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Polysporina frigida sp. nov. from Antarctica

G. KANTVILAS and R. D. SEPPELT

Abstract: The new species, *Polysporina frigida* Kantvilas & Seppelt is described and illustrated. It is the first record of this genus from the Antarctic continent.

Key words: *Acarosporaceae*, Antarctica, lichenized Ascomycetes, *Polysporina*

Introduction

Polysporina Vězda nom. cons. is a small genus in the family *Acarosporaceae* and comprises *c*. 10 species, found mostly in cool to cold climates of the Northern Hemisphere (Kantvilas 1998; Golubkova 1988). It was introduced by Vězda (1978) and separated from the related *Sarcogyne* Flot. on account of its apothecia with a thick, fissured and often exfoliating proper margin, an umbonate to gyrose disc, and richly branched and anastomosing paraphyses with non-capitate apices (see also Kantvilas 1998).

Recent collections of *Polysporina* from the Antarctic continent represent a major range extension for this genus. This material has proved to be a new species which is described here.

Material and Methods

Morphological and anatomical observations were undertaken using light microscopy. Apothecial tissues were observed and measured in water, with and without Lactophenol cotton blue. Spores and paraphyses were measured in 15% KOH. Cited dimensions of photobiont cells and ascospores are based on 100 observations of each.

G. Kantvilas: Tasmanian Herbarium, Private Bag 4, Hobart, Tasmania 7001, Australia.
R. D. Seppelt: Australian Antarctic Division, Channel Highway, Kingston, Tasmania 7050, Australia.

Comparative material examined

Polysporina cyclocarpa: **Greenland:** West Greenland, Gem. Umanek, 1983, *J. Poelt & H. Ullrich* (HO).

Polysporina simplex: **Great Britain:** *England*: **V.C. 57**, Derbyshire, 1973, *P. D. Crittenden* (HO).

Sarcogyne privigna: **Antarctica:** *Southern Victoria Land*: Lower Taylor Valley, Canada Glacier Pond outflow, 1989, *R. D. Seppelt* 17714 (HO).

The Species

Polysporina frigida Kantvilas & Seppelt sp. nov.

Species apotheciis superficialibus, basim constrictis, 0·25–0·7 mm latis, discis gyrosis contortisque, *Polysporinae cyclocarpae P. simplicique* aliquantum similis sed sporis maioribus, 4–7 µm longis et 3–4·5 µm latis differens.

Typus: Antarctica, Ingrid Christensen Coast, Vestfold Hills, NW side of Boulder Hill, E of Crooked Lake, 68°36′25″S 78°30′20″E, 150 m alt., on granitic debris on hill slope, 31 July 1994, *J. Gibson* (ADT 1543) (HO—holotypus).

(Fig. 1)

Thallus crustose, endolithic or, more typically, comprising irregular, ± eroded and convoluted, pale greyish areoles, 0·3–0·6 mm wide, 0·25–1 mm thick, dispersed or contiguous and fused, ecorticate, K−, IKI− in squash preparation, in section composed predominantly of photobiont cells, attached rather loosely to the substratum by a loose weft of short-celled hyphae, 1–3 µm thick; photobiont a unicellular green alga with individual cells rhomboid, oblong

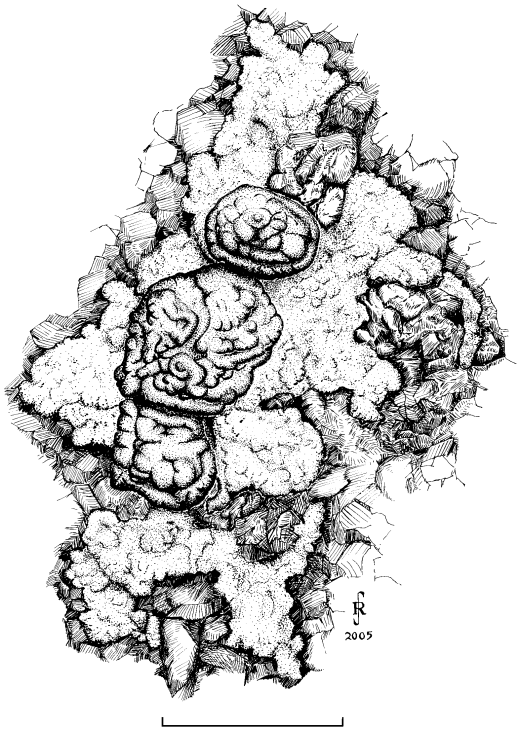

FIG. 1. *Polysporina frigida*, thallus and apothecia (holotypus). Scale = 1 mm.

or, more commonly, ± globose, 9–*13·2*–20 × 6–*10·8*–20 µm, occurring singly or in pairs or tetrads.

Apothecia scattered, clustered or arranged in lines following the microtopography of the substratum, (0·25–)0·4–0·6(–0·7) mm wide, black and glossy, superficial, basally constricted, typically roundish but sometimes deformed and ± elongate; margin prominent and persistent into maturity, inrolled and with a thin, discontinuous layer of adhering thalline tissue when very young; disc plane to convex, verrucose when young, soon becoming intensely gyrose and contorted. *Excipulum* in section 10–30 µm thick, composed of short-celled, radiating hyphae, *c.* 5 µm thick, with the outermost cells brown-pigmented, irregularly roundish, 5–10 × 5–7 µm. *Epithecium* lumpy and discontinuous, consisting of 20–30(–80) µm thick clumps of sterile, conglutinated, brown to orange-brown cellular material as in the excipulum, with individual cells ± globose, 3–4 µm wide. *Hypothecium* 60–130 µm thick, pale yellow-brown to hyaline, composed of indistinct, interwoven hyphae; subhypothecium composed mainly of tightly packed photobiont cells. *Hymenium* hyaline, K/I+ blue, 70–110 µm thick, occasionally inspersed with scattered oil droplets 3–8 µm diam. *Asci* of the *Acarosporaceae*-type *sensu* Hafellner (1993), cylindrical to obpyriform, 65–100 × 15–20 µm, very easily ruptured, containing *c.* 50–100 spores; outer wall K/I+ blue; tholus well-developed, K/I − or +very pale blue. *Paraphyses* slender, straight, separating rather easily in KOH, 1·5–2·5 (–3) µm thick, simple to very sparingly branched, sometimes with occasional anastomoses in the lower part, distinctly septate in the upper part; apices conglutinated in a hyaline to pale brown gel, rounded or, more commonly, distinctly expanded, 2–4.5 µm wide, typically hyaline or with a thin, external, brown cap. *Ascospores* subglobose to ovate, sometimes deformed and ± rhomboid when packed in the ascus, (3–)4–*5·5*–7(–8) × (2–)3–*3·6*–4·5 µm.

Pycnidia not observed.

Remarks. With its superficial, basally constricted apothecia, *Polysporina frigida* is most closely related to *P. simplex* (Davies) Vězda and *P. cyclocarpa* (Anzi) Vězda, both of which differ very clearly by their smaller, essentially narrower ascospores, 3–5·5 (–6) × 1–1·8(–2) µm in the former and 3–5 × 1·5–2·5 µm in the latter. When well-developed, the gyrose apothecia of the new species are very similar to those of *P. cyclocarpa*, a species of limestone, known only from the Northern Hemisphere. In contrast, the apothecia of *P. simplex* are irregularly contorted and deformed with a fissured margin and sterile lumpy inclusions in the disc.

The structure of the excipulum of the new species is rather unusal. In other species of *Polysporina* studied (Kantvilas 1998), the excipulum is cupular, with opaque, brown-pigmented tissue enclosing the hymenium and hypothecium at the sides and below. In

contrast, in *P. frigida*, the excipulum is open below, and the pigmented tissue is found only at the sides. Indeed, much of the excipulum may be unpigmented internally and clearly composed of radiating hyphae, with the pigmentation limited to the outermost layer of cells. In addition, densely crowded algal cells occur immediately beneath the hypothecium and may extend in a ± cup-shape into the base of the excipulum.

The structure of the gyrae and sterile lumpy inclusions in the hymenium that characterize the genus as a whole are also different in the new species. In *P. cyclocarpa*, for example, this pigmented sterile tissue extends into and subdivides the hymenium, whereas in *P. frigida*, even though the gyrose apothecia are superficially similar, the sterile tissue sits as irregular lumps on top of the hymenium which is continuous and uninterrupted. The cellular structure of this sterile tissue in both species is very similar.

Although *Polysporina* is characterized by having non-capitate, branched and anastomosing paraphyses (Vězda 1978; Galloway & Coppins 1992; Kantvilas 1998), in *P. frigida* they are ± simple, straight and capitate. However, this character does not hold consistently for all species of the genus, and in *P. cyclocarpa* the paraphyses are relatively stout, sparsely branched and with slightly capitate, faintly pigmented apices.

It is difficult to properly assess the variability of the new taxon given the scant material available for study. In several of the specimens seen, the thallus is almost entirely absent, and the apothecia are very deformed and superficially similar to those of *P. simplex*. In such specimens, there also appear to be few well-developed asci, and the ascospores seen tend to be immature and ± globose. However, even in such cases, the ascospores are relatively wide (≥ 3 µm).

In his review of the genera of *Acarosporaceae*, Hafellner (1995) suggested that the distinctions between *Polysporina* and the related *Sarcogyne* are not clear-cut. Certainly the new species has some features in common with the latter, namely a basally open excipulum and ± simple, capitate paraphyses. However, given the present classification, the very markedly gyrose, contorted apothecia place it firmly in *Polysporina*, and there are no other similarities to *Sarcogyne*, a genus with neatly lecideine apothecia with a flat, smooth, uncontorted disc. Another related genus is *Lithoglypha* Brusse, which is confined to southern Africa and is distinguished primarily by its needle-shaped pycnidia (Brusse 1988). Material of *Lithoglypha* was not available for study, and nor were pycnidia observed in *P. frigida*. However, this taxon does not appear to be relevant to the present study.

Apart from *Acarospora* itself, which is well-represented in Antarctica with 11 species, of which three are known from continental Antarctic localities (Øvstedal & Lewis-Smith 2001), the only other member of the *Acarosporaceae* known for the region is *Sarcogyne privigna* (Ach.) A. Massal. (Seppelt *et al.* 1998). This species is represented by a few widely scattered collections and is characterized by having lecideine apothecia with a dark red-brown to blackish disc and ascospores 3·5–5 × 1–2 µm.

Distribution and ecology. The new species occurs exclusively on rock and has been collected from granite and sandstone (Fig. 2).

The Vestfold Hills (68°35′S, 78°00′E and approximately 410 km^2 in area) are located on the Ingrid Christensen Coast, Princess Elizabeth Land, continental Antarctica. They represent an ice-free area of generally low hills and valleys covered by Pleistocene and Holocene glacial till and moraine debris, and with numerous lakes, ranging from fresh water to highly saline. The area was covered to a depth of probably 1000 m by the continental ice sheet during the Pleistocene and the area to the east of Crooked Lake (Boulder Hill) may have become ice-free in the Holocene, around 5000–1000 yBP (Adamson & Pickard 1986). The highest point, Boulder Hill, is 157 m a.s.l. The geology of the Vestfold Hills consists of an assemblage of gneissic lithologies derived from both igneous and sedimentary protoliths and criss-crossed by

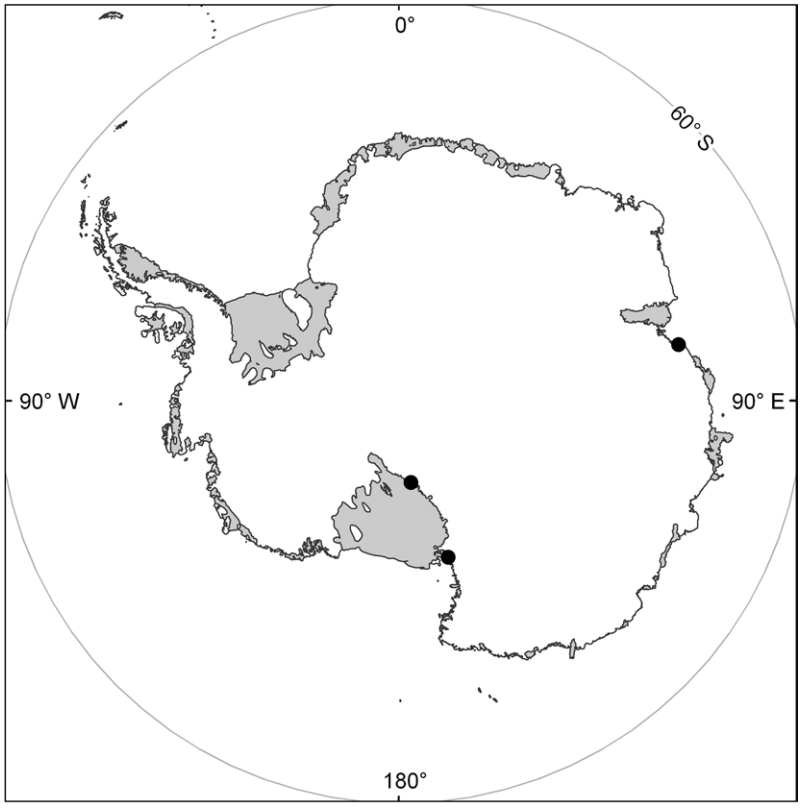

FIG. 2. Distribution of *Polysporina frigida*.

an extensive array of dykes (Collerson & Sheraton 1986).

The type collection of *P. frigida* was gathered from ice-fractured granitic rock debris on the leeward slope of a hill located towards the south-eastern corner of the Vestfold Hills. The species was growing in association with *Xanthoria elegans* (Link.) Th.Fr. and *Buellia frigida* Darb. Other species from the same locality included *Rhizoplaca melanophthalma* (Ram.) Leuck. & Poelt, *Umbilicaria aprina* (Vill.) Zahlbr., *Caloplaca citrina* (Hoffm.) Th.Fr., *Lecanora expectans* Darb. and the mosses, *Bryum pseudotriquetrum* (Hedw.) Gaertn., Meyer & Scherb. and *Bryoerythrophyllum recurvirostre* (Hedw.) Chen. The lichen flora of the Vestfold Hills comprises at least 25 species (Seppelt 1986 and unpublished data).

The ice-free areas of the TransAntarctic Mountains along the coastline of Victoria Land extend from Cape Adare (71°17′S, 170°14′E) southwards to the Queen Maud Mountains and Mt Howe (87°21″S, 149°18′W). Although there have been biological collections made at many localities over this vast expanse of mountains and valleys, these are comprehensive only for a few locations. Few botanical collections have been made by specialist lichenologists or bryologists.

In association with the University of Waikato (New Zealand) Antarctic Research Program, recent collections of lichens and mosses were made from a number of locations within the McMurdo Dry Valleys (77°–79°S) region, including the Canada Glacier/Lake Fryxell area in the Taylor

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Valley (77°37′S, 163°03′E), and near Mt Kyffin (83°48′S, 171°38′E). In these areas of extreme cold and dry climate, the lichens are rather sparsely distributed although species numbers may be surprisingly high. More than 20 lichens are now known from the Mt Kyffin area. In the Dry Valleys, endolithic lichens and relatively few species predominate on the valley floors. Species numbers rise significantly with altitude up the valley sides from about 600–800 m and upwards, where a moisture-laden cloud band commonly forms in the afternoons, at least during the summer months.

Additional specimens examined. **Antarctica:** *Victoria Land*: Taylor Valley, Canada Glacier, surroundings of field camp, 77°36′58·4″S 163°02′50·0″E, 75 m altitude, 22 i 2003, *R. Türk* (hb. Türk 33661); Taylor Valley, Kukri Hills, W. Crescent Glacier summit, 77°40′11·6″ 163°09′00·4″E, 950 m altitude, 28 i 2003, *R. Türk & L. Sancho* (hb. Türk 33731); Taylor Valley, Mt Falkoner, 77°34′S 163°06′E, 700–750 m altitude, 17 i 2003, *R. Türk* (hb. Türk 33606); Taylor Valley, 200 m NW of Lake Fryxell camp, 77°36′19·4″S 163°07′2·1″E, 60 m altitude, 22 i 2003, *R. Türk* (hb. Türk 33705). **Queen Maud Mountains:** surroundings of Mt Kyffin, 83°45′39″S 172°44′25″E, 450 m altitude, 10 i 2003, *R. Türk & L. Sancho* (hb. Türk 33420).

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