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Agaricoid fungi new to Leningrad Region, Russia

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Keywords: *Basidimycota*, biodiversity, Izhora Upland, mycobiota, threatened species.

Summary. Information on 18 species recorded for the first time in the Leningrad Region is given, including seven (*Atheniella leptophylla, Cystoagaricus sylvestris, Lepiota subalba, Mycena mirata, Pluteus ephebeus, Psathyrella longicauda* and *Psathyrella pygmaea*) previously not known from the north-west of European Russia. The species are annotated with comments on ecology, and colour illustrations of basidiomata are provided. Three species are recommended for the next edition of Red Data Book of the Leningrad Region: *Atheniella leptophylla* as confined to limestone outcrops, rare in the region, and *Cystoagaricus sylvestris* and *Pluteus aurantiorugosus* vulnerable due to substrate confinement to elm wood.

Новые находки агарикоидных грибов для Ленинградской области, Россия

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Ключевые слова: базидиомицеты, биоразнообразие, Ижорская возвышенность, микобиота, уязвимые виды.

Аннотация. Приведены сведения о 18 видах, впервые отмеченных на территории Ленинградской области, в том числе семь из них (*Atheniella leptophylla, Cystoagaricus sylvestris, Lepiota subalba, Mycena mirata, Pluteus ephebeus, Psathyrella longicauda* и *Psathyrella pygmaea*) зарегистрированы впервые на территории Северо-Запада европейской части России. Они снабжены комментариями об экологии, также даны цветные иллюстрации базидиом. Четыре вида рекомендованы к включению в следующее издание Красной книги Ленинградской области: *Atheniella leptophylla* как приуроченный к обнажениям известняка, редким в регионе, и *Cystoagaricus sylvestris* и *Pluteus aurantiorugosus*, являющиеся уязвимыми из-за субстратной приуроченности к древесине вяза.

Introduction

The Leningrad Region lies within Northwestern part of European Russia and borders of Finland, Estonia, Pskov, Novgorod, and Vologda Regions and Republic of Karelia. Approximate area of the region is 84600 km^2. It occupies the territory between 58°25'–61°15'N and 27°45'–35°45'E, forming stretched shape along E–W axis. The region is entirely located on the territory of the East European (Russian) Plain. The relief is flat, with insignificant absolute altitudes (mostly 50–150 meters above sea level). The climate of the region is atlantic-continental. Winters are mild, with frequent thaws, and summers are moderately warm, sometimes cool.

Agaricoid fungi of the Leningrad Region have been studied for almost 200 years. First data on agaricoid fungi of the region can be found in the works of J. A. Weinmann, founding father of Russian mycology (Weinmann, 1828, 1836, 1837). A. E. Kovalenko and O. V. Morozova compiled an exhaustive synopsis of published works since Weinmann through the 1990's including species list reported from the territory of the region with references to papers

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or specimens kept in Mycological Herbarium of Komarov Botanical Institute (Kovalenko, Morozova, 1999). Also, O. V. Morozova considered the history of the same period in detail, mentioning researchers, their publications, numbers of species reported and theirs geographical distribution (Morozova, 1999). In the 2000's, E. Fomina published the results of spruce forest agaricoid fungi survey (Fomina, 2001). The same year, the paper dealing with Izhora Upland mycobiota appeared (Morozova, Kovalenko, 2000). In 2007, an overview of Beryezovye Ostrova nature was issued, including list of agaricoid fungi too (Morozova, 2007). The same year, list of fungi and myxomycetes was prepared for the recent Congress of European Mycologists (Popov et al., 2007). It included an information on 1012 species of agaricoid basidiomycetes of the Leningrad Region and St. Petersburg. Only names are provided without any additional information. In 2015, the results of long-term surveys of macromycetes in Nizhne-Svirsky Nature Reserve were published (Zmitrovich et al., 2015). In 2018, the team of botanists and mycologists made the paper on threatened species, including data on agaricoid fungi too (Geltman et al., 2018). The same year, the author of present paper published list of agaricoid fungi recorded in regional protected area (Kalinina, 2018). Besides papers containing species lists, two regional Red Data Books were issued (Krasnaya kniga …, 2018; Red Data Book …, 2000).

Despite the long study history, there are habitats obviously understudied, e. g. small patches of riparian forests and abandoned manor parks with a lot of deciduous trees. Targeted surveys on mycobiota of such habitats are able to reveal species new even for the whole country (Song et al., 2019) and for the region too. The list of such species is presented below.

Material and Methods

Mycological surveys were performed in boundaries of Izhora Upland that represents a part of Ordovician plateau (Fig. 1). It is limestone upland located in western part of the Leningrad Region. At present the territory is almost deforested due to a long history of economic exploitation. Nevertheless, surviving patches of natural coniferous-deciduous and riparian forest communities as well as feral manor parks are of considerable interest because such communities differ significantly from surrounding boreal forests. The visited localities are denoted as follows.

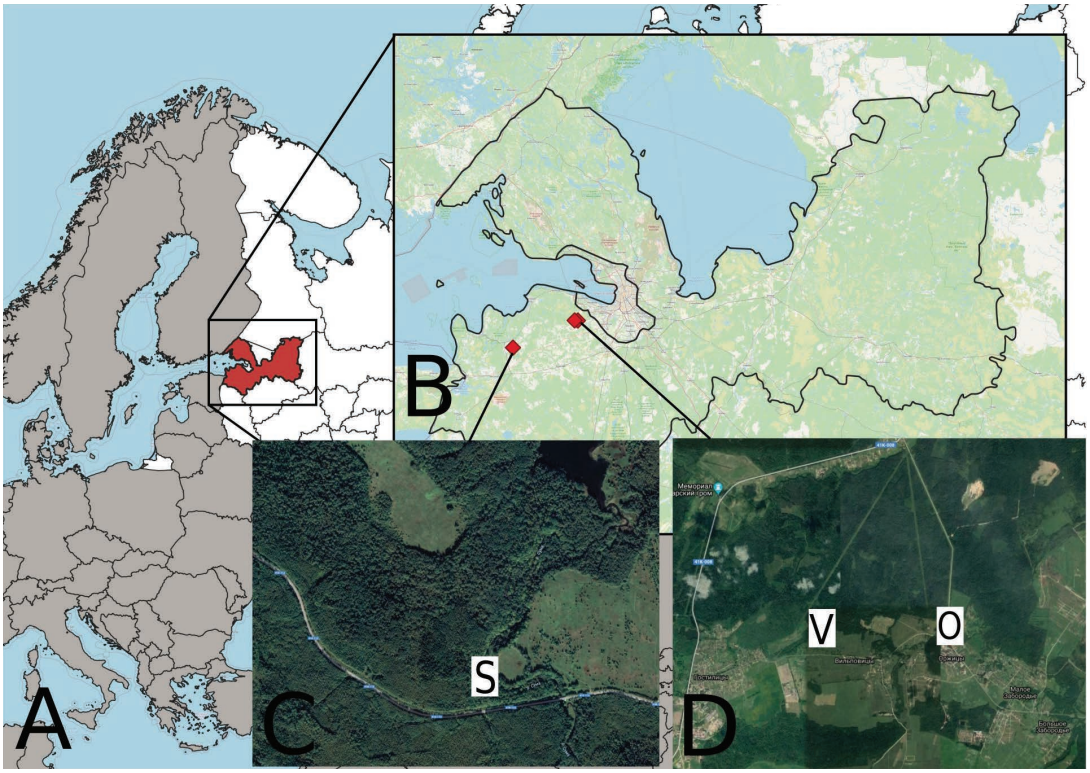

Fig. 1. A – Leningrad Region (in brown) on the map of Russia. B – Leningrad Region with main localities where collections were made (denoted as red diamonds). C – satellite image of the part of Kingissepsky district with the Suma River with locality denoted as S. D – satellite image of the part of Lomonosovsky district with villages Orzhitsy (denoted as O) and Vil'povitsy (denoted as V).

[S] – "Russia, Leningrad Reg., Kingissepsky distr., to the WNW of Kaybolovo village, the Suma River canyon (59°34'13.4"N, 28°50'06.7"E) with precipitous limestone banks up to 3 meters high, with many springs and old-age *Alnus glutinosa* growing on the slopes and in-stream islands". The slopes are stony, very wet, with old *Ulmus* sp. and with a lot of mossy coarse dead wood. Collections were made on in-stream island covered with *Ulmus*, *Alnus glutinosa* with numerous fallen trunks of *Ulmus* at various stages of decay. The territory is considered as perspective protected area "Canyon of the Suma River". Noteworthy, that the curve of the Suma River right in that place skirts the XI–XIII century settlement (Kuza, 1996).

[O] – "Russia, Leningrad Reg., Lomonosovsky distr., abandoned manor park in Orzhitsy village (59°45'09.0"N, 29°42'42.5"E) with the Levolovsky Creek flowing through it". Vegetation is represented by *Ulmus* sp., *Tilia cordata*, *Fraxinus excelsior*, and occasional *Quercus robur*. Significant amount of deciduous coarse wood debris is presented.

[V] – "Russia, Leningrad Reg., Lomonosovsky distr., vicinities of Vil'povitsy village (59°45'26.6"N, 29°40'19.6"E)". A steep slope of the Baltic–Ladoga escarpment (Malakhovsky, Greyser, 1987) covered with *Acer platanoides* and *Fraxinus excelsior* forest. On the edge of the precipice, sporadic *Quercus robur* and *Tilia cordata* grow; down the slope, *Alnus glutinosa* and *Populus tremula* appear and begin to dominate, with sporadic *Picea abies*. *Corylus avellana*, *Padus avium*, and *Ribes* sp. are found in the undergrowth. Significant amounts of dead *Acer platanoides* and *Fraxinus excelsioir* are characteristic. The territory is considered as perspective nature monument "Vil'povitsy".

Besides, three specimens were collected in two different points in regional protected area "Oak forests near Velkota village", coordinates and detailed information on the habitat are given in related records.

Data sampling

Material was collected by classical route method (Lodge et al., 2004) during 2018–2019. Macroscopic features were assessed in the field or shortly after collecting, also photos of fresh basidiomata were analyzed. Microscopy was performed in squash preparations of lamellar edge, section of pileipellis and stipitipellis of dried basidiomata mounted in 5 % KOH, 10 % NH_4OH using Axio Imager A1 microscope. To test amyloidity of the spore's walls, Melzer reagent was used. All specimens are deposited at the Mycological Herbarium of the Komarov Botanical Institute RAS (LE).

Results and discussion

The list of species new to the Leningrad Region is provided. The nomenclature of the taxa follows the Index Fungorum (2022). An annotated record includes information on locality and habitat, substrate, date of collection, herbarium number. The species new to the North West of European Russia are marked with asterisk (*). An exclamation mark (!) is used for species recommended for the next edition of the Red Data Book of the Leningrad Region. All marked species are provided with comments.

*! *Atheniella leptophylla* (Peck) Gminder et Böhning (Fig. 2B) – [S], on soil on the bank of the stream, 29 VIII 2018, LE F-331481; the same locality and habitat, 02 IX 2018, LE F-331480; the same locality, on soil, 09 IX 2018, LE F-331479. [V], on soil near the living *Ulmus* sp., 23 IX 2018, LE F-331392. – According to existing data on European findings, the species prefers damp places (as stream banks) and can be found near the base of trees in various types of forest. Our collection on the island in the Suma River was made exactly on the wet river bank near the living *Ulmus glabra*. Another specimen was found also near the base of *Ulmus* growing on the steep slope. Both collections were made near outcrops of limestone. The species is considered as rare but widespread (Aronsen, Læssøe, 2016). The species is confined to rare habitats, so it could be recommended for the next edition of the Red Data Book of the Leningrad Region.

Clitocybe truncicola (Peck) Sacc. – [O], on decayed trunk of *Ulmus* sp., 23 VII 2018, LE F-331406.

Coprinellus xanthothrix (Romagn.) Vilgalys, Hopple et Jacq. Johnson – [O], on litter, 23 VII 2018, LE F-331591. [S], on litter, 22 VIII 2018, LE F-331490.

*! *Cystoagaricus sylvestris* (Gillet) Örstadius et E. Larss. (Fig. 2G) – [S], on decaying wood of *Ulmus* sp., 22 VIII 2018, LE F-331596; the same locality, 11 VII 2019, LE F-331320. [O], on decaying wood of *Ulmus* sp., 31 VII 2018, LE F-331572; 07 VIII 2018, LE F-331579; 10 VIII 2018, LE F-331576; 11 VII 2019, LE F-331471. – In Europe and Russia, the species is confined to deciduous wood or also can be found directly on soil in rich forests (Knudsen, Vesterholt, 2012). All our collections were made on strongly decayed *Ulmus* trunks. It should be recommended for the next edition of the Red Data Book of the Leningrad Region, as it is confined to *Ulmus* stands, rare vegetation type for the region.

Lepiota boudieri Bres. – [S], on soil, 02 IX 2018, LE F-331595; the same locality, on soil, 09 IX 2018, LE F-331594. [V], on soil, 23 IX 2018, LE F-331383.

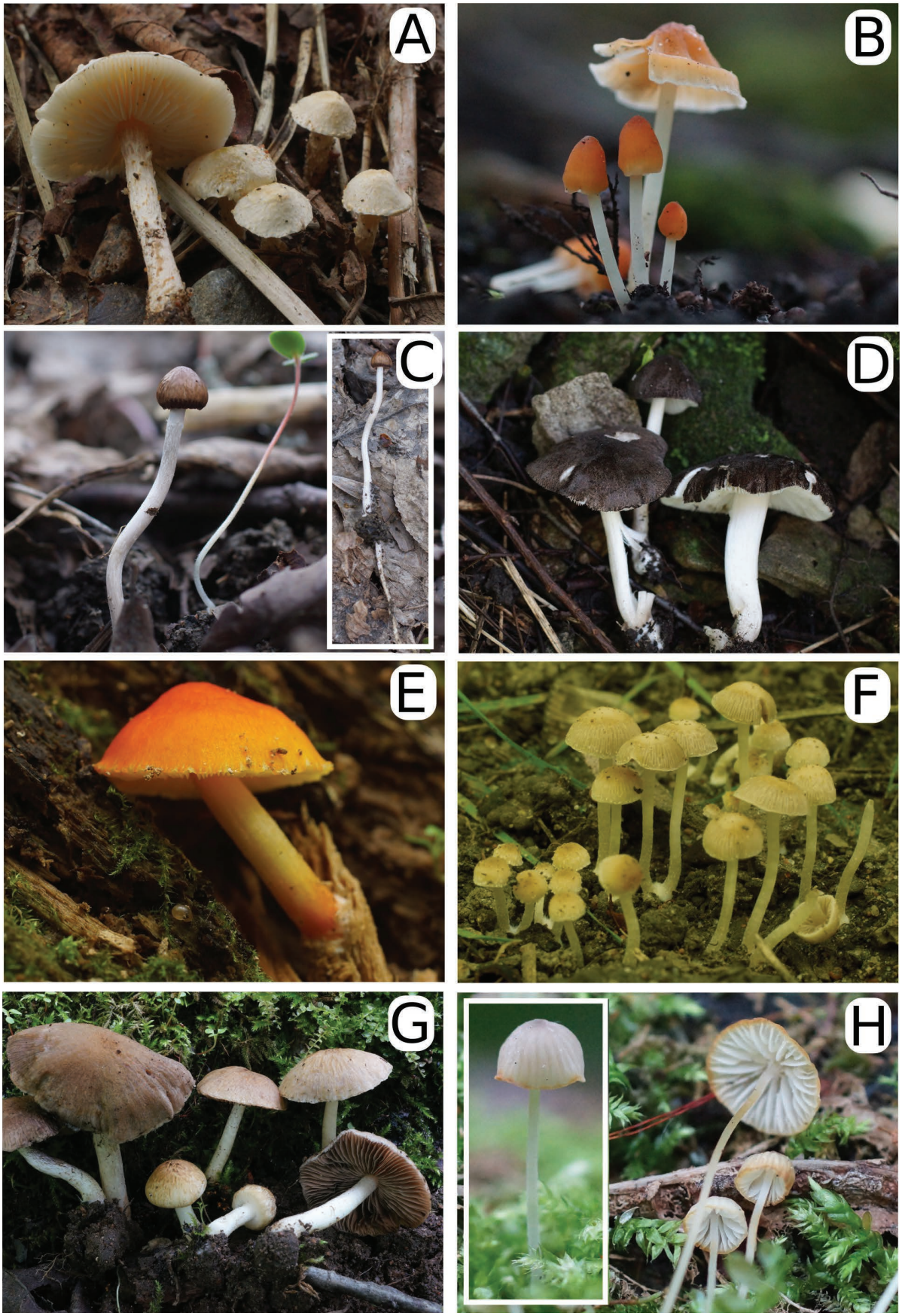

Fig. 2. Basidiomata *in situ*: A – *Lepiota subalba*, LE 321763. B – *Atheniella leptophylla*, LE F–331481. C – *Psathyrella longicauda*, LE F–331413. D – *Pluteus ephebeus*, LE F–331600. E – *Pluteus aurantiorugosus*, LE F–331518. F – *Psathyrella pygmaea*, LE F–331577. G – *Cystoagaricus sylvestris*, LE F–331320. Photo by Olga V. Morozova. H – *Mycena mirata*, LE F–331680.

* *Lepiota subalba* Kühner ex P. D. Orton (Fig. 2A) – Russia, Leningrad reg., Kingissepskiy distr., to WSW of Velkota village, 59°34'43.8"N 28°48'18.0"E, deciduous forest with *Quercus robur*, *Alnus incana*, on soil on the roadside, 29 VIII 2018, LE 321763. – The species is confined to rich soils according to data on findings in Europe (Knudsen, Vesterholt, 2012).

Mycena erubescens Höhn. – [V], on mossed base of *Ulmus* sp., 23 IX 2018, LE F-331391.

Mycena hiemalis (Osbeck) Quél. – [O], on bark of fallen *Ulmus* sp., 30 VI 2018; LE F-331417; the same locality, on mossed base of living *Ulmus* sp., 11 VII 2019, LE F-331470. [V], on bark of living deciduous tree, 23 IX 2018, LE F-331759; the same locality, on mossed base of deciduous tree, 24 X 2018, LE F-331753.

* *Mycena mirata* (Peck) Sacc. (Fig. 2H) – [O], on mossed trunk of *Ulmus*, 23 VI 2018, LE F-331680; among mosses on the living base of *Ulmus* sp., 24 X 2018, LE F-331377, LE F-331378. – In Europe, the species is probably widespread and common but overlooked due to its' tiny size (Aronsen, Læssøe, 2016).

! *Pluteus aurantiorugosus* (Trog) Sacc. (Fig. 2E) – [S], on decayed wood of *Ulmus* sp., 29 VIII 2018, LE F-331606. [O], on decayed wood of *Ulmus* sp., 23 VI 2018, LE F-331419; the same locality, 11 VII 2019, LE F-331465; the same locality, 29 VIII 2018, LE F-331432. [V], on decayed wood of *Ulmus* sp., 30 VII 2019, LE F-331518. – The species was mentioned for the Leningrad Region in species list, but actually it was found in the St. Petersburg (pers. comm.). Remarkably, all our collections were made inside the coarse decaying *Ulmus* stumps (diameter not less than 30–40 cm), literally among the wooden chaff. The species could be recommended for the next edition of the Red Data Book of the Leningrad Region. Also, it is listed in the Red Data Book of St. Petersburg (Krasnaya kniga …, 2018).

* *Pluteus ephebeus* (Fr.) Gillet (Fig. 2D) – [S], on soil near the decaying wood of *Ulmus* sp., 29 VIII 2018, LE F-331599; on soil near the fallen *Ulmus* sp. trunk, 02 IX 2018, LE F-331600; 22 VIII 2018, LE F-331621. – The species is considered here in broad sense, as there is no agreement among researchers yet on the identity of *Pluteus ephebeus* sensu stricto (Ševčíková, 2015). According to existing data on European findings (Vellinga, Schreurs, 1985), the species is mostly terrestrial, rarely on wood of deciduous trees. Our collections were made on soil in the proximity of fallen decayed trunks of *Ulmus* sp.

Pluteus inquilinus Romagn. – [V], on small fallen twig of deciduous tree, 23 VII 2018, LE F-331393.

Pluteus velutinus C. K. Pradeep, Justo et K. B. Vrinda – [O], on fallen deciduous trunk, 05 VIII 2018, LE F-331626. Specimen was identified by E. F. Malysheva.

* *Psathyrella longicauda* P. Karst. (Fig. 2C) – [O], on soil, 01 V 2019, LE F-331413. – Rarely registered species with limited records in Europe. According to existing literature data, it prefers humus, decaying leaves, rotting hay, manured grass (Kits van Waveren, 1981). Our specimen was collected in spring (May), though previous collections were dated by late autumn (October–November).

* *Psathyrella pygmaea* (Bull.) Singer (Fig. 2F) – [O], on soil, 10 VIII 2018, LE F-331577. [V], on decayed deciduous wood, 30 VII 2019, LE F-331507. – According to the data on findings from Europe and Russia, it prefers decayed wood or the bases of various deciduous trees and mostly is confined to deciduous forests (Vašutová, 2008). One of our collections (from the Orzhitsy) was made on path, on bare soil, but there's a possibility that strongly decayed wood or wooden chips were not visible. Noteworthy that in both cases basidiomata of the species grew intermixed with *Coprinellus disseminatus*, as it was mentioned previously (Legon, Henrici, 2022).

Simocybe haustellaris (Fr.) Watling – [S], on deciduous debris, 21 VII 2019, LE F-331787. [O], on deciduous debris, 23 VII 2018, LE F-331588.

Tricholomopsis flammula Métrod ex Holec – [S], on fallen deciduous trunk, 21 VII 2019, LE F-331441.

Xerocomellus cisalpinus (Simonini, H. Ladurner et Peintner) Klofac – Kingissepskiy district, to WSW of Velkota village, 59°35'02.4"N, 28°48'34.9"E, deciduous forest with *Quercus robur*, *Populus tremula*, *Coryllus avellana*, on soil, 28 VII 2018, LE F-331401; to E of Velkota village, 59.60301°N, 28.90015°E, old-growth oak forest with *Acer platanoides*, *Tilia cordata*, *Populus tremula*, *Corylus avellana*, on soil, 15 VIII 2019, LE F-331552.

Conclusions

Prior to present study, 1193 species of agaricoid fungi were known for the Leningrad Region (Bolshakov et al., 2021). As a result of mycological surveys that were held in 2017–2018, 18 species new to the Leningrad Region were revealed. Seven species (*Atheniella leptophylla, Cystoagaricus sylvestris, Lepiota subalba, Mycena mirata, Pluteus ephebeus, Psathyrella longicauda* and *P. pygmaea*) were recorded for the first time in the North West of European Russia. *Cystoagaricus sylvestris* and *Pluteus aurantiorugosus* confined to rare and declined substrate (dead

wood of *Ulmus*) and *Atheniella leptophylla* confined to rare and vulnerable habitats are recommended for the next edition of the Red Data Book of the Leningrad Region.

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