LICHENS — ЛИШАЙНИКИ

The genus *Rinodina* (Physciaceae, lichenized Ascomycota) in the Magadan Region (Far East of Russia)

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Abstract. The lichen genus *Rinodina* in the Magadan Region is revised on the basis of extensive collections by the authors in 2011–2015. Fifteen species have been recorded, of which *Rinodina cinereovirens*, *R. endospora*, *R. laevigata*, *R. metaboliza*, *R. olivaceobrunnea*, *R. parasitica*, and *R. subparieta* are new for the study area. *Rinodina endospora* and *R. sicula* are rare in Russia and have only recently been found in Northeastern Asia. The presence of *R. archaea* and *R. exigua* in the Far East of Russia has not yet been confirmed.
Keywords: biodiversity, biogeography, lichens, new records, North-East Asia.

Род *Rinodina* (Physciaceae, lichenized Ascomycota) в Магаданской области (Дальний Восток России)

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Резюме. Изучена коллекция лишайников рода *Rinodina* из Магаданской обл., собранная авторами в 2011–2015 гг. В результате проведенной нами ревизии список лишайников рода *Rinodina* для Магаданской обл. включает 15 видов, 7 из которых приводятся впервые (*Rinodina cinereovirens*, *R. endospora*, *R. laevigata*, *R. metaboliza*, *R. olivaceobrunnea*, *R. parasitica* и *R. subparieta*). *Rinodina endospora* и *R. sicula* являются редкими в России и только недавно были найдены в Северо-Восточной Азии. Присутствие видов *R. archaea* и *R. exigua* на Дальнем Востоке России к настоящему времени не подтверждено.
Ключевые слова: биоразнообразие, биогеография, лишайники, новые находки, Северо-Восточная Азия.

The genus *Rinodina* (Ach.) Gray belongs to the family Physciaceae and comprises approximately 300 species worldwide (Sheard, 2010; Wijayawardene *et al.*, 2020). According to Nadyeina *et al.* (2011), *Rinodina* is polyphyletic and includes species with crustose thallus, 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 Russia (including the Magadan Region), China, South Korea, and Japan have made a great progress in our understanding of the diversity of this genus in the Northeastern Asia (Sheard, 2010; Sheard *et al.*, 2017). Sheard *et al.* (2017) reported many species which were previously unknown in the Russian Far East. In addition, the authors also revealed the close relationship between Asian and American species, including some that were previously considered to be endemic to North America.

The genus *Rinodina* in the Russian Far East has been actively studied in the last decade. However, the majority of studies are focused on the south of the area (Galanina *et al.*, 2011, 2018, 2021; Galanina, 2013, 2016, 2019; Sheard *et al.*, 2017; Galanina, Ezkhin, 2018, 2019; Konoreva *et al.*, 2018; Yakovchenko *et al.*, 2018) while data on its northern part (including the Magadan Region) remain rather poor (Korolev, Tolpysheva, 1980; Kotlov, 1991, 1993a, 1993b, 1995, 2004), although some new species were reported from the region as it is indicated below.

The first records of the genus *Rinodina* in the Magadan Region were made by Korolev and Tolpysheva (1980) who reported two species, *R. archaea* (Ach.) Arnold and *R. exigua* (Ach.) Gray. Later, the species *Rinodina hyperborea* H. Magn., *R. milvina* (Wahlenb.) Th. Fr., *R. mniaroea* (Ach.) Körb., *R. sibirica* H. Magn., *R. turfacea* (Wahlenb.) Körb. were reported for the Verkhnekolymskoe Highland (Kotlov, 1991, 1993a, 1993b, 1995, 2004). Finally, Sheard *et al.* (2017) reported *R. freyi* H. Magn., *R. roscida* (Sommerf.) Arnold, and *R. septentrionalis* Malme. In total, ten species of the genus *Rinodina* were known for the Magadan Region before the present study.

The Magadan Region, with an area of 461400 km^2, lies in the northeastern part of the Russian Far East. The mountainous area framing the northern shores of the Okhotsk Sea and the basin of the upper reaches of the Kolyma River is formed by the ridges of the Kolyma Highlands and the spurs of the Chersky Ridge mountain system. A narrow strip along the northern coast of the Okhotsk Sea is characterized by a temperate continental climate with relatively low winter minimum temperatures and variable weather conditions. The Okhotsk-Kolyma watershed is a climate border with very frosty winters, an average January temperature there is below –32 °C (Klyukin, 1970). The mountainous regions in the upper Kolyma River basin are characterized by the greater climate continentality. According to the geobotanical zoning by Reut (1970), different parts of the study area belong to the mountainous area of dwarf pine-larch-birch forests of the Okhotsk coast, to the bog-tussock-tundra region of the Yamsk-Tauy depression, to the area of mountain-arctic tundra, and to the lichen woodlands of the Kolyma Highlands. Yurtsev (1974) assigns this ter-

ritory to the North Okhotsk province of the East Siberian subregion of the Boreal floristic region.

The aim of our study is to contribute to the knowledge about the diversity of *Rinodina* species in the Magadan Region, as well as about their ecology and distribution.

Material and Methods

The material was collected by the authors in 2011–2015 in several districts of the Magadan Region (Olsky, Omsukchansky, Yagodninsky, Severo-Evensky, Tenkinsky, and Khasynsky) (Fig. 1). Additionally, we studied vouchers from the herbaria of the Institute of Biological Problems of the North, Far Eastern Branch of the Russian Academy of Sciences (MAG) and Komarov Botanical Institute of the Russian Academy of Sciences (LE) in Russia, and the National Museum of Nature and Science (TNS) in Japan. The lichens sampled in 2012–2013 are kept at the Federal Research Center for Biodiversity of the Far Eastern Branch of the Russian Academy of Sciences (VLA). A total of 40 samples from the Magadan Region were studied.

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), $Ca(ClO)_2$ (C), and $C_6H_4(NH_2)_2$ (P). The presence of sphaerophorin crystals was studied by the method of fluorescence in longwave UV.

Results and Discussion

In total, 15 species of *Rinodina* were identified, of which *R. cinereovirens* Vain., *R. endospora* Sheard, *R. laevigata* (Ach.) Malme, *R. metaboliza* Vain., *R. olivaceobrunnea* C. W. Dodge et G. E. Baker, *R. parasitica* H. Mayrhofer et Poelt, and *R. subparieta* (Nyl.) Zahlbr. are new for the Magadan Region. Two species, *R. endospora* and *R. sicula* H. Mayrh. et Poelt, are rare in Russia and have only recently been found in North-eastern Asia (Sheard *et al*., 2017; Galanina *et al*., 2021). *Rinodina archaea*, *R. exigua*, *R. milvina*, and *R. mniaroea* were previously reported from the Magadan Region (Korolev, Tolpysheva, 1980; Kotlov, 1995), but were not found during our field studies, as well as in the herbarium collections. The presence of *R. archaea* and *R. exigua* in the Far East of Russia has also not yet been confirmed (Sheard *et al*., 2017, Galanina, Ezhkin, 2019; Galanina *et al*., 2021).

Newly recorded species for the Magadan Region

Rinodina cinereovirens Vain. (Plate I: 1, 2)

Rinodina cinereovirens is characterized by thin light gray or brownish gray thallus without vegetative propagules (Plate I: 1). Apothecia quickly become narrowly attached, sometimes almost stipitate (to 0.6–1.0 mm) with disc black and plane. Thalline margin is entire and typically persistent (80–120 μm wide), with cortex expanded to 20–60 μm wide. *Rinodina cinereovirens* has *Physcia*-type spores of Type A

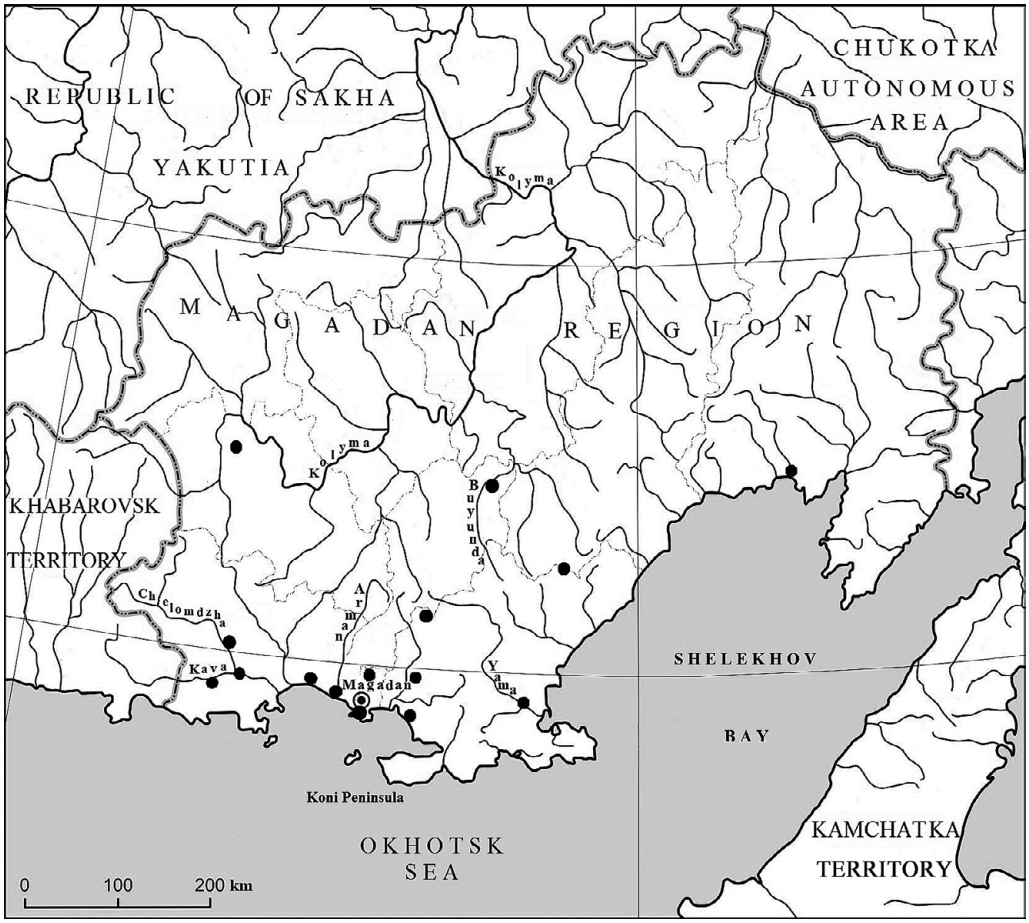
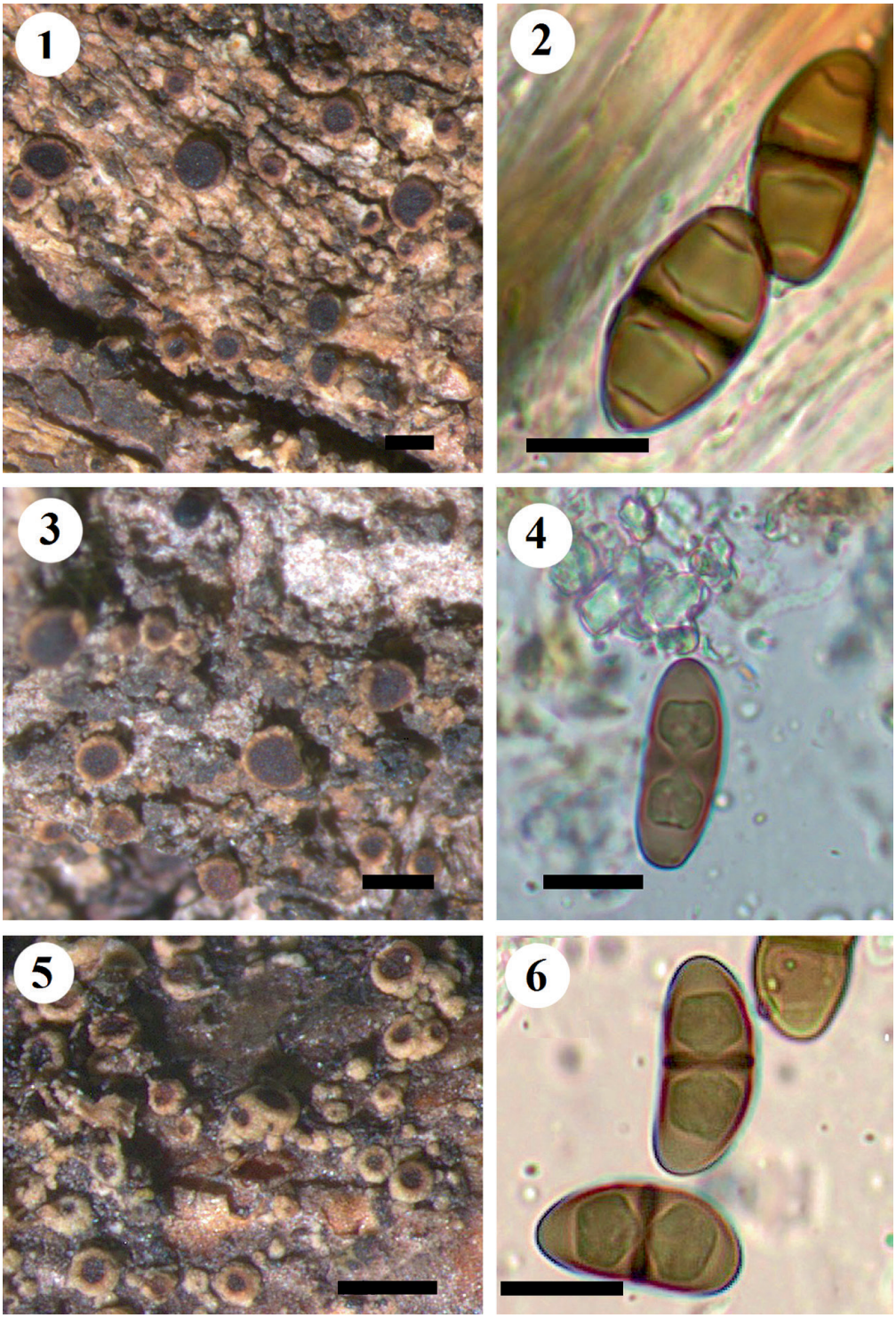


Fig. 1. The studied sites of the *Rinodina* species in the Magadan Region.

development, (21.5)23.0–25.5(27.5) × (10.0)11.5–13.5(14.0) μm (Plate I: 2). Torus well developed. Crystals absent in cortex and present in medulla (sphaerophorin). Spot tests all negative, the secondary metabolite sphaerophorin in longwave UV turns blue-white.

Rinodina cinereovirens is closely related to *R. turfacea* but differs by more broadly ellipsoid spores with more bluntly rounded apices. Furthermore, *R. cinereovirens* inhabits bark and wood, in contrast to *R. turfacea* which typically grows on decaying ground vegetation, less often on wood in oroarctic environments in North America (Sheard *et al.*, 2017).

Plate I. 1 — thallus and apothecia of *Rinodina cinereovirens*; 2 — *Physcia*-type spores of *R. cinereovirens*; 3 — thallus and apothecia of *R. endospora*; 4 — *Dirinaria*-type spore of *R. endospora*; 5 — thallus and apothecia of *R. freyi*; 6 — *Physcia*-type spores of *R. freyi*. Scale bars: 1, 3, 5 — 0.5 mm; 2, 4, 6 — 10 μm.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Distribution. In Russia, the species has previously been reported as *Rinodina turfacea* var. *cinereovirens* (Vain.) H. Mayrhofer and as *R. turfacea* var. *ecrustacea* (Vain.) H. Oliv. for different regions from the Leningrad Region to the Kamchatka Territory (Urbanavichene, Urbanavichus, 1998; Kotlov, 2008; Himelbrant *et al*., 2009; Spisok..., 2010; Chesnokov, Konoreva, 2015; Sheard *et al*., 2017). *Rinodina cinereovirens* is known in Europe from Scandinavia (Norway, Sweden, and Finland) (Mayrhofer, Moberg, 2002). In North America the species was reported from Newfoundland, New Brunswick, Wapusk National Park, northern Manitoba, northern Ontario, and Alaska (Sheard, 2018).

Ecology. *Rinodina cinereovirens* was found on bark of *Alnus* sp., *Betula* sp., *Chosenia arbutifolia*, and *Larix* sp. in floodplain shrub communities and coniferous forests.

Specimens examined: Olsky District, Tauy River, the Niro station, floodplain terrace, 59°47′17.2″N, 148°16′13.2″E, 36 m a. s. l., old larch forest with birch and alder, with tall grass and shrubs, on bark of *Alnus* sp., 6 VIII 2011, *Zheludeva*, MAG O-4581; *ibid*., Magadansky Reserve, Kava-Chelomdzhinsky area, Chelomdzha River valley, 59°47′50.3″N, 148°12′52.9″E, 36 m a. s. l., floodplain forest, on bark of *Chosenia arbutifolia*, 12 VII 2012, *Zheludeva*, MAG O-4582; *ibid*., Kamenny Range, vicinity of the tourist camp Magtur, Pyany stream, 59°45′24.5″N, 149°39′17.9″E, 9 m a. s. l., floodplain shrubs, on bark of *Alnus* sp., 6 VIII 2013, *Galanina M-13-178-3*, VLA; Omsukchansky District, 500 km NE from Magadan, foothill of Kilganskie Range, vicinity of Dzhuletta mining camp, 61°11′40.9″N, 153°56′55.7″E, 969 m a. s. l., larch-dwarf pine forest with rocks along stream, on dead twigs of *Larix* sp., 9 VIII 2012, *Yakovchenko 25-12*, VLA.

Rinodina endospora Sheard (Plate I: 3, 4)

The detailed description was given by Sheard (2010), Sheard *et al*. (2017), and Galanina *et al*. (2021). 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 spores (20.5)22.0–24.0(27.5) × (8.5)9.0–10.0(11.0) μm, often asynchronous and of Type B development (Plate I: 3, 4). *Rinodina endospora* can be confused with *R. metaboliza* which also has *Dirinaria*-type spores, but they are of smaller size (13.5)17.5–19.0(23.0) × (8.5)9.0–10.0(11.0) μm (Sheard, 2010).

Distribution. This is the third location of this species in Russia and Northeastern Asia. Previously, the species was reported from Kamchatka (Ust'-Bol'sheretsky District, on bark of *Chosenia arbutifolia*) (Sheard *et al*., 2017) and from Sakhalin Island where it was found on bark of *Populus* sp. in riparian forest (Galanina *et al*., 2021). *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). This study suggests it is the western North American — East Asian species with disjunct distribution.

Ecology. The species was found on bark of *Chosenia arbutifolia* in the valley forest.

Specimen examined: Olsky District, Magadansky Reserve, Kava-Chelomdzhinsky area, Chelomdzha River valley, 59°47′50.3″N, 148°12′52.9″E, 36 m a. s. l., floodplain forest, on bark of *Chosenia arbutifolia*, 12 VII 2012, *Zheludeva*, MAG O-4583.

Rinodina laevigata (Ach.) Malme (Plate II: 1, 2)

Rinodina laevigata is characterized by *Physcia-Physconia*-type spores (14.5)18.5–19.5(22.5) × (7.0)8.5–9.0(10.5) μm of Type A development, thin poorly developed thallus, and usually thick lower apothecial cortex (Plate II: 1, 2). *Rinodina laevigata* can be confused with *R. sibirica* H. Magn. but differs by a less developed thallus, grayish color, smaller spores, and more rounded and less elongated lumina. Apothecia in *R. laevigata* are broadly attached to the thallus, with typical plane discs and thick lower apothecial cortex.

Distribution. In Russia, the species is known from the North Caucasus to Western Siberia (Kotlov, 2008), but most probably is understudied. *Rinodina laevigata* is widespread and known from Norway, Sweden, Finland, and Scotland in Europe (Mayrhofer, Moberg, 2002), also from Alaska to California and in the Sierra Nevada in the western part of North America (Sheard, 2010).

Ecology. *Rinodina laevigata* was collected on bark of *Pinus pumila* (Pall.) Regel and *Larix* sp.

Specimens examined: Khasynsky District, ca. 25 km SW of Atka, 60°37′22.7″N, 151°33′31.6″E, 1110 m a. s. l., on twig of *Larix* sp., 11 VIII 2012, *Ohmura 10172B*, *Yakovchenko*, *Zheludeva*, TNS; Tenkinsky District, Matrosov mine, thickets of dwarf pine, 61°38′28″N, 147°48′10″E, on bark of *Pinus pumila*, 8 VI 2015, *Pavlov*, VLA.

Rinodina metaboliza Vain. (Plate II: 3, 4)

Rinodina metaboliza is characterized by a *Dirinaria*-type spores (13.5)17.5–19.0(23.0) × (8.5)9.0–10.0(11.0) μm of Type B development (Plate II: 4). The species is very variable in thallus morphology, spore size and apothecial convexity (Plate II: 3). *Rinodina metaboliza* can be confused with *R. endospora*. For the differences, see the description of *R. endospora* above.

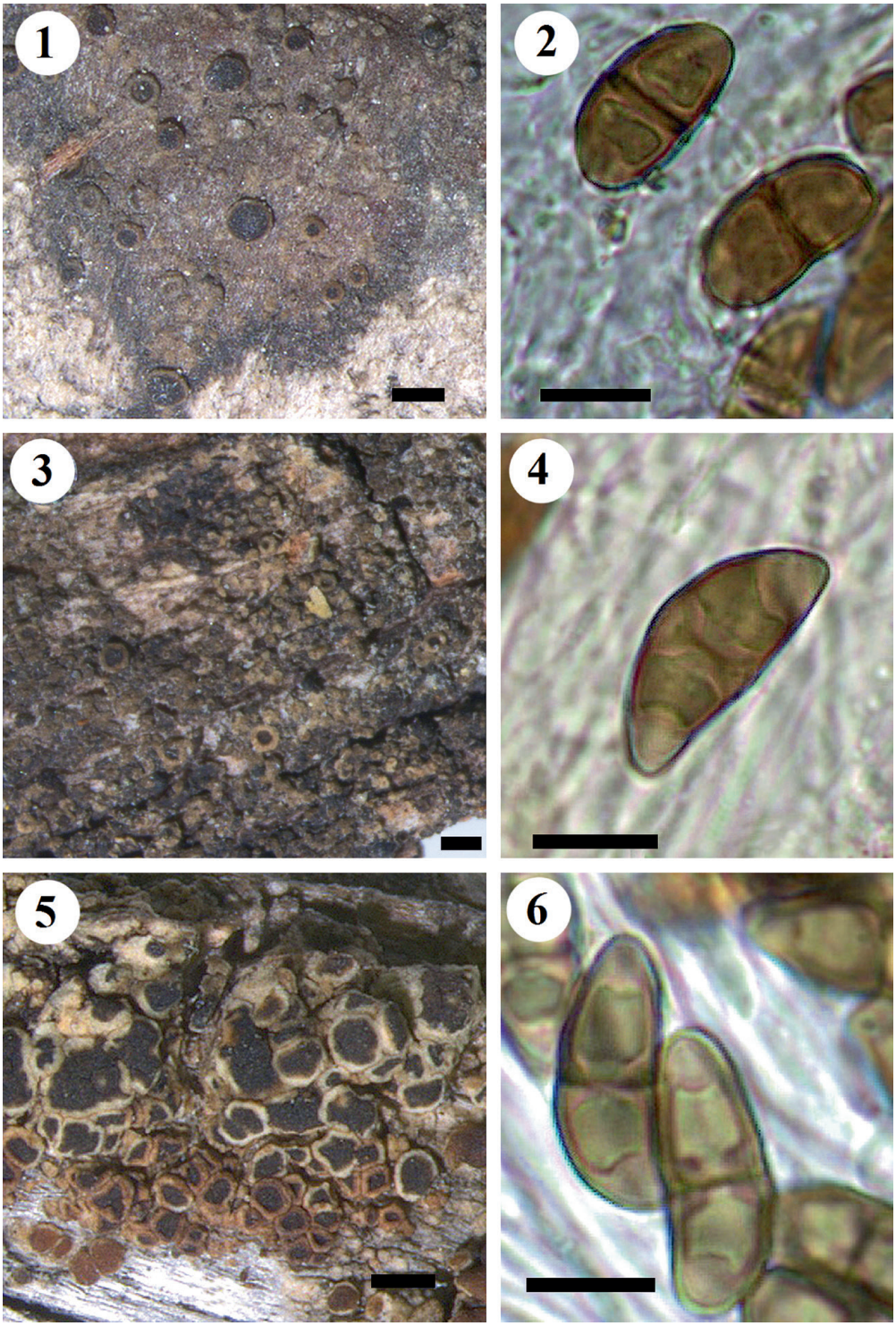
Distribution. The species was described by Vainio (1928) from several places along the Yenisei River in Siberia. In Russia, it is known from the republics of Karelia and Komi, and South Siberia (Eastern Sayan Mountains) (Kotlov, 2008; Urbanavichene, Urbanavichus, 2009). In Europe, the species was found in Scandinavia (central Sweden and Norway) (Mayrhofer, Moberg, 2002). In North America, it is a western species extending from coastal Alaska to southern California and inland to the Rocky Mountains (Sheard, 2010).

Ecology. *Rinodina metaboliza* was collected on bark of *Populus* sp. in floodplain forest.

Specimen examined: Olsky District, Magadansky Reserve, Chelomdzha River, 59°47′50.3″N, 148°12′52.9″E, 36 m a. s. l., floodplain forest with *Chosenia arbutifolia* and *Alnus* sp., on bark of *Populus* sp., 12 VII 2012, *Zheludeva*, MAG O-4584.

Rinodina olivaceobrunnea C. W. Dodge et G. E. Baker (Plate II: 5, 6)

Rinodina olivaceobrunnea is characterized by *Physcia*-type spores (16.5)20.5–21.5(26.0) × (8.0)9.5–10.0(12.0) μm of Type A development (Plate II: 6). The species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has abundant and small, narrowly attached apothecia (Plate II: 5). *Rinodina olivaceobrunnea* can be confused with *R. turfacea*, but differs in smaller spores and apothecia, absence of a massive columnar lower cortex, and lack of sphaerophorin. *R. olivaceobrunnea* can also be confused with *R. archaea*, but it is distinguished by its *Physcia*-type spores, thick lower cortex, and typically muscicolous rather than lignicolous habitat (Sheard, 2010).

Distribution. In Russia, *R. olivaceobrunnea* has wide distribution and was previously found in the Arctic (Novaya Zemlya, Taimyr, and Chukotka), Murmansk Region, Komi Republic, North Caucasus (Karachayevo-Circassian Republic), and West Siberia (Kotlov, 2008). *Rinodina olivaceobrunnea* is distributed in both hemispheres being known in Europe, central Africa, Australasia, Antarctica, and North America (Mayrhofer, Moberg, 2002; Sheard, 2010).

Ecology. *Rinodina olivaceobrunnea* was collected on old wood near the airport.

Specimen examined: Severo-Evensky District, Evensk village, 61°55′02.8″N, 159°14′20.8″E, 3 m a. s. l., old vegetable gardens behind the airport, on old logs (wood), 11 VII 2015, *Zheludeva*, MAG СЭ-4585.

Rinodina parasitica H. Mayrhofer et Poelt (Plate III: 1, 2)

Rinodina parasitica is characterized by a lichenicolous habit and brown thallus, *Physcia-Physconia*-type spores (13.5)16.0–16.5(19.0) × (7.0)8.5–9.0(10.5) μm of Type A development (Plate III: 1, 2). It can be confused with *R. obnascens* (Nyl.) Oliv., another lichenicolous species, but the latter has *Milvina*-type spores and gray thallus with minute dark brown to black consoredia (Sheard, 2010). *R. obnascens* has not been found in Russia yet.

Distribution. In Russia, *R. parasitica* was found in Siberia (Krasnoyarsk Territory, Baikal Region) (Kotlov, 2008). The species occurs in scattered localities in Europe (Norway, Sweden, and Finland) (Mayrhofer, Moberg, 2002), Asia (Mongolia) (Byazrov, 2013), and North America, where it is known in Alaska and western Canada, southern Rocky Mountains, coastal ranges, and Sierra Nevada (Sheard, 2010).

Ecology. *Rinodina parasitica* was found on the thallus of an unidentified *Aspicilia*. It is arctic-alpine lichen growing on species of *Aspicilia* and *Rhizocarpon* (Kotlov, 2008).

Specimen examined: Olsky District, Magadansky Reserve, Yamsky area, Studenaya station, a small mountain, 59°45′38.0″N, 153°34′24.9″E, 69 m a. s. l., on *Aspicilia* sp. growing on rock, 15 VII 2015, *Zheludeva*, MAG O-4586.

Plate II. 1 — thallus and apothecia of *Rinodina laevigata*; 2 — *Physcia-Physconia*-type spores of *R. laevigata*; 3 — thallus and apothecia of *R. metaboliza*; 4 — *Dirinaria*-type spore of *R. metaboliza*; 5 — thallus and apothecia of *R. olivaceobrunnea*; 6 — *Physcia*-type spores of *R. olivaceobrunnea*. Scale bars: 1, 3, 5 — 0.5 mm; 2, 4, 6 — 10 μm.

Rinodina subparieta (Nyl.) Zahlbr. (Fig. 2)

Rinodina subparieta is characterized by a *Physconia*-type spores (15.0)18.5–19.5(23.0) × (8.5)10.0–11.0(13.0) μm of Type A development, light gray scattered areoles, producing atranorin (K+ yellow) and whitish soredia forming along the areole margins in a labriform soralia (Fig. 2). *Rinodina subparieta* are similar to *R. willeyii* Sheard et Giralt, but the latter has *Pachysporaria*-type spores, whitish areolate thallus (than subsquamulose), and producing pannarin (P+ cinnabar).

Distribution. In Russia, it is a widespread species known from the Caucasus to the Far East (Spisok..., 2010; Himelbrant, Stepanchikova, 2011; Galanina, 2013; Sheard *et al*., 2017). In Europe it is known from Scotland (Giavarini *et al*., 2009), Scandinavia and Austria (Tonsberg, 1992; Mayrhofer, Moberg, 2002). *Rinodina subparieta* is also known from Mongolia (Hauck, Javkhlan, 2006) and eastern Asia with a distribution spanning Russia, Japan, and Korea (Sheard *et al*., 2017). In North America, *R. subparieta* has a Pacific and North Atlantic disjunct distribution (Sheard, 2010; Resl *et al*., 2016).

Ecology. *Rinodina subparieta* was collected on bark of *Alnus* sp. in old larch forest. In Russia, the species was found on coniferous and deciduous trees (*Abies* sp., *Alnus* sp., *Betula* sp., *Castanea* sp., *Chosenia arbutifolia*, *Picea* sp., *Prunus* sp., *Quercus* sp., *Salix* sp., and *Taxus* sp.) in deciduous and mixed forests, often along river valleys. It occurs from the sea level to 2550 m (Sheard *et al*., 2017).

Specimen examined: Olsky District, Tauy River, the Niro station, floodplain terrace, 59°47′17.2″N, 148°16′13.2″E, 36 m a. s. l., old larch forest with *Betula* sp., *Alnus* sp., tall grasses and shrubs, on bark of *Alnus* sp., 6 VIII 2011, *Zheludeva*, MAG O-4587.

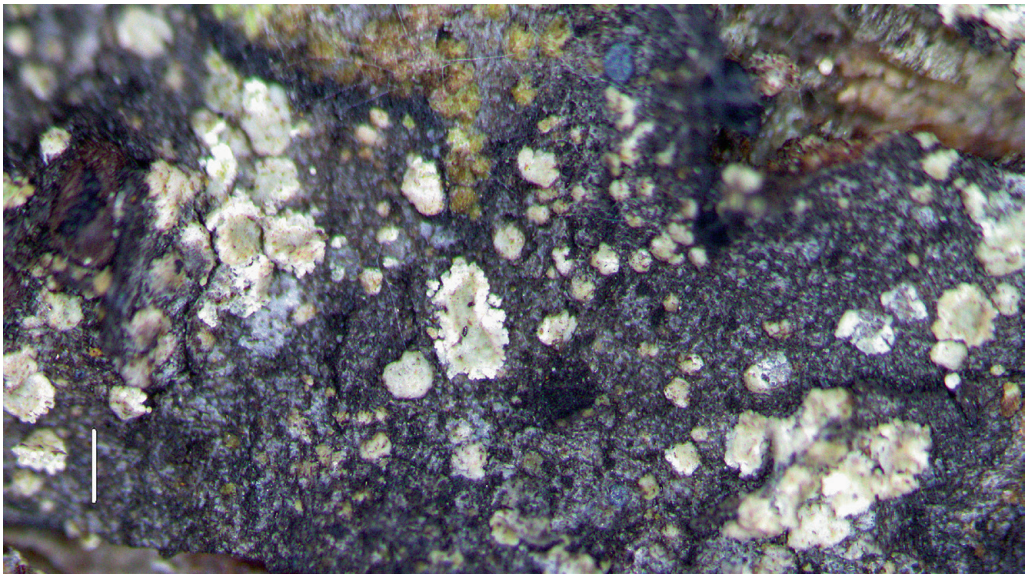


Fig. 2. Thallus of *Rinodina subparieta* consisting of light gray scattered areoles with whitish soredia forming along the areole margins. Scale bar: 0.5 mm.

Species previously known from the Magadan Region

Rinodina freyi H. Magn. (Plate I: 5, 6)

Rinodina freyi is characterized by gray-green continuous thallus, apothecia frequently becoming contiguous on small thalli (Plate I: 5), and relatively small, darkly pigmented *Physcia*-type spores (12.0)15.0–16.0(18.5) × (6.0)7.5–8.0(9.0) μm of Type A development with a heavy torus (Plate I: 6). *Rinodina freyi* can be confused with *R. septentrionalis*, but the latter species has copper-brown thallus consisting of small discrete verrucae, narrowly attached and scattered apothecia.

Distribution. In Russia, *R. freyi* was previously recorded from the Magadan Region, Kamchatka Territory, Sakhalin Island, Khabarovsk and Primorye territories (Sheard *et al*., 2017; Galanina *et al*., 2021). It has also been reported from Japan (Sheard *et al*., 2017) and western Mongolia (Hauck *et al*., 2013). European distribution of this species is poorly known although originally it was described from Europe (Switzerland) (Magnusson, 1947); the species is also published from Germany (Wirth *et al*., 2013). Sheard (2010) indicated that *R. freyi* is closely related to the European *R. septentrionalis* (Giralt, Mayrhofer, 1995). *Rinodina freyi* is the most common species of the genus in North America, being frequent in both the east and west of the continent (Sheard, 2010).

Ecology. In the Magadan Region, *R. freyi* was found on bark of *Alnus*, *Chosenia*, and *Salix* in floodplain *Chosenia* forest and alder forest. In North America it inhabits various tree species, including *Abies* spp., *Acer* spp., *Alnus crispa* (Aiton) Pursh, *Betula* spp., *Fraxinus* sp., *Picea* spp., *Pinus* spp., *Quercus macrocarpa* Michx., *Sorbus* sp., *Ulmus americana* L. mainly in the southern boreal zone (Sheard, 2010).

Specimens examined: Olsky District, Ola River, floodplain forests, on bark of *Salix* sp., 8 VII 2013, *Galanina M-13-203-1*, VLA; *ibid*., *Galanina M-13-186-1, M-13-210-1*, VLA (Sheard *et al*., 2017); *ibid*., Spafareva Island, N part of the Iisland, 59°11′41.7″N, 149°05′09.8″E, 110 m a. s. l., alder forest along the snowfield, on *Alnus* sp., 20 VII 2013, *Zheludeva*, MAG O-4588; *ibid*., the upper reaches of the Ola River, 138 km of the federal highway, near the bridge over the river, 60°24′49.5″N, 151°30′49.0″E, 13 m a. s. l., floodplain forest, on bark of *Chosenia arbutifolia*, 13 VII 2013, *Galanina M-13-193-1*, VLA; Severo-Evensky District, Evensk village, 61°55′04.2″N, 159°14′05.8″E, 3 m a. s. l., larch in the planting, on bark of *Larix* sp., 11 VII 2015, *Zheludeva*, MAG O-4589; Yagodninsky District, Myakit River valley, 295 km of the federal highway, 61°24′25.8″N, 152°05′25.9″E, 664 m a. s. l., single old larch trees at the bottom of a slope, on bark of *Larix* sp., 13 VII 2013, *Galanina M-13-195-1*, VLA.

Rinodina milvina (Wahlenb.) Th. Fr.

Rinodina milvina is characterized by thick dark brown thallus and *Milvina*-type spores (15.5)18.0–19.0(22.0) × (7.5)9.5–10.5(12.0) μm of Type A development. Young thalli of *R. milvina* can be confused with *R. parasitica*, which is well distinguished by its smaller *Physcia- Physconia*-type spores.

Distribution. *Rinodina milvina* was previously noted in the Magadan Region by Kotlov (1995). In Russia, the species is widespread from the European part to the Far

East, and from the Southern Siberia to the Arctic (Novaya Zemlya) (Kotlov, 2008). *Rinodina milvina* has scattered distribution in Europe (Mayrhofer, Moberg, 2002) and also occurs in Asia (Turkey, Iraq, Georgia, Armenia, Azerbaijan, Kazakhstan, Mongolia, and Japan) (Wagner, Spribille, 2005; Kotlov, 2008; Byazrov, 2010; Ohmura, Kashiwadani, 2018), North Africa (Kotlov, 2008), and North America (Greenland, Rocky Mountains, Sierra Nevada, Cascades and costal range) (Sheard, 2010).

Ecology. *Rinodina milvina* inhabits siliceous rocks, sometimes parasitizing crustose lichens (Mayrhofer, Moberg, 2002; Kotlov, 2008). In North America, the species was found on granites, quartzites and other acidic rocks, on sandstone, volcanic rocks, from 900 to 3660 m a. s. l. (Sheard, 2010).

Rinodina mniaroea (Ach.) Körb.

Rinodina mniaroea is characterized by its apothecia becoming convex and thalline margin becoming excluded, large *Physcia*-type spores (20.5)24.5–25.5(30.0) × (9.5)11.5–12.5(14.5) μm of Type A development. *Rinodina mniaroea* is similar to *R. turfacea*, which differs by producing sphaerophorin (UV+ blue-white) and persistently plane apothecial discs with prominent thalline margins. Another species to be distinguished from *R. turfacea* is *R. olivaceobrunnea*, which differs by its smaller apothecia and spores.

Distribution. *Rinodina mniaroea* was previously reported from the Magadan Region by Kotlov (1995). In Russia, the species is widespread in the northern and mountain regions (Arctic, northern European part, North Caucasus, Siberia, Urals, Altai, Far East) (Makarova, Katenin, 1983, 1992; Sedelnikova, 1990; Kotlov, 2008). In Europe it occurs in central part (Wirth, 1995; Giavarini *et al*., 2009), Iberian Peninsula (Giralt, 2010), and Scandinavia (Mayrhofer, Moberg, 2002). In Asia *R. mniaroea* was reported from the Caucasus, Himalayas, Mongolia, and China (Vezda, 1965; Kotlov, 2008). In North America, *R. mniaroea* is common in the western Arctic, the Rocky Mountains and scattered in the eastern Arctic and Greenland (Sheard, 2010).

Ecology. *Rinodina mniaroea* grows on mosses and plant debris in the arctic-alpine, less often in the subalpine and boreal zones (Mayrhofer, Moberg, 2002; Kotlov, 2008). In North America it was recorded up to 4070 m a. s. l. in Arizona (Sheard, 2010).

Rinodina roscida (Sommerf.) Arnold

Rinodina roscida is characterized by large *Physcia*-type spores (22.5)30.0–32.0(39.5) × (10.5)12.5–13.5(16.0) μm and Type A or rarely B development. *R. roscida* can be confused with *R. turfacea* and differs in its light gray thallus lacking sphaerophorin, pruinose apothecial discs, J+ blue lower cortex of apothecial margins, significantly larger spores with often submucronate apices (Sheard, 2010).

Distribution. *Rinodina roscida* is widespread in the northern and mountainous regions of Northern Hemisphere (Mayrhofer, Moberg, 2002; Wirth *et al*., 2013): in the Arctic from Scandinavia to Chukotka and southbound to Southern Siberia (Trans-Bai-

kal Territory, Sayany) and Asia (Caucasus, Himalayas, Mongolia, China) (Mayrhofer, Moberg, 2002; Kotlov, 2008; Spisok..., 2010). In North America it is common in the Arctic, especially in the west, extending southwards in the Rocky Mountains (Sheard, 2010).

Ecology. *Rinodina roscida* was collected on mosses and plant debris on rock in mountains.

Specimens examined: Omsukchansky District, 500 km NE from Magadan, foothill of Kilganskie Range, vicinity of Dzhuletta mining camp, 61°11′39.8″N, 153°58′49.8″E, 1480 m a. s. l., upper part of the slope with calcareous rocks, on mosses, 11 VIII 2012, *Yakovchenko M-12-Ca-3*, VLA; *ibid*., *Yakovchenko M-12-Ca-1*, *M-12-Ca-2*, VLA (Sheard *et al*., 2017); Khasynsky District, small mountain ca. 120 km NE of Atka, 61°11′43.4″N, 153°58′38.8″E, 1240 m a. s. l., on plant debris on rock, 11 VIII 2012, *Ohmura 10145*, *Yakovchenko*, *Zheludeva*, TNS.

Rinodina septentrionalis Malme
= *Rinodina hyperborea* H. Magn.

Rinodina septentrionalis is characterized by *Physcia*-type spores (13.5)16.0–17.0(19.5) × (6.5)7.5–8.5(9.5) μm with well-developed torus and Type A development. *Rinodina septentrionalis* has copper-brown thallus consisting of small discrete verrucae, narrowly attached and scattered apothecia. For the differences from similar *R. freyi* see its description.

Distribution. *Rinodina septentrionalis* was previously reported for the Magadan Region by Kotlov (1995) as *R. hyperborea*. In Eurasia, *R. septentrionalis* is widely distributed in the Arctic and boreal zones and in mountainous regions from northern Scandinavia to Kamchatka Peninsula and southbound to Georgia, Kazakhstan, Altai Mts, Sikhote-Alin Mts, Japan (Insarov, Pchelkin, 1984; Davydov, 2001; Giralt, 2001, 2010; Mayrhofer, Moberg, 2002; Tschabanenko, 2002; Kotlov, 2008; Himelbrant *et al*., 2009; Galanina, 2013; Hauck *et al*., 2013; Wirth *et al*., 2013; Yakovchenko *et al*., 2013; Chesnokov, Konoreva, 2015; Sheard *et al*., 2017; Galanina *et al*., 2021). In North America it is common in the Arctic, extending southwards in the Rocky Mountains to Colorado (Sheard, 2010).

Ecology. *Rinodina septentrionalis* was collected from the bark of *Alnus* sp., *Larix* sp., and *Salix* sp. In the Altai Mts, it was found on the bark of deciduous and coniferous trees in the wet habitats of the forest belt (Davydov, 2001). In North America it was recorded up to 3050 m a. s. l. in the Rocky Mountains (Sheard, 2010).

Specimens examined: Olsky District, Magadansky Reserve, Kava River, 59°47′37.6″N, 148°00′30.2″E, 30 m a. s. l., aspen forest with scarce larch, birch and dwarf pine, on wood, 9 VII 2012, *Zheludeva*, MAG O-4590; *ibid*., *Zheludeva 735*, MAG (Sheard *et al*., 2017); Khasynsky District, ca. 25 km SW of Atka, 60°37′22.7″N, 151°33′31.6″E, 1110 m a. s. l., on twig of *Larix* sp., 11 VIII 2012, *Ohmura 10172B*, *Yakovchenko*, *Zheludeva*, TNS; Magadansky District, 3 km W of Magadan, 59°33′48.4″N, 150°42′′39.0″E, 60 m a. s. l., on twig of *Alnus* sp., 6 VIII 2012, *Ohmura 9942*, *Yakovchenko*, *Zheludeva*, TNS; *ibid*., vicinity Snezhnaya Dolina village, floodplain forest, on bark of *Salix* sp., 4 VII 2001, *Lysenko*, MAG M-4593; *ibid*., 59°44′21.1″N, 150°51′23.3″E, 169 m a. s. l., floodplain forest, on bark of *Salix* sp., 26 VII 2001, *Artemova*, MAG M-4591.

Rinodina sibirica H. Magn. (Plate III: 3, 4)

Rinodina sibirica is characterized by *Physcia-Physconia*-type spores (17.0)20.0–21.5(25.5) × (8.5)10.0–11.5(13.0) μm with the well-developed torus, the dark-colored cell walls, and Type A development (Plate III: 4). *Rinodina sibirica* has erumpent apothecia broadly attached at first and then becoming narrow at the base, scattered, numerous with the dark brown to black disk becoming convex, sometimes hemispherical (Plate III: 3). *Rinodina sibirica* can be often confused with *R. archaea*, but the latter species has *Physconia*-type spores and mainly lignicolous (Sheard, 2010). The young apothecia of *R. sibirica* with plane discs can be confused with such of *R. cinereovirens*, but the latter has large *Physcia*-type spores and crystals in medulla (sphaerophorin, UV+ blue-white). Specimens of *R. sibirica* can be often referred to *R. sophodes*, which differs by small *Milvina*-type spores and European distribution (Sheard, 2010). *Rinodina sophodes* was probably erroneously reported for the Far East of Russia.

Distribution. *Rinodina sibirica* was previously reported for the Magadan Region by Kotlov (1995). *Rinodina sibirica* is an American-Asian species with a wide amphiberingian range (Galanina *et al*., 2021). The species was described from the environs of Yeniseisk, Tomsk, and Tobolsk in Russia (Magnusson, 1936). Later, it was additionally reported from numerous places in Siberia along the rivers Yenisei, Ob, Irkut, Lena, and Aldan (Magnusson, 1947), as well as from Altai and Sayan (Kotlov, 2008), and from Mongolia (Golubkova, 1981). Recently *R. sibirica* was reported from the Trans-Baikal and Khabarovsk territories, the Magadan Region, Sakhalin Island, and the Kamchatka Peninsula (Sheard *et al*., 2017; Galanina *et al*., 2021). The species was also reported from North America (Thomson, 1997, as *R. granulans* Vain.; Sheard, 2010).

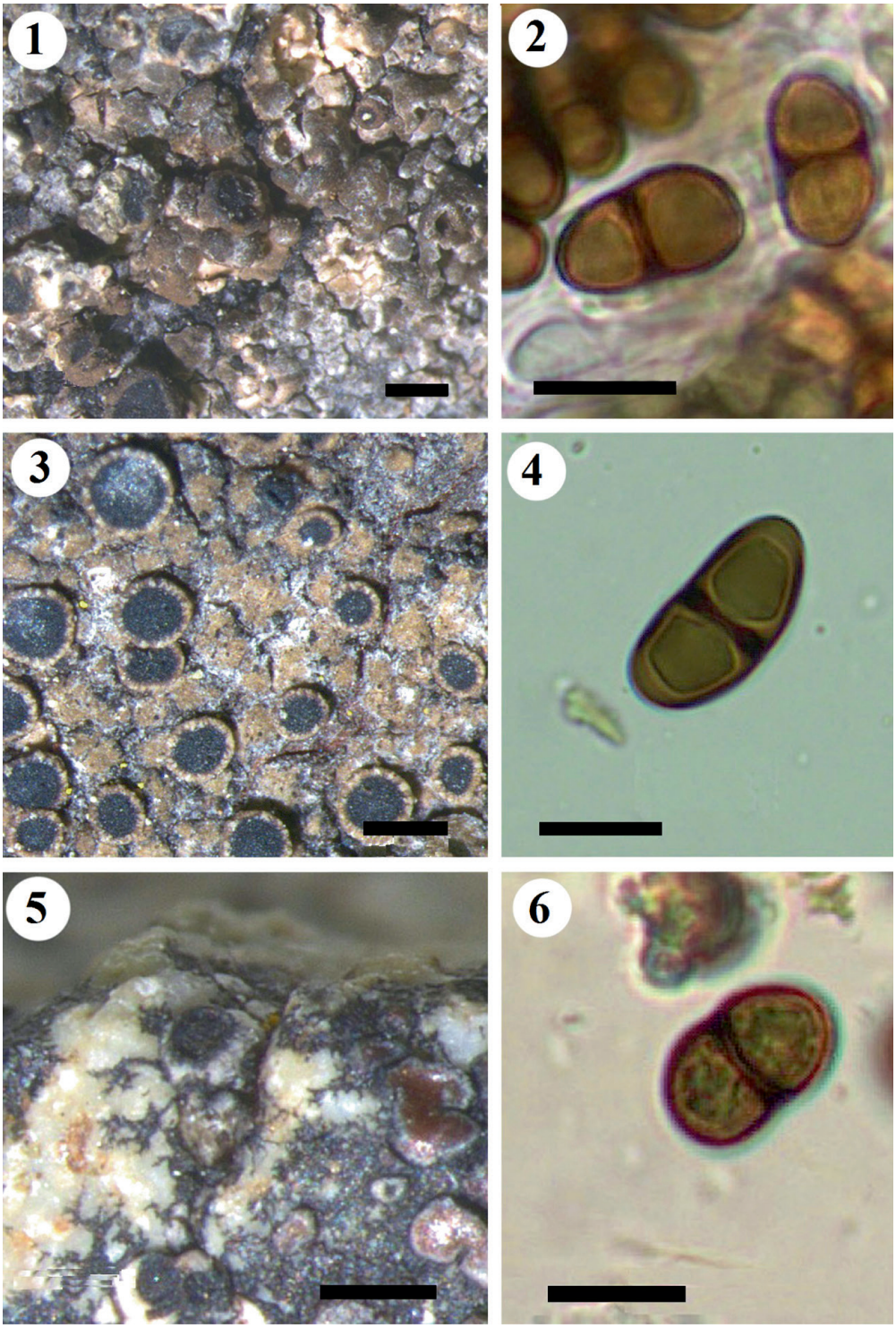
Ecology. *Rinodina sibirica* was collected on bark of *Betula* sp., *Larix* sp., and *Salix* sp. The species grows mainly on bark of deciduous trees (e. g. *Alnus* spp., *Betula* spp., *Padus avium* Mill., *Populus* spp., *Salix* spp., *Sorbus* sp.), less often on conifers (*Abies* sp., *Larix* sp., *Picea* sp., *Pinus* sp.) and on wood (Magnusson, 1936, 1947; Kotlov, 2008; Sheard, 2010; Sheard *et al*., 2017).

Specimens examined: Olsky District, floodplain of Kava River, Bogot Island, 59°46′16.6″N, 147°59′26.7″E, 39 m a. s. l., larch-birch forest, on bark of *Betula* sp., 7 VII 2012, *Zheludeva*, MAG O-4592; *ibid*., *Iamborko M-02-1*, LE (Sheard *et al*., 2017); Magadansky District, vicinity of Snezhnaya Dolina village, floodplain forest, on bark of *Salix* sp., 4 VII 2001, *Lysenko,* MAG M-4593; *ibid*., on bark of deciduous tree, 28 VI 2007, *students*, MAG.

Rinodina sicula H. Mayrh. et Poelt (Plate III: 5, 6)

Rinodina sicula is characterized by thin gray to black-brown rimose-areolate thallus (Plate III: 5), *Physconia*-type spores (16.0)18.0–19.5(23.0) × (7.5)9.0–10.0(11.5) μm

Plate III. 1 — thallus and apothecia of *Rinodina parasitica*; 2 — *Physcia-Physconia*-type spores of *R. parasitica*; 3 — thallus and apothecia of *R. sibirica*; 4 — *Physcia-Physconia*-type spore of *R. sibirica*; 5 — thallus and apothecia of *R. sicula*; 6 — *Physconia*-type spores of *R. sicula*. Scale bars: 1, 3, 5 — 0.5 mm; 2, 4, 6 — 10 μm.


1
2
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5
6

(Plate III: 6) of Type A development, and the presence of gyrophoric acid in the apothecial margin (C+ red).

Distribution. *Rinodina sicula* is described from Italy (Mayrhofer, Poelt, 1979). It is known in Europe from Italy, Iberian Peninsula, Denmark, Sweden (Mayrhofer, Poelt, 1979; Giralt, Llimona, 1997; Mayrhofer, Moberg, 2002; Mayrhofer, Sheard, 2007) and in Northeastern Asia from Kamchatka Peninsula, Magadan Region, Trans-Baikal Territory (Sheard *et al*., 2017).

Ecology. *Rinodina sicula* is a saxicolous species. In the Magadan Region it was found on rocks in the middle part of the slope with cliffs.

Specimen examined: Omsukchansky District, 500 km NE to Magadan, foothill of Kilganskie Range, vicinity of Dzhuletta mining camp, 61°11′43.3″N, 153°58′34.9″E, 1321 m a. s. l., middle part of the slope with cliffs, on rocks, 9 VIII 2012, *Yakovchenko M-12-27-4*, VLA; *ibid*., *Yakovchenko M-12-27-1*, VLA (Sheard *et al*., 2017).

Rinodina turfacea (Wahlenb.) Körb.

Rinodina turfacea is characterized by brownish-gray thallus, large apothecia with concave or plane disc, persistent thalline margin containing crystals of sphaerophorin, *Physcia*-type spores (22.0)27.5–29.5(35.0) × (10.5)12.5–13.5(15.5) μm of Type A development (Shaerd, 2010). *Rinodina turfacea* can be confused with *R. cinereovirens*; for the differences, see the description of *R. cinereovirens*.

Distribution. *Rinodina turfacea* was previously reported from the Magadan Region by Kotlov (1995). It is mainly northern circumpolar species restricted to the Arctic and Subarctic territories in Eurasia from Scandinavia to the Kamchatka Peninsula with southernmost locations in the Mongolian and Chinese parts of the Altai (Schubert, Klement, 1971; Afonina *et al*., 1980; Makarova, Katenin, 1983; Makryi, 1986; Sedelnikova, 1990; Abbas *et al*., 2001; Davydov, 2001; Mayrhofer, Moberg, 2002; Tschabanenko, 2002; Kotlov, 2008; Himelbrant *et al*., 2009; Skirina, 2012; Wirth *et al*., 2013; Sheard *et al*., 2017; Galanina *et al*., 2021). In North America, it is common in the Arctic, southward to the Rocky Mountains in Montana and Wyoming, also in the state of Colorado (Sheard, 2010).

Ecology. *Rinodina turfacea* was found on plant debris.

Specimens examined: Olsky District, Kamenny Range, vicinity of the Magtur tourist base, floodplain of Pyany stream, 59°45′24.5″N, 149°39′17.9″E, 9 m a. s. l., floodplain shrubs with *Alnus* sp., on plant debris, 6 VIII 2013, *Galanina M-13-178-3*, VLA; *ibid*., Atargan Peninsula, 59°32′35.6″N, 151°29′27.2″E, 3 m a. s. l., seashore, on dry pebble on plant debris, 3 VIII 2016, *Zheludeva*, MAG O-4595; Omsukchansky District, 500 km NW from Magadan, foothill of Kilganskie Range, vicinity of Dzhuletta mining camp, 61°11'43.3"N, 153°58'34.9"E, 1321 m a. s. l., middle part of the slope with cliffs, on plant debris, 9 VIII 2012, *Zheludeva*, MAG; *ibid*., on plant debris, *Yakovchenko 27-12-2*, *27-12-3*, VLA (Sheard *et al*., 2017); *ibid*., on plant debris, 11 VIII 2012, *Ohmura 10145B*, TNS.

As a result of the study, the list of *Rinodina* known from the Magadan Region consists of 15 species, 7 of which are reported for the first time for the region (*R. cinereovirens*, *R. endospora*, *R. laevigata*, *R. metaboliza*, *R. olivaceobrunnea*, *R parasitica*, and

R. subparieta). The genus is mainly represented by species typically occurring in the northern regions (*R. cinereovirens*, *R. metaboliza*, *R. mniaroea*, *R. olivaceobrunnea*, *R. roscida*, *R. septentrionalis*, and *R. turfacea*).

Despite the new data, the *Rinodina* genus in the Magadan Region requires further study. Noteworthy are the species *R. endospora* and *R. sicula* which are rare in Russia and have only recently been found in Northeastern Asia (Sheard *et al*., 2017; Galanina *et al*., 2021). These species might be rarely reported because saxicolous *Rinodina* spp. are poorly investigated in general. It can be assumed that they occur more frequently in the northern regions of Eurasia within epilithic lichen communities. Other species requiring attention are *R. laevigata* and *R. sibirica* which are probably widespread in Russia, although rarely found in some regions. The distribution of both taxa is worthy of further research.

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