

New lichenicolous *Opegrapha* species on *Caloplaca* from Europe

Jan VONDRÁK and Jana KOCOURKOVÁ

Abstract: Fifty-six known lichenicolous, non-lichenized *Opegrapha* (Roccellaceae, Arthoniales) species (containing some undescribed taxa) are listed here, five of which are known from *Caloplaca* (Teloschistaceae, Teloschistales). *Opegrapha vulpina*, a new lichenicolous fungus on endolithic *Caloplaca* subg. *Pyrenodesmia* (*Caloplaca erodens* and rarely *C. albopruinosa*), is described from Europe. A second new species, *Opegrapha hellespontica*, lichenicolous on *Caloplaca aurantia*, is described from the European part of Turkey. Two possible sibling species of *Opegrapha rupestris* s. l. lichenicolous on *Caloplaca cirrochroa* and *C. variabilis* s. l., respectively, are discussed in the paper, but have not been described.

Key words: Arthoniales, lichenicolous fungi, *Opegrapha hellespontica*, *Opegrapha vulpina*, Roccellaceae

Introduction

The large cosmopolitan genus *Opegrapha* (Roccellaceae, Arthoniales, sensu Eriksson 2006) contains mainly lichenized fungi, but a number of non-lichenized, lichenicolous fungi have also been described and placed in it. Fifty-six lichenicolous species of *Opegrapha* are listed in Table 1 (with their heterotypic synonyms). More than one third of them have been described from tropical regions, often from foliicolous lichens, and only 23 species are known from Europe. The majority of these lichenicolous *Opegrapha* species are strongly host specific (to one species or to a group of closely related species). Some lichenicolous species, formerly placed in *Opegrapha*, have been segregated into the genus *Plectocarpon* (Ertz *et al.* 2005) or are being transferred to *Phacothecium* (J. Hafellner, pers. comm.).

Only a few *Opegrapha* species are known from members of *Teloschistaceae*. *Opegrapha*

physciaria (syn. *Phacothecium varium* (Tul.) Trevis.) was described from *Xanthoria parietina* (L.) Th. Fr. (Nylander 1897). However, *O. physciaria* with its brown-black rounded apothecia and exposed discs seems, for example, to be closely related to *O. rotunda* and *O. zwackhii* (*cf.* Hafellner 1994a) and it is obviously different from the species lichenicolous on *Caloplaca* discussed here. *Opegrapha physciaria* was also reported on *Caloplaca rosei* Hasse (Cole & Hawksworth 2001) from North America, but the fungus on this host has subsequently been identified as *Stigidium cerinae* Cl. Roux & Triebel s. l. (Ertz & Egea 2008). Three different hosts are indicated in the protologue of *Opegrapha insidens* (J. Steiner) S. Y. Kondr., *Caloplaca circumalbata* var. *candida* (Stizenb.) Wunder, *C. pyracea* (Ach.) Th. Fr. and *Verrucaria buschirensis* J. Steiner, but this name needs neotypification (the type specimen is missing from W and WU) and its type host should be selected.

During our fieldwork and revision of herbarium material, some lichenicolous *Opegrapha* specimens on thalli of various species of *Caloplaca* (*Teloschistaceae*) were collected and examined: *C. albopruinosa* (Arnold) H. Olivier, *C. aurantia* (Pers.) Hellb., *C. erodens* Tretiach, Pinna & Grube,

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TABLE 1. List of lichenicolous, non-lichenized *Opegrapha* species. The species indicated by an asterisk are known from Europe. Host species of type is in bold

Species	Host	References
* <i>O. anomea</i> Nyl. (syn.: <i>O. wetmorei</i> Cole & D. Hawksw., <i>O. pertusariae</i> (Vouaux) Hafellner, <i>O. quaternella</i> Nyl., and possibly <i>Leciographa weissii</i> Körb.)	<i>Pertusaria amara</i> , <i>P. epixantha</i> , <i>P. exalbescens</i> , <i>P. velata</i> , <i>Pertusaria</i> sp., <i>Ochrolechia trochophora</i> , <i>O. androgyna</i> , <i>Ochrolechia</i> sp.	Vouaux (1913: 440); Hafellner (1994a); Cole & Hawksworth (2001); Ertz <i>et al.</i> (2004); Santesson <i>et al.</i> (2004)
<i>O. bacidiae</i> R. Sant. nom. ined.	“<i>Bacidia</i>” <i>brasiliensis</i>	Santesson (1952); Clauzade <i>et al.</i> (1989); Matzer (1996)
<i>O. blakii</i> Ertz & Diederich	<i>Ochrolechia</i> aff. <i>androgyna</i> , sterile, corticolous, sorediate, K –, C+ red, KC+ red, UV –	Ertz <i>et al.</i> (2004)
* <i>O. brevis</i> Coppins	<i>Thelotrema petractoides</i> (syn. <i>Thelotrema subtile</i> auct. brit.)	Coppins (1987)
<i>O. brevissima</i> Kalb & Hafellner	<i>Haematomma hilare</i>	Kalb <i>et al.</i> (1995)
<i>O. brigantina</i> Hafellner	<i>Brigantiaea leucoxantha</i> , <i>B. microcarpa</i>	Hafellner (1985)
<i>O. cladonicola</i> Ertz & Diederich	<i>Cladonia ochrochlora</i>	Ertz & Diederich (2003)
<i>O. cryptotheciae</i> Matzer	<i>Cryptothecia candida</i>	Matzer (1996)
<i>O. diffracticola</i> R. C. Harris & Ladd	<i>Bacidia diffracta</i>	Harris & Ladd (2007)
<i>O. ectolechiacearum</i> Matzer (syn. <i>O. sporopodii</i> R. Sant. nom. inval.)	<i>Calopadia fusca</i> , <i>Loflammia flammea</i> , <i>Sporopodium flavescens</i> <i>S. leprieurii</i>	Matzer (1996); Lücking <i>et al.</i> (2000)
<i>O. epiporina</i> Matzer (syn. <i>O. porinae</i> Lücking nom. inval.)	<i>Porina epiphylla</i> , <i>Phyllophiale alba</i>	Matzer (1996)
<i>O. encephalographoidea</i> Diederich & Aptroot	<i>Pyrenula</i> sp.	Aptroot <i>et al.</i> (1997)
<i>O. foreaui</i> (Moreau) Hafellner & R. Sant. (syn. <i>O. trassii</i> S. Y. Kondr. & Coppins)	<i>Heterodermia albicans</i> , <i>H. lepidota</i> , <i>H. leucomelaena</i> , <i>H. leucomela</i> , <i>H. leucomela</i> ssp. <i>boryi</i> , <i>H. magellanica</i> , <i>H. obscurata</i> , <i>H. pseudospeciosa</i> , <i>H. speciosa</i> , <i>H. sp.</i>	Moreau (1951); Coppins & Kondratyuk (1998); Hafellner (2002)
* <i>O. geographicola</i> (Arnold) Hafellner	<i>Rhizocarpon geographicum</i>	Hafellner (1994a)
* <i>O. glaucomaria</i> (Nyl.) Källsten ex Hafellner (syn. <i>O. maculans</i> (Arnold) Hafellner)	<i>Lecanora bicincta</i> , <i>Lecanora rupicola</i> , <i>Protoparmelia badia</i>	Hafellner (1994a, b); Santesson <i>et al.</i> (2004)
* <i>O. hellespontica</i> Vondrák & Kocourk.	<i>Caloplaca aurantia</i>	This paper
<i>O. insidens</i> (J. Steiner) S. Y. Kondr.	<i>Verrucaria buschirensis</i> , <i>Caloplaca circumalbata</i> var. <i>candida</i> , <i>C. pyracea</i>	Vouaux (1913: 492); Kondratyuk & Kudratov (2002)

TABLE 1. *Continued*

Species	Host	References
<i>O. kalbii</i> Matzer	<i>Byssoloma polychromum</i>	Matzer (1996)
* <i>O. lamyi</i> (O. J. Rich. ex Nyl.) Triebel	corticulous <i>Lecanora</i> sp. , (<i>Lecanora subfusca</i> gr.)	Triebel (1989); Hafellner (1994a)
<i>Plectocarpon leuckertii</i> (S. Y. Kondr. & Galloway)	<i>Pseudocyphellaria intricata</i> , <i>P. norvegica</i>	Kondratyuk & Galloway (1995); Ertz <i>et al.</i> (2005)
Ertz & Diederich (syn. <i>O. leuckertii</i> S. Y. Kondr. & Galloway)		
<i>O. lichenicola</i> Thor, Lücking & Tat. Matsumoto	<i>Porina</i> sp.	Thor <i>et al.</i> (2000)
<i>O. maligna</i> Triebel	<i>Lecidea fuscoatra</i>	Triebel (1989)
<i>O. matzeri</i> Lücking	<i>Amazonomyces sprucei</i>	Lücking (1998)
<i>O. mazosiae</i> Matzer	<i>Mazosia melanophthalma</i> , <i>M. phyllosema</i> , <i>M. rotula</i>	Matzer (1996)
<i>O. melanospila</i> Müll. Arg.	<i>Pertusaria perforata</i> var. <i>ciliata</i> , <i>Parmotrema</i> sp., <i>Rimelia reticulata</i>	Clauzade <i>et al.</i> (1989); Santesson (2001); Etayo (2002); Diederich (2003); Etayo & Boom (2006)
* <i>O. parasitica</i> (A. Massal.) H. Olivier (syn. <i>O. parasitica</i> var. <i>mutitata</i> (Arnold) H. Olivier; <i>O. persoonii</i> auct. brit.)	<i>Aspicilia calcarea</i>	Hafellner (1994a)
* <i>O. peltigerae</i> R. Sant. nom. ined.	<i>Peltigera aphthosa</i>	Santesson <i>et al.</i> (2004)
<i>O. perturbans</i> Follmann	<i>Ingaderia pulcherrima</i>	Folman & Werner (2003)
* <i>O. pertusariicola</i> Coppins & P. James	<i>Pertusaria leioplaca</i>	Coppins & James (1979); Pentecost & James (1992)
* <i>O. phlyctidicola</i> (Vouaux) Etayo	<i>Phlyctis agelaea</i> , <i>Phlyctis argena</i>	Etayo (1996)
<i>O. phyllobathelii</i> Matzer & R. Sant.	<i>Phyllobathelium epiphyllum</i>	Matzer (1996)
<i>O. phylloporinae</i> Müll. Arg.	<i>Porina epiphylla</i> , <i>P. conica</i> , <i>P. epiphylla</i> coll., <i>P. cf. lucida</i> , <i>P. similis</i> , <i>P. virescens</i>	Clauzade <i>et al.</i> (1989); Matzer (1996)
* <i>O. physciaria</i> (Nyl.) D. Hawksw. & Coppins (syn. <i>Phacothecium varium</i> (Tul.) Trevis.)	<i>Xanthoria parietina</i>	Nylander (1897: 8, 9); Atienza (1992); Coppins <i>et al.</i> (1992)
<i>O. physcidiae</i> Kalb & Elix	<i>Physcidia australasica</i>	Kalb & Elix (1995)
<i>O. plectocarpoidea</i> Diederich	<i>Phaeographis</i> sp.	Aptroot <i>et al.</i> (1997)
<i>O. porinicola</i> Matzer	<i>Porina epiphylla</i> , <i>P. mirabilis</i> , <i>Phyllophiale alba</i>	Matzer (1996); Lücking (1998)
* <i>O. pulvinata</i> Rehm	<i>Catapyrenium</i> , <i>Dermatocarpon miniatum</i> , <i>Endocarpon pusillum</i> , <i>Staurothele catalepta</i>	Pentecost & James (1992); Kondratyuk & Kudratov (2002); Nimis (2003)

TABLE 1. *Continued*

Species	Host	References
<i>O. reinkellae</i> Follmann	<i>Roccella lirellina</i>	Folman & Werner (2003)
* <i>O. rinodinae</i> Vězda	<i>Phaeorhiza nimbosea</i>	Vězda (1969); Clauzade <i>et al.</i> (1989); Hafellner (1994a)
<i>O. romsae</i> S. Y. Kondr. & Kudratov	<i>Staurothele areolata</i>	Kondratyuk & Kudratov (2002)
* <i>O. rotunda</i> Hafellner	<i>Physconia distorta</i>	Hafellner (1994a)
* <i>O. rouxiana</i> Nav.-Ros. & Hladun	<i>Polyblastia nidulans</i>	Navarro-Rosinés & Hladun (1995)
* <i>O. rupestris</i> Fr. (syn. <i>O. centrifuga</i> A. Massal.; <i>O. persoonii</i> Ach.)	<i>Thelidium incavatum</i> , <i>Verrucaria calciseda</i> , <i>Verrucaria</i> subg. <i>Bagliettoa</i> , <i>V. hochstetteri</i>	Hafellner (1994a); Kondratyuk & Kudratov (2002)
* <i>Opegrapha</i> aff. <i>rupestris</i> – 1 (syn. <i>O. parasitica</i> auct. brit. p.p.)	<i>Caloplaca cirrochroa</i>	Pentecost & James (1992), this paper
* <i>Opegrapha</i> aff. <i>rupestris</i> – 2	<i>Caloplaca variabilis</i>	This paper
<i>O. sipmanii</i> Matzer	<i>Porina epiphylla</i> , <i>Porina epiphylla</i> coll., <i>P. mirabilis</i>	Matzer (1996); Lücking (1998)
* <i>O. sphaerophoricola</i> Isbrand & Alstrup	<i>Sphaerophorus globosus</i>	Isbrand & Alstrup (1992)
<i>O. sporopodiae</i> R. Sant. nom. ined.	on foliose foliicolous lichens	Santesson (1952); Clauzade <i>et al.</i> (1989)
* <i>O. stereocaulicola</i> Alstrup & D. Hawksw.	<i>Stereocaulon alpinum</i> and <i>Stereocaulon</i> sp.	Alstrup & Hawksworth (1990)
<i>O. stigmodes</i> Nyl.	<i>Clathroporina eminentio</i>	Clauzade <i>et al.</i> (1989)
<i>O. strigulae</i> R. Sant. ex Matzer & R. Sant.	<i>Strigula nemathora</i> , <i>S. smaragdula</i> , <i>S. subelegans</i> , <i>S. subtilissima</i>	Clauzade <i>et al.</i> (1989); Matzer (1996); Lücking (1998)
* <i>O. thelotrematis</i> Coppins	<i>Thelotrema lepadinum</i> , <i>T. monosporum</i>	Coppins (1987)
<i>O. uniseptata</i> Matzer	<i>Porina atropuncta</i> , <i>Strigula smaragdula</i> and ?<i>S. scizospora</i>	Matzer (1996); Lücking (1998)
<i>O. velata</i> (Müll. Arg.) Vain.	<i>Actinoplaca vulgaris</i> , <i>Calenia</i> sp., ? <i>Echinoplaca</i> sp., ? <i>Gyalectidium caucasicum</i> , <i>G. filicinum</i> , <i>Tricharia heterella</i>	Clauzade <i>et al.</i> (1989); Matzer (1996); Lücking (1998)
* <i>O. vulpina</i> Vondrák & Kocourk.	<i>Caloplaca erodens</i> , <i>C. albopruinosa</i> (= <i>C. agardhiana</i> auct.)	This paper
* <i>O. zwackhii</i> (A. Massal. ex Zwackh) Källsten in Hafellner	<i>Phlyctis argena</i>	Clauzade <i>et al.</i> (1989); Hafellner (1994a)

C. cirrochroa (Ach.) Th. Fr and *C. variabilis* (Pers.) Müll. Arg. s. l. All these *Opegrapha* specimens examined are morphologically rather similar and probably related to *O. rupestris*. *Opegrapha rupestris* s. l., is introduced here as a provisional group containing morphologically uniform species, lichenicolous on various calcicolous lichens and possessing slit-like, rather unexposed apothecial discs and 3-septate ascospores, 13–22 × 5–8 µm, hyaline, but brown and finely granular when old. Two new species are described.

Materials and Methods

Most of the material examined was collected by the authors; vouchers are deposited in CBFS and PRM. Some additional material was obtained from herbaria C, GZU, PRM and TSB.

Measurements used for statistical calculations were made on hand-cut sections and squash preparations on a light microscope with an oil-immersion lens after pre-treatment with 10% KOH solution in water. Accuracies within 0.5 µm (conidia and ascospores), 1 µm (asci and exciple) and 10 µm (hymenium and apothecia) were achieved. The size of ascospores was determined without the perispore, and all cell measurements included their walls. The measurements are given as (min.–) x ± SD (–max.), where x = mean value and SD = standard deviation; total numbers of measurements (*n*) given in parentheses. Measurements were taken from all specimens available, but pycnidia were only observed in some of the material.

Macro- and micro-photographs were taken with a digital camera Olympus C5050 on Olympus SZX 9 Stereomicroscope and Olympus BX 50 (to × 1250) fitted with a Nomarski differential interference contrast.

The nomenclature of lichenicolous *Opegrapha* species and their hosts follows the references in Table 1. The nomenclature of the other lichen-forming fungi and lichenicolous fungi follows Nimis & Martellos (2003) or Santesson *et al.* (2004).

Material used for comparison. *Opegrapha parasitica*. **Romania:** Dobrogea: Tulcea, Enisala, on *Aspicilia calcarea*, 2007, *ŷ. Vondrák* (CBFS JV5134, dupl. PRM 857468).—**Turkey:** Black Sea coast, Sinop, Ayancik, on *A. calcarea*, 2007, *ŷ. Vondrák* (CBFS JV5138, dupl. PRM 857469).—**Ukraine:** Crimean Peninsula: Karadag, on *A. calcarea*, 2007, *ŷ. Vondrák* (CBFS JV5133, dupl. PRM 857467); Demerji Yayla, on *A. calcarea*, 2006, *ŷ. Vondrák* (CBFS JV5949).

Opegrapha rupestris. **Bulgaria:** The Rhodopes: Devin, Trigrad, on *Verrucaria calciseda*, 2002, *ŷ. Vondrák* (CBFS JV747).—**Czech Republic:** Central Bohemia: Beroun, Srbsko, on *V. cf. calciseda*, 2004, *ibid.* 2006, *ŷ. Vondrák* (CBFS JV2470, 4917); *ibid.*, 2001, *ŷ. Kocourková* (PRM 896009). *South Moravia:* Blansko,

Skalni Mlin, on *Verrucaria baldensis* and *V. parmigerella*, 2005, *ŷ. Kocourková* (PRM 909041).—**Italy:** Sicily: Distr. Cágliari, Beggerru, on endolithic *Verrucaria*, 1986, *H. Mayrhofer* (GZU); Distr. Siracusa, Cap Campolato, on *Verrucaria* sp., 1969, *S. Svane* (C). **Slovak Republic:** Western Slovakia: Západné Tatry Mts, on *Verrucaria cf. calciseda*, 1990, *ŷ. Horáková* (PRM 758582).—**Serbia:** Cupria, 1970, *S. Svane* (C, sub *Melaspilea elisae*).—**Turkey:** Black Sea coast, Istanbul, Kemberburgaz, on limestone rock in supralittoral zone, on *Verrucaria* sp., 2005, *ŷ. Vondrák* (CBFS JV3378).—**Ukraine:** Crimean Peninsula: Karadag, on *Verrucaria cf. calciseda*, 2007, *ŷ. Vondrák* (CBFS JV5469).

The Species

Opegrapha hellespontica Vondrák & Kocourk. sp. nov.

Mycobank no.: MB 511609

Fungus lichenicola, non-lichenisatus, in *Caloplaca aurantia* vigens. Similis speciei *Opegrapha rupestris* s.l. sed differt apotheciis conferte in agglomerationes rotundatas latasque congregatis.

Typus: Turkey, Gallipoli Peninsula (Gelibolu yarımadası), coast of Dardanelles, SE-exposed coastal limestone cliffs 1 km NE of Abide monument, alt. c. 5 m, 40°03'12.27"N, 26°13'41.24"E, on thallus of *Caloplaca aurantia*, 11 April 2007, *ŷ. Vondrák* (CBFS JV5137—holotypus, PRM 857463—isotypus; other isotypi will be distributed in *Exs. Lichenotheca Graecensis*).

(Fig. 1)

Vegetative thallus non-lichenized, inconspicuous, immersed in the host tissues, formed by colourless hyphae, hardly distinguishable from the host hyphae.

Ascomata lirelliform or ellipsoid apothecia (Fig. 1C), sessile, (0.24–) 0.46 ± 0.13 (–0.73) × (0.15–) 0.24 ± 0.04 (–0.31) mm (*n*=20), usually gathered into tight round aggregates (0.3–) 0.7 ± 0.2 (–1.0) mm diam. (*n*=10) (Fig. 1D). Apothecial primordia and young apothecia round, c. 0.13–0.18 mm diam. Apothecial disc a slit or slightly exposed when old, black, epruinose. *Exciple* carbonized, (20–) 50 ± 19 (–80) µm thick (*n*=19), formed of paraplectenchymatous irregularly thick-walled cells, (4.5–) 6.25 ± 1.0 (–8.0) µm diam. (*n*=15). Width of exciples increases proportionally to size of apothecia. *Hymenium* hyaline, (80–)

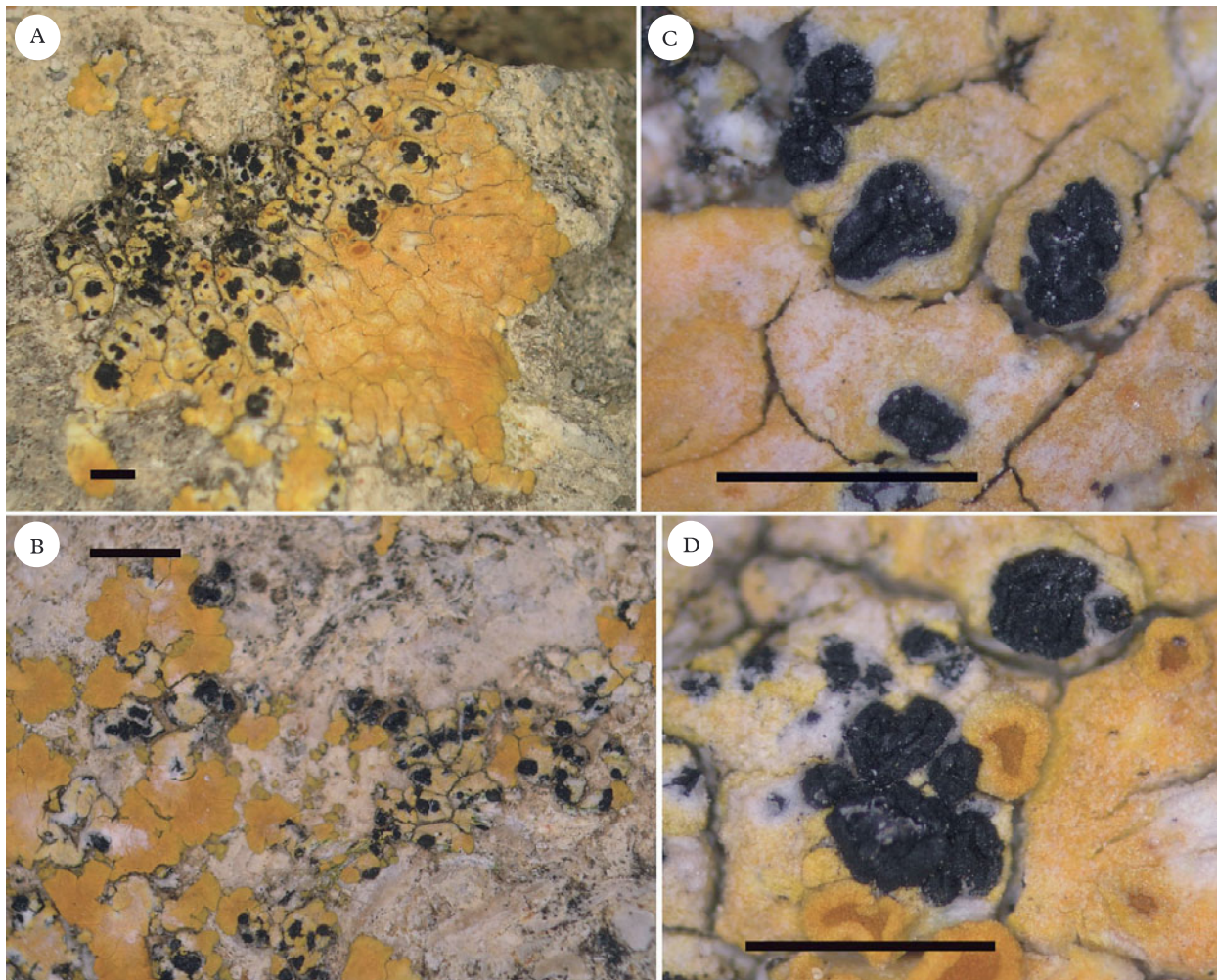


FIG. 1. *Opegrapha hellespontica* (holotype). A, heavily infected central part of host thallus; B, heavy infection causing fragmentation of the host thallus; C, detail of apothecia; D, apothecia gathered into tight round aggregate. Scales: A, C & D=1 mm; B=2 mm.

103 ± 14 (–130) µm high ($n=15$). *Epihymenium* covered by brown granules insoluble in KOH and HNO₃. *Subhymenium* colourless, *c.* 30–40 µm high, formed of prosoplectenchymatous, *c.* 2–4 µm thick cells, oil-drops up to 4 µm diam. occasionally present. *Hypothecium* brown-black, *c.* 20–30 µm high. *Paraphysoids* branched and anastomosing, *c.* 1.5–3 µm thick, with brown pigmented, broadened tips, up to 5 µm. *Asci* fissitunicate, narrowly clavate with a tholus and internal apical beak, *Opegrapha*-type, (6–7–) 8-spored, (46–) 60 ± 9 (–71) × (15–) 16 ± 1 (–19) µm ($n=12$), length/breadth ratio *c.* 3.75. *Ascospores* 3-septate, narrowly ellipsoid to slightly clavate, up to maturity hyaline, (14.0–) 16.8 ± 1.25 (–19.0) × (5.0–) 6.5 ± 0.75 (–7.5) µm ($n=26$), length/width ratio *c.* 2.6, halonate, with perispore *c.* 0.5–1.5 µm thick (not always observable) and spore wall *c.* 0.5 µm thick. Old ascospores brownish, with fine granular ornamentation.

Conidiomata not seen.

Chemical reactions. Hymenium and upper hypothecium I+ red (epihymenium I+ blue), hymenium KI+ blue. Granules in the exciple and epihymenium K–, N–.

Host. Lichenicolous in the thallus of *Caloplaca aurantia*. Infection is most frequently observed in the central part of the host thallus and avoids its marginal lobes (Fig. 1A). The fungus seems not to cause any conspicuous necroses, but strong infections may cause fragmentation of the host thallus (Fig. 1B).

Etymology. Hellespontos is an old Greek name for the famous Dardanelles between the Sea of Marmara and the Mediterranean Sea, where the type material of the new species was collected.

Ecology and distribution. The new species is apparently host specific on the thallus of *Caloplaca aurantia*, a common calcicolous lichen occurring throughout Europe, the Near East and North Africa. Since no lichenicolous *Opegrapha* species have been

reported on this widely distributed host, *O. hellespontica* may be a rare species currently known only from the type locality, on the European side of the Dardanelles. The type locality is on limestone in the xeric supralittoral zone, where the host species grows in a species-poor lichen community, with *Aspicilia contorta* subsp. *hoffmanniana* S. Ekman & Fröberg, *Caloplaca* cf. *navasiana* Nav.-Ros. & Cl. Roux, *Candelariella oleaginescens* Rond., *Diplotomma albotrium* (Hoffm.) Flotow. s.l., *Lecanora dispersa* (L.) Somerf. and *Toninia aromatica* (Sm.) A. Massal. In the type locality, *C. aurantia* is infected with other lichenicolous fungi, namely *Cercidospora caudata* Kernst., *Intra-lichen christiansenii* (D. Hawksw.) D. Hawksw. & M. S. Cole and *Muellerella lichenicola* (Sommerf.) D. Hawksw.

Remarks. Although known only from the type locality, we consider it as a good species, distinguished from the similar *Opegrapha rupestris* s. l. by its shortly lirelliform apothecia gathered into large round aggregations (Fig. 1D). It is also characterized by having long lirellae and a less exposed disc (compared with *O. parasitica*, *O. rupestris* and *O. aff. rupestris* 1 & 2; Table 2) and by larger ascospores and apothecia (compared with *O. vulpina*; Table 2).

***Opegrapha vulpina* Vondrák, Kocourk. & Tretiach sp. nov.**

Mycobank no.: MB 511610

Fungus lichenicola. Ascomata apothecia, rotunda, disciformia, sessilia, marginata, nigra, epruinata, solo (0.11–) 0.2 ± 0.04 (–0.3) mm in diametro. Ascospores 3-septatae, anguste ellipsoidae vel paulum clavatae, hyalinae vel collapsae brunneascentes, (11.5–) 14.5 ± 1.4 (–18.0) × (5.0–) 6.0 ± 0.7 (–8.0) µm. A *O. rupestris* et *O. parasitica* differt apotheciis minutis, rotundatis, non lirellatis, et ascosporis minutis.

Typus: Czech Republic, South Moravia, Pavlovské vrchy hills, Mikulov, Pavlov, ruin of castle Děvičky, *c.* 1 km W of village, alt. 422 m, 48°52′32.9″N, 16°39′41.6″E, parasitic on thallus of *Caloplaca erodens*, on W-exposed limestone rock, 15 April 2005, J. Vondrák & J. Šoum (CBFS JV4926—holotypus; GZU—isotypus).

(Figs 2 & 3)

TABLE 2. Comparison of selected characters of closely similar lichencolous *Opegrapha* species from calcicolous crustose lichens

Character	<i>O. hellespontica</i>	<i>O. vulpina</i>	<i>O. parasitica</i> *	<i>O. rupestris</i> *	<i>O. aff. rupestris</i> 1 (on <i>Caloplaca</i> <i>cirrochroa</i>)*	<i>O. aff. rupestris</i> 2 (on <i>Caloplaca</i> <i>variabilis</i> s.l.)*
Apothecia (size)	(0.24-) 0.46 ± 0.13 (-0.73) × (0.15-) 0.24 ± 0.04 (-0.31) mm	(0.11-) 0.2 ± 0.04 (-0.3) mm diam.	(0.28-) 0.41 ± 0.12 (-0.64) × (0.18-) 0.24 ± 0.04 (-0.3) mm	(0.19-) 0.34 ± 0.07 (-0.44) × (0.15-) 0.23 ± 0.05 (-0.33) mm	(0.19-) 0.27 ± 0.06 (-0.36) × (0.1-) 0.13 ± 0.03 (-0.21) mm	(0.22-) 0.39 ± 0.09 (-0.59) × (0.17-) 0.24 ± 0.07 (-0.44) mm
Aggregations of apothecia	Commonly large aggregations, c. 0.3-1.0 mm	Exceptionally	Rarely small aggregations	Rarely small aggregations	Rarely small aggregations	Rarely small aggregations
Ascospores (size)	(14.0-) 16.75 ± 1.25 (-19.0) × (5.0-) 6.5 ± 0.75 (-7.5) µm	(11.5-) 14.5 ± 1.4 (-18.0) × (5.0-) 6.0 ± 0.7 (-8.0) µm	(15.0-) 17.25 ± 1.5 (-21.0) × (6.5-) 7.25 ± 0.6 (-9.0) µm	(13.5-) 17.75 ± 2.5 (-21.0) × (5.0-) 6.25 ± 0.7 (-7.5) µm	(15.0-) 17.0 ± 1.3 (-19.0) × (5.0-) 6.5 ± 0.7 (-7.0) µm	(15.0-) 16.25 ± 1.0 (-18.0) × (5.5-) 6.25 ± 0.5 (-7.0) µm
Apothecia & ascospores length/breadth ratio	1.9 & 2.6	1.0 & 2.4	1.7 & 2.4	1.5 & 2.8	1.8 & 2.6	1.4 & 2.6
Apothecial disc	Slit, only old apothecia with slightly exposed, black disc	Exposed in mature stage, black	Exposed in mature stage, black	Exposed in mature stage, brown to black	Exposed in mature stage, black	Exposed in mature stage, black
Exciple (width)	(20-) 50 ± 19 (-80) µm	(20-) 48 ± 14 (-70) µm	(23-) 49 ± 17 (-82) µm	(18-) 43 ± 14 (-70) µm	(25-) 37 ± 8 (-52) µm	(30-) 45 ± 10 (-65) µm
Hymenium (height)	(80-) 103 ± 14 (-130) µm	(70-) 90 ± 11.5 (-110) µm	c. 100 µm	c. 50-100 µm	(119-) 150 ± 29 (-218) µm	c. 80-150 µm

*Basic statistical values for *Opegrapha parasitica*, *O. rupestris* and *O. aff. rupestris* 1 are based on our observations of reference samples (see Materials and Methods) with $n=15$ and $n=30$ for *O. aff. rupestris* 2 on *Caloplaca variabilis*.

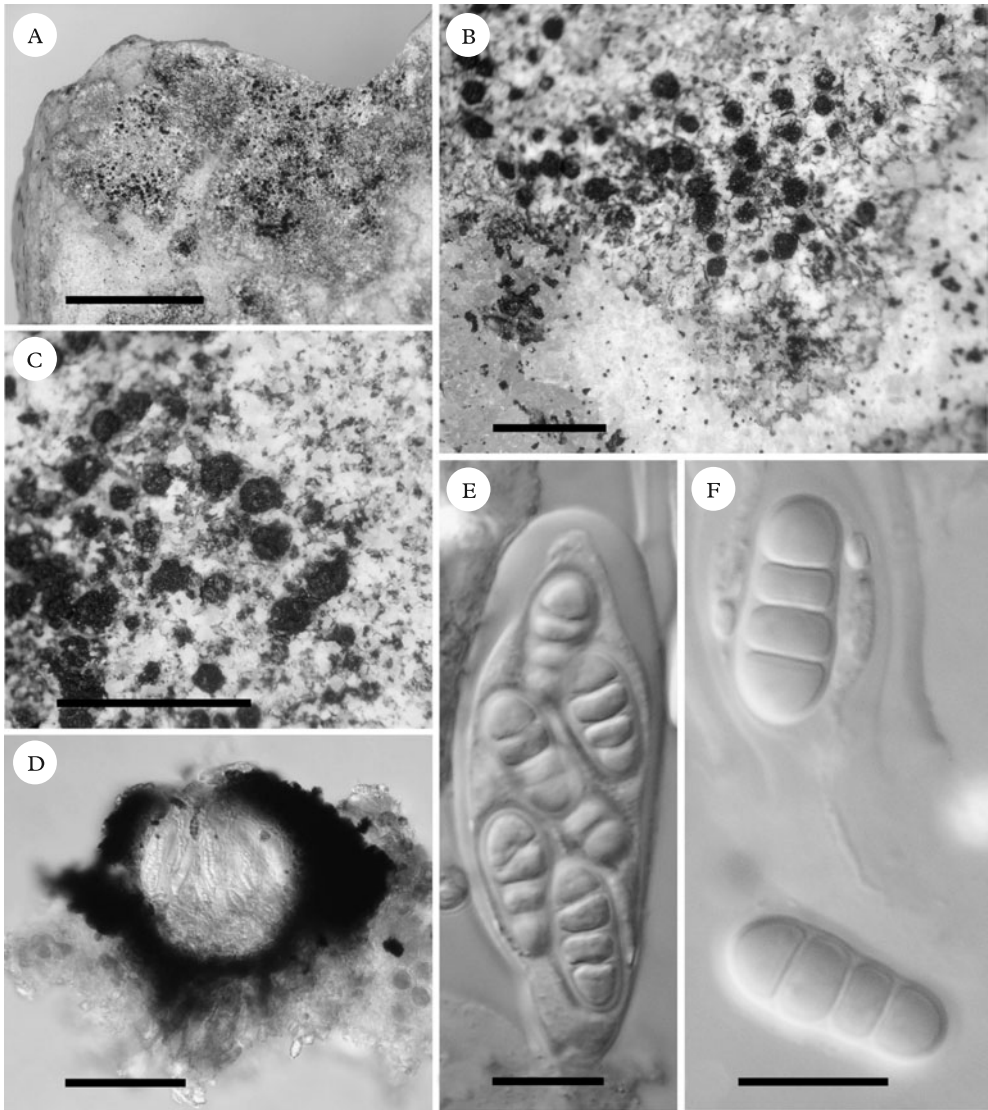


FIG. 2. *Opegrapha vulpina*. A, strongly infected host thallus (isotype); B & C, details of apothecia (B isotype, C holotype); D, section of an apothecium; E, ascus; F, young ascospores with perispore (CBFS JV4979). Scales: A=5 mm; B & C=1 mm; D=50 μ m; E & F=10 μ m.

Vegetative thallus non-lichenized, inconspicuous, immersed in the host thallus, formed by colourless hyphae, hardly distinguishable from the host hyphae.

Ascomata apothecia, usually gathered into irregular dark patches on host thallus (Fig. 2A–C), simple (or rarely loosely aggregated), always round, sessile, (0.11–) 0.2 \pm 0.04 (–0.3) mm diam. ($n=73$). Apoth-

ecia perithecium-like at first (Fig. 2D), later discoid, with slightly exposed, black, epruionose disc up to 150 μ m diam. *Exciple* carbonized, (20–) 48 ± 14 (–70) μ m thick ($n=30$), broader in upper part, formed of \pm paraplectenchymatous thick-walled cells in outer part (c. 4–8 μ m diam.) but of \pm elongated cells in inner part adjacent to the hymenium. *Hymenium* hyaline, (70–

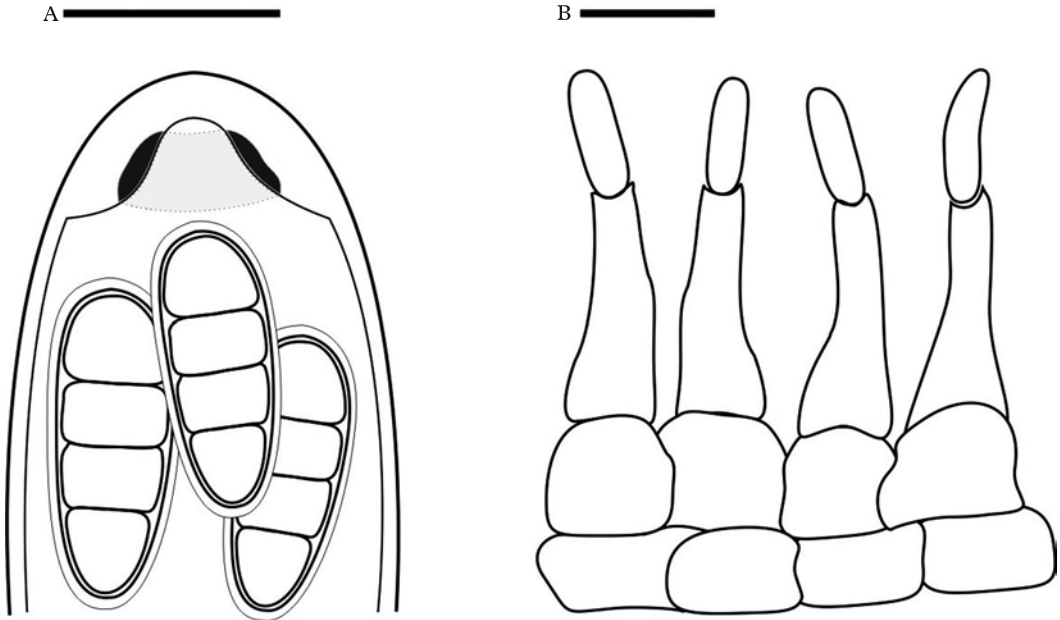


FIG. 3. *Opegrapha vulpina* (holotype). A, apical part of ascus with the ocular chamber and the amyloid ring structure in tholus, *Opegrapha*-type, observed in KI; B, conidiophores with attached conidia. Scales: A=10 µm; B=5 µm.

90 ± 11.5 (–110) µm high ($n=17$). *Epihymenium* covered by brown granules insoluble in KOH and HNO₃. *Subhymenium* pale to colourless, $c.$ 30–40 µm high, formed of prosopectenchymatous, $c.$ 2.5–4 µm thick cells, oil-drops up to 4 µm diam. occasionally present. *Hypothecium* brown-black, $c.$ 20–30 µm thick. *Paraphysoids* strongly branched and anastomosing, $c.$ 2–2.5 µm thick, with brown pigmented, broadened tips, up to 5.5 µm. *Asci* fissitunicate, narrowly clavate (Fig. 2E) with a tholus and internal apical beak, *Opegrapha*-type (Fig. 3A), 8-spored, (39–) 51 ± 5 (–67) × (13–) 16 ± 2 (–21) µm ($n=33$), length/breadth ratio $c.$ 3.2. *Ascospores* 3-septate, narrowly ellipsoid to slightly clavate, up to maturity hyaline, (11.5–) 14.5 ± 1.4 (–18.0) × (5.0–) 6.0 ± 0.7 (–8.0) µm ($n=74$), length/breadth ratio $c.$ 2.4, halonate (Fig. 2F), with perispore $c.$ 0.5–1 µm thick (not always observable) and spore wall $c.$ 0.5 µm thick. Old ascospores brownish, with fine granular ornamentation.

Conidiomata black pycnidia, $c.$ 80–130 µm diam., semi-immersed. *Conidiogenous cells*

elongate-ampulliform, arising singly, enteroblastic, acrogenous (Fig. 3B), $c.$ 8–12 × 2–4 µm. *Conidia* narrowly ellipsoid to bacilliform, rarely somewhat curved, (3.0–) 4.5 ± 0.6 (–5.0) × (1.0–) 1.2 ± 0.3 (–2.0) µm ($n=33$).

Chemical reactions. Hymenium and upper hypothecium I+ red (epihymenium I+ blue), hymenium KI+ blue. Granules in the exciple and epihymenium K–, N–.

Host. Lichenicolous in the thallus of *Caloplaca erodens*, rarely in *C. albopruinosa*. The fungus appears not to cause any conspicuous damage to its host.

Etymology. As the species is presently known mainly from the Czech Republic, it is named after the important Czech lichenologist and our friend, Jiří Liška (his surname means fox in English = *Vulpes* in Latin).

Ecology and distribution. *Opegrapha vulpina* is known only from from eight sites in the

limestone area “Pavlovské vrchy” hills in South Moravia, Czech Republic (alt. c. 230–450 m), one locality in Dobrogea (alt. c. 70 m), East Romania, and three sites in the Italian Apennines (alt. c. 900–1500 m). The species specifically affects thalli of *Caloplaca erodens* (or its related species *C. albopruinosa* in the Dobrogean locality). Both hosts are often predominant in lichen communities on sun-exposed, hard limestone outcrops. The main accompanying species are *Arthonia lapidicola* (Taylor) Brant & Rostr., *Caloplaca aurantia*, *C. dichroa* Arup, *C. saxicola* (Hoffm.) Nordin, *Candelariella aurella* (Hoffm.) Zahlbr., *C. medians* (Nyl.) A. L. Sm., *Catillaria lenticularis* (Ach.) Th. Fr., *Lecanora crenulata* (Dicks.) Hook and *L. dispersa*.

Apart from *Opegrapha vulpina*, *C. erodens* can be infected by *Intralichen christiansenii* (author's observations), *Muellerella lichenicola* (Hafellner & Muggia 2006) and a *Polysporina* species (personal observations from Iranian and Turkish specimens, CBFS JV5139, dupl. PRM 857465, CBFS JV5142, dupl. PRM 857464). Apothecia of the *Polysporina* species are superficially indistinguishable from those of *O. vulpina*. The central parts of the thallus of *C. erodens* are sometimes overgrown by *Caloplaca* sp., *Candelariella aurella* and young thalli of *Diplotomma venustum* (Korb.) Lettau agg. (Hafellner & Muggia 2006). *Intralichen christiansenii* was observed in the hymenium of *Opegrapha vulpina* (CBFS JV5135).

Contrary to the restricted and disjunct distribution of *O. vulpina*, its main host species, *Caloplaca erodens*, is already known from Austria (Hafellner & Muggia 2006), Bulgaria (Vondrák & Slaviková-Bayerová 2006), Czech Republic (Vondrák *et al.* 2007), Greece (Vondrák *et al.* 2008), Italy (Tretiach *et al.* 2003) and the Near East (J. Vondrák, unpublished data).

Remarks. The new species is described as an *Opegrapha* since it possesses characteristic asci and a carbonized raised true exciple. *Arthonia* differs in the absence of a carbonized exciple and in its broadly clavate ascus, and *Dactylospora* has asci with a non-

amyloid ascus wall and amyloid gelatinous outer cap (e.g. Hafellner 1979; Triebel 1989). Other similar genera, *Bactrospora*, *Chiodecton*, *Enterographa*, *Lecanactis*, *Lecanographa*, *Phacothecium*, *Plectocarpon*, *Schismatomma* and *Sclerophyton* differ significantly in the characteristics of their ascospores, asci, exciple, etc. (Torrente & Egea 1989; Egea & Torrente 1994; Ertz *et al.* 2005).

Apart from its host specificity, *Opegrapha vulpina* is clearly characterized by its round apothecia and smaller ascospores compared with *O. aff. rupestris* 1 & 2, and *O. hellespontica*, and by the small size of its apothecia, black disc, and thicker ascospores than *O. physciaria*. *Opegrapha parasitica* (on *Aspicilia calcarea* (L.) Korb.) and *O. rupestris* (on *Verrucaria* sp.) occur in similar habitats to the new species, but differ in their larger and shortly lirelliform apothecia and larger ascospores (Table 2).

Additional specimens examined. Czech Republic: South Moravia: Mikulov, northern peak of Mt Šibeničnick c. 2 km S of the town, alt. 249 m, 48°47'21.5"N, 16°37'48.0"E, 14 iv 2005, J. Vondrák & J. Šoun (CBFS JV4925); Mikulov, limestone rocks at the foot of the hill Svätý kopeček, at the eastern edge of the town, alt. 300 m, 19 v 2004, J. Vondrák, M. Bartoš & J. Šoun (C, MIN, UPS: in samples *Sel. Exs. Caloplaca* 5, *Caloplaca erodens*); Mikulov, Bavory, protected area “Tabulová”, rocks on SW slope of Mt Stolová hora, alt. 375 m, 48°50'11.5"N, 16°38'14.8"E, 15 iv 2005, J. Vondrák & J. Šoun (CBFS JV4924); Mikulov, Horní Věstonice, rock Martinka at W-slope of hill Obora, alt. 400 m, 48°51'56.35"N, 16°38'5.94"E, 21 i 2007, J. Vondrák (CBFS JV4960); *ibid.*: alt. 420 m, 48°51'57.13"N, 16°38'8.37"E (CBFS JV4962, hb. L. Muggia); Mikulov, Klentnice, ruin of “Siroťčí hrádek” castle, 48°50'44.63"N, 16°38'25.59"E, 20 v 2004, J. Vondrák (CBFS JV4979); Mikulov, Klentnice, locality Soutěska, alt. 420 m, 48°51'52.45"N, 16°38'38.71"E, 21 i 2007, J. Vondrák (CBFS JV4970, hb. L. Muggia).—**Italy:** *Abruzzo:* prov. L'Aquila, Rocca Calascio, alt. c. 1200 m, 4 vi 2004, *M. Tretiach* (TSB 38950, sub *Opegrapha saxatilis*); prov. L'Aquila, Rovere, alt. 1440 m, 23 vi 2001, *M. Tretiach* & *D. Pinna* (TSB 34330, sub *Opegrapha saxatilis*). *Marche:* prov. Ascoli Piceno, Monti Sibillini, at road to Pretare, close to Piana di Castelluccio, alt. 920 m, 5 vi 2004, *M. Tretiach* (TSB 38953, sub *Opegrapha saxatilis*).—**Romania:** Dobrogea: Tulcea, Enisala, limestone outcrops c. 200 m SE of Enisala castle ruin, alt. 70 m, on *Caloplaca albopruinosa*, 44°52'56.03"N, 28°50'12.41"E, 3 iv 2007, J. Vondrák (CBFS JV5135, dupl. PRM 857466).

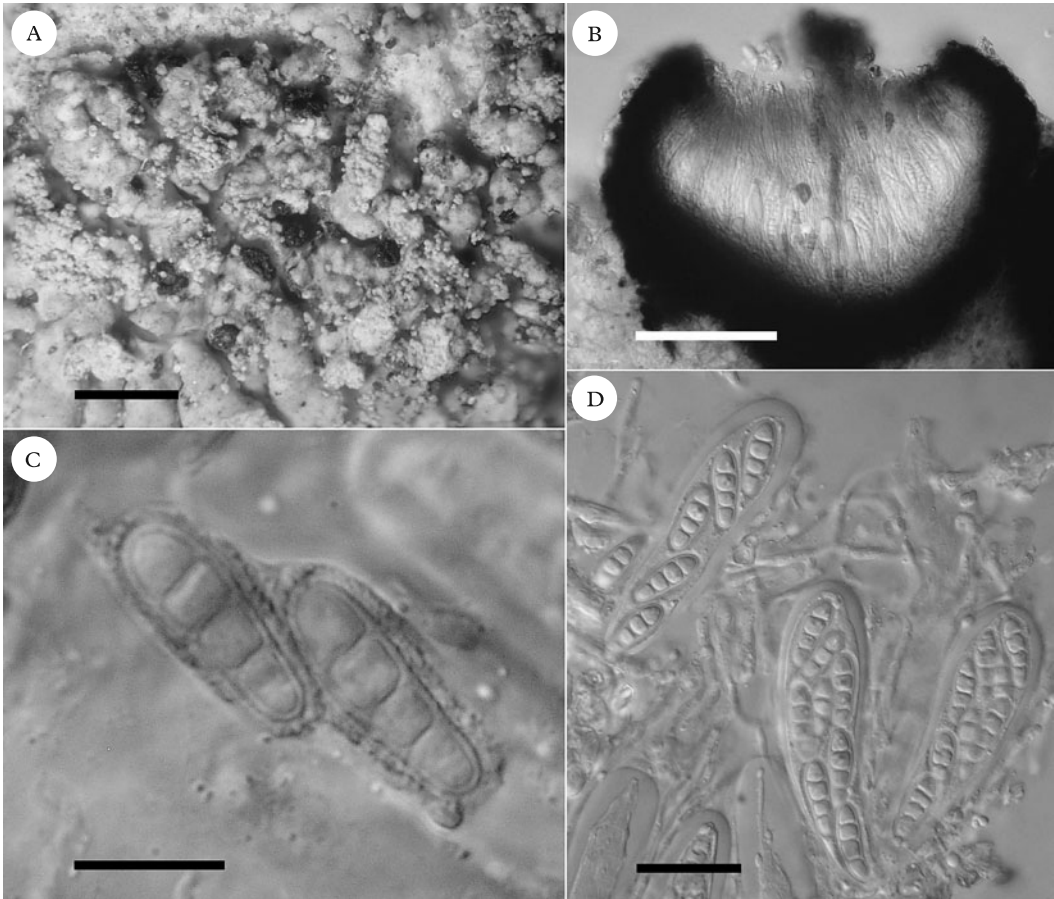


FIG. 4. *Opegrapha* aff. *rupestris* on *Caloplaca cirrochroa* (PRM 909034). A, apothecia in central part of host thallus; B, section of an apothecium; C, slightly overmature, pale brown ascospores; D, asci. Scales: A=1 mm; B=100 μ m; C=10 μ m; D=20 μ m.

***Opegrapha* aff. *rupestris* 1 (on *Caloplaca cirrochroa*) & *O.* aff. *rupestris* 2 (on *C. variabilis* s.l.)**

(Fig. 4)

We are unable to distinguish these possibly distinct species from *O. rupestris* s. str., which is confined to calcicolous *Verrucaria* species, by means of only morphological characters and chemical reactions. Specimens on both hosts possess shortly lirelliform apothecia, up to 0.6 mm long, and 3-septate ascospores, c. 15–19 \times 5–7 μ m. For other characters see Table 2. Unfortunately, most of the material examined is not

well-developed and has only a few, poorly-developed ascocarps. Better-developed material and molecular investigations are needed to determine if these taxa are distinct species.

Specimens examined. *Opegrapha* aff. *rupestris* 1. **Czech Republic:** *West Bohemia:* Horažd'ovice, Žichovice, 2007, *Ľ. Vondrák* (CBFS JV 5017). *South Moravia:* Blansko, "Pustý žleb" glen, rocks below Blansek castle ruin, 2004, *Ľ. Kocourková* (PRM 909049).—**Greece:** *Crete:* Lasithi, Vai, on coastal rocks, 1976, *H. Mayrhofer* (GZU).—**Italy:** *Sicily:* Distr. Messina, Roccaforita, 1969, *S. Svane* (C).—**Malta:** Melieha, 1989, *M. S. Christiansen* (C, sub *Opegrapha parasitica*).

Opegrapha aff. *rupestris* 2. **Czech Republic:** *South Moravia:* Blansko, "Suchý žleb" glen, 2003, *Ľ. Kocourková* (PRM 909034); Blansko, "Pustý žleb"

glen, rocks below Blanseck castle ruin, 2004, *ř. Kocourková* (PRM 909045).—**Slovakia**: High Tatra Mts, Skalné vráta, 1999, *ř. Kocourková* (PRM 909035).

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