

CRUSTACEA : CHIROSTYLIDAE (Galatheidea)

BY

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INTRODUCTION

THE Galatheidea obtained by the "John Murray" Expedition belong to two families : Chirostylidae Ortman and Galatheidae Dana. The present paper is based on the material pertaining to Chirostylidae and it is hoped that a report on the "John Murray" Galatheidae will be completed in the near future.

The family Chirostylidae comprises two subfamilies : Uroptychinae Doflein and Balss and Eumunidinae Milne-Edwards ; the latter is not represented in this collection. The subfamily Uroptychinae is at present divided into two genera : *Chirostylus* Ortman and *Uroptychus* Henderson, which are represented in this collection by thirteen species, two belonging to *Chirostylus* and eleven to *Uroptychus*. Seven species of the genus *Uroptychus* are described as new to science : *U. gordonae*, *U. murrayi*, *U. brachydactylus*, *U. sternospinosus*, *U. spinimanus*, *U. onychodactylus* and *U. siraji*. *Chirostylus hendersoni* Alcock is recorded for the second time and *Uroptychus gracilimanus* Henderson for the first time from the Indian Ocean.

Through the kindness of the authorities, I have been able to study type and other named material in the collections of the British Museum (Nat. Hist.) ; the Muséum National d'Histoire Naturelle, Paris ; the Rijksmuseum van Natuurlijke Historie, Leiden ; the Zoölogisch Museum, Amsterdam and the U.S. National Museum.

I would like to mention here that I have followed Balss in using "plastron" for the ventral plate formed by the sterna of the third to seventh thoracic segments. The "penduncle" is used for the protopod and the basal segments of the endopod of the antenna. The following abbreviations have been used : *c.l.* = carapace length measured from the orbital border to the posterior margin of the carapace ; *c.l. + r.* = carapace length from the tip of the rostrum to the posterior margin of the carapace ; *c.b.* = the breadth of carapace determined by measuring the widest part across the branchial regions ; *ch.l.* = length of chelipeds.

The material in the "John Murray" collection will be deposited in the British Museum (Nat. Hist.).

LIST OF SPECIES WITH STATIONS AT WHICH COLLECTED

Family CHIROSTYLIDAE—Subfamily UROPTYCHINAE.

Genus *Chirostylus* :

<i>Chirostylus investigatoris</i> Alcock and Anderson	159
<i>hendersoni</i> Alcock	42

Genus *Uroptychus* :

<i>Uroptychus nigricapillis</i> Alcock	50, 119, 159
<i>gracilimanus</i> Henderson108, 122
<i>australis</i> var <i>indicus</i> Alcock	124
<i>gordonae</i> n. sp.	158
<i>murrayi</i> n. sp.	Not known
<i>brachydactylus</i> n. sp.	42
<i>sternospinosus</i> n. sp.	159
<i>spinimanus</i> n. sp.	54
<i>cavirostris</i> Alcock and Anderson	157
<i>onychodactylus</i> n. sp.158, 159
<i>siraji</i> n. sp.	159

Family CHIROSTYLIDAE Ortmann

Subfamily UROPTYCHINAE Doflein and Balss

KEY TO THE DETERMINATION OF THE GENERA OF THE SUBFAMILY UROPTYCHINAE

- I. Lateral margins of the carapace not sharply defined, rostrum spiniform, antennal acicle wanting
Genus *Chirostylus* Ortmann
- II. Lateral margins sharply defined, rostrum triangular, antennal acicle present
Genus *Uroptychus* Henderson

Genus *CHIROSTYLUS* Ortmann

Miss van Dam (1933, pp. 16 and 38) listed all the species of *Chirostylus* known to her, eleven in all. Since then, as far as I know, only one Atlantic species, *Ch. affinis* Chace (1942, p. 6) has been described. The "John Murray" Expedition obtained specimens of each of the two species previously recorded from the Indian Ocean.

KEY TO THE DETERMINATION OF INDIAN OCEAN SPECIES OF THE GENUS *CHIROSTYLUS*

- I. Chelipeds stout, fifth abdominal tergum with a longitudinal row of spines or tubercles at the junction with either pleuron *investigatoris* Alcock
- II. Chelipeds very slender, fifth tergum with two transverse rows of spines *hendersoni* Alcock

Chirostylus investigatoris Alcock & Anderson

(Figs. 1 and 2.)

Ptychogaster investigatoris Alcock & Anderson, 1899, p. 24.*Ptychogaster investigatoris*, Alcock, 1901, p. 281; Ill. Zool. Investigator, Crust., pl. XLV, Fig. 1; Kemp & Sewell, 1912, p. 25.*Chirostylus investigatoris* Doflein & Balss, 1913, p. 132, fig. 1, 2.

OCCURRENCE :

Maldive Area ;

St. 159, monagésque trawl, 914–1463 metres, 1 male (*c.l.* + *r.* = 25 mm., *ch.l.* = 113 mm.) ; 1 mutilated female (*c.l.* = 12·5 mm. tip of rostrum broken, no chelipeds).

DISTRIBUTION : Indian Ocean.

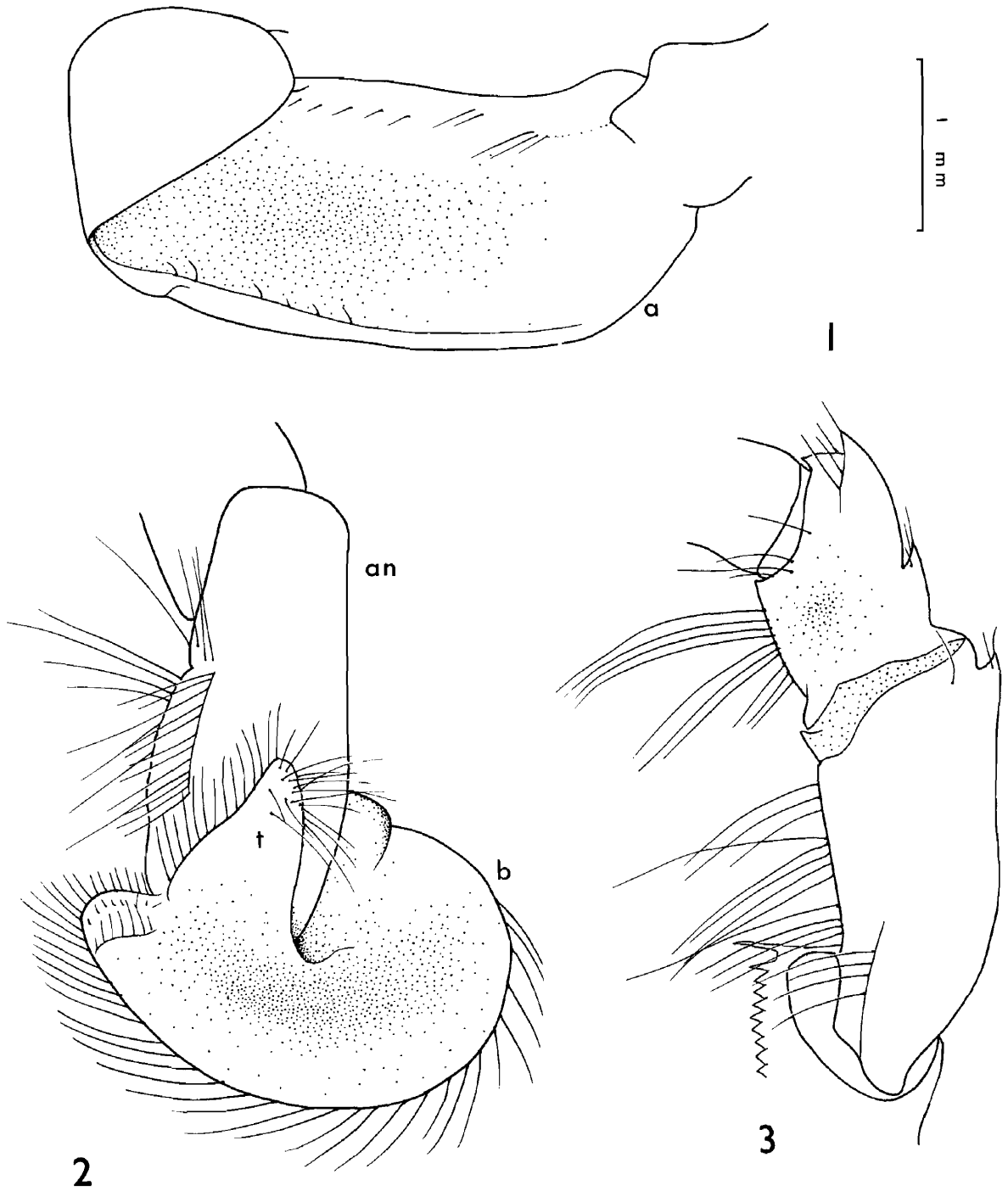
DESCRIPTIVE REMARKS : Doflein and Balss described the first male of *Ch. investigatoris* in 1913 (p. 132) and pointed out that their specimen differed from the type in the spinosity of the second and third abdominal segments. It seems that the spines of the abdominal segments are liable to some individual variations, since both "John Murray" specimens, a male and a female, differ slightly from the previous descriptions and also from each other. The female agrees more closely with the original description except that the third abdominal tergum, which according to Alcock ". . . is perfectly free from spines" (p. 281), has one or two rather weak spines on either lateral margin of the tergum exactly in the same position as in the following two segments. In the male the spines of the second segment are small and blunt and not only the third but the fourth tergum is also free from spines. The fifth tergum, in both the specimens, has spines as described in the type.

The sternum of the segment corresponding to the third maxillipeds has a median groove which is continuous over the following sternites. Immediately behind the anterior margin and on either side of the median groove, this sternum has a spine. The fourth thoracic sternum has two large spines on each lateral border and on either side of the median groove is a longitudinal row of three spines. Each of the next three sterna has a strong, setose transverse ridge. Since the female is imperfect the above observations are based entirely on the male.

The chelipeds are wanting in the female. In the male they are stout, spiny and nearly twice the length of the fully extended body.

The third maxilliped has been figured by Doflein & Balss (1913, Fig. 1). In the "John Murray" specimens the spine on the distal outer border of the merus is small and the tubercle on the same border of the carpus is simple and not bidentate, somewhat better developed in the female than in the male.

The first and second pleopods of the male have also been figured by the same authors (Doflein & Balss 1913, Fig. 2). A closer examination, however, showed that the endopod of the first pleopod is thin, elongate and deeply concave for the greater part of its dorsal surface. The posteriorly directed apex is rounded and curved over the concave surface as shown in Fig. 1. The anterior margin (*a*) is also curled inwards, towards the same surface, and has a few small spines. The endopod of the second pleopod is rather complicated (Fig. 2). It consists of a slender, stalk-like proximal part and a much broadened and rounded distal part. The surface of this rounded part is concave and, as represented in the figure, a tongue-like projection (*t*) arises from it. The tongue-like projection is curved and bears long setae at its apex. When the specimen is viewed from above, the margin labelled *an* is anterior in position, the projection *t* is directed medially and the margin *b* is directed upwards.



Chirostylus investigatoris Alcock & Anderson. Male. FIG. 1.—Endopod of left first pleopod, dorsal view. *a*. Anterior margin. FIG. 2.—Endopod of left second pleopod. *an*. Anterior margin. *b*. Margin directed upwards. *t*. Tongue-like projection.

Chirostylus hendersoni Alcock. Female. FIG. 3.—Median portion of endopod of third maxilliped.

Chirostylus hendersoni Alcock & Anderson

(Fig. 3.)

Ptychogaster hendersoni Alcock & Anderson, 1899, p. 23.*Ptychogaster hendersoni*, Alcock, 1901, p. 280; Ill. Zool. Investigator, Crust., pl. XLV, fig. 2.

OCCURRENCE :

South Arabian coast :

St. 42, Triangular dredge, 1415 metres, 1 female (*c.l.* + *r.* = 17.5 mm., *ch.l.* = 95 mm.)

DISTRIBUTION : Indian Ocean.

DESCRIPTIVE REMARKS: The "John Murray" specimen of *Ch. hendersoni* is the second female and the only other known specimen of the species besides the holotype. It is slightly bigger than the holotype with which it agrees except in the following details:

Alcock described the carapace as being ". . . covered with spinules and spines, in which a definite serial arrangement of the larger spines is hardly manifest" (1901, p. 280). In this specimen, however, the spines anterior to the cervical groove are large and sparse, with a very few small spines in between them. Posterior to the cervical groove are four longitudinal rows of large spines separated by smaller spines which, more or less, form a double row in between those of the large spines.

The first abdominal tergum has ". . . a transverse spiny carina continuous with a similar carina on the anterior edge of the second pleura; the second has two such carinae; the third has a longitudinal row of spines at the junction with either pleura but is otherwise smooth; . . ." (Alcock, 1901, p. 280). In this specimen, however, there are some additional spinules on the third tergum suggesting traces of two carinae. The armature of the following terga is as in the type specimen.

The armature of the thoracic sterna is much the same as that of *Ch. investigator*, only somewhat weaker.

According to Alcock the third maxillipeds are unarmed (p. 280). But in the "John Murray" specimen, as represented in Fig. 3, the merus is armed with a small distal spine on its outer border. The same border of the carpus has a spine near the centre and another at the anterior margin.

The chelipeds, which are long, spiny and very slender, are just a little less than two and three-quarter times the length of the fully extended body. They are said to be more than two and three-quarter times in the type.

Genus *UROPTYCHUS* Henderson

Miss van Dam listed all the known species of the genus *Uroptychus*, with their distribution, in 1933, pp. 36 and 40; her total was forty three species and four varieties. Since then, as far as I know, the following additional species and varieties have been described:

U. aguayi Chace, 1939*U. mortenseni* van Dam, 1939*U. crassipes* van Dam, 1939*U. nitidus* var. *A* Chace, 1942*U. fornicatus* Chace, 1942*U. nitidus* var. *B* Chace, 1942*U. grandirostris* Yokoya, 1933*U. nitidus* var. *C* Chace, 1942*U. joloensis* van Dam, 1939*U. spinuliferus* van Dam, 1940*U. latirostris* Yokoya, 1933.

KEY TO THE DETERMINATION OF INDIAN OCEAN SPECIES OF THE GENUS *Uroptychus*

- I. Carapace, excluding rostrum, as long as, or longer than broad.
- A. Rostrum acutely triangular.
- i. Carapace almost smooth, no granules or spinules.
- A. Gastric area with a pair of spines *U. nigricapillis* Alcock
- B. No gastric spines.
- a. Lateral margins of carapace nearly smooth or denticulate.
- i. Lateral margins smooth or obscurely crenulate, chelipeds much more than twice the length of carapace.
- a. Chelipeds slender, four to five times the length of carapace
U. gracilimanus Hend.
- b. Chelipeds moderate, about three and a half times the length of carapace *U. australis* var *indicus* Alcock
- ii. Lateral margins denticulate; chelipeds about twice as long as carapace *U. gordonae* n. sp.
- b. Lateral margins of carapace and the pterygostomial region spinose
U. murrayi n. sp.
- ii. Carapace and chelipeds covered with granules or spinules.
- A. Carapace and chelipeds covered with granules.
- a. No gastric spines, chelipeds stout, three and a half times as long as carapace *U. brachydactylus* n. sp.
- b. A pair of large gastric spines, chelipeds slender, more than five times as long as carapace *U. sternospinosus* n. sp.
- B. Carapace and chelipeds covered with spinules *U. spinimanus* n. sp.
- B. Rostrum broadly triangular, upper surface concave *U. cavirostris* Alc. & And.
- II. Carapace, excluding rostrum, broader than long.
- A. Lateral margins of the carapace smooth, dactyli of ambulatory legs hook-like
U. onychodactylus n. sp.
- B. Lateral margins crenulated, dactyli normal *U. siraji* n. sp.

Uroptychus nigricapillis Alcock

(Figs. 4, 5.)

Uroptychus nigricapillis Alcock, 1901, p. 283, pl. 3, fig. 3; Ill. Zool. Investigator Crust., pl. LV1, fig. 3.
Uroptychys nigricapillis, Laurie, 1926, p. 123; van Dam, 1933, p. 26; 1940, p. 98, fig. 2.

OCCURRENCE :

South Arabian coast :

St. 50, triangular dredge 4, 1536–1939 metres, 1 male (*c.l.* + *r.* = 15 mm., *ch.l.* = 47 mm.).

Zanzibar area :

St. 119, Agassiz trawl, 1207–1463 metres, 2 males (*c.l.* + *r.* = 9–11 mm.); 2 females (*c.l.* + *r.* = 10.5–11 mm., *ch.l.* = 30–36 mm. larger female ovig. all chelip. detached).

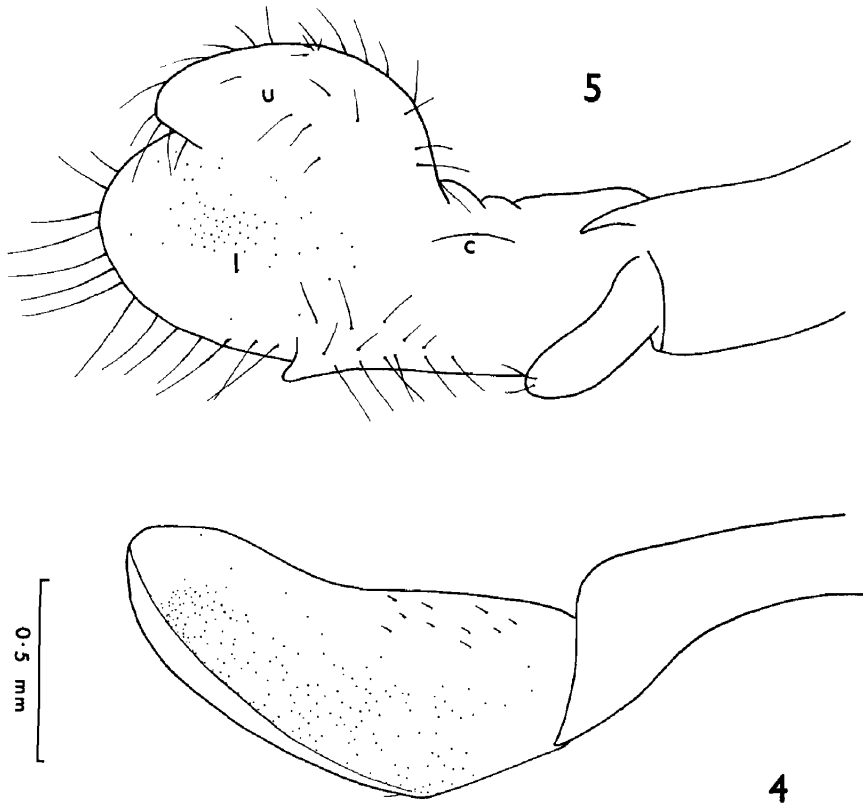
Maldive area :

St. 159, monagésque trawl, 914–1463 metres, 2 ovig. females (*c.l.* + *r.* = 12–13 mm., *ch.l.* = 40–45 mm.).

DISTRIBUTION : Indo-Pacific.

DESCRIPTIVE NOTES : Alcock in 1901 established *U. nigricapillis* as a new species for a single female collected from the Indian Ocean. The first male of the species was described by Laurie (1926), another male was reported by van Dam in 1933 and later the

same author described an ovigerous female (1940). The "John Murray" Expedition collected, for the first time, a number of specimens belonging to this species. From the literature consulted it is evident that the specimens exhibit a noticeable individual variation particularly in the number of spines on the carapace. On studying the material at hand, I find that the specimens show differences in the spinosity of the dorsum, in the size and shape of the rostrum, in the relative lengths of the peduncle and acicle of the antenna and also in the armature of the thoracic sterna.



Uroptychus nigricapillis Alcock. Male. FIG. 4.—Left first pleopod, dorsal view. FIG. 5.—Left second pleopod, ventral view. *c.* Crest-like lobe. *l.* Lower lobe. *u.* Upper lobe.

Only in one specimen are the gastric spines large, their tips exceeding the frontal margin of the carapace as is shown in the holotype (Alcock, pl. LVI, Fig. 3), in all the others these spines are rather small. In nearly all specimens a median spine or a tubercle is present on the gastric region. The lateral spines mentioned by van Dam (1933, p. 27) could be observed in two or three individuals only. In one of the two females taken from St. 159 there are two to three tubercles on the carapace median to the first post-cervical tooth. In the same female the lateral margins of the carapace, behind the cervical groove, are strongly serrated. In other individuals they are either weakly serrated or may be nearly smooth save for one or two rather obscure crenulations. The rostrum is highly variable in length, it may be short and hardly outreaching the eyes or rather long extending beyond the cornea by about a third or more of its entire length. The apex of the rostrum is rather depressed in some specimens, horizontal in others and directed upwards in three specimens from St. 119.

The antennal acicle is either as long as the peduncle or it may be considerably shorter.

The thoracic sternites have been described and illustrated by van Dam (1940, Fig. 2) and as already pointed out above, the specimens are rather variable in their sternal armature. In the "John Murray" specimens the sternum belonging to the third maxilliped has a deep notch medially, so that the two median teeth shown by van Dam (1940, Fig. 2) are separated from each other. Furthermore, the anterolateral angles of the same sternite are either unarmed or furnished with 1-3 teeth. Occasionally a tooth may be present, on the anterior margin, between the anterior tooth and the antero-lateral angle. The fourth thoracic sternum of only one specimen is in agreement with that of van Dam's specimen. In others the second row of teeth is either represented by a few weak teeth or tubercles or they may even be wanting. The teeth of the first row also show similar variations but are never totally absent. Finally, the transverse ridge on the following sternum is conspicuously granulated in some individuals, smooth in others.

The inner margin of the ischium and merus of the chelipeds may be serrated for their entire lengths or only for a short distance proximally. A few small tubercles can be seen on the lower surface of the carpus distally.

The first and second pleopods of the male have never been described or figured before. The endopod of the first pleopod is thin, elongate and concave as represented in Fig. 4. The endopod of the second pleopod is cushion-like and partially divided into an upper (*u*) and a lower (*l*) lobe (Fig. 5). The upper surface of the lobe *l* is slightly concave, whereas that of the upper lobe is somewhat swollen and provided with a few stiff setae. An obscure crest-like projection is also present at the base of the upper lobe and is labelled *c*. On the opposite surface the endopod has a median keel-like projection which extends over its basal two-thirds.

Uroptychus gracilimanus Henderson

(Figs. 6-9.)

Diptychus gracilimanus Henderson, 1885, p. 420.

Uroptychus gracilimanus, Henderson, 1888, p. 181, pl. xxi, fig. 5; Doflein & Balss, 1913, p. 134; Parisi, 1917, p. 3.

OCCURRENCE :

Zanzibar Area :

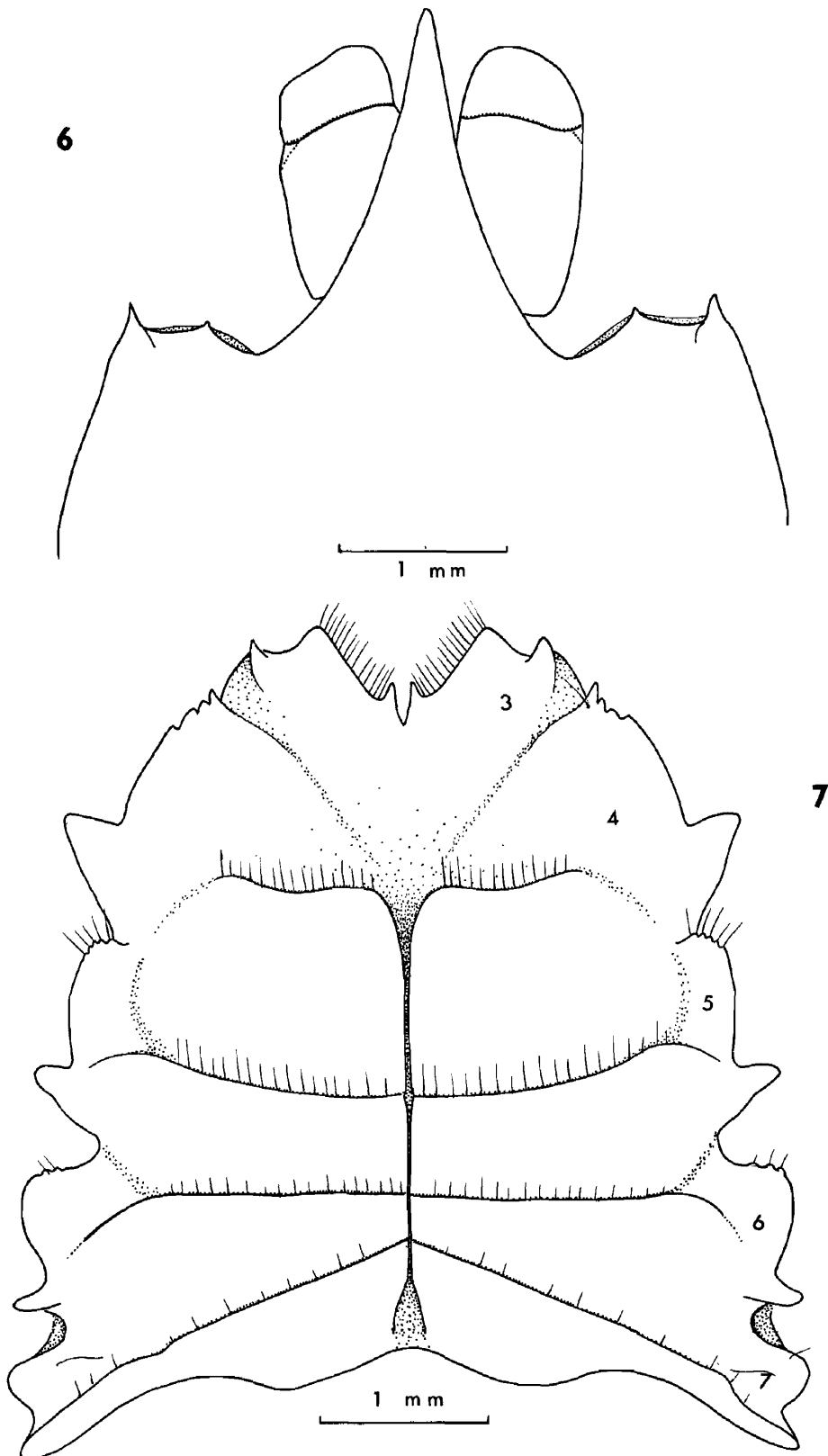
St. 108, Agassiz trawl, 421-457 metres, 2 males (*c.l.* + *r.* = 5.5 and 9 mm., *ch.l.* = 21.5 and 42 mm. respectively); 2 ovig. females (*c.l.* + *r.* = 8 and 8.5 mm., *ch.l.* = 40 and 38 mm. respectively.).

St. 122, otter trawl, 732 metres, 1 male (*c.l.* + *r.* = 8 mm., *ch.l.* = 35 mm.).

DISTRIBUTION : Indo-Pacific.

DESCRIPTIVE REMARKS : This species can be easily recognized by its long and slender chelipeds, which are even more slender in females and in the youngest male (St. 108) than in adult males.

The eyes and the anterior part of the carapace of the largest male are shown in Fig. 6. Only the tip of the rostrum lies beyond the eyes, whereas in the description of the type Henderson says that the rostrum " . . . extends for about one-third of its length beyond the ends of the eye-stalk " (p. 181). I had the opportunity to examine the type and I find



Uroptychus gracilimanus Henderson. Male. FIG. 6.—Anterior part of carapace. FIG. 7.—Plastron. 3 to 7. Thoracic sternites 3 to 7.

that the lateral margins of the carapace are microscopically crenulated with very fine hairs sticking out. In the "John Murray" specimens the lateral margins are either as in the type or are more strongly crenulated. A spine is present on each antero-lateral angle of the carapace. The outer orbital margin is also produced into a minute spine.

The plastron of the same male is represented in Fig. 7. The anterior margin of the sternum bearing the third maxillipeds is setose and has a pair of median teeth and a deep notch in the centre. The postero-lateral angles of the same sternite are produced into sharp spines. The following sternum has its antero-lateral angles denticulated and a short transverse ridge extends over its surface. This transverse ridge is separated, in the middle, by a groove which extends posteriorly over the following sterna. The transverse ridges of the fifth and sixth sterna extend almost to the lateral sternal margins. Each half of the ridge of the seventh sternum is directed obliquely backwards.

The antennal acicle varies in length, being either as long as the peduncle or somewhat shorter. It is shorter in the type.

The ischium of the cheliped has a small spine on its outer distal angle. Henderson said that the palm of the cheliped ". . . is only about three-fourths the length of the carpus" (1888, p. 181). In the "John Murray" specimens the palm is longer, being nearly as long as the carpus. The fingers of the chela are in contact with each other for the greater part of their lengths (Fig. 8). Only in the left chela of the largest male do the fingers gape proximally (Fig. 9). A compound tooth is present on the dactylus, which can easily be seen in the left chela of the male where it projects into the hiatus formed by the gaping fingers. In others, when the chela is closed, this tooth lies below the toothed margin of the fixed finger.

The first and second pleopods of the male are very similar to those of *U. nigricapillis*, except that the endopod of the first pleopod is perhaps more deeply concave in *U. gracilimanus* and that the endopod of the second pleopod is not cushion-like, being rather thin, with the crest-like lobe fairly conspicuous (c.f. Fig. 5c, of *U. nigricapillis*).

Uroptychus australis Henderson var. *indicus* Alcock

Uroptychus australis Henderson var. *indicus* Alcock, 1901, p. 284.

Uroptychus australis Henderson var. *indicus* l.c., van Dam, 1933, p. 19, figs. 24-28; 1937, p. 101.

OCCURRENCE :

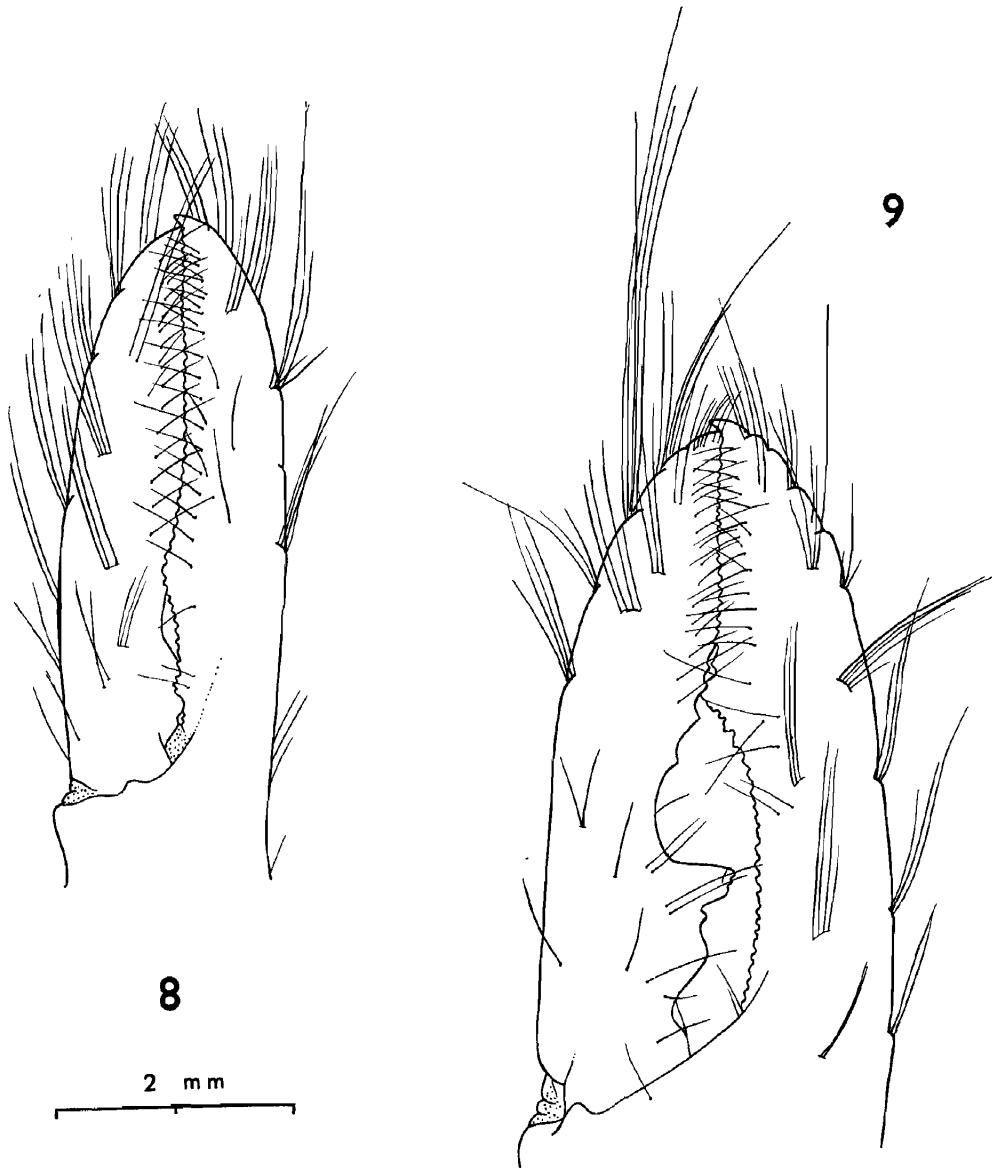
Zanzibar Area :

St. 124, monagésque trawl, 914 metres, 1 male (*c.l.* + *r.* = 8 mm., *ch.l.* = 29 mm.); 1 female (*c.l.* + *r.* = 11 mm., *ch.l.* = 39 mm.).

DISTRIBUTION : Indian Ocean.

DESCRIPTIVE REMARKS : The "John Murray" specimens agree rather well with Alcock's description of *U. australis* var. *indicus* except in having a shorter rostrum and antennal acicle and stronger armature of the ambulatory legs. The rostrum exceeds the eyes only by its tip. The antennal acicle instead of reaching nearly to the end of the peduncle extends to about two-thirds the length of the distal segment of the peduncle.

To Alcock's brief description of the thoracic sterna, I would like to add that a notch separates the median pair of teeth, situated on the anterior margin of the sternum corresponding to the third maxilliped (third thoracic sternum). The antero-lateral angles of this sternum are unarmed in the male, but have two small teeth in the female. The antero-

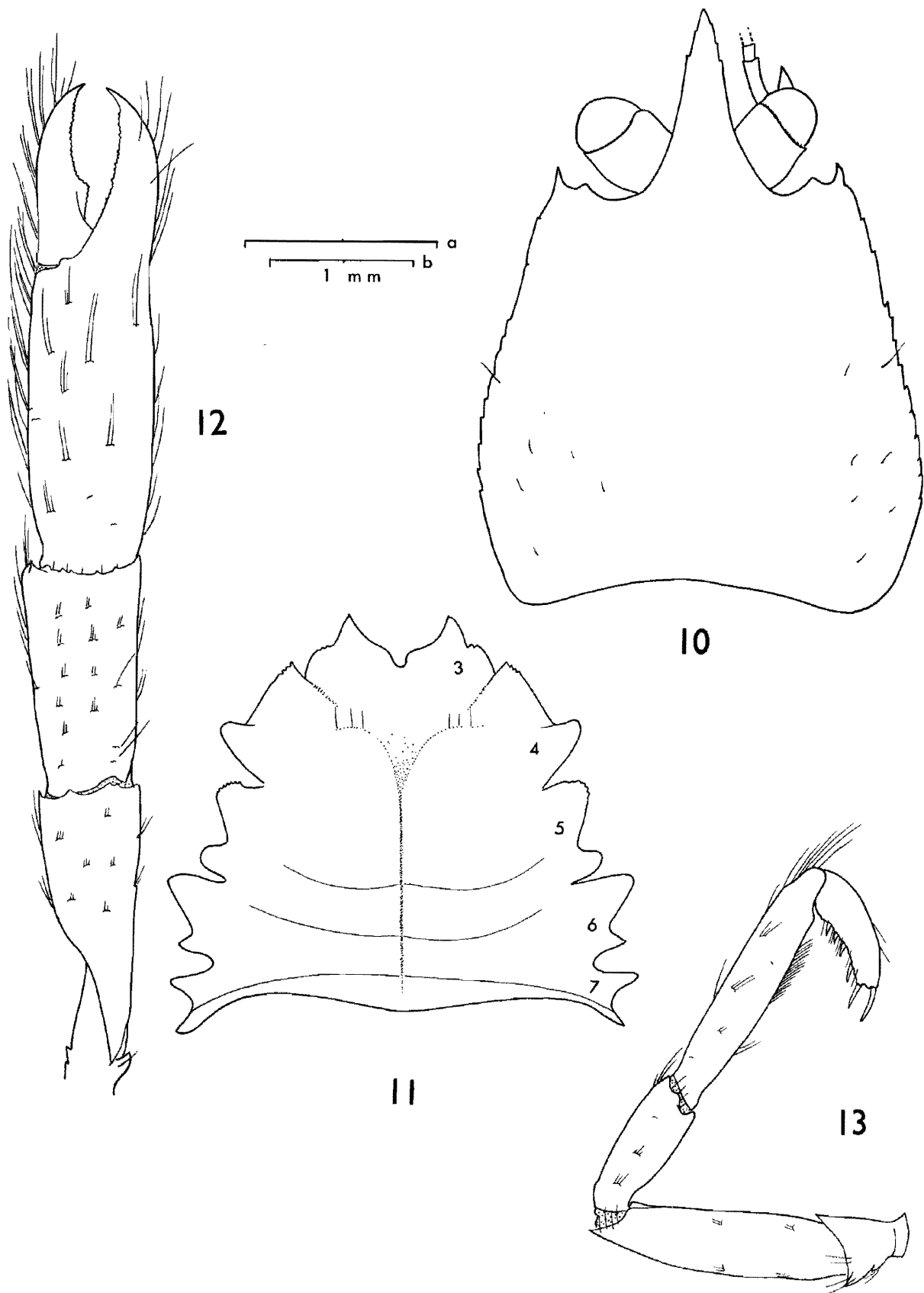


Uroptychus gracillimanus Henderson. FIG. 8.—Left chela of female. FIG. 9.—Left chela of male.

lateral angles of the fourth sternum are furnished with three to four teeth which successively diminish in size posteriorly. The same angles of the following sterna are minutely serrated. In all the thoracic sterna each postero-lateral angle has a tooth-like projection. A median groove separates the fourth and the following sterna into a right and left half. Furthermore, a short setose ridge is present on the fourth sternum, and each of the next three sterna has setose ridges which extend from the median groove to the lateral borders. These transverse ridges are densely setose in the female, only sparingly so in the male.

The chelipeds agree with those of Alcock's specimens. The posterior margin of the propodus of each ambulatory leg is spinose on a little more than its distal half. Strong spines are also present on the posterior margin of the dactylus.

The first and second pleopods of the male in the "John Murray" collection show a striking resemblance to those of *U. gracillimanus* Henderson.



Uroptychus gordonae n. sp. Male. FIG. 10.—Carapace, dorsal view. FIG. 11.—Thoracic sternites 3 to 7. FIG. 12.—Cheliped. FIG. 13.—Ambulatory leg. (Figs. 10, 12 and 13 all at scale *b*).

Uroptychus gordonae n. sp.

(Figs. 10-13.)

OCCURRENCE :

Maldive Area :

St. 158, Agassiz trawl, 786-1170 metres, 1 male, the holotype (*c.l.* + *r.* = about 4.5 mm.); 1 female (*c.l.* + *r.* = 4 mm., 2 detached chelipeds 7.5 and 8.5 mm.).

DESCRIPTION : The carapace of the male is represented in Fig. 10, its lateral margins are denticulate, and terminate anteriorly in a small but sharp spine. When the carapace is slightly dry a fine pitting and a few short hairs can be seen on its surface. The rostrum is pointed at the tip and its lateral margins are serrated anteriorly ; it extends beyond the eyes by rather less than half of its length. The eye-stalks are short and rather stout ; the cornea tapers slightly towards the distal end.

The anterior margin of the sternum that carries the third maxillipeds is deeply invaginated in the middle and has acute lateral angles (Fig. 11). The postero-lateral angles of this sternite and the antero-lateral angles of the following two sternites are serrated. The transverse ridge of the fourth sternum, which is rather obscure, has a few hairs. The ridges of the remaining sterna appear to be smooth.

The antennal acicle is shorter than the peduncle. The third maxillipeds are unarmed.

The chelipeds are short and fairly stout, the smaller cheliped is shown in Fig. 12. The ischium has a small spine on its outer distal angle. Merus, carpus and palm all have tufts of hairs. The inner margins of the fingers are finely serrated, whereas the outer ones are furnished with long hairs. A small tooth-like projection is present on the basal half of the dactylus. None of the ambulatory legs are attached to the specimens, there are, however, a few present in the same tube and one of them is shown in Fig. 13. The posterior margin of the dactylus is spinose ; but the same margin of the propodus has a thick row of hairs, especially on its distal half and, as far as I can see, no spines are present.

The first two pleopods of the male show a close resemblance to those of *U. brachydactylus* n.sp.

RELATIONSHIP : This species appears to be closely related to *U. subuensis* van Dam, in having the lateral margins of the carapace serrated, short chelipeds and unarmed propodi of the ambulatory legs. But it can easily be distinguished by the long, pointed rostrum, the short eye-stalks and the presence of hairs on the palm of the chela and also on the posterior margin of the propodi of the ambulatory legs.

Uroptychus murrayi n. sp.

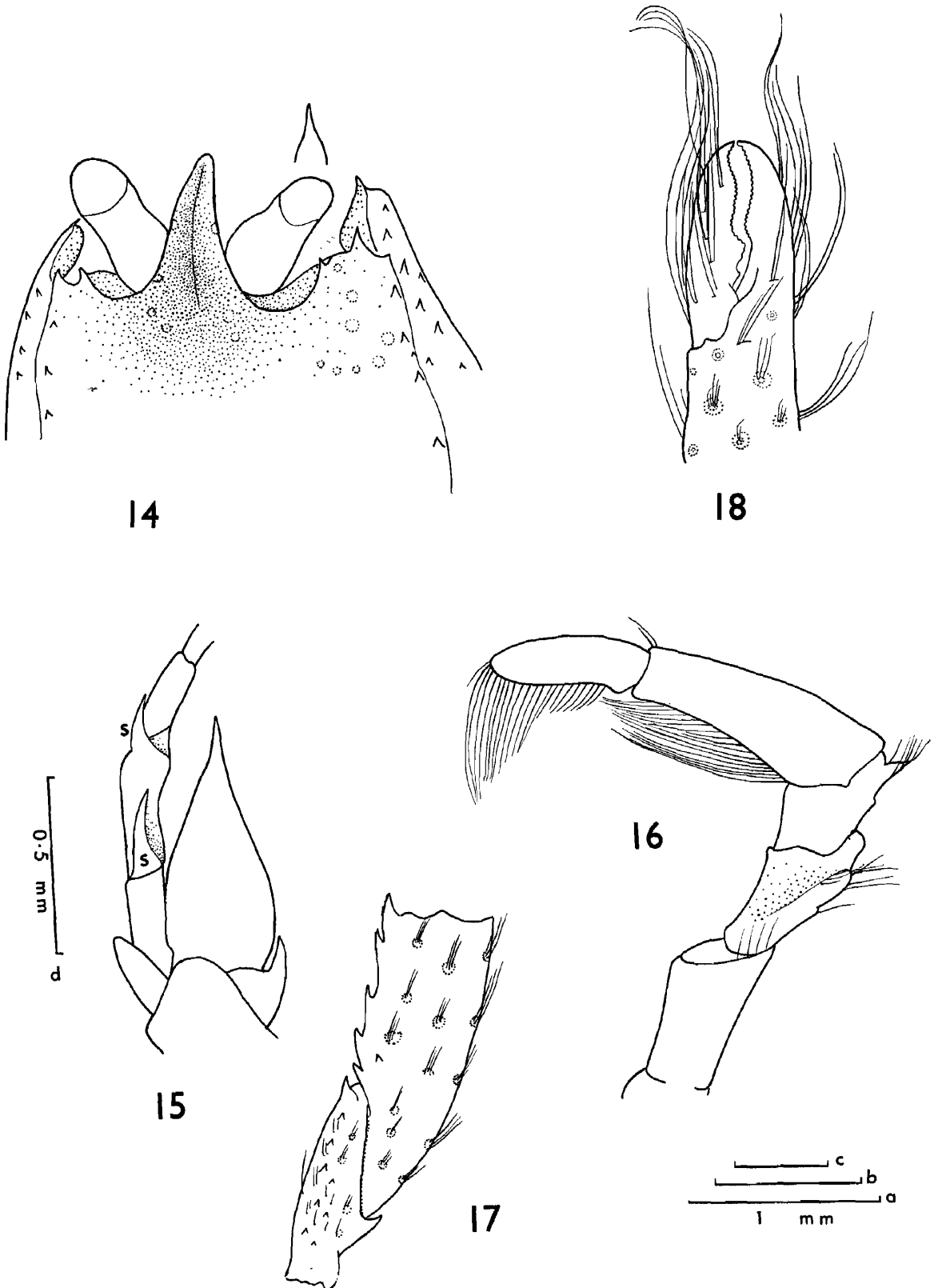
(Figs. 14-18.)

OCCURRENCE :

St. not known.

1 female, the holotype (*c.l.* + *r.* = 5 mm., *ch.l.* = 14 mm.).

DESCRIPTION : The single "John Murray" specimen, which is a female, is not in very good condition. However, the anterior part of the carapace is as represented in Fig. 14. The lateral margins of the carapace are provided with 4-5 spines, and besides the spine on the antero-lateral angle there is another smaller spine on the outer orbital margin. The pterygostomial region is also provided with small spines. The rostrum, which hardly



Uroptychus murrayi n. sp. Female. FIG. 14.—Frontal region of carapace (Scale *b*). FIG. 15.—Left antenna, ventral view. (Scale *d*). *s*. Spine. FIG. 16.—Endopod of left third maxilliped (Scale, *a*). FIG. 17.—Ischium and merus of cheliped. FIG. 18.—Distal part of chela (Both at scale *c*).

exceeds the eyes, is deeply concave and trough-like. The eyes are rather characteristic in being somewhat conical, tapering gradually from the base of the ocular peduncle to the distal margin of the cornea. Scattered over the surface of the carapace are a few circular patches, which do not appear to be setose.

The condition of the specimen does not allow of a detailed study of the sternum. But, from what could be seen, a close resemblance with that of *U. gordonae* is evident.

The antenna is also characteristic (Fig. 15). The antennal acicle is broad at the base but distally it tapers to a sharp point. The last two segments of the peduncle are each provided with a long, curved spine (*s*) on the ventral surface of the distal margin.

The merus of the third maxilliped has three rounded lobes on its outer margin, while the same margin of the carpus has a conspicuous conical projection near its distal border (Fig. 16).

Only one cheliped is present ; it is long and slender. The ischium has a spine on its inner and outer distal angles (Fig. 17) ; moreover there is a row of about six spines near the inner margin and another row of three to four still smaller spines on the median line. The merus has five fairly large spines on its inner border. All the segments of the cheliped, including the palm, are covered with circular patches from the centres of which arise tufts of hairs. The fingers, which are about half the length of the palm, are furnished with exceptionally long hairs (Fig. 18). The inner margin of the dactylus has a broad prominence near its base.

The ambulatory legs are likewise covered with setose circular patches. The posterior margins of dactylus and propodus are spinose.

RELATIONSHIP : *U. murrayi* resembles *U. tridentatus* Henderson in having spines on the pterygostomial region and also in the form of the eyes, antenna, and the third maxilliped. But it differs from *U. tridentatus* mainly in having a simple and not a tridentate rostrum and much weaker spines on the lateral margin of the carapace. I had the opportunity to compare the "John Murray" specimen with the holotype which is present in the British Museum (Nat. Hist.). The chelipeds are missing in the holotype, but they have been described and illustrated by van Dam (1933, p. 32, Figs. 45, 46) ; it can be seen that the chelipeds are not so hairy in that species.

Uroptychus brachydactylus n. sp.

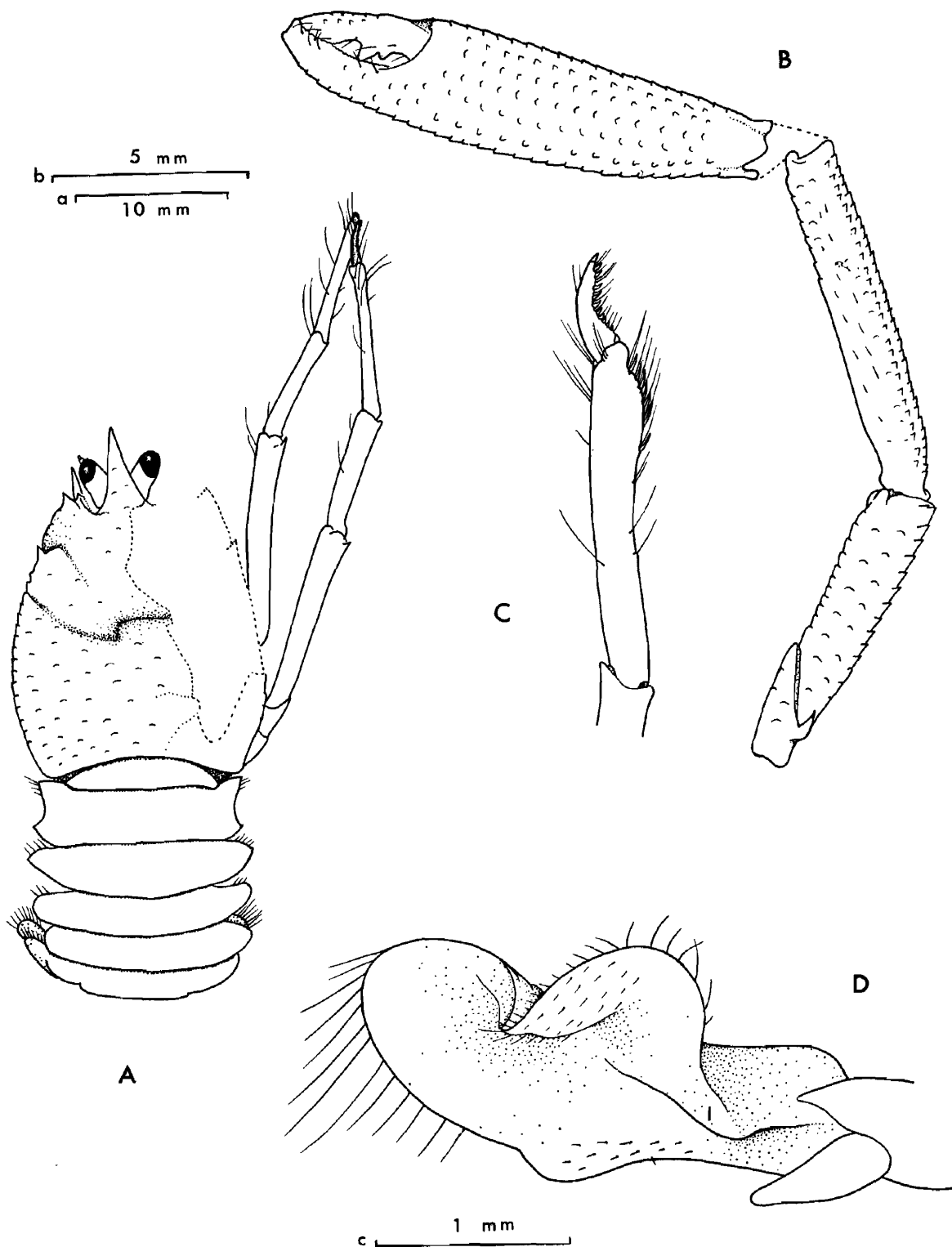
(Fig. 19.)

OCCURRENCE :—

South Arabian coast :

St. 42, triangular dredge 4, 1415 metres, 1 male holotype (*c.l.* + *r* = 21 mm., *ch.l.* = 72 mm.).

DESCRIPTION : A dorsal view of the holotype is illustrated in Fig. 19A ; unfortunately, the specimen is damaged and the right half of the carapace is missing while the rostrum is somewhat displaced. The chelipeds are detached and all the ambulatories are missing except the first and third on the right side. The triangular rostrum exceeds the eyes by about a third of its length. The lateral margin of the carapace is serrated and terminates anteriorly in a small spine ; another spine of about the same size is present at the level of the anterior branch of the cervical groove. The surface of the carapace is covered with large, well separated granules with microscopically crenate anterior margins and at least



Uroptychus brachydactylus n. sp. Holotype. FIG. 19.—A. Specimen in dorsal aspect B. Cheliped. (Both at scale *a*). C. Propodus and dactylus of right third ambulatory leg. (Scale *b*). D. Distal portion of left second pleopod, ventral view. (Scale *c*). *l*. Crest-like lobe.

some of them have fine short hairs. A few rather obscure granules are also present on the rostrum. The abdominal terga are smooth and polished.

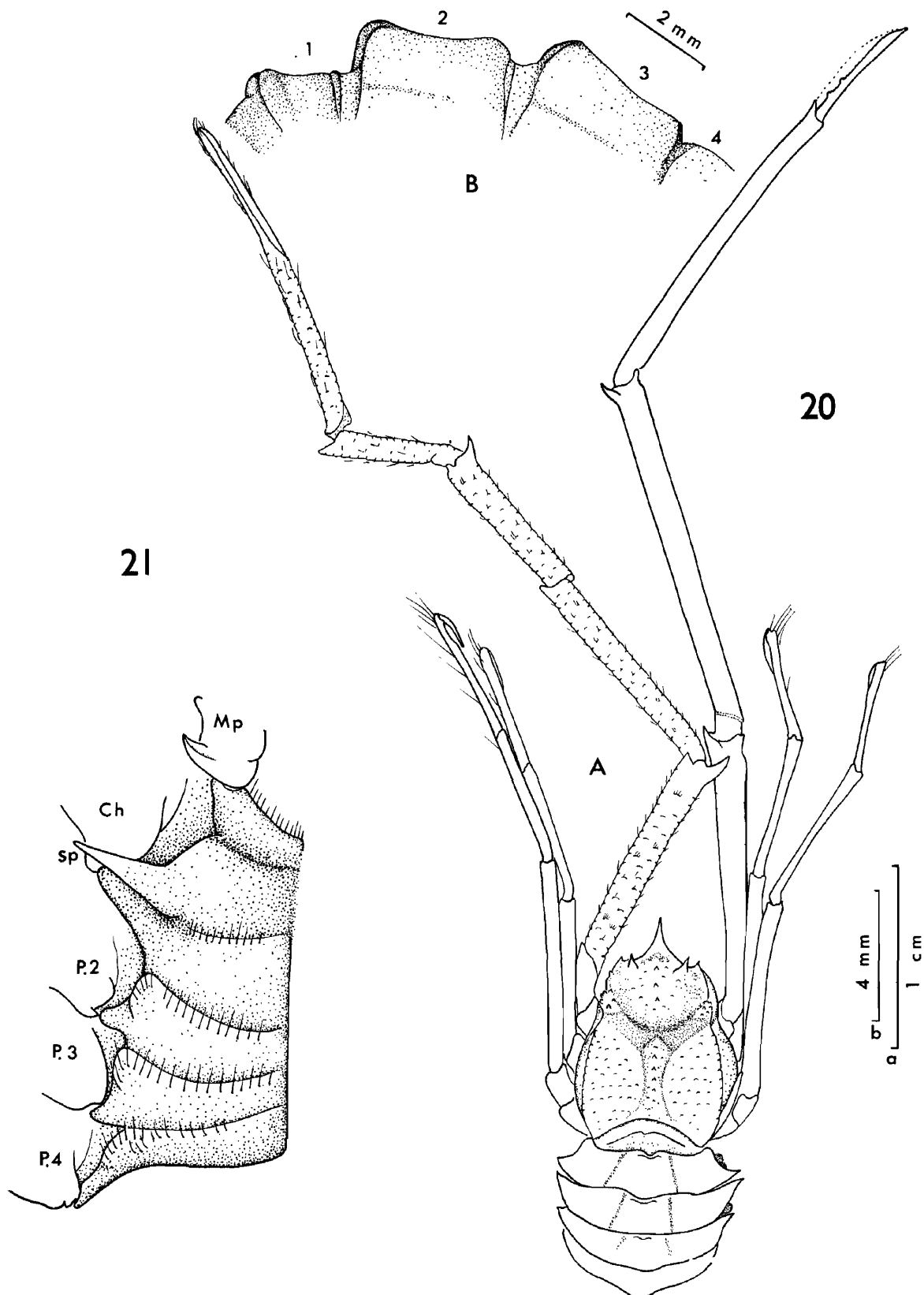
The anterior margin of the third thoracic sternum is setose; the tips of the two median teeth overlap and are separated posteriorly by a deep notch. The right half of the anterior margin bears another small tooth, a short distance from the median one. The antero-lateral angles are rounded, whereas the postero-lateral ones are each armed with a spine. The lateral margins of the fourth sternum are produced into a small spine anteriorly and a blunt tooth-like projection posteriorly. Moreover, the surface of this sternum bears numerous large setose tubercles, which are arranged more or less in transverse rows. The next three sternites have each a setose transverse ridge. The third sternum is separated from the fourth by a U-shaped depression and a very deep median groove separates the remaining sterna into right and left halves.

The antennal acicle is about as long as the peduncle. The third maxillipeds are unarmed.

The granules on the chelipeds are large and numerous, those on merus and carpus becoming squamose with fairly long setae (Fig. 19B). The ischium has a curved spine at the distal end of its inner margin; inner and outer margins of merus and carpus end in a distal knob-like projection. The cheliped gradually widens towards the palm, the distal half of which is considerably broadened and inflated. The fingers, which are less than half the length of the palm, are in contact only along their distal third; the hiatus formed by the gaping fingers is filled with the projecting bicuspid tooth of the dactylus. The ambulatories that are present are long and almost smooth; the propodus is expanded distally where the posterior border bears six to nine spines (Fig. 19c). The short curved dactylus measures less than one-third of the propodus, and the posterior margin is spinose.

The first pleopod resembles that of *U. nigricapillis*. The distal portion of the second pleopod is represented in Fig. 19D; the anterior margin is curved in a curious manner characteristic of the species and a thin crest-like lobe (1) is present near the base. On the basal half, or more, of the side opposite to that figured is a strong median keel-like projection.

RELATIONSHIP: In having granules on the carapace and chelipeds *U. brachydactylus* appears to be related to *U. granulatus* Benedict, of which only three females, including the holotype, were taken by the "Albatross" at the Galapagos Islands. I was able to examine Benedict's material at the Smithsonian Institution, Washington and later a paratype was sent on loan for comparison with the "John Murray" specimen. Although the chelipeds and all the ambulatories except the third pair are missing, it is evident that the "John Murray" specimen is not referable to *U. granulatus*. In *granulatus* the rostrum is longer, about half the length of the carapace, with serrated lateral margins and a concave upper surface. In *brachydactylus* the rostrum is shorter with smooth lateral margins and a flat dorsal surface. Moreover, in *U. granulatus* the lateral margins of the carapace are conspicuously serrated and rather spiny. The third ambulatory of *U. granulatus* has the propodus unarmed, apart from one pair of ventral spines at the distal end, and the dactylus, which exceeds half the length of the propodus, is armed on the posterior border. In *U. brachydactylus* the curved dactylus is less than one-third of the propodus, which is armed distally as shown in Fig. 19c. Although the chelipeds are missing from the paratype sent on loan, (*c.l.* + *r.* = 14 mm.), they are present in the largest female (*c.l.* + *r.* = 16 mm.) but the palm is not inflated—perhaps this is only a sexual difference, since the "John Murray" specimen is a male.



Uroptychus sternospinosus n. sp. FIG. 20.—A. Female, dorsal view (Scale *a*). B. First four abdominal segments in profile. FIG. 21.—Right half of plastron of male. *Mp*, *Ch*, *p2*, *p3*, and *p4* = coxa of third maxilliped, cheliped and pereopods 2 to 4. *sp*. Spine on sternite 4. (Scale *b*).

Uroptychus sternospinosus n. sp.

(Figs. 20–27.)

OCCURRENCE :

Maldive Area.

St. 159, monagésque trawl, 914–1463 metres, 1 male (*c.l.* about 17 mm., tip of rostrum broken, *ch.l.* = 90 mm.); 1 ovig. female (*c.l.* + *r.* = 15.5 mm., *ch.l.* = 85 mm.).

DESCRIPTION : The carapace, which is longer than broad, has the various regions well marked (Figs. 20A, 22). The branchial region is inflated where the carapace is widest. The gastric region is furnished with a pair of large spines which are directed upwards and forwards. A mid-dorsal carina extends from the anterior limit of the gastric region to the hind margin of the carapace, interrupted only by the wide cervical groove. The spines at the antero-lateral angles of the carapace are rather small. The rostrum is triangular and ends in a sharp, uptilted point, and is slightly longer than the eyes. The entire surface of the carapace is covered with large, well separated granules, at least some of which have fine hairs.

The tergum of the first abdominal segment has a sharp median carina with a slight dent in the middle (Figs. 20A and 20B). Anteriorly, the terga of the following two segments are raised into median humps or projections, which are hollowed out in front. The tergum of the fourth segment has only a slight projection, faintly hollowed in front (Fig. 20B).

The sternum corresponding to the third maxilliped is U-shaped and has a short anterior median groove. Furthermore, it is separated from the following sternum by a very wide groove. The fourth sternum is characterized by the presence of a pair of lateral spines which are of enormous size, sharply pointed and directed downwards and slightly outwards (*sp.* Fig. 21). A setose transverse groove runs from the base of these spines to the median line where it is separated from its fellow by a midventral groove which extends posteriorly over the remaining sterna. The fifth, sixth and seventh sterna have strong and setose transverse ridges which end at the base of tooth-like projections situated near the lateral margins of the sterna.

The eye-stalks are short but the cornea are large and globular (Fig. 22).

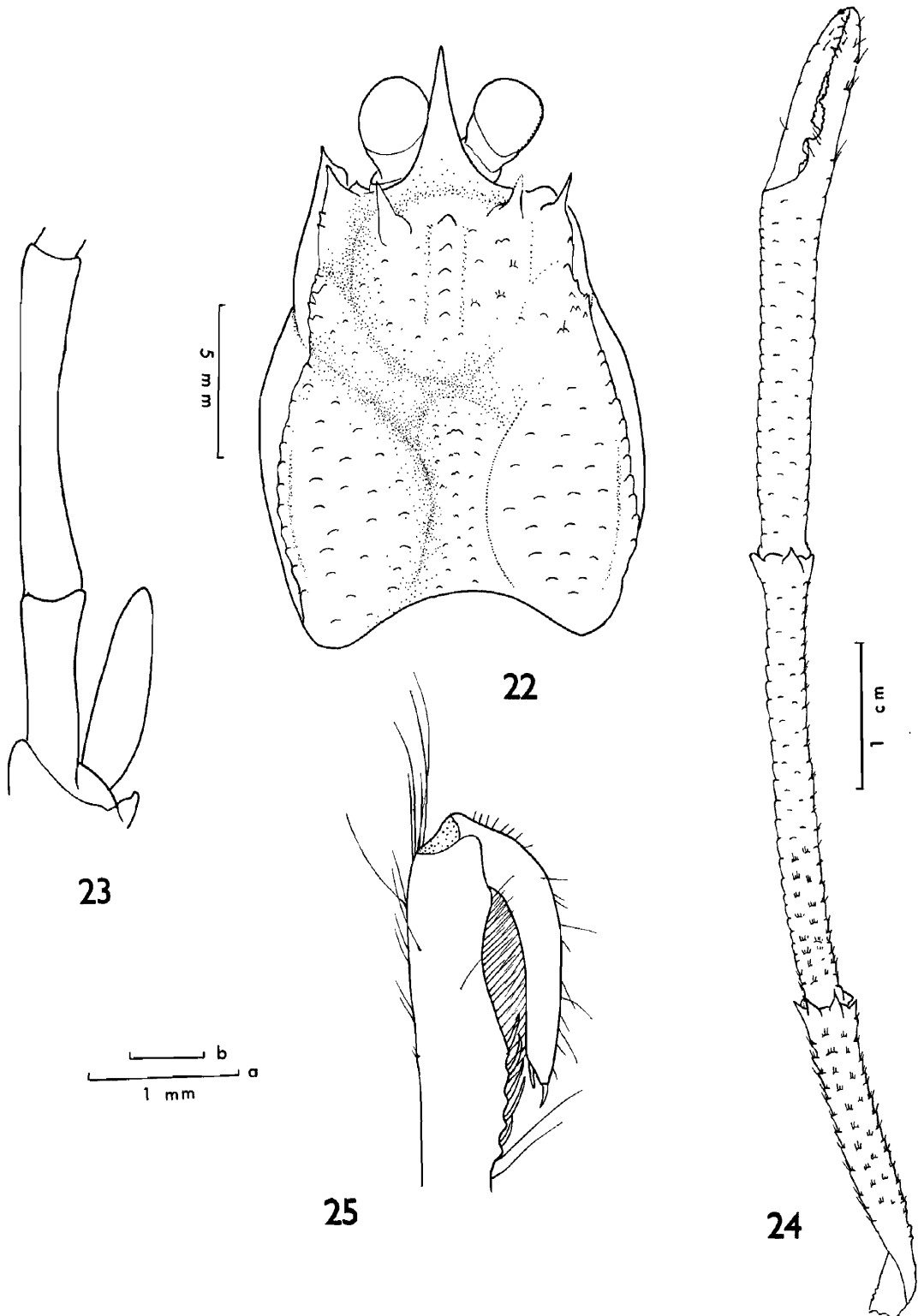
The antennae are rather peculiar in having greatly elongated proximal segments of the endopod (= distal segments of the peduncle). The antennal acicle, as illustrated in Fig. 23, is short, extending only to the base of the second segment.

The third maxillipeds are long and unarmed except for a spine on the coxa.

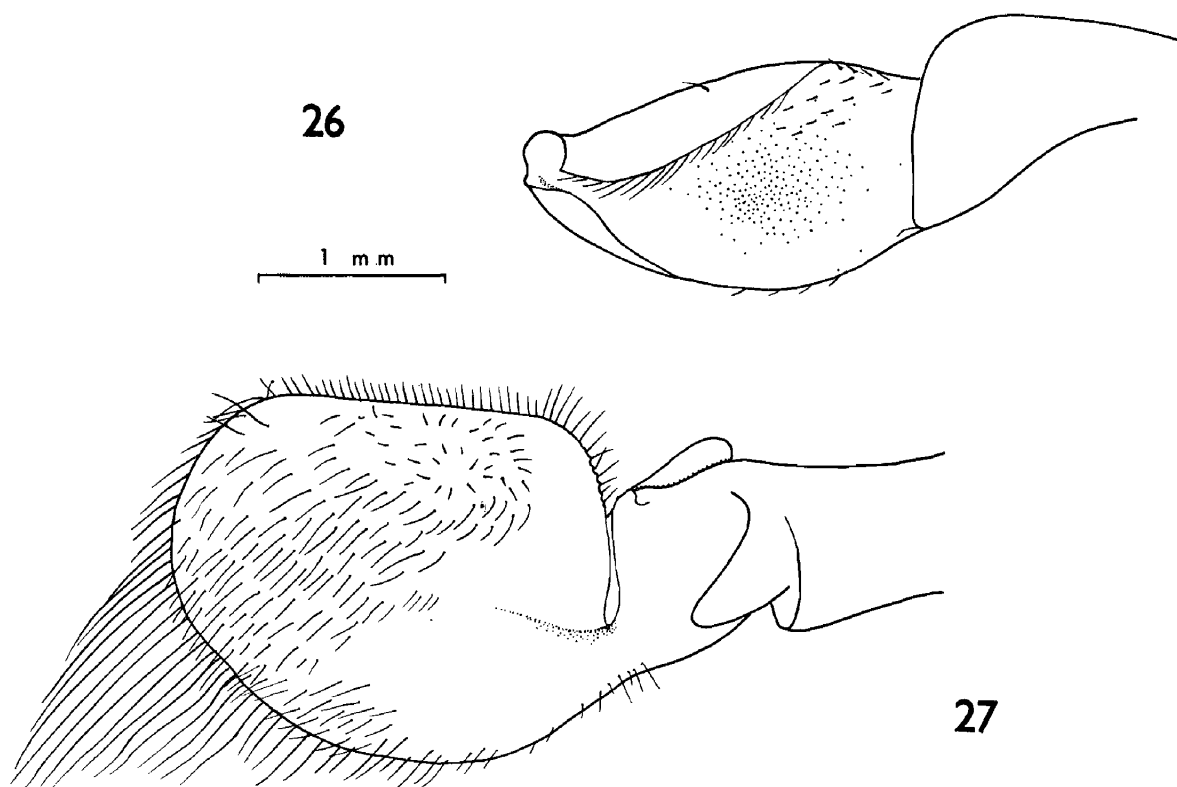
The chelipeds are more than five times as long as the carapace and are very slender in the female. A spine is present on the inner distal angle of the coxa. The ischium is relatively smooth, all the other segments are covered with setose granules. The distal margins of merus and carpus are spiny as shown in the figure (Fig. 24).

The ambulatory legs are nearly smooth and end in subchelae. The dactylus is strongly bent and its posterior margin is fringed with setae, only one spine may be present just behind the terminal one, the claw (Fig. 25). The propodus is expanded at a short distance from its distal margin, where the posterior border is provided with hairs and a few strong spines.

The first two pleopods of the male are represented in Figs. 26, 27. The endopod of the first pleopod is thin and concave dorsally; the anterior and posterior margins are bent



Uroptychus sternospinosus n. sp. FIG. 22.—Carapace of male. FIG. 23.—Left antenna, ventral view. (Scale *a*). FIG. 24.—Cheliped of male. FIG. 25.—Distal part of propodus, and dactylus of ambulatory leg. (Scale *b*).



Uroptychus sternospinosus n. sp. Male. FIG. 26.—Dorsal view of left first pleopod. FIG. 27.—Ventral view of left second pleopod.

inwards. The endopod of the second pleopod is paddle shaped, rather soft and cushion-like, and its ventral surface is furnished with numerous setae. On the opposite surface a median keel-like projection extends for a short length near the base of the endopod.

RELATIONSHIP: In having granules on the carapace and chelipeds, this species resembles *U. brachydactylus*, from which it can readily be separated by its long and slender chelipeds, the subchelate nature of the ambulatory legs and the entirely different type of pleopods of the male.

Uroptychus spinimanus n. sp.

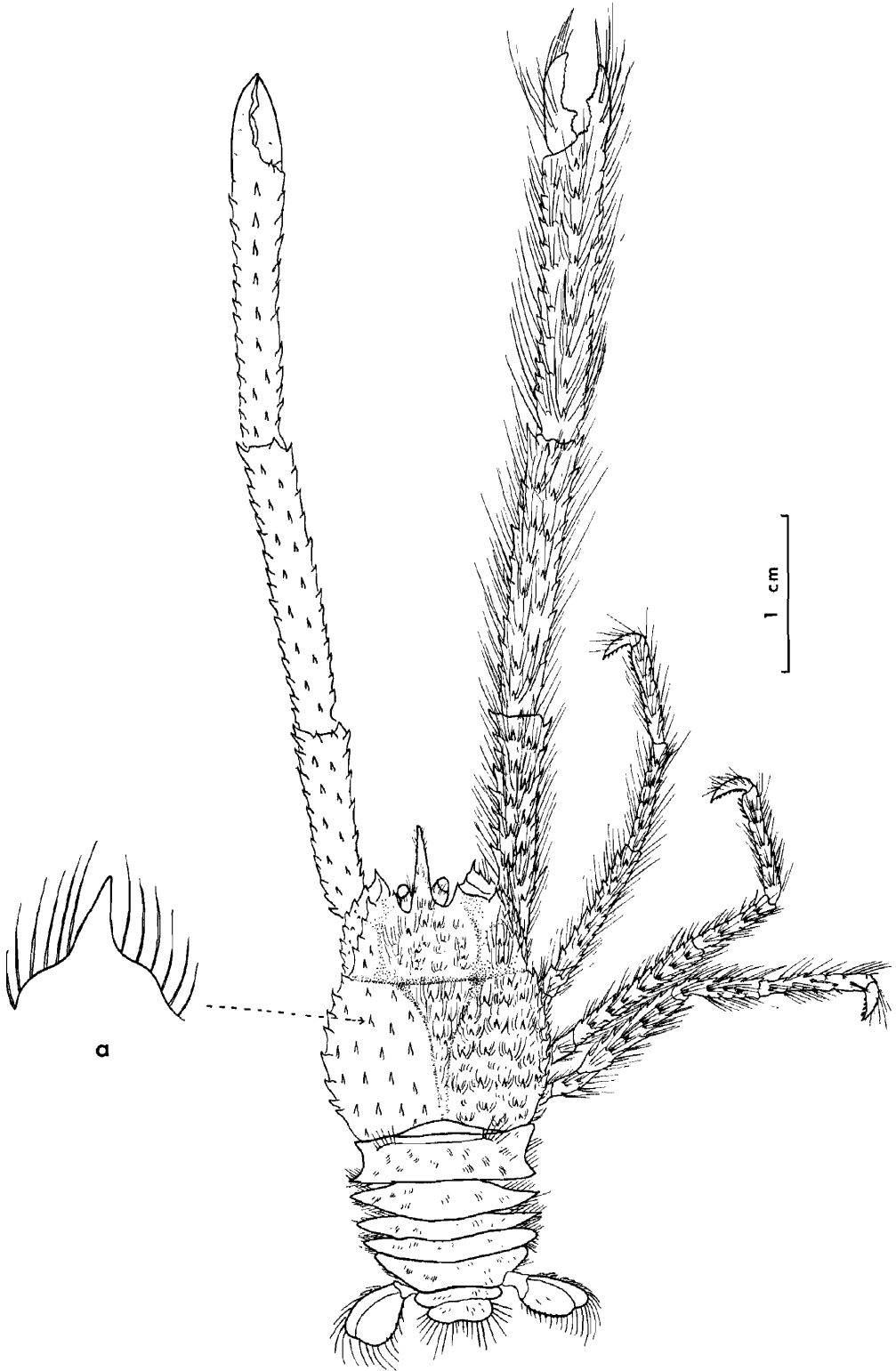
(Figs. 28–33.)

OCCURRENCE :

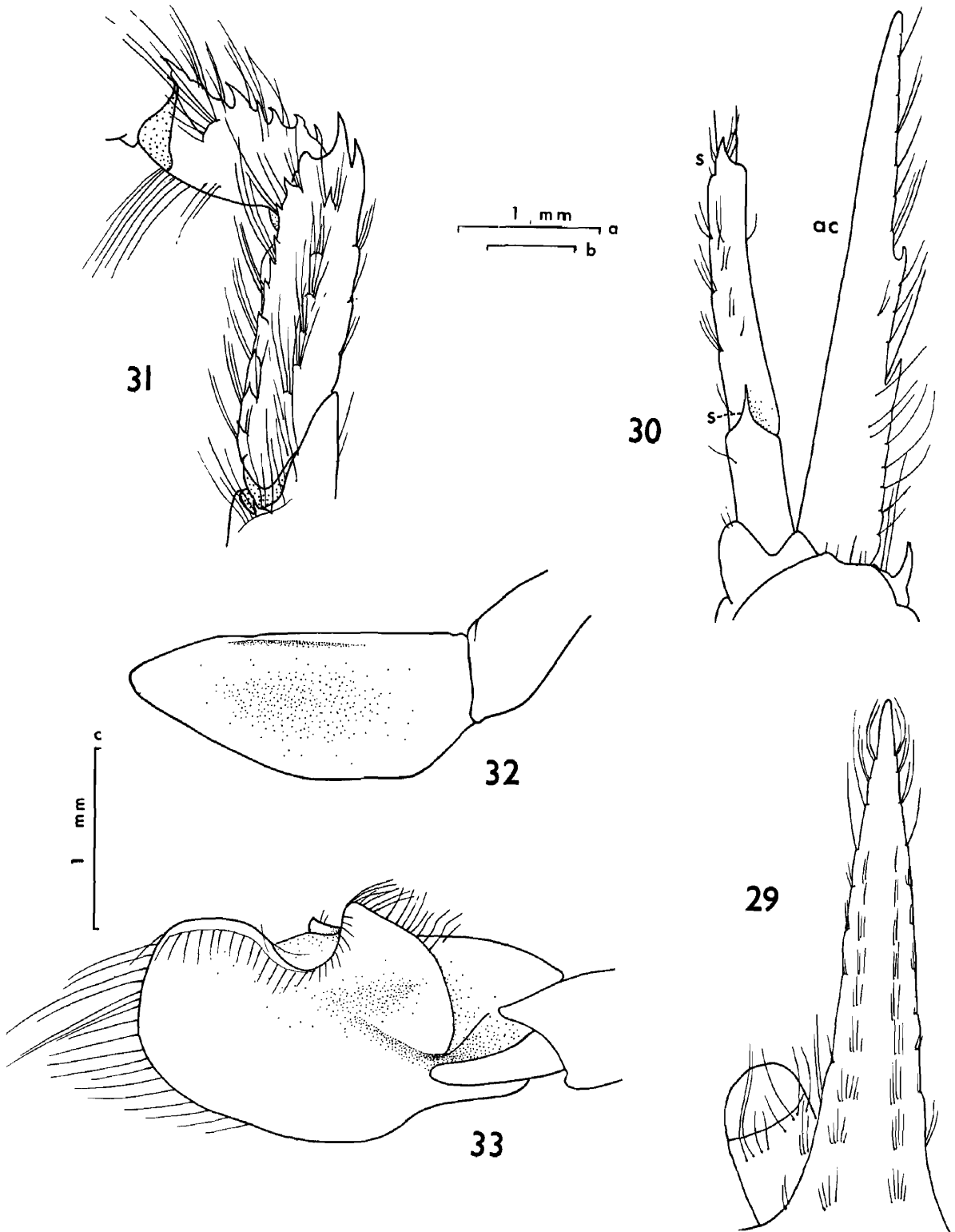
South Arabian Coast.

St. 54, Agassiz trawl, 1046 metres, 2 males (*c.l.* + *r.* = 19 and 20 mm., *ch.l.* = 61 and 59 mm. respectively); 2 ovig. females (*c.l.* + *r.* = 16 and 20 mm., *ch.l.* = 42.5 and 55 mm. respectively).

DESCRIPTION: The carapace, without rostrum, is as long as broad (Fig. 28). It is broadest across the branchial regions and considerably narrower in front. Only the cervical groove is well defined, the others are rather obscure. The rostrum is long and slender, the lateral margins are weakly serrate and hairy, tufts of setae are also present on the dorsal surface (Fig. 29). The carapace and the pterygostomial regions are studded with numerous spines. Each spine is situated on a tubercular projection and is flanked



Urotychus spinimanus n. sp. Fig. 28.—Male, dorsal view. *a*. A single spine, greatly enlarged.



Uroptychus spinimanus n. sp. Male. FIG. 29.—Rostrum and left eye. (Scale *b*). FIG. 30.—Left antenna, ventral view. (Scale *a*). *ac*. Acicle *s*. Spine. FIG. 31.—Merus and carpus of left third maxilliped. (Scale *b*). FIG. 32.—Left first pleopod, dorsal view. FIG. 33.—Distal part of left second pleopod, ventral view. (Both at scale *c*).

by long hairs (Fig. 28a). Scattered amongst the spines are a few squamiform tubercles which are also fringed with long hairs and are more numerous on the gastric region.

The abdominal segments have tufts of hairs on their dorsal surfaces.

The anterior margin of the sternum corresponding to the third maxillipeds has a pair of median teeth which are separated by a V-shaped notch. The antero-lateral angles of this sternum are provided with three to four teeth and some hairs; each postero-lateral angle has a spine. The lateral margins and the anterior angles of the fourth sternum are furnished with many spines and hairs; the surface is beset with numerous, setose, squamiform tubercles. The fifth sternum has the lateral margins and anterior angles serrated, they are weakly so in the following sternum and are entire in the seventh; they are, however, hairy in all. The postero-lateral angle of the fourth and each of the following sterna is produced into a small rounded projection. Each of the last three sterna has a setose, transverse ridge. A mid-ventral groove separates the fourth and the following sterna into right and left halves. The sternal armature of the smaller female is weaker than that of the other specimens.

The eye-stalks are short and slender, the cornea is overhung by long hairs arising from the stalk (Fig. 29).

The antenna is characteristic in having a long, acuminate acicle, which is longer than the peduncle (Fig. 30, *ac*); the outer margin of the acicle is setose and has two spines. A mid-ventral spine is present on the distal margin of the last two segments of the peduncle (Fig. 30, *s*).

The inner margin of the merus of the third maxilliped has a row of small spines, and there are two rather big spines on the outer distal angle (Fig. 31). The outer margin of the carpus is spiny and all the segments are furnished with long hairs.

The chelipeds are long and slender. They are longer in males and in the younger male the single cheliped present exceeds three times the carapace length. All the segments of the cheliped, including the palm, are spiny and with long hairs. The spinosity of the chelipeds and the ambulatory legs is shown in Fig. 28.

The endopod of the first pleopod of the male is thin and somewhat pointed at the apex, it is concave on the dorsal surface (Fig. 32). The anterior margin of the endopod of the second pleopod is curiously curved as represented in Fig. 33 and shows a striking resemblance to that of *U. brachydactylus*.

RELATIONSHIP: *U. spinimanus* is very closely related to *U. fusimanus* Alcock, but unlike that species it has spines on the palm which is slender and not swollen. It also differs from Alcock's species in having spines on the ambulatory legs and hairs on the dorsal surface of abdominal segments.

Uroptychus cavirostris Alcock & Anderson

(Figs. 34-39.)

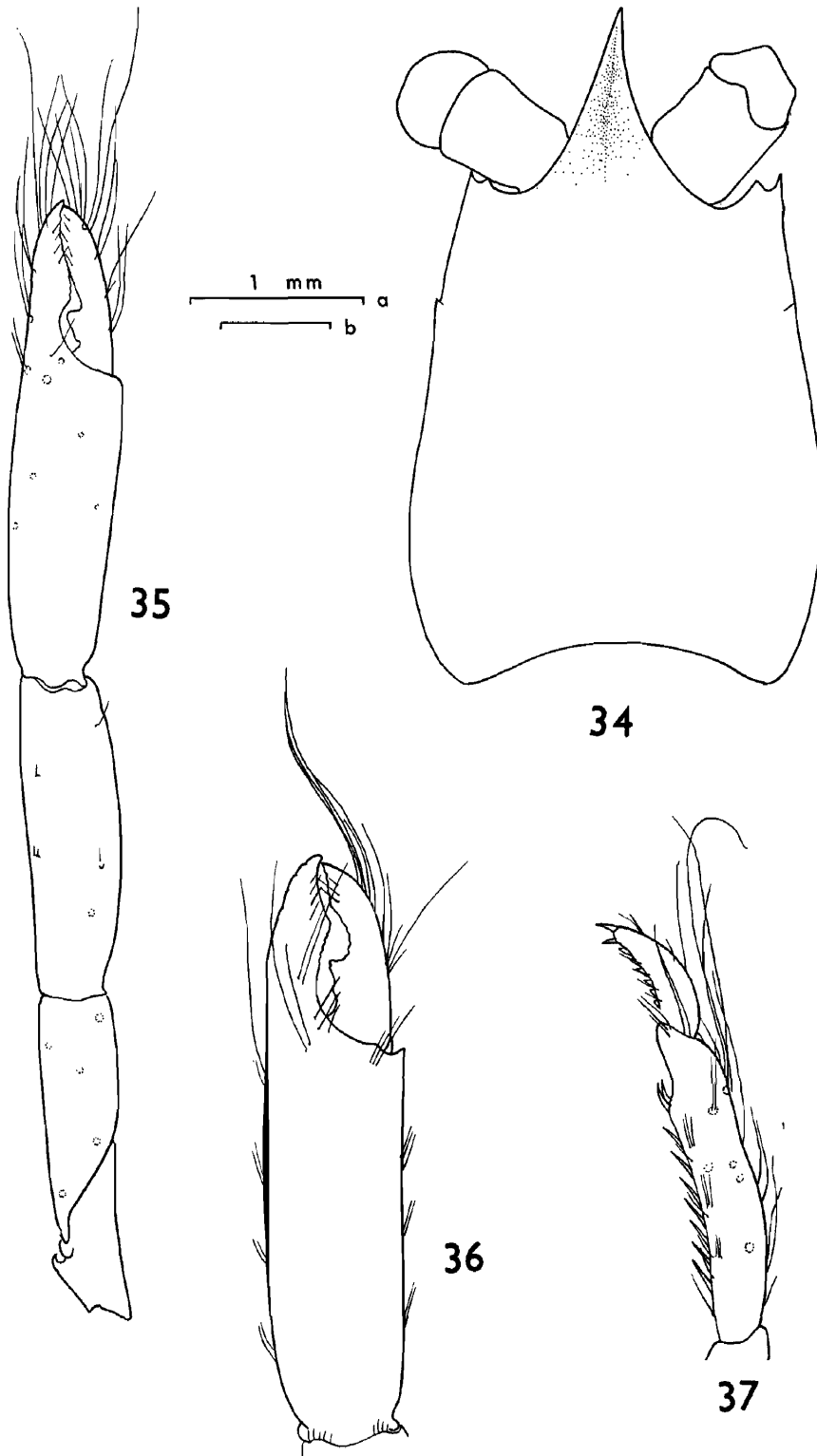
Uroptychus cavirostris Alcock & Anderson, 1899, p. 26; Ill. Zool. Investigator Crust., pl. XLIV, fig. 3.
Uroptychus cavirostris, van Dam, 1933, p. 22, fig. 33.

OCCURRENCE :

Maldive area.

St. 157, triangular dredge 4, 229 metres, 14 specimens.

DISTRIBUTION : Indian Ocean.



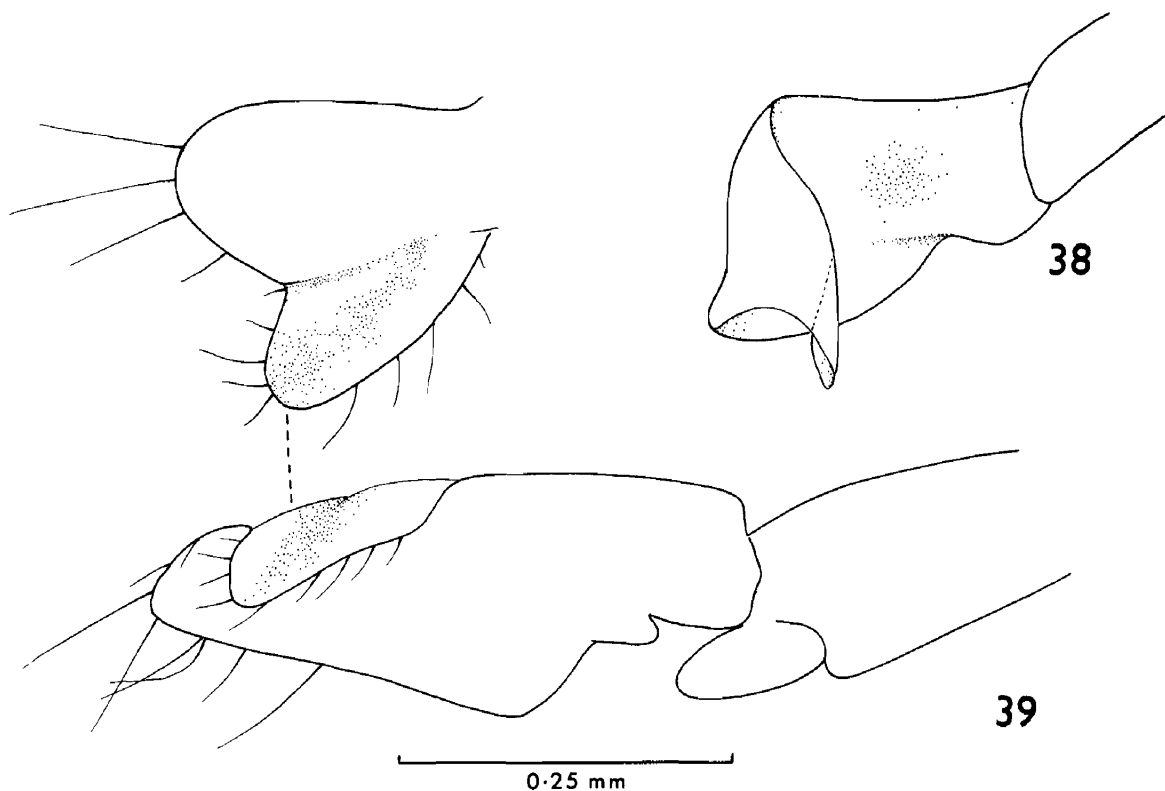
Uroptychus cavirostris Alcock & Anderson. FIG. 34.—Carapace of female, dorsal view. (Scale *a*). FIG. 35.—Cheliped of same. (Scale *b*). FIG. 36.—Chela of male. (Scale *b*). FIG. 37.—Propodus and dactylus of ambulatory leg. (Scale *a*).

REMARKS ON MATERIAL: There are four males and ten females measuring 2.5 to 5 mm. in carapace length including the rostrum. Females measuring 4 mm. in carapace length are ovigerous. Most specimens have the chelipeds detached; the measurements of those which had the chelipeds attached are given below.

Males: *c.l.* + *r.* = 3 mm. and 4.5 mm., *ch.l.* = 9.5 and 15 mm. respectively.

Female: *c.l.* + *r.* = 4 mm., *ch.l.* = 13 mm.

DESCRIPTIVE REMARKS: Hitherto *U. cavirostris* was known only from the holotype and a single "Siboga" specimen; both were ovigerous females of about the same size.



Uroptychus cavirostris Alcock & Anderson. Male. FIG. 38.—Endopod of left first pleopod, dorsal view. FIG. 39.—Distal part of left second pleopod, anterior view.

All the "John Murray" specimens are much smaller, the ovigerous females being about half as long as those recorded by Alcock and by van Dam. However, Alcock's description of the holotype applies rather well to the "John Murray" specimens except that the tooth on the lateral border of the carapace is not very distinct (Fig. 34). It may be added here that the "John Murray" specimens are poorly calcified and are not in very good condition. Furthermore, some specimens have circular patches on the carapace, similar to those present on the limbs.

The cheliped of a female is shown in Fig. 35; it agrees perfectly well with that of the holotype except that it is only one and a half times as long as the body whereas Alcock has described them as being ". . . not much less than twice the length of the fully extended body" (1899, p. 26). It is interesting to note that in the "John Murray" specimens the chelipeds are about three times as long as the carapace, as in van Dam's specimens. The chela of the male is heavier than that of the female (Fig. 36). The ambula-

tory legs are slender, hairy and in nearly all of them there are circular patches on the surface. The posterior margins of the dactylus and the propodus are spinose (Fig. 37).

In the male the endopod of the first pleopod is thin, leaf-like and rolled apically (Fig. 38). The endopod of the second pleopod is produced into an incurved lobe on the margin which is dorsal in natural position. In Fig. 39 the detached pleopod is represented as nearly as possible in anterior aspect, it may be slightly to one side; in the upper figure the apex is seen from the opposite side.

Uroptychus onychodactylus n. sp.

(Figs. 40-42.)

OCCURENCE :

Maldive area.

St. 158, Agassiz trawl, 786-1170 metres, 1 ovig. female, the holotype (*c.l.* + *r.* = 11 mm., *c.l.* = 7.5 mm., *c.b.* = 10 mm., *ch.l.* = 29 mm.).

St. 159, monagésque trawl, 914-1463 metres, 1 male (*c.l.* + *r.* = 8 mm., *c.l.* = 5.5 mm., *c.b.* = 7 mm., *ch.l.* = 24 mm.).

DESCRIPTION: The carapace, without the rostrum, is broader than long (Fig. 40). It has a small spine on each antero-lateral angle and is finely pubescent especially near the lateral margins. The rostrum is long and pointed, the dorsal surface and the lateral margins are furnished with soft hairs. The abdominal terga are quite smooth.

The anterior margin of the sternum corresponding to the third maxillipeds is concave in the female, almost V-shaped in the male. In both specimens the lateral angles of all the sterna are unarmed. The female differs from the male in having bunches of fairly long, silky hairs on the surface of the fourth sternum and also in having the lateral margins of all the sterna densely covered with long hairs, similar to those of the fourth sternum.

The eye-stalks are very small, the cornea round and not any wider than the stalk.

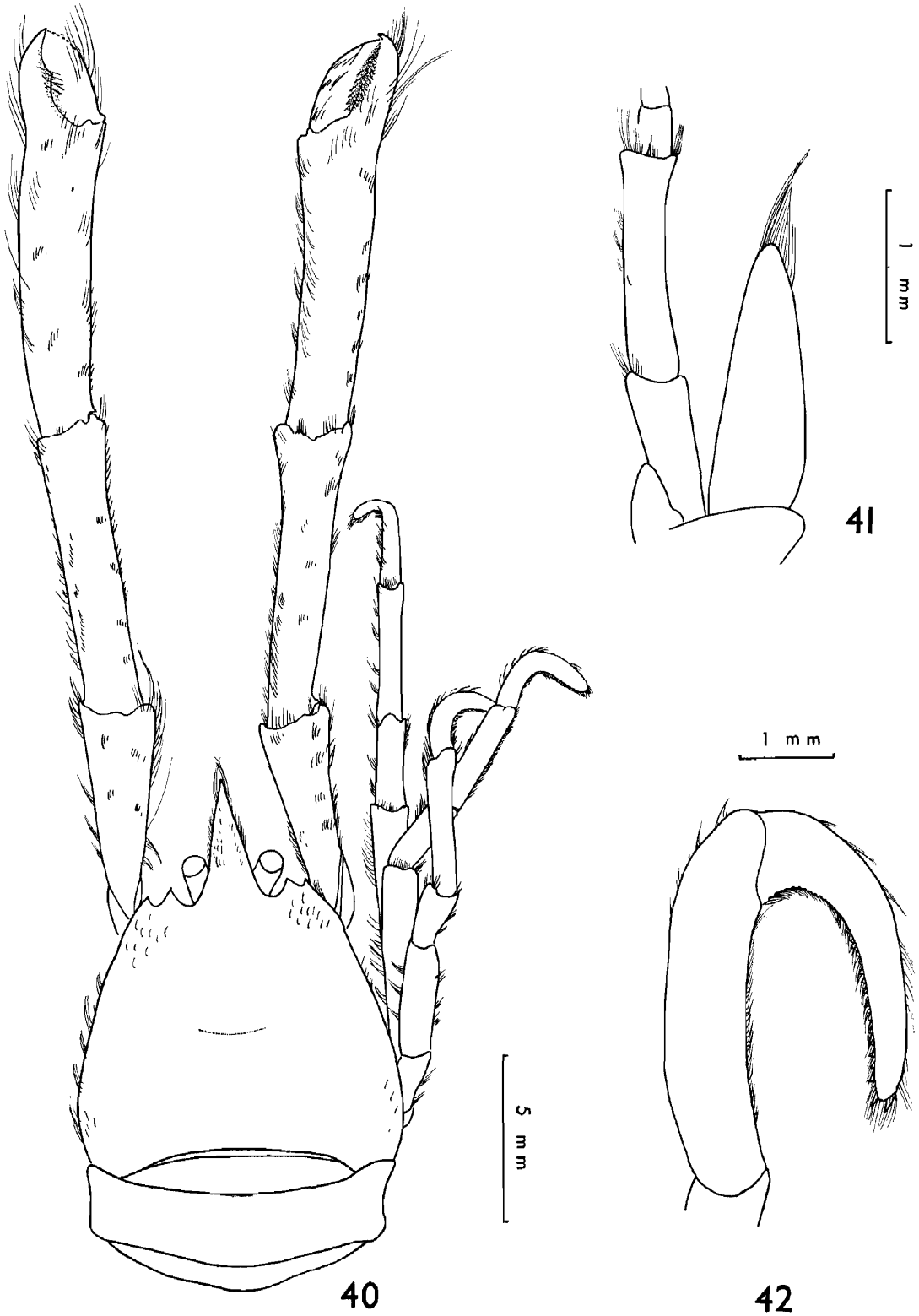
The antennal acicle is shorter than the peduncle, but the bunch of soft hairs on the apex are so matted together that on a casual glance they give a false impression of an acuminate apex which is as long as the peduncle (Fig. 41). The distal margins of the two proximal endopod segments (= distal segments of the peduncle) are also provided with silky hairs.

The third maxillipeds are unarmed, but the merus and carpus are noticeably feathery.

The chelipeds are symmetrical in the female, sub-symmetrical in the male, where the left chela is heavier and a little longer than the right. The chelipeds are three times as long as the carapace and are stout, gradually widening towards the palm which is two and a half times as long as the fingers. A spine is present on the outer distal angle of the coxa.

The ambulatory legs are characteristic in having long and strongly curved dactyli which, when bent backwards, become hook-like as illustrated in Fig. 42. The posterior margin of the propodus and of the dactylus are thickly fringed with short soft hairs. Moreover, on that of the dactylus there are horny teeth which gradually become smaller proximally, so that the proximal margin is merely serrated. These teeth are normally concealed in the fringe of hairs.

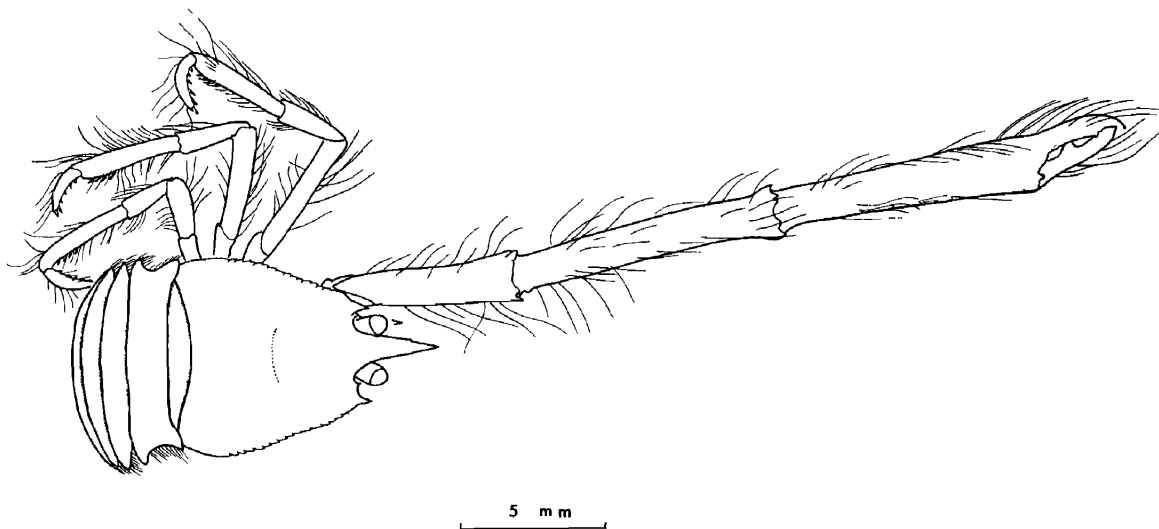
The first and second pleopods of the male are very similar to those of *U. spinimanus*,



Urotychus onychodactylus n. sp. FIG. 40.—Holotype, dorsal view. FIG. 41.—Left antenna of female, ventral view. FIG. 42.—Propodus and dactylus of third ambulatory leg of male.

except that in the second pleopod the apex of the endopod is narrower and not so broadly rounded, and the exopod has a few very long hairs on the tip.

RELATIONSHIP: In having a broad carapace, small eyes and hook-like dactyli of ambulatory legs this species is very near to *U. scambus* Benedict (= *U. glyphodactylus* MacGilchrist). However, it differs in having a much longer rostrum and the fingers of the chelae are not curved nor is the inner margin of each toothed in the very characteristic fashion illustrated in Pl. LXX, Fig. 4 of the "Illustrations . . . " Investigator " where a male of *U. glyphodactylus* MacGilchrist is depicted.



Uroptychus siraji n. sp. FIG. 43.—Holotype, dorsal view.

Uroptychus siraji n. sp.

(Fig. 43.)

OCCURRENCE :

Maldive Area.

St. 159, monagésque trawl, 914–1463 metres, 1 ovig. female (*c.l.* + *r.* = 9 mm., *c.l.* = 6 mm., *c.b.* = 7 mm., *ch.l.* = 30 mm.).

DESCRIPTION: This species is so similar to *U. onychodactylus* that in the first sorting I had placed them together. On a closer examination, however, I find that *U. siraji* differs from *U. onychodactylus* in the following details:

The lateral margins of the carapace are crenulate and the spine on the antero-lateral angles is much stronger (Fig. 43).

The plastron differs from that of the female of *U. onychodactylus* in being less hairy; in having the anterior margin of the sternum corresponding to the third maxilliped very deeply concave, almost V-shaped; the antero-lateral angles of the fourth sternum have each 2–3 denticles.

The antennal acicle has no terminal bunch of hairs.

The hairs on the limbs are much longer but are rather scanty and not grouped in bunches.

Only the left cheliped is present, it is slender and is more than three times the length of the carapace. The fingers of the chela are also longer than those of *U. onychodactylus*,

being just a little less than half the length of the palm. In addition to the spine on the coxa there is another spine on the ventral side of the disto-median angle of the merus.

The dactyli of the ambulatory legs are not strongly bent and hook-like, but resemble those of most species of the genus.

ACKNOWLEDGMENTS.

I am grateful to Dr. I Gordon of the British Museum (Nat. Hist.) for allowing me to work on this interesting material, for her unfailing kindness and help and also for going through the manuscript. My thanks are also due to the authorities of the Department of Zoology and Comparative Anatomy, Oxford, especially to Dr. A. J. Cain, for providing facilities to work there. I wish to take this opportunity to thank Mons. J. Forest of the Muséum National d'Histoire Naturelle, Paris; Dr. L. B. Holthuis of the Rijksmuseum van Natuurlijke Historie, Leiden, Dr. J. H. Stock of the Zoölogisch Museum, Amsterdam and Dr. Squires of the U.S. National Museum, for allowing me to examine types and other named material in their respective collections. Finally, I wish to mention that this work was done while I was on a Fellowship from UNESCO.

LITERATURE CITED.

- ALCOCK, A. 1901. A descriptive Catalogue of the Indian Deep-Sea Crustacea, Decapoda Macrura and Anomala in the Indian Museum, Calcutta. 286 pp., 3 pls.
- ALCOCK, A. & ANDERSON, A. R. S. 1899. Natural History Notes from H.M.R.I.M.S. Ship "Investigator". Series III, No. 2. An account of Deep-sea Crustacea dredged during the surveying-season of 1897-98. *Ann. Mag. Nat. Hist.* (7) v. 3, pp. 1-27.
- BENEDICT, J. E. 1903. Descriptions of a new genus and forty-six new species of Crustacea of the Family Galatheidae, with a list of known marine species. *Proc. U.S. Nat. Mus.* **26**, pp. 243-344, text-fig. 1-47.
- CHACE, F. A., Jr. 1939. Reports on the Scientific Results of the first "Atlantis" Expedition to the West Indies, etc. Preliminary Descriptions of one New Genus and seventeen New Species of Decapod and Stomatopod Crustacea. *Mem. Soc. Cubana Hist. Nat.*, **13**, No. 1, pp. 31-54.
- 1942. Reports on the Scientific Results of the "Atlantis" Expeditions to the West Indies, under the joint auspices of the University of Havana and Harvard University. The Anomura Crustacea. 1. Galatheidea. *Torreia. Havana.* No. 11, pp. 1-106, text-fig. 1-33.
- DAM, A. J. VAN. 1933. Die Decapoden der Siboga-Expedition. VIII. Galatheidea: Chirostyliidae: Siboga-Exped., **119**, monogr. 39 a⁷, pp. 1-46, text-figs. 1-50.
- 1937. Einige neue Fundorte von Chirostyliidae. *Zool. Anz.* **120**, pp. 99-103, 1 text-fig.
- 1939. Ueber einige Uroptychus-Arten des Museums zu Kopenhagen. *Bijdr. Dierk.* **27**, pp. 392-407, text-figs. 1-5.
- 1940. Anomura, gesammelt vom Dampfer "Gier" in der Javasee. *Zool. Anz.* **129**, pp. 95-104, text-figs. 1-3.
- DOFLEIN, F. & BALSS, H. 1913. Die Galatheiden der Deutschen Tiefsee-Expedition. *Wiss. Ergebn. deutsch. Tiefsee-Exped. (Valdivia)*, bd. **20**, lf. 3, pp. 125-184, pls. 12-17.
- GILCHRIST, A. C. MC. 1905. An account of the new and some rare decapod Crustacea obtained during the surveying-seasons 1901-1904. Natural History Notes from the R.I.M.S. "Investigator". Series III. No. 6. *Ann. Mag. Nat. Hist.* (7), xv, pp. 233-268.
- HENDERSON, J. R. 1885. Diagnosis of the new Species of Galatheidea collected during the "Challenger" Expedition. *Ann. Mag. Nat. Hist.*, (5) v. 16, pp. 407-421.
- 1888. Report on the Anomura collected by H.M.S. "Challenger" during the years 1873-76. *Rep. Sci. Res. H.M.S. Challenger. Zoology*, **27** (pt. 69), pp. 1-221, pls. 1-21.
- Illustrations of the Zoology of the H.M. Indian Marine Surveying steamer "Investigator". Crustacea. Calcutta. 1892-1907, pls. 1-79.
- KEMP, S. & SEWELL, S., 1912. Notes on Decapoda in the Indian Museum. III. *Rec. Indian Mus. Calcutta.* **7**, pp. 15-32.

- LAURIE, R. D. 1926. Anomura collected by J. Stanley Gardiner in the western Indian Ocean in H.M.S. "Sealark". *Trans. Linn. Soc. Lond. Zool.*, pp. 121-167, pls. 8 and 9.
- PARISI, B. 1917. I Decapodi Giapponesi del Museo di Milano. *Atti. Soc. Ital. Nat.* vol. 56, pp. 1-24, text-figs. 1-7.
- YOKOYA, Y. 1933. On the distribution of Decapod Crustacea inhabiting the continental shelf around Japan, chiefly based upon the material collected by S.S. Sôyô-Marû, during the years 1923-1930. *Jour. Coll. of Agr. Tokyo.* 12, No. 1, pp. 226, 71 text-figs.