Bull. Natl. Mus. Nat. Sci., Ser. B, 39(1), pp. 11–14, February 22, 2013

Opegrapha phaeophysciae (Opegraphaceae, Arthoniomycetes), a Lichenicolous Ascomycete, New to Japan

Andreas Frisch* **and Yoshihito Ohmura**

Department of Botany, National Museum of Nature and Science,
Amakubo 4–1–1, Tsukuba, Ibaraki 305–0005, Japan
* E-mail: frisch-a@kahaku.go.jp

(Received 16 November 2012; accepted 19 December 2012)

Abstract *Opegrapha phaeophysciae* is newly reported for Japan from Hokkaido and central Honshu, and a detailed description of the species is provided based on the Japanese collections. This species has previously been found on *Phaeophyscia hispidula* and was known only from Far East Russia. In Japan, *O. phaeophysciae* was found on the thallus of *P. limbata*, a species closely related to *P. hispidula*.

Key words: fungus, parasite, lichen, *Phaeophyscia hispidula*, *Phaeophyscia limbata*.

Lichenicolous fungi comprise a large and taxonomically diverse group of about 1,800 species growing as obligate parasites or saprotrophs on lichens (Lawrey and Diederich, 2003, 2011). They mainly belong to the Ascomycota, and some of them (less than 5%) belong to Basidiomycota (Lawrey and Diederich, 2003). Lichenicolous fungi have not been well studied in Japan, and only 21 species have been reported (Kurokawa and Kashiwadani, 2006), of which 10 species alone belong to the calicioid genera *Chaenothecopsis* and *Sphinctrina* (Tibell and Thor, 2003) and other species belong to various phylogenetic groups, i.e. *Cornutispora*, *Distopyrenis*, *Leptosphaeria*, *Lichenostigma*, *Phacopsis*, *Rhabdospora*, and *Stigmidium*.

In the present contribution, we newly report on *Opegrapha phaeophysciae* that has recently been collected from the thallus of *Phaeophyscia limbata* on Hokkaido and was subsequently discovered on five additional specimens of that species from Hokkaido and central Honshu preserved in the National Museum of Nature and Science (TNS).

Materials and Methods

Anatomical examinations were made using hand-cut sections mounted in water and Lactic Cotton Blue. Chemical reactions of the ascomata were investigated in 1% aqueous iodine solution (I), 0.25% aqueous iodine solution (I_{dil}), 1% aqueous iodine solution after pretreatment with 10% aqueous potassium hydroxide solution (KI), 10% aqueous potassium hydroxide solution (K), and 10% nitric acid (N). Due to the absence of a sufficient number of well-developed spores in the Japanese specimens, spore measurements are given as min.-max. values only.

All specimens examined are housed in TNS except otherwise indicated.

Results and Discussion

Opegrapha phaeophysciae R. Sant., Diederich, Ertz & Christnach, Biblioth. Lichenol. 91: 132 (2005).

[Fig. 1]

Type: RUSSIA, Primorskii Region. Lazovskii District, Lazovskii Reserve, small hill along the seashore, ca. 5 km S of Glazovska village,

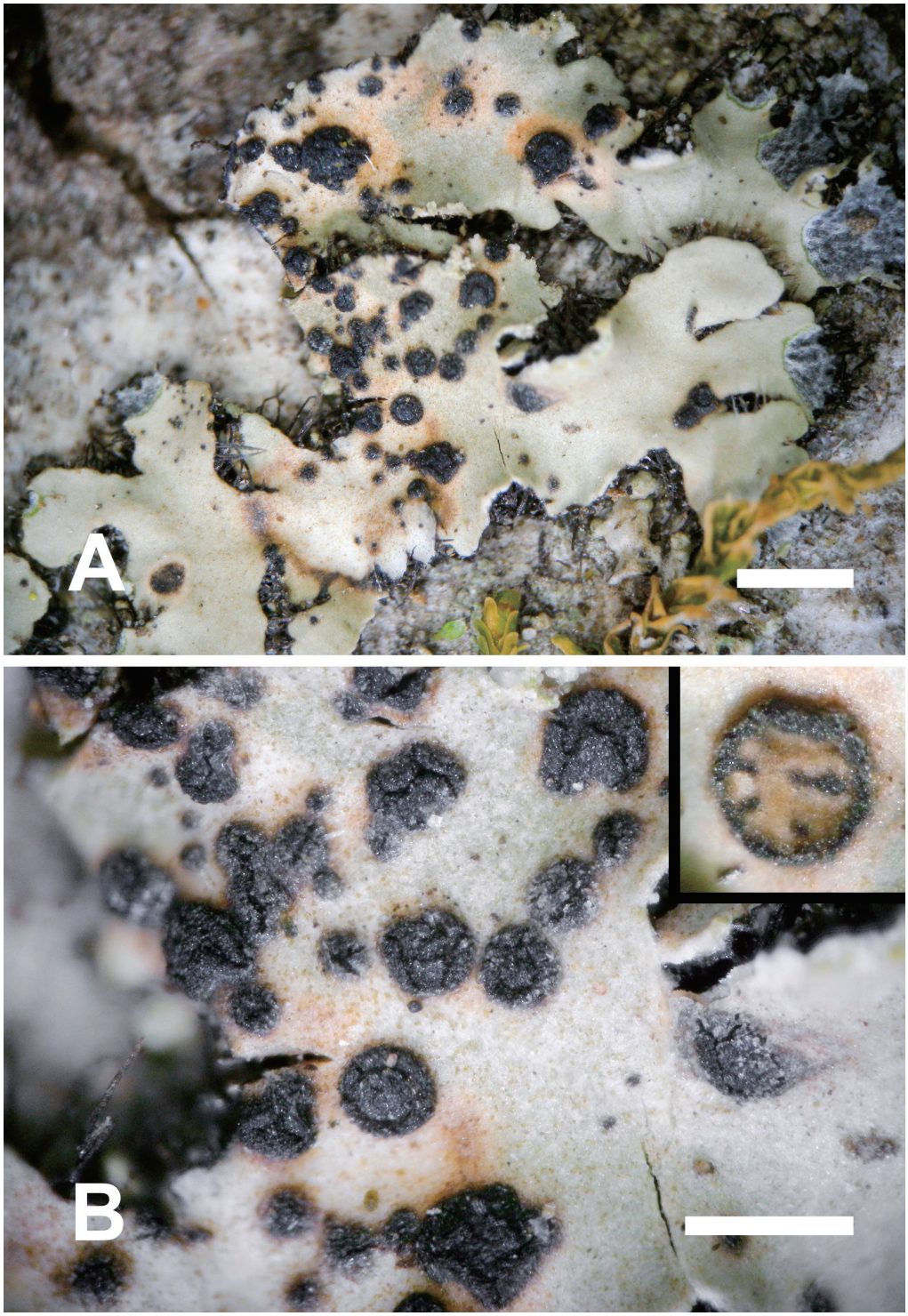

Fig. 1. *Opegrapha phaeophysciae* (Frisch 12/Jp183, TNS). A. Growth habit on *Phaeophyscia limbata*. B. Group of ascomata (the small picture shows a horizontal section through an ascoma with marginally divided hymenium). Scale bars: A = 1.0 mm, B = 0.5 mm.

41°01′N, 134°10′E, 30 m alt., on *Quercus manshurica* in the southern slope towards the sea, on *Phaeophyscia hispidula* (thallus), 22 ix 1991, R. Santesson 33270 (= R. Santesson, Fungi lichenicoli exsiccati no. 360) (UPS holotype, not seen; TNS isotype!).

ASCOMATA solitary, scattered to crowded on the upper side of the host thallus, immersed first but soon emergent, black, rounded, slightly convex to flattened, basally not constricted, 0.2–0.6 mm diam., with fragments of the host cortex attached to the younger stages; upper stromatic layer irregularly reticulate-fissured and/or with a ring-fissure along the outer margin, occasionally breaking away in the center to expose the hymenium. STROMA dark brown, 90–160 μm tall, in K olivaceous brown, in N more orange brown, pigment Atra-brown; hymenium in horizontal section undulate to marginally divided and often with one to three rounded columns of stromatic plectenchyma, in transversal section with one to three subspherical to extensive loci; marginal and apical stromatic layer 20–40 μm thick, sometimes missing in the central portions of the ascomata. SUBHYMENIUM hyaline, $I_{dil}+$ pale bluish, I+ pale red mottled with pale blue, KI+ blue, 10–15 μm tall. HYMENIUM hyaline, $I_{dil}+$ pale red, I+ red, KI+ blue, 60–100 μm tall. EPIHYMENIUM brownish, $I_{dil}+$, I+ and KI+ blue, 15–20 μm tall. PARAPHYSOIDS abundant, branched and anastomosing, 2–2.5 μm thick, apically slightly swollen. ASCI *Opegrapha*-type, clavate, with an apical K/I+ blue ring structure, 4–spored, 50–85 × 12–16 μm. ASCOSPORES hyaline, becoming brown and granular warty at maturity, elongate ellipsoid, (4–)6 septate, slightly constricted at the septa, 21–28(–32) × 4.0–6.0 μm, the median cell often somewhat elongated. PERISPORE ca. 1 μm thick, with a brown granulose pigmentation located on the outer wall at maturity. PYCNIDIA not observed.

ECOLOGY AND DISTRIBUTION. In Japan, *O. phaeophysciae* is known from three localities on Hokkaido and the mountains of central Honshu at altitudes from sea-level up to 750 m alt. It was found on *Phaeophyscia limbata* growing on various deciduous trees, including *Ulmus davidiana* var. *japonica*, *Acer miyabei*, and *Zelkova serrata*. Previously, *O. phaeophyscia* was only known from the Primorskii Region of eastern Russia, where it was collected from the thallus of *Phaeophyscia hispidula* (Ertz *et al.*, 2005). *Phaeophyscia hispidula* and *P. limbata* are closely related to each other (Kashiwadani, 1984) and could be treated at subspecies level within a common taxon (Poelt, 1974).

NOTES. The Japanese specimens agree well with the isotype of *O. phaeophysciae* (R. Santesson, Fungi Lichenicoli Exsiccati no. 360) in TNS. By checking about 300 Japanese collections of *Phaeophyscia hispidula* and *P. limbata* preserved in TNS, only five additional specimens of *O. phaeophysciae* were found. The species is possibly rare in Japan, but selective collection of 'clean' specimens in the field (i.e., lichen specimen without parasite fungi on the thallus) might also cause the lack of *O. phaeophysciae* in the collections.

Opegrapha phaeophysciae is the third parasitic *Opegrapha* species known to Japan besides *O. lichenicola* growing on foliicolous crustose lichens [e.g., *Eremothecella macrosperma*, *Mazosia melanophthalma*, and problably *Porina* sp.] (Thor *et al.*, 2000) and *O. foreaui* [= *O. trassii* (see Hafellner, 2002)] on *Heterodermia* sp. (Coppins and Kondratyuk, 1998).

The supraspecific taxonomy of the about 58 parasitic *Opegrapha* species (Lawrey and Diederich, 2011) is not resolved at present, but most species are expected not to belong to *Opegrapha* s. str. (Ertz *et al.*, 2005). *Opegrapha phaeophysciae* is placed in the parasitic *O. anomea*-group, which differs from *Opegrapha* (s. str.) mainly by the stromatic uni- to poorly multilocular roundish ascomata (Ertz *et al.*, 2005). The species in this group show affinities to the genus *Plectocarpon* Fée and the phylogenetic relationship towards this genus needs further study (Ertz *et al.*, 2004, 2005).

The Japanese common name for this species is given here as "Yadori-kigô-goke".

Specimens examined. JAPAN. Hokkaido. Prov. Abashiri: Yobito, Abashiri-city, over *Phaeophyscia limbata* on the bark of an unidentified tree in shady deciduous forest at the shore of Abashiri Lake, 43°59′36.0″N, 144°12′18.7″E, 25 m, 29 v 2012, A. Frisch 12/Jp183 & Y. Ohmura (TNS, UPS, hb Frisch). Prov. Ishikari: Maruyama, Sapporo-city, on bark of *Ulmus davidiana* var. *japonica*, ca. 20 m, 23 vii 1970, H. Kashiwadani 7500, 7502 (TNS); ibid., on bark of *Acer miyabei*, ca. 200 m, 23 vii 1970, H. Kashiwadani 7497 (TNS). Honshu. Prov. Shinano: Hiraide, Shiojiri-city, on bark of *Zelkova serrata*, ca. 750 m, 28 x 1986, H. Kashiwadani 23660, 23662 (TNS).

Acknowledgments

This study is partly funded by the Grant-in-Aid relating to JSPS Postdoctoral Fellowship for Foreign Researchers (no. 23–01706), which is gratefully acknowledged.

References

Coppins, B. J. and Kondratyuk, S. Y. 1998. *Opegrapha trassii* sp. nov., a new lichenicolous fungus on *Heterodermia*. Folia Cryptogamica Estonica 32: 9–14.

Ertz, D., Diederich, P. and Miadlikowska, J. 2004. The lichenicolous *Opegrapha* species (Roccellaceae, Ascomycota) with 3-septate ascospores on *Pertusaria* and *Ochrolechia*. Botanical Journal of the Linnean Society 144: 235–241.

Ertz, D., Christnach, C., Wedin, M. and Diederich, P. 2005. A world monograph of the genus *Plectocarpon* (Roccellaceae, Arthoniales). Bibliotheca Lichenologica 91: 3–155.

Hafellner, J. 2002. Bemerkenswerte Funde von Flechten und lichenicolen Pilzen auf makaronesischen Inseln VI. Über einige Neufunde. Fritschiana 36: 11–17.

Kashiwadani, H. 1984. On two species of *Phaeophyscia* in Japan. Bulletin of the National Science Museum, Series B 10: 127–132.

Kurokawa, S. and Kashiwadani, H. 2006. Checklist of Japanese lichens and allied fungi. National Science Museum Monographs 33: 1–157.

Lawrey, J. D. and Diederich, P. 2003. Lichenicolous fungi: interactions, evolution, and biodiversity. The Bryologist 106: 81–120.

Lawrey, J. D. and Diederich P. 2011. Lichenicolous fungi – worldwide checklist, including isolated cultures and sequences available (http://www.lichenicolous.net [12/21/2012]).

Poelt, J. 1974. Die Gattungen *Physcia*, *Physciopsis* und *Physconia* (lichenes, Physciaceae), Flechten des Himalaya 6. Khumbu Himal 6: 57–99.

Thor, G., Lücking, R. and Matsumoto, T. 2000. The foliicolous lichens of Japan. Symbolae Botanicae Upsalienses 32(3): 1–72.

Tibell, L. and Thor, G. 2003. Calicioid lichens and fungi of Japan. Journal of the Hattori Botanical Laboratory 94: 205–259.