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ON A NEW CYNODONT FROM THE MOLTENO BEDS AND THE ORIGIN OF THE TRITYLODONTIDS

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(With 5 figures in the text and 1 plate)

Contents

Introduction

Early in 1956 three fossiliferous sites were discovered on Morobong Hill in Southern Basutoland. This hill is situated on the north-east bank of the Orange River a few miles north of the point of exit of this river from Basutoland.

At site A, a little way below the P.E.M.S. school on the northern slope of the hill, several fragments of bone were found which fitted together to form the cynodont jaw described in this paper. All the fragments were found in an area not larger than 5 sq. ft. At site B, approximately 100 yards west of site A, several fragments of what appear to be a cynodont snout were found in a ploughed field. These fragments have not yet been prepared. At site C, on the southern slope of the hill, large dinosaur bones were found. This site appears to be of the same height as sites A and B. It appears that all these sites occur well below the typical Red Bed facies indicating that they occur in the uppermost layers of the Molteno Beds. Cynodonts are well known from the *Cistecephalus*, *Lystrosaurus* and *Cynognathus* zones, but only one specimen of *Cynidiognathus longiceps* (Boonstra, 1947) has been described from the lower Molteno Beds of Basutoland. This species also occurs in the *Cynognathus* zone. The only therapsid remains which have been described from the Red Beds are *Tritylodon*, *Tritheledon*, *Pachygenelus* and *Lycorhinus*. Several cynodonts have been described by Parrington (1946), von Huene (1950), Boonstra (1953) and Crompton (1955) from the Manda Beds of Tanganyika. These beds appear to be of the same age as the Molteno Beds of Southern Africa. Cynodonts of the same age have also been described by von Huene (1935–42) from the Rio do Rasto Beds of Brazil.

The discovery of a well-preserved cynodont jaw from the upper Molteno Beds, which have been assumed to be barren, is of importance and warrants a full description.

We are indebted to the Paramount Chief of Basutoland for permission to undertake a series of excavations. The senior author wishes to record his cordial thanks to the Council for Scientific and Industrial Research for a grant enabling him to visit the Eastern Free State and Basutoland. Special thanks are due to Mr. F. R. Parrington for his help and advice.

Description of Mandible

Order Therapsida
Suborder Theriodontia
Infraorder Cynodontia
Family Traversodontidae
Genus *Scalenodontoides* gen. nov.
Genotype: *Scalenodontoides macrodontes* gen. et sp. nov.

Generic description. A large specialized gomphodont cynodont with procumbent incisors and lower postcanine teeth larger, but similar to those of *Scalenodon angustifrons*. The postcanine teeth are larger than those of any known gomphodont cynodont. The type specimen is at present in Paris, but it has not yet been decided in which institution it will be placed.

Scalenodontoides macrodontes gen. et sp. nov.

Only the tooth-bearing portions of the lower jaw could be fitted together from the numerous fragments. The jaw is exceptionally large and complete would probably have measured 30 cm. in length. The matrix consists of a hard calcareous mudstone, grey to blue in colour. A hard layer containing a high percentage of iron oxide lies between the matrix and the outer surface of the bone. This made preparation extremely difficult as this layer could not be cleanly removed from the bone.

A marked characteristic of the jaw is the massive symphysis with an oblique anterior surface (fig. 2, plate 1) and procumbent incisors. The posterior surface of the symphysis is indented by a deep impression. The lower edges of the rami have been deflected outwards as a result of dorsal pressure.

Dentition

Only the roots of the first and second incisors are preserved on the left, but the crowns of the right incisors are fairly well preserved. The cross-section of the first left incisor at the alveolar border is circular to oval (anterior-posterior measurement 1·5 cm., medio-lateral measurement 2·0 cm.). The remnant of the root in the second left incisor is badly preserved and the third left alveolus is empty. The damaged tip of a replacing incisor is visible in the first right alveolus. In cross-section this tip is crescent-shaped with a marked ridge in the centre of the posterior surface. The enamel of the anterior surface of the crown is thick in contrast to the exceptionally thin enamel on the posterior surface. The second right incisor is the best preserved of the series. This tooth

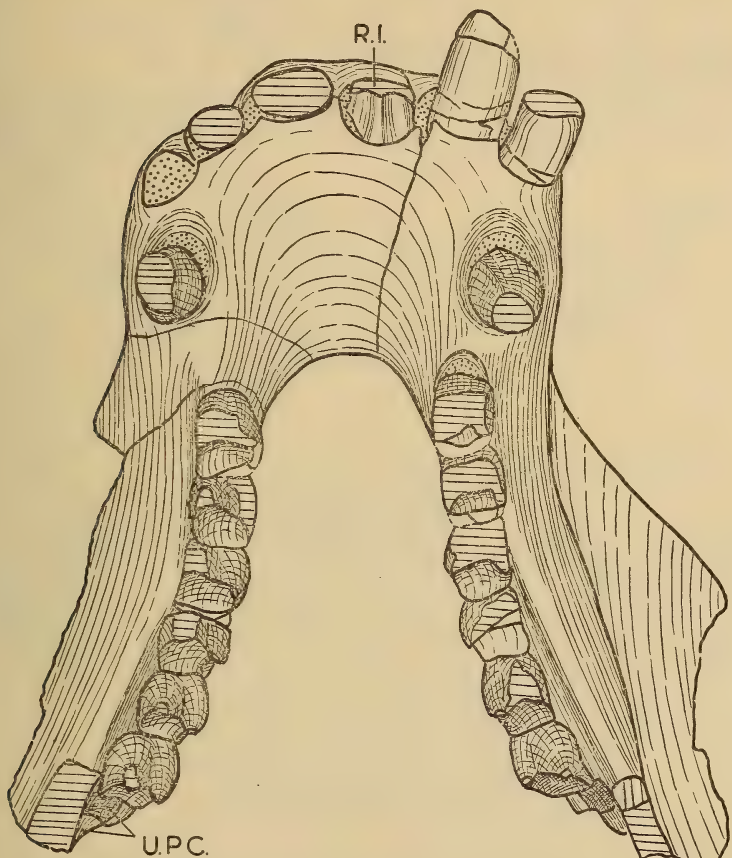

Fig. 1. *Scalenodontoides macrodontes* gen. et sp. nov. Dorsal view of lower jaw, $\times \frac{1}{2}$. U.P.C., Unerupted postcanines; R.I., Replacing incisor.

extends almost directly forwards from the mandible and this direction does not appear to be the result of distortion. This incisor is chisel-shaped with a fairly flat anterior surface and rounded posterior surface. The length of the crown measured from the posterior border of the alveolus to the apex is 3·3 cm. The anterior-posterior measurement at the alveolar border is 1·5 cm. and the medio-lateral 2·0 cm. The central ridge visible on the posterior border of the replacing incisor in the adjacent alveolus is not present in the second incisor which appears to indicate extensive wear.

A fracture through the mandibular symphysis has exposed a section through the inner portion of the alveolus of the second right incisor. A shallow pocket is visible above the root of the functional incisor in which the crown of a

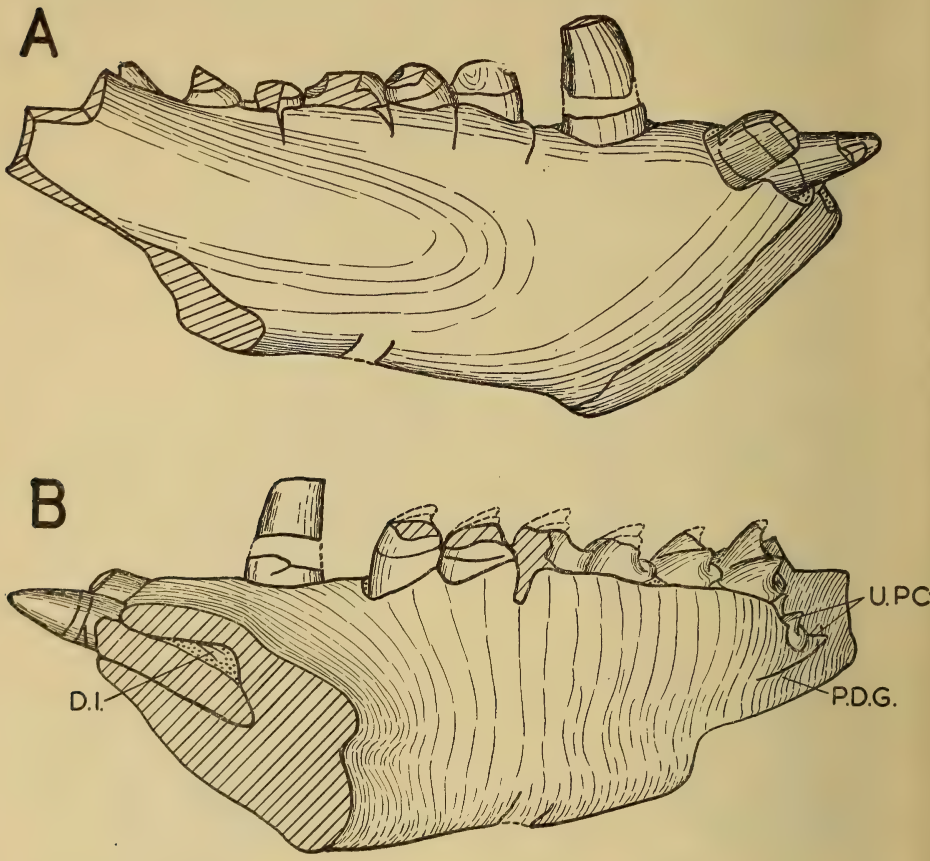

Fig. 2. *Scalenodontoides macrodontes* gen. et sp. nov. A, lateral view, and B, inner view of lower jaw, × ½. D.I., Developing incisor; P.G.D., Postdentary groove; U.P.C., Unerupted postcanines.

replacing tooth is visible (R.I., fig. 2B). Only the medial edge of this tooth is visible and in order to expose the crown a considerable portion of the mandible would have to be removed.

The crown of the third right incisor is fairly badly damaged, but its form appears to be identical to that of the second.

The incisors appear to be adapted to a herbivorous diet and are rather similar to the cropping incisors of ungulate mammals. The presence of replacement in so large a specimen is of interest. It suggests that, as in *Scalenodon* (Crompton, 1955), the incisors may have been replaced a number of times.

The fact that the crowns of the canines only partially fill the alveoli appears to indicate that the incisors have recently been replaced. The apices of the crowns of both the canines have been destroyed. In lateral view the crown appears to be slightly recurved.

The canines are ovoid in section and faint ridges are present upon the anterior and posterior edges of the crown. The maximum anterior-posterior measurement of the canine alveoli is 2·9 cm. and the medio-lateral measurement 2·2 cm.

A fracture passing vertically through the left ramus immediately behind the canine has exposed the crown of a partially developed canine medial to the

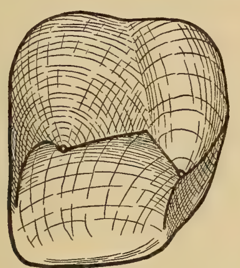

FIG. 3. *Scalenodontoides macrodontes* gen. et sp. nov. Lower view of typical ? left lower postcanine, × 2.

root of the functional canine. It appears therefore that the canines are replaced several times.

A marked feature of the postcanine series, consisting of six functional and two unerupted teeth, is that they all have the same crown pattern and there is very little difference in size between the anterior and posterior teeth. This is in contrast to the Diademodontidae where there is a marked differentiation of the postcanine row both in form and size.

The crown of a typical postcanine tooth (fig. 3) is roughly rectangular when viewed from above. The anterior region is dominated by two massive crescent-shaped cusps; the labial higher than the lingual and directed more dorsally than posteriorly, whereas the lingual cusp is directed more posteriorly than dorsally (see fig. 2B, 6th postcanine). A well-defined V-shaped depression is present on the anterior surface of the crown between the two cusps. There is no evidence of an anterior cingulum. A broad, slightly concave heel is present behind the crown. This heel is flanked by two ridges which extend backwards alongside the edge of the heel from the apices of the main anterior cusps. The posterior edge of the heel is deflected upwards to lie against the anterior edge of the succeeding tooth. There is no evidence of any minor cusps on the edge of the heel. As in the case of the incisors the postcanine teeth are characterized by thick enamel on the anterior surface of the two main cusps, whereas the enamel on the posterior surface of these cusps and upon the heel is exceptionally thin.

The postcanine teeth of the right ramus are badly preserved and the following description is based upon those of the left.

The anterior postcanines have been slightly dislocated from their sockets. The length of the diastema measured from the anterior border of the first postcanine alveolus to the posterior border of the canine alveolus is 1·2 cm. The length of the functional postcanine row of six teeth is 11·3 cm. In the anterior postcanine both the anterior cusps have been destroyed, but sufficient remains to indicate that these cusps were present. The labial portion of a broad heel is well preserved as is the ridge extending backwards along the outer side of the heel. In the second postcanine the apex of the labial cusp and the entire lingual cusp have been destroyed. Sufficient remains of the labial cusp to indicate that it was not as high as the labial cusps of the more posterior teeth. The heel of this tooth is well preserved. The V-shaped depression of the anterior surface is not as prominent as in the posterior postcanines.

The apex of the labial cusp of the third postcanine has been destroyed, but the lingual cusp is well preserved. The length of the heel behind the anterior cusps is slightly less than in the preceding two teeth. The lingual cusp of the fourth postcanine is well preserved, but the labial cusp is badly damaged. Well shown in this tooth is the ridge extending backwards alongside the heel from the lingual cusp. The V-shaped depression on the anterior surface of the crown is prominent. In the fifth and sixth postcanine teeth (plate 1, fig. 2) all the features are well preserved except that the posterior edges of the heels are damaged in both. A series of small ridges are present upon the inner surface of the crown behind the apex of the lingual cusp.

Lying partially behind and below the sixth postcanine on both sides of the jaw is the crown of an unerupted tooth. This tooth lies medial to the coronoid process which starts adjacent to the sixth postcanine. Below the crown of this unerupted postcanine the mandible is exceptionally thin, indicating that no root to this tooth has as yet been formed. The crown of this tooth has the same pattern as the functional teeth, except that the labial cusp is considerably higher than those of the functional teeth. The apex of this cusp lies below the posterio-lateral corner of the sixth postcanine. There are indications of the labial cusp of an additional unerupted postcanine behind the seventh. Unfortunately the specimen is badly damaged in this region. The following are the measurements of the postcanine teeth:

	Maximum length in cm.	*Maximum breadth in cm.*
1.	1·8	1·6
2.	1·8	1·7
3.	1·8	1·7
4.	1·8	1·7
5.	2·0	1·7
6.	2·0	1·7
7.	—	—
8.	—	—

Although the crowns of the postcanine teeth are very similar in both size and form, progressive changes can be observed in a posterior direction.

(1) There is a gradual increase in the size of the teeth, the height of the cusps and the prominence of the V-shaped depression, on the anterior surface of the crown.

(2) There is a gradual diminution in the size of the heel. The ridge extending along the labial side of the crown from the labial cusp arises more steeply in the posterior than anterior postcanines.

Increase in the size of the cusps in a posterior direction is a normal feature of several cynodont dentitions, e.g. *Scalenodon* and *Trirachodon*, but although present, it is not marked in *Scalenodontoides*. The other progressive changes are probably the result of wear, but this feature is not marked. The fact that the wear pattern increases progressively in an anterior direction appears to indicate that there has been no recent replacement of the postcanine teeth. This is in contrast to the incisor and canine regions, where active replacement is still taking place. Fracture through the rami exposed the roots of the postcanines in several places, but no replacing teeth were observed.

The roots of the functional teeth are stout and are directed slightly forwards.

Relationships

Taxonomic position of Scalenodontoides

One of the most reliable diagnostic features of cynodonts is the crown pattern of the postcanine teeth. In figure 4 the crown views of the main types of cynodont teeth have been illustrated. The only cynodonts which have lower postcanines with two anterior cusps and a heel behind are *Scalenodon* (fig. 4U), *Traversodon* (fig. 4V) and *Scalenodontoides* (fig. 4W). *Scalenodon* is from the Manda Beds of Tanganyika, *Traversodon* from the Rio do Rasto Beds of Brazil and *Scalenodontoides* from the Molteno Beds of Basutoland. All these deposits are considered to be of approximately the same age, i.e. Middle Triassic. There is a marked difference in the actual size of the postcanine teeth of these three genera and they occur in widely separated areas, but the crown pattern is so similar in all three that it is reasonable to conclude that they are related. The mandibular postcanines of *Scalenodontoides* are the largest known gomphodont cynodont teeth.

There is no evidence in *Scalenodontoides* or *Traversodon* of the anterior cingulum or heel cusps found in *Scalenodon*. This can possibly be explained as a result of wear as they are lost in older *Scalenodon* specimens. An additional similarity between the three forms is that, with the exception of the small sectorial postcanines at the back of the postcanine row in the older *Scalenodon* specimens, the crown pattern of all the postcanine teeth is the same and there is a gradual increase in the size of the teeth in a posterior direction. This is in contrast to the condition found in *Diademodon*. In both *Scalenodon* and *Scaleno-*

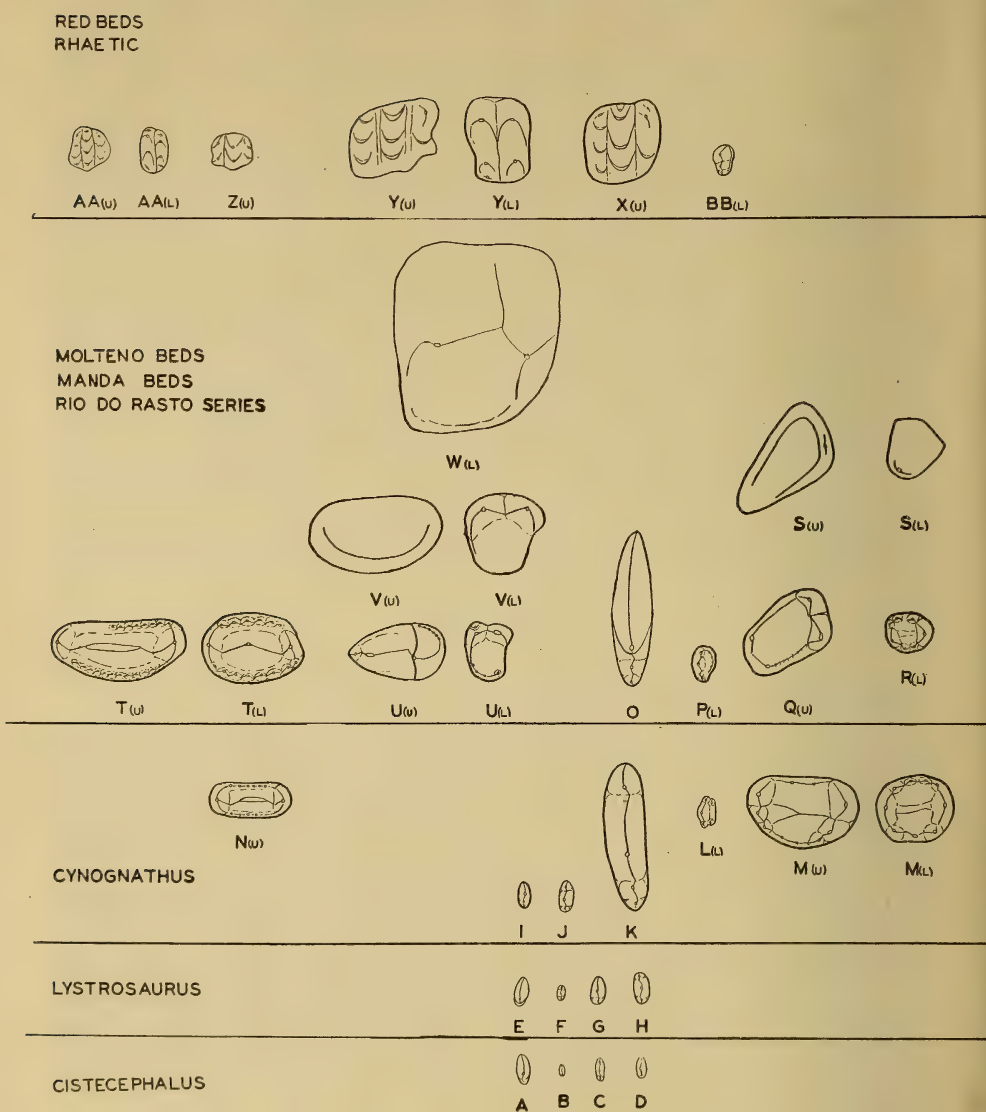

FIG. 4. Crown view of typical postcanines of cynodonts, and tritylodontids, × 1½. (U), maxillary, and (L), mandibular postcanine.

A, *Levachia*. B, *Silphedestes* and *Silphedocynodon*. C, *Baurocynodon*. D, *Nanictosuchus* and *Protocynodon*. E, *Glochinodon* and *Galesaurus*. F, *Microconodon*. G, *Noticlosaurus*. H, *Thrinaxodon* and *Nythosaurus*. I, *Sysphinctostoma*. J, *Cistecynodon* and *Nythosaurus*. K, *Cynognathus*. L, *Tribolodon*. M, *Diademodon*. N, *Trirachodon*. O, *Cynidiognathus*. P, Unidentified cynodont from Manda Beds. Q, Unidentified cynodont from Manda Beds. R, Unidentified cynodont from Manda Beds. S, *Gomphodontosuchus*. T, *Cricodon*. U, *Scalenodon*. V, *Traversodon*. W, *Scalenodontoides*. X, *Tritylodon*. Y, *Bienotherium*. Z, *Sterognathus*. AA, *Oligokyphus*. BB, *Pachygenelus*.

dontoides there is little or no evidence of tooth replacement of the postcanine teeth whereas replacement appears to occur frequently in the incisor and canine regions.

Classification of gomphodont cynodonts

Several trends of development of the postcanine teeth can be traced in fig. 4. The *Cistecephalus* and *Lystrosaurus* zone cynodonts (A–H) of the families Procynosuchidae and Galesauridae (Thrinaxodontidae) have either simple conical postcanines or shearing postcanines with minor cuspules anterior and posterior to the main cusp. *Sysphinctostoma* (I) and *Cistecynodon* (J) appear to be surviving members of the Galesauridae in the *Cynognathus* zone. The large shearing postcanines of the Cynognathidae found in both the *Cynognathus* zone (K) and Molteno Beds (O) could have developed from the type of teeth found in the Galesauridae. *Pachygenelus* (BB) from the Red Beds appears to be a surviving member of either the Galesauridae or the Cynognathidae.

The postcanines of forms such as *Tribolodon* (L) and the unnamed cynodont from the Manda Beds (P) appear to have developed from the Galesauridae. In these forms the crown has extended slightly lingually to form a cingulum supporting minor cuspules.

Watson and Romer (1956) have placed the gomphodont cynodonts in two families; the Diademodontidae and the Gomphodontosuchidae, the latter for a single South American genus. Von Huene (1956) and Haughton and Brink (1954) have placed all the African gomphodont cynodonts in the family Diademodontidae. The two South American forms *Gomphodontosuchus* and *Traversodon*, von Huene (1950) has placed in the family Traversodontidae. The postcanine teeth appear to indicate that gomphodont cynodonts developed in two independent directions from cynodonts with simple postcanine teeth and therefore should be divided into at least two families.

In both cases there is a tendency to widen the teeth transversely. In *Diademodon* (M) and *Protacmon* there are several cusps in addition to the main cusp in the lingual and labial edges of the crowns of the maxillary postcanines. A series of ridges extends transversely across the crown, but there is no evidence of a central cusp. The mandibular postcanines are similar, but the accessory cusps may not be so well developed on the labial and lingual borders and the crown is more circular in outline compared with the oval shape of the typical maxillary postcanines. An additional characteristic of *Diademodon* is that there is a marked differentiation of the postcanines; the anterior teeth are simple cones, those of the middle are transversely widened and the posterior teeth tend to be sectorial. The postcanines of the unidentified cynodont from the Manda Beds (R) are clearly similar to those of *Diademodon*. It is probable that the *Diademodon*-type of postcanine developed from the *Thrinaxodon*-type through stages represented by forms such as *Tribolodon* (L) and the unidentified cynodont from the Manda Beds (P).

In the mandibular postcanines of the unidentified cynodont from the Manda Beds (Q) there are two main cusps on both the lingual and labial borders, but the centre of the crown is hollow and the tooth is placed obliquely in the jaw. The development of more than one main cusp on the outer and inner edges and the absence of a central cusp appear to indicate that this type of crown pattern could be developed from that of the *Diademodon*-type. The postcanines of *Gomphodontosuchus* (S) are badly preserved but they appear to be of the same type as those of the Manda Beds form. Watson and Romer (1956) have placed *Gomphodontosuchus* in the separate family, the Gomphodontosuchidae.

The other direction in which gomphodont cynodonts appear to have developed is illustrated by *Trirachodon* (N) from the *Cynognathus* zone.

Unfortunately only the maxillary postcanines of this form are completely known. In the maxillary postcanines there is only one main cusp on the lingual and labial borders and a well-developed central cusp is present. A row of small cuspules is present on the anterior and posterior borders of the crown. The *Trirachodon*-type of crown pattern is also found in the Manda Beds genus *Cricodon* (T). In this form the mandibular postcanines have the same crown pattern as the maxillary postcanines. A feature of *Cricodon* and *Trirachodon* is that the postcanine row is not differentiated to the marked degree it is in *Diademodon*. In *Cricodon* two sectorial teeth are present at the posterior end of the postcanine row, but this type of tooth has not been recorded in *Trirachodon*. The presence of only one main cusp on the outer and inner edges of the tooth of the *Trirachodon*-type appears to indicate that this type of gomphodont tooth was developed from a simple conical tooth by transverse widening rather than from the *Thrinaxodon*-type, where the development was initially longitudinal.

A variation of the *Trirachodon*-type postcanine is that found in *Scalenodon* (U). In the maxillary postcanines of this form there is only one main cusp on the lingual and labial edges and one central cusp. The labial cusp has a vertical inner surface and the central cusp lies towards the lingual edge of the crown, but on the basis that this crown has only three main cusps arranged upon the same transverse plane, it appears to be related to *Trirachodon* and *Cricodon*. The mandibular postcanines, however, are fundamentally different from those of *Trirachodon* and the crown consists of two high anterior cusps and a broad heel behind. It has already been shown that, on the basis of the mandibular postcanines, *Scalenodon*, *Traversodon* and *Scalenodontoides* appear to be closely related.

On the basis of the form of the crowns of the postcanine teeth it appears that the gomphodont cynodonts can be divided into two families:

(A) Diademodontidae

More than one cusp on the lingual and labial borders of the crown and no central cusp.

(*a*) With low ridges connecting the lingual and labial crowns, e.g. *Diademodon*, *Protacmon*, etc.

(*b*) Centre of the crown hollow, e.g. *Gomphodontosuchus* and the unnamed specimen from the Manda Beds (fig. 4Q). Watson and Romer (1956) are perhaps justified in placing this type in a separate family, but nevertheless it appears to be closely related to *Diademodon*.

(B) Traversodontidae

One cusp on both the lingual and labial borders of the maxillary post-canines and a central cusp. All three cusps arranged upon the same transverse dlane.

(*a*) Upper and lower postcanines of the same pattern with minor cuspules upon the anterior and posterior margins of the crown, e.g. *Trirachodon* and *Cricodon*.

(*b*) Maxillary postcanines with three cusps, but mandibular consisting of two anterior cusps with a heel behind, *Scalenodon*, *Traversodon* and *Scalenodontoides*.

Origin of Tritylodontids

Both Watson (1942) and Kühne (1956) have stressed the similarity between the skulls of tritylodontids and cynodonts and have concluded that the tritylodontids were derived from the cynodonts, but a more precise statement could not be made. Haughton and Brink (1954) have classified tritylodontids as cynodonts. A study of the postcanine teeth of gomphodont cynodonts appears to throw some light on the origin of the tritylodontids.

The maxillary postcanine teeth of the tritylodontids consist of a variable number (not more than four) of transverse rows of three cusps. The majority of these cusps are crescent-shaped with the concave surface directed forwards. The mandibular postcanines consist of a variable number (not more than four) of transverse rows of two cusps. The majority of these cusps are crescent-shaped with the concave surface directed backwards. Kühne (1956) and Butler (1939) have shown that the number of transverse rows varies in a single dentition and that the number of rows tends to decrease in a posterior direction. Within the Tritylodontidae the number of transverse rows varies considerably. In *Stereognathus* (Simpson, 1928) for example there are only two transverse rows in the maxillary postcanines.

In *Trirachodon* and *Scalenodon* the crown pattern of the maxillary post-canines consists of one transverse row of three cusps. This has been given as a diagnostic feature for the cynodont family Traversodontidae and it therefore appears that this family is more closely related to the tritylodontids than the Diademodontidae. In *Scalenodon* the relationship with the tritylodontids is more marked for in this genus not only do the maxillary postcanines have three cusps in a transverse row, but the mandibular postcanines have two crescent-shaped cusps arranged upon the same transverse plane with the concave surfaces of the cusps directed posteriorly.

Scalenodon, *Traversodon* and *Scalenodontoides* are the only known cynodonts which have crescent-shaped cusps which are similar to those found in the tritylodontidae. The anterior region of the mandibular postcanines of the tritylodonts and especially *Oligokyphus* is almost identical to the postcanines of *Scalenodon.* The lateral views of the mandibular postcanines of *Scalenodon* and *Oligokyphus* have been compared in figure 5. In both there are two high anterior cusps with a deep depression between them. In both the anterior surfaces of the cusps arise steeply and are convex in contrast to the gentle sloping concave posterior surface. In *Scalenodon* there is a minor cuspule on the anterior surface of the

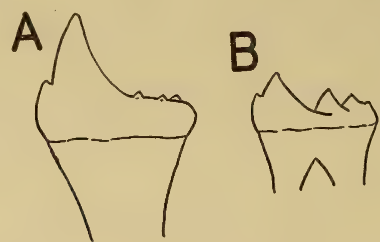

Fig. 5. Lateral views of the postcanines of: A, *Scalenodon,* and B, *Oligokyphus.*

labial cusp and in *Oligokyphus* there is a minor cuspule on both the lingual and labial cusps. Superficially it would appear possible to derive the double-rooted tritylodontid cheek teeth by the fusion of two or more teeth of the *Scalenodon*-type. On the other hand the additional cusps of the tritylodontid teeth could be developed from the additional cusps on the heel of the postcanines of *Scalenodon.* Kühne (1956) has shown that at the end of the postcanine row of *Oligokyphus* a progressive reduction of the elements takes place. In the ultimate tooth the crown consists of two anterior crescent-shaped cusps behind which there is a fairly broad heel. On the posterior edge of this heel two small cusps which are not crescent-shaped are present. It appears, therefore, that one row of cusps can be considered as a unit of which there are more in the more anterior teeth. The ultimate tooth of *Oligokyphus* is fundamentally the same as the postcanines of *Scalenodon* and consequently there is a complete overlap in the range of variation of the postcanine crown pattern of *Oligokyphus* and *Scalenodon,* and this appears to indicate a relationship between *Scalenodon* and the tritylodontids.

An additional similarity between *Scalenodon* and *Oligokyphus* is that in both the anterior cheek tooth (Kühne's zero tooth) is lost during growth.

On the basis of the above evidence it appears reasonable to conclude that the cynodonts with the type of postcanines found in *Scalenodon* are more closely related to the tritylodontids than any other known gomphodont cynodont. As these cynodonts occur in older beds than those in which tritylodontids are found it is possible that the tritylodontids were derived from this or a closely related group of cynodonts.

In an earlier paper (Crompton, 1957) it was concluded that *Diarthrognathus broomi* and Broom's Ictidosaurian A were derived from the scaloposaurids. If this is the case the Tritylodontidae which appear to have been derived from the cynodonts should be removed from the infraorder Ictidosauria as this infraorder was created for the classification of Broom's Ictidosaurians.

The close similarity of several of the features of the skulls of *Diarthrognathus* and *Tritylodontidae* appears to be the result of parallel evolution and does not indicate a true relationship between the two groups. The Tritylodontidae should be either placed in a new infraorder or, as has been done by Haughton and Brink (1954), classified as aberrant cynodonts.

Summary

(1) The lower jaw of a new cynodont, *Scalenodontoides macrodontes* gen. et sp. nov. from the upper part of the Middle Triassic Molteno Beds of Basutoland has been prepared and described. *Cynidiognathus longiceps* from the lower Molteno Beds and *Scalenodontoides macrodontes* are the only cynodonts known from these beds.

(2) On the basis of the structure of the postcanine teeth of *S. macrodontes* it is concluded that this form is closely related to the Brazilian genus from the Rio do Rasto Series, *Traversodon*, and the East African genus from the Manda Beds, *Scalenodon*. All these beds are considered to be of Middle Triassic age.

(3) The crown patterns of postcanine teeth of cynodonts have been compared. On the basis of the form of the postcanine teeth it is concluded that the gomphodont cynodonts can be divided into two families, the Diademodontidae and the Traversodontidae. The Brazilian genus *Gomphodontosuchus* may perhaps be included in a separate family, the Gomphodontosuchidae.

(4) It is concluded that the Tritylodontidae could be derived from those members of the Traversodontidae which have postcanine teeth similar to those of *Scalenodon*, *Scalenodontoides* and *Traversodon*.

(5) It is concluded that as the Tritylodontidae cannot be classified as Ictidosauria, they should be placed in a new infraorder or considered as aberrant cynodonts.

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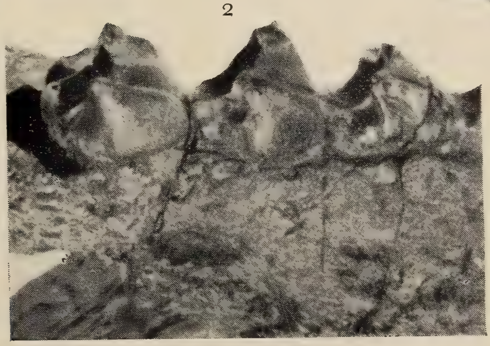

Scalenodontoides macrodontes gen. et sp. nov. 1, dorsal view of the lower jaw, $\times \frac{2}{3}$. 2, inner view of the 4th to 6th postcanines viewed slightly from above, natural size.

THE MOSCHOPID SKULLS IN THE SOUTH AFRICAN MUSEUM

BY

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South African Museum

(With eleven text-figures)

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INTRODUCTION

All the known specimens of the South African Moschopids, with the single exception of *Moschoides*—housed in the Walker Museum of the University of Chicago, have been personally examined. In addition to these there are in the collection of the South African Museum a number of cranial specimens found as isolated specimens at various locations in the Koup, and lastly the skulls of at least twenty individuals found together at Kruisvlei in a thin layer of argillaceous sandstone.

HISTORICAL

Delphinognathus conocephalus, described in 1892 by Seeley, was the first South African Moschopid to become known. Although some of the structures were misinterpreted, Seeley's woodcuts excellently portray the parts of the skull preserved. Of this skull Broom in 1910 published a restored figure which is inaccurate in a number of respects.

Nineteen years later the second genus, *Moschops*, was described by Broom (1911), the type being an incomplete skull. This Spitskop material, found by Whaits and sold by Broom to the American Museum, includes a number of topotype skulls. These skulls were subsequently studied by Gregory in 1926 and by the author in 1936.

The third genus, *Moschognathus*, was founded by Broom in 1914 on a lower jaw found by Whaits near Beaufort West and this jaw, together with the postcranial skeleton, was restudied by Gregory in 1926.

In 1914 Watson founded two additional genera, *Pnigalion* and *Lamiasaurus*, on rather poor material. As *Lamiasaurus* has as type specimen a snout which is Titanosuchian and a postorbital skull piece which is Moschopid, it has been proposed that only the snout be considered as the type and this has been found to be at most a doubtful species of the genus *Titanosuchus*. The postorbital skull piece is best left unnamed.

In 1937 Byrne founded the genus *Moschoides* on a fair skeleton with which is associated four fragments with teeth. Finally in 1952 I described a fairly good skull from Kruisvlei under the name *Avenantia kruisvleiensis*.

General Shape and Form of the Skull

The Moschopid skull is fairly light to massive and of moderate size (length 308–423 mm., width 200–395 mm., height 216–309 mm.). The snout is relatively weak, very short and fairly high (preorbital length 160–195 mm., height 108–162 mm., width 114–222 mm.).

The orbit, which is fairly small to fairly large, does not lie wholly in the posterior half of the skull (with the possible exception of *Delphinognathus*). The bones of the preorbital part of the skull are only moderately thick, whereas those of the posterior half, particularly of the cranial roof, are fairly to greatly pachyostosed: in the latter the surface is fairly smooth to rough, whereas in the former it is smooth to fairly rough. In most, except *Delphinognathus*, the 'cheek' is also thickened and fairly rough. The pachyostosis of the cranial roof is in *Delphinognathus* greatest round the pineal foramen, but in the other genera it is general and no distinct naso-frontal boss is developed. There is also no step between the facial and cranial surfaces, as these surfaces run into each other in an even convexity. The postfrontal bone is fairly light to massive and never has a boss. The orbits, except in *Delphinognathus*, are fairly small and look forwards and outwards, dorsally overhung and posteriorly bounded by the greatly thickened orbital rim.

The temporal fossa is wide and roomy in *Avenantia*, with a moderate antero-posterior diameter in *Delphinognathus* and narrow and slit-like in *Moschops*.

The interparietal width is small to large (54–198 mm.), with a parietal crista present in *Avenantia*.

Due to the forward position of the quadrate and the short snout, the lower jaw is short and the gape small.

Bones of the Dorsal and Lateral Surfaces

The premaxillaries (P.M.) form the anterior part of the upper median surface; they stretch backwards from the anterior alveolar border to end well anterior to the plane in which the anterior orbital border lies; posteriorly they lie in a groove in the nasals which bones further posteriorly, meeting each other in the median line, prevent the premaxillaries from meeting the frontals (my 1936 account on this feature in A.M.N.H. 5553 is thus incorrect and Efremov's criticism justified). Broad anteriorly up to the anterior edge of the *naris*, the premaxillaries narrow abruptly and then taper in posterior direction, but the internarial bar is strong. The surface of the premaxillaries in the median line curves evenly dorso-posteriorly and this slope is continued, without any step, on to the nasals and frontals.

The nasals (N.) together present a U-shaped surface with the limbs of the U directed anteriorly and the premaxillaries wedged in between the limbs and posteriorly lying in a groove in the nasals, anteriorly each nasal forms the posterior border of the *naris* and meets the posterior edge of the septomaxilla; posterior to the limits of the premaxillaries the two nasals meet in the median line and meet the anterior ends of the frontals, but although the bones are here greatly thickened there is no indication of any distinct naso-frontal boss, and the sweep of the upper surface is a gentle convexity with no indication of a step between the facial and cranial surfaces; there is no depression in the posterior nasal surface for a facial gland as there is in most of the Tapinocephalidae. Laterally the swollen surface of the nasal curves evenly into that of the strongly swollen prefrontal. A tongue of the frontal sometimes separates the posterior part of the prefrontal from the nasal.

The septomaxilla (S.M.) has a small facial exposure; it forms the lateral and part of the anterior and posterior borders of the *naris*; its surface within the *naris*, of which it forms the floor, is extensive. I have not located a septomaxillary foramen.

The maxilla (M.) is the largest bone of the face; although fairly short it is quite high; its posterior edge is weakly indented to receive the very short lacrimal, so that both the dorsal and the ventral processes appear to be short; the dorsal process is short and wide and posteriorly truncated to meet the prefrontal in a long suture; the ventral process is longer and tapers to a point along its short suture with the jugal; the anterior half of the alveolar edge curves gently upwards to where it meets the premaxilla.

The lacrimal (L.) has a small facial exposure; it is very short, but high and in outline presents a face which is a crescent with the tips cut off; it thus forms most of the anterior orbital rim, which though rounded is not much thickened. It is only slightly overhung by the prefrontals and has no contact with the nasal because of the intercalation of the strong dorsal process of the maxilla. No foramen is visible on the facial surface as this probably lies within the orbit.

The jugal (J.) is quite a strong bone but like the bones of the snout is but little pachystosed and its surface is fairly smooth; it forms the ventral, relatively unthickened, border of the orbit. From its contact with the maxilla, its ventral edge sweeps down sharply postero-ventrally to where it makes a small contact with the upper edge of the quadratojugal (but in *Delphinognathus* the posterior part of its ventral edge is deeply excavated to form a deep and roomy indentation breaking the even sweep of the antero-ventral border of the jugal on to the anterior face of the quadratojugal, whereas in *Moschops* and *Avenantia* this sweep is only interrupted by a slight nick at the junction of these two bones (this is also evident in some Struthiocephalids). The posterior edge of the jugal is slightly (*Avenantia*) or deeply indented by the anterior process of the squamosal so that the face of the postero-ventral process of the jugal is long and narrow, except in *Avenantia* when it is short and broad. Its contact with the postorbital is along a short curved suture.

The prefrontal (Pr.F.) is only moderately to strongly thickened; it forms the moderate to thick antero-dorsal part of the orbital border which overhangs the orbit moderately to strongly. In its anterior part, where it meets the lacrimal and maxilla, it is less swollen and its surface is smoother than in its posterior parts, and it does not strongly overhang the lacrimal. In all the Moschopid genera the prefrontal meets the maxilla and the lacrimal is thus excluded from contact with the nasal. In dorsal view its width is seen to vary, this also in specimens of the same genus. Posteriorly it usually does not meet the post-frontal, but in *Avenantia* it just meets the postfrontal, so the frontal just enters the orbital border or is just excluded from it. Medially a varying tongue of the frontal is sometimes wedged in between the nasal and prefrontal, but this tongue is sometimes absent. The swollen surface of the prefrontal passes evenly on to the swollen surfaces of the nasal and frontal and no groove is ever developed to prevent this confluence as in some Tapinocephalids and Struthiocephalids.

The frontal (F.) is the largest bone of the dorsal skull roof, being particularly large in *Moschops koupensis*. The pair together forms a roughly rectangular surface as the main body of the two bones, with, laterally, a tongue which just enters or is just excluded from the orbital border and anteriorly, there is in some specimens a varying tongue wedged in between the posterior end of the nasal and the prefrontal. The frontals meet the parietals in a nearly straight transverse suture, but in *Moschops koupensis* the parietals form a strong anteriorly directed wedge into the frontals. Sometimes a postero-laterally directed tongue separates the postfrontal from the parietal, but usually there is a fair to small contact between parietal and postfrontal. Anteriorly the thickened frontal surface flows with a gentle curve on to that of the nasal so that there is no indication whatever of a distinct naso-frontal boss. The frontal surface is similarly confluent with that of the parietals and postfrontals. Although in general the frontal face is domed there is in some forms a depression along the middle line, slight in some specimens of *M. capensis*, but in *Avenantia* it forms a decided wide but fairly shallow longitudinal groove. The pachyostosis along the line of junction of the two frontals is thus, in some specimens, less developed than more laterally.

The postfrontal (Po.F.) is a fair-sized bone moderately to very strongly thickened; it forms a small to fairly large part of the dorso-posterior section of the orbital border; it sometimes meets the prefrontal but more often the lateral tongue of the frontal is intercalated between these two bones; posteriorly it meets the parietal in most specimens, but sometimes the postero-lateral tongue of the frontal intervenes; stretching from the orbit to the temporal fossa it forms the upper part of the postorbital bar lying above the postorbital and latero-ventral to the frontal. The postfrontal, though moderately to very strongly pachyostosed, never forms a distinct boss, but has its rough outer surface confluent with the swelling of the frontal, parietal and postorbital in an even gentle convexity.

The parietal (P.) of the Moschopids is a remarkably variable element, not so much in regard to its connections with and relationships to the contiguous bones as in the shape and topography of its upper face.

In *Moschops koupensis* and in some specimens of *M. capensis* it forms and completes the general dome-shaped convexity of the upper cranial roof coalescing in gentle curves with the greatly pachyostosed surrounding bones. Whereas in other specimens of *Moschops capensis* there is a tendency, more or less pronounced, for it to form a mound around the pineal foramen, and, in one greatly distorted and probably young skull, this mound approaches the conical shape seen in *Delphinognathus*.

In *Avenantia* the parietal is but little pachyostosed; there is a circular and prominent wall around the pineal foramen, with a lateral excavation bounded by a ridge lying still further laterally; posteriorly the bone forms a low, fairly narrow crista which curves down towards the occiput, whereas in *Moschops* the parietal posterior to the foramen tends to form a groove along the median line more or less strongly developed.

In *Moschops koupensis* the parietal forms the posterior edge of the skull between the interparietal and the tabular, whereas in all the other forms the posterior edge is wholly formed by the interparietal and the two tabulars; this is due to the parietal curving down postero-ventrally much more strongly.

As a pair the parietals form a much smaller part of the cranial roof than do the two frontals. A moderate to large pineal foramen lies very near to fairly far away from the frontal suture but it is always well anterior of the occipital edge. The size of the pineal foramen varies within the same species and a greater size does not appear to be correlated with juvenility.

There is considerable variation in antero-posterior length of the parietal; the fronto-parietal suture is either a fairly straight transverse line or forms an anteriorly directed obtuse or sharp V; the parietal meets or does not meet the postfrontal. Posteriorly the parietals meet the interparietal and tabulars in a fairly straight or slightly curved suture, but in *M. koupensis* this general curve is indented where it makes contact with the interparietal.

The parietal width in the Moschopids shows considerable variation, which, within the species *Moschops capensis*, appears to be due to differences of age in some cases, but where other features exclude this explanation it can only be due to differences in sex. In *M. capensis* the parietal width varies from 108 to 172 mm.; in *M. koupensis* it is 198 mm.; in *Delphinognathus* 120 mm., and in *Avenantia* 84 mm. (with the crista 48 mm. at its narrowest part). In some skulls of *M. capensis* there is some indication of a pinching-in across the parietals to form a dorsal bay to the temporal fossa as in some species of *Struthiocephalus* and *Keratocephalus*.

The parietal forms a rounded ill-defined edge to the upper border of the temporal fossa in all the forms, except in *Avenantia* where the edge of the crista forms this edge; lateral to this the parietal forms a more or less vertical face within the temporal fossa with its ventral edge meeting the posterior end of the postorbital and the dorsal edge of the upsweeping squamosal.

Except in *Avenantia* the parietal of the Moschopids does not send a tapering process on to the posttemporal arch intercalated between the tabular and the squamosal, as is the case in Tapinocephalids and Struthiocephalids. This confirms my observation (1936) on the Spitskop material in the American Museum and Efremov's (1940) stricture on this observation is thus groundless. The mistake made by Efremov is that he made no allowance for the possibility that the postero-lateral tongue of the parietal may, by increased pachyostosis of the contiguous bones, be overgrown by them. This in fact is just what has taken place in *Moschops*.

The postorbital (P.O.) is a moderate to very massive bone forming the lower part of the postorbital bar and with a much more lightly built posterior flange lining part of the upper wall of the temporal fossa; anteriorly it forms a small to great part of the thickened posterior orbital border, and posteriorly most of the thick to very thick anterior border of the temporal fossa. Ventrally it abuts against the squamosal in a long curved suture and, except in *Avenantia*, meets the jugal along a short curved suture. Dorsally it meets the lower edge of the postfrontal along a curved suture running across the postorbital bar. Within the temporal fossa the postorbital sends a short to moderately long lightly built flange upwards and backwards to flank the lateral face of the parietal and to meet the dorsal edge of the upsweeping squamosal within the temporal fossa. These two bones together with the lateral face of the parietal thus form the median lining of the temporal fossa.

The squamosal (Sq.) is large and is the main constituent bone of the 'cheek'; it is little to greatly thickened with its outer face fairly flat and smooth in *Delphinognathus*, but more or less swollen and rough in the other genera. Anteriorly it meets the jugal in a squamous suture, fairly straight in *Avenantia*, moderately indented in *Pnigalion* and deeply indented in *Moschops* and *Delphinognathus* so that it lies over the upper edge of the postero-ventrally directed process of the jugal. In its antero-ventral corner it receives the quadratojugal overlapping the posterior part of this bone's outer face. Dorsally its anterior part forms the base of the postorbital bar and here it is overlapped by the postorbital and further posteriorly the squamosal forms the fairly thin to thick lower border of the temporal fossa and then, sweeping upwards, forms most of the posttemporal arch and the posterior border of the temporal fossa. From the posterior edge of the temporal fossa the squamosal curves inwards and forwards to meet the parietal and postorbital inside the upper part of the temporal fossa.

On the outer face of the posttemporal arch the squamosal meets the tabular and in the Moschopids there is no long tongue-like process of the parietal intercalated between the squamosal and the tabular, but in *Avenantia* there is a short wedge of the parietal between these two bones.

Postero-ventrally the thick rounded edge of the squamosal forms the edge of the skull and then on the posterior face carries the 'auditory groove', which is bounded medially by a scroll-like ridge.

The tabular (T.) in dorsal view presents only its upper edge, which is thin in *Avenantia* but thick in *Moschops* where it has overgrown the postero-lateral tongue of the parietal. In lateral view the tabular is seen to form most of the posterior edge of the skull above the squamosal.

The interparietal (I.P.) in dorsal view presents only its dorsal edge which forms the median part of the occipital edge. The dorsal interparietal edge is thin in *Avenantia*, fairly thick in *Moschops capensis* and in *M. koupensis* forms only a small part of the dorsal edge in the median line where the dorsal surface of the skull is grooved; laterally to it the parietal forms the posterior edge until it meets the tabular.

The quadratojugal (Q.J.) in lateral view, presents a narrow dorso-ventrally elongated face in *Moschops* where it is directed antero-ventrally. Dorsally it forms a weak contact with the jugal, with a slight narrow notch between these two bones anteriorly. In most specimens of *Moschops* the squamosal overlaps the posterior border of the quadratojugal, but in one specimen the squamosal also clasps the quadratojugal dorsally so that it is partly wedged in to the squamosal, but the quadratojugal never forms a narrow deep wedge into the squamosal as in Tapinocephalids.

In *Delphinognathus* the anterior half of the upper end of the quadratojugal is deeply notched and concomitantly the anterior half of the lower end of the jugal is also notched so that a deep broad notch is formed between these two bones. The posterior half of the upper end of the quadratojugal meets the posterior half of the lower end of the jugal as in *Moschops*. The lateral surface of the quadratojugal is thus not narrow and elongated as in *Moschops* but can be described as an elongated dorso-ventrally directed surface with wedge-shaped anterior process. According to Watson (1914) the quadratojugal in *Pnigalion* presents a large, roughly quadrangular outer surface meeting the jugal along a fairly long suture and not wedged into the squamosal.

The quadrate (Q.) can in lateral view be seen lying medially to the quadratojugal with the outer cotylus showing below the ventral limit of the quadratojugal, but in *M. koupensis* much of the antero-lateral surface of the quadrate above the cotylus is also visible in lateral view.

The Occiput

The occiput in the Moschopidae presents a fairly large surface, which is at least twice as broad as high and is shallowly concave from side to side. The dorsal edge of the occipital plate lies further posteriorly than the ventral edge. Along the median line there is a weak to fairly weak ridge on the interparietal. On either side of this ridge lies a shallow to moderately deep depression. The upper edge of the occipital plate proper lies high in most forms with a rounded edge, but in *Moschops koupensis* both the upper and lateral edges form a rampart-like wall enclosing the inner part of the plate and encroaching on it so that the occipital plate proper becomes very small. The condyle is directed postero-ventrally so that the skull forms a sharp angle with the neck; it is a stout rounded knob dorsally excavated by a groove, sometimes quite deep, for the *medulla*; the lateral parts of the knob are formed by the exoccipitals.

The *foramen magnum* is large and oval or is fairly small with its sides pinched in. The posttemporal fossae are small with, in one case, a median groove leading into them; they are bounded by the supraoccipital and paroccipital. The lateral border of the skull is formed by the swollen squamosal which more medially is excavated to form the 'auditory groove' and this is bounded medially by a prominent scroll-like ridge wholly formed by the squamosal. Ventrally, the condyles of the quadrates lie in a plane far anterior of the plane of the occiput.

Viewing the occiput at right angles to the plane in which the alveolar borders lie, much of the surface of the parietal, postfrontals, postorbitals and frontal is seen and the ventral edge is formed by the squamosal, quadratojugal, quadrate, quadrate ramus of the pterygoid, exoccipital and basioccipital.

The basioccipital (B.O.) in occipital view shows only a small surface, viz. an elongated strip along the middle line of the condyle; its upper part is excavated and this groove leads into the *foramen magnum*; near its lower border there lies a notochordal pit.

The exoccipitals (E.O.) form the lateral surfaces of the condyle separated by the above-mentioned strip of the basioccipital (but in *Avenantia* the two exoccipitals meet to form the lower border of the *foramen magnum*); from the condylar surface the exoccipital extends forwards and upwards to enter the occipital plate forming an irregular triangular surface lateral to the *foramen magnum* overlapping the supraoccipital and paroccipital; the ventral border of this sheet of the exoccipital is notched to allow for the exit of the tenth nerve; the exoccipital forms most of the lateral rim of the *foramen magnum.*

The supraoccipital (S.O.) is a low but broad bone; in its lower median part it forms the upper and sometimes also much of the lateral rim of the *foramen magnum.* Laterally it extends to the outer corner of the posttemporal fossa, or well lateral of this fossa, and forms the dorsal border of this fossa and above this it meets the tabular in an undulating suture; dorsally it meets the interparietal in a fairly straight to curved suture. Along its ventral edge it makes contact with the paroccipital on both sides of the posttemporal fossa (but in *Moschops koupensis* only medially of this fossa). The median ridge is low or absent on the supraoccipital, but is fairly prominent on the interparietal.

The interparietal or dermosupraoccipital (I.P.) is a moderately to large-sized element forming the upper part of the middle of the occipital plate. It is a rectangular element with the corners developed as wedge-like processes; along the median line it carries a fairly strong ridge and lateral to this the bone is slightly or quite deeply excavated. Dorsally the bone forms a strong rounded edge curving over to meet the parietal, but in *Moschops koupensis* the upper part of the bone forms a very strong overhanging rampart, which is laterally continued by a similar overhanging of the tabular.

The tabular (T.) has the largest surface of all the occipital bones. Its outer edge, which forms the lateral and part of the dorsal limits of the occipital plate proper, is weakly rounded or is developed into a very massive overhanging rampart, which greatly encroaches on to the more inner part of the occipital plate greatly reducing this area. (This condition in *Moschops koupensis* is a much more advanced development than that shown in *Tapinocephalus*, where it is only incipient.)

Dorsally the tabular meets the parietal on the dorsal surface of the skull and is just excluded from or just enters the edge of the posttemporal fossa. Its outer edge meets the upsweeping dorsal process of the squamosal but is excluded from the 'auditory ridge' which lies wholly on the squamosal. The latero-ventral corner of the tabular overlaps the paroccipital lateral to the posttemporal fossa. Internally it meets the interparietal and supraoccipital along a long undulating suture and is just or well excluded from the edge of the posttemporal fossa.

The paroccipital (P.O.) is, in occipital view, seen to be a strong bar medially abutting against the basioccipital and overlapped by the flange of the exoccipital and laterally extends to meet the squamosal and here it is overlapped by the downsweeping corner of the large tabular and itself overlaps on to the posterior face of the quadrate, which it supports very firmly. The medio-ventral corner of the paroccipital is seen to descend and form the posterior part of the rim of the *fenestra ovalis*. Its dorsal edge meets the supraoccipital except at the posttemporal fossa. In *Moschops koupensis* there is a groove medial to and leading into the fossa. In occipital view the paroccipital is seen to obscure the stapes to a smaller or greater extent.

The quadrate (Q.) shows a small to fair-sized surface when viewed at right angles to the plane in which the alveolar borders of the maxillaries lie. Its ventral edge has two fairly strong oval knobs, separated by a notch, which form the articulatory condyles for the reception of the articular. In its dorsal part the posterior face of the quadrate is overlapped by the distal end of the paroccipital firmly applied to it. Medially the short anterior process of the quadrate is overlapped by the distal end of the quadrate ramus of the pterygoid, which is firmly applied to it and which passes further backwards on to the posterior face of the quadrate above the internal cotylus. Above the pterygoid the postero-distal process of the stapes abuts securely against the posterior face of the quadrate. Just below or just distal of the postero-distal corner of the stapes there is a distinct low mound on the quadrate.

Dorso-laterally the quadrate meets the quadratojugal and along the suture these two bones are notched to form a fair-sized rounded quadratic foramen.

The quadratojugal (Q.J.) in this view presents a low but broad face between the suture with the quadrate and the edge of the downsweeping overlapping squamosal.

The stapes (St.) is, in occipital view, obscured by the paroccipital, slightly in *Moschops capensis* but greatly in *Avenantia* and *Moschops koupensis*. It is a moderately strong rod-like element with a slight waist and an expanded distal end, and is in its middle portion pierced by a large oval stapedial foramen. Its postero-distal process, directed towards the tubercle on the quadrate, is applied to the inner part of the posterior face of the quadrate, and this is firmly wedged in between the paroccipital above and the quadrate ramus of the pterygoid below. Proximally the footplate of the stapes passes anteriorly to the downwardly directed medio-ventral corner of the paroccipital to fit into the ventrally situated *fenestra ovalis*.

The stapes lies diagonally with its proximal end appreciably higher than its distal end.

The Ventral Surface of the Skull

The occiput being sloping, with its dorsal edge lying well posterior to its ventral border, is visible in ventral view. Post-mortem dorso-ventral pressure in the rock tends to accentuate this slope and in figures 9 and 11 correction to neutralize this should be allowed for.

Except for a slight upward tilt anterior to the transverse pterygoidal rami, the palate and *basis cranii* lie in practically the same plane, with the weak to fairly weak lateral pterygoidal rami lying moderately far below this plane and the suspensorium lying still further ventrally.

The articulating condyles of the quadrates lie far to very far anteriorly in a plane far anterior to the basioccipital condyle, nearly half-way up the ventral surface of the skull. The subtemporal fossae are small, short, but fairly wide; the *choanae* are fairly short but wide; the interpterygoid vacuity is a fairly narrow and short slit anteriorly bounded by the prevomer and there is a very small suborbital foramen on the suture between the palatine and transversum.

The basioccipital (B.O.) is, in ventral view, seen to form the greater part of the occipital condyle. The whole condyle is usually a more or less rounded strong knob, but in some cases it is more pear-shaped and even triangular in outline.

The basioccipital forms the anterior and medial portion of the condyle but in *Avenantia* the exoccipitals meet each other posteriorly. The notochordal pit faces postero-ventrally and the skull would in life hang downwards from its articulation with the atlas.

Anterior to its condylar part the basioccipital has a short but fairly wide to wide face which lies on a higher level than the condyle. This face is only slightly tilted downwards anteriorly and thus meets the basisphenoid in a very large angle. In its median part the basioccipital carries a pair of anteriorly converging tuberous ridges in *Moschops koupensis*, which tend to coalesce in *M. capensis* to form a low keel whereas in *Avenantia* two weak ridges are developed anteriorly with the posterior part of the surface flat.

Anteriorly the basisphenoidal tubera underlie the basioccipital which is met in a slightly concave transverse suture.

Laterally the basioccipital forms the thickened ventral rim of the *fenestra ovalis*, which thus lies far ventrally. Further backwards it abuts against the paroccipital and is underlain by the antero-medial process of the paroccipital, which forms the posterior part of the rim of the *fenestra ovalis*, and still farther backwards it is underlain by the thin sheet of the exoccipital.

The basisphenoid (B.S.) carries a low but fairly sharp median keel, lateral to which there are two posteriorly diverging fairly strongly swollen tubera (flattish in *Avenantia*); postero-lateral to the tubera the basisphenoid forms the anterior border of the *fenestra ovalis*.

Anteriorly the basisphenoid tapers and is wedged in between the quadrate rami of the pterygoids and its median keel is continued anteriorly by those of the two pterygoids. Immediately anterior to the tubera and lateral of the median keel lie the internal carotid foramina and lateral to the tubera lie the external carotid foramina.

In general the ventral faces of the basisphenoid and basioccipital lie in nearly the same plane, as these faces subtend only a very obtuse angle because the anterior part of the basioccipital is only very weakly inclined downwards in anterior direction.

The paroccipital (P.Oc.) is a large, strong and massive bone which forms a firm and strong connecting link between the cranial base and the laterally situated quadrate, squamosal and tabular. Medially the paroccipital abuts firmly against the basioccipital and is underlain by the thin flange of the exoccipital; its antero-median corner usually forms a strong process, strongly thickened where it forms the ventral and posterior parts of the rim of the *fenestra ovalis*. Its antero-lateral corner is very firmly applied to the postero-median face of the quadrate, and here the postero-distal process of the stapes is firmly wedged in between it and the quadrate. Its postero-lateral corner overlaps and is firmly applied to the medio-posterior face of the squamosal just medial of the 'auditory ridge', and also meets the ventral process of the tabular. (But in *Avenantia* the lateral end of the supraoccipital is intercalated between the paroccipital and the tabular.) Posteriorly it meets the supraoccipital on both sides of the small slit-like posttemporal fenestra in *Avenantia* and *Moschops capensis*, but only medially of this fenestra in *Moschops koupensis*.

Concomitant with the forward shift of the quadrate condyles the paroccipital has rotated on its long axis with the result that it presents a much greater face in ventral view than it does in occipital view.

The antero-ventral edge of the paroccipital is free and rounded and forms the posterior border of the fairly large fenestra lying between the basisphenoid, quadrate ramus of the pterygoid, quadrate and paroccipital.

On the suture between the paroccipital and the exoccipital lie two small foramina, the anterior being the jugular foramen and the posterior one for the exit of the tenth nerve.

The pterygoid (Pt.) is a bone of moderate size and with its fellow forms the middle portion of the ventral surface of the skull. Its most prominent components are a strong, deep but short quadrate ramus and a short and fairly weak transverse ramus. In the median line its antero-posterior length is short mainly because there is little left of the anterior process, which is so well developed in the ancestral Pelycosaurs and contemporary Therapsids.

Anteriorly the pterygoids are separated in the median line by a long and fairly open interpterygoid slit; posterior to this the pair of pterygoids meet to form a sharp keel which is posteriorly continued on the basisphenoid; the pterygoid keel is wedged into the basisphenoid.

Lateral to this median keel the pterygoid is deeply excavated and becomes very thin to form a wide and deep groove lying diagonally in the skull; in this groove the pterygoid meets the basisphenoid along a diagonally directed, fairly straight suture. This deep groove is laterally bounded by the prominent quadrate ramus, which is a deep sheet of bone lying nearly at right angles to the plane of the palate; above, where it meets the basisphenoid, it is thin, but its ventral edge is thickened and rounded and thus forms a strong girder, which posteriorly supports the quadrate.

The quadrate rami are short and diverging in posterior direction; each is firmly applied to the mesial face of the short anterior process of the quadrate and its extremity extends well posterior to the quadratic condyles. The upper edge of the end of the ramus lies below and overlaps the anterior part of the distal end of the stapes, which passing above it is firmly abutted against the mesial face of the quadrate. The quadrate ramus is connected with the lateral ramus by a strong, thickly rounded web of bone and it is here that part of the pterygoid muscle was attached. The edge of the quadrate ramus and of this web of bone form the mesial and anterior border of the subtemporal fenestra.

The lateral ramus of the pterygoid is weak, does not descend much ventrally nor extend much laterally. In *Avenantia* its ventral edge is narrow and sharp, in *Moschops capensis* it is a little thicker and in *Moschops koupensis* laterally swollen; postero-medially its edge curves to join the median keel. Laterally the ramus is met by the transversum and anteriorly by the palatine, and it has a small contact with the prevomer in the median line.

The transversum or ectopterygoid (Tr.) is a fairly small but quite strong bone linking the transverse ramus of the pterygoid with the bones of the side-wall of the skull; it is firmly joined to the inner face of the jugal and flanked by the maxilla; anteriorly its edge meets the palatine and here there is a small suborbital foramen. Due to the forward position of the transverse ramus the transversum lies lateral and even somewhat posterior to the extremity of the ramus, whereas primitively it lies anterior to the ramus.

The palatine (Pal.) is short and extends antero-laterally from its contact with the pterygoid as a sheet of fairly thick bone to form much of the lateral border of the *choana* and a varying part of its posterior border; it is laterally applied to the inner maxillary face, where it flanks the alveolar border. In the median line a tongue of the prevomer prevents it from meeting its fellow; here the palatine carries a low mound of varying shape which is not dentigerous. In *Avenantia* this mound is continued on to the short anterior ramus of the pterygoid.

The prevomers (vomers P.V.) are strong but short bones which together form a massive interchoanal bar. Their anterior bevelled edges are applied to the inner face of the premaxillaries. Posterior to the *choanae* they widen to meet the palatines and in the median line they lie between the mesial edges of the palatines and meet the pterygoids. Anteriorly along the median line there is a groove and along the lateral edge there is an undulating ridge. Dorsally the prevomers form a narrow median ridge which is posteriorly continued by the pterygoids as part of a median septum.

The premaxillary (P.M.) has a massive alveolar face and although poorly exposed in most specimens, appears always to have housed three fairly large teeth, with indications, in some specimens, of replacing teeth lying lingually.

The maxilla (M.) has the anterior part of its alveolar border massive and wide but in posterior direction it tapers fairly rapidly and, posterior to the teeth, the maxillary edge is continuous with the sharp ventral edge of the jugal. Little is known of the teeth, but the anterior ones are large and they then rapidly decrease in size backwards. There would appear to be from ten to possibly thirteen maxillary teeth.

The jugal (J.) shows, besides its internal face which is anteriorly overlain by the transversum, a sharp to somewhat rounded ventral edge, which curves downwards to have its end abutted against the quadratojugal in *Moschops* with a nick at the junction in some skulls; but in *Delphinognathus* there is a wide and deep notch preventing the ventral edges of the jugal and quadratojugal from meeting, but these bones do meet at a higher level. The squamosal is never wholly intercalated between jugal and quadratojugal as in some of the advanced Pelycosaurs and most other Therapsids.

The quadrate (Q.) in ventral view presents its articulatory surface as a very prominent feature. The quadratic condyle is bipartite, with two fairly robust ovoid cotyli separated medially by a shallow open groove. The edges of both cotyli in ventral view overhang both the anterior and posterior faces of the upper part of the quadrate. The short anterior quadratic process lies obliquely in the skull, being directed antero-internally; it is against the mesial face of this process that the quadratic process of the pterygoid is very firmly applied. Lateral to the outer cotylus there is a step up before the quadrate meets the quadratojugal in a fairly long and nearly straight suture. A third of the way up along this suture lies a fairly small *foramen quadrati*. Due to the forward inclination of the quadrate much of its posterior face can be seen in ventral view. On this otherwise featureless face there is a small low tubercle lying some distance above the inner cotylus. More medially the quadrate receives the distal surface of the stapes firmly applied to it. In ventral view it is evident how firmly the more dorsal part of the posterior face of the quadrate is overlapped by the downsweeping process of the squamosal and more internally by the robust quadratic process of the paroccipital, which is here also wedged in between the two faces of the postero-lateral stapedial process

The quadratojugal (Q.J.) is seen, in ventral view, to be a fairly small bone wedged in between the outer face of the quadrate and the lower overlapping edge of the downsweeping process of the squamosal A small *foramen quadrati* notches the mesial edge of the quadratojugal a third of the way up along the quadrate-quadratojugal suture.

The squamosal (Sq.) is seen, in ventral view, to form the postero-lateral corner of the skull, and sweeping downwards and forwards overlaps on to the posterior faces of the quadrate and quadratojugal. Internally the squamosal meets the paroccipital ventrally and the tabular dorsally. Near its junction with the paroccipital and the tabular the squamosal carries a fairly to very prominent 'auditory ridge' with an 'auditory groove' lying lateral to this ridge.

The stapes (St.) lies more or less obliquely in the skull. From its proximal end, which fits into the ventrally situated *fenestra ovalis*, it is inclined both forwardly and downwardly to abut against the quadrate. In ventral view the stapes shows two faces, viz. a ventral and a posterior. The ventral surface is elongate with a central waist and expanded ends. The proximal end is knob-like and is firmly fixed into the *fenestra ovalis* which is situated low down in the skull; the distal expansion has a long tapering postero-lateral process, the extremity of which is applied to the low tubercle on the posterior face of the quadrate; more anteriorly the main surface of the distal end abuts firmly against the quadrate and is here wedged in between the quadrate and the quadratic process of the pterygoid and the quadratic process of the paroccipital. The posterior face of the stapes, which is pierced by a fairly large oval stapedial foramen, is triangular in outline with its base applied to the quadrate after passing above the quadratic process of the paroccipital, which wedges the stapes firmly against the quadrate. The distal end of the stapes is thus seen to be firmly wedged against the quadrate with but little possibility of movement.

The tabulars (T.), interparietal (I.P.) and the supraoccipital (S.O.) are to a greater or less extent visible in ventral view because of the variable forward inclination of the occipital surface from above downwards.

These bones lie more or less posterior of the basioccipital condyle with the interparietal and the two tabulars forming the posterior edge of the skull. In ventral view the posterior edge is slightly concave in *Avenantia* but gently concave in *Moschops*.

Taxonomic

Moschopidae

Skull characters of the family

Skull of medium size (length 308–423 mm.; breadth 200–395 mm.) relatively short and broad to long and narrow (length varies from 105 to 182 per cent of the breadth); relatively low to fairly high (height varies from

55 to 80 per cent of the width); snout very short to fairly short (snout length varies from 45 to 61 per cent of the total skull length); the snout is fairly high to high and fairly narrow to broad (height of snout from 81 to 156 per cent of the width of the snout).

The orbit does not lie wholly in the posterior half of the skull except in *Delphinognathus*.

The transition from the facial to the cranial surface is by a gentle, even curve and never by an abrupt step. There is no depression in the surface of the nasal as in the Tapinocephalidae. The dorsal cranial bones are moderately to strongly pachyostosed (except in *Delphinognathus*) with the centres of thickening coalesced and running into the thickening of the dorsal facial bones.

The postorbital bar is fairly slender and light to very wide and massive; the postfrontal does not form a prominent boss but its surface curves evenly on to the dorsal surface. The temporal fossa is fairly small to small with its antero-posterior diameter fairly small to very small. The inter-temporal region is narrow to wide (54–172 mm.) with the parietals entering the upper border of the temporal fossa. The frontal is not excluded from the orbital border; the lacrimal has no contact with the nasal. The quadrate ramus of the pterygoid is very short. The dentition is well developed but undifferentiated.

Moschops

Skull characters of the genus

The preorbital length is 45–49 per cent of the total median length and the orbit does not, thus, lie wholly in the posterior half of the skull; the snout is thus short (preorbital length 160–190 mm.) and fairly broad to broad (156–227 mm.) and fairly low to fairly high (108–162 mm.) with the height 74–95? per cent of the width.

The dorsal cranial bones are strongly pachyostosed.

The prefrontal is greatly thickened and this is confluent with the pachyostosis of the nasal and frontal, but this does not greatly overhang the orbit although the orbital border is thick.

The area around the pineal foramen is greatly thickened but does not stand out above the general skull surface.

The postorbital bar is fairly to very wide and moderately to very massive.

The posttemporal arch is moderately to very thick and massive and the temporal fossa is moderate to small with its antero-posterior diameter fairly to very greatly reduced.

The dorsal parietal surface is broad to very broad (142–172 mm.) and the interorbital width is 70–100 per cent of the intertemporal width.

The intersquamosal width is moderate to great (210–395 mm.) and the median length is 103–159 per cent of the width. (The low figure for the width in one specimen is undoubtedly due to lateral compression and the average

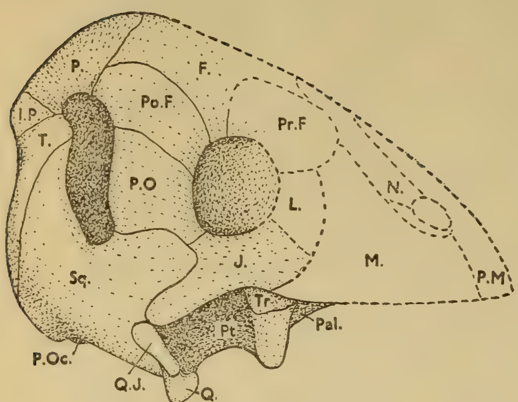

Fig. 1

Moschops capensis. Lateral view of the posterior two-thirds of a skull from Kruisvlei, Beaufort West. S.A.M. 11972. ×1/6. Note. All the figures in this paper are projections and not perspective drawings. *Lateral view* indicates an orthoprojection of the lateral surface on to the median (sagittal) plane; *dorsal view*—the dorsal surface projected on to the plane in which the alveolar borders of the maxillaries lie; *occipital view*—the occiput projected on to a plane at right angles to the above two; *ventral view*—a projection on to the plane in which the alveolar borders of the maxillaries lie.

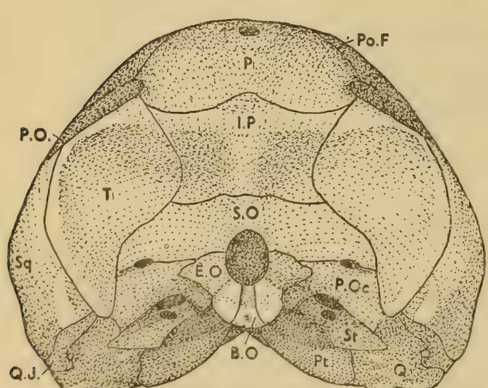

Fig. 2

Moschops capensis. Occipital view of S.A.M. 11972 ×1/6.

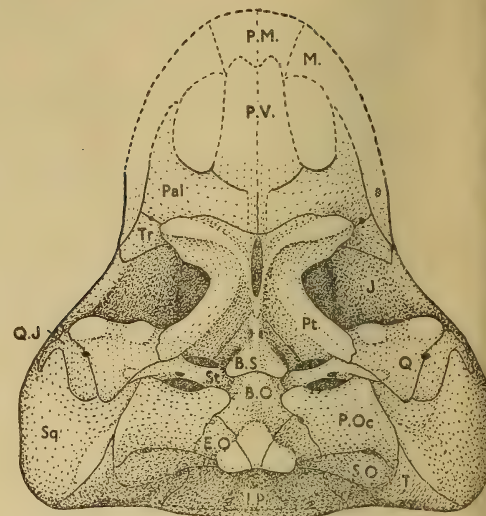

Fig. 3

Moschops capensis. Ventral view of S.A.M. 11972 ×1/6.

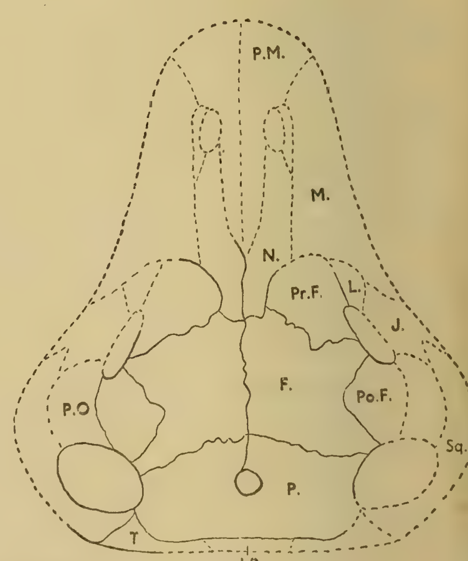

Fig. 4

Moschops capensis. Dorsal view of an imperfect skull from Groot Kruidfontein, Prince Albert. S.A.M. 5010. ×1/6.

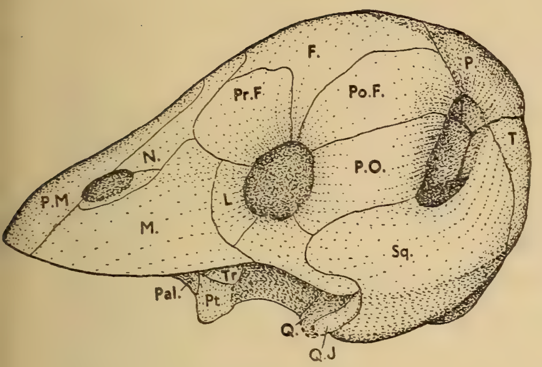

FIG. 5

Moschops koupensis nov. sp. Lateral view of a very good skull from Die Krans, Prince Albert. S.A.M. 11582. × 1/6.

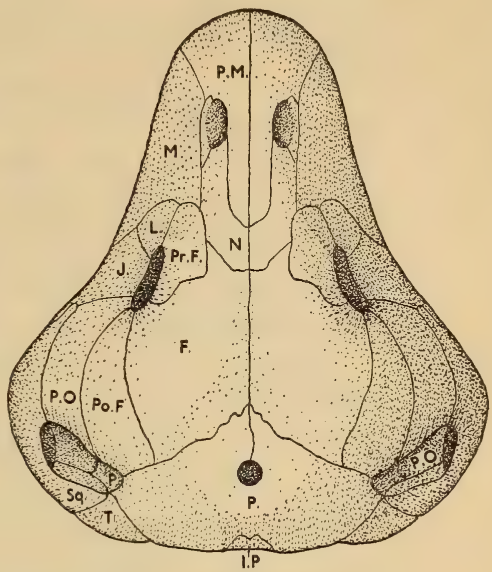

FIG. 7

Moschops koupensis nov. sp. Dorsal view of S.A.M. 11582 × 1/6 with the bilateral symmetry restored.

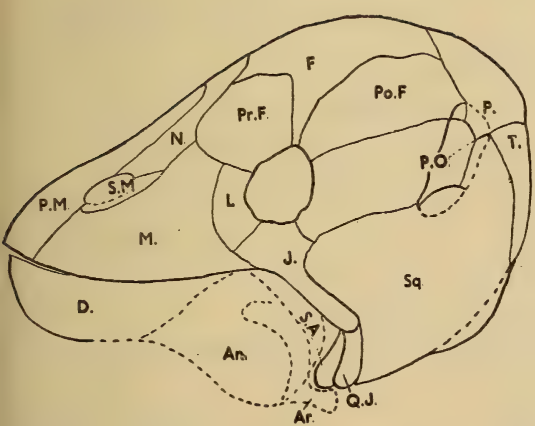

FIG. 6

Moschops koupensis nov. sp. Lateral view of S.A.M. 11582 × 1/6 with the slight dorso-ventral compression corrected.

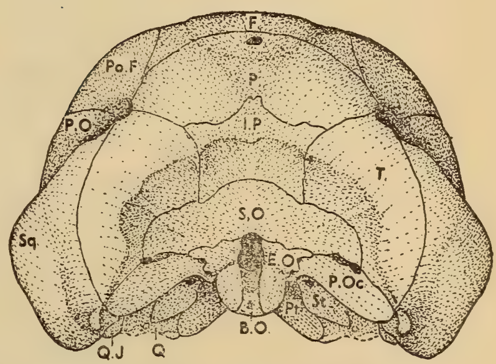

FIG. 8

Moschops koupensis nov. sp. Occipital view of S.A.M. 11582 × 1/6 with the symmetry restored, but not the effects of a slight dorso-ventral compression.

proportion appears to be about 112 per cent.) The *Moschops* skull is thus fairly short and broad.

Genotype

Moschops capensis, Broom 1911 (figs. 1–4)

Specific diagnosis:

Medium to wide across parietals, with the interorbital width 73–100 per cent of the intertemporal width. Snout relatively wide. Occipital surface unreduced and transverse pterygoidal rami weak.

Holotype A.M.N.H. 5550. Nearly complete skull with mandible which probably belongs to the same individual.

Spitskop Laingsburg Low ? *Tapinocephalus* zone Coll. Whaits.

Topotypes A.M.N.H. 5551–5557. Parts of eight skeletons.

Referred specimens:

S.A.M. 5010. Posterior two-thirds of a skull. Groot Kruidfontein, Prince Albert.
Low *Tapinocephalus* zone. Coll. Haughton.

S.A.M. 11291. A practically complete skull but distorted by dorso-ventral compression.
Kruisvlei, Beaufort West. Low *Tapinocephalus* zone. Coll. Boonstra.

S.A.M. 11295. A fairly good posterior two-thirds of a skull.
Koringplaas, Laingsburg.
Low ? *Tapinocephalus* zone. Coll. Boonstra.

S.A.M. 11970. Substantial pieces of ten separate skulls showing various parts of the cranial structure.
Kruisvlei, Beaufort West.
Low *Tapinocephalus* zone. Coll. Boonstra.

S.A.M. 11972. An excellent occiput and posterior half of a skull.
Kruisvlei, Beaufort West.
Low *Tapinocephalus* zone. Coll. Boonstra.

S.A.M. 11973. Good posterior two-thirds of a skull.
Kruisvlei, Beaufort West.
Low *Tapinocephalus* zone. Coll. Boonstra.

S.A.M. 11974. A good skull which has been subjected to a little dorso-ventral pressure.
Kruisvlei, Beaufort West.
Low *Tapinocephalus* zone. Coll. Boonstra.

Moschops koupensis sp. nov. (figs. 5–9)

Specific diagnosis:

Very wide across the parietals with the interorbital width 70 per cent of the intertemporal width. Snout relatively narrow. Occipital surface greatly reduced by overgrowth from above and from the sides. The transverse pterygoidal rami are strong.

Holotype S.A.M. 11582. A very good skull with part of the mandibles.

Die Krans, Prince Albert.

Low ? *Tapinocephalus* zone. Coll. Boonstra and Botma.

Delphinognathus

Skull characters of the genus

The preorbital length is 61 per cent of the total median length (as reconstructed); the snout is thus apparently fairly long (preorbital length 195 ? mm.) and it is narrow (125 ? mm.) and fairly high (108 mm.) with the height 86 per cent of the width. The dorsal cranial bones are not very strongly pachyostosed.

The prefrontal is not greatly thickened.

The area around the pineal foramen is greatly raised to form a conical mound standing well above the general dorsal surface.

The postorbital bar is fairly narrow and lightly built.

The posttemporal arch is apparently fairly narrow and lightly built and the temporal fossa is fairly large with its antero-posterior diameter not greatly reduced.

The dorsal parietal surface is only moderately broad (120 mm.) and the interorbital width is 96 per cent of the intertemporal width.

The intersquamosal width is apparently fairly small (200 mm. as reconstructed) and the median length is probably about 160 per cent of the width and the skull is thus relatively long and narrow.

There is a very distinctive notch between the jugal and the quadratojugal.

Genotype

Delphinognathus conocephalus, Seeley 1892 (fig. 10)

Specific diagnosis as for the genus.

Holotype S.A.M. 713. An incomplete, somewhat distorted skull.

Locality unknown, but probably from high up in the *Tapinocephalus* zone near Beaufort West. Coll. T. Bain.

Referred specimens:

S.A.M. 11971. A fair skull much distorted by lateral pressure.
Kruisvlei, Beaufort West.
Low *Tapinocephalus* zone. Coll. Boonstra.

Avenantia

Skull characters of the genus

The preorbital length (as reconstructed) is 45 per cent of the total median length and the orbit thus does not lie wholly in the posterior half of the skull; the snout (as reconstructed) is thus short (preorbital length 174 mm.) and broad (210 mm.) and fairly low (126 mm.) with the height 60 per cent of the width.

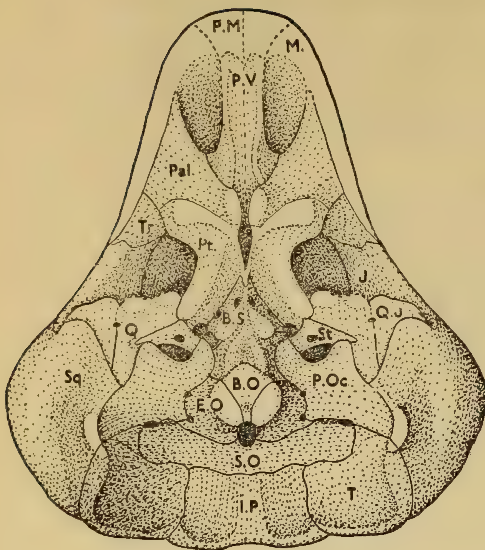

FIG. 9

Moschops koupensis nov. sp. Ventral view of S.A.M. 11582 × 1/6, with symmetry restored, but the slight forward shift of the suspensorium due to some dorso-ventral pressure is not corrected.

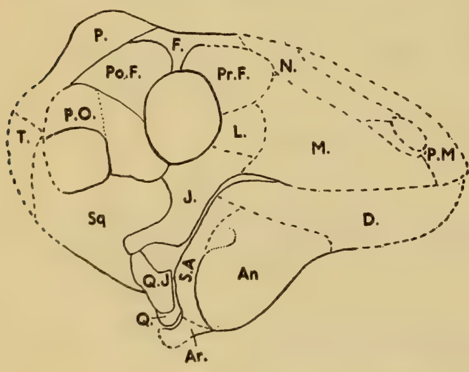

FIG. 10

Delphinognathus conocephalus. Lateral view of the type skull S.A.M. 713 × 1/6, clearly showing the notch between the jugal and the quadratojugal.

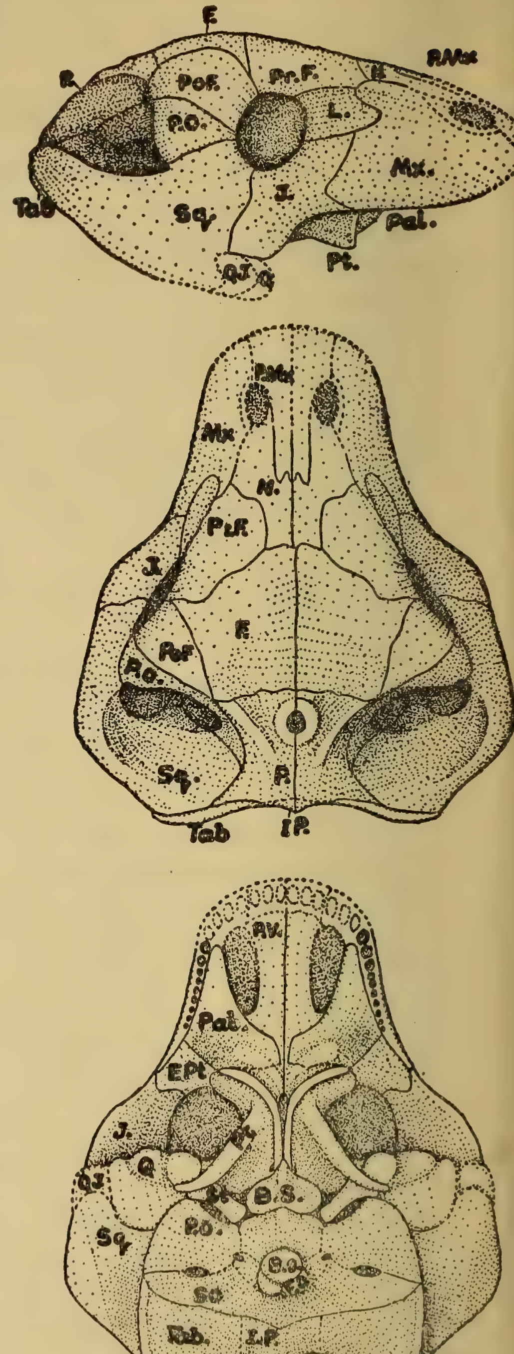

FIG. 11 →

Avenantia kruisvleiensis. The type skull S.A.M. 9166 × 1/6: Top-lateral view; middle-dorsal view; bottom-ventral view. The symmetry has been restored but more allowance should have been made for the effects of the dorso-ventral pressure that the skull has undergone. This applies mainly to the too forward position of the suspensorium.

The dorsal cranial bones are strongly pachyostosed (but moderate in the intertemporal region and along the median line).

The prefrontal is greatly thickened and this is confluent with the pachyostosis of the nasal and frontal, but this does not greatly overhang the orbit although the orbital border is fairly thick.

A well-defined ringwall is developed round the pineal foramen, but this does not rise well above the general dorsal surface.

The postorbital bar is moderately wide and massive.

The posttemporal arch has its upper edge narrow and lightly built and the temporal fossa is fairly large with a large antero-posterior diameter.

The dorsal parietal surface is narrow (54 mm.) with the development of a low crista curving down posteriorly, and the interorbital width is 333 per cent of the intertemporal width.

The intersquamosal width is great (348 mm.) and the median length (as reconstructed) 112 per cent of the width and the skull is thus short and broad.

Genotype

Avenantia kruisvleiensis, Boonstra 1952 (fig. 11)

Specific characters as for the genus.

Holotype S.A.M. 9166. A good skull lacking only the tip of the snout and the lower jaw.

Kruisvlei, Beaufort West.

Low *Tapinocephalus* zone. Coll. Boonstra.

Moschognathus

Skull characters of the genus

Only fragments of the skull and a good mandible are known, but much of the postcranial skeleton is preserved. No skull characterization can thus be given here.

Moschognathus whaitsi, Broom 1914

Holotype A.M.N.H. 5602. Good mandibles with which are associated part of the skull and much of the skeleton.

Beaufort West district.

High ? *Tapinocephalus* zone. Coll. Whaits.

Pnigalion

Skull characters of the genus

The dorsal cranial bones are not very strongly pachyostosed. The area around the pineal foramen is thickened to form a low mound standing above the general dorsal surface. The postorbital bar is not wide and is fairly lightly built. The posttemporal arch is moderately wide and massive and the temporal fossa is fairly large with its antero-posterior diameter not much reduced. The dorsal parietal surface is only moderately broad (120 mm.). The intersquamosal width is fairly great (375 mm.). The quadratojugal as identified by Watson (1914) shows a large squarish outer face. There is a distinctive step at the junction of the squamosal and tabular.

Genotype

Pnigalion oweni, Watson 1914

Holotype B.M.(N.H.) R3596. A good posterior two-thirds of the skull and dentaries.

De Cypher, Beaufort West.

Low *Tapinocephalus* zone. Coll. Seeley.

Moschoides

Skull characters of the genus

As only part of the lower jaw is known no skull characterization can be given.

Genotype

Moschoides romeri, Byrne, 1937

Holotype. Walker Museum, Chicago. A fairly good skeleton.

Hottentotsrivier, Beaufort West.

Low ? *Tapinocephalus* zone. Coll. Romer and Miller.

Discussion

As the cranial material of *Moschognathus*, *Pnigalion* and *Moschoides* is so inadequate and as, moreover, they could very well at this stage be considered co-generic with *Moschops*, only three Moschopid genera, viz. *Delphinognathus*, *Moschops* and *Avenantia*, need be discussed here.

In the genus *Moschops* the more heavily built or more pachyostotic skulls may be considered to represent either (*a*) males or (*b*) mature and old individuals male or female, and the more lightly built or less pachyostotic skulls to be of either (*a*) females or (*b*) juveniles of either sex.

Now, in the Deinocephalia generally it is clear that in the more primitive forms (*Moschosaurus*, *Agnosaurus*, *Delphinognathus*) there is little pachyostosis and in the more advanced forms the pachyostosis becomes more and more developed. The pachyostosis is thus a phyletic feature. But within certain species there is also sufficient evidence that the pachyostosis is also a function of age in the individual. There is, however, little real evidence that the pachyostosis is sexually determined.

Thus, the degree of pachyostosis in those skulls referred to the genus *Moschops* should be considered to be dependent on age only.

In the known two skulls of *Delphinognathus* the pachyostosis is moderate, being chiefly confined to the conical mound around the pineal foramen and a little thickening of the supra- and postorbital borders. There is practically no thickening, or very little, in the posttemporal, postorbital and infratemporal and infraorbital arcades.

Now, in no lightly built *Moschops* skull do we find this localization of the pachyostosis, these skulls being only slightly larger than that of *Delphinognathus*. If the lightly built *Moschops* skulls are correctly considered to be those of young animals then *Delphinognathus* cannot be considered a juvenile of *Moschops* and is thus rightly considered to be a distinct genus.

In *Avenantia* the pachyostosis is well developed in the postorbital bar, the dorsal and dorso-anterior orbital rim and the roof bones up to the fronto-parietal suture. But in the parietal region the pachyostosis is little developed, the posttemporal arch remains lightly built and the temporal fossa remains roomy. No process of simple ageing can possibly be thought capable of transforming the *Avenantia* skull into a *Moschops* skull.

Efremov (1940) has maintained that the *Moschops* skull is a growth stage of *Mormosaurus* with *Tapinocephalus* as the final product. He does not mention the Struthiocephalids and one wonders where he would fit them in this process of ageing.

In all the known heavy *Moschops* skulls the sutures are closed which allows one to conclude that they are mature. But in some *Tapinocephalus* skulls the sutures are still open and these skulls are of the same size as one in which the sutures are closed. The large skulls with open sutures may thus be considered immature. They and *Moschops* cannot thus both be considered immature *Tapinocephalus*.

Moreover, in *Tapinocephalus* the dorsal and lateral borders of the occiput slightly overgrow and encroach on to the *planum occipitale* reducing its size. Now, in most heavy *Moschops* skulls there is no or very little overgrowth and encroachment, but in the skull of *M. koupensis*, which is somewhat smaller than the heavy *M. capensis* skulls, this overgrowth and encroachment is very much greater than in the very much larger skull of *Tapinocephalus*. Obviously the skull of *M. koupensis* cannot possibly be a young *Tapinocephalus*. In any case, *Mormosaurus*, with its longer snout, cannot be intermediate between *Moschops* and *Tapinocephalus* in both of which the snout is short. Similarly the long-snouted *Keratocephalus* and Struthiocephalids (except *Struthionops*) cannot be intermediate between *Moschops* and *Tapinocephalus*.

In our present stage of knowledge the Moschopids, Struthiocephalids and Tapinocephalids must be considered as distinct directions in the evolution of the Tapinocephalia.

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SOME NEW CADDIS FLIES (TRICHOPTERA) FROM THE WESTERN CAPE PROVINCE – II

By

K. M. F. Scott, Ph.D., F.R.E.S.

Department of Zoology, University of Cape Town

(With 4 figures in the text)

Introduction

This is the second paper in the present series, in which new species of caddis flies from the Western Cape (mainly from the Great Berg River) are being described. The imagos of some new Leptoceridae are described in this paper; their immature stages will be described in Part III of the series.

Methods and other introductory matter have been given in Part I (Scott, 1955). All drawings for text-figures 2–4 were made to the same scale with the aid of *camera lucida* attachments (in the case of wings a binocular stereoscopic microscope was used at a magnification of 12·5 diameters; in the case of genitalia specimens cleared in a mixture of parachlorophenol and chloral hydrate were drawn at a magnification of 80 diameters, using a research microscope). For text-figure 1 the wings were drawn to a smaller scale as the species is larger. The wing notation and the terminology used in the description of genitalia are those employed by Mosely and Kimmins (1953). Holotypes will be lodged in the South African Museum; paratypes will be sent to the British Museum (Natural History).

Detailed descriptions of the habitats of the larvae of the new species will be found in Harrison and Elsworth (in press, 1958) and Harrison (in press, 1958).

Grateful thanks are again due to the Council for Scientific and Industrial Research for financial assistance in the form of a Senior Bursary, which has made this work possible. The author would also like to express her gratitude to Dr. Kimmins of the British Museum (Natural History) for helpful comments, as well as to Mr. A. D. Harrison of the Council for Scientific and Industrial Research, Dr. K. H. Barnard of the South African Museum, and Professor J. H. Day of this Department.

Description

Genus Athripsodes Billberg

Billberg, 1820, *Enum. Ins. Mus. Billberg*: 94.
Milne, 1934, *Stud. N. Amer. Trich.*, 1: 18.

Ross, 1938, *Ill. Nat. Hist. Surv. Bull.*, 21: 155–7
Kimmins, 1949, *Entomologist*, LXXXII, No. 1036: 201–4

= *Leptocerus* auctt. nec Leach

Athripsodes prionii sp. n.

Fig. 1, A–K

A brownish species with wide hind-wings and distinctive rather complex male genitalia bearing numerous short orange-coloured spines; inferior appendages trilobed. The larvae are swimmers; older larvae live in cases made from dead palmiet leaves (*Prionium serratum* (L.f.) Drège), whence the trivial name is derived.

Imago (in alcohol). *Head*: light chestnut brown with mingled brown and yellow setae; antennae annulate brown and yellowish; eyes black. *Maxillary and labial palps* fuscous, covered with yellowish pubescence. *Thorax*: chestnut-brown, mesonotum with short recumbent yellowish setae covering the mid-dorsal area, flanked on each side by a double line of long erect setae; sternites light chestnut; membranous parts pale yellow. *Legs*: tibial spurs 2, 2, 2; the anterior pair short, the second and third pairs long; inner spur of second and third pairs considerably longer than outer. Femora and tibiae yellow-brown; tarsi, particularly of forelegs, somewhat darker. *Abdomen* pale yellow, tergites brownish.

Wings: ♂ 9·0–9·5 mm.; ♀ 8·5 mm. (fig. 1 A–C). ♂ fore-wing: membrane brownish, darker and thickened along R and Sc, particularly in the region of the pterostigma; a slight fold between R and Sc. Pubescence brownish with a slightly brindled appearance due to an admixture of grey hairs; a brown patch over the wing-spot; a short dark fringe along the posterior border; forks 1 and 5 present (1, 3 and 5 in ♀); stalk of fork 1 about half length of R_2. ♂ hind-wing: fawn, thinly pubescent, a slight fold just above Cu_1; broadest at base, much broader than fore-wing; folded under along 2A; fringe short except along turned-in portion where it is very long and silky, there are also long hairs springing from 3A and from the wing between 3A and the margin; Sc is thickened and there is a thickened patch at the base of the wing; forks 1 and 5 present, stalk of fork 1 approximately twice length of R_2; a false vein present between 1A and 2A. ♀ as ♂, excepting that in fore-wing stalk of fork 1 is sub-equal to R_2 and fork 3 is present; the hind-wing though broad is not as broad as in the ♂.

Genitalia: ♂ (fig. 1 D–G). The ninth segment is narrow dorsally, broad ventrally, the lateral margins forming short side-pieces; the apical margin is produced to form a pair of long preanal (superior) appendages, fringed ventrally

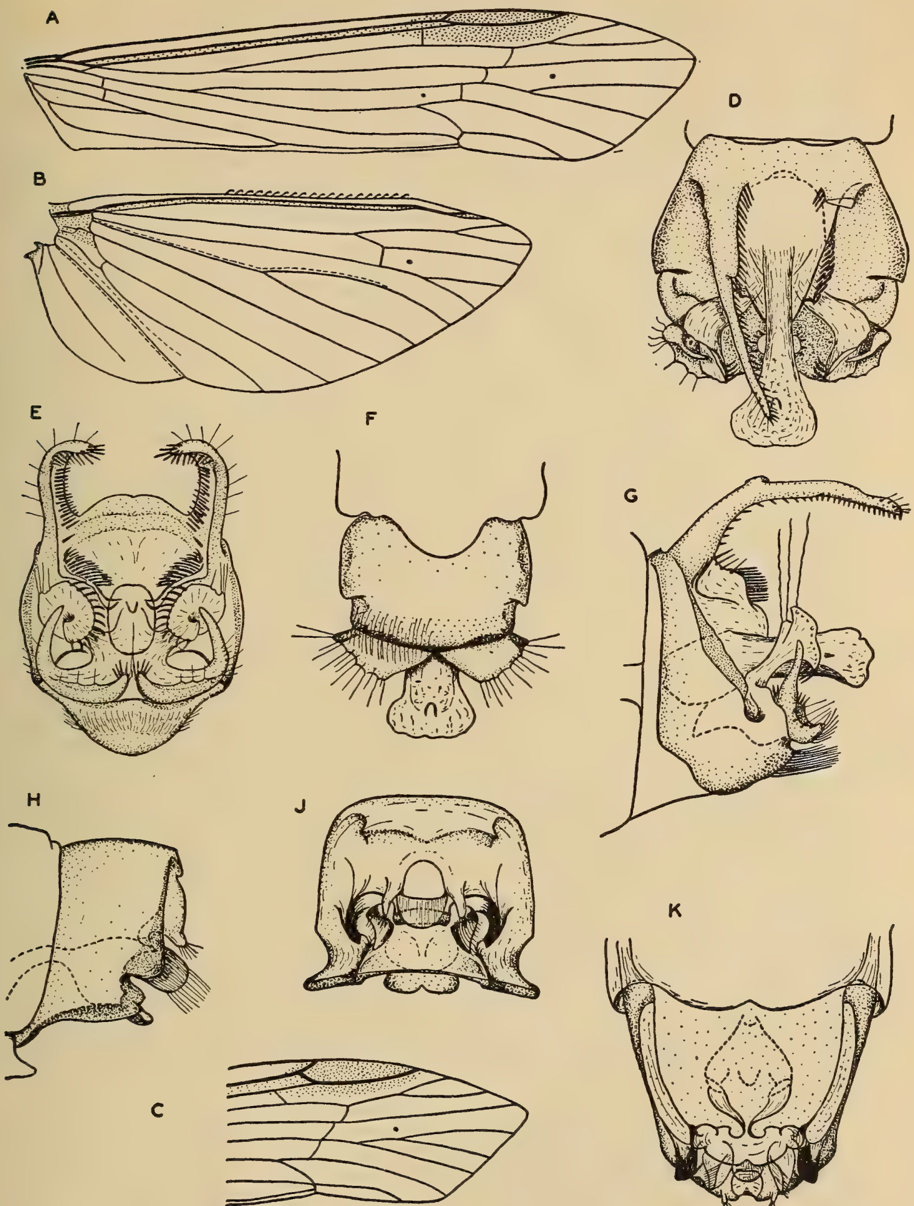

FIG. 1. *Athripsodes prionii* sp. n.

A, B, fore- and hind-wings of ♂. C, tip of fore-wing of ♀. D, E, F, G, dorsal, posterior, ventral and lateral views of ♂ genitalia (in D the right dorsal process is omitted and in E the tip of the penis). H, J, K, lateral, posterior and ventral views of ♀ genitalia.

with stout orange-coloured spines and narrowing abruptly almost midway. Between these appendages the tenth segment forms an oval membranous dorsal plate, produced downwards laterally as a thin flange on each side of the penis; each flange bears a brush of strong orange spines. The penis is stout, unarmed, with an expanded membranous tip, and appears to have thin chitinous lower penis-covers closely adhering to its ventral side. The paired claspers (inferior appendages) are trilobed. The lower lobe arises near the mid-ventral line below the penis, and is somewhat bowl-shaped, with an irregular, setose margin; it curls inwards to end in a tuft of orange spines beneath the penis, and outwards where it is produced upwards to form the second, lateral, lobe, a narrow sinuous finger-like projection. The third branch arises from the base of the first, as a tube which opens out apically into a flattened trumpet-like expansion; this curls inward, and its inner margin is armed with 10–12 stout claw-like orange spines; near the apex of the trumpet is a small projection bearing several very long colourless setae, and there are a few similar setae on the upper corner of the main lobe. The shape of the claspers is somewhat reminiscent of some *Triaenodes* species, but the wing neuration is that of *Athripsodes*. The ninth segment from beneath has a U-shaped excision along its anterior margin, paired lateral projections, and a dense band of hairs along the posterior edge.

Genitalia: ♀ (fig. 1 H, J, K). Sternite of eighth segment modified to form a flat sub-genital plate with lateral margins expanded as chitinous flaps (these form an angle of about 45° with the ventral surface of the body and are foreshortened in ventral view); through this plate the vagina can be seen in a cleared specimen. Sternite of eighth segment separated from ninth by a bilobed transverse flap of thin chitin which is connected to the lateral flaps of the eighth by a spoon-shaped chitinized lobe on each side. The ninth sternite consists of an oval flattened area flanked by a pair of trilobed setose cerci; lateral to these the margins form thickened chitinous flaps (in posterior view these are seen to curl round the cerci); between the ninth and tenth sternites is a transverse chitinous bar, and posterior to the bar a small semicircular flap. Ninth tergite normal, slightly extended and curled over posteriorly. Tenth segment small; appears to have a central opening surrounded by a thickened margin and flanked by a pair of small cerci tipped with a few hairs; this opening appears to connect dorsally with the vaginal opening in the single ♀ available.

The species is easily separable from other African species of *Athripsodes* by the very characteristic male genitalia, particularly the strong armature of orange-coloured spines and the trumpet-shaped lobe of the claspers.

Locality: Palmiet River, Elgin (A.D.H.), November 1952, 2 ♂♂, 1 ♀, bred out from larvae in the laboratory. Larvae were collected from Elgin in October and November, and from the Great Berg River at Assegaibos, Driefontein, Groot Drakenstein and Bridgetown (April to October).

Athripsodes bergensis sp. n.

Fig. 2 A–K

A small greyish insect with strongly striped front legs and annulate antennae; the larvae are black-headed crawlers living in long slender cases made from coarse sand grains, to which sticks or bits of charcoal are often attached. The trivial name is taken from the Great Berg River, in Zone IIIA of which the larvae abound.

Imago (description from dry, freshly killed insects, made before preservation in alcohol). Sexes similar, but ♀ slightly smaller than ♂. *Head*: blackish, with strong white or greyish hairs; antennae with basal part annulate cream and black, distal part grey; eyes black. *Maxillary and labial palps* black with grey pubescence. *Thorax*: black, pruinose, mesonotum with short, recumbent white setae on mid-dorsal area, flanked on each side by erect black setae; sternites blackish, pruinose. *Legs*: tibial spurs 2, 2, 2, sizes as in *A. prionii*; anterior pair of legs: femora and tibiae black, with black setae on inner side and white setae on the outer, tarsi annulate black and white, spurs whitish; middle pair of legs: similar but duller, femora browner, spurs pale fawn with white pubescence; hind legs yellowish, with slightly darker annulations on tarsal joints, pubescence whitish. The legs of different specimens vary somewhat in intensity of colouration. *Abdomen* green.

(Specimens in alcohol: general appearance brownish; thorax sepia; wings mottled brown and grey; legs yellowish, markings dull and hardly visible; antennae still conspicuously annulate.)

Wings: ♂ 5·5–6·5 mm. (Elgin specimen 7·5 mm.); ♀ 5·5–5·6 mm. (fig. 2 A–C). Fore-wing ♂: brindled dark grey and white; membrane brownish, darker and thickened along Sc and R and at the pterostigma, with clear streaks along M and Cu_2 and 1A, and sometimes a few clear spots as well; forks 1 and 5 present (1, 3 and 5 in ♀); stalk of fork 1 approximately two-thirds of length of R_2. Hind-wing ♂: membrane dusky, with sparse brownish pubescence, broadest in middle, broader than fore-wing, a small portion folded under along 2A; fringe long and silky, particularly along lower margin of wing and along turned-in portion; Sc thickened and a thickened patch at base of wing. Forks 1 and 5 present, fork 1 small, stalk five to six times length of R_2. (In ♀ R_2 is very short and stalk is about six times length of R_3.)

Genitalia: ♂ (fig. 2 D–G). Ninth segment much narrower dorsally than ventrally; side-pieces slightly produced and with heavily chitinized posterior margins; ventral plate ends posteriorly in a short triangular point. The whole ninth segment is covered with microtrichia, which are slightly longer on the ventral process than elsewhere. Dorsal plate of tenth segment wide, bilobed, setose; from it a broad median dorsal process projects backwards; this process is irregularly sub-triangular as seen from above and is somewhat folded proxi-

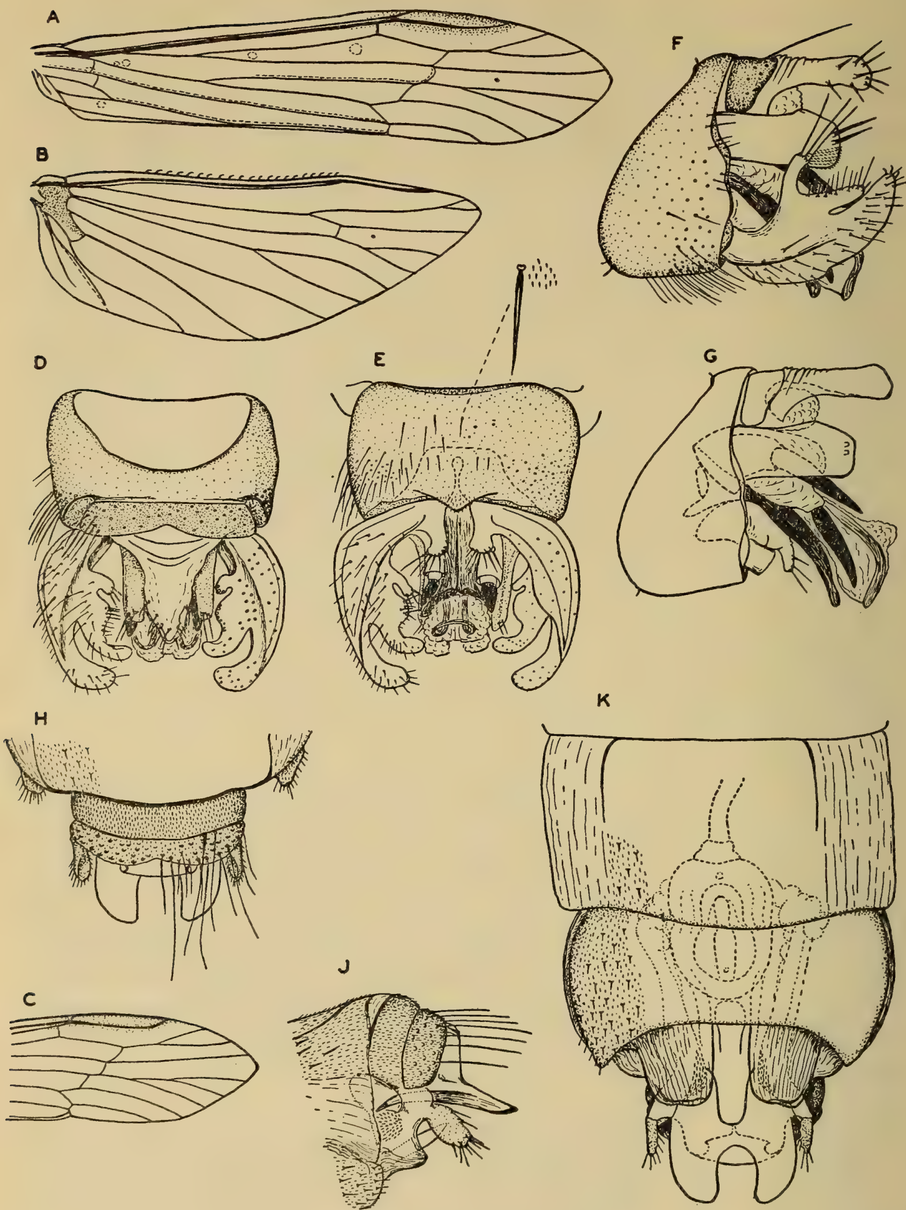

FIG. 2. *Athripsodes bergensis* sp. n.

A, B, fore- and hind-wings of ♂. C, tip of fore-wing of ♀. D, E, F, dorsal, ventral and lateral views of ♂ genitalia (seta and microtrichia further enlarged to show relative sizes). G, lateral view of ♂ genitalia with clasper removed. H, J, K, dorsal, lateral and ventral views of ♀ genitalia.

mally, the distal end bears a few stout bristles. The dorsal process is hollowed out ventrally and beneath it lies a complex set of processes which seem from their basal attachments to represent upper penis-covers; these include a pair of stout lateral processes each of which bears a pair of strong bristles and a ventro-lateral patch of fine pubescence; also two membranous lobes apparently lying one above the other, the lower one just above the penis, the upper one partly within the hollow of the dorsal process. On each side of these, mesial to the lateral processes, is a stout socketed spine. The penis is stout and membranous, with a chitinized sclerite strengthening the tip; on each side of it is another socketed spine, and below it, closely applied to it, a pair of chitinized lower penis-covers. Each of the four socketed spinous processes appears to consist of a bundle of fused setae. The claspers are trilobed as seen in lateral view, with a stout keeled base covered with microtrichia. The anterior branch is slender, with a truncate tip bearing three long setae; the middle branch as seen in dorsal view consists of two rounded inwardly projecting setose lobes; the posterior branch is the stoutest and also curls inwards. In ventral view it is seen that the claspers each have an additional basal process just beneath the penis.

Genitalia: ♀ (fig. 2 H, J, K). Seventh segment normal; eighth segment normal, but with the posterior corners of the sternite slightly produced; in a cleared specimen the vaginal structure is visible through these two segments. Ninth segment with finely pubescent tergite; sternite subdivided into three: a pair of finely folded lateral lobes, and a narrow tongue-like central plate. Tenth segment with a bilobed setose dorsal plate very like that of the ♂, posterior to this the tergite narrows and curls downwards; it is joined by vertical side-pieces to a flat rounded sternite with a large U-shaped apical excision. There is also a pair of small leaf-like cerci; each of these arises from a bridge-like side-piece (probably belonging to the ninth segment) anterior to which there is a patch of small fine chitinous points.

This species is easily separated from other African species so far described by the genitalia, both ♂ and ♀.

Locality: Imagos: Great Berg River near Driefontein (A.D.H., 1 ♂, 2 ♀♀, bred out from larvae, March 1953; K.M.F.S., 7 ♂♂, 6 ♀♀, bred out from larvae and pupae, October–December, 1956); Palmiet River, Elgin (A.D.H., 1 ♂, bred out from larva, November 1952). Larvae: collected from the Great Berg River near Driefontein and Groot Drakenstein from March to October.

Athripsodes tuckeri Barnard ? var.

Fig. 3 A–J

This may be a distinct species, or only a variety of *Athripsodes tuckeri* Barnard (1934). It is a small species with male genitalia close to those of

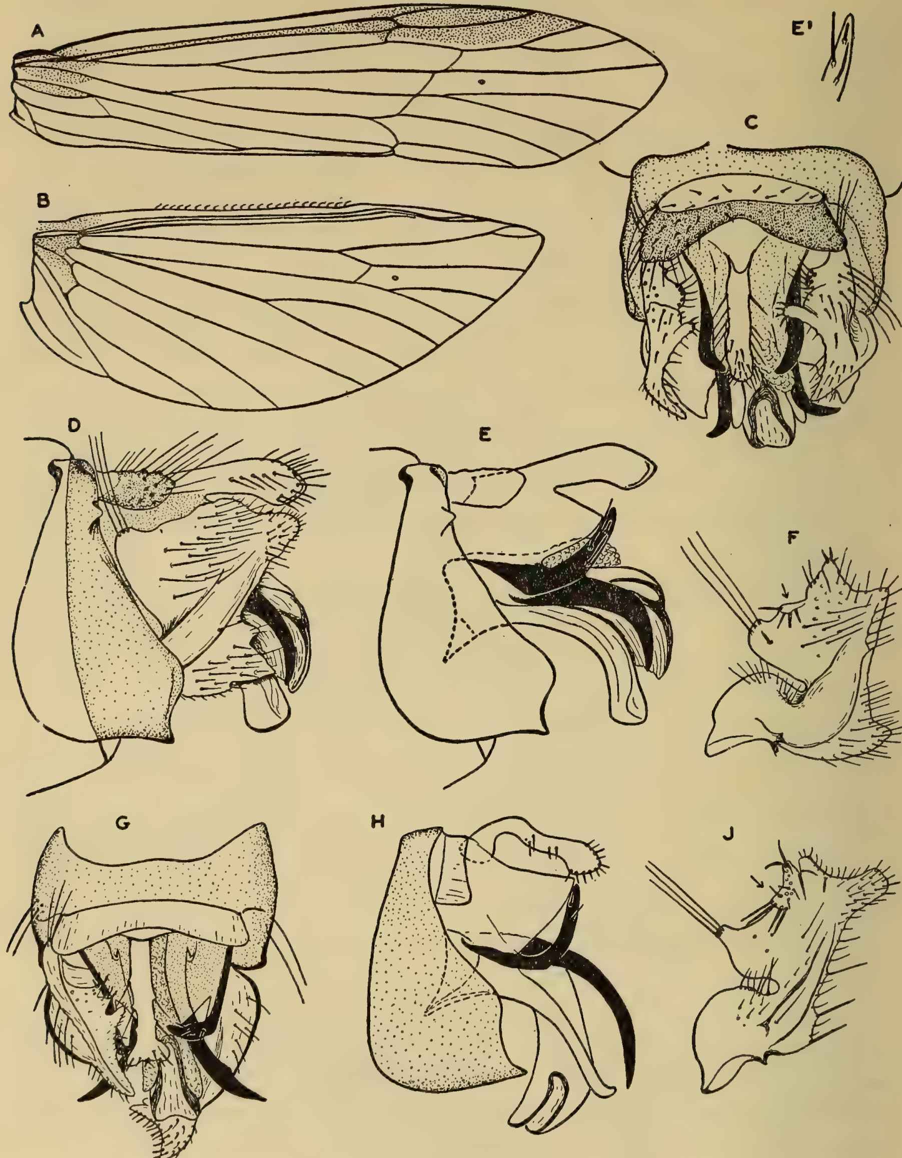

FIG. 3. *Athripsodes tuckeri* Barnard ? var. and *A. tuckeri* Barnard

A, B, fore- and hind-wings of ♂, *A. tuckeri* ? var. C, D, dorsal and lateral views of ♂ genitalia, *A. tuckeri* ? var. E, lateral view of ♂ genitalia, *A. tuckeri* ? var. (clasper removed to show penis). E_1, tip of spinous process to show spinules. F, left clasper of ♂ from another specimen of *A. tuckeri* ? var., to show variation in shape (projection marked by arrow seen by transparency). G, H, J, dorsal and lateral views of ♂ genitalia of *A. tuckeri*, and clasper of another specimen (from Jonkershoek); in G right clasper is out of place and only the lower part has been shown; in H the clasper has been removed; in J the projection marked by the arrow is seen by transparency.

A. tuckeri, the most conspicuous differences being seen in the shape of the dorsal plate and dorsal process of the tenth segment.

♂ *imago* (in alcohol). *Head*: face yellowish, vertex light brown; antennae annulate brown and yellow basally, distal portion dusky; eyes black. *Palps* fuscous. *Thorax*: pronotum yellowish, mesonotum chestnut, with setae arranged as in *A. prionii*, scutellum outlined in darker brown, metanotum paler brown, sternites brownish-yellow. *Legs*: tibial spurs 2, 2, 2; legs yellowish-brown, tarsi of fore-legs darkened distally, particularly along the anterior side. *Abdomen* pale yellow.

Wings: ♂ 6·5–7·5 mm. (fig. 3 A, B). ♂ fore-wing chequered brown and gold, giving a golden-brown appearance; there is a whitish spot at the arculus and a dark streak along the margin from the arculus to the apex of the wing. Fringe short. Membrane brownish, darkened and slightly folded along R and Sc, and thickened at the pterostigma. Forks 1 and 5 present; stalk of fork 1 subequal to R_2. Hind-wing sparsely pubescent, brownish, broadest in middle, broader than fore-wing, folded under along 2A. Fringe short except along folded-in portion. Sc thickened and a thickened area at base of wing; forks 1 and 5 present, fork 1 small, stalk five to six times length of R_2.

Genitalia: ♂ (fig. 3 C–F). Ninth segment narrow dorsally, broad ventrally; side-pieces somewhat produced, each with a small projection near the dorsal side; sternite ending in a small rounded point. Tenth segment with a bilobed transverse dorsal plate, posterior to which is a stout median dorsal process armed with colourless bristles; in dorsal view the process is slightly sinuous with a rounded (not expanded) tip, in lateral view it is a blunt hatchet shape. Below the dorsal process, and attached to it for the proximal half of its length, are paired upper penis-covers which extend downwards lateral to the penis, each ending ventrally in a strong curved spinous process with two or three spinules near its tip. Under the upper penis-covers is a median membranous hood. The penis is stout, the membranous part folded and the tip strengthened with a spur-shaped chitinous bar; on each side of it there is a stout down-curved spine or titillator, and below it are paired lower penis-covers. The claspers are strong, leaf-shaped, with a stout supporting flange; dorsal margin formed of five small setose lobes, of which the central three usually project inwards and are not visible in lateral view; one or more triangular lobes at the postero-ventral corner.

Remarks. The main differences between this variety and *Athripsodes tuckeri* Barnard lie in the shape of the transverse dorsal plate and of the median dorsal process (cf. fig. 3 C, D and E with G and H); note also the extent of attachment of the dorsal process to the upper penis-covers and the thickness of the spinous processes. These differences were constant in the three males available, and appear to be sufficiently marked to warrant a full description being given, in case this should prove to be a new species when more material is available. The figures of *A. tuckeri* given for comparison were drawn from type material kindly loaned by the South African Museum (fig. 3 G–J). The claspers also show differences, but these are less marked as different specimens show a considerable amount of variation; on the whole however those of the variety seem to be consistently wider and stronger than those of *A. tuckeri*. The number of spinules on the spinous processes varies, in both, from one to three. Wings are similar, though in the hind-wing of *A. tuckeri* fork 1 may be minute or absent.

Should this eventually prove only to be a variety, the figures given will serve as an indication of the range of variation within the species.

Locality: Great Berg River, Driefontein (A.D.H. and K.M.F.S., December 1952 and January 1955, in each case one ♂, bred out in the laboratory from material collected from backwaters). Also one ♂ imago caught flying at dusk at Groot Drakenstein, lower down on the Great Berg River (A.D.H., November 1953).

Genus Leptecho Barnard

Barnard, 1934, *Trans. Roy. Soc. S. Afr.*, XXI: 349
Barnard, 1940, *Ann. S. Afr. Mus.*, XXXII: 647.
Kimmins, 1956, *Trans. R. ent. Soc. Lond.*, 108: 117–46

The new species described below falls into the genus *Leptecho* Barnard according to the key given by Dr. Kimmins (1956). The only difference from *Athripsodes* appears to be the absence of fork 3 in the ♀ fore-wing, the wing neuration being similar in both ♀ and ♂, and it seems very probable, as Dr. Kimmins suggests, that *Leptecho* will eventually have to be sunk in *Athripsodes*. In the meantime, however, the species described here joins Barnard's two species, *L. scirpi* and *L. lupi*, in the genus *Leptecho*.

Leptecho helicotheca sp. n.

Fig. 4 A–N

A fairly small, slender, grey caddis fly with annulate antennae. The ♂ is larger than the ♀ and has considerably longer antennae, but the sexes are similar in colouring. The larvae are crawlers with bright brown heads, living in neat snail-shaped cases made of sand grains. The larvae resemble *Athripsodes* larvae, but the cases are remarkably similar to the larval cases made by species of *Helicopsyche*; the pupal cases however are straight, not coiled.

Imago (description made from dry, freshly killed insects, before preservation in alcohol). *Head*: face brownish; vertex and back of head leaden in colour (actually dark brown to black but heavily pruinose), setae mingled white and grey; eyes brown to black; antennae very long (about one and a half times body length in ♀♀, more than twice body length in ♂♂), proximally annulate black and white, distally grey. Palps leaden with silvery pubescence. *Thorax*: tergites leaden, with silvery-white hairs; pleura and sternites brownish, pruinose, with sparse silvery hairs. *Legs*: yellowish with silvery pubescence except as indicated: fore-legs: lower part of anterior side of femora and anterior side of tibiae, grey, tarsi black and white annulate; mid-legs: anterior side of tibiae and tarsi greyish, tarsi with faint annulations; hind legs: posterior side of tibiae and tarsi greyish. (Leg colouring varies somewhat in intensity in different specimens.) Spurs on tibiae as in *Athripsodes*: 2, 2, 2, and of similar proportions. *Abdomen* dark green, pruinose, genitalia yellowish.

Wings: ♂ 7·5–8·0 mm.; ♀ 5·5–6·0 mm. (fig. 4 A, B). ♂ fore-wing: membrane yellowish-brown, iridescent, densely covered with brownish-grey and silvery hairs (in most specimens the proximal half of the wing is browner and the distal half more silvery, in one ♂ however the dorsal half was more silvery and the ventral half browner); a silvery spot at the arculus; fringe short, brindled. Forks 1 and 5 only present in both ♂ and ♀; Sc, R and the pterostigma slightly thickened; stem of fork 1 sub-equal to R_2. ♂ hind-wing: membrane pale fawn with sparse silvery pubescence; fork 5 only present in both ♂ and ♀; hind-wing broader than in ♀, in both sexes the wing is turned under along 3A and this portion bears a very long silky fringe.

(Specimens in alcohol: general appearance light golden-brown with chestnut head and thorax; antennae annulate yellow and brown; wings brownish-grey brindle; legs yellowish.)

Genitalia: ♂ (fig. 4 C–J). Ninth segment somewhat narrower dorsally than ventrally, bearing long setae, specially on the sternite; side-pieces with strongly chitinized posterior margins. The tenth segment comprises a membranous dorsal plate terminating in a small, oblong, median process tipped with three long setae, and, lateral to the dorsal plate, a pair of large, finely pubescent lobes studded with sword-like stalked setae. The median projection overlies a membranous hood, lateral to which are paired upper penis-covers each bearing several stout setae and with an obliquely truncate apex. The penis itself is short, with an expanded bifid tip and a horseshoe-shaped chitinous support; beneath it there are short lower penis-covers with rounded downcurved ends. The claspers are short and strong, trilobed in lateral view, with a slight ventro-lateral keel. In dorsal or ventral view it is seen that the lower lobes of the claspers are incurved, setose, with sinuous inner edges and with a small inwardly projecting tooth near the tip. The setose median lobes project inwards; the upper lobes are truncate and tipped with two or three long setae.

Genitalia: ♀ (fig. 4 K–N). Eighth segment slightly flattened ventrally; vagina visible through this in cleared specimens. Ninth segment with a rounded setose dorsal plate; sternite slightly hollowed forming a sub-genital plate with curved lateral margins and a flat, bifid, backwardly projecting central plate.

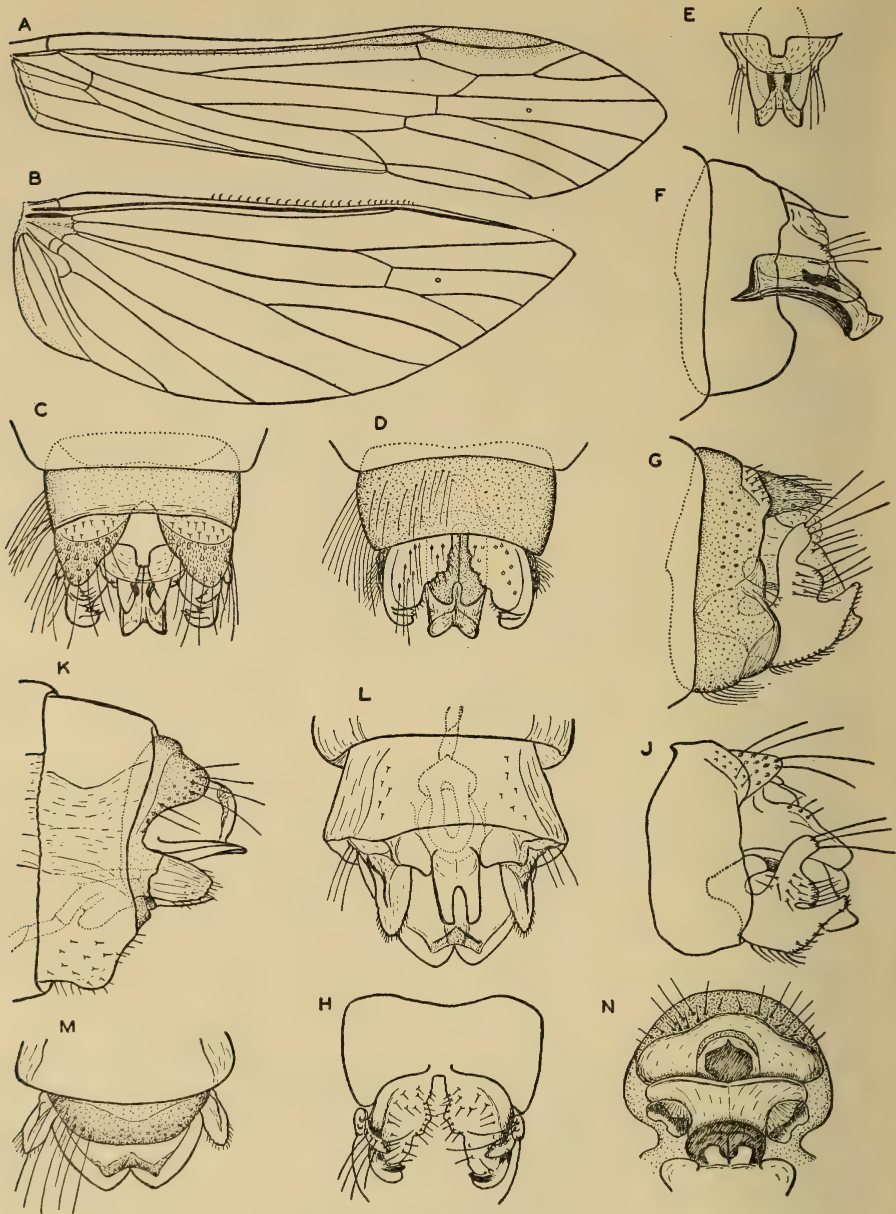

FIG. 4. *Leptecho helicotheca* sp. n.

A, B, fore- and hind-wings of ♂. C, D, dorsal and ventral views of ♂ genitalia. E, detail of upper penis-covers etc., dorsal view. F, G, lateral views of ♂ genitalia (F with clasper removed). H, dorsal view of claspers. J, lateral view of ♂ genitalia (another specimen to show variation in shape of clasper and detail of upper penis-cover). K, L, M, N, lateral, ventral, dorsal and posterior views of ♀ genitalia (in L the chitinous bar of the hood is seen by transparency).

Tenth segment hood-like, with a posterior opening strengthened by a chitinous bar which appears semicircular from behind but W-shaped in dorsal view. This hood is joined laterally to a flat, bilobed transverse plate which is larger than the hood but transparent and therefore difficult to see. The tenth segment bears two large, slightly hairy cerci, which, together with the flat transverse plate and the small bifid process, surround the genital opening.

Remarks. This species can easily be distinguished from *Leptecho scirpi* and *L. lupi* by the structure of the male genitalia, in particular by the absence of titillators, the shape of the claspers and the dorsal plate, and the existence of a median dorsal process.

Locality: Great Berg River near Driefontein (2 ♂♂ March 1951, A.D.H.; 2 ♂♂, 2 ♀♀ May 1957, K.M.F.S.; all bred out from larvae. Larvae were also collected there from November to March.) Great Berg River, Groot Drakenstein (♂♂ and ♀♀ collected in June 1951, A.D.H.).

Summary

Three new species of caddis (Trichoptera: Leptoceridae) are described from South Africa: *Athripsodes prionii*, *A. bergensis* and *Leptecho helicotheca*; also a variety of *Athripsodes tuckeri* Barnard.

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REVIEW OF THE RACES OF THE SPIKE-HEELED LARK, *CERTHILAUDA ALBOFASCIATA* LAFRESNAYE

By

J. M. Winterbottom

(*South African Museum*)

Contents

Introduction

In 1956, the List Committee of the South African Ornithological Society asked me to make a preliminary investigation on their behalf of the races of *Certhilauda albofasciata.* This paper is the result of work begun for that purpose.

The races of *Certhilauda albofasciata* have been most recently reviewed by Meinertzhagen (1951) and, in respect of the western forms, by Macdonald (1953). These two reviews do not agree with one another, though both recognize fewer races than does Roberts (1940) and, following him, Vincent (1952). The comparative data are set out in Table I. Neither Meinertzhagen nor Macdonald defines the ranges of the subspecies they recognize with precision (though this only applies to the eastern races in Macdonald's case), but it is clear that in some cases these ranges do not correspond to the joint ranges of the various 'Roberts-recognized' subspecies fused in the synonymy. The problem is not rendered any easier by doubts as to the correct names to be applied to the different races; and, in particular, as to which form should be called *C. albofasciata* Lafres. The type of *C. albofasciata* is now at Harvard. The locality is said to be 'Cape of Good Hope', but, apart from the fact that there is no record of the species occurring within 70 miles of the Cape, this locality was given at that time to a wide, but indefinite, area, covering much of the present Cape Province. Comparisons of the type specimen with others of known origin suggest that it belongs to the population found in the north-central and north-eastern Cape and southern and eastern Orange Free State; and Macdonald has recently (1958) proposed Deelfontein as the type locality.

Andrew Smith described *garrula* in *Ill. Zool. S. Afr., Aves,* 1846, pl. 106. In the description, he gives a reference to a prior description of his own in

Proc. S. Afr. Inst., 1833. These Proceedings are contained in the *S. Afr. Quart. Journ.* and no such description appears in the period 1830–6. Smith gives the range as 'the northern districts of the Colony', which might be almost anywhere north of the Olifants River and Little Karoo. Macdonald (1953), pointing out that Smith's figure is of a darker bird than that shown by Lafresnaye, has accordingly applied the name *garrula* to the dark, south-western population and fixed Vanrhynsdorp as the type locality. Actually, the colouring of Smith's plate appears to me so unlike any *Certhilauda albofasciata* specimen I have ever seen that I think it might have been wiser to have rejected the name altogether as indeterminable; but to do so now would cause a great deal of confusion and I propose to accept it.

It must be noted, however, that the consequences of accepting these findings of Macdonald's are that some of the birds called *albofasciata* by Roberts, Vincent and Meinertzhagen must now be called *garrula*; and some, at least, of the birds called *subpallida* or *alticola* by these authors now become *albofasciata* (allowing for differences in recognition of subspecies).

Acknowledgements

The total number of skins assembled for the present study was 374. I am much indebted to the Directors and staff of the following Museums for the loan of material: British Museum (Natural History), London; Coryndon Museum, Nairobi; Durban Museum and Art Gallery; East London Museum; Kaffrarian Museum, King William's Town; National Museum of Southern Rhodesia, Bulawayo; Port Elizabeth Museum and Snake Park; and the Transvaal Museum, Pretoria. I am also indebted to Messrs. J. D. Macdonald and C. M. N. White for giving me their views on some of the problems raised, though they must not be held responsible for any of the opinions expressed here; and to my colleagues of the List Committee (Messrs. R. H. N. Smithers, J. Vincent, P. A. Clancey and R. Liversidge) for much helpful criticism of my initial review. I must extend my sincere thanks, too, to Mr. Smithers and Mrs. B. P. Hall for making available the fine series of Spike-heels collected in southern Bechuanaland by the joint British Museum-National Museum expedition to that area, as noted below; and to Mr. P. A. Clancey for a preview of the material collected by the Durban Museum in the northern Cape.

I am most grateful to Mr. A. N. Rowan for statistical treatment of the measurements; and to Mr. E. H. J. Middlemiss for information on the geography and vegetation in the Johannesburg-Pretoria area, where variation among Spike-heels is so confusing.

The work on which this paper is based was done while the author was holding a Senior Bursary of the South African Council for Scientific and Industrial Research.

Review of the Material

The west coast from the Olifants valley to Little Namaqualand and inland as far east as Calvinia is occupied by the race *garrula* Smith, a dark bird, notably darker and redder above than *albofasciata* and much darker below.

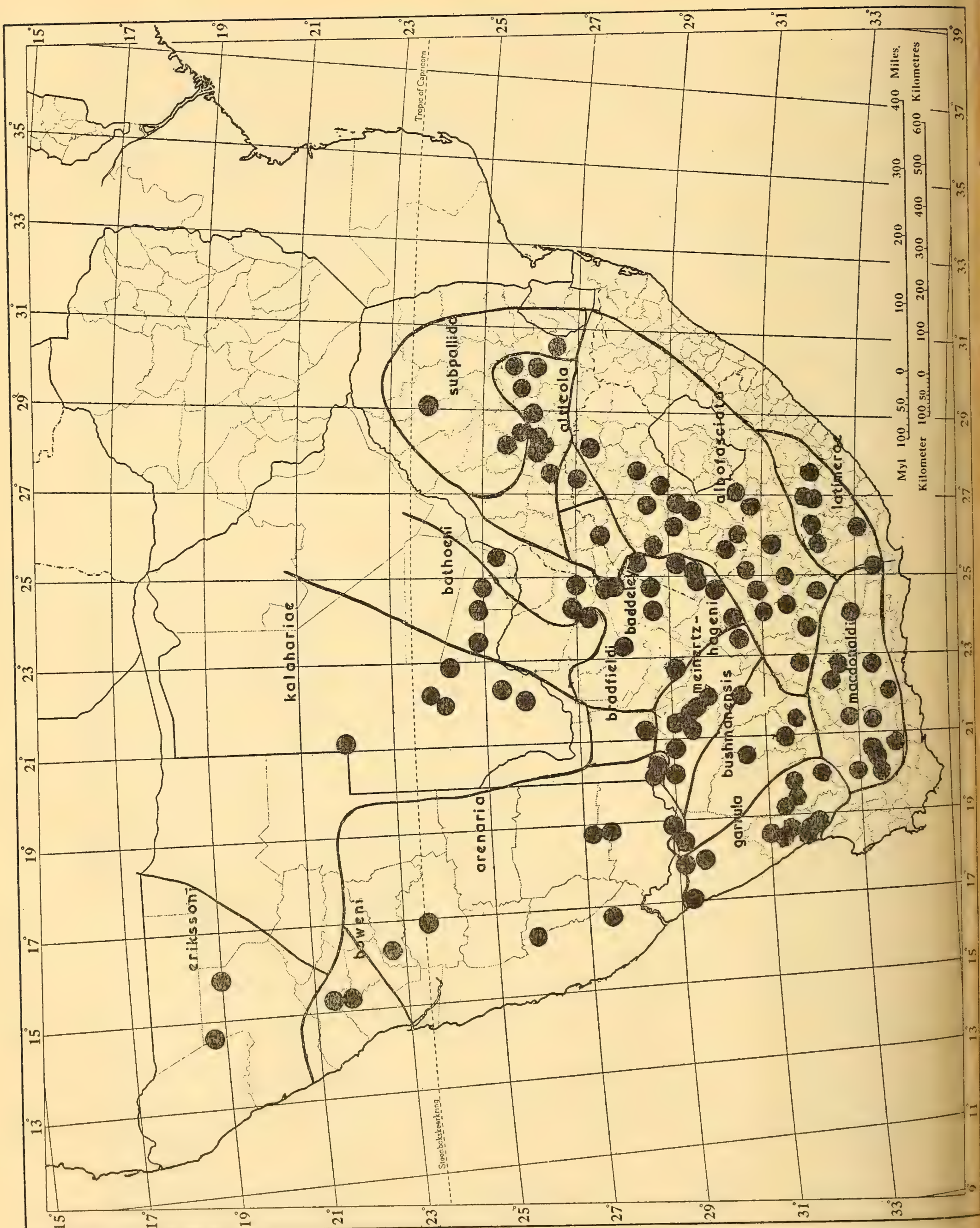
To the south and east of this, from Karoopoort, in the Ceres District, east through Beaufort West and southern Aberdeen to Bedford, is a race, greyer than *garrula* and colder and more vinaceous below. This race is without a name and I propose to call it *macdonaldi*, after Mr. J. D. Macdonald, who first pointed out that it was distinct. East of this, the birds become redder and lose the cold tone. They most closely resemble the Griqualand West series, from which they are separated by the lighter nominate form; but they are not so dark as those northern birds. I name them below *latimerae*, after Miss M. Courtenay-Latimer, whose collections from the Cape Province have done so much to clear up the races in that area.

Inland from the coast in the north-west Cape, three races have been described, *calviniensis* (Roberts), *bushmanensis* (Roberts) and *meinertzhageni* Macdonald. Macdonald places the first two in the synonymy of *garrula*; Meinertzhagen, who does not refer to *garrula*, puts the first as a synonym of *albofasciata* and the second of *boweni*.

To take *calviniensis* first, I have seen ten skins from Calvinia itself, besides one from 50 miles south and another four from Lokenburg, west of Calvinia. All these are *garrula*. But the East London and Durban Museums' series from Brandvlei, some 80 miles north-east of Calvinia, are quite different. Now Roberts's type locality for *calviniensis* is given as '35 miles east of Calvinia *on the Brandvlei road*'; and the phrase I have italicized is omitted from the citation by both Macdonald and Meinterzhagen. The omission is important because, in point of fact, the road from Calvinia to Brandvlei, though it starts by going east, swings round through 90° and ends by going north. At 35 miles, it has already started this swing; and two Transvaal Museum specimens from the type locality are much closer to the Brandvlei birds than to *garrula*. They are, however, somewhat yellower and less pink than any of the Brandvlei series, but this may be because they are in worn plumage.

The type locality of *bushmanensis* is 'border of the Bushman Flats and Little Namaqualand on the road from Goodhouse to Steinkopf'. I have seen the type, which can be matched by examples from Brandvlei. I am of the opinion that only one subspecies can be recognized from this area. It is singularly unfortunate that both the described races are from the edges of the range, but *bushmanensis* has page priority and is slightly less inappropriate, so I propose to use it.

To the north-east of *bushmanensis*, there are two skins from Pofadder and five from the Putzonderwater and Britstown areas in the East London collection and four Transvaal Museum skins from Putzonderwater and Vanwyksvlei, in



Approximate distribution of the races of *Certhilauda albofasciata* Lafresnaye. Each dot represents a locality from which one or more specimens has been examined. Unnamed areas—specimens indeterminable (see text).

which the intensity of the central dark streak in the back feathers is considerably reduced and the red tint of the rest of the feather is much deeper than in any other examples known to me. In the first of these characters, they approach *bradfieldi* of the region west of Upington, but they are much redder; while the underparts are dark—darker than either *bradfieldi* or *bushmanensis* and as dark as *garrula*. These birds are *meinertzhageni* Macdonald. In a series of eight Durban Museum skins from Vanwyksvlei, however, only one agrees with *meinertzhageni* and the others are *bushmanensis*.

Passing north from the ranges of *bushmanensis*, *meinertzhageni* and *garrula*, we come to the ranges of three more named races. On the east, to the west of Upington, is *bradfieldi* (Roberts), a subspecies of very restricted range. I have seen eight skins of this bird, all from 20 miles west of Upington and forming a well-marked and compact group with the dark centres of the back feathers much reduced, so that the effect is of a rufous bird, though, in series, yellower and less red than *meinertzhageni*.

To the west of *bradfieldi* are two named races, *barbiensis* (Roberts) and *arenaria* Reichenow. I am unable to find any distinction between them and agree with Macdonald and Meinertzhagen that *barbiensis* is a synonym. *C. a. arenaria* is paler, with narrower dark centres to the back feathers, than *garrula* to the south of it: but darker than *bradfieldi* above, though lighter below.

North-west of the range of *arenaria* is *boweni* (de Schauensee), of which *namibensis* (Roberts) has been accepted by practically everybody, including its author (but not, oddly enough, by Meinertzhagen), as a synonym. It is a pale, sandy bird, with wide light margins to the feathers of the back and the dark centres reduced and lighter or almost absent. It is also smaller.

Still further north occurs *erikssoni* Hartert, the lightest race of all, though the dark centres to the back feathers are more distinct and much darker than in *boweni*. The birds of the area east of *arenaria* and *erikssoni* have been described as another race, *kalahariae* O.-Grant. Meinertzhagen fuses this race with *erikssoni*, saying, 'I believe *kalahariae* to be the grey phase of *erikssoni*'. Only three skins of *erikssoni* were available to me, but I was fortunate to have at my disposal the long series of *kalahariae* collected by the British Museum-National Museum expedition to southern Bechuanaland in 1957, and was later able to see ten more skins of *erikssoni* in the British Museum collection. These certainly do not support Meinertzhagen's belief.

The British Museum-National Museum expedition also revealed the presence, east of the pale *kalahariae* and west of the much darker Griqualand birds, of a population resembling *arenaria* but less heavily streaked; and Liversidge has recently collected two similar birds from between Stella and Vryburg. They constitute the race *bathoeni* Smithers and Paterson.

East of these races and north of *latimerae* and *macdonaldi* occurs a form, paler and less rufous than *macdonaldi* though darker than *arenaria* and much darker than *erikssoni*. This form Macdonald has shown must be called *albofasciata*. Its range extends north over most of the Orange Free State and east, according to Macdonald, to northern Natal (no Natal skins were available to me). Westward, eight out of nine Durban Museum skins from Riverton, Kimberley, belong to this form, though Bulawayo and Cape Town skins from the Kimberley area agree with the next race.

West of this, from De Aar north to Kanye and west to Kuruman, the birds are darker and show an approach to *alticola* (with the exception noted below). They represent *baddeleyi* Clancey. From the Vaal valley, separating the range of *baddeleyi* from *alticola*, come five quite different skins. Two, from Christiana and Wolmaransstad, are yellowish brown; the other three, from Kroonstad, are a cold grey. What the status of these five is it is impossible to say in the absence of more material, but one of the National Museum skins from Riverton is a near match to the first two.

From the Witwatersrand-Pretoria area, two races have been described, *alticola* (Roberts) and *robertsi* Macdonald. I am unable to distinguish between them. Birds from this area are black and deep rufous above, darker than *griquensis* and much darker than *albofasciata.* But, as Macdonald has pointed out, birds from Fountains Blue and Zwartkops, between Johannesburg and Pretoria, are quite distinct, since they lack the dark centres to the feathers and are wholly dark rufous. They are old skins and I do not propose to name them, but the position in this area can only be described as fantastic. On a practically straight line from Boksburg through Pretoria to Zoutpan Road, we have the following forms succeeding each other:

Boksburg: *alticola* (type locality).
Modderfontein (*c.* 11 miles): *subpallida.*
Fountains Blue (*c.* 6 miles) and Zwartkop (*c.* 20 miles): rufous birds, as noted above.
Fountains (*c.* 7 miles): *robertsi* (type locality) (=*alticola*).
Zoutpan Road (*c.* 30 miles): *subpallida.*

I can find no correlation between this distribution and either the vegetation as given by Acocks (1953) or the 1955 geological map.

The extreme north-east of the species' range is occupied, from Zoutpansberg south to near Pretoria and to Lake Chrissie, by *subpallida* (Roberts), lighter above and below than *alticola*, greyer above and less red below than *albofasciata.*

Far to the north of any other form of the species, in central Angola, occurs the very dark *obscurata* Hartert.

Summary of the Races

The forms recognized may be summarized:

1. *Certhilauda albofasciata albofasciata* Lafresnaye, *Mag. de Zool.*, 1836: pl. 85. Type locality, Deelfontein.

Range: North-eastern Cape Province, most of the Orange Free State and north-western Natal. Meets *baddeleyi* in the Kimberley region, where the detailed delimitation of the respective ranges needs further study.

Moderately pale and not very red.

Average measurements:

13 ♂♂: Wing, 90·1 mm. (83–97); tail, 48·5 (44–53); culmen, 23·2 (20–25); tarsus, 25·0 (22–29); hind-claw, 13·8 (11–21).

10 ♀♀: Wing, 84·0 (81–91); tail, 43·7 (39–52); culmen, 20·3 (18–24); tarsus, 24·4 (22–27); hind-claw, 12·5 (11–15).

Material examined:

South African Museum, 12 (Deelfontein, Hanover, Richmond, Winburg, Middelburg, Vredefort road, Wagenaarskraal); Transvaal Museum, 16 (Dealesville, De Brug, Zastron-Rouxville road, Bethulie, Bloemfontein, Heilbron, Springfontein, Excelsior, Meadows, Rhenosterspruit); Durban Museum, 3 (Elandshoek, Steynsburg); East London Museum, 1 (Elandshoek); Kaffrarian Museum, 1 (Colesberg).

2. *Certhilauda albofasciata macdonaldi* subsp. nov. Type: in South African Museum, Cape Town, No. 20340, ♂, 23 miles north-east of Karoopoort, Ceres District, *c.* 33° S., 20° E.

Range: From Beaufort West and Aberdeen to the southern borders of the Karoo. Intergrades with *albofasciata* in southern Victoria West (Wagenaarskraal) and with *latimerae* at Klipplaat, in the Sundays River valley.

Greyer above than *albofasciata* and *garrula*, colder and more vinaceous below.

Average measurements:

32 ♂♂: Wing, 90·6 mm. (82–97); tail, 46·4 (40–56); culmen, 23·4 (18–28); tarsus, 25·6 (22–31); hind-claw, 13·7 (10–18).

21 ♀♀: Wing, 85·5 (78–95); tail, 43·5 (38–55); culmen, 20·3 (17–25); tarsus, 23·4 (20–27); hind-claw, 14·3 (7–18).

Material examined:

South African Museum, 24 (Karoopoort (type), Beaufort West, Dwyka, Oudtshoorn, Barrydale, Matjesfontein, Laingsburg, Touws River, Klaarstroom, Fraserburg road, Aberdeen); East London Museum, 29 (Beaufort West, Bedford-Grahamstown road, Oudtshoorn, Skietkuil); Durban Museum, 4 (Oudtshoorn, Murraysburg, Skietkuil); Coryndon Museum, 1 (Laingsburg); Port Elizabeth Museum, 1 (Klipplaat—intermediate between *macdonaldi* and *latimerae*).

3. *Certhilauda albofasciata latimerae* subsp. nov. Type: in East London Museum, No. 3235, ♂, Cofimvaba, Transkei, *c.* 32° S., 27° 30′ E.

Range: From the Transkei through Glen Grey, Queenstown and Tarkastad to the Sundays River valley, where it intergrades with the preceding.

Redder than *macdonaldi* above and lighter and less vinaceous below; darker than *albofasciata*; lighter than *baddeleyi*.

Average measurements:

5 ♂♂: Wing, 90·0 mm. (88–93); tail, 49·0 (46–52); culmen, 23·0 (21–24); tarsus, 24·6 (23–27); hind-claw, 16·6 (15–17).

4 ♀♀: Wing, 82·2 (80–91); tail, 41·5 (35–47); culmen, 19·5 (18–23); tarsus, 23·2 (20–27); hind-claw, 14.0 (10–15).

Material examined:

South African Museum, 2 (Queenstown, Glen Grey); East London Museum, 5 (Mostertshoek, Cofimvaba (type)); Durban Museum, 3 (Fish River, Tarkastad); Kaffrarian Museum, 1 (Bolotwa).

4. *Certhilauda albofasciata garrula* A. Smith, *Ill. Zool. S. Afr.*, *Aves*, 1846, pl. 106. Type locality, Vanrhynsdorp.

Range: The western Cape from the lower Olifants River to Port Nolloth, east to Calvinia and Springbok.

Darker and redder above than *albofasciata* and much darker below. Redder above and below than *macdonaldi*.

Average measurements:

26 ♂♂: Wing, 92·6 mm. (81–98); tail, 47·5 (41–63); culmen, 23·7 (21–27); tarsus, 27·1 (22–30); hind-claw, 14·4 (11–18).

23 ♀♀: Wing, 83·8 (79–92); tail, 46·9 (38–52); culmen, 19·6 (18–24); tarsus, 24·7 (21–28); hind-claw, 13·4 (11–19).

Material examined:

South African Museum, 10 (Liebendal, Springbok-Goodhouse road, Lokenburg, Papendorp, 50 miles south of Calvinia); East London Museum, 16 (Clanwilliam, Clanwilliam-Calvinia Road, Sandkraal, Bitterfontein, Nieuwerust-Bitterfontein Road, Springbok, Calvinia); Durban Museum, 13 (Vanrhynsdorp, Nieuwerust, Nieuwerust-Bitterfontein road, Okiep, Calvinia); Transvaal Museum, 9 (Klaver, Klipfontein, Nieuwerust, Port Nolloth); National Museum, Bulawayo, 1 (Vanrhynsdorp).

5. *Certhilauda albofasciata bushmanensis* (Roberts), *The Ostrich*, 1937: 99. Type locality, border of Bushman Flats and Little Namaqualand, on the road from Goodhouse to Steinkopf, *c.* 29° N., 18° 30′ E.

Synonym: *C. a. calviniensis* (Roberts), *The Ostrich*, 1937: 100.

Range: Bushman Flats and Kakamas south to 35 miles north-east of Calvinia and to Williston.

Lighter and redder above than *garrula* and *macdonaldi*.

Average measurements:

15 ♂♂: Wing, 90·7 mm. (85–95); tail, 46·9 (41–52); culmen, 24·1 (20–27); tarsus, 26·2 (23–28); hind-claw, 12·5 (9–18).

15 ♀♀: Wing, 86·3 (80–94); tail, 43·6 (38–48); culmen, 19·9 (18–24); tarsus, 23·6 (20–28); hind-claw, 11·5 (6–15).

Material examined:

Transvaal Museum, 4 (Bushman Flats (type), Brandvlei, 35 miles east of Calvinia); East London Museum, 19 (Brandvlei, Brandvlei-Kenhardt Road, Williston, Kenhardt, Kakamas-Kenhardt road, Williston-Fraserburg Road, Fraserburg); Durban Museum, 13 (Brandvlei, Vanwyksvlei).

6. *Certhilauda albofasciata meinertzhageni* Macdonald, *Proc. Zool. Soc.*, 122, 1953: 1,000. Type locality, Pofadder, *c.* 29° N., 20° E.

Range: A narrow strip along the south side of the Orange River valley from Pofadder to Britstown and Vanwyksvlei, where it occurs alongside *bushmanensis*.

Differs from *bushmanensis* in that the central dark stripes of the feathers of the upper parts are considerably reduced and the red tint of the rest of each feather is much deeper. Much redder than *bradfieldi*. Underparts darker than either of these two races and similar to *garrula*.

Average measurements:

7 ♂♂: Wing, 92·1 mm. (89–95); tail, 48·1 (46–52); culmen, 23·0 (20–25); tarsus, 25·0 (23–27); hind-claw, 12·0 (11–13).

2 ♀♀: Wing, 83·7 (83–84); tail, 43·7 (42–46); culmen, 18·0 (17–19); tarsus, 23·0 (21–25); hind-claw, 8·7 (7–10).

Material examined:

Transvaal Museum, 4 (Putzonderwater, Vanwyksvlei); East London Museum, 6 (Pofadder, Putzonderwater, Marydale, Kenhardt-Putzonderwater road, Britstown-Merriman road); Durban Museum, 2 (Marydale, Vanwyksvlei).

7. *Certhilauda albofasciata baddeleyi* Clancey, *Durb. Mus. Novit.* 5, 1957: 43. Type locality, Rietfontein, Griqualand West, *c.* 29° 15′ S., 23° E.

Synonym: *C. a. griquensis* Winterbottom, nom. nud., in Clancey, op. cit.

Range: From De Aar north and west to Kanye and Niekerkshoop and east to Boshoff and Koffiefontein in the Orange Free State.

Intermediate in colouration above between *alticola* and *albofasciata*. Below, rather darker than *albofasciata*, matching *alticola*.

Average measurements:

22 ♂♂: Wing 91.2 mm. (86–97); tail, 49·0 (40–56.5); culmen, 23·4 (20–26); tarsus, 26·6 (23–30); hind-claw, 13·2 (10–16).

9 ♀♀: Wing, 82·4 (79–86); tail, 42·0 (37–47); culmen, 19·5 (18–21); tarsus, 25·3 (24–27); hind-claw, 10·8 (10–12).

Material examined:

South African Museum, 3 (Fourteen Streams, Kimberley, Boshoff); Transvaal Museum, 8 (Barkly West, De Aar, Petrusville, Fourteen Streams, Vryburg, Fauresmith, Kanye, Niekerkshoop); National Museum, Bulawayo, 8 (Riverton, Langley, Kuruman); Coryndon Museum, 4 (Koffiefontein, Luckhoff); Durban Museum, 10 (Riverton, Rietfontein (type)); Port Elizabeth Museum, 2 (Vryburg-Mafeking road).

8. *Certhilauda albofasciata bradfieldi* (Roberts), *Ann. Tvl. Mus.*, 15, 1932: 28. Type locality, Langklip, 60 miles west of Upington, *c.* 28° 30′ S., 20° 30′ E.

Range: 20–60 miles west of Upington.

Yellower, less red, than *meinertzhageni* but, like it, with the dark centres of the back feathers reduced. Redder than *albofasciata*, lighter above and darker below than *arenaria*, yellower above and lighter below than *baddeleyi*.

Average measurements:

6 ♂♂: Wing, 92·0 mm. (89–94); tail, 47·7 (42–53); culmen, 24·3 (22–26); tarsus, 26·0 (25–27); hind-claw, 13·2 (12–14).

2 ♀♀: Wing, 82·0 (80–84); tail, 41·5 (40–43); culmen, 210· (21); tarsus, 24·0 (24); hind-claw, 12·0 (11–13).

Material examined:

Transvaal Museum, 8 (20 miles west of Upington).

9. *Certhilauda albofasciata arenaria* Reichenow, *Vög. Afr.*, 3, 1904: 354. Type locality, Rehoboth.

Synonym: *C. a. barbiensis* (Roberts), *The Ostrich*, 8, 1937: 2.

Range: From the Orange River (reaching the south bank at Aggenys and Bladgrond) north to Windhoek.

Paler above, with narrower dark centres to the feathers, than *garrula*. Darker above and lighter below than *bradfieldi*. Less red above than *bushmanensis*.

Average measurements:

13 ♂♂: Wing, 90·0 mm. (86–97); tail, 45·3 (40–51); culmen, 23·2 (21–27); tarsus, 25·3 (22–29); hind-claw, 12·1 (10–15).

9 ♀♀: Wing, 81·9 (78–93); tail, 40·6 (36–45); culmen, 18·9 (17–21); tarsus, 23·2 (21–26); hind claw, 11·2 (10–13).

Material examined:

British Museum, 6 (40 miles north of Kleinkaras, Witputs, Lower Barby, 69 miles south of Windhoek); East London Museum, 6 (Kenhardt, Aggenys, Bladgrond, Bladgrond-Kakamas road); Transvaal Museum, 3 (Gobabis, Barby, Karibib); Durban Museum, 5 (Aggenys, 30 miles from Kakamas on Kenhardt road, Bladgrond); Port Elizabeth Museum, 3 (Kenhardt).

10. *Certhilauda albofasciata boweni* (de Schauensee), *Proc. Acad. Nat. Sci. Philad.*, 83, 1931: 5. Type locality, Spitzkopjie.

Synonym: *C. a. namibensis* (Roberts), *Ann. Trans. Mus.*, 14, 1931: 243.

Range: From Swakopmund north to Omaruru.

A pale, reddish-sandy bird, with wide light margins to the back feathers and the dark centres reduced and lighter or almost absent. Smaller.

Average measurements:

10 ♂♂: Wing, 85·8 mm. (81–91); tail, 45·2 (40–51); culmen, 22·2 (21–23); tarsus, 23·7 (21–26); hind-claw, 13·0 (11–16).

8 ♀♀: Wing, 78·0 mm. (75–81); tail, 41·9 (38–44); culmen, 18·4 (17–20); tarsus, 21·8 (20–25); hind-claw, 11·8 (9–15).

Material examined:

British Museum, 14 (Ebony, Wilson's Fountain, Karibib, Okomuhe); Transvaal Museum, 2 (Ebony); National Museum, Bulawayo, 3 (Namib).

11. *Certhilauda albofasciata kalahariae* Ogilvie-Grant, *The Ibis*, 1912: 375. Type locality, Lehututu, central Kalahari.

Range: The Kalahari desert.

Much greyer than *boweni*, the dark centres of the feathers of the back very narrow but blackish. Below, rather darker and more vinaceous.

Average measurements:

25 ♂♂: Wing, 90·4 mm. (83–95); tail, 50·6 (43–54); culmen, 23·4 (20–27); tarsus, 24·9 (22–28); hind-claw, 13·0 (8–16).

20 ♀♀: Wing, 83·5 (75–90); tail, 44·5 (39–53); culmen, 20·8 (18–25); tarsus, 24·2 (21–28); hind-claw, 10·7 (8–14).

Material examined:

British Museum, 1 (Fort Rietfontein); British Museum-National Museum Expedition, 44 (Tsabong, Lochahane, Bosho Bohulu, Tsane, Chawe, Kome, Kakia).

12. *Certhilauda albofasciata erikssoni* Hartert, *Bull. B.O.C.*, 19, 1907: 82. Type locality, Okahokahana, Ovamboland.

Range: The Outjo District and Ovamboland.

Somewhat paler than *kalahariae* above and below; greyer than *boweni.*

Average measurements:

8 ♂♂: Wing, 87·4 mm. (81–95); tail, 44·1 (37–45); culmen, 20·6 (19–22); tarsus, 25·6 (24–27); hind-claw, 13·6 (12–16).

5♀♀ : Wing, 77·6 mm. (75–81); tail, 40·4 (37–47); culmen, 18·2 (17–19); tarsus, 22·4 (18–24); hind-claw, 11·4 (9–14).

Material examined:

South African Museum, 1 (Okahokahana); British Museum 11 (Kalkrand, Ondonga).

13. *Certhilauda albofasciata bathoeni* Smithers and Paterson (description in the press). Type locality, west of Kakia, B.P., *c.* 25° S., 24° E.

Range: A narrow strip of grass country in south-eastern Bechuanaland, south to the Stella-Vryburg road, between the limestone country inhabited by *kalahariae* and the Acacia country inhabited by *baddeleyi.*

Darker and redder than *kalahariae*, but much lighter than *baddeleyi.* Most like *arenaria*, but less heavily streaked above.

Average measurements:

5 ♂♂: Wing, 91·8 mm. (86–97); tail, 49·0 (46–53); culmen, 25·2 (24–26); tarsus, 26·0 (24–28); hind-claw, 13·6 (12–17).

8 ♀♀: Wing, 81·9 (80–85); tail, 44·7 (42–47); culmen, 20·8 (19–22); tarsus, 23·9 (22–26); hind-claw, 10·6 (9–13).

Material examined:

British Museum-National Museum Expedition, 13 (53–57 miles east of Kakia); Port Elizabeth Museum, 2 (Stella-Vryburg road).

14. *Certhilauda albofasciata alticola* (Roberts), *Ann. Tvl. Mus.*, 15, 1932: 28. Type locality, Van Dyk Mine, Boksburg.

Synonym: *C. a. robertsi*, Macdonald, *P.Z.S.*, 122, 1953: 1003.

Range: From Potchefstroom east to Belfast and Carolina and north to Pretoria.

The darkest of the South African races, black and dark rufous above; but below, no darker than *baddeleyi.*

Average measurements:

5 ♂♂: Wing, 88·4 mm. (85–90); tail, 44·6 (41–50); culmen, 23·6 (22–25); tarsus, 26·4 (24–28); hind-claw, 14·8 (12-16).

9 ♀♀: Wing, 83·3 (75–90); tail, 41·7 (36–50); culmen, 19·8 (18–22); tarsus, 24·4 (21–27); hind-claw, 12·8 (8–16).

Material examined:

Transvaal Museum, 15 (Boksburg, Witwatersrand, Enkeldoorn, Zwartkop, Belfast, Carolina, Fountains Blue, Potchefstroom); Durban Museum, 1 (Witbank); South African Museum, 3 (Zwartkop, between Florida and Roodepoort).

15. *Certhilauda albofasciata subpallida* (Roberts), *Ann. Tvl. Mus.*, 15, 1932: 29. Type locality, Marabastad, Pietersburg District.

Range: From Modderfontein and Lake Chrissie north to the borders of the Bushveld.

Paler above and below than *alticola* and very close to *baddeleyi*, but paler below and yellower, less rufous, above.

Average measurements:

4 ♂♂: Wing, 87·2 mm. (86–88); tail, 43·0 (41–46); culmen, 22·2 (21–23); tarsus, 26·5 (26–28); hind-claw, 14·2 (13–16).
2 ♀♀: Wing, 78·5 (78–79); tail, 39·0 (38–40); culmen, 20·0 (19–21); tarsus, 25·5 (25–26); hind-claw, 13·0 (12–14).

Material examined:

Transvaal Museum, 6 (Marabastad (type), Modderfontein, Pretoria, Lake Chrissie, Zoutpan road).

16. *Certhilauda albofasciata obscurata* Hartert, *Bull. B.O.C.*, 19, 1907: 83. Type locality, Bulu-Bulu, Bihe District, Angola.

Range: The grasslands of central Angola.

Back very dark, the feathers with whitish edges; head black, with rufous margins to feathers; below deep rufous. Hind-claw very long, probably in correlation with habitat.

Average measurements:

6 ♂♂: Wing, 86·7 mm. (81–89); tail, 40·3 (37–44); culmen, 21·8 (21–23); tarsus, 25·6 (22–28); hind-claw, 17·3 (16–19).
4 ♀♀: Wing, 80·8 mm. (74–91); tail, 36·0 (32–41); culmen, 19·2 (18–22); tarsus, 24·0 (22–30); hind-claw, 15·8 (13–19).

Material examined:

British Museum, 7 (Bure-bure, Missao de Luz); Hall Collection, 3 (Silva Porto).

In addition, as noted above, the following populations cannot be fitted into any of the above races at present and may prove to be worth naming when adequate material is to hand:

(*a*) Birds from Christiana and Wolmaransstad, South-West Transvaal.

(*b*) Birds from Kroonstad, northern Orange Free State.

The birds from Fountains Blue and Zwartkops, included in *alticola* above, may also warrant separation.

Proportions

Macdonald (1953) has shown that the sum of the lengths of the wing, tail and bill can be used as a rough measure of size and that the ratio of the means of these quantities between the sexes changes according to the locality, the females representing 85 per cent of the males south-west of Windhoek, 90 per cent over several other South-West African localities and intermediate elsewhere. Working with average figures for each race, I obtained ratios varying from 88 per cent for *boweni* and *arenaria* to 95 per cent for *macdonaldi*, the pattern roughly conforming to decreasing dimorphism as one goes east and south from west-central South-West Africa. Within races, figures are naturally less reliable since the numbers are smaller, but variation is shown by the following populations of *garrula*:

Klaver-Vanrhynsdorp (5 ♂♂, 5 ♀♀) . ♂, 164·4; ♀, 148·2 = 90%
Calvinia (7 ♂♂, 3 ♀♀) . . . ♂, 163·3; ♀, 142·3 = 87%

Brandvlei (*bushmanensis*) birds give:

Brandvlei (11 ♂♂, 8 ♀♀) . . . ♂, 159·0; ♀, 149·2 = 94%

showing an approach to equality of size, while *bradfieldi* gives:

20 m. W. of Upington (6 ♂♂, 2 ♀♀) . ♂, 163·0; ♀, 144·5 = 89%

more like the Calvinia population than the intervening one at Brandvlei.

In *macdonaldi*, we can contrast three local populations:

Skietkuil, Murraysburg (15 ♂♂, 7 ♀♀) ♂, 154·3; ♀, 143·2 = 93%
Beaufort West (5 ♂♂, 3 ♀♀) . . ♂, 157·2; ♀, 154·3 = 98%
Oudtshoorn (6 ♂♂, 1 ♀) . . . ♂, 164·0; ♀, 149·0 = 91%

It will be noticed that Skietkuil males are small—the same size as Beaufort West females.

Other populations for which more or less adequate data exist are the total population of *bathoeni*, all taken within a few miles of one another, and single populations of *baddeleyi* and *kalahariae*:

50–60 m. E. of Kakia (5 ♂♂, 8 ♀♀) . ♂, 166·0; ♀, 147·4 = 89%
Kimberley (4 ♂♂, 3 ♀♀) . . . ♂, 161·7; ♀, 144·3 = 89%
Kakia (4 ♂♂, 3 ♀♀) . . . . ♂, 165·0; ♀, 148·0 = 90%

These all agree with the neighbouring population of *bradfieldi* in proportions.

Mr. A. N. Rowan, who investigated the wing-lengths statistically, tells me that in the males only *boweni* differs significantly from the average of the species. Among the females, *arenaria* and *macdonaldi* may be significantly different. In all races except *macdonaldi*, the differences between male and female are highly significant; in *macdonaldi*, the difference may be significant. Note that the statistical analysis of wing-measurements confirms the conclusion drawn from Macdonald's 'size index' that sexual dimorphism is less marked in *macdonaldi* than in the other races.

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Table I

Names used for races of *Certhilauda albofasciata*

Race (*those in heavy type recognized in this study*)	Roberts (1940) and Vincent (1952)	Meinertzhagen (1951)	Macdonald (1953)
albofasciata Lafres. .	*albofasciata*	*albofasciata*	*albofasciata*
calviniensis Rbts. .	*calviniensis*	(=*albofasciata*)	(=*albofasciata*)
garrula Smith . .	—	—	*garrula*
alticola Rbts. . .	*alticola*	*alticola*	*alticola*
subpallida Rbts. .	*subpallida*	(=*alticola*)	*subpallida*
bradfieldi Rbts. . .	*bradfieldi*	*bradfieldi*	*bradfieldi*
arenaria Rchw. . .	*arenaria*	*arenaria*	*arenaria*
barbiensis Rbts. . .	*barbiensis*	(=*arenaria*)	(=*arenaria*)
namibensis Rbts. . .	(=*boweni*)	*namibensis*	(=*boweni*)
boweni de Schauen. .	*boweni*	*boweni*	*boweni*
bushmanensis Rbts. .	*bushmanensis*	(=*boweni*)	(=*garrula*)
erikssoni Hart. . .	*erikssoni*	*erikssoni*	*erikssoni*
kalahariae O.-Grant .	*kalahariae*	(=*erikssoni*)	*kalahariae*
meinertzhageni Macd.	—	—	*meinertzhageni*
robertsi Macd. . .	—	—	*robertsi*
obscurata Hart. . .	(extra-limital)	*obscurata*	(extra-limital)

ON THE RACES OF *LYBIUS LEUCOMELAS* (BODD.) IN SOUTH AFRICA

By

J. M. Winterbottom

(*South African Museum*)

Six races of the Barbet *Lybius leucomelas* are recognized by Roberts (1940) and Vincent (1952) from within South African limits. The races are the same in both, though Roberts refers to his own *zuluensis* as *tongensis* in his book, as he does also in his description of *L. l. centralis*. Thanks to the co-operation of the Director and Mrs. Campbell of the Transvaal Museum and the Directors of the East London and Durban Museums and the National Museum of Southern Rhodesia, a series of 110 specimens was assembled for study; and I subsequently also examined a series of 28 of the specimens in the British Museum (Natural History) on which Macdonald (1957) based his findings.

My original purpose in investigating the races of this species was to check the validity and the range, if valid, of *L. l. namaqua* (W. L. Sclater), and I shall deal with this race first.

The sole distinction given by Sclater between *namaqua* and *leucomelas* is that the former has 'the underparts thickly spotted with oval spots of black'. The type locality of *leucomelas* is given as the Cape of Good Hope; that of *namaqua* is Klipfontein. I found that most birds, though not quite all, in a coastal strip from Namaqualand to Albany, were heavily spotted. Birds from Committee's Drift, Albany and Mostertshoek, Tarkastad, varied, some being heavily spotted, others not. Clancey (1954) had already drawn attention to this and Macdonald (1957) also noted it. One of two birds from Clanwilliam was virtually unspotted and so was the only available specimen from Hopefield. But birds from Klaver, Cape L'Agulhas, Stilbaai and another Clanwilliam bird were all spotted. I noted also that one of the two British Museum birds from Klipfontein, the type locality of *namaqua*, was a lightly spotted form. Unless, therefore, there is an unspotted form confined to the area west of the Hottentots Holland Mountains and south of the Olifants River Mountains—which is just possible but highly improbable—we must take it that heavily spotted underparts are a normal feature of southern and western birds.

L. l. centralis was described by Roberts (1932) as having the underparts of the body pale yellow (though in 1940 he calls it 'clearer white below'). There is certainly a yellow tinge, of very variable depth, in all the birds I have seen from within the given range of *centralis*; but it can be matched by many birds from further south—skins from Pearston and Beaufort West, for example, are rather yellower than the average of South-West African and Bechuanaland birds.

Both Roberts and Vincent consider Eastern Cape birds to be *affinis* Shelley, described from Weenen, Natal. The characters given by Shelley are, as Sclater (1924) pointed out, those of a young bird; but in reviving the name, Roberts substituted lesser or absent striping on the flanks and smaller size than *L. l. leucomelas* or *L. l. namaqua.* He gives no diagnosis of the differences between *affinis* and *centralis.* I have seen only one Natal bird, from Colenso, and it is yellow below, almost as deep as Swaziland birds, but it can be matched by specimens from further south. The size given by Roberts for the two subspecies (*centralis* and *affinis*) is virtually identical.

L. l. nkatiensis (Roberts) is described as 'silkier and whiter below' than *centralis* and much smaller. But Roberts appears to have had only one skin, a female—and he gives the measurements of male *centralis* for comparison. A series of five Bechuanaland skins, four of them topotypical for *nkatiensis*, in the National Museum of Southern Rhodesia have wings 78–83 mm., the range Roberts gives for *centralis.* I am unable to perceive the whiter underparts which Roberts gives as the other characteristic of this race—indeed, as compared with a series from South-West Africa and the northern Cape, Bechuanaland birds appear to me to be slightly greyer, but it is not of a degree which would allow of certain separation of individual skins.

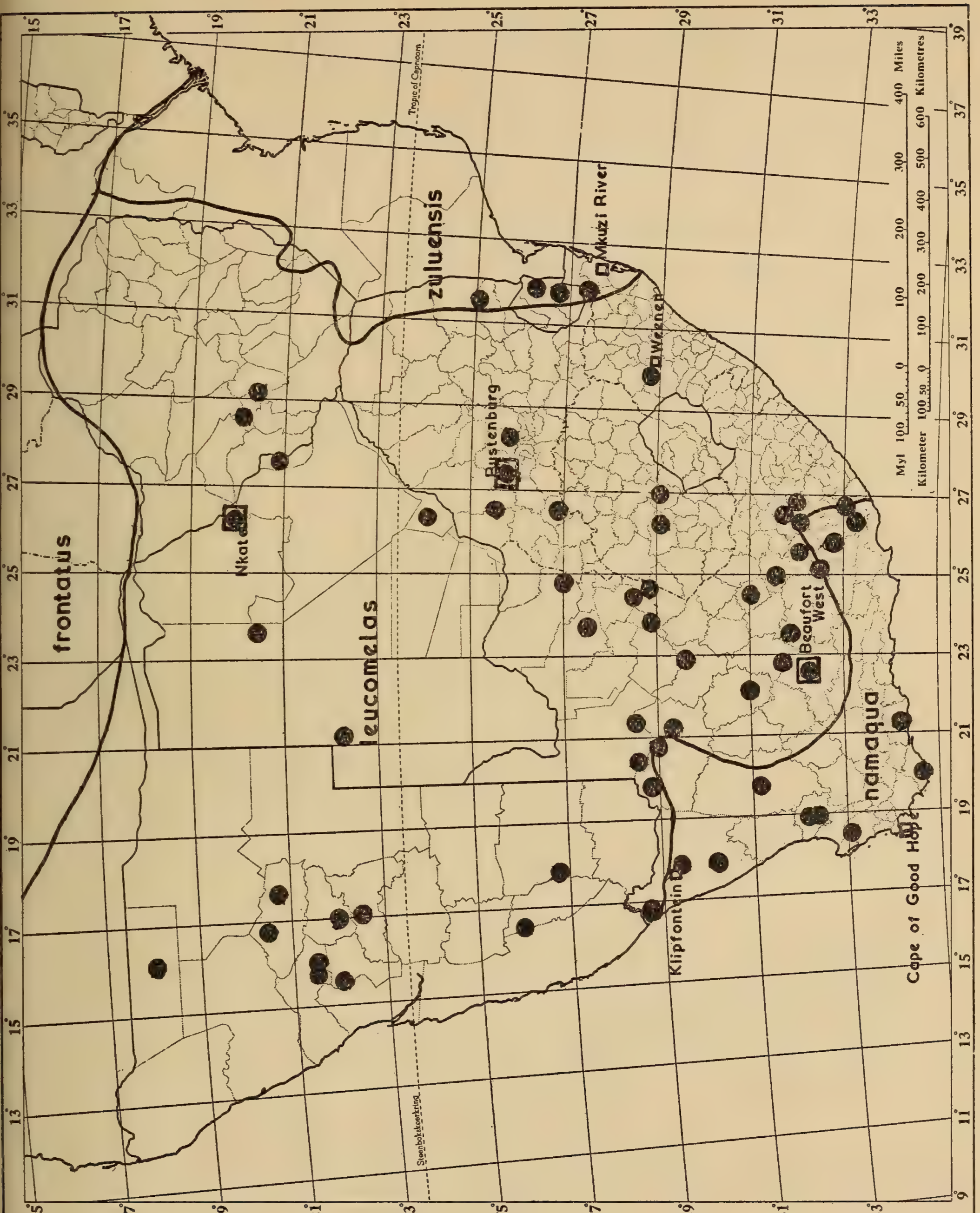
I am therefore of the opinion that only one subspecies of this Barbet is recognizable from the whole of this area, and the next problem is to decide what name to apply. If Boddaert's bird came from what is today called the Cape of Good Hope, then we must call the western and southern birds *leucomelas*, with *namaqua* a synonym, and the population east and north of this *affinis* Shelley, which is the next available name. There is, however, no certainty that Boddaert's bird did come from the Cape itself and a considerable balance of probability that it did not; for if it did, as we have seen, it would probably have been spotted below. Most of the other South African birds described by Boddaert ex Daubenton as from the 'Cape of Good Hope' are inconclusive on this point, but one of them, *Euplectes progne*, is decisive that some, at least, of them came from further north and east. I therefore propose to amend the type locality of *Lybius leucomelas* from the Cape of Good Hope to Beaufort West, Cape Province. This enables us to retain *namaqua* for the coastal birds and *leucomelas* for the bulk of the population, that inland of the range of *namaqua.*

L. l. zuluensis (Roberts) is described as yellower below, and smaller, than *affinis.* The yellow tinge below is clear in a series but not 100 per cent evident in individuals; the smaller size seems constant. I therefore recognize this race.

The subspecies of *Lybius leucomelas* within South African limits thus become:

1. *Lybius leucomelas leucomelas* (Bodd.)

Bucco leucomelas Boddaert, *Tabl. Pl. Enlum.*, 1783: 43—Cape of Good Hope; amended herein to Beaufort West, Cape Province.



Approximate Distribution of the Races of *Lybius leucomelas* (Boddaert)

Each dot represents a locality from which one or more specimens has been examined. Type localities of described races are named and indicated by an open square.

Synonyms: *Pogonorhynchus affinis* Shelley, *Proc. Zool. Soc.*, 44, 1879: 680—Weenen; *Notopogonius leucomelas centralis* Roberts, *Ann. Tvl. Mus.*, 15, 1932: 26—Rustenburg; and *Notopogonius leucomelas nkatiensis* Roberts, *Ann. Tvl. Mus.*, 15, 1932: 27—Nkate.

White or yellowish white below, without spots.

Range: The whole of southern Africa except the south-western and eastern coastal strips.

2. *Lybius leucomelas namaqua* (W. L. Sclater)

Tricholaema leucomelan namaqua W. L. Sclater, *Bull. B.O.C.*, 42, 1922: 63—Klipfontein.

Heavily spotted black on whitish below.

Range: The western Cape Province from Little Namaqualand inland to south-western Kenhardt and to Calvinia; and east along the coastal low country to Cradock, Tarkastad and Albany. Intermediates between this and the nominate form are found at Grootderm (Orange River mouth), Deelfontein and Albany.

3. *Lybius leucomelas zuluensis* (Roberts)

Notopogonius leucomelas zuluensis Roberts, *Ann. Tvl. Mus.*, 14, 1931: 240—Mkuzi River, Zululand.

Synonym: *Notopogonius leucomelas tongensis* Roberts, *Ann. Tvl. Mus.*, 15, 1932: 26—Mkuzi River.

Yellowish below, without spots. Smaller than the other two races (wing, 73–83 mm., as against 78–87 mm.).

Range: Northern Zululand, the Lowveld of Swaziland and the Transvaal, Portuguese East Africa and the Sabi Valley of Southern Rhodesia.

The work on which this paper is based was done while the author was holding a Senior Bursary of the South African Council for Scientific and Industrial Research.

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CONTRIBUTIONS TO THE KNOWLEDGE OF SOUTH AFRICAN MARINE MOLLUSCA

Part I. Gastropoda: Prosobranchiata: Toxoglossa

By

K. H. Barnard

(With 30 figures in the text and 1 plate)

Introduction

A vast amount of research will be necessary before a comprehensive and reliable monograph on South African Marine Mollusca can be produced. Therefore the following work is only a preliminary account of some of the species known to inhabit South African seas, and of their distribution around the coast.

It is based mainly on the collections in the South African Museum, and the collection made during the University of Cape Town's Ecological Survey. Of the former the most important is the collection made by the Cape Government trawler s.s. *Pieter Faure*. The latter comprises material, collected alive, from the intertidal zone and the estuaries, and by dredging in a few localities.

In South Africa, perhaps more than in other regions, the study of mollusca has suffered from the enthusiasm of shell-collectors, most of whom have been beach-combers with little or no interest in the living animals. Large numbers of dead shells have been described and given scientific names by overseas specialists, often without fully appreciating the possibilities of variation in coloration and pattern, or of the alteration in shape and sculpture which can be produced by beach-rolling.

> 'The fauna of a few favourite and accessible strands is adequately known, mainly of course from dead and more or less beach-worn material. When "live" examples, dredged or otherwise, do turn up, it is frequently a matter of the greatest difficulty to appraise their relationship with the worn types or battered series which constitute all that is hitherto available.' (Tomlin. *Ann. S. Afr. Mus.*, xxv, p. 313, 1928.)

Thus a check-list would contain many hundreds of *names*; but how many of these names denote true species—species which a zoogeographer can regard as components of the South African fauna, and can accept for comparison with the faunas of other regions?

In past years, in addition to the persistent describing of '*species abrasae litoris*', erroneous identifications have swelled the list.[1] On the other hand,

[1] Tomlin. 1922. *J. Conch.*, *16*, 256–8.

energetic collecting of living molluscs has drastically reduced it, e.g. in the genus *Patella*.[2]

Dead shells recorded from the greater part of the South African coast—from the Cape to Pondoland or southern Natal—may be accepted in most cases as genuine inhabitants of these waters, especially species whose shells occur in abundance, because the habitats of the living animals are likely to be close at hand.

Very different, however, is the case of records from Natal and Zululand, whose shores are washed by the southward flowing Mozambique current, rendering possible the existence of many tropical Indo-Pacific species. Here an element of doubt creeps in, because most collectors do not confine themselves rigidly to one area, but include in their collections shells from neighbouring regions, e.g. the east coast of Africa or Mauritius. They may have spent a holiday in those areas, or accepted shells from friends; in the latter case the locality is hearsay. How many of the Indo-Pacific species of *Conus* or *Cypraea* (collectors' 'favourites'), which have been recorded from Durban or Natal, are known to live in South African waters and thus entitled to inclusion in the fauna-list?[3]

Another source of error, known to have occurred sometimes in entries in Museum accession registers, and suspected in some published records of localities, lies in recording the *domicile of the collector* (or donor) as the habitat of the mollusc.[4]

These remarks are not intended to discredit collectors, but to show that the only (scientifically) good mollusc is a live one.

A full historical account of the growth of our knowledge of South African molluscs must wait for inclusion in a monograph, but a few of the more important steps may be mentioned here.

Dr. Ferdinand Krauss visited the Cape and Natal in 1840. He himself collected and described many molluscs, and the beautiful illustrations in his work have scarcely been surpassed.[5] He did no dredging, but it is obvious that, for the most part, he collected living specimens.

In later years several beach-combers made collections which were submitted to overseas conchologists, e.g. Dr. E. Fritsch (1874), S. D. Bairstow, Dr. H. Becker, and Lt.-Col. W. H. Turton.

After his earlier collections had been described (by Edgar Smith, and Bartsch), Turton himself undertook the description of his main collection. His work may be described as a *tour de force*, but it is a stumbling-block to students of South African molluscs because it obviously contains many synonyms, which

[2] Tomlin & Stephenson. 1942. *Proc. Mal. Soc.*, *25*, 4; Koch. 1949. *Ann. Natal Mus.*, *XI*, 487.

[3] cf. Sowerby. 1889. *J. Conch.*, *6*, 10.

[4] Bairstow lived at Port Elizabeth, but did the recorded specimen of *Purpura trigona* really come from Port Elizabeth? Did Mrs. Trotter's example of *Voluta festiva* really come from Natal?

[5] *Die südafrikanischen Mollusken*. Stuttgart, 1848.

can only be correctly assigned by the re-examination of his collection (at Oxford) by someone thoroughly conversant with the South African fauna.

H. C. Burnup was a most careful and assiduous collector, especially of living material. The animals he sent to Professor Gwatkin, who extracted the radulae, but no shells were sent for verification.[6] In this manner errors are liable to occur, and indeed have occurred (e.g. *Euthria queketti*).

The littoral fauna, however, is but a small part of the fauna of a marine province. Several overseas expeditions have 'fished' molluscs in our waters. The U.S. North Pacific Exploring Expedition visited Simon's Bay in 1853, and the naturalist W. Stimpson collected both on shore and by dredging.[7]

H.M.S. *Samarang*, H.M.S. *Sulphur* and H.M.S. *Challenger* added to our knowledge. Later, with improved methods, and probably more care in sorting the material, the German Deep-sea Expedition (*Valdivia*) obtained many new species.[8]

All these expeditions were passing voyages. The first systematic exploration of the coastal seas around South Africa was carried out by the Cape Government under the direction of Dr. J. D. F. Gilchrist (Government Biologist, 1895–1907). The object was primarily economic: to discover payable fishing-grounds for steam-trawlers, but the scientific aspect was by no means neglected. During the years 1897–1907 the Cape Government trawler s.s. *Pieter Faure* operated around the coast from St. Helena Bay to Zululand, mostly in shallow and moderate depths, but down to 400 fathoms off East London and Natal, and 1,000 fathoms off Cape Point.

Large collections of marine organisms were obtained which, on the discontinuance of the Survey, were transferred to the ownership of the South African Museum (1910).

As regards the Mollusca the 'cream' of the collection was reported on by G. B. Sowerby (Third) before the collection came to the South African Museum.[9] After registration further material was submitted to the late J. R. le B. Tomlin.[10]

The reports by these two specialists are almost entirely *conchological*. In only very few instances did Sowerby mention the anatomy or the radula, although several of the novelties were described from specimens containing the animal. There is evidence to show that Professor Gwatkin extracted the radulae of some of these animals.[11] Excepting two species, all the material sent to Tomlin was dry.

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[6] Cooke. 1919. *Proc. Malac. Soc.*, *13*, 109.
[7] See: Bartsch. 1915. *Bull. U.S. Nat. Mus.*, no. 91, p. 2.
[8] Von Martens. 1903. *Wiss. Ergebn. D. Tiefsee Exp.*, *7*; Thiele. 1925. ibid., *17*; Thiele & Jaeckel. 1931. ibid., *21*.
[9] *Marine Investigations in South Africa*, i–v, 1898–1908. N.B. The dates of publication of the reports in this work are frequently earlier than the dates on the title-pages of the respective volumes. See: Barnard. 1950. *J. Soc. Bibl. Nat. Hist.*, *2*, 6, 187.
[10] *Ann. S. Afr. Mus.*, *20*, 1925; *25*, 1927–8; *29*, 1931; *30*, 1932 & 1934.
[11] e.g. *Conus patens*. See: p. *90*.

The greater part of the *Pieter Faure* collection of Mollusca, when transferred to the Museum, was preserved in formalin (later changed to alcohol), the exceptions being the specimens returned dry by Sowerby. On two occasions (one before the present writer was appointed to the staff, the other when he was overseas on leave), the collection was encroached upon to provide a representative series of South African molluscs for the public exhibition galleries. There would have been no objection to this procedure if the animals extracted from their shells had been replaced in the jars and preserved. They were not, though the opercula were neatly mounted in the customary manner. Thus, most regrettably, several species, the animals of which would have supplied most desirable taxonomic data, remain known to science by their shells alone.

Nevertheless the hitherto unknown radulae of several species have been obtained, and are described in the present work. Not unexpectedly, some species are shown to have been wrongly classified.

Recent examination of the *Pieter Faure* bottom-samples has resulted in finding not only several additions to the fauna-list (e.g. in the family *Turritidae*), but also further examples of species hitherto known only from singletons (e.g. *Drillia fossata* Sow., *Solariella persculpta* Sow., *Heliacus petasus* Tomlin) and unworn specimens of species known only from beach-worn examples (e.g. *Afritrophon insignis*). Moreover these bottom-samples have supplied data for plotting the distribution of some of the species; for this purpose broken examples and even small fragments, if the sculpture is distinctive, are useful.

The Museum Molluscan collections comprise also several private collections which have been acquired in the course of years by gift and bequest. While most of the shells in these collections are of little use for scientific purposes, examination of large quantities, sometimes hundreds of one and the same species, often provides successive stages in weathering and abrasion and thus a clue to the manner in which natural agencies can produce 'new species' for the over-enthusiastic conchologist.

The collection bequeathed by the late Dr. John Muir of Riversdale must be specially mentioned. In his retirement he patiently sorted through bagfuls of sand collected at Still Bay, and thereby obtained an extremely useful collection of the smaller species (*Turbonilla*, *Eulimella*, *Alvania*, etc.).

At the suggestion of the present writer he concentrated on tracing the growth, from protoconch upwards, of the commoner species. These series have been of great value in the present work, in which special attention has been paid to the protoconch and early whorls with a view to providing more precise definitions of the species.

Some of the features of the South African marine province have been discussed by von Martens (1903) and Tomlin (1922). Tomlin has cleared the ground by excluding records of European species based on erroneous identifications, due probably to beach-worn material. But comparison with other marine provinces is scarcely justified until at least the great majority of the species have been correctly classified. As an example, the Antarctic genus *Glypteuthria* has been recorded from Cape waters; but one of the species assigned to this genus has been shown to belong to a different family (Barnard, 1957), and the other is a *species inquirenda*. Therefore this genus cannot be claimed as indicating an Antarctic element in the South African fauna.

The recent identification (Knudsen, 1956) of a West African *Nassa* (*Nassarius*) with a Natal species (*N. desmoulioides*); the extraordinary likeness of the West African *Pleurotoma spiralis* Smith and the South African *P. fultoni* Sow.; and the discovery of shells off the coasts of West Africa and South West Africa apparently identical with the Italian Pliocene-Miocene *Cancellaria* (*Sveltia*) *lyrata*, open up tantalizing zoogeographical questions.

Mention may be made of one feature alluded to by von Martens (1903, p. 56), viz.: the pink coloration of several South African shells. Von Martens gave examples showing that it is 'characteristic' of shells in different families. Here again the beach-worn specimen has given a false impression. *Gibbula rosea* and *Coralliophila rosacea* may have a beautiful pink colour when picked up on the beach, but they are not at all pink when alive. A pink coloration may be normal in some species, but in others is obviously the result of weathering and chemical action. In the South African Museum collection there is a *Conus* which is *aurora* on one side and *lavendulus* on the other; a clear proof of the identity of the two so-called 'species'!

Mauve or lavender is another noticeable tint occurring chiefly on the protoconch and early whorls of some shells, e.g. *Eugyrina pustulata* and *Demoulia retusa*.

Taxonomy

The present work admittedly shows some conservatism in retaining some of the old-established and well-known generic names in preference to adopting a more modern taxonomy, in which a multiplicity of genera has been founded often on characters which seem to be meagre or artificial. In the case of the Cowries this splitting-up has been carried to such a fantastic extent that, of the several hundreds of known species, *only one* remains in the original genus *Cypraea*.

It seems doubtful whether this increasingly complex classification is of any real help to zoology, in particular to faunistic zoology.

Thiele (e.g. 1929, p. 368) objects to the use of the name of a fossil genus for a recent genus, however much alike they may be conchologically. The anatomy of the extinct animal can never be known. This very sound principle applies equally to species. In the above-mentioned case of *Cancellaria lyrata* the present writer considers it would be preferable to give the recent examples a separate specific name.[12] Zoogeographical conclusions based on the assumption that the fossil and Recent examples are conspecific may be erroneous and are certainly unscientific.

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[12] Perhaps a trinomial addition would meet the case, e.g. *Cancellaria lyrata vivans*.

Acknowledgements

Acknowledgements and thanks are herewith expressed to the South African Council for Scientific and Industrial Research for a Research Grant enabling me to undertake this work; to Dr. A. W. Crompton, Director of the South African Museum, for permitting me to continue my study of the South African Museum collections; to Prof. J. H. Day, University of Cape Town, for submitting for identification and comparison the large collection of molluscs preserved in the Zoology Department under his charge; to the Professor of Zoology and Mrs. Kalk, University of the Witwatersrand, for the opportunity of examining their collection from Delagoa Bay; to Mr. A. E. Salisbury of the Conchological Society of Great Britain, for comparing many specimens and giving me the benefit of his knowledge and experience; and to my College friend H. Watson of Cambridge, well known for his malacological researches.

Tribute must also be given to H. C. Burnup (†1928) and J. R. le B. Tomlin (†1954), with whom I discussed synonymies and other matters relating to South African Molluscs for many years.

Abbreviations

P.F. . . The Cape Government trawler s.s. *Pieter Faure.*

U.C.T. . University of Cape Town Ecological Survey.

U.W. . . University of the Witwatersrand Zoology Department.

Specimens taken by the s.s. *Africana*, Fisheries Survey, Union of South Africa, were submitted through Prof. Day of the University of Cape Town.

Fam. *TEREBRIDAE*

1928. Tomlin. *Ann. S. Afr. Mus.*, xxv, p. 329 ('records . . . so scanty that any additional information is worth chronicling').

Species recorded from South Africa, but whose occurrence in South African waters has yet to be confirmed:

Hastula apicina (Desh.)	*Terebra macandrewi* Smith
,, *cuspidata* (Hinds)	,, *monilis* Q. & G.
Terebra archimedis (Desh.)	,, *pertusa* Born.
,, *babylonia* Lam.	,, *raphanula* Lam.
,, *cingulifera* Lam.	,, *subulata* Linn.
,, *grayi* Smith	,, *textilis* Hinds
,, *livida* Rve.	,, *tiarella* Desh. ? a Columbellid

Species inquirendae (only one specimen of each known):

Terebra filmerae Sow.

,, *kowiensis* Turton (*v. infra*)

For convenience the shells may be separated into two groups:

No spiral groove: *Hastula apicitincta* Sow., *casta* var. *natalensis* Smith, *Terebra diversa* Smith, *filmerae* Sow., *kowiensis* Turton, *lightfooti* Smith, *planecosta* n. sp., *thielei* n. sp.

With spiral groove: *Diplomeriza duplicata* (Linn.), *fictilis* (Hinds), *Terebra affinis* Gray, *babylonia* Lam., *capensis* Smith, *cingulifera* Lam., *circinata* Desh., *dimidiata* Linn., *evoluta* Desh., *laevigata* Gray, *loisae* Smith, *longiscata* Desh., *monilis* Q. & G., *myuros* Lam., *nebulosa* Sow., *spectabilis* Hinds, *straminea* Gray, *subulata* Linn., *suspensa* Smith.

Terebra circinata Desh.

Delagoa Bay. One animal examined: no radula.

Terebra myuros Lam.

Off O'Neil Peak (Zululand), 55 fathoms (S. Afr. Mus. P.F. Coll.); Natal (S. Afr. Mus.).

The badly worn P.F. specimen is stouter than normal (less 'rat-tail'-like). The Natal specimen is slightly worn, but retains its colouring. The exact locality is not recorded, but the P.F. specimen allows this species to be added to the South African fauna-list.

S. Afr. Mus. also has specimens collected by E. L. Layard (on board H.M.S. *Castor*, 1856) at Farquhar Island (10° S., 51° E.).

Terebra straminea Gray

Off O'Neil Peak (Zululand), 55 fathoms (S. Afr. Mus. P.F. Coll.). Two somewhat worn specimens.

Terebra lightfooti Smith

Fig. 1 *c*

Table Bay, 22 fathoms, 11 dead; twelve miles S.E. of Cape Point, 45 fathoms, 2 dead but fresh; Brown's Bank (approx. 36½° S., 21° E.), 80–100 fathoms, 1 dead. (S. Afr. Mus. P.F. Coll.) Living: False Bay, 52 metres (U.C.T.).

Apex corroded in all specimens seen, but protoconch seemingly 2-whorled.

Terebra capensis Smith

Fig. 1 *e*

Protoconch 2 whorls, alt. and diam. 0·5 mm., smooth. Very fine spiral striae in the intervals between ribs, *c.* 10 on early whorls, becoming fewer and irregularly spaced on later whorls.

Still Bay, dead shells common (S. Afr. Mus. Muir Coll.).

Off Cape St. Blaize, 37 fathoms, 1 dead (S. Afr. Mus. P.F. Coll.).

The record from Karachi (1901. Melvill and Standen. *Proc. Zool. Soc. Lond.*, ii, p. 428) is probably a misidentification.

Terebra suspensa Smith

Protoconch 2–2½ whorls, alt. and diam. 0·75 mm., smooth.

Pleistocene deposits at Sedgefield, Groenvlei (Knysna district). (S. Afr. Mus.) See A. R. H. Martin. *S. Afr. J. Sci.*, 52, p. 187, 1956.

Still Bay, dead shells (S. Afr. Mus. Muir Coll.).

Terebra diversa Smith

Protoconch 2 whorls, alt. and diam. 0·5 mm., smooth.

No records west of Pondoland (S. Afr. Mus.) except the single specimen recorded by Bartsch (1915, p. 11) as collected by Stimpson in False Bay during the U.S. North Pacific Exploring Expedition. Like other species collected on this expedition the specimen bears a *low* register number in the U.S. Nat. Mus. Catalogue (see Bartsch, *passim*), and its provenance can therefore be accepted.

Terebra affinis Gray

S. Afr. Mus. has 2 (one very worn) from Delagoa Bay. Also collected by Layard (on board H.M.S. *Castor*, 1856) at Farquhar Island.

Terebra spectabilis Hinds

Two specimens in good condition but evidently not alive when dredged: off Amatikulu River (Zululand), 24 fathoms; and off Cape Natal (Durban), 54 fathoms (S. Afr. Mus. P.F. Coll.).

The 32 mm. Zululand specimen was identified by Sowerby.

T. geminata Desh. 1859 was considered a synonym by Sowerby (1897).

Terebra longiscata Desh.

Off Cape Natal (Durban), 54 fathoms, 1 dead (S. Afr. Mus. P.F. Coll.).

Terebra casta Hinds

Typical form (with flat ribs): Nacala, north of Mozambique Island (U.W.).

In var. *natalensis* the protoconch has 4½–5 whorls, alt. 0·75 mm., diam. 1st whorl *c.* 0·15, 5th whorl 0·5 mm., smooth, dark maroon or purplish-brown.

The variety seems to merit the epithet 'tinted apex' far more than Sowerby's *apicitincta*.

No animal available for determining the correct genus.

Terebra dimidiata Linn.

Living: Delagoa Bay (U.W.). Animal (as preserved) yellowish-brown.

S. Afr. Mus. has it from Fernão Veloso Bay, north of Mozambique Island (from the collection of P. Ross Frames).

Terebra thielei n. sp.

Fig. 1 *d*

? 1925. Thiele. *D. Tiefsee Exp.*, xvii, p. 256, pl. 41 (29), fig. 17. (*Terebra* sp., part).

Four specimens, 4–6·5 mm. in length, with 3 or 4 postnatal whorls; 11 axial ribs on 1st whorl, increasing to 14–15 (16), the ribs are broadly rounded with narrower intervals, contrasting with the narrowly rounded ribs and wide intervals of *capensis*; no spiral groove or spiral striae.

33° 50′ S., 25° 48′ E. (depth?), and Algoa Bay, 155 metres (Thiele).

Algoa Bay, 67 fathoms, 4 dead specimens (S. Afr. Mus. A.8657, P.F. Coll.).

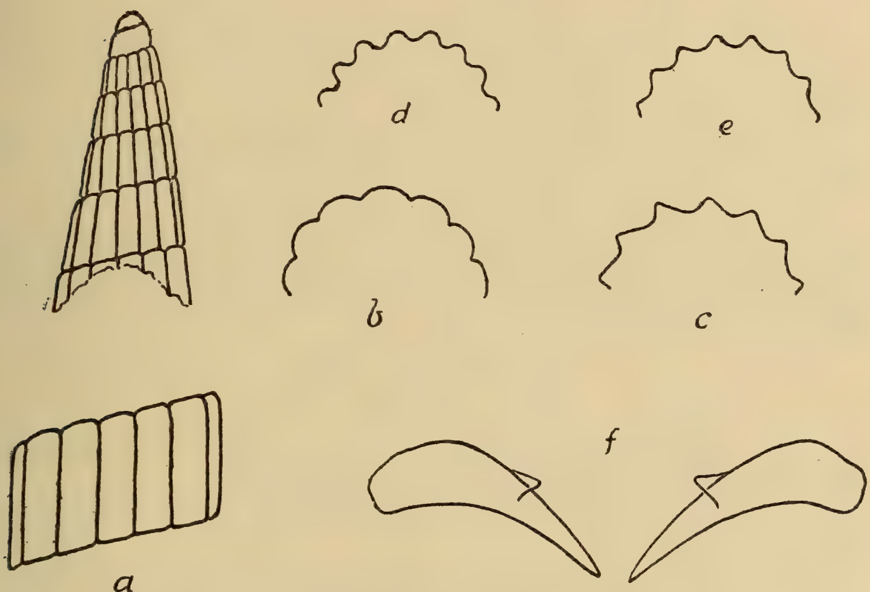

FIG. 1. *a. Terebra planecosta* n. sp. 5 mm. fragment above, one whorl of 9 mm. Type below. *b, c, d, e.* Diagrammatic cross-sections of *T. planecosta* n. sp., *lightfooti* Smith, *thielei* n. sp., and *capensis* Smith, respectively. *f.* One pair of teeth from radula of *Diplomeriza fictilis* (Hinds).

One specimen 5·25×2·25 mm., one 5·25×2 mm., one fragment 4 mm. long, one with 4 postnatal whorls 6·5 mm. long. All four appear to be conspecific, although the two complete specimens differ in proportionate width.

Thiele had one specimen from both of the above localities, and also a third from Gt. Fish Bay, Angola; but I am inclined to query the identity of the latter.

Terebra planecosta n. sp.

Fig. 1 *a*, *b*

Protoconch 2 whorls, smooth. Postnatal whorls 8, early whorls with 11 straight axial ribs, broad and flat, with narrow, shallow intervening grooves, increasing to 12 or 13 on later whorls; no spiral groove or spiral striae.

Type, protoconch plus 6 whorls 9 mm., another specimen consisting of the 3rd to 8th whorls 12·5 mm.; fragment protoconch and 5 whorls 5 mm.

Glossy, pale buff, a faint darker band on upper half of whorls.

Off Cove Rock (East London area), 4½ miles, 22 fathoms, one dead (Type, A8659); Cape St. Blaize, N. × E., 73 miles, 125 fathoms, two broken specimens, A8658 (S. Afr. Mus. P.F. Coll.).

Terebra kowiensis Turton

1932. Turton. *Mar. Sh. Pt. Alfred*, p. 11, pl. 2, no. 92.

The figure shows an 18 mm. shell with 6 whorls; nearly straight, broad axial ribs with narrow intervals, 7 on 2nd whorl, about 10 or 11 on last whorl; the photograph does not seem to have been retouched (as have some of Turton's photographs), so one may reckon there should be about 24 axial ribs on the complete circumference of the last whorl.

Such as it is, the description does not correspond: 7 whorls, and about 40 ribs on the last whorl. The number 40 is probably a misprint.

In having no spiral sculpture, Turton's shell has some resemblance to *thielei* and *planecosta*; to the former species in regard to the number of ribs, to the latter in regard to their (apparent) flatness and narrow intervals. But the *kowiensis* photograph shows a greater number of ribs, and an altogether larger shell.

Diplomeriza fictilis (Hinds)

Fig. 1 *f*

1845. Hinds in Sowerby. *Thes. Conch.*, i, p. 183, pl. 45, figs. 109, 110 (*Terebra f.*).
1928. Tomlin. *Ann. S. Afr. Mus.*, xxv, p. 329 (*Terebra f.*).

Protoconch 1½ (?2) whorls, alt. 0·2, diam. 0·25 mm., smooth (all specimens slightly corroded).

Three of the shells mentioned by Tomlin have been examined and found to possess a radula comprising 24 pairs of solid, slightly curved teeth. This species must therefore be removed from *Terebra* s.s.

In contrast with Thiele's (1929, *Handbuch*, i) figure 469 (after Troschel) of a radula tooth of *D. duplicata*, the denticle or flange is on the anterior margin in *fictilis*.

Diplomeriza duplicata (Linn.)

S. Afr. Mus. has examples obtained by P. Ross Frames from Fernâo Veloso Bay, north of Mozambique Island. There is every probability that the species occurs farther south.

Fam. *CONIDAE*

1937. Tomlin. *Proc. Malac. Soc.*, xxii, pp. 205–330 (list of Recent and fossil species).

The following species have been recorded from South Africa (Cape and Natal), but their presence as living components of the fauna has yet to be confirmed: *aplustre*, *arachnoideus*, *bandanus*, *capitaneus*, *consors*, *conspersus*, *crotchii* (Saldanha Bay!), *eumitos* Tomlin 1926 (? =*panniculus*), *figulinus* (Durban: S. Afr.

Mus.), *geographus*, *gilvus* (Saldanha Bay!), *glans*, *gubernator*, *guttatus*, *lamarckii*, *legatus*, *lineatus*, *litteratus*, *namocanus*, *nimbosus*, *obscurus*, *pauperculus*, *plumbeus*, *primula*, *punctatus*, *quercinus*, *tulipa*.

The other species may be accepted as South African, subject to future research on synonymy (e.g. *elongatus-mozambicus* and *simplex*).

Conus eucoronatus Sow. (3rd)

1903. Sowerby. *Mar. Invest. S. Afr.*, ii, p. 217, pl. 3, fig. 9.
1939. Peile. *Proc. Mal. Soc.*, xxiii, p. 354 (radula).

As the figure shows: the width '34' is a misprint for 24 mm.

The second specimen recorded from Natal by Sowerby was a dead example. A third example, also dead, 24 mm. long, was taken off Durnford Point (Zululand) in 90 fathoms; and a fragment with the distinctive sculpture, from off O'Neil Peak (Zululand), 90 fathoms. (S. Afr. Mus. P.F. Coll.)

The Type, now in S. Afr. Mus., was presumably a living specimen, the animal of which was extracted by Sowerby and sent to Gwatkin, because Peile records a Gwatkin slide of the radula (in Brit. Mus.). The radula teeth are similar to those of *aurora*. There is, however, no certainty that this radula belongs to *eucoronatus*.

Conus papillaris Ad. & Rve.

1848. Adams and Reeve. *Zool. H.M.S. 'Samarang' Moll.*, p. 17, pl. 5, figs. 7*a*, *b* (coloured).
1873. Sowerby. *Proc. Zool. Soc. Lond.*, p. 146, pl. 15, fig. 4 (coloured) (*altispiratus*).

Shoulder angular, with moderately numerous and prominent, slightly oblique knobs, spire high, turreted, angle 70°–80°, whorls above shoulder with axial lines of growth but no spiral striae. Periostracum thin, adherent. 49×23 mm.

Operculum narrow, ovate-cuneiform, margin entire, $5{\cdot}5 \times 1{\cdot}75$ mm. in 49 mm. shell.

Agulhas Bank (Sowerby, 2nd); False Bay, 18–23 fathoms (S. Afr. Mus. P.F. Coll.).

Although described in the *Samarang* Report, the type specimen of *papillaris* was taken during Sir Edward Belcher's previous voyage in H.M.S. *Sulphur*. No note of its locality was attached to it. Nevertheless there is no improbability in its having been dredged on the Agulhas Bank, together with several other molluscs which were described by Hinds in the *Sulphur* Report. This is supported by the almost exact resemblance of the largest S. Afr. Mus. specimen to Adams & Reeve's figure; it is slightly larger (if the figure of *papillaris* is natural size: 42 mm.), and not so strongly coronate, but otherwise might well have posed for the original illustration.

Moreover, although Sowerby (3rd) identified this one specimen as his father's *altispiratus*, he identified other P.F. specimens from the Agulhas Bank as *papillaris*, without however recording them in print. These latter, being non-coronate, I regard as *gradatulus* (q.v.).

At first sight there is more resemblance between the figures of *turritus* Sow. 1870 and *papillaris* than between those of *altispiratus* and *papillaris*; and Sowerby (1870. *Proc. Zool. Soc. Lond.*, p. 256) said that *turritus* was slightly suggestive of *papillaris* but was non-coronate. Sowerby's description of *altispiratus* does not mention the shoulder knobs, but his figure shows them. (His comparison with *franciscanus* seems inexplicable because the latter is quite different in shape.)

Possibly this is a case of a species having coronate and non-coronate forms, analogous to that suspected in *lividus-flavidus*. In *C. semisulcatus* Sow. the early whorls are coronate, the later ones non-coronate. See *Illustr. Zool. R.I.M.S. 'Investigator' Moll.*, pl. 14, figs. 1, 1*a*, 1907; also Smith's remarks on *C. aculeiformis* Rve. in *Ann. Mag. Nat. Hist.* (7), xiii, p. 455, 1904.

The largest specimen was taken alive, and retains the operculum; Sowerby probably retained the animal. Another specimen, 40 (protoconch missing) × 18 mm., with shoulder and spire slightly worn and corroded, closely resembles the figure of *altispiratus*.

Five dead juveniles from Still Bay (S. Afr. Mus. Muir Coll.) are coronate and may perhaps be this species; but the early whorls have 2–3 spiral striae above the shoulder, and there are no connecting stages.

Conus imperialis Lam.

1906. Smith. *Ann. Natal Mus.*, i, p. 22, pl. 7, fig. 1 (*queketti*).

In spite of Smith saying 'a very distinct species and not comparable with any of the known forms', I venture to suggest that *queketti* is synonymous with *imperialis*.

S. Afr. Mus. has examples of *imperialis* from Mozambique Island (Ross Frames Coll.), and Diego Garcia.

Conus ebraeus Linn.

1939. Peile. *Proc. Mal. Soc.*, xxiii, p. 352, fig. 16 (radula).

Living examples known from: Scottburgh (Natal) (S. Afr. Mus. Coll. Burnup); Port St. Johns and Umgazana (Pondoland), Umtwalumi (Natal) (U.C.T.); Delagoa Bay (U.W.).

Peile says the radula teeth have neither barb, blade, nor serrations.

Conus arenatus Brug.

1929. Thiele. *Handbuch*, i, fig. 463 (radula).

1939. Peile. *Proc. Mal. Soc.*, xxiii, p. 352, fig. 24 (radula).

Living: Durban (S. Afr. Mus. Coll. Burnup); Delagoa Bay (U.W.).

The radula tooth of the Delagoa Bay specimen conforms with Peile's figure.

Conus ceylanensis Brug.

1939. Peile. *Proc. Mal. Soc.*, xxiii, p. 352 (radula).

Living: Scottburgh (Natal) (S. Afr. Mus. Coll. Burnup); Delagoa Bay (U.W.).

One of the Scottburgh specimens is subscalariform.

Conus miliaris Brug.

1939. Peile. *Proc. Mal. Soc.*, xxiii, p. 352 (radula).

Living: Scottburgh (Natal) (S. Afr. Mus. Coll. Burnup); Delagoa Bay (U.W.).

Conus minimus Linn.

Living: Isipingo, Natal (S. Afr. Mus. Coll. Burnup); Delagoa Bay (U.W.); Durban Bay, and a dead but fresh specimen from Umgazana, south of Port St. Johns (U.C.T.).

Conus zeylanicus Gmelin

1939. Peile. *Proc. Mal. Soc.*, xxiii, p. 352, fig. 25 (radula).

Living: Durban (S. Afr. Mus. Coll. Burnup).

Conus lividus Brug.

Fig. 2 *g*

1939. Peile. *Proc. Mal. Soc.*, xxiii, p. 352, fig. 15 (radula).

Living: Scottburgh (S. Afr. Mus. Coll. Burnup); Isipingo and Durban (U.C.T.); Delagoa Bay (K.H.B., also U.W.).

The radula of a Delagoa Bay specimen is not long-shafted, has a barb, a narrow blade, and serrations extending to nearly midway on the shaft. This is in conflict with Peile's description and figure of a Seychelles specimen.

Conus flavidus Lam.

1939. Peile. *Proc. Mal. Soc.*, xxiii, p. 352 (radula).

1952. Braga. *Anais J. Invest. Ultramar.*, vii, 3, p. 70, pl. 1, fig. 8.

It has been suggested that this is the non-coronate form of *lividus*. The spiral striae on the whorls of the spire do not seem to be nearly so well marked as in *lividus*.

Conus textile Linn.

1939. Peile. *Proc. Mal. Soc.*, xxiii, p. 350, fig. 9 (radula).

Living: Delagoa Bay (U.W.).

Conus betulinus Linn.

1939. Peile. *Proc. Mal. Soc.*, xxiii, p. 352, fig. 21 (radula).

1952. Braga. *Anais J. Invest. Ultramar.*, vii, 3, p. 69, pl. 1, fig. 9.

Living: Delagoa Bay (U.W.).

Conus miles Linn.

1939. Peile. *Proc. Mal. Soc.*, xxiii, p. 354, fig. 26 (radula).

S. Afr. Mus. P.F. Coll. has a specimen retaining its periostracum, without precise locality.

Conus catus Brug.

1939. Peile. *Proc. Mal. Soc.*, xxiii, p. 349 (radula).

Living: Scottburgh (S. Afr. Mus. Coll. Burnup).

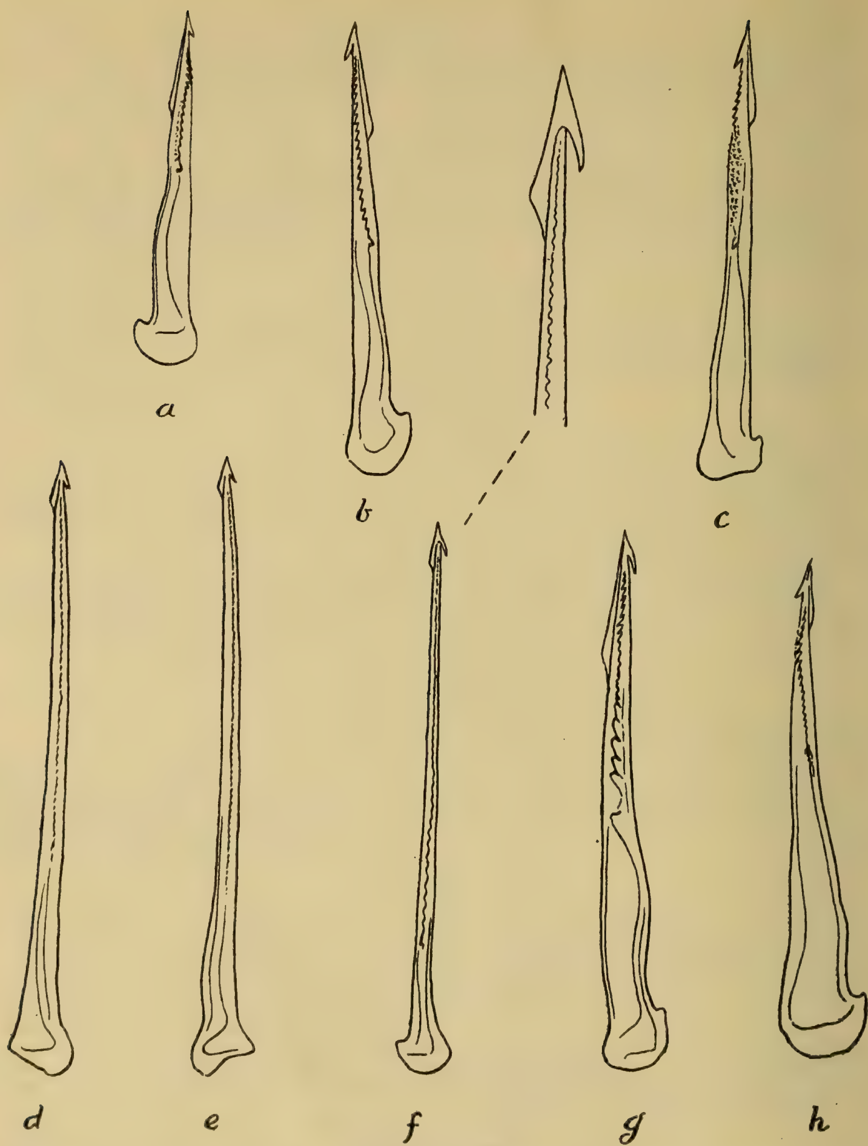

FIG. 2. Radula teeth of *Conus*. *a. infrenatus*, *b. aurora*, *c. elongatus*, *d. gilchristi*, *e. natalis*, *f. vexillum*, *g. lividus*, *h. gradatulus*, *d*, *e*. copies of drawings by H. Watson of teeth in his collection, mounted by Gwatkin; the mount of *gilchristi* is labelled [received from] 'Sowerby 1903'.

Conus rattus Brug.

1939. Peile. *Proc. Mal. Soc.*, xxiii, p. 351 (radula).
Living: Scottburgh (S. Afr. Mus. Coll. Burnup).

Conus vexillum Gmelin

Fig. 2 *f*

1939. Peile. *Proc. Mal. Soc.*, xxiii, p. 350, fig. 13 (radula).

Living: Off Cape St. Lucia (Zululand), 27 metres. 2 specimens (s.s. *Africana*, 15/5/48).

Shell thick, angle of spire 110°. Yellowish or pinkish, pale band around middle, darker band above and below; 2–3 narrow dark bands near shoulder, spire mottled; periostracum pale brown. Operculum narrow, margin entire. 56×28 mm.

Radula tooth with slender elongate shaft, small barb, bevelled blade, and serrations extending 4/5 length of shaft, ending in an obscure spur.

These specimens seem referable to this species as they are narrower than typical *namocanus*, and the brown spiral lines characteristic of the latter are absent.

Conus tessulatus Born

1939. Peile. *Proc. Mal. Soc.*, xxiii, p. 352, fig. 23 (radula).

Living: Delagoa Bay (U.W.).

The radula tooth of this specimen agrees with Peile's figure.

Conus piperatus Dillwyn

1939. Peile. *Proc. Mal. Soc.*, xxiii, p. 352, fig. 20 (radula).

Living: Scottburgh (S. Afr. Mus. Coll. Burnup).

Conus infrenatus Rve.

Fig. 2 *a*

1848. Reeve. *Conch. Icon. Suppl.*, pl. 3, sp. 285.

1889. Sowerby. *J. Conch.*, vi, p. 9, pl. 1, fig. 12 (*bairstowi*).

The S. Afr. Mus. series shows transition from the typical *infrenatus*, with numerous spots, the more prominent of which are arranged in at least 10 spiral series, 2 series in the middle usually enclosing a darker brown band; to *bairstowi* with pale unspotted ground-colour and only 6 well-spaced series of brown spots.

Living: Algoa Bay (U.C.T. *infrenatus*; and S. Afr. Mus. P.F. Coll.: *bairstowi*).

A radula of a typical *infrenatus* has 15 pairs of teeth, barb very fine, blade very narrow and inconspicuous, serrations extending not quite to midway on shaft (3/7), ending in a small spur.

Conus gilchristi Sow. (3rd)

Plate II and fig. 2 *d*

1939. Peile. *Proc. Mal. Soc.*, xxiii, p. 348 (radula).

Spire low, angle 130°. 52×27 mm.

The Type and only known specimen, now in S. Afr. Mus., was taken alive. The animal was presumably passed to Gwatkin, and, again presumably, it was a Gwatkin slide which Peile examined.

There exists another mounted tooth presented by Gwatkin to my friend H. Watson, Cambridge (in litt. 5/4/57). Shaft slender elongate (Watson: 3·65 mm.), barb small, blade short and bevelled, minute serrations extending at least to midway along shaft.

Conus natalis Sow. (2nd)

Plate II and fig. 2 *e*

Laps. cal. *natalensis* Sow. (3rd).

The shape varies: slender forms, somewhat elliptical in outline, with flatly rounded shoulder and rather high spire, angle 90° (fresh) to 105° or 110° (worn); plump forms, with more prominent shoulder and low spire, angle 120°–130° (or 135° worn).

Radula of a Port Shepstone specimen collected by Burnup, in coll. Watson, Cambridge: shaft 3·65 mm. long, similar to that of *gilchristi* (*supra*).

The most south-westerly locality for beach-worn specimens seems to be the Kowie (Port Alfred), whence S. Afr. Mus. has one example with the *gilchristi* pattern.

Placed side by side, a typical *natalis* would appear to be a species quite distinct from *gilchristi*. But the S. Afr. Mus. series indicates that they are only forms of one variable species. The accompanying photograph (Plate II) of a few specimens selected from the series demonstrates the variation in form (allowance being made for some examples which are beach-worn) and colour-pattern. The third shell from the right in the lower row has the *gilchristi* shape with the *natalis* pattern. The radula teeth are the same in the two forms.

The *Pieter Faure* obtained no specimens, dead or alive, of *natalis*. This may indicate that the *natalis* form is found in the littoral zone or very shallow water, while *gilchristi* is a deeper water form. It must, however, be borne in mind that trawling close inshore on the Natal coast is difficult; except at two or three places, e.g. Tugela River mouth, the *Pieter Faure* did scarcely any trawling within the 25-fathom contour.

A transition in colour pattern from *natalis* to *infrenatus* is almost possible, except that the latter is 'dotted' and never has the slightest trace of triangular or arrow-head markings. Moreover the radulae are quite different.

Burnup, with whom I discussed (1914) the matter, agreed that on the available evidence *gilchristi* should be regarded as a synonym of *natalis*. For the time being, however, I retain them here as two species.

Conus pictus Rve.

1843. Reeve. *Conch. Icon.*, i, pl. 18, sp. 98.
1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 14.
1937. Tomlin. *Proc. Mal. Soc.*, xxii, p. 291.

Pale buff or rosaceous, sometimes with faint darker spots, two paler bands, varying in width, articulated with darker spots or angular axial streaks, a third similar band at the anterior end, spire with irregular flames. 36 × 20 mm.

Six specimens received from the Albany Museum, Grahamstown, probably collected by Dr. H. Becker at the Kowie (Port Alfred), and labelled *pictus* Rve. This identification has been confirmed by A. E. Salisbury (1956). The shells are very like *beckeri* Sow. (1911), which both Tomlin (1937, loc. cit.) and Salisbury consider as a variety of *aurora*.

Bartsch recorded it (presumably dead) from Port Alfred and Gt. Fish River mouth.

A dead but fresh specimen was dredged in Algoa Bay (U.C.T.).

Conus scitulus Rve.

1848. Kiener. *Coq. viv.*, p. 218, pl. 55, fig. 4 (*iaspideus*, non Gmelin).
1848. Krauss. *Südafr. Moll.*, p. 131 (*jaspideus* Kien. non Gmelin).
1849. Reeve. *Conch. Icon. Suppl.*, pl. 9, sp. 283.
1858. Crosse. *Mag. Zool.* (2), x, p. 122 (*danieli*, nom. nov. for *jaspideus* Kien.).
1903. Smith. *Proc. Mal. Soc.*, v, p. 362.
1937. Tomlin. ibid., xxii, pp. 237, 263, 306.

Angle of spire 90°. A continuous reddish or orange-brown band below the shoulder, the rest of the whorl mottled orange on white ground, the mottling denser on base, spire with brown marks between white patches which latter are more or less lobate, descending to or very slightly over the shoulder (but not nearly so far as in *simplex*). 23 × 12 mm.

Algoa Bay (Kiener); Cape (Krauss, Smith); Hermanus (S. Afr. Mus.).

The worn Hermanus specimens were identified by J. H. Ponsonby, and recently (1956) confirmed by A. E. Salisbury.

The white patches around the shoulder give the species a strong resemblance to *simplex*.

Conus gradatulus Weink.

Fig. 2 *h*

1870. Sowerby. *Proc. Zool. Soc. Lond.*, p. 256, pl. 22, fig. 14 (coloured) (*turritus*, non Lam., fossil).
1875. Weinkauff in *Mart. Chemn.*, p. 356, pl. 66, fig. 15 (copy).
1903. Von Martens. *D. Tiefsee Exp.*, vii, p. 22.

Spire high, turreted, angle 70°–90°, shoulder angular, non-coronate; operculum narrow oval, margin entire; periostracum thin, fimbriate around the shoulders, adherent. Up to 54 × 24 mm.

Creamy-white, with faint indications of 3 fulvous bands, one below shoulder, one in middle and one between latter and base, aperture within faintly pink, periostracum pale buff or yellowish.

Radula tooth rather slender in distal two-thirds, barb small, blade very narrow, serrations extending about one-third length of shaft, no spur.

Agulhas Bank (Sowerby, von Martens).

Living: on Agulhas Bank from approx 27° E. to around Cape Point and off west coast of Cape Peninsula as far north as approx. latitude of Cape Town, 44–256 fathoms (S. Afr. Mus. P.F. Coll.).

Recorded also from Gt. Fish Bay, Angola, by von Martens.

Conus patens Sow. (3rd)

1939. Peile. *Proc. Mal. Soc.*, xxiii, p. 351 (radula).

Spire rather low, angle 105° (Type) to 110° (another specimen). Shoulder rounded-angular; operculum oval, margin entire; periostracum rather thick and rough.

According to Peile the radula teeth are similar to those of *vexillum*. Presumably the radula he examined was in the Gwatkin collection in the Brit. Mus. and derived from the animal of the unique Type shell.

Type in S. Afr. Mus. In the P.F. collection there is a smaller specimen, 36 mm. long, from off west coast of Cape Peninsula, 156 fathoms, identified by Sowerby. With this identification I agree. But Sowerby also identified several other specimens as *patens*, which I refer to *gradatulus* on account of their high spires. A curious feature confirms this: the thickish periostracum of both the Type and the smaller specimen of *patens* flakes off in patches, whereas the thin periostracum of *gradatulus* (and also *papillaris*) adheres closely to the shell.

Conus simplex Sow. (2nd)

1843. Reeve. *Conch. Icon.*, pl. 5, sp. 24 (*informis*, non Brug.).
1857/8. Sowerby. *Thes. Conch.*, iii, p. 31, pl. 9 (195), fig. 199.
1903. Smith. *Proc. Mal. Soc.*, v, p. 362 (quotes 'Thes. *iii*').
1937. Tomlin. ibid., xxii, p. 308 (quotes 'Thes. *ii*).

Spire high, angle 90°. Operculum oval, margin entire. Up to 54×24 mm.

Brown with a series of white irregular spots around middle and a series of crescentic or zigzag white marks in basal half, shoulder with white *lobate* blotches; or the white predominating as ground-colour, the brown forming zigzag axial streaks or flames. Animal dark grey.

Radula with 18–19 pairs of teeth which are similar to those of *elongatus* (q.v.).

Living: False Bay, 0–11 fathoms (S. Afr. Mus. P.F. Coll., also U.C.T.).

Recorded from East Indies by Sowerby. S. Afr. Mus. has two specimens from Mauritius.

The conspicuous white lobate patches around the shoulder are a distinctive feature, though somewhat similar but smaller patches occur in *scitulus*.

Conus elongatus Chemn.

Fig. 2 *c*

? Chemnitz. *Conch.*, x, pl. 144A, figs. i & k (quoted from Lamarck, 1810).
1798. Lamarck. *Tabl. Encycl.*, pl. 337, figs. 1, 2 (*mozambicus* Brug.).
1810. id. *Ann. Mus. Paris*, xv, p. 281 (*mozambicus* Brug.).

1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 13, pl. 1, fig. 12 (*alfredensis*).
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 12, pl. 3, no. 97 (juv. subscalariform).
1937. Tomlin. *Proc. Mal. Soc.*, xxii, pp. 210, 244, 278.

Protoconch $1\frac{1}{2}$–2 whorls, diam. 1·5 mm. In young shells with 1, 2 or 3 (sometimes 4) whorls spiral striae cover the whole whorl, but in older shells are confined to the base. Elongate, shoulder flatly rounded, spire high, angle *c.* 85°; operculum oval, margin entire. Up to 70×31 mm. (S. Afr. Mus. worn), 68×33 mm. (U.C.T. living).

Variable brown mottling on white ground colour, sometimes nearly continuous around body whorl, sometimes broken up into axial zigzags and flames, often a predominantly white spiral band around middle, sometimes spiral series of small brown rectangular spots; shoulder irregularly brown and white; inside of aperture faintly violaceous; periostracum yellow-brown, in fresh specimens almost concealing the shell pattern. Animal (as preserved) blackish.

Radula with 14–15 pairs of teeth, with barb, narrow blade, serrations extending to about midway along shaft, ending in a spur; the proximal part of the serrated ridge is bordered with minute scabrosities.

Living (or in fresh condition): Still Bay, Danger Point, Hermanus, False Bay, west coast of Cape Peninsula, Dassen Island, Langebaan (Saldanha Bay), Hondeklip Bay, Port Nolloth (S. Afr. Mus. and U.C.T.).

Recorded (dead) from Port Alfred and Port Elizabeth.

The *Pieter Faure* obtained the large 70 mm. worn specimen from 130 fathoms off the west coast of the Cape Peninsula.

C. alfredensis Bartsch. seems to me synonymous. Tomlin (1937, p. 210) makes it a synonym of *aurora*; but perhaps the words '=aurora' were intended to be inserted in the next entry, namely *algoensis*. The shape of *alfredensis* is more like that of *elongatus* than of *aurora*.

S. Afr. Mus. has a subscalariform example 40×17 mm. from Hermanus. cf. Turton's juv. $12 \times 5·5$ mm. from Port Alfred.

Tomlin in his 1937 list of Cones does not mention an *elongatus* of *Chemnitz*.

The identity of *mozambicus* and *elongatus*, or its occurrence on the east coast of Africa, has not yet been confirmed, so far as I am aware.

Conus aurora Lam.

Fig. 2 *b*

1939. Peile. *Proc. Mal. Soc.*, xxii, p. 352, fig. 19 (radula).

This common species has numerous synonyms: *algoensis*, *tinianus*, *caffer*, *loveni*, *secutor*, *fulvus*, *beckeri*, *lavendulus*, *kraussi*.

Shoulder rounded, spire moderate, angle 105°–115°. Up to 65×33 mm.

Colour and pattern very variable, ranging from almost uniform rose (*aurora*) and fulvous or chocolate (*algoensis*, *fulvus*) to the variously speckled, lined, and banded forms (*loveni*, *lavendulus*). The rose, lavender, or mauve coloration seems to be due, at least to some extent, to beach wear and weathering.

One specimen in S. Afr. Mus. has mauve ground colour on one side (*lavendulus*) and orange-pink on the other (*aurora*).

Radula with 14 pairs of teeth, 0·9–1 mm. long in a 35 mm. shell, with barb, narrow but rather long blade bevelled off, serrations extending to midway along shaft, ending in a small spur. Confirmed by a radula in coll. H. Watson, Cambridge (in litt. 5 Apr. 1957) with teeth 0·65 mm. long. Peile describes a tooth 0·5 mm. long with the serrations not extending beyond the blade.

Living: Richmond (Alexandria Division), and Still Bay (U.C.T.); Peile's and Watson's specimens of radulae from Algoa Bay examples.

Records of dead examples: from Tongaat (30 miles north of Durban) to Still Bay (S. Afr. Mus.).

Bartsch records an *algoensis* collected by the U.S. North Pacific Exploring Expedition in False Bay; this is probably an error because S. Afr. Mus. has no records of localities west of Still Bay, and U.C.T. has not found this species in False Bay.

The *Pieter Faure* obtained no examples in the course of all her trawling in Algoa Bay and on the Agulhas Bank.

There are plump and slender forms (cf. *loveni* and *caffer*). Sowerby figured a subscalariform *beckeri*, and Turton's No. 97 may be either *aurora* or *elongatus*. S. Afr. Mus. has a subscalariform example of the ornate variety mentioned below. This slipping of the body whorl away from the preceding whorl is particularly well shown in one freak specimen, 54 × 33 mm., which in addition has two bulbous expansions on the shoulder, the last one causing a wide bulge on the outer lip.

S. Afr. Mus. has several examples of a particularly ornate colour variety, unfortunately without precise locality: red-brown, nearly uniform or mottled to a varying extent with white, either irregular patches or axial zigzags, always a white band a little below the middle, with dark red-brown patches or zigzags, base with brown and white patches; sometimes faint spiral interrupted dark lines above and below the middle band; the latter is constant, though the relative amounts of brown and white vary.

Fam. *TURRITIDAE*

1929. Thiele. *Handbuch*, i, pp. 357–72 (*Conidae* part).

Thiele's *Conidae* embraced three subfamilies of 'Pleurotomids' and a fourth: the true Cones. The distinctive facies of the shell of the latter seems to require them to be kept in a separate family.

The family *Turritidae* is well represented in the South African region, especially by 'species' founded on beach-worn shells. The animals of most of them are unknown, and the species have been assigned to various genera on account of the similarity of the shells to typical representatives of these genera. Examination of radulae, however, has shown that some species, e.g. *Clavatula* *tumida*, *Pleurotoma* (*Drillia*) *scitecostata* and *fultoni*, have been assigned to entirely wrong genera (or even subfamilies).

For these reasons in the present work a fourth category has been added to Thiele's three subfamilies: *Species incertae sedis*. In most cases, maybe, conchologists have been guessing correctly in which genus to put a species, but until the animals have been examined we do not *know* the correct genus.

This fourth category is merely a temporary dumping-ground for 'conchological species'. It contains the great majority of the South African species, and indicates the pressing need for collecting living examples, especially of the littoral and inshore species. In some cases a species occurring in South Africa but well known from another region (e.g. *Turris cingulifera*) has been assumed to have been assigned to its correct genus in order to facilitate comparison with the shells of closely allied species.

The lateral plate of the radula of *Clavatula* and *Turris* seems to need investigation.

Thiele (1903. *D. Tiefsee Exp.*, vii, p. 173, pl. 9(4), fig. 7. *Pleurotoma* (= *Turris*)) describes the lateral plate as 'slipper'-shaped, i.e. resembling a picture of a slipper in *one plane*. He does not suggest the plate is actually slipper-like, i.e. a hollow cone, sharply pointed at one end, obliquely truncate at the other end. In *C. sinuata* the plate is a solid 3-sided pyramid with the basal half obliquely sheared off. Associated with the plate is a thin oval lamella ('wing': Thiele). Is this lamella attached to the plate at the distal end of the bevelled portion? Is it an actual appendage ('Anhang': Thiele, 1925. *D. Tiefsee Exp.*, xvii, p. 206; and 1929. *Handbuch*, i, p. 357)?

Thiele's figures 13 and 14 (1925. loc. cit.) show it as such; but figure 13 (*sinuata*) is certainly incorrectly drawn. In arranging a radula on a slide, this lamella can easily be displaced, and is then seen to have no point of attachment, being rounded at both ends, sometimes more narrowly rounded or subacute at the inner or median end.

If the lamella is not attached, the further question arises: does it lie inside the bevelled portion of the plate or outside? By manipulation of the radula during mounting, I am inclined to adopt the latter view. If this is correct, cannot this lamella be regarded as a degenerate 2nd lateral or a marginal plate? Or, following Cooke (1895. *Cambr. Nat. Hist.*, iii, pp. 218, 219) the lamella is the degenerate lateral, the conical plate the marginal or uncinus (in either case, formula 1.1.1.1.1).

In *indica*, *gilchristi*, and *lobata* I have not succeeded in separating an accessory (or concomitant) lamella from a 'lateral' plate; in fact I doubt whether there is any accessory lamella.

The distal half of the plate is conical, possibly triquetral at the apex; the proximal half is a flat 'handle', which is about half the thickness of the conical part in side view, but as broad as the latter in face view. In side view an accessory lamella often appears to be present, but in face view this appearance is seen to be due to the sides of the 'handle' curving upwards (and slightly inwards).

Thus the proximal half of the plate appears to be a hollow half-cylinder, the distal half a solid cone.

The forked appearance seen in some preparations in more or less face view (fig. 3 *g*, *h* and cf. Thiele, 1925. figs. 17, 19) is due to the transmitted light having to penetrate a greater thickness of 'chitin', the flanges being seen in edge-view.

The above suggestions should be investigated by section-cutting and more refined methods of preparation than are available to me.

Subfam. Turrinae Thiele (? emend: Turritinae)

Gen. Drillia Gray

Of the numerous South African species hitherto assigned to this genus I have been able to examine the animals of only four: *stolida*, *grayi*, *scitecostata*, *fultoni*. As a result one goes into a different genus and three into a different subfamily.

Drillia falsa n. sp.

Figs. 3 *a*, 4 *a*

Spire subtending an angle of *c*. 30°. Aperture 1½ in spire. Protoconch 2 whorls, diam. 1, alt. 0·75 mm., smooth. Postnatal whorls 5. Axial ribs 10 on 1st whorl, 9 on each of the others, oblique, protractive, narrower than intervals, not crossing sulcus, and petering out on base of last whorl. Growth-lines well marked. No spiral striae on whorls and only 3–4 very faint striae near extremity of base. Sulcus wide; lip sinus deep. Canal short. 9·5 × 3·75 mm. Operculum oval, nucleus apical. Pale fawn, operculum amber.

Radula with 34 rows, central plate narrow, lateral (intermediate) with 10–11 denticles, marginal with a small rounded lobe on postero-external corner.

False Bay (Tra. 139. s.s. *Africana* per U.C.T.).

Remarks. Thiele's species *ancilla* was 4·75 mm. long, with 4 whorls, diam. protoconch 0·55 mm. (in figure), and, judging by the figure, the lip sinus was already developed; the present specimen agrees with the characters given by Thiele, except the ribs do not cross the sulcus; but it is a larger species with distinctly larger protoconch.

Resembles *hottentota* in having no spiral sculpture, but seems to be a smaller species with more prominent shoulder and consequently more convex profile, and fewer axial ribs.

Clavatula taxus Chemn.

Figs. 3 *b*, 4 *b*

1923. Odhner. *Med. Göteb. Mus.*, xxiii, p. 7 (*taxus*, and *bimarginata* non Lam.).
1926. Tomlin. *Ann. Natal Mus.*, v, p. 289 (*bimarginata*, apud Odhner).
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 18, and var. *affinis*, p. 18, pl. 3, no. 142.
1932. id. ibid., p. 18, pl. 4, no. 144 (*rufanensis*).

FIG. 3. Radula teeth of: *a. Drillia falsa* n. sp., central, lateral and marginal. *b. Clavatula taxus* Chemn. central and lateral. *c. C. gravis* (Hinds), three centrals and laterals, showing 'accessory lamellae' displaced while arranging radula on slide for mounting. *d. C. sinuata* Born., central and lateral, face and edge views of latter. *e. Turris stolida* (Hinds), lateral. *f. T. saldanhae* n. sp., lateral. *g. T. indica* Bolten, face and edge views. *h. T. gilchristi* (Sow.), face and edge views. *i. T. lobata* (Sow.), from lobate East London specimen. *j.* from Cape Point specimen.

Protoconch 2 whorls, diam. 1·3 mm., smooth. Postnatal whorls 10. Oblique ridges above suture usually distinct in early whorls, obsolete in later whorls. Fine spiral striae. Cingulum usually prominently tumid, sometimes, chiefly in early whorls, feebly nodulose, and demarcated by a slight groove from the smooth area of sulcus, which is narrower than cingulum. Lip sinus narrow and very deep. 87 (without protoconch) × 29 mm. Up to 100 mm. (Turton).

Operculum oval, nucleus nearly at middle of inner margin, which is thickened or duplicated on outer surface; 16 × 5·5 mm. in a shell 48 mm. long.

Periostracum yellowish-brown, dark chestnut-brown, or blackish brown. Animal (as preserved) dull reddish-brown.

Radula with 42–50 rows, central plate small, narrow, with median cusp, lateral plate with wing-like appendage.

Off Cape Barracouta, 40 fathoms (Odhner); St. Sebastian Bay, 40 fathoms (coll. K.H.B.); off East London, and Algoa Bay to off Cape St. Blaize, 19–52 fathoms (S. Afr. Mus. P.F. Coll.); Simon's Bay (dredged) (S. Afr. Mus.); False Bay (U.C.T.).

Remarks. Odhner's 'bimarginata' was 25 mm. long. The Simon's Bay example (identified as *bimarginata* by J. H. Ponsonby) is 32 mm. long, and obviously a young *taxus*. There are two smaller examples, 21 and 15 mm., which show the oblique nodules and the spiral striae very clearly.

Juveniles of *taxus* and *gravis* may be liable to confusion; *taxus* has a slightly larger protoconch.

I have seen one example of the West African *bimarginata* Lam. (35 mm., from Goree). It has the whole base of the body whorl below shoulder with strong spiral lirae which completely obliterate the oblique axial ribs, reducing these to knobs on the shoulder; and the curve of the growth-lines on the sulcus is unsymmetrical, almost horizontally retractive below the cingulum and obliquely protractive above the shoulder knobs.

Melvill (1917. *Proc. Mal. Soc.*, xii, p. 165), quoting Reeve, says that the salmon-pink hue of this species (*bimarginata*) is unique in the genus. Presumably that applies to the cleaned shell, because the periostracum in the above specimen is dark chestnut or umber-brown.

There are broad and narrow individuals, e.g. 45×17 mm., 44×15 mm. and 48×18 mm. (the latter two taken in the same haul) (width across shoulder, excl. aperture).

I consider *rufanensis* Turton a young worn example of *taxus*.

Clavatula impages (Ad. & Rve.)

1848. Adams and Reeve. '*Samarang*', p. 39, pl. 9, fig. 1 (*Pleurotoma i.*).
1903. Von Martens. *D. Tiefsee Exp.*, vii, p. 23 (*Clionella impages*, non Ad. & Rve.).
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 18 (*impages ?*).

First recorded in South Africa by von Martens from 35° 16′ S., 22° 26′ E., 155 metres, and from Port Elizabeth (dead).

One of these specimens was stated by E. A. Smith to be similar to the type of *impages*. Von Martens doubted the locality 'China Sea' given by Adams and Reeve, because of the likeness to *taxus*, and the restriction of the genus *Clionella* to South Africa (the latter not at all a conclusive reason!).

Turton said he saw specimens at the British Museum labelled *taxus* var.

Both von Martens and Turton record their specimens as being narrower than *taxus*. The S. Afr. Mus. series, short as it is, shows that this is not a specific character. Moreover the original figure of *impages* shows none of the features characteristic of *taxus*.

I propose therefore to delete *impages* Lam. from the South African fauna-list, and to add the recorded localities to those of *taxus*.

Clavatula gravis (Hinds)

Figs. 3 *c*, 4 *c*

1903. Sowerby. *Mar. Invest. S. Afr.*, ii, p. 229.
1903. Von Martens. *D. Tiefsee Exp.*, vii, p. 23.
1925. Thiele. ibid., xvii, p. 213, pl. 35(23), fig. 12.
[Not Turton. 1932. p. 19, pl. 4, no. 146=very worn *tumida*.]

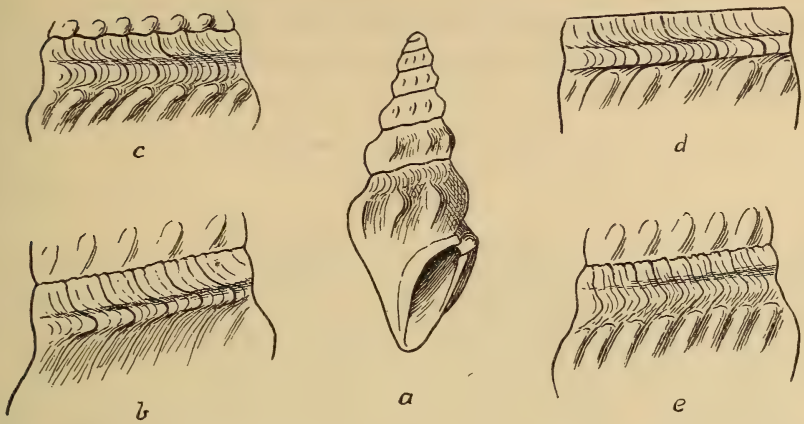

Fig. 4. *a. Drillia falsa* n. sp. *b. Clavatula taxus* Chemn. *c. C. gravis* (Hinds). *d. tripartita* Weink. *e.* 'Clavatula' *tumida* (Sow.). *b–e.* semidiagrammatic to show shape of lip sinus.

Protoconch 2 whorls, diam. 1 mm., smooth. Postnatal whorls 8–9. Fine spiral striae on all whorls, somewhat variable in strength. Nodules above shoulder appear subcircular to naked eye but slightly oblique under a lens; suture runs close below these nodules, sometimes encroaching on them, but never completely absorbing or concealing them (cf. Thiele's figure). Tumid cingulum below suture may be more prominent than the nodules above, and may itself be slightly nodulose, but is never demarcated by a groove from the smooth area of the sulcus, which is broader than the cingulum; lip sinus broad and rather deep. On last whorl the nodules extend basally as oblique ridges, sometimes with an additional ridge or a series of feeble nodules below the shoulder (cf. Thiele's figure). Up to 45 mm. long.

Operculum oval, nucleus at middle of inner margin, which is thickened; $5 \times 2{\cdot}75$ mm. in shell 23 mm. long.

Cream under the pale buff periostracum, with faint indications of slightly darker marks, end of rostrum pinkish-brown; operculum amber.

Radula with 50 rows (23 mm. shell), central plate small, narrow, acicular, lateral with wing-like appendage.

Cape Agulhas, 43 fathoms (Hinds); Agulhas Bank, 47 and 17 fathoms (Sowerby); St. Francis Bay, 80–100 metres (von Martens); off Durnford Point (Zululand), 13 fathoms; off Umhloti and Umkomaas Rivers (Natal), 27 fathoms and 40 fathoms; off East London, 45 fathoms, and Algoa Bay to False Bay, 10–47 fathoms (S. Afr. Mus. P.F. Coll., all dead but fresh). 35° S., 20° 49′ E., 91 metres, 1 dead, 1 living (s.s. *Africana*). False Bay and Mossel Bay, living (U.C.T.).

Reported from the estuary of the Congo (Dautzenberg. 1912. *Ann. Inst. Océan.*, 5, fasc. 3, p. 10). The identification should be checked.

Remarks. The 'bead-necklace' appearance, caused by the nodules above and the cingulum below the suture, is distinctive. The absence of a groove between cingulum and sulcus distinguishes this species, especially in the case of juveniles, from *taxus*.

Clavatula (*Melatoma*) *sinuata* Born

Figs. 3 *d*, 5 *a*

1877. Smith. *Ann. Mag. Nat. Hist.* (4), xix, p. 499 (*borni*).
1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 17, pl. 2, fig. 2 (*turtoni*).
1915. id. ibid., p. 18 (*sinuata* and *bornii*).
1925. Thiele. *D. Tiefsee Exp.*, xvii, p. 204, fig. 13 (radula).
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 17, pl. 3, no. 137.

Length of aperture $1\frac{1}{2}$–2 times in spire. Protoconch ? Postnatal whorls 8 (?9). Oblique ribs 11–12 on early whorls, increasing to 15–16 on later whorls, sometimes 18 on body whorl of large specimens, extending to or almost to canal. Suture undulate, embracing lower ends of ribs; a slightly nodulose cingulum below suture; sulcus shallow; outer lip with narrow and rather deep sinus, which at the formation of each successive rib produces a *nodule slightly more prominent than the rib below it.* Growth-lines across sulcus only slightly oblique to the suture. Spiral striae (when present) numerous, inconspicuous, best seen on early whorls. Up to 60 mm. long.

Operculum oval, nucleus in middle of inner margin, which is duplicated on outer surface; 8×4 mm. in shell 25 mm., 10×5 in shell 40 mm.

Brown, with dark brown or blackish periostracum; or pale brown with yellowish-brown periostracum (*bornii*, *turtoni*).

Radula with 50–60 rows, central plate small, squarish, with median cusp, lateral rather slender, with wing-like appendage.

Port Alfred, Hermanus, False Bay, west coast of Cape Peninsula, Saldanha Bay, and northwards to Buffelsrivier (S. Afr. Mus. and U.C.T.). Recorded also from Natal by Krauss.

Littoral and shallow inshore waters. Not obtained in any of the *Pieter Faure* dredgings.

The pale form occurs together with the typical dark form at Port Alfred, but at the Cape only the latter.

Remarks. The lip sinus, not being in the concavity of the sulcus but forming a series of raised nodules corresponding with the ribs, is distinctive; in slightly worn examples these abraded nodules form a series of white beads separated by grooves in which the dark periostracum persists.

The apex and early whorls are much subject to corrosion, so that the normal number of whorls is uncertain. I have seen no specimen with its protoconch.

There are plump and slender individuals, e.g. 35×14, 43×14, 45×12, and 50×15 mm.

One specimen, 25 mm., from Saldanha Bay (U.C.T.), has ribs on $5\frac{1}{2}$ whorls, then after an injury, continues with extremely feeble ribs which become obsolete on the body whorl; the sinus, however, continues to form the characteristic keel.

Other specimens become ribless from the 3rd or 4th whorl onwards (cf. *sigillata*).

var. *sigillata* Rve.

Fig. 5 *b*

Length of aperture subequal to, or a little shorter than spire (but apex broken in all specimens). Protoconch? Postnatal whorls 6–$6\frac{1}{2}$. Whorls smooth, faint indications of ribs on the upper 4 or 5 whorls, and even less defined on earlier part of 6th whorl; a feeble spiral lira immediately below suture, and another marking the lower boundary of sulcus and middle of the lip sinus, thus corresponding with the series of nodules in typical *sinuata*; below this 2 or 3 additional very feeble lirae on body whorl, best seen where they have become white from abrasion. Sulcus very shallowly concave; lip sinus moderately wide, shallow, growth-lines very slightly curved. 19 (apex broken × 9 mm. (S. Afr. Mus.); 20 (protoconch missing) × 8 mm. (U.C.T.).

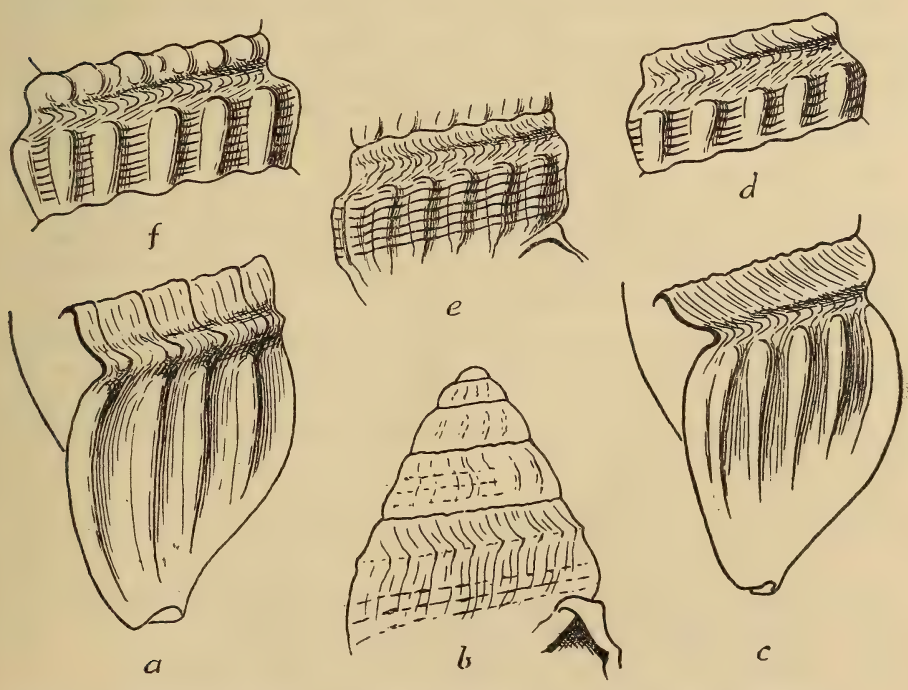

FIG. 5. *a. Clavatula sinuata* Born. *b.* var. *sigillata* Rve., worn, especially the apical whorls. *c. C. confusa* Smith. *d. C. kraussi* (Smith). *e. C. subventricosa* (Smith). *f. C. semicostata* Kiener.

Operculum as in *sinuata*, 5×2·75 mm. in shell 16 mm. long.

Greyish-brown, mottled and streaked with white due mostly to abrasion; operculum horny; periostracum yellowish.

Radula as in *sinuata*.

West and east coasts of Cape Peninsula (S. Afr. Mus. and U.C.T.).

Remarks. Seems to be merely a smooth and less turriform variety of *sinuata*.

Clavatula kraussi (Smith)

Fig. 5 *d*

1877. Smith. *Ann. Mag. Nat. Hist.* (4), xix, p. 500 (*Pleurotoma* (*Clionella*) *k.*).
1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 14 (*kraussii*).
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 15.

Length of aperture about 1½ times in spire. Protoconch ? Postnatal whorls 7–8 (?9). Oblique ribs 11–12 on early whorls, 12–13 on later whorls, starting from suture above and on body whorl extending halfway across base; shoulder slightly *below* middle of whorl; suture not, or only very slightly embracing lower ends of ribs; no nodular or only a very feeble cingulum below suture; sulcus not strongly concave. Fine spiral striae close together on sulcus, farther apart on rest of whorl, about 4 on early whorls, 6 on later whorls, usually only visible between the ribs. Outer lip with deep and narrow sinus, a little distance from suture. 33 (without protoconch) × 12 mm. Turton: up to 42 mm.

Operculum oval, nucleus at middle of inner margin, which is thickened.

White with purplish-brown dots and zigzag lines following the growth-lines, especially noticeable on the sulcus, inner surface of outer lip white, operculum horny, periostracum pale yellowish.

Radula similar to that of *sinnata*, with *c.* 50 rows, central plate small, quadrangular, with acicular median cusp, lateral with wing-like appendage.

Living: East London, Richmond (Alexandria Division); Port Elizabeth; Jeffreys Bay; False Bay (all U.C.T.).

Remarks. The 33 mm. example has on the body whorl some inconspicuous nodules on the ribs below the shoulder. One specimen (S. Afr. Mus., locality ?), 26×9 mm., has 16 ribs on each of the last four whorls, the early whorls worn.

There is a curious resemblance in colour pattern and spiral sculpture to *Drillia albotessellata* (q.v., p. 122).

Clavatula subventricosa (Smith)

Fig. 5 *e*

1877. Smith. *Ann. Mag. Nat. Hist.* (4), xix, p. 500 (*Pleurotoma* (*Clionella*) *s.*).
1892. Sowerby. *Mar. Sh. S. Afr.*, p. 6, pl. 4, fig. 76 (bad).
1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 16, pl. 2, fig. 8 (*nereia*).

Shoulder *above* middle of whorl. Protoconch ? Postnatal whorls 7 (? 8). Oblique ribs 14. Suture more or less embracing lower ends of ribs; cingulum not very noticeable and only sometimes slightly nodulose. Ribs as prominent at their lower ends as at the shoulder, and on the body whorl ending below rather abruptly, the profile being thus squarish. Spiral striae in sulcus fewer and farther apart than in *kraussi*, below shoulder 3–4 on early whorls, 5–6 on later whorls. 23×9 mm.

Operculum oval, nucleus at middle of inner margin, which is thickened.

White with orange-brown or purplish brown irregular spots and marks on sulcus; a pale band crossing the ribs and grooves, below which the base is brown, inner surface of outer lip consequently white above, followed by a brown band, canal white; operculum horny, periostracum greyish-brown.

Radula similar to that of *sinuata*, with *c.* 50 rows, central plate small, quadrangular, with acicular median cusp, lateral with wing-like appendage.

Living: East London, Richmond (Alexandria Division); Kleinmond (Bathurst Division); Port Elizabeth (all U.C.T.).

Dead: Still Bay (S. Afr. Mus.).

Remarks. Sometimes difficult to distinguish from *semicostata* and *kraussi*, but the squarish profile and the brown band inside the aperture seem to be distinctive.

The Still Bay specimens (coll. Muir) are all worn, though two retain traces of the periostracum.

Sowerby's bad figure shows a *dark* band in the middle of the whorl.

In S. Afr. Mus. 7 specimens, without locality, identified by Tomlin as *nereia*. They seem to me to be examples of *subventricosa* in which the squarish profile of the whorls has been worn to a more evenly convex curve as in Bartsch's figure.

Clavatula hottentota (Smith)

Only one specimen with the animal is available. It was collected at Lambert's Bay (U.C.T., L.B.375.V.), and like many examples of *C. sinuata* and species of *Burnupena* etc. is much corroded, surface with minute perforations probably caused by *Cliona*. The ribs are scarcely traceable. Nevertheless the specimen does not seem referable to any other species. The shape and the lip sinus correspond with those of *hottentota*. 12×4·5 mm. Operculum (damaged) appears to have the nucleus more apical than lateral.

Radula similar to that of *sinuata*, with 25 rows, small central plate, elongate lateral plate with appendage.

This one specimen scarcely justifies transferring *hottentota* definitely to the genus *Clavatula*. Moreover there are no records of *hottentota* from the west coast, not even from the west coast of the Cape Peninsula or Table Bay.

For remarks on synonymy see *infra*, p. 120.

Turris stolida (Hinds)

Fig. 3 *e*

1843. Hinds. *Proc. Zool. Soc. Lond.*, p. 37 (*Pleurotoma s.*).
1844. id. *Zool. Voy. 'Sulphur' Moll.*, p. 15, pl. 5, fig. 5 (*Pleurotoma s.*).

1923. Odhner. *Med. Göteb. Mus.*, xxiii, p. 7 (*Drillia s.*).
1926. Tomlin. *Ann. Natal Mus.*, v, p. 290 (*Drillia s.*).

Length of aperture $1\frac{1}{4}$–$1\frac{1}{3}$ times in spire. Protoconch high, $2\frac{1}{2}$ whorls, smooth. Postnatal whorls 9–10. Oblique ribs 11–12 on early whorls, 13–14 on later whorls, prominent at shoulder but petering out below, scarcely or only just reaching suture of following whorl. Fine spiral striae over whole whorl. No cingulum below suture. Outer lip with broad and deep sinus. 68 × 20 mm. (protoconch and 1 whorl missing, width across shoulder of last whorl).

Operculum ovate, nucleus apical, 11 × 4 mm. in shell 51 mm. long.

Uniform cream under the pale buff periostracum, operculum horny-amber. Animal white with black specks (K.H.B.).

Radula with 38 rows, no central plate, lateral with wing-like appendage.

Agulhas Bank, 40–43 fathoms (Hinds, Odhner). Glendower Beacon (Port Alfred area) to False Bay, 32–73 fathoms (S. Afr. Mus. P.F. Coll.). St. Sebastian Bay, 40 fathoms (coll. K.H.B.). False Bay (U.C.T.).

Slender form: slightly more slender, the ribs consequently closer together, with 5 ribs visible in face view[13] instead of 4. Yellowish brown (darker than typical form). 52 × 15 mm.

Off Cape Hangklip, 73 fathoms, 1 together with 1 typical; off Glendower Beacon (Port Alfred area), 66 fathoms, 2. (S. Afr. Mus. P.F. Coll.)

Remarks. The 60 mm. *Pleurotoma* (*Surcula*) *margaritae* Smith (1904. *Ann. Mag. Nat. Hist.* (7), xiii, p. 458) from off the Andaman Islands, 405 fathoms, appears from the figure (1907. *Illustr. Zool. R.I.M.S. 'Investigator'. Moll.*, pl. 14, figs. 2, 2*a*) to be almost indistinguishable from *stolida.*

Turris lignaria (Sow.)

1903. Sowerby. *Mar. Invest. S. Afr.*, ii, p. 215, pl. 3, fig. 4 (*Pleurotoma* (*Clavus*) *l.*).
1903. Von Martens. *D. Tiefsee Exp.*, vii, p. 24 (*Clionella semicostata* var., non Kiener).
1925. Thiele. ibid., xvii, p. 212, pl. 35 (23), fig. 10 (*Clionella semicostata* var., non Kiener).

Very close to *stolida*, but more compact in shape, the spire less tapering, canal shorter and rostrum blunter. Protoconch 2 whorls, smooth (*fide* Sowerby). Postnatal whorls 6 (? 7). Oblique axial ribs 10 on 1st whorl (as preserved, possibly this is the 2nd), increasing to 11 (12) on body whorl. Fine spiral striae over whole whorl. No cingulum. Lip sinus broad and deep. Columella slightly rimate at rostrum. 22 × 9 mm. (Sowerby).

Pale brown, columella white. Yellowish-brown, columella whitish (Thiele).

Off west coast of Cape Peninsula, 136 fathoms (Sowerby); Agulhas Bank (34° 51′ S., 19° 37′ E.), 80 metres (von Martens); False Bay, 32 fathoms, 1 dead (S. Afr. Mus. P.F. Coll.).

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[13] i.e. not counting the profile rib on either side.

Remarks. Might almost be regarded as a squat form of *stolida.* I have seen only two specimens. One returned by Sowerby with his label; this cannot be regarded as the type although it measures 22 × 9 mm. because it lacks the 2-whorled protoconch (possibly also the 1st postnatal whorl). Sowerby gave the total number of whorls as 10½; this seems excessive (cf. his figure) and is probably a misprint.

The False Bay example has the same width as this specimen, but has only the 4 last whorls.

Both these examples differ from equal-sized *stolida* by the rimate columella; only in large examples (40 mm. upwards) of the latter is the margin of the columella glaze slightly raised as a free edge, but there is no (umbilical) indent.

Although the operculum and radula are unknown, this species is included provisionally in *Turris* for the sake of comparison with *stolida.*

Turris cingulifera (Lam.)

Fig. 6 *a* and profile

1897. Sowerby. *Append. Mar. Sh. S. Afr.*, p. 2 (*Pleurotoma c.*).
1917. Melvill. *Proc. Mal. Soc.*, xii, p. 162 (*Surcula c.*).

Anterior canal short. Length of aperture less than half total length. Protoconch 3½ (4) whorls, diam. 1·25 mm., alt. 1·75 mm., apex smooth, following whorls with slightly curved axial riblets, *c.* 26 on last whorl, junction with 1st postnatal whorl abrupt. Below suture 2 (in early whorls)—5 (later whorls) spiral lirae followed by a deep narrow groove, and then 2 lirae; lip sinus forming the moderately prominent shoulder, with 2 (3) lirae, followed by 2 lirae with finer intervening lirae; on base 5–6 lirae with intermediates. Sometimes axial striae forming a fine cancellate sculpture. 55 × 15 mm. (minus protoconch, width across shoulder).

White, lip sinus (shoulder) with irregularly spaced brown spots, the other lirae with numerous brown dots.

Dead: Durban (Sowerby); Natal coast and Mozambique Island (S. Afr. Mus.); off Umkomaas River, 40 fathoms, 1 juv. dead but unworn. (S. Afr. Mus. P.F. Coll.)

Distribution. Farquhar Island (S. Afr. Mus.), Mauritius, Madagascar, Seychelles, Indo-Pacific.

Remarks. Protoconch described from a 13·5 mm. juvenile.

Turris acuta (Perry)

Fig. 6 profile

1811. Perry. *Conchology*, pl. 54, fig. 5.
1822. Lamarck. *Anim. sans Vert.*, vii, p. 95 (*Pleurotoma tigrina*).
1897. Sowerby. *Append. Mar. Sh. S. Afr.*, p. 2 (*P. tigrina*).
1917. Melvill. *Proc. Mal. Soc.*, xii, p. 142.

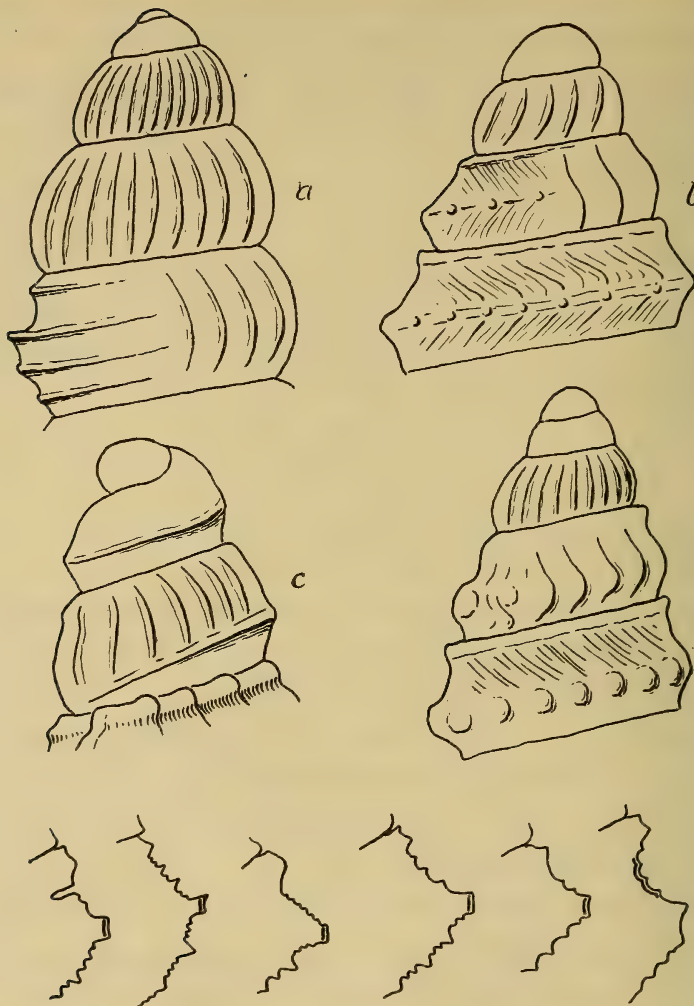


Fig. 6. Protoconchs of: *a. Turris cingulifera* (Lam.). *b. T. indica* Bolten. *c. T. multiseriata* (Smith). *d. T. gilchristi* (Sow.). Profiles of (left to right): *cingulifera, indica, acuta, gilchristi, lobata, multiseriata*; position of sinus marked by a double line.

Anterior canal long. Length of aperture half total length.

Below suture a sharp keel, followed by several lirae all of about the same strength; lip sinus forming a prominent shoulder, square in profile, below which on body whorl 3 (4) sharp lirae with finer intermediaries.

57 × 15 mm. (width across shoulder).

Operculum ovate, nucleus apical, 9 × 5 mm. in shell 57 mm. long.

Biscuit colour, with irregularly spaced dark brown spots on the keel below suture, and numerous dots on the margins of the lip sinus (shoulder) and the other lirae.

Dead: Durban (Sowerby); 2 worn specimens probably from Durban (S. Afr. Mus.).

Distribution. Farquhar Island (S. Afr. Mus.); Mauritius, Madagascar, Seychelles, Indo-Pacific.

Remarks. Distinguished from *indica* by the larger spots being on the keel below suture, the lirae between the keel and shoulder all of about same strength, and shoulder square in profile.

Turris indica Bolten-Röding

Figs. 3 *g*, 6 *b* and profile

1798. Bolten-Röding. *Mus. Bolt.*, p. 124, no. 1594 (*indica*).
1822. Lamarck. *Anim. sans Vert.*, vii, p. 95 (*marmorata*).
1843. Reeve. *Conch. Icon.*, i, pl. 3, fig. 21 *a* and *b* (var. *maculata*).
1902. Sowerby. *Mar. Invest. S. Afr.*, ii, p. 100 (*marmorata*).
1917. Melvill. *Proc. Mal. Soc.*, xii, p. 143.
1926. Tomlin. *Ann. Natal Mus.*, v, p. 289 (*marmorata*).
1942. Gravely. *Bull. Madras Govt. Mus.*, n. s. V, no. 2, p. 73 (in key), fig. 14(1).

Anterior canal very long. Length of aperture a little more than half total length. Protoconch $2\frac{1}{2}$ whorls, apex smooth, followed by 12–13 axial riblets, diam. 1·25, alt. 1·5 mm.

Postnatal whorls 10. Suture slightly underriding preceding whorl. Below suture a slightly prominent keel followed by several lirae of varying strength; lip sinus forming the shoulder, the upper edge of which forms a very prominent keel, below sinus 4 or more sharp lirae with finer intermediaries. 59×16 mm. (protoconch and end of canal broken, width across shoulder; in proportion to an unbroken Philippine Is. specimen 52×13 mm. the full length would have been 64 mm.).

Operculum ovate, nucleus apical, $5{\cdot}75 \times 3$ mm. in shell 32 mm. long.

Marbled brown and white in varying proportions, but the larger dark brown spots or marks are on the shoulder sinus. South African specimens are var. *maculata*: white or biscuit colour, with brown or orange-brown spots on shoulder and numerous smaller spots and dots on the other lirae. Albino specimens are known.

Radula with about 45 (specimen incomplete) pairs of teeth, no central plate, lateral without wing-like appendage (see p. 93).

Off Tugela River (Natal), 55 fathoms (Sowerby); Natal, from fish stomachs (Tomlin); off Tugela River, 40–73 fathoms, off Cape Vidal and O'Neil Peak (Zululand), 55–100 fathoms (S. Afr. Mus. P.F. Coll.). Most specimens dead, but living ones were taken off the Tugela River.

Distribution. Cargados Islands, Red Sea, Indo-Pacific.

Remarks. Distinguished from *acuta* by the larger spots being on the shoulder, the varying strength of the lirae between suture and shoulder, and the projecting upper edge of the latter.

Turris gilchristi (Sow.)

Figs. 3 *h*, 6 *d* and profile

1897. Sowerby. *Append. Mar. Sh. S. Afr.*, p. 2 (*monilifera* non Pease).
1902. id. *Mar. Invest. S. Afr.*, ii, p. 99, pl. 2, fig. 9 (*Pleurotoma g.*).
1903. Smith. *Proc. Mal. Soc.*, v, p. 362.
1917. Melvill. ibid., xii, p. 145.

Anterior canal very long. Length of aperture equal to, or a little more or a little less than half total length. Protoconch $3\frac{1}{2}$ whorls, diam. 1·3, alt. 1·75mm., apex smooth, followed by 20–25 axial riblets on last whorl and a half. Postnatal whorls 9–10. Suture slightly canaliculate. Below suture one strong keel followed by 3–4 less strong lirae; lip sinus forming an outstanding girdle with numerous tubercles, oblong in axial direction; below shoulder of last whorl 3–4 main keels with smaller intermediary lirae; oblique axial growth lines well marked. 61×18 mm.

Operculum ovate, nucleus apical, 7×3 mm. in 39 mm. shell.

White, some specimens with orange-brown spots in the hollows between the shoulder knobs, and orange spots or suffusions on the lirae above and below.

Radula with about 70 pairs of teeth, no central plate, lateral without winglike appendage. The radula of a Farquhar Island specimen corresponds with this.

Off Tugela River mouth (Natal), 55 fathoms (Sowerby); Zululand and Natal coast 27–90 fathoms, and as far south as off Cape Natal (Durban), 185–200 fathoms; off Hood Point (East London), 49 fathoms. (S. Afr. Mus. P.F. Coll.)

Distribution. Farquhar Island (S. Afr. Mus.); Mekran coast (S. Persia), 180 fathoms (Melvill).

Remarks. Smith suggested that the specimen recorded by Sowerby as *monilifera* was probably a *gilchristi*. Pease's description of the Sandwich Island species, as far as it goes, fits *gilchristi*; but actual specimens should be compared.

Sowerby in 1902 compared his species with the Californian *gemmata* Hinds and the Chinese *Kieneri* Doumet. He did not specify the differences but referred to the size, which may be a misleading character; Sowerby saw no specimens of *gilchristi* larger than 32 mm.

Although broken, the apex (protoconch plus 5 whorls) from the Hood Point locality is unworn, indicating that the species may occur living as far south as the East London area. Very few bottom samples are available between here and the Natal coast.

Plump and slim forms occur, e.g. 38×13 mm. and 39×11 mm.; sometimes both forms were taken in the same haul. The rather striking difference in appearance is due mainly to the greater or lesser prominence of the tuberculate shoulder band; and in the slim forms not only are the tubercles less prominent but on the later whorls they tend to degenerate into a double keel crossed by coarse growth-lines (cf. von Martens' remarks on *P. carinata* Gray, 1903. *D. Tiefsee Exp.*, vii, p. 77; also Smith on *vagata*, 1904. *Ann. Mag. Nat. Hist.* (7), xiii, p. 456). Such specimens appear at first sight to be quite different from strongly tuberculate specimens.

Further, the spiral lirae and the oblique growth-lines vary in intensity; the former may be high and sharp, with crinkly edges, especially the uppermost lira forming the lower margin of the sutural canal; and on the base of the body whorl the growth lines may produce an almost cancellate sculpture.

This species should be compared with *P.* (*Gemmula*) *carinata* Gray, a figure of which is given in *Illustr. Zool. R.I.M.S. 'Investigator', Moll.*, pl. 20, figs. 3, 4, 1908. The specimens from off the Somaliland coast and Nicobars, identified as *carinata* by von Martens (1903. loc. cit., p. 76), were later regarded by Thiele as a separate species: *valdiviae* Thiele (1925. *D. Tiefsee Exp.*, xvii, p. 208, pl. 35 (23), fig. 1). Thiele stated (p. 208) that the figure of *vagata* Smith 1895 and 1904 (*Illustr. Zool. R.I.M.S. 'Investigator' Moll.*, pl. 14, figs. 3, 3*a*, 1907) was similar to *valdiviae*; and likewise *P. sibogae* Schepman.

P. (*Gemmula*) *gemmulina* von Martens 1902 (1903. loc. cit., p. 77, pl. 1, figs. 2, 2*a*) from the eastern Indian Ocean is also not dissimilar; and is compared by von Martens (p. 78) with *praesignis* Smith 1895 from Ceylon and (1906) the Coromandel coast.

P. aethiopica Thiele (1925. loc. cit., p. 208, pl. 34 (22), fig. 25), from off the East African coast, and *P. fusiformis* Thiele (1925. loc. cit., p. 210, pl. 34 (22), fig. 24) from the East Indies, also invite comparison.

Melvill compared his specimens with *ceylonica* Smith: the tubercles are smaller and more compact in *gilchristi*; and the latter is narrower than *carinata* Gray=*granosa* (Helb.).

All these species can be more or less closely matched among the small series (60) of *gilchristi* in S. Afr. Mus.; but it is inconceivable that so many separate species, including *gilchristi*, exist together in one small area off the Natal-Zululand coast.

For the present I maintain *gilchristi*, the radula of which is now known, though eventually it will have to become a synonym of one of the above species.

Turris lobata (Sow.)

Figs. 3 *i*, *j*, 6 profile

1903. Sowerby. *Mar. Invest. S. Afr.*, ii, p. 213, pl. 4, fig. 9 (*Pleurotoma* (*Surcula*) *l.*).
1906. Smith. *Ann. Natal Mus.*, i, p. 24 (*Pleurotoma*, not *Surcula*).
1925. Thiele. *D. Tiefsee Exp.*, xvii, p. 210 (similarity of shell with *bisinuata*).

Anterior canal short. Length of aperture $1\frac{1}{3}$–$1\frac{1}{2}$ in spire. Protoconch ? Postnatal whorls 10. Below suture one rather prominent sharp keel, followed by one feeble lira (or 2 lirae); lip sinus forming an outstanding nodulose girdle, nodules rounded or very slightly oblong in an axial direction; only a portion of protoconch preserved in one specimen, but nodules beginning apparently immediately on first postnatal whorl. Below girdle 3 spiral lirae, the lowermost one in some specimens becoming prominent and coalescing with the middle lira to form a strong costa forming a sinus on margin of outer lip. 31×12 mm. lobate specimen; 32×11 mm. non-lobate; 35×14 mm. lobate; 39×13 mm., costa present but lobe not formed. (In all cases protoconch missing.)

Operculum oval, nucleus apical, 9×4 mm. in 35 mm. shell.

Radula (of an East London specimen) with *c.* 75 pairs of teeth, no central plate, lateral broadly cuneiform, one margin sharply angular (in edge view), no appendage.

Off Cape Natal (Durban), 440 fathoms, and (dead shells) off Buffalo River (East London), 310 fathoms (Sowerby).

S. Afr. Mus. P.F. Coll.: Co-types (topotypes) from above localities, one of the East London specimens taken alive.

Off Cape Point, 380–900 fathoms (3 living and 5 dead shells).

The largest of the Cape Point shells (apex corroded, only 6 whorls remaining) is 40×14 mm. These examples are more corroded than those from the Natal-East London area. There are 3–4 prominent lirae between the keel below the suture and the nodular girdle, at least in the earlier whorls; growth-lines much more prominent and on the later whorls tending to obliterate the spiral lirae. No indication of the formation of a basal costa and additional sinus in outer lip. Operculum as above.

Radula with about 70 pairs of teeth, the lateral plate broadly cuneiform as in the East London example, but no angular margin (in edge view).

Conchologically the Cape Point examples are not separable from the Natal-East London specimens. The slight difference in the radula teeth is scarcely of specific importance; but there is only one radula of each for comparison.

Remarks. The formation of a strong basal costa and an additional sinus on the outer lip is paralleled in *Ptychosyrinx bisinuata* (von Martens, 1901) (see: 1903. *D. Tiefsee Exp.*, vii, p. 82, pl. 1, fig. 8; juvenile, ibid., pl. 1, fig. 3, as *rotatilis*; and 1925. Thiele. ibid., xvii, p. 210, pl. 35 (23), fig. 4), from off the East African and Somaliland coast. The first 3 whorls of this species are axially ribbed, but so far as the embryonic and early whorls are preserved in the corroded South African specimens there is no indication of such ribbing in *lobata*. In other respects there are no conchological differences; in fact, von Martens's figure 8 might almost have been drawn from one of the East London examples.

The genus *Ptychosyrinx*, however, is distinguished by the concentric operculum, and by the large central plate in the radula.

This case illustrates the danger of attempting to classify dead shells.

Melvill (1917. *Proc. Mal. Soc.*, xii, p. 150) records the formation of a somewhat similar lobe on the outer lip of *Drillia athyrma* Melv. & Stand. 1901, from the Persian Gulf.

Turris (*Gemmula*) *multiseriata* (Smith)

Fig. 6 *c* and profile

1877. Smith. *Ann. Mag. Nat. Hist.* (4), xix, p. 491.

1901. Melvill & Standen. *Proc. Zool. Soc. Lond.*, ii, p. 434 (*Pleurotoma* (*Gemmula*) *m.*).

1917. Melvill. *Proc. Mal. Soc.*, xii, p. 145, pl. 8, fig. 3 (*Turris* (*Gemmula*) *m.*).

Aperture $1\frac{1}{4}$–$1\frac{1}{3}$ times in spire. Protoconch $2\frac{1}{2}$ whorls, diam. 0·5 mm., apex smooth, followed by a spiral keel, which is continued on to shoulder nodules on 1st postnatal whorl. Postnatal whorls 7. Curved axial plicae (*c.* 21), retractive and varicoid between suture and lip sinus, and below sinus forming a shoulder with strong nodules (oblong in axial direction), continued on base nearly to extremity; crossed by spiral lirae, 2 on the varicoid nodules, 2–3 in lip sinus, 2 on shoulder nodules, 2–3 below, with *c.* 10 additional ones on base; on base axial and spiral lirae form a more or less cancellate sculpture, slightly nodulose at the intersections. Lip sinus deep, remote from suture. Canal short. $15 \times 5{\cdot}5$ mm. Red-brown to ochraceous (Melvill).

Off Umvoti and Umhloti River mouths (Natal) 27 fathoms, 5 fresh; off Tongaat River, 36 fathoms, 1 dead; Algoa Bay, 21 fathoms, 1 dead. (S. Afr. Mus. P.F. Coll.)

Distribution. Ceylon, Persian Gulf, Karachi. From the latter locality very large specimens $\frac{5}{8}$ inch long. Also China Seas.

Remarks. Three of the South African specimens were identified by Sowerby. At first sight somewhat similar to *gilchristi* on account of the axially oblong tubercles, but the protoconchs are quite different.

Operculum and radula not present in the South African examples. It is here assumed that the radula has been examined (by Melvill or some other author) and that the species is correctly classified in the genus *Turris*.

Turris saldanhae n. sp.

Figs. 3 *f*, 7

Aperture subequal to spire, or a little shorter. Protoconch broken. Postnatal whorls $7\frac{1}{2}$–8. Shoulder somewhat angular (but frequently corroded), a little above middle of whorl; oblique axial ribs from shoulder to suture below, petering out on base, 12–14 on earlier whorls, 15–16 on later whorls, subequal in width to intervening grooves; crossed by spiral lirae, 2 or 3 on 3rd whorl, 3 or 4 on 4th, increasing to 7 or 8 (9) on last whorl, 12–14 additional lirae on base; growth-lines not conspicuous. Outer lip with broad and moderately deep sinus; canal moderately long. 33–34 (protoconch broken) × 12 mm.; and 46 × 15 mm.

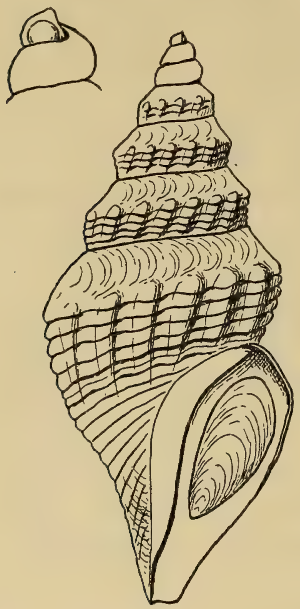


Fig. 7. *Turris saldanhae* n. sp. with protoconch further enlarged.

Operculum ovate, nucleus apical, 9 × 4 mm. in 33 mm. shell.

White with yellowish-brown periostracum, operculum amber.

Radula with 60 pairs of teeth, no central plate, lateral with wing-like appendage.

Type locality. Off Baboon Point (Saldanha Bay), 31 fathoms (S. Afr. Mus. A1738, P.F. Coll.).

26° 33′ S., 15° E. (off Lüderitzbucht), 55 metres (Fisheries Survey vessel. *Africana II*, AFR.1224); also AFR.1263, 26° 33′ S., 14° 17′ E., 311 metres, and AFR.1319, 26° S., 14° 35′ E., 183 metres.

Remarks. All the specimens taken by the *Pieter Faure* are more or less corroded, the protoconch broken off and, even in the smallest example (22 mm.), the apex stopped with secondary shelly substance. The 1st and 2nd whorls appear to have been smooth, the ribs beginning on the 3rd whorl.

The 4 *Africana* examples, 18 × 8 mm. up to 46 × 15 mm., though more slender, are obviously conspecific. The protoconchs are broken off and the early whorls corroded, though not so much as in the Saldanha Bay examples. Consequently the lirae are more prominent, and owing to the slight lengthening of the whorls there is an additional spiral lira on each whorl, and 15–20 lirae on the base. At first glance there appears to be a likeness between the *Africana* 46 mm. example and the *enlarged* figure of *macilenta* Melvill (see *Drillia platystoma*, p. 125), but the proportion of aperture to spire, and number of ribs and spiral lirae, are different.

In sculpture this species is rather similar to the worn 18·6 mm. *Drillia halidoma* Bartsch 1915 from the 'Cape of Good Hope'. The latter, however, has fewer spiral lirae (see *Clavatula semicostata*).

Three specimens, 26, 27 and 33 mm. long, from off Cape Point, 250–700 fathoms (S. Afr. Mus. A362–A364, P.F. Coll.), agree with the above except the spiral lirae are finer and more numerous, due to the development of intermediaries; this is especially noticeable on the base.

All three are dead shells, white, without protoconchs, slightly corroded, and without any trace of periostracum.

Subfam. BRACHYTOMINAE Thiele

'Clavatula' *tumida* (Sow.)

Figs. 4 *e*, 8 *a*, 9 *a*

1870. Sowerby. *Proc. Zool. Soc. Lond.*, p. 253 (*Clavatula t.*).

1892. id., *Mar. Sh. S. Afr.*, p. 5, pl. 5, fig. 101 (*Pleurotoma t.*).

1903. Von Martens. *D. Tiefsee Exp.*, vii, p. 24.

1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 19, pl. 2, fig. 3 (*Clavatula haliplex*).

1932. Turton. *Mar. Sh. Pt. Alfred*, p. 19 (*haliplex*), and p. 19, pl. 4, no. 146 (*gravis*, non Hinds).

Protoconch $1\frac{1}{2}$–2 whorls (iunction with 1st postnatal whorl not clear) diam. 1·75–2 mm., alt. 2–2·25 mm., usually corroded. Postnatal whorls 7–8. Oblique nodules above suture longer than in *gravis*, better described as oblique ridges. Cingulum below suture not very timid, obscurely nodulose; or in other words: the arcuate oblique ridges cross the whole whorl but are interrupted by the sulcus groove, above which they are less conspicuous (often quite obsolete) than they are below; no indication of additional nodules or a ridge below shoulder on body whorl. Spiral striae on early whorls (if not corroded), about 10 on 1st whorl, 12 on 2nd, microscopically granulose at intersections with growth-lines; striae usually obsolete on later whorls. Lip sinus narrow and shallow. 60 (minus protoconch) × 20 mm. Another shell: 56 × 20 mm. Sowerby's figure, if natural size, is 61 mm.

Operculum oval, nucleus slightly below middle of inner margin, which is thickened on outer surface; 11 × 6 mm. in 48 mm. shell.

Cream under the yellowish-brown periostracum, operculum horny. Animal flesh-coloured.

Radula without basal membrane, 20–24 teeth (3 radulae examined), elongate, slender, basal half slightly thicker, apex acute, one apical barb, another on opposite side a little farther proximally.

Agulhas Bank (Sowerby). Off Cape Morgan, 34 fathoms, and Agulhas Bank to False Bay, 27–55 fathoms (S. Afr. Mus. P.F. Coll.). False Bay, 54 metres (U.C.T.).

Remarks. Two live specimens taken in the same haul (P.F. Coll.) represent stout and slim forms: 49 × 17 mm. and 52 × 16 mm. respectively.

Bartsch's *haliplex* appears to be a young worn specimen of this species. There is one in S. Afr. Mus. almost exactly the same size as Bartsch's type which corresponds with his description and figure. It has the upper part of the whorls white where the periostracum is worn off.

This species combines a *Clavatula*-like operculum with a radula composed of a bunch of barbed teeth without basal membrane as in the *Brachytominae*.

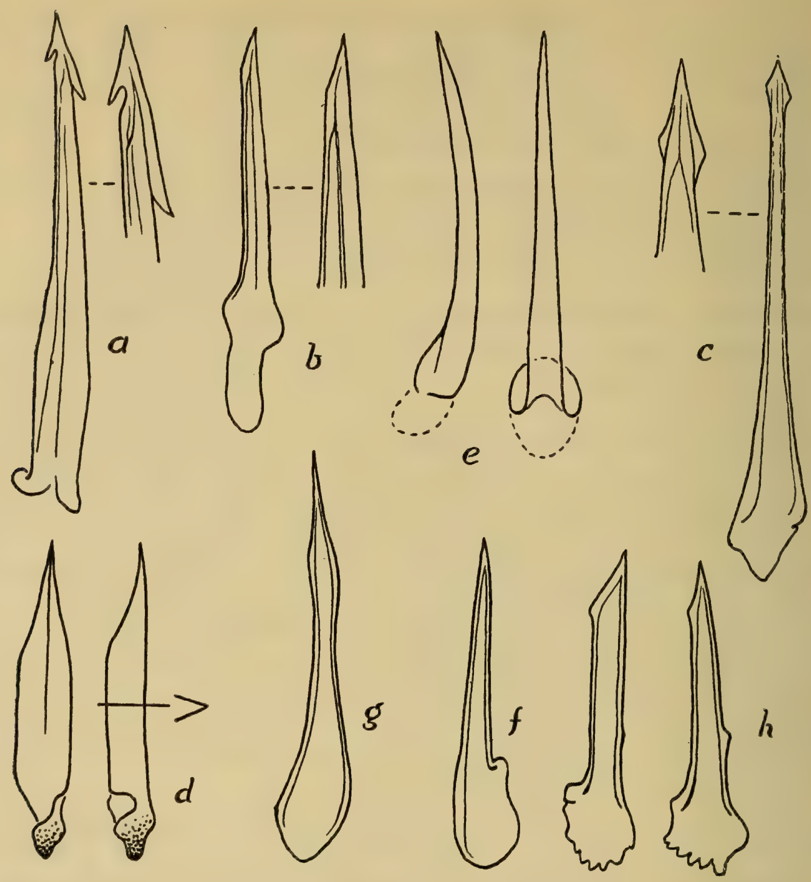


FIG. 8. Radula teeth of: *a.* 'Clavatula' *tumida* (Sow.). *b.* 'Genotia' *belaeformis* (Sow.). *c. Asthenotoma vertebrata* (Smith). *d. Cythara africana* (Sow.). *e. Lienardia grayi* (Rve.). *f.* 'Drillia' *scitecostata* (Sow.). *g.* 'Drillia' *fultoni* (Sow.). *h. Philbertia capensis* (Smith).

'Genotia' *belaeformis* (Sow.)

Figs. 8 *b*, 9 *b*

1903. Sowerby. *Mar. Invest. S. Afr.*, ii, p. 216, pl. 4, fig. 8 (*Pleurotoma* (*Genotia*) *b.*).
1906. Smith. *Ann. Natal Mus.*, i, p. 24 (*Genotia b.*).

Anterior canal short. Length of aperture subequal to half total length. Protoconch 1½ whorls, mammillate, diam. 1·75, alt. 1·5 mm., smooth (but partly corroded). Postnatal whorls 5. Whole whorl with fine close spiral striae, crossed by oblique growth-lines, the latter immediately below the suture forming a narrow crimped band above the sulcus. Outer lip prominent, sinus broad and deep. 24 × 11 mm.

Operculum ovate, nucleus apical (apex broken in the only example).

Radula without basal membrane, teeth narrow, aciculate, shallowly grooved nearly to apex, margins thickened.

Off Cape Point, 230 fathoms (Sowerby). Two cotypes in S. Afr. Mus.

Off Cape Point, 190 fathoms, 1 live, 2 dead: 36° 40′ S., 21° 26′ E., 200 fathoms, 1 dead but fresh. (S. Afr. Mus. P.F. Coll.)

Remarks. The cotypes are corroded; two of the other Cape Point specimens are slightly corroded at the apex, but the third (15 mm. long) has an unbroken protoconch. The largest specimen is from the southern slope of the Agulhas Bank; it also has an unbroken protoconch, and is more strongly sculptured, some of the sigmoid growth-lines, especially across the sulcus, being very sharp. Sowerby's expression 'a punctured groove a little below the suture' refers to the most concave portion of the sulcus immediately below the crimped band.

Generic position doubtful; the radula excludes it from the *Turrinae*, and the possession of an operculum from *Genota* (*Cytharinae*). The radula is very like that of *Thesbia nana* (see: Sars. 1878. *Moll Reg. Arct. Norv.*, pl. viii, figs. 3 *c*, *d*), another *Cytharine* genus without operculum.

Gen. Asthenotoma Harr. & Burr.

1942. Gravely. *Bull. Madras Govt. Mus.*, n.s. v, no. 2, pp. 71, 72 (key to 3 closely allied species).

Asthenotoma vertebrata (Smith)

Figs. 8 *c*, 9 *c*

1875. Smith. *Ann. Mag. Nat. Hist.* (4), xv, p. 416 (*Pleurotoma v.*).
1903. id. *Proc. Mal. Soc.*, v, p. 363.
1917. Melvill. ibid., xii, p. 149, pl. 8, fig. 4 (*Turris* (*Tomopleura*) *v.*).
1942. Gravely. loc. cit., p. 72, figs. 13 *a* (inverted), and 14 (2) (not good).

Aperture $1\frac{1}{2}$ times in spire. Protoconch $1\frac{1}{2}$ or 2 whorls (incomplete), diam. 0·5 mm., smooth, with a few feeble axial plicae before junction with 1st postnatal whorl. Postnatal whorls $10\frac{1}{2}$; 1st with one spiral keel in middle, on later whorls successively 3, 4, and 5 keels; one slightly below suture forming upper boundary of sulcus, keel in middle of whorl the most prominent (Gravely: 'lower cardinal spiral'), and forming lower boundary of sulcus; below this 3 keels, and additional lirae on base. Axial plicae between the keels; each plica in the sulcus is slightly nodulose forming a feeble moniliform lira in middle of sulcus (Gravely: 'intracardinal spiral'). Columella with a more or less prominent pleat. Canal short. 18·5 × 5·5 mm.

Operculum ovoid, nucleus at the rectangular apex, inner margin straight for greater part of length.

Pale greyish, interior of aperture violaceous.

Radula without basal membrane, *c.* 48 teeth (i.e. 24 pairs), elongate, slender, with a very delicate flange (not barbed) on either side of apex.

Durban (Smith, 1903).

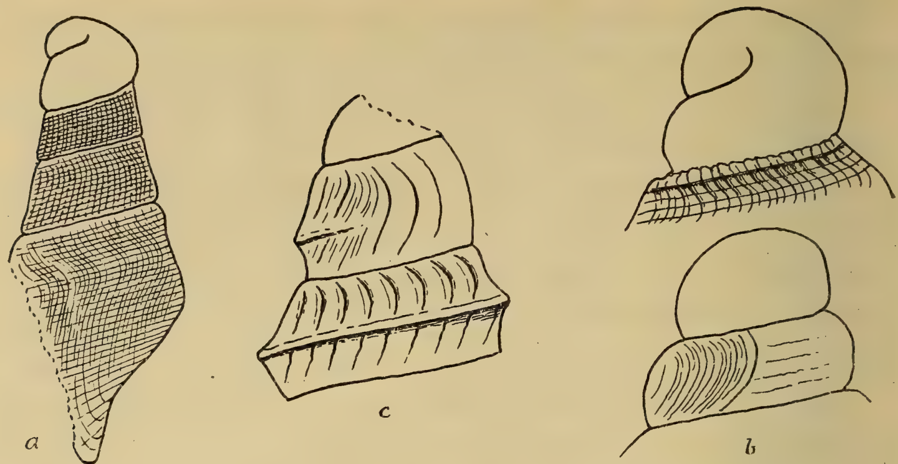


FIG. 9. Protoconchs of: *a*. 'Clavatula' *tumida* (Sow.). *b*. 'Genotia' *belaeformis* (Sow.). *c*. *Asthenotoma vertebrata* (Smith).

Off Umhlanga River (north of Durban), 22–26 fathoms, 1 dead (S. Afr. Mus. P.F. Coll.).

Delagoa Bay, 1 dead (S. Afr. Mus. Coll. K.H.B.).

Morrumbene estuary, Inhambane, Portuguese East Africa, 2 living (U.C.T.).

Distribution. Karachi, Madras, and Japan.

Remarks. Melvill, contrary to some authors, keeps *vertebrata* separate from *nivea* (Phil.) and its var. *violacea* Hinds.

From the description and figure it is impossible to say how this species compares with the Mauritian *Daphnella elata* Sow. (1893. *Proc. Zool. Soc. Lond.*, p. 490, pl. 38, figs. 19, 20).

Asthenotoma eva (Thiele)

Fig. 21 *d*

1925. Thiele. *D. Tiefsee Exp.*, xvii, p. 227, pl. 37 (25), fig. 12 (*Bela e.*).

Protoconch 1½ whorls, smooth. Postnatal whorls 3. Spiral keels 2 on each whorl, the upper one peripheral and more prominent; distinct sharp, close-set axial pliculae or growth-lines across sulcus and *between* the keels; on base 4 additional distinct lirae and 3–4 obscure ones. $3{\cdot}75 \times 1{\cdot}5$ mm. Thiele: $4{\cdot}8 \times 2{\cdot}2$ mm.

Operculum (*apud* Thiele) oval, narrowed below.

Radula (*apud* Thiele) without basal membrane, teeth 'arrow-like' ('pfeilzähne', not figured by Thiele).

35° 19′ S., 20° 15′ E., 126 metres (Thiele).

Off Cape Recife, 56 fathoms, 1 dead (S. Afr. Mus. A8563, P.F. Coll.).

Remarks. Thiele placed his species in *Bela* because it had an operculum and 'pfeilzähne', and from the character of the shell suggested the genus *Drilliola.* In 1929, however, he put *Bela* as a synonym of *Mangelia* (*Cytharinae*, without operculum), and *Drilliola* as subgen. of *Asthenotoma* in the *Brachytominae.*

The sculpture is not unlike that of *Asthenotoma* species. The axial pliculae are more conspicuous on the present specimen than in Thiele's figure.

Subfam. CYTHARINAE

Cythara africana (Sow.)

Figs. 8 *d*, 10 *a*

1903. Sowerby. *Mar. Invest. S. Afr.*, ii, p. 216, pl. 5, fig. 9 (*Mangilia* (*Eucythara*) *a.*).
1906. Smith. *Ann. Natal Mus.*, i, p. 27 (listed).

Protoconch $1\frac{1}{2}$ or 2 whorls, diam. 0·3–0·4, alt. 0·4 mm. (but nucleus broken), smooth, last half whorl with rather closely set, narrow axial plicae. Postnatal whorls 7. Axial ribs 11 on 1st whorl, increasing to 12 on penultimate, and

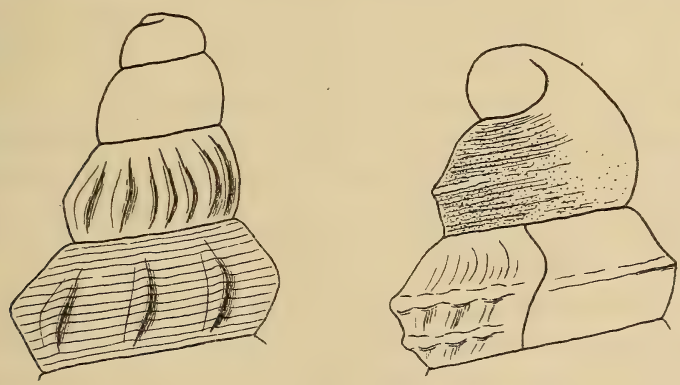


FIG. 10. Protoconchs of: *a. Cythara africana* (Sow.). *b. Lienardia grayi* (Rve.).

12–13 (14) on last whorl, from suture to suture, and extending to extremity of base, crossed by numerous very fine spiral striae over whole whorl. Columella with numerous (at least 25 in the Type) plicae. Outer lip in adult with sharp margin, internally plicate (*c.* 25), externally with varix. 20 × 7 mm.

No operculum.

Coloration faded except a faint mauve band on the sulcus and another below middle of body whorl, some dull orange spots on the lip varix.

Radula without basal membrane, number of teeth ? (only 10 observed during treatment with KOH); tooth forming a v-shaped channel, with acute non-barbed apex, base pear-shaped.

Off Umhloti River mouth (Natal), 25–27 fathoms. Type, cotype, and 6 other specimens in S. Afr. Mus. (P.F. Coll.).

Remarks. Only eight specimens were obtained in three hauls in the same area, the actual bearings being: Umhloti River mouth NW. × W$\frac{3}{4}$W. 2$\frac{3}{4}$ miles, 25 fathoms; NNW. 1$\frac{1}{2}$ miles, 27 fathoms; and N. × E., 2 miles, 27 fathoms.

The cotype is 18 mm. long, with thin outer lip.

The cotype and one of the others were taken alive. In all the specimens the actual nucleus of the protoconch is broken.

The radula teeth seem shaped to conduct poison into a wounded prey. The true shape is not seen in the final mount, but was happily seen at an earlier stage by delicately sliding the cover-slip so as to roll the teeth into different positions. Thiele (1925. *D. Tiefsee Exp.*, xvii, p. 207) mentions the 'rinnenförmige Endteil . . . mit übergebogenen Lamellen' in *Mangelia* (*Benthomangelia*); and the same shape probably occurs in *Mangelia costata* and the species of 'Bela' figured by Sars (1878. *Moll. Reg. Arct. Norv.*, pl. viii, figs. 7, etc., especially 12). In *Thesbia nana* Sars shows the tooth with a simple shallow groove (loc. cit., fig. 3) and in *Clathurella leufroyi* (fig. 2) with narrow marginal flanges.

Lienardia grayi (Rve.)

Figs. 8 *e*, 10 *b*

1845. Reeve. *Proc. Zool. Soc. Lond.*, p. 114 (*Pleurotoma g.*).
1901. Sowerby. *Proc. Mal. Soc.*, iv, p. 214, pl. 22, fig. 20 (*Drillia rugisculpta*).
1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 27, pl. 3, fig. 8 (*Mangilia arata*).
1915. id. ibid., p. 29 (*Mangilia g.*).
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 28 (*Mangilia g.*); and p. 28, pl. 6, no. 211 (*grayi* var. *assimilans*).

Protoconch 2 whorls, diam. and alt. 0·5 mm., smooth but in living examples very faintly shagreened and spirally striate, last three-quarters of 2nd whorl with a spiral lira, continued as the upper of the 2 lirae on 1st postnatal whorl. Postnatal whorls 4. Axial riblets 10–11 on 1st whorl, increasing to (12)13–14(15) on last whorl, more or less traceable across sulcus, rounded at shoulder; crossed by 2 spiral lirae on 1st whorl, 2–3 on 2nd, increasing to 5–6(7) on 4th, with 13–15 additional lirae on base, usually 2–3 very fine lirae on sulcus above shoulder. Columella with 2–3 plicae; outer lip in adult thickened, inner margin denticulate. 8·5 × 3·75 mm.

No operculum.

Castaneous brown; beach specimens castaneous, amber, buff, white, unicolorous or with pale band, broad or narrow, around middle of last whorl.

Only one animal available for dissection. The tentacles were short, rounded lobes (? due to injury), the eyes in an expansion on outer margin.

Radula without basal membrane, about 35 pairs of slender acicular teeth, expanded at base; shallowly grooved.

Table Bay, False Bay, Still Bay (S. Afr. Mus.); off Cove Rock (East London), 27 fathoms (S. Afr. Mus. P.F. Coll.); Still Bay (U.C.T.); living example from Cape Peninsula (U.C.T.) examined.

Remarks. Two lots, both from the Cape Peninsula, were labelled respectively *grayi* and *rugisculpta* by Tomlin. I fail to see any differences.

The species seems to be a typical *Lienardia.* The Tertiary genus *Glyphostoma* has precedence, but as Thiele (1929) remarked it is not feasible to include living molluscs in fossil genera of which the anatomy is unknown.

Glyphostoma siren Smith (1904. *J. Malac.*, xi, p. 28, pl. 2, fig. 7), with pale band around middle, appears to be very similar, but with slightly fewer axial riblets and spiral striae: resp. *c.* 10, and 3–4, with 6 additional lirae on base. Probably only a casual variation. cf. also *Mangilia helena* Turton (1932. p. 28, pl. 6, no. 208).

Philbertia capensis (Smith)

Figs. 8 *h*, 29 *b*

1882. Smith. *Ann. Mag. Nat. Hist.* (5), x, p. 296.
1892. Sowerby. *Mar. Sh. S. Afr.*, p. 6, pl. 4, fig. 84 (not good) (*Defrancia c.*).
1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 23 (*Mangilia c.*).
1925. Thiele. *D. Tiefsee Exp.*, xvii, p. 230 (*Clathurella c.*).
1925. id. ibid., p. 231, pl. 40 (28), fig. 21 (*Pleurotomella ida*).
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 24, pl. 5, no. 182 (*Mangilia c.*).

Protoconch $3\frac{1}{2}$ whorls, diam. 0·4, alt. 0·5 mm., nucleus smooth, 1st whorl with faint oblique axial striae, next whorl with criss-cross microsculpture, last half whorl with a spiral keel in middle and a faint lira below. Postnatal whorls 6; 1st with 3 spiral keels, the upper one being the continuation of the keel on protoconch, and forming a prominent shoulder; a fine subsidiary lira may sometimes develop between 1st and 2nd keels (sometimes between other pairs; *v. infra*); base with 8–9(10) additional keels. Narrow sharp axial ribs 9–10 on early whorls, increasing to 11–12 on body whorl, sometimes to 13 or 14 on plump examples; intersections with spiral keels sharp-pointed, especially on the shoulder keel; on base ribs extend to columella, forming a lozenge-shaped reticulation (nodulose in worn specimens). Lip sinus deep, adjoining suture. Outer lip (when coinciding with formation of a rib) thickened, plicate within.

17 (minus protoconch) × 6·5 mm.

No operculum.

Buff, a (faint) darker band below middle of body whorl, or whole lower half of whorl brown.

Radula without basal membrane, *c.* 40 teeth, rather stout, shallowly grooved, margins thickened.

Kalk Bay to Port Alfred (previous records, and S. Afr. Mus.); St. Francis Bay, 80 metres (Thiele); 35° 19′ S., 20° 12′ E., 126 metres (Thiele: *P. ida*).

Off East London, 32 fathoms, and off Cove Rock, 27 fathoms; Algoa Bay, 36 fathoms; off Umhloti River (Natal), 47 fathoms; off Tugela River, 65–80 fathoms (S. Afr. Mus. P.F. Coll.).

Living: False Bay, 55 metres (U.C.T.).

There is a single specimen in S. Afr. Mus. from Table Bay, but the record is unreliable.

Remarks. The sulcus between suture and shoulder keel is nearly horizontal on the early whorls, but on later whorls slopes to a varying degree, consequently there are squat forms (U.C.T., TRA.133N) and elongate forms (S. Afr. Mus. A4952).

Two specimens from False Bay (FB.952.4.U.C.T.) differ slightly in appearance: the shoulder keel is less prominent and does not form the widest part of the whorl, the profile of which is thus more evenly convex from suture to suture.

In one of these two specimens the intermediate lira between the shoulder and peripheral keels becomes from about the half of the 3rd whorl as strong as the primary keels, so that on the 4th whorl there are 4 keels; also on 4th whorl the lira between suture and shoulder keel becomes a keel demarcating the sulcus, and another keel develops at the bottom of the whorl immediately above the suture, thus the profile of the 5th whorl shows 6 keels.

The development of these additional keels is, in my opinion, only a casual variation.

A 5 mm. long juvenile with 4 postnatal whorls, from Algoa Bay, indicates that *Pleurotomella ida* Thiele is the juvenile of *capensis*, although Thiele's figure shows only 2 spiral keels on 1st and 2nd whorls, and the 3rd whorl is a little ambiguous at the profile.

Trophon ornatus Turton (1932. p. 75, pl. 18, no. 544), 1 mm. long, is certainly the protoconch of this or an allied species.

'Drillia' *fultoni* (Sow.)

Fig. 8 *g*

1888. Sowerby. *Proc. Zool. Soc. Lond.*, p. 210, pl. xi, fig. 17 (*Pleurotoma f.*).
1889. id. *J. Conch.*, vi, p. 7 (*Pleurotoma f.*).
1892. id. *Mar. Sh. S. Afr.*, p. 5 (*Pleurotoma* (*Drillia*) *f.*).
1903. Von Martens. *D. Tiefsee Exp.*, vii, p. 23 (*Drillia f.*).
1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 18 (*Turris f.*).
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 18 (*Turris f.*).

Protoconch smooth (present only in one specimen in S. Afr. Mus., and not well preserved). Postnatal whorls 10–11. Three spiral keels, one below the upper suture, one in middle of whorl, and one above the lower suture; the uppermost keel not always well developed, more like a low cingulum than an upstanding keel; below the lowermost keel on base 4 smaller additional keels. Between middle and lower keels minute spiral striae which form a microcancellate sculpture with the fine close-set growth-lines; cancellation distinct on base, but not in the sulcus. Periostracum hides the cancellation, and shows only close fine pleating, retractive between suture and middle keel, protractive below the latter. Columella with a slight swelling (not a pleat). Lip sinus remote from suture, adjoining the middle keel. 29 (minus protoconch) × 10 mm.

No operculum.

Yellowish or buff, with white keels, a narrow brown band immediately below suture, columella suffused, rostrum and edge of canal brown, periostracum pale buff.

Radula without basal membrane, 15 pairs of narrow, acicular teeth, slightly swollen in distal third, shallowly grooved, margins thickened.

Presumably dead: Port Elizabeth (Sowerby); Port Alfred (Bartsch, Turton). Dead: St. Francis Bay, 80–100 metres (von Martens).

Off Kowie (Port Alfred), 40 fathoms, dead; Algoa Bay, 37 fathoms, 1 fresh, 1 alive; off Cape St. Blaize, 39 fathoms, 1 fresh; off Cape Infanta, 46 fathoms, 1 broken apex (S. Afr. Mus. P.F. Coll.). False Bay, living (U.C.T.).

Remarks. The radula shows that this species has been entirely misplaced *conchologically.*

In general appearance there is a strong resemblance to the West African *Pleurotoma spiralis* Smith 1871, and Knudsen's description (1952. *Vid. Medd. Dansk. For.*, cxiv, p. 164, pl. 1, fig. 2) intensifies the likeness to such an extent that *fultoni* might be considered a synonym. But Knudsen places *spiralis* in *Asthenotoma*; thus presumably it has an operculum; *fultoni* has no operculum and therefore must go into a Cytharine genus.

'Drillia' *scitecostata* (Sow.)

Figs. 8 *f*, 20 (left)

1903. Sowerby. *Mar. Invest. S. Afr.*, ii, p. 214, pl. 4, fig. 10 (*Pleurotoma* (*Drillia*) *s.*).

1906. Smith. *Ann. Natal Mus.*, i, p. 25 (*Drillia s.*).

Protoconch 2 whorls, diam. and alt. 1·25 mm., smooth. Postnatal whorls 6. Oblique ribs slightly broader than the deep intervals, 14–15 on early whorls, increasing to 25–26 on last whorl; upper ends coronate, slightly projecting above the smooth sulcus, becoming obsolete on lower half of base. Base spirally lirate. Lip sinus rather broad, moderately deep, adjoining the suture. Columella nearly straight, canal short. 26 × 8 mm.

No operculum. Buff.

Radula without basal membrane, *c.* 33 pairs of slender, acicular teeth, shallowly grooved nearly to apex, margins thickened.

Off Glendower Beacon (near Port Alfred), 100 fathoms (Sowerby). Type (presumably) and cotype in S. Afr. Mus.

Off East London, 80–130 fathoms, 3 dead, 1 alive; Algoa Bay, 56 fathoms, 2 dead; False Bay, 20 fathoms, 1 dead (S. Afr. Mus. P.F. Coll.).

Remarks. Like *fultoni* this species must be removed from *Drillia* on account of the absence of an operculum and the character of the radula.

False Bay specimen has only 21 ribs on the last whorl.

Incertae sedis—Animals unknown

Drillia hottentota (Smith)

1882. Smith. *Ann. Mag. Nat. Hist.* (5), x, p. 208 (*Pleurotoma* (*Clavus*) *h.*).
1892. Sowerby. *Mar. Sh. S. Afr.*, p. 5, pl. 4, fig. 81.
1897. id. *Append. Mar. Sh. S. Afr.*, p. 3, pl. 8, figs. 1, 2 (*burnupi*).
1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 21.
1921. Sowerby. *Proc. Mal. Soc.*, xiv, p. 127 (var. *fuscescens*).
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 21, pl. 4, nos. 161, 162.
1932. id. ibid., p. 21, pl. 4, no. 163 (*neptuni*).

Drillia layardi Sow.

1886. Sowerby. *J. Conch.*, v, p. 5 (*Pleurotoma castanea*, non Rve.).
1897. id. *Append. Mar. Sh. S. Afr.*, p. 2, pl. 8, fig. 3 (*Pleurotoma* (*Drillia*) *l.*).
1903. Von Martens. *D. Tiefsee Exp.*, vii, p. 23.
1915. Bartsch. loc. cit., p. 21.
1932. Turton. loc. cit., p. 22.

S. Afr. Mus. has examples of both these 'species' identified by Tomlin. Unless some slip has occurred, there is a transition in colouring from typical *hottentota* (brown with white base, and brown with pale band) to the uniform brown var. *fuscescens* and *layardi*. Conchologically there are no differences, and therefore I propose to make *layardi* a synonym of *hottentota*.

Protoconch 2 whorls, diam. and alt. 1 mm., smooth but with *c.* 10 straight axial plicae on last half whorl; 1st postnatal whorl starts with oblique riblets. Postnatal whorls 5. Axial riblets on 1st whorl 10–11, increasing to 13–15(16) on 5th whorl. In some specimens, both typical *hottentota* and *fuscescens-layardi*, some (not all) of the riblets cross the sulcus and reach or almost reach the suture (*burnupi*). Spiral striae absent except on the base (and here often visible only on the lower part). Occasionally on the lower part of the intervals between the ribs there are very faint indications of 2 (3) spiral striae.

Up to 18 mm. long (Turton).

False Bay to Port Alfred (previous records, and S. Afr. Mus.).

Off Cove Rock (East London), 22 fathoms, 1 dead but fairly fresh (brown: *fuscescens-layardi*); Algoa Bay, 10 fathoms, 1 dead (*hottentota* coloration). (S. Afr. Mus. P.F. Coll.)

Remarks. The absence of spiral striae distinguishes this species from *subcontracta*.

D. burnupi, 10×4 mm. with 8 [*sic*, =2+6] whorls, was stated by Sowerby to be allied to *layardi*, but with the axial riblets running across the sulcus to suture. A very worn specimen in S. Afr. Mus. with only 3 whorls from Tongaat

(30 miles north of Durban) shows this character. It is dull yellowish with a brown band below the suture, and a very faint narrow white band below the brown, as in some examples of *hottentota*.

Drillia ancilla Thiele

1925. Thiele. *D. Tiefsee Exp.*, xvii, p. 228, pl. 37 (25), fig. 10.
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 29, pl. 6, no. 214 (*Mangilia innotabilis*).

Protoconch $1\frac{1}{2}$ whorls, diam. and alt. 0·5–0·6 mm., smooth. Postnatal whorls 4. Axial riblets 9 on each whorl, oblique, crossing sulcus. No spiral striae. Lip sinus deep, adjoining suture, but with columella callus interposed when fully developed. $4{\cdot}75 \times 2{\cdot}1$ mm.

33° 50′ S., 25° 48′ E., and 35° 26′ S., 20° 56′ E., no depth stated (Thiele). Port Alfred (Turton).

Off Cove Rock (East London area), 22 fathoms, 2 dead (S. Afr. Mus. P.F. Coll.).

Remarks. Agrees with *hottentota* and *falsa* in the absence of spiral striae, but seems to be a smaller species than either of these.

Drillia subcontracta Smith

1904. Smith. *J. Malac.*, xi, p. 26, pl. 2, fig. 2.
1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 22.
1915. id. ibid., p. 28, pl. 7, fig. 7 (*Mangilia herilda*).
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 22.
1932. id. ibid., p. 29, pl. 6, no. 215 (*Mangilia nereia*).

Protoconch $1\frac{1}{2}$–2 whorls, smooth (but worn). Postnatal whorls 6. Axial riblets 14–15 on 1st whorl, 13–14 on middle whorls, 15–16 on 5th and 6th whorls, more or less traceable across sulcus, petering out on base. Spiral striae over whole whorl, not crossing riblets (but no living specimens seen), 3–4 on sulcus, (8)9–10 below in intervals between riblets on last whorl, 12–15 additional stronger striae on base. $12 \times 4{\cdot}5$ mm.

Amber-brown, worn specimens with paler or white ribs.

Port Alfred (Smith, Bartsch, Turton, S. Afr. Mus.).

Remarks. The S. Afr. Mus. specimens were identified by Tomlin. The axial ribs are more numerous, and the spiral striae fewer than in *diversa* (Smith).

A specimen in S. Afr. Mus., identified by Tomlin as *herilda*, is a young *subcontracta* bleached white.

Drillia diversa (Smith)

1882. Smith. *Ann. Mag. Nat. Hist.* (5), x, p. 207 (*Pleurotoma* (*Clavus*) *d.*).

Drillia bairstowi (Sow.)

1886. Sowerby. *J. Conch.*, v, p. 6 (*Pleurotoma b.*).
1892. id. loc. cit., p. 6, pl. 1, fig. 6.

Drillia albonodulosa Smith

1904. Smith. *J. Malac.*, xi, p. 27, pl. 2, fig. 3.

S. Afr. Mus. has 3 *diversa* (identified by Tomlin), 1 *bairstowi* (identified by Tomlin) and 3 topotypes of *albonodulosa*; all water-worn.

All specimens have 10 axial ribs on the whorls; the 5th whorl in *bairstowi* has 11; the body whorl in *albonodulosa* only 6 or 7, the last part of the whorl being ribless. In the latter the white mark on the ribs is continued as a white band on the smooth part, but it is superficial and not deep-seated.

Spiral striae over whole whorl, 5–6 on sulcus, 14–15 (or more) below (visible in worn specimens only between the ribs) and *c.* 15 stronger and more widely spaced striae on base.

Turton (1932, p. 22) says all three species are 'quite distinct': 'orange with faint ribs and dark colouring in between', 'white with dark reddish streaks between the ribs', and 'dark brown with a row of white nodules'. The same colouring expressed in different words, and referring to water-worn, not conchological, characters.

Possibly the actual types of these three 'species' may differ, but unless and until the conchological differences (if any) have been stated, the above synonymy is suggested.

See also *Clavatula halistrepta* Bartsch (*infra*, p. 140).

Drillia rousi (Sow.)

1886. Sowerby. *J. Conch.*, v, p. 6 (*Pleurotoma r.*).
1892. id. *Mar. Sh. S. Afr.*, p. 5, pl. 1, fig. 3 (bad) (*Pleurotoma r.*).
1906. Smith. *Ann. Natal Mus.*, i, p. 26, pl. 7, fig. 3 (not good) (*albotessellata*).
1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 16, pl. 4, fig. 1 (*Clionella elizabethae*).
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 20, pl. 4, no. 154 (large specimen; ? not the juv.).

Axial ribs 9–10 on last 2 whorls, broad, rounded, shouldered or subcuspidate above, extending halfway across base on last whorl. Spiral striae 4–5 on last 2 whorls, and 5–6 additional on base, none on sulcus.

Sowerby: 20×8 mm. (4 whorls in fig.); Bartsch: 13×7 mm. ($3\frac{1}{2}$ whorls in fig.); Smith: 18×6 mm. (3 whorls in fig.). S. Afr. Mus.: 15×6 mm. (feebly shouldered), 15×7 mm. (strongly shouldered).

Port Elizabeth (Sowerby, Bartsch); Port Shepstone, Natal (Smith); Port Alfred (Turton).

Remarks. It seems clear that Sowerby, Bartsch and Turton have described and figured examples of one and the same species. Four topotypes of *albotessellata* (S. Afr. Mus. coll. Burnup) justify including this also as a synonym.

All four have only 3 whorls with portion of an earlier whorl, and Burnup's label says 'always decollated'; Sowerby's original description included the word 'decollata'. Smith's 'anfractus circiter 8' appears to be a misprint for 3, as shown in his figure.

Smith's figure is not good, as the profile of the whorls is evenly convex, without any prominent shoulder. It can, however, be nearly matched by one of the S. Afr. Mus. specimens. Two others have strong shoulders; one of them closely resembles Bartsch's figure, with the colour pattern shown in Turton's photograph. The fourth specimen has moderate shoulders.

Turton also figured a 3 mm. specimen stated to be a juvenile of *rousi*. It had protoconch 2 whorls plus 3 postnatal whorls, the 3rd whorl showing 4 axial ribs in face view; spiral striae not visible in the photograph. Presumably Turton had intermediate sizes connecting the juveniles with the decollated adults.

Drillia omia n. sp.

Fig. 11 *a*

S. Afr. Mus. No. A8651. Eleven specimens, locality ? Port Alfred. All more or less worn, uniform pale or dark brown, without any indication of a darker band.

Smallest 7 mm. long with protoconch plus 3 whorls, therefore not comparable with Turton's juvenile mentioned above under *rousi*; largest 10 mm. long with protoconch plus 4 whorls; none with parietal callus or lip sinus.

Profile strongly shouldered and convex below the slightly concave sulcus. Axial ribs broad, rounded, slightly protractive, 9–10 on 1st and 2nd whorls,

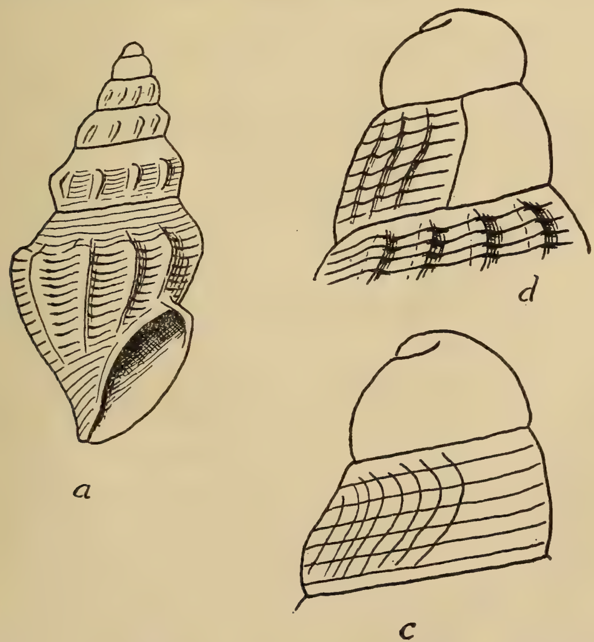


FIG. 11. *a. Drillia omia* n. sp. *b. D. sowerbyi* Turton. Protoconchs of: *c. D. caffra* (Smith). *d. D. thetis* (Smith).

10–11 on 3rd and 4th, extending halfway across base on body whorl; 4 spiral striae in sulcus on last whorl, 8 in the intervals between the ribs, and *c.* 12 additional on base (contrast *rousi*).

Drillia sowerbyi Turton

Fig. 11 *b*

1932. Turton. *Mar. Sh. Pt. Alfred,* p. 22, pl. 4, no. 170.

Aperture 1¼ in spire. Protoconch 1½ whorls, diam. 1 mm., smooth (worn). Postnatal whorls 4½; profile almost straight, a very slight convexity (cingulum) below suture, and a very slightly concave sulcus, remainder slightly convex. 10 feeble slightly oblique, protractive, axial ribs on 3rd whorl; body whorl with 6, thereafter obsolete. Whole whorl, including sulcus, with very fine close-set spiral striae, *c.* 15 on 2nd whorl, 20 on 3rd and 25–30 on 4th, *c.* 15 additional striae (slightly farther apart) on base. Parietal callus well developed, lip sinus deep. 11×4·5 mm.

Buff, remains of periostracum dark brown. Turton: very dark brown.

Port Alfred (Turton). Off Cove Rock (East London), 22 fathoms, 1 dead (S. Afr. Mus. P.F. Coll.).

Remarks. This single specimen (A354) is slightly worn but corresponds so closely with Turton's figure that it can be referred to his species. Turton makes no mention of the spiral striae, and the figure scarcely shows them. His specimen was 8×3·5 mm., with 2 plus 4 whorls (Turton reckoned 1 plus 5).

Drillia caffra (Smith)

Fig. 11 *c*

1882. Smith. *Ann. Mag. Nat. Hist.* (5), x, p. 209 (*Pleurotoma* (*Clavus*) *c.*).
1892. Sowerby. *Mar. Sh. S. Afr.*, p. 6, pl. 4, fig. 80 (bad).
1904. Smith. *J. Malac.*, xi, p. 27, pl. 2, fig. 4 (*praetermissa*).
1904. id. ibid., p. 27, pl. 2, fig. 5 (*nivosa*).
1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 21 (*Drillia c.*).
1915. id. ibid., p. 22, pl. 2, fig. 4 (*lara*).
1931. Tomlin. *Ann. Natal Mus.*, vi, p. 440 (*Clionella c.*).
1932. Turton. *Mar. Sh. Pt. Alfred,* p. 20.

Aperture about 1¼ in spire. Protoconch 1½–2 whorls (junction with 1st postnatal whorl not clear), diam. and alt. 1 mm., smooth. Postnatal whorls 6; profile slightly concave at sulcus, convex below, widest at the shoulder above middle of whorl. Axial ribs oblique, 11–12 on early whorls, increasing to 15–18 on last whorl, most prominent at shoulder, not indicated on sulcus, petering out at middle on body whorl. No cingulum at suture, or only a very slight one. Fine spiral striae over whole whorl, 6 at start of 1st whorl, becoming numerous on following whorls, at least 30 on last whorl, in fresh specimens crossing the ribs. Lip sinus deep, with (in adult) parietal callus. Columella reflected at the short and broad canal. 29×9 mm. (across shoulder).

Pale brown, mottled; beach specimens buff, pink, white, often a few dark spots below suture.

Port Elizabeth (Smith, Sowerby); Port Alfred (Bartsch, Turton).

Off Cape Natal (Durban), 55 fathoms, dead but fresh, and off Port Shepstone, Natal, 36 fathoms, 3 unicolorous pink, grey, white, dead, but 2 showing striae; off Umhloti River mouth, 40 fathoms, dead; off Cove Rock (East London) 80–130 fathoms, 2 dead, discoloured; off Nieca River (south of East London), 43 fathoms, 1 dead; off Glendower Beacon (Port Alfred), 66 fathoms, 2 dead (S. Afr. Mus. P.F. Coll.).

Remarks. Specimens from Port Alfred identified as *praetermissa* and *lara* indicate that both these are synonyms of *caffra*, and I would include also *nivosa*, as did Tomlin, 1931.

With profile similar to that of *subcontracta*, but far fewer spiral striae.

The two from the East London area have very strong auriculate and varicoid outer lips.

Drillia thetis (Smith)

Fig. 11 *d*

1904. Smith. *J. Malac.*, xi, p. 26, pl. 2, fig. 1.
1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 22.
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 21, pl. 4, no. 164 (*pretiosa*).
1932. id. ibid., p. 23, pl. 5, no. 175.

Aperture $1\frac{1}{3}$–$1\frac{1}{2}$ in spire. Protoconch $1\frac{1}{2}$–2 whorls, diam. and alt. 0·6 mm., smooth. Postnatal whorls 5; profile convex from suture to suture (no concave sulcus). Oblique axial ribs 11 on 1st whorl, increasing to 12–13 on last whorl, from suture to suture, obsolescent on base. Fine spiral striae 6–7 on 1st whorl, increasing to *c.* 25 (between sutures) on last whorl, crossing the ribs. No cingulum. Lip sinus deep, with parietal callus in adult. Columella reflected at short broad canal. 10×14 mm. (incl. outer lip).

Port Alfred (Smith, Bartsch, Turton). 33° 3′ S., 27° 57′ E. (East London area), 32 fathoms, 2 dead but fresh; off Cove Rock (East London area), 80–100 fathoms, 3 dead (S. Afr. Mus. P.F. Coll.).

Remarks. A smaller species than *caffra* (compare protoconchs) and distinguished by the ribs starting at the suture above.

Drillia platystoma (Smith)

1877. Smith. *Ann. Mag. Nat. Hist.* (4), xix, p. 501 (*Pleurotoma* (*Clionella*) *p.*).
1889. Sowerby. *J. Conch.*, vi, p. 7, pl. 1, fig. 21 (*Pleurotoma wilkiae*).
1892. id. *Mar. Sh. S. Afr.*, p. 4, pl. 1, fig. 4 (*wilkiae*).
1892. id. ibid., p. 5, pl. 4, fig. 82 (*platystoma*).
1903. Smith. *Proc. Mal. Soc.*, v, p. 363 (*Drillia p.*).
1903. Von Martens. *D. Tiefsee Exp.*, vii, p. 23 (*castanea*, non Rve.).
1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 18 (*Clionella ? p.*).

1923. Melvill. *Proc. Malac. Soc.*, xv, p. 168, pl. 5, fig. 13 (*Surcula macilenta*).
1925. Thiele. *D. Tiefsee Exp.*, xvii, p. 212, pl. 35 (23), fig. 17 (*distincta*).
1931. Tomlin. *Ann. Natal Mus.*, vi, p. 438 (*macilenta*).
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 23 (*platystoma* and var. *wilkiae*).

Aperture 1½ times in spire. Protoconch 1½–2 whorls, diam. and alt. 1 mm. (or a little less), smooth, glossy, ending with an evenly curved plica preceded by 2 obscure ones (cf. fig. 12a). Postnatal whorls 7. Oblique ribs weak, 13–14 on body whorl. Close, fine spiral striae over whole whorl, slightly less distinct on sulcus, on last whorl 8–9 in sulcus, 12–13 below shoulder, and *c.* 24 additional striae on base. 16×5·5 mm.; 17×5 (*macilenta*).

Yellowish, fuscous, pale brown or buff.

Port Elizabeth (Sowerby); Port Alfred (Bartsch, Turton); St. Francis Bay, 80–100 metres, several dead (von Martens).

Off Umhloti River mouth, 40 fathoms, 2 juv. dead; off Cape Natal (Durban), 62 and 85 fathoms, 3 dead; off Great Fish Point Lighthouse, 49 fathoms, 1 dead (S. Afr. Mus. P.F. Coll.).

Remarks. The Great Fish Point specimen seems to be an exact counterpart of the *Valdivia* specimen figured by Thiele, but even a trifle more slender. Its protoconch measures diam. and alt. 0·8 mm.

The Natal specimens were identified as *wilkiae* by Sowerby.

The oblique ribs vary in strength according to the condition of the shell: in unworn specimens they are obvious from the shoulder almost to bottom of whorl (*macilenta*), in worn specimens they are reduced to more or less conspicuous knobs at the shoulder (*platystoma* and *wilkiae*, as far as can be judged from Sowerby's 1892 feeble figures).

Mangilia benjamini Bartsch (*v. infra*) is a broader shell (width less than 3 in length), with more numerous whorls at a shorter length.

Cf. *Pleurotoma? paula* Thiele

Fig. 12 *a*

1925. Thiele. *D. Tiefsee Exp.*, xvii, p. 229, pl. 37 (25); fig. 2.

Two specimens are very similar to *platystoma*, but differ in having fewer spiral lirae.

Aperture 1½ in spire. Protoconch 2 whorls, smooth, glossy, ending with a distinct axial, evenly curved plica preceded by 2 feeble ones. Postnatal whorls 5. Twelve to fourteen very feeble oblique knobs traceable on 3rd to 5th whorls at the shoulder, which is slightly above middle of whorl. Spiral striae over whole whorl, 4 above shoulder on 2nd and 3rd, 5 on 4th and 5th whorls, 1–2 at shoulder visible between the knobs, 4 below shoulder on 2nd and 3rd, 5 on 4th and 5th whorls, 6 additional striae on base of same strength as those above, followed by 6 feebler ones; the intervening lirae flat; the lira between suture and first stria wider and stronger than those following, forming a slight cingulum. Growth-lines sigmoid, sometimes rather prominent, due possibly to surface wear on either side of them. In places the striae are slightly punctate (or the lirae slightly beaded) at the intersections with growth-lines. 11 × 4 mm.

Algoa Bay, depth not recorded, one; off Nanquas Peak (eastern part of Algoa Bay), 49 fathoms, one (S. Afr. Mus. A8591, P.F. Coll.).

Remarks. In the small (6·3 mm.) *Pleurotoma? paula* Thiele, from 35° 16′ S., 22° 26′ E., 155 metres, similar prominent sigmoid growth-lines occur at regular

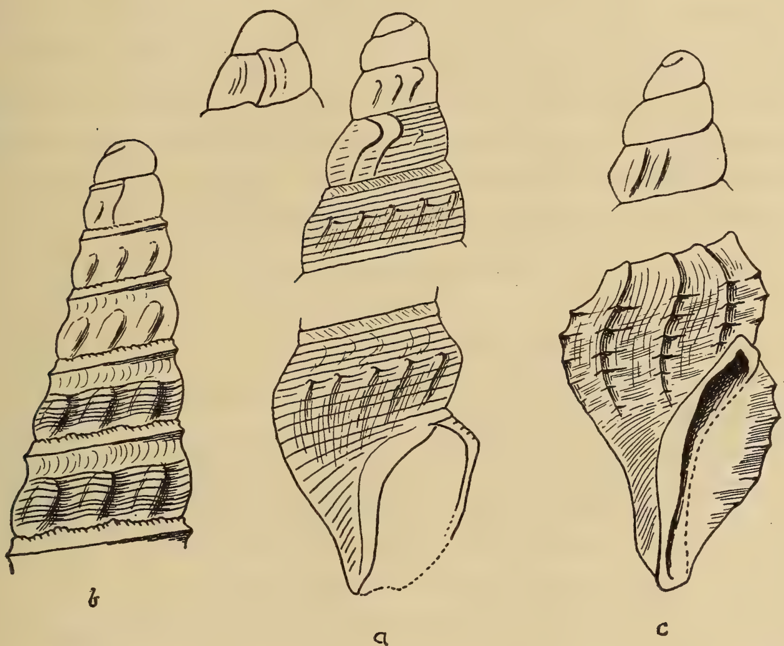


Fig. 12. *a. Pleurotoma ? paula* Thiele, body whorl, apex and protoconch further enlarged. *b. Drillia flavidula* (Lam.), apex. *c. D. laterculoides* n. sp., body whorl and protoconch.

intervals on the 3 postnatal whorls, which are otherwise devoid of any sculpture. The *Valdivia* example was worn; possibly the present unworn specimens are conspecific.

A worn specimen resembling Thiele's specimen but consisting of only the 2-whorled protoconch plus one postnatal whorl was taken off Cape Recife (34° S., 25° 44′ E. (approx. 30 fathoms)). It measures 3·25 × 1·75 mm., the protoconch alt. 1·25, diam. 1 mm. The postnatal whorl has 9 sigmoid axial grooves. (S. Afr. Mus. A8754, P.F. Coll.)

Drillia variabilis Smith

1877. Smith. *Ann. Mag. Nat. Hist.* (4), xix, p. 495.
1901. Melvill and Standen. *Proc. Zool. Soc. Lond.*, ii, p. 441.
1917. Melvill. *Proc. Mal. Soc.*, xii, p. 159, pl. 8, fig. 8.

Aperture $1\frac{1}{2}$ times in spire. Protoconch missing. Postnatal whorls 10. Oblique axial ribs 8 on early, 12–13 on later whorls, extending over base nearly to canal. A feeble, narrow cingulum below suture, inconspicuously nodulose. Below sulcus 8–10 spiral lirae crossing ribs and grooves, slightly and irregularly nodulose, visible chiefly on base where there are *c.* 12 additional lirae, with finer intermediaries. Growth-lines rather distinct on body whorl, forming a semi-cancellate sculpture. Lip sinus broad, separated from suture by cingulum. 32×10 mm.

Buff, with a few orange patches, and numerous orange spots on the cingulum and lirae. 'Freckled with pale brown' (Melvill).

Off Cape Vidal, Zululand, 22 fathoms, 1 dead (S. Afr. Mus. P.F. Coll.).

Distribution. Farquhar Island (S. Afr. Mus.); Persian Gulf, 6–15 fathoms; Karachi, 3 fathoms; off Bombay, 47 fathoms; Red Sea; Andaman Is.

Remarks. The Zululand specimen was identified by Sowerby.

Drillia flavidula (Lam.)

Fig. 12 *b*

1822. Lamarch. *Anim. sans Vert.*, vii, p. 92.
1843. Reeve. *Conch. Icon.*, i, pl. 8, fig. 66.
1917. Melvill. *Proc. Mal. Soc.*, xii, p. 152.

Slender, spire elongate, aperture $1\frac{1}{4}$ in spire. Protoconch 2 whorls, smooth, diam. 0·75, alt. 0·8 mm., junction with 1st postnatal whorl distinct. Postnatal whorls 10 (as preserved). Oblique axial ribs 9 on 1st, 10 on 2nd, increasing to 12 on 10th whorl, rounded at shoulder, petering out on anterior half of base. Crossed by spiral lirae, 3–4 fine ones in sulcus, on ribs 4 (3 in early whorls) larger followed by 4 finer lirae; *c.* 15 additional lirae on base, with an intermediate between each of the upper 6 or 7 pairs. Cingulum present from 1st whorl onwards, forming a somewhat angular keel below and an irregularly crimped or beaded sutural margin above. Lip sinus moderately deep, situated in the sulcus. Growth-lines forming the sutural crimping but indistinct across cingulum and between the ribs, distinct in sulcus and on the base. Canal narrow (rostral point broken). 29×8 mm.

Pale buff, no dark blotches visible between the ribs.

Off Tongaat River (Natal), 36 fathoms, 1 dead but unworn (S. Afr. Mus. P.F. Coll.).

Distribution. Red Sea, Persian Gulf, China.

Remarks. Melvill (p. 153) considered *flavidula* a variable species. The present specimen, described above, agrees with 2 Hong Kong examples (S. Afr. Mus. Ross Frames don.) but has a stronger cingulum and more conspicuous crimped sutural margin. The latter feature indicates *intertincta* Smith (cf. Gravely. 1942. *Bull. Madras Govt. Mus. n. s. Nat. Hist.*, v, 2, p. 75, in key), but the present shell is much more slender than Melvill's figure (1917. loc. cit., pl. 8, fig. 6), which shows moreover 3 *spaced* lirae crossing the ribs.

Drillia laterculoides n. sp.

Fig. 12 *c*

Aperture $1\frac{1}{4}$ in spire. Protoconch 3 whorls, alt. 1, diam. 0·8 mm., smooth, junction with 1st postnatal whorl distinct in one specimen, not in the other. Postnatal whorls 7, profile convex with slight shoulder. Oblique axial ribs narrower than intervals, 10 on 1st whorl, 9 on each of the others, on 1st whorl the first 4 or 5 are closer together than the following ribs, crossing sulcus, petering out below periphery on base; spiral lirae obscure on first half of 1st whorl, 4 on second half, and on each succeeding whorl, distinct on ribs but obscure or obsolete in the intervals, 1st bounding the sulcus, 2nd peripheral, 4th almost concealed by following whorl; very fine spiral striae on sulcus and between main lirae; on base 2 additional lirae (on the ribs) and numerous fine striae. Growth-lines strongly sigmoid. Sulcus concave only in the intervals between ribs. Lip sinus deep, adjoining suture. 17×6 mm. Buff.

Off Hood Point (East London area), 49 fathoms, dead, one complete and one apex (S. Afr. Mus. A8709, P.F. Coll.).

Remarks. Very similar to *Drillia laterculata* Sow. 1870 from China and N. Australia. Corresponds better with Watson's figure (*Challenger Rep.*, xv, pl. 18, fig. 5) than with Smith's figure (*Zool. H.M.S. Alert*, pl. 4, figs. E, E′), but the profile is more rounded; moreover Smith said the two (main) lirae are continuous between and across the ribs.

Similar also in shape to *variabilis*, but the axial ribs definitely cross the sulcus, reaching the suture above.

Drillia collina n. sp.

Fig. 13 *a*

Aperture $1\frac{1}{2}$ in spire. Protoconch 2 whorls, smooth with median spiral lira in last half whorl. Postnatal whorls 5, profile convex. Axial ribs 9 on 1st whorl, increasing to 10–11 on last, retractive across sulcus, protractive below, narrower than intervals; crossed by spiral lirae 2 on 1st whorl, 3 on each of the others, the upper one in the sulcus, the middle one strongest and peripheral, 3rd stronger than 1st, one fine intermediary between 1st lira and suture, one between 2nd and 3rd lirae, one below 3rd; 8–9 additional fine lirae on base; complanate nodules at intersections of ribs and lirae. Growth-lines sigmoid. Sulcus not concave, with a subsutural lira forming a narrow but distinct cingulum. Lip sinus deep, adjoining suture. $7 \times 2{\cdot}8$–3 mm. Buff.

Off East London, 32 fathoms, one; off Hood Point (East London area), 49 fathoms, 2 and 2 apices; off Cape Natal (Durban), 85 fathoms, two (S. Afr. Mus. P.F. Coll.).

Remarks. The description is taken from the East London specimens (A8587, A8710); the Natal specimens (A8711) appear to be conspecific.

With some similarity to *Pleurotomella ida* Thiele, but distinctly narrower, and with ribs crossing the sulcus. Thiele's figure seems to indicate a cingulum, but it is not mentioned in the description.

Also rather like *Bellardiella alfredensis* Turton 1932, but the latter is only 4 mm. long with 4 whorls (figure; description says 5).

Drillia bruchia n. sp.

Fig. 13 *b*

A broken specimen consisting of three whorls, apex (? 2 or 3 whorls) missing.

Profile sharply angular. Axial ribs 11 on 1st two whorls, 12 on the last, scarcely indicated on sulcus except near the shoulder, petering out on lower part

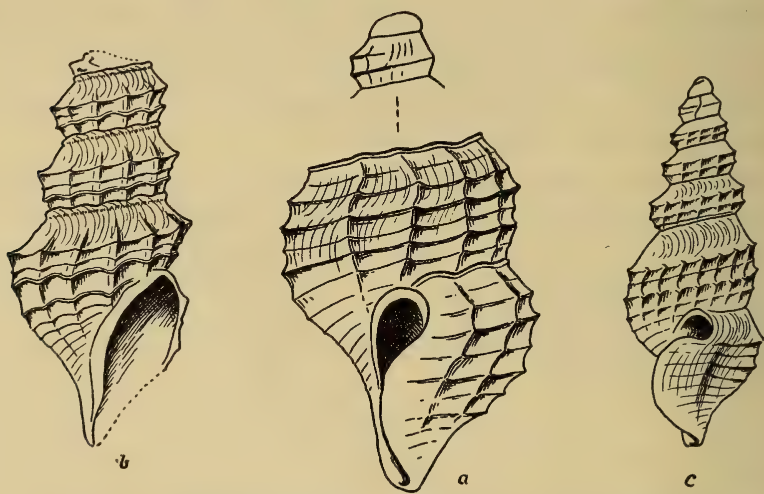


Fig. 13. *a. Drillia collina* n. sp. *b. D. bruchia* n. sp. *c. D. latisulcus* n. sp.

of base; crossed by 2 spiral lirae, with an intermediary beginning on later part of earliest whorl, continued on the two later ones, *c.* 12 additional lirae on base; lirae thin, forming sharp complanate nodules at intersections with ribs; sulcus with distinct narrow cingulum, crossed by growth-lines; lip sinus deep, adjoining suture. 8 × 3·5 mm. Buff.

Off Cape Natal (Durban), 440 fathoms, one dead (S. Afr. Mus. A8717, P.F. Coll.).

Remarks. Although similar to *D. collina* (A8711, and A8587, A8710), this specimen is distinguished by the better marked cingulum, absence of lirae in the sulcus, and the axial ribs not crossing the sulcus.

Drillia tholos n. sp.

Fig. 14

Aperture subequal to spire. Protoconch 2½ whorls, dome-like, 0·3–0·4 alt., diam. 0·7–0·8 mm., apex smooth, 5–6 feeble close-set axial pliculae on last quarter, glossy. Postnatal whorls 3–3½, profile convex with slight rounded shoulder. Axial ribs 13 on 1st, 11–12 on 2nd and 3rd whorls, crossing sulcus and extending halfway across base; narrow, sharp; crossed by narrow, sharp spiral lirae 2 on beginning of 1st whorl, increasing to 3, 5 on 2nd and 3rd, the uppermost in the sulcus, the second forming the shoulder, forming tiny points at intersections with ribs; *c.* 12 additional lirae on base. Growth-lines fine, forming, with extremely fine spiral striae, a microcancellate sculpture. Lip sinus moderate, adjoining suture. 5×2 mm. Pale brown.

Off Hood Point (East London area), 49 fathoms, 14 dead; off Cape Natal (Durban), 11 dead (S. Afr. Mus. A8735, A8759, P.F. Coll.).

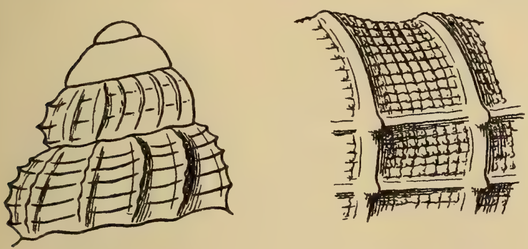


FIG. 14. Protoconch and 1st postnatal whorl of *Drillia tholos* n. sp., with portion of upper part of last whorl further enlarged.

Remarks. There is no clear distinction between protoconch and first post-natal whorl except a rather more conspicuous riblet; some of the 5 or 6 pliculae may belong to the 1st postnatal whorl.

Most of the specimens are about $3{\cdot}75 \times 1{\cdot}75$ mm.

Distinguished from *Glyphostoma siren* Smith by the microcancellate sculpture, and from *Mangilia shepstonensis* by the non-tabulate axial ribs.

Drillia latisulcus n. sp.

Fig. 13 *c*

Aperture 1⅓–1½ in spire. Protoconch 2 whorls, diam. and alt. 0·5 mm. smooth. Postnatal whorls 5, profile convex with slight shoulder. Axial ribs (below shoulder) 11 on 1st whorl, increasing to 13–14, but evanescent on last part of last whorl; crossed by spiral lirae 2 on 1st, 2nd and 3rd whorls, 2 and a fine 3rd near lower suture on 4th whorl, 3 on 5th, the lowest fine, also an intermediary between 1st and 2nd lirae, at least 12 additional lirae on base; slight complanate nodules at intersections. Growth-lines fine; sulcus rather wide, scarcely concave, no cingulum, without spiral lirae and not crossed by the ribs. Lip sinus deep, adjoining suture. Outer lip submarginally incrassate. $6{\cdot}5–7 \times 2{\cdot}3–2{\cdot}5$ mm. Pale brown.

Off Tugela River (Zululand), 65–80 fathoms, one; off Tongaat River (Natal), 36 fathoms, one; off Umhloti River (Natal), 40 fathoms, two; off Illovo River (Natal), 27–30 fathoms, one; off Cape Natal (Durban), 54 fathoms, 3 dead; off Cape Morgan, 47 fathoms, three; off Hood Point (East London area), 49 fathoms, six (S. Afr. Mus. A8718–A8723, A8760, P.F. Coll.).

Remarks. In some of the specimens the intermediary lira between the 1st and 2nd main lirae becomes as strong as the others on 4th and 5th whorls, noticeably so in the Tugela River specimen and one of the Cape Morgan specimens.

In one of the Hood Point specimens and the Tugela River specimen the axial ribs are broader and do not exceed 12 in number.

The figured specimen is one of the Hood Point lot (A8718), which may be regarded as type material.

Drillia perfluans n. sp.

Fig. 15 *a*

Aperture 1½ in spire. Protoconch 1½ whorls, diam. and alt. 0·75 mm., smooth, glossy, junction with 1st postnatal whorl distinct. Postnatal whorls 4.

FIG. 15. *a. Drillia perfluans* n. sp. *b. D. falcicosta* n. sp. *c. D. oneili* n. sp.

Axial ribs 11 on 1st and 2nd whorls, 11–12 on 3rd, 12 on 4th, crossing (*perfluans*) sulcus; crossed by very faintly impressed spiral striae 3 on 2nd, 4 on 3rd, 5 on 4th whorl, the first at shoulder; about 12 additional striae on base, obscure in upper part, more distinct on lower part. Sulcus with one fine stria below suture, and one or two others very obscure near shoulder on last whorl. Lip sinus deep, adjoining suture. 5·75 × 2·3 mm. Pale buff.

Off Hood Point (East London area), 49 fathoms, one dead (S. Afr. Mus. A8716, P.F. Coll.).

Drillia falcicosta n. sp.

Fig. 15 *b*

Aperture slightly less than spire. Protoconch 2 whorls, alt. 0·5, diam. 0·75 mm., smooth, glossy, junction with 1st postnatal whorl distinct. Postnatal whorls 3, profile convex with very slight shoulder. Axial ribs 11–12 on 1st, 12–13 on 2nd, 13–15(16) on 3rd whorl, narrow, sharp, crossing sulcus and slightly enlarged or raised at suture, slightly enlarged at shoulder but not nodular; extremely fine and faint spiral striae between ribs, chiefly visible in the sulcus near suture; upper part of base smooth, lower part with 6–7 lirae; sulcus slightly concave between ribs; lip sinus deep, adjoining suture. 6 × 2·5 mm.; both the Zululand specimens slightly larger, with 3½–4 whorls: 7 × 3 mm. Pale buff.

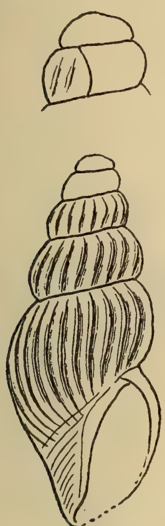


Fig. 16. *Drillia morgana* n. sp., with protoconch further enlarged.

Off Umhloti River (Natal), 40 fathoms, 2 unworn and one apex; off O'Neil Peak (Zululand), 90 fathoms, 2 worn (S. Afr. Mus. A8724, A8725, P.F. Coll.).

Described from the unworn Natal specimens (A8724).

Drillia morgana n. sp.

Fig. 16

Aperture 1⅓ in spire. Protoconch 2 whorls, nucleus depressed, alt. 0·8, diam. 1 mm., smooth, junction with 1st postnatal whorl distinct. Postnatal whorls 3½, profile evenly convex, sutures rather deep. Axial ribs 15–16 on 1st, 19 on 2nd, *c.* 25 on 3rd whorl, narrow, not conspicuous, on last whorl sometimes coalescent (making an exact count difficult), crossing the undefined sulcus. No spiral sculpture except *c.* 10 lirae on lower part of base. 7·5 × 3 mm. Creamy white.

Off Cape Morgan, 47 fathoms, one dead (S. Afr. Mus. A8739, P.F. Coll.).

Drillia oneili n. sp.

Fig. 15 *c*

Aperture slightly less than spire (protoconch incomplete). Protoconch 2 whorls, apex corroded (but only the nucleus seems to be missing), smooth. Postnatal whorls 4, profile convex, scarcely any shoulder. Axial ribs 11 on 1st whorl, 12 on 2nd and 3rd, 13 on 4th, slightly oblique, rounded, about as broad as intervals, crossing sulcus but not the cingulum, petering out on base; crossed by narrow spiral lirae (on 1st whorl?), 2 on 2nd, 3 on 3rd and 4th, *c.* 14 addi-additional lirae on base; in addition very fine spiral lirae over whole whorl, *c.* 6 in sulcus on 4th whorl. Sulcus not concave, with narrow but distinct cingulum. Lip sinus deep, adjoining suture. Growth-lines very faint, not forming any cancellation with the lirae. 6·5 × 2 mm. Pale buff.

Off O'Neil Peak (Zululand), 90 fathoms, one slightly worn (S. Afr. Mus. A8731, P.F. Coll.).

Drillia pleonastica n. sp.

Fig. 17 *a*

Aperture slightly less than spire. Protoconch 1½ whorls, alt. 0·75, diam. 1 mm., smooth, junction with 1st postnatal whorl not distinct. Postnatal whorls

4, profile with slight peripheral angle. Spiral lirae 3 on first half of 1st whorl, middle one the most prominent and continued slightly below middle of whorl as the peripheral lira on succeeding whorls; above peripheral lira 4 lirae on 2nd whorl, 6 on 3rd, 7–8 on 4th; below periphery 2 on 2nd, 3 on 3rd, 4–5 on 4th whorl; *c.* 15 additional lirae on base. No axial ribs, but growth-lines distinct, strongly sigmoid, producing a cancellate sculpture on the sulcus, and a

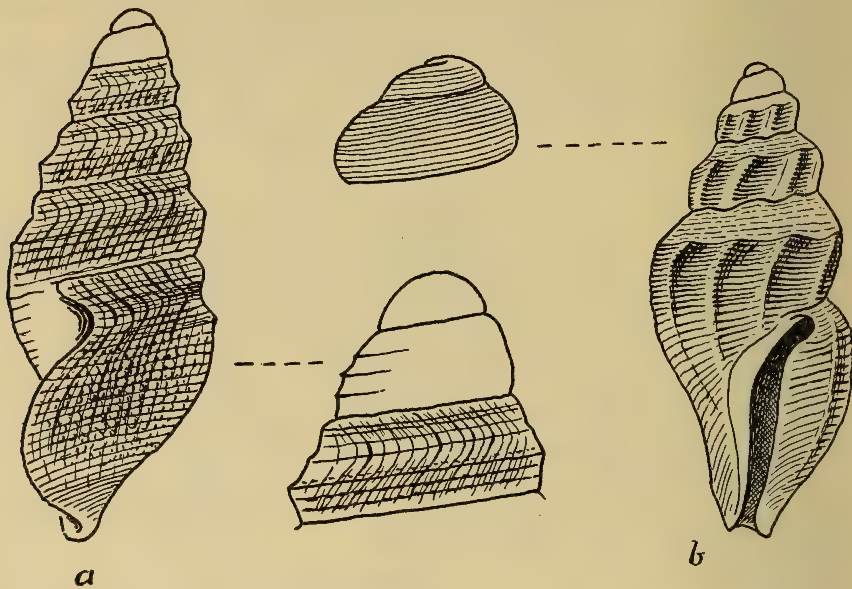


FIG. 17. *a. Drillia pleonastica* n. sp. *b. D. spiralis* n. sp. Protoconchs further enlarged.

beaded sculpture below periphery and on base. Lip sinus deep, remote from suture. 7×2·5 mm. Pale buff.

34° 26′ S., 25° 42′ E., 124 fathoms, one dead (S. Afr. Mus. A8565, P.F. Coll.).

Drillia spiralis n. sp.

Fig. 17 *b*

Aperture subequal to spire. Protoconch 2½ whorls, very finely spirally striate. Postnatal whorls 3, profile convex, with slight but definite shoulder. Obliquely protractive axial ribs 10 on 1st whorl, 9 on 2nd and 3rd whorls, traceable across base, not crossing sulcus; crossed by spiral lirae (below sulcus) 6 on 1st whorl, *c.* 10 on 2nd, *c.* 12–14 on 3rd, additional lirae on base at least 20; sulcus scarcely concave, with 4 spiral lirae on 2nd whorl, 6 on 3rd. Lip sinus deep, adjoining suture. 7×2·5 mm. Buff.

Off Cape St. Blaize, 125 fathoms, one dead (S. Afr. Mus. A8583, P.F. Coll.).

Remarks. Differs from *Haedropleura dora* Thiele (see *Cythara alfredi*) by the more prominent shoulder, less prominent ribs on last whorl, and the ribs not crossing the sulcus.

Drillia fossata Sow.

Fig. 18 *a*

1903. Sowerby. *Mar. Invest. S. Afr.*, ii, p. 214, pl. 3, fig. 5 (*Pleurotoma* (*Drillia*) *f.*).

Aperture subequal to spire. Protoconch 2 whorls, diam. and alt. 1 mm., smooth. Postnatal whorls 6. First whorl with 14 short oblique ribs, broader than intervals, increasing to 30 on body whorl, forming a sharp, coronate or undulate keel above, bounding the deeply concave sulcus; on middle whorls the ribs cross the 1st and more or less the 2nd spiral lirae, but on later whorls peter out below, and on body whorl are scarcely indicated even on 1st lira. 2–3 strong, spaced spiral lirae below keel, and *c.* 10 additional ones on base; lirae in profile tabulate above, sloping below. Lip sinus deep, adjoining suture. 21 × 6·5 mm. (Sowerby: 22 × 7 mm.).

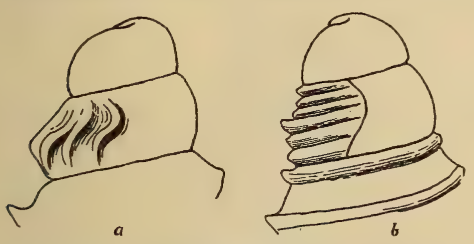


FIG. 18. *a. Drillia fossata* Sow. *b. D. simplicicingula* n. sp., protoconchs

Pale buff, the markings on the type described by Sowerby now faded.

Off Cape Vidal, Zululand, 80–100 fathoms (Sowerby). Type (with Sowerby's label) (fresh) and cotype (dead) in S. Afr. Museum, also broken apices of 4 examples and fragments of others; off Cape Natal, 85 fathoms, fragments; off Hood Point (East London), 49 fathoms, 5 broken apices; 34° 3′ S., 25° 10′ E. (St. Francis Bay), 24–34 fathoms, 1 dead but fresh (S. Afr. Mus. P.F. Coll.).

Remarks. The presence of a specimen in fresh condition as far west as St. Francis Bay is very surprising. There were no fragments of any other examples in the bottom-sample (dredged March 1899), as there were in the Cape Vidal sample (Febr. 1901) from which the type and cotype had been originally picked out. The Cape Natal (Dec. 1900) and Hood Point (July 1901) samples contained only fragments.

Drillia simplicicingula n. sp.

Fig. 18 *b*

Similar in shape to *fossata*. Aperture equal to spire. Protoconch 1½ whorls, diam. and alt. 1 mm., smooth. Postnatal whorls 4; 1st sharply demarcated from protoconch, with 6 spiral lirae, of which the uppermost continues on all whorls as a sharp keel below the suture, the 2 lirae below this (in the sulcus) soon disappear, the lower 3 continue on to 2nd whorl; on 3rd whorl 4 lirae below sulcus, on last whorl 7, with *c.* 15 additional ones on base; lirae in profile tabulate above, sloping below (as in *fossata*). Lip sinus broad and deep, separated from suture by the subsutural keel. 13 × 5 mm.

Pale buff, columella orange-brown, in one specimen aperture internally pinkish, protoconch glossy.

Off Hood Point (East London), 49 fathoms, 2 dead but unworn, 1 broken; off Sandy Point (Cape Morgan, East London area) 57 fathoms, 1 dead but unworn; off Cape Morgan, 47 fathoms, one and 2 fragments; off Great Fish

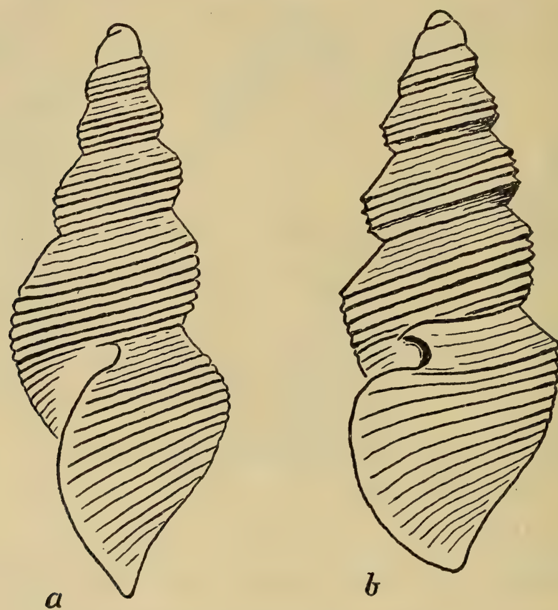


FIG. 19. *a. Drillia dolorosa* Thiele. *b. D. diasi* n. sp.

Point, 51 fathoms, 1 broken ((S. Afr. Mus. A3471, A8666, A8667, A8708, P.F. Coll.).

Remarks. Differs from *fossata* by the complete absence of any axial ribs, and by the different spiral sculpture.

The largest specimen (A8666, Hood Point) may be taken as the type; the smaller Sandy Point specimen (A3471), also with 4 whorls but only 10 × 4 mm., as a cotype. The broken Great Fish Point specimen had 5 postnatal whorls.

Drillia lea Thiele

1925. Thiele. *D. Tiefsee Exp.*, xvii, p. 226, pl. 37 (25), fig. 5.

Protoconch 1½ whorls, smooth. Postnatal whorls 4 (6 mm. shell), 5½ (8 mm. shell). Spiral lirae 3 on 1st whorl, increasing to 5 on 4th and 6–7 on 5th, 15–20 additional lirae on base of 5th whorl. No axial riblets, growth-lines indistinct. Sulcus ⅓ length of whorl. Lip sinus deep, adjoining suture.

$6 \times 2 \cdot 5$ mm. (4 whorls), $8 \cdot 5 \times 3 \cdot 5$ mm. (fragment: 2nd–5th whorls); Thiele: 8×3 ($5\frac{1}{2}$ whorls).

35° 16′ S., 22° 26′ E., 155 metres (Thiele). 34° 26′ S., 25° 42′ E., 124 fathoms, one; and off Cape St. Blaize, 125 fathoms, one and one fragment (S. Afr. Mus. A8567, A8582, P.F. Coll.).

Remarks. Like the *Valdivia* specimens, the P.F. specimens from bottom samples are corroded, and the spiral lirae rather difficult to count.

Another specimen (A8585) from the same bottom sample off Cape St. Blaize is distinctly broader than typical *lea*, and has only 2 spiral lirae on the 1st and 2nd whorls, 3 on 3rd, and 4 on 4th, with 2 very fine intermediaries. $6 \times 2 \cdot 75$ mm.

Drillia dolorosa Thiele

Fig. 19 *a*

1925. Thiele. *D. Tiefsee Exp.*, xvii, p. 227, pl. 37 (25), figs. 6, 6*a*.

Protoconch 2 whorls, diam. 0·6 mm., smooth. Postnatal whorls 4 (Thiele: $4\frac{1}{2}$), profile convex, shoulder not prominent. No axial ribs. Spiral lirae (below sulcus) 3 on 1st whorl, 4 on 2nd, 5 on 3rd and 6 on 4th, *c.* 15 additional lirae on base, very faint towards extremity. Growth-lines obscure. Sulcus scarcely concave, with 2 fine spiral lirae on 2nd whorl, 3–4 on 3rd and 4 on 4th. Lip sinus deep, adjoining suture. $7 \cdot 3 \times 2 \cdot 75$ mm.; Thiele: $10 \cdot 6 \times 3 \cdot 5$ mm. Pale buff.

35° 16′ S., 22° 26′ E., 155 metres (Thiele).

Off East London, 32 fathoms, one dead (S. Afr. Mus. A8588, P.F. Coll.).

Drillia diasi n. sp.

Fig. 19 *b*

Aperture $1\frac{1}{4}$ in spire. Protoconch 2 whorls, diam. and alt. 0·75 mm., smooth. Postnatal whorls 4. No axial ribs. Spiral lirae (below sulcus) 2 on 1st whorl, 3 on 2nd, 4 on 3rd, becoming 5 on the later part, 5 on 4th, at least 15 additional lirae on base, faint towards extremity. Growth-lines fine. Sulcus broad, nearly $\frac{1}{2}$ length of whorl, scarcely concave, with fine spiral lirae, 4 on body whorl. Lip sinus deep, adjoining suture. $9 \times 3 \cdot 75$ and $6 \times 2 \cdot 5$ mm. Creamy white.

34° 26′ S., 25° 42′ E., 124 fathoms, two dead (S. Afr. Mus. A8566, P.F. Coll.).

Remarks. Close to *lea* but with a broader sulcus, a slight but definite shoulder, and a larger protoconch; has only 3 whorls at same length as *lea* with 4 whorls.

Drillia armilla n. sp.

Protoconch $2\frac{1}{2}$ whorls, diam. 0·75 mm., smooth. Postnatal whorls 4, profile convex, without shoulder. No axial ribs. Spiral lirae 3 on 1st whorl, 3 on 2nd becoming 4 on later part, 4 on 3rd becoming 5 on later part, 5 on 4th whorl, 18–20 additional lirae on base. Growth-lines very fine, subordinate to the lirae. Sulcus $\frac{1}{3}$ length of whorl, scarcely concave, with fine spiral lirae 2 on 1st and 2nd whorls, 3 on 3rd and 4th. Lip sinus deep, adjoining suture. Outer lip submarginally incrassate. $7{\cdot}5 \times 3{\cdot}5$ mm. Buff.

Off Cove Rock (East London area), 80–130 fathoms, one dead (S. Afr. Mus. A8714, P.F. Coll.).

Remarks. Similar to *lea* but proportionately broader; the larger protoconch also indicates a different species. The lirae are sharply defined and well separated, without intermediaries.

Close to *diasi* but whorls more convex.

Drillia pselia n. sp.

Aperture subequal to spire. Protoconch 2 whorls, diam. 1 mm., smooth. Postnatal whorls 4, profile convex. Spiral lirae 2 on first quarter of 1st whorl, 3 on remainder, 3 on 2nd, 4 on 3rd, and by duplication and interpolation 6 on last whorl; slight thickenings or nodules appear on the lirae on 2nd and 3rd whorls, but there are no definite axial ribs; at least 25 fine additional lirae on base. Growth-lines for the most part obscure. Sulcus about $\frac{1}{3}$ length of whorl, with 2 spiral lirae on 1st whorl, 3 on 2nd, 4 on 3rd and 4th. Lip sinus deep, adjoining suture. $11 \times 4{\cdot}5$ mm. Buff.

Off Cape St. Blaize, 125 fathoms, one and 2 broken specimens (S. Afr. Mus. A8715, P.F. Coll.).

Remarks. A species with sculpture similar to that of *lea* but larger, and with larger protoconch.

Drillia (*Cymatosyrinx*) *eva* Thiele

Fig. 20 (right)

1925. Thiele. *D. Tiefsee Exp.*, xvii, p. 228, pl. 37 (25), fig. 9.

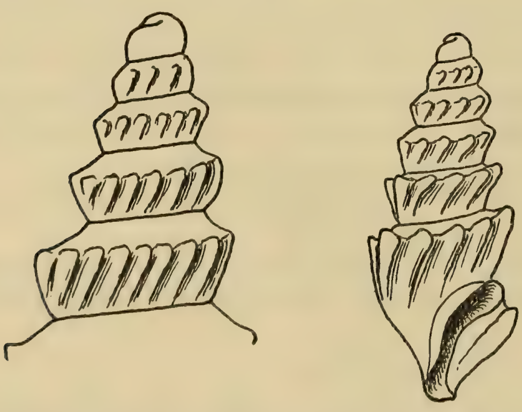


Fig. 20. Right: *Drillia eva* Thiele. Left: apex of 'Drillia' *scitecostata* (Sow.), to same scale.

Aperture $1\frac{3}{4}$ in spire. Protoconch $1\frac{1}{2}$ whorls, diam. 0·5, alt. 0·6 mm., smooth, polished. Postnatal whorls 5. Broad oblique axial ribs, wider than the deep intervals, 12 on last whorl, upper ends becoming increasingly prominent forming a coronate shoulder. No spiral sculpture. Sulcus deeply concave. Lip sinus deep, adjoining suture. $7 \times 2{\cdot}5$ mm. (Thiele and S. Afr. Mus.).

35° 16′ S., 22° 26′ E. 155 metres (Thiele). Off Cape St. Blaize, 125 fathoms, 1 dead (S. Afr. Mus. A8561, P.F. Coll.).

Remarks. At first sight the sculpturing suggests a young *scitecostata,* but the protoconch is smaller and the shell narrower.

Bela alma Thiele

Fig. 21 *a*

1925. Thiele. *D. Tiefsee Exp.*, xvii, p. 227, pl. 37 (25), fig. 13.

Aperture $1\frac{1}{2}$ in spire. Protoconch 2 whorls, smooth, last half whorl with median spiral lira. Postnatal whorls 4. Axial ribs slightly oblique below sulcus, *c.* 10 (obscure) on 1st whorl, 12 on 2nd, 15–16 on last whorl; crossed by spiral lirae on each whorl, feeble knobs at intersections, on body whorl an additional lira at top of base with small knobs, below which the ribs cease; 9–10 fine additional lirae on base. Growth-lines obscure. Sulcus not concave, not crossed by the ribs, no cingulum. Lip sinus deep, adjoining suture. $7 \times 2{\cdot}5$ mm. Pale brown.

35° 26′ S., 20° 56′ E., depth not recorded (Thiele).

Off Illovo River (Natal), 27–30 fathoms, one; off Tugela River (Zululand), 65–80 fathoms, two (S. Afr. Mus. A8712, A8713, P.F. Coll.).

Remarks. Thiele does not mention the actual number of spiral lirae and axial ribs; his figure shows 4 noduliferous lirae on body whorl. In spite of this the present specimens, which agree in dimensions, may be provisionally referred to his species.

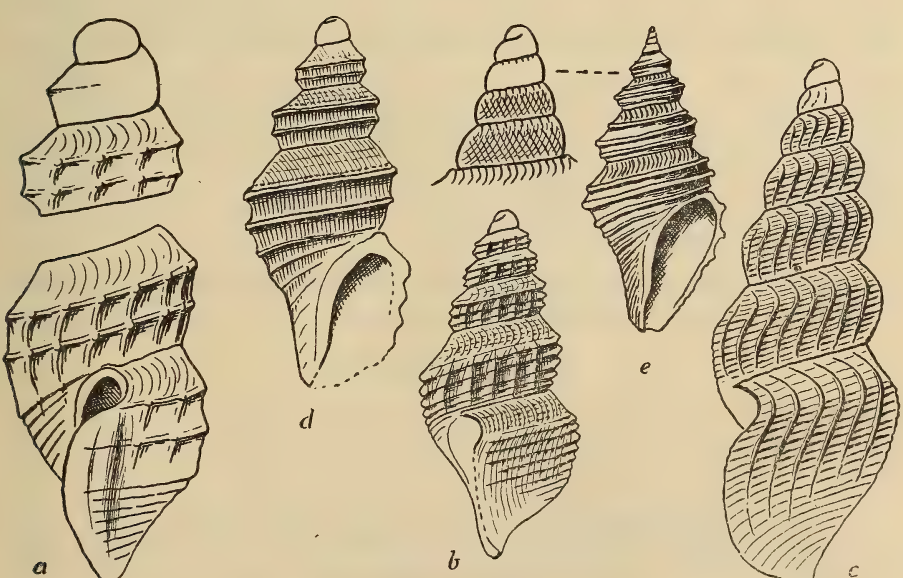


FIG. 21. *a. Bela alma* Thiele, with protoconch. *b. B. anna* Thiele. *c. B. bella* n. sp. *d. Asthenotoma eva* (Thiele). *e. Acrobela acus* n. sp., with protoconch.

Bela anna Thiele

Fig. 21 *b*

1925. Thiele. *D. Tiefsee Exp.*, xvii, p. 228, pl. 37 (25), fig. 14.

Aperture $1\frac{1}{3}$ in spire (Thiele's figure: $1\frac{1}{4}$). Protoconch $1\frac{1}{2}$ whorls, diam. 0·5 mm., smooth (corroded). Postnatal whorls 4 (shell 6 mm.), Thiele: $5\frac{1}{4}$ (shell 10·5 mm.), profile convex with slight shoulder. Axial ribs below shoulder low and rounded, 13 on 1st and 2nd whorls, 15 on 3rd, slightly curved and protractive, becoming obscure on 4th whorl; crossed by spiral lirae 2 on 1st whorl, the upper forming the shoulder, increasing to 5 on 4th whorl (Thiele's figure: 6 or 7 on 5th whorl), *c.* 7 additional lirae on upper part of base (lower part corroded); growth-lines distinct. $6\times2{\cdot}5$ mm.; Thiele: $10{\cdot}5\times4$ mm. Buff.

35° 16′ S., 22° 26′ E., 155 metres (Thiele).

Off Cape St. Blaize, 125 fathoms, one dead (S. Afr. Mus. A8584, P.F. Coll.).

Remarks. The *Pieter Faure* specimen seems to be identical with, though smaller than, the *Valdivia* one.

Bela bella n. sp.

Fig. 21 *c*

Aperture $1\frac{1}{2}$ in spire. Protoconch 2 whorls, diam. 0·75 mm., smooth (corroded). Postnatal whorls 5, profile convex with slight shoulder. Growth-lines forming narrow, sharp axial ribs 14–15 on 1st whorl (more or less corroded), increasing to 20–22 on body whorl, strongly curved in sulcus, protractive below; spiral lirae below sulcus 4 on 1st and 2nd whorls, 4–5 on 3rd, 6–7 on 4th and 7–8 on 5th, *c.* 15 additional lirae on base; sulcus scarcely concave, with 2 lirae on 2nd whorl, 3 on 3rd, 3–4 on 4th and 4 on 5th. Lip sinus deep, adjoining suture. $10\times3{\cdot}5$ mm. Pale buff.

Brown's Bank (approx. $36\frac{1}{2}$° S., 21° E.) on Agulhas Bank, 80–100 fathoms, 3 dead (S. Afr. Mus. A8639, P.F. Coll.).

Remarks. Somewhat resembling *anna*, but distinguished by the sharper, more oblique axial ribs, which cross the sulcus.

Clavatula halistrepta Bartsch

1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 19, pl. 2, fig. 5.
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 19, and var. *albocincta*, pl. 4, no. 149.
1932. id. ibid., p. 19, pl. 4, no. 150 (*hera*).

One very worn topotype Port Alfred (ex Turton), in S. Afr. Mus. I have seen one specimen from Jeffrey's Bay agreeing with Bartsch's description: 6 whorls. 28×10 (across outer lip) mm., aperture 12 mm.

Although larger there are sculptural resemblances between this and *Drillia diversa* (Smith).

Clavatula semicostata Kiener

Fig. 5 *f*

1848. Krauss. *Südafr. Moll.*, p. 109.
1892. Sowerby. *Mar. Sh. S. Afr.*, p. 6.
1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 17.
1915. id. ibid., p. 23, pl. 2, fig. 9 (*Drillia halidoma*).
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 15.

Not: Von Martens. 1903. *D. Tiefsee Exp.*, vii, p. 24.
Thiele. 1925. ibid., xvii, p. 212, pl. 35 (23), fig. 10. } =*lignaria.*

Aperture $1\frac{1}{2}$ to nearly 2 in spire. Protoconch ? Postnatal whorls 9 (10). Oblique axial ribs 11–12 on early whorls, 13–14 on later whorls, beginning at suture, on body whorl extending halfway across base, shoulder slightly *above* middle of whorl; suture embracing lower ends of ribs, producing a more or less nodular cingulum; sulcus rather deeply concave; fine spiral striae, close together on sulcus, farther apart below, 4 on early whorls, increasing to about 10 on later whorls, usually visible only in the grooves between ribs. Lip sinus deep and narrow, a little distance from suture. 48×15 mm.

White or pinkish, periostracum yellow-brown.

Cape (Krauss, Bartsch); Port Alfred (Turton). Durban, Port St. Johns, Hermanus, Kalk Bay (False Bay), and False Bay, 9 fathoms (S. Afr. Mus.).

Remarks. The Durban and the 48 mm. False Bay specimens are fresh and retain the periostracum.

Bartsch's 18·6 mm. *halidoma* can be matched with juvenile shells in S. Afr. Museum.

Bergh (1895. *Nov. Act. K. Leop-Carol. D. Ak. Naturf.*, lxv, no. 2, p. 192, pl. 13, figs. 293–6) gave a full description of the anatomy of three specimens from Saldanha Bay. The radula has a central and a lateral plate resembling those of *Clavatula taxus* and *sinuata*, but Bergh makes no mention of an appendage to the lateral plate. The species seems to be correctly placed in *Clavatula* (*Clionella*), if the identification (or alternatively the locality) is correct. Up to the present there are no other records of this species from the west coast, where the only species seems to be *sinuata* and its var. *sigillata.*

Clionella confusa Smith

Fig. 5 *c*

1906. Smith. *Ann. Natal Mus.*, i, p. 23, pl. 7, fig. 2.
1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 15 (? part only of colour vars.).
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 16 (? pl. 3, no. 130, juv.).
1932. id. ibid., p. 16, pl. 3, no. 132 (*kowiensis*), and p. 17 (*k.* var. *viridis*).

Aperture $1\frac{3}{4}$ to nearly 2 in spire. Protoconch ? Postnatal whorls 8 (9), profile nearly straight. Oblique axial ribs 14–16 on early whorls, 18–20 on later whorls, on body whorl extending across base to canal. Suture undulate, embracing lower ends of ribs, producing a strong, slightly nodular cingulum. Sulcus deep. Lip sinus narrow, forming the *deepest* part of the concave sulcus.

Growth-lines on cingulum more oblique to the suture than in *sinuata*. Spiral striae (when traceable) numerous but inconspicuous, best seen on early whorls. Up to 40 mm. (apex missing); Smith and Turton give 45 mm.; a specimen (minus protoconch and ? 2 whorls) 36 × 10 mm.

Brown, weathering to orange-red, the cingulum in weathered specimens usually paler, periostracum dark brown; var. *viridis* olive-green with white sutural band.

Port Elizabeth (Smith, Bartsch); Port Alfred (Bartsch, Turton). Port St. Johns, Port Alfred, Jeffreys Bay, Mossel Bay (S. Afr. Mus.).

Remarks. Described from a worn specimen. All S. Afr. Mus. specimens are also worn, but some retain portions of the periostracum.

In general, a narrower shell than *sinuata*, with usually a few more ribs, but best distinguished by the lip sinus. Smallest specimen in S. Afr. Mus. 15 mm.

Clionella rosaria Rve.

1848. Krauss. *Südafr. Moll.*, p. 109.
1892. Sowerby. *Mar. Sh. S. Afr.*, p. 6.
1906. Smith. *Ann. Natal Mus.*, i, p. 23 (comparison with *confusa*).
1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 15.
1915. id. ibid., p. 15, pl. 7, fig. 8 (*sybaritica*).
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 16, pl. 3, no. 131 (sinistral specimen).
1932. id. ibid., p. 17 (*sybaritica*).

Distinguished conchologically from *confusa* by the slightly narrower (in equal-sized specimens) cingulum, and stronger development of spiral striae. These are numerous (at least a dozen on middle whorls) and in live or fresh specimens probably cross the ribs.

The 'grating' effect (microcancellation) referred to by Bartsch and Turton in *sybaritica* is not a specific character; the strength of growth-lines and striae may vary, but the effect is due to weathering; it may be seen in typical examples of *rosaria*.

Protoconch ? Postnatal whorls 7 (8). Oblique axial ribs 14 on early whorls, on later whorls not exceeding 16 normally; Bartsch mentions an increase from 14 on 6th whorl to 'about 20' on 7th, but ribs are often duplicated, which probably explains the high number 20.

28 (6½ whorls present, apex broken) × 10 mm.

Weathered specimens variously coloured, usually rose or salmon, and flecked with darker red or brown spots, cingulum white with brown marks; rarely unicolorous rose with white cingulum.

Cape (Krauss); Port Alfred (Bartsch, Turton, S. Afr. Mus.).

Remarks. Knudsen (1952. *Vid. Medd. Danks. For.*, cxiv, p. 135) states, without reference, that Krauss recorded *rosacea* Rve. [*sic*] from Algoa Bay. In the above reference Krauss recorded *rosaria* from the Cape coast.

Clavatula (*Clionella*) *tripartita* Weink.

Fig. 4 *d*

1877. Smith. *Ann. Mag. Nat. Hist.* (4), xix (*bipartita*).
1892. Sowerby. *Mar. Sh. S. Afr.*, p. 6, pl. 4, fig. 83.
1902. Smith. *J. Conch.*, x, p. 115, pl. 1, fig. 7 (*parilis*).
1903. id. *Proc. Mal. Soc.*, v, p. 362 (*parilis*).
1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 14 (*bipartita*) and p. 248 (*tripartita*).
1915. id. ibid., p. 20, pl. 8, fig. 2 (*helena*) (figs. 2 and 3 transposed).
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 15, pl. 3, no. 128 (*bipartita*).

Protoconch 1½ whorls, alt. and diam. 1 mm., with fine close-set axial pliculae, junction with 1st postnatal whorl abrupt.[14] Postnatal whorls 8 (9). Oblique axial ribs well marked on shoulder of whorls, especially on early whorls. Fine spiral striae on early whorls (if not too worn). Cingulum more (*parilis*) or less (*tripartita*) tumid, a little wider than the smooth sulcus, the latter well defined (*tripartita*) or less defined (*parilis*). Lip sinus deep and narrow. Lirae on base of last whorl sometimes feebly nodulose; in one *parilis* specimen the base is nodulose in axial series, white nodules on orange ground-colour, in other words the axial ribs peter out below the shoulder but reappear as nodules on the lower base. 46 (minus protoconch) × 16 mm.

Operculum (in Sowerby's figure) oval, nucleus in middle of inner margin.

Buff, greyish, or dull orange, fine arcuate axial red-brown or orange lines and flames, often more conspicuous on cingulum than on rest of whorl.

Off Durban, 40 fathoms, from fish stomach (Smith: *parilis*); Port Alfred (Bartsch, Turton); Port St. Johns (S. Afr. Mus.). Also several specimens without locality, most of them shiny, none with protoconch (S. Afr. Mus.); 3 typical *parilis* slightly worn, probably *ex pisce* off Durban (S. Afr. Mus.).

Off Umtwalumi, Umkomaas, and Itongazi (Natal), 13–50 fathoms; and Algoa Bay, 10–16 fathoms, all dead. (S. Afr. Mus. P.F. Coll.)

Remarks. The series in S. Afr. Mus. leaves no doubt that *parilis* is synonymous. There are plump and slim forms.

The species seems to have its main habitat in the Natal area, where it is obtained from fish stomachs by the trawlers. More or less worn specimens are washed up farther south at Port St. Johns, Port Alfred, and Port Elizabeth.

Turton (p. 16) says he found it alive in the Lagoon at Port Alfred—a rather remarkable statement which needs confirmation.

Dautzenberg (1912. *Ann. Inst. Océan.*, vol. 5, fasc. 3, p. 10) records *tripartita* from south of Senegal, and from Tiger Bay (Angola). This distribution is unexpected, but cf. *Nassa demoulioides*.

[14] Only one specimen, slightly worn, showing traces of axial pliculae. In two other specimens the protoconch is worn quite smooth.

Clavatula turriplana Sow.

1903. Sowerby. *Mar. Invest. S. Afr.*, ii, p. 215, pl. 3, fig. 6 (*Pleurotoma* (*Clavatula*) *t.*).
1906. Smith. *Ann. Natal Mus.*, i, p. 24 (listed).

Aperture 1½ times in spire. Protoconch 2½ whorls, smooth, but with growth-lines on last half whorl, diam. 1, alt. 1·25 mm., junction with 1st postnatal whorl distinct. Postnatal whorls 10. Oblique axial ribs below sulcus on first 4 or 5(6) whorls, but becoming obsolete on later whorls. Fine spiral striae on all whorls. No cingulum below suture. Lip sinus broad, moderately deep. 42 × 11 mm. (Type); another specimen minus protoconch 43 × 12 mm.

Buff, shoulder of each whorl with a very indistinct pale or white band (Type) or an irregular series of pale patches; protoconch white, glossy.

Off Cape St. Blaize, 85 fathoms (Sowerby). Off Cape St. Francis, 75 fathoms (43 mm. fresh); off Cape Point, 80 fathoms (24 mm., corroded); 36° 40′ S., 21° 26′ E., 200 fathoms (24 mm. corroded) (S. Afr. Mus. P.F. Coll.).

Type in S. Afr. Mus.

Remarks. The corroded specimen from 200 fathoms has 6 whorls rather angulate at the shoulder, the last (body) whorl smoothly rounded as in the other specimens.

Genus uncertain. The shape of the shell resembles some of the dextral species (e.g. *thalaea* Dall) of *Antiplanes* (west coast of N. America).

Clavatula (*Surcula*) *opulenta* Thiele

1925. Thiele. *D. Tiefsee Exp.*, xvii, p. 226, pl. 36 (24), fig. 15.

Aperture subequal to spire. Protoconch (*apud* Thiele) smooth. Anterior canal long. Shoulder slightly above middle of whorl, slightly angular in early whorls, rounded in later whorls. Oblique axial ribs from shoulder, petering out on base, 15 on early whorls, increasing to 18–20, width subequal to grooves; fine close spiral striae crossing ribs, slightly stronger on base; growth-lines not conspicuous. Lip sinus broad and deep. 39 (protoconch and 2 or 3 whorls missing, only 6 remaining) × 12 mm.

35° 16′ S., 22° 26′ E., 155 metres (Thiele). Off Cape Point, 230 fathoms, 1 broken and corroded; 3 without locality (probably off Cape Point), 18–39 mm., also broken and corroded. (S. Afr. Mus. P.F. Coll.)

Remarks. Very like *anteridion*, but with more numerous, sharper, and longer ribs.

Clavatula (*Surcula*) *anteridion* Watson

1881. Watson. *J. Linn. Soc. Lond.*, xv, p. 399.
1886. id. '*Challenger*' *Rep.*, xv, p. 295, pl. 19, fig. 6.
1903. Smith. *Proc. Mal. Soc.*, v, p. 363 (listed).
1925. Thiele. *D. Tiefsee Exp.*, xvii, p. 223, pl. 37 (25), fig. 3 (*Surcula* sp. juv.).
? not Thiele. ibid., p. 222, pl. 36 (24), fig. 13 (? *anteridion* from New Amsterdam).

Aperture subequal to spire. Anterior canal long. Protoconch 2 ($2\frac{1}{4}$) whorls, diam. and alt. 1·3–1·5 mm., smooth, but with fine growth-lines, junction with 1st postnatal whorl distinct. Postnatal whorls 8–9. Shoulder in middle of whorl, angular in early whorls, rounded in later whorls. Oblique axial ribs from shoulder, petering out on base, 13 on 1st whorl, increasing to 15 on last whorl, subequal in width to the grooves; fine close spiral striae crossing ribs, slightly stronger on base; growth-lines not conspicuous. Lip sinus broad and deep. 42×11 (across shoulders of last whorl, 14 if aperture included).

Operculum ovate, nucleus apical, $6 \times 3{\cdot}5$ mm. in 36 mm. shell.

Cream or pale buff; protoconch white, glossy; operculum horny.

Off Cape Point, 150 fathoms (Watson); 35° 32′ S., 18° 20′ E., 2,750 metres (Thiele).

Off Cape Point, west coast of Cape Peninsula, and Table Bay, 180–230 fathoms. 15 specimens, smallest 15 mm. long, most of them corroded, one with operculum (S. Afr. Mus. P.F. Coll.).

Remarks. The identity of these specimens is not in doubt. They are distinguishable at a glance from *opulenta* by the fewer ribs. In this respect they agree with Watson's figure, though he said in his description there were 'about nineteen of these ribs and hollows on the last whorl'; but 19 is the number found in *opulenta*! I prefer to accept his illustration.

Unfortunately the animals in the fresh specimens, even the one retaining its operculum, were completely decomposed, and no radula was obtained.

Surcula sulcicancellata n. sp.

Fig. 22 *c*

Aperture subequal to spire. Protoconch $1\frac{1}{2}$ whorls, smooth. Postnatal whorls 6; profile rounded but with a slight shoulder. Oblique axial ribs 18 on early whorls, 20–21 on later whorls, not quite reaching suture of succeeding whorl, and becoming feeble and obsolescent on body whorl, upper ends projecting above sulcus and somewhat tubercular; spiral lirae 6 on early whorls, becoming more numerous on later whorls, with (especially on body whorl) finer intermediaries. Sulcus concave, with regular retrorse curved axial plicae, 3–5 times as numerous as the ribs, crossed by spiral lirae forming a cancellate sculpture, somewhat more conspicuous on the early whorls. Lip sinus wide but shallow. Canal short. 31×12 mm. White.

Off Cape Point, 130–300 fathoms, 5 dead (S. Afr. Mus. A361, A3477, A3481, A3495, P.F. Coll.).

Remarks. These five specimens are very similar to *S. obliquicosta* von Martens (1903. *D. Tiefsee Exp.*, vii, p. 80, pl. 2, fig. 1) from off Sumatra, 1,143 metres, but rather broader proportionately to length, and with distinct cancellate sculpture on the sulcus. Von Martens said the retrorse pleats on the sulcus were characteristic of his species, but similar pleats occur in *S. profundorum* Smith 1896

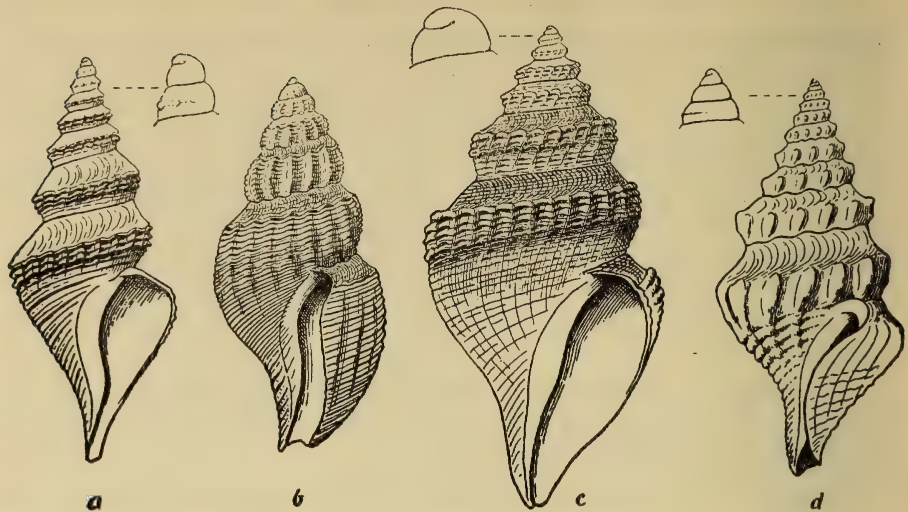


FIG. 22. *a. Surcula amplisulcus* n. sp. *b. S. faurei* n. sp. *c. S. sulcicancellata* n. sp. *d. S. scalaria* n. sp.

(and 1898. *Illustr. R.I.M.S. 'Investigator' Moll.*, pl. 7, figs. 2, 2*a*), from the Maldive Islands, 719 fathoms.

Judging from von Martens's figure these pleats do not seem to be so numerous as in the present species, and they do not extend across the whole sulcus to the tubercle-like ends of the oblique ribs; consequently the sulcus is not cancellate; nor is it cancellate in *profundorum*.

Surcula scalaria n. sp.

Fig. 22 *d*

Aperture a little shorter than spire. Protoconch $2\frac{1}{2}$ whorls, diam. and alt. *c.* 0·6 mm., apex very small, diam. 0·25 mm., smooth. Postnatal whorls 8, turreted, with prominent tubercular shoulder. Tubercles 12–13 on early whorls, 11–12 on middle whorls, increasing to 14–15 on body whorl, oval or slightly oblong (axially) strongest at the shoulder, weaker below and just reaching suture of succeeding whorl, indicated on base by slight swellings on the spiral lirae; crossed on early whorls by 2 (in one specimen 3) spiral lirae, which become obsolete on later whorls, but the lower one traceable and making the profile of the tubercles slightly rectangular; spiral lirae well spaced on upper part of base, closer together below, no intermediaries. Suture undulate. Sulcus broad, forming nearly half the whorl, crossed by fine growth-lines only. Lip sinus broad and rather deep. Canal short. 24×10 mm. White.

Off Cape Point, 480–800 fathoms, 7 dead (S. Afr. Mus. A358, A360, A1789, A3474, A3476, P.F. Coll.).

Surcula amplisulcus n. sp.

Fig. 22 *a*

Aperture subequal to spire. Protoconch $1\frac{1}{2}$ whorls, diam. and alt. 1 mm., smooth (but somewhat corroded). Postnatal whorls 7; profile of early whorls prominently shouldered, less prominently on later whorls, and rounded on body whorl. Oblique axial ribs *c.* 18 on middle whorls, not reaching suture below; crossed by well-marked spiral lirae, 2 on 3rd and 4th whorls, increasing to 5–6 on last whorl, *c.* 10 additional lirae on base, without or with only feeble intermediaries. On body whorl the axial ribs indicated only by slight thickenings on the lirae. Sulcus broad, forming half the whorl in early whorls, nearly half in later whorls, crossed by fine growth-lines only. Lip sinus broad and moderately deep. Canal long. 29×11 mm. White.

Off Table Bay, 196 fathoms; off west coast of Cape Peninsula, 120 fathoms; 36° 40′ S., 21° 26′ E. 80–100 fathoms. 5 dead (S. Afr. Mus. A1689, A1734, A3337, P.F. Coll.).

Surcula faurei n. sp.

Fig. 22 *b*

Aperture subequal to spire. Protoconch corroded. Postnatal whorls 5, profile rounded, without shoulder. 1st whorl corroded; slightly oblique axial ribs 11 on 2nd whorl, 12 on 3rd, 15 on 4th and 16–17 on 5th (obscure on later half of whorl, but 2 clearly marked at outer lip), reaching suture below, obsolete on base; crossed by spiral lirae 4 on 2nd whorl, 5 on 3rd, 9 on 4th, and 10 plus intermediaries on 5th, *c.* 14 additional fine lirae on base passing into *c.* 10 stronger and more widely spaced ones on rostrum. Suture undulate. Sulcus with numerous distinctly marked growth-lines, crossed by 1, 2 or (on last whorl) 3 fine spiral lirae. Lip sinus deep. Canal short. $21 \times 9{\cdot}3$ mm. Pale buff.

Brown's Bank, Agulhas Bank (approx. $36\frac{1}{2}$° S., 21° E.), 80–100 fathoms, 1 dead, but in good condition. (S. Afr. Mus. A8611, P.F. Coll.).

Pleurotoma (*Surcula*) *dissimilis* Watson

Fig. 23 *a*

1886. Watson. '*Challenger*' *Rep.*, xv, p. 298, pl. 26, fig. 3.

Aperture subequal to spire. Protoconch 2 whorls (lip broken) diam. 1·5 mm., with very fine oblique plicae, passing into the more sigmoid and less conspicuous growth-lines on 1st postnatal whorl, the junction marked by change of colour (brown to white). Postnatal whorls $6\frac{1}{2}$ (7), profile evenly rounded, scarcely any shoulder. Growth-lines not conspicuous. Very numerous fine spiral striae: below shoulder 3 at beginning of 1st whorl, increasing to 6, 7–8 on 2nd increasing to 12 on 4th and 18–20 on 6th, *c.* 26 on 7th; at least 55 additional striae on base. Growth-lines on sulcus *perpendicular* to the suture, where they form a slight crimping (see Watson's figure), feebly concave across the sulcus, but strongly protractive from lower border of sulcus. Lip sinus deep. 50 (probably 54 if canal complete) × 17 mm., 49 (with protoconch) × 16 mm., two others 45 × 14 mm. Creamy-white, glossy, protoconch pale brown.

Off Cape Point, 660–900 fathoms, green mud. 5 dead, but in good condition. (S. Afr. Mus. P.F. Coll.)

Distribution. SE. of the Philippine Islands, 500 fathoms (Watson).

Remarks. There is a close resemblance between this species and *S. alberti* Dautzenberg & Fischer (1906. *Res. Sci. Camp. Monaco*, fasc. 32, p. 16, pl. 1, figs. 8–10) from off Cape Verde, 3,890 metres.

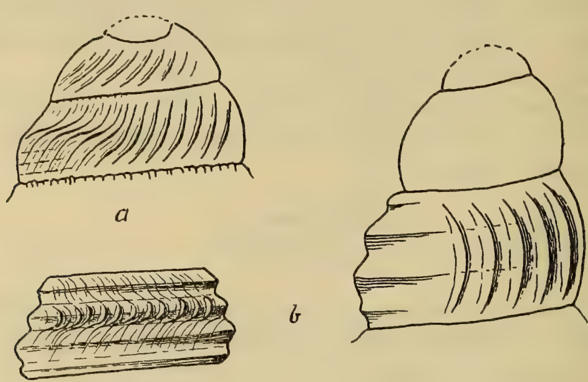


FIG. 23. *a. Surcula dissimilis* Watson, protoconch. *b. Turris ambages* n. sp., one whorl and protoconch.

Comparison of the figures shows that the lower part of the columella is a little more curved and the aperture broader in *alberti* than in *dissimilis*. The Cape specimens agree better with the latter.

For this reason it seems better to identify the Cape specimens with *dissimilis*, although evidence of a faunistic relationship, dating perhaps from Miocene times, between the north and south Atlantic off the west coast of Africa is accumulating. (See: *Cancellaria* (*Sveltia*) *lyrata*.)

The course of the growth-lines is not shown very clearly in the figures of either *dissimilis* or *alberti*, certainly not the almost horizontal direction at the lower boundary of the sulcus which is so conspicuous in the present specimens.

The animal of *alberti* was reported to be closely related to that of the genus *Bela* (not *Bela* of Thiele 1929), but no figure of its radula was given. Presumably it had no operculum.

Turris ambages n. sp.

Fig. 23 *b*

Protoconch 3 whorls, diam. 1·25–1·3, alt. 1·3–1·5 mm., with axial riblets (as in *Turris*). Postnatal whorls with 4 strong spiral keels (profile of whorl

4-lobate), 1st rather sharp, forming the cingulum, 2nd rounded forming the lip sinus, with growth-lines producing more or less conspicuous squamiform nodules, 3rd the most prominent, rounded, forming the periphery, below this the smaller 4th keel; base with ? *c.* 10 additional lirae. 17×7 mm. (protoconch and 7 whorls); 25×8 (protoconch and 8 whorls); a broken specimen 30 mm. long, with 5 whorls corresponding to the 5th–8th whorls plus a portion of the 9th whorl.

The 17 mm. example is whitish, with traces of irregular brown spots and streaks.

Off Cape Natal (Durban), 54 fathoms, 2 broken specimens; off Umkomaas River, 40 fathoms, 1 (17 mm. long); off O'Neil Peak (Zululand), 90 fathoms, 1 (25 mm. long) (S. Afr. Mus. A8683–A8685, P.F. Coll.).

Remarks. Adams & Reeves' figure of *fagina* (1850. *Voy. 'Samarang' Moll.*, pl. 9, figs. 2 *a*, *b*) shows 4 keels, but the 2nd separated from the 1st by a wide groove, and at least as wide and prominent as the 3rd. The accuracy of the drawing is confirmed by Yen's figure (1942. *Proc. Malac. Soc.*, xxiv, pl. 25, fig. 184). The position of the lip sinus is not absolutely clear in either figure.

Moreover *fagina* is a large species (78 mm. in Yen's figure if nat. size), and presumably has a larger protoconch (? 2 mm. diam. in Yen's figure) than the present specimen.

According to Melvill (1917. loc. cit., p. 147) *Pleurotoma annulata* Rve. (*Conch. Icon.*, i, pl. 5, fig. 55) is near akin to *fagina*.

Acrobela acus n. sp.

Fig. 21 *e*

Protoconch $4\frac{1}{2}$ whorls, first 2 smooth, the following with criss-cross sculpture, alt. 0·7, diam. 0·4 mm. Postnatal whorls $3\frac{1}{2}$; 1st whorl with one peripheral keel at start, but soon with one above and one below, following whorls with 3 keels, the median one peripheral and strongest; no distinct axial sculpture except the protractive curved growth-lines in the sulcus; additional lirae on base 4 or 5 rather strong and 8–9 finer ones. $4{\cdot}75 \times 2$ mm.

Off Cape Recife, 256 fathoms, 2 and one fragment, dead (type material); off Cape St. Blaize, 125 fathoms, one dead (S. Afr. Mus. A8748 and A8562, P.F. Coll.).

Remarks. Nearest to *A. sansibarica* Thiele (1925. *D. Tiefsee Exp.*, xvii, p. 239, pl. 37 (25), fig. 21), but the latter has a cingulum below the suture and only one spiral keel.

A. circumvertens (M. & S.), with which *A. optima* Thiele 1925 appears to be synonymous, from Gulf of Oman and East African coast, also has a cingulum and, in the later whorls, 2 spiral keels.

Taranis miranda Thiele (1925. loc. cit., p. 254, pl. 32 (20), fig. 7), from 34° 51′ S., 19° 37′ E., 80 metres, has a low protoconch ($1\frac{1}{2}$ whorls), 2–3 rather broad keels which are crossed (in the figure) by pliculae, retractive across the sulcus.

Distinguished from 'Bela' *eva* (*supra*, p. 114) by the three spiral keels, the absence of axial pliculae (except in the sulcus), the growth-lines in the sulcus being protractive, and by the very different protoconch.

Cythara alfredi (Smith)

Fig. 25 *a*

1892. Sowerby. *Mar. Sh. S. Afr.*, p. 7 (*Mangilia costata*, non Donovan).
1897. id. *Append. Mar. Sh. S. Afr.*, p. 31 (*costata* var. *coarctata*, non Forbes).
1904. Smith. *J. Malac.*, xi, p. 29, pl. 2, fig. 9.
1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 31 (*alfredensis* typ. err.).
1925. Thiele. *D. Tiefsee Exp.*, xvii, p. 229, pl. 37 (25), fig. 22 (*Haedropleura dora*).
1925. id. ibid., p. 232, pl. 40 (28), fig. 1 (*Mangelia misera*).
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 29, pl. 6, no. 218.
1932. id. ibid., p. 30, pl. 6, no. 219 (*thetis*) (not *Drillia thetis* Smith).

Protoconch $2\frac{1}{2}$ whorls, with faint axial pliculae towards junction with 1st postnatal whorl. Postnatal whorls usually 4, sometimes 5. Axial ribs 6 (7) on 1st whorl, 7 (sometimes 8) on following whorls; spiral lirae *c.* 8 on 1st whorl increasing to *c.* 25–30 on last whorl, about the same number of additional lirae on base. $7{\cdot}8 \times 2{\cdot}75$ mm.

Fulvous, 4th whorl usually paler with a fulvous band in middle.

Recorded (dead) from Kalk Bay (False Bay) to Port Alfred. S. Afr. Mus. has one specimen alleged to come from Table Bay, but the provenance is doubtful.

Thiele's *H. dora* from Algoa Bay, depth not stated; and *M. misera* from 35° 16′ S., 22° 26′ E., 155 metres.

Off Illovo River (Natal), 27–30 fathoms; off Cove Rock (East London area), 22 fathoms; Algoa Bay, 67 fathoms; off Cape Recife, 124 fathoms; off Cape St. Blaize, 37 fathoms; all dead (S. Afr. Mus. P.F. Coll.).

Cythara ima Bartsch

1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 31, pl. 3, fig. 1.
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 30.

Protoconch 2 whorls, smooth. Postnatal whorls 5. Axial ribs 10 on 1st–3rd whorls, 12 on 4th and 5th; spiral lirae *c.* 24 on last whorl, plus *c.* 30 on base. $8{\cdot}1 \times 3{\cdot}5$ mm. (Bartsch).

Recorded from Simon's Bay and Port Alfred.

S. Afr. Mus. has 2 worn specimens from Port Alfred, identified and presented by Turton. The larger measures 9 (apex worn, 5 whorls) $\times$ $3{\cdot}75$ mm. Neither specimen corresponds with Bartsch's description; they appear to be merely 8-ribbed examples of *alfredi*.

Cythara deliciosa n. sp.

Fig. 24

Protoconch 2½ whorls, alt. 0·6, diam. 0·75 mm., smooth at start, last half or three-quarters with a series of peripheral axially oblique knobs, and an axial plica about at the junction (which is obscure) with 1st postnatal whorl. Postnatal whorls 3½, with 7 sharp axial ribs on each whorl, and numerous fine spiral lirae, *c.* 20 on 1st whorl and 25 on body whorl (excluding base), last rib with at least 40 lirae; lirae with very minute prickles on both sides, so that the intervening striae appear punctate. $5{\cdot}3 \times 2{\cdot}3$ mm. Uniform pale brown.

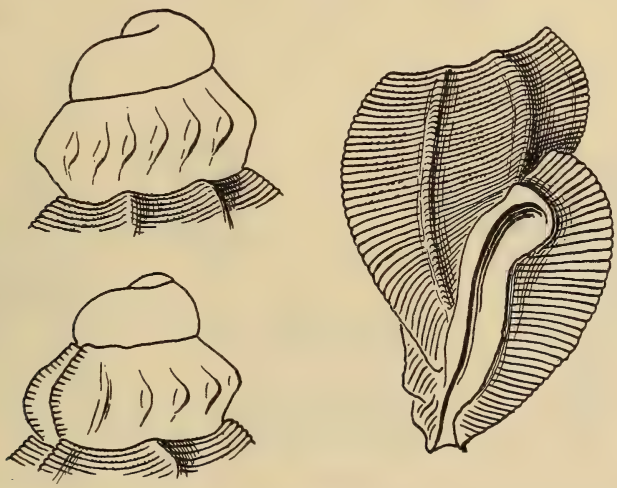


FIG. 24. *Cythara deliciosa* n. sp., body whorl and protoconch.

Off Umhloti River (Natal), 40 fathoms. 6 dead but unworn specimens (S. Afr. Mus. A8692, P.F. Coll.).

Remarks. Distinguished from *alfredi* by the lower, more squat protoconch, with nodules, the more numerous spiral lirae on the postnatal whorls, and the sharper axial ribs.

Mangilia amplexa Gould

Fig. 25 *b*

1860. Gould. *Proc. Boston Soc. N.H.*, vii, p. 338.
1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 30, pl. 2, fig. 10, pl. 7, fig. 6.
1915. id. ibid., p. 30, pl. 2, fig. 6 (*humerosa*).
1925. Thiele. *D. Tiefsee Exp.*, xvii, p. 229, pl. 37 (25), fig. 23 (*Haedropleura thea*).
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 27, pl. 6, no. 205 (*rietensis*).
1932. id. ibid., p. 29.

Protoconch 2½ whorls, smooth. Postnatal whorls 4½–5. Axial ribs 10 on 1st whorl, 10–11 on 2nd and 3rd, 11–13(14) on 4th; spiral lirae 6–7 on 1st whorl, increasing to 18–20 on last whorl, 18–20 additional lirae on base. $9{\cdot}5 \times 3{\cdot}5$ mm.

Simon's Bay (Gould), Port Elizabeth (Sowerby), Port Alfred (Bartsch, Turton).

Algoa Bay (Thiele).

Table Bay, Kalk Bay and Gordon's Bay (False Bay), Still Bay (S. Afr. Mus.).

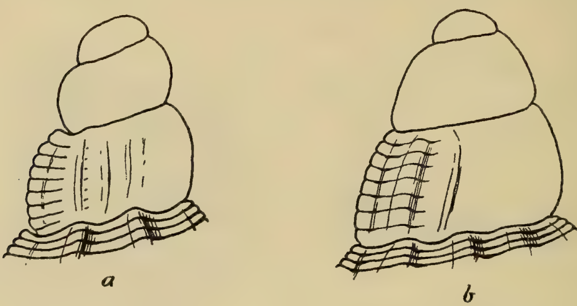


FIG. 25. Protoconchs of: *a. Cythara alfredi* (Smith), and *b. Mangilia amplexa* Gould.

Algoa Bay, 67 fathoms; off Keiskamma Point, 33 fathoms; and off East London, 27–32 fathoms; all dead (S. Afr. Mus. P.F. Coll.).

Remarks. The numbers '14' and '12' (axial ribs) in Bartsch's description of *amplexa* seem to be transposed; in any case the numbers are too high (see his figures).

Mangilia eucosmia Bartsch

1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 28, pl. 2, fig. 7.
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 27.
1932. id. ibid., p. 28, pl. 6, no. 212 (*rufanensis*).

Protoconch and coloration as in *amplexa.* Distinguished by the more convex (shouldered) whorls and deeper sutures, fewer and more oblique axial ribs. Nevertheless the two 'species' are doubtfully distinct. On two occasions both were found together in the same bottom sample.

According to topotype examples received from Turton, the numbers of ribs stated by Bartsch are much too high: the present topotypes have only 10–11 on the last whorl, which is fewer than in *amplexa.* In face view only 3 ribs appear between those forming the profile on either side, whereas in *amplexa* 4 are visible. In this respect Bartsch's figure corresponds neither with the topotypes nor with the *Pieter Faure* specimens.

Port Alfred (Bartsch, Turton). Common in the lagoon (estuary) at Port Alfred (Turton).

Off East London, 32 fathoms; off Keiskamma Point, 33 fathoms. (S. Afr. Mus. P.F. Coll.)

Mangilia muiri n. sp.

Fig. 26 *a*

Protoconch 3 whorls, smooth (but probably worn), an obscure spiral keel at end of 3rd whorl. First postnatal whorl with 2 feeble spiral keels which develop into spiral lirae with knobs at intersections with the 13–14 axial ribs; the latter starting from suture, where they are slightly enlarged.

Still Bay (S. Afr. Mus. A8647, Muir Coll.).

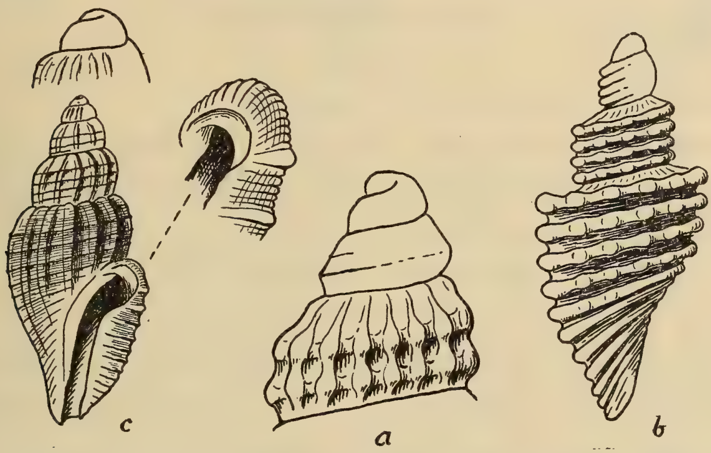


FIG. 26. *a*. Apex of *Mangilia muiri* n. sp. *b*. *M. kowiensis* Turton. *c*. *M. shepstonensis* Smith, with protoconch and lip sinus further enlarged.

Remarks. There are 8 specimens from 1 mm. long (protoconch and 1st whorl) to 2·75 × 1·5 mm. (protoconch and 2 whorls).

Mangilia benjamini Bartsch

1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 26, pl. 7, fig. 5.

False Bay (Bartsch; collected by the U.S. Exploring Exp., 1853).

Remarks. This species, based on ? only one specimen, is broader than *Surcula macilenta* Melv., the width less than 3 in the length (1 : 2·7), but otherwise there is considerable resemblance (see *Drillia platystoma*, p. 125). It was described as having 9 postnuclear whorls at a length of 15·3 mm.

Thiele described two species from the Agulhas Bank also very similar to *benjamini*, having the whole whorl covered with fine spiral lirae: *Pleurotoma? vilma* (1925. *D. Tiefsee Exp.*, xvii, p. 229, pl. 37 (25), fig. 1) and *Crassispira? agulhasensis* (ibid., p. 213, pl. 35 (23), fig. 11). In both of these, however, the axial ribs cross the sulcus to the suture above.

Mangilia kowiensis Turton

Fig. 26 *b*

1932. Turton. *Mar. Sh. Pt. Alfred*, p. 25, pl. 5, no. 190.

Protoconch 1½ whorls, smooth. Postnatal whorls 3, each with 4 strong spiral lirae separated by deep grooves. Shoulder strongly tabulate. Axial ribs not conspicuous, but indicated by 10 or 11 nodules on the lirae on 2nd and 3rd whorls; when viewed apically the periphery is undulate. 7–8 additional lirae on base, decreasing in size anteriorly. $3 \cdot 3 \times 1 \cdot 5$ mm.

Port Alfred (Turton).

34° S., 25° 45′ E., depth not recorded, 1 dead (S. Afr. Mus. P.F. Coll.).

Mangilia shepstonensis Smith

Fig. 26 *c*

1914. Smith. *Ann. Natal Mus.*, iii, p. 1, pl. 1, fig. 1.

Aperture subequal to spire. Protoconch 2½–3 whorls, alt. 0·3, diam. 0·5 mm., smooth, glossy. Postnatal whorls 4, profile convex with rounded, almost tabulate shoulder. Axial ribs 18 close together on 1st (or last half whorl of protoconch plus 1st postnatal whorl), 12 on 2nd, 3rd and 4th, not quite as wide as intervals, crossing sulcus and extending half-way across base; crossed by 4 narrow spiral lirae on each whorl, the 4th lira low down near suture, and also by extremely fine spiral striae, *c.* 10–12 of the latter in sulcus on last whorl, and *c.* 5 between each pair of lirae; *c.* 14 additional lirae on base, with intervening striae. Sulcus concave between the ribs. Lip sinus deep, adjoining suture. 5×2 (4 whorls) and $4 \cdot 5 \times 1 \cdot 75$ mm. (3 whorls); Smith: $4 \cdot 3 \times 2$ mm.

Pale buff, a faint brown mark in middle of the incrassate outer lip. Yellowish, with a narrow rufous interrupted band around middle of last whorl (Smith).

Port Shepstone (Natal) (Smith).

Off Umhloti River (Natal), 40 fathoms, one fresh, one slightly worn; off Umkomaas River (Natal), 40 fathoms, one worn; off Cove Rock (East London area), 22 fathoms, 2 unworn (S. Afr. Mus. P.F. Coll.).

Remarks. The narrow spiral lirae are continuous across, but subordinate to, the axial ribs. In addition to the semicancellate macro-sculpture, the growth-lines and the spiral striae produce a very fine micro-cancellate sculpture in each hollow.

The junction of protoconch and 1st postnatal whorl is indistinct; probably 5 or 6 of the more closely set initial axial ribs belong to the last half whorl of the protoconch.

There seems to be no great difference between this species and *Glyphostoma siren* Smith 1904. The latter has only 10 ribs, which are not '*superne rotunde tabulati*'; and Smith makes no mention of the presence of any microsculpture.

Contrast also *Drillia tholos* (*supra*).

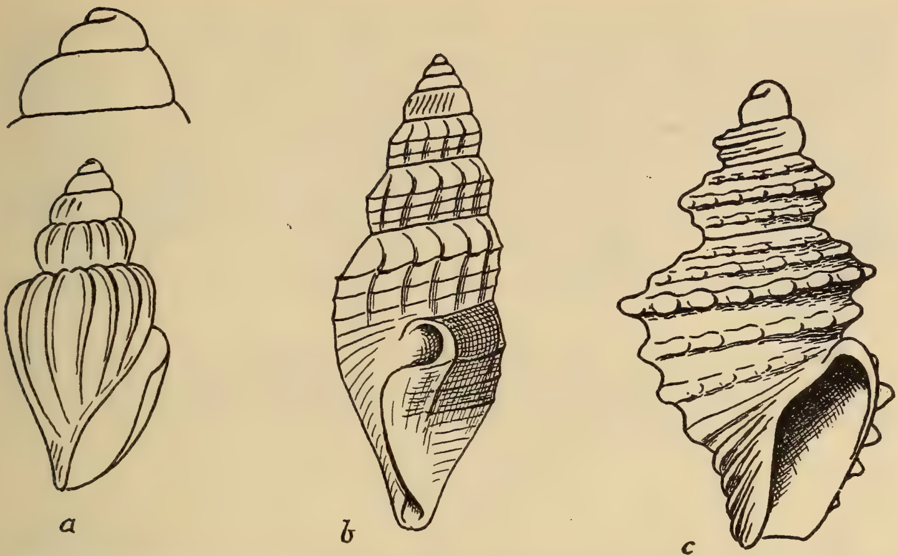


FIG. 27. *a. Mangilia translucens* n. sp., and protoconch. *b. M. phoxos* n. sp. *c. M. exstans* n. sp.

Mangilia translucens n. sp.

Fig. 27 *a*

Aperture a little longer than spire. Protoconch 3 whorls, alt. 0·5 diam., 0·75 mm., smooth, glossy. Postnatal whorls 3, profile convex with distinct but rounded shoulder. Axial ribs 12–13 on each whorl, narrow, sharp when fresh, extending across sulcus and across base; no spiral sculpture except a mere trace here and there of one or two striae. $5 \times 2{\cdot}3$ mm. Pale buff, semitranslucent, glossy.

Off Tugela River, 65–80 fathoms, one glossy; off Umhloti River (Natal), 40 fathoms, 12 specimens, some glossy, some dull, some broken (type material); off Umkomaas River (Natal), 40 fathoms, one dull; off East London, 32 fathoms, 1 glossy, 3 dull; all dead (S. Afr. Mus. A8755, A8586, A8726, A8732, P.F. Coll.).

Remarks. The ribs where they cross the sulcus and form the shoulder are usually more prominent than shown in the figure.

Mangilia phoxos n. sp.

Fig. 27 *b*

Aperture $1\frac{1}{4}$ in spire. Protoconch 4 whorls, alt. and diam. 0·75 mm., first 3 whorls smooth, fine close-set axial pliculae on last three-quarters of 4th whorl, glossy. Postnatal whorls 3, profile convex with slight shoulder. Axial ribs 11 on 1st, 12 on 2nd and 3rd whorls, fine but distinct, curved on sulcus and slightly oblique below shoulder, petering out on base; crossed by slight and narrow spiral lirae 2 on 1st, 3 on 2nd and 3rd whorls, the upper one defining the sulcus and forming the shoulder, forming slight complanate nodules at intersections, *c*. 18 additional lirae on base; in addition extremely fine spiral lirae over whole whorl, 6 in sulcus on 1st whorl increasing to 10 on 3rd, 4 between each of the two pairs of main lirae, and forming intermediaries between the lirae on base; these fine lirae together with the fine growth-lines form a microgranulate or microcancellate sculpture. Lip sinus deep, adjoining suture. $5 \cdot 8 \times 2$ mm. Pale buff, protoconch glossy.

Off Umhloti River (Natal), 40 fathoms, one dead (S. Afr. Mus. A8730, P.F. Coll.).

Remarks. Similar to *M*. (*Paraclathurella*) *padangensis* Thiele 1925 from Sumatra, but with finer spiral lirae and no regularly granulate whorl near apex (on last part of protoconch: Thiele).

Mangilia exstans n. sp.

Fig. 27 *c*

Protoconch $1\frac{1}{2}$ whorls, smooth. Postnatal whorls 3, each with 2 spiral lirae, the upper being the more prominent, especially on 3rd whorl; in sulcus one additional lira on 1st whorl, 2 lirae on 2nd and 3rd; no axial ribs, but lirae with complanate nodules: 12 on the peripheral lira on 2nd whorl, 14 on 3rd, the lower lira and those in sulcus also nodulose; 7 additional lirae on base, rather strong and well spaced, more or less feebly nodulose. $2 \cdot 5 \times 1 \cdot 3$ mm. ($1 \cdot 5$ including lirae).

Off Cove Rock (East London area), 22 fathoms, one dead (S. Afr. Mus. A8756, P.F. Coll.).

Remarks. Distinguished by the prominent peripheral lira and absence of axial ribs. Protoconch not so elevated as in *tranquilla* (*infra*).

Mangilia nisga Bartsch

Fig. 28 *d*

1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 25, pl. 7, fig. 1.

Protoconch $1\frac{1}{2}$ whorls, smooth. Postnatal whorls 3, each with 3 spiral lirae. Axial ribs beginning on later half of 1st whorl, 10 on 2nd, 11 on 3rd, forming rounded knobs at intersections with the lirae. 7–8 additional lirae on base, feebly nodulose. An additional lira with feeble knobs in the sulcus on 2nd and 3rd whorls. $3 \cdot 5 \times 1 \cdot 75$ mm.

Port Alfred (Bartsch, Turton).

34° 26′ S., 25° 42′ E., 124 fathoms, and 33° 3′ S., 27° 57′ E., 32 fathoms. 3 dead (S. Afr. Mus. P.F. Coll.).

Remarks. Bartsch said there were 14 ribs on the last whorl, which seems scarcely compatible with his figure. The 4th spiral lira shown in Bartsch's figure as *above* the posterior end of the aperture, is in these specimens on a level with or below it, and definitely on the base.

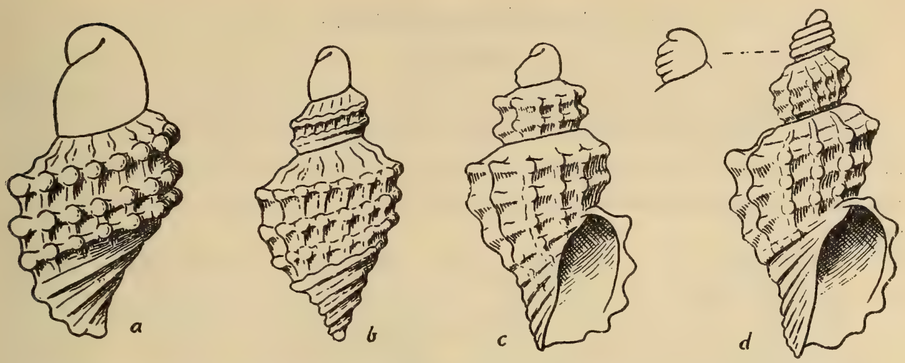


FIG. 28. *a. Mangilia minuscula* Smith (nodulose form), protoconch. *b. M. tranquilla* n. sp. *c. M. sciola* n. sp. *d. M. nisga* Bartsch, with protoconch further enlarged.

Mangilia sciola n. sp.

Fig. 28 *c*

Protoconch $1\frac{1}{2}$ whorls, smooth, junction between protoconch and 1st whorl obscure. Postnatal whorls 2, each with 2 spiral lirae. Axial ribs beginning a little later than the spiral lirae, 11 on 1st, 12 on 2nd whorl, forming rounded knobs at intersections with lirae. 6 additional lirae on base, the 3 posterior ones nodulose. No lira in sulcus. $3 \times 1{\cdot}5$ mm.

34° 27′ S., 25° 42′ E., 256 fathoms, and 33° 6′ S., 27° 55′ E., 43 fathoms. 2 dead (S. Afr. Mus. A8642, A8643, P.F. Coll.).

Remarks. Deceptively like *nisga*, but with only 2 spiral lirae. The specimen from shallower water is fresh, but that from deep water is somewhat worn.

Mangilia ponsonbyi (Sow.)

1892. Sowerby. *Mar. Sh. S. Afr.*, p. 7, pl. 1, fig. 5 (not good) (*Defrancia p.*).
1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 31.
1925. Thiele. *D. Tiefsee Exp.*, xvii, p. 230 (*Clathurella p.*).
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 25.

Sowerby gives 10 axial ribs on last whorl on shell $6{\cdot}5 \times 3$ mm. with 6 (total) whorls, and 4 spiral lirae.

Three worn specimens in S. Afr. Mus. (coll. Turton), largest with 5 whorls (minus protoconch) $8{\cdot}5 \times 3{\cdot}5$ mm., have 13 ribs on 3rd, 4th and 5th whorls, crossing sulcus, and continued across base; and 6 spiral lirae (2 fine ones on sulcus, 4 stronger ones between shoulder and suture below) on 4th and 5th whorls, slightly nodulose at intersections with ribs; 8 (9) additional lirae on base. Columella with 2–3 pleats and inner margin of outer lip 6–7 plicae.

Turton gave the size as 10×3 mm.

Recorded (dead) from Port Elizabeth and Algoa Bay, and Port Alfred.

Mangilia tranquilla n. sp.

Fig. 28 *b*

Protoconch $1\frac{1}{2}$ whorls, elevated, smooth. Postnatal whorls 2. Spiral lirae 2, slightly nodulose at intersections with axial plicae, of which there are 13–14 on 1st, and 15–16 on 2nd whorl; plicae traceable across sulcus, with slight nodular enlargements on 2nd whorl; lattice hollows between 1st and 2nd lirae square.

Protoconch plus 1st whorl $1 \cdot 3 \times 0 \cdot 75$ mm.; protoconch plus 2 whorls $2 \times 1 \cdot 5$ mm. White.

Still Bay, 2 specimens (S. Afr. Mus. A8648, Muir Coll.).

Cf. *Mangilia gemmula* Turton 1932, which has 12 axial plicae.

The protoconch is smaller and proportionately narrower than in *Tritonalia scrobiculata.*

Mangilia minuscula Smith

Fig. 28 *a*

1910. Smith. *Ann. Natal Mus.*, ii, p. 191, pl. 7, fig. 4.
1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 24, pl. 7, fig. 3 (*Mangilia gisna*).

Protoconch $1\frac{1}{2}$ whorls, elevated, smooth. Postnatal whorls 3. Two spiral lirae at beginning of 1st whorl, on later half a third lira develops between shoulder and suture below, on 2nd and 3rd whorls 3 lirae. Axial ribs subordinate to the lirae but forming conspicuous knobs at intersections, and connecting riblets between the lirae, 12 on 1st whorl, 16 on 2nd and *c.* 20 on 3rd (Bartsch's '28' is too high a number for the present specimens, and conflicts with his figure; ? type err. for 20); 7–8 additional lirae on base. Protoconch alt. 0·5, diam. 0·35 mm.; protoconch plus half 1st whorl $1 \times 0 \cdot 5$ mm.; $3 \times 1 \cdot 3$ mm.

Recorded from Port Elizabeth and Port Alfred. Kalk Bay (False Bay) and Still Bay (S. Afr. Mus.). False Bay (U.C.T.).

Remarks. Specimens from the Muir collection from protoconch up to 3-whorled examples.

Turton says *minuscula* and *gisna* are easily distinguished, but specimens of both identified by him are indistinguishable; *gisna* is the strongly nodulose form.

Similar to *verrucosa* Sow., but narrower and with more numerous axial ribs (knobs): 12–20 instead of 11–14.

M. helga Bartsch differs in having the spire distinctly longer than aperture, 4 spiral lirae on last half of 1st whorl, and on 2nd and 3rd whorls, and no axial plicae or knobs on the lirae.

Philbertia natalensis n. sp.

Fig. 29 *a*

Protoconch $3\frac{1}{2}$–4 whorls, diam. and alt. 0·5 mm., with criss-cross sculpture. Postnatal whorls 3, profile angular slightly below middle. Axial riblets 9 on each whorl, rounded, narrower than intervals, extending above almost to suture, obsolete on base; crossed by spiral lirae, 3 on 1st whorl, the lowest the strongest and peripheral, 4 on 2nd, 2 above and one below the peripheral lira, on body whorl 4–5 above and 3–4 below, *c.* 12 additional lirae on base. Sulcus not concave, a very feeble cingulum below suture. Lip sinus adjoining suture. 5×2·3 mm.

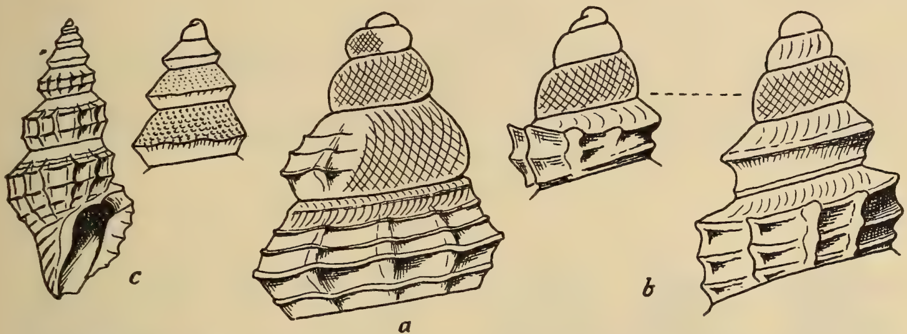


FIG. 29. *a. Philbertia natalensis* n. sp., protoconch. *b. P. capensis* (Smith), two views of protoconch. *c. P. alfredensis* (Turton), with protoconch.

Off Umhloti River mouth, Natal, 40 fathoms, 1 dead; off Cape Natal (Durban), 54 fathoms, 1 dead; (S. Afr. Mus. A8654, A8758, P.F. Coll.).

Remarks. Protoconch broader than in *P. capensis* (p. 117), 1st postnatal whorl not abruptly wider than protoconch, and sculpture less outstandingly cancellate.

Philbertia alfredensis (Turton)

Fig. 29 *c*

? 1925. Thiele. *D. Tiefsee Exp.*, xvii, p. 240, pl. 38 (26), figs. 4, 4*a* (*Bellardiella sultana*).

1932. Turton. *Mar. Sh. Pt. Alfred*, p. 24, pl. 5, no. 181 (*Bellardiella alfredensis*).

Aperture 1½ in spire. Protoconch 4 whorls, alt. 0·75, diam. 0·5 mm., 2nd to 4th whorls in profile angular slightly below middle, but not sharply keeled, minutely and closely punctate in spiral lines (and also in axial series). Postnatal whorls 3. Axial ribs 10 on 1st and 2nd whorls, 11 on 3rd whorl, feebly indicated across sulcus, obsolete on lower half of base, narrower than intervals; spiral lirae narrower than ribs, 2 on each whorl, intersections slightly nodulose, 7 additional lirae on base; in the sulcus one fine lira on 2nd whorl, 2 on 3rd whorl. Lip sinus deep, adjoining suture. 3·75×1·5 mm.

Off Tugela River (Natal–Zululand), 65–80 fathoms, one dead (S. Afr. Mus. A8761, P.F. Coll.).

Remarks. Seems to be referrable to Turton's species, based on a very worn specimen, 4×1·8 mm., from Port Alfred. Turton compared his species with *Bellardiella* sp. Thiele 1925 (loc. cit., pl. 38 (26), fig. 7) from East Africa.

Thiele described *B. sultana* and other species from the same area. I should be inclined to refer the P.F. specimen to *sultana* ($7 \times 2{\cdot}75$ mm.), but for the presence of the fine lirae in the sulcus, which Thiele neither mentions nor figures.

Daphnella sulcata (Sow.)

Fig. 30 *b*

1892. Sowerby. *Mar. Sh. S. Afr.*, p. 11, pl. 1, fig. 10 (*Cominella ? s.*).
1904. Smith. *J. Malac.*, xi, p. 28 (*Daphnella ? s.*).
1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 32 (*Daphnella? s.*).
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 30.

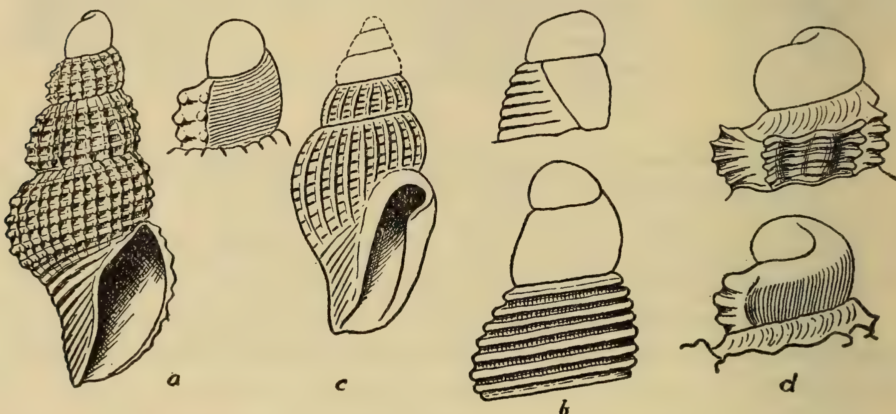


FIG. 30. *a. Daphnella recifensis* n. sp., with protoconch. *b. D. sulcata* (Sow.), two views of protoconch. *c.* Worn specimen referred to *Thesbia algoensis* Thiele. *d. Pleurotomella ursula* Thiele, two views of protoconch of 9 mm. specimen.

Protoconch $1\frac{1}{2}$ whorls, smooth, junction with 1st whorl oblique. Postnatal whorls 4 (shell 9 mm., Sowerby: total whorls 6, shell 10 mm.). Spiral lirae (5)6–7 on 1st whorl, 6–8 on 2nd and 3rd, 7–8 on 4th, width subequal to the grooves which are crossed by fine growth-lines; 8–9 additional lirae on base; 3–5 denticles on inner side of outer lip. $7{\cdot}3 \times 2{\cdot}5$ mm., Sowerby: 10×3.

Pale fulvous, obscurely mottled or uniform (Sowerby); yellow, spotted with brown, or uniform yellowish-brown (Turton).

Recorded (dead) from Port Elizabeth and Port Alfred. Still Bay, dead (S. Afr. Mus. Muir Coll.). Off Cape St. Blaize, 125 fathoms, one broken; off Cove Rock (East London area), 22 fathoms, one dead; off Umkomaas River (Natal), 40 fathoms, one and three fragments; off Cape Vidal (Zululand), 80–100 fathoms, one broken (S. Afr. Mus. P.F. Coll.).

Remarks. Sometimes the spiral lirae have slight thickenings—'subgranose' (Smith)—making their margins feebly undulate.

Three worn specimens (S. Afr. Mus. loc.?), however, show a definite cancellate sculpture, due to well-marked axial plicae, slightly nodulose at intersections with the lirae; the latter are fewer in number: 5 on 1st whorl, 6 on the others. Two of these specimens have a series of brown spots around the middle as in some typical specimens.

Of the Natal specimens, two of the fragments are normal, with growth-lines in the grooves, some of the growth-lines stronger than others; the third fragment and the complete specimen are definitely cancellate, the axial ribs as strong as the spiral lirae. This complete specimen, which has the characteristic obliquely and abruptly ending protoconch, would certainly be regarded as a separate species but for the connecting 'subgranose' specimens.

Daphnella recifensis n. sp.

Fig. 30 *a*

Protoconch $1\frac{1}{2}$ whorls, moderately elevated, very finely spirally striate, junction with 1st postnatal whorl distinct. Postnatal whorls 3. Axial ribs 16 on 1st, 20 on 2nd, 27 on 3rd whorl, from suture to suture, petering out on base; spiral lirae 3 on 1st, 4–5 on 2nd, 6 on 3rd whorl, 10 additional on base; ribs predominant over the lirae, nodulose at intersections. $4{\cdot}5 \times 1{\cdot}75$ mm. White.

Off Cape Recife (34° 27′ S., 25° 42′ E.), 256 fathoms, one dead (S. Afr. Mus. A8757, P.F. Coll.).

Remarks. A much smaller species than *alfredensis* Bartsch. Smaller and broader than *Daphnellopsis lamellosa* Schepman 1913 and *Daphnella subuloides* Schepman 1913, to which there is some similarity in sculpture.

Daphnella alfredensis Bartsch

1915. Bartsch. *Bull. U.S. Nat. Mus.*, 91, p. 32, pl. 8, fig. 3.

In an 8 mm. topotype (top of protoconch worn) with 3 postnatal whorls, there are *c.* 12, 16 and 21 axial riblets on 1st, 2nd and 3rd whorls respectively, i.e. more than Bartsch gave in his description (his figure shows too few!); spiral lirae 3 on 1st whorl, 6 on 2nd, 16–17 on 3rd, including those on sulcus (Bartsch said 'appressed portion' appears to be free of spiral sculpture).

Thesbia algoensis Thiele

Fig. 30 *c*

1925. Thiele. *D. Tiefsee Exp.*, xvii, p. 232, pl. 40 (28), fig. 14.

Aperture subequal to spire. Protoconch $1\frac{1}{2}$ whorls, somewhat lopsided (corroded). Postnatal whorls 3, profile evenly convex. Axial ribs (1st whorl corroded), *c.* 19 on 2nd whorl, 21 on 3rd, not strongly curved, crossing sulcus which is not defined, subequal in width to intervals; spiral lirae 5–6 on 2nd whorl, 6–7 on 3rd, showing only in the intervals between ribs, *c.* 12 additional lirae on base. $4{\cdot}5 \times 2{\cdot}25$ mm. Thiele: $3{\cdot}5 \times 1{\cdot}7$ mm. Buff.

Algoa Bay (33° 50′ S., 25° 48′ E.), depth not stated (Thiele). Off Cape Morgan, 47 fathoms, one abraded specimen (S. Afr. Mus. A8734, P.F. Coll.).

Remarks. Thiele did not state the number of ribs and lirae; his figure seems to show a few more than in the present specimen, but the slight discrepancy does not preclude referring the *Pieter Faure* specimen to his species.

Although Thiele's figures of *T. algoensis* and *Columbella dianae* appear different, there is considerable difficulty in practice in assigning several *Pieter Faure* shells to one or the other. The above specimen is much more like *T. algoensis* in having a broad body whorl, but other specimens are more like *C. dianae*, and have been reserved for further study.

Pleurotomella ursula Thiele

Fig. 30 *d*

1925. Thiele. *D. Tiefsee Exp.*, xvii, p. 231, pl. 41 (29), fig. 3.

Aperture subequal to spire (Thiele's figure), slightly longer than spire (15 mm. specimen), or $1\frac{1}{4}$ in spire (9 mm. specimen). Protoconch $1\frac{1}{2}$ whorls, alt. and diam. 0·6 mm. (0·5 mm. in 9 mm. specimen), apically smooth, last half whorl with close-set fine axial pliculae. Postnatal whorls 5. Axial ribs 11 on 1st whorl, increasing to 15 on last whorl; crossed by spiral lirae 4, increasing to 5–6 on 4th and 5th whorls, intermediaries on later part of 3rd and on 4th whorl (9 mm. specimen), in 15 mm. specimen intermediaries as strong as primaries, total 12–13. Sulcus deeply sunken, with well-marked growth-lines. Lip sinus very deep, adjoining suture; outer lip expanding below sulcus. Canal short, but longer than in Thiele's figure. $6{\cdot}75 \times 3$ mm. (across shoulder of body whorl, 3·5 if outer lip included), $9 \times 3{\cdot}5$ mm. (resp. 4·5), and 15×6 mm. (resp. 7). Thiele: 6×3 mm.

35° 16′ S., 22° 26′ E., 155 metres (Thiele).

Cape St. Blaize, N. × E., 73 miles, 125 fathoms, two dead; off Cove Rock (East London area), 80–100 fathoms, one dead (S. Afr. Mus. A8559, A8701, P.F. Coll.).

Remarks. The largest specimen came from the East London area; all three are larger than the *Valdivia* specimen.

The protoconch does not appear quite so high as in Thiele's figure. He described it as somewhat rough. According to his 1929 diagnosis, the genus has criss-cross sculpture.

Gen. Mitromorpha A. Adams

Subgen. *Antimitra* Iredale

Mitromorpha (*Antimitra*) *hewitti* Tomlin

1904. Smith. *J. Malac.* xi, p. 31, pl. 2, fig. 13 (*volva* Sow. var.).
1921. Tomlin. *J. Conch.*, xvi, p. 156.
1932. Turton. *Mar. Sh. Pt. Alfred*, p. 48, pl. xi, no. 359 (*striolata*).

Recorded from Port Alfred and East London.

Off Cove Rock (East London area), 22 fathoms, 2 specimens from bottom sample (S. Afr. Mus. P.F. Coll.).

Mitromorpha apollinis Thiele

1925. Thiele. *D. Tiefsee Exp.*, xvii, p. 255, pl. 31 (19), fig. 14.

Protoconch 2 whorls, alt. and diam. 0·5 mm., smooth, junction with 1st postnatal whorl distinct. Postnatal whorls 5. Axial ribs 13–14 on 1st and 2nd whorls, increasing to 15–16 on 3rd, but evanescent on later part of 3rd and obsolete on 4th and 5th, crossing the sulcus but not the cingulum; crossed by flattened spiral lirae 3 on 1st whorl, 3–4 on 2nd, 4(5) on 3rd, 5 on 4th and 5th whorls, *c.* 16 additional lirae on base. Sulcus with narrow cingulum. Fine growth-lines across sulcus, and between the lirae. $9{\cdot}5 \times 3{\cdot}5$, and $10{\cdot}5 \times 3{\cdot}75$ mm. Pale fawn.

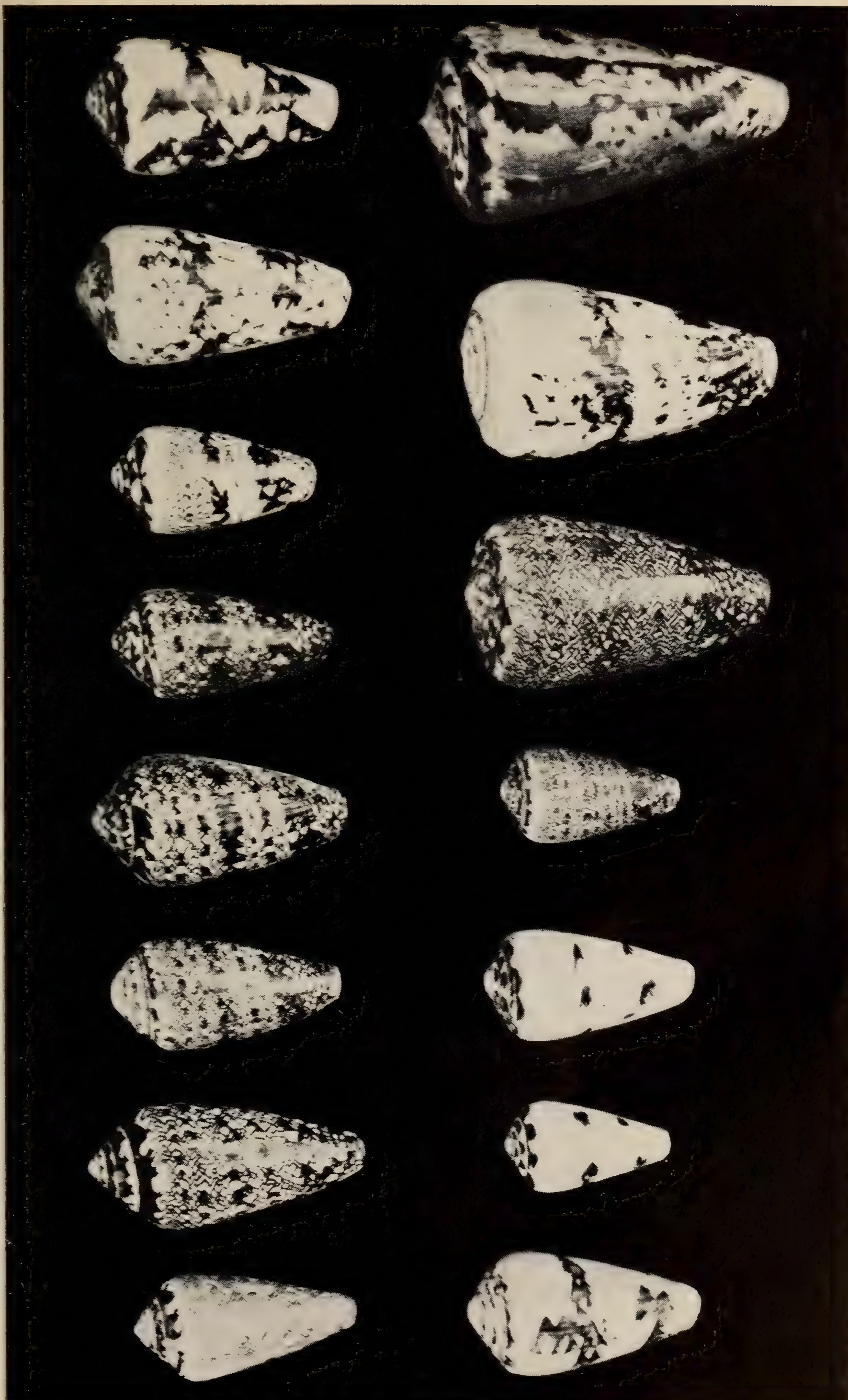
34° 51′ S., 19° 37′ E., 80 metres (Thiele).

Cape St. Blaize N. × E., 73 miles, 125 fathoms, 2 dead (S. Afr. Mus. P.F. Coll.).

Remarks. Superficially like *Daphnella sulcata*, but with smaller protoconch, flatter whorls, and spiral lirae fewer on the whorls but more numerous on the rostrum. With 5 whorls the above two specimens are larger than the four obtained by the *Valdivia*. Thiele's description says 6 spiral lirae on penultimate (i.e. 3rd whorl); this includes the cingulum, but even so the present specimens appear to have one lira less because the lowest one is weaker than the others and more or less occluded by the suture of the following whorl.

M. jovis Thiele 1925, from the same *Valdivia* station, in spite of its slightly larger protoconch (according to the figure: 0·6 or 0·7 mm.) is extraordinarily like *apollinis*.

The third South African species described by Thiele: *M. neptuni* Thiele 1925, is very similar in sculpture to *Mangilia nympha* Bartsch 1915, but is a little larger with the same number of whorls.



Conus natalis — gilchristi. First five in upper row: *natalis* typical in form and markings. Three on right in bottom row: low-spired forms, the last one being the Type of *gilchristi.*

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HYDROZOA FROM THE COASTS OF NATAL AND PORTUGUESE EAST AFRICA. Part I. CALYPTOBLASTEA.

by

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(With 16 figures in the text)

Introduction

This paper represents the second of a series describing the Hydrozoa of the coasts of South Africa. The species from Natal and the southern part of Portuguese East Africa are dealt with together since from a provisional inspection they appear to represent a fairly comprehensive geographical unit bathed by the warm waters of the southward-flowing Mozambique Current. They represent the subtropical component of the fauna of the South African coast. How far this apparent geographical unit is a real one, and how sharp a boundary there is between this unit and the more southerly one, will only be answered when the species of the south coast have been described.

The material dealt with comes from several sources. Part was collected in the early years of the century by the government survey vessel, the s.s. *Pieter Faure*, and is lodged in the South African Museum. Most of it is of more recent origin and forms part of the Ecological Survey collection in the Zoology Department of the University of Cape Town. Material has also been submitted for examination by Mrs. M. Kalk of the University of the Witwatersrand, and by Messrs. B. R. Allanson and P. Zoutendyk, to whom I wish to express my thanks. The details of localities, etc., are listed below.

My thanks are also due to Dr. W. R. Rees for enabling me to examine certain material in the British Museum, and to the Zoologische Sammlung des Bayerischen Staates, Munich, for the loan of types.

All type material described in this paper has been deposited in the South African Museum.

Financial aid from the C.S.I.R. and the Carnegie Corporation made possible the ecological survey, and grants from the Staff Research Fund of the University of Cape Town have assisted greatly in the collection of the necessary literature and microscopic apparatus. The cost of publication was partly defrayed by a grant from the publications fund of the University of Cape Town.

Station List

AFR Material collected by the government research vessel R.S. *Africana* off the Natal coast.

	Date	Position	Depth	Bottom
AFR 1028	15/5/48	28°28′S./32°25·8′E.	27 m.	Fine sand and rock
AFR 1098	1/6/48	29°57′S./31°11′E.	333 m.	Green mud

D Intertidal material from Isipingo and other localities near Durban, collected in July 1935 and July 1936.

DNB Material from Durban Bay (a land-locked bay).

DBN 2	7/7/50	From floating jetty
DBN 62–70	July 1950	Intertidal
DBN 89	8/1/51	Intertidal
DBN 119	12/1/51	Dredged just outside bay (south of S. Breakwater), from at least 8 m.
DBN 130	15/1/51	From ships' hulls operating only in Durban Bay
DBN 199, 200	3/10/51	Intertidal
DBN 238–329	April 1952	Intertidal
DBN 381	1/5/52	Dredged from 12 m.

IN Material from Inhaca Island, Delagoa Bay, Portuguese East Africa. Collected by Mrs. M. Kalk.

IN 41	Date unknown	
IN 49	1954	Intertidal
IN 91	July 1955	Intertidal
IN 100	18/9/55	Intertidal
IN 136	1/4/56	Brought up by diver from 12 m.
IN 137–138	14/7/56	Canal debris
IN 139–140	20/7/56	Intertidal

MOR Material from Morrumbane Estuary, inland from Inhambane, Portuguese East Africa.

MOR 7	14/1/54	Dredged in channel at Mongue Ferry, up to 3 m.
MOR 40	20/1/54	Linga Linga, intertidal
MOR 216–218	July 1954	Linga Linga, from hull of wreck

NA Material from intertidal zone on Natal coast, collected partly by Prof. J. H. Day, partly by B. R. Allanson.

NA 111	16/7/46	Umhlanga Rocks
NA 112	16/7/46	Tiger Rocks, Isipingo
NA 114	16/7/46	Umhlanga Rocks
NA 116–117	18/7/49	Kosi Bay reef
NA 184	July 1950	Kosi Bay reef
NA 212	14/7/46	Inyoni Rocks

PF Material dredged off the Natal coast by the s.s. *Pieter Faure*. Collection lodged in South African Museum. The positions were given in the original records as compass bearings off salient points on the coast, and were probably not very accurate. These have been converted into latitude and longitude and given to the nearest minute.

	Date	Position	Depth	Bottom
PF 10781	17/12/00	29°53′S./31°11′E. (off Cape Natal)	155 m.	s. sh.
PF 11141	31/12/00	30°15′S./30°54′E. (off Umkomaas River)	73 m.	brk. sh. st.
PF 11323	10/1/01	29°27′S./31°34′E. (off Tugela River)	73 m.	m.
PF 11803 A	8/2/01	29°0′S./31°49′E. (off Durnford Point)	24 m.	s. sh.
PF 12028	27/2/01	28°41′S./32°22′E. (off Cone Point)	62 m.	brk. sh.
PF 12308	14/3/01	30°53′S./30°28′E. (off Port Shepstone)	66 m.	brk. sh. st.
PF 12392	14/3/01	31°2·5′S./30°18′E. (off Itongazi River)	46 m.	r. st.
PF 12456	22/3/01	30°32′S./30°38·5′E. (off Umtwalumi R.)	46 m.	brk. sh.

PZ Material collected by P. Zoutendyk from Morrumbane Estuary, inland from Inhambane, Portuguese East Africa.

PZ 13 16/7/54 Linga Linga Point, dredged in 3–5 m.

RHB Material from Richard's Bay estuary, Natal.

RHB 51	1/2/49	Umhlatuzi Lake, under 1 m.
RHB 52	27/1/49	Lower Channel, drifting material brought in by tide.
RHB 76	14/7/49	Lower Channel, drifting material.
RHB 85	16/7/49	Upper Channel, drifting material.
RHB 113–114	25/1/51	Lower Channel, drifting material.

U and UU Intertidal material from Umhlali, Natal.

U 1 21/12/38
UU 2 18/7/40

List of Species

Haleciidae
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Halecium inhacae n. sp.

Campanulariidae
Campanularia ?crenata (Hartlaub)
Campanularia integra MacGillivray
Campanularia morgansi Millard
Campanularia sp.
Clytia gracilis (M. Sars)
Clytia johnstoni (Alder)
Clytia serrata n. sp.
Obelia bicuspidata Clarke
Obelia dichotoma (Linnaeus)

Campanulinidae
Stegopoma fastigiata (Alder)

Lafoeidae
Filellum ?antarcticum (Hartlaub)
Hebella scandens (Bale)
Scandia mutabilis (Ritchie)
Zygophylax ?biarmata Billard
Zygophylax geminocarpa n. sp.
Zygophylax infundibulum n. sp.

Sertulariidae
Amphisbetia bidens (Bale)
Amphisbetia minima (Thompson)
Amphisbetia operculata (Linnaeus)
Dynamena crisioides Lamouroux
Dynamena obliqua Lamouroux
Dynamena quadridentata (Ellis and Solander)
Salacia articulata (Pallas)
Sertularella arbuscula (Lamouroux)
Sertularella diaphana (Allman)
Sertularella dubia Billard
Sertularella flabellum (Allman)
Sertularella mediterranea Hartlaub
Sertularella polyzonias (Linnaeus)
Sertularella spp. (2)
Sertularia acuta (Stechow)
Sertularia distans (Lamouroux)
Sertularia ligulata Thornely
Sertularia linealis Warren
Sertularia turbinata (Lamouroux)
Stereotheca acanthostoma (Bale)
Thyroscyphus aequalis Warren
Thyroscyphus fruticosus (Esper)

Syntheciidae

Hincksella corrugata n. sp.
Synthecium ?elegans Allman

Plumulariidae

Antennella secundaria (Gmelin)
Halopteris glutinosa (Lamouroux)
Kirchenpaueria adhaerens n. sp.
Monostaechas faurei n. sp.
Monostaechas natalensis n. sp.
Paragattya heurteli (Billard)
Paragattya intermedia Warren
Plumularia filicaulis Kirchenpauer
Plumularia irregularis n. sp.
Plumularia setacea (Ellis & Solander)
Plumularia spinulosa Bale
Plumularia warreni Stechow
Pycnotheca mirabilis (Allman)
Aglaophenia late-carinata Allman
Aglaophenia pluma (Linnaeus)
Halicornaria africana n. sp.
Halicornaria arcuata (Lamouroux)
Halicornaria gracilicaulis (Jäderholm)
Halicornaria hians (Busk)
Lytocarpus filamentosus (Lamarck)
Lytocarpus philippinus (Kirchenpauer)
Thecocarpus formosus (Busk)
Thecocarpus giardi Billard

Family **Haleciidae**

Halecium beanii (Johnston) 1838

Halecium Beanii Hincks 1868, p. 224, pl. 43, fig. 2. Broch 1918, p. 38, fig. 13.
Halecium beanii Millard 1957, p. 188.

Records. MOR 218 C. DBN 329 J (reported by Day and Morgans, 1956, as *Halecium* cf. *halecinum*).

Description. Two small colonies without gonangia, reaching a maximum height of 2·1 cm. (MOR) and 3·1 cm. (DBN).

Halecium inhacae n.sp.

Fig. 1

Holotype. IN 140 H.

Description. A single fairly rich colony growing on weed. Hydrorhiza with internal thickenings of perisarc. Stem low, reaching a maximum height of 4 mm., unfascicled and generally unbranched. Nodes usually not visible; when present, oblique. Internodes of variable length. Perisarc with internal thickenings similar to those of hydrorhiza, giving a corrugated appearance, but no definite annulations.

Hydrothecae alternate, the two rows in one plane. Primary hydrothecae sessile, each borne on a broad apophysis arising from the distal half of a stem internode but well below its terminal node. Margin of primary hydrotheca perpendicular to axis of stem. Secondary hydrophores asymmetrical: peduncle convex on adcauline side, straight or concave on abcauline side, with the result that the whole structure bends away from stem. Margin of secondary hydrotheca not perpendicular to hydrophore axis, but tilted obliquely towards the adcauline side. Hydrotheca widening slightly to margin; walls straight and not bent outwards. Diaphragm distinct, attached to the upper side of a powerful thickening of the hydrophore wall, which is more heavily developed

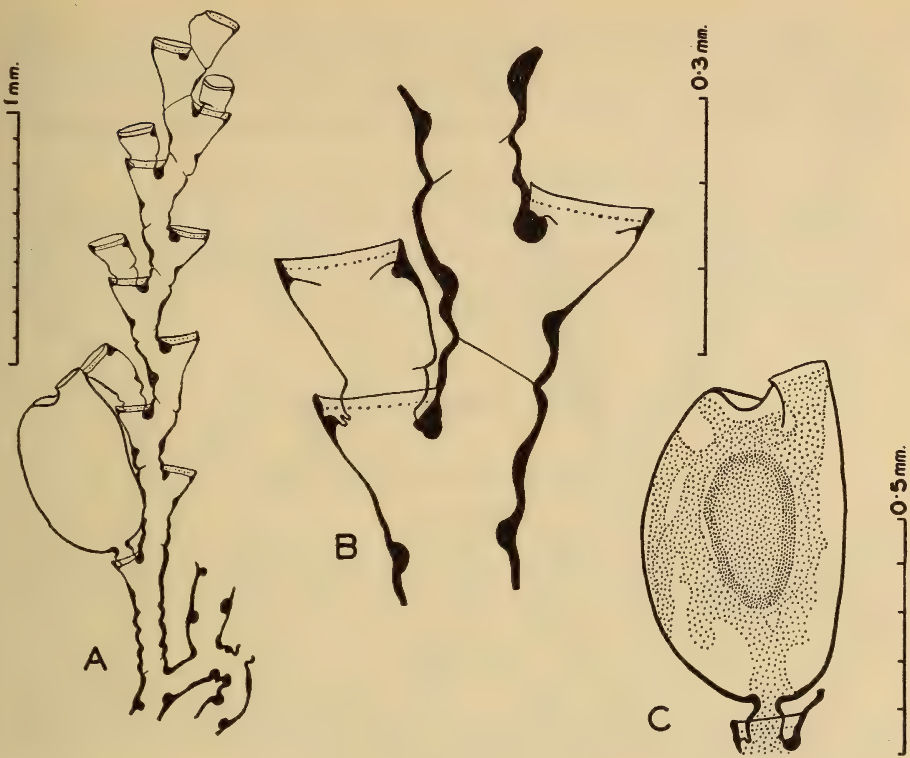

FIG. 1. *Halecium inhacae* n. sp.
A, a single stem. B, portion of stem with 2 hydrophores. C, a female gonangium containing a branching blastostyle and planula larva.

on the adcauline side. Row of puncta about midway between diaphragm and margin. Hydranth with about 19 tentacles.

Female gonangia borne abundantly on hydrorhiza, and sometimes on stem, where they always emerge from within the hydrothecae. Gonotheca broadly oval in side view, flattened from side to side, very distinctly demarcated from a short pedicel of one segment. Distal end broad, slightly convex, or occasionally dished in the centre, bearing a terminal aperture at the end of a raised collar on one side. Containing a branching blastostyle and a single planula larva. No hydranths visible.

Measurements (mm.)

Internode, length	0·20–0·29
diameter across node	0·10–0·13
Hydrotheca, depth, diaphragm to margin	0·025–0·04
diameter at level of diaphragm	0·11–0·16
diameter at margin	0·13–0·17
Gonotheca, length, excluding pedicel	0·67–0·78
maximum diameter	0·43–0·55

Remarks. The gonangia show resemblances to those of *H. halecinum*, but are much broader at the base and do not taper downwards to the pedicel. The general form of the colony, however, is different, and the shape of the secondary hydrophores differs completely from that described by Broch 1918 and Vervoort 1946.

The secondary hydrophores resemble in shape those of *H. expansum* Trebilcock 1928 from New Zealand, but the walls of the hydrothecae are always thickened below and not at the level of the diaphragm. In *H. expansum*, moreover, the two rows of hydrothecae are not in the same plane, and there are no perisarcal thickenings on the stem.

Family **Campanulariidae**

Campanularia ?crenata (Hartl.) 1901

Fig. 2A–C, E

Eucopella crenata Hartl. 1901a, p. 364, pl. 22, figs. 27–31, 33–35. ?Billard 1906b, p. 170, fig. 3. ?Ritchie 1909, p. 73.
Orthopyxis crenata Bale 1924, p. 232, fig. 3.

Records. NA 117A, 184 E. IN 49 M.

Description. Colonies growing on weed. Pedicel arising direct from hydrorhiza; annulated at base and immediately below hydrotheca, smooth or wavy in centre; perisarc of variable thickness.

Hydrotheca variable in shape and thickness of perisarc. Generally triangular, with depth less than marginal diameter, but sometimes deeper and narrower. Wall sometimes thin, sometimes greatly thickened on two opposite sides to just below margin. Margin with 11–15 low, rounded teeth.

Gonophores absent.

Measurements (mm.)

Pedicel length	0·52–4·12
maximum diameter	0·08–0·14
Hydrotheca, depth	0·33–0·50
diameter at margin	0·31–0·68

Remarks. This species cannot be identified with certainty in the absence of gonophores and in view of certain differences from the description of the type from New Zealand. In the latter the diameter of the hydrotheca is always less than the depth, and the pedicel has less distinct annulations or none at all. The South African material, however, resembles more closely Billard's specimens from the Sargasso Sea and Ritchie's specimens from Cape Verde, both of which were assigned with a query to the species. In Richie's material the diameter of the hydrotheca was equal to, or greater than, the depth.

Campanularia integra MacGill. 1842

Campanularia caliculata Warren 1908, p. 338, fig. 19.
Campanularia integra Broch 1918, p. 159. Millard 1957, p. 193.

Records. D 173. IN 49 J.

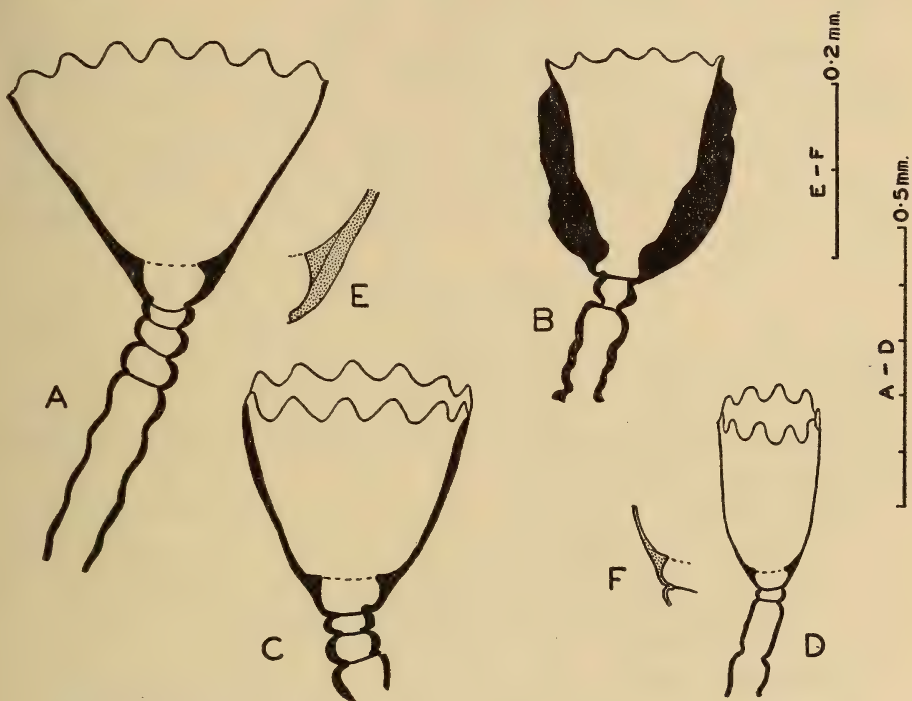

FIG. 2. *Campanularia ?crenata* (Hartl.) (A–C, E), and *Campanularia* sp. (D, F)
A–B, a normal thin-walled and a thick-walled hydrotheca from NA 184E. C, a narrower hydrotheca from IN 49M. D, a hydrotheca from DBN 2S. E, F, the diaphragms of A and D respectively.

Campanularia morgansi Millard 1957

Campanularia morgansi Millard 1957, p. 195, fig. 6.

Records. PF 12028 D.

Description. Colony growing on *Sertularella dubia* var. *magna.* Measurements completely within range of those of the type, but hydrothecae with fewer marginal teeth (8–11). No gonophores.

Campanularia sp.
Fig. 2D, F

Records. DBN 2S, 270 W (reported by Day and Morgans 1956 as *Clytia* sp.).

Description. Two small colonies growing on other hydroids. Pedicel wavy or irregularly corrugated, with one distinct spherule below hydrotheca.

Hydrotheca rather small and delicate, widening very slightly to margin. Margin with 10–12 tongue-shaped teeth. No diaphragm, but an annular thickening near base and a rather flattened basal chamber.

One rather damaged and empty gonotheca present, barrel-shaped, with about 5 annulations and a truncated distal end.

Remarks. It is safer to leave the final identification of this species until further material is available. The hydrotheca is similar to that of *C. africana* Stechow, but smaller and more delicate. The gonotheca is different.

The absence of a true diaphragm excludes it from *Clytia johnstoni* (Alder), for as yet no South African specimens of the latter show variations so completely approaching the *Campanularia* type. The pedicel is also different.

Clytia gracilis (M. Sars) 1851

Fig. 3B, E, G

Gonothyraea gracilis Hincks 1868, p. 183, pl. 36, fig. 1.
Clytia gracilis Stechow 1925, p. 431, figs. 9–10. Millard 1957, p. 196.

Records. RHB 51 (recorded by Millard and Harrison 1954 as *Clytia* sp.).

Measurements (mm.)

Pedicel, length	1·64–3·84
maximum diameter	0·10–0·12
Hydrotheca, depth	0·48–0·80
maximum diameter	0·24–0·49
length/diameter	1·47–2·00
Gonophore, length	0·84–0·97
maximum diameter	0·43–0·67

Clytia johnstoni (Alder) 1857

Fig. 3A, D, F

Clytia johnstoni Hincks 1868, p. 143, pl. 24, fig. 1. Billard 1928, p. 456.
Campanularia johnstoni Broch 1918, p. 163. 1933, p. 93, fig. 40.
Campanularia raridentata Stechow 1919a, p. 58, fig. Q.

Records. IN 49 L.

Description. Hydrorhiza creeping on weed, giving off pedicels which are generally unbranched, but occasionally branched to bear 2 hydrothecae. Pedicel closely annulated at base and at distal end, smooth or with scattered groups of annulations in middle portion.

Hydrotheca deep, expanding gently to margin. Wall smooth. Marginal teeth 10–13 in number, triangular, with rounded tips, separated by deep, rounded bays. Diaphragm well marked, of two distinct portions.

Gonotheca barrel-shaped, annulated, truncated at distal end, with a distinct collar.

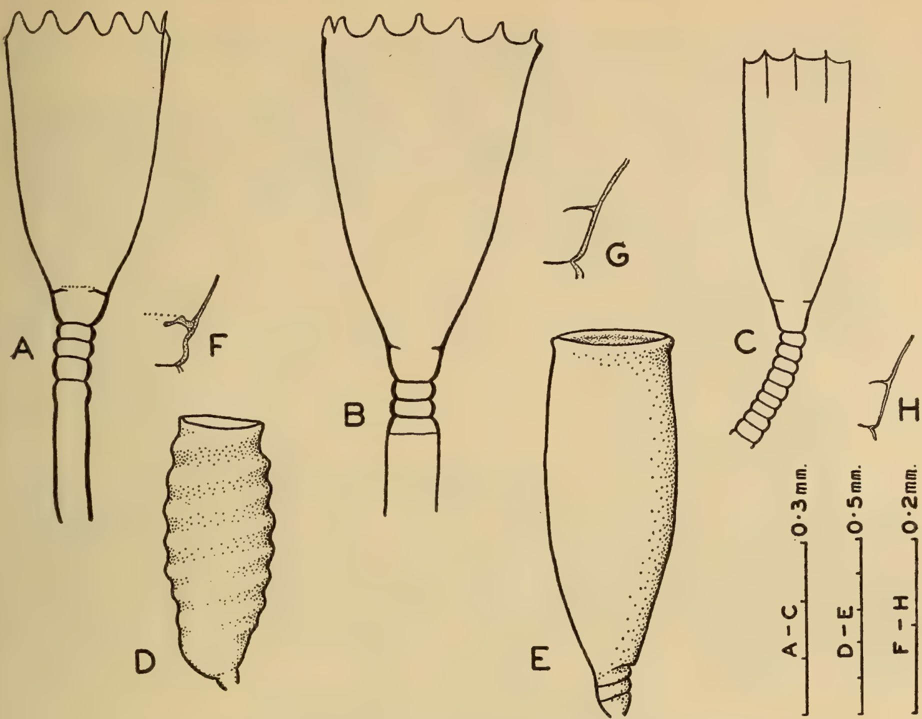

FIG. 3. *Clytia johnstoni* (Alder) (A, D, F); *Clytia gracilis* (M. Sars) (B, E, G); and *Clytia serrata* n. sp. (C, H).
A–C, the hydrothecae. D–E, gonothecae. F–H, diaphragms.

Measurements (mm.)

Pedicel, length	0·42–1·58
maximum diameter	0·07–0·09
Hydrotheca, depth	0·31–0·565
diameter at margin	0·21–0·40
length/diameter	1·41–1·89
Gonotheca, length	0·55–0·88
maximum diameter	0·32–0·43

Remarks. This is the first record of this cosmopolitan species from South Africa. Due to the difficulty of distinguishing *C. gracilis* and *C. johnstoni* in the absence of gonophores, only fruiting material of the two species has been included.

Clytia serrata n. sp.

Fig. 3C, H

Holotype. MOR 216 C.

Description. A small colony with 8 hydrothecae growing on the stem of another hydroid. Hydrorhiza creeping, giving rise directly to the pedicels of the hydrothecae.

Pedicel unbranched, closely annulated at base and distal end, smooth or with scattered groups of annulations in middle part.

Hydrotheca deep and narrow, about 3 times as deep as wide, with the walls practically parallel in the distal half. Marginal teeth 8, very narrow and needle-like, each bearing a longitudinal ridge which is continued down the wall of the hydrotheca for a quarter to half its length. Diaphragm very delicate. Basal chamber deep and quadrangular.

Gonophores absent.

Measurements (mm.)

Pedicel, length	0·76–1·46
maximum diameter	0·05–0·065
Hydrotheca, depth	0·45–0·62
diameter at margin	0·16–0·20
length/diameter	2·65–3·10

Remarks. This species is very similar to *Clytia kincaidi* (Nutting) 1899, differing from it only in its smaller size (the hydrotheca of *C. kincaidi* measures 0·57–0·65 mm. as judged from Fraser's diagrams, 1944) and less extensive longitudinal ridges. *C. kincaidi*, however, has only been found on the coasts of N. America, and it is most probable that the gonophores of the two species will be found to differ.

Obelia bicuspidata Clarke 1875

Laomedea bicuspidata Vervoort 1946, p. 298, fig. 132. 1946a, p. 344, fig. 10.

Records. DBN 89 S (reported by Day and Morgans, 1956). RHB 51 B.

Description. Slender, monosiphonic, sterile colonies reaching a maximum height of 7 mm. Stem occasionally branched in form of dichasium. Hydrothecal pedicel annulated throughout, or with a smooth, somewhat swollen region in middle. Hydrotheca long and slender, with 8–11 pairs of slender, rodlike teeth. In microscopic preparations striations are visible near the sides only.

Gonophores absent.

Measurements (mm.)	*Durban Bay*	*Richard's Bay*
Hydrotheca, depth	0·38–0·51	0·37–0·46
maximum diameter	0·19–0·27	0·18–0·22
length/diameter	1·67–2·45	1·85–2·21

Remarks. This species has a more or less cosmopolitan distribution, but this is the first record from South Africa.

Obelia dichotoma (Linn.) 1758

Obelia dichotoma Millard 1957, p. 198.

Records. DBN 62 C, 130 E (reported by Day and Morgans, 1956). IN 100 B.

Family **Campanulinidae**

Stegopoma fastigiata (Alder) 1860

Calycella fastigiata Hincks 1868, p. 208; fig. 25; pl. 39, fig. 3.
Stegopoma fastigiata Fraser 1944, p. 178; pl. 32, fig. 153.

Records. AFR 1098 L.

Description. Hydrorhiza creeping on stem of *Zygophylax ?biarmata.* Hydrotheca as in previous descriptions. Pedicel of variable length, either longer or shorter than hydrotheca. Margin of hydrotheca often reduplicated, and a node, indicative of regeneration, sometimes present in pedicel. Hydranth with about 11–13 tentacles. No gonophores.

Measurements (mm.)

Pedicel, length	0·67–1·35
diameter near base	0·07–0·09
diameter at junction with hydrotheca	0·10–0·15
Hydrotheca, depth	1·02–1·84
diameter at margin	0·24–0·33

Remarks. This is the first record of the species from South Africa.

Family **Lafoeidae**

Filellum ?antarcticum (Hartl.) 1904

Lafoea antarctica Vanhöffen 1910, p. 311, fig. 31.
Filellum antarcticum Stechow 1925a, p. 214.
Reticularia antarctica Totton 1930, p. 160.

Records. PF 11141 D.

Description. Colony growing on *Sertularella arbuscula.* Margin of hydrotheca slightly everted and usually reduplicated. Many of the hydrothecae free for entire length. No coppiniae.

Measurements (mm.)

Hydrotheca, length of free part, without reduplications	0·36–0·90
length of free part, with reduplications	0·42–1·02
diameter at margin	0·16–0·22

Remarks. There is little to distinguish *F. antarcticum* from *F. serpens* in the absence of coppiniae, although Vanhöffen states that the hydrothecae of the former are 'higher' than those of the latter, and his measurements are much greater than those given by Stechow 1925 for *F. serpens.* The measurements of the present material are greater than those of the material from False Bay (Millard 1957, *Reticularia serpens*), and it is solely on this basis that it is placed provisionally in *F. antarcticum* rather than *F. serpens.* Both species have been recorded from South Africa, though the record of *F. antarcticum* is somewhat doubtful (Stechow 1925a).

Hebella scandens (Bale) 1888

Hebella scandens Millard 1957, p. 202.

Records. DBN 267 F. PF 11323 B, 12392 B, 12456 H.

Scandia mutabilis (Ritchie) 1907

Scandia mutabilis Millard 1957, p. 202.

Records. IN 140 J.

Description. Colony growing on weeds and other hydroids. Pedicel variable in length, with 3–9 annulations. Hydrothecae rather longer and narrower than those reported from False Bay. Gonophores absent.

Measurements (mm., without reduplications. Base of hydrotheca taken as first annulation below diaphragm)

Pedicel length	0·24–0·93
maximum diameter	0·14–0·22
Hydrotheca, depth	1·40–2·11
diameter at margin	0·58–0·85
length/diameter	1·79–2·88

Zygophylax ?biarmata Billard 1905
Fig. 4A

Zygophylax biarmata Billard 1906b, p. 180, fig. 8. Broch 1918, p. 24.

Records. AFR 1098 E.

Description. A colony of 4 fascicled branching stems reaching a maximum height of 3·5 cm., in very poor condition and overgrown with sponges and worm-tubes. Stem giving off alternate hydrothecae, and branches which are roughly alternate and more or less in one plane, but the whole scheme is very irregular. Each branch usually arises from the axial tube below a hydrotheca, but in some cases no axillary hydrotheca is present. Peripheral tubes may reconnect with the branches close to the origin of the latter, and may separate in bundles from the stem to accompany worm-tubes and eventually connect up with other parts. They may also bear irregular hydrothecae, nematothecae and even branches.

Hydrotheca borne on apophysis of stem or branch, and separated from it by a partial or complete node. Pedicel short, hydrotheca curved away from stem, with adcauline wall convex. Many reduplications of margin. Diaphragm present.

Nematotheca tubular with everted rim, separated from its short pedicel by a delicate diaphragm, often much elongated by reduplications of margin. Typically two on each apophysis, although many missing.

Gonophores absent.

Measurements (mm., exclusive of reduplications)

Final branches, diameter	0·07–0·08
distance between 2 hydrothecae	0·42–0·58
Hydrothecal pedicel, length adcauline	0·06–0·11
Hydrotheca, length adcauline	0·31–0·41
length abcauline	0·27–0·35
diameter at mouth	0·13–0·16
diameter at level of diaphragm	0·06–0·07
Nematotheca, length, including pedicel	0·08–0·14
diameter at mouth	0·035–0·05

Remarks. The exact identification of this species cannot be certain due to the poor condition of the material and the absence of gonophores. The hydrotheca has a similar shape to that of *Z. africana* Stechow, but is larger and proportionally wider. The measurements are within range for those given for *Z. biarmata* and *Z. armata* (Ritchie). *Z. biarmata* has previously been reported from islands in the Indian Ocean (Jarvis 1922), but never from the Union. It can only be distinguished with certainty from *Z. armata* by the structure of the gonophores.

Zygophylax geminocarpa n. sp.

Fig. 4D–G

Holotype. PF 12308 A.

Description. Colony consisting of about 8 branching stems reaching a maximum height of 11·1 cm. Hydrorhiza forming a tangled mass up to 1 cm. in diameter, clasping quantities of sand grains and other debris amongst its tubes. Stem heavily fascicled, reaching a diameter of 3 mm., and branching in one plane. Stem bearing alternate hydrothecae, and alternate branches arising generally at the base of every third and fourth hydrotheca. Branches varying greatly in thickness, a few heavily fascicled and rebranching, others unfascicled and unbranched. Each branch arising from an apophysis of the axial tube of the stem and separated from it by a distinct node. 'Axillary' hydrotheca shifted on to upper side of apophysis. The branches are of two types:

(i) Found mainly on the lower part of the stem, but also occurring irregularly amongst type (ii). These branches may or may not be fascicled, they give off alternate hydrothecae, and sometimes alternate subbranches from the base of every third and fourth hydrotheca. The two rows of hydrothecae and subbranches are in one plane, the same as that on the stem.

(ii) Forked branches found mainly on the upper part of the stem, and always unfascicled. Each of these branches divides dichotomously immediately beyond the apophysis which bears it, and the two limbs of the fork are in a plane at right angles to the normal branching plane of the colony. At the angle of the fork and on its lower side (i.e. towards the base of the colony) is a single hydrotheca. After this each limb bears alternate hydrothecae, of which the two rows are not in one plane, but shifted on to the inner surface (so that the hydrothecae of the two limbs of the fork face towards one another).

All branches with occasional transverse nodes at irregular intervals. Occasionally the whole arrangement is complicated by the presence of more than one axial branching tube in the stem.

Hydrotheca resting on apophysis of stem or branch. Pedicel short, much narrower than apophysis at its base, widening to diaphragm distally. Hydrotheca with abcauline wall practically straight, adcauline wall convex for most of its length, concave immediately below margin. Margin slightly everted, forming an angle of approximately 45° with branch. Diaphragm formed by thickened perisarcal ring. Cauline hydrothecae almost completely immersed in the peripheral tubes of the stem.

Nematotheca tubular, widest at margin or just below, borne on a short pedicel from which it is separated by a delicate diaphragm. 1–4 on each hydrothecal apophysis (usually 2), and an irregular number on the peripheral tubes of the stem.

Gonothecae not collected in coppiniae, but attached to one another in pairs, and arranged in dense clusters around the main stem and principal branches. Each gonotheca very large, elongated, round in section, tapering to the base, and, more rapidly, to the tip, fused to its twin for about $\frac{3}{4}$ of length and then free. Scattered nematothecae borne on lower half. The gonothecae are not fully mature and have no openings to the exterior, nor can the sex be determined. It is probable that an opening will develop on the inner surface of the free distal part where a flattened area is present and where the end of the blastostyle is pressed against the perisarc. The gonothecae are borne by the peripheral tubes of the stem. Although most of them are arranged in pairs, there are occasional solitary individuals or groups of three.

Measurements (mm.)

Final branches, diameter	0·12–0·22
distance between 2 hydrothecae	0·365–0·485
Hydrothecal pedicel, length abcauline	0·06–0·12
Hydrotheca, length abcauline	0·35–0·43
length adcauline	0·34–0·42
diameter at mouth	0·17–0·21
diameter at level of diaphragm	0·10–0·15
Nematotheca, length including pedicel	0·09–0·12
maximum diameter	0·05–0·06
Gonotheca, length	3·78–4·15
maximum diameter across pair	1·46–1·75

Remarks. This species is unique in the dichotomous division of the branches, and the twin gonothecae.

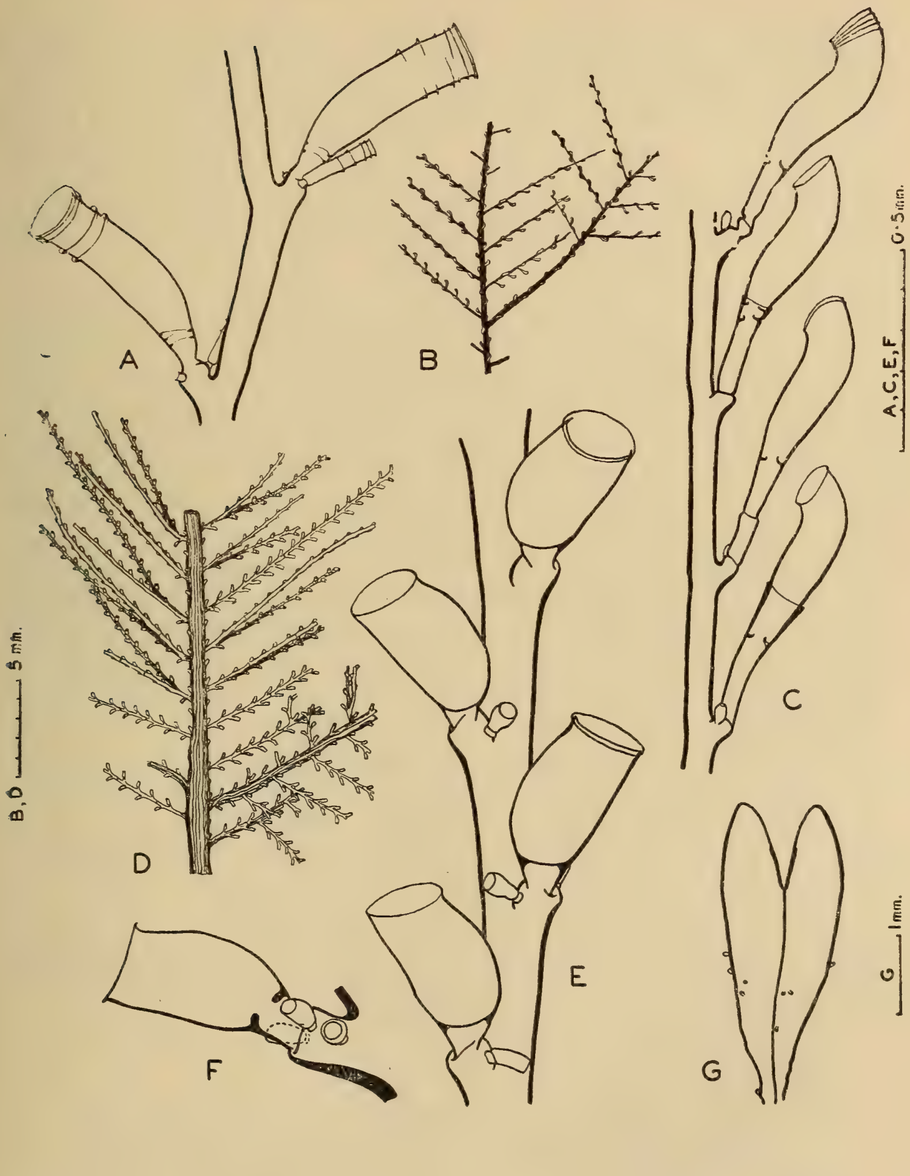

FIG. 4. *Zygophylax ?biarmata* Billard (A); *Zygophylax infundibulum* n. sp. (B–C); and *Zygophylax geminocarpa* n. sp. (D–G).

B and D, portion of stem to show branching. A, C, E, F, portion of branch on larger scale to show hydrothecae and nematothecae (C and F in side view). G, gonothecae.

Zygophylax infundibulum n. sp.

Fig. 4B–C

Holotype. PF 10781 B.

Description. A number of damaged stems reaching a maximum height of 6 cm. Hydrorhiza embedded in sponge. Stem fascicled, giving off alternate hydrothecae, and alternate branches which generally arise from the base of every third and fourth hydrotheca, though there are many irregularities. Branches often subdividing in the same manner. All branches in one plane. Final branches unfascicled; each borne on an apophysis of the axial tube of the stem or branch, from which it is separated by a distinct node; bearing alternate hydrothecae; unsegmented or with a rare transverse node midway between two hydrothecae. The two rows of hydrothecae on stem and branches not in the same plane, but shifted on to the anterior surface and forming a sharp angle (about 15–40°) between them. The hydrotheca at the origin of each branch not exactly in the axil but on the anterior surface of the apophysis.

Hydrotheca borne on a short apophysis of stem or branch and separated from it by a transverse node. Pedicel about half length of hydrotheca, widening slightly in distal region and not sharply demarcated from hydrotheca. Hydrotheca elongated, curving upwards in the distal part, with abcauline wall convex, and adcauline wall convex in proximal two-thirds and concave in distal third. Margin facing upwards but also twisted slightly outwards, so that its plane forms a right angle with the margin of a hydrotheca in the opposite row. Diaphragm in form of thickened perisarcal ring, with inner edge bent towards distal end of hydrotheca in form of inverted funnel; abcauline side better developed than adcauline.

Nematotheca tubular, widening from base to two-thirds of height, then narrowing to margin. One nematotheca on the apophysis next to each hydrothecal pedicel, but many are missing. None observed on the stem. At the origin of a branch the nematotheca of the 'axillary' hydrotheca is seated on the branch apophysis instead of on the hydrothecal apophysis.

The colony shows much evidence of regeneration following damage. This may occur immediately beyond an apophysis resulting in a second short segment, in the pedicel of the hydrotheca, or in the hydrotheca itself resulting in a repetition of the diaphragm or reduplication of the margin.

Gonophores absent.

Measurements (mm.)

Final branches, distance between 2 hydrothecae	0·33–0·47
diameter, above hydrotheca	0·06–0·07
Pedicel, length adcauline	0·18–0·23
Hydrotheca, total length	0·41–0·485
length adcauline	0·29–0·38
diameter at mouth	0·11–0·14
diameter at level of diaphragm	0·06–0·07

Nematotheca, length	0·06–0·07
maximum diameter	0·03–0·035

Remarks. This species is very close to *Z. unilateralis* Totton from New Zealand, but differs from it in the proportions of the hydrothecae, which are more slender. Very characteristic is the funnel-shaped diaphragm, which rather resembles that of *Z. curvitheca* Stechow 1913a.

Family **Syntheciidae**

Hincksella corrugata n. sp.

Fig. 5

Holotype. PF 12456 J.

Description. Hydrorhiza creeping on weed, forming a branching network. Stem unbranched, unfascicled, reaching a maximum height of 4½ mm. and bearing up to 5 hydrothecae. Basal part irregularly corrugated or annulated, remainder divided into internodes of rather irregular length by oblique nodes. Each internode bearing a hydrotheca, and with 1–3 corrugations immediately above node.

Hydrothecae alternate, the two rows in the same plane, tubular, bending slightly outwards, with about half the adcauline wall adnate. Walls smooth or with faint transverse corrugations. Margin entire, round, slightly everted, forming an angle of about 45° with stem, sometimes reduplicated.

Gonophores absent.

Measurements (mm.)

Stem, internode length ..	0·50–0·75
diameter at node	0·15–0·20
Hydrotheca, total length, in centre	0·57–0·73
length abcauline	0·53–0·69
length adcauline, adnate part	0·35–0·45
length adcauline, free part	0·28–0·42
adnate part/adcauline length	0·47–0·61
diameter at margin ..	0·41–0·45

FIG. 5. *Hincksella corrugata* n. sp.

Remarks. This species is close to *H. cylindrica* (Bale), but differs in the proportions of the hydrothecae, which are shorter and wider. In this character

H. corrugata is intermediate between *H. cylindrica* and *H. sibogae* Billard (the proportion of thecal diameter to length is approximately 1·2 in *H. sibogae*, 0·7 in *H. corrugata*, and 0·3–0·4 in *H. cylindrica*). *H. corrugata* also differs from *H. cylindrica* in the greater adnate portion of the adcauline thecal wall (about one-half as against one-third), in the less delicate wall to the hydrotheca, and in the presence of corrugations on the stem and occasionally on the hydrotheca as well.

Synthecium ?elegans Allman 1872

Synthecium ramosum Billard 1907, p. 359, fig. 8.
Synthecium ?elegans Millard 1957, p. 203, fig. 9D.

Record. PF 12308 F.

Description. A young colony of 9 simple stems reaching a maximum height of 1·6 cm. Two of the stems end in stolons, and in 3 of them stolons arise from within the hydrothecae. Shape and arrangement of hydrothecae similar to the simple stems described from False Bay (Millard 1957), except that the measurements are greater and a smaller proportion of the hydrotheca is adnate to the stem.

Gonophores absent.

Measurements (mm.)

Stem, internode length	0·90–1·17
Hydrotheca, length abcauline	0·44–0·76
length adcauline, adnate part	0·55–0·67
length adcauline, free part	0·18–0·44
diameter near base	0·21–0·27
diameter at margin	0·27–0·39

Remarks. The measurements are very similar to those of the material from Madagascar, described by Billard 1907 as *S. ramosum* but assigned to *S. elegans* in 1910.

Family **Sertulariidae**

Amphisbetia bidens (Bale) 1884

Sertularia bidens Bale 1884, p. 70; pl. 6, fig. 6; pl. 19, fig. 1. Warren 1908, p. 310, fig. 10.
Amphisbetia bidens Millard 1957, p. 220.

Records. RHB 76 B, 85 C, 114 E (recorded by Millard and Harrison 1954 as *Thuiaria bidens*). DBN 119 H (recorded by Day and Morgans 1956).

Description. Rich colonies reaching a maximum height of 13 cm. Nodes of stem very distinct. No oblique nodes separating basal part of stem from distal pinnate part (as described by Warren). Basal part of stem short (always shorter than distal part) and sometimes branched, consisting of internodes of irregular length, of which the distal one may bear hydrothecae, terminated by a normal transverse node. Distal portion bearing alternate hydrocladia, one to each internode. On the hydrocladia the two rows of hydrothecae are not always in the same plane, but sometimes shifted on to one side, although never in contact with one another. Marginal teeth of hydrothecae much longer than in False Bay material.

Gonophores triangular in section, with 2 long spines produced from two angles of the triangle, and very occasionally a third; present in January and July.

Amphisbetia minima (Thompson) 1879

Amphisbetia minima Millard 1957, p. 221.

Records. IN 49 F, 140 F.

Description. Rich colonies growing on weed. Stems bearing up to 11 pairs of hydrothecae and reaching a maximum height of 0.4 cm.

Male gonophores present.

Amphisbetia operculata (Linn.) 1758

Amphisbetia operculata Millard 1957, p. 221.

Records. RHB 76 E, 85 D (recorded by Millard and Harrison 1954 as *Sertularia operculata*). DBN 2 P, 119 J, 130 A (recorded by Day and Morgans 1956).

Dynamena crisioides Lamx. 1824

Dynamena tubuliformis Marktanner-Turneretscher 1890, p. 238; pl. 4, fig. 10.
Thuiaria tubuliformis Warren 1908, p. 314, fig. 12.
Dynamena crisioides Billard 1925, p. 181, figs. 36–37; pl. 7, fig. 21.

Records. D 170. DBN 267 E (recorded by Day and Morgans 1956). IN 49 P. MOR 40 F.

Description. Stems reaching a maximum height of 2·1 cm., zigzag, pinnate. Detailed structure similar to that in previous descriptions. Pairs of hydrothecae on pinnae well separated and not overlapping, as illustrated by Warren.

Gonothecae of the typical shape for the species, arising from below the hydrothecae, or, occasionally, from within the hydrothecae, present in January and April.

Measurements. See var. *gigantea.*

var. *gigantea* Billard 1925
Fig. 6c

Thuiaria interrupta Allman 1886, p. 145; pl. 16, figs. 8–10.
Dynamena crisioides var. *gigantea* Billard 1925, p. 186, fig. 38F; pl. 8, fig. 24. Vervoort 1941, p. 210, fig. 4.

Records. MOR 7 X.

Description. A single colony, with long, straight stems reaching a maximum height of 10 cm., and a diameter of 0·53 mm. near base. Stem divided into internodes, each bearing 2–15 subopposite hydrothecae (usually about 9), and one pinna arising below the first hydrotheca. Pinnae alternate, reaching a length of 15 mm., sometimes ending in tendrils, divided into internodes, each bearing 2–5 pairs subopposite hydrothecae (usually 4).

Hydrothecae closely set and members of a group usually overlapping, with only a very small portion of adcauline wall free.

Gonothecae present.

Measurements (mm.)	*Typical form*	*v. gigantea*
Hydrotheca, total height to top of adcauline tooth	0·51–0·68	0·55–0·70
length abcauline	0·34–0·51	0·36–0·48
length adcauline, adnate part	0·36–0·65	0·53–0·67
length adcauline, free part	0·07–0·24	0·05–0·11
adnate part/adcauline length	0·63–0·88	0·84–0·92
diameter at mouth	0·12–0·21	0·16–0·20
Gonotheca, length	0·98–1·37	2·13–2·16
maximum diameter	0·44–0·69	0·79–0·85

Remarks. This material differs from the typical form of the species mainly in its growth-form and long straight stems. The hydrothecal pairs are also more closely set, those on the pinnae usually overlapping one another. The hydrothecae are a little longer than in the typical material, and have a smaller proportion of the adcauline wall free. The gonothecae are larger, though of the typical shape for the species.

Dynamena obliqua Lamx.

Fig. 6A

Pasythea quadridentata Bale 1888, p. 770; pl. 14, figs. 6–7.
Pasythea quadridentata var. *Balei* Billard 1907, p. 355, fig. 6.
Dynamena obliqua Billard 1925, p. 198 (synonymy).

Records. PF 11803 AK, 12308 G.

Description. Two colonies reaching a maximum height of 11 mm. Hydrorhiza with internal ridges of perisarc in some areas only. Basal part of stem terminated by 1 or 2 oblique 'hinge-joints'. Remainder divided into internodes, each bearing 1 or 2 pairs of hydrothecae, but generally only one. Nodes generally transverse and very indistinct, but occasionally oblique and distinct.

Members of a pair of hydrothecae in contact in front (except near base of stem), separate behind. Hydrotheca broad with free part narrowing evenly to margin. Margin facing outwards and slightly upwards, bearing two triangular lateral teeth and a small adcauline one. Minute internal teeth present in some hydrothecae only. Operculum of 2 valves, abcauline the larger. Hydranth with no abcauline blind pouch.

Gonophores absent.

Measurements (mm., adcauline length in isolated pairs only)

Distance between 2 pairs of hydrothecae	0·42–0·62
Hydrotheca, length abcauline (without teeth)	0·21–0·34
length adcauline, adnate part	0·27–0·38
length adcauline, free part	0·12–0·16
diameter at mouth	0·12–0·14
diameter at base across pair	0·24–0·39

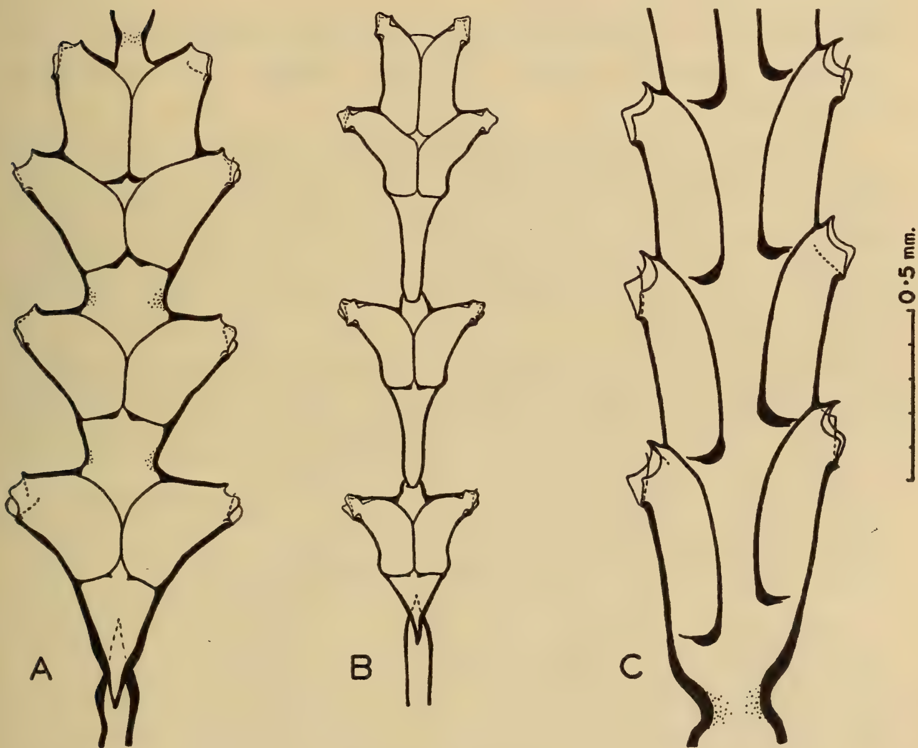

FIG. 6. *Dynamena obliqua* Lamx. (A); *Dynamena quadridentata* (Ellis & Sol.), var. *nodosa* Hargitt (B); and *Dynamena crisioides* Lamx., var. *gigantea* Billard (C).

A, upper part of stem showing normal arrangement of hydrothecae from PF 12308G. B, an unusual stem with small groups of hydrothecae from DBN 381G for comparison with A. Opercular valves in dotted lines.

Remarks. Billard (1925) is of the opinion that *D. obliqua* must remain separate from *D. quadridentata*, and assigns to it material that has previously been included in the latter species. In the South African collections both species seem to be present, *D. obliqua* differing from *D. quadridentata* in the shape of the hydrotheca, the tendency for a grouping in solitary pairs, and in the measurements. Further, *D. quadridentata* is typically a littoral form and *D. obliqua* occurs at depths of 24–66 m.

D. obliqua is known from Australia (Bale), Mozambique (Billard 1907) and possibly Japan (Stechow). This is the first record from the Union of South Africa.

Dynamena quadridentata (Ell. & Sol.) 1786 var. *nodosa* Hargitt 1908

Fig. 6B

Pasythea quadridentata Warren 1908, p. 312, fig. 11.
Dynamena quadridentata var. *nodosa* Billard 1925, p. 197, fig. 43E. Leloup 1935, p. 43, fig. 25.

Records. NA 116 A. DBN 267 C, 381 G (recorded by Day and Morgans 1956). IN 49 N.

Description. Hydrorhiza with internal ridges of perisarc in certain areas only. Stems reaching a height of 0.6 cm. and bearing hydrothecae in groups of 1–4 pairs. Basal part of stem of variable length, terminated by oblique 'hinge-joint'. Nodes oblique, but sometimes the distal end of an internode is cut off by an indistinct transverse node, and sometimes there are only these transverse nodes to separate the groups of hydrothecae. Stem occasionally terminating in stolon.

Hydrotheca slender and elongated, the lowest pair in a group swollen at base as illustrated by Leloup. Internal teeth absent, or present (including one adcauline and one or two abcauline). Operculum of 2 valves, abcauline the larger. Hydranth without abcauline blind pouch.

Gonotheca with 4 transverse annulations and broad operculate aperture, present in April (only one seen).

Measurements (mm., adcauline length in isolated pairs only)

	Durban Bay	*Kosi Bay*
Hydrotheca, length abcauline	0·17–0·34	0·19–0·35
length adcauline, adnate part	0·23–0·25	
length adcauline, free part	0·09–0·14	
diameter at mouth	0·07–0·09	0·09–0·13
diameter across pair at base	0·19–0·26	0·26–0·31
Gonotheca, length	0·98	
maximum diameter	0·70	

Remarks. The varieties of this species have been defined by Billard, and var. *nodosa* again by Leloup. The species has previously been recorded from the Natal coast by Warren 1908 and Vervoort 1946a. From the diagrams, Warren's material probably also belongs to var. *nodosa*. Vervoort's material was not illustrated.

Salacia articulata (Pallas) 1766

Salacia articulata Millard 1957, p. 208.

Records. PF 11803 AG, 12308 D, 12392 F.

Genus Sertularella

In a recent paper Picard (1956) has united *Sertularella lagenoides* Stechow 1919a, *S. mediterranea* Hartl. 1901, *S. ellisii* (M.-Edw.) 1836, and *S. fusiformis* (Hincks) 1861 (including f. *glabra* Broch 1933 and f. *ornata* Broch 1933), under the single name of *S. ellisii* on the basis of intergrading forms occurring in the Mediterranean.

He uses as his main diagnostic character the shape of the hydrotheca which in his composite species is said to be bent towards the distal end of the stem (i.e. the margin is not perpendicular to the axis of the hydrotheca but tilted towards the adcauline side). This character is used to distinguish *S. ellisii* from a group of species (including *S. polyzonias* (Linn.) 1758) in which the hydrotheca is bent towards the base of the stem.

I do not feel that this character has so great a diagnostic value as assigned to it by Picard. A study of the literature shows that the hydrotheca of *S. fusiformis* is normally mid-way between the two types (i.e. with the margin perpendicular to the hydrothecal axis), but can vary in both directions, as is clearly shown by Broch's figures (1933), and as confirmed by my own observations on the South African material. Further, in the South African material of *S. polyzonias* and *S. falsa* Millard 1957 the hydrotheca is normally bent towards the base of the stem, but occasional hydrothecae tend to approach the *ellisii* type by an elongation of the abcauline marginal tooth and a consequent tilting of the margin towards the adcauline side.

Picard rejects the diagnostic value of the internal hydrothecal teeth, for he unites in one species forms which have 3, 4, or none at all. Admittedly this feature is variable in some species (e.g. *S. fusiformis*), but where it is constant in all hydrothecae of colonies which obviously belong to the same species I can see no reason why it should not have diagnostic value.

If we are to reject both hydrothecal shape and internal teeth as diagnostic features, we would have to unite the South African species *S. mediterranea*, *S. fusiformis*, *S. falsa*, *S. capensis*, *S. africana* and *S. polyzonias*, for all are unfascicled and have hydrothecae of similar size. This does not seem reasonable since each has its own distinctive characters (Millard 1957).

Hitherto my diagnosis has depended firstly on the presence or absence of internal teeth and their number and size, and only secondly on shape, recognizing the fact that the latter may vary in certain species. For the internal teeth do appear to be constant *in the South African material*, and even in *S. fusiformis*, where the number may vary, the teeth are always small and alternate with the marginal teeth. *S. mediterranea* is one of the most constant, both as to hydrothecal shape and its three internal teeth, and I have seen no variations approaching the *fusiformis* type.

Although more extensive information may make it necessary in the future to reduce some of these species to varieties, for the present it is safer, and certainly can do no harm, to keep the species separate.

Sertularella arbuscula (Lamx.) 1816

Sertularella arbuscula Millard 1957, p. 208, figs. 10B, 11C.

Records. PF 10781 A, 11141 A, 11323 A, 11803 AH, 12028 C, 12392 A.

Description. Only one of the samples (PF 12392 A) bears gonophores, and these are annulated throughout the distal $\frac{2}{3}$ of their length, the annulations being very much more distinct than is usual for the species.

Sertularella diaphana (Allman) 1886

Fig. 7C, D

Sertularella lata Billard 1907, p. 346, fig. 4.

Sertularella diaphana Billard 1925, p. 157, fig. 22; pl. 7, figs. 12–13. ?Stechow 1925a, p. 226, fig. H.

Records. IN 136 A.

Description. A single bushy colony reaching 15 cm. in height, with a woody rooting mass $3\frac{1}{2}$ cm. in diameter. Stem and principle branches fascicled, branches given off irregularly. Distal parts unfascicled, divided into regular internodes by oblique nodes, which slope alternately to right and left. Each internode bearing one hydrotheca on one side, and two hydrothecae and a hydrocladium between them on the other.

Hydrocladium bearing alternate hydrothecae; internodes of irregular length, usually bearing 11–12 hydrothecae each, but occasionally as few as 2 or as many as 14; nodes oblique and often indistinct. The two rows of hydrothecae not diametrically opposite but shifted on to the anterior face, this condition being more pronounced on the stem than on the hydrocladia.

Hydrotheca completely adnate or with a very short free part, very slightly turgid near base and then curved outwards. Margin facing outwards and upwards, forming an angle of 25–45° with hydrocladium. Margin with 4 low teeth. Operculum of 4 valves, usually missing. Abcauline wall with perisarcal thickening below margin. No internal teeth.

Gonophores absent.

Measurements (mm.)

Hydrotheca (hydrocladial), length adcauline	0·43–0·48
length of free part	0·00–0·08
diameter at mouth	0·20–0·24

Remarks. S. diaphana is difficult to distinguish from *S. lata* (Bale) in the absence of gonophores. Fertile material of *S. diaphana* has been recorded from Portuguese East Africa by Billard 1907 and Jarvis 1922, and this fact, and the angle of the hydrotheca margin (which is said to be almost parallel to the hydrocladium in *S. lata*), makes it fairly certain that the present material should be allocated to this species.

Sertularella dubia Billard 1907
var. *magna* n. var.
Fig. 7A

Sertularella dubia Billard 1907, p. 344, fig. 3; pl. 25, fig. 1. (typical form).

Types and Records. Holotype PF 12028 B. Further records: PF 12308 H, PF 12456 D.

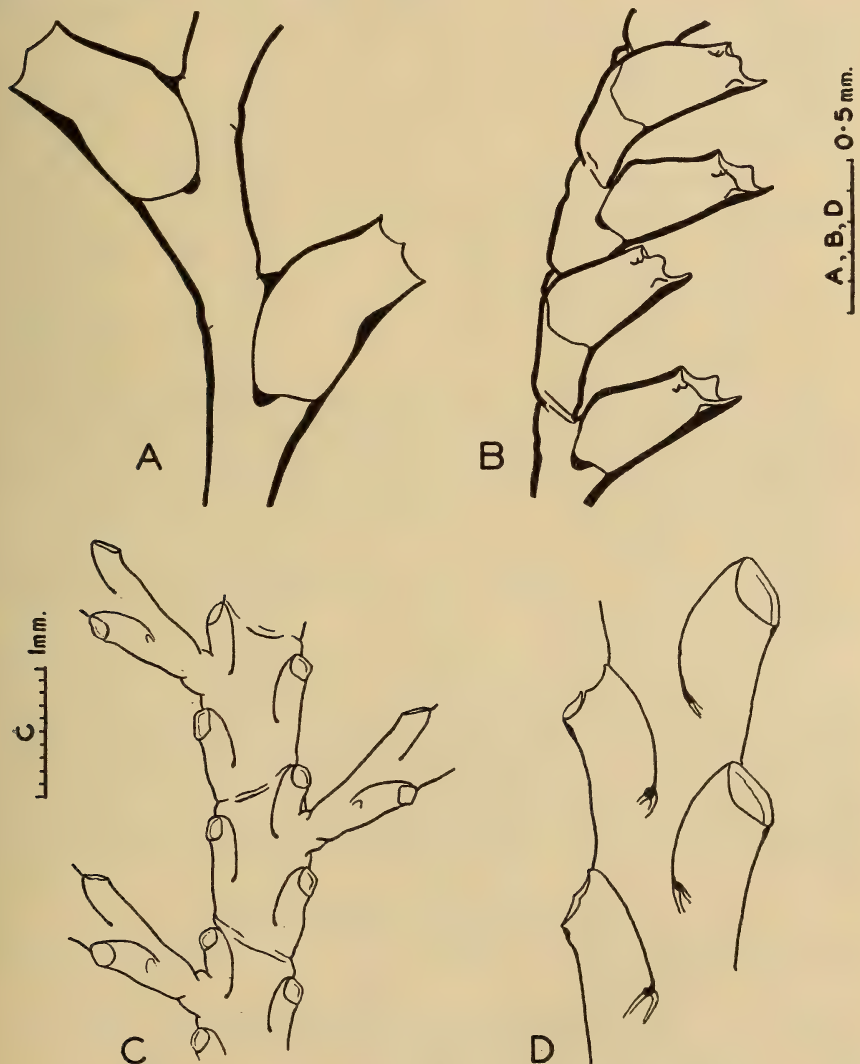

FIG. 7. *Sertularella dubia* Billard, var. *magna* n. var. (A); *Sertularella mediterranea* Hartl., var. *asymmetrica* n. var. (B); and *Sertularella diaphana* (Allman) (C, D).
A, two hydrothecae from the holotype. B, part of a stem in side view. C, part of a stem showing origin of hydrocladia. D, part of a hydrocladium.

Description. Stiff, erect colonies reaching a maximum height of 10·6 cm., and branching in one plane. Stem fascicled, bearing alternate branches usually separated by 3 hydrothecae. Branches arising from immediately below hydrothecae. Nodes visible at distal ends of branches only.

Hydrothecae swollen, narrowing to margin, adnate for about ½ length of adcauline wall, with margin not perpendicular to hydrothecal axis, but tilted slightly away from stem. Abcauline wall straight to concave, with pronounced perisarcal thickening at about ⅔ of its height. No internal teeth. Margin with 4 low teeth.

Gonophores absent.

Measurements (mm.)	*Holotype*	*PF* 12308 *H*
Internode, length	0·58–0·72	0·53–0·72
diameter across node	0·22–0·38	0·27–0·51
Hydrotheca, length abcauline	0·50–0·61	0·46–0·55
length adcauline, adnate part	0·37–0·45	0·39–0·45
length adcauline, free part	0·40–0·49	0·39–0·54
adnate part/adcauline length	0·45–0·52	0·43–0·52
diameter at mouth	0·25–0·29	0·30–0·33
maximum diameter	0·34–0·38	0·39–0·43

Remarks. The appearance of the colony and the detailed structure agree exactly with the description of the typical form from Macalonga (P.E. Africa). Var. *magna* differs only in the dimensions of the hydrothecae which are about 1⅓ times as great. The species is here recorded for the first time from the Union of South Africa.

S. dubia resembles *S. arbuscula* in the shape of the hydrotheca, and in the presence of a perisarcal thickening on the abcauline thecal wall, but differs in the absence of internal teeth.

The size and shape of the hydrotheca also resemble those of *S. xantha* Stechow 1923b, but the form of the colony is quite different. *S. xantha* has a straggling, flexuous stem, and *S. dubia* a stiff, erect stem with shorter internodes. The abcauline thecal thickening, which is pronounced in *S. dubia* and some distance from the margin, is less pronounced or absent in *S. xantha* and, if present, close to the margin. The hydrothecae of the latter also have a greater proportion of the adcauline wall adnate.

Sertularella flabellum (Allman) 1886

Sertularella flabellum Millard 1957, p. 212, figs. 10G, 11G.

Records. PF 12308 J.

Sertularella mediterranea Hartl. 1901

Sertularella mediterranea Millard 1957, p. 215, figs. 10E, 11B.

Records. D 169 (recorded by Eyre and Stephenson 1938). NA 114. PF 11803 AJ.

Measurements. See var. *asymmetrica*.

var. *asymmetrica* n. var.

Fig. 7B

Holotype. IN 49 K.

Description. Small, unbranched stems growing on weed and reaching a maximum height of 0·6 cm. The two rows of hydrothecae not in the same plane but shifted towards one side of stem.

Hydrotheca similar to the typical form with 3 internal teeth and elongated abcauline wall; but smaller in all its dimensions and with a smaller proportion of the adcauline wall adnate. Many of the hydrothecae tend to be asymmetrical, with one of the lateral marginal teeth very much longer than the other. Operculum with 4 valves.

Female gonothecae present, shorter and more truncated than the male of the typical form, with external marsupium and no marginal teeth.

Measurements (mm.)	*Typical*	*var. asymmetrica*
Internode, length	0·42–0·80	0·31–0·42
diameter across node	0·17–0·29	0·09–0·13
Hydrotheca, length abcauline	0·57–0·71	0·33–0·54
length adcauline, adnate part	0·30–0·37	0·11–0·17
length adcauline, free part	0·34–0·42	0·24–0·40
adnate part/adcauline length	0·43–0·51	0·22–0·37
diameter at mouth	0·21–0·27	0·14–0·21
maximum diameter	0·29–0·35	0·22–0·29
Gonotheca, female, length		1·08–1·29
maximum diameter		0·75–0·89
Gonotheca, male, length	2·02–2·28	
maximum diameter	0·83–0·94	

Remarks. At first appearance this material looks very different from the typical *S. mediterranea*, but intermediate forms from other parts of the coast show that there are no grounds for specific differentiation. The asymmetry of the marginal hydrothecal teeth is found towards the distal parts of the stems, but is usually not evident in the lower regions.

Sertularella polyzonias (Linn.) 1758

Sertularella polyzonias Millard 1957, p. 217, figs. 10J, 11H.

Records. AFR 1028 C. PF 12456 G.

Description. Immature colonies growing on other hydroids and reaching a maximum height of 1·8 cm. Gonophores absent.

Measurements (mm.)	
Internode, length	0·40–0·54
diameter across node	0·11–0·17

Hydrotheca, length abcauline	0·34–0·52
length adcauline, adnate part	0·25–0·31
length adcauline, free part	0·23–0·31
adnate part/adcauline length	0·46–0·57
diameter at mouth	0·18–0·22
maximum diameter	0·23–0·27

Remarks. The measurements of the internodes and hydrothecae are somewhat less than those of the material from False Bay.

Sertularella sp.

Records. PF 12308 K.

Description. A fragment of an unfascicled stem with very large hydrothecae reaching 1·42 mm. in abcauline length. Hydrotheca bent outwards, with just under half adcauline wall adnate and 3 large internal teeth.

Remarks. This is possibly a new species, but cannot be described as such until more material is available.

Sertularella sp.

Records. PF 12456 E.

Description. Several rooted, unfascicled and unbranched stems reaching a maximum height of 3·7 cm. Hydrothecae very large, reaching 1·92 mm. in abcauline length, with just over half adcauline wall adnate, free part narrow and tubular with sides almost parallel. No internal teeth.

Remarks. The shape of the hydrotheca resembles that of *S. leiocarpa* (Allman) 1888, but a greater proportion is adnate, and the size is greater. In fact, there appears to be no described species of *Sertularella* with such large hydrothecae. The material is probably that of a young colony, and without a knowledge of the form of the mature colony and the gonothecae I do not think it advisable to establish a new species.

Sertularia acuta (Stechow) 1921a
Fig. 8A, F

Sertularia loculosa Warren 1908, p. 306, fig. 8; pl. 48, fig. 37. Bale 1913, p. 121; pl. 12, figs. 7–8.

Records. RHB 52 C, 85 G (recorded by Millard and Harrison 1954 as *Sertularia turbinata*).

Description. Numerous unbranched stems growing on weed and reaching a maximum height of 6 mm. Stem with 1 or 2 spiral turns at base, remainder divided into thecate internodes bounded by transverse nodes, with occasional athecate internodes bounded distally by oblique nodes. Hydrothecae in opposite pairs, members of a pair in contact in front, free behind.

Hydrotheca squat and swollen, with intrathecal ridge about half-way up abcauline wall and extending round the sides for about ⅔ diameter. Margin facing outwards and upwards, with 2 blunt lateral teeth and a very small adcauline one. Operculum of 2 valves, the abcauline the longer. No internal teeth.

Gonotheca with 7–8 annulations and broad distal aperture, not compressed.

Measurements (mm.)

Thecate internode, length	0·39–0·54
Hydrotheca, length abcauline, without teeth	0·16–0·21
length adcauline, contiguous part	0·05–0·16
length adcauline, adnate part	0·19–0·23
length adcauline, free part	0·08–0·13
adnate part/adcauline length	0·62–0·71
diameter at margin	0·09–0·12
diameter across pair (maximum)	0·45–0·55
Gonotheca, length	1·31–1·50
maximum diameter	0·84–0·98

Remarks. See *Sertularia turbinata.*

Sertularia distans (Lamx.) 1816
var. *gracilis* Hassall 1848

Sertularia distans var. *gracilis* Millard 1957, p. 221, fig. 12.

Records. IN 140 G.

Description. A single colony with stems reaching a maximum height of 3 mm. and bearing up to 7 pairs hydrothecae. Detailed structure similar to False Bay material, but measurements somewhat less. An internal tooth present on abcauline wall of hydrotheca. Gonophores absent.

Measurements (mm., without lateral marginal teeth or reduplications)

Stem, length of basal part	0·20–0·40
Internode, thecate, length	0·30–0·41
thecate, diameter at node	0·04–0·07
athecate, length	0·10–0·22
Hydrotheca, length, abcauline	0·19–0·21
length adcauline, adnate part	0·17–0·20
length adcauline, free part	0·11–0·16
length adcauline, contiguous part	0·13–0·15
diameter at base	0·07–0·09
diameter at margin	0·07–0·08

Sertularia ligulata Thornely 1904
Fig. 8C; 9A, B

Sertularia ligulata Billard 1925, p. 178, fig. 35. Leloup 1937, p. 44, fig. 30.

Records. PZ 13 E.

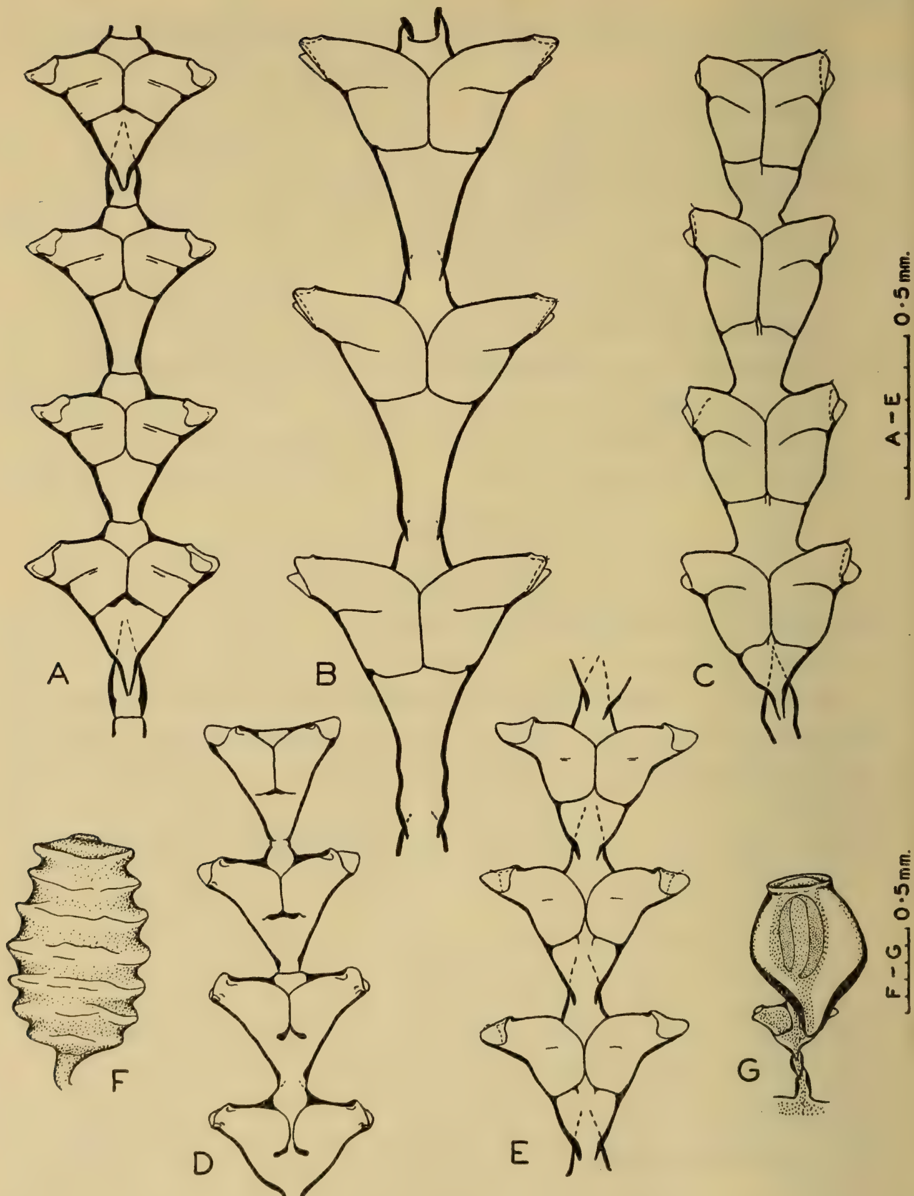

FIG. 8. *Sertularia acuta* (Stechow) (A, F); *Sertularia turbinata* (Lamx.) (B); *Sertularia ligulaat* Thornely (C); *Sertularia linealis* Warren (D, G); and *Sertularia linealis* var. *longa* n. var. (E). A and F, stem and gonotheca from RHB 52C. C from PZ 13E. D and G, stem and male gonophore from IN 49H. Opercular valves in dotted lines.

Description. A number of stems reaching a maximum height of 7 mm. growing on floating weed. Stems unbranched, with the exception of one, which has a single branch bearing two pairs of hydrothecae. Some stems ending in stolons.

Structure agreeing exactly with Billard's description, even to the finest details, except that the stem is somewhat thicker in the region of the nodes, which are not visible, and that the intrathecal ridge usually runs obliquely downwards rather than obliquely upwards round the anterior surface of the hydrotheca. Ligula not well preserved, but clearly visible in some of the hydrothecae.

Gonophores absent.

Measurements (mm.)	*PZ* 13 *E*	*Thornely's type*
Stem, distance between 2 consecutive pairs of hydrothecae	0·49–0·67	0·55–0·79
diameter in region of node	0·12–0·21	0·145–0·21
Hydrotheca, length abcauline	0·20–0·29	0·22–0·26
length adcauline, adnate part	0·27–0·39	0·33–0·38
length adcauline, free part	0·12–0·20	0·10–0·16
adnate part/adcauline length	0·58–0·76	0·68–0·78
contiguous part	0·14–0·27	0·21–0·30
diameter at margin	0·11–0·15	0·16–0·19
maximum diameter across pair	0·48–0·62	0·48–0·64

Remarks. I have seen a prepared slide of Thornely's type material of this species (fig. 9), and although the slide is unstained and the margins of most of the hydrothecae damaged, the resemblance to my own material and to Billard's is close. Nodes are not visible or only very faintly indicated at the edge of the stem, and the distance between consecutive pairs of hydrothecae is variable, being greater on the stem than on the branches. In only the lowest pair of hydrothecae can the margin be said to be 'turned a little towards the base' as stated by Billard. In all others it faces outwards and slightly upwards. The diameter at the margin is slightly greater than in my material or Billard's. See also remarks on *S. turbinata*.

Sertularia linealis Warren 1908

Fig. 8D, G

Sertularia linealis Warren 1908, p. 308, fig. 9. Jarvis 1922, p. 339.

Records. NA 117 B. IN 49 H.

Description. Two colonies growing on weed, with the hydrorhiza arranged in the typical longitudinal lines. Stem reaching a maximum length of 5 mm., and bearing up to 8 pairs hydrothecae. 1 or 2 oblique hinge-joints at base, and beyond this the internodes at first indistinct, and later distinct and oblique.

Hydrothecae in opposite pairs; members of a pair contiguous in front, except sometimes for the basal pair, separate behind. Hydrotheca bent outwards, narrowing to margin, margin facing outwards and slightly upwards. Margin with 2 rounded lateral teeth, with perisarcal thickening around inner edge and usually 3 internal teeth, 1 adcauline and 2 abcauline. Free part of adcauline wall concave below margin. The free adcauline walls of a pair of

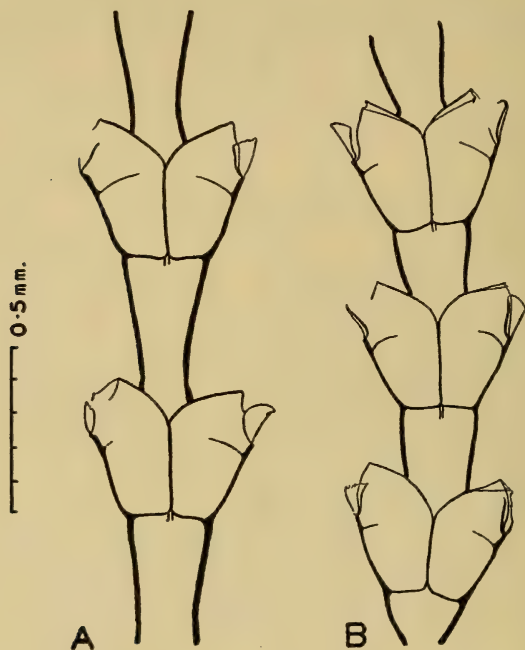

FIG. 9. *Sertularia ligulata* Thornely.
A, a portion of the stem, and B, a portion of a branch from the holotype in the British Museum (B.M. 1907.8.27.5).

hydrothecae forming more or less a straight line at right angles to the axis of the stem.

Male gonophores as described by Warren: smooth, subglobular, and with broad, operculate margin. Present in July.

Measurements. See var. *longa.*

Remarks. From Warren's description it appears that the internal teeth are not a constant feature, and this is supported by the present material. The internal teeth are seated on the internal perisarcal thickening, and in the lower parts of many stems tend to become minute and indistinguishable.

The species is known from Kosi Bay, Natal (Warren).

var. *longa* n. var.

Fig 8E

Holotype. IN 140 E.

Description. Stem longer than typical form, reaching 9 mm., and bearing up to 17 pairs hydrothecae. Nodes more distinct and more oblique. Internodes of variable length, longer towards base of stem. Perisarc in general much thinner than in typical form, and marginal thickening of hydrotheca less pronounced. Internal teeth generally absent, though observed in one hydrotheca. Marginal teeth longer. A suggestion of an intrathecal ridge present, visible on the lateral sides of the hydrotheca, but not on the abcauline wall. Gonophores absent.

Measurements (mm.)	*Typical form*		var. *longa*
	IN 49 *H*	*NA* 117 *B*	
Internode, length	0·35–0·44	0·37–0·44	0·36–0·48
Hydrotheca, length abcauline (without teeth)	0·13–0·20	0·13–0·20	0·16–0·24
length adcauline, contiguous part ..	0·00–0·13	0·00–0·13	0·00–0·21
length adcauline, adnate part ..	0·16–0·20	0·18–0·20	0·18–0·24
length adcauline, free part	0·08–0·14	0·10–0·16	0·11–0·18
diameter at margin	0·09–0·11	0·10–0·11	0·09–0·11
diameter across pair (including teeth)	0·35–0·54	0·36–0·53	0·43–0·63
Gonotheca, male, length	0·94–1·01	0·90–0·96	
maximum diameter	0·48–0·70	0·68–0·80	

Remarks. This material appears to be a variety of the typical *S. linealis*. The absence of internal teeth would probably go together with the thinner perisarc of the whole colony. The presence of an intrathecal ridge, however, might be expected to occur in colonies with heavier perisarc, and this feature, if constant, might justify the elevation of the variety to specific rank.

Sertularia turbinata (Lamx.) 1816

Fig 8B

Sertularia turbinata Billard 1925, p. 177, fig. 34.
Sertularia loculosa Jarvis 1922, p. 340.
non *Sertularia turbinata* Jarvis 1922, p. 341.

Records. PZ 13 B.

Description. Stem simple, reaching 2·5 cm. in length. Basal part unsegmented, terminated by hinge-joint. Remainder divided into thecate internodes. Nodes oblique, but often indistinct.

Members of a pair of hydrothecae in contact in front (except for one or two pairs at base), separate behind. Hydrotheca swollen in lower part, free part tapering to margin, intrathecal ridge present on abcauline wall and continuing about half-way round sides. Aperture directed outwards. Margin with 2 bluntly pointed lateral teeth and a small median adcauline one; generally thickened on abcauline side. Operculum of 2 valves, abcauline the larger.

Gonophores absent.

Measurements (mm.)

Internode, length	0·66–0·85
diameter at node	0·09–0·14
Hydrotheca, length abcauline (without teeth)	0·25–0·31
length adcauline, adnate part	0·24–0·34
length adcauline, contiguous part	0·00–0·25
length adcauline, free part	0·16–0·27
adnate part/total adcauline length	0·49–0·68
diameter at margin	0·12–0·17
diameter across pair (with teeth)	0·68–0·86

Remarks. There has been considerable confusion in the literature over a number of closely related species of *Sertularia*, but the position has been clarified by Billard 1925, who figures Lamouroux's type material of *S. turbinata.* He recognizes the following three species.

(i) *S. turbinata* (Lamx.) = *S. loculosa* Busk = *S. brevicyathus* (Versluys).

(ii) *S. acuta* (Stechow) = *S. loculosa* Bale 1913 and Warren 1908.

(iii) *S. ligulata* Thornely = *S. turbinata* Bale 1913 (= *S. turbinata* (Stechow) 1925a?).

All three species occur on the South African coast. *S. turbinata* was previously reported from Zanzibar by Jarvis 1922 as *S. brevicyathus*, and *S. acuta* from Natal by Warren 1908 as *S. loculosa.*

S. acuta can be distinguished from *S. turbinata* only by the shorter internodes, and the hydrothecae which are more squat and which narrow more abruptly towards the margin. These differences are illustrated by the accompanying measurements of internode length, abcauline thecal length, and diameter of margin in the two species. Another difference shown by the present material is that *S. turbinata* has oblique nodes, and *S. acuta* straight ones (excluding those terminating athecate internodes). Billard suggests that these two species may be synonymous, but until the gonophores of *S. turbinata* are known it is wiser to keep them separate.

S. ligulata can be distinguished by its more upright hydrothecae, of which a greater proportion is adnate to the stem, by its more poorly developed marginal teeth and by the presence of a ligula attached to the hydranth.

I have seen a sample of Jarvis's material from Zanzibar recorded as *S. turbinata* and ascribed by Billard 1925 to *S. ligulata*, and it certainly does not belong to either of these species. It has no abcauline intrathecal ridge and the hydranth is without an abcauline blind pouch, which makes it a *Dynamena*, and it appears to be closely related to *D. cornicina* McCrady.

Jarvis's material recorded as *S. loculosa* Bale from Amirante in the Indian Ocean, which I have also seen, can be included in *S. turbinata*, since the internode length and the measurements of the hydrotheca agree well with this species. The margin of the hydrotheca, however, is rather narrower (0·09–0·13 mm.).

Stereotheca acanthostoma (Bale) 1882

Sertularia acanthostoma Bale 1884, p. 85; pl. 4, figs. 7–8. 1913, p. 131. Billard 1907, p. 352. Warren 1908, p. 303, fig. 7; pl. 46, figs. 23–26.

Records. D 168. RHB 52 B, 76 C, 85 E (recorded by Millard and Harrison, 1954).

Description. Stems reaching a maximum height of 4·2 cm. Detailed structure as described by Billard and Warren. Gonophores absent.

Thyroscyphus aequalis Warren 1908

Thyroscyphus aequalis Warren 1908, p. 344, fig. 23; pl. 48, figs. 38–40.
Cnidoscyphus aequalis Splettstösser 1929, pp. 82, 124, figs. 78–82.

Records. AFR 1028 OA. PF 12028 A, 12308 E, 12456 A.

Description. Well-developed colonies reaching a maximum height of 20 cm. Root-stock massive, up to 3 cm. in diameter, consisting of a mass of tangled hydrorhizal tubes. Stem fascicled at base, branching in rather an irregular manner, though usually alternate. Gonophores absent.

Thyroscyphus fruticosus (Esper) 1788–1830

Thyroscyphus fruticosus Splettstösser 1929, pp. 7–30, 122, figs. 1–7. Vervoort 1941, p. 202.

Records. IN 49 D.

Description. Colony reaching 7·2 cm. in height, stem unfascicled, branching in an irregularly alternate manner, and occasionally rebranching. Stem and branches in one plane. Nodes not visible on stem and main branches, occasionally faintly indicated near ends of smaller branches. Shape and detailed structure of hydrothecae as described by Splettstösser, and measurements well within range. Operculum present in young hydrothecae only. Gonophores absent.

Family **Plumulariidae**

Antennella secundaria (Gmelin) 1788–1793

Antennella natalensis Warren 1908, p. 318, fig. 14.
Antenella secundaria Stechow 1925, p. 493. Broch 1933, p. 19.

Records. IN 91 Q.

Description. One small colony without gonophores reaching a maximum height of 0·5 cm. Stem simple. Basal athecate part of stem with 1–5 transverse nodes and bearing 1–6 nematothecae. Intermediate internodes long and slender, usually with 2 nematothecae, but occasionally with only one. Quite often the basal part of the internode is cut off by an extra transverse node. Gonophores absent.

Remarks. This is the first record of the species from Portuguese East Africa, although it has been reported to the north on the Tanganyika coast, to the east in Madagascar, and to the south in Natal.

Halopteris glutinosa (Lamx.) 1816

Fig. 10A–D

Heteroplon pluma Allman 1883, p. 32; pl. 8, figs. 1–3.
Plumularia glutinosa Billard 1910, p. 36, fig. 16. Stechow 1925, p. 502.

Records. D 155. DBN 70 P (recorded by Day and Morgans 1956 as *Halopteris* sp.). RHB 52 E (recorded by Millard and Harrison 1954 as *Plumularia glutinosa*). IN 49 C, 139 A.

Description. Stem unfascicled, pinnate, reaching a maximum height of 1·7 cm. Basal part without hydrothecae or hydrocladia, containing a few irregular transverse nodes and bearing a few nematothecae. Distal part divided by oblique nodes into thecate internodes, of which the basal 1 or 2 bear a pair of hydrocladia each, and the rest one each, alternately on the right and the left. The nodes may be indistinct in some regions, or the first 2 or 3 nodes of this region may be extra well defined and resemble hinge-joints.

Hydrocladium arising next to a hydrotheca immediately below the lateral nematotheca, bearing up to 7 hydrothecae. Consisting of a short athecate internode devoid of nematothecae, a longer athecate internode with one mesial nematotheca, and then thecate internodes separated by oblique nodes. Towards the distal end of the hydrocladium the upper part of each internode is usually cut off by a transverse node to form an intermediate athecate internode.

Hydrotheca adnate to a varying degree, but free for at least a third of its height, walls straight or flaring very slightly to margin, depth equal to, or slightly less than, diameter.

Nematothecae, typical arrangement per thecate internode: one immoveable, 2-chambered, mesial, inferior nematotheca below hydrotheca; one pair moveable, 2-chambered, lateral nematothecae on processes arising just below top of adnate part of hydrotheca and not quite reaching margin; one or two mesial, superior nematothecae above hydrotheca, either 1- or 2-chambered.

Gonophores (not previously described) borne on hydrocladia below hydrothecae to one side of the inferior mesial nematothecae. Male elongated-oval, present in July.

Measurements (mm.)	*D* 155	*DBN* 70 *P*	*RHB* 52 *E*	*IN* 49 *C*
Stem, internode length ..	0·40–0·47	0·56–0·74	0·26–0·30	0·49–0·77
diameter	0·13–0·25	0·13–0·18	0·22–0·26	0·11–0·20
Hydrocladium, internode length,				
1st short athecate	0·10–0·12	0·06–0·11	0·05–0·09	0·07–0·10
1st long athecate	0·27–0·32	0·29–0·33	0·15–0·22	0·20–0·30
normal thecate	0·27–0·45	0·21–0·54	0·30–0·38	0·21–0·25
normal athecate (where present)	0·19–0·21	0·19–0·33	0·06	0·16–0·22
Hydrotheca, length abcauline..	0·20–0·26	0·23–0·25	0·15–0·17	0·21–0·24
length adcauline, free part	0·09–0·135	0·08–0·10	0·09–0·12	0·08–0·09
free part/abcauline length	0·43–0·55	0·33–0·43	0·60–0·73	0·35–0·43
diameter at mouth ..	0·26–0·29	0·24	0·185–0·20	0·22–0·26
Gonophore, length, male ..	0·43–0·50			
diameter	0·15–0·22			

Remarks. This species appears to be very much more variable than is indicated in previous descriptions, particularly in the presence or absence of athecate internodes, and in the arrangement of nematothecae. The variability can be best illustrated by the description of a single hydrocladium chosen from D 155 (fig. 10A).

Thecate internodes nos. 1 and 2 have a short distal region (beyond the hydrotheca) of 0.07–0.08 mm. (measured on anterior surface). The superior mesial nematotheca is minute (0·035 mm.), 1-chambered, and situated in the exact angle between the adcauline hydrothecal wall and the internode.

In internode no. 3 the superior mesial nematotheca is longer (0·05 mm.) with an indistinct septum visible.

In internode no. 4 the distal region is longer (0·11 mm.) with a transverse node faintly indicated immediately above the adnate part of the hydrotheca. The superior mesial nematotheca (0·05 mm.) is distinctly 2-chambered, and there is a supplementary mesial 2-chambered nematotheca above it (0·04 mm.).

In internodes nos. 5 and 6 the transverse node is quite distinct and cuts off the distal part as an intermediate internode which carries the supplementary nematotheca (0·04 mm. in no. 5 and 0·07 mm. in no. 6). In both internodes the normal superior mesial nematotheca is absent, apparently a normal condition, for there is no scar for its attachment. (Distal region including intermediate internode measures 0·12 and 0·15 mm. respectively.)

A similar variation is found in the stem where the distal internodes may have their upper regions cut off as athecate internodes.

The cauline nematothecae are similar to those on the hydrocladia, although in the lower parts of the stem there may be an extra pair of lateral nematothecae or an extra superior mesial nematotheca above the level of the hydrothecal margin.

In DBN 70 P, IN 49 C and IN 139 A all the hydrocladial internodes are as nos. 5 and 6 above (fig. 10B). In RHB 52 E (fig. 10C) intermediate inter-

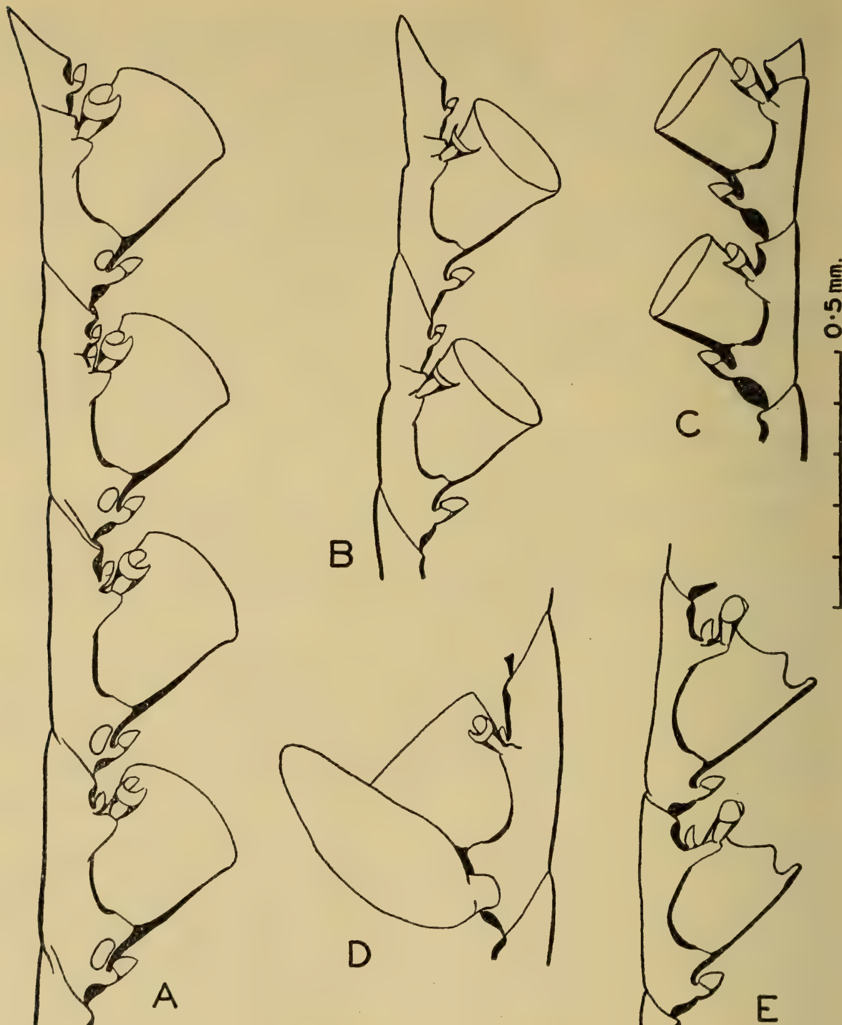

FIG. 10. *Halopteris glutinosa* (Lamx.) (A–D); and *Paragattya heurteli* (Billard) (E). A, a hydrocladium from D 155 showing its 2nd to 5th thecate internodes to illustrate arrangement of nematothecae as described in text, p. 201. B and C, portions of hydrocladia from IN 49C and RHB 52E respectively. D, a male gonophore from D 155.

nodes are only rarely present, but the superior mesial nematothecae are missing altogether.

One case of a branching hydrocladium was seen (D 155). The branch arises from the first thecate internode of the hydrocladium, below the hydrotheca and next to the mesial inferior nematotheca.

The species is closely related to *H. valdiviae*, differing from it in the shorter lateral nematothecae and in the greater length of the free part of the hydrotheca. It has been reported from Francis Bay on the south coast (Stechow), but this is the first record from Portuguese East Africa.

Kirchenpaueria adhaerens n. sp.

Fig. 13F, G

Holotype. RHB 52 G.

Description. A minute epizootic form with its stem adherent to the posterior surface of the stem of *Paragattya intermedia* Warren. Stem with no visible segmentation, giving off alternate hydrocladia, each from a long apophysis.

Hydrocladia bearing up to 6 hydrothecae on the surface facing the stem of the host (i.e. the hydrothecae face the same way as do the cauline hydrothecae of the host), divided by oblique nodes into thecate internodes, with an occasional athecate internode at the base or between consecutive thecate internodes.

Hydrotheca adnate for over half height, then free, margin facing forwards and upwards, and forming an angle of 45–65° with the hydrocladium, width slightly exceeding depth. Abcauline wall straight or slightly concave, free part of adcauline wall concave. Hydranth with about 16 tentacles.

Each thecate internode with one very shallow, saucer-shaped, monothalamic nematotheca below hydrotheca, and one naked sarcostyle above it. A similar rudimentary nematotheca on the upper surface of each hydrocladial apophysis. Nematothecae very delicate and often missing.

Gonophores absent.

Measurements (mm.)	*Kirchenpaueria adhaerens*	*Plumularia nova**
Internode length (posterior surface)	0·22–0·28	0·68–1·30
diameter near distal end	0·04–0·06	0·10–0·12
Hydrotheca, length abcauline	0·06–0·07	0·15–0·19
length of free part	0·02–0·03	
free part/abcauline length	0·29–0·50	
diameter at mouth	0·07–0·10	0·15–0·20

Remarks. K. adhaerens has a similar growth-form to *Plumularia nova* Jarvis 1922 from Zanzibar. The two species are undoubtedly closely related, but *P. nova* has greater measurements (the internodes are over three times as long, and the hydrothecae over twice as deep, as those of *K. adhaerens*), and its hydrothecae are completely adnate and held at a different angle (the margin is nearly at right angles to the internode).

In the author's opinion the present species with its rudimentary inferior nematothecae is more reminiscent of *Oswaldella* than *Kirchenpaueria*, and this probably applies to *P. nova* as well. However, as long as branching hydro-

* Measurements calculated from diagrams given by Jarvis, 1922.

cladia are taken as the diagnostic feature of *Oswaldella* the species must remain in *Kirchenpaueria*.

Monostaechas faurei n. sp.

Fig. 11

Holotype. PF 12028 F.

Description. Material consisting of 6 upright stems without rootstock, reaching a maximum height of 2·4 cm., and a number of fragments.

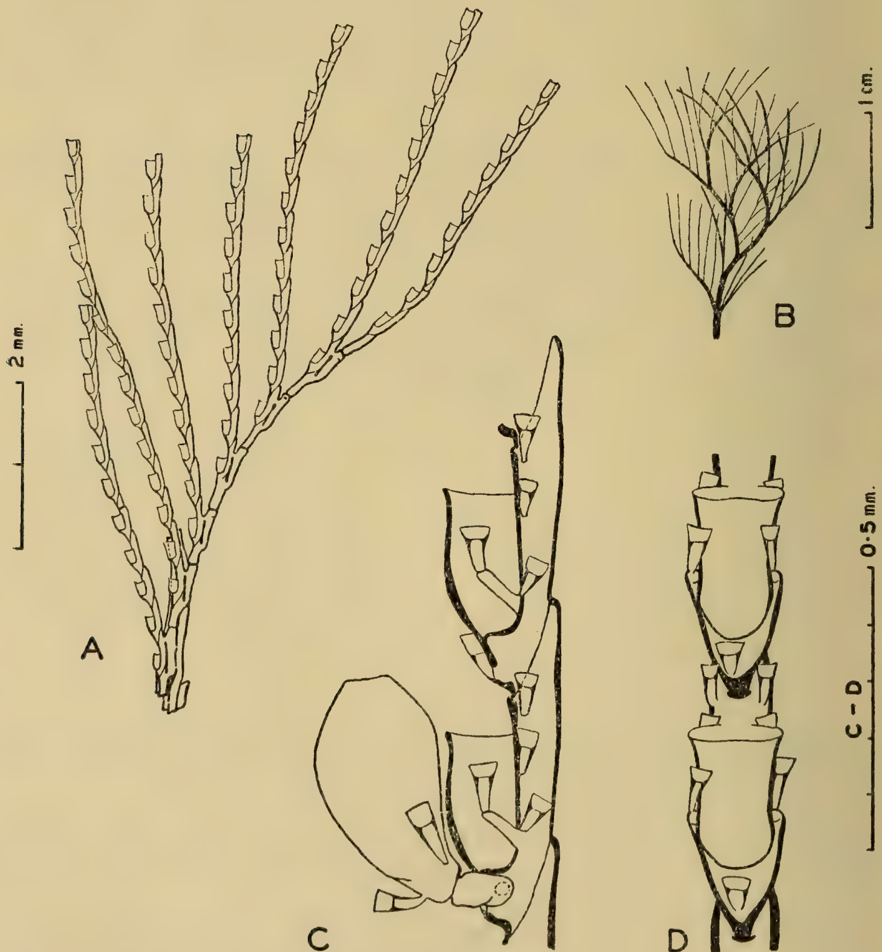

Fig. 11. *Monostaechas faurei* n. sp.

A, a single hydrocladium to show method of branching. B, a single stem. C and D, lateral and anterior views of 2 segments of a hydrocladium, C with a gonotheca.

Stem fascicled, branching in a roughly dichotomous manner. The tubes in the fascicled stem branch at intervals and are connected with one another by pores containing bridges of coenosarc. On the surface they bear numerous nematothecae. The hydrocladia are formed from the continuation of these tubes and arise from all surfaces of the stem in an irregular fashion, sometimes singly, sometimes in pairs and sometimes in clusters.

Hydrocladia branching in a sympodial manner. Each subsidiary hydrocladium arises from the posterior surface of the previous one just below the level of its first hydrotheca. The 'axis' so-formed (which consists of the basal parts of successive hydrocladia) curves gently backwards, and the distal parts of the hydrocladia lie in one plane, but diverge slightly from one another. Each hydrocladium accompanies, and is fused to, its predecessor for a short distance, and the coenosarc of the two is in communication through an opening in the perisarc just below the second hydrotheca of the latter. The basal part of each hydrocladium is of variable length and contains one or two transverse nodes; in primary hydrocladia there are usually two soon after the origin from the stem, followed by a long internode without hydrothecae but bearing two rows of nematothecae; in subsidiary hydrocladia there is one transverse node immediately beyond the communication with the previous hydrocladium, and the following athecate internode is relatively short. The remainder of the hydrocladium is divided by oblique nodes into thecate internodes.

Hydrotheca deep, completely adnate, with margin even and at right angles to hydrocladium, broad just below the centre, slightly narrowed above this and flaring again at the margin. The basal hydrotheca in each hydrocladium shorter than the following ones.

Nematothecae bithalamic and moveable, 9 to each internode: one median below hydrotheca and 4 pairs of lateral. The first lateral seated on a long process arising near base of hydrotheca, the second in the angle between the process and the hydrocladium, the third arising directly from the hydrocladium near the upper part of the hydrotheca and just overtopping its margin, and the fourth arising directly from the hydrocladium above the level of the hydrotheca. Occasionally the distal end of an internode is cut off by a transverse node which may cause some irregularity in the nematothecae.

Male gonophores borne on hydrocladia below hydrothecae, each is pear-shaped, about twice length of hydrotheca, borne on a short pedicel of 1 segment, and bears one pair of nematothecae.

Measurements (mm.)

Internode length (on posterior surface)	0·40–0·54
diameter (above hydrotheca)	0·07–0·12
Hydrotheca, height	0·18–0·26
diameter at margin	0·12–0·145
Nematotheca, height	0·07–0·095
Gonotheca, male, length (without pedicel)	0·36–0·46
maximum diameter	0·20–0·26

Remarks. So far only three species of *Monostaechas* have been described (*M. quadridens* (McCrady) = *M. dichotoma* Allman, *M. fischeri* Nutting, and *M. sibogae* Billard), none of which has been recorded from South Africa. *M. faurei* differs from all of these in the fascicled stem, the adnate hydrothecae, and in the arrangement of the nematophores.

Monostaechas natalensis, n. sp.

Fig. 12

Types. Holotype PF 12456 C. Paratypes: PF 11803 AF and PF 12392 G.

Description (Holotype). A fairly rich colony reaching a maximum height of 2·1 cm. Hydrorhiza reticular. Stem fascicled, short and stubby, often embedded in sponge or ascidian. Hydrocladia arising from the stem or directly from the hydrorhiza. Tubes of stem connected with one another by pores and cross-branches, without nematothecae.

The stem and hydrocladia often branch, but in rather an irregular fashion. The tubes of the stem may divide dichotomously, give off lateral branches, or give rise to tufts of hydrocladia at certain levels. The hydrocladia themselves may be simple or may branch in a sympodial manner, a subsidiary hydrocladium arising from the posterior surface of its predecessor at any level, either from the basal athecate part or from the distal thecate part. A hydrocladium has not been seen to branch more than twice. A subsidiary hydrocladium may be connected to its predecessor by a pore soon after its origin, as in *M. faurei*, but this is the exception rather than the rule.

Basal part of hydrocladium athecate, consisting of 2–3 internodes separated by transverse nodes, and bearing a double row of nematothecae. Remainder consisting of thecate internodes separated by oblique nodes.

Hydrotheca moderately deep, adnate for over half its height, and then free, walls flaring slightly towards margin. Margin even, not at right angles to hydrocladium but directed obliquely away from it, forming an angle of about 65°.

Nematothecae bithalamic and moveable, the number per internode varying from 6 to 10, of which only the basal 5 are constant in position. They include in all:

one median below hydrotheca on proximal end of internode,

one pair of laterals borne on long processes arising just below centre of hydrotheca,

one pair of laterals arising from angle between above-mentioned processes and internode,

one or a pair of supracalycines arising behind free part of hydrotheca and overtopping its margin,

0, 1, 2 or 3 median arising above level of hydrothecal margin on distal end of internode.

Occasionally the distal end of an internode is cut off by a transverse node above the level of the hydrotheca to form an athecate internode, taking with it one or two median nematothecae.

FIG. 12. *Monostaechas natalensis* n. sp.

A from the paratype PF 11803AF, B–F from the holotype. A, a group of hydrocladia to show method of branching. B, a branching stem and its hydrocladia. C and D, a single segment from the proximal and the distal ends respectively of the same hydrocladium in anterior view to show the arrangement of nematothecae. E and F, lateral views of different hydrocladia, E with a gonotheca.

Gonothecae (female) arising from hydrocladia immediately below hydrothecae. Each is about three times the length of the hydrotheca, pear-shaped, with wide distal aperture provided with operculum, bears 2 nematothecae, and is seated on a short pedicel of 2 segments.

Measurements (mm.)	*Holotype*	*Paratypes*
Internode length (on posterior surface) ..	0·45–0·87	0·41–0·60
diameter (above hydrotheca)	0·08–0·14	0·08–0·12
Hydrotheca, height	0·17–0·26	0·16–0·22
height of free part	0·03–0·11	0·04–0·09
free part/total length	0·17–0·46	0·22–0·43
diameter at margin	0·15–0·20	0·16–0·215
Nematotheca, length	0·06–0·10	0·07–0·09
Gonotheca, female, length (without pedicel)	0·58–0·67	
maximum diameter	0·32–0·39	

Remarks. An interesting feature of this species is the variability in the number and arrangement of nematothecae in hydrocladia of the same colony. Unlike *M. faurei*, however, any nematothecae arising above the level of the hydrothecal margin are single and not paired.

M. natalensis resembles *M. faurei* in the presence of a fascicled stem, but does not possess the same graceful scheme of branching. It is clearly more primitive, and, possessing both simple and branched hydrocladia, suggests the manner of origin of the *Monostaechas* form. It is possible that the primitive *Antennella* form gave rise to the *Halopteris* form on the one hand by lateral branching of the hydrocladium and the formation of a pinnate plume, and to the *Monostaechas* form on the other hand by branching from the posterior surface and the formation of a sympodium. This demonstrates the advisability of keeping the three genera separate, for although *Antennella* could conceivably be combined with *Halopteris* or with *Monostaechas*, due to the presence of intergrading forms, under no circumstances could *Monostaechas* be combined with *Halopteris*.

Paragattya heurteli (Billard) 1907

Fig. 10E

Plumularia Heurteli Billard 1907, p. 360, figs. 9–10.
Plumularia quadridentata Jarvis 1922, p. 348; pl. 26, fig. 22.

Records. PF 12308 C.

Description. Five upright stems without rootstock, reaching a maximum height of 10 cm., one of them with two branches. Lower parts of stem and branches slightly fascicled.

Hydrocladia-bearing ramules with 1–4 basal athecate internodes, of which the distal one bears 2 bithalamic, moveable nematothecae similar to the lateral ones. The rest divided into thecate, hydrocladia-bearing internodes by oblique nodes. Of the latter the basal two are much better defined than the rest and resemble hinge-joints.

Arrangement of hydrocladia and nematothecae as described by Billard and Jarvis. The hydrothecae are set on the anterior surface of the hydrocladia as in *Aglaophenia*, and not on the upper surface as in *Plumularia*. Some of the hydrocladia end in swollen stolons.

Gonophores absent.

Measurements (mm.)

Hydrocladia-bearing ramules, internode length (on posterior surface)	0·30–0·38
diameter (above hydrotheca)	0·11–0·20
Hydrocladia, internode length (on posterior surface)	0·30–0·44
diameter (above hydrotheca)	0·06–0·08
Hydrotheca, height, abcauline	0·115–0·26
diameter at mouth	0·16–0·21

Remarks. This species has previously been recorded from Macalonga, Portuguese East Africa (Billard) and from Pemba Is. (Jarvis), but it is a new record for the Union of South Africa.

Paragattya intermedia Warren 1908

Paragattya intermedia Warren 1908, p. 323, fig. 16; pl. 47, fig. 27. Millard 1957, p. 230.

Records. RHB 52 F.

Plumularia filicaulis Kirchenpauer 1876

Fig. 13D, E

Plumularia filicaulis Bale 1884, p. 134, pl. 11, figs. 6-7, pl. 19, figs. 41-42. Leloup 1934, p. 4.

Records. IN 49 G.

Description. A fairly rich colony growing on an alga and containing both simple and pinnate forms. Pinnate stems reaching a maximum height of 5 mm., simple stems reaching 2 mm. and bearing up to 5 hydrothecae. Detailed structure exactly as in Bale's description, to which the following points may be added.

First 2 internodes of pinnate stem without hydrocladia, the second with one nematotheca, the two separated by a rather indistinct oblique node, and the second terminated by an oblique node more sharply demarcated than the following ones. Stem decreasing in diameter towards tip, with very thick perisarc on anterior surface. The two rows of hydrocladia not in the same plane, but shifted slightly to the anterior side. Hydrothecae not borne on the upper face of the hydrocladium as is usual in *Plumularia*, but on the anterior face as in *Aglaophenia*.

First internode of hydrocladium and first internode of simple stem sterile, with no hydrotheca or nematotheca, this followed by a normal thecate internode on the hydrocladium, and a normal athecate internode on the simple stem. Perisarc on anterior surface very thick, and at times equal to the diameter of the internode.

Lateral nematothecae trumpet-shaped, with diaphragm very close to base. Only 2 cauline nematothecae visible on each stem internode, one near proximal end, and one adjacent to origin of hydrocladial apophysis.

Ripe male gonophores present, each containing a series of dense masses of spermatozoa. Transverse annulations very indistinct.

Measurements (mm., internode lengths taken on posterior surface)

Pinnate stem, diameter	0·06–0·15
internode length	0·26–0·36
Hydrocladium, 1st internode, length	0·08–0·10
thecate internode, length	0·19–0·23
athecate internode, length	0·10–0·14
Simple stem, 1st internode, length	0·19–0·20
thecate internode, length	0·21–0·26
athecate internode, length	0·13–0·19
Hydrotheca, depth in centre	0·09–0·12
diameter at margin	0·175–0·21
Gonophore, including adherent expansion, length	1·03–1·49
maximum diameter	0·49–0·60

Remarks. This comparatively rare species has been reported only once from South Africa (Table Bay: Leloup 1934). For Portuguese East Africa it is a new record.

Plumularia irregularis n. sp.

Fig. 13A–C

Holotype. DBN 70 Q (recorded by Day and Morgans 1956 as *Plumularia* sp.).

Description. Material consisting of 5 upright stems reaching a maximum height of 1·2 cm., one with a single lateral branch. Stem slightly fascicled at base, divided by transverse nodes into long internodes, each bearing a hydrocladium from an apophysis near the distal end.

Hydrocladia alternate, the two rows in one plane, bearing up to 5 hydrothecae, and very irregularly segmented. In the normal condition a hydrocladium appears to consist only of thecate internodes separated by transverse nodes, but many intermediate internodes may occur, as many as three at the base, and up to two between consecutive thecate internodes. Occasionally an oblique node is present immediately behind the hydrotheca and in a line with its posterior wall. Internodes very long and slender, hydrothecae borne near the distal ends.

Hydrotheca widening towards margin, adnate for a varying extent, but with at least part of the adcauline wall free.

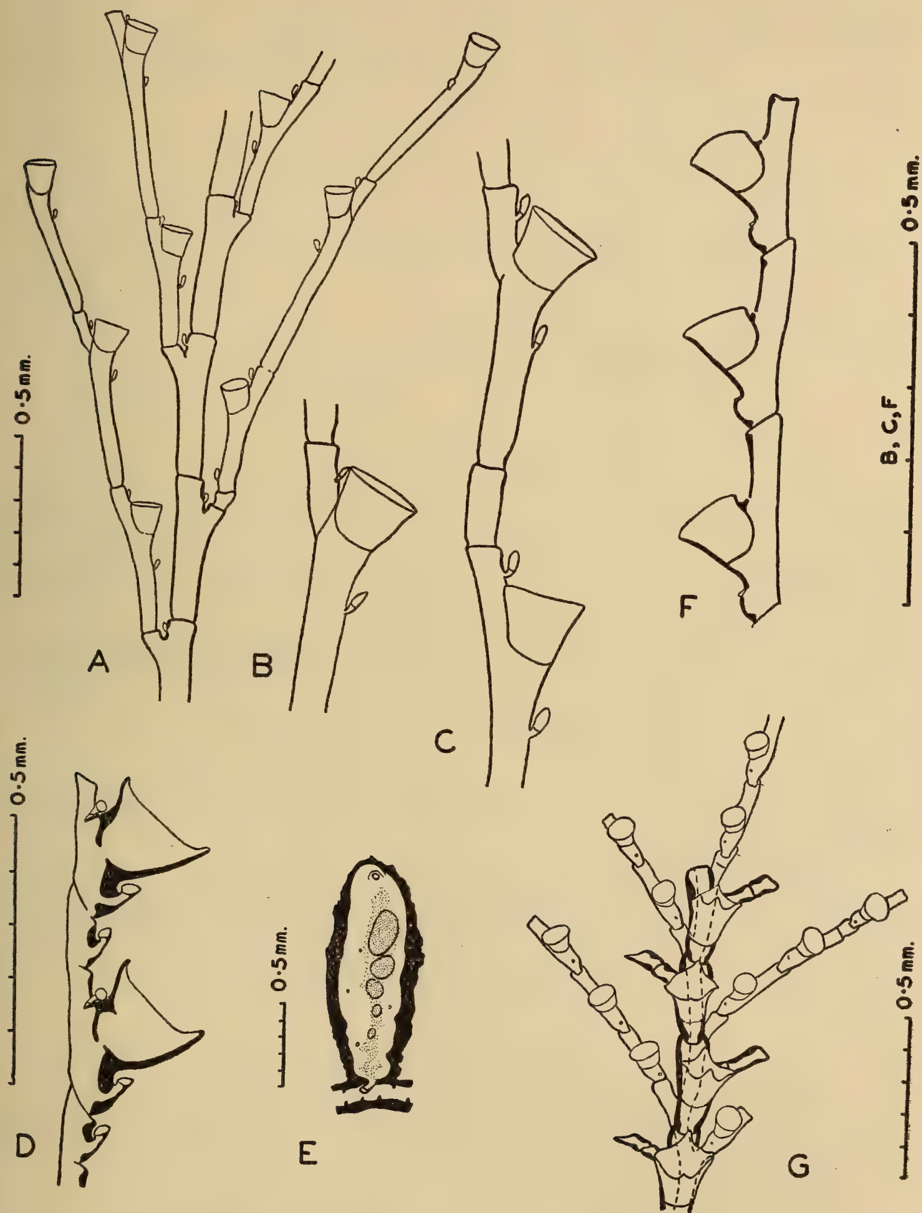

FIG. 13. *Plumularia irregularis* n. sp. (A–C); *Plumularia filicaulis* Kirch. (D, E); and *Kirchenpaueria adhaerens* n. sp. (F, G).

A–C, portions of a colony to show variations in segmentation. D, two segments of a hydrocladium of a pinnate stem. E, a male gonophore containing masses of spermatogenic cells. F, a hydrocladium in lateral view. G, anterior view of stem of *Paragattya intermedia* Warren with a colony of *Kirchenpaueria adhaerens* on its posterior surface.

Nematothecae bithalamic, with diaphragm close to base, outer surface convex, margin oblique. Two to each thecate internode, one mesial inferior and one mesial superior, and one on each stem internode immediately above hydrocladial apophysis. One 'mamelon' on upper surface of each apophysis.

Gonophores absent.

Measurements (mm.)

Stem internode, length	0·31–0·51
diameter (at distal end)	0·09–0·10
Hydrocladium, thecate internode, length	0·21–0·67
diameter (at distal end)	0·045–0·055
Hydrotheca, height abcauline	0·08–0·11
height of free part	0·02–0·075
free part/abcauline height	0·18–0·75
diameter at mouth	0·095–0·12
Nematotheca, length	0·03–0·055

Remarks. Plumularia irregularis is related to a group of species which possess only two mesial nematothecae to each hydrocladial internode, and in which athecate internodes are normally missing, namely *P. inermis* Nutting 1900, *P. triangulata* Totton 1930 and *P. bonnevieae* Billard 1906b. From these it differs in having a hydrotheca which is not competely adnate. From the two latter it also differs in the short distal part of the hydrocladial internode, in the bithalamic nematothecae, and in the arrangement of the cauline nematothecae.

Plumularia setacea (Ellis & Sol.) 1755

Plumularia setacea Hincks 1868, p. 296; pl. 66, fig. 1. Millard 1957, p. 232.

Records. D 99, 154 B. DBN 199 J, 238 R (reported by Day and Morgans 1956). NA 212 M.

Remarks. The material from the Natal coast mostly falls within Broch's forma *microtheca* (1914), but intermediate stages between this and the typical form also occur. On the whole Broch's contention is supported that forma *microtheca* is typical of tropical and subtropical waters, and the typical form of temperate waters.

Plumularia spinulosa Bale 1882

var. *typica* Stechow 1923c

Plumularia spinulosa Bale 1882, p. 30; pl. 15, fig. 8. 1884, p. 139; pl. 12, figs. 11–12. Warren 1908, p. 320.

Records. D 52, 154 A.

Description. Minute colonies reaching 0·25 cm. in height, and bearing up to 13 hydrocladia. Lower part of stem with irregular internodes without hydrocladia or nematothecae. Internodal septa very well marked, two at base and one at distal end of each stem internode, one on hydrocladial apophysis, one in first internode of hydrocladium and two in second internode behind hydrotheca. Hydrocladial apophysis arising from middle of stem internode. Spine on end of hydrocladium long and sharp and reaching above margin of hydrotheca. Gonophores absent.

Plumularia warreni Stechow 1919a

Plumularia tenuis Warren 1908, p. 316, fig. 13.

Records. D 174. NA 111, 116 B, 184 A. U 1 B (pp.). IN 140 A.

Description. Fairly abundant colonies reaching a maximum height of 2·2 cm. Stems occasionally branching near base. Gonophores present in July and December.

Remarks. This species is impossible to distinguish from *P. setacea* in the absence of gonophores, and to avoid mistakes only the fruiting material of the two species has been considered.

Pycnotheca mirabilis (Allman) 1883

Pycnotheca mirabilis Millard 1957, p. 234.

Records. PF 12456 K.

Description. One plume 10 mm. in length, without rootstock or gonophores.

var. *warreni* Totton 1930

Kirchenpaueria mirabilis Warren 1908, p. 321, fig. 15.
Pycnotheca mirabilis subspecies *warreni* Totton 1930, p. 216.

Records. RHB 52 D (recorded by Millard and Harrison 1954 at *Kirchenpaueria mirabilis*). IN 49 B, 140 B. PF 11803 AE.

Description. A fragment 0·7 cm. long from Richard's Bay, a number of stems reaching 1·5 cm. from Inhaca Is. and 4 stems reaching 0·9 cm. from off Durnford Point, Natal. Ends of hydrocladia sometimes forming tendrils. The material from Inhaca bears gonophores on the hydrorhiza (July); these contain one elongated body, which is either an embryo or a mass of gonadial tissue.

Aglaophenia late-carinata Allman 1877

Fig. 14

Aglaophenia late-carinata Allman 1886, p. 151; pl. 23, figs. 5–6.
Aglaophenia minuta Nutting 1900, p. 96; pl. 21, figs. 1–3. Billard 1906b, p. 230, fig. 19.
Aglaophenia latecarinata var. *madagascariensis* Billard 1907, p. 387; pl. 26, figs. 18–19.

Records. PF 11803 AB, 12456 B.

Description. Numerous plumes growing on sponges, worm-tubes and ascidians, reaching a maximum height of 1·9 cm. Hydrorhiza without the annulations described by Nutting. Basal part of stem without hydrocladia, but with a single row of nematothecae on anterior surface, terminated by two closely placed oblique hinge-joints with one nematotheca between them. Remainder bearing alternate hydrocladia. Segmentation usually visible in distal region only.

Hydrocladial internodes and hydrothecae as previously described. Hydrothecal margin with 9 teeth, one solid median and four pairs of lateral; of the latter the 1st and 4th are narrow and triangular, and the 2nd and 3rd broad and rounded. 'Keel' on anterior surface of hydrotheca slightly longer than median tooth. Perisarcal thickening on abcauline wall of median nematotheca of variable thickness, sometimes very pronounced, sometimes scarcely visible.

Cauline nematothecae: one large below hydrocladial apophysis, one axillary anterior, one axillary posterior, and one mamelon on anterior surface of apophysis.

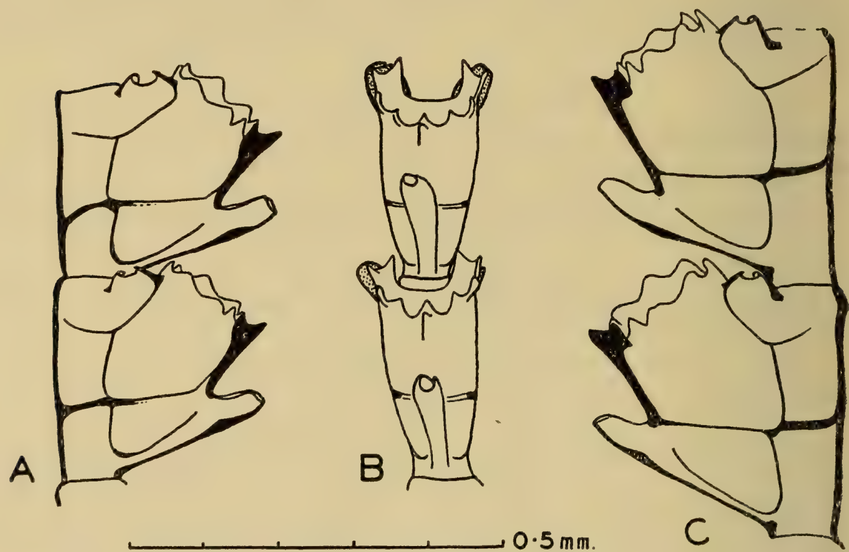

Fig. 14. *Aglaophenia late-carinata* Allman.

A, lateral view, and B, anterior view of two segments of a hydrocladium in PF 11803AB. C, lateral view in PF 12456B.

One corbula present (in February), about 2·3 mm. long and 1 mm. wide, and bearing 10 pairs of ribs. Detailed structure as described by Nutting.

Measurements (mm.)	*PF* 11803 *AB*	*PF* 12456 *B*
Hydrocladium, internode length	0·23–0·25	0·29–0·37
width in centre	0·06–0·085	0·08–0·10
Hydrotheca, height	0·24–0·27	0·30–0·36
width at mouth (excluding keel) ..	0·12–0·14	0·135–0·16

Remarks. This species is common in the western tropical and subtropical regions of the Atlantic, where it generally grows on floating weed. It has, however, been recorded by Jarvis 1922 from Cargados in the Indian Ocean (as *A. minuta*), and a separate variety has been described by Billard 1907 (var. *madagascariensis*) from Madagascar. This is the first record from South Africa.

Billard's variety differs from the type in the nature of the hydrothecal margin which has 2 pairs of bifid lateral teeth instead of 4 pairs of single teeth. The present material seems to combine features of the typical form (described and illustrated by Billard 1906b) and the variety from Madagascar. The lateral hydrothecal teeth and the arrangement of cauline nematothecae are closer to the typical form, but the shape of the median hydrothecal tooth and the size of the median nematotheca are closer to the form from Madagascar.

The measurements are rather larger in one sample (PF 12456 B) than in the other (PF 11803 AB), but on the whole the range extends over both the typical and the Madagascan types.

Aglaophenia pluma (Linn.) 1758

var. *typica* Bedot 1919

Aglaophenia pluma, var. *typica* Millard 1957, p. 238, fig. 15A.

Records. PF 12392 E.

Description. One fragment 1·2 cm. in length, without rootstock or corbulae.

var. *parvula* Bale 1882

Aglaophenia pluma var. *parvula* Millard 1957, p. 239, fig. 15D–F.

Records. D 203. NA 112. DBN 200 Q (reported by Day and Morgans 1956).

Measurements (mm.)

Maximum height of colony	14·00
Stem internode, length	0·16–0·26
Hydrocladial internode, length	0·21–0·28
Hydrotheca, depth	0·20–0·27
length above median nematotheca	0·06–0·09
diameter at margin	0·15–0·19
Corbula, male, length	1·19–1·46
male, width	0·70–0·77
female, length	1·22
female, width	0·84

Remarks. The colonies from Natal are smaller than those reported from False Bay, and the dimensions of the internodes, hydrothecae and corbulae are also less.

Halicornaria africana n. sp.

Fig. 15A–C

Holotype. AFR 1028 B.

Description. A single colony of about a dozen monosiphonic stems arising from a matted hydrorhiza and reaching a maximum height of 16·5 cm. Basal part of stem without hydrocladia, divided into internodes of irregular length by transverse nodes, bearing scattered nematothecae. Distal part divided into regular internodes by transverse nodes, each bearing a pair of opposite or subopposite hydrocladia. Three cauline nematothecae around the base of each hydrocladium, one below the origin, one posterior axillary, and one anterior axillary. Towards the distal end of the stem the axillary nematothecae have part of their margins drawn out into long slender tubes.

Hydrocladia reaching 11 mm. in length and bearing up to 39 hydrothecae. The two rows in one plane or shifted slightly on to the anterior surface. Each divided by very slightly oblique nodes into regular thecate internodes. No internodal septa.

Hydrotheca deep, widening to margin, its central axis forming an angle of 40–50° with hydrocladium. No intrathecal ridge. Margin with three pairs of low lateral teeth and one anterior tooth. No posterior tooth. Towards the basal part of the hydrocladium the lateral teeth are indistinct and the margin appears sinuated.

Median nematotheca long and gently curved, adnate as far as the anterior tooth, then free, tapering to tip which may be closed, but is usually open. Lateral nematotheca saccular, not reaching margin of hydrotheca, with a single aperture of which the lateral corner may be raised into a short tubular structure towards the distal end of the hydrocladium.

Gonophores absent, though scars for their attachment are present on the anterior faces of the hydrocladial apophyses.

Measurements (mm.)

Stem, diameter	0·285–0·74
internode length	0·46–0·68
Hydrocladium, diameter at node	0·12–0·24
internode length	0·27–0·31
Hydrotheca, length	0·20–0·25
diameter at mouth, lateral view	0·16–0·19
diameter at mouth, frontal view	0·19–0·24
Median nematotheca, length of free part	0·16–0·34

Remarks. This species is very close to *H. regalis* Totton 1930 from New Zealand, but differs in the shape of the hydrocladial internode, which is shorter and thicker, and in the nature of the hydrothecal margin. In Totton's diagram the 3rd lateral tooth is the largest of the three, but in *H. africana* this tooth is always the smallest. The anterior tooth of *H. africana* is larger and more upright than in *H. regalis*.

H. africana differs from *H. arcuata* (Lamx.) in the absence of the posterior tooth on the hydrothecal margin, the more erect position of the anterior tooth, and in the different shape of the median nematotheca.

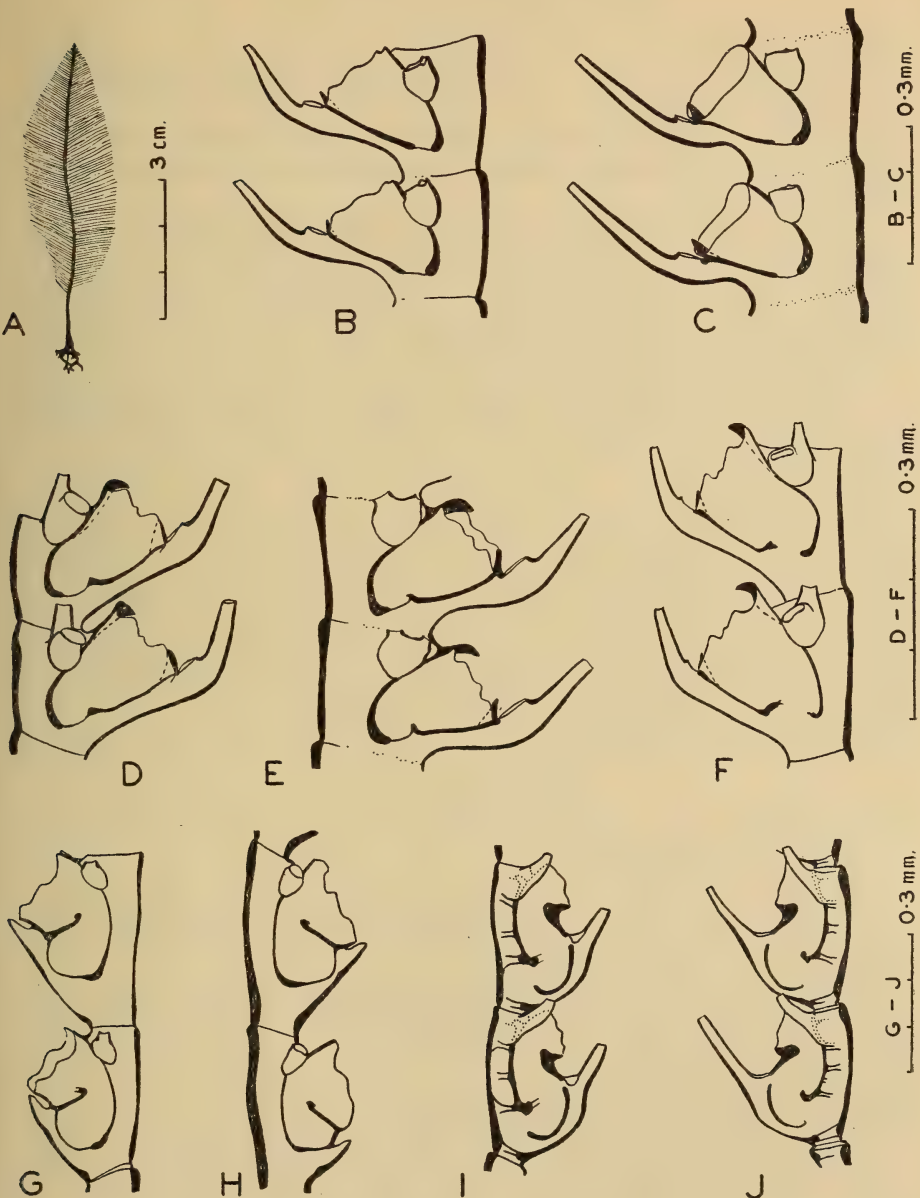

FIG. 15. *Halicornaria africana* n. sp. (A–C); *Halicornaria arcuata* (Lamx.) (D, E); *Halicornaria arcuata*, var. *epizootica* n. var. (F); *Halicornaria hians* (Busk) (G, H); and *Halicornaria gracilicaulis* (Jäd.) (I, J).

A, a single stem. B–J, two segments of a hydrocladium. B and C, and D and E, from the distal and proximal ends respectively of the same hydrocladium. I from PF 11141B. J from PF 12028E.

Halicornaria arcuata (Lamx.) 1816

Fig. 15D, E

Halicornaria arcuata Billard 1907, p. 366, fig. 13. 1910, p. 46. Bale 1913, p. 141; pl. 13, figs. 1–4.

Records. PF 11803 AC.

Description. A small colony of 9 unbranched stems reaching a maximum height of 1·8 cm. Stem internodes short and broad. Hydrocladia alternate, one to each internode.

Hydrotheca deep and narrow, without a true intrathecal ridge but with basal part of abcauline wall projecting inwards and bearing 2 or 3 small denticles. Margin with an incurved anterior tooth, an incurved posterior tooth, and 2 or 3 pairs lateral teeth. The median lateral tooth is always smaller than the others and often absent altogether.

Median nematotheca always open at tip, with its distal end pointing obliquely forwards. Lateral nematotheca with two openings, of which one may be produced into a tube.

Gonophores absent.

Remarks. This material combines some of the features of the young colonies and some of the old colonies described by Billard 1907 from Madagascar. Bale (1913) doubted whether Billard's material all belonged to the same species, but the present material seems to show that Billard was right, and that the species is variable in the nature of the hydrothecal margin, and in the presence or absence of an opening at the end of the median nematotheca. *H. ascidioides* is a separate species as shown by Bale.

var. *epizootica* n. var.

Fig. 15F

Holotype. PF 12392 D.

Description. Hydrorhiza epizootic on back of stem of *Thecocarpus formosus* (Busk), giving rise directly to a number of solitary hydrocladia and to one upright stem of 1·9 mm. in length.

Stem internodes longer and narrower than those of typical variety, each giving rise to one hydrocladium. Hydrocladia alternate, each bearing up to 3 hydrothecae.

Solitary hydrocladia alternating with those of host, bearing up to 18 hydrothecae and reaching a length of 4·2 mm.

Hydrotheca exactly like those of typical form. Median nematotheca open at tip, often rather short. Lateral nematotheca with one of its apertures forming a tubular structure towards the distal end of the hydrocladium.

Remarks. In view of the similarity in structure to *H. arcuata* it is not justifiable to create a separate species for this material. An almost parallel case within the genus is to be found in *H. longirostris* Kirch. 1872 from Australia, which can exist in a parasitic and in a free-living form.

Halicornaria gracilicaulis (Jäd.) 1903

Fig. 15 I, J

Lytocarpus gracilicaulis Jäd. 1903, p. 299; pl. 14, figs. 3–4.
Halicornaria gracilicaulis Billard 1907, p. 364, fig. 12; pl. 25, fig. 7. 1913, p. 63.

Records. PF 11141 B, 12028 E.

Description. Both samples without rootstock, one consisting of two strongly fascicled, branched stems reaching a maximum height of 9·6 cm., and the other of a few detached fragments.

Appearance and composition of colony similar to that described and figured by Billard 1907 from Macalonga. Branches and pinnae of stem all in one plane; pinnae alternate, often giving rise to alternate sub-pinnae. Branches and pinnae fascicled practically throughout, only the tips of the smaller pinnae unfascicled. Pinnae without hinge-joints at base.

Hydrocladia borne on stem and pinnae, bearing up to 6 hydrothecae. Internodal septa very well marked and varying in number from 4 to 6. The arrangement with 4 septa resembles that described by Billard in the material from Macalonga. When 6 septa occur there is one opposite the adcauline intrathecal septum, one opposite the base of the lateral nematotheca, two between these, one at the proximal end of the internode and one at the distal end.

Hydrotheca with a thick, but not very long, adcauline intrathecal septum, and a very pronounced perisarcal thickening at the point of curvature on the abcauline wall, the condition approaching that of *H. longicornis* (Busk). Margin smooth or sinuated with indications of three low teeth on each side, no posterior tooth.

Median nematotheca of variable length, sometimes not quite reaching to margin of hydrotheca, and sometimes very much longer as in Billard's var. *armata* (1913).

Gonothecae present (in February), flattened and disc-shaped, with a slit-shaped terminal aperture and no distal horns.

Remarks. Although this species has been recorded from Portuguese East Africa, this is the first record from the Union. The material shows certain features which approach the condition in *H. longicornis* (Busk), namely the pronounced perisarcal thickening on the abcauline thecal wall, and the sinuated thecal margin, and it is possible that these two species may eventually have to be united. This must wait, however, until the gonophores of the latter have been described.

Halicornaria hians (Busk) 1852

Fig. 15G, H

Halicornaria hians Bale 1884, p. 179; pl. 13, fig. 6; pl. 16, fig. 7. Billard 1913, p. 68. Vervoort 1941, p. 222, figs. 7–8.
Halicornaria hians var. *profunda* Ritchie 1910, p. 24; pl. 4, figs. 13–14.

Records. PF 11141 C.

Description. One colony including 3 pinnate stems reaching a maximum length of 0·9 cm. Hydrorhiza epizootic on *Halicornaria gracilicaulis* (Jäd.) and penetrating between the tubes of its fascicled stem. Stem delicate, unfascicled, bearing alternate hydrocladia, one to each internode. Hydrocladia about 2 mm. long and bearing up to 6 hydrothecae, distinctly segmented.

Hydrothecae well separated, margin with 3 distinct teeth on each side. Abcauline intrathecal septum thickened and upturned at end, and bearing a number of minute denticles.

Median nematotheca of variable length, adnate part not reaching level of intrathecal septum and tip not reaching thecal margin in lower parts of hydrocladia, adnate part reaching beyond level of septum and tip overreaching level of marginal teeth in upper parts. Abcauline wall convex, with perisarcal thickening usually present. Lateral nematotheca not reaching thecal margin.

Gonophores absent.

Measurements (mm.)

Hydrocladium, internode length	0·30–0·41
diameter at node	0·09–0·13
Hydrotheca, height	0·13–0·265
diameter at margin	0·16–0·22

Remarks. This species is well known from the Dutch East Indies, from which region it extends east to the Pacific Ocean, south to Australia and west to the Bay of Bengal. Var. *balei* has also been reported from the Red Sea. This is the first record from South Africa, and the delicacy of the stems suggests a young colony.

The structure of the hydrotheca agrees well with that of the typical form as described by Bale and Ritchie, but the material differs in the presence of only one hydrocladium to each internode of the stem. Marktanner 1890, however, reports that var. *balei* does rarely possess one hydrocladium to an internode, although the normal condition is two or more.

Lytocarpus filamentosus (Lamarck) 1816

Lytocarpus filamentosus Millard 1957, p. 241.

Records. DBN 119 L (recorded by Day and Morgans 1956). PF 11803 AD.

Lytocarpus philippinus (Kirch.) 1872

Lytocarpus Phillipinus Bale 1888, p. 786; pl. 21, figs. 5–7.
Lytocarpus philippinus Markt. 1890, p. 274; pl. 6, fig. 16.

Records. IN 41, 49 A, 137 A, 138 A, 140 C. PZ 13 A.

Description. Colonies with root-stock, reaching 14·0 cm. in height. Gonophores present in July.

Thecocarpus formosus (Busk) 1850

Aglaophenia formosa Markt. 1890, p. 264; pl. 6, fig. 11.
Thecocarpus formosus Billard 1907, p. 378, figs. 19–20. Vervoort 1946a, p. 332, fig. 7.
Aglaophenia parasitica Warren 1908, p. 332, fig. 17; pl. 48, figs. 28–32.

Records. DBN 119 K (recorded by Day and Morgans 1956). RHB 52 A, 76 D, 85 A, 113 K (recorded by Millard and Harrison 1954 as *T. formosus* and *T. parasiticus*). D 97 A. UU 2 J. PF 11803 AA, 12392 C.

Description. Colonies abundant along the Natal coast, often growing on Corallines or other algae, reaching a maximum height of 11·6 cm. Hydrorhiza reticular and creeping, producing suckers which can penetrate into the substratum.

Corbulae of two kinds. The first, which is probably female, is closed, and has up to 12 pairs of ribs and may reach 4 mm. in length. In addition to the series of lateral leaflets described and figured by Warren (pl. 48, fig. 31), each rib may bear two more lateral leaflets, the second arising about half-way up its length and the third near the distal end. The length of the leaflets often exceeds that of the ribs, giving to the corbula a spinous appearance.

The second type of corbula, presumably male, is generally longer, and more open, the distal ends of the ribs being separated by pores, and easily forced apart. Only one series of small lateral leaflets is present, and the appearance resembles Warren's diagram (pl. 48, fig. 30).

As suspected by Vervoort the corbula of both the parasitic and the normal type bears a hydrotheca near the base of each rib.

Remarks. Totton 1930 and Vervoort 1946a consider *A. parasitica* to be a synonym for *T. formosus*. The former is characterized by suckers on the hydrorhiza which penetrate into the tissues of coralline algae. Totton has observed similar suckers on the lectotype of *T. formosus*. The author has found that suckers are invariably present, whether the colony is growing on algae, or on worm-tubes, ascidian tests, etc., and that these are capable of penetrating a considerable distance into pebbles and barnacle shells. Under the latter conditions they can, of course, act as holdfasts only, which is probably their primary function, but there is no reason to doubt they they can also obtain nourishment from host algae. They must certainly secrete some substance capable of dissolving calcium.

Thecocarpus giardi Billard 1907

Fig. 16A

Thecocarpus Giardi Billard 1907, p. 381, fig. 21; pl. 25, fig. 9; pl. 26, figs. 11–16.
?*Aglaophenia*(?) *bifida* Stechow 1923b, p. 117. 1925, p. 515, fig. 53.
Thecocarpus giardi Vervoort 1946a, p. 335. Millard 1957, p. 240.

Records. PF 12308 B.

Description. One colony with a large rooting mass and a single stem 9·5 cm. in length. Lateral hydrothecal teeth bifurcated as in Billard's description. No corbulae.

Measurements (mm.)	*False Bay**	*Natal*	*A. bifida*†
Hydrocladium, internode length ..	0·30–0·36	0·25–0·29	0·34–0·39
Hydrotheca, height (to tip of inner point of median tooth) ..	0·26–0·30	0·28–0·32	0·32–0·36
diameter at margin (inside) ..	0·17–0·21	0·15–0·18	0·22–0·23
Median nematotheca, length ..	0·21–0·27	0·14–0·18	0·19–0·23
length of free part	0·04–0·07	0·02–0·04	0·04–0·05

Remarks. See var. *solidus*.

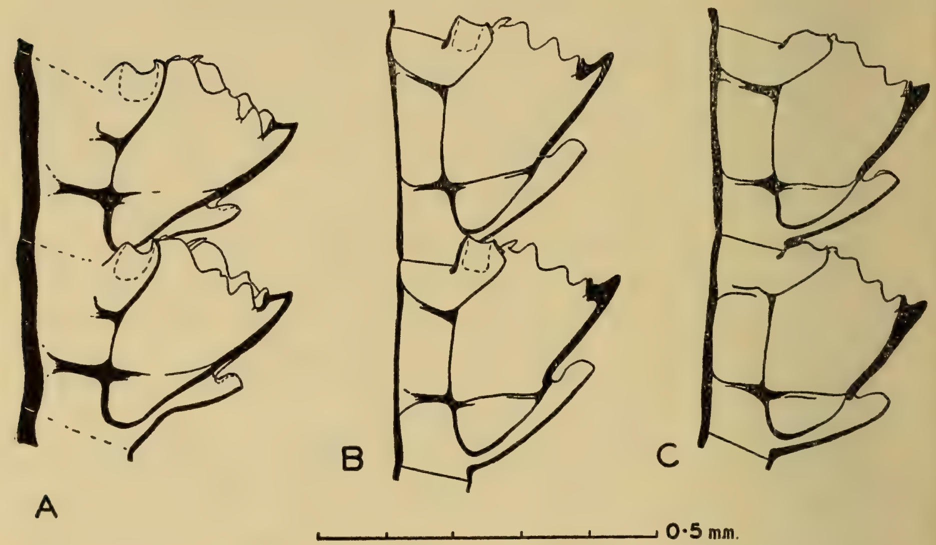

Fig. 16. *Thecocarpus giardi* Billard (A); and *Thecocarpus giardi*, var. *solidus* n. var. (B, C). B and C from the holotype, B showing a rare hydrotheca with a hollow 'keel'.

var. *solidus*, n. var.
Fig. 16B, C

Types and Records. Holotype AFR 1028 A. Further record: PF 12308 L.

Description (Holotype). A well-developed colony with a broad rooting mass and about 9 fascicled stems, reaching a height of 55 cm. Stem branching in sympodial manner to form alternate pinnae, the whole twisted in the spiral manner typical of the species. Pinna divided into a basal part devoid of hydrocladia, and a distal part bearing alternate hydrocladia, the boundary between the two commonly marked by 1 or 2 hinge-joints.

* From material described by Millard 1957.

† From type material loaned by the Munich Museum. The measurements are not quite comparable—the hydrotheca height was taken to the tip of the *outer* point of the median tooth, and the diameter is an *outside* one.

Hydrotheca with 9 teeth, 1 median and 4 pairs lateral. Median tooth bifurcated, with a small inner point and a longer outer one which is of variable length and practically always solid. First and second pairs of lateral teeth not bifurcated.

Corbulae exactly as described by Billard for the typical form, present in May.

Measurements (mm.)	*Holotype*	*PF* 12308 *L*
Hydrocladium, internode length	0·27–0·34	0·30–0·35
Hydrotheca, height (to tip of inner point of median tooth)	0·26–0·31	0·27–0·34
diameter at margin (inside)	0·15–0·20	0·14–0·19
Median nematotheca, length	0·18–0·24	0·19–0·25
length of free part	0·03–0·05	0·04–0·05
Corbula, length	5·04–7·14	
diameter	0·98–1·12	

Remarks. As in many other Indian Ocean species *T. giardi* shows considerable variability. The stems always branch in the form of a sympodium (each pinna arising from the anterior surface of the preceding one), and are spirally twisted. The appearance, however, varies from a tight spiral (as illustrated by Billard, pl. 25, fig. 9) with a geniculate 'main axis', in which the spaces between consecutive pinnae are approximately 3 mm., to a much looser spiral and a less geniculate axis in which the pinnae may be as much as 15 mm. apart.

Each pinna, after its origin from its predecessor, is divided into a basal part without hydrocladia and with one nematotheca to each internode, and a distal part bearing alternate hydrocladia. The transition between these two parts may occur after the origin of the next pinna, or before it (in which case the 'main axis' will bear hydrocladia). Both arrangements are shown occurring on the same colony in Billard's fig. 21, but in my experience one arrangement is usually characteristic of a colony. Further, at the boundary between the two regions there may occur 1, 2 or 3 hinge-joints. In AFR 1028 A and PF 12308 L hinge-joints occur on practically every pinna, and always distal to the origin of the subsequent pinna. In many cases the pinna appears to have broken off at this point and later regenerated, the regenerated portion being of lesser diameter and sometimes bearing a second group of hinge-joints. In another colony (to be described in a later paper) a few groups of hinge-joints occur on the 'main axis' itself, i.e. proximal to the origin of the next pinna. So far hinge-joints have only been observed in var. *solidus*.

Variation also occurs in the marginal teeth of the hydrotheca. Generally there is one median tooth and 4 pairs of lateral ones, but the first and second paired teeth may be bifurcated. This, however, has not been observed in var. *solidus*. The median tooth is always double, but the length of the outer point or 'keel' varies considerably. In the typical form the 'keel' is usually hollow, although solid in occasional hydrothecae. Sometimes the tip appears to be worn down, so that the cavity is open to the exterior. In var. *solidus* the 'keel' is generally solid, but occasionally hollow. The size of the median nematotheca is also variable, in some cases it does not reach to the level of the intrathecal septum, in others well beyond it. The extreme forms of the hydrotheca are very different in appearance, but as all the features show intergrading stages there does not seem to be any grounds for specific differentiation.

The corbulae are generally larger than those described by Billard. They show variation in the development of the 'crest' at the base of each rib, but are identical in all other details. One case of a double corbula occurs (AFR 1028 A) in which the pedicel bifurcates in the 5th segment giving rise to 2 corbulae which face one another and are fused together to the level of the 2nd rib. Only closed corbulae have been observed.

Aglaophenia(?) *bifida* Stechow 1923b from the Agulhas Bank is possibly a synonym for *T. giardi*. Stechow mentions 'einzelne Fiedern' reaching 6 cm. in length. These may be either young colonies or detached portions of an older colony. I have seen a prepared slide of Stechow's material loaned by the Munich Museum, and the measurements are well within range.

Discussion

It is not proposed to deal with the geographical distribution in any detail, as this can be done more profitably when the species of the south and west coasts of the Union have been described.

Ten species and five varieties of known species described in this paper are new to science, and it is noteworthy that of these, six species and three varieties have been taken in dredgings off the coast of Natal by the s.s. *Pieter Faure* and r.s. *Africana* in depths ranging from 24 to 155 metres. The shallow infratidal waters off Natal and Portuguese East Africa are still very poorly known and further dredgings in this area may be expected to yield many more new species and records.

In addition eight species represent completely new records from the coast of Africa south of the equator. Five of these have a very scattered distribution and may be considered cosmopolitan (*Campanularia crenata* (Hartl.), *Clytia johnstoni* (Alder), *Obelia bicuspidata* Clarke, *Stegopoma fastigiata* (Alder) and *Zygophylax biarmata* Billard). The other three (*Sertularia ligulata* Thornely, *Aglaophenia late-carinata* Allman and *Halicornaria hians* (Busk)) have a more restricted distribution but are known from the Indian Ocean, so their presence is not remarkable.

Four species are recorded for the first time from Natal waters (all taken by the s.s. *Pieter Faure*), although previously reported from Portuguese East Africa, so their known range is extended further south. These include *Dynamena obliqua* Lamx., *Sertularella dubia* Billard, *Paragattya heurteli* (Billard) and *Halicornaria gracilicaulis* (Jäd.).

Finally six species are recorded for the first time from Portuguese East Africa, although known previously from the Union, so that their known range is extended further north, namely *Dynamena quadridentata* (Ell. & Sol.), *Antennella secundaria* (Gmelin), *Halopteris glutinosa* (Lamx.), *Plumularia filicaulis* Kirch., *P. warreni* Stechow and *Pycnotheca mirabilis* (Allman).

Summary

This paper records a total of sixty-six species of Hydrozoa from the coasts of Natal and Portuguese East Africa. Ten of these are new to science, and include *Halecium inhacae*, *Clytia serrata*, *Zygophylax geminocarpa*, *Zygophylax infundibulum*, *Hincksella corrugata*, *Kirchenpaueria adhaerens*, *Monostaechas faurei*, *Monostaechas natalensis*, *Plumularia irregularis* and *Halicornaria africana*. In addition there are eight records new to Africa south of the equator, four new to the Union of South Africa and six new to Portuguese East Africa.

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VOLUME XLIV

PART VI, *containing*:—

Beitrag zur Kenntnis der Lamiiden Südafrikas (*Cerambycidae, Coleoptera*). Von S. Breuning.

Bestimmungstabellen der Heterochelides (*Coleoptera, Lamellicornia, Hopliini*) *mit Ausnahme von* Heterochelus *Burm. und* Ischnochelus *Burm.* Mit Neubeschreibungen und Bemerkungen. Von Hans Schein.

The genitalia of the genus Phasis *and allied genera* (*Lepid. Lycaenidae*). By Desmond Murray. (With 2 plates.)

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BEITRAG ZUR KENNTNIS DER LAMIIDEN SÜDAFRIKAS (CERAMBYCIDAE, COLEOPTERA)

VON

S. Breuning,

Paris

Dank dem freundlichen Entgegenkommen von H. Andreae konnte ich eine Anzahl Exemplare des Cap-Museums untersuchen, welche zu den nachstehenden Bemerkungen Anlass geben. Die Typen der neuen Formen befinden sich durchwegs im Cap-Museum.

1. *Sophronica carbonaria* Pasc. m. *rufa* nov.

Wie die Stammform, aber der Körper durchwegs rot mit gelben abstehenden Haaren.

Typ von Transvaal: Louis Trichardt. Weitere Stücke von Natal: Malvern (British Museum) und Moosplats (? Mooiplaats) (coll. Lepesme).

2. Nach Ansicht des Typs von *Dirphya gigantea* Nonfr. im Museum von Berlin konnte ich feststellen, dass ich diese Art falsch gedeutet hatte. *Gigantea* Nonfr. ist identisch mit der Form, welche ich unter dem Namen *Dirphya griseipennis* Breun. m. *nigrosternalis* beschrieben habe (1956, Longicornia, III, p. 590); *nigrosternalis* Breun. ist daher als Synonym einzuziehen, und *griseipennis* Breun. sowie *atriventris* Breun. (l.c.) sind als Varietäten von *gigantea* Nonfr. anzusehen.

Dagegen ist an genannter Stelle *gigantea* Nonfr. zu streichen und *similis* Gah. als gute Art anzusehen mit der einzigen Varietät *flavoabdominalis* Breun.

3. *Oberea nigrocincta* Auriv. m. *andreaei* nov.

Wie die Stammform, aber das Metasternum ohne schwarze Makeln.

Typ ein ♀ von der Delagoa Bai, Rikatla.

4. *Pseudoconizonia bicolor* Pér., dessen Typ ich nunmehr vergleichen konnte, ist als Synonym von *basalis* Gah. anzusehen. Für die Form, welche ich irrigerweise als m. *bicolor* Pér. identifizierte (1956, Longicornia, III, p. 612), schlage ich den Namen v. *rufoampliata* nov. var. vor.

Typ ein ♀ von Basutoland: Likhoele, Mrs. Dieterlein.

5. Die Art, welche ich mit *Phytoecia* (*Blepisanis*) *maculicollis* Pér. identifiziert hatte (1951, Ent. Arb. Mus. Frey, II, p. 119), ist eine von *maculicollis* abweichende Art, für welche der Name *anterufa* Breun. einzutreten hat (welch letztere die für die m. *anterufa* Breun. angegebene Pubeszenz aufweist).

6. *Phytoecia* (*Blepisanis*) *maculicollis* Pér.

Nitocris maculicollis Péringuey, 1888, Trans. S. Afr. Philos. Soc., IV, p. 184.

Sehr lang. Fühler mässig dick, um ein Viertel länger (♂) oder etwas länger (♀) als der Körper, das erste Glied wenig lang und dick, das dritte etwas länger als das vierte, merklich länger als das erste, das vierte etwas länger als das fünfte. Untere Augenloben 2 mal so lang (♂) oder um die Hälfte länger (♀) als die Wangen. Stirn etwas breiter (♂) oder fast 2 mal so breit (♀) als einer dieser Loben. Kopf und Halsschild sehr dicht und fein punktiert. Halsschild etwas länger als breit (♂) oder so lang als breit (♀), seitlich schwach verrundet, mit vier kleinen glatten runden Erhabenheiten auf der Scheibe, die beiden premedianen der Mittellinie genähert, die beiden postmedianen seitlich gelagert. Schildchen quer, apikal verrundet. Decken sehr lang, apikal schmal sehr schwach abgestutzt, dicht und mässig grob punktiert, die Punkte gereiht, im apikalen Viertel feiner und unregelmässig gelagert. Das zweite Abdominalsegment des ♂ mit einem sehr kleinen Mitteldorn an seinem Hinterrand.

Schwarz, fein hellgrau tomentiert. Kopf rot mit Ausnahme des vorderen Mittelteiles der Stirn. Halsschild rot, alle Ränder schmal schwarz. Schildchen dicht weisslich tomentiert.

Länge 7–11 mm.; Breite $1\frac{1}{4}$–2 mm.

Von Péringuey nach Stücken von der Kap-Kolonie beschrieben.

m. *trilobata* nov.

Wie die Stammform, der mittlere Teil des Scheitels zuweilen schwärzlich; der Halsschild schwarz mit Ausnahme einer sehr breiten nach vorn zu dreilappigen, postmedianen roten Makel, die premedianen glatten Erhabenheiten daher ebenfalls schwarz; die Deckenscheibe zuweilen teilweise rötlich.

Typ ein ♂ von der Kap-Provinz: East of Pakhuis Pass. Ein Allotyp idem; ein Paratyp (♀) von Klaarstroom—Prince Albert.

Maculicollis Pér. unterscheidet sich auf den ersten Blick von *anterufa* Breun. durch viel weniger grob punktierte Flügeldecken.

BESTIMMUNGSTABELLEN DER HETEROCHELIDES (COLEOPTERA, LAMELLICORNIA, HOPLIINI) MIT AUSNAHME VON *HETEROCHELUS* BURM. UND *ISCHNOCHELUS* BURM.

Mit Neubeschreibungen und Bemerkungen

VON

HANS SCHEIN
München

INHALT

EINLEITUNG

Eine der interessantesten Käfergruppen Südafrikas bilden die *Hopliini*, die zuletzt im Jahre 1902 Péringuey zusammenhängend systematisch bearbeitet hat. Seitdem sind viele neue Arten gefunden worden, daß es an der Zeit ist, Péringueys Arbeit auf den neuesten Stand zu bringen und neue Bestimmungstabellen aufzustellen. Meine erste Arbeit in dieser Richtung befaßt sich mit den *Pachycnemini*; sie wird in der Zeitschrift ,,Entomologische Arbeiten aus dem Museum G. Frey Tutzing bei München" herauskommen. In der vorliegenden Arbeit behandle ich die Hälfte der Heterochelides; die andere Hälfte—die sehr viele Arten umfassenden Untergattungen *Heterochelus* Burm. und *Ischnochelus* Burm.—soll einer gesonderten Behandlung vorbehalten bleiben.

In dem Bestreben, meiner Arbeit eine sichere Grundlage zu geben, habe ich versucht, die Typen und ein möglichst großes Käfermaterial zusammen zu tragen, was mir weitgehend gelungen ist. Es ist mir ein Herzensbedürfnis, auch hier meinen besten Dank den Männern auszudrücken, die mir dabei geholfen haben. Es sind Dr. A. J. Hesse und Dr. H. Andreae des Südafrika Museums in Kapstadt, die mir die Typen Péringueys geliehen haben; Professor Dr. J. O. Hüsing des zoologischen Institutes der Martin-Luther-Universität in Halle, der es mir ermöglicht hat, die Typen Burmeisters zu sehen; Professor Dr. René Malaise des Museums in Stockholm, der Typen Bohemans gesandt hat; Professor Dr. K. Delkeskamp der Humboldt-Universität in Berlin, dem ich Typen v. Harolds, Nonfrieds und Mosers verdanke; Fabrikant Georg Frey in Tutzing (Museum G. Fr.) und Direktor Dr. W. Forster und Hauptkonservator

H. Freude der zoologischen Sammlung des bayerischen Staates in München, die mir das ganze Material der von ihnen betreuten Sammlungen zur Verfügung gestellt haben. Besonderen Dank schulde ich dem Kurator C. Koch des Transvaal Museums in Pretoria, der mir das ganze sehr reiche Material seines Museums zur Bearbeitung geschickt hat.

Damit die Arbeit nicht zu umfangreich wird, habe ich darauf verzichtet, Ausführungen alter Autoren, besonders Beschreibungen, zu wiederholen. Die wenigen in Betracht kommenden Werke stehen Interessenten in jeder größeren Museumsbibliothek zur Verfügung: Der ,,Descriptive Catalogue of the Coleoptera of South Africa'' von L. Péringuey, 1902, das ,,Handbuch der Entomologie'' 4, Band von Hermann Burmeister, 1844, der ,,Coleopterorum Catalogus Pars 50 Hopliini'' von Junk-K.W. Dalla Torre 1912/1913 und in geringerem Umfang die ,,Insecta Caffrariae'' von Boheman 1857. Ich setze sie als bekannt voraus.

Den Bestimmungstabellen schicke ich in der bei ihnen gegebenen Reihenfolge Beschreibungen neuer Gattungen und Arten und kurze Bemerkungen voraus, in welchen ich Berichtigungen von Autoren, ergänzende Angaben besonders über ♀♀ und Angaben über den Verbleib von Typen bringe. Die oben im zweiten Absatz genannten Museen und Universitätsinstitute bezeichne ich dabei der Abkürzung halber mit ihrem Ort: Kapstadt bedeutet also Südafrika Museum in Kapstadt u.s.w.

Ein nomemklatorisch dunkler Punkt bleiben die Namen Ecklons. Dieser, Apotheker in Hamburg und Autor eines mit Zeyher herausgegebenen Werkes über südafrikanische Pflanzen, hat mit Käfern gehandelt und eine Preisliste versandt, die größtenteils nomina nuda, aber auch einige kurze Beschreibungen enthalten hat. Burmeister zitiert die Liste an verschiedenen Stellen mit ,,Ecklon Cat''. Diese Beschreibungen Ecklons haben die Priorität, wenn sie zur Erkennung der Art genügen. Die Liste ist aber nicht mehr aufzutreiben; meine Anfragen bei den großen entomologischen Bibliotheken hatten keinen Erfolg. Würde sie gefunden, könnte der Mangel an Typen ihrer Auswertung entgegenstehen.

Alle Größenangaben im folgenden Text sind ohne Beine zu verstehen.

Ortsangaben ohne Bezeichnung des Teilstaates der Südafrikanischen Union beziehen sich auf die Kap-Provinz.

Bemerkungen

1. Dichelus Serv.

Serville hat 1825 nur die Zahl, nicht auch die Länge der Krallen der Hinterbeine als Kriterium benützt; alle Arten mit einer Kralle hat er zu *Monochelus* gestellt. Burmeister hat 1844 dies als unnatürlich bezeichnet und *Dichelus* und *Monochelus* in eine einzige Gattung *Heterochelus* zusammengezogen. Lacordaire ist 1856 dem entgegengetreten. Péringuey hat 1902 als erster nicht nur die Zahl, sondern auch die Länge der Krallen zur Einteilung benützt und die Gattung *Dichelus* (Genotyp *dentipes* F.) auf die Arten mit 2 gleichlangen

Krallen beschränkt, während er die Arten mit 2 ungleichen Krallen und mit nur einer Kralle zu *Heterochelus* gestellt hat. Diese Lösung hat leider den Schönheitsfehler, daß auch bei *Dichelus* Arten mit 2 ungleichen Krallen vorkommen. Péringuey selbst mußte *denticeps* Wied. als Ausnahme nennen, *nitidissimus* Burm. und *kochi* n. sp. kommen dazu. Ich halte es deshalb für richtig, mit Burmeister nur eine einzige Gattung anzunehmen. Diese muß allerdings *Dichelus* Serv. sensu lato heißen. Sie zerfällt in die drei Untergattungen *Dichelus* Serv. sensu stricto (Genotyp *dentipes* F.), *Heterochelus* Burm. und *Ischnochelus* Burm. Hier wird nur die Untergattung *Dichelus* behandelt. Genotyp *dentipes* F.

Infolge des sehr einheitlichen Baues der ♀♀, welche die Differenzierung der ♂♂ nicht mitmachen, läßt sich bei *Dichelus* eine brauchbare Bestimmungstabelle nur für die ♂♂ aufstellen. Wenn bei manchen Arten die ♀♀ noch nicht mit Sicherheit bekannt sind, ist diese Einheitlichkeit der ♀♀ einer der Gründe.

Die Arten lassen sich nach den Hinterschienen der ♂♂ zwanglos in drei Gruppen einteilen:

denticeps-Gruppe: Die Hinterschienen nähern sich dem weiblichen Typ, indem sie ziemlich gleichmäßig an Breite zunehmen und am Ende sehr schräg abgeschnitten sind. Hierher gehören *simplicipes* Burm., *denticeps* Wied., *pallidipennis* Blanch. und *flavimanus* Burm.

dentipes-Gruppe: die Schienen tragen unten zwischen dem Zähnchen beim Knie und dem Apikalmukro einen zahnartigen Lappen. Hierher zählen *laticollis* Burm., *nitidissimus* Burm., *dentipes* F., *expansus* Pér., *acanthopus* Burm., *villosus* Burm., *luteopygus* n. ssp., *minor* n. ssp., *lucidus* Pér., *vittatus* Burm., *péringueyi* n. sp., *duplosquamosus* n. sp., *pseudovittatus* n. sp. und *holosquamosus* n. sp.

holosericeus-Gruppe: Hinterschienen schmäler, stärker gebogen, fast parallelseitig ohne den zahnartigen Lappen. Arten: *holosericeus* Burm., *albolineatus* n. sp., *platynotus* Burm., *luctuosus* Pér., *kochi* n. sp. und *pseudoluctuosus* n. sp. Wohin *zuluanus* Pér. (nur ♀) gehört, ist unsicher.

Zu den *Dichelus*-Arten:

Der Coleopterorum Catalogus zählt 24 Arten auf, weitere Arten sind nicht beschrieben. Der Katalog ist zu berichtigen:

latipes und *subpilosus* Nonfried sind zu streichen; ich habe die Typen gesehen. Ersterer ist eine *Chasme decora* Wied., letzterer ein abgeriebener *villosus* Burm.

expositus Har. ist ein *Platychelus* mit ungleichen doppelten Krallen an allen Beinen. Da die längere Kralle bis zum Grunde gespalten ist, war die Verwechslung möglich.

flavipennis Blanch. gehört zu *Omocrates*.

nigra Wied. hat nach der Beschreibung an allen Füßen doppelte ungleiche Krallen und ist kein *Dichelus*. Ich habe die Type noch nicht gesehen.

quadratus Wiedemann ist ein *Heterochelus.*

soricinus Blanch. gehört ebenfalls zu *Heterochelus.*

Auf *femoratus* Thunberg komme ich weiter unten bei *holosericeus* Burm. zurück. Thunberg, der Nachfolger Linnés in Uppsala, hat viele Käfer in der damals üblichen flüchtigen Weise beschrieben, von denen viele ohne die Typen kaum richtig zu deuten sind. Es ist schade, daß sich niemand seiner Sammlung annimmt, in der sicher noch eine ganze Anzahl von Typen ermittelt und festgelegt werden könnten.

Zu den nach Bereinigung des Katalogs verbleibenden Arten ist zu bemerken:

(1) *D. simplicipes* Burmeister 1844

Kommt im Aussehen den Arten der *holosericeus*-Gruppe nahe, die Hinterbeine des ♂ sind aber sehr verschieden. ♀ mit Sicherheit nicht bekannt. Typus in Halle. Länge 5 mm. Malmesbury, Paarl, Caledon.

(2) *D. pallidipennis* Blanchard 1850

Da das Pariser Museum grundsätzlich Typen nicht mehr ausleiht, habe ich nur 2 mit diesem Namen versehene Stücke des Südafrika-Museums gesehen, die ♀♀ sind und den *holosericeus*-♀♀ nahe zu stehen scheinen. Die Einreihung dieser Art in die Tabelle konnte ich nur nach der Beschreibung vornehmen. Beim ♂ ist auffallend, daß es einen Sporn an den Hinterschienen hat. Länge 5 mm. Malmesbury. Typen im Musé National d'Histoire Naturelle in Paris.

(3) *D. denticeps* Wiedemann 1821

Das ♂ erinnert durch seine Hinterschienen etwas an *Diaplochelus squamulatus* Burmeister, der einen abgerundeten Kopfschild hat. Das ♀ ist oben etwas dunkler als das ♂ und diesem ähnlich; sein Pygidium ist wie beim ♂ ohne Schuppen und glatt. Länge 5–5,5 mm. Cold Bokkeveld, Ceres Distr., Cape Town Rondebosch. Typus im Zoologischen Museum der Universität Kopenhagen.

(4) *D. flavimanus* Burmeister 1855

Das ♂ hat große Ähnlichkeit mit *holosericeus* Burmeister in der Form, dem Seidenglanz und der Farbe, ist aber davon durch die zitronengelben Fühler, Taster und Vorderbeine und die anders gebauten Hinterschienen leicht zu unterscheiden. Das ♀ ist noch unbekannt. Ich habe nur die Type gesehen, die Art scheint also selten zu sein, ihr genauer Fundort ist nicht bekannt. Länge 5 mm. „Kaffernland". Typus in Halle.

(5) *D. laticollis* Burmeister 1844

Diese Art fällt durch ihre längere Form, den nach vorn weniger verschmälerten Halsschild, dessen unregelmäßige grobe Punktierung und die verhältnismäßig kurzen Beine aus dem Rahmen der Gattung; Fühler, Taster und Vorderbeine sind hellrot. Das ♀ ist dem ♂ sehr ähnlich, aber durch das gewölbte Pygidium und den fehlenden Mucro an den Hinterschienen, die einen Sporn tragen, leicht zu erkennen. Länge 5–7 mm. Cape Town, Somerset West, Stellenbosch, Caledon, Heidelberg.

Die Type ist verloren gegangen. In Halle steckt zwar ein so etikettiertes ♀ in der Sammlung Burmeister, es ist aber mit Sicherheit nicht *laticollis*; ich halte es für *villosus* Burm. Ich nehme an, daß der Autor die Type nach der Beschreibung wieder an den Einsender Van Winthem in Hamburg zurückgegeben hat. Dafür spricht der Sprachgebrauch bei Burmeister, der bei dieser Art die Wendung gebraucht „von Herrn v. Winthem mitgeteilt", während er bei den noch in der Sammlung vorhandenen Arten schreibt „von . . . erstanden". Auch seine *platynotus* fehlt, die ihm ebenfalls „mitgeteilt" worden ist. Die Sammlung Van Winthem ist in das Hamburger Museum übergegangen und, wie mir der jetzige Leiter Prof. Dr. Weidner mitgeteilt hat, im letzten Krieg mit diesem Museum völlig zerstört worden. Ich habe deshalb ein Paar *laticollis* des Südafrika-Museums als Neo-Holo-und Allotypus bezeichnet.

(6) *D. nitidissimus* Burmeister 1844

Im Gegensatz zur Beschreibung haben die Hinterschienen des ♂ unten über der Mitte einen Zahn. Trotz den ungleichen Krallen passt die Art dem Habitus nach besser zu *Dichelus*. Das ♀ ist unbekannt. Länge 5,5 mm. „Südafrika". Typus in Halle.

(7) *D. dentipes* Fabricius 1781

Das ♀ dieser altbekannten großen Art ist meist etwas heller gefärbt als das ♂, ich habe aber auch, wenn auch viel seltener, Stücke mit sehr dunkelbraunen Flügeldecken gesehen; sein Pygidium ist immer einfarbig hell beschuppt und ungefleckt. Man findet manchmal Stücke des *acanthopus* Burmeister und seines *villosus*, die ihre Schuppenbinden fast ganz verloren haben, als *dentipes* bestimmt. Sie können an den Hinterschienen des ♂ unterschieden werden: diese sind unten im basalen Teil bei *dentipes* breit und gerillt, bei *villosus* breit und nicht gerillt, bei *acanthopus* zusammengedrückt, sodaß der scharfe Kiel der Kante auffällt. Bei *villosus* sind die Schuppenbinden in deutliche, breite Rillen gelagert, *acanthopus* hat eine solche schmälere und weniger deutliche Rille nur längs der Naht. Länge 6–7, 5 mm. Cold Bokkeveld Ceres Distr., Malmesbury, Paardekop, Melkbosch Strand, Cape Town Orange Kloof, Camps Bay, Kirstenbosch, Constantia Nek, Clovelly Cape Peninsula, Fish Hoek Cape Peninsula, Cape Flats, Banhoek Valley Stellenbosch, Franschhoek, Worcester, Cloete Pass, Robinson Pass. Typus im Zoologischen Museum der Universität Kopenhagen.

(8) *D. expansus* Péringuey 1902

Das Pygidium des ♀ trägt helle Schuppen mit 2 runden dunklen Flecken in der basalen Hälfte, sonst gleicht das ♀ dem von *dentipes*. Einige ♂♂ aus

Sneeugat Valley in Tulbagh haben matte, tief dunkelbraune Flügeldecken, werden aber durch die mitgefangenen ♀♀ als *expansus* ausgewiesen. Länge 6–7 mm. Ceres, Sneeugat Valley, Tulbagh, Koeberg, Noordhoek, Somerset West, Stellenbosch, Caledon, Worcester. Typus in Kapstadt.

(9) *D. acanthopus* Burmeister 1844

Die ♀♀ sind von denen der vorigen Art nicht zu unterscheiden. In der Sammlung des Südafrika-Museums sind die „*acanthoscelis* Ecklon" bezeichneten Stücke hier eingereiht; gut erhaltene Exemplare zeigen aber mehrere Schuppenbinden auf den Flügeldecken und damit die nähere Verwandtschaft mit *villosus* Burmeister, welcher Autor sie auch richtig dorthin gestellt hat, siehe folgende Ziffer 10 b. Länge 4,5 – 6,5 mm. Ceres, Tulbagh, Cape Town, Somerset West, Banhoek Valley Stellenbosch, Tradouw Pass Swellendam Distr., George Distr. Typen in Halle.

(10) *D. villosus* Burmeister 1844

Die Körperform ist etwas schmäler als bei den vorausgegangenen Arten, die dunkle Grundbehaarung ist deutlicher, die hellen Schuppen der Längsbinden, deren äußere oft nur rudimentär oder ganz verschwunden sind, sind haarähnlicher.

Die ♀♀ sind meist dunkler als bei *dentipes* und folgenden, ihr Pygidium ist, wie Burmeister im Gegensatz zu Péringuey richtig angibt, überwiegend dunkel mit schmaler weißgelber Schuppenbinde längs der Mitte. Länge 7–7,5 mm. Darling, Malmesbury, Cape Town, Camps Bay, Tafelberg Blinkwater, Rondebosch, Somerset West, Banhoek Valley Stellenbosch, Koegelberg in den Hottentots Holland Bergen. Typus in Halle.

(10a) *D. villosus* subspecies *luteopygus* nova

Ein wenig breiter gebaut, in Skulptur und Beinbildung aber ganz wie *villosus* Burmeister, in der Farbe abweichend. Die 3 Schuppenbinden auf jeder Decke, der Halsschildhinterrand, die oberen Ränder der Seitenteile der Brust und die Enden der Bauchringe sind zwar weißlich wie bei *villosus*, die Grundfarbe ist aber überall tiefschwarz und das Schildchen und der Hinterrand des sonst schwarzen Propygidiums sowie das ganze Pygidium sind auffallend orangegelb beschuppt. Das ♀ ist ebenfalls tiefschwarz, etwas mehr glänzend, das Pygidium ist bei ihm heller gelb, die dunklen Seitenflecken schimmern nur leicht durch die helle Beschuppung durch. Größe wie *villosus*. Länge 7–7,5 mm. Jakalswater Bushmanland, Gifberg Vanrhynsdorp Distr., Somerset West, Stellenbosch, Worcester, George Distr. Typus in Kapstadt.

(10b) *D. villosus* subspecies *minor* nova

Es handelt sich um den im Handbuch Burmeisters Band IV 1 Seite 110 am Schluß der Diagnose des *villosus* als „var. min. Monoch. acanthoscelis Eckl. Cat. No. 410" erwähnten Käfer. Sollte Ecklon eine Beschreibung veröffentlicht haben, hätte sein Name die Priorität vor *minor*. Will man in dem Wort *minor* eine gültige Beschreibung erkennen, ist als Autor Burmeister zu zitieren. Um keine Verwirrung zu schaffen, habe ich den Burmeisterschen Namen aufrecht erhalten.

Subspecies *minor* ist eine *villosus*-Rasse mit stärkerem grünlichem Metallschimmer des Halsschildes, hellbraunen Flügeldecken und konstant geringerer Größe, sowie anderer Fleckung des Pygidiums des ♀. Form, Skulptur und Beinbildung wie *villosus*. Kopf und Halsschild sind aufrecht grau behaart. Der Metallschimmer erinnert an *Heterochelus viridicollis* Blanchard. Die längs der Mitte des Halsschildes durchlaufende Rille ist vorn sehr seicht, hinten tief und nicht beschuppt wie auch zwei quere schmale Eindrücke an seinen Seiten neben dem Hinterrand. Die hellbraunen Flügeldecken sind sehr fein anliegend dunkel behaart und lassen je eine ziemlich breite Rille neben der Naht und neben der Mitte der Scheibe erkennen, die wie auch das Schildchen längliche weiße, den Grund nicht ganz verdeckende Schuppen tragen; eine weitere solche Schuppenbinde läuft am Beginn des Seitenabfalles. Die Nahtbinde ist immer vorhanden, die anderen sind oft rudimentär oder ganz verschwunden. Weiß beschuppt sind auch der Pygidialteil, die Seitenstücke der Brust und die Enden der Bauchringe. Die Beine sind braun oder schwärzlich, alle Beinpaare gleichfarbig.

Das ♀ gleicht dem ♂ in der Färbung; die Behaarung des Halsschildes ist heller; das Pygidium ist weißgrau beschuppt mit 2 großen keilförmigen Kahlstellen beiderseits der Mitte und einer runden Kahlstelle am Apex; die beschuppte Fläche ist größer als bei *villosus*. Länge 5–5,5 mm. Ceres, Cape Town, Camps Bay, Stellenbosch, Zwartberg Pass Prince Albert Distr. Typus in Kapstadt.

(11) *D. lucidus* Péringuey 1902

Die Flügeldecken sind heller braun und glänzen stärker als beim vorigen, der zahnartige Lappen oberhalb der Mitte des unteren Randes der Hinterschienen des ♂ ist stumpfer und fällt gegen das Schienenende allmählich ab. Die Vorder- und Mittelbeine und die Tarsen der Hinterbeine sind braun, die Hinterschenkel und -schienen pechschwarz. Die Börstchen an den Hinterschienen und besonders an den -tarsen sind braungelb im Gegensatz zu *villosus* und *minor*, wo sie pechschwarz sind. Auf dem Schildchen im Gegensatz zur Beschreibung einige helle Schuppen.

Ich habe nur die Type und ein weiteres ♂ gesehen. ♀ unbekannt. Länge 4–4,5 mm. Caledon. Typus in Kapstadt.

(12) *D. vittatus* Burmeister 1844 (nec Péringuey 1902)

Ich kenne diese Art nicht in natura. Sie fehlt in der Sammlung Burmeister in Halle. Die Type ist mit größter Wahrscheinlichkeit verloren wie bei *laticollis* oben Ziffer 5, siehe dort. ♀ unbekannt. Länge 8,7 mm. „Südafrika."

(13) *D. péringueyi* nova species

Das Stück in Kapstadt ist als *vittatus* Burm. bezettelt, passt aber nicht ganz zur Beschreibung dieser Art. Während dort die Behaarung auf Kopf und

Halsschild als tief schwarz und die Krallen als „fast" gleich bezeichnet sind, sind diese Haare hier hell und die Krallen gleich. Auch sind die Beine rotbraun, nicht schwarz. Die 4 Zähne des Kopfschildvorderrandes sind gleich, bei *vittatus* sind die mittleren kleiner. Im übrigen beziehe ich mich auf die Beschreibung des *vittatus* Péringueys in seinem „Descriptive Catalogue of the Coleoptera of South Africa 1902 Seite 702". Länge 7–7,5 mm. Ein Fundortzettel ist an der Type nicht vorhanden. 2 Paratypen in meiner Sammlung sind leider auch nur „Caffraria" bezettelt. ♀ unbekannt. Typus in Kapstadt.

(14) *D. duplosquamosus* nova species

Schwarzer *Dichelus* aus der Verwandtschaft des *vittatus* Burm. mit je 3 Längsbinden aus sehr dicht stehenden, kleinen runden weißgelben Schuppen und 2 Rippen dazwischen, die mit weißgelben aufrechten lang-kegelförmigen, weniger dicht stehenden Schuppen besetzt sind.

Kopf und Halsschild schwarz, Kopfschild mit 4 Zähnen, von denen die mittleren kleiner sind, runzlig punktiert. Halsschild nach vorn gerundet verschmälert, fein punktiert, schwach gewölbt, in der hinteren Hälfte mit Längsfurche, mit kleinen, weißgelben, über die ganze Fläche verstreuten, am Hinterrand dichteren Schuppen und abstehenden hellen Härchen. Schildchen dicht beschuppt. Flügeldecken mit rotbraunem Grund, der an den nackten Schulterbeulen und in schwächerem Maße an den Rippen sichtbar wird. Die doppelte Form der Schuppen ist auffallend, doch treten die Binden nicht sehr hervor, weil die Schuppen der Rippen wie die der Binden gefärbt sind. Der ganze Pygidialteil ist dicht weißgelb beschuppt. Die Unterseite ist dicht zottig ziemlich lang gelbweiß behaart. Die Beine sind wie bei *villosus* gebaut; die vorderen sind pechschwarz, die anderen rotbraun, gelbweiß behaart und beborstet. Alle Krallen sind doppelt, gleichlang und gespalten. ♀ unbekannt. Länge 5–6 mm. Cold Bokkeveld Ceres. Typus in Kapstadt.

(15) *D. pseudovittatus* nova species

Schwarzer *Dichelus* aus der Verwandtschaft des *vittatus* Burm. mit tief schwarz behaartem, am Hinterrand orangegelb beschupptem Halsschild, mit je drei dichten orangegelben Schuppenbinden auf den dunkelbraunen Flügeldecken und schmalen Zwischenräumen mit Schuppen von der Farbe des Grundes zwischen den Binden.

Kopf und Halsschild schwarz und kurz abstehend tief schwarz behaart, dicht runzlig punktiert, die 4 Zähne des Kopfschildes klein und gleich. Der Hinterrand des Halsschildes bis kurz vor die Ecken und der hinterste Teil der Längsfurche dicht orangegelb beschuppt wie auch das Schildchen. Flügeldecken mit braunem bis schwarzem Grund, die nackte Schulterbeule heller rotbraun, mit je 3 orangegelben Binden aus dichten runden kleinen Schuppen, von denen die Naht- und Randbinden hinten zusammenhängen und die schmälere mittlere Binde hinten verkürzt ist. Die Zwischenräume tragen runde kleine glänzende Schuppen von der Farbe des Untergrundes. Der ganze

Pygidialteil ist dicht beschuppt, die Schuppen sind etwas heller als die der Binden. Auch die Enden der Bauchringe sind so beschuppt, die übrige Unterseite schwarz behaart. Die Beine sind schwarz bis pechschwarz mit rotbraunen Tarsen, die Hinterbeine sind manchmal rotbraun. Das ♀ ist schlanker, der Halsschild ist nicht beschuppt und bräunlich behaart, die gelben Binden der Flügeldecken sind viel dünner und schmäler, das gelblich beschuppte Pygidium hat 2 seitliche keilförmige schwarze Flecken, deren Spitzen zum Apex zeigen. Die schlanken Beine sind schwarzbraun mit gelbbraunen Hinterschienen und Tarsen. Länge 5–5,5 mm. Banhoek Valley Stellenbosch, Assegaibosch-La Motte bei Humansdorp. Typus in Kapstadt.

(16) *D. holosquamosus* nova species

Schwarzer *Dichelus* aus der Verwandtschaft des *vittatus* Burm. mit Halsschild wie *duplosquamosus* n. sp. und gleichmäßig gelblich fein beschuppten Flügeldecken.

Kopf, Halsschild und Schildchen in Form, Punktierung, Beschuppung und Behaarung wie bei *duplosquamosus* n. sp. Flügeldecken mit gelbbraunem Grund und 2 schwachen Rippen, die sehr kleinen runden weißgelben Schuppen stehen dicht und sind gleichmäßig über die ganze Fläche der Decken einschließlich der Rippen verteilt. Auf den Rippen stehen nur feine gereihte gelbliche Börstchen zwischen den Schuppen. Der Pygidialteil ist dicht weißgelb beschuppt. Das Abdomen und die Brust sind ziemlich dicht und lang abstehend weiß behaart, der schwarze Grund bleibt aber sichtbar. Die Beine sind pechbraun, die vorderen etwas dunkler, die Tarsen rotbraun. Schenkel und Schienen sind dicht und fein abstehend weißlich behaart, die Börstchen der Tarsen rotbraun.

Dem *duplosquamosus* ähnlich, aber Flügeldecken heller und anders beschuppt und Beine heller. Länge 6,5 mm. Malmesbury Paardekop. ♀ unbekannt. Typus in Kapstadt.

(17) *D. holosericeus* Burmeister 1844

Mein Versuch, mir die Type des *femoratus* Thunberg 1818 zu verschaffen, von der Burmeister vermutete, daß sie synonym sein könnte, ist gescheitert; sie wurde in der Sammlung Thunberg in Uppsala nicht gefunden. Die Beschreibung allein läßt die Frage der Synonymie nicht eindeutig lösen.

Den Seidenglanz, auf den der Name anspielt, hat die Art mit mehreren anderen gemeinsam. Charakteristisch ist das Zähnchen unten am Hinterschenkel neben der Trochanterspitze.

Die Flügeldecken der ♂♂ sind braun in verschiedenen Tönen oder schwarz.

Die ♀♀ unterscheiden sich durch hellere gelbbraune Flügeldecken und rotbraunes, dicht gelb beschupptes Pygidium und Abdomen ohne Flecken auf dem Pygidium. Die Beine sind rotbraun.

Länge 4,5–5,5 mm.

Stücke mit braunen Flügeldecken: Cape Town, Witsands (White Sands), Somerset West, Banhoek Valley Stellenbosch, Houhoek, Oudebosch, Rivier Zonderend, Ashton, George Distr., Knysna, Langekloof.

Stücke mit schwarzen Flügeldecken: Gifberg Vanrhynsdorp Distr., Sneeugat Valley Tulbagh, Somerset West, Stellenbosch, Algoa Bay.

Typus in Halle.

(18) *D. albolineatus* nova species

Diese Art ist schwarzen *holosericeus* sehr ähnlich, hat insbesondere den kleinen Schenkeldorn neben der Trochanterspitze und die gleiche Form und Skulptur. Sie unterscheidet sich aber auffällig dadurch, daß die Flügeldecken je eine weiße Schuppenbinde an der Naht und in der Mitte der Scheibe tragen, von denen die Nahtbinde vorn, die Scheibenbinde hinten verkürzt ist. Die Binden stehen in Rinnen. Außerdem sind das Schildchen, der Rand des Propygidiums, die Enden der Bauchringe und der obere Rand der Hinterhüften weiß beschuppt. Die Brust ist lang abstehend weiß behaart. Die Beine sind schwarz, der Fühlerstiel pechbraun. Kopf und Halsschild sind lang und dünn abstehend dunkel behaart. Länge 5 mm. Mamre. Nur 2 ♂♂ liegen vor. Typus in Pretoria.

(19) *D. platynotus* Burmeister 1844

Länge 6 mm. „Südafrika", Cold Bokkeveld?

Die Type ist verloren gegangen wie die von *vittatus* Burm. und *laticollis* Burm., siehe oben bei Ziffer 5. Sie war auch von Van Winthem „mitgeteilt".

Ich sehe davon ab, das einzige Stück des Südafrika-Museums, das hierher gehören könnte und in der Tabelle erwähnt wird, als Neo-Typus zu bezeichnen, weil es in einigen Punkten von der Beschreibung abweicht. ♀ unbekannt.

(20) *D. luctuosus* Péringuey 1902

Warum der Autor diese Art mit *denticeps* Wied. vergleicht, zu dem wenig Ähnlichkeit besteht, nicht aber mit *holosericeus* Burm., verstehe ich nicht. Sie unterscheidet sich von diesem nur durch Größe, den weißen Schuppenstreifen entlang der Naht der Flügeldecken und das fehlende Zähnchen neben der Trochanterspitze. Das ♀ ist schwarz mit bräunlichem Schimmer, dicht weißlich beschupptem Propygidium und weniger dicht fein gelblich beschupptem, nicht geflecktem Pygidium. Die Enden der Bauchringe tragen weißliche Schuppenhaare. Die Beine sind pechschwarz. Länge 6 mm. Cape Town. Typus in Kapstadt.

(21) *D. kochi* nova species

Diese Art hat zwar ungleiche Krallen, aber ganz den Habitus der *holosericeus*-Gruppe.

Schwarzer *Dichelus* dieser Gruppe, der durch je 2 weiße Schuppenbinden auf jeder Flügeldecke, weißbeschuppten Pygidialteil und ungleiche Krallen gekennzeichnet ist.

Glänzend, stärker als der Seidenglanz des *holosericeus* Burm. Kopfschild mit 4 gleichen Zähnchen. Kopf fein gerunzelt, kurz aufrecht dunkel behaart. Fühler und Taster pechbraun. Halsschild mäßig gewölbt mit ziemlich tiefer Längsfurche über die hinteren zwei Drittel. Ohne Schuppen, unregelmäßig punktiert, aufstehend dunkel behaart, Seiten mit dunklem Borstensaum. Pedunkulus und Schildchen dicht weißlich beschuppt. Flügeldecken unregelmäßig punktiert, mit einer flachen Rille längs der Naht und einer hinten verkürzten Rille längs der Mitte der Scheibe; in diesen Rillen weiße längliche Schuppen. Die weiße Nahtbinde läuft vom Schildchen bis zum Apex, die auf der Scheibe hört hinter der Mitte auf. Der ganze Pygidialteil dicht weiß beschuppt, ebenso die Seitenstücke der Brust und die Enden der Bauchringe. Brust sonst abstehend weiß behaart. Vorder- und Mittelbeine dunkelrotbraun, Hinterbeine braunschwarz. Trochanterdorn lang, frei. Ecken der Schenkel beiderseits des Kniees scharf. Schienen wie bei den anderen Arten der Gruppe. Krallen braun, alle gespalten und ungleich. Länge 5–6 mm. Vanrhynsdorp. ♀ unbekannt. Typus in Transvaal Museum in Pretoria.

Dem Betreuer der Käfer in diesem Museum C. Koch gewidmet.

(22) *D. pseudoluctuosus* nova species

Schwarzer *Dichelus* der *holosericeus*-Gruppe ohne Schuppen auf Flügeldecken und Pygidium und ohne Schenkelzähnchen neben dem Trochanterdorn.

♂ ganz schwarz, nur Krallen rotbraun, mäßig glänzend. Kopfschild mit 4 gleichgroßen Zähnchen, von denen die mittleren einander genähert sind. Kopf körnig punktiert, kurz aufrecht schwarz behaart. Fühler und Taster mit bräunlichem Schimmer, Fächer schwarz. Halsschild mäßig gewölbt, unregelmäßig körnig punktiert, auf der Scheibe fast glatt, mit vorn fast erloschener, hinten deutlicher Längsfurche in der Mitte; Seiten bis zur Mitte fast parallel, dann stärker verschmälert. Ohne Schuppen. Schildchen weiß beschuppt. Flügeldecken mit unregelmäßig ziemlich weitläufig stehenden Punkten, die stellenweise gereiht sind; ohne Schuppen. Propygidium, obere Seitenstücke der Brust und Enden der Bauchringe dicht weiß beschuppt, Pygidium ohne Schuppen, sehr glatt und glänzend. Unterseite kurz schwarz behaart. Beine schwarz mit rotbraunen, bei einigen Stücken dunkleren Krallen, Schenkel manchmal mit bräunlichem Schimmer, stark nach unten verbreitert, sodaß ein Dreieck entsteht, dessen Basis die obere Kante des Schenkels bildet und dessen Scheitel an dem Punkte liegt, an dem der Trochanterdorn frei wird. Daneben kein Zähnchen. Länge 6 mm.

Das ♀ kommt mit schwarzen und mit kaffeebraunen Flügeldecken vor und ist stärker glänzend. Die Oberseite ist stärker punktiert. Weiß beschuppt sind das Schildchen und die Seiten der Bauchringe, gelblich beschuppt der Pygidialteil ohne Flecken auf dem Pygidium, die sonstige Unterseite ist ziemlich lang weißlich abstehend behaart. Beine pechschwarz, bei den braungeflügelten Stücken sind die Hinterbeine und alle Tarsen ebenfalls braun. Länge 5,5–6 mm. Willowmore, Uniondale Distr. Typus im Transvaal Museum in Pretoria.

(23) *D. zuluanus* Péringuey 1902

Diese Natal-Art ist nur in einem ♀ bekannt. Länge 6,75 mm. Eshowe Natal. Typus in Kapstadt.

2. Omocrates Burmeister 1844

Als Genotyp bezeichne ich *axillaris* Burm. 1844 und glaube dabei im Sinne dieses Autors zu handeln, der nach der Schulterbildung dieser Art den Gattungsnamen gewählt hat. Während Burmeister die Gattung nur auf Arten mit sexuell verschiedenen Hinterschienen beschränkt hat, spricht Péringuey diesem Merkmal generischen Wert ab und zieht die zweite Gruppe der Burmeisterschen Gattung *Goniaspidius* zu *Omocrates*, worin ich ihm folge. Zur Abgrenzung gegen die neuen Gattungen *Cylindrocrates* und *Omocnemus* muß noch die nach hinten verschmälerte Form der Flügeldecken und die einspitzige Form der Vorderschienen herangezogen werden. Damit sind die Merkmale der Gattung *Omocrates* das große, dreieckige Schildchen, die schmale Körperform, die nach hinten verschmälerten Flügeldecken, die einspitzigen Vorderschienen und ihre rechtwinklig abstehenden Seitenzähne, die in beliebiger Zahl vorhanden sein können.

Der ,,Coleopterorum Catalogus'' verzeichnet 17 Arten. Weitere sind seither nicht beschrieben worden.
Zu den *Omocrates* Arten

(1) *O. misellus* Péringuey 1902

Die 4 Zähne des Kopfschildes sind gleichgroß, ebenso die 2 Seitenzähne der Vorderschienen. Die Furche des Halsschildes ist tief, aber viel schmäler als bei *canaliculatus* Blanch. Ich habe nur die Type, ein ♀, gesehen. Länge 5,25 mm. Namaqualand. Type in Kapstadt.

(2) *O. karrooanus* nova species

Großer *Omocrates* mit 4-zähnigem Kopfschild, 3-zähnigen Vorderschienen und einzelnen einfachen Krallen an den Hinterbeinen, schwarz mit blaßgelben, seitlich angedunkelten Flügeldecken und dicht graugelb beschupptem Pygidialteil.

♂. Kopfschild quer, etwas nach vorn schmäler werdend, von den 4 Zähnen sind die 2 mittleren kleiner, wenig scharf und manchmal zu Körnchen reduziert. Eine stumpfe zahnförmige Erhebung über dem Fühleransatz. Fühler schwärzlich. Halsschild fast so lang als breit, mit abgerundeten Hinterecken, dann in den hinteren zwei Dritteln fast parallel und anschließend nach vorn verschmälert. In der hinteren Hälfte eine schwache Längsfurche. Wie der Kopf ziemlich fein und dicht körnig punktiert und aufrecht lang und dicht fein gelblich behaart. Das große schwarze körnige Schildchen mit weißlichen, den Grund nicht ganz verdeckenden Schuppen. Flügeldecken mit betonten Schultern, nach hinten verschmälert, blaßgelb, Beulen und abfallende Teile bis zum Nahtende angedunkelt, mit kurzen anliegenden dünnstehenden hellen

Härchen. Innen neben der Schulter ein Eindruck, der fast bis zur Apikalbeule reicht. Apikalrand um die Beule hinten herum dicht dunkelgelb beschuppt. Propygidium schmal, wie das Pygidium geschlossen graugelb beschuppt mit einigen hell behaarten Kahlpunkten. Abdomen grauweiß beschuppt und wie die ganze Unterseite dicht und lang weißlich behaart, die Haare sind an den Seiten besonders lang. Beine schwarz, Tarsen am Ende rot, bei einem Exemplar aus Klaarstroom Beine dunkelpechrot. Die 3 Zähne der Vorderschienen stehen wie bei den *Heterochelus* rechtwinklig ab. Hinterschenkel dick, Hinterschienen unter dem Knie am breitesten mit stumpfer Ecke, zum Apex schmäler, am inneren Ende mit kurzem spitzem Mukro, am äußeren Ende mit scharfer Ecke. Beine fein weiß behaart. Vorder- und Mittelkrallen doppelt und ungleich, Hinterkralle einzeln und einfach.

♀. Wie das ♂, Flügeldecken ohne dunklen Rand, Zähne des Kopfschildes sehr undeutlich, Pygidium nur lang behaart, ohne Schuppen, Beine braun. Länge 6–6,5 mm. Dikbome Merweville Koup, Klaarstroom Prince Albert. Typen in Kapstadt.

(3) *O. pauxillus* Péringuey 1902

Die mittleren Zähne des Kopfschildes genähert. Oben nur der Kopf schwarz, Halsschild rotbraun, fast so lang wie die Flügeldecken, in den hinteren drei Vierteln parallelseitig, dann verschmälert. Vorderschienen nur mit 1 Seitenzahn. Nur Type (♀) bekannt. Länge 4,5 mm. Hex River. Type in Kapstadt.

(4) *O. andreaei* nova species

Schwarzer *Omocrates* mit 3-zähnigem Kopfschild, blaßgelben Flügeldecken, dicht gelb beschupptem Pygidialteil, braunen Hinterschienen und Tarsen und 4-zähnigen Vorderschienen. Lang und schmal. Basis des Kopfschildes kurz verschmälert, dann ist er quadratisch, vorn mit 3 spitzen Zähnen, deren mittlerer etwas kleiner ist. Kopf fein eng gekörnt, mit sehr kurzen abstehenden Börstchen. Halsschild so lang wie breit, in der hinteren Hälfte parallelseitig, grob punktiert, mit abstehenden kurzen feinen Härchen, am Hinterrand mit feiner gelb beschuppter Rille. Schildchen grob gerunzelt und gelb beschuppt. Flügeldecken blaßgelb, stark nach hinten verschmälert, von den Hüften an die Seiten des Abdomen nicht verdeckend, mit kurzen länglichen Eindrücken innen neben den Schultern und einem gemeinsamen Eindruck auf der Scheibe, in den Eindrücken mäßig dicht punktiert, sonst glatt. Propygidium breit, wie das Pygidium beim ♂ geschlossen goldgelb beschuppt. Bauchringe mit Binden aus weißen Schuppenhaaren über die Mitte, von oben sichtbar. Brust hell behaart. Vorder- und Mittelbeine pechschwarz wie auch die Hinterschenkel, Hinterschienen und -tarsen dunkelrotbraun. Vorderschienen mit 4 Zähnen, der apikale Zahn schräg nach vorn, die anderen 3 Zähne rechtwinklig abstehend, die 2 basalen Zähne gleichstark, der Zahn zwischen diesen und dem apikalen Zahn nur halb so lang. Diese Zähnung erinnert an *Ischnochelus* Burm., welche Untergattung aber ein kleines Schildchen hat. Hintertarsen länger als die Schienen, diese einfach. Alle Beine mit 2 sehr ungleichen Krallen, beide Krallen der Hinterfüße gespalten, die größere sehr tief, die kleine ganz fein an der Spitze.

♀ dem ♂ sehr ähnlich, der letzte Bauchring dicht goldgelb fein beschuppt, das Abdomen sonst wenig dicht anliegend weißlich behaart. Länge 4–5 mm. Bosluis Pass. Gamkas Poort. Typen in Kapstadt.

(5) *O. plausibilis* Péringuey 1902

Die Art ist schon an dem Fleck über dem Schildchen aus sehr dichten kleinen ovalen dunkelgelben Schuppen, an der sehr körnigen Struktur des Halsschildes und an der langen dichten weißen Behaarung der Halsschildseiten, der Unterseite und der Schienen leicht zu erkennen. Länge 5,5 mm. Burghersdorp. Typen in Kapstadt.

(6) *O. pygidialis* nova species

Schwarzer *Omocrates* mit gelbbraunen Flügeldecken, 3-zähnigem Kopfschild und 3-zähnigen Vorderschienen, bei dem das Propygidium und Pygidium des ♂ im Basalteil dicht dunkelbraun, auf dem Rest der Fläche hellgelb beschuppt ist.

♂. Kopfschild breiter als lang, der mittlere Zahn bei einigen Exemplaren kleiner als die anderen Zähne. Stirn flach eingedrückt, runzlig punktiert, abstehend fein hell behaart. Fühler pechschwarz. Halsschild so lang als breit, körnig runzlig, schwach glänzend, fein abstehend gelb behaart, an den Seiten mit längeren weißen Haaren, am Basalrand mit weißlichem Schuppensaum. Mit seichter Furche im hinteren Teil. Schildchen runzlig mit schwach gekielter Mitte, beiderseits davon gelbweiß beschuppt. Flügeldecken stark verschmälert, sodaß das Abdomen seitlich sichtbar wird, mit deutlicher Grube innen neben der Schulter und schwacher Rille neben der Naht, wenig dicht grob punktiert mit kurzen feinen hellen anliegenden Börstchen, am Apikalrand mit weißem Schuppensaum. Propygidium und Pygidium geschlossen beschuppt, die Schuppen sind hellgelb und in der Basalgegend dunkelbraun. Nur bei einem einzigen ♂ sind sie einfarbig hellgelb (forma col. *immaculatus* nov.). Abdomen schwarz mit weißen Binden über die Mitte der Ringe, deren Ränder sichtbar bleiben, die 3 letzten Ringe bräunlich. Brust dicht und lang weiß behaart. Vorderbeine pechschwarz, Mittelbeine pechbraun, Hinterbeine rotbraun. Vorderschienen mit schrägem Apikalzahn und 2 genäherten gleichlangen Seitenzähnen, der Apikalzahn zeigt am Grunde eine scharfe Ecke (Vorstufe eines weiteren Zahnes?). Hinterschienen mit kurzen Sporen. Alle Krallen doppelt, ungleich, die größere seitlich gespalten. Alle Beine weiß beborstet.

♀. Wie das ♂, Halsschild länger behaart, der glänzende, schwarzbraune Untergrund des Pygidialteiles durch eine feine helle Behaarung sichtbar. Alle Beine braun, die hinteren heller als die vorderen, Tarsen dünner, Sporn der Hinterbeine länger. Länge 5–5,5 mm. Middelburg Div. Typen in Kapstadt.

(7) *O. variabilis* Burmeister 1844

Die Flügeldecken dieser Art sind im Grunde pechschwarz oder hellbraun, die Börstchen darauf sind stärker als beim vorigen. Der Pygidialteil ist einfarbig gelbweiß. Sonst dem vorigen ähnlich, kleiner. Länge 3,5–4,5 mm. Port Elizabeth, Uitenhage, Dunbrody. Typen in Halle.

(8) *O. axillaris* Burmeister 1844

Genotyp. Schon an der Größe und der Form der Hinterschienen des ♂ sofort zu erkennen. Das Pygidium des ♀ trägt im Gegensatz zu dem einfarbig goldgelb beschuppten Pygidium des ♂ zwei kleine dunkle Flecken. Länge 6,5–7 mm. Stellenbosch, Koeberg, Malmesbury, Clanwilliam. Type in Halle.

(9) *O. lobipes* Burmeister 1844

Dem vorigen ähnlich, kleiner und Hinterschienen des ♂ anders. Länge 4,5 mm. Algoa Bay. Die Type befindet sich nicht mehr in Halle und ist offenbar verloren gegangen. Neotypus in Kapstadt.

(10) *O. modestus* Péringuey 1902

Das Propygidium ist hier auffallend breit, der ganze Pygidialteil dicht graugelb beschuppt. Länge 5 mm. Kowie (Port Alfred). Type im Pariser Nationalmuseum.

(11) *O. hessei* nova species

Sehr lang und schmal gebauter schwarzer *Omocrates* mit blaßgelben, an den Beulen angedunkelten Flügeldecken und bei ♂♀ orangegelb beschupptem Pygidialteil, der sich durch 2-zähnigen Kopfschild und 4-zähnige Vorderschienen auszeichnet. Der Kopfschild ist parallelseitig und verhältnismäßig schmal, die Ecken sind stark aufgebogen, der Rand zwischen ihnen zeigt eine sehr schwache Wölbung (Vorstufe eines dritten Zahnes), der ganze Kopf ist grob runzlig-körnig punktiert. Fühlerstiel braun, Fächer schwarz. Der Halsschild ist etwas länger als breit, hinten wenig breiter als vorn und stark zum Schildchen vorgezogen, mit abgerundeten Ecken und schwach gebogenen Seiten. Er ist verhältnismäßig flach, vorn unregelmäßig punktiert, hinten fast glatt, jeder Punkt trägt ein gelbes, an den hinteren Seiten weißes Haar. Schildchen grob punktiert mit glatter Mittellinie, seitlich weißlich behaart. Flügeldecken hinter den Schultern stark verschmälert, auf der Scheibe fast glatt, in dem Eindruck neben der Schulter und seitlich unregelmäßig punktiert, mit schmaler Rille neben der Naht, mit unregelmäßig gereihten kurzen halb anliegenden weißen Börstchen. Am Beginn des Propygidiums ein Kranz gelber, seitlich weißer Börstchen, dieses sehr breit und wie das Pygidium bei ♂♀ geschlossen orangefarben beschuppt und dazwischen behaart, beim ♂ sind die Schuppen rund, beim ♀ länglich. Das Pygidium fällt beim ♂ schräg nach vorn, beim ♀ schräg nach hinten ab. Abdomen beim ♂ schwarz, beim ♀ rotbraun, die Ringe oben weißlich, sonst gelb behaart. Brust beim ♂ weiß, beim ♀

weniger dicht gelblich behaart. Vorder- und Mittelbeine beim ♂ schwarz mit bräunlichem Schimmer, Hinterbeine des ♂ und alle Beine des ♀ rotbraun. An den Vorderschienen ist der Zahn nach dem Apikalzahn kürzer.

Die Art hat Ähnlichkeit mit *O. andreaei* n. sp., ist aber größer und hat nur 2 Kopfschildzähne. Länge 5–6 mm. Tankwa Karroo Waterval. Typen in Kapstadt.

(12) *O. depressus* Blanchard 1850

Durch die einschließlich des Halsschildes gelb beschuppte Oberseite hervorgehoben. Von *placens* Pér. durch parallele Halsschildform und dunkelgelbe Farbe der Schuppen verschieden. Länge 4–4,5 mm. Cape Town, Stellenbosch. Typus im Pariser Nationalmuseum.

(13) *O. placens* Péringuey 1902

Sehr ähnlich dem vorigen, aber Halsschild gleichmäßig verschmälert und Schuppenfarbe mehr grau. Länge 3,5–4 mm. Stellenbosch, Caledon. Type in Kapstadt.

(14) *O. spatulipennis* Blanchard 1850 (=*lepidus* Boheman 1857)

Die Type blieb mir unbekannt. Type des *lepidus* Boh. im Museum Stockholm. Länge 4,5–6 mm. Natal, Orange Freistaat.

(15) *O. lividipennis* Boheman 1857

Als *Goniaspidius* beschrieben, der Autor vergleicht die Art aber mit seinem *lepidus*. Länge 5 mm. „Ganz Caffraria." Typus im Museum Stockholm.

(16) *O. humilis* Péringuey 1902

Durch die Form der Zähne der Vorderschienen von allen ähnlichen kleinen Arten verschieden. Länge 4,5 mm. Hex River. Typus in Kapstadt

(17) *O. placidus* Péringuey 1902

Der Halsschild ist auffallend grob weitläufig punktiert und hat hinten keine Furche. Dem *luridipennis* Burm. ähnlich, Pygidium aber einfarbig. Länge 4,5–5,5 mm. Hex River. Type in Kapstadt.

(18) *O. pseudoplacidus* nova species

Schwarzer *Omocrates* mit blaßgelben, hinten angedunkelten Flügeldecken aus der Verwandtschaft des *placidus* Pér., der sich davon besonders durch den tief gefurchten Halsschild unterscheidet.

Form ähnlich *luridipennis* Burm., Kopfschild vorn gerade, etwas aufgebogen mit ein wenig vorstehenden Ecken. Die blaßgelben Flügeldecken an den Schultern rotbraun, hinten mit einem pechschwarzen, verkehrt-keilförmigen auf der Apikalbeule endenden Fleck. Der Halsschild ist gewölbter und dichter und feiner punktiert als bei *placidus* und hat eine fast bis zum Vorderrand reichende tiefe Furche. Am Hinterrand ein Schuppensaum, sonst ist der Halsschild lang dicht abstehend bräunlich behaart. Schildchen mit Mittelkiel, daneben gelb beschuppt. Auf den Flügeldecken läuft der Eindruck neben der Schulter fast bis zum Apex, neben der Naht eine feine Rille. Oberfläche fast glatt, in den Eindrücken punktiert, auf den abfallenden Teilen gestrichelt, mit zerstreuten, im apikalen Teil dichteren feinen anliegenden weißen Härchen, hinter den Apikalbeulen mit Schuppenbindchen. Propygidium breit, wie das Pygidium beim ♂ dicht goldgelb beschuppt. Bauchringe dicht gelb behaart, Brustseiten mit längeren buschigen weißen Haaren. Alle Beine rotbraun, die 4 vorderen etwas dunkler. Schenkel und Schienen lang gelb beborstet. Vorderschienen mit schrägem, am Grund eckigem Apikalzahn, von den 2 rechtwinklig abstehenden Seitenzähnen ist der basale sehr klein. Hinterschienen mit 1 Sporn. Alle Schienen mit doppelten Krallen, deren längere gespalten ist. Nur ♂♂ bekannt. Länge 5·5–6 mm. Stellenbosch. Type in Pretoria.

(19) *O. luridipennis* Burmeister 1844

Dem *axillaris* ähnlich, Kopfschild aber nur mit Eckzähnen. Die Flügeldecken der Typen sind blaßgelb, an den Beulen angedunkelt. 4 Individuen des Südafrika-Museums sind dunkelbraun, fast schwarz; da sie 1883 gefangen worden sind, halte ich eine postmortale Veränderung der Farbe für wahrscheinlich. Das auffallendste Kennzeichen der Art sind die 4 (beim ♀ 2) dunkelbraunen Flecken auf dem Pygidialteil. Länge 4,5–5 mm. Cape Town, Stellenbosch, Koeberg, Malmesbury, Paleisheuwel. Typen in Halle.

(20) *O. mendax* Péringuey 1902

Den 3 vorausgehenden Arten und *axillaris* Burm. ähnlich, durch die nur 2-zähnigen Vorderschienen sofort zu unterscheiden. Pygidialteil des ♂ einfarbig gelb, das Propygidium des ♀ hat 2 sich wenig abhebende dunklere Flecken. Länge 6–6,5 mm. Namaqualand. Type in Kapstadt.

(21) *O. cylindricus* Burmeister 1844 (=*flavipennis* Blanchard 1850)

Bekannte Art mit rudimentärer Halsschildfurche. Länge 4 mm. Cape Town, Camps Bay, Stellenbosch, Tulbagh. Typen in Halle.

(22) *O. namaquensis* nova species

Schwarzer *Omocrates* mit gelbbraunen Flügeldecken aus der Verwandtschaft des *cylindricus*, der durch breiteren 2-zähnigen Kopfschild, gewölbteren Halsschild und nur spärlich beschuppten Pygidialteil unterschieden ist.

Während der Kopfschild des *cylindricus* Burm. verschmälert ist, bleibt er hier vorn ungefähr so breit wie an der Basis, die Ecken sind schräg aufgebogen. Der grobgerunzelte Kopf ist auf der Stirn kurz hellbraun beborstet. Der Halsschild ist gewölbter und fällt zum Kopf fast so steil ab wie bei den *Dicranocnemus*. Er ist ein wenig breiter als lang, bis zur Mitte parallelseitig, dann allmählich verschmälert, fein gerunzelt, dicht lang aufrecht bräunlich behaart, ohne Schuppen. Hinten mit rudimentärer Furche. Das glänzend schwarze Schildchen zeigt keine Schuppen, allerdings ist bei dem einzigen vorhandenen

Exemplar die Nadel durch das Schildchen gesteckt, wodurch Schuppen verdeckt worden sein könnten. Die Flügeldecken sind glänzend gelbbraun, mit tiefen Eindrücken neben der Schulter bis zur Mitte der Scheibe und neben der Naht, auf den erhobenen Stellen fast glatt, sonst zerstreut punktiert, unbehaart und unbeschuppt. Pygidialteil und Abdomen glänzend schwarz, mit kleinen borstenförmigen hellen Schuppen, größtenteils aber unbeschuppt, fein punktiert. Bauchringe zur Hälfte hell beschuppt. Brust dicht und lang gelb behaart. Alle Beine pechschwarz, alle Krallen doppelt, ungleich und die größere deutlich gespalten. Nur 1 ♂ bekannt. Länge 4 mm. Bowesdorp Namaqualand. Typus in Kapstadt.

(23) *O. elongatus* Blanchard 1850

Blieb mir in natura unbekannt und ist nur nach der Beschreibung eingeordnet. Länge 5,25 mm. „Kap." Typus im Pariser Nationalmuseum.

(24) *O. canaliculatus* Blanchard 1850

Diese etwas kürzer als die anderen kleinen Arten gebaute Art ist sehr leicht an der tiefen, den ganzen Halsschild durchlaufenden Furche zu erkennen, welche das ganze innere Drittel des Halsschildes ausfüllt. Länge 4 mm. Hopefield. Typus im Nationalmuseum Paris.

3. Cylindrocrates novum genus

Diese neue Gattung besitzt die Eigenschaften der Gattung *Omocrates* bis auf eine, die nach hinten verschmälerten Flügeldecken, welche das Abdomen nicht ganz bedecken. Das große Schildchen ist dreieckig, die Körperform schmal, die Vorderschienen sind einspitzig und ihre Seitenzähne stehen rechtwinklig ab. Die Flügeldecken sind fast parallelseitig und bedecken das Abdomen ganz, ihr Seitenausschnitt ist ein sehr flacher Bogen. Das Propygidium fällt beim ♂ senkrecht ab, das Pygidium schräg nach vorn. Das ♀ ist noch unbekannt.

Die Zahl der Seitenzähne halte ich für kein Gattungsmerkmal. Genotyp und bisher einzige Art ist *parallelus* nova species.

C. parallelus nova species

Schwarz, Grundfarbe der hinteren Hälfte des Halsschildes rotbraun, mit hellbrauner geschlossener feiner Beschuppung auf Hinterkopf, vorderem Drittel des Halsschildes und seinem Hinterrand, Schildchen und Flügeldecken; mit geschlossener orangeroter Beschuppung des Pygidialteiles und letzen Bauchringes, mit dichter weißer Beschuppung der Restfläche des Abdomen und der Seitenstücke der Brust und mit weißer Behaarung der Brustseiten.

Kopfschild glänzend schwarz, verschmälert, fein runzlig-körnig, vorn gerade, an den Ecken in schmale spitzige Zähne aufgebogen. Stirn stärker punktiert und hellbraun beschuppt, ohne Haare. Halsschild etwas länger als breit, hinten bogig zum Schildchen vorgezogen, mit verrundeten Hinterecken, in den hinteren zwei Dritteln fast parallel, dann verschmälert, vorn gerade abgeschnitten. Der größte Teil der glänzenden, stark punktierten, ziemlich flachen Oberfläche ist unbeschuppt, vorn schwarz, hinten rotbraun. Die abfallenden Seiten des vorderen Drittels und ein schmaler Hinterrand sind dicht hellbraun beschuppt. Die Schuppen sind länglich. Das große gleichseitig-dreieckige körnige Schildchen ist dicht beschuppt mit Ausnahme der Mitte der Basis auf eine kurze Strecke. Die Flügeldecken sind $1\frac{1}{2}$ mal so lang als zusammen an den Schultern breit, fast parallel, flach, mit steil abfallenden Seiten, deshalb ist der flache Seitenausschnitt von oben nicht zu sehen. Apex gemeinsam abgerundet mit rechtwinkligen Nahtecken. Schulter- und Apikalbeulen nicht betont. Auffallend ist eine schwarze eingegrabene Linie, die in gerader Richtung von der oberen Ecke des Schildchens schräg nach außen zum Beginn des Seitenausschnitts läuft und nicht beschuppt ist. Die Seiten des Abdomen sind von den Flügeldecken ganz bedeckt und nicht sichtbar. Ohne Haare. Hautflügel rauchbraun. Die orangeroten Schuppen des Pygidialteiles sind noch kleiner als die der Flügeldecken. Die Vorderbeine sind pechschwarz, die anderen Beine rotbraun. Die Vorderschienen zeigen 6 Zähne, auf den schräg-abwärts gerichteten Apikalzahn folgen nach einer Lücke die rechtwinklig und etwas nach unten gebogenen Seitenzähne, zunächst ein großer, dicht daneben ein nur wenig kürzerer und dann die 3 restigen wesentlich kürzeren und etwas weiter auseinander stehenden Zähne, deren letzter sehr kurz ist. Schenkel mit weißen, Schienen mit gelblichen Borstenhaaren. Alle Beine mit doppelten ungleichen Krallen. Die größere ist tief gespalten. Länge 5,5, Breite 2 mm. Wallekraal, Namaqualand. Nur 1 ♂ liegt vor. Typus in Kapstadt.

4. GONIASPIDIUS Burmeister 1844 (nec Péringuey 1902). Genotyp *brevis* Burm. 1844

Schon durch den Vergleich der Beschreibungen wird klar, daß jeder dieser Autoren einen anderen Käfer meint. Besonders beim Schildchen und in der Zahl der Krallen der Hinterbiene wird dies deutlich und der Vergleich der Typen Burmeisters mit den von Péringuey als *brevis* bestimmten Individuen des Südafrika-Museums beseitigt alle Zweifel. Das Schildchen bei unserer Gattung ist ein gleichschenkliges Dreieck, dessen Basis ein wenig kürzer ist als die Seiten. Im Gegensatz dazu ist es bei der Péringueyschen Gattung in der Hauptsache ein gewölbtes Viereck, dem hinten ein sehr flaches stumpfwinkliges Dreieck angehängt ist.

Die sonstigen Eigenschaften teilt die Gattung mit *Omocrates* mit Ausnahme der kurzen breiten Körperform; der Autor sagt sie verhalte sich zu *Omocrates* wie diese Gattung zu den breiten *Heterochelus*, aber mit großem Schildchen. Zu den *Goniaspidius*-Arten:

(1) *G. brevis* Burmeister 1844 (nec Péringuey 1902)

Genotyp. Durch einkrallige Hinterschienen gekennzeichnet. Kopfschild mit 3 starken Zähnen. Schwarz, Flügeldecken des ♂ dunkelrotbraun mit schwarzem Saum oder ganz schwarz, beim ♀ Flügeldecken, Abdomen und Beine ganz rotbraun. Vorderschienen mit schräg abwärts gebogenem Apikalzahn und 2 senkrecht abstehenden Seitenzähnen. Überall ohne Bindenbildung lang abstehend dunkel behaart. Tarsenglieder zylindrisch. Länge 6,5 mm. „Südafrika." Ich habe nur die Typen gesehen. Typen in Halle.

(2) *G. lebisi* (Schein)

Ich habe diese Art als *Omocrates* in einer Arbeit für das Institut des Parcs Nationaux du Congo Belge beschrieben, deren Manuskript wohl vor dieser Arbeit gedruckt werden wird.

Hinterbeine mit 2 Krallen. Kopfschild 3-zähnig. Schwarz, Flügeldecken rotbraun mit 2 unbeschuppten Rippen und 3 Längsbinden aus dicken weißen Härchen, Pygidialteil von rundlichen wenig dichten gelben Schuppen bedeckt, Vorderschienen 2-zähnig. Länge 3 mm. Congo Belge, Upemba Park. Type in dem genannten Institut des Parcs Nationaux du Congo Belge.

(3) *G. angolensis* nova species

Schwarzer *Goniaspidius* mit rotbraunen ohne Bindenbildung weiß behaarten matten Flügeldecken, 2-zähnigen Vorderschienen und 2-kralligen Hinterbeinen.

Schwarz, Flügeldecken und Beine rotbraun. Kopfschild quer, parallelseitig, vorn mit 3 aufgebogenen Zähnen, wie der Kopf fein punktiert, mit dunklen Härchen. Halsschild so lang als breit, bogig zum Schildchen vorgezogen, mit stumpfen Hinterecken, in den hinteren zwei Dritteln wenig, dann stark verschmälert, vorn gerade, die spitzen Vorderecken unter die Augen eingebogen, im hinteren Teil stark gewölbt, mit von der Mitte an tiefer Furche und schmalen Eindrücken am Hinterrand. Sehr fein punktiert, matt, in der vorderen Hälfte aufrecht gelb behaart, am Seiten- und Hinterrand mit kurzem gelbem Schuppensaum. Das große Schildchen gleichseitig-dreieckig, runzlig, matt, ohne Haare oder Schuppen. Flügeldecken so lang als zusammen breit, verschmälert und das Abdomen nicht bedeckend, Nahtecken rechtwinklig. Durch Eindrücke neben Schulter und Naht und auf der Scheibe uneben. Überall mit gereihten, nicht dichten kurzen weißen Börstchen. Apikalrand mit feinem gelbem Schuppensaum. Pygidialteil fein gelb beschuppt und dazwischen behaart. Das Pygidium fällt beim ♂ senkrecht, beim ♀ schräg nach hinten ab. Abdomen schwarz, an den letzten 3 Ringen braun mit dichten gelben Borstenschuppen. Brust schwarz, seitlich gelb behaart. Vorderschienen mit gerade vorgestrecktem Apikalzahn und einem schräg nach unten gerichteten Seitenzahn. Hinterschienen bei ♂♀ mit Sporn. Alle Krallen doppelt und ungleich, die längere gespalten. Länge 5 mm. Angola, Kuangu. Typen im Museum Georg Frey in Tutzing vor München.

5. Rectoscutaria nomen novum, für *Goniaspidius* Péringuey 1902 (nec Burmeister 1844)

Genotyp *péringueyi* nom. nov.

Da, wie oben ausgeführt, Péringuey einen anderen Käfer für *Goniaspidius brevis* Burm. gehalten hat, müssen seine Gattung und seine Art neue Namen erhalten. Ihre Beschreibung steht im „Descriptive Catalogue of the Coleoptera of South Africa" von Péringuey Seite 785/6. Hauptmerkmal ist die Form des großen Schildchens. Es stellt ein Viereck dar, dessen untere Seite die Basis eines gleichschenkligen Dreiecks mit sehr geringer Höhe ist, weshalb das Schildchen sehr stumpfwinklig endet.

Die bekannten Arten haben am Vorderrand des Kopfschildes drei starke Zähne, an den Vorderschienen außer dem Apikalzahn zwei Seitenzähne, an allen Beinen zwei ungleiche Krallen und bei ♂♀ einen Sporn an den Hinterschienen.

Zu den *Rectoscuraria*-Arten:

(1) *R. péringueyi* nomen novum für *brevis* Péringuey nec Burmeister.

Die Flügeldecken dieser schwarzen Art sind sehr uneben und schwarz oder ganz oder teilweise braun, das Pygidium ist gelb beschuppt, die Hintertarsen der ♂♂ sind etwas länger als die Schienen, die Tarsenglieder sind am Ende in scharfe Ecken ausgezogen, nicht zylindrisch wie bei der echten *brevis*. Nach der Beschuppung der Oberseite lassen sich drei Rassen unterscheiden:

Nominatform: Die weißen anliegenden haarähnlichen Schuppen bilden 3 Längsbinden auf jeder Flügeldecke. Länge 5–6 mm. Touwsrivier, Dikbome Merweville Koup, Klaarstroom Prince Albert, Lammerskraal Prince Albert, Willowmore.

Rasse *lunata* nov. Jede der 3 Binden ist vorn und hinten derart verkürzt, daß alle 6 Binden zusammen einen nach vorn offenen Bogen bilden. Meist ist der Grund der Flügeldecken im Bereich dieser bogigen unterbrochenen Querbinde rotbraun. Länge 5–6 mm. Brandkop Nieuwoudtville, Willowmore.

Rasse *uniformis* nov. Diese hat keine Binden, sondern auf der ganzen Fläche halb abstehende feine graue Härchen. Länge 5–6 mm. Willowmore. Typen der Nominatform und *lunata* in Kapstadt, der *uniformis* in Pretoria.

(2) *R. simplex* Péringuey 1902

Schwarz, Flügeldecken dunkelrotbraun mit angedunkelten Seiten und Beulen, Flügeldecken weniger uneben, nur unterhalb des Schildchens flach eingedrückt. Der Hauptunterschied liegt in der Form des Apikalzahnes, der mehr umgebogen und fast parallel zu den Seitenzähnen ist. Länge 5,6–7 mm. Touwsrivier. Type in Kapstadt.

6. Omocnemus genus novum

Diese Gattung steht zwischen *Omocrates* und *Dicranocnemus*. Von jener hat sie das große Schildchen, von dieser die beim ♂ zweispitzigen Vorderschienen. Sie ist die einzige Gattung der Heterochelides, bei der die Zähnung der Vorderschienen nach dem Geschlecht verschieden ist. Diese Schienen besitzen 3 scharfe Zähne; beim ♂ sind die beiden apikalen Zähne genähert, parallel gestellt und am Grunde verwachsen, beim ♀ sind sie getrennt, der mittlere Zahn steht vom apikalen weiter ab und zeigt fast rechtwinklig nach außen. Der basale Zahn ist bei beiden Geschlechtern ein wenig kürzer.

Der Halsschild ist flach, das Schildchen ein gleichseitiges Dreieck mit etwas ausgebogenen Seiten. Das Pygidium fällt beim ♂ schräg nach vorn, beim ♀ steil nach hinten ab. Genotyp und bisher einzige Art ist *kochi* nova species.

O. kochi nova species

Schwarzer *Omocnemus* mit rotbraunen, hinten angedunkelten, nach hinten verschmälerten im hinteren Teil weißgelb behaarten Flügeldecken, gelb beschupptem Pygidium, pechschwarzen Vorderbeinen, rotbraunen übrigen Beinen und stumpf-dreizähnigem Kopfschild.

Letzterer ist quer, fast parallelseitig mit stumpf aufgebogenen Ecken, dazwischen ein breiter oben abgerundeter aufgebogener Lappen, der aus 2 zusammengewachsenen Zähnen entstanden sein dürfte. Der ganze Kopf ist körnig-runzlig. Die Fühler sind braungelb mit schwarzem Fächer. Der Halsschild ist hinten so breit als lang, hinten bogig zum Schildchen ausgezogen, mit rechtwinkligen, die Schultern umfassenden Hinterecken, nach vorn gleichmäßig verschmälert, sehr fein punktiert und glänzend, unbehaart, über dem Schildchen mit gelblichem Schuppensaum, sonst ohne Schuppen. Schildchen runzlig, mit Ausnahme der Mittellinie dicht weiß beschuppt. Flügeldecken mit starkem Seitenausschnitt und betonten Beulen, Seiten steil abfallend, am Apex einzeln abgerundet, mit Eindrücken neben der Schulter, auf der Scheibe und längs der Naht. Die ganze Fläche ist sehr fein runzlig-punktiert und schwach glänzend, in der Nahtdepression, auf den abfallenden Seiten und auf den hinteren zwei Dritteln der Flügeldecken sind dichte feine anliegende weißgelbe Härchen vorhanden. Propygidium sammetschwarz mit gelbem Apikalrand, Pygidium des ♂ dicht orangegelb, des ♀ heller gelb beschuppt. Das Abdomen, dessen Seiten von oben sichtbar sind, ist oben weiß, sonst gelblich beschuppt. Die Seitenstücke der Brust sind weiß beschuppt, dazwischen hell behaart. Die Tarsen der pechschwarzen Vorderbeine sind braun, die anderen 4 Beine sind rotbraun, die Beine sind schlank ohne besondere Anhänge. Alle Krallen sind doppelt und ungleich, alle gespalten. Das ♀ ist—abgesehen von der Form des Pygidiums, des Abdomen und der Zähnung der Vorderschienen—dem ♂ sehr ähnlich. Länge 5–6 mm. Aus, Great Namaland. Herrn C. Koch in Pretoria gewidmet. Typen in Pretoria.

7. Dicranocnemus Burmeister 1844

Die zweispitzigen Vorderschienen und der gewölbte Halsschild sind die Merkmale dieser Gattung. Burmeister hat nur Arten mit kleinem Schildchen gekannt; inzwischen sind auch solche mit großem Schildchen wie bei *Omocrates* gefunden worden, auf welche ich die Untergattung *Macrodicranocnemus* novum subgenus errichte. Ihr einziges Unterscheidungsmerkmal gegen *Dicranocnemus* Burm. sensu stricto ist das große Schildchen. Subgenotyp *andreaei* n. sp.

Zu den *Macrodicranocnemus*-Arten:

Bisher sind zwei Arten gefunden worden, deren eine in 2 Rassen vorkommt.

(1) *D. andreaei* nova species

Schwarzer *Macrodicranocnemus* mit braunen Flügeldecken, 2-zähnigem Kopfschild, lang und dicht aufrecht behaartem Halsschild, gelb beschupptem Pygidialteil und schwarzen Beinen. Der nach vorn stark verschmälerte Kopfschild ist in 2 starke Zacken aufgebogen. Der Kopf dicht gekörnt, oben lang und dicht rotbraun behaart, seitlich abstehend schwarz beborstet. Fühler schwarz. Der stark gewölbte Halsschild ist hinten bogig abgeschnitten, hat stumpfe Hinterecken, ist in den hinteren zwei Dritteln parallelseitig und dann verschmälert und besitzt eine tiefe Furche, die fast bis zum Vorderrand reicht. Er ist dicht und fein punktiert und dicht und lang aufrecht gelblich behaart. Das große dreieckige Schildchen schwarz mit gelben nicht dichten Schuppen. Flügeldecken hellbraun mit unregelmäßig verteilten gelben Schuppen, die quer über die Scheibe beider Flügeldecken 4 Fleckchen und hinter den Apikalbeulen bogige Bindchen bilden. Mit Eindrücken neben der Schulter und auf der Scheibe, narbig punktiert, schwach glänzend. Pygidialteil sehr dicht dunkelgelb beschuppt und abstehend gelb behaart, wie auch die Seiten des sonst schwarzen Abdomen. Brust lang bräunlich behaart. Beine schwarz mit braunen Börstchen besonders an den Hinterschienen, die bei ♂♀ einen langen Sporn tragen. Alle Krallen doppelt und ungleich, die längere gespalten. Länge 6–7,5 mm. Seven Weeks Poort Berg Ladismith, Riversdale, Tradouw Pass Swellendam. Type in Kapstadt.

(1a) *D. andreaei* subspec. *zumpti* nova

Diese Rasse unterscheidet sich durch dunkelrotbraune, an den Schultern und am Apex angedunkelte Flügeldecken und dunkelbraune, vorn fast schwarze abstehende Behaarung des Halsschildes. Sonst von der Nominatform nicht verschieden. Länge 6–7,5 mm. Robinson Pass nordwestlich der Mossel Bay. Type im Museum Georg Frey in Tutzing vor München.

(2) *D. hirtipes* nova species

Schwarzer *Macrodicranocnemus* mit braunschwarzen Flügeldecken mit gelber Schuppenzeichnung, der sich durch lange buschige Behaarung der Hinterschienen und ihrer Tarsen auszeichnet. Kopf und Halsschild sehr ähnlich dem vorigen, tiefschwarz mit kürzerer braunschwarzer Behaarung. Flügeldecken schwarz, auf der Scheibe dunkelrotbraun, mit einer Zeichnung aus hellgelben Schuppen; sie besteht aus je einem kurzen Streifen neben der Mitte der Naht, je einem doppelt so langen Streifen auf der Scheibe und je 2 rundlichen kleinen Flecken an und neben dem Ende der Naht. Der Pygidialteil ist hellgelb beschuppt, das Propygidium dichter als das Pygidium. Ebenso beschuppt sind die Seiten des schwarzen Abdomen. Brust schwärzlich behaart. Beine schwarz mit braunen Krallen, die Hinterschienen mit ihren Tarsen sind auffallend dicht und lang buschig schwarz behaart. Alle Krallen sind doppelt und ungleich.

Die ♀♀ gleichen den ♂♂, die wenigen Exemplare sind kleiner als diese, was ein Zufall sein kann. Länge 5–6 mm. Leipoldtville Elandsbaai, Graafwater. Typen in Kapstadt.

Zu den Arten von *Dicranocnemus* sensu stricto. Genotyp *sulcicollis* Wied.

(3) *D. natalensis* Péringuey 1902

Die Art ist schon durch den flacheren Halsschild von den anderen sehr verschieden. Länge 5,25–5,5 mm. Natal, Estcourt. Cape Province, Dunbrody. Type in Kapstadt.

(4) *D. spiniceps* Péringuey 1904

Einzige Art mit kurzem Trochanterdorn beim ♂. Länge 4,5 mm. Willowmore, Ashton. Type in Kapstadt.

(5) *D. pulcher* Péringuey 1902

Diese und die *sulcicollis*-Formen haben ein sehr ähnliches Zeichnungsmuster, das sich auch bei *hypocrita* findet. Man unterscheidet sie am sichersten am Kopfschild. Dieser ist bei *pulcher* breiter, mit rechtwinkligen, nicht oder höchstens als kleines Körnchen aufgebogenen Ecken. Bei den *sulcicollis*-Formen ist er nach vorn verschmälert und sind seine Vorderecken in scharfe Zacken aufgebogen. Bei *hypocrita* sind die Ecken abgerundet und gar nicht aufgebogen. Länge 5–5,5 mm. Barrydale, George, Grahamstown, Port Alfred. Typen in Kapstadt.

(6) *D. sulcicollis* Wiedemann 1821

Halsschild stark aufrecht hell behaart und in der Furche und hinten an den Seiten gelb beschuppt. Die braunen Flügeldecken haben außer dem Nahtfleck mehrere gelbe Schuppenstreifen. Das ♀ ist ähnlich, nur ohne Schuppen auf dem Halsschild. Länge 4,5–6,5 mm. Cape Town, Salt River, Zeekoe Vlei, Cape Flats, Stellenbosch, Hex River. Typus im Museum Kopenhagen.

(6a) *D. sulcicollis* subspecies *niger* nova

Man könnte diese Rasse für eine gute Art halten, weil sie durch die tiefschwarze Grundfarbe des ganzen Körpers und nur einen sehr hellgelben Schuppenstreifen auf der Scheibe der Flügeldecken sehr abweichend aussieht. Da sie aber alle sonstigen Merkmale mit der Stammform gemeinsam hat, ist sie besser als Rasse zu werten. Der schwarz behaarte Halsschild ist in der Furche und hinten an den Seiten beim ♂ beschuppt, das sehr ähnliche ♀ hat auf dem Halsschild fast keine Schuppen. Die Beine sind schwarz, nur die Tarsen und die Spitzen der Seitenzähne der Vorderschienen sind rotbraun. Länge 5–5,5 mm. Obere Quellen des Olifants River in Ceres, Elandsbaai, Kamieskroon in Namaqualand. Typen in Kapstadt, Paratypen im Museum Georg Frey in Tutzing.

(6b) *D. sulcicollis* subspecies *fürschi* nova

Diese Rasse unterscheidet sich von der Nominatform durch längere und heller gelbe Behaarung des Halsschildes, den konstant fehlenden äußeren

Schuppenstreifen der Flügeldecken und die mehr graugelbe Beschuppung des Pygidiums; in allen sonstigen Merkmalen gleicht sie dem *sulcicollis*. Dem Spezialisten für Coccinelliden Fürsch in München gewidmet. Länge 5 mm. Saldanha Bay. Type in Kapstadt.

(7) *D. nudus* nova species

Schwarzer *Dicranocnemus* aus der Verwandtschaft des *sulcicollis* Wied. mit gelbbraunen Flügeldecken ohne Zeichnung, weißgelb behaartem Propygidium und nur sehr dünn staubförmig hell beschupptem, fast nackt erscheinendem Pygidium.

Kopf und Halsschild ähnlich *sulcicollis*, doch sind die Ecken des Kopfschildes weniger hoch aufgebogen. Die Halsschildfurche ist hier bei ♂♀ unbeschuppt, ebenso das schwarze Schildchen. Der Kopf ist fein gekörnt, der Halsschild fein dicht punktiert, mäßig glänzend und nicht sehr lang dicht aufrecht gelb behaart. Ebenso das Schildchen. Die hell gelbbraunen Flügeldecken sind nackt, mäßig glänzend und tragen nur am Rande einige helle Härchen. Die weißgelbe Behaarung des Propygidiums ist ziemlich dicht und liegt an, das Pygidium ist glänzend pechschwarz, die feinen staubförmigen Schuppen sieht man mit bloßem Auge kaum. Außer ihnen sind einige wenige abstehende weißliche Haare vorhanden. Das schwarze Abdomen ist an den Seiten ähnlich behaart wie das Propygidium. Auch die Brust trägt weißliche Haare. Die Beine sind braun, die Hinterscheinen haben bei ♂♀ einen Sporn, alle Krallen sind doppelt und ungleich. Das ♀ ist dem ♂ sehr ähnlich. Die Art ist von dem oberflächlich ähnlichen *natalensis* durch den gezähnten Kopfschild, den gewölbten Halsschild und die unbeschuppten und unbehaarten Flügeldecken leicht zu unterscheiden. Länge 4,5 mm. Saldanha Bay. Typen in Kapstadt.

(8) *D. mendicus* Péringuey 1902

Die Art ist an dem mit Ausnahme des vorderen Teiles dicht beschuppten Halsschild und an den grauweißen Schuppenstreifen auf den sonst braunen Flügeldecken leicht zu erkennen. Nach der mir vorliegenden Reihe scheint die Größe der Art von Westen nach Osten abzunehmen. Alle Exemplare aus Fort Beaufort messen nur 4 mm. Beim ♀ sind die Schuppen durch Härchen ersetzt. Länge 4–4,5 mm. Klaarstroom Prince Albert, Patentie Humansdorp, Uitenhage, Port Elizabeth, Algoa Bay, Dunbrody, Albany Resolution, Grahamstown, Fort Beaufort. Typen in Kapstadt.

(9) *D. hypocrita* Péringuey 1902

Ähnlich *pulcher* und *sulcicollis* gezeichnet, ist die Art an den abgerundeten Ecken des Kopfschildes zu erkennen. Länge 4 mm. Villiersdorp, Hawston, Port Elizabeth. Typen in Kapstadt.

(10) *D. burchelli* Arrow 1917

Diese mir in natura unbekannte Art ist nur nach der Beschreibung eingereiht. Länge 4,5–5,5 mm. Uitenhage. Typen Britisches Museum in London.

(11) *D. arduus* Péringuey 1904

Auch diese Art kenne ich nicht in natura. Länge 4 mm. Uitenhage Port Elizabeth. 2 Typen in Kapstadt.

(12) *D. pulverulentus* Burmeister 1844

Ähnlich *mendicus*, aber Flügeldecken einfarbig hellgelb beschuppt. Länge 4,5 mm. Knysna, Patentie Humansdorp, Uitenhage, Grahamstown. Typen in Halle.

(13) *D. squamulatus* Burmeister 1844

Von dem folgenden am leichtesten durch die deutlichen Kopfschildecken und die fast zeichnungslosen Flügeldecken zu unterscheiden. Länge 4–5 mm. Port Elizabeth, Uitenhage, Dunbrody, Grahamstown. Typen in Halle.

(14) *D. squamosus* Burmeister 1844

Die Ecken des Kopfschilds sind hier abgerundet, die Flügeldecken haben eine Zeichnung ähnlich *sulcicollis*, die stark variiert. Länge 4–5,5 mm. Cape Town, Stellenbosch, Mossel Bay, Keurbooms River Knysna, Patentie Humansdorp, Port Elizabeth, Algoa Bay, Dunbrody, Kowie (Port Alfred), Grahamstown. Type in Halle.

8. Nanniscus Burmeister 1844

Diese Gattung steht zwischen *Dicranocnemus*, von der sie die zweispitzigen Vorderschienen hat, und *Diaplochelus*, mit welcher Gattung sie den parabolischen Kopfschild gemein hat. Der flache Halsschild hat rechtwinklige Hinterecken und ist zunächst schwächer, dann stärker nach vorn verschmälert. Das kleine Schildchen ist herzförmig. Die verhältnismäßig kurzen Flügeldecken bedecken die Seiten des Abdomen vom Seitenausschnitt an nicht.

Einzige Art:

N. pulicarius Burmeister 1844

Schwarz, Flügeldecken hellgelb, Beine hellbraun. Oben von feinen fast anliegenden kurzen weißen Härchen bedeckt, die ein seidiges Aussehen verursachen und den Grund nicht verdecken. Ich habe nur die beiden Typen gesehen, deren Hintertarsen, bis auf die 2 basalen Glieder bei einem Bein, abgebrochen sind. Diese 2 Glieder sind sehr lang, dreimal so lang als breit. An der Nadel steckt eine kleine Skizze des Autors, die zeigt, daß die Hinterkrallen doppelt, sehr ungleich und beide gespalten sind. Die Hinterschienen sind sehr schräg abgeschnitten und tragen einen langen spitzen Sporn. Länge 2,5 mm. Ohne nähere Heimatangabe. 2 Typen in Halle.

9. Bizanus Péringuey 1902

Merkmale sind der parabolische, vorn von einem erhobenen Rand umgebene Kopfschild, die nach hinten verschmälerten, das Abdomen nicht ganz bedeckenden Flügeldecken und der Anhang am Grund der Kralle der Mittelschienen des ♂, der in rudimentärer Form auch beim ♀ vorhanden ist. Bei *Nanniscus* und *Diaplochelus* fehlt dieser Anhang, letztere Gattung hat fast parallelseitige Flügeldecken. Die Hinterbeine der ♂♂ sind robuster als die der ♀♀. Genotyp *caliginosus* Pér.

Zu den *Bizanus*-Arten:

(1) *B. caliginosus* Péringuey 1902

Schwarz mit schokoladebraunen Flügeldecken und beim ♂ roten Vorderbeinen. Oben beim ♂ grau beschuppt, mit gelbbeschupptem Propygidium und glattem, unbeschupptem Pygidium. ♀ oben mit dunkler, längerer Behaarung, auch auf dem Pygidium, die manchmal grauweiß wird. Länge 3,25–4 mm. Obere Quellen des Olifants River, Tulbagh, Ceres, Touwsrivier. Typen in Kapstadt.

(2) *B. vansoni* nova species

Schwarze *Bizanus*-Art mit hellbraunen Flügeldecken ohne deutliche Rippen, mit feiner staubartiger grauweißer Beschuppung der Oberseite, gelber Beschuppung des Pygidialteiles und dichter weißer Beschuppung des Abdomen, mit roten Vorderbeinen und tiefschwarzen Hinterbeinen.

Kopfschild parabolisch, vorn fein gerandet, fein gerunzelt, fast matt, fein abstehend dunkel behaart. Halsschild so lang als breit, etwas oberhalb der Mitte am breitesten, von dort nach vorn stärker verengt als nach hinten, mit stumpfen Hinterecken, hinten etwas zum Schildchen vorgezogen, wenig gewölbt, mit Furche im hinteren Teil und je einem rillenartigen Eindruck beiderseits der Mitte längs des Hinterrandes. Sehr fein punktiert, auf den Seitenteilen staubartig grauweiß beschuppt, mit einigen abstehenden hellen Haaren dazwischen, schwach glänzend. Das kleine schmale Schildchen dicht gelbweiß beschuppt. Die hellbraunen Flügeldecken sind nach hinten verschmälert und bedecken die Seiten des Abdomen nicht. Sie sind staubförmig weißlich beschuppt, der Untergrund bleibt sichtbar. Das schmale Propygidium und das Abdomen sind geschlossen weißlich beschuppt, während das Pygidium staubartig gelb beschuppt ist und bei ihm der Grund sichtbar bleibt. Die Brust ist dünn hell behaart. Die mittleren und hinteren Beine, deren tiefschwarze Farbe stark gegen die roten Vorderbeine kontrastiert, sind verdickt, wenn auch seitlich mäßig zusammengedrückt. Die Hinterschienen haben auf der oberen Kante mehrere Sägezähne mit Dornen. Die Vorderkrallen sind doppelt und ungleich, gespalten, die Mittelkralle ist einzeln und gespalten und trägt den charakteristischen Anhang an der Basis, die Hinterkrallen sind einzeln und einfach. Nur ♂♂ liegen vor. Länge 4 mm. Vanrhyns Pass. Type in Pretoria.

10. Diaplochelus Burmeister 1844

Merkmale sind der parabolische Kopfschild und die das Abdomen ganz bedeckenden Flügeldecken. Genotyp *longipes* F.

Zu den *Diaplochelus*-Arten:

(1) *D. crassipes* Burmeister 1844

Größte, allbekannte Art. Péringuey irrt, wenn er *squamulatus* Burm. damit synonym gestellt hat. Burmeister schreibt in seinem Handbuch ganz richtig, daß *crassipes* an den Hinterbeinen nur eine Kralle, *squamulatus* aber doppelte und ungleiche Krallen hat, was ich an der Type nachprüfen konnte. Länge 8–10 mm. Gifberg Vanrhynsdorp Distr., Malmesbury, Ceres, Cape Town, Franschhoek, Caledon, Cogmans Kloof Montagu, Bechuanaland. Type in Halle.

(2) *D. squamulatus* Burmeister 1844 (=*transvaalensis* Péringuey 1902)

Es ist logisch, daß Péringuey nach Synonymstellung der Burmeisterschen Art denselben Käfer neu beschrieben hat. Ein mildernder Umstand für ihn ist, daß Burmeister in seiner Beschreibung die charakteristischen Sägezähne auf der unteren Kante der Hinterschienen nicht erwähnt hat, sodaß Péringuey der Meinung sein konnte, eine neue Art gefunden zu haben. Ich habe die Typen vor mir gehabt, sie besitzen dieses Merkmal sehr deutlich. Alle *Diaplochelus*-Arten kommen mit gelbbraunen Flügeldecken und Beinen, mit schwarzen Decken und Beinen und in Übergängen dazwischen vor. Obwohl es sich um Farbformen handelt, hat man ihnen Namen gegeben, die Burmeister zitiert, so hier *castaneus* Ecklon für Stücke mit braunem Halsschild, *maculicollis* für Stücke mit schwarzem, braungeflecktem Halsschild. Zwischen *rufipes* Ecklon und der Nominatform finde ich keinen Unterschied. Man könnte *transvaalensis* als Bezeichnung einer ganz gelbbraunen Farbform benützen. Länge 5,5–7 mm. Oudebosch Zonderend, Caledon, Transvaal Johannesburg. Typen in Halle.

(3) *D. longipes* Fabricius 1787

Auch bei dieser altbekannten Art gibt es Namen für abweichende Farbformen, die Burmeister zitiert (*rufiventris* Ecklon, *pallidipennis* Ecklon, *luridipennis* Ecklon, *obscurus* Ecklon). Sie haben keinen systematischen Wert.

Länge 5,5–7 mm. Gifberg Vanrhynsdorp Distr., Clanwilliam, Malmesbury, Great Winterhoek, Tulbagh, Cape Town, Noordhoek, Schusters Kraal, Cape Flats, Somerset West, Stellenbosch, Franschhoek, Caledon, Riversdale, Knysna, Willowmore. Type im Museum Kopenhagen.

Bestimmungstabellen

Gattungstabelle der Heterochelides

1 (22) Kopfschildvorderrand gerade abgestutzt, meist mit 2–4 aufgebogenen Zähnen.
2 (15) Spitze der Vorderschienen nicht gespalten, entweder parallel zu den Seitenzähnen umgebogen oder schräg nach vorne-außen zeigend.
3 (8) Schildchen klein (etwa ¼ der Naht), herzförmig.
. . . . . *Dichelus* Serv. sensu lato (pp. 230, 257)
4 (5) Hinterbeine mit 2 gleichlangen Krallen.
. . . . . Subg. *Dichelus* Serv. sensu stricto (pp. 231, 257)
5 (4) Hinterbeine mit 2 in der Länge stark verschiedenen Krallen oder mit nur einer Kralle.

6 (7) Vorderschienen mit 3 Zähnen. . . . Subg. *Heterochelus* Burm. (p. 231)
7 (6) Vorderschienen mit mehr als 3 Zähnen. . Subg. *Ischnochelus* Burm. (p. 231)
8 (3) Schildchen groß (mindestens ¼ der Naht).
9 (14) Schildchen dreieckig.
10 (13) Körperform länglich, mindestens doppelt so lang als breit.
11 (12) Flügeldecken deutlich nach hinten verschmälert.. *Omocrates* Burm. (pp. 240, 260)
12 (11) Flügeldecken parallelseitig. . . . . *Cylindrocrates* nov. gen. (pp. 246, 263)
13 (10) Körperform kürzer, gedrungen. *Goniaspidius* Burm. (nec Péringuey) (pp. 247, 263)
14 (9) Schildchen im basalen Teil parallelseitig, im apikalen Teil stumpfwinklig.
. . . . *Rectoscutaria* nov. gen. für *Goniaspidius* Pér. nec Burm. (pp. 248, 263)
15 (2) Vorderschienen mindestens beim ♂ zweispitzig.
16 (17) Vorderschienen beim ♂ dadurch zweispitzig erscheinend, daß der apikale Seitenzahn dem Spitzenzahn genähert und parallel steht, während er beim ♀ weiter absteht und nicht parallel ist. . . . . *Omocnemus* nov. gen. (pp. 249, 264)
17 (16) Vorderschienen bei ♂♀ zweispitzig.
18 (19) Schildchen groß wie bei den Omocrates-artigen.
Dicranocnemus subgen. *Macrodicranocnemus* nov. (pp. 250, 264)
19 (18) Schildchen klein, herzförmig.
20 (21) Halsschild stark gewölbt, vorn und hinten steil abfallend.
. . . . *Dicranocnemus* Burm. sensu stricto (pp. 252, 264)
21 (20) Halsschild ziemlich flach. . . . . . . *Nanniscus* Burm. (pp. 254, 266)
22 (1) Kopfschildvorderrand halbkreisförmig oder parabolisch.
23 (24) Flügeldecken nach hinten verschmälert, die Seiten des Abdomen nicht bedeckend, Kralle der Mittelbeine an der Basis mit zahnartigem Anhang.
. . . . *Bizanus* Pér. (pp. 254, 266)
24 (23) Flügeldecken die Seiten des Abdomen bedeckend, Krallen ohne Anhang.
. . . . *Diaplochelus* Burm. (pp. 255, 266)

Dichelus Serville 1825

subgenus *Dichelus* Serv. sensu stricto

(=*Trichidius* Billberg 1820)

Bestimmungstabelle der ♂♂

1 (8) Hinterschienen vom Knie bis zum Apex mehr oder weniger gleichmäßig verbreitert und am Ende schräg abgeschnitten.
2 (3) Trochanterdorn der Hinterschenkel sehr deutlich in eine lange freie Spitze ausgezogen. Flügeldecken mit verkürzten weißen Schuppenbinden längs der Naht und auf der Scheibe.

Schwarz, Flügeldecken braun mit einer vorn verkürzten weißen Schuppenbinde neben der Naht und einer hinten verkürzten solchen auf der Scheibe. Propygidium ganz, untere Hälfte des Pygidiums und Seiten der Bauchringe weiß beschuppt. 5 mm. Malmesbury, Paarl, Caledon.
. . . . 1. *simplicipes* Burmeister 1844 (p. 232)

3 (2) Trochanterdornen kaum zu erkennen, Flügeldecken ohne Schuppenbinden.
4 (7) Am Kopfschildvorderrand sind die 2 äußeren Zähne größer.
5 (6) Krallen der Hinterbeine gleichlang, die mittleren Zähne des Kopfschildes noch erkennbar, Hinterschienen mit Sporen, Pygidium mit 2 dunklen Flecken. 5 mm. Malmesbury? . . . . 2. *pallidipennis* Blanchard 1850 (?) (p. 232)
6 (5) Krallen der Hinterbeine ungleich lang, die mittleren Zähne des Kopfschildes erloschen, Hinterschienen ohne Sporn.

Schwarz, Fühler, Flügeldecken und Beine rotbraun, Hinterschienen kurz und am Ende fast so breit wie bei *laticollis*. 5–5,5 mm. Cold Bokkeveld Ceres District, Cape Town, Rondebosch. . . 3. *denticeps* Wiedemann 1821 (p. 232)

7 (4) Alle 4 Zähne des Kopfschildvorderrandes gleich.

Schwarz mit schwachem Seidenglanz, Fühler, Taster und Vorderbeine zitronengelb, die anderen Beine schwarzbraun, nur Schildchen und Seiten der Bauchringe hell beschuppt, Pygidialteil unbeschuppt. 5 mm. „Kaffernland."

. . . . . 4. *flavimanus* Burmeister 1855 (p. 232)

8 (1) Hinterschienen nicht gleichmäßig verbreitert.

9 (36) Hinterschienen unten über der Mitte (also zwischen dem kleinen Zahn am Knie und dem Mukro am Ende) mit zahnartigem Lappen.

10 (11) Halsschild in der vorderen Hälfte so breit wie in der hinteren, mit weitläufig und unregelmäßig verteilten groben Punkten, Hinterschienen kurz und am Ende mit einem rechtwinklig nach innen abstehenden langen stumpfen Mukro.

Schwarz, manchmal mit grünem Schimmer, fast matt; Pygidialteil schwarz, ohne Schuppen. Fühler, Taster und Vorderbeine hellrot. 5–7 mm. Cape Town, Somerset West, Stellenbosch, Caledon, Heidelberg.

5. *laticollis* Burmeister 1844 (p. 232)

11 (10) Halsschild nach vorn verschmälert, gleichmäßig punktiert, Beine, besonders die Hinterschienen länger und schlanker, ihr Mukro weniger stumpf und mehr nach unten gerichtet, meist auch kürzer.

12 (27) Flügeldecken ohne Schuppen oder mit schmalen Längsbinden aus dünn stehenden hellen länglichen Schuppen.

13 (18) Flügeldecken ohne Schuppen.

14 (15) Flügeldecken stark glänzend hell rotbraun, hintere Krallen ungleich.

Kopf, Halsschild und Abdomen schwarz, Fühler (auch der Fächer) und Beine rotbraun, Halsschild abstehend dunkel behaart, der basale Teil der Mittelfurche und Hinterrand des Halsschildes, das Schildchen, die Seiten des Abdomen und das Propygidium gelblich beschuppt, Pygidium nur in der basalen Hälfte mit Ausnahme der Ränder ebenso beschuppt. Am Ende des Pygidiums ein Kranz langer weißer Haare. Die langen Trochanterdornen etwas gebogen. 5,5 mm. „Südafrika." . . . . . 6. *nitidissimus* Burmeister 1844 (p. 233)

15 (14) Flügeldecken mäßig glänzend oder matt, hintere Krallen gleich.

16 (17) Flügeldecken mäßig glänzend dunkel rotbraun oder dunkelbraun, Beine dunkelbraun oder fast schwarz.

Genotyp. Schildchen, Pygidialteil und obere Enden der Bauchringe weißgelb beschuppt. Untere Kante der Hinterschienen breit und im basalen Teil gerillt. 6–7,5 mm. Cold Bokkeveld Ceres District, Malmesbury Paardekop, Melkbosch Strand, Cape Town Orange Kloof, Camps Bay, Kirstenbosch, Constantia Nek, Clovelly Cape Peninsula, Fishhoek Cape Peninsula, Cape Flats, Banhoek Valley Stellenbosch, Franschhoek, Worcester Cloete Pass, Robinson Pass.

. . . . . 7. *dentipes* Fabricius 1781 (p. 233)

17 (16) Flügeldecken matt dunkelrotbraun, Beine rotbraun, dem vorigen sonst ähnlich. 6–7 mm. Ceres, Sneeugat Valley, Tulbagh, Koeberg, Noordhoek, Somerset West, Stellenbosch, Caledon, Worcester. . . 8. *expansus* Péringuey 1902 (p. 233)

18 (13) Flügeldecken mit länglichen weißen, den Grund nicht verdeckenden Schuppen, die in Längsbinden angeordnet sind.

19 (20) Flügeldecken nur mit einer solchen Binde, die längs der Naht angeordnet ist.

Flügeldecken braun oder pechschwarz, Beine dunkel. 4,5–6,5 mm. Ceres, Tulbagh, Cape Town, Somerset West, Stellenbosch, Banhoek Valley, Tradouw Pass Swellendam District, George District.

. . . . . 9. *acanthopus* Burmeister 1844 (p. 234)

20 (19) Flügeldecken außer der Nahtbinde mit 1–2 oft rudimentären weiteren Längsbinden.

21 (24) Große Formen von 7–7,5 mm.

22 (23) Flügeldecken braun, Schuppen des Schildchens und des Pygidiums weißlich.

Die Binden längs der Naht und auf der Scheibe der Flügeldecken laufen in breiten Rillen. Unterkante der Hinterschienen breit, nicht gerillt. Darling, Malmesbury, Cape Town, Camps Bay, Tafelberg Blinkwater, Rondebosch, Somerset West, Stellenbosch Banhoek Valley, Koegelberg in den Hottentots Holland Bergen. , , , , 10. *villosus* Burmeister 1844 (p. 234)

23 (22) Flügeldecken tiefschwarz wie der ganze Käfer, Schuppen des Schildchens und des Pygidiums orangegelb.
Sonst wie der vorige. Bushmanland Jakkalswater, Gifberg bei Vanrhynsdorp Somerset West, Stellenbosch, Worcester, George District.
. . . . 10a. *villosus* subspec. *luteopygus* nova subspecies (p. 234)

24 (21) Kleine Formen unter 6 mm.

25 (26) Flügeldecken braun, halbmatt, Börstchen der Tarsenglieder pechschwarz.
Kleine Form des *villosus*, die Binden außer der Nahtbinde oft ganz abgerieben. 5–5,5 mm. Ceres, Cape Town, Camps Bay, Stellenbosch, Zwartberg Pass Prince Albert District. . . 10b. *villosus* subsp. *minor* (Burm. nom. nud. 1844) n. ssp. (=*acanthoscelis* Ecklon, nom. nud.?) (p. 234)

26 (25) Flügeldecken braun, glänzend, Börstchen der Glieder der Hintertarsen rotgelb.
Etwas kleiner als der vorige, Pygidialteil weißgelb beschuppt, Vorder- und Mittelbeine gelbbraun, Hinterbeine pechschwarz. 4–4,5 mm. Caledon.
. . . . 11. *lucidus* Péringuey 1902 (p. 235)

27 (12) Flügeldecken mit dichten, den Grund verdeckenden Schuppen in Längsbinden oder auf der ganzen Fläche.

28 (35) Diese Schuppen bilden breite Längsstreifen.

29 (34) Farbe der Schuppen hell gelbgrau.

30 (31) Kopf und Halsschild rein schwarz behaart, Beine schwarz, Krallen der Hinterbeine nicht ganz gleichlang.
Jede Flügeldecke mit 3 Schuppenlängsbinden, die Räume zwischen ihnen schwach glänzend, dicht mit kurzen angebogenen Borsten besetzt. Pygidialteil ganz beschuppt. 8,7 mm. „Südafrika." . 12. *vittatus* Burmeister 1844 (p. 235)

31 (30) Kopf und Halsschild hell behaart.

32 (33) Die Räume zwischen den 3 Längsbinden jeder Flügeldecke unbeschuppt und mit Börstchen in der Farbe des dunklen Grundes besetzt.
Kopf und Halsschild auch hell fein beschuppt, vorn dünner, nach hinten zu dichter. Pygidialteil und Abdomen dicht gelbgrau beschuppt, Brust hell behaart. Beine rotbraun oder dunkelbraun. 7–7,5 mm. Kap-provinz (Worcester?), „Caffraria".
. . . . 13. *péringueyi* nova species (=*vittatus* Péringuey, nec Burm.) (p. 235)

33 (32) Die Räume zwischen den 3 Längsbinden jeder Flügeldecke mit aufstehenden hellen stäbchenförmigen Schuppen ausgefüllt, die im Gegensatz zu den runden Schuppen der Binden den Grund nicht ganz bedecken.
Abgesehen von der Beschuppung dem vorigen ähnlich, Beine dunkelbraun, mit feinen hellen Härchen. 5–6 mm. Cold Bokkeveld Ceres.
. . . . 14. *duplosquamosus* nova species (p. 236)

34 (29) Farbe der Schuppen dunkel orangegelb.
Kopf und Halsschild pechschwarz kurz behaart, letzterer nur längs des Hinterrandes und im basalen Teil der Mittelfurche orangegelb beschuppt. Flügeldecken tief dunkelrotbraun, fast schwarz wie das Abdomen und die 2 vorderen Beinpaare; die schuppenfreie Schulterbeule ist rotbraun, die Naht- und Randbinde, die hinten zusammenlaufen, sind mehr als doppelt so breit als die angrenzenden Zwischenräume; die zwischen ihnen liegende Binde ist schmäler und hinten verkürzt. Die Zwischenräume tragen runde kleine glänzende Schuppen von der Farbe des Untergrundes. Pygidialteil und Enden der Bauchringe dicht beschuppt, Brust schwarz, Hinterbeine rotbraun. 5–5,5 mm. Stellenbosch Banhoek Valley, Assegaibosch-La Motte bei Humansdorp.
Bei einigen Exemplaren von letzterem Fundort sind die Hinterbeine und der Grund der Flügeldecken ganz schwarz. . 15. *pseudovittatus* nova species (p. 236)

35 (28) Die ganze Fläche der Flügeldecken gleichmäßig und gleichartig dicht beschuppt, nur die Rippen mit feinen Borstenreihen.
Abgesehen von der Beschuppung dem *duplosquamosus* gleichend. Halsschild und Kopf lang abstehend hell behaart, dazwischen ziemlich dicht beschuppt, sodaß die dichte Beschuppung des Hinterrandes nicht absticht. Abdomen mit größerer Schuppenfläche und wie der Brustteil dicht weißlich behaart. Beine pechschwarz, Tarsen rotbraun. 6,5 mm. Malmesbury Paardekop.
. . . . 16. *holosquamosus* nova species (p. 237)

36 (9) Hinterschienen unten über der Mitte ohne zahnartigen Lappen, stark gebogen, fast in der ganzen Länge gleichbreit, Trochanterdornen lang und spitzig.

37 (42) Hinterschenkel kurz hinter der Trochanterspitze mit einem Zähnchen wie bei *Monochelus laetus* Péringuey.

38 (39) Flügeldecken ohne weiße Schuppenbinde. Pygidium nackt.
Flügeldecken rotbraun, schokoladebraun oder schwarz, mit schwachem Seidenglanz, Schildchen, Propygidium, Ecken der Bauchringe und Seitenteile der Brust weiß beschuppt, Beine wie die Flügeldecken gefärbt. 4,5–5,5 mm.
Exemplare mit braunen Decken liegen vor aus Cape Town, Witsands (White Sands), Somerset West, Stellenbosch Banhoek Valley, Houhoek, Oudebosch R. Zonderend, Ashton, George District, Knysna, Langekloof.
Solche mit schwarzen Decken aus Gifberg bei Vanrhynsdorp, Sneeugat Valley Tulbagh, Somerset West, Stellenbosch, Algoa Bay.
. . . . 17. *holosericeus* Burmeister 1844 (p. 237)

39 (38) Flügeldecken mit weißen Schuppenlängsbinden.

40 (41) Flügeldecken mit je 2 solchen Binden, Pygidium nackt.
Die Nahtbinde ist vorn, die Scheibenbinde hinten verkürzt; sonst wie der vorige. 5 mm. Mamre. Nur 2 ♂♂. . . . 18. *albolineatus* nov. spec. (p. 238)

41 (40) Flügeldecken mit je 3 dünnen weißen Binden, Pygidialteil hell beschuppt.
Etwas flacher als *holosericeus*, Schuppen und Haare gelb, Beine hellrot. 6 mm. „Südafrika." (Cold Bokkeveld?) . 19. *platynotus* Burmeister 1844 (p. 238)

42 (37) Hinterschenkel nur mit Trochanterdorn, ohne Zahn daneben.

43 (46) Flügeldecken mit Längsbinden.

44 (45) Nur eine Binde, die neben der Naht läuft.
Schwarz, die Binde dünn und vorn verkürzt. Schildchen, Brustseiten und Enden der Bauchringe weiß beschuppt, Haare dunkel, Beine schwarz. 6 mm. Cape Town. . . . . 20. *luctuosus* Péringuey 1902 (p. 238)

45 (44) Jede Decke mit 2 Binden.
Krallen ungleich. Schwarz, etwas glänzend, die äußere Binde vorn verkürzt, Schildchen, Enden der Bauchringe und der ganze Pygidialteil weiß beschuppt, Brustseiten weiß behaart. Hinterbeine schwarz, die anderen rot. 5–6 mm. Vanrhynsdorp. . . . . 21. *kochi* nov. spec. (p. 238)

46 (43) Flügeldecken ohne Längsbinden.
Schwarz mit Seidenglanz, Schildchen, Rand des Propygidiums, Brustseiten vor und hinter der Schulter und Enden der Bauchringe weiß beschuppt, Pygidium nackt. Haare schwärzlich. Beine schwarz, die 4 vorderen mit braunem Schimmer. 6–6,5 mm. Willowmore, Uniondale Distrikt.
. . . . 22. *pseudoluctuosus* nov. spec. (p. 239)

Nicht aufgeführt konnte werden. . . 23. *zuluanus* Péringuey 1902 (p. 240), da nur ♀ bekannt. Glänzend schwarz, Schildchen, Rand des Propygidiums, Brustseiten und Ecken der Bauchringe mit gelblichen Schuppen. 6,75 mm. Eshowe in Natal.

Omocrates Burmeister 1844

(=*Goniaspidius* Burmeister partim)

Grundfarbe bei allen Arten schwarz, Flügeldecken braun, soweit nicht anders bemerkt. Abdomen der ♀♀ meist ganz oder im apikalen Teil rotbraun. Genotyp *axillaris* Burm.

1 (6, 18) Kopfschildvorderrand mit 4 Zähnen.

2 (5) Vorderschienen mit 3 Zähnen.

3 (4) Mittlere Zähne des Kopfschildes so groß und scharf wie die äußeren.
Decken einfarbig gelbbraun. 5,25 mm. Namaqualand.
. . . . 1. *misellus* Péringuey 1902 (p. 240)

(3) Mittlere Zähne des Kopfschildes kleiner und weniger scharf als die äußeren.
Decken blaßgelb, beim ♂ mit angedunkeltem Rand. Pygidialteil graugelb beschuppt, beim ♀ behaart. 6–6,5 mm. Dikbome Merweville Koup, Klaarstroom Prince Albert. . . . . . . 2. *karrooanus* nov. spec. (p. 240)

5 (2) Vorderschienen mit 2 Zähnen.
Kopf, Schildchen und Halsschildvorderrand schwarz, Halsschild gelbrot, ohne Furche, fast glatt und sehr lang. Flügeldecken hellbraun, fein weiß behaart. Pygidialteil dicht goldgelb beschuppt, Abdomen weißlich beschuppt und behaart, Beine gelbbraun, 4,5 mm. Hex River. . 3. *pauxillus* Péringuey 1902 (p. 241)

6 (1, 18) Kopfschildvorderrand mit 3 Zähnen.

(8, 13) Vorderschienen mit 4 Zähnen.
Lang und schmal, Flügeldecken blaßgelb, Pygidialteil bei ♂♀ dicht goldgelb beschuppt. Beine pechschwarz, Hinterschienen und Tarsen braun, alle Krallen doppelt, der Zahn hinter dem Apikalzahn der Vorderschienen ist kürzer als die anderen Zähne. 4–5 mm. Bosluis Pass, Gamkas Poort. . . . . 4. *andreaei* nov. spec. (p. 241)

8 (7, 13) Vorderschienen mit 3 Zähnen.

9 (10) Basalhälfte des Halsschildes über dem Schildchen mit einem großen querrechteckigen goldgelben Schuppenfleck.
Flügeldecken und Beine gelbbraun, Halsschild grau, an den Seiten länger weiß behaart, Schildchen graugelb beschuppt, Flügeldecken mit gelben, am Apex weißlichen Schuppen, Pygidialteil graugelb beschuppt. Abdomen und Unterseite weißlich behaart, wie auch die Hinterschienen. 5,5 mm. Burghersdorp. . . . . 5. *plausibilis* Péringuey 1902 (p. 242)

10 (9) Halsschild behaart, höchstens am Basalrand ein Schuppensaum.

11 (12) Propygidium und Pygidium des ♂ mit dichter dunkelbrauner Schuppenbinde im basalen Teil, ihre Restflächen hellgelb beschuppt.
Flügeldecken mit feinen anliegenden Börstchen. 5–5,5 mm. Middelburg Div. . . . . 6. *pygidialis* nov. spec. (p. 242)
Farbform mit einfarbig weißgelbem Pygidialteil. . . . . 6a. f. col. *immaculatus* nov. (p. 242)

12 (11) Pygidialteil des ♂ einfarbig beschuppt.
Flügeldecken mit stärkeren, mehr schuppenähnlichen Börstchen. Grund der Decken pechschwarz oder braun. 3,5–4,5 mm. Port Elizabeth, Uitenhage, Dunbrody. . . . . . . 7. *variabilis* Burmeister 1844 (p. 243)

13 (7, 8) Vorderschienen mit 2 Zähnen.

14 (17) Obere Kante der seitlich stark zusammengedrückten Hinterschienen des ♂ mit Ausbuchtungen.

15 (16) Diese Kante bildet 1½ Wellenberge. Hintere Krallen einfach.
Schultern durch Eindruck daneben sehr betont. Flügeldecken blaßbraun mit schwarzem Rand. Pygidialteil des ♂ einfarbig goldgelb, des ♀ mit 2 braunen Flecken. 6,5–7 mm. Stellenbosch, Koeberg, Malmesbury, Clanwilliam. . . . . 8. *axillaris* Burmeister 1844 (p. 243)

16 (15) Diese Kante bildet nur kurz vor dem Apex einen aufrechten breiten, abgerundeten Lappen. Hintere Kralle gespalten.
Dem vorigen ähnlich, Pygidium einfarbig weißgelb.
♀ unbekannt. 4,5 mm. Algoa Bay. . 9. *lobipes* Burmeister 1844 (p. 243)

17 (14) Hinterschienen des ♂ oben ohne Ausbuchtungen.
Den beiden vorigen ähnlich, Propygidium des ♂ viel breiter, der ganze Pygidialteil dicht graugelb beschuppt. 5 mm. Kowie (Port Alfred), Algoa Bay. . . . . 10. *modestus* Péringuey 1902 (p. 243)

18 (1, 6) Kopfschildvorderrand nur mit ± zahnförmigen Ecken, dazwischen kein Zahn.

19 (20, 33) Vorderschienen mit 4 Zähnen.
Sehr schmal gebaut. Schwarz, Flügeldecken blaßgelb, hinten geschwärzt, Pygidialteil und 2–3 folgende Bauchringe dicht orangegelb beschuppt, Beine pechschwarz mit rotbraunen Hinterschienen und Tarsen. Der auf den apikalen Zahn folgende Zahn ist nur halb so lang als die anderen Zähne. 5–6 mm. Tankwa Karroo Waterval. . . . . 11. *hessei* nov. spec. (p. 243)

20 (19, 33) Vorderschienen mit 3 Zähnen.
21 (28) Beide basale Zähne ungefähr gleichlang.
22 (25) Auch Halsschild beschuppt.
23 (24) Schuppen der Oberseite einschließlich Pygidialteil dunkelgelb, auf dem Halsschild den Grund nicht ganz verdeckend.
Halsschild in den hinteren zwei Dritteln fast parallel, dann stark verschmälert, Flügeldecken, Abdomen und Beine am Grunde rotbraun. 4–4,5 mm. Cape Town, Stellenbosch, Tradouw Pass Swellendam.
. . . . 12. *depressus* Blanchard 1850 (p. 244)
24 (23) Schuppen mehr grau, auf dem Pygidialteil graugelb, auf dem Halsschild den Grund verdeckend.
Halsschild länger und gleichmäßig verschmälert. Sonst dem vorigen ähnlich. 3,5–4 mm. Stellenbosch, Caledon. . 13. *placens* Péringuey 1902 (p. 244)
25 (22) Halsschild nur behaart.
26 (27) Pygidialteil und Abdomen gelb beschuppt, Behaarung der Flügeldecken feiner, Beine dunkel.
Halsschild grau behaart, die hellbraunen Flügeldecken mit undeutlich gereihten feinen weißen Schuppenhaaren, Hinterkrallen doppelt, gespalten. 4,5–6 mm. Natal: Durban, Frere, Malvern, Park Rynie. Orange Freistaat: Smithfield.
. . 14. *spatulipennis* Blanchard 1850 (=*lepidus* Boheman 1857) (p. 244)
27 (26) Pygidialteil und Abdomen weiß beschuppt, Haare der Flügeldecken kräftiger, Beine rostrot.
Dem vorigen sehr ähnlich, Haare der Decken hinten dichter. 5 mm. „Ganz Caffraria." . . . . . . 15. *lividipennis* Boheman 1857 (p. 244)
28 (21) Der basale Zahn der Vorderschienen viel kürzer als der mittlere Zahn.
29 (30) Flügeldecken einfarbig, kleinere Art.
Halsschild grau behaart, Decken gelbbraun, Pygidialteil beim ♂ gelb beschuppt, beim ♀ gelb behaart. 4,5 mm. Hex River. . 16. *humilis* Péringuey 1902 (p. 244)
30 (29) Flügeldecken in der Gegend der Beulen angedunkelt, größere Arten.
31 (32) Halsschild ohne deutliche Längsfurche.
Halsschild weiter und gröber punktiert, dem *luridipennis* Burm. sehr ähnlich, aber Pygidialteil des ♂ einfarbig. 5 mm. Hex River.
. . . . 17. *placidus* Péringuey 1902 (p. 244)
32 (31) Halsschild mit deutlicher, fast bis zum Vorderrand durchlaufender Längsfurche.
Halsschild enger und feiner punktiert, dem vorigen ähnlich. 5,5 mm. Stellenbosch.
18. *pseudoplacidus* nov. spec. (p. 244)
33 (19, 20) Vorderschienen mit 2 Zähnen.
34 (37) Flügeldecken in der Gegend der Beulen angedunkelt.
35 (36) Propygidium und Pygidium jeweils an der Basis bei ♂♀ mit dunkelbraunen Flecken, sonst gelb.
Sonst dem größeren *axillaris* Burm. sehr ähnlich. 5 mm. Stellenbosch, Cape Town, Koeberg, Malmesbury, Paleisheuwel. . 19. *luridipennis* Burmeister 1844 (p. 245)
36 (35) Pygidialteil beim ♂ einfarbig gelb, beim ♀ nur Propygidium mit 2 runden dunklen Flecken.
Sonst dem vorigen ähnlich. 6–6,5 mm. Namaqualand.
. . . . 20. *mendax* Péringuey 1902 (p. 245)
37 (34) Flügeldecken einfarbig.
38 (43) Halsschild ohne oder nur mit schwacher und schmaler Längsfurche.
39 (42) Kopfschild zwischen den scharfen aufgebogenen Ecken gerade. Halsschild schwach gefurcht. Pygidialteil dicht gelb beschuppt.
40 (41) Kopfschild stärker verschmälert, Halsschild weniger gewölbt.
Flügeldecken hellgelb, mit apikalem Schuppenrand, mit Längseindrücken neben Naht und Schultern und auf der Scheibe, Hinterkrallen doppelt. 4 mm. Cape Town, Stellenbosch, Tulbagh. . 21. *cylindricus* Burmeister 1844 (p. 245)
41 (40) Kopfschild weniger verschmälert, Halsschild stärker gewölbt.
Sonst dem vorigen ähnlich. 4 mm. Namaqualand.
. . . . 22. *namaquensis* nov. spec. (p. 245)
42 (39) Kopfschild zwischen den 2 Zähnen ausgerandet, Halsschild nicht gefurcht, Pygidialteil grau behaart.

Schmäler als die beiden verausgegangenen, Flügeldecken rotbraun, auch Halsschild und Abdomen grau behaart, Beine schwarz, Hinterbeine mit braunem Endteil. 5,25 mm. „Kap." . . . 23. *elongatus* Blanchard 1850 (p. 246)

43 (38) Halsschild mit tiefer, durchlaufender Längsfurche, die ⅓ seiner Breite einnimmt.
Breiter und kürzer gebaut als *cylindricus*. Schildchen pechschwarz, Flügeldecken gelbbraun, Pygidialteil gelb beschuppt. Glänzend, fast glatt. Beine und Abdomen rotbraun. 4 mm. Hopefield. . . 24. *canaliculatus* Blanchard 1850 (p. 246)

Cylindrocrates nov. gen.

Einzige Art: *parallelus* nov. spec. 5,5 mm. Wallekraal, Namaqualand. (p. 246.)

Goniaspidius Burmeister 1844 nec Péringuey 1902

Genotypus *brevis* Burm.

1 (2) Hinterbeine mit einer Kralle. Schildchen ein großes gleichschenkliges Dreieck, dessen Basis etwas kürzer ist als die Seiten. Vorderschienen dreizähnig.
Schwarz, Flügeldecken des ♂ dunkelrotbraun mit schwarzem Saum oder ganz schwarz, des ♀ mit Abdomen und Beinen ganz rotbraun. Kopfschild mit 3 großen Zähnen. Überall lang abstehend dunkel behaart. Tarsenglieder zylindrisch. 6,5 mm. „Südafrika." . . . . *brevis* Burmeister 1844 (p. 247)

2 (1) Hinterbeine mit 2 Krallen. Schildchen ein großes gleichseitiges Dreieck. Vorderschienen zweizähnig. Pygidialteil gelblich beschuppt.

3 (4) Halsschild mäßig glänzend, ohne Längsfurche.
Schwarz, Flügeldecken dunkelrotbraun mit 3 Längsbinden aus anliegenden dicken weißen Härchen. 3 mm. Congo Belge, Upemba-Park.
. . . . *lebisi* (Schein) 1958 (als *Omocrates*) (p. 248)

4 (3) Halsschild ganz matt, mit Längsfurche.
Schwarz, Flügeldecken rotbraun mit gereihten, keine Binden bildenden weißen Börstchen und feinem hellem Apikalsaum. 5 mm. Angola, Kuangu.
. . . . *angolensis* nov. spec. (p. 248)

Rectoscutaria nomen nov. für *Goniaspidius* Péringuey nec Burmeister

Genotypus *péringueyi* nom. nov.

1 (6) Der Apikalzahn der Vorderschienen zeigt schräg nach vornaußen, Flügeldecken sehr uneben.

2 (5) Flügeldecken mit deutlichen Längsbinden aus anliegenden weißlichen Schuppenhaaren.

3 (4) Die äußeren Binden sind vollständig, die mittlere ist hinten verkürzt.
Schwarz, Flügeldecken schwarz oder braun oder schwarz mit braunem Fleck. 5–6 mm. Touwsrivier, Dikbome Merweville Koup, Klaarstroom Prince Albert Div., Lammerskraal Prince Albert Div., Willowmore.
. . . *péringueyi* nomen nov. für *brevis* Péringuey nec Burmeister (p. 249)

4 (3) Alle Binden sind vorn und hinten verkürzt und in einem nach vorn offenen Bogen quer über die Flügeldecken angeordnet.
Schwarz, meist mit dunkelrotbraunem Fleck im Zuge des Bindenbogens. 5–5,5 mm. Nieuwoudtville, Willowmore. . . . *péringueyi* subspec. *lunata* nov. (p. 249)

5 (2) Flügeldecken mit halbaufstehenden feinen hellen Haaren, die nicht zu Binden zusammengefaßt sind.
Farbe und Skulptur wie *péringueyi*. 5–6 mm. Willowmore.
. . . . *péringueyi* subspec. *uniformis* nov. (p. 249)

6 (1) Der Apikalzahn der Vorderschienen ist stärker nach den Seiten umgebogen, sodaß er fast parallel zu den Seitenzähnen wird, Flügeldecken nur mit flachem Eindruck unterhalb des Schildchens.

Schwarz, Flügeldecken dunkelrotbraun mit angedunkelten Seiten und Beulen. 5,5–7 mm. Touwsrivier. Willowmore. . . *simplex* Péringuey 1902 (p. 249)

Omocnemus nov. gen.

Einzige Art *kochi* nov. spec. 5–6 mm. Groß-Namaland, Aus. (p. 250.)

Dicranocnemus Burmeister 1844

Macrodicranocnemus nov. subgen. Subgenotyp *andreaei* n. sp.

1 (2) Halsschild hinten schwach gefurcht, Hinterbeine normal beborstet.

Schwarz, Flügeldecken hellbraun, Halsschild lang aufstehend gelblich behaart, Flügeldecken mit unregelmäßig verteilten, nur hinter den Apikalbeulen kurze Binden bildenden gelben Schuppen, Schildchen, Pygidialteil und Abdomen gelb beschuppt und behaart, Beine braun, gelb beborstet. 6–7,5 mm. Seven Weeks Poort Berg, Ladismith, Riversdale, Tradouw Pass Swellendam.

. . . . 1. *andreaei* nov. spec. (p. 251)

Rasse dieser Art:

Flügeldecken dunkelrotbraun, an Schulter und Apex angedunkelt, Haare des Halsschildes besonders im vorderen Teil dunkelbraun, Schuppen und Haare des Pygidialteiles und Abdomens weißlich. 6–7,5 mm. Robinson Pass nordöstlich Mossel Bay. . . . . 1a. *andreaei* subspec. *zumpti* nov. (p. 251)

2 (1) Halsschild im hinteren Teil tief gefurcht, Hinterschienen mit Tarsen buschig schwarz behaart.

Schwarz, Flügeldecken braunschwarz mit gelben Schuppenflecken auf Scheibe und Apex, Schildchen und Pygidialteil dicht gelb beschuppt. Beine braunschwarz. 5–6 mm. Leipoldtville, Elands Bay, Graafwater. . 2. *hirtipes* nov. spec. (p. 251)

Dicranocnemus Burmeister 1844 sensu stricto

Genotypus *sulcicollis* Wiedemann

1 (24) Größere Kralle der Mittelbeine ohne zahnartigen Anhang.

2 (15) Vorderrand des Kopfschildes mit rechtwinkligen oder in zahnartige Zacken aufgebogenen Vorderecken.

3 (6) Halsschild weniger gewölbt, besonders im basalen Teil, Längsfurche nur angedeutet.

4 (5) Ecken zipfelförmig aufgebogen, ihr Abfall nach innen reicht fast bis zur Mitte des Vorderrandes. Schenkel ohne Trochanterdornen.

Schwarz, Halsschild hellgrau behaart, Flügeldecken gelb beschuppt ohne Zeichnungsmuster, Pygidium und Abdomen gelb beschuppt. 5,25–5,5 mm. Natal, Estcourt. Dunbrody C.P. . . . 3. *natalensis* Péringuey 1902 (p. 252)

5 (4) Ecken steil aufsteigend, nach innen senkrecht abfallend, Hinterschenkel mit Trochanterdornen.

Schwarz, Flügeldecken schwarzbraun, längs der Basis noch dunkler, mit schmaler gelber Schuppenbinde längs der Naht um den Apex herum bis zur Schulter und mit 4 quer angeordneten grauen Schuppenflecken. Propygidium und Abdomen weißgelb, Pygidium ebenso mit 2 großen gelben Flecken. ♀ ähnlich, aber statt der Schuppen Haare. 4,5 mm. Willowmore, Ashton.

. . . . 4. *spiniceps* Péringuey 1904 (p. 252)

6 (3) Halsschild besonders im basalen Teil stärker gewölbt, hinten mit tiefer Längsfurche.

7 (8) Kopfschild mit rechtwinkligen, nicht aufgebogenen, höchstens körnchenförmigen Ecken.
Schwarz, Flügeldecken schwarzbraun mit gelber Zeichnung, Halsschild am Seiten- und Hinterrand und in der Furche gelb beschuppt. ♀ mit reduzierter, aus Härchen bestehender Zeichnung. 5–5,5 mm. Barrydale, George, Grahamstown, Port Alfred. . . . . . . 5. *pulcher* Péringuey 1902 (p. 252)

8 (7) Kopfschildecken deutlich aufgebogen.

9 (14) Flügeldecken mit Zeichnung, Kopfschild stärker verengt.

10 (11) Flügeldecken außer dem Nahtstreif mit mehreren gelben Längsstreifen.
Schwarz, Flügeldecken braun mit gelber Zeichnung, Halsschild lang dicht aufrecht gelb behaart und beim ♂ auf den hinteren Seitenteilen und in der Furche gelb beschuppt. 4,5–6,5 mm. Cape Town, Salt River, Zeekoe Vlei, Cape Flats, Stellenbosch, Hex River. . . 6. *sulcicollis* Wiedemann 1821 (p. 252)

11 (10) Flügeldecken außer dem Nahtstreif mit nur einem gelben Längsstreifen.

12 (13) Grundfarbe des ganzen Käfers tiefschwarz.
Sonst wie *sulcicollis*, doch ist die Farbe der Schuppenzeichnung weniger gelb und mehr weißlich. 5–5,5 mm. Upper sources Olifants River, Elandsbaai, Kamieskroon Namaqualand. . . . 6a. *sulcicollis* subspec. *niger* nov. (p. 252)

13 (12) Grundfarbe der Flügeldecken dunkelbraun.
Abgesehen vom Zeichnungsmuster dem *sulcicollis* sehr ähnlich. 5 mm. (ein einzelnes Stück 4 mm.). Saldanha Bay.
. . . . 6b. *sulcicollis* subspec. *fürschi* nov. (p. 252)

14 (9) Flügeldecken ohne jede Zeichnung, fast nackt.
Kopfschild wenig verschmälert, Ecken schwächer aufgebogen als bei der vorigen Art. Schwarz, Flügeldecken gelbbraun, Pygidium pechschwarz, ohne Schuppen, Halsschild gelb behaart und Pygidium mit einigen Härchen, Beine braun. 4,5 mm. Saldanha Bay. . . . . 7. *nudus* nov. spec. (p. 253)

15 (2) Vorderrand des Kopfschildes mit stumpfen oder abgerundeten Ecken.

16 (17) Halsschild des ♂ fast ganz dicht und fein von kleinen hellen Schuppen bedeckt.
Schwarz, Flügeldecken rotbraun, Flügeldecken mit 2 Rippen, gelb, in den Zwischenräumen hellgrau beschuppt, auch der Fleck an der Naht hellgrau. Beim ♀ sind die Schuppen durch Härchen ersetzt. 4–4,5 mm. Klaarstroom Prince Albert, Patentie Humansdorp, Uitenhage, Port Elizabeth, Algoa Bay, Dunbrody, Resolution Albany, Grahamstown, Fort Beaufort.
. . . . . 8. *mendicus* Péringuey 1902 (p. 253)

17 (16) Halsschild höchstens an den Seiten und an der Basis mit Schuppensaum, sonst nur behaart.

18 (21) Flügeldecken des ♂ mit deutlicher gelblicher Zeichnung.

19 (20) Die Zeichnung besteht außer der Nahtbinde aus mehreren Längsbinden und dem Nahtfleck. Pygidium einfarbig gelb.
Dem *sulcicollis* sehr ähnlich. 4 mm. Villiersdorp, Hawston, Port Elizabeth.
. . . . . 9. *hypocrita* Péringuey 1902 (p. 253)

20 (19) Die Zeichnung besteht außer der Nahtbinde und dem Nahtfleck aus nur einer Längsbinde. Pygidium gelb mit dunklem querem Fleck an der Basis.
Dunkelbraun, Flügeldecken und Beine rot, Halsschild mit Furche, Schuppensaum und lohfarbener Behaarung, Schildchen weiß beschuppt, Propygidium und Pygidium dicht orangegelb beschuppt, ersteres mit dunklem Basalfleck. ♀ nur behaart. 4,5–5,5 mm. Uitenhage. . . 10. *burchelli* Arrow 1917 (p. 253)

21 (18) Flügeldecken ohne deutliche Zeichnung.

22 (23) Halsschild ohne Schuppen, Pygidialteil mit 2 gelbbraunen Flecken.
Mir in natura unbekannt (ob Form des vorigen?). 4 mm. Uitenhage, Port Elizabeth. . . . . 11. *arduus* Péringuey 1904 (p. 254)

23 (22) Halsschild an der Basis mit Schuppensaum, Pygidialteil einfarbig.
Halsschild auch in der Furche und auf den hinteren Seitenteilen gelb beschuppt, Schildchen heller beschuppt als die Flügeldecken, diese einfarbig hellgelb beschuppt, nur der Nahtfleck ist manchmal ein wenig heller. 4,5 mm. Knysna, Patentie Humansdorp, Uitenhage, Grahamstown.
. . . . . 12. *pulverulentus* Burmeister 1844 (p. 254)

24 (1) Die größere Kralle der Mittelbeine des ♂ im Basalteil mit einem zahnartigen Anhang.
25 (26) Vorderecken des Kopfschildes deutlich, Flügeldecken mit dichten haarähnlichen hellen Schuppen ohne Zeichnung.
Halsschild mit Schuppen nur in der Furche und als schmaler Hinterrandsaum, Flügeldecken einfarbig hell beschuppt, nur der Nahtfleck ist manchmal ein wenig heller. 4–5 mm. Port Elizabeth, Uitenhage, Dunbrody, Grahamstown. . . . . . 13. *squamulatus* Burmeister 1844 (p. 254)
26 (25) Vorderecken des Kopfschildes abgerundet, Flügeldecken mit deutlicher gelber Zeichnung.
Schuppenrand an der Basis des Halsschildes breiter, Furche weniger tief, die Schuppenzeichnung der Flügeldecken ist wie bei *sulcicollis* und etwas variabel, manchmal mit zusätzlichen Schuppen, daß die Räume zwischen den Längsbinden fast ausgefüllt werden, manchmal reduziert mit breiten Zwischenräumen. 4–5,5 mm. Cape Town, Stellenbosch, Mossel Bay, Keurbooms River Knysna, Patentie Humansdorp, Port Elizabeth, Algoa Bay, Dunbrody, Kowie (Port Alfred), Grahamstown. . . . 14. *squamosus* Burmeister 1844 (p. 254)

Nanniscus Burmeister 1844

Einzige Art. . . . . *pulicarius* Burmeister 1844 (p. 254)

Offenbar selten, da ich nur die Type gesehen habe. Schwarz, Flügeldecken hellgelb, überall anliegend weiß behaart. 2,5 mm. Nähere Heimat unbekannt.

Bizanus Péringuey 1902

Vorderbeine rot, die anderen Beine schwarz, Krallen der Mittelbeine des ♂ mit zahnartigem Anhang. Genotyp *caliginosus* Pér.

1 (2) Flügeldecken schokoladebraun, ♂ mit flaumartigen grauen Schuppen, Propygidium und Abdomen gelb beschuppt, Pygidium nicht beschuppt, pechschwarz, ♀ oben und am Pygidialteil lang behaart. 3,25–4 mm. Ceres Obere Quellen des Olifants River, Tulbagh, Touwsrivier. . . . . *caliginosus* Péringuey 1902 (p. 255)
2 (1) Flügeldecken hellbraun mit flaumartigen weißlichen Härchen, Propygidium und Abdomen dicht weiß beschuppt, Pygidium weniger dicht (Grund bleibt noch etwas sichtbar) gelb beschuppt. 3,5 mm. Vanrhyns Pass. . *vansoni* nov. spec. (p. 255)

Diaplochelus Burmeister 1844

Genotyp *longipes* F.

D. squamulatus Burmeister ist nicht synonym zu *crassipes* Burm., wie Péringuey angenommen hat, sondern hat 2 Krallen an den Hinterbeinen. *D. transvaalensis* Péringuey ist synonym mit *squamulatus* Burm.

Alle Arten sind schwarz mit gelbbraunen Flügeldecken und rotbraunen Beinen und kommen gelegentlich ganz schwarz und in Übergängen zu dieser Form vor.

1 (2) Hinterbeine mit einer Kralle, große Art. 8–10 mm. Gifberg Vanrhynsdorp Distr., Malmesbury, Ceres, Cape Town, Franschhoek, Caledon, Cogman's Kloof Montagu, Bechuanaland. . . . . 1. *crassipes* Burmeister 1844 (p. 256)

2 (1) Hinterbeine mit 2 Krallen.

3 (4) Untere Kante der Hinterschienen des ♂ mit mehreren Sägezähnen. 5,5–7 mm. Oudebosch Zonderend, Caledon. Transvaal, Johannesburg.
2. *squamulatus* Burmeister 1844 (p. 256) (=*transvaalensis* Péringuey 1902)

4 (3) Untere Kante der Hinterschienen des ♂ glatt. 5,5–7 mm. Gifberg Vanrhynsdorp Distr., Clanwilliam, Great Winterhoek Tulbagh, Malmesbury, Cape Town, Noord Hoek, Schuster's Kraal, Cape Flats, Somerset West, Stellenbosch, Franschhoek, Caledon, Riversdale, Knysna, Willowmore. . . . 3. *longipes* Fabricius 1787 (p. 256)

THE GENITALIA OF THE GENUS *PHASIS* AND ALLIED GENERA. (LEPID. LYCAENIDAE)

By

Desmond Murray

(With 2 plates)

Contents

Introduction

Aurivillius (in Seitz) divides the *Phasis* group into two sections or three groups of species and sub-ordinate genera. There are approximately 46 species and subspecies. Below is given the classification as given in Seitz.

1. HW., two small tails, one at end of 1b and another at end of 2. FW 12 veins, vein 7 terminating into margin. *Phasis* Hubner.
2. HW., at end of 1, 1b angular or tailed, but always without tail at end of 2.
   (*a*) FW., above without black discal band or separate black discal spots—always 12 veins, vein 7 terminating into margin. Palpi below coarsely scaled, without bristly hairs. *Aloeides* Hubner.
   (*b*) (i) F.W., and often also HW above with black discal spots on light (orange) ground, or F.W above with coherent black discal band being only united with black marginal band in area 1b and at costal margin. *Poecilmitis* Butler.
   (ii) FW., 11 veins *Chrysoritis* Butler.
   N.B.—*P. zeuxo* and *chrysantas* also have only 11 veins.

Although the above can be taken as the classification now recognized, the genitalia have not so far been studied.

The principle laid down by Stempffer that 'today all authors should publish descriptions and figures of the genital armature of the species they study', is certainly necessary with the Lycaenidae and more especially with the *Phasis* group, because in most cases the valves are alike. All the species available have been so studied and lead one to a somewhat different division of the group. Besides the venation and other points noted in the above extract, the valves are found to be very similar in most cases; the anellus and juxta though distinct in some are not alone sufficient to separate the subordinate genera or the species.

A close study of the genitalia however shows that there is a natural division into two sections when the 'falces' (the two hooks of the gnathos) are compared. Some are 'straight', others are 'elbowed', dividing the whole group into about equal numbers. This difference is therefore used here to separate the numerous species into two sections. There can be little doubt that those included in each section show close affinity to each other. Apart from wing-colouring and size there seems to be no other character to distinguish them; the form of the aedoeagus is also helpful in distinguishing the species.

There are often many varieties among the species themselves, so that it is very difficult to separate them, especially with *pierus*, *thyra*, *taikosama* and others. Some have been named as *osbecki* from *thysbe*, but the former is now known to be distinct from the other. These differences in wing-colouring are not constant. Take for example the three species *pierus*, *thyra* and *taikosama*, they can seldom be separated for certain by wing-colouring and sometimes appear at different times or together. Riley (1938) says in the case of *thyra* that 'examination of the genitalia in seven widely different males (Cape Town) provided no character whatever on which to separate the various varieties, all seem exactly alike'. In another example he says 'a cursory (dry) examination of the genitalia confirms this finding'. But such an examination is hardly sufficient with such critical material, the very minutest comparison has to be made. That used by Stempffer, in all his papers, seems to be by far the best. By this, or what is called the 'open' method, the uncus holding the falces is separated from the tegumen, the valves and aedoeagus are also separated, so that each part can be studied separately and compared with the same in other species.

Polymorphism, E. B. Ford (*Butterflies* (*New Nature Series*)) says, 'is the occurrence together, in the same habitat of two or more distinct forms of a species, in such proportions that the rarest of them cannot be maintained by recurrent mutation'. This may help us to understand something about varieties in a species.

The genus *Phasis* is almost exclusively confined to southern Africa, only a few species being found farther north. They are generally small and brilliant coloured butterflies and in the sunshine shine like jewels.

Perhaps it will be best first to enumerate the species into the present recognized groups and then give short descriptions of each from a genitalic point of view.

The writer has to acknowledge the very generous help and encouragement of the following, without whose assistance this paper could not have been put together:

Messrs. C. G. C. Dickson, K. M. Pennington, Gowan C. Clark, D. A. Swanepoel and especially Dr. G. van Son of the Transvaal Museum, Pretoria, who very kindly went to some trouble (with a former paper on the same subject) pointing out the slips and errors as well as the difficulties to be faced by anyone who would venture to tackle this difficult group of South African insects.

That was some years ago when two papers were appearing on the genitalia of other groups of South African Lycaenidae (Murray, 1944, 1948). Since then a great deal of new material has come forward and the *Phasis* group has not been undertaken by anyone. It is to be hoped that this contribution, though by no means complete, or without errors, will help to bring the study nearer completion. There is a lot more still to be learnt, especially from the study of the early stages, from which alone we can be certain of distinction with critical species. Mr. C. G. Dickson and Mr. Gowan Clark have given us some valuable papers on this section.

At the end of this paper is given a list of food-plants, compiled for the most part from papers noticed in the references. This information is very valuable both to collectors and to breeders from whom (especially the latter) further knowledge is still to be gained from the study of these beautiful insects.

Genera and Species dealt with

Gen. *Phasis*

thero (genotype)
clavum (subspecies)
sardonyx
argyraspis
wallengrenii
malagrida
dicksoni

Gen. *Aloeides*

pierus (genotype)
egerides
aranda
simplex
damarensis
molomo
almeida
thyra
pallida
dentatis
thyra maseruna (subspecies)
taikosama
orthus
barklyi

Gen. *Poecilmitis*

lycegenes (genotype)
lyncurium
tsino (subspecies nov.)
chrysantas
aethon
lycia
chrysaor
phosphor
pyroeis
felthami
zeuxo zeuxo
zeuxo zonarius
penningtoni
turneri
aridus
palmus
thysbe
osbecki
nigricans
trimeni (subspecies)
brooksi
pelion
pyramus
Chrysorites oreas
Crudaria leroma

Several other species are awaiting description, including *Poecilmitis tsino*. Among the above *Aloeides pallida* was not available for dissection and among the *Poecilmitis*, *turneri* and *brooksi*, including also the subspecies.

The Two Sections based on the Genitalia

Falces 'straight'	Falces 'elbowed'
Phasis thero and the five other species named under *Phasis*. *Aloeides pierus* and all named under this genus, with the exception of *orthus* which has the falces 'elbowed'.	*Poecilmitis lycegenes* and all other species named under this genus, as well as *A. orthus*, excluding in both columns species not available for examination and the subspecies named.

Taken all together the total amounts to 46 species including the subspecies. It should be noted that *orthus* is distinctly misplaced among the *pierus-thyra* group, as it has the falces 'elbowed', i.e. from the genitalic view.

The figures of the genitalia have been made by the 'open' method and more or less uniform in size for ready comparison and with the aid of the camera lucida, to ensure accuracy.

There follow short descriptions of the genitalia. The data of all the species examined are given below.

Section I (Falces 'Straight')

I. *Phasis*, Butler (1869) U = uncus; V = valve; A = aedoeagus.

1. *P. thero* L. Type. (Pl. III, 1.) The genitalia of this and the next three species approximate to *Capys alphaeus* Cram. U. broad, well developed. V. large bottle-shaped, apex a straight serrated edge. Anellus large. A. broad, saccus produced into a hooked point. Cape Flats. 9/30.

P. clavum, Murr. (subspecies). The genitalia are almost the same as *thero* but the wing expanse smaller; forewing more rounded and the marking differing considerably; it has one tail only, not two as in *thero*. Taken at Nieuwoudtville, Vanrhynsdorp Dist., Cape, by Dr. G. van Son, 8/27. Since then it has been found at several places around Boskloof near De Wet in the Worcester Dist. by Mr. D. A. Swanepoel and others, all over the Karoo.

2. *P. sardonyx* Tr. (Pl. III, 2.) V. shaped somewhat like a boomerang, inner edge produced into a fine blunt point. Anellus large, divides into two long arms. A. broad with pointed apex holding cornuti; saccus produced. Cape Prov. 1941 (Gowan C. Clark).

3. *P. argyraspis* Tr. (Pl. III, 3.) Genitalia similar to the last except that the apex of the valve is convex instead of concave ending in a blunt knob instead

of a point; anellus two large pointed processes. Graaff-Reinet, Cape. 3/40 (Swanepoel).

4. *P. wallengrenii* Tr. (Pl. III, 4.) U. broad with rounded pads. V. pointed. A. very large and broad, divided at apex. Anellus small, shaped like a triangle. Mamre Dist., Cape. 3/37 (Dickson).

5. *P. malagrida* Walleng. (Pl. III, 5). U. broad. V. very similar in shape to *pierus* but smaller Anellus large triangular-shaped. A. large and broad. Lion's Head 2/35 (Dickson).

6. *P. dicksoni* Gabr. (Pl. III, 6.) U. broad. V. large and broad. Anellus small, triangular-shaped. A. large, ending in a fine point. The male of this species was first found by Mr. C. G. Dickson near Melkbosstrand in 9/46; the female the following year 8/47.

II. *Aloeides* Hubner (1816).

7. *A. egerides* Riley. (Pl. III, 7.) U. narrow. V. narrow and pointed with a distinct indentation about middle. Anellus small. A. long, the apex bulbous. Philadelphia, Cape. 3/36 (Dickson).

7a. *A. pierus* Cram. (Pl. III, 7a.) U. a narrow, hairy pad. V. large, restricted at apex, broad about middle, rounded off at base. Anellus a large broad triangular process. A. large, tapering to a blunt point. Wynberg, Cape. 11/36. Stellenbosch, Cape. 10/36.

8. *A. aranda* Walleng. (Pl. III, 8.) U. narrow. V. same as *malagrida*. Anellus a small triangle. A. large, broad. Natal, 1941.

9. *A. simplex* Tr. (Pl. III, 9.) U. narrow. V. large, ending in a blunt point. Anellus large, apex two short points. A. large with broad apex. Tsaborg, Bechuanaland. 12/55 (Pennington).

10. *A. damarensis* Tr. (Pl. III, 10). Genitalia similar to *molomo*. A. broad with blunt apex. Anellus smaller. Zululand and Natal coast Dist.

11. *A. molomo* Tr. (Pl. III, 11.) U. broad. V. broad, bottle-shaped. A. tapering to a point at apex. Anellus a large process, apex and base pointed. Johannesburg, Transvaal. 10/02 (Feltham Coll., Johannesburg University).

12. *A. almeida* Feld. (Pl. III, 12.) U. narrow. V. long and narrow, ending in a blunt point. Anellus a large triangular process. A. large and broad with a blunt apex. Weenen, Natal. 11/31.

13. *A. thyra* L. (Pl. III, 13.) U. narrow. V. bottle-shaped like *pierus*, but smaller apex a blunt point. Anellus a large triangular process. A. large and broad, apex blunt. Cape and Colenso, Natal. 1928.

14. *A. taikosama* Walleng. (Pl. III, 14.) U. narrow. V. and A. very similar to those of *thyra*. Anellus smaller. Brakpan, Transvaal. 10/30; Springs, Transvaal. 2/37.

15. *A. barklyi* Tr. (Pl. III, 15.) U. narrow. V. differs considerably from the other species, a long narrow arm with a rounded apex, there is also a broad point attachment about the middle. Anellus has apex produced into two fine points. A. moderate in size, broad with several cornuti at apex. Namaqualand, Aughrabies. 9/49 (Swanepoel).

Species not available for dissection, *pallida*.

Section II (Falces 'Elbowed')

III. *Poecilmitis* Butler (1899).

1. *P. lycegenes* Tr. (genotype). (Pl. III, 16.) U. broad with two prominent hairy pads. V. broad at centre and base narrowing to a blunt point at apex. Anellus small, triangular-shaped at top but broadening at base. A. long, broad, ending in a fine point. Natal, 1941 (G. Clark).

2. *P. lyncurium* Tr. (Pl. III, 17.) Very similar to last species but V. smaller and not so broad. A. more narrow. Mbulu, Transkei, Cape. 1/33 (Pennington).

It is unnecessary to describe all the species given under this section as they are very similar to each other, though differing slightly, as will be seen from the drawings.

3. *P. chrysantas* Tr. (Pl. III, 18.) Naauwpoort, Cape, 12/31 (Gowan C. Clark).

4. *P. aethon* Tr. (Pl. III, 19.) Pilgrim's Rest, N. Transvaal. 12/45 (Swanepoel).

5. *P. lycia* Riley. (Pl. III, 20.) Matjesfontein, Cape. 3/52 (Swanepoel).

6. *P. chrysaor* Tr. (Pl. III, 21.) Riebeek Kasteel Mts., Cape. 4/37 (Dickson).

7. *P. phosphor* Tr. (Pl. IV, 22.) Newstead, Balgowan, Natal. 5/34 (Pennington).

8. *P. pyroeis* Tr. (Pl. IV, 23.) Cape. 11/36 (Dickson).

9. *P. felthami* Tr. (Pl. IV, 24.) Cape Flats, Cape. 11/37.

10. *P. zeuxo zeuxo* L. (Pl. IV, 25.) Cape Pen. 2/27; Oakford, Natal. 2/38.

11. *P. penningtoni* Riley. (Pl. IV, 26.) Gaikaskop, Cape. 1/35 (Pennington).

12. *P. aridus* Penn. (Pl. IV, 27.) Springbok, Cape. 10/55 (Pennington).

13. *P. palmus* Cram. (Pl. IV, 28.) Tygerberg Hills, Cape. 11/45 (Dickson).

14. *P. thysbe* L. (Pl. IV, 29.) Cape Dist. 4/36 (Dickson).

15. *Aloeides orthus* Tr. (Pl. IV, 30.) Mountain Drive, Second Pass, Basutoland. 1/57 (Pennington).

16. *P. pyramus* Penn. (Pl. IV, 31.) Zwartberg Pass, Cape. 11/46 (Pennington).

17. *P. tsino.* (Pl. IV, 32.) Mbulu Ridge, Cape. 11/54 (Swanepoel). Not yet described but very near to *P. lyncurium*.

P. turneri was not available for examination.

IV. *Chrysoritis* Butler (1898).

18. *C. oreas* Tr. (Pl. IV, 33.) This species was rediscovered by Mr. M. Pennington after a lapse of some 70 years or more. Niginya, Natal. 12/27 (Pennington).

V. *Crudaria* Wallengren. Recognized as a distinct genus by Aurivillius.

19. *C. leroma* Walleng. (Pl. IV, 34.) The genitalia of this species differ from those of all the *Phasis* and so it has been placed in a genus of its own. De Wildt, Pretoria, Transvaal. 12/32.

VI. *Anthene* Doubleday (1847).

This genus is included here in order to complete the study of all the South African Lycaenids; the other groups have been dealt with previously (Murray, 1944, 1948, 1956).

The genus was created by Doubleday in 1847, afterward placed under *Lycaenesthes* Moore in 1865, the genotype being *A. larydas* Cram. It is a very large genus but there are only a few representatives in South Africa. Among other characters it is distinguished by the two or three slender pencils of hair which nearly always occur on the hind-wings at the extremities of veins 1, 2 and 3. The genitalia are very distinct, the aedoeagus always long and well developed. Bethune-Baker revised the whole African genus in 1910, including most of our species, though the figures he gives of the genitalia, from photographs, are not very helpful in distinguishing the various species. Very few life histories, including the food-plants are so far known. The descriptions given below are very brief.

1. *Anthene larydas* Cram. (genotype). (Pl. IV, 35.) U. rounded into two large hairy pads. V. of moderate size, bottle-shaped, apex blunt. A. very long and broad. Anellus large, forming a three-pronged process; saccus produced. Durban, Natal. 6/31.

2. *A. amarah* Guer. (Pl. IV, 36.) U. pads small. V. oblong in shape, inner apex pointed, outer rounded. A. very long, blunt at orifice. Anellus a crossed process, resembling a wide X. Brakpan, Transvaal. 5/51; Naboomspruit, N. Transvaal. 4/32.

3. *A. livida* Butl. (Pl. IV, 37.) V. of moderate size, broad, divided at apex into two pointed teeth. A. long, blunt at orifice. Anellus small. Pretoria, Transvaal. 9/45.

4. *A. definita* Butl. (Pl. IV, 38.) V. very large and broad, divided at apex into fine pointed teeth. A. long and narrow. Anellus small; saccus produced. Warmbaths, Transvaal. 4/32; Pretoria, Transvaal. 10/37.

5. *A. otacilia* Tr. (Pl. IV, 39.) V. round at base with a very long bent arm, ending in a fine point, holding a blunt knob near middle with two fine spines. A. long and narrow. Anellus small. Natal, 1941.

6. *A. princeps* Butl. (*neglecta* Tr.) (Pl. IV, 40.) V. very large and broad, almost as large as the whole organ, apex divided into a series of strong teeth; about middle a long, pointed arm, also with teeth. A. long and narrow, bulbous at apex. Anellus very small; saccus produced. Howick, Natal. 3/34 (Pennington).

7. *A. lemnos* Hewit. (Pl. IV, 41.) V. very large, almost round in shape, apex minutely divided. A. very long, broad, ending in a blunt point. Saccus ending in a long fine point. Anellus two curved arms. Durban, Natal. 12/34.

8. *A. millari* Tr. (Pl. IV, 42.) V. of moderate size, heart-shaped, upper edge serrate. A. very long and narrow. Anellus small. Weenen, Natal (Tring Museum).

9. *A. minima* Tr. (Pl. IV, 43.) V. divided at middle, where the inner edge is produced to a fine sharp point; upper half of V. a long, curved serrate arm. A. very long, ending in a fine point. Anellus pear-shaped, divided into two points. Saccus produced to a point. Northdene, Natal. 1/33 (H. Millar).

10. *A. talboti* Stempff. (1936). (Pl. IV, 44, redrawn from Stempffer's figure.) This species was found some years ago at Chuckomaas, Natal, by Mr. L. S. Higgins; it also occurs in Kenya. The genitalia are similar to *definita* but the V. is divided into distinct long, pointed spears. Anellus very large and broad.

11. *A. contrata* taken by Pennington in 4/53. Natal?

VII. *Desmolycaena* Trimen. (1898).

Desmolycaena Mazoensis Tr. (Pl. IV, 45.) Uncus broad. Falces small. Valve oblong in shape. Aedoeagus broad of moderate size, blunt at apex. N. Transvaal, 1947 (Swanepoel).

One or two other species have been found in recent years but they are not available.

Summary

The genitalia of the genus *Phasis* (Lepid. Lycaenidae) and its subordinate genera have been worked out, accompanied by figures of all the species available, as these have not so far been given by any other worker. The paper suggests a natural division of the approximate number of 46 species into two sections of equal numbers by means of the different shaped 'falces' or hooks of the gnathos. There is added the small number of South African species of the genus *Anthene* to complete the whole study of the South African Lycaenidae; others being dealt with elsewhere. At the end a list of food-plants and necessary references are added.

Food-Plants

Phasis—			
1. *zeuxo zeuxo*	Chrysanthemoides moniliferum C. incana	Compositae	Cape (Dickson, 1953). Eggs generally laid singly on fresh or withered leaves, also on stem and bark.
2. *lycia*	Royena hirsuta and other plants	Ebenaceae	Cape (Swanepoel, 1953).
3. *chrysaor*	Zygophyllum sessilifolium and Rhus sp.	Zygophyllaceae	Cape (Dickson, 1943). Eggs laid singly on underside of leaf.
4. *felthami*	Z. sessilifolium Z. flexuosum	Zygophyllaceae	Cape (Dickson, 1940).
5. *malagrida*	Aspalathus sp.	Leguminosae	Cape (Dickson, 1940).
	Ifloga laricifolia	Compositae	Cape (Dickson, 1940). Eggs generally laid singly, sometimes in pairs on stem.
6. *wallengrenii*	Senecio pubigerus	Compositae	Cape (Dickson, 1953).
7. *dicksoni*	Danthonia stricta	Gramineae	Cape (Dickson, 1953).
	Leucadendron sp.	Proteaceae	(Cape (Dickson, 1953).
	Pelargonium flavum	Geraniaceae	Cape (Dickson, 1953).
8. *taikosama*	Felicia muricata	Compositae	Transvaal (Murray, 1937). Reared
	Aspalathus sp.	Leguminosae	on by G. C. Clark.
9. *turneri*	Zygophyllum sp.	Zygophyllaceae	Western Karoo (Dickson, 1953).
10. *thysbe*	Aspalathus sp.	Leguminosae	Cape (Dickson). Reared on this plant.
	Chrysanthemoides	Compositae	Eggs laid singly on leaf and stem. (Dickson).
11. *nigricans*	Senecio sp.	Compositae	Cape (Dickson, 1947).
12. *palmus*	Aspalathus sarcantha	Leguminosae	Cape (Dickson, 1953).
	Berzelia sp.	Bruniaceae	
13. *thero*	Melianthus major Rhus sp.	Melianthaceae	Cape (Murray, 1939).

The following species have been reared on Aspalathus sp. by Mr. G. C. Clark: *pierus*, *aranda thyra*, *almeida* and *damarensis*, and *Crudaria leroma* on Acacia Karroo.

Anthene—			
1. *definita*	Albizzia lophanta Acacia, Rhus and other plants	Leguminosae	Cape (Penfold). Natal (Clark) on flower buds and fruit.
2. *lemnos*	Micrococca berberidea	Euphorbiaceae	Natal (Dickson, 1954).
3. *minima*	See Refer. (Clark, 1940)		Natal (Clark, 1940).
4. *livida*	Kalanchoe crenata	Crassulaceae	Kenya (Jackson, 1937).
Desmolycaena mazoensis	Acacia sp.	Leguminosae	Zululand (Pennington, 1953 and 1956).

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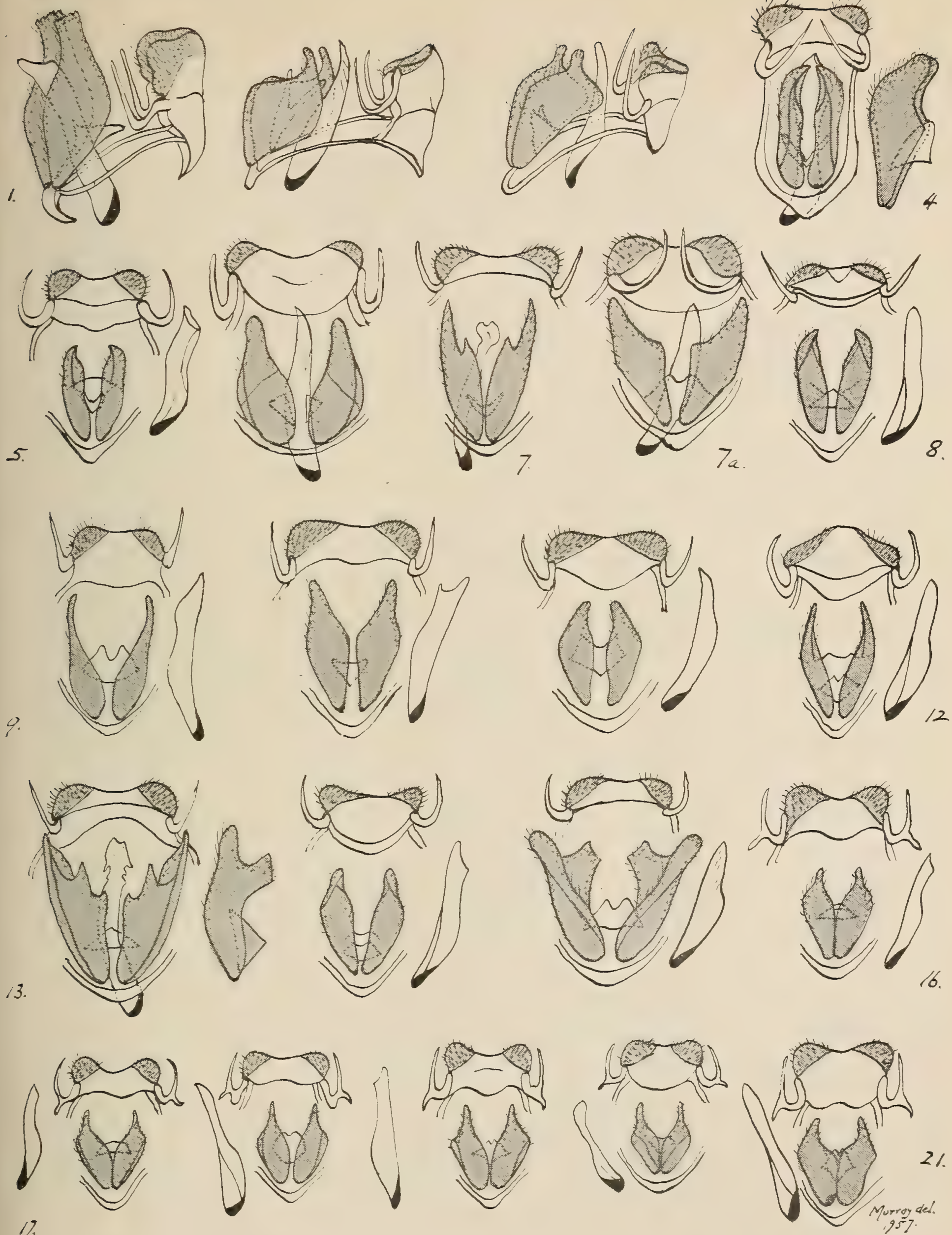
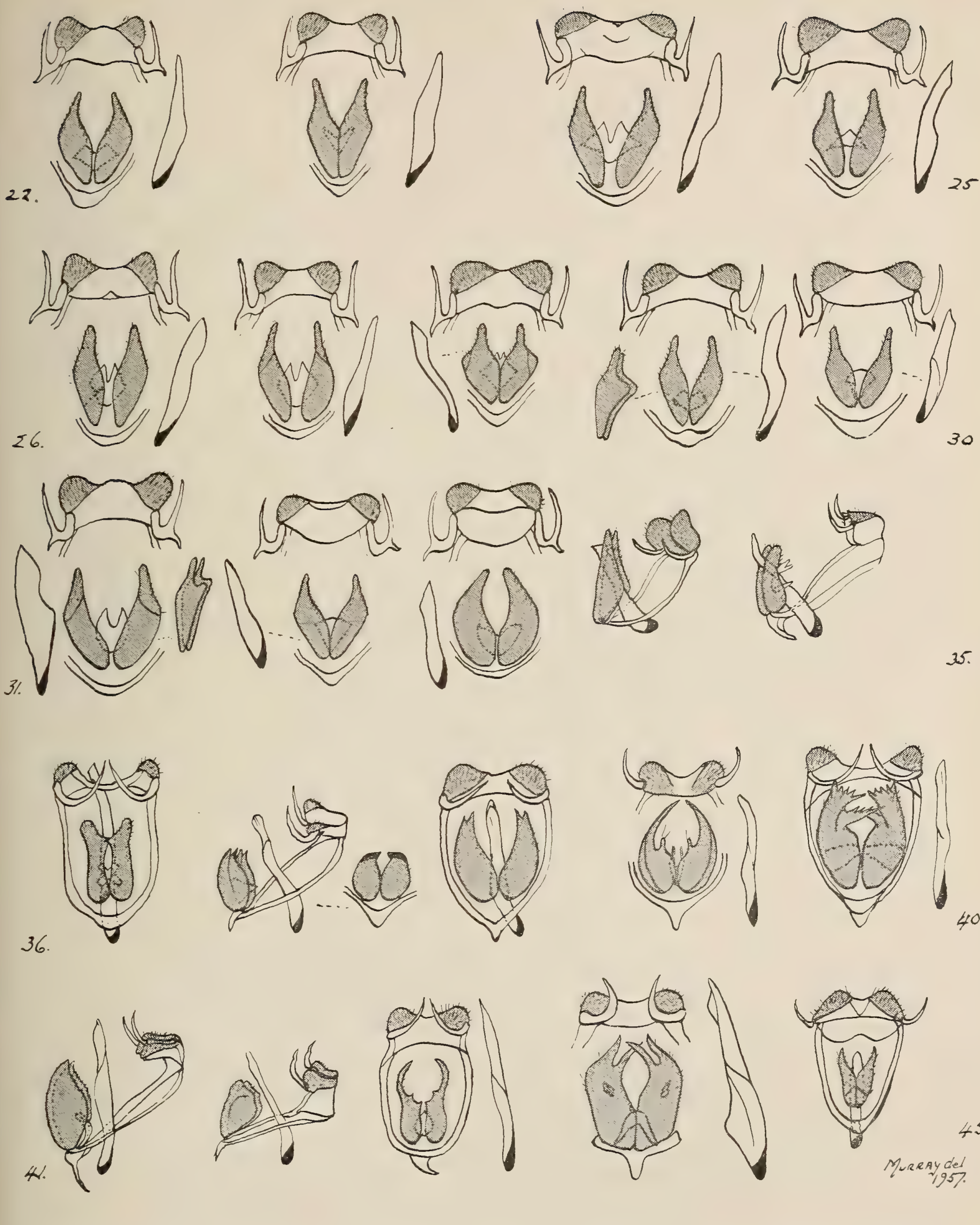


1. *Phasis thero* Linn. (genotype). 2. *P. sardonyx* Tr. 3. *P. argyraspis* Tr. 4. *P. wallengrenii* Tr. 5. *P. malagrida* Walleng. 6. *P. dicksoni* Gabr. 7. *Aloeides egerides* Riley. 7a. *A. pierus* Cram. (genotype). 8. *A. aranda* Walleng. 9. *A. simplex* Tr. 10. *A. damarensis* Tr. 11. *A. moloma* Tr. 12. *A. almeida* Feld. 13. *A. thyra* Linn. 14. *A. taikosama* Walleng. 15. *A. barklyi* Tr. 16. *Poecilmitis lycegenes* Tr. (genotype). 17. *P. lyncurium* Tr. 18. *P. chrysantas* Tr. 19. *P. aethon* Tr. 20. *P. lycia* Riley. 21. *P. chrysaor* Tr.



22. *Poecilmitis phosphor* Tr. 23. *P. pyroeis* Tr. 24. *P. felthami* Tr. 25. *P. zeuxo zeuxo* Linn. 26. *P. penningtoni* Riley. 27. *P. aridus* Penn. 28. *P. palmus* Cram. 29. *P. thysbe* Linn. 30. *A. orthus*. 31. *P. pyramus* Penn. 32. *P. tsino* (subsp. nov.) (not yet described). 33. *Chrysoritis oreas* Tr. 34. *Crudaria lerona* Walleng. 35. *Anthene larydas* Cram. 36. *A. amarah* Guer. 37. *A. livida* Butl. 38. *A. definita* Butl. 39. *A. otacilia* Tr. 40. *A. princeps* Butl. (*neglecta* Tr.). 41. *A. lemnos* Hewit. 42. *A. millari* Tr. 43. *A. minima* Tr. 44. *A. talboti* Stempff. 45. *Desmolycaena mazoensis* Tr.

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THE ECOLOGY OF SOUTH AFRICAN ESTUARIES.

Part VIII. KOSI BAY ESTUARY SYSTEM

By

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(With 1 figure in the text and Plates V and VI)

The topography of the Kosi Bay Estuary System is described and observations on the physical and chemical factors are tabulated. The estuary is partly tidal and there is a salinity gradient ranging from 3·3‰ in the top part to 33‰ near the mouth. On the basis of these factors and ecological and topographical factors, the system is divided into seven regions. The fauna and vegetation of six of these regions are described. A total of 216 species of animals was found and is listed in the appendices. The composition and distribution of the fauna are discussed and compared with those of Richard's Bay. It is concluded that the distribution is similar but the composition is very different, probably due to difference in substrata as salinity and other conditions are rather similar in both.

Contents

Introduction

In July 1949 a team of six biologists from the Department of Zoology of the University of Cape Town revisited the St. Lucia Estuary and Richard's Bay in order to investigate any differences which might have resulted from the floods since the previous visits. On that occasion the present authors joined the Third Tongoland Expedition organized by the Natal Society for Preservation of Wild Life and Natural Resorts, to carry out an ecological survey of Kosi Bay Estuary. It was thought that the results of such a survey might be of considerable interest in connection with work already carried out on St. Lucia and Richard's Bay Estuaries (Day, Millard and Broekhuysen, 1953; Millard and Harrison, 1953).

Kosi Bay was reached in the evening of 11 July and work was started the next day and continued until the 19th when we had to leave to rejoin our team at St. Lucia. Due to the short time available (eight days), the difficulties with boats, and the fact that the work had to be done by only two people, the

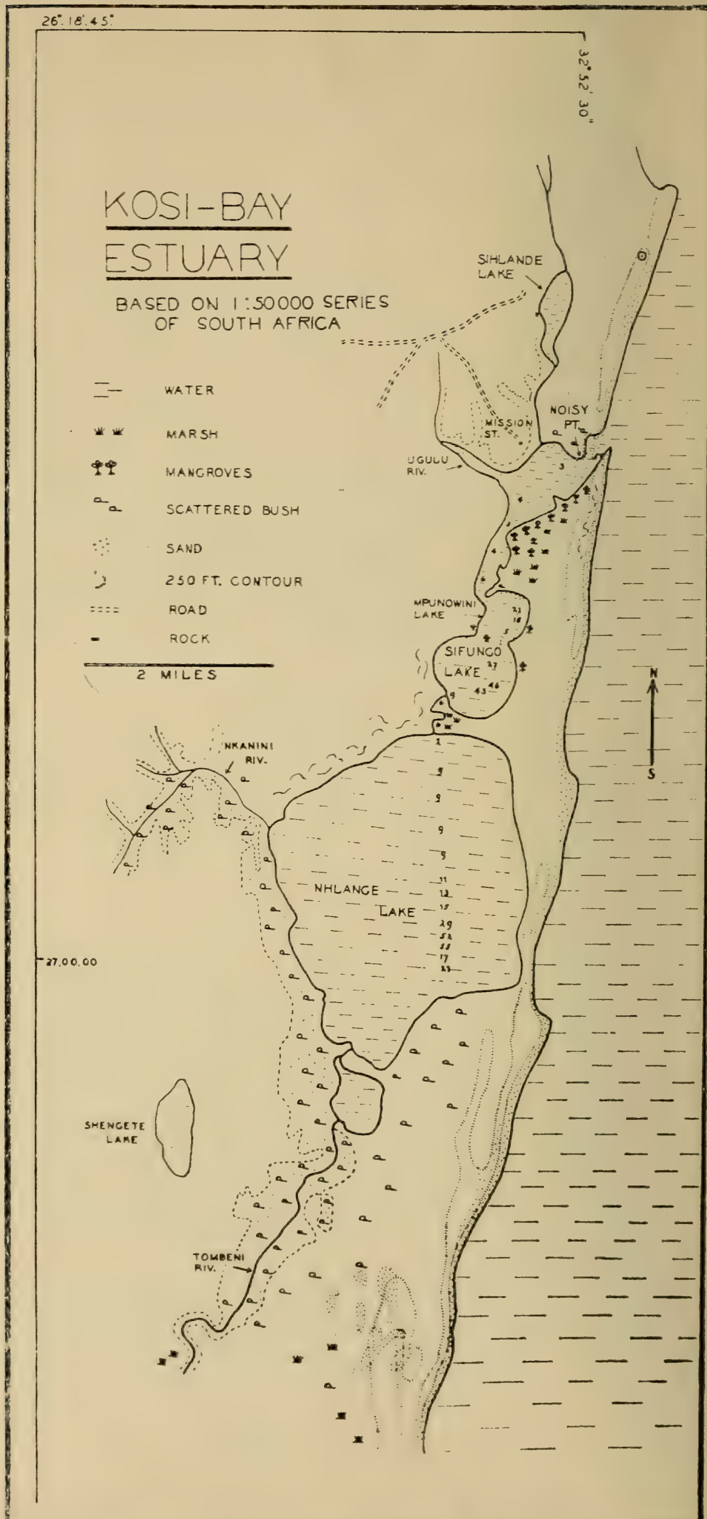

Fig. 1. A map of the Kosi Bay Estuary System based on the 1 : 50,000 series of South Africa.
The depth is given in feet.

extent of the survey was limited. As the boat and canoe were too light for dredging, we could only work the shores and shallow water. We feel, however, that a fairly comprehensive knowledge of the main biological characteristics of these shores and shallow waters has been obtained. Mr. G. D. Campbell collected the majority of the species of fish given in the Appendix C (Campbell and Allanson, 1952).

Topography of the Kosi Bay Estuary System

It consists chiefly of three lakes, e.g. Nhlange Lake, Sifungo Lake and Mpunowini Lake (fig. 1). The system runs from south-west to north-east and opens into the sea 2 to 3 miles south of Oro Point (indicated but not named on the map) which is in Portuguese territory. A narrow channel broadening into a shallow tidal basin connects Mpunowini Lake with the sea. Four rivers flow into the system: (*a*) the Tombeni River which enters Nhlange Lake at the south-west point, (*b*) the Nkanini River which enters the same lake on the west side, (*c*) the Ugulu River which enters the northern tidal basin at a point south-west of the Mission Station and (*d*) a small stream from Sihlande Lake which enters the same basin just east of Noisy Point. The whole system from the southern shore of Nhlange Lake to the mouth is 7 to 7½ miles long.

Results of the Survey

The system can be divided into seven sections, based on the physical, chemical and biological factors.

These are as follows:

I. The mouth of the estuary (the section east of Noisy Pt.).
II. The tidal basin, which is the section between Noisy Pt. and the mouth of the Ugulu River.
III. The shallows between the Ugulu River mouth and Mpunowini Lake.
IV. Mpunowini Lake.
V. Sifungo Lake.
VI. The winding narrow channel between Sifungo Lake and Nhlange Lake.
VII. Nhlange Lake.

During the eight days at our disposal we only managed to cover the first five sections though a few observations were made in the other two.

The physical and chemical properties of the water in the different sections have been tabulated in Appendix A.

I. The Mouth of the Estuary

A short straight channel, about 15 to 20 yards wide, running from west to east, formed the connexion with the sea. This channel formed the outlet of a basin bordered by sandy shores except on the south-east side where there was an outcrop of limestone and more to the south a beach covered with limestone pebbles. In the centre was a sandbank exposed during low water. By marking on a stick the lowest and the highest water level which occurred during eight days between spring and neap tides, it was found that the maximum tidal range opposite the mouth was 2 to 2½ feet. As can be seen from Appendix A the salinity varied considerably but approaching that of ordinary sea water. For the pH and temperature we can also refer to Appendix A. The water was extraordinarily clear as in all parts of the system. The 'rocky outcrop' and the 'pebble beach' were particularly rich in animal life. A large variety of molluscs and crabs were found, some of which were restricted to this area and the pebble beach was rich in Polychaet worms. For detailed information the reader is referred to Appendixes B and C. The sandy shores and the central sandbank were rather poor and even the sand-crab *Ocypode ceratophthalmus* was not common.

II. The Tidal Basin between Noisy Pt. and the Ugulu River

As can be seen from figure 1, this area was much larger than the previous one and there was a striking difference between the two shores. Except for a narrow twisting channel between 3 and 4 feet deep at low water, the basin was extremely shallow. Moreover Native fishtraps (pl. V, A) stretched across the whole area and made navigation, even in a small craft, extremely difficult The tidal range was about 1½ to 2 feet. The water was brackish (see Appendix A), while the pH and temperature in shallow pools cut off at low water were high.

The East shore

The northern part was a short narrow stretch of sandy beach with scattered mangroves. Southwards the shore widened out and formed extensive shallow pools and banks of sandy mud with large patches of dense mangroves (pl. V, B) including *Avicennia officinalis* and *Bruguieria gymnorhiza.* At a slightly higher level there was a zone of rushes—*Juncus kraussi*—which in part was very wide and stretched up to where the bush started to grow.

The three following zones were clearly marked:

(i) *Juncus zone.* Inhabited by many crabs burrowing in the ground and considerable numbers of *Littorina scabra* living on the leaves.

(ii) *Mangrove zone.* This was fairly extensive. It included the dense mangrove growth in the middle and the higher parts of muddy sandbanks separated by shallow water. The most striking features were the many crabs (up to 31 holes per square yard under the mangroves) and the two whelks *Pyrazus palustris* and *Cassidula labrella. P. palustris* was common just below the dense mangroves, but was rather patchy (Pl. VI, A). *C. labrella* lived among the thickest mangroves and seemed to prefer the shade. There was a certain amount of overlap between the two. The barnacle—*Balanus amphitrite*—was quite prominent on the mangrove trunks and fishtrap sticks.

(iii) *Zone below mangroves.* Consisted of gently sloping sandy mud with hardly any vegetation. This area was fairly rich with many Polychaets (see Appendix B), the Sipunculid *Siphostoma australe* and the bivalve *Loripes clausus* which must have been very abundant in the past judging by the many empty shells. The hermit-crab *Clibanarius longitarsus* and the prawn *Panaeus japonicus* were both common.

The West shore

This was a narrow beach bordered by a belt of *Juncus* which on the landward side was replaced by *Phragmites* growing in a swampy surrounding. Just above the reeds scattered young mangroves occurred. Most of the crabs found on the east shore also occurred here among the *Juncus* and some of the *Sesarma eulimene* were in berry. Seining in the shallows revealed the prawn *P. japonicus* and young of several fish such as *Mugil* sp., *Therapon jarbua, Gobius giuris* and *Ambassis commersoni*.

III. The Shallows between the Ugulu River Mouth and Mpunowini Lake

These shallows form the connexion between the tidal part of the estuary and Mpunowini Lake. Although some mixing between fresh and brackish water seemed to occur in this region, it was definitely much less than in the area previously described (see Appendix A). The tidal range was probably not more than 4 to 5 inches. The channel was 4 to 6 feet deep and the shallow water bordering it was obstructed by many fishtraps.

The eastern shore was very similar to that of the previous section, with a wide zone of dense mangroves at the water's edge and *Juncus* at higher levels. Near Mpunowini Lake there were only few mangroves and *Juncus* grew down to the edge of the water while a green filamentous alga became quite common along the margins at the entrance to the lake. On the western shore the mangroves were rather patchy but the *Juncus* zone remained distinct. About halfway along the shallows *Phragmites* appeared at the water's edge. These reedbeds later became quite extensive and at the entrance of the lake they were several yards wide with a forest of mangroves behind and above them. The bivalve *L. clausus* was not found alive but many empty shells were embedded in the sandy mud at the northern end of the shallows. The large whelk *Pyrazus palustris,* although common at the northern part of the shallows, petered out towards Mpunowini Lake and the individuals which did occur were stunted. *C. labrella,* so characteristic on the mud under dense mangroves of the previous section, was gradually replaced by *Assiminea bifasciata. Balanus amphitrite* disappeared just south of the Ugulu River mouth. *Littorina scabra*, however, persisted at and above extreme high-water level and on the leaves of mangroves almost to the entrance of Mpunowini Lake. The sand-prawn *Callianassa kraussi* first appeared near the northern end of the shallows and became abundant about half-way down, where 45 to 180 holes per square yard were counted. Large numbers of Polychaet worms were noticed at this point. Crabs were common not only under the mangroves in the northern part but also in the *Juncus* zone on the western shore *Hymenosoma orbiculare* made its first appearance in the narrow channel Amphipods such as *Chiltonia capensis*, *Melita zeylanica* and a species of *Grandidierella* and Isopoda including *Cirolana fluviatilis*, *Dies monodi* and *Synidothea variegata* also appeared and soon became common. The first specimen of the bivalve *Modiolus capensis* appeared here and the presence of *Chironomid* larvae in the sand indicated a strong fresh-water influence.

IV. Mpunowini Lake

This lake was the smallest of the three and the northern part was mainly shallow (about 3 feet deep). The deepest part was along the eastern shore where a depth of 21 feet was recorded. We also found a definite layering in these deeper waters with a surface salinity less than half that of the bottom. There was also a vertical temperature difference of at least $1\frac{1}{2}°$ C. Details of the physical and chemical conditions are given in Appendix A. There were indications of a tidal range of about 4 inches at the northern entrance.

The northern shore was a narrow sandy beach with *Juncus*, grass and scattered palms growing on the bank above. This vegetation harboured many large crabs (*Sesarma meinerti*). The shallow water contained more algae including two filamentous green species and one brownish one and amphipods and isopods were numerous.

The eastern shore consisted of reed-beds with scattered mangroves in between. Young fish (*Therapon jarbua*), prawns (*L. pacificus*) and many isopods and amphipods were seen in the shallows. Above and beyond the reeds were numerous holes inhabited by *S. meinerti*.

The western shore was covered with mangroves, two species of rushes, palms and grass growing at and above high-water level. At the southern end, near the connexion with Sifungo Lake the brack grass *Ruppia maritima* made its first appearance. *Littorina scabra* was still common along this shore and *Modiolus capensis* had become more numerous. *Callianassa kraussi* was common or abundant along the whole of this shore and 153 to 162 holes per square yard were counted.

V. Sifungo Lake

The connexion between Mpunowini Lake and Sifungo Lake consisted of two short channels separated from each other by an island covered with dense mangroves. The large crab *S. meinerti* occurred in great numbers on this island and was collected by Natives as food, while the small periwinkle *A. bifasciata*, common in the area between the Ugulu River mouth and

Mpunowini Lake, was present in its characteristic habitat. The two channels were fairly deep at the northern end but where they ran into Sifungo Lake they were blocked by a shallow sandbank only covered by a few inches of water.

The north-western part of the lake was only a few feet deep, but towards the middle of the eastern side depths up to 46 feet were recorded. The water was exceptionally clear. Salinity determinations of surface- and bottom water samples indicated the existence of some layering but not as striking as in the previous lake (Appendix A). The bottom water was 3° C. warmer than the surface.

The northern and southern shores were narrow beaches of clear sand while the western and eastern shores were fringed by dense reeds with mangroves growing behind them. The three algae seen in Mpunowini Lake were present but the one like a broad *Enteromorpha* seemed to peter out and a new green alga —*Chara macropogon*—appeared for the first time. *R. maritima* now became common. Two species of isopods were common and three species of amphipods were collected one of which (*Urothoë serrulidactylus*) was restricted to this area. *Modiolus capensis* had now become fairly common in places and *A. bifasciata* was still present in the north-western corner of the lake. The bivalve *Psammobia ornata* appeared to be common in the shallow water among the reeds and it is remarkable that the only other place where this species was collected was on the sandy shore of the mouth of the estuary (see Appendix B). There was one common Polychaet. The sand-prawn *Callianassa* was still abundant and from 117 to 171 holes per square yard were counted.

VI. Channel between Sifungo Lake and Nhlange Lake and Nhlange Lake itself

Since only one short visit was made to these regions, information regarding them is incomplete. As shown in pl. VI, B, a narrow winding channel fringed by tall reeds connected the two lakes. Its depth averaged 6 feet or even 11 feet in places. Nhlange Lake, which had a diameter of approximately 3 to 4 miles, is separated from the sea on the south-eastern side by a low sandbar only a few hundred yards wide. We heard rumours that the lake was over 60 fathoms deep in one spot but we know of no published records. We, therefore, took a series of depth-soundings which have been entered in figure 1. From this it can be seen that the maximum depth we found was 52 feet. The greater part of the lake appeared to be 9 feet or less. It is still possible, that greater depths occur in the western part of the lake where soundings were not taken. The figures in Appendix A indicate that the water had a very low salinity and appeared to be uniform from surface to bottom. The sole collection made was where the channel entered the lake. Large rushes and *R. maritima* were very common here. The mussel *Modiolus capensis* was abundant, attached to *Ruppia*, also a fresh-water sponge, possibly an undescribed species of *Desmospongia*. The fresh-water crab *Rhynchoplax bovis* and the shrimp *Caridina nilotica* were common, also two amphipods (*Melita zeylanica* and *Talorchestia ancheidos*). The only isopod was *Sphaeroma annandalei*, which was restricted to this lake (Appendix B).

We may summarize by saying that the Kosi Bay System is an exceptionally clear estuary. Although on the whole rather shallow, there are some very deep parts and some of these show a distinct vertical layering. The mouth was strongly saline and the 'rocky outcrop' and 'pebble beach' are very rich. The Tidal Basin, which shows a considerable drop in salinity, is characterized by a typical mangrove fauna and burrowing animals of tidal mud flats. There are indications of serious silting in recent times, probably accelerated, if not originally caused, by large numbers of Native fishtraps. Some of these have stimulated the growth of mangroves. The shallows between Ugulu River mouth and Mpunowini Lake have a small tidal range, a low salinity and a brack-water fauna. Mpunowini Lake showed a distinct layering in the deeper parts. The surface salinity was low. There was a slight increase of algal growth and a further decrease in the number of species of animals. Sifungo Lake was generally similar to Mpunowini Lake but the vertical salinity gradient was not striking although the temperature gradient suggested layering of the water. The surface salinity is somewhat lower than that of Mpunowini Lake. The fauna of the two lakes is essentially the same with minor changes in abundance.

Notes on the Fishes

Although we did a little seining, when time permitted, few records of fish could be obtained. However, members of the Tongoland Expedition and especially Mr. G. D. Campbell concentrated on the collecting of different species of fish by angling and seining. Their results from Kosi Bay and some other areas such as Lake Sibayi, Nyamiti and Kangazini Pans, etc., have already been published (Campbell and Allanson, 1952).

In Appendix C all records of fish caught in the Kosi Bay Estuary System, excluding the rivers running into it, have been listed. It is interesting to compare this list with the list of species recorded from Richard's Bay by Millard and Harrison (1952). It appears that only 22 species occur in both estuaries; 38 occur at Kosi Bay but not at Richard's Bay and 54 occur in Richard's Bay and not at Kosi Bay. Of the 38 species restricted to Kosi Bay, 19 were collected near or on the 'rocky outcrop' at the mouth of the estuary. The relatively large number of species which occurred either in the one or in the other but not in both estuaries is interesting. The fact that Richard's Bay had extensive *Zostera* beds which provided shelter and food while no *Zostera* occurred at Kosi Bay, and the fact that Kosi Bay had small rocky and pebble patches, which did not occur at Richard's Bay may account for the difference in species in the two estuaries. It should also be remembered that the water in the Kosi Bay System seemed to be clearer than that of Richard's Bay and on the whole was very much less saline.

Notes on the Birds

Aquatic birds may be important in the ecology of estuaries. During the short time in which the present survey was carried out, any birds wholly or partly dependent on water were recorded. The total number of species tabulated in Appendix D is 36. The figures in the different columns are the maximum numbers seen in the area at any one time. The number of species is relatively low possibly because the Kosi Bay System was visited during the winter when most palaearctic waders had left for their northern breeding quarters. From Appendix D it will be seen that the mouth of the estuary was the poorest in bird life. The large numbers of Avocets and relatively large numbers of Whimbrels are interesting.

Discussion

Of all the estuaries which have been investigated along the coast of Natal (Durban Bay, St. Lucia and Richard's Bay) none is actually comparable with the Kosi Bay System. Although Kosi Bay shows a gradual salinity gradient from slightly brack water at the top to almost sea water near and at the mouth, it is unique in that the major part contains brack water and that it is divided in such distinct parts interconnected by narrows. This seems to be the first time that the fauna of long stretches of brack water has been studied in the ecology of South African estuaries.

Of the other Natal estuaries studied Richard's Bay perhaps comes nearest to Kosi Bay, although the topography is very different and the largest part contained water which was much more saline. Both, however, have a gradual salinity gradient and are relatively 'clear water' estuaries. Moreover they are near enough to each other to expect considerable numbers of identical species.

Comparing the two estuaries we find that the total number of animal species—excluding birds—recorded from Kosi Bay is 173 and for Richard's Bay 183.

Although the value of these figures is limited as they are so dependent on the thoroughness of the Kosi Bay survey, their similarity is rather striking.

In Table I the distribution of the different phyla over the different parts of the Kosi Bay System has been analysed. No information for Nhlange Lake is given as this area was very inadequately covered.

From this table it is clear that the largest number of species occurred in 'the mouth of the estuary'. Millard and Harrison (1952) found that at Richard's Bay 'the middle reaches' were by far the richest. As they point out (p. 174), number of species alone cannot give an idea of richness of the population. Reference to Appendices B and C of the present paper and Appendix B of the Richard's Bay paper will show that many species were common or limited to the regions under consideration.

TABLE I. DISTRIBUTION OF DIFFERENT PHYLA

	Estuary Mouth			Tidal basin between Noisy Pt. and Ugulu River mouth	Shallows between Ugulu River mouth and Mpunowini Lake	Mpunowini Lake	Sifungo Lake
	Sandy shore	Pebble beach	Rocky outcrop				
Porifera	0	2	0	0	0	0	0
Coelenterata	0	0	3	0	0	0	0
Annelida	1	6	0	8	5	1	1
Crustacea	4	17	8	10	21	9	13
Mollusca	8	23	6	9	6	2	3
Ascidia		1					
Pisces		35		18	6	2	3
TOTAL		114		45	39	14	20

The difference in distribution of the animals in the two systems is rather striking and asks for an explanation. Considering the salinity of the water, the 'mouth of the estuary' at Kosi Bay seems to be similar to the 'middle reaches' of Richard's Bay. In the case of Kosi Bay there is no *Zostera* providing shelter and food, but there are small patches of rocky and pebble substrata which provide shelter and suitable attachment for sedentary species. In Richard's Bay there is extensive *Zostera* growth but no rocky and pebble substrata.

It therefore seems, that salinity together with the presence of shelter, food and suitable attachment are responsible for the abundance of animals in the regions under consideration.

It seems interesting to compare the actual species occurring in both systems. In Table II the species occurring in both estuaries and those occurring in one of the two only have been tabulated.

TABLE II. COMPARISON OF SPECIES AT KOSI BAY AND RICHARD'S BAY

PHYLUM	NUMBER OF SPECIES		
	Present in both	Present in Richard's Bay only	Present in Kosi Bay only
Porifera	0	0	3
Coelenterata	?	8 or 11	?
Annelida	1	7	12
Crustacea	23	34	30
Insecta	0	5	2
Mollusca	5	12	32
Ascidia	0	0	1
Pisces	22	54	38
TOTAL	51	123 120	118

From this table it is obvious that the fauna of both systems is very different and that only 51 species occurred in both the estuaries. This is the more striking as both estuaries as regards salinity conditions are to a certain extent similar. This suggests the conclusion that type of substratum may be more important than salinity especially in Mollusca.

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Appendix A

The physical and chemical factors of Kosi Bay Estuary. In each column the lowest and the highest figure represent the extremes, the other in the middle is the average. The number of records on which this average figure is based is shown as superior figure. Where surface and bottom samples were taken, these figures are given separately. The pH figures are without the salt-error and therefore somewhat too high.
* Shallows cut off between mangrove banks.
** Boggy place just above H.W.S.

Area	Salinity ‰	Water temperature in ° F.	pH	Turbidity (Secchi Disc.)
Mouth of Estuary	21·2–28·7^{3}–32·9	19·2–20·5^{12}–22·0	8·5–8·5^{7}–8·7	
Tidal Basin	9·9–13·3^{2}–16·6	21·3–23·8^{5}–26·0*	7·4**–8·4^{7}–9·2*	
Shallows between Ugulu River mouth and Mpunowini Lake	9·9^{1}	18·0–18·7^{4}–19·9	8·3–8·4^{3}–8·5	
Mpunowini Lake	7·4–7·8^{2}–8·1 Surf.: 7·4 Bottom: 18·3	18·8–19·6^{4}–20·5 18·8 20·2	8·3^{1}	
Sifungo Lake	Surf.: 6·6 Bottom: 7·6 7·5	19·3–20·7^{3}–23·0 Surf.: 19·3 Bottom: 23·0 21·7	8·3–8·6^{2}–8·8 8·3 7·5 (H_2S smell)	23 feet
Nhlange Lake	3·3–3·4^{2}–3·5 Surf.: 3·3 Bottom: 3·5	20·2–20·3^{2}–20·4 20·2 20·0	8·0–8·3^{2}–8·5	14 feet

Appendix B

Comparative list of the fauna of the Kosi Bay Estuary System.
P = present, C = common, A = abundant.

	Estuary Mouth							
	Sandy shore	Pebble beach	Rocky outcrop	Tidal basin between Noisy Pt. and Ugulu River mouth	Shallows between Ugulu River mouth and Mpunowini Lake	Mpunowini Lake	Sifungo Lake	Nhlange Lake
Porifera								
Desmospongia sp. (KOS 6B)								C
Haliclona raphidiophora (Lendenfeld)		P						
Higginsia coralloides Higgin		P						
Coelenterata: *Actinozoa*								
Small brown species (KOS 21A)			P					
Light coloured sp. (KOS 30A)			P					
Small burrowing anemone (KOS 33D) ..			C					

	Estuary Mouth			Tidal basin between Noisy Pt. and Ugulu River mouth	Shallows between Ugulu River mouth and Mpunowini Lake	Mpunowini Lake	Sifungo Lake	Nhlange Lake
	Sandy shore	Pebble beach	Rocky outcrop					
ANNELIDA: *Polychaeta*								
Ceratonereis keiskama Day				P	P			
Dasybranchus caducus (Gr.)				C				
Dendronereis arborifera Peters				P	C	P	C	
Loimia medusa Sav.				C				
Lycastis indica Southern				P	P			
Nerine cirratulus (D. Ch.)		P						
Notomastus abberans Day..								
Orbinia bioreti Fauvel				P				
Perineries capensis (Kbg.)		P		P				
Pomatoleois kraussii (Baird)		P						
Scolecolepsis indica Fauvel				C	A			
ANNELIDA: *Sipunculoidea*								
Phascolosoma scolops Sel et de Man		P						
,, *stephensoni* Stephen		P						
Siphonostoma australe	P	P		P	P			
CRUSTACEA: *Cirrepedia*								
Balanus amphitrite v. *denticulata* Broch.				C	P			
,, *trigonus* Darwin			P					
Chthamalus sp. (KOS 18A)			P					
Tetraclita squamosa (Brug.) v. *rufotincta* Pilsbry.			P					
CRUSTACEA: *Tanaidacea*								
Tanais philetaerus Stebb.							P	
CRUSTACEA: *Isopoda*								
Cirolana fluviatilis Stebb...					C			P
Dies monodi Brnrd.					C	P		
Pontogeloides latipes Brnrd.	C		P		C		C	
Sphaeroma annandalei Stebb.								C
Synidothea variegata Cllge.					P	A	C	
CRUSTACEA: *Amphipoda*								
Afrochiltonia capensis (Brnrd.)					C	C	P	
Grandidierella sp. (KOS 62D)					P			
Melita zeylanica Stebb.					A	A	C	P
Talorchestia ancheidos Brnrd.				P		C	P	A
Urothoë serrulidactylus Brnrd.							P	
CRUSTACEA: *Macrura*								
Alpheus sp. (KOS 32B)			P					
Athanas sp. (KOS 33)		P						
Caridina nilotica (P. Roux)								A
Metapenaeus (? *monoceros*) (Fabr.)					P			
Palaemon pacificus Stimps.						C	C	
Penaeus indicus M. Edw...							C	
,, *japonicus* Bate				C	P			
,, *monodon* Fabr.							C	

	Estuary Mouth: Sandy shore	Estuary Mouth: Pebble beach	Estuary Mouth: Rocky outcrop	Tidal basin between Noisy Pt. and Ugulu River mouth	Shallows between Ugulu River mouth and Mpunowini Lake	Mpunowini Lake	Sifungo Lake	Nhlange Lake
CRUSTACEA: *Anomura*								
Calcinus laevimanus (Randall)	P	P						
Callianassa kraussi Stebb.					C	A	A	
Clibanarius longitarsus (de Haan)			C	C	P			
,, *virescens* (Krss.)		P	P					
Coenobita cavipes Stimps.			P					
CRUSTACEA: *Brachyura*								
Actaea depressa (White)		P						
Actumnus setifer (de Haan)		P						
Cyclograpsus punctatus M. Edw.		C						
Epixanthus frontalis (M. Edw.)		C						
Eriphia smithii McLeay		C						
Euruppellia annulipes (M. Edw.)		P						
Grapsus strigosus (Herbst)		C						
Hymenosoma orbiculare Desm.					P	P	C	
Liomera bellus (Dana)		P						
Matuta lunaris (Forsk.)	P							
Metapograpsus messor (Forsk.)		C		C	P			
Ocypode ceratophthalmus (Pallas)	C							
Ozius regulosis Stimps.		P						
Pseudograpsus erythraeus Kossman		P						
Pseudozius caystrus (Ad. & White)		C						
Rhyncoplax bovis Brnrd.								C
Sarmatium ? crassum Dana				P	P			
Scylla serrata (Forsk.)					P		P	P
Sesarma catenata Ortm.					P			
,, *eulimene* de Man				P	C			
., *meinerti* de Man				P	P	C	C	
Uca annulipes (M. Edw.)				A	P			
Uca chlorophthalmus (M. Edw.)				P	P			
Xantho quinquedentatus Kr.		P						
Zozymodes xanthoides (Kr.)		P						
INSECTA								
Chironomid larvae					P			
Hydrometridae								P
MOLLUSCA: *Pelecypoda*								
Barbatia decussata (Sow.)		P						
Crassostrea cuculata (Born)		C	C					
Dosinia hepatica (Lam.)				P				
Isognomon dentifera (Krss.)		C						
Loripes clausus Phil.	C			C				
Modiolus (*Brachydontes*) *variabilis* Krss. ..		C						
Modiolus capensis Krss.					P	C	C	C
Mytilus perna (Linn.)		P						
Psammobia ornata Desh..	P							C
Pteria natalensis Jameson	P	C						
Tellina queketti Sow.	P							

	Estuary Mouth: Sandy shore	Estuary Mouth: Pebble beach	Estuary Mouth: Rocky outcrop	Tidal basin between Noisy Pt. and Ugulu River mouth	Shallows between Ugulu River mouth and Mpunowini Lake	Mpunowini Lake	Sifungo Lake	Nhlange Lake
MOLLUSCA: *Gastropoda*								
Assiminea bifasciata (Nevill)					A		P	
Cassidula labrella Desh.				C	P			
Cellana capensis (Gmelin)			P					
Cerithidia decollata (Linn.)				P	P			
Cerithium morus Lam.		C						
Coralliophila sp. (KOS 26U)		P						
Cypraea annulus Linn.	C	C						
Drupa squamosa (Pease)		P						
,, *tuberculata* (Blainv.)		C						
Engina (*Pusiostoma*) *mendicaria* (Linn.)		C						
Littorina obesa Sow.		P						
Littorina scabra Linn.				C	P	C		
Mitra litterata Lam.		P	P					
Natica marochiensis Gmelin				C				
Nerita albicilla Linn.		C						
,, *plicata* Linn.		P						
,, *umlaasiana* Krss.		A						
Planaxis sulcata Q. & G.		C						
Polynices mamilla Lam.	P			P				
Pyramidella mitralis A. Adams				P				
Pyrazus palustris Linn.				C	C			
Siphonaria anneae Tomlin		P	P					
,, *capensis* Q. and G.			P					
,, *oculus* Krss.		P	C					
Tricolia bicarinata (Dunker)		P						
Vermetus sp. (KOS 37A)	P							
ASCIDIA								
Styela aequatorialis Michaelson..		C						

Appendix C

Comparative list of the fishes of the Kosi Bay Estuary System
P = present, C = common, A = abundant.

	Estuary Mouth: Sandy shore	Estuary Mouth: Pebble beach	Estuary Mouth: Rocky outcrop	Tidal basin between Noisy Pt. and Ugulu River mouth	Shallows between Ugulu River mouth and Mpunowini Lake	Mpunowini Lake	Sifungo Lake	Nhlange Lake
Abudefduf saxtilis Forsk.	←	—	P	→				
Acanthopagrus berda (Forsk.)			C	C				
Acanthurus fulgiginosus (Lesson)	←P	→						
,, *triostegus* (Linn.)			P					
Alticops oryx (Cuv.)			P					
Ambassis commersoni Cuv. & Val.				C				
,, *safga* (Forsk.)				P	C			
Antennablennius bifilum (Gunth.)	←	—	C	→				
Arothron aerostaticus (Jenyns)			P					
Bothus pantherinus (Rupp.)				P				
Callyodon guttatus (Schneider)			C					
Caranx melampygus Cuv.	←	—	P	→				
,, *sexfasciatus* Q. & G.	←	—	P	→				
Chaetodon lunula (Lacep.)			P					
Coracinus multifasciatus (Pellegr.)			P					
Diplodus sargus Linn.			C					
Dules taeniurus Cuv.			C					
Echidna nebulosa (Ahl.)		Locality Unknown						
Eleotris fusca (Bloch)						P		
Ellochelon vaigiensis (Q. & G.)		Locality Unknown						
Elops saurus Linn.	←	P	→					
Enneapterygius obtusirostre Klusinger			C					
Epinephelus areolatus (Forsk.)			C					
Epinephelus tauvina (Forsk.)			P					
Fissilabrus dimidiatus (Val.)			P					
Fistularia petimba Lacep.	P							
Gerres acinaces Bleeker		Locality Unknown						
,, *oyena* (Forsk.)					C			
,, *rappi* (Brnrd.)	←	—	P	→				
Gilchristella aestuarius (Gilch. & Thomp.)	Between Sifungo and Mpunowini							
Gobius giuris Hamil.				C	P	C	C	P
Hepsetia pinguis (Lacep.)		Locality Unknown						
Hyporamphus delagoae (Brnrd.)		Locality Unknown						
Johnius hololepidotus (Lacep.)	←	—	P	→				
Kuhlia taeniura (C. & V.)			P					
Lethrinus nebulosus (Forsk.)			C					
Lithognathus mormyrus (Linn.)	←	P	→					
Liza macrolepis (Smith)	←	—	A	→				
Lutianus argentimaculatus (Forsk.)			P				C	
,, *fulviflamma* (Forsk.)		Locality Unknown						
,, *vaigiensis* (Q. & G.)			C					
Monodactylus argenteus (Linn.)	←	—	A	→				
,, *falciformis* Lacep.	←	—	A	→				
Mugil cephalus Linn.	←	—	A	→				
,, *robustus* Gunth.	←	—	P	→				
,, juv.				C	C		C	

	Estuary Mouth			Tidal basin between Noisy Pt. and Ugulu River mouth	Shallows between Ugulu River mouth and Mpunowini Lake	Mpunowini Lake	Sifungo Lake	Nhlange Lake
	Sandy shore	Pebble beach	Rocky outcrop					
Neoscorpis lithophilus (G. & T.)	←	A	→					
Periophthalmus sp.					P			
Platycephalus indicus (Linn.)	←	P	→					
Pomacentrus sindensis (Day)			P					
Pomadasys operculare (Playfair)	←	—	P	→				
Pterois volitans (Linn.)			P					
Rhabdosargus sarba (Forsk.)			C					
Rhinecanthus aculeatus (Linn.)			P					
Sphyraena jello Cuv.								C
Spyraena obtusata Cuv.	Be	twee	n M	punow	ini &	Sifu	ngo	
Strializa canaliculatas (Smith)	←	—	A	→				
Thalassoma lunare (Linn.)			C					
Therapon jarbua (Forsk.)			P	P	P		P	
Tylosurus crocodilus (Lesueur)			C					
Zanclus cornutus (Linn.)			P					

Appendix D

Birds occurring in the near vicinity of the water.

Note.—The figures appearing in the different columns are the maximum number seen at any time in that particular area. Therefore the figures for the same species in different columns may refer to the same birds but appearing in different areas.

	Estuary mouth	Tidal basin between Noisy Pt. and Ugulu River mouth	Shallows between Ugulu River mouth and Mpunowini Lake	Mpunowini Lake	Sifungo Lake	Nhlange Lake
Actitis hypoleucos (Common Sandpiper) ..				1		
Anas undulata (Yellow-billed Duck)				←	4 →	
Anhinga rufa (Snake Bird)		Localit	y Unk	nown		
Ardea cinerea (Grey Heron)			10	10		
,, *purpurea* (Purple Heron)			1			
Bubulcus ibis (Cattle Egret)				12		
Burhinus vermiculatus (Water Dikkop)			2			
Butorides striatus (Green-backed Heron) ..				←	1 →	
Ceryle rudis (Pied Kingfisher)	3	2	1	3		
Charadrius hiaticula (Ringed Plover)				1		
,, *marginatus* (White-fronted Sandplover)	36	9	4			
,, *tricollaris* (Three-banded Sandplover)		2	2	2		

	Estuary mouth	Tidal basin between Noisy Pt. and Ugulu River mouth	Shallows between Ugulu River mouth and Mpunowini Lake	Mpunowini Lake	Sifungo Lake	Nhlange Lake
Circus ranivorus (African Marsh Harrier) ..				←——	1——→	
Corythornis cristata (Malachite Kingfisher) ..				1		
Egretta garzetta (Littel Egret)	1	2	10			
Gypohierax angolensis (Vulturine Fish Eagle) ..				←——	1——→	
Hagedashia hagedash (Hadedah)				5		
Haliaëtus vocifer (Fish Eagle)	1	2				
Himantopus himantopus (Black-winged Stilt) ..		1				
Larus cirrocephalus (Grey-headed Gull)		2		1		
Megaceryle maxima (Giant Kingfisher) ..				←——	2——→	
Motacilla capensis (Cape Wagtail)		1	2	←——	3——→	
Numenius arquata (Curlew)		1	1	4		
,, *phaeopus* (Whimbrel)	10	11	10	14		
Nycticorax nycticorax (Night Heron)		Locality Unknown				
Pandion haliaëtus (Osprey)				←——1	——→	
Phalacrocorax africanus (Reed Duiker)				5		59
,, *carbo* (White-breasted Duiker) ..	2	15	3			
Phoenicopterus sp. (Flamingo)			101	←——9	1——→	
Porhyrio porhyrio (Purple Gallinule)					1	
Psalidoprocne holomelaena (Black Saw-wing Swallow)	2					
Pseudohirundo griseopyga (Grey-rumped Swallow)		3		←——6	——→	
Recurvirostra avosetta (Avocet)		282	300	300+		
Riparia riparia (African Sand Martin)	1					
Sterna bergii (Swift Tern)..	1					
Tringa nebularia (Greenshank)		17	4	←——2	6——→	

A. A typical Native fishtrap just opposite the mouth of the Ugulu River.
Photographed by G. J. Broekhuysen.

B. The southern part of the east shore of the Tidal Basin between Noisy Pt. and the Ugulu River mouth. The extensive growth of mangroves and large shallow pools in between as in the picture was characteristic.
Photographed by G. J. Broekhuysen.

A. A dense patch of the whelk *Pyrasus pallustris* typical for the lower part of the mangrove zone on the east shore of the tidal basin.

Photographed by G. J. Broekhuysen.

B. The channel connecting Sifungo Lake with Nhlange Lake. The growth of *Phragmites* reeds all along the edges was characteristic and indicated a very low salinity.

Photographed by G. J. Broekhuysen.

HYDROZOA FROM THE COASTS OF NATAL AND PORTUGUESE EAST AFRICA

PART II: GYMNOBLASTEA

By

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(With 4 figures in the text)

Introduction

This paper represents the second part of an account of the Hydrozoa from the east coast of South Africa. The first part, dealing with the Calyptoblastea, was published in the same journal in 1958.

The material includes a relatively small number of species, only 12 in all, of which 2 are new species, and 3 are new records for the country. All of them come from the littoral area or shallow water to a depth of about 7 m. There were no identifiable gymnoblasts present in the collection trawled by the s.s. *Pieter Faure* off the coast, although calyptoblasts were plentiful. However, one must bear in mind the fact that the *Pieter Faure* material was collected nearly sixty years ago and the preservation was not good. Under such circumstances the gymnoblasts are the first to suffer, and in fact a few decayed remnants indicate that several species were originally present.

The classification adopted is based on that of Rees 1957, who has attempted to integrate the traditional dual classification of hydroids and their medusae into one coherent system. Such a system should be the ultimate aim of all systematists, and a revision of the group along these lines has long been overdue. I am indebted to Dr. Rees for valuable advice on the position of problematical species.

Also following on the lines laid down by Rees I have retained 'separate genera for hydroids with fixed gonophores and for hydroids with free medusae'. In some cases this distinction is clear-cut and straightforward, but in the case of *Hydractinia* and *Podocoryne* it is not so easy, for there are various intermediate forms which produce degenerate medusae with a very short free-swimming life. Although previously following Kramp, who combines the two genera, I have now kept them apart, and have used *Podocoryne* to include forms which produce medusae of a recognizable Podocoryne type, i.e. with 4 oral tentacles, and

Hydractinia for forms with fixed gonophores of the styloid to eumedusoid type without oral tentacles, even though they may be freed for a short while.

The structure of the nematocysts of hydroids has been receiving increasing attention since the classic work of Weill in 1934. It is difficult as yet to estimate the value of nematocysts in systematics, for so few species have been fully described, but there is evidence that in some families at least they provide a useful method of distinguishing otherwise closely related species. The difficulty is that a systematist almost invariably has to work on preserved material brought in by expeditions, where the chance of finding discharged capsules is remote and where the shape is liable to be distorted. It is felt that any information at this stage, however scanty, is of value, and will serve as a basis for a future full assessment of the value of these structures in classification. Accordingly descriptions and measurements of nematocysts have been included wherever possible, using the categories suggested by Weill. Measurements are given to the nearest half-micron.

The source of the material was detailed in Part I of the paper, and I wish to thank once again those who contributed to the collection. I am also extremely grateful to the Naturhistoriske Riksmuseet, Stockholm, and to the Zoological Survey of India, for the loan of type material. The cost of publication was partly defrayed by a grant from the Editorial Board of the University of Cape Town.

As before, the type material of new species has been deposited in the South African Museum (S.A.M.).

Station List

D. Intertidal material from Isipingo and other localities near Durban, collected in July 1935 and July 1936.

DBN. Material from Durban Bay (a land-locked bay).

DBN 2.	7/7/50.	From floating jetty, Salisbury Island.
DBN 25.	13/7/50.	From dead branch below low tide mark, Salisbury Island.
DBN 47.	18/7/50.	Intertidal, on mud flats.
DBN 94.	8/1/51.	Seined from shallow water north of Salisbury Island.
DBN 112.	10/1/51.	Intertidal, on central sand bank.
DBN 130.	15/1/51.	From ships' hulls operating only in Durban Bay.
DBN 140.	16/1/51.	From rotting branch trawled in 0–7 m. north of Salisbury Island.
DBN 191.	2/10/51.	Intertidal, on causeway.
DBN 249.	24/4/52.	From ship's hull.
DBN 270.	26/4/52	Intertidal, on public ferry pier.
DBN 320.	28/4/52	From sublittoral fringe on caisson, Salisbury Island.

IN. Material from Inhaca Island, Delagoa Bay, Portuguese East Africa. Collected by Mrs. M. Kalk.

IN 49	1954.	Intertidal.
IN 112.	18/9/55.	Punta Torres.
IN 140.	20/7/56.	East shore rocks, intertidal.

MOR. Material from Morrumbene Estuary, inland from Inhambane, Portuguese East Africa.

MOR 34.	20/1/54.	From hull of wreck at Linga Linga.
MOR 51.	21/1/54.	Dredged from 3–5 m. off mouth of Rio Coche.
MOR 216.	15/7/54.	From hull of wreck at Linga Linga.
MOR 217.	12/7/54	On weed in 2 m. of water at Linga Linga.
MOR 218.	13/7/54.	From hull of wreck at Linga Linga.

NA. Material from intertidal zone on Natal coast.

NA 184.	July 1950.	Kosi Bay, reef, intertidal. Collected by B. R. Allanson.
NA 218.	18/1/58.	Wentworth Beach, Durban.

STL. Material from St. Lucia Estuary, Natal.

STL 174.	12/7/49.	'Channel' area, south of Mpate River mouth, on aerial roots of mangroves.

LIST OF SPECIES

Corymorphidae
Corymorpha sp.

Tubulariidae
Tubularia warreni Ewer.

Cladocorynidae
Cladocoryne floccosa Rotch.

Pennariidae
Pennaria disticha Goldfuss

Clavidae
Corydendrium parasiticum (Linn.)

Eudendriidae
Eudendrium carneum Clarke.
Eudendrium ?parvum Warren

Hydractiniidae
Hydractinia diogenes n. sp.
Hydractinia kaffraria Millard
Podocoryne nassa n. sp.

Pandeidae
Hydrichthys boycei Warren

Bougainvilliidae
Bimeria fluminalis Annandale

Family **Corymorphidae**

Corymorpha sp.

Records. DBN 47P.

Description. A single sterile specimen growing in the mud and reaching a total length of 14 mm. Hydranths with at least 18 filiform tentacles in each group.

Remarks. In the absence of gonophores the species cannot be determined. This is probably a young individual.

Family **Tubulariidae**

Tubularia warreni Ewer 1953

Tubularia warreni Ewer 1953, p. 351, figs. 1–4.

Records. DBN 2.O, 130D (reported by Day and Morgans 1956).

Description. Rich colonies on floating jetty and ships' hulls, reaching a maximum height of 5 cm., and with abundant gonophores. Structure agreeing with Ewer's description, with the following additions.

The longitudinal septa within the stem are a feature of the species, but are not constant in number and size. Some stems have 2 and some 3. In some cases they meet in the centre as in *T. mesembryanthemum*, but often they do not, and sometimes they are merely very low ridges on the internal surface.

The dilation of the stem on which the hydranth rests is surrounded at its widest part by a shallow transverse groove, above which the thickened ectoderm protrudes in a pendulous flap, as described for *T. bethae* Warren 1908. The ectoderm is also thickened on the lower surface of the dilation as described for *T. crocea* by Ritchie (1910*b*), but unlike the latter there is a definite thickening and differentiation of the endoderm lining the dilation, though not to the same extent as in *T. bethae*.

Hydranth tentacles often fewer than stated by Ewer, varying from 18 to 29 in the proximal row, and 15 to 24 in the oral row in mature specimens. Oral tentacles in one row, but occasionally alternate ones are slightly displaced.

Blastostyles not so constant in number as indicated by Ewer, and primary and secondary pedicels often difficult to distinguish. Actinula with as many as 6 oral tentacles at time of liberation.

Family **Cladocorynidae**

Cladocoryne floccosa Rotch. 1871

Cladocoryne floccosa. Allman 1872, p. 380, fig. 82. Warren 1908, p. 284. Vervoort 1941, p. 190.

Records. NA 184D.

Description. A single colony creeping on weed. Stems simple or with one lateral branch; increasing in diameter from base to summit; annulated at base, smooth or roughly corrugated for remainder. Hydranths very poorly preserved. No gonophores.

Family **Pennariidae**

Pennaria disticha Goldfuss 1820, var. *australis* Bale 1884

Halocordyle cooperi Warren 1906, p. 73; Pl. 9. 1907*a*, p. 209.
Pennaria australis var. *cooperi.* Warren 1908, p. 282.
Halocordyle disticha var. *australis.* Vervoort 1941, p. 192. 1946*a*, p. 290.

Records. D 39. NA 184B. DBN 2Q, 130B, 191D (recorded by Day and Morgans 1956). MOR 34J, 216A, 218A. IN 140D.

Description. Rich colonies from intertidal rocks, ships' hulls, etc., reaching a maximum height of 13·9 cm. Structure exactly as described by Warren. Hydrotheca-bearing ramules increasing in diameter towards distal end, and generally annulated in basal portion only, as characteristic of variety, but occasionally with annulations in distal portion as well. Gonophores observed in January, July and October.

Nematocysts of at least 3 kinds:

(i) Stenoteles.

(*a*) Large, reaching a maximum size of $47{\cdot}0 \times 25{\cdot}0\mu$, present only on capitate tentacles.

(*b*) Small, varying in size from about $8 \times 5\mu$ to $14 \times 10\mu$, on filiform and capitate tentacles. Very abundant.

(ii) Desmonemes, $6{\cdot}5 \times 5{\cdot}5\mu$, on capitate and filiform tentacles.

(iii) Undetermined heteronemes, $11{\cdot}5 \times 5{\cdot}0\mu$, on filiform and capitate tentacles. Scarce. Capsule similar to the microbasic mastigophores described for *P. tiarella* by Weill 1934, fig. 21, each containing a large refringent sphere in the basal part.

Remarks. Four categories of nematocysts have been described by Weill 1934 for *P. tiarella*, and the maximum size for the stenoteles is given as $18 \times 11\mu$. This species thus lacks the enormous stenoteles on the capitate tentacles which are characteristic of *P. disticha* (cf. also Warren 1906), and this may be contributary evidence for keeping the two species separate and not combining them as has been done by Vervoort 1941.

The undetermined heteronemes of the present material are almost certainly microbasic mastigophores, which occur in both *P. tiarella* and *P. cavolinii* (= *P. disticha*), and there is possibly a fourth category which can easily be overlooked in preserved material.

Family **Clavidae**

Corydendrium parasiticum (Linn.) 1767

Soleniopsis dendriformis Ritchie 1907, p. 495, figs. 142, 143; Pl. 26, fig. 1.
Corydendrium parasiticum. Vervoort 1946*a*, p. 292.

Records. DBN 2R, 140F.

Description. A well-developed colony reaching a maximum height of 7·2 cm. and a smaller one of poorly preserved material. Stem fascicled at base with a diameter of about 2 mm. Branching, and origin of hydranths as described by Ritchie, except that the branches are not strictly in one plane. Perisarc thick, smooth or faintly wrinkled, sometimes transversely folded below distal margin possibly due to contraction of the hydranth.

Hydranths with about 22–29 scattered, filiform tentacles (though this may be an underestimate since some of the tentacles may be retracted within the perisarc), and the typical swelling below the base inside the perisarc.

Gonophores absent.

Nematocysts of 2 kinds:

(i) Undetermined heteronemes, $7{\cdot}0 \times 4{\cdot}0\ \mu$.

(ii) Desmonemes, $5{\cdot}0 \times 3{\cdot}5\ \mu$.

Measurements (preserved material, mm.)

Hydranth pedicel, diameter . . .	0·27–0·48
Hydranth, length	0·51–1·10
diameter	0·20–0·37

Remarks. The identification of this species is fairly definite in spite of the absence of gonophores, since the method of branching is exactly similar to that described by Ritchie 1907.

Vervoort 1946*a* has established fairly definitely that *C. dendriforme* (Ritchie) is a synonym for *C. parasiticum*, but I am not convinced of the wisdom of including *C. sessile* Ritchie 1910*a* as well, as has been done by Leloup 1937. Young hydranth pedicels in *C. parasiticum* are necessarily adnate due to the method of branching, but they do not remain so, and it is only the distal 2 or 3 pedicels in a stem which have this arrangement. Ritchie's material of *C. sessile* was a well-developed colony of 37 mm. in height, and the pedicels were apparently adnate throughout.

C. parasiticum is known from the Mediterranean, Cape Verde Islands, French Indo-China and the Dutch East Indies. This is the first record from South Africa. *C. sessile* has been reported from several localities in the Indian Ocean (Mergui Archipelago, Cargados and Amirante).

Family **Eudendriidae**

Eudendrium carneum Clarke 1882

Fig. 1, *A–F*

Eudendrium carneum Clarke 1882, p. 137; Pl. 7, figs. 10–17.
E. cunninghami Kirkpatrick 1910, p. 127; Pl. 7, figs. 1–3.
E. carneum. Vannucci 1954, p. 101; Pl. 1, figs. 1–9; Pl. 2, fig. 8; Pl. 4, figs. 2–5.

Records. DBN 25J, 130C, 249K, 270V, 320Q (reported by Day and Morgans 1956 as *Eudendrium ?racemosum*). MOR 34K, 216B, 217A, 218B.

Description. Rich, tree-like colonies, common on ships' hulls, wrecks and piers, etc., to a depth of about 6 ft. below water-level. Colonies reaching a maximum height of 16·2 cm. Branching irregular, main stem thick and fascicled, up to 3·5 cm. in diameter, larger branches also fascicled. Groups of annulations present on origins of branches, and rarely at intervals on main stem; hydranth-bearing ramules with scattered groups of annulations or completely annulated. Hydranth with pseudohydrotheca covering basal part and terminating in annular groove, with about 30 tentacles (26–33 in 20 counts). No cnidophores.

Female gonophores borne in a whorl on a tentacular blastostyle, becoming unevenly spaced along the length at a later stage when the blastostyle lengthens and the tentacles are lost. Gonophores with a bifurcating spadix, which is later shed. Developing embryo enclosed in a transparent perisarcal capsule which is basket-shaped when empty.

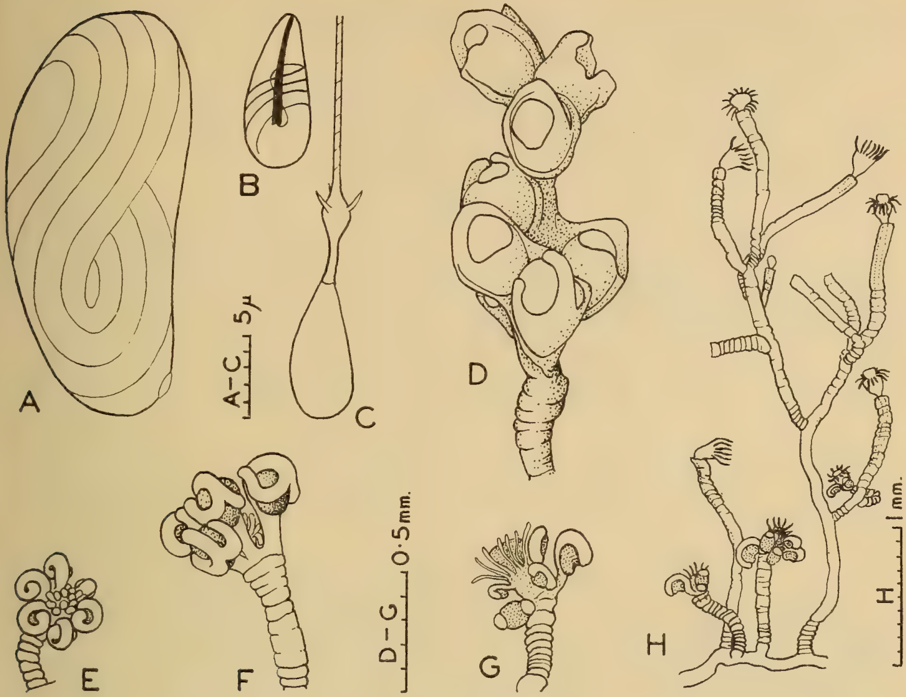

Fig. 1. *Eudendrium carneum* Clarke (A–F), and *Eudendrium ?parvum* Warren (G–H)
A, a large isorhiza. B and C, undischarged and discharged capsules of heterotrichous, microbasic euryteles. D, old female gonophores showing the basket-shaped capsules surrounding the embryos. E and F, earlier stages in the development of female gonophores showing the bifurcating spadices and the tentacles of the blastostyle. G, a female blastostyle with young gonophores. H, part of colony with female blastostyles.

Male gonophores borne in an umbel-shaped whorl on a blastostyle devoid of tentacles; 3–4 chambered.

Gonophores observed in January, April and July.

Nematocysts of 2 kinds:

(i) Large isorhizas, probably atrichous. Capsule pear-shaped, slightly curved, with operculum off-centre, measuring $24 \times 11\mu$. Tube in many coils, forming figures of 8 in the longitudinal axis. Only undischarged capsules observed. Scattered irregularly on hydranth body and manubrium, but most abundant in the 'nettle-ring'.

(ii) Small, heterotrichous, microbasic euryteles, similar to those of *E. vaginatum* (see Weill 1934). Capsule pear-shaped, narrowing at summit, measuring $9 \times 4\mu$. Butt about two-thirds length of capsule, bearing 3 large spines on the swollen distal end. Terminal tube bearing spiral ridges, coiled obliquely in undischarged capsule. Present abundantly on tips of tentacles, and also scattered irregularly in the 'nettle-ring'.

Remarks. This material agrees in all its essential features, and particularly in the nature of the female gonophores, with *E. carneum,* though the nematocysts of the latter have not been described.

It is also very similar to *E. racemosum* (Cavolini), another species with a bifurcating spadix, but differs from it in the absence of cnidophores, in the basket-shaped capsule of the female gonophore, and in the nature of the nematocysts.

E. carneum is known from the east and west coasts of North America, from Brazil, and from St. Helena. It is a new record for South Africa, and has possibly been introduced on the hulls of ships, for it has been found only in Durban Bay and Morrumbene Estuary.

Eudendrium ?parvum Warren 1908

Fig. 1, *G–H*

Eudendrium parvum Warren 1908, p. 272, fig. 1; Pl. 45, figs. 1–4.

Records. IN 49E.

Description. Colonies growing on weed and reaching a maximum height of 0·5 cm. Stem unbranched or branching irregularly, annulated at base, on the origin of the branches, and at other irregular intervals.

Female blastostyles present, borne on annulated pedicels arising from stem or direct from hydrorhiza. Blastostyle well formed, with manubrium and about 15 tentacles, bearing the gonophores in a verticil below the tentacles. Spadix of gonophore unbranched, arching round egg in form of question-mark, later shed, leaving the developing embryo enclosed in a very thin perisarcal capsule.

No large nematocysts present. Small ones (probably heteronemes) measuring $5{\cdot}5 \times 2\mu$ present on tentacles and body.

Measurements (mm.)

Hydrorhiza, diameter . . .	0·09–0·13
Stem, diameter	0·09–0·12

Remarks. Vannucci 1954 has included *E. parvum* in the synonymy of *E. capillare* Alder, but I feel that this is a dangerous assumption at the present state of our knowledge. Warren states that his species differs from *E. capillare* in 'the three-chambered condition of the male gonophore, the absence of a well-defined terminal tubercle to the gonophore, and the extension of the perisarc over the base of the polyp'. Vervoort 1946 (p. 146) also states that *E. capillare* has no nettle-ring or annular groove round the base of the hydranth, the latter being present in *E. parvum.*

The present material cannot be determined with certainty in the absence of male gonophores. Warren has not described the female. The general appearance of the colony is very similar to Warren's material, but the hydranths are too badly preserved to determine the details of structure.

Several other small *Eudendrium* colonies are present in the collections from this coast, but in the total absence of gonophores identification has not been attempted.

Family **Hydractiniidae**

Hydractinia diogenes n. sp.

Fig. 2

Holotype. MOR 51H. (S.A.M. registered number H123).

Description. Colonies covering 5 gastropod shells occupied by hermits (*Diogenes costatus*). Hydrorhiza a network of perisarcal tubes, covered by a layer of free coenosarc, but clearly visible through it in the thinner regions. Spines smooth, hollow and horn-coloured, of medium length, reaching a maximum height of 0·6 mm.

Gastrozooids reaching a height of about 2 mm. (preserved), with a long hypostome capable of great distension, and 11–26 tentacles. No spiral zooids or tentacular filaments observed.

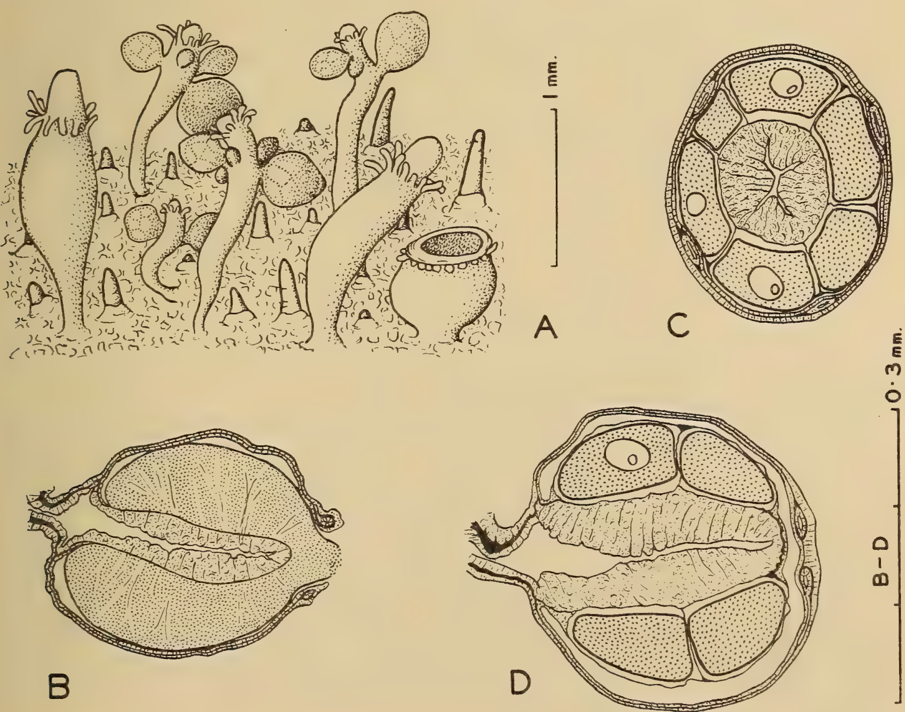

FIG. 2. *Hydractinia diogenes* n. sp.

A, portion of female colony with gastrozooids and gonozooids, drawn from preserved material. B, l.s. mature male gonophore showing circular canal. C, t.s. female gonophore showing radial canals. D, l.s. female gonophore showing circular canal.

Gonozooids variable in size, but generally smaller than the gastrozooids, with 7–15 tentacles. The gonozooids are particularly abundant and well developed around the openings and siphons of the host shells, and may completely fill the latter. In this region they are quite as long as the gastrozooids, but have slender columns and never achieve the same robustness. Some have a well-developed crown of tentacles, but in others, probably due to reproductive exhaustion, the tentacles are reduced to mere stumps.

Gonozooid bearing a circle of up to 6 shortly stalked gonophores near distal end of column. Male and female on different colonies, but colonies of opposite sex may occupy the same shell. Gonophores in the form of fixed sporosacs which have no free-living life (several partly empty ones observed still attached), more or less spherical or with diameter slightly exceeding height when fully mature, with no vestige of marginal tentacles. Spadix well developed, with its internal cavity fairly spacious in the proximal third, but reduced to a crevice in the distal region. Pedicel 0·02–0·07 mm. in length.

Male gonophore swollen with sexual products, which may protrude through the distal aperture together with the end of the spadix, reaching a maximum depth of 0·45 mm. and a maximum diameter of 0·46 mm. Circular canal present around aperture, radial canals not visible.

Female gonophore containing 5–13 large eggs generally in 1 or 2 tiers around a central spadix, reaching a maximum depth of 0·39 mm. and a maximum diameter of 0·43 mm. Radial canals and circular canal present. Though difficult to see in whole specimens the canals are easily visible in empty gonophores and in sections.

Nematocysts of 2 types:

(i) Desmonemes, $5{\cdot}0 \times 3{\cdot}5\ \mu$.

(ii) Microbasic euryteles, $9{\cdot}0 \times 4{\cdot}0\ \mu$.

Remarks. Only three species of *Hydractinia* with smooth spines are known from the southern hemisphere, namely *H. parvispina* Hartlaub 1905, *H. subinermis* Jäderholm 1923, and *H. altispina* Millard 1955.

H. diogenes is closely related to *H. parvispina*, but since Hartlaub states quite definitely that there are no radial canals in the female gonophores of the latter, the two cannot be synonymous. Attempts were made to obtain material of *H. parvispina*, but unfortunately Hartlaub's type material (deposited in the Hamburg museum) was destroyed during the war. The species was subsequently reported by Jäderholm 1905 from the Antarctic, and prepared sections of this material were loaned to the author by the Naturhistoriske Riksmuseet, Stockholm. The gonophores present were all male and immature, and no further information could be obtained therefrom. No radial canals could be found.

H. subinermis likewise has no radial canals in the gonophores, and further the gonozooids are atrophied with only 2–4 tentacles, and the spines are very short (0·16–0·19 mm.).

H. altispina is clearly distinct from *H. diogenes*, and the differences between the two are summarized in the following table.

	H. diogenes	*H. altispina*
Colony growing:	On gastropod shells occupied by hermits.	On occupied shells of *Thais squamosa*.
Perisarcal reticulation of hydrorhiza:	Clearly visible through coenosarc.	Not visible.
Spines:	Of medium length reaching 0·6 mm.	Long, reaching 1·0 mm.
Gastrozooids, number of tentacles:	Up to 26.	Up to 12.
Gonozooids:	Not particularly reduced, with up to 15 tentacles.	Much smaller than gastrozooids, with only 3–5 tentacles.
Male gonophores with:	Spermatogenic cells not divided into groups and no radial canals visible.	Spermatogenic cells divided into 4 groups and radial canals clearly visible.
Female gonophores with:	Large eggs, up to 13 in number.	Small eggs, up to 32 in number.

Sterile colonies are very similar to those of *Podocoryne carnea*, but have somewhat longer spines.

Hydractinia kaffraria Millard 1955

Hydractinia kaffraria Millard 1955, p. 217, fig. 2.

Records. DBN 47M, 94G, 112E (reported by Millard 1955, and by Day and Morgans 1956).

Podocoryne nassa n. sp.

Fig. 3

Holotype. IN 112. (S.A.M. registered number H122).

Description. Colony epizootic on the shell of the gastropod *Nassa* (*Nassarius*) *fenestrata*. Hydrorhiza for the most part reticular, following the depressions of the host-shell and covered with a thin layer of perisarc; but in the denser areas closely packed stolons may be cemented together. No spines, spiral zooids or tentacular filaments.

Hydranths columnar, but narrowed at base, reaching a height of 1·4 mm. (preserved), with a conical hypostome and 8–16 tentacles. A very thin extension of perisarc sometimes present over the base. Young hydranths have a single verticil of about 8 tentacles, older ones have a second verticil of smaller tentacles developing slightly proximal to the first and alternating with them.

Gonophores arising separately from the hydrorhiza on slender pedicels, developing into free medusae.

The young gonophore is pear-shaped, flattened at the summit and narrowing towards the base where it merges gradually into the pedicel which is only about 0·02 mm. in diameter. The whole structure is completely enveloped

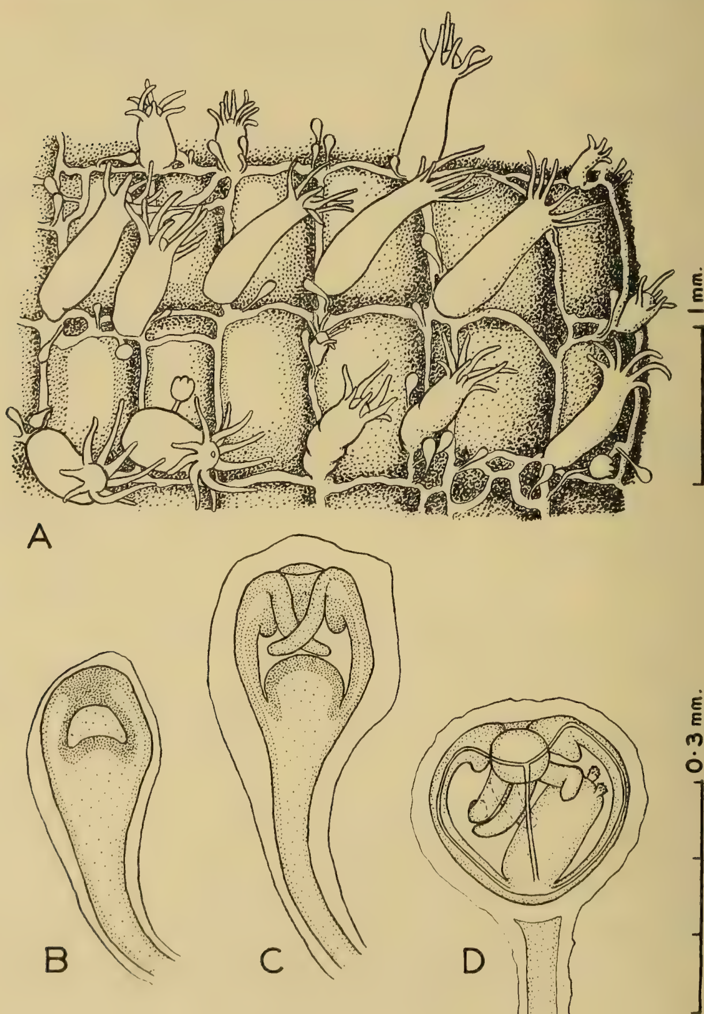

Fig. 3. *Podocoryne nassa* n. sp.

A, portion of colony on snail-shell, drawn from preserved material. B–D, stages in the development of the medusa.

in a membranous extension of the perisarc. The older gonophore is more rounded and distinctly demarcated from the pedicel. The oldest gonophores present are in the form of young medusae with the diameter approximately equal to the height (about 0·25 mm.), and with the tentacles still coiled up in the umbrella cavity. They have become detached from the pedicel but are still enclosed in a perisarcal membrane.

Medusa with 4 radial canals and a circular, 4 marginal tentacles, a large hypostome not quite reaching the margin of the bell and bearing 4 oral tentacles armed with terminal clusters of nematocysts.

Nematocysts of 2 kinds:

(i) Undetermined heteronemes, $8{\cdot}0 \times 3{\cdot}0\ \mu$.

(ii) ?Desmonemes, $6{\cdot}5 \times 3{\cdot}5\ \mu$.

Remarks. This is the only species of *Podocoryne* known to the author without spines and with gonophores arising separately from the hydrorhiza.

Family **Pandeidae**

Hydrichthys boycei Warren 1916

Hydrichthys boycei Warren 1916, pp. 172–187, fig. 12; Pl. 17–20.

Records. NA 218.

Description. Several small colonies parasitic on *Chaetodon lunula*. Structure exactly as described by Warren. Medusa buds present in various stages of development.

Family **Bougainvilliidae**

Bimeria fluminalis Annandale 1915

Fig. 4

Bimeria fluminalis Annandale 1915, p. 111, fig. 10; Pl. 9, figs. 3, 3*a*. 1917, p. 111, fig. 1.

Record. STL 174 (reported by Day, Millard and Broekhuysen 1954 as *Bimeria* sp.).

Description. Rich colonies growing on the aerial roots of mangroves and for the most part thickly covered with diatoms and other epibiotic forms. Hydrorhiza forming a matted feltwork. Stem reaching a maximum height of 6·3 cm., unfascicled, often slightly geniculate in the distal regions, giving rise to alternate branches or hydranth pedicels. Occasionally two hydranth pedicels arise from the same level, either opposite one another or from the same side. Perisarc on stem and branches fairly thick, with adhering silt and diatoms, annulated at base of stem, on origin of branches and on part or all of hydranth pedicels; continued over the base of the hydranth to form a thick 'pseudohydrotheca'. Sections show that the pseudohydrotheca terminates abruptly on the base of the tentacles (fig. 4, H, I), and that the hydranth can be partially retracted into

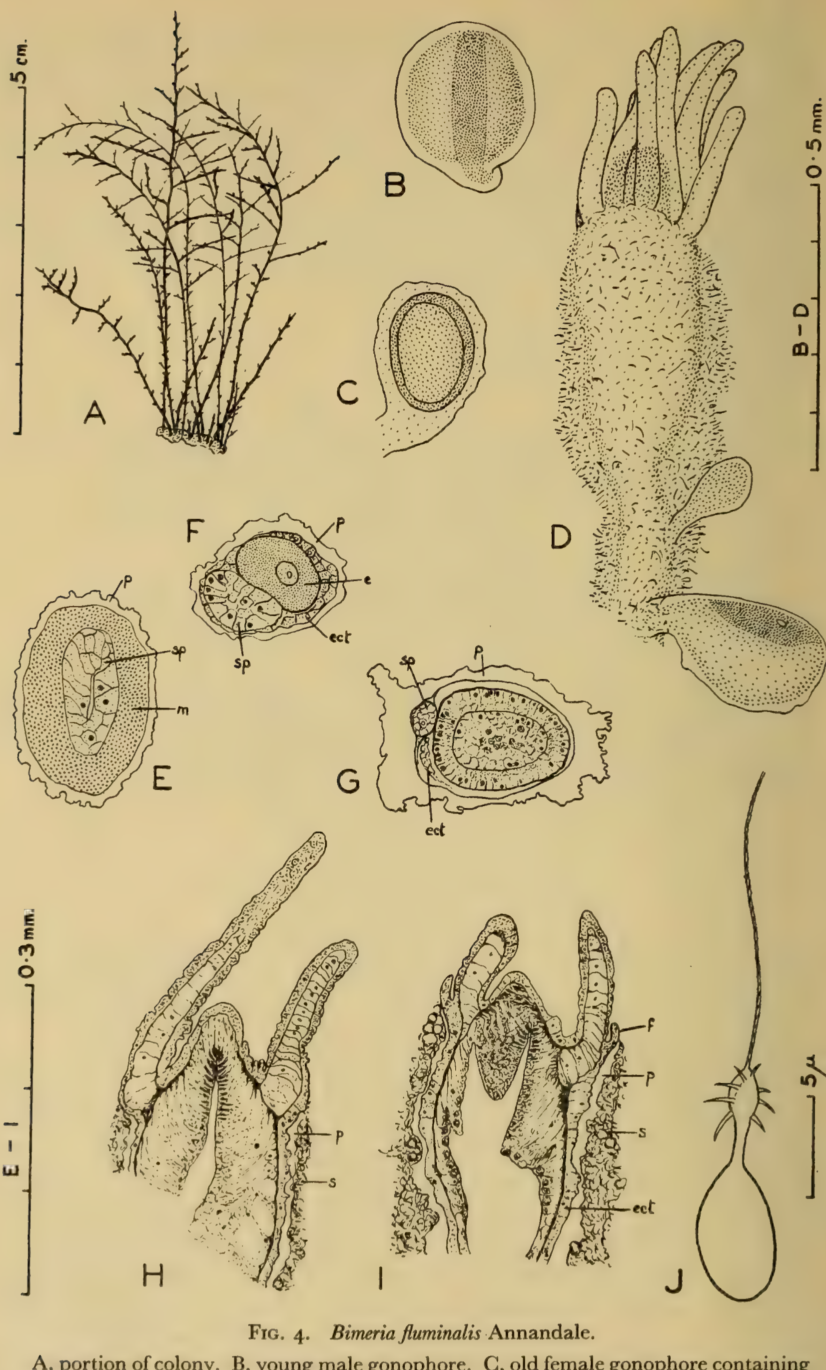

Fig. 4. *Bimeria fluminalis* Annandale.

A, portion of colony. B, young male gonophore. C, old female gonophore containing planula. D, a single hydranth and two young female gonophores, one with an egg. E, t.s. male gonophore. F, t.s. young female gonophore with egg and spadix. G, t.s. old female gonophore with planula and remains of spadix. H and I, l.s. hydranths, I more contracted than H. J, a heterotrichous microbasic eurytele.

(*e*, egg. *ect*, ectoderm. *f*, folded ectoderm. *m*, male generative cells. *p*, perisarc. *s*, adhering silt. *sp*, spadix of gonophore.)

the pseudohydrotheca, but that in the process the ectoderm at the margin is thrown into a distinct fold (*f*). A very thin layer of perisarc appears to continue for a short distance over the tentacles, but it is very difficult to detect and is only visible in isolated regions—there is no definite sheath over the tentacles as in typical members of the genus. Hydranths with 10–12 tentacles.

Gonophores in the form of fixed sporosacs, borne singly or in clusters on the hydranth pedicels, male and female on separate stems. Gonophore completely surrounded by perisarc, with a very short pedicel, and no radial canals or tentacle rudiments.

Male gonophore ovoid or spherical when young, becoming more elongated when mature, bearing a mass of spermagenic material around a central strongly developed, and sometimes curved, spadix.

Female gonophore ovoid, producing a single egg, which is flattened against the spadix, displacing it to one side and causing it to arch over the egg in the manner described by Annandale. After fertilization the egg develops *in situ*. Later the spadix degenerates completely leaving a large oval planula still enclosed in a perisarcal membrane.

Nematocysts of 2 types:

(i) Desmonemes, $3{\cdot}5 \times 2{\cdot}5\ \mu$.

(ii) Heterotrichous microbasic euryteles, reaching a maximum size of $7{\cdot}0 \times 4{\cdot}5\ \mu$.

Measurements (mm., preserved)			*STL* 174	*Annandale's Type Material*
Stem, diameter			0·12–0·32	0·13–0·20
Branch, diameter			0·12–0·20	0·09–0·16
Pseudohydrotheca (mostly contracted):				
length			0·18–0·38	0·13–0·22
diameter			0·21–0·32	0·13–0·29
Gonophores, male:	length	reaching	0·51	0·52
	diameter	reaching	0·30	0·23
Gonophores, female:	length	reaching	0·40	0·30
	diameter	reaching	0·29	0·24

Remarks. I have seen a sample of Annandale's type material of *B. fluminalis* from Calcutta kindly loaned to me by the Zoological Survey of India, and am satisfied that the South African material belongs to the same species. The general form of the colony is the same, and the nature of the gonophores leaves no room for doubt. Measurements of the type material (a small sample only) are included above.

The nematocysts of the type material are undischarged, but there are two types (heteronemes and desmonemes) whose measurements agree closely with the South African material.

I am somewhat doubtful about the inclusion of this species in the genus *Bimeria*. According to Rees (1938 and personal communication) *Bimeria* and *Garveia* can be distinguished by the presence of tubular sheaths of perisarc over the bases of the tentacles in the former and their absence in the latter. The variable nature of this character in *B. fluminalis* has been remarked on by Annandale, and in the South African material the perisarcal sheath is practically non-existent. Other things being equal it hardly seems a reliable character for generic diagnosis.

B. fluminalis is known only from brackish and temporarily fresh water connected with the Bay of Bengal and Gulf of Siam in specific gravities varying from 1·000 to 1·02575. It is therefore interesting that it should appear in South Africa, also in an estuary. Conditions in St. Lucia estuary are, however, rather different than those described by Annandale, for in times of drought the salinity may rise above that of the sea. The material was found in the 'channel' area just south of the opening of the Mpate River. At the time the salinity in the area was $28^{\circ}/_{00}$, but it has been known to rise to $35{\cdot}7^{\circ}/_{00}$, and probably falls very low when the river is in flood. Whether or not the species can survive such drastic changes from year to year is unknown.

Summary

A total of 12 species of gymnoblastic hydroids is recorded. Two of these are new species, namely *Hydractinia diogenes*, and *Podocoryne nassa*, and three are new records for South Africa, namely *Corydendrium parasiticum* (Linn.), *Eudendrium carneum* Clarke, and *Bimeria fluminalis* Annandale.

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A REVIEW OF THE SUBSPECIES OF THE YELLOW CANARY, *SERINUS FLAVIVENTRIS* (SWAINSON)

By

J. M. Winterbottom

South African Museum

Introduction

Five subspecies of the Yellow Canary, *Serinus flaviventris*, have been described: *flaviventris* (Swainson) from 'South Africa'; *marshalli* Shelley from Potchefstroom; *guillarmodi* (Roberts) from Sanqubetu Valley, Basutoland; *damarensis* Roberts from Windhoek; and *aurescens* Clancey from between Brandvlei and Kenhardt. Macdonald (1957) observed that birds from 'the limited area of the Sclerophyll Region in the extreme south-west Cape are slightly darker and may eventually be separated as a distinct race'. Material recently received in the South African Museum from Mr. R. W. Rankine, collected near the Kalahari Game Reserve, suggested that the range of *damarensis* was wider than current literature indicated. Under the circumstances, it seemed advisable to assemble the available material and review the whole species; and to make a special point of obtaining a series of breeding birds from the restricted type locality of *flaviventris*, the Berg River (this being the first locality mentioned by Andrew Smith in his field notes).

Altogether, 152 skins were examined; and my thanks are due to the following for the loan of material: the Director, Durban Museum & Art Gallery; the Director, East London Museum; the Director, Kaffrarian Museum; the Director and Mr. M. P. S. Irwin, National Museum of Southern Rhodesia; the Director and Mr. R. Liversidge, Port Elizabeth Museum and Snake Park; the Director and Mrs. Campbell, Transvaal Museum. The work on which this paper is based was done while I was holding a Senior Bursary of the South African Council for Scientific and Industrial Research.

Review of the Material

The broad pattern of variation in the Yellow Canary follows expectations in being lightest in the hot north and darkest in the colder south. Within that broad pattern, however, several more local patterns are visible.

The birds of the north-east were separated by Shelley as *marshalli* on the grounds that the males had slightly larger bills and yellower upper parts while the females were paler and less heavily streaked below. I have found no significant difference, however, in the size of the bill; but the other distinctions hold.

Roberts then separated the north-west population as *damarensis*, in which the males were a clearer yellow than those of *marshalli* and the females were unstriped below, but often with a yellow wash. This is confirmed in the series I have examined.

Occupying an area south of the range of *damarensis* is a population in which the males are duller and darker above than *damarensis* but yellower than *marshalli*; and richer yellow below than either; while the females are less green above and white below. This is *aurescens* of Clancey.

South of *aurescens*, occupying the main plateau of the Karoo from east to west, is another form, the males of which are darker above and paler below and the females more heavily streaked than any of the preceding subspecies. This population gives place in the coastal strip from Still Bay to Oranjemund to another, which is smaller, the males paler, more lemon yellow below, and the females even more heavily streaked. The last is the typical *flaviventris*; and and Karoo population is without a name. I name it below, *quintoni*.

From the mountains of Basutoland, Roberts described *guillarmodi* as being darker above than *flaviventris* in the male and more heavily streaked below in the female, in which, too, the sides of the face are darker grey. He also noted that it, and a bird from Carnarvon, were larger than coastal birds from Tulbagh to Vanrhynsdorp. Only three males (one of them immature) and five females were available to me, but the heavy streaking below of the females is broadly confirmed by these specimens, which are more heavily streaked than *quintoni*, but no more so than *flaviventris*. They also appear to have less green suffusion above than either *quintoni* or *flaviventris*. The two adult males, however, appear to me to be indistinguishable from *flaviventris*, except on size.

Conclusions

The following subspecies are accordingly recognized:

1. *Serinus flaviventris flaviventris* (Swainson)

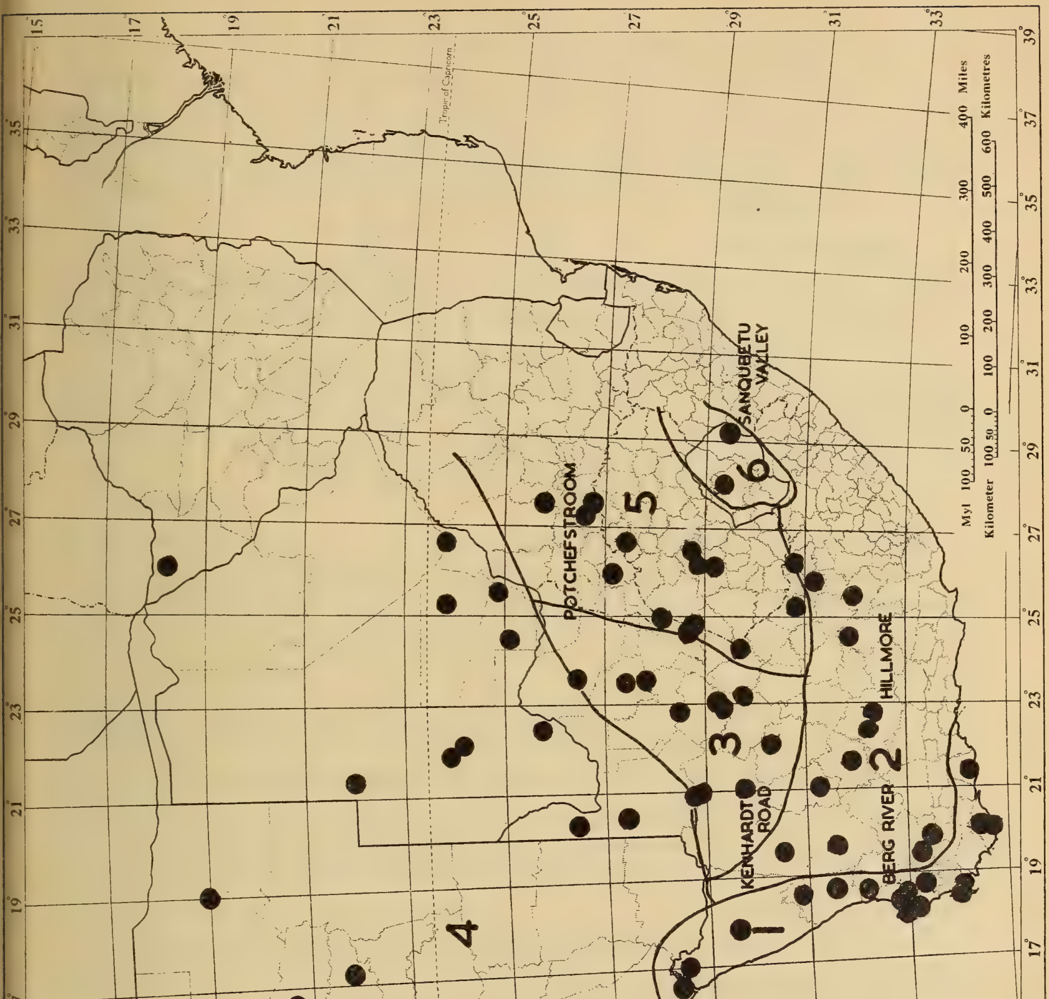
Loxia flaviventris Swainson, *Zool. Journ.*, 3, 1828: 348—South Africa (restricted to Berg River, S.W. Cape).

Range. The coastal strip from Oranjemund, just north of the mouth of the Orange River, to Still Bay, Riversdale District.

Characters. The male is dark above, like *quintoni*, from which it differs in being paler yellow, more lemon and less orange, below. The female is also similar above to *quintoni* but more heavily streaked below. Both sexes average smaller than the other forms.

Measurements:

23 ♂♂: Wing, 68–76, av. 71·6 mm.; tail, 46–56, av. 49·5; tarsus, 15–22, av. 18·8; culmen, 13–14, av. 13·8.



Distribution of the Subspecies of *Serinus flaviventris* (Swains.)

Each dot represents a locality from which one or more specimens have been examined.

Type localities of described forms are named.

1. *flaviventris*	4. *damarensis*
2. *quintoni*	5. *marshalli*
3. *aurescens*	6. *guillarmodi*

10 ♀♀: Wing, 66–72, av. 68·9 mm.; tail, 49–58, av. 51·2; tarsus, 17–21, av. 18·9; culmen, 13–15, av. 14·0.

It will be noted that there is a considerable overlap in wing-lengths between this form and the next; but the males with wing-lengths in excess of 73 mm. and the females with wing-lengths in excess of 70 mm. are all from the eastern edge of the range—Springbok, Monazite Mine, Berg River; except one, from L'Agulhas.

Material examined:

South African Museum: 24 (Berg River, Cape Town, Swartklip, Zoetendalsvlei, Still Bay, Cape Flats, Wynberg, Langebaan, Leipoldtville, Monazite Mine, Annisfontein).

East London Museum: 7 (Malmesbury, Springbok, Sandkraal, Vanrhynsdorp–Bitterfontein).

Port Elizabeth Museum: 2 (Oranjemund).

National Museum of Southern Rhodesia: 1 (Langebaan).

2. *Serinus flaviventris quintoni* subsp. nov.

Range. The Karoo areas from Calvinia, the Cold Bokkeveld and Touws River east to Skietkuil, Murraysburg District, and Fish River Station. Intergrades with *marshalli* at Elandshoek, Aliwal North District, and with *aurescens* at Vanwyksvlei.

Characters. The male is dark above, like *flaviventris*, from which it differs in being richer yellow, more orange and less lemon, below. The female is also similar above to *flaviventris* but less heavily streaked below. Both sexes are larger than *flaviventris*. From *marshalli* and *aurescens*, the male differs in being more heavily streaked and less yellow above and not so rich a yellow as *aurescens* below. The female is darker above and more heavily streaked below than either *marshalli* or *aurescens*.

Type. In the South African Museum, Cape Town; ♂, Hillmore, Beaufort West, 22 September 1955, collected by J. M. Winterbottom; collector's number, 250; S.A.M. number, 20188.

Measurements:

25 ♂♂: Wing, 71–82, av. 75·8 mm.; tail, 49–59, av. 53·2; tarsus, 16–23, av. 18·9; culmen, 13–15, av. 14·1.

7 ♀♀: Wing, 71–79, av. 73·9 mm.; tail, 49–52, av. 50·2; tarsus, 16–20, av. 18·3; culmen, 13–15, av. 13·9.

Material examined:

South African Museum: 7 (Touws River, Hanover, Beaufort West (type), Cold Bokkeveld).

East London Museum: 23 (Calvinia, Fraserburg, Williston, Brandvlei, Brandvlei-Kenhardt, Touws River, Skietkuil, Fish River Station).

Durban Museum: 1 (Calvinia).

Rankine Collection:* 1 (Beaufort West).

Note. I name this subspecies after my friend Mr. W. F. Quinton, a keen ornithologist, on whose farm the type was collected.

3. *Serinus flaviventris aurescens* Clancey

Serinus flaviventris aurescens Clancey, *Durb. Mus. Novit.*, 5, 1958: 104–10 miles from Kenhardt, on Brandvlei Road.

Range. From Kenhardt and Olyvenhout Drift, east and north to Riverton, near Kimberley, and Kuruman; intergrading with *quintoni* at Vanwyksvlei, with *marshalli* at Riverton and with *damarensis* at Olyvenhout Drift and Kuruman.

Characters. Male less heavily streaked and lighter above than *quintoni*; female, lighter above and less heavily streaked below. From *marshalli*, the male is distinguished by being yellower and less streaked above and richer, deeper yellow below; the female is greyer above and whiter, less streaked, below.

Measurements:

8 ♂♂: Wing, 73–77, av. 74·7 mm.; tail, 50–56, av. 53·1; tarsus, 16–20, av. 17·1; culmen, 14–15, av. 14·1.

2 ♀♀: Wing, 72–73, av. 72·5 mm.; tail, 47–52, av. 49·5; tarsus, 16, av. 16·0; culmen, 14, av. 14·0.

Material examined:

Durban Museum: 5 (Riverton, Kenhardt (type), Niekerkshoop, Niekerkshoop–Griquatown).

East London Museum: 4 (24 miles south of Kakamas, Klipput, Kuruman–Askham).

National Museum of Southern Rhodesia: 1 (Kuruman).

Intermediates, *quintoni-aurescens*:

Durban Museum: 4 (Vanwyksvlei).

Intermediates, *aurescens-damarensis*:

South African Museum: 2 (Olyvenhout Drift).

4. *Serinus flaviventris damarensis* Roberts

Serinus flaviventris damarensis Roberts, *Ann. Tvl. Mus.*, 8, 1922: 264—Windhoek.

Range. South West Africa (except the area at the mouth of the Orange River), Bechuanaland Protectorate, the extreme north-west corner of Southern Rhodesia and the extreme north and west of Griqualand West; intergrading with *aurescens* at Olyvenhout Drift and Kuruman.

Characters. The male is brighter and lighter above and paler yellow below than *aurescens*; and a clearer, brighter yellow below than *marshalli*. The female

* The Rankine collection will be divided between the South African Museum and the National Museum of Southern Rhodesia.

is greener above and yellower below than *aurescens*; and yellower and less striped below than *marshalli*.

Measurements:

19 ♂♂: Wing, 71–78, av. 75·2 mm.; tail, 47–58, av. 50·7; tarsus, 17–20, av. 18·1; culmen, 13–16, av. 14·0.

7 ♀♀: Wing, 70–77, av. 73·1 mm.; tail, 50–55, av. 52·3; tarsus, 14–19, av. 16·7; culmen, 12–14, av. 13·1.

Material examined:

National Museum of Southern Rhodesia: 18 (Kakia, Ghanzi, 200 miles south of Francistown, Tsabong, 55 miles west of Kanye, Tsane, Lehututu, Molepole-Lephepe, 23 miles south of Letlaking).
Transvaal Museum: 5 (Windhoek, Okahandja, Matetsi).
Durban Museum: 2 (Otjomassu).
South African Museum: 1 (Keetmanshoop).
East London Museum: 1 (Kalahari Game Reserve).
Rankine Collection*: 8 (Noeniput).

5. *Serinus flaviventris marshalli* Shelley

Serinus marshalli Shelley, *Bds. Afr.*, 3, 1902: 200—Potchefstroom.

Range. Western Transvaal, Orange Free State and the adjacent parts of the Cape Province (Fourteen Streams, Kimberley, Hopetown, Colesberg); intergrading with *aurescens* at Riverton and with *quintoni* at Elandshoek, Aliwal North District.

Characters. The male is greener and less heavily streaked above than *quintoni*; and the female is paler and with the underparts less heavily streaked. The male is greener, less yellow, above than *aurescens* and *damarensis*, and paler yellow below; the female is less streaked below than *damarensis* and greener above than *aurescens*.

Measurements:

26 ♂♂: Wing, 70–78, av. 75·1 mm.; tail, 47–59, av. 52·8; tarsus, 15–20, av. 18·3; culmen, 13–16, av. 14·0.

6 ♀♀: Wing, 70–77, av. 73·2 mm.; tail, 51–54, av. 52·5; tarsus, 17–20, av. 18·8; culmen, 14, av. 14·0.

Material examined:

South African Museum: 5 (Orange River Station, Potchefstroom).
Transvaal Museum: 12 (Brandfort, Bloemfontein, Wolmaransstad, Venterskroon, Bothaville, Fourteen Streams, Rustenburg, Hoeningspruit).
East London Museum: 10 (Rooipoort, Bloemfontein).
Durban Museum: 3 (Riverton, Glen).

* The Rankine collection will be divided between the South African Museum and the National Museum of Southern Rhodesia.

Port Elizabeth Museum: 1 (Bloemfontein).
Kaffrarian Museum: 1 (Colesberg).
National Museum of Southern Rhodesia: 1 (Rustenburg).

6. *Serinus flaviventris guillarmodi* (Roberts)

Serinops flaviventris guillarmodi Roberts, *Ann. Tvl. Mus.*, 18, 1936: 256—Sanqubetu Valley, Basutoland.

Range. The high mountains of Basutoland (*S. f. marshalli* occurs along the Caledon River valley).

Characters. Broadly speaking, a *flaviventris* swelled to the size of *quintoni*; but the upper parts of the female are darker, with less green wash, than those of *flaviventris*. It averages larger than any of the other races.

Measurements:

2 ♂♂: Wing, 78–79, av. 78·5 mm.; tail, 50–55, av. 52·5; tarsus, 19, av. 19·0; culmen, 13–14, av. 13·5.

5 ♀♀: Wing, 76–80, av. 77·0 mm.; tail, 53–58, av. 56·0; tarsus, 18–20, av. 18·8; culmen, 14–15, av. 14·4.

Material examined:

Transvaal Museum: 3 (Sanqubetu Valley (Type), Maluti Mts.).
Durban Museum: 5 (40 miles east of Maseru).

Reference

Macdonald, J. D. 1957. *A Contribution to the Ornithology of Western South Africa*, 1957.

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CONTRIBUTIONS TO THE KNOWLEDGE OF SOUTH AFRICAN MARINE MOLLUSCA.

PART I. GASTROPODA: PROSOBRANCHIATA: TOXOGLOSSA

By

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(Compiled by Brian Kensley, South African Museum)

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To be governed by the rulings of the latest *International code of zoological nomenclature* issued by the International Trust for Zoological Nomenclature (particularly articles 22 and 51). The Harvard system of reference to be used in the synonymy lists, with the full references incorporated in the list at the end of the article, and not given in contracted form in the synonymy list.

Example

Scalaria coronata Lamarck, 1816: pl. 451, figs 5 *a, b*; Liste: 11. Turton, 1932: 80.