

The first confirmed discovery in Norway of the elm leaf-mining moth *Phyllonorycter schreberella* (Fabricius, 1781) (Lepidoptera, Gracillariidae)

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A male specimen of *Phyllonorycter schreberella* (Fabricius, 1781) (Lepidoptera: Gracillariidae) was found in western Norway in Vestland at Lærdal: Husum in June 2021. The circumstances of the record, the species' biology, geographical range, identification and status are outlined. Photos of the moth and the locality are given.

Key words: Lepidoptera, Gracillariidae, *Phyllonorycter schreberella*, *Ulmus glabra*, Norway, first record, biology, distribution, identification.

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Introduction

The moth family Gracillariidae is a large Lepidoptera family worldwide. It comprises 8 subfamilies (Li *et al.* 2021), 111 genera and more than 2 000 species (De Prins & De Prins 2006–2020). The majority of species are internal feeders with larvae creating mines and galls in plant tissue. Members of the subfamily Lithocolletinae are monophagous or oligophagous creating blotch mines in the leaves of the host plant, often with a species-specific shape. The largest genus of this subfamily, *Phyllonorycter* Hübner, 1822, is distributed worldwide with about 400 species and about 60 Nordic species (Bengtsson 2011). Recent discoveries of *Phyllonorycter* in Norway are *Phyllonorycter lantanella* (Schrank, 1802) found in 2014 and *Phyllonorycter connexella* (Zeller, 1846) found in 2018 (Aarvik *et al.*

2019). With the present record of *Phyllonorycter schreberella* (Fabricius, 1781), the number of *Phyllonorycter* species in Norway reaches 42, compared to Denmark with 50, Finland with 42 and Sweden with 48 (Aarvik *et al.* 2017). Together with *P. lantanella* and *Phyllonorycter hostis* Triberti, 2007, *P. schreberella* has the most isolated populations, all found in western Norway. In the sister genus *Cameraria* we find an extraordinary example of how quickly a species, *Cameraria ohridella* Deschka & Dimić, 1986, can expand over a short time-span; it is now regarded as a pest species. From the discovery in 1984 in Macedonia it is also now common in Norway, after the first record in 2013 (Aarvik *et al.* 2014). In newly fledged individuals the moths are often characteristic, most species with an orange wing with different white and black patterns. In some cases differences between species are subtle, and

identification must be based on examination of genitalia or DNA.

Material and methods

1♂ Vestland (previously Sogn og Fjordane) (SFI, EIS 51), Lærdal: Husum, 61.0477°N 7.7894°E, 4. June 2021, leg./det. Jørn R. Gustad, coll. Natural History Museum, University of Oslo (NHMO) (Figure 1). The specimen was sweep-netted at 08:30 on a young elm, *Ulmus glabra* Huds. As it was dead on return, and then frozen, it was pinned and dried with wings in erect position to avoid specimen damage. The site was also visited (Husum, 61.04764319°N 7.79025303°E) by Reidar J.D.I. Voith on 22. June 2021 and 3 ♂♂ were swept from branches of young and older *U. glabra*, empty mines were also found. The specimens were strongly worn indicating that the flight period was almost over. The three males are preserved in the collection of Reidar J.D.I. Voith (Reidar J.D.I. Voith pers. comm.).

The specimen was photographed (Figure 1) with a Canon D5MKIII camera with macro lens (Canon MP-E 65 mm 1-5x) and macro flash (Canon Macro Ring Lite MR14-EX II). The locality (Figure 2) was photographed with an Apple iPhone 11.

Old Norwegian reports of *Phyllonorycter schreberella*

Grønlien (1926) recorded mines of *Lithocolletis schreberella* F. on *Ulmus* from Granvin in Hardanger in western Norway. Based on this record the species was listed from Hordaland in the catalogue by Haanshus (1933) and indicated with an 'N' in the Nordic list of Microlepidoptera (Krogerus *et al.* 1971). It was also included in the checklist by Opheim & Fjeldså (1983) who listed it from the faunal regions Bø, VE and TEy. These authors obviously considered the first record from HOi (Granvin is situated in HOi) as doubtful as it was only based on mines and no adults had



FIGURE 1. *Phyllonorycter schreberella* (Fabricius, 1781). The first proven Norwegian specimen. Photo: Jørn R. Gustad.



FIGURE 2. The Norwegian site. *Phyllonorycter schreberella* (Fabricius, 1781) was found on elm *Ulmus glabra* Huds. on the top left on the cliff. Photo: Jørn R. Gustad.

been bred. Aarvik et al. (2000) reported that in the University Museum of Bergen no correctly identified material of *P. schreberella* could be found. Specimens from *Ulmus* collected in Vestfold and identified as *P. schreberella* belong to *P. tristrigella* (Haworth, 1828). Consequently, *P. schreberella* was deleted from the Norwegian list (Aarvik et al. 2000). The present records from Lærdal are the first reliable records of *P. schreberella* from Norway.

Diagnostic characters

Phyllonorycter schreberella is a very small moth, wingspan 4,5-6,5 mm. (Bengtsson 2011). The moth is spectacular as newly hatched. The forewing is deep orange, with two black and silver bands medially. The apical area has two opposite silvery patches with dark inner margins. The wing base is black and grey. The head is black, and the thorax is dark and silver dorsally. The antenna is dark with white tip, about 1/5 of the total length. The

hindwing is grey. It is most likely to be confused with *Phyllonorycter stettinensis* (Nicelli, 1852), but that species lacks the dark forewing base. If the specimen is worn, a broader range of species must be considered. The larva mines the underside of leaves of *Ulmus*. The mine is short and oval, and the cocoon is greenish. There may be more than one mine in a single leaf. The other Nordic *Phyllonorycter* species on *Ulmus*, *P. tristrigella*, has a longer mine and the cocoon is pale brown. Both species are present in the locality in Lærdal. For further identification details on mine, imago and genitalia, see Bengtsson (2011), and for mine, caterpillar, cocoon and pupa, see Ellis (2021).

The Norwegian locality

The Norwegian locality is situated in the upper part of the valley Lærdalen. The site faces south and is a steep hillside with mature deciduous forest. The tree on which the specimen was found is a young tree about 7 meters high, situated on the

top of a cliff at the foot of a steep hillside 332 m. above mean sea level (Figure 2). Uphill, from the site there is a 0,494 km² nature reserve established in 2009. The locality has a large proportion of elm (*Ulmus glabra*).

A light trap was run in the year 2016 on a lower part of the site, but *P. schreberella* was not recorded. This trap was situated not far (about 50 m. downhill) from where the first record was made. In this material the two red-listed species *Bucculatrix noltei* Petry, 1912 (red-listed Endangered) and *Ethmia pusiella* (Linnaeus, 1758) (red-listed Critically Endangered) were found (Kai Berggren pers. comm.).

Reidar J.D.I. Voith (pers. comm.) found on his one day of hard field work several red-listed Lepidoptera species (number of individuals in brackets): *Elachista cingillella* (Herrich-Schäffer, 1855) – (red-listed Endangered) (3), *Phyllonorycter tristrigella* (Haworth, 1828) – (red-listed Endangered) (1), *Stephensia brunnichella* (Linnaeus, 1767) – (red-listed Endangered) (1), and *Stigmella lemniscella* (Zeller, 1839) – (red-listed Critically Endangered) (1). Of these *P. tristrigella* and *S. lemniscella* have *Ulmus* as host plant.

These records show the very high quality of the locality.

Distribution and biology

Phyllonorycter schreberella has a western and central Palaearctic distribution from the British Isles in the west to Turkmenistan in the east (Bengtsson 2011). In Sweden only in the southeast; Gotland, eastern Skåne and Öland (Bengtsson 2011). The species has not been recorded in Denmark, Finland and Estonia (Aarvik *et al.* 2017). The Norwegian record is from about 670 km. NW of the northernmost locality in Sweden.

The species is bivoltine and the flight periods are from mid-May to end of June, and the second generation in August (Bengtsson 2011). Mines are present in July and in the autumn (Svensson 1993). Adult specimens are as most *Phyllonorycter* easy to beat from branches/leaves, but they are also attracted to light at night (SLU Artdatabanken,

Species Observation System). Bengtsson (2011) gives the hosts in particular as *Ulmus minor* Mill. and *Ulmus laevis* Pall. It is indicated that in Sweden these two species of *Ulmus* are the only hosts there (Anonym 2021). Thus, the ecology of the Norwegian population differs from that of the Swedish one. Ellis (2021) also lists *Ulmus glabra* and *Ulmus pumila* L. as hosts. At the Norwegian site only *Ulmus glabra* is present.

Discussion

As with another recently discovered elm-feeder with an isolated occurrence in western Norway, *Cydia leguminana* (Lienig & Zeller, 1846) (Gustad & Aarvik 2021), the distance to the closest known locality, the species' biology and the suitability of the locality, are convincing arguments that the species is native in Norway. As there is a chance that the mines found by Grønlien (Grønlien 1926) in Granvin really belonged to *P. schreberella*, the species should be searched for there and in other suitable localities with *Ulmus* in western Norway.

Given the species' distribution, the record in Lærdal is surprising. However, the presence of this and a number of other rare insects may be explained by the local climatic qualities, with relatively high summer temperatures and low precipitation. A series of spectacular Lepidoptera records have been made in the valley. The close vicinity holds all hitherto Norwegian records of *Agonopterix purpurea* (Haworth, 1811) (Aarvik *et al.* 2015), *Athrips amoenella* (Frey, 1882) (Aarvik *et al.* 2015), *Elachista obliquella* Stainton, 1854 (Aarvik *et al.* 2015), *Metzneria aprilella* (Herrich-Schäffer, 1854) (Aarvik *et al.* 2013) and *Phyllonorycter lantanella* (Schrank, 1802) (Aarvik *et al.* 2015). There are records of several additional red-listed Lepidoptera species (see above).

The threat from the Dutch elm disease (caused by *Ophiostoma novo-ulmi* Brasier and/or *Ophiostoma ulmi* Melin & Nannf.) is discussed by Gustad & Aarvik (2021). *Phyllonorycter schreberella* may be less vulnerable from this disease as the species also uses younger elm trees (Anonym 2021). It is red-listed NT (Near

Threatened) in Sweden (Anonym 2021) and is an obvious candidate for the Norwegian Red List as well.

The present record of *Phyllonorycter schreberella* from Lærdal is the last in a series of discoveries in western Norway of Microlepidoptera with remarkably disjunct distribution ranges. These discoveries indicate that they are relicts from the warmer period after the glaciation. The localities are hotspots where usually several of these species are present at the same site. It is important to make additional inventories in Lærdal, and further along the inner parts of the fiords and their adjacent valleys in western Norway. Following discoveries of localities of high biological value, measures should be made to preserve their natural diversity

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References

- Aarvik, L., Berggren, K. & Hansen, L.O. (ed.). 2000. *Catalogus Lepidopterorum Norvegiae*. Lepidopterologisk arbeidsgruppe; Zoologisk museum, Universitetet i Oslo; Norsk institutt for skogforskning. Oslo. 192 pp.
- Aarvik, L., Boumans, L. & Sørlibråten, O. 2014. The horse chestnut leaf-miner *Cameraria ohridella* Deschka & Dimić, 1986 (Lepidoptera, Gracillariidae) established in Norway. *Norwegian Journal of Entomology* 61 (1), 8–10.
- Aarvik, L., Bengtsson, B.Å., Elven, H., Ivinskis, P., Jürivete, U., Karsholt, O., Mutanen, M. & Savenkov, N. 2017. Nordic-Baltic Checklist of Lepidoptera. *Norwegian Journal of Entomology – Supplement* 3. 1–236.
- Aarvik, L., Berggren, K., Bakke, S.A., Haugen, L.T., Sørlibråten, O. & Voith, R. 2013. Nye funn av sommerfugler i Norge 9. *Insekt-Nytt* 38 (3), 5–43.
- Aarvik, L., Berggren, K., Bakke, S.A., Slagsvold, P.K., Sørlibråten, O. & Voith, R. 2015. Nye funn av sommerfugler i Norge 10. *Insekt-Nytt* 40 (3–4), 5–42.
- Aarvik, L., Berggren, K., Engdal, J., Slagsvold, P.K., Sørlibråten, O. & Voith, R. 2019. Nye funn av sommerfugler i Norge 11. *Insekt-Nytt* 44 (1), 5–54.
- Anonym. 2021. *Lundalmsguldmal Phyllonorycter schreberellus*. Available from: <https://artfakta.se/naturvard/taxon/phyllonorycter-schreberellus-102480> (accessed 08.11.2021).
- Bengtsson, B.Å. 2011. *Phyllonorycter schreberellus lundalmsmal*, p. 193 in: *Nationalmyckeln till Sveriges flora och fauna. Fjärilar: Bronsmalar-rullvingemaler. Lepidoptera: Roeslerstammidae–Lyonetiidae*. 494 pp. ArtDatabanken, SLU, Uppsala.
- De Prins, J. & De Prins, W. 2006–2020. *Global Taxonomic Database of Gracillariidae (Lepidoptera)*. Available from: <http://www.gracillariidae.net/> (accessed 19.11.2021)
- Ellis, W.N. 2021. *Plant Parasites of Europe. Leafminers, galls and fungi*. Available from: <https://bladmineerders.nl/parasites/animalia/arthropoda/insecta/lepidoptera/ditrysia/gracillarioidea/gracillariidae/lithocolletinae/phyllonorycter/phyllonorycter-schreberella/> (accessed 10.11.2021).
- Grønlien, N. 1926. Bladminerere fra Voss og Indre-Hardanger I. *Norsk entomologisk Tidsskrift* 2, 89–108.
- Gustad, J.R. & Aarvik, L. 2021. First discovery in Norway of the elm-feeding moth *Cydia leguminana* (Lienig & Zeller, 1846) (Lepidoptera, Tortricidae). *Norwegian Journal of Entomology* 68 (1), 168–173.
- Haanshus, K. 1933. Fortegnelse over Norges Lepidoptera. *Norsk entomologisk Tidsskrift* 3, 164–216.
- Krogerus, H., Opheim, M., Schantz, M.v., Svensson, I. & Wolff, N.L. 1971. *Catalogus Lepidopterorum Fenniae et Scandinaviae. Microlepidoptera*. Helsingin Hyönteisvaihtoyhdistys, Helsinki. 40 pp.
- Li, X., Laurent, R.St., Earl, C., Doorenwerd, C., Nieukerken, E.J.v., Davis, D.R., Johns, C.A., Kawakita, A., Kobayashi, S., Zwick, A., Lopez-Vaamonde, J.K., Ohshima, I. & Kawahara, Y. 2021. Phylogeny of gracillariid leaf-mining moths: evolution of larval behaviour inferred from phylogenomic and Sanger data. *Cladistics* 2021, 1–24.
- Opheim, M. & Fjeldså, A. 1983. *The Lepidoptera of Norway. Check-List. Part V. Tineoidea, Zygaenoidea, Cossioidea and Incurvariina*. Norsk Lepidopterologisk Selskap, Oslo. 25 pp.
- Svensson, I. 1993. *Fjärilkalender*. Published privately. 124 pp.

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