

Four mushrooms species new for Azerbaijan

Dilzara N. Aghayeva¹
Elgun H. Mustafabayli
Yagut A. Yusifova

*Institute of Botany, Ministry of Science and Education of the
Republic of Azerbaijan, Badamdar 40, Baku, AZ1004, Azerbaijan*

Hamida S. Seyidova

*Institute of Bioresources, Ministry of Science and Education of the
Republic of Azerbaijan, Babek, 10, Nakchivan, AZ7000, Azerbaijan*

Abstract: This article reports four new species recently found in Azerbaijan. These are two species of ascomycetes (*Morchella semilibera* DC., *Sarcosphaera coronaria* (Jacq.) J. Schröt) and two basidiomycetes (*Leccinum scabrum* (Bull.) Grey, *Pisolithus arhizus* (Scop.) Rauschert) occurring in different ecosystems. *M. semilibera* DC., *L. scabrum* are edible. *P. arhizus*, *S. coronaria* and *L. scabrum* are ectomycorrhizal, *M. semilibera* is saprobic. These species are recommended for the next edition of the Red Book of Azerbaijan. The article provides brief information and original photographs for each species.

Keywords: *ectomycorrhizal, edible fungi, rare, saprobe, species*

INTRODUCTION

Fungi are essential for maintaining ecosystem processes by contributing, regulating and improving its functions and providing ecosystem services. They possess large and varied phylogenetic and functional diversity, as well as wide diversity of dispersal modes, due to which fungi can act as important pathogens, commensals and mutualists of macroeukaryotic hosts, as well as interact with both prokaryotes and eukaryotes in ecosystems [Berby et al., 2017; Bahram, Netherway, 2022; Niego et al., 2023]. Mushrooms display different lifestyles, reproductive and dispersal strategies, and physicochemical properties that may play an important role for their existence [Berbee et al., 2017; Fricker, 2017].

Mushrooms, as a raw material obtained from the wild, have attracted people from the earliest periods of their life on Earth, as they have been an important human food for centuries and are now widely used in

the cuisine of different nations [Comandini, Renaldi, 2020]. Mushrooms, most often fall under the category of vegetables and along with a delicious taste, also have a deadly, magical, intoxicating, yet mysterious meaning. Most mushrooms are harvested for consumption. In addition, mushroom picking is widespread custom/hobby in European countries. Mushrooms are an integral part of the European diet [Lovrić et al., 2023; Procházka et al., 2023]. The consumption of mushrooms has increased not only because of their nutritional value, but also because of their healing potential and the ability to effectively collect certain elements.

The diversity of mushrooms has been extensively investigated worldwide, species number have been estimated in various papers and noted that it is changed significantly over the past decades [Hawksworth, 2001; 2012; Wu et al., 2019; Lofgren, Stajich, 2021]. The history of the study of macromycetes in Azerbaijan is uninformative and unattractive until the 1960s. Fungal diversity studies have been planned after the middle of the last century, and a significant number of specimens have been collected and identified by various researchers, mainly A.S. Sadigov [Key, ... 1985]. As it is well known the study of wild mushrooms has its own difficulties, such as the limitations associated with their growth only in certain places. Currently, more than 2800 specimens representing about 900 species is kept in the Herbaria of the Institute of Botany (BAK). Over the past decade, about 49 taxa of fungi from various taxonomic and ecological groups have been registered in Azerbaijan [Aghayeva et al., 2022; Alimammadova, Aghayeva, 2021; Mustafabayli, 2020; Mustafabayli, Aghayeva, 2019a, b; Mustafabayli et al., 2020; Mustafabayli et al., 2021]. The purpose of this article is to report four new species for Azerbaijan, and provide their original photographs and brief information including habitat.

MATERIAL AND METHODS

Specimens. Studied specimens were collected from Shaki district (Kish village, Goygol National Park (near to the lake) and National Botanical Garden in Baku in 2021 and in Nakheivan in 2009 (Fig. 1). Collected specimens were air dried and deposited in the mycological herbarium of

¹E-mail: a_dilzara@yahoo.com

Received 26.04.2023; Received in revised form 18.05.2023; Accepted 23.05.2023

the Institute of Botany, MSE RA (BAK). Specimens at first were examined visually using magnifying lens. Macromorphological features such as shape, size, color, smell, etc. of fruit body were considered [Arora, 1986; Lodge et al., 2004].

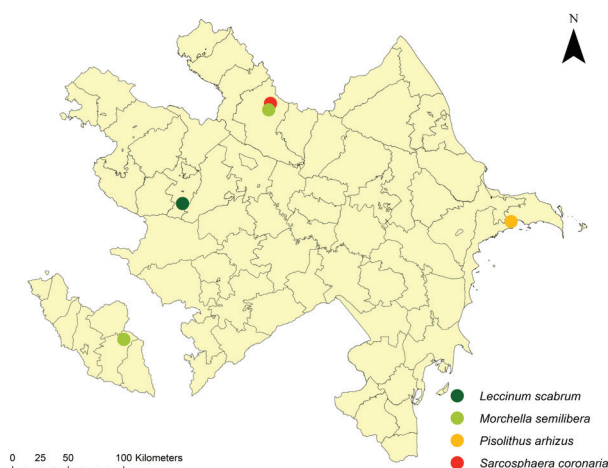


Figure 1. Location of registered new species for Azerbaijan.

Microscopic studies. Micromorphological features were investigated with light microscope (Vert. A1, Carl Zeiss, Germany) using sterile water for mounting of preparations. Congo red solution was used for better visibility of details of microscopic structures (basidia, cystidia, spores, etc.) if needed [Prance, Fechner, 2017]. For each specimen, 25 structures were measured and their average mean value was calculated. Photos of microscopic structures were obtained using the Axiocam (Zeiss, 105 color). Identification of mushrooms were carried out according to available literature [Dermek, 1979; Arora, 1986; Funga Nordica, 2012]. Nomenclature and taxonomy correspond to MycoBank databases.

RESULTS AND DISCUSSION

The studied specimens belong to different genera of Ascomycota and Basidiomycota (Fig. 2). *Leccinum scabrum* (Bull.) Gray and *Morchella semilibera* DC. are of nutritional value, while *Pisolithus arhizus* (Scop.) Rauschert is a mycorrhizal and *Sarcosphaera coronaria* (Jacq.) J. Schröt. is a ectomycorrhizal species. *M. semilibera* and *S. coronaria* were recommended for the inclusion to the third edition of Red Book of Azerbaijan. Of these mushrooms, especially *M. semilibera* is more popular and massively collected by local people.

Sarcosphaera coronaria (Jacq.) J. Schröt. (Fig. 2. 1-3) It forms a cup-shaped, later flattened ascocarp, usually

of 3-10 cm diam. (in our specimens 3-6 cm diam.) and 2-3 cm height, with crown-like edges, 3-4 mm thick, soft white spotted, inside lilac or light to dark purple, gelatinous, exterior whitish to cream, usually dirt-incrustated. Stalk rarely, short, narrow at base, up to 3 cm long. Asci are about $320-350 \times 11-13 \mu\text{m}$, eight-spored, cylindrical, smooth, paraphyses, branched, transparent, smooth, septate. Spores in D. Arora [1986] $14-22 \times 7-9 \mu\text{m}$ (but in our specimen $13-17 \times 6.5-8 \mu\text{m}$), elliptical, with long and truncate ends, smooth or slightly roughened, with 1-3 oil drops (in our specimen with 2 drops). Specimen (BAK1761) picked up in Kish village of Shaki district, under the pine trees (*Pinus sylvestris* L.) on May 06, 2021. Forest in this location solely is coniferous including *P. sylvestris*, *P. nigra* subsp. *pallasiana* (Lamb.) Holmboe, *P. brutia* subsp. *eldarica* (Medw.) Silba, *Taxus baccata* L. and small shrubs of *Rosa* sp., *Cornus mas* L. The type of soil is calcareous which is beneficial for growth of this cup fungi.

S. coronaria is used for cooking by local people in some villages of Turkey. It has high antioxidant properties. Even though the fungus is edible, it has also been considered poisonous by number of cases due to the type of soil and its content [Sevindik et al., 2018].

Morchella semilibera DC. (Fig. 2. 4-6)

Cap 4-8 cm high and broad (1.5-5 cm in our specimens), bluntly conical to round or oval when young, the edge free from stem 1/3 from distance of the cap, often flared outwards away from the stem, light-brown, honey-colored in young individuals, with age darkening from top to bottom, turning brown and black. Stem 3-10 cm (in our specimens 3-5 cm), fragile, generally white to yellowish. Asci 8-spored, $240-280 \times 17 \mu\text{m}$, paraphyses $12-15 \times 1-3 \mu\text{m}$ branched, septate, pear-shaped, swollen. Spores size in various literature differs and is about $23-34 \times 15-21 \mu\text{m}$ (in our specimen $20-22.5 \times 10-12 \mu\text{m}$), smooth, elliptical, oval, granular. Due to these features, it is rather similar to *Verpa* Sw., especially to *V. bohemica* Krombh.) J. Schröt. which has a cap that hangs completely free of the stem [Arora, 1986]. Specimen (BAK1763, 1765) was collected in Arafsa village of Julfa district in Nakhcivan on May 08, 2009 and under the apple tree on the dry tree branches and leaves in the fruit garden in vicinity of Shaki on April 11, 2021. Morels are humus saprobes, grow in small groups of 2-3 individuals.

Different names have been applied to this species, such as *M. hybrida* (Sowerby) Pers. or *Mitrophora semilibera* (DC.) Lév., however the name *Morchella*

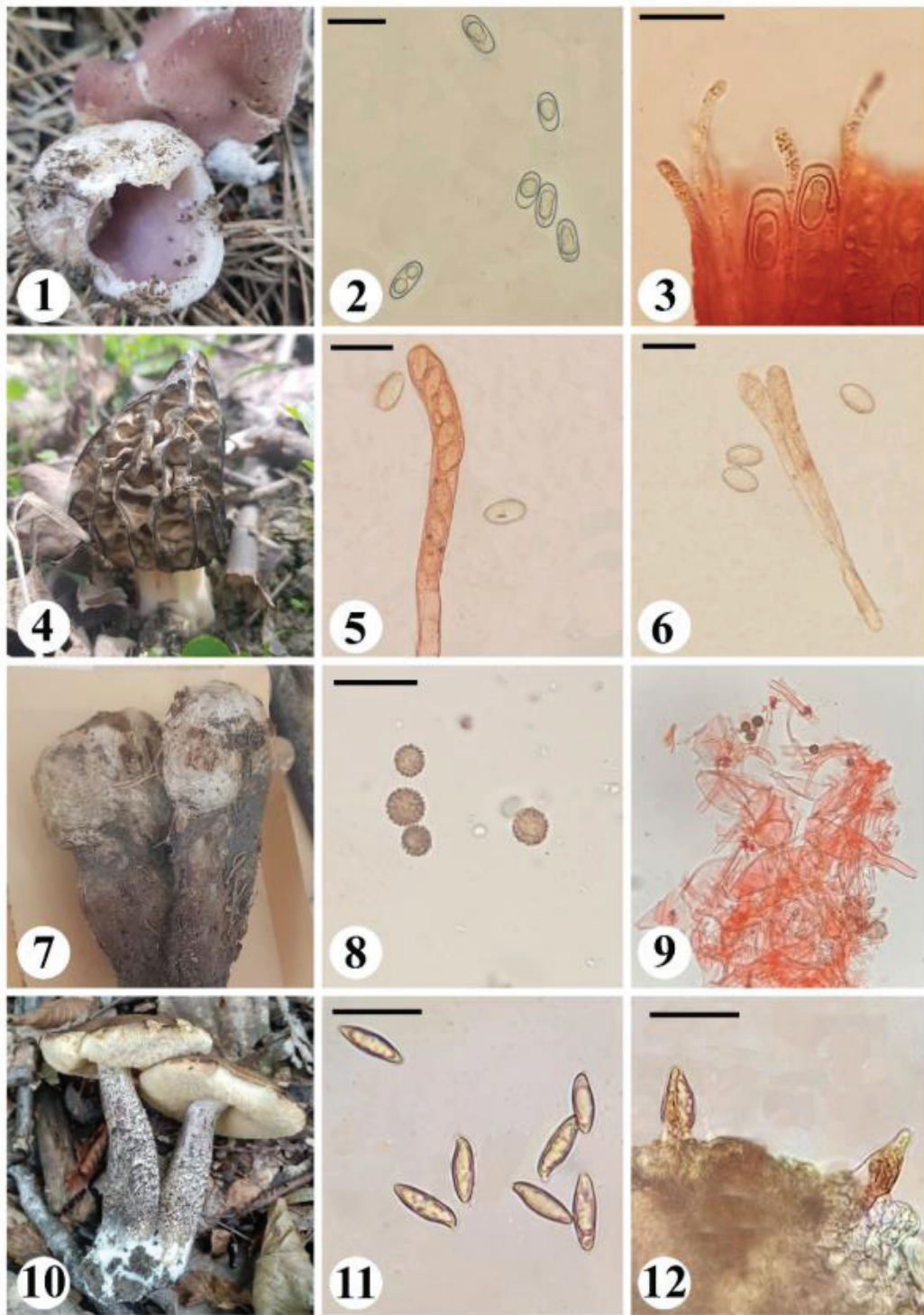


Figure 2. *Sarcosphaera coronaria* (Jacq.) J. Schröt: 1. ascocarp, 2. ascospores. 3. asci and paraphyses; *Morchella semilibera* DC.: 4. ascocarp, 5. asci and ascospore, paraphyse and spores; *Pisolithus arhizus* (Scop.) Rauschert: 7. fruiting body, 8. hyphae, 9. spores; *Leccinum scabrum* (Bull.) Gray: 10. fruiting body, 11. spores, 12. cystidia. Bar = 20 μ m.

semilibera has been proposed for conservation over the earlier names [Arora, 1986; Moreau et al. 2014, Richard 2014]. Morel bioactive compounds (polysaccharides, phenols, tocopherols, ergosterols) are known to have antioxidant, anticancer, anti-inflammatory, immune protective properties and maintain intestinal health [Li et al. 2023].

Both *S. coronaria* and *M. semilibera* have been included in the Red List of Estonian fungi [Saar et al., 2019]. These species are also proposed for the new edition of Red Book of Azerbaijan.

***Pisolithus arhizus* (Scop.) Rauschert. (Fig. 2. 7-9)**

It has fruiting body of noticeable size, in literature 4-18 cm height and 4-12 cm wide [Naik, Naika, 2021] (though our specimen were about 25-35 cm tall and 10-15 cm wide), tuberoid to spherical with a roundish head. Gleba consisting of many peridioles, dark-green to brown, outer surface pale brownish to dull yellowish, flesh tough and hard. Spores 7-11 × 7-10 µm diam. in literature (10.2-11.5 µm diam. in our specimen), echinate with spines of 1-1.5 × 0.5 µm, thick-walled, in packages embedded in blackish gel. Specimen (BAK1764) were collected on October 08, 2021, under the *Cupressus sempervirens* L. planted in the Central Botanical Garden, Baku.

This species grows in warm climate and documented from southern Europe, Africa and Japan. *P. arhizus* was included in the Red Book of the Ukraine since 2009 [European..., 2009, Papova, 2021]. This species is characterized by rich sources of protein, carbohydrates and low fat content, sporocarps can be examined for potential nutritional and bioactive potentials with rich beneficial mycochemical. [Naik, Naika, 2021].

***Leccinum scabrum* (Bull.) Gray. (Fig. 2. 10-12)**

Cap is about 4-10 cm [Arora, 1986] (in our specimen 5-12 cm) broad, convex, dull brown to greyish brown, slightly viscid when wet. Tubes and pores dull whitish or pallid, becoming dirty brownish by age. The stalk 7-15 × 0.5-1.5(3) cm in literature (in our specimen 6-17 × 2-4.5 cm), solid, white to buff or greyish, rugose, later become brownish to black at least over the upper portion, often staining blue-green below. Spores are 14-20 × 5-7 µm in literature (in our specimen 14-18.5 × 5-6.5 µm), spindle shaped to elongated elliptical, smooth with brown spore print. Specimen (BAK1762) were collected under the *Betula pendula* Roth. in mixed coniferous and deciduous forest with dominance of *Carpinus betulus* L., *Betula pendula*, *Fagus sylvatica*

L., *Taxus baccata* L. in Goygol National Park on June 24, 2021. The species is edible. It was collected together with *Coprinus comatus* O.F. Müll., *Geastrum saccatum* Fr., and *Morchella conica* Pers., which are also new for the Goygol National Park.

Leccinum Gray is a relatively small genus, the species are mainly distributed in forests of the Northern Hemisphere [Heluta, Akulov, 2012]. Species is mycorrhiza forming, mainly grows with birch on wet and mostly in dense forests. This species was recorded from neighbor Caucasus countries, but is new for Azerbaijan [Key..., 1985]. It was proposed for inclusion in the Global Fungal Red List years ago [IUCN, 2023]. Birch is one of the less distributed tree in the country and mainly grows in middle mountain zone, that is why the species may be considered as rare and can be recommended to the next edition of the Red Book of Azerbaijan.

Many of the mushrooms native to Azerbaijan are common in European forests, mainly due to the similar type of forest. There are slight differences in diversity and richness due to the geographical location as the country is located on the border of Europe and Asia. In Azerbaijan, people thinking is gradually changing from mycophobia to mycophilia as old perceptions and fears disappear and new information appears about the diversity of mushrooms in the country and how to distinguish them. However, it is not easy to recognize them all by their appearance, the similarity of the fruiting bodies has been main reason for their misleading harvesting which in its turn lead to subsequent poisonings in recent years in the country. Several publications on mushrooms have been published over the past decade, reporting on diversity, ecological groups, nutritional value, and illustrating species which will be useful to mushroom lovers. In addition to the 14 fungal species published in the 2nd edition of the Red Data Book of Azerbaijan, 25 taxa have recently been recommended for the 3rd edition which provides description in local language and important information regarding them [2023]. As it can be seen the study of the diversity is still the main direction in fungi researches, but investigations of other features, including physiology and bioactive compounds of mushroom are planned for the nearest future.

REFERENCES

- Aghayeva D.N., Mustafabayli E.H., Alimammadova A.A., Yusifova Y.A. (2022) Macrofungi of Goygol National Park and surrounding areas with special reference to medicinal species. *Plant & Fungal*

- Res.*, 5(1): 41-50. <https://doi.org/10.30546/2664-5297.2022.1.41>.
- Alimammadova A.A., Aghayeva D.N. (2021) New records on edible mushrooms collected from Guba districts. *Plant & Fungal Res.*, 4(1): 41-48. <http://dx.doi.org/10.30546/2664-5297.2021.1.41>.
- Arora D. (1986) *Mushrooms demystified: A comprehensive guide to the fleshy fungi* (2nd ed.) Berkeley: Ten Speed Press, 959 p.
- Bahram M., Netherway T. (2022) Fungi as mediators linking organisms and ecosystems. *FEMS Microbiology Reviews*, 46(2): 16 p., fuab058, <https://doi.org/10.1093/femsre/fuab058>
- Berbee M.L., James T.Y., Strullu-Derrien C. (2017) Early diverging fungi: diversity and impact at the dawn of terrestrial life. *Annu Rev Microbiol.*, 71: 41-60. doi: 10.1146/annurev-micro-030117-020324.
- Comandini O., Renaldi A.C. (2020) Ethnomycology in Europe: the past, the present, and the future. Chapter 13, 25 p. In: Pérez-Moreno, J., Guerin-Laguette, A., Flores Arzú, R., Yu, FQ. (eds) *Mushrooms, humans and nature in a changing world*. Switzerland: Springer, Cham. https://doi.org/10.1007/978-3-030-37378-8_13
- Dermek A. (1979) *Atlas našichhúb*, Bratislava: Obzor, 439 s.
- European Council for the Conservation of Fungi, 2009, 36 p.
- Fricke M., Heaton L.L.M., Jones N.S., Boddy L., Heitman J., Gow N.A.R. (2017) The mycelium as a network. *Microbiol. Spectr.*, 5(3): FUNK-0033-2017. <https://doi.org/10.1128/microbiolspec>.
- Funga Nordica (2012) Agaricoid, boletoid, clavarioid, cyphelloid and gastroid genera. Eds.: H. Knudsen, J. Vesterholt. Copenhagen: Nordsvamp, 1086 p.
- Hawksworth D.L. (2001) The magnitude of fungal diversity: the 1.5 million species estimate revisited. *Mycol Res.*, 105: 1422-1432.
- Hawksworth D.L. (2012) Global species numbers of fungi: are tropical studies and molecular approaches contributing to a more robust estimate? *Biodiversity Conserv.*, 21: 2425-2433.
- Heluta V.P., Akulov A. (2012) *Leccinum* species (Boletales, Basidiomycota) new and rare in Ukraine. *Ukr. Bot. J.*, 69(6): 886-900. [Гелюта В.П., Акулов О.Ю. (2012) Новітарідкіснідля Українивиди роду *Leccinum* (Boletales, Basidiomycota), *Укр. бот. ж.*, 69(6): 886-900]
- IUCN: The global fungal red list Initiative (2023): <https://redlist.info/en/iucn/welcome>
- Key to acaric mushrooms of Transcaucasia (1985) Institute of Botany, Academy of Sciences of Georgia SSR. Tbilisi: Meseniereba, 264 p. [Определитель агарикальных грибов Закавказья (1985) Институт ботаники Академии наук Грузинской ССР. Тбилиси: Мецниереба, 264 с.]
- Li Y., Chen H., Zhang X. (2023) Cultivation, nutritional value, bioactive compounds of morels, and their health benefits: A systematic review. *Front. Nutr.*, 10: 1159029. doi: 10.3389/fnut.2023.1159029
- Lodge J.D., Ammirati J.F., O'Dell T.E., Mueller G.M. Collecting and describing macrofungi In: *Biodiversity of fungi. Inventory and monitoring methods*. 128-172 p. (Eds.): G.M. Mueller, G.F. Bills, M.S. Foster. Oxford, UK: Elsevier academic press, 2004; 777 s.
- Lofgren L., Stajich J.E. (2021) Fungal biodiversity and conservation mycology in light of new technology, big data, and changing attitudes. *Curr Biol.*, 31(19): R1312-1325. doi: 10.1016/j.cub.2021.06.083
- Lovrić M., Da Re, R., Vidale E., Prokofieva I., Wong J., Pettenella D., Verkerk P.J., Mavsar R. (2023) Non-wood forest products in Europe – a quantitative overview. *For. Policy Econ.* 2020, 116, 102175. <https://www.sciencedirect.com/science/article/pii/S1389934120300654>
- Moreau P.-A., Bellanger J.-M., Clowez P., Courtecuisse R., Hansen K., Knudsen H., O'Donnell K., Richard F. (2014) Proposal to conserve the name *Morchella semilibera* against *Phallus crassipes*, *P. gigas* and *P. undosus* (Ascomycota). *Taxon*, 63 (3): 677-678.
- Mustafabayli E.H. (2020) Edible and poisonous fungi of Azerbaijan. *Plant & Fungal Res.*, 3(1): 54-60. <http://dx.doi.org/10.29228/plantfungalres.69>
- Mustafabayli E.H., Aghayeva D.N. (2019a) New records of mushrooms for the mycobiota of Azerbaijan. *Ukr. Bot. J.*, 76(4): 356-361.
- Mustafabayli E.H., Aghayeva D.N. (2019b) Mushroom diversity in Shaki district of Azerbaijan. *Plant & Fungal Res.*, 2(1): 23-31. <http://dx.doi.org/10.29228/plantfungalres.45>
- Mustafabayli E.H., Prydiuk M.P., Aghayeva D.N. (2020) Mycorrhizal mushrooms associated with tree species in Shaki district of Azerbaijan. *Plant & Fungal Res.*, 3(2): 8-19.
- Mustafabayli E.H., Prydiuk M.P., Aghayeva D.N. (2021) New for Azerbaijan records of agaricoid fungi collected in Shaki District. *Ukr. Bot. J.*, 78(3): 214-220. <https://doi.org/10.15407/ukrbotj78.03.214>
- Mycobank Database (Fungal databases, Nomenclature

- & Species banks), International Mycological Association: <http://www.mycobank.org/>
- Naik N.K., Naika R. (2021) GC-MS analysis of *Pisolithus arrhizus* (Scop.) Rauschert, (1959), a non-edible wild mushroom in search of novel bioactive compounds collected from Western Ghats of Karnataka, India. *Int. J. Botany Stud.*, 6(5): 204-209.
- Niego A.G.T., Rapior S., Thongklang N., Raspé O., Hyde K.D., Mortimer P. (2023) Reviewing the contributions of macrofungi to forest ecosystem processes and services, *Fungal Biol. Rev.*, 44: 100294. <https://doi.org/10.1016/j.fbr.2022.11.002>.
- Popova O.M. (2021) Distribution of *Pisolithus arrhizus* (Boletales, Basidiomycota), a rare fungus in Ukraine. *Ukr. Bot. J.*, 78(2): 139-144. [Попова О.М. (2021) Поширення в Україні рідкісного виду *Pisolithus arrhizus* (Boletales, Basidiomycota). *Ukr. Bot. J.*, 78(2): 139-144]. <https://doi.org/10.15407/ukrbotj78.02.139>
- Prance M., Fechner N. (2017) Collecting and preserving fungi specimens, a manual. 2.1 Queensland Herbarium, Science delivery division department of science, Information technology and innovation. 21 p.
- Procházká P., Soukupová J., Tomšík K., Mullen K.J., Čábelková I. (2023) Climatic factors affecting wild mushroom foraging in central Europe. *Forests*, 14 (2): 382. <https://doi.org/10.3390/f14020382>
- Richard F., Bellanger J.-M., Clowez P., Hansen K., O'Donnell K., Urban A., Sauve M., Courtecuisse R., Moreau P.-A. (2015) True morels (*Morchella*, Pezizales) of Europe and North America: evolutionary relationships inferred from multilocus data and a unified taxonomy. *Mycologia*, 107(2): 359-382.
- Saar I., Oja J., Pöldmaa K., Pärtel K., Zettur I., Kõljalg U. (2019) Red list of Estonian fungi – 2019 update. *Folia Cryptog. Estonica*, 56: 117-126. <https://doi.org/10.12697/fce.2019.56.12>
- Sevindik M., Akgul H., Korkmaz A.I., Sen I. (2018) Antioxidant potentials of *Helvella leucomelaena* and *Sarcosphaera coronaria*. *JBMOA*, 6(1): 36-38.
- Wu B., Hussain M., Zhang W., Stadler M., Liu X., Xiang M. (2019) Current insights into fungal species diversity and perspective on naming the environmental DNA sequences of fungi. *Mycology*, 10(3): 127-140. doi: 10.1080/21501203.2019.1614106.

Azərbaycan üçün dörd yeni göbələk növü

Dilzarə N. Ağayeva
Elgün H. Mustafabəyli
Yaqut A. Yusifova

Botanika İnstitutu, Azərbaycan Respublikası Elm və Təhsil Nazirliyi, Badamdar 40, Bakı, AZ1004, Azərbaycan

Həmidə S. Seyidova

Azərbaycan Respublikası Elm və Təhsil Nazirliyinin Bioreurslar İnstitutu, Babək, 10, Naxçıvan AZ7000, Azərbaycan

Məqalədə Azərbaycanda son zamanlar aşkar edilmiş dörd yeni növ haqqında məlumat verilir. Bunlar müxtəlif ekosistemlərdə rast gəlinən iki askomiset (*Morchella semilibera* DC., *Sarcosphaera coronaria* (Jacq.) J. Schröt) və iki bazidiomiset (*Leccinum scabrum* (Bull.) Grey, *Pisolithus arrhizus* (Scop.) Rauschert) növləridir. *M. semilibera* DC., *L. scabrum* yeməlidir, *P. arrhizus*, *S. coronaria* və *L. scabrum* ektomikorizal, *M. semilibera* isə saprobudur. Bu növlər Azərbaycanın Qırmızı Kitabının növbəti nəşri üçün tövsiyə olunur. Məqalədə hər bir növ üçün qısa məlumat və orijinal fotosəkillər verilir.

Açar sözlər: ektomikorizal, yeməli göbələklər, nadir, saprob, növ

Четыре вида грибов новых для Азербайджана

Дильзара Н. Агаева
Эльгун Г. Мустафабейли
Ягут А. Юсифова

Институт Ботаники, Министерства Науки и Образования Азербайджанской Республики, Бадамдарское шоссе 40, Баку AZ1004, Азербайджан

Хамида С. Сеидова

Институт Биоресурсов, Министерства Науки и Образования Азербайджанской Республики, Бабек 10, Нахчыван AZ7000, Азербайджан

В статье сообщается о четырех новых видах, недавно обнаруженных в Азербайджане. Это два вида аскомицетов (*Morchella semilibera* DC., *Sarcosphaera coronaria* (Jacq.) J. Schröt) и два – базидеомицета (*Leccinum scabrum* (Bull.) Gray, *Pisolithus arrhizus* (Scop.) Rauschert), встречающиеся в различных экосистемах. Установлено, что грибы *M. semilibera* DC. и *L. scabrum* съедобные, *P. arrhizus*, *S. coronaria* и *L. scabrum* – эктомикоризальные, *M. semilibera* – сапробный. Выявленные новые виды рекомендованы для следующего издания Красной книги Азербайджана. В статье приведены краткие сведения и оригинальные фотографии по каждому виду.

Ключевые слова: эктомикоризальные, съедобные грибы, сапробные, редкие виды