PYCNOGONIDA OF THE INDIAN MUSEUM.

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The collection described in this paper was entrusted to me for examination by the Director of the Zoological Survey of India, to whom my thanks are due, not only for the opportunity of studying these very interesting specimens but also for permission to retain, for the British Museum, such duplicates as were available.

With one or two exceptions, the specimens were collected on or near the coasts of British India. The only previous records of Pycnogonida from this region will be found in the writings of Wood-Mason (1873), Wood-Mason and Alcock (1891), and Carpenter (1904 and 1907), enumerated in the list of references at the end of this paper.

Seventeen species have been recognized, of which ten are described as new. There are also specimens which may represent some five additional species but they are too imperfect for exact description and are therefore recorded only under generic names. Where it has been necessary to refer to specimens in the British Museum collection, particulars of them are given in the lists of localities but are distinguished by being enclosed in square brackets.

Among the points of more general interest resulting from the study of this collection, attention may be called to the reduction of the typically tubular arthropodan exoskeleton to a framework of rods in *Pallenopsis* (*Rigona*) *alcocki* ; to the curious and unexplained papillae on the proboscis of *Anoplodactylus investigatoris* ; and to the numerous secondary diverticula of the digestive caeca in *Endeis flaccidus*.

The high proportion of new species is evidence of the imperfection of our knowledge of the tropical littoral Pycnogonida. Like many of the smaller inhabitants of the sea-bottom, the Pycnogonida are rarely to be obtained in bulk, and the laborious selection of single specimens is seldom undertaken except when the collecting is done by a specialist.

The difficulty of defining species in certain genera of Pycnogonida, to which I have elsewhere alluded (1915, p. 6), is illustrated especially by the specimens of *Ascorhynchus* and *Endeis* in this collection. In the former genus, the scantiness of the material gave an excuse for postponing consideration of the problem ; in the case of *Endeis* I am far from confident in the permanence of the grouping adopted. It is offered merely as a product of " museum taxonomy " (*cf.* Annandale, *Museums Journ.* XXI, 1922, p. 143) to be overturned perhaps, by the first observer who can study the living animals in the field. The importance of oecological observation as an aid to taxonomy, which has been strongly urged by the Director of the Zoological Survey of India, surely needs no further argument. In the case of marine animals, however, more especially if they come from much below the littoral level, the difficulties of observation forbid the hope of much help in the immediate future ; meanwhile we must do the best we can with our museum material.

List of Species.

Family Colossendeidae
Colossendeis colossea Wilson.
,, *macerrima* Wilson.
Rhopalorhynchus kroyeri Wood-Mason.
Family Eurycydidae.
Ascorhynchus latus, sp. nov.
,, sp.
,, sp.
,, sp.
Family Nymphonidae.
Nymphon andamanense, sp. nov.
Family Phoxichilidae (Pallenidae, auctt.).
Pallene pectinata, sp. nov.
,, sp.
Parapallene kempi, sp. nov.
,, *hospitalis* Loman.
Family Phoxichilidiidae.
Pallenopsis annandalei, sp. nov.
,, (*Rigona*) *alcocki*, sp. nov.
,, ,, *ovalis*, Loman.
Anoplodactylus cribellatus, sp. nov.
,, *saxatilis*, sp. nov.
,, *investigatoris*, sp. nov.
,, sp.
Family Endeidae (Phoxichilidae, auctt.).
Endeis meridionalis (Böhm).
,, *mollis* (Carpenter).
,, *flaccidus*, sp. nov.

Colossendeis colossea Wilson.

Colossendeis colossea, Wilson, 1881, p. 244, pls. i & iii ; Bouvier, 1917, p. 13, pl. i, fig. 2, pl. ii, fig. 1 (with synonymy).

C. gigas, Hoek, 1881, p. 61, pl. viii, figs. 1, 2, pl. x, figs. 1, 5 ; Wood-Mason and Alcock, 1891, p. 17 ; Loman, 1908, p. 21.

Locality.—"Andaman Sea, Lat. 13° 21′ N., Long. 93° 27′ E., 922 fathoms. Marine Survey, Stat. 114." 1 ♂

Remarks.—The specimen was identified by Wood-Mason and Alcock, who describe its phosphorescence (*l. c.*). It measures 50 mm. in total length and the third left leg measures 235 mm. The minute genital pores are visible on the last two pairs of legs. The label states that the colour in life was " red, with the ventral surface of the legs whitish."

In enumerating the occurrences of this species Bouvier has omitted Wood-Mason and Alcock's record and also that from the " Siboga " Expedition of a specimen from 1788 metres depth between the Kei and Aru Islands. Although known to range from Greenland to the Crozet Islands and from Japan to Nova Scotia, it does not appear to have been recorded (except for this specimen) from the tropical Indian Ocean.

Colossendeis macerrima Wilson.

Colossendeis macerrima, Wilson, 1881, p. 246, pls. i, fig. 2, iii, figs. 9—12, v, fg. 32 ; Bouvier, 1917, p. 10, pls. i, fig. 1, iii, figs. 1 and 2 (with synonymy).
C. leptorhynchus, Hoek, 1881, p. 64, pl. viii, figs. 3—7 ; Loman, 1908, p. 21.

Localities.—" Arabian Sea, 636 fathoms. Marine Survey." 1 sp.

" Laccadive Sea, Lat. 7° 5′ 45″ N., Long. 75° 4′ E., 719 fathoms. Marine Survey, Stat. 150." 1 sp.

" Andaman Sea, Lat. 11° 46′ 30″ N., Long. 93° 16′ E., 569 fathoms. Marine Survey, Stat. 331." 1 sp.

" Andamans, 7½ miles E. of N. Cinque I., 490 fathoms. Marine Survey." 1 sp.

" Andaman Sea, Lat. 13° 21′ N., Long. 93° 27′ E., 922 fathoms. Marine Survey, Stat. 114." 1 sp.

Remarks.—All the specimens (which appear to be males) come within the limits of the definition given by Bouvier for this species. They fall into two groups coming from distinct geographical areas and differing from each other as follows :—

Group I. Tip of proboscis distinctly more slender than the base. As in the typical *C. macerrima* the fourth segment of the palp (usually reckoned as the fifth) is longer by about two-thirds than the second (third) segment. Arabian Sea, 636—719 fathoms. (First two specimens enumerated above).

Group II. Tip of proboscis (as in the typical *C. macerrima*) equal in diameter to the base or slightly stouter. Fourth segment of palp more than twice as long as the second. Andaman Sea, 490—922 fathoms. (Specimens 3, 4 and 5 above).

The number of specimens is obviously inadequate to establish the geographical range of the two forms, but it may be noted that *C. gardineri* Carpenter, which agrees, except for its smaller size and shorter proboscis, with the specimens of group I, comes from a locality (Saya de Malha) which, although distant, is nearer to that of the first group than to that of the second.

No differences of any magnitude, other than those mentioned, can be established between the two groups, which are thus seen to divide between them the chief characters on which Schimkewitsch (1893, p. 30) relied to distinguish his variety *minor* from the typical form of the species. While I concur in the synonymy established by Bouvier (to which, I believe, *C. gardineri* Carpenter, must be added), giving the species the same extended geographical range as *C. gigas*, (see Bouvier, who, however, omits the Malayan records of Loman), it might be possible to establish the existence of distinct species, varieties or local races if one could bring together for comparison the specimens now distributed in museums almost as widely scattered as were the original habitats.

The specimen mentioned by Hoek (1881, p. 65), as intermediate between *C. gigas* and *C. leptorhynchus*, agrees very closely with Cole's account of his *C. cucurbita* (1909, p. 188) except that the proboscis is less expanded at the tip. Loman referred a specimen from the Monaco collections to Cole's species, but Bouvier finds it to be only an example of *C. macerrima* in which the proboscis is less slender than usual. Some

of the specimens mentioned above differ from the typical *C. macerrima* as widely in one direction as *C. cucurbita* does in another and their inclusion under one name suggests the absorption of *C. cucurbita* also.

Rhopalorhynchus kröyeri Wood-Mason.

(Text-fig. 1.)

Rhopalorhynchus kröyeri, Wood-Mason, 1873, p. 171, pl. xiii; Loman, 1908, p. 24, pl. xv, figs. 213—220.
Colossendeis tenuissima, Haswell, 1884, p. 1029, pl. lvi, figs. 5—8.
Rhopalorhynchus clavipes, Carpenter, 1893, p. 24, pl. ii, figs. 1—10.
R. gracillimus, Carpenter, 1907, p. 99, pl. xiii, figs. 25—32.
R. tenuissimus, Flynn, 1919, p. 71, pl. xviii, figs. 1—3.

Localities.—" Andamans, J. Wood-Mason." Reg. No. 401. Holotype, 1 ♂.

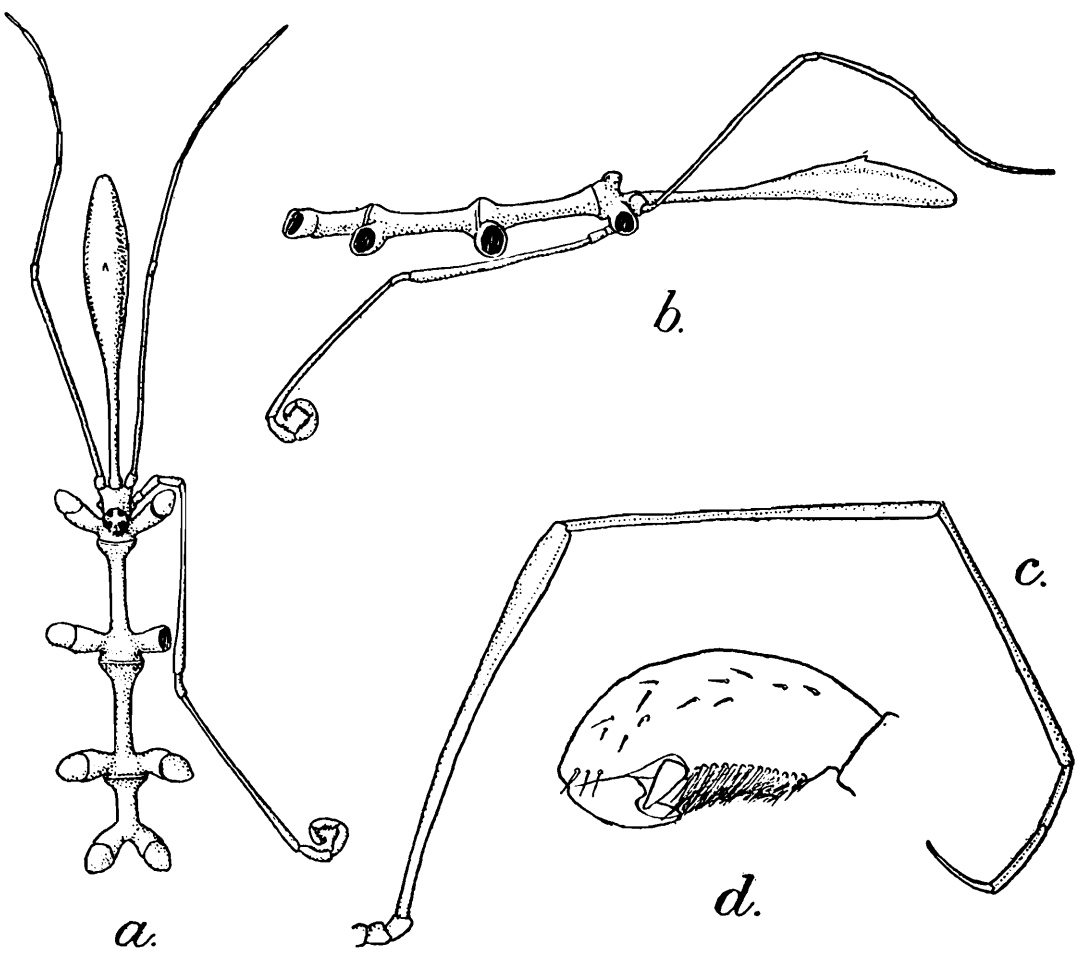

Fig. 1.—*Rhopalorhynchus kröyeri*, Wood-Mason. *a*. Dorsal view, legs omitted. *b*. Lateral view, legs omitted. *c*. Second leg of left side. *d*. Terminal segment of oviger. (*a*—*c* from the Holotype, *d* from a female from Muscat).

" N. E. of Ceylon, Lat. 8° 51′ 30″ N., Long. 81° 11′ 52″ E., 28 fathoms. Marine Survey, Stat. 175." 1 ♂.

" No History." 1 ♂, 1 ♀.

[" Between Muscat and Mutha Harbours. Major S. G. Knox, C.I.E." B. M. Reg. No. 1914. 7. 21. 6—10.]

[" Torres Straits. A. C. Haddon." Holotype of *R. clavipes*. B. M.]

[" Maldive Islands. Prof. Stanley Gardiner." Syntypes of *R. gracillimus*. B. M. Reg. No. 1908. 1. 6. 11—15.]

Notes on Holotype.—Wood-Mason describes and figures two small teeth, one behind the other, on the dorsal surface of the proboscis. The anterior tooth, however, was found on examination to be merely an adherent particle of foreign matter. It became detached on touching with a needle, leaving not the slightest scar on the surface. The holotype, therefore, agrees with all the specimens of *Rhopalorhynchus* that have been described since in having only one tooth on the proboscis.

Measurements of Holotype, in mm.

Length of proboscis	5·8
Length of trunk	6·75
Second left leg—	
Femur	8·16
First tibia	7·28
Second tibia	5·28
Tarsus	1·36
Propodus	1·6
Claw	1·56
Palp—	
Second segment	4·12
Fourth „	1·96
Fifth „	0·45
Sixth „	0·65
Seventh „	0·72
Eighth „	0·65
Ninth „	0·57

The relative lengths of tarsus and propodus vary a little in the different legs and the claw may be slightly longer than the propodus.

Remarks.—Loman, who seems to have overlooked both of Carpenter's species, regards *C. tenuissima* as without question the same as *R. kröyeri.* Flynn, who does not refer to *R. kröyeri*, has no doubt that *R. clavipes* must be regarded as a synonym of *R. tenuissimus.* I have combined these two opinions and, adding *R. gracillimus*, have placed all the described species of the genus in the synonymy of *R. krõyeri.*

The chief characters that have been relied on for discriminating the various species are the supposed presence of two teeth on the proboscis of *R. krõyeri*, the differently shaped proboscis, especially in *R. gracillimus*, and the varying lengths of the claw in proportion to the propodus of the legs. The first of these has already been shown to rest on an error. The proboscis of *R. gracillimus* is narrowly produced anteriorly and the dorsal tooth is well behind the middle of the inflated part, but almost the same outline is shown in Loman's figure (1908, pl. xv, fig. 215) of a specimen which he refers to *R. kröyeri ;* some of our specimens, notably those from Muscat, show the same character, but others are intermediate between these and the typical form. As regards the length of the claw, it varies, in our specimens, from a little longer than the propodus to less than half of its length.

Contrary to what Bouvier supposes (1913, p. 52) from Loman's figures, the interval between the bases of palps and ovigers is insignificant (see Flynn, 1919, pl. xviii, fig. 1).

In all cases the oviger has a curious subchelate termination imperfectly figured by Haswell in *R. tenuissimus* (Haswell, 1884 pl. lvi. fig. 7) which is not, as Flynn suggested (1919, p. 72) confined to the male

sex. The short terminal claw is broad and scoop-shaped and in some, perhaps in all cases, it has a deep notch on one side. It is opposed to a stout slightly curved spine.

Ascorhynchus latus, sp. nov.

(Text-figs. 2 and 3.)

Locality.—" Palk Straits, Gulf of Manaar. Marine Survey." 3 ♂.

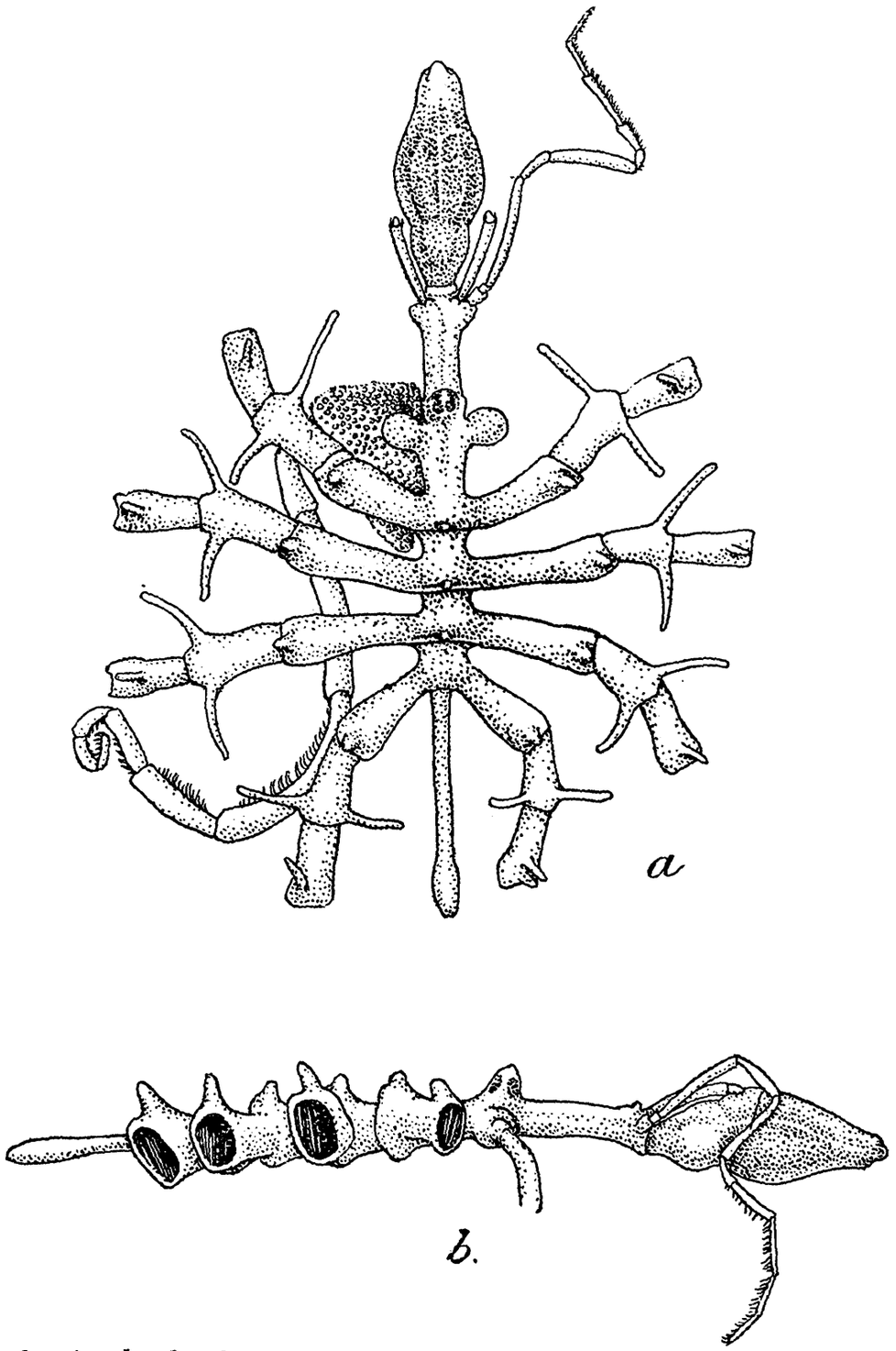

FIG. 2.—*Ascorhynchus latus*, sp. n. *a*. Male (ovigerous) dorsal view, legs omitted. *b*. Lateral view of same.

Description.—Body rather elongated, lateral processes separated by about their own diameter, width across second lateral processes eight times that measured between first and second. Cephalon (from base of proboscis to first lateral process) a little longer than rest of trunk ; interval between first lateral process and base of oviger a little less than half the distance from latter to frontal margin. Ocular tubercle set over insertion of ovigers but a little in front, rounded, eyes well marked. A blunt tubercle, little taller than wide, in middle of hind margin of

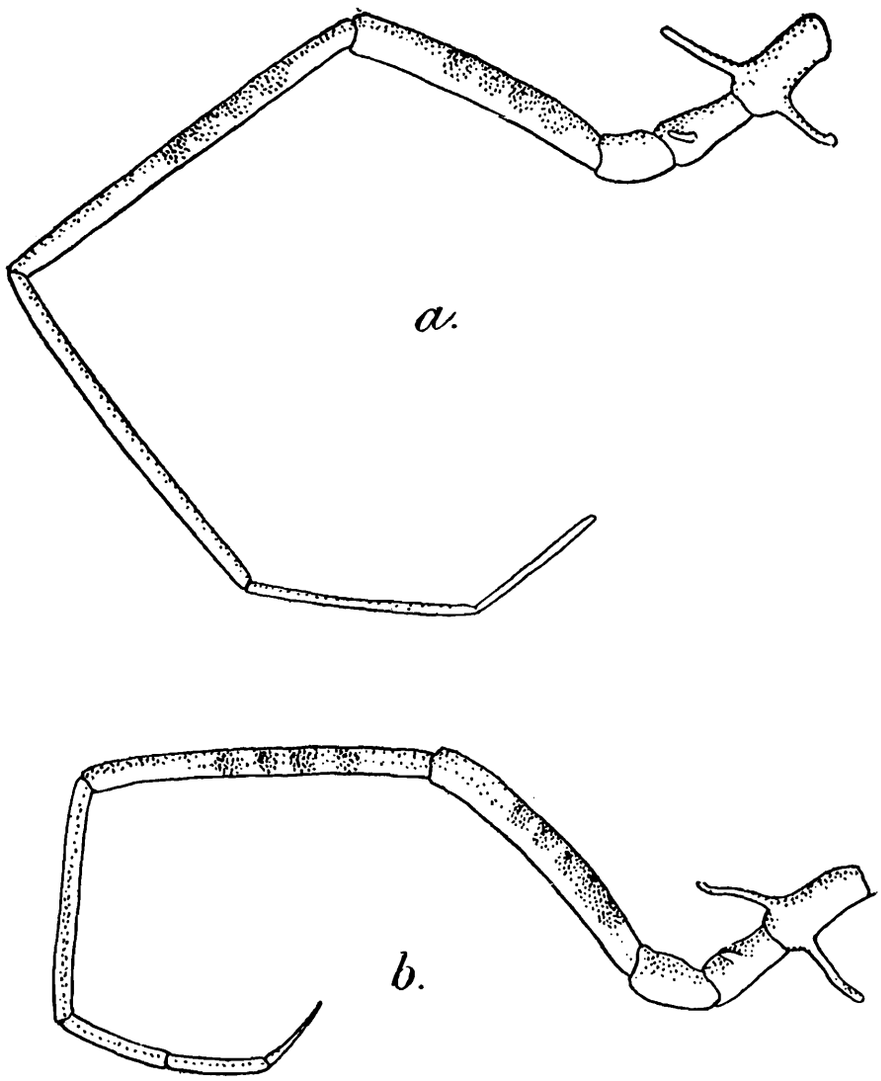

FIG. 3.—*Ascorhynchus latus*, sp. n. *a*. First leg of left side. *b*. Third leg of left side.

first three segments, a taller one on each lateral process, and a minute pair over bases of chelophores. Proboscis little more than one-fourth of total length, fusiform, bluntly pointed, with three lips not very deeply cleft, and with a constriction at less than one-third of its length from base. Abdomen slender, swollen at tip, as long as proboscis. *Chelophores* widely separated, less than $\frac{2}{5}$ths as long as proboscis, scape undivided,[1] distal segment minute and irregular. *Palps* of ten segments. *Legs* with the three coxae successively shorter, first with a pair of long

[1] In one specimen the scape of one of the chelophores is divided.

finger-like processes, second with a shorter dorsal process. First legs much longer than the others, with the second tibia, and especially the tarsus and propodus much elongated and slender and the claw absent.

Measurements, in mm.

Length of proboscis	... 2·48
Greatest diameter of proboscis	... 1·04
Length of trunk	... 4·4
Length of cephalon	... 2·36
Width across second lateral processes	... 3·44
Diameter between first and second lat. processes ...	... 0·44
Length of abdomen	... 2·4

	First Leg (left).	Second Leg (left).
First coxa	0·88	0·88
Second coxa	0·76	0·8
Third coxa	0·64	0·68
Femur	2·6	2·64
First tibia	3·88	3·28
Second tibia	3·8	2·24
Tarsus	2·28	0·96
Propodus	1·44	1·04
Claw	...	0·72

Remarks.—The species described above is clearly allied to *A. ramipes* (Böhm) (1879, p. 56) and may even prove to be identical with it, but, if Böhm's figure is to be trusted, his species has a much more dilated proboscis and much shorter lateral processes. The latter character is confirmed by Ortmann (1890, p. 161) who says that the lateral processes are "etwa gleich der doppelten Rumpfbreite." In our specimens they are about $3\frac{1}{2}$ times as long. If the synonymy given by Loman (1911, p. 6) for *A. ramipes* be accepted our specimens might well be included under the same name, but I have elsewhere (1922, p. 202) suggested that Loman has undervalued some of the distinctions between *A. ramipes* and certain of the species he identifies with it.

Ascorhynchus sp.

Locality.—" Andamans, off Ross Isd., Port Blair, 2—6 fathoms (*S. W. Kemp*)." 1 ♀.

Remarks.—The specimen (total length, 6·7 mm.) is pale and soft as if from a recent moult. The somites are contracted and partly telescoped so that measurements are untrustworthy. The scape of the chelophores is inflated. The first legs have no claw and the distal segments are much elongated, the carpus being nearly as long as the second tibia. The lateral processes are only about twice as long as the diameter of the body. The processes on the proximal segments of the legs are mere tubercles.

It seems hardly possible that this can be the female of *A. latus* but the condition of the single specimen is such that a detailed description would be of little value.

Ascorhynchus sp.

Locality.—" N. E. of Ceylon, Lat. 8° 51′ 30″ N., Long. 81° 11′ 52″ E. 28 fathoms. Marine Survey, Stat. 175." 1 ♂.

Remarks.—This specimen (total length about 9 mm.) is very imperfect. It resembles *A. tenuirostris* Carpenter (1892, p. 555) in having a finger-like process at the end of the femur and the ocular tubercle well in advance of the ovigers, but, unlike that species, it has well-marked spurs on the body and proximal segments of the legs as in *A. ramipes.*

Ascorhynchus sp.

Locality.—" Andamans, Ross Channel, 2—9 fathoms (*S. W Kemp*)." 1 sp.

" Nancowry Harbour, Nicobar Is., Marine Survey, St. 614. Surface (*Major Seymour R. Sewell*)." 1 sp.

Remarks.—These specimens (total length, 5·4 mm.) are immature, the chelophores being still perfectly chelate. They possess a claw on the first legs, the abdomen is not more than half as long as the proboscis, and the processes on the body and legs are short tubercles. In these characters it resembles *A. auchenicus* (Slater) but the ocular tubercle is more distinctly in advance of the ovigers than in the holotype of that species.

The specimen from Nancowry Harbour, which is not in good condition, differs in some details from the other. It is of interest as having been taken in the tow-net.

Nymphon andamanense, sp. nov.

(Text-fig. 4.)

Locality.—" Andamans, Marine Survey." 1 sp. (? ♂).

Description.—Body slender, neck elongated. Cephalic segment half the total length of body, including abdomen; width at base of chelophore, $2\frac{1}{2}$ times diameter of neck. Second free somite (bearing third legs) longer by one-half than the first. Lateral processes well separated, interval between first and second and that between third and fourth equal to diameter of processes, that between second and third $2\frac{1}{2}$ times that diameter; processes bearing ovigers in contact with those of first legs. Abdomen little longer than last pair of processes. Proboscis hardly more than one-third of length of cephalic segment. Ocular tubercle low, rounded, with two papillae placed side by side.

Chelophores with hand little shorter than scape, fingers less than half as long again as the palm, not very strongly curved, with slender, widely-spaced teeth.

Palps with second segment hardly longer than third, and less than half as long again as fourth or fifth.

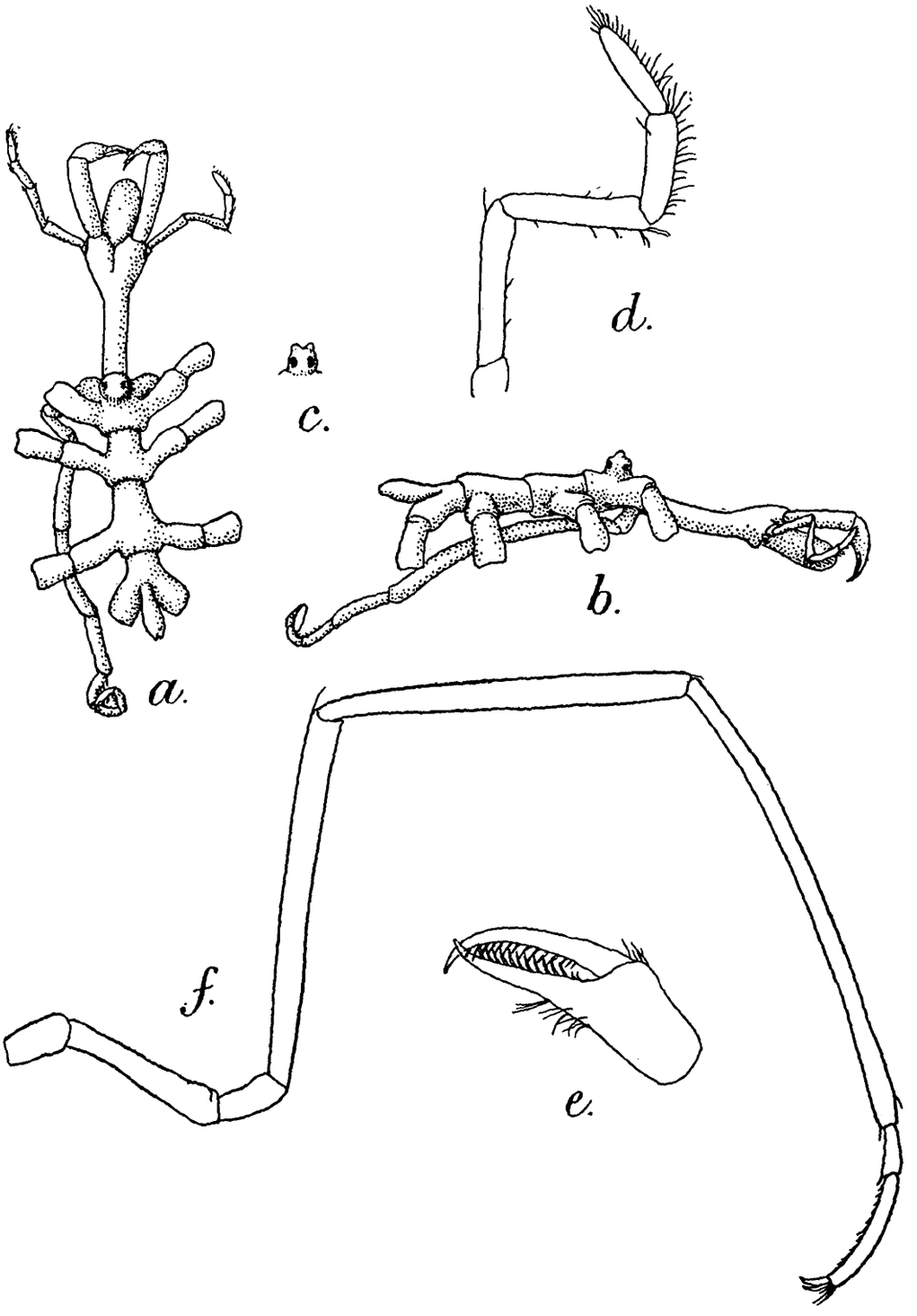

FIG. 4.—*Nymphon andamanense*, sp. n. *a*. Dorsal view, legs omitted. *b*. Lateral view. *c*. Ocular tubercle from front. *d*. Palp. *e*. Chela. *f*. Third leg of left side.

Legs slender, almost bare of setae or spines; second coxa three times as long as the first, femur a little shorter than first tibia and $\frac{3}{4}$ as long as second; propodus three times as long as tarsus and four times as long as main claw which is only a little longer than the auxiliaries.

Measurements, in mm.

Length of proboscis (above)	0·68
Length of cephalon (to base of ocular tubercle)... ...	1·4
Total length of trunk	3·28
Length of abdomen	0·52
Third right leg—	
First coxa	0·45
Second coxa	1·6
Third coxa	0·6
Femur	3·44
First tibia	3·52
Second tibia	4·4
Tarsus	0·4
Propodus	1·2
Claw	0·24

Remarks.—Among the few species of the genus *Nymphon* that have been described from tropical seas, this species would seem to approach most closely *N. maculatum* Carpenter (1910, p. 256) from the Red Sea. It differs from that species in the much shorter neck and longer proboscis, in having the first free somite much shorter than the second, the palm much longer, the fingers of the chelophores less curved, and the second tibia of the legs longer than the first.

Pallene pectinata, sp. nov.

(Text-fig. 5.)

Locality.—From tube labelled "21" without indication of locality. 1 ♂.

Description.—Body rather short, lateral processes of second and third pairs separated by less than their diameter. Cephalic segment nearly 1½ times as long as rest of trunk. Neck very short, merely a constriction in middle of cephalic segment. Abdomen very short.

Chelophores short and stout, the scape hardly more than twice as long as thick.

Legs with second coxa longer than first and third together, femur longer than first and shorter than second tibia, propodus not strongly curved, with three or four strong spines at the base; claw strongly curved, auxiliaries nearly two-thirds as long as main claw, with spiniform teeth on inner edge at the base, those of first legs with three teeth, those of third legs with one tooth.

Measurements, in mm.

Length of proboscis (below)	0·23
,, trunk	0·67
,, abdomen	0·07
Third left leg—	
First coxa	0·1
Second coxa	0·35
Third coxa	0·14
Femur	0·51
First tibia	0·48
Second tibia	0·58
Tarsus and propodus	0·28

Remarks.—Judging from the characters of the single specimen, this would seem to be a member of the genus *Pallene* in the restricted sense.

From most of the allied species it is distinguished by the abbreviation of the "neck," a character, however, subject to variation in other species. It has some resemblance in general form to *P. novae-zealandiae* Thomson (1884), but the latter (described from a solitary female) appears to have shorter claws. The most unusual feature of the present species, however, is the compound or pectinate structure of the auxiliary claws. The only Pycnogonid in which a similar structure has been described is *Pallene phantoma* Dohrn, a species differing widely from that now described in the much greater elongation of the body and especially of the "neck."

Pallene sp.

Locality.—" Pamban, Ramnad district, Gulf of Manaar. From weeds, 0—2 fathoms. February 1913 (*S. W Kemp*)." 1 ♀.

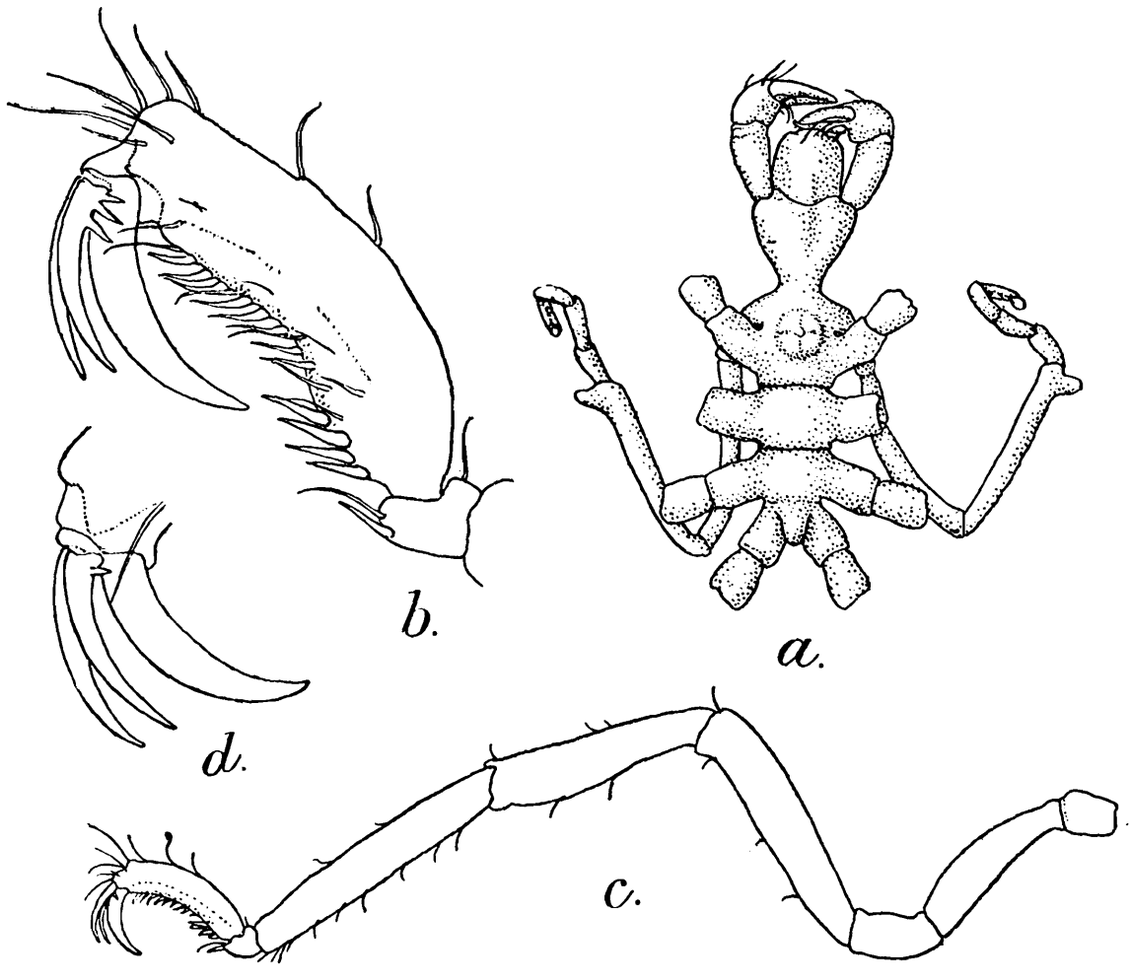

FIG. 5.—*Pallene pectinata*, sp. n. Male. *a.* Dorsal view, legs omitted. *b.* Propodus of first leg, left side. *c.* Third leg of left side. *d.* Claws of third leg.

Remarks.—This specimen (total length 1·12 mm.) resembles *P. producta* Sars, in the elongated body and " neck " but it appears to differ in having the proboscis and chelophores even shorter than in that species. There is a distinct prominence on the ventral side of the dilated femora which may prove to be a specific character. In the absence of any striking peculiarities it appears inadvisable to attempt to define a new species from this solitary specimen.

Parapallene kempi, sp. nov.

(Text-fig. 6.)

Localities.—" Orissa coast, December, 1888." 1 ♀.

" Kilakarai, Ramnad district, Gulf of Manaar. From weeds, 0—2 fathoms. February, 1913 (*S. W Kemp*)," 2 ♂ and 3 ♀.

" Waltair, Madras Presidency, Stat. 3. January, 1921. (*S. W. Kemp*)." 4 ♀, 1 ♂, 1 yg.

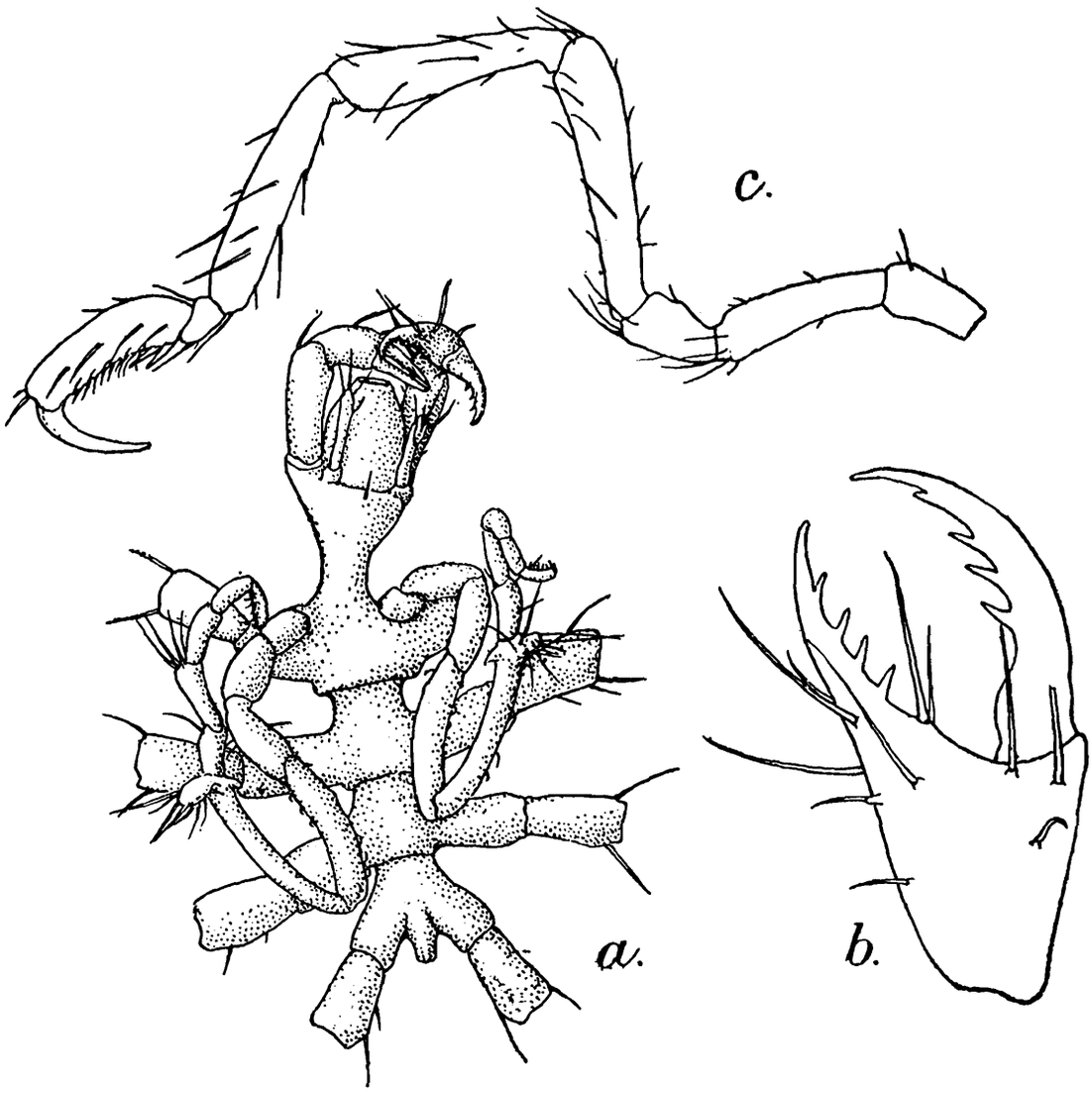

FIG. 6.—*Parapallene kempi*, sp. n. Male. *a*. Ventral view, legs omitted. *b*. Chela. *c*. Third leg of right side.

Description.—*Body* completely segmented, elongated, the lateral processes separated by about their own diameter. Cephalic segment more than half the length of trunk, neck constricted to $\frac{1}{2}$ or $\frac{1}{3}$ of diameter of anterior part. Ocular tubercle low, broadly rounded, with a small, partly sunken tubercle on each side above the eyes. Proboscis about half as long as cephalic segment, a little constricted just above the base, distal half conical, truncated, with projecting finely setose lips. Abdomen very short, cylindrical, expanded at the base where it is wedged in between the last pair of lateral processes.

Chelophores stout, scape a little longer than proboscis, palm shorter than fingers which are strongly curved and armed with a few long widely-spaced teeth.

Palps of male shorter than proboscis, of two segments, the basal one very short, the distal about six times as long, slightly clavate, with a few long setae.

Ovigers of male of 10 segments, the fifth the longest; fourth and fifth with a few curved hooks, distal lobe of fifth with a tuft of strong setae; distal segments with lanceolate, acute, strongly serrate spines with one or two pairs of the basal serrations enlarged; no terminal claw. Ovigers of female shorter, fourth segment the longest, without curved hooks on fourth and fifth.

Legs with second coxa about twice as long as first or third, femur a little longer than first or second tibia; propodus with two strong spines proximally, no auxiliary claws.

Measurements, in mm.

	Male.	Female.
Length of proboscis (below)	0·26	0·33
„ trunk	1·2	1·25
„ abdomen	0·1	0·12
„ scape of chelophore	0·32	0·35
Third left leg—		
First coxa	0·25	0·25
Second coxa	0·43	0·43
Third coxa	0·19	0·2
Femur	0·67	0·8
First tibia	0·59	0·68
Second tibia	0·58	0·75
Tarsus and propodus	0·5	0·5
Diameter of eggs carried by male	0·2	

Remarks.—This species agrees in general with Böhm's brief description of his *Pallene longiceps* from Japan, especially in having palps of two segments not reaching to the end of the rostrum and in the long curved fingers of the chelae with widely separated teeth; but Böhm described the body as shortened, with narrow intervals between the lateral processes, the abdomen as oval, and the three coxal segments of the legs as short. The size of the Japanese specimens is also much greater than that of the Indian examples. Ortmann figures a female from Sagami Bay which shows all these differences from the form here described and in addition has the second tibia only half as long as the first and the propodus very long and slender.

Parapallene hospitalis Loman.

Parapallene hospitalis, Loman, 1908, p. 45, pl. viii, figs. 102—111.

Locality.—From tube labelled "No history. No locality." 2 specimens.

Remarks.—The specimens are in very bad condition but so far as can be seen they agree with Loman's account of this species except in the following particulars :—

There is no constriction of the neck immediately in front of the first lateral processes.

The proportions of the body are slightly different from Loman's description, which, however, does not agree altogether with his figures.

The proximal spines of the propodus are distinctly enlarged.

The chelae, seen from the dorsal side in their natural position, have the movable finger on the inner side, as in Loman's fig. 110, not as in his fig. 109.

This species differs widely in important characters from the last and its retention in the same genus can only be provisional. Loman's delimitation of the genus *Parapallene* is apparently not altogether satisfactory even to himself. It may be worth pointing out, therefore, that this species recalls, in the outline of the proboscis and the form of the chelophores, some of the Antarctic species for which Hodgson (1914, p. 161) established the genus *Austropallene*. It differs from them chiefly in having a large claw on the oviger and no spurs over the bases of the chelophores.

Pallenopsis annandalei, sp. nov.

(Text-figs. 7 and 8.)

Locality.—"Laccadive Sea, Lat. 13° 47′ 49″ N., Long. 73° 7′ E., 636 fathoms. Marine Survey, Stat. 177." 1 ♂

Description.—*Body* fully segmented, elongated, the lateral processes separated by about their own diameter. Cephalon widened in front. Proboscis half as long as trunk, not wider at tip than in middle. Ocular tubercle low, rounded, recumbent; eyes small, pigmented but indistinct. Abdomen long, clavate, more than half as long again as last pair of lateral processes.

Chelophores slender, scape with two segments, the first nearly as long as proboscis and twice as long as second. Fingers longer than palm, slender, curved, gaping when closed.

Palp represented by a low rounded papilla.

Oviger with ten distinct segments.

Legs long and slender, the first four segments without conspicuous setae, the femur and second tibia with numerous long soft hairs partly set in a row along the lateral line and partly scattered over the dorsal surface. The femur is longer than the first and shorter than the second tibia. The length of the curved femoral gland-tube is about half the diameter of the segment.

Male genital openings on low rounded prominences on the last two pairs of legs. Auxiliary claws very small, less than one-fourth of length of main claw.

Measurements of Holotype (male) in mm.

Length of proboscis	3·6
„ of trunk	7·0
„ of abdomen	3·75
„ of first segment of chelophore	3·4
„ of second segment of chelophore	1·8
Third left leg—	
First coxa	1·5
Second coxa	5·5
Third coxa	2·5
Femur	17·4
First tibia	16·75
Second tibia	21·25
Tarsus and propodus	3·2

Remarks.—Loman (1916, p. 15) has given a synopsis of 33 species which he recognizes in the genus *Pallenopsis* (including *Rynona*). Among these a considerable number agree with the form now described in having

the segmentation of the body and of the chelophore scape distinct and eyes and auxiliary claws present. The species of this group are distin-

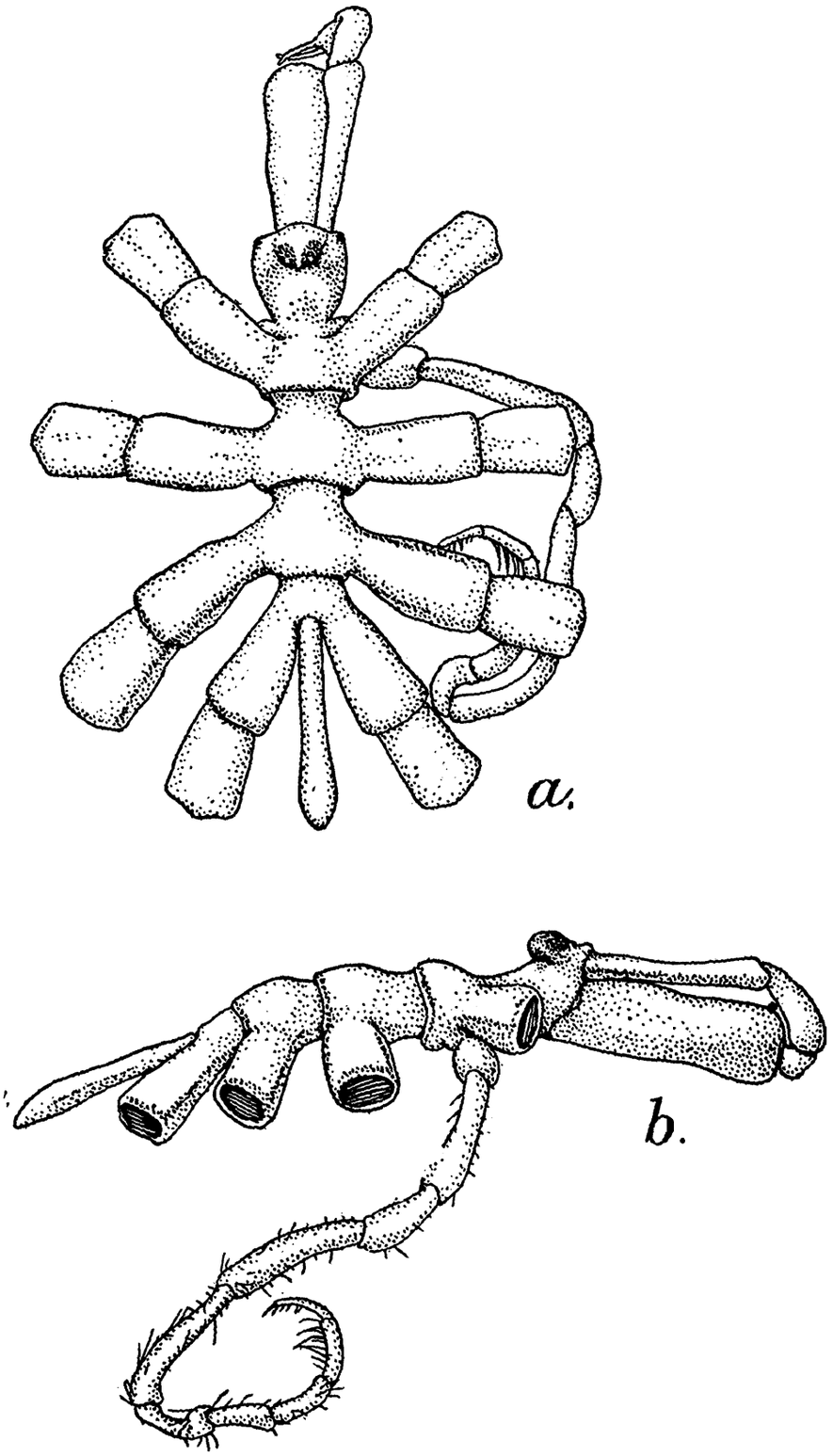

Fig. 7.—*Pallenopsis annandalei*, sp. n. Male. *a*. Dorsal view, legs omitted. *b*. Lateral view.

guished from each other by relatively small characters, some of which may be tabulated as follows :—

A. Body and legs with numerous long hairs ... ...*P. pilosa* (Hoek).
P. villosa Hodgson.
P. lanata Hodgson.

B. Long hairs, if present, restricted to tibiae of legs.—
a. Fingers of chelophores shorter than palm, broad, meeting when closed ... ...*P. forficifer* Wilson.
P. patagonica (Hoek).
P. glabra Hodgson.
P. johnstoniana (White).

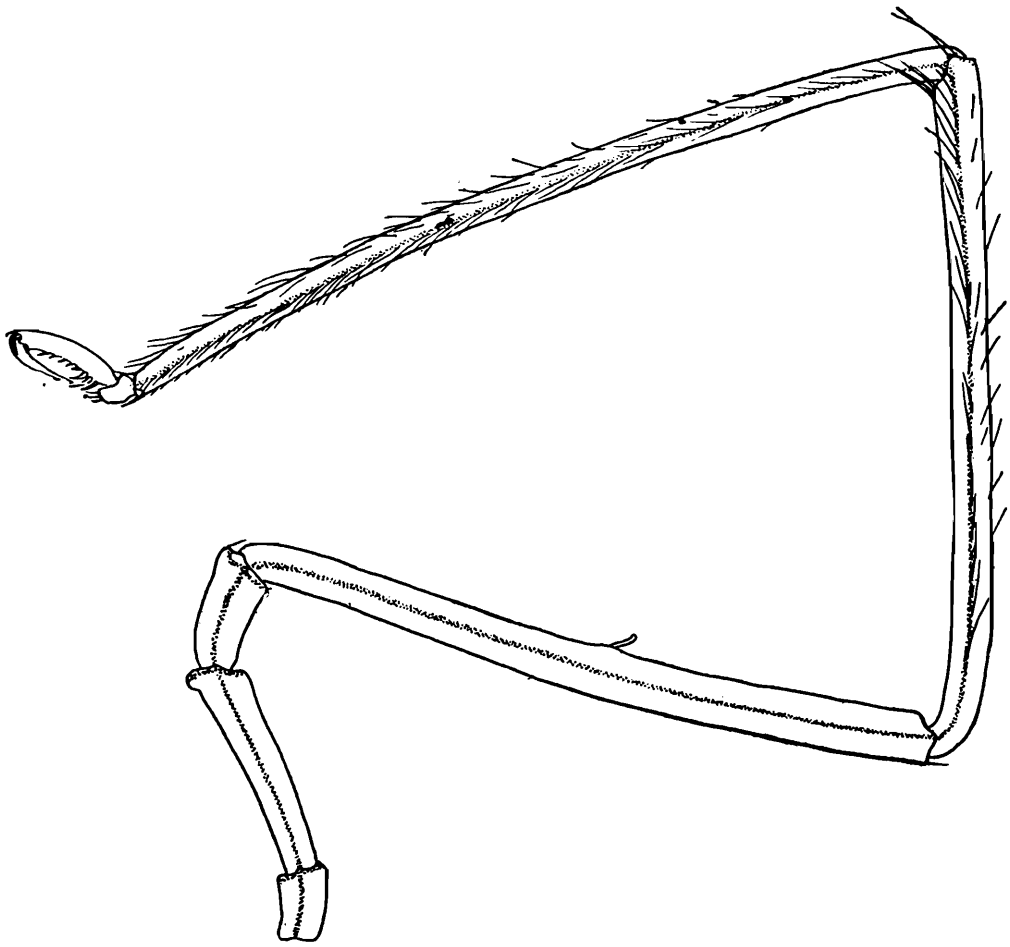

FIG. 8.—*Pallenopsis annandalei*, sp. n. Third leg of left side.

b. Fingers of chelophores equal to or longer than palm, slender, gaping when closed.—
a[1] Proboscis widest at tip ... ...*P. oscitans* (Hoek).
P. plumipes Meinert.

b[1]. Proboscis not widest at tip—.
a[2]. Proboscis as long as scape of chelophores or nearly so ; second segment of scape at least ⅔rds as long as first ... ...*P. longirostris* Wilson.
P. tritonis (Hoek). (incl. *P. holti* Carpenter.)
P. mollissima (Hoek).
P. californica Schimkewitsch.

b[2]. Proboscis hardly longer than first segment of scape which is twice as long as second ... ...*P. annandalei*, sp. nov.

Pallenopsis (Rigona) alcocki, sp. nov.

(Text-figs. 9 and 10.)

Locality.—" Andaman Sea, Lat. 14° 38′ 15″ N., Long. 96° 24′ 30″ E. 53 fathoms. Stat. 225, Marine Survey." 16 specimens.

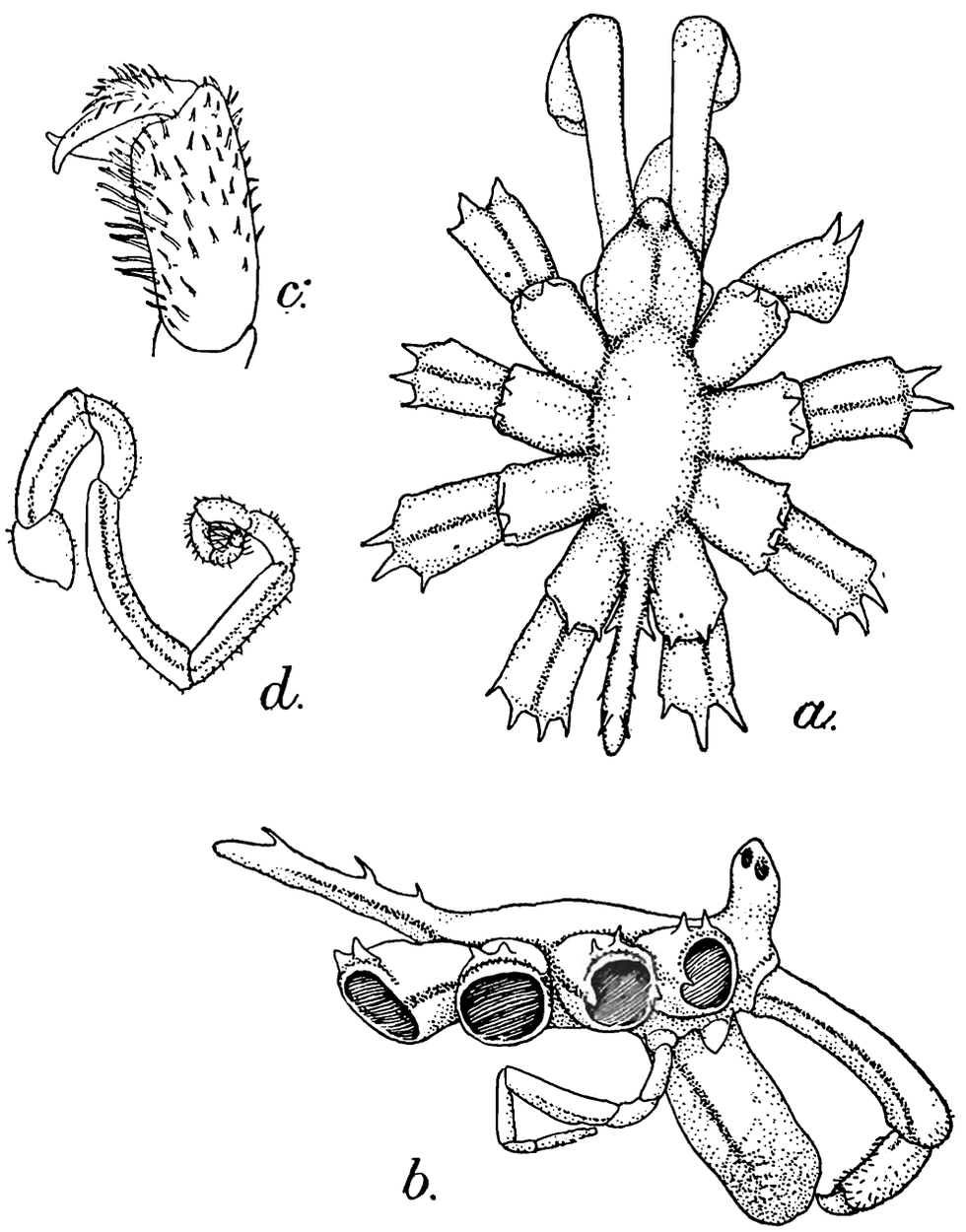

Fig. 9.—*Pallenopsis* (*Rigona*) *alcocki*, sp. n. Female. *a*. Dorsal view, legs omitted. *b*. Lateral view. c. Chela. *d*. Oviger of Male.

Description.—*Body* unsegmented, short, the lateral processes in contact at their bases. Separating the lateral processes from the body on dorsal and ventral surfaces is a dark-brown line or rod-like thickening of the chitin forming an elliptical frame within which the integument remains thin, transparent and almost membranous, so that the internal organs are clearly visible. Opposite each junction of successive lateral processes the dorsal frame is produced inwards in a short point and these points are connected across the membrane of the dorsal surface by faint intersegmental grooves. Anteriorly the dorsal frame runs out

into a median rod and a pair of lateral ones on the cephalon and laterally it is connected with the strongly marked system of " lateral lines " on the legs. On the distal part of the proboscis the median rod of each of the three antimeres breaks up into a less distinct network of chitinous thickenings. Cephalon rather more than half as long as remainder of trunk (without abdomen). Ocular tubercle tall, with pointed apex directed a little backward; eyes large, posterior pair higher than anterior. Abdomen nearly as long as middle part of trunk, with spine-tipped tubercles, not quite symmetrical, on dorsal and lateral surfaces.

Chelophores with slender scape showing no trace of jointing; palm more than twice as long as wide, spinose; movable finger with a spinose cushion for more than half its length.

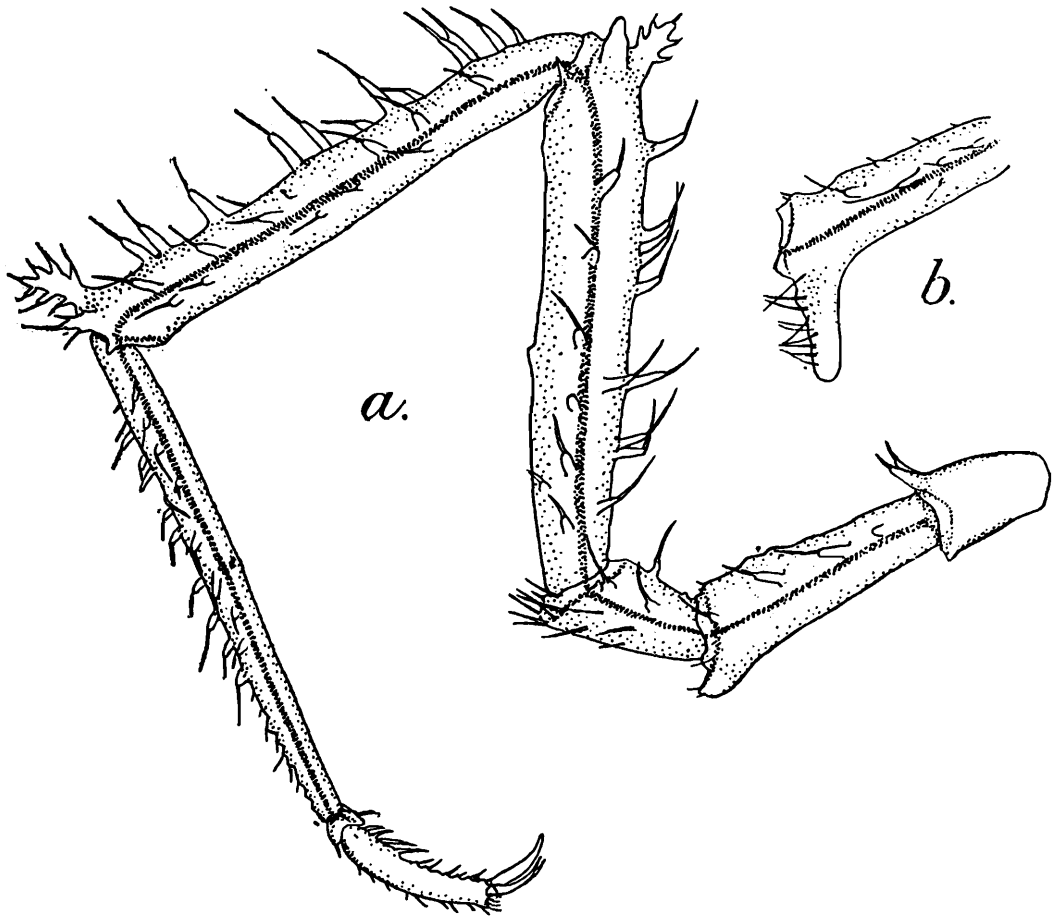

FIG. 10.—*Pallenopsis* (*Rigona*) *alcocki*, sp. n. *a*. Third left leg of female. *b*. Second coxa of last leg of male.

Palp represented by a conical papilla.

Oviger of male with ten distinct segments; that of female with last four segments coalesced.

Legs beset dorsally, from first coxa to second tibia, with finger-like processes each bearing a long apical spine. These processes are tallest and most numerous on femur and first tibia. The distal end of first coxa, femur and first tibia bears in each case five tubercles, of which three on the femur and first tibia become long processes, the median one bearing secondary spine-tipped tubercles. The first tibia is longer than the femur but shorter than the second tibia. In the male, the gland-tube on the ventral edge of the femur is longer than half the diameter of the

segment. The genital openings of the female are on short processes of the second coxa of all the legs ; those of the male on long processes on those of the last two pairs. The auxiliary claws are about two-thirds of the length of the main claw.

Measurements of holotype (female), in mm.

Length of trunk	3·92
„ abdomen	2·2
„ scape of chelophore	2·52
Third left leg :—	
First coxa	1·12
Second coxa	2·88
Third coxa	1·6
Femur	5·68
First tibia	6·0
Second tibia	7·6
Tarsus and propodus	1·76

Remarks.—Among the species of *Pallenopsis* enumerated by Loman that now described approximates to *P. crosslandi* Carpenter (1910, p. 257) by the finger-like spine-bearing processes with which the legs are armed. From *P. crosslandi* it differs in having these processes not restricted to the first tibia, the segmentation of the body completely obscured, the scape of the chelophores undivided, the female genital openings elevated on prominences and the auxiliaries distinctly shorter than the main claw.

The condition of the exoskeleton in this species is interesting and represents an advanced stage in a process that can be traced, more or less distinctly, in other species of the subgenus *Rigona*. This is the replacement of the system of supporting tubes which constitutes the exoskeleton of ordinary Arthropods by a framework of rods, a " skeleton " in the more popular sense of the word. The process has gone furthest in the case of the trunk and proximal segments of the legs, where the membrane filling the interspaces of the framework is very thin and soft. The distal segments of the legs retain the more usual condition in the stiffness of the whole exoskeletal tube.

Pallenopsis (Rigona) ovalis Loman.

(Text-fig. 11.)

Pallenopsis (Rigona) ovalis, Loman, 1908, p. 68, pl. x, figs. 137—138.

Locality.—" Andamans, off Ross Id., Port Blair, 2-9 fathoms. (*S. W Kemp.*)" 2 ♀

" N. Cheval Paar, Ceylon, (*T. Southwell*)." 1 ♂.

Measurements, in mm.

Length of trunk	2·8
Third leg :—	
First coxa	0·75
Second coxa	1·6
Third coxa	1·1
Femur	3·6
First tibia	3·7
Second tibia	4·27
Tarsus and propodus	1·5

Remarks.—The measurements and drawings here given are taken from the larger of the two specimens, which is a little smaller and, judging from the shortness of the ovigers, less mature than Loman's type. The agreement with Loman's account is fairly close except in the following points. The trace of a longitudinal division of the cephalon observed by Loman is due to the presence of a median rib of chitin like that described above in *P. alcocki*. The anterior eyes are hardly larger than the hinder pair. The abdomen is not directed straight backwards but is strongly elevated. In the legs, the third coxa is distinctly longer

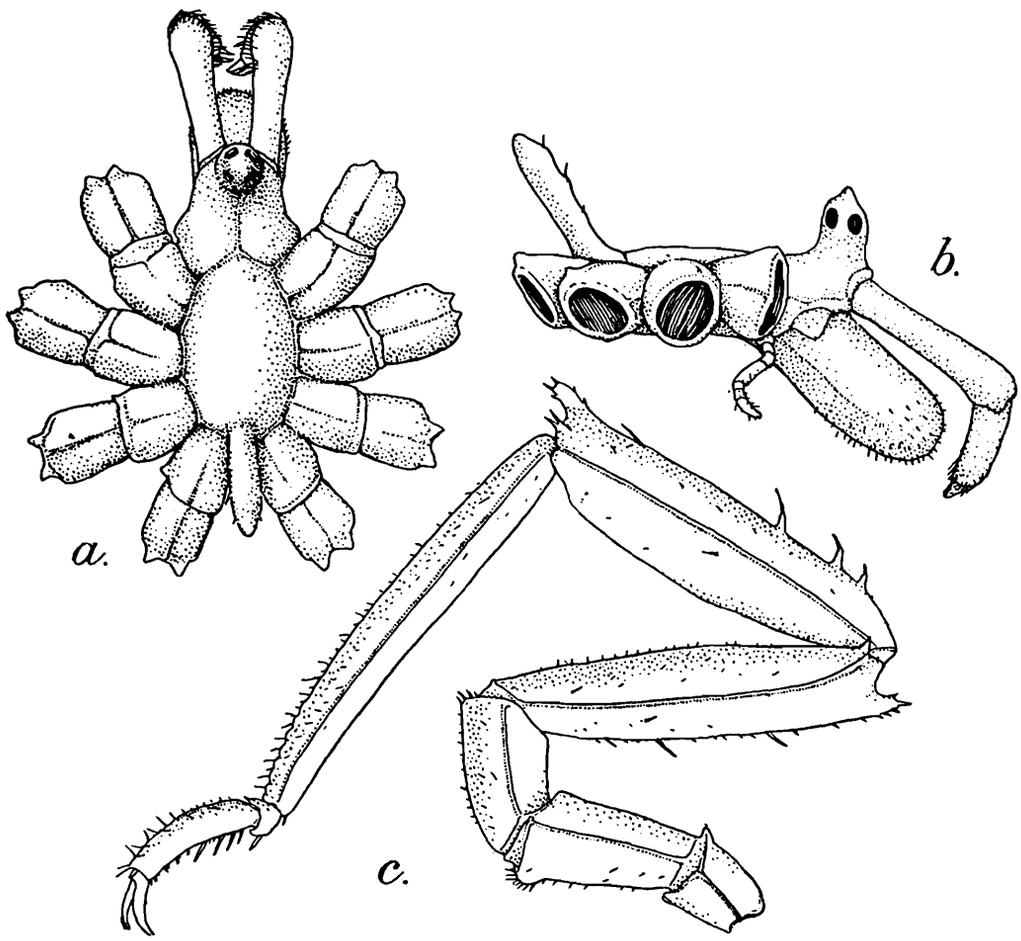

FIG. 11.—*Pallenopsis* (*Rigona*) *ovalis*, Loman, Female. *a*. Dorsal view, legs omitted. *b*. Lateral view. *c*. Third left leg.

than the first ; the femur and first tibia have each five processes distally, although only the median dorsal one is large and conspicuous ; the second tibia is distinctly longer than the first.

Anoplodactylus cribellatus, sp. nov.

(Text-fig. 12.)

Locality.—" Andamans, off Ross Id., Port Blair, 2-9 fathoms. (*S. W Kemp.*)" 2 ♂.

" Andamans, Marine Survey." 1 ♂.

Description.—*Body* elongated, the lateral processes separated by more than their diameter, last two somites coalesced. Neck of cephalon arrowed in the middle. Ocular tubercle vertical, pointed. Proboscis

dilated in its proximal fourth, then cylindrical. Abdomen as long as last pair of lateral processes, directed obliquely upwards.

Chelophores slender, scape distinctly longer than cephalic segment.

Legs slender, second coxa longer than first and third together, femur and first and second tibiae successively diminishing in length. Propodus with marked basal projection bearing two large unpaired spines followed by one pair and a series of rather slender spines extending nearly to base of claw, where there is a very short lamina. Claw long and slender, auxiliaries minute. Second coxa of last legs ending below in a short pointed process, that of penultimate legs without process; in neither case could the genital apertures be clearly seen. Femora of all legs with a series of about 15 cribriform gland-openings on dorsal surface.

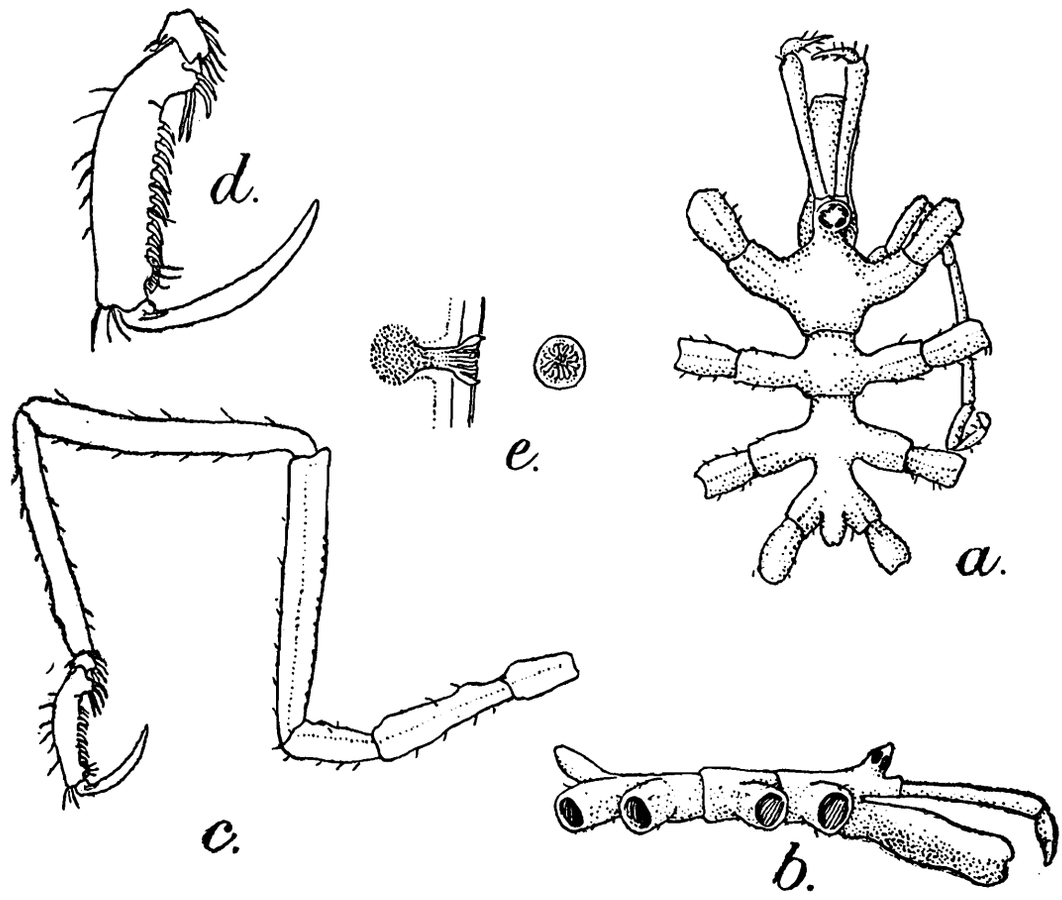

FIG. 12.—*Anoplodactylus cribellatus*, sp. n. Male. *a*. Dorsal view, legs omitted. *b*. Lateral view. *c*. Third leg of left side. *d*. Propodus of third leg. *e*. Optical section and surface view of "sieve-plate" opening of femoral gland.

Measurements, in mm.

Length of proboscis (below)	1·1
„ trunk	1·48
„ abdomen	0·24
„ scape of chelophore	0·75
Third left leg :—	
First coxa	0·3
Second coxa	0·75
Third coxa	0·4
Femur	1·33
First tibia	1·25
Second tibia	1·1
Tarsus and propodus	0·7

Remarks.—Most of the species of *Anoplodactylus* of which the males have been described differ from those of *Phoxichilidium* in that the femoral cement glands open by a single tubular orifice on the dorsal surface of the femur, whereas in *Phoxichilidium* there are numerous openings not produced into tubes. Loman states (1908, p. 18) that *A. oculatus* Carpenter is the only species forming an exception to this rule, overlooking the fact that the *Phox. angulatum* of Dohrn, which Loman transfers to *Anoplodactylus*, also possesses glands of the *Phoxichilidium*-type. The species here described resembles in many details Carpenter's *A. oculatus* which, however, differs in having the ocular tubercle very tall and acutely pointed, the legs more spiny, with a distinct process at the end of the femur and the two tibiae subequal. The femoral gland-openings are described by Carpenter simply as "cupshaped" but from his figure they appear to be, as in the present species, circular sieve-plates with a raised rim, each giving exit to a bundle of ducts.

Anoplodactylus saxatilis, sp. nov.

(Text-fig. 13.)

Locality.—"Marble Rocks, Mergui Archipelago. 27th March, 1887. Marine Survey." 1 ♂.

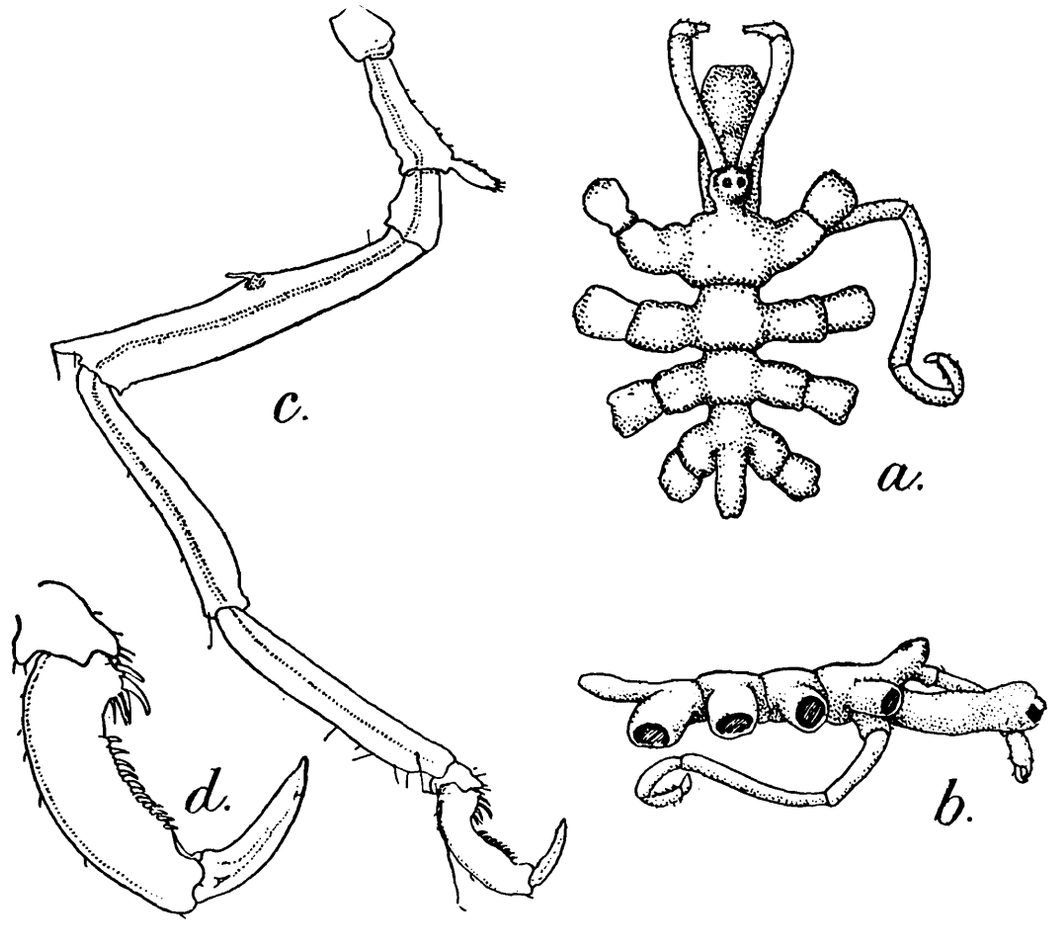

FIG. 13.—*Anoplodactylus saxatilis,* sp. n. Male. *a.* Dorsal view, legs omitted. *b.* Lateral view. *c.* Third leg of left side. *d.* Propodus of third leg.

Description.—Body rather stout, the lateral processes separated by about half their diameter. Neck of cephalon slightly constricted.

Ocular tubercle low, pointed. Proboscis cylindrical, slightly recurved. Abdomen longer than last pair of lateral processes, slightly elevated.

Chelophores slender, scape as long as cephalic segment.

Legs moderately slender, second coxa hardly longer than first and third together. Femur longer than the equal tibiae, with a prominent distal spine-tipped process and a dorsal gland-tube shorter than the width of the segment. Propodus with prominent basal projection bearing two unpaired spines, distal portion of ventral edge with a close-set row of spines and without lamina. Claw short and stout, auxiliaries very minute. Second coxa of last two pairs produced distally into a genital process, constricted at the base and more than one-third as long as the segment.

Measurements, in mm.

Length of proboscis (below)	1·15
,, trunk	1·65
,, abdomen	0·45
,, scape of chelophore	0·85
Third left leg :—	
First coxa	0·35
Second coxa	0·9
Third coxa	0·47
Femur	1·92
First tibia	1·72
Second tibia	1·72
Tarsus and propodus	0·96

Remarks.—The only species of *Anoplodactylus* known to have the male genital processes as long as those described above is *A. versluysi* Loman (1908, p. 73), in which, however, the body is greatly elongated, the lateral processes being separated by three or four times their diameter. Among the species of which only females have been described, this form would appear to resemble most closely *A. digitatus* Böhm (redescribed by Loman, 1908, p. 74), but that species is stated to have no auxiliary claws.

Anoplodactylus investigatoris, sp. nov.

(Text-fig. 14.)

Localities.—" Madras. Outside harbour, along eastern wall. *S. W. Kemp.*" 1 ♀.

" Marine Survey. No locality." In tube, together with some unrecognizable fragments, labelled " *Pallene investigatoris*, n. sp." 1 ♀.

Description (from Madras specimen).—*Body* short, the lateral processes separated by about half their diameter, segmentation distinct. Neck of cephalon narrowed in middle. Ocular tubercle inclined forwards, pointed. Proboscis cylindrical, slightly recurved, with a group of four papillae on the ventral surface about one-third of its length from the base ; the hinder pair of papillae larger than those in front, all of them inclined forwards. Abdomen as long as last pair of lateral processes, directed obliquely upwards.

Chelophores moderately slender, scape longer than cephalic segment.

Legs with second coxa equal to first and third together. Femur longer than the equal tibiae. Propodus strongly curved at base with

three unpaired spines, distal part of ventral edge with a close-set row of stout curved spines without a lamina. Auxiliary claws very minute. A short rounded genital prominence on the second coxae of all the legs, that on the last pair not more than $\frac{1}{5}$th of the length of the segment.

The specimen from an unknown locality mentioned above differs from that just described in the somewhat greater elongation of the body, of which the lateral processes are separated by about their own diameter; also in having the tubercles on the proboscis less prominent and placed a little further forward, the anterior pair about the middle of the length of the proboscis.

Measurements of Madras specimen, in mm.

Length of proboscis (below)	1·35
„ trunk	1·8
„ abdomen	0·33
„ scape of chelophore	1·0
Third left leg :—	
First coxa	0·3
Second coxa	0·9
Third coxa	0·45
Femur	2·12
First tibia	1·8
Second tibia	1·8
Tarsus and propodus	1·0

Remarks.—I do not know of any Pycnogonid having a structure of the proboscis comparable to that described above. The four tubercles have, at first sight, the appearance of embryonic limb-buds, and one might even be tempted for a moment to suppose that they represented rudiments of palps and ovigers. This, however, is out of the question, since the proboscis, whatever its morphological nature may be, is not a somite. No opening could be detected on the papillae, the integument on which appears to resemble exactly that of the adjacent surface of the proboscis, and no gland could be discovered internally.

Anoplodactylus sp.

Locality.—" Yé, Burma. 27th March, 1887 Marine Survey." 1 ♀.

Remarks.—This specimen (1·23 mm. in length of trunk) resembles rather closely certain forms of *A. petiolatus* (Kr.) but differs in the following characters :—(1) there are no tubercles on the lateral processes; (2) the ocular tubercle is very tall, exceeding in length the neck or anterior process of cephalon which carries it; (3) the " knife-edge " occupies more than half the ventral edge of the propodus.

Schimkewitsch (1889, p. 343) has recorded *A. petiolatus* (under the name of *P. longicolle* Dohrn) from the West Coast of Patagonia (Lat. 45°S.). In view of the extent of variation implied in the synonymy which Norman (1908, p. 202) gives for this species, I hesitate, on the evidence of a single specimen, either to extend the range of *A. petiolatus* to Burma or to establish a new and very closely-allied species.

Genus **Endeis** Philippi.

Calman, 1915, p. 48.
= *Phoxichilus*, auctt. plur.

Species of *Endeis* appear to be among the commonest Pycnogonida in shallow water and between tide-marks on the coasts of India. Ten lots of specimens are in the Indian Museum collection and I have also examined a large gathering from Christmas Island and the single specimen of *E. mollis* recorded by Carpenter from the Maldive Is. These specimens can be sorted with comparative ease into three groups which are here designated as species but which differ, for the most part, only in the degree of development of the spines on the body and legs. Other characters, such as the relative proportions of the proboscis and body, the distance between the lateral processes, and the form and armature of the foot, vary a good deal without affording a basis for specific separation.

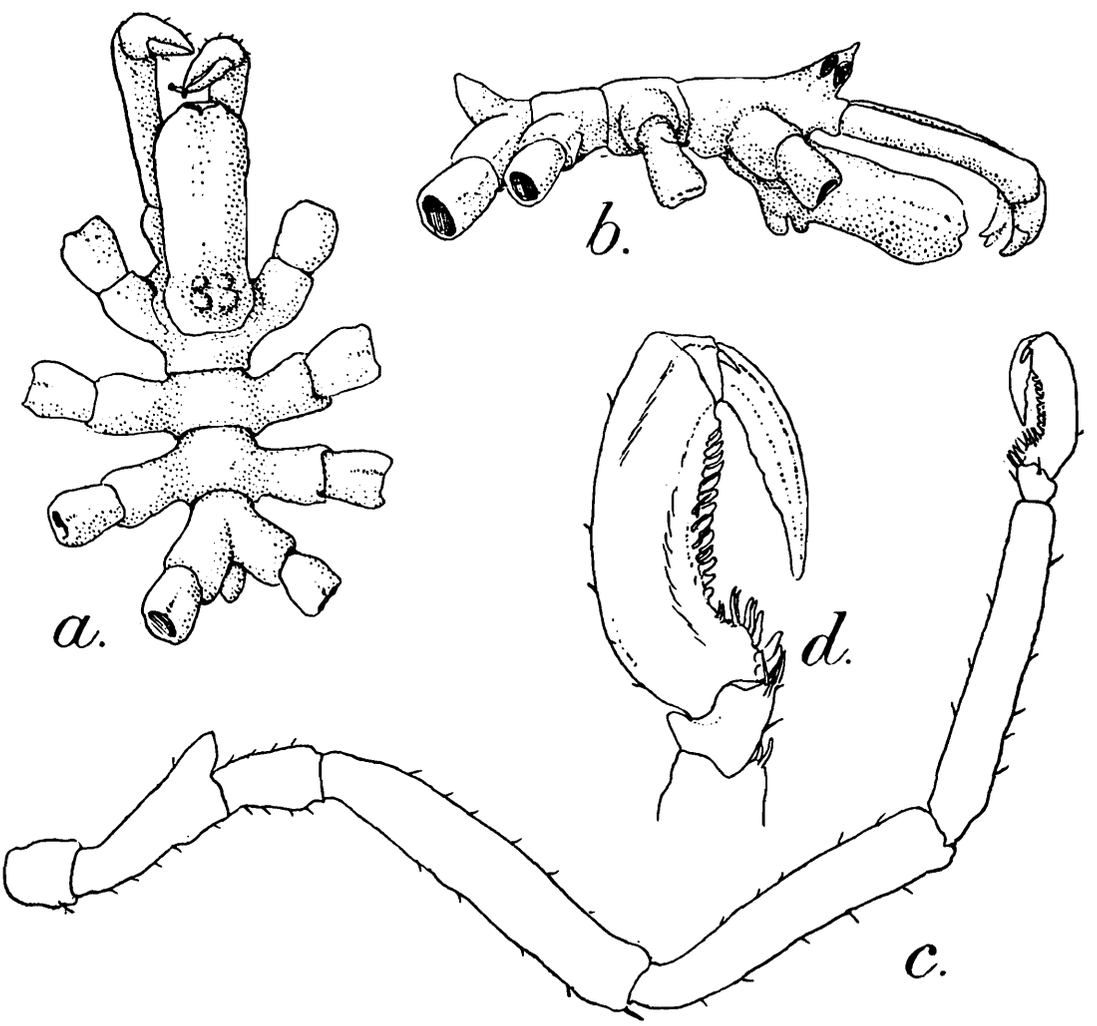

Fig. 14.—*Anoplodactylus investigatoris*, sp. n. Female. *a*. Ventral view, legs omitted. *b*. Lateral view. *c*. Third leg of left side. *d*. Propodus of third leg.

In all the species here considered, as in the European *E. spinosus* (Montagu) and *E. charybdaeus* (Dohrn), the base of the proboscis is encircled by a collar which is most prominent on the dorsal side. Two curved grooves, probably always present although sometimes hard to see, mark off from this collar a pair of dorso-lateral lobes, within each of which a more transparent area appears to indicate the "excretory organ" described by Dohrn as corresponding to the missing palp.

Behind the collar a pair of papillae can be detected, representing, according to Dohrn, the vestigial chelophores. The structures which Loman figures (1908, pl. xi, figures 151 and 154) as vestigial chelophores in *E. procerus* and *E. meridionalis* are, apparently, the lateral lobes of the collar.

The antarctic *E. australis* (Hodgson) is distinguished by the absence of the collar (Calman, 1915, p. 49, fig. 11) as well as by the presence of eight instead of seven segments in the oviger (Bouvier, 1913, p. 119, fig. 74). In the latter character, but not, apparently, in the former, it agrees with *E. clypeatus* (Möbius). The remaining species of the genus are only to be discriminated by trivial and variable characters and it is not surprising that Carpenter (1904, p. 182) even doubted whether it would be possible to maintain specific distinctions within the genus.

Bouvier (1917, p. 31) points out that *E. charybdaeus* (Dohrn) differs from *E. spinosus* (Montagu) and agrees with *E. meridionalis* (Böhm) in having the second tibia longer than the femur. In this particular nearly all the Indian specimens agree with *E. meridionalis*. They agree also with *E. mollis* (Carpenter) in having the penultimate segment of the oviger expanded laterally, although the expansion is not quite so marked as it appears in Carpenter's figure.

Endeis meridionalis (Böhm).

(Text-fig. 15.)

Phoxichilus meridionalis, Böhm, 1879, p. 189, pl. ii, figs. 4—4*b*; Loman, 1908, p. 78, pl. xi, figs. 153—155.

Localities.—" Madras. On buoys and in net hauled in harbour, close to eastern end. (*S. W Kemp*)." 1 ♀.

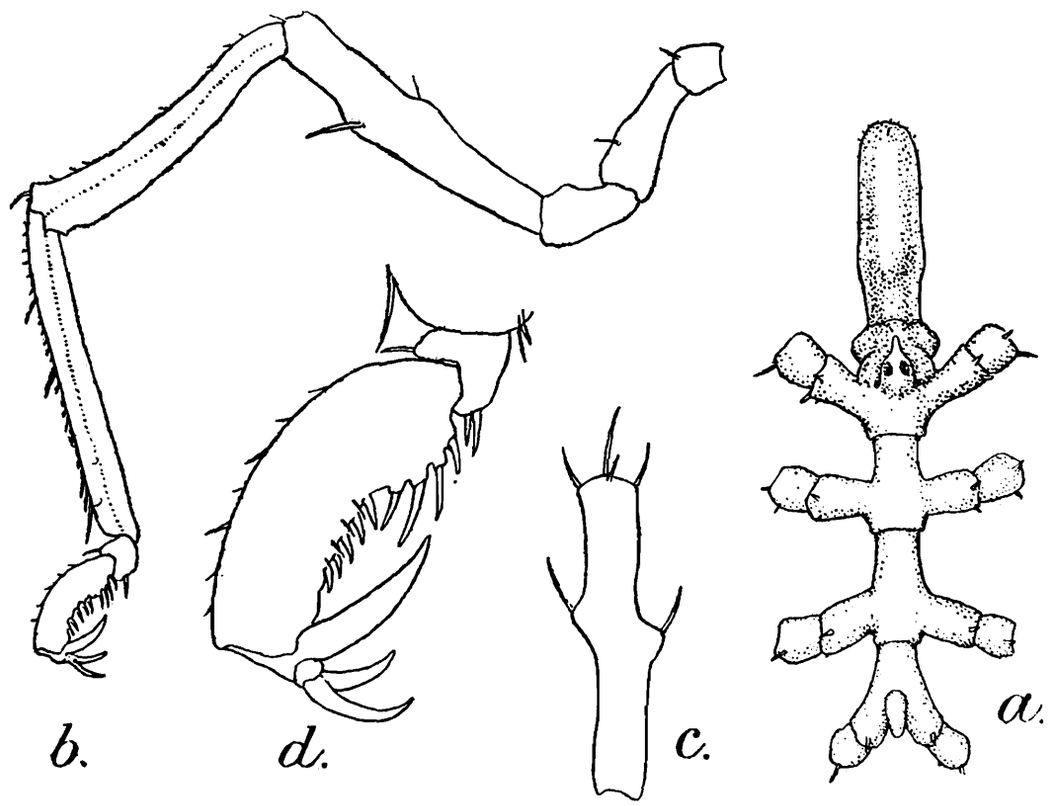

FIG. 15.—*Endeis meridionalis* (Böhm). Female, from Christmas Island. *a*. Dorsal view, legs omitted. *b*. Third left leg. *c*. Dorsal view of femur. *d*. Propodus.

[" Christmas Island. On piles of pier, Flying Fish Cove, 1908. C. W. Andrews. B. M. Reg. No. 1909.5.19. 325—329." About 40 specimens.]

Description.—Body moderately extended, the lateral processes separated by at least twice their diameter ; two teeth or sharp tubercles on first lateral processes, one on each of the others. Proboscis little wider at tip than at base. Oviger with penultimate segment expanded and armed with recurved spines. Legs rather stout, well armed with spines ; first coxa with a dorsal tooth and a posterior spine which is large in the first pair and small in the others ; second coxa with a posterior spine which also is much larger in the first pair ; femur, seen from above, distorted by swellings bearing the large lateral spines, of which the anterior is longer, sometimes much longer, than the diameter of the segment, and the posterior little, if at all, shorter ; three of the distal spines of both the femur and the first tibia very large ; second tibia longer than femur. Cement glands in femur of male about 23, in a single row.

Measurements of female, in mm.

Length of proboscis (to collar)	1·4
,, body	2·76
Width across 2nd lateral process	1·0
,, between 2nd and 3rd lat. processes	0·3
Diameter of 2nd lateral process	0·28
Interval between 2nd and 3rd lat. processes	0·56
Third left leg :—	
First coxa	0·32
Second coxa	0·88
Third coxa	0·48
Femur	2·0
First tibia	1·8
Second tibia	2·24
Tarsus and propodus	0·92

Remarks.—The spinulation of the leg in our specimens, more especially in those from Christmas Island, resembles Böhm's figure so nearly as to suggest identification with his species. His specimen, however, was a good deal larger and had the legs nearly three times instead of little more than twice as long as the body and proboscis. Further, the surface of body and limbs is described as " mit perlartigen Wärzchen dicht besetzt." Possibly this refers to the appearance of granulation produced, when the cuticle is very thick, by the canals of the dermal glands. In our specimens the cuticle is thin and the canals inconspicuous. Bouvier's suggestion (1917, p. 31) that the species might be distinguished by the strongly curved propodus and the length of the claw appears to rely too much on the accuracy of Böhm's figures. Loman (1908, p. 78) comments on the varying characters of the specimens he referred to this species. His figure 155 on pl. xi represents a large distal process of the femur very different from what is found in the specimens here discussed. The presence of as many as 40 cement glands may have been due to the large size of the specimen examined by him, but they are stated to have been arranged in two rows.

While it is improbable that Böhm's holotype agreed exactly with any of the specimens that I have examined, it seems reasonable to give his

name to the more spiny forms from the Indian region and I propose to restrict it to those that have the femur markedly distorted, with lateral spines at least as long as the diameter of the segment.

The numerous specimens collected by Dr. Andrews at Christmas Island show some differences in the length of individual spines but they have unmistakably a common facies which made it easy to sort them out from specimens of the following species with which they were mixed.

The single specimen from Madras Harbour is rather less spiny than those from Christmas Island but it differs chiefly in its very thin and flabby cuticle; this might be attributed to a recent moult were it not that all the specimens of *E. flaccidus* (v. infra) from the same locality have the same character.

Endeis mollis (Carpenter).

(Text-fig. 16.)

Phoxichilus mollis, Carpenter, 1904, p. 182, plate, figs. 1-7; Carpenter, 1907, p. 98.

Localities.—" Tongatabu. 3269/7 " 1 ♀.

" 3283/9. Lat. 6° 0′ N., Long. 81° 16′ E. 34 fathoms. 25th April, 1888. (*J. Wood-Mason.*)" 2♂, 1 ♀.

" Sta. 148. In Lagoon of Northern Maldive Atoll, 15—30 fath. Marine Survey." 1 ♂.

" Muscat, Arabia. 5th November, 1918. (*H. J. Walton.*)" 1 ♂.

" N. Cheval Paar, Ceylon. November, 1910. (*T. Southwell.*)" 2 ♂.

" Kilakarai, Ramnad Dist., Gulf of Manaar. From Weeds, 0—2 fathoms. 15th—20th February, 1913. (*S. W Kemp.*)" 1 ♂.

" Madras. (*K. Ramuni Menon.*) 7295/10." 2 ♂, 3 ♀.

" Nancowry Harbour, Nicobar Islands, Marine Survey, Sta. 614. Surface. (*Major R. Seymour Sewell.*)" 1♂.

[" Christmas Island. On piles of pier, Flying fish Cove, 1908, C. W Andrews. B. M. Reg. No. 1909. 5.19.330—334." About 20 specimens.]

[" Hulule, Maldive Islands. 'Sealark' Expedition. B. M. Reg. No. 1908.1.6.9." 1 ♀.]

Remarks.—I have included under this name specimens showing considerable diversity. While agreeing in most characters with the specimens assigned above to *E. meridionalis* they have the femur straight or nearly so, its lateral spines much shorter than the diameter of the segment, and the other spines of the body and limbs greatly reduced in size and in number. Some of the specimens, such as those from North Cheval Paar, agree very closely with Carpenter's original description and figures. Others have the body more elongated, like the specimen from Hulule, Maldive Islands, which Carpenter himself referred to this species, and the very large male (total length 7·6 mm.) from Muscat. The latter specimen is very smooth, with the legs relatively very long, approaching, though they do not reach, the proportions found in *E. procerus* (Loman);

the number of the femoral cement glands is about 40 as against 24 in the type of the species. The specimen from Tongatabu has the femora distinctly distorted, approaching *E. meridionalis*, from which it is mainly distinguished by the feeble development of the spines. Perhaps the most aberrant form is that represented by the specimen from Kilakarai (Text-fig. 16) with which those from Madras and from Nancowry Harbour are in general but not complete agreement. This form is very smooth, hardly even the most minute spines being present on the body and proximal segments of the limbs. There are three spine-bearing tubercles

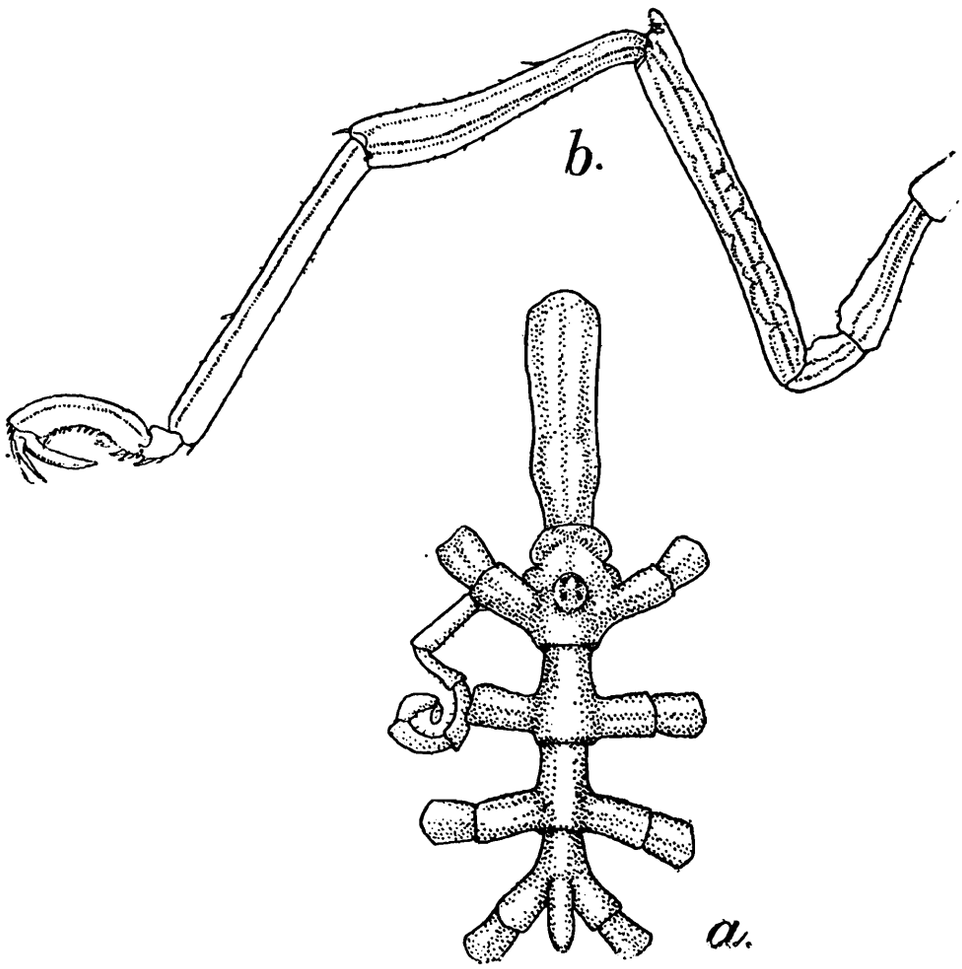

FIG. 16.—*Endeis mollis* (Carpenter). Male, from Kilakarai. *a*. Dorsal view, legs omitted. *b*. Third leg of left side.

at the distal end of the femur, the dorsal one being very prominent, much as in Loman's figure of what he regards as *E. meridionalis* (Loman, 1908, pl. xi, fig. 155). The second tibia is usually a little shorter than the femur, although it may be equal to it or even slightly longer in one or other of the legs of the same specimen. The femoral cement glands were unusually difficult to count but there appeared to be about 25.

The specimen from Nancowry Harbour, Nicobar Islands, is recorded by Major Seymour Sewell to have been taken by the tow-net along with the immature specimen of *Ascorhynchus* sp. mentioned above. The occurrence of a species of *Endeis* under these conditions is noteworthy since Miss Lebour (1916) has stated that young specimens of *Endeis spinosus* are occasionally found clinging to medusoids at Plymouth.

Endeis flaccidus, sp. nov.

(Text-fig. 17.)

Phoxichilus sp. Loman, 1908, p. 79, pl. xiii, fig. 189.

Localities.—" Madras. Springhaven, on buoys and piles at northern end. (*S. W Kemp.*)" 9 specimens.

" Madras. Springhaven, on piles at northern end. (*S. W Kemp.*)" 1 ♀.

" Madras Harbour. January, 1921. (*S. G. Manavala Ramanujam.*)" 8 specimens.

Description.—Body rather contracted, the lateral processes separated by less than their diameter; no teeth or conspicuous spines on the lateral processes. Proboscis hardly wider at tip than at base. Oviger with penultimate segment expanded and armed with recurved spines. Legs rather stout; first coxa with a dorsal spine, second coxa with only inconspicuous spines and setae; femur, seen from above, nearly straight, with very small lateral spines, one of the distal spines larger, no marked distal prominences; second tibia slightly longer than femur.

Femoral cement glands of male about 57, scattered irregularly in a broad band along the length of the femur (fig. 17*e*.)

Exoskeleton unusually thin, flaccid and transparent, allowing the internal organs to be clearly seen. The diverticula of the alimentary canal in the legs give off, along the whole of their length, short digitiform or simply branched caeca (fig. 17 *d* and *f*).

Measurements of female in mm.

Length of proboscis (to collar)	1·52
,, body	2·08
Width across 2nd lateral processes	1·2
,, between 2nd and 3rd lat. proc.	·36
Diameter of 2nd lateral process	·28
Interval between 2nd and 3rd lat. proc.	·24
Third left leg :—	
First coxa	0·32
Second coxa	1·0
Third coxa	0·6
Femur	2·2
First tibia	1·8
Second tibia	2·28
Tarsus and propodus	1·0

Remarks.—Except in its rather abbreviated body, this species does not differ conspicuously in external characters from some of the smoother forms referred above to *E. mollis*. It differs from all of them, however, in the fact that the cement glands are not uniserial and that the alimentary diverticula are provided with numerous caecal branches. In the latter character it agrees with the specimen mentioned by Loman (1908, p. 79, pl. xiii, fig. 189) and dredged by the " Siboga " off the island of Sumbawa.

Loman gives very few particulars regarding this specimen but he states that it was " durchsichtig und schlaff, wie eben gehäutet." The specimens now recorded, however, all have the cuticle thin and transparent, suggesting that the character may be specific and not temporary.

Even in species of *Endeis* where the cuticle is comparatively thick it is fairly easy to see the outline of the alimentary diverticula in the legs

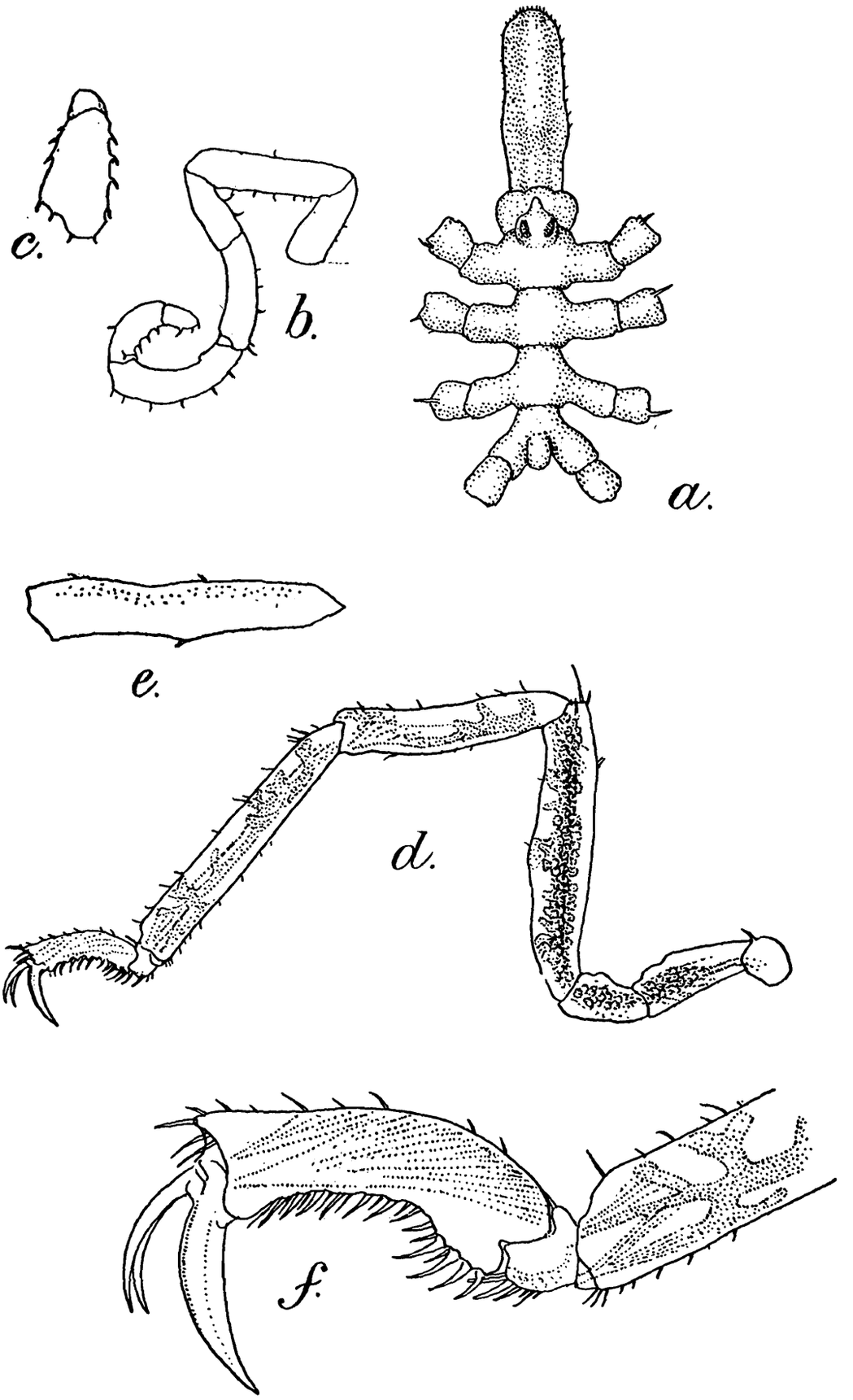

FIG. 17.—*Endeis flaccidus*, sp. n. *a*. Dorsal view of female, legs omitted. *b*. Oviger of male. *c*. Terminal segments of same. *d*. Third left leg of female *e*. Dorsal view of femur; dots indicate openings of cement glands. *f*. Terminal part of leg further enlarged.

and they are certainly devoid of accessory caeca in all the other specimens I have examined. Loman mentions as a possibility that the presence of these caeca in his specimen might have been due to the presence of some parasite, but there is no evidence that this is the case.

So far as I know, the only structures resembling these caeca in any other Pycnogonid are the " secundäre Blindsäcke des Darmes und seiner Schläuche " in *Pycnogonum littorale* mentioned by Dohrn (1881, p. 39) and before him, as " drüsige Anhänge," by Zenker (1852, p. 387). They have never been figured and the specimens at present available to me for dissection are too ill-preserved to show them.

The femoral cement glands are arranged in a single row in all the other species in which I have been able to see them distinctly, but Loman's statement that they were present in two rows in specimens which he referred, perhaps wrongly, to *E. meridionalis*, suggests that some other species may have them arranged as in *E. flaccidus*.

LIST OF PAPERS REFERRED TO.

Böhm, R.—1879*a*. Über die Pycnogoniden des Königl. Zoologischen Museums zu Berlin, insbesondere über die von S. M. S. Gazelle mitgebrachten Arten. *Monatsber. Kgl. Preuss. Akad. Wiss. Berlin*, 1879, pp. 170—195, pls. i and ii.

Böhm, R.—1879*b*. Zwei neue, von Herrn Dr. Hilgendorf in Japan gesammelte Pycnogoniden. *Sitz. Ber. Ges. Naturf. Fr. Berlin*, 1879, pp. 53—60, 1 text-fig.

Bouvier, E. L.—1913. Pycnogonides du " Pourquoi Pas ?" Deuxième Expédition Antarctique Francaise (1908—1910), pp. 169, text-figs.

Bouvier, E. L.—1917 Pycnogonides provenant des campagnes scientifiques de S. A. S. le Prince de Monaco. *Rés. Camp. Scient. Monaco*, Fasc. LI, 1917, 56 pp., 4 pls.

Calman, W T.—1915. Pycnogonida. Brit. Antarct. (' Terra Nova ') Exped., Zool. III, No. 1, pp. 1—74, 22 text-figs.

Calman, W T.—1922. The holotype of *Parazetes auchenicus*, Slater. *Ann. Mag. Nat. Hist.* (9) IX, pp. 199—203, 4 text-figs.

Carpenter, G. H.—1892. Reports on the zoological collections made in Torres Straits by Professor A. C. Haddon, 1888-89. Pycnogonida. *Sci. Proc. Roy. Dublin Soc.* (N. S.) VII, Pt. 5, No. 40, pp. 552—558, pl. xxii.

Carpenter, G. H.—1893. Reports on the zoological collections made in Torres Straits by Professor A. C. Haddon, 1888-89. Pycnogonida (Supplement). *Sci. Proc. Roy. Dublin Soc.* (N. S.) VIII, Pt. 1, No. 4, pp. 21—27, pl. ii.

Carpenter, G. H.—1904. Report on the Pantopoda collected by Professor Herdman at Ceylon. Rep. Ceylon Pearl Oyster Fisheries, Royal Society. Pt. II, Suppl. Rep. xiii, pp. 181—184, 1 pl.

Carpenter, G. H.—1907 Pycnogonida. The Percy Sladen Trust Exped. to the Indian Ocean. *Trans. Linn. Soc.*, (2) *Zool.* XII, pp. 95—101, pls. xii and xiii.

Carpenter, G. H.—1910. Reports on the Marine Biology of the Sudanese Red Sea. XVI. Pycnogonida from the Red Sea and Indian Ocean, collected by Mr. Cyril Crossland. *Journ. Linn. Soc., Zool.*, XXXI, pp. 256—259, pls. xxvi and xxvii.

Cole, L. J.—1909. Reports.....Expedition to the Eastern tropical Pacific....." Albatross." Pycnogonida. *Bull. Mus. Comp. Zool. Harvard*, LII, pp. 185—192, 3 pls.

Dohrn, A.—1881. Pantopoda. Fauna u. Flora d. Golfes v. Neapel, Monogr. III, pp. viii, 252, 18 pls.

Flynn, T. T.—1919. A re-examination of Professor Haswell's Types of Australian Pycnogonida. *Pap. & Proc. Roy. Soc. Tasmania*, 1919, pp. 70—92, pls. xviii—xxii.

Haswell, W A.—1884. On the Pycnogonida of the Australian Coast, with descriptions of new species. *Proc. Linn. Soc. New South Wales*, IX, pp. 1021—1034, pls. liv—lvii.

Hodgson, T. V.—1914. Preliminary report on the Pycnogonida of the German Southpolar Expedition, 1901-03. *Zool. Anz.* XLV, pp. 158—165. See also *Ann. Mag. Nat. Hist.* (8) XV, 1915, pp. 141—149.

HOEK, P. P. C.—1881. Report on the Pycnogonida dredged by H.M.S. "Challenger" during the years 1873-76. "Challenger" Reports, Zool. III, 167, pp., 21 pls.

Lebour, Marie V.—1916. Notes on the life-history of *Anaphia petiolata* (Kröyer). *Journ. Mar. Biol. Ass.* XI, pp. 51—56, 3 text-figs.

Loman, J. C. C.—1908. Die Pantopoden der Siboga-Expedition. Siboga-Expeditie, Monogr. XL, 88 pp., 15 pls.

Loman, J. C. C.—1911. Japanische Podosomata. (Beitr. z. Natg. Ostasiens ... F. Doflein.) *Abh. math. phys. Kl., K. Bayer. Akad. Wiss. München*, Suppl. Bd. II, Abh. 4, 18 pp. 2 pls.

Loman, J. C. C.—1916. *Pallenopsis* and *Rigona*, with description of a new species. *Zool. Mededeelingen*, II, pp. 15—25, 6 text-figs.

Norman, A. M.—1908. The Podosomata (=Pycnogonida) of the Temperate Atlantic and Arctic Oceans. *Journ. Linn. Soc., Zool.* XXX, pp. 198—238, pls. xxix and xxx.

Ortmann, A.—1890. Bericht über die von Herrn Dr. Döderlein in Japan gesammelten Pycnogoniden. *Zool. Jahrbb., Abth. Syst.*, V, pp. 157—168, pl. xxiv.

Sars, G. O.—1891. Pycnogonidea. The Norwegian North-Atlantic Expedition, 1876-78. XX, 163 pp., 15 pls., 1 map.

Schimkewitsch, W.—1889. Sur les Pantopodes ..... "Vettor Pisani." *Atti R. Accad. Lincei*, Mem., (4) VI, pp. 329—347, 1 pl.

Schimkewitsch, W.—1893. Reports ... West Coast of Central America ... "Albatross" VIII. Compte-rendu sur les Pantopodes. *Bull. Mus. Comp. Zool. Harvard*, XXV, No. 2, pp. 27—43, 2 pls.

Thomson, G. M.—1884. On the New Zealand Pycnogonida, with descriptions of new species. *Trans. N Z. Inst.*, XVI, pp. 242—248, pls. xiv—xvi.

Wilson, E. B.—1881. Reports ... East Coast of the United States ... "Blake." XIII. Report on the Pycnogonida. *Bull. Mus. Comp. Zool. Harvard*, VIII, No. 12, pp. 239—256, pls. i—v.

Wood-Mason, 1873.—On *Rhopalorhynchus kröyeri*, a new genus and species of Pycnogonida. *Journ. Asiat. Soc. Bengal*, XLII, Pt. ii, pp. 171—175, pl. xiii.

Wood-Mason, J. and Alcock, A.—1891. Natural History Notes from H. M. Indian Marine Survey Steamer " Investigator ", Commander R. F. Hoskyn, R. N., commanding.—Series II, No. 1. On the results of Deep-sea dredging during the season 1890-91. *Ann. Mag. Nat. Hist.* (6) VIII, pp. 16—34.

Zenker, W.—1852. Untersuchungen über die Pycnogoniden. *Arch. Anat. Physiol.* 1852, pp. 379—391, pl. x.