

No. VII.—PYCNOGONIDA.

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(Plates 12 & 13.)

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THE Pycnogonida described in the present paper were collected by Mr. J. Stanley Gardiner around the shores of the Maldivé Archipelago, near the Amirante Islands (which lie W.S.W. of the Seychelles), and on the Saya de Malha Banks (which are situated S.E. of the Seychelles and N. by W. of Rodriguez). Five species only are represented in the collection, but four of these appear to be new to science. One of them is a *Pallenopsis* dredged both in the Maldivé and the Amirante districts. An exquisite little new *Anoplodactylus* is represented by a single Maldivé specimen only. One specimen of a remarkable *Colossendeis* was dredged on the Saya de Malha Banks, while the allied genus *Rhopalorhynchus* is represented by a new species, several specimens of which come from the Maldives and one from the Amirante. The fifth species in the collection is a *Phoxichilus* from the Maldives, which cannot be separated from a pycnogon lately discovered on the Ceylon coral-reef by Prof. Herdman and described by the present writer, who would express his gratitude to Mr. Gardiner for the privilege of examining this interesting, if small, collection.

Attention has been drawn by Gardiner (1906, p. 313) to the scanty attention paid in recent years to the tropical waters of the Indian Ocean by scientific explorers. It is not surprising therefore to find that out of the five species in the collection, four have to be described as new. Recent systematic work on the Pycnogonida has brought home to students that a great plasticity of structure characterizes this group, and that in large genera it becomes increasingly difficult with advancing knowledge to form definite specific diagnoses. The publication of new specific names is therefore attended with more than usual risk, but the very fact that variation is so wide makes the careful study of forms from any new locality of special obligation and interest to the naturalist. The wide range of some of the species described in the present paper—the Maldives are over 1400 miles from the Amirante—can be matched in not a few Arctic and Atlantic pantopods, and is far exceeded by some of the southern *Colossendeis* described by Hoek (1881) from the 'Challenger' collections.

In the descriptive part of this paper, a few changes from current nomenclature have been introduced. Cole has lately (1904, pp. 256–7) drawn up a useful tabular statement

of the various terms applied to different parts of the body by himself, by Meinert (1899), Sars (1891), Hoek (1881), Dohrn (1881), and Wilson (1880). All these authorities agree in calling the anterior region of the body that carries the eyes and the first four pairs of appendages a "segment," qualifying it variously by such terms as "first trunk," "cephalic," "cephalothoracic," or "oculiferous." Now, although it is undesirable to depart needlessly from established terminology, it is manifestly wrong to call a region that bears four pairs of limbs a "segment." For this region I would suggest the term "head," having (1905) recently endeavoured to show that it corresponds with the primitive head-region of the Arthropoda. For the appendages of the head I use the terms "cheliferous," "palp," "oviger," and "first leg." The term "oviger" is due to Cole, and by its use (in place of "ovigerous leg" or "false leg") the cumbrous term "ambulatory leg" is avoided. The three limb-bearing segments behind the head may naturally be called the second, third, and fourth "leg-bearing segments" respectively, the first leg-bearing segment forming part of the head. For the short terminal region of the body, the name "abdomen" used by Hoek and Wilson is preferable to the "caudal segment" of Sars, Meinert, and Cole, since this region probably represents a number of segments fused together and contracted. The extreme degree of concentration in this region is shown by the genus *Rhopalorhynchus* (see Pl. 13. fig. 27).

This is hardly the place for any general discussion on the affinities of the Pycnogonida, but the writer has already offered support to the opinion of Lankester (1904) that they should be regarded as an isolated order of the class Arachnida. The use of Pycnogonida as the ordinal name is inconvenient, as it may so easily be confused with the family-name Pycnogonidæ. If it be replaced, its substitute must be the term Podosomata of Leach rather than the later, but more generally used, name Pantopoda.

Family **Pallenidæ.**

PALLENOPSIS, Wilson.

1. *Pallenopsis spinipes*, sp. nov. (Plate 12. figs. 1-12.)

Length 4 mm. (including proboscis and abdomen).

Body stout, with the two hinder leg-bearing segments fused, and with the lateral processes close together (figs. 1, 2). Abdomen slender, elongate, with prominent paired dorsal spines (figs. 1, 2). Proboscis less than half the length of body. Eye-eminence erect, acuminate at apex. Cheliferous with three segments, the scape consisting of one basal segment only, the second and third segments ("hand" and "finger") feeble (figs. 3, 4). Oviger of male as long as head, thorax, and abdomen, the fourth and fifth segments of equal length, the sixth, seventh, and eighth together being as long as the fifth (fig. 5). Oviger of the female much shorter (fig. 6), with only eight segments (fig. 7). Leg with the thigh as long as the first tibial segment, the male's cement-gland opening through a prominent tubular projection (figs. 1, 8, 9) on the flexor aspect of the limb. Second tibial segment as long as the first; propodus with three basal spines and two large accessory claws (fig. 11). Legs spinose, many of the prominent spines bearing numerous sharp denticles (fig. 10).

Localities. Hulule, Maldive Islands (W. reef in branching Polyzoa), one egg-bearing male, one female. Amirantes:—Station E 13 (20–25 fms.), one female; Station E 14 (36 fms.), one egg-bearing male; Station E 15 (35 fms.), four males, two with eggs; Station E 16 (39 fms.), one female.

The condensed body-form, the elongate, spinose abdomen, the undivided scape of the cheliforus, and the prominent tubular cement-duct on the thigh of the male's leg afford abundant distinctive characters for this species. In some of these characters *P. patagonicum* (Hoek, 1881, pp. 84–6, pl. 12. figs. 6–9) resembles it, but that pycnogon is without the tubular cement-duct in the male and is far larger. *P. fluminensis* (Kröyer), lately carefully redescribed and figured by Meinert (1899, pp. 52–4, pl. 5. figs. 1–6), has the scape of the cheliforus incompletely divided and a short outstanding tubular cement-duct; it differs from the present species in its more slender body, more widely separated lateral processes, as well as in the fourth leg-bearing segment, not fused with the third.

In *P. spinipes* the vestigial palps (Pl. 12. figs. 5, 6) bear short spines and show (in the male) a trace of segmentation. The reduction of the oviger in the female (compare figs. 5, 6) is striking, and its apparent eight-segmented condition is clearly due to the tenth segment not being separated from the ninth nor the eighth from the seventh (fig. 7). The condition of this limb indicates how the reduction in the number of segments, so often noticeable in the oviger of the female or of both sexes in this order, may have been brought about. The characteristic tubular cement-duct on the thigh of the male's leg varies in form in different individuals, being sinuous (fig. 8) or straight (fig. 9). Its outer surface is transversely wrinkled (fig. 8). Viewed in optical section (fig. 9) it is seen to be formed by an outgrowth of the cuticle and to be traversed by the slender duct which arises from a reservoir in close connection with the reniform gland.

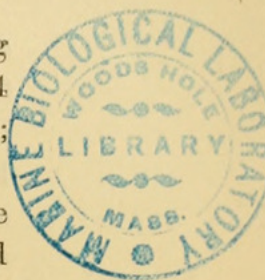
Several of the males in the collection carry eggs. These are closely packed in a trilobate mass, held by the terminal segments of the oviger (fig. 2). In the male figured a number of young larvæ also are loosely attached to the proximal segments of the oviger. Examination of these shows them to possess the typical form of a pycnogonid larva (fig. 12) with very elongate and slender cement-ducts arising from the basal segment of the cheliforus and the two succeeding appendages. The third segment of these latter is fringed with a beautiful series of delicate bristles, such as are figured for the larva of *Barana castelli* (Dohrn, 1881, Taf. 1. fig. 13). The larva of *Pallenopsis spinipes* does not resemble closely the larvæ of various species of the genus that have been figured by Meinert (1899), but rather recalls those of *Pycnogonum littorale* (Meinert, l. c. pl. 1. fig. 3) and of various Nymphonidæ.

ANOPLODACTYLUS, Wilson.

2. *Anoplodactylus pulcher*, sp. nov. (Plate 12. figs. 13–19.)

Length of male 2.2 mm. (including proboscis).

Body concentrated, with the two hinder leg-bearing segments fused and the lateral processes elongate, bearing long spines (figs. 13, 14). Abdomen nearly half as long as body, slender and erect (fig. 14). Eye-eminence prominent and subcylindrical, with eyes near the summit (fig. 14). Proboscis nearly half as long as the body, stout and



swollen centrally. Cheliforus with slender scape bearing long spines and feeble "hand" (figs. 14, 15). Oviger of male arising from base of foremost lateral process, as long as body, with third segment more than $2\frac{1}{2}$ times as long as second, and fourth segment as long as fifth and sixth together (figs. 14, 16). Legs with thigh $\frac{5}{6}$ length of first tibial segment, which is slightly longer than the second tibial segment; propodus with two stout basal spines, a row of seven spines along the lower edge, and minute auxiliary claws (figs. 13-19). The legs are spinose and the cement-gland in the male opens through a long slender process on the extensor aspect of the thigh (figs. 13, 18).

Locality. Kolumadulu, Maldive Islands, 33 fathoms, off a black crinoid. One adult male only.

The preserved type of this beautiful little species is yellowish in colour, with dark brown transverse bands on the legs. Structurally it is very distinct from any *Anoplodactylus* known to me, on account of the excessively elongate eye-eminence and abdomen, and especially of the slender cement-duct on the thighs of the legs. In all male *Anoplodactyli* in which the cement-glands have been described they occur in a series along the edge of the thigh. The proportions of the coxal segments of the leg are shown in fig. 17, together with the arrangement of the muscles and the position of the opening of the vas deferens. The long, flexible spines at the end of each lateral process are a remarkable feature in this species. There are two of these on the first and fourth processes and three on the second and third.

Family **Phoxichilidæ** *.

PHOXICHILUS, Latreille.

3. *Phoxichilus mollis*, Carpenter (1904).

A single female of this species was taken off a Polyzoon at Hulule, Maldive Islands. It differs from the type specimens (dredged by Prof. Herdman off the coasts of Ceylon) in its slightly larger size (6 mm. instead of 5 mm.). Moreover, the present specimen possesses four stout basal teeth (the third the largest) and seven small distal teeth beneath the propodus, whereas in the Ceylon specimens there are five basal and six distal teeth. In the paucity of spiny armature on the trunk and thighs it agrees, however, closely with *P. mollis*, as well as in the general build of the body.

Family **Colossendeidæ**.

COLOSSENDEIS, Jarzynski.

4. *Colossendeis gardineri*, sp. n. (Plate 13. figs. 20-24.)

Length 16 mm. (including proboscis and abdomen).

Body condensed, with short lateral processes (fig. 20). Proboscis half as long again as head and thorax, slender, tapering anteriorly with a slight curve dorsalwards (figs. 20, 21). Eye-eminence represented by a prominent transverse ridge with vestiges of eyes

* The Rev. T. R. R. Stebbing has argued that this family-name should properly belong to the family generally called Pallenidæ, and had proposed that the genus *Spinusus*, Montagu, should be re-named *Chilophoxus*, with *Chilophoxidæ* as the family-name ('Knowledge,' xxv. (1902) p. 187).

(fig. 21). Palp $1\frac{1}{3}$ as long as proboscis: fifth segment $1\frac{2}{3}$ as long as third; sixth and seventh equal, together $\frac{2}{3}$ length of third; eighth and ninth equal, shorter than tenth, the three terminal segments together being half as long again as the seventh (fig. 21). Oviger $1\frac{1}{4}$ total length of body, sixth segment $1\frac{1}{6}$ length of fourth (fig. 20). Proportions of four terminal segments as 7 : 6 : 6 : 5 (fig. 22), with five rows of spines very variable in form (figs. 22, 23). Leg with thigh equal to first tibial segment, second tibial segment $\frac{1}{7}$ shorter, tarsus $1\frac{4}{5}$ length of propodus; terminal claw rather short, only $\frac{2}{5}$ length of propodus (figs. 20, 24).

Locality. Saya de Malha, Station C 21, 450 fms. One male only.

The proportionate lengths of body and proboscis and the peculiar upturned form of the latter distinguish this species from all described members of the genus. The spines on the ovigers are simpler in form than in many species of *Colossendeis*, those on the seventh segment being flattened and somewhat serrate (fig. 23, *b*), while those on the other segments are for the most part sharp-pointed and sickle-shaped (fig. 23, *a*).

RHOPALORHYNCHUS, Wood-Mason.

5. *Rhopalorhynchus gracillimus*, sp. nov. (Plate 13. figs. 25-32.)

Length (including proboscis), male 7.5 mm.; female 8.5 mm.

Body elongate and very slender. Proboscis rather shorter than head and trunk, slenderly stalked, with a single prominent dorsal spine (figs. 25, 26). Eye-eminence cylindrical at base, subconical above eyes, with an obtuse rounded apex (fig. 28). Palp nearly half as long again as proboscis, with the third segment half as long again as the fourth and fifth together, and the fifth $1\frac{1}{6}$ as long as the five terminal segments together; proportions of the latter as 5 : 8 : 8 : 8 : 7 (figs. 25, 29). Oviger very slightly longer than palp, with sixth segment slightly longer than fourth; proportions of the four terminal segments as 7 : 6 : 5 : 4; claw short, five rows of simple spines (figs. 25, 30, 31). Legs with thigh markedly swollen distally in female (fig. 25), slightly in male (fig. 26), as long as first tibial segment; second tibial segment about $\frac{1}{10}$ shorter (fig. 25); propodus slightly longer than tarsus; terminal claw only $\frac{2}{5}$ length of propodus (fig. 32).

Localities. Maldive Islands: Kolumadulu (off a black crinoid), one male and one female; S. Nilandu, one male and one female; Haddumati, four females. Saya de Malha, Station C 12 (47 fms.), one male.

This curious and delicate species may be distinguished from *R. kröyeri*, Wood-Mason (1873, from the Andamans), the type of the genus, by the single dorsal spine on the proboscis (*R. kröyeri* having two) and by the relatively short claw to the foot. *R. tenuissimus* (Haswell, 1885, pp. 9-10, pl. 57. figs. 6-9) from Port Denison, Australia, has, like *R. kröyeri*, a very long foot-claw, and a much blunter proboscis than the present species, which resembles most closely *R. clavipes*, Carpenter (1893, pp. 22-5, pl. 2. figs. 1-10), from the Torres Straits. The latter has, however, a differently-shaped proboscis with a weaker dorsal tooth, while the seventh, eighth, and ninth segments of the oviger are equal in length. The great plasticity and range of variation shown by many genera of Pycnogonida make it quite likely, however, that intermediate links between these two forms, and even between them and *R. tenuissimus*, may be discovered later.

Indeed, among the specimens of the present collection, the single male from the Saya de Malha Banks differs from the Maldivian types, being larger (10 mm. long) and having the claw of the foot relatively longer (half as long as the propodus).

The delicacy and transparency of these *Rhopalorhynchi* have rendered possible a superficial examination of the nervous system; the chain of ventral ganglia are arranged as shown in fig. 27. As usual, the ganglia of the first leg-bearing segment are closely associated with the subœsophageal ganglionic mass, while the great anterior extension of both the second and third leg-bearing segments leads necessarily to a wide separation between the ganglia of these segments from one another and of the second from the first, while the ganglia of the fourth leg-bearing segment lie immediately behind those of the third. This differs from the ventral nerve-chain of *Colossendeis*, as figured and described by Hoek (1881, pp. 112-113, pl. 17. fig. 2), in which the ganglia of the fourth leg-bearing segment are connected with those of the third by connective nearly as long as those between the third and the second. The striking external distinctions between *Colossendeis* and *Rhopalorhynchus* thus find some parallel in the internal structure, and additional support is afforded to the separation of the two genera as advocated by the present writer (1893, p. 22) and lately supported by Schimkenitsch (1906, p. 18). The remarkably abbreviated abdomen of *Rhopalorhynchus*, which is wedged between the two hindmost lateral processes, and has the anus looking directly ventralwards, is also shown in fig. 27 of the present paper.

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