

## СООБЩЕНИЯ

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THE SECOND CONFIRMED RECORD  
 OF *UMBILICARIA PULVINARIA* (LICHENIZED ASCOMYCOTA)  
 SINCE ITS ORIGINAL DESCRIPTION IN 1914

ВТОРАЯ ПОДТВЕРЖДЕННАЯ НАХОДКА  
 ЛИШАЙНИКА *UMBILICARIA PULVINARIA*  
 СО ВРЕМЕНИ ОПИСАНИЯ ВИДА В 1914 ГОДУ

**Summary.** *Umbilicaria pulvinaria* has been re-discovered for the Far East, the new collection from North Sakhalin being only the second confirmed record of the species. Its distribution is revised, the species being recognized as endemic to Sakhalin and Kamchatka. Literature reports of the species from Siberia are considered doubtful. Gyrophoric and lecanoric acids were revealed by HPLC. Lecanoric acid is reported for the species for the first time.

**Key words:** Far East, Sakhalin, rare species, endemic, floristic finding, Umbilicariaceae.

**Аннотация.** *Umbilicaria pulvinaria* приводится с территории Северного Сахалина – второго (после locus classicus) местонахождения вида. Указания вида для Сибири признаны ошибочными. Посредством HPLC выявлены вторичные метаболиты: гирофоровая и леканоровая кислоты; леканоровая кислота приводится для вида впервые.

**Ключевые слова:** Дальний Восток, Сахалин, редкий вид, эндемик, флористическая находка, Umbilicariaceae.

*Umbilicaria pulvinaria* (Savicz) Frey is a very rare species, and the data on its geography and biochemistry are extremely scarce. It was described by Savicz (1914) based on his own gathering from South Kamchatka in 1908. During the subsequent seventy years, the species was known only from this single collection, but during the last three decades it was reported for Yakutia (Golubkova & Savicz, 1978), East Sayan (Sedelnikova, 2001) and Stanovoye upland (Makryi, 2002). Despite a long history of lichenological explorations of the Far East (Tchabanenko et al., 2002; Himelbrant & Kuznetsova, 2006) and extensive col-

lections made during Kamchatkian expeditions in 2002–2010 by D.E. Himelbrant, E.S. Kuznetsova and I.S. Stepanchikova, *U. pulvinaria* has not been reported from the Far East since Savicz (1914) and is thus considered as an extremely rare species (Davydov et al., 2011). However, this species was revealed during a revision of the Umbilicariaceae collection from Sakhalin. To specify its distribution area, available specimens ever identified as *U. pulvinaria* were revised. Although Golubkova & Schapiro (1979) examined the secondary metabolite composition of *U. pulvinaria* by thin layer chromatography (TLC) and detected gyrophoric acid and

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not-identified substance, the opportunity was taken to refine the chemical composition of the species.

Specimens, including those from the herbaria CANL, LE, NS, O and SAKH, were examined using standard light microscopy and secondary metabolites were determined using high-performance liquid chromatography (HPLC) based, with modifications, on the methodology of Feige et al. (1993). An Agilent 1200 HPLC system equipped with a gradient binary pump, micro vacuum degasser, standard autosampler, column compartment with thermostat and diode array, and multiple wavelengths UV-detector was used. A ZORBAX Eclipse XDB-C18 column (Agilent Technologies, USA), 5  $\mu\text{m}$ , 4.6  $\times$  150 mm at 26°C was applied. Solvent system A was 1% orthophosphoric acid and solvent system B was 100% methanol (high purity). The run started with 30% B at a flow-rate of 0.7 ml/min. After 5  $\mu\text{l}$  of the extract was automatically injected, solvent system B was increased to 70% within 14 min, then up to 90% B within 30 min, then up to 100% B within 18 min and then isocratically in 100% B for further 20 min. At the end of the run, solvent system B was decreased to 30% within 1 min and the column flushed with 30% B for 16 min before a new run was started. The compounds were detected at  $\lambda=245$  nm.

***Umbilicaria pulvinaria* (Savicz) Frey** 1931, Hedwigia 71 : 114 – *Gyrophora pulvinaria* Savicz 1914, Bull. Jard Imp. Bot. Pierre Grand 15 : 117. **Type:** Kamchatka: In regionibus alpinis ad rupes montis “Krasnyi Jarczik” et montium “Pope-recznyje” prope pagum “Naczika”, 1908, leg. Savicz V.P. No. 5579 (LE-L 280!, lectotype designated by Wei in Wei & Jiang 1993 : 206).

*Umbilicaria pulvinaria* is distinguished by its polyphyllous cushion-like thallus attached by a thick black underthallus, and apothecia of actinodisc-type lacking the disc margin and with very thin

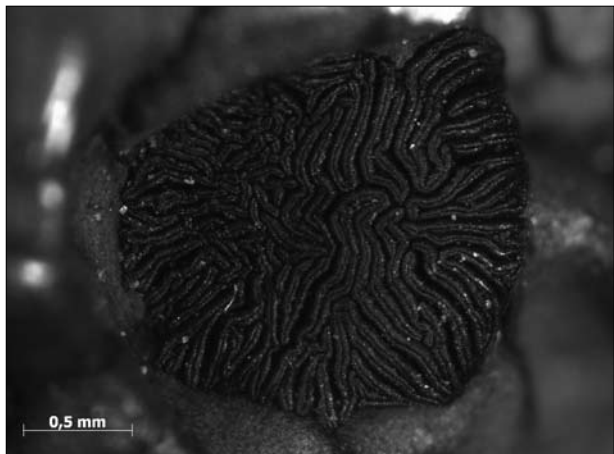


Fig. 1. *Umbilicaria pulvinaria* (LE-L 281, isolecotype). Actinodisc apothecia, scale = 0,5 mm

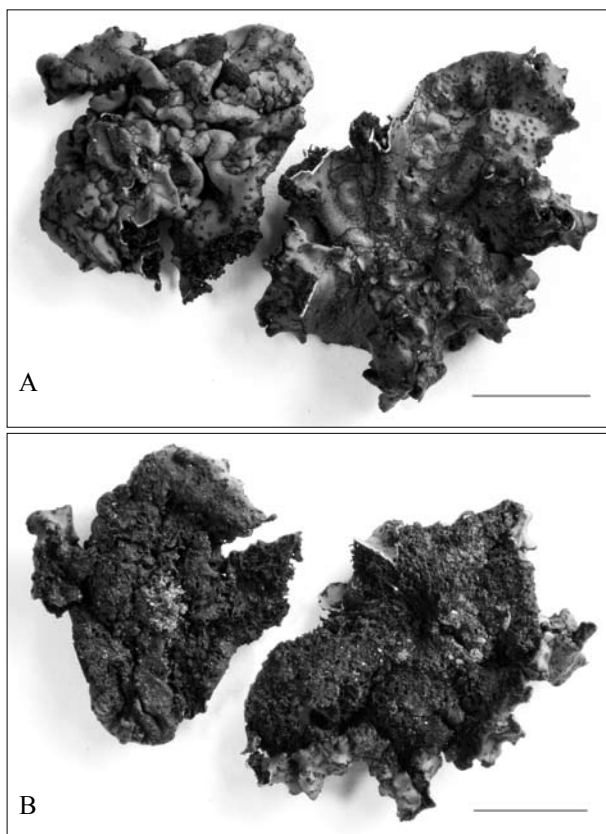


Fig. 2. *Umbilicaria pulvinaria* (LE-L 7943). A – upper surface of thallus; B – lower surface of thallus, scale = 1 cm

fissures (Fig. 1, 2). The species morphologically resembles *U. angulata* Tuck. var. *compacta* Krog and *U. lambii* Imshaug, but the apothecia type differentiates these species well. Apothecia of *U. angulata* var. *compacta* are a gyrodisc with a well developed margin, whereas *U. lambii* has leiodisc apothecia. *Umbilicaria pulvinaria* can also be confused with polyphyllous forms of *U. cinereorufescens*, but the latter possesses thalloconidia on black rhizinomorphs and has a thicker thallus. The actinodisc apothecia of *U. pulvinaria* resemble those of *U. muehlenbergii* (Ach.) Tuck. and *U. polyrrhiza* (L.) Ach., but the prior species has a large and rigid monophyllous thallus with light underthalline filaments and the latter one is characterized by well-developed rhizinomorphs bearing multicellular thalloconidia.

Two HPLC chromatograms were obtained. As the studied compounds have very similar molar extinctions, the coefficients for the wave lengths, 214 nm, 257 nm and 270 nm (Huneck & Yoshimura, 1996) which are close to ours used for the chromatographic detection (245 nm), the peak areas can be considered to be directly proportional to the concentrations of the compounds in our extracts. As a result of the HPLC analyses (Fig. 3), lecanoric acid was revealed as a mi-

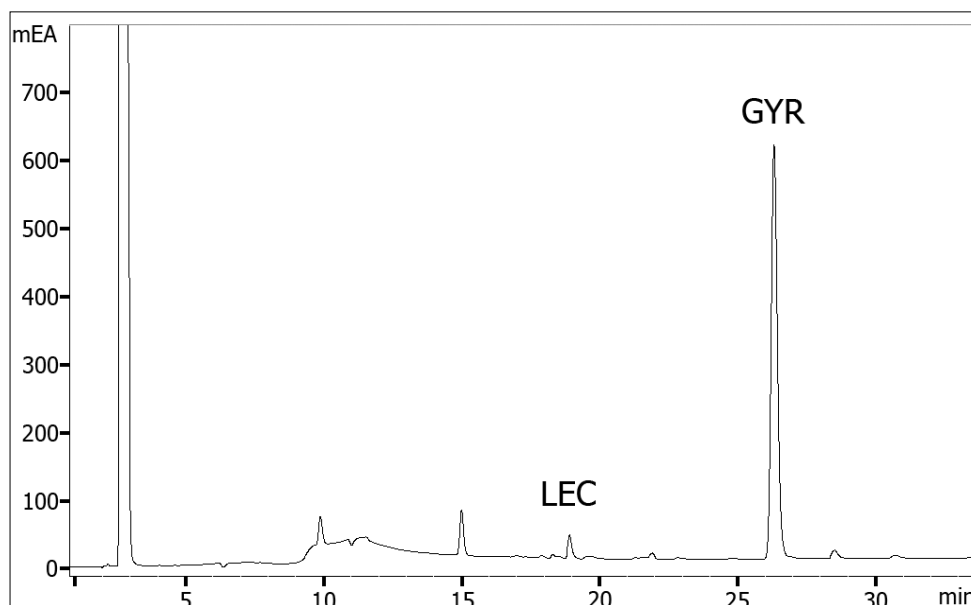


Fig. 3. Gradient HPLC of the acetone fraction from *Umbilicaria pulvinaria* (LE-L 280, lectotype). GYR – gyrophoric acid, LEC – lecanoric acid.

nor compound and gyrophoric acid as the major in both the lectotype and the specimen from Sakhalin.

*Umbilicaria pulvinaria* was reported for Yakutia by Golubkova & Savicz (1978). However, voucher specimens identified by Savicz clearly belong to *Lasallia caroliniana* (Tuck.) Davydov, Peršoh & Rambold. Last species may develop similar cushion-like growth form, but differs by a complex of characters which place it in another genus, i.e. *Lasallia Mérat* (Davydov et al., 2010). Thus, reports of *Umbilicaria pulvinaria* are considered as doubtful for Yakutia. Specimens from Stanovoye upland (East Siberia) reported by Makryi (2002a, b) were identified as *U. cinereorufescens* (Schaer.) Frey. Unfortunately, no herbarium material from East Sayan was available for this study.

Revision of available material recognized *U. pulvinaria* to be a rare species restricted in its distribution to Kamchatka and Sakhalin. There are very few epilithic species of lichens confined to East Asia, e.g. *Leptotrema lithophylla* Oxner, *Stereocaulon saviczii* DR., *S. wrightii* Tuck. and *Ramalina rjabuschinskii* Savicz (Chabanenko, 2008; Dombrovskaya, 1996; Mikulin, 1990; Oxner, 1929, 1960; Tchabanenko et al., 2002; unpublished data of Tchabanenko). An East Asian distribution is also characteristic of some mountain mosses, e.g. *Bucklandiella vulcanicola* (Frisvoll & Deguchi) Bednarek-Ochyra & Ochyra (Czernyadjeva, 2007; Czernyadjeva et Ignatova, 2008; Frisvoll, 1988). However, it is remarkable that all these species are more widely distributed than *U. pulvinaria*, occurring in addition to Kamchatka and Sakhalin, in the mountains of Sikhote-

alin, in Hokkaido, Honshu and Kuril Islands. These regions therefore appear to be plausible localities for further records of *U. pulvinaria*.

**Specimens examined:** Kamchatka: In regionibus alpinis ad rupes montis “Krasnyi Jarczik” et montium “Poperechnyje” prope pagum “Naczika”, 1908, leg. V.P. Savicz No. 5579 (LE-L 280, lectotype); [Southern] Kamchatka, [Elizovsky District], northern slope of Krasny Jarchik Mountain between Koriaki [Koryatskii Ostrog] and Nachiki, (same locality as the lectotype), VII 1908, leg. V.P. Savicz No. 5579 (LE-L 281, isolectotype), [Southern] Kamchatka, [Elizovsky District], Poperechny Range between Koriaki [Koryatskii Ostrog] and Nachiki, 1908, leg. V.P. Savicz (LE-L 282, syntype); Sakhalin, Schmidt Peninsula, Cape Elizabeth, 54°25,110' N 142°42,804' E, alt. 300–400 m. Stones and boulder outcrops in the NW range; associated with *Umbilicaria muehlenbergii*, *U. torrefacta*, *Lasallia caroliniana* and species of *Lecidea*, *Acarospora*, *Porpidia*, *Rhizocarpon* & *Ophioparma*. 15 VIII 2005, leg. S.I. Tchabanenko (LE-L7943).

**Misidentifications:** Russia, Yakutia, Tomponsy region, Verkhoyanskye Gogy Mt. upper part of a slope, alt. 1633.1 [m]. Fragments of grass-fruticulose-lichen tundra amidst stone fields, 1 VIII 1954, leg. V. Kuvaev 67/22 (LE-L6741) = *Lasallia caroliniana*; same region, East Verkhoyanye [upper part of Yana River Basin], Mola River Basin, right bank of Mudukyn River near its junction with the Udultyn River. Stony foothill of the mountain, 1954, leg. L.A. Dobretsova (LE-L7912) = *L. caroliniana*. Stanovoye upland, Kodar range, near headwaters

of the Apsat River, above timberline, [c. 57°23'N, 118°06'E] alt. 1700 m., stone outcrops, on boulder, leg. V.M. Burkova, 11 VII 1964 (NS) = *U. cinereorufescens*; same upland, Udocan range, near headwaters of the Katugin River, [c. 56°41'N, 118°57'E], alt. 1950 m., stony tundra sand rock outcrops, on rocks, leg. V.M. Burkova, 24 VII 1966 (NS) = *U. cinereorufescens*.

**Material of *U. angulata* var. *compacta* examined:** Eastern Pacific Coast District, Juneau: Granite Basin, on rocks, alt. 3000 ft. [c. 950 m], 26 VIII 1957, leg. H. Krog No. 5203 (O-001014, holotype!).

**Selected material of *U. lambii* examined:** Canada, British Columbia, Mt. Assiniboine Prov. Park, Sunburst Lake, 50°55'N, 115°39'W, alt. 2400 m, 3 VIII 1951, I.M. Lamb 6584 (CANL 66543, holo-

type!); same province, Range 2 Coast Land Distr. 25 km SSW of Tatla, northern flank of Razorback Mt. 51.7 N, 124.75 W, 21 VII 1981, T. Goward, G. Leroux & R. Thomson 81-1490 (CANL 110846); same province, Kamloops Division Yale Land Distr., southern slopes of Trophy Mountains, 10 km south of Wells Gray Provincial Park, 52°00'N, 120°00'W, alt. 2350 m, 22 VIII 1984, T. Goward 84-970 (CANL 93955).

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