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## СООБЩЕНИЯ

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### SPECIES OF FUNGI RECOMMENDED FOR INCLUSION IN THE 2<sup>ND</sup> EDITION OF THE RED DATA BOOK OF ORYOL REGION

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Виды грибов, рекомендуемые для включения  
во второе издание Красной книги Орловской области

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**Abstract.** Based on the results of the long-term (2008–2020) studies of macromycetes in Oryol Region, a list of 24 fungal species recommended for the second edition of the regional Red Data Book has been compiled. The list includes 4 species of basidial fungi (*Clavariadelphus pistillaris*, *Cortinarius violaceus*, *Grifola frondosa*, and *Gyroporus cyanescens*) that were included in the first edition of the Red Data Book of Oryol Region (2007) and another 20 species (*Aeruginoscyphus sericeus*, *Bulgaria inquinans*, *Clavaria zollingeri*, *Ganoderma lucidum*, *Gloiodon strigosus*, *Gyroporus castaneus*, *Hericium coralloides*, *Holwaya mucida*, *Hydnocristella himantia*, *Metuloidea murashkinskyi*, *Phellinidium ferrugineofuscum*, *Polyporus umbellatus*, *Ramaria fennica*, *Ramariopsis crocea*, *Ramariopsis pulchella*, *Rhizochaete sulphurina*, *Rhodonia placenta*, *Rhodotus palmatus*, *Skeletocutis odora*, *Triblidium caliciiiforme*) that are proposed for protection for the first time. Each species is provided with the Latin name, followed by brief characteristics of its current taxonomic position, biology and ecology, population-limiting factors in the region, data on the range in Russia and on the distribution in Oryol Region, as well as the recommended protection category. The presented species list includes two species (*Clavaria zollingeri*, *Rhodotus palmatus*) from the IUCN Red List of Threatened Species and three species (*Ganoderma lucidum*, *Grifola frondosa*, *Polyporus umbellatus*) recorded in the Red Data Book of the Russian Federation (2008). Two species (*Aeruginoscyphus sericeus* and *Rhodotus palmatus*) are new to Oryol Region.

**Keywords:** macrofungi, mycobiota, fungal protection, new findings, rare species, Central Russian Upland, Oryol Region.

**Аннотация.** По итогам многолетних (2008–2020 гг.) исследований макромицетов Орловской области составлен список из 24 видов грибов, рекомендуемых во второе издание региональной Красной книги. Среди них 4 вида базидиальных грибов (*Clavariadelphus pistillaris*, *Cortinarius violaceus*, *Grifola frondosa* и *Gyroporus cyanescens*) были ранее включены в первое издание Красной книги Орловской области (2007) и ещё 20 видов (*Aeruginoscyphus sericeus*, *Bulgaria inquinans*, *Clavaria zollingeri*, *Ganoderma lucidum*, *Gloiodon strigosus*, *Gyroporus castaneus*, *Hericium coralloides*, *Holwaya mucida*, *Hydnocristella himantia*, *Metuloidea murashkinskyi*, *Phellinidium ferrugineofuscum*, *Polyporus umbellatus*, *Ramaria fennica*, *Ramariopsis crocea*, *Ramariopsis pulchella*, *Rhizochaete sulphurina*, *Rhodonia placenta*, *Rhodotus palmatus*, *Skeletocutis odora*, *Triblidium caliciiiforme*) предложены к охране впервые. Для каждого вида приводится латинское название, современное таксономическое положение, краткая характеристика особенностей его биологии и экологии, описаны факторы, лимитирующие численность вида в регионе, даны сведения об ареале вида в России и о распространении в условиях Орловской области, а также рекомендуемая категория охраны. Представленный список включает 2 вида (*Clavaria zollingeri*, *Rhodotus palmatus*) из Красного списка находящихся под угрозой исчезновения видов Международного союза охраны природы (МСОП) и 3 вида (*Ganoderma lucidum*, *Grifola frondosa*, *Polyporus umbellatus*), занесённые в Красную книгу Российской Федерации (2008). Виды *Aeruginoscyphus sericeus* и *Rhodotus palmatus* указываются впервые для Орловской области.

**Ключевые слова:** макромицеты, микобиота, охрана грибов, новые находки, редкие виды, Среднерусская возвышенность, Орловская область.

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## Introduction

Fungi are integral components of natural ecosystems, being involved both in the decomposition of dead plant organic matter and in the formation of mycorrhizal symbioses that largely determine the dynamics and productivity of ecosystems. Studies of macromycetes in Oryol Region have been scattered and sporadic for a long time. The first edition of the regional Red Data Book (Krasnaia..., 2007) included only four basidiomycete species – *Clavariadelphus pistillaris*, *Cortinarius violaceus*, *Grifola frondosa*, and *Gyroporus cyanescens*.

In 2008, targeted surveys of aphylloroid macromycetes, including polypores, clavarioids, hydroids, as well as corticioid forms, were initiated. Special attention was paid to the survey of forest ecosystems of the Orlovskoe Polesye National Park (Kotkova et al., 2009; Kotkova et al., 2011; Volobuev et al., 2013), the Naryshkinskiy Nature Park (Volobuev, 2013 a), the Spasskoye-Lutovinovo Museum-Reserve (Volobuev, 2011) and other biologically valuable and specially protected nature areas in Oryol Region. For the first time, 419 species of this group of fungi, including species new to the Russian fauna, *Lindtneria panphyliensis* and *Phanerochaete aculeata*, were registered for the region (Volobuev, 2013 b). The results of the 2008–2013 surveys covering all 24 administrative districts of Oryol Region were summarized in the monograph by S. V. Volobuev (2015). The study of aphylloroid fungi of the region is ongoing (Volobuev et al., 2020).

There have been no special studies of agaricoid fungi in Oryol Region. The results of observations on representatives of this group of basidiomycetes are summarized in the work of V. I. Radygina et al. (2014). These data were later supplemented by the identification of a number of agarics new to Oryol Region (Bolshakov et al., 2020; Volobuev et al., 2020).

Wood-inhabiting ascomycetes were studied by E. S. Popov in 2012–2013 in the Orlovskoe Polesye National Park in Znamenskiy District (Popov, 2013; Popov, Volobuev, 2014), and in the broad-leaved forests in Bolkhovskiy, Dmitrovskiy, Mtsenskiy, and Shablykinskiy Districts.

## Materials and Methods

The material for this paper is based on the data obtained during the field work in Oryol Region in 2008–2020, all available literary sources, and collections of the Mycological Herbarium of the Komarov Botanical Institute of the RAS (LE) and the Mycological Collection of the V. N. Khitrovo Herbarium of the Orel State University named after I. S. Turgenev (OHHI).

The nomenclature and the authors' names of the fungal taxa are given according to the «Index Fungorum» database (2021).

## Results and discussion

An annotated list of 24 fungal species proposed for inclusion in the new edition of the Red Data Book of Oryol Region is presented below. For each species the Latin name is given, followed by brief characteristics of its biology and ecology, population-limiting factors in the region, data on the range in Russia and on distribution in Oryol Region, as well as the recommended protection category.

### Phylum *Ascomycota*

*Aeruginoscyphus sericeus* (Alb. et Schwein.) Dougloud (*Hyaloscyphaceae*, *Helotiales*) – the species occurs in old-growth broad-leaved forests with oak. Saprotroph. It develops on half-buried, deeply destroyed oak wood, on the inner surface of hollows at the butt of dead trunks, and inside old stumps. The fruiting bodies grow scattered or in groups, sometimes quite numerous (over 10 apothecia). The occurrence of the species is limited by its narrow substrate preferences and the need for a regularly renewable substrate for development. European nemoral forest species. In Russia the species is known in a number of regions of the European part (Popov, 2013; Popov, Volobuev, 2014; Svetasheva et al., 2016), listed in the Red Data Book of Bryansk Region (category 3) (Krasnaia..., 2016). In Oryol Region, it is found in Dmitrovskiy District. The estimated threat category – 3. Rare species.

*Bulgaria inquinans* (Pers.) Fr. (*Phacidiaceae, Phacidiales*) – the species occurs mainly in old-growth spruce-broad-leaved and broad-leaved forests. Saprotroph or facultative pathogen, in vegetative state develops asymptotically in host tissues. Fruiting bodies develop on bark-covered dead and felled trunks and large branches of oak trees during the first two to three years after tree death. The limiting factors are the narrow substrate specialization and the need for regularly renewable, large-sized oak deadwood for development. In Russia, the species is distributed in broad-leaved and mixed forests of the European part, in the Caucasus and in the south of the Far East (Krasnaia..., 2018). In Oryol Region, it was found in Znamensky District (Popov, Volobuev, 2014). The estimated threat category – 3. Rare species.

*Holwaya mucida* (Schulzer) Korf et Abawi (*Tympanidaceae, Leotiales*) – the species occurs in river valleys and large ravines in humid spruce-broad-leaved and broad-leaved forests with the linden trees in the stand. Saprotroph. Fruiting bodies develop on dead trunks and branches of linden with preserved bark; rarely on other tree species (e.g. willow, rowan, ash). Limiting factors are the narrow substrate specialization and confinement to old-growth undisturbed forests, high requirements for the stability of microclimatic conditions. Holarctic nemoral forest species. In Russia the species is known in several regions of the European part and in the south of the Far East (Krasnaia..., 2018; Popov, Volobuev, 2014). In Oryol Region, it was recorded in Znamensky District (Popov, Volobuev, 2014). The estimated threat category – 3. Rare species.

*Triblidium caliciiforme* Rebent. (*Triblidiaceae, Rhytismatales*) – the species is mostly found on the edges of oak groves, as well as on solitary old oaks. Saprotroph. Fruiting bodies develop in bark cracks in large live oak trunks, mainly on the side protected from direct sunlight and with a poorly developed cover of mosses and lichens. The occurrence of the species is limited by its narrow substrate preferences, presumable weak competitiveness compared to mosses and lichens, and high requirements for stable microclimatic conditions. European-American nemoral forest species. In Russia the species is known in several regions of the European part and the Caucasus (Magnes, 1997; Popov, Volobuev, 2014). In Oryol Region, it was registered in Znamensky District (Popov, Volobuev, 2014). The estimated threat category – 3. Rare species.

### **Phylum Basidiomycota**

*Clavaria zollingeri* Lév. (*Clavariaceae, Agaricales*) – the species inhabits meadows, abandoned pastures and edges of forests as well as lawns in old parks and gardens. Soil-dwelling saprotroph, with a preference for poor acidic soils and meadow communities with low grass cover and mosses. The limiting factors are spring burning of dry grasses, grazing, ploughing and trampling, the effect of which is increased by the ecological characteristics of the species and irregular fruiting. In Russia, the species is reported in the forest zone of the European part, the Urals, and the Far East, but is rare everywhere (Parmasto, 1965; Bolshakov et al., 2018). It is included in the IUCN Red List of protected species (category VU) (Jordal, Kautmanova, 2019) and the Red Data Books of Lipetsk (category 2) (Krasnaia..., 2014) and Tula (category 2) (Krasnaia..., 2010) Regions. In Oryol Region, it was observed in the forest-steppe zone in Kolpnyansky District (Shiryaev, Volobuev, 2013; Volobuev, 2015). The estimated threat category – 2. Declining, vulnerable species.

*Clavariadelphus pistillaris* (L.) Donk (*Clavariadelphaceae, Gomphales*) – the species occurs on soil in old-growth mixed coniferous-broad-leaved forests; it prefers rich carbonate loamy or clayey soils and tends to forests with a minimal anthropogenic pressure. Limiting factors are logging of old-growth forests, disturbance of forest litter, forest fires, compaction of soil cover, including trampling. In Russia, the species is known in the forest zone of the European part, the Caucasus, the Urals, Siberia, and the Far East, but it is rare everywhere (Parmasto, 1965); it is included in the Red Data Books of Bryansk (category 2) (Krasnaia..., 2016), Kaluga (category 3) (Krasnaia..., 2015), Lipetsk (category 3) (Krasnaia..., 2014), and Kursk (category 3) (Krasnaia..., 2017) Regions. In Oryol Region, it was found in Khotynetsky, Liveny and Shablykinsky Districts (Krasnaia..., 2007; Shiryaev, Volobuev, 2013). The estimated threat category – 2. Declining, vulnerable species.

*Cortinarius violaceus* (L.) Gray (*Cortinariceae*, *Agaricales*) – the species occurs on soil in deciduous and mixed coniferous-broad-leaved forests. It forms ectomycorrhiza with birch trees. Limiting factors are logging in deciduous and mixed forests, forest fires, and soil disturbance. In Russia, the species is known in the forest zone throughout the territory, but is rare everywhere (Nezdoiminogo, 1996); it is listed in the Red Data Books of Kaluga (category 3) (Krasnaia..., 2015) and Lipetsk (category 3) (Krasnaia..., 2014) Regions. In Oryol Region, the species was found in Orlovsky and Znamensky Districts (Radygina, 1997; Krasnaia..., 2007; Radygina et al., 2014). The estimated threat category – 3. Rare species.

*Ganoderma lucidum* (Curtis) P. Karst. (*Polyporaceae*, *Polyporales*) – the species occurs on dead standing and fallen trunks of larch and other conifers, also develops on hardwood, in humid old-growth coniferous and mixed forests. Saprotroph, causing white rot of wood. Limiting factors are logging of old-growth forests and individual old trees, removal of large dead wood, forest fires and collection of fruiting bodies. In Russia, the species is known in the forest zone of the European part, the Caucasus, the Urals, Siberia and the Far East (Bondartseva, 1998), included in the Red Data Book of the Russian Federation (category 3b) (Krasnaia..., 2008), Red Data Books of Bryansk (category 3) (Krasnaia..., 2016), Kaluga (category 3) (Krasnaia..., 2015), Lipetsk (category 2) (Krasnaia..., 2014), Kursk (category 3) (Krasnaia..., 2017) Regions. In Oryol Region, it was found in Novoderevenkovsky District (Volobuev, 2015). The estimated threat category – 2. Declining, vulnerable species.

*Gloiodon strigosus* (Sw.) P. Karst. (*Auriscalpiaceae*, *Russulales*) – the species inhabits fallen trunks of oak and other deciduous species (birch, willow, alder, aspen) in old-growth broad-leaved and mixed forests. It prefers forests with a minimal anthropogenic impact. Saprotroph, causing white rot of wood. The species needs large volumes of coarse woody debris and is sensitive to all types of anthropogenic impact on its habitat, including logging and recreational use. In Russia, the species is known mainly in the taiga zone of the European part, the Urals, Siberia, and the Far East (Nikolaeva, 1961). In Oryol Region, the species was found in Khotynetsky and Trosnyansky Districts (Kotkova et al., 2011; Volobuev, 2015). The estimated threat category – 3. Rare species.

*Grifola frondosa* (Fr.) Gray (*Grifolaceae*, *Polyporales*) – the species occurs on the roots of old living, dying and dead oaks and at the base of large oak stumps in old-growth broad-leaved forests. Saprotroph, which has a phytopathogenic activity, causing white rot of wood. Limiting factors are logging of old-growth broad-leaved forests, old parks and individual oak trees, and collection of fruiting bodies. In Russia, the species is known from the European part, the Caucasus, the Urals, Siberia, and to the Far East (Bondartseva, 1998), it is listed in the Red Data Book of the Russian Federation (Category 3d) (Krasnaia..., 2008), Red Data Books of Bryansk (Category 1) (Krasnaia..., 2016), Kaluga (category 3) (Krasnaia..., 2015), Tula (category 3) (Krasnaia..., 2010), and Lipetsk (category 2) (Krasnaia..., 2014) Regions. In Oryol Region, it was recorded in Mtsensky and Trosnyansky Districts (Krasnaia..., 2007). The estimated threat category – 3. Rare species.

*Gyroporus castaneus* (Bull.) Quél. (*Gyroporaceae*, *Boletales*) – the species occurs on rich soils in old-growth broad-leaved and mixed coniferous-broad-leaved forests. It forms ectomycorrhiza with broad-leaved trees, especially oak. Limiting factors are logging of old-growth broad-leaved forests, disturbance of soil cover, forest fires, and collection of fruiting bodies. In Russia, the species is known in the European part, the Caucasus and the Far East, but it is rare everywhere. It is included in the Red Data Books of Bryansk (Krasnaia..., 2016), Kaluga (Krasnaia..., 2015), Tula (Krasnaia..., 2010), Lipetsk (Krasnaia..., 2014) and Kursk (Krasnaia..., 2017) Regions (in all – category 3). In Oryol Region, it was found in Khotynetsky District (Radygina et al., 2014). The estimated threat category – 3. Rare species.

*Gyroporus cyanescens* (Bull.) Quél. (*Gyroporaceae*, *Boletales*) – the species occurs on soil in coniferous, deciduous and mixed forests, and it prefers rich, acidic soils. It forms ectomycorrhiza with various wood species, both coniferous (spruce, pine) and deciduous (birch, linden, oak). Limiting factors are logging, forest fires, recreational pressure, and collection of fruiting bodies. In Russia, the species is known in the European part, the Caucasus, the Urals, Siberia and the Far

East, it is included in the Red Data Books of Kaluga (category 3) (Krasnaia..., 2015), Tula (category 3) (Krasnaia..., 2010), Lipetsk (category 3) (Krasnaia..., 2014) and Kursk (category 4) (Krasnaia..., 2017) Regions. In Oryol Region, it was recorded in Khotynetsky and Znamensky Districts (Radygina, 1997; Krasnaia..., 2007; Radygina et al., 2014). The estimated threat category – 3. Rare species.

*Hericum coralloides* (Scop.) Pers. (*Hericiaceae*, *Russulales*) – the species occurs on fallen and dry standing trunks of birch and aspen, less often on other deciduous species, in old-growth deciduous and mixed forests; it prefers forests with an abundance of coarse woody debris. Saprotroph, causing white rot of wood. Limiting factors are logging of old-growth forests and individual old trees, removal of large dead wood, collection of fruiting bodies. In Russia, the species is known in most regions of the European part, the Caucasus, the Urals, Siberia, and the Far East (Nikolaeva, 1961), but is rare everywhere. It is listed in the Red Data Books of Bryansk (Krasnaia..., 2016), Kaluga (Krasnaia..., 2015), Tula (Krasnaia..., 2010), Lipetsk (Krasnaia..., 2014), and Kursk (Krasnaia..., 2017) Regions (in all – category 3). In Oryol Region, it was recorded in Znamensky District (Volobuev, 2015). The estimated threat category – 3. Rare species.

*Hydnocristella himantia* (Schwein.) R. H. Petersen (*Lentariaceae*, *Gomphales*) – the species inhabits dead trunks and mossy bark of living oak trees, as well as develops on wood of other broad-leaved tree species, sometimes shifting from woody substrate to forest litter, in old-growth broad-leaved forests, preferring forests with a minimal anthropogenic pressure. Saprotroph, causing white rot of wood. Limiting factors are removal of large woody debris, logging of old-growth broad-leaved forests, and recreational pressure. In Russia, the species is known in the southern taiga and broad-leaved forests of the European part, the Caucasus, the Urals, Siberia and the Far East, it is listed in the Red Data Book of Bryansk Region (category 3) (Krasnaia..., 2016). In Oryol Region, it was found in Bolkhovskiy, Dmitrovskiy, Novoderevenkovskiy, and Znamensky Districts (Volobuev et al., 2013; Volobuev, 2015). The estimated threat category – 3. Rare species.

*Metuloidea murashkinskyi* (Burt) Miettinen et Spirin (*Steccherinaceae*, *Polyporales*) (Fig., a) – the species inhabits dead trunks of oak and other deciduous species in humid old-growth forests with large dead wood. Saprotroph, causing white rot of wood. Limiting factors include logging in old-growth forests and other silvicultural treatments, removal of large dead wood, and recreational use. In Russia the species is known in the European part, the Urals, Siberia, and the Far East (Nikolaeva, 1961; Mukhin, 1993), but it is rare everywhere. In Oryol Region, the species was recorded in Zalegoshchensky District (Volobuev, 2015). The estimated threat category – 3. Rare species.



Fig. Basidiocarps of some fungal species proposed for the new edition of the Red Data Book of Oryol Region: a – *Metuloidea murashkinskyi* (photo: S. V. Volobuev), b – *Ramariopsis pulchella* (photo: E. S. Popov), c – *Rhodotus palmatus* (photo: S. V. Volobuev).

Рис. Плодовые тела некоторых видов грибов, предложенных в новое издание Красной книги Орловской области: а – *Metuloidea murashkinskyi* (фото: С. В. Волобуев), б – *Ramariopsis pulchella* (фото: Е. С. Попов), в – *Rhodotus palmatus* (фото: С. В. Волобуев).

*Phellinidium ferrugineofusum* (P. Karst.) Fiasson et Niemelä (*Hymenochaetales*, *Hymenochaetales*) – the species develops on fallen trunks of spruce, sometimes pine, in old-growth spruce forests and mixed spruce-broad-leaved forests, preferring coniferous forests with a minimal anthropogenic pressure. Saprotroph, causing white rot of wood. Limiting factors are logging of old-growth coniferous and mixed forests, removal of large coniferous dead wood, silvicultural activities. In Russia, the species is known in the taiga forests of the European part, the Urals, and Siberia (Bondartseva, Parmasto, 1986). In Oryol Region, the species was recorded in Khotynetsky and Novoderevenkovsky Districts (Kotkova et al., 2009; Volobuev, 2012) which are located near the southern border of its range. The estimated threat category – 3. Rare species.

*Polyporus umbellatus* (Pers.) Fr. (*Polyporaceae*, *Polyporales*) – the species develops on tree roots or from the underground sclerotium, forming fruiting bodies on soil at the base of living oak trunks and stumps in old-growth deciduous and mixed forests with oak. Saprotroph, which exhibits phytopathogenic activity, causing white rot of wood. Limiting factors are logging of old-growth forests and individual oak trees, forest fires, and collection of fruiting bodies. In Russia, the species is known in the European part, the Caucasus, the Urals, Siberia, and the Far East (Bondartseva, 1998). It is listed in the Red Data Book of the Russian Federation (Category 3d) (Krasnaia..., 2008) and Red Data Books of Bryansk (category 1) (Krasnaia..., 2016), Kaluga (category 3) (Krasnaia..., 2015), Tula (category 3) (Krasnaia..., 2010), Lipetsk (category 3) (Krasnaia..., 2014), and Kursk (category 3) (Krasnaia..., 2017) Regions. In Oryol Region, the species was found in Khotynetsky, Verkhovskiy and Znamenskiy Districts (Kotkova et al., 2009; Kotkova et al., 2011; Volobuev, 2014; Volobuev, 2015). The estimated threat category – 3. Rare species.

*Ramaria fennica* (P. Karst.) Ricken (*Gomphaceae*, *Gomphales*) – the species occurs on rich carbonate soils in mixed and broad-leaved forests, prefers forests with a minimal anthropogenic pressure. It forms an ectomycorrhiza mainly with broad-leaved trees. Limiting factors are logging in old-growth mixed and broad-leaved forests, forest fires, recreational use, and disturbance of forest soils. In Russia, the species is known in the forest zone of the European part, the Urals, Siberia, and the Far East; however, it is extremely rare everywhere (Parmasto, 1965; Shiryaev, Volobuev, 2013; Shiryaev, 2020), it is listed in the Red Data Book of Tula Region (category 3) (Krasnaia..., 2010). In Oryol Region, it was recorded in the forest-steppe zone in Verkhovskiy District (Shiryaev, Volobuev, 2013). The estimated threat category – 3. Rare species.

*Ramariopsis crocea* (Pers.) Corner (*Clavariaceae*, *Agaricales*) – the species develops on naked, clayey, less frequently sandy soils in deciduous forests and among shrubs in meadows and pastures; it prefers habitats with a minimal anthropogenic impact. Saprotroph. Limiting factors include spring burns of dry grasses, forest fires, soil disturbance including the result of trampling, cattle grazing, and recreational use. In Russia, the species is known in the forest zone of the European part, the Urals, Siberia and the Far East; it is rare everywhere (Parmasto, 1965; Bolshakov et al., 2020), included in the Red Data Book of Tula Region (Category 3) (Krasnaia..., 2010). In Oryol Region, the species was found in the forest-steppe zone in Verkhovskiy District (Shiryaev, Volobuev, 2013). The estimated threat category – 3. Rare species.

*Ramariopsis pulchella* (Boud.) Corner (*Clavariaceae*, *Agaricales*) (Fig., b) – the species occurs on exposed, rich, mineral soils in deciduous forests and among shrubs in grasslands and pastures; it prefers habitats with a minimal anthropogenic impact. Saprotroph. Limiting factors include forest fires, spring burning of dry grasses, disturbance of soil cover, some of the factors are caused by cattle overgrazing, trampling, and recreational use. In Russia, the species is distributed in the forest zone of the European part, the Urals, Siberia, and the Far East, but is extremely rare everywhere (Parmasto, 1965; Bolshakov et al., 2016). It is listed in the Red Data Books of Kaluga (category 2) (Krasnaia..., 2015) and Tula (category 2) (Krasnaia..., 2010) Regions. In Oryol Region, it was found in the forest-steppe zone in Dolzhanskiy District (Shiryaev, Volobuev, 2013). The estimated threat category – 2. Declining, vulnerable species.

*Rhizochaete sulphurina* (P. Karst.) K.H. Larss. (*Phanerochaetaceae*, *Polyporales*) – the species occurs on fallen trunks of aspen as well as other deciduous and coniferous species, in old-growth deciduous and mixed forests. Saprotroph, causing white rot of wood. Limiting factors are removal of coarse woody debris, logging of old-growth forests, and recreational use. In Russia, the species is known to be based on single finds in the European part, the Urals, Siberia, and the Far East (Kotkova et al., 2009; Shiryaev et al., 2010). In Oryol Region, the species was recorded in Khotynetsky District (Kotkova et al., 2009; Kotkova et al., 2011). The estimated threat category – 3. Rare species.

*Rhodonia placenta* (Fr.) Niemelä, K. H. Larss. et Schigel (*Laricifomitaceae*, *Polyporales*) – The species inhabits fallen pine and spruce trunks in old-growth coniferous and mixed forests; it prefers forests with a minimal anthropogenic impact. Saprotroph, causing brown rot of wood. Limiting factors are logging of old-growth coniferous and mixed forests and removal of large coniferous dead wood. In Oryol Region it is distributed close to the southern border of the range. Circumboreal species, rare in Europe (Ryvarden, Melo, 2017). In Russia, the species is known from the taiga zone of the European part, the Urals, Siberia, and the Far East (Bondartseva, 1998). In Oryol Region, the species was recorded in Znamensky District (Volobuev et al., 2013; Volobuev, 2015). The estimated threat category – 3. Rare species.

*Rhodotus palmatus* (Bull.) Maire (*Physalacriaceae*, *Agaricales*) (Fig., c) – the species occurs on fallen trunks of elm, less often on other broad-leaved species, in old-growth humid broad-leaved forests; it prefers forests with a minimal anthropogenic pressure. Saprotroph. Limiting factors are logging of old-growth broad-leaved forests, removal of dead broad-leaved species, first of all elm, forest management activities, and forest fires. In Russia, the species is known in broad-leaved forests of the European part, the Caucasus and the Far East, but it is rare everywhere (Iršėnaitė et al., 2019; Kovalenko, 1980). It is included in the IUCN Red List of Protected Species (category NT) (Iršėnaitė et al., 2019) and Red Data Books of Bryansk (category 3) (Krasnaia..., 2016) and Kaluga (category 3) (Krasnaia..., 2015) Regions. In Oryol Region, it is found in Znamensky District. The estimated threat category – 3. Rare species.

*Skeletocutis odora* (Sacc.) Ginns (*Incrustoporiaceae*, *Polyporales*) – the species develops on fallen trunks of aspen and spruce; it has also been recorded on fallen branches of oak, in humid old-growth aspen, spruce and mixed coniferous-broad-leaved forests; it prefers forests with a minimal anthropogenic impact. Saprotroph, causing white rot of wood. Limiting factors are logging in old-growth forests, removal of large dead wood, silvicultural activities, and recreation pressure. Holarctic species is rare in the southern regions of Europe and more common in the taiga-forest zone (Ryvarden, Melo, 2017). In Russia, the species is known in the European part, the Urals, Siberia, and the Far East (Bondartseva, 1998). In Oryol Region, the species was found in Khotynetsky, Uritsky, and Znamensky Districts (Kotkova et al., 2009; Kotkova et al., 2011; Volobuev, 2013 a; Volobuev, 2015). The estimated threat category – 3. Rare species.

## Conclusion

About 600 species of macromycetes are currently known to inhabit in Oryol Region. Twenty-four species, including two species (*Clavaria zollingeri*, *Rhodotus palmatus*) from the IUCN Red List of Threatened Species (Iršėnaitė et al., 2019; Jordal, Kautmanova, 2019) and three species (*Ganoderma lucidum*, *Grifola frondosa*, *Polyporus umbellatus*) from the Red Data Book of the Russian Federation (Krasnaia..., 2008) are proposed for the new edition of the Red Data Book of Oryol Region. It should be noted that the crucial importance in the conservation of fungi as an integral component of terrestrial ecosystems is not only and not so much the preservation of human-observed fungal fruiting bodies, but primarily the protection of habitats, including species requirements for substrate, humidity, community structure and minimization of the anthropogenic factor. This also explains the need for new protected areas in the region.

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