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## One new and one rare species of *Entoloma* from the Norwegian nature reserve Holmvassdalen

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**Abstract:** One new and one rare species in *Entoloma* subgenus *Leptonia*, viz.: *E. holmvassdalenense*, sp. nov., and *E. sublaevisporum*, are described from a Norwegian nature reserve. Macro- and microscopic-al descriptions, drawings of microscopical features and colour photographs are provided.

**Zusammenfassung:** Eine neue und eine seltene Art der Gattung *Entoloma* Untergattung *Leptonia*, nämlich *E. holmvassdalenense*, sp. nov., und *E. sublaevisporum*, werden aus einem norwegischen Naturreservat beschrieben. Die beiden Arten werden mit makro- und mikroskopischen Beschreibungen, Mikrozeichnungen und mit Farbabbildungen dokumentiert.

In Holmvassdalen Nature Reserve situated in Nordland County, northern Norway, one new and one rare species of *Entoloma* were found in the period 2008–2013. The nature reserve is about 60 km<sup>2</sup> large and was protected by the Ministry of Environment in December 2008. The findings of *Entoloma* occurred in connection with fieldwork related to recording of red-listed species in the area, and were carried out by JOSTEIN LORÅS and SIW ELIN EIDISSEN, with permission from the county governor. Up to the present day more than 120 red-listed species of fungi are recorded in Holmvassdalen according to the Norwegian Red List (KÅLÅS & al. 2010), of which 37 are of the genus *Entoloma*. The first author provided microscopy of a high number of dried specimens and by this effort the new and the rare species were ascertained, in combination with DNA-sequencing. The study of microscopic characters indicated several new and rare *Entoloma* species. Two species belonging to subgenus *Leptonia* are reported in this paper.

The localities have in common different ecological features like calcareous bedrock, humidity and vegetation. A reasonable estimate of the annual rain- and snowfall will be 1300–1400 mm (LORÅS & EIDISSEN 2011). The lower and northern part of the Nature Reserve, 160–300 m s. m., where most recordings were done, is characterized by old spruce calcareous forest (*Picea abies*) with some birch (*Betula*) and alder (*Alnus incana*). In the upper part, 300–500 m. s. m., old pine forest (*Pinus sylvestris*) and birch and spruce dominate with occasional touches of willow (*Salix caprea*) and rowan (*Sorbus aucuparia*). Several localities are highly nutritious, with

belts of limestones cutting through the area, which in some cases form pits and fissures. At some localities rich fens and wooden grassland exist, as calcareous water from the underground fertilizes the soil continuously. This process is by all accounts essential to the occurrence and distribution of most *Entoloma* species in Holmvassdalen, including the new and the rare one.

On the whole different types of vegetation characterize the Nature Reserve, forming a range of rich habitats in the area, represented by a mosaic with tall- and low-herbs (ABEL & al. 2005). Vascular plants like *Aconitum lycoctonum* ssp. *septentrionale*, *Filipendula ulmaria*, *Geranium sylvaticum*, *Trollius europaeus*, *Polygonatum verticillatum*, *Chamerion angustifolium* form meadows with tall-herbs, while *Listera ovata*, *Convallaria majalis*, *Rubus saxatilis*, *Potentilla erecta*, *Succisa pratensis*, *Fragaria vesca*, *Viola riviniana*, *Anemone nemorosa*, *Thalictrum alpinum*, *Gymnadenia conopsea* and *Parnassia palustris* commonly occur in low-herb meadows. In these often small areas strongly clustered species form hotspots, in which a whole range of rare *Entoloma* species was recorded, like *E. alvareense*, *E. callirhodon*, *E. fulvoviola-ceum*, *E. gomerense* and *E. viiduense*. Additionally, 18 red-listed *Entoloma* species, originally categorized as grassland fungi, are recorded in calcareous fens and wooden tall- and low-herb meadows in Holmvassdalen (LORÅS & EIDISSEN 2011).

***Entoloma sublaevisporum*** VILA, NOORDEL. & O. V. MOROZOVA (Fig. 1)  
GenBank no. KM503117

#### **Description:**

**Pileus:** 17–30 mm wide, hemispherical to plano-convex with distinctly depressed centre, straightened irregular margin, fibrillose all over, squamulose at centre, light grey to light taupe, sometimes subzoned with darker centre, sometimes with weak stripes at margin.

**Lamellae:** white to grey-white, sometimes with blue tinge where lamellae are attached to the stipe, some distinctly decurrent, irregular, edge concolourous.

**Stipe:** 27–75 × 1.5–2 mm, dark blue, cylindrical, innate fibrillose, sometimes striate, partly white pruinose, slightly swollen base with white tomentum.

**Context:** smell indistinct, taste and colour not noted.

**Spores:** 8.5–12.2 × 5.0–7.0 μm, in average 9.9 × 5.9 μm, Q=1.2–1.6–2.1, weakly rugulose to nodulose, not really angled, thin-walled.

**Basidia:** 4-spored, 30–65 × 9–12 μm, clamp connections at all septa.

**Cheilocystidia:** heterogenous lamellar edge with scattered, small and inconspicuous cystidia, 20–60 × 6–10 μm, mostly not protruding the basidia, cylindrical to clavate with obtuse apex.

**Pileipellis:** a cutis with a transition to a trichoderm at margin with inflated end cells, 8–20 μm wide, partly granulose intracellular as well as incrustated pigment.

**Habitat:** The species was found on five dates, spreading over four localities, concentrating at two areas, situated approx. 1.6 km from each other, on each side of river Holmvasselv, flowing at the bottom of the valley. All localities are covered with tall herbs and some low-herbs, surrounded by old, calcareous spruce forest. However, one record was on the bark of a dead, fallen spruce, probably attached to moss. Obviously, this habitat differs completely from all the others.



Fig 1. *Entoloma sublaevisporum*, left, above right habitus, phot. JOSTEIN LORÅS, below right spores, cheilocystidia, pileipellis, bar: 10  $\mu$ m.

**Material examined:** all specimens from: **Norway:** Nordland County, Grane municipality, Holmvassdalen, (3927-3931), UTM 7246448, 422195, 22. August 2008, leg. JOSTEIN LORÅS; (8554-8557), UTM 7245178, 421202, 6. September 2009, leg. MAJA EIDISSEN; (1176-1180), UTM 7246461, 422190, 3. September 2010, leg. SIW ELIN EIDISSEN; (024-028, 085-091), UTM 7245258, 421267, 22. August 2011, leg. JOSTEIN LORÅS; (033-039, 085-096), UTM 7245289, 421212, 6. September 2011, leg. JOSTEIN LORÅS and SIW ELIN EIDISSEN.

### Remarks:

*Entoloma sublaevisporum* was recently published as new to science (MOROZOVA & al. 2014). Sequencing of the ITS1+ITS2 region of one of our collections was carried out with the assistance of OLGA MOROZOVA at the Komarov Botanical Institute in St Petersburg and the results fit well to *E. sublaevisporum*. The spores of the Norwegian

collections are somewhat larger than in the type and in the specimen examined by MOROZOVA & al. (2014) from Austria.

This rare species is somewhat difficult to position within subgenus *Leptonia*, but seems to comply most convincingly with section *Leptonia* and further among species with brown, not blue, squamulose pileus and fibrillose, not polished stipe with blue or violaceous colours. The lamellar edge is concolourous with the sides and without blue or violaceous tinge. Clamp connections are abundant, and pileus colours are distinctly different from stipe colours.

***Entoloma holmvassdalenense* EIDISSEN, LORÅS & WEHOLT, spec. nova (Fig. 2)**

Mycobank MB 810937

GenBank accession no. KM610321

**Diagnosis:** *Entoloma holmvassdalenense* is close to *Entoloma coeruleoflocculosum*, but differs by 2-spored basidia and differently shaped cheilocystidia as well as larger spore size and spore shape with a broader Q-value.

**Description:**

**Pileus:** 14–38 mm broad, hemispherical to plano-convex, not or with only weakly depressed centre, straightened irregular margin, distinctly and coarsely squamulose all over, blackish to dark brown squamules, elsewhere pale to dark brown, also observed with dark violaceous hue, not striate margin.

**Lamellae:** white, adnate-emarginate, moderately crowded to somewhat distant, concolorous edge.

**Stipe:** 25–85 × 2.0–5.0 mm, blue, not very dark, fairly smooth but with innate fibrillae, slightly flocculose at apex.

**Context:** smell farinaceous, taste and colour not noted.

**Spores:** 10.0–15.0 × 7.2–10.5 μm, in average 10.2–13.7 × 7.8–10.9 μm, Q=1.29–1.35–1.45, 5–6-angled.

**Basidia:** (1–)2-spored, 25–40 μm, no clamp connections.

**Cheilocystidia:** heterogenous lamellar edge with distinct scattered, clavate lageniform cystidia in dense clusters, mostly with swollen base and attenuated to acute, even some rostrate to mucronate apex, 20–40 × 6–10 μm.

**Pileipellis:** a cutis of cylindrical up to 10 μm wide hyphae with tufts of clavate terminal elements up to 35 μm wide, length up to 60 μm, pigment intracellular.

**Etymology:** The name *holmvassdalenense* is related to the geographical area of Holmvassdalen Nature Reserve, where the fungus has been found first.

**Habitat and distribution:** So far it is only known from the Holmvassdalen Nature Reserve in Norway, where 19 collections from 16 localities were made. The soils are covered with tall herbs, several have low herbs, and some are also moist localities with mosses, e.g. *Sphagnum* spp., all are surrounded by old, calcareous spruce forest.

**Holotypus, Norway:** Nordland County, Grane municipality, Holmvassdalen, (28-2013), UTM 7245200, 421198, 25. August 2013, leg. JOSTEIN LORÅS and SIW ELIN EIDISSEN, deposited in O (Botanical museum, Oslo).

**Other material examined:** all specimens from the same location: **Norway:** Nordland County, Grane municipality, Holmvassdalen: (4015-17), UTM 7244740, 0421005, 27. August 2008, leg. JOSTEIN LORÅS; (8097-99), UTM 7240173, 420101, 24. August 2009, leg. SIW ELIN EIDISSEN; (8419-20), UTM 7245925, 421430, 4. September 2009, leg. JOSTEIN LORÅS; (8516-19), UTM 7245062,





Fig. 2. *Entoloma holmvassdalenense*, left habitus, phot. JOSTEIN LORÅS, right spores, basidium, cheilocystidia, pileipellis, bar: 10  $\mu$ m.

421020, 6. September 2009, leg. JOSTEIN LORÅS; (8393-96), UTM 7245339, 421093, 4. September 2009, leg. JOSTEIN LORÅS; (34-2011), UTM 7244970, 421847, 7. September 2011, leg. JOSTEIN LORÅS and SIW ELIN EIDISSEN; (37-2011), UTM 7244865, 421803, 7. September 2011, leg. JOSTEIN LORÅS and SIW ELIN EIDISSEN; (38-2011), UTM 7244865, 421804, 7. September 2011, leg. JOSTEIN LORÅS and SIW ELIN EIDISSEN; (46-2011), UTM 7244868, 421803, 7. September 2011, leg. JOSTEIN LORÅS and SIW ELIN EIDISSEN; (68-2011), UTM 7246587, 422459, 3. September 2011, leg. JOSTEIN LORÅS; (82-2011), UTM 7244697, 420857, 4. September 2011, leg. JOSTEIN LORÅS; (97-2011), UTM 7245145, 421115, 22. August 2011, leg. JOSTEIN LORÅS; (118-2011), UTM 7245800, 421569, 6. September 2011, leg. JOSTEIN LORÅS and SIW ELIN EIDISSEN; (161-2011), UTM 7238481, 419821, 27. August 2011, leg. JOSTEIN LORÅS; (173-2011), UTM 7245924, 421429, 21. August 2011, leg. JOSTEIN LORÅS and SIW ELIN EIDISSEN; (195-2011), UTM 7244598, 420867, 21. September 2011, leg. JOSTEIN LORÅS and SIW ELIN EIDISSEN; (233-2011), UTM 7245050, 421120, 21. August 2011, leg. JOSTEIN LORÅS; (25-2013), UTM 7245277, 421086, 25. August 2013, leg. JOSTEIN LORÅS and SIW ELIN EIDISSEN; (36-2013), UTM 7246777, 421236, 2. September 2013, leg. JOSTEIN LORÅS.

### Remarks:

The blackish to dark brown, distinctly squamulose, unstriped pileus and blue, not completely polished stipe place the species most probably in section *Anatinum*.

In NOORDELOOS (2004) it keys out close to *Entoloma coeruleoflocculosum*, but differs in 2-spored basidia and differently shaped cheilocystidia as well as larger spore size and spore shape with a broader Q-value. Further the lamellar edge is uncoloured.

In the field it may be confused with *Entoloma fulvoviolaceum*, but this one has a polished stipe, in general a more vivid blue coloured stipe, and is easy to separate microscopically by the 4-spored basidia, and the small cheilocystidia between the basidia. *Entoloma viaregale* is close, but has also 4-spored basidia and fertile lamellar edge. Macroscopically it may be discerned by less squamulose pileus and apparently

by darker blue stipe colours. *Entoloma viaregale*, however, has also been found in Holmvassdalen.

We have not found any descriptions in the literature that adequately comply with the observed characters. Hence, we have concluded that it is a new *Entoloma* species, easily recognized by its 2-spored basidia, large spores and conspicuously shaped cheilocystidia. Macroscopically the distinctly squamulose, non-striate pileus, combined with the not completely polished stipe, appear to be distinct characters.

The ITS1+ITS2 region of the holotype was sequenced by PABLO ALVARADO GARCIA at the ALVALAB in Spain. The result was interpreted by JORDI VILA, and no other sequence matches were found. Based on this and no other species found in the literature that comply, it has been concluded that the fungus merits to be published as a new species.

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