigaki Island, Ryukyu Islands, pH 7.2, coll. Y. Cai and T. Naruse, 13 June 2000; 1 female, cl 6.1 mm, ZRC 2004.0526, 123°51.84'E 24°23.65'N, fast flowing water, about 200 m from sea, Omija River, Iriomote Island, Ryukyu Islands, coll. Y. Cai, N. K. Ng and T. Naruse, 15 June 2000; 1 male, cl 4.0 mm, ZRC 2004.0527, fast flowing water, upper part of Omija River, Iriomote Island, Ryukyu Islands, coll. Y. Cai and T. Naruse, 15 June 2000; 6 males, cl 3.6–3.7 mm, 8 females, cl 4.8–5.5 mm, 3 ovigerous females, cl 5.0–5.3 mm, ZRC 2004.0528, 124°33.76'E 24°17.81'N, pH 7.7, Kara Stream, Ishigaki Island,



Ryukyu Islands, coll. Y. Cai, N. K. Ng and T. Naruse, 17 June 2000; 1 male, cl 4.3 mm, ZRC 2004.0529, Taiho River, Okinawa Island, Ryukyu Islands, coll. P. K. L. Ng et al., 31 May 1998; 2 females, cl 5.0–5.6 mm, 2 ovigerous females, cl 5.3–6.1 mm, ZRC 2004.0530, Okuma River, Okinawa Island, Ryukyu Islands, coll. P. K. L. Ng et al., 31 May 1998.

### Habitat

Lower reaches of rivers and streams which discharge to the sea.

### Remarks

Cai et al. (2006) recently designated a neotype for *C. grandirostris* Stimpson, 1860 and redescribed it in detail.

### Distribution

*Caridina grandirostris* has thus far only been reported from Japan.

### *Caridina leucosticta* Stimpson, 1860

*Caridina leucosticta* Stimpson, 1860, p 97 [type locality: Simoda, Japan]

*Caridina leucosticta*: Kamita 1963, p 9, fig. 9; Shokita and Nishijima 1977, p 189; Hayashi 1989c, p 230; Shokita 2003, p 249, figs. 18C, 19G, 20J; Shokita et al. 2002b, p 76; 2003b, p 117; Cai et al. 2006, p 401, figs. 7–10. (see Cai et al. (2006) for synonyms)

### Material examined

Neotype: ovigerous female, cl 7.7 mm, NSMT (NIES-Iz-1), 138°56.43'E 34°41.83'N, Inouzawa River, freshwater, lotic, EC 134, Shimoda City, Izu Peninsula, coll. K. Satake, 10 Aug 2004. Others: one male, cl 4.4 mm, 1 female, cl 6.3 mm, 2 ovigerous females, cl 5.8–5.9 mm, ZRC, Okuma River, Okinawa Island, Ryukyu Islands, 31 June 1998; 14 males, cl 3.5–3.9 mm, 1 female, cl 4.0 mm, 7 ovigerous females, cl 4.5–5.8 mm, ZRC 2004.0530, 128°02.48'E 26°33.48'N, freshwater stream draining to a small patch of mangrove, Oura River, Okinawa Island, Ryukyu Islands, coll. Y. Cai et al., 11 June 2000; 5 males, cl 3.0–4.0 mm, 20 females, cl 4.5–5.2 mm, 19 January 1975, Yona River, Okinawa Island, Ryukyu Islands; 1 male, cl 4.8 mm, Aritsu River, Kume-Jima, Ryukyu Islands, coll. A. Kawakami, 8 December 1995; 1 male, cl 4.3 mm, 5 ovigerous females, cl 5.5–6.2 mm, ZRC 2004.0531, 128°07.04'E 26°36.61'N, Arume River, Okinawa Island, Ryukyu Islands, coll. Y. Cai, N. K. Ng, T. Naruse and S. Islam, 11 June 2000; 1 male, cl 3.8 mm, 1 ovigerous female, cl 6.5 mm, ZRC, 123°52.80'E 24°16.64'N, shallow freshwater stream of Aira River, Iriomote Island, Ryukyu Islands, coll. Y. Cai, N. K. Ng and T. Naruse, 14 June 2000; 9 males, cl 3.0–4.2 mm, 12 ovigerous females, cl 4.7–6.5 mm, ZRC 2004.0532, 123°52.74'E 24°16.60'N, shallow freshwater stream, downstream of Aira River, Iriomote Island, Ryukyu Islands, coll. Y. Cai, N. K. Ng and T. Naruse, 14 June 2000; 7 males, cl 3.1–3.5 mm, 7 ovigerous females, cl 4.4–4.9 mm, ZRC 2004.0533, 123°51.29'E 24°18.39'N, downstream from the headwater of Nakama River, Iriomote Island, Ryukyu Islands, coll. Y. Cai, N. K. Ng and T. Naruse, 15 June 2000; 6 males, cl 4.2–4.7 mm, 8 females, cl 5.8–6.4 mm, 15 ovigerous females, cl 5.8–6.3 mm, ZRC

2004.0534, fast flowing water, upper part of Omija River, Iriomote Island, Ryukyu Islands, coll. Y. Cai and T. Naruse, 15 June 2000; 3 males, cl 2.4–3.9 mm, 8 females, cl 4.6–6.4 mm, 1 ovigerous female, cl 5.7 mm, ZRC 2004.0535, upper Hiji fall, Hiji River, Okinawa Island, Ryukyu Islands, 4 November 1987; 3 females, cl 5.0–5.9 mm, URB1750, no data; 1 ovigerous female, cl 5.7 mm, URB1221, Kawauchi-gawa River, Amami-Ohshima Island, Ryukyu Islands, coll. M. Takeda, 15 July 1988; 1 female, cl 3.0 mm, Kanyu-gawa River, Amami-ohshima, Ryukyu Islands, coll. M. Takeda, 16 July 1988; 4 males, cl 4.4–5.0 mm, 6 ovigerous females, cl 6.6–6.8 mm, URB1111, Kawauchi-gawa River, Amami-oshima, Ryukyu Islands, coll. M. Takeda, 18 July 1988; 1 ovigerous female, cl 6.2 mm, URB1219, Kawauchi-gawa River, Amami-ohshima, Ryukyu Islands, 18 July 1988.

### *Habitat*

Lower reaches of rivers and streams which discharge to the sea.

### *Remarks*

Cai et al. (2006) recently designated a neotype for *C. leucosticta* Stimpson, 1860 and redescribed it in detail.

### *Distribution*

*Caridina leucosticta* has only been reported with certainty from Japan thus far (Cai et al. 2006).

### ***Caridina multidentata* Stimpson, 1860**

*Caridina multidentata* Stimpson, 1860, p 98 [type locality: Ogasawara (Bonin) Islands, Japan].

*Caridina multidentata*: Chace 1997, p 16.

*Caridina japonica* De Man, 1892b, p 261, pl. IX, figs. 7, 8 [type locality: Kagar, Hayagana, Japan].

*Caridina japonica*: Kamita 1963, p 8, fig. 7; Shokita and Nishijima 1977, p 189; Hayashi 1989c, p 229, fig. 166a–h; Shokita 2003, p 250, figs. 18H, 19B, 20I; Shokita et al. 2002b, p 76; 2003b, p 117; Cai et al. 405, figs. 11, 12. (See Cai et al 2006 for synonym).

### *Material examined*

Neotype: ovigerous female, cl 8.8 mm, NMST, from a stream in Tenno-ura, Chichi Jima Island, Ogasawara Islands, coll. K., Satake, 4 May 2000. Lectotype of *Caridina japonica* De Man, 1892b, ZMA De 102876, Japan, coll. J. Anderson, 1881, 4 males, cl 7.8–8.2 mm, paralectotype of *Caridina japonica* De Man, 1892b, data same as lectotype; 1 male, cl 8.8 mm, paralectotype, MNHN-Na 731, Kagar, Hayagana, Japan. Others: 1 female, cl 9.9 mm, NMST1745, no data; 1 male, cl 7.5 mm, NMST1121, upper part of Kawauchi-gawa River, Amami-oshima Island, Ryukyu Islands, coll. M. Takeda, 15 July 1988; 1 ovigerous female, cl 7.9 mm, NMST1754, Shino-Kawa River, Amami-oshima Island, Ryukyu Islands, coll. M. Takeda, 17 July 1988; 1 male, cl 8.3 mm, 2 ovigerous females, cl 7.3–9.8 mm, ZRC 2004.0537, Omija River, Iriomote Island, Ryukyu Islands, coll. T. Naruse, 1 August 1999; 1 ovigerous female, cl 8.2 mm, NMST,

Amami-ohshima Island, Ryukyu Islands, 29 July 1992; 1 male, cl 16 mm, 2 ovigerous females, cl 10–12 mm, ZRC, 128°15.31'E 26°39.94'N, Arakawa River, Okinawa Island, Ryukyu Islands, coll. Y. Cai, N. K. Ng, T. Naruse and S. Islam, 11 June 2000; 1 female, cl 4.9 mm, ZRC, fast flowing water, upper part of Omija River, Iriomote Island, Ryukyu Islands, coll. Y. Cai and T. Naruse, 15 June 2000; 1 female, cl 9.5 mm, 2 ovigerous females, cl 6.2–9.8 mm, ZRC.2004.0539, Taiho River, Okinawa Island, Ryukyu Islands, coll. P. K. L. Ng et al., 31 May 1998; 1 female, cl 4.9 mm, ZRC 2004.0538, fast flowing water, upper part of Omija River, Iriomote Island, Ryukyu Islands, coll. Y. Cai and T. Naruse, 15 June 2000.

### Habitat

Lower reaches of rivers and streams which discharge to the sea.

### Remarks

Cai et al. (2006) recently designated a neotype for *C. multidentata* Stimpson, 1860 from Ogasawara (Bonin) Islands and synonymized *C. japonica* De Man, 1892 with it.

### Distribution

*Caridina multidentata* has been reported from Japan, Taiwan (Hung et al. 1993), Fiji (Choy 1991) and Madagascar (Holthuis 1965).

### *Caridina serratirostris* De Man, 1892

*Caridina serratirostris* De Man, 1892a, p 382, pl. 23, p figs. 28a–e [type locality: “Bangkalan” and “Bonea” rivers, Selajar, Indonesia].

*Caridina serratirostris*: Bouvier 1925, p 218, figs. 480–486; Kubo 1938, p 92, fig. 21; Holthuis 1965, p 25, fig. 8; 1978, p 38, fig. 13a–h; Shokita and Nishijima 1977, p 189; Shokita et al. 2002b, p 76; Shokita 2003, p 250, figs. 18E, 19J, 20M; Shokita et al. 2003a, p 101; 2003b, p 117; Cai and Shokita 2006, p 246.

*Caridina serratirostris serratirostris*: Fujino 1972, p 7; Shokita 1975, p 119.

### Material examined

One ovigerous female, cl 4.2 mm, ZRC 2004.0570, 128°07.04'E 26°36.61'N, Arume River, Okinawa Island, Ryukyu Islands, coll. Y. Cai, N. K. Ng, T. Naruse and S. Islam, 11 June 2000; 1 male, cl 3.2 mm, 2 ovigerous females, cl 4.9–5.0 mm, ZRC 2001.0571, 123°52.80'E 24°16.64'N, shallow freshwater stream of Aira River, Iriomote Island, Ryukyu Islands, coll. Y. Cai, N. K. Ng and T. Naruse, 14 June 2000; 1 male, cl 40 mm, 5 ovigerous females, cl 4.8–5.3 mm, ZRC 2004.0572, 123°52.74'E 24°16.60'N, shallow freshwater stream, downstream of Aira River, Iriomote Island, Ryukyu Islands, coll. Y. Cai, N. K. Ng and T. Naruse, 14 June 2000; 1 female, cl 4.4 mm, 3 ovigerous females, cl 4.4–4.5 mm, ZRC 2004.0573, 123°51.84'E 24°23.65'N, fast flowing water, about 200 meters from sea, Omija River, Iriomote Island, Ryukyu Islands, coll. Y. Cai, N. K. Ng and T. Naruse, 15 June 2000; 1 male, cl 3.4 mm, ZRC 2004.0574, 123°51.84'E 24°23.65'N, fast flowing water, about 200 m from sea, Omija River, Iriomote Island, Ryukyu Islands, coll. Y. Cai and T. Naruse, 16 June 2000.

*Habitat*

Lower reaches of rivers and streams which discharge to the sea.

*Remarks*

Cai and Shokita (2006) recently discussed the taxonomy of *Caridina serratiostris* and *C. celebensis*, and pointed out that “In Ryukyus, specimens with short rostrum are mostly of *C. celebensis*, while those with long rostrum, almost all having arthrobranch on the first pereopod, are of *C. serratiostris*.”

*Distribution*

Japan, Philippines, Fiji, Malaysia, Indonesia and Madagascar.

***Caridina celebensis*** De Man, 1892

*Caridina serratiostris* var. *celebensis* De Man, 1892a, p 385, pl. 23: fig. 28f–h [type locality: river at Palopo, Luwu, Sulawesi (Celebes), Indonesia].

*Caridina celebensis*: Bouvier 1925, p 220; Holthuis 1978, p 39, fig. 14a–i; Yeo et al. 1999, p 214, figs. 8a–k, 9a–e; Shokita 2003, p 250, fig. 19K; Cai and Shokita 2006, p 247.

*Caridina serratiostris koterai* Kamita, 1951, p 5, figs. A–G [type locality: Honshu Island, Japan]

*Caridina serratiostris celebensis*: Kamita 1961, p 74; 1963, p 11, fig. 11; Fujino 1972, p 8, fig. 12; Shokita 1975, p 119.

*Caridina leptocarpa* Liang and Yan, 1988, p 15, figs. 1–9 [type locality: Min Jiang (River), Fuzhou, Fujian Province, China].

*Caridina leptocarpa*: Liang and Zhou 1993, p 231.

*Paracaridina leptocarpa*: Liang 2004, p 318, fig. 155.

*Material examined*

Two ovigerous females, cl 3.9–4.1 mm, ZRC 2004.0575, upper stream of Tima River, about 4 km from river mouth, Okinawa Island, Ryukyu Islands, coll. Y. Cai, N. K. Ng, T. Naruse and S. Islam, 11 June 2000; 1 ovigerous female, cl 4.5 mm, Yakugachi River, Amami-ohshima, Ryukyu Islands, 30 July 1992; 2 ovigerous females, cl 4.8–5.3 mm, Tabaru River, Yonaguni Island, coll. S. Shokita, 31 March 2000; 26 ovigerous females, cl 3.2–4.1 mm, 7 females, cl 2.1–3.4 mm, 2 males, cl 2.4–2.5 mm, ZRC 2004.0576, 128°04.60'E 26°33.42'N upstream of Tima River, about 1–2 km from river mouth, Okinawa Island, Ryukyu Islands, pH 7.4, coll. Y. Cai, N. K. Ng, T. Naruse and S. Islam, 11 June 2000; 1 ovigerous female, cl 4.7 mm, ZRC, Okuma River, Okinawa Island, Ryukyu Islands, 31 May 1998; 2 females, cl 4.1–4.2 mm, ZRC, Tima River, Okinawa Island, Ryukyu Islands, 25 April 1998; 1 female, cl 2.9 mm, ZRC 2004.0577, upper Hiji fall, Hiji River, Okinawa Island, Ryukyu Islands, 4 November 1987.

*Habitat*

Lower reaches of rivers and streams which discharge to the sea.

*Remarks*

*Caridina celebensis* was recently reviewed by Cai and Shokita (2006). It is characterised by the absence of an arthrobranch on the base of the first pereopod. *Caridina celebensis* is distributed from Sulawesi, Indonesia to Honshu, Japan.

*Distribution*

Japan, China, Philippines, Sulawesi.

***Caridina laoagensis* Blanco, 1939**

(Figures 5 and 6A–E)

*Caridina laoagensis* Blanco, 1939, p 390, pl 2 [type locality: not indicated; presumably Laoag River, Laoag, Province of Ilocos Norte, Luzon, Philippines (after Chace 1997)].

*Caridina laoagensis*: Chace 1997, p 12, fig. 5a–t; Cai and Anker 2004, p 237, fig. 3; Cai and Shokita 2006, p 246.

*Caridina weberi*: Shokita 2003, p 250, figs. 18I, 19D, 20N.

*Material examined*

One male, cl 4.9 mm, URB, Aritsu River, Kume-jima Island, Ryukyu Islands, coll. A. Kawakami, 8 December 1995; 1 male, cl 3.5 mm, 124°14.80'E 24°22.76'N, Gaburumata River, Ishigaki Island, Ryukyu Islands, coll. Y. Cai and T. Naruse, 13 June 2000; 1 male, cl 4.3 mm, ZRC 2004.0578, 123°52.80'E 24°16.64'N, shallow freshwater stream of Aira River, Iriomote Island, Ryukyu Islands, coll. Y. Cai, N. K. Ng and T. Naruse, 14 June 2000. 1 male, cl 3.8 mm, URB, Omija River, Iriomote Island, Ryukyu Islands, 1 August, 1998, coll. T. Naruse; 1 male, cl 8.1 mm, 1 ovigerous female, cl 7.8, RUB, a small stream near Haemida beach, Iriomote, Ryukyu Islands, coll T. Naruse, 28 July 1999.

*Description*

Rostrum straight (Figure 5A), reaching to base of second segment of antennular peduncle, dorsal margin nearly horizontal, elevated slightly above dorsal margin of carapace, rostral formula 0+9–17/1–6, dorsal teeth evenly spaced, all on rostrum considerably anterior to orbital margin. Antennal spine fused with inferior orbital angle; pterygostomian margin rounded.

Sixth abdominal somite 0.40 times length of carapace, 1.3 times as long as fifth somite, shorter than telson. Telson (Figure 5C) 2.5 times as long as wide, terminating in a projection, with five pairs of dorsal spinules and one pair of dorsolateral spinules; distal end with two pairs of spines and three to four pairs of plumose setae, lateral pair of spines distinctly longer than sublateral pair, intermediate pairs of setae distinctly longer than later spines, distal margin broadly rounded. Preanal carina high, without spine (Figure 5B).

Eyes well developed, anterior end reaching to 0.7 times length of basal segment of antennular peduncle. Antennular peduncle 0.52 times as long as carapace; basal segment of antennular peduncle longer than sum of second and third segment lengths, anterolateral angle reaching 0.20 times length of the second segment, second segment distinctly longer than third segment. Stylocerite (Figure 5D) reaching 0.8 length of basal segment of antennular peduncle. Scaphocerite 2.6 times as long as wide.

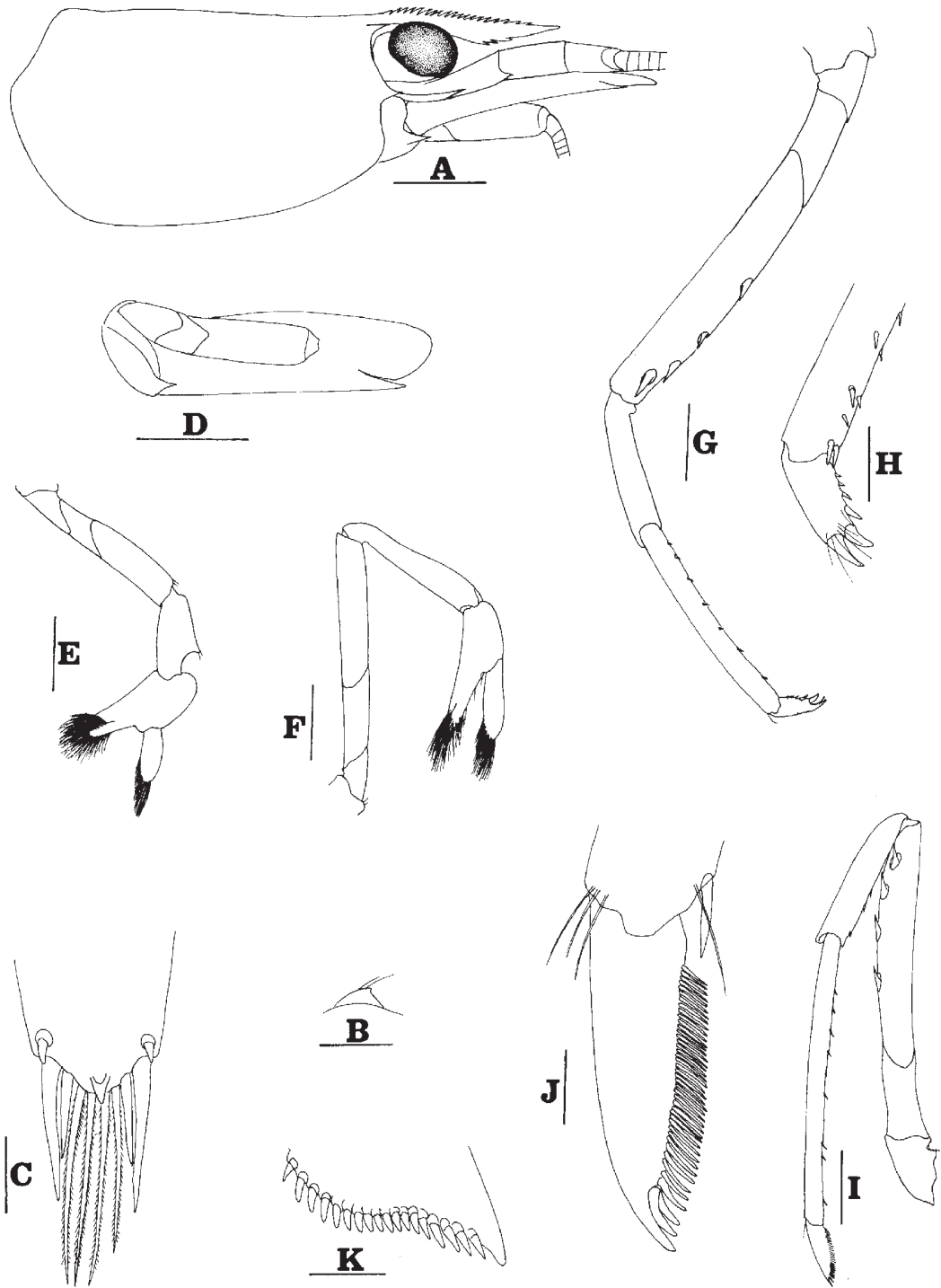


Figure 5. *Caridina laoagensis*. A, cephalothorax and cephalic appendages, lateral view; B, preanal carina; C, distal portion of telson; D, scaphocerite; E, first pereiopod; F, second pereiopod; G, third pereiopod; H, dactylus of third pereiopod; I, fifth pereiopod; J, dactylus of fifth pereiopod; K, diaeresis. Scale: A, B, D=1 mm; E-G, I=0.5 mm; C, H, J, K=0.2 mm (male, cl 3.5 mm, ZRC).

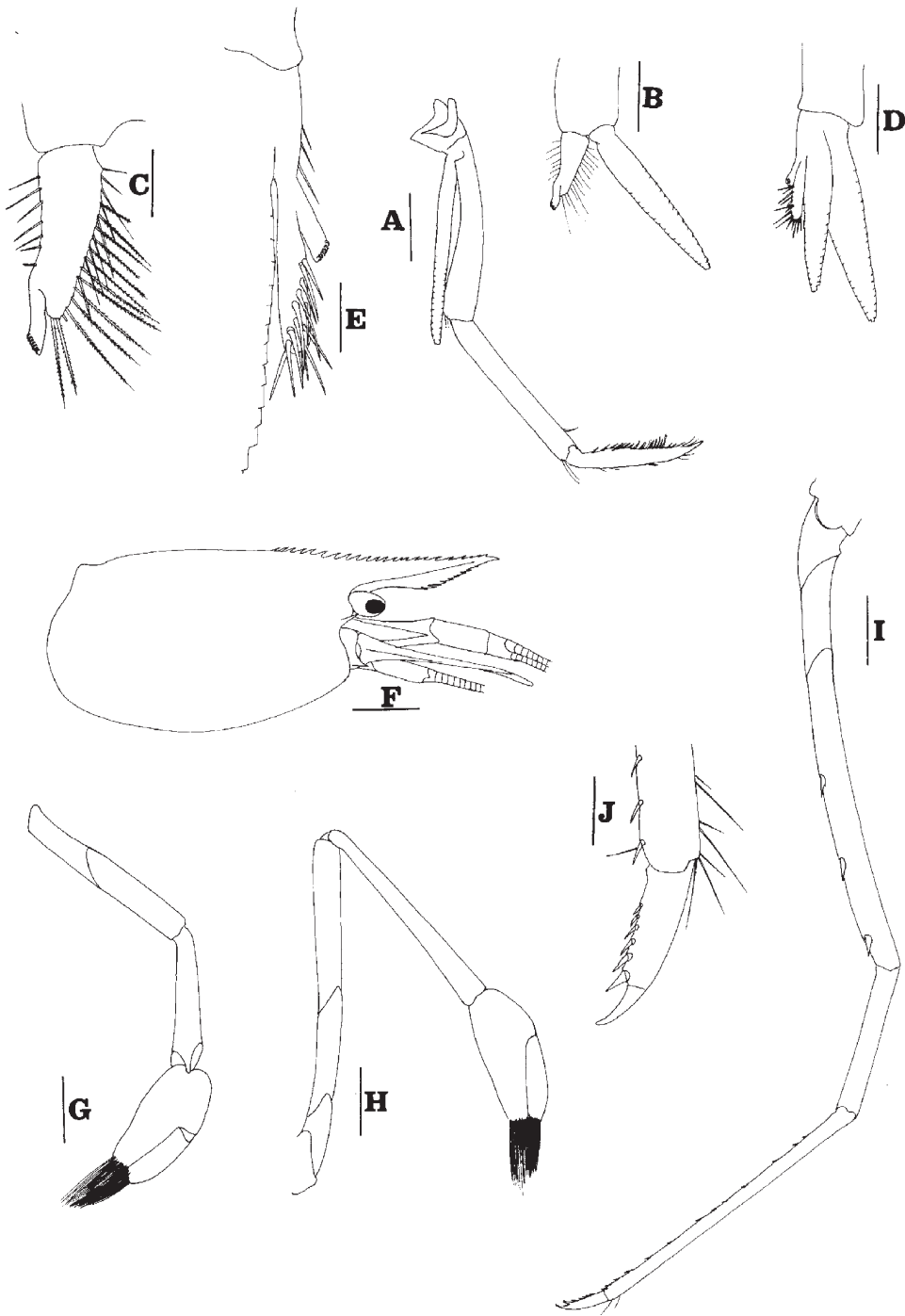


Figure 6. *Caridina laoagensis*. A, third maxilliped; B, male first pleopod; C, endopod of male first pleopod; D, male second pleopod; E, appendix masculina and appendix interna of male second pleopod; *Caridina rubella*. F, cephalothorax and cephalic appendages, lateral view; G, first pereiopod; H, second pereiopod; I, third pereiopod; J, dactylus of third pereiopod. Scale: F=1 mm; A, B, D, G-I=0.5 mm; C, E, J=0.2 mm (A-E, male, cl 3.5 mm, ZRC; F-J, female, cl 3.9 mm, URB).

Incisor process of mandible ending in irregular teeth, molar process truncated. Lower lacinia of maxillula broadly rounded, subtriangular, upper lacinia elongate, with a number of distinct teeth on inner margin, palp slender. Upper endites of maxilla subdivided, palp short, scaphognathite tapering posteriorly with numerous long, curved setae at posterior end. Palp of first maxilliped ending in a finger-like projection. Second maxilliped typical, arthrobranch well developed. Third maxilliped reaching to end of antennular peduncle, with ultimate segment shorter than penultimate segment.

Epipods well developed on first four pereopods. First pereopod (Figure 5E) reaching to distal end of basal segment of antennular peduncle; merus 2.1 times as long as broad, as long as, or slightly longer than carpus; carpus excavated anteriorly, shorter than chela, 1.3 times as long as high; chela 2.4 times as long as broad; fingers subequal to length of palm. Second pereopod (Figure 5F) reaching to end of second segment of antennular peduncle; merus slightly shorter than carpus, 4.3 times as long as broad; carpus slightly longer than chela, 4.3 times as long as high; chela 2.9 times as long as broad; fingers 1.6 times as long as palm. Third pereopod (Figure 5G, H) reaching to end of scaphocerite, propodus 8.3 times as long as broad, 3.7 times as long as dactylus; dactylus 2.2 times as long as wide (spines included), terminating in one stout claw, with five accessory spines on flexor margin. Fifth pereopod (Figure 5I, J) reaching to end of antennular peduncle, propodus 9.2 times as long as broad, 3.3 times as long as dactylus, dactylus 3.1 times as long as wide (spinules included), terminating in one elongated claw, with 28–42 spinules on flexor margin.

Endopod of male first pleopod sub-triangular, reaching to one-thirds length of exopod, appendix interna reaching beyond distal end of endopod by most of its length. Appendix masculina of male second pleopod reaching to two-thirds length of exopod.

Uropodal diaeresis (Figure 5K) with 16–18 movable spinules.

Eggs  $0.40\text{--}0.42 \times 0.20\text{--}0.25$  mm in diameter.

### *Habitat*

Rivers and streams which discharge to the sea.

### *Remarks*

Chace (1997) recently redescribed this species on the basis of specimens from Philippines. He (Chace 1997, p 13) also commented that it "...is possible that *C. laoagensis* will eventually fall into synonymy with the variable *C. weberi* from Indonesia,..." According to an on-going revision by one of the authors (YC), most of the subspecies of *C. weberi*, are in fact, distinct species. Among all the allied species, *C. laoagensis* is most similar to *C. weberi* De Man, 1908a by the form of the rostrum, which is straight, pointed and crested at the base of the rostrum; the spines and setae on the distal margin of the telson (the longer setae arranged between two pairs of strong spines, of which, the sublateral pair shorter than the lateral pair vs. the longer setae arranged between one pair of strong spines).

*Caridina laoagensis* appears to be rare in Ryukyu Islands. It has previously been reported from Tabaru River of Yonaguni Island, Nagura and Miyara Rivers of Ishigaki Island, and Shigema, Yona and Manna Rivers of Okinawa Island by Shokita (1979, p 2003) as *Caridina weberi*.

### *Distribution*

Philippines, Japan



*Caridina rubella* Fujino and Shokita, 1975

(Figures 6F–J, 7 and 8)

*Caridina rubella* Fujino and Shokita, 1975, p 102, fig. 6a–o [type locality: Izaga Cave, Morikaga Cave and a well near Hirara city of Miyako Island, Ryukyus, Japan].

*Caridina rubella*: Shokita and Nishijima 1976, p 71; Shokita 1979, p 203; 2003, p 250, figs. 18F, 19I; 2006d, p 61; Cai and Anker 2004, p 243; Fujita and Shokita 2005b, p 203.

*Material examined*

Holotype: female, cl 6.1 mm (dry), URB495; Izaga Cave, Miyako Island, Ryukyu Islands, Japan, coll. S. Shokita, 19 September 1964; paratype: 1 female, cl 5.4 mm (dry), URB496, data same as holotype. Others: 1 male cl 4.8 mm, 7 females, cl 3.9–8.8 mm, URB Murikawa, Yamato-ga, Miyako Island, Ryukyu Islands, Japan, 23 October 1982.

*Diagnosis*

Rostrum straight or slightly upturned, reaching to end of second segment of antennular peduncle, or to end of scaphocerite. Rostrum with teeth throughout its dorsal margin, rostral formula 9–14+15–24/9–23. Antennal spine prominent, situated lower than suborbital angle; pterygostomian margin rounded; eyes strongly reduced. Preanal carina with spine. Telson with five pairs of dorsal spines, small posteromedial projection, lateral pair of spines longer than or as long as intermediate pairs of setae. Antennular peduncle 0.5–0.6 times as long as carapace. Stylocerite reaching to end of basal segment of antennular peduncle, or slightly beyond it. Scaphocerite 3.1 times as long as wide. First pereopod with ischium much shorter than merus, carpus 1.0–1.5 times as long as chela, 4.2 times as long as high, chela 2.0–3.0 times as long as broad, finger distinctly longer than palm. Second pereopod with ischium much shorter than merus, carpus 1.5–2.0 times as long as chela, 8–12 times as long as high, chela 2.4–4.0 times as long as broad, fingers 1.5–2.0 times as long as palm. Third pereopod with propodus not enlarged, its length 4.0–5.0 times as long as dactylus; dactylus ending in two claws, with two to four spines on flexor margin. Fifth pereopod with propodus 5.0–6.5 times as long as dactylus, dactylus ending in one claw, with 13–17 spinules on flexor margin. Endopod of male first pleopod sub-triangular, no appendix interna. Uropodal diaeresis with 11–13 spinules.

*Habitat*

Subterranean water.

*Remarks*

The forms of the rostrum, the first two pereopods and telson are much more variable than in the original description by Fujino and Shokita (1975). Holthuis (1978) described *Caridina troglodytes*, on the basis of four incomplete specimens from Danmin Cave near Konogusgus, New Ireland. *Caridina troglodytes* is very similar to *C. rubella*, most of its characters fall within the range of variation of *C. rubella*, except for the smaller number of ventral rostral teeth (2–8 vs. 9–23) and the fewer spinules on the dactylus of the fifth pereopods (6 vs. 13–15). As the ventral rostral teeth are quite variable in both species and

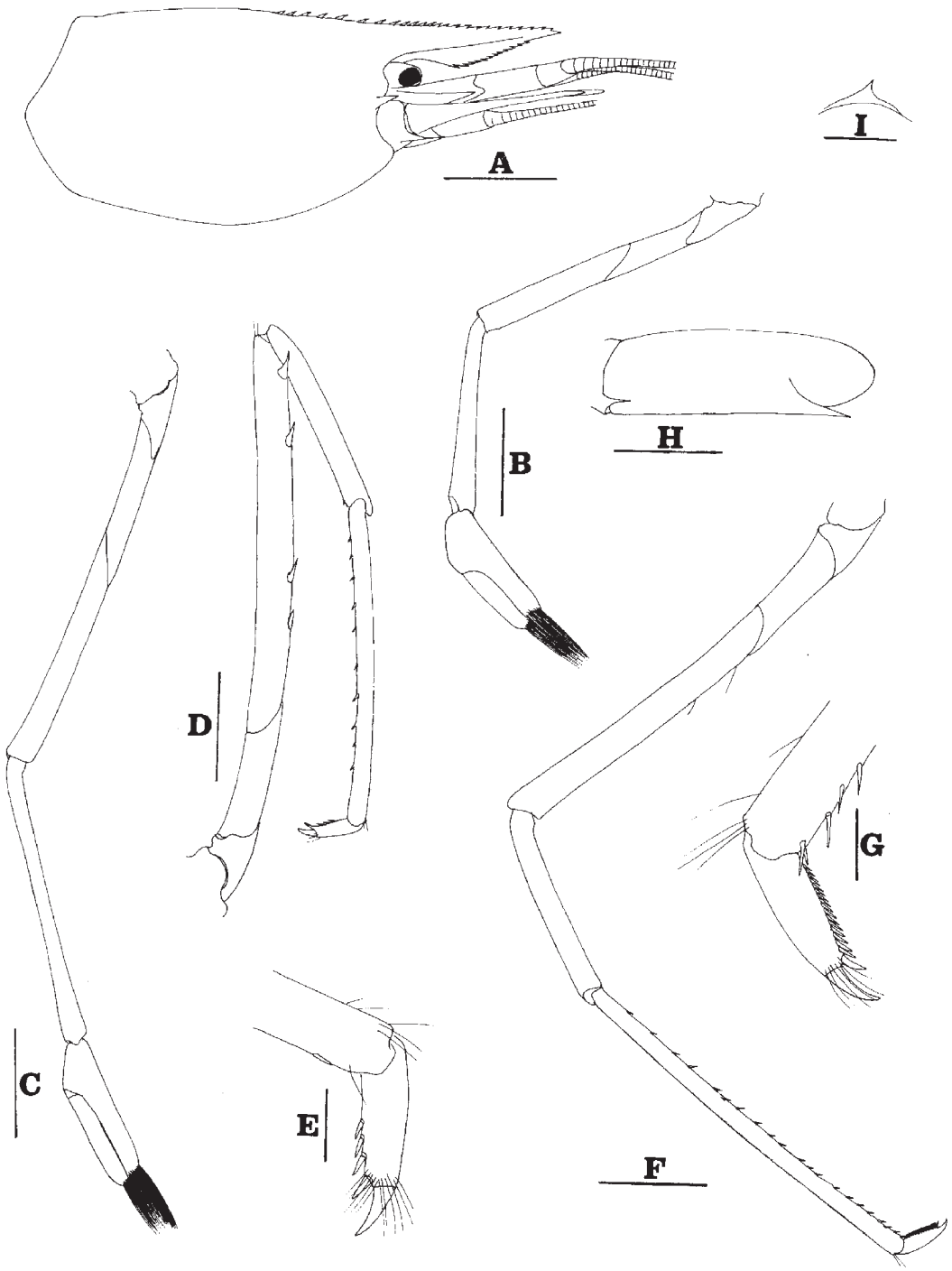


Figure 7. *Caridina rubella*. A, cephalothorax and cephalic appendages, lateral view; B, first pereiopod; C, second pereiopod; D, third pereiopod; E, dactylus of third pereiopod; F, fifth pereiopod; G, dactylus of fifth pereiopod; H, scaphocerite; I, preanal carina. Scales: A, H=0.5 mm; B-D, F=1 mm; E, G=0.2 mm; I=1 mm (A-G, female, cl 5.5 mm, URB; H, I, female, cl 8.8 mm, URB).

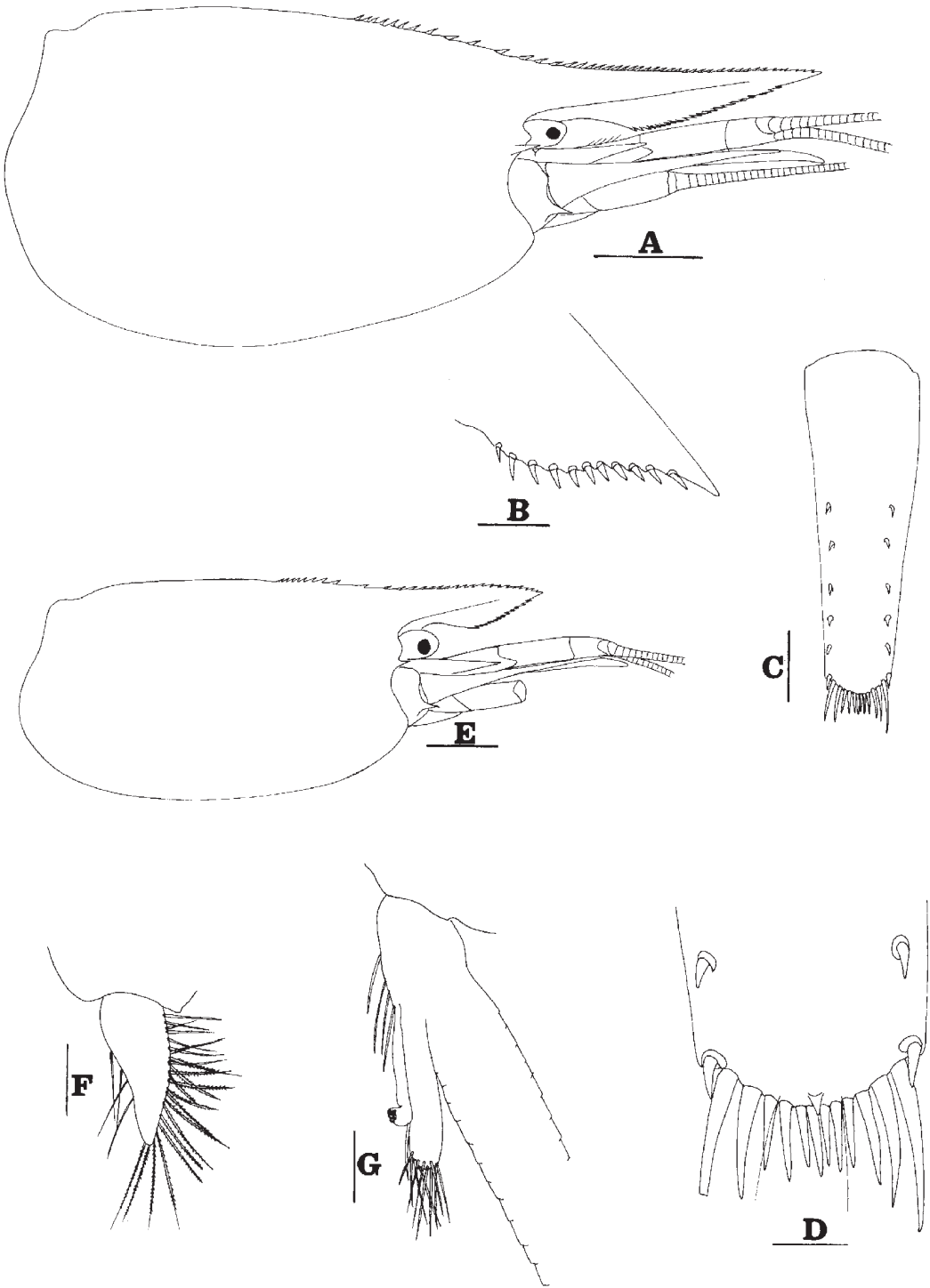


Figure 8. *Caridina rubella*. A, cephalothorax and cephalic appendages, lateral view; B, diaeresis; C, telson; D, distal portion of telson; E, cephalothorax and cephalic appendages, lateral view; F, endopod of male first pleopod; G, appendix masculina and appendix interna of male second pleopod. Scales: A=0.5 mm; B, D, F, G=0.2 mm; C, E=1 mm (A, B, female, cl 8.8 mm, URB; C, D, female, cl 5.5 mm, URB; E-G, male, cl 4.8 mm, URB).

the supposed fifth pereopod is unattached, and thus could be the fourth pereopod instead, the identity of Holthuis' species need more specimens for it to be ascertained. Shokita (1979) reported it from two more locations in southern Japan, one from subterranean water of Shiokawa River, Okinawa Island, Ryukyus, and the other from Suirendo Cave, Okinoerabu Island, Ryukyu Islands. Cai and Anker (2004) reported the occurrence of *Caridina rubella* from Palawan Island, the Philippines.

#### *Distribution*

Ryukyu Islands, Philippines.

#### ***Caridina prashadi* Tiwari and Pillai, 1971**

(Figure 9)

*Caridina prashadi* Tiwari and Pillai, 1971, p 79, figs. 3–4 [type locality: Aberdeen (Port Blair), southern Andaman Island, India].

*Caridina sakishimensis* Fujino and Shokita, 1975, p 99, fig. 5 [type locality: Sakishima islands in southern Ryukyus, Japan].

*Caridina sakishimensis*: Shokita 1979, p 205; Suzuki and Sato 1994, p 72, text-fig.

*Caridina rapaensis*: Shokita 2003, p 249, fig. 18J; 2005b, p 217; 2006e, p 62; Shokita et al., 2003a, p 101.

#### *Material examined*

Paratype of *Caridina sakishimensis*: 1 female, cl 7.2 mm, URB, Arakawabanna River, Yonaguni Island, Ryukyu Islands, coll. S. Shokita, 27 March 1972. Others: 2 females, cl 3.9–4.0 mm, ZRC 2004.0581, fast flowing water, upper part of Omija River, Iriomote Island, Ryukyu Islands, coll. Y. Cai and T. Naruse, 15 June 2000; 1 ovigerous female, cl 6.2 mm, ZRC 2004.0582, coll. A. Kawakami, Aritsu River, Kume-jima, Ryukyu Islands, 8 December 1995; 1 male, cl 3.8 mm, URB, Omija River, Iriomote, Ryukyu Islands, coll. T. Naruse, 1 August 1999; 1 ovigerous female, cl 7.8 mm, 1 male, cl 8.1 mm, URB, a stream flowing to Haemida beach, Iriomote Island, Ryukyu Islands, coll. T. Naruse, July 1999.

#### *Diagnosis*

Rostrum straight, reaching near to middle of second segment of antennular peduncle. Rostral formula 1–6/3–6. Suborbital angle acute, fused with antennal spines; pterygostomian margin rectangular. Preanal carina with no spine. Telson with small posteromedial projection, lateral pair of spines shorter than intermediate pairs. Antennular peduncle 0.6 times as long as carapace. Stylocerite reaching 0.8 times length of basal segment of antennular peduncle. Scaphocerite 2.9 times as long as wide. First pereopod with carpus 1.1–1.3 times as long as high, chela 2.0 times as long as broad, finger distinctly shorter than palm. Second pereopod with carpus 4.5 times as long as high, chela 2.6 times as long as broad, fingers 1.5 times as long as palm. Third pereopod with propodus 4.0–4.8 times as long as dactylus; dactylus ending in two claws, with two to four spines on flexor margin. Fifth pereopod with propodus 4.5–5.0 times as long as dactylus, dactylus ending in one claw, with 29 spinules on flexor margin. Endopod of male first pleopod sub-triangular, with appendix interna. Uropodal diaeresis with 21–22 spinules.

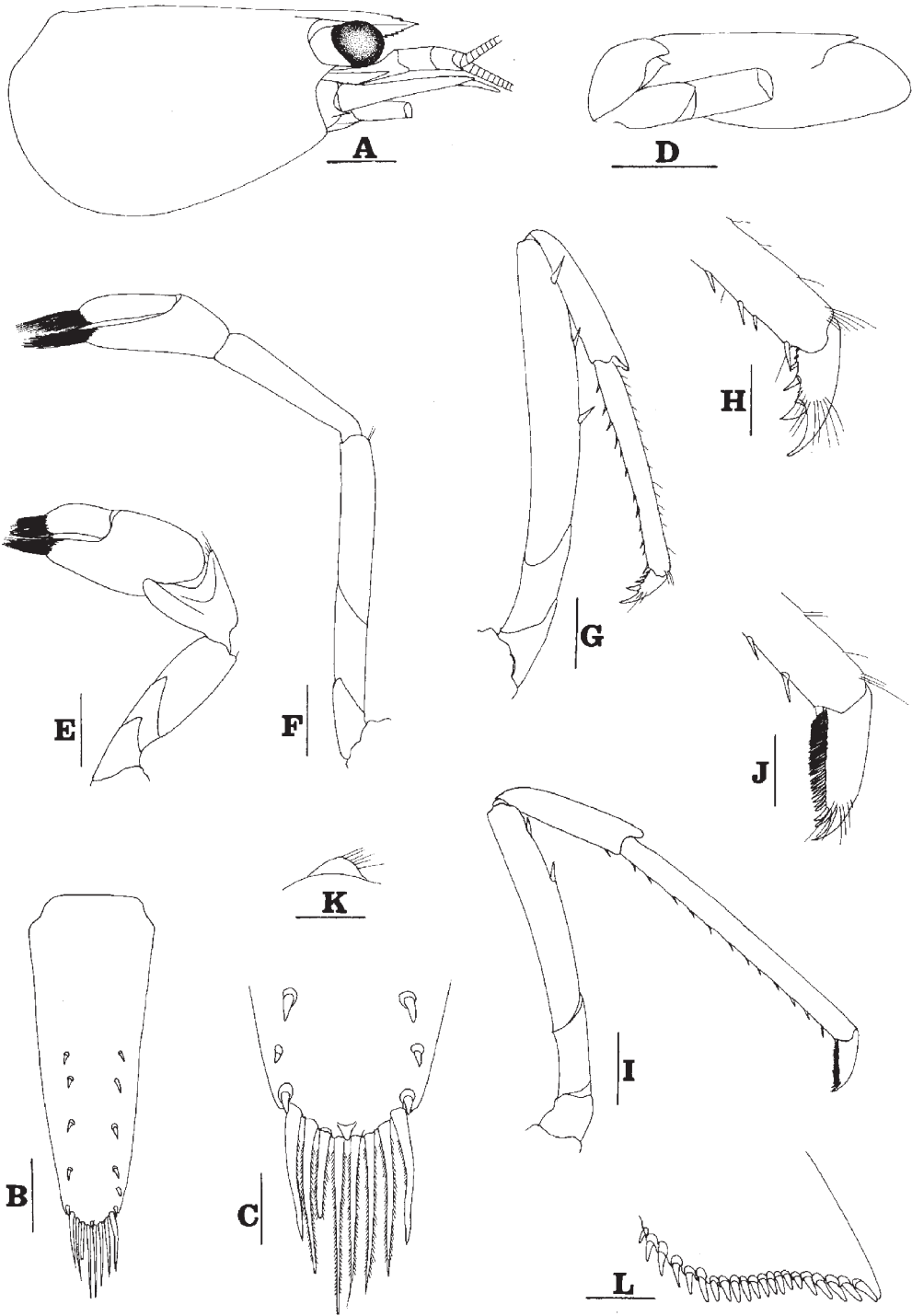


Figure 9. *Caridina prashadi*. A, cephalothorax and cephalic appendages, lateral view; B, telson; C, distal portion of telson; D, scaphocerite; E, first pereiopod; F, second pereiopod; G, third pereiopod; H, dactylus of third pereiopod; I, fifth pereiopod; J, dactylus of fifth pereiopod; K, preanal carina; L, diaeresis. Scales: A, D=1 mm; B, E-G, I, K=0.5 mm; C, H, J, L=0.2 mm (female, cl 3.9 mm, ZRC 2004.0581).

*Habitat*

Mountain streams or rivers.

*Remarks*

Tiwari and Pillai (1971) described a new species, *Caridina prashadi*, from the southern Andaman Islands. Fujino and Shokita (1975) did not compare it with *C. prashadi* when they described *C. sakishimensis* from Southern Ryukyus. It was subsequently recorded from Kume Island of the northern Ryukyus and Okinoerabu Island of the central Ryukyus (Shokita 1979; Suzuki and Sato 1994). Examination of one fresh collection from the Andaman Islands (2 females, cl 4.0–4.1 mm, 1 ovigerous female, ZRC, Mount Harriet National Park, south Andaman Islands, India, coll. Indranei Das, 20 August 1997) and re-examination of the types in the Ryukyu University, and the examination of fresh material from Iriomote Island indicated that *C. sakishimensis* is, in fact, identical with *C. prashadi*. The record of *C. rapaensis* by Shokita (2003) was based on these specimens and should thus be reassigned here.

*Distribution*

Andaman Islands, Ryukyu Islands.

***Caridina propinqua* De Man, 1908**

(Figures 10 and 11)

*Caridina propinqua* De Man, 1908b, p 227, pl 19, fig. 6 [type locality: Dhappa, near Calcutta, India].

*Caridina propinqua*: Kemp 1915, p 309; 1918, p 274; Bouvier 1925, p 181, figs. 375, 381; Johnson 1961, p 131, figs. 12–15; De Silva 1982, p 127, fig. 5; Ng and Choy 1990, p 17; Shokita 2003, p 250, fig. 18D; Shokita 2005c, p 216; 2006f, p 61; Shokita et al. 2002a, p 88; Shokita et al. 2003a, p 101.

*Caridina blancoi* Chace 1997, p 7, fig. 2 [type locality: Tayabus River, Luzon Island Philippines].

*Caridina hainanensis* Liang and Yan, 1983, p 211, fig. 1 [Wenchang County, Hainan Island, China].

*Caridina hainanensis*: Liang 2004, p 302, fig. 148.

*Material examined*

One male, cl 2.9 mm (USNM-264045, holotype of *Caridina blancoi*), near mouth of Tayabas River, Luzon Island, Philippines, 25 February 1909; 1 male, cl 2.2 mm (SHU-79-310-1, holotype of *Caridina hainanensis*), 1 female, cl 4.0 mm (SHU-79-310-2, paratype of *C. hainanensis*), Wenchang County, Hainan Island, China, coll. X. Liang and S. Yan, 14 April 1979; 11 males, cl 2.6–3.3 mm, 6 females, cl 3.5–3.8 mm, 16 ovigerous females, cl 3.4–4.0 mm, URB, mangrove of Nakama River, Iriomote Island, Ryukyu Islands, coll. S. Shokita, 3–5 June 1985; 30 specimens, ZRC 2004.0579, tide-pool in mouth of Shira River, Iriomote Island, Ryukyu Islands, 5 October 1982.

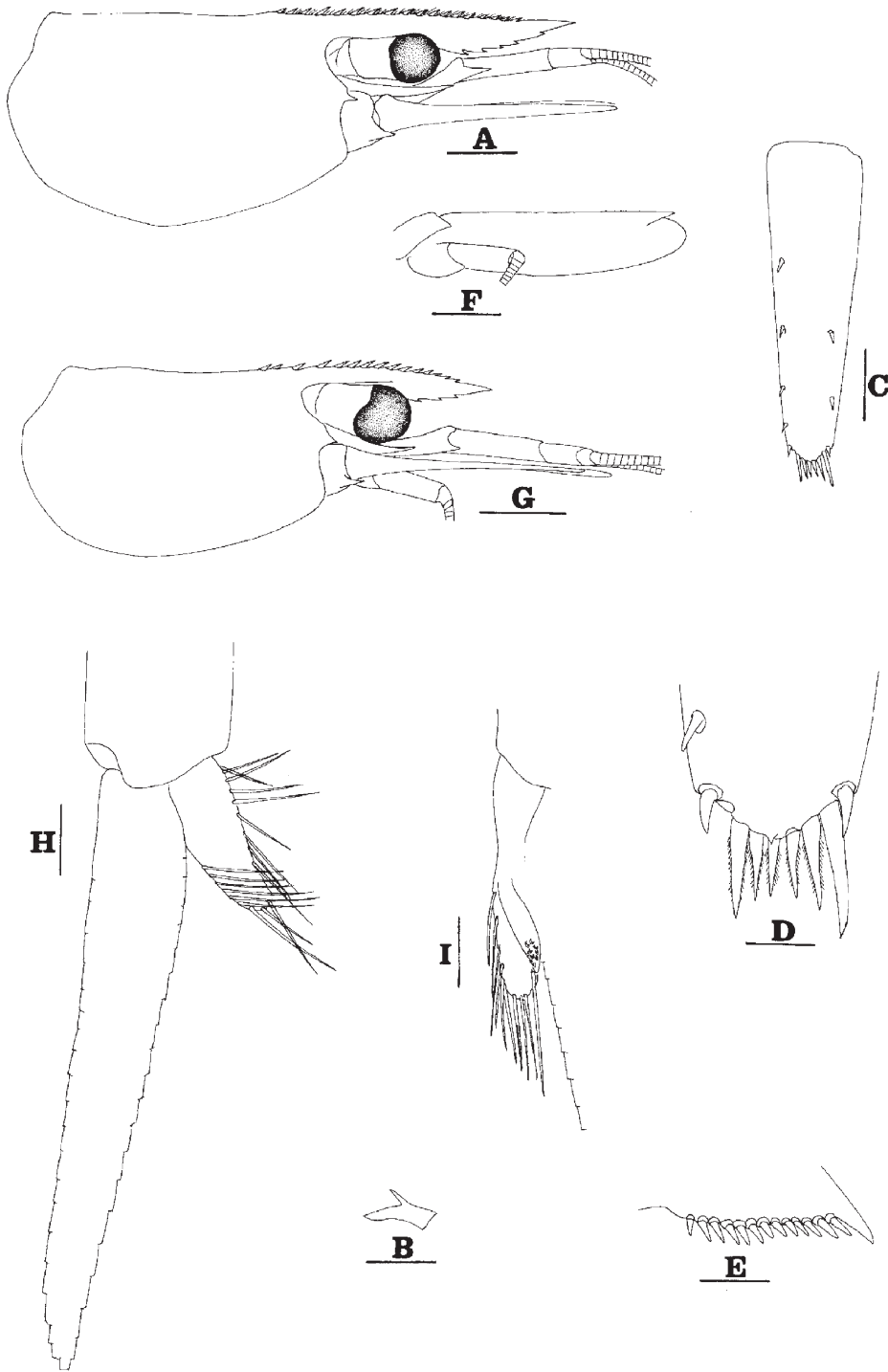


Figure 10. *Caridina propinqua*. A, cephalothorax and cephalic appendages, lateral view; B, preanal carina; C, telson; D, distal portion of telson; E, diaeresis; F, scaphoците; G, cephalothorax and cephalic appendages, lateral view; H, male first pleopod; I, male second pleopod. Scales: A–C, F, G=1 mm; D, E, H, I=0.2 mm (A–F, female, cl 4.0 mm, URB; G–I, male, cl 2.8 mm, URB).

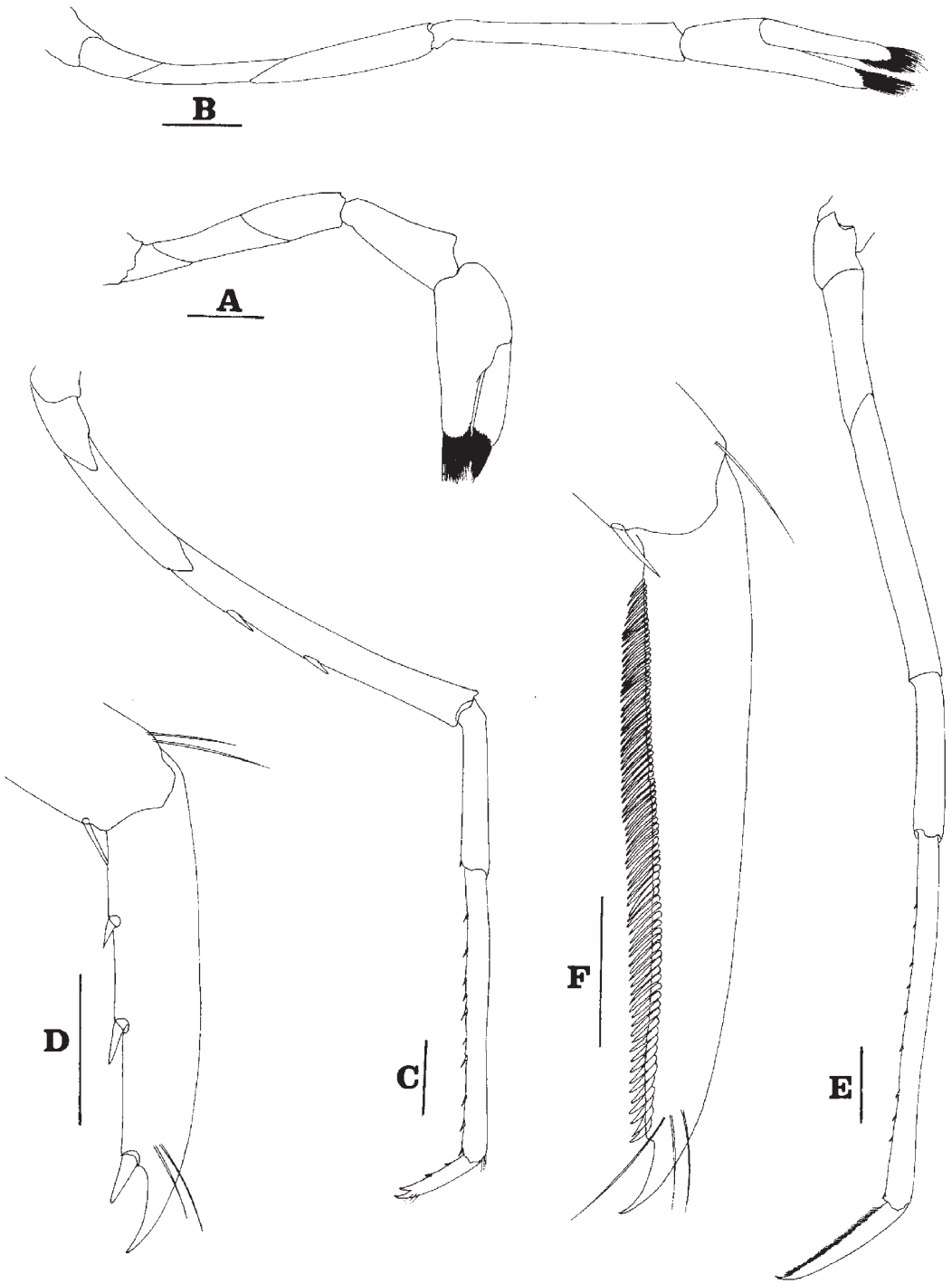


Figure 11. *Caridina propinqua*. A, first pereiopod; B, second pereiopod; C, third pereiopod; D, dactylus of third pereiopod; E, fifth pereiopod; F, dactylus of fifth pereiopod. Scales: A–C, E=0.5 mm; D, F=0.2 mm (female, cl 4.0 mm, URB).



*Diagnosis*

Rostrum (Figure 10A, G) straight or sloping ventrally anteriorly, reaching near middle of second segment of antennular peduncle, to end of third segment. Rostral formula: 3–4+9–16/1–7/1–6(3–4), no apical teeth. Suborbital angle acute, distinctly separated from antennal spines; pterygostomian margin rounded. Preanal carina (Figure 10B) with a spine. Telson (Figure 10C, D) with three to four pairs of dorsal spines and small posteromedial projection, lateral pair of spines longer than intermedial pairs. Antennular peduncle long, subequal to carapace length. Stylocerite reaching 0.8 times length of basal segment of antennular peduncle. Scaphocerite (Figure 10F) 4.0 times as long as wide. First pereopod (Figure 11A) with carpus 2.3 times as long as high, chela 2.5 times as long as broad, finger longer than palm. Second pereopod (Figure 11B) with carpus 6.8 times as long as high, chela 4.1 times as long as broad, fingers 2.0 times as long as palm. Third pereopod (Figure 11C, D) with propodus 3.2 times as long as dactylus, propodus without enlargement. Dactylus ending in two claws, with one to four spines on flexor margin. Fifth pereopod (Figure 11E, F) with propodus 2.5 times as long as dactylus; dactylus ending in one claw, with 57–76 spinules on flexor margin. Endopod of male first pleopod with no appendix interna. Uropodal diaeresis with 13–19 spinules. Egg size: 0.38–0.48 × 0.25–0.30 mm.

*Habitat*

Lower reaches of rivers or mountain streams which discharge to the sea. Commonly found in mangrove creeks.

*Remarks*

Liang and Yan (1983) described *Caridina hainanensis* on the basis of specimens from Hainan Island. Their species has the same typical characteristics as *C. propinqua*, namely the form of the rostrum and the telson, the form of various pereopods, especially the third, which has a very small number of spines (one to three in *C. hainanensis* vs. one to four in *C. propinqua*) on the flexor margin of the dactylus, the identical form of the endopod of male first pleopod. Re-examination of the types indicated that *C. hainanensis* should be regarded as a junior synonym of *C. propinqua*.

Chace (1997) proposed a new species, based on a single specimen. He commented that “(t)he proposal of a new species, based on a single specimen in a genus that is noteworthy for its variable species, may be questionable, but it seems desirable to call attention to a taxon that apparently differs from all others known in a combination of characters; the form and dentition of the rostrum and telson; the prominence of the suborbital angle; and the form of the chelae and carpi of two anterior pereopods and of the dactyls of the third and fourth pereopods.” Re-examination of the holotype confirms that it is identical with *C. propinqua*.

Egg size of this species is quite variable. It is 0.39–0.45 × 0.24–0.27 mm in specimens from Hainan (Liang and Yan 1983), 0.54 × 0.36 mm in populations from Malaysia (Johnson 1961) and 0.38–0.48 × 0.25–0.30 mm in the present specimens from the Ryukyus. Kemp (1918) reported *C. propinqua* from southern Thailand. The identity of his species is doubtful as it had an egg size of 0.64–0.70 × 0.39–0.44 mm, which is much larger than in specimens from elsewhere.

This record has recently been reported by Shokita (2003). Previously, *Caridina propinqua* has been reported from Sri Lanka (De Silva 1982), India (De Man 1908b; Kemp 1915),

Malaysia (Johnson 1961; Ng and Choy 1990), southern China (Liang and Yan 1983) and the Philippines (Chace 1997).

*Distribution*

Sri Lanka, India, Malay Peninsula, Philippines, and China.

***Caridina okinawa*, new species**

(Figure 12)

*Material examined*

Holotype: female, cl 6.5 mm, USNM-123426, Ingue Cave at Yomitan Village, Okinawa Island, Ryukyu Islands, Japan, coll. D. W. Rhodes, 3 March 1967.

*Description*

Rostrum (Figure 12A) short, straight, reaching near end of second segment of antennular peduncle; dorsal margin with 12 teeth, three of them on carapace, ventral margin with five very small teeth; inferior orbital angle of carapace fused with antennal spine, sharp and long; pterygostomial angle rectangular. Sixth abdominal somite 0.50 times as long as carapace, 1.6 times as long as fifth somite, slightly shorter than telson. Telson terminating in median projection; five pairs of dorsal spinules, one pair of dorsolateral spines near distal end, four pairs of spines on distal margin, lateral pair shortest, sublateral pair longest; preanal carina high, with a small spine. Scaphocerite 2.8 times as long as wide.

Eyestalk short, eye with an undeveloped cornea. Antennular peduncle stout, 0.5 times as long as carapace; stylocerite reaching slightly beyond end of basal segment of antennular peduncle.

Third maxilliped reaching to end of third segment of antennular peduncle, with ultimate segment shorter than penultimate segment. Epipods on first four pereopods. First pereopod (Figure 12C) stout, reaching to middle of second segment of antennular peduncle, ischium much shorter than merus, merus 2.0 times as long as broad, as long as carpus; carpus excavated anteriorly, shorter than chela, 1.2 times as long as high; chela 1.9 times as long as broad; fingers 0.6 times as long as palm. Second pereopod (Figure 12D) reaching end of second segment of antennular peduncle, ischium much shorter than merus, merus slightly longer than carpus, 5.4 times as long as broad; carpus 1.3 times as long as chela, 5.0 times as long as high; chela 2.4 times as long as broad; fingers 1.3 times as long as palm. Third pereopod (Figure 12E, F) reaching end of third segment of antennular peduncle, propodus normal shape, distinctly shorter than merus, 9.0 times as long as broad, 4.5 times as long as dactylus; dactylus ending in two strong claws; 2.6 times as long as wide (spines included), with five accessory spines on flexor margin. Fifth pereopod (Figure 12G, H) reaching to end of basal segment of antennular peduncle, propodus distinctly longer than merus, 11 times as long as broad, 4.7 times as long as dactylus; dactylus 2.6 times as long as wide, ending in two large claws, with 26 spinules on its flexor margin. Uropodal diaeresis with 17 spinules.

*Habitat*

The specimen was collected from subterranean water.

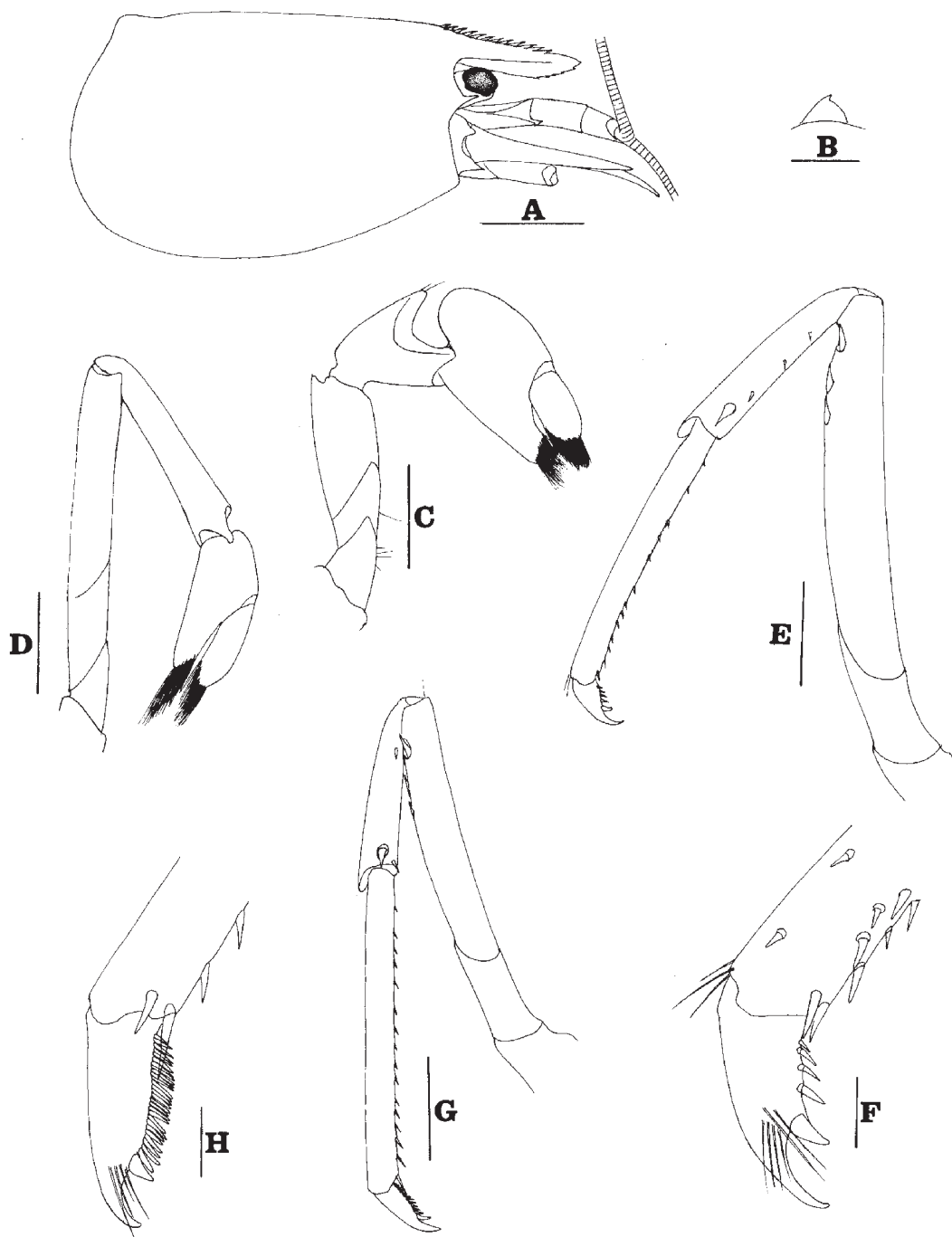


Figure 12. *Caridina okinawa*. A, cephalothorax and cephalic appendages, lateral view; B, prenal carina; C, first pereiopod; D, second pereiopod; E, third pereiopod; F, dactylus of third pereiopod; G, fifth pereiopod; H, dactylus of fifth pereiopod. Scales: A, B=1 mm; C, D, E, G=0.5 mm; F, H=0.2 mm (female, cl 6.5 mm, holotype, USNM-123426).

*Etymology*

The new species is named after the type locality, Okinawa Island, Ryukyus, used as a noun in apposition.

*Remarks*

With respect to the rostral formula, and the long stylocerite, *Caridina okinawa*, new species, is very different from all the epigeic *Caridina* species from the Ryukyus. It is however, most similar to *C. cantonensis* Yu, 1938 (cf. Cai and Ng 1999) from southern China. It could be distinguished by the shorter stylocerite (reaches to the end of basal segment of antennular peduncle vs. distinctly beyond); the less developed eyes (vs. well developed in *C. cantonensis*); the shorter finger of the first pereopod (0.6 times as long as palm vs. as long as palm).

*Distribution*

Known only from the type locality, Okinawa Island, Ryukyu Islands.

***Caridina macrodentata*, new species**

(Figures 13 and 14)

*Caridina* cf. *Pareparensis*: Cai and Ng 2001, p 666, fig. 2E, F.

*Material examined*

Holotype: Ovigerous female, cl 4.8 mm, eggs 0.25 × 0.45 mm, NMST, 123°51.84'E 24°23.65'N, fast flowing water, about 200 m from sea, Omija River, Iriomote Island, Ryukyu Islands, coll. Y. Cai, N. K. Ng and T. Naruse, 15 June 2000. Paratypes: One female, cl 4.8 mm, RUB, 1 ovigerous female, cl 4.8 mm, ZRC 2004.0583, eggs 0.50 × 0.30 mm, small river in Ohno, Ishigaki Island, Ryukyu Islands, coll. T. Naruse, 23 March 2001.

*Comparative material examined*

One ovigerous female, cl 6.1 mm, NMMBA, Dongqing river, Lanyu Island, Taiwan, coll. C. C. Han, 19 April 2002; 1 damaged female, cl 5.2 mm, ZRC, Sungai Ifis, Halmahera, Indonesia, coll. D. Robb, September 1994; 1 ovigerous female, cl 4.7 mm, ZRC, Philippines, coll. M. Kottelat, 1993; 1 female, cl 5.5 mm, SMF 947a, Mariveles Island, Philippines, coll. Semper, 1876.

*Description*

Rostrum (Figures 13A and 14A) short, straight, with a pointed end, reaching middle of second segment of antennular peduncle; dorsal margin with 12–15 large teeth, two to three of them on carapace, ventral margin with three to five very small teeth; inferior orbital angle of carapace fused with antennal spine, sharp, long; pterygostomial angle broadly rounded.

Sixth abdominal somite 0.41 times as long as carapace, 1.2 times as long as fifth somite, slightly shorter than telson. Telson (Figure 13B, C) 2.8 times as long as wide, terminating

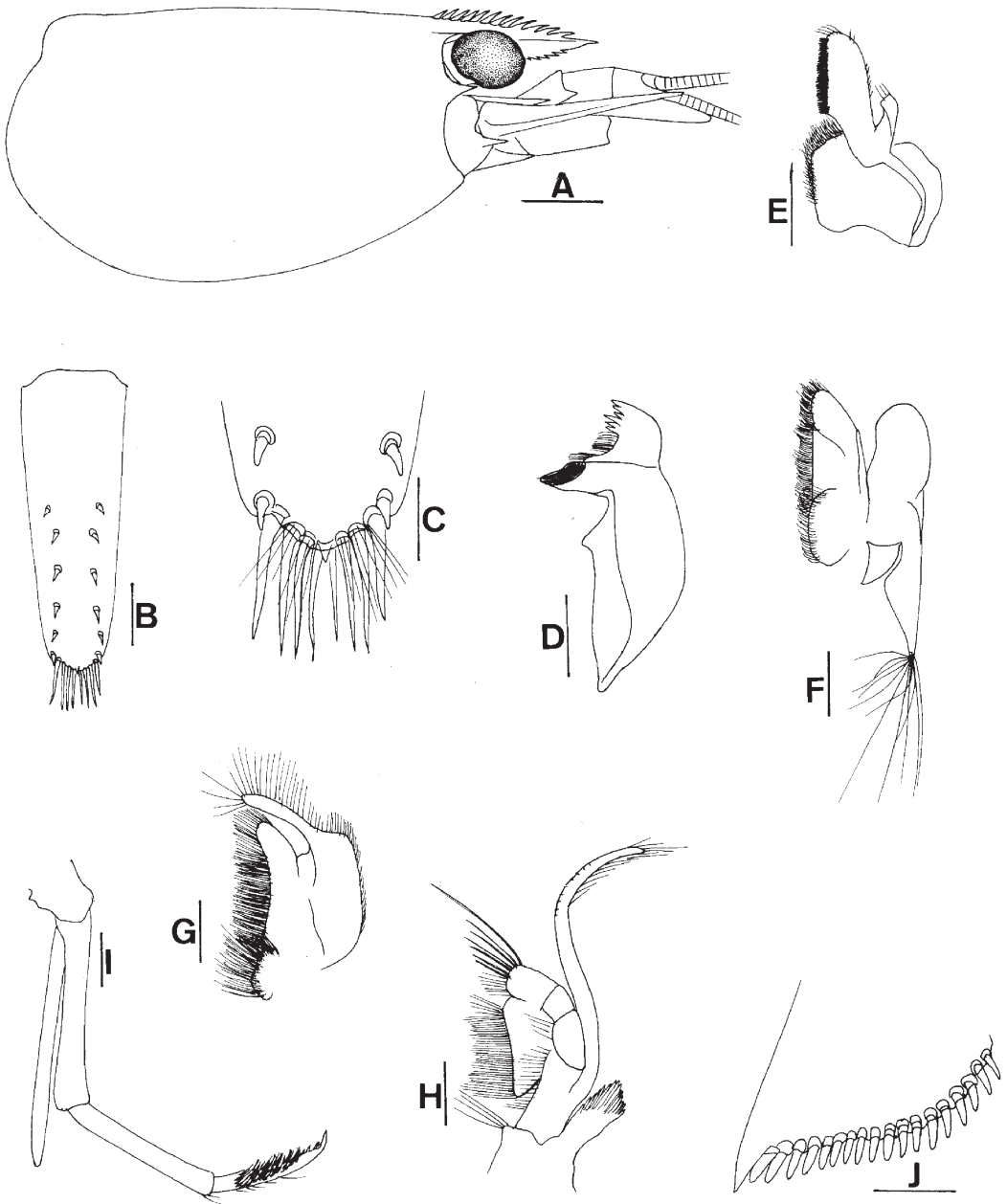


Figure 13. *Caridina macrodentata*, new species. A, cephalothorax and cephalic appendages, B, telson, C, distal portion of telson, D, mandible, E, maxillula, F, maxilla, G, first maxilliped, H, second maxilliped, I, third maxilliped, J, diaeresis. Scales: A=1 mm; B, D–I=0.5 mm; C, J=0.2 mm (ovigerous female, cl 4.8 mm, ZRC 2004.0583).

in median projection; five to seven pairs of dorsal spinules, one pair of dorsolateral spines near distal end, one pair of spines and three pairs of subequal spiniform setae on distal margin; lateral spine slightly shorter than intermediate pairs of setae. Preanal carina high, without spine.

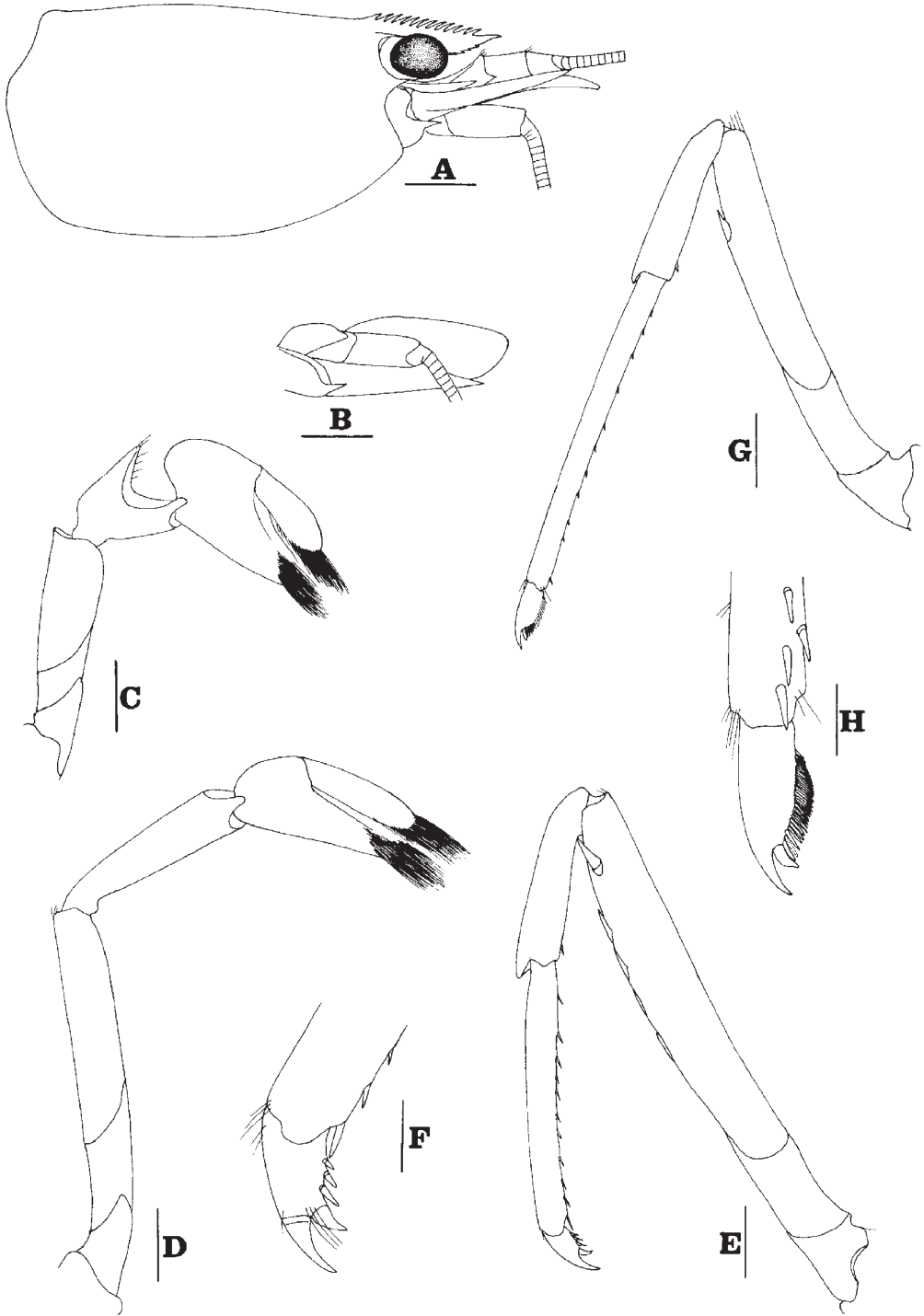


Figure 14. *Caridina macrodentata*, new species. A, cephalothorax and cephalic appendages, lateral view; B, scaphoците; C, first pereiopod; D, second pereiopod; E, third pereiopod; F, dactylus of third pereiopod; G, fifth pereiopod; H, dactylus of fifth pereiopod. Scales: A, B=1 mm; C, D, E, G=0.5 mm; F, H=0.2 mm (ovigerous female, cl 4.8 mm, holotype, NSMT).

Eyes (Figures 13A and 14A) well developed, reaching to 0.8 times length of basal segment of antennular peduncle. Antennular peduncle stout, 0.6 times as long as carapace; basal segment of antennular peduncle longer than sum of second and third segment lengths of antennular peduncle, anterolateral angle reaching 0.2 times length of second segment; second segment slightly longer than third. Stylocerite reaching 0.9 times length of basal segment of antennular peduncle. Scaphocerite (Figure 14B) 2.8 times as long as wide.

Incisor process of mandible (Figure 13D) ending in irregular teeth, molar process truncated. Lower lacinia of maxillula (Figure 13E) broadly rounded, subtriangular, upper lacinia elongate, with a number of distinct teeth on inner margin, palp slender. Upper endites of maxilla (Figure 13F) subdivided, palp short, scaphognathite tapering posteriorly with numerous long, curved setae at posterior end. Palp of first maxilliped (Figure 13G) terminating in broad triangular end. Second maxilliped (Figure 13H) typical, arthrobranch well developed. Third maxilliped (Figure 13I) reaching to end of antennular peduncle, with ultimate segment shorter than penultimate segment.

Epipods on first four pereopods. First pereopod (Figure 14C) stout, reaching to end of basal segment of antennular peduncle, merus 2.0 times as long as broad, slightly longer than carpus; carpus strongly excavated anteriorly, shorter than chela, 1.2 times as long as high; chela 2.0 times as long as broad; fingers as long as palm. Second pereopod (Figure 14D) reaching end of second segment of antennular peduncle, merus slightly longer than carpus, 4.4 times as long as broad; carpus slightly longer than chela, 3.8 times as long as high; chela 2.5 times as long as broad; fingers 1.7 times as long as palm. Third pereopod (Figure 14E, F) reaching end of third segment of antennular peduncle, propodus distinctly shorter than merus, 8.5 times as long as broad, 4.3 times as long as dactylus; dactylus ending in two strong claws; 2.5 times as long as wide (spines included), with three accessory spines on flexor margin. Fifth pereopod (Figure 14G, H) reaching to end of basal segment of antennular peduncle, propodus distinctly longer than merus, 11 times as long as broad, 4.7 times as long as dactylus; dactylus 2.4 times as long as wide, ending in two large claws, with 26 spinules on flexor margin.

Uropodal diaeresis (Figure 14J) with 19–20 spinules. Eggs 0.25–0.30 × 0.45–0.50 mm in diameter.

### *Habitat*

The holotype specimen was caught from a fast flowing stream, hiding under vegetation at the edge of the stream. The collection site is about 200 m from the sea.

### *Etymology*

The name is derived from Latin, *macro*, large, and *dentata*, toothed, alluding to the large teeth on the dorsal margin of the rostrum.

### *Remarks*

With regard to the form of the rostrum, the large number of uropodal spinules and the form of various pereopods, *Caridina macrodentata* should be referred to the *C. weberi* species group. In the group, it is most similar to *C. weberi papuana*, which, however, can be separated from *C. weberi papuana* by its longer rostrum, the larger rostral teeth and the biunguiculate dactylus of the fifth pereopod.

The new species is also close to *C. okinawa*, new species. The rostral formula, the form of the preanal carina, and pereopods are shared only by these two species in the Ryukyus. *Caridina okinawa* was found from subterranean water in Okinawa, central Ryukyus, while *C. macrodentata* was caught from epigeal waters in Iriomote, southern Ryukyus. *Caridina macrodentata* differs from *C. okinawa* by its well developed eyes, larger teeth on the dorsal margin of the rostrum, the relatively broad scaphocerite (2.5 times as long as wide vs. 2.8 times); the longer fingers of the first pereopod (as long as palm vs. 0.6 times), the longer fingers of the second pereopod (1.7 times as long as palm vs. 1.3 times) and the shorter stylocerite (does not reach the end of basal segment of antennular peduncle vs. reaching).

Cai and Ng (2001) doubtfully referred a damaged specimen from Halmahera, Indonesia, to *Caridina pareparensis* De Man, 1892a. According to the available characters, especially the rostrum and the first pereopod, it most probably belongs to the present new species, and is formally referred to it here.

#### *Distribution*

Japan, Taiwan, Philippines and Indonesia (Halmahera).

#### **Genus *Neocaridina* Kubo, 1938**

#### ***Neocaridina ishigakiensis* (Fujino and Shokita, 1975)**

(Figures 15–17)

*Caridina denticulata ishigakiensis* Fujino and Shokita, 1975, p 93, figs. 3, 4 [type locality: Ishigaki Island, Ryukyu Islands, Japan].

*Caridina denticulata ishigakiensis*: Shokita 1976, p 1.

*Neocaridina ishigakiensis*: Shokita 1979, p 200; 2002, p 164; 2003, p 249, figs. 18K, 19R, 20B; 2005d, p 195; 2006g, p 51, pl 3 (up, left); Shokita et al. 2003a, p 101.

*Neocaridina palmata ishigakiensis*: Cai 1996, p 145.

Not *Neocaridina denticulate ishigakiensis*: Liang 2004, p 84, fig. 42.

#### *Material examined*

Twenty six males, cl 3.3–4.4 mm, 8 females, cl 3.0–5.2 mm, ZRC 2004.0584, 124°12.74'E 24°25.19'N, freshwater stream connected to Sokobaru Dam Reserve, Ishigaki Island, Ryukyu Islands, coll. Y. Cai, N. K. Ng and T. Naruse, 13 June 2000; 1 ovigerous female, cl 4.9 mm, ZRC 2004.0585, 124°09.86'E 24°25.00'N, fast flowing tributary of Nagura River, below a reservoir, Ishigaki Island, Ryukyu Islands, pH 7.2, coll. Y. Cai and T. Naruse, 13 June 2000; 1 male, cl 4.0 mm, ZRC, 123°51.21'E 24°18.24'N, freshwater, very small, shallow stream, headwater of Nakama River, Iriomote Island, Ryukyu Islands, pH 7.4, coll. Y. Cai, N. K. Ng and T. Naruse, 15 June 2000; 9 males, cl 3.5–5.0 mm, 8 females, cl 4.0–5.2 mm, ZRC 2004.0586, 124°12.64'E 24°25.98'N, river below Sokobaru Dam Reserve, Ishigaki Island, Ryukyu Islands, pH 7.5, coll. Y. Cai and T. Naruse, 13 June 2000.

#### *Description*

Rostrum (Figures 15A and 17A) narrow, straight, reaching to middle of second segment of antennular peduncle, or slightly beyond end of this segment, rostral formula: 1–2+1+10(mode 5–7)/0–4(mode 1–2). Antennal spine fused with inferior orbital angle; pterygostomian margin with a spine.



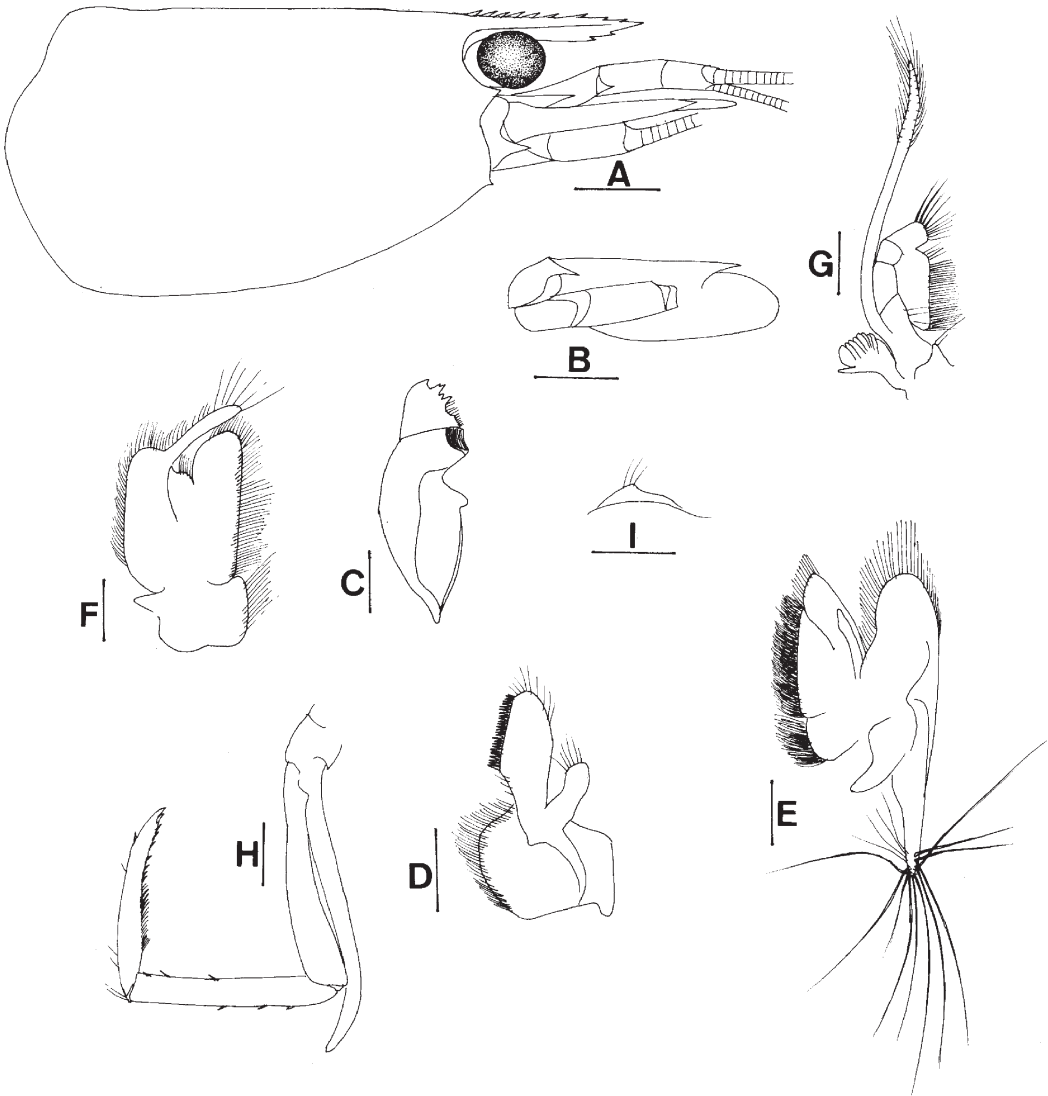


Figure 15. *Neocaridina ishigakiensis*. A, cephalothorax and cephalic appendages; B, scaphocerite, C, mandible; D, maxillula, E, maxilla; F, first maxilliped; G, second maxilliped; H, third maxilliped; I, preanal carina. Scales: A, B=1 mm; C–I=0.5 mm (male, cl 4.7 mm, ZRC 2004.0584).

Sixth abdominal somite 0.49 times length of carapace, 1.4 times as long as fifth somite, as long as telson. Telson (Figure 16A, B) 3.0 times as long as wide, terminating in a projection, with five to six pairs of dorsal spinules and one pair of dorsolateral spinules; distal end with about four to five pairs of spines, lateral pair as long as or slightly longer than intermediate pairs, sublateral pair shortest. Preanal carina (Figure 20K) without spine.

Eyes well developed, anterior end reaching to 0.8 times length of basal segment of antennular peduncle. Antennular peduncle 0.57–0.63 times as long as carapace; basal segment of antennular peduncle longer than sum of second and third segment lengths,

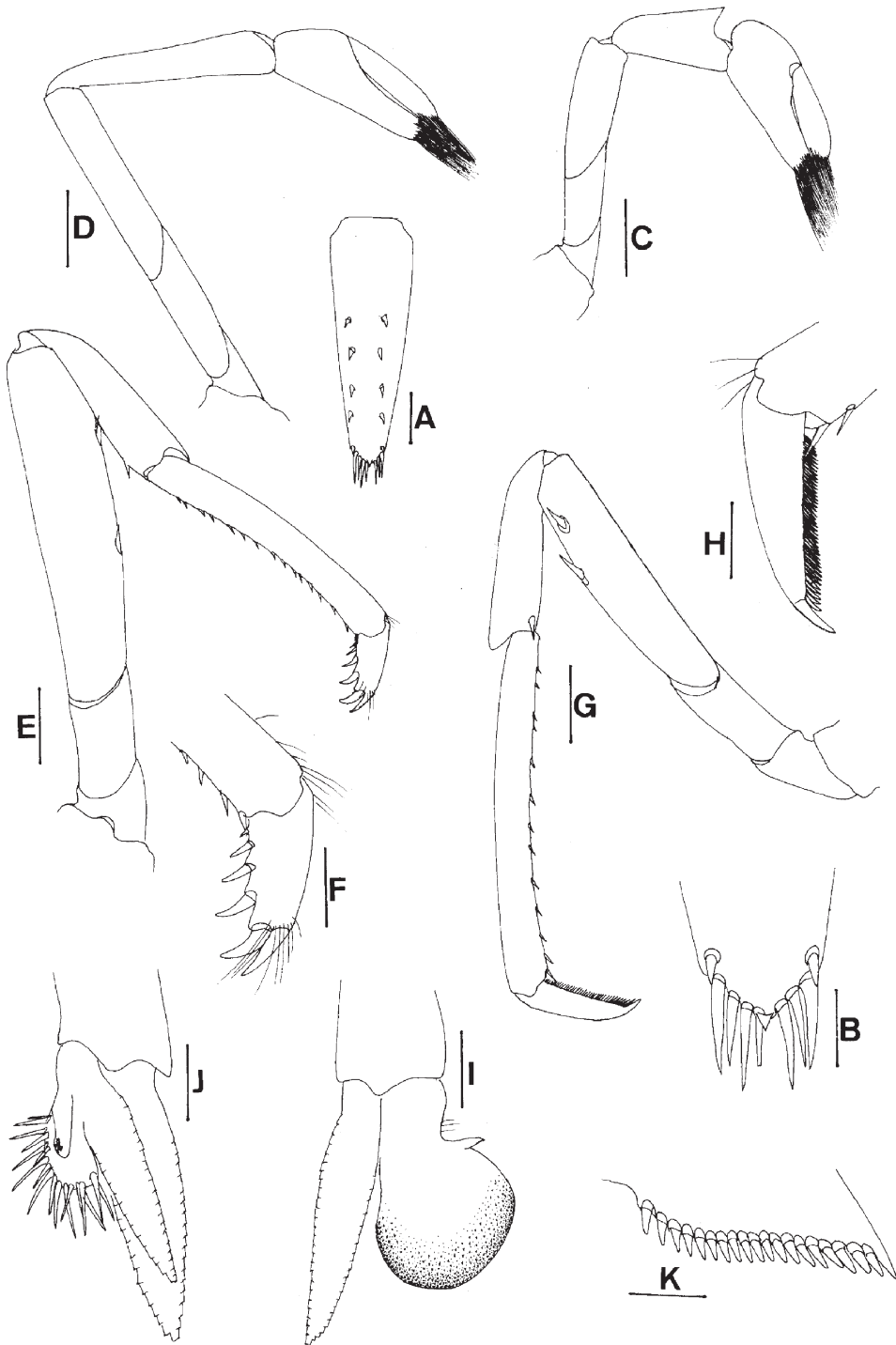


Figure 16. *Neocaridina ishigakiensis*. A, telson; B, distal portion of telson; C, first pereiopod; D, second pereiopod; E, third pereiopod; F, dactylus of third pereiopod; G, fifth pereiopod; H, dactylus of fifth pereiopod; I, male first pleopod; J, male second pleopod; K, diaeresis. Scales: A, C–E, G=0.5 mm; B, F, H–K=0.2 mm (male, cl 4.7 mm, ZRC 2004.0584).

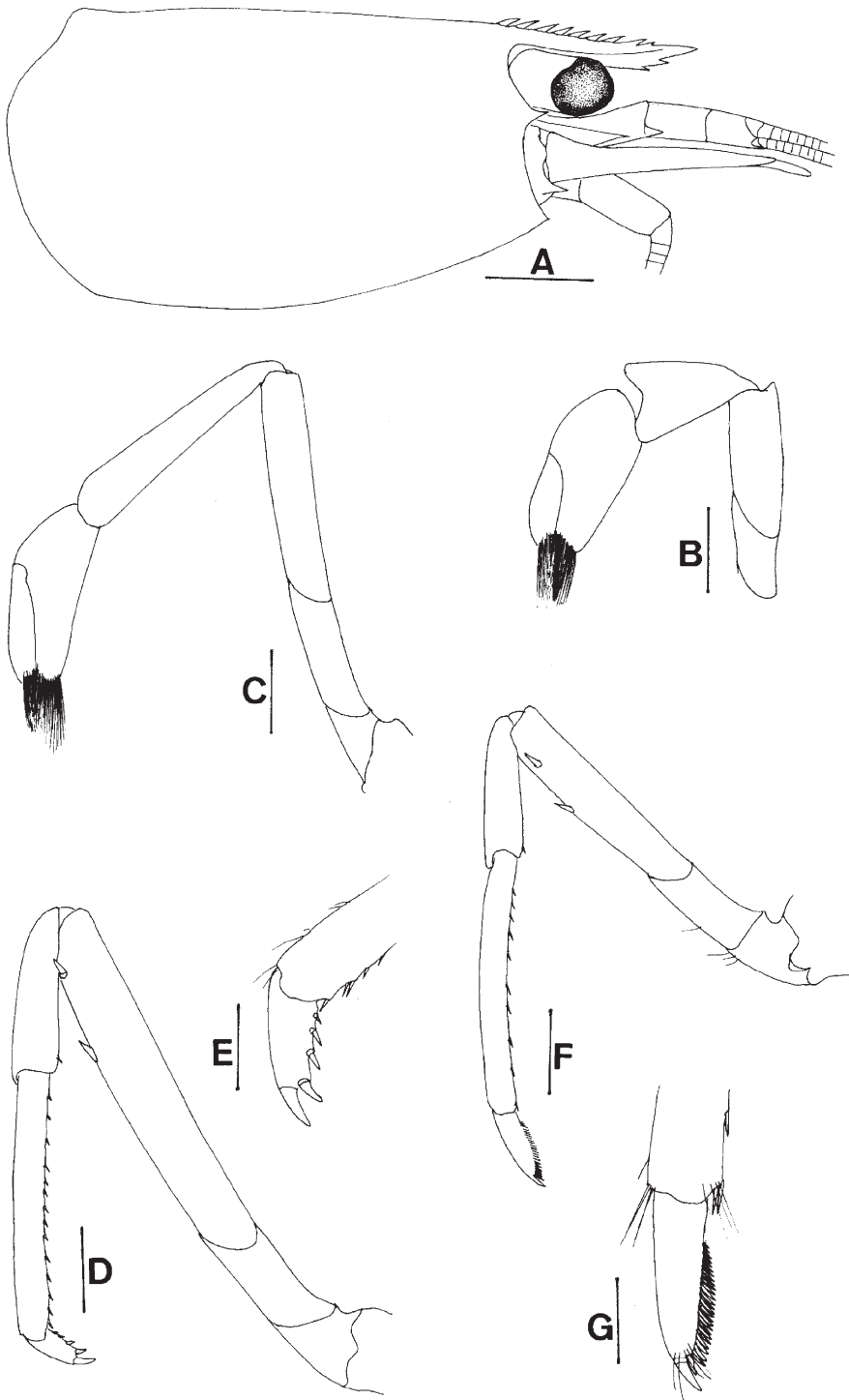


Figure 17. *Neocaridina ishigakiensis*. A, cephalothorax and cephalic appendages; B, first pereopod; C, second pereopod; D, third pereopod; E, dactylus of third pereopod; F, fifth pereopod; G, dactylus of fifth pereopod. Scales: A=1 mm; B–D, F=0.5 mm; E, G=0.2 mm (female, cl 4.1 mm, ZRC 2004.0584).

anterolateral angle reaching 0.25 times length of the second segment, second segment distinctly longer than third segment. Stylocerite reaching to 0.85–0.9 length of basal segment of antennular peduncle. Scaphocerite (Figure 15B) 2.8 times as long as wide.

Incisor process of mandible (Figure 15C) ending in irregular teeth, molar process truncated. Lower lacinia of maxillula (Figure 15D) broadly rounded, upper lacinia elongate, with a number of distinct teeth on inner margin, palp slender. Upper endites of maxilla (Figure 15E) subdivided, palp short, scaphognathite tapering posteriorly with numerous long, curved setae at posterior end. End of palp of first maxilliped (Figure 15F) truncate. Podobranch of second maxilliped (Figure 15G) well developed. Third maxilliped (Figure 15H) reaching to end of scaphocerite, with ultimate segment as long as or slightly shorter than penultimate segment.

Epipods present on first four pereopods. First pereopod (Figures 16C and 17B) reaching to distal end of basal segment of antennular peduncle; merus 2.6–2.7 times as long as broad, slightly longer than carpus; carpus excavated anteriorly, shorter than chela, 1.6–1.8 times as long as high; chela 2.1–2.3 times as long as broad; fingers 1.1–1.4 times as long as palm. Second pereopod (Figures 16D and 17C) reaching to end of antennular peduncle; merus slightly shorter than carpus, 5.1–5.3 times as long as broad; carpus 1.15–1.25 times as long as chela, 5.0–5.1 times as long as high; chela 2.6–2.9 times as long as broad; fingers 1.4–1.7 times as long as palm. Third pereopod (Figures 16E, F and 17D, E) reaching to end of scaphocerite, propodus incurved strongly in male but straight in female, 7.4–8.4 times as long as broad, 3.4–4.2 times as long as dactylus; dactylus 2.0 times as long as wide in male and 2.6 times in female (spines included), terminating in two claws, with three to four accessory spines on flexor margin. Fifth pereopod (Figures 16G, H and 17F, G) reaching beyond end of basal segment of antennular peduncle, propodus 8.6–10 times as long as broad, 3.1–3.3 times as long as dactylus, dactylus 3.0–3.3 times as long as wide (spinules included), terminating in one claw, with 25–46 spinules on flexor margin.

Endopod of male first pleopod (Figure 16I) inflated at distal three-quarters into palm-shape, with numerous tiny spinules on distal portion of dorsal surface; appendix interna at base of endopod, small, elongate, or reduced, 1.5 times as long as wide, 0.7 times length of exopod. Appendix masculina of male second pleopod (Figure 16J) cylindrical, reaching to half length of endopod, armed with numerous stout spines on surface, with appendix interna reaching to distal quarter of appendix masculina or near its distal end.

Uropodal diaeresis (Figure 16K) with 19–20 movable spinules.

Eggs  $1.1 \times 0.7$  mm in diameter.

### *Habitat*

Mountain streams.

### *Remarks*

Fujino and Shokita (1975) described it as a subspecies of *Caridina denticulata* (De Haan, 1849), on the basis of specimens from Ishigaki Island. Shokita (1979) raised it to a full species, *Neocaridina ishigakiensis*. In his revision of the genus *Neocaridina*, Cai (1996) treated it as a subspecies of *N. palmata* (Shen, 1948), as the sexual appendages are very similar to the nominal subspecies. Apart from the differences in the rostrum, the appendix interna of the male first pleopod is also shorter than that of *N. palmata*. While *N. ishigakiensis* is morphologically closer to *N. palmata* than *N. denticulata* (cf. Cai 1996), we

nevertheless follow Shokita (1979) in regarding it as a distinct species as recent investigations have shown that it is restricted to Ishigaki Island, and there are no intermediate forms, and no range overlap in the distributions of *N. ishigakiensis* and *N. palmata*.

Liang (2004) recently reported the occurrence of *Neocaridina denticulata ishigakiensis* from Wenling, Zhejiang Province. His drawing (Liang 2004, fig. 42) shows that sexual appendages of his specimens are much more like those of *Neocaridina sinensis* than *N. ishigakiensis*.

#### *Distribution*

Several localities on Ishigaki Island.

#### ***Neocaridina iriomotensis*** Naruse, Shokita and Cai, 2006

*Neocaridina iriomotensis* Naruse, Shokita and Cai, 2006, p 25 [type locality: Iriomote Island, Ryukyus, Japan].

?*Neocaridina brevisrostris*: Naruse and Shokita 2005a, p 204 (part); Shokita 2006h, p 62.

*Neocaridina* sp.: Naruse and Shokita 2005b, p 204.

#### *Material examined*

Five males, cl 3.3–4.8 mm, 1 female, cl 5.0 mm, 3 ovigerous females, cl 4.1–5.0 mm, ZRC 2004.0587, headwater of Nakama River, Iriomote Island, Ryukyu Islands, Cai et al., 16 June 2000; 19 males, cl 3.4–5.1 mm, 7 females, cl 4.0–5.2 mm, 4 ovigerous females, ZRC 2004.0588, slightly downstream of the head water area of Nakama River, Ishigaki Island, Ryukyu Islands, Cai et al., 16 June 2000; 2 males, cl 4.4–4.8 mm, 1 female, cl 5.8 mm, ZRC 2004.0589, upper stream of Nakama River, Ishigaki Island, Ryukyu Islands, Cai et al., 2 males, cl 4.1–4.2 mm, 1 ovigerous female, cl 4.5 mm, ZRC, Iriomote Island, Ryukyu Islands, Cai et al, 15 June 2000; 27 males, cl 3.2–4.3 mm, ZRC 2004.0590, headwater of Nakama river, Ishigaki Island, Ryukyu Islands, coll. Y. Cai and T. Naruse, 2000.

#### *Habitat*

Headwater of Nakama River, Iriomote Island.

#### *Remarks*

This species has been described in detail, with comparisons being made against several congeners (see Naruse et al. 2006).

#### *Distribution*

Known only from the type locality, Iriomote Island.

#### ***Neocaridina* sp**

*Neocaridina brevisrostris*: Kubo 1941, p 304, figs. 1, 2; Naruse and Shokita 2005a, p 204 (part); Shokita 2006h, p 62.

*Neocaridina* sp.: Shokita 2003, p 249, figs. 18L, 19S, 20A (part).

*Material examined*

None.

*Habitat*

Mountain stream.

*Remarks*

Stimpson (1860) briefly described *C. brevirostris* from Loo Choo (Okinawa) Island. Kubo (1941) redescribed it based on specimens from Ishigaki Island, and transferred it to the genus *Neocaridina*. Cai et al. (2006), however, synonymized *C. brevirostris* with *Atyoida pilipes* as no *Neocaridina* species have been found from Okinawa Island and the only form that fits well with Stimpson's description of *C. brevirostris* around Okinawa Island is *Atyoida pilipes* (Newport, 1847). Therefore, Kubo's (1941) *N. brevirostris* is in fact, an unnamed species. This uncertain species is morphologically very close to the short rostrum form of the *Neocaridina iriomotensis*, new species, but could be distinguished by the shorter rostrum (not reaching to the end of the basal segment of antennular peduncle vs. reaches to or slightly beyond); the pterygostomian angle rounded (vs. with small spine); the stout carapace (1.2 vs. 1.5 times as long as high) and the large egg size ( $1.5 \times 0.9$  vs.  $1.00\text{--}1.20 \times 0.6\text{--}0.8$  mm).

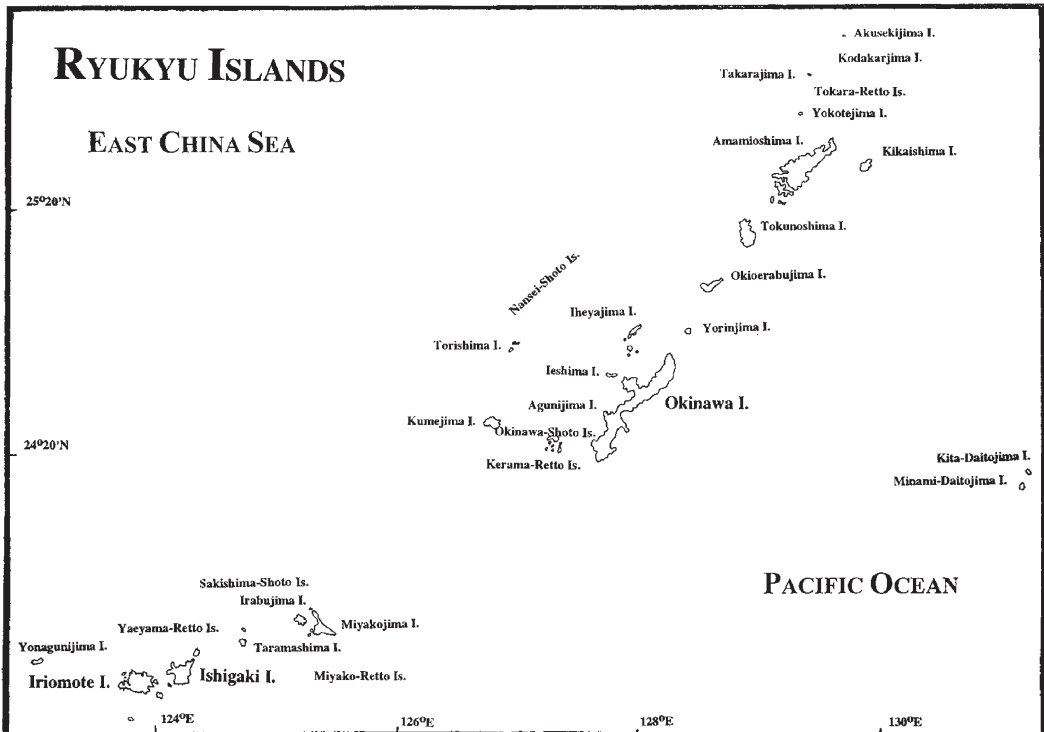


Figure 18. Map of the Ryukyu Islands, southern Japan.

### Distribution

Known only from Ishigaki Island.

### Note

A map of the Ryukyu Islands, southern Japan, is shown in Figure 18.

### Acknowledgements

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