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A new species of *Placocarpus* (*Verrucariaceae*) from southern California

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Abstract: A new species, *Placocarpus americanus*, is described from the Santa Monica Mountains in Southern California. It is a juvenile parasite on *Protoparmeliopsis muralis* and differs from *Placocarpus schaereri* in having smaller non-halonate ascospores, a negative iodine reaction of the medulla, lack of inspersion of the medulla with small crystals, and having a thallus of dispersed areoles.

Key words: lichenicolous lichens, *Protoparmeliopsis muralis*, pyrenocarpous lichens, *Verrucula*

Introduction

Placocarpus Trevis. emend. O. Breuss contains two species, *P. schaereri* (Fr.) Breuss, the type species of the genus, and *P. kashiwadanii* Aptroot & K.H. Moon (Breuss 1985; Moon & Aptroot 2009). *Placocarpus schaereri* is a juvenile parasite on *Protoparmeliopsis muralis* (Schreb.) M. Choisy (syn. *Lecanora muralis* (Schreb.) Rabenh.) usually on calcareous substrata, as well as possibly parasitic on *Lobothallia radiosa* (Hoffm.) Hafellner based on our observations and also on other lichens (*fide* Zhurbenko 2008). It eventually develops a thick independent areolate thallus which can become effigurate (see Wirth 1995 and Ozenda & Clauzade 1970 for excellent images).

Placocarpus schaereri is a wide-spread species with its distribution centred on the Mediterranean. It occurs in Europe, North Africa, the Middle East (Zschacke 1933–1934; Ozenda & Clauzade 1970; Zehetleitner 1978) and extends north into Ukraine (Kondratyuk *et al.* 1996) and Russia (Zhurbenko 2008). It is noticeably missing from Great Britain, Fennoscandia and Greenland. *Placocarpus schaereri* was reported from the United States by Thomson (1989) but Breuss found the specimen to be a species new to science and described it as *Placopyrenium coloradoense* Breuss (Breuss 2009).

After much confusion concerning the circumscription of the heterogeneous genus *Placocarpus* Trevis., Breuss emended *Placocarpus* to accommodate *Dermatocarpon monstrosum* (Schaer.) Vain., whose older name was *Parmelia schaereri* Fr. (Breuss, 1985), while the other species included by Trevisan in *Placocarpus* were transferred to *Catapyrenium*, *Heteroplacidium*, *Placidiopsis* and *Verrucaria*. The diagnostic characters of the genus, based on *P. schaereri*, are juvenile parasitism, a rimose areolate to placodioid thallus up to 2·5 mm thick with stipitate to semi-stipitate areoles, paraplectenchymatous cortex, prosoplectenchymatous I+ (blue) medulla inspersed with small colourless crystals, simple and halonate ascospores, and pycnidia of the *Dermatocarpon*-type (Breuss 1985; Gueidan *et al.*, 2009). The genus was monotypic and well-supported by molecular analysis (Gueidan *et al.*, 2007) until Aptroot and Moon (2009) described *P. kashiwadanii* from Korea. This was reported to be non-parasitic on other lichens and to have a thick thallus with well-developed effiguration,

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but some important characters were not mentioned in the protologue, and molecular data were not available.The genus *Placocarpus* is a sister genus to *Verrucula* (Gueidan *et al*. 2007), which contains only species parasitic on *Caloplaca* species with anthroquinones and on *Xanthoria elegans* (Navarro-Rosinés *et al.* 2007).

In this paper we describe a new species, *Placocarpus americanus* K. Knudsen, Breuss & Kocourk., a juvenile parasite on *Protoparmeliopsis muralis* on Conejo Volcanics that develops an independent thallus of dispersed stipitate to sub-stipitate areoles and emends some of the characters used to define the genus.

Materials and Methods

Specimens were hand-sectioned and preparations mounted in water and 10% solution of potassium hydroxide (KOH) and examined using standard microscopy. Amyloid reactions were tested with Lugol's iodine (Merck 9261) (I) pre-treated or not with 10% solution of potassium hydroxide (I/K). Measurements were made on material mounted in water. Macrophotographs were taken with a digital Olympus C5050 camera on an Olympus SZX 9 Stereomicroscope.

Specimens of *P. schaereri* studied: **Czech Republic:** *Central Bohemia*: Distr. Beroun, Křivoklátsko Protected Landscape Area, Točník, below Točník castle, MTB: 6149 A08, 370 m, on *Protoparmeliopsis muralis* on porphyritic rocks, 6 vii 1999, *J. Kocourková* (PRM 900181); Praha, Dalejské udolí valley, near Aretusinová rokle quarry, MTB 5952, 310 m, on *P. muralis*, 23 i 1993, *J. Horáková* (PRM 758588); České středohoří PLA, Distr. Louny, Třtěno, NM Třtěnské stráně, N of village, S-facing slopes, 50°25′47.069″N 13°52′32.714″E, 220 m, on *P. muralis* var. *muralis*, on marl soil, on quartzite boulder, 12 × 2008, *J. Kocourková* (PRM 915108). *Southern Moravia*: PLA Pálava, Dist. Břeclav, NR Děvín, below the Dívčí hrad ruin, MTB 7165, 370 m, on *P. muralis* on calcareous rock, 10 × 2000, *J. Kocourková* (PRM 760746).—**Spain:** *Catalonia*: Cataluna, Cadi Mountain, at top of cliff before entrance to the village, 1400 m, 28 v 2003, *C. Gueidan* s.n. (UCR).—**Slovakia:** Malé Karpaty Mountains, Smolenice village, on calcareous rocks on Molpír hill, 300 m, 29 × 1991, *J. Liška* (PRM 887625).—**Turkey:** Sinas Gùnùn 38°39.306′N 37°18.169′E, 1506 m, 9 vii 2008, *M. Halici* s.n. (hb. Halici).

The Species

Placocarpus americanus K. Knudsen, Breuss & Kocourk. sp. nov.

Mycobank: MB 513217

Similis *Placocarpo schaereri* a quo differt ascosporis minoribus (18–22 × 5–8 μm), areolis dispersis, minoribus (0·3–1·0 mm diametro, usque ad 0·5 mm crassis) medullaque non crystallis minutis inspersa, I−.

Type: USA, California, Ventura Co., Santa Monica Mountains, Westlake Village, Conejo Open Space, near Lake Elenor Dam, slope above Highway 23 South, 34°08′ 12″ N 118° 51′ 07″ W, 291 m, on *Protoparmeliopsis muralis* on Conejo Volcanics in wall of drainage channel, 24 November 2008, *Knudsen* 10711, *J. Kocourková & T. Sagar* (LI—holotypus; PRM, UCR—isotypi).

(Fig. 1)

Thallus crustose of dispersed individual areoles, >0·5 mm thick and 0·2–1·0 mm wide, areoles apparently undivided, loosely attached by weakly- to well-developed stipes. *Upper cortex* thin, 3–5 layers thick, paraplectenchymatous, cells 5–8 μm diam., hyaline, the upper layers becoming melanized and overlain with a fine epinecral layer; upper surface greyish-white. *Algal layer* discontinuous, algal cells chlorococcoid, 8–10 μm diam. *Medulla* continuous with attaching hyphae, prosoplectenchymatous, 100–200 μm thick, hyphae hyaline, 2 μm wide, cells to 10 μm long or septa indistinct, lacking an inspersion of small crystals, I−.

Perithecia globose, 100–200 μm diam., immersed in the thallus, with darkened ostiole region, lacking an involucrellum; exciple hyaline, 10–15 μm thick. *Hamathecium* of periphyses; periphyses hyaline, branching or not, 15–25 × 0·5–1·0 μm long, septate or septa indistinct, cells mostly 5 μm long. *Asci* 45–50 × 15–18 μm, contents I+ red. *Ascospores* simple, hyaline 18–22 × 5–8 μm, halonate only when immature, irregularly bi-seriate.

Pycnidia not observed.

Etymology. The species is named after the continent where it was discovered and because of its wide separation from the well-documented distribution area of *P. schaereri* in Africa, Asia and Europe, centred on the Mediterranean.

Substratum and ecology. On *Protoparmeliopsis muralis* on Conejo Volcanics, becoming independent, in microhabitats with high relative humidity in the the immediate area, such

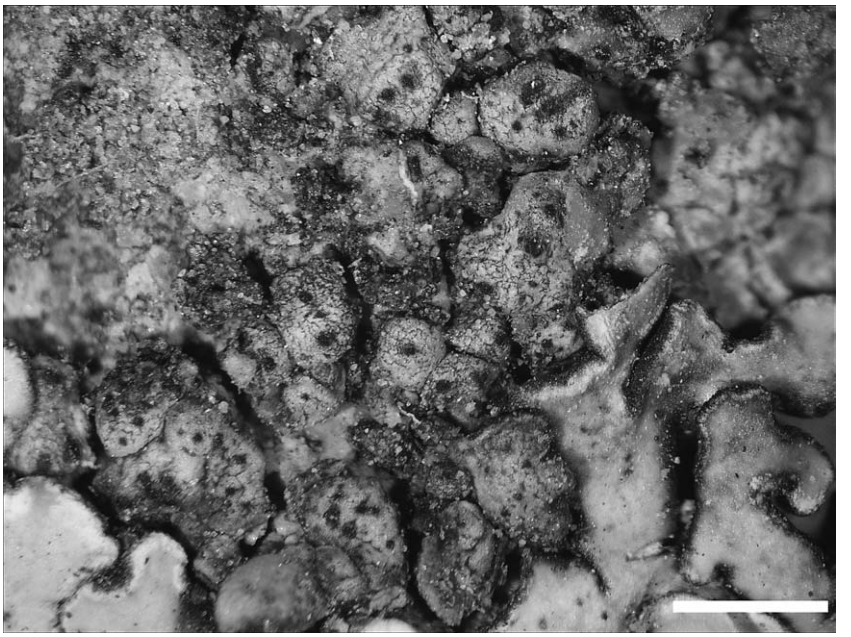

FIG. 1. *Placocarpus americanus*, habitus. Scale=1 mm.

as on a north slope in shade with winter seepage and on a wall of a seasonal drainage channel on a slope.

Distribution. Currently known only from Southern California, Santa Monica Mountains, Ventura County, on Conejo Volcanics, at elevations between approximately 250–300 metres. However, the host is widespread in western America in a variety of habitats, and it is possible that additional records of *P. americanus* will be found.

Discussion

The infection of the host begins in the same way in *P. americanus* as in *P. schaereri*. At first the host shows no signs of the infection by *Placocarpus* except for perithecia forming in the thallus and apothecia of the host. At the second stage the thallus of the host begins to discolour as *Placocarpus* forms a new cortex. Progressively an independent thallus is formed until individual units of the *Placocarpus* are identifiable.

Placocarpus americanus differs from *P. schaereri* in five characters: it does not form a thick continuous thallus (0·5–1·0 mm thick vs. up to 2·5 mm thick) and has dispersed areoles (not forming a thallus with a rimose-areolate centre and sometimes effigurate edge), its ascospores are shorter and narrower than those of *P. schaereri* (18–22 × 5–8 vs. 17–30 × 8–9 μm) and halonate only when immature, its medulla is I− and lacks an inspersion of small crystals. *Placocarpus americanus* shares with *P. schaereri* subumblicate areoles with stipitate or substipitate structures, a paraplectenchymatous cortex, a prosoplectenchymatous medulla, and they also share the same main host as juvenile parasites. Placing *P. americanus* in *Placocarpus* emends the genus so that the possession of a thick, placodioid thallus, an I+ inspersed medulla, and halonate ascospores, are now variable within the genus. Thus *Verrucula* differs from *Placocarpus* in having a pseudocortex rather than a paraplectenchymatous cortex, is restricted to different hosts, occurring on *Caloplaca*

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species and *Xanthoria elegans*, and has good molecular support as a genus (Gueidan *et al.* 2007; Navarro-Rosinés *et al.* 2007; Gueidan *et al.* 2009).

Placocarpus americanus differs from *P. kashiwadanii* in having larger ascospores (18–22 × 5–8 vs. 14–16 × 6–8 μm) and by having a dispersed thallus vs. a thick effigurate thallus, as well as being a juvenile parasite. Because the two sister genera, *Placocarpus* and *Verrucula*, contain only parasitic species, the placement of *P. kashiwadanii* in the parasitic genus *Placocarpus* is suspect, unless *P. kashiwadanii* is a juvenile parasite on lichens and the authors had observed only mature, independent thalli. As with several other species placed in *Placocarpus* Trevis. in the past before it was emended by Breuss (1985), Moon and Aptroot (2009) recognize that *P. kashiwadanii* may eventually be transferred to another genus, but their description lacks important information such as cortex and medulla structure, the reaction of the medulla to I, and pycnidia type although abundant conidia were produced.

Other specimen examined. **USA:** *California*: Ventura Co., Santa Monica Mountains, Agoura Hills, south of Agoura Road, 34°08′ 37″ N 118° 46′ 00″, 267 m, early stage of infection, on *Protoparmeliopsis muralis* on moist shaded rock outcrop with *Dudleya* species, 2008, *Lendemer* 11461 & *K. Knudsen* (NY, UCR).

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