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

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26

27 **Abstract**

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

32 **Keywords:** Arthoniales, Australasia, Lichen, Taxonomy

33

34 **Introduction**

35 The genus *Enterographa* (Roccellaceae) is identified by a set of morphological characters,
36 including a crustose thallus, rounded to elongate or punctiform ascomata that are most
37 commonly embedded in the thallus, a poorly developed excipulum, a hymenium with branched
38 and anastomosing paraphysoids, ellipsoid to cylindrical-clavate asci of the *Opegrapha*-type,
39 and usually fusiform ascospores with thin septa, a gelatinous sheath, and without enlarged

40 terminal cells (Sparrius, 2004). Most species form lichen symbioses with a trentepohlioid
41 photobiont (*Trentepohlia* s.l. or *Phycopeltis*), some are lichenicolous. The genus is similar to
42 *Opegrapha* but differs in the non-carbonized margins of the ascomata. *Chiodecton* and
43 *Sclerophyton* may be similar to *Enterographa*, but *Chiodecton* has usually a more cottony
44 thallus, perithecioid ascomata densely accumulated in groups and different ascospores types
45 (obovate or biclavate without a gelatinous sheath), while *Sclerophyton* has ellipsoid rather than
46 fusiform ascospores (Lücking, 2008).

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

52 Several molecular studies (Ertz & Tehler 2011, Frisch *et al.* 2014) show that the generic
53 delimitation within the Roccellaceae is not satisfactory and that the genus *Enterographa* is
54 polyphyletic. Species formerly accepted in the genus have been transferred to other families,
55 such as *Enterographa subserialis* (Nyl.) Redinger (1938:69) reported from New Caledonia,
56 which has been transferred to the family Roccellographaceae (= *Fulvophyton subseriale* (Nyl.)
57 Ertz & Tehler (2011:54)). Other species will be revised in this way soon (Ertz *et al.* in prep.).

58 Currently, 20 foliicolous *Enterographa* species are recognized by Santesson (1952), Vězda
59 (1975), Sérusiaux (1984), Lücking (1991), Aptroot *et al.* (1995), Lücking & Matzer (1996),
60 Lücking *et al.* (1998), Herrera-Campos & Lücking (2002), Lücking *et al.* (2003), Sparrius
61 (2004), Sparrius & Björk (2008), Yeshitela *et al.* (2009), Gao *et al.* (2009), van den Boom &
62 Sipman (2016), McCarthy & Elix (2018) and Lebreton & Aptroot (2020), including two
63 lichenicolous fungi on foliicolous lichens (Matzer 1996, Ertz *et al.* 2005). They are found in
64 most major biotic regions as defined by Lücking (2008) based on the distribution of foliicolous
65 lichens: neotropics, paleotropics (African and Eastern), and New Zealandic-Tasmanian.

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

69 **Materials & methods**

70 Colour reactions of thallus and apothecial structures were tested with C (commercial bleach),
71 K (5% water solution of potassium hydroxide) and PD (para-Phenylenediamine) (Orange *et al.*
72 2001). The external morphology was studied and measured using an Olympus SZX12
73 stereomicroscope. Macroscopic photographs were taken on fresh material using a Sony A6300
74 camera, with a Laowa 25MM F2.8 ULTRA MACRO 2.5-5X lens and Godox MF12 flashes.
75 Herbarium material (three months old) was photographed with a Keyence VHX-5000 Digital
76 Microscope and a VH-Z20R/W/T lens. Hand-cut sections and squash preparations of thallus
77 were mounted in water, K or in Lugol’s iodine solution (1% I₂) without (I) or with K pre-
78 treatment (KI), and studied using an Olympus BX51 compound microscope. The presence of
79 crystals was investigated using polarized light. Measurements refer to dimensions in water.
80 Microscopic photographs were prepared using an Olympus BX51 compound microscope fitted
81 with an Olympus SC50 digital camera.

82 **The species**

83 *Enterographa ducouretiana* Lebreton & Ertz, *sp. nov.* (Figs. 1 & 2)

84 MycoBank No.: MB849332

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

88 **Type:**—NEW CALEDONIA. Province Sud, Col de Mouirange, in rainforest patch surrounded
89 by shrubland vegetation, called ‘maquis’, 22°12’9.216” S, 166°40’11.244” E, November 18,
90 2022, *Lebreton 1787a* (holotype: PC0779840; isotypes: LG11991-ETR00A, NOU, BR).

91 *Thallus* continuous, smooth, thin, c. 15–30 μm thick, pale yellowish green, sometimes with a
92 whitish tinge, matt, esorediate. *Photobiont* trentepohlioid; cells elongated and irregular in
93 outline, 7–11 × 3.5–9 μm, in irregular plates. *Ascomata* immersed in pseudostromata covered
94 by the thallus, distinctly elongate–lirellate, usually sparsely branched; *disc* dark brown to black
95 in young and older ascomata (with a purplish tinge when fresh), slit–like, 0.12–0.9 mm long
96 and 0.02–0.04 mm broad, epruinose; *pseudostromata* solitary, prominent, with ±gentle flanks,
97 not constricted at base, 0.23–1 × 0.18–0.35 mm, smooth, pale yellowish green with an orange
98 tinge (more strongly pronounced in fresh material), or white where the thallus is abraded; in
99 section white and incrustated with hyaline, tiny crystals that dissolve in K. *Excipulum* indistinct,
100 c. 3–5 μm wide, I–, KI–. *Subhymenium* very thin, c. 5 μm high, colorless, I–, KI–. *Hypothecium*
101 12–17 μm high, dark purple, K+ becoming black. *Hymenium* 55–65 μm high, colorless, clear,
102 I+ orange–red, KI+ persistently dark blue; *epihymenium* poorly defined, hyaline, I+ orange–
103 red, K–. *Paraphysoids* branched-anastomosing, c. 1 μm thick, slightly enlarged at apex, c. 1.5
104 μm thick. *Asci* narrowly clavate, 54–59 × 12–13 μm (n = 3), KI– except for a KI+ blue, ring-
105 shaped structure surrounding a tiny ocular chamber. *Ascospores* hyaline, narrowly fusiform,
106 (3–)5-septate, (16–)20.5(–24) × (2.5–)2.9(–3.5) μm, with 1.5–2 μm thick gelatinous sheath.
107 *Pycnidia* not observed. Chemistry: thallus: K–, C–, PD–, UV–, but pseudostromata PD+ yellow
108 (probably due to the presence of psoromic acid); TLC not performed.

109 **Notes:**—The new species fits well in the genus *Enterographa* by its trentepohlioid photobiont,
110 ascomata with an inconspicuous excipulum, branched paraphysoids, clavate asci with a KI+
111 blue ring structure in the tholus and hyaline, narrowly fusiform, septate ascospores. The new
112 species is unique within the genus by the presence of a dark purple hypothecium. It is also
113 characterized by the continuous thallus with narrowly lirelliform ascomata that are immersed
114 in PD+ yellow pseudostromata covered by the thallus, a dark brown to black hymenial disc and
115 (3–)5-septate ascospores. *Enterographa membranacea* P.M. McCarthy & Elix (2018:49)
116 resembles *E. ducouretiana* in having simple to sparsely branched lirelliform ascomata that are
117 immersed in PD+ yellow pseudostromata covered by a thallus layer and (5–)6-septate
118 ascospores of 18–25 × 2–3 μm. It differs from *E. ducouretiana* in having larger pseudostromata
119 (0.4–1.5(–2) × 0.4–0.8(–1) mm) with plate-like crystals of calcium oxalate. The hymenial discs
120 are pale to medium brown and the hymenia are taller (65–85 μm). Unlike *E. ducouretiana*, it
121 lacks a dark purple hypothecium and instead has a hyaline to pale yellowish brown
122 hypothecium, K–, and 15–22(–25) μm thick. *Enterographa membranacea* also differs in having
123 a corticolous habit, even though growing on the smooth trunk of a palm tree, a substrate with
124 texture similar to leaves. The photobiont cells are much broader (7–10 μm), solitary or in very
125 short filaments and not arranged in plates (McCarthy & Elix 2018). Among the foliicolous
126 species of *Enterographa* with a PD+ yellow thallus and somewhat similar ascospores, *E.*

127 *bartlettii* Sérus. (1984:292) differs from the new species in having a thallus dispersed in patches,
128 much shorter ascomata (0.15–0.3 mm) with a pale orange brown disc, a thalline margin densely
129 filled with calcium oxalate crystals, an algiferous layer next to the excipulum and (6–)7-septate
130 ascospores that are broader (3.5–5 µm); *E. bella* R. Sant. (1952:106) has a photobiont with cells
131 arranged in radiating plates, a thallus dispersed in patches, a deep orange-brown hymenial disc
132 and 7-septate ascospores that are longer (22–29 µm); *E. foliicola* Lücking & Matzer (1996:111)
133 has a photobiont with cells arranged in radiating plates, ascomata slightly constricted below
134 with oxalate crystals in the thalline margin and 7(–9)-septate ascospores that are broader (3.5–
135 5 µm); *E. multiseptata* R. Sant. (1952:108), *E. perez-higaredae* Herrera-Campos & Lücking
136 (2002:213) and *E. vezdae* Sparrius (2004:63) have longer ascospores with notably more septa
137 (7, 7–10(–14), 7–9 septate, respectively; Sparrius 2004, Lücking 2008). All these species also
138 differ from the new species by the absence of a dark purple hypothecium. Among the
139 corticolous and saxicolous species of *Enterographa*, *E. elixii* Sparrius (2004:39) is somewhat
140 similar to the new species in having ascomata immersed in well-defined pseudostromata and in
141 having dark hymenial discs, but this lichen has notably rounded to short lirelliform ascomata,
142 a thick thallus (100–300 µm) and 3-septate ascospores (Sparrius 2004).

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

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

147

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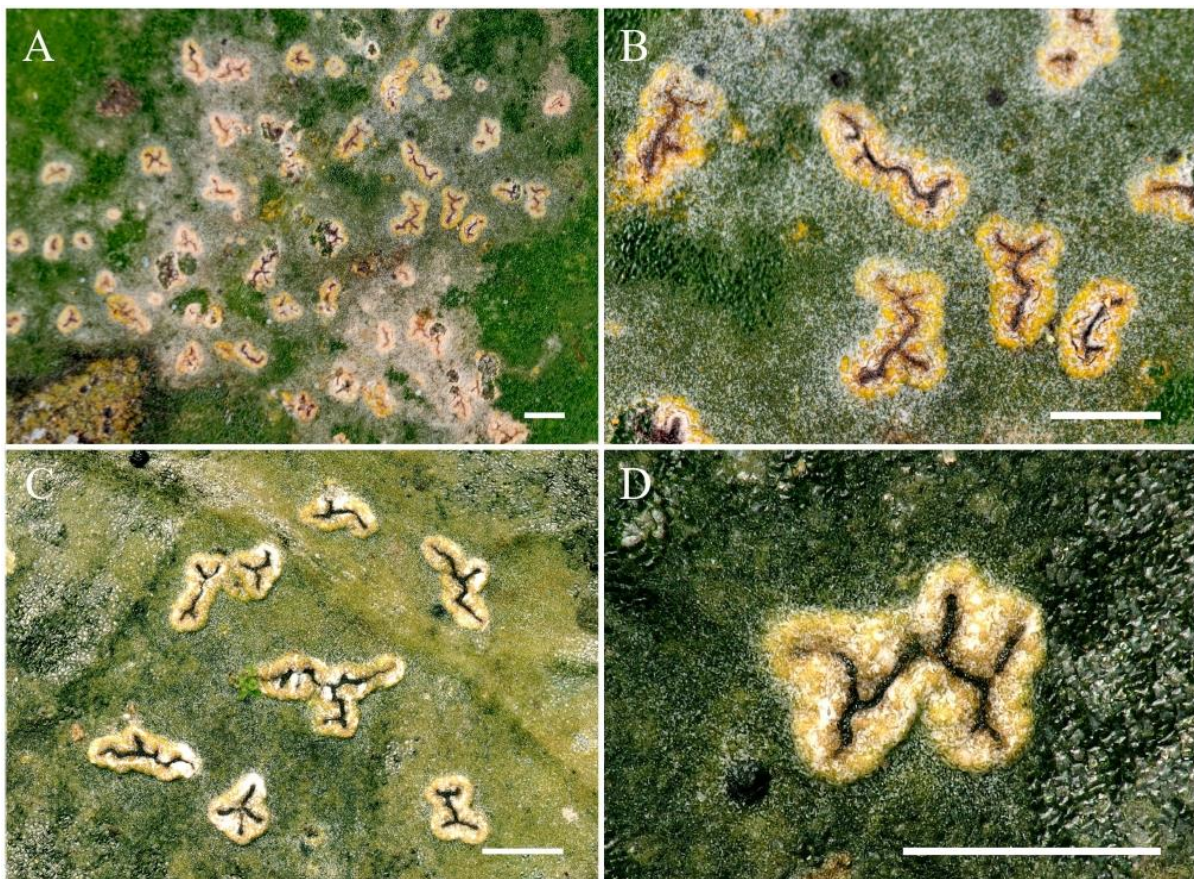
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156 **References**

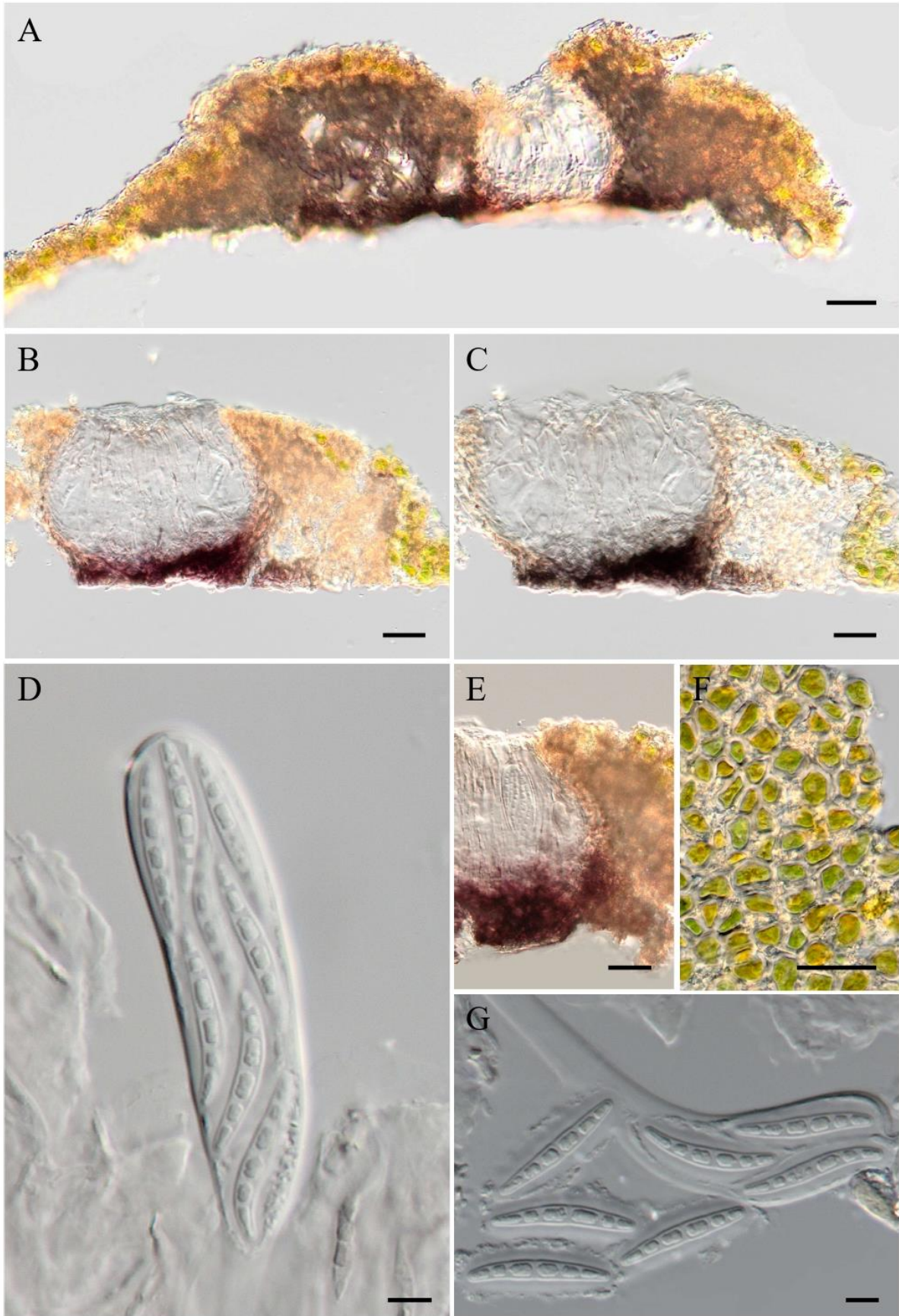
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- 228



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



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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

235 layer covering the surface of the pseudostromata (in water). C. Cross-section of an ascoma in
236 K (note the color of the hypothecium that became black and the dissolution of the crystals in
237 the margin that became more transparent). F. Thallus with trentepohlioid photobiont in irregular
238 plates (in water). D. Ascus with spores (in water). G. Ascospores (in water). Scales: A–C, E–F
239 = 20 μm , D & G = 5 μm . Photos by Damien Ertz & Elise Lebreton.

240