

A new saxicolous species of *Diploschistes* (*Thelotremataceae*) from the Canary Islands

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Abstract: *Diploschistes albopruinosus* is described as new to science. This species is found on siliceous rocks in La Caldera de Taburiente National Park (La Palma, Canary Islands). A description of the species is given together with notes on its chemistry, distribution, ecology and taxonomy. Related lichen taxa are discussed.

Key words: biodiversity, La Palma, lichen, Macaronesia, taxonomy

Introduction

The genus *Diploschistes* Norman has a world-wide distribution with approximately 35 species, being particularly common in arid and semi-arid regions where it occurs mainly on rocks and soil, although facultatively corticolous species are also known (Lumbsch & Tehler 1998; Fletcher & Hawksworth 2009). The genus is characterized by a crustose thallus, a blackish pigmented pseudoparenchymatous proper exciple, lateral paraphyses and a trebouxioid photobiont (Lumbsch 1989; Martín *et al.* 2003). The Holarctic species were monographed by Lumbsch (1989). Subsequently, several additional papers have been published focusing on specific geographic areas (Pant & Upreti 1993; Guderley & Lumbsch 1996; Lumbsch & Elix 2003; Mangold *et al.* 2009), with the description of some new species and combinations (Lumbsch & Elix 1985, 1989; Lumbsch & Mayrhofer 1990; Lumbsch & Aptroot 1993; Lumbsch & Mangold 2007). According to

preliminary molecular studies, the genus is a monophyletic group (Martín *et al.* 2003).

The lichen biota of the Canary Islands is rich, with more than 1500 species listed for an area of just 7447 km² (Hernández Padrón & Pérez-Vargas 2009). Nevertheless, new species continue to be described from this Archipelago with some frequency (Elix & Schumm 2003; van den Boom & Vězda 2005; Pérez-Vargas *et al.* 2007, 2010*a, b*; Giralte & van den Boom 2009; Pérez-Vargas & Pérez de Paz 2009), confirming that the lichen biota in this region, with its many ecosystems, is still incompletely known. In the present work, we describe a new species of *Diploschistes* from the Canaries, more precisely from La Caldera de Taburiente National Park (La Palma Island).

Material and Methods

The morphology of the lichen specimens was examined using a Leica ZOOM 2000 or a Zeiss Stemi 2000C stereo-microscope. Sections for anatomical examination were cut by hand using a razor blade and were mounted and observed in water. Anatomical structure and hymenial characters were studied with an Olympus CH light microscope. Chemical constituents were identified by thin-layer chromatography using solvent systems A [benzene : dioxane : acetic acid, 180:45:5], B [hexane : methyl *t*-butyl ether : formic acid, 140:72:18] and C [toluene : acetic acid, 85:15] (Culberson 1972; Culberson *et al.* 1981; Culberson & Johnson 1982; Elix & Ernst-Russell 1993), high performance liquid

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FIG. 1. *Diploschistes albopruinosus*, part of the holotype. Scale = 1 mm. In colour online.

chromatography (Elix *et al.* 2003) and comparison with authentic samples. Specimens are deposited in the herbaria CANB and TFC.

The New Species

Diploschistes albopruinosus Pérez-Vargas, C. Hdez.-Padr. & Elix sp. nov.

Mycobank No.: MB563093

Fungus saxicolus. Thallus crustaceus, uniformis, adnatus, continuus vel rimoso-farinosus, albidus vel griseo-albidus, pruinosus. Algae ad genus *Trebouxia* pertinentes. Apothecia immersa, fusca, pruinosa, orbicularia, usque ad 0.5 mm in diametro, disco urceolato, punctiformi. Hymenium 140–170 µm altum, hyalinum. Hypothecium 15–20 µm altum, brunneum. Paraphyses 1–1.5 µm crassae, simplices, laxae. Asci cylindrici 110–130 × 18–23 µm, 4-sporei. Ascospores ellipsoideae, brunneae, muriformes, septis transversalibus 3–5, longitudinalibus 2–3, 25–38 (–45) × 12–18 µm. Pycnidia non visa. Thallus acidum lecanorinum, decarboxylecanorinum et diploschistesicum continens.

Typus: Spain, La Palma Island, La Caldera de Taburiente National Park, La Cumbrecita, UTM: 220810/ 317736, 1280 m alt., on rocks in *Pinus canariensis* C. Sm. ex DC. in Buch forest, April 2000, C. Hernández & P. L. Pérez 2770 (TFC Lich—holotypus; CANB—isotypus).

(Fig. 1)

Thallus saxicolous, crustose, continuous to rimose, whitish grey, moderately thin, up to 0.4 mm thick. Upper surface shiny, with bright whitish pruina giving it a farinose appearance. *Medulla* white, amyloid (I+ blue). *Photobiont* trebouxiod with cells up to 12 µm diam. *Prothallus* not visible. *Vegetative propagules* absent.

Ascomata perithecioid, immersed. Disc urceolate, greyish pruinose, orbicular, 0.3–0.5 mm diam. *Proper exciple* dark brown, 60–90 µm thick. *Hymenium* hyaline, 140–170 µm high, not interspersed. *Hypothecium* yellowish brown, 15–20 µm thick. *Paraphyses* 1.5 µm thick, simple, apices not thickened. *Asci* cylindrical, 110–130 × 18–23 µm, predominantly 4-spored. *Ascospores* ellipsoid, brown, muriform, with 3–5 transverse and 2–3 longitudinal septa, 25–38 (–45) × 12–18 µm.

Pycnidia not seen.

Chemistry. K+ yellow, C+ and KC+ vivid red, PD–; containing diploschistesic, lecanoric and decarboxylecanoric acids.

TABLE 1. Main differences between *Diploschistes albopruinosus* and related species

Character	<i>D. albopruinosus</i>	<i>D. gypsaceus</i>	<i>D. candidissimus</i>	<i>D. diacapsis</i>	<i>D. hensseniae</i>	<i>D. ocellatus</i>
Ascomata	Urceolate	Urceolate	Perithecioid	Urceolate to lecanoroid	Perithecioid	Lecanoroid
Asci	4-spored	4-spored	4-8-spored	4-8-spored	8-spored	8-spored
Spores (µm)	25–38 (–45) × 12–18	30–34 × 15–18	24–34 × 14–20	20–40 × 9–17	14–22 × 5.5–9	20–32 × 7–15
Habitat	Siliceous rocks	Calciferous rocks in shaded and dump habitats	Calciferous rocks in exposed habitats	Terricolous and calciferous	Terricolous	Calciferous rocks and soil
Chemistry	Diploschistesic, lecanoric and decarboxylecanoric acids	Lecanoric and orsellinic acids	Lecanoric acid	Lecanoric, diploschistesic and orsellinic acids	Diploschistesic, lecanoric and orsellinic acids	Norstictic, connorstictic, cryptostictic and stictic acids
Distribution	Canary Islands	Cosmopolitan	Cosmopolitan	Subcosmopolitan	Southern Hemisphere (Australia, Southern Africa)	Eurasia, Australia, Southern Africa

Etymology. The specific epithet *albopruinosus* refers to the whitish pruina covering the thallus.

Habitat and distribution. At present *D. albopruinosus* is known only from La Palma Island, where it grows on exposed siliceous rocks in a *Pinus canariensis* forest, between 1100 and 2000 m in the mountains of La Caldera de Taburiente National Park.

Notes. This new species is characterized by its saxicolous habit, whitish pruina, urceolate apothecia, ascospore size, and the presence of diploschistic, lecanoric and decarboxylecanoric acids. It superficially resembles the cosmopolitan *D. gypsaceus* (Ach.) Zahlbr. That species, however, occurs on calcareous substrata in shaded and damp habitats (Lumbsch 1988; Fletcher & Hawksworth 2009). Also *D. albopruinosus* contains additional diploschistic and decarboxylecanoric acids, substances not observed in *D. gypsaceus* which contains lecanoric acid as a major substance with orsellinic acid as an accessory. The presence of *D. gypsaceus* in the Canary Islands is very doubtful. Hernández-Padrón & Pérez-Vargas (2009) included this species in the Checklist of the Lichen Biota of the Canary Islands from La Palma, Tenerife and Gran Canaria Island. However, a review of these records has shown that all are based on misidentification, or incorrect interpretations of alternative names given to this species. The most recent, and the only recorded, specimen of *D. gypsaceus* is by Tavares (1952) but no information about locality, substratum or lichen characteristics was given. The record of *D. gypsaceus* in Hafellner (1995) is based on the paper by Tavares (*op. cit.*).

Other species of *Diploschistes* with whitish pruina include *D. candidissimus* (Kremp.) Zahlbr, *D. diacapsis* (Ach.) Lumbsch, *D. hensseniae* Lumbsch & Elix and *D. ocellatus* (Vill.) Norman (Table 1). *Diploschistes diacapsis* is a terricolous, calciferous species with 4–8 spored asci and with alternative chemistry (with additional orsellinic acid rather than decarboxylecanoric acid). *Diploschistes candidissimus* occurs on calciferous rocks in

exposed habitats and has perithecioid ascomata. *Diploschistes hensseniae* is a terricolous species with perithecioid ascomata and smaller ascospores up to 22 µm long (Lumbsch & Elix 1985). *Diploschistes ocellatus* is easily distinguished from *D. albopruinosus*, and from all other species in this genus, by its large lecanoroid ascomata and the presence of the norstictic acid chemosyndrome (Martín *et al.* 2003).

Selected specimens examined. Canary Islands: La Palma: La Caldera de Taburiente National Park: "El Riachuelo", UTM: 221302/317757, 1250 m alt., on rocks, xi 2001, C. Hernández & P. L. Pérez de Paz (TFC Lich: 5928, CANB); "Cauce del Barranco de Las Traves", UTM: 217050/318059, 1100 m alt., on rocks, iv 2000, C. Hernández & P. L. Pérez de Paz (TFC Lich: 2711); "Proximidades a la Fuente Nueva", UTM: 218993/318498, 2000 m alt., on rocks, C. Hernández & P. L. Pérez de Paz (TFC Lich: 7144, CANB).

REFERENCES

- Culberson, C. F. (1972) Improved conditions and new data for the identification of lichen products by a standardized thin-layer chromatographic method. *Journal of Chromatography* **72**: 113–125.
- Culberson, C. F. & Johnson, A. (1982) Substitution of methyl *tert.*-butyl ether for diethyl ether in the standardized thin-layer chromatographic method for lichen products. *Journal of Chromatography* **238**: 483–487.
- Culberson, C. F., Culberson, W. L. & Johnson, A. (1981) A standardized TLC analysis of β-orcinol depsidones. *Bryologist* **84**: 16–29.
- Elix, J. A. & Ernst-Russell, K. D. (1993) *A Catalogue of Standardized Thin Layer Chromatographic Data and Biosynthetic Relationships for Lichen Substances* 2nd Edn. Canberra: Australian National University.
- Elix, J. A. & Schumm, F. (2003) New species and new records in the lichen family Parmeliaceae (Ascomycota) from Macaronesia. *Mycotaxon* **86**: 383–388.
- Fletcher, A. & Hawksworth, D. L. (2009) *Diploschistes*. In *The Lichens of Great Britain and Ireland* (C. W. Smith, A. Aptroot, B. J. Coppins, A. Fletcher, O. L. Gilbert, P. W. James & P. A. Wolseley, eds): 378–380. London: British Lichen Society.
- Giralt, M. & van den Boom, P. P. G. (2009). *Rinodina etayoi*, a new saxicolous species from the Canary Islands. *Lichenologist* **41**: 141–145.
- Guderley, R. & Lumbsch, H. T. (1996). The lichen genus *Diploschistes* in South Africa (*Thelotrema*-ceae). *Mycotaxon* **58**: 269–292.
- Hafellner, J. (1995) A new checklist of lichens and lichenicolous fungi of Insular Laurimacaronesia including a lichenological bibliography for the area. *Fritschiana* **5**: 1–132.
- Hernández Padrón, C. E. & I. Pérez-Vargas (2009) Lichenes, Lichenicolous Fungi. In *Lista de Especies*

- Silvestres de Canarias. Hongos, Plantas y Animales Terrestres* (M. Arechavaleta, S. Rodríguez, N. Zurita & A. García, eds) Consejería de Medio Ambiente y Ordenación Territorial. Gobierno de Canarias. ISBN 978-84- 89729-21-6.
- Lumbsch, H. T. (1988) The identity of *Diploschistes gypsaceus*. *Lichenologist* **20**: 19–24.
- Lumbsch, H. T. (1989) Die Holarktischen Vertreter der Flechtengattung *Diploschistes* (Thelotremataceae). *Journal of the Hattori Botanical Laboratory* **66**: 133–196.
- Lumbsch, H. T. & Aptroot, A. (1993) Studien über die Flechtengattung *Diploschistes* II. *Nova Hedwigia* **56**: 237–239.
- Lumbsch, H. T. & Elix, J. A. (1985) A new species of the lichen genus *Diploschistes* from Australia. *Plant Systematics and Evolution* **150**: 275–279.
- Lumbsch, H. T. & Elix, J. A. (1989) Taxonomy of some *Diploschistes* spp. (lichenized ascomycetes, Thelotremataceae) containing gyrophoric acid. *Plant Systematics and Evolution* **167**: 195–199.
- Lumbsch, H. T. & Elix, J. A. (2003) The lichen genus *Diploschistes* (Thelotremataceae) in Australia. *Bibliotheca Lichenologica* **86**: 119–128.
- Lumbsch, H. T. & Mangold, A. (2007). *Diploschistes elixii* (Ostropales: Thelotremataceae), an overlooked terricolous species from Western Australia. *Lichenologist* **39**: 459–462.
- Lumbsch, H. T. & Mayrhofer, H. (1990) A new *Diploschistes* species (lichenized Ascomycetes, Thelotremataceae) from India. *Mycotaxon* **38**: 311–313.
- Lumbsch, H. T. & Tehler, A. (1998) A cladistic analysis of the genus *Diploschistes* (Ascomycotina, Thelotremataceae). *Bryologist* **101**: 398–403.
- Mangold, A., Elix, J. A. & Lumbsch, H. T. (2009) Thelotremataceae. *Flora of Australia* **57**: 159–420.
- Martin, M. P., LaGreca, S. & Lumbsch, H. T. (2003) Molecular phylogeny of *Diploschistes* inferred from ITS sequence data. *Lichenologist* **35**: 27–32.
- Pant, G. & Upreti, D. K. (1993) The lichen genus *Diploschistes* in India and Nepal. *Lichenologist* **25**: 33–50.
- Pérez-Vargas, I. & Pérez de Paz, P. L. (2009). *Caloplaca chelyae* (Teloschistaceae), a new lichen from the Canary Islands. *Bryologist* **112**: 840–845.
- Pérez-Vargas, I., Hernández-Padrón, C. & Elix, J. A. (2007) A new species of *Xanthoparmelia* (Ascomycota: Parmeliaceae) from the Canary Islands. *Lichenologist* **39**: 445–449.
- Pérez-Vargas, I., Hernández Padrón, C., Etayo, J., Pérez de Paz, P. L. & Elix, J. A. (2010a). New species of *Pertusaria* (lichenized Ascomycota: Pertusariaceae) from the Canary Islands. *Lichenologist* **42**: 35–41.
- Pérez-Vargas, I., Hernández Padrón, C., Pérez de Paz, P. L. & Elix, J. A. (2010b) *Xanthoparmelia teydea*, a new brown *Xanthoparmelia* (Parmeliaceae) from the Canary Islands. *Bryologist* **113**: 51–54.
- Tavares, C. N. (1952) Contribution to the lichen Flora of Macaronesia I. Lichens from Madeira. *Portugaliae Acta Biologica, Series B* **3**: 308–391.
- van den Boom, P. P. G. & Vězda, A. (2005) *Gyalecta canariensis* sp. nov., a new lichen (Ascomycota) described from La Palma (Canary Islands). *Mycotaxon* **92**: 255–258.