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КРАТКИЕ СООБЩЕНИЯ

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SIX SPECIES OF *AGARICOMYCETES*, NEW TO THE PAMIR-ALAY MOUNTAINS (UZBEKISTAN PART)

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New data on basidiomycete species (*Crucibulum laeve*, *Ganoderma resinaceum*, *Leccinum duriusculum*, *Lentinus brumalis*, *Neolentinus cyathiformis*, and *Volvariella bombycina*) recorded for the first time for the Pamir-Alay ranges in Uzbekistan is presented. All collections were made within protected areas of the Zaamin National Nature Park, the Nuratau Nature Reserve, and the Kitab State Geological Reserve. Detailed information on studied specimens deposited in Tashkent Mycological Herbarium of the Institute of Botany of Academy of Sciences of Uzbekistan (TASM), including geographical coordinates, descriptions of localities, substrates and habitats, date of collection, as well as the herbarium numbers, is provided. The history of macrofungi studies in Pamir-Alay is briefly described.

Keywords: Basidiomycota, macrofungi, new records, Northern Turkestan Range, Nuratau Range, Pamir-Alay
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The Pamir-Alay is a mountain system in the southeast of Central Asia (Fig. 1), located on the territory of Tajikistan (in the northwest), Kyrgyzstan (in the west), and Uzbekistan (in the east) (Opała-Owczarek, Niedźwiedź, 2019). The Bobotog, North Turkestan, Molguzar, Nuratau, Hissar, and Zarafshan ranges of the Pamir-Alay Mountains are located in Uzbekistan. These ranges are known for its unique fauna and flora (Mustafaev, Islomiddinov, 2022; Shomurodov, Khabibullaev, 2022). These valuable areas have various plant communities, exhibiting excellent habitat for different macrofungi.

Studies on macrofungi in the Pamir-Alay started in the 20th century with collections made by the Russian scientists. The first detailed survey of fungi was carried out by Zaprometov (1928). Further studies were conducted by Rotkevich (1956) in the Guralash Reserve. Unfortunately, in these works no specimens are mentioned at all or there is no precise information about them. In addition, these studies were focused on phytopathogenic microfungi. Special studies on basidial macrofungi in the region were carried out by Petrova (1985, 1989). As a result, the researcher recorded 221 macromycete species in the Zaamin Nature Reserve. Several papers were published in the last ten years on the macrofungi from the Uzbek part of the Pamir-Alay Mountains (Mustafaev, 2017; Gafforov et al., 2017; Gafforov et al., 2020; Wang et al., 2022). Apart from these publications, no efforts have been made to produce an extensive local database on macrofungi.

Based on preliminary results of mycological surveys conducted in this area from 2019 to the present time, it has been confirmed that there is a high level of macrofungal diversity in the Pamir-Alay Mountains (Fig. 1). The aim of this paper is to describe six *Agaricomycetes* species which are new to the Hissar, the Northern Turkestan and the Nuratau ranges.

The material was collected during field investigations in Yettikechu, Usmonlisoy, O'riklisoy areas of the Zaamin National Nature Park, Majrumsoy and Khayotsoy areas of the Nuratau State Reserve and the Kitab State Geological Reserve. Photographs of basidiomata were taken with a Nikon D-7500 digital camera to fix macroscopic characters *in situ*. For microscopic studies, we used an N-300M Optical Microscope (China) and 5% KOH as a mounting medium to revive fragments of dried specimens. Fungal taxa names are accepted according to the Index Fungorum (2023) database. Specimens are deposited in Tashkent Mycological Herbarium of the Institute of Botany of Academy of Sciences of Uzbekistan (TASM).

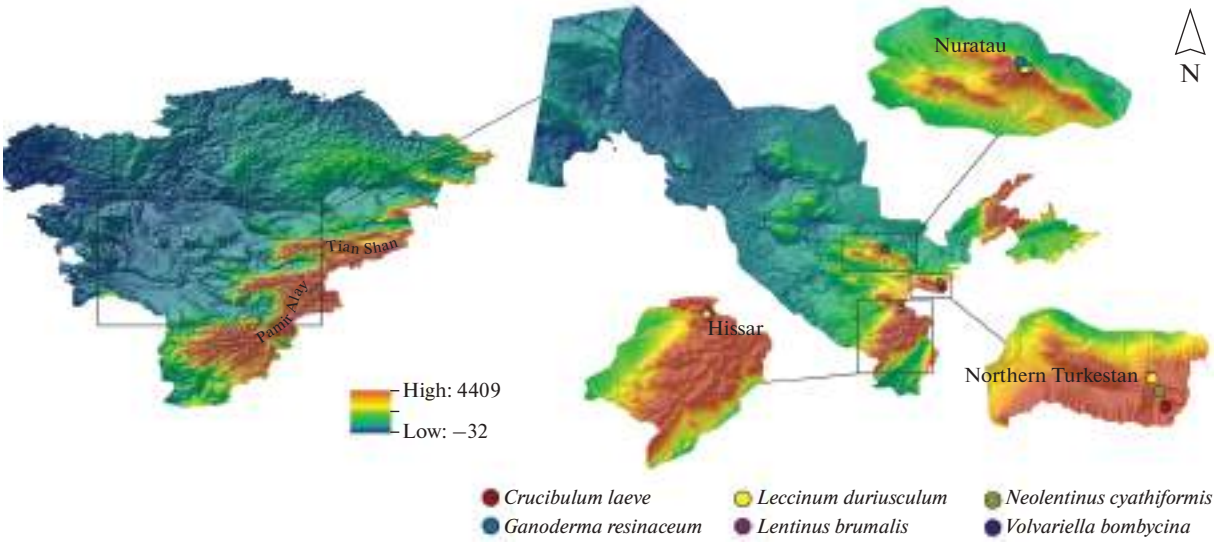


Fig. 1. The location of macrofungal collection sites in the Hissar, the Northern Turkestan and the Nuratau ranges of Uzbekistan. The map was compiled using ArcGIS (v. 10.8.1) software.



Fig. 2. Basidiomata of studied species *in situ*: a – *Crucibulum laeve*; b – *Ganoderma resinaceum*; c – *Leccinum duriusculum*; d – *Neolentinus cyathiformis*; e – *Lentinus brumalis*; f – *Volvariella bombycina* (photos Z.Sh. Islomiddinov).

As a result of the investigation six basidiomycete species, *viz. Crucibulum laeve*, *Ganoderma resinaceum*, *Leccinum duriusculum*, *Lentinus brumalis*, *Neolentinus cyathiformis*, and *Volvariella bombycina*, have been revealed from the Pamir-Alay Mountains within Uzbekistan. An annotated list of species is presented below with detailed information on substrates and habitats, geographical coordinates, descriptions of localities, date of collection, as well as herbarium numbers of specimens.

Crucibulum laeve (Huds.) Kambly – on branches of dried fallen *Juniperus* sp. tree in juniper forest with mosses, around the waterfall (39.632887 N, 68.488241 E) in the Zaamin National Nature Park (TASM IZSH-120). Note: *C. laeve* is the most well-known temperate-zone species with a circumpolar distribution. It has been collected in most European countries, the Canary Islands, North America, South America, Australia, Japan, and New Zealand (Cruz et al., 2016). The species was mentioned in research conducted in Central Asia (Cho et al., 2019). However, *C. laeve* was not reported in Uzbekistan until our research. Moreover, *Crucibulum* is a new genus to Uzbekistan.

Ganoderma resinaceum Boud. – on decaying stump of *Salix alba* in Majrumsoy area (40.582034 N, 66.724072 E) of the Nuratau Nature Reserve (TASM IM-190m). Note: *G. resinaceum* is characterized by variable pileus coloration, fibrous spongy homogeneous context, and amyloid pileipellis (Ryvarden, 2004). We note *G. resinaceum* as a new record for the Nuratau Nature Reserve, Nuratau range.

Leccinum duriusculum (Schulzer ex Kalchbr.) Singer – on soil near poplars in the village of Korongusoy (39.771470 N, 68.401093 E) of the Zaamin National Nature Park; Tikchasoy (40.527072 N, 66.804108 E) and Khayotsoy (40.525032 N, 66.764421 E) areas of the Nuratau Nature Reserve (TASM IZSH-24, TASM IMM-45m). Note: The species is reported as a new to all Pamir-Alay ranges in Uzbekistan. *L. duriusculum* is characterized by large and robust basidiomata with greyish stem squamules and flesh turning grey to violaceous, often with blue-green in the stipe base (Kibby, 2006).

Lentinus brumalis (Pers.) Zmitr. – on decayed parts of *Artemisia* spp. in Korongusoy village (39.774504 N, 68.399589 E) of the Zaamin National Nature Park; in Tikchasoy (40.527072 N, 66.804108 E), Khayotsoy (40.525032 N, 66.764421 E) area of the Nuratau Nature Reserve (TASM IZSH-34, TASM IMM-99m). Note: The species is reported as a new to all Pamir-Alay ranges in Uzbekistan. More than 60 *Lentinus* species have been reported globally, but only two species of the genus were reported for Uzbekistan. Basidiomata of *L. brumalis* found in the Zaamin National Nature Park and the Nuratau Nature Reserve is characterized by cap with yellow-brown to dark brown surface, finely hairy, with depressed center and tucked fringed edge. In contrary to the vast majority of known findings of the species on dead wood (Ryvarden, Melo, 2017), our specimen was collected from an herbaceous plant.

Neolentinus cyathiformis (Schaeff.) Della Magg. et Trassin. – on fallen trunks of *Populus alba* in Usmonlisoy village (39.707113 N, 68.446782 E) of the Zaamin National Nature Park, Tikchasoy (40.515350 N, 66.780304 E), Khayotsoy, Majrumsoy area of the Nuratau Nature Reserve and the Kitab State Geological Reserve (TASM IZSH-55, TASM IMM-64m). Note: The species is reported as a new to all Pamir-Alay ranges in Uzbekistan. Although 14 species are accepted as *Neolentinus* worldwide (Wijayawardene et al., 2022), only one species has been registered in Uzbekistan. Previously *N. cyathiformis* was recorded from the western part of the Tian Shan Mountains in Uzbekistan from the trunk of *Populus* sp. (Akhmedova, 1966). Our findings from *Populus alba* extend the distribution area of the species in Uzbekistan.

Volvariella bombycina (Schaeff.) Singer – on stump of *Populus* sp. in Qorongusoy village (39.772066 N, 68.402054 E) of the Zaamin National Nature Park and on *Juglans regia* stump in Tikchasoy area (40.506954 N, 66.781315 E) of the Nuratau Nature Reserve (TASM IZSH-155, TASM IMM-87m). Note: Among *ca.* 50 species accepted in the genus *Volvariella* worldwide (Wijayawardene et al., 2022), only three species are listed in the TASM herbarium for Uzbekistan. All morphological characters of our specimens studied, both macro- and microstructures, fit the description provided for *V. bombycina* by Menolli and Capelari (2008) and Szczepkowski with co-authors (Szczepkowski et al., 2013). Until this study, *V. bombycina* was reported by Akhmedova (1966) from the western part of the Tian Shan Mountains in Uzbekistan. New records of the species in the Uzbek part of the Pamir-Alay Mountains confirm wider distribution area of *V. bombycina*.

In conclusion, six *Agaricomycetes* species were recorded for the first time in the Uzbek part of the Pamir-Alay using the morphological identification. The knowledge on fungal diversity of this mountain system is essential to reinforce the nature protection programs, especially through the establishment of conservation areas, which are almost absent on the territory. Moreover, these records improve the knowledge on the diversity and distribution of fungal species in Uzbekistan.

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REFERENCES

Akhmedova F.G. Mycoflora of south-western slopes of Tian Shan. Cand. Sci. Thesis. Tashkent, 1966 (in Russ.).

Cho S.E., Jo J.W., Kim N.K. et al. Macrofungal survey of the Tian Shan mountains, Kyrgyzstan. Mycobiology. 2019. V. 47 (4). P. 378–390. https://doi.org/10.1080/12298093.2019.1661565

Cruz R., Baseia I.G., Hosaka K. Distribution data of bird's nest fungi in Japan: *Nidula niveotomentosa* and *Crucibulum laeve*. Bull. Natnl Mus. Nat. Sci. Ser. B. Botany. 2016. V. 42 (2). P. 49–55.

Gafforov Y., Ordynets A., Langer E. et al. Species diversity with comprehensive annotations of wood-inhabiting poroid and corticioid fungi in Uzbekistan. Front. Microbiol. 2020. V. 11. Art. 598321. https://doi.org/10.3389/fmicb.2020.598321

Gafforov Y., Riebesehl J., Ordynets A. et al. Hyphodontia (*Hymenochaetales, Basidiomycota*) and similar taxa from Central Asia. Botany. 2017. V. 95 (11). P. 1041–1056. https://doi.org/10.1139/cjb-2017-0115

Index Fungorum. CABI Bioscience, 2023. http://www.indexfungorum.org. Accessed 20.04.2023.

Kibby G. Leccinum revisited. A new synoptic key to species. Field Mycology. 2006. V. 7 (4). P. 77–87. https://doi.org/10.1016/S1468-1641(10)60573-7

Menolli Jr.N., Capelari M. Records and two new species of *Volvariella* (*Pluteaceae, Agaricales*) from Brazil. Mycotaxon. 2008. V. 106. P. 385–398.

Mustafaev E. New records of ascomycetes (*Pezizales*) for the mycobiota of Uzbekistan. Iranian J. Bot. 2017. V. 23 (1). P. 72–75. https://doi.org/10.22092/ijb.2017.111924

Mustafaev I.M., Islomiddinov Z.Sh. The first record of the genus *Geopora* (*Pezizales*) for Uzbekistan. Ukrainian Bot. J. 2022. V. 79 (1). P. 51–55. https://doi.org/10.15407/ukrbotj79.01.051

Opała-Owczarek M., Niedźwiedź T. Last 1100 yr of precipitation variability in western central Asia as revealed by tree-ring data from the Pamir-Alay. Quaternary Res. 2019. V. 91 (1). P. 81–95. https://doi.org/10.1017/qua.2018.21

Petrova A.A. Ad floram macromycetum basidialium reservati publici montano-silvatici Zaaminskij dicti in RSS Uzbekistania. I. Novosti sistematiki nizshikh rastenii. 1985. V. 22. P. 144–148 (in Russ.).

Petrova A.A. Basidial macromycetes of the Zaamin Mountain Forest Reserve. Cand. Sci. Thesis. Kiev, 1989 (in Russ.).

Rotkevich T.K. Materials for mycoflora of the former mountain-arch reserve Guralash (northern spurs of the Turkestan Range). In: Proceedings of the 1st coordination meeting of mycologists of republics of Central Asia and Kazakhstan. Frunze, 1960, pp. 142–143 (in Russ.).

Ryvarden L. Neotropical polypores. Part 1. Introduction, *Ganodermataceae* and *Hymenochaetaceae*. Synopsis Fungorum. V. 19. Fungiflora, Oslo, 2004.

Ryvarden L., Melo I. Poroid fungi of Europe. Second revised edition. Synopsis Fungorum. V. 37. Fungiflora, Oslo, 2017.

Shomurodov Kh.F., Khabibullaev B.Sh. Investigation of changes in the species composition within the plant community containing relict shrub *Moluccella bucharica* for half a century. Malayan Nature J. 2022. V. 74 (1). P. 19–29.

Szczepkowski A., Kujawa A., Halama M. Volvariella bombycina (Schaeff.) Singer in Poland: notes on its ecology, distribution and conservation status. Polish J. Environmental Studies. 2013. V. 22 (1). P. 41–51.

Wang X.W., Jiang J.H., Liu S.L. et al. Species diversification of the coniferous pathogenic fungal genus *Coniferiporia* (*Hymenochaetales, Basidiomycota*) in association with its biogeography and host plants. Phytopathology. 2022. V. 112. P. 404–413. https://doi.org/10.1094/PHYTO-05-21-0181-R

Wijayawardene N.N., Hyde K.D., Dai D.Q. et al. Outline of Fungi and fungus-like taxa – 2021. Mycosphere. 2022. V. 13 (1). P. 53–453. https://doi.org/10.5943/mycosphere/13/1/2

Zaprometov N.G. Materials on mycoflora of Central Asia. V. 2. Tashkent, 1928 (in Russ.).

Ахмедова Ф.Г. (Akhmedova) Микофлора Юго-Западных отрогов Тань-Шаня: дисс. ... канд. биол. наук. Ташкент, 1966.

Запрометов Н.Г. (Zaprometov) Материалы по микофлоре Средней Азии. Вып. 2. Ташкент, 1928. 71 с.

Петрова А.А. (Petrova) К флоре базидиальных макромицетов Зааминского горнолесного заповедника УзССР. I // Новости систематики низших растений. 1985. Т. 22. С. 144–148.

Петрова А.А. (Petrova) Базидиальные макромицеты Зааминского горно-лесного заповедника (УзССР): дис. ... канд. биол. наук. Киев, 1989. 260 с.

Роткевич Т.К. (Rotkevich) Материалы к микофлоре бывшего горно-арчового заповедника Гуралаш (северные отроги Туркестанского хребта). Мат-лы I коорд. совещ. микологов республик Средней Азии и Казахстана. Фрунзе, 1960. С. 142–143.

Шесть новых для Памиро-Алая видов *Agaricomycetes* (в пределах Узбекистана)

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Приводятся новые сведения о видах базидиальных макромицетов (*Crucibulum laeve*, *Ganoderma resinaceum*, *Leccinum duriusculum*, *Lentinus brumalis*, *Neolentinus cyathiformis*, *Volvariella bombycina*), впервые отмеченных на территории Памиро-Алайских гор в Узбекистане. Все образцы были собраны на охраняемых территориях Зааминского национального природного парка, Нуратинского заповедника и Китабского государственного геологического заказника. Представлены подробные сведения об изученных образцах, хранящихся в Ташкентском микологическом гербарии Института ботаники Академии наук Узбекистана (TASM), включая географические координаты, описания локалитетов, субстратов и местообитаний, даты сборов, а также гербарные номера образцов. Кратко описана история изучения макромицетов на территории Памиро-Алая.

Ключевые слова: Basidiomycota, макромицеты, новые находки, Памиро-Алай, Северный Туркестанский хребет, хребет Нуратау