Synopsis of the macrofungi (*Basidiomycota*) on wood of fruit trees in the Central Black Earth Region of Russia

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**Abstract**

**Aim.** To summarise and analyse data on the species diversity, distribution and substrate spectra of wood-inhabiting basidial macrofungi growing on fruit trees in the Belgorod, Voronezh, Kursk, Lipetsk, Oryol and Tambov Regions.

**Material and Methods.** The work involved a critical examination of literature sources, LE, OHHI, and VU herbaria. We undertook field researches in 2019–2020, identified specimens collected based on light microscopy techniques and isolated the basidial fungi in a pure culture.

**Results.** Data on 97 species of basidial macrofungi from 68 genera associated with *Malus*, *Pyrus* and *Prunus* wood in the Central Black Earth Region are summarised. *Antrodia serpens* and *Ceriporia torpida* are newly known to Russia. 65 new dikaryotic strains for 22 species of *Agaricomycetes* have been introduced into the LE-BIN. A total of 65 species are associated with *Malus*, 34 species with *Pyrus* and 29 species with *Prunus*. Five species (*Lyomyces crustosus*, *Stereum hirsutum*, *Trametes hirsuta*, *T. ochracea* and *T. versicolor*) grow on all three genera of host. These species specialise in fruit trees include *Sarcodontia crocea* and *Phellinus pomaceus*.

**Conclusion.** Pathogenic activity has been clearly observed for 32 species of fungi found on trunks and branches of living trees, causing necrosis and trunk rot. Furthermore, it is recommended that regular phytopathological monitoring of orchards should be carried out, taking the group of xylotrophic fungi into account.

**Key Words**

Agriculture, European Russia, fruit trees, fungal distribution, orchard, phytopathogens, wood-decaying fungi.
Резюме
Цель. Обобщить и проанализировать сведения о видовом составе и субстратной приуроченности деревообитающих базидиальных макромицетов, развивающихся на древесине плодовых деревьев в условиях Центрального Черноземья России

Материал и методы. В ходе работы критически изучены литературные источники и коллекционные фонды LE, OHHI, VU. Проведены собственные полевые исследования в 2019-2020 гг., микроскопическая идентификация образцов, а также выделение базидиальных грибов в чистую культуру.

Результаты. Обобщены сведения о 97 видах базидиальных макромицетов из 68 родов, встречающихся на территории Центрального Черноземья на древесине яблони, груши и косточковых культур (Prunus spp.). Впервые для России зарегистрированы виды Antrodia serpens и Ceriporia torpida. В коллекцию базидиомицетов БИН РАН (LE-BIN) введено 65 новых дикариотических штаммов для 22 видов агарикомицетов. В общей сложности 65 видов грибов связаны с древесиной Malus, 34 вида – с древесиной Pyrus и 29 видов – с древесиной Prunus. Пять видов макромицетов (Lyomyces crustosus, Stereum hirsutum, Trametes hirsuta, T. ochracea и T. versicolor) растут на всех трех родах плодовых деревьев. К видам, специализирующимся на фруктовых деревьях, относятся Sarcodontia crocea и Phellinus pomaceus.

Заключение. Патогенная активность достоверно отмечена для 32 видов базидиомицетов, обнаруженных на стволах и ветвях живых деревьев, вызывающих некроз и стволовую гниль. В дальнейшем необходимо проводить регулярный фитопатологический мониторинг садовых насаждений с учетом группы ксилотрофных грибов.

Ключевые слова
Сельское хозяйство, Европейская Россия, плодовые деревья, распространение грибов, фруктовые сады, фитопатогены, дереворазрушающие грибы.
INTRODUCTION

Wood-decaying basidial fungi are crucial components in forest ecosystems. These organisms also play an important role in agricultural lands, as they induce necrosis and rotten plant diseases that lead to weakening, withering, suppression of flowering or death of trees. As a result, there is a decrease in yields, which has a negative impact on orchard productivity and in extreme cases may require the re-establishment of fruit plantations. Orchards, as monoculture stands, are particularly threatened by fungal phytopathogens: this situation is currently intensified by increasing global plant trade and the effects of climate change [1].

Russian phytopathological studies on agricultural plants generally focus on diseases caused by micromycetes [2; 3], while among polypores which cause trunk rot only common or particularly dangerous species are mentioned [4-6]. A similar situation also exists in the foreign literature where there are many investigations related to microfungi – endophytes and phytopathogens, for instance, [7-9]. At the same time, only a few publications are known which study the species diversity of Agaricomycetes associated with the wood of fruit trees [10-12]. The species of basidiomycete macrofungi that develop on fruit trees are often listed in more general studies [13; 14].

The total number of basidial fungi species growing on the wood of fruit trees can be estimated as approximately 200. In particular, the monograph “Poroid fungi of Europe” [15] contains data on findings of 110 species on Malus, Pyrus and Prunus wood. On the scale of the former USSR, the most comprehensive list of fungi on fruit cultures (78 species of higher basidiomycetes) can be obtained from the monograph of I. S. Popushoy [4]. Special studies of corticioid fungi on the wood of fruit trees in Belarus were undertaken by E. O. Yurchenko, who identified 58 species developing on Malus [16; 17].

In Russia, targeted researches to reveal the species diversity of macrofungi on fruit trees were undertaken in Krasnodar Territory [18; 19], Belgorod [20], Ryazan [21], Orenburg Regions [22]. However, similar investigations have not been done for most regions of European Russia.

The Central Black Earth Region (CBER), also known as the Central Chernozem Region or Chernozemie (the literal meaning of chernozem is a black-coloured soil containing a high percentage of humus) is one of the most important Russian agricultural regions. Belgorod, Kursk, Lipetsk, Oryol, Tambov, and Voronezh Regions are considered to be sectors of the CBER. Orchard agroecosystems are widely represented here, including both large horticultural plantations and numerous private homestead plots of seed and stone fruit trees and shrubs.

In the 1990s, large areas of orchards lost proper horticultural and phyto sanitary care, which led to a significant deterioration of fruit trees and the spread of a special group of phytopathogenic fungi – wood-decaying, Agaricomycetes. The focus of phytopathologists is often omitted in the study of wood-destroying fungi which also cause pathogenesis in fruit trees. The development of xylotrophic fungi is a definitely more prolonged process, resulting in chronic trunk rots

[23], mainly associated with the pathogenic activity of certain species of aphyllorphid fungi.

At the same time, there are no detailed summaries for the CBER regions on xylotrophic species of basidial macrofungi on fruit trees, including the principal ones – Malus domestica Borkh., Pyrus communis L., Prunus cerasus L. and P. domestica L.

Special investigations of poroid fungi, including polypores in orchards, were carried out in the CBER at the beginning of the 20th century [24], which laid the basis for monitoring this group of phytopathogens. In subsequent years, data on the distribution of fungal pathogens in trunk and root rot of fruit trees have been extremely scattered in the literature, mainly as a result of studies of fungal species diversity in certain regions in different types of habitat [25-27].

The aim of this study was to summarise the available data and results of our own field research on basidiomorph fungi on fruit trees in the CBER, to determine the species diversity and to reveal the key features of their distribution and ecology.

MATERIAL AND METHODS

This study focuses on members of the subdivision of Agaricomycata (Basidiomycota), mainly polyporoid and corticioid fungi, as well as some of the agaricoid species that develop their basidiocarps on wood of seed and stone fruit trees.

Among these plant hosts, we consider the most widely distributed representatives – apple tree (Malus domestica, as well as M. baccata (L.) Borkh., M. prae cox (Pall.) Borkh., M. × prunifolia (Willd.) Borkh., M. sylvestris (L.) Mill.), pear (Pyrus communis, as well as P. pyraster (L.) Burgsd.), apricot, wild cherry, cherry plum, cherry, plum, thorn (Prunus armeniaca L., P. avium L., P. cerasifera Ehrh., P. cerasus, P. domestica and P. spinosa L.).

Analysis of available data was carried out, including scientific publications by researchers of the last century [24; 28-34], as well as modern literature [20; 25; 26; 35-46] and collections of mycological herbaria of LE (Komarov Botanical Institute of RAS, St Petersburg, Russia), OHII (Oryol State University named after I. S. Turgenev, Russia), VU (Galichya Gora Reserve, Voronezh State University, Russia).

In 2019-2020, we carried out field surveys of orchards and garden plantations of seed and stone fruit trees in the following localities: Belgorod Region (Korochansky District, vicinity of Popovka village; Shebekinsky District, vicinity of Titovka village), Kursk Region (Fatezhsky District, vicinity of Rzhava village; Zolotukhinsky District, vicinity of Oklino village), Lipetsk Region (Krasninsky District, vicinity of Znamenka village), Oryol Region (Glazunovsky District, vicinity of Lovchikovo village; Mtsensky District, vicinity of Volya village; Orlovsky District, vicinity of Zhilina village).

Ex situ isolation of basidial fungi was carried out by traditional methods of solid-phase culturing: by seeding of basidiospores or by placing small fragments of basidiocarps on an agarized AW media (4% ale-wort “Severnaya Pivovarnya”, pH 5.8 and 2% w/v agar Difco), with the addition of kanamycin water solution (final concentration in the medium – 0.5 mg/ml) in order to prevent...
bacterial contamination. Dikaryotic strains were deposited in the Komarov Botanical Institute Basidiomycetes Culture Collection (LE-BIN, St. Petersburg, Russia) [47] and are stored using the subculture method, the disk method (in distilled water at 4°C) and the cryopreservation method at −80°C [48]. Identification of fungi, as well as macro- and micromorphological features of isolates were characterized by cultural and morphological parameters using common method and terminology [49]. Notes were made for every species on AW media: the color, general aspect, growth rate and growth mode of the hyphae, the presence/absence of asexual reproduction structures, particular smell. The growth of strains was characterized by the radius of the colony (mm) by 7, 14, 21 and 28 days, estimating the growth rate by the rate of cup overgrowth: fast growth (F) – 1 week, medium (M) – 2-3 weeks and slow (S) – 4 weeks or more. Microscopic plates were analyzed with an Axio Imager A1 (Carl Zeiss, Germany) microscope.

RESULTS

An annotated list of basidial macrofungi species that develop on the wood of fruit trees in the CBER is presented below. The collection and identification of specimens was carried out by the authors, unless otherwise stated. Classification of taxa of above a genus level has been adopted in accordance with the current system of Basidiomycota [50].

AGARICOMICETES

AGARICALES

Crepidotaceae

Crepidotus calolepis (Fr.) P. Karst.

DISTRIBUTION: Lipetsk Region, Krasninsky District, Znamenka, Malus domestica, 12.08.2020, LE 305025, voucher for the strain LE-BIN 4430, OHHI 1401.

ECOLOGY: the species is a saprotroph on deciduous wood causing a white rot, and it is extremely rare that the species can be found on living trees. We collected the specimens of C. calolepis on fallen branches and on a living trunk of Malus domestica. In the CBER there known findings of this species on Acer spp. and Populus tremula.

Cyphellaceae

Chondrostereum purpureum (Pers.) Pouzar

DISTRIBUTION: Oryol Region, Orlovsky District, Dobryi, Malus domestica, 05.05.2019, coll. T.A. Tsutsupa, LE 314794. Tambov Region, Tambovsky District, Krasnosovobodnoye, Prunus domestica, 28.07.1928, coll. V.N. Bondartseva-Monteverde, det. A.S. Bondartsev, LE 36853. Voronezh Region, Gribanovsky District, Tellermanovskoye Experimental Forestry, P. domestica, 13.08.1912 [30]. The species is common and widely distributed in the CBER.

ECOLOGY: Ch. purpureum is a pathogen of deciduous trees, continuing to grow as a saprotroph after the death of the host. It rarely grows on coniferous wood. The species infects living trees damaged by frost and develops a characteristic change in the leaf epidermis called «silver leaf» [3; 51]. It was recorded on living branches and trees of Malus domestica and Prunus domestica. In the CBER this species also occurs on Acer negundo, Alnus glutinosa, Betula pendula, Populus tremula, Quercus robur, Salix sp. and Tilia cordata.

Cystostereaceae

Crustomyces expallens (Bres.) Hjortstam

DISTRIBUTION: Belgorod Region, Gubkinsky District, Belogorye Nature Reserve, Yamskaya Steppe area, Malus sp., 06.11.2015, LE 311616, LE 311624, Pyrus sp., 06.11.2015, OHHI 1326 [41].

ECOLOGY: the species is a saprotroph on deciduous wood or occasionally grows as a pathogen. According to our data, C. expallens occurs on dry and fallen branches of Malus sp., as well as on fallen branches of Pyrus sp. In the CBER this species also occurs on Salix sp. in Oryol Region.

Fistulinaceae

Fistulina hepatica (Schaeff.) With.

DISTRIBUTION: Belgorod Region, Gubkinsky District, Belogorye Nature Reserve, Yamskaya Steppe area. Kursk Region, Gorshechensky District, Tsentralno-Chernozymny Nature Reserve, Barkalovka area; Kursky District, Tsentralno-Chernozymny Nature Reserve, Streletska area; Manturovsky District, Tsentralno-Chernozymny Nature Reserve, Bukreyevy Barmy area; Medvensky District, Tsentralno-Chernozymny Nature Reserve, Kazatsky area [33]. The species is quite common and widely distributed in the CBER.

ECOLOGY: this species is a pathogen almost exclusively growing on Quercus robur. It causes a brown rot. In the CBER it also very rarely found on Betula pendula, Frangula alnus. According to Ryabova and Ignatenko [33] F. hepatica was recorded on dry stumps and trunks of Malus sp. and Pyrus sp.

Hymenogastraceae

Flammula alnicola (Fr.) P. Kumm.

DISTRIBUTION: Oryol Region, Mtsensky District, Volya, Malus domestica, 22.08.2019, det. L.B. Kalinina, LE 314780, voucher for the strain LE-BIN 4362 [46].

STRAINS: LE-BIN 4362 (ex basidiocarp), M. domestica. The aerial mycelium is yellow, becoming yellow-green in colour with age. Reverse bleached. Growing colony edge is pressed. Mycelial mat has zonal development. The colony has floccose texture: small hyphal tufts, standing out from the agar. Without any special odor. Growth rate – M. The hyphal system is monomitic. The mycelium has thin-walled hyphae 1.5-2.5 μm in diameter. Branched generative hyphae, differentiated with septate and rare clamp connections, 3.5-4.8 μm in diameter. Arthroconidia sometimes were observed at the ends of the hyphae. Crystals were observed in pure culture.

ECOLOGY: F. alnicola was recorded on a dead crumbling stump of Malus domestica.

Lycoperdaceae

Apioperdon pyriforme (Schaeff.) Vizzini (=Lycoperdon pyriforme Schaeff.)

DISTRIBUTION: Belgorod Region, Gubkinsky District, Belogorye Nature Reserve, Yamskaya Steppe area. Kursk Region, Gorshechensky District, Tsentralno-Chernozymny Nature Reserve, Barkalovka area; Kursky District, Tsentralno-Chernozymny Nature Reserve, Streletska area; Manturovsky District, Tsentralno-Chernozymny Nature Reserve, Bukreyevy Barmy area; Medvensky District, Tsentralno-Chernozymny Nature Reserve, Kazatsky area [33].
ECOLOGY: this species is a saprotroph on a wide range of deciduous wood. In particular, it was revealed on dry branches of *Malus* sp. and *Prunus* sp. [33].

**Lyophylaceae**

*Hyphizygus marmoratus* (Peck) H.E. Bigelow

**Distribution:** Oryol Region, Orlovsky District, Zhilina, *Malus domestica*, 23.08.2019, LE 314782, voucher for the strain LE-BIN 4379 [46].

**Species:** *Malus domestica*.

**Ecology:** This species is a saprotroph on wood or occasionally grows as a pathogen. According to our data, *S. commune* occurs on dead dry standing and fallen trunks of *Malus domestica* and *Prunus domestica*. In the CBER this species also occurs on *Betula pendula*, *Cornus avellana*, *Fraxinus excelsior*, *Populus tremula*, *Prunus padus*, *Quercus robur*, *Salix sp.*, *Tilia cordata*, *Ulmus sp.*, as well as on *Pinus sylvestris*.

**Psathyrellaceae**

*Coprinopsis atramentaria* (Bull.) Redhead, Vilgays & Moncalvo (≡*Coprinus atramentarius* (Bull.) Fr.)

**Distribution:** Kursk Region, Lgovsky District, Lgov, *Malus domestica*, 23.10.1998, LE 209320 [35].

**Ecology:** This species was recorded at the base of a trunk of *Malus domestica*.

**Psathyrella spadicea** (P. Kumm.) Singer

**Distribution:** Lipetsk Region, Zadonsky District, Galichya Gora Nature Reserve, Morozova Gora area, *Malus* sp., 19.10.2006, coll. and det. L.A. Sarycheva, VU 4081 [25, 42].

**Ecology:** This species was recorded at the base of a trunk of *Malus* sp.

**Atheliales**

**Atheliaceae**

*Athelia alnicola* (Bourdou & Galzin) Jülich

**Distribution:** Belgorod Region, Gubkinsky District, Belogorye Nature Reserve, Yamskaya Steppe area, *Prunus spinosa*, 06.11.2015, LE 314718 [41].

**Ecology:** This species is a saprotroph on deciduous and coniferous wood and debris. It was recorded on fallen trunks of *Prunus spinosa*.

*Athelia arachnoidea* (Berk.) Jülich

**Distribution:** Belgorod Region, Gubkinsky District, Belogorye Nature Reserve, Yamskaya Steppe area, *Prunus spinosa*, 06.11.2015, LE 314717 [41].

**Ecology:** This species is a lichenicolous fungus, growing on the bark of a wide range of deciduous trees over the films of epiphytic algae and talli of different lichens. It was recorded on a fallen trunk of *Prunus spinosa*. In the CBER *A. arachnoidea* is also known only in Lipetsk Region on lichens on *Acer negundo*, *Acer platanoides* and *Quercus robur* [44].

**Boletales**

**Coniophoraceae**

*Coniophora puteana* (Schumach.) P. Karst. – Fig. 1, D.

**Distribution:** Oryol Region, Kolpynskyan District, Aleksandrovka, *Prus* sp., 05.10.2012, LE 292096 [37]: Orlovsky District, Zhilina, *Pyrus communis*, 23.08.2019, LE 305018.

**Ecology:** *C. puteana* is a saprotroph on coniferous and deciduous wood, causing brown rot. Often grows as a house-rot fungus, causing damage in buildings. Occasionally it grows as a pathogen. It was recorded on dry standing *Pyrus* sp. and on a fallen trunk of *Pyrus* com-
In the CBER the species is a common and occurs on *Acer platanoides*, *Alnus glutinosa*, *Betula pendula*, *Corylus avellana*, *Populus tremula*, *Quercus robur*, as well as on *Picea abies*, *Pinus sylvestris* and dead basidiocarps of *Fomes fomentarius*.

**Figure 1.** Basidiocarps of macrofungi associated with fruit trees: A – *Antrodia serpens*, B – *Aurantiporus fissilis*, C – *Ceriporia torpida*, D – *Coniophora puteana*, E – *Irpex lacteus*, F – *Oxyporus corticola*, G – *Phellinus alni*, H – *Ph. pomaceus*, I – *Sarcodontia crocea*.

**CANTHARELLALES**

**Hydnaceae**

*Sistotrema brinkmannii* (Bres.) J. Erikss.

**Distribution:** Belgorod Region, Korochansky District, Popovka, *Malus domestica*, 19.08.2019, LE 314115 [20].

Kursk Region, Zolotukhinsky District, Oklino, *M. domestica*, 15.08.2020, LE 305049. The species is abundant and widely distributed in the CBER.

**Ecology:** the species is a saprotroph on deciduous and coniferous wood. It was recorded on dry branches of *Malus domestica*. In the CBER it also occurs on *Acer platanoides*, *Alnus glutinosa*, *Betula pendula*, *Corylus avellana*, *Populus tremula*, *Quercus robur*, as well as on dead basidiocarps of *Datronia mollis* and *Fomes fomentarius*.

*Sistotrema oblongisporum* M.P. Christ. & Hauerslev

**Distribution:** Belgorod Region, Gubkinsky District, Belogorye Nature Reserve, Yamskaya Steppe area, *Prunus spinosa*, 06.11.2015, det. I.V. Zmitrovich, LE 314948 [41].
ECOLOGY: the species is a saprotroph on deciduous (rarely coniferous) wood. It was recorded on a fallen branch of *Malus* sp. in the CBER. It also occurs on *Betula pendula*, *Populus tremula* and *Prunus padus*.

**Gloeophyllales**
Gloeophyllaceae

*Gloeophyllum trabeum* (Pers.) Murrill

**DISTRIBUTION:** Belgorod Region, Korochansky District, Popovka, *Pyrus communis*, 19.08.2019, LE 314114, voucher for the strain LE-BIN 4339 [20].

**STRAINS:** LE-BIN 4339 (ex basidiocarp), *P. communis*.

– Colour of mycelium is white becoming ochre with age. Reverse does not change. Growing colony edge is raised. Mycelial mat is thick, felted, aerial mycelium woolly. It has no special odour. Growth rate — *M.* Hyphal system dimitic. Marginal hyphae 2.0–4.5 µm wide. Skeletal hyphae d 1.5–3.0 (6.0) µm.

**ECOLOGY:** *G. trabeum* is a saprotroph on a wide range of deciduous and coniferous wood. It is an important cause of damage in buildings. It causes a brown rot. It was recorded on a fallen trunk of *Pyrus communis*. In the CBER the species commonly grows on timber wood and *Pinus silvestris*. The species is a saprotroph on deciduous wood or occasionally grows as a pathogen. It causes a white rot. It was recorded on living trees of *Prunus domestica*.

**Inonotus hispidus** (Bull.) P. Karst.

**DISTRIBUTION:** Belgorod Region, Gubkinsky District, Belogorye Nature Reserve, Yamskaya Steppe area, *Malus* sp., 06.11.2015, LE 311630 [41]; Korochansky District, Popovka, *Malus domestica*, 19.08.2019, LE 314118, voucher for the strain LE-BIN 4345 [20].

**STRAINS:** LE-BIN 4345 (ex basidiocarp), *M. domestica*.

– Colour of mycelium is ochre becoming yellowish-brown with age. Reverse darkened. Growing colony edge is raised and thick and dense. Mycelial mat is dense, tall, unclear-zoned, has a felty texture: cottony mycelium becomes matted. It has no special odour. Growth rate — *F.* Hyphal system monomitic. Marginal hyphae d 3.0–6.0 µm wide, often thick-walled. Much-branched short lateral hyphae absent. Pigmented hyphae were sometimes observed in the tested strain. Crystals were observed in pure cultures.

**ECOLOGY:** *I. hispidus* is a pathogen on deciduous trees, attacking sapwood. It causes a white rot. According to our data this species occurs on living *Malus domestica*.

**Phellinus alni** (Bondartsev) Parmasto – Fig. 1, G

**DISTRIBUTION:** Belgorod Region, Korochansky District, Popovka, *Malus domestica*, 19.08.2019, LE 314117, voucher for the strain LE-BIN 4344 [20, as *Ph. pomaceus*].

**Kursk Region,** Fatezhsky District, Igino, *M. domestica*, 27.05.1906 [29, as *Fomes fulvus* (Scop.) Gillet]; Kursk, *M. domestica*, 01.06.1906 [28, as *Fomes igniarius* (L.) Fr.]; Zolotukhinsky District, Oklino, *M. domestica*, 15.08.2020, LE 314805, voucher for the strain LE-BIN 4412.

**ORYL REGION**, Mitsensky District, Spasskoye-Lutuvinovo, *M. domestica*, 01.05.2008, OHHI 106 [36, as *Ph. tuberculosus*], Volya, *M. domestica*, 14.08.2019, LE 314796; Orlovsky District, Zhilina, *M. domestica*, 23.08.2019, LE 314795, voucher for the strain LE-BIN 4380. **Voronezh Region,** Rylsky District, Semenovskoye, *M. domestica*, 05.06.1915, coll. L.A. Lebedeva, det. A.S. Bondartsev as *Ph. pomaceus*, LE 30168.

**STRAINS:** LE-BIN 4344 (ex basidiocarp), *M. domestica*, LE-BIN 4380 (ex basidiocarp), *M. domestica*, LE-BIN 4412 (ex basidiocarp), *M. domestica*. – The central part of the colonies is coloured yellowish-brown; colony growth area remains white. Reverse dark brown but area under the centre of a colony’s growth remains white. Growing colony edge is raised and is thick and dense, fringed, consisting of randomly growing hyphae. Outline colonies are wavy. Mycelial mat dense, tall, clear-zone, ragged, uneven, woolly, has a cotton-like texture. The colony has a crustose texture with age: hyphae forming a solid, hard dark brown crust. It has no special odour. Growth rate — *S.* Hyphal system monomitic. Aerial hyphae d 1.5–2.9 µm. Submerged hyphae up d 3.5 to 4.5 µm, sometimes with swellings.

**ECOLOGY:** *P. alni* is a pathogen on deciduous trees. It causes a white rot. According to our data, this species
Phellinus pomaceus (Pers.) Maire (=Ph. tuberculatus Niemelä) – Fig. 1, H.

**Distribution:** Belgorod Region, Borisovsky District, Belogorye Nature Reserve, Les na Vorskla area, *Prunus cerasus, P. domestica*, 31.07.1993, *P. insititia, P. spinosa*, 08.08.1939 [31, as *Polyoporus fulvus* (Scop.) Fr.;] Gubkinsky District, Belogorye Nature Reserve, Yamskaya Steppe area, *P. spinosa*, 06.11.2015, LE 311635 [41], Gubkinsky District, Belogorye Nature Reserve, Yamskaya Steppe area, *P. spinosa*, 06.11.2015, LE 311635 [41].

**Strains:** LE-BIN 4340 (ex basidiocarp), *P. cerasus*, LE-BIN 4372 (ex basidiocarp), *P. avium*, LE-BIN 4373 (ex basidiocarp), *P. domestica*, LE-BIN 4374 (ex basidiocarp), *P. domestica*, LE-BIN 4375 (ex basidiocarp), *P. domestica*, LE-BIN 4376 (ex basidiocarp), *P. domestica*, LE-BIN 4409 (ex basidiocarp), *P. domestica*, LE-BIN 4410 (ex basidiocarp), *P. domestica*.

The central part of the colonies is coloured yellowish-brown, colony growth area remains white. Reverse unchanged (in some strains reverse dark brown under the centre of the colonies). Growing edges of colonies range from flat, thin and transparent to raised, thick and dense, fringed, consisting of feathery hyphae. Mycelial mat dense, tall, unclear-zone, ragged, uneven, woolly, has a cotton-like or woolly texture. It has no special odour. Growth rate – M. Hypshal system monomitic. The mycelium consists of straight, smooth, sometimes tortuous, hyphae 2.6-6.1 μm in diameter with widely spaced septa, and thin hyphae d (1.2) 2.2-4.0 μm wide, straight and curved, occasionally anastomosing. Some hyphae are thickened with pigmented pale yellow to ochre rusty walls.

**Ecology:** *Ph. pomaceus* is a common pathogen of *Prunus* trees, causing a white rot. According to our data this species occurs on living and dry standing *Prunus armeniaca, P. cerasifera, P. cerasus, P. domestica, P. insititia* and *P. spinosa* mostly at the base of branches. In CBER the species also occurs on *Prunus padus* [34].

Also, this species occurs on living trees of *Malus domestica*. According to Tomšovský et al. [52] these findings should be attributed to *Ph. alni*. Our investigations (this study, see above) confirm this idea.

**Oxyporaceae**

*Oxyporus corticalis* (Fr.) Ryvarden – Fig. 1, F.

**Distribution:** Oryol Region, Mtsensky District, Volya, *Malus domestica*, 22.08.2019, LE 314806, voucher for the strain LE-BIN 4360.

**Strains:** LE-BIN 4360 (ex basidiospores), *M. domestica*.

The aerial mycelium is white becoming cream coloured with age. Reverse unchanged. Growing colony edge is raised to appressed, hyphalae distant. The colony has a cottony texture: rather long, single mycelial hyphae spreading in all directions. It has no special odour. Growth rate – M. Hypshal system monomitic. The mycelium consists of well branching hyphae d 1.5-5.0 with frequent partitions. Hyphal swellings and anastomosis were observed for the tested strain.

**Ecology:** *O. corticalis* is a saprotroph on decidual wood or occasionally grows as a pathogen. It causes a white rot. It was recorded on living *Malus domestica*. In the CBER the species also occurs on *Acer negundo, A. platanoideas, Alnus glutinosa, Betula pendula, Populus tremula, Prunus padus, Quercus robur, Salix fragilis* and *Sorbus aucuparia*, as well as on *Picea abies* and dead basidiocarps of *Phellinus tremulae*.

*Oxyporus obductens* (Pers.) Donk

**Distribution:** Oryol Region, Mtsensky District, Spasskoye-Lutvinovo, *Malus domestica*, 29.09.2010, LE 284580 [36].

**Ecology:** *O. obductens* is a saprotroph on deciduous wood or occasionally grows as a pathogen. It causes a white rot. It was found on living *Malus domestica*. In the CBER the species is also registered on *Acer platanoides, Frangula alnus, Populus tremula, Quercus robur, Salix sp.* and *Sambucus racemosa*.

*Oxyporus populinus* (Schumach.) Donk

**Distribution:** Lipetsk Region, Krasinsky District, Znamenka, *Malus domestica*, 12.08.2020, LE 305037. Oryol Region, Glazunovskoy District, Lovchikovo, *M. domestica*, 21.08.2019, LE 314807, voucher for the strain LE-BIN 4352; Mtsensky District, Volya, *M. domestica*, 22.08.2019, LE 314816; Oryol Region, Zhilina, *M. domestica*, 15.08.2019. The species is one of the most common and widely distributed in CBER.
**Peniophorea praetermissa** (P. Karst.) H. Larss.

**Distribution**: Lipetsk Region, Krasninsky District, Znamenka, *Malus domestica*, 12.08.2020, LE 314808. Oryol Region, Dolzhansky District, Malinovka, *Malus sp.*, 04.10.2012, LE 292046 [37]; Glazunovsky District, Lovchikovo, *M. domestica*, 21.08.2019, LE 305040. The species is common in the CBER.

**Ecology**: The species is a saprotroph on deciduous and coniferous wood. It occurs on dry branches of *Malus domestica*. In the CBER the species also occurred on *Betula pendula*, *Corylus avellana*, *Fraxinus excelsior*, *Populus nigra*, *P. tremula*, *Prunus padus*, *Quercus robur*, *Salix sp.*, *Sorbus aucuparia* and *Ulmus sp.*

**Peniophorea pubera** (Fr.) P. Karst.

**Distribution**: Belgorod Region, Gubkinsky District, Belogorye Nature Reserve, Yamskaya Steppe area, *Prunus spinosa*, 06.11.2015, LE 311619 [41]. Oryol Region, Glazunovsky District, Lovchikovo, *Malus domestica*, 21.08.2019, LE 305041. The species is common in the CBER.

**Ecology**: *P. pubera* is a saprotroph on deciduous, less often on coniferous wood. It was found on a fallen trunk of *Prunus spinosa* and on a dry dead standing tree of *Malus domestica*. In CBER the species also occurs on *Acer platanoides*, *Alnus glutinosa*, *Betula pendula*, *Corylus avellana*, *Populus tremula*, *Quercus robur*, *Salix sp.* and *Tilia cordata*, as well as on *Larix decidua* and *Pinus sylvestris*.

**Schizoporaceae**

**Basidiорadulum rudalum** (Fr.) Nobles

**Distribution**: Oryol Region, Znamensky District, Orlovskskoe Polese National Park, Yelonyka, *Malus sp.*, 17.10.2012, LE 298482 [38].

**Ecology**: *B. rudalum* is a saprotroph on decaying wood, less often on coniferous wood or occasionally grows as a pathogen. Usually it grows on erect and hanging branches and young trunks. In CBER the species was recorded only on dry standing *Malus sp.*

**Lyomyces crustosus** (Pers.) P. Karst.

**Distribution**: Belgorod Region, Gubkinsky District, Belogorye Nature Reserve, Yamskaya Steppe area, *Malus sp.*, *Pyrus sp.*, *Prunus spinosa*, 06.15.2015, LE 311657, OHHI 1325 [41]. Oryol Region, Kolpynsky District, Aleksandrovka, *Pyrus sp.*, 05.10.2012, OHHI 727 [37]; Mtsensky District, Volya, *Malus domestica*, 22.08.2019, LE 305036; Orlovsky District, Zhilina, *Pyrus communis*, 15.08.2019, LE 305035; Oryol, regional natural monument, Balka Neprets, *Malus sp.*, 16.08.2012, LE 298999 [26]. The species is common and widely distributed in the CBER.

**Ecology**: *L. crustosus* is a saprotroph on deciduous wood or occasionally grows as a pathogen. It rarely develops on coniferous wood. According to our data the species occurs on fallen branches and trunks of *Malus domestica*, on dry branches in living trees and dry standing trees of *Pyrus communis* and on fallen branches and trunks of *Prunus spinosa*. Usually it grows on dead dry branches still hanging or fallen to the ground. In CBER this species occurs on wide range of hosts, such as *Acer negundo*, *A. platanoides*, *Alnus glutinosa*, *Betula pendula*, *Caragana arborescens*, *Corylus avellana*, *Crataegus sp.*, *Euonymus verrucosus*, *Fraxinus excelsior*, *Populus tremula*, *Prunus padus*, *Quercus robur*, *Salix sp.*, *Tilia cordata* and *Ulms sp.*, as well as on *Larix decidua* and *Pinus sylvestris*.

**Lyomyces erasti** (Saaren. & Kotir.) Hjortstam & Ryvarden

**Distribution**: Oryol Region, Mtsensky District, Volya, *Malus domestica*, 14.08.2019, LE 305034.

**Ecology**: The species is a saprotroph on deciduous and coniferous wood. It was recorded on dry branches of *Malus domestica*. In CBER it also revealed on *Acer negundo*, *Alnus glutinosa*, *Betula pendula*, *Fraxinus excelsior*, *Populus tremula*, *Ulms sp.*

**Trichaptum biforme** (Peck) Hjortstam & Ryvarden

**Distribution**: Lipetsk Region, Krasninsky District, Znamenka, *Malus domestica*, 12.08.2020, LE 314809, voucher for the strain LE-BIN 4405.

**Strains**: LE-BIN 4405 (ex basidiocarp), *M. domestica*. – The aerial mycelium is white. Reverse unchanged. Growing colony is from raised to appressed, hyphae distant. The colony has a cottony texture: rather long, single hyphae spreading in all directions. It has no special odour. Growth rate – M. The mycelium consists of straight, smooth, rarely branching hyphae – d 1.5-4.5 μm, often arranged with partitions, with thickened walls.

**Ecology**: The species is a saprotroph on deciduous wood or occasionally grows as a pathogen. It rarely develops on coniferous wood. According to our data the species occurs on fallen branches and trunks of *Malus domestica*, on dry branches in living trees and dry standing trees of *Pyrus communis* and on fallen branches and trunks of *Prunus spinosa*. Usually it grows on dead dry branches still hanging or fallen to the ground. In CBER this species occurs on wide range of hosts, such as *Acer negundo*, *A. platanoides*, *Alnus glutinosa*, *Betula pendula*, *Caragana arborescens*, *Corylus avellana*, *Crataegus sp.*, *Euonymus verrucosus*, *Fraxinus excelsior*, *Populus tremula*, *Prunus padus*, *Quercus robur*, *Salix sp.*, *Tilia cordata* and *Ulms sp.*, as well as on *Larix decidua* and *Pinus sylvestris*.
**Polyporales**

*Postia balsamea* (Peck) Jülich

**DISTRIBUTION:** Lipetsk Region, Yeletsky District, Galichya Gora Nature Reserve, Volgorskoye area, Pyrus sp., 01.10.2016, LE 313918 [44].

**ECOLOGY:** *P. balsamea* is a saprotroph on coniferous or more rarely on deciduous wood. It causes a brown rot. It was found on a fallen log of Pyrus sp. In the CBER this species is also recorded only on *Quercus rubra* in Oryol Region [37].

*Postia lactea* (Fr.) P. Karst.

**DISTRIBUTION:** Lipetsk Region, Krasninsky District, Znamenka, *Malus domestica*, 12.08.2020, LE 314815. Oryol Region, Mtsensky District, Volya, *M. domestica*, 22.08.2019, LE 314810, voucher for the strain LE-BIN 4394, LE 305044.

**STRAINS:** LE-BIN 4394 (ex basidiospores), *M. domestica.* – The aerial mycelium is cream. Reverse unchanged. Growing colony edge is pressed. Outline colonies fringed. Mycelial mat has an approximately zonal development. The colony is a mealy, powdery aspect. It has no special odour. Growth rate – M. The hyphal system is trimitic. The aerial mycelium has branched generative hyphae (d (1.5) 2.0-3.0 (4.0) μm) with septa and clamp connections (3.5) 5.0-5.8 (6.5) μm in diameter and thick-walled skeletal and binding hyphae (d 2.5-3.5 (4.5) μm), while the submerged mycelium consists of hyaline and branched hyphae (d (1.2) 1.5-2.5 (3.0) μm).

**ECOLOGY:** *P. lactea* is a saprotroph on deciduous and coniferous wood or occasionally grows as a pathogen. It causes a brown rot. We recorded it on living trees of *Prunus avium* and *P. domestica*, as well as on a fallen trunk of *Malus domestica*. In the CBER this species is also recorded on *Alnus glutinosa*, *Betula pendula*, *Corylus avellana*, *Craxinus excelsior*, *Populus tremula*, *Prunus padus*, *Quercus rubra*, *Salix sp.*, *Sorbus aucuparia* and *Ulms* sp., as well as on *Picea abies* and *Pinus sylvestris*.

*Postia subcaesia* (A. David) Jülich

**DISTRIBUTION:** Kursk Region, Kursky District, Tsentralno-Chernozemny Nature Reserve, Streletsy area, *Pyrus communis*, 12.09.1999 [34].

**ECOLOGY:** *P. subcaesia* is a saprotroph on deciduous wood. It causes a brown rot. It was found on *Pyrus communis*. In the CBER this species also occurs on *Acer negundo*, *A. platanoides*, *Alnus glutinosa*, *Corylus avellana*, *Craxinus excelsior*, *Populus tremula*, *Prunus padus*, *Quercus rubra* and *Salix* sp.

*Fomitopsidaceae*

*Antrodia serpens* (Fr.) P. Karst. – Fig. 1, A.

**DISTRIBUTION:** Oryol Region, Mtsensky District, Volya, *Malus domestica*, 22.08.2019, LE 314811, voucher for the strain LE-BIN 4364.

**STRAINS:** LE-BIN 4364 (ex basidiospores), *M. domestica.* – The aerial mycelium is white, becoming a creamy colour with age. Reverse bleached. Growing colony edge is pressed. Outline colonies fringed. The colony has a plumes-like texture: mycelial tufts with long groups of hyphae radiating from the central axis. It has no special odour. Growth rate – M. *Hypheal* system trimitic. The aerial mycelium has branched generative hyphae (d (1.5) 1.7-2.5 (2.7) μm) with septate and rare clamp connections, 3.5-4.8 μm in diameter. Arthroconidia sometimes were observed at the ends of the hyphae.

**ECOLOGY:** *A. serpens* is a saprotroph on deciduous wood. It causes a brown rot. It was found on the dry dead branch of a living tree of *Malus domestica*.

*Fomitopsis pinicola* (Sw.) P. Karst.

**DISTRIBUTION:** Oryol Region, Mtsensky District, Volya, *Malus domestica*, 22.08.2019, LE 314812, voucher for the strain LE-BIN 4361; Orlovsky District, Dobryi, *Prunus domestica*, 05.05.2019, coll. T.A. Tsutsupa; Zhilina, *Prunus avium*, 23.08.2019, LE 314813, voucher for the strain LE-BIN 4370. The species is abundant and widely distributed in the CBER.

**STRAINS:** LE-BIN 4361 (ex basidiocarp), *M. domestica*, LE-BIN 4370 (ex basidiocarp), *P. avium.* – The aerial mycelium is white and downy. Reverse unchanged. Growing colony edge is raised. The colony has a cottony-woolly texture: rather long, single mycelial hyphae spreading in all directions. It has no special odour. Growth rate – M. The hyphal system trimitic. The aerial mycelium has branched generative hyphae (d 1.5-3.0 μm) with septa and clamp connections (3.5) 5.0-5.8 (6.5) μm in diameter and thick-walled skeletal and binding hyphae (d 2.5-3.5 (4.5) μm), while the submerged mycelium consists of hyaline and branched hyphae (d (1.2) 1.5-2.5 (3.0) μm).

**ECOLOGY:** *F. pinicola* is a saprotroph on deciduous and coniferous wood or occasionally grows as a pathogen. It causes a brown rot. We recorded it on living trees of *Prunus avium* and *P. domestica*, as well as on a fallen trunk of *Malus domestica*. In the CBER this species is also recorded on *Alnus glutinosa*, *Betula pendula*, *Corylus avellana*, *Craxinus excelsior*, *Populus tremula*, *Quercus rubra* and *Tilia cordata*, as well as *Picea abies* and *Pinus sylvestris*.

*Hyphoderma mutatum* (Peck) Donk

**DISTRIBUTION:** Lipetsk Region, Krasninsky District, Znamenka, *Malus domestica*, 12.08.2020, LE 314817, voucher for the strain LE-BIN 4401. Oryol Region, Glazunovsky District, Lovchikovo, *M. domestica*, 21.08.2019, LE 305033; Orlovsky District, Zhilina, *M. domestica*, 23.08.2019, LE 305032.

**STRAINS:** LE-BIN 4401 (ex basidiospores), *M. domestica.* – The aerial mycelium is white, becoming a creamy colour with age. Reverse bleached. Growing colony edge is pressed. Outline colonies fringed. The colony has a plumes-like texture: mycelial tufts with long groups of hyphae radiating from the central axis. It has no special odour. Growth rate – M. *Hypheal* system trimitic. The mycelium has thin-walled hyphae d 1.5-3.0 μm with rare sprouting clamps 3.5-5.5 μm in diameter. Crystals were observed in pure cultures.

**ECOLOGY:** *H. mutatum* is a saprotroph on deciduous wood. It was recorded on fallen branches and dry dead branches of a living tree of *Malus domestica* infected by *Sarcdodontia crocea*. In the CBER this species also occurs on *Acer platanoides*, *Alnus glutinosa*, *Corylus avellana*, *Populus tremula*, *Prunus padus*, *Quercus rubra*, *Salix sp.*, *Sorbus aucuparia* and *Tilia cordata*.

*Iripicaceae*

*Byssomerulius corium* (Pers.) Parmasto

**DISTRIBUTION:** Belgorod Region, Shebekinskiy District, Titovka, *Malus sylvestris*, 18.08.2019, LE 314147 [45]. Oryol Region, Orlovsky District, Luzhki, *M. domestica*, 31.05.2009, coll. N.I. Grechikhina, OHHI 445 [26]. The species is common in the CBER.

**ECOLOGY:** *B. corium* is a saprotroph on deciduous wood and occasionally grows as a pathogen. It was found on living trees of *Malus domestica* and on dry branches of

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M. domestica. In the CBER this species also occurs on Acer negundo, A. platanoideis, Alnus glutinosa, Corylus avellana, Populus tremula, Prunus padus, Quercus robur, Salix sp., Sorbus aucuparia, Tilia cordata, Ulmus glabra and U. laevis.

Candelabrrochaete septocystidia (Burt) Burds.

**DISTRIBUTION:** Oryol Region, Mtsensky District, Volva, Malus domestica, 22.08.2019, LE 305027.

**ECOLOGY:** The species is a saprotroph on deciduous wood. It was recorded on a dry standing tree of Malus domestica. In CBER it also revealed only on Quercus robur [26].

**Ceriopora purpurea** (Fr.) Donk

**DISTRIBUTION:** Belgorod Region, Gubkinsky District, Belogorye Nature Reserve, Yamskaya Steppe area, Malus sp., 06.11.2015, LE 311633 [41].

**ECOLOGY:** C. purpurea is a saprotroph on deciduous wood. It causes a white rot. We found it on a fallen branch of Malus sp. and on dry standing Pyrus communis. In the CBER this species is also recorded on Acer platanoides, Populus tremula, Quercus robur and Salix sp. in the Oryol Region.

**Cerioporia torpida** Spiri & Miettinen – Fig. 1, C.

**DISTRIBUTION:** Lipetsk Region, Krasninsky District, Znamenka, Malus domestica, 12.08.2020, LE 314819, voucher for the strain LE-BIN 4403, LE 314820, voucher for the strain LE-BIN 4407. Oryol Region, Glazunovsky District, Lovchikovo, M. domestica, 21.08.2019, LE 305028, LE 314818, voucher for the strain LE-BIN 4356.

**STRAINS:** LE-BIN 4356 (ex basidiospores), M. domestica, LE-BIN 4403 (ex basidiospores), M. domestica, LE-BIN 4407 (ex basidiospores) and M. domestica. – The aerial mycelium is white (becomes a greyish-cream colour with age). Reverse unchanged. Growing colony edge is immersed. The colony has a cottony texture: rather long, single mycelial hyphae spreading all directions. It has no special odour. Growth rate – M. Hyphal system monomitic.

**ECOLOGY:** C. torpida is a saprotroph on deciduous wood. It causes a white rot. We collected basidiocarps of this species on dry branches of living trees of Malus domestica. In the CBER this species also recorded on Populus tremula.

**Laetiporaceae**

**Laetiporus sulphureus** (Bull.) Murrill

**DISTRIBUTION:** Kursk Region, Kursk, Pyrus communis, 15.09.1906 [29], 20.09.1906, LE 26870, 01.07.1911, LE 26852, all coll. and det. A.S. Bondartsev. Oryol Region, Oryol, Malus domestica, 24.05.2020.

**ECOLOGY:** L. sulphureus is a saprotroph on deciduous wood or occasionally grows as a pathogen. Causes a brown rot. It was found on living Pyrus communis as well as on stumps of Malus domestica. In the CBER this species also occurs on Acer platanoides, Betula pendula, Fraxinus excelsior, Populus tremula, Quercus robur and Salix sp.

**Merulaceae**

**Auratiporus fissilis** (Berk. & M.A. Curtis) H. Jahn ex Ryvarden – Fig. 1, B.

**DISTRIBUTION:** Kursk Region, Kursk, Malus domestica, 05.07.1906, LE 27362, 20.07.1907, LE 27349, LE 27379 [29], as Polyporus spumeus (Sowerby Fr.) (redet. in [24]), 20.09.1927, LE 27376, 16.08.1950, coll. Shumakova, LE 27352 [24]. Oryol Region, Mtsensky District, Volva, M. domestica, 22.08.2019, LE 305026; Znamensky District, Orlovskoye Polesye National Park, Yelyonka, M. domestica, 17.07.2011, LE 298528 [38].

**ECOLOGY:** A. fissilis is a pathogen and saprotroph on deciduous wood, causing a white rot. According to our data, it occurs on living and dry standing trees of Malus domestica. In the CBER this species is usually associated with Populus tremula and it is also recorded on Fraxinus excelsior and Salix sp. M. domestica, in our opinion, is the second most preferred substrate.

**Phlebia rufa** (Pers.) M.P. Christ.

**DISTRIBUTION:** Lipetsk Region, Krasninsky District, Znamenka, Malus domestica, 12.08.2020, LE 314825. Oryol Region, Mtsensky District, Volva, M. domestica,
14.08.2019, LE 314824. The species is common in the CBER.

**ECOLOGY:** *Ph. rufa* is a saprotroph on deciduous, more rarely on coniferous wood, or occasionally grows as a pathogen. It was recorded on the living trunks and dry dead branches of *Malus domestica*. In the CBER this species also occurs on *Acer platanoides*, *Betula pendula*, *Corylus avellana*, *Fraxinus excelsior*, *Populus tremula*, *Prunus padus*, *Quercus robur*, *Salix* sp. and *Tilia cordata*, as well as on *Picea abies* and *Pinus sylvestris*.

*Phlebia tremellosa* (Schrad.) Nakasone & Burds. **DISTRIBUTION:** Oryol Region, Glazounovsky District, Lovchikovo, *Malus domestica*, 21.08.2019, LE 314826; Mtsensky District, Volya, *M. domestica*, 22.08.2019, OHII 1460.

**ECOLOGY:** *Ph. tremellosa* is a saprotroph on deciduous, less often on coniferous wood, or occasionally grows as a pathogen. We recorded it at the base of living trunks and on living trees of *Malus domestica*. In the CBER this species is also revealed in *Betula pendula*, *Juglans sp.*, *Populus tremula*, *Quercus robur*, *Salix* sp. and *Sorbus aucuparia*.

*Sarcodontia crocea* (Schwein.) Kotl. (=*Hydnium schiederi*) Heufl.; *Sarcodontia setosa* (Pers.) Donk – Fig. 1, 1.

**DISTRIBUTION:** Belgorod Region, Borisovsky District, Belogorye Nature Reserve, Les na Vorskle area, *Malus domestica*, 13-14.08.1940 [31], *Pyrus communis*, 18.08.2011, LE 302180 [39]; Korchansky District, Popovka, *M. domestica*, 19.08.2019, voucher for the strain LE-BIN 4343, LE 314119, voucher for the strain LE-BIN 4346, LE 314827, voucher for the strain LE-BIN 4342 [20; 53]. Kursk Region, Fatezhsky District, Fatezh, *M. domestica*, 15.07.1903 [28]; Kursk, *M. domestica*, 10.08.1903 [28]; Zolotukhinsky District, Okina, *M. domestica*, 15.08.2020, LE 305010, voucher for the strain LE-BIN 4411. Lipetsk Region, unspecified locality – [Tambov Governorate, Romanovskoye forestry], *M. domestica*, 10.11.1919, coll. and det. S.I. Vanin, LE 23643; Krasninsky District, Znamenka, *M. domestica*, 10.08.2020, LE 305011, voucher for the strain LE-BIN 4398, LE 305012, voucher for the strain LE-BIN 4399, LE 305013, voucher for the strain LE-BIN 4400, LE 305014, voucher for the strain LE-BIN 4402, LE 305015, voucher for the strain LE-BIN 4408, LE 305046, voucher for the strain LE-BIN 4406, LE 305047, voucher for the strain LE-BIN 4414. Oryol Region, Glazounovsky District, Lovchikovo, *M. domestica*, 10.08.2011, LE 298955 [26], 21.08.2019, LE 314828, voucher for the strain LE-BIN 4347, LE 314829, voucher for the strain LE-BIN 4348, LE 314830, voucher for the strain LE-BIN 4349, LE 314831, voucher for the strain LE-BIN 4350 [53], LE 314832, voucher for the strain LE-BIN 4351, LE 314833, voucher for the strain LE-BIN 4353, LE 314834, voucher for the strain LE-BIN 4355 [53], LE 314835, voucher for the strain LE-BIN 4357, LE 314836, voucher for the strain LE-BIN 4396; Mtsensky District, Spasskoye-Lutovinovo, *M. domestica*, 22.07.2013, LE 299010 [26], Volya, *M. domestica*, 22.08.2019, LE 305000, voucher for the strain LE-BIN 4358, LE 305001, voucher for the strain LE-BIN 4359, LE 305002, voucher for the strain LE-BIN 4363, LE 305003, voucher for the strain LE-BIN 4365 [53], LE 305004, voucher for the strain LE-BIN 4367 [53], LE 305005, voucher for the strain LE-BIN 4395; Orlovsky District, Zhilina, *M. domestica*, 23.08.2019, LE 305006, voucher for the strain LE-BIN 4378 [53], LE 305007, voucher for the strain LE-BIN 4382, LE 305008, voucher for the strain LE-BIN 4383, LE 305009, voucher for the strain LE-BIN 4393; Verkhovsky District, Turovka, *M. domestica*, 12.08.2012, LE 298790 [54]; unspecified locality – [Oryol Governorate], *M. domestica*, 17.08.1916, coll. A.S. Bondartsev, det. T.L. Nikolajeva, LE 23644. Voronezh Region, Nizhnedevitsky District, Goncharovka, *M. domestica*, 01.08.1912; Ostrogozhsky District, Sinelnikovo, *M. domestica*, 13.07.1912; Semiluksky District, Zemlyansky, *M. domestica*, 28.07.1912 [50]. The species is abundant and widely distributed in orchards in the CBER.

**STRAINS:** ex basidiospores – LE-BIN 4342, 4343, 4346, 4348, 4349, 4351, 4353, 4357, 4343, 4363, 4365, 4378, 4382, 4383, 4393, 4396, ex basidiocarps – LE-BIN 4347, 4350, 4355, 4358, 4367, 4398, 4399, 4400, 4402, 4406, 4408, 4411, 4414, all strains from *M. domestica*. – The aerial mycelium is white or creamy (with age can become from dark-grey to lemon-yellow and pink orange). Reverse unchanged (less often bleached). Growing colony edge pressed. Outline of colonies ranges from fringed (sometimes broken) to wavy and occasionally smooth. Mycelial mat most commonly has an approximately zonal (sometimes immersed) development. The colony most often has a floccose or floccose-cottony texture with small hyphal tufts, standing out from the agar (less often plumose texture). Odour is very intense; strong, sweetish-fruity. Growth rate – S (less often M). Hyphal system mononotic. The mycelium most commonly has thin-walled and branched hyphae (d – 1.5 (4.0)-2.7 (6.0) μm) sometimes forming anastomosis. Branched generative hyphae, differentiated with septate and clamp connections, 3.5 (6.5)-4.5 (9.5) μm in diameter. Occasionally there were observed chlamydospores broadly ellipsoid (width – 4.0 (5.0)-5.5 (6.6) μm, length – 10.0 (15.0)-17.0 (24.0) μm) or globose chlamydospores (10.0-16.0 μm in diameter). Detailed descriptions of some strains are presented in Shakhova and Volobuev [53].

**ECOLOGY:** *S. crocea* is the most abundant pathogen of *Malus* trees. It was found on living and dry standing trees of *Malus domestica*. We also found it once on dry standing *Pyrus communis* [39]. In the CBER this species is also recorded only on *Acer platanoides* in Oryol Region [55].

*Scopolioide srimosa* (Cooke) Jülich **DISTRIBUTION:** Oryol Region, Mtsensky District, Volva, *Malus domestica*, 22.08.2019, LE 305048.

**ECOLOGY:** the species is a saprotroph on wood of deciduous trees, rarely on coniferous wood. It was recorded on fallen branches of *Malus domestica*. In the CBER *S. rimosa* is also registered on *Acer platanoides*, *Alnus glutinosa*, *Betula pendula*, *Populus tremula*, and on dead basidioles of *Phyllopora ribis*.

**Phanerochaetaceae** Bjerkandera adusta (Willd.) P. Karst. **DISTRIBUTION:** Belgorod Region, Korchansky District, Korocha, *Pyrus sp.*, 06.08.1915, coll. L.A. Lebedeva, det. A.S. Bondartsev, LE 26208 [20]. Oryol Region, Orlovsky District, Luzhki, *Malus sp.*, 03.05.2009, coll. N.I. Grechikhina, OHII 449 [26]. The species is abundant and widely distributed in the CBER.
ECOLOGY: *B. adusta* is a saprotroph on mostly deciduous wood or occasionally grows as a pathogen. It causes a white rot. It occurs on fallen, dry standing and living trunks of *Malus* sp. and *Pyrus* sp. In the CBER this species also occurs on a wide range of deciduous hosts – on *Acer negundo*, *A. platanoides*, *Alnus glutinosa*, *Betula pendula*, *Corylus avellana*, *Fraxinus excelsior*, *Populus nigra*, *P. tremula*, *Prunus padus*, *Quercus robur*, *Salix* sp., *Tilia cordata* and *Ulmus* sp., as well as on *Pinus sylvestris* and timber wood.

*Bjerkandera fumosa* (Pers.) P. Karst.  
**Distribution:** Kursk Region, Oboyansky District, Tsentralno-Chernozemny Nature Reserve, Zorinsky area, *Pyrus communis*, 14.09.1999 [34]. *Lipetsk Region, Malus* sp., [25; 42]. The species is common in the CBER.  
**Ecology:** *B. fumosa* is a saprotroph on deciduous wood or occasionally grows as a pathogen. It causes a white rot. It was found on stumps of *Pyrus communis* on the wood of *Malus* sp. In the CBER this species is also found on *Acer negundo*, *A. platanoides*, *Betula pendula*, *Corylus avellana*, *Fraxinus excelsior*, *Populus tremula*, *Prunus padus*, *Quercus robur*, *Salix* sp., *Tilia cordata* and *Ulmus* sp.  

*Hapalopilus rutians* (Pers.) Merrill (=H. nidulans (Fr.) P. Karst.)  
**Distribution:** Belgorod Region, Gubkinsky District, Belogorye Nature Reserve, Yamskaya Steppe area. *Kursk Region*, Gorshechensky District, Tsentralno-Chernozemny Nature Reserve, Barkalovka area; Kursky District, Tsentralno-Chernozemny Nature Reserve, Streletsky area; Manuturovsky District, Tsentralno-Chernozemny Nature Reserve, Bukreyevy Barmy area Medvensky District, Tsentralno-Chernozemny Nature Reserve, Kazatsky area [33].  
**Ecology:** *H. rutians* is a saprotroph on deciduous wood, causing a white rot. It was found on trunks and stumps of *Pyrus* sp. and *Malus* sp. In the CBER the species was found on *Betula pendula*, *B. pubescens*, *Caragana arborescens*, *Corylus avellana*, *Populus tremula*, *Prunus padus*, *Quercus robur*, *Salix* sp., *Sorbus aucuparia* and *Tilia cordata*.  

*Phanerochaete calotricha* (P. Karst.) J. Erikss. & Ryvarden  
**Distribution:** Belgorod Region, Gubkinsky District, Belogorye Nature Reserve, Yamskaya Steppe area, *Prunus spinosa*, 06.11.2015, LE 311656 [41].  
**Ecology:** *Ph. calotricha* is a saprotroph on deci-
duous or coniferous wood. It was recorded on stumps of *Prunus spinosa*. In the CBER this species is also recorded on *Corylus avellana*, *Prunus padus* and *Rosaceae*.  

*Phanerochaete galactites* (Bourdot & Galzin) J. Erikss. & Ryvarden  
**Distribution:** Belgorod Region, Gubkinsky District, Belogorye Nature Reserve, Yamskaya Steppe area, *Prunus spinosa*, 06.11.2015, LE 314947 [41].  
**Ecology:** *Ph. galactites* is a saprotroph on deci-
duous or coniferous wood. It was found on a fallen trunk of *Prunus spinosa*. In the CBER this species also occurs on *Acer platanoides*, *Betula pendula*, *Prunus padus* and *Quercus robur*.  

*Phanerochaete jose-ferreirae* (D.A. Reid) D.A. Reid  
**Distribution:** Oryol Region, Verkhovsk District, Turovka, *Malus* sp., 12.08.2012, LE 298800 [54].  
**Ecology:** *Ph. jose-ferreirae* is a saprotroph on deciduous wood. It was found on dry branches of *Malus* sp. In CBER this species also occurs on *Quercus robur*, *Prunus padus* and *Salix* sp.  

*Phanerochaete livescens* (P. Karst.) Volobuev & Spiri

**Distribution:** Belgorod Region, Gubkinsky District, Belogorye Nature Reserve, Yamskaya Steppe area, *Malus* sp., 06.11.2015, LE 311628 [41].  
**Ecology:** *Ph. livescens* is a saprotroph on deci-
duous wood. It was found on fallen branches of *Malus* sp. and on dry dead standing *Malus domestica*. In the CBER this species also occurs on *Acer platanoides*, *Corylus avellana* and *Quercus robur*.  

*Phanerochaete velutina* (DC.) P. Karst.  
**Distribution:** Oryol Region, Verkhovsk District, Turovka, *Pyrus* sp., 11.08.2012, LE 298834 [54].  
**Ecology:** *Ph. velutina* is a saprotroph on deciduous and coniferous wood. It was found on the bark of living *Py-
rus* sp. In the CBER this species occurs on *Alnus glutinosa*, *Betula pendula*, *Populus tremula*, *Prunus padus*, *Quercus robur* and *Tilia cordata*, as well as on *Picea abies* and *Pinus sylvestris*.  

*Porostereum spadiceum* (Pers.) Hjirstam & Ryvarden  
**Distribution:** Lipetsk Region, Krasninsky District, Znamenka, *Malus domestica*, 12.08.2020, LE 305022.  
**Ecology:** *P. spadiceum* is a saprotroph on deciduous wood. It was recorded on dry branches of *Malus domestica*. In the CBER this species also occurs on *Acer negundo*, *Fraxinus excelsior*, *Populus tremula*, *Quercus robur* and *Tilia cordata*.  

*Polyporaceae*  
*Cerioporus leptochromeus* (Jacq.) Zmitr. (=*Polyporus varius* (Pers.) Fr.)  
**Distribution:** Belgorod Region, Borisovskiy District, Belogorye Nature Reserve, Les na Vorskle area, *Pyrus communis*, 19.08.2011 [39].  
**Ecology:** *C. leptochromeus* is a saprotroph on deci-
duous wood, causing a white rot. It was recorded on dry branches of *Pyrus communis*. In the CBER this species occurs on *Betula pendula*, *Corylus avellana*, *Populus tremula*, *Prunus padus*, *Quercus robur*, *Salix* sp. and *Tilia cordata*, as well as on *Picea abies*.  

*Cerioporus squamosus* (Huds.) Quél.  
**Distribution:** Lipetsk Region, Zadonsky District, Gali-
chya Gora Nature Reserve, Morozova Gora area, *Malus* sp., 02.08.2007, coll. and det. L.A. Sarycheva, VU 4110 [25; 42].  
**Ecology:** *C. squamosus* is a saprotroph on deciduous wood or occasionally grows as a pathogen. It causes a white rot. It was found at the base of a living *Malus* sp. trunk. In CBER this species also occurs on *Acer platanoides*, *Betula pendula*, *Fraxinus excelsior*, *Populus tremula*, *Quercus robur*, *Salix* sp., *Tilia cordata*, *Ulmus glabra* and *U. laevis*.  

*Dictyoporus campestris* (Quél.) Domarzski & Orlick  
**Distribution:** Belgorod Region, Gubkinsky District, Belogorye Nature Reserve, Yamskaya Steppe area, *Malus* sp., 06.11.2015, LE 311617 [41].  
**Ecology:** *D. campestris* is a saprotroph on deciduous wood or occasionally grows as a pathogen. It causes a white rot. It was recorded on dry branches of living *Malus* sp. and *Pyrus communis*. In the CBER this species also occurs on *Corylus avellana*, *Prunus padus* and *Quercus robur*.  

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**Fomes fomentarius** (L.) Fr.

**DISTRIBUTION:** Kursk Region, Kursk, *Prunus domestica*, 01.06.1905 [29]. The species is abundant and widely distributed in CBER.

**ECOLOGY:** *F. fomentarius* is a pathogen and saprotroph on deciduous wood or more rarely on coniferous wood. It causes a white rot. It was recorded on stumps of *Prunus domestica*. In the CBER this species occurs on *Acer platanoides*, *Alnus glutinosa*, *Betula pendula*, *Fraxinus excelsior*, *Populus tremula*, *Quercus robur*, *Robinia pseudacacia*, *Salix caprea*, *Tilia cordata* and *Ulmus sp.*, as well as *Pinus sylvestris*.

**Funalia trogii** (Berk.) Bondartsev & Singer

**DISTRIBUTION:** Oryol Region, Oryolovsky District, Dobryi, *Prunus armeniaca*, 05.05.2019, coll. T.A. Tsutsupa, LE 305051. The species is a widespread in CBER.

**ECOLOGY:** *F. trogii* is a saprotroph on deciduous wood or occasionally grows as a pathogen. It causes a white rot. The species was collected on a living tree of *Prunus armeniaca*. In the CBER it also known on *Acer negundo*, *A. platanoides*, *Alnus sp.*, *Corylus avellana*, *Fraxinus excelsior*, *Populus nigra*, *P. tremula*, *Quercus robur*, *Salix sp.*.

**Ganoderma applanatum** (Pers.) Pat.

**DISTRIBUTION:** Lipetsk Region, Yelets District, Galichya Gora Nature Reserve, Vorgolskoye area, *Malus sp.*, 29.08.2020, coll. and det. L.A. Sarycheva, VU 4953. The species is a common and widespread in CBER.

**ECOLOGY:** *G. applanatum* is a saprotroph on deciduous wood or occasionally grows as a pathogen. It was recorded on stumps of *Malus sp.* In the CBER this species occurs on *Acer platanoides*, *Alnus glutinosa*, *Betula pendula*, *Fraxinus excelsior*, *Populus sp.*, *P. tremula*, *Prunus padus*, *Quercus robur*, *Salix sp.*, *Tilia cordata*, *Ulmus sp.*, *Ulmus campestris* and *Ulmus glabra*.

**Ganoderma lucidum** (Curtis) P. Karst.

**DISTRIBUTION:** Lipetsk Region, *Malus sp.* [25].

**ECOLOGY:** *G. lucidum* is a saprotroph on coniferous and deciduous wood. It causes a white rot. It was recorded on stumps of *Malus sp.* In the CBER this species also occurs on *Alnus glutinosa*, *Quercus robur* and *Larix decidua*.

**Lentinus substrictus** (Bolton) Zmitr. & Kovalenko (= *Polyporus ciliatus* Fr.)

**DISTRIBUTION:** Kursk Region, Kursksky District, Tsentralno-Chernozyomny Nature Reserve, Streletsky area, *Prunus communis*, 26.05.2001, coll. T.N. Barsukova, LE 303253 [40].

**ECOLOGY:** *L. substrictus* is a saprotroph on deciduous or rarely on coniferous wood. Causes a white rot. It was recorded on stumps of *Malus cerasus*. In the CBER this species occurs on *Betula pendula*, *Populus tremula*, *Prunus padus*, *Quercus robur*, *Salix sp.*, *Sorbus aucuparia*, *Tilia cordata* and on timber wood.

**Polyporus tuberaster** (Jacq. ex Pers.) Fr.

**DISTRIBUTION:** Kursk Region, Oboyanovsky District, Tsentralno-Chernozyomny Nature Reserve, Zorinsky area, *Pyrus communis*, 15.09.1999 [34].

**ECOLOGY:** *P. tuberaster* is a saprotroph on deciduous wood. It causes a white rot. It was recorded on fallen branches of *Pyrus communis*. In the CBER this species also occurs on *Acer negundo*, *Corylus avellana*, *Quercus robur* and *Salix sp.*

**Trametes hirsuta** (Wulfen) Lloyd

**DISTRIBUTION:** Belgorod Region, Borisovsky District, Belogorye Nature Reserve, Les na Vorskle area, *Malus domestica*, 18.08.2011, LE 302193 [39]; Korchansky District, Popovka, *M. domestica*, 19.08.2019, LE 314116 [20].

**Kurs Region**, Kursky District, Tsentralno-Chernozyomny Nature Reserve, Streletsky area, *Pyrus communis*, 12.09.1999 [34]; Shchigrovsky District, Shchigry, *M. domestica*, 15.08.1911, LE 19155. Oryol Region, Mtsensky District, Spasskoye-Lutovinovo, *Malus sp.*, 01.05.2008, OHHI 180 [36]; Orlowsky District, Dobryi, *M. domestica*, 19.05.2019, LE 314814, Zhiлина, *Pyrus communis*, 13.08.2019, LE 305017, *Prunus armeniaca*, *P. avium*, *P. cerasus*, 15.08.2019. The species is abundant and widely distributed in CBER.

**ECOLOGY:** *T. hirsuta* is a saprotroph on deciduous or more rarely on coniferous wood or occasionally grows as a pathogen. It causes a white rot. It was revealed on living and dry standing trunks of *Malus domestica* and *Prunus avium*, on living trees of *Pyrus communis* and *Prunus armeniaca* and on dry branches of living *Prunus cerasus*. In the CBER this species also occurs on *Acer negundo*, *A. platanoides*, *Betula pendula*, *Corylus avellana*, *Fraxinus excelsior*, *Populus tremula*, *Prunus padus*, *Quercus robur*, *Salix sp.*, *Sorbus aucuparia*, *Tilia cordata*, *Viburnum opulus* and on timber wood.

**Trametes ochracea** (Pers.) Gilb. & Ryvarden

**DISTRIBUTION:** Kursk Region, Oboyanovsky District, Tsentralno-Chernozyomny Nature Reserve, Zorinsky area, *Pyrus communis*, 27.10.1999 [34]. Oryol Region, Glazunovsky District, Lovchikovo, *Malus domestica*, 21.08.2019, strain LE-BIN 4354; Mtsensky District, Peredovik, *Malus sp.*, 31.07.2008, OHHI 173 [36]; Orlowsky District, Dobryi, *M. domestica*, 05.05.2019, OHHI 1462, Luzhki, *Pyrus sp.*, 05.10.2008, coll. N.I. Grechkina, OHHI 437 [26], Zhiлина, *Prunus armeniaca*, 23.08.2019, LE 305020, voucher for the strain LE-BIN 4377, *P. cerasus*, 15.08.2019. The species is abundant and widely distributed in the CBER.

**STRAINS:** LE-BIN 4354 (ex basidiospores), *M. domestica*, LE-BIN 4377 (ex basidiospores), *P. armeniaca*. – The aerial mycelium is white. Reverse bleached. Growing colony edge is appressed to raised, hyphae rather distant. Outline of colonies from smooth to wavy. The colony has a fealty-farinaceous texture with cottony, which has become packed. Odour is very intense, mushroom-like (some strains are without any special odour). Growth rate – (M) 1.5-3.5 (6.0) µm wide. Generative hyphae, differentiated with rare clamp connections, (4.5) 5.0-6.5 (9.5) µm in diameter. Skeletal hyphae 1.5-4.5 µm wide, rarely branched.

**ECOLOGY:** *T. ochracea* is a saprotroph on deciduous or very rarely on coniferous wood or occasionally grows as a pathogen. It causes a white rot. It was found on stumps of *Malus sp.*, on branch and dry standing trunks of *Pyrus communis* and on living trees of *Malus domestica*, *Prunus armeniaca* and *P. cerasus*. In the CBER this species occurs on *Acer negundo*, *A. platanoides*, *Betula pendula*, *Corylus avellana*, *Fraxinus excelsior*, *Populus tremula*, *Prunus padus*, *Quercus robur*, *Salix sp.*, *Sorbus aucuparia*, *Tilia cordata*, *Viburnum opulus* and on timber wood.


**Trametes pubescens** (Schumach.) Pilát

**DISTRIBUTION:** Oryol Region, Orlovsky District, Luzhki, Prunus domestica, 30.03.2007, coll. V.A. Nikolaev, OHII 170 [26].

**ECOLOGY:** T. pubescens is a saprotroph on deciduous wood. It causes a white rot. It was recorded on a saw-cut trunk of *Prunus domestica*. In the CBER this species also occurs on *Acer platanoides*, Betula pendula, *B. pubescens*, Corylus avellana, Populus tremula, Prunus padus and Quercus robur.

**Trametes versicolor** (L.) Lloyd

**DISTRIBUTION:** Belgorod Region, Borisovsky District, Belgorodsky Nature Reserve, Les na Vorskle area, *Pyrus communis*, 28.04.1938 [31]. Oryol Region, Glazunovsky District, Locvikhovo, *Malus domestica*, 21.08.2019; Mtzensky District, Volya, *Malus domestica*, 22.08.2019, strain LE-BIN 4366; Orlovsky District, Zhilina, *Prunus avium*, 13.08.2019, *P. cerasus*, 23.08.2019, strain LE-BIN 4371.

**STRAINS:** LE-BIN 4366 (ex basidiocarp), *M. domestica*, LE-BIN 4371 (ex basidiocarps), *Prunus cerasus*. The aerial mycelium is white. Reverse unchanged (some strains have bleached reverse). Growing colony edge is appressed, hyphae rather distant. Outline colonies from smooth to fringed. The colony has a cottony-feltly texture: woolly mycelium, which becomes matted. Some strains have a zonate texture. It has no special odour. Growth rate – F. Hyphal system monomitic. Aerial hyphae of 1.5‐3.0 μm in diameter. Generative hyphae, differentiated with rare clamp connections, (3.3) 5.0‐6.0 μm. Encrusted hyphae sometimes were observed in the tested strain in pure cultures.

**ECOLOGY:** T. versicolor is a saprotroph on deciduous or rarely on coniferous wood or occasionally grows as a pathogen. It causes a white rot. It was recorded on the living trunks of *Malus domestica,* on rotten fallen trunks of *Pyrus communis* and on living trunks of *Prunus avium* and *P. cerasus*. In the CBER this species also occurs on *Acer platanoides*, *A. glutinosa*, Betula pendula, Corylus avellana, Fraxinus excelsior, Populus tremula, *Prunus padus*, Quercus robur, Salix caprea, Sorbus aucuparia, *Tilia cordata* and *Ulmus laevis*.

**Tyromyces chioneus** (Fr.) P. Karst. (=Tyromyces albicollis (Peck) Bondartsev & Singer)

**DISTRIBUTION:** Belgorod Region, Gubkinsky District, Belgorodsky Nature Reserve, Yamskaya Stepe area. Kursk Region, Gorshechnsky District, Tsentalno-Chernozymny Nature Reserve, Barkalovka area; Kursky District, Tsentalno-Chernozymny Nature Reserve, Streletsky area; Manutovsky District, Tsentalno-Chernozymny Nature Reserve, Bukreyevy Barmy area Medvensky District, Tsentralno-Chernozymny Nature Reserve, Kazatsky area [33].

**ECOLOGY:** T. chioneus is a saprotroph on deciduous or more rarely on coniferous wood. It causes a white rot. It was recorded on *Malus* sp. and *Pyrus* sp. In the CBER this species is also found on *Acer platanoides*, Betula pendula, Corylus avellana, Populus tremula, *Prunus padus* and *Salix* sp.

**Stecheriniaceae**

**Stecherium fimbriatum** (Pers.) J. Erikss.

**DISTRIBUTION:** Belgorod Region, Gubkinsky District, Belgorodsky Nature Reserve, Yamskaya Stepe area, *Malus* sp., *Prunus spinosa*, 06.11.2015, LE 311659 [41].

**ECOLOGY:** S. fimbriatum is a saprotroph on deciduous and less often on coniferous wood. It was found on fallen branches of *Malus* sp. and on fallen branches of *Prunus spinosa*. In the CBER this species also occurs on *Acer platanoides*, Betula pendula, Corylus avellana, *Populus tremula*, *Prunus padus*, Quercus robur, Salix sp. and *Tilia cordata*, as well as on *Picea abies* and *Pinus sylvestris*.

**Steccherium ocraceum** (Pers. ex J.F. Gmel.) Gray

**DISTRIBUTION:** Belgorod Region, Gubkinsky District, Belgorodsky Nature Reserve, Yamskaya Stepe area, *Prunus spinosa*, 06.11.2015, OHII 1330 [41].

**ECOLOGY:** S. ocraceum is a saprotroph on deciduous and rarely on coniferous wood. It was recorded on fallen branches and trunks of *Prunus spinosa*. In the CBER this species also occurs on *Acer platanoides*, *A. glutinosa*, Betula pendula, Corylus avellana, *Fraxinus excelsior*, Populus tremula, Prunus padus, Quercus robur and *Salix* sp., as well as on *Pinus sylvestris* and on dead basidiocarps of *Fomes fomentarius*.

**Polyporales genera incertae sedis**

**Spongipellis spumea** (Sowerby Pat.)

**DISTRIBUTION:** Lipetsk Region, Krasninsky District, Galichya Gora Nature Reserve, Plyushchan’ area, *Malus* sp., 29.09.2016, coll. and det. L.A. Sarycheva, VU 4720 [42]. Unspecified locality – [Tambov Governorate], *Malus* sp., 28.07.1915, LE 26929.

**ECOLOGY:** S. spumea is a pathogen and saprotroph on deciduous wood. It causes a white rot. It was found on living *Malus* sp. In the CBER this species also occurs on *Acer platanoides*, *Fraxinus excelsior*, *Populus tremula*, *Quercus robur*, *Tilia cordata* and *Ulmus* sp.

A.S. Bondartsev noted [24] that he had previously misidentified *Aurantiporus fissilis* from fruit trees in the Kursk Governorate as S. spumea. In our opinion, the above references of S. spumea actually refer to *A. fissilis* but unfortunately there was no possibility to study the specimens.

**RUSSUALES**

**Peniophoraceae**

**Peniophora cinerea** (Pers.) Cooke

**DISTRIBUTION:** Belgorod Region, Shebekinsky District, Titovka, *Pyrus communis*, 18.08.2019, LE 314156, voucher for the strain LE-BIN 4336 [45]. Kursk Region, Fatezhsky District, Rzha, *Pyrus communis*, 15.08.2020, LE 305038; Kursky District, Kursk, *Pyrus* sp., 25.05.1908, coll. and det. A.S. Bondartsev, LE 35326. Oryol Region, Orlovsky District, Zhilina, *Pyrus communis*, 13.08.2019, LE 305039; Verkhovsky District, Turovka, *Malus* sp., 12.08.2012, LE 298786 [54]. The species is abundant and widely distributed in the CBER.

**STRAINS:** LE-BIN 4336 (ex basidiocarps), *P. communis*. – The aerial mycelium is white becoming creamy-beige with age. Reverse unchanged. Growing colony edge is pressed. Mycelial mat is felt: woolly mycelium, which has become matted. It has no special odour. Growth rate – F. Hyphal system monomitic. Aerial hyphae of 1.5-3.0 μm wide, thin-walled. Submerged hyphae from 2.5 to 4.5 μm wide. Crystals were observed for the tested strain in pure cultures. Generative hyphae, differentiated with rare clamp connections, d 3.5-6.0 μm.

**ECOLOGY:** P. cinerea is a saprotroph on a wide range of deciduous wood, occasionally growing as a pathogen. It was recorded on dry standing trees of *Malus* sp. and on dry branches of *Pyrus communis*. Usually grows on still hanging or dead branches recently fallen to the ground. In
the CBER this species also occurs on Acer campestre, A. platanoides, Betula pendula, Corylus avellana, Frangula alnus, Fraxinus excelsior, Juglans regia, Quercus robur, Salix sp., and on dry branches of Alnus glutinosa. Usually it grows on still attached branches. In the CBER this species also occurs on Acer platanoides, Amelanchier sp., Betula pendula, Corylus avellana, Fraxinus excelsior, Populus tremula, Prunus padus, Quercus robur, Sorbus aucuparia and Ulmus sp.

**Peniophora nuda** (Fr.) Bres.

**DISTRIBUTION:** Belgorod Region, Korchansk District, Popovka, Pyrus communis, 19.08.2019, LE 314113 [20].

**ECOLOGY:** P. nuda is a saprotroph on deciduous wood, occasionally growing as a pathogen. It was recorded on dry branches of Pyrus communis. Usually it grows on still attached branches. In the CBER this species also occurs on Acer platanoides, Fraxinus excelsior, Populus tremula, Prunus padus, Quercus robur and Ulmus sp.

**Peniophora violaceolivida** (Sommerf.) Massée

**DISTRIBUTION:** Oryol Region, Kolkynynsky District, Aleksandrovka, Pyrus sp., 05.10.2012, LE 292113 [37].

**ECOLOGY:** P. violaceolivida is a saprotroph on deciduous wood. It was recorded on fallen Pyrus sp. In the CBER this species also occurs on Acer negundo, A. platanoides, Betula pendula, Caragana arborescens and Fraxinus excelsior.

**Steraceae**

**Acanthophysellum minor** (Pilát) Sheng H. Wu, Boidin & C.Y. Chien

**DISTRIBUTION:** Lipetsk Region, Yeletsky District, Gallychya Gora Nature Reserve, Voronov Kem’ area, Pyrus sp., 01.10.2016, LE 313964 [44]. This record is the only known in Russia.

**ECOLOGY:** A. minor is a saprotroph on deciduous wood. It was recorded on a hanging dead trunk of Pyrus sp.

**Stereum hirsutum** (Willd.) Pers.

**DISTRIBUTION:** Belgorod Region, Borisovsky District, Belogorye Nature Reserve, Les na Vorskłe area, Prunus cerasus, 13.05.1938, P. domestico, 31.10.1938, P. insipititia, 08.08.1939 [31]; Gubkinsky District, Belogorye Nature Reserve, Yamskaya Steppe area, Malus domestica, Pyrus communis [33]. Kursk Region, Fatezhsky District, Rzhaava, Prunus domestica, 15.08.2020, LE 305053; Gorskhechensky District, Tsentrnalo-Chernozemny Nature Reserve, Barkalovka area; Kursky District, Tsentrnalo-Chernozemny Nature Reserve, Streletsy area; Mantuvovsky District, Tsentrnalo-Chernozemny Nature Reserve, Bukreyevy Barny area; Medvensky District, Tsentrnalo-Chernozemny Nature Reserve, Kazatsky area, Malus domestica, Pyrus communis [33]. Oryol Region, Glazunovsky District, Lovchikovo, Malus domestica, 21.08.2019, OHII 1461; Orlovsky District, Dobry, Prunus domestica, 05.05.2019, LE 305021, coll. T.A. Tsutsupa, Zhilina, P. cerasus, 13.08.2019, P. domestica, 15.08.2019, LE 305052. Voronezh Region, Gribanovsky District, Tellermanovskoye Experimental Forestry, P. cerasus, P. domestica, 13.08.1912; Khokholsky District, Gremyachye, P. cerasus, P. domestica, 04.08.1912; Ostrozhsky District, Uryv-Pokrovka, P. cerasus, P. domestica, 12.08.1912; Ramonsky District, Bolshaya Vereyka, P. cerasus, P. domestica, 30.07.1912 [30]. The species is abundant and widely distributed in the CBER.

**ECOLOGY:** S. hirsutum is a saprotroph on deciduous wood or occasionally grows as a pathogen. It was found on dry standing trunks of Malus domestica, Prunus cerasus and Pyrus communis, on living trunks and dry branches and trunks of Prunus domestica and on dry branches of P. insititia. In the CBER this species also occurs on Acer platanoides, Alnus glutinosa, Betula pendula, Corylus avellana, Frangula alnus, Fraxinus excelsior, Populus tremula, Prunus padus, Quercus robur, Salix caprea, Tilia cordata and Ulmus campestris.

**Stereum rugosum** Pers.

**DISTRIBUTION:** Lipetsk Region, Pyrus sp. [25; 42].

**ECOLOGY:** S. rugosum is a saprotroph on deciduous wood or occasionally grows as a pathogen. It was recorded on dry standing trunks of Malus domestica, Prunus cerasus and Pyrus communis, on dry branches and trunks of Prunus domestica and on dry branches of P. insititia. In the CBER this species also occurs on Alnus glutinosa, Betula pendula, Corylus avellana, Frangula alnus, Fraxinus excelsior, Populus tremula, Prunus padus, Quercus robur and Sambucus racemosa.

**Stereum subtomentosum** Pouzar

**DISTRIBUTION:** Kursk Oblast, Kursk, Prunus sp., 01.05.1905 [28, as Stereum ochroleucum (Fr.) Quél.]. The species is abundant and widely distributed in the CBER.

**ECOLOGY:** S. subtomentosum is a saprotroph on deciduous wood. It was recorded on Prunus sp. In the CBER this species also occurs on Acer platanoides, Alnus glutinosa, Betula pendula, Corylus avellana, Fraxinus excelsior, Populus tremula, Quercus robur, Salix sp. and Tilia cordata.

**THELEPHORALES**

**Thelephoraceae**

**Tomentellopsis echinospora** (Ellis) Hjortstam

**DISTRIBUTION:** Belgorod Region, Gubkinsky District, Belogorye Nature Reserve, Yamskaya Steppe area, Malus sp., 06.11.2015, LE 311631 [41]. The species is known from the CBER only by this record.

**ECOLOGY:** T. echinospora is an ectomycorrhizal fungus developing basidiocarps on deciduous and coniferous wood. It was recorded on a fallen branch of Malus sp.
**ECOLOGY:** *T. pulchella* forms ectomycorrhizae as well as develops basidiocarps on surface of woody substrate. It was recorded on a fallen trunk of *Prunus spinosa*.

**TRECHISPORALAE**

Hydnodontaceae

*Subulicystidium perlongisporum* Boidin & Gilles

**DISTRIBUTION:** Oryol Region, Mtsensky District, Volga, *Malus domestica*, 22.08.2019, LE 305050.

**ECOLOGY:** the species is a saprotroph on deciduous wood. It was collected on bark of a living *Malus domestica*. The species is registered in the CBER for the first time.

**DACRYMYCETES**

**DACRYMYCETALES**

*Calocera cornea* (Batsch) Fr.

**DISTRIBUTION:** Lipetsk Region, Zadonsky District, Galichya Gora Nature Reserve, *Pyrus communis*, 23.07.2020, coll. and det. L.A. Sarycheva, VU 4955.

**ECOLOGY:** *C. cornea* is a saprotroph on deciduous wood. It was recorded on living trunks of *Pyrus communis*. In the CBER this species also occurs on *Acer negundo*, *A. platanoïdes*, *Betula pendula*, *Prunus padus*, *Quercus robur* and *Salix* sp.

*Dacrymyces stillatus* Nees

**DISTRIBUTION:** Lipetsk Region, Zadonsky District, Galichya Gora Nature Reserve, Morozova Gora area, *Malus sylvestris*, 30.05.1994, VU 2908 [25, as *Dacrymyces deliquescentes* (Bull.) Duby].

**ECOLOGY:** *D. stillatus* is a saprotroph on coniferous and deciduous wood. It was recorded on fallen branches of *Malus sylvestris*. In the CBER this species also occurs on *Betula pendula*, *Pinus sylvestris*, *Quercus robur*, *Salix* sp. and *Sorbus aucuparia*.

**DISCUSSION**

As a result of the analysis of available data, we obtained information on 97 species of basidial macrofungi from 68 genera associated with *Malus*, *Pyrus* and *Prunus* wood in the CBER. Thirty-two species were known before our own research started in 2008 [26]. Two species – *Antrodia serpens* and *Ceriporia torpida* – have been registered for the first time in Russia.

The first verifiable find of *A. serpens* from Oryol Region clarifies the eastern limits of the species distribution range in the European part of Russia. According to the recent research based on type material and using molecular techniques [56], this species has for a long time been confused with close species of *A. alidata* [15] – the latter is now synonymous with *A. heteromorpha*. The earlier records of *A. serpens* sensu Bondartsev [24] do not correspond to a modern understanding of the taxon and need to be revised for herbarium materials.

*Ceriporia torpida* is new to Russia and significantly extends the boundaries of the previously established range away to the south-east. Until the present study this species was only known from Finland (holotype, on dead *Trametes* sp. on *Salix caprea*) and the Czech Republic (fallen branch of *Fagus sylvatica*). The species has been described as a result of the taxonomic study of the *Ceriporia purpurea* group [57] and therefore the existing records of *C. purpurea* in the CBER need to be revised.

The maximum number of macrofungi species associated with the wood of fruit trees is known for Oryol Region – 47 species, followed by Belgorod Region – 40, Lipetsk Region – 26, Kursk Region – 24, Voronezh Region – 7, and Tambov Region – 2 species.

The largest number of fungal species (65) inhabits *Malus* woods, 34 species *Pyrus* woods and 29 species *Prunus* woods. The distribution among representatives of the genus *Prunus* is as follows: six species (*Fumonia trigii*, *Irpex lacteus*, *Peniophora incarnata*, *Phellinus pomaceus*, *Trametes hirsuta*, *T. ochracea*) were registered on *P. armeniaca*, five species (*Fomitopsis pinicola*, *Irpex lacteus*, *Phellinus pomaceus*, *Trametes hirsuta*, *T. versicolor*) on *P. avium*, one species (*Phellinus pomaceus*) on *P. cerasifera*, eight species on *P. cerasus*, nine species on *P. domestica* and twelve species on *P. spinosa*.

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**Table 1.** Distribution of macrofungi species associated with the wood of fruit species by CBER regions

| Region          | All trees | On *Malus* spp. | On *Pyrus* spp. | On *Prunus* spp. |
|-----------------|-----------|-----------------|-----------------|-----------------|
| Total           | 97        | 65              | 34              | 29              |
| Belgorod Region | 40        | 21              | 14              | 16              |
| Kursk Region    | 24        | 11              | 14              | 5               |
| Lipetsk Region  | 26        | 20              | 4               | 2               |
| Oryol Region    | 47        | 37              | 10              | 10              |
| Tambov Region   | 2         | 1               | 0               | 1               |
| Voronezh Region | 7         | 4               | 0               | 4               |

Only two species were revealed in five regions (with the exception of Tambov Region) – *Phellinus pomaceus* and *Sarcodontia crocea*, the regularly occurring and the most important pathogens of *Prunus* spp. and *Malus* spp. respectively. Another four species were recorded in three-four regions: *Phellinus alni*, *Schizophyllum commune* and *Stereum hirsutum* – in four regions (except for Lipetsk and Tambov Regions), *Peniophora cinerea* and *Trametes hirsuta* – in three regions (except for Voronezh, Lipetsk and Tambov Regions). The proportion of species common to four of the most studied regions is shown in Fig. 2.

Five species of macrofungi grow on all three genera of fruit trees – *Lyomyces crustosus*, *Stereum hirsutum*, *Trametes hirsuta*, *T. ochracea* and *T. versicolor*. These are common, widespread species that are regularly found on the wood of different tree species in the CBER. The proportion of species common to the three discussed genera of fruit trees is shown in Fig. 3.
Based on an analysis of the literature data that we could verify, among the fungi found during the studies *Antrodia serpens*, *Candelabrochaete septocystidia*, *Ceriporia torpida*, *Hyphoderma mutatum*, *Phlebia rufa*, *Ph. tremellosa*, *Subulicystidium perlongisporum* and *Trichaptum biforme* were noted for fruit trees for the first time in the European part of Russia. At the same time *Candelabrochaete septocystidia* and *Subulicystidium perlongisporum* are little-known and rare species revealed in very few regions.

Most of the species registered are able to develop in a wide range of predominantly deciduous trees. The species that specialize in fruit trees include *Sarcodontia crocea* and *Phellinus pomaceus*. *Sarcodontia crocea* is in most cases strictly associated with *Malus*, much less with *Pyrus*, and was only once recorded on *Acer platanoides*. The species was recorded in all the horticultural plantations we surveyed on live, drying and dry *Malus* trees, affecting up to 100% of all trees within an orchard: this makes it one of the highly dangerous pathogens causing significant yield losses to fruit trees due to drying and death.

*Phellinus pomaceus* is regularly recorded on living and dying plants of *Prunus* species, suggesting a narrow ecological niche. However, according to the literature, this species is also associated with other fruit trees from the genera *Malus* and *Pyrus* [58], or even a wider range of host plants – up to 20 genera [15]. Available results of molecu-
lar studies [52] of the Phellinus igniarius s. l. species complex, to which this species belongs, also indicate the growth of Ph. alni and a single find of Ph. igniarius s. str. on Malus wood and the strict association of Ph. pomaceus with the genus Prunus. The results of the present study, which was carried out using molecular methods and ITS nrDNA analysis (unpublished data), confirm that in the CBER Ph. pomaceus develops exclusively on Prunus spp. trees, while Ph. alni grows on Malus spp.

The interesting finding published in the literature [33] is the discovery of Fistulina hepatica, which develops almost exclusively on Quercus robur, on Malus and Pyrus, although for this fungus it is known that in very rare cases it has also been found on other deciduous trees [15]. Unfortunately, we are not aware of the presence of specimens for this indication.

Pathogenic activity has been clearly marked for 32 species of fungi found on trunks and branches of living trees, causing necrosis and trunk rot. Five species were recorded on living branches and 31 species were registered on living trunks. The distribution of hosts is as follows: 22 pathogenic species – on Malus, 6 – on Pyrus, 11 – on Prunus. Of all the pathogens, only 14 have been observed exclusively on living trees: Calocera cornea (on Pyrus communis), Cerioporus squamosus (on Malus sp.), Fulalia trogii (on Prunus armeniaca), Hypsysigus marmoreus (on Malus domestica), Inocutis rheides (on Prunus domestica), Inonotus hispidus (on Malus spp.), Laetiporus sulphureus (on Pyrus communis), Oxyopus obsucens (on Malus sp.), O. populinus (on Malus domestica), Phanerochaete velutina (on Pyrus sp.), Phellinus alni (on Malus spp.), Psathyrella spadicea (on Malus sp.), Subulicystidium perlongisporum (on Malus domestica), Volvariella bombycina (on Malus domestica).

Forty-two species were recorded on dry dead wood, including 29 species were recorded on dry branches in the crowns of living trees and 23 species on dry standing trunks. Only 18 species have been revealed exclusively on this type of substrate: Antrodia serpens (on Malus domestica), Apioperdon pyriforme (on Malus sp., Pyrus sp.), Bacidioradulum radula (on Malus sp.), Candelabrobraechea septocystidia (on Malus domestica), Cerioporus leptophasalus (on Pyrus communis), Cerioporia viridans (on Malus domestica), Dichomitus campestris (on Malus sp., Pyrus communis), Fomitiporia punctata (on Malus sp.), Hydnoporia tabacina (on Malus sylvestris, Pyrus communis), Hyphoderma mutatum (on Malus domestica), Lyomyces erastii (on Malus domestica), Peniophora nuda (on Pyrus communis), P.eniophorea praetermissa (on Malus spp.), Phanerochaeta jose-ferreira (on Malus sp.), Porostereum spadiceum (on Malus domestica), Raduliporus aneirinus (on Malus domestica), Radulomyces confluentes (on Prunus domestica), Sistotrema brinckmannii (on Malus domestica). A total of 48 species develop on dead wood (dead fallen branches, fallen trunks, stumps), of which 31 species develop exclusively on this type of substrate.

Most of the species revealed cause a white rot. At least nine species (Antrodia serpens, Coniophora puteana, Fistulina hepatica, Fomitopsis pinicola, Gloeophyllum trabeum, Laetipor us sulphureus, Postia balsamea, P. lactea, and P. subcaesia) belong to fungi causing a brown rot.

On fallen trunks and branches, species that are not saprotrophs have also been found by chance – the ectomycorrhizal Tomentellopsis echniosora (on Malus sp.) and Tomentellopsis pulchella (on Prunus spinosa) as well as the lichenicolous Athelia alnicola (on Prunus spinosa).

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AUTHOR CONTRIBUTIONS
Sergey V. Volobuev conceived the idea, participated in the collection and processing of all type studied materials. 
Sergej Yu. Bolshakov participated in processing the herbaria and literature data. Natalia V. Shakhova obtained and characterized pure basidiomycete cultures. All authors wrote and revised the manuscript before its submission. All authors are equally responsible for plagiarism, self-plagiarism and other ethical transgressions.

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