

***Caridina nilotica* (P. Roux, 1833) (Crustacea: Decapoda: Caridea: Atyidae) from East Africa, with descriptions of four new species**

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*Abstract.*—*Caridina nilotica* (P. Roux, 1833) is redescribed and its distribution restricted to the River Nile catchment area, although confirmation is required of the presence of this species from the Blue Nile. Material identified as *C. nilotica* from outside this African area requires clarification and probably belongs to other species of *Caridina*. Two independent collections of atyids from Lake Bunyonyi, Uganda, which is not part of the Nile catchment, were re-examined and found to comprise four new *Caridina* species. These are described and illustrated, and a key is provided distinguishing the new species from *C. nilotica*.

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Hussein and Obuid-Allah (1992a: 122) appeared to synonymize *Caridina longirostris* H. Milne Edwards, 1837, *C. grandirostris* Stimpson, 1861, *C. leucosticta* Stimpson, 1861, *C. wyckii* (S. I. Hickson, 1888) and *C. nilotica typica* De Man, 1908 with *C. nilotica* (P. Roux, 1833). They (Hussein and Obuid-Allah 1992a) referred to their material (collected from Asyut, Egypt) as *C. nilotica nilotica* but they failed to clarify the status of the synonymized taxa—were these synonymies subspecific (i.e., *C. nilotica leucosticta*), or specific (i.e., *C. nilotica*)? This nomenclatorial confusion raised old problems relating to the distribution and taxonomy of *C. nilotica*. In effect, Hussein and Obuid-Allah (1992a) had resurrected the "nilotica complex" with a suggested distribution from East Africa to the West Pacific.

Johnson (1960) stated that *Caridina* had long been a difficult genus to study. He considered that this was due in part to the small morphological differences that separated closely related *Caridina* species and in part to the variability that many species showed in characters such as the armature

of the rostrum and the first thoracic leg. As a result, he concluded that *C. nilotica* was an extremely heterogeneous complex of forms extending from Central Africa to the West Pacific and that its morphology was so variable that it was undefinable. Later, Johnson (1963) argued that some tentative attempts should be made to separate the *nilotica* complex into species and suggested that typical *Caridina nilotica* was essentially African. The present study is more radical with regard to the distribution of *Caridina nilotica*, restricting it to the River Nile watershed.

The Nile flows south to north over 35 degrees of latitude and is the longest river in the world, with a length of over 6800 km. Its catchment is vast, with an estimated area of 3.3 million km<sup>2</sup>, including ca. 81,500 km<sup>2</sup> of lakes and ca. 70,000 km<sup>2</sup> of swamps. There are ten riparian countries along the Nile—Burundi, Democratic Republic of Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda. For the present study, *Caridina nilotica* material was examined from Lake Tanganyika northward to Lakes Victoria

and Albert, the White Nile, and Nile. Gordon (1930, 1933) had previously examined most of this material. Unfortunately, the presence of *C. nilotica* from the Blue Nile could not be confirmed, as *Caridina* material from this river was not available.

Of particular interest was the material studied by Gordon (1933) from Lake Bunyonyi (Bunyoni), Kabale District, in the southwestern region of Uganda. Lake Bunyonyi has an area of approximately 6100 hectares, is about 25 km long and 7 km wide, is about 1950 m above sea level, has 29 islands, and is the second deepest lake in Africa (900 m). Lake Bunyonyi is not part of the Nile catchment; it is isolated. There were two separate collections from the lake in the Natural History Museum, London. The first comprises three jars registered under the numbers 1934.2.8.8–37, 38–87, 88–90, from the Cambridge Expedition to the East African Lakes, 1930–31, collected by E. B. Worthington during August 1931, reported on by Gordon (1933) and identified by her as *Caridina nilotica*. The second collection was unregistered until the present study and was labelled *Caridina* sp., Lake Bunyuni, coll. J. Ford, and is assumed to be collected some time after the Cambridge Expedition as Gordon (1933) did not report on this material. The *Caridina* material contained within these four jars could be divided into four groups that were morphologically distinct from the Nile catchment species, *C. nilotica*.

The purpose of this study is to redescribe *Caridina nilotica*, describe four new *Caridina* species from Lake Bunyonyi, Uganda, and present a key separating these five species.

*Abbreviation used.*—NHM = Natural History Museum, London; MNHN = Muséum national d'Histoire naturelle, Paris; RMNH = Nationaal Natuurhistorisch Museum (ex Rijksmuseum van Natuurlijke Historie, Leiden); E.A.F.R.O. = East African Fisheries Research Organisation; stn = station; ovig. = ovigerous; juv. = juveniles; coll. = collected; pres. = presented.

*Measurements.*—Adults were measured from the anterior tip of the rostrum to the posterior margin of the telson. Carapace length was measured from the postorbital margin to the posterior margin of the carapace.

*Description.*—Appendages without distinguishing characters are figured but not described; these include maxillule, maxilla, first maxilliped, second maxilliped, third maxilliped, fourth pereopod, and second male pleopod.

#### Taxonomy

##### *Caridina nilotica* (P. Roux, 1833) Figs. 1–4

*Pelias niloticus* P. Roux, 1833: 73, pl. 7, fig. 1.

*Caridina nilotica*, De Man, 1908: 255, pl. 20, figs. 1 & 2; Calman, 1928: 738; Gordon, 1930: 33, fig. 13b, c; 1933: 351 (part); Woltereck, 1942: 279, figs. 12 & 13 (part).

*Caridina nilotica gracilipes*, Calman, 1906: 189–191 (part).

*Caridina nilotica typica*, Bouvier, 1925: 146 (part).

*Caridina nilotica nilotica*, Hussein & Obuid-Allah, 1992a: 121, figs 1–7 (part); 1992b: 203, figs 1–4.

*Material examined.*—**Egypt:** Port Said, pres. R. Gurney, NHM 1921.4.27.38–42, 5 males, 3 females, 1 juv.; NHM 2004.1557–59, 1 female ovig., 1 female; Nile near Cairo, coll. & pres. Capt. S.S. Flower, NHM 1906.6.1.5–9, 1 male, 6 females ovig., 1 female; NHM 2004.2560–62, 1 female ovig., 1 female; near Cairo, Egypt, NHM 2004.2541–50, 6 males, 1 female ovig.; NHM 1950.1.2.145–146, 2 females ovig.; Nile near Al Qanatir Al Khayriah (Qanatir Muhammad Ali), MNHN D39199, 4 males, 2 females ovig., 2 females; Giza, pres. Capt. S.S. Flower, NHM 1908.4.11.1–5, 10 males, 1 female ovig.; Haremlik Canal, Zoological Survey of Egypt, NHM 1922.11.22.36–55, 20 males, 60 females

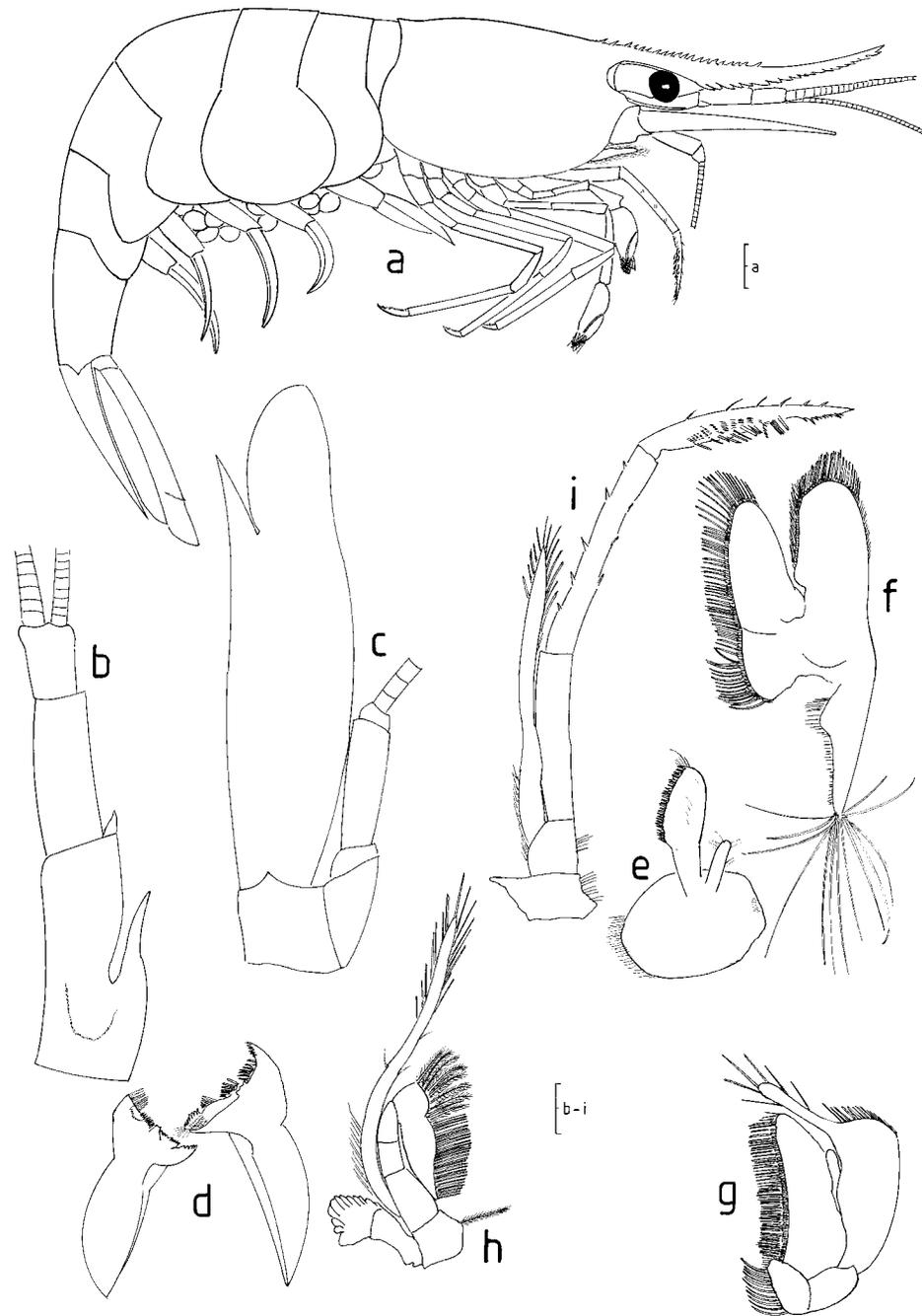


Fig. 1. *Caridina nilotica*. Female from NHM 1928.8.28.12. a. lateral view; b. antennular peduncle; c. antennal scale; d. mandibles; e. maxillule; f. maxilla; g. first maxilliped; h. second maxilliped; i. third maxilliped. Scale bars: a = 1 mm; b-i = 0.5 mm.

ovig., 5 females; NHM 2004.1551–56, 1 male, 2 females ovig.; Cambridge Expedition to Suez Canal 1924, Timsha Lagoon, NHM 1927.11.2.53–72, 25 males, 8 females ovig., 36 females, 58 juv.; Lake Ismailia, NHM 1927.11.2.73–77, 11 males, 5 females ovig., 24 females; Lake Nasser, coll. P.C. Raheja, Development Centre, NHM 1969.976, 5 males, 5 females ovig., 5 females; NHM 1950.1.2.140–144, Kabret, fresh water canal, 4 females; Egypt, NHM 1950.1.2.145–146, 2 females; Suez, NHM 1913.10.30. 19–20, 1 female; NHM 1913.10.30. 21–25, 1 male, 3 females ovig., 1 female, 3 juv.

**Sudan:** White Nile, coll. L. Loat, NHM 1906.6.1, 2 females ovig.; Nil Blanc, environs de Kosti (White Nile surroundings of Kosti), 01.29, MNHN Na 992, 4 females ovig., 1 female; Lac No, confluent Nil Blanc-Bhar el Charal (the confluent White Nile—Bhar el Charal), 01.29, MNHN Na 993, 4 females ovig., 1 female; Nil Blanc, mare de Malakal, (White Nile, pond of Malakal), coll. Brumpt, 01.29, MNHN Na 994, 6 males, 5 females, 11 juv.

**Uganda:** Lake Albert, Butiaba, coll. Ch. Alluaud, 1909, MNHN Na 796, 1 female ovig.; North end, coll. R.J. Leiper, NHM 1907. 12.18.1–5, 3 males, 1 female ovig.; stn 146, Lacustrine modification Butiaba, coll. E.B. Worthington and Michael Graham, NHM 1929.10.23.3–42, 1 male, 2 females; Shore, Buhuka, 1 male, 1 female ovig., 1 juv.; Swamp among *Pistia*, Tvtora camp, Lake Albert, pres. by Corbat, E.A.F.R.O., NHM 1958.1.20, 18.06.52, 1 male, 1 female ovig., 3 females; stn 4, 4 m, on hard bottoms, 1 male, 2 females ovig., 5 females; Ntoroko camp, Swamp amongst *Pistia*, 3 males, 10 females ovig., 20 females; Nolaiga Bay, Lake Albert, 23.03.54, 1 male, 2 females ovig., 2 females; Bukuba, 50' off shore, Lake Albert, 22.03.54, 2 females, 3 juv.; Buhuka, 23.03.54, 1 male, 1 female ovig., 1 female, 4 juv.; Butiaba Island, 18.03.54, 1 female; Crocodile Island (Central Island), Lake Rudolf, 27.04.56, 1 female ovig.; stn 195, Victoria Nile above

Murchinson Falls, coll. E.B. Worthington and Michael Graham, NHM 1929.10.23.3–42, 2 females ovig., 3 females; Lake Kwania local lacustrine modifications, NHM 1929.10.23.3–42, 9 males, 1 female; Cambridge expedition to East African Lakes 1930–1931, stn 617, Lake George, 1934.2.8.3–7, 3 males, 2 females ovig., 2 females; Entebbe, Lake Victoria (Victoria Nyanza), purchased E. Degan, NHM 1906.4.11.10–19, 1 male, 1 female ovig. 2 females; Entebbe 3700', Capt. C.R.S. Pitman, NHM 1935.6.26.1–2, 1 male, 1 female ovig., 1 female; 17 miles from Entebbe, pres. by Corbat, E.A.F.R.O., NHM 1958.1.20, 2 females ovig.; Lake Victoria, Karunga, pres. Acting Commissioner, East African Protectorate, NHM 1906.1.6.1–10, 20 females ovig.; (Victoria Nyanza) coll. W.A. Cunningham, NHM 1906.2.12.11–20, 5 males, 18 females ovig., 15 females; NHM 1906.2.12.21–25, 1 female ovig., 5 females, 6 juv.; West shore, pres. Woodhouse Esq., NHM 1911.12.21, 1 female; Jinja sailing club, coll. E.B. Worthington and Michael Graham, NHM 1929.10.23.1–2, 2 females; NHM 1929. 10.23.43–57, sample 1, 1 male, 1 female; sample 2, 1 female ovig., 1 female; sample 3, 2 males, 4 females, 3 juv.; sample 4, 2 males; sample 5, 1 male, 2 females; sample 6, 1 male; sample 7, 1 male; NHM 1929.10.23.58–64, 1 male, 1 female ovig., 1 female, 1 juv.; coll. I. Gordon, NHM 1926.VII. 10.113–115, 2 males; Off Jinja, 20 m, NHM 1964.VII.10.81–82, 2 males, 1 female; Off Jinja, NHM 1964.VII.10.83–112, 5 males, 5 females, 5 juv.; Shore, Jinja, NHM 1964.VII.10.113–115, 1 male, 2 females ovig., 3 females.

**Democratic Republic of Congo:** Kainada, stn 567, near Lake Edward, Cambridge Expedition to the East African Lakes 1930–31, NHM 1934.2.8.1–2, 1 female ovig.

**Kenya:** coll. & pres. Dr. J.O. Young, NHM 1974.65, 1 female ovig.; NHM 1974.66, 6 females ovig., 5 females, 4 juv.; coll. Alluaud et Jeannel, 1911, stn 23, Kisumuau (Kisumu) fond de la baie de Kavi-

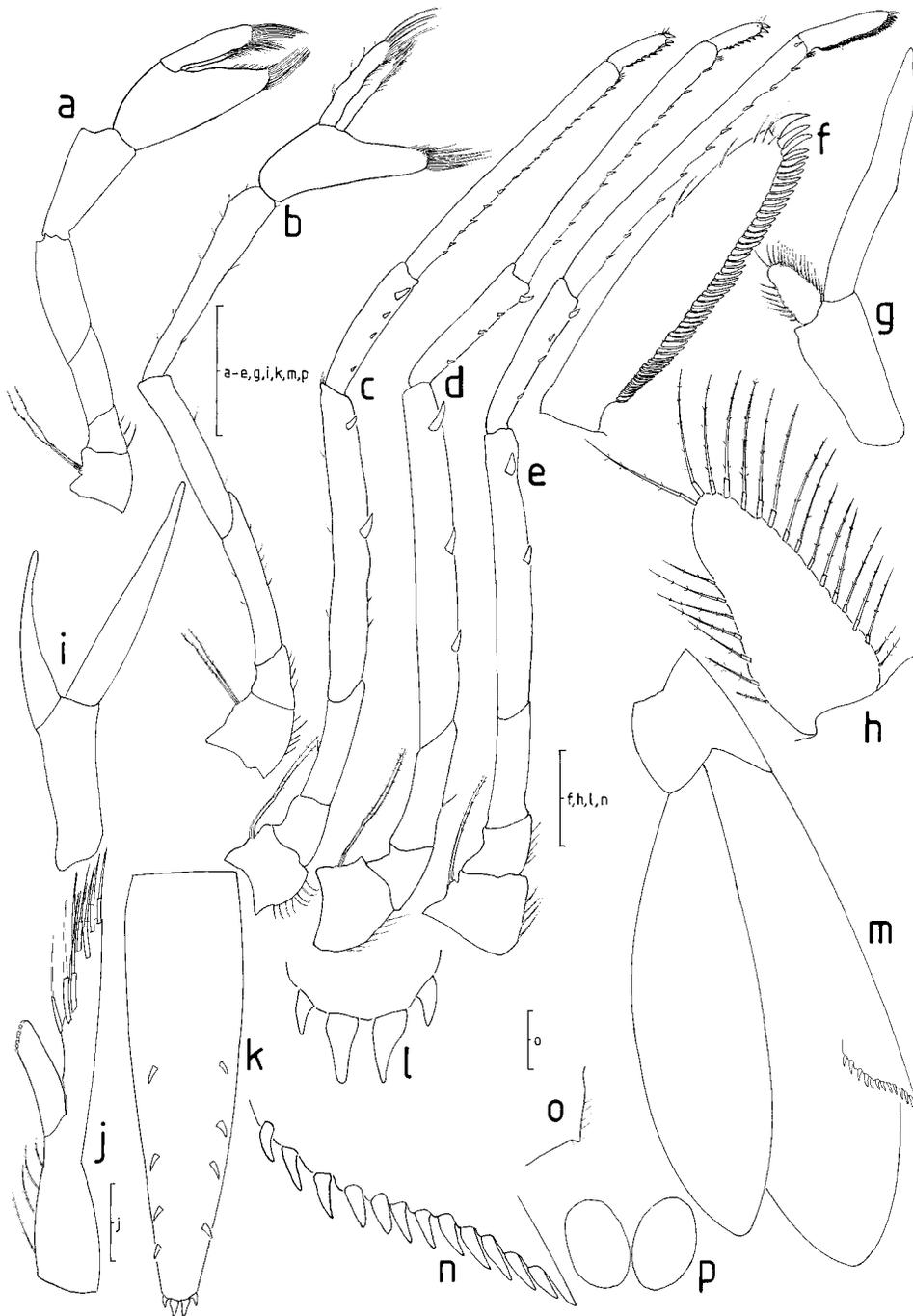


Fig. 2. *Caridina nilotica*. Female from NHM 1928.8.28.12. a. first pereopod; b. second pereopod; c. third pereopod; d. fourth pereopod; e. fifth pereopod; f. dactylus of fifth pereopod; g. first male pleopod; h. endopod of first male pleopod; i. first female pleopod; j. second male pleopod; female k. telson; l. terminal spines of telson; m. uropod; n. uropod diaeresis spinules; o. preanal carina; p. eggs. Scale bars: a-e, g, i, k, m, p = 1 mm; f, h, l, n = 0.2 mm; j = 0.2 mm; o = 0.25 mm.

rando, dans une mare, Lake Victoria, MNHN Na 780, 1 female ovig.

**Tanzania:** Tanganyika, Kirando, Up-pipe camp, coll. S.R.B. Pask, NHM 1928.8.28.12, 3 males, 6 females ovig., 14 females; Malagarasi, Iragala, pres. by Corbat, E.A.F.R.O, NHM 1958.1.20, coll. R.H. Lowe, 2 males, 15 females; Uvinza, near swamp at the edge of the rapids, 17.09.52, 1 male, 3 females ovig., 4 females; Malagarasi swamp pool, 17.09.52, 1 male, 2 females; Iragala, Derris pool, 09.09.52, 3 females; Opuya, coll. R.H. Lowe, 3 males, 9 females ovig., 6 females; Bugomga drainage ditch, coll. P.H. Greenwood, 1 female ovig., 1 female; Lake Rukuwa, lake margins at the out span of the hotel and swamps in the delta of Luika River, NHM 1964.VII.10.116–124, sample 1, 1 male, 5 females ovig.; sample 2, grassy margins of the lake 3 females ovig., 2 females; sample 3, below falls, 6 males, 15 females; coll. Mann, NHM 1964.VII.10.132–146, 2 females.

*Description.*—Male and female from NHM 1928.8.28.12; size of adults ranged from 18–32 mm.

Rostrum (Figs. 1a, 3a–i) usually long, reaching beyond antennal scale (rarely as long as antennal scale). Length of rostrum 3.5–6.5 mm, 1–1.3 times as long as carapace. Dorsal teeth 10–28 arranged proximally leaving distinct distal gap, which may be smooth or interrupted by one or two teeth (Fig. 3a, d, f). 1–3 apical teeth may be present (Fig. 3d, f, g, h). Post-orbital teeth always present, 1–3. Unarmed part of rostrum 0.4–0.8 times that of armed part. Tip of rostrum usually bifid (Fig. 3a, e, i) but may end acutely (Fig. 3b). Ventral teeth 10–28, uniformly arranged from proximal end up to tip. Rostral formula (1–3) 10–28/10–28 mostly (1–2) 14–24/13–19. Carapace with distinct antennal spine placed at orbital angle. Pterygostomial angle rounded. Carapace 3.5–5.5 mm long. Abdominal somite 6 is 0.5–0.7 times as long as carapace. Antennular peduncle (Fig. 1b) 0.8–0.9 times the carapace. Stylocerite 0.75–0.8

times length of basal segment. Anterolateral teeth of basal segment 0.1–0.2 times basal segment. 9–12 segments bear aesthetascs. Antennal scale (Fig. 1c) 3.8–4.0 times as long as broad. Mandibles (Fig. 1d) asymmetrical. Maxillule (Fig. 1e). Maxilla (Fig. 1f). First maxilliped (Fig. 1g). Second maxilliped (Fig. 1h). Third maxilliped (Fig. 1i).

First pereopod (Fig. 2a) finger 1.2–1.9 times the palm. Chela 2–3 times as long as broad. Carpus 2–2.6 times as long as broad, anteriorly excavated. Second pereopod (Fig. 2b) long and slender, finger 1–2 times as long as palm. Chela 2.5–3.0 times as long as broad. Slender carpus, 4.3–5.6 times as long as broad. Third pereopod (Fig. 2c) dactylus 3.2–4.5 times as long as broad. Spines on dactylus 7–11 (including terminal spines), mostly 9 or 10. Propodus 3.5–4.2 times as long as dactylus and 11 or 12 times as long as broad with 13–19 spines arranged along inner margin. Carpus 0.5–0.6 times as long as propodus, with small spines on inner margin. Merus with 2 large spines on posterior margin, 1.7–2 times carpus length. Fourth pereopod (Fig. 2d). Fifth pereopod (Fig. 2e, f): dactylus 4–4.8 times as long as broad with 40–60 spines arranged in comb-like fashion on inner margin. Propodus 12.0–14.5 times as long as broad and 3.5–4.5 times as long as dactylus with 11–13 spines arranged along inner margin. Carpus 0.45–0.6 times propodus length and with small spines along inner margin. Merus 1.4–1.8 times carpus length, with 2 large spines and small spines on inner margin. Epipods present on first four pereopods, two setobranchs on all pereopods.

First pleopod of male (Fig. 2g, h), endopod 0.2–0.3 times exopod length. Appendix interna absent in all specimens examined from Port Said, Egypt; Nile near Malakal, Sudan; Lakes George, Albert, Kwania, Victoria (all Uganda), Tanganyika, and Rukwa area (Tanzania), (Fig. 4e, m, p–s), but present in material examined from Suez, Egypt (Fig. 4j) and Lake Aswan, Egypt. However, in samples near Cairo,

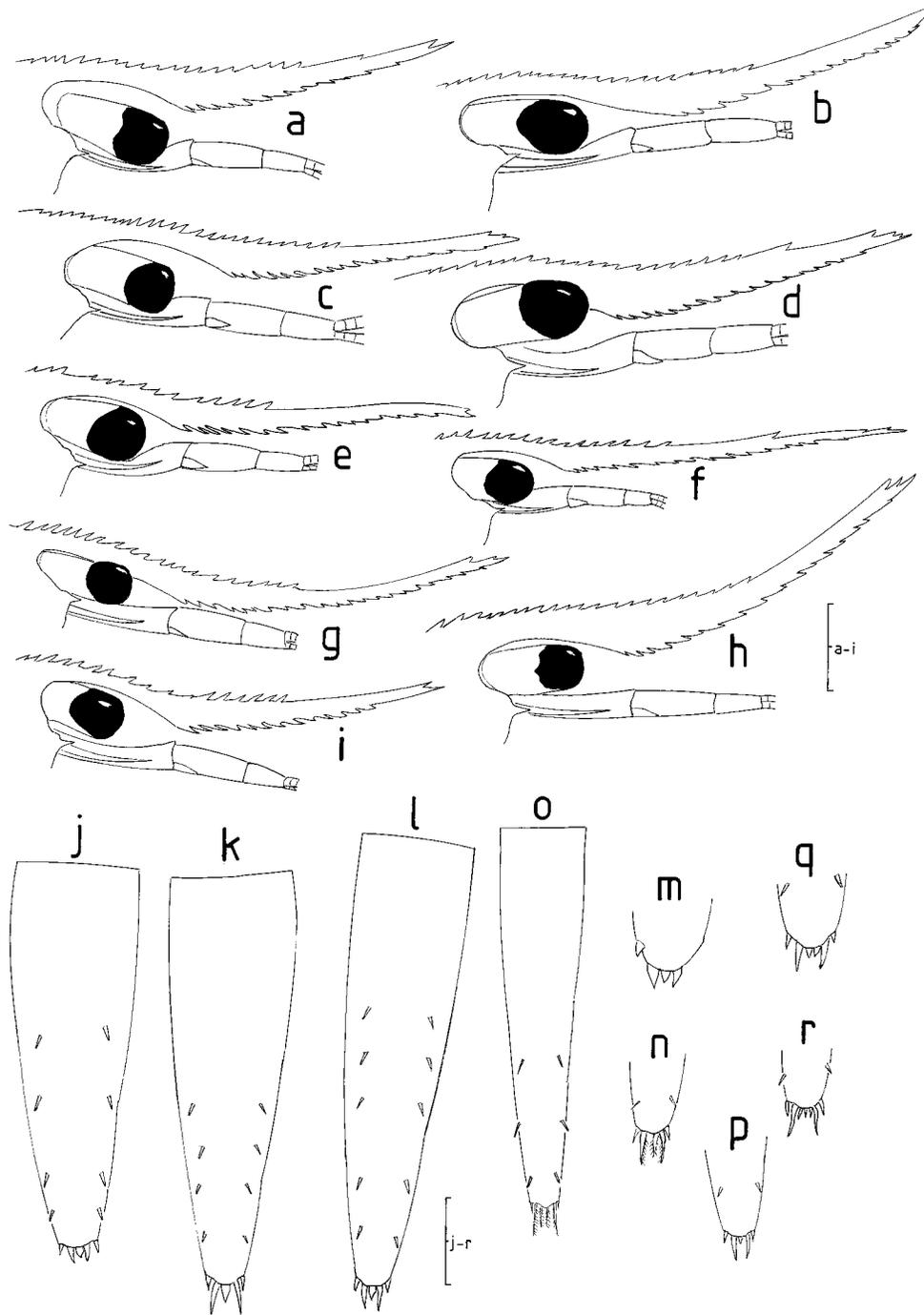


Fig. 3. *Caridina nilotica*. Rostral variation. a. Near Cairo, Egypt, NHM 2004.2541-50; b. Giza, Egypt, NHM 1908.4.11.1-5; c. Haremilik Canal, Egypt, NHM 1922.11.22.36-55; d. Malakal, Sudan, MNHN Na 994; e. above Murchinson Falls, Victoria Nile, Uganda, NHM 1929.10.23.3-42; f. stn 146, Butiaba, Lake Albert, Uganda, NHM 1929.10.23.3-42; g. Lake Kwania, Uganda, NHM 1929.10.23.3-42; h. Ntoroko camp, Lake Albert, Uganda, NHM 1958.1.20; i. Jingia, Lake Victoria, Uganda, NHM 1929.10.23.1-2; variation of telson; j. near Cairo, Egypt, NHM 2004.2541-50; k. Giza, Egypt, NHM 1908.4.11.1-5; l. Haremilik Canal, Egypt, NHM 1922.11.22.36-55; m. Malakal, Sudan, MNHN Na 994; n. above Murchinson Falls, Victoria Nile, Uganda, NHM

Giza, Haremlik Canal, Timsha Lagoon, and Lake Ismalia (all Egypt) (Fig. 4a–d, f–l) the population is mixed; in some specimens the interna is absent and in others present. First pleopod of female (Fig. 2i), endopod 0.6–0.7 times as long as exopod. Second pleopod of male (Fig. 2j).

Telson (Figs. 2k, 3j–m) tapering distally 1.1–1.3 times as long as 6<sup>th</sup> abdominal somite. Dorsal spines 3–6 pairs (including subterminal spine). 1–3 pairs of short terminal spines (mostly 1 pair) with or without median spine, arranged on posterior margin. When more than 1 pair are present, middle pairs are shorter than outer spines. Terminal spines mostly short and stout. According to Gordon (1930), adult specimens from Lake Victoria and Lake Kwania were slender and had a slender telson with slightly longer slender spines with or without sparse setae on inner side of the lateral spines and on both the margins of the middle spines.

Uropod (Fig. 2m, n), number of diaeresis spinules 7–12 (mostly 11 or 12). Preanal carina (Fig. 2o) sharp without spines. Number of eggs varies from 85 to 140; diameter (Fig. 2p)  $0.5\text{--}0.85 \times 0.35\text{--}0.55$ .

*Remarks.*—Roux (1833) described *Caridina nilotica* (as *Pelias niloticus*) from the River Nile in Egypt, but gave no indication of the precise locality. Additional field data are not available because the whereabouts of his type material are unknown. According to Holthuis (pers. comm.) it is likely lost. Apparently Roux collected the type material during his expedition with K.A.A. von Hügel, a German nobleman, to Egypt and India, 1831–1833, and the Egyptian material was later sold to dealers. There were indications that Temminck, the director of the Leiden Museum in 1836, purchased Indian material collected by Roux from the dealer Dupont in Paris, but this

could not be confirmed. There is no Egyptian material collected by Roux in Leiden.

Although the figure of *Pelias niloticus* by Roux (1833, fig. 1) is excellent, it does not give an indication of the variability of characters within this species. DeMan (1908), Gordon (1930, 1933) and Hussein and Obuid-Allah (1992a, b) have all contributed to current knowledge with regard to intraspecific variation of this Nile species. The rostrum figured by Roux is longer than the antennal scale with a dental formula of (2) 13/14 and is without subapical teeth. The observations by De Man (1908) suggested a rostrum with a dental formula ranging from (0–3)  $18+1\text{--}23+1/11\text{--}20$  with the rostral descriptions by Gordon (1930) from the Nile basin within the range scored by De Man (1908). Figures 1a, 3a–i, represent the rostrum for material examined in the present study. The rostrum is usually longer than the antennal scale (rarely as long as the scale) with a proximal arrangement of 10–28 teeth (mostly 14–24) leaving an apical gap which is interrupted by one or two teeth, and provided with or without 1–3 apical teeth. One to three post-orbital teeth are always present. The unarmed part of the dorsal margin of the rostrum is 0.4–0.8 times that of the armed part. Between 10 and 28 (typically 13–19) teeth were uniformly arranged on the ventral margin, while the tip of the rostrum was mostly bifid (Figs. 1a, 3a, e, i) or ended acutely (Fig. 3b). The dental formula (rostrum) of *C. nilotica* including its variations as presented in the description of the present study is considered to be diagnostic.

The morphometric measurements of the body somites and the proportions of the pereopod segments were considered typical for the species. The spines on the dactylus of the third and fifth pereopod were consid-

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1929.10.23.3–42; o. stn 146, Butiaba, Lake Albert, Uganda, NHM 1929.10.23.3–42; p. Lake Kwania, Uganda, NHM 1929.10.23.3–42; q. Ntoroko camp, Lake Albert, Uganda, NHM 1958.1.20; r. Jinja, Lake Victoria, Uganda, NHM 1929.10.23.1–2. Scale bars: a–i = 1 mm; j–r = 0.5 mm.

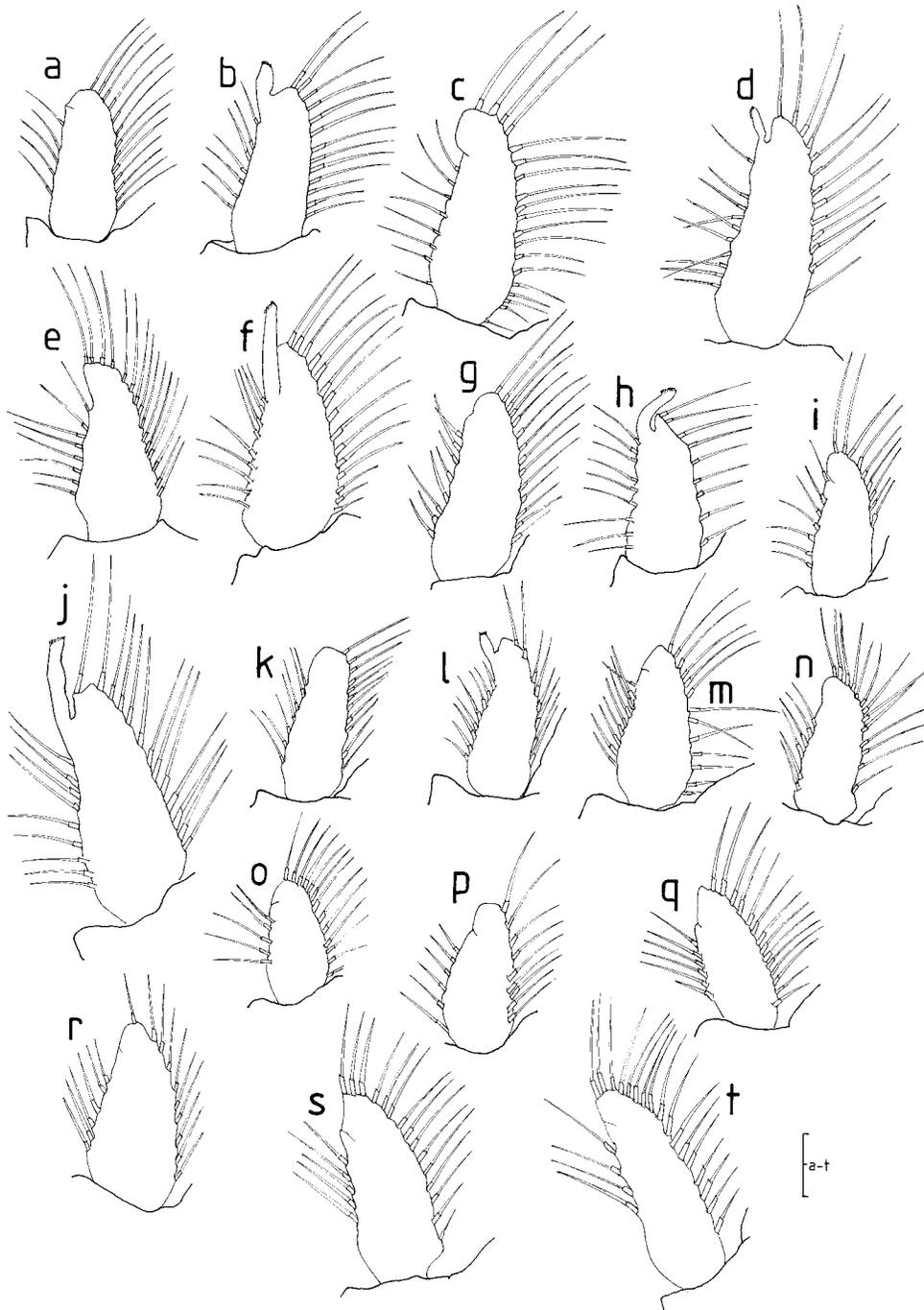


Fig. 4. *Caridina nilotica*. Examples of variation in the endopod of first male pleopod. a, b, near Cairo, Egypt, NHM 2004.2541-50; c, d, near Giza, Egypt, NHM 1908.4.11.1-5; e, Port Said, Egypt, NHM 1921.4.27.37-42; f, g, Haremlik Canal, Egypt, NHM 1922.11.22.36-55; h, i, Timsha lagoon, Egypt, NHM 1927.11.2.53.72; j, Suez, Egypt, NHM 1913.10.30.21-25; k, l, Lake Ismailia, Egypt, NHM 1927.11.2.73-77; m, Malakal, Sudan, MNHN Na 994; n, above Murchinson Falls, Victoria Nile, Uganda, NHM 1929.10.23.3-42; o, Lake Albert, Uganda, NHM 1907.18.1-5; p, Lake George, Uganda, NHM 1934.28.3-7; q, Lake Kwania, Uganda, NHM

ered to be a useful taxonomic character. The telson was longer than the 6<sup>th</sup> abdominal somite and tapered, with 3–6 pairs of dorsal spines. Asymmetry of the dorsal spines on the left and right sides of the telson was not pronounced in the present investigation as it was recorded by Hussein & Obuid-Allah (1992a, b), although occasionally one or two spines differed on either side. Abnormal specimens with regenerating telsons were not considered. Short, stout, terminal spines ranging from 1–3 pairs (typically 1 pair), with or without a median spine, were arranged at the broad tip. When more than 1 pair of spines were present, the lateral ones were slightly longer than the inner ones. The terminal spines were usually short and stout. However, in the specimens from Lakes Victoria and Kwana, the spines were slender and slightly elongated with the inner margin of the lateral spines and both the margins of the other spines sparsely plumose. The different types of telson were figured (see Fig. 3j–r). A telson with an apical protrusion plus an arrangement of 3 or more pairs of plumose spines of almost equal length figured by earlier studies (Gordon 1930, Hussein, & Obuid-Allah 1992a) was not considered typical of *C. nilotica*. However the telson inclusive of the variations described above is characteristic of the Nile species.

The endopod of first male pleopod presented some notable variations. The shape of the endopod as well as the presence or absence of appendix interna varied (see Fig. 4). From the observations of the present study, the absence of the appendix interna on the endopod seems to be a regular feature in specimens from the southern regions of the Nile Basin from Tanganyika north to White Nile at Malakal, Sudan. In the northern basin, specimens with and without ap-

pendix interna were recorded. It may be noted that fresh collections of large samples from local populations in several areas at different times of the year may provide more information concerning this character. However, identifying yet another species based on the presence or absence of appendix interna seemed unwarranted since the other characters fell within the variation expected for *C. nilotica*. The number of uropod diaeresis spinules varied between 7 and 12 (mostly 10 or 11), and was regarded as another distinguishing character.

*Caridina bunyonyiensis*, new species

Figs. 5, 6

*Caridina nilotica*, Gordon, 1933: 354–357 (part), fig. 1c.

*Material examined*.—**Uganda**: Lake Bunyonyi, coll. & pres. J. Ford, holotype, NHM 2004.2657, 1 male; paratypes, NHM 2004.2617–2627, 8 males, 2 females. Bufundi, Lake Bunyonyi, coll. E.B. Worthington, August 1931, pres. Cambridge Expedition to the East African Lakes 1930–31, stn 705, paratypes, NHM 1934.2.8.10, 8 males, 5 females ovig., 12 females; NHM 1934.2.8.11, 39 juv.; NHM 1934.2.8.19, 1 female; stn 707A, paratypes, NHM 1934.2.8.40, 9 males, 8 females ovig., 10 females, 1 juv.; NHM 1934.2.8.39, 76 juv.; figured and dissected, NHM 1934.2.8.39–40, 1 male, 1 female; stn 707B, paratypes, NHM 1934.2.8.89, 1 female.

*Description*—Holotype, paratype male and female from NHM 1934.2.8.39–40. Size of adults ranged from 15 to 22 mm.

Rostrum (Fig. 5a, b) short, shorter than eye, rarely equal to first segment of antennular peduncle, but never longer. Length of rostrum varied from 0.6 to 1 mm, 0.15 to 0.23 times as long as carapace. Rostral for-

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1929.10.23.3–42; r. Lake Victoria, Uganda, NHM 1964.VII.10.81–82; s. Lake Rukwa, Tanzania, NHM 1964.VII.10.116–146; t. grassy lake margins, Lake Rukwa, Tanzania, NHM 1964.VII.10.116–146. Scale bar: 0.2 mm.

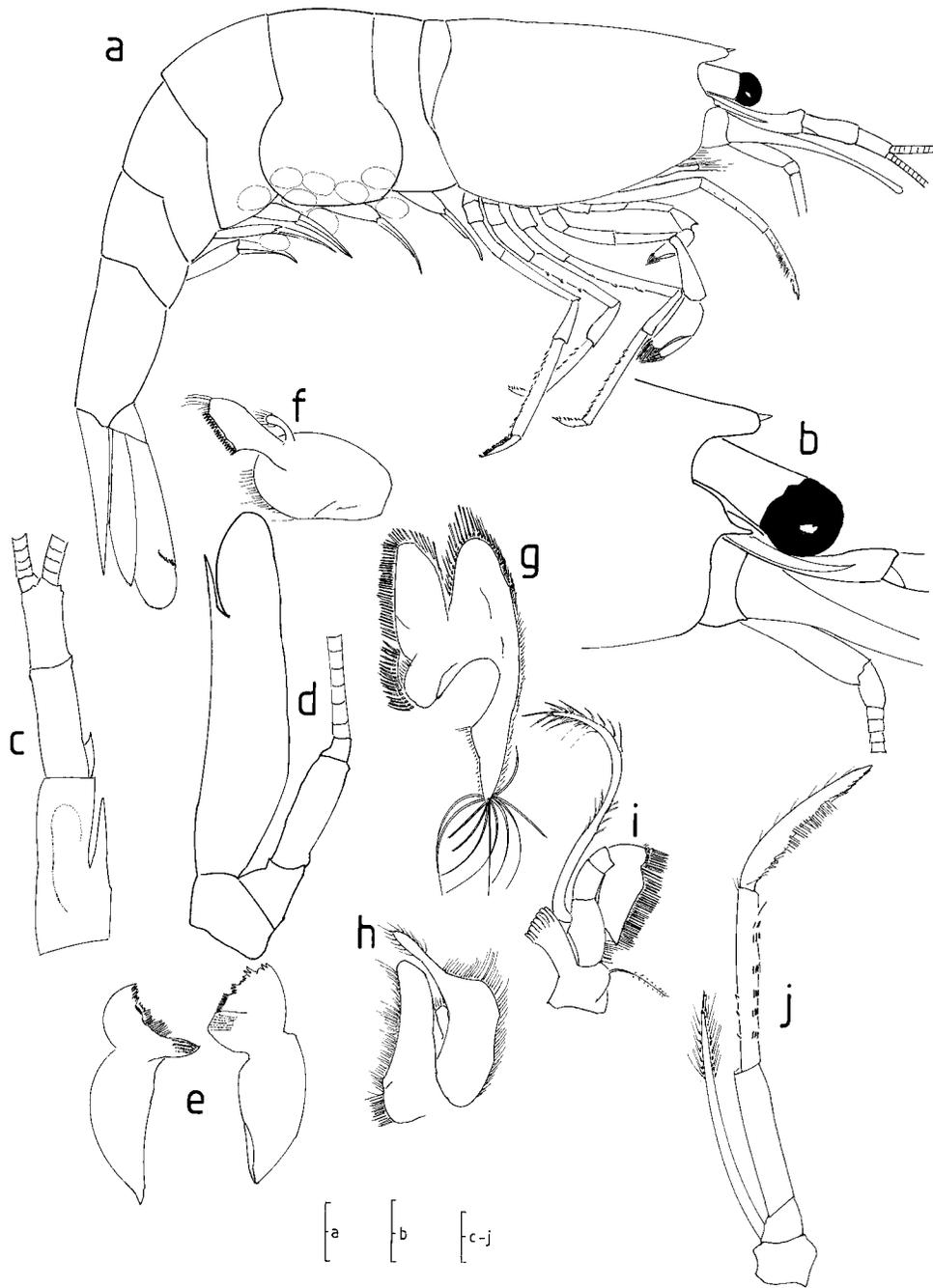


Fig. 5. *Caridina bunyonyiensis*. Paratype female from NHM 1934.2.8.39-40. a. lateral view; b. anterior lateral view of carapace; c. antennular peduncle; d. antenna; e. mandibles; f. maxillule; g. maxilla; h. first maxilliped; i. second maxilliped; j. third maxilliped. Scale bars: a = 1 mm; b-j = 0.5 mm.

mula always 0/0, occasionally small spine (rarely two) present at tip. Carapace with distinct antennal spine at orbital angle. Pterygostomian angle rounded. Carapace 4.0 to 4.5 mm long. 6<sup>th</sup> abdominal somite 0.6–0.7 times length of carapace. Antennular peduncle (Fig. 5c) 0.8–0.9 times carapace length. Stylocerite 0.7–0.8 times length of basal segment length. Anterolateral teeth of basal segment 0.2–0.25 times basal segment. 8 or 9 segments bear aesthetasc. Antennal scale (Fig. 5d) 4.0–4.5 times as long as broad. Mandibles (Fig. 5e) asymmetrical. Maxillule (Fig. 5f). Maxilla (Fig. 5g). First maxilliped (Fig. 5h). Second maxilliped (Fig. 5i). Third maxilliped (Fig. 5j).

First pereopod (Fig. 6a) finger 0.7–1.0 times length of palm. Chela stout, 2–2.5 times as long as broad. Carpus slender, 2–2.3 times as long as broad, with deep excavation anteriorly. Second pereopod (Fig. 6b) long and slender, finger 1–1.2 times as long as palm. Chela 2–2.5 times as long as broad. Carpus 3–4 times as long as broad. Third pereopod (Fig. 6c) dactylus 3.0–3.8 times as long as broad, bearing 8–9 spines (including terminal spine). Propodus 3–4 times as long as dactylus and 10 or 11 times as long as broad, with 11–13 spines arranged along inner margin. Carpus 0.5–0.6 times length of propodus, with small spines along inner margin. Merus with 4 spines on posterior margin, 1.7–2.0 times length of carpus. Fourth pereopod (Fig. 6d). Fifth pereopod (Fig. 6e, f) dactylus 4.3–5.0 times as long as broad with 45–55 spines arranged in comb like fashion on posterior margin. Dactylus has 2–8 fine setae along inner and outer margins. Propodus 2.4–3 times as long as dactylus, 9–11 times as long as broad with 11–13 spines arranged along inner margin. Merus 1.5–1.7 times length of carpus, with 2 large spines on posterior margin. Carpus with small spines on posterior margin, 0.4–0.6 times length of propodus. Epipods present on first four pereopods, two setobranchs on all pereopods.

First pleopod of male (Fig. 6g, h), endopod 0.2–0.25 times length of exopod.

The stout endopod possesses uniform stalked setae leaving a gap at the inner anterior lateral surface. Endopod without appendix interna. First pleopod of female (Fig. 6i), endopod 0.5–0.60 times as long as the exopod. Second pleopod of male (Fig. 6j).

Telson (Fig. 6k, l): slender and tapering posteriorly, with 4 or 5 pairs of dorsal spines (including the subterminal spine). Terminal spines are 1–3 pairs with or without median spine. Telson 1–1.1 times as long as 6<sup>th</sup> abdominal somite.

Uropod (Fig. 6m, n): diaeresis with 7 or 9 spinules. Preanal carina (Fig. 6o) with a small spine at tip. Number of eggs varied from 55 to 65, diameter (Fig. 6p) 0.7–0.80 × 0.40–0.50 mm.

*Etymology*.—The species is named for Lake Bunyonyi.

*Remarks*.—*Caridina bunyonyiensis* is distinguished by a short, unarmed rostrum which may be provided with a small tooth (rarely 2) at tip. The figure of Gordon (1933, Fig. 1c) refers to the occurrence of these forms in Lake Bunyonyi: “In many specimens the rostrum does not reach much beyond the cornea of the eye”. *Caridina nilotica* has an upwardly turned rostrum, longer than the antennal scale, and is different from *C. bunyonyiensis* with a short plain rostrum.

*Caridina bunyonyiensis* has a short finger and slender carpus on the first pereopod with a deep excavation; the dactylus of fifth pereopod with fine setae. The endopod of the first pleopod of the male is short and stout and without appendix interna. Uropod diaeresis spinules ranged from 7 to 9. The small spine at the tip of the preanal carina and the smaller number of eggs are features that distinguish *C. bunyonyiensis* from *C. nilotica*.

***Caridina gordonae*, new species**

Figs. 7, 8

*Caridina nilotica*, Gordon, 1933: 354–357 (part).

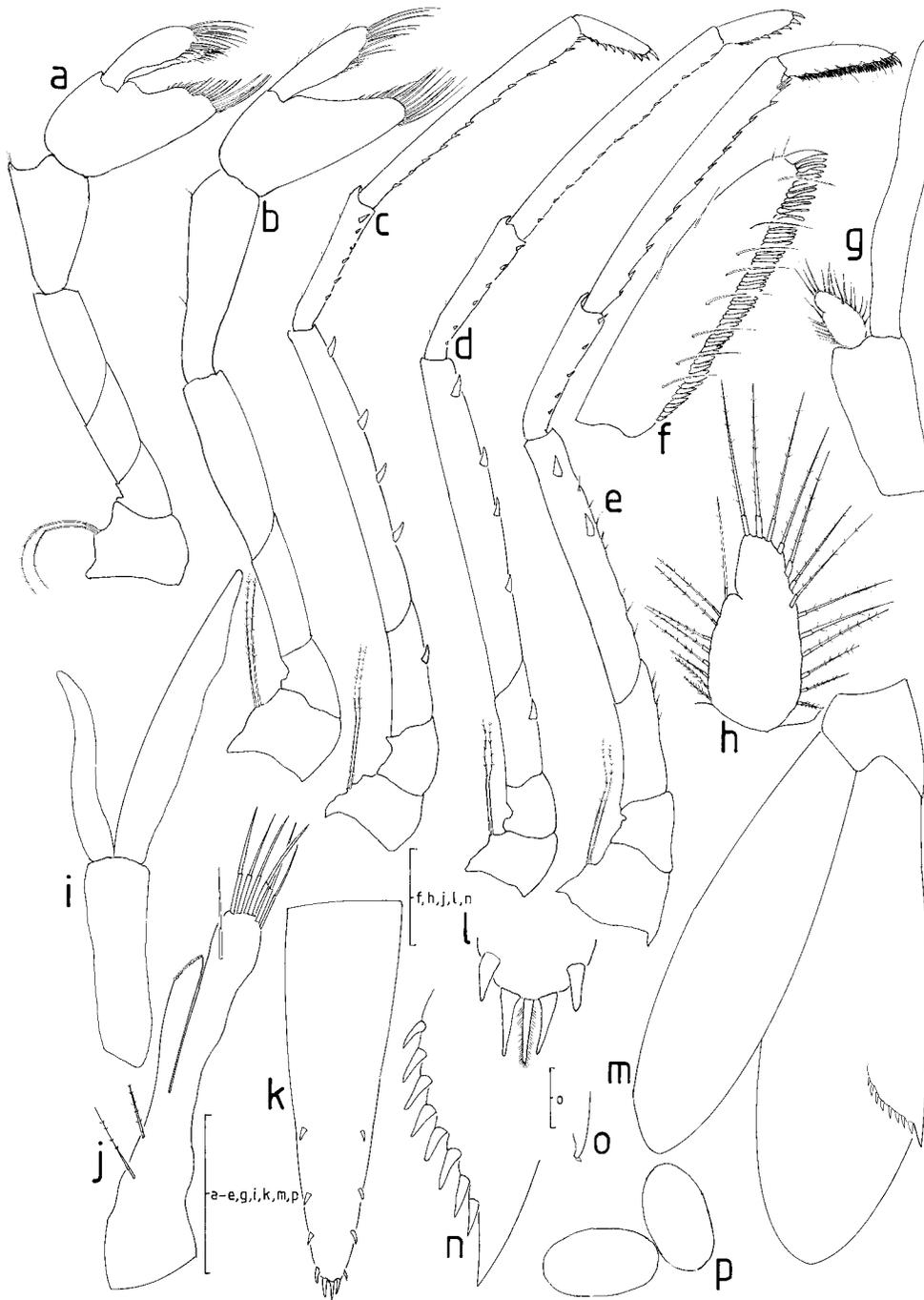


Fig. 6. *Caridina bunyoniensis*. Paratype female from NHM 1934.2.8.39-40. a. first pereopod; b. second pereopod; c. third pereopod; d. fourth pereopod; e. fifth pereopod; f. dactylus of fifth pereopod; g. first male pleopod; h. endopod of first male pleopod; i. first female pleopod; j. second male pleopod; female k. telson; l. terminal spines of telson; m. uropod; n. uropod diaeresis spinules; o. preanal carina; p. eggs. Scale bars: a-e, g, i, k, m, p = 1 mm; f, h, j, l, n = 0.2 mm; o = 0.25 mm.

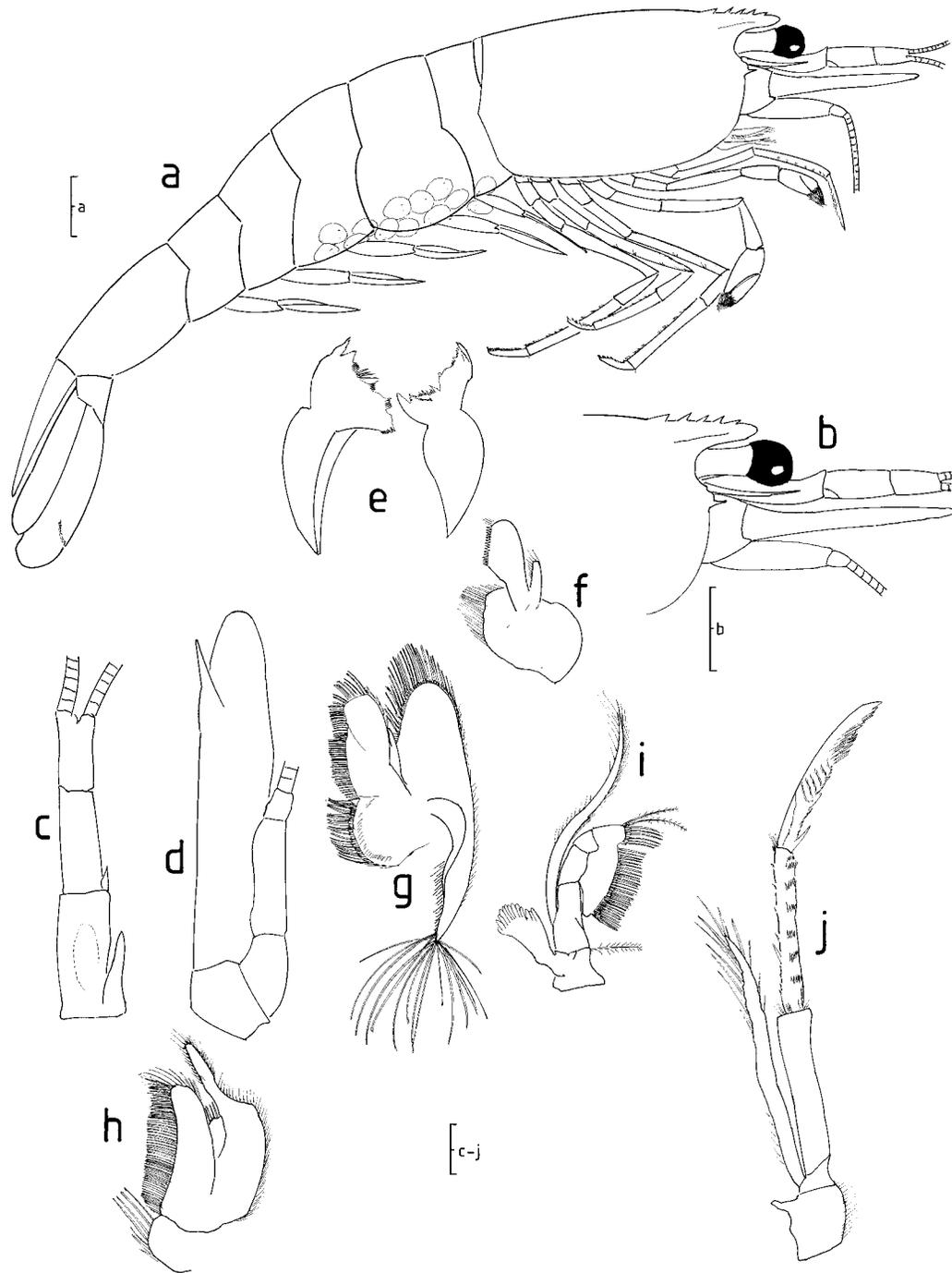


Fig. 7. *Caridina gordonae*. Paratype female from NHM 1934.2.8.41-42. a. lateral view; b. anterior lateral view of carapace; c. antennular peduncle; d. antennal scale; e. mandibles; f. maxillule; g. maxilla; h. first maxilliped; i. second maxilliped; j. third maxilliped. Scale bar: a, b = 1 mm; c-j = 0.5 mm.

*Material examined.*—**Uganda:** Bufundi, Lake Bunyonyi, coll. E.B. Worthington, August 1931, pres. Cambridge Expedition to the East African Lakes 1930–31, 12.08.31, stn 705, holotype, NHM 1934.2.8.9, 1 male; paratypes, NHM 1934.2.8.15, 24 males, 9 females ovig., 21 females; NHM 1934.2.8.12, 62 juv., 13.08.31, stn 707A, paratypes, dissected and figured specimens, NHM 1934.2.8.41–42, 1 male, 1 female ovig.; NHM 1934.2.8.43, 7 males, 7 females ovig., 17 males; NHM 1934.2.8.38, 118 juv.; stn 707B, paratypes, NHM 1934.2.8.90, 2 males, 1 female. Lake Bunyoni, coll. & pres. J. Ford, paratypes, NHM 2004.2627–2639, 6 males, 1 female ovig., 5 females.

*Description.*—Holotype, paratype male and female from NHM 1934.2.8.41–42. Size of adults ranged from 15 to 25 mm.

Rostrum (Fig. 7a, b) short and straight, slightly shorter or equal to eye, rarely reaching 1<sup>st</sup> or 2<sup>nd</sup> segment of antennular peduncle, never longer than antennular peduncle. Length of rostrum 0.75 to 1.0 mm, 0.2–0.23 times as long as carapace; dorsal teeth 1–13 (mainly 3–7), arranged uniformly almost to tip. Occasionally a tooth (rarely two) may be present at tip. Post-orbital teeth typically absent, rarely 1 or 2 may be present. Ventral margin always without teeth. Rostral formula (0–2) 2–13/0 usually (0–1) 3–7/0. Carapace with distinct antennal spine placed at orbital angle. Pterygostomian angle rounded. Carapace 3.9–4.5 mm long. Antennular peduncle (Fig. 7c) 0.7–0.8 times length of carapace. Stylocerite 0.6–0.7 times basal segment. Anterolateral teeth of basal segment 0.2–0.23 times basal segment. 12 segments bear aesthetascs. Antennal scale (Fig. 7d) 4.0–4.5 times as long as broad. Mandibles (Fig. 7e) asymmetrical. Maxillule (Fig. 7f). Maxilla (Fig. 7g). First maxilliped (Fig. 7h). Second maxilliped (Fig. 7i). Third maxilliped (Fig. 7g).

First pereopod (Fig. 8a) finger 0.8–0.9 times length of palm. Chela stout, 1.9–2.3 times as long as broad. Carpus 1.6–2 times

as long as broad, almost flat anteriorly. Second pereopod (Fig. 8b) long and slender, finger 0.8–1.0 times as long as palm. Chela 2.1–2.5 times as long as broad. Carpus 3.0–3.5 times as long as broad. Third pereopod (Fig. 8c), dactylus 3.5–4.0 times as long as broad, with 8 or 9 spines (including terminal spine). Propodus 3.0–3.3 times as long as dactylus, 10–12 times as long as broad with 11–13 spines arranged along inner margin. Carpus 0.5–0.6 times length of propodus, with small spines along inner margin. Merus with 3 spines on posterior margin, 1.3–1.8 times length of carpus. Fourth pereopod (Fig. 8d). Fifth pereopod (Fig. 8e, f), dactylus 3.5–4.2 times as long as broad, with 45–55 spines arranged in comb-like fashion on posterior margin with 2–8 spines arranged along inner margin. Propodus 2.5–3.0 times as long as dactylus, 9.0–9.5 times as long as broad with 10–17 spines arranged along inner margin. Merus 1.6–1.8 times carpus, with two big spines on posterior margin. Carpus with small spines on posterior margin, 0.4–0.7 times propodus. Epipods present on first four pereopods, two setobranchs on all pereopods.

First pleopod of male (Fig. 8g, h), endopod 0.2–0.25 times the exopod. Endopod with uniform stalked setae leaving gap at inner anterior margin. Endopod without appendix interna. First pleopod of female (Fig. 8i): with endopod 0.5–0.6 times as long as the exopod. Second pleopod of male (Fig. 8j).

Telson (Fig. 8k, l) slender, tapering at posterior end with 5–7 pairs of dorsal spines (including subterminal spine); 0.9–1.0 times the length of the 6th abdominal somite; 1–3 pairs of plain terminal spines with or without median spine present.

Uropod (Fig. 8m, n), diaeresis spinules 8–10. Preanal carina (Fig. 8o) with small medial spine, with sharp spine at tip. Number of eggs varied from 30 to 45, diameter (Fig. 8p) 0.7–0.9 × 0.4–0.5 mm.

*Etymology.*—The species is named after Dr. Isabella Gordon, as a mark of respect to

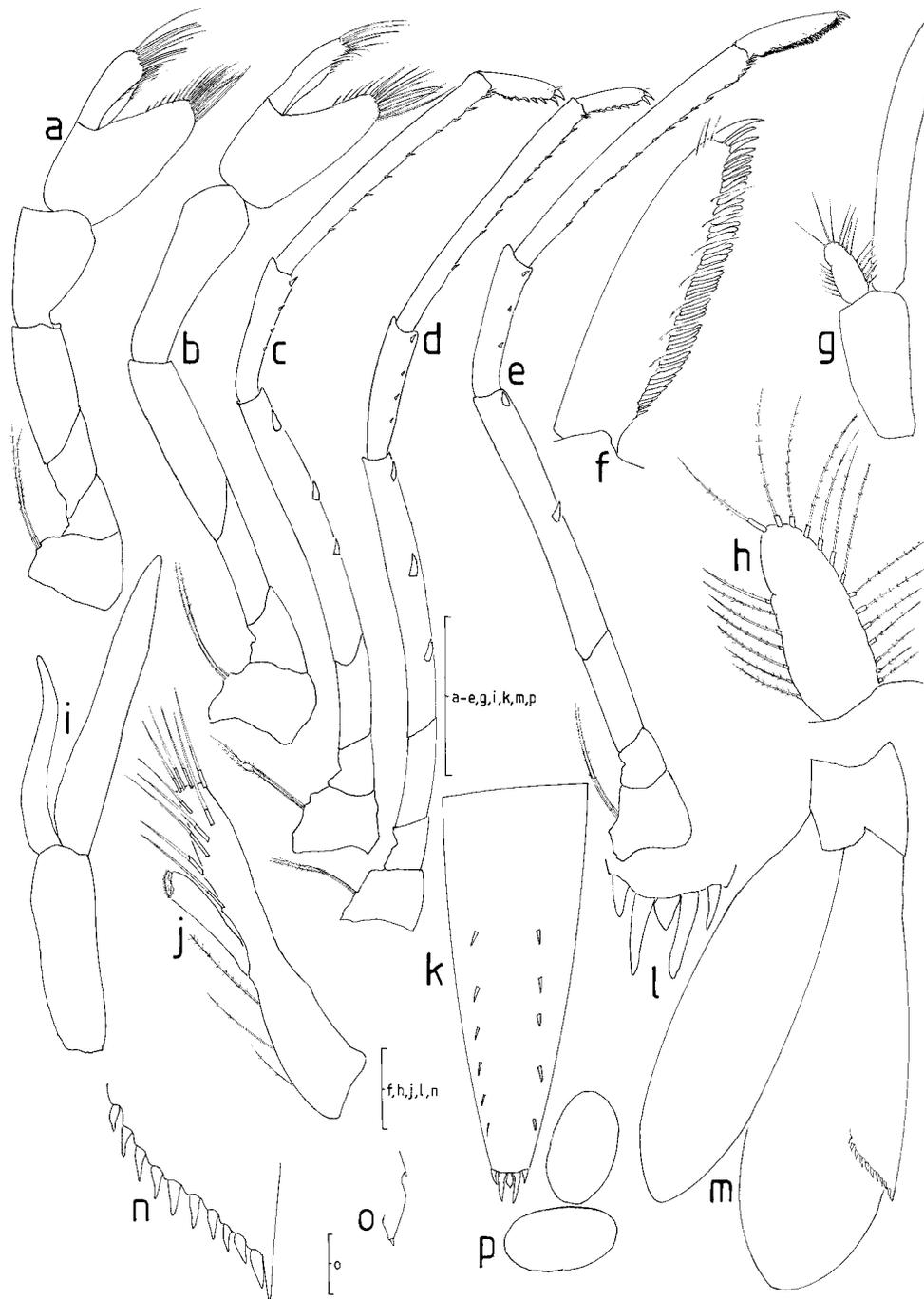


Fig. 8. *Caridina gordonae*. Paratype female from NHM 1934.2.8.41-42. a. first pereopod; b. second pereopod; c. third pereopod; d. fourth pereopod; e. fifth pereopod; f. dactylus of fifth pereopod; g. first male pleopod; h. endopod of first male pleopod; i. first female pleopod; j. second male pleopod; female k. telson; l. terminal spines of telson; m. uropod; n. uropod diaeresis spinules; o. preanal carina; p. eggs. Scale bars: a-e, g, i, k, m, p = 1 mm; f, h, j, l, n = 0.2 mm; o = 0.25 mm.

her contributions to carcinology, especially to the African Atyidae.

*Remarks.*—*Caridina gordonae* can be readily identified by its short and straight rostrum with teeth only on the dorsal margin. The rostrum is slightly shorter than or equal to the eye, but rarely reaches the first or second segment of the antennular peduncle. The rostral tip is plain, or with a small forwardly directed tooth (rarely 2 teeth). The number of dorsal teeth ranges from 2 to 13, typically 3–7, with 0–2 being post-orbital. Gordon (1933), while describing the rostral formulae of *C. nilotica* from Lake Bunyonyi, remarked, “and sometimes the ventral series is greatly reduced or absent.” Two of the seven formulae given by Gordon (1933), are  $1+7+1+1/0$  and  $0+5+0/0$ , which are well within the rostral formula for *C. gordonae*, being (0–2)  $1-13/0$ , typically (0–1)  $3-7/0$ .

*Caridina gordonae* possesses a robust chela on the first pereopod with a short finger, and a carpus almost flattened anteriorly. The preanal carina possesses two spines. The endopod of the first male pleopod is short and stout and without appendix interna. The number of eggs is less than *C. nilotica*, ranging 30–45.

*Caridina pseudonilotica*, new species

Figs. 9, 10

*Caridina nilotica*, Gordon, 1933: 354–357 (part).

*Material examined.*—**Uganda:** Bufundi, Lake Bunyonyi, coll. E.B. Worthington, August 1931, pres. Cambridge Expedition to the East African Lakes 1930–31, 12.08.31; stn 705, holotype, NHM 1934.2.8.8, 1 male; paratypes, NHM 1934.2.8.13, 12 male, 10 females ovig., 13 females 1 juv.; NHM 1934.2.8.16, 18 juv.; dissected and figured specimens, NHM 1934.2.8.9–10, 1 male, 1 female ovig.; non types, 3 specimens abnormal rostrum, NHM 1934.2.8.20, 1 female ovig., 2 females. 13.08.31; stn 707A, paratypes, NHM 1934.2.8.41, 11 males, 16 females ovig., 9 females; NHM 1934.2.8.42,

30 juv.; non types, abnormal rostrum, NHM 1934.2.8.45, 2 males, 1 female ovig., 3 females; stn 707B, paratype, NHM 1934.2.8.88, 1 female. Lake Bunyonyi, coll. & pres. J. Ford, paratypes, NHM 2004.2640–2656, 13 males, 1 female ovig., 2 females.

*Description.*—Holotype, paratype male and female from NHM 1934.2.8.9–10. Size of adults ranged from 15 to 25 mm.

Rostrum (Fig. 9a–e) shorter, as long as or sometimes fractionally longer than the antennal scale. Length of the rostrum 1.2–3.5 mm and 0.6–1.0 times as long as the carapace; tip usually bifid or pointed, rarely with 3 spines. Dorsal teeth 2–25 (mostly 5–15), arranged proximally leaving distal gap which may be interrupted by 1 or 2 teeth; distal unarmed part mostly 0.2–0.5 (rarely to 0.8) times armed part of rostrum. Post-orbital teeth absent or present (maximum of 2). Ventral teeth varying from 1 to 18, arranged uniformly from proximal to distal end. Rostral formula (0–2)  $2-25/1-18$ , typically (0–1)  $5-15/5-14$ . Carapace with distinct antennal spine, pterygostomian angle rounded. Carapace 3.0–3.5 mm long. Sixth abdominal somite 0.6–0.7 times carapace. Antennular peduncle (Fig. 9f) 0.76 times carapace length; stylocerite 0.55–0.6 times as long as basal segment; anterolateral tooth 0.15–0.2 times basal segment, 9–10 segments bear aesthetascs. Antennal scale (Fig. 9g) 4.2–4.8 times as long as broad. Mandibles (Fig. 9h) asymmetrical. Maxillule (Fig. 9i). Maxilla (Fig. 9j). First maxilliped (Fig. 9k). Second maxilliped (Fig. 9l). Third maxilliped (Fig. 9m).

First pereopod (Fig. 10a) finger 0.9–1.2 time as long as palm, chela 2.0–2.4 times as long as broad, carpus 1.5–1.7 times as long as broad, almost flat anteriorly. Second pereopod (Fig. 10b) finger 1.2–1.5 times as long as palm, chela 2.2–2.7 times as long as broad, carpus 3.4–4.0 times as long as broad. Third pereopod (Fig. 10c), dactylus 3.0–3.5 times as long as broad with 8–10 spines; propodus 3.3–4.0 times as long as dactylus, 10–12 times as long as broad with

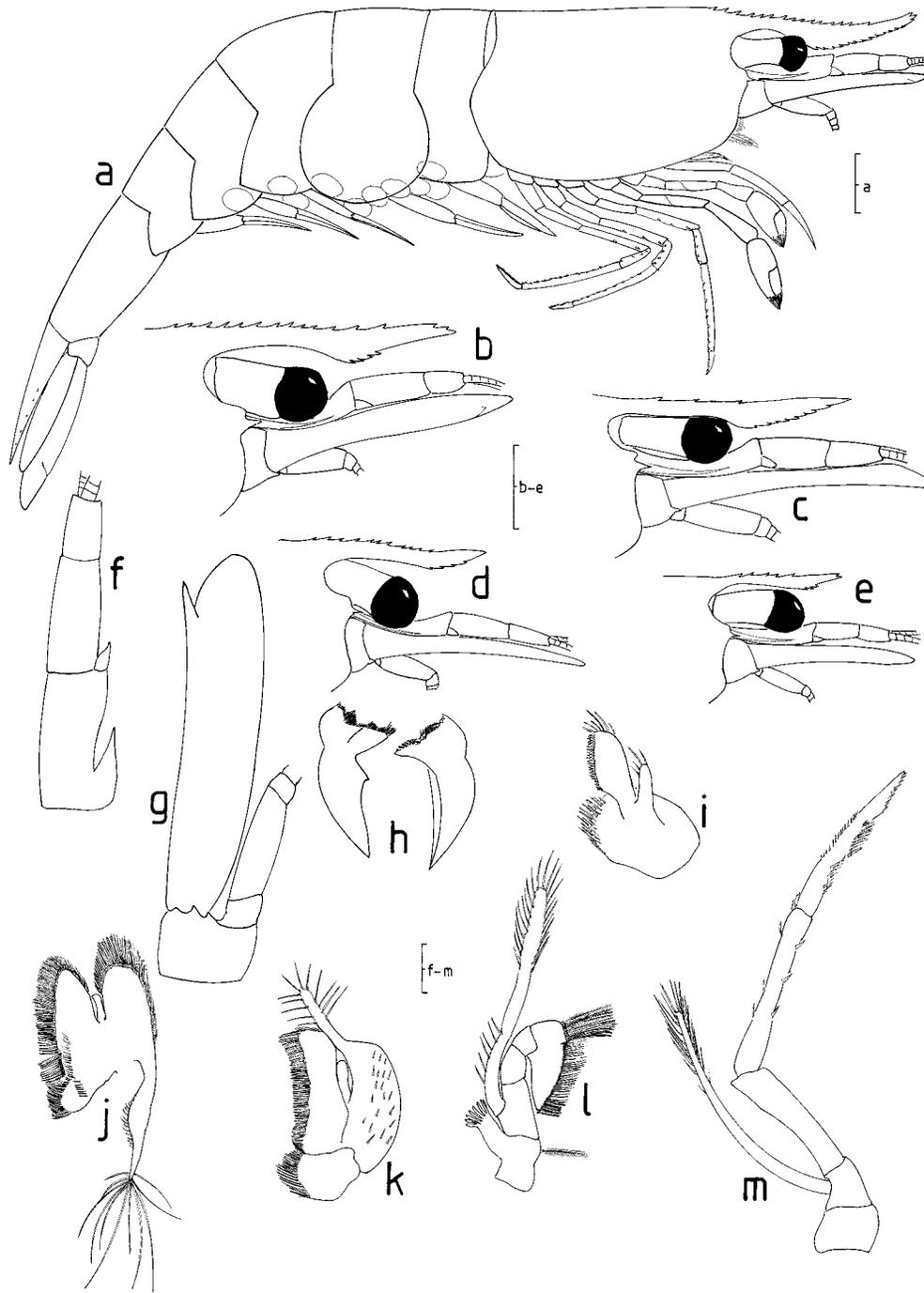


Fig. 9. *Caridina pseudonilotica*. Paratype female from NHM 1934.2.8.9–10. a. lateral view; rostral variation, NHM 1934.2.8.13, b. female ovig.; c. female; NHM 2004.2640–2656, d. male; e. male; female, f. antennular peduncle; g. antennal scale; h. mandibles; i. maxillule; j. maxilla; k. first maxilliped; l. second maxilliped; m. third maxilliped. Scale bar: a = 1 mm; b–e = 1 mm; f–m = 0.5 mm.

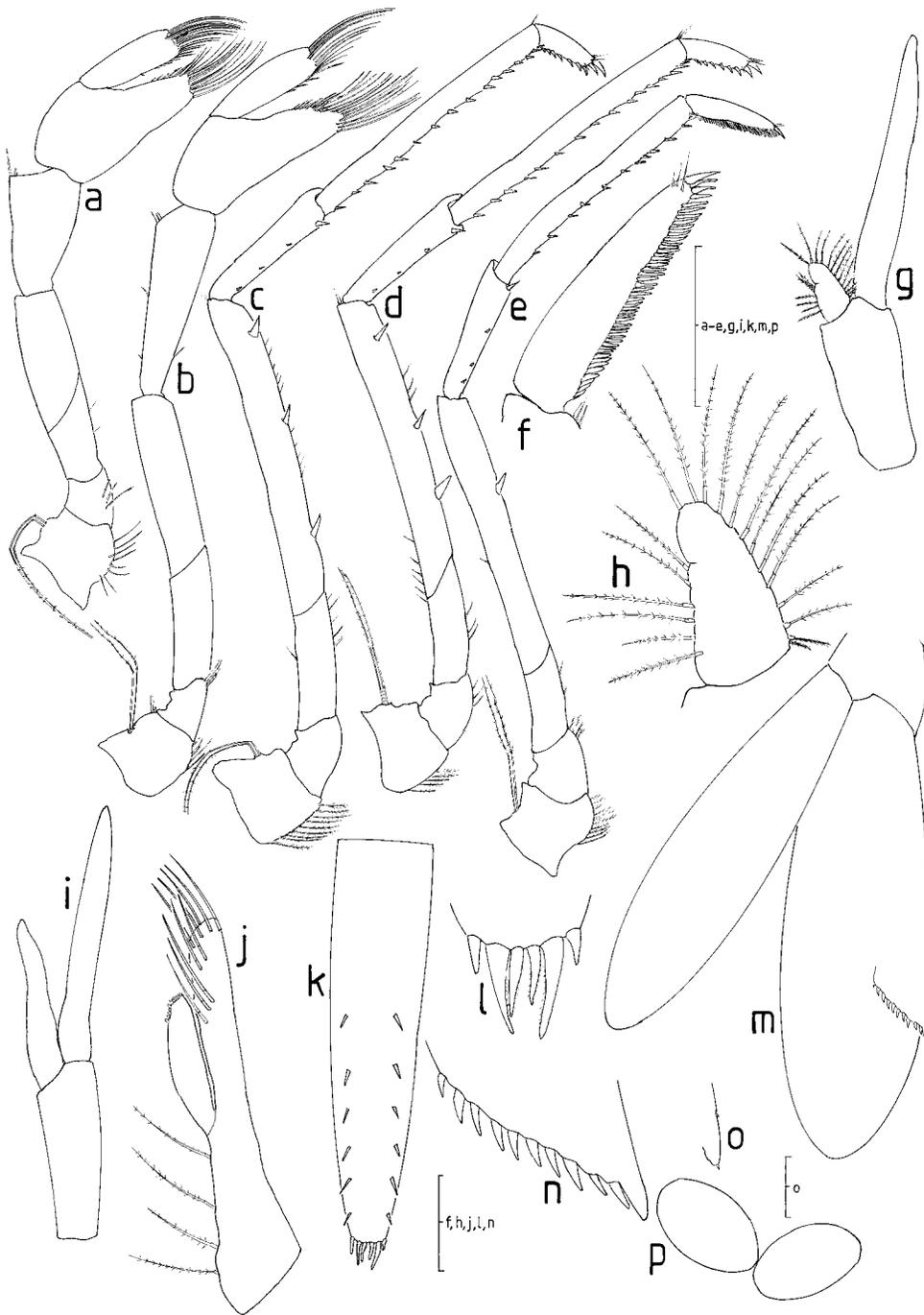


Fig. 10. *Caridina pseudonilotica*. Paratype female from NHM 1934.2.8.9-10. a. first pereopod; b. second pereopod; c. third pereopod; d. fourth pereopod; e. fifth pereopod; f. dactylus of fifth pereopod; g. first male pleopod; h. endopod of first male pleopod; i. first female pleopod; j. second male pleopod; female, k. telson; l. terminal spines of telson; m. uropod; n. uropod diaeresis spinules; o. preanal carina; p. eggs. Scale bars: a-e, g, i, k, m, p = 1 mm; f, h, j, l, n = 0.2 mm; o = 0.25 mm.

10–13 spines arranged along inner margin; carpus 0.5 to 0.6 times propodus, with small spines on inner margin; merus with 3 large spines on posterior margin, 1.7–2 times carpus. Fourth pereopod (Fig. 10d). Fifth pereopod (Fig. 10e, f), dactylus 4.0–4.2 times as long as broad, 45–50 spines arranged in a comb-like fashion on posterior margin; propodus 2.3–3.0 times as long as dactylus, 10–12 times as long as broad with 10–13 spines arranged along inner margin; merus 1.8–2 times carpus length, with two large spines on inner margin; carpus with small spines on inner margin, 0.4–0.5 times propodus length. Epipods present on first four pereopods, two setobranchs on all pereopods.

First pleopod of male (Fig. 10g, h), endopod 0.2–0.25 times exopod length. Endopod possesses uniform stalked setae leaving gap at inner margin and one long fine seta protrudes from lower margin. Endopod without appendix interna. First pleopod of female (Fig. 10i), endopod 0.6–0.7 times as long as exopod. Second pleopod of male (Fig. 10j).

Telson (Fig. 10k, l) slender, tapering at posterior end, 1.0–1.1 times as long as 6<sup>th</sup> abdominal somite, with 5–7 pairs of dorsal spines (including subterminal spine). Terminal spines are 2 or 3 pairs with or without median spine; inner pairs may be sparsely plumose.

Uropod (Fig. 10m, n) with 8–10 spinules. Preanal carina (Fig. 10o) with 2 small spines present, one medial, the other at tip. Number of eggs varied from 40 to 50, diameter (Fig. 10p) 0.7–0.8 × 0.4–0.5 mm.

*Etymology*.—Named for the resemblance to *C. nilotica* with respect to the shape and arrangement of teeth on the rostrum.

*Remarks*.—*Caridina pseudonilotica* is distinguished from *C. nilotica* by possession of a rostrum that is shorter, as long as, or sometimes fractionally longer than the antennal scale (Fig. 9a, b). The number of dorsal and ventral teeth is as low as 2 and 1, respectively. The dental formula, though it overlaps that of *C. nilotica*, mostly falls

into lower range being (0–2) 2–25/1–18, typically (0–1) 5–15/5–14. Postorbital teeth may be present or absent in *C. pseudonilotica* whereas they are always present in *C. nilotica*. Gordon (1933) referred to the unique situation of the rostral dentition of her samples from Lake Bunyonyi: “There is a marked tendency towards reduction of the dorsal series, so that, in the specimens examined, it was most usual for ventral to exceed the dorsal number of teeth (in 16 out of 22 specimens; see text-fig. 1a), sometimes the ventral series is greatly reduced or absent”. Five of the seven formulae presented by Gordon (1933) fell in to the range (0–2) 5–19/9–17. This is well within the rostral formula for *C. pseudonilotica*, noted as (0–2) 2–25/1–18 but mostly (0–1) 5–15/5–14. In *C. nilotica* the number of dorsal and ventral teeth is always above 10.

However, the shape and arrangement of teeth in the new species resemble *C. nilotica*. The dorsal teeth are arranged from the proximal end leaving a distal gap. Nevertheless, the proportion between the unarmed part to the armed part is usually less in *C. pseudonilotica*, being 0.2–0.5 (rarely to 0.8), while the unarmed part is longer in *C. nilotica*, being 0.4–0.8 times the armed part.

*Caridina pseudonilotica* possesses a shorter stylocerite, the chela of the first pereopod is robust, and the carpus is almost flat anteriorly. The endopod of the first male pleopod is strong with a short stout endopod and the preanal carina possesses 2 sharp spines. This new species has a fewer eggs (45–55) than *C. nilotica* (85–140). Even though *C. pseudonilotica* resembles *C. nilotica*, its shorter rostrum and the reduction in the number of rostral teeth are distinguishing characters. The unarmed part of the rostrum is usually shorter in the new species when compared to that of *C. nilotica*.

*Caridina subventralis*, new species

Figs. 11, 12

*Caridina nilotica*, Gordon, 1933: 354–357 (part), Fig 1b.

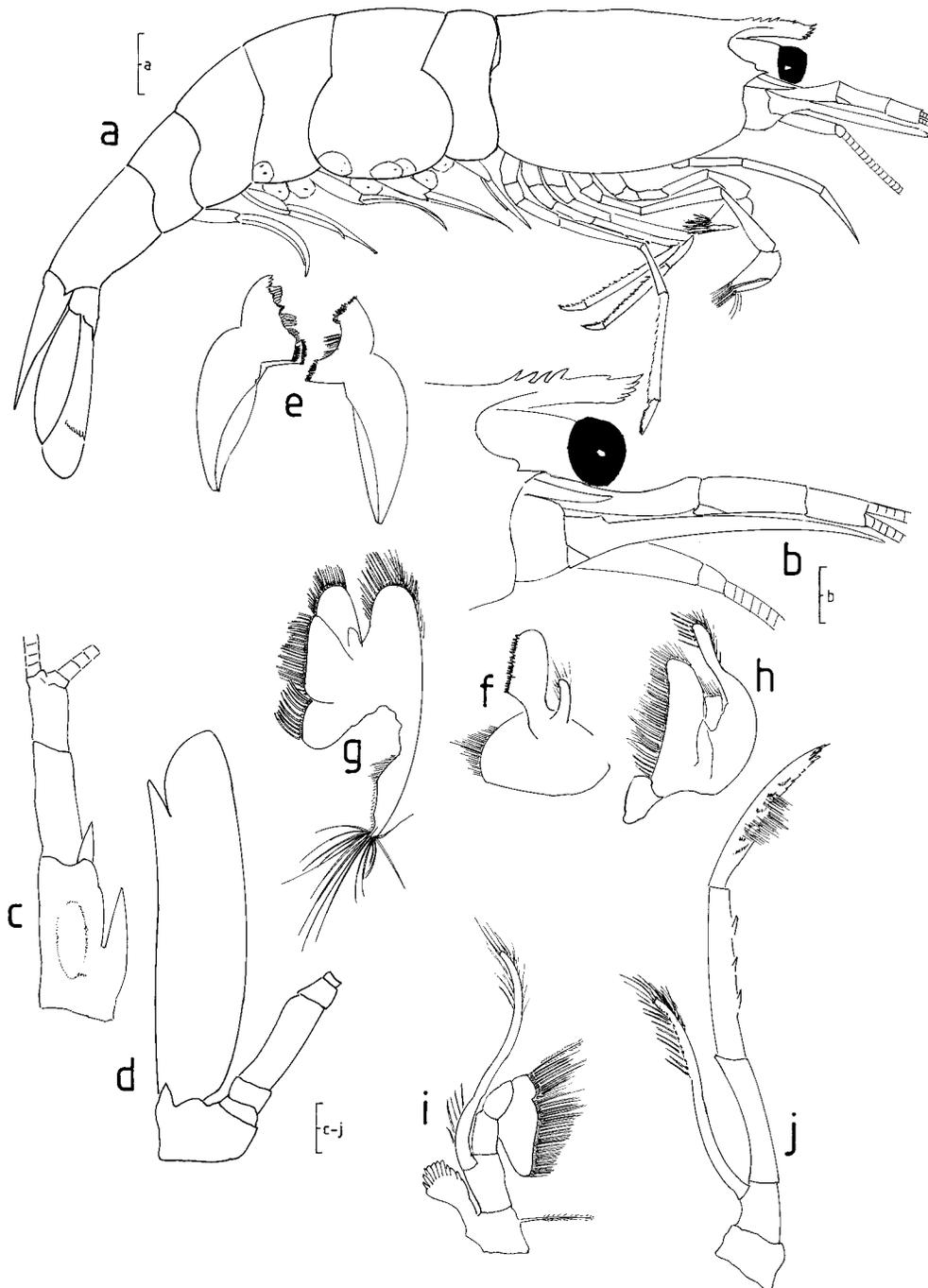


Fig. 11. *Caridina subventralis*. Paratype female from NHM 1934.2.8.43-44. a. lateral view; b. anterior lateral view of carapace; c. antennular peduncle; d. antenna; e. mandibles; f. maxillule; g. maxilla; h. first maxilliped; i. second maxilliped; j. third maxilliped. Scale bar: a = 1 mm; b-j = 0.5 mm.

*Material examined.*—**Uganda:** Bufundi, Lake Bunyonyi, coll. E.B. Worthington, August 1931, pres. Cambridge Expedition to the East African Lakes 1930–31, 13.08.31, stn 707A, holotype, NHM 1934.2.8.38, 1 male; 12.08.31, stn 705, paratypes, NHM 1934.2.8.14, 2 males, 4 females ovig., 13 females; NHM 1934.2.8.17, 4 juv.; NHM 1934.2.8.18, 2 females ovig.; 13.08.31, stn 707A, paratypes, figured and dissected, NHM 1934.2.8.43–44, 1 male, 1 female; NHM 1934.2.8.44, 11 males, 11 females ovig., 15 females; stn 707B, paratypes, NHM 2004.2658 1 female.

Lake Bunyonyi, coll. & pres. J. Ford, paratypes, NHM 2004.2607–2616, 8 males, 1 female.

*Description.*—Holotype, paratype male and female from NHM 1934.2.8.43–44. Size of adults ranged from 15 to 25 mm.

Rostrum (Fig. 11a, b): short, straight, usually reaching first segment of antennular peduncle, rarely reaching tip of peduncle, never longer than antennular peduncle. Length of rostrum 1.3–2.0 mm and 0.4–0.5 times as long as carapace. Dorsal teeth 2–13, mostly from 5–9, arranged continuously or in one or two groups in proximal region, leaving small distal gap. Post-orbital teeth typically absent, but rarely 1 or 2 present. Ventral teeth 1–10, typically 3–5 always present, arranged subventrally at distal end. Rostral formula (0–2) 2–13/1–10 usually (0) 5–9/3–5, with ventral teeth always arranged on distal curvature. Carapace with distinct antennal spine placed at orbital angle. Pterygostomian angle rounded. Carapace 3.75–4.50 mm long. Antennular peduncle 0.8–0.9 times carapace length, sixth abdominal somite 0.5–0.6 times the carapace. Antennular peduncle (Fig. 11c) 0.75–0.85 times length of carapace. Stylocerite 0.7–0.8 times basal segment, anterolateral teeth of basal segment 0.2–0.25 times basal segment, 9 or 10 segments bear aesthetascs. Antennal scale (Fig. 11d) 4.0–4.5 times as long as broad. Mandibles (Fig. 11e) asymmetrical. Maxillule (Fig. 11f). Maxilla (Fig. 11g). First maxilliped (Fig. 11h). Second

maxilliped (Fig. 11i). Third maxilliped (Fig. 11j).

First pereopod (Fig. 12a) fingers 0.8–1.0 times palm length. Chela stout, 2–2.5 times as long as broad. Carpus 1.7–1.9 times as long as broad, with shallow excavation. Second pereopod (Fig. 12b) with finger 0.9–1.0 times as long as palm. Chela 2.0–2.5 times as long as broad. Carpus 3.0–3.5 times as long as broad. Third pereopod (Fig. 12c) with dactylus 3.6–4.0 times as long as broad, bearing 7–9 spines (including the terminal spines). Propodus 3.0–3.6 times as long as dactylus, 10–11 times as long as broad, with 11–13 spines along inner margin. Carpus 0.5–0.6 times propodus length, with small spines along inner margin. Merus with 4 large spines on posterior margin, 1.7–2.0 times carpus length. Fourth pereopod (Fig. 12e). Fifth pereopod (Fig. 12e, f) with dactylus 4.5–5.0 times as long as broad, with 45–55 spines arranged a comb-like fashion on inner margin. Propodus 2.6–3.0 times as long as dactylus, 11–12 times as long as broad with 9–13 spines arranged along inner margin. Merus 1.5–1.7 times carpus, with 2 large spines on posterior margin. Carpus with small spines on posterior margin, 0.4–0.5 times propodus. Epipods present on first four pereopods, two setobranchs on all pereopods.

First pleopod of male (Fig. 12g, h) 0.2–0.25 times exopod length. Stout endopod possesses uniform stalked setae leaving gap at inner margin. Endopod without appendix interna. First pleopod of female (Fig. 12i) endopod 0.5–0.6 times as long as exopod. Second pleopod of male (Fig. 12j).

Telson (Fig. 12k, l) slender, tapering at posterior end, with 4–5 pairs of dorsal spines (including subterminal spine). Tip with 2 or 3 pairs of plain spines, with or without a median spine. Telson 1–1.1 times 6th abdominal somite.

Uropod (Fig. 12m, n) with 7 or 8 spinules. Preanal carina (Fig. 12o) with small spine at tip. Number of eggs varied from 45–60; diameter (Fig. 12p)  $0.6\text{--}0.7 \times 0.49\text{--}0.55$  mm.

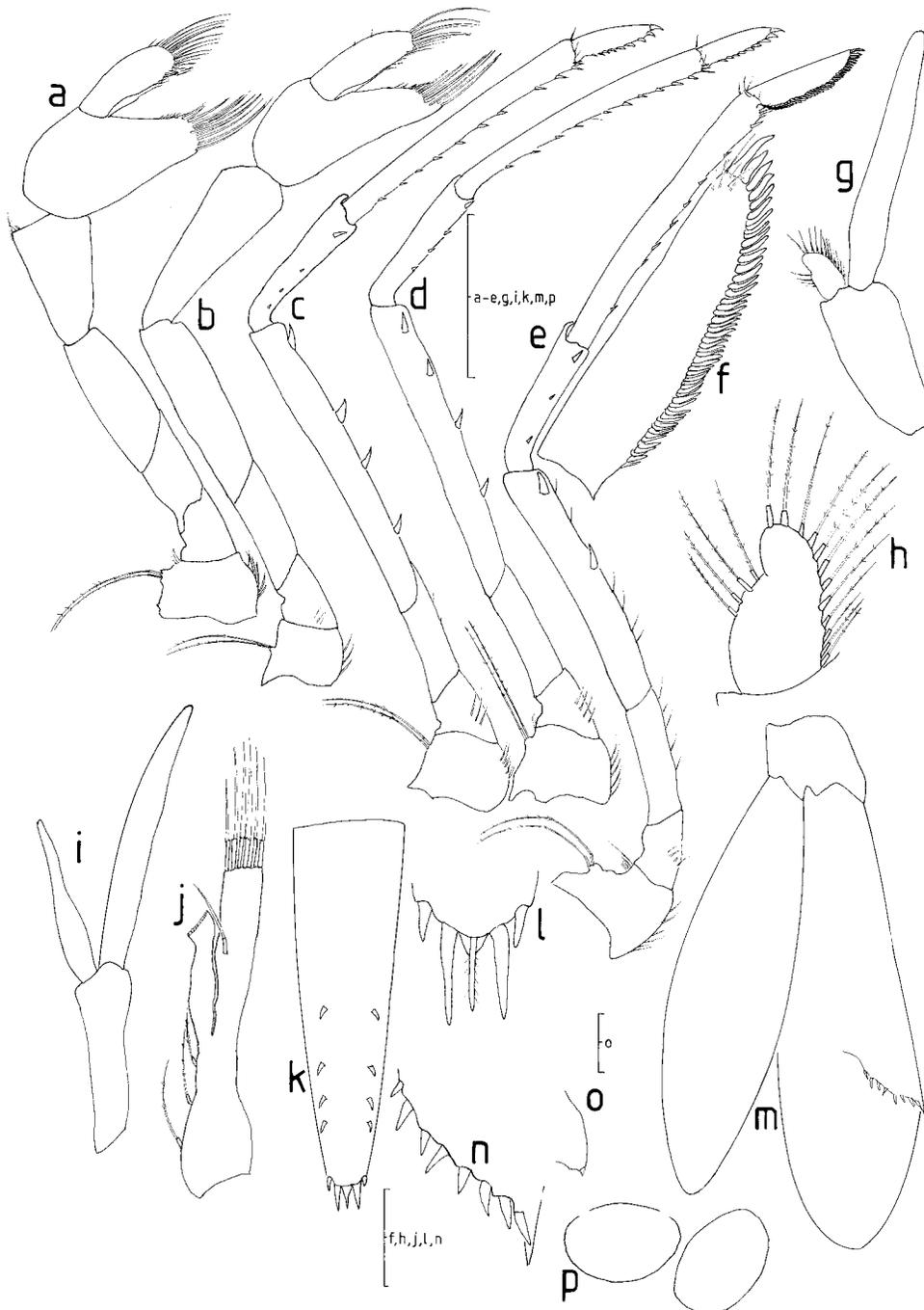


Fig. 12. *Caridina subventralis*. Paratype female from NHM 1934.2.8.43-44. a. first pereopod; b. second pereopod; c. third pereopod; d. fourth pereopod; e. fifth pereopod; f. dactylus of fifth pereopod; g. first male pleopod; h. endopod of first male pleopod; i. first female pleopod; j. second male pleopod; female k. telson; l. terminal spines of telson; m. uropod; n. uropod diaeresis spinules; o. preanal carina; p. eggs. Scale bars: a-e, g, i, k, m, p = 1 mm; f, h, j, l, n = 0.2 mm; o = 0.25 mm.

*Etymology.*—The species is named for the arrangement of the ventral teeth on the rostrum.

*Remarks.*—*Caridina subventralis* has a short and straight rostrum with a subterminal arrangement of the ventral teeth. The post-orbital teeth range from 0 to 2, but mostly none. The rostral formula is (0–2) 2–13/1–10, usually (0) 5–9/3–5, with ventral teeth always arranged on a distal curvature.

While describing the variation in the rostral dentition of *C. nilotica* from Lake Bunyonyi, Gordon (1933) referred to specimens with the type of rostrum described for *C. subventralis*. She (Gordon, 1933, text-fig. 1b) confirmed the occurrence of this type as common in Lake Bunyonyi: “Although again subject to much variation, the type represented in text Fig 1.b with a few subterminal teeth on the ventral margin is most common.”

*Caridina subventralis* has a subterminal arrangement of ventral teeth on the rostrum, a first pereopod with stout carpus with a shallow anterior excavation, a first male pleopod with a characteristic endopod, preanal carina with one spine, and fewer eggs. All these characters differentiate this species from *C. nilotica*.

Key

- 1a) Rostrum usually much longer than the antennal scale, rarely equal to but never shorter than the antennal scale . . . . . *Caridina nilotica*
- 1b) Rostrum shorter, equal to or fractionally longer than the antennal scale . . . . . 2
- 2a) Rostrum shorter, equal to or sometimes fractionally longer than the antennal scale . . . . . *Caridina pseudonilotica*
- 2b) Rostrum never reaching distal end of the antennal scale . . . . . 3
- 3a) Rostrum without teeth on the dorsal and ventral margins; one (rarely 2) tooth may or may not be present at the tip . . . . . *Caridina bunyonyiensis*
- 3b) Rostrum with teeth on both margins or on only one margin . . . . . 4

- 4a) Rostrum with teeth on the dorsal margin only . . . . . *Caridina gordonae*
- 4b) Rostrum with teeth on dorsal margin and the ventral teeth arranged subterminally . . . . . *Caridina subventralis*.

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LITERATURE CITED

Bouvier, E. L. 1925. Recherches sur la morphologie, les variations, la distribution géographique des crevettes de la famille des Atyidés. *Encyclopédie Entomologique Paris* 4:1–370.

Calman, W. T. 1906. 2. Zoological results of the third Tanganyika expedition. Report on the macrurous Crustacea.—*Proceedings of the Zoological Society of London* 1906:187–206.

———. 1928. 28. On the prawns of the family Atyidae from Tanganyika.—*Proceedings of the Zoological Society of London* 1928:737–741.

De Man, J. G. 1908. On *Caridina nilotica* (Roux) and its varieties.—*Records of Indian Museum, Calcutta* 2:255–283.

Gordon, I. 1930. 30. African freshwater prawns of the species *Caridina nilotica* (Roux) with special reference to Nile Basin.—*Proceedings of the Zoological Society of London* 1930:33–50.

———. 1933. Scientific results of the Cambridge Expedition to the East African Lakes, 1930–1.—14. Crustacea Macrura (prawns).—*Journal of the Linnean Society of London* 38:351–362.

Hickson, S. I. 1888. On a new species of the genus *Atya* (*A. Wyckii*) from Celebes.—*Annals and Magazine of Natural History, Series 6*, 2:357–362, pls 13–14.

Hussein, M. A., & A. H. Obuid-Allah. 1992a. Redescription of the freshwater prawn *Caridina nilotica nilotica* (Crustacea, Decapoda, Atyidae) collected from Egypt. I. External features.—*Journal of the Egyptian—German Society of Zoology, Invertebrate & Parasitology* 9:121–142.

- , & ———. 1992b. Description of the freshwater prawn *Caridina nilotica nilotica* collected from Egypt. II. Appendages. *Journal of the Egyptian—German Society of Zoology.—Invertebrate & Parasitology* 9:203–222.
- Johnson, D. S. 1960. Sub-specific and infra-specific variation in some freshwater prawns of the Indo-Pacific. Pp. 259–267 in R. D. Purchon, ed., *Proceedings of the Centenary and Bicentenary Congress of Biology, Singapore, December 2–9, 1958*. University of Malaya Press, Singapore.
- . 1963. Distributional and other notes on some fresh-water prawns (Atyidae and Palaemonidae) mainly from Indo-West Pacific region.—*Bulletin of the National Museum of Singapore* 32:5–30.
- Milne Edwards, H. 1837. *Histoire naturelle naturelle des Crustacés, comprenant l'anatomie, la physiologie et la classification de ces animaux*. Paris, Librairie de Roret. 2:1–532.
- Roux, P. 1833. Lettre relative a divers Coquilles, Crustacés. Insectes, Reptiles et Oiseaux, observés en Égypte.—*Annales des Sciences Naturelles Paris* 28:72–78.
- Stimpson, W. 1861. *Prodromus descriptionis animalium evertibratorum, quae in Expeditione ad Oceanum Pacificum Septentrionalem, a Republica Federata missa, Cadwalaldaro Ringgold et Johanne Rodgers Ducibus, observavit et descripsit. Pars VIII. Crustacea Macrura*.—*Proceedings of the Academy of Natural Sciences of Philadelphia* 12[1860]:22–47.
- Woltereck, R. 1942. Untersuchungen an Atyiden (Decapoda) von Belgisch Kongo, mit besonderer Berücksichtigung der Rassen—und Artbildungsfrage.—*Revue de Zoologie et de Botanique Africaines, Bruxelles* 36:229–328.

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