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# A CONTRIBUTION TO THE KNOWLEDGE OF NON-MARINE MOLLUSCA OF SOUTH WEST AFRICA

by

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With 28 text-figures and one plate

The moment to collate scattered notes on South West African non-marine molluscs arrived last year when Mr. B. H. Lamoral of the Natal Museum, Pietermaritzburg (South Africa), entrusted the present author with the study of material obtained during a Council of Scientific and Industrial Research (C.S.I.R., Pretoria)-sponsored collecting trip. During Mr. Lamoral's explorations in 1969 in South West Africa non-marine molluscs were obtained as a sideline. Nevertheless the material is certainly considered sufficiently interesting to warrant publication.

South West African material from various sources was studied and the following abbreviations have been used: BM for British Museum (Natural History), London; NM for Natal Museum, Pietermaritzburg; RMNH for Rijksmuseum van Natuurlijke Historie, Leiden; l/d for the ratio length/major diameter of shells, which gives an indication of the shape of the specimen under discussion. For small shells the figures for l/d have been calculated from micrometer readings, so that these figures may not always agree with those calculated from the measurements in mm. Collecting localities of the Lamoral expedition have been indicated by the quarter degree square system. Grid references are given according to this system as explained by Poynton (1964: 3-4, fig. 1) and in a pamphlet from the Botanical Research Institute, Pretoria (October 1967), which gives lists of one-degree squares in various parts of Southern Africa.

Acknowledgements are due to Mr. Lamoral and the Director of the Natal Museum, Dr. J. A. Pringle, for entrusting us with the study of the valuable South West African material. Furthermore the author owes a debt of gratitude to Dr. C. O. van Regteren Altena and Mr. E. Gittenberger (Rijks-

museum van Natuurlijke Historie, Leiden), Mr. W. D. Haacke (Transvaal Museum, Pretoria), Dr. H. Jungen (Zoologisches Museum der Universität, Zürich), Dr. R. Kilias (Institut für spezielle Zoologie und Zoologisches Museum der Humboldt-Universität, Berlin), Dr. J. J. van Mol (Université Libre de Bruxelles), Mr. J. F. Peake (British Museum (Natural History), London), and Dr. A. Zilch (Senckenberg-Museum, Frankfurt am Main) for most essential assistance in various forms. The author is particularly indebted to Mr. H. Heijn, staff artist of the Department of Systematic Zoology of the University (Leiden), for expert illustration (figs. 1-14, 15a, 16-18, 21-23, 27-28, pl. 1).

The terrestrial molluscs of South West Africa are comparatively well-known. Comprehensive papers of relatively recent date are those by Connolly (1931, 1939) and Zilch (1939), while a string of smaller articles by Blume, Van Bruggen, and Zilch is also indispensable. Aspects of the distribution of the land molluscs have been treated by Van Bruggen (1969). South West Africa harbours about 65 species of terrestrial molluscs, a great many of which are endemic to the region. Some genera are also endemic and these are well-known for the variation of their species. Sometimes it is very difficult indeed to try to name representatives of *Xerocerastus* (Subulinidae), *Dorcasia* (Acavidae), and *Sculptaria* (Corillidae). Fortunately the small number of species is usually compensated for by a large number of individuals. Identification of samples is rather more reliable than naming of singletons from widely scattered localities. The value of the material collected by Mr. Lamoral and his associates Messrs. R. Day and P. Olivier is thus greatly enhanced by the fact that many species are represented by series rather than by single specimens.

In general Zilch's nomenclature and classification (Zilch, 1959-1960) have been followed. Literature references under the species have been kept to a minimum and as a rule only give a few recent titles or refer to papers containing extensive bibliographic references.

## PLANORBIDAE

### **Bulinus (Bulinus) tropicus** (Krauss, 1848)

Mandahl-Barth, 1958: 70, pl. 25; Van Bruggen, 1963: 262; 1966: 104; Oberholzer & Van Eeden, 1967: 8, figs. 4-10.

Fish River canyon, 2717DA, 29.I.1969, B. H. Lamoral & R. Day (NM, RMNH, alcohol; NM, "above water line in sand").

The present specimens of *Bulinus tropicus* have marked growth striae and are almost costulate. The spire is very much depressed (cf. var. *depressus*

Haas, 1936, as figured by Mandahl-Barth on pl. 25 fig. h, and by Oberholzer & Van Eeden on fig. 8). The largest shell in the spirits sample is only 5.0 mm long. The single empty shell from "above water line in sand" was filled with mud, etc., which proved to contain two vertebrae of a small freshwater fish.

**Biomphalaria pfeifferi** (Krauss, 1848) (figs. 1-13)

Connolly, 1939: 484; Mandahl-Barth, 1958: 29, pl. 1; Azevedo et al., 1961: 56, 248, pl. 1 figs. 1-4 (under *Taphius*); Oberholzer & Van Eeden, 1967: 8, figs. 3a-c.

Sandamap Farm, Spitzkoppe, 2115CD, 12.II.1969, B. H. Lamoral (NM, RMNH).

The very variable sample consists of comparatively squat specimens with sometimes the apex prominent and protruding beyond the last whorl of the shell. Some specimens have very marked growth lines probably due to unfavourable conditions such as periodic droughts, etc. In profile this is shown by corrugations on the base of the shell (see fig. 12). The largest shell has a major diameter of 12.2 mm and a height of 6.2 mm.

Barbosa et al. (1961) have been followed in using he name *Biomphalaria* in preference to *Taphius*.

CHONDRINIDAE

**Gastrocopta damarica** (Ancey, 1888)

Van Bruggen, 1966: 104; 1966b: 325.

Palmfontein Farm, Grootberg Mountains area, 1914CB, 25.II.1969, B. H. Lamoral (NM, alcohol).

The single specimen is 2.2 mm long.

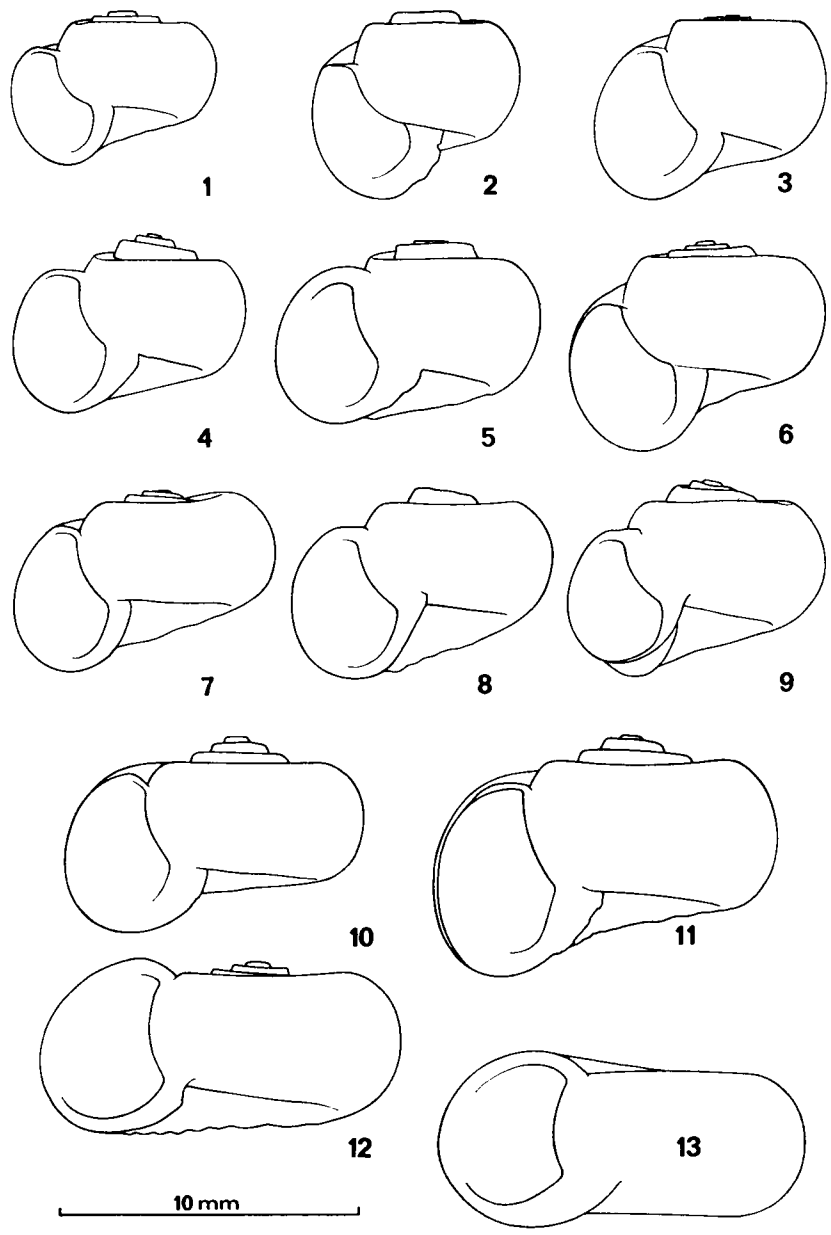
PUPILLIDAE

**Pupoides calaharicus** (Boettger, 1886) s.l.

Van Bruggen, 1966: 104; 1966b: 327, figs. 7-8; 1969: 25. See also Van Bruggen, 1963: 262 (s.n. *Pupoides minusculus* var. *major*).

Palmfontein Farm, Grootberg Mountains area, 1914CB, 25.II.1969, B. H. Lamoral (NM, RMNH, alcohol).
Okaukuejo, Etosha Pan, 1915BB, 2-6.III.1969, B. H. Lamoral & R. Day (NM, alcohol).
Ugab River bridge, 2014DD, 21.II.1969, B. H. Lamoral & R. Day (NM).
Gamkarab Cave, 2016AB, 1.III.1969, B. H. Lamoral & R. Day (NM).
De Waal Farm, Leonardville, 2318BD, 18.III.1969, B. H. Lamoral (NM).

*Pupoides calaharicus* s.l. is here taken to include *P. minusculus* (Mousson, 1887), *P. minusculus* var. *major* (Degner, 1922), and *P. bryantwalkeri* Pilsbry, 1926. Various authors have repeatedly discussed the variability of the Southern African *Pupoides*. Connolly (1939: 394-398) is obviously very




Figs. 1-13. *Biomphalaria pfeifferi* (Krss.), Sandamap Farm, Spitzkoppe (NM, RMNH), variation in the shape of the shell. All figures drawn to the same scale.

hesitant about separating the various forms, while Zilch (1939: 217-220) stresses the existence of shells intermediate between those of *P. calaharicus* and both forms of *P. minusculus*, all occurring together or even possibly belonging to one single population. Having seen a lot of material during the last decade, I have decided to call all Southern African specimens of this genus *P. calaharicus* s.l. The status of the species has been discussed before (Van Bruggen, 1966b: 328).

The above-cited material again shows a considerable amount of variation. The length of adult shells varies from 3.9 to 5.4 mm. In the first sample the shells are from 4.2 to 5.3 mm long; those in the second sample from 4.4 to 5.0 mm. The remaining lots only consist of single or a few specimens. All material at hand shows the usual variation in aperture, depth of suture, convexity of whorls, etc.

### **Microstele noltei** (Boettger, 1886)

Connolly, 1939: 398, pl. 12 fig. 2; Zilch, 1939: 220, figs. 4-6; 1952: 119; 1959: 168, fig. 578.

Okaukuejo, Etosha Pan, 1915BB, 2-6.III.1969, B. H. Lamoral (NM).
From the crest of high mountains on the north side of the Goantagab River, Kaokoveld, W. Falcon colln. (via Mrs. Helen Boswell to A. C. van Bruggen: RMNH).

According to Connolly (1931, 1939) the shell of *Microstele noltei* varies in length from 3.5 to 4.5 mm. The Okaukuejo specimen measures 3.4 × 1.4 mm, l/d 2.35, while the Leiden Museum specimens vary in length from 3.1 to 3.7 mm. The species also varies a good deal in the shape of the shell and the dentition of the aperture. Thanks to Verdcourt (1968) we know something of the variation of the possibly allied *M. iredalei* (Preston). Both species are rather similar, although relationships can probably only be elucidated by anatomical studies. Connolly (1931: 331) has considered *Microstele* to be a monotypic genus, "since I hardly think that *Leucochiloides iredalei* Prest. can, as tentatively suggested by Pilsbry, be a true *Microstele*". The evidence contained in Verdcourt's paper, however, points at least towards a close likeness in shell with the same type of variation particularly in apertural dentition. Although similarity in ecological conditions in South West Africa and the northeastern arid areas of Africa may have influenced the terrestrial molluscs to such a degree that one may think of convergent evolution, it is not altogether impossible that some species are widely distributed and occur in both these parts of Africa. This is supported by "a certain amount of botanical and other evidence pointing to a former arid corridor joining the two areas" (Verdcourt, 1968: 7).

? ENIDAE

? **Edouardia** spec. (fig. 14)

Okaukuejo, Etosha Pan, 1915BB, 2-6.III.1969, B. H. Lamoral (NM).

This small shell, obviously a juvenile, has proved totally unidentifiable. It was shown to various specialists on African molluscs, but to no avail. Eventually the author has decided to provisionally consider it an enid close to the genus *Edouardia*. The specimen is figured here for the benefit of future workers in the area. The shell has three convex whorls with little sculpture except for some granulation (particularly on the nepionic whorls) and oblique growth striae. The colour is corneous but for the columella, which is paler and almost white. Sutures are simple and fairly deep. Although small, the shell is obviously not particularly fragile; it measures 1.7 × 1.4 mm (fig. 14).

*Edouardia kaokoensis* (Conn.) is the only representative of the genus in South West Africa (Connolly, 1939: 434); the other species are confined to the much more humid areas east of the Kalahari Desert. The specimen under discussion certainly does not belong to *E. kaokoensis*.

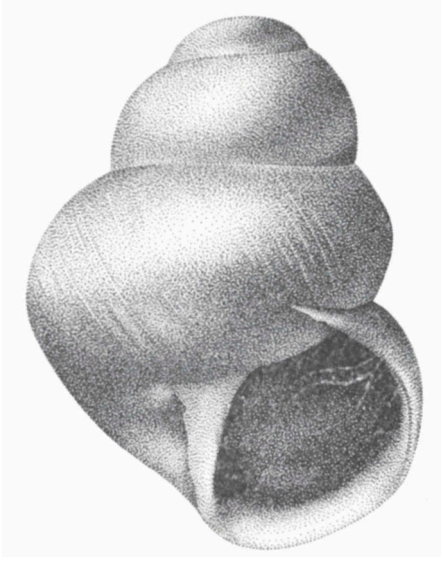


Fig. 14. ?*Edouardia* spec., Okaukuejo, Etosha Pan (NM), length 1.7 mm.

UROCYCLIDAE

**Gymnarion (Lacrimarion) lacrimosus** Connolly, 1929

Connolly, 1929: 224, pl. 14 figs. 6-9; 1931: 280; 1939: 121; Zilch, 1952: 119; 1959: 334, fig. 1226.

Palmfontein Farm, Grootberg Mountains area, 1914CB, 25.II.1969, B. H. Lamoral (NM).

The single shell is completely typical and measures 7.6 × 10.6 mm (altitude × major diameter), while Connolly's (1929, 1939) figures are 9.0 × 12.8 mm. In 1939 Connolly has erected the subgenus *Lacrimarion,* because the "shell is so completely unlike that of *Gymnarion* and other African Helicarions". Hugh Watson has dissected a specimen, but obviously has failed to completely report on it. Except those on the radula and jaw furnished by Peile (Connolly, 1929: 225, text-fig. 1) all data we have on the anatomy are: "H. Watson has kindly reported, that, in so far he has yet been able to examine the anatomy, the animal is a *Gymnarion*" (Connolly, 1929: 225). This remark is repeated in the 1930 and 1939 papers by Connolly.

Apparently the species is rare and also inhabits a fairly limited area in northwestern South West Africa all within the twenty inches mean annual rainfall zone. It is now known to occur at Ohopoho, Kaoko Otavi (type locality), Grootberg Mts. area, and Stinie (N. Damaraland according to Zilch, 1952).

FERUSSACIIDAE

**Cecilioides gokweanus** (Boettger, 1870)

Connolly, 1939: 370, pl. 8 figs. 14-17; Van Bruggen, 1966b: 351.

De Waal Farm, Leonardville, 2318BD, 18.III.1969, B. H. Lamoral (NM).

The single juvenile shell of *Cecilioides* from Leonardville is sufficiently characteristic to be identified with *C. gokweanus*; juveniles of *C. acicula* (Müll.) and *C. pergracilis* Conn. are much more slender. In Southern Africa *C. gokweanus* is new to the list of South West Africa.

**Cecilioides pergracilis** Connolly, 1939 (figs. 15-15a)

Connolly, 1939: 371, pl. 8 fig. 13.

Okaukuejo, Etosha Pan, 1915BB, 2-6.III.1969, B. H. Lamoral (NM, RMNH, alcohol).

According to Connolly (1939) the type of *Cecilioides pergracilis* measures 4.4 × 1.3 mm, l/d 3.39; the figure indicates an even more slender shell with an l/d of over 3.50. Obviously *C. pergracilis* is a very slender species.

The above sample contains four specimens:

| | |
|---|---|
| 4.1 × 1.1 mm, l/d 3.61 | 4.4 × 1.2 mm, l/d 3.68 |
| 4.2 × 1.1 mm, l/d 3.78 | 4.7 × 1.2 mm, l/d 3.75 |

It is new to South West Africa and its distribution pattern as at present known is now as follows: Isipingo, Natal; Mfongosi, Zululand (type locality); Okaukuejo, South West Africa; Zanzibar. This indicates that the species is

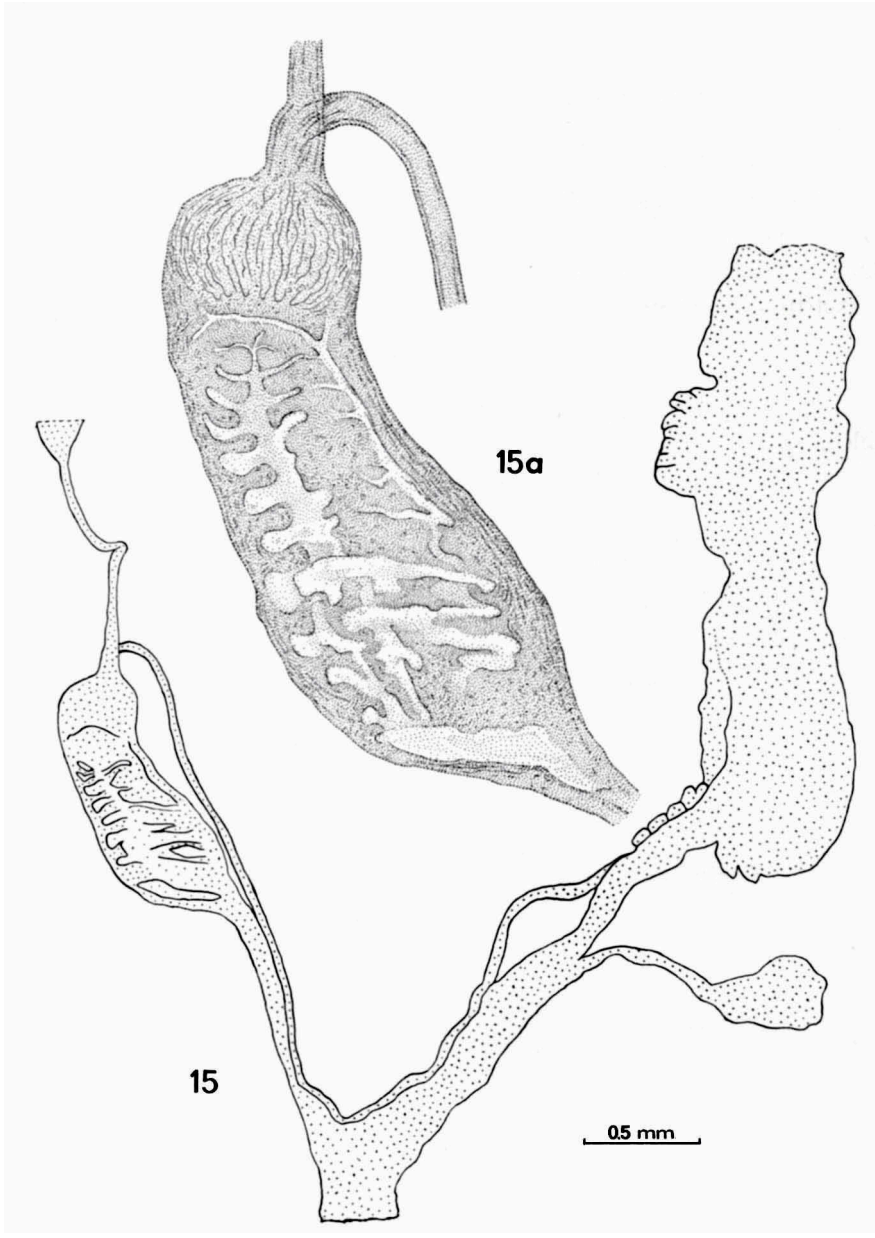



Fig. 15. *Cecilioides pergracilis* Conn., Okaukuejo, Etosha Pan (RMNH), genitalia, highly enlarged. 15a. Penis under high magnification to show internal structure.

catholic in its tastes as far as climatic conditions are concerned: Isipingo is in the wet coastal bush area, Mfongosi in the Tugela River valley has a somewhat arid climate, which probably is still somewhat more humid than that of Okaukuejo (which is inside the 20 inches mean annual rainfall isohyet), while Zanzibar again enjoys a hot and humid climate. Verdcourt (1960) records "*Cecilioides* cf. *pergracilis* Conn." from "Kenya, Turkana: Turkwell Drift", which is a decidedly arid area.

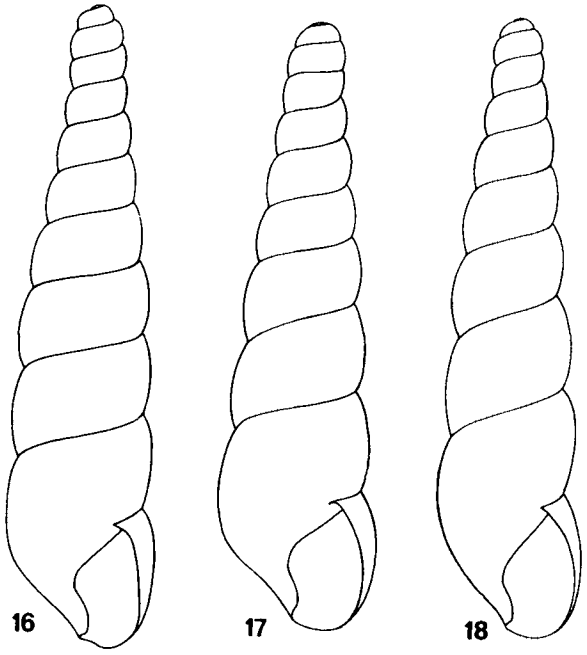
Mr. E. Gittenberger of the Leiden museum has most skilfully dissected and mounted the genitalia of two of the Okaukuejo specimens. Generally he has found the reproductive organs (fig. 15) to agree with those of *C. acicula* (Müll.) as discussed and figured by Watson (1928, 1929; see also Hesse, 1922, and Wächtler, 1929). In both specimens the penial retractor muscle was found to arise from the floor of the lung or diaphragm. According to Watson (1928: 229, pl. 5 fig. 5) this muscle arises from a branch of the columellar muscle. The penial retractor muscle of *C. acicula* has been reported to be inserted on the diaphragm (Wächtler, 1929: 376, 446, 462); on closer inspection, however, this muscle was also found to be attached to a branch of the columellar muscle. In both the present specimens Mr. Gittenberger has definitely observed insertion on the diaphragm. This may either be a character specific to *C. pergracilis* or the insertion may vary as in e.g., the Achatinidae (vide Mead, 1950: 268-271). The right tentacular retractor muscle was found to pass between the penis and the vagina as in *C. acicula* (Watson, 1928: 229). As far as can be judged from the mounted specimen the penis (fig. 15a) shows internal structures kindred to but not completely agreeing with those discussed and figured by Watson (1928: 233-234, pl. 5 fig. 4).

**Cecilioides** spec.

Kamanjab, 1914DB, 25.II.1969, B. H. Lamoral (NM).
Ghaub, Otavi highlands, 1917BC, 9.III.1969, B. H. Lamoral & R. Day (NM).

The Ghaub shell is a damaged juvenile. The Kamanjab specimen has five whorls and measures 4.1 × 1.2 mm, l/d 3.47; this may be a subadult specimen. It is too slender to be identified with *C. gokweanus* (Bttg.) although its aperture looks a bit like that of the species. The aperture does not agree with that of *C. pergracilis* Conn.

The genus *Cecilioides* appears to be widely distributed in South West Africa and has obviously adapted itself to a variety of habitats; its subterraneous way of life may make it to a certain degree independent from the climate as experienced by other terrestrial molluscs.




Figs. 16-18. *Subulina vitrea* (Mouss.), showing differences in shape and convexity of the whorls. 16. Ghaub (RMNH), length 11.0 mm. 17. Otjitundua, K. H. Barnard (BM 1937.12.30.8119-22, M. Connolly colln.), length 10.5 mm. 18. Groot Spitzkoppe Mountains (NM), length 10.6 mm.

SUBULINIDAE

**Subulina vitrea** (Mousson, 1887) (figs. 16-21)

Degner, 1922: 38; Connolly, 1939: 334; Zilch, 1939: 223; Van Bruggen, 1963: 264; 1966: 104.

Palmfontein Farm, Grootberg Mountains area, 1914CB, 25.II.1969, B. H. Lamoral (NM, RMNH, alcohol).

Okaukuejo, Etosha Pan, 1915BB, 2-6.III.1969, B. H. Lamoral & R. Day (NM, alcohol; RMNH).

Elandshoek Farm, Otavi highlands, 1917BC, 9.III.1969, B. H. Lamoral & R. Day (NM, alcohol) (see also sub *Gulella caryatis diabensis*).

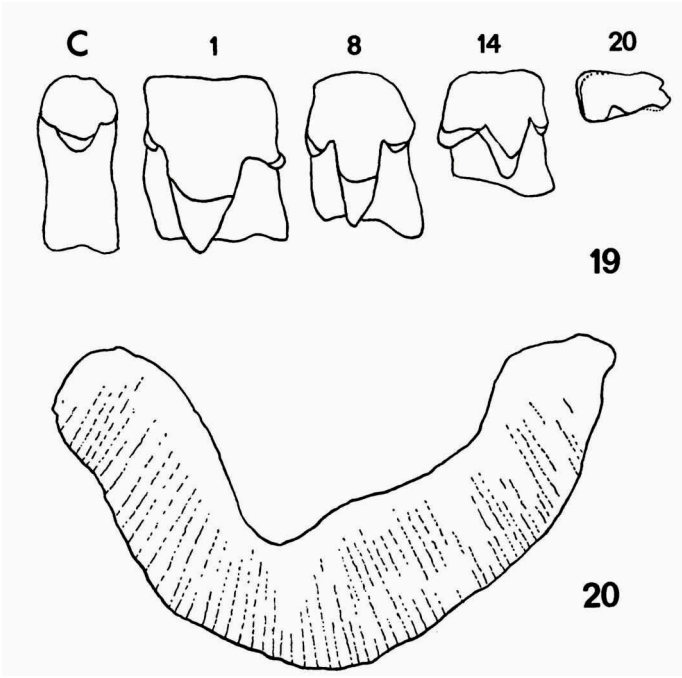
Ghaub, Otavi highlands, 1917BC, 9.III.1969, B. H. Lamoral & R. Day (NM, RMNH).

Ugab River bridge, 2014DD, 21.II.1969, B. H. Lamoral & R. Day (NM).

Gamkarab Cave, 2016AB, 1.III.1969, B. H. Lamoral & R. Day (NM).

Groot Spitzkoppe Mountains, 2115CC, 11.II.1969, B. H. Lamoral (NM, dry and alcohol).

Portsmut Farm, Hakos Mountains, 2316AB, 7.II.1969, B. H. Lamoral & R. Day (NM, RMNH, alcohol).




Figs. 19-20. *Subulina vitrea* (Mouss.), Portsmut Farm (NM). 19. Selected radula elements of a half row, highly enlarged. 20. Jaw, span 0.6 mm.

The shell of *Subulina vitrea* is subject to a good deal of variation. Among the above material the sculpture varies from little and very fine to well-marked, and the whorls are from flat to convex (see figs. 16-18). The largest available shell (Ghaub, RMNH) measures 13.1 × 2.6 mm, l/d 5.04, 12 whorls; the only specimen larger than this shell is recorded by Zilch (1939) as measuring 13.1 × 2.7 mm, l/d 4.85, 12 whorls. Otherwise the material at hand varies in length (largest shell taken from all samples containing adult specimens) from 10.1 to 12.6 mm. Mousson's type (Mousson, 1887: 296) in the Zoologisches Museum der Universität (Zürich) is a juvenile shell of 7.2 × 2.0 mm and with 8 whorls only (Mousson, 1887: 8.0 × 1.4 mm, 8 whorls). This is the only specimen available in Zürich (fide Dr. H. Jungen), although Mousson himself mentions four. According to Zilch (1939: 223) two of these are in the Senckenberg-Museum (ex O. Boettger collection), where they have been labelled as paratypes. Notwithstanding the discrepancies in measurements the Zürich shell must be considered the lectotype as it was very probably selected as such by Connolly (1939: 335, "Type of *chapmani* in British, *vitrea* in Zurich Museum."). The whereabouts of the fourth Mousson specimen are unknown to the present

author. Mousson's measurements give the wrong impression of a very slender shell (l/d 5.71, in reality however 3.60!). His coloured figure (Mousson, 1887, pl. 12 fig. 6) gives a more realistic l/d of 3.33 (see also Degner, 1922: 39). Obviously Melvill & Ponsonby (1892: 90) in describing *Stenogyra chapmani* were misled by Mousson's description and figure when they got

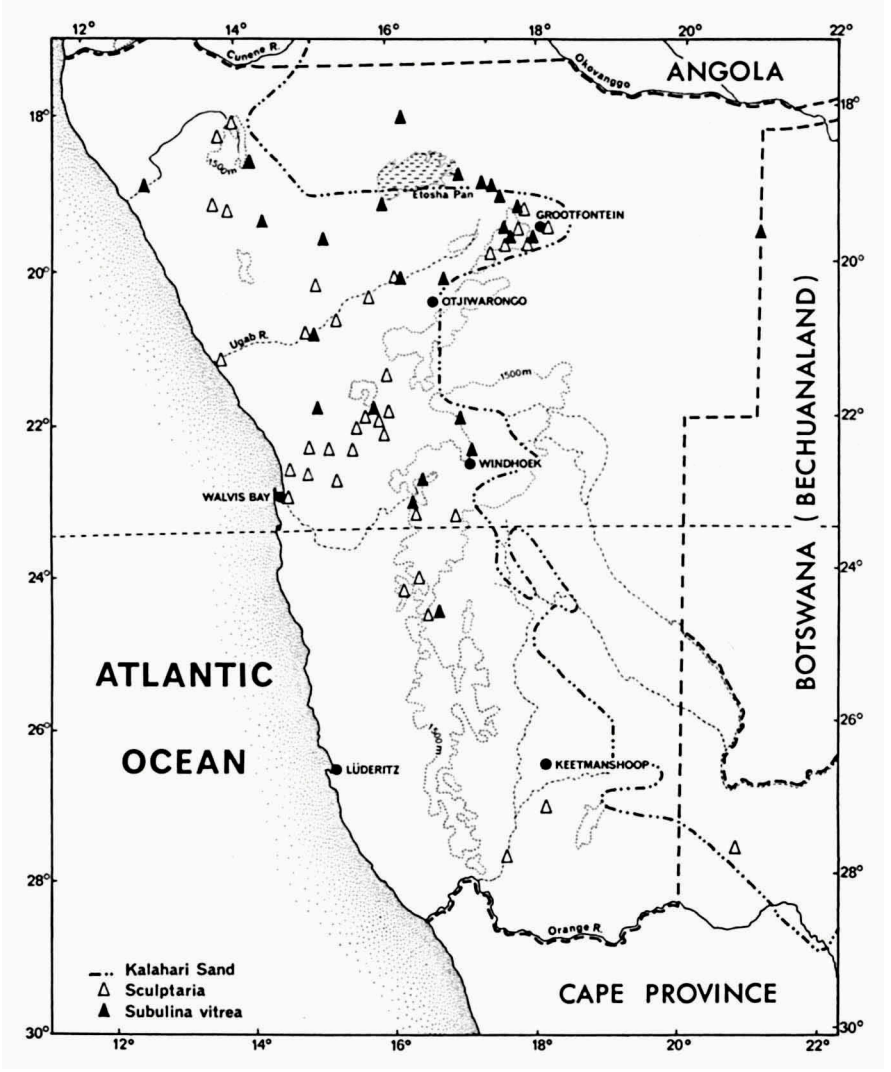



Fig. 21. Distribution of *Subulina vitrea* (Mouss.) and the genus *Sculptaria*; the latter also occurs in SW. Angola (so far only one locality). Note the western limits of the Kalahari Sand (see general discussion on *Sculptaria*).

hold of an almost adult and consequently much more slender specimen. Their type (BM No. 1912.8.16.365) is a slightly damaged shell pasted onto a piece of black paper. This specimen is approximately 9 mm long; the diameter cannot be measured because of its fixation.

The Gamkarab cave specimens have much thicker shells than usual which is due to some kind of deposit on the surface of the shell. This material is probably what is considered "subfossil" by some authors.

A fresh shell from the Ghaub sample (10.4 mm long) still retained an elongate egg of 1.6 × 0.9 mm. Another specimen in alcohol from Palmfontein Farm has an obviously mature egg in the uterus; this is visible through the penultimate whorl of the transparent shell. Reproduction in the Subulinidae normally begins comparatively early in life, at least already before the shell has attained two-thirds of its maximum size. Eggs are relatively few in number and very large in dimensions as compared to the size of the animal. With the increase in length of the shell the uterus may contain proportionnally more eggs so that it is likely that the number of eggs produced at a time increases with the age of the animal. In the author's experience Southern African *Subulina* may contain a maximum of four mature eggs at a time. In the family Subulinidae the maximum may be as high as eight (e.g., in *Pseudoglessula haackei* vBr., vide Van Bruggen, 1966a). In *S. vitrea* reproduction is very probably intimately connected with the sparse and scattered rainfall.

The colour of the animal varies as much as the size, shape and sculpture of the shell. Colour of the body may also have been influenced by food and preservation. The animals of the Portsmut Farm sample are dark grey, those of the Palmfontein Farm lot brownish, and those from Okaukuejo yellow. In certain cases among the Subulinidae the colour of the body may be diagnostic (Van Bruggen, 1966b: 353), but as far as can be judged from the present preserved material this is not the case in *S. vitrea*.

Radula and jaw were extracted from a specimen with a shell length of 11.0 mm from Portsmut Farm. The jaw (fig. 20) has a span of 0.6 mm and is of the usual type found in the family. The radula measures 1.4 × 0.5 mm and consists of about 96 transverse rows; the formula is 22 — 1 — 22. The central tooth is tricuspid. The teeth are also of the usual type in the Subulinidae; selected radula elements have been depicted in fig. 19.

According to the bibliographic references and new records cited above the species occupies a somewhat restricted area wholly within the limits of the territory of South West Africa. All known localities have been entered on the map (fig. 21). These comprise from roughly north to south: Ku-Ganab (SE. Ondonga = Ondongua = Ondangua); Otjitundua; Hoarusib R.; Na-

mutoni; Hoeis (Hoais Farm, Tsumeb dist.); Sandup (between Namutoni and Tsumeb); Otjikoto Lake (SE. Sandup); Okaukuejo; Tsumeb; Palmfontein Farm (1914CB); Auros Farm (Otavi Mts.); Elandshoek Farm (Otavi Mts.); Horasib Farm (Otavi Mts.); Leopardenschlucht (Otavi Mts.); Aha Mts. (on the border of Botswana, approximately 19°40′ S 21° E); Cauas Okawa (between Kamanjab and Otjitambi); Gamkarab Cave (2016AB); Outjo; Ugab R. bridge (2014DD); Groot Spitzkoppe Mts. (Spitzkopje, 2115CC); Onguati; Okahandja; Brakwater; Portsmut Farm (Hakos Mts.); Gaub/Diab R. (see sub *Gulella caryatis diabenis*); Friedland Farm (Maltahöhe dist., E. of Tsaris = Zaris Mts.) [1]). The distribution pattern shows that there is no reason not to expect *S. vitrea* to occur in western Botswana beyond the Aha Mountains and also in the extreme south of Angola. Ostensible absence in Angola and Botswana and also possibly the southern districts of South West Africa may be due to a dearth of collectors. It is unlikely that this species occurs as far east as certain species of *Xerocerastus* do (cf. Van Bruggen, 1964); so far there is no evidence of it in those areas in the Transvaal and Rhodesia where *Xerocerastus* has been found to occur.

**Xerocerastus (Xerocerastus) damarensis** (Adams, 1870)

Connolly, 1931: 300, pl. 3 figs. 1, 6-10; Zilch, 1939: 226, 236, figs. 18-21, 24-25; 1952: 119; 1959: 354, fig. 1306; Van Bruggen, 1963: 265; 1966: 105.

Okaukuejo, Etosha Pan, 1915BB, 2-6.III.1969, B. H. Lamoral & R. Day (NM, RMNH) (sample no. 1).
Same data (NM, RMNH, alcohol) (sample no. 2).
Same data (NM, alcohol) (sample no. 3).
Okaukuejo, Etosha Game Park, common under shrubs and in grass tufts, 28.X.1965, K. L. Tinley (RMNH) (sample no. 4).
Sandamap Farm, Spitzkoppe plains, 2115CD, 13.II.1969, B. H. Lamoral (NM, RMNH) (sample no. 5).
De Waal Farm, Leonardville, 2318BD, 17-18.III.1969, B. H. Lamoral (NM, RMNH) (sample no. 6).
Same data (NM, alcohol) (sample no. 7).

*Xerocerastus damarensis* is an extremely variable species and many an author has tried to subdivide his material into varieties, formae or even subspecies. The following names have been proposed, though this does not imply that these are all nomenclatorially available: *minor* (Pfeiffer, 1870), *exspec-*

1) All localities here mentioned either occur in The Times Atlas of the World, comprehensive edition, London, 1967, or have been related to localities shown on the maps of this atlas. The 1967 edition is essentially a reprint of The Times Atlas of the World, Mid-Century Edition in five volumes, London (Vol. 4, Southern Europe and Africa, 1956).

*tata* (Mousson, 1887), *subradiata* (Boettger, 1910), *maxima* Connolly, 1929, *minuscula* Connolly, 1931. These names have all been proposed with either the prefix "var." or "forma". Various other names have been proposed for ostensibly new species and consequently these are only synonyms of *X. damarensis*: *Helix* (*Cochlicella*) *opposita* Mousson, 1887, and *Buliminus layardi* Melvill & Ponsonby, 1892. The latter name, originally considered a synonym of *X. burchelli* (Gray) (vide Connolly, 1931: 303, pl. 3 fig. 15), has been transferred to *X. damarensis* by Zilch (1939: 229). The latter has tried to create some order in the confused nomenclature. However, he has employed a quaternary nomenclature and has obviously not succeeded in separating the various forms satisfactorily. Many forms show considerable overlaps in distribution and in fact I believe that it is altogether impossible to subdivide *X. damarensis*. This probably also holds good for the other species in this difficult genus. Far from being uniform, South West Africa abounds in (micro)niches in the range savanna to desert. These niches have been filled by comparatively few species of great plasticity. The phenomenon of genetic drift has certainly been of great influence here since many populations may have been initiated by only two or very few individuals. The present author proposes to drop all subdivision in *X. damarensis*, but only to describe population samples. In this context, however, it may be advisable to refer back to the known varieties and formae for purposes of comparison.

The material under consideration ranges from 13.5 to 24.6 mm in length. Samples nos. 1-4 have comparatively large and slender shells as witnessed by the following table of measurements:

| | |
|---|---|
| Sample no. 1 | 17.4-23.5 × 7.8-9.5 mm, l/d 2.23-2.47 |
| Sample no. 3 | 17.7-20.8 × 8.0-8.8 mm, l/d 2.21-2.36 |
| Sample no. 2 (largest shell) | 24.6 × 10.3 mm, l/d 2.39 |
| Sample no. 4 (largest shell) | 24.3 × 9.3 mm, l/d 2.61 |

This means that the above material should have been classified with the typical form and the var. *maxima* with intermediates. The other samples represent rather different populations:

| | |
|---|---|
| Sample no. 5 | 13.5-15.5 × 6.5-6.8 mm, l/d 2.08-2.31 |
| Samples nos. 6-7 | 16.6-19.8 × 7.2-8.1 mm, l/d 2.19-2.44 |

According to Zilch (1939) sample no. 5 belongs to the var. *minor*, of which he summarizes the measurements as 12.9-16.6 × 6.0-7.5 mm, l/d 2.10. The mean l/d of sample no. 5 is 2.19; the average, however, is considerably lower, so that this sample is completely within the limits of the var. *minor* as interpreted by Zilch. Samples nos. 6-7 belong to the typical form. The above data again show that it is not feasible to distinguish varieties, because of the abundant availability of intermediates. This is well illustrated by samples 1-4,

all collected within a radius of probably only a few hundred yards. Sample no. 4 represents exclusively the var. *maxima*, but in samples nos. 1-3 both the var. *maxima* and the typical form are represented with all intermediates. Even almost contiguous populations may have noticeably different types of shells (vide e.g., Van Bruggen, 1966: 105, sub *X. subteres*).

Sample no. 3 has a label indicating that the shells were being used by small salticid spiders as nests. Where terrestrial gastropods are common in habitats offering little opportunity of shelter, such as in large parts of South West Africa, empty shells are frequently used by various invertebrates (particularly arachnids) for shelter and breeding (cf. Van Bruggen, 1966a: 393).

### **Xerocerastus (Xerocerastus) burchelli** (Gray, 1834)

Zilch, 1939: 230, 236, figs. 26-27; Van Bruggen, 1963: 264; 1964: 224, fig. 2; 1966b: 367; 1967: 14.

Okaukuejo, Etosha Pan, 1915BB, 2-6.III.1969, B. H. Lamoral & R. Day (NM) (sample no. 1).

Ugab River bridge, 2014DD, 21.II.1969, B. H. Lamoral & R. Day (NM) (sample no. 2).

Goais Farm, near dry river bed 5 miles south of Helmeringhausen, 2516DD, 31.I.1969, B. H. Lamoral (NM, RMNH) (sample no. 3).

The present material of *Xerocerastus burchelli* ranges from 11.0 to 17.5 mm in length, so that in this species one could equally well distinguish small and large varieties. Scarcity of material in collections has probably prevented authors from doing so. *X. burchelli* has only recently become better known and it appears that its headquarters are in poorly investigated areas such as Botswana and NE. South West Africa. All above quoted samples are small, consisting of 4, 1, and 6 specimens respectively. The measurements are as follows:

| | |
|---|---|
| Sample no. 2 | 11.0 × 4.7 mm, l/d 2.34 (8 whorls) |
| Sample no. 1 | 14.1-15.9 × 6.2-6.5 mm, l/d 2.27-2.45 |
| Sample no. 3 | 16.4-17.5 × 6.9-7.1 mm, l/d 2.38-2.46 |

The single shell from the Ugab River bridge is small, but otherwise typical. The shells from sample no. 1 are fairly large, while those from sample no. 3 represent a population with very long and comparatively slender shells. The shells from sample no. 1 may be compared with data on other specimens from the Etosha Pan area (Ekuma River mouth, NM Moll. No. 4235, vide Van Bruggen, 1967: 14), which measure 13.6-14.3 × 5.7-6.0 mm l/d 2.27-2.50.

All data from the literature may now be summarized as follows: 11.0-17.5 × 4.7-7.1 mm, l/d 1.84-2.53. Connolly's abnormally long and slender shell (Connolly, 1931; 18.0 × 7.0 mm, l/d 2.57) has been omitted here, because

it obviously is abnormal and may not even belong to the species under discussion. The above summary of measurements sufficiently illustrates the enormous variability of *X. burchelli.*

The material from the Ugab River bridge and Goais Farm represent new distribution records for the species. These new records seem to confirm the pattern of distribution within the twenty inches mean annual rainfall isohyet (Van Bruggen, 1964).

**Xerocerastus (Lubricetta) subteres** (Boettger, 1910) (figs. 22-23)

Connolly, 1931: 305, pl. 3 figs. 21 (?), 27-29; Zilch, 1939: 231, 237, figs. 29-31; 1952: 119; Van Bruggen, 1963: 266; 1966: 105, fig. 2, pl. 10 fig. 3.

Makalani Farm, Grootberg Mountains area, 1914CD, 28.II.1969, B. H. Lamoral & R. Day (NM, alcohol; RMNH) (sample no. 1).

From soil pockets amongst dolomite of highest part of Otavi Mountains range, c. 2100 m altitude, beneath canopy of *Kirkia acuminata* woodland, 22.III.1967, K. L. Tinley (RMNH) (sample no. 2).

Northern valley, Brandberg, 2114BA, 20.II.1969, B. H. Lamoral & R. Day (NM, dry and alcohol; RMNH) (sample no. 3).

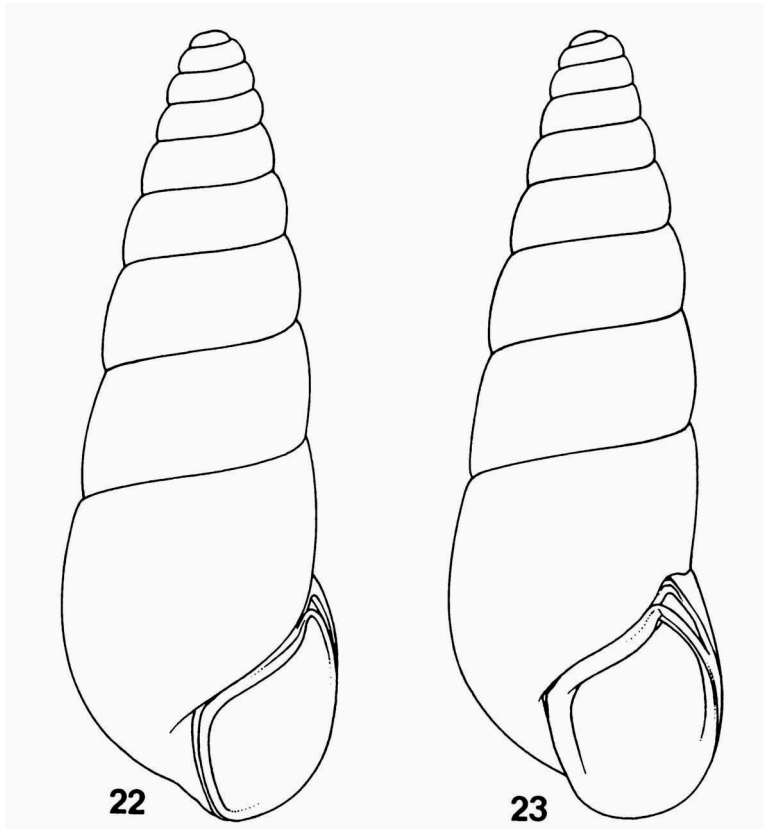
The present material of *Xerocerastus subteres* also shows a good deal of variation in shell size and shape, and in addition development of the umbilicus and the colour of the preserved animal. The measurements of the shell are as follows:

| | |
|---|---|
| Sample no. 3 | 20.4-24.3 × 7.3-7.7 mm, l/d 2.79-3.16 |
| Sample no. 2 | 20.6-23.3 × 7.6-8.4 mm, l/d 2.59-3.03 |

Literature data, including the above, which incidentally are completely within the range, give the following summary for the species: 14.6-26.0 × 5.8-9.5 mm, l/d 2.21-3.61. The largest and at the same time slenderest known shell is one from Swakopmund recorded by Connolly (1931: 305) and measuring 26.0 × 7.2 mm, l/d 3.61. The next largest known shell has an l/d of only 3.36 and belongs to the same population as the former, so that this one is probably somewhat abnormal. Sample no. 1 consists of subadult specimens (e.g., 16.9 × 6.7 mm, l/d 2.52, 8 whorls, RMNH), while sample no. 2 also contains two immature shells (e.g., 16.6 × 6.5 mm, l/d 2.55).

The shells from the Brandberg are rimate ("geritzt", Zilch, 1939), those from the Otavi and Grootberg Mountains have a completely closed umbilicus. The single live-taken specimen from the Brandberg has a pale animal, while the two from the Grootberg Mountains show a much darker colour. Food, micro-climate, and methods of preservation may have influenced this feature and further relevant discussion is therefore deemed superfluous.

The smallest shell from the Brandberg sample shows a double labrum




Figs. 22-23. *Xerocerastus subteres* (Bttg.), northern valley, Brandberg (NM), two views, of shell with double labrum, length 20.4 mm.

without traces of repaired damage (figs. 22, 23). It is difficult, however, to explain such a thing happening without at least assuming fairly serious damage to the superficial mantle tissues.

### **Xerocerastus (Lubricetta) nitens** (Degner, 1922)

Connolly, 1931: 305 (s.n. *X. subteres* sensu lato), 306, pl. 3 figs. 20, 22-25; Zilch, 1939: 232, 237, figs. 32-37; 1959: 355, fig. 1307 (s.n. *X. rollei*).

Windhoek South, 2217CA, 5.II.1969, B. H. Lamoral & R. Day (NM, RMNH, alcohol).
Windhoek, Safari Motel, 2217CA, 5.II.1969, B. H. Lamoral & R. Day (NM, alcohol).

Both Windhoek samples have been identified with *Xerocerastus nitens* var. *rollei* (Haas, 1928), mainly because of the small size, low l/d and very slightly more convex whorls as compared to *X. subteres*. Two shells from

the first sample measure: 13.4 × 6.7 mm, l/d 2.00 and 13.8 × 6.6 mm, l/d 2.09; both specimens have eight whorls and are rimate. The colour of the animal is pale yellowish brown.

Incidentally, characters such as the colour of the animal and degree of umbilication are subject to a great deal of variation and are here considered unreliable. Moreover, the genital anatomy in this group is of no great help in identification either because of too subtle and frequently probably unstable differences.

According to the meagre literature data (Degner, 1922; Connolly, 1931; Zilch, 1939) and the above-mentioned material the following distribution pattern now emerges:

Otjikoto Lake (type locality of *nitens*); Tsumeb (*nitens*); Otavifontein (*nitens*); Windhoek (*rollei*); Noukloof (type locality of *rollei*). The var. *rollei* has so far only been reported from Windhoek and Noukloof (also spelt Naukluft, Naauwkloof, etc.); if this form is indeed geographically isolated from the populations in the north it may be considered a valid subspecies. At the time of writing, data are obviously still too scanty to allow drawing conclusions. The present material from Windhoek is the first of the subgenus *Lubricetta* to have been recorded from that city. One actually wonders why not more material from this commercial and geographical centre of South West Africa has become available. The species may be very local in its distribution or it may have been scorned by collectors misled by the idea that the fauna of the capital city is ostensibly already exhaustively known. There is also another possibility, viz., that certain museums have a plethora of material, but that so far no specialist has been able to look at it.

A juvenile of the subgenus *Lubricetta* from De Waal Farm, Leonardville, 2318BD, 18.III.1969, B. H. Lamoral (NM), cannot be identified as to species.

### **Xerocerastus (Namibiella) hottentotus** (Gray, 1838)

Connolly, 1931: 298, pl. 3 fig. 17; 1939: pl. 9 figs, 19-20, 23-24 (no description); Zilch, 1939: 225, 236, fig. 16; 1954: 85, figs. 1-2; 1959: 355, fig. 1308 (s.n. *Namibiella hottentota*).

Mountains north of Rossing Mine, 2214BD, 14.II.1969, B. H. Lamoral & R. Day (NM, RMNH).

Kaokoveld, W. Falcon colln. (via Mrs. Helen Boswell to A. C. van Bruggen: RMNH).

South West Africa, W. Falcon colln. (do., RMNH).

The two specimens of *Xerocerastus hottentotus* measure 10.1 × 6.4 mm, l/d 1.58, and 10.8 × 6.6 mm, l/d 1.64, respectively. Zilch (1954) has described a subspecies with a smaller shell as *X. hottentotus scherzi*. Available data may now be compared as follows:

| | |
|---|---|
| Connolly (1931) *X. hottentotus* | 12.0 × 8.0 mm, l/d 1.50 |
| Zilch (1939, 1954) *X. h. hottentotus* | 10.4-13.4 × 7.3-8.8 mm, l/d 1.42-1.65 |
| Lamoral & Day material | 10.1-10.8 × 6.4-6.6 mm, l/d 1.58-1.64 |
| Leiden museum material | 10.8-12.8 × 7.7-8.5 mm, l/d 1.40-1.51 |
| Zilch (1954) *X. h. scherzi* | 8.7-9.0 × 5.8-6.2 mm, l/d 1.45-1.50 |

This shows that the specimens collected by Lamoral & Day perfectly fit in with Zilch's data for *X. h. hottentotus*. It shows at the same time that *X. h. scherzi* is not only somewhat smaller than the typical form, but also somewhat less slender. Both average and mean l/d for *X. h. hottentotus* are always (well) over 1.50, while for the few specimens of the other form the l/d seems to be lower, i.e., under 1.50. *X. h. scherzi* seems to occupy an area somewhat to the northwest of that of the typical form and therefore we may for the present accept it as a subspecies. However, the new record of Lamoral & Day is close to the type locality of *X. h. scherzi* (cf. Zilch, 1954: "Namib, an der Pad Swakopmund-Cap Cross, etwa 70 Meilen nördlich Swakopmund"), which form eventually may prove to be a mere local variant of the species.

*Namibiella* Zilch, 1954, here considered a subgenus of *Xerocerastus* (see Zilch, 1954, 1959; Van Bruggen, 1964: 224), is mainly characterized by the spiral sculpture on the apical whorls of the shell. However, this type of sculpture may be absent or very hard to see, even with a high magnification; only in large samples it is easily detected.

### **Xerocerastus (Namibiella) ovulum** Connolly, 1941

Connolly, 1939: pl. 9 figs. 21-22 (no description); Connolly, 1941, 244; Zilch, 1954: 86.

Mountains north of Rossing Mine, 2214BD, 14.II.1969, B. H. Lamoral & R. Day (NM, RMNH).

According to the literature *Xerocerastus ovulum* Conn. and *X. herero roessingensis* Zilch (originally spelt *X. h. rössingensis*) are closely allied (if not synonymous) and specimens appear to be very difficult to assign to one or the other of these species. The meagre literature data and the measurements taken from the above sample may be compared as follows:

| | |
|---|---|
| *X. herero roessingensis* | 6.0 × 3.0 mm, l/d 2.00 |
| *X. ovulum* | 6.6-7.0 × 4.1-5.0 mm, l/d 1.40-1.61 |
| above sample | 6.7-8.0 × 4.1-4.8 mm, l/d 1.63-1.67 |

Both length and l/d of the Lamoral & Day sample agree fairly well with those recorded for *X. ovulum*, so that for the time being this name has been employed. Representatives of the subgenus *Namibiella* are subject to the same amount of variation in the shell as those of *Xerocerastus* s.s. and *Lubricetta*.

*Namibiella* is confined to a comparatively small area in midwestern South West Africa west of Okahandja. *X. hottentotus* (Gray), however, has been described from "about the Great Fish River" (cf. Zilch, 1954: 85). This is well to the south of the area from where all other specimens have been recorded, which makes Gray's type locality seem somewhat dubious.

### Achatinidae

South West African Achatinidae are difficult to identify. For that reason we have refrained from naming a number of juvenile specimens. In these species the length, the ratio length/major diameter, the colour pattern, and the sculpture are diagnostic; these characters are not sufficiently shown by juvenile specimens to arrive at a reasonably certain identification. The following are all specimens with a shell length of well under 35 mm:

Palmfontein Farm, Grootberg Mountains area, 1914CB, 25.II.1969, B. H. Lamoral (NM, alcohol).
Makalani Farm, Grootberg Mountains area, 1914CD, 28.II.1969, B. H. Lamoral & R. Day (NM, alcohol).
Okahandja, 2116DD, 13-14.III.1969, B. H. Lamoral (NM).
De Waal Farm, Leonardville, 2318BD, 18.III.1969, B. H. Lamoral (NM).

The De Waal Farm sample consists of 19 very small shells of the same size; this may represent a single complete batch of eggs. Shells of the samples from the Grootberg Mountains area have a well-marked flame pattern.

**Achatina (Achatina) dammarensis** Pfeiffer, 1870 (fig. 24)

Degner, 1922: 34, figs. 12-13; Connolly, 1939: 320, pl. 11 (on p. 320 lapsus calami "Pl.x") fig. 6; Zilch, 1939: 238; Bequaert, 1950: 13; Mead, 1950: 261, pl. 9 fig. 54; Zilch, 1952: 119; Van Bruggen, 1963: 266, fig. 4; 1965: 80; 1966: 107.

Kamanjab, 1914DB, 25.II.1969, B. H. Lamoral & R. Day (NM).
Okaukuejo, Etosha Pan, 1915BB, 2-6.III.1969, B. H. Lamoral & R. Day (NM, RMNH, both dry and alcohol).
Ghaub (Farm), Otavi highlands, 1917BC, 9.III.1969, B. H. Lamoral & R. Day (NM, dry and alcohol).
De Waal Farm, Leonardville, 2318BD, 18.III.1969, B. H. Lamoral (NM).

All above material has been referred to *Achatina dammarensis*; only the Okaukuejo samples contain fully adult specimens, which, however, form continuous series with juvenile material in these and other samples. Adult shells in the Okaukuejo material have the following measurements:

| | |
|---|---|
| 39.0 × 25.0 mm, l/d 1.56 | 41.0 × 27.0 mm, l/d 1.52 |
| 39.0 × 27.0 mm, l/d 1.44 | 41.5 × 26.5 mm, l/d 1.57 |
| 39.5 × 26.0 mm, l/d 1.52 | 42.0 × 25.0 mm, l/d 1.68 |

42.5 × 26.0 mm, l/d 1.63 49.5 × 28.0 mm, l/d 1.77
44.5 × 25.0 mm, l/d 1.78 (genitalia fig. 24)

These measurements may be summarized as 39.0-49.5 × 25.0-28.0 mm, l/d 1.44-1.78. Data from the literature (see Van Bruggen, 1966) are

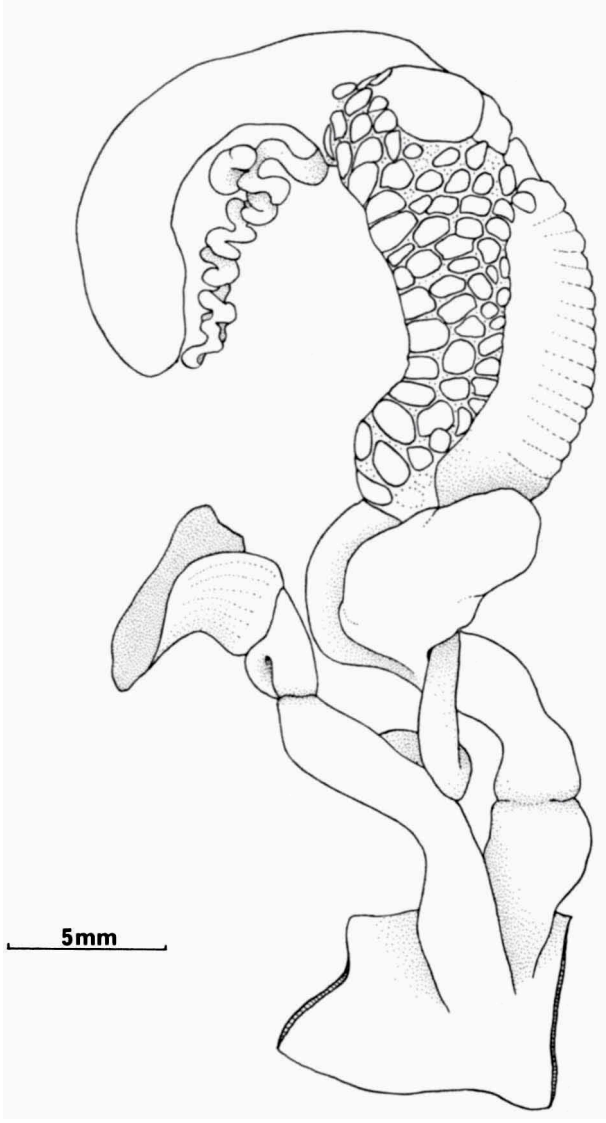



Fig. 24. *Achatina dammarensis* (Pfr.). Okaukuejo, Etosha Pan (NM), genitalia of specimen with a shell length of 44.5 mm.

36.0-58.7 × 19.0-31.0 mm, l/d 1.53-2.02. It appears that the above material represents populations with comparatively small and squat shells.

Connolly's remark (Connolly, 1939: 230) about the species having been "Founded on an immature shell" is quite incomprehensible, particularly so because he subsequently gives the measurements of another "typical specimen" in his own collection, which is obviously a good deal smaller than the type! Pfeiffer's original measurements are 45.0 × 24.0 mm, l/d 1.87, which is only slightly smaller than the mean of at present known measurements (Pfeiffer, 1870a: 31; 1870: 2). The original spelling *dammarensis* has to be retained in preference over *damarensis*. Pfeiffer has repeatedly and exclusively spelt the geographical name "Dammara" and this is to be found in his Latin diagnosis as well as in his comments in German and French.

*Achatina dammarensis* is mainly characterized by a combination of four features, viz., size and shape, sculpture, colour pattern, and genitalia. The colour pattern is uniform greenish brown with irregular and narrow darker vertical lines, which are more or less parallel to the growth lines. The basic colour varies from almost yellow to comparatively dark brown; sometimes the last whorl is noticeably paler below the periphery. As a whole the colour pattern looks fairly uniform. A real flame pattern hardly ever occurs in *A. dammarensis*. Most of the shells of the Okaukuejo sample, however, are closest to showing a flame pattern among the material known to the present author. The background colour of these is pale to darker brown, while the vertical lines are dark reddish brown. The latter are regular, narrow and closely together on the body whorl, but on the earlier whorls they are paler, more irregular, somewhat wider, and also farther apart, giving rise to a pale, but well-marked flame pattern.

The genitalia have been described by Degner (1922; repeated by Mead 1950) and by Van Bruggen (1963). In order to confirm the identity of the material at hand a specimen from the Okaukuejo lot (see table of measurements) was dissected. All main features agree (fig. 24). The musculus retractor penis has its insertion on the floor of the lung. The penis and vas deferens are not bulbous to such a degree at the region where they join each other as mentioned by Degner. The vagina is divided into basal and apical parts. The spermatheca is inserted high on the apical vagina and is bulbous and comparatively large. Upon opening the penis the inner wall folds were found to conform to Degner's description and figure including the pleat which he interpreted as a stimulatory organ.

The specimens from Ghaub Farm were dormant and are accompanied by their epiphragms.

ACAVIDAE [2])

**Dorcasia alexandri** Gray, 1838 (figs. 25-26)

Connolly, 1915: 167, pl. 3 fig. 5; 1931: 285; 1939: 273; Zilch, 1939: 245, fig. 56; 1960: 464, fig. 1648; 1969: 244, figs. 1-22.

Valencia Farm, Hakos Mountains, 2316BA, 6.II.1969, B. H. Lamoral, R. Day & P. Olivier (NM, RMNH).

Portsmut Farm, Hakos Mountains, 2316AB, 7.II.1969, B. H. Lamoral & R. Day (NM, alcohol).

Zilch has recently discussed the variability of the *Dorcasia alexandri* group and has tentatively come to the conclusion that all forms belong to a single, albeit extremely variable, species (Zilch, 1969). This view is completely acceptable to the present author (see comments sub *Xerocerastus damarensis*) and names of varieties and formae are only used here to indicate the type of shell under discussion.

The Valencia Farm sample is fairly uniform, except that in one shell the umbilicus is noticeably wider than in the others. The major diameter of adult shells varies from 26.5 to 29.8 mm. All belong to the typical form.

The two Portsmut Farm specimens are close to the var. *reflexilabris* Conn. (Connolly, 1939: 277, pl. 8 figs. 9-11), although the peristome is not expanded and reflected to such a degree as in Connolly's or Zilch's (Zilch, 1969: 246, fig. 2) specimens. Both specimens measure 17 × 31 mm (altitude × major diameter). The new record strengthens Zilch's view that this form is restricted to the Hakos Mountains and adjacent area.

Dr. J. J. van Mol of the Université Libre de Bruxelles has expressed a desire to dissect Southern African Acavidae within the framework of his anatomical studies on the relationships of certain genera and families in the southern hemisphere. The Portsmut Farm specimens have been put at his disposal and he has kindly supplied the following data on the genitalia (fig. 25). Anatomical details (albeit sometimes very incomplete) on *D. alexandri* are to be found in Simroth in Fleck (1894), Pilsbry (1895: 172-173), Watson in Connolly (1915: 168, 170), and Degner (1922: 14-15). The ovotestis consists of numerous cylindrical acini; the hermaphrodite duct is devoid of seminal vesicles. Carrefour [3]) with a very broad seminal vesicle attached to the side of the albumen gland. Free oviduct comparatively long, changing into a long vagina after its junction with the relatively long duct of the

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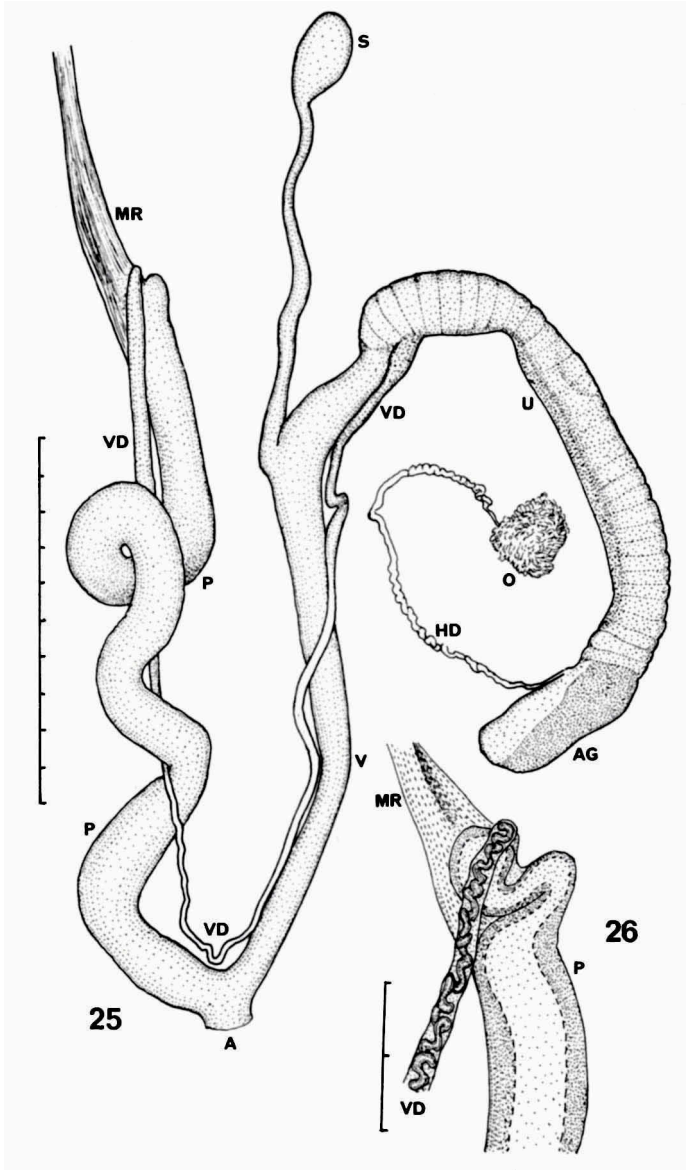
2) Also Dorcasiidae, see Van Bruggen (1969: 92, 94).

3) Hyman (1967: 592): "The hermaphroditic duct continues to a complicated area termed the carrefour into which open a large albumen gland and a small fertilization pouch and from which there proceed the sperm duct and the oviduct".




Figs. 25-26. Genitalia of *Dorcasia alexandri* (Gray), Portsmut Farm (NM). 25. Genital tract. 26. Lengthwise section through the apical part of the penis with the vas deferens. Scales in mm. Abbreviations: A for atrium, AG for albumen gland, HD for hermaphroditic duct, MR for penial retractor muscle, O for ovotestis, P for penis, S for spermatheca, U for uterus, V for vagina, VD for vas deferens. J. J. van Mol del.

spermatheca. Distal part of the vas deferens convoluted inside an elastic sheath before entering the penis (in the other specimen this part of the vas deferens is nearly straight). The lumen of the apical part of the penis is bent like an S and partly protrudes at the side of the organ, but there is no caecum (fig. 26). At the junction of penis and vas deferens a very short (much less than 1 mm long) glandular epiphallus may be distinguished. Penis without papilla, long and coiled, with strong longitudinal folds on its inner wall. No penial sheath; atrium genitale very short. An ovoid mass consisting of many concentric layers of membranous sheaths was found in the spermatheca; this may have been a spermatophore. The penial retractor muscle is inserted on the diaphragm, while the posterior tentacle passes through the peniovaginal angle.

Attention should be drawn to two facts. The two specimens show differences in minor details and reflect different stages in sexual maturity. The specimen figured is a little less advanced in sexual maturity than the other, in which the albumen gland is much larger and the uterus more swollen. The distal part of the vas deferens of this snail is almost straight and not convoluted (see above). Secondly Simroth in Fleck (1894) has mentioned a penial caecum; this was not found in the present material. Very probably this author has misinterpreted the peculiar S-bend of the apical part of the penis (cf. his figure). In the absence of a penial caecum *D. alexandri* agrees with the other species of Dorcasiinae as described by Watson in Connolly (1915).

STREPTAXIDAE

**Gulella caryatis diabensis** Connolly, 1939

Connolly, 1939: 46, pl. 2 fig. 1.

Elandshoek Farm, Otavi highlands, 1917BC, 9.III.1969, B. H. Lamoral & R. Day (NM, alcohol).

*Gulella caryatis diabensis* is a decidedly rare form; so far only two specimens (original sample, Zoologisches Museum der Humboldt-Universität, Berlin) had come to our knowledge. The specimens have the following measurements:

2.9 × 1.1 mm, l/d 2.48 (NM) 3.5 × 1.2 mm, l/d 2.80 (holotype, Berlin Mus.)
3.2 × 1.2 mm, l/d 2.60 (NM) 3.6 × 1.2 mm, l/d 2.85 (paratype, do.)

Elandshoek Farm is a new locality, only the second known for this form and widely distant from the type locality (Diab River), thus considerably extending the known distribution. This is particularly interesting because streptaxids are very rare in South West Africa. Further details and

a discussion of the status of the species will be published elsewhere at a later date.

The type locality is not usually shown on ordinary maps. Both the Gaub and Diab or Djab Rivers are tributaries of the upper course of the Kuiseb River (Haacke, in litt.), which twice crosses the Tropic of Capricorn. According to Fitzsimons (1962: 356) Djab is situated about a hundred miles SW. of Windhoek.

Subulinidae have repeatedly been found to be the prey of *Gulella* species in Southern Africa. Therefore it is perhaps more than a coincidence that the above specimens were collected together with two *Subulina vitrea* (Mssn).

## Corillidae

The genus *Sculptaria* Pfeiffer, 1855, is endemic to the arid districts of South West Africa (Van Bruggen, 1969: 97, fig. 29). Fig. 21 (p. 54) collates all distribution records at present known for the genus (Connolly, 1939; Zilch, 1939, 1951, 1952; Blume, 1952, 1963; present paper); all are within the border of the territory of South West Africa except two. One, "Gordonia", Cape Province (north of the Orange River and south of the border of Botswana), is founded on a remark by Connolly (1931: 280): "..... a single unidentified specimen in the Albany Museum from Gordonia". The other refers to *S. collaris* (Pfr.) which according to the literature occurs in only one locality in southwest Angola (Burnup, 1923). Most of the distribution area of the genus is encompassed by the 500 mm (20 inches) mean annual rainfall isohyet and the 21° C mean surface temperature isotherm. Both *Sculptaria* and *Subulina vitrea* do seem to avoid the alkaline type of soil of the Kalahari Sand (western limits shown according to Theiler, 1962: 213).

Representatives of *Sculptaria* are difficult to name because of the astonishing variability in size, shape, sculpture, and dentition of the species. Usually only shells more or less closely resembling published figures and descriptions or matching reliably identified specimens may be named with confidence. Dr. A. Zilch has kindly assisted in trying to evaluate the material under discussion.

### **Sculptaria damarensis** (Adams, 1870)

Connolly, 1939: 261; Zilch, 1939: 241; 1952: 119.

Ugab River bridge, 2014DD, 21.II.1969, B. H. Lamoral & R. Day (NM).

From highest mountain of Otavi Range, c. 2100 m altitude (between towns of Otavi and Grootfontein), in soil pockets amongst dolomite outcrops beneath *Kirkia acuminata* woodland, 22.III.1967, K. L. Tinley (RMNH).

Unfortunately both samples consist of single specimens. The Tinley specimen has a peripheral, but no basal keel; major diameter 8.6 mm. The shell collected by Lamoral and Day is slightly smaller (major diameter 8.3 mm). According to Dr. Zilch (in litt.) it belongs to the *S. damarensis* group; similar specimens are to be found in the Senckenberg Museum from Tsumeb. In the present author's opinion the specimen, which has a repaired fracture behind the labrum, is somewhat intermediate between the typical form and *S. damarensis* var. *minor* Degner, 1922.

### **Sculptaria sculpturata** (Gray, 1838)

Connolly, 1939: 260; Zilch, 1939: 239; Blume, 1952: 116.

Ugab River mouth, 2113BA, 18.II.1969. B. H. Lamoral (NM).

Mountains north of Rossing Mine, 2214BD, 14.II.1969, B. H. Lamoral & R. Day (NM, RMNH).

From dry river bed near confluence of Ugab and Goantagab rivers, Kaokoveld, W. Falcon colln. (via Mrs Helen Boswell to A. C. van Bruggen: RMNH, one duplicate each in BM and Senckenberg-Museum, Frankfurt am Main).

All above samples represent taxa near or belonging to *S. sculpturata*. The Ugab River mouth shell is somewhat weathered, which has particularly affected the sculpture; major diameter 5.4 mm. The Rossing Mine sample consists of two shells on which Dr. Zilch comments as follows: "Art aus dem *sculpturata* s.l.-Kreis, ähnliches habe ich nicht." These shells are larger, major diameter 6.4 and 6.9 mm. Finally the sample from the Falcon collection consists of small shells (major diameter 5.5-6.3 mm) with little sculpture. They represent a form which also belongs to *S. sculpturata* s.l. and of which in the Senckenberg-Museum there are specimens from the Brandberg.

### **Sculptaria pretiosa** Zilch, 1952 (figs. 27-28, pl. 1)

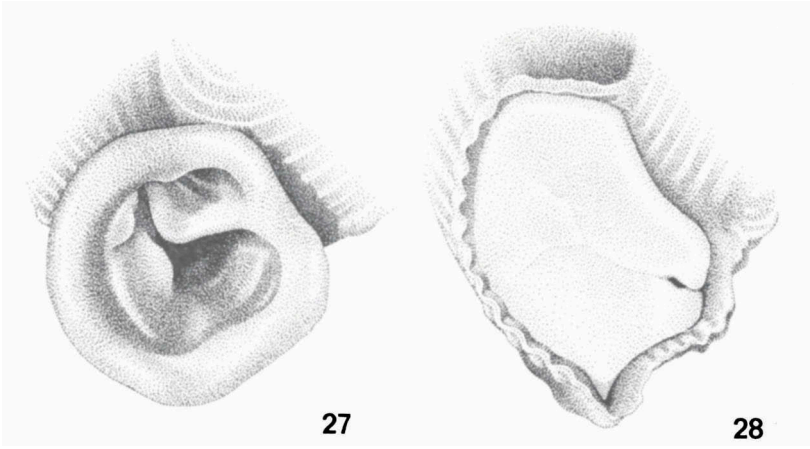
Zilch, 1952: 120, pl. 3 fig. 1, pl. 4 fig. 1.

From the crest of high mountains on the north side of the Goantagab River, Kaokoveld, W. Falcon colln. (via Mrs. Helen Boswell to A. C. van Bruggen: RMNH, two duplicates each in BM, NM, Musée de l'Afrique Centrale, Tervuren - Belgium, and Senckenberg-Museum, Frankfurt am Main; also three in Winckworth colln. in BM).

Kaokoveld (ex W. Falcon colln., etc.: RMNH).

South West Africa (ex W. Falcon colln., etc.: RMNH).

*Sculptaria pretiosa* was described from Zesfontein in the Kaokoveld. The above material represents only the second record of the species. The Goantagab River is a tributary of the Ugab River, so that the new locality is situated well to the south of the type locality.




Figs. 27-28. *Sculptaria pretiosa* Zilch var. from near Goantagab River, Kaokoveld. 27. Dentition of specimen figured on pl. 1 (RMNH). 28. Aperture of juvenile with epiphragm (RMNH). Both figures highly enlarged.

The material at hand does not wholly agree with *S. pretiosa* as described by Zilch (1952). On the whole the spire is somewhat higher, while at the same time the sculpture is considerably less marked (see plate 1): „. . . . . handelt es sich um eine Form der S. pretiosa ZILCH, die bei etwas höherem Gewinde in ihrer Skulptur weniger luxuriert." (Zilch, in litt.). Shell measurements of the Goantagab River sample are 6.6-8.1 × 2.7-3.0 mm; Zilch's measurements are 8.5-9.2 × 2.6-3.0 mm. This shows that the present sample consists of smaller and comparatively higher shells than those recorded by Zilch.

The peripheral keel is frequently chipped; obviously this does not harm the snail in the least, but, of course, cannot be repaired. A few dormant specimens, mainly juvenile, show beautiful white epiphragms (fig. 28).

## Summary

Among miscellaneous material of South West African non-marine molluscs *Cecilioides gokweanus* (Bttg.) and *C. pergracilis* Conn. are recorded as new for the territory. *Gulella caryatis diabensis* Conn. and *Sculptaria pretiosa* Zilch var. (figs.) are reported for only the second time. *Pupoides minusculus* (Mouss.), *P. minusculus* var. *major* (Degn.), and *P. bryantwalkeri* Pils. are all considered synonyms of *P. calaharicus* (Bttg.). A study of the variability of various species of *Xerocerastus* has resulted in withdrawing most taxonomic categories below the level of species. Anatomical data are supplied for *Cecilioides pergracilis* Conn., *Achatina dammarensis* Pfr., *Dorcasia alexandri* Gray (all genitalia, all figd.), and *Subulina vitrea* (Mouss.) (radula and jaw, figs.).

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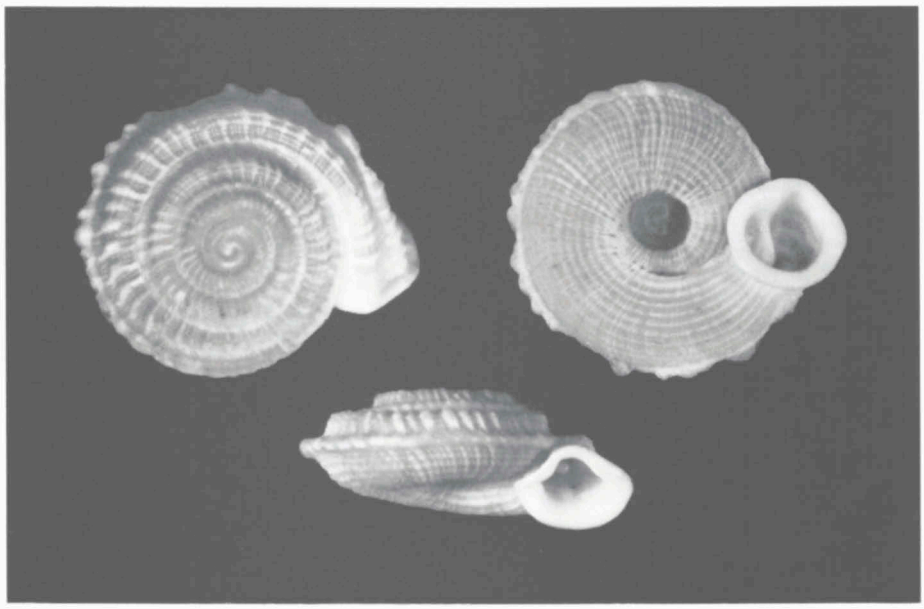

*Sculptaria pretiosa* Zilch from near Goantagab River, Kaokoveld (RMNH), to be compared with Zilch's photographs (1952: pl. 3 fig. 1). Major diameter of figured shell 8.1 mm.