On the status of ***Umbilicaria aprina*** var. halei and ***U. canescens*** (Umbilicariaceae, lichenized Ascomycota)

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**Abstract**

To clarify the nomenclature of ***Umbilicaria aprina*** var. halei and ***U. canescens***, type material from LE and MIN was investigated. Description, measurements and photos of the thalloconidia of the type specimens are provided. According to our investigation ***Umbilicaria aprina*** var. halei is a synonym of ***U. rhizinata***, and ***U. canescens*** is a synonym of ***U. aprina***. Both species belong to the ***U. aprina*** group and are distinguished by the septation of their thalloconidia. Additional specimens identified by previous authors as ***Umbilicaria aprina*** var. halei and ***U. canescens*** were re-identified. ***Umbilicaria rhizinata*** is reported as new to Xinjiang, China.

**Keywords**: Altai, China, Mongolia, thalloconidia, ***Umbilicaria rhizinata***

**Introduction**

Species of Umbilicariaceae Chevall. are predominantly saxicolous lichens mostly found in regions of higher latitudes or at higher elevations worldwide. Multilocus phylogenies resulted in a new generic concept of the family, which currently includes three genera comprising together about one hundred species of mostly umbilicate growth habit (Bendiksby & Timdal 2013, Davydov et al. 2017). The ***Umbilicaria aprina*** group is a monophyletic group of morphologically similar species within ***Umbilicaria*** Hoffm. subg. ***Umbilicaria*** (Davydov et al. 2017). Species of the ***Umbilicaria aprina*** group have a slightly areolate or reticulate centre of the grey upper thallus surface, scarce to dense, simple or branched rhizinomorphs, non-septate to 10-septate thalloconidia, and omphalodisc apothecia with asci containing hyaline, unicellular ascospores.

Thalloconidia have been shown to be highly species-specific and are the most important diagnostic trait in the ***Umbilicaria aprina*** group (Hasenhüttl & Poelt 1978, Krog & Swinscow1986, Hestmark 1990, 1991). Hestmark (1991: 356), discussing the phylogenetic relationship between ***U. aprina*** Nyl. and ***U. africana*** (Jatta) Krog & Swinscow, mentioned that “data on conidium septation perhaps…suggest the existence of intermediate forms (taxa)” between ***U. aprina*** with unicellular thalloconidia and ***U. africana*** possessing 4–10 celled ones. Regarding thalloconidia septation, ***U. rhizinata*** (Frey & Poelt) Krzewicka (Krzewicka 2010) represents such an intermediate species first described as ***U. decussata*** (Vill.) Zahlbr. var. *rhizinata* Frey & Poelt (Poelt 1977). According to Krzewicka (2010), ***U. rhizinata*** is mainly distinguished from the morphologically similar ***U. decussata***, ***U. krascheninnikovii*** (Savicz) Zahlbr. and ***U. formosana*** Frey by its 3- or 4-celled thalloconidia produced on the lower surface in patches, whereas the three latter species lack thalloconidia or possess non-septate ones. This character was also constant for specimens with similar morphology from Asia, Africa and South America (Krzewicka 2010). The species status of ***U. rhizinata*** and its inclusion in ***U. aprina*** group was supported by molecular phylogenetic analyses (Davydov et al. 2017).

Thalloconidia of ***Umbilicaria aprina*** Nyl. var. *halei* Llano and *Gyrophora canescens* Dombr. both related to the ***U. aprina*** group have not been investigated so far and the status of such taxa therefore remains unclear.

***Umbilicaria aprina*** var. *halei* was described by Llano (1956) from Baffin Island (North American Arctic). The main characters distinguishing ***U. aprina*** var. *halei* from the type variety were its diminutive size, slate to grey-black colour of the upper surface, and scarce, small, dichotomous rhizinomorphs. Ryvarden (1968) noted that specimens
from Baffin Island are more or less similar with rather variable Scandinavian material of *U. aprina*. Since that time, *U. aprina* var. *halei* has been rarely mentioned in the literature (e.g., Goward et al. 1994). However, Wei & Jiang (1993) accepted this variety in their monograph of Asian Umbilicariaceae, and suggested morphological and geographical differences from *U. aprina* var. *aprina*. They were not able to examine the type material, and recognized *U. aprina* var. *halei* by its blackish-grey upper surface, sometimes bearing apothecia, with a distribution in North-East Asia, North Europe and North America. Moreover, they reduced *U. decussata* var. *rhizinata* to synonymy with *U. aprina* var. *halei*.


Thus, the specimens recognised by different authors as *Umbllicaria aprina* var. *halei* seem to represent at least two morphologically similar species, namely *U. aprina* and *U. rhizinata*, and *Umbllicaria canescens* treated by authors as *U. aprina* var. *aprina*, *U. aprina* var. *halei*, *U. cylindrica* var. *delisei* or *U. cylindrica* s.lat. The goal of the present paper is to clarify the taxonomic status of *U. aprina* var *halei* and *U. canescens*.

### Material and methods

The holotype of *Gyrophora canescens* was studied in the herbarium of the Komarov Botanical Institute, Saint Petersburg (LE), the lectotype of *Umbllicaria decussata* var. *rhizinata* – in Staatliche Naturwissenschaftliche Sammlungen Bayerns (M), the holotype of *U. aprina* and the holotype of *U. aprina* var. *halei* were received on loan from the University of Helsinki (H) and University of Minnesota (MIN), respectively. Additional specimens were collected in the Altai Mountains as well as studied in herbaria ALTB, KPABG, LE, and M. Specimens were examined using a stereomicroscope (Zeiss Stemi 2000-C) and a compound microscope (Zeiss Axio Lab.A1). Anatomical examination was undertaken using hand-cut sections mounted in water. Thalloconidia were brushed off from the lower surface of thalli, mounted in water, then examined and photographed in the light microscope Zeiss Axio Imager A1; measurements were performed on the photographs using Zeiss software. Due to significant differences in size, thalloconidia with different septation were measured separately. Measurements of thalloconidia are presented as follows: (smallest value recorded) (X-SE)−X−(X+SE) (largest value recorded), where X is the (arithmetic) sample mean, and SE is the sample error of mean.

### Taxonomy

**Umbllicaria rhizinata** (Frey & Poelt) Krzewicka (2010: 491) Mycobank no. 548351


Type:—NEPAL. Mahalangur: Himal Khumbu, Moränen des Lobuche-Gletschers bei Lobuche, elev. 4950−5000 m, September 1962, J. Poelt L247a (lectotype M–0035585!; isolecotype M–0035586!).

*Umbllicaria aprina* Nyl. var. *halei* Llano (1956: 183), syn. nov. Type:—CANADA. N.W.T.: Baffin Island, head of Clyde Fiord, on exposed gneiss boulders, 26 August 1950, M. E. Hale 450 (holotype MIN–664956!, Fig. 1).

The holotype specimen of *U. aprina* var. *halei* has a similar morphology to the Himalayan *U. rhizinata*: small size, dark grey granulate upper surface, lower surface covered with black patches of thalloconidia in the central part only, and scarce dichotomous pale rhizinomorphs (Fig. 1). Thalloconidia are sphaerical to ellipsoid, brown to dark brown 3- or 4-celled when mature, but often also 2- or rarely 1-celled (Fig. 2). The sizes were (12.6−)15.0−16.2−17.5(−18.7) ×
The wall was 1.3–1.8(2.8) μm. The average size for all types of thalloconidia is 10.9–13.6–16.4 × 8.8–11.0–13.2 μm which agrees well with the data presented by Krzewicka (2010) for *U. rhizinata*. All the remaining characters of *U. aprina* var. *halei* also perfectly fit the circumscription of *U. rhizinata*, except, none of the three specimens of the *U. aprina* var. *halei* holotype has a distinct reticulate pattern at the centre. They are coarsely pruinose with crystals positioned centrally near the umbo, but lack a reticulate pattern. Additionally, examined specimens from the Altai Mts. are only occasionally reticulate at the centre. This can be explained by the smaller size of both the holotype and the Altaian specimens (0.8–1.3 cm v. 1–2(–3) cm of *U. rhizinata*). As has been shown in phylogenies (Davydov et al. 2017), *U. rhizinata* is closely related to *U. aprina*, and only distantly related to *U. decussata*, which consistently possesses this reticulate pattern. Therefore, this character should be used with care as a diagnosis for *U. rhizinata*. Thus, it is proposed that *U. aprina* var. *halei* be reduced to synonymy with *U. rhizinata*.

*Umbilicaria rhizinata* resembles immature *U. aprina*, but differs in its 3–4 celled thalloconidia. Due to the different conception of *U. aprina* var. *halei* by Wei & Jiang (1993) who did not pay attention to thalloconidium septation, material cited by them should be re-identified. Based on the information on the apothecia of *U. aprina* var. *halei* given in Wei & Jiang (1993) their material probably belongs to *U. aprina*. *Umbilicaria rhizinata* was previously known from Nepal and Stanovoye Nagor’e Highlands (South Siberia, Russia) in Asia, Tanzania in Africa, and Bolivia in South America (Poelt 1977, Krzewicka 2010, Davydov et al. 2019a). Further populations in the Altai Mts. both in Russia and China are recorded here. So, we have at least one verified locality for China – in Xinjiang.

**Selected specimens examined.** RUSSIA. Altai Territory: Altai Mts., Korgonsky range, headwaters of Sentelek River, 51°03’ N, 83°43’ E, elev. 1900–2200 m, mountain tundra, 19 August 1996. E. A. Davydov 5350 (ALTB); Republic of Altai: Katunsky range, Ak-Kem River, stone fields and rocks, 49°59’15.6” N, 86°35’09.3” E, elev. 2686 m, 9 August 2009. E. A. Davydov 6879 (ALTB).—CHINA. Xinjiang: South Altai range, 49°01’41” N, 86°50’38” E, elev. 2300–2600 m, 17 July 2007. Davydov 6542 (ALTB).

**FIGURE 1.** *Umbilicaria aprina* var. *halei* (MIN-664956—lectotype). Scale=1 cm
**FIGURE 2.** *Umbilicaria aprina* var. *halei* (MIN-664956—lectotype). Individual 3-, 4-cellar thalloconidia (light microscopy). Scale=10μm

**Umbilicaria aprina** Nyl. (Nylander 1869: 12) Mycobank no. 408077

Type:—ETHIOPIA (=Abyssinia). Dedschen Mts, elev. 14200 ft. *W. Schimper* (holotype H–NYL 31742!).

*Gyrophora canescens* Dombr. (Dombrovskaya: 1970a: 131), syn. nov. Type:—RUSSIA. [Murmansk Region]: Peninsula Kolaënsis, montes Chibinensis, ad declivitatem australem montis Vudjavrezor, elev. 380 m, in schistosis ad lapides nudis, No 6, 5 June 1965, *A. V. Dombrovskaya* (holotype LE-L266!, Fig. 3)


*Umbilicaria canescens* (Dombr.) N. S. Golubk. (Golubkova & Savicz 1978: 115).

Thalloconidia produced on most of lower surface of the holotype specimen of *Gyrophora canescens*, spherical to ellipsoid, brown to dark brown, mainly unicellular, rarely 2-cellular (Fig. 4). The sizes were (7.3–)7.9–8.7–9.6(–9.9) × (6.2–)7.0–7.6–8.2(–8.7) μm for 1-celled (n=25), and (10.6–)10.6–11.2–11.8(–12.3) × (7.2–)7.8–8.4–9.0(–9.0) μm for 2-celled (n=10). The wall was 1.2–1.8 μm. The size and septation of thalloconidia correspond to those known for *U. aprina* (Hestmark 1990). The morphology of the holotype (Fig. 3) and paratype specimens of *Gyrophora canescens* also agree with the circumscription of *U. aprina* except for the dark grey colour of the upper surface. However, this is not a reliable distinguishing character because it may reflect ecological variances and varies even among specimens of the same population. Thus, it is proposed to reduce *U. canescens* (Dombr.) Golubk. into synonymy with *U. aprina*.

Aside from the *locus classicus* in the Kola Peninsula *Umbilicaria canescens* was reported for the Kamchatka Peninsula (Dombrovskaya 1970a), and Mongolia (Byazrov 1986). All the specimens cited by Dombrovskaya (1970a) and Byazrov (1986) were examined and refer to *U. aprina*. *Umbilicaria aprina* Nyl. is distributed in the high Arctic, the Antarctic and high mountain habitats worldwide (Davydov et al. 2011, 2019b, Hestmark 2015, 2016). References to *U. aprina* in the Russian Altai (Davydov & Zhurbenko 2008) actually refer to *U. rhizinata*. According to its distribution pattern I suspect *U. aprina* may be present in Altai but I haven’t seen any verified specimens yet.

**Selected specimens examined.** Exiccata: Feige & Lumbsch, Umbilicariaceae Exs. no. 27, 67; Lichenotheca Afganica no. 16, 25, 58.—RUSSIA. Murmansk Region: Monchegorsk District, Nyavka-Tundra Range, at the middle section of Liva River, 9 km upstream from Livozero Lake, elev. 140 m, spruce forest, on stone, 21 July 1973. *A. V. Dombrovskaya* (KPABG–2707); Kirovsk District, Khibiny Mts, the slope of Vuonnemyok River valley near the...

FIGURE 3. Umbilicaria canescens (LE-L266—holotype). Upper and lower surfaces. Scale=1 cm
FIGURE 4. Umbilicaria canescens (LE-L266—holotype). Non-septate and one-septate thallocondia (light microscopy). Scale=10μm

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UMBILICARIACEAE, LICHENIZED ASCOMYCOTA