

New records of mushrooms for the mycobiota of Azerbaijan

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Abstract. The article reports data on 24 new records of mushrooms in Azerbaijan. Fungal specimens were collected during 2014–2018 in Shaki District of Azerbaijan. These are *Auriscalpium vulgare*, *Boletus aereus*, *B. edulis*, *B. variipes*, *Caloboletus radicans*, *Calocybe gambosa*, *Cantharellus subalbidus*, *Clavariadelphus pistillaris*, *Cortinarius triumphans*, *Hemileccinum depilatum*, *Hortiboletus rubellus*, *Hydnellum conrescens*, *Inonotus obliquus*, *Marasmius capillaries*, *Phaeomarasmius erinaceus*, *Phallus ravenelii*, *Ramaria obtusissima*, *Rheubariboletus armeniacus*, *Rubroboletus legaliae*, *R. lupinus*, *R. satanas*, *Russula turci*, *Suillus collinitus*, and *Tremella mesenterica*. For each specimen, its locality, biotope and collection data are indicated and photographs are provided.

Keywords: Azerbaijan, *Basidiomycota*, Caucasus, fungi, macromycetes, Shaki District

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Реферат. У статті подано інформацію про поширення 24 видів макроміцетів, нових для Азербайджану. Зразки зібрано протягом 2014–2018 рр. в Шекінському районі. Уперше в країні були виявлені *Auriscalpium vulgare*, *Boletus aereus*, *B. edulis*, *B. variipes*, *Caloboletus radicans*, *Calocybe gambosa*, *Cantharellus subalbidus*, *Clavariadelphus pistillaris*, *Cortinarius triumphans*, *Hemileccinum depilatum*, *Hortiboletus rubellus*, *Hydnellum conrescens*, *Inonotus obliquus*, *Marasmius capillaries*, *Phaeomarasmius erinaceus*, *Phallus ravenelii*, *Ramaria obtusissima*, *Rheubariboletus armeniacus*, *Rubroboletus legaliae*, *R. lupinus*, *R. satanas*, *Russula turci*, *Suillus collinitus* та *Tremella mesenterica*. Для кожного зразка наведено локалітет, біотоп, дату збору та фотографію.

Ключові слова: Азербайджан, гриби, Кавказ, макроміцети, Шекінський район, *Basidiomycota*

Introduction

Dedicated studies of macromycetes of Azerbaijan were launched in the early 1960s. Currently about 2300 specimens of more than 800 taxa of mushrooms collected within the country are deposited at the Mycological Herbarium of the Institute of Botany (BAK), ANAS (Sadiqov, 1972, 2007; Sadiqov, Aghayeva, 2016). That is not a large number of species taking into account rich diversity of microfungi in Azerbaijan. Based on what has been discovered, we can suggest that many species have not been revealed and explored yet. The mushroom diversity in Shaki District studied during several recent years revealed a number of species that are new for the study area, as well as for the country.

Shaki District is located along the Southern Caucasus mountain range. Most of its area is occupied by both

coniferous and broadleaf forest ecosystems where oak, beech, birch, hornbeam are dominant tree species. The aim of the article is to present data on new species of mushrooms found in Shaki District, which have not been previously registered in Azerbaijan.

Materials and methods

Specimens were collected during mycological surveys in Shaki District of Azerbaijan during 2014–2018. All samples were air-dried and deposited at the BAK Herbarium; deposition (inventory) numbers are provided below in the list. The sampling localities and their GPS coordinates are as follows: around the walls of the Gelsen-Görsen fortress (41°15'48.57"N, 47°13'40.43"E, 1220 ± 50–60 m a.s.l.); along Gilehli, hazelnut forest (41°12'14.29"N, 47°12'40.01"E, 835–860

m a.s.l.); Mustafabey oak-beech, chestnut-beech forest (41°12' 09.06"N, 47°12'52.03"E, 820–930 m a.s.l.); Naringala pine forest (41°15'33.14"N, 47°13'02.69"E, 1100 ± 50–70 m a.s.l.); Shaki Khans' Palace, included in the UNESCO World Heritage List (41°12'15.17"N, 47°11'35.83"E, 770 ± 50–70 m a.s.l.).

Phenological characteristics were recorded and micro-morphological features were examined under the microscope Nikon Eclipse E100, ZEISS (China). Microstructures were mounted in sterile water, statistics included a minimum of 20 measurements. Both size and shape of basidiospores were considered, results were estimated as average of 25 measurements for each specimen. Identification was carried out based on available literature (Wasser, 1980; Arora, 1986; Moser, 1980, 1986; Dudka, Wasser, 1987; Bondartseva, 1998; Horak, 2005; etc.). Nomenclature updates and taxonomic rearrangements are provided as in the *Index Fungorum* database (<http://www.indexfungorum.org>).

Results and discussion

In total, 24 species of the *Agaricomycetes* belonging to 9 orders and 15 families represent new records for Azerbaijan (Fig. 1). Below we list the species of fungi and discuss peculiarities of some taxa and records.

Agaricales

Cortinariaceae

Cortinarius triumphans Fr. (Fig. 1, A)

Mustafabey oak-beech, chestnut-beech forest, on forest litter. 06.10.2016 (BAK1635).

In the Transcaucasia this species was previously reported from Georgia and Armenia (Key..., 1985).

Inocybaceae

Phaeomarasmius erinaceus (Fr.) Scherff. ex Romagn. (Fig. 1, B)

Mustafabey oak-beech, chestnut-beech forest, on dead wood. 06.10.2016 (BAK1641).

Lyophyllaceae

Calocybe gambosa (Fr.) Donk (Fig. 1, C)

Naringala pine forest, on forest litter. 22.10.2013 (BAK1557).

In the Transcaucasian region the species has been reported from Georgia and Armenia (Key..., 1985).

Marasmiaceae

Marasmius capillaris Morgan (Fig. 1, D)

Mustafabey oak-beech, chestnut-beech forest, on dead fallen leaf. 27.07.2016 (BAK1614).

Boletales

Boletaceae

Boletus aereus Bull. (Fig. 1, E)

Mustafabey oak-beech, chestnut-beech forest, on forest soil. 17.08.2018 (BAK1652).

Boletus edulis Bull. var. *arenarius* H.Engel, Krieglst & Dermek (Fig. 1, F)

Mustafabey oak-beech, chestnut-beech forest, on forest soil. 25.08.2018 (BAK1665).

Based on our observation, *B. edulis* var. *arenarius* differs from *B. edulis* var. *edulis* by its smaller, reddish-yellow cap, as well as a long and curved stipe.

Boletus variipes Peck (Fig. 1, G)

Mustafabey oak-beech, chestnut-beech forest, on forest soil. 25.08.2018 (BAK1664).

Caloboletus radicans (Pers.) Vizzini (Fig. 1, H)

Mustafabey oak-beech, chestnut-beech forest, on forest soil. 18.08.2018 (BAK1649).

Hemileccinum depilatum (Redeuilh) Šutara (Fig. 1, I)

Mustafabey oak-beech, chestnut-beech forest, on forest soil. 25.08.2018 (BAK1667).

Hortiboletus rubellus (Krombh.) Simonini, Vizzini & Gelardi (Fig. 1, J)

Mustafabey oak-beech, chestnut-beech forest, on forest soil. 25.08.2018 (BAK1653).

Rheubarbariboletus armeniacus (Quél.) Vizzini, Simonini & Gelardi (Fig. 1, K)

Mustafabey oak-beech, chestnut-beech forest, on forest litter. 10.07.2016 (BAK1596).

We found the form of this species previously known as *Xerocomus armeniacus* f. *luteolus* H.Engel & Antonín; later the species was transferred to the genus *Xerocomellus* (Quél.) Šutara (2008). Currently, *X. armeniacus* f. *luteolus* is synonymised with *Rheubarbariboletus armeniacus*. In our observation, forma *luteolus* differs in color of the stipe and pileus, being greenish-yellow, which is distinct from the reddish Burgundy color of the typical form. Spore size of the species is also slightly different according to literature: 9–15 × 4–6 μm in A. Dermek & A. Pilát (1974) and 11.6–13.9 (–15.2) × 5.0–5.8 μm in A.E. Hills (2009). Spores in our measurements were fusiform, light-brown, greenish, with 1–2 oil drops, 12.5–16.0 × 4.0–5.5 μm.

Rubroboletus legaliae (Pilát & Dermek) Della Magg. & Trassin. (Fig. 1, L)

Mustafabey oak-beech, chestnut-beech forest, on forest litter. 25.08.2018 (BAK1619).

Rubroboletus lupinus (Fr.) Costanzo & Gelardi, Simonini & Vizzini (Fig. 1, M)



Fig. 1. New records of mushrooms for Azerbaijan (original photos). A: *Cortinarius triumphans*; B: *Phaeomarasmium erinaceus*; C: *Calocybe gambosa*; D: *Marasmius capillaris*; E: *Boletus aereus*; F: *B. edulis* var. *arenarius*; G: *B. variipes*; H: *Caloboletus radicans*; I: *Hemileccinum depilatum*; J: *Hortiboletus rubellus*; K: *Rheubariboletus armeniicus*; L: *Rubroboletus legaliae*



Fig. 1 (continuation). M: *Rubroboletus lupinus*; N: *R. satanas*; O: *Suillus collinitus*; P: *Cantharellus subalbidus*; Q: *Clavariadelphus pistillar*; R: *Ramaria obtusissima* var. *incarnata*; S: *Inonotus obliquus*; T: *Phallus ravenelii*; U: *Auriscalpium vulgare*; V: *Russula turci*; W: *Hydnellum conrescens*; X: *Tremella mesenterica*

Mustafabey oak-beech, chestnut-beech forest, on forest litter. 18.08.2018 (BAK1659).

Rubroboletus satanas (Lenz) Kuan Zhao & Zhu L. Yang (Fig. 1, N)

Gilehli, hazelnut forest, on forest litter. 25.08.2018 (BAK1650).

Suillaceae

Suillus collinitus (Fr.) Kuntze (Fig. 1, O)

Around the Shaki Khans' Palace fortress walls, coniferous forest, on soil. 20.11.2016 (BAK1600).

Cantharellales

Cantharellaceae

Cantharellus subalbidus A.H.Sm. & Morse (Fig. 1, P)

Mustafabey oak-beech, chestnut-beech forest, on soil. 23.07.2017 (BAK1631).

Gomphales

Clavariadelphaceae

Clavariadelphus pistillaris (L.) Donk (Fig. 1, Q)

Mustafabey oak-beech, chestnut-beech forest, on soil. 06.10.2016 (BAK1620).

Gomphaceae

Ramaria obtusissima (Peck) Corner (Fig. 1, R)

Mustafabey oak-beech, chestnut-beech forest, on soil. 26.11.2015 (BAK1630).

Hymenochaetales

Hymenochaetaeae

Inonotus obliquus (Fr.) Pilát (Fig. 1, S)

Along the Gelersen-Görersen fortress walls, on *Betula* sp. 23.07.2017 (BAK1657).

Phallales

Phallaceae

Phallus ravenelii Berk. & M.A. Curtis (Fig. 1, T)

Around the Shaki Khans' Palace fortress walls, coniferous forest, on soil. 25.07.2017 (BAK1621).

Russulales

Auriscalpiaceae

Auriscalpium vulgare Gray (Fig. 1, U)

Naringala pine forest, on cone of *Pinus sylvestris*. 08.05.2017 (BAK1647).

Russulaceae

Russula turci Bres. (Fig. 1, V)

Mustafabey oak-beech forest, on forest soil. 16.08.2016. (BAK1615).

In the Transcaucasian region it has been reported from Georgia (Key..., 1985).

Thelophorales

Bankeraceae

Hydnellum conrescens (Pers.) Banker (Fig. 1, W)

Naringala pine forest, among mosses in coniferous forest. 26.11.2015 (BAK1634).

Tremellales

Tremellaceae

Tremella mesenterica Retz. (Fig. 1, X)

Naringala pine forest, on dead pine branches. 27.07.2017 (BAK1627).

All identified taxa can be subdivided into three ecological groups: symbiotrophs, humus saprotrophs, and xylotrophs. Most of the species are symbiotrophs, including *Cortinarius triumphans* (*Cortinariaceae*) and *Calocybe gambosa* (*Lyophyllaceae*) from the order *Agaricales*. The highest number of species are representatives of the order *Boletales*: *Boletus aereus*, *B. edulis*, *B. variipes*, *Caloboletus radicans*, *Hemileccinum depilatum*, *H. rubellus*, *Rheubarbariboletus armeniacus*, *Rubroboletus legaliae*, *R. lupinus*, and *R. satanas* (*Boletaceae*) and one more species – *Suillus collinitus* (*Suillaceae*). *Cantharellus subalbidus* (*Cantharellaceae*), *Clavariadelphus pistillaris* (*Clavariadelphaceae*), and *Russula turci* (*Russulaceae*) belong to the same ecological group. These fungi are associated with some species of trees, such as *Quercus iberica* M.Bieb., *Castanea sativa* Mill., *Fagus sylvatica* L., *Carpinus betulus* L., *Ulmus minor* Mill., and *Pinus sylvestris* L.

Humus saprotrophs include *Ramaria obtusissima* (*Gomphaceae*), *Phallus ravenelii* (*Phallaceae*), and *Hydnellum conrescens* (*Bankeraceae*).

Xylotrophs can be divided into three subgroups: fungi occurring on cones, leaves, and stems. *Phaeomarasmium erinaceus* (*Inocybaceae*) was recorded on dead wood of hornbeam and beech trees. *Marasmius capillaris* was found on dead fallen leaves of oak and beech, *Auriscalpium vulgare* – on cones of dead pine trees and *Tremella mesenterica* – on stem of broadleaf tree species. Parasitic *Inonotus obliquus* (*Hymenochaetaeae*), a widely distributed species in the study area, was identified on a birch tree.

Fungal diversity studies rely on the data about collected samples, images and identified fungal taxa in certain area. This information provides a source for scientific research and management of natural resources for the mutual benefit of humans and nature. The reported research represents a new contribution to the existing data on mushroom diversity of Azerbaijan.

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