

Elaphomyces virgatosporus in NW Norway - the northernmost records of a rare truffle.

Thomas Læssøe¹, John Bjarne Jordal², Jan Gert Borgergren Nielsen¹, Dag Holtan³, and Perry Gunnar Larsen⁴

¹Department of Biology, Univ. of Copenhagen, Universitetsparken 15, DK-2100 Copenhagen Ø, Denmark, E-mails: thomasl@bio.ku.dk and ove_orm@hotmail.com

²NO-6610 Øksendal, Norway, E-mail: john.bjarne.jordal@sunndals.net

³Box 3, NO-6249 Ørskog, Norway, E-mail: samedag@adsl.no

⁴Reiakvam, NO-6260 Skodje, Norway, E-mail: perrygl@online.no

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Elaphomycetaceae, hypogeous fungi, *Corylus*, relic species

NØKKELOORD

løpekuler, underjordiske sopper, hassel, relik

ABSTRACT

The first Norwegian records of *Elaphomyces virgatosporus* Hollós are reported from two sites in Western Norway (Møre og Romsdal County) in 2008. All material was collected underneath old *Corylus avellana* in ancient, previously coppiced stands in dark, light soil with sparse herbaceous ground cover. No other species of *Elaphomyces* were found in the vicinity of the collected material. Most material was located by raking where red deer and/or roe deer evidently had been excavating truffles. They were far from evenly distributed. The species so far seems to be very rare, with a strongly disjunct distribution. The nearest sites are found in Southern Sweden, and the main population in Europe seems to be located in Hungary. The distribution of *Elaphomyces* species in Norway is poorly known, but the populations of *E. virgatosporus* in NW

Norway may be relics from the early, warm, postglacial period (early Holocene).

SAMMENDRAG

De to første funnene av løpekulearten *Elaphomyces virgatosporus* i Norge ble gjort i Møre og Romsdal (Eikesdalen i Nesset og Linge i Norddal) i 2008. Alle funnene ble gjort under gammel hassel, i mørk, lett jord med sparsom urtevegetasjon. Ingen andre *Elaphomyces*-arter ble funnet i umiddelbar nærhet. Materialet ble funnet ved å søke i groper hvor hjort og/eller rådyr hadde gravd etter underjordiske sopper. *E. virgatosporus* er svært sjelden, med et disjunkt utbredelsemønster. De nærmeste funnstedene ligger i Sør-Sverige, mens Ungarn synes å ha de største bestandene i Europa. Utbredelsen av løpekuler i Norge er dårlig kjent, men bestandene av *E. virgatosporus* på Nordvestlandet kan være relikter fra den postglasiale varmetida.

INTRODUCTION

Species of *Elaphomyces* Nees: Fr., especially some common brown species, can be very dominant as ectomycorrhizal partners in acid woodlands (e.g. Hawker 1954, Lange 1956). In dark, mostly light and calcareous soils, a rarer, but rather diverse group of "black" species can be found, for example in association with *Corylus*. Nitare (2000) included this group in

his work on Swedish indicator species. He regards the species as indicators of long continuity, a view previously published by Kers in a series of *Elaphomyces* studies (Kers 1978, 1979, 1980, 1983a, 1983b, 1984, 1997) and as relics. Both authors state that there are some differences in the ecological requirements in the six included species. Five of them would appear to belong to a southern thermophilous element only to be found south of the northern limit of *Corylus*. The widespread species, *E. leveillei*, occurs with *Betula* in thick black turf without other accepted indicator species, while four of the remaining five mostly occur on soils with relatively high pH and in association with a number of co-occurring indicator species such as species of *Cortinarius* subg. *Phlegmacium*. Rydberg (2007a) documented that *E. striatosporus* occurs in soils with a pH value around 4.5. In Norway Eckblad (1962, 1971) reported seven species of *Elaphomyces* with three belonging to the black group. Kers (1980) redescribed one Norwegian record of *E. leveillei* (under *Corylus*, near Gaustad in Oslo) as the highly characteristic *E. striatosporus*, and added a key to the Nordic black species (Kers 1981). *E. striatosporus* was later discovered in Sweden (Kers 1984).

SEARCH FOR TRUFFLES DURING THE EIKESDAL WORKSHOP 2008

During the annual Eikesdal foray and workshop in Western Norway, organized by the local mycological society "Risken" in late September 2008, a special focus was placed on hypogeous fungi, and at the first site, rather steep slopes below Rangåfjellet, many attempts were made to locate truffles under old hazels during the morning foray. In the afternoon we continued further up the slope and found an area, apparently with a slightly moister microclimate and many signs of red deer (and/or roe deer) having dug after food in the soil next to the old hazels. Already the first of these disturbed spots yielded a handful

of dark, soil encrusted *Elaphomyces* with a thick black peridium seen in section. About ten collections were retrieved from this rather small area (ca. 50 x 30 m), and back in the laboratory we discovered two things: all the material would appear to belong to the same species and all had the most intriguing striped spores. This initially led to the assumption that we were dealing with *E. striatosporus*, since this species is known from Norway, and was the only striped spored Nordic species in the key available to us (Eckblad et al. 2000). Nevertheless, not least the size of the fruit-bodies and the thickness of the peridia made us wonder. Later we came across a online description from the Swedish red list of *E. virgatosporus* Hollós (Bohlin 2002/2006), and we also got hold of Johan Nitare's "Signalarter" that immediately told us that the latter name was the right one (Nitare 2000: 266-267). During the following days we hunted truffles on all sites. *E. virgatosporus* was not refound during the foray, but four other species of truffles were (*E. muricatus*, *E. granulatus*, *Genea hispidula* and *Hydnotrya tulasnei*). Following this success Dag Holtan again found *E. virgatosporus* under old hazels at Sunnmøre. The material from Eikesdalen was discussed with S. Sivertsen who also attended the foray, and later some material was sent to Johan Nitare who duly confirmed the agreed determination from both sites. The combination of thick, dark peridia in section, striate spores and a spore size range around 17-18 µm in diam. make *E. virgatosporus* stand out from all other species of *Elaphomyces* (e.g. pers. com. J. Nitare).

A brief description of the collected material

Ascomata irregularly globose, strongly encrusted with a thick layer of soil, about the size of a hazelnut to slightly bigger (TL-13512 exsic. 11-35 mm diam) (Fig 1). Outer surface minutely and densely warty, very dark brown; in section with a thick (up to 5 mm) black rind



Figure 1. *Elaphomyces virgatosporus* and a hazel nut at the collection site in Eikesdalen. Foto: John Bjarne Jordal.

and within this a white layer. Gleba when young white and cottony, later very dark brown with a tendency to have a central, dark cavity, and finally fibrillose-powdery. Ascospores globose, dark brown, with an intricate ornament of more or less parallel ridges creating a striped impression (Fig. 2), ca. 18-19 μm diam. For a more complete, illustrated account, see Kers (1997). Selected illustrations: Kers (1997): 26-27 (incl. SEM of ascospores), Montecchi and Sarasini (2000): 86-87 (incl. SEM of ascospores).

Material examined

Locality 1, Eikesdal, Norway, Møre og Romsdal, Nesset municipality, Eikesdalen, under Rangåfjellet:

(1) under old *Corylus*, 26.09.2008, leg. and det. T. Læssøe and J.G.B. Nielsen, TL-13512 (C)



Figure 2. Ascospores (DIF) from TL-13512.

(2) in soil under *Corylus*, UTM(WGS84): MQ 5945 2610, Alt.: 132 m, 26.09.2008, leg. and det. Læssøe, Thomas; Nielsen, Jan G.B.; Nilsen, Terje Spolén; Jordal, John Bjarne; conf. Nitare, Johan (Dec. 08), F69242 (O)

(3) in soil under *Corylus*, UTM(WGS84): MQ 5948 2609, Alt.: 130 m, 26.09.2008, leg. and det. Læssøe, Thomas; Nielsen, Jan G.B.; Nilsen, Terje Spolén; Jordal, John Bjarne, F69247 (O)

(4) in soil under *Corylus*, down to 15 cm depth, UTM(WGS84): MQ 5947 2611, Alt.: 130 m, 26.09.2008, leg. and det. Læssøe, Thomas; Nielsen, Jan G.B.; Nilsen, Terje Spolén; Jordal, John Bjarne, F69248 (O)

Locality 2, Linge

Norway, Møre og Romsdal, Norddal municipality, Storfjorden: Linge, in soil under old *Corylus*, UTM(WGS84): MQ 06210 07428, Alt.: 83 m, 29.09.2008, leg. Dag Holtan, det. Perry G. Larsen, conf. Johan Nitare (Jan. 2009), F69584 (O).

Description of the localities and specific sites.

Locality 1, Eikesdal

The locality is situated on the north side of Eikesdal in Nesset municipality, under the steep mountain Rangåfjellet (1500 m) at about 130 meters a.s.l. This is a deciduous forest dominated by *Corylus avellana*, with scattered *Ulmus glabra*, *Betula verrucosa*, *Salix caprea*, *Alnus incana* and *Populus tremula*. All *Corylus* stands in the area are probably very old, with a long continuity. The climate is warm in summer. The soil is rich in humus and also sand and small stones originating mainly from scree material. The

rock consists mainly of gneisses, but there are scattered places where base rich ground water appears. The site of *Elaphomyces virgatosporus* has a slope of about 10-25 degrees towards the south-southwest. The vegetation is partly scarce, but vascular plants like *Galium odoratum*, *Viola riviniana* and *Rubus saxatilis* are common (see photo). In the vicinity many rare fungi like *Cantharellus amethysteus*, *Cortinarius olearioides*, *Lycoperdon echinatum*, *Peziza saniosa*, *Porphyrellus porphyrosporus* and *Russula aurea* have been found, and in addition a lot of rare wood-inhabiting fungi. A lot of specimens of *E. virgatosporus* were found by digging at places where red deer or roe deer had dug before us. Several other species with a disjunct, relictual distribution pattern are known from Eikesdalen, like *Lycoperdon echinatum* and *Amaurodon viridis*. For a general description of Eikesdal, further details about the deciduous forests and their diversity see Jordal (2005), Gaarder et al. (2005) and the Norwegian Mycological Database.

Locality 2, Linge

The locality is situated west of Linge in Norddal municipality, just above the place where the ferry leaves across the Storffjord from Linge to Eidsdal, at 83 meters a.s.l. This is an old deciduous forest dominated by



Figure 3. Habitat of *Elaphomyces virgatosporus* in Eikesdalen. Foto: John Bjarne Jordal.



Figure 4. Distribution of *Elaphomyces virgatosporus* in Norway. The county of Møre og Romsdal is marked by green colour.

Corylus, with scattered *Betula verrucosa* and *Salix caprea*. The vegetation is here also partly scarce, but vascular plants like *Brachypodium sylvaticum*, *Sanicula europaea*, *Galium odoratum*, *Melica nutans*, *Viola riviniana* and *Fragaria vesca* are common. The forest is probably among the oldest *Corylus* stands in the Storffjorden area. The climate is warm in summer. The soil is rich in humus and also sand and small stones originating mainly from scree material. The rock consists mainly of gneisses, but there are scattered places where base rich ground water appears, originating from calcareous rocks in the mountain massif. The site of *Elaphomyces virgatosporus* had a slope of about 10-15 degrees towards the south-southwest. In the vicinity fungi like *Cantharellus amethysteus*, *Russula aurea*, *Cortinarius praestans*, *C. olearioides* and *Lycoperdon echinatum* have been found. Only two fruitbodies of *E. virgatosporus* were found lying on the ground, dug up by red deer or roe deer. Further digging gave no result.



Figure 5. World distribution of *Elaphomyces virgatosporus*. A ring marked with an arrow shows the new area for this species in Norway. Redrawn after Kers (1997).

DISTRIBUTION AND ECOLOGY

Fig. 5

Siller et al. (2005) reported the species from at least seven sites in Hungary, mostly *Fagus sylvatica* dominated forests but also in *Quercus-Carpinus* forests, and often together with *Tuber* spp. They do not give any detailed soil descriptions. One of the sites is defined as “Melittio-Fagetum” which would indicate a thermophilous, calcareous vegetation type with *Melittis* and *Fagus sylvatica* (Chlebicki pers. com.). They cite Trappe for a pers. com. where he considers *E. virgatosporus* to represent an ancient relic species that originated before the continents drifted apart. The only American collection (see Kers 1997) was found in Mississippi with *Quercus virginiana*.

Kers (1997), furthermore, reported on a Swiss collection from Kanton Baselland but without ecological details. In the northern distribution area (Gotland, Öland, Eikesdal and Linge) all records are so far with *Corylus* as the apparent mycorrhizal partner. Common vascular plants at the Gotland site were *Hepatica nobilis*, *Sanicula europaea*, *Rubus saxatilis*, *Carex sylvatica* and *Epipactis helleborine*. At the Öland site, *Hepatica nobilis*, *Brachypodium sylvaticum* and the moss

Rhytidiadelphus triquetrus were mentioned. Kers also reported pH=5,49 and 6,10 respectively for the Swedish sites.

The strongly disjunct distribution would appear to be highly suspect, also when considering that so many recent genetic studies have shown that American populations identified under European names often can be viewed as phylogenetically independent species (e.g. in *Xerocomus*, Taylor and Eberhardt pers. com). On the other hand Kovács et al. (2008) have in a recent paper advocated for accepting another truffle (*Imaia gigantea*) as one entity, despite its extreme disjunct distribution, and presumed very long genetic isolation of the individual populations.

CONSERVATION

Siller et al. (2005) argued for a high protection status for *E. virgatosporus* in Hungary based on occurrence in few sites and these sites being threatened by high game populations and also by semi-commercial truffle picking. Bohlin (2002) recommended the species to be given legal protection in Sweden, and the Swedish red list (Gärdenfors 2005) lists the species as endangered (EN) based on criterion D (very small or restricted population) from the nature types “agricultural landscapes” and “forest” with records from Gotland and Öland (formerly mown or grazed forests). Although much inventorying remains to be done, we would recommend a similar listing in Norway. In Sweden, *E. striatosporus* and *E. aculeatus* recently have got dedicated action plans (Rydberg 2007a, 2007b). The same would be appropriate for all sites of *E. virgatosporus*. It is unclear whether the size of deer populations, or other mammalian truffle hunters, can affect the conservation status of truffles. Trappe and Mazer (1977) reported on deer foraging for truffles.

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