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The genus *Rinodina* in the Kuril Islands (Russian Far East)

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Summary. The presented work is based on the study of extensive material collected by Ezhkin A. K. in 2014–2018 from the islands of Kunashir, Iturup, Paramushir, and Shikotan. As a result of the study, the new list of species of the genus *Rinodina* for the Kuril Islands consists of 17 taxa. One species, *Rinodina herrei* H. Magn., is new to northeastern Asia and Russia, 14 taxa are new to the Kuril Islands. The genus *Rinodina* is represented by species with disjunctive distribution by 35.3 % (6 species). They are divided into two groups: East Asian – West American (*R. herrei*, *R. megistospora*) and East Asian – East North American (*R. ascociscana*, *R. subminuta*, *R. tenuis* and *R. willeyi*). East Asian species account for 17.6 % (3 species: *R. hypobadia*, *R. subalbida* and *R. xanthophaea*) of the known number of *Rinodina* species of the Kuril Islands.

Род *Rinodina* на Курильских островах (Дальний Восток России)

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Ключевые слова: биоразнообразие, дизъюнктивное распространение, лишайники, новые виды, Северо-Восточная Азия, Physciaceae.

Аннотация. Представленная работа основана на исследовании обширного материала, собранного А. К. Ежкиным в 2014–2018 гг. на Курильских островах: Кунашир, Итуруп, Парамушир и Шикотан. В результате исследования новый список видов рода *Rinodina* для Курильских островов состоит из 17 таксонов. Один вид, *Rinodina herrei* H. Magn., является новым для Северо-Восточной Азии и России, 14 таксонов являются новыми для Курильских островов. Род *Rinodina* на 35,3 % (6 видов) представлен здесь видами с дизъюнктивным распространением. Они делятся на две группы: восточноазиатско-западно-североамериканские (*R. herrei*, *R. megistospora*) и восточноазиатско-восточно-североамериканские (*R. ascociscana*, *R. subminuta*, *R. tenuis* и *R. willeyi*). Виды, ограниченные Восточной Азией, составляют 17,6 % (3 вида: *R. hypobadia*, *R. subalbida* и *R. xanthophaea*) от известного числа видов *Rinodina* Курильских островов.

Introduction

As well known, the south of the Russian Far East possesses a large flora of vascular plants and cryptogamic organisms (Kharkevich, 1985; Bulakh et al., 1990; Kozhevnikov, Probatova, 2006; Bogacheva et al., 2018). The genus *Rinodina* (Ach.) Gray remains unexplored in certain territories of Russia or the data about it is often erroneous. Species of *Rinodina* are relatively difficult to determine because of the wide variety of types of spores, which are distinguished by their development all stages.

The Russian Far East is one of the territories where the genus *Rinodina* remained poorly studied. Recently, a monograph of the genus *Rinodina* was published for North America and north of Mexico (Sheard, 2010). This work facilitated an updating of our understanding of the genus in Northeast Asia (Sheard et al., 2017). This revision included parts of Russia and China, Korea and Japan. Many *Rinodina* species not previously recognized in the Russian Far East, were discovered. These include some species previously thought to be North American endemics. Close links were found with the *Rinodina* biota of both eastern and western North America (Sheard et al., 2017; Yakovchenko et al., 2018).

The Kuril Islands are located in the northeastern part of the Pacific Ocean, between Hokkaido (Japan) and the Kamchatka Peninsula (Russia). The climate is temperate, monsoon type with cold winters, but milder than in the mainland part with a cool rainy summers. The southern Kuril Islands (Kunashir, Iturup, Shikotan) are the part of the Sakhalin-Hokkaido province of the East Asian floristic region (Takhtajan, 1978). The flora of northern Kuriles (Paramushir) is enriched with arctic-alpine elements including American flora representatives (Barkalov, 2002). The flora of South Kuriles is considered a part of the boreal zone with coniferous and mixed coniferous-deciduous forests but also includes tropical and subtropical elements.

The first lichenological investigations on Kuriles were performed by Japanese specialists in the beginning of the twentieth century. The first list of lichens numbered only 44 species Kuriles (Sato, 1936). In 2002 the list of lichens included 260 species for Kuriles (Tchabanenko, 2002), so these list additions of new records are found in several publications (Insarov, Pchelkin, 1984; Tchabanenko, 1999, 2004; Joneson et al., 2004; Makryi et al., 2010; Ezhkin, 2016; Ezhkin, Kordyukov, 2016).

The genus *Rinodina* in the lichen biota of the Kuril Islands remained unexplored due to its

difficult taxonomy. For the Kuril Islands (Kunashir Island), six species of the genus *Rinodina* were cited (Bredkina et al., 1992; Tchabanenko, 1999; Galanina et al., 2018). These were *Rinodina archaea* (Ach.) Arnold, *R. gennarii* Bagl., *R. megistospora* Sheard et H. Mayrhofer, *R. pyrina* (Ach.) Arnold, *R. sophodes* (Ach.) A. Massal., *R. xanthophaea* Nyl. In our last study (Sheard et al., 2017), it was shown that these species, with the exception of *R. gennarii*, *R. megistospora*, and *R. xanthophaea*, were not found in the Russian Far East. We believe that these species are erroneously listed for the islands. *Rinodina gennarii* was not found by us, but there is a probability of it being present on coastal rock habitats.

The presented work is based on the study of extensive material collected from different islands (Kunashir, Iturup, Paramushir, and Shikotan). As a result, the list of species for the genus *Rinodina* in the Kuril Islands includes 17 taxa. One of them is the western North American species – *Rinodina herrei* H. Magn. – recorded for the first time from Northeast Asia and Russia, and there are additional 14 new records for the Kuril Islands.

Material and methods

Herbarium specimens collected by the second author (A. K. Ezhkin) during 2014–2018 from the Kuril Islands 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 studied area. A few recent publications have been used to identify samples (Sheard, 2010, 2018; Sheard et al., 2017).

A new species for northeast Asia and Russia

Rinodina herrei H. Magn. (Fig. 2)

Specimens examined: “Iturup Island, Baranskogo Volcano surroundings, Kipyashya river valley, oak wood, on bark of *Quercus crispula*, 225 m. 45°4'43.31"N, 147°59'6.968"E. 19 VIII 2012. A. K. Ezhkin. № 525” (VLA).

The species grows on bark, often heavily dusty, less often on wood and soil. One of the most common species found in southern California, most commonly on *Quercus* bark (Sheard, 2010).

Previously cited only for North America as an endemic species belonging to the Californian

floristic element. Distributed in the coastal zone of California, Baja California, and British Columbia (Sheard, 2010). The species is first recorded here for Russia and Northeast Asia, on the bark of *Quercus crispula* Blume in an oak grove on the Iturup Island. This is another species belonging to the group of East Asian-Western North American species.

The following is a brief description of the species based on the studied samples. Thallus grayish to brown, thin to thick, areolate; areoles to 0.6–1.0 mm wide, with margins raised; surface plane, matt; prothallus lacking; sometimes blastidia may proliferate from areole margins. Apothecia erumpent, broadly attached, frequent, to 1–1.5 mm diameter; disc dark brown to black, quickly becoming convex; thalline margin concolourous with thallus, entire, becoming excluded. Spores to eight per ascus, Type A development, *Teichophila*-type (16.0–)18–22 × 8.5–11 μm. Spot tests all negative. This anatomical and morphological description closely matches the description of the species made by Sheard (2010).

New species for Kuril Islands

Rinodina ascociscana (Tuck.) Tuck.

Specimens examined: Russia, “Kunashir Island, Dubovoye village surroundings, oak forest, on bark of *Quercus crispula* Blume, 58 m. 43°46'28.7112"N, 145°31'00.9515"E. 23 VIII 2017. A. K. Ezhkin. № 1462” (SAK); *ibid*, “Mendeleev volcano, northwestern slope, dark coniferous forest, on bark of *Picea jezoensis* (Sieb. et Juss.) Carr., 592 m. 43°58'55.96"N, 145°43'49.00"E. 05 VIII 2013. A. K. Ezhkin. № 1454” (VLA); “Iturup Island, Mt. Pereval'naya surroundings, oak forest with *Larix*, on bark of *Quercus crispula*, 253 m. 45°07'49.7"N, 147°47'06.4"E. 01 VI 2018. A. K. Ezhkin. № 1684, 1685, 1692, 1693, 1695” (VLA).

This species grows on the bark of coniferous and deciduous trees, it is found in mixed deciduous forests in Honshu in Japan, at an altitude of 380–1480 m, on Jeju Island in Korea, at an altitude of 750–1600 m, and in Gangwon Province, 380–1660 m,

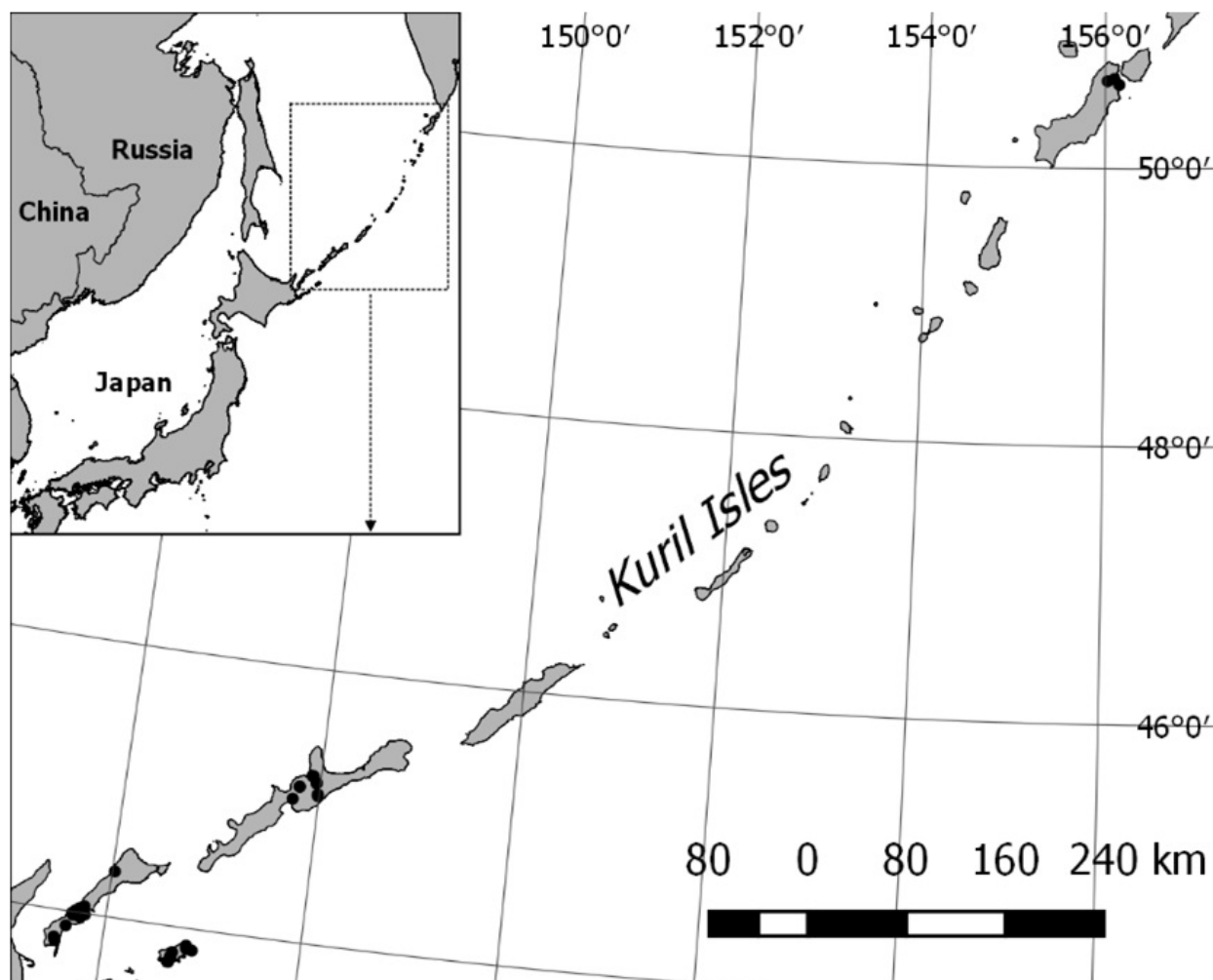


Fig. 1. The places of research of the genus *Rinodina* in the Kuril Islands of the Russian Far East.

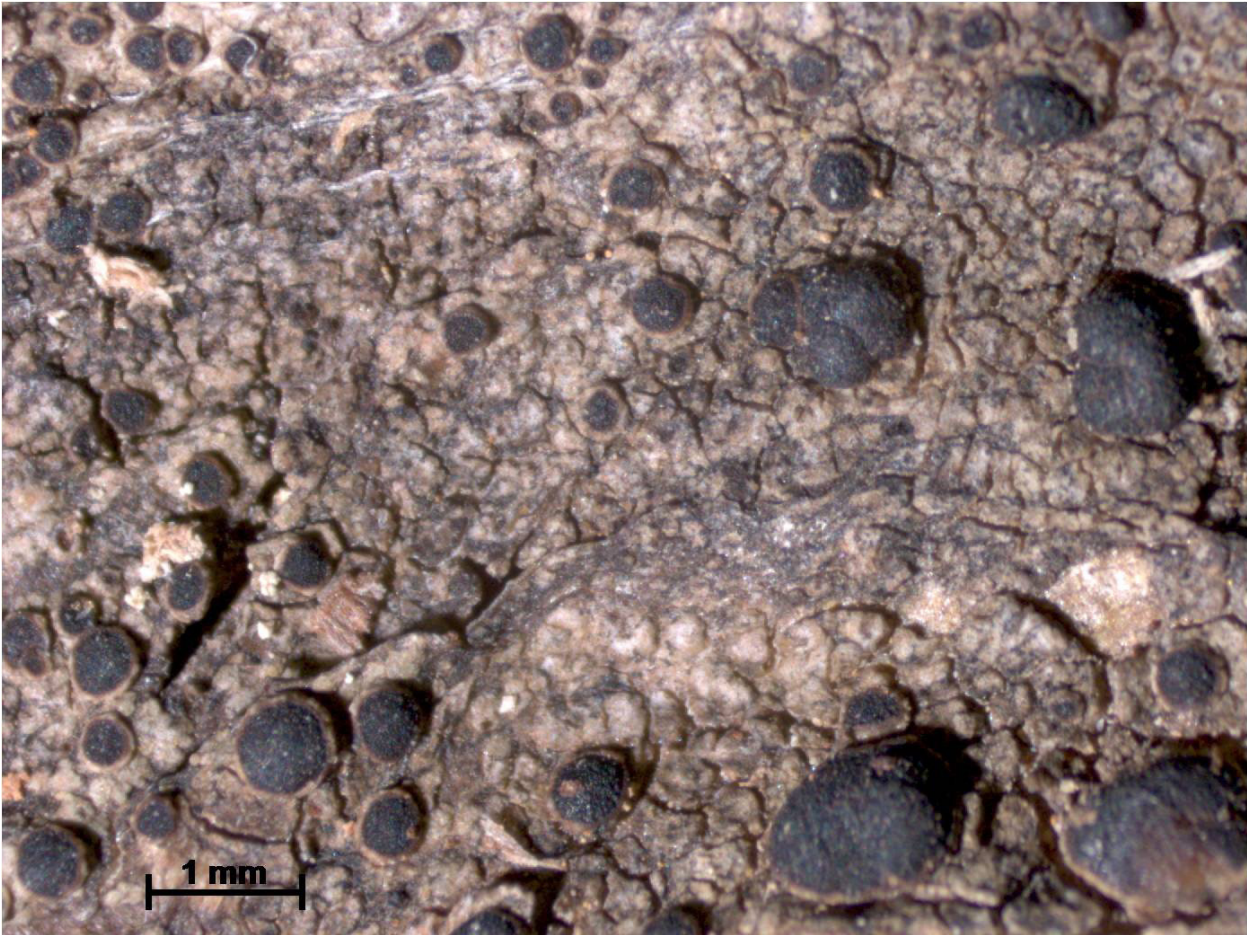


Fig. 2. *Rinodina herrei* H. Magn.

and Primorye Territory – at low altitudes (Sheard et al., 2017). *Rinodina ascociscana* was previously considered an endemic species of eastern North America (Sheard, 2010; Lendemmer et al., 2014). New for the Kuril Islands.

***Rinodina colobinoides* (Nyl.) Müll. Arg.**

Specimens examined: Russia, “Kunashir Island, Mendeleev volcano surroundings, Lesnaya river valley, mixed forest, on bark of *Hydrangea paniculata* Sieb., 135 m. 44°00'04.8"N, 145°42'26.9"E. 26 VII 2013. A. K. Ezhkin. № 1453” (VLA).

The species grows on various deciduous trees in North America (*Magnolia*, *Prosopis*, *Prunus*, *Quercus*, *Sorbus*) and is found on the coastal plain around the Gulf of Mexico, and in the Great Smoky Mountains National Park (Sheard, 2010). It is found in tropics of South America, on the Caribbean Islands, the coast of Portugal, in India (Giralt et al., 1995; Giralt, 2001, 2010), in England (Smith et al., 2009). In the latest studies of the genus *Rinodina* in Northeast Asia (Sheard et al., 2017), the species *Rinodina colobinoides* was not recorded. It was

noted that the species is listed for the south of the Russian Far East by Urbanavichus and Andreev (2010), and based on an earlier reference (Insarov, Pchelkin, 1984; Tchabanenko, 2002) to *R. soredata* H. Magn. (as a synonym) on the bark of *Quercus mongolica* in the Sikhote Alin Mountains (Insarov, Pchelkin, 1984). New for the Kuril Islands.

***Rinodina excrescens* Vain.**

Specimens examined: Russia, “Shikotan Island, Mt. Shikotan surroundings, mixed forest, bark of *Acer pictum* Thunb., 87 m. 43°52'10.3079"N, 146°50'40.6319"E. 20 VI 2017. A. K. Ezhkin. № 1478” (VLA).

The species was described from West Siberia by Vainio (1928) and is known from very few localities in Europe where it is scattered and very rare (Giralt et al., 1994; Spribille et al., 2006; Galanina et al., 2011). The species grows in Northern America on the bark of living and dead tree trunks (*Betula*, *Abies*, *Picea*, *Larix*, *Thuja*) (Sheard, 1995, 2010). *Rinodina excrescens* was found to be a new record for Japan where it occurs at elevations up to 720–

1030 m in Hokkaido (Sheard et al., 2017). It grows on bark of deciduous and coniferous trees (*Betula*, *Alnus*, *Quercus*, *Larix*, *Pinus*, *Picea*, *Salix*) in Altai Mts., in Dauria (Sokhondinskiy reserve) and in the Far East of Russia (Galanina et al., 2011; Davydov, Printzen, 2012). New for the Kuril Islands.

***Rinodina freyi* H. Magn.**

Specimens examined: Russia, “Kunashir Island, Lagunnoye lake surroundings, mixed coniferous-broad leaved forest, on bark of *Acer pictum*, 79 m. 44°2'50.20"N, 145°46'1.613"E. 17 VIII 2013. A. K. Ezhkin. № 1528” (VLA).

The species is most often found on branches of bushes and deciduous trees but also on branches of conifers. In North America, it is 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).

Distribution of the species in Europe is poorly understood, although it was described from Europe (Switzerland) (Magnusson, 1947), and the species is also given for Germany (Wirth et al., 2013).

Sheard (2010) saw specimens of this species from the Alps and Scandinavia and indicated a confusion with the species *R. septentrionalis* from Europe (Giralt, Mayrhofer, 1995). *Rinodina freyi* is most common species of the genus in North America, being frequent in both the east and west of the continent (Sheard, 2010). It has also been reported from western Mongolia (Hauck et al., 2013). Recently the species was found in Japan and Russia (Sheard et al., 2017). In Russia the species is reported for the Magadan Region, Kamchatka Peninsula, Sakhalin Island, Khabarovsk and Primorye Territory (Sheard et al., 2017). New for the Kuril Islands.

***Rinodina hypobadia* Sheard**

Specimens examined: Russia, “Shikotan Island, Mt. Notoro surroundings, elfin woodland, on bark of *Alnus hirsuta* (Spach.) Rupr., 238 m. 43°46'10.7652"N, 146°41'56.0255"E. 14 VI 2017. A. K. Ezhkin. № 1487” (VLA).

The species was recently described from Northeast Asia (Sheard et al., 2017). It grows on bark of *Abies sachalinensis*, *Salix* sp., *Populus* sp. in mixed and deciduous forests. *Rinodina hypobadia* is infrequent in Northeastern Asia, where it has been recorded in Japan and Russia, only from Hokkaido, Primorye Territory and southern Sakhalin Island. New for the Kuril Islands.

***Rinodina oleae* Bagl.**

Specimens examined: Russia, “Kunashir Island, Lagunnoye lake surroundings, mixed coniferous-broad leaved forest, on bark of *Kalopanax septemlobus*, 79 m. 44°2'50.20"N, 145°46'1.613"E, 17 VIII 2013, A. K. Ezhkin. № 1593” (SAK); “Iturup Island, Kurilsk Airport surroundings, oak forest, on bark of *Acer pictum*, 48 m. 45°12'51.54"N, 147°55'16.02"E. 05 V 2018. A. K. Ezhkin. № 1710” (VLA).

On bark of deciduous and coniferous trees, often on *Sorbus* and *Acer* (Sheard, 2010). On bark of *Quercus*, *Fraxinus* in Primorye Territory (Sheard et al., 2017) and on bark of *Kalopanax septemlobus* on Kunashir Island.

The species is known from Southern Europe (Giralt, 2001) and North America, where it has a scattered distribution (Sheard, 2010). As a synonym for *R. gennarii* Bagl., it is reported for many regions of Russia (Urbanavichus, Andreev, 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 separate (Sheard, 2010). Samples on mossy stones in seaside habitats are defined as *Rinodina gennarii*, 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 (Kondratyuk et al., 2013). In the Russian Far East, *R. olea* was first noted in the Khabarovsk Region (Yakovchenko et al., 2013) and then in Primorye Territory (Sheard et al., 2017). New for the Kuril Islands.

***Rinodina polyspora* Th. Fr.**

Specimens examined: Russia, “Iturup Island, Kurilka River valley, mixed streamside forest, on bark of *Populus maximowiczii* Henry., 29 m. 45°13'07.4"N, 147°54'50.9"E. 30 VII 2018. A. K. Ezhkin. № 1686” (SAK); “ibid, on bark of *Padus ssiori* F.Schmidt., 24 m. 45°13'12.1"N, 147°54'13.8"E. 30 V 2018, A. K. Ezhkin. № 1687” (VLA); ibid, “on bark of *Populus maximowiczii*, 30 m. 45°12'59.8"N, 147°55'05.8"E. 30 V 2018. A. K. Ezhkin. № 1688” (VLA); ibid, “Kurilsk town surroundings, mixed forest, on bark of *Prunus* sp., 24 m. 45°13'12.1"N, 147°54'13.8"E. 30 V 2018. A. K. Ezhkin. № 1694” (VLA).

The species grows on smooth bark of deciduous trees (*Acer*, *Alnus*, *Fagus*, *Fraxinus*, *Populus*, *Quercus*, *Rhamnus*) (Mayrhofer, Moberg, 2002;

Kotlov, 2008; Sheard, 2010). *Rinodina polyspora* was found in central Europe, rarely in southern and central Sweden and in southern Finland (Mayrhofer, Moberg, 2002), in North America in the Great Lakes region and on the Pacific Coast (Sheard, 2010). *Rinodina polyspora* has recently been reported from Korea (Joshi et al., 2013) and from Japan (Sheard et al., 2017). In Russia, it is found in Karelia, the Leningrad Region, Tatarstan, Western and Southern Siberia (Tyumen Region, Baikal Region, Sayan Mountains) (Kotlov, 2008). New for the Kuril Islands.

***Rinodina roscida* (Sommerf.) Arnold**

Specimens examined: Russia, "Paramushir Island, coast, on mossy soil, 57 m. 50°36'15.6708"N, 156°09'27.7236"E. 03 X 2017. A. K. Ezhkin. № 1455" (VLA).

The species grows on mosses and plant debris, less often on wood, soil or animal horns, on calcareous substrates (soil) in arctic and highland areas (Mayrhofer, Moberg, 2002; Kotlov, 2008), more rarely on the litter of arctic hare and partridge (Sheard, 2010).

The species is found in central Europe (Wirth et al., 2013), sparsely and rarely in Scandinavia, rarely in southern Europe (Mayrhofer, Moberg, 2002). In North America, it is common in the Arctic, especially in the west, and southwards in the Rocky Mountains (Sheard, 2010). In Russia, it is widely distributed in the northern and mountainous regions: in the Arctic (Franz Josef Land, Novaya Zemlya, Taimyr, Severnaya Zemlya, Yakutia, Chukotka), Murmansk Region, Karelia, Leningrad Region, Arkhangelsk Region, Republic of Komi, Western Siberia (Krasnoyarsk Territory), South Siberia (Transbaikalia, Sayan Mountains), in Asia (Caucasus, Himalayas, Mongolia, China) (Makarova, Katenin, 1983; Kotlov, 2008). New for the Kuril Islands.

***Rinodina subalbida* (Nyl.) Vain.**

Specimens examined: Russia, "Kunashir Island, Rurui Volcano surroundings, Prosolovskie springs, old grows mixed coniferous-broad leaved forest, on bark of *Sorbus commixta* Hedl., 15 m. 44°19'58.43"N, 146°1'14.52"E. 19 VI 2014. A. K. Ezhkin. 1555" (SAK); ibid, "Tretyakova village surroundings, old grows mixed coniferous-broad leaved forest, on bark of *Bothrocaryum controversum* (Hemsl. Ex Prain) Poyarkova, 163 m. 43°58'28.38"N, 145°39'49.28"E, 22 VI 2015. A. K. Ezhkin. № 1561" (VLA); ibid, "Belkina

river valley, dark conifer forest, on bark of *Picea jezoensis* (Sieb. et Juss.) Carr., 66 m. 43°53'24.81"N, 145°36'28.30"E. 23 VI 2014. A. K. Ezhkin. № 1574" (VLA); "Baranskogo Volcano surroundings, near the Kipyashaya river, oak wood, on bark of *Quercus crispula*, 225 m. 45°4'43.31"N, 147°59'6.968"E. 21 VIII 2015. A. K. Ezhkin. № 522, 521, 523, 1576" (VLA); ibid, "Lagunnoye lake surroundings, mixed coniferous-broad leaved forest, on bark of *Picea jezoensis*, 65 m. 44°2'49.70"N, 145°45'59.09"E. 17 VIII 2013. A. K. Ezhkin. № 1521" (VLA); ibid, "on bark of *Taxus cuspidate* Siebold et Zucc. ex Endl., 44°2'50.20"N, 145°46'1.613"E. 17 VIII 2013. A. K. Ezhkin. № 1522" (VLA); ibid, "on bark of *Picea jezoensis*, 79 m. 44°2'50.20"N, 145°46'1.613"E. 17 VIII 2013. A. K. Ezhkin. № 1526, 1534, 1537" (VLA); ibid, "on bark of *Acer pictum*, 65 m. 44°2'49.70"N, 145°45'59.09"E. 17 VIII 2013. A. K. Ezhkin. № 1529" (VLA); ibid, "Mendeleev volcano, northwestern slope, dark coniferous forest with *Betula ermanii* Cham., on bark of *Picea jezoensis*, 592 m. 43°58'55.96"N, 145°43'49.00"E. 05 VIII 2013. A. K. Ezhkin. № 1524" (VLA); "Iturup Island, Kurilsk Airport surroundings, oak forest, on bark of *Quercus crispula*, 93 m. 45°12'25.72"N, 147°54'30.54"E. 03 VIII 2018. A. K. Ezhkin. № 1701, 1703" (VLA); ibid, "on bark of *Quercus crispula*, 101 m. 45°16'11.15"N, 147°58'44.36"E. 04 VIII 2018. A. K. Ezhkin. № 1704, 1705, 1706" (VLA); ibid, "Kurilka river valley, Kurilsk town surroundings, oak forest, on bark of *Quercus crispula*, 101 m. 45°15'53.89"N, 147°56'13.94"E. 29 VII 2018. A. K. Ezhkin. № 1715" (VLA); ibid, "Mt. Pereval'naya surroundings, oak forest with abies, on bark of *Quercus crispula*, 221 m. 45°07'50.56"N, 147°47'21.93"E. 01 VI 2018. A. K. Ezhkin. № 1709" (VLA).

The species is found on bark of coniferous and deciduous trees (*Abies*, *Alnus*, *Berberis*, *Fagus*, *Malus*, *Picea*, *Prunus*, *Quercus*, *Salix*, *Sorbus*), often in mixed and deciduous forests (Sheard et al., 2017). A complete description of the species was first given recently (Sheard et al., 2017).

Rinodina subalbida was described from Japan and was recently found in South Korea and the southern part of far eastern Russia (Sheard et al., 2017). This is an East Asian species, new for the Kuril Islands.

***Rinodina subminuta* H. Magn.**

Specimens examined: Russia, "Kunashir Island, Mendeleev Volcano, birch forest with *Betula ermanii*, on bark of *Acer ukurunduense* Trautv. &

C.A. Mey, 627 m. 43°58'53.47"N, 145°43'51.48"E. 05 VIII 2013. A. K. Ezhkin. № 1531" (VLA); *ibid*, "Aliger lake surroundings, mixed coniferous-broad leaved forest, on bark of *Quercus crispula*, 627 m. 44°01'45.8328"N, 145°43'12.6732"E. 20 VI 2014. A. K. Ezhkin. № 1533" (VLA); *ibid*, "Zmeyinyi creek valley, mixed coniferous-broad leaved forest, on bark of *Acer pictum*, 38 m. 44°0'27.66"N, 145°40'57.30"E. 31 VII 2013. A. K. Ezhkin. № 1538, 1539" (SAK); *ibid*, "Tretyakova village surroundings, old grows mixed coniferous-broad leaved forest, bark of *Kalopanax septemlobus*, 163 m. 43°58'28.38"N, 145°39'49.28"E. 22 VI 2015. A. K. Ezhkin. № 1572" (VLA).

The species is found on the bark of coniferous and deciduous trees (*Abies*, *Alnus*, *Berberis*, *Fagus*, *Hydrangea*, *Malus*, *Picea*, *Quercus*, *Salix*, *Sorbus*) (Sheard et al., 2017), in Russia often in mixed and deciduous forests. It has a wide range of distribution (Sheard et al., 2017). The species is known from eastern Asia with a distribution spanning Russia, Japan and the Korean Peninsula (Sheard et al., 2017). It is a widespread species in the south of the Far East of Russia and in the east of the North America (Great Lakes Region, Appalachian Mountains) (Sheard, 2010). The distribution of *Rinodina subminuta* is similar to that of *R. ascociscana*, *R. excrescens* and *R. subparieta* (Galanina et al., 2011; Sheard et al., 2017). This is an exclusively East Asian-Eastern North American species, new for the Kuril Islands.

Rinodina subparieta (Nyl.) Zahlbr.

Specimens examined: Russia, "Kunashir Island, Dubovoye village surroundings, oak forest, on bark of *Quercus crispula*, 107 m. 43°47'46.9787"N, 145°30'15.2819"E. 23 VIII 2017. A. K. Ezhkin. № 1460" (VLA).

The species is found on the bark of coniferous and broad-leaved trees (*Abies*, *Alnus*, *Betula*, *Castanea*, *Chosenia*, *Picea*, *Prunus*, *Quercus*, *Salix*, *Taxus*), in Russia it is found in deciduous and mixed forests, and same along river valleys. It occurs from the sea level to 2550 m (Sheard et al., 2017). It is known from Scotland (Giavarini et al., 2009), Scandinavia and Austria (Tonsberg, 1992; Mayrhofer, Moberg, 2002), from the Khentey region of Mongolia (Hauck, Javkhlan, 2006) and from eastern and western North America (Sheard, 2010; Spribille et al., 2010). The species was previously reported from eastern Asia with a distribution spanning Russia, Japan and Korea (Sheard et al., 2017). It is a widespread species in Russia from the Caucasus to the Far East (Urbanavichus, Andreev, 2010;

Himmelbrant, Stepanchikova, 2011; Galanina, 2013). New for the Kuril Islands.

Rinodina tenuis Müll. Arg.

Specimens examined: Russia, "Kunashir Island, Belkina river valley, mixed coniferous-broad leaved forest, on bark of *Picea jezoensis*, 66 m. 43°53'24.81"N, 145°36'28.30"E. 23 VI 2014. A. K. Ezhkin. № 516" (SAK); *ibid*, "Lagunnoye village surroundings, mixed coniferous-broad leaved forest, on bark of *Ulmus laciniata* Trantv., 65 m. 44°2'49.70"N, 145°45'59.09"E. 17 VIII 2013. A. K. Ezhkin. № 1523" (VLA); *ibid*, "on bark of *Picea jezoensis*, A. K. Ezhkin. № 1527, 1535, 1536" (VLA); *ibid*, "Dubovoye village surroundings, oak forest, on bark of *Quercus crispula*, 107 m. 43°47'46.9787"N, 145°30'15.2819"E. 23 VIII 2017. A. K. Ezhkin. № 1470" (VLA); *ibid*, "13 km from the Yuzhno-Kurilsk town, Mendelev Volcano surroundings, mixed forest, on bark of *Padus ssiiorii*, 134 m. 44°01'13.9403"N, 145°43'40.2780"E. 27 VIII 2017. A. K. Ezhkin. № 1472" (VLA); "Shikotan Island, Mt. Notoro surroundings, elfin woodland, on bark of old *Betula ermanii*, 238 m. 43°46'10.7652"N, 146°41'56.0255"E. 14 VI 2017. A. K. Ezhkin. № 1469" (VLA); *ibid*, "Tserkovnaya Bay, dark coniferous forest, on bark of *Picea jezoensis*, 39 m. 43°44'13.9451"N, 146°41'12.8760"E. 12 VI 2017. A. K. Ezhkin. № 1484" (VLA); *ibid*, "mixed forest, on bark of *Salix udensis* Trautv., 47 m. 43°44'16.4904"N, 146°40'57.9216"E. 15 VI 2017. A. K. Ezhkin. № 1485" (VLA); *ibid*, "on bark of *Alnus hirsuta*, 47 m. 43°44'16.4904"N, 146°40'57.9216"E. 15 VI 2017. A. K. Ezhkin. № 1487" (VLA).

The species is found on the bark and branches of coniferous trees (*Abies*, *Picea*) as well as on mossy horizontal logs (Sheard et al., 2017). In the Kuril Islands it is found in mixed forests on coniferous and broad-leaved species (*Alnus*, *Betula*, *Padus*, *Picea*, *Quercus*, *Salix*, *Ulmus*). The species formerly known from Great Lakes-Appalachian region in North America (Sheard, 2010) and in Japan (Kurokawa, Kashiwadani, 2006). Although widespread in eastern North America, it is relatively infrequent (Sheard, 2010; Lendemmer et al., 2014, as *R. adirondackii* H. Magn.). Most recently, *Rinodina tenuis* was found in Russia, where the species seems to have a narrow distribution in the boreal zone of Khabarovsk Region, Sakhalin Island, and has a couple records from Hokkaido (Japan) (Sheard et al., 2017). We found this species is quite frequent on the southern Kuril Islands (Kunashir and Shikotan),

the closest to Japan. This is an exclusively East Asian-Eastern North American species, new for the Kuril Islands.

***Rinodina willeyi* Sheard et Giralt**

Specimens examined: Russia, “Kunashir Island, Lagunnoye village suburbs, mixed coniferous-broad leaved forest, on bark of *Phellodendron sakhalinense* (F. Schmidt) Sarg., 79 m. 44°02'50.2"N, 145°46'01.6"E. 01 VIII 2015. A. K. Ezhkin. № 1463” (SAK); “Shikotan Island, Mt. Notoro surroundings, elfin woodland, on bark of old *Betula ermanii*, 238 m. 43°46'10.7652"N, 146°41'56.0255"E. 14 VI 2017. A. K. Ezhkin. № 1469” (VLA); ibid, “riparian forest, on bark of *Padus ssiorii*, 92 m. 43°46'40.9296"N, 146°42'08.0495"E. 17 VI 2017. A. K. Ezhkin. № 1471” (SAK); ibid, “Mt. Brysova surroundings, mixed forest, on bark of *Acer pictum*, 56 m. 43°50'54.6"N, 146°51'03.8"E. 19 VI 2017. A. K. Ezhkin. № 1482” (VLA).

The species was found on the bark and branches of coniferous trees (*Abies*, *Picea*) as well as on mossy horizontal logs (Sheard et al., 2017) and in the Kuril Islands it is found in mixed forests on coniferous and broad-leaved species (*Alnus*, *Betula*, *Padus*, *Picea*, *Quercus*, *Salix*, *Ulmus*).

This species was described from North America (Sheard, 1995), and before our research in northeastern Asia (Sheard et al., 2017) was known only from North America. The species was noted in Japan (Hokkaido and Honshu islands) and Russia (Kamchatka peninsula) (Sheard et al., 2017). Now the species is found in the southern Kurils for the first time (Kunashir, Shikotan), close to Japan. This record is another addition to the list of Eastern Asia-Eastern North American disjunct species.

Species previously noted for the Kuril Islands

***Rinodina gennari* Bagl.**

The species is known from southern Europe mainly on a stony substrate (Giralt, 2001) and from North America frequent on maritime rocks. Not recorded outside coastal regions in North America (Sheard, 2010). Recently *Rinodina gennari* was found in coastal Japan on mortar and on vertical rock 100 m from the seashore (Sheard et al., 2017). *Rinodina gennari* has been reported for many regions of Russia as a synonym for the species *R. oleae* Bagl. (Urbanavichus, Andreev, 2010). These species are treated as separate taxon by Sheard (2010). See *R. oleae* below for more details. *Rinodina gennari* is reported for the Kuril Islands (Kunashir Island)

(Bredkina et al., 1992; Chabanenko, 1999), but we did not find the species on the Kuril Islands although it may well be present.

***Rinodina megistospora* Sheard et H. Mayrhofer**

Specimens examined: Russia, “Iturup Island, Baranskogo Volcano surroundings, Kipyashya river valley, oak wood, on bark of *Quercus crispula*, 225 m. 45°4'43.31"N, 147°59'6.968"E. 21 VIII 2015. A. K. Ezhkin. № 563” (SAK); ibid, “Kurilka river valley, oak wood with *Kalopanax septemlobus* (Thunb. ex. A. Murray) Koidz., on bark of *Quercus crispula*, 225 m. 45°07'49.84"N, 147°47'21.44"E. 25 VIII 2012. A. K. Ezhkin. № 520” (VLA); ibid, “Mt. Pereval'naya surroundings, Iturup Island, oak forest with *Larix*, on bark of *Quercus crispula*, 253 m. 45°07'49.7"N, 147°47'06.4"E, 01 VI 2018. A. K. Ezhkin. № 1678” (VLA); “ibid, Kurilka river valley, oak forest with birch, on bark of *Quercus crispula*, 243 m. 45°10'15.6"N, 147°57'27.8"E. 28 VIII 2018. A. K. Ezhkin. № 1679, 1681, 1682” (VLA); ibid, “oak wood, on bark of *Quercus crispula*, 246 m. 45°10'12.2"N, 147°57'21.6"E, 28 V 2018. A. K. Ezhkin. № 1680” (VLA).

The species grows on bark of *Quercus crispula*. 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 suggesting that *Rinodina megistospora* may be widespread but infrequent on the mainland (Sheard et al., 2017). Now the species is recorded also from near coastal localities at low elevations in Hokkaido, Japan and from 1610–1630 m in Kochi Prov., Shikoku Island. The species also occurs in the Sikhote Alin' Mountains, Primorye Territory, and in the Khomi Mountains, Khabarovsk Region (Sheard et al., 2017) and in the Sakhalin Region (Sakhalin and Iturup islands) (Galanina et al., 2018). The species belongs to the Eastern Asiatic-Western North American group of disjunct species.

***Rinodina xanthophaea* (Nyl.) Zahlbr.**

Specimens examined: Russia, “Kunashir Island, Tretyakova village surroundings, old grows mixed coniferous-broad leaved forest, bark of *Phellodendron sakhalinense*, 163 m. 43°58'28.38"N, 145°39'49.28"E. 22 VI 2015. A. K. Ezhkin. № 542” (SAK); ibid, “Mt. Mechnikov, Mendeleev volcano surroundings, dark coniferous forest with *Picea glehnii* (Fr. Schmidt) Mast., on bark of *Sorbus commixta* Hedl, 468 m. 43°58'33.69"N, 145°43'19.81"E. 06 VIII 2013. A. K. Ezhkin. №

1452” (VLA); *ibid.*, “13 km from the Yuzhno-Kurilsk town, Mendeleev Volcano surroundings, mixed forest, bark of *Padus ssiorii*, 134 m. 44°01'13.9403"N, 145°43'40.2780"E. 27 VIII 2017. A. K. Ezhkin. № 1472” (VLA); “Shikotan Island, Mt. Notoro surroundings, mixed forest, on bark of *Acer pictum*, 50 m. 43°46'50.6603"N, 146°42'16.3872"E. 17 VI 2017. A. K. Ezhkin. № 1475, 1465” (VLA); “Shikotan Island, Gorobets river valley, mixed forest, on bark of *Acer pictum*, 69 m. 43°48'41.2776"N, 146°42'52.2395"E. 16 VI 2017. A. K. Ezhkin. № 1476” (VLA); *ibid.*, “Tserkovnaya Bay, mixed forest, on bark of *Abies sakhalinensis* F. Schmidt., 47 m. 43°44'16.4904"N, 146°40'57.9216"E. 15 VI 2017. A. K. Ezhkin. № 1481” (VLA); “Iturup Island, Baranskogo Volcano surroundings, near the Kipyashaya river, oak wood, on bark of *Quercus crispula*, 225 m. 45°4'43.31"N, 147°59'6.968"E. 21 VIII 2015. A. K. Ezhkin. № 1497, 1576” (VLA).

The species was found on the bark of coniferous and broad-leaved trees (*Abies*, *Alnus*, *Betula*, *Castanea*, *Fagus*, *Picea*, *Quercus*, *Salix*, *Sorbus*) (Sheard et al., 2017). Elsewhere in Russia it is found in deciduous and mixed forests. It has a wide altitudinal range in Northeast Asia, it occurs 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; Pczelkin, 1987; Tchabanenko, 2002; Galanina, 2008; Skirina, 2010, 2012; Urbanavichene, Skirina, 2011; Rodnikova, 2012, 2013; Yakovchenko et al., 2013). It is widespread and has been reported as far west as the Khamar-Daban Mountains in the Baikal region (Urbanavichene, 2010), from Gora Olocha in the Stanovoye Nagor'e Mountains in Amurskaya Oblast' (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). This is East Asian species.

Discussion

The species composition of the genus *Rinodina* of the Kuril Islands reflects a variety of biogeographic connections. The genus *Rinodina* is for 35.3 % (6 species) presented here by species with disjunctive distributions in the south of Far East of Russia and in western or eastern parts of North America. For the most part, these species were considered to be endemic in North America until recently. Species with such distribution are divided into two groups: East Asian-Western North American (*R. herrei*, *R. megistospora*) and East Asian-Eastern North American (*R. ascociscana*, *R. subminuta*, *R. tenuis*, and *R. willeyi*). Species limited to East Asia make up 17.6 % (3 species: *R. hypobadia*, *R. subalbida* and *R. xanthophaea*) of the known number of *Rinodina* species of the Kuril Islands. Other species are widespread in both hemispheres (1 species – *R. colobinoides*), or the oroarctic region (1 species – *R. roscida*), or in the temperate belt of the Holarctic (35.3 % – 6 species: *R. excrescens*, *R. freyi*, *R. genari*, *R. oleae*, *R. polyspora*, *R. subparieta*).

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