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BIODIVERSITY STUDIES

New records and noteworthy lichen species from Sakhalin and Kurils, Far East of Russia

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ABSTRACT

Nine new records of lichens from Sakhalin and Kurils are presented including *Caloplaca monacensis* – new to the Russian Far East, *Phaeophyscia constipata* and *Rostania ceranisca* – new to the south of the Russian Far East, *Massalongia cornosa* and *Mycoblastus alpinus* – new to the Sakhalin Region, *Heterodermia diademata* – new to Kuriles, *Bilimbia tetramera*, *Fissurina inabensis* and *Coenogonium pineti* – new to Kunashir Island. For noteworthy species, information on distribution, ecology, and diagnostic traits of similar species is provided. Most of all reported species, namely *Bilimbia tetramera*, *Caloplaca monacensis*, *Massalongia cornosa*, *Mycoblastus alpinus*, *Phaeophyscia constipata* and *Rostania ceranisca*, are considered to be rare in the region.

Keywords: boreal zone, broad-leaved forest, old-growth forest, rare species, subtropical distribution

РЕЗЮМЕ

Ежкин А.К., Давыдов Е.А., Фролов И.В., Корзников К.А. Новые и значимые находки лишайников с Сахалина и Курильских островов, Дальний Восток России. Приводятся сведения о 9 видах лишайников с острова Сахалин и Курильских островов. Среди них впервые для Дальнего Востока России – *Caloplaca monacensis*, для юга Дальнего Востока России – *Phaeophyscia constipata* и *Rostania ceranisca*, для Сахалинской области – *Massalongia cornosa* и *Mycoblastus alpinus*, для Курильских островов – *Heterodermia diademata*, и для острова Кунашир – *Bilimbia tetramera*, *Fissurina inabensis* и *Coenogonium pineti*. Для значимых находок представлена краткая информация по распространению, экологии и отличительным признакам. Большинство представленных видов – *Bilimbia tetramera*, *Caloplaca monacensis*, *Massalongia cornosa*, *Mycoblastus alpinus*, *Phaeophyscia constipata* и *Rostania ceranisca* являются редкими в регионе.

Ключевые слова: бореальная зона, редкие виды, старовозрастный лес, субтропическое распространение, широколиственный лес

The lichen biota of the Sakhalin Region is still poorly known and new records and noteworthy species continue to be discovered. It is related to the isolation of remote areas and islands where the high biodiversity is still intact. Sakhalin Region includes Sakhalin Island and the volcanic archipelago of the Kuril Islands in the northeastern part of the Pacific Ocean with a total area of 87 100 square kilometers. The climate of the islands is temperate, monsoon type with a cold winter, but milder than in the continental part and with a cool rainy summer. According to Takhtajan (1986), northern parts of the Sakhalin Region belong to the Okhotsk-Kamchatka Province of the Circumboreal floristic Region while southern parts along with Hokkaido related to the East Asian floristic Region. The current study is a part of the work targeted to reveal rare lichen species in remote locations of the Sakhalin Region including old-growth forests and other intact lichen habitations.

This paper is based on the study of lichens collected from Sakhalin – Tymovskiy and Smirnykhovskiy districts, and the Kuril Islands – Paramushir, Kunashir, Iturup and Shikotan. Voucher specimens were deposited in the Herbarium of the Institute of Marine Geology and Geophysics (SAK). The specimens were examined using a stereomicroscope (MBS 10) and a compound microscope (LOMO Mikmed 3). Secondary metabolites were characterized by high-performance thin-layer chromatography (HPTLC) according to the methods described in Schumm & Elix (2015). Spot tests were made with 10 % potassium hydroxide solution (K), sodium hypochlorite solution (C) and 1,4-p-phenylendiamine (PD), and Lugol's solution (I). DNA extraction, amplification, and sequencing followed the methods of Davydov & Yakovchenko (2017). Cycling conditions included initial denaturation at 94°C for 35 cycles of 95°C for 20 s, 52°C for 40 s, 72°C for 60 s, and a final extension step at 72°C for 7 min. The program Geneious 6.0 (Biomatters Ltd, New Zealand) was used for assembling partial and complementary sequences.

To test the phylogenetic relationships of *Fissurina inabensis* (Vain.) M. Nakan. & Kashiw. and *Phaeophyscia constipata* (Nyl.) Moberg collected in the Sakhalin Region and their conspecificity with material with sequences available in the GenBank (NCBI, https://www.ncbi.nlm.nih.gov) the ITS region of the nrDNA (ITS1, 5.8S, and ITS2) was sequenced. Newly generated sequences were supplemented with the sequences of *Fissurina* and *Phaeophyscia* obtained from the GenBank. The distance matrixes within all sequences of two datasets were calculated in the Geneious 6.0. The maximum likelihood (ML) tree with 1000 ultrafast bootstrap replicates was performed using the online version of IQ-TREE (Trifinopoulos et al. 2016) with default settings. *Caloplaca monacensis* (Leder.) Lettau was also supported with the nrITS sequence.

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We present information on 9 lichen species from Sakhalin Island and the Kuril Islands.

***Bilimbia tetramera* De Not.**

The species is circumpolar arctic to boreal (Nash et al. 2004) and known in the Russian Far East including the islands of the Sakhalin Region – Sakhalin, Shikotan and Iturup (Chesnokov & Konoreva 2021, 2022, Kaganov & Ezhkin 2023). The species is new to Kunashir.

Specimen examined: RUSSIA, Kunashir Island, Zmeyinyi creek valley, 44°0'25.6"N 145°41'5.7"E, 58 m, old broad-leaved forest, on bark of *Ulmus japonica*, 31.08.2019, Ezhkin 2516 (SAK).

***Caloplaca monacensis* (Leder.) Lettau**

The species is similar to *Caloplaca cerina* (Hedw.) Th. Fr., however, has granular thallus and usually pruinose apothecia. It is widely distributed in temperate and Mediterranean Europe, and in Turkey, where it usually grows on bark of broad-leaved trees and is also rarely found on bark of shrubs, rotten wooden fences, and shaded limestone (Šoun et al. 2011). In Russia, the nearest known locality is in the Republic of Altai (Vondrák et al. 2019). The species is new to Sakhalin and the Russian Far East.

Specimen examined: RUSSIA, Sakhalin Island, Tymovskiy district, Zonal'noye Village surroundings, Tym' river valley, 48°57'24.4"N 142°14'23.9"E, 70 m, old-grows riparian forest, on bark of *Ulmus laciniata* Trantv., 04.07.2018, Ezhkin 2304, 2305 (SAK). GenBank Accession no.: PV133566.

***Coenogonium pineti* (Ach.) Lücking et Lumbsch**

The species has a pan-temperate distribution (Nash et al. 2004) and is widespread in the Russian Far East including the continental part (Skirina et al. 2016) and the islands of the Sakhalin Region – Sakhalin, Shikotan and Iturup (Ezhkin & Galanina 2016, Ezhkin 2020, Chesnokov & Konoreva 2021, 2022). The species is new to Kunashir.

Specimen examined: RUSSIA, Kunashir Island, Lagunnoye Lake surroundings, 44°02'50.2"N 145°46'01.6"E, 79 m, old-grows mixed coniferous broad-leaved forest, on the mossy base of old Kalopanax septemlobus (Thunb. Ex. A. Murray) Koidz., 01.08.2017, Ezhkin 1300 (SAK).

***Fissurina inabensis* (Vain.) M. Nakan. & Kashiw.**

The species is characterized by epiphloeodal greenish thallus with numerous lirelliform apothecia, non-amyloid (I–) hymenium, submuriform ascospores and the presence of stictic acid (Wainio 1918, Nakanishi et al. 2003). *Fissurina inabensis* is similar to *F. undulata* (Müll. Arg.) M. Nakan. et Kashiw., but the latter has a thin thallus, a well-developed proper exciple, crenate labia, a medulla with gonidia and 2–3-celled ascospores clearly separate *F. inabensis* from *F. undulata* (Nakanishi 1966). *Fissurina inabensis* is a corticolous species in subtropical and tropical regions and occur on bark of trees in mountain forests of Japan, Taiwan and Thailand (Nakanishi et al. 2001). In Russia, the species was known only from two localities, both on Shikotan Island (Chesnokov et al. 2023). The species is new to Kunashir.

Specimen examined: RUSSIA, Kunashir Island, at the vicinity of Golovnino Volcano, 43°52'51.6"N 145°36'20.3"E, 89 m, old-grows mixed forest, on bark of old *Taxus cuspidata* Siebold et Zucc. Ex Endl., 22.08.2017, Ezhkin 1286 (SAK). GenBank Accession no.: PV130918.

***Heterodermia diademata* (Taylor) D.D. Awasthi**

The species is widespread in the tropical and temperate zones around the world and grows on rocks and trees (Kurokawa 1962). It was reported earlier in the southern Far East of Russia from continental part (Tchabanenko 2002) and Sakhalin (Konoreva et al. 2018). The species is new to Kunashir and Kurils.

Specimen examined: RUSSIA, Kunashir Island, Belkina River valley, 43°54'10.6"N 145°35'52.7"E, 30 m, old-grows broad-leaved forest, on bark of bark of *Alnus hirsuta* (Spach.) Rupr., 01.08.2019, Ezhkin 3119 (SAK).

***Massalongia cornosa* (Dicks.) Körb**

The species is characterized by 1–3 cm diam. rosette-forming foliose thallus of chocolate-brown colour and 2-celled spores that distinguish *Massalongia cornosa* from similar looking Panariaceae species (Stenroos et al. 2016). The species habitats among mosses on a range of different acidic rocks in moist habitats at intermediate elevations (Nash et al. 2004). *Massalongia cornosa* is morphologically similar to *M. patagonica* Kitaura et A.P. Lorenz but differs by ascospores. The spores of *M. patagonica* are shorter and often two or three-septate, which is very rare in *M. carnosa*. *Massalongia cornosa* occurs only in the Northern Hemisphere – North America, Europe and Asia, the *M. patagonica* is restricted to the Southern Hemisphere (Jørgensen et al. 2019). *Massalongia cornosa* is widespread in Russia (Urbanavichus 2010) and registered in the continental part of the south of the Far East (Tchabanenko 2002). The specimen Ezhkin 1289 (SAK) was used in the work dedicated to the genus *Massalongia* in the Southern Hemisphere (Jørgensen et al. 2019) but without locality noted. The species is new to Paramushir and the Sakhalin Region.

Specimens examined: RUSSIA, Paramushir Island, Mt. Nasedkina, 50°37'51.6"N 156°01'31.4"E, 652 m, elfin wood, on soil among mosses, 30.09.2017, Ezhkin 1287 (SAK). Ibid, 50°37'28.5"N 156°02'9.4"E, 492 m, on soil among mosses, 30.09.2017, Ezhkin 1288 (SAK). Ibid, 50°37'59.7"N 156°03'48.9"E, on soil among mosses, 309 m, 03.10.2017, Ezhkin 1289 (SAK), GenBank Accession no.: MN708317 (Jørgensen et al., 2019).

***Mycoblastus alpinus* (Fr.) Th. Fr. ex Hellb.**

The species is characterized by grey thallus with bright or citrine-yellow soredia and bluish-black glossy apothecia with 1–2 spored asci. The species is close to *M. affinis* (Schaer.) T. Schauer, both have the same chemistry and number of spores in asci, but the latter is esorediate. Their separation merits further study. *Mycoblastus alpinus* also resembles *Ochrolechia inaequatula* (Nyl.) Zahlbr. which is C+ red (Smith et al. 2009). *Mycoblastus alpinus* is mostly lignicolous species and occurs on fallen pine trunks, moss and vertical granite crags (Smith et al. 2009, Stenroos et al. 2016). The species is registered in Europe, Macaronesia, N. America and Japan (Smith et al. 2009). In Russia, it is widespread (Urbanavichus 2010) including the south of the Far East – Amur Region (Tchabanenko 2002). The species is new to Kunashir and the Sakhalin Region.

Specimen examined: RUSSIA, Kunashir Island, Mt. Mechnikov, west slope, Mendeleev Volcano surroundings, 43°58'42"N 145°42'52.1"E, 340 m, old-grows coniferous forest, on bark of the base of old *Picea glehnii* (Fr. Schmidt) Mast., 18.08.2013, Ezhkin 495, 312, 2939, 2940 (SAK). Planaic acid was detected by HPTLC.

***Phaeophyscia constipata* (Nyl.) Moberg**

The species is characterized by fruticose, ciliate greenish thallus forming irregular, sparse tufts with long lobes without soredia or isidia and occurs usually on mossy or bare rocks and soil in open and dry sites. The species occurs in Europe, Asia and North America (Stenroos et al. 2016). The species is also widespread in Russia (Urbanavichus 2010) and reported from the north of the Far East – Chukotka

(Andreev et al. 1996). The species is new to Sakhalin and the south of the Russian Far East.

Specimen examined: RUSSIA, Sakhalin Island, Smirnykhovskiy district, Mt. Vaida, 49°52'49"N 143°28'0"E, 720 m, mountain tundra, among epigeic mosses, 14.07.2018, Korznikov 2019 (SAK). GenBank Accession no.: PV131382.

***Rostania ceranisca* (Nyl.) Otálora, P.M. Jørg. et Wedin**

The species is characterized by small squamulose-subfruticose thallus up to 3 cm in diam. and subglobose or subcubic eumuriform colourless or pale yellowish ascospores. The genus *Rostania* was correspond to the *Collema occultatum*-group and differs from other genera by having minute thalli and cubic muriform ascospores (Degelius 1954). *Rostania ceranisca* is mainly an arctic-alpine, terricolous species and occurs on lichens, bryophytes and plant debris or directly on bare soil often in moist habitats (Degelius 1954, Stenroos et al. 2016). *Rostania ceranisca* is most closely related to *Rostania occultata* (Bagl.) Otálora, P.M. Jørg. et Wedin but the latter is corticolous and differs by smaller thallus, apothecia and ascospores of somewhat different type (Degelius 1954). *Rostania ceranisca* occurs in Europe, Asia, North America and Antarctic (Stenroos et al. 2016). The species is also known from different parts of the Russian Arctic including the north of the Far East – Chukotka (Andreev et al. 1996). The species is new to Shikotan and the south of the Russian Far East.

Specimen examined: Russia, Shikotan Island, Gorobets River valley, 43°48'41.3"N 146°42'52.2"E, 69 m, mixed forest, on mossy vertical rock, 16.06.2017, Ezhkin 2182 (SAK).

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LITERATURE CITED

Andreev, M., Y. Kotlov & I. Makarova 1996. Checklist of lichens and lichenicolous fungi of the Russian Arctic. *Bryologist* 99(2):137–169.

Chesnokov, S.V. & L.A. Konoreva 2021. Addition to the lichen flora of Iturup Island (Sakhalin Region, Russian Far East). *Novosti sistematiki nizshikh rastenii* 55:379–392.

Chesnokov, S.V. & L.A. Konoreva 2022. Checklist of lichens of Shikotan Island (Southern Kuril Islands, Russian Far East). *Novosti sistematiki nizshikh rastenii* 56:413–440.

Chesnokov, S.V., V.V. Pan'kova & L.A. Konoreva 2023. *Fissurina inabensis* (Graphidaceae, Ascomycota), a new record to Russia from Shikotan Island. *Turczaninowia* 26(1):116–123.

Davydov, E.A. & L.S. Yakovchenko 2017. *Rhizocarpon smaragdulum*, a new monosporic yellow-thalline species and some additional species of the genus *Rhizocarpon* from the Altai Mountains (Siberia). *The Lichenologist* 49(5):457–466.

Degelius, G. 1954. The lichen genus *Collema* in Europe. Morphology, taxonomy, ecology. *Symbolae Botanicae Upsaliensis* 13(2):1–499.

Ezhkin, A.K. & I.A. Galanina 2016. Epiphytic lichens of deciduous trees in the city of Yuzhno-Sakhalinsk and specifics of their distribution by sensitivity to the anthropogenic impact. *Vestnik Severo-Vostochnogo nauchnogo tsentra DVO RAN* 4:95–107 (in Russian with English summary). [Ежкин А.К., Галанина И.А. 2016. Эпифитные лишайники лиственных деревьев г. Южно-Сахалинск и особенности их распределения по степени чувствительности к антропогенному воздействию // Вестник Северо-Восточного научного центра ДВО РАН. Т. 4. С. 95–107].

Ezhkin, A.K. 2020. Lichens of the Natural Monument "Highlands of Chekhov Mountain", Sakhalin Island. *Biota i sreda zapovednykh territorii* 4:25–38. [Ежкин А.К. 2020. Лишайники памятника природы «Высокогорья горы Чехова» (остров Сахалин) // Биота и среда заповедных территорий. Т. 4. С. 25–38].

Jørgensen, P.M., H.L. Andersen & A. Elvebakk 2019. The genus *Massalongia* (lichenised ascomycetae) in the Southern Hemisphere. *Mycokeys* 60:125–140.

Kaganov, V.V. & A.K. Ezhkin 2023. Addition to the lichen flora of Sakhalin Island. *Botanicheskii Zhurnal* 108(12):1128–1134 (in Russian with English summary). [Каганов В.В., Ежкин А.К. 2023. Дополнение к флоре лишайников острова Сахалин // Ботанический журнал. Т. 108, № 12. С. 1128–1134].

Konoreva, L.A., S.I. Tchabanenko, A.K. Ezhkin, F. Schumm & S.V. Chesnokov 2018. New and noteworthy lichen and allied fungi records from Sakhalin Island, Far East of Russia. *Herzogia* 31(1): 276–292.

Kurokawa, S. 1962. A monograph of the genus *Anaptychia* Beih. *Nova Hedwigia* 6:1–115.

Nakanishi M. 1966. Taxonomical studies on the family Graphidaceae of Japan. *Journal of Science of the Hiroshima University. Series B* 11(2):51–126

Nakanishi, M., H. Kashiwadani & K.H. Moon 2003. Taxonomical notes on Japanese Graphidaceae (Ascomycotina), including some new combinations. *Bulletin of the National Museum of Nature and Science, Series B (Botany), Tokyo* 29(2):83–93.

Nakanishi, M., H. Kashiwadani, K.H. Moon 2001. Notes on the genera *Graphina* and *Graphis* (Graphidaceae) in Thailand. *Bulletin of the National Museum of Nature and Science, Series B (Botany), Tokyo* 27(2,3):47–55.

Nash, T.H., B.D. Ryan, C. Gries & F. Bungartz (eds.) 2004. Lichen Flora of the Greater Sonoran Desert Region. Vol 2. Lichens Unlimited, School of Life Sciences, Arizona State University, Tempe, 742 pp.

Schumm, F. & J.A. Elix 2015. *Atlas of images of thin layer chromatograms of lichen substances*. Books on Demand GmbH, Norderstedt.

Skirina, I.F., A.V. Salokhin, N.A. Tsarenko & F.V. Skirin 2016. New locations of protected lichens of Sakhalin Island. *Turczaninowia* 19(2):54–63 (in Russian with English summary). [Скирина И.Ф., Салохин А.В., Царенко Н.А., Скирин Ф.В. 2016. Новые местонахождения редких и охраняемых лишайников острова Сахалин // Turczaninowia. Т. 19, № 2. С. 54–63].

Smith, C.W., A. Aptroot, B.J. Coppins, A. Fletcher, O.L. Gilbert, P.W. James & P.A. Wolseley (eds) 2009. *The Lichens of Great Britain and Ireland*. London, 1046 pp.

Šoun, J., J. Vondrák, U. Søchting, P. Hrouzek, A. Khodosovtsev & U. Arup 2011. Taxonomy and phylogeny of the *Caloplaca cerina* group in Europe. *The Lichenologist* 43(2):113–135.

Stenroos, S., S. Velmala, J. Pykälä & T. Ahti 2016. *Lichens of Finland*. Botanical Museum, Finnish Museum of Natural History, 896 pp.

Takhtajan, A. 1986. Floristic regions of the World. University of California Press, Berkeley, 544 pp.

Tchabanenko, S.I. 2002. *Checklist of the flora of lichens in the south of the Russian Far East*. Dal`nauka, Vladivostok, 232 pp. (in Russian). [Чабаненко С.И. 2002. Конспект флоры лишайников юга Российского Дальнего Востока. Владивосток: Дальнаука. 232 с.].

Trifinopoulos, J., L.T. Nguyen, A.von Haeseler & B.Q. Minh 2016. W-IQ-TREE: a fast online phylogenetic tool for maximum likelihood analysis. *Nucleic Acids Research* 44(W1):W232–W235.

Urbanavichus, G.P. 2010. *A checklist of the lichen flora of Russia*. Nauka, St. Petersburg, 194 pp. (in Russian). [Урбанавичюс Г.П. 2010. Список лихенофлоры России. СПб.: Наука. 194 с.].

Vondrák, J., I. Frolov, E.A. Davydov, L. Yakovchenko, J. Malíček, S. Svoboda & J. Kubásek 2019. The lichen family Teloschistaceae in the Altai-Sayan region (Central Asia). *Phytotaxa* 396(1):1–66.

Wainio, E.A. 1918. Lichenes ab A. Yasuda in Japonia collecti. *The Botanical Magazine, Tokyo* 32(379):154–163.