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Lichen genus *Micarea* Fr. in Asian Part of Russia. Sakha Republic (Yakutia) and Trans-Baikal Territory

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Summary. Fourteen species of *Micarea* Fr. were found in the Sakha Republic (Yakutia) and northern part of Trans-Baikal Territory. *M. prasina* and *M. denigrata* groups were identified by studying the lichen substances using standard technique of thin-layer chromatography (TLC) in solvent systems A and B. *M. tomentosa* Czarnota et Coppins is new to Eastern Siberia and *M. incrassata* Hedl. – to South Siberia. *M. hedlundii* Coppins, *M. lignaria* (Ach.) Hedl., *M. tomentosa* and *M. incrassata* are reported for the first time from Trans-Baikal Territory and *M. elachista* (Körb.) Coppins et R. Sant. – from Sakha Republic (Yakutia). *M. cinerea* (Schaer.) Hedl. and *M. cf. pseudomarginata* Coppins are given only according to literature data, because the original materials were unavailable to find or examined. Distribution in the territory of Sakha Republic (Yakutia) and Trans-Baikal Territory has been clarified for most of the listed species. Identification key, notes with diagnostic features and distribution data with maps for each species are provided. According to the results of our studies Asian part of Russia is much richer with lichens of the genus *Micarea* than it was previously known. Samples were deposited in the herbaria of Helsinki (H), the Komarov Botanical Institute (LE) and the Altai State University (ALTB).

Лишайники рода *Micarea* Fr. в азиатской части России. Республика Саха (Якутия) и Забайкальский край

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Ключевые слова: Восточная Сибирь, лишенизированные грибы, новые находки, распространение.

Аннотация. В Республике Саха (Якутия) и северной части Забайкальского края было обнаружено 14 видов лишайников из рода *Micarea* Fr. Группы *M. prasina* и *M. denigrata* определялись посредством изучения лишайниковых веществ с использованием стандартных методов тонкослойной хроматографии (TLC) в системах А и В. *M. tomentosa* Czarnota et Coppins впервые указан для Восточной Сибири, *M. incrassata* Hedl. – для Южной Сибири. *M. hedlundii* Coppins, *M. lignaria* (Ach.) Hedl., *M. tomentosa* и *M. incrassata* впервые приводятся для Забайкальского края; *M. elachista* (Körb.) Coppins et R. Sant. – для Республики Саха (Якутия). *M. cinerea* (Schaer.) Hedl. и *M. cf. pseudomarginata* Coppins указаны только по литературным данным, образцы не были изучены, поскольку они утеряны или недоступны. Дополнено и уточнено распространение большинства видов, приведенных в списке. Подготовлен ключ для определения видов, комментарии с диагностическими признаками и данными о распространении, включая карты, для каждого вида. Согласно результатам наших исследований, в азиатской части России встречается гораздо больше лишайников рода *Micarea*, чем было известно ранее. Изученные образцы хранятся в Гербариях Университета Хельсинки (H), Ботанического института им. В. Л. Комарова РАН (LE) и Алтайского государственного университета (ALTB).

Introduction

The Trans-Baikal Territory and Sakha Republic (Yakutia) occupy a large part of North-Eastern Siberia and located within arctic, subarctic and temperate zones. The climate of both regions is sharply continental. The amplitude of absolute temperatures in places is 100–105 °C, while absolute minimal temperature is –65 °C, and absolute maximal temperature is +40 °C. North-Eastern Siberia has a very diverse landscape. Mountain ranges, plateaus and lowlands are located within it (Gvozdetskiy, Mikhaylov, 1963).

The lichen flora of Trans-Baikal Territory and Sakha Republic (Yakutia) is still poorly investigated. Only local lichen floras of regions are well studied, for example, the Kodar Range in the Trans-Baikal Territory, the Arctic regions of Yakutia, and various specially protected natural areas (Sohondinskiy Biosphere Reserve, Daursky Reserve, Olekminsky Reserve, Suntar-Hayata Reserve). At the moment about 900 species of lichens are known for the Trans-Baikal Territory (Makryi, 2002, 2005, 2007a, b, 2012, 2013, 2014a, b; Urbanavichus, Urbanavichene, 2002; Makryi, Lishtva, 2005; Davydov et al., 2011; Konoreva, Andreev, 2013; Chesnokov, Konoreva, 2015; Chesnokov, Lishtva, 2016; Vondrák et al., 2016; Zhurbenko et al., 2016; Chesnokov et al., 2017a; Konoreva, Chesnokov, 2017) and about 860 lichen species are given for Yakutia (Andreev, 2004; Poryadina, 2005; Zhurbenko et al., 2005; Søchting, Figueras, 2007; Zhurbenko, Vershinina, 2014; Ahti et al., 2015; Chesnokov et al., 2015, 2016, 2017b; Vershinina et al., 2015; Konoreva et al., 2016; Konoreva, Chesnokov, 2017).

The genus *Micarea* Fr. includes lichens with crustose warted-areolate or immersed, effuse, of ± spherical granules (goniocysts) thallus, a predominantly “micareoid” photobiont, very small apothecia, with or without an exciple. Asci defined by an

apical structure in K/I with blue outer layer and apical dome and unstained wall; the apical dome with an apical cushion that in some species is surrounded by a faint to distinct dark cylindrical 'tube-structure'. Spores are simple or transversely septated, asci 8-spored (Smith et al., 2009). Currently, more than 100 species of *Micarea* occupying different substrates are distributed throughout the world (Czarnota, 2007; Smith et al., 2009). Thirty four species of *Micarea* are known for Russia, of which only 21 species are reported for Asian part; most Asian species from only 1–2 localities. For the Trans-Baikal Territory two species were known to date (Makryi, 2002; Makryi, Lishtva, 2005), and seven for the Sakha Republic (Yakutia) (Gorodkov, 1956; Afonina et al., 1979; 1980; Andreev, 1983; Makarova, Perfilova, 1985; Makarova et al., 1988; Makarova, 1989, 1998; Poryadina, 1999, 2001, 2005, 2006; Zhurbenko et al., 2005; Vershinina et al., 2015). Until now Europe was considered as the center of *Micarea* diversity because the most significant studies of this genus were devoted to this part of the world (Coppins, 1983; Czarnota, 2007, 2011; etc.). Asia was omitted to date.

Material and methods

About 80 specimens of *Micarea* were collected during the expedition 2013–2015 in Trans-Baikal Territory (Kodar Range) and 2015–2016 in Sakha Republic (Yakutia) (Fig. 1). In the laboratory handmade apothecial sections were examined in water with a light microscopes MBS-10 and microscope Zeiss Primo Star. Lichen substances were identified by using the standard technique of thin-layer chromatography (TLC) in solvent systems A and B (Orange et al., 2001). Spot tests were made with 10 % of KOH (K), Ca(ClO)₂ (C) and C₆H₄(NH₂)₂ (P). For photographs of lichen specimens we used the microscope Axio Scope A1 Carl Zeiss. Samples were

deposited in the herbaria of Helsinki (H), the Komarov Botanical Institute (LE) and the Altai State University (ALTB, Barnaul).

Results and discussion

Twelve species of *Micarea* were found in the studied area. Identification key, notes with diagnostic features and mapped distribution data for each species are provided. *M. cf. pseudomarginata* Coppins and *M. cinerea* (Schaer.) Hedl. was not revised because the specimens are unavailable to find or examined and these species were cited here only on the literature data (Makryi, 2002; Poryadina, 2006). *Micarea submilliaria* (Nyl.) Coppins reported earlier by us from Trans-Baikal Territory as new species to Russia (Konoreva, Chesnokov, 2016) has been also included. Finally, *M. tomentosa* Czarnota et Coppins was found to be new to Eastern Siberia and Trans-Baikal Territory, *Micarea hedlundii* Coppins and *M. lignaria* (Ach.) Hedl. are reported here for the first time from Trans-Baikal Territory, *M. elachista* (Körb.) Coppins et R. Sant. from Sakha Republic (Yakutia) and *M. incrassata* Hedl. – from South Siberia and Trans-Baikal Territory. The distribution on the territory of Eastern Siberia was clarified for most of the listed species. They are much more widespread than it was mentioned in the literature (Lishtva, 2000; Makryi, 2002; Makryi, Lishtva, 2005; Poryadina, 2005; Vershinina et al., 2015; etc.).

Key for the species of the *Micarea* Fr. genus in Sakha Republic (Yakutia) and Trans-Baikal Territory

1. Thallus or apothecia C+ red 2
—Thallus and apothecia C– 5
2. Thallus Pd+ yellow (alectorialic acid), on soil or decaying bryophytes in high mountains
..... *M. submilliaria*
—Thallus Pd– 3
3. Hypothecium dark purplish-black
..... *M. melaena*
—Hypothecium hyaline 4
4. Spores (0)1-septate *M. denigrata*
—Spores (3–) 5–7-septate *M. cinerea*
5. Hypothecium dark coloured 6
—Hypothecium pale 8
6. Thallus with cephalodia, on soil and plant debris in high mountains 7
—Thallus without cephalodia, on rock
..... *M. cf. pseudomarginata*
7. Thallus grey-white, grey-brown to dark grey, hypothecium dark red-brown (no purple tinge), K–,

- N± bright orange-brown *M. incrassata*
—Thallus whitish, hypothecium purple-brown, K± purple intensifying or K± dark green, N± purple-red *M. assimilata*
8. Thallus well developed, Pd+red (argopsin), spores 3–7-septate, hypothecium pale to slightly olivaceous or brownish pigmentation
..... *M. lignaria*
—Thallus Pd– or thallus thin, inconspicuous, spores 0–1-septate, hypothecium hyaline 9
 9. Pycnidia stalked 10
—Pycnidia not stalked 12
 10. Pycnidia black, without tomentum, thallus endoxylic or inconspicuous *M. misella*
—Pycnidia brown, whitish tomentose, thallus of goniocysts 11
 11. Goniocysts containing orange-brown, K+ violet droplets *M. hedlundii*
—Goniocysts without orange-brown droplets, K– *M. tomentosa*
 12. Micareic or methoxymicareic acid present, apothecia whitish grey to pale brown 13
—No substances detected by TLC, apothecia brown to brown-black *M. elachista*
 13. Micareic acid present
..... *M. prasina* s. str.
—Methoxymicareic acid present
..... *M. micrococca* s. str.

Micarea assimilata (Nyl.) Coppins (Fig. 2A).

It differs from *M. incrassata* in whitish thallus, more prominent apothecia, purple-brown hypothecium, K± purple intensifying or (especially above) K± dark green, N± purple-red. *M. incrassata* is characterized by grayish to gray-brown thallus and dark red-brown, K–, N± bright orange-brown hypothecium without purple tinge.

It was known from Sakha Republic – Ust-Yanskiy district, Kotelnyy Island (Gorodkov, 1956) as *Lecidea assimilata* Nyl., Momskiy district (Afonina et al., 1979, 1980) as *Lecidea assimilata*, Nizhnekolymskiy district, Chetyryekhstolbovyy Island (Andreev, 1983) as *Lecidea assimilata*, Nizhnekolymskiy district (Andreev, 1984) as *Lecidea assimilata*, Anabarskiy district (Makarova, Perfileva, 1985 as *Lecidea assimilata*; Poryadina, 2005), Bolshoy Lyakhovskiy Island (Makarova et al., 1988).

Revision of previously published records from Bulunskiy district (Makarova, 1989, 1998) showed that the specimens belong to *Micarea incrassata* Hedl. (Makarova, 1989) and *Bilimbia lobulata* (Sommerf.) Hafellner et Coppins (Makarova, 1998). This species is given according to only literature

data due to the remaining original material was not found.

Ecology: The species was found to grow in tundra and alpine communities on soil or plant debris.

Distribution in Siberia: Altai Territory, Kemerovo Region, Altai Republic (Sedelnikova, 2013, 2017), Krasnoyarsk Territory, Tyva Republic, Khakassia Republic (Sedelnikova, 2013), Yamal and Gydan Peninsulas, Khanty-Mansi Autonomous Area (Sedelnikova, 2017).

***Micarea cinerea* (Schaer.) Hedl. (Fig. 2B).**

It is characterized by the (3–)5–7-septate ascospores and C+ red reaction of apothecial sections. May be confused with *M. alabastrites* (Nyl.) Coppins and *M. peliocarpa*, which have 3-septate ascospores,

and with *M. lignaria* which differs in black immarginate apothecia, Pd+ rusty red thallus and C– apothecial sections. *M. alabastrites* and *M. peliocarpa* weren't found in Siberia. However, they are possible to find in the Siberia due to their worldwide distribution.

It was known from Sakha Republic (Yakutia) – Lenskiy district (Poryadina, 2006) as *Bacidia cinerea* (Schaer.) Trevis. This species is given according to only literature data due to the original material has been lost. Probably the specimens were incorrectly reported.

Distribution in Siberia: Altai Territory, Kemerovo Region, Novosibirsk Region, Altai Republic (Sedelnikova, 2013, 2017), Krasnoyarsk Region, Tyva Republic, Khakassia Republic (Sedelnikova, 2013),

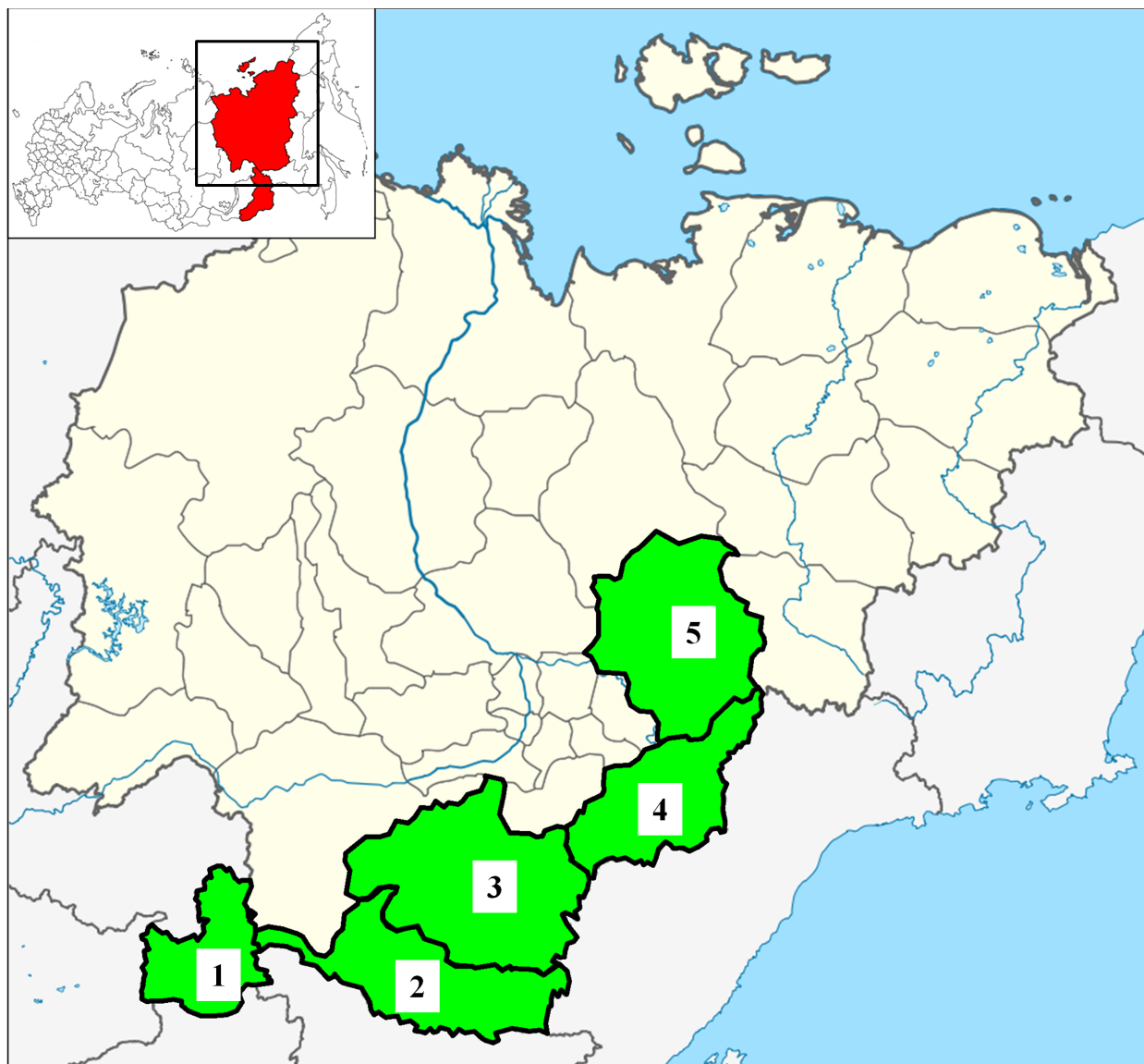


Fig. 1. Investigated area. Trans-Baikal Territory (1) and Sakha Republic (Yakutia) (2–4): 1 – Kalarsky district; 2 – Neryungri district; 3 – Aldan district; 4 – Ust'-Maysky district; 5 – Tomponsky district.

Tyumen Region, Khanty-Mansi Autonomous Area (Sedelnikova, 2017), Tomsk Region (Kovaleva, 2004).

Micarea denigrata (Fr.) Hedl. (Fig. 2C).

Photobiont micareoid, cells globose, 5–7.5 µm diam. (5–7(–8) µm diam. according to Czarnota, 2007). Apothecia whitish-grey to greyish-black and black, 0.2–0.4 mm diam. (0.1–0.5 mm diam. according to Czarnota, 2007). Epitheciium pale greyish to grey-brownish; K+ violet, C+ red violet. Hymenium 42.5–45 µm tall ((25–)30–40 µm tall according to Coppins, 1983). Asci clavate, 32.5 × 12.5 µm (28–36 × 9–12 µm according to Coppins, 1983). Ascospores (0–)1-septate, 7.5–8(–11) × 2.5–3.5 µm ((6–)8–14(–18) × 2–3.5(–4) µm according to Czarnota, 2007). The species is characterized by the C+ orange-red reaction of apothecial sections and 0–1-septate ascospores. Differs from *M. nitschkeana* in spores (3-septate in *M. nitschkeana*); from *M. misella* in immersed to ±emergent pycnidia (stalked in *M. misella*) and C+ intensive red reaction of apothecial sections (C± violet in *M. misella*); from *M. micrococca* and *M. prasina* in thallus morphology (thallus of gonocysts in *M. micrococca* and *M. prasina*). *M. nitschkeana* until wasn't found in Siberia. However, it is possible to find in the Siberia due to their worldwide distribution.

It was known from Sakha Republic (Yakutia) – Olekminsky district (Vershina et al., 2015).

Chemistry. TLC: gyrophoric acid.

Ecology: widely distributed in natural forest communities as well as in agricultural areas and settlements. It occurs on bark, wood and rotten stumps mainly coniferous trees, sometimes on deciduous trees.

Distribution in Siberia: Altai Territory, Novosibirsk Region, Kemerovo Region, Altai Republic (Sedelnikova, 2013, 2017), Krasnoyarsk Region, Tyva Republic, Khakassia Republic (Sedelnikova, 2013), Tomsk Region, Omsk Region, Tyumen Region, Khanty-Mansi Autonomous Area (Sedelnikova, 2017), Yamalo-Nenets Autonomous Area (Zhdanov, 2009).

Specimens examined: **Sakha Republic (Yakutia)**: “Aldan district, Lenskiy creek, 58°34'28"N, 125°32'7"E, alt. 763 m, *Picea obovata* forest with *Larix gmelinii* and *Pinus pumila*, on rotten wood and wood of *Pinus pumila*. 06 VII 2015, leg. L. A. Konoreva (LE) and S. V. Chesnokov (LE)”; *ibid.*, “left bank of Aldan river, 58°36'59"N, 130°16'53"E, alt. 247 m, *Betula ermanii*-*Picea obovata* forest

with *Duschekia fruticosa* between Aldan river and Kulusunakh lake, on lignum. 19 VII 2015, leg. L. A. Konoreva” (LE); “Tomponskiy district, right bank of Vostochnaya Khandyga river, 2.5 km west of Atmole river, 500 m from the road P-504 up the creek, 63°08'16.1"N, 138°46'33.5"E, alt. 765 m, creek canyon with *Larix gmelinii*, *Betula* sp., *Populus* sp. and *Salix* sp., on rotten wood. 17 VII 2016, leg. L. A. Konoreva” (LE); **Trans-Baikal Territory**: “Kalarskiy district, Kodar Ridge, Sredniy Sakukan River, *Larix gmelinii* forest with *Populus suaveolens* on the left bank, 56°53'54.7"N, 117°57'48.1"E, alt. 907 m, on rotten wood. 20 VI 2014, leg. L. A. Konoreva” (LE-L14996); *ibid.*, “Kodar Ridge, Sulban River, *Picea obovata*-*Betula* sp.-*Larix gmelinii* forest on the left bank, 56°40'12"N, 117°10'38"E, alt. 1054 m, on rotten wood. 23 VI 2015, leg. S. V. Chesnokov” (LE).

Micarea elachista (Körb.) Coppins et R. Sant. (Fig. 2D).

Thallus is poorly developed. Photobiont micareoid, cells globose, 5–8 µm in diam (5–7(–8) µm diam. according to Czarnota, 2007). Apothecia immarginate, brown to dark brown, 0.2–0.4 mm (0.1–0.4(0.6) mm according to Czarnota, 2007), epitheciium well defined, up to 10–15 µm (15(–20) µm wide according to Czarnota, 2007), brownish or dark brown, K+ slightly violet tinge, hymenium 35–50 µm tall (30–50 µm tall according to Czarnota, 2007), hypothecium hyaline, ascospores 0–1-septate, (8–)10–11 × 2.5–3 µm ((8–)10–18(–20) × 2–3.5 µm according to Czarnota, 2007). Pycnidia not found. The species is identifying by the 'Elachista-brown' pigment dissolving in K within the epitheciium and C– apothecial section.

Chemistry. TLC was not performed.

Ecology: in shady, humid conditions. On the rotten wood, stumps or bark of coniferous trees, on the decaying mosses (Coppins, 1983; Czarnota, 2007; Smith et al., 2009).

Distribution: Kemerovo Region, Altai Republic (Sedelnikova, 2013, 2017), Tyumen Region, Khanty-Mansi Autonomous Area, Yamalo-Nenets Autonomous Area (Sedelnikova, 2017), Krasnoyarsk Region (Zhdanov, 2013), Sakha Republic (Yakutia) (Chesnokov et al., 2016)

Specimen examined: **Sakha Republic (Yakutia)**: “Aldan district, Moisey bare mountain, Besprizornyy creek, 58°27'53"N, 125°31'9"E, alt. 957 m, stone slope, on rotten wood of *Pinus pumila*. 05 VII 2015, leg. L. A. Konoreva” (LE-L14979).

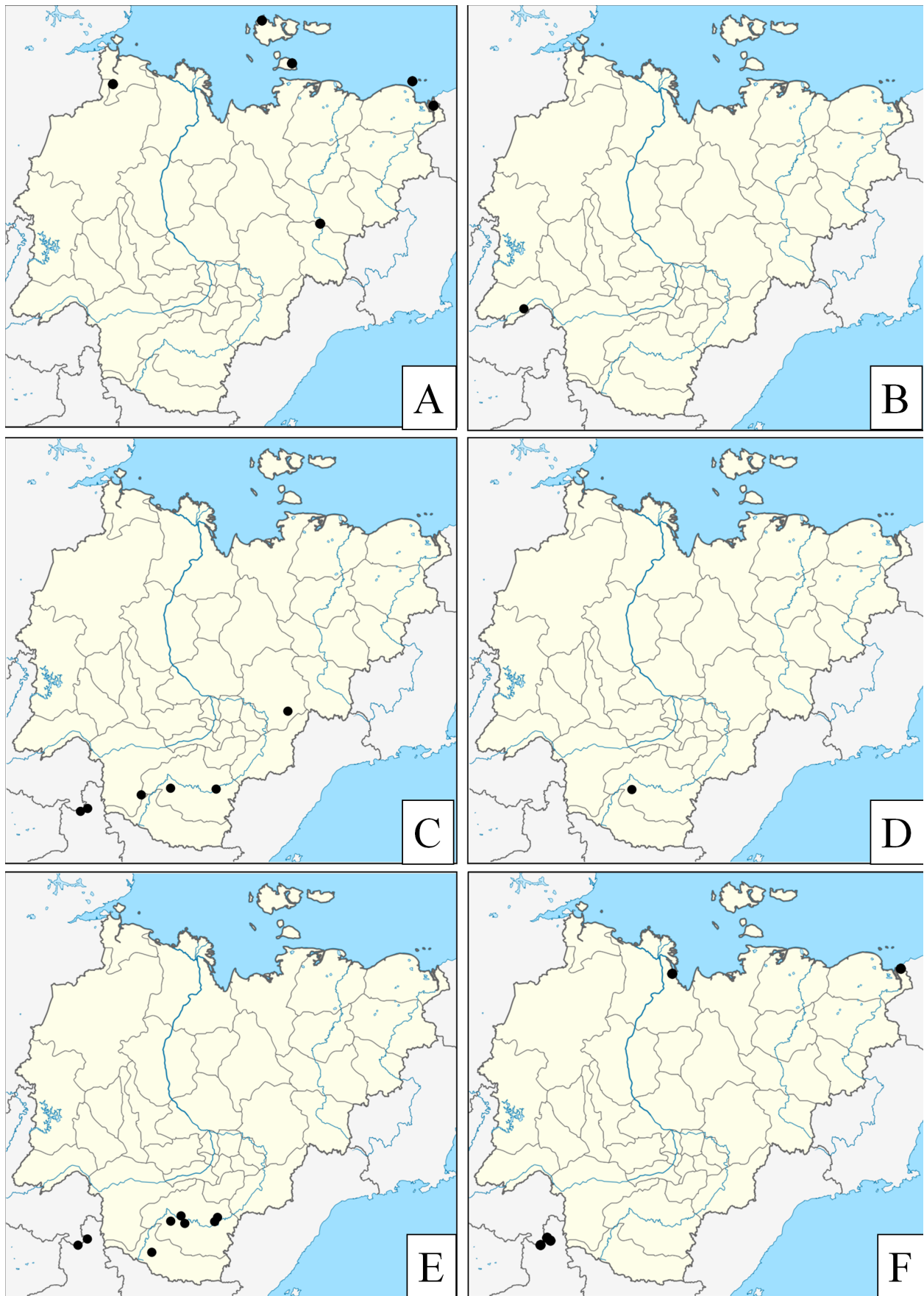


Fig. 2. Distribution of *Micarea* spp. (dots) in Trans-Baikal Territory and Sakha Republic (Yakutia): A – *M. assimilata* (Nyl.) Coppins; B – *M. cinerea* (Schaer.) Hedl.; C – *M. denigrata* (Fr.) Hedl.; D – *M. elachista* (Körb.) Coppins et R. Sant.; E – *M. hedlundii* Coppins; F – *M. incrassata* Hedl.

Micarea hedlundii Coppins (Fig. 2E).

Thallus effuse, granular, sorediose, with a gel-matrix contains ±orange, K+ violet, C+ violet oil droplets. Photobiont micareoid; algal cells 5–7.5 µm diam. (4–8 µm diam. according to Czarnota, 2007). Apothecia immarginate, 0.2–0.25 mm diam. (0.2–0.4 mm diam. according to Czarnota, 2007), brownish to dull brown. Epithecium brownish; hymenium 42.5–50(–55) µm tall (35–45 µm tall according to Czarnota, 2007), hyaline. Asci cylindrical, 30–32.5 × 7.5–10 µm (35–40 × 9–12 µm according to Czarnota, 2007). Ascospores 0–1-septate, 10–12 × 2.5–3.5 µm ((6.5–)7.5–9(–12) × (2.5–)3–4(–4.5) µm according to Czarnota, 2007). It is identified by the stalked, whitish tomentose pycnidia and the presence of orange-yellow, K± purple-violet oily droplets in the matrix of goniocysts.

Chemistry: no substances detected by TLC.

Ecology: This species prefers shady, humid forest conditions, strictly lignicolous, on rotten wood and stumps.

Distribution: Komi Republic (Pystina, 2001; Hermansson et al., 2006), Leningrad Region (Stepanchikova et al., 2011), Center of European Russia (Muchnik, 2015), Sakha Republic (Yakutia) (Chesnokov et al., 2016), Tver Region (Notov et al., 2016).

Specimens examined: **Sakha Republic (Yakutia):** “Neryungri district, Neryungri neighborhood, 4 km south of the “Serebryanny bor” village, 56°38'43"N, 124°48'59"E, alt. 836 m, *Larix gmelinii*-*Pinus sylvestris*-*Pinus sibirica*-*Alnus* sp. forest, on rotten wood. 30 VI 2015, leg. L. A. Konoreva” (LE); “Aldan district, Lenskiy creek, 58°34'28"N, 125°32'7"E, alt. 763 m, *Picea obovata* forest with *Larix gmelinii* and *Pinus pumila*, on rotten wood. 06 VII 2015, leg. L. A. Konoreva” (LE); *ibid.*, “near the village of Zarechnyy, 58°39'56.9"N, 126°14'04.4"E, alt. 702 m, slope with *Betula* sp.-*Larix gmelinii* forest and stone rubble and logs on the slope, on wood of *Larix gmelinii*. 11 VII 2015, leg. S. V. Chesnokov” (H); *ibid.*, “left bank of Yllymakh, 58°35'01"N, 126°41'55"E, alt. 378 m, rocks in *Betula* sp.-*Larix gmelinii* forest, on rotten wood. 12 VII 2015, leg. S. V. Chesnokov (LE) and L. A. Konoreva (LE-L14994)”; *ibid.*, “left bank of Aldan, opposite the mouth Timpton, 58°44'11"N, 127°10'31"E, alt. 229 m, rocks, on wood. 15 VII 2015, leg. L. A. Konoreva” (LE-L14985); *ibid.*, “left bank of Aldan river, 58°36'59"N, 130°16'53"E, alt. 247 m, *Betula ermanii*-*Picea obovata* forest with *Duschekia fruticosa* between Aldan river and Kulusunah lake, on rotten wood. 19 VII 2015, leg. L. A. Konoreva” (LE);

ibid., “left bank of Aldan, confluence of Yungyuele and Aldan rivers, 58°48'25"N, 130°33'44"E, alt. 221 m, *Picea obovata* forest with *Larix gmelinii*, *Betula ermanii* and *Salix* sp., on rotten wood. 19 VII 2015, leg. L. A. Konoreva” (LE); “Tomponsky district, right bank of Vostochnaya Khandyga river, 600 m from the road P-504 up the creek, 63°08'21.2"N, 138°46'39.8"E, alt. 804 m, moss-covered slope with *Betula* sp., on rotten wood. 17 VII 2016, leg. L. A. Konoreva” (LE); **Trans-Baikal Territory:** “Kalarskiy district, Kodar Ridge, Sredniy Sakukan River, left bank opposite the mouth of Eksa River, 56°55'00.9"N, 117°48'57.8"E, alt. 1111 m, *Betula platyphylla*-*Populus suaveolens*-*Larix gmelinii* forest with large boulders, on lignum. 07 VII 2013, leg. L. A. Konoreva” (H); *ibid.*, “Kodar Ridge, Khadytkanda River, 56°44'53.9"N, 117°15'49.9"E, alt. 1231 m, rocks and *Larix gmelinii* forest on the right bank, on rotten wood of *Larix gmelinii*. 21 VI 2015, leg. S. V. Chesnokov” (LE-L14989, ALTB); *ibid.*, “Kodar Ridge, Khadytkanda River, rocks and *Larix gmelinii* forest on the right bank, 56°44'55.3"N, 117°15'50.3"E, alt. 1230 m, on lignum. 21 VI 2015, leg. L. A. Konoreva” (LE).

Micarea incrassata Hedl. (Fig. 2F).

Thallus composed of confluent, convex-verrucose areoles that are intermixed with cephalodia. Areolae dull grey-white, or grey-brown to dark grey, matt. Photobiont micareoid; algal cells globose, 5–6.5 µm diam. (5–7 µm diam. according to Czarnota, 2007). Apothecia black to black-brown, immarginate, adnate, convex, 0.1–0.65 mm (0.3–0.6 mm diam. according to Czarnota, 2007). Epithecium olivaceous; hymenium 45–50(–67.5) µm tall (40–50 µm tall according to Czarnota, 2007). Asci clavate, 50 × 12–13 µm (40–45 × 10–13 µm according to Czarnota, 2007). Ascospores (0–)1-septate, 12–15 × 4.5–5 µm ((8.5–)10–15(–18) × 3.5–4.5(–4.8) µm according to Czarnota, 2007). Hypothecium orange-brown, 170–180 µm tall (150–400 µm tall according to Coppins, 1983). Pycnidia not found. It differs from *M. assimilata* by grayish to gray-brown thallus and dark red-brown, K–, N± bright orange-brown hypothecium without purple tinge. Some specimens without cephalodia can be confused with *Protomicarea limosa* (Ach.) Hafellner, which occurs in similar habitats, but it has a Pd+ red thallus and pale hypothecium. *Protomicarea limosa* was known from Sakha Republic (Yakutia) – Nizhnekolymskiy district (Zhurbenko et al., 2005).

Chemistry. TLC was not performed.

Ecology: This species can be found in tundra and alpine communities on acid soil or decaying mosses.

Distribution: Altai Republic (Sedelnikova, 2013, 2017), Khanty-Mansi Autonomous Area (Sedelnikova, 2017), Yamalo-Nenets Autonomous Area (Kristinsson et al., 2010; Sedelnikova, 2017), Nizhny Novgorod Region (Sharapova, 2001), Novaya Zemlya, Murmansk Region, Chukotka Autonomous Area (Kristinsson et al., 2010).

Specimens examined: **Sakha Republic (Yakutia):** “Bulunskiy district, the northern part of the Kharaulakh ridge, the Sokol base (Polar weather station Stolb), the right bank of the stream Expeditsyonnyy, the saddle between the two peaks, the north-subarctic mountain cotton grass green tundra, on the spots, on soil. 11 VII 1987, leg. V. I. Perfil’eva” (LE-L14995); **Trans-Baikal Territory:** “Kalarskiy district, Kodar Ridge, Zolotoy creek, 56°56′09.1″N, 117°37′18.0″E, alt. 1641 m, lichen-shrub tundra on north-western slope, on soil and mosses. 06 VII 2013, leg. L. A. Konoreva” (LE-L11770); *ibid.*, “Kodar Ridge, Zolotoy creek, 56°56′04.5″N, 117°37′17.8″E, alt. 1680 m, lichen-shrub tundra on north-western slope, on soil. 06 VII 2013, leg. M. P. Andreev” (LE-L13245); *ibid.*, “Kodar Ridge, Shango River, 56°57′31.4″N, 117°48′13.3″E, alt. 1715 m, thin forest with *Larix gmelinii* on the border with tundra on the right bank, on soil. 09 VI 2014, leg. L. A. Konoreva” (LE-L13248); *ibid.*, “Kodar Ridge, Uglovoe lake, 56°56′41.0″N, 117°35′12.1″E, alt. 1918 m, rock outcrops, on mosses on stones. 17 VI 2014, leg. S. V. Chesnokov” (LE); *ibid.*, “Kodar Ridge, the right bank of Sulban River, opposite the mouth of Zolotoy creek, 56°50′11.8″N, 117°17′23.0″E, alt. 1627 m, the southern slope with creek, stone rubble, rocks and thickets of *Pinus pumila*, on soil above rotten wood of *Pinus pumila*. 14 VI 2015, leg. S. V. Chesnokov” (LE-L 13253).

***Micarea lignaria* (Ach.) Hedl. (Fig. 3A).**

Thallus effuse, convex to subglobose, brown-grey. Photobiont micareoid, algal cells globose, 6–7 µm (4–8 µm according to Czarnota, 2007). Apothecia convex-hemispherical to globose, immarginate, black, 0.25–0.45 mm diam. (0.2–0.7(–0.9) mm diam. according to Czarnota, 2007). Epithecium olive-green; hymenium 37.5 µm tall (50–70 µm tall according to Czarnota, 2007). Asci clavate, 30–37.5 × 12.5 µm (40–50 × 10–16(–18) µm according to Czarnota, 2007). Ascospores 3–5-septate, 20–27.5 × 4.5–5.5 µm ((14–)16–30(–36) × (3.5–)4–5(–6) µm according to Czarnota, 2007). Hypothecium light brownish. Pycnidia not found. It differs in having Pd+ rusty red thalli and C– apothecial sections from *M. peliocarpa* and *M. cinerea* (C+ orange-red).

Protomicarea limosa which may be confused with *M. lignaria* has a similar Pd+ red thallus, but simple ascospores.

It was known from Sakha Republic (Yakutia) – Anabarskiy district (Makarova, Perfileva, 1985).

Chemistry. TLC was not performed.

Ecology: It prefers (not strictly) tundra and alpine communities, where can be found on soil and mosses and plant debris (Coppins, 1983; Czarnota, 2007; Smith et al., 2009).

Distribution in Siberia: Kemerovo Region, Altai Republic, Khanty-Mansi Autonomous Area (Sedelnikova, 2017), Altai Territory (Davydov, Konoreva, 2017), Krasnoyarsk Region, Tyva Republic, Khakassia Republic (Sedelnikova, 2013).

Specimen examined: **Trans-Baikal Territory:** “Kalarskiy district, Kodar Ridge, Tsarskiy Tron peak, 56°56′55.7″N, 117°38′02.0″E, alt. 1993 m, shaded gorge with *Cetraria* tundra, on soil. 18 VI 2014, leg. S. V. Chesnokov” (LE-L13250).

***Micarea melaena* (Nyl.) Hedl. (Fig. 3B).**

Thallus of effuse or mostly confluent granules, sometimes distinctly warted and thick, pale green to dark olive-green. Photobiont micareoid; cells 6–7.5 µm (5–8 µm according to Czarnota, 2007). Apothecia numerous, black, immarginate, hemispherical to ±globose, 0.2–0.5 mm diam. (0.1–0.5 mm diam. according to Czarnota, 2007). Hymenium 40–50(–62) µm tall (30–40 µm tall according to Czarnota, 2007) in upper part olivaceous. Asci clavate 30 × 12.5 µm (30–40 × 10–15 µm according to Czarnota, 2007). Ascospores (1–)3-septate, 15–20 × 4–5 µm (12–20 × 4–5.5 µm according to Czarnota, 2007). Hypothecium dull purplish-black, K+ intensifying. Pycnidia not found. This species is easily identified microscopically by the 3-septate spores, blue-green hymenium and dark purple-brown hypothecium. Immature forms of *M. melaena* can be confused with *M. contexta*, which differs in the indistinct thallus and 1-septate ascospores (Czarnota, 2011). *M. contexta* until now wasn’t found in Siberia. However, it is possible to find in the Siberia due to its understudied.

It was known from Sakha Republic (Yakutia) – Nizhnekolymskiy district, Chetyryekhstolbovy Island (Andreev, 1983), Anabarskiy district (Makarova, Perfileva, 1985), Tomponskiy district (Poryadina, 2001), Olekminskiy reserve (Vershina et al., 2015); Trans-Baikal Territory – Kalarskiy district (Lishtva, 2000; Makry, Lishtva, 2005).

Chemistry. TLC was not performed.

Ecology: widely distributed species in the world, in natural communities as well as in agricultural

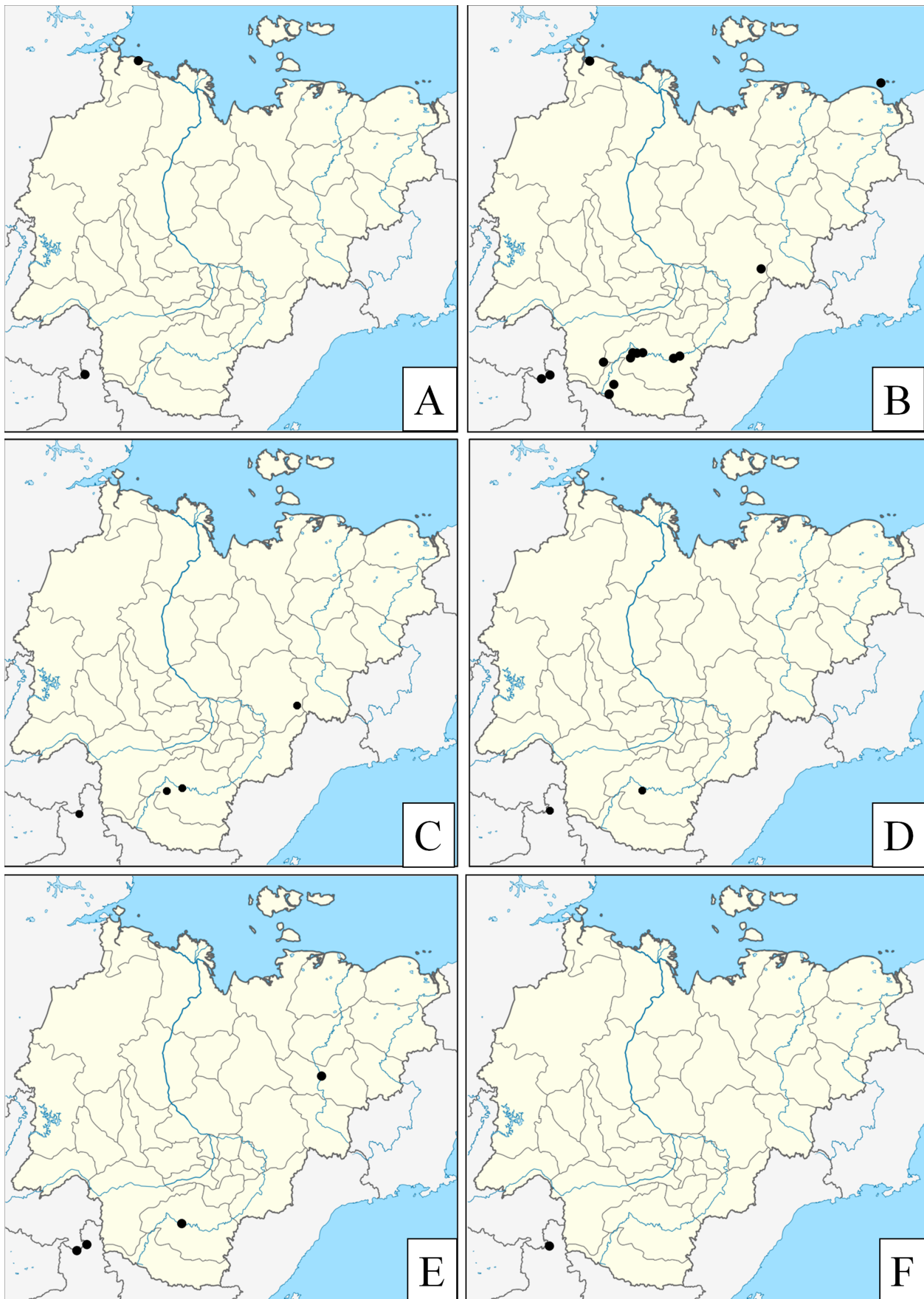


Fig. 3. Distribution of *Micarea* spp. (dots) in Trans-Baikal Territory and Sakha Republic (Yakutia): A – *M. lignaria* (Ach.) Hedl.; B – *M. melaena* (Nyl.) Hedl.; C – *M. micrococca* (Körb.) Gams ex Coppins; D – *M. misella* (Nyl.) Hedl.; E – *M. prasina* Fr. s. str.; F – *M. cf. pseudomarginata* Coppins.

areas and settlements. It occurs on bark, wood and rotten stumps, on soil and decaying bryophytes and plant debris.

Distribution in Siberia: Novosibirsk Region, Kemerovo Region, Altai Republic (Sedelnikova, 2013, 2017), Krasnoyarsk Region, Tyva Republic, Khakassia Republic (Sedelnikova, 2013), Altai Territory, Tomsk Region, Omsk Region, Tyumen Region, Khanty-Mansi Autonomous Area, Yamalo-Nenets Autonomous Area (Sedelnikova, 2017), Irkutsk Region (Makry, Lishtva, 2005).

Specimens examined: **Sakha Republic (Yakutia)**: “Neryungri district, Neryungri neighborhood, 4 km south of the “Serebryanny bor” village, 56°38'43"N, 124°48'59"E, alt. 836 m, *Larix gmelinii*-*Pinus sylvestris*-*Pinus sibirica*-*Alnus* sp. forest, on rotten wood. 30 VI 2015, leg. L. A. Konoreva” (LE); *ibid.*, “Neryungri neighborhood, 2 km south of the “Serebryanny bor” village, 56°38'58"N, 124°48'56"E, alt. 831 m, *Pinus sylvestris* forest with *Duschekia* sp., on rotten wood. 30 VI 2015, leg. L. A. Konoreva” (ALTB); *ibid.*, “100 m to west of the highway A-360, left bank of Achchygyy Gorblylakh, 56°20'16"N, 124°46'02"E, alt. 875 m, *Larix gmelinii*-*Picea obovata*-*Salix* sp.-*Vaccinium uliginosum* swamp forest, on rotten wood of *Larix gmelinii*. 01 VII 2015, leg. L. A. Konoreva” (ALTB); *ibid.*, “250 m to east of the highway A-360, between the rivers Manakhta 1st and Manakhta 2nd, 56°02'56"N, 124°52'04"E, alt. 1124 m, bare mountain with thickets of *Pinus pumila* and *Duschekia* sp., on rotten wood. 01 VII 2015, leg. L. A. Konoreva” (LE-L14983); “Aldan district, near Aldan, Bolshoy Kuranakh river, 58°38'34"N, 125°28'05"E, alt. 567 m, *Larix gmelinii*-*Betula* sp.-*Picea obo-*

vata forest, on rotten wood. 04 VII 2015, leg. S. V. Chesnokov (LE) and L. A. Konoreva (LE)”; *ibid.*, “Moisey bare mountain, Besprizorny creek, 58°27'53.2"N, 125°31'08.5"E, alt. 950 m, stone slope, on lignum of *Pinus pumila*. 05 VII 2015, leg. S. V. Chesnokov” (LE); *ibid.*, “Lenskiy creek, 58°34'28"N, 125°32'7"E, alt. 763 m, *Picea obovata* forest with *Larix gmelinii* and *Pinus pumila*, on rotten wood. 06 VII 2015, leg. L. A. Konoreva” (LE, ALTB); *ibid.*, “near Aldan, Bolshoy Kuranakh river, 58°39'49"N, 125°29'10"E, alt. 464 m, *Chosenia arbutifolia*-*Populus* sp. forest with *Larix gmelinii* and *Duschekia* sp., on lignum. 06 VII 2015, leg. L. A. Konoreva” (LE); *ibid.*, “Skarnovyy bare mountain, Turuk river, 58°32'48"N, 125°36'16"E, alt. 747 m, stone rubble on slope with *Populus tremula*, *Betula* sp., *Salix* sp., *Larix gmelinii*, on lignum. 06 VII 2015, leg. L. A. Konoreva (LE, ALTB) and S. V. Chesnokov (LE- L14984)”; *ibid.*, “near the village of Zarechnyy, 58°39'56"N, 126°14'1"E, alt. 747 m, slope with *Betula* sp.-*Larix gmelinii* forest and stone rubble and logs on the slope, on rotten wood. 11 VII 2015, leg. L. A. Konoreva” (LE); *ibid.*, “left bank of Yllymakh, 58°35'01"N, 126°41'55"E, alt. 378 m, rocks in *Betula* sp.-*Larix gmelinii* forest, on rotten wood. 12 VII 2015, leg. S. V. Chesnokov” (LE); *ibid.*, “left bank of Aldan, opposite the mouth Timp-ton, 58°44'11"N, 127°10'31"E, alt. 229 m, rocks, on soil and bark and wood of *Larix* sp. 15 VII 2015, leg. L. A. Konoreva” (LE-L14988); *ibid.*, “right bank of Aldan, 58°28'46.2"N, 129°49'56.8"E, alt. 210 m, slope with *Betula ermanii*-*Picea jezoensis* forest, on lignum of *Picea jezoensis*. 17 VII 2015, leg. S. V. Chesnokov” (ALTB); *ibid.*, “left bank of Aldan, 58°36'59"N, 130°16'53"E, alt. 247 m, *Betula*

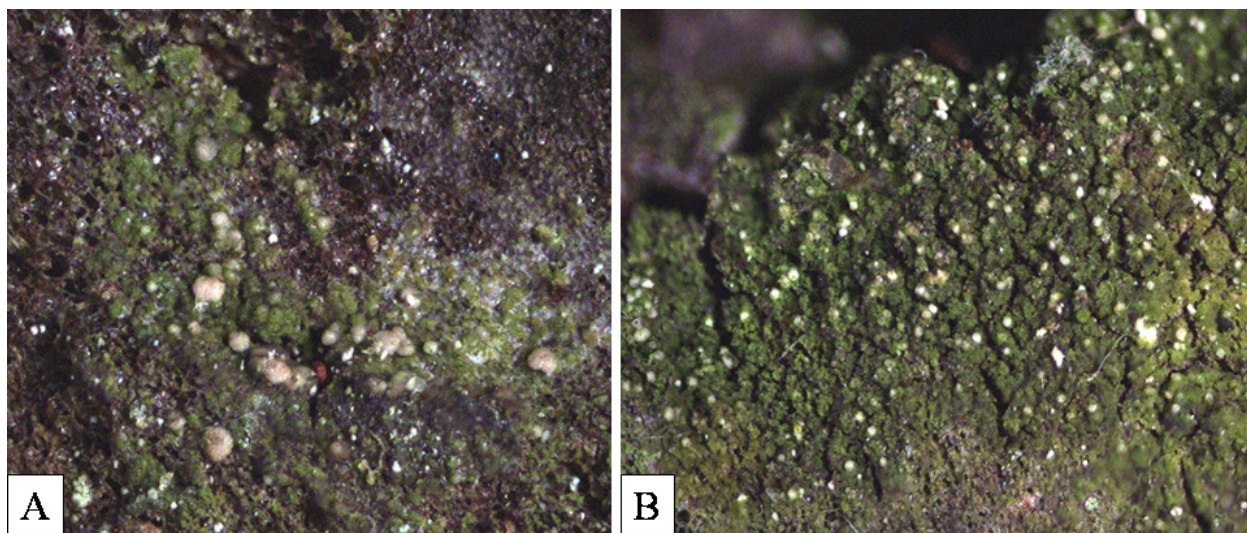


Fig. 4. *Micarea micrococca* (Körb.) Gams ex Coppins: A – apothecia; B – thallus with pycnidia.

ermanii-Picea obovata forest with *Duschekia fruticosa* between Aldan river and Kulusunakh lake, on rotten wood. 19 VII 2015, leg. L. A. Konoreva” (LE); “Ust-Maisky district, right bank of Aldan river, 60°16'59.8"N, 134°20'00.1"E, alt. 165 m, *Larix* sp. forest on a rocky shore, on rotten wood of *Larix* sp. 30 VII 2017, leg. S. V. Chesnokov” (LE-L14980); **Trans-Baikal Territory:** “Kalarskiy district, Kodar Ridge, Sredniy Sakukan River, left bank opposite the mouth of Eksa River, 56°55'00.9"N, 117°48'57.8"E, alt. 1111 m, *Betula platyphylla-Populus suaveolens-Larix gmelinii* forest with large boulders, on rotten wood. 07 VII 2013, leg. M. P. Andreev” (LE-L13244); *ibid.*, “Kodar Ridge, Shango River, 56°56'38.0"N, 117°48'17.0"E, alt. 1634 m, *Larix gmelinii*-green mosses forest on the left bank, on lignum of *Larix gmelinii*. 10 VI 2014, leg. S. V. Chesnokov” (LE); *ibid.*, “Kodar Ridge, Sulban River, left bank, 56°50'38.3"N, 117°18'04.8"E, alt. 1378 m, *Larix gmelinii*-green mosses-lichen forest with stone rubble, on wood of *Larix gmelinii*. 13 VI 2015, leg. S. V. Chesnokov” (ALTB); *ibid.*, “Kodar Ridge, Oleniy rog creek, 56°47'57"N, 117°21'59"E, alt. 1674 m, stone rubble with underground creek among *Pinus pumila* thickets on the right bank, on rotten wood. 18 VI 2015, leg. L. A. Konoreva” (ALTB); *ibid.*, “Kodar Ridge, Khadytkanda River, 56°44'53.9"N, 117°15'49.9"E, alt. 1231 m, rocks and *Larix gmelinii* forest on the right bank, on rotten wood of *Larix* sp. 21 VI 2015, leg. S. V. Chesnokov” (LE).

Micarea micrococca (Körb.) Gams ex Coppins (Fig. 3C, 4).

Thallus minutely granular, bright green to olive-green, composed of small gonocysts. Photobiont micareoid, algal cells ±globose, 3.5–5 µm (4–7 µm according to Czarnota, Guzow-Krzemińska, 2010). Apothecia numerous, whitish-cream, cream, 0.15–0.25 mm diam. (0.1–0.3 mm diam. according to Czarnota, Guzow-Krzemińska, 2010), immarginate, convex, sometimes tuberculate. Hymenium colourless, 55 µm tall (30–50(–55) µm tall according to Czarnota, 2007). Asci clavate, 30 × 10 µm ((20–)25–30(–45) × 8–11(–13) µm according to Czarnota, 2007). Ascospores 0–1-septate, 8–10 × 2.5–2.8 µm (10–12(–16) × 3–4.5 µm according to Czarnota, Guzow-Krzemińska, 2010). Hypothecium slightly yellowish. Pycnidia numerous. It differs in having whitish convex to subglobose small apothecia (0.1–0.2 mm), presence of white, sessile and gaping pycnidia and methoxymicareic acid detected by TLC.

Chemistry. TLC: methoxymicareic acid in all (4) examined specimens.

Ecology: It is one of the most common species of the genus, occurs in different forest communities and outside woodland. Usually it grows as epiphyte on bark and lignicolous, on rotten wood.

Distribution: In Russia, the species began to be cited recently and is known from Vladimir Region, Kursk Region, Leningrad Region (Gagarina, Konoreva, 2015), Chelyabinsk Region (Urbanavichene et al., 2013), Buryatia Republic (Urbanavichene, Palice, 2016), Adygea Republic (Urbanavichus, Urbanavichene, 2014), Krasnodar Region (Urbanavichene, Urbanavichus, 2016), Trans-Baikal Territory, Sakha Republic (Yakutia) (Konoreva, Chesnokov, 2017).

Specimens examined: **Sakha Republic (Yakutia):** “Aldan district, Lenskiy creek, 58°34'28"N, 125°32'7"E, alt. 763 m, *Picea obovata* forest with *Larix gmelinii* and *Pinus pumila*, on rotten wood. 06 VII 2015, leg. L. A. Konoreva” (LE); *ibid.*, “left bank of Aldan, opposite the mouth Timpton, 58°44'11"N, 127°10'31"E, alt. 229 m, rocks, on rotten wood. 15 VII 2015, leg. L. A. Konoreva” (LE); “Tomponskiy district, right bank of Vostochnaya Khandyga river, 2.5 km west of Atmole river, 500 m from the road P-504 up the creek, 63°08'16.1"N, 138°46'33.5"E, alt. 765 m, creek canyon with *Larix gmelinii*, *Betula* sp., *Populus* sp. and *Salix* sp., on lignum. 17 VII 2016, leg. L. A. Konoreva” (LE); **Trans-Baikal Territory:** “Kalarskiy district, Kodar Ridge, Khadytkanda River, 56°44'53.9"N, 117°15'49.9"E, alt. 1231 m, rocks and *Larix gmelinii* forest on the right bank, on rotten wood of *Larix gmelinii*. 21 VI 2015, leg. S. V. Chesnokov” (LE-L14990).

Micarea misella (Nyl.) Hedl. (Fig. 3D).

Thallus lignicolous, endoxylous. Photobiont micareoid; cells globose, 7–7.5 µm (4–7 µm diam. according to Czarnota, 2007). Apothecia black, grey-black or black-brown, immarginate, 0.25–0.45 mm (0.1–0.3(–0.4) mm diam. according to Czarnota, 2007). Hymenium 37.5 µm tall (25–45 µm tall according to Czarnota, 2007); epithecium dull olive to dark olive-grey, K+ intensive violet. Ascospores 0–1-septate, 6–7.5(–12.5) × 3–3.5 µm (6–9(–10) × (2–)2.5–3.5(–4) µm according to Czarnota, 2007). Hypothecium 62.5–65 µm tall (45–70 µm tall according to Coppins, 1983), hyaline. Pycnidia simple, stalked and usually subulate, black, glossy; walls olive, K+ violet; conidia 2.5–3 × 1–1.2 µm (3.5–5(–6.5) × 1.2–1.4(–1.7) µm according to Czarnota, 2007). This species is identified by immersed thallus, 0–1-septate ascospores and numerous, usually stalked, black pycnidia with greenish, C+ and K+ violet pigment.

It was known from Trans-Baikal Territory – Kalarskiy district (Chesnokov, Konoreva, 2015).

Chemistry: no substances detected by TLC.

Ecology: This species can be found in different types of habitats, but often only in a pycnidial stage. Therefore, it is overlooked. It prefers lignum but can be found on bark or plant debris (Czarnota, 2007).

Distribution in Siberia: Altai Territory, Novosibirsk Region, Kemerovo Region, Altai Republic, Omsk Region, Tomsk Region, Tyumen Region, Khanty-Mansiysk Autonomous District (Sedelnikova, 2017), Tyva Republic, Khakassia Republic (Sedelnikova, 2013).

Specimen examined: **Sakha Republic (Yakutia)**: “Aldan district, the left bank of Yllymah, 58°35'2"N, 126°41'54"E, alt. 357 m, *Betula* sp.-*Larix gmelinii* forest, rocks in the forest, on rotten wood. 12 VII 2015, leg. L. A. Konoreva” (LE-L14993); **Trans-Baikal Territory**: “Kalarskiy district, Kodar Ridge, first canyon of creek west of Anarga river, 56°55'10"N, 118°00'04"E, alt. 1592 m, narrow gorge with rocks, on lignum. 10 VII 2013, leg. L. A. Konoreva” (LE-L14992).

Micarea prasina Fr. s. str. (Fig. 3E, 5).

Thallus effuse, granular to sorediose in appearance or warted-granular, bright green to olive-

green, composed of small, very often aggregated gonocysts. Photobiont micareoid; algal cells 7–8 µm diam. (4–8 µm diam. according to Czarnota, 2007). Apothecia immarginate, whitish, brownish, grayish to dark brown, 0.2–0.35 mm diam. (0.2–0.4 mm diam. according to Czarnota, 2007). Hymenium 45 µm tall (30–60 µm tall according to Czarnota, 2007), hyaline, straw-coloured in upper part. Asci 37.5 × 15 (25–55 × 8–12 µm according to Czarnota, 2007). Ascospores 0–1-septate, 12.5 × 2.5–2.8 µm ((6–)8–12(–14) × (2.5–)3–4(–5.5) µm according to Czarnota, 2007). Hypothecium hyaline to pale ±yellowish, 150 µm tall (40–160 µm tall according to Czarnota, 2007). It differs from *M. micrococca* in having very variable in colour, whitish-grey to pale brown, grey-black or black apothecia, rather scanty paraphyses, absence of excipulum and presence of micareic acid detected by TLC (Czarnota, 2007, 2011; Czarnota, Guzow-Krzemińska, 2010). Prefers lignum, rare bark.

As *M. prasina* s. lat. it was mentioned in Sakha Republic (Yakutia) – Momskiy district (Poryadina, 1999). As *M. prasina* s. str. It was reported from one locality in Trans-Baikal Territory – Kalarskiy district (Chesnokov, Konoreva, 2015).

Chemistry. TLC: micareic acid in all (5) examined specimens.



Fig. 5. *Micarea prasina* Fr. s. str. (thallus with apothecia).

Ecology: It prefers natural moist forest conditions and occurs on lignum of decaying stumps and logs, sometimes on the bark.

Distribution: *M. prasina* s. str. is known from Novgorod Region, Kursk Region (Gagarina, Konoreva, 2015), Leningrad Region (Stepanchikova et al., 2013), Sverdlovsk Region, Trans-Baikal Territory, Sakha Republic (Yakutia) (Konoreva, Chesnokov, 2017). Numerous data on distribution *M. prasina* s. l. in Russia need to be revised.

Specimens examined: **Sakha Republic (Yakutia):** "Aldan district, left bank of Aldan, opposite the mouth Timpton, 58°44'11"N, 127°10'31"E, alt. 229 m, rocks, on lignum. 15 VII 2015, leg. L. A. Konoreva" (LE-L14986); **Trans-Baikal Territory:** "Kalarskiy district, Kodar Ridge, Sredniy Sakukan River, left bank opposite the mouth of Eksa River, 56°55'00.9"N, 117°48'57.8"E, alt. 1111 m, *Betula platyphylla*-*Populus suaveolens*-*Larix gmelinii* forest with large boulders, on lignum of *Larix gmelinii*. 07 VII 2013, leg. M. P. Andreev" (LE); *ibid.*, "Kodar Ridge, first canyon of creek west of Anarga river, 56°55'10"N, 118°00'04"E, alt. 1592 m, narrow gorge with rocks, on lignum. 10 VII 2013, leg. L. A. Konoreva" (LE); *ibid.*, "Kodar Ridge, Khadytkanda River, 56°44'53.9"N, 117°15'49.9"E, alt. 1231 m, rocks and *Larix gmelinii* forest on the right bank, on rotten wood of *Larix gmelinii*. 21 VI 2015, leg. S. V. Chesnokov" (LE); *ibid.*, "Kodar Ridge, Sulban River, 56°40'12"N, 117°10'38"E, alt. 1054 m, *Picea obovata*-*Betula* sp.-*Larix gmelinii* forest on the left bank, on bark of *Picea obovate*. 23 VI 2015, leg. S. V. Chesnokov" (ALTB).

Micarea cf. *pseudomarginata* Coppins (Fig. 3F).

It is distinguished from *Brianaria lutulata* (Nyl.) S. Ekman et M. Svensson and *B. sylvicola* (Flotow ex Körber) S. Ekman et M. Svensson in a presence of the true exciple, absence of a greenish pigment in the hymenium, thallus scurfy-granular to granular-areolate, small-celled photobiont and longer conidia (Smith et al., 2009).

It was mentioned in Trans-Baikal Territory – Kalarskiy district (Makryi, 2002). This species is given according to literature data, specimens were not examined.

Micarea submilliaria (Nyl.) Coppins (Fig. 6A).

Thallus effuse, superficial, of convex to subglobose areolae. Areolae 0.2–0.3 mm, ash, ash-grey to grey-brown, matt with a minutely roughened surface with white flecks, in the middle part often breaking down to form sorediate patches, showing

white or cream medulla, C+ red, Pd+ yellow. Photobiont micareoid, algal cells 5–7 µm diam. (5–8 µm diam. according to Czarnota, 2007). Apothecia are rare and often absent in European material (Coppins, 1983; Czarnota, 2007) whereas they are numerous in Siberian material, immarginate, convex to globose, constricted at the base, often with bluish tinge, 0.3–0.9(–1.0) mm diam. (0.2–0.8 mm diam. according to Coppins, 1983). Hymenium 50–55(–62.5) µm tall (65–90 µm tall according to Coppins, 1983), ±hyaline, upper part pale yellowish-brown. Asci clavate, 37.5–50 × 12.5 µm (60–70 × 19–22 µm according to Coppins, 1983). Spores fusiform, often slightly curved, 3–7-septate, (20–)27.5–38 × 4.5–6 µm ((35–)40–50(–60) µm according to Coppins, 1983). Hypothecium 150–200 µm tall (120–200 µm tall according to Coppins, 1983), ±hyaline or dull straw. Pycnidia not found. Its thallus is morphologically similar to *M. leprosula* but turns Pd+ yellow (alectorialic acid). Specimens with apothecia can be separated by ascospores (3–7(–9)-septate in *M. submilliaria* and 1–3-septate in *M. leprosula*) (Coppins, 1983; Czarnota, 2007).

Chemistry. TLC: alectorialic acid.

Ecology: It has an alpine distribution, growing on humus, plant debris and decaying bryophytes over thin soil and rocky crevices in dwarf-pine and alpine mountain belts at altitudes of 1680 to 1993 m (1250 to 2050 m according to Czarnota, 2007), often near the water (river or creek).

Distribution in the world: Previously reported from the mountain regions of Europe – Finland, Norway (Czarnota, 2004, 2007; Nordin et al., 2011), Sweden (Coppins, 1983; Foucard, 2001; Czarnota, 2004, 2007; Nordin et al., 2011), United Kingdom (Coppins, 1983; Czarnota, 2004, 2007; Smith et al., 2009), Germany (Wirth et al., 2013), Poland, Austria, Czech Republic, Spain, Slovakia (Czarnota, 2004, 2007); and South America – Ecuador (Czarnota, 2007). In Russia the species was reported by us from the Trans-Baikal Territory (Konoreva, Chesnokov, 2016). All specimens were found within headwaters of Sredniy Sakukan.

Specimens examined: **Trans-Baikal Territory:** "Kalarskiy district, Kodar Ridge, Zolotoy creek, 56°55'57"N, 117°36'51"E, alt. 1857 m, rocks near the waterfall with *Salix arctica*-*Rhododendron aureum* tundra, on soil and plant debris. 06 VII 2013, leg. L. A. Konoreva" (LE-L13247); *ibid.*, "Kodar Ridge, Zolotoy creek, 56°56'04.5"N, 117°37'17.8"E, alt. 1680 m, lichen-shrub tundra on north-western slope, on soil. 06 VII 2013, leg. M. P. Andreev" (LE-L13171); *ibid.*, "Kodar Ridge, source of the Sredniy

Sakukan river, 56°57'59"N, 117°37'60"E, alt. 1925 m, *Rhododendron aureum*-lichen tundra with large boulders, on soil. 16 VI 2014, leg. S. V. Chesnokov" (LE-L13249); *ibid.*, "Kodar Ridge, Sredniy Sakukan River, 56°56'28.2"N, 117°36'55.3"E, alt. 1686 m, *Salix* sp.-herb-green moss community with creek on the right bank, on mosses. 18 VI 2014, leg. S. V. Chesnokov" (H); *ibid.*, "Kodar Ridge, Tsarskiy Tron peak, 56°56'55.7"N, 117°38'02.0"E, alt. 1993 m, shaded gorge with *Cetraria* tundra, on soil. 18 VI 2014, leg. S. V. Chesnokov" (LE-L13251).

Micarea tomentosa Czarnota et Coppins (Fig. 6B).

Thallus bright green, granular, thin. Photobiont micareoid; cells ±globose, 3–7 µm diam. (4–7 µm diam. according to Czarnota, 2007). Apothecia pale, slightly brownish, convex to hemispherical, 0.15–0.25 mm (0.15–0.3 mm according to Czarnota, 2007). Hymenium 35–40 µm tall (35–40 µm tall according to Czarnota, 2007), hyaline, in upper part slightly straw-coloured, K–, C–. Asci 30–32.5 × 9–10 µm (30–35 × 7–9 µm according to Czarnota, 2007). Ascospores (0–)1-septate, 7.5–9 × 2.5–3.5 µm ((6.5–)7.5–9 (–9.5) × 2.2–3.5 (–3.75) µm according to Czarnota, 2007). Hypothecium hyaline, 50 µm tall (ca 70 µm tall according to Czarnota, 2007). Pycnidia numerous when apothecia absent or rare, globose, sessile, pale, whitish-grey or grey, distinctly tomentose. Conidia 2–3 × 1–1.5 µm ((2.98–)3.2–3.5(–3.77) × 1.23–1.5(–1.65) µm according to Czarnota, 2007). It is identified by sessile to shortly stalked pycnidia, first covered with

white tomentum, later sometimes tomentose only at the base of pycnidia, and absence of yellowish (K± purple-violet) oily droplets in the matrix of goniocysts.

Chemistry. No substances detected by TLC.

Ecology: This species prefers rotten wood in shaded humid forests conditions.

Distribution in the world: Rare species, in Europe it is known from several localities – Poland, Slovakia (Czarnota, 2007), Estonia (Suija et al., 2008), Sweden (Thor, Svensson, 2008). *M. tomentosa* is known from Russia in European part – Republic of Mordovia (Urbanavichene, Urbanavichus, 2017) and Moscow Region (Muchniik et al., in press).

Specimen examined: **Sakha Republic (Yakutia):** "Aldan district, Lenskiy creek, 58°34'27.5"N, 125°32'07.9"E, alt. 775 m, *Picea obovata* forest with *Larix gmelinii* and *Pinus pumila*, on wood of *Pinus pumila*. 06 VII 2015, leg. S. V. Chesnokov" (LE); "Aldan district, Dorozhnyy bare mountain, 58°26'24.8"N, 125°26'23.2"E, alt. 980 m, *Larix gmelinii*-small-leaved forest and thickets of *Pinus pumila* on slope, on rotten wood. 07 VII 2015, leg. S. V. Chesnokov" (LE); "Ust-Maiskiy district, right bank of Aldan river, 60°16'59.8"N, 134°20'00.1"E, alt. 165 m, *Larix* sp. forest on a rocky shore, on rotten wood of *Larix* sp. 30 VII 2017, leg. S. V. Chesnokov" (LE-L14981, L14982, ALTB); **Trans-Baikal Territory:** "Kalarskiy district, Kodar Ridge, Khadytkanda River, 56°44'53.9"N, 117°15'49.9"E, alt. 1231 m, rocks and *Larix gmelinii* forest on the right bank, on rotten wood of *Larix gmelinii*. 21 VI 2015, leg. S. V. Chesnokov" (LE).

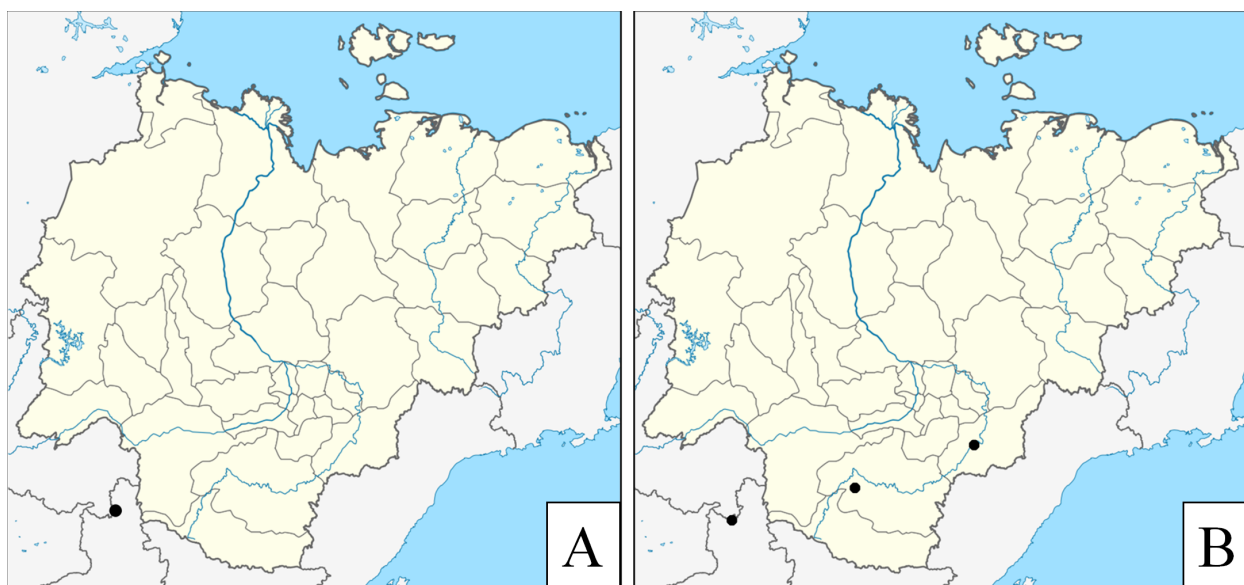


Fig. 6. Distribution of *Micarea* spp. (dots) in Trans-Baikal Territory and Sakha Republic (Yakutia): A – *M. submilliaria* (Nyl.) Coppins; B – *M. tomentosa* Czarnota et Coppins.

Excluded taxa*Micarea nitschkeana* (J. Lahm ex Rabenh.)

Harm.

After our revision of previously published *M. nitschkeana* (Chesnokov, Konoreva, 2015) is excluded from the list of lichen biota from the Trans-Baikal Territory. Revision of the corresponding

material showed that the specimens belong to *M. melaena*.

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