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Enterographa ducouretiana sp. nov. (lichenized Ascomycota, Roccellaceae), a new foliicolous species from New Caledonia

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Abstract

Enterographa ducouretiana is described as new to science from New Caledonia. It is characterized by a foliicolous habit, ascomata immersed in a pseudostroma, a dark purple hypothecium, and (3–)5-septate ascospores of (16–)20.5(–24) × (2.5–)2.9(–3.5) µm with a distinct gelatinous sheath of 1.5(–2) µm.

Key words: Arthoniales, Australasia, Lichen, Taxonomy

Introduction

The genus *Enterographa* (Roccellaceae) is identified by a set of morphological characters, including a crustose thallus, rounded to elongate or punctiform ascomata that are most commonly embedded in the thallus, a poorly developed exciple, a hymenium with branched and anastomosing paraphysoids, ellipsoid to cylindrical-clavate asci of the *Opegrapha*-type, and usually fusiform ascospores with thin septa, a gelatinous sheath, and without enlarged terminal cells (Sparrius 2004). Most species form lichen symbioses with a trentepohlioid photobiont (*Trentepohlia* s.l. or *Phycopeltis*), some are lichenicolous. The genus is similar to *Opegrapha* but differs in the non-carbonized margins of the ascomata. *Chiodecton* and *Sclerophyton* may be similar to *Enterographa*, but *Chiodecton* has usually a more cottony thallus, perithecioid ascomata densely accumulated in groups and different ascospores types (obovate or biclavate without a gelatinous sheath), while *Sclerophyton* has ellipsoid rather than fusiform ascospores (Lücking, 2008).

The world key to the genus *Enterographa* by Seavey & Seavey (2014) recognizes 55 accepted species. Two species were not included in this key, *Enterographa rotundata* M. Cáceres, E.L. Lima & Aptroot (Aptroot *et al.*, 2013:630) and *Enterographa hainanensis* B. Gao & J.C. Wei (Gao *et al.*, 2009:176), and 18 species have been described since then. The number of currently known *Enterographa* species amounts to 75.

Several molecular studies (Ertz & Tehler 2011, Frisch *et al.* 2014) show that the generic delimitation within the

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Roccellaceae is not satisfactory and that the genus *Enterographa* is polyphyletic. Species formerly accepted in the genus have been transferred to other families, such as *Enterographa subserialis* (Nyl.) Redinger (1938:69) reported from New Caledonia, which has been transferred to the family Roccellographaceae (=*Fulvophyton subseriale* (Nyl.) Ertz & Tehler (2011:54)). Other species will be revised in this way soon (Ertz *et al.* in prep.).

Currently, 20 foliicolous *Enterographa* species are recognized by Santesson (1952), Vězda (1975), Sérusiaux (1984), Lücking (1991), Aptroot *et al.* (1995), Lücking & Matzer (1996), Lücking *et al.* (1998), Herrera-Campos & Lücking (2002), Lücking *et al.* (2003), Sparrius (2004), Sparrius & Björk (2008), Yeshitela *et al.* (2009), Gao *et al.* (2009), van den Boom & Sipman (2016), McCarthy & Elix (2018), and Lebreton & Aptroot (2020), including two lichenicolous fungi on foliicolous lichens (Matzer 1996, Ertz *et al.* 2005). They are found in most major biotic regions as defined by Lücking (2008) based on the distribution of foliicolous lichens: neotropics, paleotropics (African and Eastern), and New Zealandic-Tasmanian.

Here we describe the first foliicolous *Enterographa* species from New Caledonia, discovered by the first author in geographical area named 'Col de Mouirange' in South Province of New Caledonia, in a rainforest patch in November 2022.

Materials and Methods

Colour reactions of thallus and apothecial structures were tested with C (commercial bleach), K (5% aqueous solution of potassium hydroxide) and PD (para-Phenylenediamine dissolved inethanol) (Orange *et al.* 2001). The external morphology was studied and measured using an Olympus SZX12 stereomicroscope. Macro photos were taken on fresh material using a Sony A6300 camera, with a Laowa 25MM F2.8 ULTRA MACRO 2.5-5X lens and Godox MF12 flashes. Herbarium material (three months old) was photographed with a Keyence VHX-5000 Digital Microscope and a VH-Z20R/W/T lens. Hand-cut sections and squash preparations of the thallus were mounted in water, in K or in Lugol's iodine solution (1% I_2) without (I) or with K pre-treatment (KI), and studied using an Olympus BX51 compound microscope. The presence of crystals was investigated using polarized light. Measurements refer to dimensions in water. Microscopic photographs were prepared using an Olympus BX51 compound microscope fitted with an Olympus SC50 digital camera.

The Species

Enterographa ducouretiana Lebreton & Ertz, *sp. nov.* MycoBank No.: MB849332
(Figs. 1 & 2)

Foliicolous *Enterographa* with lirelliform ascomata immersed in pseudostromata, a dark purple hypothecium, (3–)5-septate ascospores measuring (16–)20.5(–24) × (2.5–)2.9(–3.5) µm and PD+ yellow pseudostromata.

Type:—NEW CALEDONIA. Province Sud, Col de Mouirange, in rainforest patch surrounded by shrubland vegetation, called 'maquis', 22°12'9.216" S, 166°40'11.244" E, November 18, 2022, *Lebreton 1787a* (holotype: PC0779840; isotypes: LG11991-ETR00A, NOU, BR).

Thallus continuous, smooth, thin, c. 15–30 µm thick, pale yellowish green, sometimes with a whitish tinge, matt, esorediate. *Photobiont* trentepohlioid; cells elongated and irregular in outline, 7–11 × 3.5–9 µm, in irregular plates.

Ascomata immersed in pseudostromata covered by the thallus, distinctly elongate-lirellate, usually sparsely branched; *disc* dark brown to black in young and older ascomata (with a purplish tinge when fresh), slit-like, 0.12–0.9 mm long and 0.02–0.04 mm broad, epruinose; *pseudostromata* solitary, prominent, with ± gentle flanks not constricted at base, 0.23–1 × 0.18–0.35 mm, smooth, pale yellowish green with an orange tinge (more strongly pronounced in fresh material), or white where the thallus is abraded; in section white and incrusted with hyaline, tiny crystals that dissolve in K. *Exciple* indistinct, c. 3–5 µm wide, I-, KI-. *Subhymenium* very thin, c. 5 µm high, colorless, I-, KI-. *Hypothecium* 12–17 µm tall, dark purple, K+ becoming black. *Hymenium* 55–65 µm tall, colorless, clear, I+ orange-red, KI+ persistently dark blue; *epihymenium* poorly defined, hyaline, I+ orange-red, K-. *Paraphysoids* branched-anastomosing, c. 1 µm thick, slightly enlarged at their apex, c. 1.5 µm thick. *Asci* narrowly clavate, 54–59 × 12–13 µm (n = 3), KI- except for a KI+ blue, ring-shaped structure surrounding a tiny ocular chamber. *Ascospores* hyaline, narrowly fusiform, (3–)5-septate, (16–)20.5(–24) × (2.5–)2.9(–3.5) µm, with a 1.5–2 µm thick gelatinous sheath.

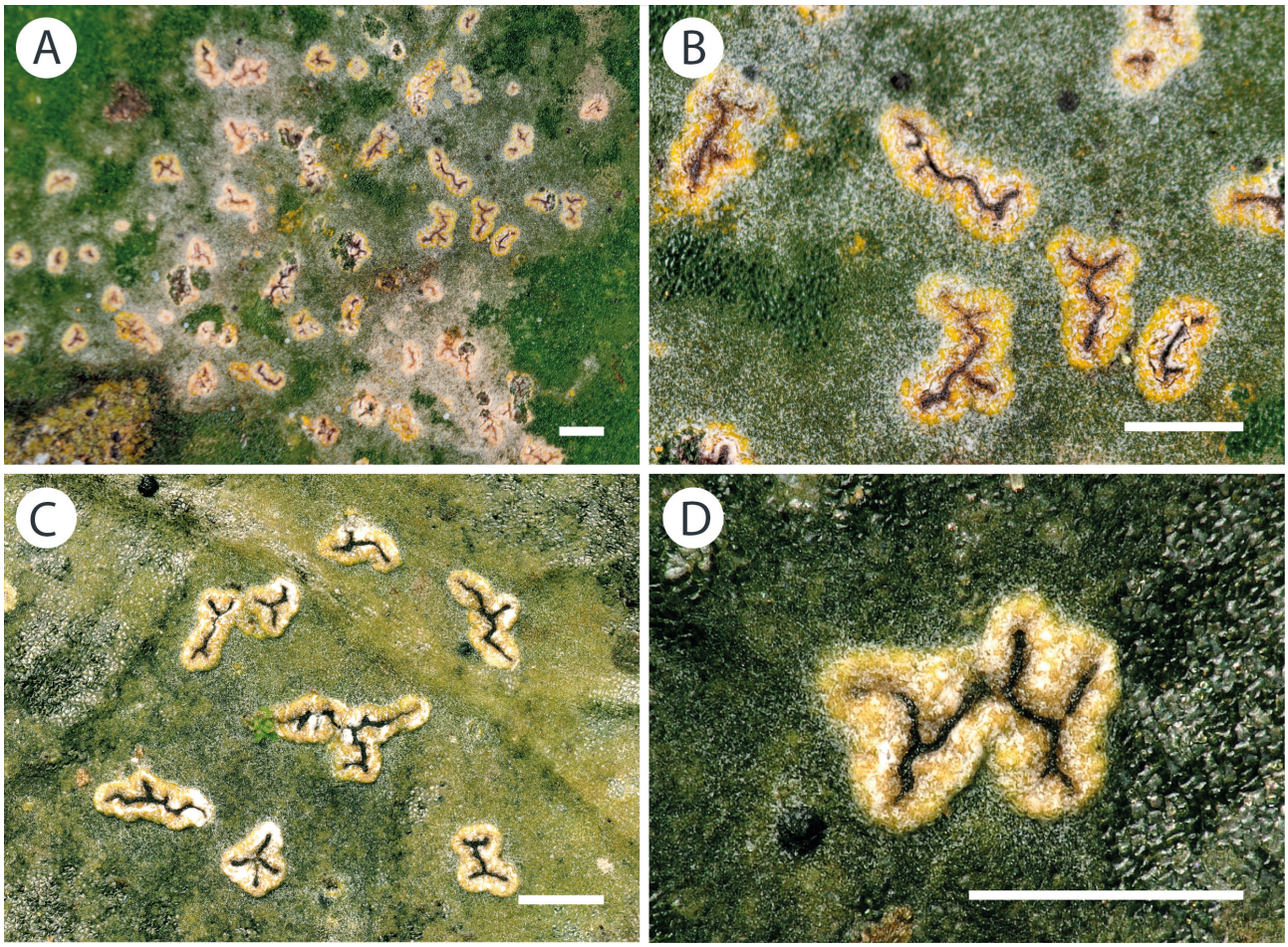

FIGURE 1. *Enterographa ducouretiana sp. nov.* A–B. Fresh specimen, photographed on collection day. C–D. Herbarium specimen (holotype), three months after collection. Scales: A-D = 0.5 mm. Photos A and B by Damien Brouste; C and D by Damien Ertz.

Pycnidia not observed.

Chemistry: thallus: K-, C-, PD-, UV-, but pseudostromata PD+ yellow (probably due to the presence of psoromic acid); thin-layer chromatography not performed.

Etymology: This new species is named after Emilie Ducouret due to her essential role in coordinating the fieldwork in New Caledonia that led to its discovery.

Distribution and habitat: Enterographa ducouretiana is known only from the type collection in rainforest near a creek.

Notes: The new species fits well in the genus *Enterographa* because of its trentepohlioid photobiont, ascomata with an inconspicuous exciple, branched paraphysoids, clavate asci with a KI+ blue ring structure in the tholus, and hyaline, narrowly fusiform, septate ascospores. The new species is unique within the genus by the presence of a dark purple hypothecium. It is also characterized by the continuous thallus with narrowly lirelliform ascomata that are immersed in PD+ yellow pseudostromata covered by the thallus, a dark brown to black hymenial disc, and (3–)5-septate ascospores. *Enterographa membranacea* P.M. McCarthy & Elix (2018:49) resembles *E. ducouretiana* in having simple to sparsely branched lirelliform ascomata that are immersed in PD+ yellow pseudostromata covered by a thallus layer and (5–)6-septate ascospores of 18–25 × 2–3 µm. It differs from *E. ducouretiana* in having larger pseudostromata (0.4–1.5(–2) × 0.4–0.8(–1) mm) with plate-like crystals of calcium oxalate. The hymenial disc are pale to medium brown and the hymenia are taller (65–85 µm). Unlike *E. ducouretiana*, it lacks a dark purple hypothecium and instead has a hyaline to pale yellowish-brown hypothecium, K- and 15–22(–25) µm thick. *Enterographa membranacea* also differs in having a corticolous habit, even though growing on the smooth trunk of a palm tree, a substrate with a texture similar to leaves. The photobiont cells are much broader (7–10 µm), solitary or in very short filaments and not arranged in plates (McCarthy & Elix 2018). Among the foliicolous species of *Enterographa* with a PD+ yellow thallus and somewhat similar ascospores, *E. bartlettii* Sérus. (1984:292) differs from the new species in having a thallus dispersed in patches, much shorter ascomata (0.15–0.3 mm) with a pale orange brown disc, a thalline margin densely filled with calcium

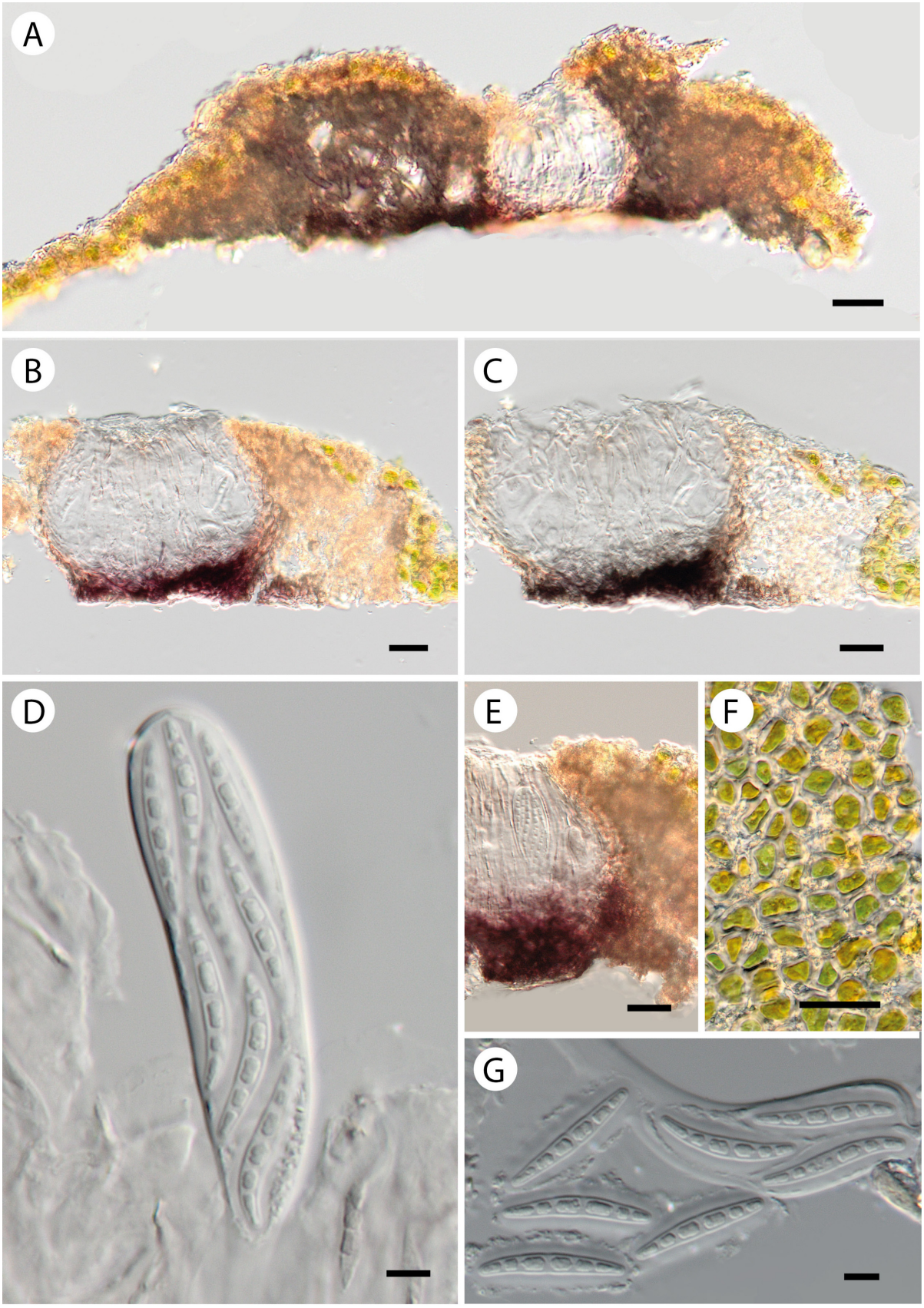

FIGURE 2. *Enterographa ducouretiana sp. nov.* (three months old herbarium specimen). A, B & E. Cross-sections of ascomata showing the purple tinge of the hypothecium and the thallus layer covering the surface of the pseudostromata (in water). C. Cross-section of an ascoma in K (note the color of the hypothecium that became black and the dissolution of the crystals in the margin that became more transparent). F. Thallus with trentepohlioid photobiont in irregular plates (in water). D. Ascus with spores (in water). G. Ascospores (in water). Scales: A–C, E–F = 20 µm, D & G = 5 µm. Photos by Damien Ertz & Elise Lebreton.

oxalate crystals, an algiferous layer next to the excipulum and (6–)7-septate ascospores that are broader (3.5–5 µm); *E. bella* R. Sant. (1952:106) has a photobiont with cells arranged in radiating plates, a thallus dispersed in patches, a deep orange-brown hymenial disc and 7-septate ascospores that are longer (22–29 µm); *E. foliicola* Lücking & Matzer (1996:111) has a photobiont with cells arranged in radiating plates, ascomata slightly constricted below with oxalate crystals in the thalline margin and 7(–9)-septate ascospores that are broader (3.5–5 µm); *E. multiseptata* R. Sant. (1952:108), *E. perez-higaredae* Herrera-Campos & Lücking (2002:213) and *E. vezdae* Sparrius (2004:63) have longer ascospores with notably more septa (7, 7–10(–14), 7–9 septate, respectively; Sparrius 2004, Lücking 2008). All these species also differ from the new species by the absence of a dark purple hypothecium. Among the corticolous and saxicolous species of *Enterographa*, *E. elixii* Sparrius (2004:39) is somewhat similar to the new species in having ascomata immersed in well-defined pseudostromata and in having dark hymenial discs, but this lichen has notably rounded to short lirelliform ascomata, a thick thallus (100–300 µm) and 3-septate ascospores (Sparrius 2004).

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