

LICHENS — ЛИШАЙНИКИ

Rinodina endospora and *R. macrospora* (Physciaceae, lichenized Ascomycota) new to Japan

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Abstract. *Rinodina endospora* and *R. macrospora* are reported as new to Japan. These species are known to be rare in Northeastern Asia and have a disjunctive distribution. *Rinodina endospora* was collected on bark of *Alnus* sp. and *Salix* sp. at 290 m a. s. l. in Hokkaido, and *R. macrospora* was on bark of *Abies mariesii* at elevation between 1960 and 2000 m a. s. l. in Toyama Prefecture of central Honshu. The paper provides data on morphology, ecology, differentiation and distribution of two *Rinodina* species.

Keywords: biodiversity, biogeography, lichens, new records, North-East Asia.

Rinodina endospora и *R. macrospora* (Physciaceae, lichenized Ascomycota) — новые виды для Японии

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Резюме. В результате изучения коллекции лишайников рода *Rinodina* в гербарии TNS (Япония) были обнаружены два новых для Японии вида: *Rinodina endospora* и *R. macrospora*. Эти виды являются редкими в Северо-Восточной Азии и имеют дизъюнктивное распространение. Вид *R. endospora* собран с коры *Alnus* sp. и *Salix* sp. на высоте 290 м над ур. м. на о. Хоккайдо, *R. macrospora* на коре *Abies mariesii* на высоте от 1960 до 2000 м над ур. м. в префектуре Тоёма в центральной части о. Хонсю. В статье приведены данные по морфологии, экологии, отличиям от других видов и распространению изученных видов.

Ключевые слова: биogeография, биоразнообразие, лишайники, новые находки, Северо-Восточная Азия.

The genus *Rinodina* (Ach.) Gray belongs to Physciaceae and comprises approximately 300 species worldwide (Sheard, 2010; Wijayawardene *et al.*, 2022). According to Nadyeina *et al.* (2010) *Rinodina* is polyphyletic and includes species with crustose

thalli, lecanorine apothecia, one-septate brown ascospores with inner wall thickenings, and *Lecanora*-type asci.

Rinodina is a difficult genus in terms of species identification due to the large variety of spore types. Recent studies of the genus *Rinodina* in the Northeastern Asia including Japan, Russia, China, and South Korea have made a great progress in our understanding of the diversity of this genus in the region (Galanina *et al.*, 2011, 2018, 2021a, b; Galanina, 2016, 2019; Sheard *et al.*, 2017; Galanina, Ezhkin, 2019). According to the latest data, 30 species of *Rinodina* were known in Japan (Sheard *et al.*, 2017; Ohmura, Kashiwadani, 2018). The first author had an opportunity to examine herbarium specimens of *Rinodina* housed in the herbarium of the National Museum of Nature and Science (TNS), Tsukuba, Japan in 2019. As a part of results, we found two species new to Japan. This study provides the detailed description of their morphology, along with ecological notes.

Material and Methods

We studied specimens from the herbaria of the National Museum of Nature and Science (TNS) in Japan in 2019. The morphological and anatomical features of the specimens were examined by standard methods of light microscopy. Chromatography was not necessary because all the studied species can be easily distinguished by anatomy and morphology as well as by standard spot tests with KOH (K) and $C_6H_4(NH_2)_2$ (P). Information on voucher specimens including collection sites is presented. Our determinations fundamentally followed Sheard (2010).

Results and Discussion

Rinodina endospora Sheard, 2002, in Sheard et Mayrhofer, *Bryologist* 105(4): 658. — Type: [USA] California, Santa Clara Co., Mount Hamilton Range, San Antonio Valley, 4 IX 1968, A. Howard s. n. (UC — holotype). (Fig. 1: C, D)

The detailed description was given by Sheard and Mayrhofer (2002), Sheard (2010), Sheard *et al.* (2017), and Galanina *et al.* (2021b). The species is characterized by a gray to gray-brown verrucose or areolate thallus, narrowly attached apothecia with flakes of the epinecral layer on the thallus, large *Dirinaria*-type ascospores $(20.5)23.0\text{--}24.0(27.5) \times (8.5)9.0\text{--}10.0(12.0) \mu\text{m}$ of Type B development (Fig. 1: C, D). *Rinodina endospora* can be confused with *R. metaboliza* Vain. which also has *Dirinaria*-type ascospores, but they are of smaller size $(13.5)17.5\text{--}19.0(23.0) \times (8.5)9.0\text{--}10.0(11.0) \mu\text{m}$ (Sheard, 2010).

Distribution. This is the first location of *Rinodina endospora* in Japan and fourth in Northeastern Asia. The species was found in Hokkaido at 290 m a. s. l. The distribution of the species in Japan suggests that it prefers to grow in wet forest areas on floodplain at low elevations. *Rinodina endospora* was previously considered to be a western North American endemic species distributed in California along the coastal ranges and in the Sierra Nevada (Sheard, 2010). Previously, the species was reported in Russia from Kamchatka [Ust'-Bol'sheretsk District, on bark of *Chosenia arbutifolia* (Pall.)

A. K. Skvortsov] (Sheard *et al.*, 2017), from Sakhalin Island where it was found on bark of *Populus* sp. in riparian forest (Galanina *et al.*, 2021a), and from Magadan Region (Magadansky Reserve, floodplain forest, on bark of *Chosenia arbutifolia*) (Galanina *et al.*, 2021b). *Rinodina endospora* is species with an East Asian — western North American disjunct distribution.

Ecology. The species was found on barks of *Alnus* sp. and *Salix* sp. in the mixed forest dominated by *Abies sachalinensis* (F. Schmidt) Mast., *Acer mono* Maxim. var. *glabrum* (Lév. et Vaniot) H. Hara, *Betula platyphylla* Sukaczew, and *Tilia japonica* (Miq.) Simonkai.

Specimen examined: **Japan**, Hokkaido, Prov. Kitami: Ikutahara-Kiyosato, Engaru-cho, Monbetsu-gun, 43°51'06.3"N, 143°29'18.7"E, 290 m a. s. l., on bark of *Alnus* sp. and *Salix* sp., 29 V 2012, Ohmura 8897, A. Frisch, det. Galanina, TNS.

Rinodina macrospora Sheard, 2002, in Sheard et Mayrhofer, Bryologist 105(4): 665. — Type: Canada, British Columbia, Vancouver Island, Botanical Beach, 4 km SW of Port Renfrew, 14 IX 1975, W.J. Noble 5371 (UBC — holotype; SASK — isotype).

(Fig. 1: A, B)

The detailed description was given by Sheard and Mayrhofer (2002) and Sheard (2010). *Rinodina macrospora* is characterized by a light gray areolate thallus, areoles discrete, plane, becoming contiguous; cortex contains atranorin (K+ yellow, P+ faint yellow). Apothecia are narrowly attached, with black plane disc, up to 1.4 mm in diam. The species has large *Physcia*-type ascospores (26.5)28.0–32.0(33.0) × (12.0)13.0–13.5(14.0) μm of Type A development (Fig. 1: A, B). In ontogeny, ascospores have various stages of locule development. Immature ascospores may have the *Physcia*-like and *Physconia*-like lumina with slight apical wall thickening. The habitat of *R. macrospora* is limited to maritime foreshores, on either driftwood or coniferous trees (Sheard *et al.*, 2017). It should be noted that the ascospores of the studied sample are similar in length but narrower than those of the samples from North America.

Rinodina macrospora can be confused with *R. megistospora* Sheard et H. Mayrhofer which also has light gray thallus (K+ yellow, P+ faint yellow) consisting of discrete areoles, and large ascospores, but the ascospores of *R. megistospora* are of *Pachysporaria*-type. Also *R. macrospora* can be confused with *R. ascociscana* (Tuck.) Tuck., *R. roscida* (Sommerf.) Arnold, and *R. tenuis* Müll. Arg. *Rinodina ascociscana* differs by having ochraceous to brownish thallus and no atranorin in cortex. *Rinodina roscida* grows on mosses and decaying plants and is common in oroarctic regions in contrast to the *R. macrospora*. *Rinodina tenuis* has *Pachysporaria*-type ascospores and pannarin in medulla and cortex (P+ cinnabar).

Distribution. This is the first record of this species in Japan and the second in Northeastern Asia. It was found in the central Honshu at elevation between 1960 and 2000 m a. s. l. The distribution of this species in Japan suggests it can be found in

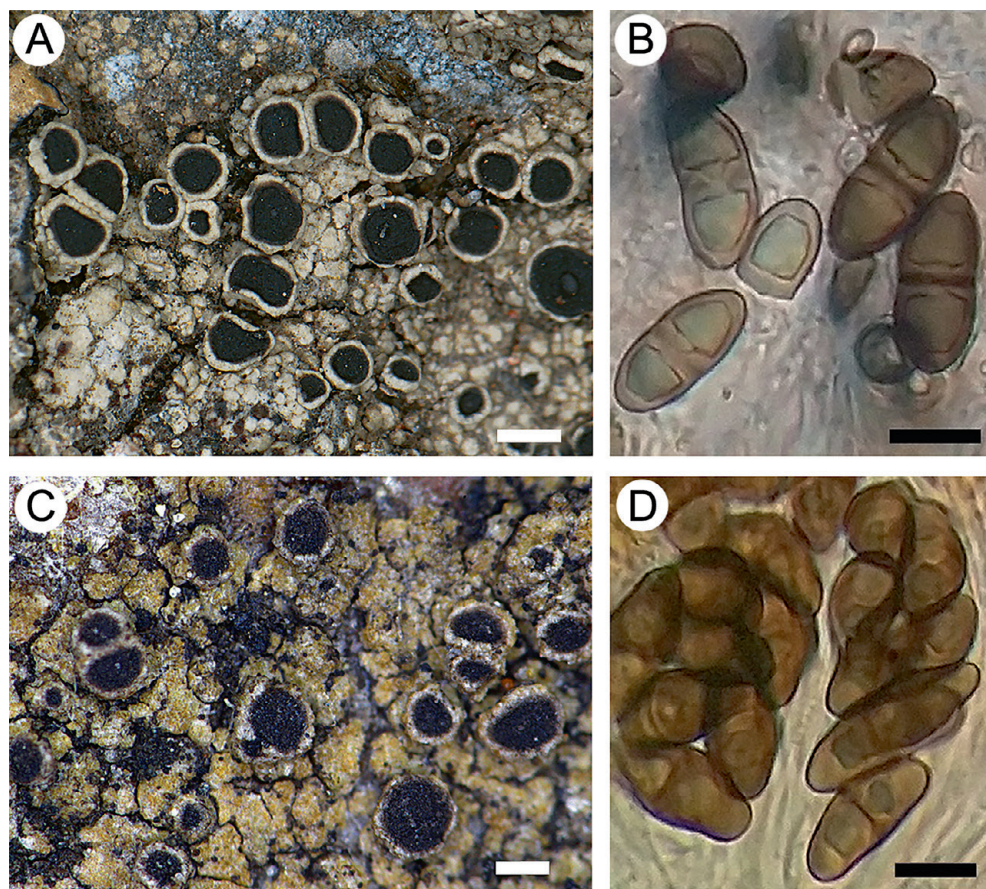


Fig. 1. *Rinodina macrospora* (Ohmura 8897, A. Frisch, TNS) and *Rinodina endospora* (G. Thor 12708, TNS).

A – the thallus and apothecia of *Rinodina macrospora*; B – *Physcia*-type spores of *R. macrospora*, the two left immature spores refer to the *Physconia*-like lumina with slight apical wall thickening; C – the thallus and apothecia of *Rinodina endospora*; D – *Dirinaria*-type spores of *R. endospora* with *Physcia*-like lumina, the septal swelling, and no torus.

Scale bars: A – 1 mm; C – 0.5 mm; B, D – 10 µm.

subalpine coniferous forests. *Rinodina macrospora* was previously considered to be a western North American endemic species distributed from mid-California to Haida Gwaii (Queen Charlotte Islands), British Columbia. This species is strictly maritime in North America (Sheard, 2010). Previously, it was reported in Russia from coast of the Khabarovsk Territory on *Picea jezoensis* (Siebold et Zucc.) Carrière (Sheard *et al.*, 2017). *Rinodina macrospora* is a species with an East Asian – western North American disjunct distribution.

Ecology. The species was found on bark of *Abies mariesii* Mast. in the fir forest.

Specimen examined: **Japan**, Honshu, Prov. Etchu (Pref. Toyama): 33 km SEE of Toyama, Midagahara, along the path to Tateyama crater 500 m SSE of Midagahara bus stop, Tteyama-cho, Nakasinka-

wa-gun, [36°34'N, 137°34'E], 1960–2000 m a. s. l., subalpine, open mixed deciduous forest with *Abies mariesii*, on dead still standing exposed *A. mariesii*, 16 XI 1994, G. Thor 12708, det. Galanina, TNS.

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