

Perigrapha superveniens (Nyl.) Hafellner, a lichenicolous fungus new to Fennoscandia from Norway

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The lichenicolous fungus *Perigrapha superveniens* (Nyl.) Hafellner is reported from Norway for the first time from three separate localities. It is a gall inducing obligate parasitic fungus on *Parmelia sulcata* and seems to prefer highly oceanic areas. A brief description of the species and notes on its ecology and distribution are provided.

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Introduction

During fieldwork in the project ‘Mapping Uncharted Diversity (MUD): a first comprehensive survey of lichenicolous fungi in Norway’, we recently came across a conspicuous, gall inducing lichenicolous fungus growing on the thallus of *Parmelia sulcata*. The species was identified as *Perigrapha superveniens* (Nyl.) Hafellner, which has not previously been reported from Fennoscandia. The genus *Perigrapha* was introduced by Hafellner (1996) for a species described by Nylander (1864) as ‘*Melanotheca superveniens* based on a collection from the Atlantic coast of France in the surroundings of Brest. At present, the genus *Perigrapha* comprises five species worldwide (Ertz et al. 2005, Péres-Vargas et al. 2013, Zhurbenko et al. 2015, Zhurbenko & Ohmura 2018), of which only *P. superveniens* is known to occur in Europe. The aim of this paper is to report on *P. superveniens* from Norway and to present some notes on its ecology and distribution.

Material and Methods

This study is based on collections made by the authors in the summer of 2021. For the detailed study of internal structures, we have used a Zeiss Axio Scope A.1 and a Leica DM 1000 Led light microscope with 10x, 40x and 100x magnification. The habitus photos were taken with an Olympus Tough TG-6 camera (Fig. 1) and a Leica M165c Stereo microscope (Figs 2, 3). GPS positional data for the specimens are according to the World Geodetic System (WGS84) datum.



Figure 1. *Perigrapha superveniens*, habitus (TRH L-19982). Scale = 2 mm. Photo: H. Holien.



Figure 2. *Perigrapha superveniens*, habitus (TRH L-19985). Scale = 2 mm. Photo: A. Frisch.

The Species

Perigrapha superveniens (Nyl.) Hafellner

Figs 1–3

Perigrapha superveniens is a distinctive species that is readily recognizable in the field. The fungus is inducing galls on the thallus of *Parmelia sulcata*. The galls are irregular to undulate in outline and constricted at the base, the ascomata being visible as black, roundish to more or less star-shaped discs surrounded by a thick rim of host tissue (Figs 1, 2). The internal structure is stromatic, with hymenia organized in perithecioid locules (carpocentres; Fig. 3) with branched and anastomosing paraphysoids, and cylindrical to narrowly clavate, 4–8-spored asci of the *Opegrapha*-type, ca $75\text{--}100 \times 12\text{--}16 \mu\text{m}$. The ascospores are 3-septate, ca $30\text{--}35 \times 4.5\text{--}6 \mu\text{m}$, with a hyaline perispore and a threadlike appendage at one end. Old ascospores are often brownish with a pale to dark brown warty ornamentation. The brownish pigment in the upper layer of the ascomata reacts dark reddish in KOH. Pycnidia were not seen by us.

A detailed description and illustration of this species is provided by Hafellner (1996).

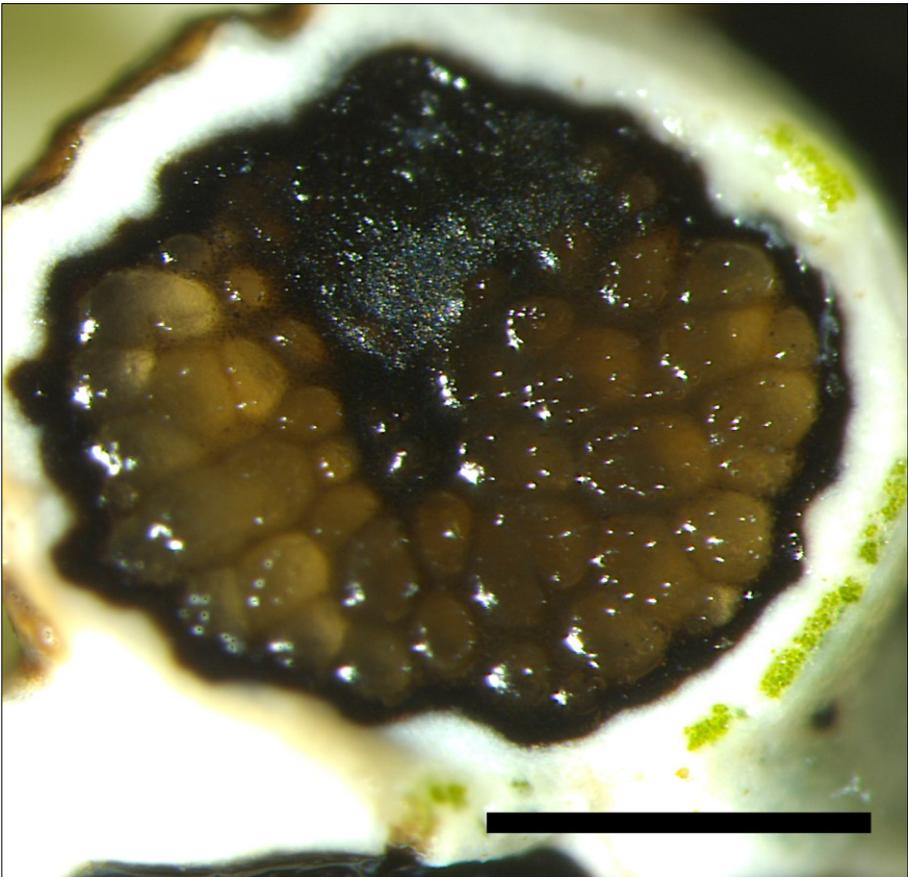


Figure 3. *Perigrapha superveniens*, showing a horizontal section of a gall soaked in water; note the perithecioid locules immersed in the fungal stroma (TRH L-19985). Scale = 0.5 mm. Photo: A. Frisch.

Specimens examined (all on the thallus of Parmelia sulcata): Norway. Nord-Trøndelag: Flatanger, Vedvika NE, Holøyfjellet S, 64.44649°N, 10.83898°E, alt. 50 m, on twigs of fallen *Populus tremula* in open coniferous forest by a small stream, 06.05.2021, H. Holien 16167 b (TRH L-19982); Flatanger, Vedvika NE, Holøyfjellet S, 64.44820°N, 10.84200°E, alt. 55 m, on twigs of *Sorbus aucuparia* in rich forest with *Picea abies* and deciduous trees including *Corylus avellana*, 22.09.2021, H. Holien 16379 & M. Lorentzen (TRH L-19983). *Nordland:* Saltdal, Stønmodalen S of Botnvatnet, 67.0771489°N, 15.533125°E, alt. 40 m, on trunks of *Salix caprea* and *Sorbus aucuparia* in boreal deciduous forest, 29.07.2021, A. Frisch 21/No337, 21/No340 & 21/No822 (TRH L-19985, TRH L-19986 & TRH L-19987); Sørfold, Straumvatnet N (Lembakkan), 67.3297889°N, 15.6958111°E, alt. 25 m, on young *Sorbus aucuparia* in boulder-rich deciduous forest, 01.08.2021, A. Frisch 21/No324 (TRH L-19984).

Ecology and distribution

Perigrapha superveniens is currently known in Norway from three localities in northern Trøndelag (Flatanger) and Nordland (Saltdal, Sørfold). The species has been found in various forest communities including boreal deciduous forest, rich mixed forest dominated by *Picea abies* and deciduous trees, and open forest dominated by *Pinus sylvestris* and *Populus tremula*. All localities are situated in the coastal lowlands in the southern boreal vegetation zone and the markedly oceanic section O2 according to Moen (1999). Two of the localities, Straumvatnet N (Fig. 4) and the Flatanger locality, are classified as boreal rainforests inhabiting several rare lichens including *Fuscopannaria ahlneri* and *Staurolemma omphalarioides*.

In all localities, *P. superveniens* was found together with other lichenicolous fungi typical for oceanic or otherwise humid forests in Norway, including *Arthophacopsis parmeliarum*, *Nesolechia oxyspora*, *Plectocarpon nephromeum*, *Plectocarpon scrobiculatae*, *Refractohilum galligenum*, *Refractohilum peltigerae*, *Protounguicularia nephromatis*, *Stigmatidium degelii* and *Tremella hypogymniae*.

Outside Norway, the species is known from France and Madeira (Nylander 1864, Hafellner 1996), Caucasus (Zhurbenko & Otte 2012, Zhurbenko 2017), the British Isles (Ireland and Scotland; GBIF 2022, Hawksworth 2003), South Africa (GBIF 2022), Canada (Newfoundland; Diederich 2003) and Japan (Zhurbenko et al. 2015).

Perigrapha superveniens seems to be an obligate parasitic fungus on the thallus of *Parmelia sulcata*, but has also been reported from *P. squarrosa* in Japan (Zhurbenko et al. 2015). Reports on other hosts, i.e. *Xanthoparmelia conspersa* and *Xanthoria parietina*, have been shown to be based on misidentifications of other lichenicolous fungi (Hafellner 1996). All reports of *P. superveniens* are from humid forests in coastal areas or in mountain forests.

Notes

Perigrapha has been suggested as being closely related with *Plectocarpon* based on morphological similarities with that genus (Hafellner 1996). This would place *Perigrapha* in Lecanographaceae (Frisch et al. 2014). The classification of the lichenicolous species in this family is not finally settled, and molecular data that could show the phylogenetic position of *Perigrapha* in this family are currently not available. The main differences between the two genera are the more or less elongated to lirelliform locules in *Plectocarpon* compared to the perithecioid locules in *Perigrapha*. Threadlike appendages of the ascospores, a rare character among lichenized fungi, are not observed in *Plectocarpon*.



Figure 4. Boreal rainforest with deciduous trees at Straumvatnet, Nordland county; habitat of *Perigrapha superveniens*. Photo: A. Frisch.

Perigrapha superveniens appears to be confined to highly oceanic forest communities including boreal rainforests in Norway, but the extend of its distribution cannot be confidently shown with the limited data available. The species has not been found in a recent, NBIC funded, extensive mapping project on crustose lichens and lichenicolous fungi in the boreo-nemoral and boreal rainforests along the Norwegian coastline (project 70184237: *Three storied diversity – mapping and barcoding crustose lichens and lichenicolous fungi in the Norwegian rainforests*). This may indicate that the species is rare rather than just overlooked, since *P. superveniens* is a conspicuous species that is easily recognized in the field.

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