БОТАНИЧЕСКИЙ ЖУРНАЛ, 2024, том 109, № 9, с. 886–890

ФЛОРИСТИЧЕСКИЕ НАХОДКИ

NEW RECORDS OF LICHENS FOR THE CAUCASUS AND DAGESTAN

© 2024 A. B. Ismailov[1, *], I. N. Urbanavichene[2, *]

[1]Mountain Botanical Garden of DFRC RAS
M. Gadjieva Str., 45, Makhachkala, 367000, Russia
[2]Komarov Botanical Institute RAS
Prof. Popov Str., 2, St. Petersburg, 197022, Russia
**e-mail: i.aziz@mail.ru*
***e-mail: urbanavichene@gmail.com*

Received 18.07.2024
Revised 28.07.2024
Accepted 10.09.2024

Calicium notarisii and *Cladonia humilis* are reported as new to the lichen flora of Dagestan. Herewith the species *C. humilis* was not known before in the Caucasus. Descriptions of the specimens with information of their habitats, distribution and some notes are given. Morphological and chemical distinctions between *C. humilis* and similar species are discussed.

Keywords: East Caucasus, floristic studies, new findings, Sosnovka tract

DOI: 10.31857/S0006813624090047 **EDN**: PAESUM

The Republic of Dagestan is intensely studied in terms of lichenofloristical surveys. Due to its diverse geomorphology and altitudinal range (from –26 to 4466 m a.s.l.), it harbours a species-rich variety of vegetation ranging from xerophilous to alpine (e.g. montane dry pine forests, mesophytic deciduous forests, and steppes) above which there is subnival and nival zone with glaciers and snowfields. This is reflected in the lichen diversity. Currently about 890 lichen species are known in Dagestan and species list is being updated.

During the fieldwork as a part of continuing studies of lichen diversity, we found several corticolous and lignicolous lichens from mountainous and lowland parts of Dagestan. Identification of the specimens has revealed new species. In this paper, we provide information on new records.

Specimens were collected on the spur of the Greater Caucasus (July 2022) and on the Tersko-Kumskaya lowland ("Sosnovka" tract, November 2023). Light microscopy (LOMO MSP-2 microscope), chemical spot tests and UV light were used for specimen investigations. The secondary metabolites of species were identified using high performance thin layer chromatography (HPTLC) in solvent system A according to the methods summarized by Arup et al. (1993). The specimens are deposited in the herbarium of Mountain Botanical Garden of DFRC RAS (DAG).

As a result of the specimens study new species were identified for the lichen flora of the Caucasus – *Cladonia humilis* (With.) J. R. Laundon, and Dagestan – *Calicium notarisii* (Tul.) M. Prieto et Wedin.

Calicium notarisii (Tul.) M. Prieto et Wedin (fig. 1).

Description. Thallus crustose, episubstratic, verrucose, bright yellow, small (to 2.5 cm long and 0.5 cm wide). Apothecia immersed in 0.3–0.7 mm wide thalline warts, 0.2–0.4 mm across, covered with a black, epruinose mazaedium. Exciple brown, thin, not thickened at the base. Hypothecium very thin, poorly pigmented. Asci ellipsoid to pyriform, with 2–3 seriate spores. Ascospores at first 1-septate, then submuriform, brown, broadly ellipsoid or irregular in outline, some constricted at the septa, 12.5–17.5 × 10.5–14 μm (n = 10), with (2)–4(6) cells. Pycnidia black, confluent. Conidia 1-celled, hyaline, ellipsoid. Photobiont chlorococcoid.

Substrate and ecology: on dry, weathered wood of pine trunk on the edge of montane mixed pine-broadleaved forest.

Spot tests: all negative (thallus K-, C-, KC-, P-).

Specimen examined: Republic of Dagestan, Tsuntinskiy district, left bank of the Simbiriskhevi River, montane mixed pine-broadleaved forest on the top of the Greater Caucasus spur, on weathered wood of pine, 2280 m a. s.

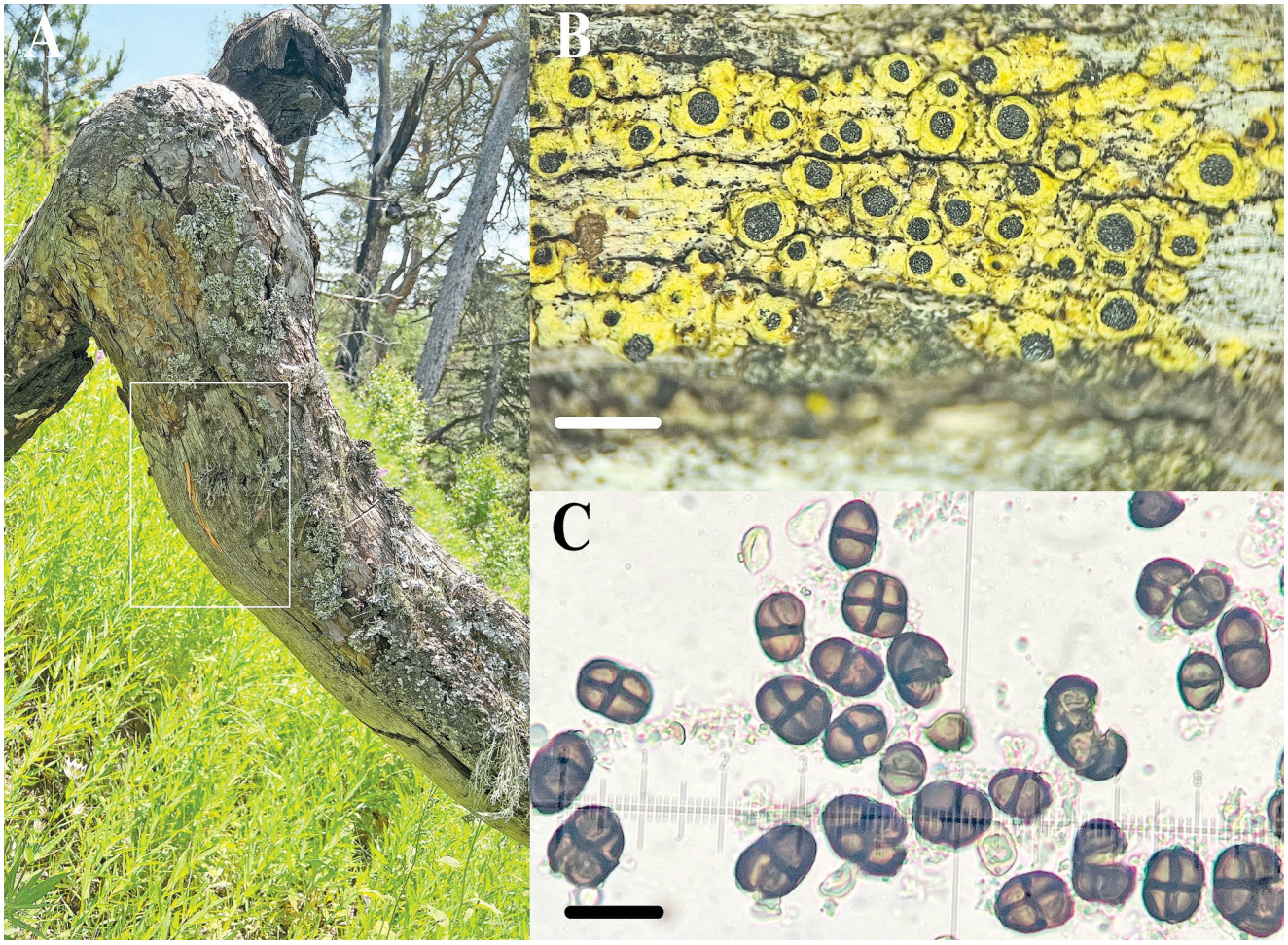

Рис. 1. *Calicium notarisii*: A – местообитание (рамкой выделена часть ствола, на которой рос образец); B – внешний вид (шкала – 0.1 см); C – споры (600×; шкала – 15 мкм).
Fig. 1. *Calicium notarisii*: A – habitat (frame indicates the part of the trunk where the specimen grew); B – habitus (scale bar 0.1 cm); C – spores (600×; scale bar 15 μm).

l. 42°05'10"N, 46°08'25"E. 14 VII 2022. A.B. Ismailov (DAG 1522).

Distribution: mainly cool-temperate to southern boreal-montane lichen. Within the Caucasus, the species is known from Lagonaki Highland on *Abies* and *Pinus* (Urbanavichus, Urbanavichene, 2014, as *Cyphelium notarisii* (Tul.) Blomb. et Forssell), Utrish Nature Reserve on *Juniperus* (Urbanavichus, Urbanavichene, 2015, as *C. notarisii*) and from Kabardino-Balkaria on *Corylus* (Slonov, 2002, as *C. notarisii*).

Note. Similar species, more widely distributed in the Caucasus is *Calicium tigillare* (Ach.) Pers. It has identical external morphology with *C. notarisii* but is distinguished by 1-septate ascospores.

Cladonia humilis (With.) J.R. Laundon (fig. 2).

Description. Primary thallus squamulose, the squamules often rather large, to 6 mm diam., rounded to sparingly incised, green, esorediate at margins, with upturned ends showing bright white undersides. Podetia to 9 mm tall, green, hollow inside, ecorticate, esquamulose, farinose-sorediate (soredia to 65 μm diam.). Scyphi to 4 mm diam., even, regular, proliferating from the rim in old podetia. Apothecia brown, convex, stipitate along the margins of cups. Asci 8-spored, clavate, thickened at apex. Ascospores 1-celled, hyaline, ellipsoid. Pycnidia dark, developing along the margins of cups. Photobiont chlorococcoid.

Substrate and ecology: on rotten juniper stump in arid conditions of desertified steppes with juniper light woodlands.

Spot tests, secondary metabolites: K+ yellow, P+ red, UV-, atranorin, fumaroprotocetraric acid (1 chemotype).

Specimen examined: Republic of Dagestan, Nogayskiy district, Tersko-Kumskiy sandy massif, “Sosnovka” tract,

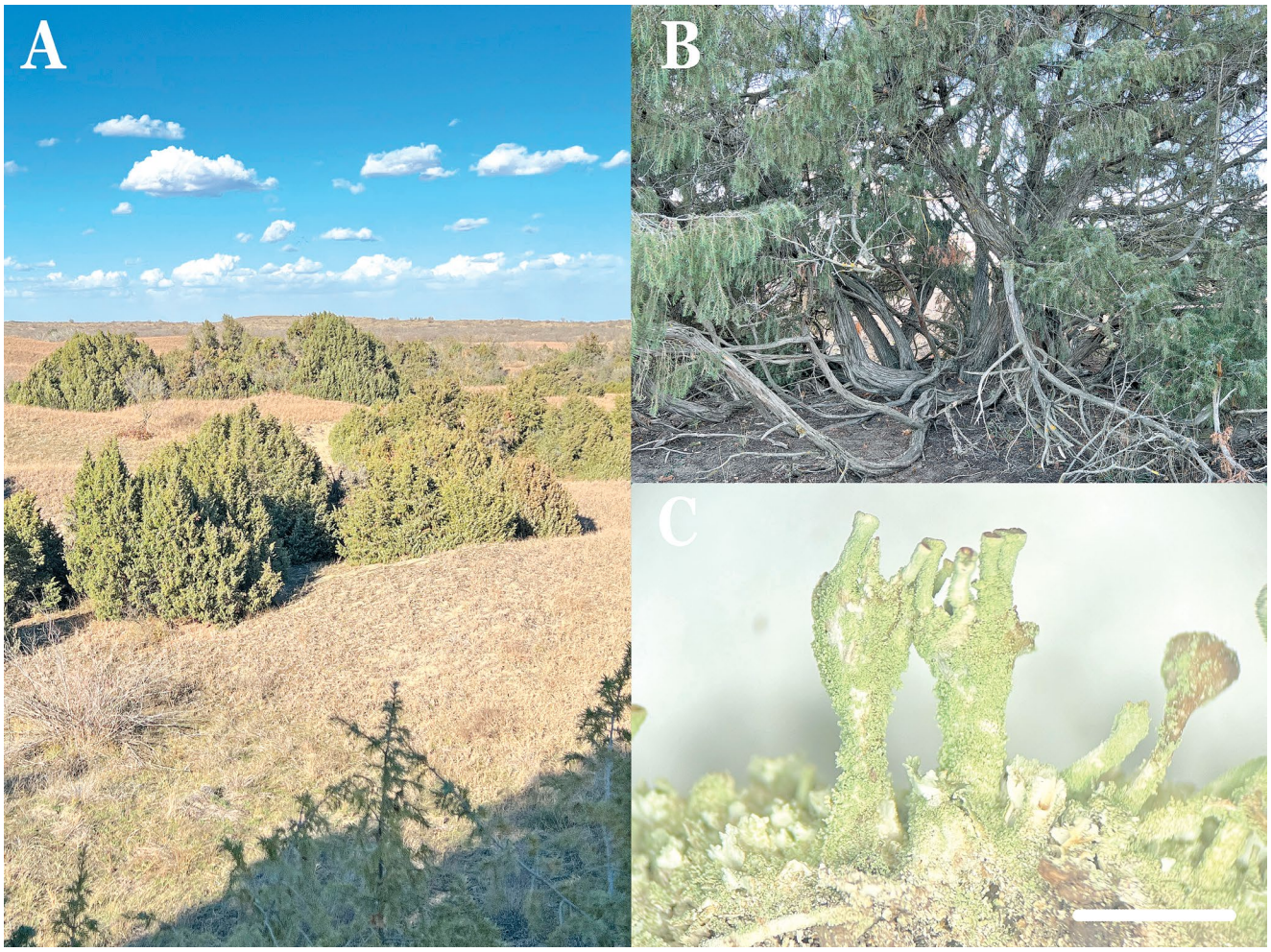

Fig. 2. *Cladonia humilis*: A – communities where the species occurred; B – habitat; C – habitus (scale bar 0.5 cm).
Рис. 2. *Cladonia humilis*: A – сообщества, в которых найден вид; B – местообитание; C – внешний вид (шкала – 0.5 см).

juniper light woodlands, on rotten juniper stump, 59 m a. s. l. 44°02'06"N, 45°37'56"E. 17 XI 2023. A.B. Ismailov (DAG 1523).

Distribution: widespread species found mostly at low elevations often on sandy soil, rarely on lignum and mossy trees. New species for the Caucasus. Within Russia is known from European part, Ural, Siberia and Far East (Urbanavichus, 2010).

Note: *Cladonia humilis* is morphologically very similar to *C. conista* (Nyl.) Robbins known within the Caucasus only from Georgia (Inashvili et al., 2022). These species differ by ecology and secondary metabolites. *C. humilis* is a common species of less acidic to neutral soils, usually in disturbed habitats. *C. conista* is common on acid soils. *C. conista* was previously considered as a chemotype of *C. humilis* (James, 2009), but is treated as a separate species by R. Pino-Bodas et al. (2012) who showed that there are clear sequence differences between the two taxa. *C. humilis* is characterized by 4 chemotypes (Nimis, 2022): 1) atranorin, fumarprotocetraric acid complex, 2) bourgeanic and fumarprotocetraric acids, 3) atranorin, fumarprotocetraric and bourgeanic acids, 4) fumarprotocetraric acid complex. *C. conista* is characterized by only one chemotype: with fumarprotocetraric and bourgeanic acids.

The morphs of *Cladonia humilis* with large corticate granules can be confused with *C. pocillum* (Ach.) O.J. Rich. The first one has bright green-grey basal squamules with upturned ends showing the white underside, while *C. pocillum* has browner squamules with downturned ends. Other similar species are *C. fimbriata* (L.) Fr. which differs by podetial surface completely covered by farinose soredia, and *C. chlorophaea* (Flörke ex Sommerf.) Spreng. with granulose corticate surface (Pino-Bodas et al., 2021).

ACKNOWLEDGEMENTS

The work of A.B. Ismailov was carried out within the framework of the research project of Mountain Botanical Garden of DFRC RAS (No. 122032300227-8). The research of I.N. Urbanavichene was carried out within the framework of the planned theme of the Komarov Botanical Institute of RAS "Flora and systematics of algae, lichens and mosses of Russia and phytogeographically important regions of the world" (No. 121021600184-6).

REFERENCES

Arup U., Ekman S., Lindblom L., Mattsson J. 1993. High performance thin layer chromatography (HPTLC), an improved technique for screening lichen substances. – The Lichenologist. 25 (1): 61–71.

https://doi.org/10.1006/lich.1993.1018

Inashvili T., Kupradze I., Batsatsashvili K. 2022. A revised catalog of lichens of Georgia (South Caucasus). – Acta Mycologica. 57 (571): 1–46.

https://doi.org/10.5586/am.571

James P.W. 2009. *Cladonia* P. Browne. – In: Lichens of Great Britain and Ireland. London. P. 309–338.

Nimis P.L. 2022. ITALIC – The Information System on Italian Lichens. Version 7.0. University of Trieste, Dept. of Biology. https://italic.units.it/index.php (Accessed: 16 July 2024)

Pino-Bodas R., Martín M.P., Burgaz A.R., Lumbsch H.T. 2012. Species delimitations in the *Cladonia cariosa* group (Cladoniaceae, Ascomycota). – The Lichenologist. 44: 121–135.

https://doi.org/10.1017/S002428291100065X

Pino-Bodas R., Sanderson N., Cannon P., Aptroot A., Coppins B., Orange A., Simkin J. 2021. Lecanorales: Cladoniaceae [revision 1], including the genera *Cladonia*, *Pilophorus* and *Pycnothelia*. – Revisions of British and Irish Lichens. 26: 1–45.

Slonov T.L. 2002. Likhenoflora Kabardino-Balkarii i yeyo analiz [Lichen flora of the Kabardino-Balkaria and its analysis]. Nal'chik. 134 p. (In Russ.).

Urbanavichus G.P. 2010. Spisok likhenoflory Rossii [A checklist of the lichen flora of Russia]. St. Petersburg. 194 p. (In Russ.).

Urbanavichus G., Urbanavichene I. 2014. An inventory of the lichen flora of Lagonaki Highland (NW Caucasus, Russia). – Herzogia. 27(2): 285–319.

https://doi.org/10.13158/heia.27.2.2014.285

Urbanavichus G.P., Urbanavichene I.N. 2015. A contribution to the lichen flora of Utrish Nature Reserve. – Turczaninowia. 18 (2): 86–95

https://doi.org/10.14258/turczaninowia.18.2.9

НОВЫЕ НАХОДКИ ЛИШАЙНИКОВ ДЛЯ КАВКАЗА И ДАГЕСТАНА

© 2024 А. Б. Исмаилов[1, *], И. Н. Урбанавичене[2, **]

[1]Горный ботанический сад Дагестанского федерального исследовательского центра РАН
ул. М. Гаджиева, 45, Махачкала, 367000, Россия
[2]Ботанический институт им. В. Л. Комарова РАН
ул. Профессора Попова, 2, Санкт-Петербург, 197022, Россия

**e-mail: i.aziz@mail.ru*
***e-mail: urbanavichene@gmail.com*

Приводятся сведения о двух новых видах лишайников (*Calicium notarisii* и *Cladonia humilis*), впервые найденных в лихенофлоре Дагестана. Вид *C. humilis* ранее не был известен на Кавказе. Дается описание образцов с информацией об их местопроизрастании и распространении. Обсуждаются морфологические и химические отличия *C. humilis* от близких видов.

Ключевые слова: Восточный Кавказ, дополнение к лихенофлоре, флористические исследования, урочище "Сосновка"

БЛАГОДАРНОСТИ

Работа А.Б. Исмаилова выполнена в рамках плановой темы ГорБС ДФИЦ РАН "Геоклиматические особенности распространения и описание сообществ с участием популяций редких и ресурсных древесных видов Северного Кавказа" (№ 122032300227-8). Работа И.Н. Урбанавичене выполнена в рамках плановой темы БИН РАН "Флора и систематика водорослей, лишайников и мохообразных России и фитогеографически важных регионов мира" (№ 121021600184-6).

СПИСОК ЛИТЕРАТУРЫ

Arup U., Ekman S., Lindblom L., Mattsson J. 1993. High performance thin layer chromatography (HPTLC), an improved technique for screening lichen substances. – The Lichenologist. 25 (1): 61–71. https://doi.org/10.1006/lich.1993.1018

Inashvili T., Kupradze I., Batsatsashvili K. 2022. A revised catalog of lichens of Georgia (South Caucasus). – Acta Mycologica. 57 (571): 1–46. https://doi.org/10.5586/am.571

James P.W. 2009. *Cladonia* P. Browne. – In: Lichens of Great Britain and Ireland. London. P. 309–338.

Nimis P.L. 2022. ITALIC – The Information System on Italian Lichens. Version 7.0. University of Trieste, Dept. of Biology. https://italic.units.it/index.php (Accessed: 16 July 2024).

Pino-Bodas R., Martín M.P., Burgaz A.R., Lumbsch H.T. 2012. Species delimitations in the *Cladonia cariosa* group (Cladoniaceae, Ascomycota). – The Lichenologist. 44: 121–135. https://doi.org/10.1017/S002428291100065X

Pino-Bodas R., Sanderson N., Cannon P., Aptroot A., Coppins B., Orange A., Simkin J. 2021. Lecanorales: Cladoniaceae [revision 1], including the genera *Cladonia*, *Pilophorus* and *Pycnothelia*. – Revisions of British and Irish Lichens. 26: 1–45.

[Slonov] Слонов Т.Л. 2002. Лихенофлора Кабардино-Балкарии и ее анализ. Нальчик. 134 с.

[Urbanavichus] Урбанавичюс Г.П. 2010. Список лихенофлоры России. СПб. 194 с.

Urbanavichus G., Urbanavichene I. 2014. An inventory of the lichen flora of Lagonaki Highland (NW Caucasus, Russia). – Herzogia 27 (2): 285–319. https://doi.org/10.13158/heia.27.2.2014.285

[Urbanavichus, Urbanavichene] Урбанавичюс Г.П., Урбанавичене И.Н. 2015. Материалы к лихенофлоре заповедника “Утриш”. – Turczaninowia. 18 (2): 86–95. https://doi.org/10.14258/turczaninowia.18.2.9