

THE GENUS *RINODINA* (PHYSICIACEAE, LICHENIZED ASCOMYCOTA) OF THE SAKHALIN ISLAND (RUSSIAN FAR EAST)

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The presented work is based on the study of extensive material collected by A.K. Ezhkin in 2011–2018 from Sakhalin Island and herbarium specimens (VLA). As a result of the study, the new list of species of the genus *Rinodina* for Sakhalin Island consists 24 taxa. One species, *Rinodina albertana* Sheard, is new to Northeast Asia and Russia, 8 taxa are new to Sakhalin Island. The species are discussed with respect to their distribution in Northeast Asia and North America. Brief descriptions of rare species (*R. albertana*, *R. bukii* Sheard, and *R. endospora* Sheard) found on Sakhalin Island are made. The record of *R. exigua* (Ach.) Gray for Sakhalin Island (Galanina, 2013) belongs to *R. freyi*.

Keywords: lichens, Physciaceae, biodiversity, endemism, distribution, Northeast Asia, North America

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INTRODUCTION

The genus *Rinodina* remains unexplored in certain territories of Russia (Kotlov, 2008; Galanina et al., 2011; Sheard et al., 2017; Galanina et al., 2018; Galanina, Ezhkin, 2019). Species of *Rinodina* are relatively difficult to determine because of the wide variety of types of spores, distinguished by their development stages. The Russian Far East is one of the territories where, until recently, the genus *Rinodina* remained poorly studied. A monograph of the genus *Rinodina* was published for North America north of Mexico (Sheard, 2010). This work facilitated an updating of our understanding of the genus in Northeast Asia (Sheard et al., 2017) and this revision included parts of Russia and China, Korea, and Japan. Many species that were not previously recognized in the Russian Far East were discovered. Close links were found with the *Rinodina* biota of both eastern and western North America (Sheard et al., 2017) including some species previously thought to be North American endemics.

Sakhalin Island is located in the northwestern part of the Pacific Ocean. Its length is 948 km from 45°50' to 54°24' with an area of 76.4 thousand km², and the maximum width of the island is 160 km. The climate is temperate monsoon type with a cold but milder win-

ter than the adjacent continent, and with a cool rainy summer. The average temperature in January is –6°C (in the south) to –22°C (in the north), in August it is 18°C and 10°C, respectively. Precipitation ranges from 500 mm on the northwestern coast, to 1200 mm in the mountainous regions and in the south (Zemtsova, 1968). The south and the north of Sakhalin vary considerably in their physiographical characteristics as well as in the nature of the vegetation. Northern Sakhalin belongs to the Okhotsk-Kamchatka Province of the circumboreal floristic region, and southern Sakhalin, together with the southern Kuril Islands, is part of the Sakhalin-Hokkaido Province of the East Asian floristic region (Takhtadzhyan, 1978). Most part of Sakhalin territory is covered by coniferous forests.

The first lichenological investigations on Sakhalin Island were performed by Japanese specialists in the beginning of the twentieth century. The first list of lichens of Sakhalin Island included 105 species (Satō, 1936). In 2002, the list of lichens rised to 322 species (Tschabanenko, 2002). Recently, new records for the island were added in several works (Galanina, 2013; Ezhkin, Galanina, 2014, 2016; Skirina et al., 2016; Bogacheva et al., 2018; Ezhkin, Jørgensen, 2018; Ezhkin, Schumm, 2018; Konoreva et al., 2018). Despite

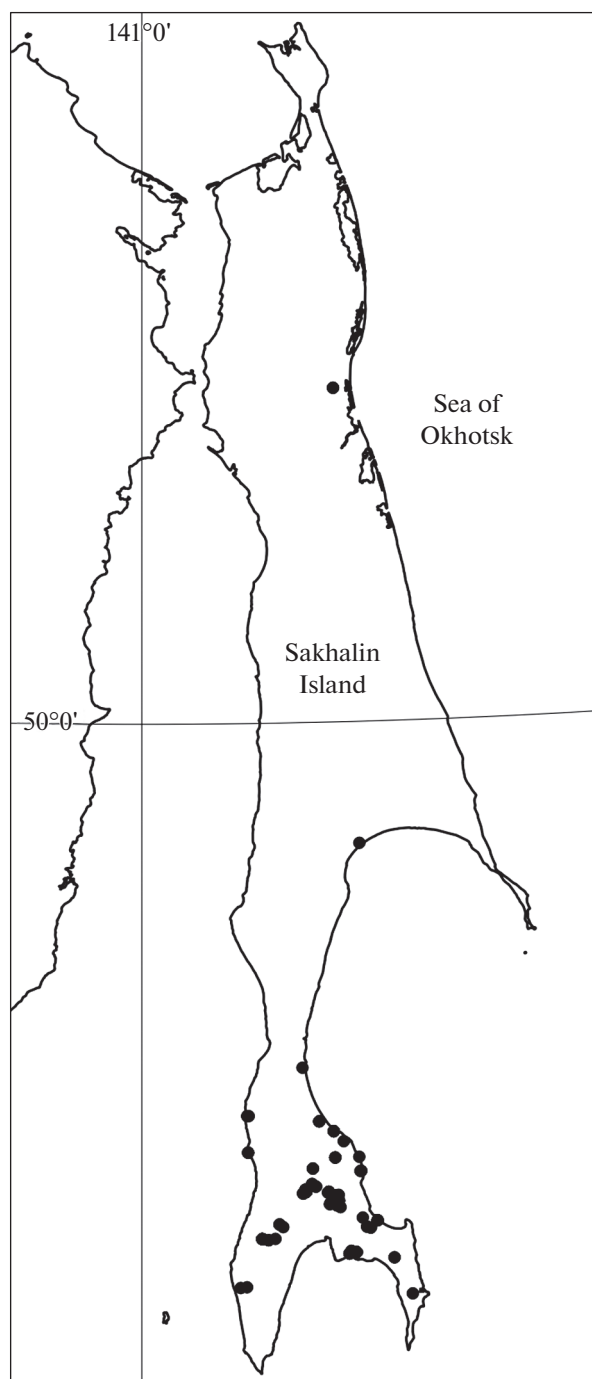


Fig. 1. The places of research of the genus *Rinodina* in Sakhalin Island of the Russian Far East.

the long period of research on the Sakhalin lichen flora — almost 100 years — many areas remain uninvestigated.

Within the lichen biota of Sakhalin Island, the genus *Rinodina* remains insufficiently studied. Recently, there have been several new publications that cite 17 *Rinodina* species for Sakhalin Island (Galanina et al., 2011; Galanina, 2013; Sheard et al., 2017; Galanina et

al., 2018; Konoreva et al., 2018). These are *Rinodina cinereovirens*, *R. excrescens*, *R. exigua*, *R. freyi*, *R. genarii*, *R. hypobadia*, *R. megistospora*, *R. orientalis*, *R. polyspora*, *R. septentrionalis*, *R. sibirica*, *R. subalbida*, *R. subminuta*, *R. subparieta* (as *R. degeliana* Cop-pins), *R. tenuis*, *R. turfacea*, and *R. xanthophaea*. In this study, *R. exigua* was identified as *R. freyi*. Sheard et al. (2017) showed that *R. exigua* was not found in the Russian Far East. We believe that this species is erroneously listed for Sakhalin Island. The remaining species were confirmed by us to Sakhalin Island.

The presented work is based on the study of extensive material collected from Sakhalin Island. As a result, the list of species for the genus *Rinodina* in Sakhalin Island now includes 24 taxa, and 26 species for the Sakhalin Region (Sakhalin and the Kuril Islands). One of them is *R. albertana* Sheard previously considered an endemic species of North America (Sheard, 2010), recorded for the first time from Northeast Asia and Russia, and additional 8 new records for Sakhalin Island. Five species (*R. albertana*, *R. buckii*, *R. efflorescens*, *R. endospora*, and *R. metaboliza*) are new to the Sakhalin Region. In this article we provide a description of *R. albertana* based on the studied samples and brief descriptions of two rare species (*R. bukii* and *R. endospora*) found on Sakhalin Island.

MATERIAL AND METHODS

Herbarium specimens collected by A. K. Ezhkin during 2011–2018 from Sakhalin Island compose the core material for this study. Voucher specimens are deposited in the herbaria SAK and VLA. Morphological and anatomical characters were analyzed by applying standard light microscopical methods. Full label data of examined specimens are provided for every species. The map (Fig. 1) shows the study area. A few recent publications have been used to identify samples (Sheard, 2010, 2018; Sheard et al., 2017).

SPECIES LIST

Rinodina albertana Sheard

The detailed description of *Rinodina albertana* was given by J.W. Sheard (2010) based on specimens from North America. The anatomical and morphological descriptions based on two Russian specimens are given below and most characters correspond to the protologue. It should be noted that spores in the East Asian samples may be a little larger.

TYPE. CANADA, Alberta, 1 mi SE Gap, N 51°03', W 115°15', *Populus tremuloides* — *P. balsamifera* woods, 4250 ft, on *P. balsamifera*, 7 VI 1972, Kalgutkar 1169 (PMAE — holotype)."

Thallus thin, dark-gray to brown-gray, first composed of dispersed scabrid areoles 0.1–0.2 mm wide, then confluent into a continuous crust with indetermi-

nate margin, surface of areoles plane, matt (Fig. 2a). Vegetative propagules present — marginal consoredia spreading to surface 30–50 µm diameter (Fig. 2c), all propagules darker than thallus.

Apothecia broadly attached, scattered, numerous, sometimes contiguous, 0.5–0.7 mm diameter (N = 20); disc dark brown to black, first flat, then becoming slightly convex; thalline margin concolorous with thallus, entire, to 0.1 mm wide, persistent, excipular ring is present in some mature apothecies. Cortex to 10–15 µm wide not pigmented, epinecral layer absent or very thin, algal cells to 9–10 µm long, crystals absent in cortex and medulla; proper exciple hyaline, 5–10 µm wide, expanding to 10–40 µm at surface and becomes brown; hypothecium hyaline or yellowish, 70–110 µm high; hymenium 90–130 µm high, paraphyses 1.5–2.0 µm wide, not conglutinate, apices to 3.0–4.0 µm wide, pigmented, forming a dark brown epihymenium to 15 µm high.

Ascospores 8 per ascus, type B development, Dirinaria-type (Fig. 2b), (20) 21.0–23.0 (25.0) × (8.5) 9.5–10.0 (11.5) µm (N = 31), torus lacking, walls lightly ornamented.

Chemistry. Spot tests all negative.

Rinodina albertana is well distinguished by its large spores of Dirinaria-type and the presence of blastidia or marginal consoredia among all species found in Northeast Asia. *Rinodina oleae* is similar to *R. albertana* by its Dirinaria-type spores, but it has smaller spores (12.0) 15.0–16.5 (19.0) µm, and does not have blastidia or consoredia. In addition thickenings of the spore septum of *R. oleae* are very difficult to see, whereas in *R. albertana* thickenings of the spore septum are perfectly distinguishable.

Ecology. Corticolous, collected on *Populus* in riparian mixed forest on Sakhalin Island. In North America, it was collected on *Acer*, *Fraxinus*, *Juniperus*, *Populus*, *Pinus* and *Salix* primarily in riverine habitats (Sheard, 2010).

Distribution. *R. albertana* was found for the first time in one locality in Russia, in riparian mixed forest of southern part of Sakhalin Island on bark of *Populus* (Fig. 3). The species was previously described from Canada, and also found in the USA (Sheard, 2010). Before our discovery, the species was considered endemic for North America. The species is distributed in the Rocky Mountain foothill from Alberta to Colorado, east into the Dakotas, with outliers in Minnesota and Michigan (Sheard, 2010). *R. albertana* is new to Eurasia, Northeast Asia and Russia. This is one of the East Asian — North American species.

Specimens examined: Nevelskiy District, Shebunino village surroundings, Shebuninka River valley, riparian mixed forest, N 46°26'9.16080", E 141°54'12.4919", alt. 13 m, bark of *Populus*, 18 V 2016, Ezhkin, 46R/04.17, 28R/04.17 (VLA).



Fig. 2. (a) *Rinodina albertana* Sheard. (b) Dirinaria-type spores of *Rinodina albertana* Sheard. Immature colorless spores show the Type B spore development. 2c. The thallus of *Rinodina albertana* with vegetative propagules — marginal consoredia.

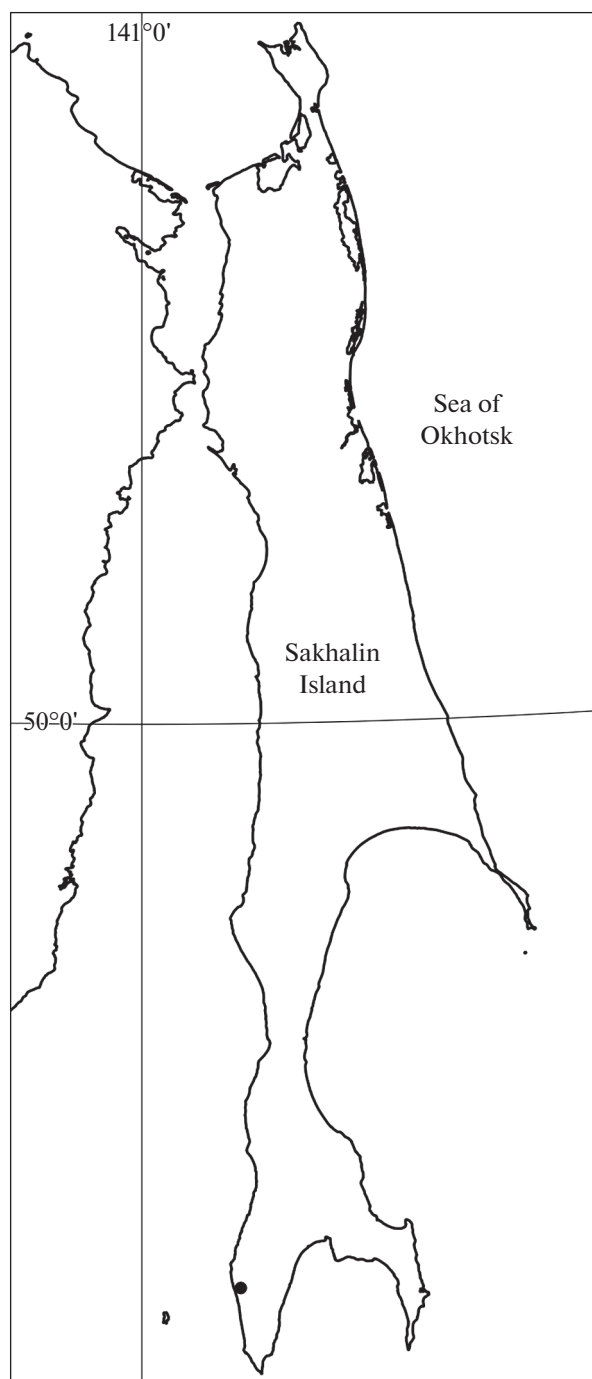


Fig. 3. The places of research of *Rinodina albertana* Sheard in Sakhalin Island of the Russian Far East.

Rinodina ascociscana (Tuck.) Tuck.

R. ascociscana was found for the first time in riparian, mixed and oak forests of southern part of Sakhalin Island on bark of *Salix* and *Quercus*. For the first time in Russia, it was recently discovered in Primorye Territory (Sikhote-Alin and Khasanskiy District) (Sheard et al., 2017) and then in the Kuril Islands (Galanina, Ezhkin, 2019). This species grows on bark of conifer-

ous and deciduous trees, it was found in mixed deciduous broad-leaved forests on Honshu in Japan, at an elevation of 380–1480 m, on Jeju Island in Korea, at an elevation of 750–1600 m, in Gangwon Province of Korea, 380–1660 m, and Primorye Territory – at low elevation (Sheard et al., 2017). *R. ascociscana* was previously considered an endemic species of eastern North America (Sheard, 2010; Lendemer et al., 2014).

Specimens examined: Yuzhno-Sakhalinsk mudd volcano surroundings, mixed forest, N 47°05'09.09", E 142°34'22.72", alt. 239 m, bark of *Salix*, 23 X 2018, Ezhkin, 4R/02.19 (VLA); Dolinskiy District, Sokol village surroundings, Belaya River valley, riparian forest, N 47°15'00.3", E 142°47'33.3", alt. 56 m, bark of *Salix*, 22 XI 2017, Ezhkin, 59R/04.17 (VLA); Okhotsk village surroundings, coast of the Sea of Okhotsk, oak forest, N 46°50'49.93", E 143°10'5.797", bark of *Quercus*, 14 VI 2015, Ezhkin, 9R/06.2015 (VLA).

Rinodina buckii Sheard

The species is new for Sakhalin Island (Fig. 4, 5a). It was found in a broad-leaved forest on bark of *Phellodendron*. It was recently described from the Appalachian Mountains of the eastern USA, Japan, South Korea and the Russian Far East (Sheard et al., 2012). In eastern North America, *Rinodina buckii* occurs at low to middle elevations (225–1535 m). In the Hokkaido of Japan, it is found at elevations from close to the sea level to 750 m, in far eastern Russia at altitude of 340 m (the single record from Russia before our research), in South Korea it was reported for higher elevations (Seorak Mts, Mt. Dachong, 1300–1600 m) (Sheard et al., 2012, 2017) as well as on Halla Mountain at altitude of 943 m (Yakovchenko et al., 2018). Below is a brief description of the species based on the studied sample.

R. buckii is characterized by a thin, areolate thallus, the areoles becoming verrucose, verrucae developing raised soralia (Fig. 5b), erumpent apothecia, ascospores of *Teichophila*-type, (19.5) 22.0–24.0 (26.5) × (10.5) 11.5–12.0 (13.0) μm, Type A development; presence of pannarin in cortex and medulla (P+ cinnabar), which is absent from the epihymenium (P–). The presence of zeorin was also noted (Sheard et al., 2012). The collected thalli are fertile with well-developed verrucae that produce soredia. Species of sterile lichens with vegetative propagules are often easily confused. *R. buckii* is reminiscent of *R. willeyi* Sheard et Giralt but its areoles initially develop marginal soredia in contrast to *R. buckii*, which first develops soredia on verrucae in the centre of its areoles (Sheard et al., 2017). Sterile thalli of *R. buckii* are also reminiscent of *R. excrescens* Vain., but the thallus of *R. excrescens* typically has a glossy surface, a brownish tinge, and rarely includes zeorin, whereas *R. buckii* has a matt surface, is always a shade of grey, and typically contains zeorin (Sheard et al., 2017). *R. buckii* is related to *R. subalbida* by its spore type and size as well as

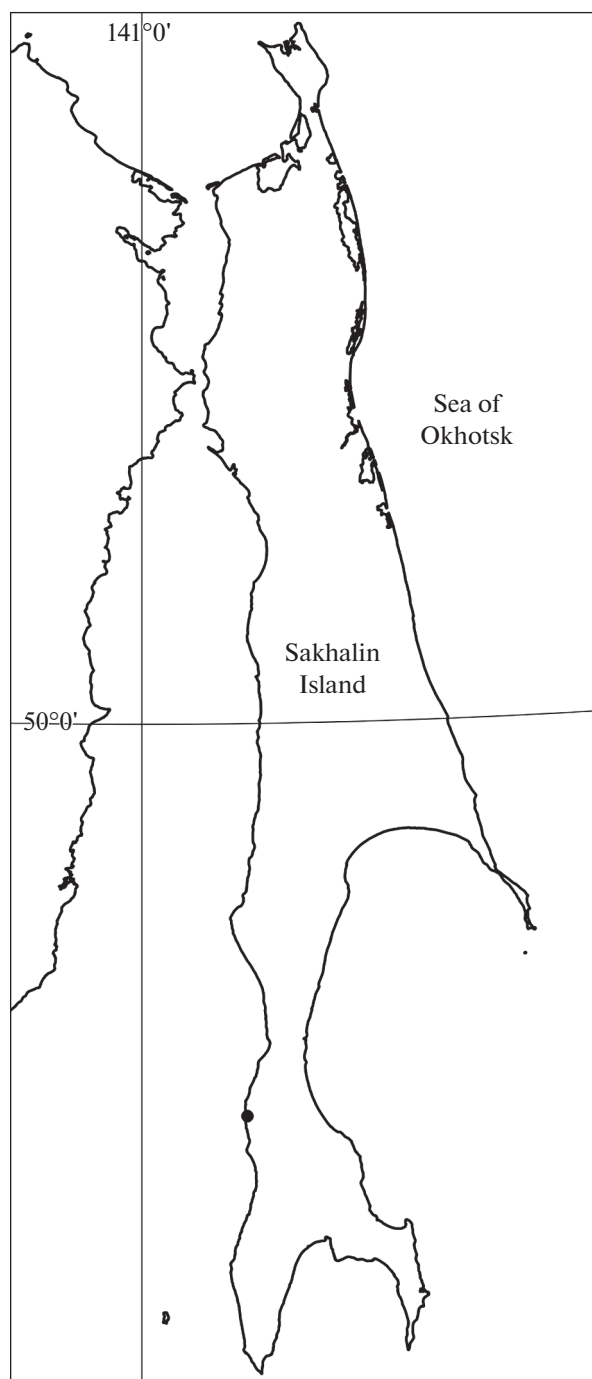


Fig. 4. The places of research of *Rinodina buckii* Sheard in Sakhalin Island of the Russian Far East.

thalline chemistry, but the latter species is never sorediate and its epihymenium typically contains crystals of pannarin that are not present in *R. buckii* (Sheard et al., 2017). *R. buckii* is one of the East Asian – East North American species.

Specimens examined: Chekhovskiy District, Arkanzas River valley, broad-leaved forest, bark of *Phellodendron*, N 47°31'16.5", E 141°59'01.9", alt. 83 m, 29 VI 2016, Ezhkin, 6R/04.17 (VLA).

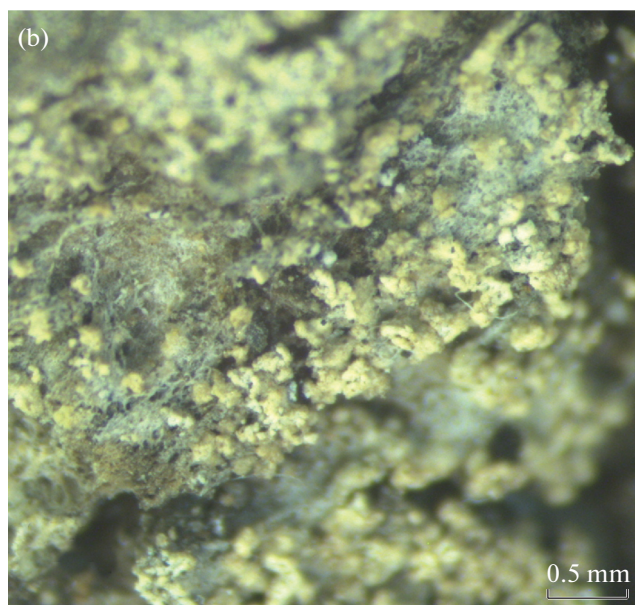
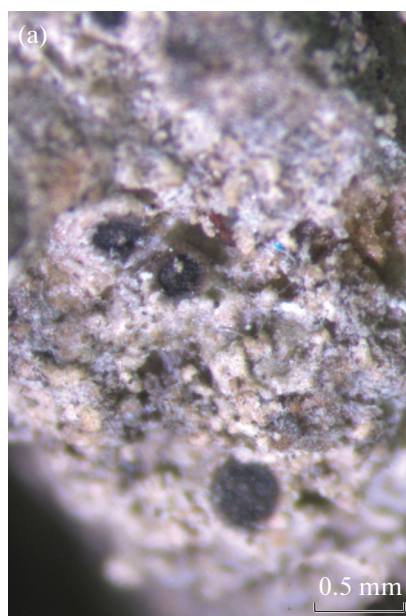


Fig. 5. (a) *Rinodina buckii* Sheard with apothecia. Species with vegetative propagation rarely form apothecia. (b) The thallus of *Rinodina buckii* with vegetative propagules – verrucose areoles developing raised soralia.

Rinodina cinereovirens (Vain.) Vain.

R. cinereovirens has recently been given the status of a separate species and has a boreal distribution (Sheard et al., 2017). The species is found on bark and wood, in contrast to *R. turfacea*, which typically grows on decaying ground vegetation, less often on wood, in oroarctic environments.

R. cinereovirens was found previously on Sakhalin Island (Sheard et al., 2017). In our study the species was found on bark of *Abies*, *Alnus*, *Betula*, *Picea*, *Quercus*, *Salix*, *Sorbus*, on thalli of *Pseudocypbellaria* in a

mixed, coniferous, deciduous and oak forests. In Russia, it has previously been reported as *R. turfacea* var. *cinereovirens* (Vain.) H. Mayrhofer and as *R. turfacea* var. *ecrustacea* (Vain.) H. Oliv. from the Murmansk Region, Karelia, the Leningrad Region, in the Ural Mountains, as well as in Siberia (Republic of Buryatia, Trans-Baikal Territory, Sayan Mountains, Tyumen Region) and in the Far East (Kamchatka Peninsula) (Urbanavichene, Urbanavichus, 1998; Kotlov, 2008; Himelbrant et al., 2009; Urbanavichus, 2010; Chesnokov, Konoreva, 2015; Sheard et al., 2017). *R. cinereovirens* (as *R. turfacea* var. *cinereovirens*) is reported in Europe from northern Scandinavia (Norway, Sweden and Finland) (Mayrhofer, Moberg, 2002) and is absent from the species list for southern Europe (Iberian Peninsula) (Giralt, 2010). The species was not separated from *R. turfacea* by Sheard (2010) in North America but is now known to occur in Newfoundland, New Brunswick, Wapusk National Park, northern Manitoba, northern Ontario and Alaska (Sheard et al., 2017). It is a Eurasian-American species with a circumpolar distribution in the boreal zone.

Specimens examined: Dolinskiy District, 108 km of the Federal Highway, sparse *Sorbus* forest with bush wood and multi herb cover, on dry branch, 12 VII 2008, Bogacheva, Tsarenko, № S-T12-3 (VLA); *ibid.*, *Salix* forest with *Alnus*, on dry branch, 13 VII 2008, Bogacheva, Tsarenko, S-T6-4 (VLA); *ibid.*, Krutoyarka River valley, 81 km of the Federal Highway, *Alnus* forest with mixed grass and *Betula* and coniferous trees, bark of *Betula*, 11 VII 2008, Bogacheva (VLA); *ibid.*, Sovetskoye village surroundings, Ai River valley, mixed forest, N 47°28'49.6", E 142°39'02.7", alt. 9 m, bark of *Alnus*, 10 X 2015, Ezhkin, 49R/04.17 (VLA); *ibid.*, bark of *Picea*, *Salix*, 10 X 2015, Ezhkin, 51R/04.17, 50R/04.17 (VLA); *ibid.*, Yuzhno-Sakhalinsk mud volcano surroundings, mixed forest, N 47°04'7.8", E 142°36'30.6", alt. 194 m, on dry *Abies*, 15 VI 2012, Ezhkin, 16R.5.13 (VLA); *ibid.*, Starodubskoye village surroundings, oak forest, N 47°24'57.76", E 142°47'4.516", alt. 4 m, bark of *Quercus*, 03 VI 2015, Ezhkin, 4R/06.2015 (VLA); Yuzhno-Sakhalinsk city surroundings, Parkovaya Mountain, coniferous forest, N 46°58'29.04", E 142°46'10.99", alt. 269 m, bark of *Abies*, 01 IX 2011, Ezhkin, 19R/04.17 (VLA); Nevelskiy District, Lovetskiy Pass, mixed forest, N 46°44'35.91", E 142°6'21.02", alt. 424 m, on thallus of *Pseudocyphellaria*, 11 VI 2013, Ezhkin, 12R/04.17 (SAK); Korsakovskiy District, Prigorodnoye village surroundings, deciduous forest, N 46°38'57.4", E 142°58'07.7", alt. 206 m, bark of *Salix*, 22 V 2015, Ezhkin, 40R/04.17 (VLA); *ibid.*, coniferous forest, N 46°38'26.76", E 142°54'10.11", alt. 4 m, bark of *Abies*, 23 V 2014, Ezhkin, Ri32 (VLA); Okhotsk village surroundings, coast of the Sea of Okhotsk, oak forest, N 46°50'49.93", E 143°10'5.797", bark of *Quercus*, 14 VI 2015, Ezhkin, 6R/06.2015 (VLA).

Rinodina efflorescens Malm

The species was found for the first time in the Russian Far East on Sakhalin Island on *Larix* in a coniferous forest. In Russia, *R. efflorescens* is widespread. It was found in Moscow, Bryansk, Yaroslavl, Tver, Penza, Irkutsk Regions, the Republics of Karelia, Komi and Buryatia, Ural, West and South Siberia (Makryi, Lishtva, 2005; Paukov, Trapeznikova, 2005; Kotlov, 2008; Notov et al., 2011; Paukov, Mikhailova, 2011; Muchnik, 2016, 2017; Urbanavichene, Palice, 2016; Davydov, Konoreva, 2017; Sedelnikova, 2017). The species is known from Northwest Europe (British Isles, Norway, Sweden) and central Europe, the Iberian Peninsula (Tønsberg, 1992; Giralt et al., 1995; Mayrhofer, Moberg, 2002; Giralt, 2010). *Rinodina efflorescens* is also found in boreal western and eastern parts of North America, with southern outliers in Arizona and North Carolina (Sheard, 2010). It is a Eurasian-American species with a circumpolar distribution predominantly in the temperate zone and with southern outliers in Europe and North America.

Specimens examined: Noglikskiy District, southward of the Val village, 690 km of the Federal Highway, *Larix* forest with *Pinus pumila* (Pall.) Regel and lichen cover burnt some years ago, bark of *Larix*, 07 VIII 2008, Bogachyova, Barkalov, S-08-55-5 (VLA); Dolinskiy District, vicinity of the Sokol village, *Larix* forest with *Carex*-mosses cover, bark of *Larix*, 20 VIII 2008, Tsarenko, S-W-29-02E-1 (VLA).

Rinodina endospora Sheard

The species is characterized by a gray to gray-brown verrucous or areolate thallus, apothecia narrowly attached with flakes of the epinecral layer on the thallus, large Dirinaria-type spores (19.0)21.5–24.0(27.5) × (8.5)9.0–10.0(11.0) μm often asynchronous and type B development. *Rinodina endospora* can be confused with *R. metaboliza* also with Dirinaria-type spores but the latter has smaller spores.

Rinodina endospora is reported from Sakhalin Island (Fig. 6) for the first time and it is second point in Russia. For the first time in Russia the species was noted for Kamchatka Peninsula (Ust'-Bol'sheretsk District, on bark of *Chosenia*) (Sheard et al., 2017). Previously considered to be a western North American endemic species distributed in California along coastal ranges and in Sierra Nevada (Sheard, 2010). It is the western North American – East Asian disjunct species listed here.

Specimens examined: Nevelskiy District, Shebunka River valley, riparian forest, N 46°26'23.5", E 141°57'38.7", alt. 41 m, bark of *Populus*, 17 V 2016, Ezhkin, 5R/04.17 (VLA).

Rinodina excrescens Vain.

The species was recorded for the first time on Sakhalin Island by Galanina et al. (2011). The species grows on broad-leaved deciduous trees (*Betula*, *Alnus*, *Quercus*, *Salix*) and coniferous trees (*Larix*, *Pinus* and *Picea*) in Altay and Trans-Baikal Territories (Sokhondinskiy Reserve) and in the Far East of Russia (Galanina et al., 2011; Davydov, Printzen, 2012; Sheard et al., 2017; Galanina, Ezhkin, 2019). The species was described from West Siberia by E.A. Vainio (1928) and is known from a few localities in Europe where it is scattered and very rare (Giralt et al., 1994; Spribille et al., 2006; Galanina et al., 2011). It is known from the Great Lakes region of North America on *Betula*, *Abies*, *Picea*, *Larix*, and *Thuja* where it is relatively frequent (Sheard, 1995, 2010). *Rinodina excrescens* was recently found in Japan (Hokkaido: Sheard et al., 2017) where it occurs at elevations up to 720–1030 m. It is an Eurasian-American species.

Specimens examined: Susunaiskiy Range, Yuzhno-Sakhalinsk city surroundings, Parkovaya Mount, alt. 100 m, mixed forest, bark of *Picea*, 05 V 2010, Ezhkin, 11R-G-EE-SW, 3R-V-PI-U (VLA); *ibid.*, southwestern exposure of the slope, bark of *Abies*, 05 XI 2013, Ezhkin, R13 (VLA); *ibid.*, N 46°58'23.6", E 142°45'30.9", alt. 207 m, bark of *Abies*, 11 XI 2012, Ezhkin, 21R.5.13 (VLA); Yuzhno-Sakhalinsk City Park, N 46°57'52.1", E 142°45'17.7", alt. 79 m, bark of *Betula*, *Prunus*, 04 V 2014, Ezhkin, 8R/08.2016, 27R/06.2015 (VLA); Dolinskiy District, valley Pchelinyaya River, floodplain forest, N 47°21'06.1", E 142°52'28.6", alt. 10 m, bark of *Abies*, 07 V 2012, Ezhkin, 20R.5.13 (VLA); *ibid.*, surroundings of Dolinsk city, *Larix* forest, N 46°50', E 142°16', bark of *Abies*, 01 VIII 2009, Tsarenko, W-2008-29-03W (VLA); Starodubskoye village surroundings, oak forest, N 47°24'57.76", E 142°47'4.516", alt. 4 m, bark of *Quercus*, 03 VI 2015, Ezhkin, 3R/06.2015 (VLA); Noglikitskiy District, southward of the village Val, 690 km of the Federal Highway, *Alnus* forest with *Betula* and multi-herb cover, bark of *Alnus*, 07 VIII 2008, Bogachyova, Barkalov, S-08-54-1 (VLA); Korsakovskiy District, Tunaycha Lake surroundings, mixed forest, N 46°48'07.4", E 143°06'15.7", bark of *Betula*, 26 X 2017, Ezhkin, 40R/03.18 (VLA); *ibid.*, Prigorodnoye village surroundings, coniferous forest, N 46°38'57.4", E 142°58'07.7", alt. 206 m, bark of *Picea*, 22 V 2015, Ezhkin, 15R/06.2015 (VLA).

Rinodina freyi H. Magn.

The record of *R. exigua* (Ach.) Gray for Sakhalin Island (Galanina, 2013) also belongs to *R. freyi*. Both species have Physcia-type spores, but *R. freyi* lacks at-ranorin in the cortex.

R. freyi is most often found on branches of bushes and broad-leaved deciduous trees (*Acer*, *Alnus*, *Betula*, *Fraxinus*, *Quercus*, and *Salix*) but also on branches of

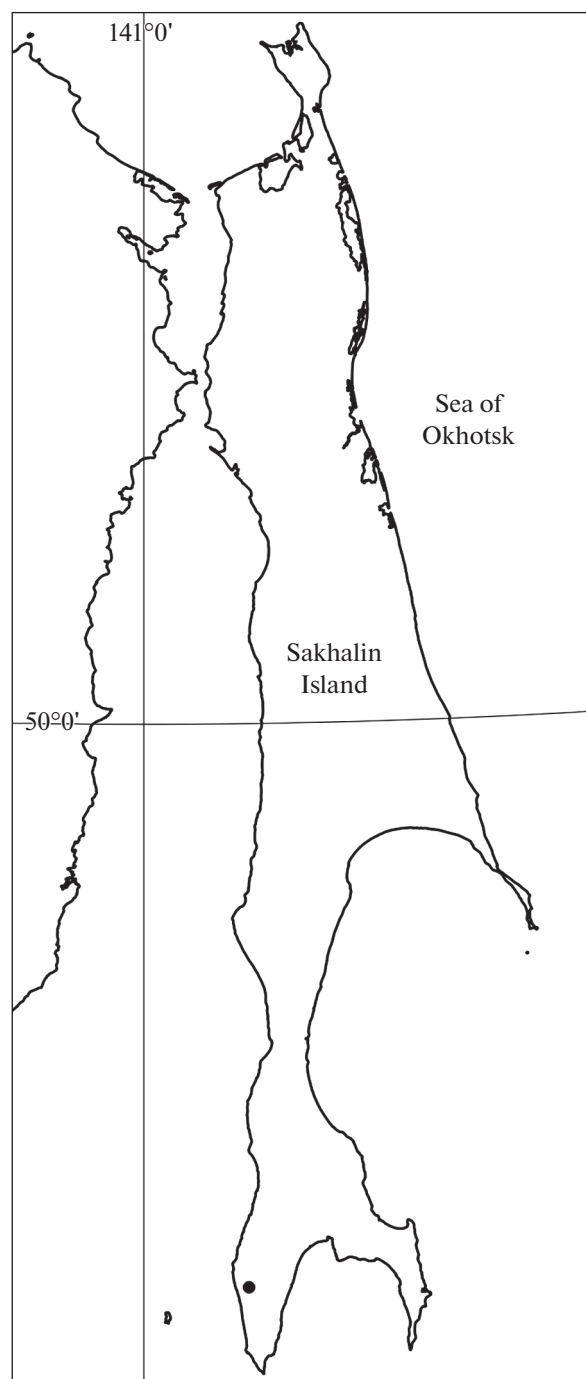


Fig. 6. The places of research of *Rinodina endospora* Sheard in Sakhalin Island of the Russian Far East.

conifers (*Picea*) on Sakhalin Island. In Russia the species is reported in the Magadan Region, Kamchatka Peninsula, Sakhalin Island, Kuril Islands, Khabarovsk and Primorye Territories as well as in Japan (Sheard et al., 2017; Galanina, Ezhkin, 2019). It has also been reported from western Mongolia (Hauck et al., 2013). Distribution of the species in Europe is poorly understood, although it was described from Europe (Swit-

zerland) (Magnusson, 1947) and is also given for Germany (Wirth et al., 2013). Sheard (2010) indicates that he saw specimens of this species from the Alps and Scandinavia and indicates confusion with the species *R. septentrionalis* from Europe (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). In North America, it was found on a large number of tree species: *Abies*, *Acer*, *Alnus*, *Betula*, *Fraxinus*, *Picea*, *Pinus*, *Quercus*, *Sorbus*, *Ulmus*, and others, mainly in the southern boreal zone (Sheard, 2010). It is a Eurasian-American species.

Specimens examined: Pass in the vicinity of Kholmsk city, mixed forest, bark of *Picea*, 15 IX 2006, Galanina, S-06-1 (VLA); Dolinskiy District, Makui River valley, bog, on twig of *Picea*, 15 VIII 2008, Nesterova, Tsarenko, W-2008-25-03E-2 (VLA); *ibid.*, bog with *Ledum*, on twig of *Betula*, bark of *Picea*, 08 V 2008, Nesterova, Tsarenko, W-2008-25-03E, S-W-25-02E-2 (VLA); *ibid.*, northward of Firsovo vicinity, 107 km of the Federal Highway, sparse forest with multi herb, N 47°49'17", E 142°30'17", on dry branch, on twig of *Betula*, 12 VII 2008, Bogacheva, Tsarenko, S-T1-1 (VLA); *ibid.*, bog with *Ledum* and *Osmunda* cover, on twig, 15 VIII 2008, Tsarenko, Nesterova, S-W-27-03W-1 (VLA); Krutoyarka River valley, 107 km Federal Highway, seaside meadow on the coastal shaft with anthropogenic influence, on twig of *Picea*, 14 VII 2008, Tsarenko, Bogacheva, T-23(2008) (VLA); *ibid.*, 81 km Federal Highway, *Alnus* forest, on twig of *Alnus*, 07 VI 2008, Bogacheva, Khrapko, Tsarenko, S-06-09-07-1 (VLA); Dolinskiy District, Starodubskoye village surroundings, oak forest, N 47°24'57.76", E 142°47'4.516", alt. 4 m, bark of *Quercus crispula* Blume, 03 VI 2015, Ezhkin, 1R/06.2015 (VLA); 48 km from Yuzhno-Sakhalinsk city, middle course of Lyutoga River valley, coniferous forest, N 46°49', E 142°18', on twig of *Betula*, 12 VII 2005, Galanina (VLA); Yuzhno-Sakhalinsk city, Mira Street, street planting N 46°57'55.20", E 142°44'25.81", alt. 64 m, bark of *Salix*, 14 XII 2014, Ezhkin, R11/12.14 (VLA); *ibid.*, N 46°57'57.46", E 142°44'50.27", alt. 88 m, bark of *Salix*, 11 IV 2014, Ezhkin, R14/12.14 (VLA); *ibid.*, N 46°57'51.49", E 142°44'54.38", alt. 77 m, bark of *Fraxinus*, *Acer*, 01 IV 2016, Ezhkin, 9R/04.17, 37R/04.17, 39R/04.17 (VLA); Yuzhno-Sakhalinsk surroundings, Rogatka River valley, riparian forest, N 46°58'5.707", E 142°47'49.03", alt. 162 m, bark of *Salix udensis* Trautv. et C.A. Mey., 19 V 2014, Ezhkin, R9/12.14 (VLA).

Rinodina gennarii Bagl.

The species grows primarily on maritime rocks. It has been reported in the southern Far East of Russia from the Kunashir Island (Bredkina et al., 1992; Tschabanenko, 2002) and in the south-east of Sakhalin Island (Korsakovskiy district) (Konoreva et al.,

2018). The species is widespread in Russia but Yu.V. Kotlov (2008) refers to specimens inhabiting both bark and rock and therefore being a mixture of two species, *R. gennarii* and *R. oleae*. *R. gennarii* is primarily a species of maritime rocks which also occasionally grows on lignicolous maritime pilings, whereas *R. oleae* is corticolous (Sheard, 2010; Sheard et al., 2017). *R. gennarii* is widely distributed on maritime rocks in temperate regions of the Northern and Southern Hemispheres, more rarely on calcareous substrates inland in Europe and is not recorded outside coastal regions in North America (Trinkaus et al., 1999; Kaschik, 2006 as *R. oleae*; Sheard, 2010). *R. gennarii* was recorded in Japan (Trinkaus et al., 1999; Sheard et al., 2017). This is a species with multi-regional distribution (Northern and Southern Hemispheres).

Rinodina hypobadia Sheard

The species was recently described from Northeast Asia (Sheard et al., 2017) where it grows on bark of *Abies*, *Alnus*, *Salix*, and *Populus* in mixed and broad-leaved deciduous forests. *R. hypobadia* has been recorded in Japan and Russia infrequently and only from Hokkaido, the Primorye Territory and the southern part of Sakhalin Island (Sheard et al., 2017), and recently recorded to the Kuril Islands (Galanina, Ezhkin, 2019). Additional finds of *R. hypobadia* were made on the bark of *Populus*, *Prunus*, and *Phellodendron* in broad-leaved deciduous and mixed forests of Sakhalin Island. This is one of the East Asian species.

Specimens examined: Susunai range, Yuzhno-Sakhalinsk city surroundings, Ostraya Mount, N 46°58'38.85", E 142°46'37.41", alt. 350 m, mixed forest, southeastern slope exposure, bark of *Populus*, 12 IV 2011, Ezhkin, 20R-G-ST-SE (VLA); Nevelskiy District, Lovetskiy Pass, mixed forest, N 46°44'7.220", E 142°9'52.76", alt. 223 m, bark of *Prunus*, 11 VI 2013, Ezhkin, 6Ri (VLA); Chekhovskiy District, Arkanzas river valley, broad-leaved forest, N 47°31'16.5", E 141°59'01.9", alt. 83 m, bark of *Phellodendron*, 29 VI 2016, Ezhkin, 22R/04.17 (VLA).

Rinodina megistospora Sheard et H. Mayrhofer

The species grows on the bark of *Betula*, *Picea*, and *Sorbus* in spruce-fir forest on Sakhalin Island. First described from a *Quercus* stand at the type locality in southern Oregon, in a relatively high rainfall region close to the coast (Sheard et al., 2011). Recent studies of the genus *Rinodina* in Northeast Asia suggest that *R. megistospora* may be widespread but infrequent on the mainland (Sheard et al., 2017). The species was also recently recorded from near coastal localities at low elevations in the Hokkaido Island, Japan and from 1610–1630 m in Kochi Pr., Shikoku Island, in the Sikhote Alin' Mountains, Primorye Territory, and in the Khomi Mountains, Khabarovsk Region (Sheard et al., 2017). *R. megistospora* was found in the Sakhalin Ter-

ritory (Sakhalin and Iturup Islands) (Galanina et al., 2018). The species belongs to the Eastern Asiatic – Western North American group of disjunct species.

Specimens examined: Yuzhno-Sakhalinsk surroundings, Mitsul Mountain, western slope at the top, spruce-fir forest with *Betula*, N 47°02'13.4", E 142°31'04.9", alt. 712 m, bark of *Sorbus*, 26 VIII 2016, Ezhkin, 13R/08.2016, 14R/08.2016 (VLA); *ibid.*, N 47°02'12.0", E 142°30'55.5", alt. 638 m, bark of *Picea*, 26 VIII 2016, Ezhkin, 17R/08.2016 (VLA); 18R/08.2016; *ibid.*, N 47°01'36.5", E 142°29'24.5", alt. 594 m, bark of *Picea*, 07 VIII 2016, Ezhkin, 19R/08.2016 (VLA).

Rinodina metaboliza Vain.

The species was found for the first time on Sakhalin Island on bark of *Populus* and *Salix* in riparian forests. The species was described by Vainio (1928) from several places in Siberia along the Yenisei River. In Russia, it occurs in the Republic of Karelia, Republic of Komi, Southern Siberia – the Oka Plateau (Eastern Sayan Mountains) (Kotlov, 2008; Urbanavichene, Urbanavicius, 2009). The species is frequent in Scandinavia (central Sweden and Norway) (Mayrhofer, Moberg, 2002). In North America it is frequent in southern boreal regions and scattered in the Arctic and southwards to Arizona in the western mountains (Sheard, 2010). *R. metaboliza* is a Eurasian-American species.

Specimens examined: Yuzhno-Sakhalinsk surroundings, Rogatka River valley, riparian forest, N 46°58'2.118", E 142°46'16.75", alt. 108 m, bark of *Populus*, 06 XII 2014, Ezhkin, R6/12.14 (VLA); Noglikskiy District, Dagi River valley, riparian forest, N 52°06'33.55", E 142°57'26.19", alt. 9 m, bark of *Salix*, 13 X 2012, Ezhkin, 11R/04.17 (VLA).

Rinodina oleae Bagl.

R. oleae is reported in Sakhalin Island for the first time. In the Russian Far East, *R. oleae* was first noted in the Khabarovsk Territory (Yakovchenko et al., 2013) and then in Primorye Territory on bark of *Quercus*, *Fraxinus* (Sheard et al., 2017) and in the Kuril Islands (Galanina, Ezhkin, 2019). The species is reported for many regions of Russia as a synonym of *R. gennarii* (Urbanavichus, 2010). The close relationship of these species has been discussed in several papers (Giralt, Mayrhofer, 1995; Trinkaus et al., 1999; Giralt, 2001), also using molecular methods in recent works (Helms et al., 2003; Kaschik, 2006). These species are currently treated as being separate by Sheard (2010). The samples on rocks in seaside habitats are defined as *R. gennarii* (see above), while *R. oleae* occurs on bark and has smaller spores (Sheard, 2010). In East Asia, the species is known from China and Japan (Sheard et al., 2017) and was recently recorded from Korea (Konratyuk et al., 2013). The species is known from

Southern Europe (Giralt, 2001) and North America, where it has a scattered distribution and grows on the bark of broad-leaved deciduous and coniferous trees, often on *Sorbus* and *Acer* (Sheard, 2010). *R. oleae* is a Eurasian-American species.

Specimens examined: Yuzhno-Sakhalinsk City Park, N 46°58'06.3", E 142°45'53.6", alt. 105 m, bark of *Acer*, 09 IX 2014, Ezhkin, 30R/06.2015 (VLA); Yuzhno-Sakhalinsk surroundings city, Sakhalin Botanical Garden, mixed forest, bark of *Alnus*, 01 IX 2014, Ezhkin, 1Ri (VLA); Yuzhno-Sakhalinsk city surroundings, bark of *Salix*, 11 V 13, Ezhkin, 2R (VLA); *ibid.*, Mitsul Mountain, coniferous forest with *Betula ermanii*, N 47°02'13.4", E 142°31'04.9", alt. 712 m, bark of *Sorbus*, 26 VIII 2016, Ezhkin, 26R/04.17 (VLA); *ibid.*, near Sakhalin Botanical Garden, Podoroshka River valley, mixed forest, N 46°57'35.32", E 142°45'29.88", alt. 75 m, bark of *Alnus*, 01 IX 2014, Ezhkin, 1Ri/09.2014 (VLA); Korsakovskiy District, Prigorodnoye village surroundings, deciduous forest, N 46°38'57.4", E 142°58'07.7", alt. 206 m, bark of *Salix*, 22 V 2015, Ezhkin, 41R/04.17 (VLA); Chekhovskiy District, Arkanzas River valley, broad-leaved forest, N 47°31'16.0", E 141°59'43.2", alt. 111 m, bark of *Phellodendron*, 29 VI 2016, Ezhkin, 1R/04.17 (VLA).

Rinodina orientalis Sheard

R. orientalis was described in Japan (Hokkaido Island, Kitami Provinces) on the bark of *Sorbus* (Sheard et al., 2017). The species was also found in Russia, Primorye Territory (on bark of *Quercus*), on the Sakhalin and Kunashir Islands (on barks of *Acer*, *Populus*, *Salix*, and *Sorbus*) and in Korea (on barks of *Acer*, *Fraxinus*, and *Quercus*). This species is widespread in East Asia as far west as the Mongolian border region (Sheard et al., 2017). We also confirm that *R. orientalis* is very often found in floodplain forest on various trees (*Juglans*, *Quercus*, etc.) on Sakhalin Island. This is one of the East Asian species.

Specimens examined: Yuzhno-Sakhalinsk city surroundings, Rogatka River valley, floodplain forest, N 46°58'2.118", E 142°46'16.75", alt. 108 m, bark of *Populus*, 06 XII 2014, Ezhkin, 29R/06.2015 (VLA); *ibid.*, Mitsul Mountain, coniferous forest with *Betula ermanii*, N 47°03'02.2932", E 142°30'39.4704", alt. 536 m, bark of *Acer*, 26 V 2012, Ezhkin, 65R/04.17 (VLA); *ibid.*, N 47°02'13.4", E 142°31'04.9", alt. 712 m, bark of *Sorbus*, 26 VIII 2016, Ezhkin, 44R/04.17 (VLA); *ibid.*, bark of *Salix*, 11 V 13, Ezhkin, 5R, 3R (VLA); *ibid.*, village Novo-Aleksandrovka, valley of Krasnoselskiy stream, floodplain forest, N 47°02'4.2", E 142°43'34.8", alt. 48 m, bark of *Juglans*, 30 V 2012, Ezhkin, 24R.5.13 (VLA); Yuzhno-Sakhalinsk City Park, N 46°58'06.3", E 142°45'53.6", alt. 105 m, bark of *Acer*, 09 IX 2014, Ezhkin, 34R/06.2015 (VLA); Susunaiskiy Range, Yuzhno-Sakhalinsk surrounding, Parkovaya Mountain, coniferous forest, N 46°58'29.04", E 142°46'10.99", alt.

269 m, bark of *Sorbus*, 01 IX 2011, Ezhkin, 38R/04.17 (VLA); *ibid.*, southwestern slope exposure, mixed forest, N 46°58'26.15", E 142°45'26.12", alt. 122 m, bark of *Acer*, *Populus*, 10 X 2011, Ezhkin, 22R-G-SK-SW, 23R-G-ST-YuZ (VLA); *ibid.*, southern part, mountain floodplain forest, N 46°58'36.6", E 142°49'07.4", alt. 282 m, bark of *Salix*, 10 X 2011, Ezhkin, 4R.5.13 (VLA); *ibid.*, Bolchevik Mountain, southern part, mixed forest, N 47°56'31.7", E 142°48'21.1", alt. 95 m, bark of *Juglans*, 10 III 2012, Ezhkin, 26R.5.13 (VLA); *ibid.*, southeastern part, mixed forest, N 46°56'56.6", E 142°47'55.1", alt. 315 m, bark of *Salix*, 22 IX 2012, Ezhkin, 1R.5.13 (VLA); *ibid.*, Krasnaya Mountain, southwestern part, mixed forest, N 46°56'8.5", E 142°49'50.3", alt. 737 m, bark of *Acer*, 04 IX 2012, Ezhkin, R6/5.13 (VLA); *ibid.*, Turgeneva Mountain, northern part, mountain floodplain forest, N 47°00'33.6", E 142°48'35.7", alt. 592 m, bark of *Salix*, 04 VI 2012, Ezhkin, R9/5.13 (VLA); *ibid.*, Ostraya Mountain, southeastern slope exposure, mixed forest, N 46°58'38.85", E 142°46'37.41", alt. 344 m, bark of *Sorbus*, 12 IV 2011, Ezhkin, 18R-Г-CP-IOB (VLA); Dolinskiy District, valley of Pchelina River, floodplain forest, N 47°21'06.1", E 142°52'28.6", alt. 10 m, bark of *Alnus*, 05 XI 2012, Ezhkin, 11R.5.13 (VLA); Nevelskiy Pass, mountain stream, mixed forest, N 46°44'35.92", E 142°6'21.02", alt. 425 m, bark of *Sorbus*, 11 VI 13, Ezhkin (VLA); Nevelskiy District, Lovetskiy Pass, mixed forest, N 46°44'35.91", E 142°6'21.02", alt. 424 m, bark of *Salix*, 11 VI 2013, Ezhkin, 29R/04.17 (VLA).

Rinodina polyspora Th. Fr.

This species was first found on Sakhalin Island (on bark of *Salix*) and in Japan (on barks of *Acer* and *Picea*) by Sheard (Sheard et al., 2017). In Far East Asia it was recorded for the first time from the Primorye Territory (Chuguevskiy District) on bark of *Acer* (Skirina, Skirin, 2013) and then on the Kuril Island (Galanina, Ezhkin, 2019). In Russia, *R. polyspora* is found in Karelia, the Leningrad Region, Tatarstan, Western and Southern Siberia: Tyumen Region, the Trans-Baikal Territory, the Sayan Mountains (Sedelnikova, 2001; Kotlov, 2008). The species has recently been reported from Korea (Joshi et al., 2013) and it was found in Central Europe, rarely in southern and central Sweden and in southern Finland (on smooth bark) (Mayrhofer, Moberg, 2002). In North America, *R. polyspora* has a northern temperate distribution in the Great Lakes – St. Lawrence and Pacific Northwest regions (on barks of *Acer*, *Alnus*, *Fagus*, *Fraxinus*, *Populus*, *Quercus*, and *Rhamnus*) (Sheard, 2010). Our study showed that *R. polyspora* on Sakhalin Island is often found in floodplain forest on the bark of various trees (*Acer*, *Alnus*, *Fraxinus*, *Juglans*, *Populus*, and *Salix*). *R. polyspora* is a Eurasian-American species

Specimens examined: Yuzhno-Sakhalinsk City Park, N 46°57'51.49", E 142°44'54.38", alt. 77 m, bark

of *Fraxinus*, 01 IV 2016, Ezhkin, 7R/04.17 (VLA); Yuzhno-Sakhalinsk city, Lenin Square, N 46°57'20.6", E 142°43'58.4", alt. 51 m, bark of *Salix*, 05 VII 2014, Ezhkin, 16R/06.2015 (VLA); *ibid.*, Rogatka River valley, riparian forest, N 46°58'2.118", E 142°46'16.75", alt. 108 m, bark of *Populus*, 06 XII 2014, Ezhkin, R6/12.14 (VLA); *ibid.*, N 46°58'5.707", E 142°47'49.03", alt. 162 m, bark of *Populus*, 19 V 2014, Ezhkin, R8/12.14 (VLA); *ibid.*, floodplain forest, N 46°58'0.440", E 142°46'13.02", alt. 111 m, bark of *Populus*, 04 V 2014, Ezhkin, 33R/06.2015, 36R/06.2015 (VLA); *ibid.*, N 46°58'2.118", E 142°46'16.75", alt. 108 m, bark of *Populus*, 06 XII 2014, Ezhkin, 25R/06.2015 (VLA); *ibid.*, Krasnoselskiy stream valley, Novo-Aleksandrovka village, floodplain forest, N 47°02'4.2", E 142°43'34.8", alt. 48 m, bark of *Juglans*, 30 V 2012, Ezhkin, R25/5.13 (VLA); Nevelskiy District, Lovetskiy Pass, mixed forest, N 46°44'35.91", E 142°6'21.02", alt. 424 m, bark of *Salix*, 11 VII 2013, Ezhkin, 16R/04.17, 3Ri (VLA); Dolinskiy District, Sokol village surroundings, Belaya River valley, riparian forest, N 47°15'00.3", E 142°47'33.3", alt. 56 m, bark of *Alnus*, 22 XI 2017, Ezhkin, 60R/04.17 (VLA); *ibid.*, valley forest, bark of *Salix*, 28 V 2013, Ezhkin, 3Ri/05.14 (VLA); Korsakovskiy District, Tunaycha Lake surroundings, mixed forest, N 46°48'07.4", E 143°06'15.7", bark of *Fraxinus*, *Populus*, 26 X 2017, Ezhkin, 41R/03.18, 37R/03.18, 36R/03.18 (VLA); *ibid.*, N 46°48'30.3227", E 143°04'16.1904", alt. 20 m, bark of *Acer*, 20 IX 2017, Ezhkin, 39R/03.18 (VLA).

Rinodina septentrionalis Malme

R. septentrionalis was previously recorded on Sakhalin Island on the bark of *Larix* (Galanina, 2013; Sheard et al., 2017). In Russia, it is widely distributed in the Arctic and boreal zones, in northern and mountainous regions (Arctic, European part, Ural Mountains, Siberia, and Far East), in Asia (Georgia) (Kotlov, 2008). In Altai, it is found on the bark of deciduous and coniferous trees in the wet habitats of the forest belt (Davydov, 2001), as well as for the Stanovoy Highland (Chesnokov, Konoreva, 2015) and Katon-Karagay National Park on *Larix* in Kazakhstan (Hauck et al., 2013). In the Far East, *R. septentrionalis* is known from the Sikhote-Alin Mountains (Insarov, Pchelkin, 1984; Tschabanenko, 2002), on the Kamchatka Peninsula (Himelbrant et al. 2009) in the lower reaches of the Amur River (Yakovchenko et al., 2013). *R. septentrionalis* was recently found in Japan twice at altitudes above 1600 m a.s.l. (Sheard et al., 2017). In North America, it is common in the Arctic, extending southwards in the Rocky Mountains to Colorado (Sheard, 2010). The species is found in Europe in Germany (Wirth et al., 2013), widely distributed in northern Scandinavia, noted in the mountains of southern Europe as an ordinary scattered mountain (800–2000 m a.s.l.) (Giralt, 2001, 2010; Mayrhofer,

Moberg, 2002). Our research on Sakhalin Island confirms the claim of Sheard (Sheard et al., 2017) that *R. septentrionalis* is widely distributed in the study area, especially north of 45°. The species here is widespread on the barks of *Abies*, *Alnus*, *Betula*, *Fraxinus*, *Larix*, *Picea*, *Populus*, *Quercus*, *Salix*, and *Sorbus* in mixed forests. *R. septentrionalis* is a Eurasian-American species with a circumpolar distribution predominantly in boreal and arctic zone and with southern outliers in Europe, North America and Japan.

Specimens examined: Yuzhno-Sakhalinsk City Park, N 46°57'51.49", E 142°44'54.38", alt. 77 m, bark of *Fraxinus*, 01 IV 2016, Ezhkin, 8R/04.17 (VLA); Yuzhno-Sakhalinsk city surroundings, valley, vicinity of Novo-Aleksandrovsk village, N 47°01'47", E 142°43'2.2", alt. 50 m, wood (lamp post), 18 IV 2012, Ezhkin, R10/5.13 (VLA); Susunaiskiy Range, surroundings of Yuzhno-Sakhalinsk city, Parkovaya Mountain, *Picea-Abies* forest, southwestern exposure of the slope, N 46°58'26.15", E 142°45'26.12", alt. 198 m, bark of *Picea*, 05 V 2010, Ezhkin, 11R-G-EE-UZ (VLA); *ibid.*, Ostraya Mountain, mixed forest, alt. 350 m, bark of *Populus*, *Sorbus*, 12 IV 2011, Ezhkin, 16R-G-ST-SE, 17R-G-ST-SE (VLA); 48 km of the Yuzhno-Sakhalinsk – Kholmsk Highway, Lutoga River, northeastern slope exposure, N 46°50', E 142°16', spruce-fir bamboo forest, bark of *Abies*, 11 IX 2006, Galanina, S-C2-06 (VLA); road to the mud volcano, Klyuchi village vicinity, lower part of the slope, N 47°11', E 142°35', larch bamboo forest, on twig of *Larix*, 14 IX 2006, Galanin, Galanina, S-C1-06, S-C1-05, S-C1 (VLA); Poronayskiy District, Poronaysk city surroundings, mixed forest, N 49°13'58.6704", E 143°05'42.5399", alt. 10 m, bark of *Salix*, 25 V 2017, Ezhkin, 42R/03.18 (VLA); Smirnykhovskiy District, vicinity of Pobedino, scattered *Larix-Betula* forest, on twig, 01 IX 2008, Tsarenko, S-08-W-16-02-NW-7 (VLA); *ibid.*, bog with *Ledum* and moss cover, on twig, 31 IX 2009, Tsarenko, S-W08-18-02NW-6, S-W08-18-02SE-3, S-W-08-18-03SE-6, S-08-W-21-02W, S-W08-18-02SE-3 (VLA); *ibid.*, bark of *Abies*, 31 VIII 2008, Tsarenko, S-W-17-03W-2 (VLA); *ibid.*, Smirnykh vicinity, bog with shrubs and *Carex* cover, on twig of *Betula*, 26 VII 2009, Tsarenko, S-08-W-21-03E (VLA); Timovskiy District, 441 km Federal Highway, bog with shrubs and mosses-*Carex* cover, on twig, 02 IX 2008, Tsarenko, S-W08-20-03E-5 (VLA); *ibid.*, vicinity of Palevo village, 454 km Federal Highway, meadow with *Calamagrostis* cover, on twig of *Betula*, 07 VIII 2008, Bogachyova, Barkalov, S-08-Pal1 (VLA); *ibid.*, on dry twig, 20 IX 2008, Tsarenko, S-Pal1-08-1 (VLA); Noglikskiy District, vicinity of Val village, Evay River, meadow with *Calamagrostis* cover, 07 VIII 2008, Bogacheva, Barkalov, S-T83-1 (VLA); Dolinskiy District, 108 km of the Federal Highway, *Salix* forest with *Alnus*, on dry branch, 13 VII 2008, Bogacheva, Tsarenko, S-T6-4 (VLA); *ibid.*, vicinity of Firsovo village, 108 km of the Federal Highway, sparse *Alnus-Sorbus* forest with *Osmunda* cover, on dry twig,

12 VII 2008, Bogacheva, Tsarenko, S-T6-4, S-T1-1 (VLA); *ibid.*, Starodubskoye village surroundings, oak forest, N 47°24'57.76", E 142°47'4.516", alt. 4 m, bark of *Quercus*, 03 VI 2015, Ezhkin, 5R/06.2015 (VLA); Okhotsk village surroundings, coast of the Sea of Okhotsk, oak forest, N 46°50'49.93", E 143°10'5.797", bark of *Quercus*, 14 VI 2015, Ezhkin, 8R/06.2015, 6R/06.2015 (VLA); Nevelskiy District, Lovetskiy Pass, mixed forest, N 46°44'35.91", E 142°6'21.02", alt. 424 m, bark of *Salix*, 11 VI 2013, Ezhkin, 31R/06.2015, 32R/06.2015, 29R/04.17, 31R/06.2015 (VLA).

Rinodina sibirica H. Magn.

On Sakhalin Island, the species was found twice in a mixed forest on the barks of *Betula* and *Larix*. The habitat is a relatively cool environment of central part of Sakhalin Island. *R. sibirica* is a northern boreal species and does not occur south of Sakhalin Island. The species was described from the vicinity environs of the cities of Yeniseysk, Tomsk and Tobolsk in Russia (Magnusson, 1936). Subsequently, the species was also mentioned from Siberia, in numerous places along the rivers: Yenisei, Ob, Irkut, Lena, Aldan (Magnusson, 1947), as well as from Altai and Sayan Mountains (Kotlov, 2008) and from Mongolia (Golubkova, 1981). Recently, it was noted in the Trans-Baikal and Khabarovsk Territories, Magadan Region, on Sakhalin Island and the Kamchatka Peninsula (Sheard et al., 2017). The species was found in North America in the forest tundra and tundra (Thomson, 1997 as *R. granulans*; Sheard, 2010). *R. sibirica* usually grows on barks of deciduous trees (*Alnus*, *Betula*, *Populus*, *Prunus*, *Sorbus*, and *Salix*) less often than on barks of conifers (*Abies*, *Larix*, *Picea*, and *Pinus*), on wood (Magnusson, 1936, 1947; Kotlov, 2008; Sheard, 2010; Sheard et al., 2017). *R. sibirica* is a Eurasian-American species with circumpolar distribution in the boreal zone.

Specimens examined: Tymovskiy District, vicinity of Palevo village, birch scrub-grass forest, bark of *Larix*, 22 IX 2008, Tsarenko, S-08-Pal-7 (VLA); *ibid.*, alt. 441 km Federal Highway, *Betula-Larix* forest with *Carex-Calamagrostis* cover, on dry wood, bark of *Betula*, 02 IX 2008, Tsarenko, S-W08-19-03W-7 (VLA).

Rinodina subalbida (Nyl.) Vain.

R. subalbida is an East-Asian species, described from Japan and recently discovered in South Korea and the south of the Russian Far East, including Primorye Territory and Sakhalin Island (Sheard et al., 2017) and then in the Kuril Islands (Galanina, Ezhkin, 2019). The species is found on bark of coniferous and broad-leaved deciduous trees (*Abies*, *Alnus*, *Berberis*, *Fagus*, *Malus*, *Picea*, *Prunus*, *Quercus*, *Salix*, and *Sorbus*), often in mixed and broad-leaved deciduous forests. A complete description of the species was given

recently (Sheard et al., 2017). Our study confirms that the species is particularly common on Sakhalin Island.

Specimens examined: Slepikovskogo Cape, mixed *Quercus* forest with *Abies*, N 47°17'26.33", E 141°59'09.93", alt. 8 m, bark of *Abies*, 18 V 2013, Ezhkin, 10R/06.2015 (VLA); Yuzhno-Sakhalinsk city surroundings, Mitsul Mountain, coniferous forest with *Betula ermanii*, N 47°03'02.2932", E 142°30'39.4704", alt. 536 m, bark of *Sorbus*, 26 V 2012, Ezhkin, 63R/04.17 (VLA); *ibid.*, Turgeneva Mountain, northern slope, mixed forest, N 47°00'27.1", E 142°47'18.7", alt. 447 m, bark of *Salix udensis*, 19 IX 2014, Ezhkin, R13/12.14 (VLA); *ibid.*, Rogatka River valley, riparian forest, N 46°58'2.118", E 142°46'16.75", alt. 108 m, bark of deciduous tree, 06 XII 2014, Ezhkin, 17R/04.17 (VLA); Korsakovskiy District, Prigorodnoye village surroundings, coniferous forest, N 46°38'57.4", E 142°58'07.7", alt. 206 m, bark of *Abies*, 01 XI 2014, Ezhkin, R3/12.14 (VLA); Nevelskiy Pass, mountain stream, mixed forest, N 46°44'35.92", E 142°6'21.02", alt. 425 m, bark of *Salix*, 11 VI 2013, Ezhkin (VLA); *ibid.*, N 46°44'35.11", E 142°13'36.13", alt. 173 m, bark of *Salix*, 28 VI 2013, Ezhkin (VLA); Nevelskiy District, Lovetskiy Pass, mixed forest, N 46°44'35.91", E 142°6'21.02", alt. 424 m, bark of *Salix*, 11 VI 2013, Ezhkin, 32R/06.2015, 48R/04.17, 47R/04.17 (VLA); Dolinskiy District, Sokol village surroundings, Belaya River valley, riparian forest, N 47°15'00.3", E 142°47'33.3", alt. 56 m, bark of *Salix*, 22 XI 2017, Ezhkin, 61R/04.17 (VLA); *ibid.*, Sovetskoye village surroundings, Ai River valley, mixed forest, N 47°28'49.6", E 142°39'02.7", alt. 9 m, bark of *Picea*, 10 X 2015, Ezhkin, 50R/04.17 (VLA); Chekhovskiy District, Arkanzas River valley, broad-leaved forest, N 47°31'16.5", E 141°59'01.9", alt. 83 m, bark of *Phellodendron*, 29 VI 2016, Ezhkin, 55R/04.17, 54R/04.17, 25R/04.17 (VLA).

Rinodina subminuta H. Magn.

R. subminuta is found on coniferous and broad-leaved deciduous trees (*Abies*, *Alnus*, *Berberis*, *Fagus*, *Hydrangea*, *Malus*, *Picea*, *Quercus*, *Salix*, and *Sorbus*) in Russia, often in mixed and broad-leaved deciduous forests (Sheard et al., 2017). The species was described from Siberia (Magnusson, 1947), but in Russia it is most often found in the south of the Far East (Primorye Territory, Sakhalin Island, and the Kuril Islands) (Sheard et al., 2017; Galanina, Ezhkin, 2019). It is the most common and frequent *Rinodina* species here. The species is also found in Japan and Korea (Sheard et al., 2017). Also it is widespread in the east of the North America (Great Lakes Region, Appalachian Mountains) (Sheard, 2010). This is an East Asian – Eastern North American species.

Specimens examined: Yuzhno-Sakhalinskii mud volcano surroundings, mixed forest, N 47°05'09.09", E 142°34'22.72", alt. 239 m, bark of *Salix*, 23 X 2018, Ezhkin, 3R/02.19, 4R/02.19, R17.5.13 (VLA);

Yuzhno-Sakhalinsk city surroundings, Mitsul Mountain, coniferous forest with *Betula ermanii*, N 47°02'23.9064", E 142°30'50.9616", alt. 604 m, bark of *Sorbus*, 20 V 2017, Ezhkin, 62R/04.17 (VLA); *ibid.*, Novo-Aleksandrovka village, Krasnoselskiy stream valley, floodplain forest, N 47°02'4.2", E 142°43'34.8", alt. 48 m, bark of *Juglans*, 30 V 2012, Ezhkin, R25, 15R, R18, R23, 24R/5.13 (VLA); Susunayskiy Range, Yuzhno-Sakhalinsk city surroundings, Turgenev Mountain, alt. 200 m, mixed forest, western slope exposure, bark of *Populus*, 19 XI 2011, Ezhkin, 4R-N-C-3 (VLA); *ibid.*, southern part of Turgenev Mountain, mixed forest, N 46°59'56.6", E 142°47'12.4", alt. 360 m, bark of *Salix*, *Acer*, *Sorbus*, 19 XI 2011, Ezhkin, 22R.5.13, 27R.5.13, 29R-B-ER-SZ (VLA); *ibid.*, southern slope exposure of Turgenev Mountain, floodplain forest, N 47°00'02.11", E 142°48'11.59", alt. 442 m, bark of *Salix*, 19 XI 2011, Ezhkin, 2R-B-PI-U, 3R-B-PI-U (VLA); *ibid.*, Rogatka River, floodplain forest, southern exposure of the slope, alt. 207 m, bark of *Salix*, *Populus*, 05 V 2011, Ezhkin, 45S-RCh-U, 7R-R-PI-U, 26R/06.2015, 33R/06.2015, R9/12.14, R7/12.14, R6/12.14, 4R/04.17 (VLA); *ibid.*, riparian forest, N 46°58'4.789", E 142°48'18.88", alt. 161 m, bark of *Alnus*, *Salix*, 14 XI 2014, Ezhkin, R12/12.14, R16/12.14, 45S-R-PI-U (VLA); Susunayskiy Range, Yuzhno-Sakhalinsk city surroundings, southwestern part of Parkovaya Mountain, larch plantations, mixed forest, N 46°58'23.6", E 142°45'30.9", alt. 207 m, *Acer*, *Populus*, 04 VI 2012, Ezhkin, 30R.5.13 (VLA); *ibid.*, southern slope exposure of Parkovaya Mountain, floodplain forest, N 46°58'23.30", E 142°46'4.84", alt. 100 m, bark of *Salix*, 10 X 2011, Ezhkin, 31R-G-PI-U, 24R-G-ST-UZ, 33R-G-ST-UZ, 21R-G-SK-UZ (VLA); *ibid.*, southern part of Ostraya Mountain, mixed forest, N 46°58'39.2", E 142°46'24.4", alt. 237 m, bark of *Populus*, 10 VI 2012, Ezhkin, R29.5.13, 16R-G-ST-SE, 10R-G-ST-UZ, 3R.5.13, 42R, 3R.5.13 (VLA); Yuzhno-Sakhalinsk city, Gagarin City Park, mixed forest, N 47°02'4.2", E 142°43'34.8", alt. 48 m, bark of *Populus*, *Salix*, *Acer*, 12 VI 2011, Ezhkin, 15R-P-T, 15R-P-T, R15/12.14 (VLA); Nevelskiy District, Lovetskiy Pass, mixed forest, N 46°44'7.220", E 142°9'52.76", alt. 223 m, bark of *Prunus*, 11 VI 2013, Ezhkin, 6Ri (VLA); Kholmskiy District, Slepikovskogo Cape, mixed *Quercus* forest with *Abies*, N 47°17'23.1", E 141°59'10.49", alt. 10 m, bark of *Abies sakhalinensis* F. Schmidt, 18 V 2013, Ezhkin, 12R/06.2015 (VLA); Dolinskiy District, Sokol village surroundings, Belaya River valley, riparian forest, N 47°15'00.3", E 142°47'33.3", alt. 56 m, bark of *Salix*, 22 XI 2017, Ezhkin, 61R/04.17, 59R/04.17 (VLA); *ibid.*, Chekhovskiy District, Arkanzas River valley, broad-leaved forest, N 47°31'16.5", E 141°59'01.9", alt. 83 m, bark of *Phellodendron*, 29 VI 2016, Ezhkin, 6R/04.17, 2R/04.17, 3R/04.17, 54R/04.17, 58R/04.17 (VLA); Korsakovskiy District, Prigorodnoye village surroundings, deciduous forest, N 46°38'57.4",

E 142°58'07.7", alt. 206 m, bark of *Salix*, 22 V 2015, Ezhkin, 40R/04.17, 42R/04.17 (VLA); Slepikovskogo Cape, mixed *Quercus* forest with *Abies*, N 47°17'23.1", E 141°59'10.49", alt. 10 m, bark of *Abies*, 18 V 2013, Ezhkin, 12R/06.2015 (VLA).

Rinodina subpariata (Nyl.) Zahlbr.

R. subpariata was previously recorded on Sakhalin Island on *Betula* and *Abies* (Galanina, 2013 as *R. degeliana*; Sheard et al., 2017). The species is found on other coniferous and broad-leaved deciduous trees (*Abies*, *Alnus*, *Betula*, *Castanea*, *Chosenia*, *Picea*, *Prunus*, *Quercus*, *Salix*, and *Taxus*), in deciduous and mixed forests in Russia, and also along river valleys. It occurs from the sea level to 2550 m (Sheard et al., 2017). It is a widespread species in Russia from the Caucasus to the Far East (Urbanavichus, 2010; Himelbrant, Stepanchikova, 2011 as *R. degeliana*; Galanina, 2013; Sheard et al., 2017; Galanina, Ezhkin, 2019). In Europe it is known from Scotland (Giavarini et al., 2009), Scandinavia and Austria (Tonsberg, 1992; Mayrhofer, Moberg, 2002 as *R. degeliana* Coppins). *R. subpariata* is also known from the region of Khentey Mountains of Mongolia (Hauck, Javkhlan, 2006), and was previously reported from eastern Asia with a distribution spanning Russia, Japan and Korea (Sheard et al., 2017). *R. subpariata* has a Pacific and North Atlantic disjunct distribution in North America (Sheard, 2010 as *R. degeliana*; Spribille et al., 2010; Resl et al., 2016). This is a Eurasian-American species.

Specimens examined: 48th km of the Yuzhno-Sakhalinsk — Kholmsk Highway, Lutoga River valley, northeastern slope exposure, N 46°50', E 142°16', spruce-fir bamboo forest, bark of *Abies*, *Betula*, 11 XI 2006, Galanina, S-C2-06, S-C2-07, S-C2-08 (VLA); Yuzhno-Sakhalinsk city surroundings, N 46°52', E 143°02', *Larix* forest with shrub, bark of *Abies*, 15 XI 2006, Galanina (VLA); *ibid.*, Bolshevik Mountain, eastern slope, mixed forest, N 46°56'49.8", E 142°47'54.9", alt. 399 m, bark of *Picea*, 20 V 2014, Ezhkin, 4Ri (VLA); *ibid.*, Klyuchi village surroundings, on the slope, N 47°11', E 142°35', larch bamboo forest, bark of *Abies*, 15 XI 2006, Galanina (VLA); Prigorodnoye village surroundings, coniferous forest, N 46°39'27.79", E 142°55'16.70", alt. 47 m, bark of *Abies*, 06 XI 2014, Ezhkin, R4/12.14 (VLA); Dolinskiy District, 106 km of the Federal Highway, *Salix* forest with *Alnus*, bark of *Alnus*, 13 VII 2008, Bogacheva, Tsarenko, S-T19-3 (VLA); *ibid.*, Sovetskoye village surroundings, Ai River valley, mixed forest, N 47°28'49.6", E 142°39'02.7", alt. 9 m, bark of *Picea*, 10 X 2015, Ezhkin, 50R/04.17 (VLA); Korsakovskiy District, Vavayskoye Lake surroundings, coniferous forest, N 46°36'35.9172", E 143°18'50.8968", alt. 21 m, 01 VIII 2016, Ezhkin, 32R/04.17 (VLA).

Rinodina tenuis Müll. Arg.

R. tenuis, a species described from Japan (Mueller, 1892), is found in mixed and coniferous forests (on bark of *Picea*, *Abies*, *Betula*, and *Sorbus*) on Sakhalin Island. Most recently it was found in Russia where it seems to have a narrow distribution in the boreal zone of the Khabarovsk Region, Sakhalin Island with a couple of records from Hokkaido Island (Japan) (Sheard et al., 2017; Ohmura, Kashiwadani, 2018) and in the Kuril Islands (Galanina, Ezhkin, 2019). The species was found on bark and branches of coniferous trees (*Abies*, *Picea*) as well as on mossy horizontal logs. A full description of *R. tenuis* was given earlier (Sheard et al., 2017) where it was shown to be a priority name for *R. adirondackii* H. Magn. of the Great Lakes—Appalachian region in North America (Sheard, 2010). Although widespread in eastern North America, it is relatively infrequent (Sheard, 2010; Lendemer et al., 2014). This is an East Asian — Eastern North American disjunct species.

Specimens examined: Yuzhno-Sakhalinsk city surroundings, Mitsulskiy Ridge, Mitsul Mountain, mixed forest, N 47°02'59.5", E 142°30'39.1", alt. 480 m, bark of *Picea*, 26 V 2012, Ezhkin, 5R.5.13 (VLA); *ibid.*, N 47°01'44.0", E 142°29'19.4", alt. 461 m, bark of *Picea*, 07 VIII 2016, Ezhkin, 16R/08.2016 (VLA); *ibid.*, coniferous forest with *Betula ermanii*, N 47°01'36.5", E 142°29'24.5", alt. 594 m, bark of *Sorbus*, 07 VIII 2016, Ezhkin, 10R/04.17 (VLA); *ibid.*, N 47°02'13.4", E 142°31'04.9", alt. 712 m, bark of *Sorbus*, 26 VIII 2016, Ezhkin, 27R/04.17 (VLA); *ibid.*, N 47°02'09.9", E 142°30'59.6", alt. 686 m, 26 VIII 2016, Ezhkin, 45R/04.17 (VLA); *ibid.*, N 47°02'23.9064", E 142°30'50.9616", alt. 604 m, bark of *Sorbus*, 20 V 2017, Ezhkin, 66R/04.17 (VLA); Susunayskiy Range, Yuzhno-Sakhalinsk city surroundings, Turgeneva Mountain, mixed forest, N 47°00'42.3", E 142°48'13.2", alt. 602 m, bark of *Abies*, 04 VI 2012, Ezhkin, 8R.5.13 (VLA); Yuzhno-Sakhalinsk city surroundings, Bolshevik Mountain, northwestern slope, coniferous forest, N 46°57'33.46", E 142°46'45.47", alt. 312 m, bark of *Abies*, 01 VIII 2014, Ezhkin, 7Ri, 5Ri (VLA); Korsakovskiy District, Tunaycha Lake surroundings, N 46°48'30.3227", E 143°04'16.1904", alt. 20 m, mixed forest, bark of *Salix*, 20 IX 2017, Ezhkin, 38R/03.18 (VLA); *ibid.*, Prigorodnoye village surroundings, coniferous forest, N 46°39'27.79", E 142°55'16.70", alt. 47 m, bark of *Picea*, *Abies*, 06 XI 2014, Ezhkin, 9Ri, 14R/06.2015, R4/12.14 (VLA); *ibid.*, Vavayskoye Lake surroundings, coniferous forest, N 46°36'35.9172", E 143°18'50.8968", bark of *Picea*, 01 VIII 2016, Ezhkin, 32R/04.17 (VLA); Tonino-Anivskiy Range, Novikovo village surroundings, coniferous forest, N 46°22'43.8", E 143°28'16.1", alt. 173 m, bark of *Picea*, 24 VIII 2016, Ezhkin, 43R/04.17 (VLA); Dolinskiy District, Anna River valley, coniferous forest, N 47°09'40.71", E 143°01'20.81", alt. 52 m, bark of *Picea*, 31 X 2018, Ezhkin, 1R/02.19 (VLA);

ibid., N 47°09'43.24", E 143°01'49.34", alt. 94 m, bark of old *Betula ermanii*, 30 X 2018, Ezhkin, 2R/02.19 (VLA); ibid., N 47°09'46.39", E 143°01'44.01", alt. 15 m, bark of *Picea*, 30 X 2018, Ezhkin, 5R/02.19 (VLA).

Rinodina turfacea (Wahlenb.) Körb.

R. turfacea grows on decaying plants and mosses on soil, wood, in arctic and subarctic regions (Mayrhofer, Moberg, 2002; Kotlov, 2008; Sheard, 2010), and rarely on rabbit dung (Sheard, 2010). On Sakhalin Island *R. turfacea* is found on the thallus of *Pseudocypbellaria* and seaside meadow soil. It was previously listed for Sakhalin Island (Sheard et al., 2017). The species was previously reported from the Russian Far East, from Republic of Sakha (Yakutia) (Afonina et al., 1980), Chukotka Peninsula (Makarova, Katenin, 1983), Kamchatka Peninsula (Himmelbrant et al., 2009), the Sikhote-Alin' Mountains (Tschabanenko, 2002) and Khabarovsk Region (Skirina, 2012 as *R. turfacea*). In Russia, *R. turfacea* occurs in the Arctic, the Ural Mountains, Siberia (Kotlov, 2008), Altai Territory (Makryi, 1986; Sedelnikova, 1990; Davydov, 2001), as well as from the Mongolian (Schubert, Klement, 1971) and Chinese parts of the Altai Mountains (Abbas et al., 2001). It is found in Europe in Germany (Wirth et al., 2013), and Scandinavia (Norway, Sweden and Finland) (Mayrhofer, Moberg, 2002). *R. turfacea* is absent from the Iberian Peninsula (Giralt, 2010). 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). This is a Eurasian-American species.

Specimens examined: Noglikitskiy District, Dagi River valley, N 52°06'33.55", E 142°57'26.19", alt. 9 m, riparian forest, on thallus of *Peltigera collina*, 12 X 2012, Ezhkin, 13R/04.17, 19R.5.13 (VLA); ibid., Lovetskiy Pass, mixed forest, N 46°44'35.91", E 142°6'21.02", alt. 424 m, on thallus of *Pseudocypbellaria*, 11 VI 2013, Ezhkin, 12R/04.17 (VLA); Dolinskiy District, Pchelinaya River valley, floodplain forest, N 47°21'06.1", E 142°52'28.6", alt. 10 m, on thallus of *Peltigera* sp., 15 VII 12, Ezhkin, 12R/5.13 (VLA); ibid., Ostryi Cape, seaside meadow soil, N 47°15'03.85", E 143°00'54.69", alt. 59 m, 30 X 2018, Ezhkin, 7R/02.19 (VLA).

Rinodina willeyi Sheard et Giralt

R. willeyi is reported from Sakhalin Island for the first time on bark of *Abies*, *Betula ermanii*, *Quercus*, and *Sorbus*. In Russia, *R. willeyi* was first noted from the Kamchatka Peninsula (Sheard et al., 2017) on *Chosenia* and then in the Kuril Islands (Galanina, Ezhkin, 2019). This species was described from North America (Sheard, 1995), and before our research in Northeast Asia (Sheard et al., 2017) was known only from North America. The species was noted in Japan

(Hokkaido and Honshu Islands) (Sheard et al., 2017). It is an Eastern Asian – Eastern North American disjunct species.

Specimens examined: Yuzhno-Sakhalinsk city surroundings, Bolshevik Mountain, eastern slope, mixed forest, N 46°56'49.8", E 142°47'54.9", alt. 399 m, bark of *Picea*, 20 V 2014, Ezhkin, 4Ri (VLA); Yuzhno-Sakhalinsk city surroundings, Mitsul Mountain, coniferous forest with *Betula ermanii*, N 47°02'13.4", E 142°31'04.9", alt. 712 m, bark of *Sorbus*, 26 VIII 2016, Ezhkin, 30R/04, 15R/08.2016 (VLA); Prigorodnoye village surroundings, coniferous forest, N 46°38'26.76", E 142°54'10.11", alt. 4 m, bark of *Abies*, 23 V 2014, Ezhkin, 8Ri (VLA); Okhotsk village surroundings, coast of the Sea of Okhotsk, oak forest, N 46°50'49.93", E 143°10'5.797", bark of *Quercus*, 14 VI 2015, Ezhkin, 7R/06.2015 (VLA).

Rinodina xanthophaea (Nyl.) Zahlbr.

On Sakhalin Island *R. xanthophaea* was first noted on the bark of coniferous and deciduous trees (*Abies*, *Alnus*, *Betula*, *Castanea*, *Fagus*, *Picea*, *Quercus*, *Salix*, and *Sorbus*) (Sheard et al., 2017). Elsewhere in Russia it is found in broad-leaved deciduous and mixed forests. It has a wide altitudinal range in Northeast Asia, occurring from sea level to 1700 m (Sheard et al., 2017). The species was described from Japan (Nylander, 1890) and has been previously recorded from Russia (Oxner, 1948; Pchelkin, 1987; Tschabanenko, 2002; Galanina, 2008; Skirina, 2010, 2012; Urbanavichene, Skirina, 2011; Rodnikova, 2012, 2013; Yakovchenko et al., 2013; Galanina, Ezhkin, 2019). It is widespread and has been reported as far west as the Khamar-Daban Ridge in the Trans-Baikal Territory (Urbanavichene, 2010), from Gora Olocha in the Stanovoye Nagor'e Mountains in Amur Region (Urbanavichene, Skirina, 2011) and from the Jewish Autonomous Region (Urbanavichene, Skirina, 2011), also as the host of *Ovicuculispora parmeliae* (Berk. et Curt.) Etayo (Zhurbenko, 2014). It was recently reported as new to Korea (Kondratyuk et al., 2016). It is an East Asian species.

Specimens examined: Nevelskiy Pass, mountain stream, mixed forest, N 46°44'35.92", E 142°6'21.02", 425 m, bark of *Salix*, 11 VI 2013, Ezhkin (VLA); Yuzhno-Sakhalinsk city surroundings, Rogatka River valley, floodplain forest, N 43°53'24.81", E 145°36'28.30", alt. 66 m, on mosses on *Ulmus*, 23 VI 2014, Ezhkin, 2R/08.2016 (VLA), ibid., N 46°58'4.789", E 142°48'18.88", alt. 161 m, bark of *Salix*, 14 XI 2014, Ezhkin, 10R/08.2016 (VLA); ibid., Mitsul Mountain peak, coniferous forest with *Betula*, N 47°01'33.5", E 142°29'20.3", alt. 606 m, bark of *Sorbus*, 07 VIII 2016, Ezhkin, 3R/08.2016, 9R/08.2016 (VLA); ibid., N 47°01'36.5", E 142°29'24.5", alt. 594 m, bark of *Betula*, 07 VIII 2016, Ezhkin, 4R/08.2016 (VLA), ibid., N 47°02'09.9", E 142°30'59.6", alt. 686 m, bark of *Picea*, *Sorbus*, 26 VIII

2016, Ezhkin, 5R/08.2016, 11R/08.2016 (VLA), ibid., N 47°02'13.4", E 142°31'04.9", alt. 712 m, bark of *Sorbus*, 06 VIII 2016, Ezhkin, 12R/08.2016 (VLA).

DISCUSSION

The species composition of the genus *Rinodina* of Sakhalin Island reflects a variety of biogeographic connections. On Sakhalin Island 24 species of *Rinodina* were recorded; in the south of the Far East: the Kuril Islands – 17, Primorye Territory – 25, Khabarovsk Territory – 16, Amur Region – 2; in Japan: on Hokkaido – 17, Honshu – 15, Shikoku – 2, Kyushu – 2; in South Korea – 12 (Insarov, Pchelkin, 1984; Bredkina et al., 1992; Tschabanenko, 2002; Spribille et al., 2006; Galanina et al., 2011, 2018; Rodnikova, 2012, 2013; Ezhkin, Galanina, 2014; Kondratyuk et al., 2013, 2016; Galanina, 2013, 2016; Skirina, Skirin, 2013; Yakovchenko et al., 2013, 2018; Sheard et al., 2017; Konoreva et al., 2018; Galanina, Ezhkin, 2019). Despite recent studies in Northeast Asia (Sheard et al., 2017), the degree of exploration of the above territories is different and incomplete. At the moment, the most similar by species diversity of the genus *Rinodina* on Sakhalin are the Islands of Japan: Hokkaido – 17 taxa and Honshu – 15. If we compare the species composition of the *Rinodina* genus with the mainland of the south of Far East, the south of Sakhalin Island will be closer to the south of Primorye Territory, and the northern part is closer to Khabarovsk Territory. In this case, the diversity will depend on the size of the studied territory and substrate. Sakhalin Island has a vast territory and a length from north to south, so its species diversity is higher than in Hokkaido or Honshu in Japan for instance. The northern part of Sakhalin is enriched with boreal species. In the southern part of Sakhalin Island, the South Kuril Islands, the Primorye Territory, Japan, and South Korea more nemoral and subtropical species appear. There is a tendency toward decrease in the diversity of species when moving south on the Japanese Islands, partly due to the poor knowledge of individual islands, but more so due to a change in vegetation and substrates for lichens in Japan.

An interesting question is the presence of disjunctive species. The genus *Rinodina* is presented here by species with disjunctive distributions in the south of Far East of Russia and in western or eastern parts of North America. Some of these species (*R. albertana*, *R. ascociscana*, *R. endospora*, and *R. megistospora*) were considered to be endemic to North America until recently. Species with such distribution are divided into two groups: East Asian – Western North American (*R. endospora*, and *R. megistospora*) and East Asian – Eastern North American (*R. ascociscana*, *R. buckii*, *R. subminuta*, *R. tenuis*, and *R. willeyi*). There are three species limited to East Asia (*R. hypobadia*, *R. subalbida*, and *R. xanthophaea*). Other species are widespread in both hemispheres (1 species – *R. gennari*) or are the

Eurasian-American species (12 species – *R. cinereo-virens*, *R. efflorescens*, *R. excrescens*, *R. freyi*, *R. metaboliza*, *R. oleae*, *R. polyspora*, *R. septentrionalis*, *R. sibirica*, *R. subparieta*, and *R. turfacea*). The record of *R. exigua* for Sakhalin Island (Galanina, 2013) belongs to *R. freyi*.

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РОД *RINODINA* (PHYSICIACEAE, LICHENIZED ASCOMYCOTA) ОСТРОВА САХАЛИН (ДАЛЬНИЙ ВОСТОК РОССИИ)

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Представленная работа основана на исследовании обширного материала, собранного А.К. Ежекиным в 2011–2018 гг. на острове Сахалин, а также образцов, хранящихся в гербарии (VLA). В результате исследования ревизован список видов рода *Rinodina* для острова Сахалин. Он включает 24 вида, из которых *R. albertana* Sheard является новым для Северо-Восточной Азии и России, 8 видов являются новыми для острова Сахалин. Виды обсуждаются в контексте их распространения в Северо-Восточной Азии и Северной Америке. Дано краткое описание редких таксонов (*R. albertana*, *R. bukii* Sheard, *R. endospora* Sheard), найденных на острове Сахалин. *Rinodina exigua* (Ach.) Gray, ранее отмеченная для острова Сахалин (Galanina, 2013), определена как *R. freyi* H. Magn.

Ключевые слова: лишайники, Physciaceae, биоразнообразие, эндемизм, распространение, Северо-Восточная Азия, Северная Америка