

A new southern African genus in the holothurian family Cucumariidae (Echinodermata: Holothuroidea) with the recognition of two subspecies in *Cucumaria frauenfeldi* Ludwig

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A new genus *Roweia* in the holothurian family Cucumariidae is erected to accommodate two southern African dendrochirotiids, *Cucumaria frauenfeldi* Ludwig and *C. stephensoni* John which have previously always been classified in *Cucumaria* (s.l.). Some intraspecific variations in *R. frauenfeldi* are discussed and, on this basis, the species is rediagnosed and two subspecies recognized. The species and subspecies of the new genus are keyed, their synonymy is considered and distributions mapped. New information in regard to *R. stephensoni* is also included.

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'n Nuwe genus *Roweia* in die Holothurioidea-familie Cucumariidae is geskep om twee Suid-Afrikaanse dendrochirotiiede, *Cucumaria frauenfeldi* Ludwig en *C. stephensoni* John, te akkommodeer. Albei spesies is sedert hul beskrywing in die genus *Cucumaria* (s.l.) geplaas. Sommige intraspesievariasies in *R. frauenfeldi* word bespreek en op grond hiervan is die spesie herdiagnoseer en twee subspecies word erken. Die spesie en subspecies in die nuwe genus word van sleutels voorsien, hulle sinonimie word bespreek en hulle verspreidings gekarteer. Nuwe inligting ten opsigte van *R. stephensoni* word ook ingesluit.

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Introduction

During preparation of a doctoral thesis on the southern African holothurian fauna it became apparent that several southern African dendrochirotiids have not been satisfactorily assigned generically. In conformity with current views on generic distinctions in the order Dendrochirotida, new generic names are required. Two such species are *Cucumaria frauenfeldi* Ludwig, 1882 and *C. stephensoni* John, 1939, which, since the time of their descriptions, have been classified in *Cucumaria* (s.l.). The designation of *C. frondosa* Gunnerus as type species of *Cucumaria* (Panning, 1949) restricts the genus to those cucumariids with 10 equal tentacles, pedicels not restricted to the ambulacra (in adults), a simple calcareous ring without posterior processes on the radial plates, and exclusively flat, thin, multilocular, often thorny plates as body wall spicules. Such plates in the type species are often found only in the posterior region or the pedicels.

Although the two southern African species named above correspond with the type species in having 10 equal tentacles and a simple calcareous ring, they differ in having pedicels generally confined to the ambulacra and numerous body wall spicules in the form of a superficial layer of slender rods and an inner layer of thick, usually bilocular or spectacle-shaped plates or rods. Panning (1955) commented on this anomaly but refrained from assigning the two southern African species to a new genus. Since these species are not referable to *Cucumaria* (s.s.) a new genus is here diagnosed to accommodate them with the designated type species, *C. frauenfeldi* Ludwig.

The north-east Pacific *C. nigricans* Brandt, 1835 and *C. vegae* Théel, 1886, also with spectacle-shaped rods, cannot be included in the new genus because of the reduction of their two ventral-most tentacles, the presence of pedicels also in the interambulacra and the absence of slender rods from the body wall. The resemblance of their spicules to those of *C. frauenfeldi* is perhaps a result of parallel evolution and convergence (Panning, 1955).

Roweia gen. nov.

Diagnosis: Medium-sized, cylindrical to U-shaped species, up to 130 mm long. Tentacles 10, more or less equal in size. Pedicels usually restricted to ambulacra in 2–12 rows ventrally and two rows dorsally; interambulacra naked or with papillae (papulae). Radial plates of calcareous ring without posterior processes but with long anterior projections. Spicules of body wall a superficial layer of minute, slender, curved rods, forked and/or perforated at extremities (absent or rare in one subspecies), and an inner layer of fairly thick spectacle-

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shaped rods or 'biscuits' with one or more holes at each end and often with few knobs, digitations or processes on the margin.

Type species: Cucumaria frauenfeldi Ludwig, 1882.

Other species included: Cucumaria stephensoni John, 1939.

Etymology: The genus is named after Dr F.W.E. Rowe of the Australian Museum in recognition of his invaluable contributions to the systematics of echinoderms. The gender is feminine.

Remarks: The genera most closely related to the new genus are *Hemioedema*, Herouárd, 1929, *Pawsonia* Rowe, 1970 and possibly *Cladodactyla* Brandt, 1835. *Hemioedema* has podia generally scattered over the body and exclusively thin, smooth, oval to rectangular, multilocular plates as body wall spicules. *Pawsonia* has the two ventral-most tentacles reduced, a single row of podia in the dorsal ambulacra and a superficial layer of small, stellate spicules (Rowe 1970). *Cladodactyla* has spicules similar to those of *Hemioedema* but, in addition, tiny baskets may be present. The relationship of these four genera is strengthened in that they are mostly east Atlantic in distribution. *Hemioedema* includes three west African species; *Pawsonia* is monotypic, being represented by a single British species; while *Cladodactyla* includes two Antarctic and two west African species.

A study of numerous specimens from around the southern African coast shows the type species of the new genus to be extremely variable. The species is hence rediagnosed and, on the basis of geographical variations, two subspecies are here recognized, of which the nominate subspecies appears restricted to the west and south coast, west of East London (Cape Province, South West Africa and southern Angola) and the other to the east coast, north of East London (Transkei, Natal and southern Mozambique). Of the two other southern African species with spectacle-shaped rods, *C. deichmanni* Cherbonnier, 1952 is here declared to be a synonym of the nominate subspecies, while *C. webbi* Thandar, 1977 is regarded as an abnormal variant of the east coast form of *R. frauenfeldi* and hence lowered to the rank of a subspecies.

A key to the species and subspecies is given below. Previous records of the species and of the material here examined are expressed in terms of latitude/longitude degree squares as expounded by Day (1967). The following symbols are used to indicate regions and depth records: A = Angola, C = Cape Province, M = Mozambique, N = Natal, SWA = South West Africa, T = Transkei, i = intertidal, s = shallow (0–100 m).

Key to the species and subspecies of *Roweia*

- U- or barrel-shaped species, colour variable, never uniformly black; ventral pedicels in 2–4(5) rows per ambulacrum; no interradial papillae; superficial spicules, if present, with perforated ends *Roweia frauenfeldi* (Ludwig, 1882) — 2.
Straight, cylindrical species, uniformly black in life; ventral pedicels in 6–12 rows per ambulacrum; numerous interradial papillae (papulae); superficial spicules of body wall slender, curved rods with forked ends *Roweia stephensoni* (John, 1939).
- Superficial spicules dense, always forming a continuous layer; anal region generally without rosettes; south and west coast form *Roweia frauenfeldi frauenfeldi* (Ludwig, 1882).
Superficial spicules usually absent, if present, rare, never forming a continuous layer; anal region generally with rosettes; east coast form *Roweia frauenfeldi webbi* (Thandar, 1977).

Roweia frauenfeldi (Ludwig) comb.nov. (Figures 1 and 2)
Cucumaria sp. Semper, 1868: 236, pl. 39, fig. 22.

Cucumaria frauenfeldi Ludwig, 1882: 130; Cherbonnier, 1952: 477 (synonymy), pl. 37, figs. 1–14.

Cucumaria posthuma Lampert, 1885: 248, fig. 52; Théel, 1886: 265.

'*Cucumaria*' *frauenfeldi* Clark & Rowe, 1971: 192 (part dist.), pl. 29, fig. 1.

Cucumaria deichmanni Cherbonnier, 1952: 478, pl. 37, figs. 16–24, pl. 38, figs. 14–21; syn. nov.

Cucumaria webbi Thandar, 1977: 57, figs. 1 & 2; syn. nov.

Diagnosis (From Deichmann, 1948, modified herein): Length up to 90 mm. Colour in life usually a shade of brown or yellow, never uniformly black. Pedicels in 2–4(5) rows, extending onto introvert; interambulacra naked. Calcareous ring with anteriorly projecting radial plates linked to small interradial plates by one or more calcareous fragments (Figure 1 a–h). Spicules a superficial layer of slender curved rods (0,03–0,07 mm) (rare or absent in *R. frauenfeldi webbi*), usually perforated by 1–3 holes at each extremity, and an inner layer of much stouter, spectacle-shaped rods or 'biscuits' (0,07–0,14 mm), with one or few holes at ends and often with knobbed or digitated margins (Figure 2A–D), holes frequently reduced, completely absent or never developed; rods rarely developed into plates with up to seven holes and a wavy margin.

Holotype and locality: Leyden Museum; Cape of Good Hope.

Paratypes: Leyden Museum; locality unknown.

Previous southern African records: A(15/12); SWA(23/14/i; 26/15/i); C(30/17/i to 32/18/i; 34/18/i to 34/21/i; 34/23/i to 33/28/i); N(29/30/i).

Material examined: *R.f. frauenfeldi* — SWA(19/12/i, 20/13/?i,s; 23/14/i); C(28/16/s; 30/17/i; 33/17/i,s; 34/18/i to 33/28/i); 204 spec.

R.f. webbi — T(32/30/i); N(30/30/i to 29/30/i; 27/32/i); M(24/35/i); 18 spec.

Distribution (Figure 3): R.f. frauenfeldi — Moçamedes (S. Angola) to East London.

R.f. webbi — Transkei to Jangamo (S. Mozambique).

Remarks: Semper (1868) illustrated only the spicules of his *Cucumaria* sp. without a description of his single Vienna Museum specimen and Ludwig (1882) merely named the species, including his three Leyden Museum specimens, also without a description, but with reference to Semper's figure. Semper's type was stated to be from Java but, in the absence of any other record of the species outside the southern African region, it must be assumed that the Vienna specimen is either mislabelled or not the same species as Ludwig's material. Therefore, although John (1939) compared the spicules of his southern African material with those of the Vienna specimen, the latter cannot be designated the type. Since Vaney (1911) compared his material from southern Africa directly with one of Ludwig's specimens and concluded that they are identical, Deichmann's (1948) designation of Ludwig's specimen from the Cape of Good Hope as the type must be accepted. Since both the locality and the name of the Vienna specimen are dubious *R. frauenfeldi* must be regarded as a species endemic to southern Africa.

Since Ludwig's naming of the species, specimens assigned to this species or suspected to be identical with Semper's specimen have been described several times (Lampert 1885 — as *C.*

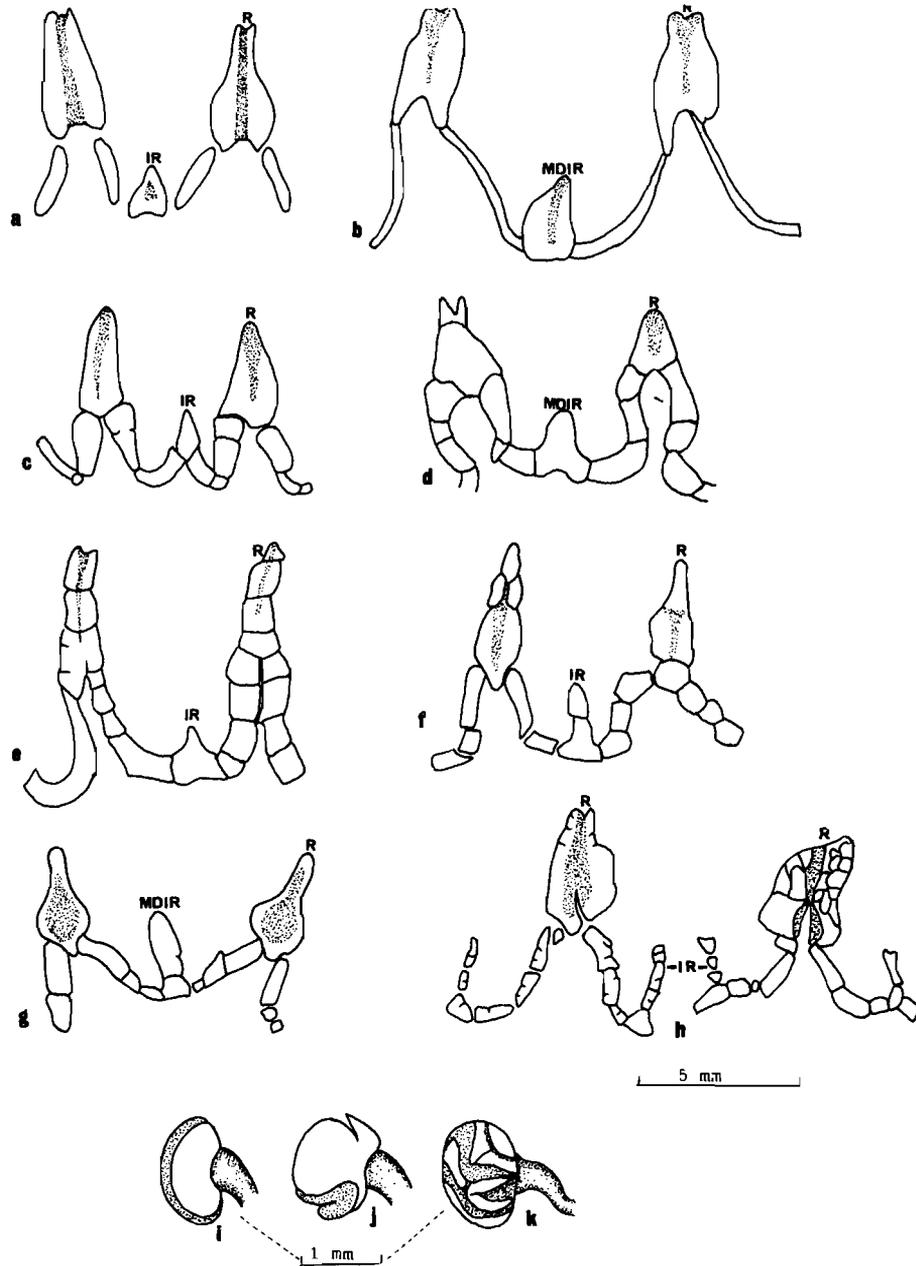


Figure 1 *Rowsea frauenfeldi* (Ludwig). Calcareous rings and madreporites of specimens from (a) Isipingo (Natal), (b) Transkei, (c) Port Elizabeth (C.P.), (d) Arniston (C.P.), (e) St James (False Bay), (f) Cape Peninsula, (g) Off Orange River Mouth, (h) Torra Bay (SWA), (i) Isipingo, (j) Off Orange River Mouth, (k) Torra Bay. All calcareous rings drawn to same scale. IR = interradial plate, MDIR = middorsal interradial plate, R = radial plate.

posthuma, Britten 1910; Vaney 1911; Clark 1923; John 1939; Deichman 1948; Cherbonnier 1952). However, most of these descriptions are based on few specimens, not truly representative of the entire southern African region. A study of some 222 specimens with a geographic range from Rocky Point in northern South West Africa to Jangamo in southern Mozambique shows the species to be extremely variable. While some of these variations are individual, others appear to be clinal and some distinctly geographic.

Individual variations exist in the presence or absence of anal 'teeth', distribution of pedicels, form of the spectacle-shaped rods and the nature of the tentacular deposits. Anal 'teeth' could only be identified with any degree of certainty in about 40% of the specimens studied. Since anal 'teeth' may be present or absent even in specimens taken from the same locality, this character must be regarded as an individual variation of no taxonomic significance.

The pedicels are always restricted to the ambulacra and

generally occur in 2–4 rows ventrally and 2–3 rows dorsally. In only one specimen from Groen River (W. Cape Province) and another from South West Africa are the ventral pedicels, of especially the anterior end, in five rows and the dorsal in 2–4 rows. Hence a larger number of rows of pedicels is an individual variation of rare occurrence.

There are, however, considerable variations in the type of spectacle-shaped deposits but no correlation is apparent in forms taken from different localities, except in specimens collected from the east coast where such rods are slightly longer and with fewer holes. Generally the margins of the rods may be smooth, wavy or slightly serrate; projections, knobs and/or digitations may be absent; and the holes may vary in size and number.

The tentacular deposits usually include rosettes, rods and large multilocular plates of varying shapes and sizes. However, rosettes or plates may be absent, without any order, in some specimens while in rare cases tentacular spicules are altogether

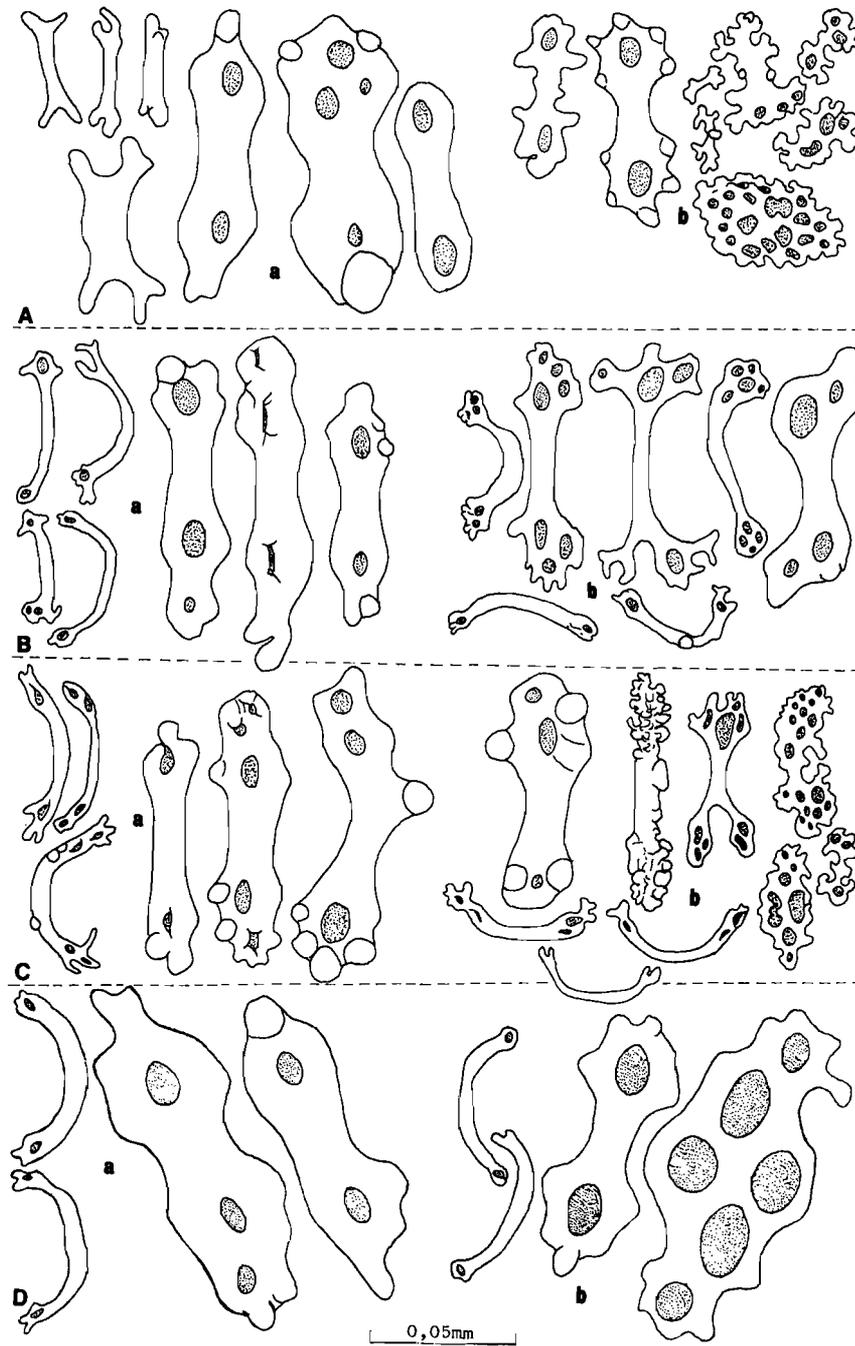


Figure 2 *Roweia frauenfeldi* (Ludwig). (a) Body wall and (b) anal spicules of specimen from (A) Jangamo (Mozambique), (B) Port Elizabeth (C.P.), (C) St James (False Bay) and (D) Torra Bay (SWA). All drawn to same scale.

wanting.

The calcareous rings of eight specimens taken randomly from the east to the west coast are illustrated in Figure 1a–h. A comparison of the illustrations shows that the observable variations in the form of the calcareous ring are roughly clinal. There is a tendency, from the east to the west coast, for the once pyriform radial plates to increase in size, become quadrangular and fragmented, and for their connecting links with the interradials to also become fragmented. These clinal variations are, however, not clear-cut since in one specimen from the east coast the radials are broad with subdivided connecting links and similarly, in a few specimens from the south and west coasts, the radial plates are not fragmented (Figure 1g). It is not certain whether the fragmentation of parts of the calcareous ring is a natural occurrence or the effect of the preserving or bleaching fluids. Lack of fresh material from

the west coast prevents a positive conclusion. It is noteworthy that the plates of the madreporite are also fragmented in some specimens from the west coast (Figure 1k). However, specimens from the south and west coasts (Cape Province and South West Africa) can be distinguished from those from the east coast (Transkei, Natal and southern Mozambique) on the bases of several geographic variations tabulated in Table 1.

It is noteworthy that, as in the type, specimens from the south and west coasts always display a continuous layer of slender rods in the superficial integument except for three specimens from Groen River (W. Cape Province) and two from South West Africa. However, since all the spicules in these specimens are partially corroded no significance can be attached to this anomaly. Cherbonnier (1952) did not report slender rods from the body wall in his material from the Cape of Good Hope but his specimens are also stated to be poorly

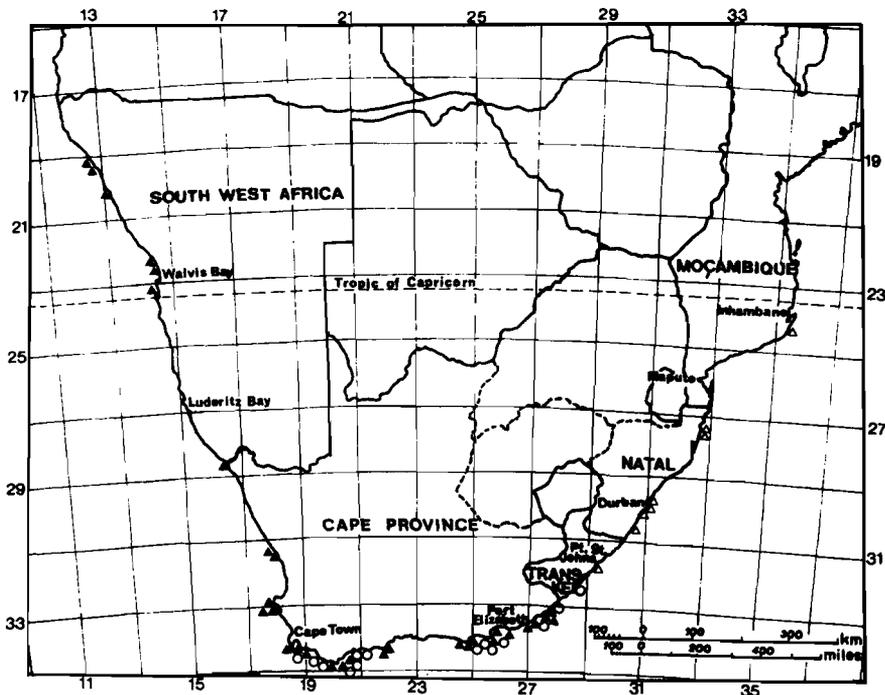


Figure 3 Distribution of the species and subspecies of *Roweia*. ▲ *R. frauenfeldi frauenfeldi* (Ludwig). △ *R.f. webbi* (Thandar). ○ *R. stephensoni* (John).

Table 1 Geographic variations in *Roweia frauenfeldi* (Ludwig)

	West and south coast form	East coast form
Habitat	In pools or under rock, usually embedded in sand.	In crevices or between stone slabs containing little or no sand.
Form	Robust, slightly curved to barrel-shaped.	Less plump, distinctly U-shaped when alive.
Colour	Light greyish brown to pink, yellow, orange or even rust-coloured with few exceptions.	Usually an admixture of dark shades of brown with one or two exceptions.
Superficial body wall spicules	Slender rods nearly always forming a continuous layer.	Slender rods mostly absent; if present, of different form (Figure 2A) and never developed as a continuous layer.
Anal spicules	Typically like body wall spicules; rosettes only present in one specimen from St James (False Bay) but accompanied by slender rods typical of body wall.	Rosettes and strongly digitated spectacle-shaped rods with one exception where only spicules typical of body wall occur.

preserved. It is therefore certain that two forms of the species exist which, because of their allopatry and some intergradations, are here designated as subspecies.

A full history of this species is given by John (1939) who was also the first to re-examine the spicules of Semper's specimen. Since then Deichmann (1948) re-diagnosed the species; Cherbonnier (1952) redescribed the species while separating Vaney's (1911) *C. frauenfeldi* from Moçamedes (Angola) and some material from Swakopmund (South West Africa) as *C. deichmanni*; Clark & Rowe (1971) figured some spicules from the type; and Thandar (1977) described *C. webbi* while separating it from the Natal form of *C. frauenfeldi*.

C. deichmanni is based on pedicels in 4–5 rows, a calca-

reous ring with fragmented links and spectacle-shaped rods without digitations but with minute holes. Since these characters are highly variable within *R. frauenfeldi*, *C. deichmanni* can no longer be upheld and is here relegated to the synonymy of *R. frauenfeldi frauenfeldi*.

C. webbi was separated from *C. frauenfeldi* mainly on the bases of the calcareous ring with fragmented links, short gonadal tubules, smooth spectacle-shaped rods and the absence of anal rosettes. Apart from the short gonadal tubules these characters are also highly variable and therefore *C. webbi*, not found again, is here regarded as an abnormal variant of the east coast form of *R. frauenfeldi* and relegated to the rank of a subspecies.

Roweia stephensoni (John) comb. nov. (Figure 4)

Cucumaria frauenfeldi H.L. Clark (partim), 1923: 413.
Cucumaria stephensoni John, 1939: 321, figs. 1–4. Cherbonnier, 1953: 596 (synonymy), fig. 2 (1–15).

Syntypes: British Museum (Natural History) (BMNH), St. James, False Bay, T.A. Stephenson, 26 Aug 1938; Somerset West, False Bay, received by BMNH in 1898; South Africa, received by BMNH in 1877.

Previous records: C(34/18/i, s to 34/19/i; 33/25/i, 33/27/i); T(32/28/i).

Material examined: C(34/18/s to 34/21/i; 34/24/i to 33/28/i); T(32/18/i); 94 spec.

Distribution: False Bay to Qoloha (Transkei). Figure 3.

Habitat: Exposed in rock pools and crevices containing little or no sand.

Remarks: The specimens examined range in size from 11–95 mm; none is 130 mm as recorded by John (1939). The tentacle number occasionally varies from 8–12. Pedicels sometimes occur in the interambulacra of the ventral surface. The plates of the calcareous ring appear to be connected by tiny calcareous elements (Figure 4) but it was not possible to establish beyond doubt whether this is normal or a result of preserva-

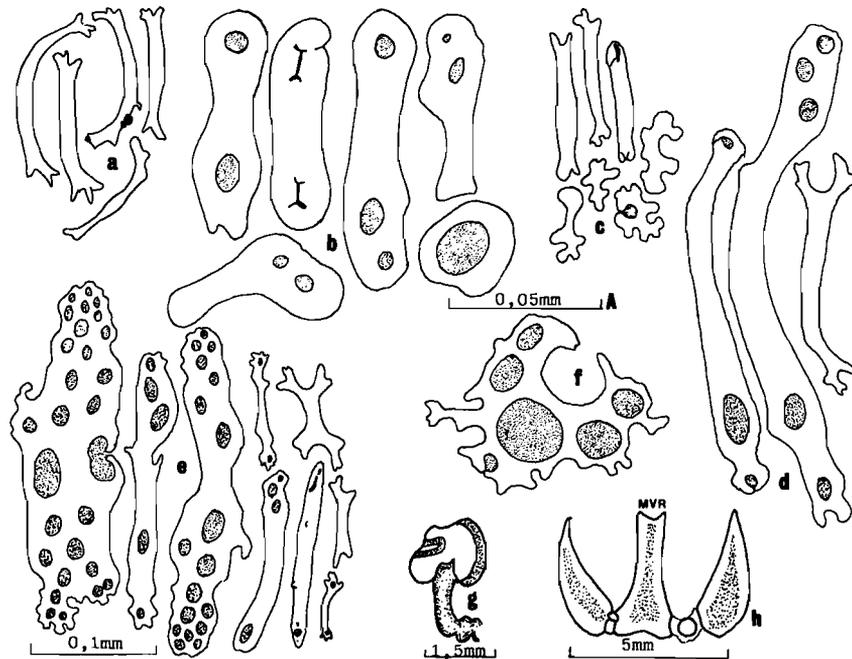


Figure 4 *Rowesia stephensoni* (John). (a) slender rods from dorsal body wall, (b) spectacle-shaped rods from ventral body wall, (c) introvert spicules, (d) pedicel rods, (e) tentacular spicules, (f) periproctal plate, (g) madreporite, (h) midventral radial (MVR) and adjoining interradial plates of calcareous ring (a–d & f Scale A).

tion and preparation. John (1939) does not mention these elements while Cherbonnier (1953) reports non-calcified ligaments between the plates.

The spicule dimensions of the present material vary slightly from those recorded by John (1939). The slender rods (Figure 4a) measure 0,04–0,06 mm while the spectacle-shaped rods (Figure 4b) are 0,05–0,09 mm. The former are always forked and never perforated while the latter usually have one hole at each end. The tentacular (Figure 4e) and pedicel (Figure 4d) deposits are typical while the introvert is characterized by minute rods that are often branched and rosette-like (Figure 4c).

R. stephensoni is distinct from *R. frauenfeldi* in having interradial papillae (papulae), a high pedicel number and a different type of calcareous ring. These features in combination are perhaps worthy of a higher taxonomic status for the species and even Deichmann (1948: p.346) observes that 'the two forms are not particularly closely related'. The two species may not be phylogenetically close but are here referred to the same genus in order to limit the number of monotypic genera. Since both species are sympatric but occupy different ecological niches, the similarity in their spicules may after all be indicative of a remote common ancestry rather than parallel evolution.

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