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A new lichen species from the Heritage Range, Ellsworth Mountains, Antarctica

Dag Olav Øvstedal[1,3] and Carlos Ernesto Gonçalves Reynaud Schaefer[2]

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ABSTRACT - (A new lichen species from the Heritage Range, Ellsworth Mountains, Antarctica). *Opegrapha edsonii*, with soralia and norstictic acid is described.
Key words: Antarctica, norstictic acid, *Opegrapha edsonii*

RESUMO - (Uma nova espécie de líquen de Heritage Range, Montanhas Ellsworth, Antártica). Uma nova espécie de liquen, com soralia e ácido norstíctico, *Opegrapha edsonii* é descrita, ocorrendo nas Montanhas Ellsworth, Antártica continental.
Palavras-chave: Antártica, ácido norstíctico, *Opegrapha edsonii*

Introduction

The terrestrial biota of the Antarctica comprises almost exclusively lower organism, and among these, lichens are by far the most dominant. New knowledge has revealed a higher diversity of lichen species than previously known (Ruprecht *et al.* 2012), and the total number for the Antarctic and South Georgia now well exceeds 500 (Øvstedal & Lewis Smith 2011, Øvstedal unpublished data).

A soil and permafrost field study in the Ellsworth Mountains in the summer 2012 included the collection of some lichens growing on cryoturbic soils from ice free areas of the Union Glacier Region in the southern Heritage Range. The Heritage Range forms the southern part of the Ellsworth Mountain system, consisting of scattered ridges and peaks of moderate height, escarpments, hills and nunataks, the various units of relief set off by numerous intervening glaciers, such as the Union Glacier (figure 1). Lichens were sampled on two polygonal soils, both on felsenmeer of Crashsite quartzite, one at 754 m and one at 785 m altitude.

The collection comprises both saxicolous and terricolous lichens. Only the saxicolous ones are treated here. Among these was an undescribed species, which is described below.

Material and methods

The specimens are deposited in BG. Anatomy and morphology were studied using a Zeiss Stemi 2000C microscope, and a Zeiss Axiolab compound microscope. Chemical constituents were identified by thin layer chromatography (Elix & Ernst-Russell 1993).

Soil material associated with the lichens were studied by routine chemical analyses (pH, available P, exchangeable Ca^{2+}, Mg^{2+}, K^{+}, Al^{3+}, H + Al, and extractable Pb and Cu) and textural analyses (granulometry), all carried out by standard international procedures (Kuo 1996, EMBRAPA 1997). Total organic carbon was determined according to Yoemans & Bremner (1988).

Results and Discussion

Opegrapha edsonii Øvstedal & C. Schaefer sp. nov. Figure 2

Opegrapha gyrocarpa similis, sed soredia minoribus et acidum norsticticum continens. Apothecia et pycnidia non vidi.

Type: Antartica. Antarctic Peninsula: Ellsworth Mountains, Heritage group, Edson Hill, 79º50'S and 83º39'W, 10-I-2012, *C. Schaefer 2012-05* (holotypus BG).

1. University Museum, P.O. Box 7803, N-5020 Bergen, Norway
2. Soil Science Department, Viçosa Federal University, 36570-000 Viçosa, MG, Brazil
3. Corresponding author: dag.ovstedal@um.uib.no

Thallus crustose, ca. 1 × 0.4 cm, up to 1.5 mm thick, sorediate, dark brown to brown-grey, strongly rimose to areolate, areolae convex, 0.2-0.4 mm diam., crowded, scabrid, UV-. No prothallus seen. Photobiont *Trentepohlia*, cells in clusters, 4-5 µm diam., similar to those in W Norwegian specimens of *O. gyrocarpa* (several specimens in BG examined). Soralia pink, when eroded orange (carotenoids in *Trentepohlia*), up to 0.4 mm diam., with irregular outline, crater-formed to flat. Soredia coarse, 17.1 ± 2.03 µm (n = 20), conglutinated into consoredia up to ca. 70 µm wide. No hyphae projecting from soredia. No apothecia or pycnidia seen.

Chemistry: norstictic acid.

Habitat: mostly overgrowing a sterile white crust (with *Carbonea vorticosa* (Flörke) Hertel as parasymbiont) on rock.

The specimen is similar to *Opegrapha gyrocarpa* Flotow, found in Europe, Asia, Macaronesia and North America (Smith *et al.* 2009), but differs in chemistry, having smaller soredia and distinct different ecology. *Opegrapha gyrocarpa* grows mainly under rock overhangs, but also rarely on bark (Tønsberg 1992). It has discrete soredia, but the soralia are larger, 24.5 ± 2.04 µm (several Norwegian specimens in BG studied). In addition, *O. gyrocarpa* contains gyrophoric and ± schizopeltic acids. Generally the thallus is smooth and thin, not rough and thick as in the present species. Norstictic acid is found in the paleotropic species *O. semiatra* Müll. Arg. and *O. mozambica* Vain. (Ertz 2009), both of which are non-sorediate species and very different from *O. edsonii*. Other taxa with *Trentepohlia* as photobiont recorded from the Antarctic include *Cystocoleus* aff. *ebeneus* (Dillw.) Twaites (Øvstedal & Lewis Smith 2001) and *Porina aenea* (Wallr.) Zahlbr. (Øvstedal & Lewis Smith 2004). A number of *Opegrapha* species are known from Argentina (Redinger 1940), but they are all corticolous and non-sorediate, with no species similar to *O. edsonii* known (S. Calvelo unpublished data).

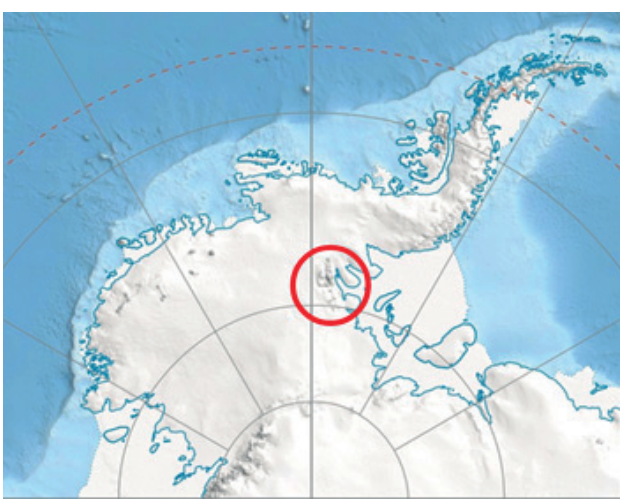

Figure 1. Map of Antarctic peninsula with location of Ellsworth Mountains marked.

The following lichens were collected from the same locality: *Bacidia subcoprodes* Olech & Czarnota, *Buellia evanescens* Darb., *B.* cf. *grisea* C.W. Dodge & G.E. Baker, *B.* cf. *lignoides* Filson, *Lecanora polytropa* (Hoffm.) Rabenh., *L.* aff. *orosthea* (Ach.) Ach., *Carbonea vorticosa* (Flörke) Hertel, *Pseudephebe minuscula* (Nyl. *ex* Arnold) Brodo & D. Hawksw. and *Umbilicaria decussata* (Vill.) Zahlbr.

The soils had permafrost at between 10-15 cm depth, and showed cryoturbic features, though not very well developed. Lichens were found growing on sheltered, loose fragments of rock and on soil in the middle of the sorted polygons of north-western facing slopes. Liquid water was present within the polygons.

The soils had dry and ice-cemented permafrost, with turbic microstructure. Location and soil temperatures at 10th January 2012: site 1 (UTM 0469778/1143176, alt. 754 m); air temperature 4.6 ºC; 5 cm: -0.6 ºC; 10 cm: -2.6 ºC; 15 cm -1.9 ºC; site 2 (UTM 0469922/1143193, alt. 785 m); air temperature 3.3 ºC, 5 cm: 2.3 ºC; 10 cm: -0.8 ºC; 15 cm: -1.9 ºC.

The climate in the Heritage range is typical of the low Plateau of continental Antarctica (*e.g.* Byrd Station), and average air temperature at the Union Glacier is around -12 to -35 ºC.

Surface temperatures above zero last for a few hours a day, and during for less than 30 days during the summer. It is very cold year-round, with approx. -12 to -35 ºC monthly averages, with decreasing temperatures decreasing with altitude. In the summer, clear skies, calm air and little precipitation is common; other phenomena are the strong karabatics, occasional fogs and low clouds from the Ronne ice shelf (King & Turner 1997).

Based on soil characterization, all sites have alkaline pHs and salt accumulation on the lee side of rock fragments; salts are usually gypsum ($CaSO_4.nH_2O$) and typical of Ellsworth Polar desert soils; the amounts of available P is surprisingly high by polar desert standards, and with very low amounts of organic carbon (table 1), corroborating the extremely low

Table 1. Characterization of soils at the sites investigated.

Layer	depth. (cm)	[1]pH	[2]P	[2]K	[2]Na	[3]Ca	[3]Mg	[3]Al	[4]H+Al	Cu (ppm)	Pb (ppm)	[7]CEC	Munsell colour	Clay content	[10]Na satur	[11]TOC
			mg.dm^{-3}			cmol$_c$ dm^{-3}								%		dag kg
Heritage site 1-quartzite																
Crust	0-3	8.18	273.0	184	49.4	1.24	0.21	0.00	0.5	0.35	0.89	2.63	5Y 7/1	5%	10.08	0.13
Heritage site 2- quartzite / phyllite																
Crust	0-3	8.95	37.9	62	16.3	1.34	0.12	0.00	0.3	0.45	0.96	1.99	5Y 7/2	4%	4.19	0.10

[1]water; [2]extracted with Melich-1; [3]exchangeable cations; [4]extracted with Ca acetate 0.5 mol L^{-1} on pH 7.0; [6]Cation Exchange capacity; [10]Na saturation percentage; [11]Total organic carbon.

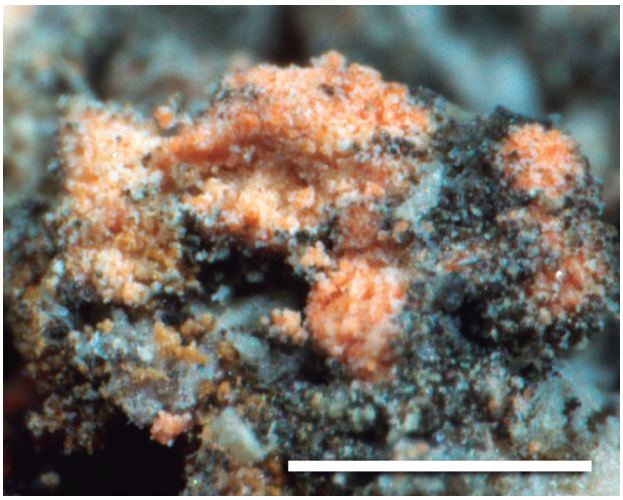

Figure 2. *Opegrapha edsonii*. Holotype. Scale bar = 1 mm.

biomass. The amount of selected heavy metals (Pb and, Cu) are within the range of polar desert soils. The relative concentration of exchangeable cations (Ca, Na, Mg and, K) in nutrient-poor quartzites can be attributed to salt sprays from distant marine sources, concentrated by long term deposition and the absence of leaching.

These extremophilous lichens are present on nutrient-poor substrates (quartzites) and associated with salt-affected soils from the Antarctic Polar deserts. They have only been observed on sheltered sites where liquid water was apparent, and mostly on northern or north-western facing slopes.

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