

Remarkable records of *Micarea* (Pilocarpaceae) from the Russian Far East. II

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Abstract. We report several new findings of *Micarea* species in the Russian Far East: *M. fennica* new to Russia and Asia; *M. botryoides* new to the Far East; *M. misella* and *M. tomentosa* new to the southern Russian Far East. Six species from the genus *Micarea*, including rather rare *M. adnata* and *M. contexta*, were found in the Khabarovsk Territory.

Keywords: lichens, biogeography, distribution, new records, Asia, Far East, Russia.

Интересные находки видов рода *Micarea* (Pilocarpaceae) с Дальнего Востока России. II

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Резюме. Приведены новые находки видов из рода *Micarea* с территории Дальнего Востока России: *M. fennica* — для России и Азии; *M. botryoides* — для Дальнего Востока; *M. misella* и *M. tomentosa* выявлены впервые для юга Российского Дальнего Востока. Шесть видов из рода *Micarea*, включая довольно редкие виды *M. adnata* и *M. contexta*, приведены впервые для Хабаровского края.

Ключевые слова: лишайники, биогеография, новые находки, распространение, Азия, Дальний Восток, Россия.

The genus *Micarea* Fr. has been extensively studied in Europe and North America for about half of a century (Vězda, Wirth, 1976; Coppins, 1983; Tønsberg, Coppins, 2000; Fryday, 2006, 2017; Czarnota, 2007; Smith *et al.*, 2009; Barton, Lendemer, 2014; McCune, 2017; etc.). Several factors — small size of the lichen, difficulties in identification, some features of their ecology (they live in predominantly coniferous forests with

dead wood and stumps, which often are overlooked) – complicated the process. The most progress happened in the last 10 years, after molecular phylogenetic methods became widely available (Czarnota, Guzow-Krzemińska, 2010; Guzow-Krzemińska et al., 2016, 2019; van den Boom et al., 2017; Launis et al., 2019a, b; Launis, Myllys, 2019).

Data on *Micarea* in the Far East remain scarce (Aptroot, Seaward, 1999; Aptroot, Sparrius, 2003; Joshi et al., 2011; Kondratyuk et al., 2013, 2015, 2016a, b; Aptroot, Moon, 2014; Ohmura, Kashiwadani, 2018; etc.). A wide range of natural conditions present in the region (e. g., humidity), and the presence of old-growth forests leads us to suspect that the genus *Micarea* might be more diverse in the Far East than is currently known. In our previous study, we summarized the available information and created a list of *Micarea* species for the Russian Far East (Konoreva et al., 2019). The list included 19 species. The present study adds to the list with material from the Sakhalin Region, Khabarovsk and Kamchatka territories.

Materials and Methods

The lichen specimens studied derive from the field investigations conducted by Liudmila Konoreva and Sergey Chesnokov in the Sakha Republic (2015), in the Trans-Baikal Territory (2015), in the Sakhalin Region (2017), in the Khabarovsk Territory (2018); and by Gulnara Tagirdzhanova, Irina Stepanchikova, Dmitry Himelbrant, and Alexandra Dyomina in the Kamchatka Territory (2016) (Fig. 1).

High performance thin-layer chromatography (HPTLC) was performed by Chesnokov and Konoreva according to the standard techniques using solvent system C (Orange et al., 2001). We identified pigments present in *Micarea* samples following Meyer and Printzen (2000). The distribution map was prepared using MapInfo GIS software. Geographical coordinates were given in spatial reference system WGS 1984. We used a compound microscope with polarization filters to study crystalline granules. Photographs of the species were made using a Fujifilm XQ1 camera and MBS-10 stereomicroscope. All collected and identified specimens are stored in the herbaria of the Laboratory of Lichenology and Bryology, Komarov Botanical Institute (LE), Botanical Garden-Institute of the Far Eastern Branch of the Russian Academy of Sciences (VBGI), and University of Helsinki (H).

Results

We report *Micarea fennica* for the first time from Russia and Asia. Nine species are new for the Khabarovsk Territory; among them *M. botryoides*, which is also new for the Far East. *Micarea misella* and *M. tomentosa* are new to southern Russian Far East, *M. misella* is also new to Sakhalin Region. *Micarea peliocarpa* is new to Kamchatka Territory and Sakhalin Region. Previously, no information existed on the genus *Micarea* in the Khabarovsk Territory. The list of species of the genus *Micarea* in the Russian Far East now includes 21 species. Below, we list all newly found species for each region and give the distribution of species in the Russian Far East. For *M. fennica* we also included its distribution and how it differs from closely related taxa.

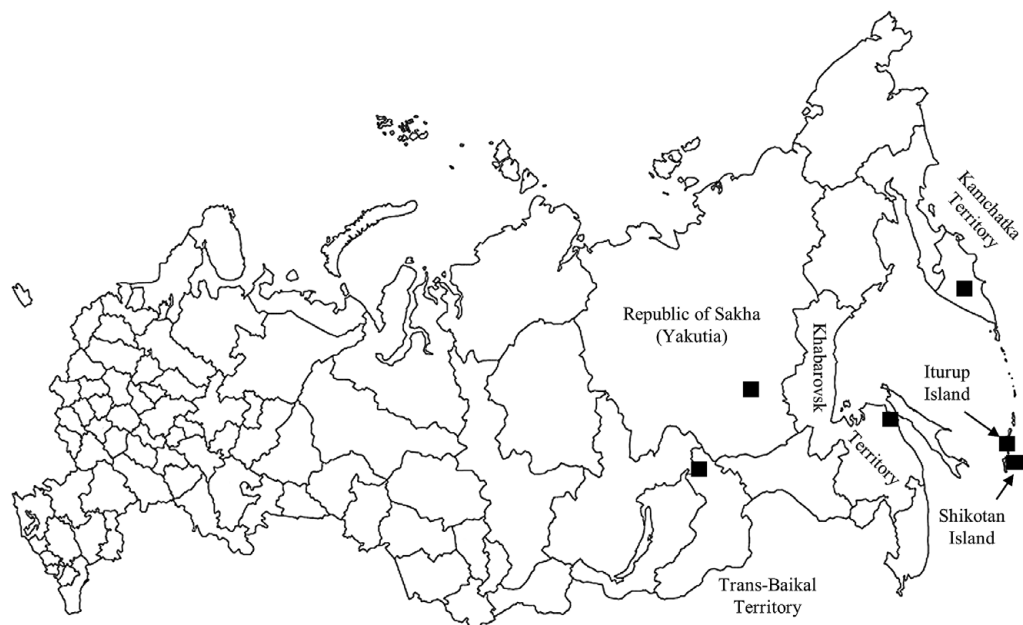


Fig. 1. Investigated areas.

New for Russia and Asia

Micarea fennica Launis et Myllys

(Plate I)

Thallus effuse, pale olive green, whitish green or greyish green, to dark greyish green, minutely granular, composed of small goniocysts 17–25 μm in diam., often coalescing to form larger granules, K– and C–. Photobiont micareoid, algal cells 4.5–7.0 μm (Launis, Myllys, 2019). Apothecia convex to subglobose and mostly becoming tuberculate, usually semi-immersed within the thallus, immarginate, (0.2)0.3–0.6 mm in diam. (or up to 1.8 mm in diam. when tuberculate), brownish to dull brown. Epihymenium brownish (K–, C– or K \pm violet, C \pm violet), hymenium 50–65 μm tall, hyaline, hypothecium colorless or pale yellowish, up to 250 μm tall. Ascospores ellipsoid, oblong-ellipsoid, oblong-ovoid, 0(1)-septate, (10)10.5–12.0 \times 3.0–4.0 μm . Paraphyses of one type, hyaline, branched and anastomosing, 0.8–1.5 μm wide, apices only slightly widening. Pycnidia numerous and conspicuous, simple or branched, dark grey to dark brown, covered with thin whitish tomentum, 0.2–0.4 mm tall. Pycnidial wall K+ violet and C+ violet (Sedifolia-grey), mesoconidia cylindrical, 3.7–4.5(5.0) \times 1.5 μm [according to Launis, Myllys (2019): (3.8)4.0–5.5 \times 1.2–1.8 μm]. Crystalline granules not detected in thallus and apothecia in polarized light.

HPTLC: micareic acid.

Ecology and distribution. *Micarea fennica* is known from two old-growth forests in southern and central Finland (Launis, Myllys, 2019). In Russia *M. fennica* was

found in a primeval forest in the Far East, and in slightly disturbed forests in Siberia (Fig. 2). Three specimens from Siberia were found on softwood stumps of *Larix gmelinii* (Rupr.) Kuzen. and *Picea abies* (L.) H. Karst. The specimen from Kamchatka grew on the bark of *Larix cajanderi* Mayr.

Note. Pycnidia covered with thin whitish tomentum make *Micarea fennica* very similar to *M. hedlundii* and *M. tomentosa*, but it differs from them by pale olive green, whitish green or greyish green color of thallus, the presence of micareic acid, and longer ascospores (10)10.5–12.0 μm [*M. hedlundii* – (6.5)7.5–9.0(12.0) μm , *M. tomentosa* – (6.5)7.5–9.0(9.5) μm according Czarnota (2007)]. In addition, *M. hedlundii* can be distinguished from *M. fennica* by the presence of Intrusa-yellow pigment in the thallus (K+ violet, C+ violet); and *M. tomentosa* unlike *M. fennica* has globose, sessile pycnidia. *Micarea fennica* is the closest relative to *M. prasina* s. str. (Launis, Myllys, 2019) which also produces micareic acid, but pycnidia of *M. prasina* s. str. are never conspicuously stalked. *Micarea fennica* with branched pycnidia can be confused with *M. botryoides*, but *M. botryoides* has a thin crusty thallus (not goniocysts) and K+ green pycnidial wall, and lacks secondary metabolites detectable by TLC (Czarnota, 2007).

The description of our samples does not differ from the description in the protologue (Launis, Myllys, 2019). In addition, for the first time we present data on apothecia, their internal structure, the presence of crystals and the size of the spores which are absent in the protologue.

Specimens examined. **Trans-Baikal Territory:** Kalarsky District, Kodar Ridge, right bank of Khadytkanda River, 56°44'53.9"N, 117°15'49.9"E, 1231 m a. s. l., rocks and larch forest on bank, on rotten wood stump of *Larix gmelinii*, 21 VI 2015, *Chesnokov 244* (LE); *ibid.*, 56°44'55.3"N, 117°15'50.3"E, 1230 m a. s. l., rocks and larch forest on bank, on rotten wood stump of *L. gmelinii*, 21 VI 2015, *Konoreva 282* (H). **Republic of Sakha (Yakutia):** Aldansky District, between Aldan River and Kulusunakh Lake, left bank of Aldan River, 58°36'59"N, 130°16'53"E, 247 m a. s. l., Erman's birch-spruce forest with *Duschekia fruticosa* (Rupr.) Pouzar, on rotten wood stump of *Picea obovata* Ledeb., 19 VII 2015, *Konoreva 671* (LE). **Kamchatka Territory:** Central Kamchatka, Mil'kovo District, ca. 11 km SW of Lazo, N foot of the Nikolka (Kunchokla) Mt., 55°26'30.1"N, 159°41'30.6"E; 92 m a. s. l., primeval spruce forest with *Sphagnum* mosses, on bark of *Larix cajanderi*, 17 VIII 2016, *Stepanchikova, Tagirdzhanova, Dyomina Nik-16* (H).

New for Russian Far East

Micarea botryoides (Nyl.) Coppins

Rare in Russia. In Russia, the species is known from the European part: Leningrad Region (Stepanchikova et al., 2017), Republic of Karelia (Alstrup et al., 2005; Fadeeva et al., 2007), Kaliningrad Region (Dedkov et al., 2006; Czarnota, 2007), Arkhangelsk Region (Tarasova et al., 2020); and Caucasus: Republic of Dagestan (Ismailov et al., 2019).

Specimens examined. **Khabarovsk Territory:** Ulchsky District, road 08A-10, 51°22'06.3"N, 140°06'18.1"E, 39 m a. s. l., larch-spruce-fir forest near road, on the root of conifers (bark), 21 IX 2018, *Chesnokov 116* (LE); *ibid.*, 2.4 km NW of Ostraya Mt., 51°33'48.9"N, 140°50'25.3"E, 151 m a. s. l., fir-spruce forest, on bark of coniferous tree stump, 25 IX 2018, *Chesnokov 197* (LE).

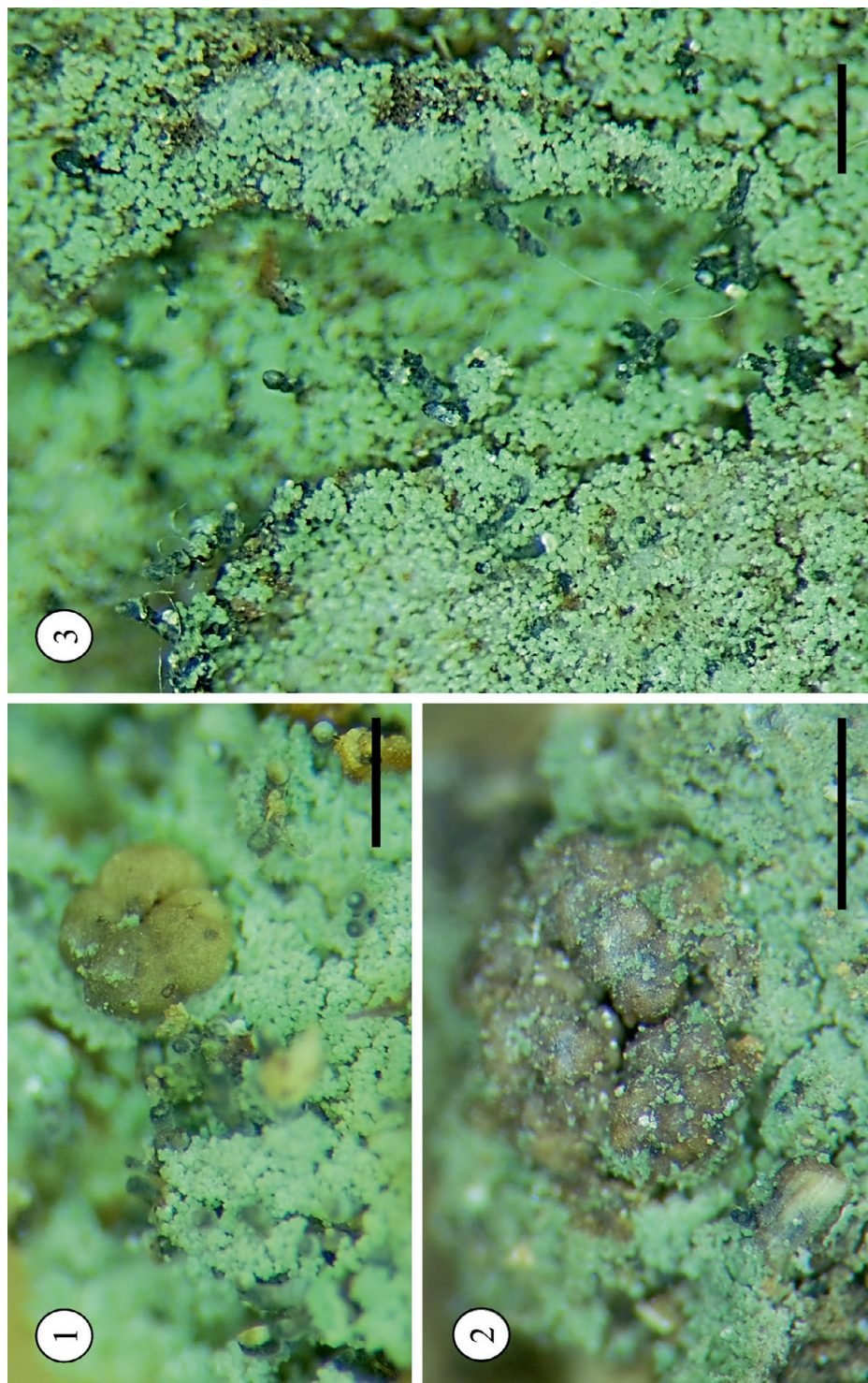


Plate I. *Micarea fennica*: 1 — apothecia and pycnidia, *Chesnokov 244* (LE); 2 — tuberculate apothecia, *Konoreva 282* (H); 3 — numerous pycnidia, *Stepanchikova, Tagirdzhanova, Dyomina Nik-16* (H). Scale bars: 1, 3 — 0.5 mm, 2 — 1.0 mm.

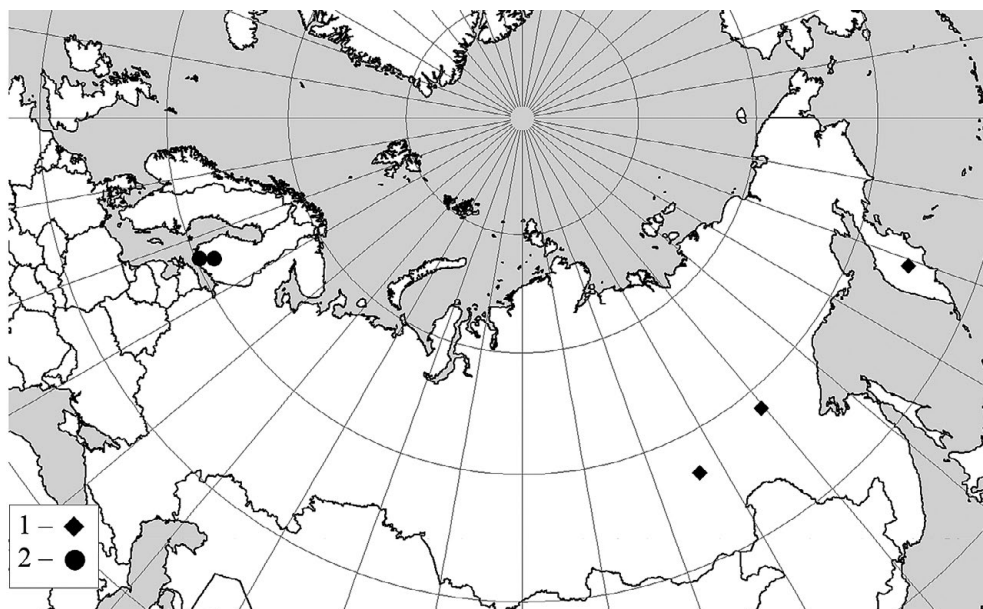


Fig. 2. Distribution of *Micarea fennica* in the world.
1 – our data, 2 – data from literature (Launis, Myllys, 2019).

New for southern Russian Far East

***Micarea misella* (Nyl.) Hedl.**

Previously reported for the Russian Far East only from Kamchatka Territory (Himmelbrant *et al.*, 2014).

Specimens examined. **Sakhalin Region:** Iturup Island, Ostrovnoy Reserve, Stokap Volcano, Kraterny Creek, 44°50'25.9"N, 147°17'44.7"E, 369 m a. s. l., fir forest on slope, on wood of *Abies sachalinensis* (F. Schmidt) Mast., 15 VIII 2017, *Konoreva 619* (LE). **Khabarovsk Territory:** Ulchsky District, 1.7 km W of Thabo Mt., 51°39'21.4"N, 140°53'45.9"E, 111 m a. s. l., spruce forest with mosses and *Pinus pumila* (Pall.) Regel, on rotten stump, 23 IX 2018, *Konoreva 276* (LE); *ibid.*, the vicinity of Shaman Mt., 51°27'29.1"N, 140°00'34.0"E, 154 m a. s. l., young fir forest with stumps and ferns, on stump of *Abies nephrolepis* (Trautv. ex Maxim.) Maxim., 20 IX 2018, *Konoreva 178* (LE).

***Micarea tomentosa* Czarnota et Coppins**

Previously reported for the Russian Far East only from Kamchatka Territory (Konoreva *et al.*, 2019).

Specimens examined. **Khabarovsk Territory:** Ulchsky District, between Arbat and Golubinaya Mts, 51°23'02.5"N, 140°42'26.9"E, 85 m a. s. l., larch forest, on tree stump, 24 IX 2018, *Konoreva 326* (LE); *ibid.*, road 08A-10, 51°22'06.3"N, 140°06'18.1"E, 39 m a. s. l., larch-spruce-fir forest near the road, on rotten stump of *Abies* sp., 21 IX 2018, *Chesnokov 117* (LE).

New for Khabarovsk Territory

Micarea adnata Coppins

Rare in Russia. Previously reported for the Russian Far East from Sakhalin Island (Konoreva *et al.*, 2019).

Specimens examined. **Khabarovsk Territory:** Ulchsky District, the vicinity of Shaman Mt., 51°28'17.5"N, 139°59'32.8"E, 260 m a. s. l., fir-spruce forest, on deadwood, 19 IX 2018, *Konoreva 162* (VBGI 103759); *ibid.*, on rotten wood, *Konoreva 158* (H); *ibid.*, Schumny Creek, 51°28'35.5"N, 139°59'17.0"E, 237 m a. s. l., fir forest, on rotten wood of *Abies* sp., 19 IX 2018, *Chesnokov 81* (LE); *ibid.*, 51°28'58.3"N, 140°00'23.1"E, 185 m a. s. l., spruce-fir forest, on wood, 20 IX 2018, *Konoreva 194* (LE); *ibid.*, on rotten decaying coniferous wood, *Chesnokov 105* (H).

Micarea contexta Hedl.

Rare in Russia. Previously reported for the Russian Far East from Sakhalin Island and Kamchatka Territory (Konoreva *et al.*, 2019).

Specimens examined. **Khabarovsk Territory:** Ulchsky District, the vicinity of Shaman Mt., 51°28'17.5"N, 139°59'32.8"E, 260 m a. s. l., fir-spruce forest, on rotten wood of *Abies* sp., 19 IX 2018, *Chesnokov 90* (LE); *ibid.*, 51°27'29.1"N, 140°00'34.0"E, 154 m a. s. l., young fir forest with stumps and ferns, on wood, 20 IX 2018, *Konoreva 181* (LE); *ibid.*, Schumny Creek, 51°28'35.5"N, 139°59'17.0"E, 237 m a. s. l., fir forest, on rotten *Abies* sp., 19 IX 2018, *Chesnokov 81* (LE); *ibid.*, Tabo Bay, 51°37'52.4"N, 140°52'39.7"E, 25 m a. s. l., spruce-larch forest with rowan, on stump of *Larix* sp., 22 IX 2018, *Chesnokov 126* (LE); *ibid.*, between Arbat and Golubinaya Mts, 51°23'20.4"N, 140°42'33.4"E, 94 m a. s. l., spruce-fir-larch forest, on dry tree, 24 IX 2018, *Konoreva 322* (LE).

Micarea hedlundii Coppins

Previously reported for the Russian Far East from Kamchatka Territory, Sakhalin and Shikotan Islands (Konoreva *et al.*, 2019).

Specimens examined. **Khabarovsk Territory:** Ulchsky District, the vicinity of Shaman Mt., Schumny Creek, 51°28'35.5"N, 139°59'17.0"E, 237 m a. s. l., fir forest, on wood, 19 IX 2018, *Konoreva 150* (LE); *ibid.*, 51°27'29.1"N, 140°00'34.0"E, 154 m a. s. l., young fir forest with stumps and ferns, on stump, 20 IX 2018, *Konoreva 182* (LE); *ibid.*, 51°28'58.3"N, 140°00'23.1"E, 185 m a. s. l., spruce-fir forest, on rotten stump of *Abies* sp., 20 IX 2018, *Chesnokov 104* (LE); *ibid.*, road 08A-10, headwater of Khanda River, 51°23'39.7"N, 140°16'30.6"E, 156 m a. s. l., fir-spruce forest, on rotten wood, 21 IX 2018, *Konoreva 224* (LE); *ibid.*, Tabo Bay, 51°38'05.2"N, 140°52'31.8"E, 42 m a. s. l., larch forest with mosses, on wood of *Larix* sp., 22 IX 2018, *Konoreva 244* (VBGI 103762); *ibid.*, on stump of *Larix* sp., *Chesnokov 131* (VBGI 103751); *ibid.*, 51°37'52.4"N, 140°52'39.7"E, 25 m a. s. l., spruce-larch forest with rowan, on rotten wood, 22 IX 2018, *Konoreva 232* (VBGI 103761); *ibid.*, on stump of *Larix* sp., *Chesnokov 126* (LE); *ibid.*, 1.7 km W of Tabo Mt., 51°39'21.4"N, 140°53'45.9"E, 111 m a. s. l., spruce forest with mosses and *Pinus pumila*, on rotten stump, 23 IX 2018, *Chesnokov 152* (LE) and *Konoreva 275* (LE); *ibid.*, 3.8 km E of Idol Mt., 51°42'32.3"N, 140°57'05.9"E, 114 m a. s. l., fir-spruce forest, on rotten stump, 23 IX 2018, *Chesnokov 154* (LE); *ibid.*, Severnaya Bay, 51°30'06.3"N, 140°49'22.1"E, 22 m a. s. l., fir forest, on rotten stump, 23 IX 2018, *Chesnokov 200* (H); *ibid.*, Sushchevsky Kluch River near the road, 51°46'37.3"N, 141°00'59.5"E, 65 m a. s. l., larch forest with *Ledum* sp. and mosses, on stump of *Larix* sp., 23 IX 2018, *Chesnokov 159* (VBGI 103755) and on fallen *Larix* sp., *Chesnokov 161* (LE); *ibid.*, neighborhood of Arbat Mt., 51°24'38.5"N, 140°42'51.8"E, 199 m a. s. l., fir-spruce

forest with *Vaccinium myrtillus* L., on rotten stump, 24 IX 2018, *Konoreva 306* (H), *308* (LE) and on stump of spruce, *Chesnokov 169* (LE); *ibid.*, between Arbat and Golubinaya Mts, 51°23'20.4"N, 140°42'33.4"E, 94 m a. s. l., spruce-fir-larch forest, on stump of *Larix* sp., 24 IX 2018, *Chesnokov 177* (VBGI 103757); *ibid.*, the vicinity of Tabo Bay, 51°37'02.9"N, 140°51'46.3"E, 91 m a. s. l., spruce-fir forest, on rotten stump, 25 IX 2018, *Chesnokov 192* (LE).

***Micarea melaena* (Nyl.) Hedl.**

Distribution in the Russian Far East: Kamchatka Territory (Himelbrant et al., 2019), Magadan Region (Kotlov, 1995), Primorye Territory (Skirina, 1996), and Sakhalin Island (Konoreva et al., 2018b).

Specimens examined. **Khabarovsk Territory:** Nikolaevsky District, 3.5 km E of Lysaya Mt., 51°54'27.7"N, 141°07'57.3"E, 90 m a. s. l., spruce forest, on rotten wood of *Picea* sp., 23 IX 2018, *Chesnokov 168* (LE); Ulchsky District, Tabo Bay, 51°38'05.2"N, 140°52'31.8"E, 42 m a. s. l., larch forest with mosses, on wood of *Larix* sp., 22 IX 2018, *Chesnokov 132* (LE); *ibid.*, Sushchevsky Kluch River near the road, 51°46'37.3"N, 141°00'59.5"E, 65 m a. s. l., larch forest with *Ledum* sp. and mosses, on stump of *Larix* sp., 23 IX 2018, *Chesnokov 159* (VBGI 103756); *ibid.*, neighborhood of Arbat Mt., 51°24'38.5"N, 140°42'51.8"E, 199 m a. s. l., fir-spruce forest with *Vaccinium myrtillus*, on wood, 24 IX 2018, *Konoreva 308, 313* (LE) and on stump of *Picea* sp., *Chesnokov 169* (LE); *ibid.*, between Arbat and Golubinaya Mts, 51°23'20.4"N, 140°42'33.4"E, 94 m a. s. l., spruce-fir-larch forest, on stump, 24 IX 2018, *Konoreva 316* (LE) and on dry tree, *Konoreva 322* (LE); *ibid.*, 51°23'02.5"N, 140°42'26.9"E, 85 m a. s. l., larch forest, on stump, 24 IX 2018, *Konoreva 326* (LE).

***Micarea peliocarpa* (Anzi) Coppins et R. Sant.**

Previously reported for the Russian Far East from Primorye Territory (Skirina, 1996).

Specimens examined. **Sakhalin Region:** Iturup Island, Ostrovnoy Reserve, neighborhood of Iodny Cape, Iodny village, 44°43'23.7"N, 147°21'31.5"E, 30 m a. s. l., abandoned border post, on rotten wood, 17 VIII 2017, *Konoreva 669, 670* (LE); Shikotan Island, neighborhood of Malokurilsk, 43°52'16.1"N, 146°50'36.9"E, 96 m a. s. l., fir-yew-Erman's birch forest with maple, on wood, 11 VI 2017, *Konoreva 291* (LE); *ibid.*, neighborhood of Malaya Tserkovnaya Bay, 43°43'42"N, 146°40'28.4"E, 66 m a. s. l., larch forest with *Sasa kurilensis* (Rupr.) Makino et Shibata, on wood, 13 VI 2017, *Konoreva 314* (LE); *ibid.*, neighborhood of Gorobets Mt., 43°48'37.9"N, 146°42'58"E, 28 m a. s. l., mossy rocks on the left bank of river, on wood, 17 VI 2017, *Konoreva 413* (LE). **Khabarovsk Territory:** Nikolaevsky District, 3.5 km east of Lysaya Mt., 51°54'27.7"N, 141°07'57.3"E, 90 m a. s. l., spruce forest, on rotten wood of *Picea* sp., 23 IX 2018, *Chesnokov 168* (LE); Ulchsky District, vicinity of Shaman Mt., 51°28'58.3"N, 140°00'23.1"E, 185 m a. s. l., spruce-fir forest, on rotten wood of coniferous tree, 20 IX 2018, *Chesnokov 105* (H, VBGI 103750) and on rotten stump, 20 IX 2018, *Chesnokov 107* (LE). **Kamchatka Territory:** Central Kamchatka, Mil'kovo District, ca. 33 km NWW of Dolinovka, E foot of Sredinny Ridge, basin of the Bolshaya Kimitina River, 55°12'21.2"N, 158°34'59.8"E, 294 m a. s. l., old-growth spruce forest with mosses and ferns, on lignum of *Picea jezoensis* (Siebold et Zucc.) Carr., 25 VIII 2016, *Stepanchikova, Tagirdzhanova, Dyomina Kim-2* (LE); *ibid.*, 55°11'19.0"N, 158°37'34.7"E, 275 m a. s. l., old-growth spruce forest with *Sphagnum* mosses, on lignum of *Picea jezoensis*, 25 VIII 2016, *Stepanchikova, Tagirdzhanova, Dyomina Kim-1* (LE); Eastern Kamchatka, Elizovo District, Kronotsky Nature Reserve, Valley of Geysers, 54°26'13"N, 160°08'05"E, 616 m a. s. l., thermal area, on mosses and soil, 27 VIII 2013, *Himelbrant, Stepanchikova Pk9-11, Pk5* (LE).

Micarea prasina Fr. s. str.

Distribution in the Russian Far East: Kamchatka Territory (Himmelbrant *et al.*, 2014, 2019), Jewish Autonomous Region (Skirina, 2015), and Shikotan Island (Inсарov, Pchelkin, 1988).

Specimens examined. **Khabarovsk Territory:** Ulchsky District, the vicinity of Shaman Mt., 51°28'17.5"N, 139°59'32.8"E, 260 m a. s. l., fir-spruce forest, on rotten stump of *Abies* sp., 19 IX 2018, *Chesnokov* 90 (H); *ibid.*, 51°27'29.1"N, 140°00'34.0"E, 154 m a. s. l., young fir forest with stumps and ferns, on rotten stump of *Abies nephrolepis*, 20 IX 2018, *Chesnokov* 98 (H), 99 (LE) and *Konoreva* 178, 179 (LE), 182 (VBGI 103760); *ibid.*, 51°28'58.3"N, 140°00'23.1"E, 185 m a. s. l., spruce-fir forest, on rotten stump, 20 IX 2018, *Chesnokov* 104 (LE), 107 (H); *ibid.*, 2 km S of the road 08A-10, Yai River, 51°20'51.0"N, 140°05'26.2"E, 47 m a. s. l., spruce-fir forest with birch, on rotten stump, 21 IX 2018, *Chesnokov* 115 (LE); *ibid.*, Tabo Bay, 51°38'05.2"N, 140°52'31.8"E, 42 m a. s. l., larch forest with mosses, on stump of *Larix* sp., 22 IX 2018, *Chesnokov* 131 (LE), 132 (VBGI 103752); *ibid.*, 51°37'52.4"N, 140°52'39.7"E, 25 m a. s. l., spruce-larch forest with rowan, on stump of *Larix* sp., 22 IX 2018, *Chesnokov* 126 (LE); *ibid.*, 51°37'30.0"N, 140°52'28.5"E, 1 m a. s. l., birch-alder-spruce forest on slope, on stump, 22 IX 2018, *Chesnokov* 145 (H); *ibid.*, 1.7 km W of Tabo Mt., 51°39'21.4"N, 140°53'45.9"E, 111 m a. s. l., spruce forest with mosses and *Pinus pumila*, on rotten stump, 23 IX 2018, *Konoreva* 276 (LE) and *Chesnokov* 151 (VBGI 103753); *ibid.*, 3.8 km E of Idol Mt., 51°42'32.3"N, 140°57'05.9"E, 114 m a. s. l., fir-spruce forest, on rotten stump, 23 IX 2018, *Chesnokov* 154 (VBGI 103754); *ibid.*, Sushchevsky Kluch River near the road, 51°46'37.3"N, 141°00'59.5"E, 65 m a. s. l., larch forest with *Ledum* sp. and mosses, on fallen *Larix* sp., on stump of *Larix* sp., 23 IX 2018, *Chesnokov* 160, 161 (LE); *ibid.*, between Arbat and Golubinaya Mts, 51°23'20.4"N, 140°42'33.4"E, 94 m a. s. l., spruce-fir-larch forest, on stump, 24 IX 2018, *Konoreva* 316, 319 (LE), on dry tree, *Konoreva* 322 (LE) and on stump of *Larix* sp., *Chesnokov* 177 (VBGI 103758); *ibid.*, 51°23'02.5"N, 140°42'26.9"E, 85 m a. s. l., larch forest, on stump, 24 IX 2018, *Konoreva* 326 (LE); *ibid.*, neighborhood of Arbat Mt., 51°24'38.5"N, 140°42'51.8"E, 199 m a. s. l., fir-spruce forest with *Vaccinium myrtillus*, on stump of *Picea* sp., 24 IX 2018, *Chesnokov* 169 (LE) and on rotten stumps, *Konoreva* 306 (LE), 314 (VBGI 103763).

Discussion

Micarea species are often overlooked by researchers due to the lack of knowledge of their ecological preferences. They can grow on a wide range of predominantly acidic substrates — bark, wood, rotting wood, soil, bryophytes, plant detritus, rocks, and human-made substrates (Coppins, 1983; Czarnota, 2007; Smith *et al.*, 2009; McCune, 2017). All species we found grew on their typical substrates — rotten wood and bark of conifers.

The richest worldwide in the number of recorded *Micarea* species are virgin and old-growth forests of North America (Barton, Lendemer, 2014; McCune, 2017; Sprille *et al.*, 2020; etc.), Europe (Czarnota, 2007; Smith *et al.*, 2009; Mylly, Launis, 2018; Launis *et al.*, 2019a, b; Launis, Mylly, 2019; etc.) including European Russia (Alstrup *et al.*, 2005; Dedkov *et al.*, 2006; Fadeeva *et al.*, 2007; Stepanchikova *et al.*, 2017; Tarasova *et al.*, 2020; etc.), Siberia (Konoreva *et al.*, 2018a), and north of the Russian Far East (Himmelbrant *et al.*, 2014, 2019). However, in the south of the Russian Far East, according to our observations and collected material (Konoreva *et al.*, 2019, 2020; this paper), *Micarea* species were much more often found in secondary forests

formed on the sites of old felling, in young spruce-fir forests and mixed forests with conifers. In mixed forests, *Micarea* species were observed on bark and wood of deciduous trees. In old-growth forests, *Micarea* were less common, apparently, due to moisture, lighting, rapid decomposition of wood, and the inability to compete with mosses and other lichen species.

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