First discovery in Norway of the elm-feeding moth *Cydia leguminana* (Lienig & Zeller, 1846) (Lepidoptera, Tortricidae)

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A female specimen of *Cydia leguminana* (Lienig & Zeller, 1846) (Lepidoptera, Tortricidae) was found in Western Norway in Møre og Romsdal at Molde: Eikesdalen, Ljåstranda in June 2020. The circumstances of the record, the species' biology, geographical range, identification and status are outlined. Figures of the moth and its genitalia are given.

Key words: Lepidoptera, Tortricidae, *Cydia leguminana*, *Ulmus glabra*, Norway, first record, biology, distribution, identification.

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Introduction

The moth family Tortricidae is one of the larger Lepidoptera families worldwide. It comprises 1 151 genera and 11 365 species (Gilligan *et al.* 2018). The genus *Cydia* Hübner, 1825 (tribe Grapholitini, subfamily Olethreutinae) is distributed worldwide and their larvae feed on generative parts of plants or under bark (Razowski 2003). According to Razowski (2003) the number of European *Cydia* species is 49. However, a survey of recent literature shows that this number has risen nearly to 60. The increase is caused by new discoveries and taxonomic changes. Recent discoveries of *Cydia* in Norway are *C. albipicta* (Sauter, 1968) which had been confused with the similar *C. succedana* (Denis & Schiffermüller, 1775) and *C. amplana* (Hübner, 1800) which is an expansive Mediterranean species (Aarvik *et al.* 2010). With the present record of *C. leguminana* (Lienig & Zeller, 1846), the number of *Cydia* species in Norway reaches 19. *Cydia leguminana* was together with *C. exquisitana* (Rebel, 1889) and *C. seductana* (Kuznetsov, 1962) placed by Danilevsky & Kuznetsov (1968) in the section "exquisitanae". This is apparently a species-group that is taxonomically and biologically well-defined. Both *C. leguminana* and *C. exquisitana* have larvae feeding under bark of various deciduous trees (Razowski 2003). The circumstances of the Norwegian capture of *C. leguminana* indicate that the species in Norway feeds under the bark of elm *Ulmus glabra* Huds.

Material and methods

The Norwegian specimen, a female, has the following label data: Møre og Romsdal (MRI, EIS 78), Molde: Eikesdalen, Ljåstranda, 62.4941°N 8.1697°E, 14. June 2020, leg. Jørn R. Gustad, genitalia slide NHMO 3834, coll. Natural History

Museum, University of Oslo (NHMO) (Figures 1–3). The specimen was netted at CET 16:30 on a mature pollard elm *Ulmus glabra*. The specimen was frozen and sent by express mail to the Natural History Museum, University of Oslo (NHMO). It was set and dried with wings in standard position. After drying the abdomen was removed, macerated in 10% KOH, and the genitalia dissected under a Leica MZ6 stereoscopic microscope and embedded in Euparal on a glass slide.

The specimen was photographed in situ (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 pinned specimen (Figure 2) was photographed with a Nikon D800E camera with macro lens (Nikon AF-S Micro Nikkor 60 mm), and the genitalia (Figure 3) with a Zeiss Axiocam 506 colour camera mounted on a Zeiss AX10 microscope. The locality (Figure 4) was photographed with an iPhone SX.

Diagnostic characters

Cydia leguminana is a small moth, wingspan 12–15 mm., the female usually is the largest (Bradley *et al.* 1979). The forewing is dark with a characteristic short, whitish dorsal patch, often double-lined and slightly curved. *C. leguminana* has smaller and more indistinct costal strigulae than similar species. The hindwing is lighter in the basal half. It is most likely to be confused with *C. cognatana* (Barrett, 1874), *C. illutana* (Herrich-Schäffer, 1851), *C. indivisa* (Danilevsky, 1963) and *Grapholita lunulana* (Denis & Schiffermüller, 1775). If the specimen is worn, a broader range of species must be considered. The genitalia of the Norwegian specimen (Figure 3) agree with the illustrations given by Razowski (2003) and Svensson (2006).

The Norwegian locality

The Norwegian locality is situated in the valley Eikesdalen close to lake Eikesdalsvatnet. The site faces west and is surrounded by deciduous forest. The forest is dominated by *Corylus avellana* L. and *U. glabra*, also with *Alnus incana* (L.) Moench, *Betula pubescens* Ehrh. and *Populus tremula* L. *Ulmus glabra* is dominant at the site, with several

FIGURE 1. *Cydia leguminana* (Lienig & Zeller, 1846). The Norwegian specimen photographed alive in resting position. Photo: Jørn R. Gustad.

FIGURE 2. *Cydia leguminana* (Lienig & Zeller, 1846). The Norwegian specimen with wings spread. Photo: Leif Aarvik.

FIGURE 3. *Cydia leguminana* (Lienig & Zeller, 1846). The genitalia of the Norwegian specimen. Photo: Leif Aarvik.

mature pollarded trees. The tree on which the specimen was found is a stand-alone tree situated on an old cultivated patch grazed by animals at the foot of a steep hillside 32 meters above mean sea level (Figure 4). The tree is situated about 10 meters from the public road and about 50 meters from the lake. The valley, Eikesdalen, is famous for its rich diversity and Norway's largest populations of mature *C. avellana* and pollard *U. glabra*. Several outstanding botanical records by European standards give evidence for a relict habitat in a broad context. For a general and detailed botanical description, see Jordal (2005). For information on the distribution of pollard *U. glabra* in Eikesdalen, and pollarded trees in Møre og Romsdal county, see Jordal (2011).

Distribution and biology

Cydia leguminana has a Palaearctic distribution. It is distributed in most countries from England and France in the west, to North Africa in the south and to China and Korea in the east (Bradley *et al.* 1979, Karsholt & Razowski 1996, Razowski 2003, Aarvik *et al.* 2017, Anonym 2020). The

FIGURE 4. The Norwegian site. *Cydia leguminana* (Lienig & Zeller, 1846) was found on this stand-alone pollarded elm *Ulmus glabra* Huds.. The photo was taken on the 28th. February 2021 and shows that the tree has not been pollarded in recent years. Photo: John Bjarne Jordal.

species is Red-listed EN (Endangered) in Sweden (Anonym 2020), strongly indicating that it is rare in Norway as well. With 8 records in Sweden (5 records (1968, 1977, 1979, 1992, 1993) (op. cit.), 3 records (2013, 2016 (2), 2019 (3)) (The Swedish Species Information Centre) and 77 records (141 individuals) in Finland (Kaila & Mutanen 2021), this indicates a population stronger towards the east, albeit it is Red-listed VU (Vulnerable) in Finland. It is also indicated in the English name - Eastern Piercer. The records in Denmark (Falster, Lolland and Møn (Anonym, 2020)), England, Finland and Sweden indicate a SE distribution in these countries. The overall impression in Europe is local occurrence and sparse records, and the species has not been recorded from Poland since 1960 (op. cit.). This even though Sheldon (1921) caught about 50 adult specimens over one week of hard work at the famous site Wicken Fen, Cambridgeshire in 1915. At this site the species disappeared when the pollarded elm trees were cut down in 1976 (Johnson 1978). In England (previously found in Cambridgeshire and Essex) it is not recorded since 1976, before it again was recorded in Bedfordshire in 2015 (Manning 2015). The Norwegian record is from about 400 km. NW of the northernmost locality in Sweden.

The flight period is from mid-May to early July. Adult specimens fly in sunshine in the afternoon, and can be beaten from bark/branches/leaves in the morning/daytime when they are sluggish (Sheldon 1921); they are also attracted to light at night (Anonym 2020). As a species laying eggs under bark, spraying the bark with water may be an effective method of flushing out the adult moth at daytime. The species is univoltine and hibernates as larva. The ovum is dull red when laid, becoming light grey and slightly opalescent

after about a week; surface of chorion rough and irregularly reticulate (Sheldon 1921). Sheldon (1921) reported the larvae to be active from August to March. In England larvae were found on pollarded *Ulmus minor* Mill. on excrescences which have soft bark (Sheldon 1921). The species is obviously polyphagous as Disqué (1905) reported finding larvae under bark on *Fagus* L. (in November) and *Acer* L. (29. March). Schütze (1931) found it on *Acer pseudoplatanus* L. and *Fagus*; on beech trunks it was present where there were wounds, living in a web covered with excrement where dry and fresh bark meet, gnawing the latter. It is also reported on *Alnus* Mill., *Fagus sylvatica* L. and *Ulmus procera* Salisb. (Ellis 2020). Emmet (1978) reported old records from England partly on *Carpinus betulus* L. He also mentioned *Abies* Mill. as a possible host. Razowski (2003) also notes *Betula* L. and *Salix* L. Ellis (2020) also states that the larva lives in a frass-filled silk tube in recovering bark wounds, preferably in the youngest tissue. Disque (1905) did not mention this tube, but described the larvae as whitish with grey spots, with head, neck shield and anal plate dark brown, with some variation. It pupated in spring, April–May. The pupa is light reddish brown with paler wings, head blunt and rounded (Sheldon 1921). Given the distance to the closest known locality, the species' biology and the suitability of the locality, we are convinced that the species is native to Norway.

Discussion

We expect that thorough search for *C. leguminana* in suitable habitats in Western Norway will lead to additional discoveries of the species. However, the site in Eikesdalen may be of especially high nature quality as another Lepidoptera elm specialist was found on the same visit, namely *Stigmella lemniscella* (Zeller, 1839), listed as CR (critically endangered) in the Norwegian Red-list. The present record, and records from England, indicates that old-fashion land use involving pollarding of elm trees favours the species. This has implications for protection of both biodiversity and areas where old agricultural methods and land use still exist. The Dutch elm disease (caused by *Ophiostoma novo-ulmi* Brasier and/or *Ophiostoma ulmi* Melin & Nannf.) is a threat to this special habitat and a number of insect species feeding on elm. The disease has not yet reached Western Norway, but was recorded in Bergen in 1997 (Solheim 2012). Solheim (op. cit.) reports the disease for the first time in 1963 (*O. ulmi*), again in 1972, and after the second epidemic in 1981 (*O. novo-ulmi*), it is established in a chronic stage in Eastern Norway. Solheim (op. cit.) mentions that the slow spreading in Norway may be connected with one or several of the following factors: (1) Climatic change involving higher temperature, (2) the vector (the large elm bark beetle *Scolytus laevis* Chapuis, 1869), (3) the fungus, and/or (4) tree population structure. The population of the red deer *Cervus elaphus* Linnaeus, 1758, has grown strongly, and Jordal (2011) alerts the species' negative effect on elm of all ages, caused by bark and root gnawing. Jordal (op. cit.) concludes that the ecologic damage of bark stripping has by far exceeded an acceptable level. Even though *C. leguminana* is present on other tree species in Central Europe, it is uncertain whether it is able to adapt to other tree species in Northern Europe. *Fagus* is not an alternative host as it is not distributed naturally in Western Norway. We suspect the reason for the preference for pollarded elm trees is due to the presence of coarse and rough bark.

Several species of Lepidoptera have isolated populations along fiords and in valleys in western Norway, e.g. *Acasis appensata* (Eversmann, 1842), *Acrolepiopsis betulella* (Curtis, 1838), *Athrips amoenella* (Frey, 1882), *Cerastis leucographa* (Denis & Schiffermüller, 1775), *Elachista obliquella* Stainton, 1854 and *Paratalanta hyalinalis* (Hübner, 1796). *Cydia leguminana* might well turn out to have a similar range. The fact that it has not been discovered in the rather well explored southeastern part of the country makes this likely. This shows the importance of finding such populations and seeking to protect them for the future.

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References

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. & Voith, R. 2010. Nye funn av sommerfugler i Norge 8. *Insekt-Nytt* 35, 25–50.

Anonym. 2020. *Almbarksvecklare Cydia leguminana.* Available from: https://artfakta.se/artbestamning/taxon/cydia-leguminana-215195 (accessed 21.11.2020).

Bland, K.P., Razowski, J. & Hancock, E.F. 2014. *The moths and butterflies of Great Britain and Ireland. Volume 5 (Part 2).* Tortricidae, Olethreutinae. 378 pp. Brill, Leiden.

Bradley, J.D., Tremewan, W.G. & Smith, A. 1979. *British Tortricoid Moths. Tortricidae: Olethreutinae.* 336 pp. The Ray Society, London.

Danilevsky, A.S. & Kuznetsov, V.I. 1968. Insects. Lepidoptera. Tortricidae: Laspeyresiini. Fauna SSSR New Series no. 98, Vol. 5 (1). 635 pp. Naukam Moscow/Leningrad, [In Russian.]

Disqué, H. 1905. Die Tortriciden-Raupen der Pfalz. *Deutsche Entomologische Zeitschrift Iris* 18, 209–256, 319.

Ellis, W.N. 2020. *Plant Parasites of Europe. Leafminers, galls and fungi.* Available from: https://bladmineerders.nl/parasites/animalia/arthropoda/insecta/lepidoptera/ditrysia/apoditrysia/tortricoidea/tortricidae/olethreutinae/grapholitini/cydia/cydia-leguminana/ (accessed 22.11.2020).

Emmet, A.M. 1978. *Cydia leguminana* [L. & Z.] in Epping forest. *The Entomologist's Record and Journal of Variation* 90, 305.

Gilligan, T.M., Baixeras, J. & Brown, J.W. 2018. T@ORTS: Online World Catalogue of the Tortricidae (Ver. 4.0). Available from: http://www.tortricidae.com/catalogue.asp (accessed 03.12.2020).

Johnson, P.J. 1978. A review of *Cydia leguminana* (Lienig & Zeller, 1846) (Lepidoptera: Tortricidae) in Britain together with an account of the breeding of the species. *The Entomologist's Record and Journal of Variation* 90, 199–202.

Jordal, J.B. 2005. Kartlegging av naturtypar i Nesset kommune. *Rapport J. B. Jordal* nr. 6–2005. 162 pp.

Jordal, J.B. 2011. Styvingstrær og høsting, *miljøvernavdelinga, rapport* 2011: 06. 55 pp.

Karsholt, O. & Razowski, J. (eds). 1996. The Lepidoptera of Europe. A distributional Checklist. 380 pp. Apollo Books, Stenstrup.

Manning, D.V. 2015. *Cydia leguminana* (Lienig & Zeller, 1846) (Lep.: Tortricidae) – first British record since 1976. *The Entomologist's Records and Journal of Variation* 127, 200.

Kaila, L. & Mutanen, M. 2021. *Cydia leguminana* in: FinBIF. Available from: https://laji.fi/en/taxon/MX.60520 (accessed 01.01.2021).

Razowski, J. 2003. *Tortricidae of Europe. Volume 2. Olethreutinae.* 301 pp. František Slamka, Bratislava.

Schütze, K.T. 1931. *Die Biologie der Kleinschmetterlinge unter besonderer Berücksichtigung ihrer Nährpflanzen und Erscheinungszeiten. Handbuch der Microlepidopteren Raupenkalender geordnet nach der illustrierten deutschen Flora von H. Wagner.* Verlag des Internationalen Entomologischen Vereins e.V. 235 pp. Frankfurt am Main.

Sheldon, W.G. 1921. The life-cycle and habits of *Cydia leguminana*, Z., with a note on its synonymy. *The Entomologist* 54, 225–229.

Solheim, H. 2012. Almesjukesopp *Ophiostoma novo-ulmi*. Artsdatabankens faktaark nr. 236. Available from: http://www2.artsdatabanken.no/faktaark/Faktaark236.pdf (accessed 31.12.2020).

Svensson, I. 2006. *Nordens vecklare - The Nordic Tortricidae*. 349 pp. Entomologiska Sällskapet i Lund.

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