Addition to the lichen biota of Paramushir Island (Northern Kuril Islands, Russian Far East)

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Abstract. The paper provides data on 143 species, one subspecies, and one variety of lichens, 13 species of lichenicolous fungi and one species of non-lichenized saprobic fungus from Paramushir Island. One hundred thirty-eight taxa are reported for this territory for the first time. Of them, *Lecanora confusa* is reported for the first time for Russia, eight species are new to the Russian Far East, 36 species and one variety are new to the Sakhalin Region, 20 species are listed for the first time for the Kuril Islands, and 72 species for Paramushir Island. Substrates and coordinates of collection sites are given for all species. The nearest known localities are given for species first found in the Kuril Islands, the Sakhalin Region or the Russian Far East.

Keywords: distribution, lichens, lichenicolous fungi, new records, rare species, Asia.

Дополнение к лихенобиоте о. Парамушир (Северные Курильские острова, Российский Дальний Восток)

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Резюме. В статье приведены данные о 143 видах, одном подвиде и одной разновидности лишайников, 13 лихенофильных грибах и одном сапротрофном грибе с о. Парамушир. Для этой территории выявлены впервые 137 таксонов. Из них *Lecanora confusa* является новым видом для России, восемь видов — новыми для Дальнего Востока, 36 видов и одна разновидность — для Сахалинской обл., 20 видов впервые указаны для Курильских о-вов, 72 — для о. Парамушир. Для всех видов указаны субстраты и координаты точек сбора. Для видов, впервые найденных на Курилах, в Сахалинской обл. или на Дальнем Востоке России, приведены ближайшие известные местонахождения.

Ключевые слова: лишайники, лихенофильные грибы, новые находки, распространение, редкие виды, Азия.

Paramushir Island is located in the north of the Great Kuril Ridge between the islands of Shumshu and Onekotan, from which it is separated by the Second and Fourth

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Kuril Straits. In the north-west it is washed by the waters of the Sea of Okhotsk, and in the south-east by waters of the Pacific Ocean (Grishin, Shlyakhov, 2008). Administratively, its territory belongs to the North Kuril District of the Sakhalin Region. Paramushir, having an area of about 2053 km^2, is the largest of the North Kuril Islands (Zemtsova, 1967; Barkalov, 2009). The significant size of the island leads to the presence of quite diverse forms of relief: volcano-tectonic, abrasion, accumulative, and glacial (Vlasov, 1958; Gorshkov *et al*., 1964; Chemekov, 1972; Grishin, Shlyakhov, 2008). Paramushir has medium and low mountains, hills, and plains. The highest peak is Chikurachki Volcano (1815 m). The other two active volcanoes on Paramushir are Ebeko and Fussa (Barkalov, 2009). Due to the presence of mountainous terrain, abundant precipitation and low moisture loss, the island has a large number of rivers and streams (Atlas..., 1967; Barkalov, 2009). Under the influence of the cold Sea of Okhotsk and the cold Oyashio current, the climate on Paramushir is maritime and quite harsh, with cold winters and cool summers. Precipitation varies from 1000 to 1400 mm per year (Barkalov, 2009). The vegetation on the island is dominated by thickets of dwarf alder *Duschekia fruticosa* (Rupr.) Pouzar with patches of *Pinus pumila* (Pall.) Regel (Grishin, 2008). They occupy about 50% of the island's surface. Tundra, meadow and swamp communities are also present. The river valleys are dominated by thickets of *Salix udensis* Trautv. et C. A. Mey and tundra shrub communities with *Betula exilis* Sukaczev. Rich coastal soils with flowing moisture are occupied by tall grasses. Halophytes and *Rosa rugosa* Thunb. are found in the coastal zone. There are shrub, dwarf shrub and meadow tundras, nival and alpine meadows in the alpine belt (Grishin, Barkalov, 2009).

The lichen biota of Paramushir Island is still little known despite the long-term study of lichens of the Russian Far East (e. g., Elenkin, 1902; Satô, 1936; Dombrovskaya, 1987; Tchabanenko, 2002; Yakovchenko *et al*., 2013; Davydov *et al*., 2021; Chesnokov, Konoreva, 2022; Glazkova *et al*., 2023). To date, there are no summarized papers on lichens of this territory. Only fragmentary data exist in several papers devoted to distribution of lichens on the Kuril Islands (Satô, 1936), as well as in the Sakhalin Region (Krasnaya..., 2019), in the south Russian Far East (Tchabanenko, 2002), and some taxonomic studies (Ahti, 1961; Dombrovskaya, 1987, 1996; Galanina, Ezhkin, 2019; Ezhkin, Davydov, 2021). In total, 53 species were reported from Paramushir, which is extremely insignificant for an island of such area.

Material and Methods

The specimens were collected by L. A. Konoreva and S. V. Chesnokov in September and October 2021. Collections were made in the northeast part of island between Cape Levashova and Cape Ozerny(Fig. 1) mainly in tundra communities, thickets of *Pinus pumila* and *Duschekia fruticosa*, and on coastal rocks (Fig. 2). In total, about 500 specimens were collected.

The laboratory study was carried out according to the standard technique (The Lichens..., 2009; Stepanchikova, Gagarina, 2014) in the Laboratory of Lichenology

Fig. 1. Study area. Lichen collection sites are marked with black dots.

and Bryology of the Komarov Botanical Institute RAS. Lichen and fungal specimens were studied using a binocular stereoscopic microscope Olympus SZ51, transmitted light microscopes Mikmed-6 and Zeiss Axio Scope.A1, and a standard set of chemical reagents for color spot reactions. The specimens of lichens were identified by A. S. Zueva and L. A. Konoreva; lichenicolous fungi were identified by S. V. Chesnokov. Some specimens were studied using high performance thin-layer chromatography in solvent system C by A. S. Zueva and I. S. Stepanchikova (Orange *et al.*, 2001).

Photographs of the species were taken with a stereoscopic microscope Motic SMZ-171-LED with an attached MotiCam S6 camera and Axio Scope.A1 with Axiocam 506 color camera. Geographical coordinates are given in the system WGS 1984. The maps were prepared using GIS Axioma 5.1 program. Nomenclature of lichens and lichenicolous fungi mainly follows Diederich *et al.* (2018), Kondratyuk *et al.* (2020), Westberg *et al.* (2021), and Spribille *et al.* (2023). All collected and identified specimens are stored in the lichenological (LE L) and mycological (LE F) herbaria of Komarov Botanical Institute RAS and in the herbaria of the Botanical Garden-Institute of the Far Eastern Branch of the Russian Academy of Sciences (VBGI).

List of collecting localities in Paramushir Island: 1 — right bank of the Levashov River, 50°32′12.9″N, 156°08′53.4″E, 6 m a. s. l., thickets of Siberian alder, 26 IX 2021; 2 — 600 m to the S from

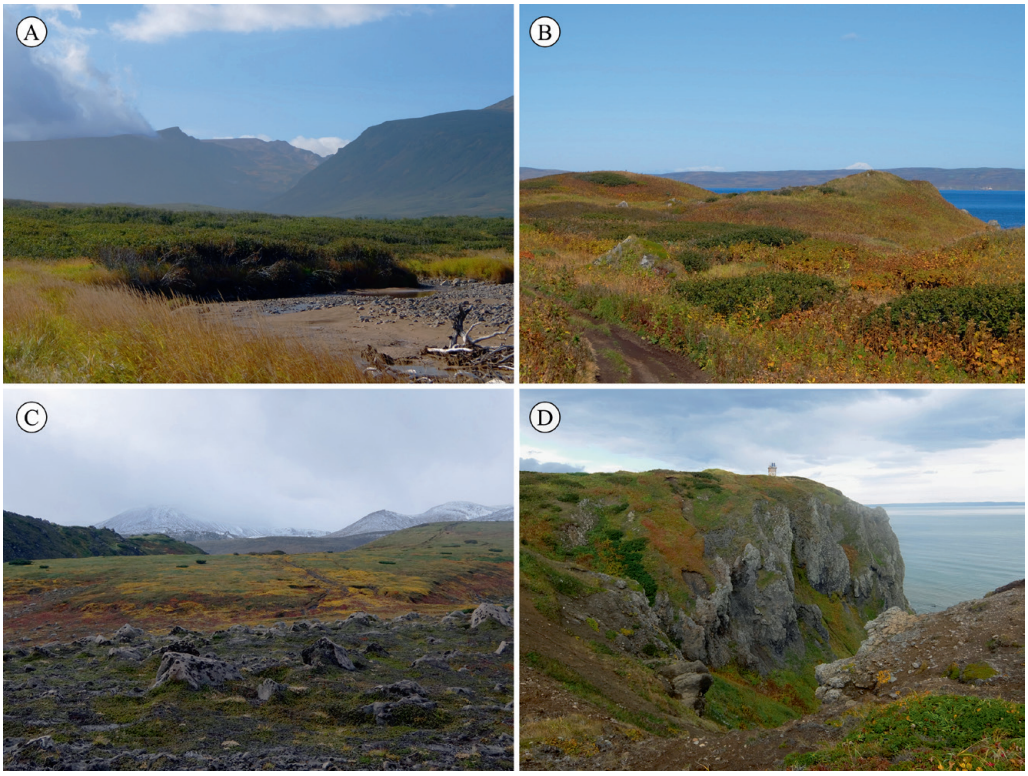

Fig. 2. Studied localities on Paramushir Island: A — thickets of alder on the right bank of Levashov River; B — rocky outcrops with thickets of bushes and tall grass in the vicinity of Cape Ozerny; C — slope with stones near the stream, Plateau Yagodnoe, trail to the Ebeko Volcano; D — areas of soil overgrown with cereals, dwarf shrubs and lichens on Cape Levashov.

the mouth of the Levashov River, 50°31′53.9″N, 156°08′56.0″E, 9 m a. s. l., remains of a brick building in tall grass, 26 IX 2021; 3 — vicinity of Cape Levashov, 50°30′39.2″N, 156°09′50.3″E, 118 m a. s. l., abandoned lighthouse, surrounded by grassland community, 27 IX 2021; 4 — Cape Levashov, 50°30′29.6″N, 156°10′04.1″E, 105 m a. s. l., areas of soil overgrown with cereals, dwarf shrubs, and lichens, 27 IX 2021; 5 — vicinity of Cape Ozerny, 50°36′12.6″N, 156°09′40.7″E, 13 m a. s. l., seaside rocks, 29 IX 2021; 6 — *ibid*., 50°36′00.9″N, 156°09′50.8″E, 25 m a. s. l., rocky outcrops with thickets of bushes and tall grass, 29 IX 2021; 7 — *ibid*., 50°35′59.8″N, 156°09′55.9″E, 29 m a. s. l., tundra community on a hillside with crowberry, lingonberries and dead dwarf pine, 29 IX 2021; 8 — *ibid*., 50°35′58.0″N, 156°10′05.8″E, 18 m a. s. l., rocky outcrops among tall grass, 29 IX 2021; 9 — Plateau Yagodnoe, trail to the Ebeko Volcano, 50°40′52.4″N, 156°04′49.6″E, 396 m a. s. l., slope near the stream with stones, 7 X 2021.

Results

The species reported for the first time for Paramushir Island are marked with "*", Kuril Islands with "**", Sakhalin Region with "!", Russian Far East with "!!", Russia with "!!!"; lichenicolous fungi with "#", non-lichenized fungi with "+". Collector names are abbreviated as follows: S. Chesnokov — SC, L. Konoreva — LK.

***Acarospora fuscata** (Schrad.) Th. Fr. — 6, on stones, *LK 32*, *33*, *34*, *36*, LE L-25882, L-25948, L-25949, VBGI 170075.

Alectoria nigricans (Ach.) Nyl. — 6, 8, on soil and plant debris, *LK 37*, *51*, *52*, *54*, LE L-25836, L-25837, L-25933, VBGI 170097. Previously reported from Paramushir by Satô (1936).

***Amandinea coniops** (Wahlenb.) Scheid. et H. Mayrhofer — 3, 5, 6, on stone and concrete, *SC 11*, *23*, *24*, *25*, *29*, *LK 22*, *23*, *28*, *30*, *32*, *33*, *34*, *38*, LE L-25838, L-25839, L-25859, L-25863, L-25895, L-25929, L-25959, L-25978, L-25988, VBGI 170012, 170033, 170038, 170069.

***A. punctata** (Hoffm.) Coppins et Scheid — 3, 7, on wood of *Pinus pumila*, *SC 34*, *LK 11*, LE L-25840, L-25985, VBGI 170047.

***Anaptychia bryorum** Poelt — 4, on soil, *SC 14*, LE L-25841.

!!#**Arthonia apotheciorum** (A. Massal.) Almq. (Fig. 3A) — 2, on apothecia of *Lecanora strobilina* on bark of *Duschekia fruticosa*, *LK 7*, LE F-350987. The nearest locality is known in the Trans-Baikal Territory (Zhurbenko, Yakovchenko, 2014).

!#**A. molendoi** (Heufl. ex Frauenf.) R. Sant. — 3, on thalli of *Rusavskia elegans* on stone, *LK 12*, LE F-310276. The nearest locality is known in Wrangel Island (Zhurbenko, 2008).

!**Arthrorhaphis alpina** (Schaer.) R. Sant. — 2, on soil, *LK 3*, LE L-25842. The nearest localities are known in the Kamchatka Territory (Himelbrant *et al.*, 2019, 2021).

!**A. citrinella** (Ach.) Poelt — 8, on soil, *LK 55*, VBGI 170101. The nearest localities are known in the Kamchatka Territory (Himelbrant *et al.*, 2014, 2019, 2021).

****Aspicilia cinerea** (L.) Körb. — 6, on stone, *LK 36*, LE L-25843. The nearest locality is known in Sakhalin Island (Tchabanenko, 2002).

***Athallia holocarpa** (Hoffm.) Arup et al. — 3, on stone and concrete, *SC 9*, *LK 8*, *13*, LE L-25844, L-25845, L-25957, VBGI 170015, 170058.

!**A. scopularis** (Nyl.) Arup et al. — 5, on stone, *SC 29*, LE L-26005. The nearest localities are known in the Primorye Territory (Tchabanenko, 2002; Rodnikova *et al.*, 2019).

***Bacidina chloroticula** (Nyl.) Vězda et Poelt — 5, on soil, *LK 24*, LE L-25846.

***Baeomyces rufus** (Huds.) Rebent. — 4, 5, 8, on soil, *SC 14*, *LK 54*, LE L-25847, LE L-25945.

***Biatora albohyalina** (Nyl.) Bagl. et Carestia — 1, on bark of *Duschekia fruticosa*, *SC 1*, LE L-25848, L-25910, L-25954.

***B. efflorescens** (Hedl.) Räsänen — 2, 3, on bark of *Duschekia fruticosa*, *LK 7*, *20*, LE L-25849.

***B. subduplex** (Nyl.) Räsänen ex Printzen — 3, 6, on mosses, rotten wood, and bark, *LK 14*, *15*, *17*, *35*, *43*, *45*, LE L-25850, L-25851, L-25852, L-25853, VBGI 170073.

!**Blastenia ammiospila** (Wahlenb.) Arup et al. — 3, on soil, *LK 15*, LE L-25854. The nearest localities are known in the Kamchatka Territory (Himelbrant *et al.*, 2019, 2021).

***Bryocaulon divergens** (Ach.) Kärnefelt — 4, 6, 8, on soil and plant debris, *SC 15*, *LK 37*, *38*, *51*, LE L-25855, L-25856, L-25944, VBGI 170081, 170096.

***Bryoria nadvornikiana** (Gyeln.) Brodo et D. Hawksw. — 4, on wood, *SC 16*, LE L-25857.

!**Bryostigma lapidicola** (Taylor) S. Y. Kondr. et Hur — 2, on rotten wood, *LK 5*, LE L-25858. The nearest localities are known in the Kamchatka Territory (Himelbrant *et al.*, 2021).

!**Buellia aethalea** (Ach.) Th. Fr. — 6, on stone, *LK 34*, LE L-25859. The nearest localities are known in the Kamchatka Territory (Himelbrant *et al.*, 2014, 2021).

***Caloplaca stillicidiorum** (Vahl) Lynge — 3, on soil and mosses, *SC 11*, *12*, LE L-25860, L-25861, VBGI 170013.

****Candelariella aurella** (Hoffm.) Zahlbr. — 2, 3, 5, 6, on iron, concrete, stones, and wood, *SC 8*, *9*, *11*, *LK 2*, *6*, *10*, *12*, *13*, *29*, *30*, *34*, *38*, LE L-25844, L-25845, L-25859, L-25862, L-25835,

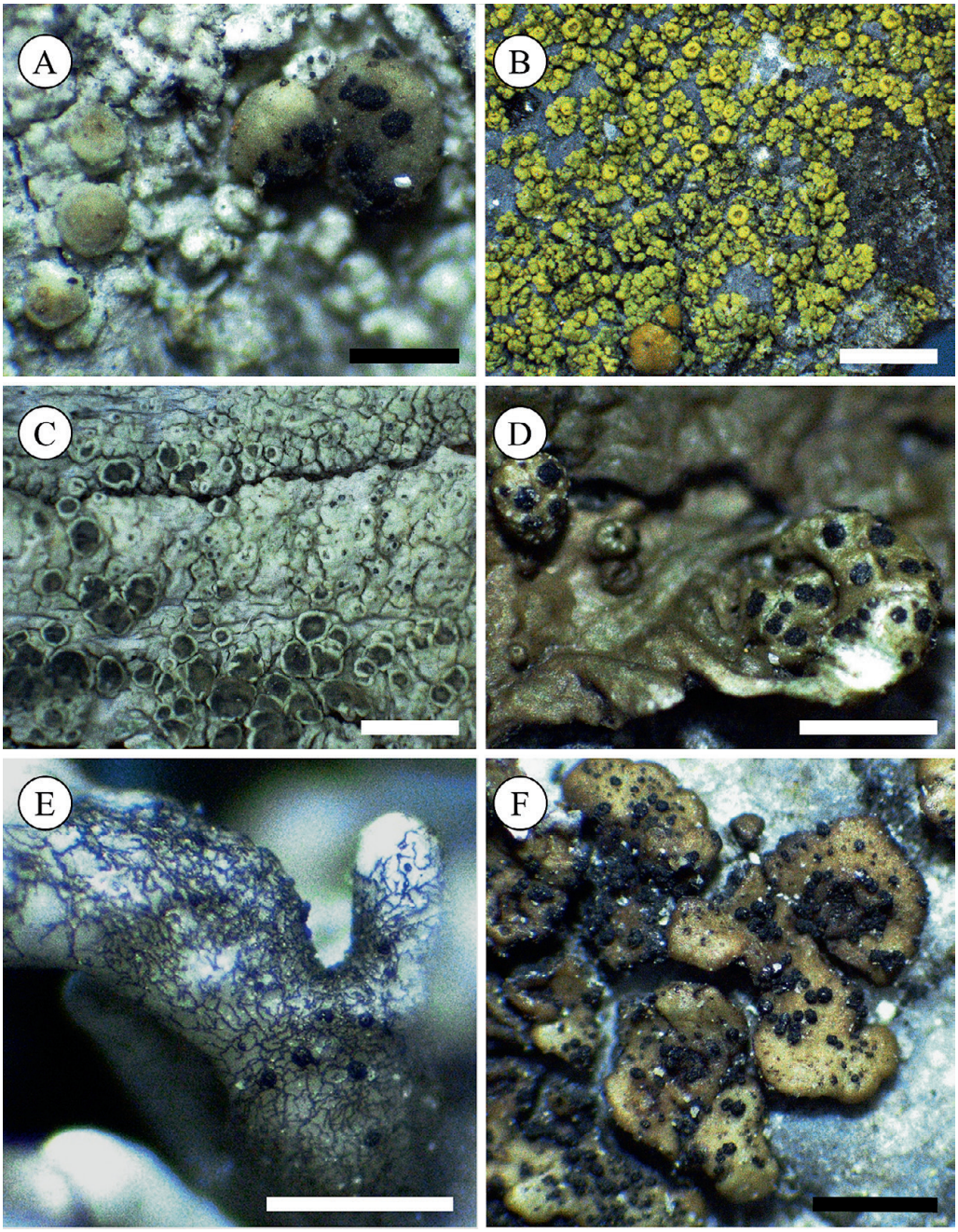

Fig. 3. New lichens and lichenicolous fungi species for Paramushir Island: A — *Arthonia apotheciorum* (LE F-350987), B — *Candelariella rosulans* (LE L-25832), C — *Lecanora confusa* (LE L-25834), D — *Nesolechia oxyspora* (LE F-350996), E — *Sphaerellothecium minutum* (LE F-350991), F — *Stigmidium fuscatae* (LE F-350998).
Scale bars: A, E, F — 0.5 mm, B, C — 2 mm, D — 1 mm.

L-25925, L-25982, L-25986, L-25988, VBGI 170012, 170015, 170056, 170058. The nearest locality is known in Sakhalin Island (Skirina *et al*., 2021).

!!**Candelariella rosulans** (Müll. Arg.) Zahlbr. (Fig. 3B) — 5, on stone, *SC 29*, *LK 28*, LE L-25832, L-25833. The nearest locality is known in Krasnodar Territory (Ismailov *et al*., 2017).

*__C. vitellina__ (Hoffm.) Müll. Arg. — 5, 6, on stones, *SC 22*, *23*, *24*, *25*, *LK 32*, *33*, LE L-25839, L-25863, L-25895, L-25958, L-25964, L-25969, L-25978, VBGI 170039.

**__Cetraria aculeata__ (Schreb.) Fr. — 3, 4, on soil, *SC 18*, *LK 16*, LE L-25864. The nearest locality is known in Sakhalin Island (Tchabanenko, 2002).

__C. islandica__ (L.) Ach. — 3, 4, 9, on soil, *SC 14*, *16*, *38*, *39*, *LK 15*, *17*, LE L-25857, L-25865, L-25887, L-25940, VBGI 170051. Previously reported from Paramushir by Satô (1936) and Tchabanenko (2002).

__C. laevigata__ Rass. — 3, 4, 6, 8, on soil, on plant debris, *SC 13*, *14*, *15*, *16*, *LK 14*, *16*, *17*, *19*, *38*, *51*, *52*, *53*, LE L-25857, L-25866, L-25867, L-25881, L-25888, L-25940, VBGI 170063, 170066, 170081, 170095, 170097, 170098. Previously reported from Paramushir by Tchabanenko (2002).

*__C. sepincola__ (Ehrh.) Ach. — 2, 3, on bark of *Duschekia fruticosa*, on wood, *LK 1*, *20*, LE L-25868, L-25892, L-25897.

**__Cetrariella delisei__ (Schaer.) Kärnefelt et A. Thell — 3, 4, on soil, *SC 15*, *18*, *LK 16*, LE L-25869, L-25870, VBGI 170028. The nearest localities are known in Sakhalin Island (Tchabanenko, 2002; Skirina *et al*., 2021).

__Cladonia arbuscula__ (Wallr.) Flot. — 7, on plant debris, *LK 47*, LE L-25884. Previously reported from Paramushir by Satô (1936) as *C. sylvatica* (L.) Hoffm.

!__C. carneola__ (Fr.) Fr. — 7, on wood of *Pinus pumila*, *SC 33*, LE L-25871. The specimen contains usnic acid, zeorin, and two unknown substances. The nearest localities are known in Amur Region (Tchabanenko, 2002) and Kamchatka Territory (Himelbrant *et al*., 2014, 2019, 2021).

*__C. cenotea__ (Ach.) Schaer. — 2, 7, on soil and rotten wood, *LK 5*, *48*, *49*, LE L-25872, L-25873, VBGI 170093.

__C. ciliata__ Stirt. — 3, on soil, *SC 8*, LE L-25874. Previously reported from Paramushir by Tchabanenko (2002) as *C. ciliata* var. *tenuis* (Flörke) Ahti.

__C. coccifera__ (L.) Willd. — 3, on soil, *LK 18*, LE L-25875. Previously reported from Paramushir by Satô (1936).

__C. coniocraea__ (Flörke) Spreng. — 2, 7, on wood of *Pinus pumila* and rotten wood, *SC 33*, *LK 5*, LE L-25871. Previously reported from Paramushir by Tchabanenko (2002).

**__C. cyanipes__ (Sommerf.) Nyl. — 7, on rotten bark, *SC 32*, LE L-25876. The nearest locality is known in Sakhalin Island (Skirina *et al*., 2021).

*__C. fimbriata__ (L.) Fr. — 1, 7, on wood and rotten bark, *SC 2*, *32*, LE L-25877, VBGI 170045.

*__C. gracilis__ (L.) Willd. subsp. **__gracilis__** — 3, 4, 7, on soil and plant debris, *SC 14*, *16*, *17*, *31*, *LK 14*, *19*, *47*, LE L-25878, L-25879, L-25884, L-25888, VBGI 170042.

__C. gracilis__ subsp. **__elongata__** (Jacq.) Ahti — 3, on soil, *LK 13*, LE L-25880. Previously reported from Paramushir by Satô (1936).

__C. kanewskii__ Oxner — 4, on soil, *SC 13*, LE L-25881. The nearest localities are known in Sakhalin Island (Tchabanenko, 2002; Skirina *et al*., 2021).

*__C. pyxidata__ (L.) Hoffm. — 2, 5, 7, 8, on soil and rotten wood, *LK 5*, *24*, *49*, *52*, LE L-25882, L-25948, L-25949.

*__C. rangiferina__ (L.) F. H. Wigg. — 1, 2, 7, on soil and plant debris, *SC 6*, *31*, *LK 5*, *47*, LE L-25883, L-25884, VBGI 170044.

*__C. rei__ Schaer. — 2, on wood, *LK 1*, LE L-25871, L-25885.

Cladonia squamosa Hoffm. — 2, 6, on soil, *LK 5*, *44*, LE L-25951, L-25953, L-25971. Previously reported from Paramushir by Tchabanenko (2002).

C. stellaris (Opiz) Pouzar et Vězda — 3, on soil, *LK 21*, LE L-25886. Previously reported from Paramushir by Satô (1936).

****C. subfurcata** (Nyl.) Arnold — 9, on soil, *SC 38*, *40*, LE L-25887, VBGI 170053. The nearest localities are known in Sakhalin Island (Tchabanenko, 2002; Skirina *et al*., 2021).

C. uncialis (L.) F. H. Wigg. — 3, 7, on soil, *SC 31*, *LK 14*, LE L-25888, VBGI 170043. Previously reported from Paramushir by Satô (1936).

****Dibaeis baeomyces** (L. f.) Rambold et Hertel — 9, on soil, *SC 38*, LE L-25889. The nearest localities are known in Sakhalin Island (Tchabanenko, 2002; Ezhkin, 2020; Skirina *et al*., 2021).

!Diploschistes scruposus (Schreb.) Norman — 6, 8, on stones, *LK 54*, LE L-25890. The nearest localities are known in the Kamchatka Territory (Himelbrant *et al*., 2014).

!!#Endococcus macrosporus (Hepp ex Arnold) Nyl. — 6, on thallus of *Rhizocarpon geographicum* on stone, *LK 43*, LE L-25961, F-350988. This is the second find for Russia. The nearest locality is known in the Trans-Baikal Territory (Zhurbenko *et al*., 2016).

!#E. propinquus (Körb.) D. Hawksw. — 2, 8, on thalli of *Candelariella aurella* and *Rhizocarpon geographicum* on stone, *LK 6*, *54*, LE F-350985, F-350986. The nearest locality is known in the Chukotka Autonomous Area (Zhurbenko, 2009).

!#Epicladonia sandstedei (Zopf) D. Hawksw. — 2, on podetia of *Cladonia* sp. on soil, *LK 3*, LE F-350989. The nearest localities are known in the Magadan Region (Zhurbenko, Zheludeva, 2015), Chukotka Autonomous Area, Primorye and Khabarovsk territories (Zhurbenko, Pino-Bodas, 2017).

***Hypogymnia bullata** Rass. — 7, 8, on wood of *Pinus pumila*, on soil, *LK 46*, *54*, LE L-25891, L-25993.

***H. submundata** (Oxner) Rass. — 2, 3, on bark of *Duschekia fruticosa*, on wood, *LK 1*, *20*, LE L-25892, L-25893.

****Japewia tornoënsis** (Nyl.) Tønsberg — 7, on wood of *Pinus pumila*, *SC 33*, LE L-25894. The nearest locality is known in Sakhalin Island (Skirina *et al*., 2021).

!!Lecanora argopholis (Ach.) Ach. — 6, on stones, *LK 33*, *34*, *40*, LE L-25895, VBGI 170085. The nearest locality is known in the Republic of Sakha (Yakutia) (Andreev *et al*., 1996).

!L. boligera (Norman ex Th. Fr.) Hedl. — 1, 2, 3, 7, on wood of *Pinus pumila*, on bark of *Duschekia fruticosa*, *SC 1*, *34*, *LK 1*, *20*, LE L-25896, L-25897, L-25994, VBGI 170047, 170065. The nearest localities are known in the Kamchatka Territory (Himelbrant *et al*., 2014, 2019, 2021).

***L. campestris** (Schaer.) Hue — 8, on stones, *LK 54*, LE F-350985.

!!!L. confusa Almb. (Fig. 3C) — 3, on wood, *SC 16*, *LK 9*, LE L-25834. The specimens contain usnic and thiophanic acids, arthothelin, and zeorin. This species is closely related to *L. strobilina*, *L. perconfusa*, and *L. substrobilina*. From these species, *L. confusa* can be distinguished by the size and shape of its spores. The ascospores of studied specimens 12.9–15.4 × 3.9–5.1 µm, broadly ellipsoid in shape. The other three species have narrower spores (*L. substrobilina* also shorter ones). In the most similar species, *L. perconfusa*, they are narrowly ellipsoid and frequently bent in contrast to the broadly ellipsoid spores of *L. confusa* (Printzen, 2001). *Lecanora strobilina* can also be distinguished by the lack of xanthones resulting in a C– reaction of thallus and apothecia. In addition, *L. confusa* is confined to regions with a pronounced oceanic influence. It is known from oceanic North America and Europe (Printzen, 2001).

****L. orae-frigidae** R. Sant. — 2, on wood, *LK 1*, LE L-25885, L-25892, L-25898. The nearest locality is known in Sakhalin Island (Konoreva *et al*., 2018).

***L. polytropa** (Ehrh. ex Hoffm.) Rabenh. — 4, 6, 9, on stone, *SC 21*, *36*, *LK 32*, *33*, *34*, *38*, *45*, LE L-25899, L-25859, L-25900, L-25835, L-25895, VBGI 170049.

***L. pulicaris** (Pers.) Ach. — 2, 3, 7, on wood of *Pinus pumila*, on bark of *Duschekia fruticosa*, *SC 33*, *LK 7*, *20*, LE L-25892, L-25894, L-25901.

***L. strobilina** (Spreng.) Kieff. — 2, on bark of *Duschekia fruticosa*, *LK 7*, LE L-25902.

***L. symmicta** (Ach.) Ach. — 3, on bark of *Duschekia fruticosa*, *LK 20*, LE L-25892, L-25903, L-25910, VBGI 170064.

!**Lecidea confluens** (Weber) Ach. — 4, on soil, *SC 17*, LE L-25904. The nearest localities are known in the Khabarovsk (Tchabanenko, 2002) and Kamchatka (Himelbrant *et al*., 2021) territories.

***Lecidella elaeochroma** (Ach.) M. Choisy — 1–4, on wood of *Pinus pumila*, on bark of *Duschekia fruticosa*, *SC 1*, *14*, *15*, *16*, *19*, *LK 7*, *9*, *10*, *11*, *14*, *15*, *18*, LE L-25850, L-25851, L-25862, L-25894, L-25902, L-25905, L-25906, L-25907, L-25908, L-25910, L-25938, L-25972, L-25982, L-26003, VBGI 170017, 170019, 170021, 170030, 170059.

***L. euphorea** (Flörke) Hertel — 3, 7, on wood of *Pinus pumila*, *SC 33*, *LK 17*, LE L-25909, L-25910, L-25954, VBGI 170060.

***Lendemeriella borealis** (Vain.) S. Y. Kondr. — 1, 2, 4, on bark of *Duschekia fruticosa*, *SC 1*, *19*, *LK 7*, LE L-25848, L-25910, L-25954, VBGI 170031.

***Lepra dactylina** (Ach.) Hafellner — 3, 4, 6, on soil and plant debris, *SC 18*, *LK 15*, *32*, LE L-25911, VBGI 170026.

!**Lepraria jackii** Tønsberg s. str. — 4, on soil, *SC 14*, *17*, LE L-25912, VBGI 170023. The specimens contain atranorin, jackinic/rangiformic and norjackinik/norrangiformic acids. The nearest locality is known in the Kamchatka Territory (Neshataeva *et al*., 2004).

!#**Lichenostigma alpinum** (R. Sant. et al.) Ertz et Diederich — 7, on thallus of *Ochrolechia frigida* on wood of *Pinus pumila*, *LK 46*, LE F-350990, VBGI 170100. The nearest locality is known in the Jewish Autonomous Region (Zhurbenko, 2014), Chukotka Autonomous Area and Primorye Territory (Zhurbenko, Pino-Bodas, 2017).

Lobaria linita (Ach.) Rabenh. — 3, 4, 6, 8, on soil, *SC 13*, *19*, *LK 14*, *15*, *18*, *37*, *54*, LE L-25881, L-25888, L-25913, L-25914, L-25915, VBGI 170029, 170062, 170079. Previously reported from Paramushir by Tchabanenko (2002).

!**Lopadium coralloideum** (Nyl.) Lynge — 6, on mosses, *LK 38*, LE L-25916. The nearest localities are known in the Kamchatka Territory (Himelbrant *et al*., 2014, 2019, 2021).

!**L. pezizoideum** (Ach.) Körb. — 3, on soil, *LK 17*, LE L-25917, VBGI 170017, 170032. The nearest localities are known in the Kamchatka Territory (Himelbrant *et al*., 2014, 2019, 2021).

Melanelia hepatizon (Ach.) A. Thell — 6, 8, on stone, *LK 36*, *37*, *38*, *40*, *45*, *54*, *55*, LE L-25890, L-25918, L-25935, L-25962, L-25970, L-25992, VBGI 170076, 170082. Previously reported from Paramushir by Satô (1936).

***Melanohalea exasperata** (De Not.) O. Blanco et al. — 1, 2, on bark of *Duschekia fruticosa*, *SC 7*, *LK 7*, LE L-25902, L-25919, L-25920, VBGI 170055.

***M. olivacea** (L.) O. Blanco et al. — 1, on bark of *Duschekia fruticosa*, *SC 7*, LE L-25903, L-25921, L-25983.

!**Micarea incrassata** Hedl. — 4, on soil, *SC 20*, LE L-25922. The nearest localities are known in the Kamchatka Territory (Himelbrant *et al*., 2021).

***Miriquidica leucophaea** (Flörke ex Rabenh.) Hertel et Rambold — 6, on stones, *LK 40*, *43*, LE L-25923, VBGI 170084.

***Mycobilimbia tetramera** (De Not.) Vitik. et al. ex Hafellner et Türk — 6, on soil, *LK 45*, LE L-25924.

***Myriolecis dispersa** (Pers.) Śliwa et al. — 2, 3, 5, on iron, concrete, and stone, *SC 8*, *9*, *29*, *LK 1*, *8*, *12*, *22*, LE L-25844, L-25845, L-25927, L-25959, L-25986.

****M. semipallida** (H. Magn.) Śliwa et al. — 2, 3, on concrete, *SC 1*, *12*, *LK 2*, *6*, LE L-25861, L-25925, L-25926, VBGI 170012, 170014. The nearest locality is known in Sakhalin Island (Davydov *et al*., 2023).

!**M. straminea** (Ach.) Śliwa et al. — 3, 5, on stones and concrete, *SC 9*, *24*, *25*, *28*, *LK 23*, *24*, *27*, LE L-25838, L-25927, L-25928, L-25929, VBGI 170039, 170040, 170041, 170067, 170068. The nearest localities are known in the Primorye (Tchabanenko, 2002) and Kamchatka (Himelbrant *et al*., 2019, 2021) territories.

!**M. zosterae** (Ach.) Śliwa et al. var. **zosterae** — 5, on carbonate stone, *SC 24*, LE L-25930. The nearest localities are known in Wrangel Island (Kristinsson *et al*., 2010).

!**M. zosterae** (Ach.) Śliwa et al. var. **palanderi** (Vain.) Śliwa — 3, on concrete, *LK 8*, LE L-25931. The nearest localities are known in the Kamchatka Territory (Himelbrant *et al*., 2021).

!**Naetrocymbe punctiformis** (Pers.) R. C. Harris — 3, 5, on bark of *Duschekia fruticosa*, *SC 7*, *LK 15*, LE L-25919, L-25932. The nearest localities are known in the Primorye (Tchabanenko, 2002) and Kamchatka (Himelbrant *et al*., 2014, 2021) territories.

***Nephroma bellum** (Spreng.) Tuck. — 8, on mosses over stone, *LK 54*, LE L-25933.

***N. parile** (Ach.) Ach. — 6, on soil, *LK 42*, *44*, LE L-25934, VBGI 170089.

!#**Nesolechia oxyspora** (Tul.) A. Massal. (Fig. 3D) — 2, on thallus of *Melanohalea olivacea* on bark of *Duschekia fruticosa*, *LK 7*, LE F-350996. The nearest localities are known in the Jewish Autonomous Region (Zhurbenko, 2014), Primorye [Kondratyuk *et al*., 2015; as *Phacopsis oxyspora* (Nordin) D. Hawksw.], and Kamchatka (Zhurbenko *et al*., 2012) territories.

!**Ochrolechia alaskana** (Verseghy) Kukwa — 8, on stone, *LK 55*, LE L-25935. The specimen contains gyrophoric, variolaric acids, and unknown substance. This is the second find for Russia. The nearest locality is known in the Kamchatka Territory (Himelbrant *et al*., 2021).

!!**O. bahusiensis** H. Magn. — 7, on rotten bark, *SC 32*, LE L-25936. The specimen contains gyrophoric, murolic, and two fatty acids. The nearest localities are known in the Republic of Mordovia (Urbanavichene, Urbanavichus, 2016).

***O. frigida** (Sw.) Lynge — 2–4, 6–8, on soil, bark, wood of *Pinus pumila*, and plant debris, *SC 15*, *16*, *17*, *LK 3*, *4*, *5*, *16*, *42*, *46*, *53*, LE L-25872, L-25884, L-25937, L-25938, L-25971, VBGI 170019, 170020, 170087, 170100. The specimens contain gyrophoric and murolic acids, or gyrophoric acid with two fatty acids, or gyrophoric acid only.

***Ophioparma ventosa** (L.) Norman — 8, on stone, *LK 55*, LE L-25939.

***Parmelia omphalodes** (L.) Ach. — 3, 4, 6, 8, on stone, soil, wood, and plant debris, *SC 15*, *19*, *LK 16*, *17*, *19*, *37*, *38*, *42*, *51*, *52*, LE L-25934, L-25940, L-25941, L-25975, VBGI 170077, 170080, 170096.

P. saxatilis (L.) Ach. — 3, 6, 8, on stone, soil, and plant debris, *LK 16*, *19*, *33*, *42*, *51*, LE L-25895, L-25942, L-25943, VBGI 170086, 170094. Previously reported from Paramushir by Satô (1936).

***P. shinanoana** Zahlbr. — 8, on soil and on plant debris, *LK 51*, LE L-25944.

!**P. skultii** Hale — 4, 5, on soil and stone, *SC 14*, *16*, *27*, LE L-25945, L-25975, VBGI 170022. The nearest localities are known in the Kamchatka Territory (Himelbrant *et al*., 2014, 2019, 2021).

***P. sulcata** Taylor — 2, on wood, *LK 1*, LE L-25892.

***Parmeliella parvula** P. M. Jørg. — 5, on stone, *SC 21*, LE L-25946.

***Parmeliopsis hyperopta** (Ach.) Arnold — 3, 7, on wood of *Pinus pumila*, on bark of *Duschekia fruticosa*, *SC 33*, *LK 20*, LE L-25995, L-25998.

Peltigera canina (L.) Willd. — 2, 7, on soil, *LK 4*, *49*, LE L-25947, L-25948, VBGI 170054, 170092. Previously reported from Paramushir by Satô (1936).

****P. didactyla** (With.) J. R. Laundon — 2, 6, on mosses and soil, *LK 5*, *44*, LE L-25949, VBGI 170088. The nearest locality is known in Sakhalin Island (Tchabanenko, 2002).

***P. extenuata** (Nyl. ex Vain.) Lojka — 8, on plant debris, *LK 53*, LE L-25950, VBGI 170099.

***P. leucophlebia** (Nyl.) Gyeln. — 6, on soil, *LK 44*, LE L-25951.

***P. membranacea** (Ach.) Nyl. — 6, on soil, *LK 39*, LE L-25952.

***P. praetextata** (Flörke ex Sommerf.) Zopf — 2, 6, on soil, *LK 5*, *37*, LE L-25953, VBGI 170078.

!**Pertusaria carneopallida** (Nyl.) Anzi ex Nyl. — 1, on bark of *Duschekia fruticosa*, *SC 1*, LE L-25954. The nearest localities are known in the Primorye, Khabarovsk (Tchabanenko, 2002), and Kamchatka (Himelbrant *et al*., 2014, 2019, 2021) territories.

!**P. oculata** (Dicks.) Th. Fr. — 3, 6, on soil, bark, and wood, *LK 17*, *18*, *36*, LE L-25955, L-25956. The nearest localities are known in the Kamchatka Territory (Himelbrant *et al*., 2014, 2019, 2021).

*+**Phaeocalicium compressulum** (Szatala) A. F. W. Schmidt — 2, on bark of *Duschekia fruticosa*, *LK 7*, LE L-25902.

***Physcia caesia** (Hoffm.) Fürnr. — 3, 5, 6, on stone, concrete, and rotten wood, *SC 9*, *23*, *24*, *25*, *29*, *LK 8*, *10*, *12*, *13*, *22*, *23*, *28*, *29*, *30*, *31*, *34*, LE L-25832, L-25833, L-25838, L-25839, L-25859, L-25861, L-25862, L-25863, L-25929, L-25931, L-25957, L-25959, L-25964, L-25978, L-25982, L-25988, VBGI 170040, 170058, 170070.

***P. dubia** (Hoffm.) Lettau — 5, on stone, *SC 22*, LE L-25958, L-25969.

!#**Plectocarpon linitae** (R. Sant.) Wedin et Hafellner — 6, 8, on thallus of *Lobaria linita* on soil, *LK 37*, *54*, LE F-350994, F-350995. The nearest localities are known in the Magadan Region (Zhurbenko, Zheludeva, 2015).

***Polycauliona candelaria** (L.) Frödén et al. — 4, 5, on stones, *SC 15*, *25*, *LK 22*, *23*, *27*, *31*, LE L-25838, L-25959, VBGI 170040, 170041, 170067, 170072.

!**P. verruculifera** (Vain.) Arup et al. — 5, on stone, *SC 28*, *LK 31*, LE L-25960, VBGI 170072. The nearest localities are known in the Kamchatka Territory (Himelbrant *et al*., 2021).

****Porpidia albocaerulescens** (Wulfen) Hertel et Knoph — 6, on stones, *LK 43*, *44*, *45*, LE L-25961, L-25962, L-25963, VBGI 170090. The specimens contain stictic acid. The nearest locality is known in Sakhalin Island (Tchabanenko, 2002).

***P. contraponenda** (Arnold) Knoph et Hertel — 3–5, 9, on stones, *SC 21*, *23*, *39*, *LK 3*, *29*, LE L-25963, L-25964, L-25980, L-25981, VBGI 170052, 170071.

***P. crustulata** (Ach.) Hertel et Knoph — 4, 6, on stones, *SC 19*, *LK 30*, *38*, LE L-25965, L-25988.

!**Protomicarea alpestris** (Sommerf.) McCune — 2, on soil, *LK 3*, LE L-25966. The nearest localities are known in the Kamchatka Territory (Himelbrant *et al*., 2014, 2021).

***Protopannaria pezizoides** (Weber) P. M. Jørg. et S. Ekman — 2, 4, on soil, *SC 18*, *LK 3*, LE L-25967.

***Protoparmelia badia** (Hoffm.) Hafellner — 6, 9, on stones, *SC 37*, *39*, *LK 34*, LE L-25859, L-25968, L-25980.

!**Protoparmeliopsis muralis** (Schreb.) M. Choisy — 5, 6, on stones, *SC 22*, *23*, *LK 30*, LE L-25958, L-25969, L-25988, VBGI 170033. The nearest localities are known in the Primorye and Khabarovsk territories (Tchabanenko, 2002).

!**Pseudephebe minuscula** (Nyl. ex Arnold) Brodo et D. Hawksw. — 6, 8, 9, on stones and soil, *SC 38*, *39*, *LK 38*, *54*, LE L-25887, L-25890, L-25970, L-25980, VBGI 170050, 170082.

The nearest localities are known in the Khabarovsk (Tchabanenko, 2002) and Kamchatka (Himelbrant *et al*., 2014, 2021) territories.

****Psoroma hypnorum** (Vahl) Gray — 2, on soil, *LK 5*, LE L-25971. The nearest locality is known in Sakhalin Island (Tchabanenko, 2002).

Ramalina almquistii Vain. — 3, 4, 6, on stone and rotten wood, *SC 21*, *LK 10*, *33*, *38*, LE L-25899, L-25972, L-25973, VBGi 170083. Previously reported from Paramushir by Satô (1936) and Tchabanenko (2002).

***R. roesleri** (Hochst. ex Schaer.) — 3, 4, on wood, *SC 15*, *16*, *LK 9*, LE L-25974, L-25984, L-26003, VBGI 170018.

***R. scoparia** Vain. — 3, on stone, *LK 19*, LE L-25975.

!**Rhizocarpon alpicola** (Fr.) Rabenh. — 9, on stone, *SC 36*, LE L-25976. The nearest localities are known in the Primorye and Khabarovsk territories (Tchabanenko, 2002).

***R. badioatrum** (Flörke ex Spreng.) Th. Fr. — 9, on stone, *SC 37*, LE L-25977.

!**R. geminatum** Körb. — 5, on stones, *SC 24*, LE L-25978. The nearest localities are known in the Kamchatka Territory (Himelbrant *et al*., 2021).

***R. geographicum** (L.) DC. — 6, 8, on stones, *LK 43*, *54*, LE L-25961, L-25979.

***R. grande** (Flörke) Arnold — 5, on stone, *LK 29*, LE L-25833.

***R. leptolepis** Anzi — 9, on stone, *SC 39*, LE L-25980.

****R. reductum** Th. Fr. — 4, on stones, *SC 17*, *21*, LE L-25904, L-25981. The nearest localities are known in Sakhalin Island (Ezhkin, Schumm, 2018; Tchabanenko *et al*., 2018; Ezhkin, 2020).

****Rinodina cinereovirens** (Vain.) Vain. — 3, on rotten wood, *LK 10*, LE L-25982. The nearest localities are known in Sakhalin Island (Sheard *et al*., 2017).

***R. freyi** H. Magn. — 1, on bark of *Duschekia fruticosa*, *SC 7*, LE L-25983.

!**R. olivaceobrunnea** C. W. Dodge et G. E. Baker — 3, on rotten wood, *LK 9*, LE L-25984. The nearest localities are known in Wrangel Island (Kristinsson *et al*., 2010).

***R. turfacea** (Wahlenb.) Körb. — 3, on wood, *LK 11*, LE L-25985.

***Rusavskia elegans** (Link) S. Y. Kondr. et Kärnefelt — 3, on iron, concrete, and stone, *SC 8*, *9*, *11*, *12*, *LK 8*, *12*, *13*, LE L-25845, L-25861, L-25927, L-25931, L-25957, L-25986, VBGI 170012, 170016, 170056, 170057, 170058.

!#**Sagediopsis campsteriana** (Linds.) D. Hawksw. et R. Sant. — 6, on thallus of *Ochrolechia* sp. on stone, *LK 44*, LE L-25987, F-350999. The nearest localities are known in the Magadan Region (Zhurbenko, Zheludeva, 2015).

***Scoliciosporum umbrinum** (Ach.) Arnold — 6, on stone, *LK 30*, LE L-25988.

#Sphaerellothecium minutum** Hafellner (Fig. 3E) — 6, 8, on branches of *Sphaerophorus fragilis* on stone, *LK 32*, *52*, LE L-25989, F-350991. The nearest locality is known in Sakhalin Island (Zhurbenko, Ohmura, 2019).

#S. parmeliae** Diederich et Etayo — 5, 8, on thallus of *Parmelia omphalodes* on soil, *SC 27*, *LK 51*, LE F-350992, F-350993. The nearest locality is known in Sakhalin Island (Zhurbenko, Ohmura, 2019).

****Sphaerophorus fragilis** (L.) Pers. — 6, 8, on soil and plant debris, *LK 32*, *52*, LE L-25989, VBGI 170074. The nearest locality is known in Sakhalin Island (Tchabanenko, 2002).

****S. globosus** (Huds.) Vain. — 3, 4, on soil and bark, *SC 18*, *LK 15*, LE L-25990, L-25991, VBGI 170027, 170061. The nearest locality is known in Sakhalin Island (Tchabanenko, 2002; Skirina *et al*., 2021).

Stereocaulon glareosum (Savicz) H. Magn. – 9, on soil, *SC 35*, LE L-26004. Previously reported from Paramushir by Dombrovskaya (1996) and Tchabanenko (2002).

!!**Stereocaulon** cf. **tornense** (H. Magn.) P. James et Purvis (Fig. 4A–F) — 9, on stone, *SC 36*, LE L-25831. Like *S. tornense* in McCune (2019), our specimen has patches of areoles with dark centers (Fig. 4B) and contains atranorin and stictic acid in the thallus. Epithecium, exciple, and hypothecium are brown (Fig. 4D), spores are 3-septate, 20.1–23.1 × 6.4–7.1 μm (Fig. 4E, F). However, our specimen differs from the description in McCune (2019) in the absence of soralia and the presence of crystals in the epihymenium and exciple (pol+) (Fig. 4C). *Stereocaulon cephalocrustatum* McCune et al. is a morphologically similar species which also has crystals in the epihymenium (pol+) but it is distinguished by the presence of cephalodia. Our specimens, despite the presence of crystals in the epihymenium, lack cephalodia and are not associated with free-living *Stigonema*. The nearest locality of *S. tornense* is known in the Murmansk Region (Melekhin, 2010).

!!#**Stigmidium fuscatae** (Arnold) R. Sant. (Fig. 3F) — 6, on squamules of *Acarospora fuscata* on stone, *LK 32*, *34*, LE L-25835, F-350998. The nearest localities are known in the Murmansk Region (Urbanavichus *et al*., 2008) and St. Petersburg (Himelbrant *et al*., 2016).

!#**S. stereocaulorum** Zhurb. et Triebel (Fig. 4G) — 9, on thallus of *Stereocaulon* cf. *tornense* on stone, *SC 36*, LE L-25831, L-25859, F-350997. The nearest locality is known on Wrangel Island (Zhurbenko, Triebel, 2008).

***Tephromela atra** (Huds.) Hafellner — 6, on stone, *LK 40*, LE L-25992.

***Tetramelas chloroleucus** (Körb.) A. Nordin — 7, on wood of *Pinus pumila*, *LK 46*, LE L-25993.

Thamnolia vermicularis (Sw.) Schaer. — 3, 4, on soil, *SC 15*, *LK 16*, *18*, LE L-25855. Previously reported from Paramushir by Satô (1936).

Vulpicida juniperinus (L.) J.-E. Mattsson et M. J. Lai — 3, on bark of *Pinus pumila*, *LK 20*, LE L-25994. Previously reported from Paramushir by Satô (1936) and Tchabanenko (2002).

V. pinastri (Scop.) J. E. Mattsson et M. J. Lai — 1, 3, 7, on wood of *Pinus pumila*, on bark of *Duschekia fruticosa*, *SC 1*, *LK 20*, *46*, LE L-25848, L-25849, L-25893, L-25993, L-25995. Previously reported from Paramushir by Satô (1936).

***Xylographa hians** Willey ex Tuck. — 7, on wood of *Pinus pumila*, *SC 32*, *34*, *LK 46*, LE L-25993, L-25996, VBGI 170046.

***X. parallela** (Ach.) Fr. — 2, 3, 7, on wood of *Pinus pumila*, *SC 16*, *33*, *LK 1*, *11*, *46*, LE L-25834, L-25840, L-25892, L-25898, L-25993, L-25997, L-26003, VBGI 170048, 170091.

!**X. vitiligo** (Ach.) J. R. Laundon — 7, on wood of *Pinus pumila*, *SC 33*, *34*, *LK 46*, LE L-25996, L-25998, L-25999. The nearest localities are known in the Kamchatka Territory (Himelbrant *et al*., 2014).

Discussion

In total, we have identified 143 species, one subspecies, and one variety of lichens, 13 species of lichenicolous fungi and one species of non-lichenized saprobic fungus. *Lecanora confusa* is reported for the first time for Russia. Eight species, *Arthonia apotheciorum*, *Candelariella rosulans*, *Endococcus macrosporus*, *Lecanora argopholis*, *Ochrolechia bahusiensis*, *Stereocaulon* cf. *tornense*, *Stigmidium fuscatae*, and *S. stereocaulorum*, are new for the Russian Far East, 36 species are new for the Sakhalin Region, 20 species are listed for the first time for the Kuril Islands, and 72 species for Paramushir Island. Altogether, 190 species, one subspecies, and one variety are known for this territory including 176 species, one subspecies and one variation of lichenized fungi, 13 lichenicolous fungi, and one non-lichenized saprobic fungus (Satô, 1936; Ahti, 1961; Dombrovskaya,

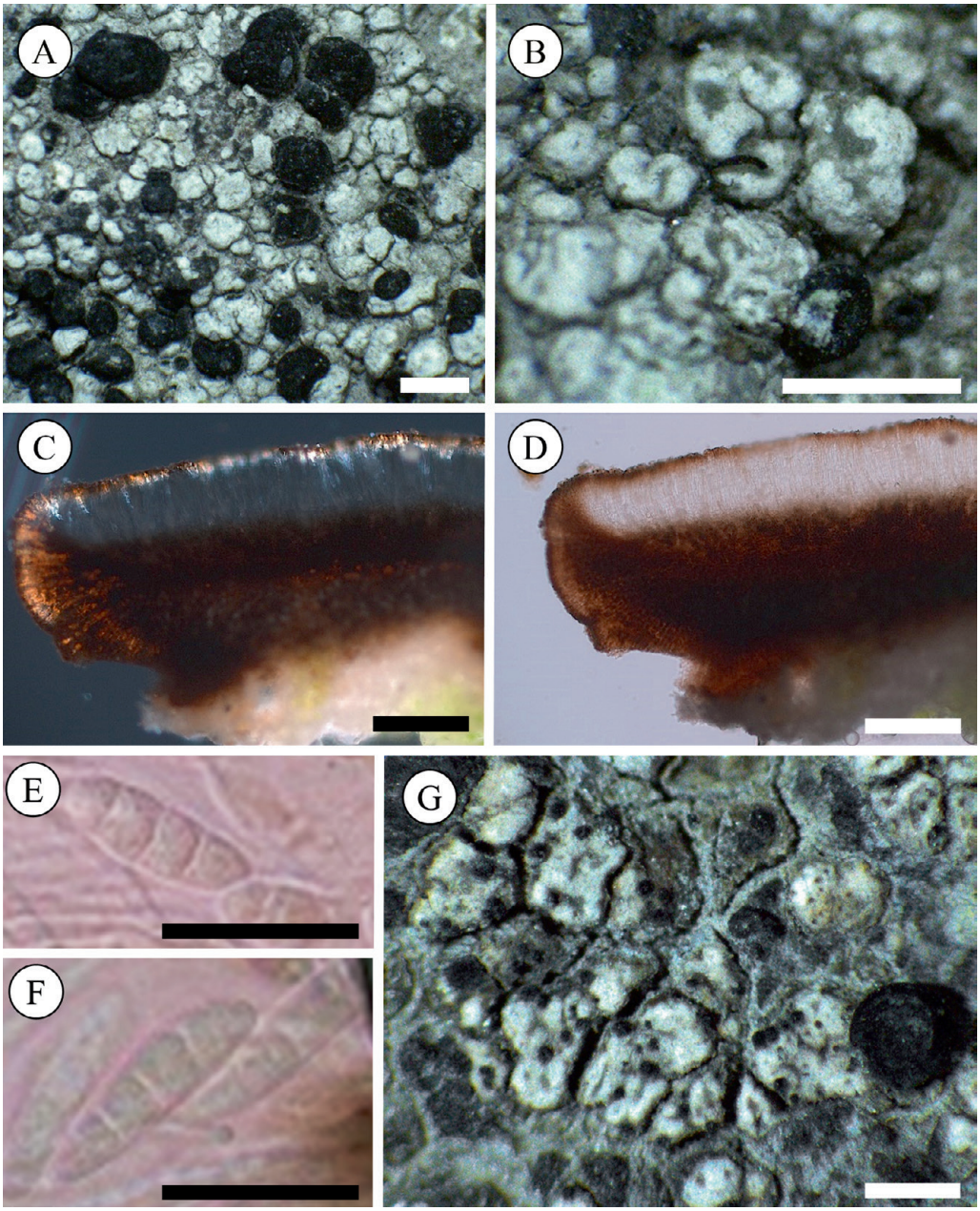

Fig. 4. *Stereocaulon* cf. *tornense* (LE L-25831): A — areoles without dark centers with apothecia, B — areoles with dark centers, C — section of apothecium in polarized light, D — section of apothecium in transmitted light, E and F — transversely septate ascospores; G — *Stigmidium stereocaulorum* (LE F-350997).
Scale bars: A, B — 1 mm, C, D — 100 μm, E, F — 25 μm, G — 0.5 mm.

1996; Tchabanenko, 2002; Galanina, Ezhkin, 2019; Krasnaya..., 2019; Ezhkin, Davydov, 2021). Most of the lichen species reported here are common in the Russian Far East. Although the main part of the island still remains unexplored, some conclusions about its lichen biota are already possible. The greatest species diversity is observed on soil (56) and stones (46). The corticolous and lignicolous taxa are represented by a smaller number of species (37 and 26, respectively) most probably due to lack of forest vegetation on the island and the low species diversity of shrubs, which are dominated by dwarf alder. We expect the list of species to be supplemented with further exploration of the island.

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