# ANNALS

OF THE

# SOUTH AFRICAN MUSEUM

*VOLUME XXXII*

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SEMPER ALIQUID NOVI AFRICA AFFERT

PRINTED FOR THE
TRUSTEES OF THE SOUTH AFRICAN MUSEUM
BY NEILL AND CO., LTD., 212 CAUSEWAYSIDE, EDINBURGH.
1935–1940.

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## DATE OF ISSUE OF THE PARTS.

Part 1, June 1935.
Part 2, March 1937.
Part 3, July 1937.
Part 4, July 1938.
Part 5, February 1940.
Part 6, August 1940.

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*ISSUED JUNE 1935. PRICE 2s. 6d.*

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# ANNALS

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## 1. *A new Giant Sea-star,* Mithrodia gigas *n. sp., from South Africa.*—By Th. Mortensen, University Zoological Museum, Copenhagen.

(With Plate I and 1 Text-figure.)

Some months ago I received from Dr. K. H. Barnard, South African Museum, Cape Town, photographs of a very large sea-star which he had received from Mr. Bell Marley, Durban, who suggested that it might be a *Mithrodia.* The photographs left no doubt of its being really a *Mithrodia*, and a new species, markedly different from the three species of that genus known till now. Dr. Barnard then sent me the specimen, asking me to describe it. On account of its being by far the largest of any specimen of *Mithrodia* hitherto recorded, and, indeed, one of the largest sea-stars known, I name it

### *Mithrodia gigas* n. sp.

Rays five, of somewhat unequal length. The longest ray is 330 mm., another ray is 310 mm., and the three others 300 mm. long. The total diameter thus is some 600 mm. Diameter of disk c. 90 mm.

The rays of the dried specimen are c. 50–60 mm. broad, but clearly they are not so broad in life. The specimen evidently has been dried directly from the sea, not first fixed in alcohol or formalin, and therefore the dorsal wall of the rays has sunk in and the rays become flattened. Presumably, the rays will be cylindrical in life as in the other *Mithrodia* species, and their diameter not more than c. 30–40 mm. They are scarcely constricted at the base. The interbrachial angles appear to be somewhat rounded.

The disk is rather closely set with low, almost spherical knobs, the largest of which slightly exceed 2 mm. in diameter; on their upper surface they are densely set with low, rounded prominences, producing a somewhat scaly appearance.

These knobs continue a little more sparsely on the dorsal side of the rays in their basal half, becoming then much more scarce in the distal part, disappearing almost completely, until at the tip of the rays they are replaced by large, spherical knobs of up to 5 mm. diameter (fig. 1). These large knobs are likewise covered with small, scaly prominences. There are no large spines on the dorsal side of disk and rays.

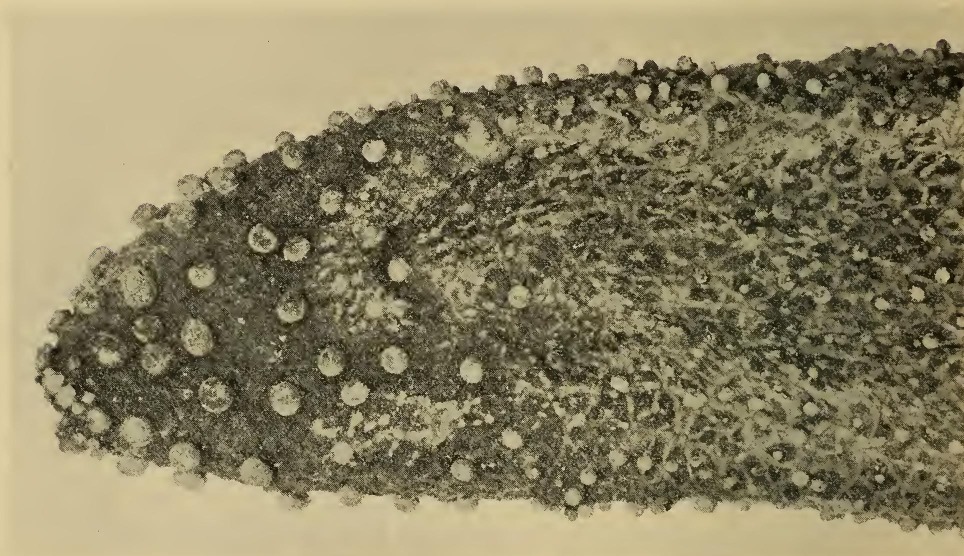


Fig. 1.—*Mithrodia gigas*, n. sp. Tip of ray, natural size.

The dorsal skeleton consists of low ridges arranged so as to form more or less distinct stars, in the centre of which the knobs are placed. The whole dorsal side has evidently been covered by a thick skin, in which are imbedded numerous small spinelets, the ridges of the skeleton thus having a very finely granular, almost velvety appearance. Also the larger knobs have been covered with such a rather thick skin.

On the sides of the rays the knobs increase in number, but no larger spines are found here either, and only close to the ambulacral furrow the knobs gradually grow a little larger, passing very evenly into the outer adambulacral spines.

The ambulacral, or furrow spines are only four in number; the two median ones are somewhat stouter and longer (4–5 mm.) than the two lateral ones, the latter being, however, not rudimentary. The inner adambulacral spines are 5–6 mm. long, stout, club-shaped, and of the usual scaly-granular appearance, the side turning towards the ambulacral furrow being partly more smooth. They form a perfectly regular series, one to each adambulacral plate. The outer series of adambulacral spines is, on the whole, very inconspicuous, these spines passing very gradually into the general covering of the oral side of the rays. No ventro-lateral series of spines or larger knobs observable. At the tip of the rays the knobs grow larger, globular, but not so large as those of the dorsal side. The inner adambulacral spines do not thus transform.

As on the dorsal side a thick skin covers the body skeleton and the knobs and spines also on the ventral side. Even the ambulacral spines are covered by this thick skin, so that—on the present, dried specimen—the number of these spines can only be ascertained on cleaning away the skin (by means of hypochlorite of sodium). A very extraordinary fact is that in this skin covering the ambulacral spines are imbedded a number of small, sharp granules or spinelets, so that even the ambulacral spines get a scaly appearance like the larger spines and knobs.

The oral edges, or jaws, are rounded; there is no special oral armature, only the usual ambulacral and adambulacral spines, which are not larger here than along the ambulacral furrow.

The madreporite is small, partly covered by the knobs. It is a little nearer the edge than the centre of the disk.

The colour of the live specimen was, according to Mr. Bell Marley, purplish pink, the tip of the rays more cinnamon red; below pale yellowish; the ambulacral feet white. The dried specimen has lost the colour completely.

The specimen was caught on a fish hook, having taken to the bait, fouling itself in the line. It was taken off Point Morgan, East London, on fishing grounds in 25–30 fathoms, on stony ground.

This is another highly interesting addition to the rich endemic fauna of the seas along the South African East Coast. Mr. Bell Marley is to be sincerely congratulated on having secured this, and so many other treasures of that fauna. But it is not enough to leave it to the casual catches on fish hooks or by trawlers (a good deal of interesting forms have been saved by Captain Pace). A real scientific investigation of this sea is greatly needed. It will be sure to yield most important results. The little we know already shows this area to be one of the richest and most characteristic zoogeographical regions of the world.

The present species differs strikingly from the three other species of the genus *Mithrodia* hitherto known, *M. clavigera* (Lamarck) of the Indo-Pacific, *M. bradleyi* Verrill of the American West Coast and Hawaii, and *M. fisheri* Holly of Hawaii. It would seem the nearest related to *M. bradleyi*, which also lacks the large spines on the dorsal surface (in the adult); but it differs from all of them in the total absence of long spines, in having only four ambulacral spines (in the other species c. 6–12) and these even covered with granular spinelets imbedded and lying loosely in the thick skin enclosing the ambulacral spines. Finally, the large spherical knobs on the point of the rays is a quite unique feature.

Mortensen

MITHRODIA GIGAS, n. sp.

## 2. *The European and South African Sea Breams of the Genus* Spondyliosoma *and Related Genera; with Notes on* Dichistius *and* Tripterodon.—By J. R. Norman, Department of Zoology, British Museum (Natural History).

(With Plate II and 6 Text-figures.)

Having encountered some difficulty in identifying one or two specimens of Sea Breams allied to *Spondyliosoma* collected by the "Discovery" Expedition at the Cape, I sought the opinion of Dr. K. H. Barnard, Assistant Director of the South African Museum. He was good enough to suggest that I should undertake a revision of these fishes, and very kindly offered, not only to submit all the material in the South African Museum, including the types of the species described by Gilchrist and Thompson, but also to hand over to me some notes he had already prepared with a view to eventual publication. I take this opportunity of offering Dr. Barnard my sincerest thanks for his generosity, and of expressing my appreciation to the authorities of the South African Museum for permission to study this valuable material, which, with the specimens in the collection of the British Museum (Natural History), has enabled me to clear up a number of points concerning this group of fishes. My thanks are also due to Mr. A. Fraser-Brunner, for his assistance in procuring for me a series of specimens of *Spondyliosoma cantharus* from the Mediterranean and from the British coast, and for several helpful suggestions; and to Dr. C. Tate Regan for valuable advice given during the progress of the work. The names adopted for the new species of *Pachymetopon* are those which appear in Dr. Barnard's MSS.

### Spondyliosoma, Cantor.

*Cantharus* (*non* Bolten, 1798; Montfort, 1808), Cuvier, 1817, R. Anim., vol. ii, p. 278 [*Sparus cantharus*, Linnaeus].

*Spondyliosoma*, Cantor, 1850, J. Asiat. Soc. Bengal, vol. xviii (1849), p. 1032 [*Sparus cantharus*, Linnaeus—a substitute for *Cantharus*, preoccupied].

*Caranthus*, Barnard, 1927, Ann. S. Afr. Mus., vol. xxi, p. 720 [*Sparus cantharus*, Linnaeus—a substitute for *Cantharus*, preoccupied].

*Cantharusa*, Strand, 1928, Arch. Naturgesch., vol. xcii, A. 8, p. 54 [*Sparus cantharus*, Linnaeus—a substitute for *Cantharus*, preoccupied].

*Spondyliosoma* (part), Fowler, 1933, Bull. U.S. Nat. Mus., 100 (12), p. 182.

Body ovate covered with rather small, finely ctenoid scales; many scales, especially on hinder part of body, lobate in centre of free margin; tubules of lateral line short, bifurcated posteriorly. Praeorbital narrow, its lower edge generally more or less notched. Posterior nostril slit-like. Teeth in front of jaws in broad bands, that become narrower laterally, arranged in 5 to 7 irregular rows; teeth of the outermost row largest, compressed, narrow, lanceolate; no canines; those of the innermost row mostly obtuse, molariform. Cheek and opercular bones scaled; interorbital region and flange of praeoperculum naked. Dorsal with 11 spines; soft rays naked, but with a low scaly sheath at the base of the fin. Anal with 3 spines.

Two species: one from the Mediterranean and eastern Atlantic; the other from the coast of south-east Africa, Madagascar, and Mauritius.

### *Synopsis of the Species.*

I. 64 to 72 scales in lateral line, 8 to 10 from origin of dorsal fin to lateral line 1. *cantharus.*

II. 80 to 92 scales in lateral line, 14 or 15 from origin of dorsal fin to lateral line 2. *emarginatum.*

### 1. *Spondyliosoma cantharus* (Linnaeus).

*Sparus cantharus*, Linnaeus, 1758, Syst. Nat., ed. 10, p. 280.*

*Sparus brama*, Bloch, 1791, Nat. ausl. Fische, vol. v, p. 77.

*Sparus lineatus*, Montagu, 1818, Mem. Werner, N.H. Soc., vol. ii (2), p. 451, pl. xxiii.

*Sparus vetula*, Couch, 1823, Tr. Linn. Soc. London, vol. xiv (1), p. 79.

*Cantharus tanuda*, Risso, 1826, H.N. Europe, vol. iii, p. 366.

*Pagrus lineatus*, Fleming, 1828, Hist. Brit. Anim., p. 211.

*Cantharus vulgaris*, Cuvier and Valenciennes, 1830, H.N. Poiss., vol. vi, p. 319, pl. clx.

*Cantharus brama*, Cuvier and Valenciennes, 1830, *t.c.* p. 328; Günther, 1859, Cat. Fish., vol. i, p. 416; Moreau, 1881, H.N. Poiss. France, vol. iii, p. 52; Carus, 1889–93, Prodr. Faun. Medit., vol. ii, p. 626.

* I have not attempted to give a full list of references under each name, but have merely indicated the principal synonyms and combinations of generic and trivial names.

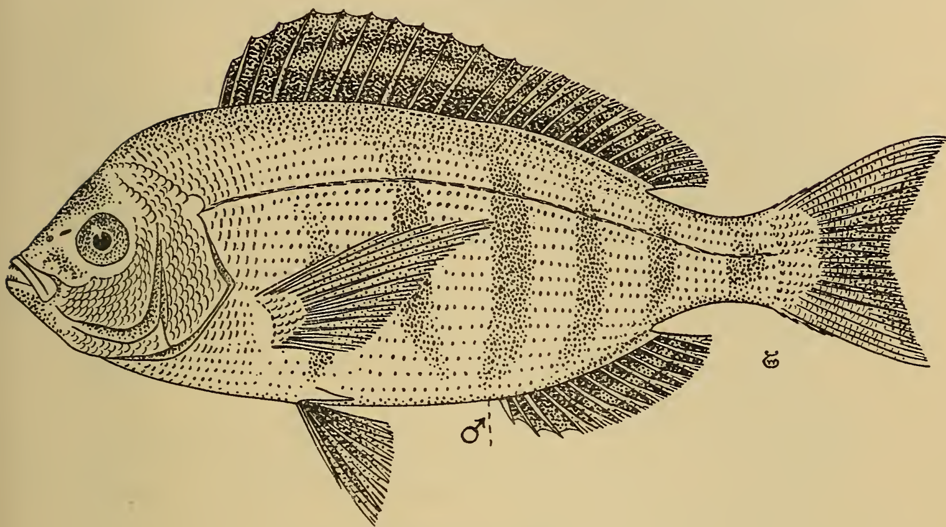


Fig. 1a.—*Spondyliosoma cantharus.* $\times \frac{3}{8}$. ♂.

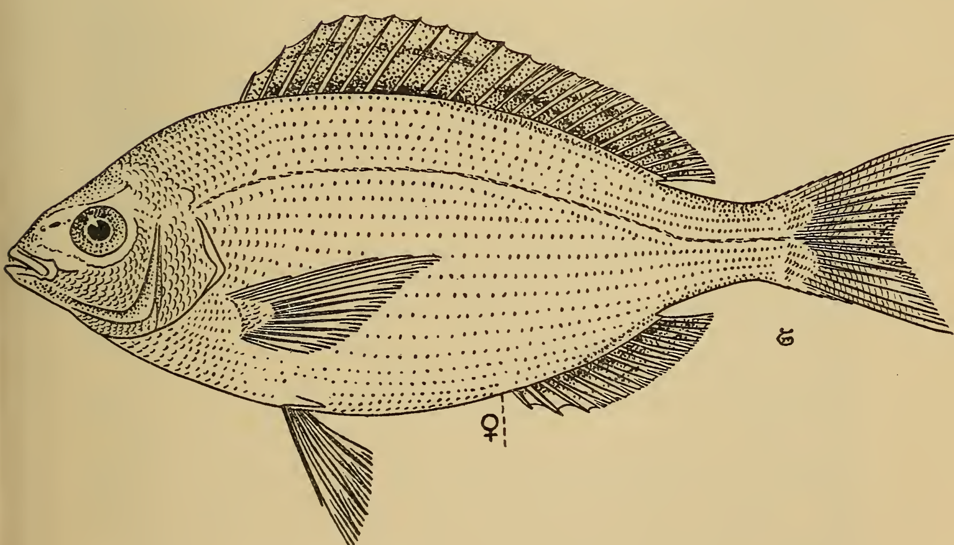


Fig. 1b.—*Spondyliosoma cantharus.* $\times \frac{1}{2}$. ♀.

*Cantharus orbicularis*, Cuvier and Valenciennes, 1830, *t.c.* p. 331; Günther, 1859, *t.c.* p. 416; Moreau, 1881, *t.c.* p. 52; Carus, 1889–93, *t.c.* p. 626.

*Cantharus griseus*, Cuvier and Valenciennes, 1830, *t.c.* p. 333; Lowe, 1839, Tr. Zool. Soc. London, vol. ii, p. 178; Yarrell, 1859, Brit. Fish., ed. 3, vol. ii, p. 165, fig.; Moreau, 1881, *t.c.* p. 49.

?*Cantharus senegalensis*, Cuvier and Valenciennes, 1830, *t.c.* p. 337.

*Cantharus lineatus*, Thompson, 1846, Ann. Mag. N.H. (2), vol. xviii, p. 313; Günther, 1859, *t.c.* p. 413; Steindachner, 1867, Sitzungsber. Akad. Wien, vol. lvi (1), p. 649; Day, 1880–84, Fish. Britain, p. 26, pl. ix; Carus, 1889–93, *t.c.* p. 625; Smitt, 1893, Scand. Fish., vol. i, p. 54, fig. 14; Pellegrin, 1914, Ann. Inst. océan., vol. vi, p. 51; Le Gall, 1931, in Joubin, Faune Ichth. Atlant. Nord, No. vi, fig.

*Cantharus linnei*, Malm, 1877, Göteborgs Bohus. Faun., pp. 97, 384.

*Spondyliosoma cantharus*, Jordan and Fesler, 1893, Rep. U.S. Com. Fish., vol. xvii (1889–91), p. 530; Buen, 1926, Cat. ict. Médit. Españ. Marruecos, p. 141.

*Spondyliosoma orbiculare*, Jordan and Fesler, 1893, *t.c.* p. 530.

*Spondyliosoma brama*, Fage, 1907, Arch. Zool. exp. gén. (4), vol. vii, p. 73.

*Caranthus lineatus*, Barnard, 1927, Ann. S. Afr. Mus., vol. xxi, p. 722.

Depth of body 2 to $2\frac{2}{3}$ in the length, length of head 3 to $3\frac{3}{4}$. Profile more or less straight to occiput, thence moderately convex to origin of dorsal fin. Snout as long as or longer than eye, diameter of which is 3 (young) to $4\frac{1}{3}$ in length of head, 1 to $1\frac{3}{5}$ in interorbital width, and twice or nearly twice depth of praeorbital. Lower edge of praeorbital usually more or less notched, but sometimes nearly straight. 38 to 48 teeth in outer row of upper jaw, 42 to 52 in outer row of lower jaw. 14 to 16 gill-rakers on lower part of anterior arch. 6 or 7 series of scales on cheek; 64 to 72 scales in lateral line, 8 to 10 from origin of dorsal fin to lateral line; scales on upper surface of head extending forward to a point above middle of eye. Dorsal XI 12; 4th to 6th spines longest, length $1\frac{5}{6}$ to $2\frac{1}{3}$ in that of head; first soft ray not or only very little longer than last spine. Anal III 10; 2nd spine a little shorter than 3rd and $1\frac{2}{3}$ to more than twice as long as first; 3rd spine about $\frac{3}{5}$ length of longest dorsal spine. Pectoral with 15 or 16 (occasionally 17) rays, extending to or a little beyond vent or not quite as far, length equal to or rather longer than that of head. Pelvic not reaching vent. Coloration variable; generally silvery grey, with numerous narrow, dark longitudinal lines on the side, mainly below the lateral line; male with about 6 rather indistinct dark cross-bars on the sides, which are more clearly defined in the young; sometimes some narrow bars between the broader ones; male sometimes with irregular dark patches on head; dorsal and anal fins greyish in the female, more or less spotted and blotched with dusky; in the male these fins are much darker, the dorsal sometimes being quite black; caudal variegated in young, greyish in the adult female, more or less blackish in the male; pectoral pale in the female, dusky in the male; pelvic blackish or brownish in both sexes.

Described from numerous examples, 100 to 390 mm. in total length, from the English Channel, Lisbon, Majorca, Monaco, Naples, Malta, Propontis, Madeira, Mogador, and the Cape Verde Islands.

*Hab.:* Coasts of south-western Europe, from southern Scandinavia to the eastern Mediterranean; coasts of northern and western Africa, southwards to Angola.

The marked sexual dimorphism in this species does not appear to have been previously recognised, but there is little doubt that the two forms respectively named *S. cantharus* (=*lineatus*, *griseus*) and *S. orbicularis*, both of which have received distinct local names in parts of the Mediterranean, represent the male and female of the same species. In addition to the differences in coloration, which are very marked in the living fish, comparison of specimens of equal size shows that the females have a constantly deeper body, more oblique anterior profile, and a somewhat shorter pectoral fin than the males. Mr. Fraser-Brunner informs me that his experience with Black Bream on the south coast of England suggests that the two sexes shoal separately.

2. *Spondyliosoma emarginatum* (Cuvier and Valenciennes).

*Cantharus emarginatus*, Cuvier and Valenciennes, 1830, H.N. Poiss., vol. vi, p. 338; Günther, 1859, Cat. Fish., vol. i, p. 416; Kner, 1865, Reise "Novara," Zool., vol. i, 5. Fische, p. 73.

*Cantharus microlepis*, Gilchrist and Thompson, 1909, Ann. S. Afr. Mus., vol. vi, p. 231.

*Scatharus graecus*, Clark, 1915, Sci. Res. "Scotia," vol. iv, p. 396.

*Pagellus microlepis*, Regan, 1921, Ann. Mag. Nat. Hist. (9), vol. vii, p. 419.

*Caranthus emarginatus*, Barnard, 1927, Ann. S. Afr. Mus., vol. xxi, p. 722.

*Caranthus microlepis*, Barnard, 1927, *t.c.* p. 723.

*Pachymetopon grande*, Fowler, 1929, Ann. Natal Mus., vol. vi, p. 259; Fowler, 1933, Bull. U.S. Nat. Mus., 100 (12), p. 214.
*Spondyliosoma microlepis*, Fowler, 1933, *t.c.* p. 183.
*Spondyliosoma emarginata*, Fowler, 1933, *t.c.* p. 183.

Depth of body $2\frac{1}{5}$ to $2\frac{2}{3}$ in the length, length of head 3 to $3\frac{1}{2}$. Profile in smaller specimens nearly evenly convex, but with a slight emargination above eyes, in larger specimens nearly straight to above eyes, thence convex to origin of dorsal. Snout as long as or a little shorter than eye, diameter of which is 3 (young) to nearly 4 in length of head, 1 to $1\frac{1}{2}$ in interorbital width, and 2 to $2\frac{2}{3}$ times depth of

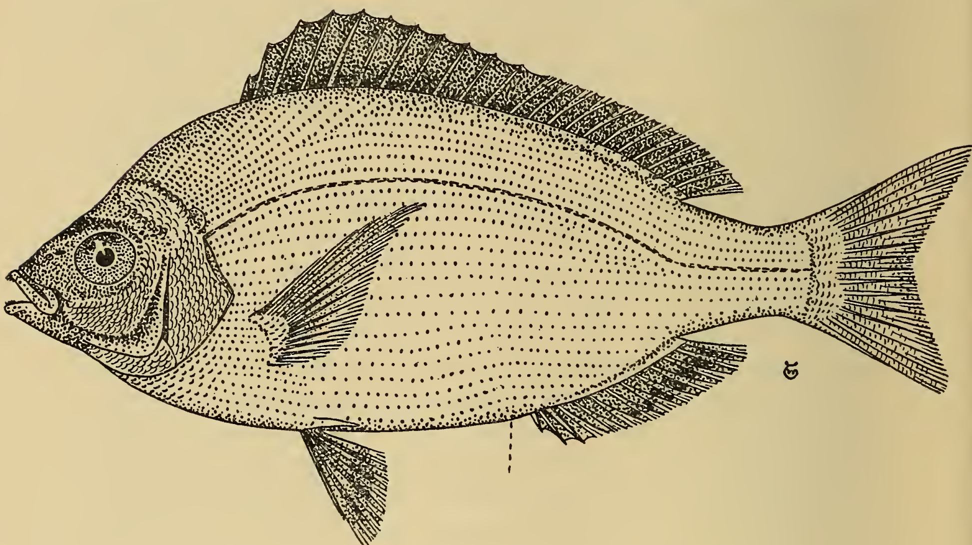



FIG. 2.—*Spondyliosoma emarginatum.* × About $\frac{2}{5}$. ♂.

praeorbital. Lower edge of praeorbital with a notch which is much shallower in the young. 38 to 50 teeth in outer row of upper jaw, 42 to 54 in outer row of lower jaw. 15 to 17 gill-rakers on lower part of anterior arch. 8 series of scales on cheek; 80 to 92 scales in lateral line, 14 or 15 between origin of dorsal fin and lateral line; scales on upper surface of head extending forward to a point behind middle of eye. Dorsal XI 11–13; 4th or 5th spines longest, length $1\frac{4}{5}$ to nearly 3 (generally about twice) in that of head; first soft ray a little longer than last spine. Anal III 10; 2nd spine shorter than 3rd and twice or more than twice as long as first; 3rd spine $\frac{3}{5}$ to $\frac{2}{3}$ length of longest dorsal spine. Pectoral with 15 or 16 rays, extending to a little beyond vent, length about equal to that of head. Pelvic not or scarcely reaching vent. Greyish or brownish, with traces of dark longitudinal lines on the sides; male with a more or less distinct dark bar between the eyes, and with a dark patch on the suborbitals and on the flange of the praeoperculum; dorsal, anal, and pelvic fins blackish in the male, greyish or dusky in the female; male (?) with a dark spot in the axil of the pectoral.

Described from 13 examples, 105 to 300 mm. in total length, from Table Bay, Simon's Bay, Cape St. Blaize, False Bay, and coast of Natal; including the types of *Cantharus microlepis* and *Pagellus microlepis*.

*Hab.:* Coast of south-east Africa, from Saldanha Bay to Natal; Mauritius; Madagascar.

This species is clearly related to *S. cantharus*, but the scales are smaller and those on the posterior part of the body more distinctly lobate or even pointed in the centre of the free margin. The two sexes appear to differ somewhat in coloration, but, owing to the small amount of material and the difficulty of sexing many of the specimens, I am unable to say whether there are other differences as in the preceding species. It seems certain that *S. microlepis* is identical with *S. emarginatus*: in 4 examples of the former, including the types of Regan's and Gilchrist and Thompson's species, I count 83 to 92 scales in the lateral line, and in 9 examples of the latter, 80 to 86.

### Pachymetopon, Günther.

*Pachymetopon*, Günther, 1859, Cat. Fish., vol. i, p. 424 [*Pachymetopon grande*, Günther].

*Caranthus* (part), Barnard, 1927, Ann. S. Afr. Mus., vol. xxi, p. 720.

*Simocantharus*, Fowler, 1933, Bull. U.S. Nat. Mus., 100 (12), pp. 182, 185 [*Cantharus aeneus*, Gilchrist and Thompson].

*Spondyliosoma* (part), Fowler, 1933, *t.c.* p. 182.

Close to *Spondyliosoma*, but with a deeper praeorbital, the lower edge of which is nearly straight. Teeth nearly all compressed, in 4 or 5 (occasionally 6) rows, those of the outermost row broader and fewer than in *Spondyliosoma*, those of the innermost row not molariform. Dorsal with 10 or 11 spines; soft dorsal and anal densely scaled on basal third of fin, but without sheath.

Five species from South Africa.

## *Synopsis of the Species.*

I. 26 to 36 teeth in outer row of upper, 36 to 44 in outer row of lower jaw; depth of praeorbital usually less than diameter of eye; 13 to 16 gill-rakers on lower part of anterior arch.

- A. Flange of praeoperculum not scaled; 60 to 66 scales in lateral line; scales on upper surface of head extending forward to a point behind level of middle of eye; pectoral as long as or shorter than head.
  - 1. (28) 30 to 36 teeth in outer row of upper, 40 to 44 in outer row of lower jaw; 1st dorsal spine $\frac{1}{2}$ to $\frac{2}{3}$ eye . . 1. *blochi.*
  - 2. 26 to 28 teeth in outer row of upper, 36 in outer row of lower jaw; 1st dorsal spine about $\frac{4}{5}$ eye . . 2. *canescens.*
- B. Flange of praeoperculum partly scaled; 80 to 86 scales in lateral line; scales on upper surface of head extending forward to above level of anterior part of eye; pectoral $1\frac{1}{5}$ to $1\frac{1}{4}$ times as long as head 3. *aeneum.*

II. 18 to 22 teeth in outer row of upper, 22 in outer row of lower jaw; depth of praeorbital about equal to diameter of eye; 10 or 11 gill-rakers on lower part of anterior arch.

- A. Depth about $2\frac{1}{3}$ in length; anal III 10; pectoral nearly $1\frac{1}{2}$ times as long as head . . . . . . . . . 4. *grande.*
- B. Depth about $1\frac{5}{6}$ in length; anal III 11; pectoral about $1\frac{1}{3}$ times as long as head . . . . . . . 5. *glaucum.*

### 1. *Pachymetopon blochi* (Cuvier and Valenciennes).

?*Sparus brama*, Bloch, 1791, Nat. ausl. Fische, pl. cclxix.

*Cantharus blochii*, Cuvier and Valenciennes, 1830, H.N. Poiss., vol. vi, p. 339; Günther, 1859, Cat. Fish., vol. i, p. 416; Kner, 1865, Reise "Novara," Zool., vol. i, 5. Fische, p. 74.

*Cantharus castelnaui*, Bleeker, 1860, Nat. Tijdschr. Ned. Ind., vol. xxi, p. 59.

*Caranthus blochi*, Barnard, 1927, Ann. S. Afr. Mus., vol. xxi, p. 721.

*Spondyliosoma blochii*, Fowler, 1933, Bull. U.S. Nat. Mus., 100 (12), p. 184.

Depth of body $2\frac{1}{4}$ to $2\frac{1}{2}$ in the length, length of head 3 to $3\frac{1}{4}$. Profile more or less evenly convex from snout to origin of dorsal. Snout as long as to twice as long as eye, diameter of which is 3 (young) to $5\frac{1}{4}$ in length of head, 1 to $2\frac{1}{2}$ in interorbital width, and $\frac{9}{10}$ to $1\frac{1}{2}$ times depth of praeorbital. Lower edge of praeorbital without notch, the hinder part of the maxillary not concealed. (28) 30 to 36 teeth in outer row of upper jaw, 40 to 44 in outer row of lower jaw; teeth of outer row considerably larger than those of succeeding inner rows, their apices reaching a much higher level. 13 or 14 gill-rakers on lower part of anterior arch. 9 series of scales on cheek; 60 to 66

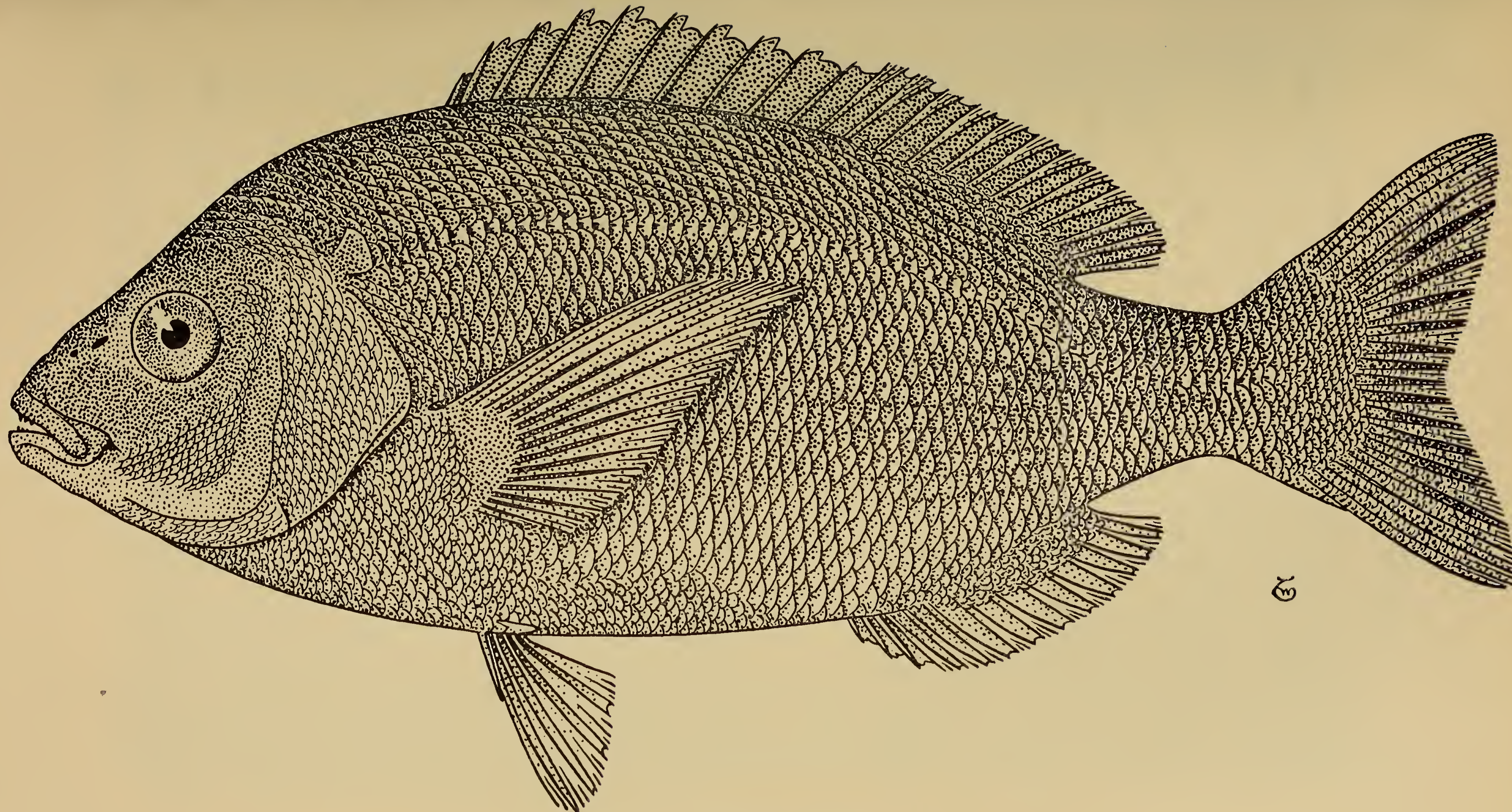


FIG. 3.—*Pachymetopon blochi*. $\times \frac{2}{3}$.

scales in lateral line, 9 or 10 from origin of dorsal fin to lateral line; scales on upper surface of head extending forward to a point behind level of middle of eye; flange of praeoperculum not scaled; scales on caudal fin not extending to its posterior margin. Dorsal X–XI 11–12; length of first spine $\frac{1}{2}$ to $\frac{2}{3}$ diameter of eye; 4th or 4th and 5th spines longest, length about 3 (sometimes 4) in that of head; first soft ray much longer than last spine. Anal III 10; 2nd spine shorter than 3rd and $1\frac{1}{2}$ to twice as long as first; 3rd spine $\frac{3}{5}$ to $\frac{2}{3}$ length of longest dorsal spine. Pectoral with 17 or 18 rays, extending to vent or not quite as far, length equal to or less than that of head. Pelvic not reaching vent. Uniformly greyish or brownish, sometimes with bronze or bluish shades, sometimes darker sometimes paler; usually paler or silvery below.

Described from 10 examples, 85 to 450 mm. in total length, from Saldanha Bay, Table Bay, and False Bay.

*Hab.*: South-west Africa.

2. *Pachymetopon canescens*, sp. n.

(Plate II.)

Close to the preceding species. Depth of body $2\frac{1}{2}$ in the length, length of head $3\frac{1}{5}$. Snout $1\frac{1}{3}$ times eye, diameter of which is 4 in length of head, $1\frac{1}{2}$ in interorbital width, and $1\frac{2}{5}$ times depth of praeorbital. Praeorbital nearly completely concealing the maxillary. 26 to 28 teeth in outer row of upper jaw, 36 in outer row of lower jaw; teeth of inner series larger than in *P. blochi*, the apices of the teeth in all the rows reaching the same or nearly the same level, at least in lower jaw. 14 gill-rakers on lower part of anterior arch. 8 or 9 series of scales on cheek; about 65 scales in lateral line, 10 from origin of dorsal fin to lateral line. Dorsal X–XI 10–11; length of first spine about $\frac{4}{5}$ diameter of eye; 4th spine longest, length 3 in that of head. Anal III 9–10; 2nd spine shorter than 3rd and about $1\frac{3}{4}$ times as long as first; 3rd spine $\frac{4}{5}$ length of longest dorsal spine. Pectoral with 17 rays, extending to vent, length about equal to that of head. Pale yellowish brown, with a small dark patch below the eye, another larger one on the operculum, and with irregular dark areas on upper parts of sides and on upper surface of caudal peduncle; a number of minute dark dots scattered over head and body, which below the lateral line tend to be arranged in longitudinal rows; similar dots on the rays of the fins.

Described from a single example (holotype), 275 mm. in total length, believed to be from False Bay: this is the specimen mentioned by Barnard in his monograph of South African Marine Fishes (p. 721). A second specimen (263 mm.), from Kalk Bay, False Bay, is in the South African Museum.

3. *Pachymetopon aeneum* (Gilchrist and Thompson).

*Cantharus aeneus*, Gilchrist and Thompson, 1908, Ann. S. Afr. Mus., vol. vi, p. 166.

*Cantharus natalensis*, Gilchrist and Thompson, 1908, *t.c.* p. 167.

*Cantharus simus*, Gilchrist and Thompson, 1909, *t.c.* p. 231.

*Caranthus aeneus*, Barnard, 1927, Ann. S. Afr. Mus., vol. xxi, p. 724.

*Spondyliosoma aenea*, Fowler, 1933, Bull. U.S. Nat. Mus., 100 (12), p. 185.

Depth of body $2\frac{1}{4}$ to $2\frac{1}{2}$ in the length, length of head $2\frac{1}{2}$ to $2\frac{3}{4}$. Profile more or less evenly convex from snout to origin of dorsal, but there is a fairly prominent bulge in front of the eyes, below which the snout is concave. Snout longer than eye, diameter of which is $3\frac{1}{2}$ (young) to $4\frac{1}{3}$ in length of head, $1\frac{1}{4}$ to $1\frac{3}{4}$ in interorbital width, and $1\frac{1}{3}$ to $1\frac{4}{5}$ times depth of praeorbital. Lower edge of praeorbital straight or very little concave, the maxillary not entirely concealed. 30 to 36 teeth in outer row of upper jaw, 36 to 40 in outer row of lower jaw; teeth of inner rows more or less chisel-shaped, usually with a single median point. 15 or 16 gill-rakers on lower part of anterior arch. About 10 series of scales on cheek; 80 to 86 scales in lateral line, 10 to 12 from origin of dorsal fin to lateral line; scales on upper surface of head extending forward to a point above level of anterior part of eye; flange of praeoperculum scaled; scales on caudal fin extending nearly to its posterior margin. Dorsal XI 11; 4th or 4th and 5th spines longest, length 2 to $2\frac{4}{5}$ in that of head; first soft ray longer than last spine. Anal III 10; 2nd and 3rd spines subequal or 2nd a little longer and $1\frac{1}{2}$ to $1\frac{2}{3}$ times as long as first; 3rd spine about $\frac{3}{4}$ length of longest dorsal spine. Pectoral with 16 or 17 rays, extending to or beyond vent, length $1\frac{1}{5}$ to $1\frac{1}{4}$ times that of head. Pelvic not or scarcely reaching vent. Greyish or brownish above, silvery below, with dark longitudinal lines, especially below the lateral line; dorsal, anal, pelvics, and sometimes hinder part of caudal fin blackish or violaceous.

Described from 7 examples, 225 to 430 mm. in total length, including the holotype of the species and the types of *Cantharus natalensis* and *C. simus*.

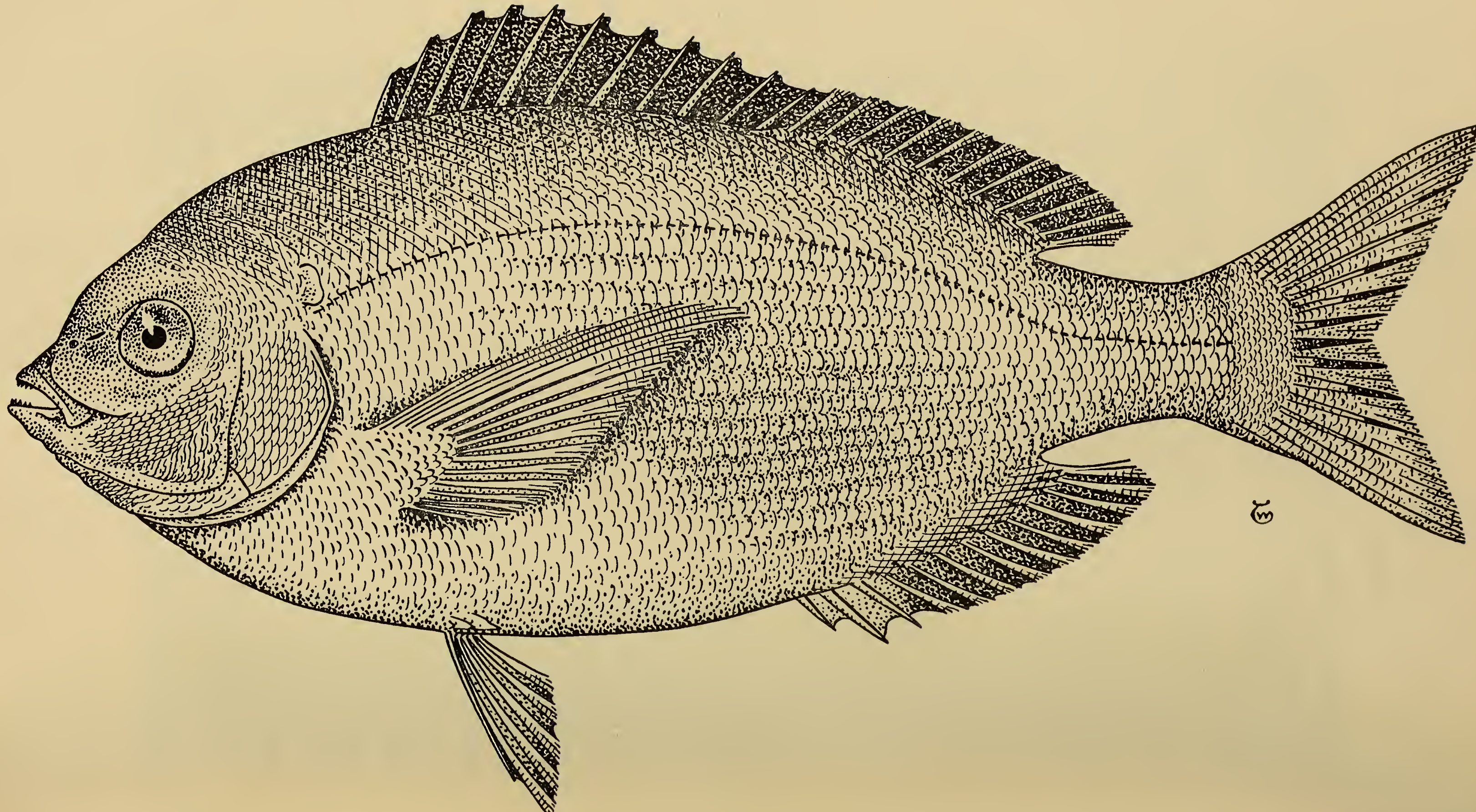


FIG. 4.—*Pachymetopon aeneum*. $\times \frac{2}{3}$.

*Hab.:* Coast of Natal, at certain seasons extending as far westwards as False Bay.

Fowler (1933) makes this species the type of a new subgenus, *Simocantharus.*

4. *Pachymetopon grande,* Günther.

*Pachymetopon grande,* Günther, 1859, Cat. Fish., vol. i, p. 424; Günther, 1886, Ann. Mag. Nat. Hist. (5), vol. xviii, p. 367; Barnard, 1927, Ann. S. Afr. Mus., vol. xxi, p. 636.

*Pachymetopon guentheri,* Steindachner, 1869, Sitzungsber. Akad. Wiss. Wien, vol. lx (1), p. 135.

?*Pachymetopon gibbosus,* Pellegrin, 1914, Bull. Soc. zool. France, vol. xxxix, p. 264.

Depth of body about $2\frac{1}{3}$ in the length, length of head about 4. Profile convex from snout to origin of dorsal, with a bulge in front of the eye, more prominent in the larger specimen. Snout longer than eye, diameter of which is 4 in length of head, $1\frac{3}{4}$ in interorbital width, and equal to depth of praeorbital. Lower edge of praeorbital a little concave, the maxillary not entirely concealed. Apices of teeth truncate, rounded, or with a single median point; 18 to 20 teeth in outer row of upper jaw, about 22 in outer row of lower jaw. 10 or 11 gill-rakers on lower part of anterior arch. 7 series of scales on cheek; about 80 scales in lateral line, 11 from origin of dorsal fin to lateral line; scales on upper surface of head extending forward to a point above level of anterior part of eye; flange of praeoperculum not scaled; scales on caudal fin extending nearly to its hinder margin. Dorsal XI 11; 4th to 6th spines longest, length 2 to $2\frac{1}{6}$ in that of head; first soft ray longer than last spine. Anal III 10; 2nd and 3rd spines subequal and $1\frac{1}{4}$ to $1\frac{2}{5}$ times as long as first; 3rd spine about $\frac{2}{3}$ as long as longest dorsal spine. Pectoral with 17 rays, extending to or nearly to origin of anal, length nearly $1\frac{1}{2}$ times that of head. Pelvic scarcely reaching vent. Brownish, with a number of narrow, dark longitudinal lines on the side below the lateral line; spinous dorsal black; soft dorsal and anal blackish or violaceous; pectorals, pelvics, and hinder part of caudal dusky.

Described from 2 examples, 420 and 520 mm. in total length, including the holotype of the species, a stuffed skin, 520 mm. long.

*Hab.:* Coast of Natal; Cape of Good Hope; Madagascar (?).

Steindachner's description of *P. guentheri* differs a little from the above, but, as he does not state the size of his specimen, it is impossible to say how far these differences are due to age. Günther himself has suggested that *guentheri* and *grande* are identical.

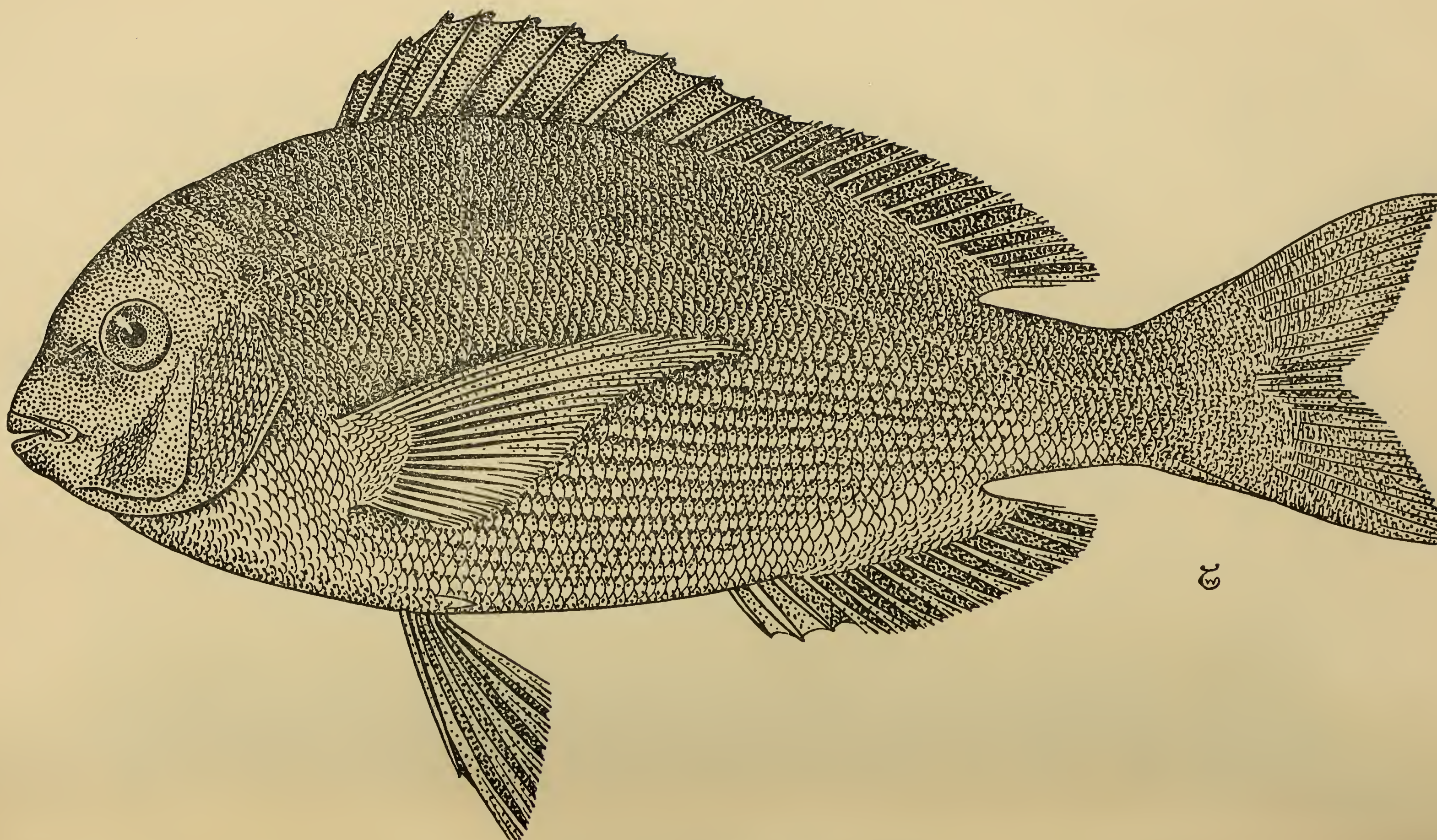


FIG. 5.—*Pachymetopon grande*. × About $\frac{2}{3}$.

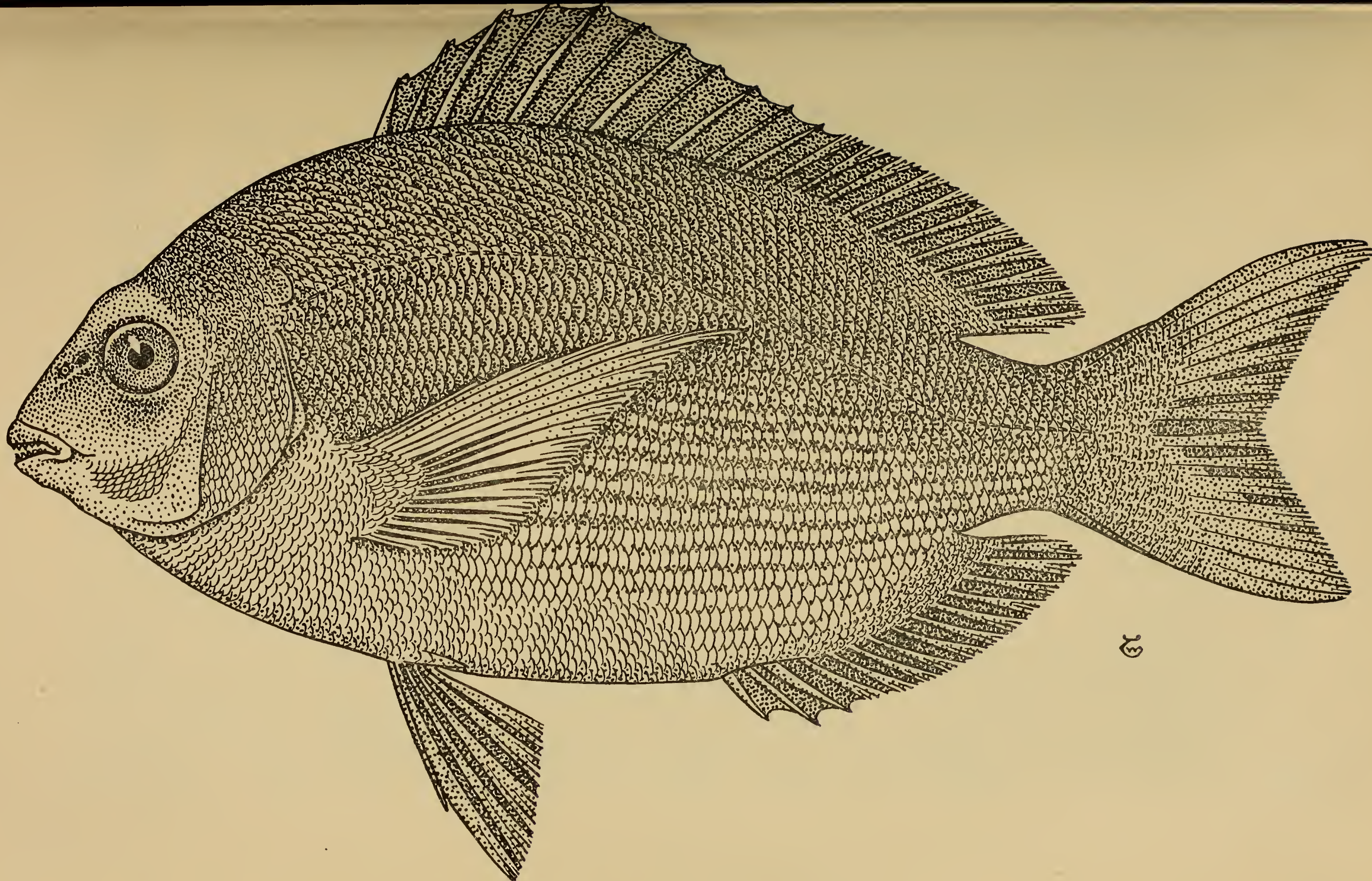


Fig. 6.—*Pachymetopon glaucum*. × About $\frac{2}{3}$.

### 5. *Pachymetopon glaucum*, sp. n.

Close to the preceding species. Depth of body $1\frac{5}{6}$ in the length, length of head $3\frac{2}{3}$. Diameter of eye $3\frac{2}{3}$ in length of head, $1\frac{2}{3}$ in interorbital width, and about equal to depth of praeorbital. Lower edge of praeorbital nearly straight; flange of praeoperculum not scaled. Apices of teeth of inner rows mostly truncate, but sometimes with a small median point or feebly crenulate; 22 teeth in outer row in both upper and lower jaws. 11 gill-rakers on lower part of anterior arch. 85 scales in lateral line, 10 or 11 from origin of dorsal fin to lateral line; caudal fin less densely scaled. Dorsal XI 11; 5th spine longest, length 2 in that of head. Anal III 11; 2nd and 3rd spines subequal, $1\frac{3}{5}$ times as long as first; 3rd spine about $\frac{2}{3}$ as long as longest dorsal spine. Pectoral about $1\frac{1}{3}$ times as long as head. Dark grey above, with a bluish or violaceous tinge, silvery below; a number of narrow, dark longitudinal lines on the side, mainly below the lateral line; dorsal, anal, pelvics, and hinder part of caudal fin dark violaceous; upper part of pectoral dusky, lower part pale.

Described from a single example (holotype), 310 mm. in total length, from East London. This was sent to the South African Museum by Mr. W. L. Wright, Hon. Secretary of the South African Sea-Anglers Association, in June 1933. According to him, this species, locally known as the Blue Fish,* attains a weight of 10 lb., but none of the local anglers have taken one under 2 lb. A prominent frontal gibbosity over the eye is sometimes developed.

*Hab.:* South Africa.

### Gymnocrotaphus, Günther.

*Gymnocrotaphus*, Günther, 1859, Cat. Fish., vol. i, p. 432 [*Gymnocrotaphus curvidens*, Günther].

Close to *Pachymetopon*, but with no scales on the cheek. Teeth of innermost series more or less obtuse, but not molariform.

A single species from South Africa.

### 1. *Gymnocrotaphus curvidens*, Günther.

*Gymnocrotaphus curvidens*, Günther, 1859, Cat. Fish., vol. i, p. 432; Barnard, 1927, Ann. S. Afr. Mus., vol. xxi, p. 727, pl. xxix, fig. 3; Fowler, 1933, Bull. U.S. Nat. Mus., 100 (12), p. 186.

* This vernacular name is apparently applied indiscriminately to several species. Dr. Barnard informs me that examples of *Pachymetopon grande*, *P. aeneum*, *Polyamblyodon germanus*, as well as of another type of Percoid fish, were all sent to the South African Museum as "Blue Fish."

*Hab.:* False Bay, extending along the coast to East London.

The holotype is a stuffed specimen, 320 mm. in total length, from the "Cape of Good Hope": I have also examined 3 examples in spirit, 175 to 300 mm. in length, from Kalk Bay, presented by the South African Museum in 1932.

### Polyamblyodon, gen. nov.

Genotype—*Pachymetopon germanum*, Barnard.

Close to *Pachymetopon*, differing in the form of the dentition. An outer row of strong, curved, compressed chisel-like teeth in each jaw, behind which is a broad band composed of 6 or 7 rows of small rounded molariform teeth.

A single species from South Africa.

#### 1. *Polyamblyodon germanus* (Barnard).

*Pachymetopon germanum*, Barnard, 1934, Ann. Mag. Nat. Hist. (10), vol. xiii, p. 231, fig. 2.

*Hab.:* Coast of Natal.

The holotype, 382 mm. in total length, in the British Museum collection, is believed to have come from Natal: a second specimen, 375 mm. long, from Durban, is in the South African Museum.

### The Systematic Position of Dichistius and Tripterodon.

When he published his classification of the Percoid fishes, Regan * was able to examine only dried specimens of *Pachymetopon* and *Dichistius* (= *Dipterodon*, Cuvier *nec* Lacepède),† both of which he placed with doubt in the family *Girellidae*, a position which they occupy in Barnard's monograph. The close relationship of *Pachymetopon* to the Sparid genus *Spondyliosoma* has already been demonstrated, and the examination of a well-preserved specimen of *Dichistius capensis* leaves little doubt that this genus should be removed from the *Girellidae* and placed in the allied family *Kyphosidae*. The principal characters distinguishing the *Kyphosidae* from the *Girellidae* are the exposed distal part of the maxillary; the scaly

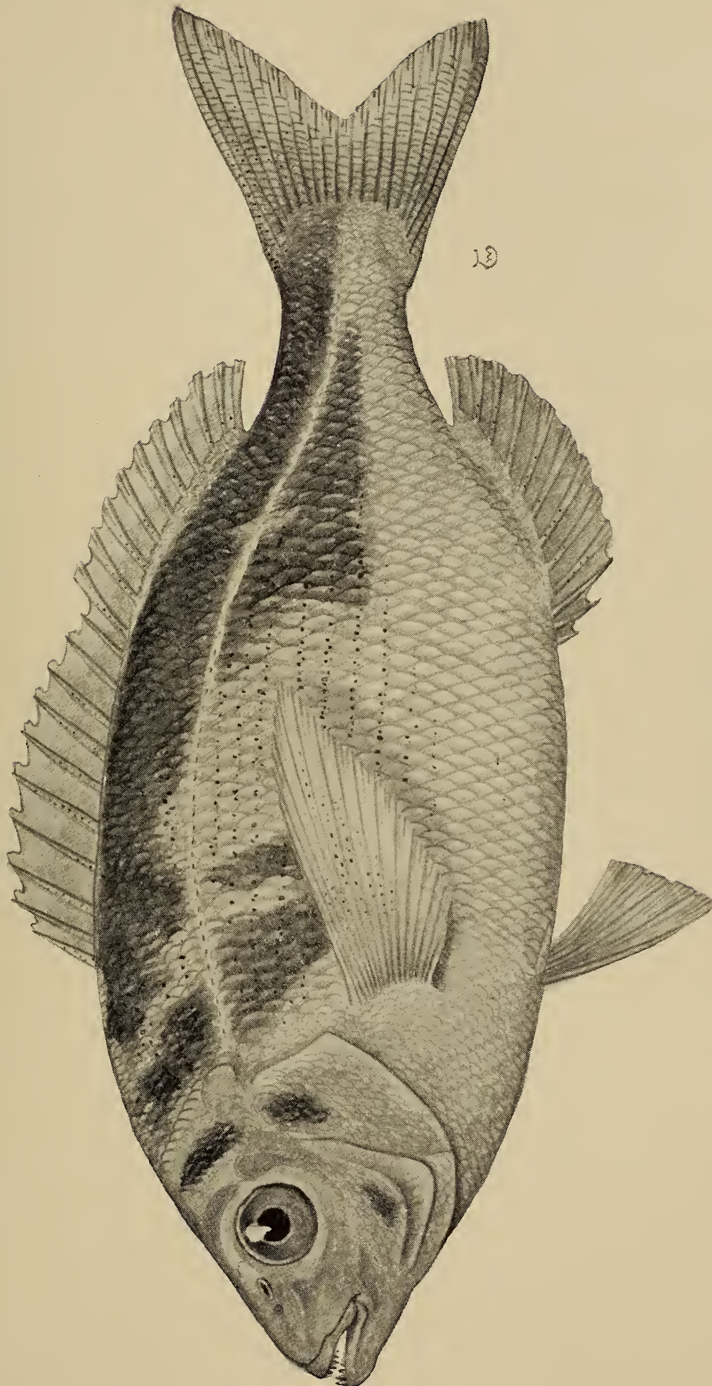
* 1913, Ann. Mag. Nat. Hist. (8), xii, p. 127.

† *Dipterodon*, Cuvier, 1829, is preoccupied by *Dipterodon*, Lacepède, 1802 (type *D. hexacanthus*, Lacepède)—a synonym of *Apogon*. Lacepède's genus includes species of *Lutianus*, *Apogon*, *Aspro*, *Bairdiella*, etc. Gill (1888) has proposed the name *Dichistius* as a substitute. *Coracinus*, Gronovius, 1763, is not accepted (Opinion 89).

gill-membranes, joined to the isthmus; and the outer row of incisors in the jaws, implanted by horizontal roots, behind which is a series of small villiform teeth. In *Dichistius* the roots of the incisors are not conspicuous, and the inner series of teeth is represented by a few small conical teeth which are occasionally present, and are more or less concealed in fleshy pads.* Nevertheless, in other respects this fish appears to be a typical Kyphosid, and the definition of the family should be emended for its inclusion.

Regan did not mention *Tripterodon* in his classification, but, here again, at the time that his paper was published the British Museum possessed only the type of *T. orbis*, a dried skin from Playfair's Zanzibar collection. A much smaller example preserved in alcohol was received from Messrs. Marley and Robinson in 1919, but unfortunately the mouth has been damaged and it is impossible to ascertain the form of the jaws. However, I feel certain that this fish cannot belong to the *Sparidae*, and its place is almost certainly either with the *Girellidae* or with the *Ephippidae*. The compressed, tricuspidate teeth are reminiscent of those of *Girella*, but the general appearance of the fish is so like certain species of *Ephippus* and *Chaetodipterus* that it is difficult to believe that they are not related. Pending a study of its osteology, therefore, *Tripterodon* may be placed in the family *Ephippidae*.

* Barnard, 1927, Ann. S. Afr. Mus., xxi, p. 635.



*Pachymetapon canescens* n. sp. $\times \frac{2}{3}$.

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# ANNALS

OF THE

# SOUTH AFRICAN MUSEUM

*VOLUME XXXII.*

PART II, *containing* :—

3. *Reports on the Marine Mollusca in the Collections of the South African Museum.* X. Family *Verticordiidae*.—By J. R. LE B. TOMLIN, M.A. (With 1 Text-figure.)

4. *A New Species of Emerita* (*Crustacea*) *from South Africa.*—By WALDO L. SCHMITT, Curator of Marine Invertebrates, U.S. National Museum, Washington, D.C. (With Plate III.)

5. *A New Dendrochirote Holothurian from South Africa, with some Remarks on the* Rhopalodinidae.—By S. G. HEDING, University Zoological Museum, Copenhagen. (With Plates IV, V, and 3 Text-figures.)

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7. *On a New South African Species of* Balanoglossus *and a Comparison between it and* Balanoglossus capensis (*Gilchrist*).—By C. J. VAN DER HORST, University of the Witwatersrand. (With 19 Text-figures.)

*ISSUED MARCH 1937. PRICE 7s. 6d.*

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BY NEILL AND CO., LTD.,
212 CAUSEWAYSIDE, EDINBURGH

3. *Reports on the Marine Mollusca in the Collections of the South African Museum.* X. Family *Verticordiidae.*—By J. R. le B. Tomlin, M.A.

(With 1 Text-figure.)

*Halicordia flexuosa* (Verrill and Smith).

This lamellibranch species is very remarkable—not only for its general appearance, but for the wideness of its range.

It was originally described by two joint authors as *Mytilimeria flexuosa* in the American Journal of Science (3), vol. xxii, p. 302, 1881,

Fig. 1.—*Halicordia flexuosa* (Verrill and Smith).

from a dead shell dredged off the New England coast in 571 metres. Subsequently it was dredged there alive in 137–1211 metres, and Verrill described both animal and shell in Tr. Connecticut Academy, vol. vi, p. 258, 1884. The type was also figured in vol. v of the same serial, on plate 58, fig. 38, 1882.

Only two years after its discovery as above it was dredged by the "Talisman" at two stations on the West African coast, in 1495–2330 metres, and figured in the "Expéditions Scientifiques du Travailleur du Talisman," Moll. Test., vol. xi, p. 210, pl. 10, f. 14–17, 1898, by Locard.

In 1894 Dall minutely described and figured the anatomy of the species in Proc. U.S. Nat. Mus., vol. xvii, p. 697, pl. 23, figs. 1, 3, 5, 6, and pl. 24, fig. 3, from a specimen dredged off Georges Bank in the Gulf of Maine in 677 fathoms. This shell measured 45 by 39 mm.—more than half as large again as the holotype. In this paper Dall assigns the species to a new genus, *Halicordia*, and withdraws a previous reference of it to *Verticordia*. *Halicordia* is placed near to *Lyonsiella*.

We next hear of it in the Report of the Scientific Results of the Michael Sars North Atlantic Deep Sea Expedition (1910), vol. iii, pt. 2, pl. 7, figs. 1–4, 1920, in which Grieg reports it from the west coast of Scotland and gives most admirable photographs.

Two dead specimens were dredged by the Cape Government trawler s.s. "Pieter Faure" in 1903 at the following localities: Cape Point N.E. by E., distant 36 miles, 650 fathoms, and Cape Point N. 81° E., distant 32 miles, 460–630 fathoms. The bottom at both localities was green mud. The first specimen (S.A.M., Reg. No. 150019) measures 54 mm. in breadth and 41 mm. in height, the second one (deposited in Brit. Mus.) measures 41 mm. either way.

Grieg particularly remarks on the great variation in the dimensions of the species, the breadth varying from 83 to 103·2 per cent. of the height.

4. *A New Species of Emerita (Crustacea) from South Africa.*—By WALDO L. SCHMITT, Curator of Marine Invertebrates, U.S. National Museum, Washington, D.C.

(With Plate III.)

IN the course of a revision of the genus *Emerita* (Sci. Survey Porto Rico and Virgin Ids., N.Y. Acad. Sci., vol. xv, pt. 2, p. 210 *et seq.*, figs. 71–78) the regret was expressed that no South African specimens were at hand for examination. Recently the South African Museum has been so kind as to remedy this lack. In view of the number of species added to the genus from the Atlantic coast of America, it appeared likely that a second species might also occur in Indo-Pacific waters. Such, indeed, is the case, for these South African specimens from Durban Bay represent an undescribed species which may not inappropriately be known as :

*Emerita austroafricana*, n. sp.

1910. *Emerita emeritus* Stebbing, Ann. S. Afr. Mus., vol. vi, pt. 4, p. 366 (non Linn.).

A strikingly different species, inasmuch as the distally sharply pointed dactyls of the first legs are laterally toothed or spined, perhaps better described as being armed with conspicuous marginal teeth tipped with tiny, movable, clear, corneous spines. These first dactyls in general outline are ovate, and, not counting the terminal or apical tooth or spine, are armed with two spines on the upper or outer margin and four on the inner or lower. This count holds for the specimen selected as the holotype, as well as for each of the other four specimens before me, all a part of the same lot, with the exception of the left first dactyl of one of the two largest and "soft" or recently moulted specimens, which carries five teeth on the lower margin instead of the usual four. Between these teeth or spines the margin of the dactyl is finely spinulose.

The carapace is more or less cylindrical and dorsally conspicuously and transversely striate from behind the groove or impressed line, setting off the frontal region from the anterior portion of the carapace before the cervical groove to the posterior margin of the carapace.

The greater part of the lateral or epimeral regions of the carapace is smooth and punctate. The transverse striae are well marked, rather widely spaced, and considerably interrupted. For the most part they are somewhat wavy, and toward their outer ends sparsely and scatteringly crenulate on their raised margins. In running a needle up the median line, or in a line parallel to it and not far removed from it on the dorsum of the carapace, one will cross parts or dash-sections of approximately 17 to 21 transverse lines or striae.

The impressed line just before the hinder margin of the carapace and under the epimeron of the second abdominal somite to which I have elsewhere referred in characterising other representatives of this genus, is not in evidence in any of the five specimens of the present species before me. This line in other species is formed, as it were, by the thickening of the hinder margin of the carapace, and, where it occurs, sets off this thickening from the surface of the carapace proper. Our species seems not to present such a thickening, and hence no impressed line of demarcation. I must needs here make note that a number of specimens of *E. talpoida* do show a suggestion, or even a slight ventral extension, of this line below the epimeron of the second abdominal somite contrary to an earlier observation (*loc. cit.*) that this was not the case.

In shape, acuteness, and relative length the three projections of the front are much like those of *E. emeritus* (L.). The lobe at the antero-inner angle of the large and operculiform joint of the third or outer maxilliped is low-triangular, broad at base, and distally rounded.

The prominently spined second joint of the antennal peduncle is quite smooth, and ornamented, if at all, with a few scattered double punctae. Near its ventral margin, dipping anteriorly and toward the under side, are two oblique incisions, the lower margins of which are densely piliferous and ridge-like. These ridges or incisions seem to be developed in all species of *Emerita*, and end, in the case of the more anterior of the two, at or on the third and lowermost of the three spines with which this joint of the antennal peduncle is distally armed. The uppermost, or dorsal, of the three spines arming this joint is quite long and slender, continuing the line of the upper margin of the joint more or less straight forward; the outer margin of the joint at the level of the median spine, as viewed from above, is about straight.

*Holotype.*—An ovigerous female (U.S.N.M. Cat. No. 71446) from Durban Bay, Natal, measuring in length of carapace, including the median rostral projection, 26 mm., greatest width 18 mm. With this specimen were four other females, of which three are also ovigerous. Of these last, two are larger and soft, one of these being the largest of the five specimens seen, 33 mm. long over the carapace and rostral projection. (Paratype: S.A. Mus. Cat. No. A 911.)

Regarding the distribution of this species, Dr. Barnard writes: "The specimens come from Durban Bay, Natal, and, so far as I am aware, *Emerita* has not been collected anywhere farther westwards along the coast, though it probably extends northwards all up the East African coast." Stebbing (Ann. S. Afr. Mus., vol. vi, pt. 4, p. 366) merely mentions: "A specimen sent by Mr. Quekett, from the Durban Museum, has a carapace measuring 30 mm. in length from the central tooth of the tridentate front to the hind margin."

*Remarks.*—In true *E. emeritus* from the Indo-Pacific (*loc. cit.*) the second joint of the antennal peduncle, on its outer surface, is ornamented with several oblique, somewhat irregular lines of crenulations (crenulated ridges running obliquely downward and back from the dorsal spine) and a number of very short crenulated ridges of similar inclination in a series behind and on the upper, dorsal slope of the rise or swollen ridge, as it might well be called, which terminates anteriorly in the largest or major spine of the joint. The lower half of the joint is more or less smooth except for the two oblique piliferous incisions common to all members of the genus. The uppermost spine is short and stubby, and at extreme tip a little bent up, not particularly noticeably so, but very acute and spiniform. The outer margin of the joint at the level of the middle spine, as viewed from above, is very slightly concave at about the base of the spine.

The second joint of the antennal peduncle of *E. analoga* is much like that of *E. emeritus*, but in degree of ornamentation lies between the latter species and *E. austroafricana*, though nearer the former; the outer margin of the joint in dorsal view is slightly concave.

*E. talpoida* has this second joint much like that of *E. analoga* and *E. emeritus* in general shape; the outer margin, too, is slightly concave; the upper spine is short and stubby, and directed more straightly forward than in the other two. However, the ornamentation is strikingly different, inasmuch as a crenulated ridge or line runs backward from both the uppermost and median spines to distinctly mark off a depressed area between them; these lines converge and meet at or a little behind the middle of the joint at that level. Above and behind these lines, and on the hinder portion of the joint below their level, there are some scattered, irregular, short lines of crenulations. The noticeably depressed area or sinus between the V or narrow U formed by the two crenulated lines running back from the spines is roughened a bit with a few more or less isolated, much abbreviated, little lines of crenulations.

*E. portoricensis* much resembles *E. talpoida* in these several respects; the crenulated line running back from each of the two upper spines meets its fellow to form a more broadly U-shaped but less depressed area, also roughened within. In some specimens there are several broadly U-shaped lines of crenulations, the upper limb of the more prominent one running part way on to the base of the uppermost spine of the joint, while the lower limb is more or less continuous with a line of crenulations running out on to and forming a ridge or line of crenulations on the middle spine; both before and behind this major U are similar duplicate shallow U's without the arms or lines of crenulations running up on the spines. The rest of the surface of the joint carries a few widely separated, short lines of crenulations.

In these respects *E. benedicti* is much like *portoricensis.*

In the larger, older, and better-developed specimens of *E. rathbunae* there is a longitudinal, raised, crenulated line running back from the middle or larger spine of the joint to about half the length of the body of the joint; above this line the surface of the joint is conspicuously roughened with short, wavy, coarsely crenulated lines, which also ornament the surface of the joint posterior to the hind end of the line on the middle spine, as well as, to a lesser degree, the surface below the line. The uppermost spine is somewhat abruptly and markedly bent upwards above the general trend of the upper margin of the joint; the outer margin of the joint at the level of the middle spine, as viewed from above, and the general trend of the spine tend to meet at quite a decided, though shallow, angle of 150° more or less.

In *E. brasiliensis* a shallow U-shaped depressed area lies behind the sinus between the upper and middle spines; below, this is bounded by a line or crenulated ridge made up of a successive series of short little vertical lines of crenulations, one close behind the other, along the line of the larger or middle spine of the joint; this shallow U-shaped area is bounded by one or more short crenulated lines, while farther back are a few more, except for which the surface of the joint is generally smooth and sparsely punctate; there is no ridge or crenulated line along the line of the upper spine of the joint.

This spine is of good size, directed quite straightly forward. The outer margin of the joint, as viewed from above, though markedly concave, is not angled as in *E. rathbunae.*

In order to fit our new species into a recently published key to the species of *Emerita* (Sci. Survey Porto Rico and Virgin Ids., N.Y. Acad. Sci., vol. xv, pt. 2, p. 210 *et seq.*, figs. 71–78), the first major head A[1] and the first secondary head B[1] under it need to be revised as follows:

*A*[1]. Dactyls of the first legs distally subacute or sharply pointed. Transverse striations on carapace often conspicuously crenulate, more or less continuous, and crossing dorsum for whole of its extent, except at times the frontal region.

B[1]. Dactyl broadly ovate, distally pointed, less than twice as long as greatest width. Surface of lateral, epimeral expansion of carapace smooth and punctate. The three projections of the front are all quite narrowly triangular and more or less sharply pointed, the median more so than the lateral.

C[1]. Margins of dactyl armed with several conspicuous spines or teeth. No impressed line just before hinder margin of carapace either side of first abdominal somite. Transverse lines or striations on carapace little crenulate, for most part wavy and considerably interrupted . *austroafricana* Schmitt.
(Type locality: Durban Bay, Natal, South Africa.)

C[2]. Lateral margins of dactyl not armed with conspicuous teeth or spines. Impressed line just before hinder margin of carapace either side of first abdominal somite, not showing in lateral view below epimeron of second somite. Crenulations of transverse lines on hinder part of carapace numerous, crowded, and very rough to touch when finger is passed over carapace from front to back . . *emeritus* (Linn.).
(*E. asiatica* of Milne Edwards and others.)
(Type locality: "Habitat in Mari Indico.")

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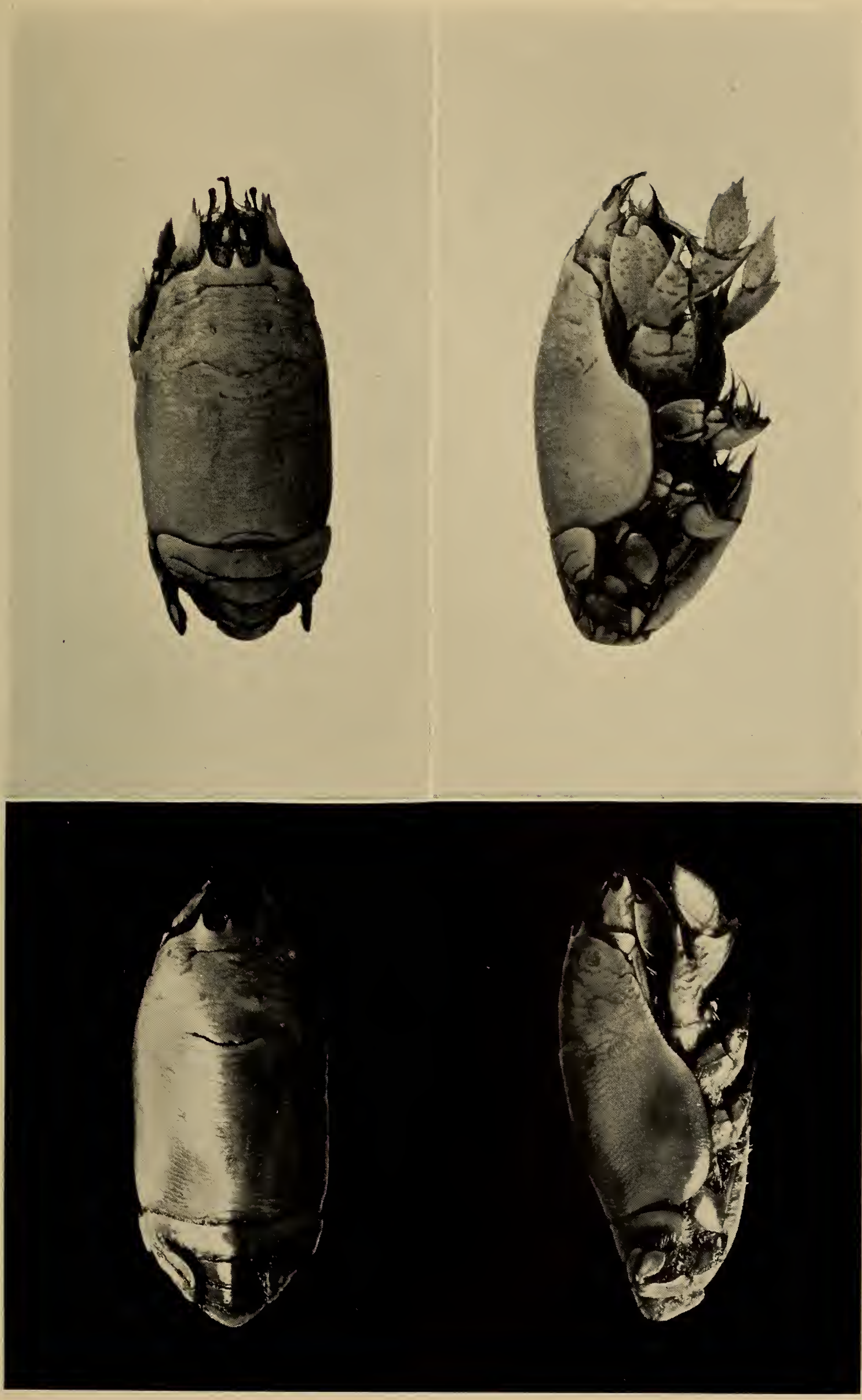
## EXPLANATION OF PLATE.

Dorsal and lateral views of:

Top: *Emerita austroafricana* n. sp. Type. $\times 1\frac{1}{2}$.
Bottom: *Emerita emeritus* (Linn.). $\times 1\frac{1}{2}$.



EMERITA.

Schmitt. Neill & Co., Ltd.

# 5. *A New Dendrochirote Holothurian from South Africa, with some Remarks on the* Rhopalodinidae.—By S. G. Heding, University Zoological Museum, Copenhagen.

(With Plates IV, V, and 3 Text-figures.)

## I.

### *Rhopalodinopsis* n.g.

*Diagnosis.*—Body composed of two parts, a lower spherical soft part containing the intestine, the gonads, and the respiratory trees; and an upper part, which is proboscis-shaped and hard, and contains the cloaca, the oesophagus, the ring-canal with the polian vesicle, and the stone-canal and the calcareous ring with the retractors. Mouth and anus are both placed at the end of the proboscis, but are clearly separated by the dorsal part of the dorsal interambulacrum. The tube-feet are confined to the radii of the sphere and the proximal part of the proboscis. Tentacles about twenty. Retractor muscles present and respiratory trees well developed. Tentacle-ampullae and rete mirabile lacking. Gonads in two tufts, opening on a conical papilla into the cloacal cavity, close to the anal opening. Anal opening supplied with five pairs of papillae, placed on a system of large perforate anal plates. Calcareous deposits of body-wall in two layers, an inner well-developed layer of perforate, rather solid plates, and an outer very sparse layer of rudimentary tables.

*Genotype.*—*Rhopalodinopsis capensis* n.sp.

*Remarks.*—The specimens at hand must without doubt be referred to the family *Rhopalodinidae* as characterised by Panning in 1932 and 1936, but they differ in several characters so definitely from the species described by Panning in his latter work that it seems most reasonable to establish a separate genus.

One of the features which I consider as being of generic value in the classification of these forms is the arrangement of mouth and anus. These two openings are well separated in *Rhopalodinopsis*, and thereby form a real "dorsal side" on the specimens, whereas in *Rhopalodina* they are set very close together and usually in such a way that the anal pore is placed on the tip of the trunk, and the mouth on the side of it, though quite close to the tip. Another feature available for separating the genera is the presence of well-developed tube-feet on the ventral pole of the body-sphere. In the species of *Rhopalodina* such well-developed ventral tube-feet (pedicels) are lacking, which has occasioned Semper's statement that *R. lageniformis* has 10 ambulacra. In the present genus the well-developed tube-feet clearly show the shape of the ambulacra, and that they are only 5 in number, of which the two dorsal ones do not reach the pole of the body-sphere (Plate IV and fig. 1*a*). Also the shape of the calcareous plates from the inner layer of the body-wall, and especially the shape of those from the sphere, indicates a generic difference between the present species and those of *Rhopalodina*.

### *Rhopalodinopsis capensis* n.sp.

*Locality.*—Kalk Bay, Cape Peninsula, low water (the specimens were found washed ashore after a storm, October 1931, and presented to the Museum by Mr. C. L. Biden).

*External Features.*—The specimens (Plate IV) measure about 10 cm. in length. They are shaped as *Bonellia* with the proboscis stretched out. The ventral part of the specimens, the sphere, measures about 3 cm. in diameter and is quite soft to the touch, due to the relatively few and small plates in the body-wall. Its colour in alcohol is pale yellowish, and the body-wall itself is semi-transparent, so that the gonads and the intestine can be seen through it. The trunk is hard and white, due to the numerous large imbricated plates. [The colour was the same when the specimens were first brought to the Museum.—Ed.]

The pedicels are placed in two rows in each ambulacrum, and reach from the ventral pole of the sphere to about 1 cm. on the base of the proboscis. They are largest on the ventral half of the sphere (Plate IV), and are rudimentary on the proboscis. Contrary to what is the case in *Rhopalodina* the pedicels are well developed on the ventral pole of the sphere (Plate IV, fig. 4 and fig. 1*a*), and it is easily seen that only the mid-ventral ambulacrum crosses the actual pole. The other ambulacra are only bent towards the pole, leaving narrow interambulacral spaces free.

Mouth and anus are both placed on the dorsal side (*i.e.* the tip of the proboscis) (fig. 1*b*). There is a distinct interambulacral dorsal space developed, and here the large calcareous plates of the trunk are lacking and replaced by a few small perforated plates. The oral opening is surrounded by some rather large scales, which, when the tentacles are totally retracted, may close the opening. Around the anal opening there are ten surprisingly well-developed anal papillae, two in each ambulacrum. Anal teeth are lacking, but the anal papillae are at their base supplied with some large perforated plates, one for each papilla; these plates further lie in pairs on five other deeper-lying radial plates. Superficially we may thus speak about an anal calcareous ring, as did Semper. Further, care must be taken

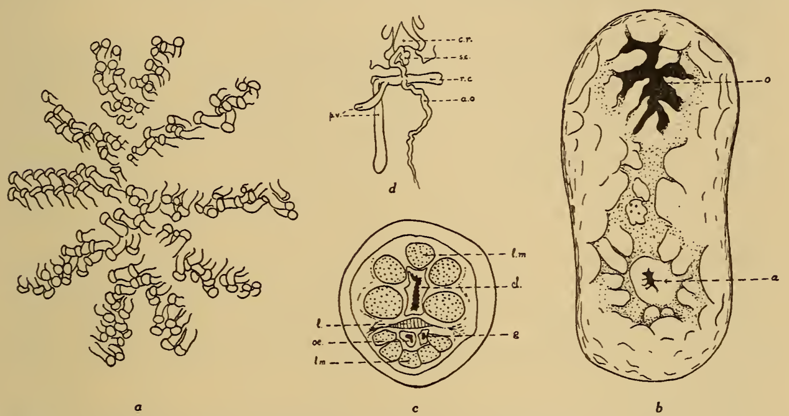



FIG. 1.—*Rhopalodinopsis capensis* n.g., n.sp. (*a*) Ventral pole of body-sphere, showing arrangement of radii and tube-feet. (*b*) End of proboscis with oral (o.) and anal (a.) openings, showing the peculiar medio-dorsal part of the dorsal interambulacrum. (*c*) Transverse section of proboscis about 1 cm. from end, showing longitudinal muscles (l.m.), cloaca (cl.) gonoduct (g.) oesophagus (oe.) and cavity (l.) between anterior and posterior part of the folded inner layer of the medio-dorsal interambulacrum. (*d*) Medio-dorsal part of calcareous ring (c.r.), with ring-canal (r.c.), polian vesicles (p.v.), stone-canal (s.c.), and axial organ (a.o.).

that the highly developed anal papillae with their fenestrated plates are not confounded with the tentacles and the calcareous ring.

*Anatomy.*—The specimens were all washed ashore, so they are scarcely well enough preserved to allow a very detailed examination of their anatomy; in any case, not of that of the body-sphere. In the sphere the intestine, the respiratory trees, and the gonads are found, and in the proboscis the cloaca and the anterior body-end with calcareous ring, ring-canal, oesophagus, gonoduct, and retracted muscles.

A transverse section of the proboscis about 1 cm. from its distal end shows the arrangement of some of these organs (fig. 1*c*). On the one side (*i.e.* that which represents the posterior end of the animal) there is a rather voluminous cloaca (*cl*) surrounded by five strong longitudinal muscles. On the other side (*i.e.* the anterior end) there are the oesophagus (*oe*) and the gonoduct (*g*), also surrounded by five longitudinal muscles. In the section here figured the oesophagus and the gonoduct are placed side by side, but farther towards the end of the proboscis the gonoduct bends behind the oesophagus and then runs through the two laminae seen in the figure, and opens on a large papilla into the cloaca. This is quite a unique place for the genital opening in Holothurians.

Further, it appears from the section that the oesophageal part of the proboscis is separated from the cloacal part by a narrow cavity, a cavity the origin of which is at first sight difficult to ascertain. A closer examination, however, shows that the two laminae which separate the oesophageal and cloacal parts of the body-cavity are the muscular part of the dorsal interambulacrum which, forming a large fold, divides the coelomic cavity of the proboscis into two channels. Thus the cavity separating these two laminae is seen to be, not of coelomic origin, but merely a secondary cavity formed when the saddle-shaped external layer of the dorsal interambulacrum parted from the muscular inner layer and was drawn into the interior of the proboscis.

The ring-canal (fig. 1*d*) is supplied with 2–3 polian vesicles, a short stone-canal with a rather large madreporite, and a long and well-developed "axial organ." The calcareous ring (fig. 2) consists of ten pieces, of which the radials have more or less rudimentary posterior prolongations. The interradials are all rather simple, triangular, thick pieces, usually with a deep incision in their posterior margin. The radials are of different shape, not only in different specimens, but even in the same specimen, and the mid-ventral radial is always less well-developed than the lateral ones. Anteriorly all the radials have more or less deep incisions, and in every case the larger part of these incisions form insertions for tentacles or incisions for the passage of the water-vascular system and the radial nerves. In spite of the fact that the pieces of the calcareous ring are rather thick, so thick that we should not call them incisions, but rather bowl-shaped depressions for the musculi retractor tentaculi, the limits between the calcified part of the ring and the surrounding connective tissue are often indistinct; for which reason it is impossible to ascertain the real number of tentacles when studying the shape of the calcareous ring.

From the shape of the calcareous ring one would expect between 20 and 30 tentacles, and a careful dissection of the retracted muscles showed that there were 22, but of these 2 may perhaps be merely torn-off pieces or folds of the introvert. In any case, this species has about 20 tentacles, and of these it seems (it is not *quite* certain) that 5 are placed in an inner circle. The tentacles themselves are all unbranched and supplied with numerous calcareous deposits.

*Calcareous Deposits.*—Similar to the species of *Rhopalodina* (as shown by Panning), the present species of *Rhopalodinopsis* has two


FIG. 2.—*Rhopalodinopsis capensis* n. g., n. sp. (*a–c*) Calcareous ring of specimen I. (*a*) Right ventral radial with additional interradials. (*b*) Mid-ventral radial with additional interradials. (*c*) Mid-dorsal interradial with additional radials. (*d*) Mid-ventral radial with additional interradials of specimen II. (*e, f*) Pieces of calcareous ring of specimen II cleared in xylol and mounted in balsam: (*e*) Mid-ventral radial with left ventral radial and additional interradials. (*f*) Mid-dorsal interradial and left dorsal interradial with left dorsal radial and fragments of right dorsal radial and left ventral radial.

layers of calcareous deposits in the body-wall, a deeper layer of perforated plates and a superficial layer of tables, but here the outer layer is so reduced that it has not been possible to find more than two rudimentary tables.

The deposits of the inner layer are very different in the two main parts of the body. In the proboscis they are large circular plates with round holes (Plate V, fig. 1). They are imbricated, and in their free parts have a number of large knobs on their external side. These knobs are smallest in the plates from the proximal part of the proboscis, and close to the free end of the proboscis they may be as high as is shown in the figure (Plate V, fig. 1*a*). The deposits from the wall of the sphere (Plate V, figs. 2–5) are not imbricated, being small thick bodies which are fairly uniformly dispersed. None of these plates, either from the proboscis or from the sphere, consists of more than one layer, which is often the case in the genus *Rhopalodina*.

As stated above, the deposits of the superficial layer are nearly lacking. There are, however, two small spiny button-like deposits lying superficially above the large "fat" bodies in the wall of the sphere, deposits which do not leave much doubt that they are rudimentary tables (Plate V, figs. 6, 7).

The tube-feet are without end-plates, but have small spiny rods (Plate V, figs. 14–18) in their walls. In the tentacles there are two different sorts of rods: relatively large perforated plates (Plate V, figs. 8–10) and rather characteristic small oval plates or bodies (Plate V, figs. 11–13).

## II.

### Remarks on the *Rhopalodinidae*.

The fact that the new species described above has about 20 tentacles appeared to be quite contrary to what is the case in the other species belonging to the *Rhopalodinidae*; Semper, as well as Panning, stating the normal number of tentacles in *Rhopalodina* to be 10. A comparison of the calcareous ring of *Rhopalodinopsis capensis* with Semper's figure of that of *R. lageniformis* showed, however, that there were reasons for supposing that Semper's statement was not quite correct. I therefore wrote to Dr. Panning in Hamburg asking him to undertake a renewed examination of the tentacles of his specimens. As Dr. Panning had long ago finished his beautiful work on the genus *Rhopalodina*, and for the present had no time to work on these specimens, he kindly sent me some specimens and fragments of the two species *R. lageniformis* and *gracilis*, and suggested that I undertake the examination myself.

This examination gave the following results: in the specimens of *R. lageniformis* (Nos. 4477 and 4479) the calcareous ring consists of ten pieces, of which all the radials have a distinct posterior bifurcating prolongation (fig. 3, *a–d*). The real shape of the pieces is very difficult to ascertain, as they are not only small, but also placed in such a way that quite different results are obtained when the piece under observation is turned a little to one side or the other. Figures *a–l* in fig. 3 are all drawn, as far as possible, in such a position that the central piece in the figure is lying parallel to the surface of the alcohol in the dissecting dish. Only figures *b* and *c* are drawn in a slightly oblique position—in *b* turned slightly to the right, in *c* slightly to the left. It is evident that if all the incisions in the anterior side of the calcareous ring, apart from the five radial incisions for the radial nerves and canals, are insertions for tentacles, which is normal in

Fig. 3.—*Rhopalodina lageniformis* Gray. (*a–d*) (Panning, No. 4477). (*a*) Mid-ventral radial with the two ventral interradials and parts of the two lateral radials. (*b, c*) Right ventral radial and interradial drawn in two slightly different positions, showing how the contours of the pieces may vary in accordance with the position of the piece under examination. (*d*) Mid-dorsal interradial with the two dorsal radials and lateral interradials.

(*e, f*) (Panning, No. 4479). Mid-ventral radial with ventral interradials and mid-dorsal interradial with right dorsal radial, showing the variation of the shape of the calcareous ring in this species.

*Rhopalodina gracilis* Panning. (*g–l*) (Panning, No. 4484). (*g*) Mid-dorsal inter-radial with the abnormal double right radial; the stippled line is the outline of the abnormally wide right retractor. (*h*) Right lateral interradial with a part of the right ventral radial. (*i*) Right ventral radial with additional interradials. (*j*) Mid-ventral radial with ventral interradials. (*k*) Left dorsal radial with mid-dorsal interradial. (*l*) Left lateral interradial with additional radials.

most other Holothurians, we should expect about 20 tentacles, and dissection of specimen No. 4479 showed 18 tentacles, of which 5 were placed in an inner circle. After having done this as carefully as possible, I cleared the whole introvert in xylol and mounted it on a slide. Further examination showed that I had overlooked two small ventral, apparently regenerating, tentacles. The number of tentacles is thus in this specimen (i.e. *R. lageniformis* sens. str.) 20, and they are arranged with 15 in an outer and 5 in an inner circle. The other specimen of *R. lageniformis*, No. 4477, was unfortunately so badly preserved that I was unable to count the tentacles.

The two other specimens at hand, Nos. 4484 and 5863, represent the species *R. gracilis* Panning. One of them, No. 5863, had the calcareous ring destroyed, and could not throw any light on either the shape of the ring itself or the number of tentacles. The other, No. 4484, showed a slight but apparently distinct difference from the calcareous ring of *R. lageniformis*. This may be a systematic character, but as the ring is evidently abnormal, having two right dorsal radials, we should not lay too much stress on the shape of it. The examination of the tentacles in the opened introvert, as well as in cleared preparation, showed that they were 18 in number. As far as it was possible for me to ascertain there were not more than 18 tentacles, and if the calcareous ring were not abnormal we should have here a valid character for separating the two species *lageniformis* and *gracilis*. As, however, the calcareous ring *is* abnormal, it is possible that the normal number of tentacles is 20 in *gracilis* also.

The fact that the species of *Rhopalodina* and *Rhopalodinopsis*, *i.e.* all the members of the family *Rhopalodinidae*, have not 10 (as previously assumed) but about 20 tentacles, arranged in two circles with 5 in the inner and 12–15 in the outer circle, appears to be of the greatest value for the classification of the Dendrochirote Holothurians. Owing to the large number of tentacles it is now quite evident that *Rhopalodina* (and *Rhopalodinopsis*) cannot be placed close to *Echinocucumis* and *Sphaerothuria* with *Ypsilothuria* (see Perrier, 1902), but that it is closely related to the *Phyllophorinae*. If all the characters are taken into consideration, there is no reason to maintain a separate family for these two genera, since they may be placed, without serious difficulty, close to or within the subfamily *Phyllophorinae*. However, so long as our knowledge of the classification of the *Phyllophorinae*, and indeed of the whole order *Dendrochirota*, is as unsatisfactory as it is at present, it is of no practical use to try to find the true natural place for these odd forms. I prefer for the moment to maintain a separate taxonomic group for the two genera here under discussion, but I suppose it must be regarded as a subfamily, the *Rhopalodinae*, closely related to the *Phyllophorinae*. In reality the only important difference between the *Rhopalodinae* and the *Phyllophorinae* is the presence of large plates in the former, as I do not think that the peculiar body-shape is of any higher taxonomic value.

I wish to express my sincerest thanks to the Director of the South

African Museum, who has given me the opportunity of studying these very interesting specimens, and to Dr. Panning, Hamburg, who has supplied me with material of *Rhopalodina* for examination of the calcareous ring and tentacles in that genus, and to Dr. Mortensen of Copenhagen, whose good advice and never-failing interest in my studies have been of invaluable help to me.

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## EXPLANATION OF PLATES.

### Plate IV.

*Rhopalodinopsis capensis* n. g., n. sp.

Figs. 1–3. Three specimens, natural size.

Fig. 4. The pole of specimen 3 slightly enlarged.

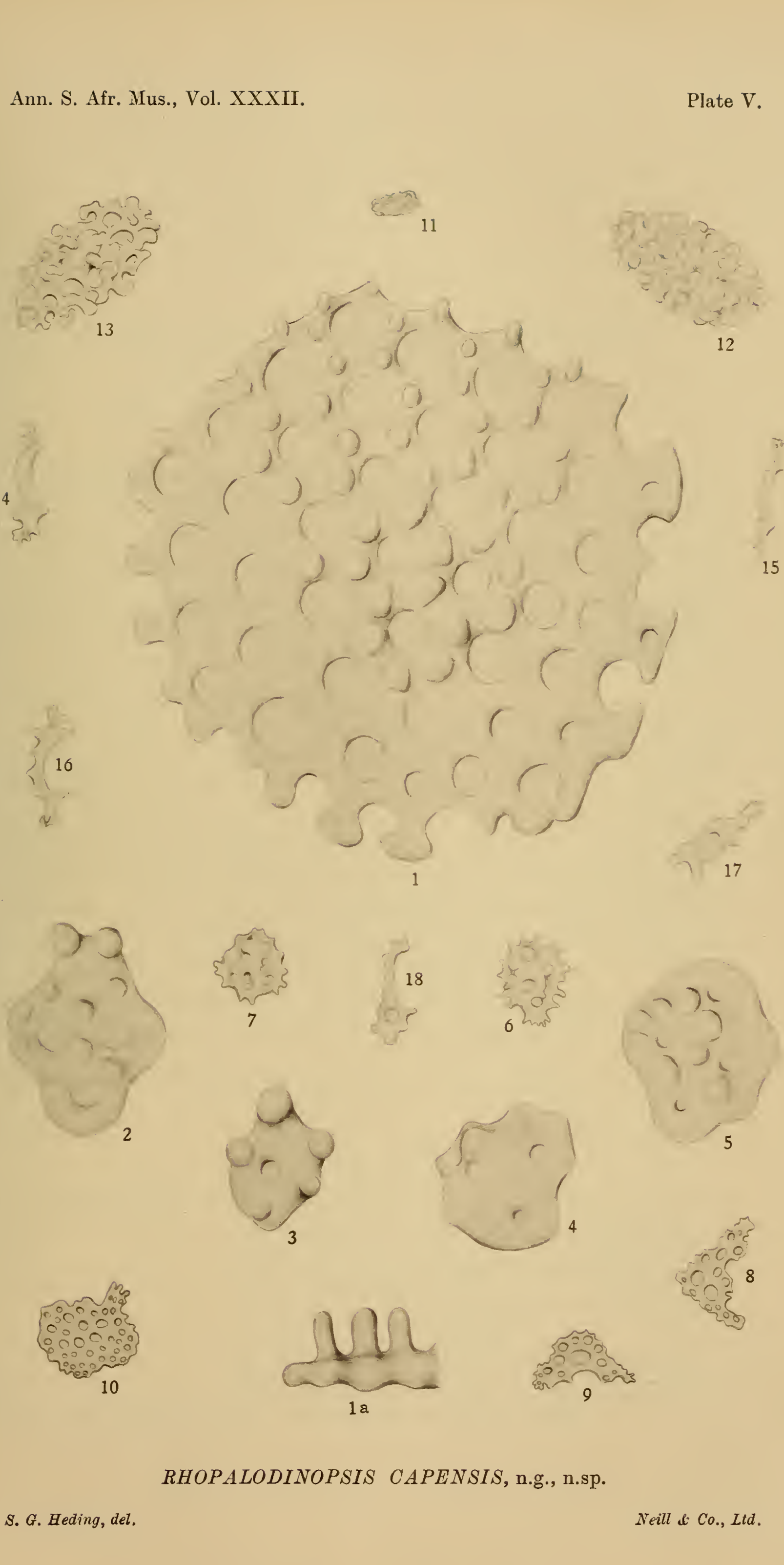
## Plate V.

Calcareous deposits of *Rhopalodinopsis capensis* n. g., n. sp.

Fig. 1. Circular fenestrated plate from the proboscis.
,, 1*a*. Part of circular plate from the end of proboscis, seen from the side, showing high spine-like tubercles.
,, 2–5. Small perforate plates from the wall of the sphere.
,, 6–7. Rudimentary tables from the outer layer of the wall of the sphere.
,, 8–10. Perforated plates from tentacles (inner layer).
,, 11–13. Oval minute bodies from tentacles (superficial layer). Fig. 11 with the same magnification as the other figures.
,, 14–18. Rods from the tube-feet.


*RHOPALODINOPSIS CAPENSIS*, n.g., n.sp.

*S. G. Heding, photo.* *Neill & Co., Ltd.*




*RHOPALODINOPSIS CAPENSIS*, n.g., n.sp.

*S. G. Heding, del.* *Neill & Co., Ltd.*

## 6. *Further Notes on South African Marine Fishes.*—By K. H. Barnard, Assistant Director.

(With Plates VI–VIII and 4 Text-figures.)

The following notes are based on specimens added to the South African Museum collection in recent years. For several species a large number of new localities has been ascertained, thanks to several correspondents. These have not been included here, as the net result is to show that many of the so-called warmer water species extend much farther westwards than was hitherto thought to be the case. The occurrence of the Springer (*Elops saurus*) in False Bay is perhaps the most noteworthy record.

A list of papers published since 1927 is given, and some of the main changes in nomenclature, particularly in the names of the Flat-fishes, are incorporated.

It is a pleasure to refer to the work which Dr. J. L. B. Smith, of Rhodes University College, Grahamstown, is doing in this country. Dr. Smith is favourably situated for investigating the stretch of coast between the Cape and Natal, in particular the Knysna and Port Alfred areas, about whose marine fauna we know so little at present, and he is making excellent use of his opportunities.

The following papers, published since 1927, deal wholly or partly (changes in nomenclature, etc.) with South African marine fishes:—

1934. Barnard, K. H., Ann. Mag. Nat. Hist. (10), xiii, pp. 228–235, figs.
1935. ,, Ann. S. Afr. Mus., xxx, pp. 645–658, text-figs. and pl. xxiii.
1927. Chabanaud, P., Bull Inst. Océan. Monaco, No. 500, pp. 1–15.
1927. ,, Ann. Mag. Nat. Hist. (9), xx, pp. 523–527.
1928. ,, Bull. Soc. Zool. France, liii, pp. 272–279.
1929. ,, Ann. Inst. Océan. Paris, n.s. vii, pp. 215–260, text-figs. and plates.
1930. ,, Bull. Inst. Océan. Monaco, No. 550, pp. 1–23.
1934. ,, Bull. Soc. Zool. France, lix, pp. 420–436.
1929. Fowler, W. H., Ann. Natal Mus., vi, pp. 245–264.

1931. Fowler, W. H., Proc. Ac. Nat. Sci. Philad., lxxxiii, pp. 245–249 (marine).
1931. ,, Bull. U.S. Nat. Mus., No. 100, vol. 11.
1933. ,, *Ibid.*, vol. 12.
1934. ,, Proc. Ac. Nat. Sci. Philad., lxxxv, pp. 233–367, text-figs. (subfam. names, etc.) (Jan.).
1934. ,, *Ibid.*, lxxxvi, pp. 405–514, text-figs. (Nov. 6).
1934. ,, Ann. Natal Mus., vii, pp. 403–433.
1935. ,, Proc. Ac. Nat. Sci. Philad., lxxxvii, pp. 361–408, text-figs.
1928. Fowler, W. H., and Bean, B. A., Bull. U.S. Nat. Mus., No. 100, vol. 7.
1929. ,, ,, *Ibid.*, vol. 8.
1930. ,, ,, *Ibid.*, vol. 10.
1929. Norman, J. R., Ann. Mag. Nat. Hist. (10), iv, pp. 153–168.
1930. ,, "Discovery" Reports, ii, pp. 261–370, text-figs. and pl. ii.
1931. ,, Ann. Mag. Nat. Hist. (10), viii, pp. 507–516.
1934. ,, Monograph of Flat-fishes, vol. 1, Brit. Mus.
1935. ,, Ann. S. Afr. Mus., xxxii, pp. 5–22, text-figs. and pl. ii (*Spondyliosoma*).
1935. ,, Proc. Zool. Soc. Lond., pp. 99–135, 18 text-figs. (*Synodontidae*).
1929. Regan, C. T., and Trewavas, E., "Dana" Oceanogr. Rep., No. 5, pp. 12–30, text-figs. and plates.
1930. ,, ,, *Ibid.*, No. 6, pp. 1–143, text-figs. and plates.
1929. Schnakenbeck, W., Mitt. Zool. Mus. Hamburg, xliv (1931), pp. 23–46.
1931. Smith, J. L. B., Rec. Albany Mus., iv, pp. 145–160, text-figs. and pl. xvi.
1933. ,, Tr. Roy. Soc. S. Afr., xxi, pp. 125–127, pl. ix (*Myctophum*).
1933. ,, *Ibid.*, xxi, pp. 129–150, pls. x-xii and 1 text-fig. (*Hemirhamphidae*).
1934. ,, *Ibid.*, xxii, pp. 83–87, pl. iv and 1 text-fig. (*Pteroplataea*).
1934. ,, *Ibid.*, xxii, pp. 89–100, pls. v, vi and 1 text-fig.

1934. Smith, J. L. B., *Ibid.*, xxii, p. 321–336, pls. xvi–xxiii and 1 text-fig. (*Triglidae*) (Dec.).
1935. ,, Ann. S. Afr. Mus., xxx, pp. 587–644, pls. xv–xxii and 17 text-figs. (*Mugilidae*).
1935. ,, *Ibid.*, iv, pp. 358–364, pls. xl–xlii (*Aluteridae*).
1935. ,, Rec. Albany Mus., iv, pp. 169–235, text-figs. and pls. xviii–xxiii.
1935. ,, Tr. Roy. Soc. S. Afr., xxiii, pp. 265–276, pls. xiii–xvii (*Dichistiidae*).
1936. ,, *Ibid.*. xxiii, pp. 303–310, 1 text-fig. and pls. xxi–xxiii (*Tripterodon*).
1936. ,, *Ibid.*, xxiv, pp. 1–6, 2 text-figs. and pls. i, ii.
1936. ,, *Ibid.*, xxiv, pp. 47–54, 2 text-figs. and pls. iii–v (*Gobioidei*).
1936. Svetovidov, A., Faune de l'Urss. Poissons, vi, 9, pp. 1–21, pls. i–iii, with resumé in English, pp. 22–24 (*Triglidae*).
1929. von Bonde, C., Fish. Mar. Biol. Surv., vii, Spec. Rep. 3, pp. 1–11, figs. (*Heterosomata*).
1933. ,, J. Comp. Neur., lviii, pp. 377–417 (cranial nerves, etc. (*Pliotrema* and *Sphyrna*).

## Fam. Isuridae.

### *Cetorhinus maximus* (Gunner).

(Plates VI, VII and text-fig. 1.)

1925. Barnard, Ann. S. Afr. Mus., xxi, p. 34, pl. ii, figs. 1, 1*a*.

Two more specimens have been captured in South African waters. Like the first recorded specimen, which was caught in 1917 and mounted in the South African Museum, the second specimen was also a young individual. It measured 11 feet 6 inches, and was caught in Table Bay 23rd March 1930. It was blackish in colour, with small black spots on the sides; the lips were white, and there were white streaks below the snout and on the chin and throat.

The third specimen to be recorded from South African waters was netted by Mr. Trauter in Hout Bay (west coast of Cape Peninsula) on 20th January 1935. It was a male measuring 28 feet in length, and was towed into Table Bay and exhibited for a few days on the Cape Town pier.

The animal was then cut up and dumped in the sea, without advising the Museum. The head was presented to the Museum, but the chance of securing one of the claspers was lost. This is much to be regretted, as White (1930, Bull. Amer. Mus. Nat. Hist., lxi, p. 158) says the

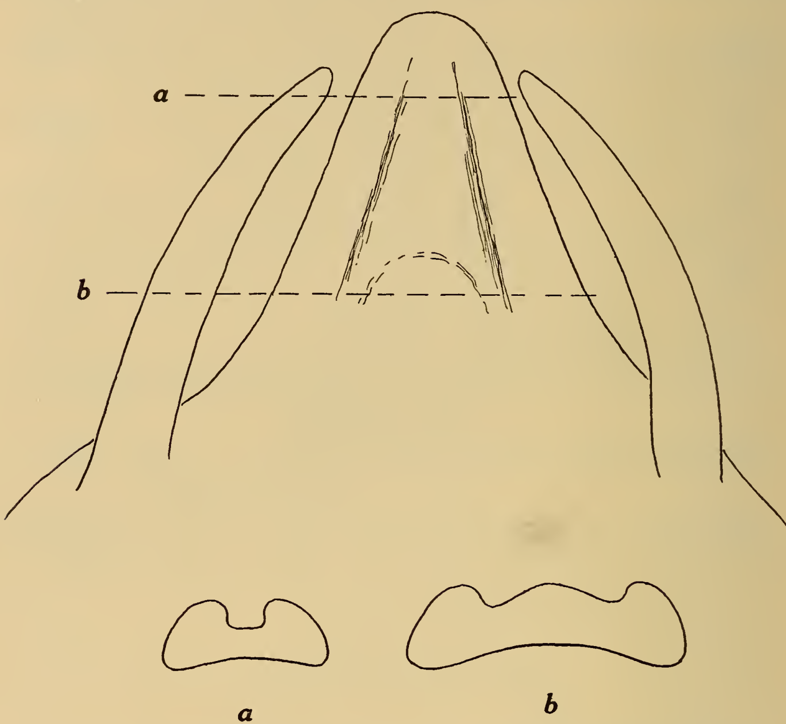



FIG. 1.—*Cetorhinus maximus* (Gunner). Dorsal view of rostral cartilages, with cross-sections of the ventral projection at *a* and *b*.

examination of the clasper of an adult might help to clear up the relationship between *Cetorhinus* and *Rhineodon.*

The following measurements were taken:—

Tail hanging in water—not measured; ventral distances separating gill-slits not visible, and outer margin 1st dorsal curled up and not measured.

| | |
|---|---|
| Pit at root of caudal to end of base 2nd D. . . . . | 33 inches |
| Base of 2nd D. . . . . . . . . . . | 11 ,, |
| Front margin of 2nd D., 14 inches; hind margin, 15 inches; lower margin . . . . . . . | 12 ,, |
| Front of 2nd D. to end of base 1st D. . . . . . | 75 ,, |
| Base of 1st D. . . . . . . . . . . | 33 ,, |
| Front margin of 1st D., 47 inches; lower margin . . | 13 ,, |

| | | |
|---|---|---|
| Depth of caudal peduncle | 11 | inches |
| Base of C. to end of base of anal | 26 | ,, |
| Base of A. | 10 | ,, |
| Front margin of A., 13 inches; upper margin, 9 inches; lower margin | 8 | ,, |
| Front of base of A. to angle of base of ventrals | 36(+6) | ,, |
| Base of V. | 24 | ,, |
| Front margin of V., 27 inches; outer margin of V. | 30 | ,, |
| Clasper | 36 | ,, |
| V. to base of pectoral | 96 | ,, |
| Upper margin of P., 57 inches; outer margin of P., 52 inches; lower margin of P. | 10 | ,, |
| Width of base of P. | 17 | ,, |
| 1st D. to snout | 117 | ,, |
| Snout to 1st gill-cleft | 54 | ,, |
| 1st gill-cleft to 5th cleft | 22 | ,, |
| Snout to eye | 14 | ,, |
| Eye diameter, vertical, $2\frac{3}{8}$ inches; horizontal | $2\frac{5}{8}$ | ,, |
| Eye to eye over curve of head | 20 | ,, |
| Eye to angle of mouth | 20 | ,, |
| Base of D. to 5th gill-cleft (lower margin) | 14 | ,, |
| Nostril to eye | 5 | ,, |
| 5th gill-cleft, dorsal to ventral length | 47 | ,, |

Distances separating dorsal ends of gill-slits (over curve of back), 1st, 5 inches; 2nd, 9 inches; 3rd, 15 inches; 4th, 22 inches; 5th, 29 inches.

The symphysis of the upper jaw at the vertical from eye.

*Mucus Canals.*—Snout with large mucous pores, mostly transverse, a faint indication of longitudinal arrangement where the rostral and prenasal canals might be expected to lie. No other canals visible externally.

*Rostral Cartilages.*—There is a triangular ventral projection, with a groove on its upper surface; and slender, gently curved, dorsal processes (fig. 1).

*Teeth.*—In the upper jaw the bands of teeth are separated by a wide bare space. The teeth in the first two or three rows (nearest the middle line) are triangular with broad bases; the successive rows show a gradual transition to the more conical and terete form of tooth found throughout the rest of the dental band (Plates VI and VII).

### Fam. Orectolobidae.

*Stegostoma tigrinum* (Gmelin). — Algoa Bay (Port Elizabeth Museum); St. Francis Bay (C. L. Biden); Durban (H. W. Bell-Marley, presented to the South African Museum, 1935).

## Fam. Harriottidae.

Whether or not *Rhinochimaera* be regarded as a synonym of *Harriotta*, the latter is the earlier genus, and the family name should be in accordance.

*Harriotta pinnata* Schnakenbeck 1929. Walfish Bay.

## Fam. Alepocephalidae.

*Bathytroctes rostratus* Brnrd. 1925, non Gnthr. = *Alepocephalus barnardi* Norman 1930, p. 270.

## Fam. Gonorhynchidae.

Dr. Chabanaud informs me that an examination of type specimens in the Paris Museum has shown that the Cape species is correctly termed *gronovii* C. and V. It is an endemic species and is not conspecific with Australasian and Japanese species.

## Fam. Stomiatidae.

The correct date for *Astronesthes boulengeri* Gilch. is 1902, not 1904 (see Monograph, p. 1032, footnote).

Two specimens have been captured by trawlers belonging to Messrs. Irvin & Johnson, Cape Town, and presented to the South African Museum. Both were taken off Dassen Island, north of Table Bay, in 200–300 fathoms; one on 8th July 1925, the other 2nd July 1936.

For *Astronesthes capensis* G. and von B. see Regan and Trewavas, 1929, p. 30.

For *Borostomias richardsoni* see Regan and Trewavas, 1929, p. 25. The South African examples should be re-examined to see whether they belong to *Borostomias* or *Astronesthes*.

*Idiacanthus ferox* (Gnthr.) should read *I. fasciola* Peters, 1876. See Regan and Trewavas, 1930, p. 129.

The same authors reduce *Neostomias* to the rank of a subgenus of *Eustomias*, *loc. cit.*, p. 73. Throughout this paper the name of Gilchrist's species is spelt "*filifer*" instead of *filiferum*. *Gonostoma grandis* Coll. = *G. bathyphilum* (Vaill.); see Norman, 1930, p. 285.

The genus *Yarella* stands, but *Y. africana* G. and von B. becomes a synonym of *Y. corythaeola* (Alcock); see Norman, 1930, p. 289. *Maurolicus pennanti* (Walb.) becomes *M. muelleri* (Gmelin); see Norman, 1930, p. 298.

### Gen. *Haplostomias* R. and T.

1930. Regan and Trewavas, *loc. cit.*, p. 109.

Separated from *Melanostomias* by having the teeth simple, not bicuspid.

The specimen described below is a ♀, and the question may be raised whether simple and bicuspid teeth are merely characteristic of the ♀ and ♂ respectively. If so, the genus *Haplostomias* is unnecessary.

### *Haplostomias tentaculatus* R. and T.

1930. Regan and Trewavas, *loc. cit.*, p. 109, pl. xi, fig. 1, and text-figs. 105*a*, 106*a*.

Depth $5\frac{1}{2}$ length of head 7, in length of body. Eye subequal to snout, 6 in length of head. Teeth: about 18 in upper jaw, 1st and 3rd short, 2nd and 4th long, 4th longest, 5th–7th subequal, 8th onwards small and decreasing in size posteriorly; 12 in lower jaw, 2nd, 4th and 5th smallest, 3rd, 7th and 8th largest, last 4 increasing slightly in length posteriorly (the two sides in both jaws not quite symmetrical); 1 on each vomer, and 4–5 on each palatine, 2 pairs on tongue; none of the teeth bicuspid. Gill-rakers 8–9 small single or double spines on anterior arch. D 16. A 18. P 5. V 7. Branchiostegals 10 or 11 (as nearly as can be counted). Photophores, except the suborbital one, very indistinct. Barbel about twice length of head, ending in an elongate ovate bulb, with the black stem continued as a filament half the length of the bulb.

*Length.*—235 mm.

*Colour.*—Black, the bulb at end of barbel dull orange.

*Locality.*—Off Table Bay, 185 fathoms.

*Distribution.*—Caribbean Sea.

The specimen is a ♀ containing ripe or nearly ripe eggs, and was caught in a trawl about the middle of November 1928.

In spite of certain small differences (proportions of body, relative sizes of teeth) this specimen is referred to *tentaculatus*. These differences may be due to age, as the specimen is more than twice as large as the "Dana" specimens described by Regan and Trewavas.

### Gen. *Echiostoma* Lowe.

1843. Lowe, Proc. Zool. Soc. Lond., p. 87.

1883. Gill, Proc. U.S. Nat. Mus., vi, p. 256 (*Hyperchoristus*).

1895. Goode and Bean, Ocean. Ichth., p. 108.

1930. Regan and Trewavas, *loc. cit.*, p. 116.

Body elongate, compressed, naked. Eye moderate. Mouth large, straight. Teeth on jaws typically large, depressible; teeth also on vomer, palatine and tongue. Barbel well developed. Pectoral small, the uppermost ray elongate, free. Ventral short, far behind middle of body. Dorsal and anal opposite, far back. No adipose fin. Caudal forked. Pseudobranchiae absent. A large suborbital photophore and two lateral rows. Gill-rakers minute.

The first record of this genus in South African waters.

### *Echiostoma tanneri* (Gill).

1883. Gill, *loc. cit.*, p. 256 (*Hyperchoristus tanneri*).

1895. Goode and Bean, *loc. cit.*, p. 109, fig. 130 (*barbatum*, non Lowe).

1927. Parr, Bull. Bingham Ocean. Coll., iii, p. 53, fig. 31 (*barbatum*, non Lowe).

1930. Regan and Trewavas, *loc. cit.*, p. 117, fig. 113 (barbels).

Depth of body equal to length of head, $6\frac{1}{2}$ (smaller)–$7\frac{1}{3}$ (larger specimen) in length of body. Eye $1\frac{1}{2}$ in snout, 7 in length of head. Teeth: 12 plus a number of minute ones on hind part of maxilla, 2nd or 3rd, 4th and 5th largest; about 12 in lower jaw, 3rd, 6th and 7th largest (the two sides not quite symmetrical), the posterior teeth in a double or triple series; 1 on each vomer, about 7 on each palatine, 2 pairs and 2 small single teeth on tongue; most of the teeth minutely bicuspid. Gill-rakers: 7–9 pairs of minute spines on anterior arch. D 12. A 16. P 1 + 3, the free ray $1\frac{3}{4}$–2 times length of head, arising in front of (neither above nor below) the bases of the 3 short rays. V 8. Branchiostegals 10 or 11 (as nearly as can be counted), with a series of 10 photophores (one between each pair of branchiostegals), very distinct in the smaller specimen, but only the hinder ones distinct in the larger specimen. Cuneiform postocular photophore $1\frac{1}{2}$ times the eye; 2–3 photophores on opercle; lower series of photophores beginning on isthmus: isthmus to pectoral 8 + 2, pectoral to ventral 26–27, ventral to beginning of anal 14–15 + 2 along anterior base of anal; lateral series opercle to ventral 24–25, ventral to beginning of anal 16, anal to caudal 12. Regan and Trewavas' figure (of *barbatum*) shows the ventral series continuous along base of anal to caudal; here the ventral series has 2 photophores along anterior base of anal and then stops, while the lateral series curves evenly down to posterior end of anal and continues along lower side of caudal peduncle. Barbel rather shorter than head, ending in two bulbous swellings, with several short filaments, corresponding with that of a fish 223 mm. in length figured by Regan and Trewavas.

An anteorbital spine with 3–4 small denticles, a postorbital spine, 2 temporal spines, interorbital with 2 denticulate ridges beginning far apart at a level a little behind eye, and converging forwards, meeting in a single short spine at a level just in front of nostrils; a few other scattered denticles on upper part of head. All these spines more or less concealed by the loose skin, the interorbital crests very distinct in the larger specimen.

A large mucus pore on each side of interorbital, just within (medial to) the denticulate ridge; large suborbital and temporal pores.

*Length.*—200 mm. and 305 mm.

*Colour.*—Dark slaty-black, with small black dots on head and similar dots in vertical band-like series along the body to tail (*cf.* Günther's figure of *Opostomias* on pl. liii, fig. 4. of Challenger Rep., xxii, and Parr's figure 32 of *E. ctenobarbus*, and as described by Günther for *barbatum*); each of these black dots (photophores, as described by Günther) with a pale translucent centre; fins whitish, barbel greyish, postocular photophore pink, ventral and lateral series of photophores lilac or amethyst.

*Locality.*—Off Table Bay.

*Distribution.*—Gulf of Mexico, Caribbean Sea.

The smaller specimen was captured in the trawl at a depth of 185 fathoms in November 1928, together with the specimen of *Haplostomias* mentioned above, and the larger specimen in September 1935, depth probably also about 200 fathoms.

The South African Museum is indebted to Messrs. Irvin & Johnson for both these specimens, the larger of which is the largest specimen of this genus yet recorded.

### Fam. Anguillidae.

*Anguilla mossambica* (Peters).

1925. Barnard, Ann. S. Afr. Mus., xxi, p. 175 and 1927; *ibid.*, p. 1018.

1935. *Id.*, Rep. S. Afr. Mus., 1934, p. 10.

An elver of this species was caught in the estuary of the Uvongo River, near Port Shepstone, Natal, by Mr. L. A. Day of the Inland Fisheries Survey. The specimen was handed to Mr. A. C. Harrison, from whom I received it, without further data as to time of year when caught.

It is 49 mm. in length, with 103 myomeres. It thus falls within the limits found for this species by the late Dr. J. Schmidt, viz. 100–105, as I am informed by Dr. V. Tåning (in litt. 9/2/35).

### Fam. Myridae.

#### Gen. *Muraenichthys* Blkr.

1853. Bleeker, Verh. Batav. Gen., xxv, p. 71.
1916. Weber and de Beaufort, Fish. Indo-Austr. Archip., iii, p. 274.

Elongate cylindrical, vermiform. Scales absent. Vent before middle of length. Dorsal arising far behind gill-openings. Dorsal, anal and caudal confluent. Pectorals absent. Snout somewhat projecting. Nostrils on margin of upper lip, the anterior tubular, the posterior at base of a flap. Teeth on vomer and jaws. Tongue adnate. Lateral line present. Gill-openings small.

#### *Muraenichthys gymnotus* Blkr.

1857. Bleeker, Act. Soc. Sc. Indo-neerl., ii, p. 90.
1864. ,, Atl. Ichthyol., iv, p. 33.
1871. Klunzinger, Verh. Zool. Bot. Ges. Wien., xxi, p. 608.
1916. Weber and de Beaufort, *loc. cit.*, p. 277.
1934. Barnard, Ann. Mag. Nat. Hist. (10), xiii, p. 230.

### Fam. Myctophidae.

*Loweina*, a new subgeneric name to include *Myctophum rarum*. Fowler, Amer. Mus. Novitat., No. 162, p. 2, 1925.

*Lampanyctus warmingi* (Lütken) = *L. townsendi* Eig. and Eig. 1889.

*Lampanyctus argenteus* Gilch. = *L. hectoris* Gnthr. 1876.

### Fam. Hemirhamphidae.

#### *Euleptorhamphus longirostris* (Cuv.).

1925. Barnard, Ann. S. Afr. Mus., xxi, p. 264 (references).
1928. Fowler, Mem. B. P. Bishop Mus., x., p. 74.
1936. ,, Bull. Amer. Mus. Nat. Hist., lxx, p. 432 (quotes the South African record under name of *E. viridis* (van Hasselt)).

A specimen of this genus, the second specimen to be recorded from South African waters, was brought in a perfectly fresh condition to the S. Afr. Museum in June 1936 by a fisherman, who stated that it had been caught somewhere "in Table Bay."

Depth of body 20, length of head $2\frac{1}{2}$, length of lower jaw $3\frac{1}{4}$, in length of body. Eye $3\frac{1}{2}$ in distance from tip of snout to hind margin of operculum, subequal to interorbital width and to snout, $\frac{2}{3}$ post-orbital part of head. Longitudinal length of preorbital scarcely more than $\frac{1}{2}$ eye-diameter.

D 23, arising slightly in advance of anal fin (above anterior margin of vent). A 22. V inserted at a distance in front of anal fin equal to the distance from anterior margin of nostril to hind margin of operculum; its length subequal to eye-diameter, and $7\frac{1}{2}$ in length of uppermost pectoral ray. P 9, the lowermost ray very short, uppermost ray not quite twice the distance from tip of snout to hind margin of operculum. Lower caudal lobe longer than the upper lobe. Scales nearly all lost.

Bright silvery, the back duller, greenish-black, lower jaw bluish-black, fins pale, caudal with suffused hind margin.

*Length.*—355 mm. to end of mid-caudal rays, or 375 mm. to end of lower caudal lobe. The tip of lower jaw appears to be not quite complete.

*Remarks.*—The differences between this specimen and the Walfish Bay one described in 1925 are not to be taken as indicating specific differences, because the latter specimen is in a very poor condition, scarcely suitable for a critical study. On the contrary, it is a reasonable assumption that the two are conspecific. Jordan and Evermann (1905. Hawaiian Fishes) seem to be the only authors who have had adequate material on which to base a specific diagnosis.

Whether van Hasselt's name deserves priority I have no means of determining.

### Fam. Coryphaenoididae.

Whitley (1931, Austr. Zool., vi, p. 334) proposes *Fuyangia* in place of *Chalinura* G. and B., preoccupied.

### Fam. Berycidae.

*Beryx splendens* Lowe.

1833. Lowe, Proc. Zool. Soc. London, p. 142.
1843–60. *Id.*, Fishes of Madeira, p. 47, pl. viii.
1895. Goode and Bean, Ocean. Ichth., p. 176, fig. 197.
1924. Roule, Bull. Mus. Paris, No. 1, p. 73.
1934. Barnard, Ann. Mag. Nat. Hist. (10), xiii, p. 230.

Distinguished from the other South African species, *B. longipinnis*

Brnrd., by the more oblong body, fin and scale formulae, and by the absence of the filamentous rays of the dorsal and ventral fins.

Depth $2\frac{1}{2}$, length of head 3, in length of body. Eye $2\frac{1}{2}$ in length of head, twice length of snout, which is slightly longer than interorbital width. No spine on nasal or lower jaw; preorbital spine without accessory spine. D IV 13. A IV 27. V I 11. Longest rays scarcely reaching to origin of anal. P 17, $\frac{2}{3}$ length of head. Scales scabrous, with smooth median longitudinal groove; l.l. 77, l.tr. $\frac{8}{20}$.

*Length.*—270 mm.

*Colour.*—As in *longipinnis.*

*Locality.*—45 miles off Table Bay.

*Distribution.*—Madeira, West Indies, Japan.

A single specimen was caught in the trawl in December 1932, and presented to the South African Museum by Captain Taylor.

### Fam. Melamphaidae.

See Norman, 1929. *Plectromus* is a synonym of *Melamphaes* Gnthr. 1864. *M. mizolepis* stands; *coronatus*, inadequately described by Gilchrist and von Bonde, is regarded as possibly the same as *unicornis* Gilb. 1905; and *macrophthalmus* Gilch. = *megalops* Lütken, 1877.

### *Heterosomata.*

Norman (1931, p. 508) vindicates *Pseudorhombus natalensis* Gilch. as a species distinct from *arsius* (= *russelli*), and makes the following changes:—

*Laeops microphthalmus* von Bonde, transferred to *Arnoglossus.*

*Lambdopsetta kitharae* von Bonde, non Smith and Pope, redescribed as *Laeops natalensis* Norman.

*Barnardichthys* Chabanaud 1927, new genus to include *Solea fulvomarginata* Blgr.

*S. quadriocellata* von Bonde = *Quenselia ocellata* (Linn.); see Chabanaud (1930, p. 12).

*S. melanoptera* Gilch. and *S. capensis* Gilch. = *Synapturichthys kleini* Bonap. subsp. *variolosa* Kner. *S. alboguttata* Fowler 1929 seems to belong here also; see Chabanaud (1930, p. 10). *S. impar* = *Pegusa lascaris* (Risso).

*Synaptura barnardi* Smith 1931. Gt. Fish Point. Close to *marginata* Blgr.

*Achirus* = *Heteromycteris* Kaup.

*Coryphaesopia* Chab. 1930, new genus for *A. cornuta* Kaup. The South African form is described as a n. subsp. *barnardi* Chab. 1934.

*Pseudaesopia* Chab. 1934, new subgen. of *Zebrias* for *Aesopia regani* (Gilch.).

Revised nomenclature of South African Flat-fishes in the sequence adopted by Norman (Monogr. Flat-fishes, vol. i, 1934) (equivalents in Barnard, 1925, in brackets). Norman's vol. ii, containing the *Soleidae*, not yet published.

*Psettodidae.*

*Psettodes erumei* (Bl. Schn.).

*Bothidae.*

*Pseudorhombus arsius* (Hamilton). (*P. russellii.*)
,, *natalensis* Gilch. (*P. russellii.*)
*Citharoides marcrolepis* (Gilch.). (*Paracitharus m.*)
*Arnoglossus capensis* Blgr.
,, *dalgleishi* (v. Bonde). (*Trichopsetta d.*)
,, *microphthalmus* (v. Bonde). (*Laeops m.*)
*Engyprosopon grandisquama* (Temm. and Schl.). (*Scaeops g.*)
,, *natalensis* Regan. (*Crossorhombus dimorphus* part, juv.)
*Crossorhombus valde-rostratus* (Alcock). (*C. dimorphus* part, adult.)
*Bothus pantherinus* (Rüppell).
,, *mancus* (Brouss.).
,, *ovalis* (Regan). (*Platophrys circularis.*)
*Chascanopsetta lugubris* (Alcock). (*C. gilchristi.*)
*Laeops nigromaculatus* v. Bonde.
,, *natalensis* Norman. (*Lambdopsetta kitharae* v. Bonde, non Smith and Pope.)
,, *pectoralis* (v. Bonde). (*Lambdopsetta p.*)

*Pleuronectidae.*

*Poecilopsetta natalensis* Norman. (*Limanda beani* v. Bonde, non Goode and Bean.)
*Marleyella bicolorata* (v. Bonde). (*Poecilopsetta b.*)
*Paralichthodes algoensis* Gilch.
*Samaris ornatus* v. Bonde.
,, *delagoensis* v. Bonde. (Norman: "perhaps identical with *cristatus*.")

*Soleidae.*

*Dicologlossa cuneata* (Moreau). (*Solea senegalensis*, non Kaup.)
*Barnardichthys fulvomarginata* (Gilch.). (*Solea f.*)
*Quenselia ocellata* (Linn.) (*Solea quadriocellata.*)
*Synapturichthys kleini* Bonap. *variolosa* Kner. (*Solea melanoptera* and *capensis.*)
*Pegusa lascaris* (Risso). ? (*Solea impar.*)
*Solea bleekeri* Blgr.
,, *turbynei* Gilch.
*Heteromycteris capensis* (Kaup.) (*Achirus c.*)
*Pardachirus marmoratus* (Lacep.).
*Synaptura marginata* Blgr.
,, *barnardi* Smith. (Close to *marginatas.*)
*Austroglossus pectoralis* (Kaup).
,, *microleps* (Blkr.).
*Zebrias* (*Pseudoaesopia*) *regani* (Gilch.). (*Aesopia r.*)
*Coryphaesopia cornuta* (Kaup), subsp. *barnardi* Chab. (*Aesopia c.*)
*Paraplagusia marmorata* (Blkr.).
*Cynoglossus lida* (Blkr.).
,, *durbanensis* Regan.
,, *gilchristi* Ogilby.
,, *hunteri* v. Bonde.
*Arelia attenuata* (Gilch.).
*Areliscus marleyi* (Regan).
,, *ecaudatus* (Gilch.).
*Trulla capensis* Kaup.
,, *microphthalmus* (v. Bonde).
*Symphurus variegatus* (Gilch.).
,, *strictus* Gilbert.
,, *ocellatus* v. Bonde.

Fam. Carangidae.

*Trachinotus baillonii* (Lacep.).

1934. Fowler, Proc. Ac. Nat. Sci. Philad., lxxxvi, p. 452.

Fowler accepts the synonymy of *russelli* and *oblongus* with Lacépède's species.

Fowler's remarks at the end of his description of this species are difficult to understand. I did not place Fowler's 1919 description of *Caesiomorus glaucus* Linn. under *Trachynotus glaucus* of Bloch, but under *glaucus* of Linnaeus, clearly stating "not *glaucus* Bloch," as reference to my monograph, p. 553, will show. *C. glaucus* Linn. was not later placed in a new genus *Campogramma* by Regan (1903, Ann. Mag. Nat. Hist. (7), xii, pp. 348 *sqq.*); in fact, neither *glaucus* Linn. nor *glaucus* Bloch were placed in this genus.

### Fam. Histiopteridae.

### *Quinquarius capensis* (C. and V.).

(Plate VIII.)

1927. Barnard, Ann. S. Afr. Mus., xxxi, p. 623.

1935. Fowler, Proc. Ac. Nat. Sci. Philad., lxxxvii, p. 393, fig. 26.

For the opportunity of including a record of this species in this paper I am indebted to Mr. R. Orpen, who forwarded a specimen picked up on the beach at Port Nolloth, Namaqualand, by Miss Irene Carstens in October 1935.

Since the original description of a single specimen by Cuvier and Valenciennes in 1829, only two other specimens have been recorded. One was taken by the Government Survey vessel s.s. *Pickle* off the coast of Natal on 28th December 1920. No description of this specimen was given, which is all the more unfortunate since the present specimen differs in a rather important feature from the original description. One cannot say whether Cuvier's specimen or the present one is abnormal. The other specimen, described by Fowler, also came from Natal.

The main features of the Port Nolloth specimen are as follows:—

Total length 63 mm. Depth $1\frac{1}{5}$, length of head $2\frac{3}{4}$, in length of body (caudal excl.). Width of the flat space between the ventral fins a little more than $1\frac{1}{2}$ in the depth of body, subequal to the distance between the bases of ventral spines and the somewhat projecting knob on the throat (Günther, 1859, Cat. Fish. B.M., i, p. 212, seems to have reckoned the *narrowest* width between the ventrals, and the *longest* medio-ventral distance extending to the angle of the branchiostegals in C. and V.'s figure), and a little more than the distance between ventral spine and vent. Eye equal to snout, 3 in length of head. Depth of caudal peduncle (between ends of bases of dorsal and anal fins) slightly greater than its length. A band (4–5 rows) of fine conical teeth on both jaws, the outer ones slightly larger, and a few more granular ones in an oval patch on vomer: apparently none on palatines. Pseudobranchiae well developed. Gill-rakers 6 on upper, 16 on lower part of anterior arch, the longest ones about $\frac{1}{3}$ eye-diameter. The bony scute (1st suborbital) has a short acute forwardly directed spine on its anterior margin. The spine on the median occipital scute is directed backwards.

D XIII 12, 1st spine short, $\frac{1}{2}$ eye-diameter and $3\frac{1}{4}$ in 2nd spine, 4th and 5th longest, a trifle more than 2 eye-diameters, 13th spine a little shorter than the rays which are subequal to eye. A VI 7, 1st, 4th and 6th spines subequal, slightly less than eye, 5th shorter, 3rd a little longer, 2nd longest, $1\frac{1}{5}$ eye-diameter. V I 5, the spine a little over 2 eye-diameters. P 17, 1st ray short, 4th and 5th longest, 17th very short. C 17 (+3), rounded-truncate.

Lat. line 46–47 (35–36 to where the line becomes horizontal on the caudal peduncle). Cheek-scales 5 vertical rows (across the deepest part of the patch).

Body silvery with blackish-brown markings almost exactly as in C. and V.'s figure, but the dark irregular bands on the flanks broader; a faint yellowish tinge on hinder part of body and on caudal peduncle; the flat ventral surface silvery-grey, with a white band between the bases of the ventrals and a pale area around the vent; opercle and cheek silvery; spinous dorsal and ventrals dark; soft dorsal, caudal and anal faintly yellowish; pectoral transparent.

The specimen thus follows the description and excellent figure given by the French authors, except as regards the extra spine in the dorsal and anal fins. This is an interesting feature in view of the number of spines found in allied species.

| | | | | |
|---|---|---|---|---|
| *Pentaceropsis* | | | | |
| *recurvirostris* . . | | DX–XI 14. | A III 11 | (total) D 24–25. A 14. |
| *Pseudopentaceros* | | | | |
| *richardsoni* . . | (type) | D XIV 10. | A IV 8. | D 24. A 12. |
| | (juv.) | D XIV 9–10. | A IV 8–9. | D 23–24. A 12–13. |
| *Quinquarius* | | | | |
| *japonicus* . . . | | D XI 14. | A V 9. | D 25. A 14. |
| *capensis* . . | (type) | D XII 12. | A V 7. | D 24. A 12. |
| | (Port Nolloth) | D XIII 12. | A VI 7. | D 25. A 13. |
| *Quadrarius* | | | | |
| *decacanthus* . . | | D X 13. | A IV 8. | D 23. A 12. |
| *hendecacanthus* . . | | D XI 13–15. | A IV 10–11. | D 24–26. A 14–15. |

So far as concerns the dorsal and anal fins all these species are closely allied, and Jordan's arrangement (1907) seems a little artificial. McCulloch has already (1915) made *Quadrarius* a synonym of *Quinquarius,* as the only difference seems to be in the number of anal spines; and suggested that, though possibly the latter may be synonymous with *Pseudopentaceros,* there are other differential characters.

The shape of the body and the relative length to breadth of the space between the throat and the ventral fins seem to be good characters. McCulloch's figure of the young of *P. richardsoni* (1923, Rec. Austral. Mus., xiv, p. 18, pl. iv, fig. 1) shows that the body shape does not alter much between the young and the adult. Such is also the case in *Q. hendecacanthus* McCull. (1915, "Endeavour," Sci. Res., iii, p. 144, pl. xxvi). But one feature does alter with age, viz. the gradual disappearance of the spines on the head. Consequently we can regard the type of *Q. capensis* and the present specimen as juveniles, and we may expect the adult, when captured, to have more or less the same body-shape, but to have no spines on the scutes on the head.

The 180 mm. specimen described by Fowler is interesting, as it has only 4 anal spines (as in *Pseudopentaceros* and *Quadrarius*) in association with 12 dorsal spines (as in the type of *Q. capensis*). There is also considerable resemblance between Fowler's figure and McCulloch's figure of the 70 mm. young *P. richardsoni* (*loc. cit.*), and I do not feel fully satisfied that Fowler's specimen should not rather be identified as *richardsoni*. Smith's figure of the 525 mm. type of the latter species may be possibly not quite accurate as to shape of body and head, if the figure, like the description, was taken from the dried skin. When more material is available it may be possible to decide the true relationship between *P. richardsoni* and *Q. capensis*.

In view of the excellence of the original figure there is no need to figure the present specimen. But as a matter of interest an illustration from an early work on fishes is here reproduced. This is the frontispiece to "The Naturalist's Library: Ichthyology, vol. i, by Sir William Jardine, Bart.", published in Edinburgh by W. H. Lizars & Stirling & Kenney in 1835, in which a very accurate copy of Cuvier and Valenciennes' figure is engraved against a vignette of Table Bay. The following paragraph appears on page ix of the publishers' advertisement:—

"We have introduced as back grounds, wherever they could be procured, the scenery which the fishes frequent. In many cases, the landscapes are representations of real views, which will be discovered upon examination of the plates; the figures upon which, . . . have been taken from the magnificent work upon this subject, by the Baron Cuvier and M. Valenciennes, whose representations are so perfect, as to leave little to be desired in the way of improvement."

In this instance the only "improvement" has been the addition of patches of pale pink on the pre- and post-orbital scutes, and of pale yellow on the opercle, below the pectoral fin, and on the flank (Plate VIII).

### Fam. Lutianidae.

*Lutianus duodecimlineatus* (Val.).

?1802. Lacépède, Hist. Nat. Poiss., iii, pp. 430, 477, pl. xxii, fig. 2 (*Labrus octovittatus*).
1830. Cuvier and Valenciennes, Hist. Nat. Poiss., vi, p. 529.
1874.* Bleeker in Pollen and van Dam. Faune Madagasc., pt. 4, Poiss., p. 27, pl. ix, fig. 1 (coloured) (*octovittatus*, non Lacép.).
1927. Barnard, Ann. S. Afr. Mus., xxi, p. 653, p. 27, fig. 3 (after Sauvage).
1931. Fowler, Bull. U.S. Nat. Mus., No. 100, xi, p. 153.
1934. *Id.*, Proc. Ac. Nat. Sci. Philad., lxxxvi, p. 466, fig. 38.

Fowler (1934) makes the following statement: "The colour pattern as described by Barnard . . . is therefore incorrect as my figure and description show." This is a *non sequitur*. I have re-examined the specimens and can state that my description of the pattern is correct for the specimens in the South African Museum. Except for the absence of the common base of the 3rd and 4th streaks, Sauvage's figure agrees. As a matter of fact, Fowler's figure also agrees, except that in my specimens the streaks are no longer traceable on the head. It would perhaps have been clearer if after the word "behind" [the opercle] in my description the following words had been used: "behind the head" or "behind a line drawn more or less vertically from the upper part of opercle."

Bleeker's identification of this form as Lacépède's *octovittatus* is not accepted by Fowler (1931).

### Gen. *Etelis* Cuv.

1828. Cuvier and Valenciennes, Hist. Nat. Poiss., ii, p. 127.
1931. Fowler, Bull. U.S. Nat. Mus., No. 100, vol. xi, p. 193.

Distinguished from *Pristipomoides* by the shortness of the hinder spines in the spinous dorsal fin, causing a concavity in the margin; the spinous and soft portions, however, are not separate.

* The South African Museum copy has 1875 on the outer cover and 1878 on the title-page. The British Museum Library Catalogue gives 1874.

*Etelis carbunculus* Cuv.

1828. Cuvier, *loc. cit.*, p. 127, pl. xviii.
1905. Jordan and Evermann, Bull. U.S. Fish. Comm., xxiii, p. 242, pls. xviii and xxxviii (*Etelis evurus*).
1928. Fowler, Mem. B. P. Bishop Mus., x, p. 193, pl. xvii, fig. A.
1931. *Id.*, *loc. cit.*, p. 195.

Depth $3\frac{3}{4}$, length of head $3\frac{1}{2}$, in length of body. Eye $4\frac{1}{2}$ in head, $1\frac{1}{2}$ in snout. Snout subequal to interorbital, 3 in head. Least depth of preorbital half the (longitudinal) diameter of eye.

Cardiform bands of teeth in both jaws, with well-spaced small canines in outer row; teeth on vomer and palatines, but none on tongue. Gill-rakers, 14 on lower part of anterior arch.

D X 11. 1st spine very short, $2\frac{1}{2}$ in eye, 6 in 2nd spine, 3rd spine slightly longer than 4th, nearly 2 in head, 10th spine $1\frac{1}{2}$ in eye; last ray prolonged, half as long again as penultimate ray. A III 8, last ray not prolonged. Caudal forked, but lobes not prolonged.

Scales: l.l. 51; l.tr. 6 to base of 1st dorsal spine (including the uppermost narrow sheath-like scale), 13 to base of ventral fin, 16 to middle line of belly. Cheek scales 6–7. Axillary scale of ventral fin present, but more or less concealed under an ordinary body scale.

800 mm. As preserved, silvery, most of the scales on upper part of body with a rose or pale crimson centre.

*Locality.*—Off Bashee River mouth. Caught by Mr. H. Smedsvik, of *Seafoods Successors*, Durban; and forwarded for identification by E. C. Chubb, Esq., Curator, Durban Museum, August 1936.

*Remarks.*—I have little doubt that this specimen should be identified with Cuvier's species, which is known from Mauritius, Réunion, Seychelles, Japan, and the Hawaiian Islands (and the West Indies). It does not entirely agree with the published descriptions. It is a male.

*Aetiasis* n. g.

Teeth on jaws conical, the front ones moderately large, the hinder ones small, an irregular row of small teeth internal to the outer row in front; small conical teeth on vomer and palatines; tongue smooth. An inconspicuous flat spine on opercle. Preopercle entire. Top of head, cheeks, and maxilla scaly. Caudal fin, but not dorsal and anal, scaly. Dorsal not deeply notched, spines 12. Anal rays 8. Dorsal and anal rays not produced. Pectoral subequal to head, scarcely falcate, scaly at base. No transverse groove between interorbital and occipital.

The fish for which this genus is proposed does not seem to fit in with any of the other genera of the family, though the complaint (αἰτιασις) is justified that there is already a large amount of synonymy among the Indo-Pacific species, which await a full and authoritative revision.

*Aetiasis cantharoides* n. sp.

(Text-fig. 2.)

Depth about 3, length of head $3\frac{3}{4}$, in length (excl. caudal). Eye (long diameter) subequal to snout, 4 in length of head. Interorbital

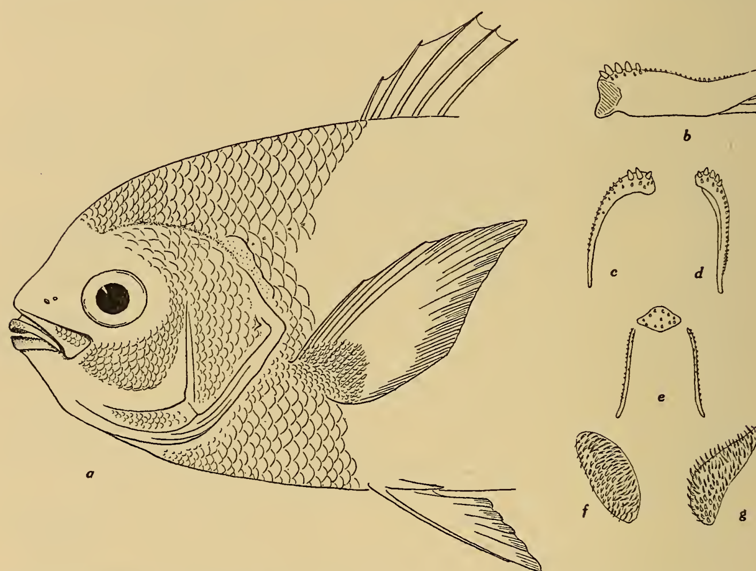



Fig. 2.—*Aetiasis cantharoides* n. g., n. sp. *a*, Head; *b*, inner view of right dentary bone, cleaned to show teeth; *c*, ventral view of right premaxilla, cleaned; *d*, dorsal view of right dentary, cleaned; *e*, vomer and palatines; *f*, left upper pharyngeal, anterior end above; *g*, left lower pharyngeal, anterior end below (inner margin (median line) to left in both *f* and *g*).

width slightly more than $1\frac{1}{2}$ times eye. Preorbital (opposite end of maxilla) $\frac{1}{4}$ the long diameter of eye. Greatest depth of caudal peduncle (between ends of bases of dorsal and anal fins) subequal to length along its dorsal profile, $1\frac{1}{4}$ times length of its ventral profile, least depth (at base of caudal) twice in greatest depth. A very small notch near the angle of preopercle, which is not denticulate. One short flat spine (not prominent) on opercle.

D XII 7 (possibly XIII 6, the posterior spines and anterior rays being broken), spines slender, 1st $\frac{3}{4}$ the long diameter of eye, 2nd about twice the 1st, 3rd longest, twice the long diameter of eye, following spines successively shorter, ultimate ray more slender and shorter than the penultimate ray, which is the longest ray and equal to the 4th spine. Rays not scaly. Apparently not notched between spinous and soft portions.

A III 8, spines stouter than the dorsal spines, 1st $1\frac{1}{2}$ times in the 2nd, which is subequal to the long diameter of eye, and $1\frac{3}{4}$ times in 3rd, ultimate and penultimate rays subequal, not elongate, $1\frac{1}{4}$ times the eye diameter. Rays not scaly.

P 17, subequal to length of head, scaly at base, the uppermost 2 rays simple.

V I 5, with axillary and medio-ventral enlarged scales.

Caudal forked, scaly.

Maxilla without supplementary bone, exposed, extending to below anterior margin of eye, its posterior width subequal to diameter of pupil, with 2 series of scales. Lips and gums villous, the teeth in consequence being concealed, even the larger canines not being clearly visible.

Teeth small, conical, in a single row laterally on lower and upper jaws, becoming a double row in front, and with an outer series of enlarged conical teeth in front, 6 in upper jaw, 10 in lower jaw. A few small conical teeth in an oval patch on vomer, and a single row (in some places anteriorly double) on each palatine. Tongue smooth. Upper and lower pharangeals with conical teeth in centre, passing into slender curved spiniform teeth around margins.

Branchiostegals 6, the anterior 4 slender, the posterior 2 stout.

Gill-rakers 19–20 on lower part, 6 on upper part, of anterior arch. Pseudobranchiae present.

Scales minutely ctenoid. L.l. 72; l.tr. 9 (1st dorsal spine to l.l.), 18 (l.l. to spine of ventral fin). Seven series on cheek. About 24 predorsal scales beginning at about vertical from anterior third of eye. Opercle and subopercle scaly.

*Length.*—400 mm.

*Colour* (as preserved).—Brownish, silvery on cheeks, opercles, and belly.

*Locality.*—Natal coast (one specimen secured by the kindness of Mr. C. L. Biden).

This fish bears a strong resemblance to a species of *Pachymetopon* (*olim Cantharus*), e.g. *P. aeneum.* In fact, it was included in the material sent to Mr. Norman for his revision of the Spondyliosome and allied fishes (Ann. S. Afr. Mus., xxxii, p. 5, 1935), and I am indebted to Mr. Norman for suggestions as to its true position.

### Fam. Scorpididae.

*Neoscorpis* Smith 1931, new genus for *Scorpis lithophilus.*

### Fam. Sparidae.

*Dentex macrophthalmus* (Bl.), Schnakenbeck 1929, p. 25, Walfish Bay.

Fowler (1925, Amer. Mus. Novit., No. 162, p. 4) places this species in a new subgenus *Opsodentex.*

In the same paper (p. 4) Fowler proposes a new subgenus *Eusalpa* for *Box salpa*, but in 1934 (Proc. Ac. Sci. Philad., lxxxvi, p. 472) records this species as *Sarpa sarpa* Linn.

Revision of *Spondyliosoma* and *Pachymetopon*: see Norman (1935, Ann. S. Afr. Mus., xxxii, pp. 5 *sqq.*).

### Fam. Gobiidae.

*Gobius delagoae* n. sp.

(Text-fig. 3.)

Body elongate. Depth $6\frac{2}{3}$, length of head $4\frac{1}{2}$, in length of body. Eye slightly greater than snout, $3\frac{1}{2}$ in length of head. Interorbital

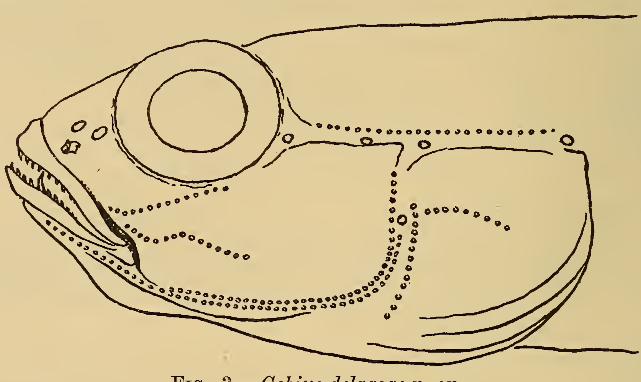


Fig. 3.—*Gobius delagoae* n. sp.

very narrow, 4 in vertical diameter of eye. Maxilla extending to below anterior margin of eye.

Teeth in narrow bands in both jaws, the outer ones somewhat enlarged, a single enlarged curved canine on each side of lower jaw. Tongue truncate in front. Gill-rakers reduced. No flaps on shoulder girdle.

Anterior nostril shortly tubular. No nuchal crest. Large pores; one medial to each pair of nostrils, 4 in a groove running from eye to upper end of gill-opening, one between preopercle and opercle. No pores on chin. Rows of minute papillae as shown in figure.

DVI + I 13, 1st spine half-length of head, 5th twice as long as 1st, produced in a filament. AI 13. P 19, upper rays not silk-like. Ventrals reaching to vent (almost to anal fin). Caudal lanceolate, half as long again as head, middle rays filamentous.

Scales cycloid, those on hinder part of body feebly ctenoid. Many of the scales lost, apparently about 55 in longitudinal series, and 16 between dorsal and ventral fins.

75 mm. Pale brown with darker mottling, somewhat vermiculate on head, blotchy on body; the body with oblique dark bands running from above downwards and forwards, the first band broad, behind pectoral, followed by 2 narrow bands, then a broad one ending below at vent, then one narrow, one broad, one narrow, the last between middle of soft dorsal and middle of anal; the narrow bands are composed of 2 dark stripes with pale interval, the broad ones of 3 dark stripes. Two dark stripes between eye and upper jaw; the dorsal with a few small black spots, anal dark grey, middle rays of the ventral and of caudal blackish.

*Locality.*—Inyack Island, Delagoa Bay, buried in mud. Professor C. J. van der Horst, Witwatersrand University, 1935.

## Fam. Clinidae.

Fowler (1934, Proc. Acad. Nat. Sci. Philad., lxxxvi, pp. 505–507) records *Clinus capensis*, *superciliosus*, *cottoides*, and *anguillaris*, without localities, but he says in his introduction (p. 405) that in such cases it is to be understood that the specimens came from Durban.

I know, however, that Mr. C. L. Biden, when residing in the Cape Peninsula, collected and sent to Mr. Bell-Marley several "klip-fishes," and it seems not unlikely that the above records are based on these specimens, without definitely specified localities. The presence of these typically Cape species in Natal needs confirmation.

### *Clinus rotundifrons* n. sp.

(Text-fig. 4.)

Body strongly compressed, of similar build to *C. fucorum*. Depth $3\frac{1}{2}$, length of head 4, in length of body. Depth of caudal peduncle subequal to its length. Eye slightly greater than snout, 4 in length of head. Snout and interorbital subequal. Profile rather abruptly descending, snout blunt. Lower jaw not projecting, maxilla reaching vertical from posterior $\frac{2}{3}$ of eye, lips thin. No barbels. No supra-orbital tentacle. Anterior nostril a short tube, with a sub-bifid tentacle on its hind margin; posterior nostril fringed with 6–7 short

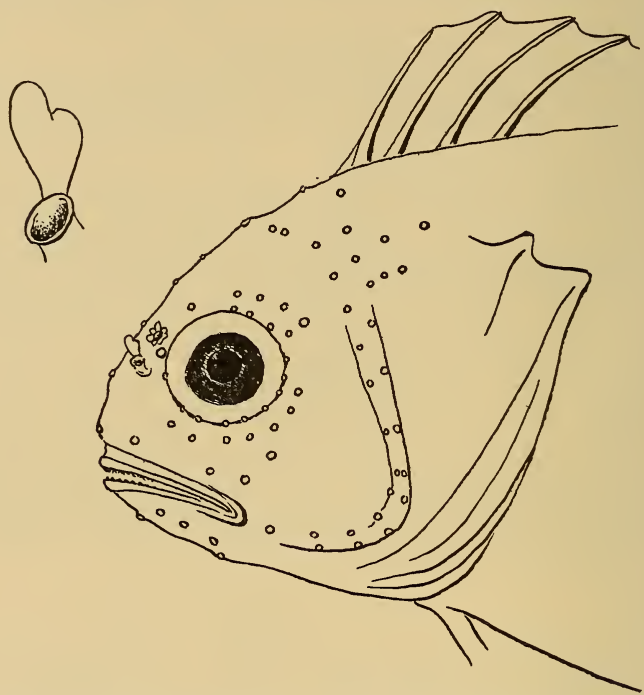


FIG. 4.—*Clinus rotundifrons* n. sp. Head, with anterior nostril further enlarged.

lobes. Numerous pores on upper and hinder parts of head, on suborbital and preopercle, and a row of 5 pores on each side of chin.

Teeth in a narrow band (3–4 rows) in upper jaw, in a double row in lower jaw, a single transverse row on vomer. Gill-rakers few and feeble, about 5 filaments in each pseudobranch. A hooked process on inner margin of shoulder-girdle.

DXXX 8, arising above preopercle, 1st spine a little over 3 times in length of head, 2nd and 3rd longer, 4th and 5th decreasing to 6th, which equals 1st, subsequent spines gradually increasing to the last, which equals 2nd; first 2 rays longer than last spine. AII 22. P 13. Third ray of ventral distinct.

Scales minute, cycloid. Lateral line a single row of tubules, about 42.

95 mm. Colour (as preserved) uniform yellowish, centre of eye black.

*Locality.*—Oudekraal (south of Camps Bay), west side of Cape Peninsula. Professor T. A. Stephenson, July 1934.

Although only a single ♀ specimen was captured, it seems distinct enough from all the other South African species to justify description. At first sight it looks very like an example of *C. fucorum* with abnormal blunt snout, but closer examination reveals a number of essential differences.

### Fam. TRIGLIDAE.

Schnakenbeck (1929, pp. 27, 28) records two species of *Trigla*: *lyra* Linn. and *hirundo* Bl. from Walfish Bay.

For revision of South African species see Smith (Tr. Roy. Soc. S. Afr., xxii, pp. 321–336, December 1934).

Fowler (1934, November 6) describes *Lepidotrigla stigmapteron* (p. 487, fig. 46), which has the breast scaleless, and seems to be synonymous with *natalensis*.

### Gen. *Chelidonichthys* Kaup.

1927. Barnard, Ann. S. Afr. Mus., xxi, p. 939.
1934. Smith, *loc. cit.*, p. 328.

Although neither Dr. Smith nor myself have compared South African examples of this genus with actual European examples, we are both agreed that in South African waters there are three well-distinguished species.

Recently, however, Svetovidov (1936) has attempted to show that *capensis*, *kumu*, and *queketti* are all synonymous with the European *lucerna ; queketti* being small, and *kumu* middle-sized, examples. He distinguishes a subspecies *kumu* from the typical *lucerna* as follows:—

No bluish-white spots on inner side of pectoral fin in adult. Atlantic coasts of Europe, South Africa, Mediterranean, Black Sea . . . . *lucerna.*
Several bluish-white spots on inner side of pectoral fin. Pacific coasts of Japan, Sea of Japan, Yellow Sea, coasts of Australia, New Zealand, and Tasmania *lucerna kumu.*

To one who has examined a large number of South African specimens, and moreover has seen them landed alive on board trawlers, Svetovidov's arguments are inadequate and unconvincing. They are based, as least in part, on a misreading of my descriptions; *e.g.*

"coloration of the inner side of the pectoral fin in *T. capensis* and *queketti* is the same, at [sic = as] in *T. lucerna*." But *capensis* has bluish-white spots on the pectoral in both young (200 mm.) and adult, and surely specimens 450–500 mm. in length can be regarded as adult.

I have seen examples of *capensis* from 100–500 mm., *kumu* 75–300 mm., and *queketti* 150–300 mm. in length. When freshly trawled there is no difficulty in distinguishing all three forms, *queketti* (all sizes) by the scaly breast (a feature ignored by Svetovidov), and the absence of spots on the pectoral, and *kumu* (all sizes) by the keeled preorbital. In the face of these facts it is a little difficult to see how growth-changes could account for the observed differences.

Sexual differences in coloration have not been observed in the South African species.

### Fam. Balistidae.

#### *Cantherines modestus* (Gnthr.).

1934. Fowler, Proc. Ac. Nat. Sci. Philad., lxxxvi, p. 510.

Fowler has the following paragraph: "Barnard distinguishes his *C. arenaceus* by the 'Skin with distinct scales, each of which is granular or spinulose,' and adds: 'The character of the skin distinguishes [it] . . . from all the other South African species.' It is thus evident that this character is also shared by *C. modestoides*." As written, the sentence seems illogical. My key and description of *modestoides* (*loc. cit.*, 1927, pp. 957, 958) state clearly that this species has a soft velvety skin.

#### *Balistes conspicillum* Bloch Schn.

1865. Bleeker, Atlas Ichthyol., v, p. 116, pl. ccxxi, fig. 2 (coloured).
1929. Gudger, Bull. Amer. Mus. Nat. Hist., lviii, fig. 3 (p. 499) (reproduction of figure from Pike's "Mauritius Fishes").
1935. Smith, Rec. Albany Mus., iv, p. 232.

Dr. C. J. van der Horst, of the Witwatersrand University, collected a specimen at Delagoa Bay.

## EXPLANATION OF PLATES.

### Plate VI.

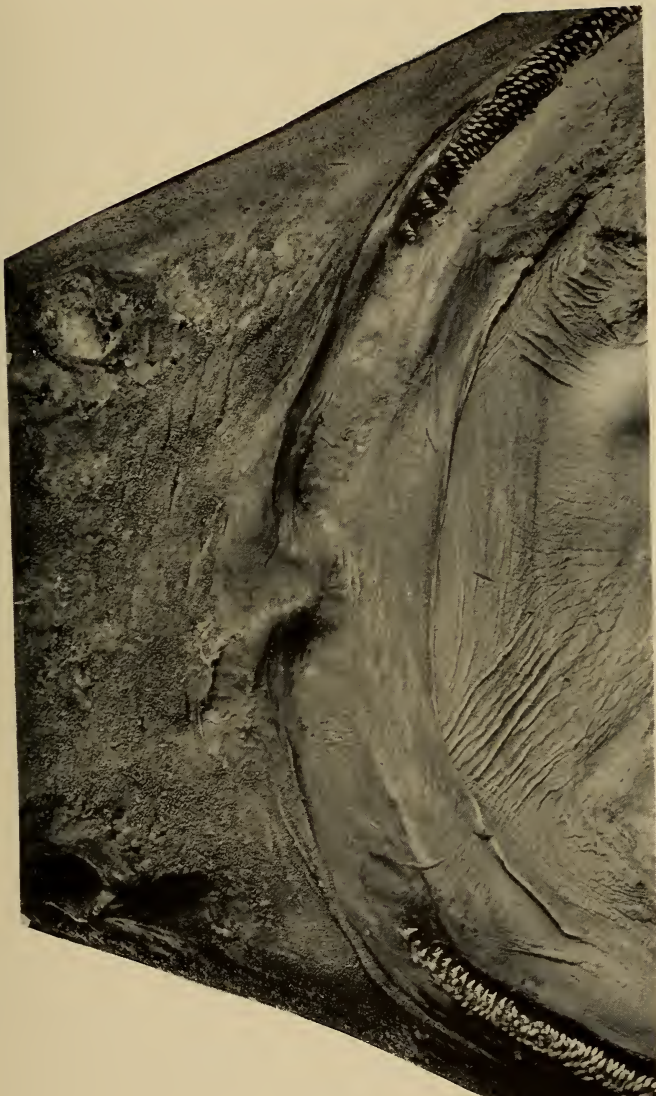
*Cetorhinus maximus* (Gunner). View of centre of upper jaw and base of snout, after mounting.

### Plate VII.

*Cetorhinus maximus* (Gunner). Enlarged view of the beginnings of the dental bands, the figure on the left showing the right side of jaw, and *vice versa.*

### Plate VIII.

*Quinquarius capensis* (C. and V.). Reproduction of the frontispiece to "The Naturalist's Library," by Sir William Jardine, 1835.



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## 7. *On a New South African Species of* Balanoglossus *and a Comparison between it and* Balanoglossus capensis (*Gilchrist*). By C. J. van der Horst, University of the Witwatersrand.

(With 19 Text-figures.)

In July 1936 Professor T. A. Stephenson of the University of Cape Town collected some Enteropneusta near Port Elizabeth and sent them to me for identification. The three specimens proved to belong to the genus *Balanoglossus*, two species of which have been described from the S. African coast by Gilchrist, viz. *B. natalensis* and *B. capensis*. The latter species, the anatomy of which has been described in more detail by von Bonde, occurs in a sexual and an asexual generation, known as *B. capensis* and *B. proliferans* (Gilchrist). *B. natalensis* is a large animal, as yet very imperfectly known, but as I collected some material at Delagoa Bay I hope to give a more accurate description of its anatomy soon. The Port Elizabeth specimens are, however, very small, and as *B. capensis* also belongs to the smaller species of this genus an accurate comparison of these specimens with *B. capensis* is necessary. This comparison reveals that the specimens from Port Elizabeth differ in several of their characters from *B. capensis* as well as from all other species of *Balanoglossus*; *B. australiensis* (Hill), however, seems to resemble them most closely. For this reason I am describing the specimens collected by Professor Stephenson as a new species, and have pleasure in naming it

### *Balanoglossus stephensoni* n. sp.

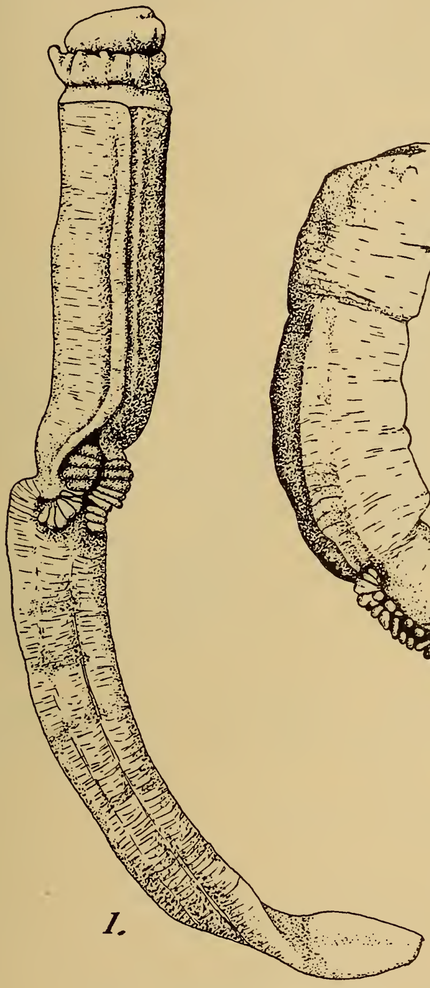
*B. stephensoni* was found underneath stones rather close inshore, half buried in muddy sand. For a species of *Balanoglossus* it is remarkable that it lives under stones ; this is the usual habitat of *Ptychodera* rather than *Balanoglossus*. Hill mentions that *B. australiensis* is found in loose gravelly sand, especially under and around larger stones, but otherwise the different species of *Balanoglossus* make burrows in the sand more or less U-shaped, as described by Stiasny. According to von Bonde *B. capensis* also occurs generally in coarse sand or gravel.

This species belongs to the smallest among Enteropneusts, and it is undoubtedly the smallest species of *Balanoglossus.* The total length of the specimen of fig. 1 is 38 mm. and of that of fig. 2 only 31·5 mm. *B. proterogonius*, the next largest in size, is about 9 cm. long and *B. australiensis* 10 cm. Even allowing for a considerable contraction in fixing, the living animal will have a total length of well under 10 cm., probably not more than 5 or 6 cm.

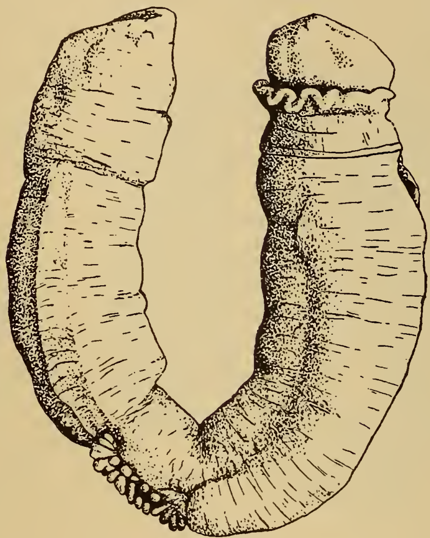
In some species of *Balanoglossus*, as, for instance, *B. numeensis*, the proboscis is greatly reduced in size, whereas the collar is long; but a long, well-developed proboscis may also occur in this genus. In *B. stephensoni*, as far as this can be judged from its contracted stage, the proboscis is of a medium size and the collar is rather short for this genus. As the dimensions of these parts depend largely on the degree of contraction in preserved material, they are not of great importance and may be gauged from figs. 1 and 2.

The anterior part of the collar, as frequently occurs in preserved specimens, is undulated. The five epidermal zones, though present, cannot be seen externally except for the narrow ring along the posterior end of the collar, but even this ring zone cannot always be easily distinguished from the part in front of it.

The branchio-genital region is 11–14 mm. long, of which no more than 3 mm. comprises the branchial region proper, so that this region is extremely short. The genital wings are demarcated from the body by a lateral groove (figs. 2 and 13). The posterior end of the collar is directly continuous with the genital wings. This, combined with the fact that the two wings adhered to each other along their free edge by the much swollen epidermis, made it very difficult to expose the branchial region. They also completely covered the anterior liver saccules. The wings are broadest near the posterior end of the branchial region, but on the whole, taking their entire length into consideration, there is not much variation in their breadth as far as the liver region. But in the anterior part of the liver region the wings decrease in size rather abruptly, soon disappearing altogether. In this respect this species obviously differs from *B. capensis*, in which species, as has been figured by von Bonde, the wings decrease very gradually in size from the posterior end of the branchial region, where they reach their maximum breadth. They extend far into the liver region, but as their disappearance is so gradual it is difficult to ascertain their posterior limit. But even more pronounced is the difference between *B. stephensoni* and such species as *B. biminiensis*, where the genital wings end suddenly in front of the liver region, so that there is a transitional zone between the genital and the liver region.



*1.*



*2.*

Fig. 1.—*Balanoglossus stephensoni.* Dorsal view. ×4.
Fig. 2.—*Balanoglossus stephensoni.* Side view. ×4.

The most obvious external character of *B. stephensoni* is the shortness of the liver region and the abrupt beginning and ending of the external liver saccules. Internally a few more small saccules can be seen both at the anterior and the posterior end of the row, but these do not bulge out on the dorsal surface. In a specimen of

*B. capensis.* 13 cm. long, the liver region measures about 3·5 cm., but as the saccules fade away very gradually at the posterior end it is difficult to give the exact length of the liver region. In Hill's figure of *B. australiensis* the liver region is about one-fifth of the total length of the animal, and in this species also the saccules fade away at the posterior end of the row. In *B. stephensoni*, on the other hand, the liver region comprises only about one-tenth of the total length, but as all three specimens were abruptly bent in the liver region it is difficult to determine the measurements exactly. The number of saccules is accordingly small; there are 20 to 22 in a row, whereas in *B. capensis* about 75 liver saccules are visible in each row.

In both species a few of the liver saccules—4 to 5 in *B. stephensoni*—have a dark brown colour, whereas those in front and behind are pure white. In general two kinds of liver saccules may be distinguished in the Ptychoderidae, but in other species of this family all the frontal saccules differ in colour from the caudal ones, whereas in *B. capensis* and *B. stephensoni* it is only a few in the middle of the row that exhibit this colour variation. This also corresponds with the observations on their histological structure.

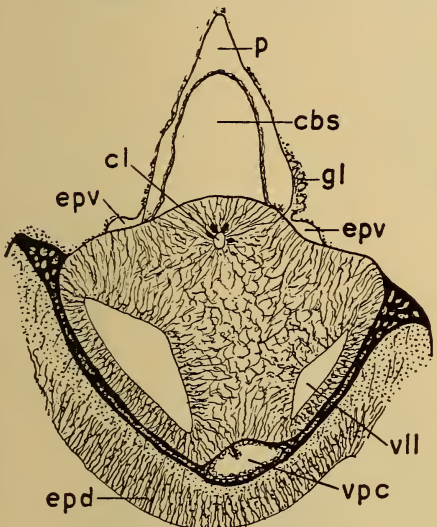
The long abdominal region—2 cm. in the specimen of 38 mm.—is characterised by the usual absence of distinguishing features. The caudal region, 3·5 mm. in length, is not swollen, but differs from the abdominal region in the absence or scarcity of the cross-striations.

The preserved specimens are of a uniform white colour, except for the few darker liver saccules. Professor Stephenson informs me that the animals, when alive, had almost the same colour, being rather more yellow.

### *Internal Anatomy.*

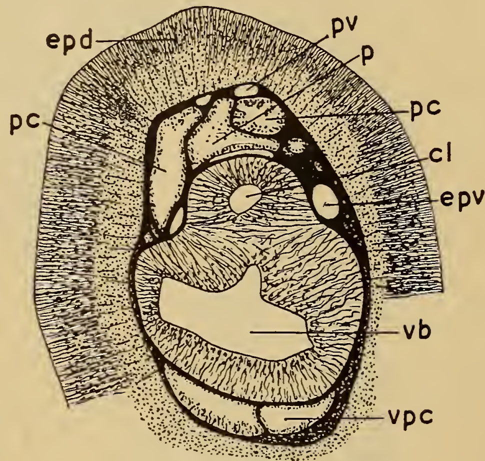
*Proboscis.*—The epidermis and musculature of the proboscis do not show any features that might separate *B. stephensoni* from other species. Von Bonde has described these tissues fully in *B. capensis.*

Concerning the ventral proboscis septum of *B. capensis,* my observations do not quite agree with von Bonde's description. I find this septum greatly reduced in this species. Starting a short distance behind the top of the stomochord there is a thin layer of dorso-ventral muscle fibres just where the septum is to be expected, but no septum in the form of a limiting membrane is visible here. Somewhat more caudally a thick blood-vessel, the ventral proboscis artery, runs from the ventral side of the stomochord to the epidermis, accompanied by some muscle fibres (fig. 10), and more caudally there are some more but thinner blood-vessels, without, however, any trace of a septum. It is only at the level of the ventral pouch of the stomochord that the septum appears, separating the two ventral coelomic blind-sacs; but here too it is not complete, as there is a large hole in it (fig. 3). Nevertheless the septum extends to the caudal end of the blind-sacs, which are not, however, deep, as they cease at the front end of the skeleton.




3.

FIG. 3.—*Balanoglossus capensis.* Cross-section of the proboscis organs. ×66. *cbs* = central blood space; *cl* = central lumen of stomochord; *epd* = epidermis; *epv* = efferent proboscis vessels; *gl* = caudal end of glomerulus; *p* = pericardium; *vll* = ventro-lateral cavity of stomochord; *vpc* = ventral proboscis coelomic blind-sac.




4.

FIG. 4.—*Balanoglossus stephensoni.* Cross-section of the proboscis organs. ×66. *cl* = central lumen of stomochord; *epd* = epidermis; *epv* = efferent proboscis vessel; *p* = pericardium; *pc* = right and left part of dorsal proboscis coelom; *pv* = proboscis vein; *vb* = ventral blind-sac of stomochord; *vpc* = ventral proboscis coelom.

In *B. stephensoni* I find the septum better developed. In front of it and free from it is seen the ventral proboscis artery; the septum itself begins a short distance behind the top of the stomochord, and from there it is complete and without a hole up to the posterior end of the ventral blind-sacs, that is near the frontal end of the skeleton (fig. 4). There are some smaller blood-vessels running through the septum. In contrast to *B. capensis* there are no dorso-ventral muscle fibres neither near the ventral artery nor at the sides of the septum, the latter being covered by a layer of coelomic epithelium only.

The dorsal part of the proboscis coelom is as usual divided into right and left halves by the attachment of the pericardium to the basal membrane of the epidermis. According to von Bonde in one of his series the right dorsal proboscis coelom opens into the end-sac, and further by the proboscis pore to the exterior. This is unusual, as the right dorsal coelom nearly always splits up into smaller branches and ends blindly in the chondroid tissue, whereas the left opens to the exterior. This more usual condition was found by von Bonde in another specimen of *B. capensis.* In two series of sections of *B. capensis* which I studied the right coelomic sac was found to open to the exterior, the left splitting up in the chondroid tissue. It therefore seems that this is the normal condition in *B. capensis,* whereas in other Enteropneusta it is to be considered as abnormal. In *B. stephensoni* the normal condition obtains, the left dorsal proboscis coelom opening to the exterior. But in both species the ectodermal pouch or end-sac with which the coelom communicates and which in its turn opens to the exterior by the proboscis pore shows a bilateral symmetry, to some extent at least. It always extends in an anterior direction at one side, mostly the left, to its communication with the proboscis coelom. In both species, however, I found in addition an anteriorly directed extension of the end-sac on the opposite side, but in *B. capensis* it is on the left side and in *B. stephensoni* on the right side ; in both species this extension ends blindly without communicating with the coelom. Hill sometimes found a similar condition in *B. australiensis,* and von Bonde describes this feature of the end-sac, called by him the proboscis canal, in one of his specimens. In between these two forward extensions of the end-sac lies the connection between the proboscis veins and the sinus venosus (fig. 5).

In both species the end-sac is large ; in *B. capensis* it is nearly square in cross-section, in *B. stephensoni* it is greatly elongated dorso-ventrally (figs. 6 and 7). The proboscis pore of *B. capensis* is small and round and slightly inclined towards the left side. In *B. stephensoni* the pore is much larger and the end-sac extends for a short distance beyond the proboscis pore ; a feature not found in *B. capensis.*

The stomochord of *B. capensis* is very compressed near its anterior end, as has been figured by von Bonde. In the sections, where the pericardium appears, the dorsal part of the stomochord disappears and the stomochord assumes the usual circular form in the cross-section (fig. 10). There are small isolated cavities in this anterior part, the continuous main lumen appearing only a short distance in front of the ventral extension of the stomochord. Although the stomochord of *B. capensis* has the usual swelling or extension at its ventral side there is no blind-sac of the main lumen extending into

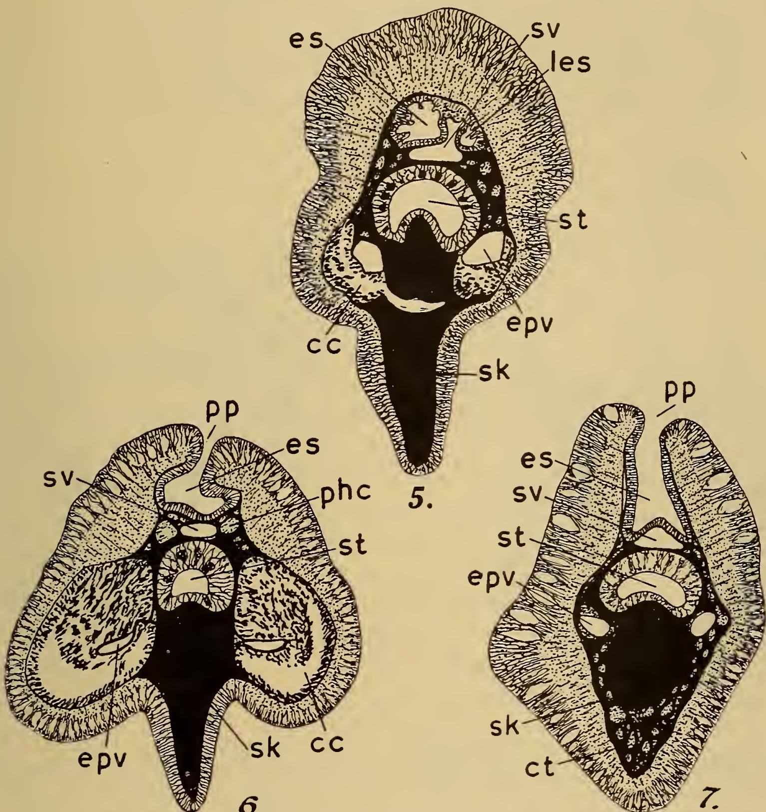



Fig. 5.—*Balanoglossus capensis.* Cross-section of the proboscis neck. ×66. *cc*=collar coelom; *epv*=efferent proboscis vessel; *es*=end-sac; *les*=forward extension of end-sac at the left side; *sk*=skeleton; *st*=stomochord; *sv*=sinus venosus.

Fig. 6.—*Balanoglossus capensis.* Cross-section of the proboscis neck. ×66. *cc*=collar coelom; *epv*=efferent proboscis vessel; *es*=end-sac; *phc*=top of perihaemal cavity; *pp*=proboscis pore; *sk*=skeleton; *st*=stomochord; *sv*=sinus venosus.

Fig. 7.—*Balanoglossus stephensoni.* Cross-section of the proboscis neck. ×66. *ct*=chondroid keel of skeleton; *epv*=efferent proboscis vessel; *es*=end-sac; *pp*=proboscis pore; *sk*=skeleton; *st*=stomochord; *sv*=sinus venosus.

this swelling, a feature also found by von Bonde. Instead of the one ventro-median blind-sac there are two ventro-lateral cavities. Usually, as in *B. australiensis* and *B. clavigerus,* these ventro-lateral cavities communicate with a ventro-median extension of the main lumen. In *B. capensis*, however, they remain separate as there is no ventro-median extension (fig. 3). More towards the posterior end of the swelling, however, the cavities shift in dorso-lateral direction, where they have the appearance of dorso-lateral cavities of the stomochord (fig. 8), and at the level of the caudal end of the swelling

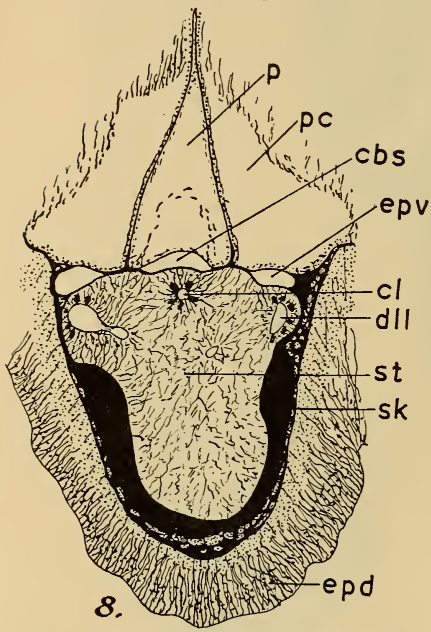



FIG. 8.—*Balanoglossus capensis.* Cross-section of the proboscis organs. × 66. *cbs* = central blood space; *cl* = central lumen of stomochord; *dll* = dorso-lateral lumen of stomochord; *epd* = epidermis; *epv* = efferent proboscis vessel; *p* = pericardium; *pc* = dorsal proboscis coelom; *sk* = skeleton; *st* = stomochord.

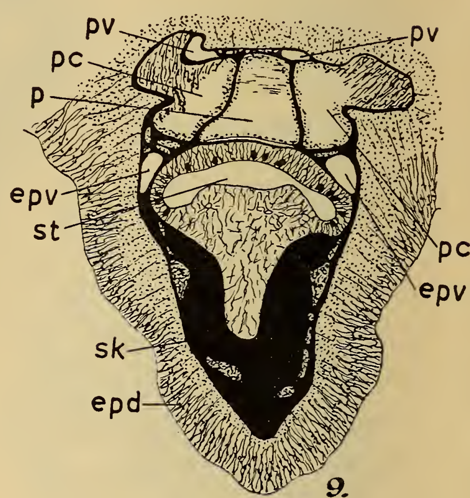



FIG. 9.—*Balanoglossus capensis.* Cross-section near the anterior end of the proboscis neck. × 66. *epd* = epidermis; *epv* = efferent proboscis vessels; *p* = pericardium; *pc* = dorsal coelomic cavities of the proboscis; *pv* = proboscis veins; *sk* = skeleton; *st* = stomochord.

they communicate with the main lumen (fig. 9). In some species of Balanoglossus (*B. carnosus*, *B. biminiensis*, *B. jamaicensis*, *B. numeensis*, and *B. gigas*), which also in other respects are nearly related to each other, there are separate ventro-lateral and dorso-lateral cavities present in the stomochord; in others (*B. clavigerus*, *B. australiensis*, *B. stephensoni*) only the ventro-lateral cavities are found. *B. capensis* is intermediate between these groups, as the ventro- and dorso-lateral cavities intercommunicate on each side.

In *B. stephensoni* the anterior end of the stomochord is slightly compressed and contains some small isolated cavities. The continuous main lumen appears where the stomochord widens out in a ventral, and especially in a lateral, direction. At this place is found a large ventral blind-sac that is connected with the main lumen by a narrow canal (fig. 4). Where the ventral blind-sac disappears and the body of the stomochord passes over into the neck, the main central lumen widens out considerably. As in *B. capensis* the anterior part of the neck is nearly round in cross-section (fig. 6), then it becomes broader (fig. 7). Somewhat more towards the posterior end, where the proboscis neck has already fused with the collar, the dorsal wall of the stomochord of *B. stephensoni* bulges out in between the perihaemal cavities, which thereby are separated from each other ventrally (fig. 12). Furthermore the lumen of the stomochord sends out a blind-sac into this bulge. This may be a peculiarity of the specimen that was studied in serial sections, but it is more likely that this feature is of specific importance because a similar blind-sac is found in *B. misakiensis*. In *B. capensis* it is absent. As the crura of the skeleton spread out nearly in the transverse plane in *B. stephensoni*, the stomochord becomes very broad just before it communicates with the buccal cavity.

Anteriorly the skeleton starts in the cross-sections in the form of a U in both species, the anterior rim being of rather chondroid appearance in *B. capensis* (fig. 8). When the stomochord becomes smaller, owing to the disappearance of its ventral blind-sac, the skeleton becomes more of a solid structure (fig. 9) and the keel appears, which becomes more and more prominent until it soon surpasses the body in size. In *B. stephensoni* the anterior part of the keel is quite chondroid (fig. 7). In *B. capensis* the keel gradually diminishes in size towards its posterior end and disappears altogether a short distance in front of the splitting up of the body into the two crura. In *B. stephensoni*, on the other hand, the size of the keel is almost constant up to the region just in front of the splitting up of the body (fig. 12), and here the keel stops suddenly.

In some species of Balanoglossus (*B. biminiensis*, *B. carnosus*, *B. numeensis*) a reduction of the skeleton can be observed, caused by other tissues penetrating into the skeleton and more or less breaking it up. In *B. biminiensis* there is even a connection between the right and left collar coelomic cavities piercing through the body of the skeleton. Although the skeleton of *B. capensis* cannot be considered as being reduced, a similar connection between the collar coelomic cavities was found here, locally separating the keel from the body of the skeleton (fig. 5). Von Bonde also seems to have observed this, as he mentions that the body, in the form of a rod, is completely separated from the keel.

In *B. capensis* the crura of the skeleton reach to about one-third of the length of the collar and they surround the buccal cavity for about one-third of its circumference. In *B. stephensoni* the crura are even shorter and are lying almost completely in the transverse plane.

The pericardium does not show any peculiarities in either species. In *B. stephensoni* its anterior end is at the same level as the top of the stomochord, and in *B. capensis* it is slightly behind this level, as was also observed by von Bonde.

In *B. stephensoni* the central blood space projects as a free blind-sac into the anterior part of the pericardium, as was described by Hill in *B. australiensis*. I do not consider this, however, to be of specific importance ; it may be found in one specimen, and in another the blood space occupies its usual place in between the pericardium and the stomochord for the whole length of the pericardium. I was not able to find such a free projection of the blood space in *B. capensis*, but von Bonde describes it in the specimens of the species studied by him.

The glomerulus is markedly different in the two species. In *B. capensis* the glomerulus appears in the cross-sections at the same place as the stomochord, so that the glomerulus does not project in front of the stomochord. But the right and the left parts of the glomerulus are connected here along the dorsal side of the stomochord in front of the pericardium, and when later the pericardium appears in the sections this connection is found at the dorsal side of the pericardium (fig. 10). Thus the anterior part of the pericardium is completely covered by the glomerulus. More caudally the glomerulus is broken up into two lateral parts owing to the disappearance of the dorsal connection. Here the glomerulus covers the ventral half of the lateral pericardial wall and extends only slightly over the stomochord. Its caudal end is found near the anterior end of the ventral swelling of the stomochord.

In *B. stephensoni*, on the other hand, the glomerulus projects in front of both the stomochord and the pericardium, and it is already well developed when the top of the stomochord appears in the cross-sections. In this species the lateral parts of the glomerulus are connected along the ventral side of the stomochord and not along the dorsal side of the pericardium (fig. 11). When this ventral connection has disappeared from the sections the glomerulus almost equally covers the pericardium and the stomochord. It disappears just in front of the ventral blind-sac of the stomochord. Although there is no dorsal connection of the two parts of the glomerulus there is a very small dorsal glomerulus at the side of the dorsal proboscis artery, quite isolated from the main glomerulus (fig. 11).

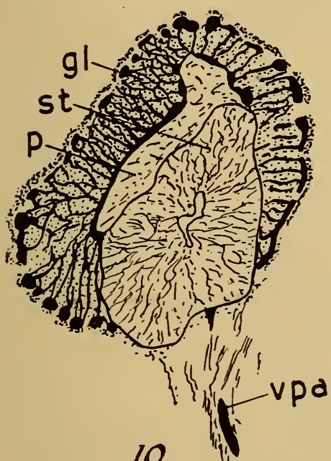



Fig. 10. — *Balanoglossus capensis.* Cross-section of the anterior part of the proboscis organs. ×66. *gl* = glomerulus; *p* = pericardium; *st* = stomochord; *vpa* = ventral proboscis artery.

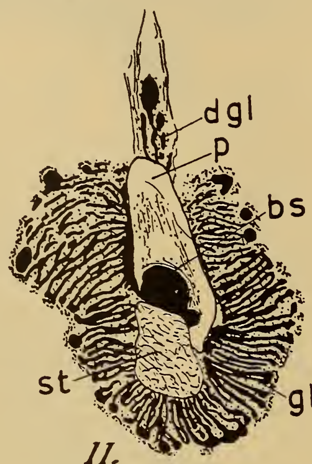



Fig. 11.—*Balanoglossus stephensoni.* Cross-section of the anterior part of the proboscis organs. ×66. *bs* = central blood space; *dgl* = dorsal glomerulus; *gl* = glomerulus; *p* = pericardium; *st* = stomochord.

*Collar.*—In both species the epidermis of the collar shows the usual five zones, the second and fourth of which are composed of thin cells and stain more deeply, because the numerous slime glands occurring in the other zones are lacking in these two (fig. 12). The collar musculature also exhibits no features that might distinguish these species from others.

Concerning the coelom von Bonde writes that " the dorsal and ventral septa dividing the collar coelom into two halves are well developed." I find, however, that the ventral mesentery in both *B. capensis* and *B. stephensoni* is greatly reduced. It is only present in the most posterior part of the collar near the collar-trunk-septum. For nearly the whole length of the collar the right and left coelomic cavities communicate freely with each other along the ventral side. The dorsal septum is better developed. In *B. capensis* it begins with the first and only dorsal nerve root and in *B. stephensoni* with the second root, from where it extends to the posterior end of the

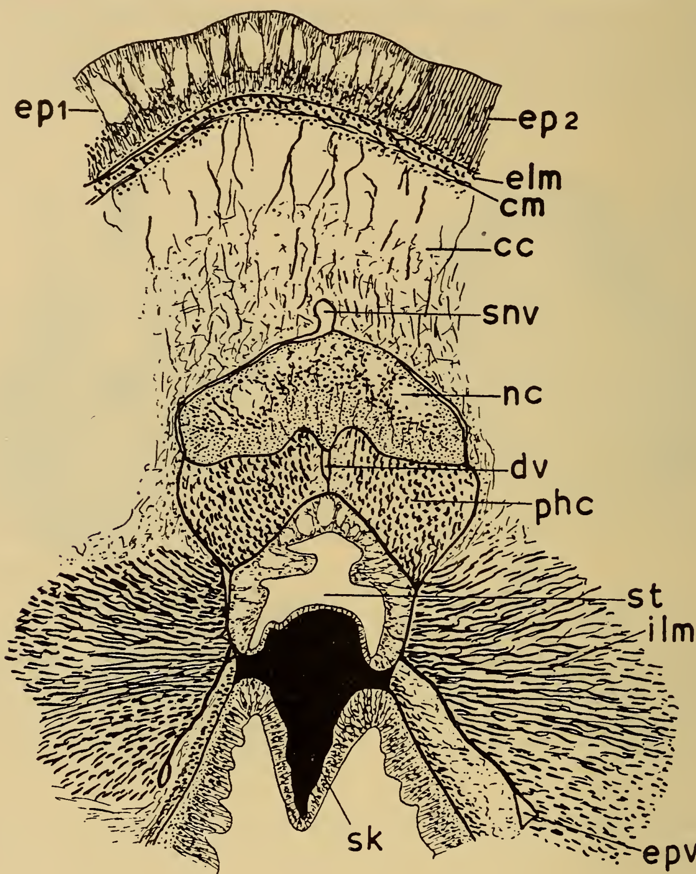



FIG. 12.—*Balanoglossus stephensoni.* Cross-section of the dorsal part of the collar near its anterior end. ×66. *cc* = collar coelom; *cm* = circular musculature; *dv* = dorsal blood-vessel; *elm* = external longitudinal musculature; *epv* = efferent proboscis vessel; *ep*1 = first epidermal zone; *ep*2 = second epidermal zone; *ilm* = internal longitudinal musculature; *nc* = nerve cord; *phc* = perihaemal cavity; *sk* = skeleton; *snv* = supra-neural blood-vessel; *st* = stomochord.

collar. In *B. capensis,* however, there are some holes in this septum; in *B. stephensoni* it is entire.

The collar pores of both species exhibit the usual features. They have a longitudinal fold along their dorsal side, and the epithelium of this fold is hardly thinner than that of the ventral side of the pores.

The collar pores unite with the first branchial pouch near the external opening.

In *B. capensis* the anterior end of the perihaemal cavities is found at the level of the proboscis pore (fig. 6) and in *B. stephensoni* just behind this pore. In both species there are some openings in the septum separating the perihaemal cavities ventrally to the dorsal blood-vessel.

An anterior epidermal depression, connected with the anterior end of the collar nerve cord, is just indicated in *B. capensis*; in *B. stephensoni* it is entirely absent. In the latter species the posterior epidermal depression is also missing, whereas it is deep in *B. capensis*.

The collar nerve cord is very flattened in both species. There is neither an anterior nor a posterior neuropore, as the central canal is quite reduced to a number of small cavities. In *B. stephensoni* the lateral cavities are small and isolated; in *B. capensis* they have more the form of narrow elongated canals, of which a few occur behind each other throughout the whole length of the cord. This was also observed by von Bonde. A few isolated median cavities are found in both species. *B. stephensoni* has three dorsal nerve roots, the first of which runs free through the coelom as the dorsal mesentery only begins with the second root. All the roots are found in the anterior half of the collar. In *B. capensis* von Bonde found one root in one specimen and two roots in another. In the specimens I have studied there is a single root, but its peripheral part divides, so that it has two connections with the epidermis.

*Trunk.*—In all three specimens of *B. stephensoni* the epidermis of the trunk, and especially that of the branchial region, is very much swollen, except along the dorsal and ventral nerve cords and around the branchial and genital pores (fig. 13). As the intestine is quite empty, the animals apparently were kept for some time in a disk with sea-water before being fixed, and I have noticed in other species of Balanoglossus that the animals in these circumstances, unprotected as they are by stones or sand, secrete an enormous amount of slime.

*B. stephensoni* is characterised by its short and broad branchial tongues and septa; in *B. capensis*, as in other species of Balanoglossus, they are narrower. In *B. capensis* the dorsal or branchial part of the pharynx is larger than the ventral or digestive part, a feature also observed by von Bonde. This author, however, refers to this ventral part as the oesophagus, a term which is obviously inaccurate, for, as in Amphioxus, Tunicates, or Vertebrates, that part of the alimentary tract, which is pierced by the gill slits, is

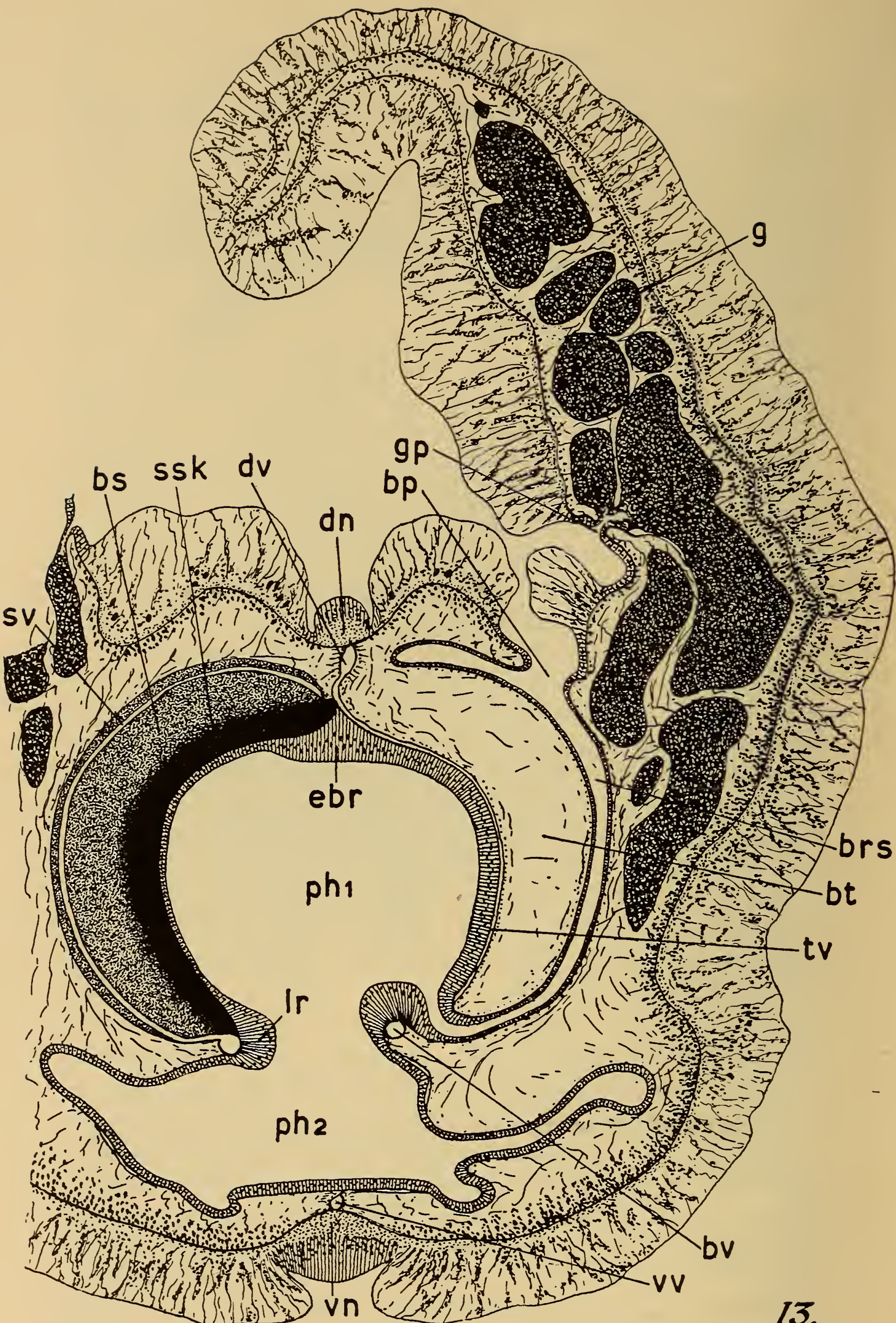



Fig. 13.—*Balanoglossus stephensoni*. Cross-section of the branchial region, composed from a number of sections. ×45. *bp* = branchial pore; *brs* = branchial sac; *bs* = branchial septum; *bt* = branchial tongue; *bv* = parabranchial blood-vessel; *dn* = dorsal nerve cord; *dv* = dorsal blood-vessel; *ebr* = epibranchial ridge; *g* = gonad; *gp* = genital pore; *lr* = parabranchial or limiting ridge; *ph*1 = branchial part of pharynx; *ph*2 = digestive part of pharynx; *ssk* = septal skeletal bar; *sv* = septal blood-vessel; *tv* = tongue blood-vessel; *vn* = ventral nerve cord; *vv* = ventral blood-vessel.

termed the pharynx, and this is followed by the oesophagus, which in Enteropneusta extends up to the liver region. With the exception of Schizocardium the gill slits of Enteropneusta are confined to the dorsal part of the alimentary canal, for which reason the ventral half is best designated the digestive part of the pharynx. Taking into account the many folds of the ventral wall, the two parts of the pharynx are nearly equal in size in *B. stephensoni.*

As was to be expected in such a small animal, the number of gill slits in *B. stephensoni* is very small; I counted only 30 of them. Next comes *B. australiensis,* where, according to Hill, the number of gill slits does not exceed 40; in *B. capensis* there are 52, which also is a small number for a species of Balanoglossus. In both *B. capensis* and *B. stephensoni* the first gill slits open to the exterior by separate pores; in *B. misakiensis* the first four gills have a common opening. But *B. stephensoni* and *B. capensis* show a remarkable feature in connection with the first branchial pore. All these pores are found in a row at the medial side of the genital wings (fig. 13) as in other species of Balanoglossus, but the common opening of the collar canal and the first gill is found on the outer side of the genital wings (fig. 14). The wings, which are continuous with the dorsal wall of the collar, are only incipient in this region. The difference between the first and the second branchial pores is quite evident on comparing figs. 14 and 15. Even at the level of the second branchial pore the genital wings are better separated from the dorsal side of the body than they are at the first pore. In *B. australiensis* the first branchial pore also occupies a similar position on the outer side of the genital wing, though it is not mentioned in Hill's description. On the other hand, in *B. carnosus* and *B. biminiensis* the first branchial pore is on the medial side of the genital wing. I could not verify its position in the other species of Balanoglossus owing to lack of material.

The number of synapticula is 10 in *B. stephensoni* and 12 to 13 in *B. capensis.* Ventral blind pouches to the branchial sacs are absent in both species. In both species, owing to the fact that the epithelium on the inner side of the tongues attains about twice the thickness of that on the septa, the branchial tongues project slightly more into the pharyngeal cavity than the septa. Even so the epithelium of the tongues is rather low compared with that of other Enteropneusta. In both species the cells of the epibranchial ridge, and therefore also those of the inner side of the tongues and septa, are all of the same character.

The parabranchial ridges between the branchial and digestive parts of the pharynx are well pronounced in both species, and attain a thickness about twice that of the rest of the pharynx.

In *B. stephensoni* it could clearly be seen that a side branch of the parabranchial blood-vessel ascends along the peripheral edge of the

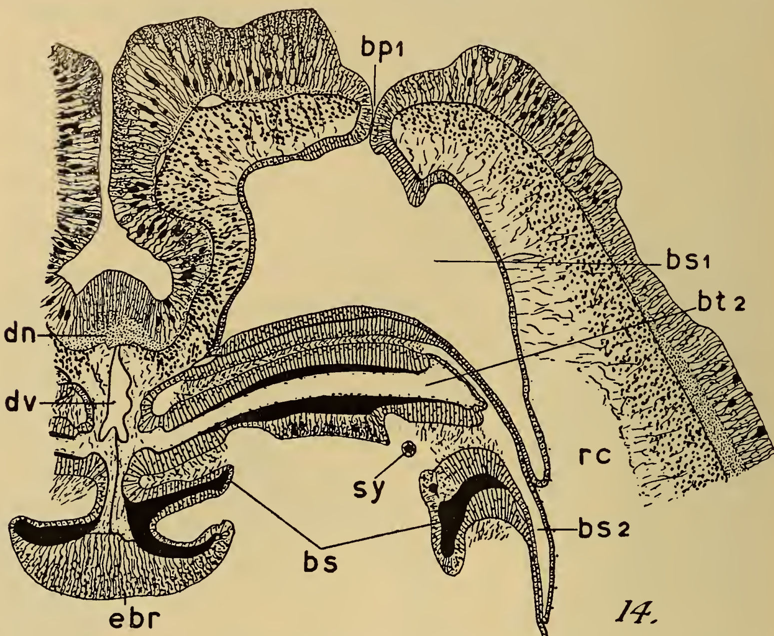



FIG. 14.—*Balanoglossus capensis.* Cross-section through the first branchial pore. ×66. *bp*1 = first branchial pore; *bs* = second branchial septum; *bs*1 = first branchial sac; *bs*2 = second branchial sac; *bt*2 = second branchial tongue; *dn* = dorsal nerve cord; *dv* = dorsal blood-vessel; *ebr* = epibranchial ridge; *rc* = trunk coelom; *sy* = synapticulum.

branchial septum up to the dorsal end of the septum (figs. 13, 15). This vessel does not give off lateral branches, nor does it connect with the main dorsal vessel, but it breaks up into smaller vessels at the dorsal end of the septum. These smaller vessels could not be traced further; undoubtedly they enter the tongue and form a capillary network in the tongue, after which they unite again with another larger vessel that could be seen ascending just underneath the epithelium of the inner side of the tongue. This vessel joins the dorsal blood-vessel (fig. 13).

The post-branchial canal, forming a short continuation of the branchial part of the pharynx, is very similar in the two species.

The only difference is that in *B. stephensoni* the high epithelium of the post-branchial canal is divided into dorsal and lateral parts by two dorso-lateral grooves (fig. 16), whereas in *B. capensis* this epithelium is thrown into numerous irregular folds (fig. 17). In

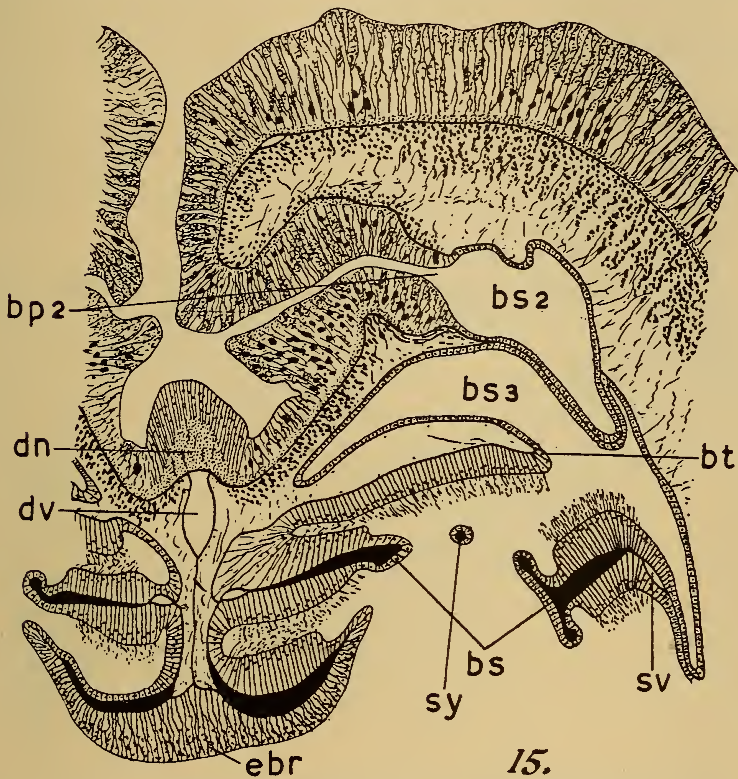



Fig. 15.—*Balanoglossus capensis.* Cross-section through the second branchial pore. ×66. *bp*2 = second branchial pore; *bs* = third branchial septum; *bs*2 = second branchial sac; *bs*3 = third branchial sac; *bt* = third branchial tongue; *dn* = dorsal nerve cord; *dv* = dorsal blood-vessel; *ebr* = epibranchial ridge; *sv* = septal blood-vessel; *sy* = synapticulum.

both species an anteriorly directed blind-sac of the canal, which in other species is found lying dorsally to the branchial part of the pharynx, is absent. Maser found that it may be absent in young individuals of *B. clavigerus* and *B. carnosus*, whereas it is present in older ones. The specimens of *B. stephensoni* and *B. capensis*, which I have studied, however, are not young individuals, as their gonads are fully developed. In both species the coelomic blind-pouches that usually project like a pair of valves into the oesophagus are also absent. Otherwise these valves seem to be a constant character of the Ptychoderidae, though they are missing in *B. proterogonius* also. The post-branchial canal ends abruptly in both species.

In *B. stephensoni* the lateral septum could be followed for some considerable distance into the branchial region ; it extends over 15 gill pores from the posterior end of the branchial region, *i.e.* about over half of that region. On the other hand, in the larger *B. capensis* it could only be followed for a distance of 10 gill slits, *i.e.* for not even one-fifth of the branchial region. As usual, the medial attachment of the branchial septum shifts along the last gill slit from the epidermis to the intestinal wall (figs. 16 and 17).

In *B. capensis* the first genital pore is found between the fourth and the fifth branchial pores, but the corresponding gonad is very small and it is either sterile or very young. All the anterior gonads are small, although they may contain some yolk cells. They occupy only a small part of the genital wing and hardly extend into the body proper. Posteriorly the gonads gradually increase in size, and although the tops of the gonads are also sterile they contain ripe eggs. This indicates that the row of gonads is about to extend in an anterior direction by the addition of secondary gonads. The gonads are profusely branched, and except for the top they fill up the whole of the genital wing ; ventrally they extend into the body cavity and reach as far as the ventral end of the gills (fig. 17). Although the gonads are much more branched than in *B. clavigerus* they have only the primary pore in the sublateral line ; secondary pores which may occur either at the distal or medial side of this line are absent.

Concerning the position of the most anterior of the gonads in *B. stephensoni*, these are even further forwards than in *B. proterogonius*, which was so called by Belichov on account of the occurrence of gonads between the second and third gills. In *B. stephensoni* gonads are found immediately behind the collar-trunk-septum ; they can be seen in the same sections as the collar pores. These anterior gonads are small, but they show some branches and each opens by a separate pore in the niche between the genital wing and the body. Their pores are thus found in front of the second branchial pore. These pores may be considered as secondary ones unless it can be assumed that the sublateral line curves round in the niche. Further back in the row *B. stephensoni*, like *B. capensis*, has only primary pores in the sublateral line. Behind these anterior small gonads an increase in size soon is observed, and the gonads become profusely branched in both dorsal and ventral directions. In *B. stephensoni* the peripheral part of the genital wing is quite empty ; on the ventral side the gonads penetrate into the body cavity to about the middle of the gills (fig. 13).

As has been previously mentioned, a few of the liver saccules in

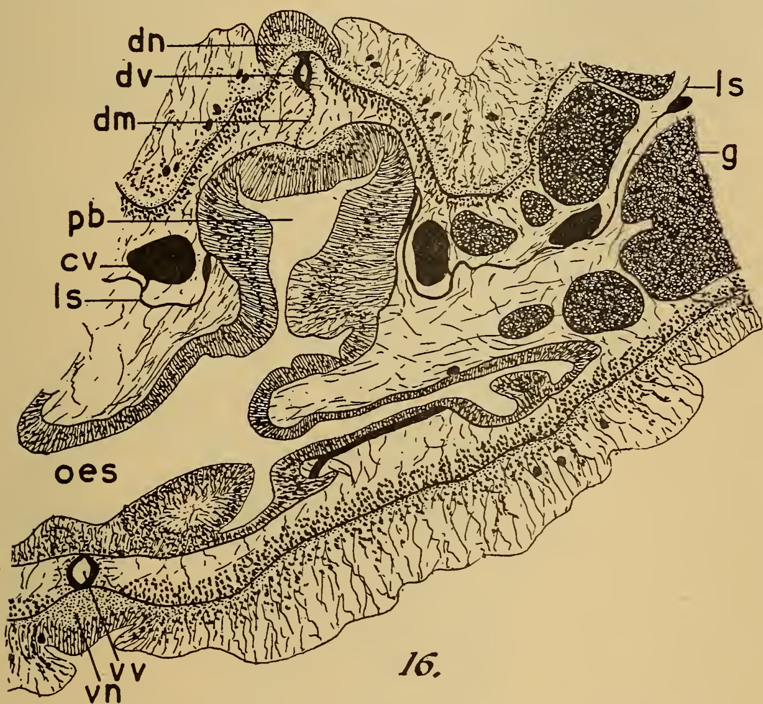



FIG. 16.—*Balanoglossus stephensoni* Cross-section at the level of the post-branchial canal. ×45. *cv* = commissural blood-vessel; *dm* = dorsal mesentery ; *dn* = dorsal nerve cord ; *dv* = dorsal blood-vessel ; *g* = gonad ; *ls* = lateral septum ; *oes* = oesophagus ; *pb* = post-branchial canal; *vn* = ventral nerve cord ; *vv* = ventral blood-vessel.

about the middle of the row are sharply defined by their dark colouration from the pure-white saccules in front of and behind them. In most Ptychoderidae all the anterior saccules differ from the posterior ones, sometimes, as in *B. biminiensis,* not only in colour but also in their form. In *B. carnosus* it was found that the two kinds of liver saccules were separated from each other by a well-pronounced swelling of the intestinal wall and the anterior saccules contain many glandular cells in their walls. In *B. stephensoni* the

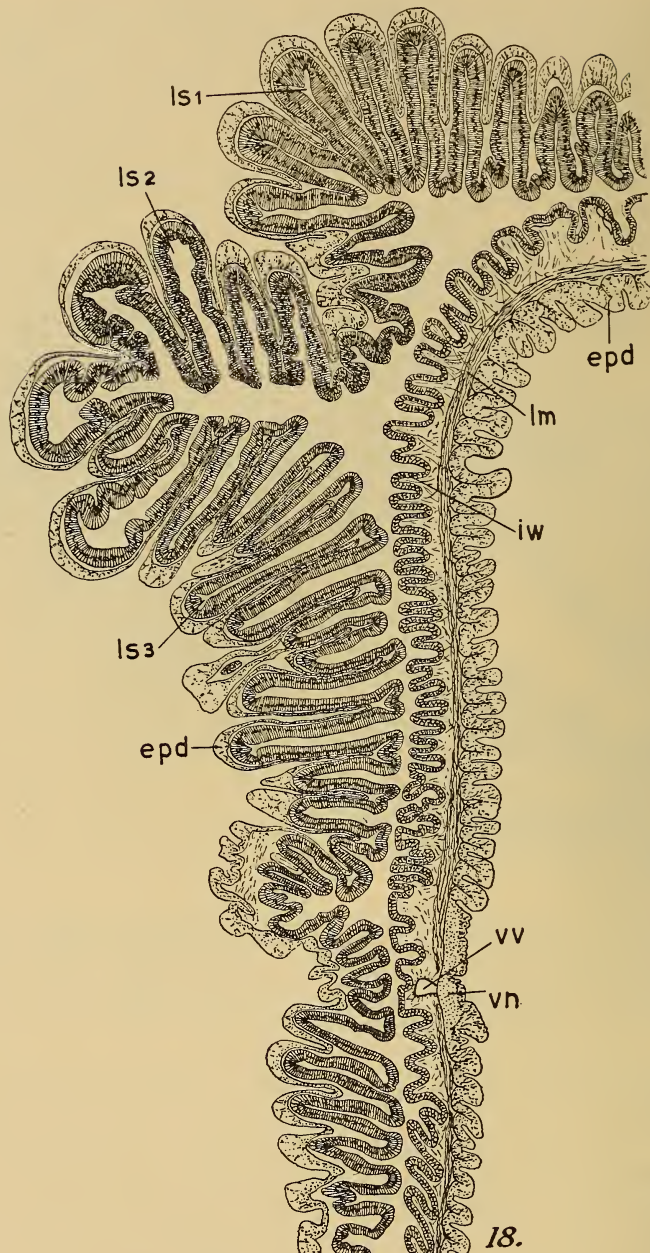



Fig. 18.—*Balanoglossus stephensoni*. Longitudinal section of the hepatic region. ×27. *epd*=epidermis; *iw*=ventral wall of intestine; *lm*=longitudinal musculature; *ls*1, *ls*2, and *ls*3=first, second, and third region of liver saccules; *vn*=ventral nerve cord; *vv*=ventral blood-vessel.


Fig. 17.—*Balanoglossus capensis.* Cross-section at the level of the post-branchial canal. ×45. *cv* = commissural blood-vessel; *dn* = dorsal nerve cord; *dv* = dorsal blood-vessel; *gp* = genital pore; *ls* = lateral septum; *lv* = lateral blood-vessel; *oes* = oesophagus; *pb* = post-branchial canal; *vn* = ventral nerve cord; *vv* = ventral blood-vessel.

Fig. 19.—*Balanoglossus stephensoni.* Cross-section of the pygochord. ×290. *iw* = intestinal wall; *pg* = pygochord; *vv* = ventral blood-vessel.

dark saccules could easily be identified in sections by numerous small dark granules in the liver cells. The nuclei of the liver cells occupy their usual position almost in the middle of the cell and the dark granules are found only at the side of the nucleus facing the intestinal lumen (fig. 18). Although there is a clear limit between the saccules with granular cells and those without, a swelling of the intestinal wall such as occurs in *B. carnosus* could not be found. All the saccules have the same form. At the anterior as well as at the posterior end of the row a few small saccules are found that do not cause an epidermal bulging, so that they are invisible from the outside. The ventral wall of the intestine in the liver region is thrown into numerous small transverse folds. As the epidermis in this region also shows similar folds, these may have been caused, at least partially, by the contraction of the ventral longitudinal muscles during fixation.

The intestine in the abdominal region of *B. stephensoni* has the usual pair of ciliary bands, but I was unable to find a continuous line of epidermis without glandular cells, corresponding to the ciliary bands as described by Hill in *B. australiensis*, although indications of it were seen here and there. Anteriorly the ciliary bands could be followed through the whole liver region, but at the anterior end of this region they become very indistinct and they do not extend in front of it; in *B. australiensis*, however, they extend for a considerable distance into the genital region. Posteriorly the ciliary bands stop at the caudal region.

The anus is surrounded by a feebly developed sphincter.

The pygochord of *B. stephensoni* extends over the whole length of the caudal region, and it is not separated from the intestinal wall. Anteriorly it starts as a small evagination of the wall of the intestine in the ventral midline. Growing larger it reaches the ventral blood-vessel, and more posteriorly, where this vessel ends, it comes into contact with the basal membrane of the epidermis (fig. 19). The pygochord has the same breadth throughout. Its cells, especially those along the dorsal side near the intestine, contain large vacuoles.

### *Diagnosis of Balanoglossus capensis* (Gilchrist).

Total length up to 13 cm.; in a specimen of 13 cm. the length of the proboscis is 3·5 mm., that of the collar 3 mm., of the branchial region 7·5 mm., the total length of the genital wings is 37 mm. and of the liver region 35 mm.; the abdominal region is 68 mm. long. Genital wings fused with posterior rim of collar; they reach their maximum breadth at the end of the branchial region, from where they gradually decrease in size ; they reach well into the liver region, where they fade away gradually. The liver saccules form a regular row of about 75 visible saccules on each side. The middle liver saccules are dark, the anterior and posterior ones light in colour.

Right and left halves of the glomerulus connected along the dorsal side of the pericardium ; glomerulus only slightly covering the stomochord ; ventral proboscis septum greatly reduced but extending to the end of the ventral coelomic blind-sacs ; stomochord without ventro-median blind-sac, but with ventro-lateral blind-sacs which communicate with dorso-lateral blind-sacs ; only the latter are in connection with the central lumen. Keel of skeleton well developed, gradually diminishing in size towards its posterior end ; crura short, surrounding the buccal cavity for about one-third of its circumference. In the majority the right dorsal coelomic cavity of the proboscis opens into a large end-sac, which has a blind forward extension on the left side as well. Proboscis pore small and round.

Nerve cord without central lumen, with one or two dorsal nerve roots. Ventral collar mesentery only present near hind end of collar.

Anterior branchial sacs not connected with each other, each opens to the exterior by a separate pore ; first branchial pore at the outer side of the genital wings, all the others at the medial side. Branchial sacs without ventral blind-sacs. 12 to 13 synapticula, about 50 gills. Post-branchial canal without anteriorly directed blind-sac ; no valves projecting into the oesophagus. The first genital pore between the 4th and the 5th branchial pores ; except near the anterior end of the row the gonads are large and much branched ; no secondary genital pores.

*Locality.*—False Bay, South Africa.

### *Diagnosis of Balanoglossus stephensoni* n. sp.

Total length up to 4 cm. ; in a specimen with a length of 38 mm. the proboscis is 1·5 mm. long, the collar nearly 2 mm., the branchial region 3 mm. ; the total length of the genital wings is 12·5 mm. ; the abdominal region is 20 mm. long. Genital wings fused with posterior rim of the collar ; they reach their maximum breadth near the hind end of the branchial region, this breadth remaining practically constant up to the beginning of the liver region. In the anterior part of the liver region the genital wings decrease abruptly in size. The short liver region begins and ends abruptly. The liver saccules form a regular row on each side and there are about 20 saccules visible in each row. The middle liver saccules are dark, those in front and behind light in colour.

Anteriorly the right and left halves of the glomerulus are connected with each other along the ventral side of the stomochord. Glomerulus covering the pericardium and the stomochord about equally. There is a very small dorsal glomerulus present. Ventral proboscis septum extends from shortly behind the top of the stomochord to the end of the ventral coelomic blind-sacs. Stomochord with large ventro-median blind-sac, which communicates with the central lumen ; no dorso-lateral blind-sacs. Keel of the skeleton well developed, its size is almost constant throughout its whole length ; it stops suddenly just in front of the bifurcation of the body into the crura. Crura of skeleton short, situated nearly in the transverse plane. The left dorsal coelomic cavity of the proboscis opens into a large end-sac, which has a blind forward extension on the right side as well. Proboscis pore large and elongated.

Nerve cord without central lumen, with three dorsal nerve roots. Ventral collar mesentery only present near the hind end of the collar.

Each anterior branchial sac opens to the exterior by a separate pore ; first branchial pore at the outer side of the genital wings, all the others at the medial side. Branchial sacs without ventral blind-sacs. 10 synapticula, about 30 gills. Post-branchial canal without anteriorly directed blind-sac ; no valves projecting into the oesophagus. The first genital pore between the first and second branchial pores. Gonads large and much branched ; no secondary genital pores.

*Locality.*—Port Elizabeth, South Africa.

Type in South African Museum, Cape Town.

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# SOUTH AFRICAN MUSEUM

*VOLUME XXXII.*

PART III, *containing:—*



*ISSUED JULY 1937. PRICE 17s.*

PRINTED FOR THE

TRUSTEES OF THE SOUTH AFRICAN MUSEUM, CAPE TOWN

BY NEILL AND CO., LTD.,

212 CAUSEWAYSIDE, EDINBURGH.

8. *South African Geophilomorpha* (*Myriopoda*).—By Dr. Karl W. Verhoeff, Pasing, Munich.

(With Plates IX and X.)

Subsequent to Attems's monograph on the Myriopoda of South Africa which appeared in 1929 in the Annals of the South African Museum, the following species of Geophilomorpha have been made known from South Africa:—

*Aspidopleres intercalatus* Porat.
*Mesoschendyla monopora* Attems.
,, *caledonica* Attems.
*Schendylurus australis* Silvestri.
,, *polypus* Attems.
*Ballophilus braunsi* Silvestri.
*Purcellinus robustus* Attems.
*Geoperingueyia conjungens* Attems.
*Achilophilus monoporus* Attems.
*Eurytion dolichocephalus* Attems.
,, *trichopus* Attems.
,, *aporopus* Attems.
,, *badiceps* Attems.
,, *dentatus* Attems.
,, *sabulosus* Attems.
*Polygonarea kraepelini* Silvestri.
,, *oligopus* Attems.
,, *monospathis* Attems.
*Brachygonarea apora* Attems.
(*Philacroterium cribellatum* Attems)
= *Aphilodon cribellatum* (Att.).
(*Philacroterium pauperum* Attems)
= ♀ of *Aphilodon weberi*.
*Aphilodon weberi* Silvestri.

To the Director, and to Dr. R. F. Lawrence, formerly Assistant at the South African Museum, Cape Town, I here take the opportunity of tendering my best thanks for sending me the series of Geophilomorpha from the Cape Province with which this paper deals.

It contains 14 species of which 10 are new to Science, a fact which proves that the extent of the Geophilomorphid fauna of South Africa has by no means as yet been determined. The following is the list of the forms under consideration:—

*Polygonarea porosa* n. sp.
,, *litoralis* n. sp.
*Eurytion dentatus* Attems.
,, *lawrencei* n. sp.
,, *trichopus* Attems.
,, *gracillimus* n. sp.
,, *kalaharinus elongatus* n. subsp.
,, *brevis* n. sp.
*Achilophilus pachypus* n. sp.
*Aphilodon weberi* Silvestri.
,, *caffrarium* n. sp.
,, *porosum* n. sp.
*Mesoschendyla cribrifera* n. sp.
*Aspidopleres intercalatus* Porat.

Of the 22 species given by Attems and the 14 which now lie before me, 4 species are contained in both lists. It must also be taken into account that my investigations have demonstrated that the genus *Philacroterium* erected by Attems is untenable, as it is identical with *Aphilodon.* Attems separated *Philacroterium* with a two-jointed tarsus of the terminal legs from *Aphilodon*, as the latter has only a single-jointed tarsus in the terminal leg. I have been able to show that this dimorphism of the terminal legs is a sexual character, as the male has thickened terminal legs with a single tarsal segment, while the female has slender terminal legs with a normal two-jointed tarsus. *Philacroterium pauperum* Att. must be dropped, as it represents the female of *Aphilodon weberi* Silv., and *P. cribellatum* thus becomes *Aphilodon cribellatum* Att. From this it follows that Attems's list comprises 21 and not 22 species, and with the new forms contributed by myself no less than 31 forms are now known to occur in South Africa.

As my 10 new species are not known from any other countries and of Attems's list only 3 are known from other regions, and those 3 from South West Africa (*Aspidopleres intercalatus*, *Mesoschendyla monopora*, and *Polygonarea kraepelini*), it follows that all the 31 Geophilomorphid species are endemic in South Africa and 28 of them are known only from the Cape Province and Natal.

The genus *Aphilodon* requires special attention from the viewpoint of comparative morphology. In his work on the Geophilomorpha in "Das Tierreich," Lief. 52, 1929, Attems (on p. 157) makes the *Aphilodontinae* a subfamily of the *Geophilidae*, and says of it: "Trochanteropraefemur und Femur der Kieferfüsse verwachsen, sodass das Telopodit dreigliedrig erscheint." By this character the *Aphilodontinae* can be readily distinguished from all other *Geophilidae.* In contrast to the above statement Attems writes (on p. 12) that the telopodite of the maxillipedes in the *Aphilodontinae* is "sogar nur dreigliedrig, indem Femur und Tibia verschmelzen." He therefore says that one of the segments of the maxillipede has disappeared, in the first place by the fusion of the femur and tibia, and then again by the fusion of trochanteropraefemur and femur, so that there is no basis for either one or other of these hypotheses. Actually there is nothing to be seen in his figures of the maxillipedes of the *Aphilodontinae* to support either view (*e.g.* his fig. 39 on p. 191, in "The Myriopoda of South Africa ").

In the circumstances I was determined, with Aphilodontine material before me, not to let slip the opportunity of settling this question. Previously there was, besides the views put forward by Attems, a third possibility, namely, that of the two short intersegments of the maxillipedes, one had become altogether atrophied or suppressed, as can be observed in the Chilopoda in general where successive reductions of both the intersegments can be observed, and in many Geophilids, *e.g.* the subgenus *Onychopogaster* of the genus *Geophilus*, where these intersegments have actually been strongly reduced. My investigations on the maxillipedes of *Aphilodon* soon proved that in this genus there is actually a fusion of femur and trochanteropraefemur, as can be seen from figs. 4 and 8. In *Aphilodon weberi* and *caffrarium* there is a more or less long suture in front of the more basal of the two tubercles which occur on the inner margin of the maxillipede telopodite which I at once recognised as the vestigial traces of an articulation between trochanteropraefemur and femur; this suture extends further above than it does below towards the outer side. If there was still any doubt remaining this would be dispelled by *Aphilodon porosum* (fig. 4), in which species the boundary between trochanteropraefemur and femur has remained almost complete; above and below and just at the outer end (y) a small portion is missing. On the inner side behind the tubercle there is even a small intersegmental membrane representing the remains of a true articulation.

From this it will be seen that the femur is not always absent in *Aphilodon*, but that it is sometimes reduced to a more or less imperfectly defined terminal portion of the trochanteropraefemur. Thus all the segments of a normal walking leg are recognisable in the maxillipedes of *Aphilodon*, the trochanter being indicated by the well-known "Trochanterkerbe" (tk), which also exhibits an abbreviated marginal suture, while the coalescence of tarsus and ungulum to form a tarsungulum (tau) is denoted by at any rate a difference of chitinisation and pigmentation.

This leads me finally to the conclusion that too much systematic weight has been attributed to the alleged 3-jointed telopodite of the maxillipede, at least when it has been made the basis of family distinctions, as Silvestri has done. The *Aphilodontinae* without doubt constitute a natural group, but seeing that they have lost the labrum and both pairs of maxillae are reduced, their natural relationships are not with the true *Geophilidae* but as a subfamily of the *Scolioplanidae* (*Dignathodontinae*).

I must here refer to an important characteristic of the *Aphilodontinae*, as it has hitherto been quite unknown, viz. the structure of the poison glands of the maxillipede. As is well known, the body of the poison glands in most *Geophilidae* lie on the inner side of the maxillipedes, so that the vesicles of the poison gland are found on the inside of one or two of the segments of the telopodite; in *Achilophilus*, for instance (fig. 10), where four segments of the telopodite are found close together, they are situated at the outer extremity of femur and tibia. In *Achilophilus*, however, there is nothing to be seen of a poison vesicle in the neighbourhood of the maxillipedes. In an unmacerated specimen of *A. caffrarium* I could follow the fine poison canal throughout the whole maxillipede telopodite, and even further backwards in the region of the coxosternum of the maxillipede between muscles. Further along the body, however, the faint outline of the canal could no longer be seen. On the other hand, I have observed the presence of a poison vesicle in the neighbourhood of the 18th leg segment in *Aphilodon porosum*, which was about half the length of the 18th sternite, truncate anteriorly and posteriorly, and about as wide as the trochanter of a leg. I noticed this vesicle only on the one side, on the other it became lost. That it really is a vesicle of the poison glands is proved by its well-known structure, namely, the penetration of the walls of the vesicle by large numbers of fine close-set pores, by means of which the canals of the individual cells of the gland open.

That the poison glands of the maxillipedes are situated in the body instead of the maxillipedes has hitherto only been observed once in the *Geophilidae*, namely, in the genus *Chaetechelyne*. On this question I wrote in 1902 in my work on Chilopoda (Bronn's Klass. u. Ordn. des Tierreichs, Lief. 63–65, p. 35) the following:—

"A noteworthy exception (from the usual position of the poison glands) is found in the genus *Chaetechelyne* where the glands have left the maxillipede segment and retreated to the 12th to 18th segment of the body (Duboscq)."

This exception in the case of *Chaetechelyne* is of all the more interest as this genus belongs to the *Scolioplanidae*, and thus both the exceptions with regard to the maxillipedes belong to the same family, a position which is therefore in accord with my previously stated views on the systematic status of the *Aphilodontinae*.

Finally, I should like to observe that the "absence of ventral pores," which as a common character has hitherto united members of the *Aphilodontinae*, and therefore also the absence of glands in the region of the sternites, has been invalidated by my discovery of a species, *Aphilodon porosum*, in which a number of sternites in the posterior part of the body have two large porose areas situated one behind the other (fig. 6).

### Gen. Aphilodon Silv.

(= *Aphilodon* ♂ + *Philacroterium* ♀ Attems.)

I have been able to show that *Aphilodon* and *Philacroterium* are generically identical, and, as mentioned above, merely represent different sexes of the same form in the case of *weberi* Silv. and also *caffrarium*, while I have only seen the ♀ of *porosum*. Attems has recognised 5 species of *Aphilodon* in the old sense, of which, however, only one, *weberi* Silv., inhabits South Africa, while the four others from South America certainly need re-examination.

The South African species can be distinguished as follows:—

(*a*) The 8 sternites anterior to the terminal segment with a large porose area which is usually divided, one area lying behind the other (fig. 6). Claw of the maxillipede with an inner tooth basally (fig. 4). Coxopleurae of terminal legs with numerous scattered pores (fig. 5). 75 pairs of legs *porosum* n. sp.

(*b*) All sternites entirely without pores. . . . . . . . *c, d.*

(*c*) Claw of maxillipede with a small basal tooth. Coxopleurae of terminal legs with numerous scattered pores. 55–71 pairs of legs? *cribellatum* Attems.

(I do not consider this species valid, and regard it as merely representing larger individuals of *weberi* Silv. in which a small tooth is present at the base of maxillipede claw. It is also noteworthy that Attems must have seen a ♂ of his *cribellatum*, as he says, "Terminal legs of ♂ moderately incrassate and densely covered with hairs ventrally." Here either the ♂ possesses an abnormal 2-jointed tarsus of the terminal legs or Attems has been mistaken.)

(*d*) Claw of maxillipede without a tooth (fig. 8) . . . . . . . *e, f*.

(*e*) Coxopleurae of terminal legs with 5–8 large pores (fig. 9) of which almost all lie opposite the semi-circular sternite and only one is occasionally situated more posteriorly. The femoral tubercle of the maxillipede is well developed, that of the praefemur, on the other hand, rudimentary (fig. 8). Ultimate segment of terminal legs of ♀ only $\frac{1}{2}$–$\frac{1}{3}$ as long as the penultimate segment. 49–55 pairs of legs . . . *caffrarium* n. sp.

(*f*) Coxopleurae of the terminal segment with numerous pores which are, however, on an average smaller and far more scattered (fig. 7), its more trapeziform sternite broadly truncate posteriorly. The praefemur of the maxillipede with an inner tubercle, but little smaller than that of the femur. Terminal legs of ♀ with the two last segments of equal length. 45–55 pairs of legs . . . . . . . . . . . *weberi* Silv.

## *Aphilodon porosum* n. sp.

(Figs. 4–6.)

♀ from 64 mm. with 75 pairs of legs.

Most of the characters are the same in all species of the genus *Aphilodon* so that I shall give only those of diagnostic value. In the maxillipedes the upper coxal plates are fused posteriorly in the middle, this fusion being reinforced in the middle line by a strong rib enclosing a brown stripe (which is absent in other species with a rib).

Clypeus with close reticulation but *without* bristles (both the other species have them). Instead of a labrum there are two undifferentiated transverse plates divided in the middle by weak reticulation. The fulcra are transverse and anteriorly are elongated outwards and forwards as lobes. The almost triangular basal joints of the antennae overlap each other only slightly in the middle (more markedly in the other species). The maxillipedes, which have already been dealt with above, have four distinctly projecting tubercular teeth on the inner side (fig. 4); at the same time they are longer than in the other species, which is evident from the fact that the trochanteropraefemur is as long on its outer side as its basal width (in the other species, fig. 8, they are considerably shorter). The maxillipedes are accordingly as long as the head.

On the anterior leg-bearing sternites there is a median strip of reticulation in the posterior and middle thirds, whereas the whole of the anterior third is taken up with reticulation in which the pores appear like islands. Of the porose areas which appear on the 8 sternites anterior to the terminal legs, those on the 5 most posterior sternites are divided into two large rhomboidal areas, the one situated close behind the other (fig. 6); those on the sixth sternite from the end unite to form a single very large area, on the seventh from the end they are again separate, while on the eighth from the end only the posterior area is present, being the same size as that of the following sternite, while the anterior area is reduced to a few pores. From the ninth last sternite anteriorly, there is no trace of pores. Otherwise there are a few pores on the procoxa of almost all the legs, these being most conspicuous in the posterior part of the body in front of the terminal segment.

Terminal legs of the ♀ slender, with scattered, fairly short bristles, the last segment $\frac{3}{5}$–$\frac{3}{4}$ as long as the penultimate, the claws well developed. Sternite of last segment (fig. 5) broadly truncate behind, the pores of the coxopleurae numerous but all confined to the under side, their openings nearly always free, a few being hidden by the sternite.

*Locality.*—This species, the largest of the genus and with the most numerous segments, is known to me only by a ♀ from Oudebosch, River Zonder End, Cape Province.

### *Aphilidon caffrarium* n. sp.

(Figs. 8 and 9.)

♀, ♂ 28–30 mm. with 49–55 pairs of legs.

To distinguish this species from the closely related *weberi* I here supplement the key given above with the following description:—

On the anterior sternites the reticulation forms a longitudinal strip $\frac{1}{4}$–$\frac{1}{3}$ of their width, which widens only near the anterior margin; the bristles are short and scattered. (In *weberi* the anterior sternites have irregularly disposed reticulation, while the bristles are longer and less numerous.) Most of the pores are situated on the coxopleurae of the terminal segment (fig. 9), being larger than the posterior stigmata, while they are so close together that the distance between them is often less than the width of the pores themselves (in *weberi*, on the other hand, fig. 7, the largest pores are hardly larger than the posterior stigmata, while they are so dispersed that the distance between them is always much greater than the width of the pores themselves). The claws of the terminal legs are rudimentary and blunt in the ♂ (in *weberi* they are also very small but clearly defined and sharply pointed); the terminal segment in the ♂ is about $1\frac{3}{5}$ as long as wide in both species.

*Locality.*—This species is found at Hogsback, Amatola Mts., and Grahamstown, both in the Eastern Cape Province.

*Aphilodon weberi* Silv. is the commonest species of the genus, and seems to be found throughout the greater part of the Cape Province, viz. River Zonder End, Table Mountain (Cape Peninsula), Ladismith, and Leliefontein (Namaqualand).

### Gen. ACHILOPHILUS Attems.

The genus *Achilophilus* is known only from the Cape Province by a single species *monoporus* Att.

### *Achilophilus pachypus* n. sp.

(Figs. 10 and 11.)

The form before me corresponds so closely with Attems's description that I can confine myself to merely a statement of the diagnostic characters.

| *monoporus* Att. | *pachypus* n. sp. |
|---|---|
| 38 mm. in length, 49–55 pairs of legs. Clypeus anteriorly with area. Head not $\frac{1}{4}$ longer than wide. "Maxillipedes do not reach the frontal margin." Antennae touching at their bases. Telopodite of first maxillae with small external lobes. Clypeus anteriorly with some bristles. Anterior sternites with ill-defined porose areas which tend more and more to move to the sides. Fulcra T-shaped, widening anteriorly. Trochanter of terminal legs as long as wide. | 22 mm. in length, 53 pairs of legs. Clypeus entirely without area. Head more than $1\frac{1}{2}$ times as long as wide. Claws of maxillipedes reaching to beyond the head (fig. 10). Antennae not touching. Telopodite of the first maxilla entirely without outer lobes. Clypeus smooth, without bristles anteriorly. Anterior sternites in and posterior to the middle with a few scattered pores. Fulcra bent to form a blunt angle and transversely situated. Trochanter of the terminal legs much wider than long. |

As a supplement to the description of *pachypus* I note the following: The claws of the maxillipedes (fig. 10) exceed the head anteriorly, and their bases are situated only a little posterior to the anterior margin of the head. The sutures of the pleurocoxae run somewhat obliquely. Claws of the maxillipedes with a small basal tooth, the structures otherwise without teeth. The small abbreviated poison vesicles lie on the outer extremity of the two intersegments, and the femur is inserted decidedly obliquely. Labrum atrophied. Coxosternum of the second maxilla with a median suture. The coxopleurae of the terminal segment have a gland on each side (fig. 11), the pore of which lies above the lateral margin of the broad trapezoid sternite, just as in *monoporus*. The coxal parts project below, posteriorly, and on the inner side as a rounded pad, and above this I made out a gland; this also exhibits an inner vesicle, which does not, however, open to the exterior. Whether this gland is as yet undeveloped (like that of *monoporus*) must be decided by further investigation. Some glands without a recognisable opening (fig. 11) are also present in the segments of the telopodite, a condition which I have also observed in some other *Geophilomorpha*, e.g. *Schendylidae*. Anal glands absent. Antennae 3 times as long as the head, with sparse, short hairs, the ultimate segment $2\frac{1}{2}$ times as long as the penultimate one.

*Locality.*—I have seen only two specimens from Prince Albert, Cape Province.

### Gen. Eurytion Attems.

The genus *Eurytion*, of which Attems in his monograph on the Geophilomorpha recognised 13 species, has been hitherto represented in South Africa by 7 species, of which 6 are found in the Cape Province, *kalaharinus* being confined to South West Africa. *Eurytion* is by far the richest in species of the Geophilomorphid genera, a fact confirmed by the series before me which contains 6 forms of *Eurytion*.

The characters used by Attems in his key are for the most part beyond criticism. I have, however, to reconsider his so-called "Aussentaster" of the first maxillae. This expression must certainly be rejected as these structures have absolutely nothing to do with organs of touch (y, fig. 1), but are, on the other hand, very pale and delicate lobes,* and even then as macerated specimens they are often so extremely transparent that one is in great doubt as to their actual nature. Further, on account of their delicacy, the lateral lobes can be easily folded over and in this way overlooked. On these grounds I have in the following key, which includes all South African forms, completely ignored the lateral lobes ("Taster") of the first maxillae.

* The term "Taster" could at most only be applied to the telopodite (t, fig. 1).

Another misleading character is that of the fringes of the labrum, as these are also of a very pale delicate nature, so that in macerated specimens they may be quite indistinguishable. All, or at any rate the majority, of the pores of the coxopleurae of the terminal segment are scattered and have free openings (figs. 20 and 23).

### *Key to the South African Species of* Eurytion.

(*a*) Coxopleurae of the terminal segment entirely without pores, 57–61 pairs of legs . . . . . . . . . 1. *aporopus* Attems.

(*b*) Coxopleurae of the terminal legs with scattered pores . . . . *c, d.*

(*c*) Trochanteropraefemur of maxillipedes with 2 stout teeth on the inner side *e, f.*

(*d*) Trochanteropraefemur of maxillipedes with 1 or without teeth on the inner side *i, k.*

(*e*) The pores of the coxopleurae arranged in the form of a horseshoe of which the ventral portion abuts on the lateral margin of the sternite, the dorsal portion being dispersed above, while some pores lying between these two groups are anteriorly situated.* Claws of terminal legs normal. Porose areas of the sternites longish oval. 71–81 pairs of legs 2. *dentatus* Attems.

(*f*) The pores of the coxopleurae dispersed ventrally . . . . . *g, h.*

(*g*) Claws of terminal legs unusually small (fig. 19), hardly half as long as the width of the second tarsus. Median piece of the labrum transversely elongate, not toothed (fig. 18). Clypeus with close hexagonal reticulation but no bristles, a rather ill-defined area. 59 pairs of legs 3. *gracillimus* n. sp.

(*h*) Claws of terminal legs normal, thus as long or almost as long as the width of second tarsus (fig. 21).

* The 7–8 pores of the coxopleurae situated in two rows next to the sternite. Porose area of the anterior sternites round. Area of the clypeus longish oval with 3–5 bristles, behind these 2–6 bristles. Median portion of the clypeus almost cordiform, not wider than long. 69–77 pairs of legs . . 4. *sabulosus* Attems.

** The 9–10 pores of the coxopleurae (fig. 20) not all situated close to the sternite, half of them lying more laterally. Porose areas on sternites 2–14 transversely oval. Clypeal area rounded and with a bristle. Median piece of the labrum transversely elongate, more than twice as broad as long. 47 pairs of legs . 5. *brevis* n. sp.

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* Attems's account (*loc. cit.*, p. 261), in which the coxopleurae of *dentatus* "are provided with 2 groups of larger pores, the one consisting of a strip of 7–8 opening beneath the margin of the sternite, the other of 5–6 dorsally beneath the margin of the tergite," is not sufficiently exact and refers to immature individuals.

(*i*) The pores of the anterior sternites form a transverse dispersed strip posterior to the middle of the sternite, and in addition there is a small group of pores on each side anterior to the middle. Trochanteropraefemur of the maxillipedes entirely toothless. Coxopleurae of the terminal segments with 15–16 dispersed ventral and lateral pores. 39–49 pairs of legs *lawrencei* n. sp.

(*k*) The pores of the anterior sternites forming a compact rounded to transversely oval area. Clypeus with area . . . . . . . *l*, *m*.

(*l*) Trochanteropraefemur of the maxillipedes with a tooth or tubercle on the inner side. Anal glands absent . . . . . . . *n*, *o*.

(*m*) Trochanteropraefemur entirely without a tooth or tubercle . . *p*, *q*.

(*n*) Porose area of the sternite, beginning from the second, transversely oval. Pores of the coxopleurae dispersed over the greater part of the ventral surface almost as far as the posterior margin of the coxae. 71–75 pairs of legs . . . . . . . 7. *dolichocephalus* Att.

(*o*) Porose area of sternites round to slightly transverse ovate.

* Pores confined to the anterior half of the coxopleurae, not passing beyond a line touching the hind margin of the sternite. Tibia and both the tarsal segments of the terminal legs much slenderer than the preceding segments. Sternite of the terminal segment with its sides convex. Areas of sternites round. 61 pairs of legs 8. *kalaharinus* Att. ♂

** Pores of the coxopleurae opening partly above, partly below; some of them, however, situated posteriorly to a line touching the hind margin of the sternite (fig. 23). Only the two tarsal segments of the terminal legs much slenderer than the remaining segments. Sternite of the terminal segment with straight sides, being thus trapeziform. Areas of sternites slightly transverse ovate. 83–87 pairs of legs . . . 9. *kalaharinus elongatus* n. subsp.

(*p*) The porose areas situated posterior to the middle beginning from the second sternite, entirely round. Coxosternum of first maxillae without lateral lobes. Anal glands absent. Pores of the coxopleurae numerous, ventrally and dorsally. 81–89 pairs of legs . . 10. *badiceps* Attems.

(*q*) The porose areas situated posterior to the middle beginning from the second sternite and bounded anteriorly by an arcuate furrow while posteriorly they form approximately a right angle, thus resembling a quadrants. Coxosternum of the first maxilla with lateral lobes. Anal glands present. Pores of the coxopleurae numerous, ventral and pleural. 65–69 pair. of legs . . . . . . . 11. *trichopus* Attems.

## *Eurytion lawrencei* n. sp.

(Figs. 16 and 17.)

♀ 24–32 mm., with 39–49 pairs of legs. Antennae with segments 2–5 with 3 whorls of hairs. Labrum with a bluntly triangular median piece (fig. 17) about as long as wide, and weakly striated posteriorly; I have not observed a fringe on the labrum. Head-plate with sparse bristles; clypeus anteriorly without an area and without bristles, with dense mosaic cell structure; posteriorly, on each side in front of the labrum a smooth window-like area (fe, fig. 17). Coxosternum of the first maxilla without, basal segment of the telopodite with, a short outer lobe; maxillipedes with a small tooth only at its base. Vesicle of poison gland twice as long as wide, situated at the base of the claw. First sternite with 6 pores. The 2–11 anterior sternites on each side with a transverse strip of well-separated pores posterior to the middle, well separated from the sides of the sternites (fig. 16), while anteriorly another small group of pores can be seen on each side; otherwise all these sternal pores are not very noticeable, but in their arrangement they differ from those of all other South African species. On the sternites following, the pores are entirely absent. Two pairs of larger bristles are present on the most anterior and most posterior sternites, while the sternites between them are provided with a few very short bristles.

Sternite of terminal segment trapeziform but arcuate posteriorly. The 14–15 pores of the coxopleurae open freely and are scattered ventrally and at the sides, most of them being as large as the posterior stigmata, but 4 on each side distinctly smaller. Terminal legs of ♀ with a few bristles, the claws stout, the proximal tarsal segment little shorter than the terminal one. Genital sternite with 2 transverse rows of bristles. Anal pores large.

*Locality.*—This species, named in honour of Dr. R. F. Lawrence, is represented only by a ♀ from River Zonder End, Cape Province.

*Eurytion brevis* n. sp.

(Figs. 20 and 21.)

Immature example 19–26 mm. in length, with 39–47 pairs of legs. In general most closely resembling *sabulosus* Att., from which it differs in its smaller size, in having fewer pairs of legs, in the more scattered coxopleural pores (fig. 20), in the median piece of the labrum being $\frac{1}{2}$ as wide as the lateral pieces (in *sabulosus* it is hardly $\frac{1}{4}$ as wide as these), and in the homogeneity of the clypeal reticulation, which contains neither an area nor bristles; furthermore, the porose areas beginning from the second segment are transversely oval. Trochanteropraefemur of the maxillipedes with 2 sharp stout teeth on the inner side, a similar one at the base of the claw, while both intersegments are smooth; anterior margin of coxosternum with 2 blunt tubercles.

Segments 1–5 of the antennae with 1–2 whorls of hairs (it is doubtful if the first maxillae have lateral lobes). First sternite without pores, the transversely oval porose areas which are distinct up to the thirteenth sternite consist in the second sternite of 3–4 pores in a longitudinal row, 6–7 in a transverse row; fourth sternite similarly with 4 and 10 pores. These areas are situated behind the middle and occupy the middle third of the segment in a transverse direction. The 9–10 coxopleural glands have free openings by means of scattered pores (fig. 20).

*Locality.*—The specimens before me I take to be half grown, but the species is nevertheless quite distinct from the other known forms. Table Mountain, Cape Town.

### *Eurytion kalaharinus elongatus* n. subsp.

(Figs. 22 and 23.)

♀ 47–56 mm. With 83–87 pairs of legs.

Median piece of the labrum weak (fig. 22), hardly as wide as long, and without noticeable serrations on the hind margin. (In *dolichocephalus* Att., though it is not larger than *elongatus*, the median piece of the labrum is distinctly dentate posteriorly and the lateral pieces have long fringes.) The fringes of the lateral pieces fairly long, but diminishing fairly suddenly mesially. Maxillipedes quite similar to *dolichocephalus*, the claws therefore with a sharp triangular tooth and the trochanteropraefemur with a small blunt inner tooth. Poison vesicles hardly longer than wide, situated on the outer side of the tibia. Clypeus with a large area bearing 2 pores, a few bristles at the sides only. First sternite without pores. From the second sternite onwards there is short transversely oval to round porose area which on sternite 5 is not quite as wide as its distance from the lateral margins. These sternal pores are divided into two fairly large groups in the posterior half of the body, which again converge on the two sternites before the terminal segment. The sternites are practically smooth, large bristles being absent on nearly all of them. The numerous scattered and freely opening pores of the coxopleurae lie partly above and partly below (fig. 23) their sternite trapezoid.

*E. dolichocephalus*, *kalaharinus*, and *elongatus* are all closely related, and further material will show whether or not their position as given above is valid. The 4 ♀♀ before me are from Kakamas (Orange River) and Garies (Namaqualand).

### *Eurytion gracillimus* n. sp.

(Figs. 18 and 19.)

Subadult form 28 mm., with 59 pairs of legs.

Trochanteropraefemur of maxillipedes with 2 blunt teeth, claw with a sharp basal tooth, intersegments without teeth, anterior margin of coxosternum with 2 blunt projections bearing a small bristle. Antennal segments 1–5 each with 1–2 whorls of hairs. Median piece of the labrum transverse, not toothed; the whole labrum with extremely weak fringes (fig. 18). First maxilla entirely without lateral lobes. Clypeus with comparatively large hexagonal reticulation, without area and without bristles. Anterior sternites in and posterior to the middle with a very small group of a few ill-defined pores. Body very slender. Only one pore opening freely in the middle of the underside of the coxopleurae of the terminal segment; posterior to this are 1–2 incompletely developed glands without a pore opening. The species is distinguished by the unusually small size of the claws of the terminal legs (fig. 19), both tarsi of which are more slender than the tibia.

Although I have only seen a subadult example of this form, I must regard it as new; even if we disregard the number of the coxal glands, which as we know increase during epimorphosis, it differs from its nearest ally, *E. brevis*, in several respects.

*Locality.*—Prince Albert, Cape Province.

### *Eurytion trichopus* Attems.

(Figs. 24 and 25.)

♂ 52 mm. with 65 pairs of legs. ♀ 50 mm. with 71 pairs of legs.

The author writes of this species on p. 262 of his monograph, "first maxillae with 2 pairs of '*Aussentastern*' both finely spined, those of the synocoxite short triangular, those of the first telopodite segment longer and slenderer." I have already mentioned the incorrect use of the term "Taster," but the expression "spined" is also misleading, as by spines we mean strong setae or bristles, while actually no bristles are present on these lateral lobes and no nerve fibres enter them, which shows how little morphological meaning this expression has. In actual fact there are on the lateral lobes of all Geophilomorpha very minute prickles which apparently represent minute chitinous hairs. *E. trichopus* has only short and extremely pale lateral lobes on the first maxilla.

On the coxopleurae there are, according to Attems, "numerous large pores"; his fig. 227 shows these as being of different size, but he does not say whether they also occur dorsally. I therefore state that the pores of the coxopleurae are ventral, pleural, and dorsal in the ♂ and ♀.

The posterior portion of the last sternite and the postero-ventral region of the coxae are so thickly covered with short bristles that the comparatively large sockets of these bristles resemble a porose area. This area of bristles decreases posteriorly throughout the whole of the ventral region in the ♀, in the ♂ it widens on the inner side near the margin of the sternite; in the ♂ the coxopleurae exceed the hind margin of the sternite by $\frac{1}{2}$ their length, in the ♀ by only $\frac{1}{4}$.

Terminal segment of last legs about $\frac{2}{3}$ as long as the penultimate in ♂ and ♀; the sternal porose areas are larger than those shown in Attems's fig. 226, *e.g.* almost twice as wide as their distance from the lateral margins in sternite 6. The first sternite with more than 20 pores in the ♂ and 8 in the ♀. In sternite 22 the area is broader and shorter, and on 23 it begins to divide into two lateral groups.

*Locality.*—I have identified this species from River Zonder End, and Table Mountain, Cape Town.

*Eurytion dentatus* seems to be the commonest species of the genus. I have examples from Garies, Leliefontein (Namaqualand); Hout Bay, Smitswinkel Bay (Cape Peninsula); Swellendam; Grahamstown. 71–79 pairs of legs.

### Gen. Polygonarea Attems.

Three species have thus far been known of this genus, which is endemic in South Africa. *Eurytion* and *Polygonarea* are extremely similar. I should thus like to indicate that *Polygonarea*, besides the lateral longitudinal grooves of the coxosternum of the second maxilla (which are present in all *Chilenophilenae*), differs further from *Eurytion* in the glands of the coxopleurae of the terminal segment; the pores of these glands are not only larger and on an average fewer in number, but almost all of their openings are hidden. In addition there is a process on the inner side of the second maxillar coxa.

The following is a key to the known species of *Polygonarea*:—

(*a*) The 2–6 antennal joints densely covered with strong bristles which form 4–5 irregular whorls (fig. 15). Middle piece of the labrum distinctly toothed. Anal pores large. Trochanteropraefemur of the maxillipedes with a strong blunt tubercle on the inner sides. Clypeus without bristles. Head-plate anteriorly and anterior to the middle with a reticulated transverse band, between these bands on each side about 15 strong bristles. 51–53 pairs of legs . . . . . . . . *litoralis* n. sp.

(*b*) The 2–6 antennal joints with only 1–2 bristle whorls (fig. 12), or if in joints 2–4 other bristles are present between the two whorls, they are either isolated or very small . . . . . . . . . . *c*, *d*.

(*c*) The 3–6 antennal joints with only one basal bristle whorl, sternites 2–18 and the 10 last sternites with a median, rounded, porose area, in addition a small group of pores on each side anteriorly. 51–57 pairs of legs *monospathis* Attems.

(*d*) The 3–6 antennal joints with 2 bristle whorls. Most of the sternites with a transverse band of pores posterior to the middle which is more or less interrupted in the middle of the body and divided into two groups, in addition a small group of pores on each side anteriorly . . . *e*, *f*.

(*e*) Middle piece of the labrum smooth, not toothed. Anal pores present. (Clypeus?) Trochanteropraefemur of the maxillipedes with a small, blunt tubercle. First sternite with 2 small pore groups. 61–65 pairs of legs *kraepelini* Silv.

(*f*) Middle piece of the labrum toothed (fig. 13) . . . . . . *g*, *h*.

(*g*) Anal pores present. Trochanteropraefemur of the maxillipedes on the inner side entirely without a tubercle. First sternite with a transverse band of scattered pores. Clypeus with a dense mosaic reticulation, unspined except in the rounded area, head-plate anterior and posterior to the middle with a transverse band of reticulation, between these 2–3 long bristles laterally. Claws of the second maxilla $\frac{3}{5}$–$\frac{2}{3}$ as long as the inner side of the middle joint of the telopodite. 51–59 pairs of legs . *porosa* n. sp.

(*h*) Analdrüsen fehlen, Trochanteropraefemur der Kieferfüsse innen mit stumpfem Häcker . . . . . . . . . . *i*, *k*.

(*i*) Sternite 1 with 2 small pore groups, clypeus with a rounded area without bristles posterior to it. Coxae of the second maxillae with a process on their inner side which reaches the middle of the praefemur (as in *porosa*) not longer than basally broad. Claws as long as the inner side of the middle joint of the telopodite . . 5. *porosa nodulifera* n. subsp.

(*k*) Sternite 1 without porose area. Clypeus with a transversely oval area and posterior to it a transverse row of 4–6 bristles. Coxae of the second maxillae with an inner process which reaches the inner apex of the prefemur (or a very little below it) and is longer than basally broad. Claws of second maxillae only half as long as the inner side of the middle joint of the telopodite. 51–51 pairs of legs . . . *oligopus* Attems.

The three forms *porosa*, *porosa nodulifera*, and *oligopus* are perhaps all races of one species, a question which must be decided by further investigation.

### *Polygonarea litoralis* n. sp.

(Fig. 15.)

♀ 34–48 mm., with 51 or 53 pairs of legs.

This species can be distinguished from all others by the short and dense bristles of the head-plate and antennae (fig. 15).

Clypeus with dense reticulation but entirely without bristles, the area also only with fine punctuations. Middle piece of the labrum weakly toothed. Maxillipedes with a stout tubercle on trochantero-praefemur, a pointed tooth at the base of the claws. The porose areas of the sternites resemble those of most other species in having posteriorly a transverse, in the middle a more or less interrupted zone of pores, and anteriorly behind the anterior angles two rounded groups. Anterior sternites with extremely short weak bristles. Legs partly clothed with long bristles, the terminal legs of the ♀ with its last segment little shorter than the penultimate one, with stout claws which are, however, exceeded by 4 long bristles. Anal glands present.

*Locality.*—Only the ♀ of this species is known from Hout Bay, Cape Peninsula, and from Keurbooms River near Knysna.

### *Polygonarea porosa* n. sp.

(Figs. 12–14.)

♀ and ♂ 29–52 mm., with 51–59 pairs of legs.

Process on the inner side of the coxae of the second maxillae at most reaching the middle of the praefemur. Sternite I on each side with a small transverse porose area. Coxopleurae of the terminal legs with 4–8 large concealed pores on each side. Anal glands present.

Attems portrays in his fig. 267 of *P. monospathis* a projecting lobe densely covered with short fine hairs on the inferior side of the coxae of the terminal legs, which he also gives as a generic character, assuming that it occurs in all species of *Polygonarea.* In the form before me the ♀ and ♂ is provided on the posterior margin of the coxopleurae with a more or less projecting area clothed with short hairs. I have, however, not observed an outwardly projecting lobe. The tooth-like appearance of the outer extremity of the first and second telopodite joints of the second maxilla as shown by Attems in fig. 266 for *P. monospathis* is not present in the forms seen by me.

*Locality.*—Grahamstown and Hermanus. Perhaps these localities represent two races, as I observed differences in the forms of the poison sacs. To decide this point, however, more specimens are required.

### *Polygonarea porosa nodulifera* n. subsp.

23–24 mm. 45 or 47 pairs of legs. Claws of the maxillipedes serrated on the inner side. Coxopleurae of terminal legs with 5 + 5 large concealed pores. Other than the characters already given in the key there is little of importance to describe.

*Locality.*—Hogsback near Alice, Eastern Cape Province.

## Gen. Mesoschendyla Attems.

Of the three known forms of *Mesoschendyla* two are found in South Africa and one in Java, so that it is very probable that other species will be found in the intervening regions. The new species is closely related to *monopora* Att., but can be distinguished from it as follows:—

*monopora* Att.

♀ with 59–69 pairs, ♂ with 57–59 pairs of legs. Anterior margin of the coxosternum of the maxillipedes incised. Coxosternum of first maxillipede without, telopodite with lateral lobes. Claws of the second maxilla serrated. Sternites 2–30 (32) with round to transversely oval porose areas. Ventral surface of body well provided with hairs, dorsal surface almost smooth. Terminal legs well provided with hairs. Terminal joint in the ♂ almost half as long as the penultimate joint. The two joints of the gonopods about equal in length.

*cribrifera* n. sp.

♀ and ♂ with 55 pairs of legs. Anterior margin of coxosternum of maxillipedes with a median incision. Coxosternum and telopodite of first maxillae with lateral lobes (fig. 1). Claws of the second maxillae below with striated lamellae. Sternites 2–25 usually with a triangular, anteriorly truncated, posteriorly rounded, porose area (fig. 3). Tergites with two intercalary tergites provided with a transverse row of fine hairs. Sternites sparsely covered with fine hairs. Hairs of the terminal legs so minute that they appear almost smooth. Terminal joint of ♂ $\frac{3}{5}$ as long as the penultimate, comparatively longer than in *monopora*. The basal of the two joints of the gonopods about twice as long as the terminal one in the ♂ (fig. 2).

### *M. cribrifera* n. sp.

(Figs. 1–3.)

♂ and ♀ 34 mm. Body slender and pale.

The teeth of the labrum cannot be counted with precision as they are indistinct in the middle. Antennae with reticulated structure only on the first joint; the fine hairs commence on the first joint, there being no stouter hairs; the last segment with sensory pits on each side behind the middle. The claws of the second maxillae widening on the inner side into an extremely delicate lamella which appears to have very fine striations (fig. 1). It gives the impression that the minute teeth which form a serrated edge in related species are here fused to form a lamella, as the outer side is smooth and simple. There is a prebasal plate behind the head. The porose areas in sternites 2–25 become progressively less distinct in sternites 20–25 owing to their delicacy. The two isolated pores of the coxopleurae of the terminal legs are situated exactly as figured by Attems in fig. 108 for *M. monopora*, and the sternite has an identical shape. In the joints of the telopodite there are numbers of gland cells without recognisable pores.

*Locality.* — Kamieskroon, Leliefontein, and Garies, all in Namaqualand.

### Gen. Aspidopleres Porat.

### *Aspidopleres intercalatus* Porat.

The ♀♀ before me, 74–84 mm. in length and with 107 pairs of legs, agree very closely with Attems' description of specimens from South West Africa in "Das Tierreich," Lief 52, 1929, p. 115. They were collected at the Aughrabies Falls and Kakamas, both on the Orange River.

## Review of the Geographic Distribution of the South African Geophilomorpha.

Up to the present 13 genera are known from South Africa. These can be divided into two groups, the one consisting of endemic genera, the other of genera occurring outside of South Africa as well.

Seven genera can be regarded as endemic, viz. *Achilophilus*, *Aspidopleres*, *Brachygonarea*, *Diphtherogaster*, *Geoperingueyia*, *Polygonarea*, and *Purcellinus*, each of which, with the exception of *Achilophilus* and *Polygonarea*, are represented by a single species.

Of the six remaining genera which are found outside the South African region, *Orphnaeus* (*O. brevilobatus* Newp.) is the only one which is widely distributed (and that only in the Tropics), and is thus without special interest here, seeing, moreover, that *Orphnaeus* is the only genus of the Geophilomorpha appearing in South Africa (including the Transvaal) which does not possess an endemic species in this region. All the other South African species are thus endemic, a proof of the spatial and climatic isolation of South Africa which has endured through vast periods of time.

With regard to *Mesoschendyla*, besides the three species from South Africa, only one is known from Java, which differs so strongly from the others that it may prove on closer investigation to represent another genus. *Aphilodon*, besides South Africa, occurs only in South America. *Schendylurus* is found in South, West, and North Africa and in South America. *Ballophilus* is represented in South and Central Africa as well as in the Indo-Australian region; *Eurytion*, as the genus with the widest distribution, is most strongly represented in South Africa, but two species are found in Chile and three in Australia.

Although we might be inclined to regard the South African fauna as having its closest relationships with that of Central and North Africa, judging from the present land distribution, this is not supported by the distribution of the Geophilomorpha, of which South and Central Africa have only two genera in common, South and North Africa only one. On the other hand, three genera are found both in South Africa and South America, while the similarity between South Africa and the Indo-Malayan region is expressed by having three genera in common. There is therefore an undeniable relationship between the regions of the Southern Hemisphere (South Africa, South America, and Australia), which may be explained by ocean currents, or sunken land masses, or by both.

The Geophilomorpha as animals without a calcareous skeleton can easily float on water, and as at the same time they are well adapted for attaching themselves to objects and for concealment in narrow holes and fissures, it is not improbable that, in spite of the enormous distances between South America, South Africa, and Australia, in the course of long periods of time they were occasionally transported by trees drifting on ocean currents from one of these regions to another.

The North African deserts represent such a formidable barrier that only a single genus, *Schendylurus*, has been able to overcome it. With Europe, Asia, and North America, South Africa has neither a genus nor a species in common (the widespread tropical *Orphnaeus brevilabiatus* excepted).

It is especially remarkable that the *Himantariidae*, though very well represented in North Africa, are completely absent in South Africa. The *Oryidae* are evidence of the very old connection between Africa and South America, as they are practically found in these two continents alone, where they are represented by several genera; these genera are, however, with the exception of *Orphnaeus*, different. In a few cases members of the *Oryidae* have reached India, but with these exceptions they are absent from Asia, Europe, North America, and the Malayo-Australian region. When all the distributional evidence is taken into consideration, there can be no doubt that the Ethiopian Geophilomorpha are most closely allied to those of South America.

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## EXPLANATION OF PLATES IX, X.

FIGS.

1–3. *Mesoschendyla cribrifera* n. sp.

1. First and second maxillae, seen from above. p, pore of the maxillary glands on the coxosternum of the second maxilla. × 220
2. Gonopods (gp) and penis of ♂ (p), seen from below. × 220.
3. Sternite of seventh segment. × 125.

4–6. *Aphilodon porosum* n. sp.

4. Telopodite of maxillipede, seen from below. x, boundary between the tarsus and ungulum of the tarsungulum (tau); y, termination of the suture between femur (fe) and praefemur (prf), tk, notch of trochanter. × 125.
5. Sternite, coxopleura, and trochanter of terminal segment, seen from below. × 125.
6. The third sternite from the posterior end of body. × 125.

7. *Aphilodon weberi* Silv. ♀. Sternite, coxopleura, and trochanter of the terminal segment, seen from below. × 125.

8, 9. *Aphilodon caffrarium* n. sp.

8. Telopodite of maxillipede, seen from below. × 125.
9. Sternite, coxopleura, and trochanter of terminal segment in the ♂, seen from below. × 125.
10. Telopodite of maxillipede, seen from below. × 220.
11. Sternite, coxopleura, trochanter, and praefemur of the terminal segment, the glands indicated by dotted lines. × 220.

12–14. *Polygonarea porosa* n. sp.

12. The two basal antennal joints. × 125.
13. Labrum seen from below. × 340.
14. Sternite, coxapleura, and trochanter of the terminal segment; pores of the coxal glands indicated by dotted lines. × 125.

15. *Polygonarea litoralis* n. sp. The two basal antennal joints. × 56.

16, 17. *Eurytion lawrencei* n. sp.

16. Fifth sternite with pore groups. × 125.
17. Labrum (la) and the portion of the clypeus anterior to it with window-like smooth areas (fe). × 125.

18, 19. *Eurytion gracillimus* n. sp.

19. Labrum seen from below. × 220.
19. The two tarsal joints of the terminal leg. × 125.

20, 21. *Eurytion brevis* n. sp. ♀.

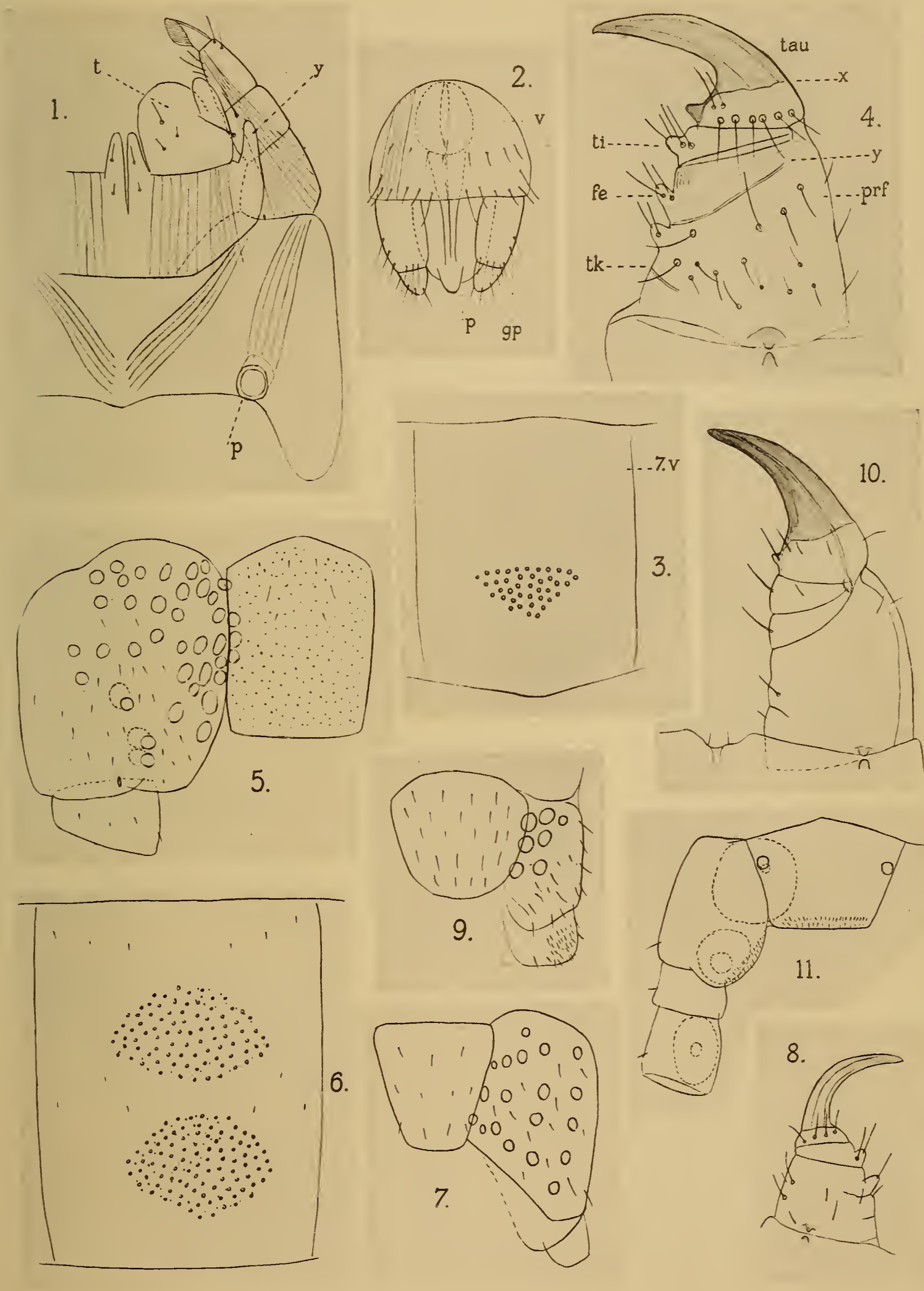
20. Sternite and coxopleura of the terminal segment, seen from below. × 125.
21. The two tarsal joints of the terminal legs. × 125.

22, 23. *Eurytion kalaharinus elongatus* n. subsp.

22. Labrum seen from below. ×220.
23. Sternite and coxopleura of terminal segment, seen from below. ×125; below and at the side, the receptacula of two coxal glands. ×220.

24, 25. *Eurytion trichopus* Att.

24. Labrum seen from below, anterior to it a portion of the cell structure of the clypeus. ×340.
25. Area of the clypeus with a portion of the cell structure. ×340.

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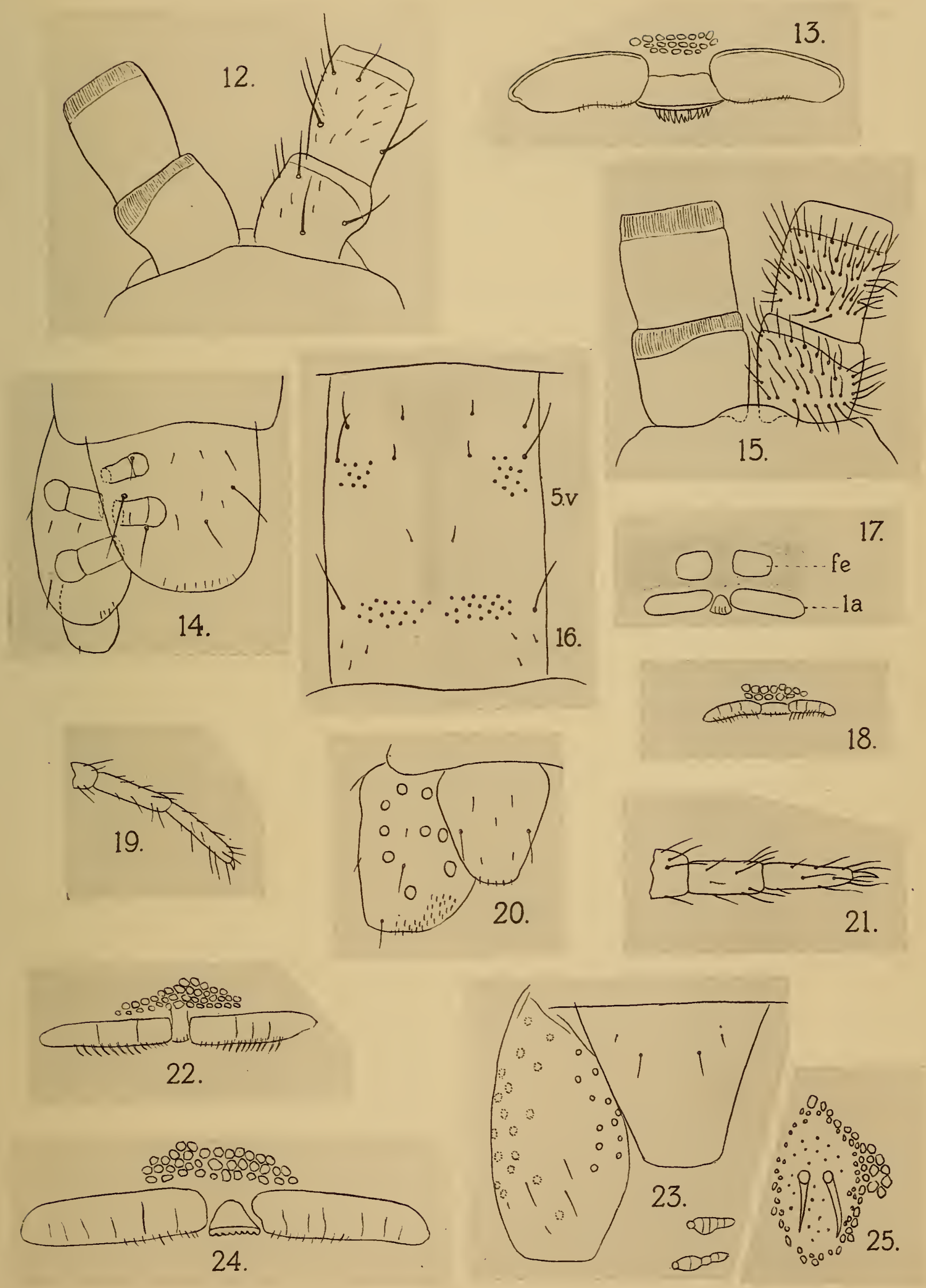
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## 9. *A New Genus of Colobognatha from the Cape Peninsula.*

By Dr. Karl W. Verhoeff, Pasing, Munich.

(With Plate XI.)

In 1929 C. Attems made the first comprehensive study of South African Diplopods in his "Myriopoda of South Africa" (Ann. S. Afr. Mus., vol. xxvi), in which it may be noted that only a single Colobognathid has been recorded from this region, viz. the Polyzoniid *Burenia nasuta*, Attems. This form its author rightly placed in his subfamily *Hirudisominae*, as it possesses both of the two most important characters of this subfamily: firstly, the vasa differentia opening on the coxae of the second pair of legs in the ♂; secondly, the position of the pore remote from the suture. Seeing that both these characters, as is clear from figs. 5 and 6, also hold good for the new genus *Cylichnogaster*, they can henceforward only be used in connection with the *Hirudisominae*. In the key (*loc. cit.*, p. 417) which Attems has given for the three genera of *Hirudisominae*, *Hirudisoma*, *Burenia*, and *Rhinotus*, he makes in the first place the following distinctions:

1*a*. Two or three ocelli on each side, anal segment completely concealed by the prae-anal segment and not visible from above . *Hirudisoma* Carl.
1*b*. One ocellus on each side, anal segment partly visible from above *Burenia* and *Rhinotus*.

Generally speaking, not much weight can be attached to the difference in the number of eyes, as here a mistake may easily occur on account of the deep pigment and the indistinctly differentiated ocelli. With regard to the distinction dealing with the anal region, however, this must receive a more precise interpretation, as the expressions "not visible" and "partly visible," when applied to the new genus and to my fig. 4, give rise to justifiable doubt. Thus in *C. lawrencei*, though the anal segment is indeed beneath the prae-anal one, its posterior apex protrudes a little beyond it, and is on this account more or less visible from above. Seeing that *Cylichnogaster* has 2 + 2 ocelli, I should be compelled on this character to place it with *Hirudisoma*, alternatively in consideration of the prae-anal segment, with *Burenia*. If, on the other hand, we consider not the variable amount of the prae-anal segment visible from above, but the *different positions of the anal valves at the dorsal posterior border of the prae-anal segment,* we have far more precise criteria to apply to the relative positions of the anal and prae-anal segments. Thus in *Burenia* apparently the whole, but actually only the posterior halves, of the anal valves lie posterior to the prae-anal segment, while in *Hirudisoma* they lie well in front of the posterior margin of this segment.* As this latter applies almost equally well to *Cylichnogaster,* there is no doubt that it is, of the two genera, more closely related to *Hirudisoma* than to *Burenia.*

As a survey of the three genera I give the following key:—

A. The anal segment † with its posterior half *posterior* to the hind margin of the prae-anal segment. Head with one rounded ocellus on each side. Trunk of ♂ with 64–88 segments; the trunk cannot be enrolled. Sixth antennal segment distinctly narrowed from base to apex. Sternites of second pair of legs in ♂ with a triangular process between the coxae. Collum with several rows of bristles, its postero-lateral angles bluntly rounded. Anterior gonopods 6-jointed, the post-femur being followed by a fused tibio-tarsus ‡ . . . . . . . . . . *Burenia.*

B. The anal segment lying wholly *in front* of the hind margin of the prae-anal segment. Head on each side with two or three ocelli situated in a large elongate pigmented area (fig. 1). Sternites of the second pair of legs in ♂ truncate . . . . . . . . . . . *c* and *d.*

C. Hind margin of the prae-anal segment a considerable distance behind the posterior margin of the anal segment. The trunk can be only partially flexed, not enrolled, the tergites are less curved. Head but little elongated anteriorly so that it forms an approximately right-angled triangle in front of the antennae. Anterior legs of ♂ with a foliiform structure instead of a claw . . . . . . . . . . *Hirudisoma.*

D. The hind margin of the prae-anal segment lies almost exactly in a line with that of the anal segment, so that the posterior apices of the anal valves (according to the position in which the telson is viewed) show a little or not at all beyond the hind margin of the prae-anal segment (fig. 4). The trunk, which in the ♂ consists of only 20–26 segments, can be *completely enrolled,* and the tergites are thus strongly curved. Head more decidedly elongated anteriorly so that in front of the antennae it appears slender, the apex bluntly pointed (fig. 1). Anterior legs of ♂ with normal claws, these,

* See also the ninth paper of my "Beiträge zur Kenntnis paläarctischer Myriopoden," 1899, Archiv. f. Naturgesch., Berlin, Bd. 1, H. 3, Taf. xix, fig. 1.

† Attems's drawing of the telson of *Burenia* in fig. 424 of his "Myriopoda of South Africa" is not wholly clear, as the hind margin of the prae-anal is not put in. He has indicated the prae-anal segment with an *R* and the anal valves with an av.

‡ Compare, however, what I have said below about the two different interpretations of the gonopod articulation.

however, with an additional slender lappet (fig. 2). Sides of sixth antennal segment almost parallel. Anterior gonopods 7-jointed, the tibia and tarsus remaining completely separate . . . . *Cylichnogaster.*

With regard to the telson I should like to remark as follows: In all *Hirudisominae* the anal segment is sunk into the ventral surface of the prae-anal segment, so that the anterior ventral boundary between the segments is indicated by a semicircular line, while the dorsal hind margin always forms a transverse one. The anal valves lie ventrally far down this semicircle. The deeper the anal segment is sunk in these forms the more degenerate is the anal tergite. In *Hirudisoma* it is therefore rudimentary, in *Cylichnogaster* it forms a small strip, while it is most strongly developed in *Burenia*; the latter is, however, not correctly portrayed in Attems's fig. 424, as the transverse groove in the middle is not shown.

*Cylichnogaster lawrencei* n. sp.

♂: length $3\frac{3}{4}$–5 mm. ♀: length $3\frac{3}{4}$–$5\frac{1}{4}$ mm., juvenile $3\frac{1}{2}$ mm. Both ♂ and ♀ with 20–26 somites, juvenile with 18.

Tergites dark brown, smooth, shiny, strongly curved. In adaptation to the animal's ability to enroll, *the body is more strongly narrowed, both anteriorly and posteriorly, than in the allied genera.* A further adaptation appears to me to be the strong thickening of the sternites and pleurites and the excavation of the pleurites, as seen in fig. 3. While in the allied genera there are indentations between the tergites which give the sides of the body a serrated appearance, in *Cylichnogaster*, on account of the sloping sides of the tergites, caused by a considerable reduction in their anterior width (fig. 5), there are still deeper incisions between the paratergites, by means of which the telescoping of these tergites is brought about during enrolment.

The head is only covered by the collum in its posterior fourth (fig. 1), but in enrolment it is pressed strongly downwards and backwards towards the venter. There is throughout a connective relation between the sternites and pleurites, which takes the form of a longitudinal suture between them. The pleurites have only a membranous connection with the tergites, so that in a preparation they can easily be separated from each other. Dorso-ventral muscles connect the tergites on each side with the sides of the sternite and assist in raising the ventral surface.* The two sternites belonging to each pair of

* It should be noticed that in enrolment the tergites are to a large extent forced away from each other, the paratergites on the contrary towards each other.

pleurites are almost equally broad, but otherwise very differently formed, the anterior being only about as long as the posterior. All sternites lie overlapping one another, the hind margin of the anterior covering the front margin of the posterior one; the anterior angles of the anterior sternite have a membranous connection with the pleurites, the anterior angles of the posterior sternite are triangular, narrowly produced anteriorly to fit into a small cavity in the anterior one. The coxae in the middle of the body are separated from each other by $\frac{2}{3}$ their own width and implanted in a curved slit on the hind margin of the sternite. Farther forward along the body the coxae draw nearer to each other (fig. 6), but still remain separate throughout. The small coxal sacs begin on the third pair of legs. There is a small lappet close to the claw of the anterior pair of legs of the ♂, which is more than twice as long as the claw (figs. 6 and 7), while next to it there is in most legs a long bristle.

Head with sparse bristles (fig. 1), two of which, characterised by unusual length, are situated anteriorly between the anterior ocelli of the eyes. The antennary pits are distant from each other about twice the breadth of the basal segment of the antennae, and are somewhat obliquely inserted, their anterior end being directed inwards. In the same way the eyes are also directed obliquely, being placed in two pigmented areas which anteriorly are about as far from each other as the length of the pigmented area itself. Each pigmented area contains two ocelli, a small round one anteriorly, a large oval one posteriorly; these ocelli are only discernible when the incidence of the light under the microscope is favourable. The antennae consist of six very distinct stout joints, with a seventh, small and disc-like, appearing at the apex of the sixth joint, while from this again protrude the four well-known olfactory cones; the antennae are thus altogether 8-jointed. On the distal outer ends of joints 5, 6, and 7 are several sensory rods, thus agreeing with *Burenia*, according to Attems's fig. 413; these rods are, however, easily seen only on the fifth joint, while on the sixth and seventh they are often indistinct owing to pigment and bristles. The spination of the tergites is in general very sparse and weak and almost always confined to the sides and hind margins (figs. 2 and 5); superficially most of the tergites appear to be quite smooth, but under higher power 2–3 very fine hairs can be seen on their rounded posterior angles. Stouter and sometimes longer bristles are found only on the telson (fig. 4). Four long bristles project posteriorly apparently from the hind margin of the anal segment, but actually from the hind margin of the prae-anal tergite. The pores (po, fig. 5) open on the paratergites, where they are equidistant from the anterior, posterior, and lateral margins. Attems has shown in the walking leg sternites of *Burenia* (though not in those of the anterior and posterior gonopods) a bluntly triangular projecting lappet between the coxae, while in *Cylichnogaster* the margin of the sternite between the coxal (figs. 3, 6, 8, and 10) is always completely truncate without a projection, and this posterior truncated portion usually bears two bristles para-medially, while the sternites are otherwise smooth in contrast to the outer edges of the pleurites, which are more or less fringed with hairs (Pl. XI, fig. 6). The walking legs are broad where their coxae join the sternite, but they terminate with a very slender tarsus. In the second pair of legs in the ♂ (fig. 6), the medially fringed tarsus is also much more slender than the tibia, differing in this from *Burenia*, where the segments, according to Attems, are almost equally broad.

On cursory inspection the anterior and posterior gonopods of *Burenia* and *Cylichnogaster* seem very alike, but on closer examination considerable differences and also some difficulties appear. While the gonopods of *Burenia* have been described as having 6 segments, I found them to consist of 7 in *Cylichnogaster*, a difference which I have attributed in my key to the separation of the fused tibia and tarsus. This difference can, however, be explained in another way. In the gonopods of both genera, one of the segments of the telopodite (fe, fig. 8) is distinguished by its outstanding size, and broadly triangular shape, caused by its strong external curvature. As can be seen from fig. 8, the gonopods of *Cylichnogaster* have the same articulation as the walking legs, except that a normal claw is no longer present. The large triangular segment therefore corresponds to the femur; between it and the coxa are two other segments narrowed on the inner side—a large praefemur, and a smaller trochanter. Distally to the femur are three more segments differing little in size, viz. post-femur, tibia, and tarsus; the last named is produced into such a striking tooth or claw-like process, bent strongly backwards and basalwards (figs. 8 and 9), that we may regard it as a coalescence of the tarsus and claw, *i.e.* a tarsungulum. When we apply to these gonopods the interpretation given by Attems in his fig. 423 of the gonopods of *Burenia*, and at the same time consider the interpretation of the tibio-tarsus as expressed in my key, it appears that on the one hand there are, between the large triangular segment and the tibio-tarsus, two segments in *Burenia*, as opposed to only one in *Cylichnogaster*; whilst, on the other hand, there are, between the large triangular segment and the coxa, two segments in *Cylichnogaster* but only one in *Burenia*. There are two possible explanations:

Either, *A*. The large triangular segment (fig. 8) is the femur in both genera. In this case the trochanter has disappeared in *Burenia* and the praefemur has been reduced to a small outer triangle, while the terminal segment is not the tibio-tarsus (as it is treated in my key), but a tarsungulum, as in the other genus (*Cylichnogaster*);

Or, *B*. The large triangular segment is only the femur in *Cylichnogaster*, while in *Burenia* it is the praefemur; then the small intermediate segment developed only on the outside is the trochanter, the femur being, however, reduced and pushed more inward. The femur is followed by the post-femur and tibio-tarsus, conforming with the interpretation expressed in my key. Which of these two views is the correct one will be finally decided by making use of the character of the musculature. The muscles of the gonopods of *Cylichnogaster* I have indicated in fig. 8, but unfortunately nothing is known of those of *Burenia*. As can be seen from fig. 8, there are in the telopodite of the gonopods of *Cylichnogaster* two muscle bundles, one behind the other, agreeing with those of the posterior gonopods (fig. 10). If, however, we compare these muscle bundles with the musculature of the walking legs of Polyzoniidae, *e.g.* with figs. 3 and 4 of my third paper on the legs of tracheates (Sitz. Ber. d. Ges. naturforsch. Fr., Berlin, 1903, No. 2, Taf. 1), we readily see that in them, exactly as in the gonopods, the main line of division in the musculature of the telopodite lies *between the prae-femur and femur*, which confirms my interpretation of the articulation of the gonopods as shown in fig. 8. The decision as to whether the largest segment of the gonopod telopodite is femur or prae-femur in *Burenia*, therefore, depends entirely upon the position of the division between the two muscle bundles of the telopodite. At the extremities of the gonopods of *Burenia* there occur, according to Attems (figs. 414 and 423), an inwardly projecting lappet at the base of the terminal segment (lo). This lappet is completely absent in *Cylichnogaster*. If Attems's fig. 423 is correct then the gonopods in *Burenia* should be much more deeply sunk in the sternite than in *Cylichnogaster*; moreover, the hind margin of the sternite in *Cylichnogaster* is truncated, in *Burenia*, on the other hand, broadly concave.

The posterior gonopods of *Cylichnogaster* (fig. 10) strongly resemble those of *Burenia* which Attems has described as 7-jointed, and are likewise much less deeply sunk in the sternite on the one hand and more strongly bent towards the anterior on the other. The 7 segments of *Burenia* are composed of coxa, trochanter, prae-femur, femur, post-femur, tibia, tarsungulum, so that there is an almost normal articulation. Although the curved blade-like terminal portion of the posterior gonopods is practically similar in the two genera, except for the slender apex which is simple in *Cylichnogaster*, one cannot speak of a normal articulation in the latter genus. The four distal segments are very similar, the penultimate one in *Burenia* being, however, twice as broad as long and in *Cylichnogaster* longer than broad; in the proximal half, however, *i.e.* in the neighbourhood of the basal muscle bundles, the articulation has become obliterated; a trochanter is altogether absent, and the boundary between coxa and prae-femur is only incompletely developed, and that on the outer side.

### *Occurrence.*

I am indebted to Dr. R. F. Lawrence, formerly Assistant in Charge of Arachnida and Myriopoda at the South African Museum, Cape Town, for the specimens 3 ♂♂ and numerous ♀♀ which form the basis of this paper; the new form is named in his honour. They were discovered by him beneath damp rotting logs in one of the valleys of the mountain slopes near Chapman's Peak, Cape Peninsula.

*Note.*—From the point of view of distribution this Polyzoniid is of extraordinary interest for the reason that it is decidedly more closely allied to the Mediterranean genus *Hirudisoma* than to the South African *Burenia*, which is evidence that, at an earlier period of the earth's history, there was an interchange of forms between North and South Africa. It is highly probable that still more representatives of the *Colobognatha* may eventually be found in South Africa.

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## EXPLANATION OF FIGURES.

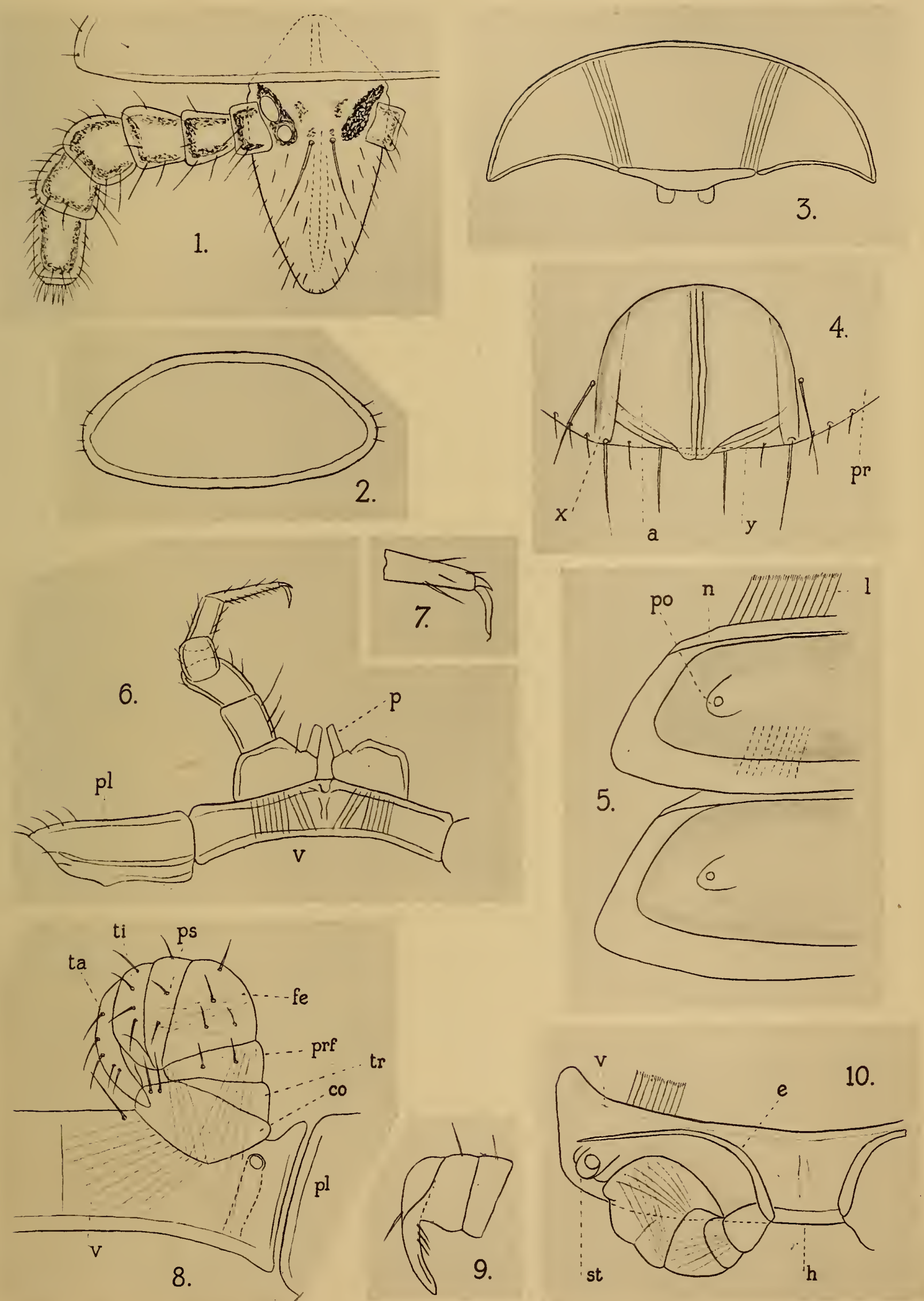
(Plate XI, with Figures 1–10.)

*Cylichnogaster lawrencei* nov. gen. et nov. sp.

FIG.

1. Head, right antenna, and anterior region of collum, seen from above. ×125.
2. Collum. ×125 ?
3. A segment from the middle of the body in transverse section; tergite above, sternite (with coxa) below, and pleurite. ×56.
4. Anal segment and the hind margin of the prae-anal segment (pr) seen from below. ×220. a, anal valves; y, dorsal portion of the anal segment.
5. Lateral portion of two tergites from the middle of the body; n, suture; l, longitudinal muscles; po, pore. ×125.

6. Second pair of legs of, with sternite (b), pleurite (pl), pseudopenis (p). × 125.
7. Apex of second leg with claw and lappet. × 220.
8. Right gonopod with sternite (v) and the most medial scelerite of the pleurite (pl), seen from in front; co, coxa; tr, tronchanter; prf, praefemur; fe, femur; ps, post-femur; ti, tibia; ta, tarsus. × 220.
9. Apex of gonopod, seen from behind. × 220.
10. Posterior gonopod with its sternite, seen from below; v, anterior; h, posterior margin of the sternite; st, stigma; e, terminal piece. × 220.




K. W. Verhoeff. Neill & Co., Ltd.

## 10. *New Colobognatha from South Africa.*

By Dr. Karl W. Verhoeff, Pasing, Munich.

(With Plate XII.)

### Introductory Remarks.

Until a few years ago not a single member of the Colobognatha was known from South Africa, and Attems in his Myriopoda of South Africa was the first to record a representative of this order, with its peculiarly modified mouthparts, in *Burenia nasuta* Att. I had therefore great pleasure in receiving from Dr. R. F. Lawrence, formerly of the South African Museum, Cape Town, an interesting series of South African Myriopods, among which I found three new species of Colobognatha, belonging to the genera *Burenia*, *Rhynchomecogaster* n. gen., and to the genus *Cylichnogaster* which has been described in a previous paper. Four species of Colobognatha belonging to three genera are thus now known from South Africa, and it can be safely predicted that many more new forms of this order await discovery, especially from the mountainous regions of South Africa. A study of the South African Colobognatha led me to question whether the definition of the Hirudisominae, as given by Attems in the work cited above and in Kükenthal's Handbuch der Zoologie, Bd. 4, 1926, p. 213, is a correct one?

His key to the genera of the Hirudisominae is as follows:—

1*a*. Two or three ocelli on each side. Anal segment completely concealed by the preanal segment and not visible from above . *Hirudisoma* Cav.
1*b*. One ocellus on each side. Anal segment partly visible from above . . 2.
2*a*. Pleurites connected with the tergites by membranes. Anterior gonopod 4-jointed, posterior gonopod 3–5 jointed . . *Rhinotus* Cook.
2*b*. Pleurites nearly coalescent with the tergites . . . . . 3.
3*a*. Anterior gonopod 6-jointed, posterior gonopod 7-jointed, the latter with a bristle only on the third joint . . . . *Burenia* Attems.
3*b*. Anterior gonopod 3-jointed, posterior gonopod 5-jointed, both pairs with groups of bristles bearing accessory spicules . . *Siphonotus* Bröl.

### The Telson of the Colobognatha.

A complete reinvestigation of the telson of *Hirudisoma* as compared with those of other genera is very necessary, seeing that, on the one hand, this structure has not been clearly enough defined; on the other, the distinctions expressed in Attems' key under 1*a* and 1*b* give rise to serious doubts. Furthermore, the difference in the number of ocelli is an untenable character and should certainly not be used in generic distinctions.

In the telson of the Diplopods we have to distinguish between an anal and a preanal segment (figs. 1 and 2). As Attems speaks only of an anal segment it is doubtful if he means thereby the true anal segment or the whole telson. The distinctions in the anal segment expressed by Attems under 1*a* and 1*b* are made clear in fig. 1 for *Hirudisoma*, and fig. 2 for the other genera. In fig. 1 the anal segment is thus seen to be shifted far forward, while in fig. 2 it projects somewhat with its posterior extremity.

Even so the distinctions between *Hirudisoma* and the other genera have not been sufficiently defined. If we consider the Diplopoda in general, there is no doubt that a telson clearly visible from above represents a primitive condition as contrasted with one which has been shifted forwards, because the simple position of the somites, one behind the other, constitutes the most primitive condition that we can conceive. Thus fig. 2 shows the primitive structure of the telson in *Rhynchomegaster* (and *Burenia*), while in *Hirudisoma* it is indubitably of a secondary nature.

We have thus in figs. 1 and 2 three segments posterior to the last leg-bearing somite, viz. a posterior legless segment (ul), a preanal segment (pr), and an anal segment consisting of two lateral anal valves (an).

In *Burenia* and its allies (fig. 2) only the ventral part of the legless segment is visible from below, but in *Hirudisoma* (fig. 1) the telson (pr + an) has moved so far forward that a section of the dorsal part of the legless segment is visible behind it. The extreme hind margin of the body is thus part of the last segment in *Hirudisoma*, while in the genera represented by fig. 2 it is formed by the telson. In the latter the anal valves are placed so far back that they are situated entirely behind the legless segment, being at the same time only partly enclosed by the preanal segment, while they are also much shorter than the section of the preanal segment anterior to them. The anal valves of *Hirudisoma*, on the other hand, have not only drawn nearer the legless segment (fig. 1), but they are so largely enclosed by the preanal segment that they are longer than the section of the preanal segment in front of them, in which the ventral displacement in an anterior direction is especially marked.

From these conditions it appears that the distinctions between *Hirudisoma* and the other genera are more far-reaching and complicated than those used in the above-mentioned key of Attems.

This difference in the structure of the telson runs parallel with another in respect of the mouthparts, up to now unknown. *Hirudisoma,* on account of its mouthparts and especially the fairly well-developed wedge-shaped mandibles, is allied to *Polyzonium.* In *Burenia* and its allies, on the other hand, there are no such wedge-shaped mandibles, showing that degeneration has already gone a long way.

Similarly, the prolongation of the anterior part of the head in *Burenia* and its allies is far more marked than in *Hirudisoma,* indicative of an approach to the *Siphonophoridae.* The conclusion I am forced to draw from all these differences is that *Burenia* and its allies form a distinct family standing midway between *Hirudisoma* and the *Siphonophoridae. Hirudisoma* is, however, so widely different from the *Polyzoniidae* that it represents a separate family between the *Polyzoniidae* and the *Bureniidae.* The following are the points of difference between the two families:—

A. The telson is so completely sunk in the preceding segment that it is not visible from above (fig. 1). The anal valves are so sunk in the preanal segment that they are almost encircled by it. The dorsal posterior margin of the preanal segment lies far in front of that of the preceding segment, the telson being less than half as wide as the latter. Head but little projecting so that anteriorly it forms a right angle or almost a right angle. The mandibles are developed as biting organs in the form of little wedges like those of *Polyzonium.*

Family *Hirudosomidae* n. fam. (for *Hirudosoma*).

B. The telson is not completely sunk in the preceding segment (fig. 2), the hinder end being thus to a large extent visible from above. The anal valves are only slightly sunk in the preanal segment and are situated so far back that they are much shorter than the ventro-preanal portion in front of them. The dorsal hinder margin of the preanal segment lies behind that of the preceding segment. The telson is much more than half as wide as the latter. Head strongly projecting anteriorly so that its apex forms less than half a right angle, thus appearing beak-like. The mandibles are not modified to form wedge-shaped biting organs.

Family *Bureniidae* n. fam. (containing the genera *Burenia, Rhynchomecogaster* n. gen., *Cylichnogaster, Rhinotus,* and *Siphonotus*).

The family *Bureniidae* can be divided into the following subfamilies:—

*a.* Body short and broad, able to enroll. Trunk with 20–26 segments. Pleurites transversely rectangular

1. Subfamily *Cylichnogastrinae* (for *Cylichnogaster* mihi).

*b.* Body longer and more slender, with 35–90 segments, never able to enroll. Pleurites of more or less quadrate form (figs. 3 and 4)
2. Subfamily *Bureniinae* (containing the remaining genera).

The two genera *Rhinotus* (from Sierra Leone, Madagascar, Seychelles, and the Malayan-Australian region) and *Siphonotus* (from South America and the Malayan-Australian region) have 3–4 jointed anterior gonopods and 3–5 jointed posterior gonopods in common as distinguished from the South African genera *Burenia* and *Rhynchomecogaster*; they require, however, further investigation with regard to other characters.

### *Rhynchomecogaster* n. gen.

The genus is most closely allied to *Burenia*, from which, however, it can be distinguished as follows:—

| *Rhynchomecogaster* mihi. | *Burenia* Attems. |
|---|---|
| Metatergites clothed with such numerous and long hairs that they have a silky sheen. Collum provided with such numerous and long hairs (fig. 5) that 7–8 rows can be distinguished, which are, however, not all regular. Pleurites (fig. 3) with hairs on their outer posterior sides and also partly on the inner ones. Head acuminate anteriorly and without sensitive rods at its apex. One simple bristle near the claw of the anterior pair of legs in the ♂. Terminal segment of the anterior gonopods (fig. 6) drawn out into a recurved hook which reaches to beyond the femur. Terminal segment on the outer side without a lobe. Prefemur of the anterior gonopod plate-like, well defined on the inner and outer sides (fig. 6). | Metatergites sparsely clothed at the sides with short hairs so that the back appears smooth and shiny. Collum also with hairs mainly at the sides, but these so few and small that it appears hairless. Pleurites with only a few weak hairs at the sides on the outer and posterior portions (fig. 4). Head truncate anteriorly, usually with 2 + 2 very small sensory rods.* A small thickened tongue-like bristle near the claw of the anterior pair of legs in the ♂ (cp. Attems' figs. 416, 419, and 420). Terminal segments of the anterior gonopod produced into a process which at most only reaches to the femur. On the outer side of the terminal segment a marginal lobe (cp. fig. 9).† Prefemur of the anterior gonopod cuneiform, its inner surface so much contracted as to be indistinct (prf., fig. 8). |

### Comparative Anatomy of the Anterior and Posterior Gonopods.

It is easy for errors to arise respecting the segmentation of the anterior and posterior gonopods of the Colobognatha, as the bound-

* Attems made these much too large in his fig. 412.

† Attems denoted the marginal lobe with "lo" in his fig. 414.

aries of the segments are often difficult to make out, while sometimes they actually have partly disappeared (fig. 9). This being so, it is important to study the relations of the muscles, because a correct idea of the segmentation can be gained from the well-defined points of insertion of these muscles. Regarding their segmentation, the anterior and posterior gonopods are homodynamous throughout—that is, of equal value—apart from the differences of the segments. Both pairs of appendages are 6-jointed in the South African *Bureniidae*. The muscles of the gonopods constitute two segments, one behind the other, which do not overlap each other, *i.e.* a basal and an apical. The apical muscles always end basally on the inner side of a terminal joint which is drawn out distally into a process. Whether this process constitutes merely a claw or a tarsungulum is a point which cannot be decided with certainty. On account of the small change which had taken place in the anterior gonopods of the Colobognatha in contrast to the walking legs (in comparison with other Proterandria), it is probable that they have retained their original postfemur. Then the segments marked (*a*) in figs. 6 and 9 would have to be regarded as the postfemur, (*b*) as the tibia, and (*c*) as the tarsungulum, and the same with the posterior gonopods (fig. 10). It is noteworthy that the muscle segments of the anterior gonopods have apparently different relations in *Burenia* and *Rhynchomecogaster*, for although 5 segments follow after the coxa (co) in both genera, the basal muscle segment in *Rhynchomecogaster* traverses two joints, the terminal muscle segment three joints; in *Burenia* the basal muscle segment traverses only one, the terminal four, joints. As the gonopod segmentation in *Rhynchomecogaster* is much more clearly defined than in *Burenia*, the former genus must be regarded as deciding the issue. There are also in these gonopods four distinct telopodite segments between coxa and terminal joint, as in the walking legs. In *Burenia*, on the other hand, I observed only one well-defined segmental boundary, the others being more or less indistinct and imperfect. This applies to the species before me, *B. attemsii* n. sp., while Attems, in his fig. 423 of *B. nasuta*, gives six distinctly separate segments, of which the second, the prefemur, appears as a wedge-shaped segment developed only on the outer side.

The muscles of *Burenia* and *Rhynchomecogaster gracile* (fig. 6) according to their positions thus show a difference of one segment as has been figured for *Burenia attemsii* in fig. 9. There is in *Burenia attemsii*, however, a fine striated band behind the coxa, marked (x) in fig. 9, which can be considered as a very poorly developed prefemur, and in this case the position of the gonopod muscles is the same in the two genera. The segment (prf) would then be the femur, (fe) the postfemur. For this interpretation I have used another system of lettering bracketed beside the previous notation. The faint line (y) (fig. 9) would not then define a segment seeing that it does not pass right across the gonopod.

In both interpretations of the anterior gonopods of *Burenia attemsii* there is agreement with *B. nasuta* in that the prefemur is a wedge-shaped segment diminishing on its inner side, in contrast to *Rhynchomeccgaster.*

The position of *Burenia attemsii* regarding the weak or incomplete formation of boundaries between the telopodite segments is noteworthy, as it shows that too much weight cannot be attributed to the number of gonopod segments alone in regard to genera, and I must draw attention to this fact in connection with unsatisfactory characters of the genera *Rhinotus* and *Siphonotus.*

The physiological significance of the posterior gonopods is as yet unknown, and in this connection I refer to fig. 9 in which the slender terminal segment of the posterior gonopod can be seen hooked into a groove in the terminal segment of the anterior gonopod. What effect is produced by the mechanical coupling of the anterior and posterior gonopods is difficult to say when we know of no analogous occurrences in other Diplopod groups. It reminds me especially of the flagella in *Julidae,* the physiological significance of which I have repeatedly discussed. In my opinion the posterior gonopods are organs of stimulation whose terminal segments, by being inserted in the apical segment of the anterior gonopods, are guided to their correct position for stimulating the female in copulation.

### *Rhynchomecogaster gracile* n. sp.

♂ $16\frac{1}{2}$–19 mm., with 48–56 segments.

♀ 20–$21\frac{1}{2}$ mm., with 54–55 segments.

The body appears on the whole to be greyish yellow without noticeable pigmentation.

The narrowly produced fore part of the head gives the appearance of a concavity at the sides. Fore part of the head with 2 rows of bristles on each side below, the outer constituting a laterally projecting fringe of which 3–4 are outstanding in respect of their length and curvature. Forehead with fairly long scattered hairs above; anteriorly on the inner side a long bristle between the ocelli. The antennae, which are provided with long hairs, are sunk into a circular basal lobe, the distal margin of the fourth segment reaching almost to the apex of the head.

The transversely oval collum (fig. 5) has been already mentioned. Between the antennae 2 + 2 ocelli, the dense pigment round them forming an oblique ellipse on each side.

The coxae of the walking legs, which carry the well-known small coxal sacs, are close to each other, remaining, however, separate in the median line, while between them at their bases is a small sternal horseshoe-shaped lobe, serving as a buffer (fig. 2). Walking legs with long bristles, prefemur and postfemur about as long as wide, femur and tibia on the other hand much longer than wide.

Of the two smooth sternites of each segment the anterior one is rounded behind, the posterior one truncated behind, the postero-lateral angles, however, projecting backwards.

The dense hairs of the tergites have already been mentioned. They are entirely confined to the metatergites, which are twice as long as the prozonites and divided from them by a fine transverse suture. Most of the tergites have five transverse rows of long bristles, and just anterior to their hind margins there are two fine transverse striations. There is a continuation of the transverse suture on the pleurites (fig. 3), the metapleurites being twice as long as the propleurites, bristles being found only on the metapleurites. On their inner inferior margins the pleurites form a blunt angle in the middle, while the anterior margin is not only enlarged, but forms above on the outer side a knob-like projection (fig. 2). The pores of the tergites situated more or less as in *Burenia*.

The anal valves of the telson quite hairless, while the preanal segment (fig. 2) has bristles above as well as at the sides. The anal valves agree with *Burenia* in having their hinder extremities reaching to a little beyond the preanal segment, and the posterior margin of the latter in the middle forms a bluntly rounded projection. In these characters of the telson *Rhynchomecogaster* and *Burenia* differ from *Rhinotus* and *Siphonotus* in which the telson is completely rounded posteriorly and the anal valves end a little in front of the posterior margin of the preanal segment (cp. my paper on Diplopoda in Mjöbergs Australischer Expedition, Arkiv för Zoologie, Stockholm, 1924, Bd. 16, N. 5, Taf. V, Abb. 93 and 100, *Rhinotus mjöbergi* and *Siphonotus latus* Verh.).

The anterior gonopods of *Rhynchomecogaster* have been mentioned above. The following may be added (fig. 6).

The 6 segments described are all clearly separated from one another and the hairs are of considerable length, longer than in *Burenia.* On the outer extremity of the coxa there is a demarcated triangular field; this is either a membrane or the indication of a trochanter. The terminal segment is drawn out into a powerful dagger-like process which has an oblique strip bordering it below at its base and a small notch on its outer side. The posterior gonopods (fig. 7) thus correspond fully with the anterior gonopods in their segmentation. Only on the prefemur are there two fine hairs. The prefemur is not so broad as that of *Burenia,* and the same applies to the two segments proximal to the terminal piece.

*Locality.*—The numerous specimens before me have the sexes in the proportion of ♂ : ♀ = 1 : 3. Most of the specimens are from Noordhoek, Cape Peninsula, the remainder being from Hermanus, River Zonder End, and Bredasdorp. From these last three localities, I must, however, add, I have seen only females.

### *Burenia attemsii* n. sp.

♂ 11 mm., with 52 segments. ♀ 16 mm., with 53 segments. (The ♂ of *B. nasuta* Att. has 64–88 segments.)

Dorsal surface either a uniform whitish yellow or with 1–2 small transverse greyish-brown stripes on the tergites.

2 + 2 ocelli which lie obliquely close behind each other (according to Attems *nasuta* has only 1 + 1 ocelli, but this is open to doubt as it is easy to overlook the second ocellus on account of the centration of pigment in the ocellar area).

As far as the characters given by Attems go, *nasuta* agrees with *attemsii,* but important differences exist in the anterior and posterior gonopods which have to a certain extent already been discussed. The boundaries of the gonopod segments are sometimes indistinct or incomplete, while in *nasuta* they are well defined. The hairs in *attemsii* are much shorter than in *nasuta,* this being especially noticeable in the terminal segments. The process of the terminal segment in *nasuta* is distinctly stronger, projects far out when seen in profile, and is obliquely truncate at its apex. In *attemsii,* on the other hand, the process of the terminal segment (fig. 8) is not only much shorter, so that seen in profile it hardly projects at all, but it terminates in two small teeth which are opposed to each other, the outer one being provided with a further accessory nodule. The prefemur of the posterior gonopods is provided with a bristle, while in *attemsii* the posterior gonopods are altogether muticous (fig. 10). The femur of *nasuta* is much wider than long, while in *attemsii* it is a little longer than wide. Attems figured a trochanter between the coxa and prefemur for *nasuta* of which I have seen no sign in *attemsii*.

*Locality.*—Among several female and immature specimens from Hermanus there was only 1 ♂. Other individuals from River Zonder End and French Hoek.

Attems described his *nasuta* from Knysna, Cape Province.

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## EXPLANATION OF PLATE XII.

FIG.

1. *Hirudisoma carniolense* Verh. Posterior end of body seen from below. an, anal valves; pr, preanal segment; ul and l, the two preceding segments; m, detractor muscles of the telson. × 125.

2, 3. *Rhynchomecogaster* n. g. *gracile* n. sp.

   2. Posterior end of body seen from below (only the coxae and prefemora of the last pair of legs drawn in). × 125.
   3. Pleurites of the gonopod segment. v, anterior, h, posterior, u, inferior, o, superior margin; su, suture; z, knob-like projection. × 125.

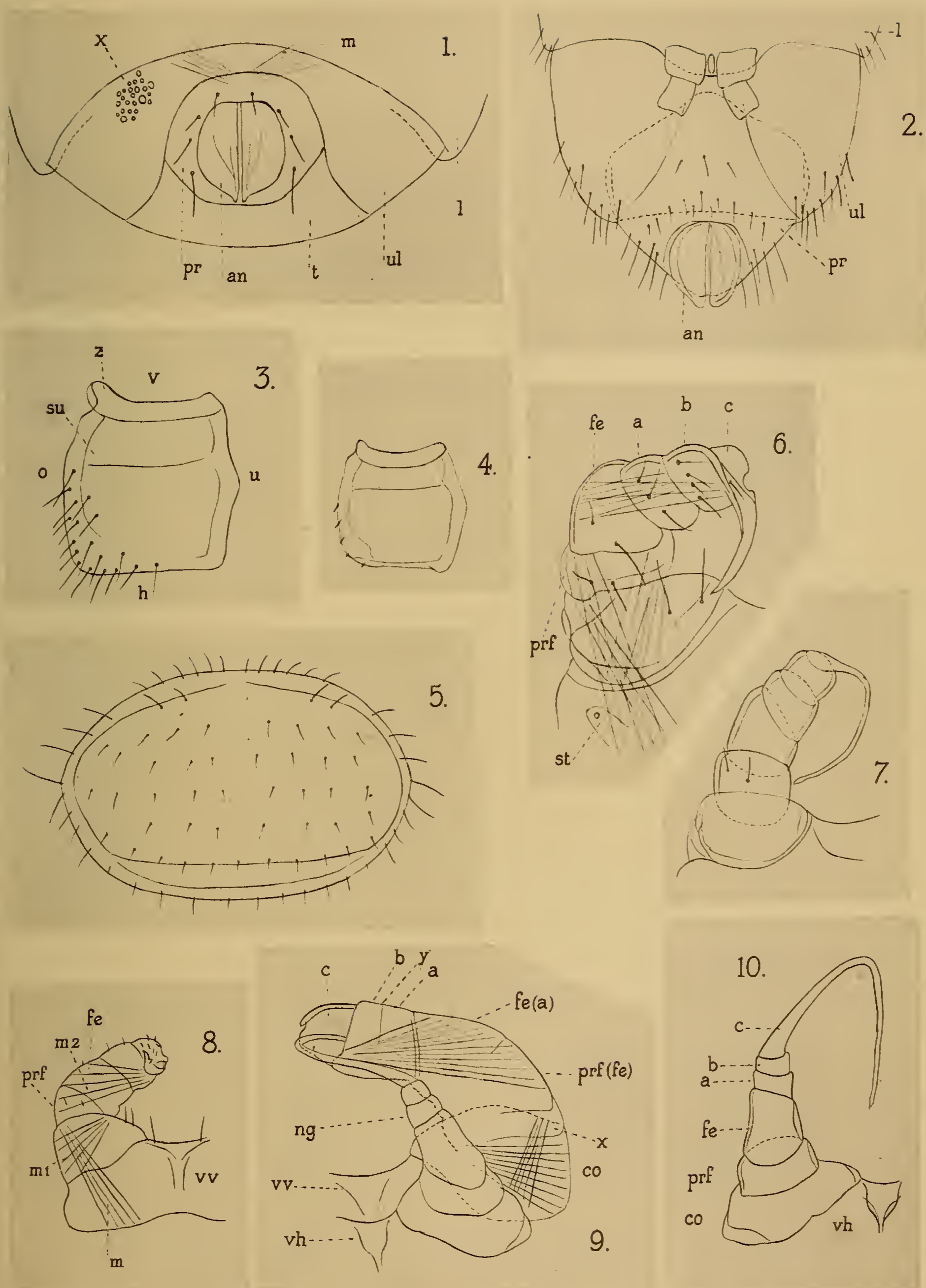
4. *Burenia attemsii* n. sp. Pleurite of the gonopod segment. × 125.

5–7. *Rhynchomecogaster gracile* n. sp.

   5. Collum seen from above. × 125.
   6. Anterior gonopod seen from in front. fe, femur. × 125.
   7. Posterior gonopod seen from in front. × 220.

8–10. *Burenia attemsii* n. sp.

   8. Anterior gonopod with its sternite (vv) seen from in front. prf, prefemur; fe, femur; $m^1$, $m^2$, muscles. × 125.
   9. Anterior and posterior gonopods seen from behind. The hooked terminal rod of the posterior gonopod is inserted in the terminal joint of the anterior gonopod. co, coxa; vv, anterior, vh posterior sternites. × 220.
   10. Posterior gonopod seen from behind. co, coxa; prf, prefemur; fe, femur; *a*, *b*, *c*, the three terminal segments. × 220.




K. W. Verhoeff. Neill & Co., Ltd.

11. *New Acridiidae from South Africa.*—By K. H. L. Key, M.Sc., Ph.D., D.I.C., Canberra, Australia.

(With Plates XIII–XVII and 2 Text-figures.)

Most of the material which forms the basis of the present paper was collected by myself during the years 1928–1931. In the case of *Betiscoides meridionalis* Sjöst., my own material was supplemented by specimens from the collection of the South African Museum, from which the unique type of *Pyrgomorphella rugosa* was also obtained. The two specimens of *P. variegata* are from the British Museum collection. I have to thank the Director and Dr. A. J. Hesse of the South African Museum and Dr. B. P. Uvarov of the British Natural History Museum for permitting me to use this material, and for putting at my disposal all the facilities of the two museums. The Type of *Pyrgomorphella rugosa* has been deposited in the South African Museum, and the Type and allotype of *P. variegata* in the British Museum. All the other Types are in the British Museum, and paratypes in both museums.

## CATANTOPINAE.

### Genus Betiscoides Sjöst.

(Ark. f. Zool. 15, No. 22, 1923, p. 12.)

The material before me includes Sjöstedt's *B. meridionalis* and two new species. These enable us to see the genus in a new light, and Sjöstedt's description is shown to require modification. In particular, the differences mentioned by him between the genera *Betiscoides* and *Betisca* are seen, with one exception, to be inconstant and unreliable, while two characteristic differences are not mentioned by him. I have therefore undertaken a redescription of the genus *Betiscoides* and of *B. meridionalis* in the light of the new material, transferring a number of characters from the generic description to the species.

Body slender or very slender, smooth, apterous.

Antennae more or less tapering, evenly punctured.

Head from above conical; fastigium of vertex produced, poorly or not at all marginated; its surface strongly and evenly convex sideways. A faint median carina is discernible at any rate at the extreme apex of the fastigium. Head in profile nearly straight above; face nearly straight and strongly sloping. Frontal ridge between the antennae compressed, not sulcate, but becoming sulcate lower down; margins of ridge more or less diverging towards the clypeus, either not reaching the clypeus or obsolescent by the time it is reached. Eyes longitudinal, not very prominent from above. Median ocellus very small; lateral ocelli absent.

Pronotum cylindrical, with no true carinae; anterior margin slightly convex, posterior slightly concave. Sides of pronotum flat; lower margin straight or slightly incurved; anterior margin sloping forward, straight or more or less incurved in the lower part; posterior margin nearly straight in the lower part, more or less sloping forward in the upper part. Sulci of pronotum represented only by a short shallow sulcus somewhat behind the middle of the lobes, which does not reach the disk nor the lower margin of the lobe, and one shortly behind the anterior margin of the lobe, which also does not reach the disk.

Prosternal tubercle more or less compressed in a longitudinal direction.

Meso- and metanota and tergites of abdomen traversed by a very fine median longitudinal carina, which may often be traced even on the pronotum as a very fine sulcus or carina. Tympanum absent.

Anterior and middle legs short. Hind femora smooth, almost devoid of hairs, both upper and lower margins widely rounded; no median apical spine. Inner genicular lobes widely rounded, outer somewhat produced and pointed.

*Male.* — Cerci very small, straight, conical. Supra-anal plate roughly diamond-shaped; the plate is traversed by a curved transverse sulcus, the convex aspect of the curve being directed anteriorly; the basal part of the plate thus divided bears a longitudinal depression. Subgenital plate elongate, convolute, conical.

*Female.*—Genital valves more or less recurved at the tips, not toothed, provided with hairs on the inside. Supra-anal plate longer than in the male, especially in the apical part; transverse sulcus not so distinct. Subgenital plate flattened, with an apical median triangular projection.

Genotype : *Betiscoides meridionalis* Sjöst.

All known members of the genus are confined to patches of short reeds of the family Restionaceae.

The British Museum collection contains a series of specimens of the genus *Betisca* from various localities in Australia, and these permitted a careful comparison to be made with the *Betiscoides* series. Two characters considered to be characteristic of *Betisca* were found to be variable. These were (1) the lateral depressions of the fastigium, and (2) the hind margin of the pronotum, which is sometimes as much incurved as in *Betiscoides*. On the other hand, a very characteristic feature of *Betisca* is the enlargement of the galeae of the maxillae, which are turned upwards, almost completely covering the labrum, their points reaching to about the clypeus. In this respect *Betisca* resembles *Acanthoxia*, and differs completely from *Betiscoides*, in which the galeae are normal. Further, the apex of the fastigium is always sulcate in *Betisca*, carinate in *Betiscoides*. The characters of the prosternal tubercle, the galea of the maxilla, and the apex of the fastigium thus readily enable the two genera to be separated.

### *Betiscoides meridionalis* Sjöst.

(*Loc. cit.* 1923, p. 14, pl. 2, figs. 8, 9.)

*Male* (Plate XIII, A, B, C, E.).—Body very slender and elongate. Antennae 24-jointed; distinctly triangular in cross-section; distinctly biserrate; tapering gradually to a fine point; in length subequal to the head and pronotum together.

Head very elongate, about $3\frac{1}{2}$ times its width at the occiput; fastigium of vertex nearly twice the length of an eye; its margin takes the form of a broad, flat, very slightly raised portion of the head extending forwards from each eye, and narrowing, until at the base of the antennae it has become fairly sharp, but little raised; margins straight, converging very gradually to the apex; median carinula faintly discernible only near the apex of the fastigium. Head in profile nearly straight above, face nearly straight and very strongly sloping. Frontal ridge between the antennae projecting somewhat, and then bending upward to meet the fastigium, so that in profile the head appears to be more or less obliquely truncate; margins of frontal ridge only slightly diverging and obsolescent shortly below the ocellus; lateral facial carinae ill-defined, and obsolescent above about the middle of the eyes. Eyes elongate-oval, almost oblong, about $1\frac{3}{4}$ times as long as their maximum width;

their surface almost flat; the lower margin straight, and the upper margin almost so; both anterior and posterior ends widely rounded, the latter somewhat wider than the former.

Hind margin of pronotum noticeably concave. Sides of pronotum with the lower margin almost straight; anterior margin sloping well forward, incurved; posterior margin straight below, sloping forward above; anterior lower angle slightly more than 90°, widely rounded; posterior lower angle 90°, rounded.

Prosternal tubercle strongly laminate, with its length (measured along the cephalo-caudal axis) many times its width in the middle, where it is very thin, its anterior end strongly swollen and rather more downwardly projecting than the rest of the tubercle, so that the lower surface of the tubercle is not quite level, but slopes down gently from the anterior to the posterior end; posterior end very slightly swollen.

Hind legs only just reaching the tip of the abdomen. Hind femora about seven times as long as their maximum breadth. Hind tibiae with 11 outer and 15 inner spines. Hind tarsi rather less than a third the length of the tibiae.

Apex of abdomen slightly upturned. Supra-anal plate with the basal part one-third to one-half the length of the apical part; the longitudinal depression well marked, straight, and narrow; apical part roughly triangular, but with the apex much attenuated and the sides somewhat incurved; a shallow depression in the apical angle.

Subgenital plate extremely elongate and acutely pointed, about three times as long (measured from tip of anal plate to tip of subgenital plate) as the supra-anal plate. Lower margin slightly convex at the base; upper margin nearly straight.

General coloration purple-brown, somewhat darker at the sides than above. A pale yellow stripe extends from the base of each eye across the cheeks, along the lower margin of the pronotum, and across the pleurae to the base of the hind femur. Head, eyes, antennae, and abdomen purplish brown, subgenital plate somewhat paler than the rest and greenish at the tip; fore and middle tibiae and tarsi greenish; hind femora greenish brown outside, pale green inside; hind tibiae pale brownish above, dark underneath; spines and spurs pale with black tips.

*Female.*—Larger than the male. Antennae not quite as long as the head and pronotum together; head about three times as long as its width at the occiput; head in profile very slightly concave above.

Eyes, relatively to the size of the head, smaller than in the male. Lower margin of side of pronotum distinctly incurved; anterior margin also strongly incurved; anterior and posterior angles each about 90° and widely rounded. Hind tibiae with 11–12 outer and 15–16 inner spines. Genital valves very feebly curved.

General coloration pale green, faintly tinged with brown on the margins of the fastigium, bases of antennae, abdomen, and knees. Eyes dark; fore and middle legs and tip of abdomen bright green; hind legs green, tibial spines and spurs black-tipped. No trace of a pale stripe extending back from the eye.

*Measurements :*

| | Male. | Female. |
|---|---|---|
| | mm. | mm. |
| Body | 37·5 | 42·5 |
| Pronotum | 3·0 | 3·8 |
| Hind femur | 10·5 | 12·5 |
| Antenna | 11·0 | 10·5 |
| Head | 6·5 | 7·5 |
| Subgenital plate | 7·0 | .. |

Described from 28 males and 18 females. The two specimens selected for description are both from the Cape Flats, Cape Peninsula, December 1930 (K. Key). The remainder are from the following localities: Table Mountain, Cape Peninsula, 3500 ft. (16 males, 4 females); "Cape Town" (3 females); other parts of the Cape Peninsula (6 males, 5 females); Elgin, Cape Province (2 males); near Hermanus, Caledon Division, Cape Province (1 male); Paarl Road, Cape Province (1 male); Tradouw Pass, Swellendam District, Cape Province (1 male, 2 females); Great Winterhoek, Tulbagh, Cape Province, 4500 ft. (1 female) ; Steenbras River, Sir Lowry Pass, Cape Province (2 females).

Dates, where given, fall within the period November to May.

In form the species is very variable. The specimens from the Cape Flats represent the extreme of elongation, the head being narrow and long, especially the fastigium, and the antennae and subgenital plate also very long. The specimens from Table Mountain (Plate XIII, D) and all the other mountainous localities are more robust, the head being broader, and the eyes, owing to the relatively shorter fastigium, set further forward. The two extremes are united, however, by a complete series of forms, those from Hermanus, Elgin, and Paarl Road being intermediate conditions. There is also a great variation in size.

In colour the males are relatively constant, being always dark with a pronounced lateral stripe backwards from the eye, and the hind femora usually green or greenish. The females, however, are extremely variable, all kinds of colour combinations being found, and many, like the specimen described, are of a more or less uniform colour throughout. The lateral stripe may be very well marked, but is usually much less so than in the male, and often quite absent.

### *Betiscoides sjostedti* sp. n.

*Male* (Type) (Plate XIV).—Much less elongate and more robust than the genotype.

Antennae 21-jointed, not biserrate, slightly flattened above, hardly tapering, not finely pointed, in length subequal to the head.

Head from above about $1\frac{2}{3}$ as long as its breadth at the occiput; fastigium about $\frac{2}{3}$ the length of an eye; the margins well raised but obtuse, narrowing from the anterior margin of the eye forwards, straight; apex of fastigium acute; median carinula discernible on the fastigium. Head in profile very slightly convex above, face nearly straight. Frontal ridge between the antennae hardly projecting at all, the apex of the head appearing sharply pointed in profile; margins of ridge fairly distinct in the sulcate portion and for a short distance below the ocellus, faintly discernible right to the clypeus. Lateral facial carinae straight, distinct throughout. Eyes ovate, about $1\frac{3}{4}$ times as long as their maximal width, the surface somewhat convex; both margins somewhat curved, the upper more so than the lower.

Hind margin of pronotum very slightly concave. Sides of pronotum with the lower margin straight, dipping slightly in front; anterior margin sloping forward, somewhat incurved in the lower part; posterior margin practically straight; anterior and posterior lower angles about 90°, rounded.

Prosternal tubercle slightly laminate, about twice as long as broad, its margins and angles rounded; the anterior end little broader than the posterior; lower surface level.

Hind legs reaching the tip of abdomen or just beyond. Hind femora fairly robust, about $4\frac{1}{2}$ times as long as their maximal width; hind tibiae with 10–11 outer and 11–12 inner spines. Hind tarsi about a third the length of the tibiae.

Apex of abdomen slightly upturned. Supra-anal plate with the basal part about half the length of the apical part; the longitudinal depression indistinct; the apical part of the plate shaped like an equilateral triangle with the base curved and the sides straight; apical angle rounded; no depression in the apical angle.

Subgenital plate (measured from the apex of the supra-anal plate) about equal in length to the anal plate; comparatively bluntly pointed; lower margin slightly convex, upper margin straight, convex at the base; apex rounded.

General coloration deep purple-brown, slightly paler above than at the sides. Head, antennae, fore and middle legs the same colour as the rest of the body. Eyes very dark. Hind femora very dark, both inside and outside, except the carinae and knees, which are fairly pale. Hind tibiae very dark on the lower side, spines and spurs black-tipped. Subgenital plate not as dark as the rest of the abdomen. Lateral stripe present but not very clear.

*Female* (Allotype).—Larger than the male. Fastigium about as long as an eye. Sides of pronotum with the lower margin straight; anterior margin sloping forward, only very slightly incurved; posterior margin slightly incurved, sloping forward in the upper part. Anterior lower angle more than 90°, posterior lower angle 90°, both rounded. Hind tibiae with 9–10 outer spines, 11–12 inner. Genital valves more strongly curved than in the genotype.

General coloration similar to, but slightly less dark than, that of the male. Hind femora, both outside and inside, paler than the rest of the body; hind tibiae darker apically than basally.

*Measurements :*

| | Male. | Female. |
|---|---|---|
| | mm. | mm. |
| Body . . . . . | 22·5 | 29·8 |
| Pronotum . . . . | 2·7 | 3·8 |
| Hind femur . . . . | 7·5 | 9·5 |
| Antenna . . . . | 4·5 | 4·5 |
| Head . . . . . | 4·0 | 4·5 |
| Subgenital plate . . . | 2·5 | . . |

Described from 6 males and 3 females from Table Mountain, December 1929–30 (K. Key). There is practically no variation in form in these specimens. All are of a more or less uniformly dark colour, except one male, which is olive-green above. The species occurs on the top of Table Mountain in the same patches of reeds as *B. meridionalis*, yet no intermediate forms occur.

*Betiscoides parva* sp. n.

In form resembling *B. sjostedti* much more closely than the genotype, but readily separable from both the other species on account of its much smaller size, as well as by other good characters.

*Male* (Type) (Plate XV).—Antennae 21-jointed, practically filiform, slightly tapering, reaching nearly to the hind margin of the pronotum.

Head from above about $1\frac{2}{3}$ as long as its breadth at the occiput; fastigium about half the length of an eye; margins less obtuse than in *B. sjostedti*, somewhat curved; apex not as acute as in *B. sjostedti*; median carinula discernible on the fastigium. Head in profile slightly convex above, face nearly straight. Margins of fastigium in profile somewhat arched, so that the apex of the head in profile is fairly widely rounded. Frontal ridge between the antennae somewhat projecting; margins of ridge fairly distinct in the sulcate portion and for a short distance below the ocellus, discernible right to the clypeus. Lateral facial carinae straight, distinct throughout. Eyes large, fairly prominent, ovate, about $1\frac{1}{2}$ times as long as their maximal width, their surface strongly convex; both margins curved, the upper strongly so. A low, obtuse, pale, callous ridge starts on the upper margin of each eye, follows the margin round for a short distance, and then traverses the side of the occiput in a longitudinal direction, and continues as a slightly incurved lateral carina along the pronotum, losing itself after a while in the abdomen.

Hind margin of pronotum very slightly concave. Sides of pronotum with the lower margin straight; both anterior and posterior margins sloping forward and slightly incurved in the lower part; anterior lower angle slightly more than 90°, rounded; posterior lower angle 90°, rounded.

Prosternal tubercle slightly laminate, 2–3 times as long as broad, its margins and angles rounded; somewhat broader and considerably higher at the anterior end, so that it slopes strongly downwards from the anterior to the posterior end.

Hind legs reaching beyond the tip of the abdomen. Hind femora fairly robust, about four times as long as their maximal width; hind tibiae with 9 outer and 11 inner spines. Hind tarsi nearly half the length of the tibiae.

Apex of abdomen strongly upturned, making an angle of about 90° with the long axis. Supra-anal plate with the basal part more than half the length of the apical part; the longitudinal depression short and broad, but deep; the apical part of the plate with the base curved and the sides straight; apical angle rounded; no depression in the apical angle.

Subgenital plate (measured as in the previous species) subequal to the anal plate, comparatively bluntly pointed, with the apex rounded; both upper and lower margins slightly convex.

General coloration plum, with the upper surface of the head, thorax, and abdomen, within the callous carinae, pale and silvery. A darker longitudinal stripe extends from the front of the head backwards along the central ridge of the body. The lateral stripe backwards from the base of the eye is silvery, and extends a short way round the lower hind corner of the eye as a somewhat raised callous ridge. The stripe does not reach the hind femur. Antennae plum; eyes pale; hind femora very pale; hind tibiae somewhat pale above, dark beneath.

*Female* (Allotype).—Larger than the male. Antennae shorter than those of the male, reaching only to about the middle of the pronotum. Head in profile nearly straight above; face straight. Eyes relatively smaller than in the male. Lower margin of sides of pronotum incurved in the anterior part; anterior and posterior margins almost straight; anterior angle about 90°, posterior a little more than 90°; angles rounded. Prosternal tubercle shorter and somewhat less sloping than in the male. Hind tibiae with 10 outer and 13 inner spines. Genital valves more strongly curved than in the genotype.

Sides of body deep plum, top of body pale yellow-green, with only a trace of the darker central stripe; antennae plum; cheeks yellow-green, frontal ridge plum, rest of face yellow-green tinged with plum; eyes brownish; fore and middle legs green in the femur, becoming plum in the tibia and tarsus. Hind femora yellow-green, paler inside than outside; hind tibiae green at the base, becoming plum at the apex; tarsi plum; spines and spurs black-tipped; genital valves green.

*Measurements :*

| | Male. | Female. |
|---|---|---|
| | mm. | mm. |
| Body . . . . . | 15·0 | 18·5 |
| Pronotum . . . . | 1·5 | 2·0 |
| Hind femur. . . . | 5·5 | 6·5 |
| Antenna . . . . | 4·3 | 4·0 |
| Head . . . . . | 2·5 | 3·0 |
| Subgenital plate . . . | 1·5 | . . |

Described from 9 males and 8 females collected by the author, the Type and Allotype from the Cape Peninsula, Cape Province, December 1930; 1 male paratype from near Hermanus, Cape Province, January 1931; the rest from Cape Peninsula, 1928–30. The male from Hermanus has a very slightly longer head and subgenital plate, but on the whole the species is fairly constant in its morphological features. In colour both males and females are exceedingly variable, but the females show no tendency to a uniform colour as in *B. meridionalis*.

A fairly homogeneous series of specimens collected by myself from Ceres, Cape Province, resemble *B. sjostedti*, but are more elongated. Other isolated specimens from various localities appear to differ slightly from the three species described above. The genus has every appearance of being a difficult one, and much more extensive collecting will be necessary before the status of these specimens can be determined.

### Frontifissia nov. gen.

This interesting new genus belongs to the group including the three genera *Kabulia*,* Ramme; *Eurynotacris*,† Ramme; and *Lyrotylus*,‡ Uv. The genotype is smaller than any of the other species of the group, and differs in its vivid coloration, but especially in the structure of the fastigium, which is unlike any of the others, but nearest to *Eurynotacris*. The pronotum and femora, on the other hand, are least like *Eurynotacris*. The front of the head is nearest to *Kabulia*.

*Frontifissia* is the first representative of this peculiar group to be found in Africa.

Fairly small, but robust (Plate XVI and text-figs. 1 and 2); body pilose, especially in the male.

Antennae fairly short and thick, filiform. Head from above short, little exserted; both occiput and fastigium punctured; fastigium flat, moderately sloping; more so in the male than in the female; distinctly marginated, roughly diamond-shaped, transverse; the lateral angles acute, the anterior margin with a V-shaped median emargination produced by the deep sulcus of the frontal ridge cutting into the apex of the fastigium, which is not roundly continuous with the frontal ridge, but meets it at an obtuse, but quite obvious,

* Deutsch. Entomol. Ztschr., pp. 299–302, 1928.

† Mitt. Zool. Mus. Berlin, xvi, p. 935, 1931.

‡ Journ. Bombay Nat. Hist. Soc., xxix, No. 3, 1923.

angle; temporal foveolae absent, median carina distinctly traceable right along the head, or obsolete. Face in profile somewhat sloping, frontal ridge straight or very slightly incurved, except at the base, where it bends up to meet the fastigium. Frontal ridge broad, more than half the breadth of the lateral frontal areas, strongly concave, with the margins well raised, especially above the ocellus, subparallel below the ocellus, more or less widening at the ocellus or just above it, and gradually converging towards the fastigium; frontal ridge, where it meets the fastigium, about half its breadth below the ocellus. Lateral facial keels well raised, subparallel to the frontal ridge, straight, or more or less curved forwards, reaching the fastigium. Subocular sulcus more or less distinct, straight or somewhat curved. Cheeks and front punctured. Eyes large, prominent from above; separated, in the male, by a distance subequal to the breadth of the frontal ridge at the ocellus, in the female by a greater distance; viewed laterally, more or less oval, the anterior margin tending to be straight, especially in the female; viewed from in front, curved.

Pronotum tectiform, widening from anterior to posterior end, slightly in the male, strongly in the female; anterior margin convex, posterior margin widely emarginate; median carina low, thick; lateral carinae obsolescent or indicated on each side by two very slightly raised regions only: an anterior one, not reaching the first transverse sulcus; and a posterior one, sloping backwards and inwards between the second and third sulci. In the female these areas may be broad and callous; first transverse sulcus obsolescent in the female, at any rate on the disk, bending horizontally forward on the lobe; second and third transverse sulci nearly straight on the disk, bending somewhat forwards on the lateral lobes, the third completely intersecting the median carina, the second not. Metazona about one-third the length of the prozona (measured along the median carina). Anterior margin of lateral pronotal lobes slightly forward-sloping, slightly incurved; lower margin curved, first sloping downward, then level; hind margin straight as far as the shoulder, sloping at an angle of about 45°, thickened, raised, and callous; anterior lower angle obtuse, rounded; posterior lower angle obtuse, very widely rounded. There is a well-marked vertical sulcus shortly behind the anterior margin of the lateral lobe, which follows the line of the anterior margin, not reaching the disk. Whole of pronotum coarsely punctured, especially on the disk.

Part of mesonotum visible behind pronotum; mesonotum and metanotum similar to the abdominal terga, but more coarsely punctured.

Prosternal tubercle straight, conical. Mesosternal lobes with the inner margin straight, inner angles obtuse, rounded; mesosternal interspace in the male subquadrate, subequal to the lobes in width; in the female slightly transverse, slightly wider than the lobes. Metasternal lobes with the inner margin straight, inner angles very obtuse, rounded; metasternal interspace trapezoidal, in the male a quarter or less of the width of the lobes, in the female about half the width of the lobes and narrower than the mesosternal interspace.

Elytra lateral, lobe-like, covering well-developed tympana. Wings absent.

Anterior and middle tibiae with a few spines. Pulvilli large. Hind femora just reaching, or not quite reaching, the tip of the abdomen in the female, reaching well beyond it in the male; the upper and lower margins slightly, and about equally, curved; upper median carina not very pronounced, serrulate; lateral carina strong, slightly serrulate; externo-median area flat; outer and inner genicular lobes similar, rounded apically. Hind tibiae, both from above and to a lesser degree from the side, curved, with a swelling near the base; tibial spines not constant, about 7–8 outside, 9–11 inside; inner apical spine present, outer absent. Inner spurs much longer than the outer.

Abdomen only very lightly punctured, with a broad, low, callous, median keel.

*Male.*—Supra-anal plate slightly transverse; divided, somewhat anterior to the middle, into an apical and a basal part by a well-raised transverse carina; the basal part traversed longitudinally by a deep broad sulcus with its margins well raised, which partly interrupts the transverse carina, and is continued as a fine indistinct sulcus in the apical part of the plate; apical part more or less depressed on either side of the median sulcus; apical angles rounded; apical margin with a slight median emargination. Cerci long, laterally compressed, strongly attenuate apically, the apical third, seen from above, bent slightly inwards, reaching the apex of the supra-anal plate or just beyond. Subgenital plate short, conical.

*Female.*—Supra-anal plate about twice as long as broad, the apical part shorter than the basal, and indistinctly separated from it by a fine transverse sulcus. Longitudinal sulcus well marked throughout, though more so in the basal than in the apical part. Genital valves long, strongly curved, not denticulate. Cerci short, very broad at the base, attenuate apically.

Genotype : *Frontifissia elegans* sp. n.

*Frontifissia elegans* sp. n.

*Female* (Type) (Plate XVI and Text-fig. 1). — When fresh a remarkably striking insect. General coloration deep green, with numerous silvery-white spots and markings. Head green, with several indistinct whitish markings on the face; median carina on the occiput white; eyes and antennae purple-brown; a white stripe sloping down from the eye across the cheek, and one passing straight back from the eye to connect with a short white line on the shoulder of the pronotum.

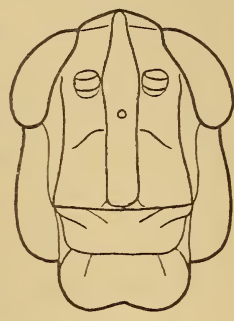


Fig. 1.

Pronotum green, with the median line white, broadening in the neighbourhood of the second transverse sulcus; a large oblique white mark on the shoulder, extending from just behind the second sulcus to just behind the third sulcus, and below the large mark, on the lobe just behind the second sulcus, a smaller white spot; a white line, situated on the lateral lobe at a level slightly above the base of the clypeus, connects the second sulcus to the anterior margin; region of the lobe between the anterior margin and the second sulcus blackish for a short distance above this line; sloping hind margin of pronotal lobes bearing a white stripe, bounded dorsally by a dark purplish stripe of about the same width.

Mesonotum without markings, except for the pale median carina. Metanotum with two white patches in the same relative positions as those occurring on the abdominal terga.

Elytra green, darker at the base than at the apex; lower margin with a white stripe, upper margin white at the base.

Anterior and middle legs green. An irregular white mark on the pleuron just above the insertion of the middle coxa, and another in the corresponding position above the hind coxa. Hind legs pale green throughout (the interno-median area of the femur is discoloured); a row of black dots, which are of the nature of obtuse teeth, on the upper external and internal carinae, but not on the lower internal and external carinae, which are whitish, especially the former.

Abdomen dark green, the median keel dirty white; two rows of large white spots on each side of the abdomen, each row consisting of one spot on each tergite; the upper row is in line with the large oblique spot on the shoulder of the pronotum; the lower row lies just above the lower margins of the tergites; on the under side of the abdomen there are also two rows of white spots running along the sides of the sternites. The spots on the sternites, and those of the lower row on the tergites, are triangular in shape, the apex being directed posteriorly. Sternum pale green, the lateral margins white; metasternal interspace, and a short line forwards from it, and also a line forwards from the mesosternal interspace, white. Genital valves pale green, the tips black.

*Male* (Allotype) (Text-fig. 2).—About half the size of the female and much less striking. General coloration green. Top of head green, except the fastigium, which is dark; frontal ridge and lateral frontal areas red-brown; cheeks green; antennae deep purple-brown; eyes buff; clypeus and mouth parts deep purple-brown. Pronotum green, with median carina and lower and hind margins of lateral lobes buff, and with a bright maroon mark on the shoulder just inside the hind margin. Abdomen green, with a median buff stripe bounded on either side by a row of small black dots; hind margins of tergites buffish. Forelegs brown-purple with a tinge of green, especially on the tibiae; middle legs green with a tinge of brown, especially on the femora, and the tarsi brown-purple. Elytra about twice as long as their width at the middle, lower margin nearly straight, upper margin curved; green with a tinge of purple and with the lower margin pale. Hind femora green, except in the internal and external upper areas, which are brownish. Upper external, upper internal, and lower external carinae with a number of black dots, which are of the nature of obtuse teeth, and are most pronounced on the upper external carina. Hind tibiae green at the very base, red-purple in the rest, with the tarsi purplish tinged with green. Sternum deep brown-purple, under side of abdomen pale brown.

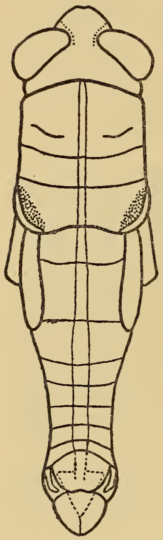


Fig. 2.

*Measurements :*

| | Male. | Female. |
|---|---|---|
| | mm. | mm. |
| Body . . . . . | 10·5 | 23·0 |
| Pronotum . . . . | 3·2 | 6·0 |
| Elytron . . . . | 1·5 | 2·5 |
| Hind femur . . . | 8·0 | 12·5 |
| Antenna . . . . | 5·0 | 6·0 |

Described from 13 males, 7 mature females, and 5 female nymphs; the Type and Allotype from the Cape Peninsula, Cape Province, 1930 (K. Key); the other male paratypes from the Cape Peninsula, 1 female paratype from near Hermanus, January 1931; the rest from Cape Peninsula, 1930; 2 nymphs from Paarl Road, January 1931; and 3 nymphs from Cape Peninsula, 1928–30. (All collected by the author.)

The species is fairly constant in its characters, the chief differences in the males being the degree of invasion by purple-brown, none of the male paratypes having any on the face, though all have it on the under side. The female from near Hermanus is distinctly smaller than the other mature females, but it is only recently mature, the abdomen being very contracted and shrunken. It also differs to some extent in the markings, these being dirty white, and the median stripe on the pronotum being present only near the centre.

## PYRGOMORPHINAE.

### Genus PYRGOMORPHELLA Bolivar.

(Bol. Soc. Esp. Hist. Nat., iv, p. 457, 1904.)

The genus *Pyrgomorphella* was founded by Bolivar in 1904, to include the species *Pyrgomorpha granosa* Stål, from Beyrout, and *Pyrgomorpha serbica* Brunn., from Serbia, as well as three new species from Africa and Madagascar. Since that date no further species have been described. The material before me includes five very distinct new species, all from Africa, bringing the total number of known species up to ten. The subjoined key enables these species to be readily separated. Of the earlier species, I have examined the Type and female paratype of *P. serbica* and a good series of *P. granosa* from Jerusalem (Brit. Mus. Coll.), but as regards Bolivar's three species I have had to rely, in compiling the key, upon his own key and descriptions. *P. sphenarioides* is included, although as a completely apterous insect it should perhaps be placed in a separate genus.

*Key to the Species.*

1. Apterous . . . . . . . . . . *P. sphenarioides* Bol.
1.1 Brachypterous.
    2. Elytra hardly exceeding anterior margin of metanotum.
        3. Elytra rounded apically. . . . *P. madecassa* Bol.
        3.3. Elytra acuminate apically . . . *P. carinata* Bol.

2.2. Elytra extending over the whole of the metanotum or beyond.
3. Definite tympanum absent.
4. Elytra dorsal, the inner margins overlapping.
5. Elytra about twice as long as their maximal width, covering about half the first abdominal segment. Hind margin of pronotum not excised . . . *P. rugosa* sp. n.
4.4. Elytra dorso-lateral, well separated.
5. Elytra about twice as long as their maximal width, just covering the metanotum, separated at the base by a distance subequal to their length. Hind margin of pronotum widely angulately excised, not quite reaching the metanotum. Wings absent *P. capensis* sp. n.
5.5. Elytra less than twice as long as their maximal width, covering part of the first abdominal segment, separated at the base by a distance equal to about half their length. Hind margin of pronotum with small, sharp, median emargination—covering half the metanotum. Minute scarlet wings present *P. senecionicola* sp. n.
3.3. Definite tympanum present.
4. Elytra narrow (about four times their maximal width), diverging outwards and downwards from their point of origin. Scarlet wings absent. Insects not green.
5. Front nearly straight. Anterior lateral carinae of pronotum running back to join the posterior lateral carinae. Hind margin of pronotum widely angulately excised *P. granosa* Stål.
5.5. Front considerably concave. Anterior and posterior lateral carinae completely separate. Hind margin of pronotum with a very small median emargination . *P. variegata* sp. n.
4.4. Elytra broad (about twice their maximal width), growing straight backwards. Small scarlet wings present. Insects usually green.
5. Sulcus of frontal ridge widening considerably before meeting fastigium, and continuous on to it. Elytra covering part or whole of second abdominal segment, the lower margin rather sharply upturned about one-third from the apex. Hind margin of pronotum very slightly indented medianly. Pronotal carinae sharp . . *P. serbica* Brunn.

5.5. Sulcus of frontal ridge narrowing uniformly, extremely fine anterior to antennal bases. Elytra not extending on to second abdominal segment, lower margin not sharply upturned. Hind margin of pronotum uniformly convex. Pronotal carinae poorly developed
*P. rubripennulis* sp. n.

### *Pyrgomorphella capensis* sp. n.

*Male* (Type) (Plate XVII, E and F).—Body slender, fusiform, finely punctuated, slightly hairy, especially on the under side.

Antennae subequal to head and pronotum, 16-jointed, the third joint subequal to the fourth, the last two joints indistinctly separated, the last joint straight on the outside, sloping or incurved on the inside. Section between fifth and sixth joints triangular, the upper inner and outer lower faces being flat and broad, the inner lower narrower and slightly rounded.

Head from above conical, about twice as long as its width at the occiput. Occiput with a fine median carina originating at the fastigium and reaching almost to the pronotum. Fastigium as long as broad or very slightly longer, varying somewhat in shape among individuals. The foveolae in contact along a length equal to the greatest width of a foveola, distinctly but not strongly marginated, and but little depressed. Head from the side slightly and evenly convex above, the face strongly sloping, slightly and evenly concave (though the degree of concavity varies slightly in individuals), bending upwards between the antennae to meet the fastigium. Frontal ridge straight, fine, even, sulcate throughout, very nearly reaching the clypeus. Median ocellus extremely minute, evanescent. Lateral facial carinae faint, extending to the base of the antennae. A small tubercle reminiscent of an ocellus situated between the lateral facial carina and the lower angle of the eye. The true lateral ocelli very small, each situated directly in front of the eye, between the upper anterior angle and the base of the antenna, and at the base of the margin of the fastigium. Eyes from above and in front prominent, from the side more or less oval, but the hind end more or less obliquely truncate. A single row of white callosities stretching from the eye to the lower margin of the lateral pronotal lobes.

Pronotum on top slightly convex. Anterior margin slightly emarginate, posterior margin strongly angulately emarginate. Hind margin not quite reaching the metanotum. Median carina fine but distinct, intersected by the second and third transverse sulci. The first sulcus is represented only by a slight transverse furrow not reaching the lateral carinae. The second sulcus exactly bisects the median carina, and is slightly curved forwards at the point of intersection. Lateral carinae almost, though not entirely, obsolete, even in the prozona, and obliquely interrupted in the manner characteristic of the genus. They reach their greatest development in the metazona, where they are indicated by a line of two or more very small white callous tubercles, and a purplish mark. Lateral lobes with the inferior margin slightly sinuate, raised, and callous; anterior margin sloping forward, a very indistinct sulcus just behind it; hind angle about 90°, hind margin incurved; a broad callous rugose stripe immediately above the inferior margin, and continuous with the line of tubercles from the eye. The second sulcus distinct right to the callous stripe, the third sulcus not, though in some individuals it is. Surface of lateral lobes flat. Mesonotum just visible behind the pronotum. Metanotum resembling an abdominal tergum.

Mesosternal lobes subquadrate. Mesosternal interspace subquadrate, slightly wider than the lobes. Metasternal interspace not as wide as the mesosternal interspace, small, slightly transverse, oval, depressed. Prosternal tubercle blunt, broad.

Elytra about twice as long as their greatest width, the inner margins subparallel, separated at the base by a distance subequal to their length, with a few longitudinal rows of fine pits, just covering the metanotum. Wings absent.

Abdomen with a low dorso-median carina, obsolescent in places. Tympanum absent.

Fore and middle tibiae with outer and inner spines. Hind femora with the upper outer carina and the oblique carinae of the outer area not very strongly developed. Hind tibiae with 8–9 outer and 10 inner spines (11 in two male paratypes). A small apical outer and a large apical inner spine present.

General colour yellow-green. Antennae (except the two basal joints, which are green) and apex of fastigium purple-brown. Eyes pale brown. Row of callosities from eye, white. Pro- and mesonotum with a faint purple-brown line along the median carina, and continued along the abdomen, widening in the first abdominal tergum. Lower margin of pronotal lobes with a white band surmounted by a fine dark line. Hind portions of lateral carina with white callosities bordered below by a fine dark line. Under side pale. Fore and middle legs brownish. Sides of abdomen with a black spot on the anterior margin of each segment. Hind femora green, the knees pink at the apex. Hind tibia blue-green, the apex and the feet purplish.

*Female* (Allotype).—Larger than the male, body more fusiform. Antennae and eyes relatively smaller. Lateral facial carina further from the eye than in the male owing to the smaller size of the eye. Line of callosities from the eye, and also the callous border to the lateral pronotal lobes, less well developed than in the male. Median pronotal carina with a fine sulcus. Elytra separated at the base by a distance greater than the length of an elytron. Mesosternal interspace rectangular, transverse, about twice as wide as long. Metasternal interspace elongated transversely, about four times as wide as long, equal in width to the mesosternal interspace. Genital valves slender, gently curved, the upper pair roughly serrate in the basal half. Hind tibia with 10 outer and 10–11 inner spines. (In other paratypes there are 9 outer and 10–11 inner spines.) Both outer and inner apical spines present, the former small.

General coloration brown. Antennae purple-brown. Head dark brown. Line of callosities below the eye and on the pronotal lobes less vividly white than in the male. Abdomen brown with a dark brown stripe on the sides, especially in front. Under side pale. Fore and middle legs dark brown. Hind femora more or less mottled with brown and dark brown. Hind tibiae almost black apically.

*Measurements :*

| | Male. | Female. |
|---|---|---|
| | mm. | mm. |
| Body . . . | 11·25 | 15·7 |
| Pronotum . . . | 2·0 | 3·0 |
| Hind femur . . . | 6·5 | 8·0 |
| Antenna . . . | 4·75 | 5·0 |
| Head . . . | 2·5 | 3·0 |

Described from 4 males and 16 females from the Cape Flats, Cape Peninsula (Key, December 1930). The colour pattern exhibited by the Type apparently occurs only among the males, though other patterns are equally common. Both among males and females, however, coloration is very variable, ranging from pale grey, through all shades of grey and brown, to grey-green and blue-green. All the specimens were collected from a mass of low-growing silvery-leaved herbs of the family Compositae, which presumably forms their food-supply.

*Pyrgomorphella senecionicola* sp. n.

Larger than the previous species, and differing from it mainly in the pronotum from above, especially the posterior margin, the elytra, and the typical female coloration.

*Male* (Type) (Plate XVII, D an G).—Body fusiform, less slender and slightly more rugulose than in the previous species, slightly hairy.

Antennae subequal to head and pronotum, 16-jointed, the third joint much longer than the fourth, but showing traces of division (more pronounced in a few of the paratypes), the last two joints indistinctly separated, the last joint straight on the outside, sloping on the inside, not so pointed as in *P. capensis.* Section between fourth and fifth joints triangular, the upper inner and lower outer faces being flat and broad, the lower inner narrower and slightly rounded.

Head from above conical, very nearly twice as long as its width at the occiput. Occiput with a fine median carina originating at the fastigium and reaching the pronotum. Occiput somewhat rugose, the rugosities tending to become transverse on the vertex. Fastigium as long as broad, varying somewhat in shape among individuals. The foveolae in contact along a length equal to the greatest width of a foveola, more or less distinctly, but not strongly marginated, and but little depressed. Head from the side slightly and evenly convex above, the face strongly sloping, slightly and evenly concave, bending slightly upwards to meet the fastigium. Frontal ridge fine, straight, even, sulcate throughout, very nearly reaching the clypeus. Median ocellus small, but not as degenerate as in *P. capensis.* Lateral facial carinae faint, extending to the base of the antennae. A small tubercle reminiscent of an ocellus situated between the lateral facial carina and the lower angle of the eye. The true lateral ocelli each very small, situated directly in front of the eye, between the upper anterior angle and the base of the antenna, and at the base of the margin of the fastigium. Eyes from above and in front prominent, from the side more or less oval, but the hind end more or less obliquely truncate. A single row of white callosities stretching from the eye to the lower margin of the lateral pronotal lobes.

Pronotum on top slightly convex. Anterior margin slightly emarginate, posterior margin in general contour slightly convex, but with a small, sharp, median emargination. Hind margin covering half the metanotum. Median carina very faint, but discernible, intersected by the second and third transverse sulci. The first sulcus is represented only by a slight transverse furrow not reaching the lateral carinae. The second transverse sulcus is situated slightly but definitely in front of the mid-point of the median carinae, and bends slightly forwards at the point of intersection. Lateral carinae almost, though not entirely, absent in the prozona, and obliquely interrupted in the manner characteristic of the genus. In the metazona they are indicated by a line of two or more white callous tubercles and a purplish mark. The two lines of tubercles diverge slightly forwards. Lateral lobes with the surface very slightly impressed; the inferior margin slightly sinuate, raised, and callous; anterior margin sloping forward, a very indistinct sulcus just behind it, hind angle about 90°, hind margin incurved. A callous rugose stripe, narrower than in the previous species, immediately above the inferior margin and continuous with the line of tubercles from the eye. Both transverse sulci distinct down to this stripe.

Mesonotum not visible behind pronotum; hind half of metanotum visible only.

Mesosternal lobes with the inner hind angle rounded, somewhat less than 90°, the interspace slightly transverse, trapezoidal, about as wide as the lobes. Metasternal interspace oval, transverse, about twice as wide as long, nearly as wide as the mesosternal interspace.

Elytra larger than in *P. capensis*, less than twice as long as their greatest width, the inner margins converging towards the base, separated at the base by a distance about half their length, with many longitudinal rows of pits, covering part of the first abdominal segment. Minute scarlet wings, incapable of being expanded, present beneath the elytral pads.

Abdomen with a low dorso-median carina, callous in some parts, obsolescent in others. Tympanum absent.

Fore and middle tibiae with inner and outer spines. Hind femora with the oblique carinae on the externo-median area not strongly developed. Hind tibiae with 8–9 outer and 11 inner spines (8–10 outer and 9–11 inner in the male paratypes). A small apical outer and a large apical inner spine present.

General coloration green and brown. Antennae purple-brown except the two basal joints, which are green. Head brownish on the vertex, green elsewhere. Eyes brown. Lateral row of tubercles from the eye yellowish white. Pronotum pale brown on top, brownish green on the lateral lobes. Pleura greenish brown. Dorsal surface of abdomen brown, the apex and sides greenish brown. Fore and middle legs brown. Hind femur green, the apex of the knee brown. Hind tibia blue-green for about the basal two-thirds, the apical third and the tarsus pink. Under side pale brown.

*Female* (Allotype).—Larger than the male, the body more fusiform, more rugose. Antennae and eyes relatively smaller than in the male. Antennae 15-jointed (16-jointed in one paratype). Head from above relatively shorter, the median carina less distinct than in the male and much less distinct than in the female *P. capensis*. Median ocellus obsolete (present in the other paratypes). Lateral facial carina further from the eye than in the male. The row of callous tubercles below the eye narrower, less distinct, the tubercles reduced in number and in size, hardly larger than the other tubercles on the head. The stripe on the pronotal lobe similarly reduced. Median carina of pronotum obsolete except in the hindmost part of the metazona, where it is just discernible. Lateral pronotal carina very blunt—really only an angular bend in the plane of the pronotum—and with not more than one extremely small white tubercle (in some paratypes tubercles are quite absent). Surface of lateral lobes slightly more impressed. Mesosternal interspace rectangular, about twice as wide as long, and twice as wide as the lobes. Metasternal interspace strongly transverse, about five times as wide as long, and equal in width to the mesosternal interspace. Elytra separated at the base by a distance slightly less than the length of an elytron. Genital valves more robust than in *P. capensis*, strongly curved, the upper pair roughly serrate in the basal half. Hind tibia with 10 outer and 11 inner spines (8–9 outer and 10–11 inner among other paratypes). Both outer and inner apical spines present.

Antennae pale pinkish. Eyes pale brown. Callous stripe below eye and on inferior margin of pronotal lobe indistinct, yellowish white. The rest uniformly green.

*Measurements :*

| | Male. mm. | Female. mms. |
|---|---|---|
| Body | 13·0 | 19·25 |
| Pronotum | 2·8 | 4·2 |
| Hind femur | 7·5 | 9·2 |
| Antenna | 5·2 | 5·5 |
| Head | 2·7 | 3·25 |

Described from 7 males and 5 females, all from near Hermanus, in the Caledon Division, Cape Province (Key, January 1931). The males all possess essentially the same coloration, differing only in the extent to which brown invades green, while the pink apex to the hind tibia may be absent. All the females possess the same coloration except one, which is uniformly buff. No approach is made to the degree of variability exhibited in both males and females of *P. capensis.*

### *Pyrgomorphella rubripennulis* sp. n.

Larger than either of the last two species, and differing from them mainly in the pronotum and elytra, and in the possession of a tympanum.

*Male* (Type) (Plate XVII, C and H).—Body fusiform, slightly hairy, more rugulose than in the previous species.

Antennae subequal to head and pronotum together. Third and fourth joints imperfectly separated (quite separate in some paratypes). Counting these joints as separate there are 17 joints in all. The last joint with the outer margin straight, the inner sloping. Section between fifth and sixth joints more or less triangular, the one long side (representing the upper inner face) straight, the other long side (representing the lower outer face) curved, and the short side somewhat curved.

Head from above conical, less than twice as long as its width at the occiput. Occiput with a fine median carina originating at the fastigium and reaching the pronotum. Occiput somewhat rugose, more so than in the preceding species, the rugosities tending to become transverse on the vertex. Fastigium as long as broad, the apex more rounded than in the previous species (though in one paratype it is indistinguishable from *P. senecionicola*). The foveolae in contact along a length equal to the greatest width of a foveola, clearly marginated, little depressed. Head from the side very slightly convex—almost straight—on top, the face strongly sloping, slightly and evenly concave, bending slightly upwards to meet the fastigium. Frontal ridge straight, fine, even, sulcate throughout, very nearly reaching the clypeus. Median ocellus small. Lateral facial carinae clearly marked, extending to the base of the antennae. A small tubercle reminiscent of an ocellus situated between the lateral facial carina and the lower angle of the eye. The lateral ocelli small, situated directly in front of the eye between the upper anterior angle and the base of the antenna, and at the base of the margin of the fastigium. Eyes from above and in front prominent, from the side more or less oval, but the hind margin more or less obliquely truncate. A band of callous tubercles which may contain more than one row stretching from the eye to the lower margin of the pronotal lobes.

Pronotum from above slightly convex. Anterior margin nearly straight, posterior margin very obtusely angulate, the apex rounded, without any emargination (one male paratype has a slight median indentation). Hind margin covering about half the metanotum. Median carina very faint, in some places obsolescent, in others very finely sulcate, intersected by the second and third transverse sulci. The first sulcus is represented only by a slight transverse furrow not reaching the lateral carinae. The second transverse sulcus is situated in front of the middle, and has a forward bend in the middle. Lateral carinae very blunt and poorly developed, being little more than angular bends in the surface plane of the pronotum; interrupted obliquely in the manner characteristic of the genus; the hind portion with only one small white tubercle (two in some paratypes). Lateral lobes with the surface very slightly impressed, the inferior margin sinuate, raised, and callous, anterior margin sloping forward, a very indistinct sulcus just behind it, hind angle about 90°, hind margin incurved. A callous band of tubercles immediately above the inferior margin and continuous with the band of tubercles from the eye. Transverse sulci extending down to this band.

Mesonotum not visible behind pronotum. Hind part of metanotum only visible.

Mesosternal lobes with the inner angle rounded, somewhat less than 90°, the interspace trapezoidal, not transverse, about as wide as the lobes. Metasternal interspace oval, transverse, about twice as wide as long, nearly as wide as the mesosternal interspace.

Elytra larger than in the previous species, about twice as long as their greatest width, the inner margins almost in contact at the base; with rudimentary longitudinal veins separated by rows of pits, extending just beyond the hind margin of the first abdominal segment (in one paratype the elytra just fail to reach the hind margin). Elytra capable of being raised when the insect is disturbed to exhibit the minute scarlet wings, just capable of being expanded. Integument under and immediately around the wings (but covered by the elytra) scarlet.

Abdomen with a low dorso-median carina. The infero-apical part of the elytron covers a functional quadrant-shaped tympanum.

Fore and middle tibiae with outer and inner spines. Hind femora with the oblique carinae on the externo-median area not strongly developed. One hind tibia with 10 spines on the outside and 10 on the inside, and both apical spines present, the other with 8 outer spines, the apical one represented only by a small tubercle, and 11 inner spines (in the paratypes there are 9–10 outer spines and 10–11 inner; in one paratype there are 8 outer spines on both tibiae, the apical one in each case being only a small tubercle). When present, the outer apical spine is very small.

General coloration green invaded by purple-brown. Antennae dark purple-brown, except the basal two joints, which are somewhat greenish. Head on top mainly purple-brown, especially on the fastigium. Rest of head buff-green. Eyes pale brown. Pronotum purple-brown in the prozona, brownish green in the metazona. Lateral lobes of pronotum brownish green. The stripe below the eye and on the lower margin of the pronotum yellow. Pleura, abdomen, and fore and middle legs brownish green. Elytra purple-brown on top, greenish near the outer margin. Hind legs dull green, apex of knees pinkish. Under side buff-green.

*Female* (Allotype). — Larger than the male, the body more fusiform.

Antennae relatively slightly shorter than in the male, more ensiform at the base, and in that region also slightly serrate. Third and fourth joints imperfectly separated. Counting them as separate there are 18 joints in all, the last two imperfectly separated. (In some paratypes the third and fourth joints are quite separate, in others quite united, so that the antenna has only 17 joints.) Head from above relatively shorter than the male. Lateral facial carinae further separated from the eyes than in the male on account of the relatively smaller size of the eyes. Row of tubercles below the eye less well developed than in the male; the band of the inferior margin of the pronotal lobes nothing more than a yellow stripe, because the tubercles are no larger than those on the rest of the pronotum. Pronotum from above more convex than in the male. Hind margins very slightly incurved before they meet at the rounded apex. Lateral pronotal carina obsolescent in the prozona, where it is indicated by a row of extremely small callous tubercles (better developed in some female paratypes), similar to the male in the metazona. Surface of the lateral lobes slightly more impressed than in the male. Mesosternal lobes with the inner hind angle rounded, 90° (less than 90° in some paratypes), the interspace rectangular (trapezoidal in some paratypes), transverse, nearly twice as wide as the lobes and as its own length. Metasternal interspace transverse, about 6–8 times as wide as long, equal in width to the mesosternal interspace. Elytra more widely separated at the base than in the male, but not separated by a distance greater than half the width of an elytron at the base.

Hind tibiae with 10 outer and 11 inner spines, both apical spines present, but the outer one very small. (In other female paratypes there are 8–10 outer and 10–11 inner spines.) Genital valves more robust than in the two previous species, the upper pair more abruptly curved at the apex.

General coloration uniformly green. Antennae, eyes, and metanotum grey. Apex of fastigium and fore and middle legs with a trace of grey. Sides of abdomen with the lower margins of the tergites buff. Subocular and lateral pronotal stripes yellow. Infero-external carina of hind femur yellow.

*Measurements :*

| | Male. | Female. |
|---|---|---|
| | mm. | mm. |
| Body . . . . | 15·5 | 21·5 |
| Pronotum . . . | 4·0 | 5·25 |
| Hind femur . . . | 9·25 | 11·0 |
| Antenna . . . . | 6·25 | 6·8 |
| Head . . . . | 2·8 | 4·0 |

Described from 7 males and 6 females, all from Grahamstown, Eastern Cape Province (Key, May 1931). Some of the specimens are somewhat discoloured. The males vary in the extent to which purple-brown has invaded green. One male paratype is of exactly the same colour as the allotype, while one is uniformly brown. The females vary to a less extent. Both sexes vary considerably in size, shape of fastigium, and degree of concavity of face. The external lower carina of the hind femur may be either yellow (as described for the female allotype) or normal in both sexes.

The three species *capensis*, *senecionicola*, and *rubripennulis* form (in the order mentioned) an interesting series which shows a steady gradation from one species to the next in several characters. The direction of the gradation corresponds with the distribution of the species geographically. Thus, starting with *capensis* at Cape Town, and passing east along the coast, we come to *senecionicola* at Hermanus, about 40 miles away as the crow flies, and then to *rubripennulis* at Grahamstown, a further 430 miles east. The following characters show a regular increase from *capensis* to *rubripennulis*: size, relative length of elytra, degree of development of wings and tympanum; and the degree of emargination of the hind margin of the pronotum shows a regular decrease.

*Pyrgomorphella variegata* sp. n.

*Male* (Type) (Plate XVII, A and L).—Body fusiform, rugulose, very slightly hairy on the legs and under side.

Antennae in length subequal to head and pronotum together, 17-jointed, the third joint not perfectly separated from the fourth, the last joint straight on the outside, sloping on the inside; somewhat flattened and serrate, especially near the base, triangular in section, the long sides of the triangle representing the upper inner and lower outer faces.

Head from above conical, about twice as long as its width at the occiput. Occiput with a fine median carina, originating at the fastigium and reaching the pronotum. Fastigium slightly longer than wide, slightly convex, the apex widely rounded. Foveolae in contact along a length equal to the greatest width of a foveola, not impressed. The carinae which, at the base, form the inner margin of the foveolae are not in contact until the very apex of the fastigium, owing to the fact that they invade the foveolae and no longer form the true inner margins of the foveolae. Head from the side evenly convex above, the face strongly sloping, considerably concave. Frontal ridge narrow, very indistinct in the lower part, not quite reaching the clypeus, sulcate throughout, narrowing gradually towards the fastigium. Median ocellus minute. Lateral ocelli small, situated just in front of the eye, and between the eye and the base of the antenna. Lateral facial carina faint in the middle, more distinct above and below. A small low tubercle reminiscent of an ocellus situated between the lateral carina and the lower angle of the eye. Eyes from above and in front prominent, from the side more or less oval, but the hind end more or less obliquely truncate. A fairly broad band of more than one row of raised callosities stretching from below the eye to the base of the lateral pronotal lobe. Surface of the gena above and below the subocular stripe smooth and shiny.

Pronotum on top more or less flat. Anterior margin nearly straight, posterior margin slightly convex, with a slight median emargination. Hind margin not quite reaching the metanotum. Median carina low and fine but distinct, intersected by three transverse sulci. The first is poorly developed and only just reaches the lateral pronotal carinae; the second is well developed and cuts deeply into the lateral carinae; the third is also well developed, but cuts the lateral carinae less deeply. The second sulcus cuts the median carina slightly in front of the mid-point, and is slightly bent forward at the point of intersection. The lateral carinae are quite well developed, and obliquely interrupted. The anterior portions of the carinae do not extend further back than the second transverse sulcus, and diverge strongly forwards. The posterior portions diverge forwards at an angle subequal to that of the anterior portions, and extend obliquely downwards and forwards into the lateral lobes as far as the anterior margin, though they are less well developed at the very front. At the second sulcus the anterior portion of the lateral carina and the posterior portion are separated, along the line of the sulcus, by a distance subequal to the distance between the second and third sulci. In front of the second sulcus, running right between the anterior and produced posterior portions of the lateral carina, is another short low carina formed by a row of tubercles; this carina bends upwards in front to meet the anterior portion of the lateral carina. Lateral pronotal lobes with the lower margin somewhat sinuate, raised, and callous; the anterior margin sloping forward, the posterior margin incurved; hind angle about 90°, rounded. Surface of the lateral lobes impressed. A broad, raised, yellowish, callous stripe traversed by irregular sulci extends just above the lower margin and is continuous with the subocular stripe; it is less well developed in the region behind the third sulcus. Shortly behind the anterior margin of the lateral lobe is a transverse sulcus. The second and third sulci reach the callous stripe. The surface of the lobe in front of the third sulcus and above the callous stripe is smooth and shiny, that behind the third sulcus lightly rugose like the disk.

Mesonotum just visible behind the pronotum. Metanotum smoother than the abdominal segments. Mesosternal lobes and interspace subquadrate and subequal. Inner hind angles of mesosternal lobes not rounded. Metasternal interspace more or less oval, but the anterior margin straight; about twice as wide as long, not quite as wide as the mesosternal interspace.

Elytra 3–4 times as long as their maximal width, diverging outwards and downwards from their point of origin, the outer margin nearly straight, the inner slightly curved, the apex rounded; just failing to reach the hind margin of the first abdominal segment, separated at the base by a distance subequal to their maximal width.

Abdomen without a dorso-median carina. A small tympanum present just underneath the apex of the elytron.

Fore and middle tibiae with outer and inner spines. One hind leg missing, the other detached. Hind femur with the upper outer carina and the oblique carinae on the externo-median area well developed. Hind tibia with 8 outer and 11 inner spines. An apical inner, but no apical outer spine present.

General coloration brown. The Type is clearly a good deal faded. Antennae grey, somewhat paler near the outer margin, and the distal margin of each joint pale, so that the antenna appears striated. Basal three or four joints brown. Head brown, somewhat darker along the hind part of the median carina, and above the subocular stripe, which is yellowish. Eyes reddish brown.

Pronotum discoloured on the lobes and the anterior part of the disk; brown, darker on the shiny part above the stripe on the inferior margin of the lobes. The stripe discoloured, probably yellowish in life. The pleura are very characteristically coloured. Beginning at the suture separating the anterior half of the mesopleuron from the mesosternum, and working backwards, we have first a dark brown region; at about the lower hind angle of the pronotal lobe there arises a pale band running parallel to the pleural sutures, to the coxa; behind this comes a dark band, and behind that, just in front of the mesopleural suture, another pale band; the hind half of the mesopleuron—that is, behind the afore-mentioned suture—is mainly dark; then comes the suture separating the meso- and metapleura, and behind that the front of the metapleuron, which is pale, then the metapleural suture, followed by the hind half of the metapleuron, which is dark save for the infero-posterior process, which is pale.

Abdomen brown with a narrow dorso-median pale stripe. The sides with a pale stripe along the lower margins of the terga, surmounted on each segment by a small dark mark. Elytra and legs brown.

*Female* (Allotype). — Larger than the male, the body more fusiform, more rugose.

Antennae with the joints relatively longer than in the male, especially the last one, less flattened and serrate, the one 15- the other 16-jointed.

Head from above less than twice as long as its width at the occiput. Median carina very faint. Foveolae slightly impressed. A slight transverse depression on the vertex shortly behind the apex of the eyes. Head in profile nearly straight above. Median ocellus not as small, nor the frontal ridge so indistinct below the ocellus, as in the male. Eyes relatively smaller than in the male. Pronotum on top with a few slight depressions, especially one on either side of the metazona. Hind margin covering part of the metanotum. Transverse sulci less well developed than in the male. Lateral pronotal carinae subparallel. Mesonotum not visible behind the pronotum. Mesosternal lobes and interspace trapezoidal, the inner hind angles of the lobes considerably less than 90°, the interspace not quite twice as wide as long. Metasternal interspace as wide as the mesosternal, about four times as wide as long. Elytra not quite as attenuate as in the male, about three times as long as their maximal width, just surpassing the hind margin of the first abdominal segment, separated at the base by a distance nearly twice their maximal width. Genital valves strongly curved, black-tipped, the upper pair coarsely serrate above, slightly hairy below.

Coloration essentially similar to the male, but unfaded. Antennae purple-brown, striated as in the male. Head pale in front. Subocular stripe yellowish, bordered above and below by a very dark, nearly black band. Head and pronotum on top purple-brown, but the heads of the numerous small rugosities yellowish, so that a paler brown effect is produced. The dorsal surface of the abdomen is darker, because there are fewer rugosities. A very dark dorsomedian stripe on the head. Eyes purple-brown. Shiny part of lateral pronotal lobe deep purple-brown. Pleura as in male, except that the lower anterior part of the metapleuron is dark purple-brown. Under side mottled purple-brown and yellowish. Fore and middle legs purple-brown. Hind legs missing.

*Measurements :*

| | Male. | Female. |
|---|---|---|
| | mm. | mm. |
| Body . . . . | 19·5 | 28·0 |
| Pronotum . . . . | 4·0 | 5·5 |
| Hind femur . . . | 9·5 | .. |
| Antenna . . . . | .. | 8·25 |
| Head . . . . | 3·8 | 3·8 |

Described from one male (Type) from Narosura, Masai Reserve, Kenya (Capt. A. O. Luckman, February 1914, 6500 feet), and one female from El donyo eb Viru, Kenya (C. S. Betton, 1902, May–July). Though the Type and allotype differ in several points, especially the top of the head, these are almost certainly sexual differences. In any case, the shape of the head varies considerably among individuals in the other species.

### *Pyrgomorphella rugosa* sp. n.

*Male* (Type) (Plate XVII, B and K).—Body slightly hairy.

Antennae slightly shorter than head and pronotum together, 15-jointed, the third joint imperfectly separated from the fourth and itself showing a very faint sign of a dividing line, the last joint straight on the outside, curved on the inside; slightly wider and flattened at the base, evenly tapering, triangular in section, the long sides of the triangle representing the upper inner and lower outer faces.

Head from above slightly conical, about twice as long as its width at the occiput. Occiput with a fine, well-raised, median carina originating a short distance behind the fastigium, and obsolete shortly behind the eyes. Fastigium about as long as wide, well marginated, the apex widely rounded; foveolae in contact along a length equal to the greatest width of a foveola, slightly impressed. Vertex with a few irregular rugosities. Head in profile strongly convex above, the bend being mainly between the eyes; the face strongly sloping, irregularly concave, suddenly impressed a short distance below the ocellus. Frontal ridge wider than in all the previous species, distinctly marginated throughout, not quite reaching the clypeus, widened at the ocellus, suddenly depressed shortly below the ocellus, strongly compressed between and above the antennae, but sulcate throughout. Median and lateral ocelli well developed. Lateral ocelli situated level with the front of the eye, and between the eye and the base of the antenna. Lateral facial carinae distinct throughout, well developed in the region of the eyes, less so lower down. A small tubercle reminiscent of an ocellus situated between the lateral carina and the lower angle of the eye. Face and gena with a few small rugosities. Eyes from above and in front very prominent, from the side nearly circular. No subocular stripe.

Pronotum on top slightly convex, coarsely rugose. Anterior margin slightly and widely emarginate. Posterior margin slightly convex, not emarginate, not reaching the hind margin of the mesonotum. Median carina well raised, but, like all the carinae, widely interrupted and broken up by the transverse sulci, including the first. The first sulcus is very faint and stretches only as far as the front portions of the lateral carinae. The second and third sulci are well developed, widely interrupting the median and lateral carinae. Both bend forward somewhat at their points of intersection with the median carina. The second sulcus intersects the median carina at its mid-point or very slightly in front. The lateral carinae are much broken up, both by the transverse sulci and apart from them, and their course is further obscured by the presence of other rugosities and short carinae on the pronotum and its lobes.

Each lateral carina is obliquely divided into an interior and posterior portion. The anterior portions can be traced back as far as the second transverse sulcus, and diverge forwards. The posterior portions are most clearly indicated in the metazona; they are produced forwards and downwards on to the lateral lobes, becoming obsolescent towards the anterior margin. Lateral pronotal lobes with the surface slightly impressed, the lower margin strongly sinuate, raised, and callous; the anterior margin sloping forward, the posterior margin incurved; hind angle obliquely truncate. Shortly behind the anterior margin is an indistinct short sulcus. The second transverse sulcus extends on to the lateral lobe and nearly reaches the lower margin; the third sulcus does not extend so far. Surface of lobe strongly punctured in the metazona.

Mesosternal interspace trapezoidal, wider than the lobes. Inner hind angles of mesosternal lobes rounded, less than 90°. Metasternal interspace somewhat depressed, oval, slightly wider than long, narrower than the mesosternal interspace.

Elytra more or less oval, about twice as long as their maximal width, the outer margin straight for the basal two-thirds, bending inwards for the apical third; inner margins straight except at the very base, overlapping right to the apex, but leaving a small triangular portion of the mesonotum showing between them at the very base. Elytra covering the whole of the metanotum, no part of which is visible, and half the first abdominal segment.

Abdomen with a low dorso-median carina. Tympanum indicated only by a small depression behind the first abdominal spiracle.

Anterior and middle femora well developed, the tibiae spined. Hind legs missing.

General coloration grey-brown, the apices of the larger rugosities dark. Antennae grey, in the basal part paler at the margins than in the centre; there are also paler regions at about joints 9–11 and joint 14. Foveolae of fastigium also greyish. Eyes reddish brown with dark streaks. Face pale brown. Frontal ridge, below the ocellus, at the point where it is suddenly depressed, with the margins black; margins below that point also black in parts. Lower margin of pronotal lobes with a broad pale stripe interrupted at the second sulcus. Pronotal lobes darkish except in the metazona. Abdomen dark in the region of the first spiracle, the lower margin of each tergite with a slightly oblique black mark. Under side buff.

*Measurements*:

| | Male mm. |
|---|---|
| Body | 16·4 |
| Pronotum | 3·0 |
| Hind femur | .. |
| Antenna | 5·0 |
| Head | 3·0 |

Described from one male only in the South African Museum's collection, from Dunbrody, Uitenhage Division, March 1912.

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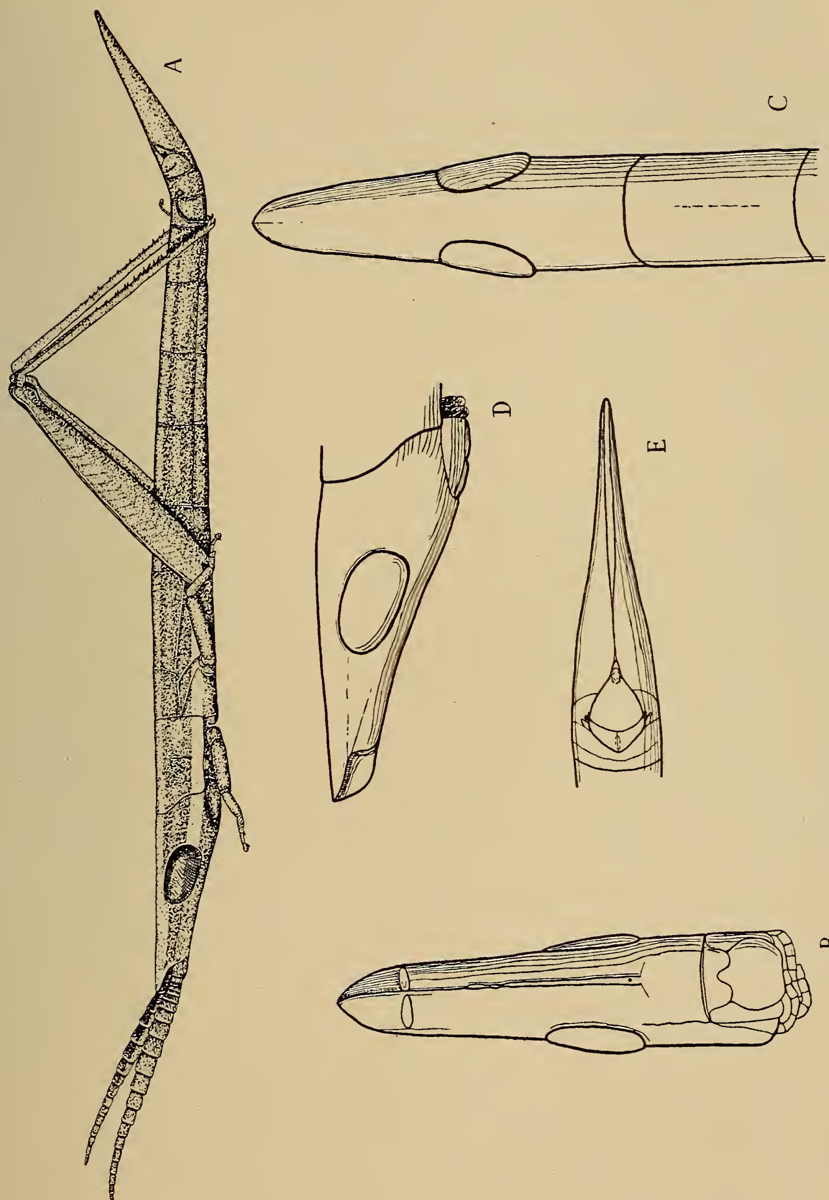
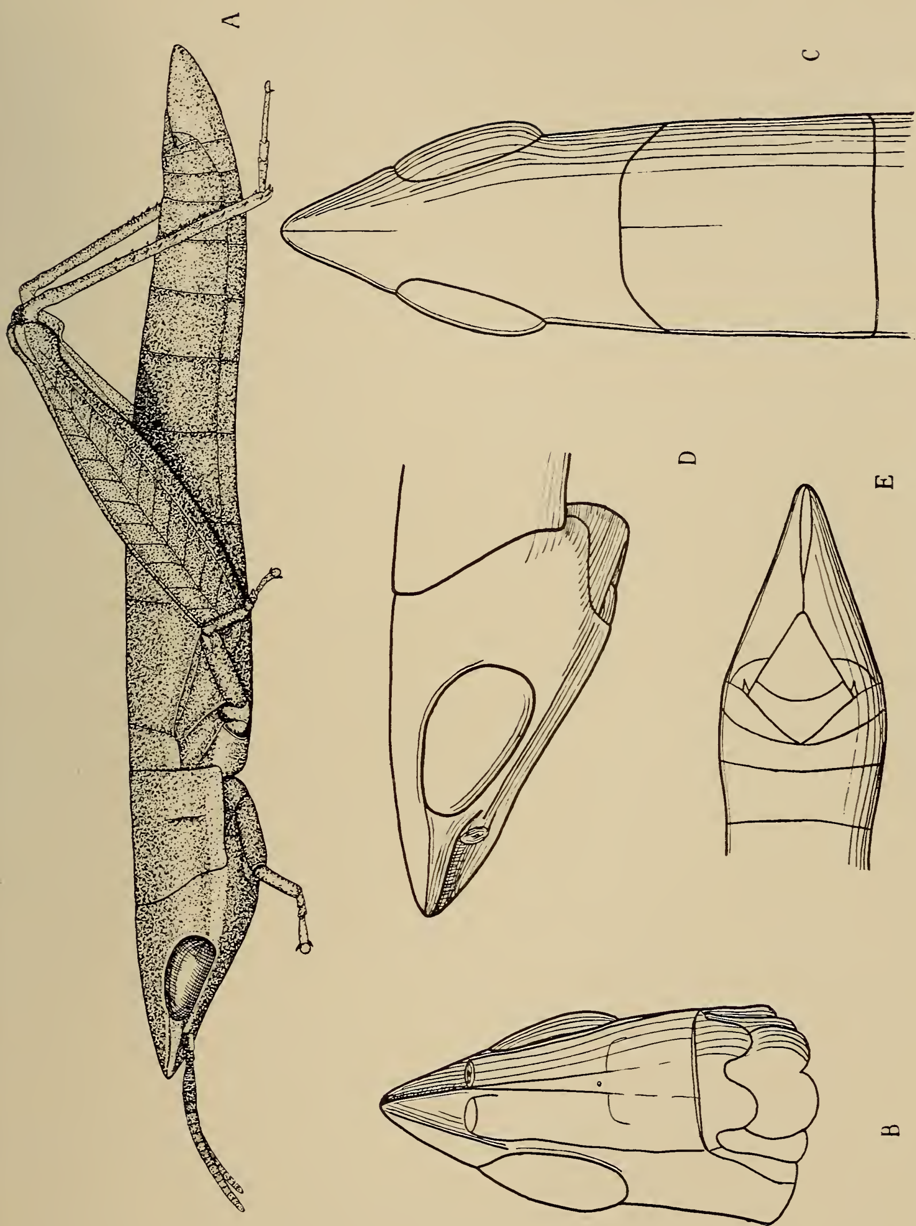
EXPLANATION OF PLATES XIII–XVII.

XIII. *Betiscoides meridionalis* Sjöst.
XIV. *Betiscoides sjostedti* sp. n.
XV. *Betiscoides parva* sp. n.
XVI. *Frontifissia elegans* sp. n.
XVII. *Pyrgomorphella capensis* sp. n., figs. E, F.
" *senecionicola* sp. n., figs. D, G.
" *rubripennulis* sp. n, figs. C, H.
" *variegata* sp. n., figs. A, L.
" *rugosa* sp. n., figs. B, K.



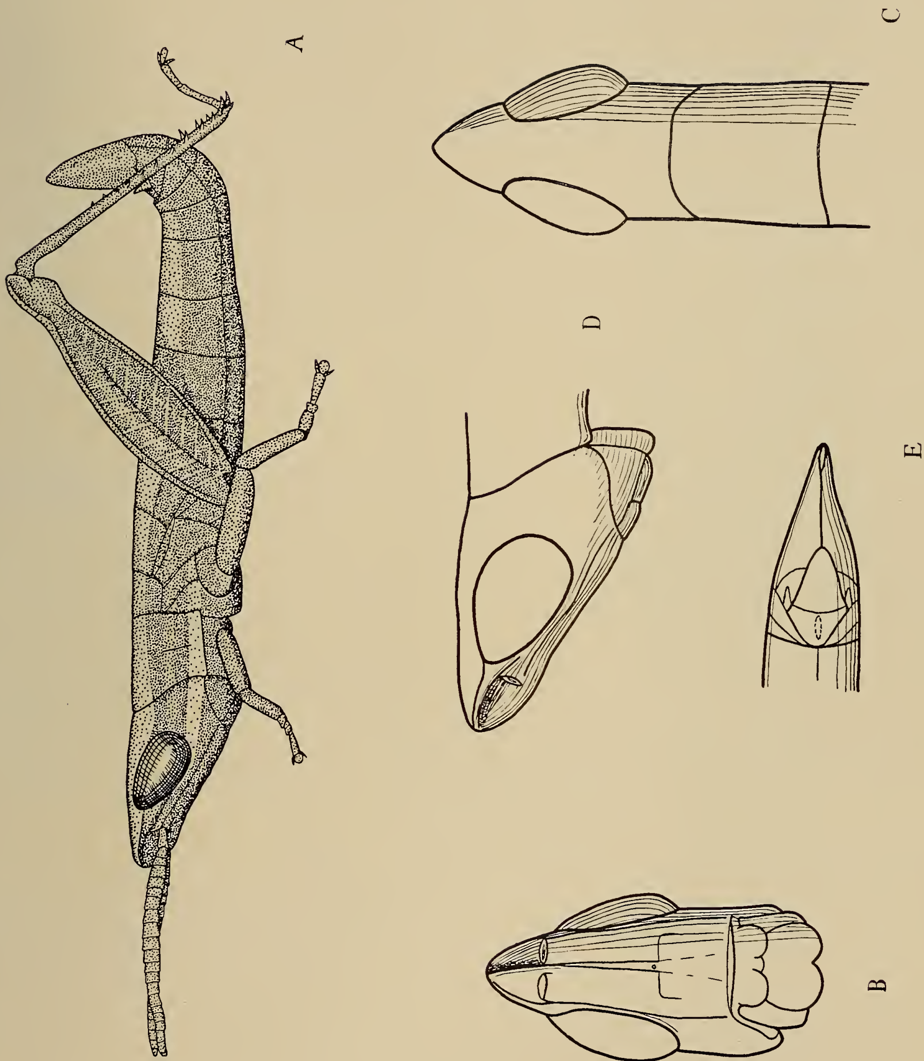

SOUTH AFRICAN *ACRIDIIDAE.*

K. H. L. Key. Neill & Co., Ltd.




SOUTH AFRICAN *ACRIDIIDAE*.

*K. H. L. Key.* *Neill & Co., Ltd.*

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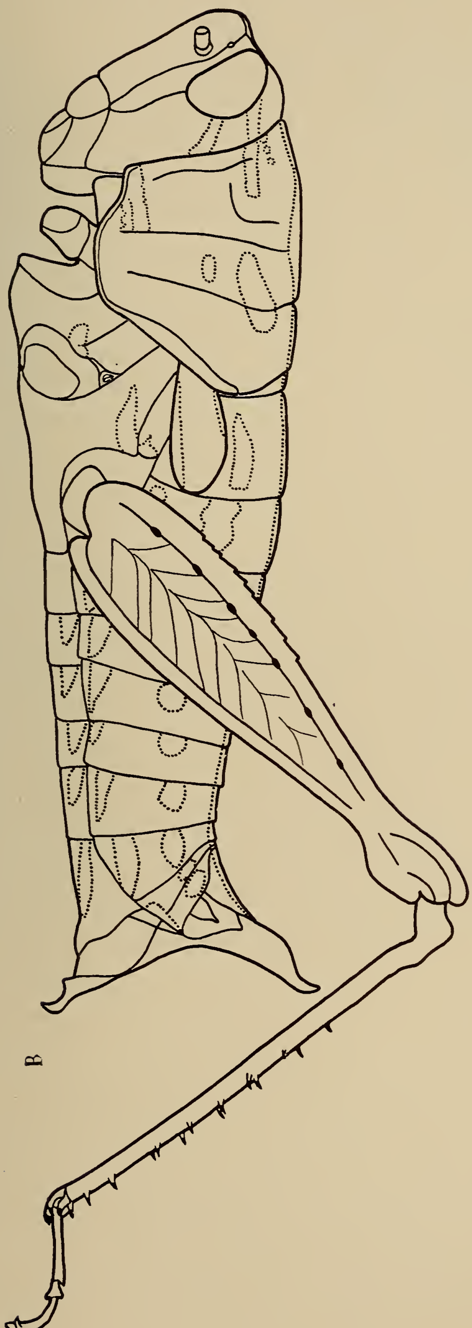

B

A

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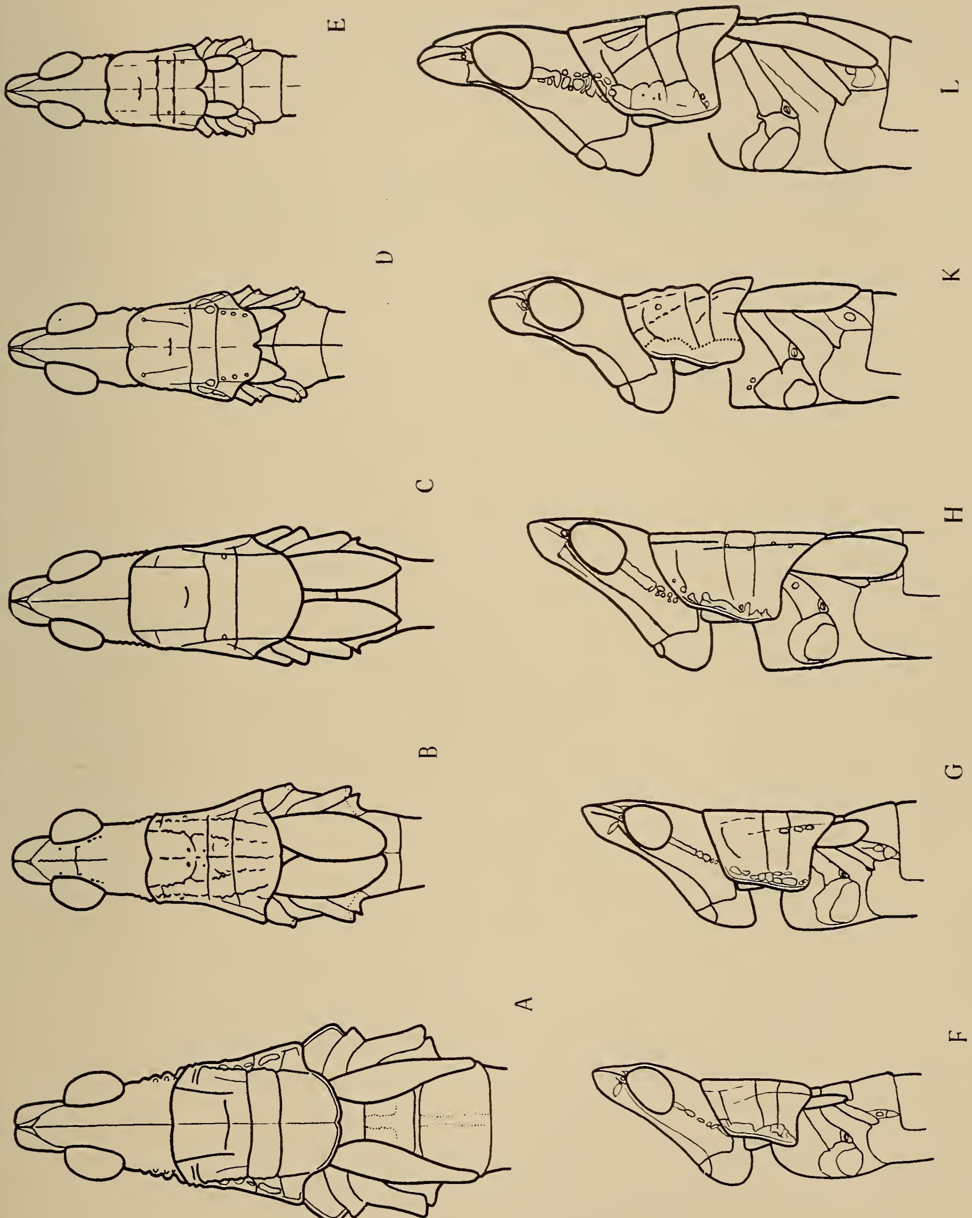


K. H. L. Key. *Neill & Co., Ltd.*

## 12. *Notes on Dragon-flies (Odonata) of the S.W. Cape, with Descriptions of the Nymphs, and of New Species.*—By K. H. Barnard, D.Sc., Assistant Director.

(With 32 Text-figures.)

This is the tenth report on the Fauna of the Mountain Ranges of the Cape Province, for the investigation of which I have received grants from the Royal Society of South Africa and the Research Grant Board.* My thanks and acknowledgments are herewith tendered to these bodies.

Both from a general faunistic point of view, and also in connection with the food of trout and other fishes, dragon-flies are of considerable importance. During the course of my researches on the Mountain Fauna much material and many observations have been collected. Additional occurrences and localities of several species since the publication of Ris' monograph of the South African Odonata (1921, Ann. S. Afr. Mus., vol. xviii) have accumulated and are worthy of record.

The main purpose of this paper is to describe the nymphs (larvae, or naiads) of the Cape species, only one of which was available for inclusion in Ris' work.

Only those species occurring in the S.W. Cape, roughly within a radius of 200 miles from Cape Town, have been included, as I have had no opportunities of investigating the life-histories of the more tropical forms. The fauna-list for this area includes 39 species and 2 varieties, of which 4 species and 2 varieties are described as new. The nymphs of 24 of these have been discovered; in terms of genera, the nymphs of only 4 genera out of 22 remain to be discovered (viz. *Lestes*, *Ceriagrion*, *Palpopleura*, *Sympetrum*).

* Previous reports: 1. "Freshwater Crustacea," Trans. Roy. Soc. S. Afr., vol. xiv, 1927. 2. "Colophon (Coleoptera)," *ibid.*, vol. xviii, 1929. 3. "Alder-flies," *ibid.*, vol. xix, 1931. 4. "May-flies," *ibid.*, vol. xx, 1932. 5. "Terrestrial Isopoda (Woodlice)," Ann. S. Afr. Mus., vol. xxx, 1932. 6. "Further New Species of Colophon," Stylops, vol. i, pt. 8, 1932. 7. "A New Corduline Dragonfly," *ibid.*, vol. ii, pt 7, 1933. 8. "Caddis-flies," Trans. Roy. Soc. S. Afr., vol. xxi, 1934. 9. "Stone-flies," Ann. S. Afr. Mus., vol. xxx, 1934.

In 1929 Brain (Insect Pests and their Control in South Africa, pp. 159–160) gave a short key to 15 genera of dragon-flies found in the winter-rainfall area. Following the localities given in Ris, he did not include any Gomphines or Cordulines, or the genera *Chlorocypha* (*olim Libellago*) and *Elattoneura* (*olim Disparoneura*).

As regards the imagos, particular attention has been paid to the genitalia of both sexes, and for the sake of comparison several figures of species occurring outside the S.W. Cape area are given. This aspect of dragon-fly taxonomy is one to which far too little attention has been paid in the past. In so many instances where the "♂ genitalia" are figured, it is found that actually only the secondary or accessory structures are figured; and discussions on synonymy take no account of the *penis,* which, as the sequel will show, often offers valuable specific characters.

Once again I have to record the great assistance rendered by Mr. H. G. Wood, who has discovered several new localities for species not hitherto believed to occur so far to the south-west, and who has very generously provided motor transport on our joint expeditions. Mr. A. C. Harrison, Mr. F. G. Chaplin (of the Jonkershoek Trout Hatchery), and Mr. J. C. Dendy have taken an interest in the work from the angler's point of view, and have been of very material assistance. Mr. Harrison was the first to discover a Corduline in South Africa (Stylops, vol. ii, 1933), and has bred several of the nymphs recorded in the present paper. My colleagues Dr. A. J. Hesse and Mr. C. W. Thorne have also rendered much assistance.

Mr. Harrison has contributed the following paragraphs on Economics, for which I express my thanks.

## Economics.

Dragon-flies may take some part in the control of aquatic insects which are directly harmful to man—such as mosquitoes, or even of orchard pests in the vicinity of streams and dams.

Their importance to inland fisheries depends to some extent upon the food requirements of the fish under consideration. Apart from vertebrates, dragon-flies are the dominant insectivores in many waters, and thus their position in the economy of trout waters is a doubtful one. Trout grow well and attain high condition upon a regular diet of the smaller aquatic insects—such as may-flies, caddises, and chironomids, and dragon-flies must be considered as direct competitors for such food. In stony mountain streams, dragon-fly larvae are usually well concealed from the trout, either on or beneath the substratum (Aeschnine, Gomphine, and Libelluline nymphs) or in vegetation (damsel-fly nymphs); and they are not very common in numbers in trout stomachs although they are sometimes prominent in bulk, except when floods have disturbed them from their usual haunts. At such times they occur more numerously along with other large food items—such as alder-fly larvae and river crabs.

In the slower reaches of trout streams, the larvae may play a very useful part in the diet of the larger trout. On 9th May 1936 Mr. Robert Murdock, of Capetown, caught a rainbow trout of $1\frac{1}{4}$ lb. in the lower Eerste River at Faure, C.P. Its stomach contained 115 *Mesogomphus* nymphs (averaging about $\frac{3}{4}$ in. long), 10 *Aeschna* nymphs ($\frac{1}{2}$ in. to $1\frac{1}{4}$ in. long), and 10 Libelluline nymphs (about $\frac{1}{2}$ in. long, and probably *Trithemis* sp.); and no other food could be recognised. Another trout of similar size caught at the same time contained a smaller amount of the same larvae.

*Aeschna* and *Anax* nymphs are a direct menace to trout alevins and young fry.

Adult dragon-flies are not usually common in trout stomachs, but on one occasion an adult of the large species *Anax speratus*, the "Great Red Dragon-fly," was found in the stomach of a brown trout of 1 lb. caught in the Witte River, Wellington, during the summer peak of this species. (Several long *Mermis*-like parasitic Nemotodes were found loose in the same stomach. Tillyard (1917, p. 331) mentions a *Filaria* found by Selys.)

Dragon-flies are of value as a fish-food in enclosed waters devoted to large-mouth black bass, as, on the whole, these fish require larger food-items than do trout. Libelluline dragon-fly larvae have been found to be a staple aquatic insect food taken by the bass in Paarde Vlei Lake, Somerset West, and some stomachs have contained from 50 to 100 individuals forming in bulk a good meal. The annual visit of the "Migratory Dragon-fly," *Sympetrum fonscolombei* Selys, to Cape waters has been noticed to induce surface feeding by black bass and to improve the fly-fishing. Black bass have been seen to leap right out of the water to take these insects as they flew close to the surface, particularly when the females were going through the actions of ovipositing or flying *in copula* with the males.

## Terminology of Wing Veins.

Although Ris retained the old system, he was evidently open to receive the new interpretations of Lameere and Tillyard, based on a study of fossil wings. It might be thought convenient to adopt in this paper the same terminology as in Ris' monograph of the South African Dragon-flies, but one must keep pace with scientific progress. Tillyard's notation, as expressed in his Insects of Australia and New Zealand (1926), is therefore adopted here, and the following table will show the chief alterations. Tillyard's Biology of Dragon-flies (1917) is such a useful book that the preliminary new notation there used is also included.

| Ris 1921. | Tillyard 1917. | Tillyard 1926. |
|---|---|---|
| R | R | $R_1$ |
| $M_{1-3}$ | $M_{1-3}$ | Rs |
| $M_1$ | $M_1$ | $R_2$ |
| — | $M_{1A}$ | $IR_2$ |
| $M_2$ | $M_2$ | $R_3$ |
| Rs | Ms | $IR_3$ |
| $M_3$ | $M_3$ | $R_{4+5}$ |
| $M_4$ | $M_4$ | MA |
| Cu | Cu + A | $Cu_2 + 1A$ |
| $Cu_1$ | $Cu_1$ | $Cu_2$ |
| $Cu_2$ | $Cu_2$ | 1A |
| A* | Ab | A′ |
| Cuq | Ac | Ac |

The Radial and Median Supplements (Rspl, Mspl) may remain the same, though the latter should really be MAspl. $Cu_1$, except in a single fossil form, is regarded as absent in all fossil and recent Odonata (Tillyard, *loc. cit.*, 1926, p. 68, footnote).

### Genitalia.

For purposes of the systematics of this paper, attention had already been paid to the penis, and certain structural peculiarities had been noted, when Mr. Harrison gave me a pair of *Ischnura senegalensis* preserved in alcohol, which had remained *in copula*. The study of this pair enabled one to observe the interaction of the several parts of the ♂ copulatory appendages and the ♀ valve and stylets.

The grasping of the ♀ prothorax by the ♂ claspers is well known, but a figure (1*b*) is given of this specimen showing how the ♀ prothoracic ridge is held between the lower and upper ♂ appendages, while the projecting tergite of the 10th segment presses down on the ♀ mesothorax (*cf.* Kennedy, Proc. U.S. Nat. Mus., vol. xlix, p. 296, fig. 89, 1915).

The relation of the parts of the 2nd segment ♂ and the genital segments of the ♀ is shown in fig. 1*c*. The amplexus is actually closer, but for the sake of clearness in the figure the sexes have been pulled slightly apart. The bursa copulatrix or vagina (*b*) (*cf.* fig. 1 *d*) opens between the bases of the stylets on the 8th segment. Both pairs of stylets lie in the anterior pocket of the genital fossa of the ♂, where they are held by the anterior lamina and its posterior processes (Tillyard, Biol. Dragonfl., p. 218). Kennedy (*loc. cit.*, p. 296) says that the anterior laminae fold inwards and that the ovipositor sheath of ♀ does not fit into the depression on 2nd segment of ♂.

Kennedy examined dried material. In the present instance the ♂ anterior laminae undoubtedly clasp and enclose the ovipositor sheath of ♀ (genital valves).

The penis is inserted to the end of the bursa or vagina, with the apical fork recurved and the two spines pointing distally (for a more detailed figure of the penis of this species, see fig. 19).

In all the *Zygoptera* studied in this paper, the penis is strongly curved like a fish-hook, and for the most part is heavily chitinised (see figs. 4, 9, etc.). It is attached at two points (fulcra) in the median line to the membranous and elastic wall of the genital fossa (fig. 1*c*, *h*). From the upper (anterior) point of attachment a thickening of the wall of the fossa forms a chitinous strut (*st.*) on either side, which runs downwards and backwards, with an elbow-like articulation, to the posterior hamule. Splaying or an outward lateral movement of the hamules will exert a downward pull on the penis, which will thus be exserted from the fossa to enter the bursa of the ♀.

The heavy chitinisation of the basal portion is continued on the anterior and ventral edges of the penis, but the inner and dorsal surface forms a groove (fig. 1*h*, *gr.*) bordered by a membranous flange. Useful specific characters may often be found in the sculpturing of the flanges and the presence of spines on the chitinous framework (see figs. 11–13). Kennedy (Ohio Journ. Sci., vol. xxi, No. 1, 1920) has already figured the penes of four South African species (3 genera), but as his purpose was to show the general relationships of the Zygopterous genera his figures are too small for details.

The apical portion is more or less distinctly hinged. The chitinous framework of the basal part is continued as a pair of more or less strongly chitinised plates, and the groove formed by the flanges is continued on to a soft membranous flap of variable extent. Sub-apical, exsertile appendages (distal hook) of manifold shape occur (figs. 9, etc.), which are of specific or even generic importance.

These appendages may be for the purpose of retaining the penis in the bursa, while the sperms or sperm-packets pass down the groove formed by the flanges. How the sperms are propelled is a matter

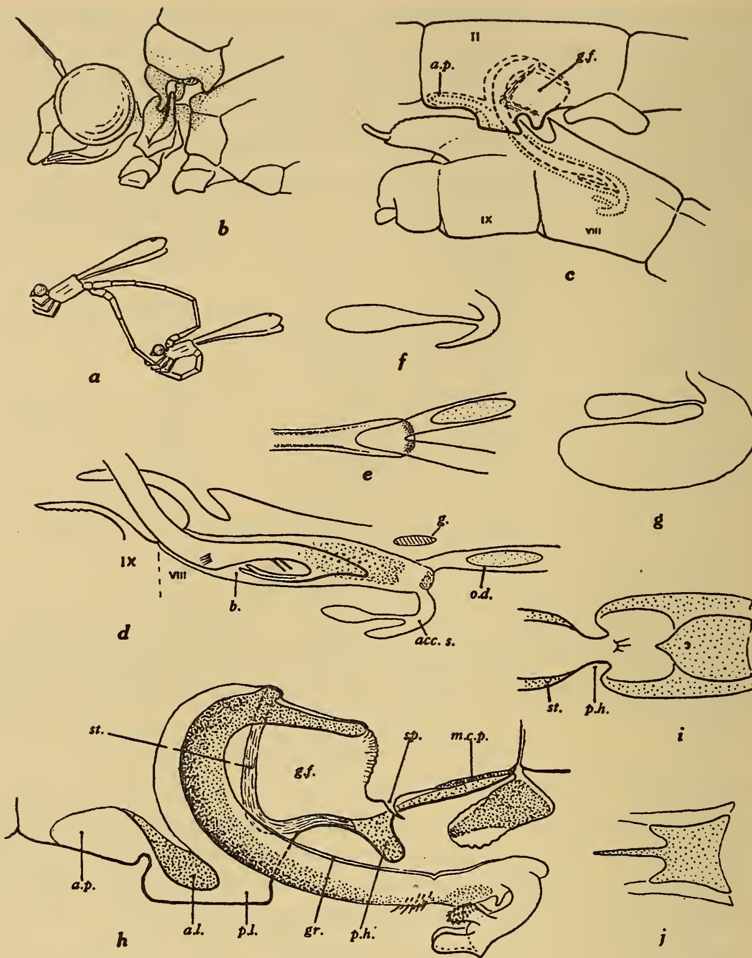


Fig. 1.—*Ischnura senegalensis.* *a*, ♂ and ♀ *in copula.* *b*, apex of abdomen ♂ clasping prothorax ♀. *c*, optical section of ♂ and ♀ genitalia *in copula.* *d*, penis ♂ in bursa, ventral surface of latter uppermost. *e*, ventral view showing the 2 oviducts entering the bursa. *f*, *g*, accessory sacs from other specimens. *j*, ventral view of median chitinous plate (cf. *h*, *i*).

*Phaon iridipennis.* *h*, sagittal section of 2nd abdominal sternite ♂, showing genital fossa, penis, and associated structures, and appendage of 3rd sternite.

*Chlorolestes conspicua.* *i*, ventral view of median chitinous plate.

(*acc.s.* accessory sac (with or without saccule). *a.l.*, anterior lamina. *a.p.*, anterior pocket. *b.*, bursa copulatrix or vagina. *g.*, 8th ganglion. *g.f.*, genital fossa. *gr.*, groove between membranous flaps on penis. *m.c.p.*, median chitinous plate. *o.d.*, oviduct. *p.h.*, posterior hamule. *p.l.*, posterior lobe. *sp.*, spine. *st.*, strut.)

for conjecture. Possibly the curious structure on the anterior margin of the 3rd sternite may help to perform this function. It would certainly seem to serve the purpose of retaining the sperms in the genital fossa prior to intromission.

This vesicular process of the 3rd sternite appears to be homologous with the "vesicle of the penis" (Tillyard) of the *Anisoptera*. It is heavily chitinised along the sides and basal ventral surface, leaving the whole of the upper (inner) and the lower apical surfaces membranous, and the membranous portion is apparently distensible. In ventral view the membranous area has the appearance of a window (fig. 9). It is filled with a homogeneous tissue, without tracheae, and there is no opening either to the exterior or into the body-cavity. In this latter respect it differs from its supposed homologue in the *Anisoptera*. In repose the apex of the penis is tucked in between this vesicle and the 2nd sternite.

The posterior part of the 2nd sternite is occupied by a chitinous plate (fig. 1, *m.c.p.*), with rather indefinite boundaries in *Phaon*, but in *Chlorolestes conspicua* definitely shield-shaped with a minute tubercle, and in *Ischnura* tricuspid. Chitinous strips flank the median plate on either side and continue to the posterior hamules. Anterior to the plate the sternite is membranous and bears a flexible spiniform process (*Phaon*) (fig. 1, *h, sp.*) or a small knob with 2–3 setules (*Chlorolestes conspicua*).

In one very important point the above description of the Zygopteran penis differs from that given by Tillyard (*loc. cit.*, p. 217), viz. the lack of communication between the penis and the body-cavity. In fact, it would seem that every statement in the last paragraph on p. 217 is erroneous, except that the penis occupies the same position as the Anisopteran sheath, and that it lacks muscles and tracheae. Apparently Tillyard relied on statements by early writers and on "chitin preparations," which latter would be flattened by the cover-slip in mounting, thus giving a distorted conception of the structure.

When we examine the bursa copulatrix of the ♀ we find that the impression created by Tillyard's description (*loc. cit.*, p. 221), viz. that the possession of *two* accessory sacs is a feature common to all dragon-flies, must also be qualified. Here again Tillyard relied on early authorities, and happened to study an example of the *Anisoptera*, which confirmed the earlier work. In all the *Zygoptera* here examined the bursa has only one accessory sac.*

* This discrepancy was also noted by George (Quart. J. Microsc. Sci., n.s., vol. lxxii, 1928, pp. 469–470) when studying *Agrion*.

The bursa is a fairly elongate tube, whose diameter in the various genera can be more or less correlated with the robustness or bulk of the subapical appendages on the penis of the respective males (cf. *Phaon*, figs. 1, *h* and 2, *b*, with *Ischnura*, fig. 1, *d*). Its lateral walls are more or less chitinised, chiefly towards the inner end, sometimes (*Phaon*, *Chlorocypha*) forming rather definitely demarcated

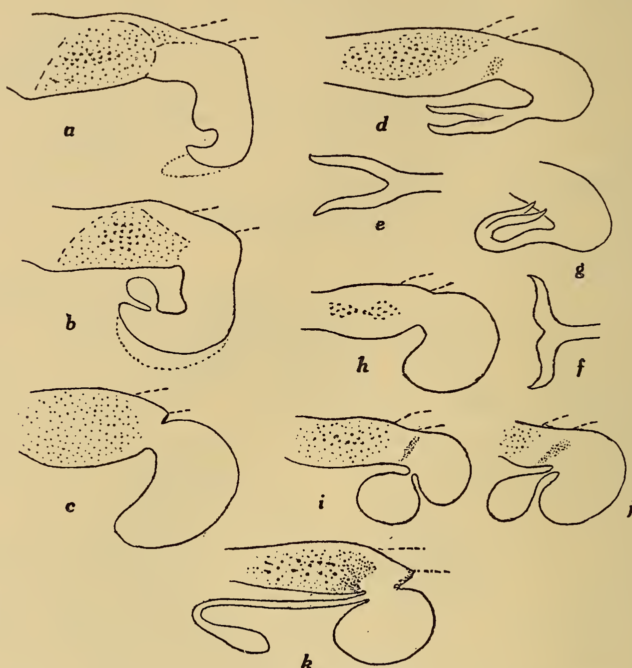


FIG. 2.—Bursa copulatrix (vagina) and accessory sac ♀ of *Zygoptera*. *a*, *Chlorocypha caligata*. *b*, *Phaon iridipennis*. *c*, *Lestes virgatus* and *plagiatus*. *d*, *e*, *f*, *Chlorolestes conspicua*, with variation in shape of apex of accessory sac. *g*, *C. longicauda*, accessory sac. *h*, *C. peringueyi* and *nylephtha*. *i*, *j*, *Elattoneura mutata* and *frenulata*, respectively. *k*, *Pseudagrion caffrum*.
(In *a*–*d*, *h*–*j* the opening of the united oviducts is dotted. Variation in apex of accessory sac indicated by dotted line in *a*, *b*.)

chitinous plates, and as a rule with a patch of minute granules on the internal surface (fig. 2).

The oviducts (*o.d.*) enter the bursa by a common opening on the ventral surface. Between this opening and the dorsal accessory sac is a small (*Ischnura*, *Enallagma*, *Pseudagrion*, *Allocnemis*), or very small (*Lestes*), chitinous patch; in *Elattoneura* and *Chlorolestes*, where the opening of the accessory sac into the bursa is large, there is a feebly chitinised patch on either side, which in *Phaon* and *Chlorocypha* is scarcely traceable.

The accessory sac (*acc.s.*) in *Ischnura, Enallagma, Elattoneura, Pseudagrion, Allocnemis, Phaon,* and certain species of *Chlorolestes* has its own accessory saccule attached to its posterior surface by a longer or shorter duct. Both the sac and its saccule are distensible, and vary in size in different individuals of the same species. When largely distended the contents seem to be of a homogeneous glutinous constitution, not spermatozoa. In certain species of *Chlorolestes,* viz. *conspicua, longicauda, fasciata, umbrata,* the saccule is bifurcate; in two other species, *peringueyi* and *nylephtha,* there is no saccule at all. It is noteworthy that this difference is correlated with certain differences in the ♂ appendages (see *infra,* p. 191).

In *Lestes virgatus* and *plagiatus* there is also no saccule; and *Chlorocypha,* in which the whole bursa closely resembles that of *Phaon,* has only a slight distension in the position of the saccule (the same shape was found in two specimens).

Thus it will be seen that there is considerable variety in the bursa and that it is worthy of further study. The very curious differentiation in *Chlorolestes* and its correlation with features of the ♂ is especially intriguing.

The technique here used involved cutting out only the 8th sternite and underlying tissues, and no attempt was made to examine the accessory glands in the 9th segment noted by George (*loc. cit.*, 1928, p. 469).

Turning to the *Anisoptera* we find that the ♀ bursa possesses two accessory sacs, but that there may be considerable variations in shape; and that previous accounts of the structure of the penis cannot be confirmed.

Both Ingenitzky (Zool. Anz., vol. xvi, p. 405, 1893 *) and Tillyard (*loc. cit.*, p. 217) maintain that the lumen of the penis opens to the exterior by a pore, on the 1st joint according to the former, on the 2nd according to the latter. If there were an opening one would expect, after treatment with KOH, to be able to press out the softened and disconnected contents (muscles, tracheae) through this opening. Williamson (Occ. Papers, Mus. Zool. Ann Arbor, Michigan, No. 80, 1920, explanation to fig. 8 on pl. 1) says there is an opening on the 1st joint and also one on the (presumably) 3rd, and that in relaxing the specimen air and fluids were discharged through the opening

* I have not seen the paper in Russian (Warsaw Univ. Bericht, No. 1, 1893) where his results are set forth in greater detail.

on the 1st joint. As he used dried material the possibility of cracking and accidental pricking by dissecting needles is not excluded. For my part, in all the dozens of penes examined for purposes of this paper, including both dried and alcoholic material, I have not been able to squeeze out any contents or to satisfy myself of the existence of any natural opening.

On the other hand, there is an opening at the base of the "bulbus" (Ingenitzky) or "vesicle" (Tillyard) into the body-cavity, through which tracheae, etc., enter the penis, though Ingenitzky (*loc. cit.*, p. 406) says the bulbus is completely shut off from the body-cavity.

The apex of the 1st joint on its dorsal surface, and the dorsal surface of the 2nd joint are much less heavily chitinised than the rest of these joints, being sometimes quite membranous, and this gives the impression of an opening. The dorsal surface of the 2nd joint is more or less grooved (as Ingenitzky correctly states), leading on to the apical joint with its manifold varieties of lobes and processes.

Instead of the bulbous 1st joint (or vesicle) forming a reservoir for the sperms as Ingenitzky maintained, it would seem that the sperms or sperm-packets prior to copulation are merely held in position between the penis, the sheath (Ingenitzky: ligula), and the sternite of the 2nd segment; during copulation they could be pressed along the channel formed by the groove on the 2nd joint of the penis and the opposed sheath, while the apical lobes of the penis distend the vagina. For determination of the actual method, however, one needs a pair preserved *in copula*.

As mentioned above, the ♀ bursa possesses a pair of accessory sacs. Figures are given here of the bursa in most of the genera studied for this paper. In most cases the bursa is shorter than in the *Zygoptera*, but is fairly long in the Aeschnines (*Anax*, *Aeschna*) and the Corduline *Presba*. In the Libellulines there is a dorso-lateral pair of more or less well-chitinised areas, with or without a median connecting band, and anteriorly to them a median projecting chitinous plate. The latter varies in shape in different genera, and apparently serves as a muscle attachment. In the closely allied genera *Trithemis* (*arteriosa* and *risi*) and *Helothemis* (*dorsalis* typical and the var. mentioned *infra*, p. 255) this plate is of the same shape. This plate is absent in *Presba*, *Mesogomphus*, and *Ceratogomphus*, and in the Aeschines, and in the latter the paired chitinous areas are also absent.

In the Gomphines there is a long chitinous spiniform process at the anterior end of the bursa, dividing posteriorly into a fork. An

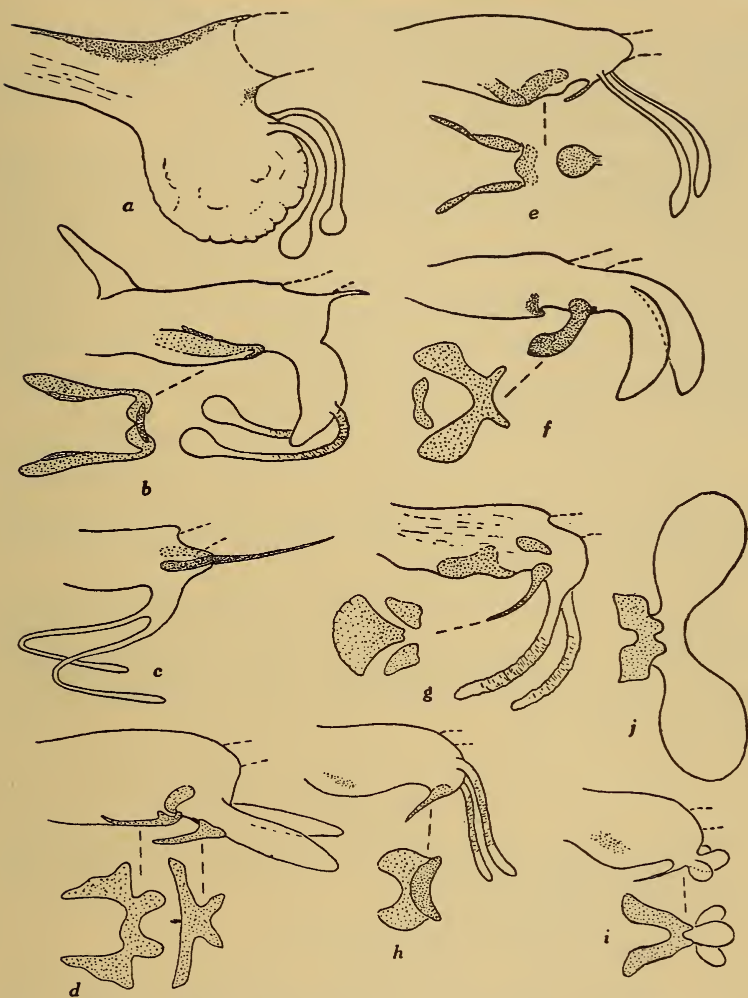


FIG. 3.—Bursa copulatrix and accessory sacs ♀ of *Anisoptera*. *a*, *Anax imperator mauricianus* and *Aeschna minuscula*. *b*, *Presba venator*, with dorsal view of chitinous plate. The genital valve at upper left-hand corner is abnormally shaped (*cf.* fig. 1, *c* in original description. Stylops, 1933). *c*, *Mesogomphus cognatus* and *Ceratogomphus pictus*, in latter the anterior chitinous process is longer. *d*, *Pseudomacromia torrida*, with dorsal view of chitinous plates. *e*, *Orthetrum capense*, with dorsal view of chitinous plates. *f*, *Crocothemis erythraea*, with dorsal view of chitinous plates. *g*, *Helothemis dorsalis*, *Trithemis risi* and *arteriosa*, with dorsal view of chitinous plates. The paired plates at base of fan-shaped plate absent in typical *H. dorsalis*. *h*, *Sympetrum fonscolombei*, with dorsal view of chitinous plate. *i*, *Palpopleura jucunda*, with dorsal view of chitinous plate and accessory sac. *j*, *Palpopleura lucia*, dorsal view of chitinous plate and accessory sac.

(The opening of the united oviducts indicated by dotted lines in *a*–*i*.)

indication of such a process, but not chitinised or forked, is seen in *Presba.* In the Aeschnines there is a median chitinous patch in a corresponding position at the end of the bursa, and a median chitinous rod-like thickening of the ventral wall of the bursa.

The accessory sacs in the Libellulines are mostly elongate and slender tubes, transversely wrinkled as if indicating a capacity for considerable distension. Viewed dorsally they spread out laterally and then curve posteriorly like two horns. In one example of *Pseudomacromia* and six *Crocothemis* they were large and of considerable diameter. In *Palpopleura* they are saccoid in shape; in *jucunda* (2 specimens examined) they are all small compared with a median prolongation of the bursa, but in *lucia* (also 2 specimens examined) they are very large and the bursa has no median prolongation.

In the Gomphines the accessory sacs unite and enter the bursa by a common tube of rather large calibre. In *Presba* and the Aeschnines they appear as accessory appendages to a large sac, which in the Aeschnines is enormous; when fully distended this sac must almost fill the whole of the 8th segment.

From the foregoing remarks it will be realised that the genital structures in both *Zygoptera* and *Anisoptera* are in need of much fuller and detailed comparative study. I have not had recourse to serial sectioning, and have confined my study to such genera as are found in the S.W. Cape.

### *Key to the genera of the S.W. Cape region : Imagos.*

#### *Zygoptera.*

I. Numerous ante-nodal cross-veins. Clypeus (*epistome*) enlarged and projecting. Tibiae of ♂ flattened . . . . . . *Chlorocypha.*

II. Only 2 ante-nodal cross-veins.

- A. Pterostigma long, covering 2 or more cells. Superior appendages of ♂ forcipate.
  1. Origin of $R_{4+5}$ nearer to arculus than to nodus . . *Lestes.*
  2. Origin of $R_{4+5}$ at nodus, or nearer to nodus than to arculus *Chlorolestes.*
- B. Pterostigma short, covering 1 cell. Superior appendages of ♂ not forcipate.
  1. Quadrilateral rectangular.
     - *a.* IA extending several cells beyond nodus. $R_{4+5}$ at nodus, $IR_3$ 1 cell distal. Pterostigma cream, end of abdomen orange . . . . . . . . *Allocnemis.*
     - *b.* IA absent, A′ stopping at cross-vein which continues distal end of quadrilateral. $IR_3$ at nodus, $R_{4+5}$ 1 cell proximal. Pterostigma brown. ♀ with 2 pairs of prothoracic stylets *Elattoneura.*

2. Quadrilateral oblique, anal distal angle acute.
   *a.* Origin of A′ at Ac or very slightly proximal. ♀ without spine on 8th sternite.
      i. Colour scheme mostly blue and black. No transverse ridge at frons. Superior appendages of ♂ usually bifurcate . . . . . . *Pseudagrion.*
      ii. Colour scheme orange or red. A transverse ridge at frons. Superior appendages of ♂ short, entire *Ceriagrion.*
   *b.* Origin of A′ considerably proximal to Ac. ♀ with spine on 8th sternite.
      i. $R_3$ in fore-wing at 5th or 6th, in hind-wing at 4th or 5th, post-nodal cross-vein. Pterostigma of ♂ alike in fore- and hind-wings . . . . *Enallagma.*
      ii. $R_3$ at 4th and 3rd cross-veins respectively. Pterostigma in fore-wing of ♂ black and blue . . *Ischnura.*

## *Anisoptera.*

I. Lateral lobes of labium about equal to median lobe. Triangles similar in both wings, their long axes in long axis of wing. Ante-nodal cross-veins in costal and subcostal areas not coinciding.
   A. Eyes widely separated. Inferior appendages ♂ bifid.
      1. No anal loop . . . . . . *Mesogomphus.*
      2. A distinct anal loop . . . . . *Ceratogomphus.*
   B. Eyes contiguous. Inferior appendage ♂ not bifid.
      1. $IR_3$ forked proximal to pterostigma, more than 2 rows of cells between its branches . . . . . *Aeschna.*
      2. $IR_3$ forked distal to middle of pterostigma, only 2 rows of cells between its branches . . . . . *Anax.*

II. Lateral lobes of labium very large, contiguous in middle line; median lobe very small. Triangles dissimilar, long axis transverse in fore-wing, longitudinal in hind-wing. Ante-nodal cross-veins coinciding.
   A. Anal border of hind-wing excised in ♂. Auricles on 2nd abdominal segment ♂. Triangle of fore-wing not very narrow.
      1. Anal loop short, 3 cells in width . . . . *Macromia.*
      2. Anal loop longer, 2 cells in width . . . . . *Presba.*
   B. Anal border rounded in both sexes. No auricles. Triangle in fore-wing narrow.
      1. Arculus at or distal to 2nd Anq. More than 10 Anq in fore-wing, the last one complete . . . . . *Orthetrum.*
      2. Arculus proximal to 2nd Anq.
         *a.* Last Anq in fore-wing complete . . . *Helothemis.*
         *b.* Last Anq incomplete.
            i. Costal margin in fore-wing indented. Wings with black and yellow markings . . *Palpopleura.*
            ii. Costal margin not indented.
               *α.* Number of Anq $6\frac{1}{2}$–$7\frac{1}{2}$ . . . *Sympetrum.*
               *β.* Number of Anq $9\frac{1}{2}$–$13\frac{1}{2}$.

§ Triangles at about same level in fore- and hind-wing.
* MA and $Cu_2$ in fore-wing divergent. One row of cells in $IR_3$–Rspl . . . *Crocothemis.*
** MA and $Cu_2$ parallel or slightly convergent.
† Anal loop short. Medium-sized species (hind-wing not exceeding 30 mm.) . *Trithemis.*
†† Anal loop long. Large species (hind-wing 40 mm.) . . . *Pseudomacromia.*
§§ Triangle in fore-wing considerably distal to level of triangle in hind-wing . . . *Pantala.*

## *Key to genera of the S.W. Cape region: Nymphs.*

*Zygoptera.*—Body slender. 3 (or 2) lamellate or triquetral gills at end of abdomen. Mask flat.

I. Two triquetral caudal gills . . . . . . . *Chlorocypha.*
II. Three caudal gills, lamellate but sometimes more or less triquetral.
A. Median lobe of mask with median cleft. Gills lamellate, broadly oval *Chlorolestes.*
B. Median lobe of mask not cleft.
1. Gills simple, triquetral . . . . . . *Allocnemis.*
2. Gills nodate, lamellate, elongate. One mental seta, 3 lateral *Pseudagrion.*
3. Gills lamellate or feebly triquetral, lanceolate, subnodate or simple.
*a.* Mental setae, 4–5; lateral, 6 . . { *Enallagma.* / *Ischnura.* }
*b.* One mental seta, 3 lateral setae . . . *Elattoneura.*

*Anisoptera.*—Body robust. Abdomen ending in an anal pyramid composed of 5 appendages.

I. Mask flat.
A. Only 4 antennal joints (4th often minute). Median lobe of mask not cleft. Legs more or less adapted for burrowing, fore and mid tarsi only 2-jointed.
1. Abdomen relatively narrow. Legs short . . *Mesogomphus.*
2. Abdomen relatively broad. Legs longer . *Ceratogomphus.*
B. Antennae 7-jointed. All tarsi 3-jointed. Median lobe of mask cleft.
1. Eyes large, hemispherical. Mask not extending beyond mid coxae *Aeschna.*
2. Eyes very large, flattened dorsally. Mask extending to hind coxae *Anax.*
II. Mask spoon-shaped, with broad lateral lobes.
A. Lateral lobes of mask with deep indents on distal margin. Mental and lateral setae very stout.
1. Body flattened, abdomen broadly oval. Eyes very prominent. *Macromia.*
2. Body not flattened, abdomen elongate oval.
*a.* Abdomen segments 8 and 9 without strong lateral spines *Presba.*
*b.* Abdomen segments 8 and 9 with strong lateral spines *Pantala.*

B. Lateral lobes with indents very shallow or obsolete.
  1. Eyes small. Lateral margins of head behind eyes parallel. Legs short. Body strongly setose, opaque . . *Orthetrum.*
  2. Eyes prominent. Lateral margins behind eyes convergent. Legs moderately long. Body sparsely setose or nearly glabrous, more less mottled and semitransparent.
    *a.* Abdomen dorsally not keeled . . . *Crocothemis.*
    *b.* Abdomen medio-dorsally keeled and toothed.
      i. Segments 8 and 9 ending in small points. Medio-dorsal teeth large . . . . . { *Helothemis.* / *Trithemis.* }
      ii. Segments 8 and 9 ending in strong spines. Medio-dorsal teeth small.
        *α.* 14–16 mm. . . . . . *Sympetrum.*
        *β.* 24–26 mm. . . . . *Pseudomacromia.*

## Fam. LIBELLAGINIDAE.

1917. Tillyard, Biology of Dragon-flies, p. 274 (*Calopterygidae* part).
1926. ,, Insects Austr. N. Zeal., p. 80.
1934. Fraser, Fauna Ind. Odonata, vol. ii, p. 1 (*Agriidae* part).

*Imago.*—Wings seldom petiolate. Nodus distant from base of wing. Numerous ante-nodal cross-veins (Anq). Quadrilateral rectangular or nearly so, long, crossed by 1 or more cross-veins.

*Nymph.*—First antennal joint elongate. Gizzard nearly always with 16 folds. Mask with median lobe entire or more or less incised; mental and lateral setae absent. Caudal gills saccoid or triquetral, the median one sometimes short, lamellar, or obsolete. Lateral abdominal gills sometimes present.

### Subfam. Libellaginae.

1934. Fraser, *loc. cit.*, p. 2.

### Gen. *Chlorocypha.*

1921. Ris, Ann. S. Afr. Mus., vol. xviii, p. 261 (*Libellago*).
1928. Fraser, J. Bombay Nat. Hist. Soc., vol. xxxii, p. 684.
1934. *Id.*, *loc. cit.*, p. 55.
1936. Longfield, Tr. R. Entom. Soc., vol. lxxxv, p. 467.

*Imago.*—Wings petiolate, hyaline in both sexes. Quadrilateral with only 1 cross-vein. Pterostigma long and narrow in both wings of both sexes. Ante- and post-clypeus (epistome) enlarged and projecting. Sectors of arculus arising separately. MA curved but not zigzagged until at level of or distal to nodus. 1A zigzagged almost from its origin. All tibiae in ♂ flattened and dilated (but not in all species).

*Nymph.*—First antennal joint very elongate, at least twice as long as 2nd, 5 flagellar joints. Mask flat, with median lobe narrowly and not very deeply incised. No lateral abdominal gills. Lateral


Fig. 4.—*Chlorocypha caligata* (Selys). Imago: *a*, dorso-lateral view of right inferior appendage ♂, the upper left-hand hollow being position of insertion of the superior appendage. *b*, penis, with sculpturing of the membranous portion further enlarged. *c*, ventral view of apical lobe of penis. *d*, genital valve ♀, with margin further enlarged. *e*, 3 major and 2 minor folds of the gizzard. Nymph: *f*, head with basal joints of antenna. *g*, dorsal view of XIth abdominal segment with bases of the 2 caudal gills, left cercoid omitted. *h*, lateral view of XIth segment with rudimentary median gill. *i*, ventral view of XIth sternite, with base of 1 gill. *j*, outer view of caudal gill. *k*, portion of mask.

caudal gills triquetral, median gill reduced to a mere conical rudiment. Cercoids prominent. Gizzard with 16 folds. IXth sternite without processes (Anlagen of genital valves).

*Remarks.*—Ris stated that a new generic name would be necessary for the African species, and in 1928 Fraser proposed *Chlorocypha*. In 1934 he includes the two Asiatic species while expressing doubt as to their being really congeneric. The Indian *vittata* has MA zigzagged almost from its origin, and quadrilateral with 3 cross-veins (Fraser, *loc. cit.*, p. 56, fig. 19). If future students consider it advisable to separate them, a further new name will be required for these two species, leaving *Chlorocypha* solely for the African species.

Karsch (Berl. Ent. Zeitschr., vol. xxxviii, 1893) described two forms of nymphs from Togoland (figs. 10 and 11), both of which he was inclined to assign to "Libellago." Tillyard (*loc. cit.*, p. 275) and Ris (*loc. cit.*, p. 262) have accepted only one of these (fig. 11) as being in all probability the nymph of "Libellago." This is confirmed by Fraser's discovery of the Indian nymphs, and by the South African nymph described below. In the Togoland nymph only 1 of the triquetral lateral gills was present, and Karsch consequently did not appreciate the fact that the median gill was not merely missing in his specimen, but normally quite rudimentary.

In 1928 Fraser (*loc. cit.*, p. 691, pl. iii) described three species of Libellagine nymphs: two of *Rhinocypha* and one of *Libellago* (*sensu stricto*). These agree in all essentials with the present nymph. The XIth tergite is present as a short conical or spiniform *appendix dorsalis* in *Rhinocypha*, but does not appear in the figure of the *Libellago* nymph. In the latter the cercoids are represented, but not in the two figures of *Rhinocypha*. The gizzard has 16 folds, each bearing 4–5 teeth. Fraser's accounts of the antennae, and his figures are conflicting (see 1928, *loc. cit.*, p. 691, pl. iii; and 1934, *loc. cit.*, pp. 4 and 5).

### *Chlorocypha caligata* (Selys).

1908. Ris in Schultze's Reise, vol. i, p. 307.
1921. *Id.*, *loc. cit.*, p. 262, fig. 6; and pl. vi, fig. 6.

*Imago.*—All tibiae of ♂ dilated. A figure of the lower appendages of ♂ is given here because the teeth (4–6) on the inner upper margin are indistinctly represented in Ris' figure. Penis as in fig. 4, *b*, *c*. Gizzard with 16 folds, 8 major (of which 4 are shorter than the other 4) and 8 minor, each fold with 2 series of recurved spine-like teeth.

*Nymph.*—Up to 18–19 mm. plus gills 6·5–7 mm. (only empty shucks examined). First joint of antennae equal to anterior width of mask, 2½ times the length of 2nd joint, the 5 flagellar joints decreasing in length, the 5th minute. Mask extending back to bases of fore-legs; median lobe moderately convex, crenulate, with short cleft, lateral margins with strong spines each on a scute-like base; inner margin of lateral lobes feebly crenulate. A small conical tubercle on each side of prothorax, a little above insertions of legs. Median gill (XIth tergite) rudimentary, merely a short concial process. Lateral gills elongate ($2\frac{1}{2}$ times width of last abdominal segment), terete, triquetral, all three edges armed with strong spines and setae. The two halves of the XIth sternite (to which the lateral gills are attached) are produced in triangular lamellar processes. IXth sternite without any trace of the valvules or ovipositor surrounding the genital pores of imago. Gizzard?

*Localities.*—In addition to the localities mentioned in Ris, I have seen examples from Port St. Johns, Pondoland; and from two localities in the S.W. Cape: Palmiet River, near Kleinmond, Southern Hottentots Holland Mts. (H. G. W., December 1931, 1933; K. H. B. and H. G. W., December 1934), and Tradouw Pass, near Swellendam (A. J. Hesse, November 1925).

*Remarks.*—There are no differences in the ♂ appendages or penis between the Cape specimens and those from Zululand identified by Ris. The discovery of the Palmiet River colony and of the very interesting nymph is due to Mr. H. G. Wood, who in 1933 obtained two empty shucks. In December 1934 Mr. Wood and myself visited the locality with a view to obtaining living nymphs. The search, however, was unsuccessful, although all possible habitats were examined, not forgetting Fraser's remarks (*loc. cit.*, 1928, p. 691, and 1934, p. 4) on the habits of the Indian species.

I have therefore figured a portion of the gizzard of the imago. Tillyard (1917, *loc. cit.*, p. 107) says that in the imago the gizzard and its dentition is considerably reduced, though least in the *Calopterygidae* and *Agrionidae.* As the dentition in the imago *C. caligata* is by no means feeble, that of the nymph may be expected to be somewhat more powerful. Probably it will be found to be easily distinguished from that of the Indian species of *Rhinocypha*, which Fraser says has only 4–5 teeth on each fold.

Apparently no trace of the gizzard remains in the nymph-shuck after emergence of the imago. The gizzard belongs to the fore-gut and is presumably drawn out through the mouth of the emerging imago, while the hind-gut is drawn out through the vent. The latter portion of the digestive canal remains in the nymph-shuck, and in the *Anisoptera* even the delicate "branchial basket" can be dissected out. But even in robust species of *Anisoptera* (e.g. *Orthetrum*, *Pseudomacromia, Presba*) I have not found the remains of the fore-gut including the gizzard. It would be interesting to know what becomes of it, as it is the one character lacking in the nymph-shuck which prevents one from giving a satisfactory diagnosis of the nymph based on an empty shuck. Probably the examination of a series of examples of nymphs fixed immediately before emergence of the imago, and during the early phases of emergence, would provide a solution of the problem.

The imagos settle on rocks in mid-stream, with the wings folded over the abdomen. Pairing or oviposition has not been observed.

### Fam. LESTIDAE.

1917. Tillyard, *loc. cit.*, p. 276.
1933. Fraser, Fauna Ind. Odonata. I., p. 18 (*Coenagriidae* part).

*Imago.*—Wings petiolate. Only 2 ante-nodal cross-veins (Anq). Pterostigma large, covering 2 or more cells. Short intercalary veins between distal ends of longitudinal veins. Quadrilateral with anal distal angle very acute. Superior appendages of ♂ forcipate.

*Nymph.*—Slender. Legs long. Caudal gills in form of simple lamellae. Gizzard with 8 major folds, each bearing a few large teeth.

### Subfam. Lestinae.

1917. Tillyard, *loc. cit.*, p. 277.
1933. Fraser, *loc. cit.*, p. 27.

*Imago.*—Arculus midway between base of wing and nodus. Sectors of arculus arising high up near R. Origin of $R_{4+5}$ much nearer to arculus than to nodus. Origin of A′ at Ac.

*Nymph.*—Mask elongate, with incised median lobe; lateral lobes irregularly cleft; mental and lateral setae present. Caudal gills with secondary tracheae at right angles to main axis.

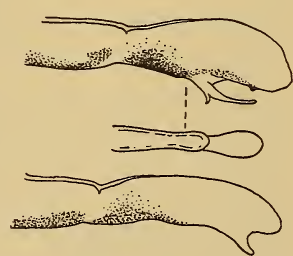

Fig. 5.
*Lestes plagiatus* (Burm.) (upper) and *virgatus* (Burm.) (lower). Apex of penis, with ventral view of linguiform process of former.

### Gen. *Lestes* Leach.

1921. Ris, *loc. cit.*, p. 268.
1933. Fraser, *loc. cit.*, p. 29.

It is not proposed to deal with the South African species of *Lestes* as only one species has yet been found in the S.W. Cape. Kennedy, however, has proposed to separate *L. virgatus* under the generic name *Africalestes* (1920, Ohio Journ. Sci., vol. xxi, p. 84), and so a brief discussion of its validity may be included, together with figures of the penis.

*Africalestes* is defined as having the venation of *Chalcolestes* (*L. viridus*), *i.e.* differing from *Lestes* in that the upper half of the arculus equals the lower half; $IR_2$ is nearly straight throughout its length; the penis has a "strap-like inner fold as in *Ceylonolestes*" (the latter n.g. has "penis with a spiral strap on the terminal lobe").

The equal division of the arculus by the sectors is a character in conflict with Tillyard's definition of the *Lestinae*, and, moreover, all the South African Museum specimens of *virgatus* and *plagiatus* have the sectors arising high up near R.

In some specimens of *virgatus* $IR_2$ is nearly straight, but in others distinctly zigzag; intermediate stages are found, and the wings on opposite sides of the same individual are not always symmetrical in this respect. Specimens from the same locality vary. The same variability is found also in *plagiatus*.

Examination of the penes of 3 examples each of *virgatus* and *plagiatus* shows a strap-like projection in *plagiatus* but not in *virgatus*, though the latter was made the genotype.

In view of the above conflicts I consider that the validity of *Africalestes* is very doubtful.

The nymphs of the South African species are not known (for figure of a European species see Ris, *loc. cit.*, pl. xii, fig. 1).

### *Lestes plagiatus* Burm.

1921. Ris, *loc. cit.*, p. 276, fig. 13; and pl. vi, fig. 8.

*Locality.*—Knysna (H. G. W., January 1936, 1 ♂).

This is the first record of a species of *Lestes* so far to the south-west in the Cape, the nearest hitherto being Dunbrody (Uitenhage district).

The penis agrees with those of the 3 specimens (identified by Ris) mentioned above. The apical lobe is spatulate, concave dorsally, and the two heavily chitinised areas at its base are connected by a less strongly chitinised horseshoe-shaped band which forms a slight ridge ventrally.

### Subfam. Synlestinae.

1917. Tillyard, *loc. cit.*, p. 277.

1933. Fraser, *loc. cit.*, p. 19.

*Imago.*—Arculus nearer nodus than to base of wing. Sectors of arculus arising a little above half-way along arculus. Origin of

$R_{4+5}$ at or slightly proximal to subnodus (usually). Origin of A′ distal to Ac. $Cu_2$ at its origin from quadrilateral strongly curved towards costa.

*Nymph.*—Mask with incised median lobe; lateral lobes narrow, cleft into 2 teeth, movable hook long and slender; no lateral or mental setae. Pedicel of antenna elongate. Caudal gills with secondary tracheae oblique to main axis.

*Remarks.*—This subfamily is only found in South Africa and Australasia, and according to Tillyard is a survival of the palaegenic fauna. *Chlorolestes* is characteristic of the Cape mountain ranges, although extending to Natal, Zululand, and the Transvaal.

### Gen. *Chlorolestes* Selys.

1862. Selys, Bull. Ac. Roy. Belg., ser. 2, vol. xiv, p. 33.
1920. Kennedy, Ohio Journ. Sci., vol. xxi, p. 84 (*Euchlorolestes*).
1921. Ris, *loc. cit.*, p. 279.
1933. Fraser, *loc. cit.*, pp. 19, 20.

*Imago.*—Wings petiolate to level of quadrilateral (discoidal cell). $IR_3$ and $R_{4+5}$ arising nearer to nodus than to arculus. Nervures at end of wing strongly curved downwards towards hind margin. ♂ claspers with or without a basal tooth; inferior appendages entire or bifid; penis with or without an exsertile distal hook. Posterior hamules well developed. Accessory sac of ♀ bursa copulatrix with a bifurcate saccule, or without a saccule (see p. 177).

*Nymph.*—First joint of antenna long and slender, but not as long as 2nd. Cercoids acute, conspicuous. Pedicel of caudal gills flattened, forming part of the gill lamella, gills not caducous. Gizzard with 8 major folds, no minor folds.

*Remarks.*—In the thoracic coloration all the species are much alike, except *peringueyi*. In venation there are some useful specific differences. All species except *umbrata* have 2 or 3 rows of cells in the area between $IR_2$–$R_3$ (at level of pterostigma). All species have a single row of cells between $IR_3$–$R_{4+5}$ except *conspicua*, which has 2 rows. Two pairs of veins, $R_3$ and $IR_3$, $R_{4+5}$ and MA, are subparallel in *umbrata*, *peringueyi*, and *nylephtha*, but divergent in the other species.

The following revised key has been based mainly on the venation and the ♂ genitalia. The two species *peringueyi* and *nylephtha*, form a group sharply marked off from the rest Another group is formed by *fasciata*, *tessellata*, and *longicauda*.

Kennedy (*loc. cit.*, p. 84) has proposed the genus *Euchlorolestes* to include *fasciata*, *tessellata*, and *longicauda*, based on the shape of the distal hook of the penis, and the position of Ac in relation to the first Anq. There is undoubtedly a clear distinction between this group and *conspicua*, but it does not seem to call for generic separation because, in my opinion, the difference between the *conspicua* and *fasciata* groups are less striking than those between the *conspicua-fasciata* group and the *peringueyi* group.

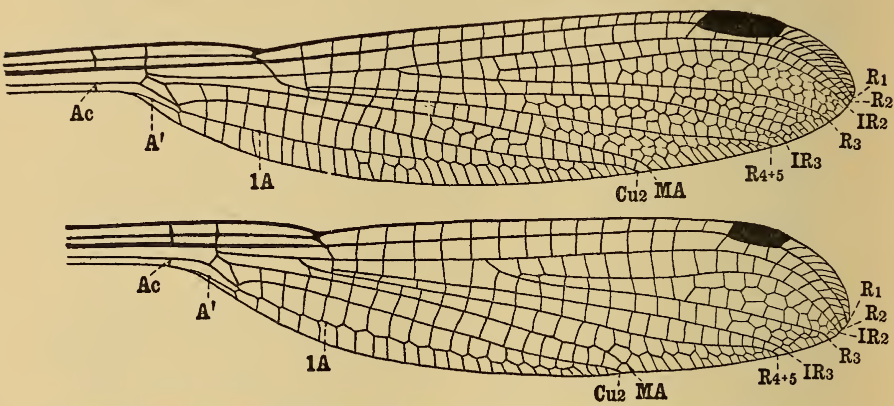


Fig. 6.—Fore-wings of *Chlorolestes conspicua* ♂ (upper) and *peringueyi* (lower).

The position of $R_{4+5}$ is surely more important than the position of Ac, which is never quite constant even in the same species (see e.g. *conspicua* and *peringueyi*). With the position of $R_{4+5}$ are correlated the characters of the ♂ claspers, the penis, and the accessory structures of the ♀ bursa copulatrix.

The present grouping of the species was worked out before seeing Kennedy's paper, and there seemed no occasion to multiply names. Since, however, the *fasciata* group has been named, there is no avoiding a name (*Ecchlorolestes* nov.) for the more important *peringueyi* group. The interrelationships of the species are far better visualised by keeping all of them in one genus.

In addition to that of *conspicua*, the nymphs of *umbrata*, *longicauda*, *peringueyi*, and *nylephtha* have been correlated. That of *umbrata* does not attain so large a size as that of *conspicua*, but otherwise there are no tangible specific differences between any of the species. The acute points to the lateral abdominal keels are less well developed in *longicauda* than in other species, but as in these latter there is often variation, this character should not be used.

A noticeable feature of the gills in comparison with those of Agrionid nymphs is the flattening of the "pedicel," so as to form part of the gill lamella. At first sight the gill appears to be 2-jointed or nodate. But these basal portions correspond with the chitinous rings which support the gills in Agrionid nymphs, and are really the remnants of the XIth segment (see Tillyard, 1917, Biol. Dragonfl.,

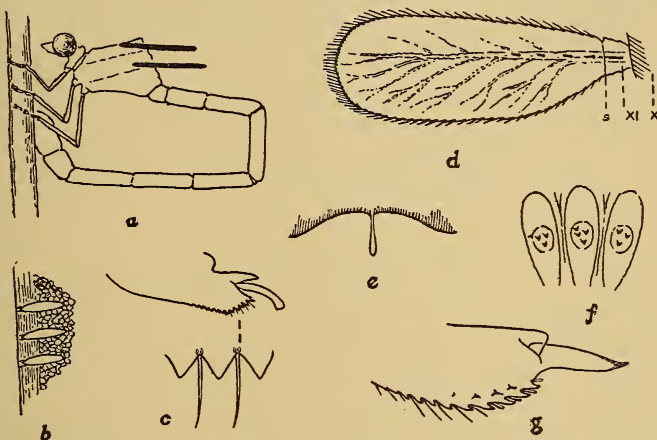


FIG. 7.—*Chlorolestes conspicua* Selys. Imago: *a*, ♀ ovipositing in stem of reed. *b*, reed stem cut open to show 3 ova. *c*, genital valve ♀, with margin further enlarged. Nymph: *d*, Xth abdominal segment with XIth tergite and median gill, showing suture (*s*). *e*, anterior margin of median lobe of mask. *f*, 3 major folds of gizzard. *g*, genital valve ♀.

fig. 39, H, J.). In Agrionid nymphs the gills break off very easily at the junction between gill and basal supporting ring, whereas in *Chlorolestes* the gills are not caducous.

### *Key to the species of Chlorolestes.*

I. $R_{4+5}$ at subnodus. Claspers (superior appendages) ♂ without either basal teeth, or lobes on inner margin. Penis with a distal hook. Accessory sac of ♀ bursa with bifurcate saccule (fig. 2*d*).

*Chlorolestes* (*sensu stricto*).

- A. Inferior appendages ♂ not bifid. Distal hook of penis apically acute. Pterostigma unicolorous.
  1. Larger. Hind-wing 32–37 mm. Wings never banded. Yellow stripe on mesepisternum entirely dorsal to humeral suture. Veins $R_3$–$IR_3$ and $R_{4+5}$–MA evenly diverging *conspicua Selys.*
  2. Smaller. Hind-wing 22–25 mm. Wings when fully mature banded. Yellow stripe on mesepisternum embracing the humeral suture. $R_3$–$IR_3$, and likewise $R_{4+5}$–MA, subparallel (except near margin) . . . . . *umbrata Selys.*

B. Inferior appendages ♂ bifid. Distal hook of penis with spatulate apex. Pterostigma bicolorous. Ac distal to 1st Anq . . *Euchlorolestes Kenn.*

1. Metepimeron with dark (metallic) stripe adjoining the 2nd lateral suture . . . . . . . . . *fasciata* Burm.
2. Metepimeron wholly pale, with only indistinst traces of dark patches.
   *a.* Wings banded . . . . . . . *tessellata* Burm.
   *b.* Wings hyaline . . . . . . *longicauda* Burm.

II. $R_{4+5}$ proximal to subnodus. Claspers ♂ with basal tooth. Penis without distal hook. Accessory sac of ♀ bursa without a saccule (fig. 2, *h*). $R_3$–$IR_3$ and $R_{4+5}$–MA subparallel (except near margin). Inferior appendages ♂ not bifid . . . . . . . *Ecchlorolestes* nov.

A. Clasper with distinct lobe distally on inner margin. Anteclypeus pale cream. No spot on metanotum . . . *peringueyi* Ris.

B. Clasper without distal lobe, merely thickened. Anteclypeus metallic green. A blue spot on metanotum . . *nylephtha* n.sp.

### *Chlorolestes conspicua* Selys.

1839. Burmeister, Handb. Entom., vol. ii, p. 823 (*longicaudum* part).

1862. Selys, Bull. Ac. Roy. Belg., ser. 2, vol. xiv, p. 34.

1921. Ris, *loc. cit.*, p. 280, fig. 15; and pl. vii, figs. 1, 2.

1921. Barnard in Ris, *loc. cit.*, p. 445, fig. (oviposition and nymph).

*Imago.*—Ac at about level of 1st Anq (slightly proximal, at, or slightly distal). Origin of A′ at level of proximal side of Q (misprinted "9" in Ris). $R_{4+5}$ at subnodus; $IR_3$ 1 cell distal. Pterostigma covering 3 (or 4) cells. At level of pterostigma 3 rows of cells in area $IR_2$–$R_3$, 3 rows in $R_3$–$IR_3$, these 2 veins diverging; 2 rows in $IR_3$–$R_{4+5}$, usually only 1 row from middle of pterostigma, but the double row sometimes continued almost to margin; 2 rows in $R_{4+5}$–MA beginning at level of origin of $IR_2$, usually changing to 3 rows near margin, these 2 veins evenly diverging. In MA–$Cu_2$ there is a single row of cells, but sometimes an incomplete double row, or in ♀ up to 12 double rows.

*Genitalia* ♂.—Posterior hamules with antero-distal corners rectangular. Penis with short, strongly curved hook distally, which apically narrows rather abruptly to an acute point. Claspers without either basal teeth, or lobes on inner margin. Inferior appendages with the chitinised portions forming single claw-like processes.

*Abdomen* (excl. claspers).—♂ 47–51, ♀ 41–49 mm. Hind-wing, ♂32–33, ♀ 33–37 mm.

Labrum and occiput pale yellowish or ochreous, the upper portion of latter metallic blue-green, often blackish in ♀. Genae and bases of mandibles yellow. Anteclypeus pale ochreous, postclypeus dark brown. Labrum black. Frons and vertex metallic blue-green, darker and duller or often blackish brown in ♀; the vertex separated from upper metallic portion of occiput by an ochreous or brown interocular band. Prothorax metallic green (dark) in ♂, duller and dark brown in ♀, with a deep yellow round spot on each side. Mesepisternum metallic peacock-green, often darker and more bronzy in ♀, with a chrome-yellow stripe near (but wholly dorsal to) the humeral suture, extending $\frac{3}{4}$–$\frac{4}{5}$ length of mesepisternum. Mesepimeron metallic green except the antero-ventral portion. Metepisternum chrome-yellow, not extending quite to the 2nd lateral suture, along which is a metallic green stripe, more extensive and often brown in ♀. Lower portion of metepimeron and metasterna pale yellowish or whitish, with white pruinosity in ♂. Abdomen as described by Ris, but bright metallic green in ♂, duller and more bronzy in ♀; segment 1 laterally, segments 9 and 10 dorsally with pale bluish white pruinosity in ♂. Wings hyaline. Pterostigma russet in ♂, paler ochreous in ♀.

*Nymph.*—To the description already given, may be added: 1st joint of antenna slender, $\frac{1}{2}$–$\frac{2}{3}$ length of 2nd, 5 flagellar joints; margin of median lobe of mask finely setulose laterally, becoming spinulose medianly, inner margin of lateral lobe very feebly and inconspicuously crenulate; lateral abdominal keels ending in short acute points on the 6th (5th–7th)–9th segments; teeth on the major folds of gizzard all of the same size, alternating 3, 4, 3, 4, etc.

Brownish, somewhat mottled, especially the gills, which usually have a dark transverse band.

*Oviposition.*—The puncturing of twigs on trees overhanging streams has been recorded (Barnard, *loc. cit.*, p. 445). The name of the tree, however, should be *Cunonia*. On Table Mt. the females have been observed ovipositing in the stems of rushes (*Elegia juncea*). While ovipositing the female is not held by the male, who may not even be in attendance. On one occasion a female was seen to interrupt egg-laying in order to pair with a male; the act lasted about two minutes, when the sexes separated, and the female continued egg-laying.

The position of the female is shown diagrammatically in fig. 7, *a*; the wings are held horizontally at right angles to the body, and the abdomen forms a double right-angled bend at the 4th segment.

*Habits.*—This species inhabits wooded and open ravines in the S.W. Cape mountains, where it is common and widely distributed.

On Table Mt. the imagos start emerging about the end of November or beginning of December, and they can be found on the wing throughout the summer up to the end of April. One or two can occasionally be found in the first week in May, but by the middle of this month they have all disappeared. One specimen was seen on 21st August 1933 and was apparently freshly emerged.

They settle on bushes and rushes, never far from the stream.

The nymphs live openly on the bottom of streams or crawling about on rocks or submerged vegetation. They are very carnivorous; a full-grown one has been observed to seize a tadpole almost as long as itself and hold on to it until its struggles ceased.

Before emergence the nymph crawls up, by preference, rocks projecting out of the water.

*Localities.*—Has been observed over the whole area in question, as far north as the Cedar Mts. (Clanwilliam), and as far east as the Zwartberg Pass in the Zwartberg Range (Prince Albert), and the Robinson Pass in the Outeniqua Range. Altitude from about 500 ft. to 5000 ft., but the character of the stream is more important than actual altitude.

*Remarks.*—This is the only species which has a double row of cells between $IR_3$ and $R_{4+5}$ (not reckoning the 2 or 3 double cells immediately within the margin). The area $IR_2$–$R_3$ is broad, and sexual dimorphism occurs in the area MA–$Cu_2$, where there is usually an extensive series of double cells in the ♀.

### *Chlorolestes umbrata* Selys.

1862. Selys, *loc. cit.*, p. 37.
1921. Ris, *loc. cit.*, p. 283.

*Imago.*—Ac about at (or slightly proximal or slightly distal) level of 1st Anq. Origin of A′ distal to proximal end of Q. $R_{4+5}$ at subnodus, $IR_3$ 2–3 cells distal. Pterostigma covering 2–3 cells. One row of cells in area $IR_2$–$R_3$, a short series (2–3) of double or triple cells at margin; 1 row in $R_3$–$IR_3$, these 2 veins subparallel, very slightly diverging near margin where there are 2 rows of cells; 1 row in each of the areas $IR_3$–$R_{4+5}$, $R_{4+5}$–MA, and MA–$Cu_2$, veins $R_{4+5}$ and MA subparallel except at margin.

*Genitalia* ♂.—Posterior hamules apically narrowed. Penis with short, strongly curved distal hook, apically with acute point. Process of sternite III shorter than in other species (fig. 9*r*). Claspers without either basal teeth, or lobes on inner margin. Inferior appendages with the chitinised portions forming single claw-like processes.

*Abdomen* (excluding claspers).—♂ 34–37, ♀ 31–32 mm. Hind-wing, ♂ 22–25, ♀ 21–23 mm.

Labrum black. Occiput bronzy black. Labium, genae, and bases of mandibles pale ochreous. Anteclypeus dark brown. Postclypeus, frons, and vertex metallic blue-green. Prothorax bronzy black, with a pale ochreous bar on each side. Mesepisternum bronzy greenish black, with bluish-white pruinosity in mature specimens with banded wings, with a lemon-yellow stripe which at about $\frac{3}{4}$ the length crosses the humeral suture on to the postero-dorsal end of mesepimeron. Remainder of mesepimeron except antero-inferior corner dull bronzy green. A lemon-yellow stripe along 1st lateral suture. A dark bronzy cuneiform stripe on metepisternum. Rest of metepisternum and metepimeron pale lemon-yellow or cream, with whitish pruinosity when mature; a dark stripe on postero-inferior margin of metepimeron. Meta-sterna cream, with dark streak anterolaterally. Legs testaceous, dark on outer edges. Abdomen metallic bronzy or bluish green, with pale narrow bands antero-laterally on segments 3–7; segments 9 and 10, and sometimes posterior half of 8 also, with bluish white pruinosity dorsally. Wings hyaline when freshly emerged; when mature banded, whitish pruinose from nodus to 6–8 post-nodal cross-vein in fore-wing, to 5–7 in hind-wing, thence brownish to pterostigma, or to middle of pterostigma. Pterostigma russet, unicolorous. ♀ similar, but duller, the metallic portions more bronzy than green.

*Nymph.*—Resembling that of *conspicua* except in its smaller size.

*Habits.*—Occurring in the same habitats and with the same habits as *conspicua*, but apparently much more local.

*Localities.*—Table Mt., Cape Town (H. G. W. and K. H. B., March); Groot Drakenstein (K.H.B., March 1931); Kogel Berg, Hottentots Holland Mts. (K. H. B., January 1923); Palmiet River (H. G. W., January 1937); du Toit's Kloof, Rawsonville (K. H. B., March 1932, and H. G. W., March, April 1934); Wellington Mts. (H. G. W., January 1934); Waaihoek Mts., Goudini (K. H. B., March–April 1934); Buffelshoek, Hex River Mts., Worcester Distr. (K. H. B., April 1936); Knysna (R. M. Lightfoot, March 1892, 2 ♂♂); George (H. G. W., January 1936, ♂♂); Coldstream (H. G. W., January 1936, 1♂).

*Remarks.*—I have to thank Mr. D. E. Kimmins and Miss Longfield for comparing Cape specimens with the ♂ specimen in the British Museum referred to by Ris. In their opinion the specimens are certainly conspecific. The inferior appendages of the B.M. ♂ have only a single point, corresponding with Selys' description. Evidently Ris made a slip when he said (p. 284) the appendages were "of the same type as in the three following species" (i.e. *fasciata, tessellata, longicauda*), unless he intended to refer only to the superior appendages.

This is the smallest species of the genus. Apart from the non-bifid inferior appendages, it is easily separated from *fasciata* and *tessellata,* both of which develop bands on the wings, by the single row of cells in the area $IR_2$–$R_3$, and the subparallel pairs of veins $R_3$, $IR_3$ and $R_{4+5}$, MA, and also the position of origin of $IR_3$. The penis is like that of *conspicua.*

### *Chlorolestes fasciata* Burm.

1839. Burmeister, Handb. Entom., vol. ii, p. 822.
1862. Selys, *loc. cit.*, p. 36.
1920. Kennedy, Ohio. Journ. Sci., vol. xxi, p. 84 (*Euchlorolestes f.*).
1921. Ris, *loc. cit.*, p. 284, fig. 17; and pl. vii, fig. 4.

*Imago.*—Ac slightly distal to 1st Anq. Origin of A′ distal to proximal side of Q. $R_{4+5}$ at subnodus, $IR_3$ 1 cell distal. Pterostigma covering 3–4 cells. Two rows of cells in area $IR_2$–$R_3$, 3 beyond pterostigma; 3 rows in $R_3$–$IR_3$, these 2 veins diverging evenly; 1 row in each of the areas $IR_3$ $R_{4+5}$ and MA–$Cu_2$; 2 rows in area $R_{4+5}$–MA at level of origin of $IR_2$, 3 rows distal thereto, these 2 veins diverging evenly.

*Genitalia ♂.*—Posterior hamules narrowing apically. Penis with rather long, gently curved distal hook, cultrate in shape, the dorsal edge being thin, apex spatulate or with disc-like expansion; the distal corners of the two flaps, between which the hook lies, are sharp. Claspers without either basal teeth, or lobes on inner margin. Inferior appendages with the chitinised portion forming a bifid process.

*Abdomen.*—♂ 32–38, ♀ 32 mm. Hind-wing, ♂ 25–28, ♀ 26 mm.

Labium, genae, bases of mandibles, and anteclypeus pale ochreous. Labrum, occiput, postclypeus, frons and vertex metallic blue-green. Prothorax metallic blue-green with a yellow bar on each side. Mesepisternum metallic bronzy green (duller in ♀), with a narrow yellow stripe at the humeral suture but not extending quite to dorsal end. Mesepimeron metallic green above, yellow below, with a metallic green or dark bar on ventral margin. Metasterna yellow, with small median line at hind end. Legs ochreous, darker and somewhat metallic greenish on outer sides. Abdomen as described by Ris. Wings hyaline or banded; in the latter case whitish pruinose from Q or nodus to 5th – 6th postnodal cross-veins, thence brownish to a short distance proximal from pterostigma. Pterostigma bicolorous, blackish proximally, ferruginous distally.

*Localities* (see Ris).—This species has not been found in the S.W. Cape, except the one record from "Albert Distr." (= Prince Albert.)

*Remarks.*—The metallic stripe along the upper half of the metepisternum is the most conspicuous difference separating this species from *tessellata* and *longicauda*. All three species form a closely allied group distinguished from the other species by the apex of the distal hook on the penis, the bifid inferior appendages of ♂, and the venation.

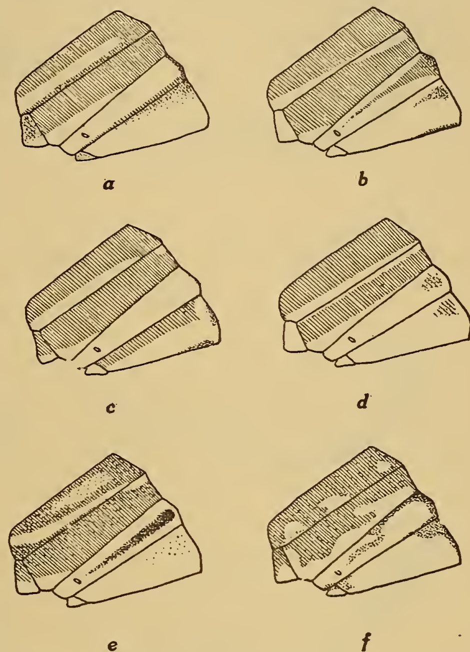


Fig. 8.—*Chlorolestes*, diagrams of thoracic patterns. *a*, *conspicua*. *b*, *umbrata*. *c*, *fasciata*. *d*, *tessellata* and *longicauda*. *e*, *nylephtha* n.sp. *f*, *peringueyi*. Cross shading represents metallic green or bronzy; dots, brown; unshaded, yellow, cream, or whitish.

## *Chlorolestes tessellata* Burm.

1839. Burmeister, *loc. cit.*, p. 822.
1862. Selys, *loc. cit.*, p. 35.
1921. Ris, *loc. cit.*, p. 286, pl. vii, fig. 5.

*Imago.*—Venation and ♂ genitalia as in *fasciata*, except that the posterior hamules are slightly clavate, and the distal corners of the two flaps, between which the distal hook of the penis lies, are rounded.

*Abdomen.*—41–44 mm. Hind-wing, 29–31 mm.

Coloration as in *fasciata*, but the mesepisternal yellow stripe

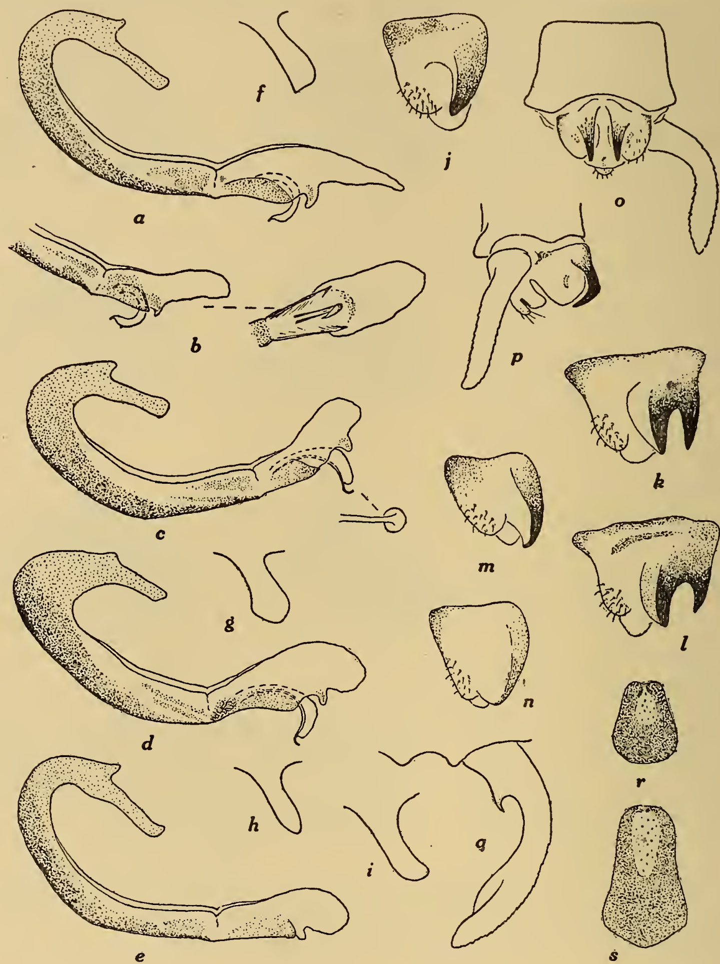


FIG. 9.—*Chlorolestes*, ♂ genitalia. *a, b, c, d, e*, penes of *conspicua, umbrata* (apex in lateral and ventral view), *fasciata, tessellata*, and *peringueyi* respectively. *f, g, h, i*, posterior hamule (anterior margin to left) of *conspicua, tessellata, peringueyi*, and *nylephtha* respectively. *j, k, l, m, n*, ventral view of inferior appendage of *conspicua, fasciata, tessellata, peringueyi*, and *nylephtha* respectively. *o, p*, ventral and lateral views of upper and lower appendages of *umbrata*. *q*, dorsal view of upper appendage of *nylephtha*. *r, s*, ventral view of process of 3rd sternite of *umbrata* and *tessellata* (and all other species) respectively.

broader and extending the whole length, and also below the humeral suture on to the mesepimeron; whole of the metepisternum and metepimeron yellowish with only a faint and indefinite suffusion near the dorsal ends of these two plates.

*Localities.*—See Ris, and add, Port St. Johns, Pondoland.

*Remarks.*—I have seen one ♂ from Grahamstown, April 1892, which is not the specimen seen by Ris as the date is different. The two old specimens mentioned by Ris are no longer in the South African Museum, but there are two from Port St. Johns, named by Ris. Some specimens from the S.W. Cape may belong to this species, but as they are all unbanded they are listed under *longicauda.*

### *Chlorolestes longicauda* Burm.

1839. Burmeister, *loc. cit.*, p. 823.

1862. Selys, *loc. cit.*, p. 35.

1921. Ris, *loc. cit.*, p. 287, fig. 18; and pl. vii, fig. 6.

*Imago.*—Venation, ♂ genitalia, and coloration as in *tessellata*, except that the wings apparently always remain hyaline.

*Abdomen.*—(Transvaal and Zululand specimens) ♂ 43–45, ♀ 38–45 mm. (Cape specimens) ♂ 35–39, ♀ 38 mm. Hind-wing (Transv., Zululd.) ♂ 29–34, ♀ 33–35 mm. (Cape) ♂ 27–28, ♀ 31 mm.

A pale cobalt-blue spot (often not conspicuous) between bases of hind-wings. Pterostigma in both sexes bicolorous, black (or very dark brown) proximally, cream distally (Cape specimens).

*Nymph.*—Resembling that of *conspicua.*

*Localities.*—See Ris, and add: St. Mathews, King Williams Town Distr. (R. M. Lightfoot, 1894, 1 ♀); and the following Cape localities: Keurbooms River, Plettenberg Bay (K. H. B., January 1931); Seven Weeks Poort, Ladismith (K. H. B. and H. G. W., February 1932); Robinson Pass, Outeniqua Range (K. H. B. and H. G. W., February 1932); George (H. G. W., January 1936).

*Remarks.*—Ris says this may be a geographical race or subspecies of *tessellata.* In view of the Western Province records it can scarcely be regarded as a race. The Western Province specimens are appreciably smaller than those from Zululand and the Transvaal.

### *Chlorolestes peringueyi* Ris.

1921. Ris, *loc. cit.*, p. 282, fig. 16; and pl. vii, fig. 3.

*Imago.*—Ac at level of 1st Anq (or slightly proximal or slightly distal). Origin of A′ at level of proximal side of Q. $R_{4+5}$ proximal to subnodus, $IR_3$ at subnodus. Pterostigma covering 2–2½ cells.

$IR_2$ strongly curved towards costa at level of pterostigma. Three rows of cells in area $IR_2$–$R_3$; 2 rows (distally) in $R_3$–$IR_3$, these 2 veins subparallel except at margin; 1 row in each of the areas $IR_3$–$R_{4+5}$, $R_{4+5}$–MA, and MA–$Cu_2$, veins MA and $R_{4+5}$ subparallel except near margin.

*Genitalia* ♂.—Posterior hamules apically narrowed. Penis without a distal hook. Claspers with basal teeth, and subterminal lobes on inner margin. Inferior appendages with the chitinised portions forming single processes.

*Abdomen.*—38–39 mm. Hind-wings, 27–29 mm.

Labium, genae, bases of mandibles, and anteclypeus pale buff or cream. Occiput black, becoming metallic greenish ventrally. Labrum, postclypeus, frons, and vertex metallic peacock-green in ♂, duller in ♀. Prothorax dull coppery or bronzy green, with 2 pale buff or cream round spots anteriorly. Mesepisternum dull metallic coppery or bronzy green, with 3 pale buff or cream spots near humeral suture, the inferior one sometimes divided into 2. Mesepimeron dull metallic coppery or bronzy with cream-coloured irregular stripe bordering 1st lateral suture. Metepisternum cream with irregular dark brown behind the spiracle, more or less confluent with a dark line along the posterior half of 1st lateral suture. Metepimeron cream with dark marks anteriorly and postero-dorsally. Metasterna pale cream or whitish with dark marks. Abdomen as described by Ris, except that "reddish brown" should be pale buff or cream (in living or fresh specimens); segments 9 and 10, sometimes also hinder half of 8, dorsally with pale bluish white pruinosity in ♂. Wings hyaline. Pterostigma dark brown in ♂, paler in ♀.

*Nymph.*—Resembling that of *conspicua.*

*Habits.*—This species inhabits open stream-beds, where the flies settle on the rocks with their wings spread out flat and closely adpressed to the surface of the rock. Their non-metallic (compared with the brilliance of e.g. *conspicua*) coloration harmonises very closely with the rocks, which, whether they be granite or sandstone, are of a more or less greyish colour. Only very rarely have the males been observed to settle on bushes; on the other hand, the females have frequently been seen in such situations, presumably with a view to oviposition, though the act in this species has not actually been observed. The resting position at night has not been observed.

*Localities.*—Ceres (R. M. Lightfoot, April 1913); Waaihoek Kloof, Goudini (K. H. B., March, April 1928); Bain's Kloof (east side) K. H. B., 1st May 1933); Jonkershoek, Stellenbosch (H. G. W., April 1931); Breede River near Mostertshoek (K. H. B., April 1933); du Toits Kloof, Rawsonville (H. G. W. and C. W. T., April 1934); Zanddrift and Buffelshoek Kloofs, Hex River Mts., Worcester Distr. (K. H. B., April 1930 and April 1936).

*Remarks.*—In common with *umbrata* and *nylephtha* this species has the 2 pairs of veins $R_3$–$IR_3$, and $R_{4+5}$–MA subparallel. The strong curve of $IR_2$ distally is characteristic. Also the thoracic colour scheme is quite different from that of the other species.

### *Chlorolestes nylephtha* n.sp.

*Imago.*—Ac slightly distal to level of 1st Anq. Origin of A′ distal to level of proximal side of Q. $R_{4+5}$ proximal to subnodus, $IR_3$ at subnodus. Pterostigma covering 2–3 cells. $IR_2$ evenly curved. Two rows of cells in area $IR_2$–$R_3$; 1 row in area $R_3$–$IR_3$, these 2 veins subparallel except at margin; 1 row in each of the areas $IR_3$–$R_{4+5}$, $R_{4+5}$–MA, and MA–$Cu_2$, veins $R_{4+5}$ and MA subparallel except at margin.

*Genitalia* ♂.—Posterior hamules slightly angular at postero-inferior corners. Penis without distal hook, as in *peringueyi*. Claspers with basal teeth, but no lobes on inner margin, merely a subterminal thickening. Inferior appendages with feebly chitinised portions along inner margins, apices not bifid.

*Abdomen.*—♂ 47–48, ♀ 40–41 mm. Hind-wing, ♂ 27–30, ♀ 29 mm.

Labium, genae, and bases of mandibles cream or pale buff. Occiput black, becoming slightly metallic greenish ventrally. Labrum, anteclypeus, postclypeus, frons, and vertex nitidulous, in ♂ very bright metallic green, in ♀ very dark brown or black. Prothorax dark brown, slightly lighter at posterior corners. Thoracic dorsum dull brown, with a slight metallic green sheen, with a lighter ochreous shade in middle or anteriorly or posteriorly, mid-dorsal line blackish, a pale yellow stripe bordering the humeral suture, at anterior end curving slightly medio-dorsally, at the posterior end descending slightly ventral to the suture. Mesepimeron similar to the mesepisternum, with the antero-ventral corner pale yellow. Metepisternum pale yellow, with a blackish cuneiform stripe in ventral half from posterior end to the spiracle. Metepimeron, metinfraepisternum, and metasterna pale yellowish white, with whitish pruinosity in ♂. In ♂ a bright cobalt-blue metanotal spot between bases of hind-wings; sometimes a similar but less conspicuous mesonotal spot between bases of fore-wings. Abdomen dark bronzy brown dorsally, paler ventrally, with paler rings on anterior margin of each segment, dorsum of segments 1 and 2 in ♂ more or less metallic green; segments 9 and 10 dorsally with bluish white pruinosity in ♂. Wings hyaline. Pterostigma dark brown.

*Nymph.*—Resembling that of *conspicua.*

*Habits.*—At George this species inhabits the densely wooded ravines on the southern slopes of the Outeniqua Range. The flight is difficult to follow, but when resting on the bushes, the metallic green head and the blue-spot between the wings in the males are conspicuous. The Kaaiman's Gat locality is near the sea, and the flies were seen flying in the open between the forest and the river. Lemoenshoek is the most westerly locality yet discovered.

*Localities.*—George (K. H. B., January 1931); Kaaiman's Gat, near George (H. G. W. April 1933); Robinson Pass, Outeniqua Range (K. H. B. and H. G. W., February 1932); Lemoenshoek, Langeberg Range (near Heidelberg, Cape) (K. H. B., November 1927).

*Remarks.*—Agrees with *peringueyi* in the origin of $R_{4+5}$ proximal to subnodus, basal teeth on claspers, absence of distal hook on penis, and the subparallel veins $R_3$–$IR_3$ and $R_{4+5}$–MA. The thoracic pattern, however, conforms with that of the other species. The nitidulous and very brilliant "face," and the blue metanotal spot in ♂ are distinctive. Named after the Fair Queen in Rider Haggard's "Alan Quatermain."

## Fam. AGRIONIDAE.

1917. Tillyard, *loc. cit.*, p. 277.
1921. Ris, *loc. cit.*, pp. 266, 288.
1933. Fraser, *loc. cit.*, p. 18 (*Coenagriidae* part).

*Imago.*—Pterostigma small, covering 1 cell or less (rarely more). No intercalary veins. Quadrilateral rectangular or oblique. Superior appendages ♂ not forcipate.

*Nymph.*—Slender. Caudal gills lamellate, simple, subnodate, or nodate, or triquetral (more or less). Gizzard with 8–16 folds, dentition variable.

### Subfam. Platycneminae.

1917. Tillyard, *loc. cit.*, p. 279.
1921. Ris, *loc. cit.*, p. 288.
1933. Fraser, *loc. cit.*, p. 150.

*Imago.*—Quadrilateral rectangular. 1A fully developed, reduced, or absent.

*Nymph.*—Mask with median projecting lobe, not cleft, mental and lateral setae present. Caudal gills thickened. Gizzard with 16 folds.

Gen. *Allocnemis* Selys.

*Imago.*—1A fully developed, extending several cells beyond nodus. Origin of A′ at Ac. $R_{4+5}$ at nodus, $IR_3$ 1 cell distal. Posterior


Fig. 10.—*Allocnemis leucosticta* Selys. Imago: *a*, ♂ and ♀ in act of oviposition. *b*, rootlet cut open to show 2 ova in cortex. *c*, genital valve ♀, with margin further enlarged. *d*, penis ♂. *e*, posterior hamule. *f*, *g*, lateral and dorsal views of appendages ♂. Nymph: *h*, genital valve ♀. *i*, dorsal view of caudal gills, with diagrammatic cross-sections. *j*, median gill, showing XIth tergite and suture (*s*) where gill breaks off. *k*, 3 folds of gizzard. *l*, portion of mask.

hamules well developed. Penis without a distal hook, but with the membranous apex strongly developed and bifid.

*Nymph.*—As under subfamily. Cercoids small, obtuse.

### *Allocnemis leucosticta* Selys.

1921. Ris, *loc. cit.*, p. 289, fig. 19; and pl. vii, fig. 7.

*Imago.*—The bright patch on segments 8–10, and the superior appendages in ♂, are deep chrome-yellow or orange in life.

Figures of the ♂ appendages are given because Ris (fig. 19) seems to have overlooked a small strongly chitinised medio-dorsal knob between the superior appendages, and his figure does not show the ventrally projecting, somewhat bifid tooth on the superior appendages.

*Nymph.*—Up to 16–17 mm. plus gills 5–6 mm.

2nd joint of antenna twice length of 1st, 5 flagellar joints, of which the apical one is small. Mask extending back to bases of fore-legs; mentum distally projecting, margins straight, minutely crenulate and with slender conical spines, 1 mental seta on each side, lateral setae 2. Gizzard with 1–4 denticles on each of the 16 folds, which are not differentiated into major and minor folds. Gills thickened, the median one lozenge-shaped, the lateral ones triquetral in cross-section, in lateral view ovate, sublanceolate; pedicels (remnants of XIth segment) ring-like, small; gills moderately caducous.

*Oviposition.*—The position of the sexes in oviposition may be seen from fig. 10, *a*. So far as observed the ♀ is always accompanied by the ♂ (*cf.* Kennedy, 1915, Proc. U.S. Nat. Mus., vol. xlix, p. 287, fig. 54, *Argia emma*). The eggs are laid in the cortical layer of the exposed roots of *Cunonia* trees, either at the surface meniscus or below the surface of the water, nearly to the full extent of the ♀ abdomen. No doubt other trees and plants are pierced to receive the eggs, but in all observations the *Cunonia* was chosen.

*Habits.*—The species is widely distributed in the mountains of the S.W. Cape, preferring the wooded and shady ravines rather than more open ones. It has not been observed on the Cape Peninsula. Before emergence the nymphs crawl up rocks by preference. The imagos are found from October to March.

*Localities.*—All over the S.W. Cape (except the Cape Peninsula), as far north as the southern Cedar Mts., Citrusdal, and as far east as Seven Weeks Poort in the Zwartberg Range, Ladismith, George in the Outeniqua Range, and Keurbooms River, Plettenberg Bay. Probably extends throughout the coastal belt to the Eastern Province and Natal. See Ris, and add, King Williams Town (R. M. Lightfoot, 1894).

### Subfam. Protoneurinae.

1917. Tillyard, *loc. cit.*, p. 279.
1933. Fraser, *loc. cit.*, p. 209.

*Imago.*—Quadrilateral rectangular. 1A reduced to a short vein descending to the wing margin, or absent altogether.

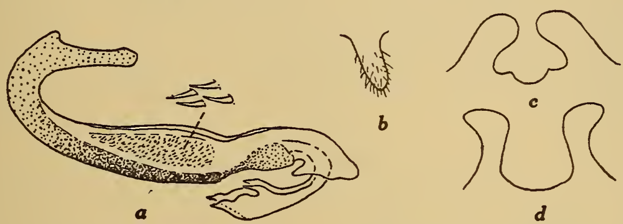


Fig. 11.—*Elattoneura mutata* (Selys). *a*, penis ♂, with sculpturing on flange of groove further enlarged. *b*, posterior hamule. *c*, dorsal view of the posterior; and *d*, front view of the anterior, prothoracic processes of ♀.

*Nymph.*—Mask without setae (Tillyard, but see below). Gills constricted, saccoid, or lamellar. Gizzard with 16 folds.

### Gen. *Elattoneura* Cowley.

1921. Ris, *loc. cit.*, pp. 266, 293, 439 (*Disparoneura*).
1933. Fraser, *loc. cit.*, p. 228 (*Disparoneura*).
1935. Cowley, Ent. Monthly Mag., vol. lxxi, p. 14.

*Imago.*—1A absent; A′ stopping at cross-vein, which continues the distal end of quadrilateral, its origin slightly proximal to Ac. $IR_3$ at subnodus, $R_{4+5}$ 1 cell proximal. Two pairs of styliform processes on posterior lobe of prothorax in ♀, the anterior pair upstanding, the hinder pair more or less horizontal, projecting backwards. Posterior hamules well developed. Penis with distal hook strongly developed.

*Nymph.*—One mental setae on each side; lateral setae 3. Gizzard with 8 major and 8 minor folds. Gills simple, lamellar, lanceolate, secondary tracheae oblique to main axis. Cercoids very short.

### *Elattoneura mutata* (Selys).

1896. Calvert, Proc. U.S. Nat. Mus., vol. xviii (1895), p. 141, fig. 15.
1921. Ris, *loc. cit.*, p. 293, fig. 21; and pl. vii, fig. 9.
1936. Cowley, Ann. Mag. Nat. Hist. (10), vol. xvii, p. 518.

*Imago.*—Gentalia ♂. Appendages as in Ris (fig. 21), *i.e.* with 2 downwardly projecting teeth on each superior appendage. A small subtriangular strongly chitinised plate between the superior appendages as in *frenulata.* Penis as in fig. 11, *a*, spinules on the basal membranous portion closely and evenly set without definite arrangement; apical claw-like process not scabrous. ♀ genital valve as figured for *frenulata* (fig. 12, *d*). Styliform processes on prothorax ♀ as described by Ris, and here figured (fig. 11, *c*, *d*).

*Locality.*—Kogman's Kloof, Montagu (K. H. B. and H. G. W., January 1935); Bot River (K. H. B., January 1937).

### *Elattoneura frenulata* (Hagen, Selys).

1860. Hagen in Selys, Bull. Ac. Roy. Belge, 2nd ser., vol. x, p. 17.
1921. Ris, *loc. cit.*, p. 439.
1936. Cowley, *loc. cit.*, p. 518.

*Imago.*—Venation as in *mutata*; A′ curving towards anal margin, but joining the cross-vein, which continues the distal side of Q, either near or at its junction with margin of wing. $R_3$ and $IR_2$ at 5th–6th and 8th–10th postnodal cross-veins in fore-wing, at 4th and 7th–9th in hind-wing, usually at 5th and 9th, and 4th and 8th respectively.

*Genitalia* ♂.—Superior appendages with only a single downwardly projecting tooth. Penis as in fig. 12, *a*, the spinules on the membranous portion arranged in short arcs giving an imbricate (fish-scale) appearance, teeth of the distal claw-like process minutely scabrous on their hind surfaces.

Styliform processes on prothorax ♀ as in fig. 12, *e*, *f*, the hinder pair less horizontal than in *mutata*, more at an angle of 45° with the front pair.

*Abdomen.*—Very dark, almost black. In ♂ an indication of a pruinose band between frons and ocelli, and on abdominal segments 8–10, but no definitely pruinose specimens observed. Thorax very dark bronzy green to middle of metepisternum (just above the metastigma), a dark suffusion along the 2nd lateral suture, the suture itself narrowly black; rest of sides and the ventral surface dirty white or pale grey. Abdomen blackish, with scarcely any differential colouring except more brownish ventrally. Pterostigma light brown. Legs blackish, inner surfaces of femora lighter. ♀ almost as dark as ♂; a faint indication of a dark brown stripe just above the humeral suture, and a short ochreous streak midway just below; the dark


FIG. 12.—*Elattoneura frenulata* (Hagen, Selys). Imago: *a*, penis, with sculpturing on flange further enlarged. *b*, *c*, lateral and dorsal views of appendages ♂. *d*, genital valve ♀, with margin further enlarged. *e*, dorsal view of the posterior; and *f*, front view of the anterior, prothoracic processes of ♀. Nymph: *g*, portion of mask. *h*, portion of gizzard. *i*, lateral gill, with marginal spine further enlarged.

bronzy green not extending on to the metepisternum, which nevertheless has a more or less extensive smoky suffusion.

*Nymph.*—Up to 10–11 mm. plus gills 4·5–5 mm. Antenna, 1st joint short, 2nd more slender and not quite twice as long as 1st, 3rd slightly longer than 2nd, 4th subequal to 2nd, 5th, 6th, and 7th decreasing in length, but 7th not minute. Mask extending back to between bases of fore and mid legs; median lobe not very prominent, margin straight, minutely crenulate, with blunt more or less incisiform spinules; 1 metal and 3 lateral setae; lateral margin with numerous, rather long, apically blunt spines. Gills elongate, lanceolate, with rather tapering apex, and strong marginal spines. Gizzard with 3–4 denticles in middle of each major fold, and 1 anteriorly, 1–2 denticles on each minor fold. Brownish, living amongst submerged stems of Palmiet, ferns, or other vegetation.

*Localities.*—Orange Kloof, Table Mt., Cape Town (K. H. B. and H. G. W., January); Palmiet River, near Kleinmond (H. G. W., December 1933; K. H. B. and H. G. W., December 1934; H. G. W., January 1937); N. of Tradouw Peak, Langeberg Range, near Barrydale (K. H. B., January 1935); George (H. G. W., January 1936); Hex River, Worcester (L. Peringuey, 1 ♂, 1883; 1 ♂, January 1888).

*Remarks.*—Probably no reliance can be placed on the coloration for distinguishing this species from *mutata.* The two species are easily separated, however, by the superior appendages of the ♂, and the prothoracic stylets in the ♀; the penis is an additional character.

At my request Dr. Banks kindly examined the type in the Museum of Comparative Zoology, Harvard, and sent a drawing of the ♂ appendages. There is no doubt that the present specimens are *frenulata*, a species which Dr. Banks thinks should be attributed to Hagen, who drew up the description, rather than to Selys.

### Subfam. Agrioninae.

1917. Tillyard, *loc. cit.*, p. 279.

1933. Fraser, *loc. cit.*, p. 272 (*Coenagriinae*).

*Imago.*—Quadrilateral oblique, anal distal angle acute. 1A normal.

*Nymph.*—Mask with projecting median lobe, not incised, mental and lateral setae present. Caudal gills usually slender, lamellate, nodate, subnodate, or simple; secondary tracheae oblique to gill-axis. Gizzard with 8–16 folds.

### Gen. *Pseudagrion* Selys.

1921. Ris, *loc. cit.*, pp. 266, 297.

1933. Fraser, *loc. cit.*, p. 274.

1936. Ris (and Schmidt), Abh. Senckenb. Nat. Ges., 433, pp. 1–68.

*Imago.*—Origin of A′ at Ac, or slightly proximal (not more than length of Ac). No transverse ridge at frons. Superior appendages of ♂ mostly bifurcate; penis with apical hook well developed, variously bilobed; posterior hamules small, conical, setose. No vulvar spine at 8th sternite in ♀. Most females with 2 small stylets

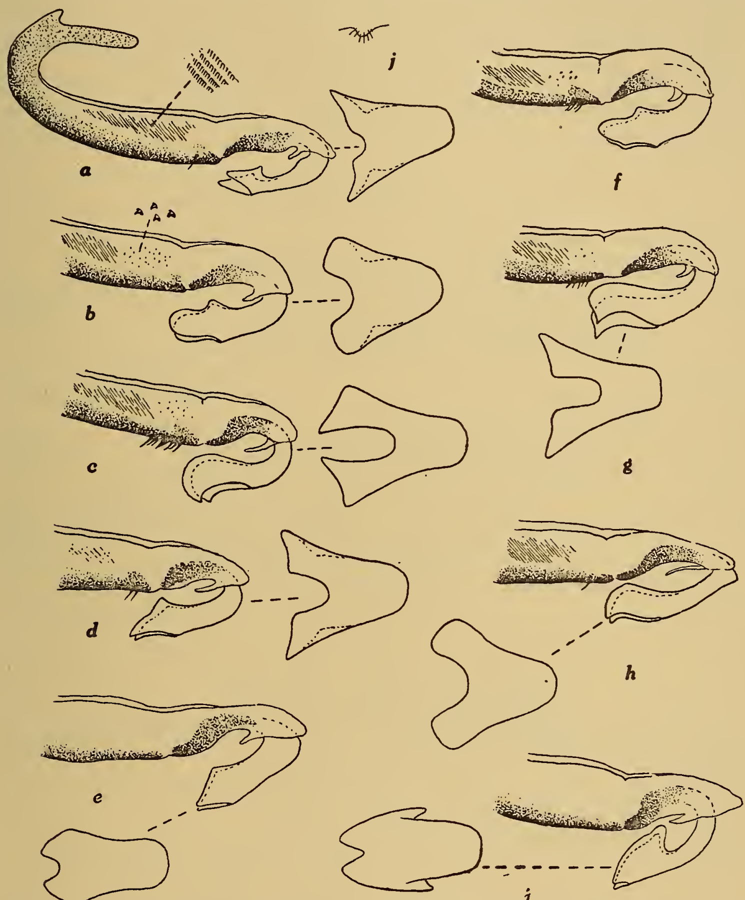


Fig. 13.—*Pseudagrion*, penes, with ventral views of apical lobe flattened out. *a*, *kersteni*; and *b*, var. *draconis*. *c*, *caffrum*. *d*, *citricola* n.sp. *e*, *acaciae*. *f*, *natalense*. *g*, *angolense*. *h*, *salisburyense*. *i*, *massaicum*. *j*, posterior hamule.

(*a* and *e–i* from specimens identified by Ris.)

at hind border of prothorax. Colour scheme mostly blue and black, most species with pale postocular spots.

*Nymph.*—Median lobe of mask rather strongly projecting; 1 mental and 3 lateral setae on each side. Gills nodate, elongate. Gizzard with 8 major and 8 minor folds. Cercoids small.

*Remarks.*—For the sake of comparison figures of the penis of all species represented in the South African Museum collections are given, taken from specimens identified by Ris. It is much to be regretted that Ris himself did not consider this feature in his 1936 revision (published posthumously, with editorial notes by Schmidt), a work which does not greatly advance the study of the genus so far as concerns the South African species. The name *praetextatum* is definitely dropped in favour of *kersteni* Gerst.

### *Key to species found in the S.W. Cape.*

♂♂

A. Superior appendages bifid.
  1. Superior appendages with basal inner tooth.
    *a.* 7th abdominal segment dorsally black . . . *caffrum.*
    *b.* 7th abdominal segment dorsally blue . . . . *citricola.*
  2. Superior appendages without basal inner tooth *kersteni* and var. *draconis.*

B. Superior appendages entire . . . . *massaicum* var. *cogmani.*

♀♀

  1. Stylets on prothorax rather long.
    *a.* 8th abdominal segment almost entirely blue . . *citricola.*
    *b.* 8th abdominal segment blue only on posterior half *kersteni* and var. *draconis.*
  2. Stylets short, acute. 8th abdominal segment entirely blue, and a blue spot on hind margin of 7th segment . . . *caffrum.*
  3. Stylets obsolete. 8th abdominal segment bronzy black *massaicum* var. *cogmani.*

### *Pseudagrion caffrum* (Burm.).

1908. Ris in Schultze's Reise, i, pp. 315, 316 (♀ from Table Mt. *kersteni* non Gerst.).

1921. *Id., loc. cit.*, p. 300, fig. 22 (*furcigerum*).

1921. *Id., loc. cit.*, p. 301, fig. 23.

1936. *Id., loc. cit.*, p. 16, fig. 3; and p. 17, fig. 4 (*furcigerum*).

*Imago.*—Superior appendages showing gradations between the two forms represented in Ris's figs. 22 and 23, the inner basal tooth either blunt, rounded, or acute. Penis with apical hook very large, in repose the rounded apical lobes embracing the stem, which has a series of 8–10 spines on each side near the ventral margin, and often another one higher up. Prothoracic stylets of ♀ short, acute.

*Abdomen.*—♂ 25–30, ♀ 25–26 mm. Hind-wing, ♂ 19–22, ♀ 20–23 mm.

♂. Occiput pale greenish yellow. Labium, labrum, anteclypeus and lower half of eye grass green, the labrum with 1–3 black dots or a black line at its base. Postclypeus black. Frons and dorsal surface of head bronzy blue-black in teneral, blackish in old examples, with light bluish pruinosity especially on frons. Postocular spots visible in teneral specimens, but in old specimens masked by pruinosity. Prothorax and thorax as described by Ris for *caffrum*; a black line in dorsal third of 2nd lateral suture; in old specimens a bluish pruinose antehumeral band occupying half the space between mod-dorsal keel and humeral suture, not quite touching latter. Abdomen as in Ris; on segments 8 and 9 a medio-dorsal blue band, sometimes narrow, sometimes broad, but completely concealed in old specimens by bluish pruinosity which extends over whole dorsal and lateral surfaces of segments 8–10. Superior appendages black externally, the points of the fork and the inner basal tooth black. Pterostigma reddish brown or russet (pale brown if teneral).

♀ as in Ris. Frons and postocular spots raw-sienna, darkening with age. Short black lines on dorsal third of 1st and 2nd lateral sutures. A dorsal patch on posterior half of 7th (more or less extensive), on whole of 8th, 9th, and 10th segments bright blue, but concealed under pruinosity in aged specimens. Pterostigma pale brown. In very teneral specimens the head, prothorax, and thorax are predominantly orange-brown.

*Nymph.*—Up to 16–18 mm. plus gills 7 mm. 1st and 2nd joints of antenna subequal, or 2nd slightly longer; 4 flagellar joints, with a minute apical 5th. Mask extending back to midway between bases of fore and middle legs; median lobe prominent, with slightly concave margins, set with short conical spinules; 1 mental and 3 lateral setae; outer margin of lateral lobes with blunt spinules. Gills elongate, narrow, nodate, apices shortly acute. Gizzard with 3–4 large denticles in middle of each major fold, with 3–5 in line anteriorly to these, minor folds with 2 fairly large denticles in line and 2–3 in line anterior to them. Greenish, or brownish when fully mature; living amongst weeds (*Scirpus*, etc.).

*Localities.*—Cape Peninsula (various localities from sea-level to top of Table Mt., November–March); widely distributed over S.W. Cape as far north as the Cedar Mts., Clanwilliam (K. H. B., January 1930), and as far east as Meiring's Poort, Zwartberg Range (north of Oudtshoorn) (K. H. B. and H. G. W., February 1932 and January 1935), October–March.

*Remarks.*—This species is common on Table Mt. and throughout the S.W. Cape mountains and lowlands. It seems extraordinary that the S.A. Museum had no specimens to send to Ris. There is no doubt as to the identity of the species, and from the series at hand I do not hesitate to place *furcigerum* in synonymy. The ♀ described by Ris in 1908, and assigned to *kersteni*, should be assigned to the present species.

### *Pseudagrion citricola* n.sp.

*Imago.*—Superior appendages ♂ closely resembling those of *salisburyense* Ris. Penis nearest to that of *kersteni*, but with the differences shown in fig. 13, *a*, *d*. Prothoracic stylets ♀ as in *kersteni*. Origin of A′ slightly proximal to Ac.

*Abdomen.*—♂ 26–27, ♀ 27–28 mm. Hind-wing, ♂ 20, ♀ 20–21 mm.

♂. Occiput, labium, labrum, and anteclypeus pale buff. Postclypeus, frons, and vertex bronzy black. Postocular spots small, circular, dull bluish. Prothorax black, with bluish pruinose patches dorsally and laterally. Thorax dorsally bronzy black, pruinose, extending to the 2nd lateral suture, or slightly beyond at the dorsal end, and enclosing a narrow pale stripe on the metepisternum. Metepimeron and ventral surface pale buff, with whitish pruinosity. Abdomen dorsally metallic steel-blue black, ventrally whitish; three-quarters of dorsal surface of segment 7, and whole dorsal surface of 8 and 9 blue, more or less concealed in pruinosity. Superior appendages black at tips. Pterostigma russet-brown. Legs pale grey or buff internally, black externally.

♀. Teneral: Occiput and labium pale buff. Labrum, anteclypeus, frons, the oval postocular spots and bar connecting them orange-brown; postclypeus and an interocular band embracing the ocelli black. Prothorax black, with orange marks dorsally, orange laterally, stylets orange. Thorax orange-brown, including a narrow medio-dorsal line; a black band immediately next to the medio-dorsal line, and another from the humeral suture occupying half the width of mesepimeron. Abdomen bronzy green dorsally, buff ventrally; dorsal patches on segments 8 and 9, and whole of 10 pale. Pterostigma pale brown. Legs buff, femora and tibiae with narrow black lines externally. Intermediate stage: Darker with the orange portions on head and thorax olivaceous. Sides of thorax greyish. Abdomen bronzy black dorsally. Dark form: Almost as in ♂. Labrum and anteclypeus orange-olivaceous. The postocular spots small, round, and disconnected. Prothorax, including stylets, thorax, and abdomen black dorsally; the latter somewhat bronzy distally, and the pale patches more or less pruinose. Pterostigma pale brown. Black stripes on legs narrower than in ♂.

*Locality.*—Kridouw Krans, Olifants River, between Citrusdal and Clanwilliam (K. H. B., September 1931).

*Remarks.*—The ♂ closely resembles *salisburyense*, and the ♀ resembles *kersteni*. The pale patches on abdomen in both sexes separate this species from the other two.

*P. salisburyense* has recently been found at Aiais on Gt. Fish River, South West Africa (A. J. H. and C. W. T., November 1936).

### *Pseudagrion kersteni* (Gerst.).

1921. Ris, *loc. cit.*, p. 303, fig. 25 (*praetextatum* Selys).

1936. *Id.*, *loc. cit.*, p. 18, figs. 2, *a*, 5 (synonymy).

*Imago.*—To supplement Ris's description, and for comparison with the two preceding species, figures of the abdominal markings in ♂ and ♀, and of the penis, are here given, taken from specimens identified by Ris.

*Localities.*—Cold Bokkeveld, N. of Ceres (M. Versfeld, October 1934, 2 ♂♂, 3 ♀♀. Bosch Kloof, Clanwilliam (K. H. B. and C. W. T., September 1936, 2 ♂♂). Seven Weeks Poort, Ladismith, Cape (K. H. B. and H. G. W., January 1935, 1 ♂).

*Remarks.*—This species appears to be very local in the S.W. Cape.

### *Pseudagrion kersteni* var. *draconis* n.

*Imago.* — Superior appendages ♂ resembling those of *kersteni* in having no internal basal tooth. Penis differing from that of *kersteni* as shown in fig. 13, *a*, *b*, viz. no spines on lower margin of stem, but with minute denticles on the membranous portion, and the apical lobe with wider excision. Prothoracic stylets ♀ as in *kersteni*.

Origin of A′ slightly proximal to Ac.

*Abdomen.*—♂ 28, ♀ 27 mm. Hind-wing, ♂ 19–21, ♀ 21 mm.

♂. Head black (bronzy black), postocular spots obsolete in fully mature, a band of bluish-white pruinosity between the eyes. In teneral specimens occiput, labium, labrum, ante- and post-clypeus, frons and postocular spots buff or brown, the postclypeus with dark band at base, vertex dark bronzy green. Prothorax bronzy black, with bluish pruinosity; in teneral bronzy green above with 2 buff spots. Thorax bronzy black above, shading on lower part of sides to pale greyish, with bluish pruinosity; in teneral bronzy green dorsally and upper half of mesepimeron, antehumeral stripe and sides buff. Abdomen dorsally bronzy black with bluish pruinosity, ventrally whitish; in teneral metallic steel-blue; segments 8 and 9

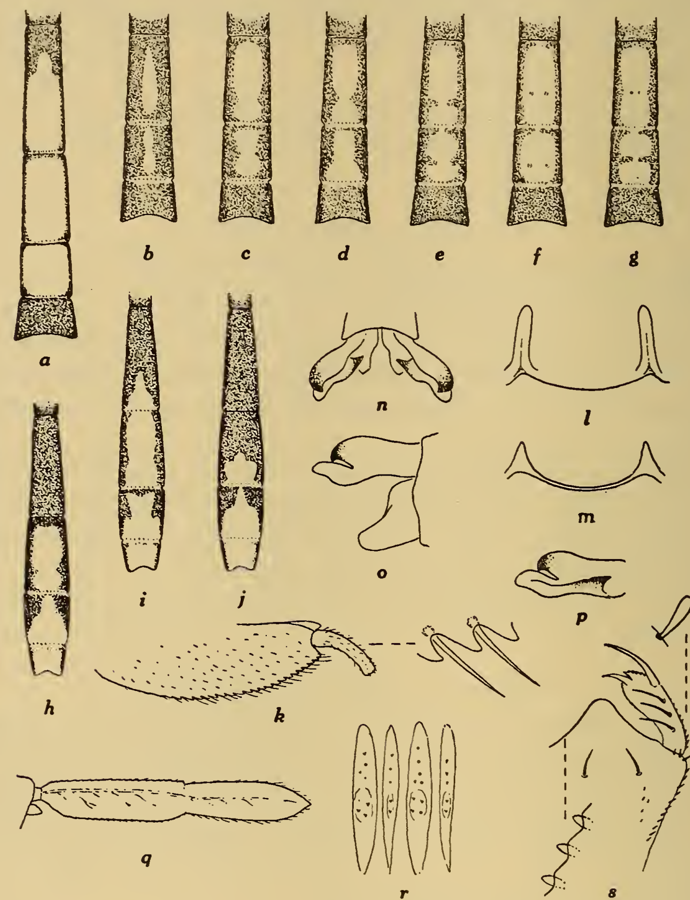


FIG. 14.—*Pseudagrion.* Imago: *a*, 7th–10th abdominal segments of ♂ *citricola* n.sp. *b–e*, 8th–10th segments ♂ of four varieties of *caffrum* (Hottentots Holland Mts., Cedar Mts., Table Mt., and Seven Weeks Poort respectively). *f*, the same, *kersteni*; and *g*, var. *draconis*. *h*, 7th–10th segments, ♀ *citricola* n.sp. *i*, the same, *caffrum*. *j*, the same, *kersteni*. *k*, genital valve ♀ *caffrum* with margin further enlarged. *l*, *m*, prothoracic stylets ♀ *kersteni* and *caffrum* respectively. *n*, *o*, *p*, dorsal and external lateral views of appendages ♂ *citricola* n.sp., and inner lateral view of upper appendage. Nymph of *caffrum*: *q*, median gill, with cercoid. *r*, 2 major and 2 minor folds of gizzard. *s*, portion of mask, with margin of median lobe further enlarged.

dorsally blue, more or less concealed in pruinosity (Gt. Drakenstein); in the Montagu specimen the blue colour extends half-way down the sides of the segments, so that in dorsal view the whole surface appears blue, or there is a small transversely oval blue patch on segment 10. Apices of superior appendages blackish. Pterostigma dark brown in mature, paler in teneral specimens. Legs blackish and more or less pruinose in mature, buff with thin dark lines on the femora in teneral.

♀. Teneral (but *in copula*) : Occiput, face, and postocular spots buff, vertex bronzy green. Prothorax ochreous. Thorax ochreous, with bronzy green stripe on either side of mid-dorsal keel, and a similar stripe on mesepimeron bordering the humeral suture. Abdomen bronzy green above, buff below, buff-coloured dorsal patches on segments 8 and 9 as in *kersteni*, 10 wholly buff. Legs buff with narrow black lines on outer surface of femora. Pterostigma pale brown. Thorax and abdomen becoming bluish in adult, segment 10 blue.

*Localities.*—Groot Drakenstein (K. H. B., March 1931, 1 ♂).

Kogman's Kloof, Montagu (K. H. B., January 1935, ♂♂, ♀♀; A. J. Hesse and C. W. Thorne, November 1935, ♂♂, ♀♀). Bot River (K. H. B., January 1937, ♂♂).

### *Pseudagrion massaicum* Sjöstedt.

1921. Ris, *loc. cit.*, p. 310, fig. 29.
1936. *Id.*, *loc. cit.*, p. 50, fig. 26.
1936. Longfield, Trans. Roy. Entom. Soc., vol. lxxxv, p. 473.

#### var. *cogmani* n.

*Imago.*—Ac nearly equidistant from 1st and 2nd Anq, slightly nearer the former. Origin of A′ proximal to Ac by slightly less than length of Ac. Post-nodal cross-veins 12 in fore-wing, 10 in hind-wing. $R_3$ and $IR_3$ respectively at the 6th and 8th post-nodal cross-veins in fore-wing, at 5th and 9th in hind-wing. No cross-vein between A′ and anal margin until opposite lower distal angle of Q. Apices of wings not much rounded. Pterostigma longer than deep in both wings. Hind margin of prothorax evenly convex; stylets in ♀ obsolete. No mesepisternal tubercle. Tarsal claws with inferior tooth. Superior appendages ♂ equal to mid-dorsal length of Xth segment, which is not elevated, but widely excised, with 4–5 digitiform spines on hind margin on either side of median line. Each appendage entire (not bilobed), appearing to end in an incurved acute point owing to feeble chitinisation of inner distal surface. Inferior appendages broadly lobate, obscurely bilobed. Penis without lateral spines on stem, apical hook elongate, with 2 short proximal and 2 elongate distal lobes, and short lateral alate projections. Posterior hamules obsolete.

*Abdomen.*—♂ 27, ♀ 26–27 mm. Hind-wing, ♂ 18, ♀ 19–20 mm.

♂. Occiput and labium yellow ochre, the former blackish around foramen and the postocular band. Labrum, clypeus, frons, vertex, and postocular spots (which are connected) coppery red. Eyes scarlet. Prothorax blackish with 3 coppery spots. Thorax dorsally coppery red, shading on sides into greenish, and then ventrally into

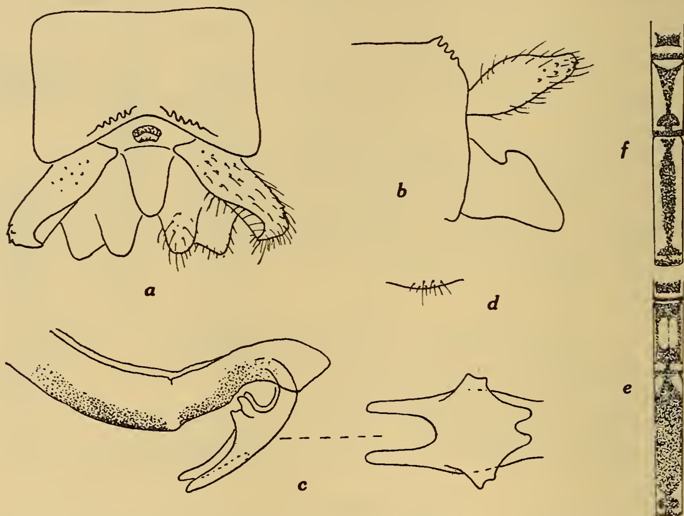


FIG. 15.—*Pseudagrion massaicum* Sjost. var. *cogmani* n. *a*, *b*, dorsal and lateral views of ♂ appendages. *c*, apex of penis, with dorsal view of apical lobe. *d*, posterior hamule. *e*, *f*, diagrams of pattern on abdominal segments 1–3, ♂ and ♀ respectively.

cobalt-blue. A bronzy black medio-dorsal stripe, a similar stripe on humeral suture with a semicircular expansion on medial side near dorsal end, and dark marks at postero-dorsal ends of 1st and 2nd lateral sutures. Femora black, tibiae and tarsi ochreous, former with black line externally, latter with black junctions between the joints. Abdomen with segments 1–7 bronzy green, dorsal pattern on segments 1–3 (see fig. 15, *e*), segments 8, 9, and 10 deep cobalt-blue. Superior appendages blackish. Pterostigma russet.

♀. Occiput and face buff. Vertex and postocular spots brownish, the latter outlined with black. Eyes grey with darker bands. Prothorax ochreous brown, with black marks. Thorax bronzy brown, paler and pruinose below, black markings as in ♂. Legs as in ♂, but ground colour paler. Abdomen with segments 1–9 bronzy green above, pale greenish below, dorsal pattern on segments 1–3 (see fig. 15, *f*), segment 10 cobalt-blue, segment 1 often pruinose. Pterostigma russet.

*Locality.*—Kogman's Kloof, Montagu (K. H. B., January 1935, 1 ♂; A. J. Hesse and C. W. Thorne, November 1935, ♂♂, ♀♀).

*Remarks.*—This form is exceedingly close to the Zululand specimens identified by Ris as *massaicum*, but differs in the quite distinctive penis in ♂, and the slightly stronger dorsal pattern on abdominal segments 1–3 in ♀. It may eventually be raised to specific rank.

The male of this damsel-fly is most striking in flight, as its head and thorax, appearing like burnished copper, make a wonderful contrast with the bright blue of the end of the abdomen.

### Gen. *Ceriagrion* Selys.

1921. Ris, *loc. cit.*, pp. 267, 314.

1933. Fraser, *loc. cit.*, p. 313.

*Imago.*—Origin of A′ at Ac or slightly proximal. A transverse ridge on frons. Superior appendages ♂ not bifurcate. No vulvar spine on 8th sternite ♀. No prothoracic stylets ♀. Colour scheme mostly orange or reddish, no postocular spots.

Fig. 16.—*Ceriagrion glabrum* (Burm.). Penis, with ventral view of apical lobe. The heavily chitinised portion of stem is only faintly dotted so as to show the adpressed spinules.

### *Ceriagrion glabrum* (Burm.).

1921. Ris, *loc. cit.*, p. 314, fig. 31.

*Imago.*—Posterior hamules well developed (cf. *Elattoneura*, fig. 11, *b*). Penis with apical lobe broadly expanded and shortly notched at apex, 3–4 short adpressed spinules on each side of stem.

*Localities.*—Knysna (R. M. Lightfoot, April 1890; and H. G. W., January 1936). Keurbooms River, Plettenberg Bay (K. H. B., January 1931). Drakenstein (A. C. H. and K. H. B., February 1937).

*Remarks.*—The nymph of this damsel-fly is unknown.

Gen. *Enallagma* Charpentier.

1908. Ris, *loc. cit.*, p. 310.
1920. Kennedy, Ohio Journ. Sci., vol. xxi, p. 87.
1921. Ris, *loc. cit.*, pp. 267, 317.
1933. Fraser, *loc. cit.*, p. 371.
1936. Longfield, Trans. Roy. Entom. Soc., vol. lxxxv, p. 474.

*Imago.*—Origin of A′ proximal to Ac by more than length of Ac. Arculus at 2nd Anq (or only slightly distal). $R_3$ usually at 5th

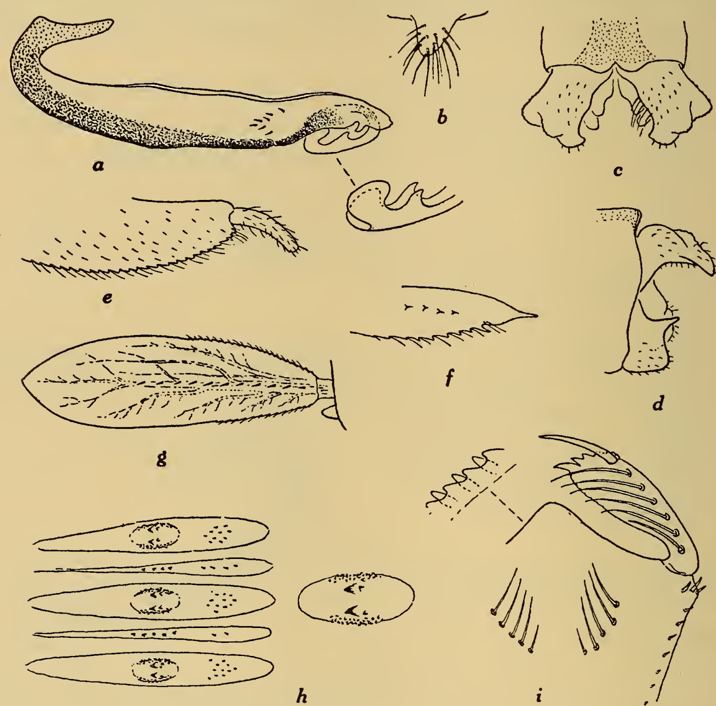


Fig. 17.—*Enallagma glaucum* (Burm.). Imago: *a*, penis, with apical lobe further enlarged. *b*, posterior hamule. *c*, *d*, dorsal and lateral views of appendages ♂ (in *c* the upper appendages are more spread out than in Ris's 1921 figure). *e*, genital valve ♀. Nymph: *f*, genital valve ♀. *g*, median gill with cercoid. *h*, portion of gizzard, with one of the chitinous plates further enlarged. *i*, portion of mask with margin of median lobe further enlarged.

(or 6th) postnodal cross-vein in fore-wing, at 4th (or 5th) in hind-wing. Xth segment ♂ not, or only slightly, elevated at posterior margin. ♀ with vulvar spine on 8th sternite. Pterostigma in ♂ unicolorous in both wings. Posterior hamules rather small, conical, setulose. Penis with bilobed apical hook.

*Nymph.*—Median lobe of mask rather strongly projecting, 4 mental and 6 lateral setae. Gills subnodate or simple, sometimes slightly thickened. Cercoids small. Gizzard with 8 major and 8 minor folds.

*Remarks.*—Kennedy (*loc. cit.*, 1920, p. 87) has proposed for *E. glaucum* and *subfurcatum* the respective generic names *Africallagma* and *Proischnura*. *Africallagma* is based on the Xth segment of ♂ elevated into a dorsal keel, notched at apex. It includes also *nigridorsum* Selys, *obliteratum* Selys, and *schultzei* Ris. *Proischnura* has the Xth segment ♂ apically forked, the pterostigma of hind-wings smaller than that of fore-wings, and penis intermediate between those of *Ischnura* and *Enallagma*. I have no material by which to test the value of these characters; and, moreover, it seems that Kennedy's division does not coincide with that of Ris. See also Miss Longfield's remarks. So far as concerns the South African fauna the subdivision of *Enallagma* has no practical value.

Of the species mentioned in Ris (1921), I have examined the penis of *nigridorsum*, *pseudelongatum*, and *sinuatum* in addition to that of *glaucum*. In *pseudelongatum* and *sinuatum* the penis is very similar to that of *glaucum*, and scarcely of specific importance. That of *nigridorsum*, however, has the apical lobes of the distal hook quadrangular instead of rounded, and sufficiently distinct to serve as a differential character.

### *Enallagma glaucum* (Burm.).

1908. Ris, *loc. cit.*, p. 313, fig. 3.
1921. *Id.*, *loc. cit.*, pp. 318, 326, fig. 38.

*Imago.*—Figures of the ♂ appendages are given here, viewed in a slightly different position from those figured by Ris.

*Nymph.*—Up to 11–12 mm. plus gills 5 mm. Antenna with 2nd joint half as long again as 1st (or nearly so), 3rd subequal to 1st and 2nd together. Mask extending back to between bases of fore and middle legs; median lobe with anterior margins slightly concave, minutely serrulate and with short conical spinules; often a 5th mental seta on one side or on both sides, smaller than the usual 4. Gills slightly obovate, lamellate, thin, spinules on the median gill extending farther along the dorsal than along the ventral margin, *vice versa* in the lateral gills. Gizzard with denticles arranged as in fig. 17, *h*. Pale greenish or brownish, sometimes slightly variegated.

*Oviposition.*—Females, held by the males, have been observed ovipositing just beneath the surface in stems of reeds (*Juncus*)

(Table Mt., K. H. B.). They were also observed crawling down 3 or 4, or even 6 inches below the surface in order to oviposit, but unaccompanied by the males (Muizenberg Reservoir, A. C. H. and K. H. B.). The eggs are laid singly in rows.

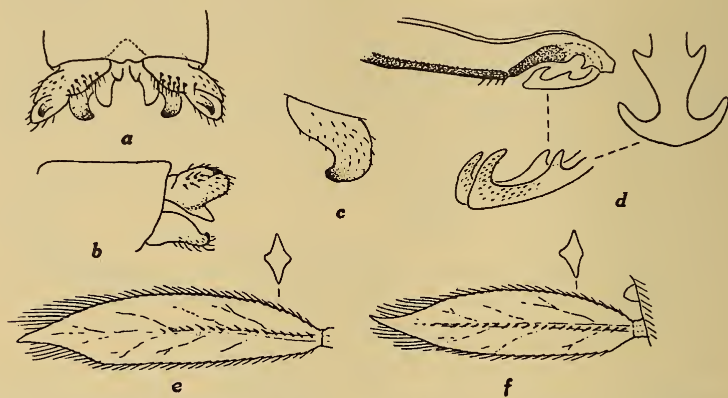


Fig. 18.—*Enallagma polychromaticum* n.sp. Imago: *a*, *b*, dorsal and lateral views of appendages ♂. *c*, ventral view of inferior appendage. *d*, apex of penis, with apical lobe further enlarged, and in ventral view. Nymph: *e*, *f*, median and lateral gills, with cross-sections, and cercoid.

*Localities.*—Widely distributed in the S.W. Cape from the Cape Peninsula to the Kamiesberg, Namaqualand, in the north (K. H. B., September 1931), and eastwards to Knysna (R. M. Lightfoot, 1890), Murraysburg (C. W. T., 1931), Vogelfontein, Prince Albert Div. (A. J. H., 1930), and Grahamstown (Miss Walton). May, September, November to April; probably all the year round in many localities.

### *Enallagma polychromaticum* n.sp.

*Imago.*—Ac equidistant from 1st and 2nd Anq. Origin of A′ proximal to Ac by slightly more than length of Ac. A cross-vein between A′ and anal margin at level of upper distal angle of quadrilateral. Postnodal cross-veins 10 in fore-wing, 8 in hind-wing. $R_3$ and $IR_2$ respectively at the 5th and 7th (sometimes 4th and 6th) postnodal cross-veins in fore-wing, at 4th and 6th (or 7th) in hind-wing. Apices of wings rounded, almost as much as in *rotundipenne*; pterostigma longer than deep, less so in hind-wing. Hind margin of prothorax evenly convex, with small medio-dorsal rounded tubercle. A small rounded tubercle on anterior margin of mesepisternum midway between medio-dorsal keel and humeral suture. Tarsal claws with inferior tooth.

Superior appendages ♂ half length of Xth segment, which is not elevated and has a small notch between 2 small rounded lobes on hind margin (smaller than the similar notch in *glaucum*), dorsally a chitinised point, which, however, scarcely projects above the surface (fig. 18). Inferior appendages with blunt, incurved, and slightly upturned apices. Penis without the lateral spinules found in *glaucum*; apical hook with the projections narrow and acute, the inner surfaces minutely scabrous. ♀ with vulvar spine on 8th segment; genital valve as in *glaucum*. Abdomen: ♂ 17–71·5, ♀ 18 mm. Hind-wing, ♂ 12–12·5, ♀ 12·5 mm.

♂. Occiput pale buff, blackish around foramen. Labium pale buff. Labrum mauve with 3 black dots at its base. Postclypeus mauve with black basal transverse bar. Frons mauve. Vertex dark bronzy green. Postocular spots cuneiform, violet, narrowly connected. Prothorax dark bronzy green with 3 mauve dots (1 median and 1 on each lateral margin), sometimes 2 dots in place of each single dot. Thorax bronzy green, without a medio-dorsal pale line (in fully adult), with a violet antehumeral stripe nearly as wide as the dark median band, but not extending quite to humeral suture; the latter occupied by a bronzy-green stripe as wide as the violet antehumeral stripe. Rest of mesepimeron, whole of metepisternum, and a cuneiform patch at dorsal end of metepimeron violet. Rest of metepimeron, mesinfraepisternum, sterna, and coxae pale buff but shading up into the violet. Pterostigma dark sepia. Femora wholly black in fully mature on inner and outer surfaces. Tibiae with black lines on outer surface. Abdomen with segments 1–7 bronzy green above, pale buff below; a narrow pale ring anteriorly on segments 3–7, and the dorsal colour extending slightly down the sides at the posterior margins of segments 2–6. Segments 8 and 9 each with a shield-like bright violet (fully adult) or deep cobalt-blue patch dorsally, surrounded by bronzy green. Segment 10 bronzy green dorsally and laterally. Segments 8–10 ventrally pale buff. Superior appendages blackish, inferior appendages with black chitinised apices. The mauve and violet colour fades after death to buff or greyish.

♀ similar but with the following differences; all mauve or violet patches are here buff or pale greyish, a narrow pale medio-dorsal line on thorax, femora with blackish lines on outer surfaces only, a small oval cobalt-blue patch dorsally on 9th abdominal segment, pterostigma pale sepia brown.

*Nymph.*—Up to 9–10 mm., plus gills 3–4 mm.

In general similar to that of *glaucum*. Mask with 4 mental and 6 lateral setae. ♀ genital valve as in *glaucum* but the teeth rather stronger. Gizzard with fewer denticles on the folds. Gills lanceolate, with pointed apices, slightly thickened (see cross-sections, fig. 18), the margins more strongly spinulose, and the distal portions with rather long setae.

*Locality*.—Seven Weeks Poort, Zwartberg Range, Ladismith, Cape (K. H. B. and H. G. W., February 1932 and January 1935. ♂♂, ♀♀ and nymphs).

*Remarks*.—This is the smallest dragon-fly yet found in the Western Province, and, barring the tropical *Agriocnemis exilis*, the smallest in the South African fauna.

### Gen. *Ischnura* Charpentier.

1917. Kennedy, Proc. U.S. Nat. Mus., vol. lii, p. 496 (penis).

1921. Ris, *loc. cit.*, pp. 267, 333.

1933. Fraser, *loc. cit.*, p. 346.

*Imago*.—Origin of A′ proximal to Ac by more than length of Ac. Arculus at 2nd Anq (or only very slightly distal). $R_3$ usually at 4th postnodal cross-vein in fore-wing, at 3rd in hind-wing. Xth segment ♂ elevated at posterior margin. ♀ with vulvar spine on 8th sternite. Posterior hamules fairly prominent, stout, setose. Penis with long bifurcate apical hook. Pterostigma in ♂ bicolorous in fore-wing.

*Nymph*.—Median lobe of mask rather strongly projecting; 4 mental and 6 lateral setae. Gills simple (or subnodate), lanceolate, thin. Gizzard with 8 major and 8 minor folds. Cercoids small and inconspicuous.

### *Ischnura senegalensis* (Rambur).

1908. Ris, *loc. cit.*, p. 310.

1921. *Id.*, *loc. cit.*, p. 333, fig. 42.

1928. Andrés, Mem. Roy. Entom. Soc. Egypt, vol. iii, p. 25, pl. iii, figs. 5, 6 (coloured).

1933. Fraser, *loc. cit.*, p. 348, figs. 150, 151.

1936. Longfield, Trans. Roy. Entom. Soc., vol. lxxxv, p. 471.

*Imago*.—Coloration as given by Ris. Abdominal segments "5–7" should read 3–7. The blue colour on segments 1 and 2, and especially on segments 8, 9, and 10 is very brilliant sky or cobalt blue. The distal half of pterostigma in fore-wing ♂ is blue in life.

*Nymph.*—Up to 17–18 mm. plus gills 6–6·5 mm.

Antenna with 2nd joint not quite twice length of 1st, 3rd slightly longer than 2nd. Mask extending back to between bases of fore and middle legs; median lobe with straight anterior margins, crenulate and with short, bluntly conical spinules. Gills lanceolate with acute apices; spinules on median gill extending farther along


FIG. 19.—*Ischnura senegalensis* (Rambur). Imago: *a*, *b*, lateral and ventral views of appendages ♂. *c*, penis. *d*, posterior hamule. *e*, genital valve ♀, with margin further enlarged. Nymph: *f*, lateral gill with cercoid. *g*, genital valve ♀. *h*, portion of mask with margins of median and lateral lobes further enlarged. *i*, major and minor folds of gizzard.

dorsal margin than along ventral, *vice versa* in lateral gills. Gizzard with denticles on the folds as in *E. glaucum*.

Pale greenish or yellowish, more or less variegated. Living amongst weeds.

*Oviposition.*—The ♀, unaccompanied by the ♂, rests on weeds floating on the surface, and bends the abdomen forwards to deposit eggs in the vegetation just under the surface (*cf.* Kennedy, Proc.

U.S. Nat. Mus., vol. xlix, p. 302, fig. 88, 1915). The eggs are laid singly in rows.

*Localities.*—Widely distributed over the S.W. Cape, but more of a lowland than a mountain form, from Olifants River, Clanwilliam (A. J. H., 1932), in the north, to Keurbooms River, Plettenberg Bay (K. H. B., 1931), in the east. Also Aiais on Gt. Fish River, South West Africa (A. J. H. and C. W. T., November 1936).

*Remarks.*—This species is very abundant at Lakeside in the Cape Peninsula, where the water is at times slightly brackish.

## Fam. AESCHNIDAE.

1917. Tillyard, *loc. cit.*, p. 259.

1921. Ris, *loc. cit.*, p. 338.

1934. Fraser, Fauna Ind. Odonata, vol. ii, p. 154 (*Gomphidae*).

*Imago.*—Triangles of fore- and hind-wings similar or nearly so. Lateral lobes of labium of about the same size as median lobe. Antenodal cross-veins in costal and subcostal areas not corresponding.

*Nymph.*—Mask flat (in South African forms).

### Subfam. Gomphinae.

1917. Tillyard, *loc. cit.*, p. 260.

1921. Ris, *loc. cit.*, p. 338.

1934. Fraser, *loc. cit.*, p. 157.

1936. Schmidt. Senckenbergiana, xviii, p. 270 (nymphs, West Europe species).

*Imago.*—Eyes separated by a large space. Triangles short, costal side not much longer than proximal side, free or crossed. Inferior appendage ♂ bifid. No well-developed ovipositor. Auricles present on 2nd abdominal segment in ♂.

*Nymph.*—Legs more or less modified for digging, fore and mid tarsi 2-jointed. Antennae reduced to 4 joints, the 4th often minute. Mask not extending beyond (or only slightly) bases of fore-legs, with flat median lobe, lateral lobes with narrow rounded or uncinate apex and strong movable spine. Gizzard with 4 folds. Rectal gills simplex undulate or simplex papillate.

### *Key to S.W. Cape genera.*

1. No distinct anal loop. 8th and 9th segments foliate. Superior appendages ♂ longer than 10th segment. ♀ vulvar scale short and broad. Nymph with narrow ovate abdomen, without dorsal keel . . . *Mesogomphus.*
2. A distinct anal loop of more than 2 cells. 8th segment foliate. Superior appendages ♂ shorter than 10th segment. ♀ vulvar scale narrow and elongate. Nymph with broadly ovate abdomen, with dorsal keel . *Ceratogomphus.*

### Gen. *Mesogomphus* Forster.

1918. Rich, S. Afr. J. Sci., vol. xiv, p. 426 (rectal gills of nymph).
1921. Ris, *loc. cit.*, pp. 340, 343.
1929. Ander, Konowia, vol. viii, p. 159 (nymph).
1934. Fraser, *loc. cit.*, p. 228.

*Imago.*—Hind femora not reaching beyond junction of thorax and abdomen. MA and $Cu_2$ in fore-wing diverging at level of nodus or more distally. Between Rs and MA in hind-wing a single cross-vein. No distinct anal loop. Superior appendages ♂ considerably longer than 10th segment. Penis in *cognatus* and *elpidius* ending in two slender divergent prongs, which in repose lie between two lateral flaps on the bulbous basal portion. In *hageni* the penis is noticeably different, ending in two short prongs which lie within the cowl-like projection of the basal portion. Vulvar scale ♀ (8th segment) short and broad. Lateral margins of 8th and 9th abdominal segments foliate.

*Nymph.*—Wing sheaths divergent. Anterior margin of median lobe of mask strongly convex, minutely denticulate, with fringe of close-set palisade-like spines, outer distal angle with 2–3 spines, and lateral margins slightly convergent, sparsely setose; apex of lateral lobe narrowly rounded or subacute, but not uncinate, inner margin not denticulate. Legs short. Third antennal joint fusiform, 4th joint distinct, upturned. Abdomen narrow-ovate, without medio-dorsal keel. Anal appendages all of same length. Gizzard with strong denticles on the 4 folds. Rectal gills papillate.

*Remarks.*—Ander described only the external features of the nymph. Rich described the rectal gills of a nymph assumed to be that of *Mesogomphus*. His paper was prior to Ris's monograph, and a misidentification seems certain because he described the rectal gills as undulate, whereas I find them to be papillate (at least in *cognatus*). It may be, however, that the character of the rectal gills does not coincide with the generic characters of the imagos, and that other species, e.g. *hageni*, do have undulate gills. Perhaps Rich's specimens were *Ceratogomphus*.

Ander says the anterior margin of median lobe of mask is not denticulate in *hageni*, but in *cognatus* I find that it is denticulate when seen under a high magnification.

*Mesogomphus hageni* (Selys).

1921. Ris, *loc. cit.*, pp. 343, 344, figs. 46–48; pl. ix, fig. 2.
1929. Brain, *loc. cit.*, p. 155.
1929. Ander, *loc. cit.*, p. 159, figs. 1–4 (nymph).

*Imago.*—Tips of superior appendages ♂ parallel, acute. Anterior hamule uncinate, posterior hamule irregularly rectangular (Ris,

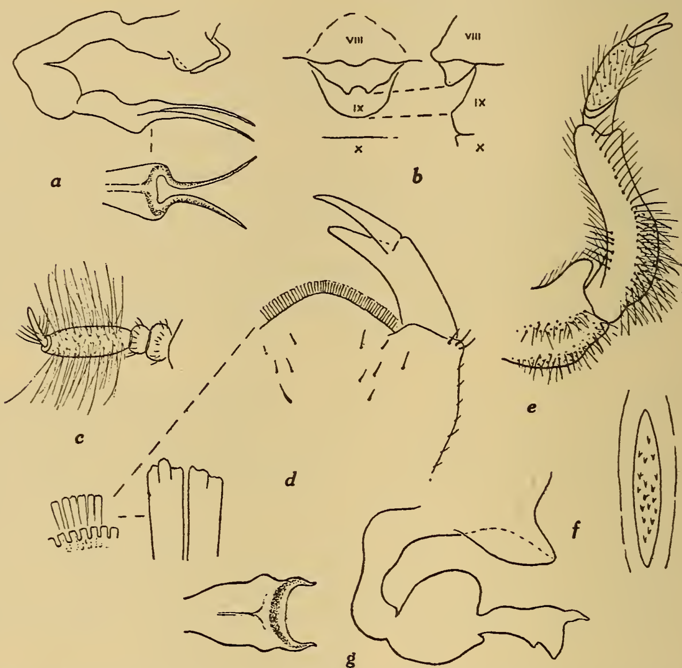


FIG. 20.—*Mesogomphus cognatus* (Rambur). Imago: *a*, penis, with ventral view of apical lobe. *b*, ventral and lateral views of 8th–10th abdominal segments ♀. Nymph: *c*, lateral view of antenna. *d*, portion of mask, with margin of median lobe and spines further enlarged. *e*, dorsal view of right fore leg. *f*, 1 of the 4 folds of the gizzard. *M. hageni* (Selys). *g*, penis in lateral view, with apex in ventral view.

fig. 47). Penis strongly bulbous subapically, the apical portion being broad, with two short, widely separated prongs, which lie within the cowl-like projection on the basal portion. Pterostigma light ochreous, greyer near margins, in ♀ between strong black veins. Costa yellowish. Face and frons without dark bands. Thoracic markings pale.

*Nymph.*—Anal appendages 2½ times length of 10th tergite (Ander).

*Locality.*—Nearest locality to S.W. Cape recorded by Ris, Dunbrody. Messrs Lawrence, Hesse, and Thorne (of the S.A.M.) caught two ♂♂ near Viol's Drift on the Orange River, Namaqualand, in March 1935. Brain, however, says it occurs "as far south as Tulbagh."

### *Mesogomphus cognatus* (Rambur).

1908. Ris, *loc. cit.*, p. 318 (*Onychogomphus c.*).
1921. *Id.*, *loc. cit.*, pp. 343, 347, figs. 52, 53; pl. viii, fig. 3; pl. ix, fig. 4.
1929. Brain, *loc. cit.*, p. 155.

*Imago.*—Tips of superior appendages ♂ divergent, blunt, minutely dentate. Anterior and posterior hamules uncinate (Ris, fig. 53). Penis (see fig. 20, *a*); in repose the apices lie between the lateral flaps of the bulbous basal part. Pterostigma dark or blackish brown. Costa yellowish. Frons with black band at base in ♂, frons and face with black transverse lines in ♀. Thoracic markings dark.

*Nymph.*—Up to 24–26 mm., width of abdomen 6 mm. Resembling that of *hageni* (as described by Ander), but the anal appendages do not exceed twice the length of 10th segment, usually scarcely twice as long. Segments 4–9 with small lateral points. A small medio-dorsal tubercle on segments 2 and 3. Appendix dorsalis acutely pointed. Abdominal pattern as in *hageni*. Rectal gills papillate. Hind femora reaching to end of 2nd abdominal segment. All femora with prominent distal lobe. Mid and fore tibiae curved, armed on outer margin with strong setae. Claws slightly curved, apically blunt, glabrous. Pale sand-coloured, faintly mottled.

*Localities.*—Cape Peninsula; S.W. Cape as far north as Cedar Mts., Clanwilliam (K. H. B., January 1930 and September 1936), and as far east as Cango (K. H. B. and H. G. W., February 1932).

*Remarks.*—This species is very common and widely distributed. The nymphs burrow in sand and gravel in running streams, but are easily bred in captivity. They do not climb up reeds or other vegetation before emergence of the imagos, but crawl on to a stone or the margin of the stream, or a projecting sand-spit in mid-stream, or floating vegetation.

### Gen. *Ceratogomphus* Selys.

1921. Ris, *loc. cit.*, pp. 340, 354.

*Imago.*—Hind femora not reaching beyond junction of thorax and abdomen. MA and $Cu_2$ in fore-wing diverging at level of nodus or more distally. Between Rs and MA hind-wing a single cross-vein. A distinct anal loop of 4 cells. Appendages of ♂ much shorter than


Fig. 21.—*Ceratogomphus pictus* Selys. Imago: *a, b,* lateral and dorsal views of apical abdominal segments ♂ with appendages (in *a* the right upper appendage omitted). *c,* ventral view of lower appendage. *d,* dorsal view of variation in right upper appendage. *e, f,* lateral and dorsal inner views of lower appendage of same specimen as *d*. *g,* 2nd abdominal segment ♂ with genitalia. *h,* ventral view of apical portion of penis. Nymph: *i,* dorsal view of nymph, with profile of abdomen. *j,* dorsal view of right antenna. *k,* portion of mask with margin of median lobe further enlarged. *l,* dorsal view of right fore leg.

10th segment. Penis (see below, and fig. 21, *h*). Vulvar scale of ♀ on 8th segment long and narrow. Xth segment in ♂ with a dorsal acute process fitting into a groove on the 9th segment. Lateral margins of 8th segment foliate.

*Nymph.*—Wing sheaths divergent. Anterior margin of median lobe of mask convex, minutely denticulate, with palisade-like spines, and setae near hinge of lateral lobe, outer distal angle without spines, lateral margins parallel, thickly setose; apex of lateral lobe bluntly pointed, not uncinate, inner margin denticulate. Legs moderately long. Third antennal joint with straight inner margin, 4th joint minute. Abdomen broadly ovate, medio-dorsally keeled. Cercoids shorter than the other anal appendages. Gizzard with strong denticles on the 4 folds. Rectal gills undulate.

### *Ceratogomphus pictus* Selys.

1908. Ris, *loc. cit.*, p. 319, fig. 7 (wings).
1921. *Id.*, *loc. cit.*, p. 355, fig. 60; pl. viii, fig. 6; pl. ix, fig. 7.

*Imago.*—As Ris had no ♂ good enough for a figure of the genitalia and appendages, figures of these are here given. Anterior hamules ovate, set transversely; posterior hamules very large, oblong, with forwardly directed tooth on antero-inferior margin. Penis with prongs of the apical fork produced in long recurved points. The bulbous basal part with a lateral flap on either side, between which the apices of the penis lie. Superior appendages strongly chitinised, outer basal margin serrate, apices curved downwards, somewhat variable in shape, dorsal surface proximally with a feebly chitinised area which is produced in a membranous digitiform process. Lower appendage subquadrangular but somewhat variable, usually with deep and well-marked apical cleft (fig. 21, *c*), but sometimes with very narrow cleft (fig. 21, *f*), dorsal surface distally with a black, strongly chitinised ridge on either side of the cleft, which ridge may develop one or two distinct pointed teeth.

*Nymph.*—Up to 27 mm., width of abdomen 9 mm. 4th antennal joint less than apical width of 3rd joint. Mask extending to between bases of fore-legs, median lobe with parallel sides. Hind femora reaching to end of 4th or middle of 5th abdominal segment. All femora with small distal lobe, and 2 glabrous stripes on dorsal surface not covered with setae or pilosity. Tibiae also with a bare stripe; the fore tibia with distal outer angle prominent. Claws setose, apically acute. Abdomen narrowing rather rapidly from 7th segment; segments 7–9 with short acute lateral points. Segments 2–9 medio-dorsally keeled; on segments 2 and 3 the keel forms small tubercles, on the others a low backwardly directed tooth, that on segment 9 being the largest. Cerci a trifle longer than, cercoids slightly shorter than, the appendix dorsalis, which is acutely pointed. Denticles on gizzard folds as in *M. cognatus* (fig. 20, *f*). Pale brown, with a pair of darker spots on segments 5–9 dorsally.

*Localities.*—Cape Peninsula, Stellenbosch, French Hoek, Cango.

*Remarks.*—Not actually bred, but the correlation seems quite certain as this is the only other Gomphine genus besides *Mesogomphus* known from the S.W. Cape, and the nymphs came from Jonkershoek, Stellenbosch, where the adults are plentiful.

## Subfam. AESCHNINAE.

1917. Tillyard, *loc. cit.*, p. 262.

1921. Ris, *loc. cit.*, p. 356.

1936. Fraser, Fauna Ind. Odonata, vol. iii, p. 53 (*Aeshnidae*).

*Imago.*—Eyes dorsally contiguous. Trianglesl ongitudinally elongate, crossed. Inferior appendage ♂ not bifid. ♀ with ovipositor similar to that of the *Zygoptera.*

*Nymph.*—Abdomen elongate. Legs and antennae normal. Mask flat, without setae (except in *Gynacantha*), lateral lobes narrow, apices variable. Gizzard with 4 folds, each with one large tooth or a few large teeth. Rectal gills duplex, foliate or papillo-foliate.

### *Key to S.W. Cape genera.*

1. $IR_3$ forked proximal to pterostigma, with more than 2 rows of cells between its branches. Sectors of arculus, near its middle. Anal angle of hind-wing angulated in ♂. Auricles present in ♂ . . . . . . *Aeschna.*
2. $IR_3$ forked distal to middle of pterostigma, with only 2 rows of cells between its branches. Sectors of arculus, nearer to R. Anal angle of hind-wing rounded in both sexes. No auricles in ♂ . . . . . . *Anax.*

## Gen. *Aeschna* Fabricius.

1917. Tillyard, *loc. cit.*, pp. 340, 350.

1921. Ris, *loc. cit.*, pp. 358, 361.

1921. Rousseau, Larves et Nymphes Aquat., vol. i, p. 118 (nymph).

1936. Fraser, *loc. cit.*, p. 123 (original spelling: *Aeshna*, etym. doubtful).

*Imago.*—As above in key. Cells between $IR_3$ and Rspl not distinctly arranged in rows. End of $R_3$ slightly and gently convex towards costa.

*Nymph.*—Eyes hemispherical. Mask in repose not extending beyond coxae of middle legs; lateral lobe with broad, squarely truncate apex. Anal pyramid long.

*Key to species.*

1. Upper surface of frons with black spot surrounded by yellow, and then a dark margin. Lateral lobes of 2nd segment ♂ much produced. ♀ appendages long. Supra-coxal projection of nymph single . . . . *rileyi.*
2. Upper surface of frons with black T mark. Lateral lobes of 2nd segment ♂ not strongly produced. ♀ appendages short. Supra-coxal projection of nymph bifid . . . . . . . . . *minuscula.*

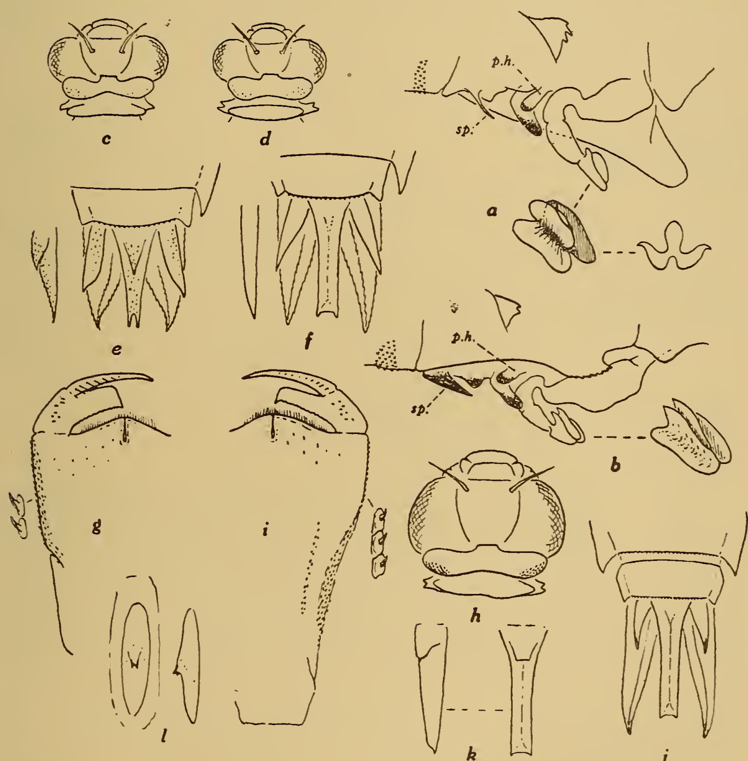


FIG. 22.—*Aeschna.* Imago: *a,* lateral view of 1st–3rd abdominal segments ♂ of *rileyi,* with apical lobe of penis viewed obliquely and in cross-section, the left lateral lobe omitted. *b,* the same segments of *minuscula.* Nymph: *c, d,* head and prothorax of *rileyi* and *minuscula* respectively. *e. f,* anal pyramid of *rileyi* ♂ and *minuscula* ♀ respectively, with appendix dorsalis in lateral view. *g,* portion of mask.
*Anax imperator mauricianus.* Nymph: *h,* head and prothorax. *i,* portion of mask. *j,* anal pyramid ♀. *k,* lateral and dorsal views of appendix dorsalis ♂. *l,* one of the folds of the gizzard, with lateral view of tooth.
(*p.h.* posterior hamule. *sp.* spinous process.)

*Aeschna rileyi* Calvert.

1892. Calvert, Trans. Amer. Entom. Soc., vol. xix, p. 164.
1921. Ris, *loc. cit.*, p. 361, fig. 63, and pl. viii, fig. 8 (*subpupillata*).
1929. Brain, *loc. cit.*, p. 158 (*subpupillata*).
1936. Longfield, Trans. Roy. Entom. Soc., vol. lxxxv, p. 480 (discussion).

*Imago.*—Characters as in key. Anal triangle of hind-wing ♂ 3-celled (*cf.* Tillyard, *loc. cit.*, 1917, fig. 171, B). Auricles with 3 denticles. Lateral lobes of 2nd segment ♂ strongly produced posteriorly, lobes of 3rd segment also produced anteriorly. Anterior spinous process (fig. 22, *a*) slender, chitinised only at apex. A narrow transverse band of spinules on 1st sternite. Penis (fig. 22, *a*).

*Nymph.*—Up to 38 mm. Supra-coxal projection single. Anal pyramid equal to 9th plus 10th segments. Cerci broad with all margins strongly serrate. Appendix dorsalis narrowing to a narrowly cleft apex. Whole surface of abdomen and anal pyramid strongly granulate. Lateral margins of 6th to 9th segments produced in spines.

*Localities.*—Widely distributed over the S.W. area, but not yet actually caught in the Cape Peninsula.

*Aeschna minuscula* MacLach.

1895. MacLachlan, Ann. Mag. Nat. Hist. (6), vol. xvii, p. 421.
1921. Ris, *loc. cit.*, pp. 361, 364, fig. 64.
1929. Brain, *loc. cit.*, p. 158.

*Imago.*—Characters as in key. Anal triangle of hind-wing ♂ 3-celled. Auricles with 2 denticles. Lateral lobes of 2nd segment ♂ slightly produced, margin serrate; lobes of 3rd segment also slightly produced. Anterior spinous process (fig. 22, *b*) strong, chitinised throughout. A broad transverse band of spinules on 1st sternite. Penis (fig. 22, *b*). Superior appendages ♂ slightly narrower than in *rileyi*.

*Nymph.*—Up to 40 mm. Supra-coxal projection bifid. Anal pyramid slightly longer than 9th plus 10th segments. Cerci slender with margins feebly serrate. Cercoids more slender than in *rileyi*, tapering evenly. Appendix dorsalis with subparallel margins, apex with wide but shallow notch. Surface of abdomen and anal pyramid less strongly granulate than in *rileyi*. Lateral margins of 7th–9th segments produced in spines.

*Localities.*—Widely distributed in the S.W. area, including the Cape Peninsula.

### Gen. *Anax* Leach.

1917. Tillyard, *loc. cit.*, pp. 341, 350.
1921. Ris, *loc. cit.*, pp. 358, 367.
1921. Rousseau, *loc. cit.*, p. 122 (nymph).
1936. Fraser, *loc. cit.*, p. 134.

*Imago.*—As above in key. Cells between $IR_3$ and Rspl arranged in distinct rows. End of $R_3$ abruptly bent towards costa opposite distal end of pterostigma.

*Nymph.*—Eyes very large, flattened dorsally. Mask in repose extending back to coxae of hind legs; lateral lobe with apex narrowed and with incurved tooth. Anal pyramid very long.

*Key to species.*

1. Bright red . . . . . . . . . . . . *speratus.*
2. Blue or green . . . . . . . . *imperator mauricianus.*

### *Anax speratus* Hagen.

1921. Ris, *loc. cit.*, p. 368.

This unmistakable dragon-fly has been observed at the reservoirs, Kalk Bay (Cape Peninsula); Palmiet River, River Zonder End Mts.; Wellington Mts.; and George. Its nymph is as yet unknown.

### *Anax imperator* Leach.
### Form *mauricianus* Rambur.

1908. Ris, *loc. cit.*, p. 320, figs. 9–11.
1921. Ris, *loc. cit.*, p. 368; pl. xii, fig. 4 (nymph).
1936. Longfield, *loc. cit.*, p. 482.

*Nymph.*—Up to 55 mm. Supra-coxal projection bidentate but not prominent. Abdominal segments and anal pyramid smooth, only finely and sparsely granulate. Lateral margins of 7th–9th segments produced in spines. Appendix dorsalis almost as long as cerci, parallel-sided, apex with wide and shallow notch. Mask (fig. 22, *i*). The tooth on each fold of the gizzard is apically bidentate and surrounded by a few very minute denticles. Greenish or brownish, more or less mottled.

*Localities.*—Widely distributed over the S.W. area, including the Cape Peninsula.

*Remarks.*—Tillyard (*loc. cit.*, p. 351, footnote) has pointed out Ris's slip in regard to the length of the appendix dorsalis. This mistake has been copied by Rousseau (*loc. cit.*, p. 122).

## Fam. LIBELLULIDAE.

1917. Tillyard, *loc. cit.*, p. 265.
1921. Ris, *loc. cit.*, pp. 338, 374.
1936. Fraser, Fauna Ind. Odonata, vol. iii, p. 156.

*Imago.*—Triangles of fore- and hind-wings dissimilar, that of former transverse and far removed from arculus, that of latter longitudinal and close to or under arculus. Lateral lobes of labium very large and overlapping the small median lobe. Antenodal cross-veins in costal and subcostal areas coinciding, one or more of the distal ones sometimes incomplete. ♀ with vulvar scale. Inferior appendage ♂ not bifid.

*Nymph.*—Antennae 7-jointed. Mask spoon-like, with wide lateral lobes. Gizzard with 4 folds, each fold with 1–2 strong teeth, the 2 dorsal ones farther forward than the 2 ventral ones, thus bilaterally symmetrical.*

### Subfam. Corduliinae.

1917. Tillyard, *loc. cit.*, p. 265.
1921. Ris, *loc. cit.*, pp. 338, 374.
1936. Fraser, *loc. cit.*, p. 158.

*Imago.*—Triangle of fore-wing not much narrowed. Anal border of hind-wing angulated in ♂. Auricles present in ♂. Tibial keel present in ♂ (on all legs or only on fore-legs).

*Nymph.*—Lateral lobes of mask with deep or moderately deep indentations. Rectal gills duplex, lamellate, usually purplish in colour.

*Key to genera of S.W. Cape.*

1. Anal loop of hind-wing short, rounded, 3 cells in width. Triangle of hind-wing distal to arculus . . . . . . . . . . . *Macromia.*
2. Anal loop of hind-wing rather long, not more than 2 cells in width. Triangle of hind-wing very slightly distal to arculus . . . . . . *Presba.*

#### Gen. *Macromia* Rambur.

1921. Ris, *loc. cit.*, p. 375.
1936. Fraser, *loc. cit.*, p. 161.

*Imago.*—Characters as in key. Tibial keel present on all legs ♂. Sectors of arculus with a common stalk.

* Tillyard (p. 107) says "there are four folds, two on one side lying considerably more anteriorly than the other two." If this were so, the gizzard could not be described as bilaterally symmetrical; the true orientation is as above.

*Nymph.*—Legs long. A conical horn-like process on front of head between the antennae.


Fig. 23.—Nymph provisionally assigned to *Macromia picta* Selys. *a*, head, with scale-like spines on frontal ridge further enlarged. *b*, portion of mask, with margins of median and lateral lobes further enlarged.

### *Macromia picta* Selys.

1908. Ris, *loc. cit.*, p. 326, figs. 14, 15.

1921. *Id.*, *loc. cit.*, pp. 376, 377, pl. viii, fig. 10, and pl. x, fig. 1.

*Locality.*—This species has been found in the S.W. Cape area at Palmiet River, near Kleinmond (H. G. W., December 1933). There is also a specimen in the S.A. Museum from Upington.

### Nymph provisionally assigned to *Macromia picta.*

Several nymphs were collected at the Palmiet River locality (mid December 1934, K. H. B. and H. G. W.), 5–13 mm. in length. They were mostly found between the decaying leaf-bases on submerged stems of the Palmiet (*Prionium*), and apparently in conformity with the habitat, were noticeably flattened. Dark brown, somewhat greenish, with a paler medio-dorsal stripe on the abdomen.

Surface finely and closely granulate, without setae or pilosity, but with a few scattered rather long setae in the smallest specimens. Antennae in length about $1\frac{1}{2}$ times their distance apart, similar to those of *Presba venator.* Head with a projecting triangular transverse ridge just below the bases of antennae, its apex truncate and margins with flattened scale-like spines; on upper surface behind level of eyes a pair of conical tubercles, slightly wider apart than the bases of antennae; lateral margins behind eyes strongly convergent. Eyes very prominent. Abdomen flattened, ovate, without any medio-dorsal keel or tooth-like projections, postero-lateral angles of segments 8 and 9 produced in short acute points, segment 10 short,


Fig. 24.—*Presba venator* Brnrd. Nymph: *a*, dorsal view. *b*, antenna. *c*, ventral view 8th–10th abdominal segments and anal pyramid ♂. *d*, portion of mask, with margins of lateral and median lobes further enlarged. *e*, *f*, a posterior and an anterior lamella from the rectal gills. *g*, diagram of hind part of a hemibranch of the rectal gills, showing position of tubercles on the lamellae. *h*, gizzard, opened out, showing the 2 ventral teeth on left, the 2 dorsal ones on right. *i*, lateral view of a ventral and a dorsal tooth.

much narrower than 9th, cercoids slightly shorter than appendix dorsalis, which is shorter than the cerci. Mandibles with the same arrangement of teeth as in *Helothemis* (fig. 30, *k*). Mask extending back to between bases of middle legs; median lobe with distal margins concave, a series of 11–12 spines; lateral lobes with 6 (7) lobes and 5 (6) rather deep indents, 7 lateral spines, hind margins spinose, outer margin with stout apically blunt spines. Femora and tibiae with a few elongate slender spines on upper margin, mostly in pairs, least numerous on fore-leg, trifid and quinquefid spines on lower anterior surface of apex of fore-tibia, no other divided spines (see figs. 26, 30); upper margin of tibiae distally with strong, blunt-tipped spines, tarsi with double rows of acute spines. Gizzard as in *Presba venator* (*infra*, fig. 24). Rectal gills with 15–20 lamellae on each hemibranch, faintly mauve in colour.

### Gen. *Presba* Brnrd.

1933. Barnard, Stylops, vol. ii, p. 167 (notation as in Ris and Tillyard, 1917).

*Imago.*—Characters as in key. Tibial keel present on all legs ♂. Sectors of arculus arising separately in both wings. In fore-wing MA and $Cu_2$ parallel, or slightly divergent distal to level of nodus.

*Nymph.*—Legs moderately long. Eyes small. No conical process or tubercles on front of head; a transverse ridge just below bases of antennae. Anal pyramid short, all the appendages of equal length. Abdominal segments without any medio-dorsal tubercles or processes.

#### *Key to species.*

1. Coloration in general black and red, with white marks on abdomen. Inferior appendage ♂ half length of superior appendages . . . *venator.*
2. Coloration black and yellow. Inferior appendage ♂ $\frac{3}{4}$ length of superior appendages . . . . . . . . . . . *piscator.*

### *Presba venator* Brnrd.

1933. Barnard, *loc. cit.*, p. 167, fig. 1, *a–e.*

*Imago.*—As in key.

*Nymph.*—Up to 25 mm. Surface smooth, finely setose, but often appearing granulate on account of foreign particles adhering to the surface. Lateral margins of head behind eyes convergent, but each with a triangular projection. Antennae slender, length $1\frac{1}{2}$ times distance between their bases. Abdominal segments without any medio-dorsal projections, lateral margins of segments 8 and 9 only ending in very small points. 10th segment very short, considerably narrower than 9th. Anal pyramid about equal to 9th plus 10th segments, all the appendages of the same length, or cercoids slightly shorter. Mandibles as in *Helothemis* (fig. 30, *k*), the apical teeth in full-grown nymphs very blunt (worn down). Mask in repose extending back to coxae of middle legs; median lobe with distal margins slightly concave, a series of 14–16 mental setae; lateral lobes with 7 projections and 6 moderately deep indentations, a series of 9–10 lateral setae. Fore tibia and tarsus (all 3 joints) with divided spines (see p. 240); mid and hind tibiae and tarsi with simple acute spines. Gizzard with 4 strong, almost molariform teeth. Rectal gills with about 25 lamellae on each hemibranch, each lamella with only 1 anterior tubercle, except the posterior pair which have a posterior tubercle also; each lamella with scabrous apical papilla, the posterior lamellae more falcate than the anterior ones.

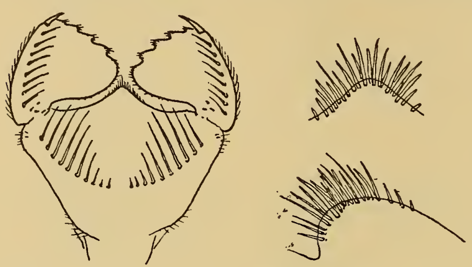

Fig. 25.—Nymph provisionally assigned to *Presba piscator* Brnrd. Mask with apex of median, lobe, and margin of lateral lobe further enlarged.

*Oviposition.*—The ♀ extrudes a clump of ova and then dips the end of the abdomen in the water, the eggs separating at once on touching the water. The eggs are subspherical, ·5 mm. in diameter, salmon coloured.

*Localities.*—Table Mt., Cape Town (K. H. B. and H. G. W., December–February); French Hoek Mts. (K. H. B. and H. G. W., December 1932; H. G. W., October 1933); Hottentots Holland Mts. (K. H. B. and H. G. W., January 1933); Wellington Mts. (H. G. W., January 1934); Keeromberg, Worcester (K. H. B., January 1930, nymph shucks); Gt. Winterhoek Mts., Tulbagh (K. H. B. and H. G. W., November 1932, nymph shucks).

*Remarks.*—A number of nymphs was collected in Orange Kloof, Table Mt., in March 1933; from some of these, kept in a tank well supplied with mud and Entomostracan food, the flies emerged in October–November (H. G. W.); others, not so well supplied, lived until January 1934, when they were killed for anatomical purposes (K. H. B.). It may be mentioned that one of them lived for 2 hours in a solution of 95 per cent. alc. plus glacial acetic acid. The French Hoek locality was visited on 1st October 1933 (K. H. B.), when no flies were observed. On the 8th October, however, they were abundant and feeding on stone-flies, etc. (H. G. W.).

The time of emergence therefore seems to be from early in October; and the flies are on the wing until the end of February.

The nymphs live in streams, underneath stones and amongst the mud and vegetable debris. The duration of the nymph stage appears to be about 20 months. Prior to emergence the nymphs crawl up the sides of rocks.

*Presba piscator* Brnrd.

1933. Barnard, *loc. cit.*, p. 168, figs. 1, *f–h* and 2.

No further examples of this species have been captured or observed.

Nymph provisionally assigned to *Presba piscator*.

Up to 25–26 mm. Body sparsely setose. Legs moderately long. Antennae slightly longer than distance between their bases, inserted distinctly in advance of level of anterior margin of eyes; a transverse ridge just below bases of antennae. Eyes rather small but prominent. Lateral margins of head behind eyes strongly convergent. Abdomen regularly oval, widest across segment 5. Segments 8 and 9 ending in short, acute lateral points. No medio-dorsal keel or projections. Anal pyramid slightly longer than segments 9 plus 10, cerci slightly longer than appendix dorsalis, cercoids $\frac{2}{3}$ length of latter. Mask extending to between coxae of fore-legs; median lobe with narrowly rounded apex and concave margins, apex densely set with spines which decrease in size laterally. Lateral lobes with 5 broad projections separated by moderately deep indents. Mental setae 10, lateral setae 7–8, very stout. No divided spines on legs; stout simple spines on apices of tibiae, and in double rows on 1st and 2nd joints of tarsi, more slender spines on 3rd joint of tarsi.

*Localities.*—Ceres (K. H. B., March 1922); Bains' Kloof, Wellington Mts. (Breede River side) (K. H. B., May 1933).

*Remarks.*—Both empty shucks. The close resemblance of this nymph to that of *P. venator* suggests that it belongs to *piscator*, the only other Corduline as yet known from the S.W. districts (except *Macromia picta*, see *supra*), although there is a marked difference in the armature of the legs.

Subfam. LIBELLULINAE.

1917. Tillyard, *loc. cit.*, p. 269.
1936. Fraser, *loc. cit.*, p. 240.
1921. Ris, *loc. cit.*, pp. 338, 382.
1927. Calvert, Univ. Iowa Studies Nat. Hist., vol. xii, No. 2, pp. 15 *sqq.*).

*Imago.*—Triangle of fore-wing usually narrowed (transversely elongate). Anal border of hind-wing rounded in both sexes. Auricles absent. No tibial keel on fore-legs.

*Nymph.*—Lateral lobes of mask with very shallow (normally) indentations. Rectal gills duplex, lamellate; white, purplish or black. Legs sometimes short and robust, sometimes rather elongate and slender.

*Remarks.*—Calvert has drawn attention to certain characters of the nymphs, which may be useful for generic distinction, viz. the mandibles and the armature on the legs.

In addition to the four apical teeth in each mandible, the hindmost two of which may coalesce, there are (in some genera) 4 knob-like, strongly chitinised teeth; between these latter and the apical teeth there may be a denticle on the anterior margin and another on the posterior margin. One or more of the knob-like teeth, and the marginal teeth may be obsolete, and Calvert gives a distinctive formula for the four genera studied by him. The South African genera, whose nymphs are known, likewise show distinctive dental features; but while *Pseudomacromia* (fig. 32, *e*) is well distinguished by having only a single knob-like tooth in each mandible, the other genera (*Orthetrum*, *Crocothemis*, *Helothemis*, and *Trithemis*) are very similar (fig. 30, *k*).

As regards the armature of the legs the grouping of the genera is different. On the lower surface of the tibiae and tarsi there are numerous movable spines,* which on the tarsi are arranged in two longitudinal rows, an anterior and a posterior row (the legs being extended at right angles to the body-axis). Some of these spines are simple and others divided into 2, 3, 4, or 5 prongs. The distribution of the divided spines on the legs seems to be of generic importance. In the South African nymphs they are present on the fore tibia and hind tarsus in *Orthetrum capense*, on the fore and mid tibiae, and all the tarsi in *Crocothemis erythraea*, *Helothemis dorsalis*, and *Trithemis arteriosa*, but are completely absent in *Pseudomacromia* (figs. 26, 30, 32).

It should be emphasised that the nymphs of other species of these genera should be examined before the above mandibular and pedal characters are incorporated in the generic diagnoses.

### Gen. *Orthetrum* Newman.

1921. Ris, *loc. cit.*, pp. 385, 391.

1936. Fraser, *loc. cit.*, p. 291.

*Imago.*—Arculus as a rule distal to 2nd Anq. More than 10 Anq, the last one in fore-wing complete. Sectors of arculus with common

* Calvert uses the word *seta* for a spiniform structure articulated by a ball and socket joint to the integument, and *spine* for a non-articulated spiniform projection of the integument itself. In this paper articulated structures are called spines or setae according as they are respectively robust or slender and hair-like.

stalk. Discoidal cell in fore-wing beginning with (usually) 3 rows of cells. Triangle in fore-wing with usually 1, but sometimes 2, cross-veins; proximal side of triangle in hind-wing at arculus, usually free, sometimes crossed. One Ac in hind-wing. One or 2 rows of cells between $IR_3$ and Rspl. Lobe of prothorax large.

*Nymph.*—Body setose. Legs short, robust. Lateral margins of head behind eyes nearly parallel. Antennae inserted considerably in advance of level of anterior margin of eyes. Medio-dorsal keel on abdomen more or less developed, but no tooth-like projection on segment 8.

*Remarks.*—As Ris remarks (*loc. cit.*, p. 391), the work of Calvert and himself has brought order out of chaos among the very numerous species of this genus. The identification of South African species is fairly easy. It is therefore a thankless proceeding to upset Ris's arrangement and question some of his identifications. A study of the penis, however, in the comparatively very small collection of the South African Museum, has revealed characters which are likely to be of systematic importance. Neither Ris, nor so far as I am aware any other worker, has examined or utilised this structure.

The most important results of this study of the penis, using the specimens actually identified by Ris, are these: *farinosum* has a penis so different from those of the other species as almost to justify generic separation; the Worcester specimen of *caffrum* is quite different from those from the Transvaal and Eldoret; *guineense* and *abbotti* are very closely allied, but easily distinguished from *chrysostigma*.

The penis of *farinosum* is described below. In all the other species included in Ris's monograph, except *trinacria* and *icteromelas*, of which there are no ♂♂ in the S.A. Museum collection, the penis has the following structure:—

The basal joint is much enlarged proximally, strongly geniculate, and has a blunt tooth on the antero-dorsal distal margin. The 2nd joint is much smaller.* The 3rd joint is bulbous. Ventrally it bears two lobes separated by a small notch, each lobe in cross-section is L-shaped, the outer portion lying horizontal, the median portion vertical. Dorsally there is a feebly chitinised cowl-like projection, from the hollowed base of which springs a long hair-like process,

* Tillyard (*loc. cit.*, 1917, p. 217) says that the orifice is situated on this joint. It may be noted that after treating the penes in KOH, the dissolved internal tissues could not be squeezed out through any orifice situated at the spot indicated by Tillyard (fig. 96 C *or.*).

strongly arched proximally, and distally armed with very minute retrorse points. The structure is completed by a pair of lateral clasper-like moderately chitinised processes, which vary in shape and hence are useful classificatory characters (fig. 26, *b–h*).

According to these lateral processes the species fall into the following groups:—

| | |
|---|---|
| Processes slender, elongate, not bifid . . . . . . | *guineese.* *abbotti.* |
| „ sublanceolate, not bifid . . . . . . | *caffrum* (from Transvaal and Eldoret). *rubens* n.sp. |
| „ with a tooth on lower margin, sub-bifid . . . | *chrysostigma.* |
| „ strongly bifid . . . . . . . . | *stemmale* (Lorenzo Marques and M'fongosi). *brachiale.* *capense.* |

The question of the identity of *capense* and its separation from *stemmale* is discussed below.

Calvert's suggestion (Proc. U.S. Nat. Mus., vol. xviii, p. 130, 1896) that the vulvar lamina of the ♀ might provide specific characters has not been found to hold good, except in the case of *farinosum* as opposed to the other species.

The character of the hamule of the ♂ genitalia should be used with caution, as this process may be subject to shrivelling in dried specimens, and in a KOH preparation it will probably not coincide exactly with the figures given by various authors.

### *Key to the S.W. Cape species.*

[Extra-Cape species in brackets.]

I. Basal segments of abdomen not widened laterally and very little dorso-ventrally; segment 3 not constricted. Penis and vulva (see fig. 26, *a*, *k*). *farinosum.*

II. Basal segments considerably widened, and segment 3 constricted. Penis and vulva (see fig. 26, *b*, *j*).

- A. Abdominal appendages (superior appendages ♂, anal appendages or cercoids ♀) pale yellow. Penial processes bifid.
  1. Antenodal subcostal cross-veins blackish. Usually one row of cells between $IR_3$ and Rspl . . . . . [*stemmale*].
  2. Antenodal subcostal cross-veins pale or ochreous. Usually 2 rows of cells $IR_3$–Rspl . . . . . . . [*brachiale*].


FIG. 26.—*Orthetrum.* Imago: *a,* penis of *farinosum* (Dunbrody). *b,* penis of *capense,* with ventral lobe in ventral view, and with one half flattened out (lateral process of right side omitted). *c,* apex of penis of *caffrum* (Transvaal and Eldoret). *d, e, f, g, h,* lateral process of penis of *brachiale* (Lorenzo Marques), *stemmale* (Zululand), *chrysostigma* (Lorenzo Marques), *guineense* (Natal), and *abbotti* (Zululand) respectively. *i,* left side of 2nd abdominal segment ♂ *capense.* *j, k,* 8th and 9th sternites ♀ of *capense* (and other species) and *farinosum* respectively. Nymph of *capense*: *l,* dorsal view of 8th–10th segments and anal pyramid. *m,* head. *n,* profile of abdominal segments 3–8. *o,* dorsal tooth of gizzard. *p,* portion of mask with margins of lateral and median lobes further enlarged. *q,* anterior surface of tarsus and apex of tibia of fore leg.

(*a, c–h, k* from specimens identified by Ris.)

B. Abdominal appendages dark brown or blackish. Antenodal subcostal cross-veins pale.
  1. Triangle in fore-wing once crossed, in hind-wing free. [Here also *chrysostigma, guineense, abbotti.*]
    *a.* Penial processes bifid . . . . . . . *capense.*
    *b.* Penial processes not bifid, sublanceolate . . [*caffrum*].
  2. Triangle in fore-wing twice crossed, in hind-wing usually free but sometimes crossed. Wings suffused greyish yellow . *rubens.*

### *Orthetrum farinosum* Forster.

1908. Ris, *loc. cit.*, p. 331.
1921. *Id.*, *loc. cit.*, pp. 392, 401, fig. 76.

*Imago.*—Penis ♂. Basal joint shorter than in the other species, not geniculate, but with a pseudo-joint indicated by feebler chitinisation. The 3rd joint bears 2 feebly chitinised, minutely scabrous lobes dorsally (*i.e.* in the position corresponding with the cowl-like process in the other species). On the opposite surface a median recurved lobe, also scabrous. The apex is a membranous, feebly chitinised scabrous lobe, hollowed and cowl-like below, and bearing dorsally just distal to the dorsal lobes a patch of spinules. Vulvar lamina ♀: on either side of the vulva is a small chitinised pocket (one ♀ Waterval). The specimen has no appearance of the pockets being accidental invaginations of the knobs found in other species, but the structure should be confirmed.

*Remarks.*—This species is at once distinguished by the nearly parallel-sided abdomen, without basal enlargement and constriction. The wing tips are suffused in ♀. The penis of the ♂ and the vulvar lamina ♀ (if the latter is confirmed) are notably different from those of any other species examined.

It seems to be rare in the S.W. Cape, but has been observed on Kalk Bay Mts., Cape Peninsula (A. C. H., December 1931).

### *Orthetrum capense* Calvert.

1893. Calvert, Proc. U.S. Nat. Mus., vol. xvi, p. 584, fig. 3.
1921. Ris, *loc. cit.*, p. 395 (*caffrum* part: ♂ from Worcester).
1936. Longfield, Trans. Roy. Entom. Soc., vol. lxxxv, p. 486.

*Imago.*—Regularly one row of cells $IR_3$–Rspl, with occasional double cells. Hamule corresponding closely with Ris's figure 75 of that of a Zululand specimen of *stemmale,* but the inner uncinate lobe rather broader and more robust, its inner anterior surface setose.

Apex of anterior lamina broadly rounded, without trace of notch. Lateral processes at apex of penis strongly bifid.

Antenodal subcostal cross-veins pale ochreous to brown. Superior appendages ♂ and anal appendages ♀ dark brown on emergence from nymph, becoming black in mature specimens. Thoracic pattern: a dark ante-humeral stripe midway between median crest and humeral suture; the latter with a dark stripe; mesepimeron with a broad pale stripe, bordered below by a dark stripe which is slightly anterior to the 1st lateral suture; a second, less distinct, pale stripe on the metepimeron immediately below the 2nd lateral suture. Abdomen with medio-dorsal and lateral keels dark or blackish, an ill-defined dark lateral stripe from segments 3 or 4 to 9; segment 10 blackish. In fully mature specimens the abdomen is bluish pruinose, and the thoracic pattern is more or less obscured.

*Nymph.*—Up to 18–20 mm. Body and legs densely setose. Antennae moderately long, in length $1\frac{1}{2}$ times distance between their bases. Abdomen in dorsal view regularly oval, greatest width not quite twice in length (incl. anal pyramid). Very small lateral acute points on segments 8 and 9. A slight medio-dorsal keel on segments 4–6, ending on each segment in small teeth, much obscured by setae, that on segment 6 being the most conspicuous. Anal pyramid subequal to segments 9 plus 10; appendix dorsalis and cerci subequal in length, cercoids $\frac{2}{3}$ length. Mandibles similar to those of *Helothemis* (fig. 30, *k*), but apical teeth 3 and 4 coalesced in right mandible, and no indication of the anterior marginal denticle. Mask in repose extending to coxae of fore-legs. Median lobe with front margins straight, feebly crenulate, with a short blunt spinule in each indent, a small blunt median projection, not prominent but distinct; lateral lobes with about 8 very shallow indents, 4–5 spinules (usually 2 large, 2 small) near each indent. Lateral setae 6, median setae 3 long and about 14 short, the latter curving forwards towards the median line. Legs with divided spines on fore tibia and hind tarsus; 1st and 2nd joints of tarsus with blunt spines in anterior row in fore and mid legs and in posterior row in hind leg. Dorsal teeth of gizzard with a few large subsidiary denticles. Rectal gills with about 30 lamellae in each hemibranch. Uniform dark brown. Rectal gills greyish or slightly mauve tinted.

*Localities.*—Widely distributed over the S.W. districts, including the Cape Peninsula.

*Remarks.*—Ris (Coll. Selys. Libellulinae, fasc. x, 1909, p. 216) mentions a dark ♂ from Cameroon with suffused yellowish brown superior appendages, and another very dark ♂ with black appendages. In immature examples the appendages are whitish. In all the S.A. Museum examples (♂ and ♀) the appendages are pale yellow. The antenodal subcostal cross-veins, even in very immature specimens, are black (Ris, 1921, *loc. cit.*, p. 400). Calvert's ♂ was partly pruinose, and he states that the superior appendages were black. The subcostal cross-veins are not specially mentioned ("reticulation blackish").

The Cape form here described has constantly pale subcostal cross-veins, even in dark mature specimens; at most they become slightly brownish near their junctions with Sc and R. The appendages (♂ and ♀) in freshly emerged specimens are always dark brown, becoming later black. There can be no reasonable doubt that this form and Calvert's single ♂ are identical.

I suggest therefore that the name *capense* (if the rules of nomenclature allow it—see Ris, 1908, p. 330, and 1909, p. 215) be retained for this Cape form characterised by dark appendages and pale subcostal cross-veins; and that the more tropical form (specimens from Zululand, Lorenzo Marques, and Pretoria, identified by Ris in S.A. Museum), characterised by pale appendages and dark cross-veins, be regarded as a separate race under another name (*cf.* Ris, 1909, p. 216).

*Habits.*—This species is one of the commonest Libellulids in the Cape districts. In the neighbourhood of Cape Town the imagos are on the wing from September to April.

The nymphs burrow in mud and decaying vegetable debris in more or less stagnant pools and slow-running streams. They crawl up the bank, or up rocks and rush stalks before emergence.

### *Orthetrum rubens* n. sp.

*Imago.*—Triangle in fore-wing twice crossed (on both sides in 6 specimens), once crossed (on both sides in 1 specimen), once on one side and twice on the other (3 specimens), twice on one side and thrice on the other (1 specimen); in hind-wing crossed in 3 specimens, on one side only (1 specimen). Supra-triangle in fore-wing (Ris: *ht*) normally with one cross-vein, occasionally 2 on one side, or no cross-vein at all on one side. Arculus very slightly proximal to 2nd Anq in 7 specimens, at 2nd Anq in 2, and distal in 2 specimens. A single Ac. 13–15 Anq in fore-wing, 10 (sometimes 9) in hind-wing. Three rows of cells in discoidal field (between MA and $Cu_2$) in fore-wing, sometimes 4 or even 5 at the beginning, but, if so, usually asymmetrical. In both wings 2 rows of cells between $IR_3$ and Rspl, though in one case there are only 2 double cells in each hind-wing, 3 in one of the fore-wings, 4 in the other. One row between MA and Mspl. $Cu_2$ in hind-wing at (6 specimens) or separated from (5 specimens) anal angle of triangle.

Genitalia ♂ : Anterior lamina feebly notched at apex, its anterior surface with stout spinules and a few long setae; hamule with inner and outer lobes nearly equally developed, both strongly chitinised, the inner with acute out-turned apex, lobes rather widely separated. Penis with lateral apical projections sublanceolate as in *caffrum* (fig. 26, *c*). Vulvar lamina ♀ as in *capense* (fig. 26, *j*).

Abdomen : ♂ 28–29, ♀ 29–30 mm. Hind-wing; ♂♀ 29–31 mm.

Lateral lobes of labium, labrum, clypeus, frons, and occiput gamboge, often deep orange; median lobe of labium more or less suffused. Vertex shiny black. Lobe of prothorax gamboge, its dorsal margin dark brown. Thoracic dorsum ruby red in life, dull orange brown when dried, suffused with darker brown along median crest, especially anteriorly; an ante-humeral dark brown stripe about midway between crest and humeral suture, disconnected at both ends; humeral suture dark brown or blackish followed by a broad pale yellow or whitish stripe occupying about half width of mesepimeron; 2nd lateral suture dark brown or blackish followed by a second pale whitish stripe on the metepimeron; rest of mes- and met-epimeron and sternum ruby red in life (orange brown when dried), like the dorsum but becoming paler ventrally. Abdomen orange, the dorsal and lateral keels and the subsidiary keels on segments 2 and 3 black; a black lateral stripe from segment 1, connected with its fellow across the posterior margins of segments 4–8; segments 9 and 10 black, with dull orange marks in ♀, usually not visible in ♂; ventral surface from 3rd segment black or in ♀ dark brown. Superior and inferior appendages ♂, and anal appendages ♀ black, the inferior appendage ♂ dull orange brown in centre. Legs black, the femora ochreous at base, especially in fore-legs; in ♀ the ochreous parts are more extensive on all the femora. Wings more or less strongly suffused with greyish or smoky yellow, the first postnodal costal cell usually remaining hyaline; the suffusion densest towards the costal and pterostigmal areas. A bright orange spot at base of both wings, that on hind-wing more extensive, and sometimes reaching to the arculus, less marked in ♂ than in ♀. Costa pale yellow in front. Pterostigma deep yellow between narrow black veins. Venation dark brown except the antenodal subcostal cross-veins which are pale luteous. Membranule grey. In general, ♀♀ are not so dark as ♂♂; in some of the latter a faint pruinosity is developed on the dorsal surface of the abdomen.

*Localities.*—Kirstenbosch Botanic Gardens, Cape Town (R. F. Lawrence, January 1923, 1 ♂, 4 ♀♀); Gt. Winterhoek Mts., Tulbagh (K. H. B. and H. G. W., November 1932, 3 ♂♂, 2 ♀♀); Michell's Pass, Ceres (A. J. Hesse and H. G. W., October 1934, 2 ♀♀); Tradouw Pass, Langeberg (K. H. B., January 1935, 1 ♀); French Hoek Pass (K. H. B. and C. W. T., October 1936, 1 ♀).

*Remarks.*—This very striking dragon-fly resembles *caffrum* in the structure of the penis, and in having 2 conspicuous whitish lateral stripes on the thorax. But the twice-crossed triangle in fore-wing, the hamule, and the strong suffusion and greater extent of orange basal spot on the wings seem to indicate a separate species. In life the ruby-red tints on the thorax are a noticeable feature.

Gen. *Palpopleura*, Rambur.

1921. Ris, *loc. cit.*, pp. 385, 401.
1936. Fraser, *loc. cit.*, p. 316.

*Imago.*—Arculus proximal to 2nd Anq. More than 10 Anq, the last one in fore-wing incomplete. Sectors of arculus with common


Fig. 27.—*Palpopleura jucunda* Rambur, ♂ genitalia. *a*, lateral view of left side 2nd segment showing anterior lamina (*a.l.*), posterior hamule (*p.h.*), and genital lobe. *b*, ventral view of anterior lamina and posterior hamules. *c*, one of the latter flattened out. *d*, penis, with ventral process and lateral processes in ventral view.

stalk. Costa in fore-wing indented about half-way between base and nodus. Discoidal field in fore-wing beginning with 3 rows of cells. Triangle transverse in fore-wing, crossed in both wings (once or twice). One or two Ac in hind-wing. Lobe of prothorax moderate. Abdomen short, depressed. Wings variegated with black and yellow.

*Palpopleura jucunda* Rambur.

1908. Ris, *loc. cit.*, p. 331.

1921. *Id.*, *loc. cit.*, pp. 402, 404, pl. x, figs. 9, 10.

1929. Brain, *loc. cit.*, p. 158.

*Localities.*—Knysna (recorded by Kirby); Stellenbosch (Brain); Ceres (R. M. Lightfoot, December 1912); Tradouw Pass, Langeberg Range, east of Swellendam (A. J. Hesse, November 1925); French Hoek Pass (K. H. B. and C. W. T., October 1936); River Zonder End, near Greyton, Caledon Div. (H. G. W., December 1931); Gt. Winterhoek Mts., Tulbagh (K. H. B. and H. G. W., November 1932); Bosch Kloof, Clanwilliam (K. H. B. and C. W. T., September 1936).

*Remarks.*—This unmistakable dragon-fly, with its mottled wings, appears to be local, but occurs both at low levels as well as high up in the mountains. The nymph has not yet been discovered.

Gen. *Crocothemis* Brauer.

1921. Ris, *loc. cit.*, pp. 386, 410.

1921. Rousseau, *loc. cit.*, p. 140 (nymph).

1936. Fraser, *loc. cit.*, p. 343.

*Imago.*—Arculus proximal to 2nd Anq. More than 10 Anq in fore-wing, the last one incomplete. Sectors of arculus with common stalk. Triangle in fore-wing transverse, crossed, in hind-wing free. One Ac in hind-wing. Discoidal field in fore-wing beginning with 3(–4) rows of cells. One row of cells between $IR_3$ and Rspl.

*Nymph.*—Body nearly glabrous. Legs moderately long. Antennae inserted a little in advance of level of anterior margin of eyes, which are large and prominent. Lateral margins of head behind eyes strongly convergent. Abdomen oboval, abruptly narrowed posteriorly, without medio-dorsal tubercles; segments 8 and 9 with short lateral points. Lateral lobes of mask with numerous very shallow indents. Gizzard as in *Orthetrum*.

*Crocothemis erythraea* (Brulle).

1921. Ris, *loc. cit.*, pp. 412, 414.

1921. Rousseau, *loc. cit.*, p. 140, figs. 34, *d* and 35, *d* (nymph).

*Imago.*—In addition to the characters given by Ris for differentiating this species from *sanguinolenta*, the penis also shows slight differences. The distal joint is shorter in *erythraea*, the lateral clasper-like projections larger, the apical process dorso-ventrally flattened, semi-spatulate, without membranous lateral lobes.

*Nymph.*—Up to 18–20 mm. Antennae slender, but only very slightly longer than distance between their bases. Abdomen widest across segment 7. Short acute lateral spines on segments 8 and 9.

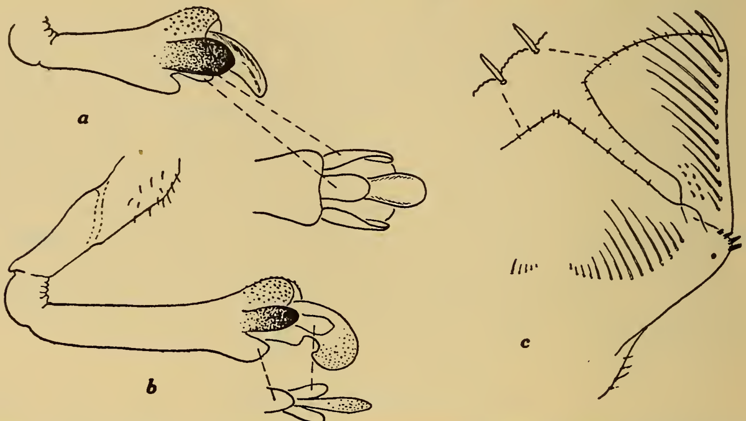


Fig. 28.—*Crocothemis.* Imago: *a*, penis of *erythraea*, with apex in ventral view. *b*, the same of *sanguinolenta*. Nymph: *c*, portion of mask of *erythraea*, with margins of median and lateral lobes further enlarged.

Dorsal surface without any medio-dorsal keel or tubercles. Cerci and appendix dorsalis subequal in length, cercoids $\frac{2}{3}$ length. Mandibles as in *Helothemis* (fig. 30, *k*), the anterior marginal denticle in right mandible present or absent. Mask extending to middle coxae. Median lobe with margins straight (or almost so), with feeble indents, with a spinule in each, the whole margin very minutely crenulate. Distal margin of lateral lobes similar, about 12 indents, sometimes 1 spine at each indent, sometimes 1 larger and 1 smaller. Lateral setae 11–12, mental setae 14–16. Armature of legs as in *Helothemis* (fig. 30, *l*), divided spines on fore and mid tibiae and all the tarsi. Rectal gills with about 40 lamellae on each hemibranch.

*Localities.*—Widely distributed over the S.W. Cape area, including the Cape Peninsula.

*Crocothemis sanguinolenta* Burm.

1921. Ris, *loc. cit.*, p. 413, pl. xi, fig. 3.

*Imago.*—The comparatively coarse serration of the lateral keels of the abdomen, and the black spots in the middle of the lateral margins of segments 4–7 are good differential characters; but the most conclusive character is the penis.

*Localities.*—French Hoek Pass (H. G. W., October 1933, 1 ♂); Tradouw Pass, Langeberg Range (H. G. W. and C. W. T., January 1935, 2 ♂♂).

*Remarks.*—Much rarer in the S.W. Cape than *erythraea*, the above being the only specimens which have come to hand.

### Gen. *Sympetrum* Newman.

1921. Ris, *loc. cit.*, pp. 387, 417.
1921. Rousseau, *loc. cit.*, p. 141 (nymph).
1936. Fraser, *loc. cit.*, p. 370.

*Imago.*—Arculus proximal to 2nd Anq. Less than 8 Anq, of which the last one in fore-wing is incomplete. Sectors of arculus with common stalk. Triangle in fore-wing transverse, crossed, in hind-wing free. One Ac in hind-wing. Discoidal field in fore-wing beginning with 3 rows of cells, narrowing towards margin. One row of cells between $IR_3$ and Rspl. Lobe of thorax large, bilobate, setose. ♀ with prominent vulvar flaps.

*Nymph.*—Body glabrous or sparsely setose. Legs long and thin. Head large, eyes prominent, lateral margins behind eyes convergent. Antennae inserted a little in advance of level of anterior margin of eyes. Mask extending to coxae of middle legs; lateral lobes warty, with very shallow indents. Abdominal segments 8 and 9 with strong lateral spines; medio-dorsal projections small.

### *Sympetrum fonscolombei* Selys.

1917. Tillyard, *loc. cit.*, p. 345, fig. 176 C (2nd abd. seg. ♂).
1921. Ris, *loc. cit.*, p. 417, pl. xi, fig. 4.
? 1929. Brain, *loc. cit.*, p. 158, fig. 76 (nymph).
1936. Fraser, *loc. cit.*, p. 377, fig. 106, *b* (2nd abd. seg. ♂).

*Remarks.*—This dragon-fly, easily recognised by the few antenodal cross-veins, is widely distributed in the S.W. Cape, including the Peninsula.

Its nymph has not yet been discovered in South Africa. Adults have been observed ovipositing, and teneral specimens have been captured at Stellenbosch (A. C. H.); large numbers of likely nymphs (*i.e.* those with large points on sides of segments 8 and 9) have been bred without success. It is extremely doubtful whether the nymph figured by Brain belongs to this species; it looks far more like that of a *Crocothemis.*

Fig. 29.—*Sympetrum fonscolombei* Selys. Penis with apical portion in ventral view.

In Europe the species is well known to be migratory, and this explanation might be adopted to account for the failure to obtain the nymphs, if it were not for the teneral specimens mentioned above.

### Gen. *Helothemis* Karsch.

1921. Ris, *loc. cit.*, pp. 388, 419.

1936. Longfield, Trans. Roy. Entom. Soc., vol. lxxxv, p. 489.

*Imago.*—Like *Trithemis* (*infra*), but last Anq in fore-wing complete. Penis of the same type as in *Trithemis.* Black lateral stripes of thorax not fused into an horizontal band.

*Nymph.*—Body nearly glabrous. Legs moderately long. Antennae inserted a little in advance of level of anterior margin of eyes, which are large and prominent. Lateral margins of head behind eyes convergent. Abdomen medio-dorsally keeled; segments 8 and 9 ending in short lateral points. Lateral lobes of mask with several shallow indents. Gizzard as in *Orthetrum.*

### *Helothemis dorsalis* (Rambur).

1898. Kirby, Ann. Mag. Nat. Hist. (7), vol. ii, p. 236 (*Stoechia distanti*).

1921. Ris, *loc. cit.*, p, 419.

1923. Campion, Ann. Mag. Nat. Hist. (9), vol. xii, p. 673, (♂ accessory genitalia) (*Trithemis distanti*).

1936. Longfield, *loc. cit.*, p. 490, fig. 8, *c* (♂ accessory genitalia).

Penis (fig. 30, *f*). Anterior lamina (see Longfield's figure) with subapical tuft of rather long hairs, and spines on the anterior surface.

Posterior hamule (fig. 30, *g*) (see also Campion's and Longfield's figures) with small apical hook and semicircular excision.


Fig. 30.—*Helothemis dorsalis* (Rambur). Imago: *a*, *b*, lateral diagrammatic view of thorax of typical form, and Silvermine Valley form respectively. *c*, *d*, labium and labrum, ♂ and ♀ respectively, of typical form. *e*, the same (♂ and ♀) Silvermine Valley form. *f*, penis, with apical portion in ventral view. *g*, posterior hamule and genital lobe, 2nd segment ♂. Nymph: *h*, head. *i*, portion of mask with margin of lateral lobe further enlarged. *j*, profile of abdominal segments 3–9. *k*, inner view of apices of mandibles (right mandible on right, anterior margin above). *l*, anterior surface of tarsus and apex of tibia of fore leg.

*Imago.*—Labrum ♂ black, ♀ yellow. Labium in ♂ with very broad black median band, the yellow confined to the lateral margins, and sometimes restricted to the anterior corners; in ♀ the black band is much narrower. Thoracic markings in ♀ and immature ♂ sharply defined without any tendency to fusion and the formation of a longitudinal dark band along the side; dorsally the ante-humeral yellow ground colour extends the whole length of mesepisternum. Abdominal segment 9 with pale cuneiform marks (continuing those on the preceding segments). Adult ♂ thorax and abdomen dark blue, pruinose.

*Nymph.*—Up to 17–18 mm. Body sparsely setose. Legs rather long and slender. Antennae slender, twice as long as distance between their bases. Abdomen broadly oval, greatest width across segment 6 slightly more than half length of abdomen (including anal pyramid). Segments 8 and 9 ending in short acute lateral points. Segments 3–9 medio-dorsally keeled, the keel produced in strong upstanding tooth-like processes, that on segment 6 being the largest. Anal pyramid slightly longer than segments 9 plus 10, cerci subequal to appendix dorsalis, which is dorsally keeled, cercoids scarcely half length of latter. Mandibles (fig. 30, *k*): Mask extending to between coxae of middle legs; median lobe with straight anterior margins; lateral with about 8 feeble indents, with 3 graduated spines near each indent, inner angle with several unequal spines; mental setae 9–10, lateral setae 6–7. Divided spines on fore and mid tibiae and all the tarsi (fig. 30, *l*). Rectal gills with 25–30 lamellae on each hemibranch.

Greenish brown, semi-transparent, more or less mottled, femora banded.

*Localities.*—Table Mt., Cape Town (K. H. B. and H. G. W., December–March); Kalk Bay Mts. (A. C. H., November–March; Groot Drakenstein (A. C. H., March); French Hoek Mts. (K. H. B. and H. G. W., December); Hottentots Holland Mts. (K. H. B. and H. G. W., January); Houw Hoek Mts. and Bot River (K. H. B., January 1937); Caledon (T. D. Butler, December 1894).

*Remarks.*—Neither the ante-humeral stripe, nor the labium (♂), nor the 9th abdominal segment are decisive in separating this species from *Trithemis risi*. The dark lateral thoracic band and the incomplete last Anq as a rule serve to distinguish the latter species (see Ris, *loc. cit.*, p. 420), which also has a paler blue pruinosity in old ♂♂; there are, however, cases in which one or other of these characters is not constant. An incomplete extra Anq may be developed, fusion of the thoracic stripes into a dark longitudinal band, and reduction of the ante-humeral yellow stripe to the anterior half, are liable to occur in ♀♀.

In the Silvermine Valley, the upper waters of which are dammed to form the Muizenberg Reservoir (Lakeside Plateau, Kalk Bay Mts.), there seems to be a colony which at first was considered to be *Trithemis risi* or *stictica*. Only a few specimens have been closely examined (2 ♂♂, 2 ♀♀), but they all show the incomplete last Anq (sometimes oblique and disconnected either from C or Sc) ($10\frac{1}{2}$–$13\frac{1}{2}$ ♂, $9\frac{1}{2}$ ♀), the horizontal thoracic stripe, and both sexes have 2 yellow spots on the labrium (larger in ♀ than in ♂). The penis, however, agrees exactly with that of *H. dorsalis*.

Typical *dorsalis* also occurs in the same locality, and the nymphs of the two forms are indistinguishable.

Gen. *Trithemis* Brauer.

1921. Ris, *loc. cit.*, pp. 387, 420.

1936. Fraser, *loc. cit.*, p. 381.

*Imago.*—Arculus proximal to 2nd Anq. More than 10 Anq, the last one in fore-wing incomplete. Sectors of arculus with common

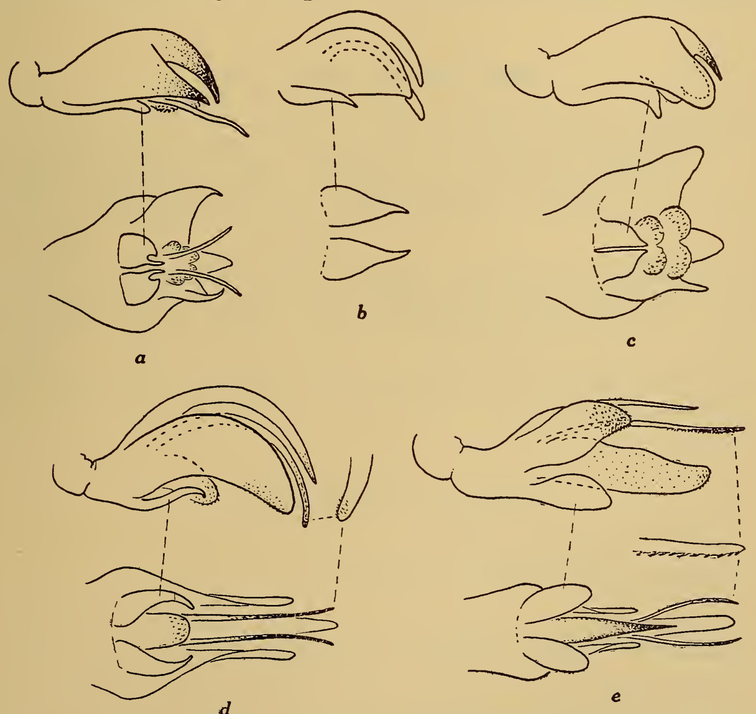


FIG. 31.—*Trithemis*, apices of penes of: *a*, *ardens*. *b*, *aureola* (Inhambane). *c*, *arteriosa*. *d*, *stictica* (Rhodesia). *e*, *risi*, with ventral views (ventral paired processes alone in *b*). In *a* and *c* the left lateral process is turned outwards.

stalk. Triangle in fore-wing crossed. One Ac in hind-wing. Discoidal field beginning with 3 rows of cells, narrowing to wing margin. Two rows of cells between $IR_3$ and Rspl (often only a few double cells).

Penis with the terminal joint broad and dorso-ventrally flattened, dorsal process elongate, spatulate, chitinised, usually strongly curved; lateral clasper-like processes large or very large; a pair of ventral scale-like or elongate processes, a pair of more or less curved slender rod-like processes ("titillators") arising from the base of a membranous lobe.

*Nymph.*—(*arteriosa*) as in *Helothemis.*

*Remarks.*—The penes of *ardens, arteriosa, aureola, risi* (= *distanti* Ris, 1921), and *stictica* have been examined, and all of them agree in type of structure, except that the rod-like processes are absent in *arteriosa.*

One specimen of *annulata* (Kaapmuiden, identified by Ris) has also been examined, but the penis is of quite a different type, resembling that of *Crocothemis.*

### *Key to the S.W. Cape species.*

1. Colour predominantly red.
   - *a.* General colour maroon or dark red. Frons dorsally and vertex of ♂ violaceous coppery, of ♀ ochreous red. Thorax ♂ dorsally deep mauve or violaceous, ♀ golden brown. Abdomen ♂ blood red, ♀ more ochreous. Legs all black. Small golden spots at bases of wings *arteriosa.*
   - *b.* General colour scarlet or orange-red. Frons ♂ scarlet dorsally, ♀ paler. Thorax reddish brown or olivaceous. Abdomen ♂ scarlet, ♀ ochreous. Fore and mid femora ochreous. Large golden spots at bases of wings *ardens.*
2. Colour predominantly black and yellow, ♂ blue pruinose, with metallic violet frons and vertex . . . . . . . . . . . *risi.*

### *Trithemis arteriosa* (Burm.).

1908. Ris, *loc. cit.*, p. 337.
1921. *Id.*, *loc. cit.*, pp. 421, 423, 425.

*Imago.*—Penis ♂. Lateral processes large, broad, wing-like when expanded; ventral processes sublanceolate, the inner margins straight, separated by a narrow cleft; dorsal process comparatively short; no rod-like processes arising from the membranous central portion which is divided into 4 lobes.

*Nymph.*—Indistinguishable from that of *Helothemis dorsalis.*

*Localities.*—Widely distributed over the S.W. Cape, including the Cape Peninsula.

### *Trithemis ardens* (Gerst.).

1908. Ris, *loc. cit.*, p. 338.

1921. *Id.*, *loc. cit.*, pp. 421, 423, 426 (*kirbyi ardens*).

*Imago.*—Penis ♂. Lateral processes large, rather acutely pointed; ventral processes ovate, with sharp point on inner apex, flanked by a notch on outer margin; dorsal process moderately elongate; 2 rod-like processes arising from the membranous central portion which is divided into 4 lobes.

*Locality.*—Kogman's Kloof, Montagu (K. H. B. and H. G. W., January 1935). Calvinia (K. H. B. and C. W. T., September 1936). Also Aiais on Gt. Fish River, S.W.A. (A. J. H. and C. W. T., November 1936).

### *Trithemis risi* Longfd.

1908. Ris, *loc. cit.*, p. 339 (*T. distanti* non Kirby).

1921. *Id.*, *loc. cit.*, pp. 422, 424, 427, pl. xi, fig. 5 (wings). (*T. distanti* non Kirby.)

1936. Longfield, Trans. Roy. Entom. Soc., vol. lxxxv, p. 490, fig. 8, *a* (♂ accessory genitalia).

*Imago.*—Penis ♂. Lateral lobes moderately large, ovate; ventral lobes also ovate, apices rounded, somewhat irregularly and feebly crenulate; dorsal process slender, not strongly curved; rod-like processes nearly straight, arising from base of a long, prominently projecting central lobe, the latter being chitinised on either side, but membranous dorsally and ventrally in its basal portion. Hamule larger and with a wider semicircular excision than in *Hemithemis dorsalis.* Anterior lamina with a subapical tuft of short bristles, and no spines on anterior surface (see Longfield's figure).

Anq ♂ $10\frac{1}{2}$–$11\frac{1}{2}$, ♀ $9\frac{1}{2}$ (Cape specimens); ♂♀ $10\frac{1}{2}$–$13\frac{1}{2}$ (Transvaal and Rhodesian specimens).

*Localities.*—Widely distributed in the S.W. Cape districts, but not yet found on the Cape Peninsula.

*Remarks.*—In ♂♂ the penis, hamules, and anterior lamina serve at once to distinguish this species from *Helothemis dorsalis.*

### Gen. *Pseudomacromia* Kirby.

1921. Ris, *loc. cit.*, pp. 387, 428.

*Imago.*—Arculus proximal to 2nd Anq. 10–12 Anq in fore-wing, the last one incomplete. Sectors of arculus with common stalk. Triangle in fore-wing crossed. One Ac in hind-wing. Discoidal field beginning with 3 rows of cells, parallel-sided to wing margin. Anal loop very long. Pterostigma comparatively small.

*Nymph.*—See *infra.*

*Remarks.*—The Ceres specimen of *torrida* is a ♀, but by a printer's error was recorded as a ♂ in Ris's monograph. This specimen and a ♀ from George have only 1 row of cells between $IR_3$ and Rspl; the M'fongosi ♀ has only 1 double cell in each wing. One (♀) out of four specimens (2 ♂♂, 2 ♀♀) from Palmiet River has 1 double cell in fore-wing of one side, 2 in hind-wing of same side; on the other side only a single row as in all the wings of the other three specimens. The ♀ from Hottentots Holland Mts. has 1 double cell in 1 fore-wing only.

All the Cape specimens have 3 rows of cells between $A_3$ and wing margin, except the Ceres and Hottentots Holland Mts. specimens, both of which have an incomplete 4th row on one side only.

The character of the tarsal claws seems to be more a sexual than a specific character; and the differences in the tibial spines, mentioned by Ris, I am unable to appreciate.

I think it very doubtful if *natalensis* can be maintained as a distinct species, and I record all the Cape specimens under Kirby's name, with the comment that, as regards the anal area in hind-wing and the $IR_3$–Rspl cells, they correspond with *natalensis* in Ris's key.

The penis of the M'fongosi ♂ (identified by Ris as *natalensis*) corresponds with that of the Cape specimens.

### *Pseudomacromia torrida* Kirby.

1889. Kirby, Trans. Zool. Soc. London, vol. xii, pp. 299, 340, pl. lii, fig. 7.

1908. Ris, *loc. cit.*, p. 341.

1921. *Id.*, *loc. cit.*, p. 429.

*Imago.*—Penis ♂. Terminal joint heavily chitinised, dorsally with a large wing-like lobe on either side of a median membranous, globose, and scabrous lobe, supported internally by a chitinous framework which ventrally bears a pair of strongly spinulose processes. Below these latter a plate, chitinised on either side, but with membranous tip; ventrally a pair of strongly chitinised, short, rod-like projections.

*Nymph.*—Up to 24–25 mm. Body smooth except for very fine

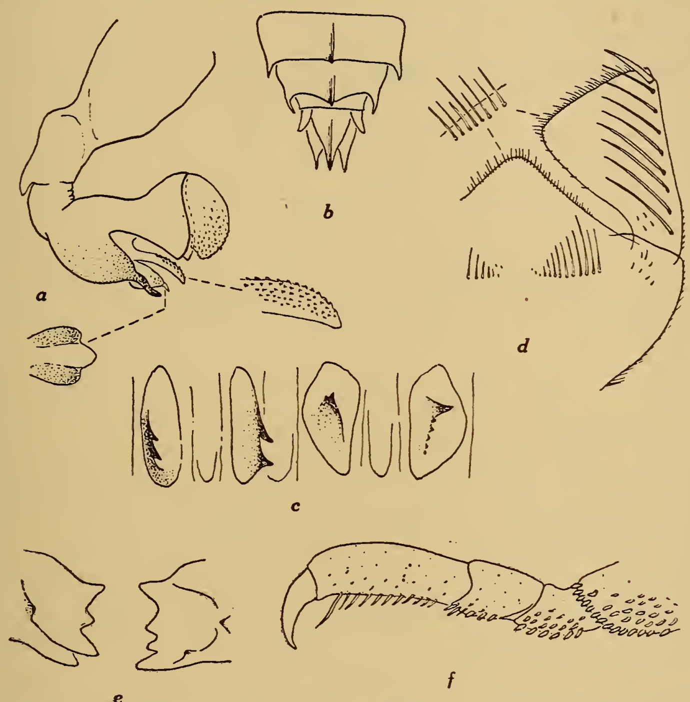


FIG. 32.—*Pseudomacromia torrida* Kirby. Imago: *a*, penis, with apex of one of the paired processes further enlarged, and ventral view of the median ventral plate. Nymph: *b*, dorsal view of 8th–10th abdominal segments and anal pyramid. *c*, gizzard opened out, the 2 ventral teeth on left, the 2 dorsal ones on right. *d*, portion of mask, with margin of median and lateral lobes further enlarged. *e*, inner view of apices of mandibles. *f*, anterior surface of tarsus and apex of tibia of fore-leg.

pilosity. Legs long and relatively slender. Eyes large and prominent. Antennae inserted slightly in advance of level of anterior margin of eyes, very short, slightly shorter than distance between their bases. Lateral margins of head behind eyes convergent. Abdomen ovate, broadest across segments 6 and 7. Segments 8 and 9 with strong lateral acute spines. Segments 3–9 medio-dorsally keeled, the keel produced in upstanding tooth-like processes, similar to, but relatively smaller than, those of *Helothemis dorsalis.* Anal pyramid a little longer than segments 9 plus 10, cerci subequal to appendix dorsalis, which is dorsally keeled, cercoids $\frac{1}{3}$ to nearly $\frac{1}{2}$ length of latter. Mandibles with only a single knob-like tooth (fig. 32, *e*). Mask very short, extending only to between coxae of fore legs. Median lobe with rather broadly rounded apex and slightly concave margins, set with somewhat unequal spines (more or less alternately long and short); lateral lobes with distal margin without any trace of indents, set with unequal spines. Mental setae 9–10, with a few irregular small ones near median line, lateral setae 8. Legs without any divided spines, armature on anterior surface of fore and mid legs, and on posterior surface of hind leg as in fig. 32, *f*. Gizzard with 2 strong denticles on the ventral teeth, a single one on each of the dorsal teeth, the apex sometimes bifid, and sometimes 2–3 little denticles on the posterior edge of the large tooth. Rectal gills lamellate, about 50 lamellae to each hemibranch.

Brown, with a more or less distinct greenish tinge; rectal gills white.

*Localities.*—Ceres (Ris, ♀, printed in error as ♂); Palmiet River, near Kleinmond (H. G. W., December 1932, 1933; K. H. B., December 1934); Hottentots Holland Mts. (K. H. B. and H. G. W., January 1933); Berg River, Groot Drakenstein (K. H. B., March 1931, nymph shuck); Kaaiman's River, George District (H. G. W., April 1933, nymph shuck, and January 1936, 1 ♀).

*Remarks.*—Correlated by means of a teneral ♀ just emerged from its shuck (H. G. W., Palmiet River, December 1933). In mid December 1934 the shucks were very common on the rocks and on the stems of the Palmiet (*Prionium*) in the same locality, and the imagos were flying on the slopes of the nearby hills. A few living nymphs were still to be found amongst the submerged stems and roots of the palmiet, and other vegetation.

### Gen. *Pantala* Hagen.

#### *Pantala flavescens* (Fabr.).

While this paper was in the press, this dragon fly, and its nymph, has been found within the S.W. Cape region, viz. Letjesbosch, Beaufort West, and Olifants River, Clanwilliam.

A figure of the nymph is given by Needham (1904, Proc. U.S. Nat. Mus., xxvii, p. 712, pl. 40, fig. 5). A fuller description, with figures, of the South African nymphs will be given on another occasion.

## 13. *A New* Jenkinshelea (*Dipt. Ceratopogonidae*) *from Southern Rhodesia*.—By Botha de Meillon, D.Sc., F.R.E.S. (South African Institute for Medical Research, Johannesburg).

(With 1 Text-figure.)

### Jenkinshelea rhodesiensis sp. nov.

*Female.*

A medium-sized brown insect. *Wing length:* 2·5 mm., greatest width 1·1 mm. *Head*: eyes widely separated. Occiput and clypeus grey; basal segments of the antennæ—all segments except the tori and the first are missing—and mouth parts light brown. Segments III, IV, and V of the palpi subequal. *Mesonotum:* slightly produced over the head, without a frontal spine; very dark brown, covered with dense, light brown, pubescence, and some scattered light brown hairs. Scutellum paler brown than mesonotum. Paratergites not unduly prominent. Halteres brown with darker crowns. *Legs:* coxae very dark brown; femora brown; tibiae paler brown, not swollen. First tarsal segment pale brown, shorter than tibiae on all legs and two-thirds of that segment on the hind leg. Second tarsal segment of the fore leg infuscated apically; third, fourth, and fifth all dark brown; the second about as long as the fifth and slightly longer than the third and fourth together; fourth more or less bell-shaped; third slightly longer than broad; fifth elongate with at least four black spines.

Claws equal, about one-third the length of the fifth tarsus, each with a short basal tooth. Tarsi II–V are missing on the mid and hind legs. *Wing* (fig. 1): Differs from all other species of this genus in having only one radial cell, apart from this it closely resembles the type of wing seen in *accraensis* Ing. and Macfie, and *polyxenae* De Meill. *Abdomen:* Dark brown, especially the apical segments, the basal ones apparently membranous.

The insect was securely glued on to a piece of pith, and as maceration might easily have resulted in the loss of the only remaining tarsal segments we did not dissolve it off. The finer tarsal measurements and exact number of black bristles on the fore tarsal segment cannot therefore be given.

This insect belongs to those genera in which the thorax is produced over the head, namely, *Jenkinshelea* Macfie, *Macroptilum* Becker, and *Calyptopogon* K. In spite of the fact that the wing has only one radial cell the insect seems more nearly related to *Jenkinshelea* than to the other two genera; as, for example, in the very broad wing

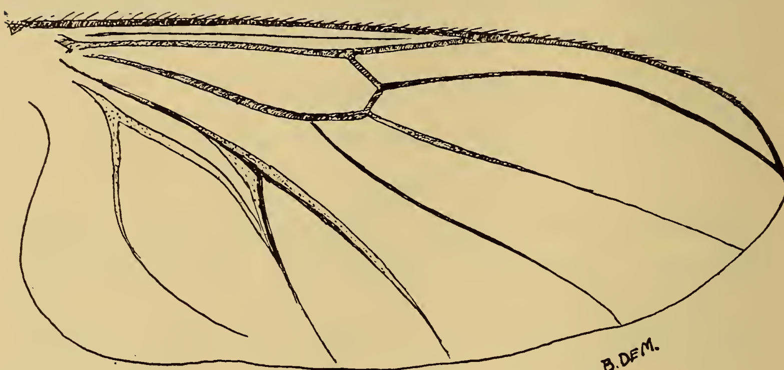


Fig. 1.—*Jenkinshelea rhodesiensis*, sp. nov., female wing.

with large anal lobe and prominent anal vein, short hind tarsus and armed fifth tarsi.

Johannsen (1) has suggested that the characters which Kieffer placed so much confidence in, namely, the production of the thorax over the head, shape of the apex of the wing, and position of the cross-vein, are not of generic value, and hence the closely related genera *Macropeza* Meigen, *Macroptilum* Becker, *Calyptopogon* Kieffer, and *Paryphoconus* Enderlein should all be sunk under *Macropeza* Meigen. Macfie (2), however, recognises these characters. The genus *Jenkinshelea* Macfie chiefly differs from the above-mentioned ones by possessing two radial cells. In the present species this character is shown to be of no generic value; furthermore, the thorax is not pointed in front and only very slightly produced over the head. In *J. polyxenae* De Meill. the thorax is pointed but again hardly produced. On the whole, the validity of both these features is open to doubt. The *Jenkinshelea* so far described from Africa have the anal angle of the wing well developed so that the wing is very broad at the base.

This feature is apparently not shared by the only other species in which it is mentioned, namely, *boliviensis* Kieff. from South America; here Kieffer says: "Ailes . . . graduellement amincies a la base."

It would therefore seem that *Jenkinshelea* should also be regarded as a subgenus of *Macropeza* and that it should contain *setosipennis* K., *boliviensis* K., and probably *Macropeza similis* Joh., and that a new subgenus be erected for the Ethiopian species with enlarged basal angle of the wing, namely, *accraensis* Ing. and Mac., *polyxenae* De Meill., and the new species described above.

*Holotype.*—Female: Hippo Pools, Hartley, S. Rhodesia, 24th February 1935. Taken as a prey of the Asilid *Philodicus tenuipes* Lw. (W. L. Williams).

The collector writes as follows about the circumstances of capture: "At 'Hippo Pools' in the River Umfuli, Hartley District, 24th February 1935, the Asilid was observed with this prey. The captor rested on bare ground under tall trees, and I was able to approach it closely. I was surprised to see this tiny fly apparently being sucked dry. The Asilids were in the early morning (about 8 a.m.) extremely active and, as far as I could judge, very 'hungry'."

I am greatly indebted to Mr. A. Cuthbertson of the Department of Agriculture, Southern Rhodesia, for permission to describe this interesting insect and to Mr. W. L. Williams for presenting it to the Institute collection.

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(1) Johannsen, O. A.—*Macropeza* and its Allies (*Chironomidae*, Diptera), Ent. Mitteil, vol xvi, p. 423. 1927.

(2) Macfie, J. W. S.—Report on a Collection of *Ceratopogonidae* from Malaya, Ann. Trop. Med. and Parasit., vol. xxviii, pp. 292–293. 1934.

## 14. *Report on Some Anthidiine Bees (Apoidea) in the South African Museum.*—By G. A. Mavromoustakis, Limassol, Cyprus.

The present paper is based on a collection of Anthidiine bees loaned by the South African Museum, through the kindness of the Director and of Dr. A. J. Hesse. The type of the new species is placed in the South African Museum.

### *Anthidium tuberculiferum* Brauns.

Namaqualand. Bowesdorp, 1 ♂, November 1931; Klip Vlei, Garies, 2 ♂♂, November 1931. This species was described by Brauns from Willowmore; it is a member of *Anthidium* (s. str.).

### *Anthidium platyscepum* Mavromoustakis.

S.W. Africa. Kaross, 1 ♂, February 1925.

### *Anthidium poecilodontum* Mavromoustakis.

Namaqualand. Bowesdorp, 2 ♀♀ 1 ♂, November 1931.
The type locality of this species is Matjesfontein.

### *Anthidium capicola* Brauns.

Cape Province. Olifants River Valley, Clanwilliam, 8 ♀♀ 2 ♂♂. Similar to topotypical specimens in my collection, but differs as follows:—

First abdominal tergite black; tergites 2 to 4 with a short linear, central, pale yellow stripe interrupted in middle.

### *Dianthidium bruneipes* (Friese).

*Female.*—Length 11·5 mm.

Black; lower margin of clypeus crenulate; pulvilli present; second recurrent nervure out of second transverse cubital nervure; scutellum normal and rounded; apical half of abdominal tergites 1 to 5 yellowish brown; last abdominal tergite black, apical margin rounded and slightly emarginate in middle.

*Male.*—Length 11·5 mm.

Black; similar to the female; clypeus yellow; face laterally, clypeus, supraclypeal area and between antennae with somewhat dense and shining white hairs; cheeks with shining white hairs; vertex and occiput with pale yellowish brown hairs. Thorax with pale yellowish brown hairs above and shining white hairs at sides; wings clouded; sixth abdominal tergite with apical margin produced in middle, and with a short and stout spine at sides; seventh tergite with a curved spine laterally, and between these lateral spines triangularly produced in a long spine (the spine rounded at the apex and longer than the lateral ones); ventral segments black, apical margins of sternites 1 to 4 yellowish brown; fifth ventral segment with a very short tubercle in middle of apical margin; sixth ventral segment polished and shining, base concave except laterally, apical margin truncate.

Namaqualand. Kamieskroon, 1 ♀ 1 ♂, September 1930.

This species was described by Friese in the female sex (Zool. Jahrb., xxxv, Abt. f. Syst., p. 596), and it is a member of *Dianthidium* of the group of *Dianthidium rufocaudatum* (Friese).

### *Anthidiellum polyochrum* n. sp.

*Female.*—Length hardly 5 mm.

Black with cream-coloured markings; clypeus shining, densely punctured, cream-coloured; lateral marks on face nearly reaching level of antennal insertions and a mark above each eye, cream-coloured; a longitudinal cream-coloured stripe on sides of supra-clypeal area and on each inner side of antennal insertions ; mandibles black with a basal cream-coloured rounded spot; antennae black brown; vertex and occiput moderately shining ; clypeus, sides of face and cheeks with some very short and sparse shining white hairs. Thorax black; mesonotum strongly and densely punctured, dullish, and with a cream-coloured mark on each side near tegulae; tubercles sharply pointed, cream-coloured; scutellum projecting, rounded at sides, apical margin truncate in middle and without emargination; apical margin of scutellum cream-coloured and broadly interrupted by black in middle; tegulae very finely punctured, deep brown, with subhyaline margin except behind; wings clear; second recurrent nervure out of second transverse cubital nervure; thorax with some very short and sparse white hairs above and shining white hairs at sides; femora and tibiae black; apex of femora narrowly yellowish brown; anterior tibiae with the basal cream-coloured stripe nearly reaching apex; middle and hind tibiae with a basal cream-coloured stripe above; anterior tarsi yellow brown; middle tarsi with nearly black brown basitarsi, small joints yellow brown; hind tarsi with basitarsi cream-coloured, small joints brown, last ones yellow brown; legs with shining white hairs; hind basitarsi with short and dense golden hairs on inner side; spurs yellowish; pulvilli present. Abdomen black and shining ; first and second tergites finely punctured; third tergite finely and somewhat sparsely punctured; first tergite with a lateral cream-coloured mark; second tergite with a longer lateral cream-coloured mark; tergites 3 to 5 on each side of middle with a short basal cream-coloured stripe, that on fifth longer; sixth tergite cream-coloured, sides basally black; third tergite with a narrow cream-coloured mark at sides; sixth tergite with very short white hairs; ventral scopa very light golden white.

S.W. Africa. Kaross, near Franzfontein Kaokoveld, 1 ♀ (type), February 1925.

Related to *Anthidium absonulum* Ckll., but the latter has the abdominal markings lemon yellow, the punctures of abdominal tergites strong, and the tegulae black. This small species is a member of the *Anthidiellum zebra* (Friese) group.

## 15. *A New Species of Plume-footed Mite from South Africa.*—By

R. F. Lawrence, Ph.D., Director, Natal Museum, Pietermaritzburg.

(With 4 Text-figures.)

In December 1936, Dr. A. J. Hesse of the South African Museum, Cape Town, sent me for identification two small mites collected by himself and Mr. C. Thorne at Kamieskroon and Bitterfontein in Namaqualand. These appeared at first sight to be *Erythraeus plumipes* L. Koch, but for various reasons which appear below, it has been decided to describe them as a separate species, *Erythraeus namaquensis.*

This Namaqualand form in its appearance and habits very closely resembles *Erythraeus plumipes* L. Koch, a widespread species or group of allied species, characterised by a peculiar feathery tuft of modified hairs on the tibia of the last pair of legs. Dr. M. André has cleared up the synonymy (**1**, **2**), and given an account of the geographical distribution and habits (**3**) of *E. plumipes* in a recent series of very helpful papers. According to him the distribution of the species is as follows: Jersey, France, Switzerland, Spain, Northern Africa, Corfu, Russian Armenia, and Turcomania.

The Namaqualand form of *Erythraeus* described in this paper is of unusual interest; though many Trombidiform mites have been collected in various parts of South Africa, none resembling *E. plumipes* of the European and Mediterranean regions have hitherto been discovered. The South African Museum has organised a number of expeditions to Namaqualand during recent years; on at least four occasions large collections of invertebrates, including Acari, have been made at Kamieskroon and Bitterfontein. On two of these occasions I accompanied Dr. Hesse and Mr. Thorne and collected numerous Trombidiform mites. More Acarine material has therefore been taken in Namaqualand than in most other regions of South Africa, so that this form of *Erythraeus* must, to say the least, be uncommon in South Africa. The discoverers, who have done intensive collecting in South Africa for many years, stated that they had never before seen an Arachnid anything like it.

### Habits.

Dr. Hesse has sent me an account of his observations on the mite which can be summarised as follows: In agreement with the statements of various authors, it is a diurnal animal running over the bare sand. The specimens were captured during the hottest time of the day, one at noon, the other in the early afternoon; they were found on reddish driftsand near a dried river bed, and did not seem to be associated with any special plant or type of vegetation, though a species of *Mesembryanthemum* was the commonest plant in the vicinity. "It does not run straight, but more or less in circles." With regard to its running powers, Dr. Hesse says "it runs like a small Solpuga but even quicker," and "it runs so quickly that the eye has difficulty in following it." With regard to the position of the posterior legs he says, "the two feathery processes are kept upright," while the specimen caught by Mr. Thorne "had the last pair of legs projecting straight backwards while running." In both cases there was an extremely rapid alternate

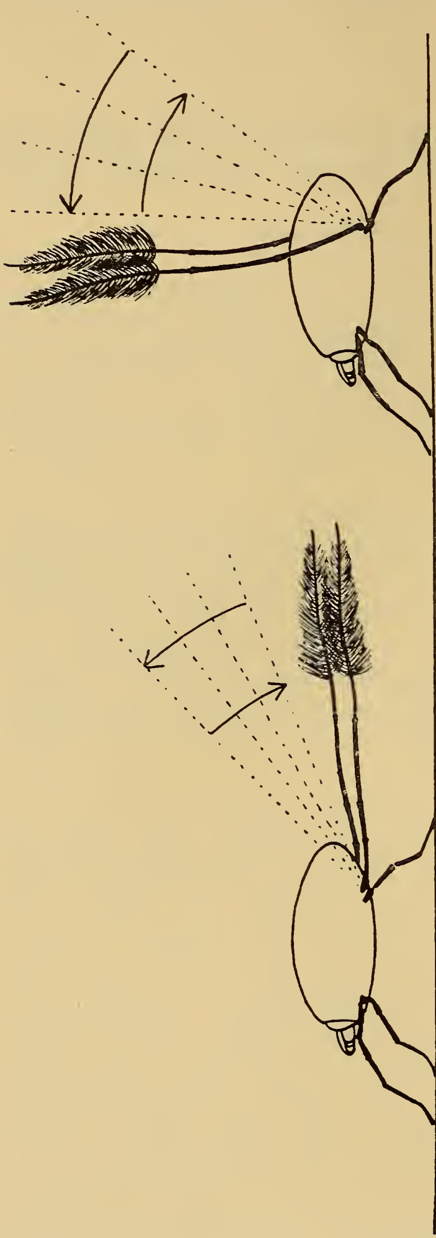


Fig. 1.—*Erythraeus namaquensis* n.sp. Horizontal and erect positions of the posterior legs while running. The arrows indicate the arc through which the legs move alternately (see text).

movement or vibration of these legs, as illustrated diagrammatically in fig. 1, adapted from a sketch supplied by Dr. Hesse. This account of the positions assumed by the last legs agrees with the observations of various European authors which have been ably summarised by M. André (**3**). Quoting Dr. André, the posterior legs, according to Gessner (in **4**), are trailed like caudal appendages, while Luff (in **5**), Tragardh (**6**), and Birula (**7**) describe them as being carried erect in the air; this attitude is figured in M. André's paper on the distribution of *E. plumipes* (**3**). J. Millot (in **3**) states they are directed backwards at an angle of 45° to the body, while Cambridge (**8**) describes them as being moved rapidly, the feathery tufts resembling the dance of minute flies above the mite. Birula and Tragardh also mention the 'to and fro' movements of the legs while they were held aloft. All these attitudes, then, are substantially the same as reported in the case of *E. namaquensis*, and probably represent different phases of the same movement of the legs.

### *The Function of the Modified Posterior Legs in Erythraeus.*

With regard to the function of these curiously modified appendages nothing is known. Lucas (**9**) has compared them to the tufts of silky hairs on the legs of certain longicorn beetles. In advancing a tentative and quite hypothetical explanation of the use to which these specialised legs are put, four possibilities may be considered: (1) a mechanical function aiding locomotion; (2) a sensory function; (3) a defence mechanism; (4) a sex character.

(1) *A Mechanical Function Aiding Locomotion.*—Tragardh (**6**) is inclined to regard them as balancing organs which enable the mite to shift its centre of gravity while in motion. It seems also admissible to suggest that these feathered legs may be used simply as sails to take advantage of a following wind, the legs being lowered when the wind is in an adverse direction, or when the mite has arrived at its temporary goal; the movements of the legs may be used to test whether the wind is favourable. This would partly explain the extraordinary speed which the mite exhibits in running from place to place. It seems difficult otherwise to account for such exceptional running performances, carried out with only three pairs of legs which are by no means strongly constructed.

(2) *A Sensory Function.*—Tragardh (**6**), as an alternative to his suggestion that the legs may serve as balancers, supposes that they may be tactile organs for apprehending movements of the air, enabling the animal to take refuge from strong winds. Dr. Hesse also con-

siders that "they may be connected with a sense which enables the mite to become aware of external sensations connected with weather, such as wind movements, etc." He says further, "it is possible that the mites appear only just after or just before rain. The one specimen was taken a day before thundery weather set in, the other a day or two after a storm had passed over the spot. The ground was still damp." In this connection it may be noted that the flattened hairs which form the feathery tufts of the posterior legs are covered with large numbers of fine setae (fig. 2, *f*, *g*), a fact also noted by Tragardh (**6**) in specimens captured in the desert near Cairo.

(3) *A Defence Mechanism.*—Tragardh (**6**) does not think that this modification can be interpreted as a defence mechanism on account of its delicate structure. In this connection one fact should be mentioned which does not seem to have attracted comment from any previous authors. In both specimens sent me, both of the posterior legs had become detached, all four appendages having broken off at the same point, the junction of the trochanter and the trochantin; the remaining legs of both specimens were all *in situ*. Dr. Hesse also remarks of the posterior legs, "they are easily detachable, for the one specimen (captured by Mr. Thorne) lost one of its appendages very easily." This fact points to a specially weakened joint at which the posterior legs can be easily thrown off. Though this may not necessarily be considered a defence or escape mechanism, as the legs may be discarded for other reasons, it is difficult to avoid the suspicion that natural enemies such as sand-living lizards would be more attracted by, and more liable to seize, the plumed legs waving aloft than the mite itself. Desert-living lizards, which are mainly insect feeders, would very readily snap at a small fast-moving object, and might in this case easily mistake the vibrating tufts of hair for a hovering insect. Other Arthropoda, like the centipede *Cryptops*, lose the last pair of legs very easily; in members of this genus the gonopods almost inevitably break off in captured specimens, always at the same joint.

(4) *A Sex Character.*—There seems to be some justification for inferring that these feathered legs in *Erythraeus plumipes* and *E. namaquensis* may have a sexual significance. A very similar condition is found in many diurnal Solifuges, a group which is most usually found in desert and sandy localities resembling those in which the plume-footed mite has been captured. In the genus *Solpuga*, a distinct "mane" of long silky hairs often adorns the distal segments of the fourth leg, very conspicuous in South African species of diurnal habits

such as *S. derbiana* and *S. chelicornis* (**11**, figs. 2, 3, pl. ii); though quite noticeable in the female this "mane" is more strongly developed in the male. These Solifuges, when seen darting hither and thither during the hottest time of the day, also have a rapid and erratic gait. The writer (**12**, p. 262) has recorded his impressions of the males of *Solpuga sericea* in South West Africa as follows: "The erect mane of the hind legs, together with their erratic gait, gives them a striking resemblance to a fluffy wind-blown seed."

Of these four possible explanations, we have no information with regard to (4); of the others (1) and (3) appear to me to have more in their favour than (2); it is not impossible to suppose that these specialised appendages may have a mechanical function while also serving as a defence or escape mechanism.

If this view is taken, the plumed feather-like legs would in the first place have been evolved as a purely mechanical device for taking advantage of currents of wind; such a device would be of great value in accelerating the speed of a small light animal in which the legs are comparatively short and weak. If he were to judge from preserved specimens only, a morphologist would hardly guess that this small mite could rival the speed and activity of the Solpuga. In the second place, the habit of holding the conspicuously feathered legs erect would become a danger to their owner on account of their attraction for predaceous animals. To meet this danger the joint between the two trochanter segments, which allows the leg to be readily detached, would have been developed as a secondary escape mechanism.

The Namaqualand form is described below in some detail, on account of its close resemblance to the European form, and owing to the confusion which has arisen from a lack of accurate figures and descriptions by the older authors.

## Family ERYTHRAEIDAE Oudemans.

### Gen. *Erythraeus* Latr. 1806.

### *Erythraeus namaquensis* n. sp.

Type, 1 specimen collected by Mr. C. W. Thorne and Dr. A. J. Hesse at Kamieskroon, Namaqualand (November 1936).

*Colour.*—Body in general light reddish-brown, dark reddish or wine-red in living specimens. The feathery tuft of hairs on the tibia of the fourth leg blackish, individual hairs seen under the microscope yellow-brown, the smaller tuft of hairs on the dorsal apex of the patella entirely white, contrasting strongly with those of the tibia.

*Body.*—Body longer than broad, its anterior and posterior margins truncate, widest between the anterior and posterior pairs of legs. General body surface on the dorsum and sides with small flattened pear-shaped hairs, ventral surface between the legs with normal slender and pointed hairs. The pear-shaped hairs of the dorsal surface seen under high power of the microscope (fig. 2, *a*) leaf-like, with spicules on their dorsal surface and a main central darker axis which is seen better when focussing a little downwards from the dorsal surface; under surface entirely smooth; these modified hairs usually curved, sometimes strongly so, the convexity directed upwards. Hairs of dorsal surface very numerous, not arranged in rows but evenly spaced, 40–60 across the body, giving the skin a granulose appearance.

Two sessile eyes on each side, posterior to the middle of the crista, anterior eye twice as large as posterior one; posterior enlargement of crista with a pair of fine hairs of insignificant size, the anterior enlargement with a row of 4–6 flattened and spiculated hairs on each side, the proximal ones broad and short, the distal ones narrower and longer; in addition a pair of fine smooth hairs in the middle, anterior to the lateral flattened hairs.

*Mouthparts.*—Palpi as in fig. 2, *b*, the second joint with some enlarged and flattened serrated hairs along its dorsal surface. Maxillary lobes (fig. 2, *b*, *c*) more or less immovably attached to each other along the middle line; they can, however, be easily separated. Each internal lobe ending anteriorly in a corolla-like suctorial organ composed of two or more concentrically arranged rings of transparent, membranous, modified hair-like structures resembling the petals of a flower (fig. 2, *c*). Each circle of hairs entire except for an opening in its inner side which is continuous with a straight groove passing down the inner side of the maxillary lobe, in which the mandible lies. Seen from above in an undissected specimen, the closely contiguous rami of the mandibles project slightly from the suctorial organ, the greater part of which, while enclosing them, is situated laterally to them.

Mandibles styliform, seen from below (fig. 2, *d*), showing a portion of the two main tracheal branches piercing the muscles attaching the two halves of the mandible.

*Legs.*—All legs 7-jointed, I and II subequal, III longer than I and II, IV much longer than III. Coxa I largest of the four, its posterior apex forming an angle of 45°, the inner margins of the opposing coxae vertical and parallel. All legs covered evenly with hairs, those of the proximal segments short, fairly broad, blunt, and with distinct spicules, those of the distal segments longer, narrower, sharply pointed, and with indistinct spicules. All these hairs with a median groove.

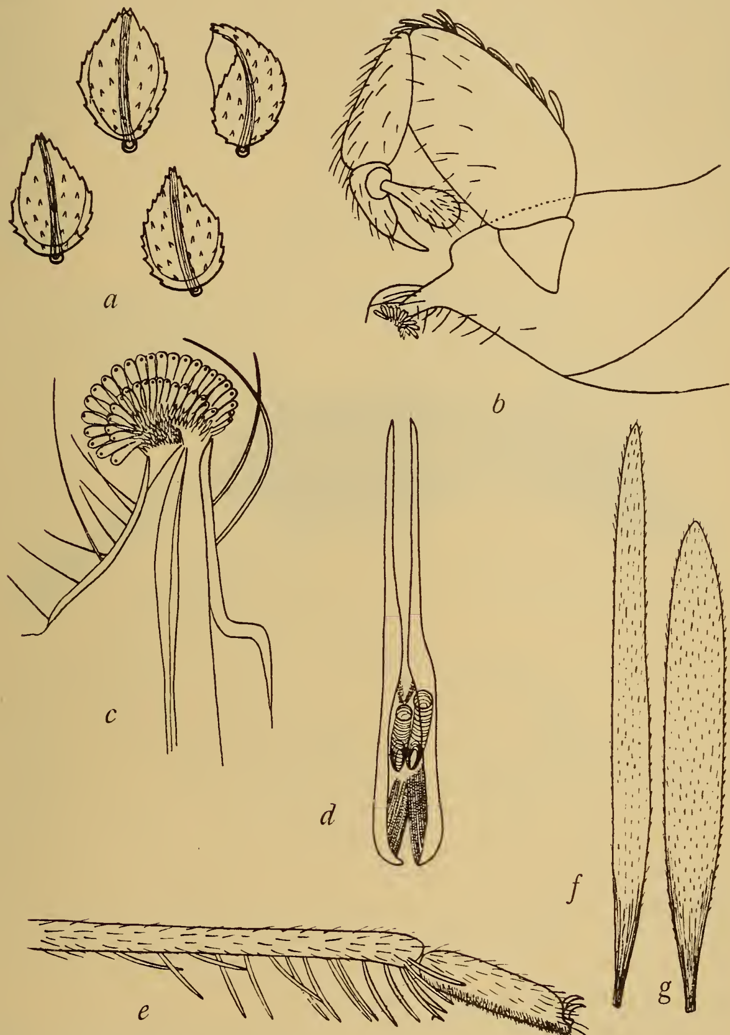



FIG. 2.—*Erythraeus namaquensis* n. sp. (*a*) dorsal hairs; (*b*) pedipalp and maxillary lobe; (*c*) apex of maxillary lobe, enlarged; (*d*) mandibles; (*e*) tibia and tarsus, leg III; (*f*) modified hair, ventral surface of tibia IV; (*g*) the same, dorsal surface of tibia IV.

Tibiae of legs I–III on their ventral surfaces with thickened, modified, spine-like hairs, fleshy pink in colour and provided with fine accessory filaments (fig. 2, *e*); these hairs larger and more distinct in

II than in I, and more so in III than in II, I with 12–14 on the distal two-thirds of its ventral surface, II similarly with 14–16, III with 16–18 (fig. 2, *e*). All tarsi, especially the first, swollen and short, I about two-thirds, II half, III less than half as long as the preceding tibial segment; tarsi I–III with a pad of numerous short sinuous hairs on their ventral surfaces, these hairs provided with lateral filaments longer than those of the remaining hairs of the legs. Claws of all tarsi small and simple.

Leg IV as in fig. 3, about $3\frac{1}{2}$ times as long as body, tibia very long and slender, provided along its entire length, except for a small basal

FIG. 3.—*Erythraeus namaquensis* n. sp. Patella, tibia, and tarsus of leg IV.

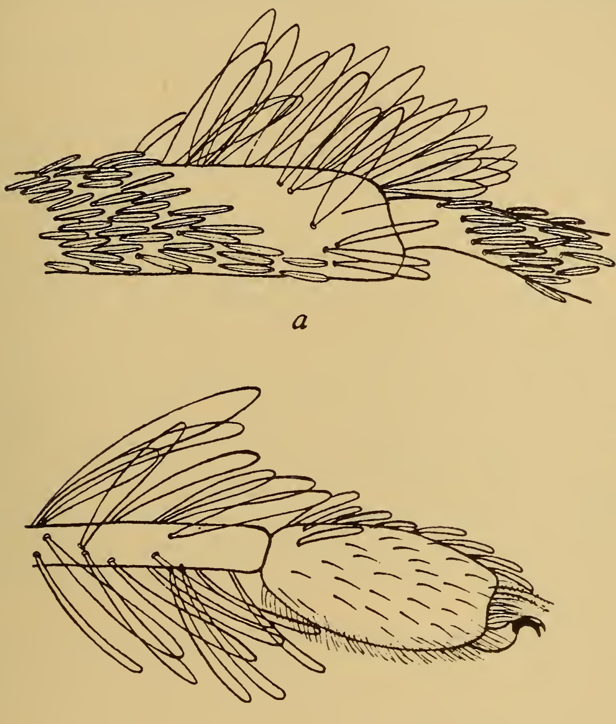
portion, with modified hairs; these hairs much more numerous in the basal than in the apical half, extremely flattened and leaf-like, semi-transparent, and thickly covered with fine setae. The modified hairs of the dorsal surface shorter, broader, and not so sharply pointed (fig. 2, *g*) as those of the ventral surface (fig. 2, *f*). Tarsus (fig. 4, *b*) incrassate, flattened, and sharply truncate apically, many times shorter than the tibia, with a few more or less flattened hairs on its dorsal surface. Dorsal apex of patella with a small cluster of snow-white hairs, similar in shape but a little shorter than those on the dorsal surface of the tibia (fig. 4, *a*).

*Genital Opening.*—In the smaller of the two specimens the genital opening is opposite the junction of coxae III and IV; it consists of an oval longitudinal area enclosing a pair of smaller, dark, chitinous plates, the whole area about as long as the distance between the first pair of coxae. Anal opening situated considerably posterior to coxa IV and not far from the posterior margin of the body. It is also oval in shape and considerably smaller than the genital opening.

*Dimensions*.—Length of body 1·6, breadth 1·2, leg III 2·2, leg IV 6 mm.

Dr. Hesse and Mr. Thorne also collected a second larger specimen at Knegsvlakte, Bitterfontein, Namaqualand. This specimen is about 2 mm. in length; legs, I 2·7, II 2·6, III 3, IV 7·5 mm.

*Erythraeus namaquensis* seems to resemble most closely the form described by Tragardh under the name of *Lucasiella plumipes* from



a

b

FIG. 4.—*Erythraeus namaquensis* n. sp. (*a*) apex of patella and base of tibia, leg IV; (*b*) apex of tibia, and tarsus, leg IV.

the neighbourhood of Cairo (**6**). Both forms have spines on the under surface of tibia I and II; these are, however, also present on the femora of legs II and III in Tragardh's specimens, while absent in the Namaqualand ones. The two forms also agree in the general shape and structure of the tibial hairs of leg IV, which Tragardh describes as "mit schwarzbraunen, langen, lanzettförmigen, fein behaarten Haaren besetzt." Though the differences between the two forms are very small, it seems probable that minor distinctions will be found to exist when specimens from the two localities can be compared.

Tragardh's form is again undoubtedly co-specific with Lucas's types and probably also with the specimens taken by various collectors in the Mediterranean region (Malaga and Corfu). The appearance of the fourth leg in *E. namaquensis* is, however, rather different from that of Lucas's specimens judging by the figure given by André (**1**, p. 382, P. iv). The modified hairs in this figure are longer, narrower, and more sinuous, there is no tuft of hairs at the apex of the patella, and the tarsus is quite devoid of flattened hairs.

Still more apparent is the difference between the South African and Swiss forms figured by Haller and reproduced by André (**1**, p. 382, 1). Apart from the improbability of identical forms of *Erythraeus* occurring in such widely separated and climatically different regions as Namaqualand and Switzerland, the South African species is obviously distinct from the Swiss form, if Haller's figure has any semblance of accuracy. The more obvious differences are that in the latter the dorsal hairs of the body are much fewer and larger; the pair of hairs on the posterior enlargement of the crista are far longer and project beyond the sides of the body (in *E. namaquensis* they are minute); the greater size of the mouthparts. Haller's specimens are also probably larger in body size, and the hairs of the tibial tuft of leg IV appear to be longer and different in shape.

I have not been able to see Birula's description and figures of his *Macropus plumifer*, which according to André is also synonymous with *E. plumipes*.

It would seem that all forms recently grouped by André (**1**, **2**, **3**) under the name of *Erythraeus plumipes* L. Koch, and including the one described in this paper, are very closely allied. They all have the same flattened papillate hairs on the dorsal surface of the body, and a cluster of peculiarly modified hairs on the tibia of the fourth leg. It is, however, quite possible that, when actual specimens from the various regions where they have been collected are compared, the South-Russian, Swiss, Mediterranean, and Namaqualand forms may be found to be distinct. They will, however, have to be separated on other characters and for different reasons than those given by N. Banks (**10**); the differences may be so slight that no more than a recognition of varieties or local races of the one species will be justified. The characters which appear to be most convenient for establishing such differences are (1) the number of dorsal papillate hairs, (2) the mouthparts, (3) the size and shape of the modified hairs of the fourth tibia.

The features which distinguish *Erythraeus namaquensis* from other members of the *plumipes* group are (1) the mouthparts, (2) the apical tuft of hairs on the patella of leg IV, (3) the shape and size of the flattened hairs of tibia IV.

I wish to tender my best thanks to Dr. Hesse and Mr. Thorne for sending me these interesting mites and for the observations they have made.

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OF THE

# SOUTH AFRICAN MUSEUM

*VOLUME XXXII.*

PART IV, *containing* :—



*ISSUED JULY 1938. PRICE 1s.*

PRINTED FOR THE
TRUSTEES OF THE SOUTH AFRICAN MUSEUM, CAPE TOWN
BY NEILL AND CO., LTD.,
212 CAUSEWAYSIDE, EDINBURGH.

16. *A new Genus and new Species and Subspecies of Mammals from Little Namaqualand and the North-West Cape Province; and a new Subspecies of* Gerbillus paeba *from the Eastern Cape Province.*—By G. C. Shortridge, Director, Kaffrarian Museum, King William's Town. (In collaboration with Donald Carter, Assistant Curator of Mammals, American Museum of Natural History.)

This is the first report on the Cape Museums' Mammal Survey of the Cape Province. Owing to generous financial co-operation on the parts of the Museum of Comparative Zoology (at Harvard University), the South African Museum, the Natal Museum, the Cape Provincial Museums (at Grahamstown, Kimberley, Port Elizabeth, King William's Town, and East London), the Research Grant Board of the Union of South Africa, and Dr. H. Merensky, it has been possible to undertake, by means of two expeditions, a systematic mammal survey of (1) the whole of Little Namaqualand, and (2) the northern part of the Western Cape Province.

The preliminary scientific results of this mammal survey of the Cape Province include the determination of a new genus of Golden Moles, and the discovery of no less than three genera of mammals, *Platymops*, *Gliriscus*, and *Petromyscus*, that were not known previously to occur in the Cape Province.

An unexpected discovery is that of an alpine form of Bathyergus, a genus hitherto thought to be restricted to coastal sand-dunes, on the highest plateau of the Kamiesberg.

Besides the new forms herein described, further additions to the Cape Mammal Fauna include two South-West African Bats, *Cistugo seabrae* and typical *Platymops haagneri*; whilst the re-discovery in the Cape Province of the rare *Eptesicus megalurus*, after nearly a hundred years, is of considerable zoological interest.

No Mammal Survey of Little Namaqualand had been carried out since the Rudd Expedition in 1903, when Mr. C. H. B. Grant collected in the region between Port Nolloth and Klipfontein in the north-western part of that territory.

Memorable results of the Rudd exploration included the discoveries of *Bathyergus janetta* and *Herpestes ruddi*, both of which were figured in the Proceedings of the Zoological Society of London (1904, vol. i, pl. vi).

The number of mammals already collected totals just over 3700 specimens, and full reports on the results of the expeditions, together with field notes and short topographical details of the camping-places, will be published in due course.

## Fam. VESPERTILIONIDAE.

### *Scotophilus angusticeps* sp. n.

Two specimens ♀♀ from near Citrusdal.

General colour above drabby umber-brown (rather as in *Eptesicus capensis*), without gloss or sheen; below light drabby brown, centre of abdominal and anal regions strongly washed with rufous, throat tinged with sienna-brown; base of fur, above and below, dark seal-brown; ears and flying membranes dusky black.

*Type* (in the Kaffrarian Museum).—Adult female, original number 1937, collected 28th December 1937 at Hex River Estate, 10 miles north of Citrusdal, N.W. Cape Province.

*Co-type.*—Adult female, original number 3308, collected 3rd January 1938.

*Dimensions of Type and Co-type.*—H. and b., 77 (74); tl., 58 (57); hf., 12 (11·5); ear, 18 (17·5); forearm, 53 mm.

*Skulls.*—Total length, 20; basal length, 17 (17·2); zygomatic width, 13·5; width of brain case, 10 (9·5); interorbital constriction, 4·5; length of palate, 9; upper dental series (from front of canine), 7 (7·5); lower dental series (from front of canine), 7·5 (8); mandible, 16 (15·5); height of brain case, 7·5 mm.

Skull flatter, less massive and with a markedly narrower zygomatic width than in *S. nigrita dingaani* or *S. n. herero*; cranially *S. n. herero* is in some respects intermediate between *S. n. dingaani* and *S. angusticeps*, although much more closely resembling the former.

## Fam. MOLOSSIDAE.

### *Platymops* (*Sauromys*) *haagneri umbratus* subsp. n.

One specimen from Kliphuis, northern spur of the Cedarberg.

A Cape subspecies of *P. haagneri*, distinguished by its dark coloration.

Colour above smoky seal-brown, a shade paler than in *Nyctinomous bocagei*; under surface smoky-brown, several shades lighter than the upper surface; ears and flying membranes almost black—as opposed to comparatively pale horn-brown in typical *haagneri*.

In typical *haagneri* (series from Goodhouse, lower Orange River, examined, and a single specimen from Berseba, Great Namaqualand) the colour above is drabby brown, paler and less cinereous than the under surface of *umbratus*, and pale buffy, approaching whitish, below.

*Type* (in the Kaffrarian Museum).—Adult male, original number 2827, collected 7th December 1937 at Kliphuis, Pakhuis Pass, 11 miles N.E. of Clanwilliam, N.W. Cape Province.

*Dimensions of Type.*—H. and b., 61; tl., 31; hf., 8·5; ear, 15; forearm, 37 mm.

*Skull.*—Basal length, 16·2; zygomatic width, 10; width of brain case, 9; interorbital constriction, 3·7; length of palate, 5·5; upper dental series (from front of canine), 6; mandible, 12·5 mm.

Genus new to the Cape Province.

## Fam. Macroscelididae.

### *Macroscelides typicus isabellinus* subsp. n.

One specimen from Port Nolloth (near township).

A markedly pale form of *Macroscelides typicus*.

Upper parts pale ashy-buff with only the faintest peppering caused by dusky tips to the hairs; underparts white; tail buffy, bristles on terminal half black above and below; hands and feet pale buff; ears blackish, as in the other local race of *typicus*.

*Type* (in the Kaffrarian Museum).—Adult male, original number 1821, collected 3rd February 1937 at Port Nolloth (close to the sea).

*Dimensions of Type.*—H. and b., 114; tl., 122; hf. (s.u.), 36·5; ear, 25 mm.

*Skull.*—Greatest median length, 33; basal length, 27·5; zygomatic width, 20·5; width of brain case, 15·5; interorbital constriction, 6; width across inflations, 18; length of nasals, 11; upper dental series (including incisors), 16; lower dental series (including incisors), 15; mandible, 25 mm.

I am regarding this specimen as representing a desert subspecies, like the pallid coastal races of other mammals peculiar to the South-West African Namib.

Four other specimens from the Port Nolloth hinterland (only 10–15 miles inland) are indistinguishable from specimens provisionally referred to *P. t. typicus* from other parts of Little Namaqualand.

### Fam. Chrysochloridae.

### *Cryptochloris* gen. nov.

Type *Cryptochloris zyli* sp. n.

Size and shape of body foreshortened as in *Eremitalpa*, but with relatively short, iridescent fur.

Claws of forefoot well developed and equal respectively in size to those of *Eremitalpa*.

Skull, with 40 teeth in all, approaching that of *Chrysochloris*, but interorbital region more expanded.

### *Cryptochloris zyli* sp. n.

A small rather dark coloured Golden Mole, similar in form to *Eremitalpa granti*, but with relatively short fur, as in *Chrysochloris*. One specimen from near Lamberts Bay.

General colour above drabby lead colour washed with an inky violet iridescence. Underparts drabby lead colour, hardly paler than above. Base of fur dark slate throughout. A slight admixture of pale hairs between the whitish-buff face markings—which are well defined, as in *Chrysochloris asiatica*.

*Type* (in the Kaffrarian Museum).—Adult male, original number 3477, collected 13th January 1937 at Compagnies Drift, 10 miles inland from Lamberts Bay, North-Western Cape Province.

*Dimensions of Type*.—H. and b., 82; hf., 12 mm.

*Skull*.—Greatest length, 22; basal length, 17·5; greatest breadth, 15·5; interorbital breadth, 8·5; greatest height, 11; dental series (front of incisors to back of posterior molar), 10; palate (across posterior molars), 8 mm.

*Chrysochloris wintoni* Broom should apparently be assigned to this genus.

I have named this very distinct Golden Mole, the type of a new genus, in honour of Mr. Gideon van Zyl, Compagnies Drift, to whom I am indebted for much assistance during my visit to Lamberts Bay.

### *Chrysochloris concolor* sp. n.

Two specimens ♂♀ from Nieuwoudtville and Traveller's Rest (15 miles N.E. of Clanwilliam).

A silvery drab Golden Mole, much resembling pale individuals in a series of *C. namaquensis* from the Kamiesberg, but without any trace of greenish or violet reflections.

Upper parts pale drab with a satiny sheen; underparts pale drab washed with greyish white; base of fur dusky slate throughout; whitish buff cheek markings like those of *C. asiatica,* but with a more profuse admixture of whitish hairs above snout.

*Type* (in the Kaffrarian Museum).—Adult male, original number 2500, collected 10th November 1937, 3 miles west of Nieuwoudtville, N.W. Cape Province.

*Dimensions of Type.*—H. and b., 110; hf., 13 mm.

*Skull.*—Greatest length, 23·5; basal length, 18; greatest breadth, 17·5; greatest height, 12; interorbital breadth, 8·5; palate (across posterior molars), 9; dental series (front of incisors to back of posterior molar), 10·5 mm.

## Fam. Protelidae

### *Proteles cristatus canescens* subsp. n.

Specimens from Eselfontein, Witwater, Eenriet, and Port Nolloth (Little Namaqualand); Kliphuis and Klaver (N.W. Cape Province); and from Oas and Sandfontein (South-West Africa—Gobabis Dist.).

A long-haired, uniformly dark grey race of *P. cristatus,* heavily grizzled throughout.

General colour above iron-grey, individual hairs strongly annulated; flanks similar in colour to dorsal crest, which tends to become tipped with black on the rump only; black bands on flanks relatively ill defined, owing to a profuse overlapping of long grizzled-grey hairs; buttocks faintly washed with brownish rufous; head dusky, speckled with buff; blackish region above almost bare muzzle three times as wide as in typical *cristatus* (specimens from Kaffraria). Underparts buffy, tinged with rufous; tail, individual hairs grey at base, tipped with black; end of tail heavily blackened; forefeet black above, the black extending outwardly 6 inches along the forearm; hindfeet black above, thighs mottled (not striped) with black; ears, outside black, narrowly but conspicuously edged with buff, inside whitish.

*Type* (in the Kaffrarian Museum).—Adult male, original number 1048, collected 11th December 1936 at Eselfontein (Kamiesberg), Little Namaqualand.

*Dimensions of Type.*—H. and b., 700; tl., 270; hf. 154; ear, 103 mm.

*Skull.*—Total length, 136·5; basal length, 130·5; palate, 71·5; nasals, 37; zygomatic width, 85; width of brain case, 48; greatest length of mandible, 101 mm.

In a specimen from Witwater (Kamiesberg) with worn fur and only scattered long hairs on the flanks the side stripes contrast almost as in typical *cristatus,* and the dorsal crest is tipped with black throughout its length.

In two specimens, from Port Nolloth and Eenriet, the hairs of the dorsal crest are everywhere uniform grizzled grey like the flanks.

In two newly born puppies, from Sandfontein and Klaver, the dorsal lines and tails are entirely black, all individual hairs being black from the base.

The approximate range of *P. c. canescens* appears to be the Western Cape Province and South-West Africa—to at least as far north as the Tropic of Capricorn.

Two specimens from the Kaokoveld (the extreme north-west of S.W. Africa), referred to *P. c. harrisoni* of Angola, approach typical *cristatus* in general coloration, the flanks being rich buffy, contrasting with the grizzled dorsal crest.

## Fam. Muscardinidae.

### *Gliriscus rupicola australis* subsp. n.

Two specimens ♂♀ from Eenriet; a third specimen (in alc.) since received from Port Nolloth.

A southern subspecies of *G. rupicola* with a uniformly whitish tail—below as well as above.

General coloration above a shade paler than in typical *rupicola,* this being especially marked on the forehead; under surface also paler, the ends of the hairs being more profusely white; tail paler throughout, the individual hairs, below as well as above, more uniformly tipped with white than in either of the two South-West African subspecies; hands and feet white; colour of ears and ocular markings as in typical *rupicola* and *r. montosus.*

*Type* (in the Kaffrarian Museum).—Adult female, original number 1522, collected 19th January 1937 at Eenriet, Little Namaqualand.

*Co-type.*—Adult male, original number 1320, collected 12th January 1937.

*Dimensions of Type.*—H. and b., 115; tl., 86 (105 in co-type) hf. (s.u.), 22; ear, 19 mm.

*Skull.*—Total length, 32; basal length, 24; zygomatic width, 17·5; width of brain case, 15; interorbital constriction, 5; length of palate, 9·5; upper dental series, 4; lower dental series, 3·7; mandible (excluding incisors), 15 mm.

*G. r. montosus* from Brukaros Mountain, Great Namaqualand, the darkest of the three races, with drabby feet, separates geographically this slightly larger-eared Cape form from *G. r. rupicola* of Damaraland.

Genus new to the Cape Province.

## Fam. Muridae.

### *Taterona brantsi namaquensis* subsp. n.

Three specimens ♂♂ ♀ from Goodhouse, south bank of the lower Orange River.

A desert-coloured race of *Taterona brantsi*.

*T. b. namaquensis* from the north of Little Namaqualand agrees closely in colour with *T. b. perpallida* from the Kalahari and Ngamiland, but the pale, crescentic, somewhat shadowy ocular markings are almost if not entirely absent. The uniform coloration of the head thus serves to distinguish *namaquensis* from the geographically distant *perpallida*.

General colour above pale sandy buff, slightly grizzled, below white; tail pale speckled sandy buff above, white below; in two out of three specimens (including the type) the terminal third of the tail is white above; ears sandy buff, not differing in shade from the head; hands and feet buff-white.

*Type* (in the Kaffrarian Museum).—Adult female, original number 1088, collected 23rd December 1936 at Goodhouse (Raman's Drift), Lower Orange River.

*Dimensions of Type.*—H. and b., 126; tl., 167; hf. (s.u.), 34; ear, 21 mm.

*Skull.*—Total length, 36; basal length, 28; length of palate, 15; zygomatic width, 18·5; length of nasals, 15; upper molar and premolar series, 5·5; lower molar and premolar series, 6; mandible (exclusive of incisors), 20 mm.

The range of *T. b. namaquensis* is separated from that of *T. b. perpallida* by the whole of Great Namaqualand, in which no species of *Taterona* has yet been discovered.

### *Poemys melanotis insignis* subsp. n.

Specimens from Eselfontein.

A small, silvery grey, narrowly striped form of *P. melanotis* without any trace of ocular markings, but with a dark frontal patch, almost as well defined as in *P. nigrifrons*.

General colour above pale drab grey, closely approximating in shade to that of *P. m. capensis* (typically from Wolseley, C.P.): black dorsal stripe narrow, extending as far forward as in a specimen I refer to *P. m. melanotis* from the Pirie Forest; a conspicuous dusky black frontal patch; ocular markings obsolete; underparts drabby white; ears dusky, not so dark as in typical *melanotis*; tail drab grey above and below; hands and feet white.

*Type.*—Adult female, original number 843, collected 27th November 1936 at Eselfontein, Kamiesberg.

*Dimensions of Type.*—H. and b., 70; tl., 75; hf. (s.u.), 16·5; ear, 17·5 mm.

*Skull.*—Greatest length, 20·5; basilar length, 16; zygomatic width, 10·5; width of brain case, 9·5; interorbital constriction, 3·5; length of upper molars, 3·3 mm.

This Namaqualand form of *Poemys melanotis* may prove to be restricted in range to the Kamiesberg.

### *Petromyscus barbouri* sp. n.

Specimens from Witwater, Platbakkies, Eselfontein, and Eenriet.

A small drab grey *Petromyscus*, at once distinguishable from all other members of the genus by its bicoloured tail.

General colour above grizzled drab grey (about as in *Mus musculus*); underparts white; tail markedly bicoloured, drab grey above, white below; hands and feet white; ears drab grey. Mammae 4 (ing.); no pectoral mammae.

*Type* (in the Kaffrarian Museum).—Adult male, original number 253, collected 20th October 1936 at Witwater (Kamiesberg), Little Namaqualand.

*Co-type.* Adult female, original number 146, collected 11th October 1936.

*Dimensions of Type.*—H. and b., 78; tl., 80; hf. (s.u.), 19; ear, 14 mm.

*Skull.*—Total length, 23; basal length, 17·3; zygomatic width, 11 approximately (of co-type 11); width of brain case, 11; interorbital constriction, 4; length of palate, 9·2; upper molar and premolar series, 3·5; lower molar and premolar series, 3·5; mandible (exclusive of incisors), 11·5 mm.

This rather short-tailed species of *Petromyscus*, the most southern representative of the genus, approaches the relatively long-tailed *P. shortridgei*, the largest and most northern representative, most closely in colour; but it is drabby cinereous instead of umber brown. It may further be noted that in *P. shortridgei* the two pectoral mammæ are also usually but not invariably absent, whereas they are present in all females of the *P. collinus* group collected, as well as in the only known female of *P. monticularis.*

*P. monticularis,* which occurs in association with *P. collinus bruchus* on Brukaros Mountain (Great Namaqualand), may be distinguished from all of the other species by its short ears and relatively thick tail.

Genus new to the Cape Province.

The genus *Petromyscus* and all of its previously known species and subspecies were discovered by myself in South West Africa.*

To these may now be added *Petromyscus barbouri* and *P. collinus capensis,* both from Little Namaqualand.

I am naming the above strikingly distinct new species in honour of Dr. Thomas Barbour, Director of the Museum of Comparative Zoology, Harvard University, who is so generously contributing towards and associating himself with the Cape Museums Mammal Survey of the Cape Province.

### *Petromyscus collinus capensis* subsp. n.

Two specimens ♂♂ from Goodhouse, northern Little Namaqualand.

A brownish-chestnut form of *P. collinus,* approaching the typical Damaraland subspecies in colour, but separated from it by the darker *P. collinus bruchus* of Great Namaqualand. Characterised by a markedly hairy tail, the individual bristles being twice the length of those in *collinus* and *bruchus.*

General colour above brownish chestnut; underparts white; tail pale drabby, slightly darker above and still more so terminally (above and below) owing to a thick pencilling of relatively long dusky bristles; ears dusky brown, not tinged with rufous as in *collinus* and *bruchus*; hands and feet buffy white.

*Type* (in the Kaffrarian Museum).—Original number 1223, collected 5th January 1937 at Goodhouse (Raman's Drift), lower Orange River—south bank.

*Dimensions of Type and Co-type.*—H. and b., 87 (90); tl., 99 (98); hf. (s.u.), 17 (17); ear, 16·5 (17) mm.

*Skulls.*—Total length, 26·5 (26); basal length, 20 (19); zygomatic

* *P. shortridgei,* typically from the Kaokoveld, has since been found to extend into S.-W. Angola.

width, 12 (12·5); width of brain case, 13·5 (12); interorbital constriction, 4·5; length of palate, 11·5 (10·5); upper molar and premolar series, 3·5; lower molar and premolar series, 3·5; mandible (exclusive of incisors), 13 mm.

The Orange River Valley presumably constitutes the southern limit of the range of *P. collinus* and its subspecies, the genus being represented farther south in Little Namaqualand by *P. barbouri*.

### Fam. Bathyergidae.

#### *Bathyergus janetta inselbergensis* subsp. n.

Specimens from Eselfontein, Kamiesberg.

This mountain race of *Bathyergus janetta* differs from the typical coastal subspecies in the general colour above being silvery buff instead of drab grey, and thus the seal-brown dorsal and occipital area, together with the dark forearms and thighs, contrasts much more sharply with the flanks, which have an almost frosty appearance. The tail hairs (above) are slaty black basally instead of pale brown, and buff-white terminally; the hairs on the forefeet are whiter, less soiled looking, than in typical *janetta*.

*Type* (in the Kaffrarian Museum).—Adult female, original number 977, collected 4th December 1936 at Eselfontein, Kamiesberg (altitude 4400 ft. approx.).

*Dimensions of Type*.—H. and b., 230; tl., 44; hf., 45 mm. Of a large male (without skull), h. and b., 280; tl., 52; hf., 51 mm.

*Skull*.—Total length, 50·5; basal length, 44; zygomatic width, 33; width of brain case, 19·5; interorbital constriction, 9; upper molar and premolar series, 10; lower molar and premolar series, 10·5; mandible (excluding incisors), 39·5 mm.

The discovery of *Bathyergus* in the Kamiesbergen at an altitude of between 4000 and 5000 ft. was unexpectedly interesting, previously known forms being only known to occur in low-lying coastal sand-plains.

### Fam. Muridae.

#### *Gerbillus paeba exilis* subsp. n.

Three specimens ♂♂♀ from Alexandria District (coast), Cape Province.

A remarkably pallid race of *G. paeba* with fawn-white flanks, white ocular rings and a white tail tip.

General colour above pale rufous fawn; flanks still paler, shading to white; cheeks and ring above eye white; underparts white; tail very pale fawn above, white below, tail tuft white; hands and feet white; ears pale fawn.

In the type and co-type there is no trace of dusky tips to the hairs anywhere, but in a third specimen (original No. 102X—in the Albany Museum) the dorsal region has a smoky appearance due to a slight darkening of the ends of the hairs.

*Type* (in the Albany Museum).—Adult male, original number 100X, collected 27th May 1937 at Paardevlei, Alexandria Dist. (coast), by F. and W. Pannell.

*Co-type* (in the Kaffrarian Museum, presented by the Albany Museum).—Adult female, original number 101X, collected 13th March 1934 at Sundays River Mouth, Alexandria Dist., by O. West.

*Dimensions of Type and Co-type.*—H. and b., 84 (80); tl., 108 (–); hf. (c.u.) 27 (26) ; ear, 15 (12?) mm.

*Skulls.*—Total length, 29·5 (30); basal length, 21 (23); length of palate, 12 (11·5); zygomatic width, 13·5 (–); interorbital constriction, 5 (5·5); width of brain case, 13 (13·5); length of nasals, 11·5 (12); upper molar series, 4·5; lower molar series, 4·5; mandible, 14·5 (15) mm.

This eastern subspecies of *G. paeba*, from a region far from where any other form of *Gerbillus* is known to occur, approaches most closely in colour some bright orange-rufous specimens in a series of *G. p. broomi* from Little Namaqualand, but it may at once be distinguished by its almost white flanks, and by the white on the cheeks extending in a broad ring round the eye.

Dr. J. Hewitt, Director of the Albany Museum, who has kindly given me permission to describe this gerbil, records that it was discovered amongst drift-wood just above high-water mark on the east side of the Sundays River Mouth and also on adjacent sand-hills at Paardevlei, Alexandria District.

Genus new to the Eastern Cape Province.

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# ANNALS

OF THE

# SOUTH AFRICAN MUSEUM

*VOLUME XXXII.*




*ISSUED FEBRUARY 1940. PRICE 20s.*

PRINTED FOR THE

TRUSTEES OF THE SOUTH AFRICAN MUSEUM, CAPE TOWN

BY NEILL AND CO., LTD.,

212 CAUSEWAYSIDE, EDINBURGH

# 17. *The Enteropneusta from Inyack Island, Delagoa Bay.*—By C. J. van der Horst, University of the Witwatersrand, Johannesburg.

(With 70 Text-figures.)

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The island of Inyack, in Delagoa Bay, Portuguese East Africa, is an ideal place for collecting marine animals that live burrowing in the soil in the tidal zone. The eastern side of the island is exposed to the Indian Ocean, but along its northern, western, and southern sides it faces the Bay, which is here very shallow. As the difference between high and low tides can be over 3 metres, large flats and sand-banks are exposed at low tide. In the more sheltered bays these flats have a muddy soil; in places where a coral reef extends in front of the flats the mud is mixed with coral debris, but in the more exposed parts, where either the tidal stream or the action of the waves is stronger, large banks of pure sand occur. This is a place where one can expect Enteropneusta, and they are found here in great abundance. During the last few years I have visited Inyack repeatedly and have collected a great number of Enteropneusta. Up till now I found six different species, only one of which had previously been described. Another species was recently described by my student, Mrs. Kapelus, and in the following pages the description of the other four species is presented.

## Saccoglossus inhacensis Kapelus.

The small enteropneust, *Saccoglossus inhacensis*, described by Mrs. Kapelus, occurs in countless numbers on the muddy flats west of the island. In nearly every spadeful of sandy mud one can find one or more specimens.

In a letter to "Nature" I described the characteristic burrow made by this animal in the mud; and now, after some further observations, I am able to supplement the previous remarks (fig. 1). At the place where the animal occurs most abundantly the black mud is covered by a layer, about 1 cm. in thickness, of yellow sand, and as this sand does not hold together so well as the mud, I was at first unable to detect the tube of the animal in the sand. But later I found it extending from the surface to a depth of 4 to 7 cm. The upper part of the burrow is irregularly coiled, but deeper down it takes the form of a regular spiral, consisting of up to eight turns. The direction of the main axis of the spiral is variable; in the majority it was found to be approximately vertical, but it may even be horizontal. In the dark mud this burrow is very conspicuous because it is lined by a thin layer of clear sand. This in turn is covered by a layer of slime, giving the inner surface a smooth and shiny appearance. As the sand is also cemented together by the slime the spirals are rather persistent; at least as many were found that had been vacated by the animals as inhabited ones.

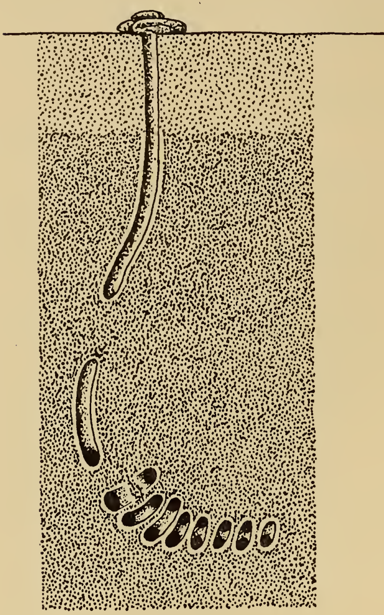


Fig. 1.—Burrow of *Saccoglossus inhacensis* Kapelus. Nat. size.

In the letter to "Nature" I stated that no indication of the presence of the animal was found on the surface during low tide. Subsequently I found that this statement was wrong. Like other enteropneusts, *Saccoglossus inhacensis* also makes heaps of coiled castings round the entrance of its burrow. But these heaps are very small, and the coils seem to be not so persistent as in *Balanoglossus.*

Only when there is no disturbance at all the heaps, which are about 1 cm. wide and 2 mm. high, will preserve their typical form and then they cover the surface in great numbers at low tide. In order to make these heaps of castings, the animals must protrude their hind-ends, where the anus is, above the surface of the sand. Nevertheless, when one finds the animals in their burrow by digging, they invariably take up a position with the proboscis and anterior end of the body in the irregularly formed upper part of the burrow, and the abdominal region is found in the spiral. Therefore the animal must be able to turn round in its burrow.

In miocene strata from different localities (Switzerland, Bavaria, Maryland, California, Mexico) fossilised internal casts in the form of spirals have been described under the name of *Xenohelix.* Several suggestions have been made about the origin of these spirals. Mansfield was of the opinion that they owe their origin to some marine plant; Heer supposes them to be the burrows of the mussel *Mactrina.* Abel, in his book "Vorzeitliche Lebensspuren," expresses the opinion that these spirals are the burrows of small crabs. Along tropical shores a small crab, *Mictyris,** may occur in countless numbers, and at the approach of danger these crabs disappear in the mud by digging a burrow in the form of a spiral. However, these burrows can be only of a very temporary nature, and as Abel wrote me later he has given up this opinion. The stratum in which these spirals are found was formed in a shallow sea with a very level shore, where mangroves grew in great abundance. It is exactly in such a place that the spirals of *Saccoglossus inhacensis* are found, and as these spirals are rather persistent, even when they are uninhabited, I venture to suggest that *Xenohelix* is the fossilised burrow of an enteropneust.

### Willeyia delagoensis n. sp.

In November 1935, during a short stay on Inyack Island, I secured a single specimen of a pure white enteropneust on the flats at the west side of the island. It proved to belong to the genus *Willeyia,* established by Punnett for an enteropneust from Zanzibar. This genus is more or less intermediate between *Glandiceps* and *Spengelia*; it agrees with *Spengelia* in having peripharyngeal cavities and with *Glandiceps* in the absence of synapticula. As Punnett's description is not as extensive and accurate as it might have been, Spengel has expressed his doubts about the validity of the genus. However, I can corroborate Punnett's observations by the study of this specimen, and this leaves me in no doubt regarding the validity of the genus *Willeyia.* In addition to some minor characters, the only specimen that was collected at Inyack differs in one important feature from *Willeyia bisulcata* Punnett, *i.e.* in the extension of the gonads into the branchial region, a character which Punnett thought might be

* *Mictyris* has not been recorded from South African shores, but the closely allied *Dotilla* is very common.—Ed.

of generic importance. It is for this reason that I am describing this specimen as belonging to a new species of the genus *Willeyia*.

### *External Features.*

In its external appearance *W. delagoensis* closely agrees with *W. bisulcata* according to Punnett's description (fig. 2). The proboscis is very elongated; in the fixed animal it has a length of 15 mm.

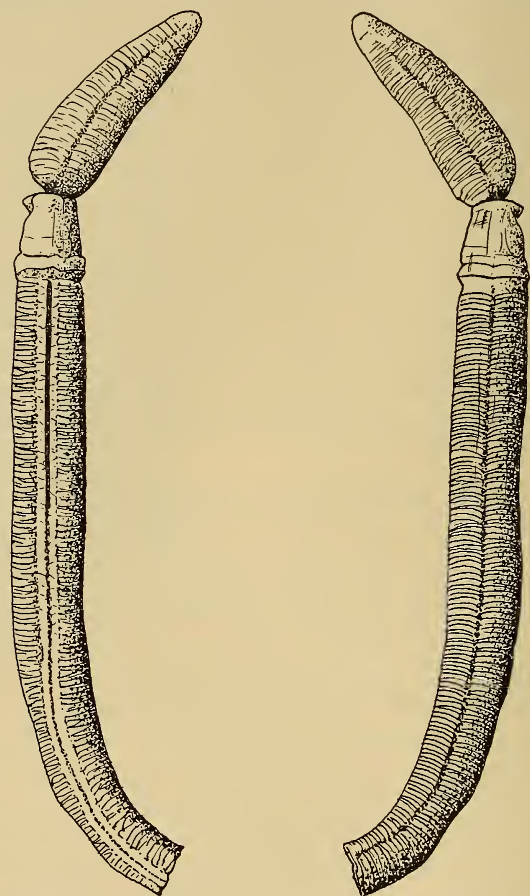


Fig. 2.—*Willeyia delagoensis* n. sp. Dorsal (left) and ventral (right) views. ×2.

and its greatest width is 5 mm.; in the living animal the proboscis was considerably longer. It also shows the longitudinal grooves along the dorsal and ventral mid-lines. The collar is about 5 mm. long and is broader behind than in front. The proboscis is flattened, but the collar and the trunk, at least as far as the latter is present, are nearly cylindrical. There is no trace of genital wings or folds, not even behind the branchial region.

It is difficult to determine the length of the branchial region owing to the fact that the minute branchial pores open into a narrow and often deep groove, which fades away gradually in the anterior part of the genital region. By counting the sections it was possible to estimate that the branchial region is about 3 cm. long. The specimen was broken off in the genital region, so that it remains uncertain whether *Willeyia* has liver saccules or not. Punnett's specimen was also incomplete.

The animal, when alive, was of a pure white colour throughout.

### *Internal Anatomy.*

*Proboscis.*—The epidermis of the proboscis consists of elongated cells. I can confirm Punnett's statement that the epidermis is almost destitute of glands, particularly as special glandular cells seem to be absent. A great number of the ordinary cells are swollen in their peripheral part, exhibiting the features of slime cells. It seems likely that all epidermal cells can secrete slime. As in *W. bisulcata*, elongated nuclei are arranged in a distinct row in the middle of the cells, and another layer of round nuclei is found in the basal part of the epidermis; the latter are evidently the nuclei of the nerve cells.

In *W. bisulcata* the circular muscle layer is about half as thick as the nerve layer; in *W. delagoensis*, however, these layers are of about the same thickness, except in the grooves where the nerve-fibre layer is better developed (fig. 3). Sensory cells could not be found in the epidermis of these grooves.

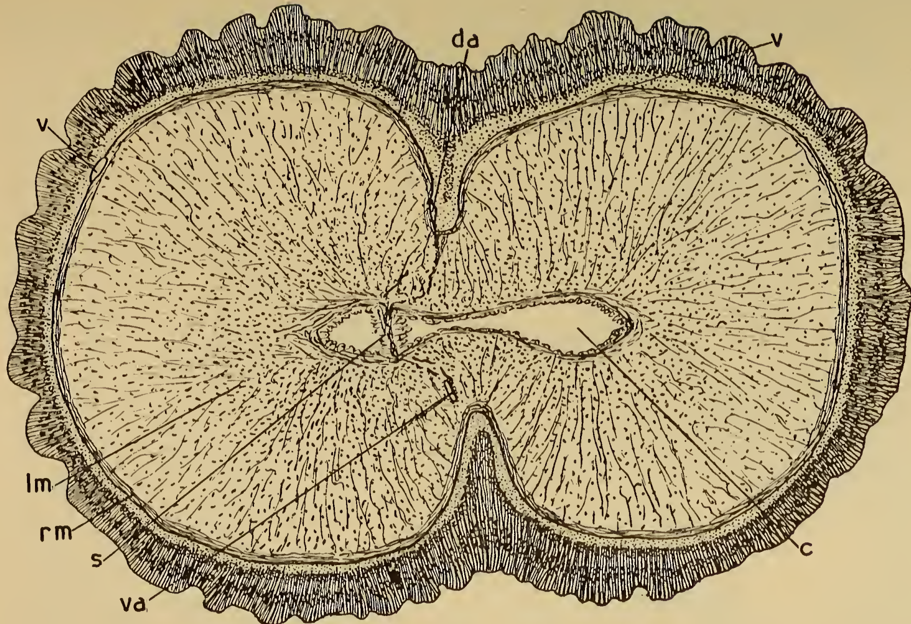
The muscle fibres are neither arranged radially nor in concentric layers; they are only more crowded in the central part of the proboscis than near the epidermis. It is well known that these longitudinal muscle fibres are attached by both ends to the basal membrane of the epidermis. Whereas the anterior end of each fibre pierces the circular muscle and attaches itself to the basal membrane independent of other fibres, one finds that in the posterior part of the proboscis the longitudinal muscle fibres collect in bundles, where they pierce the circular muscle layer and are attached to the basal membrane. In cross-section it seems therefore that the circular muscle layer is interrupted; in reality this muscle layer will have the appearance of a network. The basal membrane is produced into an inwardly directed point or crest where the longitudinal muscle fibres are attached to it (fig. 4).

The proboscis coelomic cavity extends nearly to the top of the proboscis. Over its whole length it is separated into a right and a left part by a kind of dorso-ventral septum formed of connective tissue and muscle fibres (fig. 3). Near the anterior end of the glomerulus and again just in front of it there are a few openings in this septum by means of which the right and the left coelomic cavities intercommunicate. Punnett figures the right and the left coelomic parts as of equal size in *W. bisulcata*, but in *W. delagoensis* the right part is wider than the left, though taken together the two parts form a symmetrical figure; the septum between the two has evidently shifted towards the left side (fig. 3). Owing to the fact that this septum consists of fibres only and not of a limiting membrane, this shifting does not seem to be of great importance and the difference in size of the coelomic parts may not be of specific value.

The dorso-ventral muscle fibres go by way of this septum from the dorsal to the ventral mid-line, so that they deviate somewhat from the straight course. These fibres are thicker than those of the longitudinal or circular musculature. They do not form a continuous layer as they run separately; there may be one or more fibres visible in a cross-section or none at all. At the dorsal side of the septum the fibres are arranged in two longitudinal rows. Ventrally there is usually one row, but if there are two rows these lie very close together, except in the posterior part of the proboscis, just in front of the glomerulus, where the two rows are more distant from each other and can be easily discerned at the ventral side of the septum.

From the anterior to the caudal part of the proboscis the coelomic cavity gradually increases in width. This cavity is surrounded by a distinct epithelium which, as Punnett also mentions, is considerably thickened on the septum. It is somewhat lower in the right and the left angles of the cavities and it is very low along the dorsal and ventral border, although here also it is clearly visible (fig. 3). This epithelium does not seem to be of an excretory nature, as may be the case in some other Enteropneusta.

The ventral proboscis septum, as in *Glandiceps*, reaches to the top of the stomochord but leaves the vermiform process free. Its attachment to the basal membrane of the epidermis, however, does not reach so far forward, as a result of which the free edge of the

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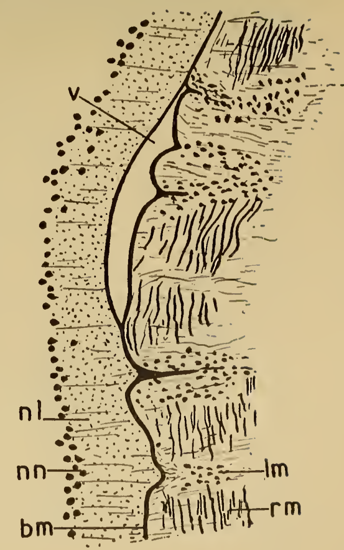


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FIGS. 3, 4.—*Willeyia delagoensis* n. sp. 3. Cross-section of proboscis in front of the central organs. ×34. 4. Part of a cross-section of the proboscis. ×215.

*bm*, basal membrane of epidermis. *c*, coelomic cavity. *da*, dorsal artery. *lm*, longitudinal musculature. *nl*, nerve-fibre layer. *nn*, nuclei of nerve cells. *rm*, ring musculature. *s*, septum. *v*, proboscis veins. *va*, ventral artery.

septum runs from the top of the stomochord to the epidermis in a ventro-caudal direction. Probably on account of this the ventral

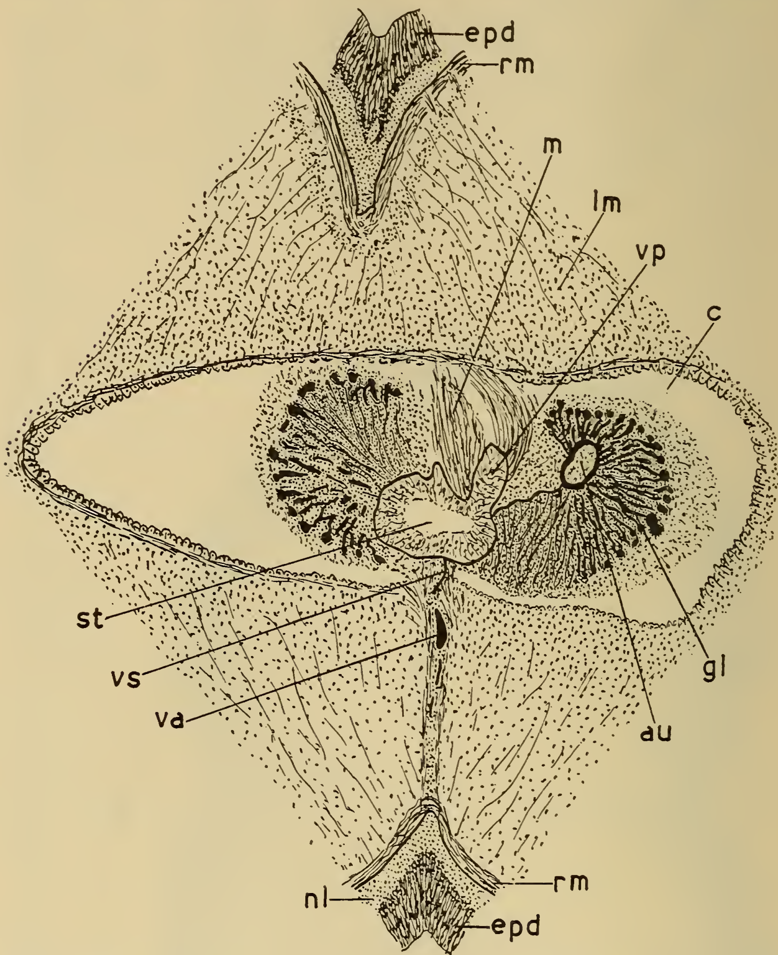



Fig. 5.—*Willeyia delagoensis* n. sp. Cross-section of anterior part of the central organs of proboscis. × 55.

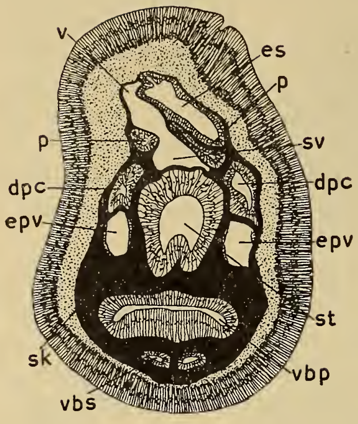
*au*, auricle of pericardium. *c*, coelomic cavity. *epd*, epidermis. *gl*, glomerulus. *lm*, longitudinal musculature. *m*, dorso-ventral muscle fibres. *nl*, nerve-fibre layer. *rm*, ring musculature. *st*, stomochord. *va*, ventral proboscis artery. *vp*, vermiform process. *vs*, ventral proboscis septum.

proboscis artery is not found in the septum; it runs from the top of the stomochord freely through the coelom and directly to the epidermis in a ventral direction (fig. 5). According to Punnett this vessel, called by him the ventral recurrent vessel of the proboscis, runs in the upper edge of the septum in *W. bisulcata*, and according to his figure the ventral septum is exceedingly long in this species, reaching to nearly the top of the proboscis. The ventral coelomic blind-pouches are separated from each other throughout their whole length by this septum; they have the form of narrow finger-like canals, the epithelium of which is higher on the dorsal than on the ventral side (fig. 8). Their caudal end is at the same level as the caudal extremity of the ventral blind-sac of the stomochord; here near their posterior end the ventral pouches are quite embedded in the skeleton (fig. 6).

The right dorsal coelomic pouch ends blindly, but the left is continuous with a median end-sac (fig. 6) which opens by a left proboscis pore to the exterior (fig. 7). The proboscis pore has the form of an elongated fissure, the caudal end of which opens into the anterior neuropore. The end-sac does not extend beyond the caudal end of the pore and is surrounded by a thick limiting membrane, which probably contains blood-vessels (fig. 7).

It is impossible for the right and the left halves of the glomerulus to fuse in front of the pericardium or the stomochord because of the presence of the dorso-ventral septum. The glomerulus reaches as far in a frontal direction as the vermiform process, and that is not far in front of the stomochord. It covers the stomochord to the same extent as the pericardium and is found at the lateral side of these structures only; it even remains at some considerable distance from the dorsal and ventral mid-line. There is a triangular mass of cells extending for a considerable length along the dorsal side of the pericardium, but this mass does not seem to be a dorsal glomerulus as no blood-vessels could be detected in it; otherwise a dorsal glomerulus seems to be present in all Spengeliidae. On the coelomic side the glomerulus is covered by a rather thick layer of cells (fig. 5).

Immediately caudal to the mass of cells mentioned above, the free dorsal wall of the pericardium is thrown into irregular folds, which continue to where the pericardium attaches itself to the basal membrane of the epidermis, and only then the pericardium assumes its usual triangular form. Anteriorly the pericardium has two auricles as in other Spengeliidae. These auricles, however, are small; they do not reach to the top of the stomochord, but they are, as usual, surrounded by the anterior portion of the glomerulus (fig. 5). Anteriorly the pericardium is quite filled with a mass of cells; the middle portion, on the other hand, is quite empty except for a layer of cells along the wall; and in the posterior part, where the

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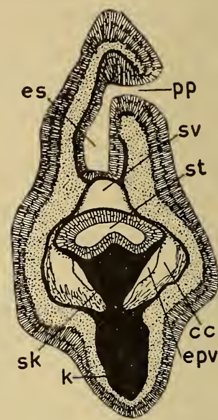


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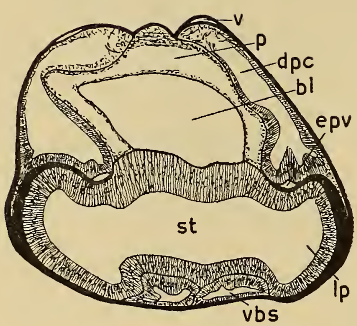


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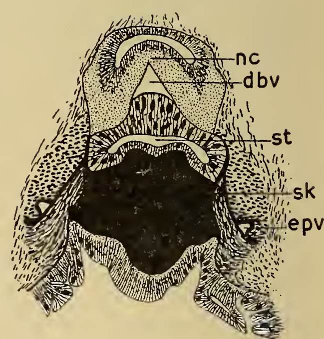


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Figs. 6–9.—*Willeyia delagoensis* n. sp. 6. Cross-section of proboscis neck. 7. Cross-section of proboscis neck caudal to that of fig. 6. 8. Cross-section of proboscis neck frontal to that of fig. 6 (epidermis being much damaged is not drawn in). 9. Dorso-median portion of a cross-section of anterior part of collar. All × 45.

*bl*, central blood sinus. *cc*, collar coelom. *dbv*, dorsal blood-vessel. *dpc*, dorso-lateral pouches of proboscis coelom. *epv*, efferent proboscis vessel. *es*, end-sac. *k*, keel of skeleton. *lp*, lateral blind-pouch of stomochord. *nc*, nerve cord. *p*, pericardium. *pp*, proboscis pore. *sk*, skeleton. *st*, stomochord. *sv*, sinus venosus. *v*, proboscis vein. *vbp*, ventral blind-pouch of stomochord. *vbs*, ventral blind-sacs of proboscis coelom.

pericardium is connected with the epidermis, strong fibres are seen connecting the two side walls.

Near the posterior end of the pericardium the two proboscis veins unite at the right-hand side of the end-sac of the proboscis pore and then communicate with the wide sinus venosus (fig. 6). This communication pushes the posterior wall of the pericardium slightly forward so that in the sections the pericardium is visible at both sides of the blood-vessel.

As in all Spengeliidae, the stomochord is prolonged into a vermiform process (fig. 5), but in *W. delagoensis* this process is extremely short, being only 80 $\mu$ in extent. In *W. bisulcata* its length is about two-thirds of the length of the rest of the stomochord.

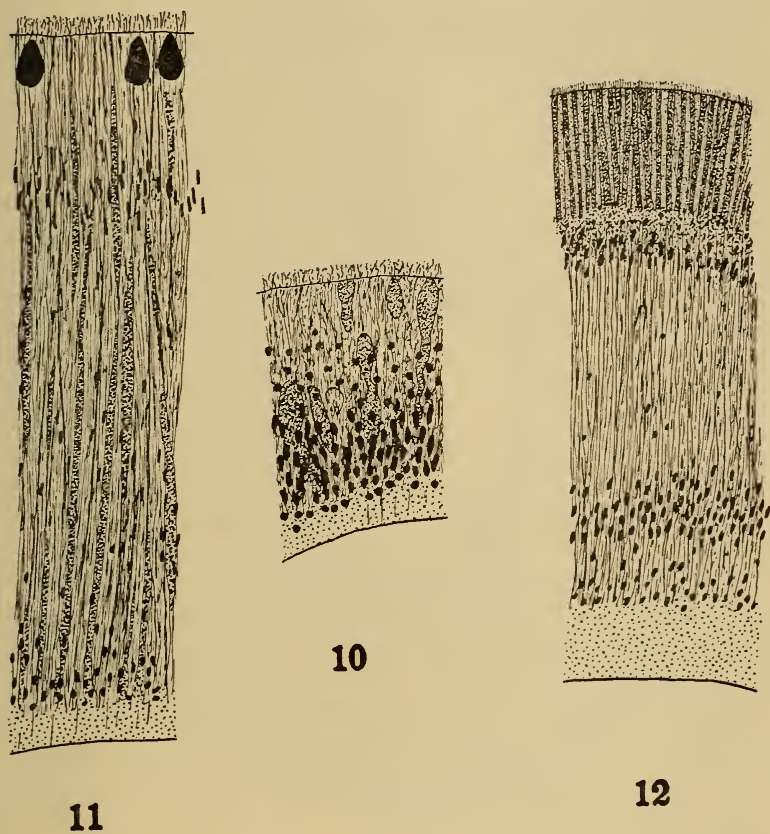
The anterior part of the stomochord is flattened; in cross-section it is oval in shape (fig. 5). Farther caudally it becomes more quadrangular. The lateral blind-pouches protrude somewhat in an anterior direction before they connect with the main middle part of the stomochord. The lumen, which is continuous throughout and begins near the top of the stomochord (fig. 5), becomes very wide and broad where the lateral blind-pouches connect with the middle part. The rather regular epithelial wall of the stomochord is very distinct in this region (fig. 8). More caudally, in the proboscis neck, the stomochord becomes first narrower but higher, then it is divided by the skeleton into a dorsal part, which is the neck of the stomochord, and a ventral blind-pouch, which is quite embedded in the skeleton (fig. 6). Except for the fact that ventrally an upgrowth of the skeleton causes an inpushing in its wall, this portion of the neck is nearly circular in cross-section (fig. 6), but farther caudally the neck becomes more depressed (figs. 7 and 9). In the neck part of the stomochord the epithelium contains numerous glandular cells, but in the body such cells could not be found.

Near the level of the middle of the lateral blind-pouches the limiting membrane at the sides of the stomochord increases in thickness, and this constitutes the most anterior end of the proboscis skeleton (fig. 8). The limiting membrane also becomes slightly thicker ventrally to the stomochord and the coelomic blind-sacs. More posteriorly these two lateral portions of the cup-shaped anterior end of the skeleton are united across the mid-line by the dorsal side of the cup, by which, as previously mentioned, the neck of the stomochord is separated from its ventral blind-pouch (fig. 6). Furthermore, the ventral wall of the cup has also thickened here considerably. At this point a dorso-median ridge of the skeleton cuts into the ventral wall of the stomochordal neck. In the dorsal part of the proboscis neck as well the limiting membranes have become very thick and the whole may be considered as one skeletal mass in which the efferent proboscis vessels, the dorso-lateral coelomic sacs, the posterior end of the pericardium, the sinus venosus, and the end-sac are embedded (fig. 6). On the other hand, chondroid tissue, otherwise so well developed in the Spengeliidae, is hardly present in *W. delagoensis.* Caudally to the ventral blind-pouch of the stomochord, where the real skeleton becomes a solid structure, the more dorsally situated limiting membranes become thinner again.

Anteriorly, *i.e.* directly behind the anterior cup, the body of the skeleton cannot be distinguished from the keel, but near the anterior end of the collar coelomic cavities the skeleton is constricted by these cavities, so that body and keel may be easily distinguished here (fig. 7). The keel has here a pair of wings dorso-laterally; it is large and broad though its dorso-ventral diameter is longer than its horizontal diameter. At the level where the proboscis neck is attached to the collar, the connection between the body and the keel of the skeleton becomes broader again (fig. 16); here the crura also become visible in the middle of the skeleton, thus the fused crura are surrounded by secondary layers of skeletal material on all sides. The skeleton now increases considerably in breadth, and the keel is much broader than high (fig. 9). The crura reach to about half the length of the collar, and their extremities are found in the ventro-lateral angles of the buccal cavity, so that they surround this cavity for about two-thirds of its circumference.

*Collar.*—The epidermal zones of the collar are quite distinct and well differentiated from each other. The epidermis of the anterior zone is rather low and it shows the usual nerve-fibre layer adjoining the basal membrane; this is followed by a layer of round nuclei of the nerve cells (fig. 10). Externally to this is a dense and thick layer of elongated nuclei, which apparently belongs to the undifferentiated epidermis cells; this layer reaches nearly to half the thickness of the epidermis. In the peripheral part of the epidermis are found some scattered, nearly round nuclei, which may belong to the glandular cells. There are many glandular cells in the epidermis and they seem to extend over the whole thickness of this layer. They are not swollen over their entire length, but the swollen part of the cells may be found at any level in the epidermis. In some patches the swollen part of most if not all glandular cells is found near the surface, in others near the base of the epidermis. In the latter case the oval nuclei of the epidermis cells are displaced and found higher up in the cells.

The greater part of the epidermis of the collar consists of a very high epithelium formed by narrow, elongated cells (fig. 11). Here




FIGS. 10–12.—*Willeyia delagoensis* n. sp. 10. Epidermis of the anterior zone of collar. 11. Epidermis of second zone of collar. 12. Epidermis of third zone of collar. All × 220.

again are found the round nuclei of the nerve cells adjoining the nerve-fibre layer. A few very elongated nuclei are found scattered over the greater part of the epidermis, but these nuclei form a distinct layer at about one-quarter of the total thickness of the epidermis from the surface. In this part of the epidermis there are many glandular cells, which are of two types. Some are as long as the epidermis is thick, their content is granular and stains with haematoxylin. The other type is found only near the surface, at least the part of the cell containing the glandular product; this product is homogeneous and stains with eosin. This zone is separated from the next one by a narrow deep groove in which the cells are similar to those just described except that they are not so elongated.

The next, rather narrow epidermal zone consists of a very characteristic epithelium (fig. 12). It is somewhat lower than that of the preceding zone, although the nerve-fibre layer is thicker. Next to the fibre layer are found the round nuclei of the nerve cells. The oval nuclei of the elongated epidermal cells are arranged in two distinct rows; one is found slightly external to the nerve-cell nuclei and the other higher up in the cells. Between these two rows of nuclei the cells are coloured uniformly blue by haematoxylin. External to the peripheral layer of nuclei and all starting at exactly the same level, all cells are filled with a fine granular substance that stains with eosin. The epidermis in this region therefore gives the impression that it is formed by two layers of cells. The cilia of this zone are very short, much shorter than in the two preceding zones. The zone is sharply delimited from the next one.

The posterior part of the collar, just in front of the circular nerve, is covered by a low epithelium containing many glandular cells and not differing from the epidermis of the trunk.

The external longitudinal musculature of the collar is well developed in the anterior half of the collar. It fills about half of the coelomic cavity between the epidermis and the gut (fig. 13). Its fibres, however, do not cross the body cavity in order to become attached to the wall of the gut at their caudal end. They remain in the same position near the epidermis throughout their whole length, and caudally they are fixed to the basal membrane of the epidermis. The external longitudinal musculature ends abruptly in about the middle of the collar (figs. 14 and 15).

According to Punnett there is no layer of circular muscles outside the longitudinal musculature. This is usually the case in Enteropneusta, as the external circular muscle of the collar is found inside the external longitudinal musculature. This external ring-muscle layer is very well developed in *Glandiceps*, but it is reduced in its extent in *Spengelia*. In *Willeyia* I find this layer very poorly developed and it is often interrupted (fig. 13). Furthermore, it is restricted to the anterior part of the collar.

The internal longitudinal musculature consists of coarser fibres than the external. It is, as in other Spengeliidae, fan-shaped.

Starting anteriorly at the dorsal side of the gut, where it is attached to the folds of the limiting membrane in which the efferent proboscis vessels run (figs. 9 and 13), its fibres gradually spread out caudally

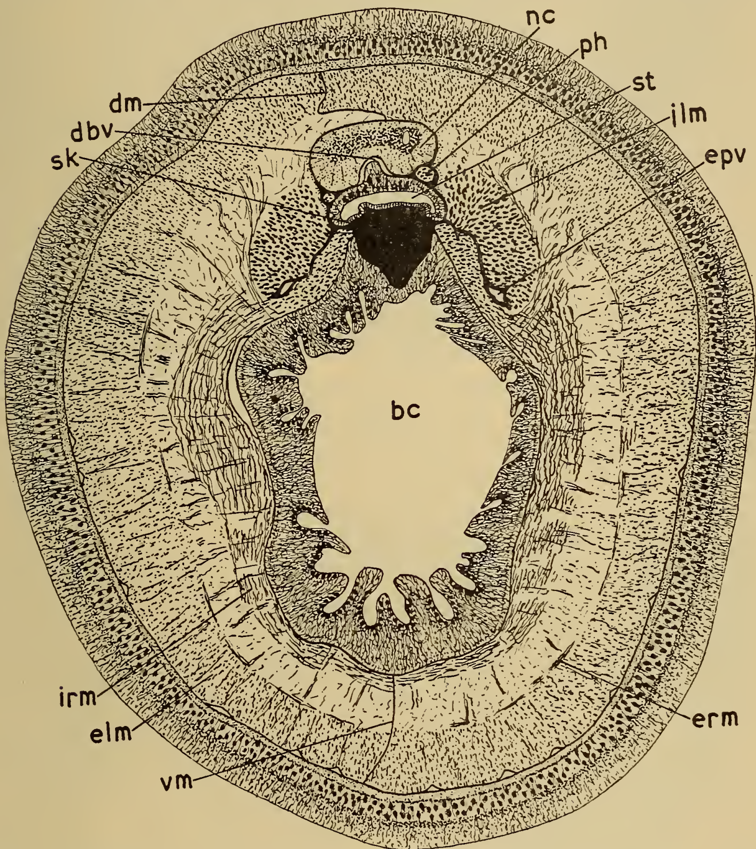



Fig. 13.—*Willeyia delagoensis* n. sp. Cross-section of anterior part of collar. × 35. *bc,* buccal cavity. *dbv,* dorsal blood-vessel. *dm,* dorsal mesentery. *elm,* external longitudinal musculature. *epv,* efferent proboscis vessel. *erm,* external ring musculature. *ilm,* internal longitudinal musculature. *irm,* internal ring musculature. *nc,* nerve cord. *ph,* top of perihaemal cavity. *sk,* skeleton. *st,* stomochord. *vm,* ventral mesentery.

towards the ventral side, reaching the ventral mid-line about in the middle of the collar near the posterior end of the external longitudinal musculature (fig. 15). In the posterior half of the collar the internal longitudinal musculature is very strong, filling nearly the whole body cavity. It is divided up in irregular bundles by strands of radial muscle fibres (fig. 15). In the anterior part of the collar there is a strong internal circular muscle layer round the buccal cavity (fig. 13).

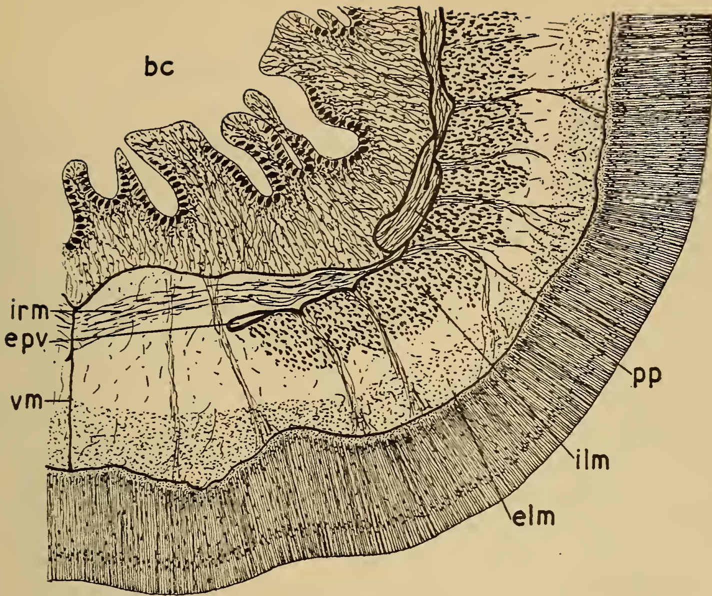
The peripharyngeal cavities with their circular muscle fibres begin in the anterior part of the collar near the dorsal side of the buccal cavity, and as these cavities extend caudally they gradually surround a greater part of the buccal cavity and replace the internal ring musculature of the collar. The peripharyngeal cavities are rather irregular, because the limiting membranes at their outside and inside often coalesce locally, thereby interrupting the ring musculature in the cavities (fig. 14). On the other hand, the ventral end of the peripharyngeal cavities is not always closed, so that there are communications between these cavities, which in reality form part of the trunk coelom and the collar coelom. The ring muscles of the peripharyngeal cavities are then directly continuous with the internal ring musculature of the collar (fig. 15). In the anterior part of the collar the ventral boundary of the peripharyngeal cavities follows, as usual, the crura of the skeleton. From there the fold of the limiting membrane, in which the efferent proboscis vessel runs, extends somewhat more ventrally. The peripharyngeal cavities are closed off ventrally up to the end of the crura, and it is only beyond the crura that these communications occur.

At the dorsal side the peripharyngeal cavities do not extend below the perihaemal cavities; they do not even reach the latter cavities. Therefore, though there are ring-muscle fibres in the perihaemal cavities, there is nevertheless an interruption in the whole ring-muscle layer round the buccal cavity.

At their anterior end the perihaemal cavities diverge, so that here only the dorsal blood-vessel separates the collar nerve cord from the stomochord (fig. 13). The perihaemal cavities are also rather short, as they do not reach the anterior end of the collar (fig. 16). The septum between the right and the left perihaemal cavities is entire throughout their whole length.

The dorsal and ventral mesenteries stretch uninterruptedly throughout the whole length of the collar. In this species the ventral mesentery reaches the anterior end of the collar, whereas, according to Punnett, it is lacking in *W. bisulcata*.

At the front end of the collar nerve cord there is a deep anterior epidermal depression (the "vordere Vorhöhle" of Spengel). In *Spengelia alba* and *Glandiceps hacksi* there exists besides this anterior depression another inpouching of the epidermis just dorsal to the depression (" Epidermisgrube " of Spengel). Willey interpreted the

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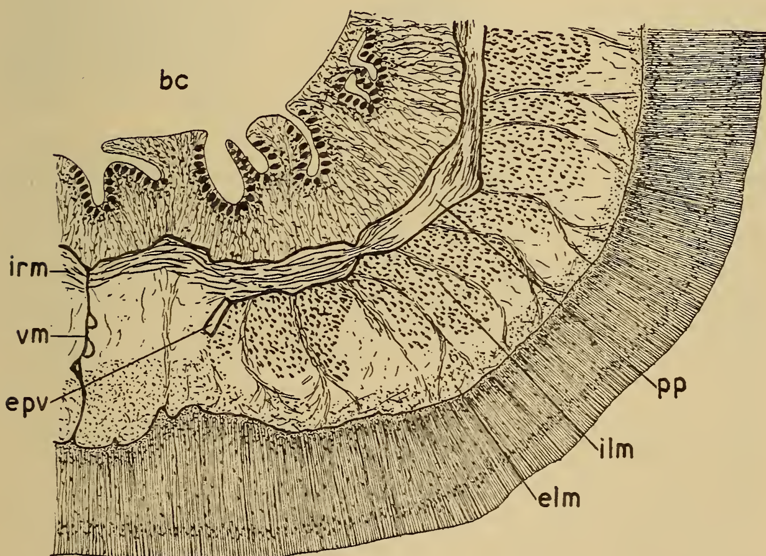



**15**

FIGS. 14, 15.—*Willeyia delagoensis* n. sp. 14. Ventro-lateral part of a cross-section of the collar. 15. The same, a few sections behind that shown in fig. 14. Both × 52.

*bc*, buccal cavity. *elm*, external longitudinal musculature. *epv*, efferent proboscis vessel. *ilm*, internal longitudinal musculature. *irm*, internal ring musculature. *pp*, peripharyngeal cavity. *vm*, ventral mesentery.

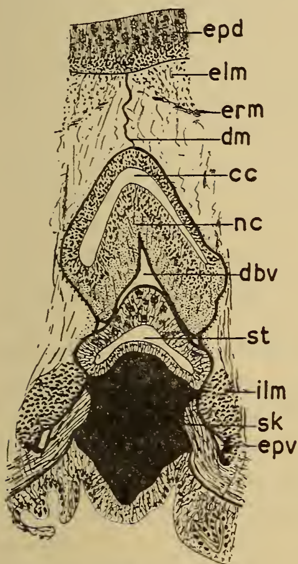
depression and the pouch as the same structure, which he called anterior neuropore. Spengel has pointed out that they are different structures, but he was of the opinion that the depression could not be called anterior neuropore, because its wall has an epidermal structure. However, it must be noted that the dorsal wall of the collar cord itself, if a central canal is present, may have an epidermal character, and as epidermis and collar cord are continuous, it is often very difficult to determine where the one stops and the other begins. Therefore I think it best to call the opening of the depression the neuropore; in a general way it corresponds with the neuropore of vertebrates. The depression itself is then the central canal that is present in the anterior part of the collar only. Thus, in addition to the neuropore, there may be an epidermal pouch dorsal to it, or the neuropore may be closed and the pouch present, or the pouch may be absent as in most Enteropneusta.

In his fig. 10 on plate xli Punnett draws the neuropore only, but in his fig. 15 on plate xlii the infolding of the epidermis is partially separated from the nerve cord and lying at its dorsal side. From this figure and fig. 16 one gets the impression that both pouch and neuropore are present in *W. bisulcata*, that the two are not completely separated from each other, and that the pouch is the deeper of the two.

However this may be, in *W. delagoensis* there is no pouch dorsal to the collar cord, but as a canal penetrates from the anterior end deep into the collar cord there is an open anterior neuropore (figs. 9, 13, and 16). A similar canal penetrating into the collar cord at its posterior end is hardly present; one may therefore conclude that the posterior neuropore is closed. The nerve cord shows only a few medullary cavities; in *W. bisulcata* it is quite solid. Punnett mentions a well-marked ridge projecting up towards the dorsal mesentery in the hinder portion of the nerve cord in *W. bisulcata.* No trace of such a ridge could be found in *W. delagoensis.* Punnett's statement that there are oesophageal nerves connecting the cord with the epithelium of the buccal cavity, called by him oesophagus, seems doubtful to me, as nothing resembling these nerves could be found either in *W. delagoensis* or any other enteropneust.

The collar canals fuse near their anterior ends with the first branchial sac, which here is already reduced to the size of a canal. Therefore what seems to be the collar canal is partly branchial pore, the inner wall of this canal being formed by the epithelium of the branchial sac (fig. 17). The dorsal or outer wall of the canal, which is slightly thinner than the side walls, shows a deep, inwardly directed fold.

The two lateral walls are very thick, and as in *Glandiceps talaboti* and a few other Enteropneusta the cells are so numerous and narrow that their nuclei, instead of being arranged in a single layer in the middle of the cells, form a dense mass occupying nearly the whole thickness of the epithelium (fig. 17).

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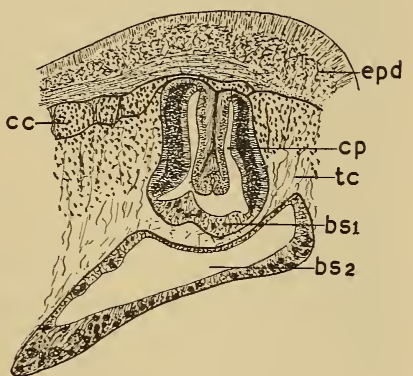



**17**

FIGS. 16, 17.—*Willeyia delagoensis* n. sp. 16. Dorso-median portion of a cross-section of collar slightly in front of that shown in fig. 9. 17. Cross-section of the collar canal. Both × 45.

*bs*1, wall of first branchial sac. *bs*2, second branchial sac. *cc* (fig. 16), central canal of collar nerve cord. *cc* (fig. 17), collar coelom. *cp*, collar canal. *dbv*, dorsal blood-vessel. *dm*, dorsal mesentery. *elm*, external longitudinal musculature. *epd*, epidermis. *epv*, efferent proboscis vessel. *erm*, external ring musculature. *ilm*, internal longitudinal musculature. *nc*, collar nerve cord. *sk*, skeleton. *st*, stomochord. *tc*, trunk coelom.

The inner surface of the buccal epithelium is very irregular owing to the presence of numerous small folds penetrating into this epithelium (figs. 13, 14, and 15). There are numerous small glandular cells, which occur only in these folds and are absent from the free surface. They secrete a slimy substance in the form of long threads. The threads of the separate cells coalesce into thicker strands, which emerge from the folds into the buccal cavity. The whole is reminiscent of a byssus gland of a Lamellibranchiate.

*Trunk.*—The first few branchial sacs are situated far in front of their external apertures, so that these sacs are drawn out into long canals leading to the pores (fig. 17). The total number of gills is 144 on each side of the body; Punnett, unfortunately, does not give the number of gills in *W. bisulcata.* The latter species is characterised by the very short branchial bars, so that the branchial part of the pharynx is much smaller in the cross-section than the digestive part. Although the tongues are also short in *W. delagoensis,* the two parts of the pharynx are of about equal size, the branchial part being even a little larger than the digestive part. There is no indication even of parabranchial ridges separating the two parts of the pharynx.

According to Punnett the first three gill pouches of *W. bisulcata* are dorsally confluent, forming a chamber with a single external pore into which opens the collar pore. A similar fusion of a few of the anterior gill pouches is known in some other Enteropneusta. In *W. delagoensis,* however, the anterior gill pouches have separate pores, though the first and second pores touch each other. These pores open into a very deep and narrow sublateral groove. In the middle portion of the branchial region the groove becomes shallower (fig. 18), but in the posterior part it is very deep again (fig. 19). This accounts for one's inability to see the small branchial pores when studying the external features of the animal.

The absence of synapticula has been already mentioned as a character of the genus *Willeyia.*

The tongues are short and very thick, so that they fill up nearly the whole of the branchial sacs (fig. 18). This is due to the fact that the ciliary epithelium covering the anterior and posterior surfaces of the tongues and septa is very high. It has the same character as the epithelium of the collar canals, consisting of very high and narrow cells, the nuclei of which fill up nearly the whole thickness of the epithelium instead of forming a single row in the middle. In *Glandiceps talaboti* the collar canals have a similar epithelium, but the gills have the low ciliated epithelium as in most Enteropneusta. On the other hand, *Harrimania kupfferi* and a few other species belonging to the Harrimaniidae have high epithelium like *W. delagoensis* both in the collar canals and the gills. The nature of this epithelium in *W. bisulcata* is not mentioned by Punnett. The back of the septa, facing the pharyngeal lumen, is covered by a thin epithelium, while that on the back of the tongues is higher.

Following the last gill there are two more rudimentary gills, each consisting of a small sac and tongue only but having no opening to the exterior (fig. 19).

The digestive part of the pharynx is covered by a very high epithelium, the inner surface of which shows many irregular folds (fig. 18). In the anterior part of the oesophagus the epithelium is much lower and without folds (fig. 19).

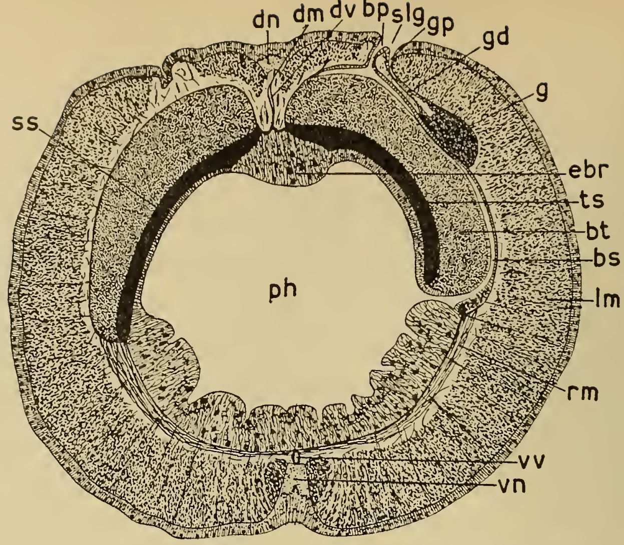
The longitudinal musculature of the branchial region as well as that of the genital region, as far as this could be studied in this specimen, is very well developed. It fills nearly the whole of the body cavity, leaving only a narrow space around the intestine. There is no special thickening of this musculature near the ventral mid-line; it was only found that the fibres may be more crowded there (fig. 18). An internal ring muscle around the ventral pharynx is well developed. The ventral nerve cord projects very far inwards, a fact which has also been observed by Punnett.

According to Punnett the branchial region of *W. bisulcata* is probably devoid of gonads, or if gonads occur here then they are found only in the most posterior portion. In this respect *W. delagoensis* shows a marked difference from *W. bisulcata.* In the former species the first gonopore is found near the 34th branchial pore, which means that the row of gonads starts at about a quarter of the total length of the branchial region away from the collar. Punnett's specimen of *W. bisulcata* was a male; the only specimen of *W. delagoensis* available is a female, but as the extent of the gonads is not known to show sexual dimorphism in any other enteropneust it seems most unlikely that such a difference should occur here.

The first gonads are small and have a well-pronounced gonoduct, opening in the sublateral groove at the ventral side of the branchial pores (fig. 18). Caudally they increase in size, thus gradually enveloping the intestine as they extend towards the ventral side (fig. 19). The specimen was broken off in the anterior part of the genital region, and, as yet, the gonads had not increased sufficiently in size to cause the body wall to protrude in the form of genital folds. As in *W. bisulcata*, there are no median gonads, although the gonads project forward around the posterior gill slit so as to appear on its medial side (fig. 19).

### *Diagnosis of* Willeyia delagoensis *n. sp.*

In the fixed state the proboscis is 15 mm. long and its greatest width is 5 mm., the collar is 5 mm. long and broader behind than in front, the branchial region is about 3 cm. long (the only specimen collected is broken off near the frontal end of the genital region).

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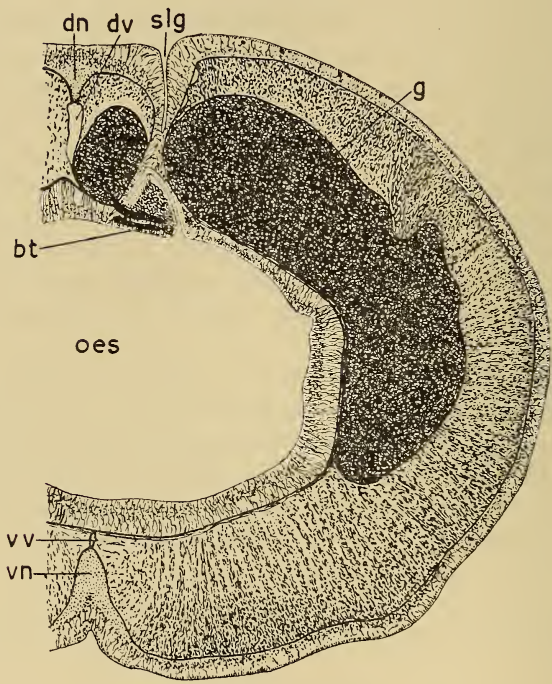


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FIGS. 18, 19.—*Willeyia delagoensis* n. sp. 18. Cross-section of the branchial region, composed of several sections, in order to show a tongue at one side and a septum at the other; in reality two tongues are opposite one another. The section is not through the middle of the tongue, showing the tongue coelom, but through the anterior or posterior end of the tongue and the septum in order to show the thick layer of crowded nuclei. ×20. 19. Cross-section of the posterior end of the branchial region. ×34.

*bp*, branchial pore. *bs*, branchial sac. *bt*, tongue. *dm*, dorsal mesentery. *dn*, dorsal nerve cord. *dv*, dorsal blood-vessel. *ebr*, epibranchial ridge. *g*, gonad. *gd*, gonoduct. *gp*, genital pore. *lm*, longitudinal musculature. *oes*, oesophagus. *ph*, pharynx. *rm*, ring musculature. *slg*, sublateral groove. *ss*, septal skeletal bar. *ts*, tongue skeletal bar. *vn*, ventral nerve cord. *vv*, ventral blood-vessel.

The proboscis is flattened, with a distinct groove in dorsal and ventral mid-lines. The collar and the branchial region are cylindrical, no trace of genital wings. The living animal is of a pure white colour.

*Proboscis.*—No special glandular cells in the epidermis of the proboscis. Circular muscle layer of the proboscis about as thick as the nerve-fibre layer; longitudinal muscle fibres do not show any special arrangement. The proboscis coelomic cavity extends nearly to the top of the proboscis and is separated into right and left parts of unequal size by a dorso-ventral septum formed of connective tissue and muscle fibres. Ventral proboscis septum does not extend farther forward than the top of the stomochord. Ventral proboscis artery free from ventral septum. Ventral coelomic blind-sacs separated from each other throughout their whole length. Left dorsal coelomic sac communicates with a median end-sac; proboscis pore on the left side. Right and left half of the glomerulus not connected in front of the pericardium or stomochord nor at their dorsal or ventral sides; frontal end of glomerulus at both sides surrounding the auricles of the pericardium. No dorsal glomerulus. Pericardium with two short auricles. Vermiform process of stomochord very short. Stomochord with wide lumen, extending to near the top, very wide where the lateral pouches connect with central part. Hardly any chondroid tissue, but skeleton very well developed, with deep anterior cup; just behind the cup the body of the skeleton is nearly separated from the keel by the collar coelomic cavities, farther caudally the skeleton becomes broader, and keel and body are indistinguishable. Crura reach to about half the length of the collar and surround the buccal cavity for about two-thirds of its circumference.

*Collar.*—First zone of collar epidermis low, second zone with very thick epithelium and small superficial glandular cells, third zone with thick epithelium and a distinct superficial layer of glands, fourth zone low like trunk epithelium. External longitudinal musculature in anterior half of collar only, attached to the epidermis at both ends. Thin external circular muscle layer, internal circular muscle layer well developed ventrally to the peripharyngeal cavities; these cavities do not reach the perihaemal cavities, the latter with a layer of circular muscle fibres. The perihaemal cavities quite separated from each other, their anterior ends diverge and do not reach the anterior end of the collar. Dorsal and ventral mesenteries complete. Central canal in anterior end of collar cord only; in the rest a few medullary cavities. No epidermal pouch dorsal to the anterior neuropore. No dorsal ridge on the nerve cord. Collar canals with thick epithelium that is almost entirely filled by the crowded nuclei.

*Trunk.*—Number of gills 144. Branchial part of the pharynx about equal in size to digestive part. No parabranchial ridges. The first gills open to the exterior by separate pores, though the first and second pores touch each other. Sublateral groove narrow and deep in anterior and posterior part of branchial region, shallower in middle portion. No synapticula. Ciliated epithelium of tongues and septa very high, with thick and dense layer of nuclei. Epithelium of digestive part of the pharynx very high, much higher than that of anterior portion of oesophagus. Row of gonads begins at one-quarter the length of the branchial region. No median gonads.

## Glossobalanus alatus n. sp.

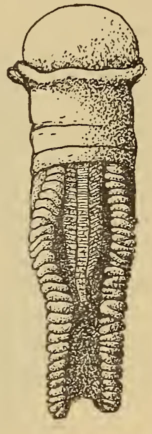
### *External Features.*

In the material collected at Inyack in July 1934 was found a single specimen of a *Glossobalanus*, broken off near the hind end of the genital region (fig. 22). Two other specimens were found in November 1935, one of which was broken off shortly behind the liver region (fig. 20) and the other in the genital region (fig. 21). The specimens 1 and 3 were cut into serial sections.

On account of its rather broad genital pleura it might be thought to be a species of *Balanoglossus*, but its internal anatomy clearly shows it to be a *Glossobalanus*. *Gl. marginatus* seems to have even broader genital wings as can be seen from Meek's figures, but otherwise the genital pleura are not very pronounced and set off from the body in the species of *Glossobalanus*. In *Gl. mortenseni* and *Gl. ruficollis* the pleura are absent altogether.

These genital wings are well set off from the body itself (fig. 22); they start shortly behind the collar and reach their maximum width near the end of the branchial region (figs. 36 and 37). In the genital region they show hardly any decrease in size and they end well in front of the liver region, so that, as in some species of *Balanoglossus*, a transitional region is formed between the genital and hepatic regions. In most species of *Glossobalanus* the branchial region is short compared with that of *Balanoglossus*. In *Gl. alatus* it is extremely short, measuring only 3·3 mm. of a total length of about 28 mm. for the whole branchio-genital region, or 34·5 mm. for the distance between the collar and the liver region (fig. 20). This is relatively and also absolutely shorter than in any other species of

*Glossobalanus*, with the exception of *Gl. ruficollis*, in which much larger animal the branchial region measures about 8 mm. in a full-



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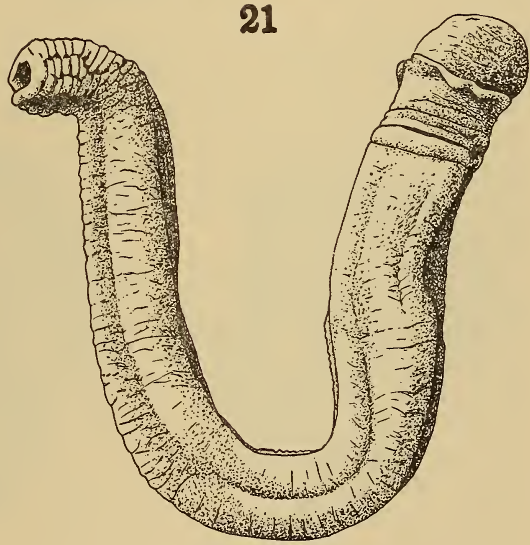

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22

Figs. 20–22.—*Glossobalanus alatus* n. sp. 20. Dorsal view, ×3. 21. Dorsal view, ×5. 22. Lateral view, ×6.

grown specimen; the specimens of *Glossobalanus alatus* are full grown also, as is shown by the well-developed gonads. Moreover, Spengel has shown that during growth the branchial region becomes relatively shorter in comparison with the genital region, but even in the largest specimens of *Gl. minutus* Spengel found the branchial region to have a length of one-fifth of the whole branchio-genital region; here in *Gl. alatus* it is only one-tenth.

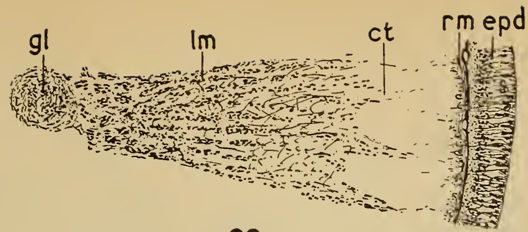
The epithelial ridges of the trunk are not so pronounced as in other species, e.g. *Gl. marginatus*. The proboscis is 2 mm. long and 3 mm. broad; the collar is 3 mm. long by a greatest width of 3·8 mm. The total length of the genital pleura is 28 mm. and of the transitional region 6·5 mm. The liver region is very short, 3·7 mm. only, and well delimited both at the anterior and posterior ends. Only 14 liver saccules could be seen from the outside, and they are all subequal in size. Over the whole length of the trunk, as far as could be seen from the specimens, a regular row of small depressions is clearly visible at both sides of the ventral nerve cord.

### *Internal Anatomy.*

*Proboscis.*—The epidermis of the proboscis is of uniform thickness, no longitudinal striae, as shown in *Gl. mortenseni*, being visible either on the surface or in cross-sections. The nuclei are scattered in the basal half of the epidermis outside the nerve-fibre layer; a few nuclei may be found in the peripheral part (fig. 23). Many small glandular cells occur in the peripheral part of the epidermis between the ordinary epithelial cells.

A thin circular muscle layer, about half as thick as the nerve-fibre layer, is found underneath the basal membrane of the epidermis. Though no membrane could be detected along the inner side of the circular musculature as in *Gl. crozieri*, there are in this place many cells which, however, do not form a well-defined epithelium. In *Gl. mortenseni* both the membrane and the cells between the circular and the longitudinal musculature are absent. The longitudinal muscle fibres are accumulated in the central part round the proboscis cavity; in the peripheral part a delicate network of connective tissue is found with only a few isolated muscle fibres. The longitudinal muscle fibres show a tendency to form bundles, and these bundles again are more or less radially arranged, especially in the caudal part of the proboscis near the central organs (fig. 23). A dorso-ventral muscle plate, found in other species, is absent in *Gl. alatus*.

The central proboscis cavity is small and is confined only to the posterior part of the proboscis round the central organs. It is also

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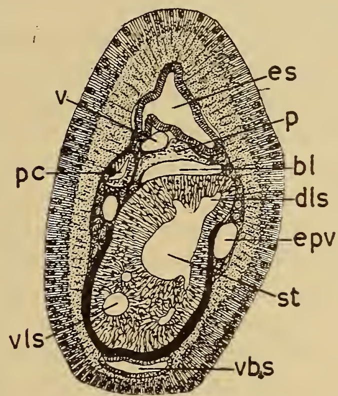


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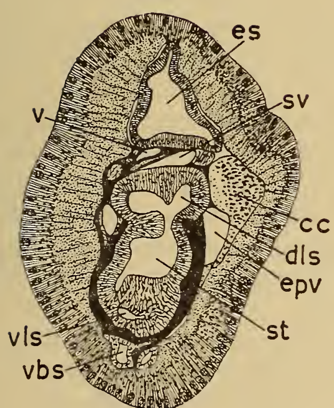
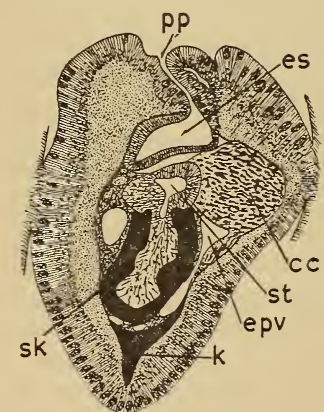



**25** **26**

FIGS. 23–26.—*Glossobalanus alatus* n. sp. 23. Dorso-median segment of a cross-section of proboscis. 24. Cross-section of proboscis neck. 25. The same, a few sections caudal to that of fig. 24. 26. Cross-section of proboscis neck where it fuses with the collar. All × 52.

*bl*, central blood space. *cc*, collar coelom. *ct*, connective tissue. *dls*, dorso-lateral blind-pouch of stomochord. *epd*, epidermis. *epv*, efferent proboscis vessel. *es*, end-sac. *gl*, anterior extremity of glomerulus. *k*, keel of skeleton. *lm*, longitudinal musculature. *p*, posterior end of pericardium. *pc*, posterior end of right dorso-lateral proboscis coelom. *pp*, proboscis pore. *rm*, ring musculature. *sk*, skeleton. *st* (figs. 24, 25), main lumen of stomochord. *st* (fig. 26), neck of stomochord. *sv*, sinus venosus. *v*, proboscis vein. *vbs*, ventral proboscis blind-sac. *vls*, ventro-lateral blind-pouch of stomochord.

very narrow, at the dorsal side it is even quite suppressed, the glomerulus and the pericardium being here in direct contact with the muscular and connective tissues surrounding the cavity (figs. 23 and 27). The central cavity is therefore crescent-shaped in cross-section.

The ventral proboscis septum is very short. It connects with the basal membrane of the epidermis only at the level of the lateral blind-pouches of the stomochord; its attachment to the stomochord extends slightly more frontally. The ventral proboscis artery runs along its anterior edge (figs. 28, 29, and 30). The ventral coelomic blind-sacs of specimen 1 are very small, being found in only 7 sections each 10 $\mu$ thick. When they have disappeared in the cross-sections one finds in the same position between the stomochord and the epidermis a group of cells without a lumen. These cells are continuous with the wall of the blind-pouches. A few sections more caudally, at the anterior end of the skeleton, there appears a median lumen in this group of cells that becomes rather wide and can be considered as a reappearance of the ventral blind-sacs (fig. 24). A few sections farther on, this lumen is divided into two parts by the keel of the skeleton (fig. 25), and when the keel becomes larger this continuation of the ventral blind-sacs ends (fig. 26). In specimen 3, however, an interruption of the ventral coelomic blind-sacs does not occur; after fusing with each other, they continue backwards between the body and the keel of the skeleton and disappear at the level where the keel increases in size.

The right dorsal coelomic sac ends blindly as usual, only the left being in communication with the rather irregular, triangular, median end-sac. The proboscis pore is also median (figs. 24, 25, and 26). After the two proboscis veins have fused with each other, they run along the right-hand side of the end-sac and unite with the sinus venosus along the caudal end of the pericardium (figs. 24 and 25). The sinus venosus exhibits no particular features.

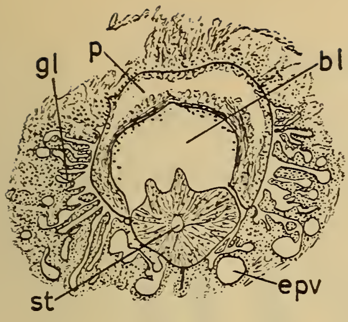
The anterior end of the stomochord is, except for some protrusions into the central blood space, nearly cylindrical at first (fig. 27); then the dorsal side becomes flatter, so that the stomochord is here broader than high (figs. 28, 29, and 30). The lumen begins as a small cavity near the top and is continuous throughout; in specimen 3 it is a straight canal, but in specimen 1 it is often twisted, so that it may be cut three times in one section. Two ventro-lateral blind-pouches of the lumen occur in the ventral dilation of the stomochord (fig. 24). In specimen 1 each of these blind-pouches has a separate narrow connection with the main lumen that has here increased considerably in size; they are also connected with each other by an equally narrow canal (fig. 25). As in specimen 3, these narrow canals are interrupted, the pouches are here not connected with each other nor with the main lumen. Besides the ventro-lateral blind-pouches, the stomochord of specimen 1 has also dorso-lateral blind-pouches, which otherwise are found only in some species of *Balanoglossus* (fig. 24). They have a common communication with the central lumen (fig. 25). Caudal to the level of fig. 25 the lumen in the dorsal part of the stomochord disappears, leaving only the main central lumen in the body. The tissue of this dorsal part remains, however, and is continuous with the neck of the stomochord. A new lumen appears here which is connected with the main lumen of the body by a narrow canal (fig. 26). The dorso-lateral blind-sacs are altogether absent in specimen 3. There are hardly any glandular cells in the stomochord except near its opening into the buccal cavity.

The pericardium reaches as far anteriorly as the stomochord in specimen 1; in specimen 3 the stomochord extends in front of the pericardium. In the anterior part of the pericardium there is a thick layer of muscle fibres along its ventral wall (fig. 27), but even before the pericardium has become attached to the epidermis these fibres have disappeared (fig. 29). The pericardium of specimen 1 shows a remarkable peculiarity that has never before been recorded in any other enteropneust. Always in Enteropneusta the pericardium is a completely closed vesicle, and no conclusion can be drawn as yet as to whether it originates from the coelom or not. It is therefore of interest that the pericardium of this specimen communicates with the proboscis coelom. In its anterior part the pericardium is closed off completely from the coelom, and the limiting membrane between the two is uninterrupted (fig. 27). But where the pericardium wall begins to extend towards the dorsal side in order to attach itself to the basal membrane of the epidermis, there appears a large opening in the dorsal wall (fig. 28), which opening extends along the right wall of the pericardium when the latter is in contact with the epidermis (fig. 29). Further caudally the pericardium again is completely closed off from the proboscis coelom (fig. 30). Through this opening the connective tissue and even the longitudinal muscle fibres of the proboscis coelom enter the pericardium. Such an opening has never been described in any other enteropneust before; it may be quite accidental in this specimen, but it is certainly not an artefact.

The glomerulus covers and surrounds the anterior ends of both the pericardium and the stomochord. The glomerulus soon becomes smaller and then disappears at the dorso-median side (fig. 27). At this point it reaches nearly to the mid-ventral line, but as the stomochord is small and the pericardium extends far ventrally, the greater part of the glomerulus covers the sides of the pericardium (figs. 27 and 28).

The anterior end of the skeleton is U-shaped in cross-section and surrounds the ventral dilation of the stomochord (fig. 24). It becomes thicker when this dilation gets smaller (figs. 25 and 26), until it becomes more of a solid mass (fig. 31). But also in this region it seems to be composed of two symmetrical halves due to the presence of a dorso-median groove and a deep narrow fissure extending from this groove deep into the body of the skeleton. In specimen 1 it is only in a few sections, near the posterior end of the keel, that the body appears as a real unit. The keel begins shortly behind the anterior end of the skeleton (fig. 25); it is small at first but then suddenly increases in size and it extends over nearly the whole length of the body; caudally it ends rather abruptly. A very characteristic feature is the separation of the keel from the primary body of the skeleton nearly throughout its whole length. Only with the secondary body, formed by the fusion of the crura, is the keel firmly united. Also, extensions from the collar coelom and side branches from the efferent proboscis vessels penetrate in between the body and the keel (fig. 26). Coelomic tissue also invades the sides of the body itself, thus giving it the appearance of chondroid tissue (fig. 31), which otherwise is only poorly developed. In specimen 1 the secondary body, formed by the union of the crura, begins immediately behind the posterior end of the keel, but in the older specimen 3 the secondary body is much longer and the keel extends along it over a considerable distance. The free crura are short and thick, and extend straight in ventro-lateral direction from the body. They surround the buccal cavity for about half its circumference.

*Collar.*—The five epidermal zones of the collar are well demarcated (fig. 32). The first, rather broad, zone is well supplied with large vacuoles. The nuclei are found just outside the nerve-fibre layer, below the vacuoles, but as many vacuoles reach as far down as the nerve-fibre layer, the nuclear layer is rather irregular. A few scattered nuclei may be seen in the more peripheral part of the epidermis. There are small, short glandular cells filled with a granular substance near the surface, and some narrow elongated glandular cells extending deeper down in the epidermis, the content of which is darkly stained and homogeneous.

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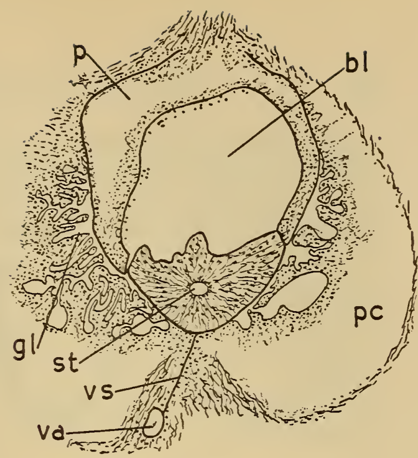


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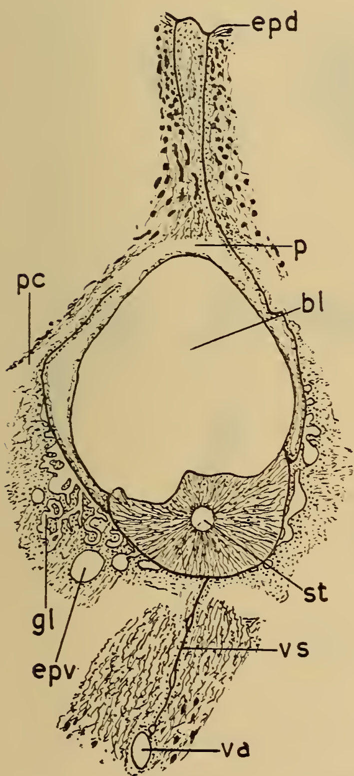


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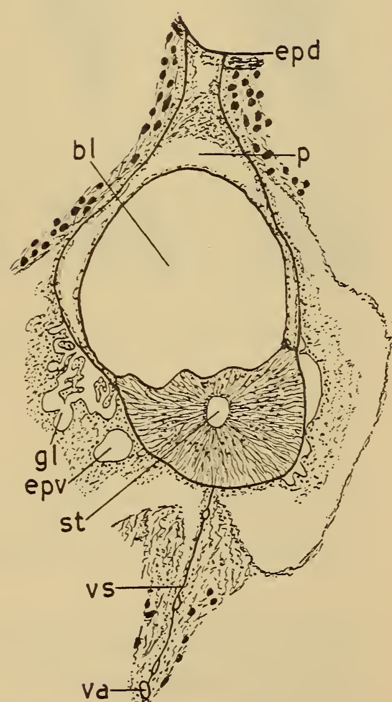



30

FIGS. 27–30.—*Glossobalanus alatus* n. sp. 27. Cross-section through anterior part of proboscis organs. 28. The same, caudal to that of fig. 27. 29. The same, caudal to that of fig. 28. 30. The same, caudal to that of fig. 29. All × 100.

*bl,* central blood space. *epd,* basal membrane of epidermis. *epv,* efferent proboscis vessel. *gl,* glomerulus. *p,* pericardium. *pc,* proboscis coelom. *st,* stomochord. *va,* ventral proboscis artery. *vs,* ventral proboscis septum.

The second zone is narrower than the first, but the epithelium is about twice the thickness of that of the first zone. It consists of very elongated, non-vacuolated cells, the oval nuclei of which are situated in a row about in the middle of the cells. A layer of

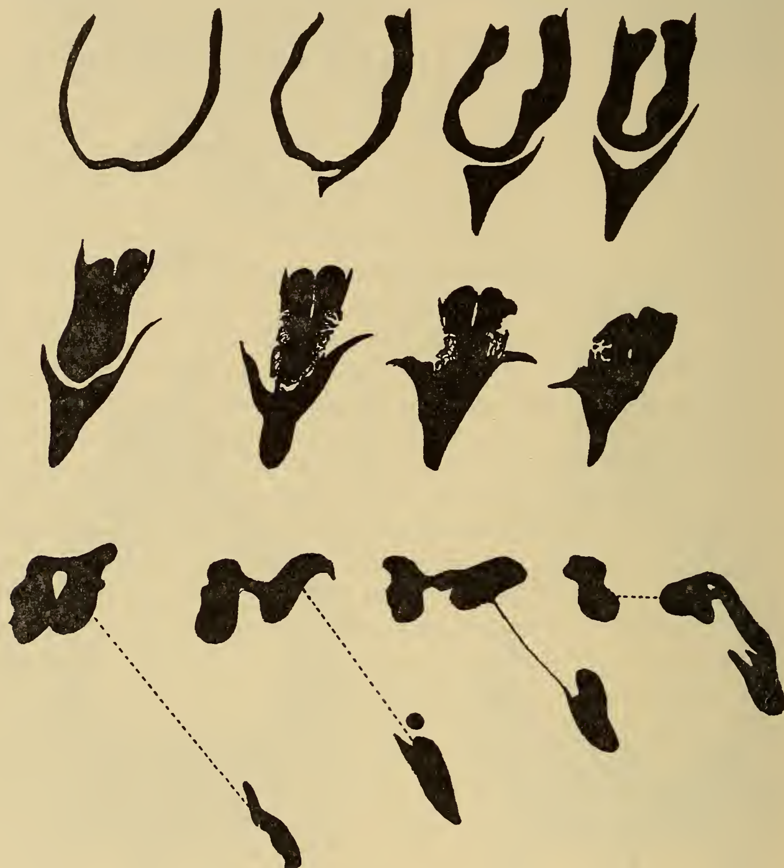


Fig. 31.—*Glossobalanus alatus* n. sp. Every fifth cross-section, each 10 $\mu$ thick, of the proboscis skeleton. $\times 55$.

round nuclei, apparently belonging to the nervous cells, lies just outside the nerve-fibre layer. Very small glandular cells with a granular content are found just beneath the outer surface of the epithelium.

The third zone is a little broader and as thick as the second, and has a few vacuoles in the peripheral part of the epithelium. The whole basal half is filled with nuclei, and judging by the number of nuclei the cells must be very numerous and consequently narrow. This is the main difference between the second and the third zones. There are a few small glandular cells near the free surface.

The fourth zone, forming the circular groove, is consequently narrow and consists of a low epithelium. It is a striking fact that the nerve-fibre layer in this zone is very thin. Just above this layer is a single row of nuclei, and a few more nuclei are scattered throughout the epithelium. The cells must be rather broad here. There are large vacuoles and long thin glandular cells that reach to near the basal membrane. The cilia of this zone are much shorter than those of the other zones.

The fifth and last zone is very similar to the first. The epithelium, which is very vacuolated throughout its whole thickness, contains small glandular cells near the surface. The majority of the nuclei are found in the basal part underneath the vacuoles, only a few scattered nuclei being observed nearer the surface.

As in other species of Enteropneusta, the dorsal mesentery of the collar begins at the first or the second dorsal nerve root and is complete from there to the posterior end of the collar. No trace of this mesentery could be found in front of the first nerve root. A ventral mesentery, on the other hand, is almost entirely missing, it being only present over a short distance in the posterior end of the collar. Furthermore, there are a few connections between the ventro-median blood-vessels running along the intestinal wall and along the inner side of the epidermis.

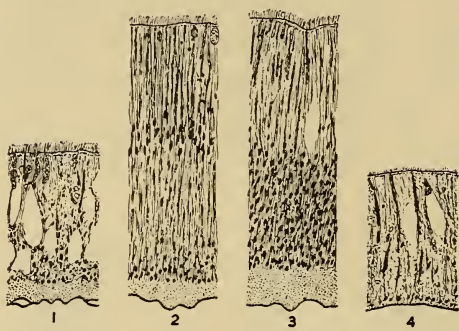
The collar canals have the usual form with only the dorsal wall folded inwards.

As in *Gl. mortenseni* the medullary cord has a continuous central canal, but *Gl. alatus* differs from that species in the absence of an anterior epidermal pouch dorsal to the anterior neuropore. There are two dorsal nerve roots in specimen 1 and four in specimen 3, and although the central canal sends a branch into these roots, they are solid for the greater part of their length (fig. 33). The supraneural blood-vessels are quite conspicuous.

The perihaemal cavities begin at the level of the proboscis pores. Their anterior ends are adjacent to each other except where they are separated by the dorsal blood-vessel. The mesentery separating the two perihaemal cavities from each other is complete over the whole length of the collar.

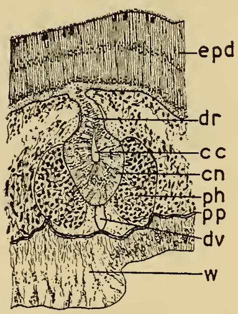
The epithelium of the buccal cavity shows a nearly uninterrupted layer of glandular cells near the free surface. Their contents are darkly stained by haematoxylin. The nuclei are found just underneath the glands (fig. 33).

*Trunk.*—A mid-ventral groove accompanying the ventral nerve cord is hardly indicated and then only in the anterior part of the




**32**

**35**

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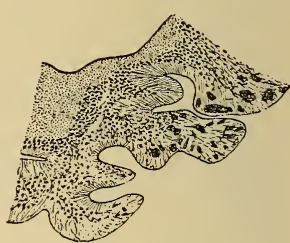


**34**

Figs. 32–35.—*Glossobalanus alatus* n. sp. 32. Sections of the five epidermal zones of the collar. ×180. 33. Cross-section of the dorso-median part of the collar. ×40. 34. A more or less tangential section through the epidermis of the branchio-genital region near the mid-ventral line, showing the ventral nerve cord and two epidermal pits. ×77. 35. A few of the cells forming the bottom of the epidermal pits. ×735.

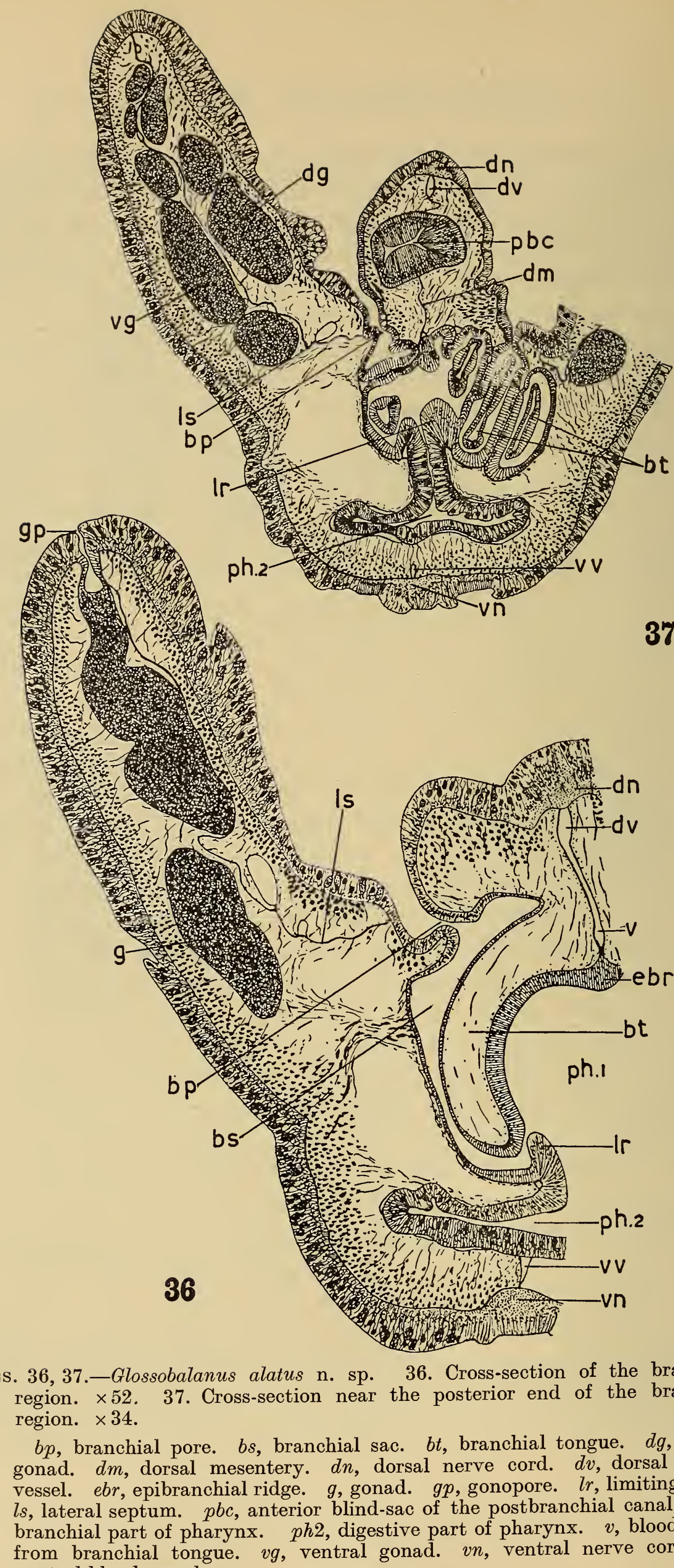
*cc*, central canal. *cn*, collar nerve cord. *dr*, dorsal nerve root. *dv*, dorsal blood-vessel. *epd*, second epidermal zone. *ph*, perihaemal cavity. *pp*, peripharyngeal cavity. *w*, wall of buccal cavity.

branchial region. The dorso-median groove is also shallow and disappears altogether at the beginning of the genital wings. On the other hand, the branchial groove is deep over the whole length of the branchial region (figs. 36 and 37); anteriorly it is very narrow, but it widens out at the beginning of the genital wings.

The epidermis of the trunk contains a great many glandular cells of two types. The larger ones are granular or at least not homogeneous and stained with haematoxylin; the smaller ones contain a homogeneous substance stained with eosin. Both types of glandular cells are found over the whole thickness of the epidermis, although they are more numerous near the surface (fig. 36).

There is a row of peculiar epidermal depressions with a conspicuous epithelium at both sides of the ventral nerve cord extending throughout the whole length of what there was of the trunk in the two specimens available. I have never seen anything similar in other Enteropneusta, nor has it been described by other authors. Judging from Spengel's figures these depressions might be present in *Gl. hedleyi*, but in his very accurate and detailed description of that species Hill does not mention nor figure them. In *Gl. marginatus* Meek mentions a paired series of pigment spots which lie on each side of the ventral median line of the branchio-genital region. In their position these pigment spots quite agree with the epidermal pits of *Gl. alatus*; in the latter species, however, no pigment was observed.

These pits are more or less oval depressions each of which is separated from the next one by a ridge of much higher ordinary epidermal epithelium (figs. 36–41). As this epithelium overhangs the depressions on all sides, they appear like little niches, opening to the surface by a rather narrow slit (fig. 34). In that part of the animal that was bent (fig. 22), more or less tangential sections of the epidermis near the ventral mid-line were obtained; here it could be seen that the middle part of the bottom of the depression is slightly raised (fig. 34). The product of the glandular cells of the epidermis fills the depressions to some extent; at any rate, the epithelium here is to a large extent covered by a substance that seems to be derived from these glandular cells, viz. from those that stain with haematoxylin. Histologically the epithelium forming the bottom of these pits differs greatly from the rest of the epidermis. There are no glandular cells, but only regular columnar cells, slightly swollen near the base where the nuclei are found (fig. 35). The free surface of the cells shows small protrusions, on some of which a small black point could be seen. The protoplasm is accumulated in the peripheral part of the cells, while in the basal half the protoplasm is only located along the cell walls. The nuclei are very characteristic. In the nuclei of the ordinary epidermis cells and also in those of the nerve cells the usual chromatin network is present, but in these cells the nuclei have the form of an 8, the middle of which is very darkly stained, so most of the chromatin




FIGS. 36, 37.—*Glossobalanus alatus* n. sp. 36. Cross-section of the branchial region. ×52. 37. Cross-section near the posterior end of the branchial region. ×34.

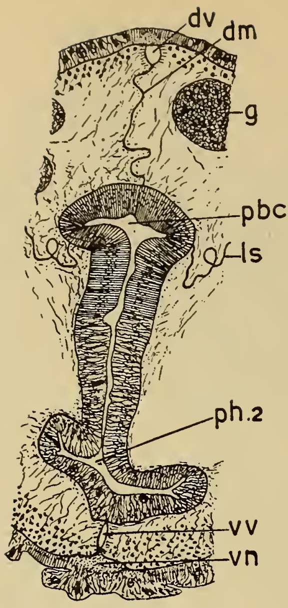
*bp*, branchial pore. *bs*, branchial sac. *bt*, branchial tongue. *dg*, dorsal gonad. *dm*, dorsal mesentery. *dn*, dorsal nerve cord. *dv*, dorsal blood-vessel. *ebr*, epibranchial ridge. *g*, gonad. *gp*, gonopore. *lr*, limiting ridge. *ls*, lateral septum. *pbc*, anterior blind-sac of the postbranchial canal. *ph*1, branchial part of pharynx. *ph*2, digestive part of pharynx. *v*, blood-vessel from branchial tongue. *vg*, ventral gonad. *vn*, ventral nerve cord. *vv*, ventral blood-vessel.

seems to be accumulated here. Below this dark part and at the side towards the basal membrane the nucleus is slightly and evenly stained; there may be chromatin here, but it does not form a network. The peripheral part of the nucleus looks like a vacuole with a thick wall, which is much thicker than a normal nuclear membrane. In this part the nucleus is not stained at all. The base of each cell is continued into a thread-like process that penetrates into the nerve-fibre layer, but nowhere could it be observed that this thread goes right through the nerve-fibre layer in order to attach itself to the basal membrane, a condition easily seen in ordinary epidermal cells. It is thus possible that the thread-like base bends off into the nerve-fibre layer; in other words, that the cells are continued into nerve fibres at their bases. On the other hand, it must be borne in mind that the nerve-fibre layer underneath these pits is much thinner than in the surrounding epidermis.

About the nature of these pits with their peculiar cells nothing definite can be said. They give one the impression of being nervous or sensory and remind one of the epidermal sensory organs (lateral line) of fishes. If they are sensory organs their position is rather peculiar. They are found in the branchio-genital and liver regions, thus far away from the proboscis, which with its abundant nerve supply is the most sensitive part of the body, and also far behind the mouth. Further, they are situated in a long row next to the ventral mid-line, so that they are far removed from the branchial pores on the dorsal side, while in the genital region there are no branchial pores at all. Therefore these organs cannot be concerned with the food or with the water for respiration. Their ventral position precludes the possibility that they are organs for light perception.

There is no external circular muscle layer in the trunk. The layer of longitudinal muscle fibres is slightly thicker than the epidermis, except along the medial side of the genital wings, where this layer is distinctly thinner than the epidermis (fig. 36). Also in the dorso-median part, *i.e.* between the two branchial grooves, this layer decreases in thickness near the end of the branchial region (fig. 37). In the genital region the longitudinal muscle layer of the dorsal side is much thinner than that of the ventral side (fig. 42). As in other Ptychoderidae, with the exception of *Gl. mortenseni*, there are no internal circular muscle fibres.

Both the dorsal and the ventral mesentery show many interruptions through which the right and left coelomic cavities intercommunicate (figs. 37 and 40).

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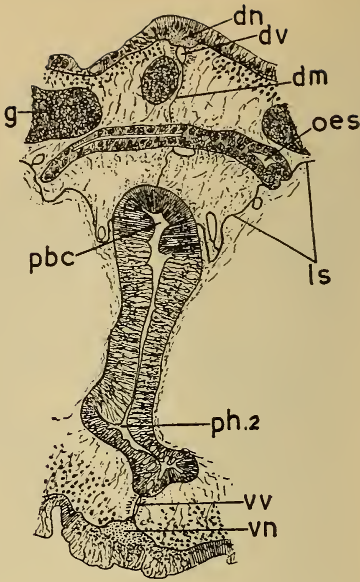


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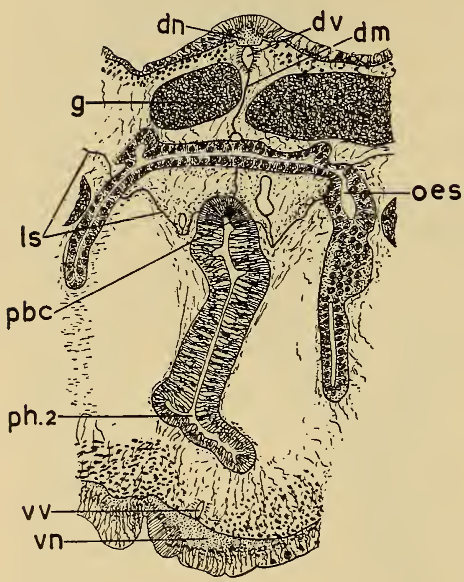


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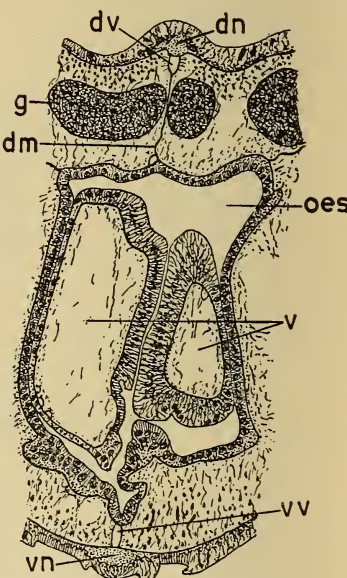


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FIGS. 38–41.—*Glossobalanus alatus* n. sp. 38. Cross-section just posterior to the last gill slit. 39. Cross-section of the median part of the trunk a few sections caudal to that of fig. 38. 40. The same, a few sections caudal to that of fig. 39. 41. The same, a few sections caudal to that of fig. 42. All × 36.

*dm*, dorsal mesentery. *dn*, dorsal nerve cord. *dv*, dorsal blood-vessel. *g*, gonad. *ls*, lateral septum. *oes* (figs. 39, 40, 42), anterior blind-sac of oesophagus. *oes* (fig. 41), oesophagus. *pbc*, postbranchial canal. *ph2*, digestive part of pharynx. *v*, the two valves containing blind-sacs of the coelom and projecting backwards into the oesophagus. *vn*, ventral nerve cord. *vv*, ventral blood-vessel.

The dorsal, branchial part of the pharynx is wider than the ventral, digestive part. The limiting ridges, separating these two parts, are not very pronounced.

The wall of the ventral pharynx is thinner than that of the buccal cavity. There are many vacuoles in this epithelium, but they are confined to the outer part of the cells facing the lumen (fig. 37). The nuclei are found in the basal part of the epithelium. Many small granular glandular cells occur near the surface, and long thin glandular cells with a homogeneous, darkly stained substance extend through the whole thickness of the epithelium of the ventral pharynx.

The number of gills is 24 on each side in specimen 3. This is a very small number, corresponding with the shortness of the branchial region. But even in *Gl. ruficollis*, which has an equally short branchial region, the number of gills is 36. The exact number of gills in specimen 1 could not be counted, owing to some irregularities. Several septa had bifurcated, and on the left side there were more of these irregular septa than on the right side.

The number of synapticula is 9.

In specimen 3 and on the left side of the body of specimen 1 the first and second branchial pores were completely separated from each other; on the right side of specimen 1, on the other hand, the two pores had fused to form a single opening, and the epithelium of the collar canal extended to the opening of the second gill.

The epithelium on the back of the tongues is high, that on the back of the septa low; conseqently the tongues protrude farther into the lumen of the pharynx than the septa. There are many glandular cells on the back of the tongues, and similar cells are found also on the epibranchial ridge. Hill found in *Gl. hedleyi* numbers of gland cells occurring in the thin walls of the branchial sacs. Similar cells are also present in the same epithelium of *Gl. alatus*; they have a similar appearance to the granular cells of the epidermis.

The postbranchial canal is very large in this species. It has, as is usual in the genus *Glossobalanus*, a dorsal blind-sac extending forwards above the last gills (fig. 37). As it extends to the level of the fourth last branchial pore it is very deep, even for a species of *Glossobalanus*. As in *Gl. hedleyi* and *Gl. elongatus*, the epithelium of this blind-sac, as well as that of the whole postbranchial canal, does not show irregular folds, but it is very high, consisting of regular, thin, long cells, and by its darker stain it contrasts well with the epithelium of the pharynx (fig. 38). Immediately behind the last branchial pore the postbranchial canal is connected with the ventral pharynx by a narrow vertical slit (fig. 38). The whole of the intestine is here laterally strongly compressed with a dorsal wider part, which

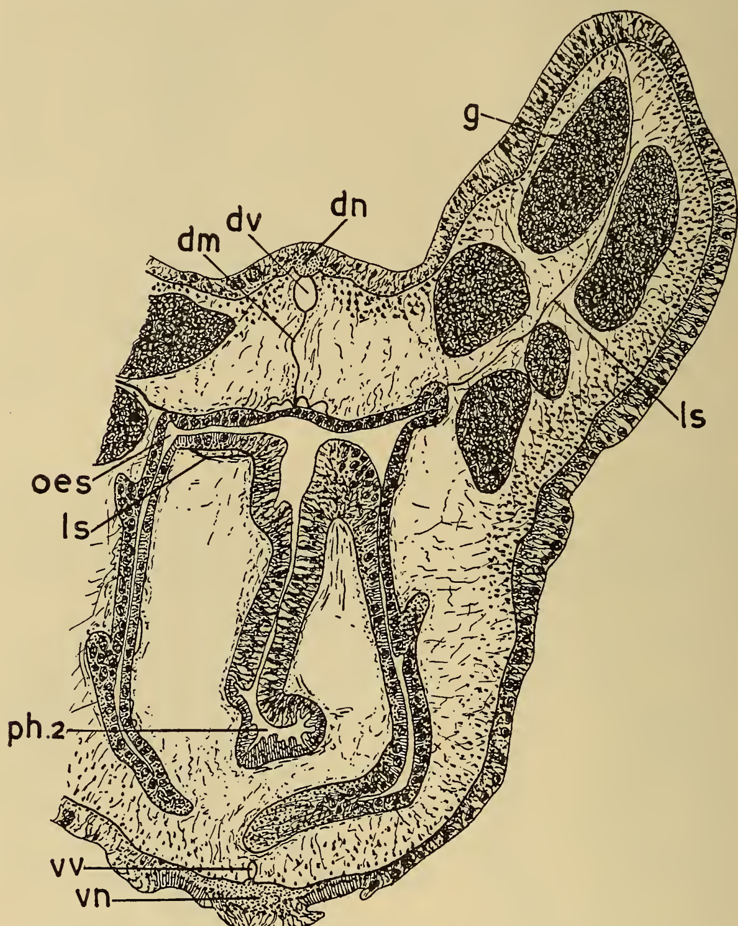



Fig. 42.—*Glossobalanus alatus* n. sp. Cross-section of the trunk a few sections behind that of fig. 40. × 45. For lettering see preceding figure.

is the postbranchial canal, and an even wider ventral part. The latter is the ventral pharynx and not the oesophagus, as is clearly shown by the histological character of its wall. In specimen 1 the connection of this part of the intestine with the oesophagus is quite different from the usual condition in *Glossobalanus* that is also found in specimen 3. In the majority of the Ptychoderidae the ventral pharynx is directly continuous with the oesophagus; the ventro-lateral corners of the oesophagus then turn upwards, and, reaching the level of the postbranchial canal, they again turn inwards and connect with the postbranchial canal, which here terminates. In this way two valves, containing an extension of the coelomic cavity, are formed and these valves extend for some distance backwards into the oesophagus. In this specimen of *Gl. alatus* there first appears a narrow cavity dorsal to the postbranchial part of the intestine (fig. 39). By the nature of its wall this cavity proves itself to be an anteriorly directed blind-sac of the oesophagus. At first it is quite flat and horizontal, then it turns ventralwards on both sides (fig. 40). It is here that the postbranchial canal terminates, and the main intestinal canal is merely the prolongation of the ventral pharynx. The ventro-lateral corners of the oesophageal blind-sac, having arrived at a level ventral to the main intestinal canal, bend inwards (fig. 42), and at the same time the main canal communicates with the oesophageal blind-sac in the dorsal mid-line. Somewhat farther on the ventral ends of the oesophageal blind-sac fuse with each other in the mid-line and also with the ventral end of the main canal (fig. 41). In this way two portions of the coelomic cavity are cut off from the rest; they are surrounded by the wall of the intestine, which medially exhibits the features of the wall of the ventral pharynx and laterally of the oesophageal wall. These coelomic blind-pouches extend as in other species for some distance into the oesophagus in the form of a pair of valves that may prevent the food in the oesophagus from passing back into the branchial pharynx. The epithelial wall of the oesophagus is very thin and contains many darkly stained glandular cells.

The first genital pore is situated on both sides behind the ninth or tenth branchial pore. In specimen 1 this first pore is on one side only, the opening of a short gonaduct, there being no real gonad. There are more of these pores without gonads farther back, as well as immature gonads that have not yet reached the full size. This may be an indication that the number of gonads is still increasing in this specimen. The gonopores are situated exactly on the edge of the genital wings (fig. 36), so that there is no empty, sterile part of the genital wings as in *Gl. marginatus*. In correspondence with the broad genital wings, the gonads are very elongated, reaching to about the middle of the branchial bars. In general they have the form of long sacs, the inferior part of which is broadest and shows irregular protrusions. The gonad can also be branched, especially in the posterior part of the branchial and the anterior part of the genital regions.

The lateral septum reaches far into the branchial region, beginning even in front of the fifth branchial pore. Nevertheless, the dorsal coelomic cavity remains devoid of gonads for a long distance, the first dorsal branch of a gonad being found at about the level of the 20th branchial pore. There is no doubt, however, that dorsal gonads are found in the branchial region (fig. 37).

As in nearly all species of *Glossobalanus*, there is a ciliated groove on the left side of the intestinal wall only. This groove begins in the genital region, but it cannot extend far into this region. The specimen (fig. 22) must have been broken off at the hind end of the genital region, because the available part of the pleura is 25 mm. long, and in the other somewhat larger specimen, broken off behind the liver region, the pleura are 28 mm. long; also the gonads are very small near the end of the series of sections.

### *Diagnosis of* Glossobalanus alatus.

Genital pleura very broad, like wings, beginning shortly behind the collar, reaching their maximum width in the hinder end of the branchial region, decreasing hardly in size, and disappearing well in front of the liver region. Branchial region very short, $\frac{1}{10}$ the total length of the thorax. In the smaller specimen the proboscis is 1·7 mm. long, the collar about 2 mm., the branchial region 2·5 mm., and the branchio-genital region 25 mm. In the larger specimen the proboscis is 2 mm. long and 3 mm. wide, the collar has a length of 3 mm. and a greatest width of 3·8 mm., the branchial region is 3·3 mm. long, the genital pleura 28 mm., the transitional region 6·5 mm., and the liver region 3·7 mm. The liver region is well delimited both at its anterior and its posterior ends; all liver saccules, 14 of which are visible externally, are approximately of equal size.

*Proboscis.*—Ventral proboscis septum very short, connecting with the epidermis at the level of the ventro-lateral blind-pouches of the stomochord. Ventral proboscis blind-sacs deep, extending between body and keel of skeleton. Only left dorsal coelomic sac connected with a median end-sac. Proboscis pore median. Lumen of stomochord continuous throughout; two ventro-lateral blind-pouches in stomochord; they may be connected with the main lumen and intercommunicating, or there are at least indications of these connections. Small dorso-lateral blind-pouches of stomochord may be present with common opening into main lumen. Glomerulus surrounds the anterior ends of pericardium and stomochord; farther caudally the glomerulus covers the pericardium to a greater extent than the stomochord. Keel of skeleton separated from the primary body nearly over its whole length; keel begins on U-shaped anterior part of skeleton, increases suddenly in size, extends nearly over whole length of body, and ends rather abruptly; crura short, surrounding about half the buccal cavity.

*Collar.*—Second and third epidermal zones of collar with much higher epithelium than the first, fourth, and fifth zones. Dorsal mesentery complete from first or second dorsal nerve root to end of collar. Ventral mesentery only present in extreme caudal end of collar. Collar canals with dorsal fold only. Perihaemal cavities begin at the level of the proboscis pore; their anterior ends adjacent to each other; the mesentery between them entire over whole length. Medullary cord with continuous central canal and 2–4 dorsal roots; no anterior epidermal pouch.

*Trunk.*—Ventro- and dorso-median grooves present only in anterior end of branchial region; branchial grooves deep. A row of small epidermal pits with an epithelium quite different from that of the epidermis, at both sides of ventro-median line over whole length of trunk. No external nor internal circular musculature in the trunk. Dorsal and ventral mesenteries often interrupted. Dorsal pharynx wider than ventral; limiting ridges feebly developed. About 24 gills and 9 synapticula; first and second branchial pores may be fused. Post-branchial canal with large anterior blind-sac. First genital pore behind the ninth or tenth branchial pore; gonopores on edge of genital wings; no sterile part in genital wings; gonads large, branched, extending to middle of branchial bars. Lateral septum begins near fifth branchial pore; dorsal gonads present in posterior end of branchial region. Ciliated groove on left side of alimentary canal only, extending slightly into the genital region.

## Two New Species of *Balanoglossus*: *B. hydrocephalus* and *B. studiosorum*.

### *Occurrence.*

*Balanoglossus* is most abundant on the muddy flats along the western side of Inyack Island. Part of these flats is formed by sand mixed with mud; another part, however, in front of which extends a coral reef, contains a great amount of coral debris, which makes digging with a spade there impossible. By digging in the sandy mud a fair number of specimens was procured, but not one that was quite intact. When, however, a place was found in the coral gravel, where, judging from the castings, *Balanoglossus* was most abundant, digging was also attempted there, although most of it had to be done with the hands. We started to make a circular furrow about a foot deep. Scooping the water from this furrow made the central part more or less dry, so that it was less easy for the animals to escape, and also one could see where one was digging. From this furrow we proceeded to remove the gravel towards the centre; undermining proved to be better than digging from the top layer. In this way we collected quite a number of entire specimens. By following this same method some entire specimens were also collected in the sandy mud later on. In one respect one has to exercise care when digging out the specimens. When the abdominal part is seen first, it is better to leave it alone, even when it disappears in the sand or the gravel, because, when touched, this part of the body invariably breaks off. But when the head end is seen first, it is quite safe to take it in the hand and to dig out the rest of the body carefully. Once the hepatic region has been exposed in this way, one can slowly pull out the whole abdominal region from the burrow without breaking it. This was also observed by Stiasny in *B. clavigerus*.

It was at once clear that the *Balanoglossus* from the gravel was different from that living in the sand. I will describe in the following pages the *Balanoglossus* from the gravel, the proboscis of which is very large, under the name of *B. hydrocephalus*, and as my students helped me so much in collecting this material I wish to name the species from the sandy mud *Balanoglossus studiosorum*.

The existence in gravel or in sandy mud is not the only difference in habitat between these two species. Though the flats, where they live, are nearly level, so that there is hardly any difference in length of exposure at low tide, *B. hydrocephalus* occurs most abundantly near the shore, and in certain patches a great number of specimens are crowded together; in an area of about half a square metre we found 21 specimens. On the other hand, *B. studiosorum* lives in the mud at some distance from the shore, and the specimens are scattered and isolated from each other, so that by adopting the procedure described above only one specimen was procured at a time.

It is possible that a third species of *Balanoglossus* lives on these flats. Judging from its castings, which are heaps of coiled mud

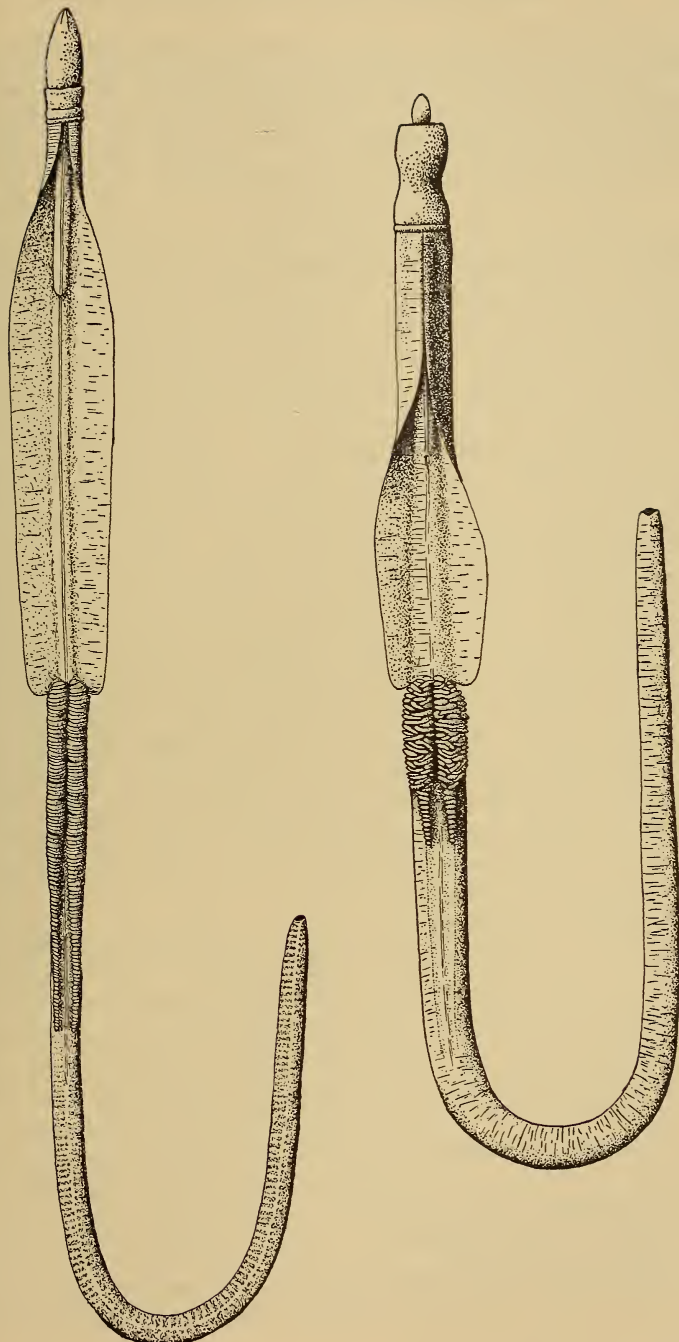


Fig. 43.—*Balanoglossus hydrocephalus* n. sp. (left) and *Balanoglossus studiosorum* n. sp. (right). Both in dorsal view and about two-thirds of nat. size.

about 10 cm. high, this species must be one of great dimensions. Though I tried more than once, I did not succeed in procuring even a small piece of a specimen. Evidently they burrow very deep down into the mud, over two feet at least, and they have disappeared before one is able to dig a furrow as deep as that.

### *External Features.*

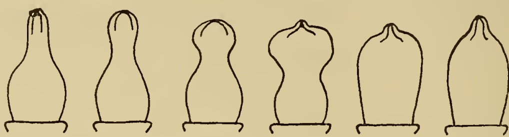
Though the two species, *B. hydrocephalus* and *B. studiosorum*, occur very near each other and are of about equal size, they are easily distinguished from each other. On the whole, *B. hydrocephalus* is the more slender and *B. studiosorum* the stouter of the two. The most obvious difference is shown by the relation between the proboscis and the collar. There are some species of *Balanoglossus* (e.g. *B. clavigerus*) in which the proboscis is well developed and longer than the collar, the latter is then about as long as broad. In other species (e.g. *B. carnosus*) the proboscis is greatly reduced in size and protrudes hardly beyond the elongated collar. The two species from Inyack exhibit this difference in a very marked way. *B. hydrocephalus* has a very large proboscis; in the living animal it can easily reach a length of over 2 cm., though it changes its form and thereby its length continually; it has a larger proboscis than any other known species of *Balanoglossus*. But the collar is short; it is at most as long as it is broad. On the other hand, in *B. studiosorum* the proboscis is greatly reduced in size, it never protrudes more than a few millimetres out of the collar, and often in the living as well as in the preserved animal it is quite retracted into the collar. But the collar is very elongated, it reaches a length of about 2 cm., and is about twice as long as it is broad.

This difference in size of proboscis and collar is correlated with a difference in the locomotion of the animals. On the whole *B. studiosorum* is a more sluggish, *B. hydrocephalus* a more active animal. All parts of the body and especially the abdominal region can contract considerably, and though they may help in it, yet the proboscis and collar are the principal organs of locomotion in Enteropneusta. But in *B. studiosorum* the small proboscis can hardly be an organ for locomotion. It is constantly protruded from and retracted into the collar and it moves in all directions. It may help to loosen the sand, but its principal function seems to be that of a sensory organ, somewhat similar to the tongue of a snake. Locomotion is effected especially by the collar, and it is more likely that the animal eats rather than bores its way through the sand. In *B. hydrocephalus* the condition is quite different. In this animal the proboscis is an active and powerful boring organ. Waves of contraction start at the top and move from there backwards, but the base of the proboscis maintains about the same diameter, as the waves do not quite reach the base. Each wave takes from 5 to 9 seconds to travel over the proboscis, and 9 to 10 movements are made per minute (fig. 44). If the animal is very active, several waves are present at the same time and each wave needs only 3 seconds to cover the length of the proboscis; up to 26 contractions were then counted in one minute (fig. 45).

The branchio-genital region also exhibits some characters which help in the differentiation of the two species. In *B. hydrocephalus* the hind end of the branchial basket is clearly marked by a depression, but in *B. studiosorum* it is very difficult, in some specimens even impossible, to demarcate the branchial from the genital region. In both species the genital wings start immediately behind the collar; anteriorly the wings are fused with the posterior rim of the collar. In *B. studiosorum* the wings in this region already attain a considerable breadth, so that their free edges touch each other in the mid-line, and as a rule they are bent over the dorsal side of the body. Over their whole extent a canal, which is open only at the caudal end of the wings, is thus formed between them and the body. When spread out it appears that the wings increase rapidly in breadth behind the collar and that they keep the same breadth over the greater part of their length; only near their posterior end they become narrower. In *B. hydrocephalus*, on the other hand, the wings are not so broad near their anterior end, so that there is a gap between their free edges. When the wings are bent over the dorsal surface of the body, their edges touch each other except just behind the collar, where a small triangular opening is left. But mostly the wings are spread out in the living animal, and if not, they are easily spread out, which is not the case in *B. studiosorum*. In *B. hydrocephalus* the wings reach their maximum breadth near the hind end of the branchial region and from there they decrease gradually. In one respect the two species correspond, and that is that the wings end abruptly just at the beginning of the liver region. They do not extend into that region as in *B. clavigerus*, nor is there a transitional region between the genital and liver regions as in *B. carnosus*.

In regard to the liver region there is a great difference between these two species of *Balanoglossus*. In *B. hydrocephalus* we find much the same arrangement of the liver saccules as in *B. carnosus*. The liver region is here very long; the anterior end is well marked off;

a few smaller saccules are found here that rapidly increase in size and then the saccules reach their maximum breadth. They form a very regular row at each side of the dorsal nerve cord and each saccule extends over the whole breadth of the row. In the first half of the



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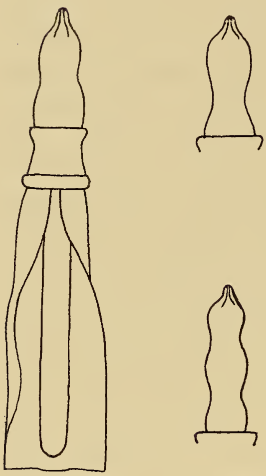

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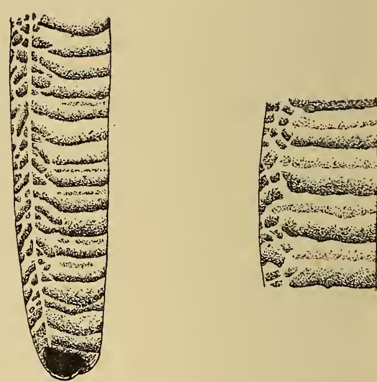

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FIGS. 44–46.—*Balanoglossus hydrocephalus* n. sp. 44. Successive stages of contraction of the proboscis of a slowly moving animal. 45. Forms of the proboscis of a quickly moving animal. 46. The caudal region and part of the abdominal region. ×4·5.

liver region the saccules hardly decrease in size, but then they gradually become smaller. At the posterior end of the row they become so small that in many specimens it is hardly possible to determine the posterior end of the liver region, especially as the row of saccules are often continued into two dark lines that extend some distance into the abdominal region. In *B. clavigerus* the smaller saccules near the posterior end of the rows are situated at some distance from each other, which distance increases towards the posterior end. This is not so in *B. hydrocephalus*; all saccules over the whole extent of the region are closely applied to each other; only when the animal is stretched out very much the saccules may be slightly separated from each other. The number of saccules is very great; there may be about 200 of them.

The liver region is quite different in *B. studiosorum*, where it is short and compact. Each row consists of a number of irregularly arranged saccules that on the surface at least hardly ever extend over the whole breadth of the row, most saccules being considerably narrower. The anterior end of the rows is well defined, the posterior end may be so. But often the broad row of irregular saccules comes to a rather sudden end and is then continued into a short row of much smaller but regularly arranged saccules that gradually decrease in size towards the posterior end.

Like the whole body, the abdominal region of *B. hydrocephalus* is more slender than that of *B. studiosorum*. A separate caudal region could not be discerned in either species.

On the whole the colour of *B. studiosorum* is dull and uniform. The proboscis is pale yellow and the collar dull yellow. The genital wings are yellow shading into orange-brown. The anterior part of liver region is more of a bright orange-brown, and the larger posterior part greenish brown. The abdominal region is colourless; faint transverse striae may be seen here, owing to the presence of the usual glandular ridges, which do not show a regular arrangement.

On the other hand, *B. hydrocephalus* is vividly coloured, and a great variation in the colour was found in different specimens. The proboscis is always yellow; the collar can be yellow like the proboscis or more yellow-brown. In the branchio-genital region the body itself shows a brown colour and the genital wings are often bright brick-red; they may, however, be dark or light brown, or their anterior part is dark brown and their posterior part gradually becomes lighter, hardly differing from the colour of the collar. The anterior part of the liver region, about 1 cm. long, is dark brown, almost black; the rest of the liver saccules is greyish brown. The abdominal region shows a very characteristic colour scheme, by which it is possible to recognise even small detached pieces of the abdominal region as belonging to this species (fig. 46). On a greyish-yellow background occur regular rings of a dark brown to black pigment, which are only broken up into small dots near the mid-dorsal line.

In many places it can be seen that darker rings alternate with lighter ones, and the darker rings show a very well-defined hind limit but they fade away anteriorly.

The dimensions of the various body parts in Enteropneusta are always somewhat dubious, because during life these animals are capable of considerable expansion and contraction. Furthermore, during fixation the regions of the body contract in varying degrees. The proboscis and the abdominal region are especially liable to great extension and contraction, and as the relative lengths of the proboscis and collar are of great importance, and the length of the long abdominal region determines the total length of the animal to a great extent, one has always to bear in mind that these dimensions have to be taken *cum grano salis.* When one pulls an animal out of its burrow in the way described above, the abdomen may be stretched to a length of 20 cm., and when the contents of the intestine are emptied this same abdomen may not be longer than 4 cm. The proboscis of *B. hydrocephalus,* when fully extended, may be well over 2 cm. long; on the other hand, it can be contracted to 5 mm.

The following are the dimensions in mm. of some living animals:—

<table>
<tr><th>Proboscis.</th><th>Collar.</th><th>Branchial region.</th><th>Genital region.</th><th>Liver region.</th><th>Abdominal region.</th></tr>
<tr><td colspan="6">Balanoglossus hydrocephalus.</td></tr>
<tr><td>12</td><td>7</td><td>22</td><td>38</td><td>35</td><td>—</td></tr>
<tr><td>12</td><td>5</td><td>15</td><td>20</td><td>20</td><td>30</td></tr>
<tr><td>15</td><td>6</td><td>30</td><td>40</td><td>35</td><td>50</td></tr>
<tr><td>15</td><td>7</td><td>40</td><td>30</td><td>35</td><td>30</td></tr>
<tr><td>15</td><td>6</td><td>30</td><td>40</td><td>30</td><td>—</td></tr>
<tr><td colspan="6">Balanoglossus studiosorum.</td></tr>
<tr><td>3</td><td>20</td><td colspan="2">160</td><td>10</td><td>70</td></tr>
<tr><td>5</td><td>18</td><td colspan="2">132</td><td>10</td><td>—</td></tr>
</table>

These animals were measured the day after they had been collected and when they were already partly anaesthetised; in all the intestinal contents were emptied and therefore the abdomen is contracted, but by pulling it carefully it can easily be extended to a much greater length. Also, the proboscis is shorter than it usually is. The normal length of living specimens of both species is about 30 cm.

If one wants fully extended fixed specimens, one has to kill the animals very carefully. I anaesthetised the animals, but did not dare to go so far that they did not show any movements at all, as a dead animal disintegrates and becomes a slimy mass almost at once. Therefore the partly anaesthetised animals were arranged on a dry board so that they had about the natural dimensions. Now it appears that the most sensitive parts of the body are the tip of the proboscis and the end of the tail. As soon as the preserving fluid touches either of these regions they are contracted to their smallest dimensions. Thereby the top of the proboscis is often invaginated to such an extent that there seems to be an opening, which Kowalevsky thought to open into the proboscis coelom. For this reason I started the fixation in the liver region and proceeded from there towards both ends by adding the fixation fluid drop by drop. In this way the abdominal region is fixed, and is incapable of further contraction when finally the end of the tail is reached. With the proboscis, one has to do this even more slowly. It will not contract when the fluid reaches its base, but even when half the proboscis is killed off, the top will contract immediately when it is reached by the fluid. Therefore the fixative must penetrate the proboscis from its base only, and then one can obtain specimens with the proboscis well extended.

The dimensions in mm. of some of these preserved animals are as follows:—

*Balanoglossus hydrocephalus.*

| Proboscis. | Collar. | Branchial region. | Genital region. | Hepatic region. | Abdominal region. |
|---|---|---|---|---|---|
| 13 | 7 | 44 | 82 | 54 | 107 |
| 11·5 | 5 | 59 | 67 | 95 | 137 |
| 12 | 5·5 | 25 | 25 | 44 | 80 |
| 6·5 | 4·5 | 20·5 | 11·5 | 20·5 | 10 |

The maximum distance between the free edges of the outstretched genital wings is 16·5 mm. in the first specimen of this list and 21 mm. in the second, and in the latter the minimum distance that is found near the hind end of the wings is 11 mm. The proboscis is not flattened, it is more or less conical; its maximum width in the first specimen is 5·5 and in the second 6·5 mm. The anterior rim of the collar is extended funnel-like round the base of the proboscis.

Behind this extension the collar is often greatly contracted in the living animal as well as in the preserved, so that its diameter here can be considerably less than near its posterior end. For instance, in the first specimen of the above list the diameter of the collar is 7 mm. anteriorly and 8·5 mm. posteriorly.

*Balanoglossus studiosorum.*

| Proboscis. | Collar. | Branchial region. | Genital region. | Hepatic region. | Abdominal region. |
|---|---|---|---|---|---|
| 0 | 12 | 116 | | 16 | 80 |
| 2 | 8 | 93 | | 20 | 120 |
| 2 | 8 | 215 | | 22 | 106 |

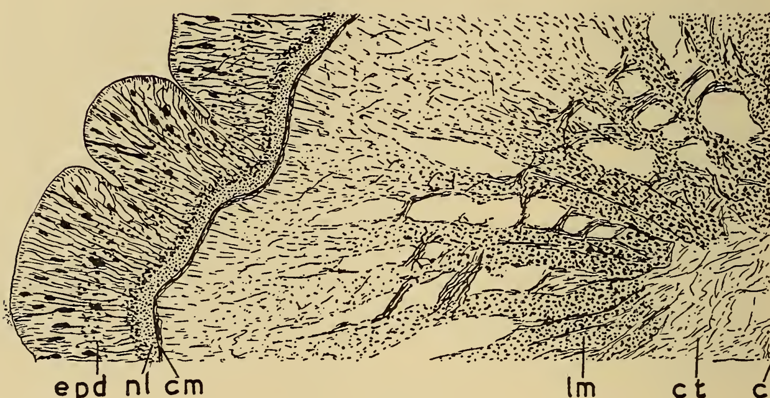
The maximum distance between the free edges of the outstretched genital wings in these three specimens is 20, 19, and 21 mm. respectively. But in the third specimen one wing was much broader than the other, the greatest half-breadth being 14 mm. The collar, though somewhat constricted in the middle, has about the same diameter anteriorly as posteriorly; in the second and third specimens of the above list this diameter is 7 and 8 mm. respectively.

In 1908 Gilchrist described a species of *Balanoglossus* under the name of *Ptychodera natalensis* from Durban Bay. Unfortunately Gilchrist gives the external characters of this species only; though these are described rather accurately, they are not sufficient to identify the species beyond doubt, especially as the description is not accompanied by a figure of the animal. Furthermore, Gilchrist's specimens, from which the description was made, cannot be found. At first I expected that one of the species from Inyack would be identical with *Balanoglossus* (*Ptychodera*) *natalensis*. It is clear that *B. studiosorum* is certainly different from *B. natalensis*, but *B. hydrocephalus* agrees in some respects with it. According to Gilchrist the proboscis of *B. natalensis* is relatively short and was not observed to vary much in the living animal. It was about 11 mm. in length and in the preserved condition 9·5 mm. Judging from the other dimensions given by Gilchrist, his specimen must have been large for *B. hydrocephalus*, and then the proboscis should have been considerably longer than 11 mm. As previously mentioned, the proboscis can easily reach a length of 2 cm. during life; I have a preserved specimen in which it is still 19·4 mm. long. The dimensions of the collar, 6 mm. long and 8·5 mm. broad, agree with those of *B. hydrocephalus.* In his description of the branchio-genital region Gilchrist obviously makes a mistake. He says that this region was broken up into four pieces, respectively 90, 56, 42, and 16 mm. long, so that the total length of this region was a little over 200 mm. Having described the first and second fragments, Gilchrist says that the third and smallest fragment includes part of the liver region, that a few hepatic coeca occur in a small part of the pleural (*i.e.* genital) region over a length of about 6 mm., and further, "the fourth fragment was 42 mm. in length, and was covered with the hepatic coeca." Therefore it seems that the branchio-genital region was 156 mm. in length and not 200 mm., of which the branchial region measures 45 mm. The length of the liver region agrees with that of *B. hydrocephalus*, but in *B. natalensis* the hepatic coeca are arranged at first in a single row on each side and are hardly compressed, becoming towards the centre larger, crowded together, and arranged in an irregular mass, and this is different from what is shown by *B. hydrocephalus.* On the other hand, both species have the pigmented annular rings, which are broken up into isolated patches along the dorsal side, in the abdominal region, and also the coloration of the rest of the body of *B. natalensis* is similar to that of *B. hydrocephalus.* The only internal character of specific value mentioned by Gilchrist is that there appears to be one nerve root only, and this is not the case in *B. hydrocephalus.* If everything in Gilchrist's description is taken into consideration, I think that it is better to describe the specimens from Inyack as belonging to another species—*Balanoglossus hydrocephalus.*

## *Internal Anatomy.*

*Proboscis.*—In *B. hydrocephalus* the nuclei of the epidermal cells are situated in the basal half of the cells (fig. 47), whereas in *B. studiosorum* they form a thick layer in the middle of the epidermis (fig. 50). In the latter species all ordinary epidermis cells seem to contain mucus that fills the peripheral and basal parts of the cells and is discharged at the surface in great quantity. On the other hand, in *B. hydrocephalus* special glandular cells occur in between the undifferentiated epithelial cells; these glandular cells are very narrow, extend over the greater part of the thickness of the epidermis, though they do not reach the nerve layer; they stain very darkly with haematoxylin. In both species small glandular eosinophil cells are found; they occur especially in the outer part of the epidermis; towards the nerve layer they become less numerous; the glandular


**47**




**48**

Fig. 47.—*Balanoglossus hydrocephalus* n. sp. Cross-section of a part of the proboscis.

Fig. 48.—*Balanoglossus studiosorum* n. sp. The same. Both × 38.

*c*, centre of proboscis. *cm*, circular musculature. *ct*, connective tissue. *epd*, epidermis. *lm*, longitudinal musculature. *nl*, nerve-fibre layer. *pc*, proboscis cavity.

part of these cells is almost round or oval, and they often show a narrow tube-like extension to the surface. In *B. studiosorum* a dense layer of nuclei, apparently the nuclei of the nerve cells, is situated just outside the nerve-fibre layer; in *B. hydrocephalus* there are not so many nerve-cell nuclei. The layer of nerve fibres has about the same thickness in both species.

In *B. studiosorum* the layer of circular muscles is very thin, it is not thicker than about one-third of the nerve-fibre layer (fig. 48). In *B. hydrocephalus*, on the other hand, the circular musculature is very conspicuous and reaches to a thickness equal to that of the nerve-fibre layer (fig. 49). A sphincter at the base of the proboscis, such as occurs in *B. clavigerus*, is missing in both species.

The longitudinal muscle fibres are especially numerous in the peripheral part of the proboscis in *B. hydrocephalus*; towards the centre they become less concentrated and show a tendency to arrange themselves in small bundles (fig. 47). They are split up radially, as is usual in the Ptychoderidae, and it is clearly shown that the radial cracks are pre-established. Strands of fine connective-tissue fibres intersect the longitudinal musculature in a radial direction, and it is along these strands that the radial cracks occur. This was clearly shown in one specimen of *B. hydrocephalus*, in which the muscles had not contracted so much as they usually do, so that some radial strands of connective tissue were quite intact, others were torn up over a short distance, and some split up over their whole length.

In *B. studiosorum* the longitudinal muscle fibres show quite a different arrangement, and, moreover, they are far less numerous (fig. 48). They are concentrated along the central core of connective tissue, and hardly any fibres occur in the peripheral part of the proboscis. They are not arranged in little bundles, and the radial cracks are very irregular and do not reach the central connective tissue. Also, the fibres apparently do not follow an almost straight course; most of them are cut across in the cross-sections and run therefore in fronto-caudal direction, but others are seen following a radial and even a tangential course. Strands of fibres overbridge the radial cracks; these, of course, were running nearly radially, but have been pulled aside by the occurrence of the cracks.

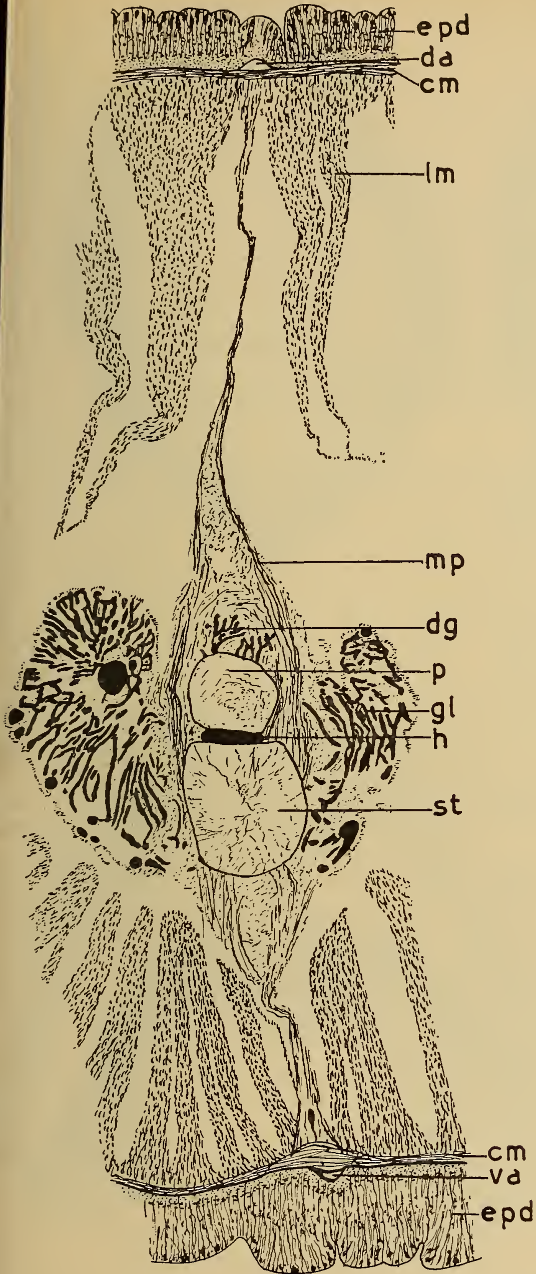
A dorso-ventral muscle plate is well developed in *B. hydrocephalus*, but it does not extend in front of the central proboscis organs (fig. 49). On the other hand, in *B. studiosorum* such a muscle plate is almost entirely absent; only a few muscle fibres are seen running along the sides of the pericardium.

On the whole, the proboscis musculature is very strong in *B. hydrocephalus* and poorly developed in *B. studiosorum*, as was anticipated.

A very large central proboscis cavity was found in *B. hydrocephalus* (fig. 47). It extends over the posterior two-thirds of the proboscis and has a regular conical form with the point directed anteriorly. In front of this cavity and also surrounding its anterior part, where the longitudinal muscles are not so strongly developed as in the posterior part of the proboscis, a very loose connective tissue is found; more posteriorly the muscle fibres extend to the cavity. No cells could be seen surrounding the cavity, only a regular layer of connective-tissue fibres. I have never seen so large a proboscis cavity in any other species of *Balanoglossus*. On the other hand, in *B. studiosorum* there is practically no proboscis cavity at all, an open space being found in the ventral blind-sac and near the proboscis pore only (fig. 48). A central core of connective tissue extends over the whole length of the proboscis, and the glomerulus and other proboscis organs are quite enveloped by this tissue.

The ventral proboscis septum of *B. hydrocephalus* starts somewhat in front of the ventral dilation of the stomochord, and except for some perforations in its anterior part it is complete to the end of the ventral coelomic blind-sacs, which therefore are entirely separated from each other. The anterior part of the septum lying in the ventro-dorsal muscle-plate is very thin, and the ventro-median proboscis vessel running along its anterior edge is very inconspicuous. The posterior part of the septum is very thick and swollen, because many cells have penetrated into the septum, giving it a spongy appearance (fig. 50). The ventral coelomic blind-sacs are rather narrow, and end at the level of the caudal end of the ventral dilation of the stomochord. These blind-sacs have not the regular epithelial wall as in most other species, but are filled with cellular tissue (fig. 50). At their hind end they break up into chondroid tissue, which extends into the skeleton and separates the end-plate from the keel of the skeleton in much the same way as in *B. clavigerus* according to Spengel's description.

In *B. studiosorum* the ventral proboscis septum is short; it starts about midway between the top of the stomochord and its ventral dilation, or even farther backwards, and it stops already near the frontal side of the ventral dilation. The ventral proboscis artery, which should run through the septum, was not visible. So the ventral coelomic blind-sacs have fused to a single cavity over a great extent (fig. 58). This ventral blind-sac is large compared with other species of *Balanoglossus*, and, as in *Ptychodera*, protrudes at the ventral surface of the proboscis neck without, however, forming a racemose

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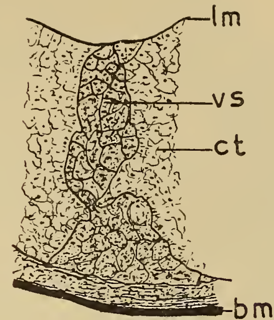


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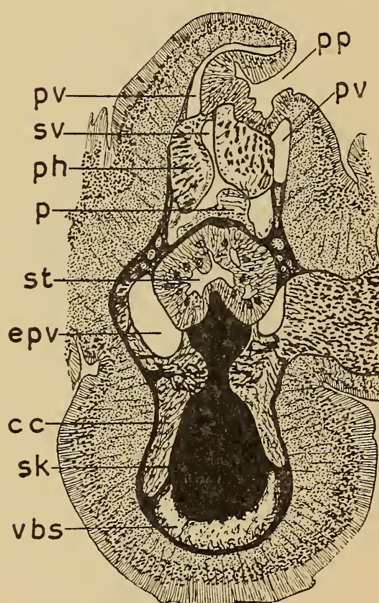


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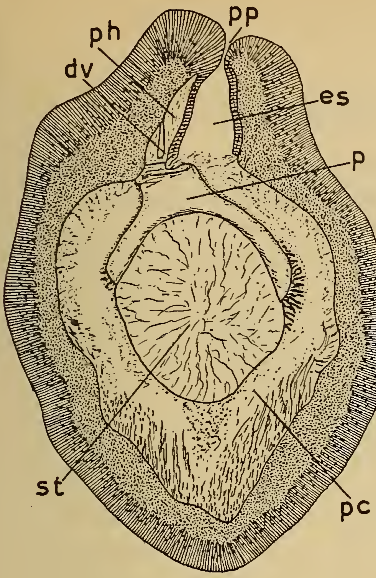
FIGS. 49–51.—*Balanoglossus hydrocephalus* n. sp. 49. Median part of a cross-section through the proboscis at a level near anterior end of proboscis organs. ×24. 50. Cross-section of the ventral proboscis septum. ×110. 51. Cross-section of the proboscis neck. ×40.

*bm*, basal membrane of the epidermis. *cc*, collar coelom. *cm*, circular musculature. *ct*, cellular tissue filling the ventral coelomic blind-sacs. *da*, dorsal proboscis artery. *dg*, dorsal glomerulus. *epd*, epidermis. *epv*, efferent proboscis vessel. *gl*, glomerulus. *h*, central blood space. *lm* (fig. 49), longitudinal musculature. *lm* (fig. 50), limiting membrane surrounding the stomochord. *mp*, dorso-ventral muscle-plate. *p*, pericardium. *ph*, perihaemal cavity. *pp*, proboscis pore. *pv*, proboscis veins. *sk*, end-plate of skeleton. *st*, stomochord. *sv*, sinus venosus. *va*, ventral proboscis artery. *vbs*, ventral coelomic blind-sac. *vs*, ventral proboscis septum.

organ. The sac is almost circular or rectangular in cross-section; at any rate it is as high as broad. In caudal direction it extends well beyond the end-plate of the skeleton, and there occupies the place of the keel. It is surrounded here, mostly along its lateral sides, by chondroid tissue, and it ends just where the skeletal keel protrudes farthest, the caudal end making a small indentation in the anterior surface of the keel (fig. 59). *B. hydrocephalus* differs from *B. studiosorum* in that in the latter species the ventral proboscis blind-sac is lined by a regular layer of cells and shows an open cavity (fig. 58).

As is usually the case, only the left dorsal coelom is connected by way of an end-sac with the proboscis pore in both species. There is not even the slightest indication of an opening at the right side neither in the end-sac nor in the coelom. In other species, e.g. *B. stephensoni*, the end-sac has a forward extension on the right side, or, when the opening is on the right side as in *B. capensis*, a forward extension is found on the left side. In *B. hydrocephalus* the end-sac is rather small and not prolonged beyond the caudal end of the pore. The pore itself is also small and situated on top of a dorso-median or slightly left tubercle (fig. 51). In *B. studiosorum* the end-sac is long and narrow, corresponding with the form of the pore and the end-sac has a small prolongation beyond the posterior end of the dorso-median pore (fig. 52).

The stomochord of *B. hydrocephalus* is well developed. Its anterior part is nearly round in cross-section (fig. 49). At the place of its ventral dilation it becomes much broader, but its dorso-ventral diameter hardly increases. In the whole body of the stomochord a central lumen is absent; there are, however, numerous isolated small cavities. But the ventro-lateral blind-pouches are large, although they are not connected with each other and, of course, neither with the main lumen, as this is not yet present at this level (fig. 53). There are no dorso-lateral blind-pouches. The main lumen appears only in the neck of the stomochord, and even here it may be interrupted and irregular in outline, although in one of the specimens it is continuous throughout the neck. Towards the posterior end, in front of its communication with the buccal cavity, the lumen widens out considerably (fig. 54). As the crura of the skeleton stand out nearly at right angles, the stomochord communicates with the buccal cavity by a very large opening, which shows a frontally directed narrow median slit between the basal parts of the crura. The neck of the stomochord has two dorso-median blind-sacs, directed frontally, and

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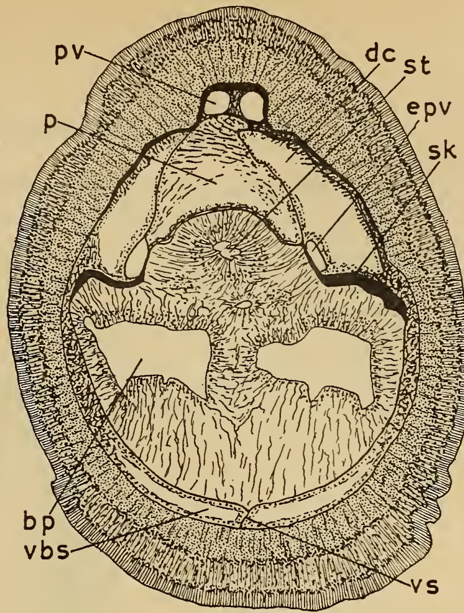


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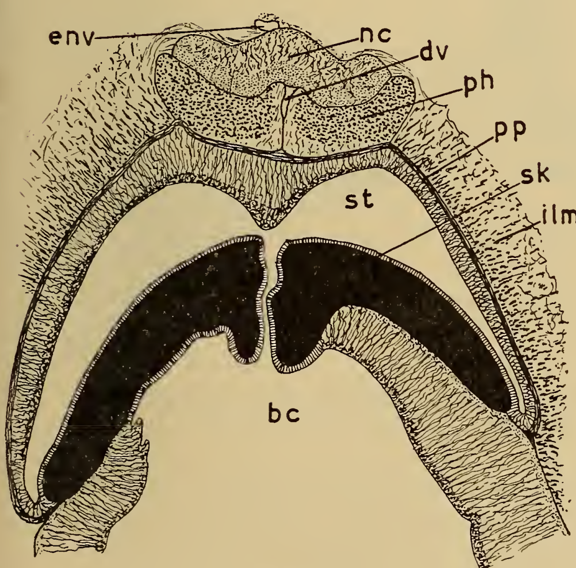


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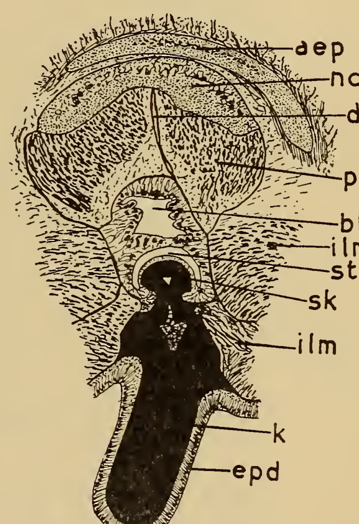


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FIG. 52.—*Balanoglossus studiosorum* n. sp. Cross-section of the proboscis neck. ×21.

FIGS. 53–55.—*Balanoglossus hydrocephalus* n. sp. 53. Cross-section of the proboscis at level of the blind-pouches of the stomochord. ×35. 54. Cross-section of the dorso-median part of the collar at the level of the opening of the stomochord into the buccal cavity. ×21. 55. Cross-section of the dorso-median part of the collar at level where the proboscis neck has fused with the collar. ×21.

*aep*, anterior epidermic pouch. *bc*, buccal cavity. *bl*, dorsal blind-sac of the neck of the stomochord. *bp*, ventro-lateral blind-pouch of the stomochord. *dc*, dorsal coelomic cavity. *dv*, dorsal blood-vessel. *env*, epineural vessel. *epd*, epidermis. *epv*, efferent proboscis vessel. *es*, end-sac. *ilm*, internal longitudinal musculature. *k*, keel of skeleton. *nc*, nerve cord. *p*, pericardium. *pc*, proboscis coelom. *ph*, perihaemal cavity. *pp* (fig. 52), proboscis pore. *pp* (fig. 54), peripharyngeal cavity. *pv*, proboscis vein. *sk*, skeleton. *st*, stomochord. *vbs*, ventral coelomic blind-sac. *vs*, ventral septum.

in the epithelium of this part of the stomochord occur many glandular cells of the same type as are found in the wall of the buccal cavity (fig. 55).

In *B. studiosorum* the stomochord is different from that of *B. hydrocephalus*, and agrees more with that of *B. numeensis* described by Maser, which is also a species with a very small proboscis and a large collar. The anterior part is round (fig. 52), and in the region of the ventral dilation the cross-section of the stomochord is nearly square. Furthermore, there is no main lumen in the body, but small isolated cavities which are surrounded by numerous glandular cells that stain dark blue. The ventro-lateral blind-pouches are small and not connected with each other (fig. 58). There is an indication of dorso-lateral blind-pouches in *B. studiosorum*; in *B. numeensis* these are well developed, but in *B. hydrocephalus*, as previously mentioned, they are quite absent. In *B. studiosorum* there is just a dorso-lateral extension of the stomochord, but a real lumen, as in the ventro-lateral pouches, could not be detected here, only some isolated cavities surrounded by glandular cells being present. The neck of the stomochord, like this whole part of the proboscis, is very short. The anterior part of the neck especially is very irregular; outgrowths from the skeleton penetrate into it and may cut it up entirely. In this respect *B. studiosorum* resembles *B. carnosus*, another species in which the proboscis is reduced. The lumen accordingly is here greatly reduced, and it is only in the posterior part of the neck, caudal to the skeletal outgrowths, that a well-developed main lumen appears in the stomochord, which opens into the buccal cavity. As the keel of the skeleton protrudes caudally the anterior part of the opening of the stomochord is forked (fig. 59).

The pericardium does not exhibit anything in particular in either species. Only in one specimen of *B. hydrocephalus* is the frontal point of the pericardium pushed in by the muscle plate, with the result that the pericardium extends slightly more in frontal direction lateral to the muscle plate than in the mid-line, thereby forming a pair of short horns. These pericardial horns, however, are not so pronounced as in *Gl. ruficollis* or the Spengeliidae; at the best they are like those of *B. misakiensis*, in which species the top of the pericardium is pushed in in the mid-line by a dorsal extension of the stomochord.

The central blood-space also does not show anything of particular interest; it may extend freely in the anterior part of the pericardium as described by Hill for *B. australiensis*.

The glomerulus is larger in *B. hydrocephalus* than in *B. studiosorum.* Besides that it extends well in front of the pericardium and the stomochord and stops only at the level of the ventro-lateral blind-pouches of the stomochord in the former species, whereas in the latter

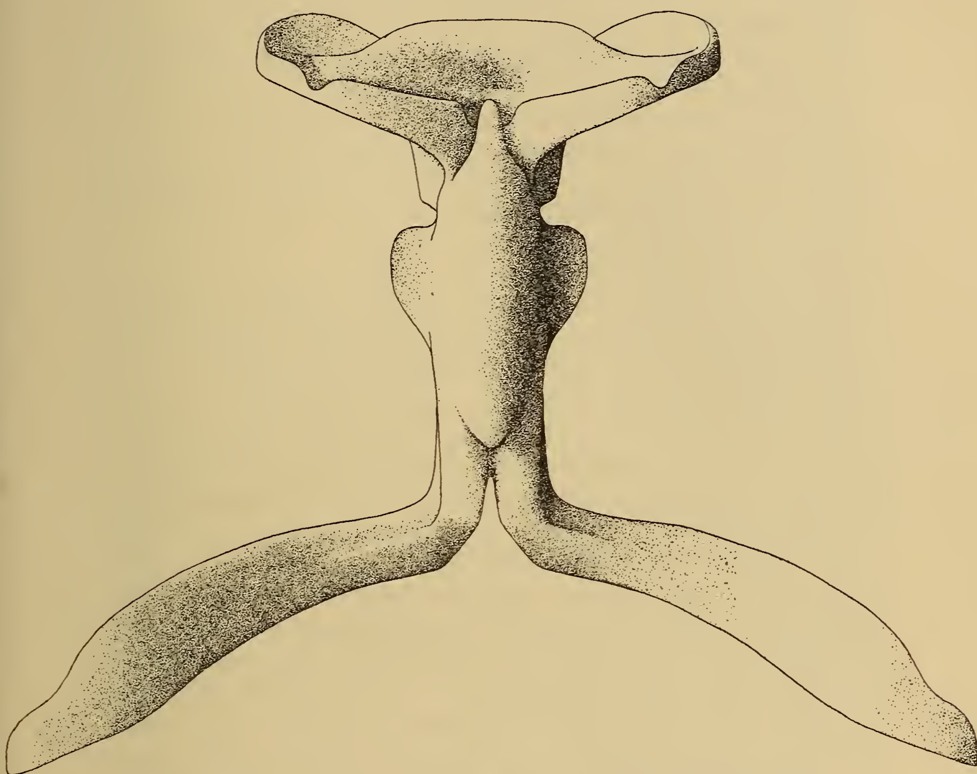


FIG. 56.—*Balanoglossus hydrocephalus* n. sp. Proboscis skeleton from a wax model, ventral side. × 33.

it does not extend in front of the stomochord and stops in front of the blind-pouches, it is also much broader and its vessels are thicker in *B. hydrocephalus* than in *B. studiosorum* (fig. 49). The function of the glomerulus is not quite known. That it is an excretory organ is beyond doubt, but besides it may help in extending the proboscis by secreting water into the proboscis cavity. Its greater size in *B. hydrocephalus* would then be in correspondence with the size of the proboscis. In this species the two lateral halves of the glomerulus, although extending in front of the pericardium, are separated here from each other by the fibres of the dorso-ventral muscle plate. Farther caudally the glomerulus covers the lateral walls of the pericardium for the greater part and hardly, if at all, extends on to the sides of the stomochord. But where the fibres of the dorso-ventral muscle plate run along and are fixed to the sides of the pericardium, these fibres separate the glomerulus from the pericardial walls. Besides these two lateral parts, forming the main glomerulus, *B. hydrocephalus* has also a dorsal glomerulus, covering the free dorsal side of the pericardium, and although it is narrow this dorsal glomerulus is very elongate; it is present already at the top of the pericardium and stops only shortly in front of the main glomerulus, where the dorsal edge of the pericardium connects also with the basal membrane of the epidermis (fig. 49).

An interesting point of difference between the two species in question is formed by the skeleton, which supports the stomochord, strengthens the connection between the proboscis and the collar, and serves as a base of attachment for the inner longitudinal musculature of the collar. In correspondence with the size and function of the proboscis, the skeleton is well developed in *B. hydrocephalus*, and in general it does not greatly differ from the form usually found in Enteropneusta (fig. 56). The convex end-plate has a small projecting rim surrounding the ventro-lateral blind-pouches of the stomochord; it also shows a short dorso-median point that projects forwards between the neck and the ventral dilation of the stomochord. Though the outside of the end-plate has the tapering form of a funnel, the inside has not, because the centre is very thick and projects forwards. The body of the skeleton is well developed and shows two pairs of short wings, one at the anterior end and one in the middle. The keel is very large and, covered by the epithelium, it projects far into the mouth-opening (fig. 55). Anteriorly the keel is separated from the end-plate by the ventral proboscis blind-sacs, therefore its anterior end points freely forwards. In caudal direction it decreases gradually in size, nevertheless its posterior end is detached from the body of the skeleton and points freely backwards; this point does not reach the level where the crura separate from each other. The crura at first hardly deviate from the longitudinal direction, only a narrow slit by which the stomochord connects with the buccal cavity being found between them (fig. 54). But then they turn suddenly and stand out from the longitudinal axis nearly at right angles; in one specimen they are even turned forward, but in the other the more lateral parts of the crura bend slightly in caudal direction; nevertheless in this specimen the whole of the crura are also situated near the anterior end of the collar.

In *B. studiosorum*, with its small proboscis, the skeleton is correspondingly poorly developed even more than in *B. numeensis*, another species with a small proboscis (fig. 57). The end-plate has an upstanding rim round the ventro- and dorso-lateral extensions of the stomochord and its central part is very convex, with a prominent dorso-median point protruding between the neck of the stomochord and its ventral dilation. But unlike *B. hydrocephalus*, the end-plate is rather thin, as its under side is concave and follows more or less its frontal surface. But the whole body of the skeleton is missing, the end-plate being connected dorsally and ventrally directly to the crura; at best the dorsal connection could be considered as a very short secondary body (fig. 58). The ventral connection is very narrow and paired, as there is a large opening at the middle of the ventral side between the end-plate and the keel. This opening extends to the central part of the skeleton and separates here the dorsal from the two ventral connections, and by this opening in the centrum of the skeleton the right and left coelomic cavities of the collar, filled with muscle fibres, communicate with each other; it occurs where the body of the skeleton should be. The keel, otherwise an elongate structure, is very short; it is hardly more than a point that protrudes considerably into the mouth-opening. The anterior surface of this keel is hollowed out and in this hollow is situated the caudal end of the ventral coelomic blind-sac of the proboscis (fig. 59). Being separated from the end-plate, the keel has only a narrow lateral connection with the crura. *B. numeensis* hardly seems to have a proper keel; Maser writes that only "Seitenplatten" are present; these "Seitenplatten" may correspond to the connections between the keel and the crura of *B. studiosorum*. The crura stand out at right angles and are the best developed part of the skeleton, although they are thin. They have a very characteristic form, more or less like two very deep spoons fused in the mid-line and with the handles turned to the lateral sides and extending only into the dorsal wall of the buccal cavity. The plate of the spoons is very broad and its deeply concave surface is facing anteriorly. As aforementioned, the proboscis is connected to the collar about in the middle of the latter, and therefore the crura are situated about in the middle of the length of the collar. The longitudinal musculature is very strong in the anterior half of the collar, and the muscle fibres find a base of attachment in the broad, concave, anterior surface of the crura.

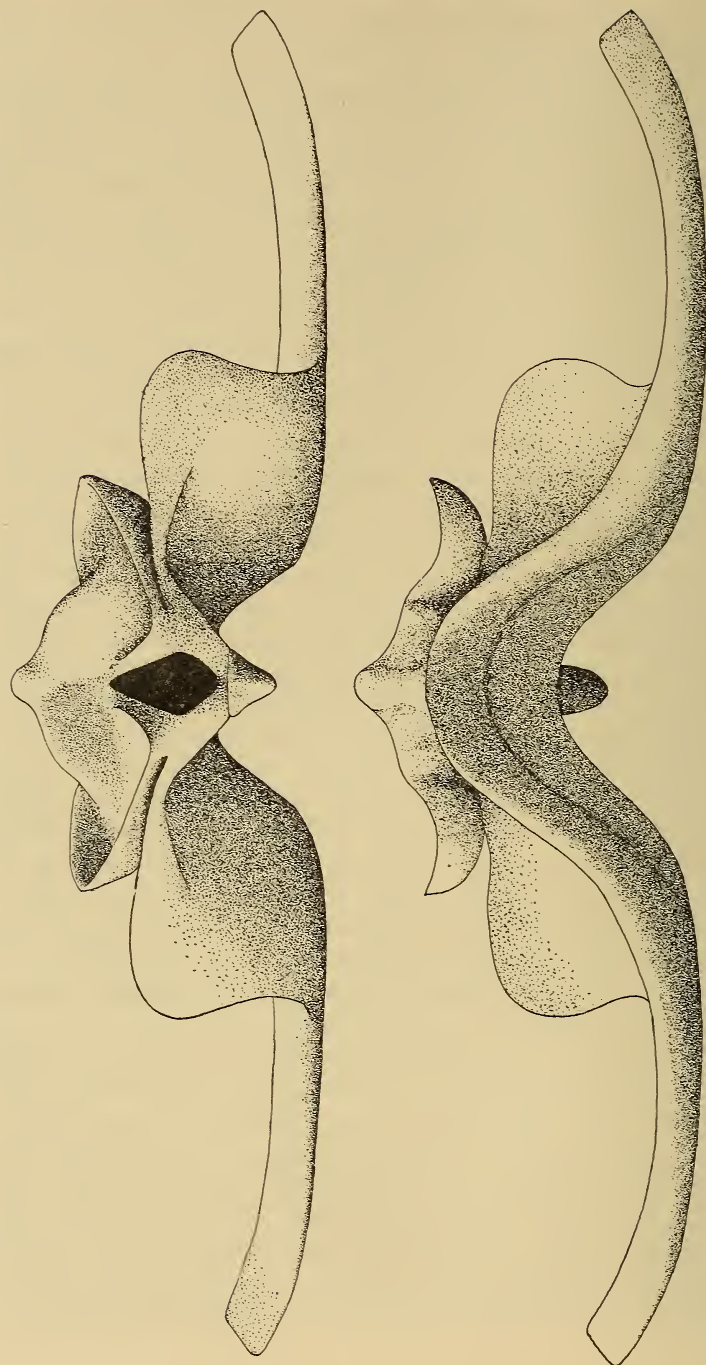
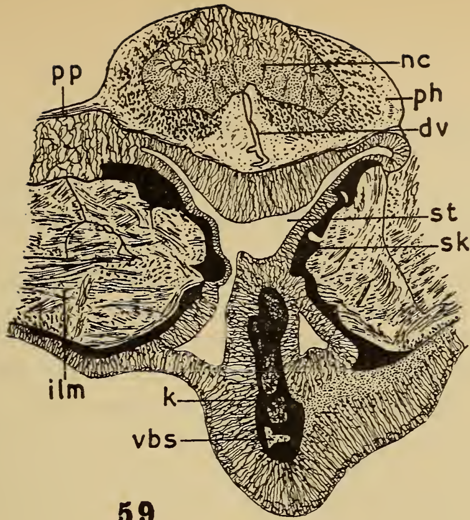


Fig. 57.—*Balanoglossus studiosorum* n. sp. Proboscis skeleton from a wax model, ventral side (above), dorsal side (below). ×40.

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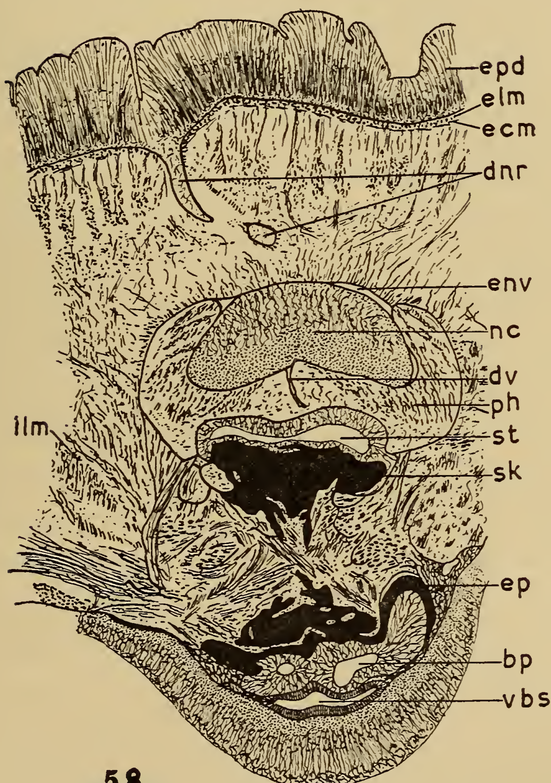


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FIGS. 58, 59.—*Balanoglossus studiosorum* n. sp. 58. Cross-section of the dorso-median part of the collar at level where the proboscis neck has fused with the collar. 59. Cross-section of the dorso-median part of the collar shortly in front of the opening of the stomochord into the buccal cavity. Both × 21.

*bp*, ventro-lateral blind-pouch of stomochord. *dnr*, dorsal nerve root. *dv*, dorsal vessel. *ecm*, external circular musculature. *elm*, external longitudinal musculature. *env*, epineural vessel. *ep*, end-plate of skeleton. *epd*, epidermis. *ilm*, internal longitudinal musculature. *k*, keel of skeleton. *nc*, nerve cord. *ph*, perihaemal cavities. *pp*, peripharyngeal cavity. *sk* (fig. 58), secondary body of skeleton. *sk* (fig. 59), crus of skeleton. *st*, stomochord. *vbs*, ventral coelomic blind-sac of proboscis.

*Collar.*—The epidermis of the collar shows the different zones as usually present, but I do not find them well differentiated from each other in either species.

Concerning the musculature of the collar there is a great difference between *B. hydrocephalus* and *B. studiosorum*, as could be expected in accordance with the difference in size and function of this part of the body. In the former species the muscles show the arrangement usually found in the Ptychoderidae. Along the outside of the collar, just under the basal membrane of the epidermis, we find the outer longitudinal muscles, and inside them, at least in the anterior part of the collar, is the layer of the external circular musculature (fig. 60). Both layers, the longitudinal and the circular musculature, are well developed and of about equal thickness in the anterior part of the collar that encloses the proboscis neck; farther caudally the circular musculature disappears altogether and the external longitudinal muscle layer becomes very thin, much thinner than the internal musculature along the wall of the buccal cavity. The latter is, as usual, interrupted along the dorsal side of the collar nerve cord; the muscles of the perihaemal cavities at the ventral side of the nerve cord here supplement the internal longitudinal musculature (fig. 54). Dorsally the internal longitudinal muscle fibres are attached to the proboscis skeleton, and here the collar coelom sends forward two finger-like extensions, filled with longitudinal muscle fibres, that penetrate deeply into the proboscis neck (fig. 51). To the proboscis skeleton are also attached the muscle fibres that spread out along the anterior funnel-like surface of the collar and here form an internal longitudinal muscle layer. This layer is only thin in *B. hydrocephalus*, at most as thick as either the external longitudinal or external circular layer at the same level. An internal circular layer along the anterior surface of the collar could not be found. The radial muscle fibres, traversing the coelomic cavity between the outside of the collar and the funnel-like anterior surface or, more posteriorly, between the epidermis and the wall of the buccal cavity, are not very numerous and rather thin in *B. hydrocephalus.*

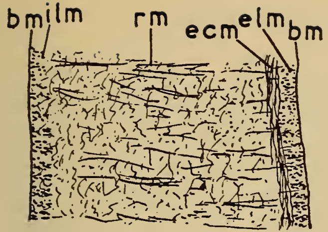
In *B. studiosorum* the anterior part of the collar in front of the connection between the proboscis and the collar has not the form of a funnel but more that of a hollow cylinder surrounding the proboscis. The external longitudinal and circular muscle layers are slightly stronger than in *B. hydrocephalus* (fig. 61). The internal longitudinal musculature, however, is very strong, not only in the posterior part of the collar along the buccal cavity but also in the anterior cylinder-like part. Here the internal longitudinal musculature forms a layer at least as thick as the external longitudinal and circular together. Usually in Enteropneusta the internal longitudinal muscle fibres stop at the vascular fold surrounding the buccal cavity, and the internal fibres along the anterior funnel-like wall of the collar form another set, spreading out from the proboscis skeleton. But in *B. studiosorum* the internal longitudinal musculature does not stop at the vascular fold, but is continuous with the layer along the inside of the cylinder. Only at the dorsal side the broad thin crura of the skeleton intersect this muscle layer, and the fibres are attached to both sides of the crura. Finger-like extensions of the collar coelom into the proboscis neck, in which otherwise a great part of the muscle fibres arise, are absent in *B. studiosorum*, not only because there is no real proboscis neck, but also because of the continuity of the internal longitudinal musculature in front of and behind the attachment of the proboscis. As in *B. numeensis* and *B. aurantiacus*, longitudinal muscle fibres as well as radial fibres are also found dorsally to the nerve cord, though the layer here is not very thick. The radial musculature between the inner and the outer wall of the cylinder is much stronger in *B. studiosorum* than in *B. hydrocephalus*. Not only are the fibres thicker but they are also more numerous. In the peripheral half of their course they form irregular bundles and there are open spaces between the bundles, whereas in the central half they run independently and are embedded in connective tissue. These open spaces, filled with coelomic fluid which probably is just water, apparently make the action of the musculature easier. In *B. hydrocephalus* the whole coelomic cavity is filled with loose connective tissue (fig. 60). The action of the radial musculature seems to be antagonistic to both the circular and longitudinal musculature. Upon contraction of the radial fibres the outer and inner walls of the cylinder approach each other, so that the cylinder either has to become longer or get a greater diameter. The first will happen if the circular musculature is contracted and the longitudinal relaxed, and the second if the longitudinal is contracted and the circular relaxed.

As in many Ptychoderidae the dorsal mesentery of *B. hydrocephalus* is absent in the anterior part of the collar and starts only at the back of the first dorsal nerve root. But whereas in one specimen it is complete from there to the end of the collar, in the other sectioned specimen it stops again some way behind the last nerve root and is reduced then to a broader or narrower vascular fold along the dorsal side of the collar nerve cord, and only over a short distance near the hind end of the collar is it complete again. In this same specimen also the ventral mesentery is represented by a broad vascular fold hanging down from the wall of the buccal cavity, and it is only in the posterior part of the collar that this fold attaches itself to the basal membrane of the epidermis, thereby forming a complete ventral mesentery. In the other specimen the vascular fold extends over a shorter distance and therefore the ventral mesentery is longer.

In *B. studiosorum* the dorsal mesentery is greatly reduced. In the long anterior part of the collar it is absent altogether, neither does it start at the back of one of the dorsal roots. There is a vascular fold, containing the epineural vessel, caudal to the last nerve root, and this vessel gives off a few side branches that run free through the coelomic cavity to the epidermis; only near the posterior end of the collar a dorsal mesentery is present. In the ventral mid-line a broad and complicated vascular fold hangs down from the wall of the buccal cavity, but it connects with the basal membrane of the epidermis only near the posterior end of the collar, thereby establishing a short ventral mesentery.

The tops of the perihaemal cavities, applied to each other, are found at the level or slightly in front of the proboscis pore in *B. hydrocephalus* (fig. 51). Except for some small openings ventral to the dorsal vessel the two cavities are quite separated from each other (fig. 55). In *B. studiosorum* the perihaemal cavities also reach the level of the proboscis pore, but on account of the absence of a proboscis neck, the pore is situated far forwards in respect to the other proboscis organs; the perihaemal cavities extend in frontal direction quite a distance along the dorsal side of the pericardium and therefore well in front of the sinus venosus (fig. 52). There is hardly a sinus venosus in this species; the dorsal blood-vessel of the collar is directly continuous with the dorsal vein of the proboscis that is situated between the anterior ends of the perihaemal cavities and splits up into two dorso-lateral veins in front of these cavities. Near the posterior end of the pericardium this dorso-median vessel gives off two branches that connect along the sides of the pericardium with the central blood space. As in *B. hydrocephalus* the perihaemal cavities of *B. studiosorum* are only connected with each other along a narrow opening at the ventral side of the dorsal vessel (fig. 58).

In *B. hydrocephalus* the peripharyngeal cavities, surrounding the buccal cavity, are quite separated from the perihaemal cavities

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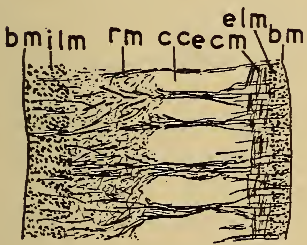


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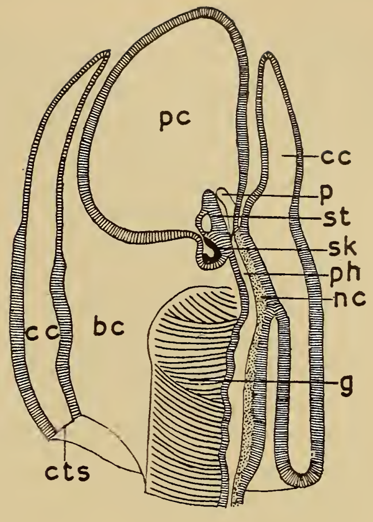


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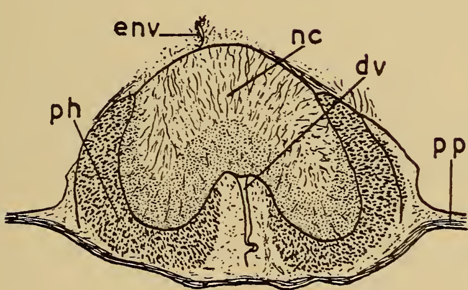


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FIG. 60.—*Balanoglossus hydrocephalus* n. sp. Part of a cross-section through the anterior region of the collar. × 50.

FIGS. 61–63.—*Balanoglossus studiosorum* n. sp. 61. Part of a cross-section through the anterior region of the collar. × 50. 62. Cross-section of the collar nerve cord and surrounding structures. × 36. 63. Median section of the proboscis and collar. × 3.

*bc*, buccal cavity. *bm*, basal membrane of the epidermis. *cc*, collar coelomic cavity. *cts*, collar-trunk-septum. *dv*, dorsal vessel. *ecm*, external circular musculature. *elm*, external longitudinal musculature. *env*, epineural vessel. *g*, branchial basket pulled high up into the collar. *ilm*, internal longitudinal musculature. *nc*, nerve cord. *p*, pericardium. *pc*, proboscis coelom. *ph*, perihaemal cavity. *pp*, peripharyngeal cavity. *rm*, radial muscle fibres. *sk*, skeleton. *st*, stomochord.

(fig. 54). They extend to the dorsal mid-line along the ventral side of the perihaemal cavities, and here a distinct limiting membrane can be seen between the peripharyngeal and perihaemal cavities. In *B. studiosorum*, on the other hand, the peripharyngeal cavities have fused with the perihaemal cavities (fig. 62). The circular musculature of the former can be seen running along the ventral wall of the latter. In one of the two sectioned specimens the peripharyngeal cavities widen out along the lateral sides of the perihaemal cavities, and some longitudinal muscle fibres are found here in the peripharyngeal cavities. A distinct limiting membrane separates the cavities here, but this membrane does not reach the ventral wall.

The collar pores of both species have the usual appearance found in the Ptychoderidae, so that their wall is not very thick and the nuclei in the cells form approximately a single row. The dorsal fold of the pore is apparent in both species, only in *B. hydrocephalus* this fold is much deeper than in *B. studiosorum.*

An anterior epidermic pouch, dorsal to the place of the anterior neuropore, is quite distinct, although shallow, in *B. hydrocephalus* (fig. 55), but in *B. studiosorum* there is no trace of such a pouch.

As in nearly all species of *Balanoglossus* a central canal in the collar nerve cord is absent, but there are medullary cavities, and these are wider and more numerous in *B. hydrocephalus* than in *B. studiosorum.* Also at the anterior end of the cord there is no trace of a canal, and therefore also the anterior neuropore is absent. A central canal with a posterior neuropore is present in both sectioned specimens of *B. studiosorum* and in one of *B. hydrocephalus*; in the other specimen of the latter species the nerve cord is solid up to its posterior end. This canal is present before there is any indication of the splitting up of the collar nerve cord into the dorsal nerve of the trunk and the circular nerves, therefore it cannot be considered to be a simple epidermic depression. In the two specimens of *B. hydrocephalus* there are 3 and 4 dorsal nerve roots, all of which are rather thin. The fourth root of the second specimen is very far back near the caudal end of the collar. In one specimen of *B. studiosorum* I find 2 nerve roots, the anterior of which is very thick and has a wide central canal that ends blindly at both sides. In the other specimen there are 3 nerve roots, the first and last of which also have a similar central canal. The first nerve root is situated far anteriorly, at the anterior end of the nerve cord.

In a species like *B. hydrocephalus* with a short collar, the anterior surface of which is funnel-shaped, there is no doubt about the position of the mouth opening. It is found at the bottom of the funnel, where the proboscis neck is fixed to the collar or more exactly where the stomochord opens into the buccal cavity. Here the epidermis of the anterior surface of the collar is continued into the wall of the buccal cavity, and there is a sudden change in the character of the epithelium. Whereas the epidermis is very thin and the nuclei of the cells are scattered over the whole thickness of the epithelium, the wall of the buccal cavity is very thick and the nuclei are found in a thin layer near the surface; a few very small glandular cells, stained very darkly by haematoxylin, are found near the surface (fig. 54). In *B. studiosorum,* on the other hand, the proboscis is connected with the collar about in the middle of the latter, and the part of the collar in front of this connection is not funnel-shaped but cylindrical (fig. 63). In general form, therefore, there is hardly any difference between the part of the collar in front of and behind the connection, and it would at first sight be possible to maintain that the mouth opening is situated at the anterior end of the collar. But in *B. studiosorum* there is a sudden change in the character of the epithelium at the level of the opening of the stomochord, and this clearly indicates the position of the mouth opening. Not only is the wall of the buccal cavity again much thicker than the epidermis at the inside of the anterior end of the cylinder, but the nerve-fibre layer, which as usual is rather thick in the epidermis of the collar, suddenly becomes very thin just where the buccal epithelium begins.

*Trunk.*—In many Enteropneusta, e.g. *B. stephensoni,* there is a more or less deep groove along the ventral and dorsal mid-line in the branchial region, and the dorsal and ventral nerve cords are found under these grooves. In *B. hydrocephalus* there is such a groove in the dorsal mid-line, but the nerve cord, with the cell layer covering it, is at least as thick as the epidermis alongside of it (fig. 64). In the ventral mid-line there is not even a groove at all, and the nerve cord protrudes. On the other hand, the ventral nerve cord of *B. studiosorum* is found in a median groove and, together with the covering cell layer, is much thinner than the adjacent epidermis (fig. 65). There is also a shallow groove in the dorsal mid-line in this species, but the nerve cord here is not thinner than the epidermis at its sides, and as the glandular cells in the epidermis are swollen considerably, the nerve cord may even protrude here, when the glandular cells are not hypertrophied.

The epidermis of the branchial region contains many glandular cells in both species, some of which are darkly stained by haematoxylin

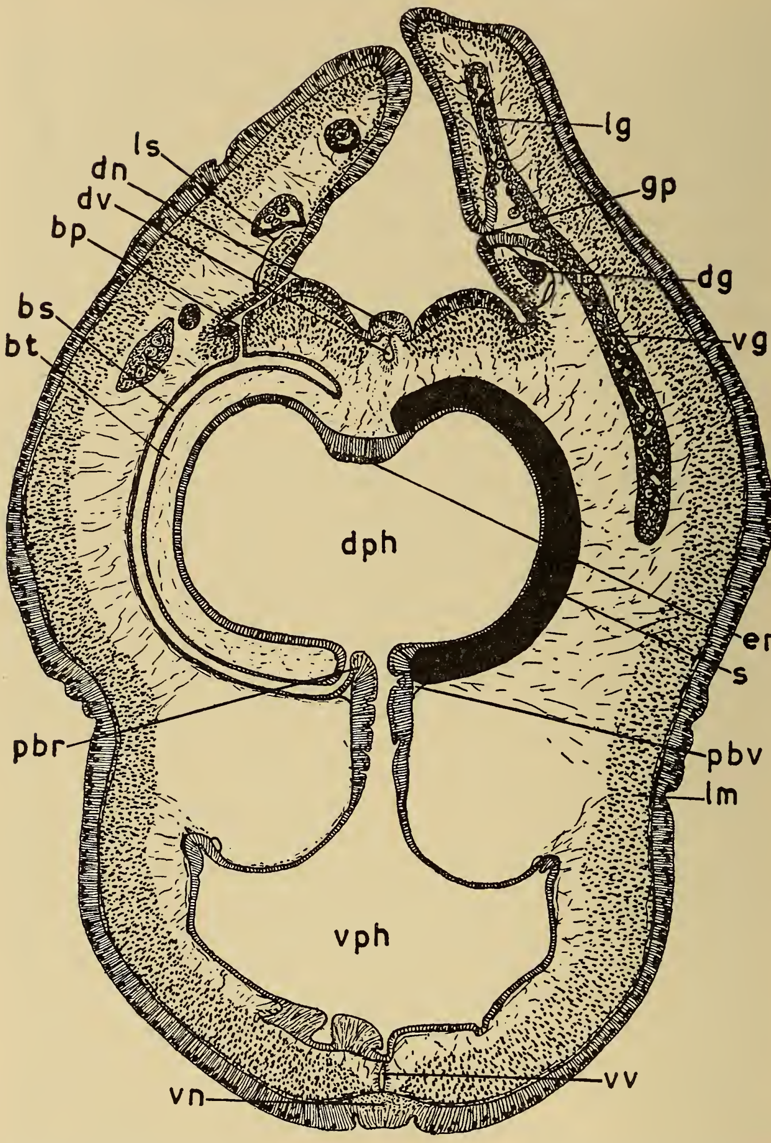



FIG. 64.—*Balanoglossus hydrocephalus* n. sp. Cross-section of the branchial region, partly (branchial basket and gonad at side) composed from a number of sections. × 12.

*bp*, branchial pore. *bs*, branchial sac. *bt*, branchial tongue. *dg*, dorsal branch of gonad. *dn*, dorsal nerve cord. *dph*, dorsal pharynx. *dv*, dorsal vessel. *er*, epibranchial ridge. *gp*, genital pore. *lg*, lateral branch of gonad. *lm*, longitudinal musculature. *ls*, lateral septum. *pbr*, parabranchial ridge. *pbv*, parabranchial vessel. *s*, branchial septum. *vg*, ventral branch of gonad. *vn*, ventral nerve cord. *vph*, ventral pharynx. *vv*, ventral vessel.

and are found in the external one- or two-thirds of the epidermis only. In *B. studiosorum* especially these cells form a nearly continuous layer in the epidermis. In this species deep slits occur in the epidermis running at regular intervals from fronto-dorsally to caudo-ventrally

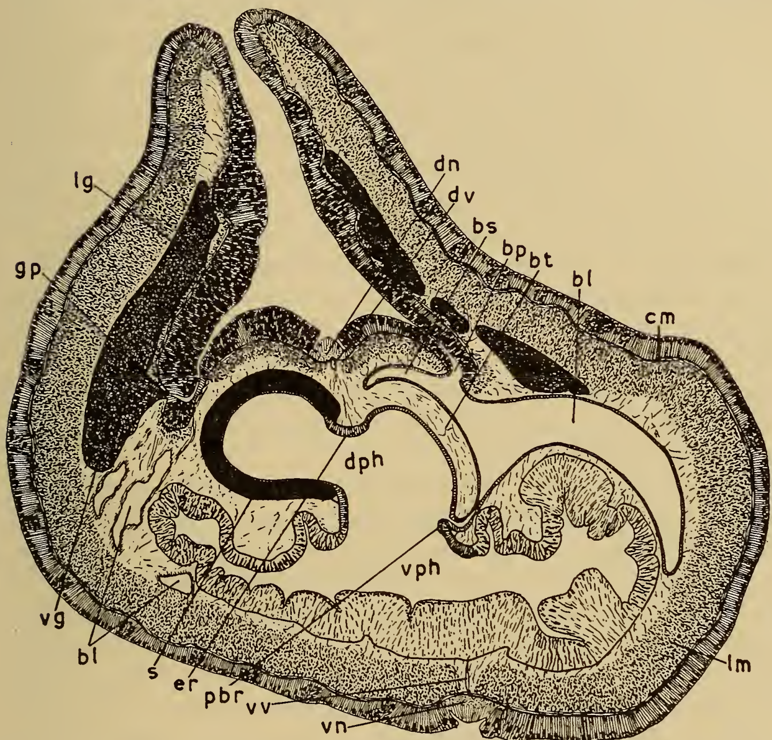



Fig. 65.—*Balanoglossus studiosorum* n. sp. Cross-section of the branchial region, partly (branchial basket, blind-sac at right side, and gonad at left side of figure) composed from a number of sections. × 8.

*bl*, blind-sac of branchial sac. *bp*, branchial pore. *bs*, branchial sac. *bt*, branchial tongue. *cm*, circular musculature. *dn*, dorsal nerve cord. *dph*, dorsal pharynx. *dv*, dorsal vessel. *er*, epibranchial ridge. *gp*, genital pore. *lg*, lateral gonad. *lm*, longitudinal musculature. *pbr*, parabranchial ridge. *s*, branchial septum. *vg*, ventral branch of gonad. *vn*, ventral nerve cord. *vph*, ventral pharynx. *vv*, ventral vessel.

(figs. 65 and 67). Darkly stained glandular cells are found along these slits, and these reach the basal membrane because the nerve-fibre layer underneath the slits is reduced to a minimum. These slits are so deep that the basal membrane of the epidermis assumes a wavy course. There are also many eosinophil cells in both species, and these are found throughout the whole thickness of the epidermis.

The dorsal side of the body and the inside of the genital wings are even richer in glandular cells than the outside of the wings and the ventral side of the body, and at the dorsal side the cells stained with haematoxylin extend over the whole thickness of the epidermis.

The external circular muscle layer is better developed in *B. studiosorum* than in *B. hydrocephalus.* It is not only slightly thicker in the former species, but it is also continuous and quite distinct along the inside of the genital wings, whereas in *B. hydrocephalus* it becomes so thin that only here and there can a few fibres be distinguished. The longitudinal musculature also is better developed in *B. studiosorum* than in *B. hydrocephalus*, especially on the ventral side of the body and the outside of the wings. On the dorsal side of the body of *B. studiosorum* the layer of longitudinal muscle fibres reaches about half the thickness of that of the ventral side of the body, whereas in *B. hydrocephalus* it is of about equal thickness dorsally and ventrally. As usual, the longitudinal musculature is poorly developed on the inside of the wings in both species. The muscle fibres in *B. studiosorum* are thinner but by far more numerous than in *B. hydrocephalus.*

The dorsal mesentery presumably is absent in the greater part of the branchial region in both species. As, however, the whole branchial region was not sectioned, this cannot be said with certainty, but near the hind end of the branchial region the dorsal mesentery is complete. The dorsal vessel in the branchial region runs along the inside of the epidermis, and the connections between this vessel and the branchial vessels go freely through the coelomic cavity. The ventral mesentery is complete in *B. hydrocephalus*, but in *B. studiosorum* it is not complete throughout; sometimes it is attached to the alimentary canal only, leaving an opening between the right and left coelomic cavities near the epidermis, and sometimes it is attached to the basal membrane of the epidermis only and free from the alimentary canal.

In *B. studiosorum* the ventral, digestive part of the pharynx is wider than the dorsal branchial part (fig. 65). The wall of the ventral pharynx is very thick throughout, and much thicker than the parabranchial or limiting ridges between the dorsal and ventral parts. Therefore the limiting ridges are not very conspicuous in this species. On the other hand, in *B. hydrocephalus* the limiting ridges are well pronounced (fig. 64). In the smaller of the two specimens of this species the dorsal pharynx is about twice the size of the ventral, but in the larger specimen the ventral part has at least the same dimensions as the dorsal (fig. 64). The wall of the ventral pharynx exhibits a noteworthy peculiarity in *B. hydrocephalus.* According to a figure of *B. clavigerus,* given by Spengel, the dorso-lateral walls of the digestive pharynx are much thinner than the ventro-lateral walls, the whole of this part of the alimentary canal being about quadrangular, and the transition between the thicker and thinner epithelium is very sudden at the lateral edges of the canal. In his description of the species Spengel does not mention this difference in thickness. A similar condition occurs in *B. hydrocephalus,* in which the ventral pharynx is also nearly quadrangular in cross-section. But *B. hydrocephalus* differs from *B. clavigerus* in that the ventro-lateral walls are thin and the dorso-lateral thick (fig. 66). In the ventral mid-line is a groove and here the wall is thicker than the ventro-lateral wall. This difference in thickness was especially clear in the small specimen; in the bigger one the dorso-lateral walls are also rather thin except near the limiting ridge and along the lateral edges (fig. 64). At regular distances a narrow strip of thicker epithelium crosses the thin ventro-lateral wall between the lateral edge and the ventral mid-line. This thicker epithelium does not protrude into the lumen of the pharynx but into the coelomic cavity; it resembles the beams supporting a floor. In the larger specimen it appeared that these strips are in reality deep and very narrow grooves, but as they run in the transverse plane it is difficult to see this in transverse sections.

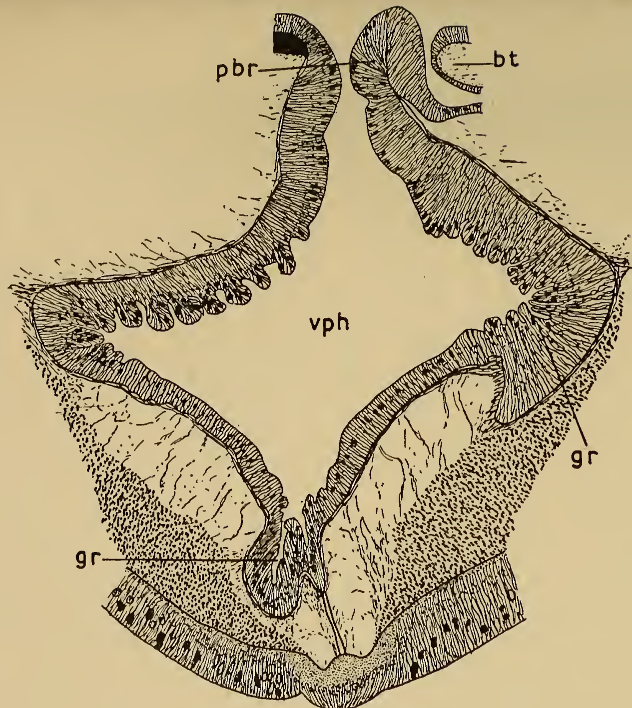
In both species the branchial pores are too small to be visible externally, therefore it was not possible to count the number of gills directly. But by counting the number of pores in the serial sections it was found that in *B. studiosorum* there occur 32 pores over a length of 4·5 mm. of the branchial region. In the larger specimen of *B. hydrocephalus* 21 pores were counted in a length of 4 mm., but in the smaller specimen the gills are by far more crowded as 21 pores were counted in only 1·65 mm. This cannot be due to contraction only, although it may have been possible that the smaller specimen was more contracted than the larger. Apparently the branchial region extends during growth, not only by an increase in the number of gills at the posterior end of the row, but also by an increase in size of the individual gills, which results in an increase in the distance between the succeeding pores. The estimation of the total number of gills from the numbers given above is rather unreliable, but it is the only method of approach. In the well-preserved and large specimen of *B. hydrocephalus* the branchial region has a total length of 58 mm., and with 21 pores in 4 mm. this would give a total number of about 300 gills. In *B. studiosorum* it becomes even more difficult, because, as previously mentioned, it is hardly possible to distinguish the posterior end of the branchial region in this species. In a large specimen, in which this could be done, this region was only 22 mm. long, and that would give a total number of about 160 gills.

The epibranchial ridge of *B. hydrocephalus* is made up of a high, convex epithelium (fig. 64). In the middle of the ridge is a number of small glandular cells stained by haematoxylin; in the large specimen this row of glandular cells is broader than in the small one. This central strip with glandular cells is flanked by rows of undifferentiated high epithelial cells, and here the nuclei are situated in a regular row near the free ends of the cells, with some scattered nuclei in the basal half of the epithelium. In *B. studiosorum* the epibranchial ridge is much thinner than in *B. hydrocephalus* and it is hardly convex (fig. 65); glandular cells occur over the whole breadth of the ridge, and all nuclei are scattered.

As usual, the tongue protrudes farther into the pharyngeal cavity than the septum. The septa are narrow, and the epithelium on their back is lower than that on the backs of the tongues; in *B. hydrocephalus* the thickness of this epithelium on the tongues reaches even twice the thickness of that on the septa; in *B. studiosorum* the difference is less. In conformity with the structure of the epibranchial ridge, glandular cells are found over the whole breadth of the back of the tongue in *B. studiosorum*, whereas in *B. hydrocephalus* there are two rows of glandular cells separated from each other by a central row of undifferentiated cells. On the narrow backs of the septa a few glandular cells are also found.

The number of synapticula is the same in both species; it is about 20.

The branchial sacs of *B. hydrocephalus* are rather spacious, and although the wall between these sacs and the coelomic cavity is very much folded, ventral blind-sacs to the branchial sacs are absent (fig. 64). In *B. studiosorum*, as in *B. numeensis* and some other species, these blind-sacs are well developed and reach the ventral wall of the digestive part of the pharynx (fig. 65). Also, at the dorsal side of the branchial sacs blind-sacs are formed that extend into the base of the genital wings, lying there in between or external to the gonads (fig. 68). Small glandular cells occur in the thin walls of the branchial sacs of both species; in *B. hydrocephalus* these glandular cells appear to be more numerous than in *B. studiosorum*. The

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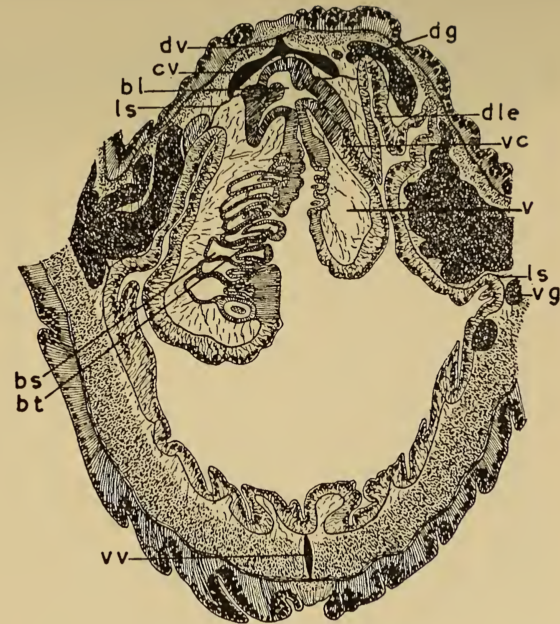


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FIG. 66.—*Balanoglossus hydrocephalus* n. sp. Cross-section of the ventral part of pharynx. ×45.

FIG. 67.—*Balanoglossus studiosorum* n. sp. Cross-section at the level of the branchio-genital transition; the genital wings are omitted. ×9.

*bl*, dorsal blind-sac of postbranchial canal. *bs*, branchial sac. *bt*, branchial tongue. *cv*, commissural vessel. *dg*, dorsal branch of gonad. *dle*, dorso-lateral extension of ventral pharynx. *dv*, dorsal vessel. *gr*, transverse groove. *ls*, lateral septum. *pbr*, parabranchial ridge. *v*, ventral valve. *vc*, ventral connection between the dorso-lateral extension and the dorsal blind-sac. *vg*, ventral branch of gonad. *vph*, ventral pharynx. *vv*, ventral vessel.

branchial pores of *B. hydrocephalus* are very small, and a short canal, piercing through the longitudinal musculature, connects the branchial sac with the pore. In *B. studiosorum* such a canal is absent; the sac itself touches the epidermic basal membrane directly, and the pores on the whole are wider than in *B. hydrocephalus.*

In *B. studiosorum* the first two gills, with the collar canal, open to the exterior by a common pore. The peripheral part of the septum between the first two gills is missing, and in this way these two sacs communicate with each other. Similarly in *B. misakiensis* the first four gill-sacs are connected and have a common pore. In *B. hydrocephalus,* as in most species of this genus, the first branchial sacs do not communicate with each other and each sac has its own pore. As in *B. carnosus,* the first pore in both species is situated at the inside of the incipient genital wing, whereas in *B. capensis* and some other species this pore is at the outside of the wing and all the subsequent pores are at the inside.

The postbranchial canal exhibits some features of interest, all the more so as the two species differ from each other in this respect. In *B. hydrocephalus* the branchial pores are at the bottom of a deep groove, except at the posterior end of the branchial region, where the pores are higher up at the medial side of the groove. This branchial groove comes to a sudden end; it is even slightly prolonged at its caudal end as a small blind-sac, in which the last gill opens. Near the posterior end of the row the gills gradually become smaller, as a result of which the epibranchial and parabranchial ridges approach each other and finally fuse behind the last gill-pore. As the parabranchial ridges are lying close to each other in the branchial region, a narrow median slit-like extension of the wide ventral pharynx is the result of the fusion of the three ridges, much in the same way as described and figured by Maser for *B. clavigerus.* This narrow dorsomedian part of the gut corresponds to the postbranchial canal of other Ptychoderidae. The wall of this postbranchial canal retains the same structure as the parabranchial ridges and is therefore much thicker than the wall of the ventral pharynx or oesophagus. In *B. clavigerus* the postbranchial canal has a small blind-sac dorsal to the posterior gills; in other Ptychoderidae, as in most species of *Glossobalanus,* this blind-sac is much larger than in *B. clavigerus.* In *B. hydrocephalus* there is no trace of such a blind-sac. In the posterior part of the branchial region the lateral edges of the ventral pharynx turn in a dorsal direction and form two narrow dorsal extensions of this part of the gut as is shown in all Ptychoderidae.

These extensions become higher and higher, then their tops turn suddenly in medial direction and fuse with the dorsal end of the postbranchial canal. In this way there is formed on each side a coelomic blind-sac that extends into the oesophagus and that probably acts as a valve in the alimentary canal. The commissural vessels exhibit nothing of particular interest; they are simple transverse connections between the lateral and dorsal blood-vessels, running in the lateral septum and over a short distance, dorsal to the postbranchial canal, free through the coelom.

In *B. studiosorum* the hind end of the branchial region and the postbranchial canal are more complicated than in *B. hydrocephalus*. Further, the deep branchial groove does not gradually become shallower towards the posterior end of the branchial region, but it is suddenly separated from the surface and from there it continues in a caudal direction over a rather long distance in the form of a blind-sac. Quite a number of gills open into this blind-sac. In fig. 67, where some of the last gills are still visible, the blind-sacs have already disappeared; farther frontally they lie between the gills and the dorso-lateral extensions of the ventral pharynx. The postbranchial canal has a well-developed blind-sac, lying dorsal to the posterior gills and extending slightly beyond the caudal end of the branchial region. This blind-sac is clearly defined from the epibranchial and parabranchial ridges, because in the latter small glandular cells are found near the surface of the epithelium, whereas the epithelium of the blind-sac is darkly stained by numerous very narrow glandular cells extending over its whole thickness. The dorso-lateral extensions of the ventral pharynx form ridges increasing in height as in *B. hydrocephalus*; finally, they nearly reach the basal membrane of the epidermis. Already in the posterior end of the branchial region the dorsal blind-sac makes a connection with the two dorso-lateral extensions; this connection is, however, made at about the middle of the height of the extensions, so that a considerable part extends freely farther dorsally. By these connections there is formed a pair of coelomic blind-sacs, in which a part of the posterior gills is still visible (fig. 67). Just behind the branchial region the dorsal ends of the extensions turn to the mid-line and fuse with the top of the dorsal blind-sac, so that another pair of coelomic blind-sacs, lying dorsally to the first, is formed. Both pairs of coelomic blind-sacs protrude backwards into the oesophagus, but as they are small and the oesophagus here is wide, they can hardly act as valves. In *B. hydrocephalus* these valves really block up the whole lumen of the oesophagus. Each commissural vessel makes two connections with the dorsal blood-vessel.

As only one specimen of each species was cut into serial sections at the level of the postbranchial canal, it is difficult to be certain about the specific value of the form of the postbranchial canal and the valves. *B. hydrocephalus* is almost in complete agreement with *B. clavigerus* in this respect, and there seems to be no doubt that the form of the postbranchial canal, as described above, is characteristic for the species. The two pairs of coelomic blind-sacs, as found in *B. studiosorum*, are not known to exist in any other species. But the animal is quite symmetrical, which makes it at least likely that the two pairs of blind-sacs are a normal feature and of specific value.

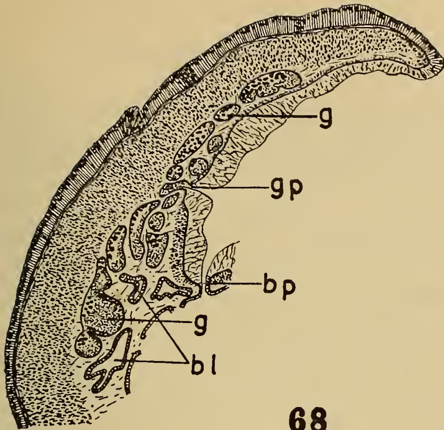
The lateral septum of *B. hydrocephalus* extends very far forwards into the branchial region (fig. 64). In most species of *Balanoglossus* the lateral septum extends only over a very short distance into the branchial region; for instance, in *B. capensis* it stops already at the level of the 10th gill-slit from behind. In *B. stephensoni*, with its very short branchial region, the lateral septum reaches about the middle of that region. But in *B. hydrocephalus* this septum extends over nearly the whole length of the branchial region. As previously stated, there may be 300 gills in this species, and I found the anterior end of the dorsal coelomic chamber and therefore of the lateral septum at the level of the 13th branchial pore. How far the septum extends into the branchial region of *B. studiosorum* has not been ascertained. In the two series of sections of the anterior part of the body, which extends a good distance into the branchial region, no lateral septum is present, but it was found over the whole length of a series of the branchio-genital transitional zone.

The row of gonads in *B. hydrocephalus* begins already a short distance behind the collar, the first genital pore being found near the 8th branchial pore. The gonads of the branchial region are very slender, having much the same form as those of *B. clavigerus*; they do not nearly fill the open coelomic space of the genital wings (fig. 64). The lateral lobe of the gonad nearly reaches the edge of the genital wing, therefore the peripheral part of the wing is rigid and not turned in as in *B. stephensoni* and especially in *Glossobalanus marginatus*, as described by Meek. The ventral genital lobe goes down into the body cavity to about half of the height of the branchial basket. A distinct though narrow lumen could be seen in the ovary of the larger specimen, containing many ripe eggs. In the small specimen only a few egg-cells were present, but a great amount of yolk filled the whole gonads, so that no lumen was visible. In the posterior part of the branchial region the gonads are much larger and fill up the whole coelomic space in the wings. The gonads are also lobed here, whereas more anteriorly they consist of simple lateral and ventral branches. But secondary genital pores, as are found in some other species of *Balanoglossus*, are absent in *B. hydrocephalus*. In most species of *Balanoglossus* dorsal branches of the gonads, lying in the dorsal coelomic chamber, occur only in the genital region and in the most posterior part of the branchial region. But just as the lateral septum extends so far forward in *B. hydrocephalus*, the gonads have dorsal branches nearly from the anterior end of the row (fig. 64). The first dorsal branch, although small, was found at the level of the 25th branchial pore. As the genital pores are rather high up on the inside of the genital wings and consequently the lateral septum is rather broad and the dorsal coelomic chamber rather wide, these dorsal branches of the gonads soon reach a considerable size. The gonads have here three branches, a dorsal, a lateral, and a ventral. In other species of *Balanoglossus* these three branches can be found in the genital region. But in this region only two branches, the dorsal and the lateral, occur in *B. hydrocephalus*. In cross-sections the lateral septum from its insertion to the intestinal wall can be seen going in lateral direction, and then, closely applied to the inside of the external longitudinal musculature, it enters the wing and follows this course up to the level of the genital pore. Here it turns to the inner side of the wing, where it is inserted along the row of genital pores. Therefore branches of the gonads are found only peripherally to the genital pores and in the dorsal coelomic chamber.

The row of gonads begins in *B. studiosorum* at the same level as in *B. hydrocephalus*, *i.e.* near the 8th or 9th branchial pore. A very small gonad was observed in front of the first genital pore in one specimen, but this gonad does not seem to open to the exterior, at least no pore could be found. The ovaries of the branchial region are much stouter than in *B. hydrocephalus*; there is hardly any room left in the coelomic cavity between the gonads and the longitudinal musculature (fig. 65). But the testes are more slender and repeatedly branched, whereas the ovaries form only blunt lobes. Although the gonads do not quite reach the peripheral end of the genital wings, the top of the wing, nevertheless, is not turned inwards like a loose flap; because of the thickness of the longitudinal muscle layer this part of the wing is rigid. In a ventral direction the gonads reach nearly to the level of the digestive part of the pharynx. But in the frontal end of the row the ventral branch of the gonad is small and short, as its place is occupied by the blind-sacs of the gills (fig. 65). In the female I find the genital pore much nearer the base of the wing than in the male or than in *B. hydrocephalus.* Secondary genital pores could not be found in the region of the branchio-genital transition. In conformity with most species of *Balanoglossus,* but distinct from *B. hydrocephalus,* the gonads have well-developed ventral branches here; the lateral septum could be followed from its insertion in the intestinal wall peripherally, where it lies between the ventral and dorsal branches of the gonads.

When the testes are quite ripe and full of spermatozoa they exhibit a remarkable form in *B. studiosorum* (figs. 68 and 69). They are profusely branched, and each branch or duct ends in a swollen vesicle filled with spermatozoa. These end vesicles are all turned towards the medial side of the wing, the ducts are along the lateral side applied to the external longitudinal muscle layer along the lateral wall of the genital wing. The yolk cells are well separated from the primary genital cells; the former are found in the ducts and the part of the wall of the end vesicle near the ducts, the rest of the wall of the end vesicles being formed by genital cells. In *B. misakiensis* a similar clear separation between the yolk and the genital cells was found, but here the yolk cells are away from the ducts, and the genital cells form the wall at the side of the ducts.

As I wanted to make out what causes the regular dark rings that make the abdominal region of *B. hydrocephalus* so conspicuous, a part of this region with the caudal region was cut into serial sections. It was found that the epidermis shows here alternating regions that are quite different from each other (fig. 70). In some parts the epidermis is very thin and composed of almost cubical cells. Suddenly these very thin stretches become continuous with parts in which the epidermis is much higher, about five times as high as the thin parts. In these thick regions of the epidermis the nuclei form a dense regular layer in the middle of the cells, and many glandular cells are found in the outer half of the epidermis. The circular musculature under the basal membrane of the epidermis is quite distinct and about as thick as the thin regions of the epidermis; it is continuous and of equal thickness over its whole course. The longitudinal musculature exhibits a remarkable arrangement. It forms a rather thick layer underneath the thick epidermal parts, but it is absent underneath the thin epidermis. It does not even quite reach the edges of the thick epidermal zones. The dark rings, visible externally, are most

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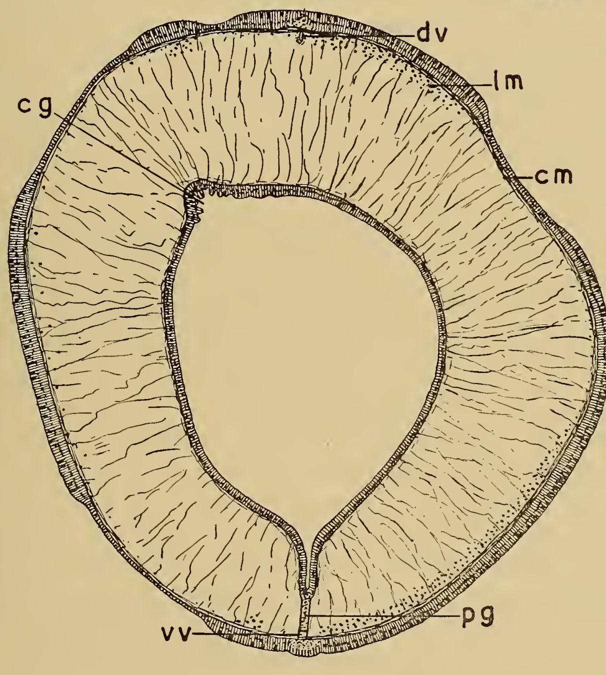


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FIGS. 68, 69.—*Balanoglossus studiosorum* n. sp. 68. Cross-section of a genital wing of male. ×10. 69. Part of testis of fig. 68 further enlarged. ×50.

FIG. 70.—*Balanoglossus hydrocephalus* n. sp. Cross-section of the abdominal region. ×30.

*bl*, blind-sacs of the branchial sacs. *bp*, branchial pore. *cg*, ciliary groove. *cm*, circular musculature. *dv*, dorsal vessel. *g*, testis. *ge*, germinal epithelium. *gp*, genital pore. *lm*, longitudinal musculature. *pg*, pygochord. *sp*, spermatozoa. *vv*, ventral vessel. *y*, yolk cells.

likely formed by the thick epidermis with its many glandular cells; therefore the longitudinal musculature is broken up into rings, which are separated from each other by stretches without these muscle fibres.

A dorsal mesentery is entirely absent in the caudal end of the animal, and the place of the ventral mesentery is occupied by the pygochord. So the latter structure is not confined to the caudal region, but is also found over some length in the abdominal region. It is not separated from the intestinal wall by a limiting membrane, and it exhibits much the same form as that described by Dakin in *Ptychodera flava* (*Pt. pelsarti*) but differs in that it is not swollen ventrally. The pygochord does not show any interruptions, and it is only absent at the extreme caudal end of the animal.

A ciliated groove is conspicuous at one side of the intestine only, occurring for some distance on the right and for some distance on the left side. On the other side it is only indicated by a thickening of the intestinal wall, where the free surface of the epithelium is undulated. This thicker undulating epithelium extends into the caudal region, and finally near the anus it forms the whole wall of the intestine.

### *Diagnosis of* Balanoglossus hydrocephalus.

Total length about 30 cm. Proboscis conical, long, up to 20 mm., collar less than half the length of the proboscis, and at most as long as it is broad; branchial region and genital region of about equal length, 30–40 mm.; liver region long, as long as or longer than branchial region. Posterior end of branchial basket well indicated. Genital wings fused with posterior rim of collar, wings narrow at their anterior end, so that their free edges are separated by a short distance from each other; they reach their maximum breadth near the hind end of the branchial region, and decrease gradually from there; they end abruptly at the beginning of the liver region; no transitional zone present. The liver region is well delimited anteriorly; the saccules in two regular rows, each saccule extends over the whole breadth of the row. At the anterior end the liver saccules soon reach their maximum size and in the first half of the region they hardly decrease in size; in the second half they gradually become smaller, but they are closely applied to each other; it is often hard to determine the hind end of the liver region; there may be about 200 liver saccules. Abdominal region with regular dark rings.

*Proboscis.*—Circular muscle of equal thickness as nerve-fibre layer;

it does not form a sphincter at the base of the proboscis. Longitudinal musculature strongly developed, fibres more numerous in peripheral than in central part of proboscis. Dorso-ventral muscle-plate well developed, but not extending in front of the central proboscis organs. Large open proboscis cavity in posterior two-thirds of proboscis. Ventral septum extends to end of coelomic blind-sacs. Only left dorsal coelom opens by proboscis pore. No central lumen in body of stomochord; large ventro-lateral blind-pouches not connected with each other; no dorso-lateral blind-pouches. Glomerulus large, extending in front of stomochord and caudally to level of ventro-lateral blind-pouches; the two halves separated from each other by the dorso-ventral muscle-plate; dorsal glomerulus present. Skeleton well developed, with long and prominent keel and thick end-plate.

*Collar.*—External longitudinal and circular musculature of about equal thickness. Longitudinal musculature along anterior surface of collar thin, and circular muscles here absent. Radial muscle fibres thin and not very numerous. Coelomic cavity almost entirely filled with connective tissue. Dorsal mesentery starts at first dorsal nerve root; from there it may be complete or not to the end of the collar. Ventral mesentery not complete, of varying length. Perihaemal cavities reaching to proboscis pore, almost entirely separated from each other. Peripharyngeal cavities separated from perihaemal cavities. Collar pores with thin epithelium and deep dorsal fold. Nerve cord with anterior epidermic pouch, no anterior neuropore, posterior neuropore may be present, with numerous medullary cavities and 3 or 4 dorsal nerve roots.

*Trunk.*—No grooves in dorsal and ventral mid-line of branchial region. External circular muscle layer thin, hardly present on inside of genital wings. Longitudinal musculature on dorsal side of body of about equal thickness as that of the ventral side; muscle fibres thick and not very numerous. Dorsal mesentery absent in anterior part of branchial region, present in posterior part; ventral mesentery complete. Parabranchial ridges well pronounced; ventral pharynx smaller than or equal to dorsal pharynx; ventral pharynx with thin wall and thick cross-bars formed by deep grooves along ventro-lateral sides. Number of gills probably about 300; 20 synapticula. Epibranchial ridge high and convex with a strip of glandular cells in the middle. Tongues more protruding than septa; no ventral blind-sacs to the branchial sacs; branchial pores very small; first branchial sacs open to the exterior independently of each other. Postbranchial canal without dorsal blind-sac. Lateral septum extends nearly over whole branchial region, begins near 13th branchial pore. First genital pore near 8th branchial pore; lateral lobe of gonads nearly reaches the edge of the genital wing; no secondary genital pores; in the branchial region the gonads have dorsal, ventral, and lateral branches; no lateral branches in genital region.

### *Diagnosis of* Balanoglossus studiosorum.

Total length about 30 cm. Proboscis short, extending a few mm. only from the collar; collar long, up to 20 mm., and about twice as long as broad; branchial region short, 22 mm., but hind end of branchial region hardly distinguishable; whole branchio-genital region about 150 mm. long; liver region short, 10–20 mm. long. Genital wings fused with posterior rim of collar; they are here already so broad that their free edges touch each other; they increase rapidly in breadth, keep the same breadth over the greatest length, and become narrower only near their hind end; wings end abruptly just at beginning of liver region; no transitional region present. Liver saccules of irregular form; anterior end of liver region well defined; posteriorly the broad row of saccules ends suddenly but may be followed by a row of small, regularly arranged saccules that gradually become smaller.

*Proboscis.*—Circular musculature very thin, about one-third of nerve-fibre layer; it does not form a sphincter at the base of the proboscis. Longitudinal musculature poorly developed, concentrated along central core of connective tissue. Dorso-ventral muscle-plate almost entirely absent. Proboscis cavity greatly reduced, only in ventral blind-sacs and near proboscis pore. Ventral septum short and not reaching the end of the ventral blind-sacs; the latter large and extending beyond the end-plate of the skeleton; only the left dorsal coelom opens by proboscis pore. No central lumen in body of stomochord; ventral blind-pouches small, not connected with each other; dorso-lateral blind-pouches may be present; neck short and of irregular form. Glomerulus small; no dorsal glomerulus. Skeleton poorly developed; end-plate thin; body absent or very small; keel short but prominent; crura broad, thin, anteriorly concave.

*Collar.*—External longitudinal and circular musculature well developed and of equal thickness. Internal longitudinal musculature very strong, at least as thick as external longitudinal and circular together in anterior part of collar. Radial muscle fibres numerous and thick. Coelomic cavity rather open; connective tissue only in central part. Dorsal and ventral mesenteries only present near posterior end of collar. Perihaemal cavities reaching to proboscis pore, almost completely separated from each other. Peripharyngeal cavities not separated from perihaemal cavities. Collar pores with thin epithelium and small dorsal fold. Nerve cord without anterior epidermic pouch; without anterior but with posterior neuropore; with few medullary cavities and 2–3 dorsal nerve roots.

*Trunk.*—A groove in ventral mid-line of branchial region present, but hardly in dorsal mid-line. External circular muscle layer well developed also on the inside of the wings. Longitudinal musculature on the dorsal side of the body of about half the thickness of that of the ventral side; muscle fibres thin and very numerous. Dorsal mesentery absent in anterior part of branchial region, present in posterior part; ventral mesentery not complete everywhere. Parabranchial ridges thin; ventral pharynx wider than dorsal pharynx; ventral pharynx with very thick wall. Number of gills probably about 160; 20 synapticula. Epibranchial ridge thin and rather flat, with glandular cells over whole breadth. Tongues more protruding than septa; branchial sacs with large ventral blind-sacs, extending also dorsally into base of genital wings; branchial pores rather small; first 2 gills with common pore. Postbranchial canal with dorsal blind-sac; 2 pairs of valves formed by postbranchial canal. First genital pore near 8th or 9th branchial pore. Testes much branched, ovaries lobed. Lateral branch of gonad does not quite reach the top of the genital wings; no secondary genital pores; gonads with dorsal, lateral, and ventral branches in the genital region.

## Ptychodera flava Eschscholtz.

*Ptychodera flava*, ubiquitous in the tropical Indo-Pacific region, occurs also near Inyack Island, and this is the most south-westerly locality in which it has been found up till now. It occurs on a flat, to the south-west of the island, that is dry at low tide. A great number of small specimens were procured here by turning over stones.

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18. *Contributions to the Crustacean Fauna of South Africa.* XII. *Further Additions to the Tanaidacea, Isopoda, and Amphipoda, together with Keys for the Identification of the hitherto Recorded Marine and Fresh-water Species.*—By K. H. Barnard, D.Sc., F.L.S., Assistant Director.

(With 35 Text-figures.)

This paper contains records of new localities, and of species new to the fauna-list, and descriptions of new species. The new material in the South African Museum is due partly to collecting by members of the staff, and partly to correspondents. Professor T. A. Stephenson, of the University of Cape Town, in the course of ecological work has submitted many specimens, including the very interesting addition to the fauna-list of a species of the Amphipodan family *Ochlesidae*. Mr. H. W. Bell-Marley, of Durban, has added several species to the fauna-list.

One of Professor Stephenson's collecting localities was Port Nolloth, from which there are very few previous records. In addition to the records given below under various species, the following Isopods were also collected at this locality. *Sphaeramene polytylotos*, and *Paridotea ungulata*, *rubra*, *reticulata*, and *fucicola*.

Although many more additions may confidently be expected, it would seem that keys to the identification of the recorded species might be of some value to South African students. An attempt has therefore been made to provide such means of identification. While the aim has been to make the keys as simple as possible, it should be emphasised that a modicum of knowledge of the chief forms of Isopods and Amphipods, and of the terminology employed in describing them, is necessary.

## TANAIDACEA.

### Fam. TANAIDAE.

*Tanais gracilis* Heller.

1866. Heller, "Novara" Exp., vol. ii, p. 133, pl. xii, fig. 3.
1905. Stebbing, Herdman's Ceylon Pearl Fish. Rep. Suppl., 23, p. 3, pl. i, fig. D.

1914 (Feb.). Barnard, Ann. S. Afr. Mus., vol. x, p. 198, pl. xvii, fig. A (*spongicola*).

1914 (July). Vanhöffen, D. Südpol. Exp., vol. xv, p. 468, fig. 6.

1925. Barnard, Ann. S. Afr. Mus., vol. xx, p. 381.

*Additional Localities.*—(West coast) Lambert's Bay (Professor Stephenson, 1938), Table Bay (K. H. B.); (south coast) Simon's Bay (Vanhöffen), Buffels Bay, False Bay (K. H. B.), Still Bay and East London (Prof. T. A. Stephenson).

*Distribution.*—St. Paul and New Amsterdam, Ceylon.

### Fam. APSEUDIDAE.

*Apseudes austro-africana* nom. nov.

1920. Barnard, Ann. S. Afr. Mus., vol. xvii, p. 322, pl. xv, fig. 2 (*australis*, non Haswell, 1881).

## ISOPODA.

### Fam. GNATHIIDAE.

1926. Monod, Les Gnathiidae, Mem. Soc. Sci. nat. Maroc., vol. xiii, pp. 1–668, 1 pl. and 277 text-figs.

*Gnathia cryptopais* Brnrd.

1925. Barnard, Ann. Mag. Nat. Hist. (9), vol. xv, p. 417.

1926. Monod, *loc. cit.*, p. 625.

This species was originally likened to *elongata* (Kröyer) (syn. *cerina* Stimpson), which, as Monod shows, is very like *antarctica* (Studer). The type specimen is more slender than Monod's figure of the latter species, but with only one specimen available a detailed comparison is not possible.

### Fam. ANTHURIDAE.

1925. Barnard, J. Linn. Soc. Lond., vol. xxxvi, p. 109, revision.

Gen. *Haliophasma* Hasw.

1925. Barnard, Ann. S. Afr. Mus., vol. xxv, p. 385.

A point to which perhaps more attention might be paid (in the whole family) is the junction of the telson with the 6th pleon segment. With one exception, in the species of this genus already described and in those to be described below, the junction between the two is always clearly marked by the hind margin of the 6th pleon segment forming a more or less pronounced ridge, the telson being at a lower level than that of the 6th pleon segment. In *pseudocarinata*, however, the telson and 6th pleon segment are completely fused, there is no transverse ridge, and the level of the telson is flush with that of the 6th pleon segment.

*Haliophasma hermani* n. sp.

(Fig. 1.)

Integument not strongly indurated, not pitted. Dorso-lateral keels feeble, dorso-lateral grooves distinct. Medio-dorsal pits deep. Eyes well developed. Pleon segments 1–5 with indistinct sutures.


Fig. 1.—*Haliophasma hermani* n. sp. *a*, hind margin of 6th pleon segment, with telson, and sagittal and cross-sections of latter. *b*, peraeopod 1. *c*, outer ramus of uropod.

Telson arising beneath the arcuate hind margin of 6th pleon segment; obovate, apex semicircularly rounded, upturned, ventral surface evenly but rather strongly convex, dorsal surface concave, with sharp medio-dorsal keel.

Flagellum of antenna 1 a single joint, with minute setiferous apical rudiment of a 2nd joint; flagellum of antenna 24-jointed. Maxilliped 5-jointed.

Peraeopod 1, 4th joint very broad, 5th with lower apex slightly projecting, 6th not as wide proximally as the 4th, tapering distally, palm straight.

Pleopod 1 not indurated, outer surface smooth.

Uropod, inner ramus slightly longer than wide, apex rounded, not reaching to level of telsonic apex, outer ramus folding over telson, ovate, apically obliquely truncate, outer margin finely serrulate, with fringe of plumose setae.

20 mm. Cream coloured, with faint greyish stippling in the hollows beneath the dorso-lateral margins into which peraeopods 2–7 can be folded, eyes black.

*Locality.*—Hermanus, from cavity in the root-stock of an *Allopora* coral (April 1932, 1 immature ? ♀).

*Remarks.*—Easily distinguished from the other species of the genus by the telson, but nearest to *dakarensis* in this respect. The hand of peraeopod 1 is unusually feeble.

### *Haliophasma foveolata* n. sp.

(Fig. 2.)

Integument strongly indurated, with numerous large foveolae. Dorso-lateral keels feeble, dorso-lateral grooves distinct. Medio-dorsal pits obsolete. Eyes well developed. Pleon segments 1–5 with sutures indistinct. Hind margin of 6th pleon segment distinct but not projecting strongly over base of telson.

Telson broadly ovate, the distal half narrowing rather abruptly, apex narrowly rounded, dorsally with 3 longitudinal subparallel ridges which do not coalesce basally, the intervening grooves foveolate, ventral surface slightly concave.

Flagellum of antenna 1 7-jointed, the distal joints with sensory filamentous setae; flagellum of antenna 2 6-jointed. Maxilliped 5-jointed, inner plates small but distinct.

Peraeopod 1 robust, 3rd joint unusually long, lower apex of 5th subacute, 6th subtriangular, palm expanded at base; outer surface of 2nd, 3rd and 6th joints with scattered foveoles.

Pleopod 1, outer surface of outer ramus with a medio-longitudinal groove, another groove on outer margin distally, between the two grooves a few large foveoles.

Uropod, inner ramus subtriangular, longer than its basal width, not reaching telsonic apex, outer ramus folding over basal lateral portion of telson, ovate, with sinuous outer margin, apex acute, outer margin serrulate, with plumose setae.

12·5 × 1·5 mm. Creamy-white with faint grey speckling on dorsal surface, eyes black.

*Locality.*—Port Elizabeth, amongst corallines, worm-tubes, etc., under stones (Prof. T. A. Stephenson, July 1936, 1 immature ? ♀).

*Remarks.*—Like the ♀ co-type of the Australian *purpurea* (Barnard,

J. Linn. Soc., vol. xxxvi, p. 132), this specimen has the integument strongly pitted or foveolate. The telson agrees with that of *purpurea* in being noticeably wider in the proximal than in the distal half; but it agrees with that of the South African *tricarinata* in that the 3 dorsal keels do not coalesce basally. There is, however, a difference in the shape of the telson in cross-section: biconvex in *tricarinata*, concavo-convex in *foveolata*. Perhaps the wider body, the pitted integument, and the telson proximally widened and concavo-convex

FIG. 2.—*Haliophasma foveolata* n. sp. *a*, maxilliped. *b*, peraeopod 1. *c*, telson, with cross-section.

in cross-section are female characters. I am inclined to suspect that this is so, and that this species is only the female of *tricarinata*.

A comparison with *coronicauda* (fig. 3, *d*) on the other hand shows that in cross-section the telson is nearly the same; there is even a very slight indication of a median ridge in *coronicauda*; but the thin rim of the telson shows no sudden narrowing as in the present specimen.

In view of this perplexity, all the specimens of the three forms being immature, and until some definite evidence of sexual dimorphism is forthcoming, it seems clearly advisable to institute a full specific name for this foveolate specimen.

As *coronicauda* has not been figured previously, a figure of the telson is given here for comparison.

*Haliophasma pseudocarinata* n. sp.

(Fig. 3, *a–c*.)

Integument strongly indurated, not pitted. Dorso-lateral keels feeble, dorso-lateral grooves distinct. Medio-dorsal pits shallow and ill-defined. Eyes well developed. Pleon segments 1–5 with sutures indistinct, but indicated ventro-laterally by pale (non-pigmented) lines.

Telson fused with 6th pleon segment, without any transverse dividing ridge or suture, surface flush with that of 6th pleon segment; ovate, sides slightly sinuous, apex rounded; dorsally apparently smooth when viewed in liquid, but when dried there is seen a shallow median pit basally, a pair of shallow depressions laterally (into which

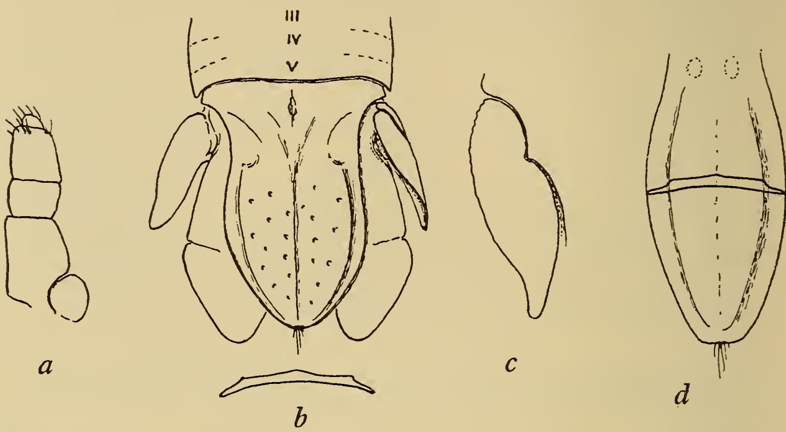



FIG. 3.—*Haliophasma pseudocarinata* n. sp. *a*, maxilliped. *b*, 3rd–5th pleon segments, fused 6th segment and telson, with cross-section of latter. *c*, external view of outer ramus of uropod.
*Haliophasma coronicauda* Brnrd. *d*, telson, with cross-section.

the statocysts open), and three very feeble longitudinal keels, one median, and one on each side nearly parallel with the lateral margin, but gradually coalescing with the margin apically; ventral surface concave.

Flagellum of antenna 1 8-jointed, of antenna 2 6-jointed. Maxilliped 5-jointed.

Peraeopod 1, 6th joint robust, proximally much wider than the preceding joints, subtriangular, palm straight, unguis short.

Pleopod 1 feebly indurated, outer ramus with slight median and lateral grooves.

Uropod, inner ramus ovate, apex extending slightly beyond apex of telson, outer ramus folding inwards, but so narrow as not to overlap on to telson when thus infolded, ovate, outer (upper) margin slightly sinuous, serrulate, with plumose setae.

18 × 2·3 mm. Creamy, the dorsal surface of head, peraeon, pleon, telson, and peduncle of uropods mottled with brown, eyes black.

*Locality.*—Port Elizabeth, under stones (Prof. T. A. Stephenson, July 1936, 1 immature ♀).

*Remarks.*—The telson of this species is a good example of the danger of examining a specimen in liquid only; the sculpturing is so slight as to be easily overlooked. It bears a very strong resemblance to that of *coronicauda* (fig. 3, *d*), and this form may eventually prove to be the ♀ of the last-mentioned species. The shape of the tail-fan, however, which can scarcely be said to form a cup owing to the narrowness of the outer rami of the uropods; and the complete fusion of the telson and 6th pleon segment seem to indicate the necessity of a separate specific name.

*Exanthura macrura* Brnrd.

1925. Barnard, *loc. cit.*, p. 131.

*Additional Locality.*—Lambert's Bay (Prof. T. A. Stephenson, 1938, 1 ♀).

*Apanthura sandalensis* Stebb.

1925. Barnard, *loc. cit.*, p. 141.

*Additional Locality.*—East London (Prof. T. A. Stephenson, July 1937).

Fam. EURYDICIDAE.

1930. Monod, Ann. Sci. Nat. Zool., ser. 10, vol. xiii, pp. 129–183 (*Cirolanidae*).

Gen. *Eurydice* Leach.

1914. Vanhöffen, Deutsch. Südpol. Exp., vol. xv (Zool. vii), p. 505.

1914. Barnard, Ann. S. Afr. Mus., vol. x, p. 350 *a*.

1925. *Id.*, *ibid.*, vol. xx, p. 381.

1931. Nierstrasz, Siboga Exp. monogr., xxxii *c*, p. 147.

*Eurydice latistylis* Vanhöffen (non Dana) is obviously not an *Eurydice* (which has the 5th pleon segment free laterally), and is perhaps an *Argathona* or a young *Cirolana cranchii* (syn. *vicina* Brnrd.).

*Eurydice natalensis* Vanhöffen also is clearly not a member of this genus, but belongs to *Pontogeloides* as I suggested in 1925, or to *Excirolana* (see *infra*). This genus contains therefore only the one species in South Africa, viz. *E. longicornis* (Studer).

Gen. *Excirolana* Richardson.

1912. Richardson, Proc. U.S. Nat. Mus., vol. xliii, p. 201.

1931. Nierstrasz, *loc. cit.*, p. 148.

*Excirolana natalensis* (Vanhöffen).

(Fig. 4.)

1914. Vanhöffen, *loc. cit.*, p. 506, fig. 42.
1925. Barnard, *loc. cit.*, p. 381.
1931. Nierstrasz, *loc. cit.*, p. 149.

A single ♀ resembles *P. latipes* very closely. It possesses the same clypeus and frontal lamina, bifoveolate telson with the median row

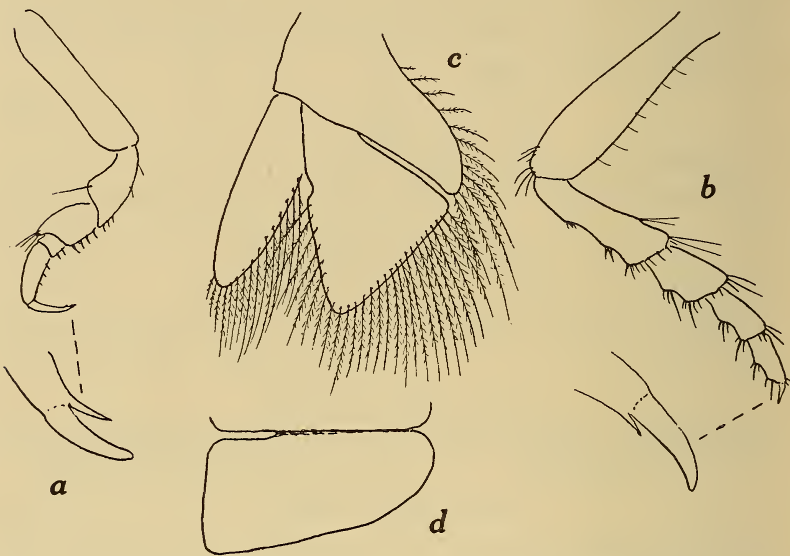



Fig. 4.—*Excirolana natalensis* (Vanhöffen). *a, b*, peraeopods 1 and 7, with ungues further enlarged. *c*, uropod. *d*, 1st free side-plate (on segment 2) of right side.

of little pits, pleopods with accessory laminae, acorn-like 1st and 2nd joints of peduncle of antenna 1, 4-jointed peduncle of antenna 2, and free margins of 5th pleon segment. The differences, however, are as follows:—

Antenna 1 extending to end of 3rd peraeon segment, antenna 2 to middle of 6th segment; joints of peduncle of antenna 2 not so broadly laminar, 4th joint distinctly longer than 3rd.

Side-plates shallower, especially the anterior ones, side-plate 1 (*i.e.* 1st free plate, on segment 2) being twice as long as deep.

Uropod, inner apex of peduncle not so quadrate, slightly tapering, inner ramus with small notch slightly *proximal* to middle of outer margin.

Peraeopods not so robust (fig. 4, *a*, *b*).

Mandibular palp 3-jointed, slender, inserted behind level of molar process (as in *P. latipes*).

10 × 4·3 mm. Pale straw colour, a few black stellate specks on head, and a single series across each peraeon and pleon segment.

*Locality.*—Plettenberg Bay (K. H. B., Jan. 1931. 1 ♀ washed up on ocean beach near mouth of Keurbooms River).

*Remarks.*—Whether this specimen is really the same as Vanhöffen's Port Natal (Durban) species is uncertain, because Vanhöffen did not dissect the mouth-parts of his single specimen, and left several other features undescribed; unfortunately also his figure of the pigmentation shows the hinder side-plates instead of the anterior ones.

The antennae fit in with *natalensis* as regards the length, but the peduncle of antenna 2 in my specimen is more robust (but not so robust as in *latipes*); possibly Vanhöffen's specimen was a ♂, though in *latipes* there is no sexual difference in the antennae.

The figure of *natalensis* shows the outer margin of inner ramus of uropod without any notch.

Both Vanhöffen's and the present specimens have the telson shorter relatively to its breadth than in *orientalis* (Dana).

### Gen. *Pontogeloides* Brnrd.

1914. Barnard, *loc. cit.*, p. 355 *a*.

1930. Monod, *loc. cit.*, pp. 174 *sqq.* (subgen. of *Excirolana*).

1931. *Id.*, Rev. Zool. Bot. Afric., vol. xxi, p. 3.

1931. Nierstrasz, *loc. cit.*, p. 149 (subgen. of *Excirolana*).

Nierstrasz included *japonica* Thielemann, 1910, because the figure shows a 2-jointed mandibular palp, though this is not mentioned in Thielemann's text. The character of the peduncle of 1st antenna, however, fits in with *Excirolana*, all three joints being subequal.

### *Pontogeloides latipes* Brnrd.

(Fig. 5.)

1914. Barnard, *loc. cit.*, p. 356 *a*, pl. xxx, fig. C.

1930. Monod, *loc. cit.*, p. 179, figs. 28 F, 31, 32.

1931. *Id.*, *loc. cit.*, p. 3.

The statement in my original description that the peduncle of antenna 2 is 5-jointed is incorrect; it is impossible to distinguish two fused joints in the first free joint, and thus in practice the peduncle must be regarded as 4-jointed.

I also overlooked the fact that the telson is bifoveolate, a character which makes the resemblance of *E. carangis* van Name to *latipes* all the greater. The whole integument is very sparsely pitted, but on

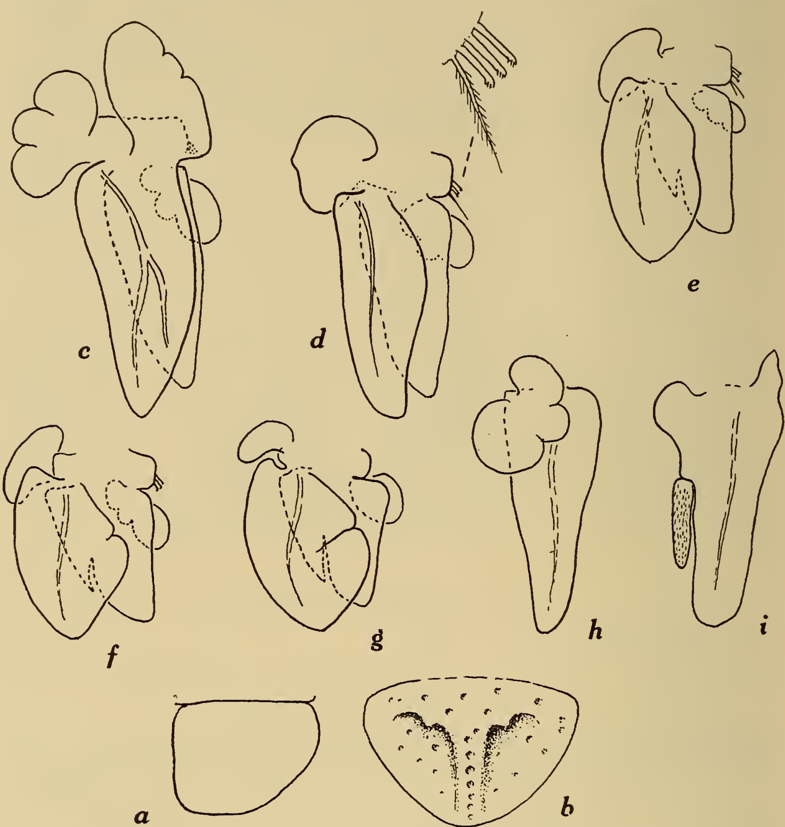



Fig. 5.—*Pontogeloides latipes* Brnrd. *a*, 1st free side-plate (on segment 2) of right side. *b*, telson. *c, d, e, f, g*, pleopods 1–5 respectively. *h*, inner (dorsal) view of inner ramus of pleopod 1. *i*, inner ramus of pleopod 2, ♂.

the median region of the telson between the two foveae, a number of them form a single more or less regular medio-longitudinal line.

The suture between the rostral point of the head and the anterior upturned end of the frontal lamina is distinct and on the dorsal surface.

The pleopods are interesting (*cf.* Monod, 1930, *loc. cit.*, fig. 31). The peduncle of all 5 pairs has a laminar expansion (? epipodite) of the outer margin (*cf.* Calman in Lankester's Treatise Zool., 1909, fig. 127, *Nerocila*). Further, the inner ramus of all the pleopods bears a lobe at its inner basal corner (*cf.* Calman's figure), which lobe is usually folded back on the inner (*i.e.* the dorsal surface) of the ramus. The outer ramus of pleopod 1 also bears a lobe on its inner basal corner. All these lobes, especially that on outer ramus of pleopod 1, are larger in the ♀ than in the ♂. The ♂ stylet on pleopod 2 is densely covered with minute adpressed spinules.

Side-plates deep; side-plate 1 (on segment 2) a little longer than deep (if dissected; prior to dissection the anterior corner is concealed under peraeon segment 1, and the side-plate appears to be as deep as long).

Monod (1924, Parasitolog. Maurit. Bull. Com. d'Et. Hist. Sc. Afr. Occid. Fr., vol. i, p. 68, fig. D, and *loc. cit.*, 1930, 1931) makes *carangis* van Name (1920, Bull. Amer. Mus., vol. xliii, p. 49, figs. 1–5) a synonym of this species, and gives its distribution as from Rio de Oro (Sahare Occidental) to South Africa. The 1st antennae are much longer in *carangis* than in *latipes*, and in my opinion the identity of the former with the latter requires confirmation from a comparison of actual specimens.

*Locality.*—Keurbooms River estuary, Plettenberg Bay (K. H. B., Jan. 1931, numerous specimens on the sandbanks in the estuary, collected at low tide).

## Gen. *Gnatholana* Brnrd.

1920. Barnard, *loc. cit.*, vol. xvii, p. 352.

Monod in his monograph of the *Gnathiidae* (1926, *loc. cit.*, pp. 639 *sqq.*) has discussed the relationship of the fossil *Urda*, from the Jurassic of Solenhofen, to the *Gnathiidae* and Cymothoids; and regards *Gnatholana* as a living representative of the *Urdaidae*. Without having seen any of the actual fossils of *Urda* (*Rektur*), or even the original descriptions (*e.g.* Kunth, 1870, Zeitsch. Deutsch. Geol. Ges., vol. xxii), I make no comment except that the figure of *U. rostrata* (Monod, *loc. cit.*, fig. 274 after Kunth) shows many resemblances to the Cymothoids, especially some juveniles, and none to *Gnatholana*. And without throwing the slightest doubt on the interpretation of the falcate processes in front of the head as being really mandibles, one may remark that some juvenile Cymothoids have falcate dactyli and that the first pair of legs might have been pushed forward prior to fossilisation. One assumes, however, that a fossil specimen clearly showing the ventral surface has been examined. Nevertheless I feel some doubts as to the propriety of uniting the living *Gnatholana* with the fossil *Urda* in one and the same family.

Gen. *Cirolana* Leach.

1925. Hale, Trans. Roy. Soc. S. Austr., vol. xlix, p. 129.
1930. Monod, *loc. cit.*, pp. 130 *sqq.*, 141, 142.
1931. Nierstrasz, *loc. cit.*, pp. 149 *sqq.*
1935. Barnard, Rec. Ind. Mus., vol. xxxvii, p. 308.

One character, to which insufficient attention has been paid, is the form of the penial processes or papillae. Vanhöffen (1914, *loc. cit.*),

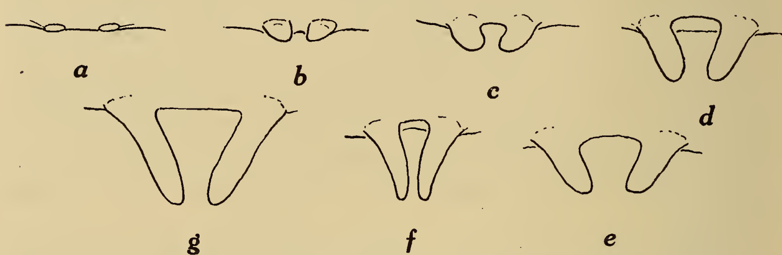


FIG. 6.—*Cirolana*, penial processes. *a, venusticauda* Stebb. *b, cranchii* Leach (*vicina* Brnrd.). *c, theleceps* n. sp. *d, cingulata*. *e, meinerti* Brnrd. *f, sulcata* Hansen. *g, palifrons* Brnrd.

however, is an exception among authors, and has given figures for all the species described by him, except *hirtipes*, of which species apparently he had no ♂♂. The reason for this exception may be due to the fact that in this species there are no upstanding papillae, the vasa deferentia opening by pores flush with the surface of the sternum (Barnard, 1935, *loc. cit.*, p. 309).

As far as ♂ material is available, the South African species fall into the following groups (fig. 6):—

| | |
|---|---|
| No papillae, pores flush with surface . | *hirtipes.*<br>*virilis.*<br>*undulata.*<br>*fluviatilis.*<br>*littoralis.*<br>[*pleonastica* not S. Afr.]. |
| No papillae, pores flush with surface but on a very slight transverse ridge . . | *venusticauda* and var. *simplex.* |
| Papillae very short, mammilliform . . | *cranchii* (*vicina* Brnrd.).<br>*theleceps.*<br>[*willeyi* not S. Afr.]. |

| | |
|---|---|
| Papillae well developed, at least twice as long as broad . . . . . | *meinerti.* *cingulata.* *palifrons.* *sulcata.* *rugicauda.* |

Clearly this character is worth incorporating in the description of a species.

### *Cirolana virilis* n. sp.

(Fig. 7, *d.*)

Superficially resembling *hirtipes.* Antenna 2 extending back to beginning of 4th peraeon segment. Side-plates with oblique ridges slightly more distinct than is normal in *hirtipes,* thus differing from *borealis* (where they are obsolete). Postero-inferior corner of side-plate 4 (on 4th peraeon segment) quadrate. On the head the impressed punctate line is confined to the hind margins of the oblong eyes and is *not continuous* across the median area. Frontal lamina and peraeopods as in *hirtipes.* Vasa deferentia opening by pores flush with the surface. Apex of telson with 16 spines in addition to the plumose setae.

Stylet on pleopod 2, ♂, very stout and strongly curved, even more so than in *borealis* (see Hansen, 1890, Cirolanidae, pl. i, fig. 1, *t*), and absolutely different from the slender, straight stylet of *hirtipes* (Hansen, pl. i, fig. 2, *f*). 13·5 mm.

*Locality.*—33° 59′ S., 25° 43′ E. (Algoa Bay), 33 fathoms (s.s. "Pieter Faure," Nov. 1898, 1 ♂).

### *Cirolana natalensis* n. sp.

In general appearance similar to *hirtipes.* Eyes subrotund. A small rostral point almost meeting the frontal lamina and separating the bases of 1st antennae. An obscure impressed line on hind margin of eyes, but not continued across the median area. Side-plates 1–4 with postero-inferior corners distinctly rounded. Telson about as long as its basal width, apex somewhat pointed (cf. *neglecta,* Hansen, *loc. cit.*, pl. i, fig. 3, *a*), with 12 spines among the plumose setae.

Antenna 2 extending back to end of peraeon segment 3. Frontal lamina as in *hirtipes.*

Peraeopods 1–3 more slender than in *hirtipes,* with a less conspicuous spine on outer apex of 4th joint, and more slender spines on inner margins of 4th–6th joints. Peraeopods 4–7 more robust than in *hirtipes*, the inner margins of 3rd–5th joints undulate and crenulate rather than definitely notched (*cf.* Hansen, *loc. cit.*, pl. i, fig. 2, *d*), and with more numerous and longer spine-setae; 2nd joint

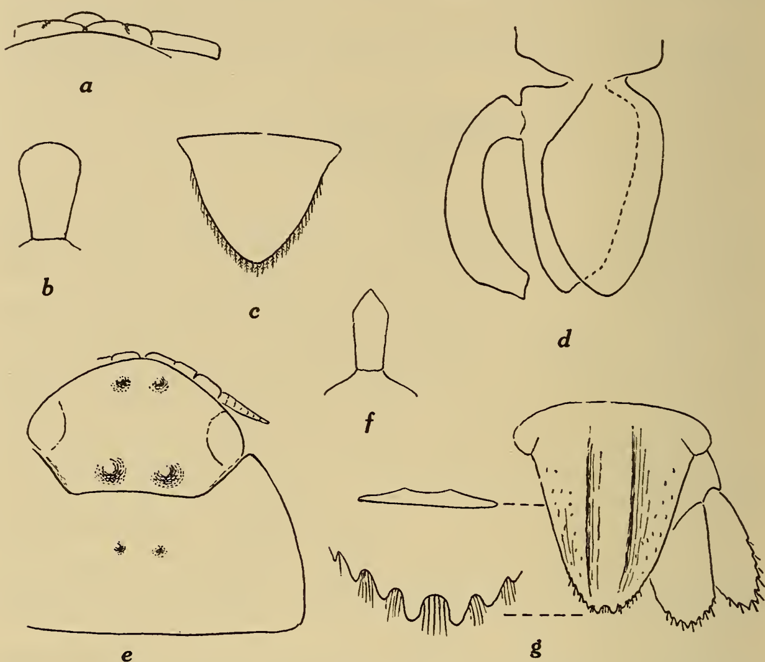



Fig. 7.—*Cirolana luciae* n. sp. *a*, dorsal view of front of head. *b*, frontal lamina. *c*, telson. *Cirolana virilis* n. sp. *d*, pleopod 2, ♂. *Cirolana theleceps* n. sp. *e*, dorsal view of head and 1st peraeon segment. *f*, frontal lamina. *g*, telson and uropod, with cross-section of telson, and apex further enlarged.

of peraeopods 5–7 more broadly oval, in peraeopod 7 its greatest width in the *middle* of the joint (not in distal third), but with fringe of long plumose setae as in *hirtipes*. Up to 13 mm., but no adult ♂♂ or ovigerous ♀♀.

*Locality.*—Illovo, Natal (H. W. Bell-Marley, 1934, "An enemy of fishes, and anglers' *bête noire*").

*Remarks.*—The shape of the eyes, the stouter and more spinose hinder peraeopods, and the hind angle of the 4th side-plate distinguish this species from *hirtipes*; the telson also is more pointed. The shape of the 2nd joint of peraeopod 7 seems to distinguish this species from other species belonging to this group (*borealis*, *japonensis*, etc.), in all of which the greatest width is towards the distal end.

*Cirolana undulata* Brnrd.

1914. Barnard, *loc. cit.*, p. 353 *a*, pl. xxx, fig. A.

*Additional Locality.*—Port Nolloth (Professor Stephenson, 1938).

*Cirolana fluviatilis* Stebb.

1902. Stebbing, S. Afr. Crust., pt. 2, p. 52.
1920. Barnard, *loc. cit.*, p. 346, pl. xv, fig. 19 (frontal lamina).
1924. Chilton, Mem. Ind. Mus., vol. v, p. 882, pl. lx, fig. 2 (*pleonastica*, non Stebbing).
1926. *Id.*, Rec. Ind. Mus., vol. xxviii, p. 180, fig. 2 (*pleonastica*, non Stebb.).
1935. Barnard, *ibid.*, vol. xxxvii, p. 310, fig. 19.

The vasa deferentia open by pores flush with the ventral surface. The apex of the telson is rather broadly rounded in the young and half-grown, but assumes a narrow-rounded shape in the adult, slightly more narrow in ♂ than in ♀ (fig. 19 in Barnard, 1935).

*Additional Localities.*—St. Lucia Bay, Zululand (H. W. Bell-Marley, 1919, 1 ♂); Keurbooms River, Plettenberg Bay (K. H. B., Jan. 1931, ♂♂, ♀♀, from submerged rotting logs and timber in the estuary); Knysna River (K. H. B., Nov. 1938).

*Distribution.*—Chilka Lake, India; Talé Sap, Siam.

*Cirolana theleceps* n. sp.

(Figs. 6, *c*, 7, *e–g*.)

Body smooth, coarsely but sparsely punctate, convex, sublinear in outline. Head without rostral point, slightly produced over the contiguous bases of 1st antennae, dorsal surface in ♂ with 4 rounded tubercles, 2 near the anterior margin feeble, 2 near the hind margin much stronger; in ♀ quite smooth. Frontal lamina a trifle more than twice as long as wide, elongate pentagonal.

Peraeon segment 1 in ♂ with 2 small tubercles approximately in the middle of dorsum (easily overlooked unless specimen is examined dry). Side-plates shallow, 4–7 with oblique ridges. Lateral margins of pleon segment 5 overlapped by segment 4. Telson triangular, longer than basal width, apex rather broadly rounded, with 4–5 strong teeth on either side of median line, 3–5 setae arising from each notch, except the proximal ones where there is only 1 seta, dorsal surface not very convex, with broad shallow median longitudinal groove of nearly even width from base to apex, and with minute scattered setules.

Antenna 1 short, reaching to hind margin of third peraeon segment, flagellum 5–6-jointed. Antenna 2 reaching to middle or end of peraeon segment 4, peduncle 5-jointed, 4th and 5th joints subequal, flagellum about 23-jointed, with brush-like hemi-whorls of setae, stronger in ♂ than in ♀, on the proximal joints.

Mouth-parts normal. Second joint of palp of maxilliped very broad, subcircular.

Peraeopod 1 stout, 3rd joint with a very stout blunt spine on inner apex, 4th not strongly produced on outer apex, with 5 similar stout blunt spines on inner margin, 5th very short, underriding 6th, latter with 1 stout conical spine on inner apex, 7 with very short blunt spine at base of unguis. Peraeopod 7, 2nd joint oval, half as long again as broad.

Penial processes on 7th sternite short and stout. Stylet on pleopod 2, ♂, slender, straight, arising from base of, and extending slightly beyond, inner ramus.

Uropod, inner ramus extending beyond telsonic apex, apex rounded with about 8 teeth, the intervening notches with 2–5 setae rather longer than those on telson, outer ramus slightly shorter, apex rounded with 4–5 teeth, intervening notches with setae. 7–8 × 2·5 mm.

Pale yellowish, with transverse series of dendritic or stellate dots, 3–4 rows across each peraeon segment, a single row across each pleon segment.

*Locality.*—Durban and Illovo (H. W. Bell-Marley, June 1930 and July 1934, ♂♂, ♀♀).

*Remarks.*—The strong teeth on the margins of the telson and the uropods are a feature of this species, though paralleled by *hanseni* Bonnier, 1896 (see also Hansen, 1905, J. Linn. Soc. London, xxix); the uropods of *Neocirolana obesa* Hale, 1925, also are somewhat similar. The presence of tubercles on the head in the ♂ is reminiscent of the genera *Corallana* and *Lanocira*, but the mouth-parts of the present species are typical of *Cirolana*. The presence of a secondary unguis on some or all of the peraeopods (*Neocirolana* Hale, 1925) can scarcely be considered of generic importance; it occurs in varying degrees of prominence in quite a number of species of *Cirolana*.

### *Cirolana luciae* n. sp.

(Fig. 7, *a–c*.)

Body smooth, convex, oval in general outline. Head without rostral point, bases of 1st antennae contiguous. Frontal lamina oblong, about twice as long as middle width, widening slightly in front to the gently rounded anterior margin, which is free and visible beyond the 1st antennae in dorsal view.

Side-plates shallow, 4–7 with oblique ridge. Pleon segment 5 laterally overlapped by segment 4. Telson triangular, length a little less than basal width, smooth, apex rounded, sides convex, margin with closely set short plumose setae, but no spines.

Antenna 2 extending to end of peraeon segment 3, 5th peduncular joint very slightly longer than 4th.

Peraeopods 1–4, 4th joint not produced. Peraeopods 5–7, 2nd joint nearly linear, not expanded, not strongly setose. Uropod, inner ramus extending beyond telsonic apex, apex subacute, distal margin with plumose setae and 9 widely spaced spines, outer rami lost. 9 × 3·5 mm.

*Locality.*—St. Lucia Bay, Zululand (H. W. Bell-Marley, Oct. 1919, 1 ♀).

*Remarks.*—In association with *fluviatilis*, with which species it closely agrees in the shape of the frontal lamina.

The frontal lamina appears to be similar also to that of *arcuata* Hale, 1925, but there it does not project so as to be visible in dorsal view as in the present species. The same remark applies to *indica* Nierst, 1931, which species has an even shorter telson.

### *Cirolana rugicauda* Heller.

(Fig. 8.)

1868. Heller, Reise der "Novara" Crust., p. 142, pl. 12, fig. 13.
1890. Hansen, Vidensk. Selsk. Skr., ser. 6, Bd. v, p. 358.
1914. Vanhöffen, *loc. cit.*, p. 503, fig. 40.

The present specimens agree with Heller's description as supplemented by Vanhöffen's account of specimens obtained at the type locality. The explanation of Heller's figure, which shows (apparently) *two* knobs on the telson, seems to be that the artist mistook a pale dot in the otherwise dark pigmentation for a knob; such a pale dot is present in nearly all the South African examples between the real knob and the base of the telson. The knob is not present in a young specimen 3 mm. in length, but is present in one of 4·5 mm.

The whole integument is coarsely and rather closely pitted, a feature mentioned by Heller for the telson ("grob puntiert"). Vanhöffen says the telson is "gekörnelt" and that the whole surface is covered with hexagonal markings, from each of which arises a bristle;

which is likewise correct for the South African specimens, the bristles being mostly on the pleon and telson.

The anterior margin of the clypeus is free and prominent. The bases of the 1st antennae are contiguous. The anterior margin of the head is costate, and there is a very small rostral point.

Vanhöffen mentions that the 3rd pleon segment overlaps laterally the 4th segment, but in his figure this overlapping is not so marked as in the present specimens, where the point of segment 3 overlaps as

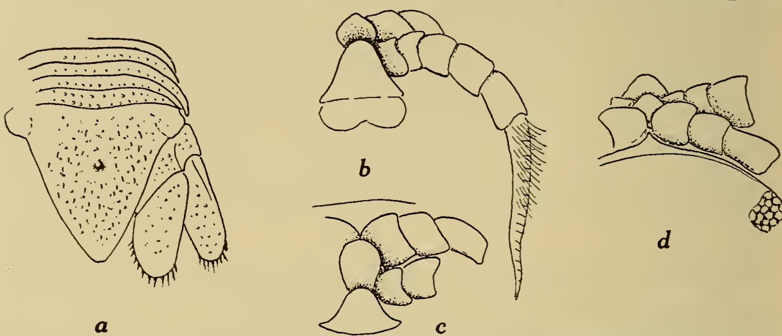



Fig. 8.—*Cirolana rugicauda* Heller. *a*, pleon, telson, and uropod. *b, c, d,* ventral, frontal, and dorsal views of head front of, showing clypeus, frontal lamina, bases of antennae, and rostral point.

far as the basal lateral swelling of the telson and is almost contiguous with the peduncle of the uropod. This feature is very distinctive and might be utilised to subdivide (subgenerically) the genus *Cirolana.*

Penial processes on 7th sternite well developed (see figure in Vanhöffen).

Up to 14 mm. Colour as described by Vanhöffen.

*Locality.*—Port Nolloth (several specimens ex Natal Museum).

*Type Locality.*—St. Paul Island (southern Indian Ocean).

*Remarks.*—The discovery of this species on the west coast of South Africa, within the influence of the cold west-drift (Benguella) current, is very interesting. Heller noted (*loc. cit.*, p. 269) two Crustacea common to St. Paul and the Cape: the crayfish *Palinurus lalandei* and the Isopod "Sphaeroma" (=*Parisocladus*) *perforata.* He might have added *Neptunus sanguinolentus*, as appears from his table of species on p. 256. Further species common to the two regions are *Tanais gracilis* Heller and *Dynamenella huttoni* (syn. *brunnea* Vanhöffen and *kraussi* Brnrd.).

This species was not found by Professor Stephenson at either Port Nolloth or Lambert's Bay, but has recently (February 1939) been collected by him at Steenbergs Cove, St. Helena Bay.

*Cirolana incisicauda*, n. sp.

(Fig. 9, *a*, *b*.)

The remarkable species here figured agrees in all essentials with *venusticauda-simplex* except as regards the telson and the prominently acute side-plates on segments 4–7.

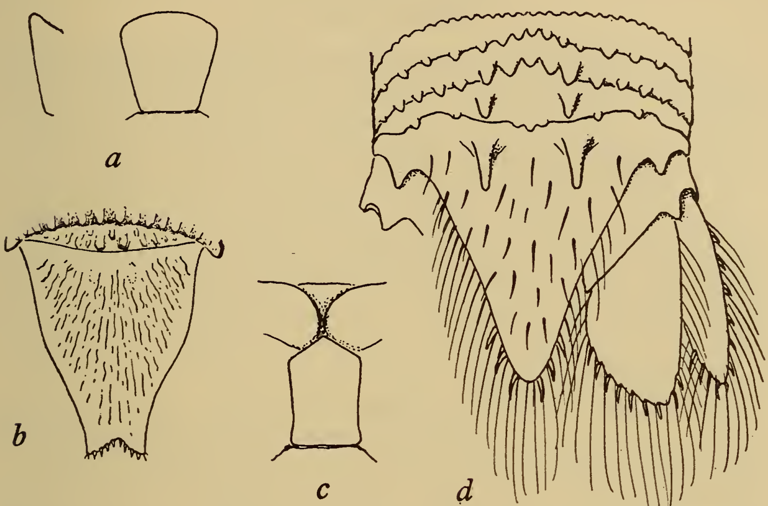



Fig. 9.—*Cirolana incisicauda*, n. sp. *a*, frontal lamina, profile and ventral view. *b*, telson.
*Cirolana bovina* n. sp. *c*, frontal lamina and bases of 1st antennae. *d*, pleon, telson, and uropod (setae on telson and uropods plumose).

The frontal lamina agrees with that of the species just mentioned. The hinder peraeon segments are crimped (with short longitudinal ridges and furrows), and the pleon segments are rugulose as in *simplex*. The telson is thin, slightly upturned at the apex which is shallowly notched, with 4 spines on each side in the notch. The dorsal surface is finely rugulose (best seen when dried), with minute and short, scattered setules. The inner ramus of uropod has 7 strong spines on inner margin and 5 small spinules on outer margin; the outer ramus is considerably shorter than the inner, and carries 7 strong spines on inner margin and 7 spinules on outer margin.*

Length 17 mm. Creamy-white, with faint brown dendritic mottling and dots.

* Since this was in print I have seen 4 more specimens, which show that this is not a casual aberration but a valid species.

*Localities.*—Port Elizabeth and Port Alfred (Prof. T. A. Stephenson, 1936 and 1939). Inhabits the tubes of the Polychaet *Gunnarea*; the tail-fan forms an effective "operculum," as in the case of *Exanthura macrura* Brnrd.

### *Cirolana bovina* n. sp.

(Fig. 9, *c*, *d*.)

Anterior margin of head evenly convex, without rostral point, with submarginal impressed line. Bases of 1st antennae in contact, first two joints of peduncle not clearly distinct, flagellum 10–12-jointed. Second antennae reaching to about end of 4th peraeon segment.

Frontal lamina pentagonal, half as long again as broad, sides straight, distal margins meeting in an obtuse angle, apex not freely projecting.

Peraeon segments smooth, sparsely punctate, no transverse impressed lines, hind margins of posterior segments (6 and 7, or 5–7) feebly crenulate or denticulate. An oblique ridge on side-plates 4–7; the hinder side-plates with a few long setae. No fringes of long setae on 2nd joints of peraeopods.

Pleon segments 2–5 with denticulate hind margins; hind margin of segment 4 arcuate, with median excision, and a slightly enlarged submedian denticle on either side; segment 5 with 2 large submedian conical tubercles. The lateral margin of segment 4 is posteriorly angular (not rounded as in *fluviatilis*); an oblique ridge on segment 4, a much feebler one on segment 3.

Telson triangular, sides slightly concave, apex narrowly rounded, with 3 spines (sometimes 4 on one side) on each side hidden amongst the dense fringe of plumose setae; dorsal surface with a conical denticle overhanging the insertion of uropod, and a pair of strong submedian, backwardly projecting conical or spiniform tubercles near base, rest of surface smooth with rather long scattered setae.

Uropods, inner ramus broadly rounded, with 7 (6–8) spines on inner, and 2 on outer, distal margin; outer ramus narrow ovate, with 4 spines on inner distal margin and about 6 on outer margin; all spines hidden in the dense fringe of plumose setae.

Ovig. ♀ 9 × 4 mm., juv. but no adult ♂ present. Creamy-white with greyish mottling, eyes black.

*Locality.*—East London, "shelly beach" (Prof. T. A. Stephenson, July 1937).

*Remarks.*—Nearest to *pleonastica* Stebb. (see Barnard, Rec. Ind. Mus., vol. xxxvii, p. 309, fig. 18, *a*, 1935), but distinguished by the broader frontal lamina, absence of transverse impressed lines on peraeon segments, and sculpture of telson.

The specific name in allusion to the Buffalo River, East London, and the two prongs on the telson.

## Fam. AEGIDAE.

### *Aega semicarinata* Miers.

1875. Miers, Ann. Mag. Nat. Hist., vol. xvi, p. 115.

1879. *Id.*, Trans. Roy. Soc. London, vol. clxviii, p. 201, pl. 11, fig. 1.

1911. Bouvier, Ann. Inst. Ocean., ser. 1, vol. iii, p. 39, pl. 2, figs. 3–5.

1914. Barnard, *loc. cit.*, p. 367, pl. 32, fig. A (*urotoma*).

1916. *Id.*, Ann. S. Afr. Mus., vol. xv, p. 106 (*corrigendum*).

1919. Stebbing, Proc. Zool. Soc. London, p. 334.

*Remarks.*—Bouvier gives photographic reproductions of specimens from the type locality Kerguelen, but the figure of the ventral surface does not show the frontal lamina. Stebbing records the species from the Falkland Islands.

The species is common off Cape Point and N.W. of Table Bay in 130–200 fathoms (stock-fish grounds). When alive the animal is pale salmon-coloured, with ruby-red eyes.

*A. truncata* Rich. (1910, Bur. Fish. Wash., Doc. No. 736, p. 14, fig. 13) from the Philippine Islands, and *A. bicavata* Nordenstam (1930, Nat. Hist. Juan Fernandez and Easter Is., vol. iii, p. 547, pl. 20, fig. 11, and text-fig. 11) from Juan Fernandez, are both very closely allied to one another and to *semicarinata*, and a direct comparison of specimens of all three forms might prove them to be conspecific.

### *Aega monilis* Brnrd.

1914. Barnard, Ann. S. Afr. Mus., vol. x, p. 365, pl. xxxi, fig. C.

Several other specimens have been obtained from off Cape Point and Table Bay, as far north as Saldanha Bay. Some of the specimens were found in *Leuconia*-like sponges.

The transverse rows of granules are sometimes very obscure except on the pleon and posterior peraeon segments.

### Gen. *Syscenus* Harger.

1923. Stebbing, Fish. Mar. Surv. Spec. Rep., 3, p. 9.

Differs from *Rocinela* in the total absence of eyes, the pleon distinctly narrower than the peraeon, the absence of a linguiform process on the mandible, the 6th joint of the 3 anterior pairs of peraeopods not expanded, with abruptly curved dactylus, and the longer 6th joint of the posterior 4 pairs of peraeopods.

Besides *infelix*, two other species of the genus have been described: *latus* Richardson (1909, Proc. U.S. Nat. Mus., vol. xxxvii, p. 85, fig. 11) from the N.W. Pacific, and *intermedius* Richardson (1910, Bur. Fish., Doc. 736, p. 17, fig. 16) from the Philippine Islands.

*Syscenus infelix* Harger.

1897. Sars, Crust. Norw., vol. ii, p. 67, pl. xxviii, and 1899, *ibid.*, Appendix, p. 247, Suppl., pl. i.

1905. Richardson, Bull. U.S. Nat. Mus., No. 54, p. 212, figs. 216, 217.

1910. *Id.*, Bur. Fish., Doc. 736, p. 17.

1923. Stebbing, *loc. cit.*, p. 9.

There is a *typ. err.* in Stebbing (p. 10); "5th" and "4th" peraeopods should read 7th and 6th respectively. Stebbing gives no other details, except the length 17 mm. The flagellum of the 1st antenna in Sars' figures of *infelix* is 5 (juv.)–7 (adult)-jointed; in *intermedius* 10-jointed, and in *latus* 13-jointed. In these two latter species the apex of the telson is rounded, not pointed as in *infelix.*

*Locality.*—Natal coast, in a coral.

*Distribution.*—Atlantic coast of N. America; Norwegian, Danish, and British coasts; Japan; Philippine Islands.

## Fam. CYMOTHOIDAE.

Gen. *Nerocila* Leach.

1924. Monod, Parasit. Maurit. Bull. Com. Hist. Sci. Afr. Occid. franç., pp. 75 *sqq.*

1931. *Id.*, Rev. Zool. Bot. Afric., vol. xxi, pp. 5 *sqq.*

1936. Barnard, Rec. Ind. Mus., vol. xxxviii, p. 163.

In the second paper Monod admits that the forms which in 1924 he called *rhabdota* are not the *rhabdota* of Koelbel, thus recognizing the validity of my observations (1925, Ann. S. Afr. Mus., vol. xx, pp. 390, 391) that "rhabdota" as figured by him in 1924 and *cephalotes* were connected by transitional forms and were conspecific.

Very little diagnostic value can be attached to the extent of the prolongation of the hind corners of peraeon segments 6 and 7, and it should certainly not be compared relatively to the pleon segments (Monod, 1924, pp. 83, 84), because the pleon segments are subject to a variable amount of contraction according to the method of preservation.

The shape of the side-plates on segments 2 and 3 seems to be a better criterion, and judged by it all the South African Museum specimens, except two, clearly fall into *orbignyi*. One of these two, a 29-mm. ♀ "rhabdota" form, has side-plates 2 and 3 slightly outstanding and can scarcely be counted as an exception, but is interesting as leading on to the second one. This specimen is a 28-mm. ♀ "rhabdota" from Algoa Bay with side-plates 2 and 3 acute, outstanding and upturned, but only the left-side corner of peraeon segment 3 is slightly produced. It might well be claimed as a transition to *armata* Dana; it is very similar to Monod's fig. 4 (1931).

*Nerocila orbignyi* (Guér. Mén.).

1829–32. Guérin-Méneville, Iconogr. Règne Anim., pl. xxix, figs. 3, *a–e* (*Ichthyophilus orbignyi*).

1832. *Id.*. Crust. Exp. sci. Morée, p. 47 (*Ichthyophilus o.*).

1881. Schioedte and Meinert., Naturh. Tidsskr., ser. 3, vol. xiii, p. 60, pl. iv, figs. 16–18 (*cephalotes*).

1902. Stebbing, Mar. Invest. S. Afr., vol. ii, p. 55 (*cephalotes*).

1914. Barnard, *loc. cit.*, p. 371 (*rhabdota*, non Koelbel).

1920. van Name, Bull. Amer. Mus. Nat. Hist., vol. xliii, p. 53, figs. 6–9 (*cephalotes*).

1921. Stebbing, Ann. Durban Mus., vol. iii, p. 23 (*armata*, non Dana).

1923. *Id.*, Fish. Mar. Biol. Surv. Spec. Rep., 3, p. 10, pl. xv (*Rosca rogans*).

1924. Monod, *loc. cit.*, pp. 436 (75) *sqq.* figs. (*cephalotes* and *rhabdota*, non Koelbel).

1925. Barnard, *loc. cit.*, p. 390 (*armata*, non Dana).

1926. Hale, Trans. Roy. Soc. S. Austr., vol. l, p. 206, figs. 4, 5, (*macleayii*).

1931. Monod, *loc. cit.*, p. 10, figs. 5–11 (references and synonymy).

1936. Barnard, *loc. cit.*, p. 165, footnote.

1937. Schuurmans, Stekhoven. Mem. Mus. Roy. Belg. (2), fasc. 9, p. 25, figs. 19–22.

Although Stebbing, in describing *Rosca rogans* in 1923, refers to the character of the incised pleurae of the pleon segments as distinguishing *Nerocila* from *Rosca*, the figure of his specimen corresponds so exactly with *Nerocila orbignyi* that there can be little doubt that he overlooked the incisions, which are often small and inconspicuous, on the first two pleurae (he says the "dissection of the mouth-organs in December fogs was unsuccessful").

There is in the South African Museum an exactly similar specimen, 25 mm. in length, with the last three peraeon segments broader than the anterior ones, but without any brood-plates (see Barnard, *loc. cit.*, 1936).

There are also two ♂♂, 25 and 26 mm. in length, with the inner ramus of uropod triangular, widening to the truncate distal margin. When the change to the ♀ stage occurs, the inner distal corner of the ramus shifts proximally and forms the tooth on the inner margin of the now nearly parallel-sided ramus.

To the list of hosts (Barnard, *loc. cit.*, 1925, p. 391) may be added the Snoek (*Thyrsites atun*).

Gen. *Anilocra* Leach.

1936. Barnard, Rec. Ind. Mus., vol. xxxviii, p. 165, fig. 7.

Certain differences between *capensis* and *leptosoma* are noted and figured.

Gen. *Codonophilus* Hasw.

1881. Haswell, Proc. Linn. Soc. N.S.W., vol. v, p. 471.
1883. Schioedte and Meinert, Naturh. Tidsskr., ser. 3, vol. xiii, p. 322 (*Ceratothoa*, non Dana, 1853).
1893. Stebbing, History of Crustacea, London, p. 354 (*Meinertia*).
1900. *Id.*, Mar. Invest. S. Afr., vol. i, p. 57 (*Meinertia*).
1910. *Id.*, Gen. Cat. S. Afr. Crust., p. 424 (*Meinertia*).
1926. Hale, Trans. Roy. Soc. S. Austr., vol. l, p. 223.
1931. Nierstrasz, *loc. cit.*, p. 131.

Hale's examination of the type of Haswell's *Codonophilus argus* has shown that it is a young form of *Meinertia imbricata*, and as Haswell's name antedates Stebbing's the generic name must be changed. *C. imbricata* remains the only species recorded from South African waters.

## Fam. SPHAEROMIDAE.

### Hemibranchiatae.

Gen. *Sphaeroma* Bosc.

*Sphaeroma terebrans* Bate.

1879. Hilgendorf, MB. Ak. Wiss. Berlin, 1878, p. 846, pl. iv, fig. 13 (*tuberculato-crinitum*).
1908. Budde-Lund, Voeltzkow's Reise., vol. ii, p. 304, pl. xvii, fig. 55 (*bigranulatum*).

1920. Barnard, *loc. cit.*, p. 358.
1921. Calman, Proc. Zool. Soc. London, p. 217.
1926. Baker, Trans. Roy. Soc. S. Austr., vol. l, p. 247, pl. xxxviii, figs. 11–13.
1931. Monod, Mem. Soc. Sci. nat. Maroc., vol. xxix, figs. 22 B, 42 A, 43 J, K, L.

*Additional Localities.*—Mouth of Mtunzini River, Zululand (H. W. Bell-Marley, 1926); Keurbooms River, Plettenberg Bay (K. H. B., Jan. 1931. ♂♂, ♀♀, juv. in water-logged timber at Whisky Creek, 5 miles from mouth, limit of tidal water); Knysna River, at tidal limit (K. H. B., Nov. 1938. ♂♂, ♀♀, juv.).

*Distribution.*—Mozambique (Hilgendorf), Zanzibar (Budde-Lund), Madras, Ceylon, Queensland, Florida, Brazil.

*Remarks.*—There can be little doubt that Hilgendorf's and Budde-Lund's species are synonymous. *S. retrolaeve* Rich., 1904, and *peruvianum* Rich., 1910, are very closely allied to one another, but appear to differ from *terebrans* in the broadly rounded or rounded-truncate telsonic apex.

### *Sphaeroma walkeri* Stebb.

1920. Barnard, *loc. cit.*, p. 360.
1928. Baker, Trans. Roy. Soc. S. Austr., vol. lii, p. 49.
1931. Monod, *loc. cit.*, p. 36, figs. 5, 23 A, 43 A, B.
1936. Barnard, Rec. Ind. Mus., vol. xxxviii, p. 178, fig. 13, *b* (epistome).
1937. Monod, Mem. Inst. d'Egypte, vol. xxxiv, p. 13.

*Distribution.*—Ceylon, Suez, New South Wales.

### *Sphaeroma annandalei* Stebb.

1911. Stebbing, Rec. Ind. Mus., vol. vi, p. 181, pl. x.
1936. Barnard, Rec. Ind. Mus., vol. xxxviii, p. 178, fig. 13, *c* (epistome).

Stebbing's description and the distinctness of this species from *walkeri* are fully confirmed.

Front margin of head with distinct raised rim. A short transverse ridge in the middle of peraeon segment 4, and a longer one on each of segments 5, 6, and 7, on the 6th and 7th segments the ridge tends to break up into a series of transversely elongate tubercles (see Stebbing's figure). Similarly the tubercles on the anterior portion of the pleon are transversely elongate. The apex of the telson is broadly rounded, with an upturned rim, but not so strongly marked as in *walkeri*. The arrangement of the tubercles on the telson is as Stebbing describes.

The epistome is wider across the arms (embracing the upper lip) than in *walkeri*, and the raised margins narrower (see Barnard, 1936, figs.). The inner lobe of maxilla 2 broad and subquadrangular as in the Indian examples. The inner plate of maxilliped is certainly narrower and more pointed than in *walkeri*, but the actual shape depends a lot on the view-point and whether the appendage is flattened under a cover-slip; Stebbing's figures of the maxillipeds of the two species are not, I think, strictly comparable. Up to 11 mm.

*Locality.*—Mouth of Mtunzini River, Zululand (H. W. Bell-Marley, 1926).

*Distribution.*—Port Canning, and Ganges Delta, India.

### Gen. *Exosphaeroma* Stebb.

### *Exosphaeroma hylecoetes* n. sp.

(Fig. 10.)

1902. Stebbing, Mar. Invest. S. Afr., vol. ii, p. 69 (*gigas*, non Leach).

1910. *Id.*, Gen. Cat. S. Afr. Crust., p. 428 (*gigas* part, non Leach, No. 81, A).

1914. Barnard, *loc. cit.*, p. 375 (*gigas* part, non Leach).

Integument matt, with minute scattered setules. Head with slightly thickened rim on sinuous front margin. Telson a little broader than long, more so in ♂ than ♀, sides in ♂ subtending an angle of about 60°, rather strongly convex, smooth, sides gently concave near the somewhat truncate apex, which is narrow in ♂ but considerably broader in ♀; ventral surface with low semicircular ridge, and in ♂ a shallow transverse groove.

Epistome triangular, bluntly pointed anteriorly, surface evenly convex. Maxilliped with 2nd–4th joints of palp lobed on inner margins.

Anterior peraeopods not differentiated, without natatory setae.

Uropod, rami lamellate, more so in ♂ than in ♀, inner ramus not quite reaching telsonic apex, outer reaching very slightly beyond, outer margin crenulate proximally, gradually becoming serrate distally, apex acute, a few minute serrulations on inner distal margin, outer margin of outer ramus and apices of both rami setulose, inner margin of outer ramus densely setose (furry); the Cape specimens have the outer ramus apically blunt, and only 3–4 crenulations distally on outer margin.

Up to 6·5 mm. (Keurbooms R.), 11·5 mm. (Cape Town).

Brownish or slaty-grey, with paler mottling, the most constant being patches in the mid-dorsal line on the pleon and base of telson.

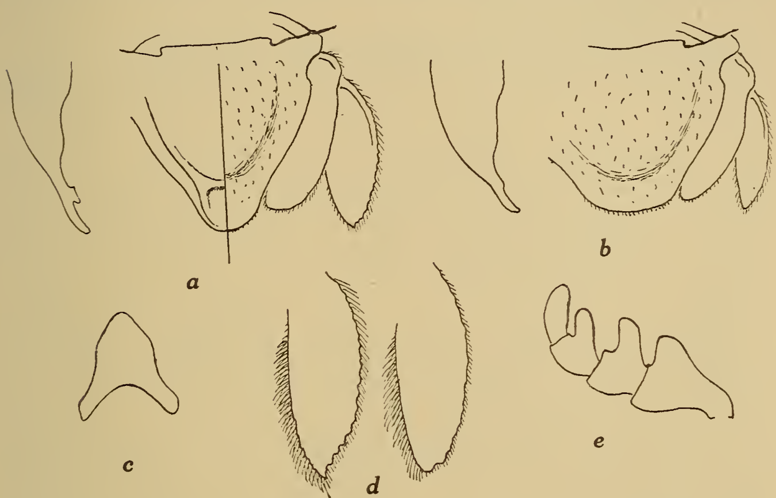



FIG. 10.—*Exosphaeroma hylecoetes* n. sp. *a*, telson and uropod, ♂, dorsal view on right, ventral on left, with diagrammatic sagittal section. *b*, telson, ♀, with section. *c*, epistome. *d*, outer ramus of uropod of Keurbooms River specimen (left) and Cape specimen (right). *e*, palp of maxilliped (setae omitted).

*Localities.*—Salt River, near Cape Town (W. F. Purcell, Jan. 1902, ♂♂, ♀♀, juv. 1½ miles from mouth, S.A.M. Reg. No. 9869); Keurbooms River estuary, Plettenberg Bay (K. H. B., Jan. 1931, ♂♂, ♀♀, juv. in water-logged timber in the tidal area, S.A.M. Reg. No. A7848); Buffalo River, East London (Stebbing; also coll. R. M. Lightfoot, 1914).

*Remarks.*—The telsonic apex in the larger Cape specimens is unusually thickened, more so in ♂ than in ♀. The palp of maxilliped and the peraeopods are of the *Exosphaeroma* type, but as Monod (*loc. cit.*, 1931, pp. 11 *sqq.*) points out, there is a series of species ranging from typical *Sphaeroma* to typical *Exosphaeroma* which makes a sharp differentiation of these two genera wellnigh impossible.

Like other estuarine and log-loving species, the integument of this species is usually more or less concealed under a coating of fine particles of foreign matter. Evidently Stebbing did not clean the specimens he examined, and consequently missed the characteristic serration on the outer rami of the uropods.

*Exosphaeroma laeviusculum* (Heller).

(Fig. 11, *a–c*.)

1843. Krauss, Südafrik. Crust., p. 65 (*jurinii*, non Audouin).
1868. Heller, Reise Novara, ii, Crust., p. 138, pl. xii, fig. 7.
1905. Hansen, Q.J. Microsc. Sci., vol. xlix, p. 117 (no opinion on generic status).
1914. Barnard, *loc. cit.*, p. 375 (*gigas* part, non Leach).

Integument nitidulous, with sparse and shallow punctae. Front

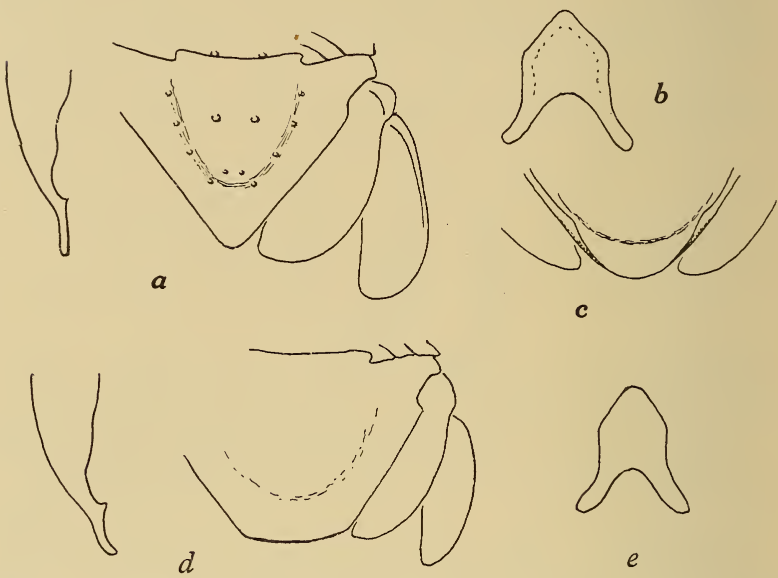



Fig. 11.—*Exosphaeroma laeviusculum* (Heller). *a*, dorsal view of telson and uropod, ♂, with section. *b*, epistome. *c*, ventral view of apex of telson, ♀. *Exosphaeroma truncatitelson* n. sp. *d*, telson and uropod, ♂, with section. *e*, epistome.

margin of head with very feebly raised rim. Epistome with straight sides, apex triangular, surface evenly convex.

In ♂ a series of very low and inconspicuous granules on hind margin of each of peraeon segments, 2 submedian ones on hind margin of first division of pleon; 2 submedian on telson and a series of 5–6 in an arc on either side; in ♀ these granules obsolete.

Telson broader than long, in ♂ triangular, nearly straight sides subtending an angle of about 80°, apex acute; in ♀ sides convex and apex rather broadly rounded, in juvenile still more so; ventral surface with well-marked semicircular ridge. Distance between tips of inner rami of uropods about $3\frac{1}{2}$ times in ♂, 2 in ♀, in length of telson.

Uropod in ♂ lamellate, apically rather broadly rounded, in ♀ narrower, outer ramus extending beyond telsonic apex.

Penial processes relatively short and stout.

Spines on outer margins of all peraeopods as long as width of the joints. Up to 10 mm.

Lighter or darker slaty-grey or bluish-black (according to habitat), more or less mottled.

*Localities.*—Port Nolloth (Prof. Stephenson, 1935); Lambert's Bay (Prof. Stephenson, 1938); Table Bay, Mouille Point, and Hout Bay, littoral (R. M. Lightfoot, 1896; J. Drury, 1914; K. H. B., 1914); Dyer's Island (J. Drury, 1915); Keurbooms River, Plettenberg Bay (K. H. B., Jan. 1931, coast near "Cathedral Rocks").

*Distribution.*—Java; but the "Novara" locality has never been confirmed by later records.

*Remarks.*—Through the kindness of the then (1914) Director of the Vienna Museum, I was enabled to examine the types of Heller's species (5 ♂♂, 1 ♀, 2 juv.). The very minute granules on the peraeon, pleon, and telson, which are only to be seen with certainty in a dried or semi-dried specimen, correspond exactly in the types and the Cape specimens. The largest Cape ♂♂ have the apex of the telson slightly more acute, and the rami of the uropods rather more broadly lamellate, but otherwise a side-by-side comparison reveals no differences.

The Lambert's Bay specimens are particularly smooth, only the submedian pair of granules on the telson being perceptible.

### *Exosphaeroma varicolor* Brnrd.

1914. Barnard, *loc. cit.*, p. 379, pl. xxxii, C.

1926. Baker, Trans. Roy. Soc. S. Austr., vol. l, p. 259.

1929. Hale, Crust. S. Austr., pt. 2, p. 276.

*Distribution.*—Baker says: "They [*Cymodoce unguiculata*] were taken . . . in 5 fathoms at Beachport, South Australia, accompanied by a species so close to *Exosphaeroma varicolor* that I hesitate to separate it." The South African and South Australian forms should, in my opinion, be directly compared before finally accepting their identity.

### *Exosphaeroma planum* Brnrd.

1914. Barnard, *loc. cit.*, p. 380, pl. xxxii, F.

*Locality.*—Keurbooms River, Plettenberg Bay (K. H. B., Jan. 1931, 1 juv. from debris washed up on ocean beach); Port Nolloth (Prof. Stephenson, 1938).

*Remarks.*—In the original description it should perhaps have been stated that in juveniles the uropods do not reach to the telsonic apex. Even juveniles, however, are easily recognized by the depressed shape, the granulations and rugae, and the epistome. The smaller Californian species *amplicauda* (Stimpson) appears to be very much of the same general shape, but has tubercles on the peraeon segments; probably several other differences would appear if the two species were compared side by side.

### *Exosphaeroma truncatitelson* n. sp.

(Fig. 11, *d*, *e*.)

Integument nitidulous, with sparse and shallow punctae. Rim of front margin of head very slightly thickened and raised only near the rostral point. Epistome with very slightly concave sides and bluntly pointed apex, surface evenly convex. No trace of any granules on peraeon, pleon, or telson.

Telson broader than long, apex broadly truncate, apical margin very slightly convex in ♂, nearly straight in ♀ and juv.; ventral surface with semicircular ridge. Distance between tips of inner rami of uropods 1·75 times in length of telson.

Uropod lanceolate, outer rami extending slightly beyond telsonic apex.

Penial processes relatively short and stout. Spines on the peraeopods as long as width of the joints.

Up to 8 mm. Biscuit colour, more or less speckled with greyish.

*Locality.*—Kleinmond, near Hermanus, Cape Province (K. H. B., Feb. 1927, ♂♂, ♀♀, juv.).

*Remarks.*—Both sexes of this form bear a close resemblance to the ♀ of *laeviusculum*, but are quite distinct from the ♂ of the latter species. Up to the present it has not been collected in any other locality.

### *Exosphaeroma pallidum* n. sp.

(Fig. 12, *a*–*c*.)

Integument nitidulous, with rather numerous punctae. Front margin of head with raised sinuous rim. Epistome pentagonal, sides concave, surface flat or slightly concave, anterior margin projecting freely, with a deeper-lying bluntly triangular extension meeting the rostral point. Peraeon, pleon, and telson quite smooth.

Telson broader than long, triangular, sides subtending an angle of about 70°, apex rounded-truncate, dorsal surface evenly convex; ventral surface with semicircular ridge. Distance between tips of inner rami of uropods about 2·6 times in length of telson.

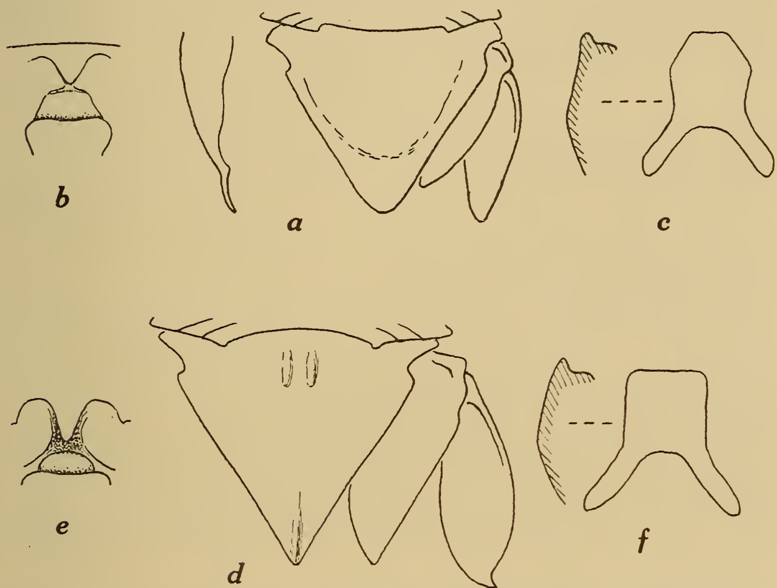



Fig. 12.—*Exosphaeroma pallidum* n. sp. *a*, telson and uropod, ♂, with section. *b*, frontal view of rostral point and epistome. *c*, epistome, with sagittal section.
*Exosphaeroma antikraussi* n. sp. *d*, telson and uropod, ♂. *e*, frontal view of rostral point and epistome. *f*, epistome, with sagittal section.

Uropods ovate, apices subacute, inner ramus not reaching level of telsonic apex, outer ramus extending to or very slightly beyond it.

Penial processes relatively short and stout.

Up to 13 mm. Colour (as preserved) uniform pale pinkish, eyes reddish.

*Locality.*—Woodstock Beach, Table Bay (R. M. Lightfoot, Apr. 1908, ♂♂).

*Remarks.*—The epistome has the somewhat shovel-like shape, with freely projecting front margin (or, in other words, a subapical transverse ridge) as is found in *antikraussi* and *kraussii.*

The late Mr. R. M. Lightfoot told me that the specimens were collected amongst seaweed and debris washed up on the beach (sandy) after a storm, and that when alive they were uniformly pale in colour. I have never collected it myself on any of the rocky portions of the foreshore around Table Bay.

*Exosphaeroma kraussii* Tattersall.

1910. Stebbing, Ann. S. Afr. Mus., vol. vi (Cat. S. Afr. Crust.), p. 428 (*lanceolatum*, non White).

1914. Barnard, *loc. cit.*, p. 375, pl. xxxii, D (synonymy).

*Remarks.*—Since my 1914 paper some specimens from St. Sebastian Bay, collected by the s.s. "Pieter Faure," have been found in the South African Museum, which are, without reasonable doubt, part of the lot (No. 132) sent to Stebbing by Dr. Gilchrist and recorded in 1910. I have always suspected that Stebbing's specimens were *kraussii*, and this is now confirmed.

The St. Sebastian Bay specimens have a more strongly granulate integument than the majority of examples, the micro-granulate texture being particularly noticeable on the posterior margins of the peraeon segments, and on the pleon and telson; but I have seen similar examples from Table Bay and Dyer's Island.

The shape of the epistome is constant, but in my description I omitted to mention an important feature of it: the front margin projects freely, and there is a deeper-lying rounded triangular portion which connects with the rostral point, as in *antikraussi* and *pallidum*.

*Additional Localities.*—(West coast) Port Nolloth and Lambert's Bay (Prof. Stephenson, 1938), Dassen Island; (south coast) Dyer's Island, Port Elizabeth, Port Alfred. The species therefore ranges, as at present known, from Lambert's Bay to East London.

*Exosphaeroma antikraussi* n. sp.

(Fig. 12, *d–f*.)

1914. Barnard, *loc. cit.*, p. 375 (*gigas-lanceolatum*, part).

Integument granulate, more strongly so than in the micro-granulate form of *kraussii* (*supra*). Rim of front margin of head slightly thickened. Epistome quadrate, sides straight, surface flat, anterior margin truncate, projecting freely and visible beyond the antennae in dorsal view, with a deeper-lying rounded extension connecting (or almost so) with the rostral point. Peraeon and pleon without any traces of tubercles. Telson broader than long, triangular, sides subtending an angle of about 70° in ♂, 75° in ♀, apex acute; dorsal surface with a pair of short and feebly raised ridges proximally, and an indistinct median keel distally (less strongly marked than in normal *kraussii*); ventral surface with semicircular ridge. Distance between tips (*outer* angles) of inner rami of uropods $1\frac{1}{3}$–$1\frac{1}{2}$ in length of telson.

Uropod, inner ramus parallel-sided, *inner* apical angle rounded, outer apical angle rectangular or slightly acute, reaching to level of telsonic apex, outer ramus ovate-lanceolate, proportionately broader in ♂ than in ♀, apex acute and uncinately curved outwards, extending slightly beyond level of telsonic apex.

Penial processes relatively short and stout.

Up to 8 mm. Pale buff or whitish, more or less speckled with grey, often the head and anterior four peraeon segments grey, the rest pale.

*Localities.*—Mouille Point, Cape Town (K. H. B., 1913, ♂♂, ♀♀); Oudekraal, near Camps Bay, west coast Cape Peninsula (Prof. T. A. Stephenson, 1934, 1 ♂); Reef Bay, Port Elizabeth (Prof. T. A. Stephenson, 1936, ♂♂, ♀♀).

*Remarks.*—This is the form mentioned in 1914 as having been considered by Dr. Tattersall as *lanceolatum* (White), but on which I preferred to suspend my own opinion pending confirmatory evidence. At a hurried glance it might be confused with *kraussii*. The epistome, however, is quite constant and distinct, and together with the uropods forms a ready means of distinguishing the two species.

### *Exosphaeroma gigas* (Leach).

(Fig. 13, *a–f*.)

1900. Stebbing, Proc. Zool. Soc. London, p. 553, pl. xxxix (references and synonymy).
1909. Chilton, Subantarctic Islands, N.Z., vol. ii, p. 652 (part).
1918. Nierstrasz, Zool. Med., vol. iv, p. 123 (remarks under *calcareum*).
1925. Memoria Annual, 1924, Mus. Nac. Buenos Aires, pl. xxxv, fig. 1 (fig. of *lanceolatum* ex Giambiagi, Ann. Soc. Cient. Argent., 1925).
1931. Monod, Mem. Soc. Sci. nat. Maroc., vol. xxix, p. 69, figs. 23 L, 25 B, 36 A, 37 C, I.

In 1902 Stebbing took the view that it was better to keep *gigas* (Leach) and *lanceolata* (White) specifically separate, "although it may not be absolutely certain which of the forms Leach had before him."

It seems impossible to settle the matter without a direct appeal to the types (if extant), but I have endeavoured to place the South African forms, which hitherto have been regarded as *gigas-lanceolatum*, on a definite taxonomic basis. A comparison with a few specimens from New Zealand, given me by the late Dr. Chilton, and also some Tasmanian examples from the South Australian Museum, has been of considerable help. Although all the New Zealand examples were regarded by Chilton as *gigas*, I am of opinion that two distinct species should be accepted, and that the Tasmanian examples represent a third species.

The distinguishing characters are to be found (♂♂ in all cases) in the presence or absence of a frontal ridge on the head (mentioned by Stebbing, 1900, *loc. cit.*, p. 536), the epistome, the ventral surface of the telsonic apex, and the surface texture of the integument. The shape of the telson and the uropods, previously employed in descriptions, are of course also of diagnostic value.

The specimens from Auckland Is., New Zealand, a ♂ and a ♀ (with embryos) 21 mm., and a juvenile 14 mm. in length, are in agreement with Stebbing's Falkland Is. specimens (1900) in having a nearly straight frontal ridge on the head. Chilton also noticed this in his larger specimens. Stebbing's figures of the telson and epistome seem to have been drawn somewhat foreshortened; as both structures are convex a slight difference in the angle from which they are viewed may account for the small discrepancies between Stebbing's figures and mine.

The ratio of the length to breadth of telson is: 1 : 1·41 (♂), 1 : 1·57 (♀), 1 : 1·68 (juv.). The ratio of the distance between the tips of inner rami of uropods to length of telson is 1 : 2·4 (♂), 1 : 1·86 (♀), 1 : 1·6 (juv.). Thus the telson is relatively longer in the adult than in the young, and the apex is more broadly rounded in the ♀ and juv. than in the ♂.

On the ventral surface of the telson there is a feeble semicircular ridge separating the proximal portion of telson, in which the pleopods lie, from the distal portion.

As regards the epistome Stebbing draws a second line within the margin. In view of the Tasmanian form mentioned below, where there is a definite raised margin, this method of draftsmanship is ambiguous. In the present case, however, one may assume that in the Falkland Is. specimens the surface of the epistome was evenly convex, not sunken and concave in the middle.

Stebbing's description of the penial processes (on 7th sternite)

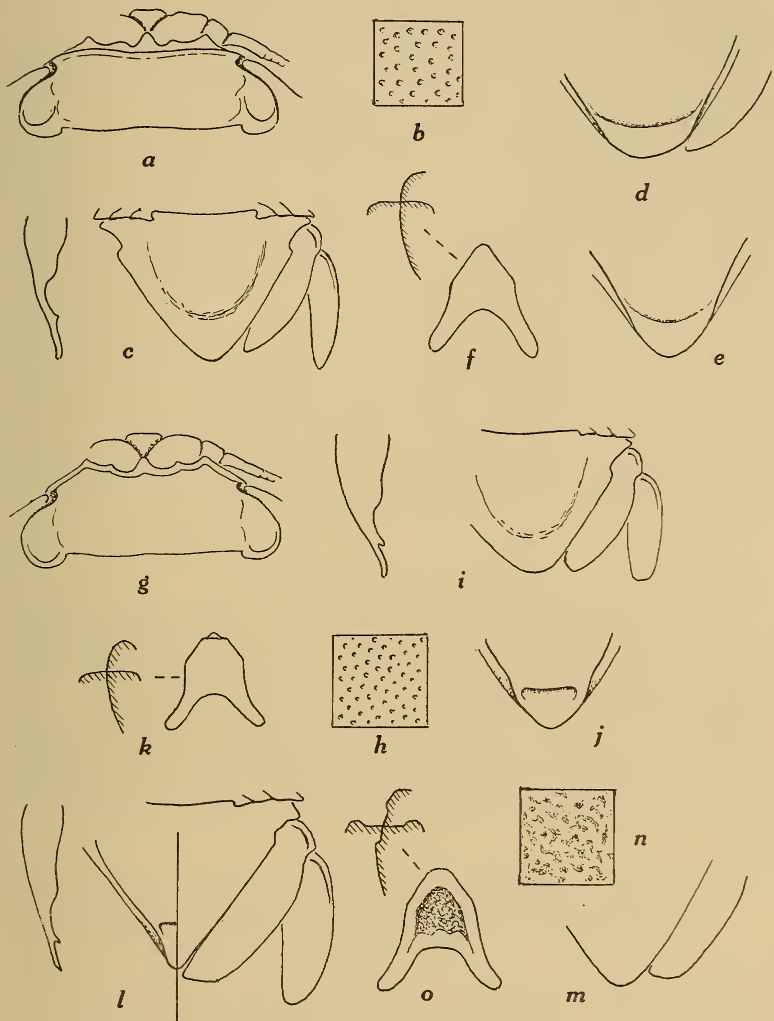



FIG. 13.—*Exosphaeroma gigas* (Leach). Auckland Is., New Zealand. *a*, dorsal view of head. *b*, portion of integument (1st peraeon segment). *c*, telson and uropod, ♂ (21 mm.), with section. *d*, ventral view of apex of telson, juv. (14 mm.). *e*, ventral view of apex of telson, ♂. *f*, epistome, with sagittal and transverse sections.

*Exosphaeroma* sp. Carnley Harbour, Auckland Is., and Dunedin, New Zealand. *g*, dorsal view of head. *h*, portion of integument. *i*, telson and uropod, ♂, with section. *j*, ventral view of apex of telson. *k*, epistome, with sagittal and transverse sections.

*Exosphaeroma* sp. Tasmania. *l*, telson and uropod, ♂ (26 mm.), dorsal view on right, ventral on left, with section. *m*, apex of telson, juv. (15 mm.). *n*, portion of integument. *o*, epistome, with sagittal and transverse sections.

as "about 4 times" as long as broad is not quite in accordance with his figure unless one measures the breadth very near the tip.

The surface of the integument is smooth and nitidulous, with shallow and moderately closely set punctae.

The following may serve as a diagnosis of this form: integument nitidulous, shallowly punctate; head with nearly straight transverse frontal ridge; epistome anteriorly more or less pointed, surface evenly convex; telson broader than long, evenly convex dorsally, apex rounded; the distance between the tips of inner rami of uropods slightly over twice in ♂, slightly less than twice in ♀, in length of telson; ventral surface of telson subapically with a low semicircular ridge; uropods apically subacute or narrowly rounded, the outer ramus extending beyond telsonic apex; penial processes relatively short and stout; outer margins of 2nd and 3rd joints and apex only of inner margin of 3rd joint of peraeopod 1 furry (inner margins of 4th–6th joints in all peraeopods furry); spines on outer margins of all peraeopods few and stout (less than width of joints).

*Distribution.* — Falkland Is. (Stebbing); Auckland Is., New Zealand (Chilton); Kerguelen.

No South African specimens have been collected which conform to the above diagnosis or resemble the above Auckland specimens. I have seen specimens from the Falkland Is. and Kerguelen (ex. Brit. Mus.) which agree entirely with the Auckland Is. specimens.

Although I leave the naming of the following two forms to some other carcinologist, I propose to outline briefly some of the characters distinguishing them from the above form which is regarded as *gigas*.

Carnley Harbour, Auckland Is., New Zealand, and Dunedin Harbour, New Zealand (2 ♂♂ from each locality, don: Dr. Chilton).
(Fig. 13, *g–k*.)

13–14·5 mm. Integument nitidulous, with closer and stronger punctae; front margin of head with a slightly raised rim, sinuous, and not forming a straight transverse ridge; epistome anteriorly in ventral view apparently truncate, but with a triangular point which curves strongly dorsally to meet the rostral point, the longitudinal profile therefore strongly convex; telson broader than long, evenly convex dorsally, apex more narrowly rounded, the distance between tips of inner rami of uropods is 2·5–2·7 times in length of telson; ventral surface of telson with the semicircular ridge so well developed medianly as to form a definite transverse groove on its distal side;

uropods apically subtruncate, the outer projecting only very slightly beyond telsonic apex; penial processes more slender and longer relatively to length of animal.

Tasmania (2 ♂♂ and 1 juv., don: South Australian Museum). (Fig. 13, *l–o*.)

26–27 mm., juv. 15 mm. Integument matt, with very shallow and irregularly vermiculate impressions; frontal margin of head as in the Carnley Harbour specimens; epistome bluntly pointed anteriorly, the central portion slightly sunken and surrounded by a gently raised rim; telson more depressed, broader than long, triangular, sides straight, subtending an angle of approx. 75°–78°, apex acute; distance between tips of inner rami of uropods about 12 times in length of telson; ventral surface of telson with transverse ridge and groove; uropods apically somewhat bluntly rounded, the outer extending beyond telsonic apex; penial processes relatively short and stout (as in *gigas*).

### *Exosphaeroma porrectum* Brnrd.

1914. Barnard, Ann. S. Afr. Mus., vol. x, p. 382, pl. xxxii, E.

The ♀ is similar to the ♂ in sculpturing, but the telson does not project so far beyond the inner rami of uropods, the distal portion is not narrowed, though the apex is acutely pointed, and the outer rami of uropods are not so broadly lanceolate.

*Additional Localities.*—Port Elizabeth (Prof. T. A. Stephenson, 1936, 1 ♀); Lambert's Bay (Prof. T. A. Stephenson, 1938, 1 ♂).

### Gen. *Pseudosphaeroma* Chilton.

1909. Chilton, Subantarc. Is., New Zealand, vol. ii, p. 653.
1931. Monod, Mem. Soc. Sci. nat. Maroc., vol. xxix, p. 73.

### *Pseudosphaeroma barnardi* Monod.

1931. Monod, *loc. cit.*, p. 78; figs. 62–66, 67 A–D, 68–71.

*Localities.*—Hout Bay, in stream (Monod); Keurbooms River, Plettenberg Bay (K. H. B., Jan. 1931, ♂♂, ♀♀, juv. in water-logged timber at Whisky Creek, limit of tidal flow); estuary of Klip Drifts Fontein stream, Potteberg, Bredasdorp district (A. C. Harrison, May 1936); Palmiet River lagoon, Kleinmond (K. H. B., April 1937, under stones, swims on surface at night).

### *Zuzara furcifer* Brnrd.

1920. Barnard, *loc. cit.*, p. 361; pl. xv, figs. 26, 27.

Juveniles of 4 mm. in length have a short blunt apical telsonic projection, and a blunt (truncate) process on 7th peraeon segment extending to end of the composite pleon segment.

*Additional Localities.*—Kleinmond, near Hermanus (K. H. B., February 1927, 1 ♂); Keurbooms River, Plettenberg Bay (K. H. B., January 1931, 2 ♂♂, 3 juv. from debris washed up on ocean beach).

### *Cymodoce valida* (Stebb.).

1902. Stebbing, Mar. Invest. S. Afr., vol. ii, p. 67; pl. xii, A.

1914. Barnard, Ann. S. Afr. Mus., vol. x, p. 388; pl. xxxiii, C.

A young specimen, 9 mm. in length, is creamy-white in colour, with black spots arranged very nearly in the same pattern as in Stebbing's original figure, except that the largest and most conspicuous spot is not on the anterior part of the pleon, but on the base of the telson; a small ovate spot on inner ramus of uropod.

### *Cymodoce unguiculata* Brnrd.

1914. Barnard, *loc. cit.*, p. 394, pl. xxxiv, B.

1926. Baker, Trans. Roy. Soc. S. Austr., vol. l, p. 259.

1929. Hale, Crust. S. Austr., part 2, p. 285.

*Distribution.*—Beachport, South Australia (Baker).

### *Parisocladus perforatus* (M. Edw.).

1914. Barnard, Ann. S. Afr. Mus., vol. x, p. 402, pl. xxxii, fig. H.

*Additional Localities.*—(West coast) Port Nolloth and Lambert's Bay (Prof. T. A. Stephenson); (south coast) Dyer's Island (J. Drury), Port Alfred (Albany Mus.), East London (Prof. T. A. Stephenson, 1937).

*Remarks.*—In the ♀♀ from Lambert's Bay the telson, instead of having 2 submedian ridges or humps each with 1–2 minute points (Barnard, *loc. cit.*), has 2 pairs of submedian very distinct tubercles, and the 2 tubercles on the 4th pleon segment are also much more distinct than usual.

## Eubranchiatae.

### *Dynamenella dioxus* Brnrd.

1914. Barnard, Ann. S. Afr. Mus., vol. x, p. 419; pl. xxxiv, fig. E.

*Additional Localities.*—Port Nolloth and Lambert's Bay (Prof. T. A. Stephenson, 1938).

*Dynamenella scabricula* (Heller).

1914. Barnard, Ann. S. Afr. Mus., vol. x, p. 411; pl. xxxv, fig. A.

*Additional Localities.*—(West coast), Port Nolloth (Natal Mus.), Lambert's Bay (Prof. T. A. Stephenson, 1938), to Table Bay and west coast of Cape Peninsula; (south coast), St James, False Bay and Keurbooms River, Plettenberg Bay (K. H. B.).

*Dynamenella huttoni* (Thomson).

1879. Thomson, Trans. N.Z. Inst., vol. xi, p. 204; pl. x, *a*, fig. 6.
1909. Chilton, Subantarc. Is., N.Z., vol. ii, p. 657 (comparison with *eatoni*).
1914. Vanhöffen, *loc. cit.*, p. 516, fig. 49 (*brunnea*).
1914. Barnard, *loc. cit.*, p. 415; pl. xxxv. B (*kraussi*).
1916. *Id.*, *loc. cit.*, p. 106 (corrigendum = *huttoni*).
1917. Nierstrasz, Zool. Med., vol. iii, p. 109.
1918. *Id.*, *ibid.*, vol. iv, p. 122; pl. ix; figs. 14, 15 (*kraussi*).
1931. Monod, Senckenbergiana, vol. xiii, p. 25.

Chilton's distinctions (based on Calman) between this species and *eatoni* are confirmed except the last one; if by the "sinuous transverse groove" is meant the suture between the 1st and 2nd pleon segments, I find this present in both species. The raised rim of the front margin of head in *eatoni*, and the shape of the animal (both juv. and adult) are clearly marked distinctions. In *huttoni* the body is nearly parallel-sided and very convex, the side-plates being nearly vertical, the height of the body half the width (cross-section semicircular). The slot at end of telson is proportionately narrower in *huttoni* than in *eatoni*.

I have seen South African specimens up to 18 mm. in length.

Monod remarks on the curious fact that *eatoni* occurs at Kerguelen and South America, whereas *huttoni* occurs in South Africa and New Zealand. If *brunnea* be proved (by comparison of Vanhöffen's types) to be the same as *huttoni*, the distribution becomes even more curious.

*Localities.*—As shown by additional records the species occurs along the whole South African coast from Port Nolloth, Lambert's Bay, and Table Bay (Melkbos Strand) to Natal.

*Distribution.*—New Zealand, Chatham Is., Kermadec Is.; St Paul Is. (Indian Ocean) (*brunnea*).

*Dynamenella macrocephala* (Krauss).

1914. Barnard, *loc. cit.*, p. 418, pl. xxxv, C.

In adult ♂ the 7th peraeon segment is noticeably longer in middle line than the preceding segments, with convex hind margin, and is slightly gibbous, overhanging base of pleon.

This species is further distinguished from *huttoni* by having a slightly raised rim on the front margin of head.

*Additional Localities.*—Port Elizabeth (Prof. T. A. Stephenson, 1936); East London (Prof. T. A. Stephenson, 1937).

*Dynamenella ovalis* Brnrd.

1914. Barnard, *loc. cit.*, p. 418, pl. xxxv, D.

This species has a very slightly raised rim on front margin of head. The integument is a little more strongly shagreened or micro-granulate than in *eatoni*, but in spite of this and the feeble rim on the head, there is a possibility that *ovalis* should be regarded as merely a dwarf form of *eatoni*.

*Additional Localities.*—Mouille Point and Oudekraal (west coast of Cape Peninsula); Still Bay, East London.

*Dynamenella australis* Rich.

1914. Barnard, *loc. cit.*, p. 414, pl. xxxv, E.

This species seems to be rare, as since 1914 I have only seen 2 ♀♀ from Sea Point (K. H. B.), and 8 specimens from Lambert's Bay (Prof. Stephenson, 1938). As Miss Richardson pointed out, the ♀ does not differ in the ornamentation of the pleon from the ♂, the granules and the prominent tubercle in front of the apical notch being equally well developed.

*Dynamenella australoides* n. sp.

(Fig. 14.)

Body nearly parallel-sided, convex, glabrous; head, peraeon and anterior part of pleon with very feeble granulation and rugae (best seen when the specimen is partially dried). Posteriorly the granules become slightly more distinct. Telson distinctly granulate-tuberculate, but the arrangement differing from that in *australis*, no prominent median tubercle immediately in front of the apical notch.

Epistome wider than in *australis*, and with evenly sinuous margins, anteriorly more pointedly produced than in *huttoni*.

Uropod, inner ramus sinuous and slightly narrowing apically as in *australis*, but with less acute apex; outer ramus oblong-oval, with bluntly rounded apex (not ovate with subacute apex as in *australis*).

$9 \times 5$ to $10{\cdot}5 \times 5{\cdot}5$ mm. Reddish or greyish brown, more or less mottled, the granules on telson and uropods pale.

*Locality.*—St. James, False Bay, littoral (Prof. T. A. Stephenson, August 1936, ♀♀).

*Remarks.*—This species on a cursory glance looks like *huttoni*, but is easily distinguished (especially if dried) by the granules on the

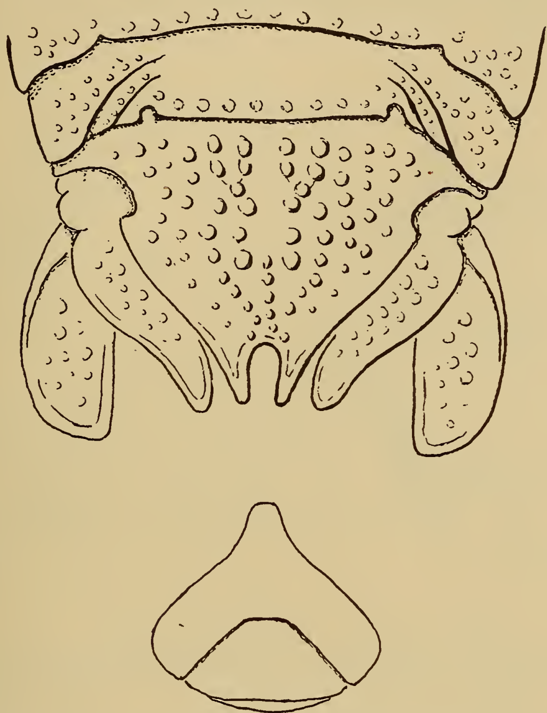


FIG. 14.—*Dynamenella australoides* n. sp. 7th peraeon segment, and pleo-telson; epistome.

telson; it resembles *australis* in the shape of the inner ramus of uropod, but differs in the shape of the outer ramus; the sculpturing of the telson is different, and the body is not setose.

*Dynamenella taurus* n. sp.

(Fig. 15.)

Head strongly bigibbous, front descending steeply to the rim-like anterior margin, rostral point blunt, meeting the epistome.

Peraeon broad, nearly parallel-sided, markedly convex, but the height not half the width ($2\frac{1}{2}$ times in the width), segments smooth and unsculptured, segment 7 rather prominently convex in centre;

epimera very broad, measured ventrally to insertion of peraepods about $\frac{1}{4}$ total width of segment (distance between insertions of the two peraeopods on a segment half the total width of the segment).

Telson triangular, apex narrowly truncate, ventrally notched, but notch not showing in dorsal view, surface strongly convex, with two rounded ridges.

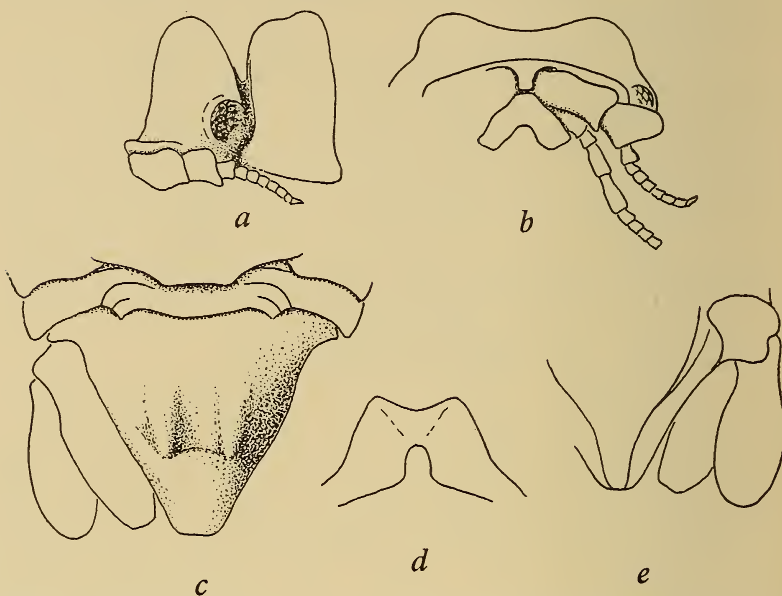


FIG. 15.—*Dynamenella taurus* n. sp. *a*, lateral view of head, 1st peraeon segment, and 1st antenna. *b*, ventral view of head and epistome (flagellum of antenna 2 not completely drawn in). *c*, dorsal view of 7th peraeon segment, pleotelson, and uropod. *d*, posterior view of telson. *e*, ventral view of apex of telson.

First antenna, 1st and 2nd peduncular joints robust, flagellum short, 6–7-jointed. Second antenna, flagellum 12–14-jointed.

Uropod, inner and outer rami broadly oval, apices rounded, extending to, or the outer ramus slightly beyond, telsonic apex.

6 × 4 mm. Reddish or pinkish, with a more or less conspicuous dark-margined, pale, hourglass-shaped dorsal patch on peraeon, the projecting anterior corners of 1st and 2nd peduncular joints of first antennae, the lateral margins of the 1st peraeon segment (both dorsally and ventrally), and the peduncle and outer ramus of uropod chalky white; legs pale, with a brownish mark at base of 2nd joints near insertions; apices of mandibles also white.

*Localities.*—East London (Prof. T. A. Stephenson, July 1937, 3 immature specimens); Port Nolloth (Prof. Stephenson, Aug. 1938, 1 immature specimen).

*Remarks.*—A very distinct species, with an even more gibbous and bull-like head than *macrocephala*; hence the specific name. Distinguished by the oblong-oval shape from *navicula*. The coloration also appears to be distinctive.

### *Dynamenella navicula* n. sp.

(Fig. 16.)

Body boat-shaped, in dorsal view nearly symmetrically lenticular, in lateral view strongly convex; the legs can be completely withdrawn within the margins. Surface smooth and glabrous.

Head (♀) strongly gibbous dorsally, less strongly so in the juveniles. Epimera on segments 2–7 faintly demarcated.

Pleon segment 1 not concealed, though only faintly indicated medianly. No ornamentation on any of the pleon segments.

Telson strongly convex, triangular with truncate apex, the apical margin very feebly concave, with scarcely any groove ventrally.

First antennae, 1st and 2nd joints stout, with a few short plumose setae on the anterior surface, 3rd joint short and narrower; flagellum 6-jointed, the last 3 or 4 joints with sensory setae. Second antennae, flagellum 9-jointed.

Epistome with short quadrangular projection meeting the apically truncate rostral point which separates the bases of the 1st antennae.

Marsupial lamellae overlapping in middle line, brood developed in internal pouches.

Third pleopod with unjointed outer ramus. Fourth and fifth pleopods with strong pleats on both rami.

The uropods can lie horizontal, or can be folded vertically so that when the animal is grasping a stem of seaweed the outer edges of the uropods are applied to the seaweed, leaving a terminal gap through which water can enter to the pleopods: a groove on the ventral surface of the telsonic apex is thus unnecessary. When horizontal, the inner apex of inner ramus almost reaches the telsonic apex, outer ramus much smaller, oval.

$5 \times 2{\cdot}25$ mm. As preserved (after about one month in formalin) dull crimson (probably brighter in life), with faint pale patches dorsally on the peraeon segments, uropods pale, legs pale with grey dendritic dots, eyes black.

*Locality.*—Port Elizabeth, amongst a miscellaneous lot of Amphipods and Isopods collected from seaweed (Prof. T. A. Stephenson, 1936, 2 ovig. ♀♀, 2 juv.); East London (Prof. T. A. Stephenson, 1937, 1 ovig. ♀).

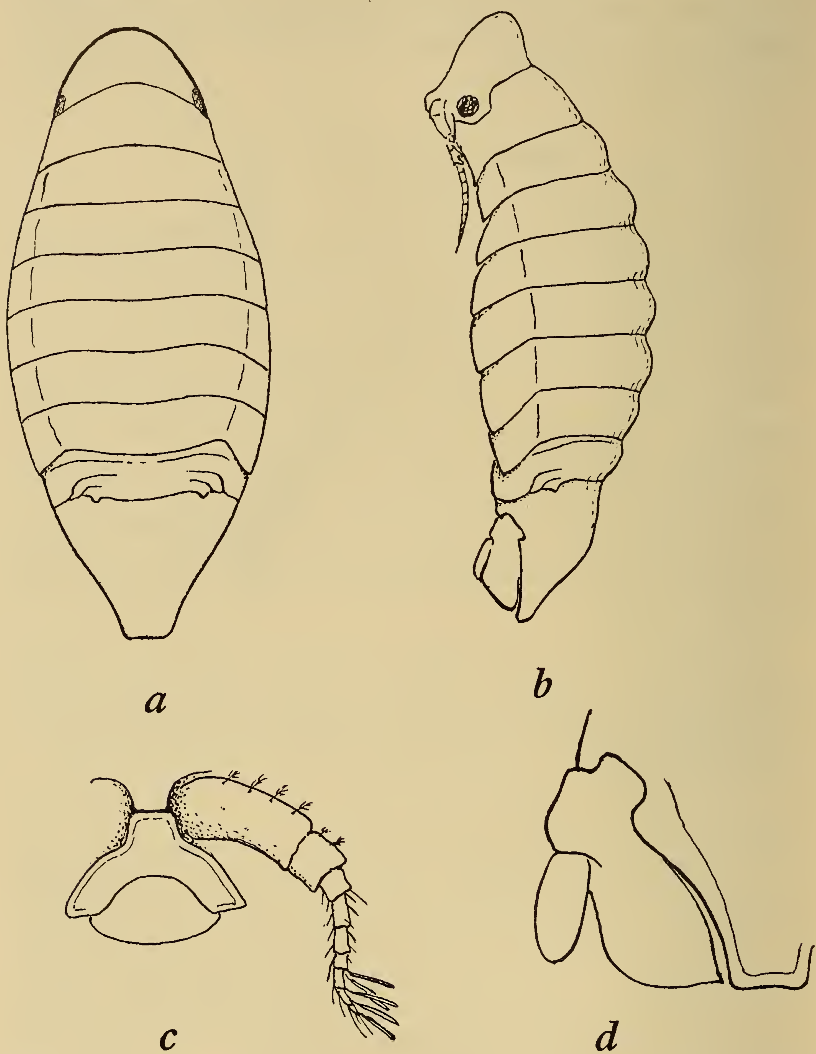


Fig. 16.—*Dynamenella navicula* n. sp. *a, b,* dorsal and lateral views of whole animal. *c,* epistome and 1st antenna. *d,* ventral view of apex of telson and uropod.

*Remarks.*—It is rather unfortunate that no ♂ of this noteworthy little Sphaeromid is present. It would not be surprising if the head of the ♂ were found to be even more prominent than in the ♀. A swollen head, though less developed and without any marked sexual dimorphism, is found in two other South African Sphaeromids: *Dynamenella macrocephala* (Krss.) and *Cymodoce amplifrons* (Stebb.): and a comparison is invited by Baker's figure of an unnamed and undescribed Sphaeromid from the Gt. Barrier Reef (1926, Tr. Roy. Soc. S. Austr., vol. l, pl. 47, figs. 10, 11, explanation, p. 279).

The smaller juvenile, 2·3 mm. in length, although scarcely differing in size ($\frac{1}{12}$ inch) from Stebbing's specimen of *Cymodocella algoense* (*cf.* Barnard, Ann. S. Afr. Mus., vol. x, p. 421, 1914), shows no resemblance, the relative lengths of the telson and uropods being as in the adult.

Although not found *in situ*, there can scarcely be any doubt that this little boat-shaped Isopod lives on seaweed, and by closely examining handfuls of weed future collectors might be rewarded by the discovery of the exact habitat, and also the male.

## Platybranchiatae.

### *Artopoles natalis* Brnrd.

(Fig. 17, *a–c*.)

1920. Barnard, *loc. cit.*, p. 377.

This opportunity is taken to give a figure of this Sphaeromid. The rostral point is small and blunt; ventrally it is pinched in to form a slight median ridge which connects with the spiniform anterior process of the epistome.

### *Stathmos* n. g.

Body oblong, moderately depressed, the side-plates broad and nearly horizontal, margins not ciliate. Head laterally enclosed in 1st peraeon segment. Peraeon segment 7 not quite as wide as 6th, but forming part of the lateral margins. Telson at base much narrower than anterior portion of pleon, triangular. Epistome projecting in front, visible in dorsal view. First 2 joints of antenna 1 expanded. Fourth to 6th joints of maxilliped inwardly produced. Peraeopods normal, the hinder ones becoming slightly more slender; the anterior 3 pairs with rather long spine-setae (not natatory plumose setae). Inner ramus of pleopod 1 almost twice as long as (basally) wide. Both rami of pleopod 3 with plumose setae, the outer ramus 2-jointed. Both rami of pleopods 4 and 5 without transverse folds, the outer rami 2-jointed, feebly setose. Uropods not reaching telsonic apex, but both rami well developed.

*Stathmos coronatus* n. sp.

(Fig. 17, *d–k*.)

*Female*.—Surface minutely granulate. Head with small rostral point, slightly raised front margin, 2 low rounded submedian tubercles, and a low rounded transverse ridge between the eyes. Each of the

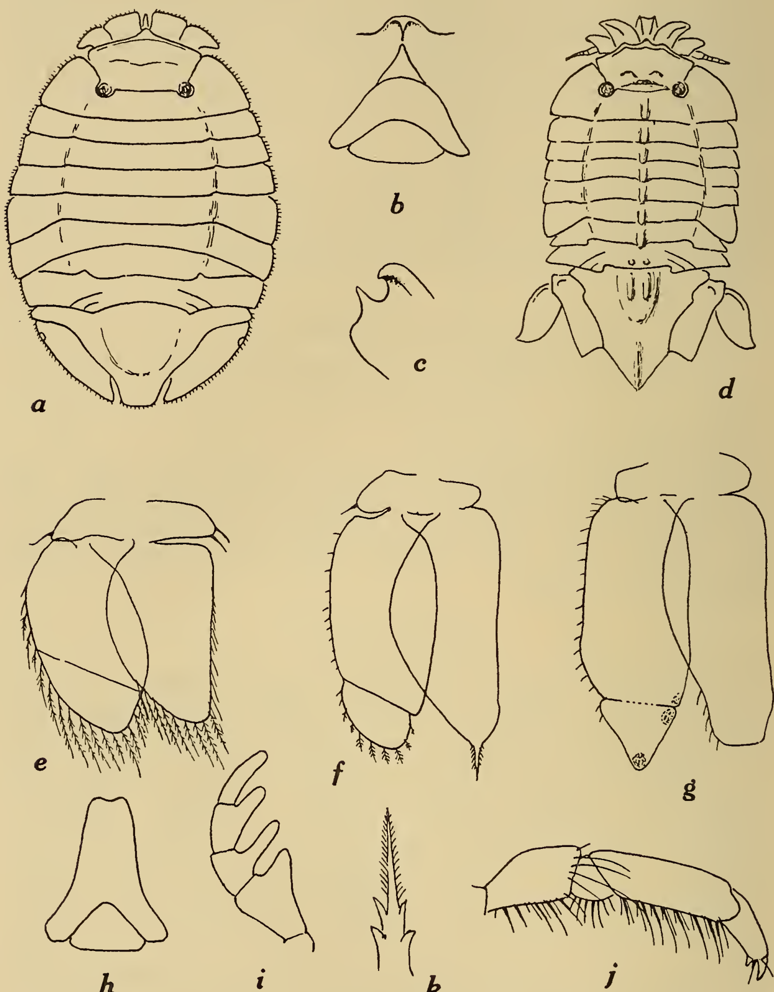



Fig. 17.—*Artopoles natalis* Brnrd. *a*, whole animal. *b*, *c*, ventral and lateral views of epistome and rostral point.
*Stathmos coronatus* n. g., n. sp. *d*, whole animal. *e*, *f*, *g*, pleopods 3, 4, and 5 respectively. *h*, epistome. *i*, palp of maxilliped (setae omitted). *j*, peraeopod 1. *k*, spine from inner apex of 5th joint of peraeopods 5–7.

peraeon segments with a low median longitudinal ridge, ending on the hinder segments in a slightly projecting tubercle. Anterior portion of pleon with 2 slight submedian tubercles. Telson triangular, apex acute, margin slightly concave where the inner rami of uropods abut against it, 2 faint submedian keels proximally, passing into a low median keel distally.

Epistome projecting conically in front, apex truncate, ventrally smooth, dorsally grooved between 2 ridges which converge towards the rostral point on head.

Antenna 1, first 2 joints triangularly expanded, the antero-distal angles sharp, an oblique ridge on dorsal surface of 1st joint, 3rd joint small, flagellum 7-jointed. Antenna 2, flagellum 10–11-jointed, extending to end of 1st peraeon segment. Maxilliped, 4th–6th joints inwardly expanded, 4th rather broadly, 5th and 6th narrowly.

Peraeopods normal, the hinder ones, especially the 7th, more slender than the anterior ones; the 3 anterior ones with rather long simple spine-setae on lower margins of 4th–6th joints.

Pleopod 1, inner ramus subtriangular, nearly twice as long as wide; 3 coupling-spines on peduncle of both pleopods 1 and 2. Pleopod 3, both rami with plumose setae, outer ramus 2-jointed, 2 coupling spines on peduncle. Pleopod 4, outer ramus 2-jointed with a few short setae on outer margin, and some short plumose setae around apex; inner ramus non-setose, but with a single rather short and stout plumose seta on apex. Pleopod 5, outer ramus 2-jointed, the suture somewhat indistinct in the middle, outer margin with 2 short setae; inner ramus apically truncate, with a few short setae on outer margin distally.

Uropods, not nearly reaching telsonic apex, inner ramus subquadrangular, apex truncate, slightly emarginate, outer ramus ovate-lanceolate, apex turned outwards.

6 (not incl. epistome) $\times$ 3·5 mm. White, eyes black.

*Locality.*—Oudekraal, near Camps Bay, west coast of Cape Peninsula (Prof. T. A. Stephenson, 1934, littoral, 1 non-ovigerous ♀).

σταθμος = a cattle-pen (kraal).

## Fam. ASTACILLIDAE.

### Gen. *Arcturella* Sars.

1925. Monod, Bull. Soc. Sci. nat. Maroc., vol. v, p. 76 (validity of genus).

### *Arcturella brevipes* Brnrd.

(Fig. 19.)

1920. Barnard, *loc. cit.*, p. 396, pl. 16, fig. 27.

Further specimens from a specimen of *Gorgonia albicans* from Table Bay, ♀ up to 11 mm. in length, 3·75 mm. in width.

One immature ♂, 6 mm. in length, has the 4th peraeon segment 1·3 mm. in length and just under 1 mm. in greatest width. In dorsal view this segment is somewhat bottle-shaped, the anterior quarter being narrower and forming the neck; the width across posterior margin is much less than that of segment 5. There are 2 small rounded tubercles in the mid-dorsal line.

## Fam. IDOTEIDAE.

### *Cleantis natalensis* Brnrd.

1925. Barnard, *loc. cit.*, p. 394.

1936. *Id.*, Rec. Ind. Mus., vol. xxxviii, p. 186, fig. 17.

First described from juveniles which probably reached the Natal coast in drift-weed by the agency of the Mozambique current. The adult, and the tubular case it inhabits, are described in the second paper quoted above.

*Distribution.*—Bay of Bengal.

### *Synidotea variegata* Cllge.

1917. Collinge, Rec. Ind. Mus., vol. xiii, p. 2, pl. i.

1924. Chilton, Mem. Ind. Mus., vol. v, p. 891, fig. 10 and pl. lx, fig. 6.

1927. Omer-Cooper, Tr. Zool. Soc. Lond., vol. xxii, p. 205 (? *hirtipes*).

1935. Barnard, Rec. Ind. Mus., vol. xxxvii, p. 313.

1936. *Id.*, *ibid.*, vol. xxxviii, p. 185, fig. 16.

A young specimen has been compared with Indian specimens, and appears to agree in all respects.

*Locality.*—Port Elizabeth, amongst seaweed (Prof. T. A. Stephenson, 1936, 1 juv.).

*Distribution.*—Coasts of India and Ceylon; Suez Canal.

### *Paridotea ungulata* (Pallas).

1910. Stebbing, Gen. Cat. S. Afr. Crust., p. 433.

1914. Barnard, Ann. S. Afr. Mus., vol. x, p. 430.

*Additional Localities.*—(West coast) Walfisch Bay to Table Bay; (south coast) False Bay to East London.

*Paridotea rubra* Brnrd.

1914. Barnard, *loc. cit.*, p. 426, pl. xxxvii, fig. A.

*Additional Localities.*—Port Nolloth and East London (Prof. T. A. Stephenson).

*Glyptidotea lichtensteinii* (Krss.).

1910. Stebbing, Gen. Cat. S. Afr. Crust., p. 434.

*Additional Localities.*—Port Nolloth and East London (Prof. T. A. Stephenson).

Gen. *Engidotea* Brnrd.

1914. Barnard, Ann. S. Afr. Mus., vol. x, p. 203.

The definition of the genus requires a slight modification: the side-plates on segments 2 and 3 in the ♀ are not as long as their segments, thus resembling *Paridotea.* In fact these two side-plates are not as long as the length of their segments in the ♂ if the length of the segment be taken in the mid-dorsal line; it is only the peculiar intersegmental notching which develops in the ♂, and bevels off the postero-lateral corners of the segments, which permits the original statement to be regarded as correct.

Juveniles and females are typical *Paridotea,* as regards the side-plates, and the two genera are certainly very close. On account of the sexual dimorphism I am inclined to let *Engidotea* stand.

*Engidotea lobata* (Miers).

(Fig. 18.)

1881. Miers, J. Linn. Soc. Lond., vol. xvi, p. 57, pl. ii, figs. 8, 9 (♂).

1914. Barnard, *loc. cit.*, p. 204, pl. 17, C (♂).

Figures of both sexes are given here to show the different shapes. The telson is not quite so widely notched in females and juveniles. The coloration is remarkable. The mid-dorsal pale line, expanding into an oval spot on segments 1, 4, and 7, is characteristic of all specimens, from 4 mm. upwards, which I have seen, though it fades in alcohol. The margins of the peraeon segments are pale, especially around the postero-lateral corners. In the ♂ these corners become bevelled off as growth proceeds, but the pale margin remains narrow. In the ♀, however, no structural alteration takes place, but the pale margin becomes a broad, more or less triangular, pale patch at the postero-lateral corners. Consequently when a fresh female is placed on a pale background, the coloration produces the effect of incised lateral margins simulating the actually incised margins in the ♂.

Length of ovig. ♀ 17 mm., greatest width (across 3rd peraeon segment) 5 mm. The ground colour may be deep maroon, greenish,

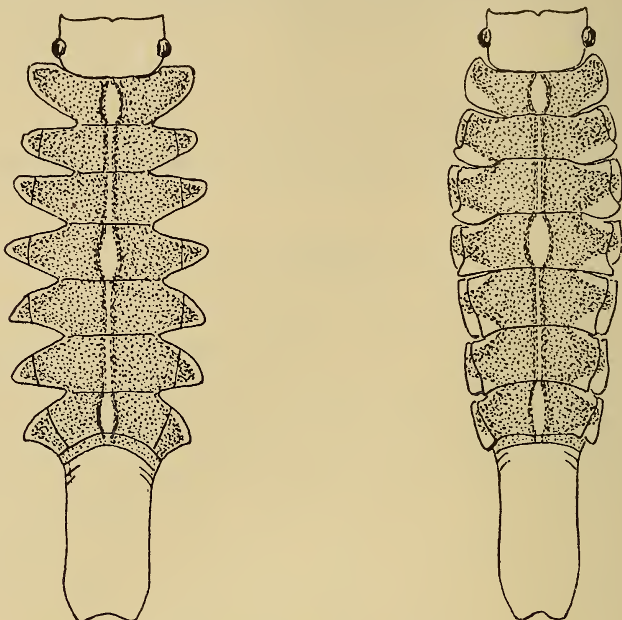


Fig. 18.—*Engidotea lobata* (Miers), showing how the morphological alteration in the male (left) follows the line of demarcation between the pigmented and unpigmented areas in the female (right). The pigmentation on head and telson not shown.

brown, or buff according to the colour of the seaweed and other surroundings amongst which the animals live.

*Additional Localities.*—St. James and Buffels Bay (False Bay) (K. H. B., 1914, 1915); Sea Point and Melkbos Strand (Table Bay) (K. H. B., 1913 and 1927); Port Elizabeth (Prof. T. A. Stephenson, 1936, 1 ovig. ♀); Lambert's Bay (Prof. T. A. Stephenson, 1938, 1 ♂, 2 juv.).

## Fam. STENETRIIDAE.

### Gen. *Stenetrium* Hasw.

1920. Barnard, *loc. cit.*, p. 398 (references).

1925. Monod, *loc. cit.*, p. 238.

*Stenetrium bartholomei* n. sp.

(Fig. 19.)

Very like *diazi* Brnrd. at first sight, but with the following differences. Rostrum triangular, as long as basal width, apex subacute. Ventral keel with forwardly directed point on each of segments 1–3, and backwardly directed point on segments 6 and 7, obsolete on segments 4 and 5. Antenna 1, 2nd joint shortest, $\frac{1}{2}$ length of 1st,

FIG. 19.—*Arcturella brevipes* Brnrd. (left). Dorsal view of 3rd–5th peraeon segments of immature ♂.
*Stenetrium bartholomei* n. sp. (right). Hand of peraeopod 1.

3rd $\frac{2}{3}$ length of 1st. Peraeopod 1, ♂, elongate, 2nd joint longer than 3rd–5th together, slender at base and without tooth, 6th joint $\frac{2}{3}$ length of 2nd, broadly subtriangular, palm transverse, defining tooth strong, palm with one rather long slender tooth and 3 smaller teeth, finger robust, overlapping and closing down on inner side of palm, apex subacute; in ♀ as in *diazi*. Pleopod 1 as in *diazi* but outer margins of rami less angular.

♂ 5·5 mm., ♀ 6·5 × 3 mm., length of peraeopod 1 (base of 2nd joint to palm) 5 mm. Creamy-white, with greyish-brown mottling, chiefly on lateral corners of head, a small medio-dorsal spot on peraeon segments 2–7, and the anterior half or two-thirds of the pleon, the latter with pale apex, and pale lateral and medio-dorsal spots, eyes dark.

*Locality.*—Still Bay and Port Elizabeth, littoral (Prof. T. A. Stephenson, 1932, 1 ♂, 1 ovig. ♀, 9 juv., and 1936, 1 ♂, 1 ♀ respectively).

*Stenetrium syzygus* n. sp.

(Fig. 20.)

Body nearly parallel-sided, dorsally smooth, but the hinder peraeon segments feebly grooved transversely, surface finely hirsute.

Head with antero-lateral angles acute, but not strongly produced; rostrum prominent, acute. Eyes reduced to 3–4 separate ocelli. Antero-lateral angles of peraeon segment 1 not prominent, nor acute. Ventral keel not prominent on any of the segments, distinct on segments 1 and 2, but not raised into processes or denticles. Pleon slightly longer than broad, the anterior 2 segments distinct.

Antenna 1 short, scarcely as long as length of head, and not extending beyond 4th peduncular joint of antenna 2, flagellum apparently composed of only one joint. Antenna 2, 1st joint not produced on outer apex, scale on 3rd joint short and broad, 6th joint slightly longer than 5th, flagellum longer than peduncle, multi-articulate. Mouth-parts normal; 2nd joint of maxilliped not so elongate as in *crassimanus* Brnrd. (1914, pl. xx).

Peraeopod 1 not elongate, outer apex of 3rd joint blunt, of 4th acute, 6th short and broad, outer margin strongly convex, inner margin straight, palm transverse, with stout defining spine at angle, outer margin with dense fringe of long setae curving over on to inner surface. Peraeopods 2–7 biunguiculate.

Penial processes on 7th peraeon segment curving towards one another, apices nearly touching.

Pleopod 1 fused, peduncles very short, rami elongate ovate. Pleopod 2, ♂, normal, outer ramus 2-jointed, 2nd joint short, with one strong subapical seta, inner ramus with apical setae, and a short subapical appendage. Pleopod 3, outer ramus operculiform, 2-jointed, inner ramus shorter, narrow, with a few apical setae. Pleopod 4, outer ramus narrow, 2-jointed, apically incurved, inner ramus oval, shorter and broader. Pleopod 5 with a single ovate ramus. Uropods, peduncle short, outer ramus shorter than inner, both with simple setae.

6 × 1·5 mm. Creamy-white, ocelli faintly reddish.

*Locality.*—Still Bay (Prof. T. A. Stephenson, 1932, ovigerous and non-ovigerous specimens).

*Remarks.*—The reduction of the eyes to 3 or 4 feebly pigmented ocelli gives this Isopod the appearance of a deep-sea form; it was, however, collected under rocks and among worm-tubes, ascidians, etc., in the littoral zone. Except for the eyes it is a normal

*Stenetrium,* though the peduncles (fused) of the 1st pleopods are unusually short.

There is one most remarkable feature of these specimens. In all

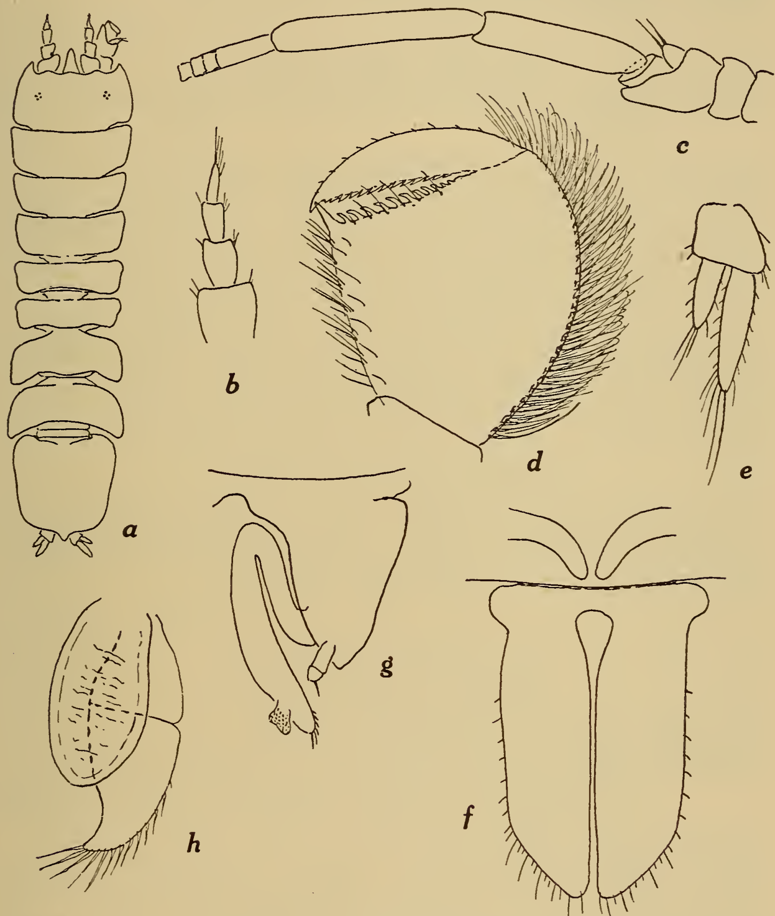



FIG. 20.—*Stenetrium syzygus* n. sp. *a*, whole animal. *b*, antenna 1. *c*, antenna 2. *d*, hand of peraeopod 1. *e*, uropod. *f*, penial processes of 7th sternite, and 1st pleopods. *g*, pleopod 2. *h*, pleopod 4.

of them the pleopods are of the same structure characteristic of the ♂ of *Stenetrium,* but some of the specimens have well-developed brood-plates and carry ova or embryos. This extraordinary fact is confirmed by Dr. Th. Monod (in litt. 23/10/35), to whom I had forwarded specimens.

## Fam. JAERIDAE.

### Gen. *Austrofilius* Hodgson.

1910. Hodgson, Nat. Antarct. Exp., vol. v, p. 51.
1914. Vanhöffen, *loc. cit.*, p. 554.

### *Austrofilius serrata* (Brnrd.).

?1914. Vanhöffen, *loc. cit.*, p. 554, fig. 81 (*Austrofilius furcatus*, non Hodgson).
1914. Barnard, *loc. cit.*, p. 433, pl. xxxviii, A (*Jaera s.*).

I have a strong suspicion that Vanhöffen's Simonstown material and my *Jaera serrata* are the same species; possibly the Kerguelen specimens are also the same, but I doubt whether the South African specimens should be assigned to Hodgson's antarctic species.

In any case *serrata* would seem to be more happily placed in *Austrofilius* than in *Jaera*. These minute *Asellota* are very difficult to examine and usually the material is very scanty. There is a great likeness between Vanhöffen's figure of pleopod 1, ♂, and mine.

### *Jaeropsis curvicornis* (Nicolet).

1914. Barnard, Ann. S. Afr. Mus., vol. x, p. 224, pl. xx, fig. C (♂).

*Additional Localities.*—Sea Point, Table Bay (K. H. B., 1914), Lambert's Bay (Prof. T. A. Stephenson, 1938).

## Fam. PHREATOICIDAE.

### *Phreatoicus capensis* Brnrd.

1914. Barnard, *loc. cit.*, p. 233, pls. xxiii, xxiv.
1927. *Id.*, Trans. Roy. Soc. S. Afr., vol. xiv, pp. 141 *sqq.*, pls. vi–ix, and text-figs. 1–6 (general biology, and vars. *abbreviatus* and *depressus*) (January).
1927. Sheppard, Proc. Zool. Soc. London, p. 109 (April).

In my 1927 paper the following correction should be made in the legend to fig. 6: for "Kogelberg" read "Steenbras"; figs. *b* and *d* represent the var. *depressus*.

The following additional character of var. *abbreviatus* may be noted: uropods with numerous setae as well as the typical spines.

### var. *penicillatus* n.

Side-plates and lateral portions of head strongly setose. Hand of gnathopod (peraeopod 1) in the largest ♂♂ as large as the head in lateral view, robust, palm scarcely longer than hind margin; in ♀ and juv., however, palm distinctly longer than hind margin (*cf.* Barnard, 1927, fig. 4, *b*).

Antenna 2, lower surfaces of 2nd–5th peduncular joints strongly setose, flagellum with dense whorls of setae.

Telson strongly setose, setae on lateral margin long, 2 apical spines and often one lateral on each side, sometimes a subapical pair on dorsal surface (as in var. *depressus*); all the spines more slender than in the typical form.

Uropods with spines as in typical form, but outer ramus with 3 apical spines and inner ramus with 3 or 4; peduncle and rami in addition strongly setose, most of the setae, especially the distal ones, at least twice as long as the spines; ♀ not so strongly setose as ♂.

*Locality.*—Hermanus (K. H. B., Nov. 1935).

*Remarks on the Locality.*—The specimens were found in a stream issuing from the base of a cliff in an amphitheatre immediately to the west of the Riviera Hotel, which stands on the 60–70 ft. sea-cut terrace. This amphitheatre or basin was formerly a lagoon opening to the sea, but the mouth is now completely closed by a sand-bar, and it has become merely a marsh overgrown with rushes, palmiet, etc. Although *Phreatoicus* has not been collected in the coastal mountains behind Hermanus, its occurrence there is to be expected. Evidently the animals have been carried down to their present habitat by flooding of the mountain streams, or possibly by more or less subterranean channels. As the habitat can only have been formed after the major and minor uplifts (Haughton) * the establishment of this colony is of quite recent geological age. The occurrence of *Phreatoicus* at an altitude very little above sea-level has therefore no particular significance, and the details of the habitat are given merely because the habitat was somewhat unexpected.

*Remarks on the Riversdale Locality.*—This locality (recorded without details in 1927, *loc. cit.*, p. 148) was also rather unexpected. It lies on the northern dip slope of the Langeberg Range, a short distance west of the north end of Garcia's Pass (through which the Riversdale-Ladismith road runs). A small stream rises on the Table Mt. Sandstone of the Langeberg and loses itself on the Bokkeveld Beds, which are banked up against the T.M.S. and form the nearly level plain stretching northwards towards Ladismith. The Crustaceans were living amongst clumps of the liverwort *Aneura fastigiata* (K. H. B., Oct. 1926). The stream apparently is not perennial, and

* Geol. Cape Town. Explan. sheet 247, p. 41. Geol. Surv. Union S. Afr., 1933.

it would be interesting to visit the locality at the end of the summer to see whether the stream really is perennial, and if not what happens to the animals.

## Fam. BOPYRIDAE.

### Gen. *Scyracepon* Tattersall.

1905. Tattersall, Fish. Ireland Sci. Invest., 1904, vol. ii, p. 35.

Female broadly oval. Peraeon segments, except the first one, each with a medio-dorsal boss, increasing in size posteriorly. The first five pleon segments with the pleurae produced in long digitate processes, decreasing in length posteriorly; sixth pleon segment with very short lateral processes. All seven pairs of peraeopods present on both sides, ending in a short claw. Pleopods biramous, the outer rami elongate and digitate like the pleural processes, the inner rami short and ovate. Uropods uniramous, elongate, digitate.

Male with the first 3 pleon segments more or less distinctly marked by lateral indents. A ventral median boss on each of the peraeon segments and on the first 2 pleon segments. Pleopods and uropods absent.

*Remarks.*—One of the reasons for differentiating this genus, viz.: the ventral bosses in the male, does not hold good, as they are found in other allied genera (e.g. *Grapsicepon*). And as regards the dorsal processes in the female, there are species in which they are more or less distinct on all the segments, and others in which they are restricted to the posterior segments. The specimens described below show a distinct median carina on all the segments in the young female, but only three distinct bosses on the hinder segments in the ovigerous female. This character, therefore, is of little generic value (*cf.* Stebbing, 1904, F. and Geogr. Mald. Laccad. Archip., vol. ii, p. 716, and 1910, Tr. Linn. Soc. Lond., vol. xiv, pp. 112–115).

Morphologically it is not at all easy to separate many of the genera, and one of the reasons for multiplying genera and species in the past has been the theory that each different host must have a different parasite; a theory which is not free from criticism.

### *Scyracepon levis* n. sp.

(Fig. 21.)

Female—Young ♀ symmetrical, ovigerous ♀ asymmetrical. In the former there is a medio-dorsal keel on each peraeon segment, gradually increasing in height posteriorly; in the ovigerous ♀ the keel is obsolete on the 1st–4th segments and is present as an elevated tubercle on 5th–7th segments, that on 7th segment being the highest. Anterior rim of head smooth, postero-lateral angles rounded. Ovarian bosses moderately well developed. All the plates forming the brood-pouch, including the last pair, smooth, not tuberculose, the last two pairs fimbriate on their posterior margins. Pleural lamellae and outer

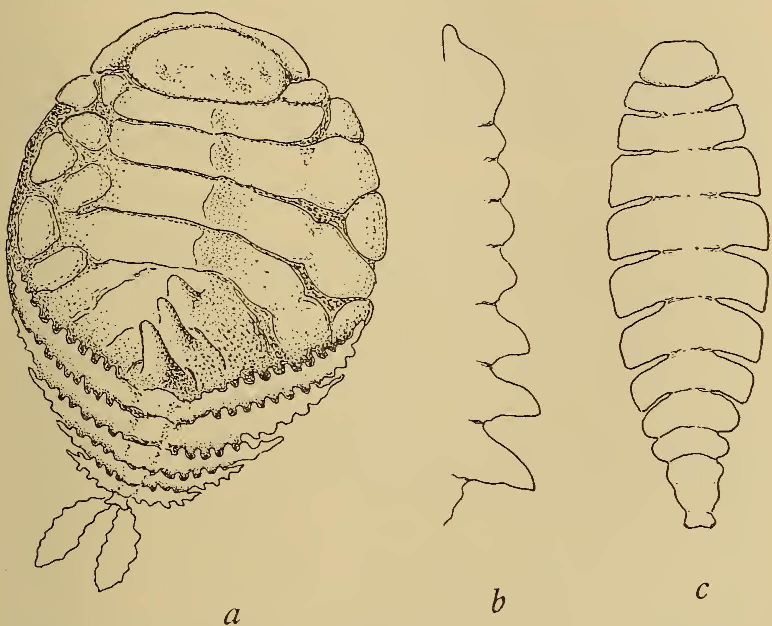



FIG. 21.—*Scyracepon levis* n. sp. *a*, dorsal view of ovigerous ♀. *b*, profile of dorsum of young ♀. *c*, dorsal view of ♂.

rami of pleopods crenulate on one edge and digitate on the other edge, or digitate on both edges, with more numerous digitations than in *S. tuberculosa*.

Male—Medio-ventral bosses on first 2 pleon segments obscure. Lateral portions of pleon segments ventrally gibbous, but without actual projecting lobes (rudimentary pleopods).

Length, ♀ 9, ♂ 3·5 mm.; breadth, ♀ 7·5, ♂ 1·25 mm.

*Locality.*—Off Table Bay and Cape Point, in the branchial cavity of *Scyramathia hertwigi* Doflein.

*Remarks.*—*Scyramathia hertwigi* is very closely allied, perhaps only a subspecies, of the Northern Atlantic *S. carpenteri*, and the parasites of the respective crabs are also very much alike. The northern parasite has the last pair of marsupial plates tuberculose, whereas the southern form has them smooth; and the latter seems to have more digitations on the pleural lamellae and outer rami of the pleopods in the ♀.

### Fam. TYLIDAE.

*Tylos granulatus* Krss.

1932. Barnard, Ann. S. Afr. Mus., vol. xxx, p. 217, fig. 11, *a* and *b*.

In this paper it was stated (p. 216) that no actually ovigerous female had been examined. In February 1937 two ovigerous females were dug up at the mouth of the Schusters River, west coast of Cape Peninsula.

In the position of the brood-pouch they resemble those woodlice which completely roll themselves up into a ball (*loc. cit.*, pp. 225, 226, fig. 13, *b*, *c*), that is: the 5 pairs of oostegites (peraeon segments 1–5) lie perfectly flat, simulating the sterna, while the developing ova and brood press the true sterna inwards against the dorsal body-wall. In the present case this squeezing of the internal organs between the sternal and dorsal plates is carried to such an extreme that these organs appear to be quite degenerate. The chitinous stomach in the head segment remains, but behind this no intestine can be traced, and the hepatic glands are gone also. In fact it would seem improbable that the mother could recover after the escape of the brood.

Each oostegite has two supporting rib-like thickenings and the margins are non-setose. The anterior margin of one overlaps the hind margin of the one in front of it. Cotyledons are developed. Eggs, and young nearly ready to escape, were found together in the brood-pouch of both these females.

## AMPHIPODA.

Further records of distribution and notes on some South African species, in addition to those quoted below, will be found in my report on the Amphipods of the John Murray Expedition (vol. iv, 1937).

### Fam. LYSIANASSIDAE.

*Stomacontion capense* Brnrd.

1916. Barnard, Ann. S. Afr. Mus., vol. xv, p. 109, pl. xxviii, figs. 27, 28.

1937. *Id.*, John Murray Exp. Rep., vol. iv, p. 140, fig. 1.

*Distribution.*—South Arabian coast.

*Remarks.*—Monod (1937, Mem. Inst. d'Egypte, vol. xxxiv, pp. 6, 10, figs. 1–3, 4, *a–c*, 5, 6, *a*) describes a species *prionoplax* from the Suez Canal, very close to *pepinii* (Stebb.). The John Murray Expedition obtained a specimen in the Red Sea which I identified as *pepinii* (*loc. cit.*, *supra*, p. 140).

*Lysianassa ceratina* (Wlkr.).

1900. Chevreux, Res. Sci. Camp. Monaco, vol. xvi, p. 16, pl. v, fig. 1.
1912. Chilton, Trans. Roy. Soc. Edin., vol. xlviii, p. 464, pl. i, fig. 5 (*cubensis*, non Stebb.).
1916. Barnard, Ann. S. Afr. Mus., vol. xv, p. 120 (*cubensis*, non Stebb.).
1925. Chevreux and Fage, Faune de France, Amphip., p. 42, fig. 23.
1925. Schellenberg, Beitr. Kenntn. Meeresf. Westafr., vol. iii, p. 113, fig. 1.
1926. *Id.*, Deutsch Südpol. Exp., vol. xviii (zool. x), p. 250.
1928. *Id.*, Trans. Zool. Soc. Lond., vol. xxii, p. 633 (part references).
1938. Ruffo, Ann. Mus. Civ. Genoa, vol. lx, p. 154, fig. 1.

*Additional Localities.*—Luderitzbucht and Simon's Bay (Schellenberg); Port Nolloth and Lambert's Bay (Prof. Stephenson, 1938); Port Elizabeth (Prof. T. A. Stephenson, 1936); East London (Prof. T. A. Stephenson, 1937).

*Remarks.*—I am not prepared to admit *cinghalensis* Stebb., 1897; into the synonymy of this species, as Walker and Schellenberg have done, in view of *cinghalensis* having an enlarged 1st joint in the 1st antenna. The 1st antennae admittedly tend to be stouter in the ♂ than in the ♀, but in a ♀ collected by the John Murray Expedition (1937, Barnard, J. M. Exp. Rep., vol. iv, p. 142) I found the 1st joint of antenna 1 was enlarged as in Stebbing's figure of the ♂ *cinghalensis*. Moreover, in the South African examples now referred to *ceratina*, the 2nd and 3rd uropods are stouter, the 2nd with the inner ramus more strongly constricted, the 3rd with stronger (♂) or much stronger (♀) keel on the peduncle, than in *cinghalensis*.

I also do not think Walker was correct in making *urodus* a synonym of *cinghalensis* and thus of *ceratina*; but probably he and Schellenberg are right in not distinguishing *bispinosa* as a separate species.

*Distribution.*—Atlantic to Senegal; Canary Is.; Mediterranean, Red Sea, and East Africa.

*Orchomenella plicata* Schell.

1925. Schellenberg, *loc. cit.*, p. 119, fig. 3 (*chilensis*).
1926. *Id.*, p. 292, fig. 28 (*chilensis* forma *plicata*).

*Localities.*—Luderitzbucht, Simon's Bay (Schellenberg). Port Nolloth (Prof. Stephenson, 1938); Oudekraal, west coast of Cape Peninsula (Prof. T. A. Stephenson, 1934).

*Cyphocaris anonyx* Boeck.

1926. Schellenberg, p. 244 (references).
1926*a*. *Id.*, Deutsch. Tiefsee Exp., vol. xxiii, p. 210, pl. v, fig. 2; and text-figs. 2, *b*, 5, *a*, *b*.

*Locality.*—S.W. of Cape Agulhas.

*Cyphocaris challengeri* Stebb.

1926. Schellenberg, *loc. cit.*, p. 243 (references).
1926*a*. *Id.*, *loc. cit.*, p. 212, pl. v, fig. 3 and text-figs. 2, *d*, 6–10.

*Locality.*—S.W. of Agulhas.

Gen. *Eurythenes* S. I. Smith.

1891. Sars, Crust. Norw., vol. i, p. 85 (*Euryporeia*).
1905. Chevreux, Bull. Inst. Océan. Monaco, No. 35, p. i (*Katius*).
1927. Schellenberg, Nord. Plankton, Lf. 20, Amphip., p. 678 and p. 681 (*Katius*).
1932. Barnard, Discovery Rep., vol. v, p. 55 (*Katius*) and p. 58 (discussion of identity of the two genera).
1933. Stephensen, Medd. Gronland Komm. Vidensk. Unders. Gronl., vol. lxxix, no. 7.

*Eurythenes gryllus* (Licht.) Mandt.

1926*a*. Schellenberg, *loc. cit.*, p. 217, fig. 26, *d* (*Katius obesus*).
1932. Barnard, *loc. cit.*, p. 56, fig. 21, and pl. i, fig. 1 (coloured) (*Katius obesus*).
1933. Stephensen, *loc. cit.*, p. 12, figs. 4–7.
1937. Barnard, John Murray Exp. Rep., vol. iv, p. 144.

Since my 1932 exposition of the likenesses between the two genera, Stephensen from an examination of abundant material in the Copenhagen Museum, has furnished the proof that not only are the two (monotypic) genera identical, but also the two "species" are really one: *Katius obesus* being the ♂ and juvenile form, and *Eurythenes gryllus* the ♀.

*Locality.*—S.W. of Cape Agulhas (Schellenberg), a record overlooked by me in 1932.

Gen. *Bathyamaryllis* Pirlot.

1933. Pirlot, Siboga Exp. monogr., vol. xxxiii *c*, p. 123.

Distinguished from *Amaryllis* by the pronounced rostrum, and differences in the relative lengths of peduncular joints of 1st antenna. *Amaryllis conocephala* Brnrd. (1925, Ann. S. Afr. Mus., vol. xx, p. 324) is transferred to *Bathyamaryllis*.

Gen. *Chironesimus* G. O. Sars.

1891. Sars, Crust. Norw., vol. i, p. 108.

1908. Holmes, Proc. U.S. Nat. Mus., vol. xxxv, p. 498 (*Lakota*).

1926*a*. Schellenberg, *loc. cit.*, p. 219.

*Lakota rotundatus* Brnrd., 1925, is also to be transferred to this genus.

*Chironesimus adversicola* (Brnrd.).

1925. Barnard, Ann. S. Afr. Mus., vol. xx, p. 327 (*Lakota a.*).

1926*a*. Schellenberg, *loc. cit.*, p. 219, fig. 13.

*Locality.*—S.W. of Cape Agulhas (Schellenberg).

*Microlysias xenokeras* Stebb.

1918. Stebbing, Ann. Durban Mus., vol. ii, p. 64, pl. x.

*Locality.*—Keurbooms River, Plettenberg Bay, in "red-bait" (ascidian) washed ashore on ocean beach (K. H. B., Jan. 1931, several ♀♀ and juv.).

*Remarks.*—No adult ♂ is present. The branchial lamellae are pleated on both sides. The 5th joint of gnathopod 1 is not so long as represented by Stebbing, the lower apex forming a narrow projecting lobe (cf. *Orchomenopsis nodimanus* Wlkr.), and the 6th joint has a slight notch with 2–3 setae in middle of lower margin. Epistome in profile slightly concave above, its lower half together with the upper lip forming an even convex curve. Both lobes of maxilla 2 narrow.

Remarks on genus, and description of a second species (from Arabian coast): 1937, Barnard, John Murray Exp. Rep., vol. iv, p. 144.

## Fam. AMPELISCIDAE.

Gen. *Ampelisca* Kroyer.

1925. Schellenberg, *loc. cit.*, p. 120 (key to West African species).

*Ampelisca spinimana* Chevr.

1900. Chevreux, Res. Camp. Sci. Monaco, vol. xvi, p. 39, pl. vi, fig. 2.
1925. Schellenberg, *loc. cit.*, p. 127 (forma *aspinosa*).
*Locality.*—Luderitzbucht.

*Ampelisca palmata* Brnrd.

1925. Schellenberg, *loc. cit.*, p. 127.
1932. Barnard, *loc. cit.*, p. 85.
*Localities.*—Luderitzbucht, Walfisch Bay, Angola, extending to French Congo and Senegal (Schellenberg).

*Ampelisca brevicornis* Costa.

1925. Schellenberg, *loc. cit.*, p. 130 and p. 133 (forma *platypus*).
1928. *Id.*, Trans. Zool. Soc. Lond., vol. xxii, p. 634 (size and distribution).
1932. Barnard, *loc. cit.*, p. 84.
*Localities.*—Luderitzbucht, extending to Belgian Congo, Loango, Cameroon, and Dahomey (Schellenberg).

## Fam. PHOXOCEPHALIDAE.

### Gen. *Pontharpinia* Stebb.

1899. Stebbing, Ann. Mag. Nat. Hist. (7), vol. iv, p. 207 (*Parharpinia*).
1922. Tattersall, J. Linn. Soc. Lond., vol. xxxv, p. 4.
1930. Barnard, Terra Nova Exp. Amphip., p. 335 (*Protophoxus*).
1932. *Id.*, *loc. cit.*, p. 101.
1932. Pirlot, Siboga Exp. monogr., vol. xxxiii *b*, p. 59 (diagnosis of genus and synopsis of species).

*Pontharpinia villosa* (Hasw.).

1922. Tattersall, *loc. cit.*, p. 4, pl. i, figs. 7–14.
1926. Schellenberg, *loc. cit.*, p. 300.
1931. *Id.*, Swed. Antarct. Exp., vol. ii, p. 75.
1932. Pirlot, *loc. cit.*, p. 60 (*villosa* auctorum, non Haswell).
*Locality.*—Simon's Bay (1 juv.) (Schellenberg).
*Remarks.*—According to Schellenberg (1931) and Pirlot, *villosa* auctorum, non Haswell is an insufficiently known species. Under this

heading Schellenberg includes his own 1926 record and Tattersall's record. The Simon's Bay example, being young, may for the time being be referred to *stimpsoni* Stebb., already recorded from South Africa.

Gen. *Cyproidea* Hasw.

1904. Walker, Herdman, Ceylon Pearl Fish. Suppl. Rep., vol. xvii, p. 256 (*Gallea*).
1906. Stebbing, Das Tierreich, vol. xxi, pp. 157, 723.
1906. *Id.*, *ibid.*, p. 723 (*Gallea*).
1924. Spandl, Zool. Anz., vol. lxi, p. 243 (*Gallea*).
1925. Barnard, Ann. S. Afr. Mus., vol. xx, p. 341.

When my 1925 paper was written I was unaware of Spandl's paper. Spandl contents himself with the opinion that *Gallea* is more nearly allied to the *Amphilochidae* than to the *Leucothoidae*, but suggests that it may possibly be regarded as representing a separate family. On the contrary, it seems that *Gallea* cannot be separated from *Cyproidea*. Both Walker and Spandl made the same mistake of transposing gnathopods 1 and 2.

*Cyproidea ornata* (Hasw.).

? 1904. Walker, *loc. cit.*, p. 256, pls. iii and viii, fig. 16 (*G. tecticauda*).
1924. Spandl, *loc. cit.*, p. 243, fig. 2 (*G. crinita*) (fig. 2, *G. tecticauda* for comparison).
1925. Barnard, *loc. cit.*, p. 341.
1927. Hale, Tr. Proc. Roy. Soc. S. Austr., vol. li, p. 314, fig. 3 (as *Stenothoe valida.* Corrected Hale 1929, see next reference).
1937. Sheard, Tr. Proc. Roy. Soc. S. Austr., vol. lxi, p. 20.
1938. Schellenberg, K. Sv. Vet. Ak. Handb., vol. xvi, p. 18.

Spandl separated his *crinita* from *tecticauda* mainly on the different shape of the 5th joint of gnathopod 2 (gn. 1 in Walker and Spandl), and its armature; he also says the 3rd and 4th side-plates are fused in *tecticauda*, a statement apparently based on Walker's figure, because Walker himself does not actually say they are fused.

Whether enough reliance can be placed on the difference in shape of the 5th joint of gnathopod 2 is doubtful, and it is possible that Walker overlooked the fringe of setae on its lower margin in his specimens. There seems little doubt, however, that Spandl's *crinita* is synonymous with Haswell's *ornata*: the South African specimens agree with both.

Schellenberg has no doubts about the synonymy.

*Additional Localities.*—Port Alfred (Spandl); East London (Prof. T. A. Stephenson, 1937).

*Distribution.*—S. Australia, Ceylon, Suez, Bismarck Archipelago.

## Fam. METOPIDAE.

### *Proboloides rotunda* (Stebb.).

1917. Stebbing, Ann. S. Afr. Mus., vol. xvii, p. 39, pl. vii, B (S. Afr. Crust., pl. xcvi, B).

Examination of the type slide shows that Stebbing was mistaken in regarding the palp of maxilla 1 as being 1-jointed (as in *Metopa*); actually it is 2-jointed, and the species should therefore be transferred to *Proboloides*. There is no accessory flagellum.

## Fam. AMPHILOCHIDAE.

### Gen. *Hoplopeon* Brnrd.

1932. Barnard, *loc. cit.*, p. 105.

The genotype is *Peltocoxa australis* Brnrd., 1916.

### *Hoplopleon medusarum* Brnrd.

1932. Barnard, *loc. cit.*, p. 105, fig. 54.

*Locality.*—Saldanha Bay, in medusae (R.R.S. "Discovery").

### *Gitanopsis pusilla* Brnrd.

1925. Schellenberg, *loc. cit.*, p. 140.

*Additional Localities.*—Luderitzbucht, Swakopmund (Schellenberg); Port Nolloth and Lambert's Bay (Prof. Stephenson, 1938); Still Bay, (Prof. T. A. Stephenson, 1935).

*Remarks.*—Chilton (1923, Rec. Austral. Mus., vol. xiv, pp. 82 *sqq.*) united this species with *Amphilochus neapolitanus* Della Valle, a synonymy with which neither Schellenberg nor myself agree.

## Fam. PHLIANTIDAE.

1936. Sheard, Rec. S. Austr. Mus., vol. v, p. 456.

### Gen. *Palinnotus* Stebb.

1906. Stebbing, Das Tierreich, vol. xxi, p. 202.

*Palinnotus natalensis* n. sp.

(Fig. 22.)

Resembling *P. thomsoni* Stebb. so closely that scarcely any characters, which might be considered of specific value, can be found. (See Stebbing, 1899, Tr. Linn. Soc. Lond., vol. vii, p. 417, pl. xxxv, A).

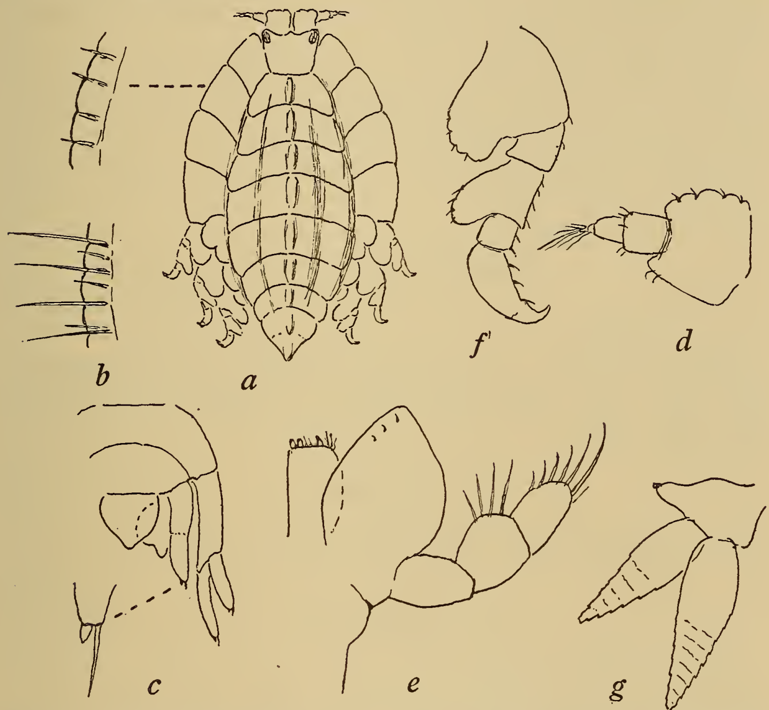



Fig. 22.—*Palinnotus natalensis* n. sp. *a*, dorsal view, 3rd and following pleon segments bent underneath, with margin of anterior side-plates further enlarged. *b*, margin of side-plate of young. *c*, telson and uropods, with apex of ramus (the same for both uropods 1 and 2) further enlarged. *d*, antenna 1. *e*, maxilliped. *f*, peraeopod 5. *g*, pleopod 3, setae omitted.

In fact the greater expansion of the 2nd joint of peraeopod 5 in the largest specimen is the only apparent difference; in the juveniles the expansion is no greater than in Stebbing's species.

The margins of the first four side-plates are very feebly crenulate in the ♀, with minute setules; in the juveniles, however, there are numerous longer setae.

Nevertheless I am reluctant to identify these Natal specimens with a species which has only been found in New South Wales. If the specimens had been found actually in Durban harbour one might perhaps call in the agency of dispersal by ships (*cf.* Chilton, 1911, Tr. N.Z. Inst., vol. xliii, p. 131) as an explanation of their occurrence in South Africa, but the locality is some 20 miles south of Durban.

Barring accidental capture, these small Amphipods are only likely to be collected in the course of intensive investigations such as Prof. Stephenson has been carrying out, and of which there is great need in many parts of the world.

Length (incl. pleo-telson) 4 mm., greatest width 2 mm. Creamy, the gut showing through the integument as a deep red streak, as if the animal had been sucking blood, eyes black.

*Locality.*—Isipingo, Natal (Prof. T. A. Stephenson, 1936, 1 ♀ and 2 juv. from algae, littoral).

### *Temnophlias capensis* Brnrd.

1916. Barnard, Ann. S. Afr. Mus., vol. xv, p. 158, pl. xxvi, figs. 25–35.

*Additional Localities.*—(South coast) Still Bay (Prof. T. A. Stephenson, 1932); (west coast) Port Nolloth and Lambert's Bay (Prof. Stephenson, 1938).

## Fam. OCHLESIDAE.

1910. Stebbing, Mem. Austral. Mus., vol. iv, p. 581.

### Gen. *Ochlesis* Stebb.

1910. Stebbing, *loc. cit.*, p. 581.
1932. Pirlot, Siboga Exp. monogr., vol. xxxiii *b*, p. 105.
1932. *Id.*, Ann. Inst. océan., vol. xii, pp. 24, 26, 29, 30, fig. 17.
1936. *Id.*, Siboga Exp. monogr., vol. xxxiii *e*, p. 298.

General appearance like that of *Odius* or *Iphimedia.* Integument indurated. Head strongly rostrate. Eyes present. Peraeon and first three pleon segments carinate. Pleon segment 4 elongate, 5th short but distinct from 6th. Side-plates 1–3 much deeper than long. Telson entire. Antennae short but with the normal number of peduncular joints; flagella reduced to 1–3 joints, no accessory flagellum. Upper lip elongate. Lower lip with narrow pointed lobes, no inner lobes, mandibular processes short, acute. Mandibles broad at base, tapering to an acute apex, secondary cutting-plate, spine-row and molar absent, palp set far back, slender, 1–3 spinules at apex. Maxilla 1 with small unarmed inner plate, outer plate narrow, with 5 apical spines (or 4 and a subacute apical process), palp absent or a minute rudiment. Maxilla 2, both plates narrow, with a few apical spines. Maxillipeds, inner plates very narrow, separate, with a few spinules on inner margin and apex, outer plates ovate, closely adjacent, palp absent. Gnathopod 1 simple, from the rather elongate 3rd joint onwards slender. Gnathopod 2, complexly subchelate, the 5th joint being produced in an acute process below the 6th (in the Australian species). Peraeopods 1–5 stout, 7th joints strong, uncinate. Pleopods not reduced. Uropods 1–3 biramous.

*Remarks.*—The above diagnosis is drawn up from the Australian species (hitherto the only known species) and the South African one described below. The two species are obviously congeneric. In the latter the 2nd gnathopod is not known. Stebbing was unable to distinguish the 5th from the 6th pleon segment; they are here clearly separate, though the 5th is dorsally very short and more or less telescoped into the 4th segment.

The remarkable feature of this genus is the absence of the palp of the maxilliped, a feature unknown in any other member of the *Gammaridea* at that time, but found in certain *Caprellidea* (*Cyamidea*) in the adult, and throughout the *Hyperiidea* (Stebbing, p. 582). The nearest approach was the rudimentary 2-jointed palp in *Laphystius.* Since then, however, the genera *Thoriella* Steph., *Chevreuxiella* Steph., and *Danaella* Steph. have been discovered. These three genera are aberrant bathypelagic Lysianassids in which the outer plates of the maxillipeds are operculiform (as in *Laphystius* and *Ochlesis*) with a remnant of the palp in the first two named genera, but with no trace of it in *Danaella.*

Pirlot (Ann. Inst. océan.) has given a comparative study of the degeneration of the palp of the maxilliped in various *Gammaridea*, showing a complete transition to that of the *Hyperiidea*, amongst which certain forms approximate to the former. Pirlot believes that this degeneration of the palp and the expansion of the outer plates to form an operculum closing the mouth below is an adaptation to an inquiline or parasitic mode of life.

### *Ochlesis lenticulosus* n. sp.

(Fig. 23.)

Integument indurated, surface of peraeon and pleon closely and finely pitted. Rostrum strong, moderately deflexed, apically acute. Antero-lateral angles of head rounded-quadrate. Eyes small, circular.

Peraeon and pleon segments 1–3 dorsally carinate; peraeon segment 7 and pleon segments 1 and 2 ending posteriorly in a blunt mediodorsal projection; pleon segment 3 with an upstanding triangular process about in middle of its length; pleon segment 4 dorsally


Fig. 23.—*Ochlesis lenticulosus* n. sp. *a*, whole animal. *b*, *c*, *d*, side-plates 1–3 (anterior margin to right). *e*, dorsal and lateral views of telson. *f*, upper lip. *g*, mandible. *h*, maxilla 1, with apex of outer lobe further enlarged. *i*, maxilla 2. *j*, maxillipeds. *k*, lower lip. *l*, gnathopod 1, with apex further enlarged. *m*, 2nd–4th joints of peraeopod 1. *n*, 2nd–4th joints of peraeopod 3. *o*, inner view of 2nd–4th joints of peraeopod 5.

rounded; segment 5 dorsally very short, segment 6 with a dorsolateral keel projecting almost horizontally on either side. Postero-inferior angles of pleon segment 3 sharply upturned. Side-plates 1–3 increasing in depth, anterior margin strongly concave, antero-basal angle slightly projecting in side-plate 1, more so in 2, still more so in 3, extending almost to anterior margin of 2; 4 shallower than 3, its basal anterior corner overlapping 3, anterior margin concave; 5–7 moderately shallow, 5 with anterior projecting point, 6 quadrate, hinder lobes of 5 and 6 deeper than anterior lobes, 7 oblong. Telson rather elongate, oval, apically narrowly rounded, entire, equal in length to peduncle of 3rd uropod, with strong medio-ventral keel.

Antennae short and stout; 1st antenna with spinous projection on distal lower margin of 1st and 2nd joints, flagellum very short, 1-jointed (with an obscure minute terminal joint); antenna 2, flagellum half length of 5th peduncular joint, obscurely 3-jointed, apical joint minute. Upper lip elongate, apically acute. Mandibles with apices acutely pointed, palp elongate, slender, 3rd joint almost as long as 2nd, armed with only a single apical spinule. Maxilla 1 acute, apex with a few minute adnate hooked spinules, inner lobes small, palp absent. Maxilla 2, both lobes narrow, with a few apical spinules. Maxilliped, outer and inner plates well developed, the latter separate from base, palp absent.

Gnathopod 1 simple, slender, 6th joint longer than 5th. Gnathopod 2, distal joints missing on both sides. Peraeopod 1, 2nd joint stout, strongly expanded distally, 4th expanded, twice as broad as 3rd, the upper proximal corner somewhat projecting, heel-like. Peraeopod 2 stout, but 4th joint not strongly expanded, upper proximal corner rounded. Peraeopods 3–5, 2nd joint stout, expanded (in peraeopod 4 more elongate in proportion to width than in the figure of peraeopod 3), anterior margin of 6th joint with a series of spinules, and a pair of slightly larger ones at apex. Seventh joints in peraeopods 1–5 stout and strong. Peraeopods unarmed except for the spinules on 6th joints.

Uropod 1 longest, rami shorter than peduncle, outer slightly shorter than inner. Uropod 2, rami subequal to peduncle, outer ramus slightly shorter than inner. Uropod 3 a little shorter than 2nd, outer ramus distinctly shorter than inner.

*Length.*—About 8 mm.

*Colour.*—(As preserved after 2 days in formalin) bright orange, paler laterally, where there is a transverse red or crimson stripe on each peraeon segment, continued below on to the side-plate, on each of pleon segments 1–3 three such stripes, all the stripes ending dorsally in a lateral crimson stripe, rather sharply demarcated on its lower edge, but passing gradually into the orange colour above: 3rd peduncular joint and flagellum of antenna 1, flagellum of antenna 2, and the 7th joints of peraeopods 1–5 white; eyes red; cheek red with corner or antero-lateral angle white. The red or crimson markings were said to be violet or mauve before preservation.

*Locality.*—Simonstown, littoral (coll. Dr. and Mrs. T. A. Stephenson, 11/6/32, 1 specimen).

*Remarks.*—Closely allied to *O. innocens* Stebb., 1910, but distinguished by the 1st antennae, the flagellum of which is shorter than the 3rd peduncular joint (instead of *vice versa*) and the 1st peraeopod. The telson in *innocens* is described as having a "process or stout spine" on ventral surface; in the present species it is keeled from base to apex, the keel expanding in basal third into a triangular projection.

The known distribution of *innocens* is now (1936, Pirlot, *loc. cit.*) extended to the Aru Islands, East Indies.

## Fam. ACANTHONOTOZOMATIDAE.

### *Iphimedia capicola* Brnrd.

1932. Barnard, *loc. cit.*, p. 118, fig. 66.
*Locality.*—Off Saldanha Bay, 4 fathoms (R.R.S. "Discovery").

### *Panoploea excisa* Brnrd.

1932. Barnard, *loc. cit.*, p. 129, fig. 73.
*Locality.*—Off Saldanha Bay, 4 fathoms (R.R.S. "Discovery").

## Fam. LILJEBORGIIDAE.

### *Liljeborgia proxima* Chevr.

1916. Barnard, *loc. cit.*, p. 167.
1938. Schellenberg, K. Sv. Vet. Ak. Handb., vol. xvi, p. 31, fig. 15.

### *Liljeborgia kinahani* Bate var. *capensis* Brnrd.

1894. Sars, Crust. Norw., vol. i, p. 532, pl. clxxxviii, fig. 1.
1932. Barnard, *loc. cit.*, p. 142, fig. 81, *a*.
*Locality.*—Simon's Bay (R.R.S. "Discovery").

### *Liljeborgia epistomata* Brnrd.

1932. Barnard, *loc. cit.*, p. 144, fig. 83.
*Locality.*—Saldanha Bay (R.R.S. "Discovery").

### Fam. CALLIOPIIDAE.

Gen. *Calliopiella* Schell.

1925. Schellenberg, *loc. cit.*, p. 147.

*Calliopiella michaelseni* Schell.

(Fig. 24.)

1925. Schellenberg, *loc. cit.*, p. 147.

*Localities.*—Swakopmund (Schellenberg). Table Bay (K. H. B., 5/10/14).

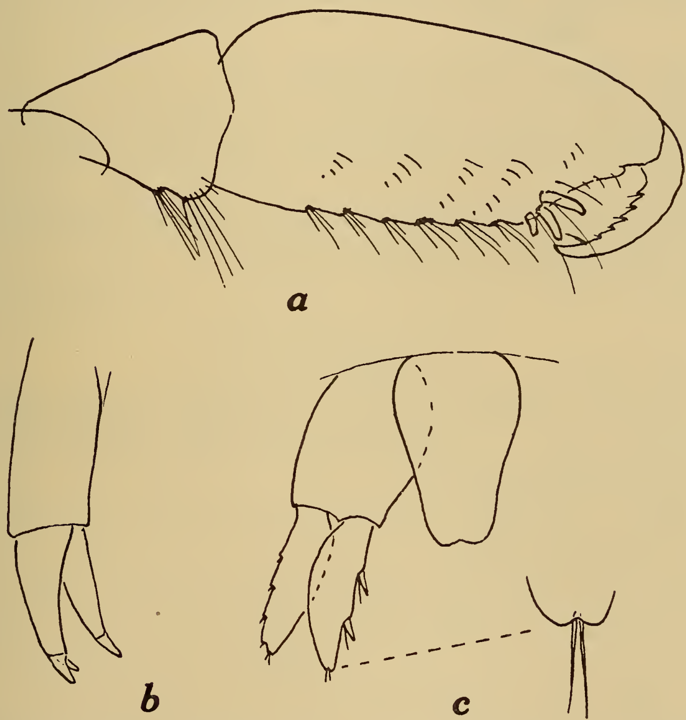



Fig. 24.—*Calliopiella michaelseni* Schell. *a*, hand of gnathopod 2. *b*, uropod 2. *c*, telson and uropod 3, with apex of inner ramus of latter further enlarged.

*Remarks.*—A single ♂ specimen, 8 mm. in length, was collected at Mouille Point, Cape Town. As it was a singleton and would not fit in with Stebbing's key to the rather heterogeneous family *Calliopiidae*, it was reserved for future study. No more specimens have come to hand, but the 1914 specimen is clearly referable to Schellenberg's species. The accessory flagellum is absent. The telson has a slight apical indent.

## Fam. PONTOGENEIIDAE.

### *Paramoera capensis* (Dana).

1916. Barnard, *loc. cit.*, p. 183 (references, except *magellanica*).
1918. Stebbing, Ann. Durban Mus., vol. ii, p. 66, pl. ix, C (*schizurus*).
1925. Schellenberg, *loc. cit.*, p. 149.
1926. *Id.*, *loc. cit.*, p. 363 (forma *capensis*).
1926. *Id.*, Zool. Anz., vol. lxxxv, p. 280 (*fissicauda* Dana var. *capensis*).
1931. *Id.*, *loc. cit.*, pp. 194, 197 (*fissicauda*).
1932. Barnard, *loc. cit.*, p. 209, figs. 118, *n*, 128.

*Additional Localities.*—(West coast) Luderitzbucht, Redford Bay, Possession and Pomona Islands, Swakopmund (Schellenberg); Port Nolloth and Lambert's Bay (Prof. Stephenson, 1935 and 1938); Saldanha Bay (K. H. B., 1912); (south coast) Still Bay (Prof. Stephenson); Port Shepstone, Natal (H. C. Burnup).

### *Paramoera bidentata* Brnrd.

1932. Barnard, *loc. cit.*, p. 210, figs. 118, *m*, 129.

*Localities.*—Kalk Bay (S.A. Mus.). Oudekraal, west coast of Cape Peninsula (Prof. T. A. Stephenson, July 1934). Still Bay (Prof. T. A. Stephenson, 1932).

*Remarks.*—The length of the type specimen should have been given as 13 mm., not 15 mm.

A second specimen, also a ♀, measuring 12 mm., was found at Still Bay; as preserved it is pure white (probably translucent when alive), with maroon or crimson patches as follows: a stripe on postero-lateral margin of head (next to the lower part of peraeon segment 1 and upper part of its side-plate), and on the postantennal angle, along the lower margins of 1st and 2nd joints of antenna 1, junctions of 3rd and 4th, and 4th and 5th peduncular joints of antenna 2, and junction of 5th joint and flagellum, apices of mandibular palps, maxillae and maxillipeds, 4th joints and palm of 6th joints of gnathopods 1 and 2; eyes dark reddish-brown.

The Oudekraal specimen is a very fine ovigerous ♀ measuring 19 mm.

### Fam. GAMMARIDAE.

Gen. *Megaluropus* Hoek.

1906. Stebbing, Das Tierreich, vol. xxi, p. 420.
1925. Schellenberg, *loc. cit.*, p. 151.
1932. Barnard, *loc. cit.*, p. 145 (*Phylluropus*).

*Megaluropus agilis* Hoek.

1893. Della Valle, F. Fl. Neapel, vol. xx, p. 695, pl. iii, fig. 9, pl. xxxiv, figs. 1–17.
1904. Walker in Herdman's Ceylon Pearl Fish. Rep., vol. xvii, p. 278.
1925. Chevreux and Fage, *loc. cit.*, p. 226, figs. 236, 237.
1925. Chevreux, Bull. Soc. zool. France, vol. l, p. 304.
1928. Schellenberg, *loc. cit.*, p. 644.
1932. Barnard, *loc. cit.*, p. 146, figs. 84, 85 (*P. capensis*).

*Locality.*—False Bay (R.R.S. "Discovery").

*Distribution.*—North Sea, Mediterranean, Port Said, Ceylon, Canary Islands.

*Remarks.*—As Dr. Schellenberg has pointed out to me, the "Discovery" specimen should probably be identified with this European species. A second species, *longimerus* (fig. 14 is labelled "*longimanus*"), was described by Schellenberg in 1925 from Lagos.

Gen. *Eriopisella* Chevr.

1920. Chevreux, Bull. Soc. zool. France, vol. xlv, p. 81.
1925. Chevreux and Fage, *loc. cit.*, p. 220.
1933. Schellenberg, Mitt. Zool. Mus. Berlin, vol. xix, pp. 408, 409.
1935. Barnard, Rec. Ind. Mus., vol. xxxvii, p. 284.

This genus is separated from *Eriopisa* by the acute antero-inferior angle of side-plate 1, the very slender mandibular palp, inner plate of maxilla 1 with 2–3 setae at apex only, inner plate maxilla 2 narrow, without setae on inner margin, and the short almost styliform 2nd joint of outer ramus of uropod 3.

It includes *seychellensis* (Chevr.) 1901, *pusilla* Chevr. 1920, and *capensis* (Brnrd.) 1916.

*Melita subchelata* Schell.

1925. Schellenberg, *loc. cit.*, p. 153 (*fresnelii* var. *subchelata*).
1932. Barnard, *loc. cit.*, p. 211, fig. 130.

*Localities.*—Luderitzbucht (Schellenberg), Walfisch Bay (R.R.S. "Discovery").

*Melita orgasmos* n. sp.

1916. Barnard, Ann. S. Afr. Mus., vol. xv, p. 191 (part *inaequistylis*, non Dana).

Surface nitidulous, with scattered but rather deep pits. Peraeon segments and pleon segments 1–3 smooth, non-dentate; pleon segment 4 produced in a slender median tooth; segment 5 with 2 submedian denticles *on each side*, with a seta between each pair. Side-plate 1 triangular, strongly expanded forwards, the lower margin as long as the hind margin, with only 2–3 setules, and scarcely any indent near the hind corner. Side-plate 6 in ♀ hooked (as in *palmata* and *zeylanica*). Postero-inferior angle of pleon segment 3 rather strongly produced (cf. *aculeata* or *obtusata*, and also *festiva* Chilton, *loc. cit.*, *infra*), the lower margin with feeble indents.

Gnathopod 1 in ♂ more like that of *coroninii* than that of *palmata* (see Chevreux and Fage, Faune de France, Amphip., figs. 240 and 241, 1925), with upper apex produced in a lobe overhanging base of dactylus which impinges against an oblique setose surface.

Gnathopod 2 in ♂ also like that of *coroninii*, 6th joint broadly oval and in fully-grown specimens somewhat wider distally, but not so strongly expanded as in the figures of *palmata* given by Chevreux and Fage (*loc. cit.*) or Sars (1894, Crust. Norw., vol. i, pl. clxxix).

Gnathopods 1 and 2 in ♀ as in *palmata*.

Peraeopods 3–5, 2nd joints spinulose but not serrate on front margin, with feeble indents on hind margin; 4th joints not markedly wider than 5th joint.

Length and coloration as in Barnard, 1916.

*Localities.*—Sea Point, Table Bay; St. James, False Bay; Kleinmond, near Hermanus (K. H. B., Feb. 1927); Dyer's Island (J. Drury, 1915); Still Bay (Prof. Stephenson); Port Elizabeth (1 ♂); Port Nolloth (Prof. Stephenson, 1938); Lambert's Bay (Prof. Stephenson, 1938).

*Remarks.*—My views on the identity of the South African specimens formerly assigned to Dana's species have changed. In the first place my statement that side-plate 5 in ♀ is not hooked is perfectly correct, but without specific import; side-plate 6 in ♀ *is* hooked, as in *palmata* and *zeylanica*.

Closer examination has shown that two distinct forms were confused; one with, and one without, a toothed carina on pleon segment 4; with further differences in the hind angle of pleon segment 3, and the first gnathopod in ♂ together with its side-plate. The non-carinate form is recorded below as *zeylanica.*

The carinate form now appears to me to be quite distinct from *palmata,* and is certainly not the *tenuicornis* of Walker (1904). In spite of Chilton's (1909) remarks, I think that *inaequistylis* remains in the category in which Stebbing (1906) left it: a *species inquirenda.* At any rate South Africa should be excluded from the distribution as given by Chilton (1921, Mem. Ind. Mus., vol. v, p. 535) and Schellenberg (1931, Res. Swed. Ant. Exp., vol. ii, p. 203, as *M. gayi* Nicolet).

The South African form is close to the Australasian *M. festiva* (Chilton) (1916, Tr. N.Z. Inst., vol. xlviii, p. 359, figs. 1, 2) but differs in the ♂ gnathopods. Side-plate 1 is even more markedly triangular in the South African form than in *festiva.* Also Chilton says the 5th pleon segment in *festiva* is dorsally produced into two small teeth, whereas in the South African form there are two teeth on each side of the median line (four in all).

The specific name refers primarily to the expanded 1st side-plate.

The Lambert's Bay examples (4) agree in all respects except in having no tooth on pleon segment 4.

*Melita zeylanica* Stebb.

? 1904. Walker in Herdman's Ceylon Pearl Fish. Suppl. Rep., vol. xvii, p. 273, pl. v, fig. 33 (*tenuicornis* Dana).

1904. Stebbing, Spolia Zeylanica, vol. ii, p. 22, pl. v.

1916. Barnard, Ann. S. Afr. Mus., vol. xv, p. 191 (part *inaequistylis,* non Dana).

? 1921. Chilton, Mem. Ind. Mus., vol. v, p. 535 (*inaequistylis*).

Peraeon and pleon segments dorsally non-dentate; 5th pleon segment dorsally with a few spinules. Side-plate 1 broadly rounded below, slightly wider than at base, but not markedly produced forwards, lower margin setose; side-plate 6 in ♀ hooked (as in *palmata*). Postero-inferior angle of pleon segment 3 quadrate, with a short point (cf. *palmata*). Gnathopod 1, ♂, 6th joint oblong, without an apical lobe overhanging base of finger, which is terminal and closes against a setose lobe. Hand of gnathopod 2 in full-grown ♂ widening distally, but not strongly expanded as in *palmata.* Front margin of 2nd joints in peraeopods 3–5 with widely spaced spinules, but not serrate as represented in Stebbing's figures; 4th joints also not so broad.

Up to 13 mm. Greenish-brown, somewhat mottled, the hind margin of most of the segments somewhat darker.

*Localities.*—Little Brak River (Mossel Bay) (K. H. B., Jan. 1931, ♂♂, ovig. ♀♀); Keurbooms River estuary (K. H. B., Jan. 1931); Wilderness lagoon, George District (K. H. B., Jan. 1931); Port Elizabeth; East London (R. M. Lightfoot); Klaasjagers Lagoon, West Coast of Cape Peninsula (K. H. B., March 1938).

*Distribution.*—Lake Negombo, Ceylon (Stebbing).

*Remarks.*—I have little doubt that this is the same as Stebbing's species. Those I have seen alive agree in coloration. Two small points of difference in the hinder peraeopods are noted above. The Port Elizabeth and East London specimens were probably also collected in an estuarine or brackish-water habitat, as in the other localities.

Although Chilton (1909, Subant. Is., New Zealand, vol. ii, p. 630) expressed the view that the Ceylonese specimens described by Walker and Stebbing were identical with Dana's New Zealand species (*inaequistylis*), I feel that further study would be welcome. Walker's description of the 4th pleon segment as having a *double* carina ending in two teeth is curious, and quite possibly may not be a chance variation, but a constant specific character (in spite of Chilton's and Norman's remarks).

At present I am not prepared to go farther than to identify the South African specimens with Stebbing's species.

## Gen. *Ceradocus* Costa.

1906. Stebbing, Das Tierreich, vol. xxi, p. 430.

### *Ceradocus aviceps* n. sp.

(Fig. 25.)

Integument strongly pitted. None of the peraeon or pleon segments dorsally dentate. Eyes dumb-bell shaped. Side-plates 1–3 very feebly notched at lower hind corner, side-plate 4 deeper than 5, hind margin slightly excavate, a small denticle at lower hind corner, lower hind margin of 7 feebly serrate. Postero-lateral corner of pleon segments 2 and 3 quadrate with a small point, the hind margin feebly crenulate, with a few outstanding setae. Telson cleft to base, lobes divergent, apically notched, with a spine in the notch.

Antenna 1 extending back to middle of pleon, slender, accessory flagellum 11–12 jointed. Antenna 2 slightly shorter than antenna 1, not quite so slender, but not stout, 4th and 5th peduncular joints subequal, flagellum half as long again as 5th joint.

Mandibular palp slender, 3rd joint very slightly longer than 3rd, tipped with 2–3 setae. Inner plates of maxillae 1 and 2 strongly setose on inner margins.

Gnathopod 1, 5th joint slender, about $3\frac{1}{2}$ times as long (measured along upper margin) as wide, 6th joint narrow, about $2\frac{1}{2}$ times as long


FIG. 25.—*Ceradocus aviceps* n. sp. *a*, 4th and 5th side-plates. *b*, postero-inferior angle of 3rd pleon segment. *c*, gnathopod 1. *d*, gnathopod 2, ♂, inner view, with finger further enlarged. *e*, gnathopod 2, ♀. *f*, 2nd joint of peraeopod 5. *g*, telson. *h*, uropod 3.

as wide, widening slightly to the transverse palm, finger matching palm.

Gnathopod 2, ♂, equal on both sides, 5th joint broader than long, 6th robust, as long as the other joints together, oblong-oval, lower distal surface minutely scabrous, with a short blunt ridge apically; finger not hinged dorso-ventrally, but folding inwards on to inner surface of 6th joint, short, stout, strongly hooked, with subacute rudimentary unguis. In ♀ 5th and 6th joints of normal shape, 6th with oblique palm almost as long as hind margin, with 3 spines at junction but without well-marked defining angle, finger matching palm.

Peraeopods 3–5, 2nd joint broader proximally than distally, lower hind corner quadrate, not lobed, hind margin weakly serrate, in peraeopod 3 evenly convex, but in 4 and 5 slightly concave in distal half.

Uropod 3, peduncle extending not quite to apices of uropods 1 and 2, rami extending far beyond these, both rami elongate oval, with rounded apices, upper margin with spaced spinules, apices and lower margin (especially that of lower or inner ramus) setose.

14–15 mm. Uniform greyish brown.

*Locality.*—Palmiet River lagoon, near Kleinmond, under stones at junction of river and tidal areas (K. H. B., March 1937, ♂, ♀).

*Remarks.*—Agrees with *Ceradocus* as regards 1st and 2nd maxillae, and mandibular palp, but 4th side-plate better developed than in *C. rubromaculatus* and the other species, and 1st gnathopod unusually slender.

The 2nd gnathopod of ♂ is remarkable for the torsion of the articulation between 6th joint and the finger, whereby the latter closes against the inner surface of the former, instead of against the apical margin usually termed the palm. A partial overlapping of the finger on to the inner surface is seen in *C. semiserratus* (Chevreux and Fage, Faune de France, Amphip., fig. 247, 1925). In the actual shape of 6th joint and finger, the nearest approach to the present form is that of *Melita festiva* (Chilton) (Chilton, Tr. N.Z. Inst., vol. xlviii, p. 359, fig. 1, 1916). The specific name in allusion to the bird's-head appearance of the finger of gnathopod 2, ♂.

*Ceradocus rubromaculatus* (Stimpson).

1922. Tattersall, J. Linn. Soc. Lond., vol. xxxv, p. 6, pl. 1, figs. 15, 16.

1925. Schellenberg, *loc. cit.*, p. 154.

1936. Pirlot, Siboga Exp. monogr., vol. xxxiii *e*, p. 305.

1937. Barnard, John Murray Exp. Rep., vol. iv, p. 160, fig. 9.

1937. Monod, Mem. Inst. d'Egypte, vol. xxxiv, p. 10, fig. 6, *b–g*.

1938. Schellenberg, K. Sv. Vet. Ak. Handl., vol. xvi, p. 63.

*Additional Localities.*—Luderitzbucht, Swakopmund (Schellenberg); Port Nolloth and Lambert's Bay (Prof. Stephenson, 1935 and 1938).

Gen. *Maera* Leach.

1938. Schellenberg, K. Sv. Vet. Ak. Handl., vol. xvi, pp. 37, 39 (discussion of characters).

Schellenberg has shown that there is but one decisive character by which to separate the several species which have been placed in the genera *Maera* and *Elasmopus*, to wit: the mandibular palp. Species with a slender palp, the 3rd joint of which is straight and tipped only with a few setae, are assigned to *Maera*.

The following South African species, formerly placed in *Elasmopus*, are consequently transferred to *Maera*: *subcarinatus* (Hasw.), *boeckii* (Hasw.), and *levis* Brnrd. The last mentioned species while in the genus *Elasmopus* was liable to confusion with *laevis* Holmes, 1905, though it might be claimed that *levis* is not actually preoccupied by *laevis*.* On transference to *Maera*, however, it conflicts with *Maera levis* S. I. Smith, 1874, and the name is herewith changed to *Maera vagans* nom. nov.

*M. subcarinata* is easily distinguished from all the other South African species by the double keel on pleon segment 4.

### *Maera grossimanus* (Mont.).

1906. Stebbing, Das Tierreich, vol. xxi, p. 435.

1925. Chevreux and Fage, Faune de France, Amphip., p. 239, figs. 248, 250.

1925. Schellenberg, *loc. cit.*, p. 155.

*Locality.*—Swakopmund. Also Senegal.

*Remarks.*—Schellenberg is inclined to unite *hirondellei* with *grossimanus*, and suspects that my Saldanha Bay specimens (referred to *hirondellei*, 1916, *loc. cit.*, p. 194) are identical with his material. Chevreux and Fage employ a character to separate *inaequipes* and *hirondellei* on the one hand from *grossimanus* on the other, which is not considered by Schellenberg, viz. the projecting lower hind corner of 2nd joint of peraeopods 4 and 5. As my specimens have this projecting lobe, I am inclined to retain them as *hirondellei*. For figure of gnathopod 2 of *hirondellei* see Monod, 1937, *loc. cit.*, p. 10, figs. 7, *e*, 10, *c*.

### *Maera vagans* nom. nov.

1910. Stebbing, Ann. S. Afr. Mus., vol. vi, p. 457 (*bruzelii*, non Stebbing, 1888).

1912. Chilton, Tr. Roy. Soc. Edin., vol. xlviii, p. 510 (*mastersii*, non Haswell, 1879).

1916. Barnard, *loc. cit.*, p. 200, pl. xxvii, fig. 15 (*Elasmopus levis*).

*Additional Locality.*—Lambert's Bay (Prof. Stephenson, 1938).

* The Zoological Record gives the spelling of Holmes's species as *laevis*. I have not seen the original paper and can check neither the spelling nor the actual date of publication.

*Maera boeckii* (Hasw.).

1916. Barnard, *loc. cit.*, p. 199, pl. xxvii, figs. 13, 14.

Further specimens (♂♂ and juv. Still Bay, Prof. Stephenson, 1932) confirm the description of the form identified as Haswell's species.

The convexity of the hind margin of 2nd joint of peraeopod 4 is intermediate between that of peraeopods 3 and 5. The mandible was compared with Walker's figure of that of *sokotrae*, but it should have been stated that only the trunk is thus short and stout, the palp being considerably longer than in Walker's figure, more like that figured by Stebbing for *bruzelii* (Challenger Rep., pl. xcvii). The ♂ gnathopod 2 is quite like that of the ♀, only slightly heavier.

*Maera subcarinata* (Hasw.).

1910. Stebbing, Ann. S. Afr. Mus., vol. vi, p. 457 (references).
1922. Tattersall, *loc. cit.*, p. 9.
1931. Stephensen, Res. Sc. Voy. Ind. Or. Neerland, vol. iii, p. 11.
1936. Pirlot, *loc. cit.*, p. 317, figs. 136–145.

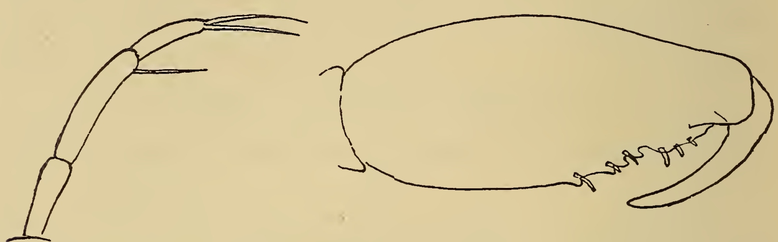


Fig. 26.—*Maera subcarinata* (Hasw.), mandibular palp and hand of gnathopod 2, ♂ (setae omitted).

Two specimens (♂ ♀) from Natal. The mandibular palp is very slender, and, contrary to Walker's statement and Stebbing's figure (Challenger Rep., pl. xcviii, *persetosus*), the 3rd joint is distinctly shorter than the 2nd, with only 2 apical setae (*cf.* Pirlot's figures 137, 143). The hand of gnathopod 2, ♂, is in general agreement with Walker's figure.

Gen. *Elasmopus* Costa.

1932. Stephensen, Annot. Zool. Jap., vol. xiii, p. 487 (synopsis of species. *E. latibrachium* is listed under wrong heading).
1936. Schellenberg, Zool. Anz., vol. cxvi, p. 153.
1938. *Id.*, *loc. cit.*, pp. 37, 52.

Mandibular palp robust, its 3rd joint more or less falcate, and with a comb-like row of spine-setae.

After the transference of *subcarinata*, *boeckii* and *levis* (*v. supra* = *vagans*) there are only two South African species to be assigned to this genus.

### *Elasmopus pectenicrus* (Bate).

1916. Barnard, *loc. cit.*, p. 197, pl. xxviii, fig. 33.

1917. Stebbing, Ann. Durban Mus., vol. i, p. 446 (*brasiliensis*, non Dana).

1928. Schellenberg, *loc. cit.*, p. 647.

1936. Pirlot, *loc. cit.*, p. 312.

1937. Barnard, John Murray Exp. Rep., vol. iv, p. 161.

There is often a small denticle at base of dactylus in 2nd gnathopod, ♂, fitting in between the hinge and the tooth on palm. Colour: peraeon and pleon purplish-grey with white speckling, a dark medio-dorsal spot on hind margin of peraeon and pleon segments (sometimes only on peraeon, or only on peraeon segments 1–4), a dark lateral spot anteriorly on pleon segments 2–4, dark spots on distal joints of peraeopods 3–5, the 2nd joints pale, eyes black with a yellowish mark behind them.

*Additional Localities.*—Still Bay and East London (Prof. Stephenson, 1935 and 1937).

*Distribution.*—Indian Seas, East Indies. Also West Indies.

### *Elasmopus japonicus* Steph.

1925. Barnard, *loc. cit.*, p. 358 (*spinimanus*, non Walker).

1932. Stephensen, *loc. cit.*, p. 490, figs. 1, 2.

The fact that the South African specimens have a dorsal keel (albeit rather low) on pleon segment 4 excludes them at once from being Walker's *spinimanus*. Comparison with Stephensen's figures leaves no doubt as to their correct identity.

*Additional Localities.*—Isipingo, Natal; Port Elizabeth (Prof. Stephenson).

*Distribution.*—Japan.

### *Parelasmopus suluensis* (Dana).

1888. Stebbing, Challenger Rep., vol. xxix, p. 1029, pl. c.

1904. Walker in Herdman's Ceylon Pearl Fish. Rep., vol. xvii, p. 278, pl. vi, fig. 38.

1935. Barnard, Rec. Ind. Mus., vol. xxxvii, p. 286, fig. 6.
1936. Pirlot, Siboga Exp. monogr., vol. xxxiii *e*, p. 311.
1938. Schellenberg, K. Sv. Vet. Ak. Handb., vol. xvi, p. 62,

Two ♂♂ from Still Bay (Prof. T. A. Stephenson, 1932, littoral) are white with violet markings and speckling on head, peraeon and pleon, spots and bands on antennae, legs and uropods, the posterior half of the 2nd joint of peraeopods 3–5 also violet; eyes black.

*Distribution.*—Sulu Sea, Marshall and Solomon Is., Indian Seas to N.W. Australia, Red Sea, British East Africa. Stebbing (1922) records a young specimen from Angola.

### Gen. *Gammarus* Fabr.

1916. Barnard, Ann. S. Afr. Mus., vol. xv, p. 202.
1926. Schellenberg, D. Sudpol. Exp., vol. xviii, p. 367 (*Paramelita*).
1927. Barnard, Trans. Roy. Soc. S. Afr., vol. xiv, pp. 167 *sqq.*
1937. Schellenberg, Zool. Jahrb. Abt. Syst., vol. lxix, pp. 469 *sqq.*, esp. pp. 472, 480, 481.

Schellenberg in his latest paper, comprising very valuable critical remarks on the fresh-water *Gammarus* species of the world, maintains *Paramelita* as a full genus. He considers that it has affinities with *Melita* rather than with *Gammarus*, and that it may in fact be derived from *Melita*-like marine ancestors, thus avoiding the supposition of a very ancient cosmopolitan distribution of *Gammarus*-like forms. The argument is considerably weakened by the presence of admittedly typical *Gammarus* forms in parts of Australia.

The taxonomy and phylogeny of the genus *Gammarus* are beset with so many difficulties that, *pace* the high authority of Dr. Schellenberg, I am unwilling as yet to admit *Paramelita* to more than subgeneric rank.

The particular features of *Paramelita* appear to be inner margins of inner lobes of 1st and 2nd maxillae with long setae or bristles only distally (proximally there are usually shorter and very fine setae which pass gradually into the longer distal setae; in *Gammarus sensu stricto* the whole inner margin of these lobes is fringed with long setae or bristles); palm of 1st gnathopod, ♂, with only a few spines; presence of accessory branchiae; dactylus (7th joint) of 1st–5th peraeopods with several (usually) spines on inner margin (reduced to 1 or 2, or absent altogether, in *auricularius*); inner ramus of 3rd uropod considerably shorter than outer ramus.

Individually these characters, or some of them, are not decisive, but taken in combination they may serve to indicate that the South African representatives are not quite typical *Gammarus*.

### Fam. DEXAMINIDAE.

*Polycheria atolli* Wlkr.

1905. Walker, Fauna Geogr. Mald. Laccad. Arch., vol. ii, p. 926, pl. lxxxviii, figs. 1–5.
1916. Barnard, *loc. cit.*, p. 211 (*antarctica*, non Stebbing).
1925. Schellenberg, *loc. cit.*, p. 157.
1930. Barnard, Terra Nova Exp. Zool., vol. viii, p. 390.

*Additional Localities.*—Luderitzbucht (Schellenberg); Lambert's Bay (Prof. Stephenson, 1938); Still Bay (Prof. T. A. Stephenson, 1932).

*Distribution.*—Maldives, Seychelles, and British East Africa.

### Fam. TALITRIDAE.

Gen. *Talitrus* Latr.

1906. Stebbing, Das Tierreich, vol. xxi, p. 524 and p. 527 (*Talitroides*).
1925. Hunt, J. Mar. Biol. Assoc. Plymouth, vol. xiii, p. 854.
1934. Schellenberg, Zool. Anz., vol. cv, p. 159.
1934. Burt, Spolia Zeylanica, vol. xviii, p. 181 (subgen. *Talitropsis*).

Hunt discussed the various characters which have been used to differentiate the terrestrial species from the typical *saltator*, and came to the conclusion that two groups could not be differentiated.

Schellenberg is in favour of retaining the terrestrial species in a genus separate from the typical littoral species, and shows that *Talitriator* Meth. falls into the synonymy of *Talitroides* (Bonnier) Stebb. It would seem that Burt's subgenus should also become a synonym.

Apparently the decision as to which of these two courses should be adopted rests on the value to be attached to the shape of the joints of the maxilliped palp and its armature, a character to which Hunt drew attention (*loc. cit.*, p. 857, fig. 2). *T. saltator* seems to be unique in having the joints (including the outer plate) broad and densely set with stout spines; in the other species they are narrower and bear only a few slender spine-setae near the apices. No transitional state has been recorded (except perhaps in *T. gulliveri.* See Barnard, 1936, Ann. Natal Mus., vol. viii, p. 12).

On the other hand transitions or variations have been observed in all the other characters, especially in the pleopods.

I suggest therefore that the maxilliped palp and the 2nd joint of peraeopod 3 be regarded as the diagnostic features of *Talitrus* (*s.s.*) and that, following Schellenberg, all the other species be grouped together either generically or subgenerically.

Gen. *Talitroides* (Bonnier) Stebb.

1898. Bonnier in Willem. Ann. Soc. Entom. Belge, vol. xlii, p. 208.
1906. Stebbing, *loc. cit.*, p. 527.
1913. Methuen, Proc. Zool. Soc. Lond., p. 109 (*Talitriator*).
1916. Barnard, *loc. cit.*, p. 222 (*Talitriator*).
1917. Stebbing, Ann. Mag. Nat. Hist. (8), vol. xix, p. 330 (April).
1917. Chilton, Trans. New. Zeal. Inst., vol. xlix, p. 294 (Aug.).
1934. Schellenberg, *loc. cit.*, p. 159.

Genotype: *T. alluaudi* Chevr., 1896, Seychelles.

After my 1916 identification of specimens from numerous localities as belonging to Methuen's species, Stebbing (1917) on the basis of some Natal specimens came to the conclusion that *eastwoodae* was identical with Bate's *africanus*. A revision of my former material, together with a lot of new material, shows unfortunately that the matter is not quite so simple.

The expansion of the 5th joint of gnathopod 1 was noted by Methuen, and incorporated in my diagnosis and Hunt's table (*loc. cit.*, p. 860). Bate's figure, however, shows a linear (or cylindrical) 5th joint. One might pass over this detail in the figure of the whole animal, but Bate has also given an enlarged figure of this joint, in which the linear shape is unmistakable. Amongst my material there are specimens in which this joint is linear, but not one of these specimens comes from a locality *east* of 26° E. long. All the specimens from Natal, including some from Stella Bush, Durban (Port Natal was the old name for Durban), Zululand and the Eastern Cape Province have the expanded 5th joint as found in *eastwoodae*.

On the other hand they all agree with Bate's description and figure as regards the length of the 1st antennae, and the pleopods are just long enough to show their tips below the pleurae as in Bate's figure; the 2nd joint of peraeopod 3 in his figure, however, is too broad for our specimens.

Although I admit that there is much justification for Stebbing's view, I prefer to wait until specimens from the type locality showing a linear 5th joint in gnathopod 1 are available, before deciding definitely on the position of Bate's species; and in the meantime to retain Methuen's specific name.

Whether all the South African forms should bear this name is a question which has been considerably complicated by the study of all the material now at hand.

The eastern form is clearly demarcated by the characters given below, and cannot be separated from *Talitrus* except on the two characters given above (mxp. palp and 2nd joint peraeopod 3); the pleopods are neither degraded nor even reduced in size, and the length of the 1st antennae is connected by intergrading forms with the very short antennae of *T. saltator.* This form I have called *eastwoodae* forma *typica.*

All the specimens from the western Cape Province exhibit shorter 1st antennae and stouter pleopods, the latter with a varying degree of degradation, at least of the inner rami. As regards the 5th joint of gnathopod 1 it is linear in specimens from some localities, and expanded in those from other localities. I have separated off four forms; no doubt with still more detailed study of further material other forms, races or local varieties, could be distinguished, but for the present I think discrimination has gone far enough.

Reference must be made to the very curious form with enlarged ungues in the peraeopods, which up to now has only been found in one locality in the S.W. Cape mountains.

*Talitroides eastwoodae* (Meth.).

(Fig. 27.)

1913. Methuen, *loc. cit.*, p. 110, pls. x, xi.
1916. Barnard, *loc. cit.*, p. 223.
1917. Stebbing, *loc. cit.*, p. 330.

Forma *typica.*

(Fig. 27, *a–d.*)

The 5th joint of gnathopod 1 expanded, *i.e.* the inner margin more or less prominently rounded, the length (along upper margin) not more than twice the greatest width. 6th joint ovate, with indistinct palm (*eastwoodae*), but in larger and mature specimens more parallel-sided, with very short but distinct palm.

Antenna 1 extending at least to half length (cotypes of *eastwoodae*, and samples from Pinetown, Natal) of 5th peduncular joint of


FIG. 27.—*Talitroides eastwoodae* (Meth.). Forma *typica*. *a*, 5th–7th joints of gnathopod 1, immature. *b*, the same, adult. *c*, pleopod 1. *d*, pleopod 3. Forma *cylindripes*. *e*, gnathopod 1. *f*, *g*, *h*, pleopods 1–3. Forma *macronyx*. *i*, gnathopod 1. *j*, 6th and 7th joints of peraeopod 4 (peraeopod 5 similar).

antenna 2, usually to $\frac{3}{4}$ or $\frac{4}{5}$, or even to end of peduncle (Durban).

Pleopods slender, elongate, outer margin of peduncle even (nearly straight) with numerous close-set plumose setae along whole length (cotypes *eastwoodae*), or along distal half, or only a few at distal $\frac{1}{3}$ (Durban); the rami subequal (the outer slightly the longer), more or less distinctly jointed.

*Localities.*—Transvaal: Woodbush (*eastwoodae*).
Natal: Pietermaritzburg, Howick, Pinetown, Karkloof, Durban.
Zululand: M'fongosi.
Eastern Cape Province: Port St. Johns, Doornnek (Alexandria Div.). Gt. Winterberg, 7000 ft. (Fort Beaufort Div.).

All these localities are *east* of about 26° E. long.

Forma *cylindripes*.

(Fig. 27, *e–h*.)

The 5th joint of gnathopod 1 more or less parallel-sided, length (along upper margin) at least $2\frac{1}{2}$ times, usually 3 times, the width, inner margin nearly straight or only very slightly convex. 6th joint elongate, ovate, tapering, with very feeble, scarcely developed, palm.

Antenna 1 extending $\frac{1}{4}$ to $\frac{1}{2}$ length of 5th peduncular joint of antenna 2, usually $\frac{1}{3}$–$\frac{1}{2}$.

Pleopods stout or moderately stout, peduncle distally more or less swollen, outer margin sinuous, with plumose setae on distal half or third; rami stout, more or less distinctly unequal (the outer the longer), not jointed.

*Localities.*—S.W. Cape Province: Cape Peninsula, Sir Lowry Pass, Houw Hoek, Mossel River (Hermanus), Gt. Winterhoek Mts., 3500 ft. (Tulbagh).

Forma *setosa*.

The 5th joint of gnathopod 1 expanded (as in *eastwoodae*).

Antenna 1 extending $\frac{1}{4}$–$\frac{1}{2}$ (usually $\frac{1}{2}$) along 5th peduncular joint of antenna 2.

Pleopods stout, peduncle with close-set, plumose setae along *whole* of sinuous outer margin, rami subequal or distinctly (though not greatly) unequal.

*Localities.*—S.W. Cape Province: Cape Peninsula, Stellenbosch, Tulbagh and Gt. Winterhoek Mts., Somerset West, Ceres, River Zonder End Mts., Onderberg Vlei (Clanwilliam).

A variety of this form occurs in Orange Kloof, Table Mt., in which the peduncle of the pleopods is setose only on the distal third.

### Forma *calva.*

As in forma *setosa*, but the peduncle of pleopods non-setose, the rami unjointed, but the incisions marking the limits of the fused joints very deep, so that the ramus becomes a series of subglobose segments.

*Localities.*—Western Cape Province: Cape Peninsula, Wellington, Swellendam Mts., northern slopes of Matroosberg (Hex River Mts.), George, Knysna, Zwartberg Range at Meiring's Poort (Oudtshoorn Distr.).

### Forma *macronyx.*

(Fig. 27, *i*, *j*.)

The 5th joint of gnathopod 1 ovate, inner margin subparallel with outer margin, almost straight or only slightly convex; 6th oblong, parallel-sided, palm distinct though short (equal to basal width of 7th joint), transverse, with rounded angle bearing 2 very strong spines and a smaller one; 7th joint bearing an unusually strong spinule on inner apex; unguis elongate, twice as long as 7th joint.

Ungues of peraeopods 1–5 longer than their 7th joints.

Antenna 1 extending half-way along 5th peduncular joint of antenna 2.

Pleopods stout, peduncle setose along whole of outer margin, rami stout, subequal (outer slightly the longer), not jointed.

*Locality.*—S.W. Cape Province: Hottentots Holland Mts., 4000 ft. (Somerset West) (Jan. 1916, K. H. B.).

## Gen. *Talorchestia* Dana.

1916. Barnard, *loc. cit.*, p. 215.

1917. Chilton, Trans. New Zeal. Inst., vol. xlix, p. 293 (N. Zealand species).

1922. Stebbing, Goteb. K. Vetensk. Vitt. Handb., vol. xxv, no. 2, p. 8.

1922. Tattersall, Mem. Asiat. Soc. Bengal, vol. vi, p. 454.

Tattersall has given a key to some of the species, including two of the South African ones. He has, however, transposed *ancheidos* and *australis*, and assumed that in the latter ("ancheidos" in his key) "side-plates 2–4" are without a well-marked lobe on hind margin, whereas my description referred to side-plate 2 only ("side-plate . . . 2 without a strongly produced lobe"). As a matter of fact this character should not be used; the lobe in question is present in *australis* but not nearly so prominent as in the other species.

A synopsis of the four South African species is given below (p. 536) which permits the identification not only of ♂♂, but also of ♀♀.

A very interesting feature has been noted in *ancheidos*, which was

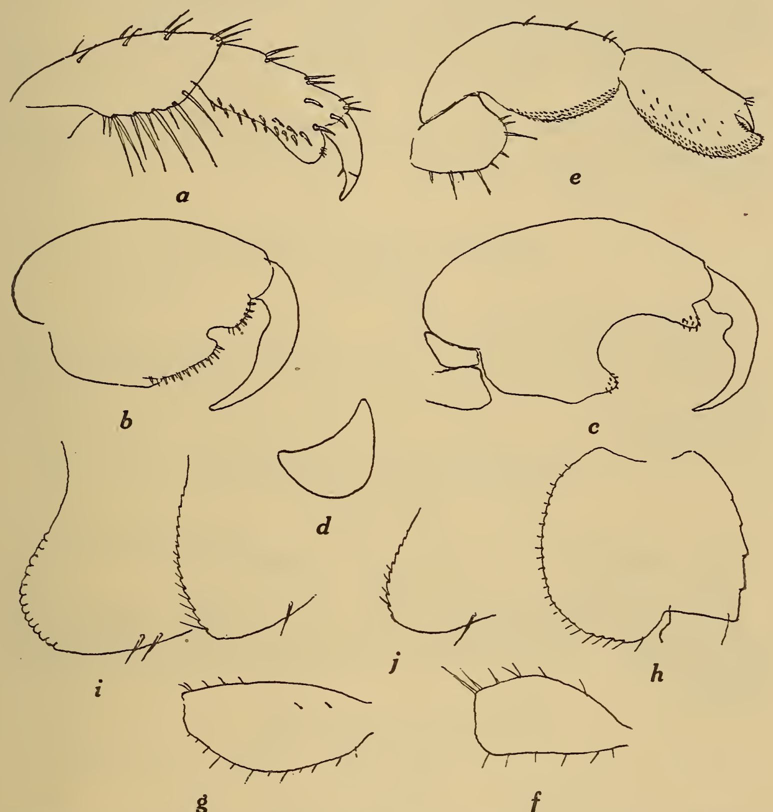



Fig. 28.—*Talorchestia capensis* (Dana). *a*, gnathopod 1, ♂. *b*, hand of gnathopod 2, ♂, immature. *c*, the same, adult (inner view). *d*, cross-section of 2nd joint of gnathopod 2, ♂ (outer side to right). *e*, distal joints of gnathopod 2, ♀. *f*, *g*, 2nd joints of gnathopod 1 and 2 respectively, ♀ (anterior margin below). *h*, 2nd joint of peraeopod 5. *i*, pleon segments 1 and 2, ♂. *j*, pleon segment 3, ♀.

entirely overlooked in my original description. viz.: the minute corrugations or ridges on the lower margins of pleon segments 2 and 3 (in both sexes), causing an appearance of crimping. It occurs also in *Orchestia floresiana* Weber. See: Stephensen, 1935, B. P. Bishop Mus. Bull., vol. cxlii, p. 24, and Barnard, 1935, Rec. Ind. Mus., vol. xxxvii, p. 288, fig. 7; but see also Schellenberg's remarks on

Stephensen's and my identifications (Zool. Anz., vol. cxvi, pp. 155, 156, 1936).

*T. tricornuta* Shoemaker, 1920, from both sides of the Congo River mouth, is near *quadrispinosa*, but has only 3 dorsal spines, and differently shaped gn. 2 and prp. 4 in ♂.

*T. skoogi* Stebb., 1922, from Port Alexandra, has a distinctive 2nd gnathopod in ♂.

*T. landanae* Schell, 1925, from Portuguese West Africa, is near *ancheidos*, but differs in the palm of gn. 2, ♂, and the hind margin of 2nd joint of prp. 5.

### *Talorchestia capensis* (Dana).

(Fig. 28.)

1916. Barnard, *loc. cit.*, p. 216.

*Locality.*—Keurbooms River, Plettenberg Bay (K. H. B., Jan. 1931, ♂♂, ♀♀ on ocean beach); Port Nolloth (Prof. Stephenson, 1935, ♂♂, ovig. ♀♀, juv.).

### *Talorchestia quadrispinosa* Brnrd.

(Fig. 29.)

1916. Barnard, *loc. cit.*, p. 217, pl. xxvii, figs. 29–32.

1925. Schellenberg, *loc. cit.*, p. 159.

*Localities.*—Luderitzbucht, Prince of Wales Bay, Walfisch Bay (Schellenberg); Port Nolloth and Lambert's Bay (Prof. Stephenson, 1938).

### *Talorchestia australis* Brnrd.

(Fig. 30.)

1916. Barnard, *loc. cit.*, p. 220, pl. xxvii, figs. 33, 34.

*Locality.*—Kleinmond, mouth of Bot River (Caledon Division) (K. H. B., Jan. 1927, ♂♂, ♀♀).

### *Talorchestia ancheidos* Brnrd.

(Fig. 31.)

1916. Barnard, *loc. cit.*, p. 221, pl. xxvii, figs. 35, 36.

*Localities.*—Keurbooms River, Plettenberg Bay (K. H. B., Jan. 1931, ♂♂, ♀♀ under logs, dead Zostera and other debris on margins of estuary); Masiene (near Chai Chai), Portuguese East Africa (R. F. Lawrence, 1924, ♂♂, ♀♀).

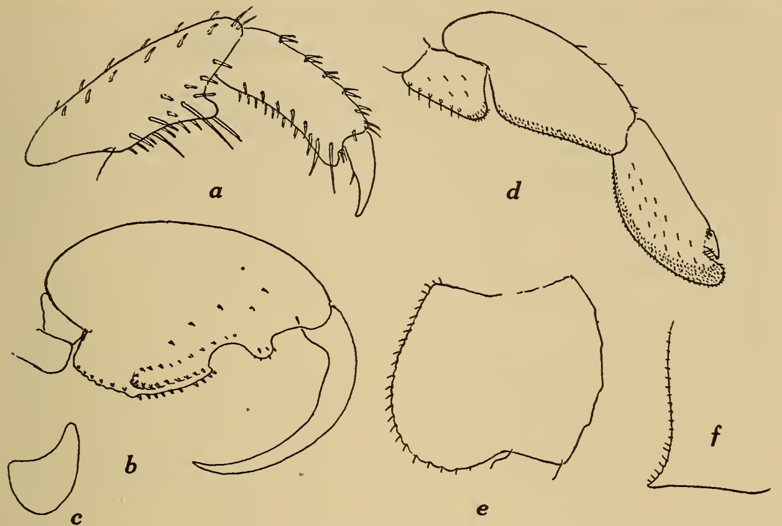



FIG. 29.—*Talorchestia quadrispinosa* Brnrd. *a*, gnathopod 1, ♂. *b*, gnathopod 2, ♂ (inner view). *c*, cross-section of 2nd joint of gnathopod 2, ♂. *d*, gnathopod 2, ♀. *e*, 2nd joint of peraeopod 5. *f*, pleon segment 3.

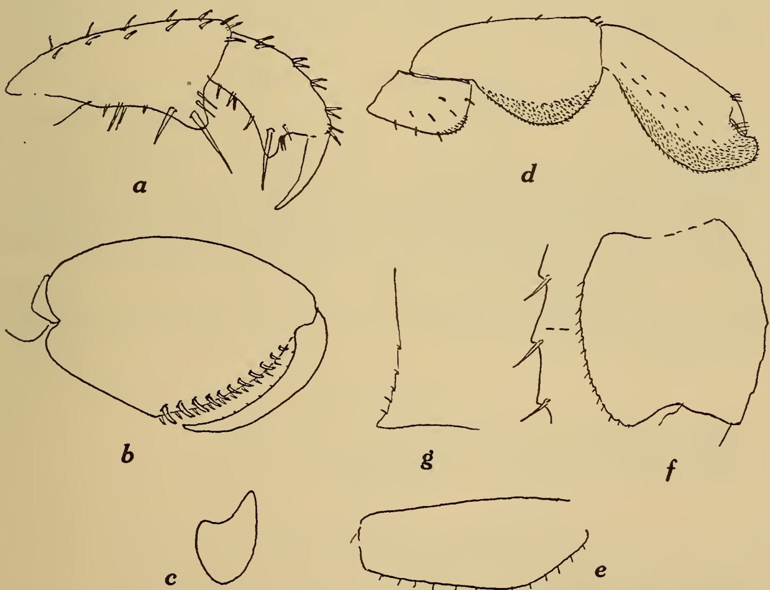



FIG. 30.—*Talorchestia australis* Brnrd. *a*, gnathopod 1, ♂. *b*, gnathopod 2, ♂ (inner view). *c*, cross-section of 2nd joint of gnathopod 2, ♂. *d*, gnathopod 2, ♀. *e*, 2nd joint of gnathopod 2, ♀ (anterior margin below). *f*, 2nd joint of peraeopod 5, with hind margin further enlarged. *g*, pleon segment 3.

*Remarks.*—The Masiene specimens have a slightly more robust 6th joint on gnathopod 2, ♂, and a slightly broader 6th joint on gnatho-

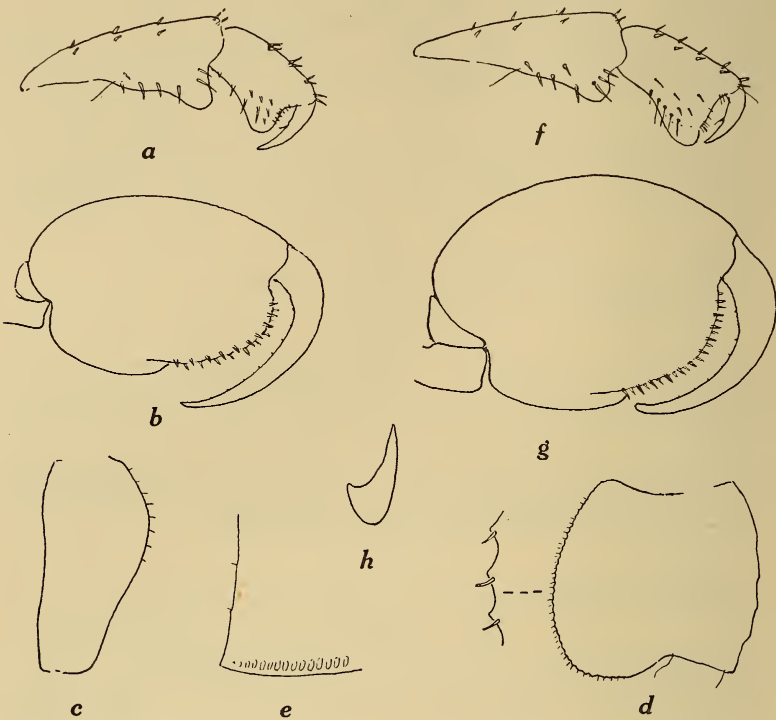



Fig. 31.—*Talorchestia ancheidos* Brnrd. *a*, gnathopod 1, ♂. *b*, gnathopod 2, ♂. *c*, 2nd joint of gnathopod 2, ♀ (anterior margin to right). *d*, 2nd joint of peraeopod 5, with hind margin further enlarged. *e*, pleon segment 3. *f*, gnathopod 1, ♂. *g*, gnathopod 2, ♂. *h*, cross-section of 2nd joint of gnathopod 2, ♂. (*f*, *g*, *h*, specimens from Masiene, Portuguese East Africa.)

pod 1, ♂, so that the finger extends only to the base, not the apex, of the apical lobe.

Gen. *Parhyale* Stebb.

1906. Stebbing, Das Tierreich, vol. xxi, p. 556.
1934. Iwasa, J. Fac. Sci. Hokkaido, Zool., vol. ii, p. 1.

*Parhyale inyacka* (Brnrd.).

1916. Barnard, *loc. cit.*, p. 233, pl. xxviii, fig. 4 (*Hyale i.*).
1925. Chevreux, Bull. Soc. zool. France, vol. l, p. 370, fig. 17 (*Hyale i.*).

1933. Stephensen, Zool. Jahrb. Abt. Syst., vol. lxiv, p. 441, figs. 3, 4 (*Hyale i.*).

Specimens from Senegal (Chevreux) and from Bonaire Is., Dutch West Indies (Stephensen), have been identified with this species. Stephensen showed the presence of a rudimentary inner ramus on uropod 3, the same has been confirmed in Chevreux's specimens by Fage and Monod (1936, Arch. Zool. Exper. Gen., vol. lxxviii, p. 105, figs. 3–7); and it is present also in the types of *inyacka* although entirely overlooked by me in 1916. All these specimens therefore are correctly transferred to the genus *Parhyale.* Fage and Monod, however, refer them all to the West Indian *fasciger* Stebb., 1897. As *P. fasciger* has been recorded from Cameroons (Schellenberg, 1925), there is perhaps some justification for suspecting that all the Atlantic records of *inyacka* are referable to Stebbing's species. Stebbing's figure of the 2nd gnathopod, ♀, however, is quite different from that of the type of *inyacka* (and from Stephensen's 1933 figure).

Until a long series of all stages of both sexes from Delagoa Bay and Atlantic localities has been compared, I prefer to keep *inyacka* as a separate species, especially as the hind margin of 2nd joint of peraeopod 5 is more strongly serrate than in Stephensen's figure, and much more strongly so than in the figures of Stebbing and of Fage and Monod.

### Gen. *Parorchestia* Stebb.

1906. Stebbing, Das Teirreich, vol. xxi, pp. 557, 735.
1916. Barnard, *loc. cit.*, p. 226.
1922. Stebbing, Goteb. K. Vet. Vitt. Handl., vol. xxv, no. 2, p. 9.

The finding of some specimens at a locality intermediate between Cape Town and East London (the extreme west and east localities recorded by me in 1916) has led to the re-examination of all the material, and I have come to the conclusion that the species formerly identified as the New Zealand *tenuis* should really be regarded as a separate species.

### *Parorchestia rectipalma* n. sp.

(Fig. 32.)

1916. Barnard, *loc. cit.*, p. 226 (*tenuis*, non Dana).

It is unfortunate that the adult ♂ of the New Zealand *tenuis* has, apparently, never been figured. Thomson's *Allorchestes recens* is regarded as synonymous with *tenuis*, and the hand of the gnathopod 2 of the *immature* South African ♂ corresponds fairly closely with

Thomson's figure (Trans. N. Zeal. Inst., vol. xvi, pl. 13, figs. 2–5, 1884). But if Thomson figured an adult ♂, then there is considerable difference between his species and the South African one.

Chilton (1909) described four new species from the New Zealand region alone, and *a fortiori* it seems very unlikely that one species should inhabit both New Zealand and South Africa. I therefore

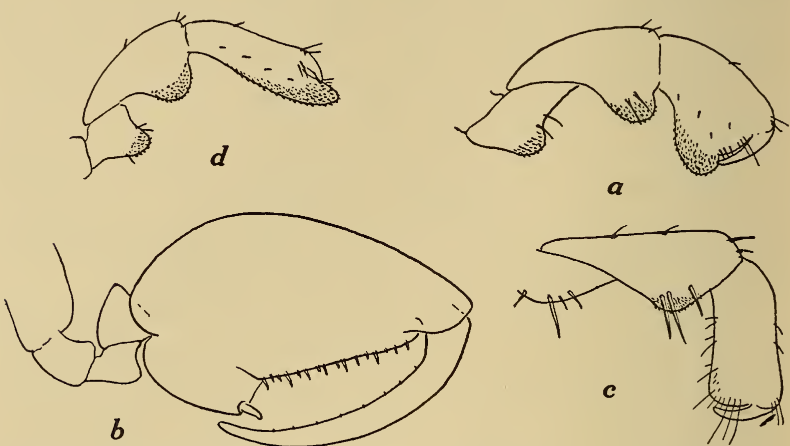



Fig. 32.—*Parorchestia rectipalma* n. sp. *a*, gnathopod 1, ♂. *b*, gnathopod 2, ♂ (adult). *c*, gnathopod 1, ♀. *d*, gnathopod 2, ♀.

propose a new specific name for the South African specimens, and give figures of the 1st and 2nd gnathopods in both sexes.

*Locality.*—Keurbooms River, Plettenberg Bay (K. H. B., Jan. 1931, ♂♂, ovig. ♀♀ and juv., beneath logs and debris washed up on the banks of the estuary); estuary of Klip Drifts Fontein stream, Potteberg, Bredasdorp District (A. C. Harrison, May 1936).

### *Parorchestia dassenensis* Brnrd.

1916. Barnard, *loc. cit.*, p. 227, pl. xxviii, figs. 1, 2.

1922. Stebbing, *loc. cit.*, p. 10, pl. iv (*tenuis*, non Dana).

Stebbing's statement that gnathopod 2, ♂, "makes a near agreement with G. M. Thomson's figure" is incompatible with his own figure of this limb. On the contrary the palm with its two notches is very similar to that of *dassenensis*, except that the proximal notch is deeper in Stebbing's figure. I have no doubt that the two forms are conspecific.

*Locality.*—Dyer's Island, near Danger Point (Stebbing).

*Hyale saldanha* Chilton.

(Fig. 33.)

1916. Barnard, *loc. cit.*, p. 229, pl. xxvii, fig. 37.

1925. Schellenberg, *loc. cit.*, p. 162.

*Localities.* — Luderitzbucht (Schellenberg); Port Nolloth and Lambert's Bay (Prof. Stephenson); Dyer's Island (S.A. Museum).

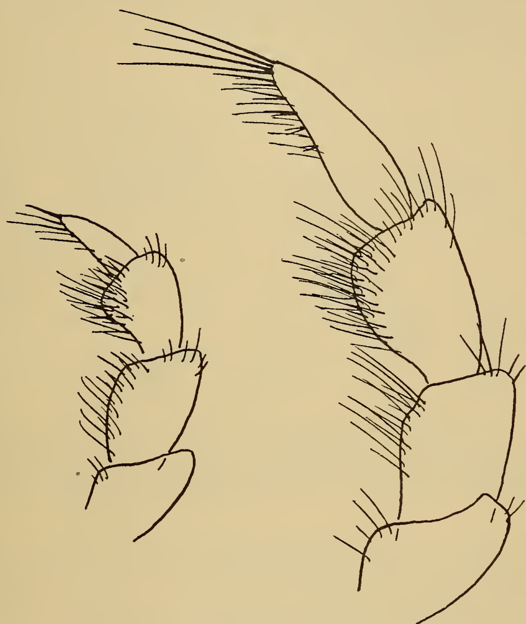


Fig. 33.—*Hyale saldanha* Chilton. Palp of maxilliped, ♀ on left, ♂ on right.

*Remarks.*—Neither Chilton, nor myself, nor Schellenberg have referred to the notable sexual difference in the palp of the maxilliped (fig. 33). The example figured is an extreme case; usually the palp is not quite so much larger in the ♂ than in the ♀, but nevertheless the difference is always noticeable. So far as I am aware such a feature has not been recorded for any other species of the genus, though in *camptonyx* the apical seta is stated by Stebbing (Das Tierreich, vol. xxi, pp. 561 (key), 570) to be very long in ♂, implying that it is longer in ♂ than in ♀.

Gen. *Allorchestes* Dana.

1906. Stebbing, *loc. cit.*, pp. 581, 736.

1926. Chilton, Trans. New Zeal. Inst., vol. lvi, p. 515.

The character distinguishing this genus from *Hyale* is the small lobe of the 5th joint of gnathopod 2 in ♂ (fig. 34). The ♀♀ of the two genera appear to be indistinguishable.

A recent examination of the examples previously referred to *Hyale grandicornis* (1916, Barnard, *loc. cit.*, p. 230), together with further material, has shown that in some samples the ♂♂ had the lobed 5th joint characteristic of *Allorchestes*. The lobe was found to be present in the youngest specimens recognizable as ♂♂, and was as

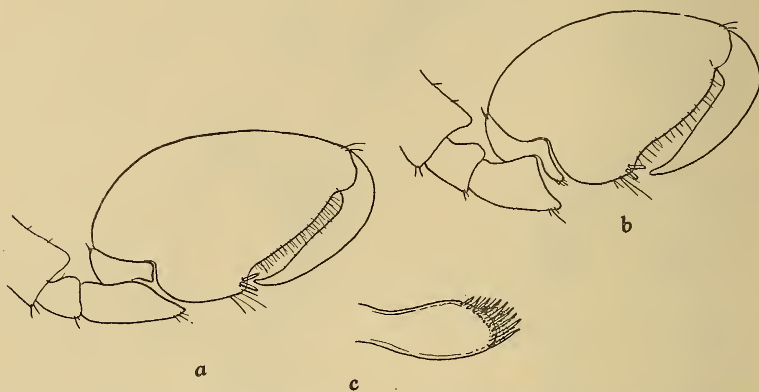



Fig. 34.—*Hyale grandicornis* (Kröyer). *a*, hand of gnathopod 2. *Allorchestes inquirendus* n. sp. *b*, hand of gnathopod 2. *c*, process of 5th joint of gnathopod 2.

well developed as in ♀♀, extending to the lower apex of the 4th joint. In later stages the lobe tended to become smaller, extending only about half-way along the distal margin of 4th joint. But even in the largest and fully adult ♂♂ it was present as a thin plate set transversely between the 4th and 6th joints, with an apical fringe of plumose setae.

In other lots, however, there was only a very small conical knob forming the outer apex of 5th joint, as is found in other species of *Hyale*; even in the youngest ♂♂ only this knob and no trace of a setigerous lobe was found.

It seems, therefore, that two species, assigned to different genera, must be recognized, until perhaps breeding experiments can show whether the character has any diagnostic value. In other respects the two forms are indistinguishable, though there is a tendency for the 2nd antennae to be slightly longer in *Hyale grandicornis*, and for spines to be absent from the outer ramus of 1st uropod in the *Allorchestes* specimens.

On the other hand, my remarks (*loc. cit.*) on the variability of characters holds good. All the *Allorchestes* come from localities in the Cape Peninsula, east and west sides, except one lot from Port Elizabeth; *Hyale grandicornis* occurs as far east as Natal, and has not yet been found on the *west* side of the Cape Peninsula, as the following list of localities will show:—

| | | *Allorchestes.* | *H. grandicornis.* |
|---|---|---|---|
| West side of Cape Peninsula | Table Bay . . . | × | |
| | Oudekraal . . . | × | |
| | Hout Bay . . . | × | |
| | Near Cape Good Hope. | × | |
| East side of Cape Peninsula (False Bay) | Kalk Bay and St. James | × | × |
| | Buffels Bay . . | × | |
| South and south-east coast | Kleinmond (Caledon Div.) . . . | .. | × |
| | Still Bay . . . | .. | × |
| | Keurbooms R., Plettenberg Bay . . | .. | × |
| | Port Elizabeth . . | × | |
| | East London . . | .. | × |
| | Port Shepstone, Natal. | .. | × |

*Allorchestes inquirendus* n. sp.

(Fig. 34, *b*, *c*.)

To the features given for *Hyale grandicornis* (1916, *loc. cit.*, p. 231) may be added:

Gnathopod 1, ♂, similar to Stebbing's figure of that of *A. humilis* (1899, Trans. Linn. Soc. Lond., vol. vii, pl. xxxiii, D) the 2nd joint strongly expanding from a narrow base, the hind margin convex.

Gnathopod 2, ♂, fig. 34, *b*. The lobe of 5th joint relatively larger in younger specimens.

In the ♀ gnathopods 1 and 2 as in Stebbing's figures (*loc. cit.*, pl. xxxiii, A, B), the hind margin of 2nd joint in gnathopod 1 being convex as in the ♂.

Peraeopods 3–5. *Cf.* Chilton's figure of peraeopod 3 in *A. novi*-

*zealandiae* (*loc. cit.*, fig. 3, *e*), but the spines on hind margin of 4th joint usually set in a tuft of setules, and 6th joint relatively longer.

Palp of maxilla 1 reaching to bases of the apical spines of outer lobe.

Telson cleft to base, apices of lobes subacute.

## Fam. AORIDAE.

### *Aora typica* Kröyer.

1916. Barnard, *loc. cit.*, p. 236 (references).
1926. Schellenberg, *loc. cit.*, p. 372, fig. 59 (forma *anomala*).
1932. Barnard, *loc. cit.*, p. 220, fig. 135 (forma *gibbula*).

*Localities.*—False Bay (Schellenberg; R.R.S. "Discovery"); Port Nolloth and Lambert's Bay (Prof. Stephenson, 1938).

### *Lembos leptocheirus* Wlkr.

1909. Walker, Trans. Linn. Soc. Lond., vol. xii, p. 338, pl. xliii, fig. 7.
1926. Schellenberg, *loc. cit.*, p. 373.
1928. *Id.*, *loc. cit.*, p. 662.

*Locality.*—Simon's Bay (Schellenberg).

*Distribution.*—Port Said; Suez; British East Africa.

### *Lembos hypacanthus* Brnrd.

1925. Schellenberg, *loc. cit.*, p. 166.

*Locality.*—Swakopmund.

### *Lembos hirsutipes* Stebb.

1895. Stebbing, Ann. Mag. Nat. Hist. (6), vol. xvi, p. 207, pls. viii, ix, B.
1925. Chevreux, Bull. Soc. zool. France, vol. l, p. 373.

*Distribution.*—Dakar, Senegal.

### Gen. *Grandidierella* Coutière.

1904. Coutière, Bull. Soc. Philom., ser. 9, vol. vi, pp. 166, 173.
1908. Stebbing, Rec. Ind. Mus., vol. ii, p. 120.
1921. Chilton, Mem. Ind. Mus., vol. v, p. 548.
1922. Tattersall, Mem. Asiat. Soc. Bengal, vol. vi, p. 455.
1925. Chevreux, Bull. Soc. zool. France, vol. l, p. 392.
1925. Schellenberg, *loc. cit.*, p. 166.

1933. Stephensen, Zool. Jahrb. Abt. Syst., vol. lxiv, pp. 434, 446.
1935. Shoemaker, J. Wash. Ac. Sci., vol. xxv, p. 65.
1935. Barnard, Rec. Ind. Mus., vol. xxxvii, p. 295.
1936. Schellenberg, Zool. Anz., vol. cxvi, p. 154.
1938. *Id.*, K. Sv. Vet. Ak. Handl., vol. xvi, p. 90 (transferred to *Corophiidae*).

*Grandidierella lignorum* Brnrd.

1935. Barnard, *loc. cit.*, p. 300, fig. 14.

*Locality.*—Keurbooms River, Plettenberg Bay (K. H. B., Jan. 1931, ♂♂, ♀♀ under water-logged tree-trunks and driftwood in estuary); Zoetendal Vlei, Bredasdorp Division (A. C. Harrison, July 1937).

Fam. PHOTIDAE.

*Photis uncinata* Brnrd.

1916. Barnard, *loc. cit.*, p. 243, pl. xxviii, fig. 26 (*longicaudata*, non Bate and Westw.).
1932. *Id.*, *loc. cit.*, p. 223, fig. 138.

*Photis longimanus* Wlkr.

1925. Schellenberg, *loc. cit.*, p. 175.

*Locality.*—Luderitzbucht.

*Eurystheus palmoides* Brnrd.

1932. Barnard, *loc. cit.*, p. 231, fig. 144.

*Locality.*—Simon's Bay (R.R.S. "Discovery").

*Eurystheus imminens* Brnrd.

1916. Barnard, *loc. cit.*, p. 250, pl. xxviii, fig. 12.
1937. *Id.*, John Murray Exp. Rep., vol. iv, p. 165, fig. 11.

*Distribution.*—Red Sea.

*Eurystheus afer* (Stebb.).

1916. Barnard, *loc. cit.*, p. 249, pl. xxviii, fig. 11.
1928. Schellenberg, Tr. Zool. Soc. Lond., vol. xxii, p. 662.
1937. Barnard, *loc. cit.*, p. 165, fig. 12.

*Distribution.*—Gulf of Suez and Zanzibar area.

*Remarks.*—*Cf.* Monod, 1937, Mem. Inst. d'Egypte, vol. xxxiv, p. 10, fig. 10, *b*.

*Cheiriphotis megacheles* (Giles).

1937. Barnard, *loc. cit.*, p. 167, fig. 14 (references and synonymy).

*Distribution.*—Bay of Bengal, Ceylon, East Indies.

### Fam. AMPITHOIDAE.

*Ampithoë ramondi* (Audouin).

1826. Audouin, Expl. Pl. Crust. Descr. Egypte, vol. i, p. 93.
1916. Barnard, *loc. cit.*, p. 253 (*vaillantii*) (references).
1928. Schellenberg, *loc. cit.*, p. 665.
1937. Barnard, John Murray Exp. Rep., vol. iv, p. 170.
1938. Pirlot, Siboga Exp. monogr., vol. xxxiii *f*, p. 346.

*Additional Localities.*—Port Nolloth and Lambert's Bay (Prof. Stephenson, 1938).

*Distribution.*—Atlantic to Azores, Mediterranean; Indian Ocean, Southern Pacific.

*Ampithoë falsa* Brnrd.

1916. Barnard, *loc. cit.*, p. 255, pl. xxviii, fig. 34 (*brevipes*, non Dana).
1932. *Id.*, *loc. cit.*, p. 240.
1937. *Id.*, *loc. cit.*, p. 170, fig. 16.

*Locality.*—Still Bay (Prof. T. A. Stephenson, 1935).

*Distribution.*—Gulf of Aden, and Central Arabian Sea, on drift-weed.

Gen. *Cymadusa* Sav.

1816. Savigny, Mem. An. sans Vert., vol. i, p. 109.
1868. Czerniavski, Syezda Russ. Est. Syezda I. Zool., p. 103 (*Grubia*).
1916. Barnard, *loc. cit.*, p. 257 (references) (*Grubia*).
1938. Pirlot, Siboga Exp. monogr., vol. xxxiii *f*, p. 348.

*Cymadusa australis* (Brnrd.).

1916. Barnard, *loc. cit.*, p. 258.

*Locality.*—Knysna Lagoon (C. W. Thorne, 1938).

*Macropisthopous stebbingi* Brnrd.

1916. Barnard, *loc. cit.*, p. 260, pl. xxviii, figs. 15–17.

*Localities.*—Sea Point, Table Bay (K. H. B., March 1928); Still Bay (Prof. T. A. Stephenson, 1935).

## Fam. JASSIDAE.

### *Ischyrocerus gorgoniae* n. sp.

(Fig. 35.)

♂.—Body strongly triquetral in cross-section anteriorly; in dorsal view resembling a member of the family *Phliantidae.* Head not

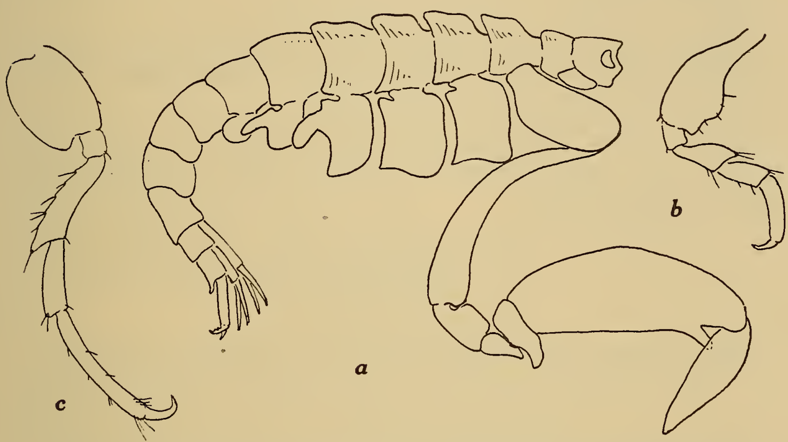



Fig. 35.—*Ischyrocerus gorgoniae* n. sp. *a*, animal, ♂, with gnathopod 2. *b*, peraeopod 1. *c*, peraeopod 5.

carinate. Peraeon smooth, medio-dorsally carinate on segments 1–6; the keel on segment 1 moderate, those on segments 2–5 strong, and that on segment 6 feeble. Peraeon segment 7 and pleon not carinate. Side-plate 1 small, deeper than long, subtriangular; 2 very large, much deeper than long, ovoid; 3 and 4 deeper than long, oblong, antero-inferior corner rounded, postero-inferior corner quadrate; 5 with deep incision between the lobes, the hind lobe much the smaller; 6 similar to 5 but smaller; 7 small, ovoid. Postero-inferior angle of pleon segment 3 rounded. Telson broader than long, apically obtuse, a spinule on each lateral margin.

Antenna 1 with 2-jointed accessory flagellum, the 2nd joint minute, flagellum missing. Antenna 2 missing. Mouth-parts typical.

Gnathopod 1 as in *megalops* Sars (Crust. Norw., vol. i, pl. 210, fig. 2).

Gnathopod 2, 2nd joint very long, curved, margins entire, antero-distal corner moderately lobed, 3rd with anterior margin lobed, 6th elongate ovate, upper margin convex, lower margin straight, with a narrow subacute tooth near hinge, finger a thin cultrate plate, lanceolate, unguis indistinguishable (the finger may be abnormal in shape, the hand of the other gnathopod is missing).

Peraeopods 1 and 2, 2nd joint flask-shaped, antero-distal margin expanded.

Peraeopods 3–5 slender, 2nd joint rather broadly oval, 6th joint relatively longer than in any of Sars (*loc. cit.*) figures.

Uropods typical.

*Length.*—4·5 mm.

*Colour.*—(As preserved) chalky-white, eyes darker.

*Locality.*—Somerset Strand, False Bay. 1 ♂, Sept. 1926, found on a piece of Red Fan-coral, *Gorgonia flammea.*

*Remarks.*—This species is remarkable for its Phliantid appearance in dorsal view, and the dorsal carination, which is much stronger than in *carinatus* Brnrd.

## Fam. COROPHIIDAE.

### Gen. *Corophium* Latr.

1934. Shoemaker, Proc. Biol. Soc. Wash., vol. xlvii, pp. 23 *sqq.*

### *Corophium acherusicum* Costa.

1916. Barnard, *loc. cit.*, p. 272.
1917. Stebbing, Ann. Durban Mus., vol. i, p. 448.
1928. Schellenberg, *loc. cit.*, p. 672.
1931. *Id.*, Swed. Antarct. Exp., vol. ii, p. 259, footnote.
1934. Shoemaker, *loc. cit.*, p. 24.

Schellenberg identifies the European *acherusicum* with the earlier *cylindricum* Say, but Shoemaker does not accept this on the ground that Say's species is not recognisable with certainty.

### *Corophium triaenonyx* Stebb.

1904. Stebbing, Spolia Zeylanica, vol. ii, p. 25, pl. vi, A.
1921. Chilton, Mem. Ind. Mus., vol. v, p. 555.
1935. Barnard, Rec. Ind. Mus., vol. xxxvii, p. 305.

*Locality.*—Keurbooms River, Plettenberg Bay, in water-logged tree-trunks and drift wood, in the estuary and as far up as the river is tidal (Whisky Creek) (K. H. B., Jan. 1931, ♂♂, ovig. ♀♀, and juv.); Knysna River (K. H. B., Nov. 1938, ♂♂, ovig. ♀♀); estuary of Klip Drifts Fontein stream, Potteberg, Bredasdorp district (A. C. Harrison, May 1936).

*Distribution.*—Ceylon; Chilka Lake; Cochin and Travancore coasts.

*Cerapus abditus* Templ.

1916. Barnard, *loc. cit.*, p. 271.
1938. Pirlot, Siboga Exp. monogr., vol. xxxiii *f*, p. 349, figs. 157, 158 (detailed figures).

FAM. PODOCERIDAE.

Gen. *Podocerus* Leach.

1937. Barnard, John Murray Exp. Rep., vol. iv, p. 174. (Key to species of the Indian region.)

*Podocerus cristatus* (Thomson).

1916. Barnard, *loc. cit.*, p. 276.
1925. Schellenberg, *loc. cit.*, p. 188.
1926. Chilton, Trans. New Zeal. Inst., vol. lvi, p. 513, fig. 2.

*Locality.*—Swakopmund (Schellenberg).

*Podocerus inconspicuus* (Stebb.).

1888. Stebbing, Challenger Rep., vol. xxix, p. 1194, pl. cxxxi.
1906. *Id.*, Das Tierreich, vol. xxi, p. 702.
1916. Barnard, *loc. cit.*, p. 277, pl. xxviii, fig. 23 (*palinuri*).
1937. *Id.*, *loc. cit.*, p. 175, fig. 18 (growth changes in gn. 2, ♂) (*palinuri*).
1938. Pirlot, Siboga Exp. monogr., vol. xxxiii *f*, p. 356, fig. 160.

*Locality.*—Port Nolloth (Prof. Stephenson, 1938, littoral, under stones).

*Distribution.*—South Arabian coast, Bay of Bengal, East Indies, Port Jackson.

*Podocerus africanus* Brnrd.

1916. Barnard, *loc. cit.*, p. 278, pl. xxviii, figs. 24, 25.
1925. *Id.*, *loc. cit.*, p. 367.
1937. *Id.*, *loc. cit.*, p. 176, fig. 19 (urop. 1, and growth changes in gn. 2, ♂).

*Distribution.*—South Arabian coast.

FAM. VIBILIIDAE.

*Vibilia chuni* Behn. and Wolt.

1912. Behning and Woltereck, Zool. Anz., vol. xli, p. 8.
1913. Stewart, Ann. Mag. Nat. Hist. (8), vol. xii, p. 251, pl. vi (*hodgsoni*).

1925. Behning, Deutsche Tiefsee Exp., vol. xix, p. 496, figs. 68–79.
1925. Barnard, *loc. cit.*, p. 376 (*hodgsoni*).
1925. Stephensen, Rep. Dana Exp., vol. ii, D 5, p. 246 (? *chuni*).
1927. Behning, Deutsche Südpol. Exp., vol. xix, p. 120.
1932. Barnard, *loc. cit.*, p. 262 (*hodgsoni, sp. dubia*).

Although Behning does not refer either in 1925 or 1927 to Miss Stewart's species, I think Stephensen is correct in identifying it with *chuni*; as Behning says, the 7th peraeopod is very distinctive.

*Distribution.*—Equatorial and Southern Atlantic.

## Fam. PHRONIMIDAE.

### *Phronima atlantica* Guérin.

1901. Vosseler, Hyperiidae Plankton Exp., vol. ii, p. 21, pl. ii, figs. 1–10.
1932. Barnard, *loc. cit.*, p. 285.

*Locality.*—Several ♀♀ and 2 ♂♂ washed ashore at Durban, 9/7/32 (H. W. Bell-Marley).

*Distribution.*—Cosmopolitan.

### *Phronima colletti* Bov.

1887. Bovallius, Bih. K. Sv. Vet. Ak. Handl., vol. xi, p. 25.
1887. Giles, J. Asiat. Soc. Bengal, vol. lvi, p. 215, pl. iii, figs. 1, 2 (*bucephala*).
1901. Vosseler, *loc. cit.*, p. 32, pl. iii, figs. 8–10, pl. iv, figs. 1–3.
1932. Barnard, *loc. cit.*, p. 286.

*Locality.*—One ♂ along with the previous species, Durban, 9/7/32 (H. W. Bell-Marley).

*Remarks.*—Bovallius (1889, K. Sv. Vet. Ak. Handl., vol. xxii, p. 378) gives the date of Giles' species as 1888, though on pp. 346 and 351 he gives it correctly as 1887. Bovallius' paper was received at the British Museum (Nat. Hist.) library in October, whereas Giles' paper was not published until November 2nd, so there is no question as to the priority of Bovallius' name.

*Distribution.*—Mediterranean, Atlantic 41° N. –35° S., Indo-Pacific.

### *Phronimella elongata* Claus.

1887. Giles, *loc. cit.*, p. 217, pl. iii, fig. 3 (*hippocephala*).
1888. Stebbing, Challenger Rep., vol. xxix, p. 1362, pl. clxiii.
1889. Bovallius, K. Sv. Vet. Ak. Handl., vol. xxii, p. 389, pl. xvi, figs. 51–67.

1932. Barnard, *loc. cit.*, p. 286.

*Locality.*—One ♂, 6 ♀♀ washed ashore at Durban, 9/7/32 (H. W. Bell-Marley).

*Distribution.*—Mediterranean, Atlantic 43° N.–37° S., Indo-Pacific, Antarctic.

### Fam. OXYCEPHALIDAE.

#### *Oxycephalus clausi* Bov.

1887. Bovallius, Bih. K. Sv. Vet. Ak. Handl., vol. xi, p. 35.
1890. *Id.*, The Oxycephalids, p. 60, pl. i, figs. 19–24, pl. ii, fig. 1.
1923. Stebbing, Fish. Mar. Surv. Spec. Rep., 3, p. 11.
1932. Barnard, *loc. cit.*, p. 294.

*Localities.*—One ♀ Algoa Bay (s.s. "Pieter Faure"); one ♀ washed ashore at Hout Bay, Cape Peninsula, 1917; several ♂♂ and ♀♀ washed ashore at Durban, 9/7/32 (H. W. Bell-Marley).

#### *Oxycephalus latirostris* Claus.

1879. Claus, Gatt. Platysceliden, p. 193.
1887. *Id.*, Die Platysceliden, p. 71, pl. xxiv, fig. 1.
1890. Bovallius, *loc. cit.*, p. 66, pl. ii, figs. 7–12, and text-fig. 84.

The rostrum is more acute than in Bovallius' figure (pl. ii, fig. 7). The telson extends to the level of the apex of outer ramus of uropod 3, and almost to that of the inner ramus.

*Locality.*—One ♀ washed ashore at Durban, 9/7/32 (H. W. Bell-Marley).

*Distribution.*—Subtropical Atlantic and Indian Oceans.

#### *Glossocephalus milne-edwardsi* Bov.

1887. Bovallius, *loc. cit.*, p. 35.
1888. Giles, J. Asiat. Soc. Bengal, vol. lvii, p. 250, pl. vi (*Elsia indica*).
1890. Bovallius, *loc. cit.*, p. 106, pl. v, fig. 5, and text-figs. 6, 6*a*, 71.
1931. Barnard, Gt. Barrier Reef Exp., vol. iv, p. 131.

The lower (hind) margin of 6th joint of peraeopods (gnathopods) 1 and 2 is smooth, as in Walker's Ceylon specimens, and those from the Barrier Reef.

*Locality.*—One ♂ washed up at Durban, 9/7/32 (H. W. Bell-Marley).

*Distribution.*—Mediterranean, tropical Atlantic, Indian Ocean.

*Streetsia pronoides* (Bov.).

1887. Bovallius, Bih. K. Sv. Vet. Ak. Handl., vol. xi, no. 16, p. 36.
1888. Stebbing, *loc. cit.*, p. 1603, pl. ccvii (*challengeri*).
1925. Stephensen, Dan. ocean. Exp., vol. ii, D 5, p. 194, fig. 75 (growth-changes and synonymy) (*challengeri*).
1932. Barnard, *loc. cit.*, p. 295 (*challengeri*).
1938. Pirlot, Siboga Exp. monogr., vol. xxxiii *f*, p. 369 (synonymy).

*Locality.*—One immature ♀ washed up at Durban, 9/7/32 (H. W. Bell-Marley).

*Distribution.*—Mediterranean, Atlantic, 41° N.–19° S., Indo-Pacific.

*Rhabdosoma whitei* Bate.

1927. Spandl, Deutsch. Südpol. Exp., vol. xix (zool. xi), p. 208, fig. 31, *a–f* (typo. error, *withei*).
1932. Barnard, *loc. cit.*, p. 296.
1933. Schellenberg, Zool. Anz., vol. ciii, p. 154, figs. 1–4 (brood-lamellae).

*Locality.*—Many specimens washed ashore at Durban, 9/7/32 (H. W. Bell-Marley).

*Distribution.*—Atlantic, Indo-Pacific.

## Fam. CAPRELLIDAE.

Gen. *Pseudaeginella* Mayer.

1890. Mayer, F. u. Fl., Golf, Naples, vol. xvii, p. 37.

*Pseudaeginella tristanensis* (Stebb.).

1932. Barnard, Discovery Rep., vol. v, p. 300, fig. 166.

*Locality.*—East London, littoral (Prof. T. A. Stephenson, July 1937, 3 ♂♂, 3 ♀♀).

*Distribution.*—Tristan d'Acunha.

*Remarks.*—The largest ♂ (6 mm.) is larger than any specimens yet recorded, but the hand of gnathopod 2 does not differ from my 1932 figure, except that there is a distinct tooth on the distal anterior margin of the 2nd joint. This tooth is much less distinct in the ♀ (ovig. ♀ 3·5 mm.).

This one difference, without more material from both localities, scarcely justifies specific separation.

# KEYS TO THE IDENTIFICATION OF SOUTH AFRICAN TANAIDACEA, ISOPODA (Marine and Freshwater), AND AMPHIPODA.

## Notes on the Keys.

In the family keys where a family contains more than one (South African) genus and/or species the page number is given on which will be found the key to the genera and/or species; and similarly in the case of genera containing more than one species. Where a family, or genus, contains only one genus, or species respectively, the student is referred to the list of species.

In the *Isopoda* the only important family not represented in South African waters is the *Serolidae*. Some minor families allied to the *Eurydicidae* and *Corallanidae* are not included in the key, although it is quite possible that eventually they will be found in the warmer waters of Natal and Portuguese East Africa.

In the *Gammaridea* the two families *Pleustidae* and *Sebidae* are included [in square brackets], although not yet definitely recorded from South Africa. Certain other families of minor importance are not included, mainly for geographical reasons; for these families, see Stebbing, Das Tierreich, xxi, 1906.

All the families of *Phronimidea* (*Hyperiidea*), except a few aberrant ones like the *Mimonectidae* and *Chuneolidae*, are included, because many of these pelagic forms are likely to be found, sooner or later, within the South African region. References to such species not yet recorded from South African waters and to the relevant literature will be found in Spandl, 1927 (German South Polar Expedition reports), Barnard, 1930 ("Terra Nova" reports), and Barnard, 1932 ("Discovery" reports).

In the *Gammaridea* and *Cyamidea* it is customary to reckon the two anterior pairs of legs as *gnathopods*, so that the seven pairs of legs comprise: gnathopods 1 and 2, peraeopods 1–5. In the *Phronimidea* (*Hyperiidea*), however, owing probably to the fact that the anterior legs are so frequently simple and in no way prehensile (subchelate or chelate), it is customary to speak of peraeopods 1–7.

As the *Amphipoda* are perhaps the more difficult group to identify, a few explanatory figures are given to illustrate particular differential characters utilised in the keys.

1. A distinct carapace embracing the true head and first two peraeon segments, and overhanging laterally to form a branchial chamber. Maxilliped with an epipodial process lying in the branchial chamber. First pair of the 7 pairs of peraeopods chelate. Uropods slender and terminal . . . . *Tanaidacea* (=*Chelifera*).
   No distinct carapace, the apparent "head" composed of the true head plus the 1st (rarely also the 2nd) peraeon segment coalesced. Maxilliped usually without epipodial process; the latter when present not in a branchial chamber . . . 2.
2. Dorso-ventrally depressed (in *Phreatoicidae* the pleon is laterally compressed). Pleopods, when present, lamellar, branchial in function (heart in the pleon) . . . . . . . *Isopoda.*
   Laterally compressed (except the *Cyamidae*, whale-lice). Branchiae attached to bases of some of the peraeopods (heart in the peraeon). Pleopods, when fully developed, divided into two sets, the first 3 pairs natatory, the last 2 pairs similar to the uropods, with unsegmented rami . . . . . *Amphipoda.*

## *List of South African Tanaidacea* (=*Chelifera*).

*Tanaidae.*

*Tanais philetaerus* Stebb.
,, *annectens* Brnrd.
,, (*Anatanais*) *gracilis* Heller (syn.: *spongicola* Brnrd.).
*Paratanais euelpis* Brnrd.
*Leptochelia savignyi* (Kröyer) (syn.: *dubia* Kröyer).
*Haplocope oculatus* Stebb.
*Agathotanais ingolfi* Hansen.
*Heterotanais* (?) *capensis* Vanhöffen.

*Apseudidae.*

*Apseudes grossimanus* N. and S.
,, *agulhensis* Brnrd.
,, *avicularia* Brnrd.
,, *austro-africana* Brnrd. (=*australis* Brnrd., non Haswell).
*Trichapseudes tridens* Brnrd.
*Sphyrapus malleolus* N. and S.

## Key to the families of *Tanaidacea*

(after Richardson, Bull. U.S. Nat. Mus., No. 54, 1905).

Body scarcely attenuated behind. First antenna with only one flagellum. Mandible without palp. First maxilla with only a single lobe and a 1-jointed palp; second maxilla quite rudimentary. Epipod of maxilliped narrow, falciform . . . . . . . . . *Tanaidae*, p. 489.
Body narrow, elongate. First antenna with 2 flagella. Mandible with 3-jointed palp. First maxilla with 2 lobes and a 2-jointed palp; second maxilla well developed and setose. Epipod of maxilliped large, laminar. Second peraeopod with large, broad, flat hand . . . . . . . . . . *Apseudidae*, p. 489.

## Key to the genera of *Tanaidae*.

| | | |
|---|---|---|
| 1 | Three pairs of pleopods. Uropods uniramous. Brood pouch formed of only one pair of plates, arising from bases of 5th peraeopods. Eyes present . . . | *Tanais*, p. 489. |
| | Five pairs of pleopods. Brood pouch normal. (In *Agathotanais* pleopods absent and brood pouch unknown) . | 2. |
| 2 | Uropods biramous . . . . . . . . . . | 3. |
| | Uropods rudimentary. Antenna 2 rudimentary. Eyes absent . . . . . . . . . . | *Agathotanais.* |
| 3 | Rami of uropod subequal, both 2-jointed. First peraeopod similar in both sexes . . . . . . . | *Paratanais.* |
| | Outer ramus of uropod very small, inner ramus with several joints. First peraeopod dissimilar in ♂ and ♀ . . | 4. |
| 4 | Pleopods biramous . . . . . . . . | 5. |
| | Pleopods uniramous (♀) . . . . . . . . | *Haplocope.* |
| 5 | Peraeopod 1 ♂ slender, elongate, chelate, 6th joint with forwardly produced "thumb" . . . . . . | *Leptochelia.* |
| | Peraeopod 1 robust, imperfectly chelate, 6th joint with backwardly directed process . . . . . . | *Heterotanais.* |

## Key to the species of *Tanais*.

| | | |
|---|---|---|
| 1 | Six pleon segments (*Anatanais*). Uropod 5–6-jointed. 6th joint of maxilliped narrow . . . . . . | *gracilis.* |
| | Five pleon segments (*Tanais* s.s.). Uropod 4-jointed . | 2. |
| 2 | Carapace broader than long. 6th joint of maxilliped ovate | *annectens.* |
| | Carapace longer than broad . . . . . . | *philetaerus.* |

## Key to the genera of *Apseudidae*.

| | | |
|---|---|---|
| 1 | Six free peraeon segments. Antenna 2 with scale at end of 2nd joint . . . . . . . . . . | 2. |
| | Five free peraeon segments. Antenna 2 without scale . | *Sphyrapus.* |
| 2 | Neither the small mandibular palp nor the maxilliped fringed with plumose setae. Five (normally) pairs of pleopods . . . . . . . . . . | *Apseudes*, p. 489. |
| | Both the large mandibular palp and the maxilliped fringed with plumose setae. Three pairs of pleopods . . | *Trichapseudes.* |

## Key to the species of *Apseudes*.

| | | |
|---|---|---|
| 1 | Rostrum tridentate . . . . . . . . . | *grossimanus.* |
| | Rostrum simple . . . . . . . . . . | 2. |
| 2 | Rostrum with acute apex and sinuous, entire margins. . | 3. |
| | Rostrum with straight, serrate margins . . . . | *deltoides.* |
| 3 | Pleon segments 1–5 laterally with spiniform processes . | *austro-africana.* |
| | Pleon segments laterally obtuse . . . . . . | 4. |
| 4 | Telson apically obtuse . . . . . . . . | *agulhensis.* |
| | Telson apically acutely produced; 6th pleon segment with 2 acute tubercles . . . . . . . . | *avicularia.* |

## List of South African Marine and Freshwater *Isopoda*.

(For Terrestrial *Isopoda* see Barnard, 1932, Ann. S. Afr. Mus., xxx.)

### *Flabellifera* or *Cymothoidea*.

*Gnathiidae.*

*Gnathia africana* Brnrd.
,, *spongicola* Brnrd.
,, ,, var. *minor* Brnrd.
,, *disjuncta* Brnrd.
,, *cryptopais* Brnrd.
,, *aureola* Stebb. (juv. = *Praniza* form).

*Anthuridae.*

*Exanthura macrura* Brnrd.
,, *filiformis* (Lucas).
*Haliophasma tricarinata* Brnrd.
,, *coronicauda* Brnrd.
,, *hermani* Brnrd.
,, *foveolata* Brnrd.
,, *pseudocarinata* Brnrd.
*Malacanthura linguicauda* (Brnrd.).
*Anthelura remipes* Brnrd.
*Cyathura carinata* (Kröyer) (syn. *estuarius* Brnrd.).
*Apanthura sandalensis* Stebb. (syn. *dubia* Brnrd.).
,, *africana* Brnrd.
*Panathura serricauda* Brnrd.
*Mesanthura catenula* (Stimpson).
*Leptanthura laevigata* (Stimpson) (syn. *faurei* Brnrd.).
*Paranthura punctata* (Stimpson).
*Pseudanthura lateralis* Richardson.

*Eurydicidae* (*Cirolanidae* auct.).

*Eurydice longicornis* (Studer).
*Excirolana natalensis* (Vanhöffen).
*Pontogeloides latipes* Brnrd.
*Gnatholana mandibularis* Brnrd.
*Cirolana hirtipes* M. Edw.
,, *virilis* Brnrd.
,, *natalensis* Brnrd.
,, *sulcata* Hansen.
,, *parva* Hansen.
,, *cranchii* Leach (syn. *vicina* Brnrd. and ? *Eurydice latistylis* Vanhöffen, non Dana).
,, *meinerti* Brnrd.
,, *undulata* Brnrd.
,, *venusticauda* Stebb.
,, ,, var. *simplex* Brnrd.
,, *littoralis* Brnrd.
,, *fluviatilis* Stebb.

*Cirolana theleceps* Brnrd.
,, *rugicauda* Heller.
,, *cingulata* Brnrd.
,, *palifrons* Brnrd.
,, *luciae* Brnrd.
,, *bovina* Brnrd.
,, *incisicauda* Brnrd.
*Conilorpheus scutifrons* Stebb.

*Corallanidae.*
*Corallana africana* Brnrd.
*Lanocira gardineri* Stebb. (syn. *capensis* Brnrd.).

*Bathynomidae.*
*Parabathynomus natalensis* Brnrd. (1924, Fish. Mar. Biol. Surv. Union S. Afr. Rep., 4, p. 2, figs.).

*Aegidae.*
*Aega webbii* (Guérin).
,, *semicarinata* Miers (syn. *urotoma* Brnrd.).
,, *monophthalma* Johnston.
,, *gracilipes* Hansen.
,, *monilis* Brnrd.
,, *antillensis* Sch. and Mein.
*Rocinela dumerilii* (Lucas).
,, *orientalis* Sch. and Mein.
,, *granulosa* Brnrd.

*Cymothoidae.*
*Nerocila orbignyi* (Guér. Mén.).
,, *serra* Sch. and Mein.
,, *trichiura* (Miers).
,, *phaeopleura* Blkr.
*Anilocra capensis* Leach.
,, *leptosoma* Blkr.
*Codonophilus imbricata* (Fabr.).
*Cteatessa retusa* Sch. and Mein.
*Cymothoa borbonica* Sch. and Mein.
*Irona melanosticta* Sch. and Mein.
*Cinusa tetrodontis* Sch. and Mein.
*Livoneca raynaudii* M. Edw.

*Limnoriidae.*
*Limnoria lignorum* (Rathke).

*Sphaeromidae.*
*Sphaeroma terebrans* Bate.
,, *walkeri* Stebb.
,, *annandalei* Stebb.
*Exosphaeroma hylecoetes* Brnrd.
,, *planum* Brnrd.
,, *brevitelson* Brnrd.
,, *varicolor* Brnrd.

*Exosphaeroma laeviusculum* (Heller).
,, *truncatitelson* Brnrd.
,, *antikraussi* Brnrd.
,, *kraussii* Tattersall.
,, *pallidum* Brnrd.
,, *porrectum* Brnrd.
*Pseudosphaeroma barnardi* Monod.
[*Isocladus tristensis* (Leach). Tristan d'Acunha.]
*Zuzara furcifer* Brnrd.
*Parisocladus stimpsoni* (Heller).
,, *perforatus* (M. Edw.).
*Sphaeramene polytylotos* Brnrd.
*Dynoides serratisinus* Brnrd.
*Paracilicaea mossambicus* Brnrd.
*Cilicaea latreillei* Leach.
*Cymodoce tuberculosa* Stebb. var. *tripartita* Rich.
,, *falcata* Brnrd.
,, *uncinata* Stebb.
,, *unguiculata* Brnrd.
,, *umbonata* Brnrd.
,, *amplifrons* Stebb.
,, *acanthiger* Brnrd.
,, *africana* Brnrd.
,, *valida* (Stebb.).
,, *comans* Brnrd.
,, *setulosa* (Stebb.).
,, *cryptodoma* Brnrd.
,, *tetrathele* Brnrd.
,, *japonica* Rich. var. *natalensis* Brnrd.
,, *cavicola* Brnrd.
,, *excavans* Brnrd.
*Dynamenella dioxus* Brnrd.
,, *scabricula* (Heller).
,, *bicolor* Brnrd.
,, *australis* Richardson.
,, *australoides* Brnrd.
,, *macrocephala* (Krauss).
,, *taurus* Brnrd.
,, *huttoni* (Thomson).
,, *ovalis* Brnrd.
,, *navicula* Brnrd.
*Cymodocella sublevis* Brnrd.
,, *pustulata* Brnrd.
,, *cancellata* Brnrd.
,, *algoensis* (Stebb.) (species *dubia*, juv.).
*Cassidias africana* Brnrd.
*Parasphaeroma prominens* Stebb.
*Artopoles natalis* Brnrd.
*Stathmos coronatus* Brnrd.

## *Idoteoidea* or *Valvifera.*

*Idoteidae.*

*Idotea metallica* Bosc.
,, *indica* M. Edw.
*Euidotea peronii* (M. Edw.).
*Paridotea ungulata* (Pallas).
,, *reticulata* Brnrd.
,, *rubra* Brnrd.
,, *fucicola* Brnrd.
*Engidotea lobata* (Miers).
*Synidotea hirtipes* (M. Edw.).
,, *setifer* Brnrd.
,, *variegata* Cllge.
*Glyptidotea lichtensteinii* (Krauss).
*Cleantis natalensis* Brnrd.

*Pseudidoteidae.*

*Holidotea unicornis* Brnrd.

*Astacillidae.*

*Astacilla mediterranea* Koehler.
,, *bacillus* Brnrd.
*Arcturella corniger* (Stebb.) (syn. *hirsuta* Brnrd. and *Astacilla setosa* Vanhöffen).
,, ,, var. *subglaber* Brnrd.
,, *lineata* (Stebb.).
,, *pustulata* Brnrd.
,, *longipes* Brnrd.
,, *brevipes* Brnrd.
,, *lobulata* Brnrd.
*Arcturina hexagonalis* Brnrd.
*Antarcturus kladophoros* Stebb.
,, *similis* Brnrd.
*Neoarcturus oudops* Brnrd.
*Pleuroprion chuni* (zur Strassen).
*Idarcturus platysoma* Brnrd.

## *Asellota* or *Aselloidea.*

*Stenetriidae.*

*Stenetrium crassimanus* Brnrd.
,, *diazi* Brnrd.
,, *bartholomei* Brnrd.
,, *dagama* Brnrd.
,, *dalmeida* Brnrd.
,, *saldanha* Brnrd.
,, *syzygus* Brnrd.

*Jaeridae.*

*Jaera pusilla* Brnrd.
*Austrofilius serrata* (Brnrd.) (? syn. *A. furcatus* Vanhöffen, non Hodgson).

*Jaeropsis curvicornis* (Nicolet).
*Janira capensis* Brnrd.
,, *angusta* Brnrd.
,, *exstans* Brnrd.
*Ianiropsis palpalis* Brnrd.
*Iais pubescens* (Dana).
*Haploniscus dimeroceras* Brnrd.
*Pseudojanira stenetrioides* Brnrd.
*Protojanira prenticei* Brnrd. (freshwater).

*Munnidae.*
*Paramunna laevifrons* Stebb.
,, *concavifrons* Brnrd.
,, *capensis* Vanhöffen.
*Kuphomunna rostrata* Brnrd.
*Antias uncinatus* Vanhöffen.

*Munnopsidae.*
*Munnopsurus mimus* Brnrd.
*Pseudomunnopsis beddardi* (Tattersall).
*Eurycope sulcifrons* Brnrd.
,, *quadrata* Brnrd.
,, *fusiformis* Brnrd.
*Ilyarachna affinis* Brnrd.
,, *crassiceps* Brnrd.

*Desmosomidae.*
*Eugerda* sp.
*Ilychthonos capensis* Brnrd.
*Macrostylis spiniceps* Brnrd.
*Rhabdomesus bacillopsis* Brnrd.

## *Phreatoicidea.*

*Phreatoicidae.*
*Phreatoicus capensis* Brnrd.
,, ,, var. *abbreviatus* Brnrd.
,, ,, var. *depressus* Brnrd.
,, ,, var. *penicillatus* Brnrd.

## *Bopyroidea* or *Epicaridea.*

*Bopyridae.*
*Scyracepon levis* Brnrd. On *Scyramathia.*
*Pseudione munidae* Brnrd. } On *Galatheidea.*
,, *crenulata* Sars. }
,, sp. On *Upogebia africana.*
*Palaegyge plesionikae* Brnrd. On prawns.
*Bathygyge grandis* Hansen On *Glyphocrangon.*
*Paragigantione papillosa* Brnrd. On *Galatheidea.*
*Hemiarthrus nematocarcini* Stebb. On prawns.
*Epipenaeon japonicum* Thielemann. On prawns.

*Dajidae.*

*Zonophryxus quinquedens* Brnrd. On prawns.

*Cryptoniscidae.*

*Cyproniscus crossophori* Stebb. On *Ostracoda.*
*Clypeoniscus stenetrii* Brnrd. On *Isopoda.*
*Aegoniscus gigas* Brnrd. On *Isopoda.*
*Liriopsis* sp. (Brady, 1914, Ann. Durban Mus., i). On parasitic Cirripedes on hermit-crabs.

*Incertae sedis.*

*Microniscus ornatus* Vanhöffen (a free-swimming larval stage, adult?).
Gen. et sp. incert. (Barnard, 1920, fig.). On *Isopoda.*

## Key to the suborders of *Isopoda.*

(Modified after G. O. Sars, Crustacea Norway, ii, 1896.)

1 Uropods lateral . . . . . . . . . . 2.
Uropods terminal or subterminal . . . . . . 3.

2 Uropods forming together with the last pleon segment (telson) a caudal fan . . . . . . . . . *Cymothoidea* or *Flabellifera*, p. 495.
Uropods valve-like, inflexed ventrally and arching over the pleopods . . . . . . . . . . *Idoteoidea* or *Valvifera*, p. 506.

3 Pleopods modified for air-breathing. Terrestrial, inland and littoral, forms . . . . . . . . . *Oniscoidea.*
Pleopods not modified for air-breathing. Marine and fresh-water forms . . . . . . . . . 4.

4 Pleopods usually covered by a thin opercular plate (the modified 1st pair of pleopods) . . . . . . . . *Aselloidea* or *Asellota*, p. 509.
Pleopods never covered by an opercular plate . . . . 5.

5 Pleon laterally compressed. Free-living, fresh-water forms . *Phreatoicidea.*
Pleon depressed. Parasitic forms, with free-swimming larval stages, marine . . . . . . . . . *Bopyroidea* or *Epicaridea*, p. 513.

For descriptive account, with keys, of the *Oniscoidea* (Woodlice) see Barnard, 1932, Ann. S. Afr. Mus., xxx; additional species, Ann. Natal Mus., viii, p. 155, 1937.

## Key to the families of *Cymothoidea* (*Flabellifera*)

(after Richardson, 1905, Bull. U.S. Nat. Mus., No. 54).

1 Adult with 5 free peraeon segments and only 5 pairs (2nd–6th) of normal peraeopods; peraeopod 1 modified, peraeopod 7 wanting. Juvenile stage parasitic on fishes . . . . . . . . . *Gnathiidae*, p. 496.
Adult with 7 free peraeon segments and usually 7 pairs of peraeopods . . . . . . . . 2.

| | | |
|---|---|---|
| 2 | Body narrow, cylindrical. Uropod with outer ramus arching dorsally over the telson. (*Pseudanthura* has rudimentary outer ramus, but the body-form throughout the family is distinctive) . . . | *Anthuridae*, p. 497. |
| | Body normal, depressed. Uropod normal, outer ramus lateral . . . . . . . . . | 3. |
| 3 | Pleon usually composed of 6 segments. . . . | 4. |
| | Pleon composed of 2–4 segments. . . . . | 9. |
| 4 | Uropod with both rami well developed, usually lamellar | 5. |
| | Uropod with outer ramus rudimentary, more or less unguiform. Boring in piles and floating timber . . | *Limnoriidae*. |
| 5 | Palp of maxilliped free, margins of last 2 joints more or less setose, never armed with hooks . . . | 6. |
| | Palp of maxilliped embracing the cone formed by the mouth-parts; apex armed with hooks, never setose. | 8. |
| 6 | No plumose branchial tufts on bases of pleopods. Eyes (when present) dorsal or lateral . . . . | 7. |
| | Plumose branchial tufts on bases of pleopods. Eyes confined to the ventral surface . . . . . | *Bathynomidae*. |
| 7 | Mandible with distal half stout and conspicuous, molar prominent . . . . . . . . . | *Eurydicidae*, p. 498. |
| | Mandible with distal half narrow, more or less concealed by the upper and lower lips, molar much reduced . | *Corallanidae*, p. 500. |
| 8 | Body symmetrical. Both antennae with well-defined peduncles and flagella. Pleopods setose. Rami of uropod large, more or less foliaceous . . . | *Aegidae*, p. 500. |
| | Body often distorted. Both antennae reduced, without clear distinction between peduncle and flagellum. Pleopods not setose. Rami of uropod long or short, but always narrow . . . . . . . | *Cymothoidae*, p. 501. |
| 9 | Pleon of 2 segments. Uropod with inner ramus immovable . . . . . . . . . | *Sphaeromidae*, p. 501. |
| | Pleon of 4 segments. Both rami of uropod movable . | [*Serolidae*.] |

For an account of the *Serolidae*, a family confined to the Southern Hemisphere (with one exception), but which has not yet been found in South African waters, see Sheppard, 1933, "Discovery" Reports, vii.

## Key to the species of *Gnathia*.

| | | |
|---|---|---|
| 1 | Frontal margin semicircularly produced forwards and downwards between bases of mandibles. 5th (4th free) peraeon segment not constricted medio-dorsally . . . . . . . . . | *cryptopais*. |
| | Frontal margin transverse . . . . . . | 2. |

| | | |
|---|---|---|
| 2 | Fifth (4th free) peraeon segment in ♂ not divided medio-dorsally. Anterior margin of head in ♀ not notched | *africana.* |
| | Fifth peraeon segment in ♂ divided medio-dorsally. Anterior margin of head in ♀ notched . . . | 3. |
| 3 | Mandibles in ♂ denticulate on the straight inner margin . | *spongicola* and var. *minor.* |
| | Mandibles with entire, convex inner margin . . . | *disjuncta.* |

*G. aureola* is founded on the juvenile or "*Praniza*" form.

## Key to the genera of *Anthuridae*

(see Barnard, J. Linn. Soc. London, xxxvi, 1925).

| | | |
|---|---|---|
| 1 | Mouth-parts normal (lower lip with rounded lobes, mandible with dentate cutting-edge, and maxilla 1 with conspicuous spine-teeth). Statocysts paired, but sometimes absent . . . . . | 2. |
| | Mouth-parts modified (lower lip with acute lobes, mandibles apically acute, maxilla 1 slender, lancet-like). Sometimes a single statocyst, but usually none . . . . . . . . . | 10. |
| 2 | Fifth joint of peraeopods 4–7 not underriding 6th . | 3. |
| | Fifth joint of peraeopods 4–7 underriding 6th . . | 7. |
| 3 | Maxilliped 4-jointed * . . . . . . . | 4. |
| | Maxilliped 5-jointed . . . . . . . | 5. |
| 4 | Pleon segments distinct . . . . . . . | *Exanthura,* p. 497. |
| | Pleon segments fused . . . . . . . | *Haliophasma,* p. 498. |
| 5 | Eyes present . . . . . . . . . | 6. |
| | Eyes absent . . . . . . . . . | *Anthelura.* |
| 6 | Unguis of peraeopod 1 short . . . . . | *Haliophasma,* p. 498. |
| | Unguis of peraeopod 1 long . . . . . | *Malacanthura.* |
| 7 | Maxilliped 4-jointed . . . . . . . | *Cyathura.* |
| | Maxilliped 5–6-jointed . . . . . . . | 8. |
| 8 | Pleon segments distinct . . . . . . . | 9. |
| | Pleon segments fused . . . . . . . | *Mesanthura.* |
| 9 | Maxilliped 5-jointed . . . . . . . | *Apanthura,* p. 498. |
| | Maxilliped 6-jointed . . . . . . . | *Panathura.* |
| 10 | Outer ramus of uropod rudimentary . . . . | *Pseudanthura.* |
| | Outer ramus of uropod well developed . . . | 11. |
| 11 | With statocyst. 5th joint of peraeopods 4–7 underriding 6th . . . . . . . | *Leptanthura.* |
| | No statocyst. 5th joint of peraeopods 4–7 not underriding 6th . . . . . . . | *Paranthura.* |

## Key to the species of *Exanthura.*

| | |
|---|---|
| Telson widening distally, truncate . . . . | *macrura.* |
| Telson ovate, with a median longitudinal keel . . | *filiformis.* |

* The basal joint, which is ankylosed to the head, is included.

### Key to the species of *Haliophasma*.

| | | |
|---|---|---|
| 1 | Telson tricarinate . . . . . . . . . | 2. |
| | Telson not tricarinate . . . . . . . . | 3. |
| 2 | Integument not pitted . . . . . . . . | *tricarinata.* |
| | Integument pitted . . . . . . . . . | *foveolata.* |
| 3 | Telson obovate, apically upturned, with median keel . . | *hermani.* |
| | Telson ovate, dorsal surface wholly convex, with raised central portion like a flat hat, more or less surrounded by a rim . | 4. |
| 4 | Telson distinct from 6th pleon segment . . . . . | *coronicauda.* |
| | Telson fused with 6th pleon segment . . . . . . | *pseudocarinata.* |

### Key to the species of *Apanthura*.

| | |
|---|---|
| With eyes. Outer ramus of uropod apically indented . . | *sandalensis.* |
| Eyes absent. Outer ramus of uropod not indented . . | *africana.* |

### Key to the genera of *Eurydicidae*.

| | | |
|---|---|---|
| 1 | Fifth pleon segment with free lateral margins . . . | 2. |
| | Lateral margins of 5th pleon segment overlapped by those of the 4th segment. Inner apex of peduncle of uropod produced. Peduncle of antenna 2–5-jointed . . . | 4. |
| 2 | First joint of peduncle of antenna 1 extended straight in front, rest of antenna at right angles to it. Mandibular palp 3-jointed. Inner plate of maxilliped without coupling-hooks. Pleopods without accessory lobes. Inner apex of peduncle of uropod not produced . . . . . . | *Eurydice.* |
| | First joint of peduncle of antenna 1 not at right angles to rest of antenna. Inner plate of maxilliped with coupling-hooks. Pleopods with accessory lobes. Inner apex of peduncle of uropod produced . . . . . . | 3. |
| 3 | Mandibular palp 3-jointed . . . . . . . . | *Excirolana.* |
| | Mandibular palp 2-jointed . . . . . . . . | *Pontogeloides.* |
| 4 | Mandibles very stout, projecting forwards. Frontal lamina not distinct from median process of head . . . . . | *Gnatholana.* |
| | Mandibles not prominent. Frontal lamina distinct . . | 5. |
| 5 | Antenna 2 distinctly longer than antenna 1. Frontal lamina not projecting prominently in front. Inner ramus of pleopod 1 broad. In ♂ stylet on pleopod 2 attached near base . . . . . . . . . . . . | *Cirolana*, p. 499. |
| | Both antennae short, second not much longer than first. Frontal lamina projecting prominently in front. Inner ramus of pleopod 1 narrow. In ♂ stylet on pleopod 2 attached far from base . . . . . . . | *Conilorpheus.* |

## Key to the species of *Cirolana*.

| | | |
|---|---|---|
| 1 | Pleon segment 3 laterally overlapping both 4th and 5th segments . . . . . . . . . . . | *rugicauda.* |
| | Pleon segment 3 not overlapping 4th, but 4th overlapping 5th | 2. |
| 2 | Anterior margin of frontal lamina not free or produced . | 3. |
| | Anterior margin of frontal lamina free, somewhat produced, but not in the shape of a prominent horn or knob. 2nd joint of peraeopods 6 and 7 without long plumose setae . | 10. |
| 3 | Frontal lamina very narrow, linear. 2nd joints of peraeopods 6 and 7 with long plumose setae . . . . . . | 4. |
| | Frontal lamina broad, pentagonal or subhexagonal. 2nd joints of peraeopods 6 and 7 without long plumose setae | 6. |
| 4 | Side-plate 4 with postero-inferior angle quadrate . . . . | 5. |
| | Side-plate 4 with postero-inferior angle rounded . . . | *natalensis.* |
| 5 | Impressed line on hind margin of eyes continuous across the head. In ♂ stylet on pleopod 2 slender, straight . . | *hirtipes.* |
| | Impressed line on head not continuous. In ♂ stylet on pleopod 2 robust and strongly curved . . . . . | *virilis.* |
| 6 | Telson with median longitudinal furrow . . . . . | 7. |
| | Telson dorsally smooth . . . . . . . . . . | 9. |
| | Telson with 2 submedian basal tubercles, otherwise smooth . | *bovina.* |
| 7 | Telsonic furrow strong. Apices of telson and uropods pointed | *sulcata.* |
| | Telsonic furrow shallow . . . . . . . . . . | 8. |
| 8 | Apices of telson and uropods pointed . . . . . . | *palifrons.* |
| | Apices of telson and uropods rounded, with notches . . | *theleceps.* |
| 9 | Telsonic apex broadly rounded, with 8 spines . . . . | *parva.* |
| | Telsonic apex narrowly rounded or subacute, with 13–14 spines . . . . . . . . . . . . | *cranchii.* |
| | Telsonic apex narrowly rounded, with 7–8 spines; 2 bands of setae on dorsal surface . . . . . . . . | *meinerti.* |
| 10 | Frontal lamina subquadrate, as broad as, or broader than, long | 11. |
| | Frontal lamina linguiform, rounded in front and slightly wider than at base . . . . . . . . . . | 13. |
| 11 | Frontal lamina smooth. Telson with continuous median longitudinal keel . . . . . . . . . | *undulata.* |
| | Frontal lamina with transverse ridge near front, apex at a lower level and meeting rostral point of head . . | 12. |
| 12 | Pleon and telson unsculptured . . . . . . . . | *littoralis.* |
| | Pleon segments with transverse series of denticles. Telson with median series of denticles and several others basally and laterally . . . . . . . . . . | *venusticauda.* |
| | Pleon as in *venusticauda.* Telson with a single median denticle near base . . . . . . . . | *venusticauda* var. *simplex.* |
| | Telson apically incised . . . . . . . . . | *incisicauda.* |
| 13 | Head and peraeon with transverse grooves and impressed lines of punctae . . . . . . . . . | *cingulata.* |
| | Head smooth. Hinder peraeon segments with denticles or rugae . . . . . . . . . . . . | *fluviatilis.* |
| | Head, peraeon and pleon smooth . . . . . . | *luciae.* |

## Key to the genera of *Corallanidae.*

| | | |
|---|---|---|
| 1 | Bases of the antennae, at least the 1st joint, visible from above. 2nd joint of maxilliped much longer than broad. | *Corallana.* |
| | Bases of both antennae hidden by rostral projection of head. 2nd joint of maxilliped very little longer than broad . | 2. |
| 2 | Maxilla 1 strongly falcate . . . . . . . | *Lanocira.* |
| | Maxilla 1 unguiform, moderate . . . . . . . | [*Argathona*]. |

*Argathona* is included owing to the likeness of *Eurydice latistylis* Vanhöffen, 1914 (non Dana), to a species of this genus.

## Key to the genera of *Aegidae.*

| | | |
|---|---|---|
| 1 | Head with median point wholly or partly separating bases of 1st antennae. Frontal lamina usually large. Maxilliped not less than 6-jointed . . . . . . | *Aega*, p. 500. |
| | Head more or less covering bases of 1st antennae. Frontal lamina small. Maxilliped not more than 4-jointed . | 2. |
| 2 | Eyes present. Pleon not much narrower than peraeon . | *Rocinela*, p. 500. |
| | Eyes absent. Pleon abruptly narrower than peraeon . . | *Syscenus.* |

## Key to the species of *Aega.*

| | | |
|---|---|---|
| 1 | First 2 joints of peduncle of antenna 1 much dilated, flattened; 2nd joint apically produced. Frontal lamina flat or concave . . . . . . . . . . . | 2. |
| | First 2 joints of peduncle of antenna 1 cylindrical, not dilated; 2nd joint not apically produced. Frontal lamina convex or compressed and elevated . . . . | 5. |
| 2 | Bases of 1st antennae partly separated by rostral point . | 3. |
| | Bases of 1st antennae completely separated by rostral point | *monophthalma.* |
| 3 | Inner apex of 6th joint of peraeopods 2 and 3 with a linguiform process . . . . . . . . . . . | *webbii.* |
| | Inner apex of 6th joint of peraeopods 2 and 3 without such process . . . . . . . . . . . | 4. |
| 4 | Telson truncate . . . . . . . . . . | *semicarinata.* |
| | Telson pointed . . . . . . . . . . | *antillensis.* |
| 5 | Peraeopods very slender. Frontal lamina forming a transverse projecting plate. Side-plates acutely produced posteriorly . . . . . . . . . | *gracilipes.* |
| | Peraeopods not very slender. Frontal lamina forming a rounded knob. Side-plates not acutely produced. . | *monilis.* |

## Key to the species of *Rocinela.*

| | | |
|---|---|---|
| 1 | Front of head with prominently produced subtriangular process over bases of antennae . . . . . . | *dumerilii.* |
| | Front of head not strongly produced . . . . . . | 2. |
| 2 | Flagellum of antenna 2 14–16-jointed. Outer ramus of uropod apically rounded . . . . . . . | *orientalis.* |
| | Flagellum of antenna 2 10–12-jointed. Outer ramus of uropod lanceolate, apically acute . . . . . | *granulosa.* |

### Key to the genera of *Cymothoidae*.

| | | |
|---|---|---|
| 1 | Head not immersed in 1st peraeon segment. Anterior margin of latter trisinuate. Body symmetrical | 2. |
| | Head immersed in 1st peraeon segment. Anterior margin of latter not trisinuate. Body more or less distorted | 3. |
| 2 | Head broadly rounded in front | *Nerocila*, p. 501. |
| | Head distinctly narrowed in front | *Anilocra*, p. 501. |
| 3 | Bases of 1st antennae contiguous | 4. |
| | First antennae not dilated, their bases separated | 5. |
| 4 | Antenna 1 much dilated. Ungues of peraeopods short, stout. Inferior margin of side-plates 6 and 7 concave | *Codonophilus*. |
| | Antenna 1 compressed. Ungues long, strongly curved. Inferior margin of side-plates 6 and 7 convex | *Cteatessa*. |
| 5 | Pleon manifestly distinct from peraeon | 6. |
| | Pleon and peraeon continuous | 7. |
| 6 | Bases of 1st antennae widely separated | *Cymothoa*. |
| | Bases of 1st antennae narrowly separated | *Cinusa*. |
| 7 | Pleon very little immersed in peraeon | *Livoneca*. |
| | Pleon deeply immersed in peraeon | *Irona*. |

### Key to the species of *Nerocila*.

| | | |
|---|---|---|
| 1 | Inner ramus of uropod terete, slender, acute; outer ramus elongate | 2. |
| | Inner ramus of uropod broader, margins subparallel, a tooth on inner apex; outer ramus not much longer than inner | 3. |
| 2 | Outer ramus of uropod very long. Side-plates rounded behind; segments rounded postero-laterally | *trichiura*. |
| | Outer ramus of uropod elongate. Side-plates and segments acute behind | *phaeopleura*. |
| 3 | Postero-lateral angles of all peraeon segments acutely produced. Outer margin of inner ramus of uropod serrate | *serra*. |
| | Postero-lateral angles of only the 4 posterior segments more or less acutely produced. Outer margin of inner ramus of uropod smooth | *orbignyi*. |

### Key to the species of *Anilocra*.

| | |
|---|---|
| Antenna 1 geniculate, the flagellum distinct from peduncle owing to enlargement of 3rd joint of latter | *leptosoma*. |
| Antenna 1 undifferentiated | *capensis*. |

### Key to the groups of *Sphaeromidae*.

| | |
|---|---|
| Pleopods 4 and 5 with transverse pleats on the inner rami only, the outer rami thin and membranous | *Hemibranchiatae*, p. 502. |
| Pleopods 4 and 5 with pleats on both rami | *Eubranchiatae*, p. 505. |
| Pleopods 4 and 5 with both rami membranous | *Platybranchiatae*, p. 506. |

## Key to the genera of *Hemibranchiatae.*

| | | |
|---|---|---|
| 1 | Telsonic apex in ♀ without a notch, rounded or somewhat produced, more or less acute; in ♂ generally as in ♀, but sometimes much produced in the shape of a median process narrowed at its base. Mouth-parts in adult ♀ not modified . . . . . | 2. |
| | Telsonic apex in both sexes with a notch, usually stronger in ♂, frequently divided by a median lobe. Mouth-parts in adult ♀ modified.* Maxilliped with 4th–6th joints lobed. Outer ramus of pleopod 3 2-jointed. Marsupial plates overlapping in middle line . . . . . . . . | 6. |
| | Telsonic apex entire in ♀, in ♂ with a median slit, frequently widening anteriorly to a foramen. Mouth-parts in ♀ not modified. Maxilliped with 4th–6th joints lobed . . . . . . | 8. |
| 2 | Maxilliped with 4th–6th joints not lobed. Peraeopods 1–3 slender, with long natatory setae. Outer ramus of pleopod 3 1-jointed. Outer margin of outer ramus of uropod distinctly serrate. Marsupial plates overlapping in middle line . . | *Sphaeroma*, p. 503. |
| | Maxilliped with 4th–6th joints lobed. Peraeopods 1–3 without long setae. Outer ramus of pleopod 3 2-jointed. Outer margin of outer ramus of uropod not or only indistinctly serrate. Marsupial plates not reaching middle line . . . . . . | 3. |
| 3 | Peraeon segment 7 unarmed in both sexes . . | 4. |
| | Peraeon segment 7 with a process in ♂ (sometimes also in ♀) . . . . . . . . . . | 5. |
| 4 | Outer ramus of uropod well developed, subequal to inner . . . . . . . . . . | *Exosphaeroma*, p. 503. |
| | Outer ramus of uropod much smaller than inner . | *Pseudosphaeroma.* |
| 5 | Telsonic apex similar in both sexes, scarcely produced, with a ventral groove . . . . . . | *Isocladus.* |
| | Telsonic apex somewhat produced in ♀, strongly produced in ♂ with process narrowed at base, scarcely any ventral groove . . . . . . . | *Zuzara.* |
| 6 | Both rami of uropod well developed. Pleon segment 4 without median process. . . . . . | *Cymodoce*, p. 504. |
| | Inner ramus of uropod very short . . . . | 7. |
| 7 | Pleon segment 4 with median process in ♂ . . | *Cilicaea.* |
| | Pleon segment 4 without process . . . . | *Paracilicaea.* |

* Mandibles lose their dark, strongly chitinised apices, other appendages bluntened and non-setose. See Hansen, Q.J. Microsc. Sci., n.s., No. 193, vol. 49, pt. 1, p. 82, 1905.

8. Outer ramus of 3rd pleopod 2-jointed. Telsonic slit widening to a foramen in ♂. ♂ appendages on 7th segment separate . . . . . . . 9.
   Outer ramus of 3rd pleopod 1-jointed. Telsonic slit not widening to a foramen. ♂ appendages on 7th segment fused basally . . . . . . *Dynoides.*

9. Peraeon segment 7 in ♂ with, in ♀ with or without, a median process . . . . . . *Parisocladus*, p. 505.
   Peraeon segment 7 unarmed in both sexes . . *Sphaeramene.*

## Key to the species of *Sphaeroma.*

1. Telson triangular, apex pointed. Epistome flat . . . *terebrans.*
   Telson spoon-shaped, apex broadly rounded. Epistome concave 2.

2. Tubercles on peraeon circular. On telson the 2 submedian series of tubercles diverge slightly and continue nearly to apex . *walkeri.*
   Tubercles on peraeon transversely elongate. On telson 2 pairs of submedian tubercles, followed by a single median one . *annandalei.*

## Key to the species of *Exosphaeroma.*

1. Integument minutely setulose. Outer ramus of uropod fringed with setae, especially on inner margin . . . . *hylecoetes.*
   Integument including uropods glabrous. . . . . . 2.

2. Epistome somewhat like a shovel, its anterior margin freely projecting. Telsonic apex acute or narrowly pointed . . 3.
   Epistome without freely projecting anterior margin, its apex curving over to meet rostral point . . . . . . 5.

3. Telson smooth, evenly convex. Inner ramus of uropod narrowing to a pointed apex . . . . . . . . *pallidum.*
   Telson with a pair of low (often indistinct) ridges proximally and a median keel distally. Inner ramus of uropod more or less truncate apically . . . . . . . . . . 4.

4. Inner ramus of uropod with outer distal corner rounded; outer ramus serrulate on outer margin distally. . . . . *kraussii.*
   Inner ramus of uropod with outer distal corner sharply quadrate; outer ramus with apex uncinately curved outwards . . *antikraussi.*

5. Body very depressed. Uropods very large, lamellate. Epistome with a concavity . . . . . . . *planum.*
   Body moderately depressed. Uropods moderate. Epistome not concave . . . . . . . . . . . 6.

6. Telson considerably broader than long, in ♂ not extending to apices of uropods . . . . . . . . . *brevitelson.*
   Telson only slightly, if at all, broader than long; or longer than broad, extending at least to level of apices of uropods . 7.

7. Inner ramus of uropod quadrangular (parallel-sided). Telson longer than broad, narrowing to a very acute apex . . *porrectum.*
   Inner ramus of uropod ovate-lanceolate . . . . . 8.

8. Telson apically broadly rounded-truncate . . . . . *truncatitelson.*
   Telson apically narrowly rounded or subacute . . . . 9.

| | | |
|---|---|---|
| 9 | Telson extending beyond apices of inner rami of uropods . . | *varicolor.* |
| | Telson not extending beyond apices of inner rami of uropods; in ♂ with 2 minute submedian granules and 10–12 other granules in an arc submarginally . . . . . | *laeviusculum.* |

## Key to the species of *Cymodoce.*

(♂♂ only. It is often impossible to assign isolated ♀♀ or juveniles to their proper species.)

| | | |
|---|---|---|
| 1 | First peduncular joint of antenna 1 denticulate on front margin . . . . . . . . . . . | *tuberculata* var. *tripartita.* |
| | First peduncular joint of antenna 1 not denticulate . . | 2. |
| 2 | Median lobe of telsonic apex ♂ dorsally with either a recurved hook or a round button-like knob . . . . | 3. |
| | Median lobe of telsonic apex without either hook or knob . | 6. |
| 3 | Telsonic apex with a knob . . . . . . . | *umbonata.* |
| | Telsonic apex with a hook . . . . . . . | 4. |
| 4 | Pleon segment 4 without tubercles . . . . . | *unguiculata.* |
| | Pleon segment 4 with 2 submedian tubercles . . . | 5. |
| 5 | Hook very long. Tubercles on pleon stronger than those on telson. Hind margin of pleon segment 4 laterally strongly setose . . . . . . . . | *falcata.* |
| | Hook short. Tubercles on telson stronger than those on pleon . . . . . . . . . . . | *uncinata.* |
| 6 | Head strongly inflated . . . . . . . . | *amplifrons.* |
| | Head not inflated . . . . . . . . . . | 7. |
| 7 | Both rami of uropod tapering to acute points. Pleon segment 4 with submedian processes or tubercles . | 8. |
| | Rami of uropod not tapering to acute points; or if one of them is acute (lanceolate) then pleon segment 4 without tubercles . . . . . . . . . . | 9. |
| 8 | Pleon segment 4 with 2 long submedian processes . . | *acanthiger.* |
| | Pleon segment 4 with 2 tubercles . . . . . . | *africana.* |
| 9 | Body glabrous. Peraeon without tubercles. Often with blue or black spots . . . . . . . . | *valida.* |
| | Body more or less pilose or setulose . . . . . . | 10. |
| 10 | Outer ramus of uropod not distinctly smaller than inner ramus . . . . . . . . . . . | 11. |
| | Outer ramus of uropod much smaller than inner ramus . | 12. |
| 11 | Anterior peraeon segments glabrous. Outer ramus of uropod subacute. Telsonic apex deeply trifid, median lobe subacute . . . . . . . . . | *comans.* |
| | Whole body thickly setose. Outer ramus of uropod apically acute. Telsonic apex shallowly trifid, median lobe broad, truncate . . . . . . . . | *japonica* var. *natalensis.* |
| 12 | Uropods not extending beyond telsonic apex . . . | 13. |
| | Uropods extending beyond telsonic apex . . . . | 14. |

13 Pleon segment 4 without tubercles or bosses. Median and lateral lobes of telsonic apex acute, the lateral ones curved outwards . . . . . . . . *cavicola.*
Pleon segment with 2 submedian tubercles. Lobes of telsonic apex blunt . . . . . . . *setulosa.*

14 Telson with 2 submedian bosses followed by 2 conical tubercles . . . . . . . . . *tetrathele.*
Telson with 2 submedian ridges or longitudinally elongated bosses . . . . . . . . . *cryptodoma.*
Telson with 2 submedian conical tubercles . . . . *excavans.*

## Key to the species of *Parisocladus.*

Process on peraeon segment 7 in ♂ short, apically bifid; in ♀ very short. Telsonic slit in ♂ widening very little anteriorly . *stimpsoni.*
Process long, apically entire in ♂; ♀ without process. Telsonic slit in ♂ widening to a circular or transverse foramen . *perforatus.*

## Key to the genera of *Eubranchiatae.*

1 Peraeon usually without processes. Telsonic apex with either a notch, or a narrow slit widening anteriorly, with or without a median lobe . . . . . 2.
Peraeon without processes. Telson with the lateral margins bent downwards and inwards to form a tube *Cymodocella*, p. 506.

2 Uropods normal . . . . . . . . . *Dynamenella*, p. 505.
Inner ramus of uropod in ♂ rudimentary, outer ramus very long . . . . . . . . . *Cassidias.*

## Key to the species of *Dynamenella.*

1 Peraeon segment 7 in ♂ with 2 strong submedian processes. Telsonic slit widening anteriorly, with a median lobe . *dioxus.*
Whole peraeon without processes . . . . . . . 2.

2 Telsonic apex with a slit widening anteriorly into a foramen, without median lobe. One or more of the peraeon segments tuberculate . . . . . . . . . . 3.
Telsonic apex with a notch not widening anteriorly, or apex truncate. Peraeon segments not tuberculate . . . . 6.

3 Mouth-parts elongate. Telsonic slit widening to a distinct transverse foramen. 2 submedian longitudinal ridges on middle of telson, with a shorter pair between them basally. Inner ramus of uropod oblong, apically rounded. Peraeon with tubercles on all segments (more or less distinct) . *scabricula.*
Mouth-parts not elongate. Telsonic slit not widening to a foramen, with a tubercle just in front of the slit . . 4.

4 Inner ramus of uropod oblong, apically broadly rounded. Peraeon with tubercles on all segments . . . . *bicolor.*
Inner ramus of uropod sinuous, narrowly apically. Peraeon with tubercles only on segment 7, either distinct or very obscure . . . . . . . . . . 5.

| | | |
|---|---|---|
| 5 | Tubercles on peraeon segment 7 distinct. A prominent median tubercle immediately in front of apical notch . . . | *australis.* |
| | Tubercles very obscure. No median tubercle immediately in front of apical notch . . . . . . . . | *australoides.* |
| 6 | Telsonic apex with a notch . . . . . . . . | 7. |
| | Telsonic apex truncate. Body boat-shaped. Head strongly inflated . . . . . . . . . . . | *navicula.* |
| 7 | Head strongly inflated. Telson with 2 ridges. Only base of 2nd joint of peraeopods dark . . . . . . . | *taurus.* |
| | Head rather inflated. Telson with 2 low tubercles. Whole of 2nd joint of peraeopods dark . . . . . . | *macrocephala.* |
| | Head not inflated. Telson quite smooth. 2nd joints of peraeopods not dark . . . . . . . . . | 8. |
| 8 | Body convex, nearly parallel-sided . . . . . | *huttoni.* |
| | Body depressed, oval . . . . . . . . | *ovalis.* |

## Key to the species of *Cymodocella*.

| | | |
|---|---|---|
| 1 | Peraeon without tubercles or ridges . . . . . | 2. |
| | Peraeon with tubercles and ridges giving a cancellate appearance. Telson with 2 large submedian processes . . | *cancellata.* |
| 2 | Telson and pleon segment 4 both with 2 obscure submedian tubercles . . . . . . . . . . | *sublevis.* |
| | Telson with 6 tubercles. Peraeon segment 7 posteriorly bilobed, at least in ♂ . . . . . . . . . | *pustulata.* |

## Key to the genera of *Platybranchiatae*.

| | | |
|---|---|---|
| 1 | Body vaulted. Basal joints of antenna 1 not expanded. Eyes lateral. Head not sunk in 1st peraeon segment. Uropods biramous . . . . . . . | *Parasphaeroma.* |
| | Body depressed, more or less elliptical. Basal joints of antenna 1 expanded. Eyes dorsal. Head sunk in 1st peraeon segment . . . . . . . | 2. |
| 2 | Seventh peraeon segment excluded from the lateral margin. Outer ramus of uropod apparently obsolete | *Artopoles.* |
| | Seventh peraeon segment forming part of the lateral margin. Outer ramus of uropod well developed . | *Stathmos.* |

## Key to the families of *Idoteoidea* (*Valvifera*).

| | | |
|---|---|---|
| 1 | Ramus of uropod small. Pleopod 1 often modified in ♂. A single penial process . . . . . . . | 2. |
| | Ramus of uropod large. Pleopod 1 never modified in ♂. Usually a pair of penial processes. Body depressed. Peraeopods more or less prehensile, the anterior 4 pairs often subchelate . . . . . . | *Idoteidae*, p. 507. |
| 2 | Body narrow, cylindrical, rarely depressed. Anterior 4 pairs of peraeopods directed forwards, not prehensile, slender, with long setae . . . . . | *Astacillidae*, p. 508. |
| | Body broad, depressed. Anterior 4 pairs of peraeopods normal, prehensile, not setose . . . . . | *Pseudidoteidae.* |

## Key to the genera of *Idoteidae*.

| | | |
|---|---|---|
| 1 | Eyes dorsal. Maxilliped 7-jointed. Pleon with 2 complete sutures and one incomplete | *Cleantis*. |
| | Eyes lateral | 2. |
| 2 | Side-plates distinct. A pair of penial processes | 3. |
| | Side-plates not distinct. A single penial process. Maxilliped 5-jointed | *Synidotea*, p. 507. |
| 3 | Maxilliped 6-jointed | 4. |
| | Maxilliped 7-jointed | 5. |
| 4 | Pleon with one incomplete and 2 complete sutures | *Idotea*, p. 507. |
| | Pleon with 3 incomplete sutures | *Euidotea*. |
| 5 | Pleon with one complete and 2 incomplete sutures | 6. |
| | Pleon completely fused, with 3 incomplete sutures. Body with low medio-dorsal longitudinal keel | *Glyptidotea*. |
| 6 | Side-plates contiguous in both sexes | *Paridotea*, p. 507. |
| | Side-plates widely separated in ♂ | *Engidotea*. |

## Key to the species of *Synidotea*.

| | | |
|---|---|---|
| 1 | Side-plates on segments 2 and 3 rounded. Telson with postero-lateral angles rounded. Peraeopods strongly setose. Uropod with 2 oblique ridges on peduncle | 2. |
| | Side-plates on segments 2 and 3 angular. Telson with postero-lateral angles acute. Peraeopods not strongly setose. Uropod without ridges on peduncle | *setifer*. |
| 2 | Peraeopods strongly setose. Uropod with 2 oblique ridges on peduncle | *hirtipes*. |
| | Peraeopods not strongly setose. Uropod without oblique ridges on peduncle | *variegata*. |

## Key to the species of *Idotea*.

| | |
|---|---|
| Telson apically truncate. Colour blue. Pelagic | *metallica*. |
| Telson apically emarginate. Colour variable | *indica*. |

## Key to the species of *Paridotea*.

| | | |
|---|---|---|
| 1 | Body very narrow and elongate. Ramus of uropod longer than broad | *fucicola*. |
| | Body not very narrow. Ramus of uropod not longer than broad | 2. |
| 2 | Posterior margins of sterna straight or convex. Peduncle of uropod without longitudinal keel. Antenna 2 with 3rd–5th joints not produced. Lateral margin of telson thin, not grooved | 3. |
| | Posterior margins of sterna concave. Peduncle of uropod with longitudinal keel. Antenna 2 with inner apex of 3rd–5th joints produced. Lateral margin of telson thick, grooved | *reticulata*. |
| 3 | Ramus of uropod distinctly broader than long. Postero-lateral angles of telson subacute | *rubra*. |
| | Ramus of uropod very little broader than long. Postero-lateral angles of telson acute | *ungulata*. |

## Key to the genera of *Astacillidae*.

| | | |
|---|---|---|
| 1 | Body cylindrical or only slightly depressed . . . | 2. |
| | Body strongly depressed, not bent. Peraeon segment 4 not elongate. 3 pairs of marsupial plates. Side-plates distinct. All pleon segments and telson completely fused . . . . . . . . | *Idarcturus.* |
| 2 | Four pairs of marsupial plates. Peraeon segment 4 in ♂, and to a less extent in ♀, elongate. Body bent between segments 4 and 5. Side-plates distinct . . | 3. |
| | Three pairs of marsupial plates . . . . . . | 4. |
| 3 | Peraeon segments in ♂ without any ventral processes. Segment 4 in ♀ without lateral wing-like expansions. Pleopod 1 in ♂ modified . . . . . . | *Antarcturus*, p. 508. |
| | Peraeon segment 4 in ♀ laterally expanded. Pleopod 1 in ♂ not modified . . . . . . . . | *Arcturella*, p. 508. |
| 4 | Peraeon segment 4 in both sexes, but more in ♂ than in ♀, elongate. Body bent between segments 4 and 5 . | 5. |
| | Peraeon segment 4 not elongate. Body not bent . . | 6. |
| 5 | Peraeopod 1 stout, patent. Peraeopods 2–4 slender. Peraeon segment 4 often very elongate in ♂ . . | *Astacilla*, p. 509. |
| | Peraeopods 1–4 short and stout, peraeopod 1 latent, concealed in a buccal chamber formed by downward projections of lateral margins of head and peraeon segment 1. Peraeon segment 4 not so very long in ♂ . | *Arcturina.* |
| 6 | Side-plates distinct. Pleon with 3 segments in front of telson. Body not spinose . . . . . . | *Neoarcturus.* |
| | Side-plates not distinct. Pleon with one segment in front of telson. Body spinose . . . . . . | *Pleuroprion.* |

## Key to the species of *Antarcturus*.

| | |
|---|---|
| Peraeopods 2–7 serrate or spinose. Body granulate in ♂, spinose in ♀. A pair of long spines on head, knobbed in ♂, spinulose in ♀ . . . . . . . | *kladophoros.* |
| Peraeopods smooth. Head and peraeon segments each with 2 submedian tubercles forming 2 longitudinal ridges down the body . . . . . . | *similis.* |

## Key to the species of *Arcturella*.

| | | |
|---|---|---|
| 1 | Width of peraeon segment 4 ♀ less than length, in ♂ very much less. Body in both sexes subcylindrical. Flagellum 2nd antenna 2–3-jointed . . . | 2. |
| | Width of segment 4 ♀ greater than length, considerably less than length in ♂. Body in both sexes depressed. Flagellum 2nd antenna 1-jointed . . . . | 3. |

| | | |
|---|---|---|
| 2 | A small ventral process on 3rd segment ♂. Body ♀ normally hirsute and strongly tuberculate | *corniger.* |
| | No ventral process. Body ♀ glabrous and feebly tuberculate | *lineata.* |
| 3 | Antero-lateral angles 1st segment ♀ not distinct. Lateral margin 4th segment ♀ straight or nearly so | 4. |
| | Antero-lateral angles 1st segment distinct, acute. Lateral margin 4th segment lobulate (only ♀ known) | *lobulata.* |
| 4 | Segment 4 tuberculate (only ♀ known) | *pustulata.* |
| | Segment 4 not tuberculate | 5. |
| 5 | Outer margin 2nd joint antenna 2 entire. Peraeopod 5 ♀ 2nd joint longer than all others together. 4th segment ♂ with median hooked tubercle near hind margin | *longipes.* |
| | Outer margin 2nd joint antenna 2 notched. Peraeopod 5 2nd joint shorter than all others together. Segment 4 ♂ with 2 tubercles in middle line | *brevipes.* |

## Key to the species of *Astacilla.*

| | |
|---|---|
| Smooth, glabrous, very slender in ♂. Segment 4 in ♀ a little less, in ♂ a little more than half the total length, smooth in both sexes. Amongst the spines on Echinoids | *bacillus.* |
| ♀ granulate. Head spinose. Segment 4 much less than half total length, with a large median tubercle in front, and a smaller one behind | *mediterranea.* |

## Key to the families of *Aselloidea* (*Asellota*).

(Marine species. If the specimen is freshwater see *Protojanira* under *Jaeridae*).

| | | |
|---|---|---|
| 1 | First pair of pleopods in ♂ not coupled with the 2nd pair, their peduncles short and fused, rami distinct. 2nd pair small. 3rd pair in both sexes forming an operculum. 1st pair in ♀ small, fused, forming a small operculum * | *Stenetriidae*, p. 510. |
| | First pair of pleopods in ♂ coupled with the 2nd, forming a large operculum; peduncles of 1st pair elongate, the rami often obscure. 2nd pair large. 3rd pair not forming an operculum in either sex. 1st pair in ♀ large fused, opercular | 2. |
| 2 | Posterior 3 peraeopods not natatory. Eyes usually present | 3. |
| | Posterior 3 peraeopods either natatory or slender. Eyes absent | 4. |

* But see *Stenetrium syzygus.*

| | | |
|---|---|---|
| 3 | Peraeon segments 5–7 not marked off from the rest, nor smaller. Eyes (when present) dorsal or dorso-lateral, but not pedunculate. Bases of 1st antennae not widely separate . . . . . . . . | *Jaeridae*, p. 510. |
| | Peraeon segments 5–7 sharply marked off from, and smaller than, the rest. Eyes (when present) on lateral pedunculate processes. Bases of 1st antennae widely separate . . . . . . . . | *Munnidae*, p. 511. |
| 4 | Posterior 3 peraeopods slender, sometimes with long spines, but none of the joints enlarged . . . | *Desmosomidae*, p. 512. |
| | Posterior 3 peraeopods with enlarged and flattened joints bearing long plumose setae . . . . . | *Munnopsidae*, p. 512. |

## Key to the species of *Stenetrium*.

| | | |
|---|---|---|
| 1 | Eyes well developed and pigmented . . . . . . | 2. |
| | Eyes reduced to 3–4 feebly pigmented ocelli . . . | *syzygus*. |
| 2 | Outer apex of 1st joint of antenna 2 produced into an acute process . . . . . . . . . . . . | 3. |
| | Outer apex of 1st joint of antenna acute but not produced or dentiform . . . . . . . . . . . | 6. |
| 3 | Finger of peraeopod 1 ♂ slender, tapering. Ventral keel present on all peraeon segments . . . . . . | 4. |
| | Finger of peraeopod 1 ♂ robust, not tapering. Ventral keel absent on segments 4 and 5 . . . . . . . | *bartholomei*. |
| 4 | Rostrum longer than broad. 6th joint of peraeopod 1 in ♂ as broad as long, in ♀ scarcely widening distally; 2nd joint in ♂ without basal tooth . . . . . . . | *crassimanus*. |
| | Rostrum broader than long. 6th joint of peraeopod 1 in ♀, widening distally . . . . . . . . . | 5. |
| 5 | Second joint of peraeopod 1 in ♂ with basal tooth, 6th joint longer than wide. Ventral keel on all segments . . | *diazi*. |
| | Second joint of peraeopod 1 in ♂ without basal tooth; 6th joint as broad as long. Ventral keel present only on segments 3, 4 and 7 . . . . . . . . . . . | *dalmeida*. |
| 6 | Rostrum quadrate, broader than long. 6th joint of peraeopod 1 in ♂ as broad as long . . . . . . . | *dagama*. |
| | Rostrum triangular, longer than basal width. 6th joint of peraeopod 1 in ♂ longer than broad . . . . | *saldanha*. |

## Key to the genera of *Jaeridae*.

| | | |
|---|---|---|
| 1 | Freshwater. First pleopods in ♂ abnormal for the family, consisting of 2 foliaceous rami arising from a short basal piece, and overlapping the 2nd pleopods (not coupled with them to form an operculum) . . . | *Protojanira*. |
| | Marine. First pleopods normal . . . . . . . | 2. |

| | | |
|---|---|---|
| 2 | Antenna 2 long, peduncular joints not dilated, flagellum multiarticular. Mandible with prominent molar. Uropods with rami | 3. |
| | Antenna 2 short, peduncle dilated, flagellum rudimentary. Mandible with molar obsolete. Uropods minute, nodular, rami obsolete | *Jaeropsis.* |
| 3 | Eyes distinct | 4. |
| | Eyes absent | *Haploniscus.* |
| 4 | Antenna 1 very small, flagellum 2–3-jointed. Uropods short | 5. |
| | Antenna 1 well developed. Uropods well developed | 7. |
| 5 | No rostral process. Peraeopod 1 not subchelate | 6. |
| | A rostral process. Peraeopod 1 subchelate | *Pseudojanira.* |
| 6 | Third joint of antenna 2 without scale (spine) | *Jaera.* |
| | Third joint of antenna 2 with a scale | *Austrofilius.* |
| 7 | Maxilliped with 4th and 5th joints very much enlarged. Peduncles and rami of pleopod 1 in ♂ fused and dilated | *Ianiropsis.* |
| | Maxilliped with none of the joints much enlarged. Peduncles and rami of pleopod 1 in ♂ usually not fused or dilated | 8. |
| 8 | Apex of mandible in ♂ not prolonged. Eyes with several ocelli. Peraeopod 1 usually more or less modified for prehensile purposes | *Janira*, p. 511. |
| | Apex of mandible in ♂ much prolonged. Each eye consisting of only 2 lenses. All peraeopods alike | *Iais.* |

## Key to the species of *Janira*.

| | | |
|---|---|---|
| 1 | Third joint of antenna 2 with scale. Maxilliped with 3rd–5th joints broad. Anterior margin of head not strongly produced | 2. |
| | Third joint of antenna 2 without scale. Maxilliped with all joints narrow. Anterior margin of head strongly produced. 3rd joint of peraeopod 1 in ♂ with transverse rugae | *exstans.* |
| 2 | Body not very narrow. 5th joint of peraeopod 1 in ♂ narrow, more than twice as long as broad | *capensis.* |
| | Body very narrow. 5th joint of peraeopod 1 in ♂ oval, not twice as long as broad | *angusta.* |

## Key to the genera of *Munnidae*.

| | | |
|---|---|---|
| 1 | Uropods minute. Mandible with small palp | *Paramunna*, p. 512. |
| | Uropods well developed | 2. |
| 2 | Mandible with palp. Head not produced in a rostrum in ♂. 1st peraeon segment in ♂ not gibbous | *Antias.* |
| | Mandible without palp. Head in ♂ rostrate. 1st peraeon segment in ♂ gibbous | *Kuphomunna.* |

### Key to the species of *Paramunna*.

| | | |
|---|---|---|
| 1 | Lateral margin of pleon serrulate . . . . . | *capensis.* |
| | Lateral margin of pleon entire . . . . . . | 2. |
| 2 | Front of head evenly convex . . . . . . | *laevifrons.* |
| | Front of head quadrately produced . . . . | *concavifrons.* |

### Key to the genera of *Desmosomidae*.

| | | |
|---|---|---|
| 1 | Pleon consisting of one segment. Body moderately elongate. Peraeon segment 1 not laterally produced . | 2. |
| | Pleon consisting of 2 segments. Body very elongate. Peraeon segment 1 laterally produced forwards, segments 4 and 5 very long . . . . . . | *Rhabdomesus.* |
| 2 | Uropod biramous. Mandible with palp . . . | *Eugerda.* |
| | Uropod uniramous . . . . . . . . . | 3. |
| 3 | Mandible with a feeble palp. Uropod short . . . | *Ilychthonos.* |
| | Mandible without palp. Uropod long . . . . | *Macrostylis.* |

### Key to the genera of *Munnopsidae*.

| | | |
|---|---|---|
| 1 | Antenna 2 with scale on 3rd joint . . . . . | *Munnopsurus.* |
| | Antenna 2 without scale on 3rd joint . . . . . | 2. |
| 2 | Head produced between bases of 1st antennae, which are widely separated . . . . . . . . . | 3. |
| | Head truncate in front, bases of 1st antennae close together | *Ilyarachna*, p. 512. |
| 3 | Posterior part of body abruptly narrower than the anterior part. Uropod uniramous . . . . . . | *Pseudomunnopsis.* |
| | Posterior part of body not narrower than anterior part. Uropod biramous . . . . . . . . . | *Eurycope*, p. 512. |

### Key to the species of *Ilyarachna*.

| | |
|---|---|
| Posterior margin of peraeon segment 6 nearly straight, segment 6 medio-dorsally longer than 7 . . . | *affinis.* |
| Posterior margin of peraeon segment 6 concave, segment 7 medio-dorsally longer than 6 . . . . . | *crassiceps.* |

### Key to the species of *Eurycope*.

| | | |
|---|---|---|
| 1 | Head produced between bases of 1st antennae . . | 2. |
| | Head concave in front, not produced . . . . . | *fusiformis.* |
| 2 | Head very shortly produced. Antero-lateral angles of peraeon segments 5–7 and of pleon acute; segment 7 longer than either 5 or 6 . . . . . . | *quadrata.* |
| | Head strongly produced. Antero-lateral angles of peraeon segments 5–7 and of pleon rounded; segment 6 longer than either 5 or 7 . . . . . . . . . | *sulcifrons.* |

## Key to the families of *Bopyroidea* (*Epicaridea*).

1 ♀ with true peraeopods and some or all of the other appendages. ♂ differing from the last larval stage of ♀ . 2.

♀ a simple sac, without peraeopods and with most or all of the other appendages absent. ♂ resembling the last larval stage of the ♀. Oral cone without disc. Basal joint of antenna 1 expanded, usually with spiniform teeth. Side-plates (coxal-plates) pectinate (except *Liriopsis*). Peraeopods 1 and 2 shorter and thicker than the others, the former prehensile, the latter slender, with setiform dactyli. Outer ramus of uropod shorter than inner. Parasitic on various other Crustacea . . . . . . . . *Cryptoniscidae*, p. 514.

2 ♀ distinctly segmented, more or less asymmetrical. 7 pairs of peraeopods, all except 1st sometimes obsolete on one side. Pleopods usually present. ♂ with 7 distinct peraeon segments. Last larval stage with oral cone simple, basal joint of antenna 1 entire, flagellum of antenna 2 4-jointed, peraeopods all alike, and inner ramus of uropod shorter than outer. Parasitic on Decapod Crustacea . . . . . *Bopyridae*, p. 513

♀ symmetrical, segmentation (if present) visible only on the dorsal side. 5 pairs of peraeopods. Pleopods rudimentary or absent. ♂ with 6 free peraeon segments (the 1st segment fused with head). Last larval stage with oral cone ending in a sucking disc, basal joint of antenna 1 with spiniform process, flagellum of antenna 2 5-jointed, peraeopod 1 shorter and thicker than the others, and rami of uropod subequal. Parasitic on Decapods and Schizopods . *Dajidae*.

## Key to the genera of *Bopyridae*.

1 ♀ asymmetrical, but not greatly swollen on one side. 7 peraeopods on both sides. Uropods present . . 2.

♀ greatly swollen on one side. Only 1st peraeopod present on the swollen side. Uropods absent. 5 pleon segments. ♂ with pleon segments completely fused . . . . . . . . . *Hemiarthrus*.

2 Uropods of ♀ uniramous . . . . . . . 3.

Uropods of ♀ biramous . . . . . . . 5.

3 Pleurae and outer rami of pleopods of ♀ elongate, digitate. ♂ with medio-ventral boss on all peraeon segments; and pleon segments partly distinct . . . . *Scyracepon*.

Pleurae and pleopods of ♀ not elongate or digitate. ♂ without medio-ventral bosses, and with all pleon segments distinct . . . . . . . 4.

4 Pleopods of ♀ tuberculate or warty . . . . *Pseudione*, p. 514.

Pleopods of ♀ smooth . . . . . . . *Palaegyge*.

| | | |
|---|---|---|
| 5 | Epimera of ♀ not enlarged. Pleon segments in ♂ distinct . | *Paragigantione.* |
| | Epimera of ♀ considerably or greatly enlarged, and separate. Pleon segments in ♂ fused . . . . . . . | 6. |
| 6 | Lateral parts of pleon segments in ♀ not developed . . | *Bathygyge.* |
| | Lateral parts of pleon segments in ♀ well developed, but only 5 segments visible . . . . . . | *Epipenaeon.* |

## Key to the species of *Pseudione.*

| | |
|---|---|
| Epimera of ♀ rounded, pleura acute . . . . . | *crenulata.* |
| Epimera of ♀ acute, pleura rounded . . . . . | *munidae.* |

## Key to the genera of *Cryptoniscidae.*

| | | |
|---|---|---|
| 1 | Body of ♀ consisting of 2 sacs connected by a narrow neck, without attachment cord. ♂ with eyes, and epimera and basal joint of antenna 1 entire. Parasitic on rhizocephalous Cirripedes on Hermit-crabs . . . . | *Liriopsis.* |
| | Body of ♀ consisting of a single sac. ♂ without eyes, and epimera and basal joint of antenna 1 pectinate . . | 2. |
| 2 | ♀ attached to host by a cord. Ventral surface without slit. First larval stage without a ventral plate. Parasitic on Ostracods . . . . . . . . . . . | *Cyproniscus.* |
| | ♀ not attached. Ventral surface with a slit closed by valve-like flaps. First larval stage with a ventral plate. Parasitic on Isopods. . . . . . . . . . . . | 3. |
| 3 | Body slightly lobulate laterally, without distinct segmentation | *Clypeoniscus.* |
| | Body distinctly lobulate, the segmentation extending nearly from mid-dorsal line to mid-ventral line. ♂ and larval stages unknown . . . . . . . . . | *Aegoniscus.* |

## List of South African Amphipoda.

### *Gammaridea.*

*Lysianassidae.*

*Trischizostoma remipes* Stebb.
,, *paucispinosum* Brnrd.
,, *serratum* Brnrd.
*Stomacontion capense* Brnrd.
*Acidostoma obesum* (Bate).
*Phoxostoma algoense* Brnrd.
*Paravalettia chelata* Brnrd.
*Euonyx biscayensis* Chevr.
*Amaryllis macrophthalma* Hasw.
*Bathyamaryllis conocephala* (Brnrd.).
*Cyphocaris richardi* Chevr.
,, *anonyx* Boeck.
,, *challengeri* Stebb.
,, *faurei* Brnrd.
*Lysianassa variegata* (Stimps.).
,, *ceratina* (Wlkr.) (syn. *cubensis*, non Stebb.).

*Aristias symbiotica* Brnrd.
*Hippomedon longimanus* (Stebb.).
*Microlysias xenoceras* Stebb.
*Ichnopus taurus* Costa. (syn. *macrobetomma* Stebb.).
*Socarnopsis crenulata* Chevr.
*Orchomenella plicata* Schell.
*Uristes natalensis* Brnrd.
,, *induratus* Brnrd.
*Cheirimedon pectenipalma* Brnrd.
*Tryphosa onconotus* Stebb.
*Chironesimus adversicola* (Brnrd.).
,, *rotundatus* (Brnrd.).
*Eurythenes gryllus* (Licht.).

*Stegocephalidae.*

*Stegocephaloides australis* Brnrd.
,, *attingens* Brnrd.
*Parandania boecki* (Stebb.).

*Ampeliscidae.*

*Ampelisca brevicornis* (Costa).
,, *anomala* Sars.
,, *chiltoni* Stebb. ( ? =*eschrichtii* Kröyer).
,, *fusca* Stebb.
,, *diadema* (Costa).
,, *miops* Brnrd.
,, *natalensis* Brnrd.
,, *palmata* Brnrd.
,, *excavata* Brnrd.
,, *spinimanus* Chevr.
,, *byblisoides* Brnrd.
*Byblis anisuropus* Stebb.
,, *gaimardi* (Kröyer).
*Triodos insignis* Brnrd.

*Haustoriidae.*

*Urothoë pulchella* (Costa).
*Platyischnopus capensis* Brnrd.

*Phoxocephalidae.*

*Harpinia excavata* Chevr.
*Pontharpinia stimpsoni* Stebb. ( ? syn. *villosa juv.* Schell.).

*Amphilochidae.*

*Gitanopsis pusilla* Brnrd.
*Hoplopleon australis* (Brnrd.).
,, *medusarum* Brnrd.
*Cyproidea ornata* (Hasw.) (syn. *Gallea crinita* Spandl.)

*Leucothoidae.*

*Leucothoë spinicarpa* (Abildg.).
,, *richiardii* Less.
,, *dolichoceras* Brnrd.
,, *ctenochir* Brnrd.

*Metopidae.*

*Proboloides rotundus* (Stebb.).

*Stenothoidae.*

*Stenothoë adhaerens* Stebb. (only ♀ known).
,, *gallensis* Wlkr.
,, *dolichopous* Brnrd.
,, *assimilis* Chevr.

*Phliantidae.*

*Plioplateia triqueter* Brnrd.
*Temnophlias capensis* Brnrd.
*Palinnotus natalensis* Brnrd.

*Colomastigidae.*

*Colomastix pusilla* Grube.

*Ochlesidae.*

*Ochlesis lenticulosus* Brnrd.

*Pardaliscidae.*

*Nicippe tumida* Bruz.
*Halice anacantha* Brnrd.

*Acanthonotozomatidae.*

*Iphimedia capicola* Brnrd.
*Panoploea excisa* Brnrd.

*Liljeborgiidae.*

*Liljeborgia dubia* (Hasw.).
,, *consanguinea* Stebb.
,, *proxima* Chevr.
,, *kinahani* Bate var. *capensis* Brnrd.
,, *epistomata* Brnrd.

*Oedicerotidae.*

*Halicreion* (?) *ovalitelson* Brnrd.
*Bathymedon palpalis* Brnrd.
*Oediceroides cinderella* Stebb.
,, *plumicornis* Brnrd.
*Aceroides limicola* Brnrd.
*Perioculodes longimanus* (B. and W.).
*Synchelidium* (? *tenuimanus* Norm.).

*Tironidae.*

*Tiron australis* Stebb.
*Bruzelia diodon* Brnrd.
*Syrrhoites tenellus* Brnrd.
*Austrosyrrhoë crassipes* Brnrd.

*Calliopiidae.*

*Calliopiella michaelseni* Schell.

*Paramphithoidae.*

*Epimeria cornigera* (Fabr.).
,, *semiarmata* Brnrd.
,, *longispinosa* Brnrd.

*Lepechinellidae.*

*Lepechinella chrysotheras* Stebb.

*Atylidae.*

*Nototropis homochir* (Hasw.).
,, *granulosus* (Wlkr.).

*Eusiridae.*

*Eusiroides monoculodes* (Hasw.).
*Eusirus minutus* Sars.
*Cleonardopsis carinata* Brnrd.
*Rhachotropis palporum* Stebb.
,, *kergueleni* Stebb.
,, *grimaldii* Chevr.
,, *paeneglaber* Brnrd.
,, *anomala* Brnrd.

*Pontogeneiidae.*

*Paramoera capensis* (Dana) ( ? syn. *schizurus* Stebb.).
,, *bidentata* Brnrd.

*Gammaridae.*

*Megaluropus agilis* Hoek (syn. *Phylluropus capensis* Brnrd.).
*Melita fresnelii* (Aud.).
,, *subchelata* Schell.
,, *zeylanica* Stebb.
,, *orgasmos* Brnrd.
*Maera inaequipes* (Costa).
,, *mastersii* (Hasw.).
,, *hamigera* (Hasw.).
,, *hirondellei* Chevr.
,, *grossimanus* (Mont.).
,, *bruzelii* Stebb. 1888.
,, *vagans* Brnrd. (syn. *bruzelii* Stebb. 1910, non Stebb. 1888.
*levis* Brnrd., non S. I. Smith).
,, *subcarinata* (Hasw.).
,, *boeckii* (Hasw.).

*Ceradocus rubromaculatus* (Stmpsn.).
,, *aviceps* Brnrd.
*Elasmopus pectenicrus* (Bate) (syn. *brasiliensis* Stebb. non Dana).
,, *japonicus* Steph.
*Parelasmopus suluensis* (Dana).
*Elasmopoides chevreuxi* Stebb.
*Eriopisella capensis* (Brnrd.).
*Eucrangonyx robertsi* Meth.*
*Gammarus* (*Paramelita*) *capensis* Brnrd. (syn. *P. ctenodactyla* Schell.).
,, ,, *nigroculus* Brnrd. and var. *persetosus* Brnrd.
,, ,, *crassicornis* Brnrd.
,, ,, *auricularius* Brnrd.
,, ,, *tulbaghensis* Brnrd.
,, ,, *seticornis* Brnrd.
,, ,, *kogelensis* Brnrd.
,, ,, *aurantius* Brnrd.
,, ,, *spinicornis* Brnrd.
,, ,, *granulicornis* Brnrd.

*Dexaminidae.*

*Polycheria atolli* Wlkr.
*Guernea laevis* Chevr.

*Talitridae.*

*Talitroides eastwoodae* (Meth.) (? = *T. africana* Bate).
,, ,, formae *cylindripes, setosa, calva, macronyx.*
*Talorchestia capensis* (Dana).
,, *quadrispinosa* Brnrd.
,, *australis* Brnrd.
,, *ancheidos* Brnrd.
,, (?) *africanus* Bate (species *dubia*).
*Neobule reynaudi* (M. Edw.) (species *dubia*).
*Parhyale inyacka* (Brnrd.).
*Chiltonia capensis* Brnrd.
*Parorchestia rectipalma* Brnrd.
,, *dassenensis* Brnrd.
*Hyale saldanha* Chilton.
,, *hirtipalma* (Dana).
,, *macrodactylus* Stebb.
,, *grandicornis* Kröyer.
,, *maroubrae* Stebb.
,, *diastoma* Brnrd.
*Allorchestes inquirendus* Brnrd.
*Parhyalella natalensis* (Stebb.).
*Orchestia excavata* Chevr. (Upper Zambezi.)
[ ,, *platensis* Kröyer. Tristan d'Acunha.]

* Retained in *Crangonyx* by Schellenberg, Zool. Jahrb. Abt. Syst., lxix, p. 482, 1937.

*Aoridae.*

*Aora typica* Kröyer.
,, ,, forma *anomala* Schell.
,, ,, ,, *gibbula* Brnrd.
*Lembos hirsutipes* Stebb.
,, *leptocheirus* Wlkr.
,, *hypacanthus* Brnrd.
*Lemboides afer* Stebb.
,, *acanthiger* Brnrd.
,, *crenatipalma* Brnrd.
*Grandidierella lignorum* Brnrd.

*Photidae.*

*Photus dolichommata* Stebb.
,, *longimanus* Wlkr.
,, *uncinata* Brnrd.
*Cheiriphotis megacheles* (Giles) (syn. *walkeri* Stebb., *durbanensis* Brnrd.)
*Eurystheus afer* (Stebb.).
,, *atlanticus* (Stebb.).
,, *holmesi* Stebb.
,, *imminens* Brnrd.
,, *semidentatus* Brnrd.
,, *palmoides* Brnrd.
,, (?) *scissimanus* Brnrd.
*Chevalia aviculae* Wlkr.

*Ampithoidae.*

*Ampithoë ramondi* (Aud.).
,, *falsa* Brnrd.
,, *africana* Brnrd.
*Exampithoë natalensis* Brnrd.
*Cymadusa australis* (Brnrd.).
*Macropisthopous stebbingi* Brnrd.

*Jassidae.*

*Jassa falcata* (Mont.).
*Ischyrocerus anguipes* Kröyer.
,, *carinatus* Brnrd.
,, *gorgoniae* Brnrd.
*Isaeopis tenax* Brnrd.

*Corophiidae.*

*Camacho bathyplous* Stebb.
*Ericthonius brasiliensis* (Dana).
*Siphonoecetes orientalis* Wlkr.
,, *dellavallei* Stebb.
*Corophium acherusicum* Costa.
,, *triaenonyx* Stebb.
*Cerapus abditus* Templ.

*Cheluridae.*

*Chelura terebrans* Phil.

*Sebidae.*

*Seba saundersii* Stebb. (Doubtfully S. African.)

*Podoceridae.*

*Laetmatophilus purus* Stebb.
,, *tridens* Brnrd.
,, *durbanensis* Brnrd.
*Podocerus cristatus* (Thomson).
,, *africanus* Brnrd.
,, *multispinis* Brnrd.
,, ,, ,, var. *levis* Brnrd.
,, *brasiliensis* (Dana).
,, *inconspicuus* (Stebb.) (syn. *palinuri* Brnrd.).

## *Phronimidea* (*Hyperiidea*).

*Lanceolidae.*

*Scypholanceola vanhoeffeni* Wolt.

*Vibiliidae.*

*Vibilia armata* Bov. (syn. *gracilenta* Bov.).
,, *chuni* Behn. and Wolt.

*Cystisomatidae.*

*Cystisoma africanum* Brnrd.

*Hyperiidae.*

*Hyperia galba* Mont. (syn. *gaudichaudii*).
,, *promontorii* Stebb. (syn. *schizogeneios*).
*Hyperoche cryptodactylus* Stebb.
*Parathemisto* (*Euthemisto*) *gaudichaudii* (Guer.).

*Phronimidae.*

*Phronima sedentaria* (Forsk.).
,, *atlantica* Guer.
,, *colletti* Bov.
*Phronimella elongata* Claus.

*Phrosinidae.*

*Phrosina semilunata* Risso.
*Primno macropa* Guer.

*Pronoidae.*

*Parapronoë crustulum* Claus (syn. *Parapronoë clausi* Stebb. and *Amphipronoë cuspidata* Bate).

*Brachyscelidae.*

*Brachyscelus rapax* Claus.

*Oxycephalidae.*

*Oxycephalus tuberculatus* Bate.
,, *clausi* Bov.
,, *latirostris* Claus.
*Glossocephalus milne-edwardsi* Bov.
*Streetsia pronoides* (Bov.).
*Rhabdosoma whitei* Bate.
*Calamorhynchus rigidus* Stebb.

*Platyscelidae.*

*Hemityphis tenuimanus* Claus.
*Paratyphis maculatus* Claus.
,, *promontorii* Stebb.
*Tetrathyrus forcipatus* Claus.

## *Cyamidea.*

*Caprellidae.*

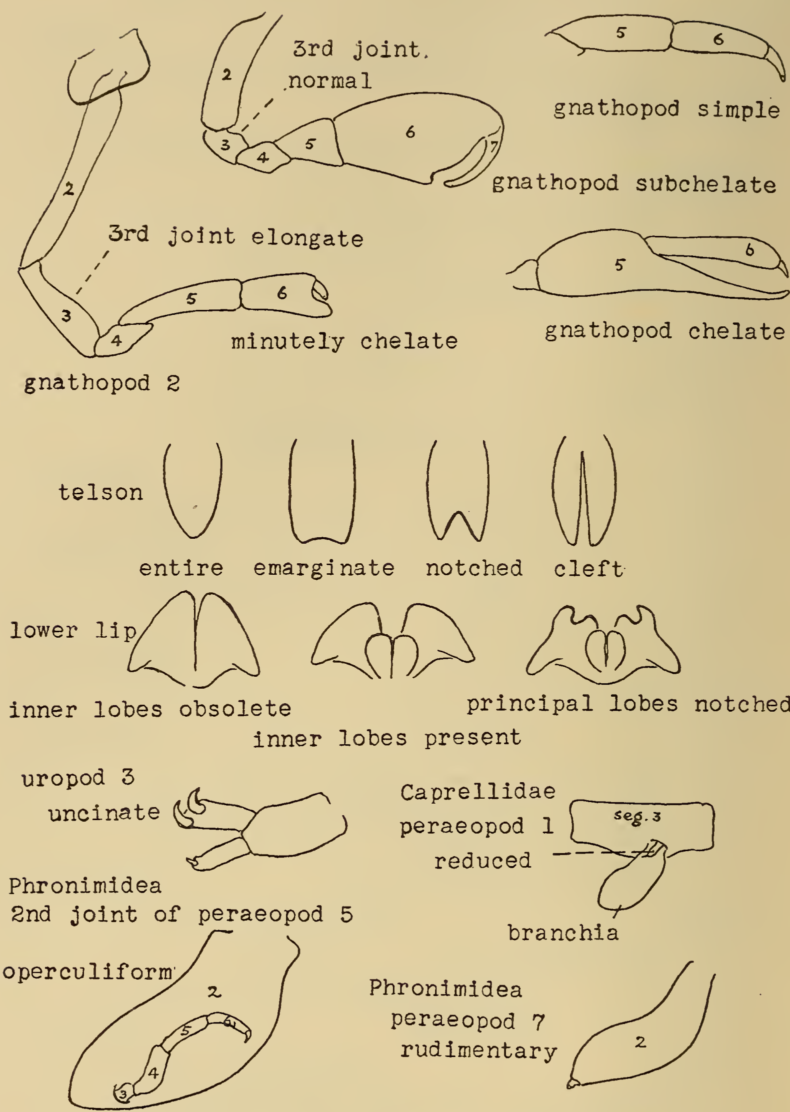
*Caprella penantis* Leach (syn. *acutifrons* Latr.).
,, ,, ,, var. *porcellio* Mayer.
,, ,, ,, var. *natalensis* Mayer.
,, *equilibra* Say.
,, *scaura* Templ.
,, *solitaria* Stimpson (species dubia, ? = *scaura*).
,, *cicur* Mayer.
,, *falsa* Mayer.
,, *laevipes* Mayer.
,, *triodous* Stebb.
,, *danilevskii* Czern.
*Caprellina longicollis* (Nicol.).
,, *spiniger* Brnrd.
*Phtisica marina* Slabber.
*Metaprotella makrodaktylos* Stebb.
*Metaproto novaehollandiae* (Hasw.).
*Paradeutella serrata* Mayer.
*Orthoprotella mayeri* Brnrd.
*Pseudaeginella tristanensis* (Stebb.).

*Cyamidae.*

*Cyamus ovalis* R. de V.
*Paracyamus erraticus* R. de V.
,, *gracilis* R. de V.
,, *boöpis* Lütken.

## Synopsis of the three sub-orders of *Amphipoda*.
## (After Stebbing. Das Tierreich, xxi, 1906.)

1. Normal Amphipoda, usually not pelagic, usually opaque and more or less pigmented. Head not fused with 1st peraeon segment. Palp of maxilliped 2–4-jointed (absent only in *Ochlesis*). Peraeon with 7 pairs of legs,




*Amphipoda.* Figures (schematic) to illustrate some of the differential characters utilized in the Keys.

the 1st joints of which form well developed side-plates. Pleon usually consisting of 7 free segments, carrying 3 pairs of pleopods and usually 3 pairs, at least 1 pair, of uropods; uropod 1 always biramous . *Gammaridea*, p. 523.

2. Pelagic Amphipoda, usually semitransparent or feebly pigmented. Head not fused with 1st peraeon segment. Palp of maxilliped absent. Peraeon with 7 pairs of legs, the 1st joints (side-plates) small or wanting. Pleon usually consisting of 7 free segments, carrying 3 pairs of pleopods and 3 pairs of uropods; rami of the latter often evanescent. Eyes usually large . . . . . . . . . . *Phronimidea* (*Hyperiidea*), p. 526.

3. Slender, elongate, cylindrical Amphipoda, modified for living among weeds (Skeleton-shrimps); or short and depressed and ectoparasitic on whales (Whale lice). Head fused with 1st peraeon segment. Palp of maxilliped 1–4-jointed. Peraeon often with less than 7 pairs of legs, the 1st joints (side-plates) absent. Pleon and its appendages rudimentary. Eyes small *Cyamidea* (*Caprellidea*), p. 527.

A fourth sub-order, *Ingolfiellidea*, is accepted (see Hansen, 1903, J. Linn. Soc. London, xxix, and Calman, 1909, in Lankester's Treatise on Zoology, pt. 7); but no representatives of it have yet been found in South Africa.

## Key to the families of *Gammaridea*.

(Adapted from Stebbing. Das Teirreich, xxi, 1906. Gnathopods 1 and 2, and peraeopods 1–5 are reckoned.)

| | | |
|---|---|---|
| 1 | Ant. 1 1st joint stout,* accessory flagellum present; mandible with cutting-edge almost smooth,† with palp; gn. 2 with 3rd joint elongate . . . . . . . (* Except *Amaryllis*. † Except *Paravalettia*.) | *Lysianassidae*, p. 527. |
| | These characters not combined . . . . | 2. |
| 2 (1) | Body plump; ant. 1 with accessory flagellum; mandible without molar and without palp | *Stegocephalidae*, p. 529. |
| | These characters not combined . . . . | 3. |
| 3 (2) | Head tapering, truncate; eyes, when present, simple, usually 4; ant. 1 without accessory flagellum; telson more or less cleft . . | *Ampeliscidae*, p. 529. |
| | These characters not combined . . . . | 4. |

| | | |
|---|---|---|
| 4 (3) | Ant. 1 with accessory flagellum; mandible with palp normal; prps. 3–5 with joints expanded for burrowing . . . . | 5. |
| | These characters not combined . . . | 6. |
| 5 (4) | Prp. 4 not greatly longer than prp. 5 . . | *Haustoriidae*, p. 530. |
| | Prp. 4 greatly longer than prp. 5 . . . | *Phoxocephalidae*, p. 530. |
| 6 (4) | Upper lip incised; mxp. normal; urop. 3 biramous; telson elongate and entire . | *Amphilochidae*, p. 530. |
| | These characters not combined . . . | 7. |
| 7 (6) | Ant. 1 without accessory flagellum; mxp. more or less abnormal; telson entire . . | 8. |
| | These characters not combined . . . | 13. |
| 8 (7) | Gnathopod 1 chelate . . . . . . | *Leucothoidae*, p. 531. |
| | Gnathopod 1 not chelate . . . . . | 9. |
| 9 (8) | Uropod 3 biramous . . . . . . | 10. |
| | Uropod 3 uniramous . . . . . . | 11. |
| 10 (9) | Mxp. with palp . . . . . . . | *Colomastigidae*. |
| | Mxp. without palp . . . . . . | *Ochlesidae*. |
| 11 (9) | Mandible with palp . . . . . . | *Metopidae*. |
| | Mandible without palp . . . . . . | 12. |
| 12 (11) | Mxp. outer plate obsolete . . . . . | *Stenothoidae*, p. 531. |
| | Mxp. with both plates developed . . . | *Phliantidae*, p. 531. |
| 13 (7) | Mandible with molar weak or wanting; telson more or less divided . . . . . | 14. |
| | These characters not combined . . . | 16. |
| 14 (13) | Mxp. inner plate well developed . . . | *Acanthonotozomatidae*, p. 531. |
| | Mxp. inner plate small . . . . . . | 15. |
| 15 (14) | Gnathopods 1 and 2 simple . . . . | *Pardaliscidae*, p. 531. |
| | Gnathopods 1 and 2 strongly subchelate . . | *Liljeborgiidae*, p. 531. |
| 16 (13) | Eyes, when present, dorsally contiguous or confluent . . . . . . . . . | 17. |
| | Eyes, when present, lateral . . . . . | 19. |
| 17 (16) | Ant. 1 without accessory flagellum; 3rd joint mandibular palp large; prp. 5 much longer than prp. 4; telson entire . . . | *Oedicerotidae*, p. 532. |
| | Ant. 1 with accessory flagellum; 3rd joint mandibular palp small; prp. 5 not much longer than prp. 4; telson cleft (except in *Bruzelia* of the *Tironidae*) . . . . . . | 18. |
| 18 (17) | Prps. 1 and 2, 4th and 5th joints dilated (pelagic) . . . . . . . | [*Synopiidae*]. |
| | Prps. 1 and 2, 4th and 5th joints not dilated . | *Tironidae*, p. 532. |
| 19 (16) | Side-plate 4 usually excavate behind; prp. 1 and 2 not glandular; telson variable; animal usually not domicolous . . | 20. |
| | Side-plate 4 usually not excavate behind; prp. 1 and 2 glandular; telson entire; animal usually domicolous. . . . . . | 29. |

| | | |
|---|---|---|
| 20 (19) | Mandible with palp | 21. |
| | Mandible without palp | 28. |
| 21 (20) | Telson variable, usually cleft; ant. 1 usually with accessory flagellum | *Gammaridae*, p. 533. |
| | Telson entire | 22. |
| | Telson cleft | 24. |
| 22 (21) | Rostrum weak | *Calliopiidae*. |
| | Rostrum well marked | 23. |
| 23 (22) | Side-plates 1–4 rounded; ant. 1 longer than ant. 2 | [*Pleustidae*]. |
| | Side-plates 1–4 angular; ant. 1 shorter than ant. 2 | *Paramphithoidae*, p. 532. |
| 24 (21) | Pleon segments 5 and 6 coalesced | 25. |
| | Pleon segments 5 and 6 not coalesced | 27. |
| 25 (24) | Lower lip with inner lobes obsolete | *Atylidae*, p. 533. |
| | Lower lip with well developed inner lobes | 26. |
| 26 (25) | Urop. 3 not greatly elongate | *Lepechinellidae*. |
| | Urop. 3 greatly elongate | [*Melphidippidae*]. |
| 27 (24) | Gnathopods 1 and 2, hands powerful | *Eusiridae*, p. 533. |
| | Gnathopods 1 and 2, hands not powerful | *Pontogeneiidae*, p. 533. |
| 28 (20) | Urop. 3, both rami well developed | *Dexaminidae*, p. 535. |
| | Urop. 3, one ramus very small or wanting | *Talitridae*, p. 535. |
| 29 (19) | Uropods 2 and 3 well developed | 30. |
| | Uropods 2 and 3, one or other wanting or rudimentary | *Podoceridae*, p. 539. |
| 30 (29) | Pleon compressed; urop. 3 biramous (except *Grandidierella*) | 31. |
| | Pleon usually depressed; urop. 3 uniramous (except *Chelura*) | 34. |
| 31 (30) | Uropod 3 not uncinate | 32. |
| | Uropod 3 outer ramous uncinate | 33. |
| 32 (31) | Gnathopod 1 larger than gnathopod 2 | *Aoridae*, p. 537. |
| | Gnathopod 1 not larger than gnathopod 2 | *Photidae*, p. 537. |
| 33 (31) | Lower lip with principal lobes notched | *Ampithoidae*, p. 538. |
| | Lower lip with principal lobes not notched | *Jassidae*, p. 539. |
| 34 (30) | Ant. 2 with flagellum not spatulate; urop. 3 uniramous, terete (or inner ramus very minute) | 35. |
| | Ant. 2 with spatulate flagellum; urop. 3 inner ramus minute, outer ramus foliaceous (wood-boring) | *Cheluridae*. |
| 35 (34) | Both gnathopods chelate; gn. 2 with 3rd joint rather long | [*Sebidae*]. |
| | Gnathopods not chelate (gn. 2 sometimes complexly subchelate, 5th joint prolonged); gn. 2 with 3rd joint short | *Corophiidae*, p. 539. |

## Key to the families of *Phronimidea* (*Hyperiidea*).

(Adapted from Bovallius, K. Sv. Vet. Ak. Handl., xxi, No. 5, 1887.)

(Peraeopods 1–7 are here reckoned.)

| | | |
|---|---|---|
| 1 | Ant. 1 straight, 1st joint of flagellum large, the rest inserted terminally; ant. 2 straight in both sexes . . . . . . . | 2. |
| | Ant. 1 curved, 1st joint of flagellum large, the rest inserted subterminally; ant. 2 in ♂ angularly folded (in *Lycaeopsidae* rudimentary in ♂, absent in ♀) . . . | 10. |
| 2 (1) | Ant. 1 flagellum few jointed . . . . . | 3. |
| | Ant. 1 flagellum in ♂ many jointed, filiform, in ♀ very small, rudimentary or absent . | 7. |
| 3 (2) | Head not swollen . . . . . . . | 4. |
| | Head large, swollen; mandible without palp . | 6. |
| 4 (3) | Ant. 1 flagellum elongate, styliform; mandible without palp; inner rami of urops. fused with peduncles, outer rami rudimentary in urops. 1 and 2, small in urop. 3 . . | [*Scinidae*]. |
| | Ant. 1 flagellum short, terete or laminar; mandible with palp; all rami of urops. well developed, the inner rami not fused with peduncles . . . . . . . | 5. |
| 5 (4) | Ant. 1 terete; last prp. normal, dactylus acute, unguiform . . . . . . | *Lanceolidae*, p. 540. |
| | Ant. 1 flagellum laminar, oval or lanceolate (terete in the Antarctic *Cyllopus*); last prp. more or less reduced in length, dactylus blunt, digitiform . . . . . | *Vibiliidae*, p. 540. |
| 6 (3) | Ant. 1 flagellum elongate, styliform (large forms reaching 70–80 mm.) . . . . | *Cystisomatidae*. |
| | Ant. 1 flagellum oval or lanceolate (small forms, up to 15 mm.) . . . . . . | [*Paraphronimidae*]. |
| 7 (2) | Urops. normal, with rami; last prp. normal . | 8. |
| | Urops. foliaceous, without rami; last prp. reduced . . . . . . . | *Phrosinidae*, p. 541. |
| 8 (7) | Mandible without palp . . . . . | 9. |
| | Mandible with palp . . . . . | *Hyperiidae*, p. 540. |
| 9 (8) | All peraeopods simple . . . . . | [*Dairellidae*]. |
| | Prp. 5 with enlarged prehensile hand . . | *Phronimidae*, p. 540. |
| 10 (1) | Prp. 6, 2nd joint not operculiform, the following joints articulated terminally . . . | 11. |
| | Prp. 6, 2nd joint operculiform, the following joints articulated subterminally . . | 14. |
| 11 (10) | Ant. 1 attached to anterior surface of head; prp. 5 very slender; prp. 6 robust . . . | [*Lycaeopsidae*]. |
| | Ant. 1 attached to inferior surface of head . | 12. |

| | | |
|---|---|---|
| 12 (11) | Head not (or very slightly) produced in a rostral point . . . . . . . | 13 |
| | Head more or less produced in a rostral point | *Oxycephalidae*, p. 541. |
| 13 (12) | Prps. 1 and 2 simple . . . . . | [*Lycaeidae*]. |
| | Prps. 1 and 2 prehensile, the expanded 5th joint forming a chela with the dactylus . . | *Brachyscelidae*. |
| 14 (10) | Prp. 5, 2nd joint normal . . . . . | *Pronoidae*. |
| | Prp. 5, 2nd joint operculiform . . . | 15. |
| 15 (14) | Prp. 7 normal . . . . . . | [*Thyropidae* (=*Parascelidae*)]. |
| | Prp. 7 rudimentary . . . . . | *Platyscelidae*, p. 541. |

## Key to the families of *Cyamidea*.

| | |
|---|---|
| Body elongate, cylindrical; both pairs of antennae well developed (free-living, among weed, coral, etc.) . . . . . | *Caprellidae*, p. 542. |
| Body short, depressed; 2nd antennae rudimentary (ecto-parasitic on whales) . . | *Cyamidae*, p. 543. |

## Key to the genera of *Lysianassidae*.

| | | |
|---|---|---|
| 1 | Mouth-parts greatly projecting below, more or less styliform. . . . . . . | 2. |
| | Mouth-parts not styliform . . . . | 5. |
| 2 (1) | Eyes and gn. 1 strongly developed. Telson entire . . . . . . . . | *Trischizostoma*, p. 528. |
| | Eyes and gn. 1 not strongly developed . . | 3. |
| 3 (2) | Uropod 3 biramous . . . . . . | 4. |
| | Uropod 3 uniramous . . . . . . | *Stomacontion*. |
| 4 (3) | Maxilla 1 palp rudimentary . . . . | *Acidostoma*. |
| | Maxilla 1 palp 2-jointed . . . . | *Phoxostoma*. |
| 5 (1) | Gnathopod 1 chelate . . . . . . | 6. |
| | Gnathopod 1 not chelate . . . . . | 7. |
| 6 (5) | Gn. 2 chelate. Telson entire. Uropod 3 uniramous . . . . . . . . | *Paravalettia*. |
| | Gn. 2 subchelate. Telson cleft. Urop. 3 biramous . . . . . . . | *Euonyx*. |
| 7 (5) | Maxilla 1 without palp . . . . . | 8. |
| | Maxilla 1 with 2-jointed palp. . . . | 9. |
| 8 (7) | Rostrum scarcely developed . . . . | *Amaryllis*. |
| | Rostrum well developed . . . . | *Bathyamaryllis*. |
| 9 (7) | Side-plates 1 and 2 very small . . . | *Cyphocaris*, p. 528. |
| | Side-plates 1 and 2 not very small . . . | 10. |
| 10 (9) | Telson entire. Gnathopod 1 simple . . | *Lysianassa*, p. 529. |
| | Telson cleft . . . . . . . . | 11. |
| 11 (10) | Side-plate 1 almost completely concealed by side-plate 2 . . . . . . . | *Aristias*. |
| | Side-plate 1 not concealed . . . . | 12. |

| | | |
|---|---|---|
| 12 (11) | Branchial lamellae pleated on both sides . | 13. |
| | Branchial lamellae pleated on one side only . | *Hippomedon.* |
| | Branchial lamellae simple, not pleated . . | 15. |
| 13 (12) | Gnathopod 1 subchelate . . . . . | *Microlysias.* |
| | Gnathopod 1 simple . . . . . . | 14. |
| 14 (13) | Prp. 5 longer than prp. 4. Urop. 2 inner ramus strongly constricted distally . . . | *Ichnopus.* |
| | Prp. 5 not longer than prp. 4. Urop. 2 inner ramus not constricted . . . . | *Socarnopsis.* |
| 15 (12) | Mandible, palp attached behind (proximally to) molar . . . . . . . . | *Orchomenella.* |
| | Mandible, palp attached not behind molar . | 16. |
| 16 (15) | Gnathopod 1 imperfectly subchelate . . | *Uristes*, p. 529. |
| | Gnathopod 1 distinctly subchelate . . . | 17. |
| 17 (16) | Gnathopod 1, 6th joint distally widened . . | *Cheirimedon.* |
| | Gnathopod 1, 6th joint not distally widened . | 18. |
| 18 (17) | Maxilla 2, inner plate not much shorter than outer plate . . . . . . . | *Tryphosa.* |
| | Maxilla 2, inner plate much shorter than outer plate . . . . . . . . . | 19. |
| 19 (18) | Gn. 2, 6th joint widening distally. Upper lip with forwardly projecting lobe . . | *Chironesimus*, p. 529. |
| | Gn. 2, 6th joint not widening, slender. Epistome and upper lip rounded in front, neither of them strongly projecting. . | *Eurythenes.* |

## Key to the species of *Trischizostoma.*

| | | |
|---|---|---|
| 1 | Palm of gnathopod 1 with numerous minute spinules or denticles . . . . . . . . . . | *remipes.* |
| | Palm of gnathopod 1 smooth . . . . . . . | 2. |
| 2 | Gn. 1 inner margin of finger denticulate; palmar angle produced . . . . . . . . . . | *serratum.* |
| | Gn. 1 inner margin of finger smooth; palmar angle not produced . . . . . . . . . . | *pauci-spinosum.* |

## Key to the species of *Cyphocaris.*

| | | |
|---|---|---|
| 1 | Prp. 3, 2nd joint, hind margin serrate, not produced into a sharp point or spur . . . . . . . | *richardi.* |
| | Prp. 3, 2nd joint, lower hind corner produced in a sharp point or spur . . . . . . . . . . | 2. |
| 2 | Prp. 3, 2nd joint produced in a sharp point, the margin above and below serrate . . . . . . . | *anonyx.* |
| | Prp. 3, 2nd joint produced in a long spur . . . . | 3. |
| 3 | Spur very long, the margin above with a few serrations. . | *challengeri.* |
| | Spur moderately long, the margin above smooth. . . | *faurei.* |

### Key to the species of *Lysianassa*.

| | |
|---|---|
| Pleon segment 3, postero-lateral lobe with a minute tooth on its upper corner, lower corner rounded. Telson apically notched. Urop. 3, peduncle feebly keeled . . . | *variegata.* |
| Pleon segment 3, postero-lateral lobe rounded at both corners. Telson apically truncate, entire. Urop. 3, peduncle strongly keeled on upper margin. . . . . . | *ceratina.* |

### Key to the species of *Uristes*.

| | |
|---|---|
| Body not indurated. Telson oblong, lobes divergent. Side-plate 1 not very small, widening distally, oblong . . | *natalensis.* |
| Body indurated. Telson lanceolate, lobes contiguous. Side-plate 1 very small, semicircular . . . . . . | *induratus.* |

### Key to the species of *Chironesimus*.

| | |
|---|---|
| Pleon segment 3, postero-lateral angle acutely produced . | *adversicola.* |
| Pleon segment 3, postero-lateral angle rounded . . . | *rotundatus.* |

### Key to the genera of *Stegocephalidae*.

| | |
|---|---|
| Telson cleft. Mandible denticulate . . . | *Stegocephaloides,* p. 529. |
| Telson entire. Mandible not denticulate . . . | *Parandania.* |

### Key to the species of *Stegocephaloides*.

| | |
|---|---|
| Prp. 5, 2nd joint with postero-inferior apex rounded, hind margin feebly serrate . . . . . . . | *australis.* |
| Prp. 5, 2nd joint with postero-inferior apex subacute, hind margin distinctly serrate . . . . . . | *attingens.* |

### Key to the genera of *Ampeliscidae*.

| | | |
|---|---|---|
| 1 | Pleon without tufts of setae . . . . . . . | 2. |
| | Pleon with tufts of setae . . . . . . . | *Triodos.* |
| 2 | Prp. 5, 6th joint foliaceous, 7th lanceolate . . . | *Ampelisca,* p. 529. |
| | Prp. 5, 6th joint narrow, 7th spiniform . . . . | *Byblis,* p. 529. |

### Key to the species of *Byblis*.

| | |
|---|---|
| Uropod 3 not extending beyond uropods 1 and 2. Telson not deeply cleft . . . . . . . | *gaimardi.* |
| Uropod 3 extending much beyond uropods 1 and 2. Telson deeply cleft. . . . . . . . | *anisuropus.* |

### Key to the species of *Ampelisca*.

| | | |
|---|---|---|
| 1 | Prp. 5, 3rd joint shorter than 4th joint . . . | 2. |
| | Prp. 5, 3rd joint longer than 4th joint . . . | 6. |
| 2 (1) | Prp. 5, 7th joint spiniform as in *Byblis* . . . | *byblisoides.* |
| | Prp. 5, 7th joint lanceolate . . . . . | 3. |

| | | |
|---|---|---|
| 3 (2) | Prp. 5, 2nd joint postero-distally excavate . . . | *excavata.* |
| | Prp. 5, 2nd joint not excavate . . . . . | 4. |
| 4 (3) | Pleon segment 3, postero-lateral margin bisinuate . | *brevicornis.* |
| | Pleon segment 3, postero-lateral margin not bisinuate | 5. |
| 5 (4) | Pleon segment 3, postero-lateral angle quadrate . | *chiltoni.* |
| | Pleon segment 3, postero-lateral angle rounded . . | *fusca.* |
| 6 (1) | Peraeon segments 5–7 with ventral hooks . . . | *diadema.* |
| | Peraeon segments without ventral hooks . . . | 7. |
| 7 (6) | Antenna 2 not much longer than antenna 1 (the relative lengths may vary in the two sexes) . . . | 8. |
| | Antenna 2 much longer than antenna 1 . . . | 10. |
| 8 (7) | Gn. 1, palm with spines. Prp. 5, 4th joint with front apex produced. Corneal lenses small . . | 9. |
| | Gn. 1, palm without spines. Prp. 5, 4th joint not produced. Corneal lenses large . . . . | *anomala.* |
| 9 (8) | Gn. 1, palm with numerous spines. Prp. 5, 4th joint strongly produced . . . . . . | *palmata.* |
| | Gn. 1, palm with about 6 spines. Prp. 5, 4th joint slightly produced . . . . . . | *spinimanus.* |
| 10 (7) | Corneal lenses 4. Pleon segment 3 shortly produced . | *natalensis.* |
| | Corneal lenses 2. Pleon segment 3 strongly produced | *miops.* |

## Key to the genera of *Haustoriidae*.

| | |
|---|---|
| Head elongate. Prp. 4 and 5 with 4th and 5th joints strongly expanded . . . . . . | *Platyischnopus.* |
| Head slightly produced. Prp. 4 and 5 with 4th and 5th joints not greatly expanded . . . | *Urothoe.* |

## Key to the genera of *Phoxocephalidae*.

| | |
|---|---|
| Eyes absent. Prp. 3, 2nd joint linear . . . | *Harpinia.* |
| Eyes present. Prp. 3, 2nd joint expanded . . | *Pontharpinia.* |

## Key to the genera of *Amphilochidae*.

| | | |
|---|---|---|
| 1 | Opposing margins of side-plates 3 and 4 not exactly fitting. | *Gitanopsis.* |
| | Opposing margins of side-plates 3 and 4 exactly fitting | 2. |
| 2 | Mandible, molar absent, palp present . . . . | *Cyproidea.* |
| | Mandible, molar present, palp absent . . . . | *Hoplopleon*, p. 530. |

## Key to the species of *Hoplopleon*.

| | |
|---|---|
| Prp. 4 (and 5), 2nd joint with hind margin straight. Finger of gn. 1 and 2 strongly ctenate . . . . | *australis.* |
| Prp. 4 (and 5), 2nd joint with hind margin convex. Finger of gn. 1 and 2 not ctenate . . . . . | *medusarum.* |

### Key to the species of *Leucothoë.*

| | | |
|---|---|---|
| 1 | Pleon segment 3, postero-lateral angle quadrate | 2. |
| | Pleon segment 3, postero-lateral angle produced, with sinus above the point | 3. |
| 2 | Palm of gn. 2 minutely serrate | *spinicarpa.* |
| | Palm of gn. 2 with a comb-like row of teeth | *ctenochir.* |
| 3 | Palm of gn. 2 feebly denticulate. Antenna 1 not reaching beyond peraeon | *richiardii.* |
| | Palm of gn. 2 strongly denticulate. Antenna 1 reaching to pleon segment 3 | *dolichoceras.* |

### Key to the species of *Stenothoë.*

| | | |
|---|---|---|
| 1 | Uropod 3 geniculate. Gn. 2 ♂, lower margin of 4th joint crenulate | *gallensis.* |
| | Uropod 3 not geniculate. Gn. 2 ♂, lower margin of 4th joint entire | 2. |
| 2 | Gn. 2 ♂, palm with 2 teeth before the one at the finger-hinge. Gn. 1 greatly elongate | *dolichopous.* |
| | Gn. 2 ♂, palm with only one tooth at the finger-hinge. Gn. 1 not greatly elongate | *assimilis.* |

*S. adhaerens* known only from ♀.

### Key to the genera of *Phliantidae.*

| | | |
|---|---|---|
| 1 | Body not depressed. Telson transverse | *Plioplateia.* |
| | Body depressed. Telson pyriform. | 2. |
| 2 | Side-plates small, separated. Head not sunk in 1st peraeon segment | *Temnophlias.* |
| | Side-plates 1–4 large, contiguous. Head sunk in 1st peraeon segment | *Palinnotus.* |

### Key to the genera of *Pardaliscidae.*

| | |
|---|---|
| Cutting edge of mandible and 2nd joint of palp of maxilla 1 greatly expanded. Maxilliped, inner plates small, palp very large | *Nicippe.* |
| Cutting edge of mandible and 2nd joint of palp of maxilla 1 not greatly expanded. Maxilliped, inner plates obsolete, palp not very large | *Halice.* |

### Key to the genera of *Acanthonotozomatidae.*

| | |
|---|---|
| Palp of maxilla 1 reaching beyond apex of outer plate | *Iphimedia.* |
| Palp of maxilla 1 not reaching apex of outer plate | *Panoploea.* |

### Key to the species of *Liljeborgia.*

| | | |
|---|---|---|
| 1 | Pleon segment 1 without any dorsal teeth. Epistome strongly projecting in an acute point | *epistomata.* |
| | Pleon segment 1 with at least one dorsal tooth. Epistome not very strongly projecting | 2. |

| | | |
|---|---|---|
| 2 | Pleon segments 1, 2, 4 each with 1 medio-dorsal tooth . | 3. |
| | Pleon segments 1 and 2 with more than one tooth . . | 4. |
| 3 | Side-plates 1–3, postero-inferior angles not notched . . | *proxima.* |
| | Side-plates 1–4, postero-inferior angles notched. Side-plate 4 with 4 teeth on hind margin. . . . . | *consanguinea.* |
| 4 | Pleon segments 1 and 2 quinquedentate . . . . | *dubia.* |
| | Pleon segments 1 and 2 tridentate . . . . . | *kinahani* var. *capensis.* |

## Key to the genera of *Oedicerotidae*.

| | | |
|---|---|---|
| 1 | Eyes completely confluent without any line of demarcation, Gn. 1 and 2, process of 5th joint very long and slender . | *Perioculodes.* |
| | Eyes not completely confluent. Gn. 1 and 2, process of 5th joint not very long . . . . . . . | 2. |
| 2 | Gn. 2, hand elongate, chelate . . . . . . | *Synchelidium.* |
| | Gn. 2, hand not elongate, not chelate . . . . | 3. |
| 3 | Uropod 3 much longer than uropods 1 and 2 . . . | *Halicreion.* |
| | Uropod 3 not much longer than uropods 1 and 2 . . | 4. |
| 4 | Eyes wanting or not placed on the rostral projection. . | 5. |
| | Eyes or ocular pigment placed on rostral projection . . | *Oediceroides*, p. 532. |
| 5 | Peraeopods 1 and 2 with widened joints . . . . | *Aceroides.* |
| | Peraeopods 1 and 2 without widened joints . . . | *Bathymedon.* |

## Key to the species of *Oediceroides*.

| | |
|---|---|
| Antenna 1, 2nd joint not plumose. Peraeopod 5, 2nd joint oval . . . . . . . . . . . | *cinderella.* |
| Antenna 1, 2nd joint plumose. Peraeopod 5, 2nd joint pyriform . . . . . . . . . . | *plumicornis.* |

## Key to the genera of *Tironidae*.

| | | |
|---|---|---|
| 1 | Telson entire . . . . . . . . . | *Bruzelia.* |
| | Telson cleft . . . . . . . . . . | 2. |
| 2 | Eyes 4. Telson strongly spinose . . . . . . | *Tiron.* |
| | Eyes 2, coalesced, separate, or none. Telson not spinose . | 3. |
| 3 | Side-plate 3 scarcely widened below. Gn. 1 and 2 feeble, imperfectly subchelate . . . . . . . | *Syrrhoites.* |
| | Side-plate 3 widened below. Gn. 1 and 2 simple, 1 stouter than 2 . . . . . . . . . . | *Austrosyrrhoe.* |

## Key to the species of *Epimeria* (*Paramphithoidae*).

| | | |
|---|---|---|
| 1 | Side-plate 5 acutely produced . . . . . . | 2. |
| | Side-plate 5 not acutely produced . . . . . | *semiarmata.* |
| 2 | Peraeon segments 5–7, as well as pleon, dentate . . | *cornigera.* |
| | Only the pleon carinate and dentate . . . . | *longispinosa.* |

### Key to the species of *Nototropis* (*Atylidae*).

| | | |
|---|---|---|
| | Branchial lamellae simple | *homochir.* |
| | Branchial lamellae pleated | *granulosa.* |

### Key to the genera of *Eusiridae*.

| | | |
|---|---|---|
| 1 | Gn. 1 and 2, 6th joint attached to the produced apex of 5th joint | *Eusirus.* |
| | Gn. 1 and 2, 6th joint with normal attachment | 2. |
| 2 | Gn. 1 and 2, 5th joint small, cup-shaped. | 3. |
| | Gn. 1 and 2, 5th joint large, triangular | *Cleonardopsis.* |
| 3 | Peraeopods stout | *Eusiroides.* |
| | Peraeopods slender | *Rhachotropis*, p. 533. |

### Key to the species of *Rhachotropis*.

| | | |
|---|---|---|
| 1 | Prp. 5, 2nd joint with strong process on hind margin. Maxilliped with elongate palp | *palporum.* |
| | Prp. 5, 2nd joint without process on hind margin. Palp of maxilliped not very long | 2. |
| 2 | Pleon segment 3, postero-lateral margin not serrate | *anomala.* |
| | Pleon segment 3, postero-lateral margin serrate | 3. |
| 3 | Prp. 5, 2nd joint acute at lower hind corner | *kergueleni.* |
| | Prp. 5, 2nd joint not acute at lower hind corner | 4. |
| 4 | Pleon segment 3 with the dorsal keels ending in teeth | *grimaldii.* |
| | Pleon segment 3 with the keels not ending in teeth | *paeneglaber.* |

### Key to the species of *Paramoera* (*Pontogeneiidae*).

| | | |
|---|---|---|
| | Pleon dorsally without teeth. Postantennal angle of head rounded-quadrate | *capensis.* |
| | Pleon segments 1 and 2 each with a flat dorsal tooth. Postantennal angle of head acute | *bidentata.* |

### Key to the genera of *Gammaridae*.

| | | |
|---|---|---|
| 1 | Telson emarginate. (Fresh-water. Transvaal) | *Eucrangonyx.* |
| | Telson cleft | 2. |
| 2 | Urop. 3, rami large, foliaceous. Gn. 1 simple | *Megaluropus.* |
| | Urop. 3, rami not foliaceous. Gen. 1 subchelate | 3. |
| 3 | Urop. 3, outer ramus elongate, its 2nd joint unusually long | *Eriopisella.* |
| | Urop. 3, 2nd joint of outer ramus very short | 4. |
| 4 | Mandible, 2nd joint of palp shorter than 1st | *Parelasmopus.* |
| | Mandible, 2nd joint of palp longer than 1st | 5. |
| 5 | Body with dorsal groups of spinules on pleon. (Fresh-water. Cape Province) | *Gammarus.** |
| | Body without groups of spinules on pleon (Marine) | 6. |

* For key to the species of *Gammarus* see Barnard, Trans. Roy. Soc. S. Afr., vol. xiv, p. 167, 1927.

| | | |
|---|---|---|
| 6 | Urop. 3, rami very unequal . . . . . . | *Melita*, p. 534. |
| | Urop. 3, rami not very unequal . . . . . . | 7. |
| 7 | Maxilla 1 and 2, inner plates very setose. . . . | 8. |
| | Maxilla 1 and 2, inner plates not very setose . . . | 9. |
| 8 | Urop. 3, rami greatly developed, elongate. Mandible, 3rd joint of palp as short as 1st . . . . . . | *Ceradocus*, p. 534. |
| | Urop. 3, rami short. Mandible, 3rd joint of palp much longer than 1st . . . . . . . | *Elasmopoides*. |
| 9 | Mandibular palp robust . . . . . . | *Elasmopus*, p. 534. |
| | Mandibular palp slender . . . . . . | *Maera*, p. 534. |

## Key to the species of *Melita*.

| | | |
|---|---|---|
| 1 | Gn. 2 in ♂, one of the pair very robust, chelate. Prp. 5, 2nd joint widest proximally . . . . . . | *fresnelii*. |
| | Gn. 2 in ♂ subchelate . . . . . . . . | 2. |
| 2 | Gn. 2 in ♂, one of the pair very robust. Prp. 5, 2nd joint widest distally . . . . . . . . | *subchelata*. |
| | Gn. 2 in ♂ moderate. Prp. 5, 2nd joint widest proximally | 3. |
| 3 | Pleon segment 3, postero-inferior angle shortly acute. Pleon segments non-dentate dorsally. Side-plate 1 oblong . . . . . . . . . . | *zeylanica*. |
| | Pleon segment 3, postero-inferior angle strongly produced. Pleon segment 4 with one dorsal tooth, segment 5 with 2 pairs of denticles. Side-plate 1 triangular, produced forwards . . . . . . . . | *orgasmos*. |

## Key to the species of *Ceradocus*.

| | |
|---|---|
| Pleon segments dorsally dentate. 6th joint gn. 1 broadly ovate . . . . . . . . . . | *rubromaculatus*. |
| Pleon segments not serrate. 6th joint gn. 1 narrow, cylindrical . . . . . . . . | *aviceps*. |

## Key to the species of *Elasmopus*.

| | |
|---|---|
| Pleon segments without dorsal keel . . . . | *pectenicrus*. |
| Pleon segment 4 with a single keel. . . . . | *japonicus*. |

## Key to the species of *Maera*.

| | | |
|---|---|---|
| 1 | Pleon segments without dorsal keels . . . . | 2. |
| | Pleon segment 4 with a pair of keels . . . . | *subcarinata*. |
| 2 | Urop. 3 scarcely or not at all extending beyond urop. 1 | 3. |
| | Urop. 3 extending much beyond urop. 1. . . . | 7. |
| 3 | Prp. 4 and 5, 2nd joint not prolonged at lower hind corner | *grossimanus*. |
| | Prp. 4 and 5, 2nd joint lobed at lower hind corner . | 4. |
| 4 | Side-plates 1 and 2 serrate on lower margin . . . | *bruzelii*. |
| | Side-plates 1 and 2 not (or scarcely) serrate . . . | 5. |

5. Gn. 2, palm defined by one tooth . . . . . . 6.
   Gn. 2, palm defined by a pair of teeth, ♀ palm with a notch between two teeth . . . . . . . . *hirondellei.*

6. Gn. 2, palm ♂ transverse, with notch, ♀ slightly oblique, regularly crenulate. Postero-inferior angle pleon segment 3 with short point and notch above it (hind margin sinuous) . . . . . . . . *inaequipes.*
   Gn. 2, palm ♂♀ oblique, crenulate. Postero-inferior angle pleon segment 3 acute (hind margin evenly concave) . *vagans.*
   Gn. 2, palm ♂♀ oblique, with 4 strong teeth (incl. one at defining angle). Postero-inferior angle pleon segment 3 quadrate with very small point (hind margin straight) *boeckii.*

7. Body extremely slender . . . . . . . *hamigera.*
   Body not extremely slender . . . . . . *mastersii.*

## Key to the genera of *Dexaminidae*.

Sixth joint of all peraeopods distally expanded, forming an imperfect chela with the finger . . . . . *Polycheria.*
Sixth joint of peraeopods not expanded, slender . . *Guernea.*

## Key to the genera of *Talitridae*.

1. Maxilliped, 4th joint of palp wanting or rudimentary . 2.
   Maxilliped, 4th joint of palp distinct . . . . . 3.

2. Gn. 1 simple in ♂♀. Gn. 2 feebly chelate in ♀♂. (Terrestrial. Inland) . . . . . . . *Talitroides.*
   Gn. 1 subchelate in ♂♀. Gn. 2 strongly subchelate in ♂, feebly chelate in ♀. (Littoral) . . . . . *Orchestia.*
   Gn. 1 subchelate in ♂, simple in ♀. Gn. 2 strongly subchelate in ♂, feebly chelate in ♀. (Marine. Littoral) *Talorchestia*, p. 536.

3. Urop. 3 consisting of a single joint . . . . . *Chiltonia.*
   Urop. 3 consisting of a peduncle and at least one ramus . 4.

4. Urop. 3 with two rami (the inner one, or both rami, very small) . . . . . . . . . . . 5.
   Urop. 3 with one ramus . . . . . . . . 6.

5. Telson divided . . . . . . . . . *Parhyale.*
   Telson entire . . . . . . . . . *Neobule.*

6. Telson entire (or minutely notched) . . . . . 7.
   Telson divided . . . . . . . . . 8.

7. Maxilliped, 4th joint of palp not unguiform. Gn. 1 subchelate. Gn. 2 strongly subchelate in ♂, feebly chelate in ♀. Gn. 2 ♂, 5th joint not lobed . . *Parorchestia*, p. 536.
   Maxilliped, 4th joint unguiform. Gn. 1 and 2 subchelate, stronger in ♂ than in ♀. Gn. 2, 5th joint lobed below. *Parhyalella.*

8. Gn. 2, 5th joint not lobed or produced between the 4th and 6th joints in ♂ . . . . . . . . *Hyale*, p. 537.
   Gn. 2, 5th joint produced between 4th and 6th joints in both sexes . . . . . . . . . *Allorchestes.*

## Key to the species of *Talorchestia.*

Gnathopod 1 ♂, 4th joint without (scabrous) lobe on inner margin in all the species, including the West African species.

A. Postero-inferior corner pleon segment 3 rounded. Gn. 1 ♂, 5th joint without lobe on inner apex. Gn. 1 ♀ 2nd joint broad, hind margin convex. Gn. 2 ♂, 6th joint with large excision on palm in adult. Gn. 2 ♀, 2nd joint anterior margin evenly convex . . . . . . . *capensis.*

B. Postero-inferior corner pleon segment 3 quadrate, sometimes with more or less acute, shortly produced point. Gn. 1 ♂, 5th joint with lobe on inner apex.

1. Adult ♂ with pairs of dorsal spines on pleon segments 1 and 2. Gn. 2 ♂, 6th joint with excision on palm. Gn. 1 ♀, 2nd joint broad, hind margin convex. Gn. 2 ♀, 2nd joint anterior margin evenly convex, 5th joint widest at base. Peraeopod 4 ♂, long, 2nd joint expanded . . . *quadrispinosa.*

2. Adult ♂ without dorsal spines. Gn. 2 ♂, 6th joint with evenly convex palm. Gn. 1 ♀, 2nd joint nearly linear. Gn. 2 ♀, 5th joint with lower margin expanded into a broadly rounded lobe. None of the peraeopods unusually long, or with expanded joints in ♂.

*a.* Lower margin pleon segments 2 and 3 not sculptured. Peraeopod 5 2nd joint hind margin with comparatively few serrations. Gn. 2 ♂, 6th joint widening to palm which is only slightly convex. Gn. 2 ♀, 2nd joint not strongly expanded on anterior margin, anterior and posterior margins subparallel . . . . . . . *australis.*

*b.* Lower margin pleon segments 2 and 3 with a series of minute ridges appearing as if crimped. Peraeopod 5 2nd joint hind margin with very numerous crenulations. Gn. 2 ♂, 6th joint oval usually widest in basal third, palm distinctly convex. Gn. 2 ♀, 2nd joint strongly expanded on proximal half of anterior margin . . *ancheidos.*

## Key to the species of *Parorchestia.*

Gn. 1 ♂, 6th joint subtriangular, widening distally. Gn. 2 ♂, palm oblique, straight, well-defined . . . . *rectipalma.*

Gn. 1 ♂, 6th joint cylindrical. Gn. 2 ♂, palm not very oblique, rounded with 2 shallow notches, ill-defined. ♀ unknown . . . . . . . . *dassenensis.*

## Key to the species of *Hyale*.

| | | |
|---|---|---|
| 1 | Antenna 1, 1st joint with projection on lower apex, ♂♀ | *saldanha*. |
| | Antenna 1, 1st joint without projection | 2. |
| 2 | Gn. 2 ♂, hind margin * of hand extremely short | 3. |
| | Gn. 2 ♂, hind margin of hand not extremely short | 4. |
| 3 | Gn. 1 ♂, hand as wide as long, palm transverse | *maroubrae*. |
| | Gn. 1 ♂, hand oval, palm oblique | *macrodactylus*. |
| 4 | Gn. 2 ♂, finger strongly constricted at base | *diastoma*. |
| | Gn. 2 ♂, finger not constricted at base | 5. |
| 5 | Antenna 2, flagellum strongly setose | *hirtipalma*. |
| | Antenna 2, flagellum not strongly setose | 6. |
| 6 | Prp. 5, hind margin of 2nd joint strongly serrate | *inyacka*. |
| | Prp. 5, hind margin of 2nd joint entire (or only feebly crenulate) | *grandicornis*. |

## Key to the genera of *Aoridae*.

| | | |
|---|---|---|
| 1 | Urop. 3 biramous | 2. |
| | Urop. 3 uniramous | *Grandidierella*. |
| 2 | Gn. 1 ♂, 4th joint immensely produced | *Aora*. |
| | Gn. 1 ♂, 5th joint not produced | 3. |
| 3 | Gn. 1 ♂, 5th and 6th joints subequal in width | *Lembos*, p. 537. |
| | Gn. 1 ♂, 5th joint much wider than 6th | *Lemboides*, p. 537. |

## Key to the species of *Lembos*.

| | | |
|---|---|---|
| 1 | No ventral spines. Gn. 2, 2nd joint not hooked | 2. |
| | Ventral spines on peraeon segments 3–7 in ♂. Gn. 2, 2nd joint hooked at front apex | *hypacanthus*. |
| 2 | Prp. 2, 4th joint setose. Gn. 2, hand not more than twice as long as broad | *hirsutipes*. |
| | Prp. 2, 4th joint not setose. Gn. 2, hand very slender, nearly 4 times as long as broad | *leptocheirus*. |

## Key to the species of *Lemboides*.

| | | |
|---|---|---|
| 1 | No ventral spines | 2. |
| | Ventral spines on peraeon segments 3–7 | *acanthiger*. |
| 2 | Gn. 1 ♂, palm oblique | *afer*. |
| | Gn. 1 ♂, palm transverse | *crenatipalma*. |

## Key to the genera of *Photidae*.

| | | |
|---|---|---|
| 1 | Urop. 3 with inner ramus rudimentary | *Cheiriphotis*. |
| | Urop. 3 with two rami | 2. |
| 2 | Urop. 3, rami unequal, the inner ramus minute | *Photis*, p. 538. |
| | Urop. 3, rami subequal, the inner not minute | 3. |
| 3 | Gn. 2 stronger in ♂ than in ♀, with 5th joint relatively small | *Eurystheus*, p. 538. |
| | Gn. 2 alike in both sexes, with large 5th joint | *Chevalia*. |

* Exclusive of the palmar portion against which the finger closes.

## Key to the species of *Photis*.

| | | |
|---|---|---|
| 1 | Ocular lobes very long . . . . . . . . | *dolichommata.* |
| | Ocular lobes not very long . . . . . . . | 2. |
| 2 | Gn. 2 ♂, defining tooth of hand and the lobe of 3rd joint pointing inwards . . . . . . . . | *longimanus.* |
| | Gn. 2 ♂, defining tooth of hand not pointing inwards, 3rd joint not lobed . . . . . . . | *uncinata.* |

## Key to the species of *Eurystheus*.

| | | |
|---|---|---|
| 1 | Prp. 3–5, hind margin of 2nd joint strongly dentate . . | *holmesi.* |
| | Prp. 3–5, hind margin of 2nd joint not strongly dentate . | 2. |
| 2 | Eyes lageniform or oblong . . . . . . . | 3. |
| | Eyes horizontally or obliquely oval . . . . . | 5. |
| 3 | Eyes lageniform . . . . . . . . . . | *atlanticus.* |
| | Eyes oblong . . . . . . . . . . . | 4. |
| 4 | Gn. 2 ♂, hand ovoid, palm with several small lobes . . | *afer.* |
| | Gn. 2 ♂, hand ovoid, palm with 2 large lobes . . . | *imminens.* |
| | Gn. 2 ♂, hand oblong, palm transverse with deep incision . | *scissimanus.* |
| 5 | None of the segments dorsally dentate. Gn. 2, finger shorter than palm, closing on to inner surface of hand . | *palmoides.* |
| | Pleon segment 4 with 3, segment 5 with 2 dorsal teeth, Gn. 2, finger matching palm and closing on to its edge . . | *semidentatus.* |

## Key to the genera of *Ampithoidae*.

| | | |
|---|---|---|
| 1 | Antenna 1 without accessory flagellum . . . . | 2. |
| | Antenna 1 with small, 1-jointed accessory flagellum . . | *Cymadusa.* |
| 2 | Peraeopod 5 enormously enlarged . . . . . | *Macropisthopous.* |
| | Peraeopod 5 not enlarged . . . . . . . | 3. |
| 3 | Side-plates deep. Mandibular palp stout. Prp. 3–5, 6th joint not expanded apically . . . . . . | *Ampithoë*, p. 538. |
| | Side-plates shallow. Mandibular palp slender. Prp. 3–5 6th joint apically expanded to form a distinct palm . | *Exampithoë.* |

## Key to the species of *Ampithoë*.

| | | |
|---|---|---|
| 1 | Gn. 2 ♂, palm deeply excavated, defined by a conspicuous tooth . . . . . . . . . . . | *ramondi.* |
| | Gn. 2 ♂, palm not deeply excavate, not defined by a conspicuous tooth . . . . . . . . | 2. |
| 2 | Antenna 2 not densely setose. Prp. 1 and 2, 2nd joint strongly expanded. Prp. 3 and 4 very stout . . | *falsa.* |
| | Antenna 2 densely setose. Prp. 1 and 2, 2nd joint not strongly expanded. Prp. 3 and 4 not very stout . | *africana.* |

### Key to the genera of *Jassidae*.

1 { Prp. 1–5, 6th joint not prehensile . . . . . 2.
Prp. 1–5, 6th joint prehensile . . . . . . *Isaeopsis*.
2 { Gn. 2 ♂, hind margin of 6th joint produced in a tooth. Gn. 2 ♀ much larger than gn. 1 . . . . . *Jassa*.
Gn. 2 ♂, hind margin of 6th joint not armed. Gn. 2 ♀ not much larger than gn. 1 . . . . . *Ischyrocerus*, p. 539.

### Key to the species of *Ischyrocerus*.

1 { None of the peraeon segments keeled . . . *anguipes*.
Some of the segments dorsally keeled in ♂ . . . 2.
2 { Peraeon segments 1, 2, 6 and 7 keeled . . . *carinatus*.
Peraeon segments 1–6 keeled . . . . . . *gorgoniae*.

### Key to the genera of *Corophiidae*.

1 { Mandibular palp 3-jointed . . . . . 2.
Mandibular palp not 3-jointed . . . . . . 4.
2 { Urop. 3, inner ramus distinct but very minute . . *Camacho*.
Urop. 3, inner ramus wanting, or not articulated . 3.
3 { Urop. 2 biramous . . . . . . . . *Ericthonius*.
Urop. 2 uniramous . . . . . . . . *Cerapus*.
4 { Mandibular palp 1-jointed. Antenna 2 not very stout *Siphonoecetes*, p. 539.
Mandibular palp 2-jointed. Antenna 2 very stout . *Corophium*, p. 539.

### Key to the species of *Siphonoecetes*.

{ Antenna 1, flagellum 7-jointed . . . . . . *dellavallei*.
Antenna 1, flagellum 10–14-jointed . . . . . *orientalis*.

### Key to the species of *Corophium*.

{ Pleon segments 4–6 coalesced. Gn. 2, dactylus with feeble decumbent denticles. . . . . . *acherusicum*.
Pleon segments 4–6 distinct. Gn. 2, dactylus with strong outstanding denticles . . . . . *triaenonyx*.

### Key to the genera of *Podoceridae*.

{ Pleon with only 5 distinct segments in front of the telson. Two pairs of uropods . . . . *Laetmatophilus*, p. 539.
Pleon with 6 distinct segments in front of telson. Three pairs of uropods . . . . . . . *Podocerus*, p. 540.

### Key to the species of *Laetmatophilus*.

1 { Gn. 2 ♂, palm with 3 teeth . . . . . . *tridens*.
Gn. 3 ♂, palm with 2 teeth . . . . . . 2.
2 { Gn. 1, 6th joint widened . . . . . . . *purus*.
Gn. 1, 6th joint not widened . . . . . . *durbanensis*.

## Key to the species of *Podocerus*.

| | | |
|---|---|---|
| 1 | Body not carinate . . . . . . . . . | 2. |
| | Body carinate. . . . . . . . . . | 4. |
| 2 | Body with spiniform tubercles . . . . . | *multispinis.* |
| | Body without spiniform tubercles . . . . | 3. |
| 3 | Prp. 1 and 2, 2nd joint linear . . . . . | *brasiliensis.* |
| | Prp. 1 and 2, 2nd joint with process on distal front margin . . . . . . . . . | *africanus.* |
| 4 | ♂ peraeon segments 6 and 7, and pleon segments 1 and 2 carinate . . . . . . . . . | *cristatus.* |
| | ♂ head, peraeon and pleon segments 1 and 2 carinate . | *inconspicuus.* |

## Key to the genera of *Lanceolidae*.

| | |
|---|---|
| Eyes small and indistinct . . . . . . . | [*Lanceola*]. |
| Two large concave "reflectors" on each side of head . | *Scypholanceola.* |

## Key to the species of *Vibilia*.

| | |
|---|---|
| Prp. 7, 2nd joint shorter than the following joints together . . . . . . . . . | *armata.* |
| Prp. 7, 2nd joint longer than the following joints together | *chuni.* |

## Key to the genera of *Hyperiidae*.

| | | |
|---|---|---|
| 1 | Prp. 2 (gn. 2), 5th joint produced in a long knife-like process opposing, and as long as, the 6th joint . | *Hyperoche.* |
| | Prp. 2, 5th joint not produced in a long thin process, but with a spoon-shaped lobe . . . . . . | 2. |
| 2 | Prp. 3 and 4, 5th joint expanded. Prp. 5 very long . | *Parathemisto.* |
| | Prp. 3 and 4, 5th joint not expanded. Prp. 4 not excessively long . . . . . . . . | *Hyperia*, p. 540. |

## Key to the species of *Hyperia*.

| | |
|---|---|
| Head not longer than peraeon segments 1 and 2 together. All the peraeon segments distinct. 12–30 mm. . | *galba.* |
| Head large, equal to first 4 segments together. Peraeon segments 1 and 2 (usually) fused in ♂ (antennae long), segments 1–3 (or 4) fused in ♀ (antennae short). 2–4 mm. . . . . . . . | *promontorii.* |

## Key to the genera of *Phronimidae*.

| | |
|---|---|
| Body not very slender. Peraeon segments 1 and 2 distinct. Peraeopods not very elongate. Urop. 2 well developed . . . . . . . . | *Phronima*, p. 541. |
| Body very slender. Peraeon segments 1 and 2 coalescent. Peraeopods very elongate and slender, Urop. 2 rudimentary or absent . . . . | *Phronimella.* |

### Key to the species of *Phronima*.

1. ♀ (antenna 1 very short) . . . . . . . 2.
   ♂ (antenna 1 well developed) . . . . . . 4.
2. Pleon segments 1–3, postero-lateral angles acutely pointed. 15–40 mm. . . . . . . 3.
   Pleon segments 1–3, postero-lateral angles obtusely rounded. 5–10 mm.. . . . . . . *colletti.*
3. Prp. 5, hand ½ length of 2nd joint, palm very oblique, finger with swelling on inner margin . . . *sedentaria.*
   Prp. 5, hand subequal to 2nd joint, palm transverse, finger with inner margin even . . . . *atlantica.*
4. Antenna 2 rudimentary. Pleon segments 1–3, postero-lateral angles subacute . . . . . . *sedentaria.*
   Antenna 2 well developed. Pleon segments 1–3, postero-lateral angles rounded. . . . . . 5.
5. Prp. 5, finger overlapping palm. . . . . . *atlantica.*
   Prp. 5, finger matching palm . . . . . *colletti.*

### Key to the genera of *Phrosinidae*.

1. Prp. 2 reduced to the 2nd joint only. Prp. 3–6 subchelate . . . . . . . . . *Phrosina.*
   Prp. 2 normal. . . . . . . . . 2.
2. All the peraeopods simple, except 5th, which is prehensile. Uropods lanceolate . . . . . *Primno.*
   Prp. 3–5 subchelate ; Prp. 5 very stout. Uropods broadly oval . . . . . . . . [*Anchylomera*].

### Key to the genera of *Platyscelidae*.

Prp. 1 and 2 chelate . . . . . . . *Hemityphis.*
Prp. 1 and 2 minutely subchelate . . . . *Tetrathyrus.*
Prp. 1 and 2 simple . . . . . . . *Paratyphis*, p. 541.

### Key to the species of *Paratyphis*.

Prp. 7 with a distinct terminal joint attached to the 2nd joint. Urop. 3, outer ramus ¾ length of inner . *promontorii.*
Prp. 7 reduced to the 2nd joint and a minute rudiment of another joint. Urop. 3, outer ramus not more than half length of inner . . . . . *maculatus.*

### Key to the genera of *Oxycephalidae*.

1. Body moderately elongate. Prp. 7 normal . . 2.
   Body extremely elongate, rod-like. Prp. 7 reduced to a single oval sac-like joint . . . . . . *Rhabdosoma.*
2. Inner rami of some of the uropods fused with their peduncles. . . . . . . . . . 3.
   None of the inner rami of uropods fused with their peduncles. . . . . . . . . 4.

3 { Inner rami of urop. 3 fused with peduncle . . . *Calamorhynchus.*
Inner rami of uropods 2 and 3 fused with peduncles . *Oxycephalus*, p. 542.

4 { Head acutely rostrate in front, not constricted into a neck behind . . . . . . . . *Streetsia.*
Head bluntly rostrate in front, constricted into a neck behind . . . . . . . . . *Glossocephalus.*

## Key to the species of *Oxycephalus*.

{ Lower (hind) margin of 6th joint of prp. 1 and 2 strongly serrate. Lower margin of pleon segments 1–3 each with a sharp tooth . . . . . . . *clausi.*
Lower margin of 6th joint of prp. 1 and 2 smooth. Lower margin of pleon segments 1–3 rounded, without teeth . . . . . . . . *tuberculatus.*
Lower margin of 6th joint of prp. 1 and 2 pectinate. Lower margin of pleon segments 1–3 without teeth *latirostris.*

## Key to the genera of *Caprellidae*.

(Adapted from Mayer, Siboga Exp. monogr., xxxiv, 1903. Mayer reckons paraeopods 1–7, but here gnathopods 1 and 2 and peraeopods 1–5 are reckoned.)

1 { Three pairs of branchiae (on segments 2–4) . . . 2.
Two pairs of branchiae (on segments 3 and 4) . . . 4.

2 { Prp. 1 and 2 normal. Prp. 3 with 5 free joints . . 3.
Prp. 1 and 2 absent. Prp. 3 with 4 free joints. Mandibular palp 3-jointed . . . . . . . . *Caprellina*, p. 542.

3 { Pleon ♂ with 3, ♀ with 2 distinct and one indistinct pairs of appendages . . . . . . . . . . *Phtisica* (*Proto*).
Pleon of ♂ and ♀ with only one pair of appendages . . *Metaproto.*

4 { Prp. 1 and 2 absent . . . . . . . . . 5.
Prp. 1 and 2 each reduced to a single joint (fig. p. 522). Mandibular palp 3-jointed . . . . . . 6.

5 { Mandibular palp 3-jointed . . . . . . . *Pseudaeginella.*
Mandibular palp absent . . . . . . . *Caprella*, p. 542.

6 { Pleon ♂ with 1 pair of appendages. Pleon segments 6 and 7 fused . . . . . . . . . . *Metaprotella.*
Pleon ♂ with 1 pair of 2-jointed appendages . . . *Orthoprotella.*
Pleon ♂ with 2 pairs rudimentary appendages . . . *Paradeutella.*

## Key to the species of *Caprellina*.

{ Body smooth . . . . . . . . . *longicollis.*
Body spinose . . . . . . . . . *spiniger.*

## Key to the species of *Caprella*.

1 { Prp. 3–5, 6th joint parallel-sided, without clasping spines near base. Gn. 2 ♂ inserted posteriorly on segment 2. 2.
Prp. 3–5, 6th joint subtriangular, more or less expanded basally, and with clasping spines . . . . 3

2 { Gn. 2, 2nd joint longer than the not very long 2nd segment of peraeon . . . . . . . . . *laevipes.*
Gn. 2, 2nd joint shorter than the very long 2nd segment of peraeon . . . . . . . . . *danilevskii.*

3 { Gn. 2, 2nd joint equal to length of 2nd segment, or nearly so 4.
Gn. 2, 2nd joint distinctly shorter than segment 2 . . 5.

4 { Head with strong forwardly directed rostral point . . *scaura.*
Head rounded in front . . . . . . . . *triodous.*

5 { Head with short rostral point . . . . . . 6.
Head rounded or feebly quadrate in front. A ventral spine between bases of gn. 2 . . . . . . . *equilibra.*

6 { A ventral spine between bases of gn. 2 . . . . *cicur.*
No ventral spine . . . . . . . . . *penantis* and vars., and *falsa.*

## Key to the genera of *Cyamidae.*

1 { Maxilla 2 with outer lobes. Unguis of gn. 1 not distinct from dactylus . . . . . . . . . 2.
Maxilla 2 without outer lobes. Unguis of gn. 1 distinct from dactylus. Maxilliped, lobes fused, palp absent. Branchiae on segments 3 and 4 single . . . . [*Isocyamus*].

2 { Maxilliped, palp fully developed in adult. Branchiae on segments 3 and 4 single or double . . . . . *Cyamus*, p. 543.
Maxilliped, palp well developed only in young, rudimentary in adult. Branchiae on segments 3 and 4 single . *Paracyamus*, p. 543.

*Isocyamus*, not yet recorded from the South African region, occurs on dolphins, black-fish, *Grampus* and *Pseudorca.*

## Key to the species of *Cyamus.*

{ Body broadly ovate. Branchiae double (at least in adult) . *ovalis.*
Body narrow, parallel-sided in ♂, more oval in ♀. Branchiae single . . . . . . . . . . . [*balaenopterae*].

## Key to the species of *Paracyamus.*

1 { Body ovate . . . . . . . . . . 2.
Body parallel-sided. No ventral pointed tubercles in either sex . . . . . . . . . . . *gracilis.*

2 { Ventral pointed tubercles on segments 5–7, in ♀ one pair each on segments 5 and 7, 2 pairs on segment 6, in ♂ one pair on each of the segments . . . . . *erraticus.*
Ventral pointed tubercles on segments 5–7, in ♀ one pair on each segment, in ♂ one pair each on segments 6 and 7. *boöpis.*

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*The Annals of the South African Museum will be issued at irregular intervals, as matter for publication is available.*

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# ANNALS

OF THE

# SOUTH AFRICAN MUSEUM

*VOLUME XXXII.*

PART VI, *containing* :—



SEMPER ALIQUID NOVI AFRICA AFFERT

*ISSUED AUGUST 1940. PRICE 10s.*


PRINTED FOR THE

TRUSTEES OF THE SOUTH AFRICAN MUSEUM, CAPE TOWN

BY NEILL AND CO., LTD.,

212 CAUSEWAYSIDE, EDINBURGH

19. *Notes on the Early Stages of* Phasis felthami *Trim., a Lycaenid Butterfly from the Cape Peninsula, and a List of some recently determined Food-plants of some other South African Butterflies.* —By C. G. C. Dickson.

(With Plates XVIII, XIX.)

The genus *Phasis* constitutes one of the largest groups of the South African Lycaenidae, being represented in the Union by about thirty known species, a number of which are peculiar to the country. Despite the fact that many of these insects are abundant (though generally local), particularly in the Western Districts of the Cape Province, the life-histories of the great majority of them are still unknown.

The species whose early stages are outlined in these notes was described by Trimen in the Transactions of the Entomological Society of London, 1904, p. 233, and recently redescribed and figured by the Rev. Desmond P. Murray in "South African Butterflies: A Monograph of the Family Lycaenidae," p. 108, and coloured illustration, No. 55.

I am very much indebted to my friend, Mr. Gowan C. Clark, of Port Elizabeth, to whom I forwarded examples of the egg and larva of the insect in March 1937, for the loan of a set of beautifully executed enlarged paintings, some of which are reproduced in half-tone on Plate XIX, and for furnishing me with an interesting description of the action and function of the retractile tubercles of the larva.

Near Milnerton on 20th April 1936 a female of *Phasis felthami* was kept under observation for the purpose of procuring eggs of the species and ascertaining the food-plant. The butterfly was followed for some time until it eventually selected a suitable spot for ovipositing, this proving to be a collection of dead leaves and other debris, which had accumulated under a low succulent-leaved shrub (*Zygophyllum sessilifolium* L., Plate XVIII), which grows commonly in the sandy ground bordering the coast-line. The insect alighted under the bush and immediately commenced ovipositing, crawling about for short distances and laying eggs singly at fairly frequent intervals on the withered leaves, small twigs, and among particles of loose sand.

Eight or more eggs were laid before it moved off again into open ground. The eggs were deposited at about 3.30 p.m.

The *egg* (Plate XIX) is about ·8 mm. in diameter, subglobular in shape, flattened at the base, and creamy-white in colour. The crown is somewhat compressed and the micropyle sunken. The surface is sculptured with a fine network of ridges, the interstices being extremely small round the centre of egg and attaining a maximum size on the sides.

The egg-stage lasted 20 days—cold weather prevailing during this period—and a single larva hatched out on 10th May. Prior to emergence a portion of the crown of the egg is eaten away, and before long a few hairs of the larva appear through the opening thus formed.

The *larva on emergence* (Plate XIX) is about 1 mm. in length, proportionately broad and considerably flattened. Ground colour dull yellow. Upperside sparsely speckled with black and marked longitudinally with broken reddish streaks. Head of moderate size; black. A broad area on first segment and a disc on anal segment hardened; dark brown or blackish. Surrounding body is a ridge, set with prominent, mostly curved, bristles. On the 10th segment dorsally is a pair of long branched spines, normally prostrate but at times directed upwards. Setae, forming a double row on dorsal surface, appressed. Pair of retractile tubercles on 11th segment.

The larva feeds on the leaves of the food-plant, devouring the fleshy interior substance and the overlying cuticle. Feeding occurs between long intervals of rest, when the larva remains motionless in some chosen resting place. The rate of growth in captivity was remarkably slow, though this may have been caused by the change to winter conditions usual in the month of May. Unfortunately the single larva obtained was lost, due to falling off a sprig of the food-plant, a month after emergence. It was then still in the first instar.

Mr. Clark succeeded in rearing a larva from the egg to the end of the third instar and has supplied me with the following record, which may perhaps be taken as typical of the normal rate of development of the larvae:—

| | | | | |
|---|---|---|---|---|
| Duration of first | instar | . | 10 days, | |
| ,, ,, second | ,, | . | 12 ,, | |
| ,, ,, third | ,, | . | 12 ,, | (larva died while moulting). |

After the first moult the form of the larva closely approximates to that ultimately assumed. The pair of branched spines are lost, the lateral bristles are increased in number, most of the more prominent longitudinal lines (which are dull light-red at this stage) and some other principal markings of the mature larva are recognisably distinct, and, as Mr. Clark has pointed out to me, the honey gland now appears on the 10th segment. The ground-colour of the larva is white at this period, but in time changes to a stone-coloured tint.

On 6th June a small colony of 15 larvae, ranging in size from 5 mm. to 13 mm., was found in the original locality at the base of one of the food-plants. The larvae were associated with ants (a species of *Cremastogaster*) and were afforded cover and concealment among a mass of debris consisting of withered leaf and other vegetable fragments mixed with numerous grains of sand, small pebbles and a few small snails' shells. This accumulation was loosely bound together with silken web, being partially attached to the bottom of the stem, and at one point extending below the surface of the ground. A few larvae were found below ground-level in a little cavity at the side of the stem, and two others were seen some distance up the stem within reach of the leaves. It was obvious that the larvae were engaging the attention of the ants, the source of attraction being the honey-gland, a characteristic feature of many of the larvae of the Lycaenidae. The actual act of "milking" on the part of the ants was not observed on this particular occasion, though the retractile tubercles in close proximity to the gland came into action whenever the larvae were disturbed. Similar ants were previously seen under the *Zygophyllum* bush when the butterfly was ovipositing.

The larvae were collected and later placed on a young food-plant growing in a pot, a light framework of sticks being secured over the top and covered with mosquito netting. A portion of the original "nest" was attached to the bottom of the stem.

In captivity the larvae existed independently of ants and the majority ultimately pupated, but their development was very slow, and it was not until 2nd August that pupation of the largest specimen took place. The larvae were very sluggish in their movements, and when not engaged in feeding continued to assemble together on the side of the stem and among the debris. When the larva is inactive the head is retracted into the first segment. At a later date further larvae in smaller groups, and at times occurring singly, were discovered below the food-plants, and occasionally in fissures that had formed between the stems. *Zygophyllum flexuosum* E. & Z. (Plate XVIII) and *Z. morgsana* L. were found to be additional plants used by the species.

The *full grown larva* (Plate XVIII, larva about 80 per cent. full grown; Plate XIX, lateral view of 7th segment) measures 16–17 mm., is broad, and ventrally flattened. Dorsum slightly arched; ridge surrounding body crenate on sides and upswept on first segment, curving round in front of well chitinised dorsal portion; last segment much flattened and sloping to anal extremity, with a circular dorsal area chitinised like upper surface of first segment. Numerous small stud-shaped spines (Plate XIX), perceptible as such only under a strong lens, are distributed over upper surface of body and over ridge (these contributing towards producing pattern of upperside); spines variously coloured: black, white, or more or less of the ground-colour of body. Bristles on sides of body and round extremities brownish grey, the majority darkening appreciably towards base, of various lengths and considerably more numerous and relatively shorter than on newly emerged larva.

Ground colour of body above, stone-coloured; often tinged in parts, especially on dorsal surface, with salmon-pinkish. Ventral surface (including prolegs) pale green to greenish-grey, tinged extensively with pale vinous. Head black, tinged on clypeus with dull reddish; division between lobes whitish; basal section of antennae red. Greater portion of dorsal area of first segment blackish. Longitudinal lines reddish brown to blackish; all except a barely separated very dark medio-dorsal pair, decidedly sinuous or irregular. Narrow space between sub-dorsal line and a series of very dark markings, creamish; line above spiracles, separated from the latter series by a broad strip, darker (often considerably darker) than general background; the lowest line of upperside between spiracles and margin of lateral ridge. Large areas of last three segments, particularly 11th and terminal ones, blackish. Underside of body bordered below ridge with deep maroon. Thoracic legs brown, for most part very dark; fleshy portions of the ground colour of ventral surface.

In regard to the honey-gland (situated between a greenish false gland and a dull red bulge) and retractile tubercles (Plate XIX), Mr. Clark in a letter to me states:—

"The tubercles of the Lycaenidae, at one time an unexplained organ, can now I think be described as a sentinel of the honey gland.

"In the case of *Myrina ficedula* Trim. it is merely a small warning projection. In the smaller species of the genus *Cupido* it is more developed and is a larger projection crowned with barbed and pointed spines, the larvae of *telicanus* Lang. sometimes using the partially extended tubercle as a brush. The larvae of *Phasis osbecki* Aur. and *felthami* Trim. definitely use the tubercle as a brush or whip and sweep the vicinity of the honey-gland with quick, determined lashes.

"Dealing with *Phasis felthami*, the tubercle is present in the newly hatched larva and can be made to function by touching the larva with a hair of a paint brush. This organ is level with the body and difficult to detect until it functions. The honey-gland is not apparent in the first stage.

"After the first moult the tubercle is encased in a prominent black cylindrical mole and is shot out on being disturbed and remains stationary for some seconds. It resembles a white club with seven spines, three on each side and one on top, the seven being in one row.

"After the second moult the cylindrical mole containing the tubercle develops a semicircle of spokes round the rim and these act as a protection to the protruding hairs; the remaining portion of the circle is open to allow the tubercle to function.

"The tubercle from this stage on consists of a piston fitted with three hairs on top and two more on each side near the top, working in and out of the cylindrical case.

"As the piston is protruded the three top hairs strike out and with the bending of the piston strike the vicinity of the honey-gland. The two hairs on either side shoot out with the rest but as the piston is extended their position on the side makes them sweep through an arc, the one to the side, the other to the rear on each side. In this way a large field is dusted.

"The beats are very rapid, vibrating at the rate of some two or three strokes per second, and are preceded by fretful tremblings of the unextended tubercle.

"Any small insects attempting to approach the honey-gland meet with a whirl of beating hairs and retreat. In this way the honey is reserved for the larva's protectors."

In captivity pupation was in most instances effected on the surface of the pile of debris, at the base of the food-plant.

The *pupa* (Plate XVIII) is 9–10 mm. in length, being relatively full in diameter; colour very dark brown. Front of head rounded; thorax distinctly convex dorsally; wing bases protuberant; abdomen wide to about middle, then tapering, curving downwards to extremity and terminating obtusely. Cremastral hooks small, golden-brown, disposed beneath, and over end of terminal segment. Pair of small protuberant patches above eyes and first one or two small protuberant spiracular patches, pale buff; remaining spiracular patches terra-cotta. Last few segments narrowly marked at edges (principally in dorsal and lateral regions), and the anal segment rather prominently beneath with terra-cotta.

The pupa derived from the larva previously mentioned as pupating on 2nd August produced a male imago on 6th September, *i.e.* 35 days later. An example bred by Mr. Clark remained in the pupal state for 21 days. The majority of the butterflies emerged earlier in the season than would have been the case under natural conditions, and all were below the usual average size of the species.

The *imago* (Plate XVIII) does not normally appear in any numbers before October, remaining out until the middle or end of December. It reappears in February and continues up to the beginning of May. A badly worn specimen, however, has been noted as late as 27th May. The insect is very local, but not uncommon where it occurs. It is often found frequenting plants of *Mundia spinosa* DC. (Schilpadbessie) and on one occasion this shrub was used for ovipositing, a single egg being laid, but a larva which was subsequently offered the plant as food refused to feed upon it. The species was discovered by the late Mr. H. L. L. Feltham in the Cape Peninsula, October–February, 1900–1902.

*Distribution.*—Localities in Cape Town district: Retreat; Ronde Vlei; Strandfontein; Durbanville; near Milnerton; Melkbosch Strand; near Brakfontein (on road to Mamre).

Further locality: Near Montagu.

The larva of *Phasis felthami* bears a close superficial resemblance to that of *Phasis thysbe* L. (an abundant species in most of the above localities), but may be distinguished from this by the longer bristles on body and round tubercles, the better defined longitudinal lines, the absence of a pair of small white protuberances (composed of minute closely set flower-shaped spines) on first segment, and the different form of some of the markings on the three rear segments. It should be noted, however, that a colour variety of the larva of *thysbe* sometimes occurs in which green replaces the usual brownish-grey hue of the upper surface of the body.

## A List of Recently Determined Food-plants of a few South African Butterflies' Larvae.

By C. G. C. Dickson and Gowan C. Clark of Port Elizabeth, who has kindly supplied the names of food-plants (with notes) of all species marked with an asterisk.

| Species of Butterflies. | Food-plants and Notes. |
|---|---|
| *Danaida chrysippus* L. | *Stapelia variegata* L. (Asclepiadaceae). |
| *Pseudonympha hyperbius* L. | *Ehrharta* (Gramineae): Eggs laid singly on leaf-blades. |
| *P. vigilans* Trim. | *Restio cincinnatus* Mast. (Restionaceae): Eggs laid singly on stems. |
| *Leptoneura mintha* Geyer. | *Ficinia* (Cyperaceae): Butterfly drops eggs while fluttering in middle of clump of grass. (Observed by Mr. P. R. Robertson and myself.) |
| *Acraea horta* L. | *Asclepias curassavica* L. (Garden shrub introduced from West Indies) (Asclepiadaceae): Food-plant noted by Mr. N. S. Pillans, to whom I am also indebted for the identification of several other plants. |
| *Pyrameis cardui* L. | *Arctotis*, cultivated (Compositae): Eggs laid singly on stems and leaves. |
| * *Precis* (*Junonia*) *cebrene* Trim. | *Barleria pungens* L. (Acanthaceae): Eggs laid singly, hidden between leaves of young shoot. |
| * *Cupido lysimon* Hubn. | *Amaranthus deflexus* L. (Amaranthaceae). |
| | *Tribulus terrestris* L. (Zygophyllaceae): Eggs laid singly under leaf. |
| *C. lingeus* Cram. | *Salvia* species (Labiatae): Eggs laid singly on leaves. |
| *C. thespis* L. | *Saxifraga* species (introduced from Europe) (Saxifragaceae). |
| | *Phylica imberbis* Berg. (Rhamnaceae): Eggs laid singly on flower-heads and leaves. |
| *Lycaenesthes definita* Butl. | *Rhus* species (Anacardiaceae). |
| | *Acacia saligna* Wendl. (Port Jackson willow, introduced) (Leguminosae): Eggs laid singly on young flower-heads and leaves. |
| * *Deudorix antalus* Hopff. | *Schotea speciosa* Jacq. (Leguminosae): Eggs laid singly. Larvae remain in pod, eating the bean. |

| Species of Butterflies. | Food-plants and Notes. |
|---|---|
| *Phasis zeuxo* L., small dark subspecies. | *Osteospermum moniliferum* L. (Compositae): Eggs laid singly on underside of leaves (observed on only one occasion). |
| *P. felthami* Trim. | *Zygophyllum sessilifolium* L.<br>*Z. flexuosum* E. & Z.<br>*Z. morgsana* L. (Zygophyllaceae): Eggs laid singly under plant. Larva associated with ants (*Cremastogaster* species). |
| *P. pyroeis* Trim. | *Zygophyllum* species and association of larva with ants as above. |
| *P. thysbe* L., and var. *osbecki* Aur. | *Zygophyllum sessilifolium* L.<br>*Z. flexuosum* E. & Z.<br>*Z. morgsana* L.: Eggs laid singly on younger stems and underside of leaves. Larva associated with ants (*Cremastogaster peringueyi* Emery). |
| *P. thysbe*, variety with blue area of male much reduced (principally in forewing) in comparison with that of ordinary form (hind-margins dentate). | *Aspalathus spinosa* L. (Leguminosae).<br>*Zygophyllum* species as above, also association with ants. |
| *P. thysbe*, variety resembling *osbecki* but with blue area in forewing of male reduced (hind-margins non-dentate). | *Osteospermum moniliferum* L.: Eggs laid singly on stems and leaves. |
| *P. thero* L. | *Melianthus major* L. (Melianthaceae): Ascertained by the Rev. D. P. Murray since the publication of his work.<br>*Rhus* species. In case of latter food-plant a single egg was seen being deposited in cleft between flower-bearing and leaf stems. |
| *P. wallengrenii* Trim. | *Senecio pubigerus* L. (Compositae): Eggs laid in small batches on stems. Spinous scales from butterfly's abdomen adhere to surface of egg. |
| *P. malagrida* Wllg. | *Ifloga laricifolia* Less. (Compositae).<br>*Aspalathus* species: Eggs laid singly or in pairs on stems. Numerous scales adhere to surface of egg. |
| * *Terias brigittu* Cram. | *Cassia mimosoides* L. (Leguminosae): Eggs laid singly near tip of young frond. |

| Species of Butterflies. | Food-plants and Notes. |
|---|---|
| * *Pieris zochalia* Boisd. | *Maerua triphylla* Thunb. (Cappariđeae): Eggs laid singly, generally on upper side of leaf. |
| * *P. mesentina* Cram. | *Capparis oleoides* Burch. *Maerua triphylla* Thunb. (Capparideae): Eggs laid in cluster, generally on underside of leaf or near terminal of young shoot. |
| * *P. gidica* Godt. | *Capparis citrifola* Lam.: Eggs laid singly on leaf of young shoot. |
| * *P. severina* Cram. | *Maerua triphylla* Thunb. *Capparis oleoides* Burch. *C. zeyheri* Turcz.: Eggs laid in cluster, generally on underside of leaf. |
| * *Herpaenia eriphia* Godt. | *Maerua triphylla* Thunb.: Eggs laid in small clusters on leaf. |
| * *Teracolus eris* Klug. | *Capparis oleoides* Burch.: Eggs laid singly, generally under young leaf. |
| * *T. omphale* Godt. * *T. antigone* Boisd. | *Capparis citrifolia* Lam. *Cadaba juncea* Harv. (Capparideae): In each case eggs laid singly on young shoot. |
| * *Eronia buquetii* Boisd. | *Azima tetracantha* Lam. (Salvadoraceae): Eggs laid singly on young shoot. |
| *Kedestes lenis* Riley. | *Imperata arundinacea* Cyr. var. *thunbergii* Hack. (Gramineae): Eggs laid singly on leaf-blades. |
| *Parnara mohopaani* Wllg. | Food-plant and egg-laying as above. (Observed by Mr. P. R. Robertson.) |

A number of the above plants were kindly identified for me at the Bolus Herbarium, Kirstenbosch, and at the Herbarium of the South African Museum.

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## EXPLANATION OF PLATES.

Plate XVIII. *Phasis felthami* Trim.
(Plate of black and white drawings by C. G. C. Dickson.)

Pupa, ×3.
Larva, ×3 (about 80 per cent. full grown).
Imago, ×1, male and female.
Food-plants, *Zygophyllum sessilifolium* L. and *Z. flexuosum* E. & Z. (ant associated with larva on tip of former).

PLATE XIX. *Phasis felthami* Trim.

(Half-tone reproductions of coloured drawings by Gowan C. Clark.)

Egg, ×20, and section of surface highly magnified.

Larva on emergence, ×40, cross-section of same, and outline of last two segments showing position of tubercles and pair of branched spines.

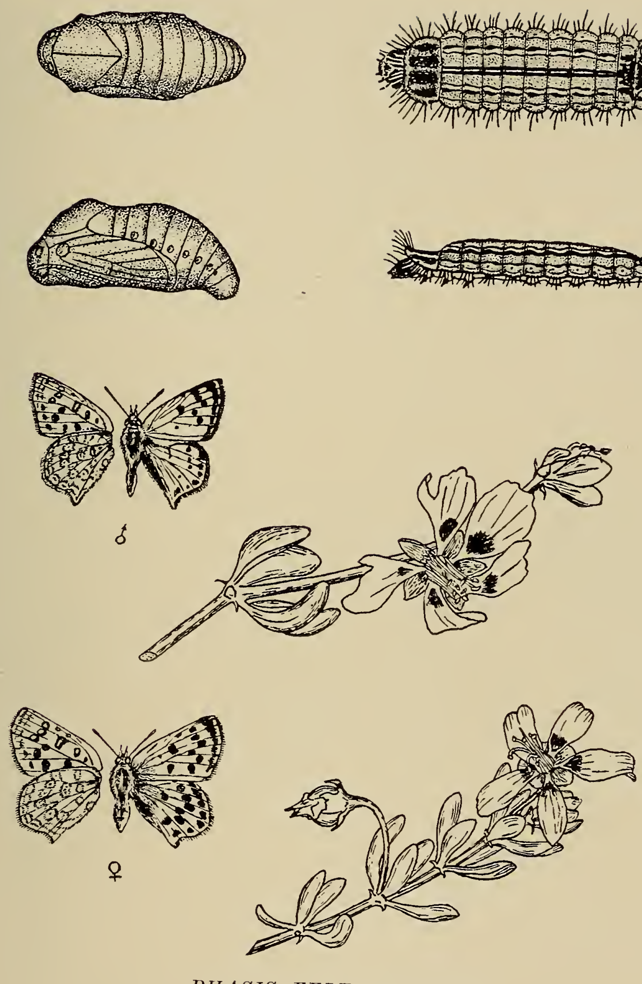
Lateral view of 7th segment of full-grown larva (from right side).

Stud-shaped spines.

Tubercle (half extended).

Tubercle (fully extended) and position of spiracle.

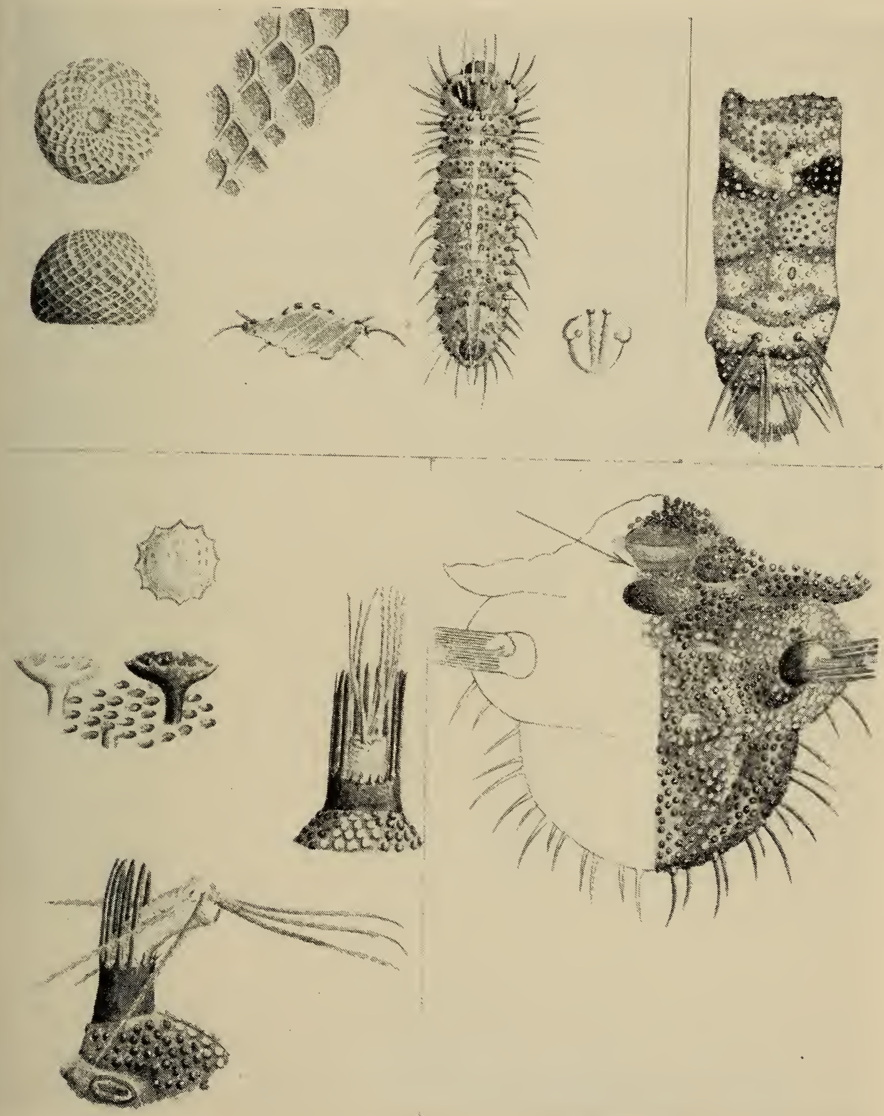
Dorsal view of last three segments, showing position of honey gland (indicated by arrow) and tubercles.




*PHASIS FELTHAMI* TRIM.

*C. G. C. Dickson, del.*

*Neill & Co., Ltd.*



PHASIS FELTHAMI TRIM.

G. C. Clark, pinx.

Neill & Co., Ltd.

# 20. *The Genus* Selenops (*Araneae*) *in South Africa.*

By R. F. Lawrence, Ph.D., Natal Museum, Pietermaritzburg.

(With 47 Text-figures.)

The genus *Selenops* has for some time stood in need of revision owing to the large number of undescribed forms which occur in South Africa. An exceptionally large number of new species has been discovered in the collections of the various Museums of South Africa, and the writer is indebted to the Directors of these institutions for the loan of their material. The revision of the genus is based on specimens from the South African Museum, where the great majority of the types are housed, the Transvaal Museum, Pretoria, the Albany Museum, Grahamstown, and the Natal Museum, Pietermaritzburg.

Most of the species of *Selenops* in South Africa have a comparatively limited distribution and each subregion differs in its fauna from the others. The species which is best represented in tropical Africa and which appears to have the widest distribution of all African forms of *Selenops*, viz. *S. radiatus* Latr., is poorly represented in the South African region. This species appears to undergo a process of breaking up into a number of closely allied subspecies as it passes over from the tropical African to the temperate South African zone. On the other hand the smaller forms of *Selenops*, with a larger number of tibial spines than is the case in *radiatus*, are abundant, both numerically and with regard to the large number of species into which they break up. All members of the genus seem to be typical cryptozoic and nocturnal forms, living in retreat under logs and stones during the day, but often attracted by bright light into houses at night, where they can be seen resting on the walls of rooms.

The following abbreviations have been used throughout the paper to indicate the Institutions where the types and other specimens are to be found:—

S.A.M. *South African Museum, Cape Town.*
T.M. *Transvaal Museum, Pretoria.*
N.M. *Natal Museum, Pietermaritzburg.*
A.M. *Albany Museum, Grahamstown.*

The following key may be used for distinguishing the main groups of species of *Selenops* found in the South African region:—



## GROUP A.

*Key to the species of* Selenops *of the* radiatus *group.*

♀♀.

1. Vulva with two lobes meeting in the middle line; tibiae of legs with black bands . . . . . . . . . . . . . . . . 2.
   Vulva without lobes, with a simple, more or less rounded opening; tibiae of legs uniformly blackish-brown . . . . . . . . . 5.
2. Anterior opening of vulva rounded, a little wider than long *radiatus radiatus, radiatus peryensis.*
   Anterior opening of vulva triangular, considerably wider than long . 3.
3. Opening of vulva much wider than long, lateral lobes not completely separated *radiatus damaranus.*
   Lateral lobes completely separated . . . . . . . . . 4.
4. Anterior median eyes more than their diameter apart . . *radiatus krugeri.*
   Anterior median eyes less than their diameter apart . *radiatus ovambicus.*
5. A line touching the upper surfaces of anterior median eyes passing below the centres of the posterior medians . . . . . . *rhodesianus.*
   A line touching the upper surfaces of anterior median eyes passing above the centres of the posterior medians . . . . . . . . . 6.
6. Opening of vulva wider than long . . . . . . . . . 7.
   Opening of vulva longer than wide . . . . . . . . . 8.
7. Opening of vulva subquadrate . . . . . . . *brachycephalus.*
   Opening of vulva rounded . . . . . . . . . *zuluanus.*
8. Anterior median eyes less than their diameter apart . . . . *lesnei.*
   Anterior median eyes more than their diameter apart . . . *tenebrosus.*

♂♂.

| | | |
|---|---|---|
| 1. | Pedipalp tibia with two widely separated processes . . . . . | 2. |
| | Pedipalp tibia with two processes close to each other . . . . . | 3. |
| 2. | Processes of pedipalp tibia almost equal in size . . | *radiatus krugeri.* |
| | Processes of pedipalp tibia unequal in size . . . | *radiatus radiatus.* |
| 3. | Tibia of pedipalp longer than patella, subequal to tarsus . . | *lesnei.* |
| | Tibia of pedipalp shorter than patella, much shorter than tarsus . | *zuluanus.* |

*Selenops radiatus damaranus* n. subsp. (fig. 1).

*Type*, 1 ♀, Sandfontein (185 miles east of Windhoek), South West Africa (S.A.M., B. 5637).

*Colour.*—Carapace reddish brown with a number of short black stripes radiating from the fovea but well removed from it, cephalic area a little darker than thoracic area, its boundaries defined by darker lines; mandibles dark reddish brown, darker than carapace; abdomen mottled with dark brown spots and smaller dots on a yellow background, the whole appearance not dark; femora of legs mottled, tibia banded with distinct blackish markings, under surface of anterior femora entirely dark, metatarsi entirely dark brown.

Fig. 1.—*Selenops radiatus damaranus* n. subsp. ♀, vulva.

*Eyes.*—Medians weakly recurved, a line touching the upper surfaces of the anteriors passing well above the centres of the posterior medians, anterior medians $\frac{3}{4}$ the diameter of the posterior medians, their own diameter apart, and a little less than a radius from the posterior medians; posterior medians half the diameter of the posterior laterals; anterior medians a little more than a radius from the edge of the clypeus.

*Chelicerae.*—Inferior margin with 2 equal-sized teeth separated by their basal width.

*Legs.*—Anterior tibiae with 3 pairs, anterior metatarsi with 2 pairs of inferior spines.

*Vulva* as in fig. 1.

*Dimensions.*—Length of carapace 5·2, width of carapace 6·2, total length 14 mm.

*Other Specimens.*—1 ♀, Loangwa Valley, N. Rhodesia (S.A.M., 9494).

*Selenops radiatus ovambicus* n. subsp. (fig. 2).

*Type*, 1 ♀, Ongandjera, Ovamboland, S.W. Africa (S.A.M., B. 6221).

*Colour.*—Carapace reddish brown, cephalic portion a little darker than thoracic portion, defined at its posterior apex by two short blackish stripes, a narrow incomplete blackish stripe in the middle; thoracic portion with some submarginal spots, radiations from the thoracic stria short and ill-defined, the stria itself deeply grooved and blackish; mandibles blackish brown, ocular area dark; abdomen much macerated; femora of anterior legs with 2 distinct blackish bands on their anterior surfaces, these confluent along the under sides; anterior tibiae with 2 black and 2 lighter bands; labium blackish brown, sternum narrowly margined with black.

*Eyes.*—Median eyes slightly recurved, a line touching the upper surfaces of the anteriors passing between the centres and the upper surfaces of the posterior medians; anterior medians a little smaller than the posterior medians, a little less than their own diameter apart, and about half their radius from the posterior medians; posterior medians about $\frac{2}{3}$ the diameter of the posterior laterals; anterior medians $\frac{2}{3}$ their diameter from the edge of the clypeus.

Fig. 2.—*Selenops radiatus ovambicus* n. subsp. ♀, vulva.

*Chelicerae.*—Inferior margin with 2 moderate equal-sized teeth separated by their basal width from each other.

*Vulva* as in fig. 2 differing somewhat in detail from *damaranus* and the typical form of *radiatus.*

*Legs.*—Anterior tibiae with 3, anterior metatarsi with 2 pairs of inferior spines.

*Dimensions.*—Length of carapace 5·2, width 5·9, total length 13·4 mm. This specimen was designated as a typical *radiatus* by the writer in Ann. S.A. Mus., vol. xxv, pt. 1, p. 41, 1927.

*Selenops radiatus krugeri* n. subsp. (fig. 3).

*Types*, 1 ♀, Sabie Reserve, Transvaal (S.A.M., B. 5735); 1 ♂, Sabie Reserve (S.A.M., B. 7164), coll. E. L. Gill.

♀ *Colour.*—Carapace reddish brown, cephalic portion dark reddish brown; fovea strongly, radiations faintly marked; mandibles reddish black; abdomen rubbed above, mottled with brown spots and specks; anterior femora with 3 faint dark bands, tibiae with fairly strong dark bands.

*Eyes.*—Median eyes weakly recurved, a line touching the upper surfaces of the anteriors passing through the centres of the posterior medians; anterior medians $\frac{3}{4}$ the diameter of the posterior medians, more than their diameter apart, and a radius from the posterior medians; posterior medians $\frac{1}{2}$–$\frac{2}{3}$ the diameter of the posterior laterals; anterior medians a little less than their diameter from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 strong equal-sized teeth, less than their basal width from each other.

*Vulva* as in fig. 3, *a*.

*Legs.*—Tibia I and II with 3 pairs of inferior spines, metatarsus I and II with 2 pairs of inferior spines; no lateral spines.

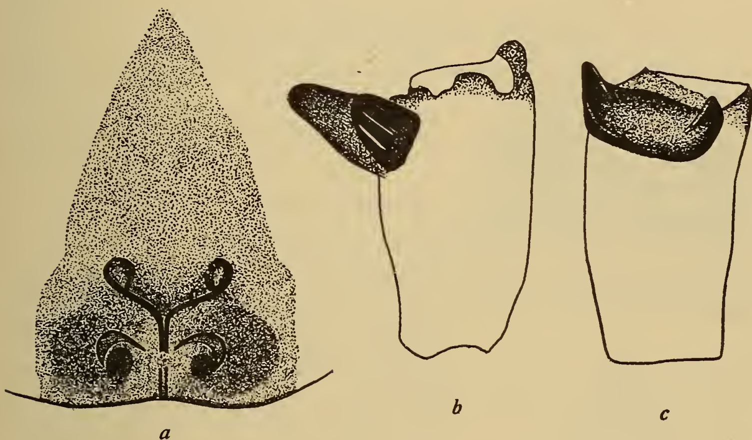



FIG. 3.—*Selenops radiatus krugeri* n. subsp. *a*, ♀, vulva. *b*, *c*, tibia of pedipalp, ♂, from in front and from outer side.

*Dimensions.*—Length of carapace 7, length of abdomen 9·8 mm.

♂ *Colour* as in description of ♀, except that the tibiae of legs are entirely dark except at base and apex.

*Eyes* and *chelicerae* as in description of ♀, the teeth on inferior margin of chelicerae their basal width apart.

*Legs.*—Anterior tibiae with 3 pairs of inferior spines, anterior metatarsi with 2 pairs, tibia I with a lateral spine on each side near the base, tibia II without lateral spines.

*Pedipalp.*—Femur with 1 outer, 3 superior spines near the apex, patella without spines; tibia distinctly longer than patella but shorter than tarsus; process of tibia as in fig. 3, *b*, seen from in front, fig. 3, *c*, seen from outer side.

*Dimensions.*—Length of carapace 6, total length 12·7 mm.

*Other Specimens.*—1 ♀, Potgietersrust, Transvaal (T.M., 1853); 1 ♀, Kuruman (S.A.M., 13176); 1 ♀, Lake Ngami (S.A.M., 13354).

*Selenops radiatus radiatus* Latr.

The species is not common in the South African region and only occupies the northern fringe of it. The South African Museum has specimens from the following localities: 1 ♀, Salisbury, S. Rhodesia (2045); 1 ♀, Windhuk, S.W. Africa (B. 5169); 1 ♀, Otjituo, S.W. Africa (B. 5028); 1 ♀, Namakunde, S.W. Africa (B. 5028). Lessert also records it from Portuguese E. Africa (Chemba, Nova Choupanga, Sinjal) and Angola.

*Selenops radiatus peryensis* Lessert.

*S. radiatus peryensis* Lessert, Rev. Suisse. Zool., vol. xliii, p. 263, figs. 57–59, 61, 1936.

The types, ♀ and ♂, were described from Vila Pery, Portuguese E. Africa.

*Selenops rhodesianus* n. sp (fig. 4).

*Type*, 1 ♀, Salisbury, Rhodesia (S.A.M., B. 3284).

*Colour.*—Carapace reddish brown with a distinct narrow blackish margin, decorated with indistinct markings, eyes surrounded by black; mandibles reddish brown; abdomen mottled blackish brown, almost black posteriorly; legs with moderate fuscous markings, these not very clearly defined.

Fig. 4.—*Selenops rhodesianus* n. sp. ♀, vulva.

*Eyes.*—Medians not strongly recurved, a line touching the upper surfaces of the anteriors passing a little below the centres of the posterior medians; anterior medians $\frac{4}{5}$ the diameter of the posterior medians, $1\frac{1}{4}$ times their own diameter apart, and a little more than a radius from the posterior medians; posterior medians half the diameter of the posterior laterals; anterior medians a little less than their diameter from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 teeth, the basal one a little larger than the apical one, from which it is separated by its basal width.

*Legs.*—Tibiae of anterior legs with 3 pairs, metatarsi of anterior legs with 2 pairs of inferior spines.

*Vulva* as in fig. 4.

*Dimensions.*—Length of carapace 5·4, width of carapace 6, length of abdomen 6·3 mm.

*Other Specimens.*—2 ♀♀, Mokeetsi, E. Transvaal (T.M., 6411).

*Selenops brachycephalus* n. sp. (fig. 5).

*Type*, 1 ♀, Salisbury, Rhodesia (S.A.M., 3292).

*Colour.*—Carapace brown with some darker markings radiating forwards and sideways from the thoracic stria, those on the cephalic portion more strongly defined; mandibles uniform reddish brown, hardly darker than carapace; abdomen above dark mottled brown, a few white speckles among the predominating brown ones; legs brown with some vague infuscations.

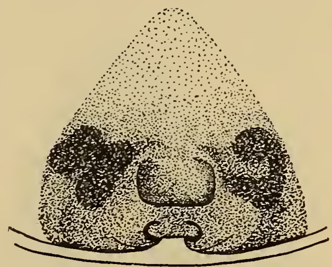


Fig. 5.—*Selenops brachycephalus* n. sp. ♀, vulva.

*Eyes.* — Median eyes weakly recurved, a line touching the upper surfaces of the anteriors passing well above the centres of the posterior medians; anterior medians $\frac{2}{3}$ the diameter of posterior medians, their own diameter or a little more apart, and a radius from the posterior medians; posterior medians $\frac{1}{2}$–$\frac{2}{3}$ the diameter of the posterior laterals; anterior medians about a radius from the edge of the clypeus.

*Chelicerae.*—Inferior margin with 2 teeth, the basal slightly larger than the apical one, separated by less than the greatest width of the basal tooth.

*Legs.*—Tibia I and II with 3 pairs of inferior spines, metatarsus I and II with 2 pairs of inferior spines.

*Vulva* as in fig. 5.

*Dimensions.*—Length of carapace 5·7, width of carapace 6·7, length of abdomen 6 mm.

*Selenops zuluanus* n. sp. (fig. 6).

*Types*, 1 ♂, 2 ♀♀, Ingwavuma, Zululand (N.M., 2398).

♀ *Colour.*—Carapace reddish brown, darker anteriorly, with a blackish marginal border, some ill-defined radiations from the thoracic stria, and an indistinct dark stripe bisecting the cephalic area; mandibles much darker than carapace, almost black; abdomen above almost uniformly black, speckled with some minute light dots, those near the anterior margin larger; legs almost black, the anterior surfaces of femora a little lighter (especially near the base), remaining segments uniformly black except tarsi which are dark brown.

*Eyes.*—Median eyes weakly recurved, a line touching the upper surfaces of the anteriors passing well above the centres of the posterior medians, anterior medians $\frac{1}{2}$–$\frac{2}{3}$ the diameter of the posterior medians, their own diameter apart, and a little less than their diameter from the posterior medians; posterior medians half the diameter of the

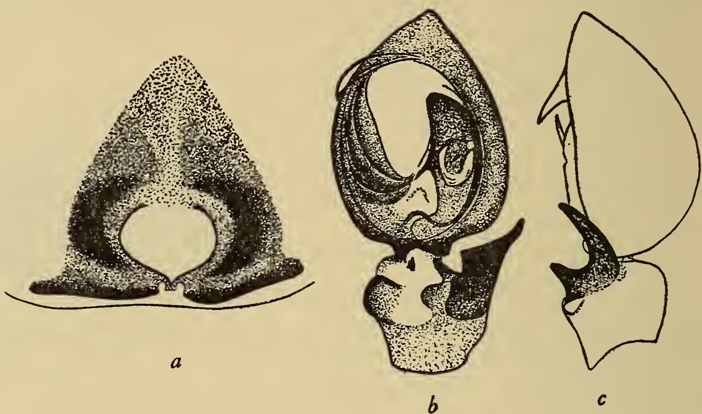



Fig. 6.—*Selenops zuluanus* n. sp. *a*, ♀, vulva. *b*, *c*, tibia of pedipalp, ♂, from in front, and from outer side.

posterior laterals; anterior medians $\frac{2}{3}$ their diameter from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 teeth, the basal one distinctly larger than the apical one, separated from it by its basal width.

*Legs.*—Anterior tibiae with 3, anterior metatarsi with 2 inferior pairs of spines.

*Vulva* as in fig. 6, *a*.

*Dimensions.*—Length of carapace 6·2, width of carapace 7·6, length of abdomen 10 mm.

♂ *Colour.*—Carapace light yellow brown, without distinct markings; mandibles reddish brown, a little darker than the carapace; abdomen above blackish at the sides and posteriorly, the anterior two-thirds of the middle portion light yellow brown, enclosing a blackish tree-like marking; legs lighter than in the ♀, femora olive green below, lighter anteriorly, remaining segments dark brown.

*Eyes.*—Medians forming a weakly curved row, a line touching the upper surfaces of the anteriors passing half-way between the centres and upper surfaces of the posterior medians; anterior medians $\frac{3}{4}$ the diameter of the posterior medians, a little more than their own diameter apart, and a little more than a radius from the posterior medians; posterior medians half the diameter of the posterior laterals; anterior medians a little more than a diameter from the edge of the clypeus.

*Chelicerae.*—Inferior margin with 2 subequal teeth separated by $1\frac{1}{2}$ times their basal width.

*Legs.*—Tibia I and II with 3 pairs of inferior spines, I with 2 lateral spines on each side and 2 superior spines, II with 2 lateral spines on each side and 1 superior spine; metatarsus I and II with 2 pairs of inferior spines, a lateral spine on each side near the base.

*Pedipalp.*—Femur with 1 inner and 3 superior spines in distal half above, patella with 0 spines above; tibia distinctly shorter than patella and less than half as long as tarsus when seen from above; tibial process as in fig. 6, *b*, seen from in front, fig. 6, *c*, seen from the outer side.

*Dimensions.*—Length of carapace 5·6, width 6·6, total length 12·3 mm. This seems to be a fairly widely distributed form. The South African Museum has examples from Insiza, Pungwe River, and Umtali, all localities in Rhodesia; and Kaapmuiden and Potgietersrust in the Transvaal. The pedipalp resembles that of *lesnei* Lessert (Rev. Suisse. Zool., vol. xliii, p. 266, fig. 64, 1936) in the external processes of the tibia, but differs in having this segment much shorter than the tarsus, while in *lesnei* it is subequal to it. The vulva, on the other hand, resembles that of *annulatus* Simon (see Lessert's figure, Rev. Suisse. Zool., vol. xxxvi, p. 124, fig. 12, *c*, 1929).

### *Selenops tenebrosus* n. sp. (fig. 7).

*Types*, 2 ♀♀, Gravelotte, N.E. Transvaal (T.M., 2228).

*Colour.*—Carapace rich dark reddish brown with a conspicuous pattern of markings in addition to the fovea, foveal radiations, and the boundaries of the cephalic area; mandibles reddish black; abdomen almost entirely black above with 1 or 2 pairs of light spots in its anterior half, ventral surface yellow brown, the sides and posterior margin black, spinners almost encircled with black; legs uniformly black, a little lighter towards their bases; coxae, sternum, and mouth-parts reddish brown.

*Eyes.*—Median eyes weakly recurved, a line touching the upper surfaces of the anteriors would pass a little above the centres of the posterior medians; anterior medians $\frac{3}{4}$ the diameter of the posterior medians, more than their own diameter apart ($1\frac{1}{2}$ times), and $\frac{2}{3}$ their diameter from the posterior medians; posterior medians half the diameter of the posterior laterals; anterior medians about $\frac{2}{3}$ their diameter from the edge of the clypeus.

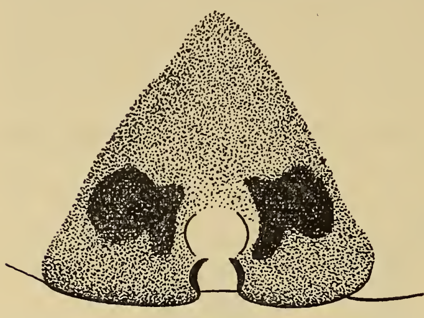


FIG. 7.—*Selenops tenebrosus* n. sp. ♀, vulva.

*Chelicerae.*—Inferior margin with 2 large subequal teeth separated by less than their basal width.

*Legs.*—III, II, IV, I; II considerably longer than I; tibiae I and II with 3 pairs of inferior spines, metatarsi I and II with 2 stout pairs of inferior spines.

*Vulva* as in fig. 7, resembling that of *S. zuluanus.*

*Dimensions.*—Length of carapace 8·3, width of carapace 9·7, length of abdomen 13·4 mm. Total length of second type specimen 23 mm.

*Other Specimens.*—1 ♀, Olifants River District, Transvaal (T.M., 6364); 1 ♀, Louis Trichardt, Transvaal (B. 7187, S.A.M.).

### *Selenops lesnei* Lessert.

*S. lesnei* Lessert, Rev. Suisse. Zool., vol. xliii, p. 265, figs. 60, 62–64, 1936.

The types, ♀ and ♂, were described from Mouvia-Sare on the Zambesi (♀), and Inhafoune near Canxixe (♂), both localities in Portuguese E. Africa.

## GROUP B.

### SUB-GROUP $B_1$.

*Key to the species of* Selenops *with 4 pairs of inferior tibial spines.*

♀♀.

| | | |
|---|---|---|
| 1. | Anterior median eyes their diameter apart . . . . | *natalensis.* |
| | Anterior median eyes more than their diameter apart . . . . | 2. |
| 2. | Vulval plate not large, circular, without lateral lobes . . | *lycosiformis.* |
| | Vulval plate very large, with lateral lobes . . . . . | *parvulus.* |

*Selenops lycosiformis* Lawrence.

*S. lycosiformis* Lawrence, Ann. Natal Mus., vol. viii, pt. 2, p. 246, text-fig. 18, 1937.

The type came from the Nkandhla Forest, Zululand, and was based on an adult ♀ specimen.

*Selenops natalensis* n. sp. (fig. 8).

*Types*, 2 ♀♀, 1 ♂, Estcourt, Natal (N.M., 1717).

♀ *Colour.*—Carapace blackish brown at the sides, with a median, more or less parallel, yellow marking (as wide as the darkened area on

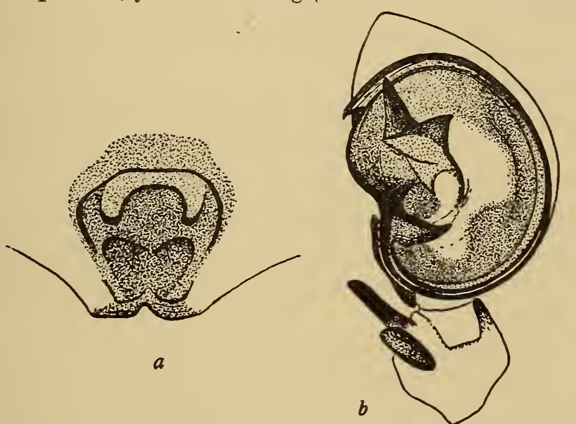



Fig. 8.—*Selenops natalensis* n. sp. *a*, ♀, vulva. *b*, pedipalp, ♂, from in front.

each side); this lighter marking with crenulated sides and constricted behind the thoracic stria, reaching from the ocular area to the posterior margin and containing a blackish median stripe with a pair of lateral branches, one just in front of the stria and one in the middle of the cephalic area; darkened areas at the sides with a submarginal broken row of lighter spots; mandibles as light coloured as the middle of the carapace, their inner margins and apices darkened, a dark dot on the outer side near the base; abdomen above dark brown, a pair of long oval lighter markings on each side of the anterior half, a pair of smaller oval light spots above the spinners; under surface of abdomen with a considerable part of the sides and posterior portion blackish brown, the spinners surrounded by the darkened area; sternum narrowly bordered with black and with a few blackish dots in the middle. Legs almost uniformly dark brown, the black bands absent or barely visible; inferior surfaces of anterior femora black in front and quite light behind, posterior femora spotted black above, their anterior and posterior surfaces black with a fine yellow longitudinal line.

*Eyes.*—Medians not strongly recurved, a line touching the upper surfaces of the anteriors passing a little below the centres of the posterior medians; anterior medians $\frac{2}{3}$ the diameter of the posterior medians, their own diameter apart, and $\frac{2}{3}$ their diameter from the posterior medians; posterior medians $\frac{2}{3}$ the diameter of the posterior laterals; anterior medians a little less than their diameter from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 equal-sized teeth separated by their basal width.

*Vulva* as in fig. 8, *a*.

*Legs.*—Anterior tibiae with 4 pairs of inferior spines, anterior metatarsi with 3 inferior pairs, no lateral spines, anterior tibiae unusually short and stout.

*Dimensions.*—Length of carapace 3·3, total length 8 mm.

♂ *Colour* as in ♀, anterior femora white below, posterior femora blackish below with a fine longitudinal yellow stripe on anterior and posterior sides.

*Eyes and chelicerae* as in ♀.

*Legs.*—Anterior tibiae with 4 pairs of inferior spines and in addition 2 lateral spines on each side and 2 superior spines in the middle of the segment; anterior metatarsi with 3 pairs of inferior spines and 2 lateral spines on each side.

*Pedipalp.*—Femur with 1 inner, 1·2 superior, 1 outer spine in distal half, patella with 1 inner spine; tibia much shorter than tarsus and distinctly shorter than patella, seen from above; tarsus and tibial process as in fig. 8, *b*, seen from in front.

*Dimensions.*—Length of carapace 2·7, total length 5·9 mm.

### *Selenops parvulus* Pocock.

*S. parvulus* Pocock, A.M.N.H. (7), vol. vi, p. 332, 1900.

The type came from Port Elizabeth and was based on an adult ♀ specimen. No figure was given of the vulva which, however, seems characteristic, being described as situated on a very large plate and with lateral lobes.

### Sub-group $B_2$.

*Key to the species* Selenops *with 5 pairs of inferior tibial spines.*

♀♀.

1. Teeth on inferior margin of chelicerae their basal width apart . . 2.
   Teeth on inferior margin of chelicerae more than their basal width apart 10.
2. Anterior medians a little less than their diameter apart . . *minor.*
   Anterior medians a little more than their diameter apart . . . 3.
3. Anterior medians half as large as posterior medians . . . . 4.
   Anterior medians more than half as large as posterior medians . . 5.
4. Tibiae of legs with 2 dark and 2 light bands . . . . . *barnardi.*
   Tibiae of legs with 1 dark and 1 light band . . . *namaquensis.*
5. Vulva with a median tongue-like selerite . . . . . . *civicus.*
   Vulva without a median tongue-like selerite . . . . . 6.
6. Posterior medians subequal to posterior lateral eyes . . *caledonicus.*
   Posterior medians half the diameter of posterior lateral eyes . . 7.
7. Vulva without lateral sclerites . . . . . . *karrooicus.*
   Vulva with distinct lateral sclerites . . . . . . . . 8.
8. Lateral sclerites meeting in the middle line . . . . . *broomi.*
   Lateral sclerites not meeting in the middle line . . . . . . 9.
9. Vulva as in fig. 17 . . . . . . . . . . . *hessei.*
   Vulva as in fig. 23 . . . . . . . . . . . *maculosus.*
10. Vulva extremely small, body size small . . . . . *atomarius.*
    Vulva usually large, body size larger . . . . . . . . 11.
11. Posterior medians half the diameter of posterior laterals . . . 12.
    Posterior medians subequal to posterior laterals . . . . . . 13.
12. Vulva with two incurved arms at its base . . . . . *schonlandi.*
    Vulva different, much smaller; body size smaller . . . *hewitti.*
13. Vulva with an elongate quadrate opening . . . . . . *thornei.*
    Vulva without elongate opening . . . . . . . . 14.
14. Anterior medians a radius from posterior medians . . . *helenae.*
    Anterior medians less than a radius from posterior medians . . . 15.
15. Vulval plate rounded . . . . . . . . *bechuanicus.*
    Vulval plate not rounded . . . . . . . . . . 16.
16. Vulva with a median septum . . . . . . . . *longipes.*
    Vulva without a median septem . . . . . . . . . 17.
17. Vulva narrowed anteriorly . . . . . . . . *purcelli.*
    Vulva not narrowed anteriorly . . . . . . . . *lignicolus.*

♂♂.

1. Tibia of pedipalp equal or subequal to tarsus in length . . . . 2.
   Tibia of pedipalp much shorter than tarsus . . . . . . 4.
2. Tibial apophysis of pedipalp with 4 short processes . . . *hewitti.*
   Tibial apophysis of pedipalp with 3 longer processes . . . . . 3.
3. Processes of tibial apophysis slender, subequal . . . . . *atomarius.*
   Processes of tibial apophysis strong and differing greatly in length and thickness . . . . . . . . . . . . . . *broomi.*

4. Tibia of pedipalp longer than patella . . . . *namaquensis.*
 Tibia of pedipalp sometimes equal to, usually shorter than patella . 5.
5. Anterior tibiae of legs without lateral spines . . . . . . 6.
 Anterior tibiae of legs with lateral spines . . . . . . . 7.
6. Body length 6·8 mm. . . . . . . . . . . *alticolus.*
 Body length 5·2 mm. . . . . . . . . . . *minutus.*
7. Anterior tibiae with superior spines . . . . . . . . 8.
 Anterior tibiae without superior spines . . . . . . . 10.
8. The processes of tibial apophysis widely separated like forefinger and thumb *pococki.*
 The processes of tibial apophysis close together . . . . . . 9.
9. Pedipalp tarsus seen from in front more or less rounded . . *lignicolus.*
 Pedipalp tarsus seen from in front oval (fig. 21, *a*) . . . *lesserti.*
10. Anterior metatarsi without lateral spines . . . . . . *smithersi.*
 Anterior metatarsi with lateral spines . . . . . . . 11.
11. Anterior metatarsi with 2 lateral spines on each side . . *bechuanicus.*
 Anterior metatarsi with less than 2 lateral spines on each side . . 12.
12. Anterior metatarsi with a lateral spine on each side . . *immaculatus.*
 Anterior metatarsi with lateral spines on posterior surface only . . 13.
13. Processes of tibial apophysis far apart like a forefinger and thumb *minor.*
 Process of tibial apophysis close together . . . . . . . 14.
14. Tibial apophysis as in fig. 20, *b*, *c* . . . . . . . . *karrooicus.*
 Tibial apophysis as in fig. 15, *b*, *c* . . . . . . . *civicus.*

## *Selenops alticolus* n. sp. (fig. 9).

*Type*, 1 ♂, Ingwavuma, Lebombo Mts., Zululand (N.M., 2423).

*Colour.*—Carapace light brown with some darker patches along the lateral margins, eyes surrounded by black; mandibles reddish brown, darker than carapace, the inner half of their anterior surfaces blackish brown; abdomen brown, variegated with some minute light dots and blackish markings; legs with very weak bands and spots, the strongest being a longitudinal bar near the base of the infero-anterior surface of femur I and II.

*Eyes.*—Medians not strongly recurved, a line touching the upper surfaces of the anteriors passing through or a little below the centres of the posterior medians; anterior medians not much smaller than posterior medians ($\frac{3}{4}$ their diameter), their own diameter apart, and a little less than a radius from the posterior medians; posterior medians $\frac{2}{3}$ the diameter of the posterior laterals; anterior medians a radius from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 moderate subequal teeth, about twice their basal width from each other.

*Legs.*—Anterior tibiae with 5 pairs of rather weak inferior spines, no lateral or superior spines; anterior metatarsi with 3 pairs of inferior spines, no lateral spines.

*Pedipalp.*—Femur above with 1 inner (subapical) and 1·2 superior spines in distal half; patella without spines; tibia much shorter than tarsus and shorter than patella, seen from above; tarsus and process

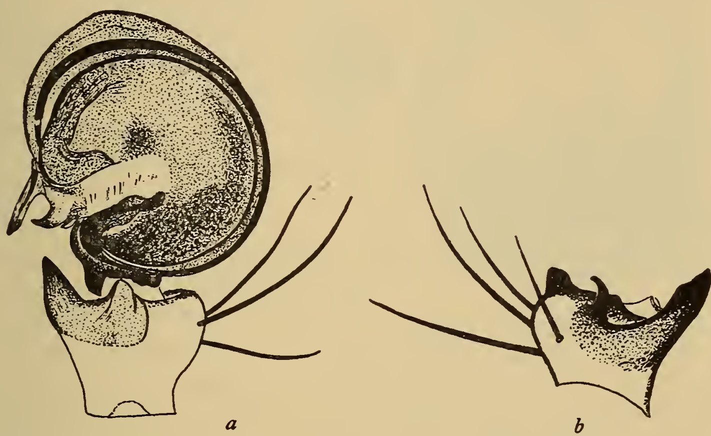


Fig. 9.—*Selenops alticolus* n. sp. *a*, pedipalp, ♂, from in front. *b*, tibia of pedipalp from the side.

of tibia as in fig. 9, *a*, seen from in front, process of tibia from outer side as in fig. 9, *b*.

*Dimensions.*—Length of carapace 3, total length 6·8 mm.

### *Selenops atomarius* Simon (fig. 10).

*S. atomarius* Simon. Bull. Soc. Zool. France, vol. xii, p. 466, 1887.

♀ *Colour.*—The specimens much bleached, legs with fairly distinct dark bands, abdomen yellow, its dorsal surface with chevron markings, the sides with numerous minute blackish dots increasing in number and size posteriorly.

*Eyes.*—Medians strongly recurved, a line touching the upper surfaces of the anteriors only cutting a small part of the posterior medians; anterior medians about $\frac{3}{4}$ the diameter of the posterior medians, a little more than their own diameter apart, and less than half a radius from the posterior medians; posterior medians a little more than half the diameter of the posterior laterals; anterior medians $\frac{2}{3}$ their diameter from the edge of clypeus.

*Chelicerae* with 2 moderate subequal teeth, twice their basal width from each other.

*Vulva* as in fig. 10, *a*, resembling that of *S. hewitti* and remarkable for its extremely small size.

*Legs.*—Anterior tibiae with 5, anterior metatarsi with 3 pairs of inferior spines.

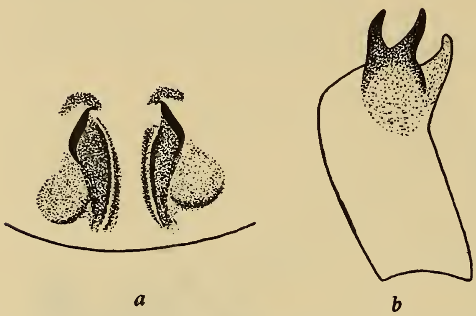



Fig. 10.—*Selenops atomarius* Simon. *a*, ♀, vulva. *b*, tibia of pedipalp, ♂, from outer side.

*Dimensions.* — Length of carapace 3·7, total length 9·5 mm.

♂ *Colour* as in the ♀, the legs, however, without, or with weaker markings, median eyes differing less in size than in the ♀, anterior medians their own diameter apart.

*Chelicerae.* — Inferior margin with 2 teeth, the basal one a little smaller and 2–3 times its width from the apical tooth.

*Legs.*—Anterior tibiae with 5 inferior pairs of spines, II with 1 posterior lateral spine in addition, anterior metatarsi with 3 inferior pairs of spines, 0 lateral spines.

*Pedipalp.*—Femur with 1 inner, 1·2 superior and 0 outer spines in its distal half; patella with 1 inner and 1 superior (apical) spine; tibia subequal to tarsus and distinctly longer than patella, with 3 processes on the outer side, two directed forwards and one downwards and forwards, fig. 10, *b*. This figure agrees substantially with that of Simon in "Hist. Nat. des Araignees," vol. ii, p. 27, text-fig. 23, 1897.

*Dimensions.*—Length of carapace 3·7, total length 8 mm.

*Specimens.*—3 ♀♀, 1 ♂, Port Elizabeth (S.A.M., 4524). Pocock records it from Grahamstown.

*Selenops barnardi* n. sp. (fig. 11).

*Type*, 1 ♀, Pokwani, South Rhodesia (S.A.M., 14667).

*Colour.*—Carapace fairly dark reddish brown, cephalic a little darker than thoracic portion, ocular area black, radiations from the thoracic stria not strongly marked, a number of submarginal spots subjoined to form a wavy band; mandibles a little darker than cephalic area; abdomen above blackish brown, with some ill-defined symmetrical markings; legs with well-defined and fairly strong bands.

*Eyes.*—Medians well recurved, a line touching the upper surfaces of the anteriors passing well below the centres of the posterior medians; anterior medians about half as large as posterior medians, their own diameter apart and less than a radius from the posterior medians; posterior medians $\frac{2}{3}$ the diameter of the posterior laterals; anterior medians their diameter, or a little less, from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 equal-sized teeth separated by their basal width.

*Legs.*—Tibia I and II with 5, metatarsus I and II with 3 pairs of inferior spines.

*Vulva* as in fig. 11.

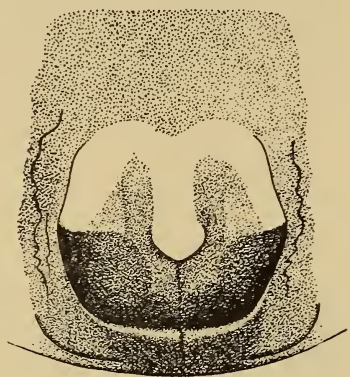


FIG. 11.—*Selenops barnardi* n. sp. ♀, vulva.

*Dimensions.*—Length of carapace 4·9, width of carapace 5·6, total length 10·3 mm.

*Selenops bechuanicus* n. sp. (fig. 12).

*Types*, 1 ♀, 1 ♂, Vryburg, Bechuanaland (S.A.M., 14506).

♀ *Colour.*—Carapace yellow-brown, narrowly bordered with black and prettily variegated with symmetrical brown markings, an oval patch on each side of the thoracic stria without markings; mandibles light yellow-brown, a narrow inner and outer dark stripe on their anterior surfaces; abdomen yellow-brown with indistinct symmetrical markings; legs with distinct dark bands, those of the femora mottled and irregular, those of the tibiae clearly defined.

*Eyes.*—Median eyes moderately recurved, a line touching the upper surfaces of the anteriors passing well below the centres of the posterior medians; anterior medians $\frac{2}{3}$ the diameter of the posterior medians, their own diameter apart, and half a radius from the posterior medians; posterior medians $\frac{1}{2}$–$\frac{2}{3}$ the diameter of the posterior laterals; anterior medians their diameter from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 subequal teeth separated by $1\frac{1}{2}$ times their width.

*Vulva* as in fig. 12, *a*.

*Legs.*—Tibia I and II with 5, metatarsus I and II with 3 pairs of inferior spines.

*Dimensions.*—Length of carapace 3·6, length of abdomen 6·5 mm.

♂.—Dark bands of the legs not as well defined as in the ♀. Tibiae and metatarsi of anterior legs with 2 lateral spines on each side in addition to the inferior ones. Otherwise as in description of ♀.

*Pedipalp.*—Femur above with 1·4 spines in distal half; patella with 1 superior and 1 inner spine; tibia a little shorter than patella, less than half as long as tarsus, seen from the outer side with process as

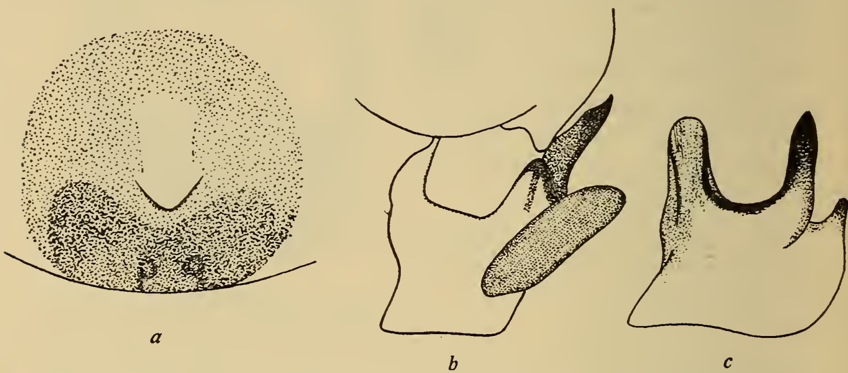


FIG. 12.—*Selenops bechuanicus* n. sp. *a*, ♀, vulva. *b*, *c*, tibia of pedipalp, ♂, from in front, and from outer side.

in fig. 12, *c*, seen from in front fig. 12, *b*. Tarsus seen from in front with style describing an almost complete circle on the outer periphery.

*Dimensions.*—Length of carapace 4·5, total length 9·5 mm.

### *Selenops broomi* Pocock (fig. 13).

*S. broomi* Pocock. A.M.N.H. (7), vol. vi, p. 331, 1900.

The type was a ♀ from Garies, Little Namaqualand, no figure being given of the vulva.

♀ *Colour.*—Carapace reddish brown, the thoracic stria black and strongly defined, continued on to the cephalic portion as a very fine black line, radiations from thoracic stria long, fine, but distinct; mandibles darker than carapace; abdomen light brown, with some short (longitudinal) black bars and spots, a wavy transverse blackish band above the spinners; legs with dark bands, those on the femora poorly defined, especially the posterior ones, those of the tibia well defined.

*Eyes.*—Median eyes not strongly recurved, a line touching the upper surfaces of the anteriors passing between the centres and lower surfaces of the posterior medians; anterior medians $\frac{2}{3}$ the diameter of the posterior medians, a little more than their diameter apart, and their radius from the posterior medians; posterior medians half the diameter of the posterior laterals, which are large and prominent; anterior medians $\frac{2}{3}$ their diameter from the edge of the clypeus.

*Chelicerae.*—Inferior margin with 2 teeth, the basal one distinctly larger than the other and separated from it by its width.

*Vulva* as in fig. 13, *a*.

*Legs.*—Anterior tibiae with 5, anterior metatarsi with 3 pairs of inferior spines.

*Dimensions.*—Length of carapace 6·6, length of abdomen 8·1 mm.

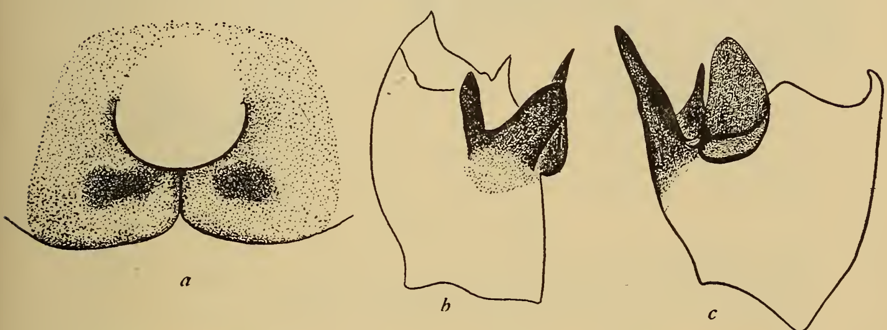



Fig. 13.—*Selenops broomi* Pocock. *a*, ♀, vulva. *b*, *c*, tibia of pedipalp, ♂, from outer side, and from in front.

♂ *Colour.*—Much lighter than in ♀, carapace and mandibles yellow; legs yellow, without markings.

*Eyes.*—Anterior medians half the diameter of posterior medians and their radius or a very little more from the edge of clypeus; otherwise as in the ♀.

*Chelicerae.*—Inferior margin with 2 equal-sized teeth, $1\frac{1}{2}$ times their basal width from each other.

*Legs.*—Anterior tibiae with 5 inferior pairs of spines, 2 lateral spines on each side and 3 superior spines; anterior metatarsi with 3 inferior pairs of spines, I with 2 lateral spines on each side in basal half, II with 2 lateral spines on each side in basal half and 2 superior spines in basal half.

*Pedipalp.*—Femur with 1 inner, 1·2 superior, and 1 outer spine in distal half, patella with 1 inner and 2 superior spines, tibia with 1 inner, 2 superior, and 1 very strong outer spine; tibia subequal to tarsus but longer than patella, with 3 processes at its outer apex, seen from in front as in fig. 13, *c*, and from the outer side, fig. 13, *b*.

*Dimensions.*—Length of carapace 4·8, total length 9·8 mm.

*Specimens*, 4 ♀♀, 2 ♂♂, Kleinzee, Little Namaqualand (S.A.M., 8871).

*Selenops caledonicus* n. sp. (fig. 14).

*Types*, 2 ♀♀, Caledon, Cape Province (S.A.M., 150421).

*Colour.*—Carapace light yellow-brown with a Y-shaped darker marking formed by the thoracic stria and posterior boundaries of the cephalic area, a few small dark spots half-way between the stria and lateral margins; mandibles similar in colour to the carapace; abdomen above with 3 pairs of short curved blackish bars; well-defined brown bands on femora and tibiae of all legs.

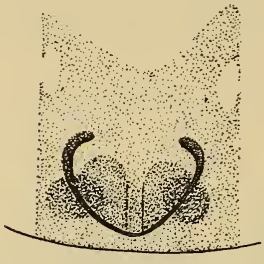


Fig. 14.—*Selenops caledonicus* n. sp. ♀, vulva.

*Eyes.*—Medians moderately recurved, a line touching the upper surfaces of the anteriors passing half-way between the centres and lower surfaces of the posterior medians; anterior medians $\frac{2}{3}$ the diameter of the posterior medians, their own diameter apart, and a radius from the posterior medians; posterior medians $\frac{3}{4}$ the diameter of the posterior laterals; anterior medians a little less than their diameter from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 strong teeth, the basal a little stouter than the apical one and its own width from it.

*Vulva* as in fig. 14.

*Legs.*—Tibia I and II with 5, metatarsus I and II with 3 pairs of inferior spines.

*Dimensions.*—Length of carapace 3·3, total length 7·8 mm.

*Selenops civicus* n. sp. (fig. 15).

*Type*, 1 ♀, Burghersdorp (S.A.M., B. 76).

*Colour.*—In general resembling that of *karrooicus*, the markings of the carapace forming a fairly well-defined crenulated submarginal band, sides with a narrow blackish margin and between this and the submarginal band some blackish-brown spots; foveal radiations indistinct, legs with markings as in *karrooicus*; abdomen above with some indistinct brown markings on the posterior half, including some indistinct Λ-shaped markings.

*Eyes.*—Median eyes distinctly recurved, a line touching the upper boundaries of the anteriors passing well below the centres of the posterior medians; anterior medians a little more than their diameter apart, their radius from the posterior medians and two-thirds as large as these; posterior medians less than half the diameter of the posterior laterals; anterior medians a little less than their diameter from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 subequal teeth separated by a distance equal to their width.

*Legs.*—Tibia I and II with 5, metatarsus I and II with 3 pairs of inferior spines.

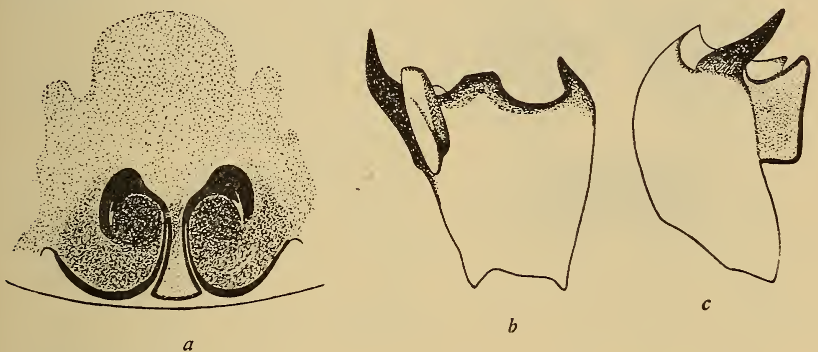



Fig. 15.—*Selenops civicus* n. sp. *a*, ♀, vulva. *b, c*, tibia of pedipalp, ♂, from in front, and from outer side.

*Vulva* as in fig. 15, *a*.

*Dimensions.*—Length of carapace 4·8, width of carapace 5·8, total length 12·5 mm.

*Other Specimens.*—2 ♀♀, 4 juveniles, and 2 ♂♂ from Smithfield, O.F.S. (S.A.M., B. 465).

The following is a description of one of the two males from Smithfield:—

♂ *Colour.*—Much lighter than in the ♀, the markings of the legs almost absent; teeth of inferior margin of chelicerae separated by twice the basal width of the apical tooth.

*Legs.*—Tibia I and II with 5 pairs of inferior spines; I with 1 anterior lateral, 2 posterior lateral, and 1 superior spine in addition; II with 2 anterior lateral, 2 posterior lateral, 2 superior spines in addition; metatarsus I and II with 3 pairs of inferior spines and 1 posterior lateral spine near the base.

*Pedipalp.*—Femur with 1 inner, 1·2 superior, and 1 outer spine in distal half, the inner and outer spines much weaker than the others; tibia subequal to patella and much shorter than tarsus, as in fig. 15, *b*, seen from in front, fig. 15, *c*, seen from outer side; 3 long spines on its inner side.

*Dimensions.*—Length of carapace 4·2, width 4·5, total length 7·5 mm.

*Selenops helenae* n. sp. (fig. 16).

*Type*, 1 ♀, St. Helena Bay, Cape Province (S.A.M., 11717).

*Colour.*—Carapace light reddish brown, ornamented with minute black specks and larger blackish spots, a tuft of white hairs above and overhanging the anterior median eyes; mandibles the same colour as the carapace; abdomen above brown with some rather ill-defined symmetrical darker markings; anterior legs with brown bands, posterior ones without.

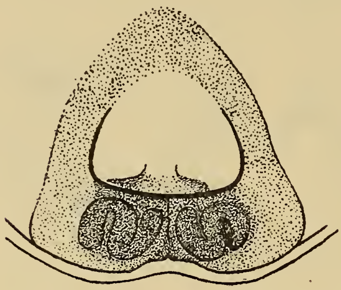


FIG. 16.—*Selenops helenae* n. sp. ♀, vulva.

*Eyes.*—Median eyes moderately recurved, a line touching the upper surfaces of the anteriors passing well below the centres of the posterior medians; anterior medians half, or a little more, the diameter of the posterior medians, a little more than their own diameter apart and a radius from the posterior medians; posterior medians subequal to posterior laterals; anterior medians about $\frac{3}{4}$ their diameter from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 strong subequal teeth separated by twice their width.

*Vulva* as in fig. 16.

*Legs.*—Tibiae I and II with 5, metatarsus I and II with 3 pairs of inferior spines.

*Dimensions.*—Length of carapace 3·5, length of abdomen 4 mm.

*Other Specimens.*—2 juveniles, Stompneus, St. Helena Bay (S.A.M., 11677), and 1 adult ♀ from the same locality (S.A.M., 11666).

*Selenops hessei* n. sp. (fig. 17).

*Type*, 1 ♀, Matjesfontein, Cape Province (S.A.M., 1665).

*Colour.*—Carapace reddish brown with a fine blackish marginal border, cephalic portion darker than the thoracic portion; thoracic stria and its radiations distinct, the remaining markings somewhat vague; chelicerae dark reddish brown, abdomen rubbed but apparently with a number of blackish-brown spots near the spinners; femora of legs with ill-defined banded markings, those of the tibiae more distinct, metatarsi dark brown.

*Eyes.*—Median eyes distinctly recurved, a line touching the upper margin of the anteriors passing well below the centres of the posteriors; anterior medians a little more than half the diameter of the posterior medians, more than their own diameter apart and about a radius from the posterior medians; posterior medians half the diameter of the posterior laterals; anterior medians a little less than a diameter from the edge of the clypeus.

FIG. 17.—*Selenops hessei* n. sp. ♀, vulva.

*Chelicerae.* — Inferior margin with 2 subequal teeth separated by the width of the basal tooth.

*Legs.*—Tibia I and II with 5, metatarsus I and II with 3 pairs of inferior spines.

*Vulva* as in fig. 17.

*Dimensions.*—Length of carapace 5·5, width of carapace 6·4, length of abdomen 8·3 mm.

*Other Specimens.*—3 ♀♀, Matjesfontein (S.A.M., 13119); 1 ♀, Prince Albert (S.A.M., 3919).

### *Selenops hewitti* n. sp. (fig. 18).

*Types*, 3 ♀♀, Grahamstown (Albany Museum).

♀ *Colour.*—Carapace light brown with a narrow black margin; stria and some fine radiations from it black, some spots close to the lateral margins black, a pair of short anteriorly diverging black bars behind the posterior median eyes; mandibles light reddish brown; abdomen above with two transverse black recurved markings in its posterior half, area above the spinners blackish; legs with strong black bars, especially on the femur and base of tibia, these much fainter in the posterior legs.

*Eyes.*—Anterior row strongly recurved, a line joining the upper surfaces of the anterior medians passing well below the centres of the posterior medians; anterior medians $\frac{2}{3}$ the size of the posterior medians, $\frac{3}{4}$ their own diameter apart and about half a radius from the posteriors; posterior medians half as large as posterior laterals; anterior medians about their radius from the edge of the clypeus.

*Chelicerae.*—Inferior margin with 2 large subequal teeth, $1\frac{1}{2}$ times their width from each other.

*Vulva* as in fig. 18, *a*.

*Legs.*—Tibia I and II with 5, metatarsi I and II with 3 pairs of inferior spines.

*Dimensions.*—Length of carapace 3·2, total length 9·4 mm.

*Other Specimens.*—1 ♂, 2 ♀♀, Grahamstown (B. 8274, S.A.M.); 1 ♂, Grahamstown (S.A.M., 5755). The Transvaal Museum has 2 ♀♀ from the same locality (8280).

The following is a description of an adult ♂ from Grahamstown (5755).

♂ *Colour.*—Carapace (bleached) light yellow-brown, thoracic stria long and narrow, continued on to the cephalic area as a fine median

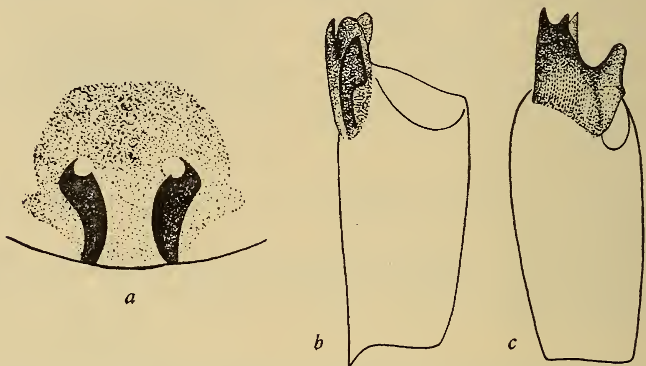



FIG. 18.—*Selenops hewitti* n. sp. *a*, ♀, vulva. *b*, *c*, tibia of pedipalp, ♂, from in front, and from outer side.

line, a few faint radiations from the stria; mandibles a little darker than carapace; abdomen above with some ill-defined symmetrical markings, legs apparently without spots or bands, light yellow.

*Eyes.*—Median eyes fairly strongly recurved, a line touching the upper surfaces of the anteriors passing half-way between the lower surfaces and centres of the posterior medians; anterior medians subequal to posterior medians (more than $\frac{3}{4}$ their diameter), their own diameter apart and almost touching the posterior medians (less than half a radius from them); posterior medians a little more than half the diameter of the posterior laterals; anterior medians a little less than their diameter from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 equal-sized teeth distinctly smaller than those of the superior margin, $1\frac{1}{2}$–2 their width from each other.

*Legs.*—Tibia I and II with 5 pairs of inferior spines and 2 lateral spines on each side, metatarsus I and II with 3 pairs of inferior spines and without lateral spines.

*Pedipalp.*—Femur above with 1 inner, 3 superior, 0 outer spines; patella with 1 inner basal, 1 apical and 1 basal superior spines; tibia long and parallel-sided, subequal to or a little longer than tarsus, with process as in fig. 18, *b*, seen from in front, and fig. 18, *c*, from outer side.

*Dimensions.*—Length of carapace 3·8, total length 8 mm.

*Selenops immaculatus* n. sp. (fig. 19).

*Type*, 1 ♂, Florida, Transvaal (S.A.M., B. 4505).

*Colour.*—Carapace yellow-brown, thoracic stria and some very faint radiations from it a little darker, eyes surrounded by a blackened area; mandibles yellow-brown; abdomen yellow with a few blackish brown spots; legs without markings except for two very faint brown bands on the anterior tibiae.

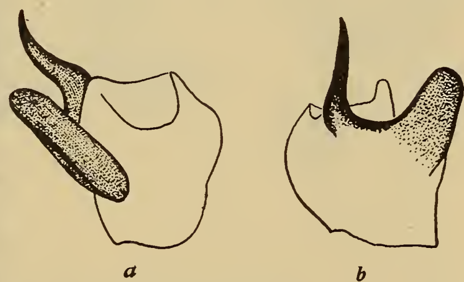


Fig. 19.—*Selenops immaculatus* n. sp. *a*, *b*, tibia of pedipalp, ♂, from in front, and from outer side.

*Eyes.*—Medians moderately recurved, a line touching the upper surfaces of the anteriors passing a little below the centres of the posterior medians; anterior medians $\frac{2}{3}$ the diameter of the posterior medians, a little less than their own diameter apart, and less than a radius from the posterior medians; posterior medians $\frac{2}{3}$ the diameter of the posterior laterals; anterior medians about $\frac{2}{3}$ their diameter from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 subequal teeth separated by $1\frac{1}{2}$ times their width.

*Legs.*—Tibia I and II with 5 pairs of inferior spines and 2 lateral spines on each side, metatarsus I and II with 3 inferior pairs and 1 lateral spine on each side.

*Pedipalp.*—Femur with 1 outer, 3 superior, and 1 inner spine in apical half; patella with 1 outer and 1 inner spine near its base above, and 1 superior apical spine; process of tibia as in fig. 19, *a*, seen from in front, and fig. 19, *b*, seen from the outer side. Tibia subequal to patella, less than half the length of tarsus.

*Dimensions.*—Length of carapace 3·9, total length 8·5 mm.

*Selenops karrooicus* n. sp. (fig. 20).

*Types*, 7 ♀♀, 4 ♂♂, Hanover, Cape Province (S.A.M., 9499).

♀ *Colour.*—Carapace light reddish brown, sides narrowly bordered with black, ocular area blackish, thoracic portion with irregular

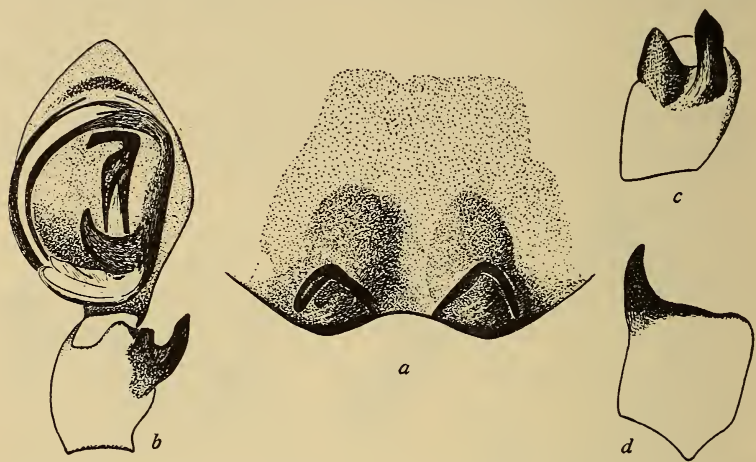



FIG. 20.—*Selenops karrooicus* n. sp. *a*, ♀, vulva. *b*, pedipalp, ♂. *c*, *d*, tibia of pedipalp from outer side, and from behind.

stripes and spots, the radii from the thoracic stria blackish but incomplete; cephalic portion bordered by narrow blackish lines and bisected by a narrow line; mandibles reddish brown; abdomen dull white or yellow dorsally, with symmetrical light-brown markings in the middle line, a darker -shaped transverse marking just above the spinners. Legs yellow, strongly banded with black except on their ventral surfaces; femora with 3 black bands, patellae with 1 basal band, tibiae with 2 bands.

*Eyes.*—Medians well recurved, a line touching the upper surfaces of the anteriors passing well below the centres of the posterior medians; anterior medians $\frac{2}{3}$ the diameter of the posterior medians, a little more than their own diameter apart and a little less than their radius from the posterior medians; posterior medians half or a little less than half the diameter of posterior laterals; anterior medians $\frac{2}{3}$ their diameter from the edge of the clypeus.

*Chelicerae.*—Inferior margin with 2 equal-sized teeth separated by their basal width.

*Legs.*—Tibia I and II with 5, metatarsus I and II with 3 pairs of inferior spines.

Abdomen large, subquadrate, truncate anterior and posteriorly, wider behind than in front.

*Vulva* as in fig. 20, *a*.

*Dimensions.*—Length of carapace 5·6, width 6·6, total length 17·4 mm.

♂ *Colour* much lighter than in ♀, legs without strong black bands. Inferior margin of chelicerae with 2 teeth, the apical one a little larger, $1\frac{1}{2}$ times its width from the basal tooth. Eyes as in ♀.

*Legs.*—Tibia I and II with 5 inferior pairs of spines and 2 lateral spines on their posterior surfaces (occasionally also on the anterior surfaces); sometimes in addition 1 or 2 superior spines; anterior metatarsi with or without 1–2 lateral spines on their posterior surfaces and 3 pairs of inferior spines.

*Pedipalp.*—Femur with 1 inner, 1·2 superior, but no outer spine in apical half; tibia subequal to patella, much shorter than tarsus, with 2 long spines on its inner surface; apophysis of tibia bilobed as in fig. 20, *b*, seen from in front, fig. 20, *c*, seen from the outer side, and fig. 20, *d*, seen from behind.

*Dimensions.*—Length of carapace 4·6, width 5·2, total length 9 mm.

*Other Specimens.*—From the same locality, 1 ♀, 1 ♂ (S.A.M., 11945); 2 ♂♂ (S.A.M., 11875); 1 ♀ (S.A.M., 11853); from Naauwpoort, 3 ♂♂, 5 ♀♀ (B. 1594, S.A.M.).

### *Selenops lesserti* n. sp. (fig. 21).

*Type*, 1 ♂, Touws River, Worcester, Cape Province (S.A.M., B. 7541).

*Colour.*—Carapace orange-yellow with the thoracic stria and its radiations a little darker; mandibles much darker than carapace, reddish brown; abdomen light yellow-brown above, with minute scattered black dots and a wavy transverse black stripe above the spinners; legs apparently without markings or bands of any kind.

*Eyes.*—Medians not strongly recurved, a line touching the upper surfaces of the anteriors passing a little below the centres of the posterior medians; anterior medians about $\frac{3}{4}$ the diameter of the posterior medians, a little less than their own diameter apart, and about half a radius from the posterior medians; posterior medians half or even less the diameter of the posterior laterals; anterior medians a little more than their radius from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 strong equal-sized teeth separated by $1–1\frac{1}{2}$ times their basal width.

*Legs.*—Tibia I and II with 5 pairs of extremely long inferior spines, 2 lateral spines on each side, and 3 superior spines in proximal half; metatarsus I and II with 3 pairs of long inferior spines and 2 lateral spines on each side in proximal half.

*Pedipalp.*—Femur with 1 inner, 3 superior, 1 outer spines in distal half; patella without spines; tibia shorter than either patella or tarsus, with processes as in fig. 21, *a*, seen from in front, and fig. 21, *b*, seen from the outer side. Pedipalp unusually large for a species of Group B.

*Dimensions.* — Length of carapace 5·2, total length 10·2 mm.

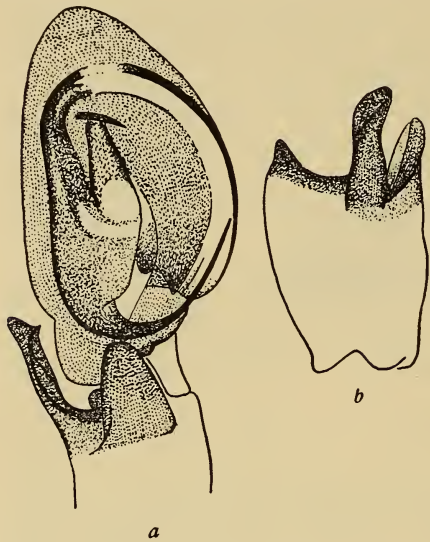



FIG. 21.—*Selenops lesserti* n. sp. *a*, pedipalp, ♂, from in front. *b*, tibia of pedipalp from outer side.

*Selenops lignicolus* Lawrence.

*S. lignicolus* Lawrence. Ann. Natal Mus., vol. viii, pt. 2, p. 239, fig. 14, *a–c*, 1937.

The types were described from Hluhluwe, Zululand, and were based on 2 ♀♀ and a ♂ specimen.

*Selenops longipes* n. sp. (fig. 22).

*Types*, 2 ♀♀, 1 immature ♂, Johannesburg (S.A.M., 150495).

*Colour.*—Specimens somewhat bleached. Carapace light yellow-brown with indistinct spots and mottling, boundaries of cephalic area and stria a little darker, areas surrounding the eyes blackish, mandibles not darker than carapace; abdomen above with indistinct spots and mottling in the anterior half, two black bow-shaped transverse bars in posterior half; legs with indistinct blackish brown bands, those at the bases of the anterior tibiae and femora well defined.

*Eyes.*—Medians forming a weakly recurved row, a line joining the upper surfaces of the anteriors passing through or just below the centres of the posterior medians; anterior medians $\frac{2}{3}$ the diameter of the posterior medians, their own diameter apart, and a little less than a radius from the posterior medians; posterior medians about $\frac{3}{4}$ the diameter of the posterior laterals; anterior medians a little less than their diameter from the edge of the clypeus.

*Chelicerae.*—Inferior margin with 2 moderate subequal teeth (smaller than those of the superior margin), separated by twice their width.

*Vulva* as in fig. 22.

*Legs.*—Tibia I and II with 5, metatarsus I and II with 3 pairs of inferior spines.

*Dimensions.*—Length of carapace 4·7, total length 9·5 mm.

*Other Specimens.*—1 ♀, Johannesburg (S.A.M., 4206).

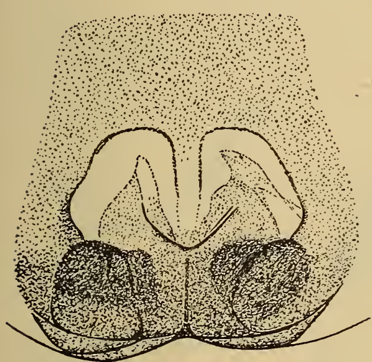


FIG. 22.—*Selenops longipes* n. sp. ♀, vulva.

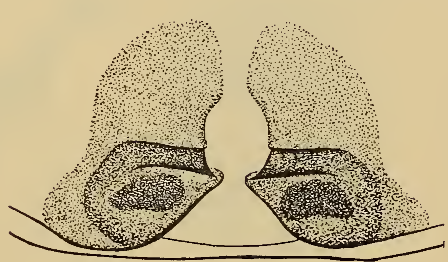


FIG. 23.—*Selenops maculosus* n. sp. ♀, vulva.

*Selenops maculosus*, n. sp. (fig. 23).

*Types*, 2 ♀♀, Willowmore District (S.A.M., 12931).

*Colour.*—Carapace with well-defined radiations from the thoracic stria and crenulated submarginal bands, a well-defined but narrow blackish marginal marking; mandibles reddish brown with some darker markings; abdomen above dirty yellow, with some ill-defined brownish spots and a number of minute dots scattered over its surface; legs with fairly well-defined bands.

*Eyes.*—Median eyes well recurved, a line touching the upper surfaces of the anteriors passing half-way between the centres and the lower surfaces of the posteriors; anterior medians $\frac{2}{3}$ the size of the posterior medians, a little more than their own diameter apart, and less than their radius from the posterior medians; posterior medians half the diameter of posterior laterals; anterior medians about a radius from the edge of the clypeus.

*Chelicerae.*—Inferior margin with 2 large subequal teeth separated by a little less than their basal width.

*Legs.*—Tibia I and II with 5, metatarsus I and II with 3 pairs of inferior spines.

*Vulva* as in fig. 23.

*Dimensions.*—Length of carapace 4·7, width 5·3, length of abdomen 6·4 mm.

*Other Specimens.*—4 ♀♀, Beaufort West (B. 1634, B. 1930, S.A.M.).

*Selenops minor* n. sp. (fig. 24).

*Types,* 1 ♀, 1 ♂, Empangeni, Zululand (T.M., 6389).

♀ *Colour.*—Carapace brown with a very broad blackish-brown marginal band, crenulated along its inner margin and including some


Fig. 24.—*Selenops minor* n. sp. *a*, ♀, vulva. *b*, *c*, tibia of pedipalp, ♂, from in front, and from outer side.

light brown spots; the lighter inner portion of the carapace without distinct radiations from the thoracic stria, a V-shaped blackish marking behind the eyes, the cephalic portion with a narrow blackish margin; mandibles blackish brown; abdomen blackish, variegated with a few symmetrically arranged lighter spots, a large pair just anterior to the posterior margin, some minute black spots at the sides of the under surface; femora of legs with only one complete well-defined band in the middle, the other two bands represented by blotches and spots.

*Eyes.*—Median eyes recurved but not strongly so, a line touching the upper surfaces of the anteriors passing below the centres of the posterior medians; anterior medians $\frac{2}{3}$ the posterior medians, a little less than their own diameter apart, and a radius from the posterior medians; posterior medians about $\frac{3}{4}$ the diameter of the posterior laterals; anterior medians about a radius from the edge of the clypeus.

*Chelicerae.*—Inferior margin with 2 strong subequal teeth separated by their basal width.

*Legs.*—Tibia I and II with 5 pairs of inferior spines, metatarsus I and II with 3 pairs of inferior spines.

*Vulva* as in fig. 24, *a*.

*Dimensions.*—Length of carapace 3·1, width 3·4, length of abdomen 4·2 mm.

♂ *Colour* as in the ♀ but a little lighter, legs without black bands; tibia I and II with 5 pairs of inferior spines and 2 lateral spines on their posterior surfaces; metatarsus I and II with 3 pairs of inferior spines and no lateral spines.

*Pedipalp.*—Femur with 1 outer, 1·2 superior, and 1 inner spine in apical half; patella with 1 or 2 spines; tibia shorter than patella and about half the length of tarsus, with 4 superior spines; tibial apophysis as in fig. 24, *b*, seen from in front, as in fig. 24, *c*, seen from the outer side.

*Dimensions.*—Total length 5·2 mm.

### *Selenops minutus* n. sp. (fig. 25).

*Type*, 1 ♂, Grahamstown (S.A.M., B. 2409).

*Colour.*—Carapace reddish brown, with some confused submarginal markings, thoracic stria continued as a Y-shaped marking, cephalic area divided by a very faint narrow blackish stripe, eyes surrounded by blackened areas; mandibles reddish brown; abdomen light brown, a broad, sharply defined, procurved band above the spinners, this transverse band whitish and contrasting strongly with the remainder of abdomen; legs with some confused mottlings but no definite bands.

Fig. 25.—*Selenops minutus* n. sp. Tibia of pedipalp, ♂. *a*, from outer side, and *b*, from in front.

*Eyes.*—Medians not strongly recurved, a line touching the upper surfaces of the anteriors passing well below the centres of the posterior medians; anterior medians $1\frac{1}{2}$ times their own diameter apart and a radius from the posterior medians; posterior medians $\frac{2}{3}$ the diameter of the posterior laterals; anterior medians a little less than a diameter from the edge of the clypeus.

*Chelicerae.*—Inferior margin with 2 moderate equal-sized teeth, 2–3 times their width from each other.

*Legs.*—Tibia I and II with 5, metatarsus I and II with 3 pairs of inferior spines; no lateral spines.

*Pedipalp.*—Femur with 1 inner apical and 3 superior spines, patella without spines; tibia much shorter than tarsus but subequal to the patella, external process seen from in front as in fig. 25, *b*, from outer side as in fig. 25, *a*.

*Dimensions.*—Length of carapace 2·3, total length 5·2 mm.

### *Selenops namaquensis* n. sp. (fig. 26).

*Types*, 1 ♀, 1 ♂, Lekkersing, Little Namaqualand (S.A.M., B. 8493).

♀ *Colour.*—Carapace light reddish brown, the cuneiform thoracic stria with fine long black radiations from it, a short black bar behind


FIG. 26.—*Selenops namaquensis* n. sp. *a*, ♀, vulva. *b*, *c*, tibia of pedipalp, ♂, from outer side, and from in front.

each posterior lateral eye, an indistinct row of brown submarginal dots; mandibles a little darker than carapace; abdomen above light brown, darker posteriorly, with minute scattered black dots and a few large symmetrical spots above the spinners; legs differing from all the other species of this group in having one instead of two black bands on the tibiae, occupying the basal two-thirds of the segment, femora with vague brownish blotches; sides of patellae black, the remainder brown; anterior metatarsi black, the posterior ones lighter.

*Eyes.*—Medians weakly recurved, a line touching the upper surfaces of the anteriors passing through or a little below the centres of the posterior medians; anterior medians half the diameter of the posterior medians, a little more than their own diameter apart, and a radius from the posterior medians; posterior medians half or even a little less the diameter of the posterior laterals; anterior medians $\frac{2}{3}$ their diameter from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 large equal-sized teeth, their basal width from each other.

*Vulva* as in fig. 26, *a*.

*Legs.*—Anterior tibiae with 5, anterior metatarsi with 3 inferior pairs of spines.

*Dimensions.*—Length of carapace 4·8, total length 11 mm.

♂ *Colour* in general yellow; mandibles dark reddish brown, contrasting strongly with the carapace; abdomen above with minute scattered black dots; legs yellow, anterior metatarsi distinctly darker than remaining segments.

*Eyes* as in ♀, the anterior medians a little less than their diameter apart, and less than their radius from the posterior medians; posterior medians less than half the diameter of the posterior laterals.

*Chelicerae.*—Inferior margin with 2 equal-sized teeth, 2–2½ times their basal width from each other.

*Legs.*—Anterior tibiae with 5 pairs of inferior spines, 2 lateral spines on each side, and 3 superior spines; anterior metatarsi with 3 inferior pairs of spines, and 2 lateral spines on each side.

*Pedipalp.*—Femur above with 1 inner, 1·2 superior, and 1 outer spine in apical half; patella with 3–4 long setae; tibia with 4 long spines, 1 outer and 3 inner; tibia longer than patella but distinctly shorter than tarsus, with the external process as in fig. 26, *c*, seen from in front, and fig. 26, *b*, seen from outer side.

*Dimensions.*—Length of carapace 4·8 mm., total length 9·2 mm.

### *Selenops pococki* n. sp. (fig. 27).

*Type*, 1 ♂, Lydenburg, Transvaal (T.M., 2372).

*Colour.*—Carapace dark brown with numerous darker spots and radiations, ocular area black; mandibles a little darker than carapace; abdomen yellow with blackish-brown symmetrical markings; legs with weak, ill-defined, and confused markings, those of the femora strongest, those of the posterior legs almost obsolete.


*a* *b*

Fig. 27.—*Selenops pococki* n. sp. Tibia of pedipalp, ♂. *a*, from in front, and *b*, from outer side.

*Eyes.*—Median eyes not strongly recurved, a line touching the upper surfaces of the anteriors passing a little below the centres of the posterior medians; anterior medians a little more than half the diameter of the posterior medians, their own diameter apart, and about half a radius from the posterior medians; posterior medians a little more than half the diameter of the posterior laterals; anterior medians ⅔ their diameter from the edge of the clypeus.

*Chelicerae.*—Inferior margin with 2 teeth, the basal one a little larger, $1\frac{1}{2}$ times its width from the other tooth.

*Legs.*—Tibia I and II with 5 pairs of inferior spines, 2 lateral spines on each side, and 3 superior spines; metatarsus I and II with 3 pairs of inferior spines and 2 lateral spines on each side.

*Pedipalp.*—Femur with 1 inner, 1·2 superior, and 1 outer spine in distal half, patella and tibia with long spine-like setae; tibia distinctly shorter than patella and much shorter than tarsus, with its external apophysis as in fig. 27, *a*, seen from in front, fig. 27, *b*, seen from outer side.

*Dimensions.*—Length of carapace 4·2, total length 9·4 mm.

This species closely resembles *S. minor*, from Empangeni, Zululand, in the tibial apophysis of the ♂ pedipalp.

### *Selenops purcelli* n. sp. (fig. 28).

*Type*, 1 ♀, Montagu Baths, Cape Province (S.A.M., 12675).

*Colour.*—Specimen probably rather faded. Carapace yellow-brown with a blackish marginal border, thoracic stria brown, a number of short blackish stripes near the lateral margins directed towards, but not connected with the stria, cephalic portion defined posteriorly by a blackish V-shaped marking; from posterior apex of cephalic portion to just behind the anterior median eyes a very fine black stripe bisecting the carapace; mandible with 2 or 3 longitudinal blackish stripes; abdomen blackish brown above, rather rubbed, but with a clearly defined broad V-shaped marking above the spinners; legs with large black blotches on the antero-inferior surfaces of the anterior femora, and wide brown bands on the tibia, these markings becoming fainter in the posterior legs.

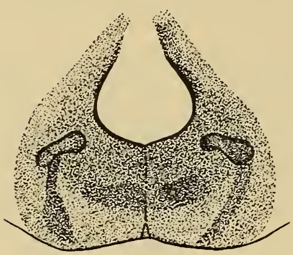


Fig. 28.—*Selenops purcelli* n. sp. ♀, vulva.

*Eyes.*—Medians strongly recurved, a line joining the upper surface of the anterior medians passing a little above the lower surfaces of the posterior medians; anterior medians $\frac{2}{3}$ as large as posterior medians, $1\frac{1}{4}$ times their own diameter apart, and a little less than their radius from the posterior medians; posterior medians equal to the posterior laterals in size; anterior medians a little less than their diameter from the edge of the clypeus.

*Chelicerae.*—Inferior margin with 2 rather small subequal teeth, separated by about $1\frac{1}{2}$ times their width.

*Vulva* as in fig. 28.

*Legs.*—Tibia I and II with 5, metatarsus I and II with 3 pairs of inferior spines.

*Dimensions.*—Length of carapace 3·1, total length 8 mm.

### *Selenops schonlandi* Pocock (fig. 29).

*S. schonlandi* Pocock. A.M.N.H., ser. 7, vol. x, p. 22, pl. iii, fig. 15, 1902.

The ♀ type was from Jansenville, Cape Province.

♀ *Colour.*—Carapace reddish brown with a narrow black margin, cephalic portion a little darker than thoracic portion, a crenulated submarginal marking on thoracic portion blending anteriorly with the darker cephalic portion; thoracic stria cuneiform and dark, with fine blackish radiations, cephalic portion bisected by a fine black line, a branch from the middle of this line running to the base of each posterior median eye; mandibles as dark as the cephalic area; abdomen above thickly covered with blackish-brown symmetrical blotches and markings, the sides more dotted, a broad transverse bow-shaped light marking above the spinners, separated from them by a black wavy transverse bar; legs with strong black bands, as strong on the posterior as on the anterior legs, the bands on the lower surfaces of femora tending to coalesce, forming a continuous stripe in femur IV.

Fig. 29.—*Selenops schonlandi* Pocock. ♀, vulva.

*Eyes.*—Median eyes not strongly recurved, a line touching the upper surfaces of the anterior passing a little below the centres of the posterior medians; anterior medians a little more than half the diameter of the posterior medians, a little less than their own diameter apart, and more than half a radius from the posterior medians; posterior medians half the diameter of posterior laterals which are very large and prominent; anterior medians $\frac{2}{3}$ their diameter from the edge of the clypeus.

*Chelicerae.*—Inferior margin with 2 large equal-sized teeth, twice their basal width from each other.

*Vulva* as in fig. 29. Pocock's figure apparently does not represent the colouring correctly.

*Legs.*—Anterior tibiae with 5, anterior metatarsi with 3 pairs of inferior spines.

*Dimensions.*—Length of carapace 4·2, total length 12·8 mm.; a smaller adult specimen with total length 10·4 mm.

*Specimens.*—3 ♀♀, Graaff Reinet, Cape Province (S.A.M., 12573). Pocock also records it from Pearston and Graaff Reinet.

### *Selenops smithersi* n. sp. (fig. 30).

*Type*, 1 ♂, Morigate, Basutoland (S.A.M., 14424).

*Colour.*—Carapace yellow, variegated with brown markings, a narrow black marginal border; mandibles a little darker than the carapace; abdomen above mottled brown, ornamented with numerous blackish blotches and dots; legs with faint irregular markings and bands.

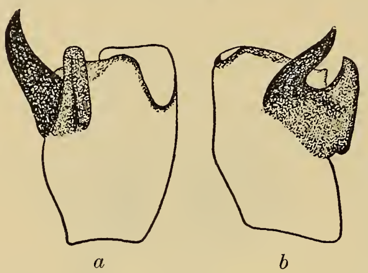


Fig. 30.—*Selenops smithersi* n. sp. Tibia of pedipalp, ♂. *a*, from in front, and *b*, from outer side.

*Eyes.*—Median eyes not strongly recurved, a line touching the upper surfaces of the anteriors passing just below the centres of the posterior medians; anterior medians $\frac{2}{3}$ the diameter of the posterior medians, their own diameter or slightly less apart, and half a radius from the posterior medians; posterior medians half the diameter of the posterior laterals; anterior medians $\frac{2}{3}$ their diameter from the edge of the clypeus.

*Chelicerae.*—Inferior margin with 2 teeth, the basal one a little smaller, separated by 2–2$\frac{1}{2}$ times the width of the apical tooth.

*Legs.*—Tibia I and II with 5 pairs of inferior spines and 1 lateral outer spine near the base, metatarsus I and II with 3 pairs of inferior spines but without lateral spines.

*Pedipalp.*—Femur above with 1 inner, 3 superior, 1 outer spines in its distal half; patella with 1 inner and 1 superior apical spine; tibia with some long spines on the inner side near its base; tibia distinctly shorter than patella or tarsus, as in fig. 30, *a*, seen from in front, and fig. 30, *b*, seen from the outer side.

*Dimensions.*—Length of carapace 3·2, total length 6 mm.

*Selenops thornei* n. sp. (fig. 31).

*Type*, 1 ♀, Cedarberg Mts., Cape Province (S.A.M., 5867).

*Colour.*—Carapace light yellow-brown, a broad margin on each side a little darker, thoracic stria and boundaries of cephalic area clearly defined, the latter bisected by a fine dark line; mandibles infuscated near their apices on anterior surface; abdomen infuscated above, becoming darker posteriorly, a narrow median light stripe in anterior two thirds, and two small, well-defined, circular, whitish patches above the spinners, each containing a minute brown dot; legs without bands but almost the entire anterior surface of femur I (less so in remaining femora) blackish brown.

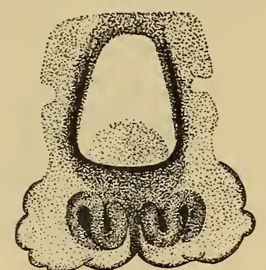


Fig. 31.—*Selenops thornei* n. sp. ♀, vulva.

*Eyes.*—Median eyes moderately recurved, a line touching the lower surfaces of the anteriors passing below the centres of the posterior medians; anterior medians $\frac{2}{3}$ the diameter of posterior medians, their own diameter apart, and less than a radius from the posterior medians; posterior medians fully equal to the posterior laterals in size; anterior medians a diameter from the edge of the clypeus.

*Chelicerae.*—Inferior margin with 2 teeth, the basal distinctly larger than the apical one, separated by twice the width of the basal tooth.

*Vulva* as in fig. 31.

*Legs.*—Tibia I and II with 5 pairs of weak inferior spines, metatarsus I and II with 3 pairs of inferior spines.

*Dimensions.*—Length of carapace 2·4, total length 7·3 mm.

Sub-group $B_3$.

*Key to the species of* Selenops *with* 6 *pairs of inferior tibial spines.*

♀♀.

1. Vulva with distinct lateral sclerites divided by a median septum . . 2.
   Vulva without lateral sclerites, usually a large plate with rounded opening 6.
2. Vulva with a broad median septum . . . . . . . *kraussi.*
   Vulva with a narrow median septum . . . . . . . . 3.
3. Anterior median eyes more than their diameter apart . . . *braunsi.*
   Anterior median eyes less than their diameter apart . . . . 4.
4. Lateral sclerites almost touching in middle line . . . . *montanus.*
   Lateral sclerites further apart . . . . . . . . . 5.

5. Anterior medians subequal to posterior medians . . . . *capensis.*
   Anterior medians half the diameter of posterior medians . *sexspinatus.*
6. Teeth of inferior margin of chelicerae 4 times their width from each other *regalis.*
   Teeth of inferior margin of chelicerae nearer to each other . . . 7.
7. Vulval plate not longer than wide and not subquadrate . . . 8.
   Vulval plate longer than wide, subquadrate . . . . . . 9.
8. Inferior teeth of chelicerae their width apart . . . . *stauntoni.*
   Inferior teeth of chelicerae 3 times their width apart . . . *amatolae.*
9. Vulval plate a little longer than wide . . . . . . . 10.
   Vulval plate considerably longer than wide . . . . . . 11.
10. Vulva with a subquadrate anterior opening . . . . *tuckeri.*
    Vulva without such an opening . . . . . . . *reservatus.*
11. Opening of vulva rounded . . . . . . . *barbertonensis.*
    Opening of vulva not rounded . . . . . . . *transvaalicus.*

♂♂.

1. Femur of pedipalp not longer than patella+tibia, with a patch of spines on its inferior surface . . . . . . . . . *stridulans.*
   Femur of pedipalp longer than patella+tibia, without a patch of spines on its inferior surface . . . . . . . . . . . . 2.
2. Anterior tibiae with 2 lateral spines on each side . . . . . 3.
   Anterior tibiae without lateral spines on each side . . . . . 4.
3. Anterior metatarsi with lateral spines . . . . *fitzsimonsi.*
   Anterior metatarsi without lateral spines . . . . . *stauntoni.*
4. Tibia of pedipalp less than half length of tarsus . . . . . *gilli.*
   Tibia of pedipalp more than half length of tarsus . . . *capensis.*

### *Selenops amatolae* n. sp. (fig. 32).

*Type*, 1 ♀, Hogsback, Amatola Mts., Cape Province (S.A.M., 2416).

*Colour.*—Carapace finely bordered with black, dark brown with long blackish radiations from the thoracic stria, the latter appearing as a wedge-shaped dark marking pointed posteriorly; mandibles similar in colour to carapace; abdomen above rubbed; femora and tibiae of anterior legs with broad brown bands.

*Eyes.*—Medians moderately recurved, a line touching the upper surfaces of the anteriors would cut a small portion of the posterior medians; anterior medians $\frac{2}{3}$ the diameter of posterior medians, a little more than their own diameter apart, and a full radius from the posterior medians; the oval anterior laterals unusually large and conspicuous; posterior medians subequal to the posterior laterals; anterior medians less than their diameter from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 moderate subequal teeth separated by almost 3 times their width.

*Vulva* as in fig. 32.

*Legs*.—Tibia I and II with 6 pairs of strong and very long spines (the longest about a third the length of tibia I), metatarsus I and II with 3 pairs of even longer spines (the longest about half the length of metatarsus I).

*Dimensions*.—Length of carapace 5·3, total length 15·3 mm.

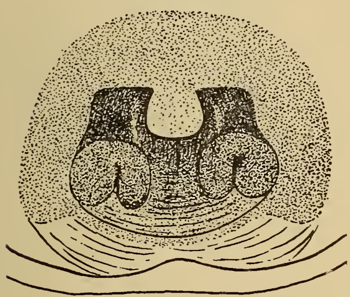


Fig. 32.—*Selenops amatolae* n. sp. ♀, vulva.

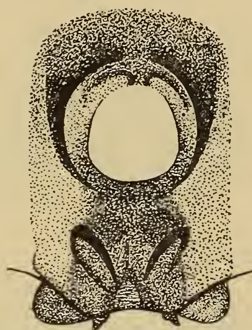


Fig. 33.—*Selenops barbertonensis* n. sp. ♀, vulva.

### *Selenops barbertonensis* n. sp. (fig. 33).

*Type*, 1 ♀, Barberton, Transvaal (S.A.M., 4194).

*Colour*.—Carapace light brown with spots and dashes of brown, thoracic radiations faint, thoracic stria and sides of cephalic area defined by brown stripes, cephalic area bisected by a faint median stripe, which at half-way gives off a branch to each posterior median eye; mandibles light brown, their inner apices darkened; abdomen light brown, finely speckled with some larger indistinct bars and spots; legs in general with irregular blotches and dots, femora with an inferior fuscous longitudinal stripe, anterior tibiae with well-defined blackish bands.

*Eyes*.—Medians fairly strongly recurved, a line touching the upper surfaces of the anterior medians passing about half-way between the centres and the lower surfaces of the posterior medians; anterior medians about half the diameter of the posterior medians, their diameter apart, and less than a radius from the posterior medians; posterior medians $\frac{2}{3}$ the diameter of the posterior laterals; anterior medians a little less than a diameter from the edge of the clypeus.

*Chelicerae*.—Inferior margin with 2 equal-sized teeth separated by $1\frac{1}{2}$–2 their width.

*Vulva* as in fig. 33.

*Legs.*—Tibia I and II with 6, metatarsus I and II with 3 pairs of inferior spines.

*Dimensions.*—Length of carapace 3·9, total length 8·4 mm.

*Other Specimens.*—2 ♀♀, between Badplaats and Barberton, Transvaal (N.M., 2468).

*Selenops braunsi* n. sp. (fig. 34).

*Type*, 1 ♀, Willowmore, Cape Province (S.A.M., 12911, Coll. H. Brauns).

*Colour.*—Carapace light reddish brown, thoracic stria well defined, with some fine lines radiating from it, a line from the stria bisecting the cephalic area and bifurcating behind the anterior median eyes; mandibles a little darker than carapace; abdomen rubbed, yellow above but with some darker spots and blotches above the spinners; legs with the dark bands very faint, almost invisible.

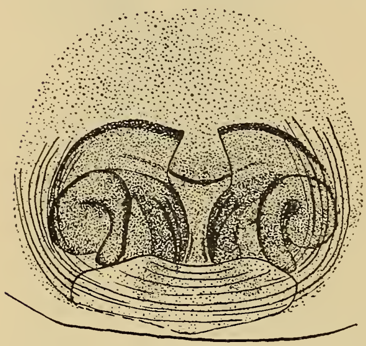


Fig. 34.—*Selenops braunsi* n. sp. ♀, vulva.

*Eyes.*—Medians moderately recurved, a line touching the upper surfaces of the anteriors passing half-way between the centres and the lower surfaces of the posterior medians; anterior medians half the diameter of the posterior medians, a little more than their own diameter apart, and a radius from the posterior medians; posterior medians $\frac{2}{3}$ the diameter of the posterior laterals; anterior medians a little less than their diameter from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 subequal teeth (smaller than those of the superior margin), separated by 3 times their width.

*Vulva* as in fig. 34.

*Legs.*—Tibia I and II with 6, metatarsus I and II with 3 pairs of inferior spines.

*Dimensions.*—Length of carapace 5·3, total length 12 mm.

*Selenops capensis* n. sp. (fig. 35).

*Types*, 1 ♀, 1 ♂, Cape Town (S.A.M., 8970).

♀ *Colour.*—Carapace yellow-brown with darker radii from the thoracic stria, cephalic portion a little darker than thoracic portion; mandibles reddish brown; abdomen above yellow-brown with small scattered blackish dots, darker towards the posterior apex, especially at the sides and just above the spinners; legs not strongly banded, tibiae with 2 light and 2 dark bands.

*Eyes.*—Medians fairly strongly recurved, a line touching the upper surfaces of the anteriors passing through the centres of the posterior

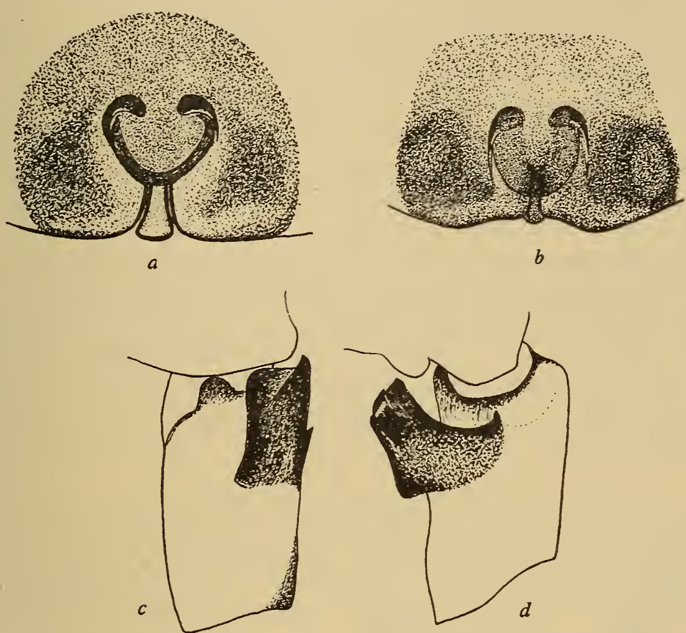



FIG. 35.—*Selenops capensis* n. sp. *a*, normal, and *b*, abnormal, form of vulva, ♀. *c*, *d*, tibia of pedipalp, ♂, from in front, and from outer side.

medians; anterior medians a little smaller than posterior medians, a little less than their own diameter apart, their radius from the posterior medians; posterior medians half the diameter of the posterior laterals; anterior medians their radius or a little more from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 teeth separated by more than the width of the apical tooth, the basal a little smaller than the apical tooth.

*Legs.*—Tibia I and II with 6 pairs of inferior spines, metatarsus I and II with 3 pairs of inferior spines.

*Vulva* as in fig. 35, *a*. This is the usual type of structure found in this species, while fig. 35, *b*, represents an abnormal form from the same locality (Signal Hill, Cape Town).

*Dimensions.*—Length of carapace 6, width 6·6, length of abdomen 7·8 mm.

♂ *Colour* and eyes as in the description of the ♀; chelicerae with the two teeth of the inferior margin distant 3–4 times the width of the apical tooth from each other. Tibia and metatarsus of anterior legs without lateral spines.

*Pedipalp.*—Tibia about $\frac{2}{3}$ the length of tarsus and subequal to patella, seen from in front as in fig. 35, *c*, seen from outer side as in fig. 35, *d*. Dorsal surface of femur with a spine in the middle and a transverse row of 3–4 spines between this spine and the apex of segment; tibia with 3 stout spines on its inner surface.

*Dimensions.*—Length of carapace 6·3, width 6·8, total length 13·3 mm.

*Other Localities.*—2 ♀♀, Kalk Bay (S.A.M., 1173 and 4602); 1 ♀, Steenbraas River, Gordons Bay (S.A.M., 3348); 3 ♀♀, Sir Lowry's Pass, Somerset West (S.A.M., 6072); 1 ♂, 2 ♀♀, Clifton, Cape Peninsula (S.A.M., 4181); 1 ♀, Table Mountain (S.A.M., 4602); 1 ♀, Hermanus (S.A.M., 8488); 2 ♀♀, Matroosberg Mountains (4000–6000 ft.) (S.A.M., 3454); 2 ♀♀, Kirstenbosch, Cape Town (B. 8305–8306, S.A.M.).

*Selenops fitzsimonsi* n. sp. (fig. 36).

*Type*, 1 ♂, Barberton, Transvaal (T.M., 2439).

*Colour.*—Carapace yellow-brown, without radiations from thoracic stria, a lighter parallel-sided broad yellow area behind the eyes as wide as the ocular row, bisected by the stria which is continued as a brown stripe on to the cephalic area; the broad median area of carapace bordered at the sides by a wavy brown line; eyes surrounded by black; mandibles yellow, with a blackish-brown stripe of uniform width along their inner anterior margins; abdomen yellow above with a few indistinct brown markings ; under surface and legs yellow, legs without black bands.

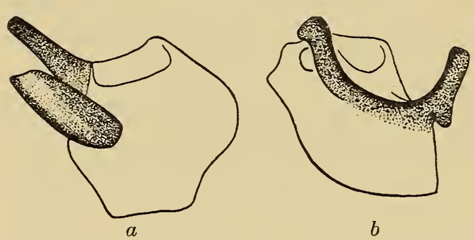



Fig. 36.—*Selenops fitzsimonsi* n. sp. Tibia of pedipalp, ♂. *a*, from in front, and *b*, from outer side.

*Eyes.*—Median eyes fairly strongly recurved, a line touching the upper surfaces of the anteriors, passing a little below the centres of the posterior medians; anterior medians about $\frac{2}{3}$ the diameter of posterior medians, less than their own diameter apart, and almost touching the posterior medians (less than $\frac{1}{2}$ their radius from them); posterior medians $\frac{3}{4}$ the diameter of posterior laterals; anterior medians their radius from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 moderate subequal teeth, separated by more than twice their basal width.

*Legs.*—Tibia I and II with 6 pairs of inferior spines and 2 lateral spines on each side, metatarsus I and II with 3 pairs of inferior spines and 2 lateral spines on each side.

*Pedipalp.*—Femur above with 1 spine in the middle and a transverse row of 4 spines between this spine and apex of segment; patella above with 2 spines, tibia with 4 spines above. Tibia with two widely separated processes, as in fig. 36, *a*, seen from in front, and fig. 36, *b*, seen from the outer side. Palp in general resembling that of *minor* from Empangeni, Zululand, to which this species is allied.

*Dimensions.*—Length of carapace 3·8, width of carapace 4·2, total length 8·6 mm.

*Selenops gilli* n. sp. (fig. 37).

*Types*, 2 ♂♂, Hell's Gate, Uitenhage, Cape Province (S.A.M., 8448).

*Colour.*—Specimens doubtlessly bleached. Carapace light reddish brown, a little darker anteriorly, thoracic stria brown, with some fine long radiating lines from it, cephalic area bisected by a light brown line which is duplicated for most of its length; mandibles a little darker than carapace; abdomen above with some brown spots and wavy cross-bars over most of its surface, near its posterior extremity a transverse, procurved, fairly broad black stripe, followed behind by a slightly broader light transverse marking; legs yellow entirely without spots or dark bands.

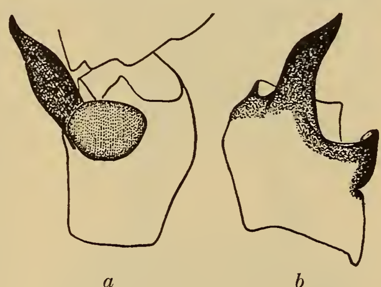



Fig. 37.—*Selenops gilli* n. sp. Tibia of pedipalp, ♂. *a*, from in front, and *b*, from outer side.

*Eyes.*—Medians moderately recurved, a line touching the upper surfaces of the anterior medians passing a little below the centres of the posterior medians; anterior medians $\frac{2}{3}$ the diameter of the posterior medians, a little less than their own diameter apart, and a little less than a radius from the posterior medians; posterior medians about $\frac{2}{3}$ the diameter of a posterior lateral; anterior medians a radius from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 moderate equal-sized teeth (distinctly smaller than those of the superior margin), separated by 3–3½ times their width.

*Legs.*—Tibia I and II with 6, metatarsus I and II with 3 pairs of inferior spines; no lateral spines.

*Pedipalp.*—Femur with 1 inner, 2 superior, 1 outer spine near apex; patella with a superior apical spine; tibia subequal to patella and less than half the length of tarsus, with outer process seen from in front as in fig. 37, *a*, and from the outer side as in fig. 37, *b*.

*Dimensions.*—Length of carapace 3·5, total length 6·8 mm.

## *Selenops kraussi* Pocock.

*S. kraussi* Pocock. A.M.N.H. (7), vol. ii, p. 350, fig. 3, 1898.

The type came from "Cape Colony" and was based on an adult ♀. It is without doubt closely allied to *S. capensis*, but differs from it in the general form of the vulva, which has a wider median area between the lateral lobes.

## *Selenops montanus* n. sp. (fig. 38).

*Type*, 1 ♀, Clanwilliam, Cape Province (S.A.M., 5347).

*Colour.*—Carapace light reddish brown with distinct radii from the thoracic stria, one of these passing straight forwards and terminating behind the median eyes; areas surrounding the eyes blackish; mandibles reddish brown, a little darker than the carapace; abdomen above with a number of minute brown dots becoming more numerous posteriorly, otherwise uniformly light yellow; legs with black bands on tibiae, more distinct on the anterior legs, femora without markings except at the base below.

Fig. 38.—*Selenops montanus* n. sp. ♀, vulva.

*Eyes.*—Median eyes moderately recurved, a line touching the upper surfaces of the anteriors, passing well below the centres of the posterior medians; anterior medians $\frac{2}{3}$ the diameter of the posterior medians, a little less than their own diameter apart, and less than a radius from the posterior medians; posterior medians $\frac{2}{3}$ the diameter of the posterior laterals; anterior medians little more than a radius from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 moderate subequal teeth separated by twice their width.

*Vulva* as in fig. 38.

*Legs.*—Tibia I and II with 6 pairs of extremely long and strong inferior spines; metatarsus I and II with 3 similar pairs of spines.

*Dimensions.*—Length of carapace 6·3, total length 14·5 mm.

*Other Specimens.*—1 ♀, Gt. Winterhoek Mts., 4000–5000 ft. (S.A.M., 2731 and 2828); 2 ♀♀, Matroosberg Mountains (S.A.M., 3454 and 3519) (S.W. Cape Province).

The mandibles much swollen and rounded in this species which is closely allied to *S. capensis*, differing from it, however, in the form of the vulva.

### *Selenops regalis* n. sp. (fig. 39).

*Type*, 1 ♀, Knysna, Cape Province (N.M., 1910), coll. Rex.

*Colour.*—Carapace brown, a roughly circular patch in the middle of the posterior half much lighter, a few fine radiations from the thoracic stria, eyes surrounded by a blackened area; mandibles dark reddish brown, much darker than carapace; abdomen above mottled brown; all legs with well-defined and distinct dark bands on both femora and tibiae.

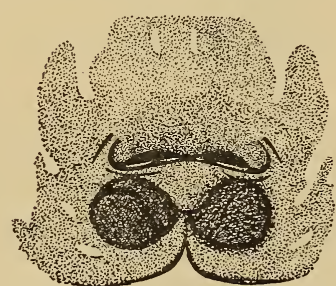


Fig. 39.—*Selenops regalis* n. sp. ♀, vulva.

*Eyes.*—Medians weakly recurved, a line touching the upper surfaces of the anteriors passing below the centres of the posterior medians; anterior medians $\frac{3}{4}$ the diameter of the posterior medians, a little more than their own diameter apart, and about $\frac{2}{3}$ their diameter from the posterior medians; posterior medians subequal to posterior laterals; anterior medians a little less than their diameter from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 subequal teeth, far removed from each other by about 4 times their basal width, or the distance between the basal and the apical tooth of the superior margin.

*Vulva* as in fig. 39.

*Legs.*—Anterior tibiae with 6, anterior metatarsi with 3 pairs of inferior spines.

*Dimensions.*—Length of carapace 5·4, width 5·5, length of abdomen 6·5 mm.

*Selenops reservatus* Lawrence.

*S. reservatus* Lawrence. Ann. Natal Mus., vol. viii, pt. 2, p. 241, text-fig. 15, 1937.

The type was described from Hluhluwe, Zululand, and was based on an adult ♀.

*Selenops sexspinatus* n. sp. (fig. 40).

*Type*, 1 ♀, Concordia, Little Namaqualand (S.A.M., 5353).

*Colour.*—Specimen doubtlessly much bleached. Carapace light yellow-brown, darker anteriorly than posteriorly; thoracic stria, the boundaries of the cephalic area, and the areas surrounding the eyes brown, darker than the remainder; radiations from the stria faint; mandibles light reddish brown, darker than the carapace but not darker than the areas surrounding the eyes; abdomen above bleached or rubbed, yellow; all legs with distinct bands, especially on the tibiae.

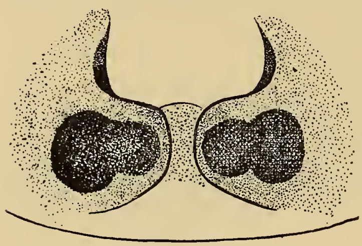


Fig. 40.—*Selenops sexspinatus* n. sp. ♀, vulva.

*Eyes.*—Medians fairly strongly recurved, a line touching the upper surface of the anterior medians cutting the posterior medians a little above their inferior surfaces; anterior medians half or less than half the posterior medians in size, their own diameter or a little less apart, and $\frac{1}{3}$ their radius from the posterior medians; posterior medians $\frac{2}{3}$ the diameter of the posterior laterals or a little less. Anterior medians their diameter from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 large subequal teeth, a little less than twice their width from each other.

*Vulva* as in fig. 40.

*Legs.*—Tibia I and II with 6, metatarsus I and II with 3 pairs of inferior spines.

*Dimensions.*—Length of carapace 5, length of abdomen 9·3 mm.

*Selenops stauntoni* Pocock.

*S. stauntoni* Pocock. A.M.N.H. (7), vol. x, p. 330, 1902.

*S. elusus* Lawrence. Ann. Natal Mus., vol. viii, pt. 2, p. 242, text-fig. 16, *a–c*, 1937.

The type which was based on an adult ♀, came from Durban. No figure was given of the vulva. Various localities are given for the species by Lawrence in "Ann. Natal Mus.," vol. viii, pt. 3, p. 492, 1938.

The South African Museum has it from Kentani (13079), Bashee River (13103), Grahamstown (B. 5691), and East London (2441).

### *Selenops stridulans* n. sp. (fig. 41).

*Type*, 1 ♂, Steinkopf, Little Namaqualand (S.A.M., B. 8852).

*Colour.*—Carapace pale yellow, almost without markings, a few indistinct darker spots near the lateral margin, a dark bar behind each

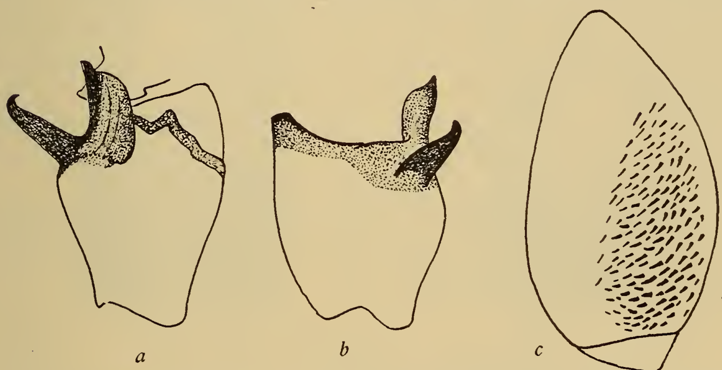



FIG. 41.—*Selenops stridulans* n. sp. *a*, *b*, tibia of pedipalp ♂, from in front, and from outer side. *c*, femur of pedipalp, outer and inferior surface.

posterior lateral eye containing two spines; eyes surrounded by large black areas; mandibles pale yellow, the inner two-thirds of their anterior surfaces somewhat darkened; abdomen yellow, a few minute spots at the sides of the posterior extremity; legs yellow with a few indistinct blackish spots and stripes.

*Eyes.*—Median eyes strongly recurved, a line touching the upper surfaces of the anteriors, passing a little above the lower surfaces of the posterior medians; anterior medians half or a little less than half the diameter of the posterior medians, a little less than their own diameter apart, and less than half a radius from the posterior medians; posterior medians about half the diameter of posterior laterals; anterior medians $\frac{1}{2}$–$\frac{2}{3}$ their diameter from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 moderate teeth, the basal one a little larger than the apical one and separated from it by its own basal width.

*Legs.*—Tibia I and II with 6 pairs of inferior spines, some of them extremely long, 2 lateral spines on each side and 4–5 superior spines; metetarsus I and II with 3 pairs of inferior spines and 2 lateral spines on each side in basal half.

*Pedipalp.*—Femur differing from those of all other species of the genus in being short and globose (equal to, or a little shorter than the combined patella and tibia, while in other species it is distinctly longer and subparallel), and in having a patch of strong black spines and teeth on the outer side of the inferior surface (text-fig. 41, *c*). This perhaps represents a stridulating organ, as the inner surface of the trochanter of leg I also bears a fairly large number of minute chitinous teeth and spines which may represent the opposing surface of friction. Femur with 1 inner, 1·2 superior, and 1 outer spine in basal half, patella with 1 inner and 2 superior spines, the distal one the stronger, tibia with 2 unusually strong inner spines and 1 superior spine; tibial apophysis as in fig. 41, *a*, seen from in front, and fig. 41, *b*, seen from the outer side.

*Dimensions.*—Length of carapace 4, total length 7·8 mm.

This species is characterised by the large number of strong spines on the legs and pedipalp, and by the peculiar patch of short spines and teeth on the pedipalp femur.

### *Selenops transvaalicus* n. sp. (fig. 42).

*Types*, 2 ♀♀, Lydenburg, N.W. Transvaal (S.A.M., 13171).

*Colour.*—Carapace reddish brown, cephalic portion hardly darker than the rest, with a trident-shaped marking in the middle behind the median eyes; thoracic portion with the radiations of the stria ill-defined, each bearing a blackish dot in the middle, a few brown dots near the marginal border which is not well defined; mandibles reddish brown with a narrow black stripe along their inner margin and an apical black marking; abdomen with some large ill-defined blackish-brown markings above; legs with weak and ill-defined dark bands.

*Eyes.*—Median row not strongly recurved, a line touching the upper surfaces of the anteriors passing a little below the centres of the posterior medians; anterior medians half as large as posterior medians, their own diameter apart, and less than a radius from the posterior medians; posterior medians $\frac{2}{3}$ the diameter of the posterior laterals; anterior medians a little less than their diameter from the edge of the clypeus.

*Chelicerae.*—Inferior margin with 2 equal-sized teeth, 1½–2 their width from each other.

*Legs.*—Tibia I and II with 6, metatarsus I and II with 3 pairs of inferior spines.

*Vulva* as in fig. 42.

*Dimensions.*—Length of carapace 4·8, width of carapace 5·5, total length 11·4 mm.

*Other Specimens.*—1 ♀, Lydenburg (S.A.M., 13555); 1 ♀, Komatipoort, E. Transvaal (S.A.M., B. 4363).

FIG. 42.—*Selenops transvaalicus* n. sp. ♀, vulva.

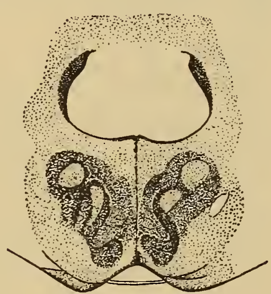


FIG. 43.—*Selenops tuckeri* n. sp. ♀, vulva.

*Selenops tuckeri* n. sp. (fig. 43).

*Type,* 1 ♀, Junction of Crocodile and Marico Rivers, Transvaal (S.A.M., B. 3718), Coll., R. W. Tucker.

*Colour.*—Carapace light reddish brown with indistinct markings, thoracic stria and sides of the cephalic area darker, a faint stripe in the middle of the cephalic area bifurcating half-way between the eyes and the stria, eyes surrounded by black areas; mandibles lighter than the carapace except on their inner anterior surfaces; abdomen light yellow with symmetrical brown markings; legs without bands except for 3 on inferior surface of femur I, and some fainter ones on inferior surface of femur II.

*Eyes.*—Median eyes moderately procurved, a line touching the upper surfaces of the anteriors passing a little below the centres of the posterior medians; anterior medians ⅔ the diameter of posterior medians, their own diameter or slightly more apart, and a radius from the posterior medians; posterior medians subequal to the posterior laterals; anterior medians $\frac{2}{3}$ their diameter from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 teeth, the basal distinctly larger than the apical one, separated by $1\frac{1}{2}$ times the width of the basal tooth.

*Vulva* as in fig. 43.

*Legs.*—Tibia I and II with 6, metatarsus I and II with 3 pairs of long inferior spines.

*Dimensions.*—Length of carapace 3·6, total length 10·3 mm.

### Sub-group $B_4$.

*Key to the species of* Selenops *with* 7 *pairs of inferior tibial spines.*

♀♀.

1. Vulval plate large, black, subquadrate . . . . . . *spenceri.*
   Vulval plate not large or black . . . . . . . . . . 2.
2. Vulva with lateral lobes partly meeting in the middle line . . . 3.
   Vulva without lateral lobes meeting in the middle line . . . . 4.
3. Total body length 18 mm. . . . . . . . . . . *basutus.*
   Total body length 9 mm. . . . . . . . . *rubicundus.*
4. Plate of vulva wider than long . . . . . . . . *decoratus.*
   Plate of vulva longer than wide . . . . . . . *septemspinatus.*

♂♂.

1. Apophysis of pedipalp tibia with 2 processes . . . . . *decoratus.*
   Apophysis of pedipalp tibia with 4–5 processes . . . . . . 2.
2. Apophysis of pedipalp tibia with 5 processes, the lateral process bifurcate *septemspinatus.*
   Apophysis of pedipalp with 4 processes, the lateral process not bifurcate 3.
3. No angular prominence at base of pedipalp tarsus . . . . *whiteae.*
   An angular prominence at base of pedipalp tarsus . . . . *marshalli.*

### *Selenops basutus* Pocock.

*S. basutus* Pocock. A.M.N.H. (7), vol. vii, p. 288, 1901.

The type was based on a ♀ from Teyateyaneng in Basuotland. No figure was given of the vulva. The species is unusual for its large size, 18 mm. in total length.

### *Selenops decoratus* n. sp. (fig. 44).

*Types,* 5 ♀♀, 1 ♂, Ingwavuma, Zululand (N.M., 2422 and 2424).

♀ *Colour.*—Carapace brown, narrowly margined with black, decorated with spots and short bars of black, including a row of black spots along the lateral margin, and a large one on each side of the stria along the posterior margin; mandibles brown, their inner margins black, a black dot on the outer side near the base; abdomen mottled with black spots and bars, the whole effect dark brown;

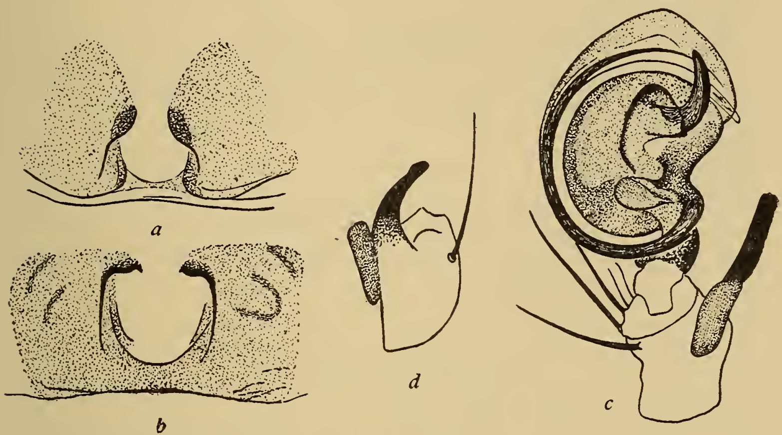



FIG. 44.—*Selenops decoratus* n. sp. *a*, *b*, vulva, ♀. *c*, pedipalp, ♂, from in front. *d*, tibia of pedipalp from outer side.

all legs with very clearly defined black blotches and bands, the posterior surfaces of femora white, metatarsi with 2 distinct black bands.

*Eyes.*—Medians very strongly recurved, a line touching the upper surfaces of the anteriors would not cut the posterior medians; anterior medians small, less than half the diameter of the posterior medians, a little more than their own diameter apart, and a radius from the posterior medians; posterior medians $\frac{2}{3}$ the diameter of the posterior laterals; anterior medians a little less than their diameter from the edge of the clypeus.

*Chelicerae.*—Inferior margin with 2 equal-sized teeth distinctly smaller than those of the superior margin, $2\frac{1}{2}$ times their basal width from each other.

*Vulva* as in fig. 44, *a* and *b*.

*Legs.*—Anterior tibiae with 7, anterior metatarsi with 3 pairs of inferior spines.

*Dimensions.*—Length of carapace 3·3, total length 9 mm.

♂ *Colour.*—Carapace light brown, with ill-defined markings; eyes surrounded by deep black areas, a curved black bar behind the posterior lateral eyes, a black marginal spot on each side above the mandibles; mandibles almost white, a broad black band at their apices and a narrow black stripe along their inner sides; abdomen above mottled blackish brown; legs with fairly distinct blackish bands and blotches, these, however, not nearly so well defined as in the ♀.

*Eyes* and *chelicerae* as in description of the ♀.

*Legs.*—Anterior tibiae with 7–9 pairs of inferior spines and a lateral spine on each side near the base, anterior metatarsi with 3 pairs of inferior spines.

*Pedipalp.*—Femur with 1 inner and 1·2 superior spines in distal half, patella with 1 inner and 2 superior spines; tibia shorter than patella and much shorter than tarsus seen from above; tarsus and tibial process as in fig. 44, *c*, seen from in front, tibial process seen from outer side as in fig. 44, *d*.

*Dimensions.*—Length of carapace 3, total length 6·2 mm.

One of the female specimens which agrees with the types in colour, eyes, chelicerae, and the number of spines on the anterior legs, differs markedly in the form of the vulva (fig. 44, *b*). I presume that this figure represents the vulva at a later, perhaps more mature stage.

### *Selenops marshalli* Pocock.

*S. marshalli* Pocock. A.M.N.H. (7), vol. x, p. 21, fig. 6, 1902.

The type was a ♂ from Estcourt, Natal. Other localities: 1 ♂, Durban (N.M., 2183). The total length of the type was 11 mm. Pocock records a ♂ of *S. spenceri* from Estcourt, so that it seems likely that these two species, *spenceri* and *marshalli*, may be synonymous.

### *Selenops rubicundus* n. sp. (fig. 45).

*Type*, 1 ♀, Witpoort, near Belfast, Transvaal (T.M., 1155).

*Colour.*—Carapace yellow-brown, cephalic area not darker than thoracic area, a marginal and submarginal row of ill-defined blackish spots, thoracic stria continued on to the cephalic area as a fine blackish median line with a lateral branch on each side; eyes surrounded by blackened areas; mandibles with their inner halves blackened, the remainder coloured as in the carapace; abdomen with a symmetrical pattern of black spots intermixed with red hairs; femora of legs with black irregular spots tending to merge into each other as stripes; tibiae and metatarsi with weakly defined dark bands, that at the base of each tibia strongest.

*Eyes.*—Medians not strongly recurved, a line touching the upper surfaces of the anteriors passing a little below the centres of the posterior medians; anterior medians $\frac{2}{3}$ the diameter of the posterior medians, a little more than their own diameter apart, and $\frac{2}{3}$ their diameter from the posterior medians; posterior medians $\frac{3}{4}$ the diameter of the posterior laterals; anterior medians $\frac{2}{3}$ their diameter from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 teeth, the basal one distinctly larger than the apical one and $1\frac{1}{2}$–2 its basal width from it.

*Vulva* as in fig. 45.

*Legs.*—Tibia I and II with 7, metatarsus I and II with 3 inferior pairs of spines.

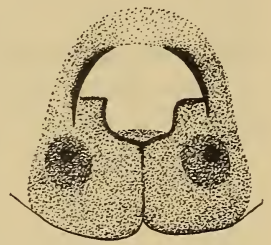


Fig. 45.—*Selenops rubicundus* n. sp. ♀, vulva.

*Dimensions.*—Length of carapace 4, total length 9 mm.

## *Selenops septemspinatus* Lawrence.

*S. septemspinatus* Lawrence. Ann. Natal Mus., vol. viii, pt. 2, p. 243, fig. 17, *a–c*, 1937.

The species was based on 3 ♂♂ and 5 ♀♀ from Kosi Bay, Zululand.

## *Selenops spenceri* Pocock (fig. 46).

*S. spenceri* Pocock. A.M.N.H. (6), vol. xvii, p. 55, figs. 8, 8*a*, 1896.

The type ♀ was from Durban, Natal.

*Other Localities.*—1 ♀, M'fongosi, Zululand (S.A.M., 4166); 1 ♀, Umtata, C. Province (S.A.M., 9256); 1 ♀, Manubi Forest, Transkei, C. Province (S.A.M., 14509); 1 ♀, Blue Cliff, Uitenhage, C. Province (S.A.M., 5710); 1 ♀, Grahamstown (S.A.M., B. 8283); 2 ♀♀, Port St. Johns, C. Province (S.A.M., 11735); 1 ♀, Winkel Spruit, Natal (N.M., 1798); 1 ♂ from Estcourt, Natal (4000 ft.), has also been recorded by Pocock (A.M.N.H., ser. 7, vol. ii, p. 224, 1898).

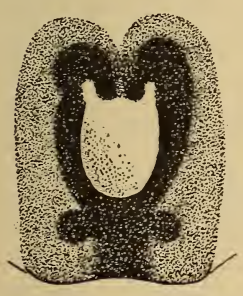


Fig. 46.—*Selenops spenceri* Pocock. ♀, vulva.

*Vulva* of one of the ♀ specimens from Port St. Johns as in fig. 46.

The average total length (6 adult ♀♀ measured) was 14·5 mm.; the type was 11 mm. in length. Pocock unfortunately did not describe or figure the male specimen which he recorded from Estcourt (*loc. cit.*), and it is possible that his *S. marshalli* is the male form of this species.

*Selenops whiteae* Pocock (fig. 47).

*S. whiteae* Pocock. A.M.N.H. (7), vol. x, p. 21, fig. 7, 1902.

The type was a ♂ from Grahamstown; the following is a description of the ♀ based on an adult ♀ and ♂ from the Pirie Forest, Kingwilliamstown, Cape Province (N.M., 1516).

*Colour.*—Carapace light yellow in the thoracic region, with a number of ill-defined darker lines radiating from the stria; cephalic portion darker, light reddish brown, bisected by a discontinuous median blackish stripe; ocular area in general blackish brown; mandibles yellow, blackish towards their apices; abdomen brown with some darker broad chevron markings; femora with blotched markings; tibiae with ill-defined brown bands, metatarsi with strong blackish bands (a black band at apex and base, a yellow between them).

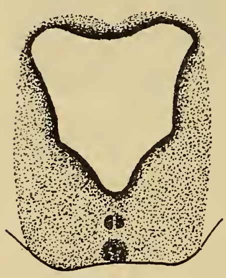


Fig. 47. — *Selenops whiteae* Pocock. ♀, vulva.

*Eyes.*—Median eyes strongly recurved, a line touching the upper surfaces of the anteriors just cutting the lower edges of the posterior medians; anterior medians very small, less than half the diameter of the posterior medians, their own diameter or a little less apart, and less than a radius from the posterior medians; posterior medians subequal to posterior laterals; clypeus unusually high and concave so that the anterior medians project over it; anterior medians about twice their diameter from the edge of clypeus.

*Chelicerae.*—Inferior margin with 2 large subequal teeth about twice their basal width from each other.

*Vulva* as in fig. 47, occupying a large subquadrate plate and rather resembling that of *S. spenceri* Pocock.

*Legs.*—Anterior tibiae with 7, anterior metatarsi with 3 pairs of inferior spines.

*Dimensions.*—Length of carapace 5·2, total length 13·7 mm.

*Other Specimens.*—1 ♂, Port St. Johns, Cape Province (S.A.M., 13072).

# 21. *Additional Records, and Descriptions of New Species, of South African Alder-flies (Megaloptera), May-flies (Ephemeroptera), Caddis-flies (Trichoptera), Stone-flies (Perlaria), and Dragon-flies (Odonata)*.—By K. H. Barnard, D.Sc., F.L.S., Assistant Director.

(With 19 Text-figures.)

This is the eleventh report on the Fauna of the Mountain Ranges of the Cape Province, for the investigation of which I have received grants from the Royal Society of South Africa and the Research Grant Board.* My thanks and acknowledgments are herewith tendered to these bodies. I have also to thank Dr. Hewitt, Director of the Albany Museum, and Dr. Lawrence, Director of the Natal Museum, for submitting material; and to Mr. H. G. Wood (H. G. W.) and Mr. C. W. Thorne (C. W. T.) for their help and co-operation in the field-work.

## MEGALOPTERA.

With the exception of a *n. sp.* of *Platychauliodes*, and some additional localities for the other species, no great advance has been made in our knowledge of the Cape Alder-flies since my 1931 paper (Trans. Roy. Soc. S. Afr., vol. xix, 2, 1931). A ♂ and ♀ *Leptosialis africana* have been collected, and their genitalia are described; but the larva still remains undiscovered. No larvae or pupae of the *Taeniochauliodes* type have been found which might be assigned to the genus *Platychauliodes*.

The discovery of the common Cape genus, *Taeniochauliodes*, in the Drakensberg in Natal, not only greatly increases the known distribution of the genus, but indicates that the mountain streams in Natal have an Alder-fly fauna hitherto unsuspected.

* Previous reports: 1. "Freshwater Crustacea," Trans. Roy. Soc. S. Afr., vol. xiv, 1927. 2. "Colophon (Coleoptera)," *ibid.*, vol. xviii, 1929. 3. "Alder-flies," *ibid.*, vol. xix, 1931. 4. "May-flies," *ibid.*, vol. xx, 1932. 5. "Terrestrial Isopoda (Woodlice)," Ann. S. Afr. Mus., vol. xxx, 1932. 6. "Further New Species of Colophon," Stylops, vol. i, pt. 8, 1932. 7. "A new Corduline Dragonfly," *ibid.*, vol. ii, pt. 7, 1933. 8. "Caddis-flies," Trans. Roy. Soc. S. Afr., vol. xxi, 1934. 9. "Stone-flies," Ann. S. Afr. Mus., vol. xxx, 1934. 10. "Dragon-flies," *ibid.*, vol. xxxii, 1937.

*Chloroniella peringueyi* E. P.

1931. Barnard, *loc. cit.*, p. 171.

*Localities.*—French Hoek Pass (head-waters of River Zonder End) (13th December 1932, K. H. B. and H. G. W., 1 ♂); same locality (October 1933, H. G. W., larva); Oudebosch, River Zonder End Mts. (September 1933, H. G. W., larva); Gt. Winterhoek Mts., Tulbagh (November 1932, K. H. B. and H. G. W., larva); Kaaiman's River, near George (January 1936, H. G. W., 1 ♀).

The French Hoek ♂ has fewer costal cross-veins in the fore-wing, viz. 23; the 5th cross-vein is at the point of origin of Rs, and the 9th at the first cross-vein R–Rs.

The ♀ genitalia resemble those of *Taeniochauliodes*, but, owing to the abdomen of the single specimen not being in good condition, the presence of mobile apical papillae on the lower appendages could not be determined with certainty.

*Platychauliodes capensis* Brnrd.

(Fig. 1, *a*, *b*.)

1931. Barnard, *loc. cit.*, p. 175.

*Localities.*—Bosch Kloof, Keeromberg, Worcester (January 1933, H. G. W., 1 ♂); Jonkershoek, Stellenbosch (26th February 1931, H. G. W., 2 ♂♂; 4th April 1931, H. G. W., 1 ovig. ♀; 14th February 1933, K. H. B. and H. G. W., 1 ♂, 1 ♀).

*Genitalia* ♀.—A figure is given which applies to all three species of this genus. The genital plate on the 8th segment is ovate and strongly chitinised, with an apical membranous projection. The subanal plate (lower appendages) is divided into two halves, separated by a groove with membranous lining; the apical lobes have no mobile papillae, such as are found in *Taeniochauliodes* and *Leptosialis* (*v. infra*).

*Platychauliodes woodi* Brnrd.

(Fig. 1, *c*.)

1931. Barnard, *loc. cit.*, p. 177.

*Localities.*—Palmiet River (December 1932, H. G. W., 2 ♂♂); Oudebosch, River Zonder End Mts. (January 1933, H. G. W., 1 ♂, 1 ♀; and January 1934, 1 ♂); Meiring's Poort, Zwartberg Range (January 1935, H. G. W., 1 ♂); Kaaiman's River, near George (January 1936, H. G. W., 3 ♂♂).

*Genitalia* ♂.—An additional figure is given here to show the subanal lobe (or penis), the apex of which is subpentagonal and shield-like.

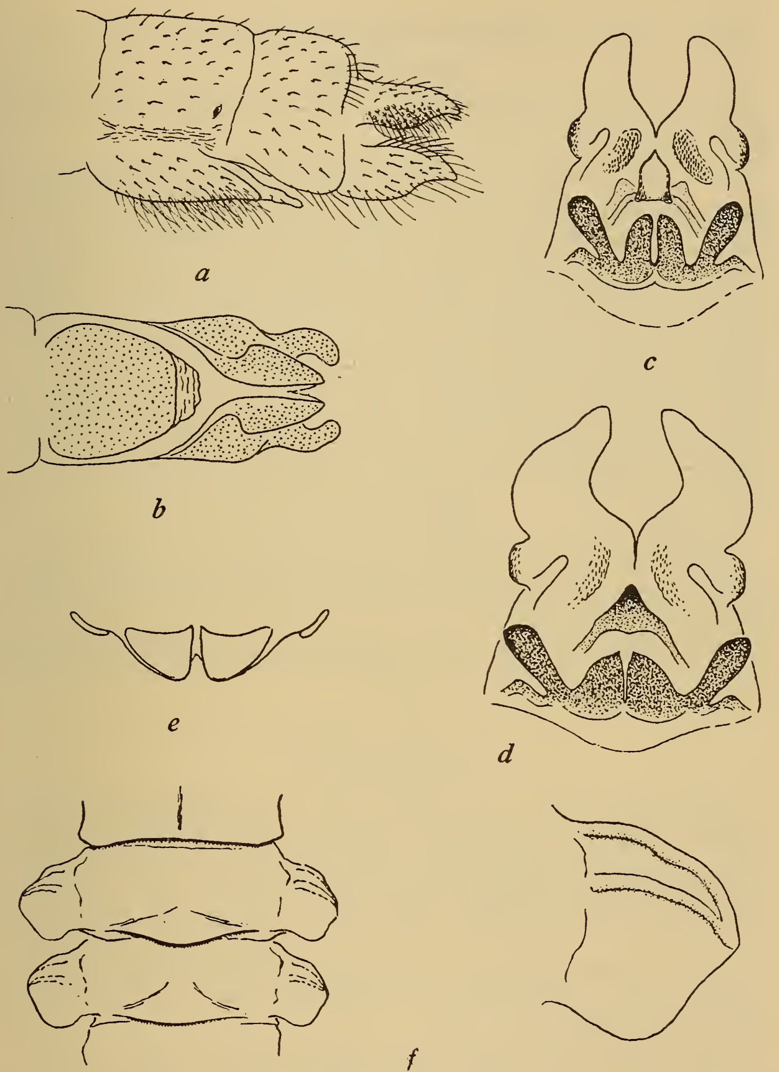



Fig. 1.—*Platychauliodes capensis* Brnrd. *a*, *b*, lateral and ventral views of 8th and 9th abdominal segments, ♀, in *b* the more strongly chitinised areas dotted.

*Platychauliodes woodi* Brnrd. *c*, ♂ genitalia viewed from behind and slightly from below, for comparison with *d*.

*Platychauliodes thornei* n. sp. *d*, ♂ genitalia, from same viewpoint as *c*. *e*, projections of the genital plate viewed from above, for comparison with fig. 8, *c*, in Barnard, *loc. cit.*, 1931.

*Platychauliodes* sp. micropterous ♀. f. meso- and meta-thoracic segments with winglets, and one winglet further enlarged.

### *Platychauliodes thornei* n. sp.

(Fig. 1, *d*, *e*.)

*Locality.*—Hottentot Holland Mts. (January 1933, K. H. B. and H. G. W., 1 ♂, 1 ♀).

Similar to the other two species, but larger and distinguished by the ♂ genitalia. The latter are of the same general structure as in *woodi*, but, as may be seen by comparing the figures here given, show several differences. The superior appendages are more falcate and the patch of spinules on inner (ventral) surface is less strongly developed. The median projections of the genital plate are much broader, triangular when viewed from behind, but strongly cowl-shaped as in *woodi*. The lateral projections do not differ very much, but are feebly spatulate, only the top margin being curled over slightly. A subanal lobe, which may function as penis or intromittent organ, ends in a strongly chitinised triangular point.

Fore-wing ♂ 27 mm., ♀ 42 mm.

Named after Mr. C. W. Thorne, of the South African Museum, who has accompanied Mr. Wood and myself on many collecting expeditions in the Cape mountains.

It is possible that the large ♀ described and figured on p. 178 (*loc. cit.*, 1931) belongs to this species.

### ? *Platychauliodes* sp.

*Micropterous form, or aberration.*—In the Gt. Winterhoek Mts., January 1939, Mr. C. W. Thorne found a ♀, 28 mm. in length, which is remarkable for having greatly reduced wings. All four winglets are alike; each consisting of a roughly semicircular membrane, spoon-like, *i.e.* convex above and concave below, without trace of venation except a costal and (?) subcostal thickening meeting at the rounded apex. The length of each winglet is about $\frac{1}{3}$ the width of the thoracic segment (fig. 1, *f*).

The winglets are considerably smaller than the wing-pads of a normal pupa of *Taeniochauliodes*, and the unexpanded wings contained therein; moreover, they show no evidence of being normal-sized wings which have failed to expand on emergence.

Judging by the shape of the head and the labrum, and the position of the ocelli, the specimen appears to belong to the genus *Platychauliodes*; the lower appendages, however, have mobile papillae at their apices as in *Taeniochauliodes*.

Although of frequent occurrence among the Stone-flies (see Barnard, Ann. S. Afr. Mus., vol. xxx, p. 576, and also *infra*, p. 658), I am not aware of any record of a micropterous Alder-fly.

*Taeniochauliodes ochraceopennis* E. P.

1931. Barnard, *loc. cit.*, p. 179.

*Localities.*—French Hoek Pass (River Zonder End system) (December 1932, K. H. B. and H. G. W.); Palmiet River (December 1932, H. G. W.); River Zonder End Mts., 1500–4000 feet (January 1933, H. G. W., pupae and imagos, and January 1934, K. H. B. and H. G. W.); Seven Weeks Poort, Ladismith, Cape (February 1932, K. H. B. and H. G. W.); George, Outeniqua Mts. (January 1931, K. H. B., larva); Robinson Pass, Outeniqua Mts. (February 1932, K. H. B. and H. G. W.); Kalk Bay Mts., Cape Peninsula (May 1933, A. C. Harrison, young larvae); Cathkin Peak, Drakensberg, Natal, 6000 feet (R. F. Lawrence, January 1938).

The largest ♀ yet collected has the fore-wing 38 mm. in length.

The ♀ genitalia resemble those of *Platychauliodes*, but the subgenital plate is transverse, broader than long, without definite membranous distal projection; and the lower appendages have an apical mobile papilla as in *Leptosialis*.

*Leptosialis africana* E. P.

(Fig. 2.)

1931. Barnard, *loc. cit.*, p. 184.

*Localities.*—Gt. Winterhoek Mts., Tulbagh (3rd November 1932, K. H. B., 1 ♂); Hottentots Holland Mts. (23rd November 1932, C. W. Thorne, 1 ♀); Upper Olifants River, north of Ceres (8th October 1937, C. W. Thorne, 1 ♀).

The wings are not held roof-like over the body when at rest, but curled round the body as in *Taeniochauliodes* and other local Corydalids.

In both these specimens the junction of M and $Cu_1$ in fore-wing is more proximal, only slightly distal to the level of origin of Rs. In the hind-wing the fork of $Cu_1$ is slightly proximal to the cross-vein $M_{3+4} - Cu_1$.

As the ♂ comes from the type locality there is no reason to doubt its identity with *africana*, of which the genitalia have not been described (they are missing in the type specimen). It is unlikely, but nevertheless just possible that a second species may exist in the

Hottentots Holland Mts., although the ♀ shows no differences in venation.

Genitalia ♂. Superior appendages lateral in position, short, incurved, clasper-like, hollowed on inner lower surface; supra-anal

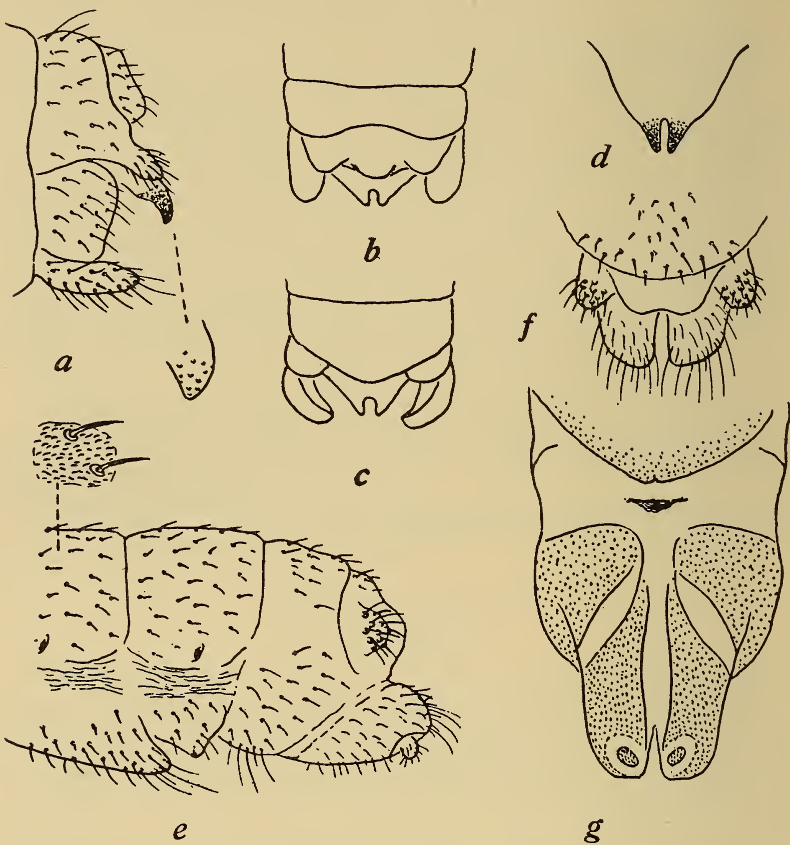



Fig. 2.—*Leptosialis africana* E. P. *a, b, c*, lateral, dorsal and ventral views of ♂ genitalia. *d*, supra-anal lobe viewed from behind or flattened, not foreshortened as in *b* and *c*. *e*, lateral view of 7th, 8th and 9th abdominal segments ♀, with portion of integument further enlarged. *f*, dorsal view of apical segment ♀. *g*, ventral view ♀, the more strongly chitinised areas dotted.

lobe (? 10th tergite) triangular, with narrow apical cleft, the two apical points curved downwards and strongly chitinised; subgenital plate broadly rounded.

♀. Subgenital plate on 7th segment broadly rounded, with minute median notch; superior appendages short, rounded-conical; subanal plate divided into two halves by a groove, and ending in a blunt lobe with a mobile papilla on lower apical surface; the lining of the groove is feebly chitinised and the two halves of the lobe can be moved to and fro, and evidently serve to place the ova in position.

The whole surface of the integument (in both sexes) is minutely hirsute (fig. 2, *e*) in addition to the larger setae.

## EPHEMEROPTERA.

Since the publication of my 1932 paper (Trans. Roy. Soc. S. Afr., vol. xx, pt. 3) numerous additional locality records have accumulated as the result of continued collecting. A few more dried specimens have been found in the S.A. Museum, and small collections have been submitted for identification by Mr. H. K. Munro of the Etomological Department, Pretoria, Dr. J. Hewitt, Director of the Albany Museum, and Dr. R. F. Lawrence, Director of the Natal Museum.

Three undescribed species also have been collected; and a nymph which appears to be the true nymph of *Elassoneuria trimeniana* has been discovered.

Mr. A. C. Harrison has observed another case of longevity, and proved the ovoviviparity of the Red Border Wing (*Cloeon lacunosum*).

A large Polymitarcid from Natal has been described by me in Ann. Natal Mus., vol. viii, 1937.

Some unfortunate typographical errors occurred in the 1932 paper and are herewith corrected:—

Venation, figs. 1, 2, 4, 5, 17, 19, 42. For "$1R_2$, $1R_3$, 1MA, 1M, 1Cu (but not 1A)," read "I (=intercalary) $R_2$, $IR_3$, etc., respectively."

Pages 204, 208, and 244, line 32. For "*westermanni*" read "*dislocans.*"

Page 245, fig. 35*b*. For "*westermanni*" read "*dislocans*"; fig. 35*c*, for "*dislocans*" read "*auriculata.*"

Page 217, fig. 7. For "*perkensi*" read "*perkinsi.*"

Page 220. Delete last sentence at bottom of page: "the nymph . . . discovered."

Page 230, line 1. For "access" read "assess."

Page 246, line 12. For "long stalk of MA" read "long stalk of M."

Page 252. Delete last sentence of first paragraph: "Other similar . . . October 1931."

*Taxonomy.*—Dr. Ulmer (Stettin. Entomol. Zeit., xciii, 1932, pp. 204–219) has briefly commented on the new genera proposed by me. In his opinion *Euthraulus*, *Austrocaenis*, and *Austrocloeon* are of doubtful validity, but he declines to express an opinion as to whether nymphal characters alone are sufficient to justify generic separation (p. 216).

For my part I feel that the nymphal stage has very strong claims for recognition in classification, although its full value cannot be estimated until the nymphal stages of all the known species of imagos have been correlated. As examples of the value of nymphal characters one may refer to *Torleya* Lest., *Ephemerellina*, and *Lithogloea*, *Aprionyx* and *Atalophlebia*, *Epeorus* and *Iron* (see Ueno. Annot. Zool. Japon, xiii, 3, 1931, p. 192), and *Acentrella* (v. *infra*). Tillyard (Proc. Linn. Soc. N.S.W., lviii, 1933, p. 2) speaks in favour of founding new genera on nymphal characters alone; and in 1934 (Pap. Proc. Roy. Soc. Tasman. for 1933) he describes the nymph of the genotype of the genus *Atalophlebia* as having denticulate claws, thus confirming the validity of the genus *Aprionyx*.

*Genotypes.*—It is usually understood that when a new genus containing more than one species is proposed, and the genotype is not specifically designated, the first species listed or described is to be reckoned as the genotype. In view, however, of the resolution of the Budapest Congress of 1927 (see Entomol. Monthly Mag., December 1932), *Austrocloeon africanum* (E. P.) and *Aprionyx tabularis* (Eaton) are herewith designated as the genotypes of their respective genera. The other new genera proposed by me were monotypic.

*Hot Springs.*—Nymphs of *Baetis bellus* and *Centroptilum sudafricanum* have been found at the stream issuing from the Warmbaths near Citrusdal. At the spot where the nymphs occurred the water would be a few degrees lower than 108° to 110° F. (see "South African Caddis-flies," Trans. Roy. Soc. S. Afr., xxi, p. 297).

## Fam. PROSOPISTOMATIDAE.

1921. Lestage in Rousseau, Larves et Nymphes Aquatiques, i, p. 177 (*Prosopistomidae*).

1932. Lieftinck, Tijdschr. Entomolog., lxxv, suppl., p. 44 (references).

The remarkable May-fly nymph (only one subimago has ever been discovered) known as *Prosopistoma* has been recorded from Europe, Madagascar, and Java. Recently (August 1939) I have seen a specimen taken from a trout stomach in Kenya.

It seems therefore worth while to mention the occurrence of *Prosopistoma* in Africa, in the hope that some day it will be found in

South Africa. According to Lieftinck the Javanese species lives in the crevices on the undersides of boulders in fast-flowing streams.

### Fam. POLYMITARCIDAE.

*Polymitarcys savignyi* (Pict.).

1932. Barnard, *loc. cit.*, p. 209.

Ulmer (1932, *loc. cit.*, p. 208, and *in litt.* 26/5/32) points out that the vein labelled in my figure 1 as $Cu_2$ is really only a branch of $Cu_1$, and that the true $Cu_2$ is the vein labelled 1A.

Gen. Exeuthyplocia Lest.

1918. Lestage, Rev. Zool. Afric., vi, p. 74.
1933. Ulmer, Peking Nat. Hist. Bull., vii, p. 197.
1937. Barnard, Ann. Natal Mus., viii, p. 275.

Distinguished from *Polymitarcys* by the subparallel sigmoid cross-veins in the anal area of the fore-wing.

*Exeuthyplocia sampsoni* Brnrd.

1937. Barnard, *loc. cit.*, p. 276, fig.

*Localities.*—Umzimkulu River (28th October 1936); Yarrow and Mooi Rivers (Mid-October 1933); Mooi River, Nottingham Road (6th November 1933). (All in Natal.)

Nymph provisionally assigned to *Exeuthyplocia sampsoni.*
(Fig. 3.)

On the 25th October 1939 Dr. B. Sampson found a single empty nymph-shuck floating in an eddy on the Umzimkulu River, Natal. No imagos were seen, and Dr. Sampson says there was no hatch between 22nd and 30th October.

From the size of the nymph one suspects it to be the nymph of *E. sampsoni*, which is the largest and bulkiest May-fly in the Natal fauna, excepting perhaps *Eatonica schoutedeni.*

It resembles the *Euthyplocia* nymph described by Eaton (Trans. Linn. Soc. London, 2nd ser., zool., iii, p. 37, 1883, and pl. 29, 1884), and also *Palingenia*, in the 3-jointed maxillary and labial palps; but differs in having a small, non-fimbriate gill on the 1st abdominal segment. In the latter character it resembles *Ephemera, Hexagenia*, and *Polymitarcys.* The 2nd–7th gills, however, are not like those of *Polymitarcys.*

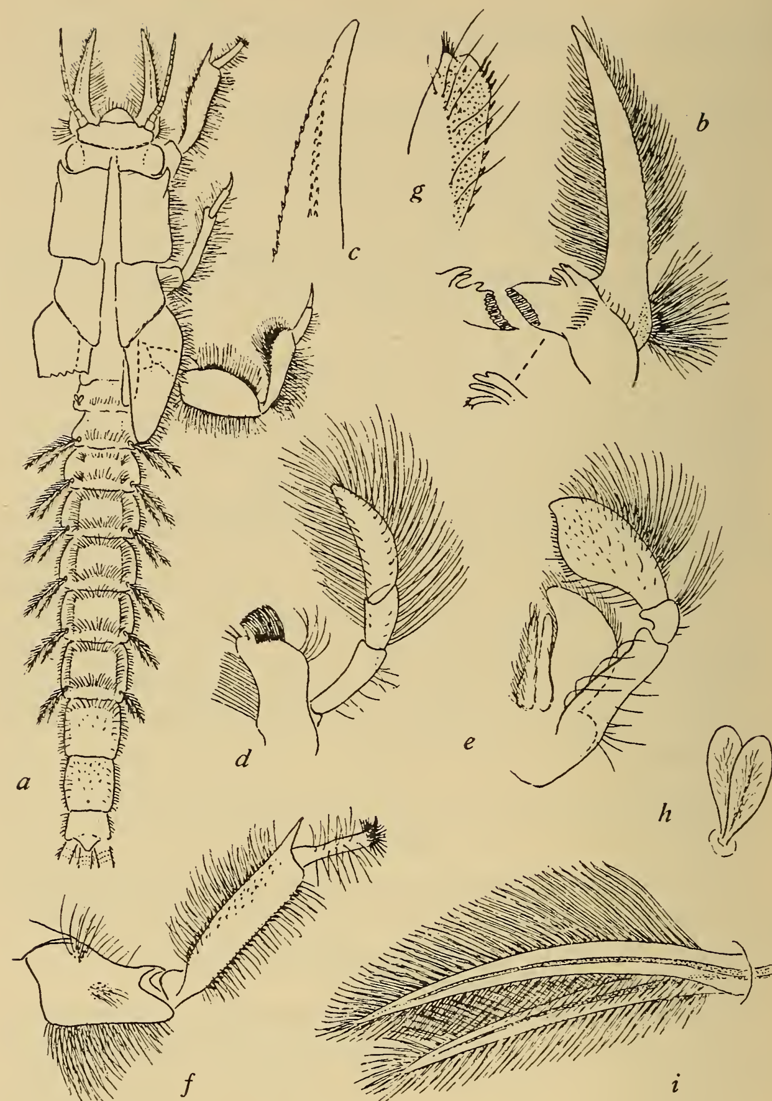



Fig. 3.—Nymph provisionally assigned to *Exeuthyplocia sampsoni* Brnrd. *a*, nymph drawn from empty shuck, showing split in middle line of thorax; left wing-cases cut away to show small 1st gill; cerci cut off. *b*, ventral view of left mandible, and molar portion of right mandible. *c*, dorsal view of apex of left mandible, setae omitted. *d*, maxilla. *e*, labium. *f*, ventral view of fore-leg. *g*, ventral view of apex of tibia of middle leg, only a few of the long setae shown. *h*, 1st gill. *i*, 2nd gill.

Front of clypeus to end of abdomen 25 mm., cerci 12–13 mm. (apparently complete).

Clypeus projecting horizontally, setose. Mandibles triquetral, thickly setose on inner and outer margins, outer margin with short spinules, a line of spinules on upper margin, double proximally, becoming a single series distally.

Tibia of fore-leg with lower surface flattened and spinules along inner and outer margins, upper surface convex, densely setose. Claw of fore-leg short, almost concealed in a thick bunch of short blackish spines and bristles on apex of tarsus. Tibia of middle leg cylindrical, spinose and densely setose on outer surface, long setae also on outer distal portion of lower surface, inner apex with a tuft of stiff bristles. Femur of hind leg broadly ovate, flattened but not specially so on lower surface, both margins and upper surface densely setose, inner (front) margin in addition with spinules, which are inserted ventrally to the long setae. Hind tibia expanding distally, densely setose on hind (outer) margin, inner margin with long setae and stiff bristles, the latter especially numerous and densely packed distally.

Abdomen in cross-section trapezoidal, the dorsal surface narrower than the ventral surface, the former marked by a dorso-lateral setose ridge on segments 3–7; on segments 8 and 9 there is a fringe of setae but no very definite ridge. A single transverse fringe of setae on segments 1, 2, and 8, near hind margin on segments 1 and 2, anterior on 8; on segments 3–7 two transverse fringes of setae.

Gills, 7 pairs; the 1st pair very small, bilamellate, non-fimbriate and non-setose; 2nd–7th pairs elongate, gently curved with very numerous (far more numerous than represented in the figure, especially on anterior margin of upper lobe) long slender filaments. Owing to the dorsal transverse and dorso-lateral fringes of setae on the abdominal segments, it is doubtful if the gills are held curved over the back in life; apparently they can be folded against the sides and more or less protected between the dorso-lateral and ventro-lateral fringes of setae.

## Fam. EPHEMERIDAE.

*Eatonica schoutedeni* (Navas).

1932. Barnard, *loc. cit.*, p. 210.

*Locality.*—Nelspruit, Transvaal (November), H. K. Munro.

## Fam. OLIGONEURIIDAE.

*Elassoneuria trimeniana* (McLach.).

(Fig. 4.)

1932. Barnard, p. 212, fig. 4 (references).

Lestage (1916, Rev. Zool. Afric., iv, p. 314, figs. 1–5) described a nymph (20 mm. in length, excl. cerci) from the Belgian Congo, resembling in general that of *Oligoneuria rhenana* (see Lestage, Larves et Nymphes Aquatiques, i, p. 214, fig. 54, 1921). The head was not figured, but part of the description says, "bord antérieur finement cilié et offrant sur la partie médiane une saillie longitudinale caréniform bien visible légèrement prolongée en avant et formant comme un petit nez procéphalique." In this respect it differs from *Oligoneuria* (*loc. cit.*, 1916, p. 318).

In 1917 (Rev. Zool. Afric., v, p. 122, fig. 1) Lestage assigned this nymph to *E. trimeniana*, and gave a figure of the whole animal showing the head with its anterior point and dorsal keel.

The two nymphs (13 mm. in length, excl. cerci) before me, from Cathkin Peak, 6000 ft. alt., Drakensberg, Natal (Dr. R. F. Lawrence, January 1938), differ in the shape of the head which is rounded in front, without any longitudinal keel or ridge, widest in front of eyes instead of across the postero-lateral angles, and in the shorter antennae (as in *Oligoneuria*).

Since *E. trimeniana* was originally described from Natal, there is the greatest probability that this is its true nymph. In which case, either the Congo nymph belongs to another species whose imago is as yet unknown, or the *E. trimeniana* of Ulmer (1916, Arch. Naturg., lxxi, 1915, Abt. A, p. 4) is not the true *trimeniana* of McLachlan. The further alternative that the carinate and pointed head and the longer antennae are assumed only in nymphs larger than, say, 13 mm. does not seem at all likely.

This latter statement is confirmed by some nymphs, 13–19 mm. in length, from Kenya, which I have recently examined. These have the head widest across the postero-lateral angles, without medio-dorsal keel or anterior point, antennae short as in the Natal specimens, but the median cercus at least half the length of the lateral ones.

It seems probable that more than one species will eventually be recognised in Africa.

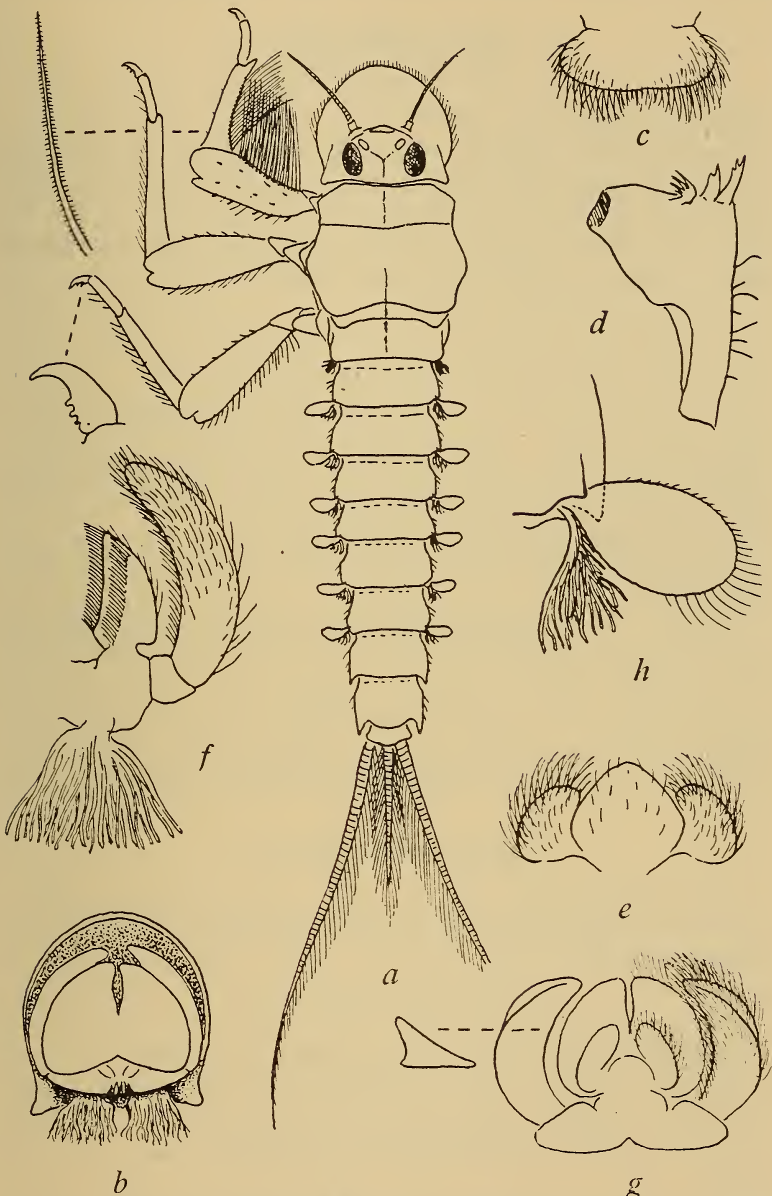



FIG. 4.—*Elassoneuria trimeniana* (McLach.). *a*, whole animal, with seta from fore-leg, and claw of middle and hind legs further enlarged (the claw of fore-leg is without denticles). *b*, ventral view of head, showing maxillary gills projecting from under the labium (setae omitted). *c*, labrum. *d*, mandible. *e*, hypopharynx. *f*, maxilla, the submarginal row of bristles is on the outer (ventral) surface. *g*, labium, inner (dorsal) view, with cross-section of palp. *h*, one of the lateral gills in dorsal view.

## Fam. BAETIDAE.

### *Cloeon lacunosum* Brnrd.

1932. Barnard, *loc. cit.*, p. 214.

*Longevity.*—Mr. Harrison records a further case (*cf.* Barnard, p. 214). A ♀ subimago emerged at 8 p.m. on 15th July 1932, and transformed to the imago during the night 16th–17th. She lived until 8 p.m. on 7th September 1932, *i.e.* for 54 days after emergence from the nymph. Although ♂♂ were supplied, she died unfertilised, as in the case previously recorded.

*Ovoviviparity.*—On 12th December 1932 Mr. Harrison was able to prove that this species is ovoviviparous like *C. dipterum*. "A female alighted on the water with wings flat out, and as she lay there a stream of larvules left her. After placing in a tube of water a few more larvules came away. Immediately afterwards a second female alighted and was promptly placed in a tube, when the larvules streamed out and swam fast in all directions."

The larvules possess two cerci and the buds (anlagen) of the seven pairs of gills.

*Localities.*—Reservoir, Platteklip stream, Cape Town (26th November and 26th December 1932, ♀♀, K. H. B.); Orange Kloof, Table Mt. (1st March 1933, ♀♀, K. H. B. and H. G. W.); St. James (21st January 1933, A. C. H., ♂♂, "swarming"); Muizenberg Reservoir (December 1932, A. C. H., ♀♀, with larvules); Diep River, near Philadelphia, Cape Div. (26th April 1932, K. H. B., nymphs).

### *Cloeon chaplini* Brnrd.

1932. Barnard, *loc. cit.*, p. 216.

*Locality.*—Jonkershoek, Stellenbosch (November 1931, F. G. Chaplin, nymphs).

### *Cloeon aeneum* Brnrd.

1932. Barnard, *loc. cit.*, p. 216.

*Localities.*—Palmiet River mouth (31st July 1932 and 25th December 1932, H. G. W.); French Hoek Pass (1st October 1933, K. H. B.); Upington (November 1920, Father Sollier). The latter mutilated specimen in the S.A. Museum collection seems to be this species.

### *Cloeon perkinsi* Brnrd.

1932. Barnard, *loc. cit.*, p. 216.

*Locality.*—East London (March, H. K. Munro).

*Austrocloeon africanum* (E. P.).

1932. Barnard, *loc. cit.*, p. 218.

*Localities.*—S.A. Museum grounds, Cape Town (12th April 1932, 8th May 1933, and 7th December 1932, Dr. E. L. Gill); Welgemoed Farm, east of Ceres (February 1922, K. H. B.); Swellendam Mts. (October 1925, K. H. B.); Platteklip stream, Table Mt. (26th April 1933, K. H. B.); Meirings Poort Mts. (February 1932, K. H. B. and H. G. W.); Boschluis Kloof, Zwartberg Range (February 1932, K. H. B. and H. G. W.).

*Austrocloeon virgiliae* Brnrd.

1932. Barnard, *loc. cit.*, p. 219.

*Localities.*—Reservoir, Platteklip stream, Cape Town (26th December 1932, K. H. B.); Ida's Valley, Stellenbosch (20th February 1932, A. C. H.); Boschluis Kloof, Zwartberg Range (February 1932, K. H. B. and H. G. W.); Meirings Poort, Zwartberg Range (January 1935, K. H. B. and H. G. W.); Near Cango Caves, Oudtshoorn Distr. (September 1933, K. H. B.); Willow R., north slopes of Cockscomb Peak (Uitenhage Div.) (K. H. B., October 1938).

*Austrocloeon* nymphs.

*Locality.*—Drieling's Kloof, between Laingsburg and Ladismith (February 1932, K. H. B. and H. G. W.).

*Pseudocloeon vinosum* Brnrd.

1932. Barnard, *loc. cit.*, p. 220.

*Localities.*—Orange Kloof, Table Mt. (1st March 1933, K. H. B. and H. G. W.); French Hoek Pass (1st October 1933, K. H. B.); Hottentot Holland Mts. (January 1933, K. H. B. and H. G. W.); du Toits Kloof, Rawsonville (25th March 1932, K. H. B.); Seven Weeks Poort, Ladismith, Cape (February 1932, K. H. B. and H. G. W.); Upper Olifants R., north of Ceres (October 1937, K. H. B. and C. W. T.).

*Pseudocloeon magae* Brnrd.

1932. Barnard, *loc. cit.*, p. 221.

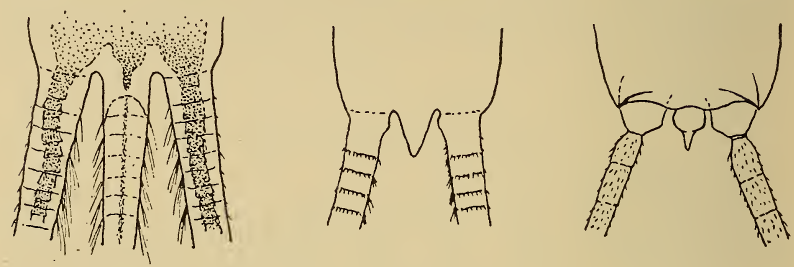
*Localities.*—Orange Kloof, Table Mt. (1st March 1933, K. H. B. and H. G. W., ♂♂, 1 ♀); Silvermine Stream, Kalk Bay Mts. (12th March 1933, A. C. H.).

### *Baetis harrisoni* Brnrd.

(Fig. 5, *a*).

1932. Barnard, *loc. cit.*, p. 222.

*Localities.*—Groot Drakenstein (25th October 1933, K. H. B. and H. G. W.); French Hoek Pass (1st October 1933, H. G. W.); Platteklip stream, Cape Town (26th April 1933, K. H. B.); du Toits Kloof,



*a* *b* *c*

Fig. 5.—*Baetis harrisoni.* *a*, apex of abdomen of nymph, with subimago ready to hatch.

*Acentrella capensis.* *b*, *c*, apex of abdomen of nymph and of imago.

Rawsonville (25th March 1932, K. H. B.); Seven Weeks Poort, Ladismith, Cape (September 1933, K. H. B., nymphs); Near Cango Caves, Oudtshoorn Distr. (February 1932, K. H. B. and H. G. W., nymphs, and September 1933, K. H. B., imagos); Fairy Glen, Worcester (12th August 1932, K. H. B. and H. G. W.); Porterville (August 1937, A. C. H.); Upper Olifants R., north of Ceres (October 1937, K. H. B. and C. W. T.).

### *Baetis bellus* Brnrd.

1932. Barnard, *loc. cit.*, p. 222.

*Localities.*—Great Winterhoek Mts., Tulbagh (November 1932, K. H. B. and H. G. W.); Warmbaths, Citrusdal (September 1932, K. H. B., nymphs); Platteklip stream, Cape Town (26th April 1933, K. H. B.); Blinkwater stream, above Camps Bay, Cape Peninsula (21st August 1932, K. H. B.).

### *Baetis* sp.

Nymphs of what seems to be a different species of *Baetis* were found at Meirings Poort mountains, Zwartberg Range (February 1932, K. H. B. and H. G. W.).

*Acentrella capensis* Brnrd.

(Fig. 5, *b*, *c*).

1932. Barnard, *loc. cit.*, p. 259.

It seems impossible to separate with certainty the adults of this species from those of *Baetis harrisoni* except by breeding. Unless examined when freshly caught the abdominal coloration is liable to be inconclusive. The short branch of the fork 1 A may be clearly disconnected, or it may be almost connected. In any case this feature is variable among the species of *Baetis*, as Dr. Ulmer has kindly pointed out to me (*in litt.* 26/5/32), and should not be used as a specific character.

Figures are here given of the apex of the abdomen of the nymph and the adult. For comparison a figure is also given of the abdomen and cerci of a nymph of *Baetis harrisoni*, showing the subimago ready to hatch. The median cercus is fully developed in the nymph, but in the final instar the enclosed adult cercus degenerates and becomes detached near the base, remaining behind in the empty shuck after emergence of the subimago.

*Localities.*—Naudesberg, Worcester (August 1932, K. H. B. and H. G. W., nymphs); Gt. Winterhoek Mts., Tulbagh (November 1932, K. H. B. and H. G. W., nymphs).

*Centroptilum sudafricanum* Lest.

1932. Barnard, *loc. cit.*, p. 224.

*Localities.*—Orange Kloof, Table Mt. (1st March 1933, K. H. B. and H. G. W.); Platteklip stream, Cape Town (26th April 1933, K. H. B.); Blinkwater stream, above Camps Bay (31st January, 21st March, and 21st August 1932, K. H. B.); Hottentots Holland Mts. (January 1933, K. H. B. and H. G. W.); Gt. Winterhoek Mts., Tulbagh (November 1932, K. H. B. and H. G. W.); Warmbaths, Citrusdal (September 1932, K. H. B., nymphs); Farm Ezelfontein, 7 miles east of Ceres (September 1933, K. H. B.); Prince Albert, mouth of the Zwartberg Pass (September 1933, K. H. B.); Palmiet River, Kleinmond (March 1932, H. G. W.); Jonkershoek, Stellenbosch (14th February 1933, K. H. B. and H. G. W.); Oudebosch, River Zonder End Mts. (September 1933, H. G. W.); Groot Drakenstein (25th October 1933, K. H. B. and H. G. W.); Meirings Poort, Zwartberg Range (February 1932, K. H. B. and H. G. W.); du Toits Kloof, Huguenot (31st March 1934, H. G. W.).

*Centroptilum excisum* Brnrd.

1932. Barnard, *loc. cit.*, p. 224.

*Localities.*—Meirings Poort, Zwartberg Range (February 1932, K. H. B. and H. G. W.); Onderbokfontein, Cold Bokkeveld, north of Ceres (September 1932, K. H. B.); M'fongosi, Zululand (April 1917, W. E. Jones).

*Centroptiloides bifasciatum* (E.-P.).

1932. Barnard, *loc. cit.*, p. 226.

*Locality.*—Yarrow River, Karkloof, Natal (18th March 1934, L. A. Day).

## Fam. BRACHYCERCIDAE.

*Austrocaenis capensis* Brnrd.

1932. Barnard, *loc. cit.*, p. 227.

*Localities.*—Diep River, Philadelphia, Cape Div. (26th April 1932, K. H. B., nymphs); Palmiet River (March 1932, H. G. W., nymph); du Toits Kloof, Rawsonville (25th March 1932, K. H. B.); Seven Weeks Poort, Ladismith, Cape (February 1932, K. H. B. and H. G. W.); Boschluis Kloof, Zwartberg Range (February 1932, K. H. B. and H. G. W.); near Cango Caves, Oudtshoorn Distr. (September 1933, K. H. B., nymphs, imagos).

*Austrocaenis* sp.

A ♂ imago caught at Groot Drakenstein (25th October 1933, H. G. W.) is smaller and much darker than the normal *capensis*. Length of wing 3·25 mm. Head and thorax dark Vandyke brown, abdomen strongly suffused with sepia, legs normal, but the dark streaks almost black, Sc and R brown, cerci white. Also 2 ♂♂ from Umzimkulu R., Natal (Dr. B. F. Sampson, October 1937).

### Gen. Tricorythus Eaton.

Ulmer (1932, *loc. cit.*, p. 215) remarks that *T. discolor*, with its peculiar nymph, is not typical of the genus *Tricorythus*. If that is so, possibly a new genus may later be required for the South African species.

The characteristic nymphs have been found at the following localities: Hogsback, Amatolas, King Williams Town Div. (February 1933, R. F. Lawrence); Seven Weeks Poort, Ladismith, Cape (September 1933, K. H. B.); Cathkin Peak, 6000 feet, Drakensberg, Natal (January 1938, R. F. Lawrence); Bushmans and Umzimkulu Rivers, Natal (Dr. Sampson).

*Tricorythus reticulatus* Brnrd.

1932. Barnard, *loc. cit.*, p. 232.

*Locality.*—Pretoria, at light (February 1934, H. K. Munro, ♀♀) (one with egg-mass), wings, 6·5–7 mm.

## Fam. LEPTOPHLEBIIDAE.

### Gen. Aprionyx Brnrd.

1934. Tillyard, Pap. Proc. Roy. Soc. Tasman. for 1933, pp. 5, 6 (discussion).

*Aprionyx peterseni* (Lest.).

1932. Barnard, *loc. cit.*, p. 236.

*Localities.*—Du Toits Kloof, Rawsonville (25th March 1932, K. H. B.); Lemoenshoek, Langeberg Range (November 1927, K. H. B.); Palmiet River, Kleinmond (March 1932, H. G. W.); Elands Kloof, Citrusdal (5th March 1933, H. G. W.); French Hoek Pass (December 1932, K. H. B. and H. G. W.); Oudebosch, River Zonder End Mts., 1500 feet (January 1933, H. G. W., and January 1934, K. H. B.); Tulbagh Valley and Gt. Winterhoek Mts. (February 1934, K. H. B.); Meirings Poort, Zwartberg Range (January 1935, K. H. B. and H. G. W.).

*Aprionyx intermedius* Brnrd.

1932. Barnard, *loc. cit.*, p. 238.

*Localities.*—Fairy Glen, Worcester (12th August 1932, K. H. B. and H. G. W.); Groot Drakenstein (12th September 1932, A. C. H.); Ruiterbosch, Robinson Pass, Outeniqua Range (February 1932, K. H. B. and H. G. W.); Great Winterhoek Mts., Tulbagh (September 1932, K. H. B.).

*Aprionyx rubicundus* Brnrd.

1932. Barnard, *loc. cit.*, p. 239.

*Localities.*—Hottentots Holland Mts. (east side of Spitzkop) (November 1932, K. H. B. and H. G. W.); Witte River, Wellington Mts. (1st October 1933, H. G. W.); French Hoek Pass (1st October 1932 and 1933, K. H. B. and H. G. W.); Oudebosch, River Zonder End Mts., 1500 feet (December 1931 and January 1933, H. G. W., and January 1934, K. H. B.); Fairy Glen, Worcester (12th August

1932, K. H. B. and H. G. W.); Gt. Winterhoek Mts., Tulbagh (November 1932, K. H. B. and H. G. W.); Upper Olifants R., north of Ceres (October 1937, K. H. B. and C. W. T.).

When freshly caught most specimens are considerably darker than would appear from the description; in fact, when settling on white stones in the sunlight the flies look quite black. Wing length of ♀♀ 9–10 mm.

### *Aprionyx pellucidulus* (E. P.).

(Fig. 6, *a*.)

1932. Barnard, *loc. cit.*, p. 239.

*Localities.*—Hottentots Holland Mts. (January 1933, K. H. B. and H. G. W.); River Zonder End Mts., 3500–4500 feet (January 1933, H. G. W., and January 1934, K. H. B.); Gt. Winterhoek Mts., Tulbagh (November 1932, K. H. B. and H. G. W., nymphs and adults).

*Nymph.*—With smooth claws, and other features as in diagnosis of *Aprionyx*. Front tibia and tarsus as in *peterseni*, without the fringe of long hairs found in *tabularis*.

Mottled brown, antennae and cerci ochraceous. Femora banded. Gills greyish-white, tracheae blackish. Abdomen pale yellowish or ochraceous, segments 1–9 each with narrow transverse dark band on hind margin, segment 6 slightly suffused on anterior margin, segments 7–9 with anterior half suffused but leaving a narrow pale median line, on either side of which is a small pale spot (fig. 6, *a*). Females are rather more strongly suffused, the transverse bands being enlarged at both ends into a small dark spot; the whole abdomen is deeper in colour owing to the eggs developing inside.

The suggestion that the Zwartberg nymph (*loc. cit.*, fig. 29, *c*) might be the nymph of this species is herewith withdrawn.

### *Aprionyx argus* n. sp.

(Fig. 6, *d–f*.)

*Imago.*—8–9 strong cross-veins before bulla, 9–10 in pterostigmal area, oblique, straight or nearly so, only occasionally forming forks at costal margin or anastomosing. Hind-wing with Sc extending nearly to end of wing, 4–6 cross-veins in subcostal area. Penis ♂ thin dorso-ventrally, broad, apically notched, with the openings of the vasa deferentia laterally at apex. Clasper with inner margin angularly curved proximally. Ventral plate ♀ apically indented.

Body ♂ 10 mm., ♀ 12 mm.; wing ♂ 10–11 mm., ♀ 12 mm.

♂. Head and thorax dark Vandyke brown. Legs ochreous, femora with dark band in middle and at apex. Abdomen brown,

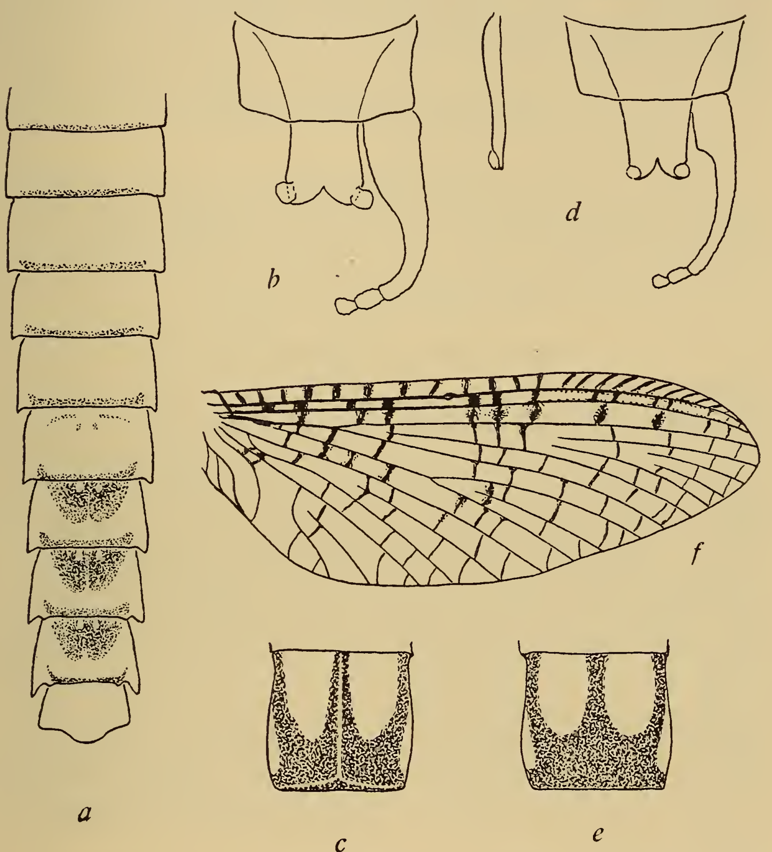



Fig. 6.—*Aprionyx pellucidulus* (E. P.). *a,* abdomen of nymph. *Aprionyx natalica* (Lest.). *b,* penis and clasper ♂. *c,* segment of abdomen. *Aprionyx argus* n. sp. *d,* penis and clasper, with lateral view of former. *e,* segment of abdomen. *f,* fore-wing.

segments 1, 9, and 10 unicolorous, segments 2–8 each with a pair of large pale spots at base dorsally, pale spots laterally and ventrally. Neuration dark fuscous-brown, some specimens more heavily marked than in the specimen figured. Cerci whitish, annulated. Penis pale, apices (or only inner apical margin) of claspers whitish. ♀ similar.

*Locality.*—Cathkin Peak, 6000 feet, Drakensberg, Natal (R. F. Lawrence, January 1938).

*Remarks.*—Somewhat like *natalica* but more heavily veined, and reminiscent of the Cape species *peterseni*. A figure of the penis and clasper of *natalica* (fig. 6, *b*), from the above same locality, is given for comparison. Both the Natal species differ from all the Cape species in the shape of the penis.

### *Adenophlebia auriculata* Eaton.

1932. Barnard, *loc. cit.*, p. 242.

*Localities.*—Stutterheim (September, H. K. Munro); Hogsback, Amatolas, King Williams Town district (February 1933, R. F. Lawrence); Kaaiman's Gat, near George (April 1933, H. G. W.); Howieson's Poort, near Grahamstown (October 1933, J. Hewitt).

### *Adenophlebia peringueyella* Lest.

1932. Barnard, *loc. cit.*, p. 242.

*Localities.*—Seven Weeks Poort, Ladismith, Cape (February 1932, K. H. B. and H. G. W., also September 1933, K. H. B.); Gt. Winterhoek Mts., Tulbagh (September 1932, K. H. B.); Schoemann's Poort, Cango, Oudtshoorn Distr. (September 1933, K. H. B.); Huis River, between Cango and Calitzdorp (September 1933, K. H. B.).

Three small ♂♂ from Seven Weeks Poort, February 1932, appear to be this species. Wing-length 8 mm.; in two of the specimens there are 8 cross-veins between $R_{4+5}$ and $MA_1$, and also between $MA_2$ and $M_{1+2}$, in the third specimen 9 cross-veins. The wings are rather heavily spotted, but not so much as in the wing dissected from a Zwartberg Pass nymph (*loc. cit.*, fig. 31). Another ♂ caught on the same occasion has wing-length 8·5 mm.; 9 cross-veins on either side of MA; veins no more enlarged or spotted than in *auriculata* (*loc. cit.*, fig. 30).

In the extreme western Cape *peringueyella* is a spring fly and does not seem to last on until the summer. It is possible that these small forms may be a later brood (the typical *peringueyella* with wing-length 10–12 mm. occurs in the same locality in September), but it must be remembered that the Zwartberg Range may get some heavy rainfalls in summer, so that a marked diminution in the flow of the streams and consequent lessening of the food supply cannot be invoked to explain the small size of these later forms. If it were possible, observations throughout a whole year at Seven Weeks Poort would prove very interesting.

*Adenophlebia dislocans* (Wlkr.).

1932. Barnard, *loc. cit.*, p. 244.

*Localities.*—Platteklip stream, Cape Town (3rd January 1932 and 26th April 1933, K. H. B.); Oudebosch, River Zonder End Mts. (September 1933, H. G. W., and January 1934, K. H. B.); Fouches Hoek, Mosterts Hoek (Breede River valley) (17th April 1933, K. H. B.); du Toits Kloof, Huguenot (31st March 1934, H. G. W.).

*Adenophlebia* nymphs.

*Locality.*—Ezelfontein, east of Ceres (September 1933, K. H. B.).

Gen. Castanophlebia Brnrd.

1932. Barnard, *loc. cit.*, p. 244.

1932. Ulmer, *loc. cit.*, p. 214.

This genus appears to be accepted by Ulmer. Unfortunately Ulmer received a reprint of my paper with the typographical error "long stalk of MA" instead of "long stalk of M" (see corrigenda).

The beautiful May-fly described below is a typical *Castanophlebia* as regards the imago, but shows remarkable features in the nymph, which necessitate an emendation of the generic diagnosis.

*Nymph.*—Maxillary palp with 3rd joint either short, its junction with 2nd joint transverse, or elongate with oblique junction. Gills seven pairs, either double or single, but always slender and narrow lanceolate.

The reduction of the inner lamina of the 7th gill and its occasional complete absence in *calida*, seems to indicate the course of evolution of the new species.

Genotype: *C. calida* Brnrd.

*Castanophlebia albicauda* n. sp.

(Fig. 7.)

*Imago.*—7–8 cross-veins before bulla, 10 (♂) 14–15 (♀) in pterostigmal area, the latter oblique, straight or slightly sigmoid, with occasional Y-forking on costa; subcostal 16–17 (♀); between $R_{4+5}$ and $MA_1$ 8 (♂) 9–10 (♀); between $MA_2$ and $M_{1+2}$ 9 (♂) 9–10 (♀); 1–3 (4) cross-veins between IMA and $MA_1$ and $MA_2$ (not counting proximal connecting veins); $IR_{3b}$ usually not connected with Rs. Hind-wing as in *calida* (not always so many cross-veins in subcostal area as represented in fig. 36, *b*). Tenth sternite, penis, and forceps

♂ as in *calida*, each lobe of the penis with a small knob in middle, which appears as if it could be extruded into an acute process as in *calida*. Ventral plate of ♀ short, broader than long, with deep excision as in *calida*.

Fore-wing: ♂ 9 mm., ♀ 11 mm.

Castaneous, occiput, and prothorax slightly paler; a dark brown bar on lateral margin of scutum as in *calida*; abdominal segments

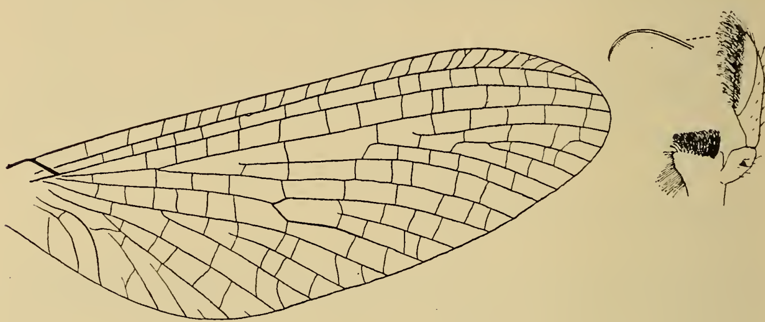


FIG. 7.—*Castanophlebia albicauda* n. sp. Fore-wing (♀), and maxilla.

1–6 ♂, 1–7 ♀ castaneous, the junctions of the segments and the pleural junctions of tergites and sternites pale, segments 7–9 ♂, 8 and 9 ♀ pale fawn. Legs and cerci pale fawn, uniform. Neuration fulvous-castaneous, costal and subcostal areas in pterostigmal region semi-opaque. Neuration in ♂ much paler and less conspicuous than in ♀, the cross-veins especially faint.

*Subimago* similar but paler.

*Nymph.*—As in *calida*, but the labrum more angular, the spines on front margins of femora acute. The maxillary palp as figured, the junction of 2nd and 3rd joints oblique, 3rd greatly elongate, with dense brush of setae along its inner margin, most of the setae apically falcate, with extremely minute setules on inner margin. Labial palp with 3rd joint not so slender relatively to the 2nd as figured for *calida* (even for *calida* fig. 37, *g*, shows the 3rd joint too slender). Seven pairs of gills, each gill consisting of a single narrow lamina, with unbranched trachea.

Up to 10–11 mm., cerci 15–18 mm.

Fulvous-castaneous, mature nymphs deep castaneous, pro- and meso-thorax slightly mottled dorsally. Abdominal segments 1–7 castaneous, segments 8–10 pure ivory-white. Ventral surface of thorax and abdominal segments 1–7 pale brownish, usually with the

3 dark spots as in *calida*. Femora ochraceous, tibiae and tarsi paler. Cerci white. Anterior gills greyish, with dark tracheae, the posterior ones white with inconspicuous tracheae. Maxillary palp with 2nd and 3rd joints pale.

*Localities.*—Gt. Winterhoek Mts., Tulbagh, 4000–5000 feet (end September 1932, nymphs, K. H. B., beginning of November 1932, nymphs and adults, K. H. B. and H. G. W.); Witte River, Wellington Mts. (October 1933, H. G. W., nymphs); Bosch Kloof, Keeromberg, Worcester (end of January 1933, half-grown nymphs, H. G. W.).

*Remarks.*—A larger and apparently more local fly than the "Chestnut Dun" (*C. calida*). It is easily recognised by the white or pale apex of the abdomen, which is very conspicuous in the nymph (*cf.* similar coloration in nymphs of *Lithogloea harrisoni*, and Agrionid Dragon-fly nymphs from the Gt. Winterhoek Mts.).

Under a hand-lens the head of the nymph with its maxillary palps projecting forwards resembles a dust-pan with a pair of hand-brushes; and the palps evidently function as brushes to sweep up particles of food-stuff into the mouth.

The fly may be known as the Larger Chestnut Dun.

### *Castanophlebia calida* Brnrd.

1932. Barnard, *loc. cit.*, p. 246, figs. 36, 37.

*Localities.*—Hottentots Holland Mts. (November 1932, K. H. B., H. G. W., and C. W. T.); Tradouw Pass, Langeberg Range (February 1932, K. H. B., H. G. W., and C. W. T.); Meirings Poort, Zwartberg Range (February 1932, K. H. B., H. G. W., and C. W. T.); Gt. Winterhoek Mts. (September 1932, K. H. B., H. G. W., and C. W. T.); Porterville (August 1937, K. H. B. and A. C. H.); Upper Olifants R., north of Ceres (October 1937, K. H. B. and C. W. T.).

## Fam. EPHEMERELLIDAE.

The discovery of a second species of *Lithogloea* necessitates another alteration in the family diagnosis, as the nymph of this n. sp. has only four pairs of gills on segments 1–4.

### Gen. Ephemerellina Lest.

1932. Barnard, *loc. cit.*, p. 347.

1932. Ulmer, *loc. cit.*, p. 214.

The generic diagnosis may be completed thus: fore tarsus ♂ slightly longer than tibia, which is twice as long as femur; 1st tarsal joint very short, 2nd longest, 3rd–5th decreasing, claws alike. Ventral plate ♀ broader than long.

In the subimago the fore-leg of ♂ is no longer than that of the ♀.

Although the fly has not actually been bred, further collecting, especially on Table Mt., leaves no doubt that the nymph described and figured by me (*loc. cit.*, p. 252, fig. 43, *d–g*) is correctly assigned. Both nymphs and flies have been found in the Gt. Winterhoek Mts. and on Table Mt.; and nymphs in several other localities, including the river system in which the type locality is situated.

Whether there is more than one species in the Cape mountains is a moot point. The ♂♂ from the Gt. Winterhoek Mts. have a much more strongly bilobed penis than the single ♂ from the Wellington Mts.

*Ephemerellina barnardi* Lest.

1932. Barnard, *loc. cit.*, p. 251, fig. 42, *e*, and p. 252, fig. 43, *d–g* (nymph).

*Imago.*—Some specimens collected in the Gt. Winterhoek Mts., 4000 feet (beginning November 1932, K. H. B. and H. G. W.), are

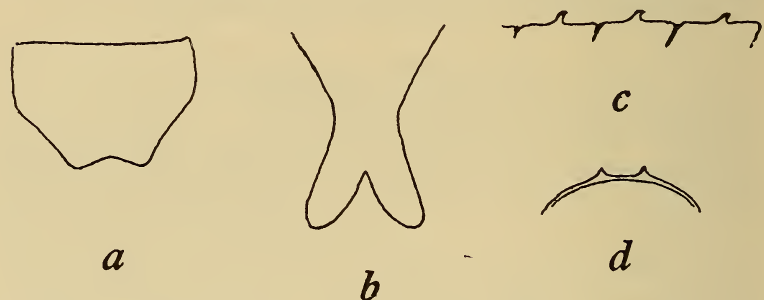



Fig. 8.—*Ephemerellina barnardi* Lest. *a*, ventral plate, ♀. *b*, penis. *c*, *d*, dorsal abdominal spinules of imago, lateral view and cross-section.

very much darker than the original specimens. The whole body is dark Vandyke brown, with lighter marks laterally on the mesothorax. Wings hyaline, slightly milky along the costal margin, longitudinal veins dark brown or sepia, the cross-veins very inconspicuous.

Penis somewhat hour-glass shaped, apically deeply bilobed. Ventral plate ♀ broader than long, lateral margins feebly angular, and distal margin slightly concave.

Abdominal segments 2–6 each with a small transverse thickening in the middle of the tergite, each bearing 2 small conical tubercles or spinules.

Fore-wing ♂ 9 mm., ♀ 10 mm.

These specimens are smaller than the Gt. Winterhoek ♀ (November 1916), but barring the colour are exactly similar. The ventral plate and the abdominal spinules were not mentioned in my description.

The ♂♂ differ in the penis from the Wellington Mts. ♂ figured by me. A subimago from this locality (1st January 1934, H. G. Wood) confirms this figure, though a comparison between subimago and imago is not too reliable. The abdomen in the latter specimen is too mutilated to determine the presence of the spinules.

Some ♀♀ from Table Mt. (5th January, 2nd February, and 29th December 1933, K. H. B.) agree in the shape of the ventral plate and other features, but the coloration is distinctly castaneous or rufous. Fore-wing 10–11 mm.

The original pair described by Lestage is not in the S.A. Museum (Barnard, *loc. cit.*, footnote, p. 202), so that further comparison must wait until more material is obtained from the type locality.

*Nymph.*—Nymphs similar to that described from the Cedarberg Mts. have been found in the Gt. Winterhoek Mts., end September 1932, K. H. B.; in the head-waters of the Palmiet River (Groenland Mts., south side of Viljoen's Pass, Elgin, 29th October 1931, K. H. B., and Hottentots Holland Mts., November 1932 and January 1933, K. H. B. and H. G. W.); French Hoek Pass (head-waters of River Zonder End) December 1932, K. H. B. and H. G. W.; Table Mt., August–September 1933, K. H. B., half and three-quarters grown.

The Elgin nymph is a large one measuring 12 mm., cerci 9 mm., 3 mm. across the wing-cases and 2·75 mm. high at the same level. The largest from the Gt. Winterhoek Mts. is 10 mm. in body length, and is evidently in a younger stage as the projecting tips of the wing-cases are not so prominent.

The larger nymphs are very solidly built, plump and high; they can be picked off the rock with thumb and finger without damage. They inhabit only those portions of the mountain streams which are shallow and where the water is always rushing tumultuously over the rocks and stones.

### Gen. Lithogloea Brnrd.

1932. Barnard, *loc. cit.*, p. 252.

The diagnosis stands, except that the penis is not always broad in contrast with that of *Ephemerellina*, and that gills are present in the nymph on segments 1–6 *or* 1–4.

The confusion of two species under the name *harrisoni* was due to my collecting very young nymphs from Table Mt. streams and referring them without actual breeding to the Drakenstein specimens bred by Mr. Harrison. We were led to think that there might be two species in the Drakenstein material by differences in coloration; but this was definitely proved not to be so, as stated on p. 255, lines 5–6. This has been further confirmed by breeding from nymphs of another different colour-pattern.

Barring a slight difference in size, and the penis of the ♂, there is no distinction between the imagos of the two species; but the nymphs are quite distinct.

Genotype: *L. harrisoni* Brnrd.

*Lithogloea harrisoni* Brnrd.

1932. Barnard, *loc. cit.*, p. 253, figs. 42, *a–d*, 44 (*harrisoni* part; not the young nymph described and figured).

The locality Table Mt. should be deleted, as the true *harrisoni* has not yet been found in the Cape Peninsula.

Add the following localities: Gt. Winterhoek Mts., Tulbagh (November 1932, K. H. B. and H. G. W.); Palmiet River, Kleinmond (December 1932, H. G. W.); Hottentots Holland Mts. (November 1932, K. H. B. and H. G. W.).

In the nymph the following colour varieties have been observed: From Stellenbosch Mr. Harrison has collected nymphs of a uniform very dark Vandyke brown, almost black. In the Gt. Winterhoek Mts. nearly all the nymphs have definite white spots; the ground colour in the younger nymphs is mottled as originally described (p. 255), but in the larger ones becomes very dark sepia, almost black. The following parts are pure white: 2 small dots on head behind lateral ocelli and contiguous with inner margins of eyes, a large oval median spot on anterior part of mesonotum, whole of 10th tergite and the lateral projections of the 9th segment, the distal ends of all the femora, and the distal half of the cerci except the extreme tips. In life the contrast between the blackish ground-colour and the white thoracic spot, 10th abdominal segment and "knees" is very striking. The nymphs are very conspicuous on the stones and are not in the least protectively coloured as are the nymphs of the following species.

It is interesting to note that in the same locality the nymphs of one of the Agrionid Dragon-flies has the same scheme of coloration: blackish with white terminal segment and white knees; and also the nymphs of *Castanophlebia albicauda* (cf. *supra*).

*Lithogloea penicillata* n. sp.

1932. Barnard, *loc. cit.*, p. 255, fig. 43, *a–c* (*harrisoni* part, young nymph).

*Imago.*—As in *harrisoni*, but slightly smaller, and penis narrower (*cf.* fig. 42, *e*, of *E. barnardi*). Ventral plate ♀ as in *harrisoni.*

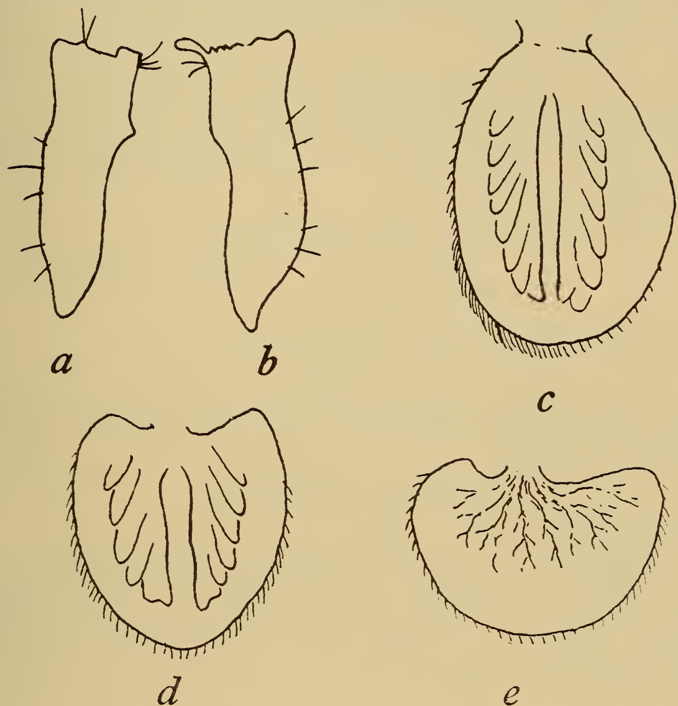


Fig. 9.—*Lithogloea penicillata* n. sp. Nymph. *a*, *b*, left and right mandibles. *c*, *d*, *e*, gills on 2nd, 3rd, and 4th segments, ventral view, the external margin on the left in each case.

Body ♂ 5–6 mm., ♀ 6 mm.; fore-wing ♂ 5·5–6 mm., ♀ 6·5 mm.

*Nymph.*—Full-grown nymph resembling the young described and figured. Abdomen triquetral in cross-section, medio-dorsally slightly carinate, but none of the segments raised or imbricate. Only three pairs of lamellate gills, those on segments 2 and 3 being double, that on segment 4 single. Gill on segment 1 as in *harrisoni*. Mandibles even more oblong than in the young, the apices being squarely truncate, the outer angle usually worn quite blunt. Cerci feebly setose.

Up to 5–6 mm.

Ochraceous or straw-coloured, with faint darker markings on thorax, abdomen with a series of dark spots dorso-laterally, that on segment 2 being the largest and most conspicuous.

*Localities.*—Streams on slopes of Table Mt. (Blinkwater, Platteklip, and Skeleton Ravines, Orange Kloof) (November to March, K. H. B.); Amandel River, Hex River, Worcester (October 1931, mature nymphs from trout stomachs, A. C. H.); Gt. Winterhoek Mts., Tulbagh (September 1932, K. H. B., and November 1932, K. H. B. and H. G. W.); Porterville (August 1937, A. C. H.); Seven Weeks Poort, Ladismith, Cape (September 1933, nymphs and subimagos, K. H. B.); Prince Albert, mouth of Zwartberg Pass (September 1933, nymphs, K. H. B.).

### Fam. ECDYONURIDAE.

#### *Afronurus peringueyi* (E. P.).

1932. Barnard, *loc. cit.*, p. 255.

*Localities.*—Yarrow River, Karkloof, Natal (18th March 1934, L. A. Day); Umzimkulu River (April 1936, nymphs, Dr. Sampson); Cathkin Peak, 6000 ft., Drakensberg, Natal (January 1938, nymphs, Dr. R. F. Lawrence).

#### *Afronurus harrisoni* Brnrd.

1932. Barnard, *loc. cit.*, p. 257.

*Localities.*—Du Toits Kloof, Rawsonville (25th March 1932, ♀ imago, K. H. B.); Michell's Pass, Ceres (September 1932, nymphs, K. H. B.); Seven Weeks Poort, Ladismith, Cape (September 1933, nymphs, K. H. B.); Upper Olifants River, north of Ceres (October 1937, ♀ imago, K. H. B.).

## TRICHOPTERA.

A considerable amount of material has accumulated since the publication of "South African Caddis-flies" (Barnard, Trans. Roy. Soc. S. Afr., xxi, pt. 4, 1934), comprising undescribed species and numerous new locality records due to collecting by Mr. H. G. Wood and myself. Only the most important localities are recorded, namely, those extending the already recorded distribution or linking up widely separated localities.

## INAEQUIPALPIA.

### Fam. SERICOSTOMATIDAE.

### Gen. Goerodes Ulmer.

1907. Ulmer, Cat. Coll. Selys. fasc. 6, p. 37.

1927. Martynov, Ann. Mus. Zool. Ac. Sci. U.R.S.S., xxviii, p. 471 (*Crunobiodes*).

1939. Mosely, Ruwenzori Exp. (Brit. Mus.), iii, p. 4.

This genus is characterised by a fold in the fore-wing of the ♂, and a certain type of genitalia.

As the South African species conform with the genus *Goerodes* as redefined, Mosely (*loc. cit., supra*, p. 2) has transferred it, together with other African species, to *Goerodes*, leaving *Crunoeciella* with a single Madagascan species.

### *Goerodes caffrariae* (Brnrd.).

(Fig. 10.)

1934. Barnard, *loc. cit.*, p. 302, fig. 2 (♂) (*Crunoeciella c.*).

*Imago* ♀.—Fore-wing narrower and more oval than in ♂, covered with hairs only, no scales. Venation similar to that of *sjoestedti* Ulmer,

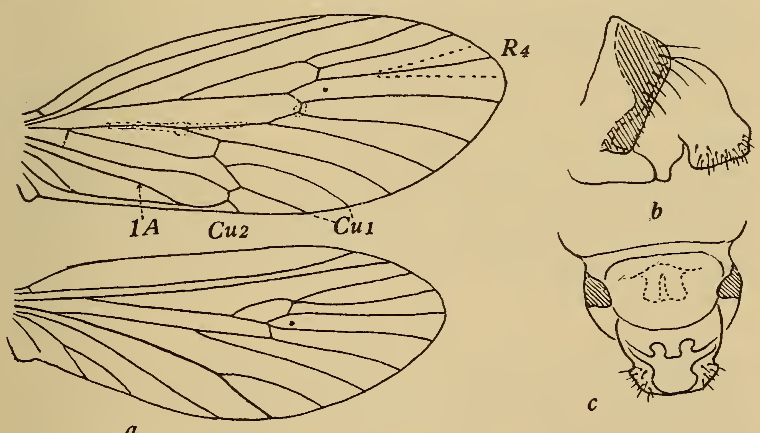



Fig. 10.—*Goerodes caffrariae* (Brnrd.). *a*, fore- and hind-wings ♀, dotted line representing forking of $R_4$ in one of the specimens. *b, c*, lateral and ventral views of ♀ genitalia.

but fork of $Cu_1$ midway between distal cross-vein of thyridial cell ($M_{3+4} - Cu_1$) and cross-vein $Cu_{1b} - Cu_2$. Basal cross-vein $Cu_1 - Cu_2$ perpendicular and situated at the fork of M and $Cu_1$ (this cross-vein was omitted in the figure of the ♂). Hind-wing as in *sjoestedti*; Sc and R separate throughout (as is probably the case in *sjoestedti*, though the figure shows them fused proximally). One specimen has $R_4$ forked in both fore-wings, as indicated by dotted lines in fig. 10, *a*.

On the membrane the cross-vein $R_5 - M_1$ is surrounded by an oval clear space, and a clear space along M and $M_{1+2}$, with a slight expansion at forking of $M_{1+2}$ and $M_{3+4}$. Coloration as in ♂.

Fore-wing 6–6·5 mm.

Genitalia, terminal tergite projecting rather prominently, in dorsal (or ventral) view rounded-truncate; terminal sternite apically trilobed; penultimate sternite forming a flat semicircular plate.

*Locality.*—Grahamstown (Carl's Rust and Paradise Kloof) (J. Hewitt, 2 ♀♀).

*Dyschimus collyrifer* Brnrd.

1934. Barnard, *loc. cit.*, p. 306, fig. 5, *a–e*.

*Locality.*—Malgas River, George (K. H. B., November 1938, 1 ♂).

*Dyschimus ensifer* Brnrd.

(Fig. 11.)

1934. Barnard, *loc. cit.*, p. 306, fig. 5, *f–k* (♂).

*Imago*, ♀.—Venation; in fore-wing $Cu_{1b}$ complete to margin, cross-vein from fork of $Cu_1$ nearly straight to margin, joining $Cu_2$ and 1A, neither of the latter veins continued to margin. In hind-wing distal portion of Sc running obliquely upwards and forwards to C (not recurved as in ♂), R incomplete basally and distally, discoidal cell present, fork 3 shortly stalked. Genitalia, supra-anal plate prominent, in dorsal (or ventral) view broadly subtriangular with apical notch; subanal plate small, longer than wide, apically rounded.

Fore-wing 10 mm.

Colour as in ♂, antennae dark umber.

*Locality.*—Grahamstown (Carl's Rust) (J. Hewitt, 1 ♀).

*Remarks.*—In the venation of the hind-wing and the genitalia, in both sexes, this species is somewhat isolated from the other two species of the genus.

*Rhoizema montanum* Brnrd.

1934. Barnard, *loc. cit.*, p. 311, fig. 8.

*Locality.*—Prince Alfred's Pass, Avontuur, Outeniqua Range, 3500 feet (K. H. B. and C. W. T., January 1940, 1 ♂).

*Petroplax phleophila* Brnrd.

1934. Barnard, *loc. cit.*, p. 319, fig. 14, *a–g*.

*Locality.*—Willow R., north slopes of Cockscomb Peak (Uitenhage Div.) (K. H. B. and C. W. T., October 1938).

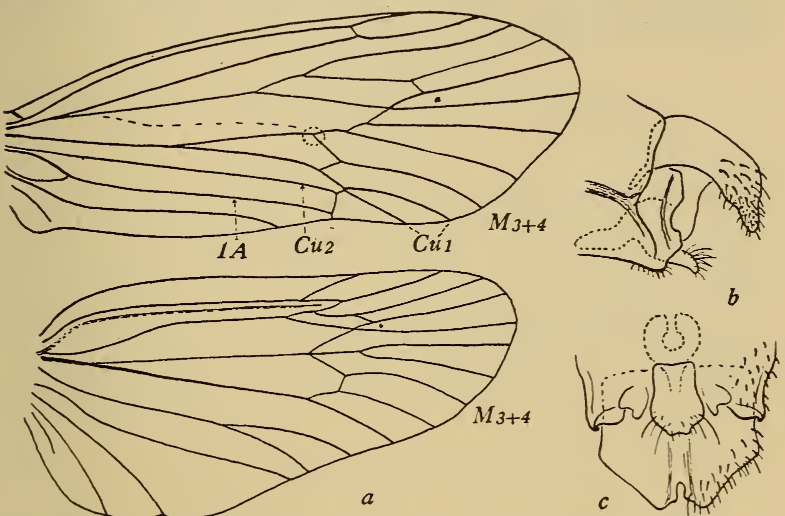



FIG. 11.—*Dyschimus ensifer* Brnrd. *a*, fore- and hind-wings, ♀, dotted line in fore-wing representing a fold. *b*, *c*, lateral and ventral views ♀ genitalia.

*Petroplax anomala* n. sp.

(Fig. 12.)

*Imago*, ♂.—Head and thorax dark umber with blackish hairs. Legs and antennae fuscous, the latter unicolorous. Wing membrane with the anastomosis and a streak along M clear white; hairs on fore-wing sepia-brown with golden-brown hairs intermixed, androconia blackish; hairs on hind-wing sepia, fringe blackish.

Fore-wing 7 mm.

*Venation.*—M prolonged basally and without apparent connection with $Cu_1$; between these two veins a fold forming a deep groove on lower surface; on anterior side of $Cu_1$ at base on lower surface a series of androconia, extending about 1 mm. in length; $Cu_2$ and 1A obsolete, represented by a fold which does not extend more than $\frac{1}{3}$ length of wing; thyridial cell resembling that of the ♀ of the other species; two of the branches of M forming a reversed fork or cell which is symmetrical in both right and left wings. Hind-wing with an indication of a cross-vein between M and $Cu_{1a}$.

*Genitalia*, 9th and 10th tergites fused, the portion representing the 9th somewhat raised and medianly scabrous, the distal portion (10th) apically cleft, the lower lateral margins with fine recurved serrulations; penis with 2 stout subterminal spiniform processes, whose apices are slightly upturned, the membranous apex bilobed; clasper spatulate, hollowed on inner side, apex rounded (not bifid); 9th sternite with

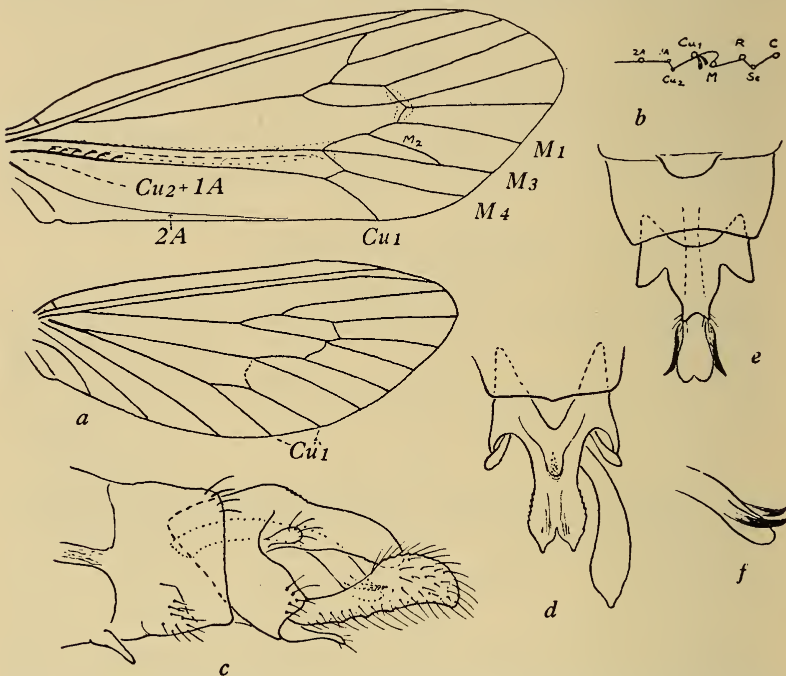



Fig. 12.—*Petroplax anomala* n. sp. *a*, fore- and hind-wings ♂ (androconia actually on lower surface). *b*, diagrammatic cross-section of fore-wing near base, showing androconia attached to lower surface of $Cu_1$. *c, d, e*, lateral, dorsal and ventral views of ♂ genitalia. *f*, lateral view of apex of penis.

stout process, the apex slightly excavate; lamina on 7th sternite transversely crescentic.

*Locality*.—Grahamstown (Carl's Rust) (J. Hewitt, 1 ♂).

*Remarks*.—In general features this species unmistakably belongs to the genus *Petroplax* (Barnard, *loc. cit.*, p. 316), but it is markedly distinct from the other three species in the modification of the fore-wing. The patch of androconia is much larger than in the other species.

In consequence of the suppression of $Cu_2$ and 1A in the fore-wing, M and $Cu_1$ are pushed farther towards the hind margin, and the area between Rs and M becomes very broad.

*Cheimacheramus caudalis* Brnrd.

1934. Barnard, *loc. cit.*, p. 316, fig. 12.

The Palmiet River specimens (H. G. W., December 1933) are even smaller than the Tradouw ones, viz.: fore-wing ♂ 4·5 mm., ♀ 4·75 mm. The posterior projection of the ♂ claspers is more slender, the prongs of the fork of 10th tergite longer and less divergent, and the ventral process of 9th sternite bluntly pointed.

*Locality.*—Upper Olifants River, north of Ceres (K. H. B., October 1937, 1 ♂).

*Barbarochthon brunneum* Brnrd.

1934. Barnard, *loc. cit.*, p. 321, figs. 15 and 1, *a*.

The specific identity of the Table Mt. form with that from the type locality has been established by breeding. In fresh specimens, especially noticeable in those collected in the Hottentots Holland Mts., there is a pale or white band along the side of the abdomen.

*Locality.*—Upper Olifants River, north of Ceres (K. H. B. and C. W. T., October 1937, ♂♂, ♀♀).

## AEQUIPALPIA.

*Petrothrincus triangularis* (Hagen).

1934. Barnard, *loc. cit.*, p. 325, fig. 18, *g–q*.

Cases were found (K. H. B., September 1933) in the Valsch Gat stream on the Ceres (north) side of Matroosberg in the Hex River Mts.

## Fam. LEPTOCERIDAE.

*Pseudoleptocerus cupreus* Brnrd.

1934. Barnard, *loc. cit.*, p. 329, fig. 19.

Mosely (Ann. Mag. Nat. Hist. (10), xi, p. 541, figs. 6–10, 1933) has redescribed *P. schoutedeni* Navas. These two species would seem to be closely allied, but Mosely says nothing about the spines on the penis; the shape of the process on the 9th sternite in *schoutedeni* is more like that of *cupreus* var. *subfuscus* (fig. 19, *i*).

*Leptocerus schoenobates* Brnrd.

1934. Barnard, *loc. cit.*, p. 333, figs. 21, 22, *a–l*.

*Localities.*—Upper Olifants River, north of Ceres (K. H. B. and C. W. T., October 1937, ♂♂, ♀♀); Clarkson, between Humansdorp and Tsitsikama (C. W. T., November 1938, ♂♂).

*Leptocerus bibulus* n. sp.

(Fig. 13, *a–d*.)

*Imago.*—In fore-wing anastomosis between $R_{2+3}$ and $Cu_1$ straight, or almost so, slightly oblique; stalk of fork 1 subequal to upper

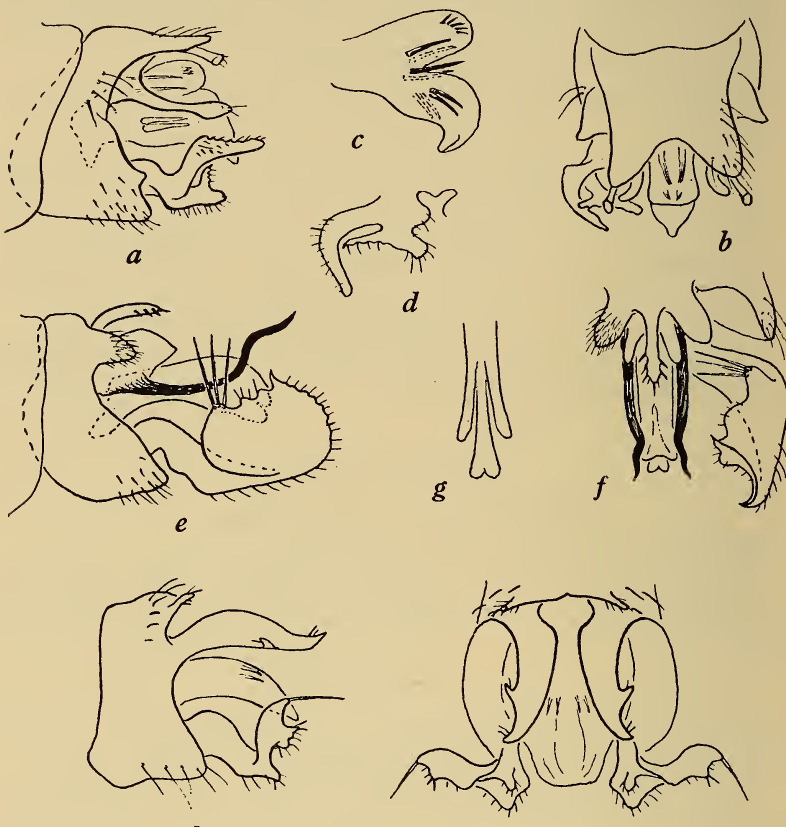



Fig. 13.—*Leptocerus bibulus* n. sp. *a, b*, lateral and dorsal views of ♂ genitalia. *c*, penis. *d*, ventral view of one of the claspers.

*Leptocerus spatula* n. sp. *e, f*, lateral and dorsal views of ♂ genitalia. *g*, ventral view of penis and lower sheath.

*Leptocerus dieseli* n. sp. *h, i*, lateral and dorsal views of ♂ genitalia.

branch ($R_2$) of fork 1; apical cell 4 ♂ with stalk almost or quite obsolete, sessile on anastomosis; stalk of cell 4 ♀ ($M_{1+2}$) subequal to stalk of fork 1. In hind-wing apical fork 1 very short, about $\frac{1}{4}$ length of its stalk; stalk of apical cell 4 very short, not more than $\frac{1}{2}$ the cross-vein between Rs and M, *i.e.* the cell almost sessile.

*Genitalia* ♂ in general similar to those of *potes* Brnrd. (*loc. cit.*, p. 341), but distinguished by the large dorsal plate, different shape of the two dependent processes, spination of penis, and claspers.

Fore-wing 5–6 mm. Coloration as in *potes*.

*Locality*.—French Hoek Pass (K. H. B. and H. G. W., October 1933).

*Leptocerus spatula* n. sp.

(Fig. 13, *e–g*.)

*Imago*.—In fore-wing anastomosis between $R_{2+3}$ and $Cu_1$ straight, oblique; stalk of fork 1 equal to upper branch ($R_2$) of fork; apical cell 4 ♂ with short stalk not quite equal to cross-vein between M and $Cu_1$. In hind-wing apical fork 1 short, less than $\frac{1}{3}$ length of its stalk, much shorter in the Clanwilliam specimens; stalk of apical cell 4 about $1\frac{1}{2}$ times length of cross-vein between Rs and M.

*Genitalia* ♂ somewhat like those of *tuckeri* Brnrd. and variety, but distinguished by the extraordinarily long spinous processes and the more lamellately expanded claspers.

Fore-wing 9 mm. Head and thorax umber brown, abdomen paler; wings pale brown, neuration slightly darker.

*Locality*.—French Hoek Pass (H. G. W., October 1933, 1 ♂; K. H. B., October 1936, 1 ♂); Jan Diesel's River, Clanwilliam (K. H. B., September 1936, 2 ♂♂); Upper Olifants R., north of Ceres (K. H. B. and C. W. T., October 1937, ♂♂, ♀♀).

*Leptocerus tabularis* Brnrd.

1934. Barnard, *loc. cit.*, p. 337, fig. 24.

Top of Kasteel's Poort, Table Mt. (7th May 1935, K. H. B.), in very dry places. All attempts to locate the larva of this species have been unsuccessful.

*Leptocerus harrisoni* Brnrd.

1934. Barnard, *loc. cit.*, p. 337, figs. 25, 26.

Jan. Diesel's River, Clanwilliam (K. H. B., September 1936, 1 ♂).

*Leptocerus dieseli* n. sp.

(Fig. 13, *h, i*.)

*Imago*.—In fore-wing anastomosis between $R_{2+3}$ and $Cu_1$ straight, oblique; stalk of fork 1 subequal to upper branch of fork; apical cell 4 ♂ with stalk $1\frac{1}{2}$ times length of cross-vein between M and $Cu_1$.

In hind-wing apical fork 1 absent; stalk of apical cell 4 subequal to cross-vein between Rs and M.

*Genitalia* ♂—a transverse band projecting laterally in a short setose process on each side, below this a pair of strongly chitinised processes, with sinuous dorsal margin in lateral view, and a short retrorse spinous projection on lateral margin; penis very broad in dorsal view, with 4 weak spines dorsally; no titillators; claspers relatively small, twisted so that the upper margin (in lateral view) becomes the front margin, in general somewhat like those of *L. cedri* (Barnard, *loc. cit.*, fig. 27, *h*, *i*).

Fore-wing 6–6·3 mm. Colour of fore-wing uniform greyish.

*Locality.*—Jan Diesel's River, Clanwilliam (K. H. B., September 1936, 4 ♂♂).

*Remarks.*—At first sight resembling *L. cedri* in the genitalia, but without the small medio-dorsal bifid process of the latter species, and apical fork 1 in hind-wing completely absent.

### *Leptocerus cedri* Brnrd.

1934. Barnard, *loc. cit.*, p. 341, fig. 27, *h*, *i*.

Upper Olifants River, north of Ceres (K. H. B. and C. W. T., October 1937, ♂♂, ♀♀).

### *Leptocerus potes* Brnrd.

1934. Barnard, *loc. cit.*, p. 341, fig. 28, *a–g*.

*Locality.*—Kaimans River, near George (K. H. B., November 1938, ♂♂, ♀♀).

### *Leptocerus longistylis* Brnrd.

1934. Barnard, *loc. cit.*, p. 341, fig. 27, *j–l*.

*Locality.*—Upper Olifants River, north of Ceres (K. H. B. and C. W. T., October 1937, ♂♂).

### *Leptocerus securis* Brnrd.

1934. Barnard, *loc. cit.*, p. 343, fig. 30, *a*, *b*.

*Localities.*—Wellington Mts. (H. G. W., October 1933); French Hoek Pass, east side (K. H. B., October 1936, ♂♂, ♀♀); Pakhuis Pass, Clanwilliam (K. H. B., September 1936, ♂♂, ♀♀); Willow R., north slopes of Cockscomb Peak (Uitenhage Div.) (K. H. B., October 1938); George and Kaimans River (K. H. B., November 1938).

In the George and Kaimans River specimens (1 ♂ from each locality), the medio-dorsal process, instead of being laterally compressed, forms a dorso-ventrally flattened process. When more material is available, this may prove to be of varietal or specific value, though in other respects the genitalia do not seem to show any differences from the typical form.

*Leptocerus stephanus* Brnrd.

1934. Barnard, *loc. cit.*, p. 348, figs. 22, *k*, 31, *d*, *e*.

*Localities.*—Tradouw Peak, Langeberg Range (K. H. B., January 1935); Meirings Poort, Spitzkop, Zwartberg Range (K. H. B. and H. G. W., January 1935); Rust en Vrede, near Cango, Zwartberg Range (H. G. W., January 1938).

The Zwartberg Range specimens have the 10th tergite with outstanding lateral spines as figured in fig. 31, *e*.

*Leptocerus elaphus* Brnrd.

1934. Barnard, *loc. cit.*, p. 348, fig. 31, *f*, *g*.

*Localities.*—River Zonder End Mts., 4000 feet (K. H. B., January 1934); du Toits Kloof, Wellington Mts. (H. G. W., March 1934).

*Leptecho scirpi* Brnrd.

1934. Barnard, *loc. cit.*, p. 349, figs. 22, *p–s*, 31, *j*, *k*.

*Localities.*—River Zonder End Mts., 4000 feet (K. H. B., January 1934); French Hoek Pass (K. H. B. and H. G. W., April 1935).

Gen. Leptocerina Mosely.

The suggestion (Barnard, *loc. cit.*, p. 350) that *furcata* Mosely was synonymous with *ugandanus* Ulmer is confirmed by Mosely (Ann. Mag. Nat. Hist. (10), xvii, p. 429, 1936) after examination of Ulmer's type.

*Oecetis afra* Mosely.

1934 (May). Mosely, Eos., ix, p. 24, figs. 14–16.

It is possible that *kunenensis* Brnrd., described from the ♀ only, will prove synonymous with the Northern Rhodesian *afra*.

*Oecetis lucipetens* n. sp.

(Fig. 14.)

*Imago.*—Tibial spurs 1, 2, 2. Fore-wing with Sc and R thickened and connected by an oblique cross-vein distally, Sc only faintly continued to costal margin; apical fork 1 sessile, fork 3 shortly stalked; anastomosis stepped; hind-wing narrow, fork 1 absent, M and $Cu_1$ forked.

*Genitalia* ♂.—9th (or 9th and 10th?) tergite ovoid, with 2 minute setose apical lobes, and 2 subapical groups of setae on a slightly

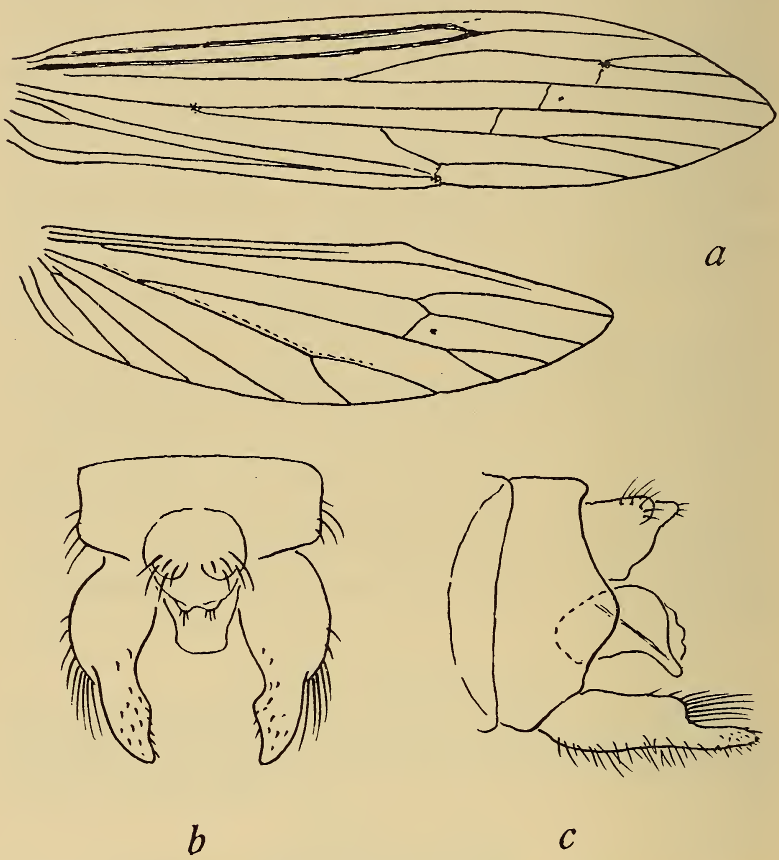


Fig. 14.—*Oecetis lucipetens* n. sp. *a,* fore- and hind-wings. *b, c,* dorsal and lateral views of ♂ genitalia.

raised boss-like projection; penis short, curved downwards; clasper distally abruptly narrowed, upper margin proximal to the narrow apex with a fringe of rather long setae.

Fore-wing 6 mm., antenna 18 mm.

Head and thorax fulvous, wings pale with sepia venation, in fore-wing a small dot formed by black hairs at base of fork 1, at base of thyridial cell, and at junction of $Cu_{1+2}$ with hind margin. Legs and antennae pale.

*Locality.*—Olifants River, Citrusdal, Clanwilliam Division, Cape (K. H. B., 2 ♂♂, 3 ♀♀, 13th February 1939).

*Remarks.*—Although this is rather an aberrant species with features reminiscent of *Ptochoecetis*, I am referring it for the time being to *Oecetis* on the advice of Mr. Mosely, to whom I submitted specimens.

The flies were caught round the lamp on the bank of the river; the taxonomist also seeks light on many puzzling cases.

### Gen. Homilia McLach.

1934. Barnard, Tr. Roy. Soc. S. Afr., xxi, p. 354.

1936. Mosely, Ann. Mag. Nat. Hist. (10), xvii, pp. 429, 432.

Mosely describes two species, one of which, *H. lomia*, is found at Sabie, Transvaal, and in Sierra Leone. He does not give the tibial spur formula for either species. In 1934 under *Leptocerus fissus* (*loc. cit.*, p. 336), I remarked that as this species was stated to have the formula 2, 2, 2 in both sexes, it could not be included in *Homilia* in spite of the similarity of the ♂ genitalia.

The two n. spp. described below have a 2, 2, 2 formula, in the case of *elephas* in both sexes; in other respects they are essentially representatives of the genus *Homilia.* Although the tibial spurs are customarily regarded as of considerable taxonomic importance, I am including both these n. spp. in *Homilia,* and suggest that *L. fissus* may eventually also be transferred to this genus.

Of the two species here described, *knysnaensis* agrees with *vetulata* Brnrd. and *malia* Mosely in lacking the lateral appendages of the 10th tergite; and *elephas* is more closely allied to *lomia* Mosely than to *vetulata* Brnrd. from the Kunene River.

### *Homilia elephas* n. sp.

(Fig. 15, *d–f.*)

*Imago.*—Tibial spurs 2, 2, 2; the two on the fore-tibia are subequal and easily distinguished in both sexes when the limb is cleared. Venation as in *lomia* Mosely (*loc. cit.*, fig. 5) in both sexes, stalk of apical fork 1 shorter than its upper branch, and shorter than stalk of apical cell 4.

*Genitalia* ♂.—9th tergite, as in *vetulata* and *lomia,* with 2 patches of minute spinules or granules, preanal (superior) appendages elongate, slender, sparsely setose; 10th tergite (upper penis sheath) elongate, deeply cleft, without prongs, apices of lobes acute, near the base of the 10th tergite on each side there arises an elongate process (lateral appendage) (not found in either *vetulata* or *lomia*), sinuous, with setose apex; penis robust, in side view bent downwards at right angles, deeply grooved dorsally and posteriorly; clasper in side view widely bifid, proximal upper branch ending in a sharp, incurved, strongly chitinised apex (cf. *lomia*), distal branch slender, elongate, apically incurved, a slender process arising from inner side, lower margin with a tooth-like process.

Fore-wing 6–7 mm. Antennae 14 mm.

Head and thorax fuscous with black and white hairs. Wings umber brown, somewhat speckled apically with white hairs; in fore-wing a whitish costal mark proximal and another distal to the pterostigmal area, which in the denuded wing by transmitted light is suffused, a whitish mark at junction of $Cu_{1+2}$ with hind margin. Tarsi and antennae annulate.

*Locality.*—Olifants River, Citrusdal, Clanwilliam Division, Cape (K. H. B., 13th February 1939, 2 ♂♂, 3 ♀♀).

### *Homilia knysnaensis* n. sp.

(Fig. 15, *a–c*.)

*Imago*, ♂.—Tibial spurs 2, 2, 2. Fore-wing not scaly, with stalk of apical fork 1 subequal to its upper branch, stalk of apical cell 4 shorter; thyridial cell longer than discoidal cell; anastomosis nearly perpendicular to long axis of wing, cross-veins $R_4$–$M_{1+2}$ in line, distal to cross-vein M–$M_{3+4}$.

*Genitalia* ♂, preanal appendages somewhat clavate, setose; 10th tergite an elongate process, its depth basally in lateral view greater than its width in dorsal view, bifurcate for about half its length, with a pair of movable slender processes dorsally; no lateral appendages; penis stout, curved, with subterminal lateral expansions when viewed dorsally; claspers with an internal ventral bifid process at base, one lobe of which bears short spines, the other long setae, on its ventral surface a small digitiform process, with apical spinule, the longer external arm of the clasper apically trifid, the upper two processes being movable.

Fore-wing 8 mm. Antennae 18 mm.

Head and thorax piceous-brown. Fore-wing dark sepia with 2 cuneiform white marks distally from the costa inwards, subcosta and hind-margin as far as end of $Cu_2$ pale, a pale speck also at junction of cross-vein $M\text{–}M_{3+4}$ with M. Antennae pale sepia, annulated. Legs pale ochreous.

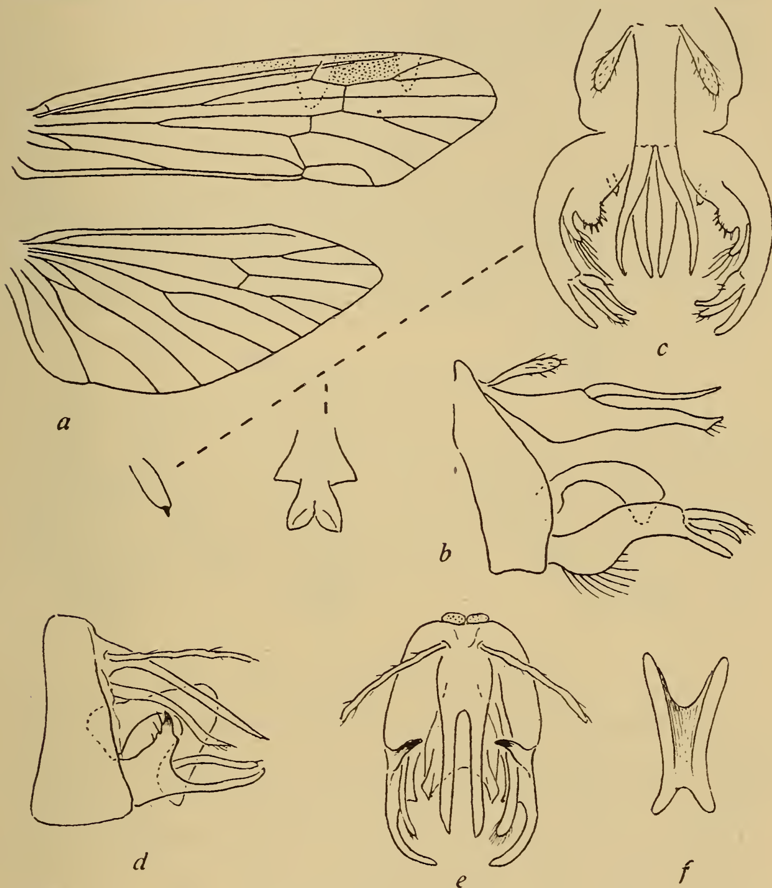



FIG. 15.—*Homilia knysnaensis* n. sp. *a*, fore- and hind-wings. *b*, lateral view of ♂ genitalia. *c*, dorsal view of same, with penis drawn separately to same scale, and ventral basal process further enlarged.

*Homilia elephas* n. sp. *d*, lateral view of ♂ genitalia. *e*, dorsal view of same, the appendages of 9th tergite displaced, lateral appendages omitted on left side, inner process of clasper omitted on right side. *f*, posterior view of penis (on a larger scale).

*Locality.*—Goukama River, near Knysna (K. H. B., 5th November 1938, 1 ♂).

*Remarks.*—The colour pattern of this single specimen suggests its inclusion in the genus *Homilia*, apart from other features.

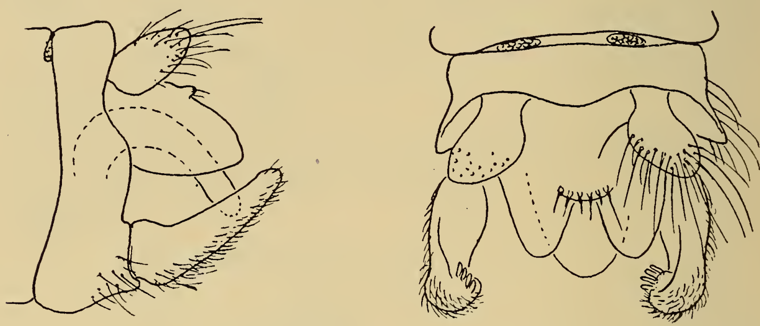
Gen. ADICELLA McLach.

1932. Barnard, *loc. cit.*, p. 357.
1932. Ulmer, Peking Nat. Hist. Bull., vii.
1936. Martynov, Rec. Ind. Mus., xxxviii, p. 279.

*Adicella monachus* n. sp.

(Fig. 16.)

*Imago.*—Venation like that of *pulcherrima* Ulmer, and *biramosa* Mart. (*loc. cit.*, 1936); in fore-wing $M_1$ and $M_2$ arising together at upper distal corner of thyridial cell, anastomosis almost straight, $R_1$ thickened distally, stalk of fork 1 subequal to its upper branch



a b

FIG. 16.—*Adicella monachus* n. sp. *a, b,* lateral and dorsal views of ♂ genitalia.

($R_2$); in hind-wing fork of M nearer to level of fork of R than in *biramosa*.

*Genitalia* ♂, 9th tergite transverse, preanal appendages ovate, strongly setose, 10th tergite forming a broad, cowl-like process, apically bilobed, with a short transverse median ridge, penis stout, simple, strongly curved, clasper uniramous, upturned, somewhat twisted, with a few short spines on apex.

Fore-wing 5·5 mm. Head and thorax ochreous, with greyish hairs, antennae pale ochreous, faintly annulate, wings grey, anastomosis on fore-wing faintly indicated by a whitish streak.

*Larva.*—Similar to that of *filicornis* (Rousseau, 1921, p. 636, fig. 219). Case composed of small pieces of vegetable matter forming a tube more or less 4-sided in cross-section; sometimes sand-grains are incorporated; one case is composed entirely of sand-grains, but is circular, not 4-sided in section.

*Locality.*—Natal (Natal Mus.).

*Remarks.*—As regards the ♂ genitalia this species is very like *syriaca* Ulmer (1907, Notes, Leyden Mus., xxix, p. 52, figs. 71, 72). In lateral view (fig. 71) there is very little difference; but the claspers are described and figured (fig. 72) as 2-jointed. One suspects that this is an error, as they appear to be only 1-jointed in fig. 71. In *syriaca* the fore-wings are yellow, and the species is stated to be the palest or brightest of the species then known. This coloration does not fit the present species. Although *syriaca* has been recorded from widely separated localities (Lestage, 1919, also Barnard, *loc. cit.*), it seems better to regard the Natal form as a separate species until a revised description of *syriaca* has been given.

*Potamoryza modesta* Brnrd.

1934. Barnard, *loc. cit.*, p. 352, fig. 33.

Larvae and pupae (imagos dissected from latter) were collected at the northern entrance to the Zwartberg Pass, Prince Albert (K. H. B., September 1933); Willow R., north slopes of Cockscomb Peak (Uitenhage Division); Patentie (Gamtoos valley); and Knysna (K. H. B., October–November 1938).

## Fam. HYDROPSYCHIDAE.

### Gen. Cheumatopsyche Wallengr.

1891. Wallengren, K. Sv. Ver. Ak. Handl., n.s., xxiv, pp. 138, 142.
1934. Barnard, *loc. cit.*, p. 360. (*Hydropsychodes.*)
1936. Mosely, Ann. Mag. Nat. Hist. (10), xvii, p. 438.

*H. maculata* (Mosely).

1934 (May). Mosely, Eos., ix, p. 22, figs. 11–13.
1934 (July). Barnard, *loc. cit.*, p. 362, figs. 37, *a–f*, 38 (*lateralis*).

It is evident that Mosely and I have described forms of the same species. This very common and somewhat variable Western Province species must therefore bear the name proposed by Mosely.

In Ann. Mag. Nat. Hist. (10), xv, p. 231, 1935, Mosely gives a list of the African species of this genus.

### *Leptonema natalense* Mosely.

1933. Mosely, Rev. Gen. *Leptonema*, Brit. Mus., p. 24, figs. 43–48.

1934. Barnard, *loc. cit.*, p. 370, fig. 41, *f–i* (*occidentale*, non Ulmer).

By an oversight the correction was not made in my paper. In this paper delete the words: "Distribution: Cameroons."

### *Macronema natalense* Ulmer.

1934. Barnard, *loc. cit.*, p. 372, fig. 42, *a–e*.

*Localities.*—Kromme River at Assegai Bush (C. W. T., 1st November 1938, 1 ♀); Goukama River, near Knysna (K. H. B., 5th November 1938, ♂♂).

## Fam. POLYCENTROPODIDAE.

### *Dipseudopsis capensis* Wlkr.

(Fig. 17.)

1934. Barnard, *loc. cit.*, p. 374, fig. 43, *a–i*.

*Pupa* (described from empty skins).—Mandibles bulbous at base, distally very slender, curved, terete. Presegmental dorsal plates on

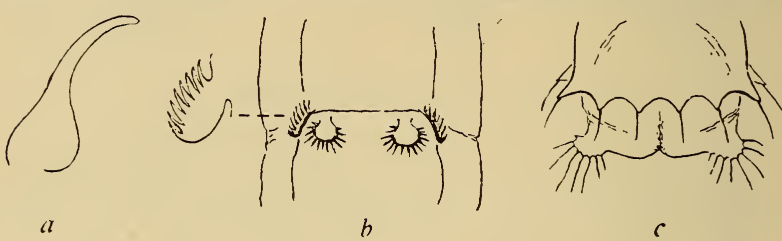



Fig. 17.—*Dipseudopsis capensis* Wlkr. Pupa. *a*, mandible. *b*, dorsal view of 5th and 6th abdominal segments, showing postsegmental plates on 5th and presegmental plates on 6th segment, with postsegmental plate in lateral view and further enlarged. *c*, dorsal view of 9th abdominal segment.

segments 3, 4, and 6–8, sometimes (in 1 out of 13 specimens) also on segment 5; postsegmental plates dorso-laterally on segment 5. The presegmental plates bear spines, 6–8 on the plates on segments 3 and 4, 4–5 on those on segment 8, 10–12 on those on segment 7, and about 14 on those on segment 6; the postsegmental plates are oval in shape, nearly vertically upstanding, and with 6–8 strong spines on upper edge. 9th segment with a transverse dorsal series of 8 chitinised conical projections, the outermost (lateral) one on each side smaller than the others, each bearing a single rather long seta;

posterior margin arcuate, postero-lateral corners with several setae of varying length.

*Localities.*—Dolley Reservoir, Zwartkops River, Uitenhage (K. H. B. and C. W. T., 28th October 1938, ♂, ♀♀, and empty pupal skins); Goukama River, near Knysna (K. H. B., 5th November 1938, 2 ♀♀).

## Fam. PSYCHOMYIDAE.

### *Ecnomus similis* Mosely.

1934. Barnard, *loc. cit.*, p. 378, fig. 45, *e, f*.

*Locality.*—Grobelaars R., Schoemann's Poort, north of Oudtshoorn (K. H. B., October 1937). One ♂ agreeing with Mosely's description, but the inner and distal margins of the claspers are very distinctly scalloped or crenulate.

### *Ecnomus natalensis* Ulmer.

1934. Barnard, *loc. cit.*, p. 378, fig. 45, *g–i*.

*Locality.*—Knysna (K. H. B., November 1938, 3 ♂♂).

### Gen. Paduniella Ulmer.

1912. Ulmer, Notes, Leyden Mus., vol. xxxv, p. 80.

1934. Martynov, Tabl. Anal. Fauna U.R.S.S., vol. xiii, p. 209.

1936. Mosely, Ann. Mag. Nat. Hist. (10), vol. xvii, p. 444.

Tibial spurs ♂ 2, 4, 4, ♀ 1, 4, 4. No ocelli. Maxillary palp ♂ 6, ♀ 5-jointed. Labial palp ♂ 4, ♀ 3-jointed. Wings narrow (much resembling those of Hydroptilids), especially the hind-wing, lanceolate, fore-wing with anal lobe, and forks 2, 3, 4, 5, hind-wing with forks 2 and 5.

Originally instituted for a Javanese species.

### *Paduniella capensis* n. sp.

(Fig. 18.)

*Imago.*—Venation very similar to that of *africana* (Ulmer) (*cf.* Mosely, *loc. cit.*, fig. 30), but venation very difficult to trace.

*Genitalia* ♂. 9th tergite in dorsal view triangular with truncate apex, upper appendages ovate both in dorsal and lateral views, with slightly scalloped or serrate edges, setose; penis in lateral view apically enlarged, a slender dorsal process arising near base; claspers oblong, apically bifid, with a setose lobe on middle of upper margin.

Fore-wing ♂ 4, ♀ 4–5 mm. Head, thorax, and abdomen pale brown, fore wing fawn brown, darker (sepia) in the Cu and anal


Fig. 18.—*Paduniella capensis* n. sp. *a*, fore- and hind-wings. *b*, *c*, *d*. lateral, dorsal and ventral views of ♂ genitalia. *e*, penis.

areas where the scaling is denser; antennae annulate, legs pale ochreous.

*Locality.*—Schoemann's Poort, north of Oudtshoorn (K. H. B. and C. W. T., October 1937, ♂♂, ♀♀).

*Remarks.*—Differs from *africana* (Ulmer), from Cameroon and Sierra Leone, in the shape of the upper appendages and the claspers.

## Fam. PHILOPOTAMIDAE.

### *Chimarrha ambulans* Brnrd.

1934. Barnard, *loc. cit.*, p. 382, figs. 47 and 1, *b*.

*Localities.*—Meirings Poort, Zwartberg Range (K. H. B., January 1935); Bosch Kloof, Clanwilliam (K. H. B., September 1936); George and Kaimans R. (H. G. W., January 1938); Kaimans R. and Tsitsikama R. (K. H. B., November 1938); Goukama R., Knysna (K. H. B., November 1938).

*Thylakion urceolus* Brnrd.

1934. Barnard, *loc. cit.*, p. 386, fig. 49, *a–j*.

*Localities.*—Palmiet R., near Kleinmond (Caledon Div.) (K. H. B., December 1934); Willow R., north slopes of Cockscomb Peak (Uitenhage Div.) (K. H. B., October 1938).

## Fam. RHYACOPHILIDAE.

*Myspoleo agilis* Brnrd.

1934. Barnard, *loc. cit.*, p. 388, fig. 50, *a–m*.

*Locality.*—Upper Olifants River, north of Ceres (K. H. B. and C. W. T., October 1937).

*Myspoleo murinus* Brnrd.

1934. Barnard, *loc. cit.*, p. 390, fig. 50, *n–p*.

*Localities.*—Drakenstein (K. H. B., October 1933) and French Hoek Mts. (H. G. W., November 1933); Malgas River, George (K. H. B. and C. W. T., November 1938).

## Fam. HYDROPTILIDAE.

*Argyrobothrus velocipes* Brnrd.

1934. Barnard, *loc. cit.*, p. 393, fig. 52.

*Locality.*—Found in the Kirstenbosch Botanic Gardens, Newlands, Cape Peninsula (H. G. W., August 1933).

# PERLARIA.

To the records in Barnard (Ann. S. Afr. Mus., vol. xxx, 1934) may be added the following:—

## Fam. NEMOURIDAE.

*Aphanicerca capensis* Tillyard.

1934. Barnard, *loc. cit.*, p. 524, figs. 7, 8, *a–h*.

*Localities.*—Gydo Pass, north of Ceres (K. H. B. and C. W. T., October 1937, ♂, ♀ (var. $\beta$)); Kaimans River, near George (K. H. B., November 1938, ♂♂).

### *Aphanicerca bovina* Brnrd.

1934. Barnard, *loc. cit.*, p. 531, fig. 12.

French Hoek Pass (east side) (H. G. W., April 1935, 2 ♂♂).

### *Aphanicercella barnardi* Tillyard.

1934. Barnard, *loc. cit.*, p. 537, fig. 15.

French Hoek Pass (east side) (H. G. W., April 1935, 3 ♂♂, 1 ♀ (var. $\gamma$)).

### *Aphanicercella scutata* Brnrd.

1934. Barnard, *loc. cit.*, p. 540, fig. 16.

French Hoek Pass (east side) (H. G. W., April 1935, 1 hemipterous ♂, 7 micropterous ♂♂, 7 micropterous ♀♀, including one pair *in cop*); same locality (H. G. W., September 1935, 1 ♂, 2 ♀♀, and 1 hemipterous ♂, 1 hemipterous ♀).

In the hemipterous ♂ the fore-wing measures 3 mm., extending to the end of the 7th abdominal segment; the hind-wing measures ·75 mm.

In the micropterous specimens the fore-wing measures 1 mm. in the ♂♂, and 1·5–2 mm. in the ♀♀; in both sexes the hind-wing measures ·4–·5 mm.

### *Aphanicercella bifurcata* Brnrd.

1934. Barnard, *loc. cit.*, p. 542, fig. 18.

Hermitage Kloof, Swellendam (H. G. W., January 1938).

### *Aphanicercella nigra* Brnrd.

1934. Barnard, *loc. cit.*, p. 544, fig. 20.

Additional specimens, including ♂♂ and ♀♀ in copula, from the type locality (K. H. B., 3rd October 1936).

### *Desmonemoura pulchellum* Tillyard.

1934. Barnard, *loc. cit.*, p. 546, fig. 21.

*Localities.*—Rust en Vrede, near Cango, Oudtshoorn District (H. G. W., January 1938); George (K. H. B., November 1938).

## ODONATA.

### *Chlorocypha caligata* (Selys).

1937. Barnard, Ann. S. Afr. Mus., vol. xxxii, p. 185, fig. 4.

At Patentie, in a side stream of the Gamtoos River, a young nymph was found under a stone (K. H. B., 31st October 1938). The gizzard shows 7–10 denticles in a double row (somewhat irregular) on each major fold, and 4–5 in a single row on each minor fold.

### *Pseudagrion massaicum* Sjöst.
### var. *cogmani* Brnrd.

1937. Barnard, *loc. cit.*, p. 215, fig. 15.

The Cogman's Kloof River flows into the Breede River, and this Damsel-fly has now been collected (K. H. B., February 1938) higher up the main valley at Robertson.

### Gen. Sympetrum Newman.

1921. Rousseau, Larves et Nymphes Aquat., vol. i, p. 141.

1930. Lucas, Aquat. Stage Brit. Dragonfl. Ray Soc., No. 117, pp. 79–91, pls. 19–22.

1937. Barnard, *loc. cit.*, p. 251.

The diagnosis given by me in 1937 and based on that of Rousseau, must be slightly altered to include the now authenticated nymph of *S. fonscolombei*, viz.: medio-dorsal projections on abdomen small *or absent*, and lateral spines on segments 8 and 9 strong *or feeble*.

### *Sympetrum fonscolombei* Selys.

1929. Brain, Insect Pests and their Control in S. Afr., p. 158, fig. 76 (nymph).

1930. Lucas, *loc. cit.*, p. 83.

1937. Barnard, *loc. cit.*, p. 251, fig. 29 (penis).

Several nymph skins were at hand in 1937, but owing to their extraordinary resemblance to those of *Crocothemis erythrae*, they were not recognised as being really nymphs of *S. fonscolombei*. Imagos have now been bred and the nymph authenticated.

The description of the nymph of *C. erythrae* (Barnard, *loc. cit.*, p. 250) applies except for the following differences: length up to 15–17 mm.; antennae longer than the distance between their bases by the length of the last two joints; *divided spines on all the tibiae, but only on the fore and hind tarsi* (spines on the mid tarsi being simple).

### Gen. PANTALA Hagen.

1921. Ris, Ann. S. Afr. Mus., vol. xviii, pp. 388, 431.

*Imago.*—Arculus proximal to 2nd Anq. More than 10 Anq in fore-wing, the last one incomplete, 7 in hind-wing. Sectors of arculus with common stalk. Triangle not crossed in either wing. One Ac in hind-wing, and a second cross-vein running obliquely to proximal corner of triangle. Anal field in hind-wing very broad. $R_3$ strongly sinuous. Irregularly one or two rows of cells in $IR_3$–Rspl.

*Nymph.*—Body sparsely setose. Legs slender, moderately long; divided spines on all joints of all the tarsi. Antennae inserted a little in advance of level of anterior margin of eyes, lateral margins of head behind eyes convergent. Abdomen oval, without medio-dorsal tubercles; segments 8 and 9 with very strong lateral spines. Mask extending to middle coxae; lateral lobes with deep indents.

### *Pantala flavescens* (Fabr.).

(Fig. 19.)

1904. Needham, Proc. U.S. Nat. Mus., vol. xxvii, p. 712, pl. 40, fig. 5 (nymph).

1921. Ris, *loc. cit.*, p. 431.

1937. Barnard, Ann. S. Afr. Mus., vol. xxxii, pp. 182, 260.

*Nymph.*—Up to 25 mm. Antennae about $1\frac{1}{4}$ times the distance between their bases. Abdomen widest across segment 6. Anal pyramid as long as segments 8 and 9 together; appendix dorsalis longer than the cercoids, and subequal to the cerci. Median lobe of mask with straight margins, meeting in an angle very slightly greater than 90°; lateral lobes with 9 deep indents, each intervening tooth tipped with about 4 graduated spines; lateral setae 13–14, mental setae 16–20. Gizzard with 2 denticles on each ventral tooth, and a series of 6 on each dorsal tooth. Rectal gills with 48–50 lamellae in each hemibranch.

*Localities.*—Olifants River, Clanwilliam (April 1937, K. H. B.); Letjesbosch, Beaufort West (L. Boonstra and C. W. Thorne, March 1937. Nymph).

*Remarks.*—The gizzard and gills are described from the Letjesbosch specimen; the imago was bred from the Clanwilliam nymph.

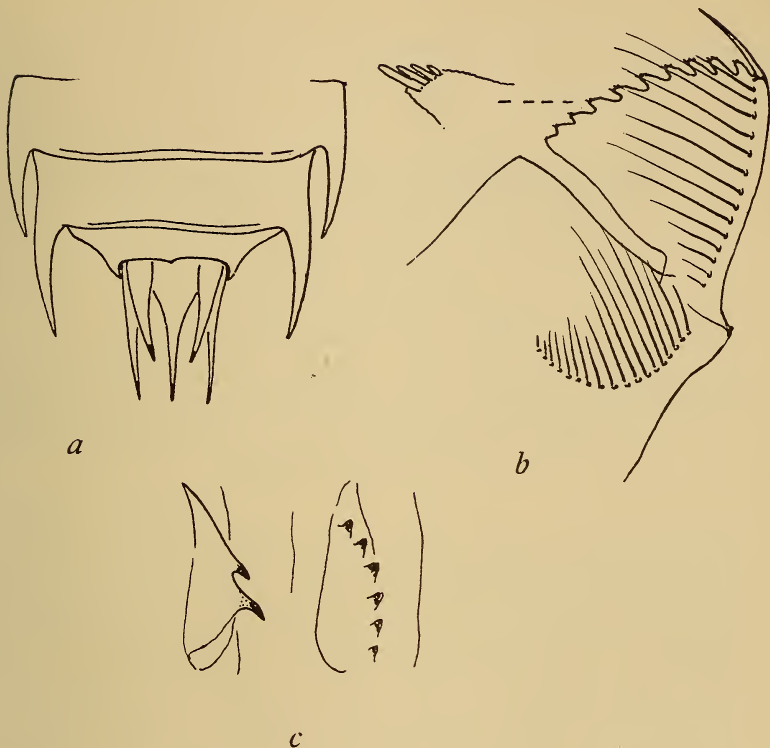



Fig. 19.—*Pantala flavescens* (Fabr.). *a*, apex of abdomen of nymph. *b*, median and lateral lobes of mask. *c*, one ventral and one dorsal tooth of gizzard.

## 22. *Descriptions of New African Anthidiinae* (*Apoidea*).

By G. A. Mavromoustakis, Limassol, Cyprus.

(With 1 Text-fig.)

### *Anthidium niveocinctum* Gerst.

I have both sexes from Uganda: Hoima (C. C. Gowdey); the mesonotum is smooth and shining, and sparsely punctured, the scutellum is produced and broadly emarginate in middle.

### *Anthidium karossense* n. sp.

*Female.*—Length, 11 mm.

Black; clypeus a little above the apical margin transversely and somewhat elevated, apical margin very slightly emarginate in middle and angular at sides; clypeus densely punctured (the punctures finer above), ochreous, with two short longitudinal black and parallel linear stripes above, apical margin narrowly brown; lateral face marks (filling space between clypeus and eyes) nearly reaching level of insertion of antennae, large mark between ocelli, a rounded spot above each eye, ochreous; mandibles 6-dentate, ochreous, apex black-brown; vertex and occiput densely punctured and moderately shining; antennae black, scape with yellow-brown mark in front; third antennal joint longer than fourth or fifth; clypeus, sides of face, supraclypeal area, with white hairs; vertex and occiput with somewhat dense yellow-brown hairs; cheeks with dense and short snow-white hairs. Thorax black; mesonotum and scutellum dull, finely and very densely punctured; scutellum rounded, united with axillae, apical margin very slightly emarginate in middle; a short pale yellow linear stripe at sides of mesonotum; apical margin of scutellum with narrow pale yellow stripe interrupted in middle; outer side of axillae narrowly pale yellow; tegulae finely punctured, brown in middle, and rest ochreous, with subhyaline margin (broadly in front); mesonotum and scutellum with some short and yellowish-brown hairs, apical margin of scutellum with long and dense erect hairs; sides of thorax with dense snow-white hairs, wings subhyaline, marginal cell with transverse clouded streak above; second recurrent nervure interstitial with second transverse cubital nervure; femora black, anterior and middle ones with a narrow and short yellow stripe beneath; tibiae black, anterior and middle ones with a narrow yellow stripe nearly reaching the apex above; tarsi black, last joint with brown apex; pulvilli absent; hind spurs black; anterior and middle femora with dense and short shining white hairs beneath; tibiae and basitarsi with dense and short shining white hairs above; hind basitarsi with dense and short black-brown hairs on inner side. Abdomen shining, basal half of tergites 1 to 3 somewhat finely punctured, rest very finely and densely punctured (the punctures covering the apical margins); first tergite with basal half yellow-brown (suffused with orange), rest black (the black narrow at sides); second tergite with basal half yellow-brown (suffused with orange), and pale yellow beneath, rest black (the black narrow at sides); third tergite with base yellow-brown (suffused with orange), and with a pale yellow stripe beneath, rest black; fourth tergite black, with a transverse median dull yellow stripe; fifth tergite with basal half dull yellow, rest yellow; sixth tergite black, with two very large dull yellow rounded marks; base and sides of first tergite with white hairs; fourth and fifth tergites with some short and sparse white bristles; sixth tergite with short shining white bristles (the apical ones denser); first and second sternites yellowish brown, third and fourth with apical margin yellowish brown, rest of sternites black; ventral scopa shining white, the hairs on sixth sternite short and black-brown.

South West Africa: Kaross, 1 ♀ (type), 1 ♀ (paratype), February 1925, in South African Museum.

*Anthidium karossense* n. sp., differs from *Anthidium niveocinctum* Gerst., or *Anthidium banzonis* Strand, in the form of the scutellum, the puncturation of the mesonotum and abdomen, the colour of the pilosity and the integument.

### *Anthidium tuberculiferum* Brauns.

*Female.*—Length, 10 mm.

Clypeus black, lower margin with six rounded tubercles of the same size; vertex and occiput with dense yellowish-brown hairs; thorax with dense yellowish-brown hairs above, and shining white hairs at sides; wings slightly clouded, upper part of marginal cell clouded; second recurrent nervure slightly out of second transverse cubital nervure; hind tibiae black; hind tarsi with basitarsi black, rest of joints reddish brown; pulvilli absent; scopa black-brown, sides narrowly whitish.

*Male*.—Length, 9·5 mm.

Similar to the female; mandibles yellow, apex narrowly deep reddish brown, teeth black brown; clypeus creamy, lateral face marks not reaching level of insertion of antennae, antennae black-brown above and brown beneath; sixth tergite broadly yellow at sides, and with a subapical narrow and short transverse brownish streak; seventh tergite with a broad and deep rounded incision; sixth ventral segment smooth and shining, rounded at the apex; stipes rounded at the apex.

Cape Province: Willowmore, 1 ♀, 5. xi. 1919, 1 ♂, 25. xii. 1903 (H. Brauns); both specimens compared with the type, by my friend Mr. G. van Son (Transvaal Museum).

Both agree with the description, but the clypeus of the female has six, instead of five tubercles, as mentioned by Brauns.

### *Anthidium tuberculiferum* subsp. *namaqualandicum* nov.

*Male*.—Length, 8·5 mm.

Supraclypeal area with a linear transverse basal cream-coloured stripe; sixth and seventh tergites light yellowish brown; seventh tergite as in *A. tuberculiferum*; tibiae light yellowish brown, with a basal light yellow stripe above, that on anterior ones nearly reaching the apex; tarsi light yellowish brown, hind basitarsi with a light yellow stripe on outer side.

Namaqualand: Bowesdorp, 1 ♂ (type), November 1934; Klip Vlei (Garies Distr.), 1 ♂ (paratype), November 1931; both in South African Museum.

Similar to the typical male, but smaller. The type from Willowmore has the hind tibiae and the supraclypeal area black, and sixth tergite mostly black.

### *Anthidium katbergense* n. sp. (Fig. 1.)

*Male*.—Length, 8 mm.

Related to *Anthidium tuberculiferum* Br.; black; mandibles black, with small lemon-yellow mark, apex narrowly deep reddish brown, teeth black; clypeus moderately shining, strongly punctured, with a very small median impunctate and shining area above; clypeus black, with a very broad reversed T-shaped mark ochreous, the middle branch oval and not reaching supraclypeal area; the ochreous lateral face marks not reaching apex of clypeus; antennae black, and black-brown beneath; vertex and occiput strongly punctured, dull; entire face below antennae with dense and somewhat long shining white hairs; front with somewhat dense and long dull greyish-white hairs; cheeks with shining white hairs mostly on outer side. Thorax black; mesonotum strongly and densely punctured, dull; scutellum entire; tegulae minutely and very sparsely punctured, black-brown, narrowly bordered by reddish brown and pale in front; mesonotum and scutellum with somewhat short greyish-white hairs; thorax

Fig. 1.—Seventh abdominal tergite of *Anthidium katbergense* n. sp., ♂.

with dense shining white hairs at sides; wings somewhat clouded, apical margin very clouded; nervures black; second recurrent nervure slightly out of second transverse cubital nervure. Femora and tibiae black (apex of anterior and middle femora narrowly yellowish brown beneath); anterior tibiae yellowish brown on inner side, and narrowly on inner side above; middle tibiae yellowish brown beneath and narrowly on inner side above; anterior tarsi yellowish brown; middle tarsi yellowish brown, basitarsi brown; hind tarsi with basitarsi, small second and third joints black-brown, rest of joints yellowish brown; legs with shining white hairs; hind basitarsi with short and dense yellowish-brown hairs on inner side; spurs yellow; pulvilli absent. Abdomen black and shining, apical margins broadly and minutely coriaceous; first and second tergites with the base broadly and strongly punctured (the punctures somewhat dense at sides), and somewhat finely punctured in middle, subapical area somewhat finely punctured; tergites 1 to 4 with a small lateral light yellow spot (that on fourth very small); tergites 3 to 5 on each side of middle with a light yellow mark; sixth tergite black, apical margin yellowish brown (broadly at sides), rounded at sides and slightly emarginate in middle, as in *Anthidium tuberculiferum*; seventh tergite yellowish brown, apical margin with two small lobes and between the lobes a shallow elongate incision (fig. 1); sides of abdomen with dense shining white hairs, tergites with sparse white bristles, those on the apical ones more sparse; sixth sternite yellowish brown, flat and polished; apical margin rounded; stipes pointed at the apex.

*Female.*—Length, 8 mm.

Similar to the male; head entirely black; lower margin of clypeus with five tubercles (three large ones in the middle and two smaller ones laterally, with an incision between the median and the sublateral tubercles, and without an incision between the sublateral and the lateral ones); mandibles 5-dentate (basal one stout), black, with subapical linear space reddish brown; first tergite with light yellow lateral mark; second tergite with two lateral and two sublateral yellow spots; sixth tergite black, with somewhat shining white hairs, apical margin emarginate in middle; ventral scopa shining white, but narrowly from middle to apex the apices of hairs are tinged with light yellowish white.

Cape Province: Katberg, 4000 feet, 1 ♂ (type), 1, 15.1.1933, 1 ♀ (allotype), 15, 30.1.1933 (R. E. Turner), in British Museum.

Differs from the female *Anthidium tuberculiferum* Br. in the colour of scopa, mandibles, pilosity, the form of the lower margin of clypeus, and from the male in the form of seventh tergite, the colour of pilosity and other details. *Anthidium crassidens* Cameron, from Katberg, is larger, and it has the mandibles 4-dentate, the scutellum slightly incised in middle, the tegulae black, the hair of the front, vertex and thorax above, fuscous, and the white ventral scopa tinged with rufous.

*Anthidium severini* Vachal, subsp. *eriksoni* nov.

Scape black; occiput with a yellow mark on each side; thorax black; first abdominal tergite black, yellow at sides, and below the yellow light reddish brown; second tergite with basal lateral yellow stripe, rest light reddish brown; third tergite with basal yellow stripe nearly reaching middle (the yellow suffused with light reddish brown), rest light reddish brown; fourth and fifth tergites with broad yellowish stripe, suffused with light reddish brown, rest light reddish brown.

S.W. Africa: Kunene River, Erikson's Drift, 1 ♀ (type), March 1923, in South African Museum.

This subspecies is related to *Anthidium severini melanaspis* (Ckll.), but the colour on abdominal tergites is sufficiently different.

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