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THREE NEW SPECIES OF OPEGRAPHACEAE (LICHENS) FROM THE NAMIB DESERT

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Abstract.- **Bactrospora namibiensis**, **Lecanographa longicarpa** and **L. tehleri** are described as new from coastal localities of the Namib desert (SW Africa).

INTRODUCTION

The Namib desert is a narrow belt of desert of more than 2000 km along the coast of SW Africa (Namibia) between the Olifants river (South Africa) in the south and the Carunjamba river (Angola). It is one of the most arid parts of the world as virtually the entire area receives less than 100 mm of rain per year, but the

coastal fringe experiences fog on more than 120 days per year, the fog being extremely rich in salt (c. 120 kg/ha/year according to Goudie 1972). Such a persistent and regular mist permits a rich and luxuriant, and adaptively interesting, lichen development, as in similar areas elsewhere in the world (Rundel 1978). One of the best examples of the exuberant lichen vegetation is the so-called "lichen fields" on the gravel and sandy flats near the sea north of Swakopmund, which are dominated by the cushions of **Teloschistes capensis** (L.f.) Vainio ex Müll. Arg. and **T. puber** (Ach.) Almborn; the ground cover of these fruticose dominated lichen fields can exceed 70% and their biomass can reach 400 mg/m^2 (Schieferstein & Loris 1992). Jürgens & Niebel-Lohmann (1995) provide detailed information on the structure and ecology of two extraordinary lichen fields in the Southern Namib (near Lüderitz and near Alexanderbay).

Although not very rich in species, the Namib desert hosts several interesting growth forms and endemic taxa. Several examples are listed below:

- the genus **Caloplaca** Th. Fr. has numerous species in the desert, with the subfruticose endemic **C. eudoxa** (Müll. Arg.) Zahlbr. (Poelt & Pelleter 1984) and the spectacular **C. elegantissima** (Nyl.) Zahlbr. and its isidiate relative **C. namibensis** Kärnefelt (Kärnefelt 1988), the former being reported from Namibia and the Atacama desert in Peru and the latter being a Namibian endemic (Kärnefelt 1990);
- the monotypic, subfruticose and endemic genus **Coronoplectrum** Brusse (Brusse 1987);
- the genus **Neofuscelia** Essl. has several endemic species in the Namib desert: **N. follmannii** Krug, **N. incomposita** (Essl.) Essl., **N. lagunebergensis** Krug, **N. namaënsis** (J. Stein & Zahlbr.) Essl. and **N. tentaculina** (Essl.) Essl. (Esslinger 1977; Krug & Sang 1995);
- the fruticose and endemic genus **Santessonia** Hale & Vobis, with three species which develop a lacunose cortical layer for the interception of fog (Hale & Vobis 1978; Sérusiaux & Wessels 1984; Follmann 1987);
- the genus **Teloschistes** Norman is represented by three species: **T. capensis** and **T. puber** which are very abundant but restricted to the coastal areas of the Namib desert, the Karoo and the North Western Cape province in South Africa, and by **T.**

chrysocarpoides Vainio, a rare, epiphytic species of the Namib desert (Almborn 1989);
- the monotypic genus **Xanthodactylon** P. Duvigneaud, abundant along the coasts of the Namib down to the Cape area in South Africa (Kärnefelt 1989);
- the spectacular genus **Xanthomaculina** Hale, with the terricolous and free-growing endemic **X. convoluta** (Hue) Hale and the south African endemic **X. hottentota** (Ach.) Hale (Hale 1985).

This paper is a modest contribution to the knowledge of the lichen flora of the Namib desert and deals with the Opegraphaceae collected there by two of us (E. S. & D. W.) during a joint field trip in 1983. Besides the three species described as new below, the recently described **Lecanographa subcaesioides** Egea & Torrente (Egea & Torrente 1994) has also been found. It is known from Uruguay and from Namibia.

METHODS

Sections of thalli and ascomata were mounted in water, a 10 % KOH solution (K), Lugol's solution (I) and lactophenol cotton-blue (LCB). All measurements indicated were made in water. The iodine reaction of the asci was studied in Lugol's solution after pretreatment with K (K/I). Thin layer chromatography (TLC) of acetone exctracts of thalli was carried out following the standard systems (e.g. White & James 1985).

Bactrospora namibiensis Egea, Sérusiaux, Torrente & Wessels sp. nov. (Fig. 1 A-E)

Thallus endophloeodes. Ascomata nigra, dispersa, rotundata vel leviter irregularia, 0.4-1.2 mm lata, primum subimmersa, demum adnata. Excipulum dimidiatum, in parte laterali usque 125 µm crassum. Paraphysoides ad 2 µm crassae, apicem versus leviter incrassatae, ramoso-connexae. Asci 180-240 x 8-10 µm. Ascosporae a typo '*Dryina* ' dicto. Pycnidia non visa.

Typus: Namibia, Skeleton Coast Park, 11 km N of the Outpost at Ugabmond following the coastal road, near a marble ridge orientated E-W, on dead wood lying on the beach, 2.1983, E. Sérusiaux 5299 & D. Wessels (LG-holotypus).

Thallus endophloeodal; photobiont: a species of Trentepohliaceae. Ascomata apothecioid, black, scattered, subimmersed to adnate, roundish or somewhat irregular in outline, 0.4-1.2 mm across, slightly pruinose, plane or slightly concave with a shallow margin, becoming +/- convex and immarginate. Excipulum well-developed, laterally dark brown, composed of conglutinate, thick-walled hyphae, up to 125 µm thick, open at the bottom, I-, K/I-. Hymenium colourless, 200-300 µm thick, I-, K/I-. Subhymenium greyish, 50-80 µm thick, I-, K/I-. Paraphysoids dichotomously branched, with few or no anastomoses and loosely interlaced in the hymenium, up to 2 µm wide. Apical cells of paraphysoids strongly branched and anastomosing, forming a reticulate dark brown epithecium. Asci fissitunicate, 180-240 x 8-10 µm, cylindrical with a foot-like base not or slightly widened, easily separated from ascogenous hyphae and often broken, appearing multispored; exoascus and endoascus not amyloid or hemiamyloid. Ascospores acicular when young, but soon fragmenting within the ascus into unicellular or paucicellular segments (*Dryina*-type, Egea & Torrente 1993); each cell cylindrical, 3-5 µm in length and 2-2.5(-3) µm in diam.
Pycnidia not seen.

Chemistry: Thallus and medulla K-, C-, KC-, P-. No lichen substances detected by TLC.

Distribution and habitat: **Bactrospora namibiensis** is known only from the type locality at the southern edge of the Skeleton Coast Park in Namibia. It was abundant on dead wood lying on the beach. This locality also hosts an exuberant population of **Santessonia namibensis** Hale & Vobis (Sérusiaux & Wessels 1984).

Notes: On account of its non-hemiamyloid asci, the inclusion of this new taxon in **Bactrospora** Massal. is somewhat doubtful, but no other described genus is available for it. This taxon is easily distinguished from other species of that genus with *Dryina*

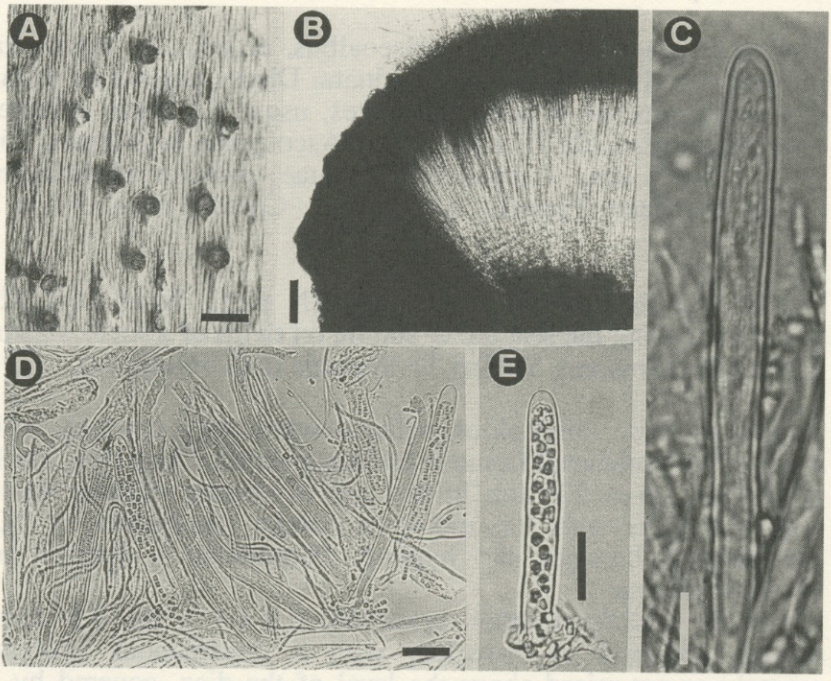

Figure 1. **Bactrospora namibiensis** (holotype). A, Habit. B, Vertical section of an ascoma. C, Ascus. D, Hymenium after squash. E, Broken ascus. (C-E mounted in K/I). Scales: A = 2 mm; B = 50 µm; C = 10 µm; D-E = 20 µm.

-type ascospores (see fig. 2 in Egea & Torrente 1993:214) by its very long, cylindrical asci: the other three species with that type of ascospores always have asci less than 150 µm long. Since the monograph of the genus published by two of us (Egea & Torrente 1993), Henssen & Thor (1994) have recognized the genus level for the species with ascospores of the *Homalotropa* - and *Jenikii* -type and have adopted **Melampylidium** Stirt. ex Müll. Arg. for that group.

Lecanographa longicarpa Egea, Sérusiaux, Torrente & Wessels sp. nov. (Fig. 2 A-D)

Thallus crustaceus, albus vel griseoalbus, ecorticatus. Ascomata lirellata (0.5-1.9 x 0.2-0.3 mm), adnata. Discus pruinosus. Paraphysoides ramosae et anastomosantes, usque ad 2 µm crassae. Asci fissitunicati, 62-70 x 17-20 µm. Ascosporae fusiformes, 25-29 x 5.5-6.5 µm, 7-septatae, halonatae, primum incoloratae, deinde brunneae. Pycnidia subimmersa. Conidia recta, 5-7 x 1 µm.

Typus: Namibia, Laguneberg Range (N part), N of Myl 72, basalt hill facing the sea, alt. c. 200 m, on twigs of a small shrub, 2.1983, E. Sérusiaux 5186 & D. Wessels (LG-holotypus).

Thallus crustose, corticolous, white to white-grey, cracked, with a smooth or somewhat farinose surface, delimited by a thin, black prothallus, up to 125 µm in section, ecorticate; medulla white with many crystals of unknown nature (insoluble in K) incorporated between the hyphae. Photobiont: a species of Trentepohliaceae.
Ascomata lirelliform, often branched, 0.5-1.9 x 0.2-0.3 mm, adnate, scattered or crowded, with a conspicuous margin, scarcely or not raised above the level of the disc, covered by a dense coating of white pruina; disc plane. Excipulum well developed, dark brown, K+ dark green. Hymenium hyaline, 80 µm thick, I+ reddish. Subhymenium pale brown, 30 µm thick. Paraphysoids up to 1.5 µm wide, branched and anastomosing, not or slightly widened and with slightly pigmented walls at the apices. Asci of the *Grumulosa* -type (Torrente & Egea 1989), 62-70 x 17-20 µm at maturity, with a distinct ring structure.

Ascospores 25-29 x 5.5-6.5 µm, 7-septate, fusiform, surrounded by a thick gelatinous sheath, hyaline but turning brown when old; cell walls thin, not or slightly widened at level of the septa. Pycnidia subimmersed, secondarily multilocular. Conidia 5-7 x 1 µm, straight or slightly curved.

Chemistry: Thallus K-, C-, P-; confluentic acid detected by TLC.

Distribution and habitat: **Lecanographa longicarpa** is known only from the type locality, a low basalt hill near the sea in the Namib desert, where it grows on twigs of small shrubs. The shrubs in this locality have a luxuriant lichen flora with **Trichoramalina melanothrix** (Laur.) Rundel & Bowler, **Xanthodactylon flammeum** (L. f.) Dodge, **Xanthoria turbinata** Vainio, and many, still unidentified species (incl. a **Ramalina** and an **Usnea** species). **Santessonia lagunebergii** Sérusiaux & Wessels, **S. hereroensis** (Vainio) Follm. (= **S. sorediata** Sérusiaux & Wessels) and **Xanthomaculina hottentota** are abundant on rocks and pebbles of the desert pavement in the same locality.

Notes: The 7-septate ascospores surrounded by a thick gelatinous sheath, and the C-negative thallus suggest a close relationship to **Lecanographa subcaesioides** Egea & Torrente, known from Uruguay and the Namib desert, and to **L. dialeuca** (Cromb.) Egea & Torrente, known from coastal areas in the Cabo Verde Is, the Canary Is and Madeira, in the Macaronesian region (Egea & Torrente 1994). The two latter species differ in having narrower asci (14-17 µm) and ascospores (3.5-5 µm), and by their saxicolous habitat. In addition, **L. subcaesoides** has more rounded and shorter ascomata (0.2-0.7 mm).

Lecanographa tehleri Egea, Sérusiaux, Torrente & Wessels sp. nov. (Fig. 2 E-G)

Thallus crustaceus, brunneus, ecorticatus. Ascomata lirellata (0.4-1 x 0.2-0.4 mm), subimmersa vel adnata. Discus pruinosus. Paraphysoides ramosae et anastomosantes, usque ad 2 µm crassae. Asci fissitunicati, 60-65 x 14-15 µm. Ascosporae fusiformes, 18-21 x 5-6 µm, (4-)5-septatae, halonatae, primum

incoloratae, deinde brunneae. Pycnidia immersa. Conidia recta, 6-7 x 1 µm.

Typus: Namibia, Laguneberg Range (S part), N of Myl 72, basalt hill facing the sea, alt. c. 150 m, on small twigs of a shrub, 2. 1983, E. Sérusiaux 5199 & D. Wessels (LG-holotypus).
Other specimen examined: Road from Swakopmund to Hentiesbaai, 2 km S of Myl 14, coastal flats, marble outcrops, on twigs of a dead shrub, 2.1983, E. Sérusiaux 5057 & D. Wessels (LG).

Thallus crustose, brownish, cracked, with a granulose surface, without any distinct prothallus, very thin in section, ecorticate; medulla white with crystals of unknown nature (insoluble in K) incorporated between the hyphae. Photobiont: a species of Trentepohliaceae.
Ascomata lirelliform, 0.4-1 x 0.2-0.4 mm, simple, subimmersed to +/- adnate, scattered or rarely crowded, with a conspicuous margin, pruinose; disc plane, widened at maturity. Excipulum well developed, dark brown. Hymenium hyaline, 100-140 µm thick, I+ blue or reddish. Subhymenium brownish, 20-25 µm thick. Paraphysoids up to 2.5 µm wide, sparingly branched, slightly widened at the apices, and with slightly pigmented walls forming a greenish epithecium. Asci of the *Grumulosa*-type (Torrente & Egea 1989), 60-65 x 14-15 µm at maturity, with a distinct ring structure. Ascospores 18-21 x 5-6 µm, (4-)5-septate, fusiform, surrounded by a thick gelatinous sheath, hyaline but turning brown when old; cell walls thin and not or slightly widened at the level of the septa. Pycnidia immersed, secondarily multilocular. Conidia 6-7 x 0.8 µm straight.

Chemistry: Thallus K-, C-, P- ; no lichen substances detected by TLC.

Distribution and habitat: **Lecanographa tehleri** is known from two localities in the coastal areas of the Namib desert. It is an epiphytic species growing on twigs of shrubs. The lichen vegetation of the type locality is similar to that of the site where **L. longicarpa** grows (see above).

Notes: The size of the asci and the number of septa of the ascospores suggest some affinities with **Lecanographa lynceoides** (Müll. Arg.) Egea & Torrente (known from a single locality in coastal areas in Venezuela; Egea & Torrente 1994), which differs in having narrower (1.5-2 µm) and much branched paraphysoids, narrower (4-5 µm) and more or less constricted ascospores, and a dark brown epithecium. A further closely related taxon occurs in coastal areas of California and will be described in a forthcoming paper by two of us (J. M. E. & P. T.) as a subspecies of **L. tehleri**.

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REFERENCES

ALMBORN, O., 1989. Revision of the lichen genus *Teloschistes* in central and southern Africa. Nord. J. Bot. 8: 521-537.

BRUSSE, F. A., 1987. *Coronoplectrum*, a new lichen genus from the Namib desert, South West Africa/Namibia. Mycotaxon 28: 131-135.

EGEA, J. M. & TORRENTE, P., 1993. The lichen genus *Bactrospora* Massal. Lichenologist 25: 211-255.

EGEA, J. M. & TORRENTE, P., 1994. El género de hongos liquenizados *Lecanactis* (Ascomycotina). Bibl. Lichen. 54: 1-205.

ESSLINGER, T. L., 1977. A chemosystematic revision of the brown *Parmeliae*. Journ. Hattori Bot. Lab. 42: 1-211.

FOLLMANN, G., 1987. Vorarbeiten zu einer Monographie der Flechtenfamilie Rocellaceae Chev. VIII. Inhaltsstoffe und Verwandtschaftsverhältnisse von *Roccella hereroensis* Vain. und *Roccella mossamedana* Vain. J. Plant Physiol. 131: 145-151.

GOUDIE, A., 1972. Climate, weathering, crust formation, dunes and fluvial features of the Central Namib Desert, near Gobabeb, South West Africa. Madoqua, ser.2, 1: 15-31.

HALE, M. E., Jr., 1985. *Xanthomaculina* Hale, a new lichen genus in the Parmeliaceae (Ascomycotina). Lichenologist 17: 255-265.

HALE, M. E., Jr. & VOBIS, G., 1978. *Santessonia*, a new lichen genus from Southwest Africa. Bot. Not. 131: 1-5.

HENSSEN, A. & THOR, G., 1994. Developmental morphology of the "Zwischengruppe" between *Ascohymeniales* and *Ascoloculares*. In Hawksworth, D. L.: Ascomycetes Systematics. Problems and Perspectives in the Nineties. Nato ASI Series, Ser. a: Life Sciences, 269: 43-56.

JÜRGENS, N. & NIEBEL-LOHMANN, A., 1995. Geobotanical Observations on Lichen Fields of the Southern Namib Desert. Mitt. Inst. Allg. Bot. Hamburg 25: 135-156.

KÄRNEFELT, I., 1988. Two closely related species of *Caloplaca* (Teloschistaceae, Lichenes) from the Namib Desert. Bothalia 18: 51-56.

KÄRNEFELT, I., 1989. Morphology and Phylogeny in the Teloschistales. Crypt. Bot. 1: 147-203.

KÄRNEFELT, I., 1990. Evidence of a slow evolutionary change in the speciation of lichens. Bibl. Lichenol. 38: 291-306.

KRUG, J. C. & SANG, S., 1995. New species of *Neofuscelia* (Parmeliaceae, Lecanorales) from Namibia, South-Western

Africa. In Daniëls, F. J. A., Schulz, M. & Peine, J. : Flechten Follmann, Contributions to lichenology in honour of Gerhard Follmann. Geobot. & Phytotax. Study Group, Bot. Inst., Univ. of Cologne, Cologne, Germany, p. 263-271.

POELT, J. & PELLETER, U., 1984. Zwergstrauchige Arten der Flechtengattung *Caloplaca*. Pl. Syst. Evol. 148: 51-88.

TORRENTE, P. & EGEA, J. M., 1989. La familia Opegraphaceae en el Area mediterranea de la Peninsula Ibérica y Norte de Africa. Bibl. Lichenol. 32: 1-282.

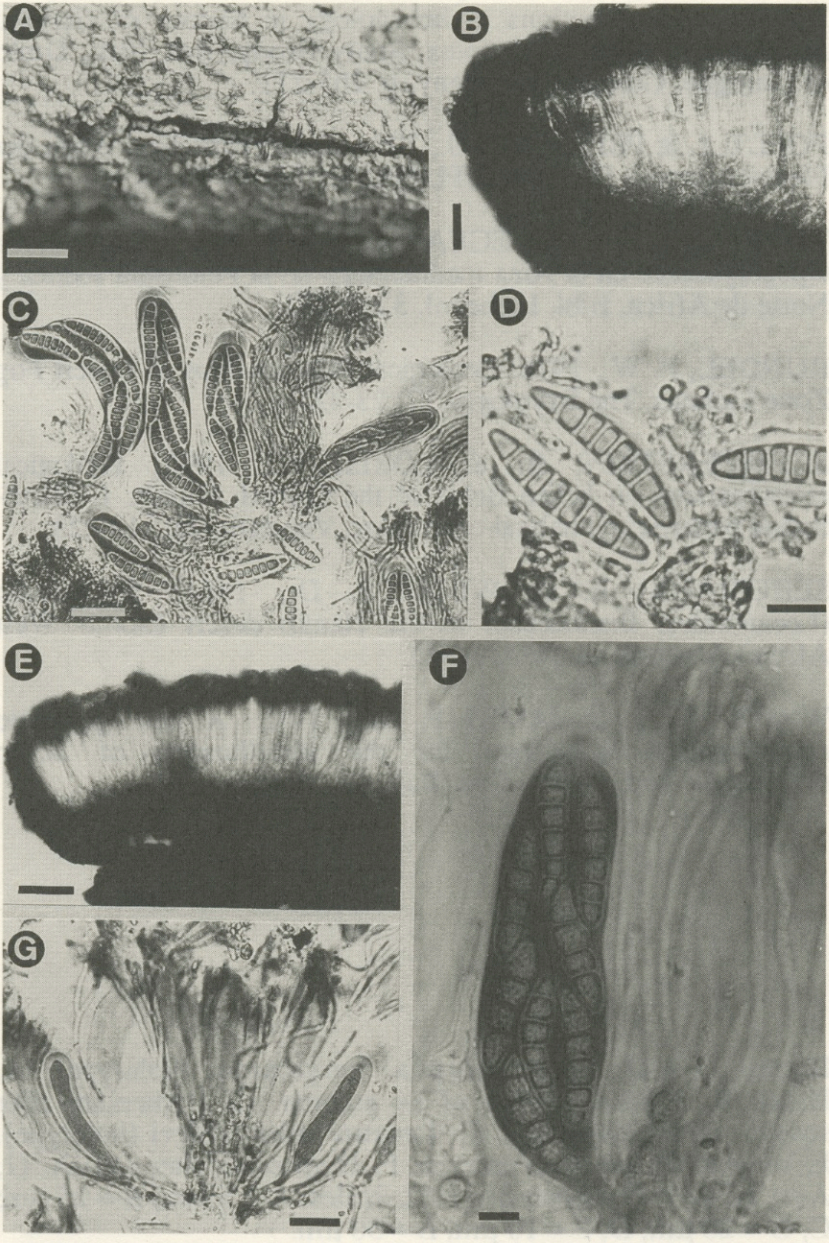
RUNDEL, P. W., 1978. Ecological Relationships of Desert Fog Zone Lichens. The Bryologist 77: 23-32.

SCHIEFERSTEIN, B. & LORIS, K., 1992. Ecological investigations on lichen fields of the Central Namib. I. Distribution patterns and habitat conditions. Vegetatio 98: 113-128.

SÉRUSIAUX, E. & WESSELS, D., 1984. *Santessonia* (Lecanorales, Buelliaceae) in the Namib desert (South West Africa). Mycotaxon 29: 479-502.

WHITE, F. J. & JAMES P. W., 1985. A new guide to microchemical techniques for the identification of lichen substances. Brit. Lichen Soc. Bull. 57 (suppl.): 1-41.

Figure 2. A-D, **Lecanographa longicarpa** (holotype). A, Habit. B, Vertical section of an ascoma. C, Hymenium after squash. D, Ascospores. E-G, **Lecanorapha tehleri** (holotype). E, Vertical section of an ascoma. F, Hymenium after squash. G, Asci. (C-D, F-G mounted in K/I). Scales: A = 3 mm; B = 25 µm; C, G = 20 µm; D, F = 10 µm; E = 50 µm.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