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Miss Rathbun

Mary J. Rathbun.

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SCIENTIFIC RESULTS OF THE CAMBRIDGE EX-
PEDITION TO THE EAST AFRICAN LAKES,
1930-1.—14. CRUSTACEA MACRURA (PRAWNS).

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Scientific results of the Cambridge Expedition to the East African Lakes,
1930-1.—14. Crustacea Macrura (Prawns). By ISABELLA GORDON, D.Sc.,
Ph.D., British Museum (Nat. Hist.).

(With 7 Text-figures)

[Read 6 April 1933]

INTRODUCTION.

By far the greater number of the Crustacea are fresh-water prawns belonging, for the most part, to the genus *Caridina*. The majority of the specimens were collected in Lake Bunyoni, and these exhibit an unusual amount of variation of the rostrum. With regard to Lake Edward it is almost certain that none of the specimens came from the lake itself*, although *Caridina africana* was found in several affluents at a distance of a mile or less from the lake.

It is an interesting fact that *Caridina* does not occur in Lake Rudolf, where it is replaced by a species of *Palaemon*. In this respect Lake Rudolf differs from Lakes Albert and Victoria. The specimens probably represent a variety or local race of the species *P. niloticus* previously recorded from the Nile (Egypt and the Sudan) and from Lake Chad.

I have to thank Dr. Worthington for submitting the material to me for examination.

CARDINA NILOTICA (Roux).

De Man, J. C., 1908, Rec. Ind. Mus. ii, pt. 3, no. 28, pp. 253-8, pl. xx.

Bouvier, E. L., 1925, Encyclopédie Entomologique.—IV. 'Atyidés,' Paris, pp. 143-159.

Gordon, I., 1930, P. Z. S. pp. 33-50.

Most of the specimens belonging to the genus *Caridina* are apparently referable to *C. nilotica*, a species of wide distribution in East Africa, where it has given rise to a considerable number of local forms differing somewhat from each other and from the typical Egyptian form (Gordon, 1930). It is therefore deemed advisable to discuss the material in the present collection under each separate locality. The specimens were studied in much the same way as those from Lakes Albert and Victoria (Gordon, 1930). Wherever possible ovigerous females were measured, and the ratios given in Table I (for the peraeopods) should be compared with those in Table II of the previous paper (Gordon, 1930, pp. 42 & 43). Owing to the extreme variability of the rostrum, especially as regards length, in the material from Lake Bunyoni,

* With the possible exception of the specimen from Kaianda (see p. 352).

the length of the specimens given in this paper is that from postorbital border to tip of telson.

- A. Near LAKE EDWARD. (a) Stn. 567. From shallow weedy backwater, River Semliki, $\frac{1}{4}$ mile down stream from L. Edward: 1 ovigerous ♀.
 (b) Kaianda, north end of Lake: 1 ovigerous ♀*.

Description.—*Telson* in each specimen of type 1, i.e. similar to that represented in fig. 1 (Gordon, 1930, p. 34).

Peraeopods. In the female from Kaianda peraeopod 1 is similar to that of *C. nilotica* var. *typica* from Egypt, but peraeopod 2 has the fingers rather longer relatively to the palm. Peraeopods 3 and 5 are typical.

In the specimen from Stn. 567 peraeopods 1 and 2 have each considerably longer fingers relatively to the palm, and the former has a somewhat longer and narrower carpus than in var. *typica*. Peraeopod 3 is typical; peraeopod 5 has a slightly narrower dactylus.

Rostrum in both specimens exceeds the antennal scale and is equal to, or slightly longer than, the carapace. Rostral formula: $\frac{3+13+1+2}{15}$ (st. 567) and $\frac{2+14+3}{14}$; proportion of dorsal surface unarmed approximately two-fifths in each case (.38 and .41 respectively).

Sixth abdominal segment exceeding half, but less than two-thirds, the length of the carapace.

Ova measuring .59–.64 × .36–.40 mm.; a little smaller than in var. *typica*.

Remarks.—According to the key given by de Man (1908, pp. 257–9) these specimens are nearest to *C. nilotica* (i.e. to var. *typica*) and *C. nilotica* var. *natalensis*, but the ova are nearer in size to those of the former. Apart from the differences in the peraeopods already mentioned, these specimens agree with the typical form.

- B. LAKE GEORGE. Stn. 617. Swamp at north end of lake: 3 ♂♂, 4 ♀♀ (3 ovigerous), and several young specimens.

Description.—*Telson* of type 2 (i.e. similar to that represented in fig. 2; Gordon, 1930, p. 134) in ten specimens and of type 1 in the remaining one.

Peraeopods. Peraeopods 1 and 2 have the fingers somewhat longer relatively to the palm than in var. *typica*. Peraeopod 3 agrees with, but peraeopod 5 has the dactylus rather more slender than in the typical form.

Rostrum extending beyond antennal scale; subequal to or slightly longer than the carapace (1.05–1.15:1), armed with $\frac{2-3+13-16+1}{14-16}$ teeth; proportion of dorsal surface unarmed .36–.40.

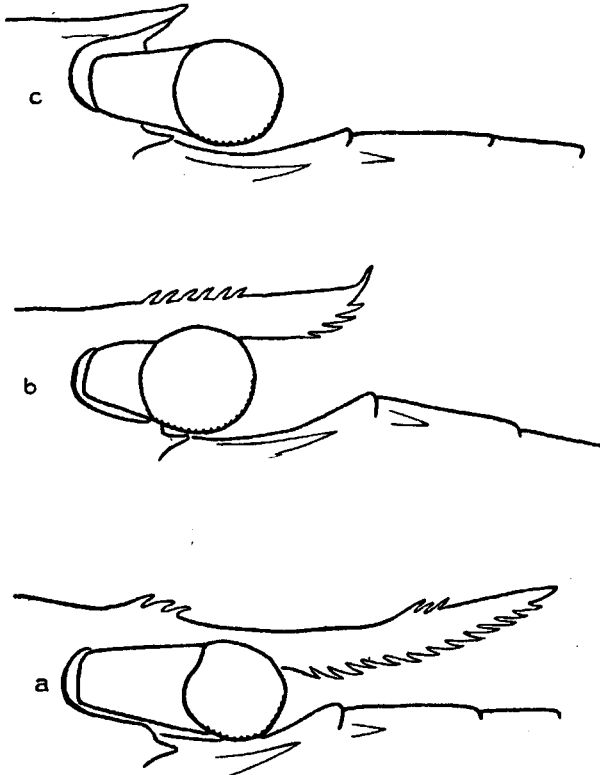
Sixth abdominal segment rather more than half the length of the carapace (.55–.57:1).

* [This specimen was collected by Mr. Beadle, and I am not quite certain of the data. It was almost certainly from a lagoon close to the lake shore and actually connected with the lake by a narrow passage. It may conceivably have come from the shore of the main lake.—E. W. B.]

Ova measuring $.84-.88 \times .52-.56$ mm.; somewhat larger than in var. *typica*, almost as large as in *C. nilotica* from Lake Ngami (Gordon, 1930, p. 43; Table II).

Remarks.—Unfortunately the specimens are incomplete, with one or more of the peraeopods missing in the females. According to De Man's key (1908, pp. 257-9) the form falls into division I cc, since the number indicating the proportion between length and breadth of the dactylus of peraeopod 5 exceeds

TEXT-FIG. 1.



a-c. *Caridina nilotica* (Roux) from Lake Bunyoni; rostrum in lateral aspect to illustrate the large range of variation.

4.6 [4.86 (? sex) and 5.23 (♂)]. But it does not agree with de Man's var. *paucipara*, since there are only 48-56 instead of 60-74 spines on the dactylus of peraeopod 5 and the ova are of smaller size.

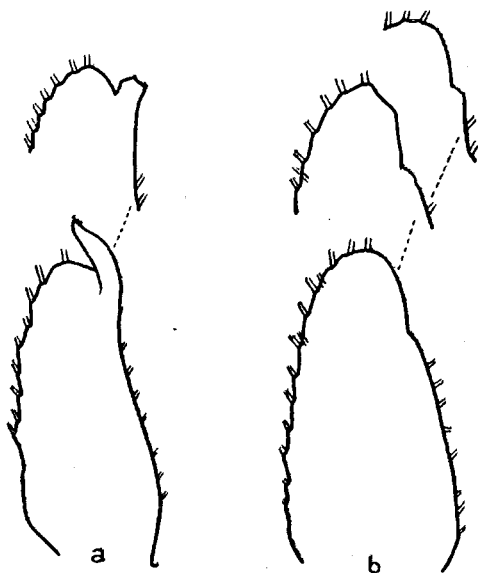
The specimens are too few to afford much idea of the range of variation in the peraeopods. This form is near to the two specimens collected from Lake Edward; the dactylus of peraeopod 5, however, appears to be more slender than in the latter.

C. LAKE BUNYONI. (a) Stn. 705. Bufundi; from weedy area bordering the lake: numerous specimens both adult and young. (b) Stn. 707, A & B. Bufundi; from weedy area bordering the lake: numerous specimens both adult and young.

Description.—1. *Female.*

Telson. Of the 260 specimens examined, 23, 68, and 5 per cent. belong to the types represented in figs. 1, 2, and 3 respectively (Gordon, 1930, pp. 34, 35, and 37; Table I); the remainder are either incomplete or somewhat abnormal. In this respect, therefore, the specimens agree with those from Egypt and Lakes Albert and Victoria.

TEXT-FIG. 2.



Endopod of pleopod 1 of ♂ of *Caridina nilotica* (Roux).

a, from Egypt (var. *typica*); b, from Lake Bunyoni. $\times 100$. The setae are not drawn in, but their position is indicated by short double lines.

Peraeopods. Fourteen ovigerous females were measured. Peraeopods 1 and 3 agree for the most part with *C. nilotica* var. *typica*. Peraeopod 2 has the fingers longer relatively to the palm in eight specimens. Peraeopod 5 in the majority of the specimens (10) has the propodus shorter relatively to the dactylus; the latter segment is also more slender in seven specimens.

Rostrum. These specimens are remarkable for the extreme variability of the rostrum (text-fig. 1). In many instances it extends to the distal end of the antennular peduncle, or even to the tip of the antennal scale (i.e. varies from two-thirds of, to equality with, the carapace-length). Moreover, the number of teeth on the dorsal and ventral margin varies greatly as the following formulae show:—

$$\frac{2+16+1}{12}; \frac{0+12+1+1}{17}; \frac{0+10+0}{15}; \frac{0+6+0}{12}; \frac{1+7+1+1}{0}; \frac{0+5+0}{9}; \frac{0+5+0}{0}$$

There is a marked tendency towards reduction of the dorsal series, so that, in the specimens examined, it was most usual for the ventral to exceed the dorsal number of teeth (in 16 out of 22 specimens; see text-fig. 1, *a*). Sometimes the ventral series is greatly reduced or absent.

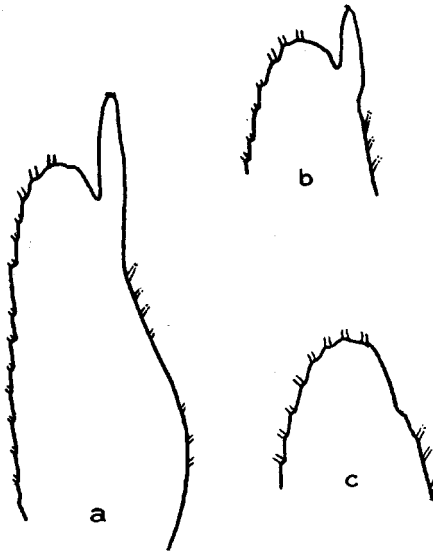
In many specimens the rostrum does not reach much beyond the cornea of the eye (i.e. $=\frac{1}{3}-\frac{1}{4}$ of the carapace-length). Although again subject to much variation, the type represented in text-fig. 1, *b*, with a few subterminal teeth on the ventral margin, is most common.

The rostrum is even more reduced in a large number of specimens until, in extreme cases, it does not exceed one-tenth of the carapace-length (text-fig. 1, *c*). These three groups are united by many intermediate forms.

Sixth abdominal segment varies from .56--.63 of the carapace-length.

Ova .76 × .48 mm.

TEXT-FIG. 3.



a-c. Caridina nilotica (Roux), from Lake George; endopod of pleopod 1 of ♂. × 100.

2. *Male*.

The endopod of the first pleopod of *C. nilotica* var. *typica* is represented in text-fig. 2, *a* (l.=14 and 17.4 mm. respectively, exclusive of the rostrum). No trace of the elongated subapical process is apparent in three males from Lake Bunyoni (text-fig. 2, *b*; l.=17.76, 17.6, and 16.4 mm. respectively, exclusive of the rostrum). This was thought to indicate a difference between the specimens from these two localities, until the process in question was found to be absent in one out of three large males from Lake George (text-fig. 3, *c*; *a-c*, l.=18.56, 18.56, and 19.6 mm. respectively, rostrum excluded). It may be that this sexual process is only present for a short time during the breeding-season, but no exact data on this point are available.

TABLE I.

Locality.	Peraeopods.					Size of ova (in mm.).
	1.	2.	3.	4.	5.	
A. <i>Caridina nitidica</i> .						
1. Near Lake Edward (2)*	a, 3.00 and 2.67 b, 1.50 " 1.20 c, 0.93 " 1.25	a, 5.81 and 5.04 b, 1.48 " 1.40 c, 0.79 " 0.84	x, 4.21 and 4.65 y, 3.80 " 3.33 z, 9 " 9	x, 3.39 and 3.77 y, 4.67 " 4.42 z, 4.6 " 4.4		l, 0.59-0.64 b, 0.34-0.40
2. Near Lake George (4)	a, 2.4 -2.86 b, 1.30-1.55 c, 1.15-1.12	a, 5.38-5.79 b, 1.30-1.62 c, 0.70-0.81	x, 4.34- 5.00 y, 3.50- 3.90 z, 10 -12	x, 3.3 y, 4.86 z, 4.8		l, 0.84-0.88 b, 0.52-0.66
3. Lake Bunyoni (14)	a, 1.32-1.96 b, 0.97-1.30 c, 1.29-1.57	a, 3.31-4.00 b, 1.10-1.73 c, 0.88-1.16	x, 3.78- 4.45 y, 3.33- 4.17 z, 8 -12	x, 2.58- 3.33 y, 4.11- 5.30 z, 3.8 -5.0		l, 0.76 b, 0.48
B. <i>Caridina africana</i> .						
Near Lake Edward (5)	a, 2.1 -2.43 b, 1.2 -1.36 c, 1.13-1.31	a, 4.29-5.28 b, 1.25-2.13 c, 0.77-0.83	x, 4.65- 5.76 y, 2.78- 3.57 z, 7 - 9	x, 2.5 - 3.07 y, 5.42- 5.88 z, 5.8 -7.6		l, 1.20-1.24 b, 0.75-0.80

a = length ÷ breadth of carpus.

b = length of fingers ÷ length of palm.

c = length of chela ÷ length of carpus.

x = length of propodus ÷ length of dactylus.

y = length ÷ breadth of dactylus.

z = number of dactylar spines (terminal claw included).

* Number of specimens measured.

Remarks.—The specimens from Lake Bunyoni are more variable than any other African material of *C. nilotica* examined. In this respect they recall *C. brevisrostris* from the Seychelles (Bouvier, 1913, Trans. Linn. Soc., Zool. xv, pt. 4, no. 28, p. 448), where, however, the chelipeds as well as the rostrum vary considerably. Apart from the rostrum, the Lake Bunyoni specimens are quite near to *C. nilotica* var. *typica*. The differences exhibited by pereopods 2 and 5 are somewhat similar to, though less pronounced than, those found in the prawns from Butiaba, Lake Albert, and from the open waters of Lakes Albert and Victoria (Gordon, 1930, p. 42; Table II).

CARIDINA AFRICANA Kingsley.

Bouvier, E. L., 1925, 'Atyidés,' Encyclopédie Entomologique, p. 212.

Localities.—

1. Near LAKE EDWARD :—

(a) Stn. 512, 5. River Chambura, which flows into the Kazinga Channel near Katunguru—from swampy shore about a mile from mouth of river : 7 specimens.

(b) Stn. 522, 1. River Niamweru, which flows into east shore of Lake Edward—from swampy shore about a mile from mouth of river : 6 specimens.

(c) Stn. 522, 4. River Luampuno, east shore of Lake Edward—from swampy shore about a mile from mouth of river : 6 specimens.

(d) Stn. 542, 2. Swampy back-water of River Niamweru, actually at river's mouth into Lake Edward : 6 specimens.

'Thus all specimens of this species came from more or less swampy conditions, not actually from the lake itself, but from the lower reaches of the affluent rivers close to the lake.'—E. B. W.

(e) Small river near Malabunde, Belgian Congo, near Lake Edward : 4 specimens.

2. B. 36. Probably from KAMPALA, collected by G. L. R. Hancock, Esq. : 1 ♀.

3. ARUA, WEST NILE, collected by G. L. R. Hancock, Esq. : 6 specimens.

Remarks.—*E. africana* can at once be distinguished from *C. nilotica* by the *telson*, which possesses a group of 7–11 long slender setose spines between the pair of strong lateral ones (Gordon, 1930, P. Z. S. p. 38, cf. fig. 6 with figs. 1–4).

The *rostrum*, although subequal to the antennal scale, is always shorter than the carapace (67–84 : 1). Rostral formula $\frac{3-4+11-18}{5-10}$; thus there are always at least twice as many dorsal as ventral teeth; the unarmed portion of the dorsal surface is usually one-fifth or less (Gordon, 1930, P. Z. S. p. 49, fig. 13, a).

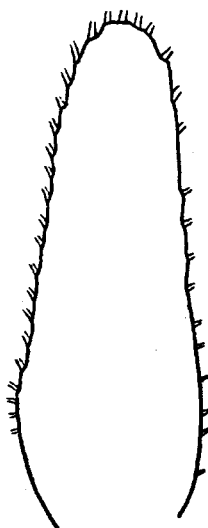
The specimens may reach a length of 27–28 mm., exclusive of the rostrum.

The ova measure $1.20-1.24 \times .75-.80$ mm., i.e. are approximately twice as large as those of *C. nilotica* collected in the vicinity of Lake Edward ($.59-.64 \times .36-.40$ mm.).

According to Bouvier's key to the varieties (1925, p. 213) these specimens are nearest to *C. africana* var. *typica*, since the dactylus of pereopod 3 is, on an average, one-fifth of the propodus.

The rostral formula is not quite the same as that given by Kingsley and Ortmann for var. *typica* ($\frac{10-15}{7-12}$), but agrees with that of a female from River Waki, Lake Albert, referred to var. *typica* by Bouvier (1925, pp. 213-4). The ova are also of similar size to those of the latter specimen.

TEXT-FIG. 4.



Caridina africana Kingsley; endopod of pleopod 1 of ♂ (l.=21 mm.+rostrum).

Peraeopods. The pereopods differ considerably from those of *C. africana* var. *aegyptiaca* (cotypes, Gordon, 1930, P. Z. S. p. 43; Table II). In pereopod 1 the fingers are somewhat shorter relatively to the palm in three of the five specimens measured, while, in all cases, the carpus is slightly longer relatively to the chela. In each specimen measured the dactylus of pereopod 3 is shorter relatively to the propodus, and the dactylus of pereopod 5 is rather narrower in proportion to its length. The number of spines on the latter exceeds 70 in the largest specimens.

Pleopods. No trace of a protruding subterminal sexual process could be detected on the inner margin of the endopod in the two males examined (l.=19.6 and 21 mm. respectively, exclusive of the rostrum; text-fig. 4).

Sixth abdominal segment just over half the length of the carapace ($.52-.59 : 1$).

PALAEMON NILOTICUS Roux.

Roux, 1833, Ann. Sc. Nat. xxviii, p. 73, pl. vii, f. 2.

Klunzinger, C. B., 1866, Zeitschr. f. wiss. Zool. xvi, p. 357, pl. xx.

De Man, J. G., 1900, Trans. Linn. Soc., Zool. viii, p. 63.

Sollaud & Tilho, 1911, C. R. Ac. Sci. Paris, clii, p. 1868.

Locality.—LAKE RUDOLF :—

(a) Stn. 263. Open water near middle of lake : 10 specimens.

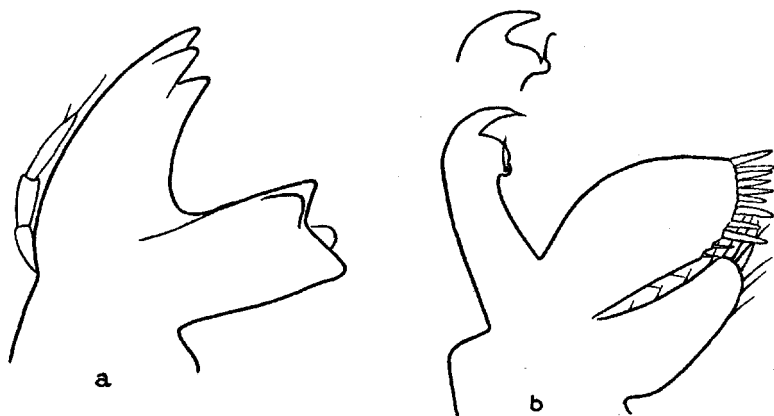
(b) Stn. 267. From stomach of *Lates* sp.?, caught at 50 metres depth near centre of lake : about 30 specimens all under 25 mm. in length.

(c) Stn. 275. Caught in trawl in Ferguson Gulf, depth 4 metres : 3 ♀♀ ; 4 ♂♂, two young specimens.

Description of female (l.=32.4 mm. ; from Stn. 275).—

Rostrum horizontal, a little longer than antennular peduncle, but hardly as long as antennal scale. Dorsal surface rather convex, armed with nine

TEXT-FIG. 5.



Palaemon niloticus Roux, ♀.

a. Part of mandible : $\times 47$. b. Maxillula : $\times 60$.

teeth, one of which is on the carapace ; distal fifth unarmed. Apex acutely lanceolate. A single tooth on the ventral surface opposite the distal articulation of the second segment of antennular peduncle. Accessory flagellum of *antennule* consisting of thirteen free segments ; antennal flagellum considerably longer than the total body-length (but not quite complete).

Mouth-parts very similar to those figured rather poorly by Klunzinger (1866, pl. xx, figs. 4-9) ; part of mandible and the maxillula represented in text-fig. 5, a and b. The third maxillipeds extend beyond the antennal peduncle by one-third the length of their last joint.

Peraeopods. The first peraeopod extends to the tip of the spine on the antennal scale. Carpus and merus equal (text-fig. 6, c, and Table II, ♀). Chela just over two-thirds of the merus ; fingers scarcely longer than palm.

Second peraeopod relatively slender, not quite half the total length of the body (1 : 2.4) ; reaching beyond the accessory antennular flagellum by about

half the length of the fingers. Carpus equal in length to merus and three-fourths of chela (Table II). Fingers one-third as long again as palm, straight, meeting along their whole length; inner margins with smooth cutting-edges without any trace of teeth; widely-scattered short setae on chela, but no trace of spinules; minute setae near inner margin of finger.

The succeeding pairs of peraeopods are long and slender, the fourth pair extending to the tip of the antennal scale. The dactyli are of approximately equal length, but the propodi increase as one passes backwards, so that the ratio propodus ÷ dactylus is 1.9 for peraeopod 3, 2.75 for peraeopod 5.

TABLE II.

Locality.	First peraeopod.			Second peraeopod.		
	Length of fingers *.	Length of chela †.	Length of carpus †.	Length of fingers *.	Length of chela †.	Length of carpus †.
Lake Rudolf, Stn. 275.						
♀ ₁ (l.=32.4 mm.) ...	1.05	0.68	1.00	1.35	1.33	1.00
♀ ₂ (l.=32 mm.)	1.2	0.67	1.06
♀ ₃	1.25	0.69	1.04
♂ ₁ (l.=24.4 mm.) ..	1.13	0.64	1.00	2.25	1.77	1.07
♂ ₂	1.18	0.67	1.05	2.09	1.77	1.04
♂ ₃ (l.=27.12 mm.) .	1.33	0.67	1.06	1.84	1.59	1.03
♂ ₄ (l.=30.56 mm.) .	1.22	0.69	1.07	2.05	1.70	1.06
Nile.						
Bahr el Gebel, 1908.						
♀ (l.=42.8 mm.) ...	1.0	0.6	1.20	1.06	1.13	1.25
Blue Nile, 1906.						
♀ (l.=46 mm.)	1.14	0.56	1.20	1.03	1.18	1.33
White Nile, 1905.						
♀ (l.=40 mm.)	1.17	0.53	1.16
♂ (l.=34.56 mm.) ..	1.22	0.61	1.21	2.09	1.69	1.12
Korusko.						
♀	1.08	0.56	1.16	1.00	1.40	1.34
♂	1.21	0.54	1.15	2.20	1.60	1.16

End of *telson* very similar to that of *P. moorei* (Calman, 1899, P. Z. S. p. 710, pl. xi. fig. 241).

Uropod as represented in text-fig. 7, *b*.

Size of *ova* (♀, Stn. 267) 1.16–1.24 × .80–.88 mm.

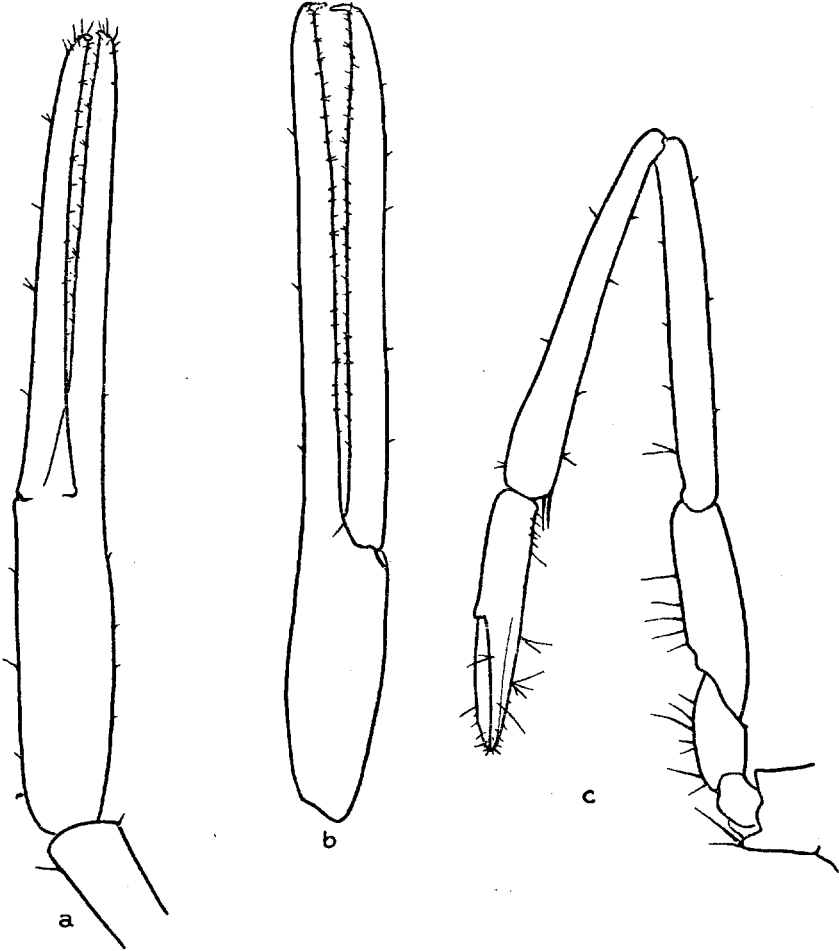
The *male* is very similar to the female in general appearance. The second peraeopod is again scarcely half of the total body-length (1 : 2.13) and is not more massive than that of the female. It differs, however, in the relative proportions of the distal parts (Table II). The carpus is subequal to, but the

* Length of palm = 1.

† Length of merus = 1.

chela is approximately three-fourths as long again as the merus. Also, the palm is much shorter relatively to the fingers (text-fig. 6, *b*). We cannot be certain that the chela of the males exhibits the fully adult characters, but the fact that a female (l.=22 mm.) from Stn. 267 is ovigerous proves that this is a very small form.

TEXT-FIG. 6.



Palaemon niloticus Roux.

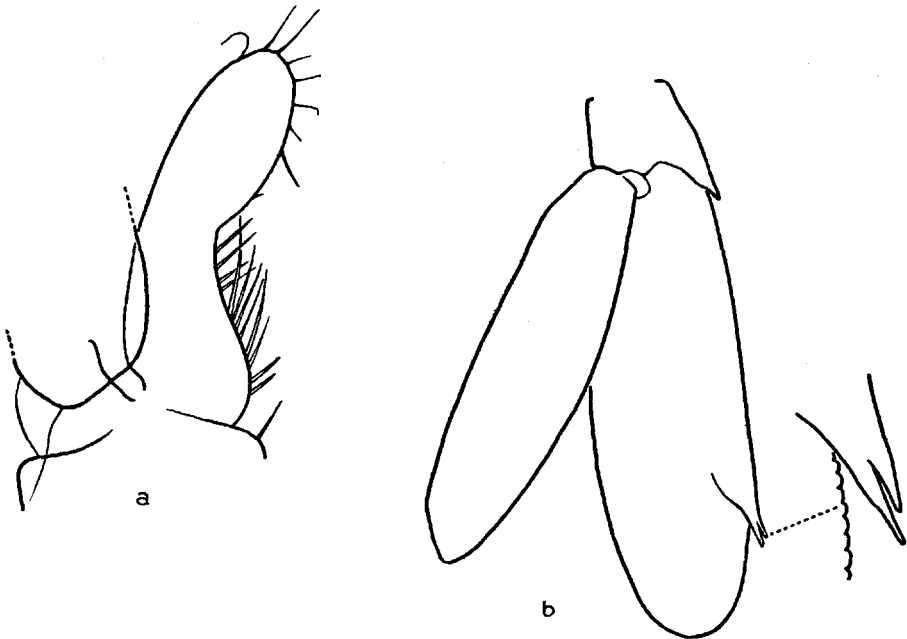
- a. Chela of peraeopod 2 of ♀. b. Chela of peraeopod 2 of ♂.
c. Peraeopod 1 of ♂. × 27.

The endopod of the first pleopod is represented in text-fig. 7, *a*.

Remarks.—*Palaemon niloticus* does not appear to have been described since 1866, and Klunzinger's account is more or less defective. A number of specimens from the Nile in the British Museum Collection undoubtedly belong to this species. The greater number of the specimens, labelled 'Nile

Shrimps caught at Korusko, August 1861, are in very poor condition, having apparently been dried. Four specimens from various localities were presented by Major S. S. Flower in 1905, 1906, and 1918. One of the latter, a female from the Blue Nile, differs from the Lake Rudolf specimen described above in several respects:—(1) The accessory flagellum of the antennule has 17–18 free segments. (2) The chela of peraeopod 1 is almost exactly half of the carpus as described by Klunzinger (Table II); the distal end of the carpus reaches to the tip of the spine on the antennal scale. (3) The second peraeopod is almost exactly half the total length of the body (1 : 2.06), and extends beyond

TEXT-FIG. 7.

*Palaemon niloticus* Roux.

a. Endopod of pleopod 1 of ♂ : $\times 90$. b. Uropod : $\times 17$ and 60 .

the accessory flagellum of the antennule by almost the whole length of the chela. The fingers are shorter in proportion to the merus. (4) In both chelate peraeopods the carpus is considerably longer relatively to the merus (Table II). Some of these differences may be due to the larger size of the female in question, but those shown in Table II are of constant occurrence (mentioned in nos. 2, 3, and 4 above).

Although it is very probable that the Lake Rudolf specimens have not attained their maximum size, it is also likely that they represent a local race of *P. niloticus*, differing from the typical Nile form in the relative proportions of certain parts of the two chelate appendages. It is unfortunate that the Lake Chad material has not been described in detail.

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