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TWO NEW LICHENICOLOUS SPECIES OF OPEGRAPHA FROM WESTERN SCOTLAND

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ABSTRACT. Two new lichenicolous species of *Opegrapha* (Opegraphaceae) are described from western Scotland: *O. brevis* (on *Thelotrema subtile*) and *O. thelotrematis* (on *Thelotrema lepadinum* and *T. monosporum*). Comparative notes are provided for all known lichenicolous species of *Opegrapha* occurring in the British Isles.

The large genus *Opegrapha* Ach. (Opegraphaceae) contains about 300 predominantly lichenized fungi. However, a few species are now understood to be lichenicolous fungi. These include: *O. brigantina* Haf. on *Brigantiaea* spp. in Australia and E Africa (Hafellner, 1985); *O. parasitica* (Massal.) Vězda, widely occurring in Europe on various crustose lichens (especially Verrucariaceae) on limestone, as well as on the foliose lichen *Xanthoria parietina* (on rocks and trees); *O. pertusariicola* Coppins & P. James on *Pertusaria leioplaca* DC. in the British Isles; *O. pulvinata* Rehm on *Dermatocarpon miniatum* agg. in Europe; and *O. rinodinae* Vězda on *Phaeorrhiza nimbosa* (Fr.) Mayrh. in Czechoslovakia and Norway (Vězda, 1969). Two additional species have been reported from oceanic woodlands in western Scotland, and have been referred to as '*Opegrapha* sp. A' and '*O.* sp. B' by Coppins & James (1979) and Hawksworth (1983). These are formally described below as *O. brevis* and *O. thelotrematis* respectively.

Opegrapha brevis Coppins, **sp. nov.** (Figs 1A, D–E; 2D–F).

Fungus lichenicola. *Ascomata* breviter lirelliformia vel elliptica, demum disciformia, simplicia vel raro breviter furcata, epruinosa, 0·14–0·46mm longa, 0·12–0·24mm lata. *Epithecium* fascum, K−. *Excipulum* laterale fuscoatrum, K+ viridiatrum, c.23–30μm latum; excipulum ad basim comparate debiliter evolutum, fuscum, K+ viridulum, 9–20μm latum. *Hymenium* 45–60μm altum; I+ caeruleum, demum sordide aeruginascens vel inferne sordide rubescens. *Paraphyses* parce ramosae, c.1.7–2μm crassae, versus apices usque 3·5μm crassae. *Asci* clavati, 38–51 × 12–15μm, 4-spori. *Ascosporae* 3-septatae, (14–)15–18(–19) × 4·5–5(–6)μm, hyalinae vel cum granulis brunneascentes. *Pycnidia* pauca, ± immersa, 50–70μm diam., conidiis bacilliformibus c.5–7 × 0·8μm.

Typus: Caledonia, Westerness, Loch Sunart, Laudale Woods, in valle angusta ad austro-orientem ex Laudale House, 17/75.59, in thallo *Thelotrematis subtilis* ad corticem *Coryli,* 9 iii 1983, *B. J. Coppins et P. M. Jørgensen,* Coppins 9346 (holo. E; iso. BM, GZU, UPS, US, hb Vězda).

Lichenicolous on thallus of *Thelotrema subtile* Tuck., often producing fawn-coloured necrotic patches. *Ascomata* scattered or somewhat clustered, black, epruinose, at first shortly lirellate with slit-like disc, but disc soon widely expanded and ascomata becoming ± elliptic or ± disciform when viewed from above (Fig. 1A); a few ascomata sometimes contorted or shortly once furcate; 0·14–0·46mm long, 0·12–0·24mm wide, 0·1–0·14mm high. Ascomata originating within the endophloeodal host thallus, emerging by rupture of overlying bark tissue. *Excipulum* well-

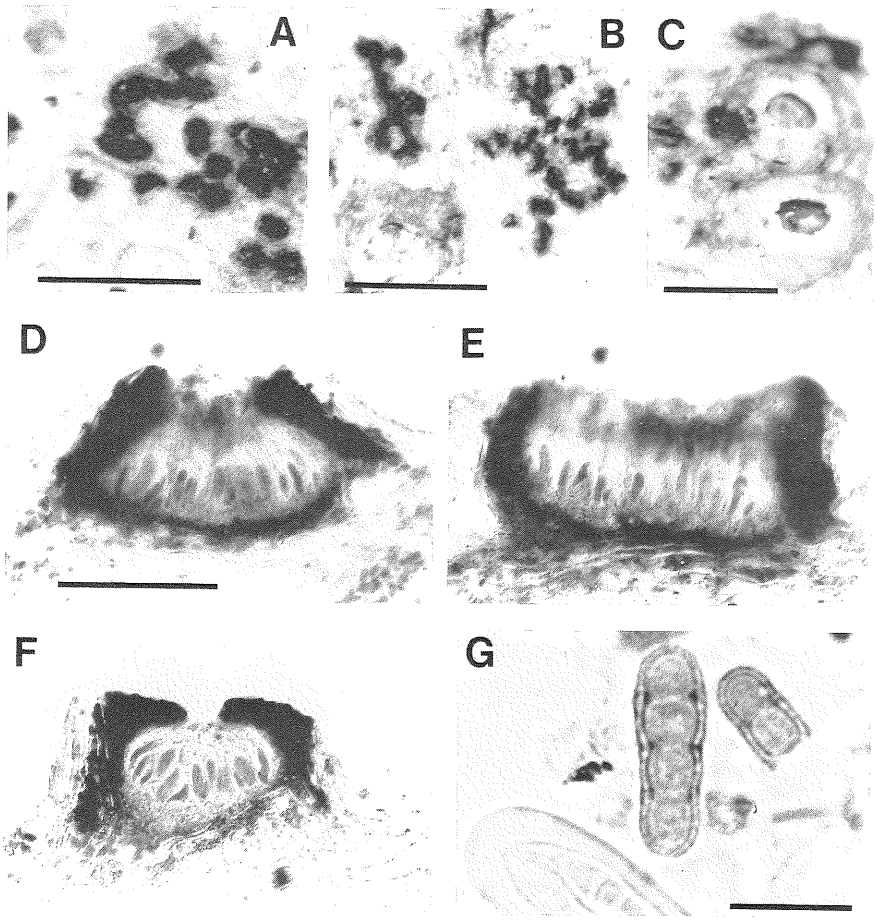


FIG. 1. A & D–E, *Opegrapha brevis* (holotype). B–C & F–G, *O. thelotrematis* (holotype). A–C, ascomata on host thalli or apothecia (in C). D–E, vertical sections of ascomata of *O. brevis,* showing almost closed and fully expanded disc, respectively; note the dark epithecial zone. F, vertical section of ascoma of *O. thelotrematis*; note absence of a dark epithecium. G, ascospore with pigmented epispore. Scales: A–C = 1mm; D–F = 100μm; G = 10μm.

developed laterally, c.23–30μm wide (Fig. 1D–E), brown-black, K+ greenish, composed of closely compacted hyphae, c.2–3·5μm wide, together with upwardly reflexed bark cells. Excipulum at base of ascoma c.9–20μm wide, rather irregular and containing bark cells, dark brown, K+ greenish. *Epithecium* dilute fuscous brown, K−, with pigment in the form of minute granules deposited in the gel matrix and around the outside of the apices of paraphyses and asci. *Hymenium* 45–60μm tall, hyaline, I+ blue but gradually turning sordid blue-green or, in the lower half, reddish. *Subhymenium* indistinct, hyaline, c.5–10μm tall. *Paraphyses* (paraphysoids) sparingly branched, 1·7–2(–2·7)μm thick (in KOH), widening to 3·5μm in the epithecium. *Asci* clavate, 38–50 × 12–15μm, *Opegrapha*-type with minute dark amyloid apical ring, 4-spored at maturity. *Ascospores* 3-septate, upper two cells slightly wider, ends obtuse,

hyaline or becoming brown due to deposition of minute pigment granules on the epispore, (14–)15–18 × 4·5–5(–6)μm; epispore thin, <1μm wide (Fig. 2D–F). *Pycnidia* inconspicuous, ± immersed, usually in close proximity to ascomata, c.50–70μm diam.; walls dark brown, K+ greenish. *Conidiogenous cells* sessile or two or three borne on a conidiophore, ± cylindrical, 4–13 × 1·3–2μm. *Conidia* cylindrical, straight, simple, 5–7 × c.0·8μm.

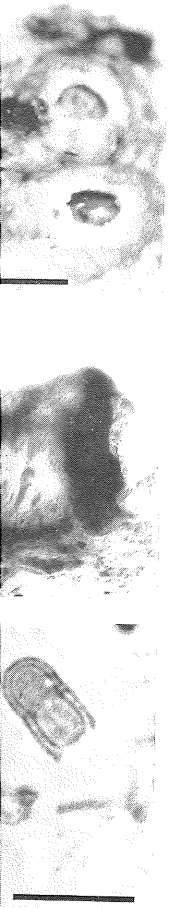
SCOTLAND. Westerness (v.c. 97): N side of Loch Sunart, Resipole Ravine, 17/76, 1983, *Coppins* 9427 (E); *ibidem*, Camasine [Ceol na mara], 17/76, 1983, *Coppins* 9240 (E). Argyll Main (v.c. 98): Seil, Ballachuan, 17/71, 1980, *Coppins* 8097 (E); S of Taynuilt, Glen Nant, 27/02, 1980, *Coppins* 8013 (E). Kintyre (v.c.101): Ellary Woods, by Abhainn Mhore, 16/77, 1976, *Coppins* 2625 (E). South Ebudes (v.c. 102): Islay, Ardilisty, 16/44, 1979, *V. J. Giavarini* (E). West Ross (v.c. 105): Inverpolly NNR, Rhegreanoch, 29/01, 1985, *R. G. Woods* (E). All collections on smooth bark of *Corylus*.

Opegrapha thelotrematis Coppins, **sp. no.** (Figs 1B–C, F–G; 2A–C).

Fungus lichenicola. *Ascomata* lirelliformia, interdum aggregata, simplicia vel interdum breviter furcata, epruinosa, 0·14–0·6(–0·8)mm longa, 0·1–0·14mm lata; disco rimiformi haud valde expanso. *Epithecium* nullum. *Excipulum* laterale fuscoatrum, K+ viridiatrum, c.20–36μm latum; excipulum ad basim irregulariter evolutum, fuscum, K+ viridulum, c.15–20μm latum. *Hymenium* 45–60μm altum, I+ caeruleum demum rubescens. *Paraphyses* multum ramosae, 1–2μm crassae. *Asci* clavati, 35–50 × 12–13μm, 6–8-spori. *Ascosporae* 3-septatae, 13·5–17 × (4–)4·5–5·5(–6)μm, hyaline vel cum granulis brunneascentes. *Pycnidia* pauca, ± immersa, 50–70μm diam., conidiis ± bacilliformis, c.3·5–4·8 × 0·8μm.

Typus: Caledonia, Argyll, ad meridiem ex Taynuilt, Glen Nant, 27/02, in thallo *Thelotrematis lepadini* ad corticem *Coryli*, 3 viii 1980, *B. J. Coppins* 8037 (holo. E).

Lichenicolous on thalli or ascomatal verrucae (Fig. 1B–C) of *Thelotrema lepadinum* (Ach.) Ach. or *T. monosporum* Nyl., often producing fawn-coloured necrotic patches. *Ascomata* scattered or frequently in dense clusters up to 1mm across, black, epruinose, lirellate, simple or occasionally shortly 1–3-furcate, with persistently slit-like disc; 0·14–0·6(–0·8)mm long, 0·1–0·14mm wide, 0·1–0·12mm high. Ascomata originating within the endophloeodal host tissue, emerging by rupture of overlying bark tissue. *Excipulum* well-developed laterally (Fig. 1F), c.20–36μm wide, brown-black, K+ greenish, composed of closely compacted hyphae, c.2–3·5μm wide, together with upwardly reflexed bark tissue. Excipulum at base of ascoma c.15–20μm wide, but often irregular with a few hyphae penetrating deeper into the substratum, incorporating bark cells, dark brown, K+ greenish. *Epithecium* absent, the excipulum remaining incurved over the top of the hymenium except for the narrow slit. *Hymenium* 45–60μm tall, hyaline, I+ blue gradually turning reddish. *Subhymenium* 10–15μm tall, hyaline. *Paraphyses* (paraphysoids) richly branched, c.1–2μm wide (in KOH), most with their apices remaining attached to the overlying excipulum. *Asci* clavate, 35–50 × 12–13μm, *Opegrapha*-type with minute, dark amyloid apical ring (Fig. 2A), 6–8-spored at maturity. *Ascospores* as for *O. brevis*, 13·5–17 × (4–)4·5–5·5 (–6)μm (Figs 1G, 2A–B). *Pycnidia* as for *O. brevis*. *Conidiogenous cells*



s (holotype). A–
ascomata of *O.*
dark epithecial
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= 10μm.

-black, K+
·5μm wide,
se of ascoma
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around the
5–60μm tall,
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Paraphyses
(in KOH),
) × 12–15μm,
4-spored at
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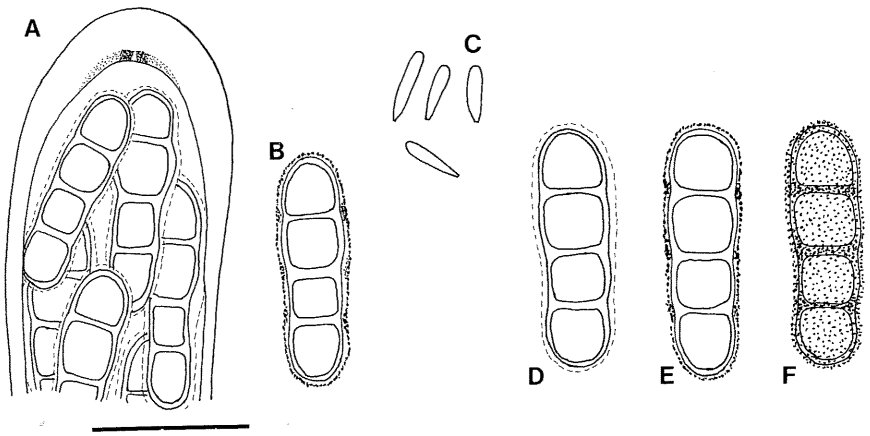


FIG. 2. A–C, *Opegrapha thelotrematis* (holotype). D–F, *O. brevis* (holotype). A, upper part of ascus in Lugol's iodine after pretreatment in KOH (amyloid parts stippled), showing dark amyloid apical ring. B & D–F, ascospores: young spore with hyaline epispore (D); mature spores with pigmented epispore in optical section (B & E) or surface view (F). C, conidia. Scale = 10μm.

sessile or 1–3 borne on a conidiophore, narrowly lageniform to ± cylindrical, 5–12 × 1·2–1·7μm. *Conidia* short-cylindrical or slightly broader towards proximal end, straight, simple, 3·5–4·8 × c.0·8μm (Fig. 2C).
SCOTLAND. Westerness (v.c. 97): N side of Loch Sunart, Resipole Ravine, 17/76, on *T. lepadinum,* 1983, *Coppins* 9430 (E); S side of Loch Sunart, Laudale Woods, ravine to SE of Laudale House, 17/75, on *T. monosporum,* 1983, *Coppins* 9338 (E). Argyll Main (v.c. 98): Seil, Ballachuan, 17/71, on *T. monosporum,* 1976, *Coppins* 2559 (E); *ibidem,* 1980, *Coppins* 8107 (E); Benderloch, Lochnell House, 17/8838, on *T. lepadinum,* 4 iii 1980, *P. W. James* (BM); S of Taynuilt, Glen Nant, 27/02, on *T. lepadinum,* 1985, *Coppins* 11181 (E). All collections on smooth bark of *Corylus.*

Opegrapha brevis and *O. thelotrematis* occur on the same host genus and were at first thought to be the same parasitic species. However, additional collections showed that the parasite of *Thelotrema subtile* (i.e. *O. brevis*) differs from that on *T. lepadinum* and *T. monosporum* (i.e. *O. thelotrematis*) in having relatively shorter and broader ascomata with an expanding disc, 4-spored asci, stouter and less branched paraphyses, and longer conidia. *O. thelotrematis* differs further in lacking an epithecium (cf. Figs 1D–E & 1F). The excipulum of both species turns greenish in KOH, a feature common to *O. pertusariicola* (Coppins & James, 1979); these three species are certainly closely related, although *O. pertusariicola* has (5–)6-septate ascospores. It is interesting to note that these three species are found only when their hosts are growing on *Corylus. Thelotrema lepadinum* and *Pertusaria leioplaca* very commonly occur on other trees, but have never, in such cases, been seen to be infected by the *Opegrapha* species—despite careful searching.

The two remaining lichenicolous *Opegrapha* species reported from Britain, *O. parasitica* and *O. pulvinata,* have larger ascomata with an

excipulum that does not turn greenish in KOH. *O. pulvinata* differs from the other four species in that its spores soon become dark brown due to pigmentation of the spore-wall, and not the epispore. This feature is shared by a small, anomalous collection (Somerset, Mendip Hills, Dolebury Warren, on unidentified crustose lichen on Carboniferous limestone, 1984, *Coppins* 10119, E) which could otherwise be mistaken for *O. parasitica*; further collections are required to establish if an undescribed species is involved.

The main diagnostic characters of the five named parasitic *Opegrapha* species found in the British Isles are given in Table 1. It should be noted that the conidia in all these species are straight; curved conidia, as found in *O. vulgata* auct. and *O. niveoatra* (Borrer) Laundon, have not been observed.

Observations of young asci of *O. brevis* and *O. thelotrematis* show that reductions in ascospore number result from the abortion of two or four spores prior to the stage when septa first appear. The same may be true in the case of *O. pertusariicola,* but no more than four spores have been detected, even in young asci prior to the delimitation of septa.

In the British Isles, species of *Thelotrema* have few additional fungal parasites or parasymbionts. *Skyttea nitschkei* (Körber) Sherw., D. Hawksw. & Coppins, a common parasite of *T. lepadinum,* has urceolate ascomata with 0–1-septate ascospores, 8–13 × 2–3μm (Sherwood et al., 1981). The dematiaceous hyphomycete, *Taeniolella delicata* M. S. Christ. & D. Hawksw., parasitizes several crustose lichens, and has been reported on *Thelotrema subtile* (Hawksowrth, 1983).

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TABLE 1

Diagnostic features of British lichenicolous *Opegrapha* species.

	O. brevis	**O. thelotrematis**	**O. pertusariicola**	**O. parasitica**	**O. pulvinata**
Ascoma width (mm)	0·12–0·24	0·1–0·14	0·15–0·2	0·2–0·3	0·16–0·3
Ascoma height (mm)	0·1–0·14	0·1–0·12	0·1–0·15	0·15–0·21	0·2–0·24
Excipulum width (μm)	23–30	20–36	25–60	33–35	35–50
Excipulum in K	greenish	greenish	greenish	brown with reddish tinge	brown with reddish or yellowish tinge
Epithecium	present	absent	present	present	present
Spore septa	3	3	(5–)6	3	3
Spore size (μm)	(14–)15–18 × 4·5–5(–6)	13·5–17 × (4–)4·5–5·5(–6)	21–28 × 4·5–6	14–22 × 5–8	(18–)20–24(–26) × 6–8
Location of spore pigment	epispore	epispore	epispore	epispore	spore wall
Spores/ascus	4	6–8	4	8	8
Conidiogenous cells, length (μm)	4–13	5–12	7–12	7–11	10–18
Conidia (μm)	5–7 × c. 0·8	3·5–4·8 × c. 0–8	3·3–4 × c. 0·8	3·7–4·8 × c. 0·8	6·5–7 × 1–1·5
Host	*Thelotrema subtile*	*Thelotrema lepadinum* and *T. monosporum*	*Pertusaria leioplaca*	crustose Verrucariaceae and *Caloplaca cirrochroa* on limestone; also on *Xanthoria parietina*	*Dermatocarpon miniatum* agg.