Мікологічні знахідки
Mycological Records

https://doi.org/10.15407/ukrbotj79.01.051

The first record of the genus *Geopora* (*Pezizales*) for Uzbekistan

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Abstract. The first record of *Geopora arenicola* for Uzbekistan is reported from Nuratau Nature Reserve. The genus *Geopora* is also recorded for the first time in Uzbekistan. Ascocarps of the fungus at first are usually spherical, completely immersed in soil, later they emerge at the ground surface and open at the top. Mature apothecia have a central opening with torn edges and whitish to grayish hymenium surface. A description, distribution data, images of apothecia and micromorphological characters of the fungus are provided.

Keywords: *Acer tataricum*, *Geopora arenicola*, Nuratau Nature Reserve, micromorphology, mycorrhiza, *Pyronemataceae*

Article history. Submitted 17 September 2021. Revised 20 January 2022. Published 11 March 2022.

Citation. Mustafaev I.M., Islomiddinov Z. Sh. 2022. The first record of the genus *Geopora* (*Pezizales*) for Uzbekistan. *Ukrainian Botanical Journal*, 79(1): 51–55

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Introduction

The genus *Geopora* Harkn. (*Pezizales*, *Ascomycota*) currently comprises approximately 30 species (Kirk et al., 2008; http://www.indexfungorum.org/). Species of the *Geopora* have been reported from various regions of the world with gypsum soils (Burdsall, 1968). In Uzbekistan, several scientists conducted mycological studies on macrofungi (Petrova, 1985; Baltaeva, 1993, 1991; Xoliqova, 1989; Iminova, 2009; Gafforov, 2020). Some groups of macrofungi of Nuratau Nature Reserve (NNR) have been studied by Baltaeva (1993) and Mustafaev (2017). However, species of the *Geopora* genus have not yet been recorded from Uzbekistan. In the present study, we report the first find of *Geopora arenicola* (Lév.) Kers for Uzbekistan from Nuratau Nature Reserve and provide description of morphological characters of the collected specimens.

Study area

Several specimens of *Geopora* were observed during 2018–2019 on the territory of Nuratau Nature Reserve (Jizzakh, Uzbekistan) located between 40.468487° N to 40.562476° N and 66.65931° E to 66.927651° E in the central part of the Nuratau Ridge, a major ridge of the Nuratau Mountains (Fig. 1).

It is a strictly protected area of the IUCN Category I that was established in 1975 (IUCN, 2022). Its total area is 177.52 km^2 with altitudes ranging from 530 to 2169 m a. s. l. The Nuratau Mountains with the adjacent small insular ridges are the peripheral northwestern branches of the Pamir-Alay Mountain System wedged deeply into the Kyzylkum Desert. Nuratau Nature Reserve is located in the central part of Uzbekistan. The reserve is home to many dominant forests as well as unique habitats of rare, unidentified, and overlooked macrofungi. Macrofungi grow on a variety of substrates, such as manure, live or dead tree trunks, mountain slopes, humus soils, and form ectomycorrhizal associations with broadleaf trees. Data

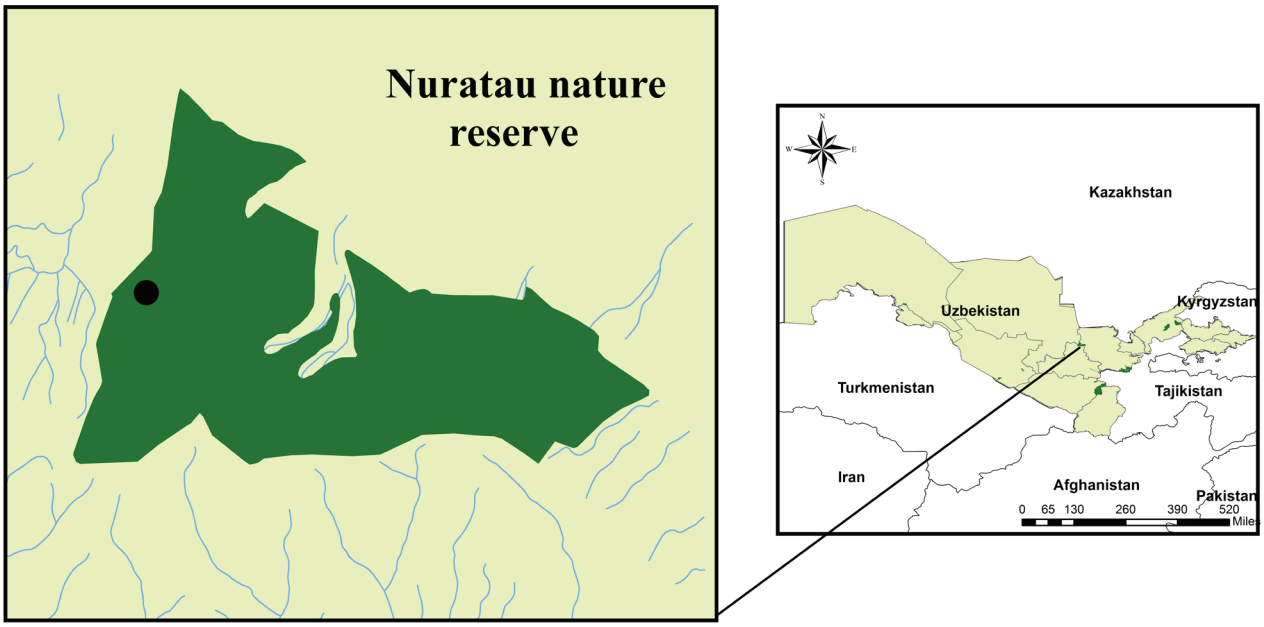

Fig 1. Schematic maps of Nuratau Nature Reserve (with location of *Geopora arenicola* indicated by a black circle).

on some macrofungi of the reserve have been reported (Baltaeva, 1993; Mustafaev, 2017). However, so far no representatives of the *Pyronemataceae* (*Pezizales*) have been found in the area.

Material and Methods

Ascocarps of *Geopora* were collected in Nuratau Nature Reserve in April 2019. Pictures were taken on the spot in the field. The specimens were collected following the methods used by Baseia et al. (2014).The ascomata were photographed with scales and geographical data and then cut with a pocket knife. The specimens were studied both in fresh and dried state; section were made by hand. In general, we followed commonly used methods of collection as well as macroscopic and microscopic studies (Castellano et al., 1989; Pegler et al., 1993). The photographs and measurements were made using a light BX40 microscope with a Moticam N-300M digital camera. The specimens are deposited with number "IM-125" in the Mycological Herbarium (TASM) of the Institute of Botany, Academy of Sciences of the Republic of Uzbekistan. A current name of species is given according to the *Index Fungorum* database (http://www.indexfungorum.org/).

Results

Geopora arenicola (Lév.) Kers, Svensk bot. Tidskr. 68(3): 345 (1974). (Fig. 1)

= *Lachnea arenicola* (Lév.) Gillet, Champignons de France, Discom. (3): 68 (1880) [1879]

= *Peziza arenicola* Lév., Annls Sci. Nat., Bot., sér. 3 9: 140 (1848)

= *Sepultaria arenicola* var. *bloxamii* (W.Phillips) Ramsb., Trans. Br. Mycol. Soc. 4(2): 366 (1914) [1913]

Apothecia 2.5–3 cm in diam., usually spherical, at first completely immersed in soil, later come to surface and have a hole in the upper part with torn edges, resembling small flower buds; mature apothecia break apart to form an irregular star- or crown-shaped cup, but remain not flattened to a saucer shape. Hymenium light creamy, creamy or yellowish gray. Exterior surface much darker, brownish, covered with hairs, often with adhering sand grains. Hairs thick-walled, brown, flexuous. Ascospores ellipsoid, hyaline, uniseriate, measuring 25.2–26.6 × 13–15 µm. Asci 8-spored with a pleurorhynch base, cylindrical, 260–270 × 18–20 µm (Fig. 2). Paraphyses with fine granular droplets in protoplasm, cylindrical, right, hyaline, septate, 2–3 µm in diam., at the top extended. Subhymenium up to 50 µm, of compact structure and texture intricate, with cells measuring 5–10 µm.

Fig. 2. *Geopora arenicola*. A–D: apothecia; E: asci; F: ascospore. Bars: 100 µm (E); 20 µm (F). Photo by I. Mustafaev.

Distribution and habitat. Presently reported collections were found growing solitary in sandy ground under *Acer tataricum* L. in the forest of Nuratau Nature Reserve (40.547897° N, 66.692144° E), in April 2019, at the altitude ranging from 950–1000 m a. s. l.

Discussion

Originally described from Sweden (Kers, 1974), *Geopora arenicola* has been reported from Europe (Denmark, Norway), Asia (Israel, Jordan, Turkey, Iran) (Ershad, 2009), and North America.

Table 1. Comparison of micromorphological characters of *Geopora arenicola*

Micromorphological character	Kers, 1974	Perić, Perić, 2011	Present study
Ascocarp (mm)	20–30 mm, spherical	6–30 mm, spherical	25–30 mm, spherical
Ascospores (µm)	18–25 × 9–14, ellipsoid	24.1–27.8 × 12.3–15.7, ellipsoid	25.2–26.6 × 13–15, ellipsoid
Asci (µm)	8-spored, 200–265 × 16–20, cylindrical	8-spored 250–300 × 18–21, cylindrical	8-spored, 260–270 × 18–20, cylindrical
Paraphyses	–	2–3 µm in diam.	2–3 µm in diam.

All morphological characters of the present collection, both of the external and internal structures, fit the description provided for *Geopora arenicola* by Kers (1974). *Geopora arenicola* is a species very close to *G. arenosa* with which it has often been confused. There have been great differences in terms of similarities and differences between *G. arenicola* and *G. arenosa* (Perić, Perić, 2011). Based on the measurements of apothecia and ascospores, the difference between *G. arenicola* and *G. arenosa* is as follows: in *G. arenicola*, apothecia are 2–5 cm in diam., while in in *G. arenosa* – 1 cm; similarly, ascospores size varies within (22–25) –29 × (12)15–16 µm) in *G. arenicola*, and (21–22)–26 × 14.5–16 µm) in *G. arenosa* (Honrubia et al. 1983). Some authors consider a broad species concept including more synonyms (Southworth, Frank, 2011; Saba et al. 2019). A comparison of micromorphological characters of the reported specimens of *Geopora arenicola* with bibliographic data is provided in the Table 1.

Identification of *Geopora* species has relied primarily on ascospore shape and size, position of apothecia in the ground, and the length of excipular hairs (Burdsall, 1965; Tamm et al., 2010; Flores-Rentería et al., 2014). *Geopora arenicola* found in Uzbekistan is also characterized by cup-shaped brown fruit bodies covered with hairs on the external surface. Our samples are morphologically very similar to those of *G. arenicola* collected in Montenegro (Perić, Perić, 2011).

Perić and Perić (2011) have found mycorrhizal association of *G. arenicola* with scattered trees of *Cupressus sempervirens* L. in Montenegro. Maia et al. (1996) reported potential ectomycorrhizal relationships of *G. arenicola, G. cervina* (Velen.) T. Schumach., *G. clausa* (Tul. & C. Tul.) Burds., *G. cooperi* Harkn., *G. foliacea* (Schaeff.) S. Ahmad, *G. nicaeensis* (Boud.) M. Torre, and *G. sumneriana* (Cooke ex W. Phillips) M. Torre with various conifers and deciduous trees, such as *Abies grandis* (Douglas ex D. Don) Lindl., *Cedrus* spp., *Juniperus* spp., *Picea* spp., *Pinus* spp., *Populus* spp., *Pseudotsuga menziesii* (Mirb.) Franco, and *Quercus* spp. Although the above mentioned taxa are known as ectomycorrhizal (Tedersoo et al., 2006), we have not been able to determine ectomycorrhizal association for our new record of *G. arenicola* found next to *Acer tataricum*. Further studies are required to determine whether *G. arenicola* has ectomycorrhizal associations with *Acer tataricum* in Uzbekistan.

Acknowledgements

The study was carried out within the framework of the State Research Grant PZ-20170921183. The authors thank Bakhtiyor Sheraliev for valuable comments on an early draft of the manuscript.

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Recommended for publication by V.P. Hayova

Мустафаєв І.М., Ісломіддінов З.Ш. **Перша знахідка грибів роду *Geopora* (*Pezizales*) в Узбекистані.** *Український ботанічний журнал*, 79(1): 51–55.

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Реферат. У статті повідомляється про першу знахідку *Geopora arenicola* для Узбекистану із Нуратинського природного заповідника. Це також є першим повідомленням про знахідку грибів роду *Geopora* в Узбекистані. Плодові тіла цього сумчастого гриба зазвичай спочатку округлі, повністю занурені в ґрунт, згодом з'являються на поверхні і розкриваються на верхівці. Зрілі апотеції мають центральний отвір з нерівними краями та білувату або сірувату поверхню гіменію. Наводиться опис, дані про поширення цього виду, а також ілюстрації апотеціїв і мікроморфологічних ознак гриба.

Ключові слова: *Acer tataricum*, *Geopora arenicola*, Нуратинський природний заповідник, мікроморфологія, мікориза, *Pyronemataceae*