



Morchella steppicola (Morchellaceae) in the Belgorod region of the Russian Federation

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Abstract

Morchella steppicola (Morchellaceae) Zerova is included in the main list of the Red Book of the Belgorod Region of the Russian Federation. It has been assigned category and status 3 - a rare species. However, information about it is clearly incomplete, which is due to the peculiarities of its phenology and ecology, as well as the lack of systematic research aimed at finding its existing habitats. At the beginning of the 2020 season, reconnaissance surveys of characteristic ecotopes revealed 2 new localities of *Morchella steppicola* in unknown habitats (in the Belgorod and Shebekinsky administrative regions). The article describes these habitats in connection with the available data on the occurrence and distribution of this species, both within the region and beyond. The fact that new habitats have been identified should in no way call into question that *Morchella steppicola* is a species in relation to which the recommended measures should be followed: preserving existing habitats and searching for new ones, taking the identified populations under territorial protection, monitoring the abundance in known habitats.

Keywords: *Morchella steppicola*, fruit body, Belgorod oblast, location, habitat, rare species, micropopulation

Dunaev AV, Zelenkova VN, Dunaeva EN, Tokhtar VK, Lyashenko IV, Doborovich AN (2020) *Morchella steppicola* (Morchellaceae) in the Belgorod region of the Russian Federation. Eurasia J Biosci 14: 3773-3778.

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INTRODUCTION

The mushroom taxa of the updated Red Data Book of the Belgorod Region (Red Data Book of the Belgorod region(2019) which are included in the main list, have their descriptions and data on habitats; their conservation status is also assessed. But a new 2020 field season has begun, and new finds have emerged. For example, there were identified two micropopulations of an early and short-term fruiting species of the Ascomycota – the *steppe Morchella steppicola* from the main list (Red Data Book of the Belgorod region, 2019). New findings complete the picture of the distribution of this species in the Belgorod region. The purpose of this article was to describe new habitats of *Morchella steppicola* in connection with the available data on its occurrence and distribution, both within the region and beyond.

MATERIAL AND METHODS

The studies were carried out in March-April 2020 in the gully-ravine ecotopes in Belgorod and Shebekino districts of the Belgorod region according to an integrated technique, including the methods of mycofloristics (Leontiev, 2008). and population ecology

(Lacey, 1996; Anderson, Kohn, 1998; Dahlberg, Mueller 2011) and according to the "Methodological recommendations ..." (Guidelines for maintaining the red book of the subject of the Russian Federation, 2006). The search for habitats of *Morchella steppicola* was carried out by the itinerary method during the period of the most probable formation of spore-bearing structures of the fungus. The presence of this species in this habitat was determined by the presence of characteristic fruit bodies.

RESULTS AND DISCUSSION

Morchella steppicola Zerova, Bot. Zh., Kyiv (J. bot. Acad. Sci. Ukr.) 2(1): 155 (1941) (Index Fungorum [Electronic resource] (2020). Systematic position: Morchellaceae, Pezizales, Pezizomycetidae, Pezizomycetes, Ascomycota, Fungi.

The fruit body consists of a cap and a stem (**Fig. 1**). The cap is spherical or angularly spherical, sometimes slightly flattened at the sides or at the apex, often

Received: April 2019

Accepted: April 2020

Printed: September 2020



Fig. 1. Fruit body of *Morchella steppicola* (photo by V.N. Zelenkova, 01.04.2020)

somewhat saddle-shaped, with honeycomb appearance, 5-15 cm high, 5-15 cm in diameter. It is grayish brown in color, hollow and is tightly attached to the stem. The stem is short, thick, more or less cylindrical, 4-9 × 4-6 cm, wrinkled, grayish-white, at first dense, with several hollows throughout development, or almost hollow inside. The flesh is dense, without a special smell. Fruit bodies can reach a height of 25 cm and a weight of up to 2 kg (Gorlenko, 1976; El-hamady, 2017). The spores are white. The asci are 200-270 × 15-24 μm wide, 8-spore, cylindrical. The spores are 17-30 × 10-18 μm wide, translucent, unicellular, ellipsoidal, arranged in one row (Red Data Book of the Belgorod region (2019, Vasilkov, 1948. Zerov, 1970. Promyshlennost, 1984 Red Data Book of Ukraine, 2010-2019. Red Book of the Rostov region (2014-1741).

Morchella steppicola belongs to the ecotrophic group of humus saprotrophs, but, probably, it is able to enter into additional mycorrhizal relationships with herbaceous and woody (Rosaceae) plants (Red Data Book of the Republic of Kalmykiya 2014. Baranova, et al. 2017). It is a thermophilic species. It inhabits open areas, mainly the areas with moderate cattle grazing, the slopes of ravines, and sparse forest belts. Fruit bodies are solitary or, in favorable years, form groups, in April-May, sometimes, with an early arrival of heat, already in March (Red Data Book of the Belgorod region, 2019). The fruit bodies of *Morchella steppicola* are considered poisonous when raw, but are edible after heat treatment. The species has no commercial value. In certain years it may be an object of mushroom foraging. In nature, it is important as a mineralizer and a soil former.

The mass appearance of *Morchella steppicola* fruit bodies is facilitated by the conditions of accumulation of

moisture in the soil in the early spring period (March) and atmospheric humidification and warming of the air and soil during the spring (March-May). Under the conditions of dry springs, fruit bodies do not appear for several years in a row (Red Data Book of Ukraine, 2010-2019). Micropopulations of *Morchella steppicola* in some habitats in favorable years represent relatively sparse groups of 15-20 fruit bodies. The outlines of groups are linear or circular ("witch circles"), the diameter of the circles reaches 7-8 m (Red Data Book of Ukraine, 2010-2019). *Morchella steppicola* bears fruit for no more than a week. Fruit bodies often stop growing prematurely, wither and dry out due to the rapid drying of the upper soil horizon due to a lack of atmospheric moisture, strong insolation, and continuously blowing winds.

Morchella steppicola is similar to large representatives of *Morchella esculenta* (common morel) and *Morchella crassipes* (thick-footed morel), it is distinguished by its habitat (open spaces, slopes of gullies) and a spherical shape of the cap.

Morchella steppicola is considered to be an East European-Central Asian species. It can be found in the southern regions of European Russia: Rostov, Volgograd, Saratov, Belgorod, Kursk, Voronezh, Kalmykia and Crimea; forest-steppe and steppe regions of Moldova, Ukraine; the republics of Central Asia (Turkmenistan, Kazakhstan, Uzbekistan, Tajikistan) (Red Data Book of the Belgorod region 2019., Zerov, 1970, Red Data Book of Ukraine, 2010-2019, Didukh, 2009. www.inaturalist.org/taxa/710294-Morchella-steppicola). *Morchella steppicola* is considered a relatively rare species Gorlenko, 1976, Promyshlennost, 1984, Red Data Book of Ukraine, 2010-2019), but it is not listed in the Red Data Book of the Russian Federation (Khapugin, et al. 2017). Recently, single finds of this species have been discovered in the southern part of Western Europe: in Serbia (1 locality) and Italy (1 locality) (www.inaturalist.org/taxa/710294-Morchella-steppicola).

In the Rostov region, 6 habitats of *Morchella steppicola* were registered. The species is included in the regional Red Data Book (Red Book of the Rostov region.(2014-1741).as decreasing in numbers as a result of changes in conditions of existence or destruction of habitats and in need of protection (category 2a); category of the regional rarity criterion (RRC) – "B": a rare species, unique for the flora of Russia, but characteristic of the vegetation cover of the region. The limiting factors in the region are: reduction of the area of natural habitats – virgin steppes, changes in climatic conditions, mass collection of fruit bodies by the population. The species is protected in specially protected natural areas (SPNA). The protective measures include: raising public awareness of this species of mushrooms as rare and in need of protection, the study of the biology of the species in the conditions of the region, and the search for new locations.

In the Volgograd region, 17 habitats of *Morchella steppicola* were recorded. The species is included in the regional Red Data Book (Baranova, et al. 2017). with category 3b – a rare species with a low natural abundance, found in a limited area, with a narrow ecological confinement associated with specific growing conditions. The category of the regional rarity criterion (RRC) is "B": a rare species, unique for the flora of Russia, but characteristic of the vegetation cover of the region. Single specimens are observed in the habitats. In certain years, there is a massive development of fruiting bodies of this species. The limiting factors for *Morchella steppicola* in the Volgograd region include: reduction in the area of natural habitats – virgin steppes, mass collection of fruit bodies by the population. The species is protected in natural parks; it is recommended to create sanctuaries in places where there is a massive development of fruit bodies.

1 habitat of *Morchella steppicola* was registered in the Saratov region. The species is included in the regional Red Data Book (Red Data Book of the Saratov region 2006). with category 3 (R) – a rare species. The limiting factor in the region is the plowing of the steppes. The species is protected in specially protected natural areas (SPNA). The protective measures include: studying the distribution of the species, taking control of habitats, prohibiting the collection of fruit bodies.

There is evidence that *Morchella steppicola* is found in the Crimea, (mikhailvishnevsky.com/stepnoj-smorchok-korol-vesennih-gri). but the species is not listed in the Red Data Book of Crimea (Ena, & Fateryga, 2015). Two habitats of *Morchella steppicola* were registered in Kalmykia. The species is included in the regional Red Data Book (Red Data Book of the Republic of Kalmykiya 2014). with category 2 – a decreasing in numbers (vulnerable) species. Within Kalmykia, it grows in groups in wormwood steppes. It is noted that data on the number of the species are insufficient due to non-annual fruiting and the difficulty of observing the species in nature (due to fruiting in early spring). The limiting factors for *Morchella steppicola* in Kalmykia include: burning of steppe vegetation, plowing of steppes, collection of fruit bodies. A number of important nature conservation measures include: the search for new habitats, control over the state of populations.

Morchella steppicola was registered in many forest-steppe and steppe regions of Ukraine and Novorossia (Red Data Book of Ukraine, 2010-2019, Didukh, 2009. www.inaturalist.org/taxa/710294-Morchella-steppicola), the southern neighbors of the Belgorod region. Its habitats have been identified in the following regions: Kiev, Sumy, Cherkassk, Kirovograd, Dnepropetrovsk, Poltava, Kharkov, Donetsk, Lugansk, Odessa, Nikolaev, Kherson, Zaporozhye. The species is included in the Red Data Book of Ukraine (Red Data Book of Ukraine, 2010-2019; Didukh, 2009). with the following conservation status: rare – a rare species. The limiting

factors for *Morchella steppicola* in Ukraine include: plowing of steppe areas and fallow lands, excessive grazing on the steppe slopes, collection of fruit bodies. The species is protected in nature reserves.

Morchella steppicola was registered in Moldova – 1 habitat. The species is included in the Red Data Book of the Republic of Moldova (Болуца, 2010). with the status of “vulnerable species” (VU – Vulnerable). No limiting factors were noted. Monitoring of the state of identified populations is recommended as protection measures.

Morchella steppicola is registered in the Central Asian republics: Turkmenistan, Kazakhstan, Uzbekistan, Tajikistan (Gorlenko, 19769; Vasilkov, 1948; Batyrov, 1977). The species is included in the Red Data Book of mushrooms in Kazakhstan (List of the rare fungi of the Republic of Kazakhstan, 2020) and Tajikistan (Fungi of Tadzhikistan, 2020) as a rare species. The species was not recorded in the Red Data Book lists of mushrooms in Uzbekistan and Turkmenistan (Red Data Book of Turkmenistan 2011).

Thus, the *Morchella steppicola* range includes the forest-steppe and steppe regions of Russia, Ukraine, Moldova (Eastern Europe) and the steppe regions of Turkmenistan, Kazakhstan, Uzbekistan, and Tajikistan (Central Asia). In the eastern part of the range, the species, according to available data, is represented unevenly. In most regions, where it is registered, it is considered a rare or vulnerable species in need of protection. There is a probable lack of data on its habitats due to non-annual fruiting and the difficulty of observing it (it bears fruit in early spring). The following necessary protection measures are more often mentioned: preservation of existing habitats and search for new ones, educational work with the population in connection with the conservation value and vulnerability of this species.

In the Belgorod region, *Morchella steppicola* was registered in Gubkin district (the areas around the village of Dubravka, the Yamskaya Steppe area of the Belogorye Special Protected Natural Area) (Red Data Book of the Belgorod region 2019) (locality 1, **Fig. 2**). The mushroom has been assigned the following category and status: 3 – a rare species. The threatening factors include: destruction of habitats, collection of fruit bodies by the population. Recommended protection measures are as follows: conservation of existing habitats and search for new ones, taking identified populations under territorial protection, monitoring the abundance in known habitats (Red Data Book of the Belgorod region 2019).

As part of the current monitoring of rare early species in the 2020 season, 2 new localities of *Morchella steppicola* were identified in the Belgorod Region (see **Fig. 2**).

Location 2. Outskirts of the village of Bezlyudovka (Shebekino district). A gully stretched in the SW – NE direction. The upper part of the slope of the gully, SE



Fig. 2. Locations of identified micropopulations of *Morchella steppicola* in the Belgorod region (data from: 1 – A.V. Prisky (2019); 2, 3 – V.N. Zelenkova (2020))

exposure, slope grade ~ 10-15°. Soil (substrate) in the form of thin loam on chalk deposits. Micropopulation of elongated (linear) configuration; 12 fruit bodies with the distance of 0.6-0.9 m between them. Date of discovery: 04/01/2020. Coordinates: N: 50.396038, E: 36.76127.

Location 3. The areas around Nikolskoye village (Belgorod district). A gully stretched in the SWZ - SVV direction. The middle part of the slope stretched in the South-South-East direction, slope grade ~ 10-15°. Soil (substrate) in the form of thin loam on chalk deposits. Micropopulation of elongated (linear) configuration; 9 fruit bodies: two – side by side, the distance between the rest is 0.4-0.9 m. Fruit bodies with signs of premature wilting due to moisture deficit in the soil and drying wind. Date of discovery: 04/13/2020. Coordinates: N: 50.461912, E: 36.62206.

The fact of identifying habitable ecotopes of *Morchella steppicola* unknown to researchers indicates the lack of our knowledge about its prevalence within the region, the probable existence of habitats not yet discovered (but known to the local population), the possibility of new discoveries of micropopulation formations of this species in characteristic ecotopes.

It should be noted that the *Morchella steppicola* localities were registered in the Voronezh (2 localities) and Kursk (1 localities) regions of the Russian Federation (Batyrov, 1977) bordering the Belgorod region, but the species is not listed in the Red Data Book species lists of these regions (Red Data Book of the

Voronezh region, 2011; Red Data Book of the Kursk region, 2017).

CONCLUSION

The distribution area of *Morchella steppicola* Zerova includes the forest-steppe and steppe regions of Russia, Ukraine, Moldova (Eastern Europe) and the steppe regions of Turkmenistan, Kazakhstan, Uzbekistan, Tajikistan (Central Asia). In the eastern part of the range, the species, according to available data, is represented unevenly. In most of the regions where it is noted, it is considered a rare or vulnerable species in need of protection. There is not enough data on its habitats due to non-annual fruiting and difficulty of observation (it bears fruit in early spring). The following necessary protection measures are more often mentioned: preservation of existing habitats and search for new ones, educational work with the population.

On the territory of the Belgorod region, 2 new habitats of *Morchella steppicola* were revealed in characteristic ecotopes of the gully type, which indicates the lack of our knowledge about its prevalence within the region, the probable existence of habitats that have not yet been discovered (but known to the local population), the possibility of new discoveries of micropopulation formations of this species in characteristic ecotopes. The fact of the identification of new habitats and the final considerations expressed in connection with their identification should in no way call into question the fact

that *Morchella steppicola* is a species for which the recommended measures should be followed: preservation of existing habitats and the search for new ones, taking the identified populations under territorial protection, observation of the number in known habitats.

ACKNOWLEDGEMENTS

The research has been done within the framework of the State Assignment of the Russian Federation Ministry of Science and Higher Education № FZWG-2020-0021.

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