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Oleg N. Ezhov,
Ivan V. Zmitrovich and Roman V. Ershov [1]

NEW RECORDS OF WOOD-ROTTING BASIDIOMYCETES IN THE BOREAL FORESTS OF THE EASTERN EUROPEAN NORTH, ARKHANGELSK REGION, RUSSIA

SUMMARY

Observations of wood-rotting basidiomycetes in the boreal forests of the Eastern European North (Russia, Arkhangelsk Region) reveal some rare, but little known taiga species, namely *Athelia alnicola*, *Byssocorticium atrovirens*, *Ceriporiopsis jelicii*, *Ginnsia viticola*, *Hypochnella violacea*, *Lopharia cinerascens*, *Phlebia deflectens*, *Ph. ochraceofulva*, *Postia persicina*, *Scytinostroma portentosum*. The morphology, substrate preferences and the distribution of the species revealed are discussed.

Key words: Basidiomycetes, Boreal forests, Russia

INTRODUCTION

During last years, the wood-rotting basidiomycetes of the boreal forests of the Eastern European North have been intensively studied (Niemelä et al., 2001; Kosolapov, 2008; Ezhov et al., 2011). The highly specific environments of boreal forests are the reason for the stable species composition of mosses, lichens and fungi. Concerning wood-rotting fungi, the core boreal species are associated, as a rule, with fallen *Picea* and *Abies* debris in moist forests, the boreonemoral species are associated with *Populus tremula* and *Betula* debris, the multiregional coniferous species are associated with Scots pine (*Pinus sylvestris*) forests, whereas nemoral irradiating species are associated here with the *Alnus* spp. The previously mentioned species complexes and the several cosmopolitan wood-decayers are distributed throughout the boreal forests. Some of them, such as *Fomes fomentarius* (L.) J.J. Kickx, *Trametes hirsuta* (Wulfen) Lloyd, or *T. versicolor* (L.) Lloyd, are proof members of the forests' ecosystems in the boreal zone, whereas other widely distributed fungi are presented in boreal forests only by several finds.

The purpose of this work is the generalisation of information on the casual finds of rare wood-rotting basidiomycetes in the boreal forests of the Eastern European North (Arkhangelsk Region) and an attempt for chorionomic characterisation of the mentioned species.

[1] Oleg N. Ezhov (corresponding author: olegezhik@gmail.com), Roman V. Ershov, Institute of Ecological Problems of the North, 23 North Dvina quay, 163000 Arkhangelsk, Russia. Ivan V. Zmitrovich, V.L. Komarov Botanical Institute, 2 Popov Street, 197376 St. Petersburg, Russia.

MATERIAL AND METHODS

The fieldwork was carried out during the years of 2004–2010 in the Pinega reserve (Arkhangelsk Region, northern boreal zone). Wood-decaying fungi were collected from standing trees, fallen logs and branches, and wood debris of forests litter. The specimens collected were dried and then later examined in the laboratory.

A microscopic study of basidiomata was carried out, as described by Gilbertson & Ryvarden (1986). Freehand sections and squash mounts were examined in 5% KOH and 2% Cotton Blue. And, spore measurements were based on 30 spores per specimen.

The material kept in the herbarium of the Institute of Ecological Problems of the North (AR); the duplicates were placed at mycological herbarium at the Komarov Botanical Institute RAS (LE).

The distribution patterns were analysed with support from the literature. The areas in distributional patterns of the fungi were arranged from the North West to the South East. The substrate trees were arranged from subtropical to boreal optimum-areas.

RESULTS AND DISCUSSION

ATHELIA ALNICOLA (Bourdot et Galzin) Jülich – Fig. 1a, 2a.

This corticioid fungus develops a resupinate and totally prostrate pellicular carpets, which expanded to 2 cm in diameter, and a thickness of nearly 0.1 mm. Hymenium smooth, white, cracked and falling off, marginal zone narrow, farinaceous-fibrillose. Hyphae monomitic, 4–8.5 μm in diameter, simple- septate or (basal ones) with occasional clamps, thin-walled in subhymenium, and strictly thick-walled in subicular parts. Basidia 16–20 × 5–7.5 μm, clavate, 4-spored, without a basal clamp. Basidiospores 6.7–8.0 × 3.5–4.2 μm, ellipsoid, smooth, thin-walled, inamyloid and acyanophilous.

These species were differentiated from the *Athelia epiphylla*-complex due to their wide subicular hyphae and rather large basidia.

Material studied: Russia, Arkhangelsk Region, Pinega reserve, flood land, on the fallen log of *Alnus incana*. Coll. O.N. Ezhov 24 IX 2009, det. I.V. Zmitrovich 20 XI 2009 (AR 1114, LE 269727).

General substrate range: *Acer pseudoplatanus*, *Ulmus* sp., *Alnus incana*, *Pinus strobus*.

General distribution: Europe (Great Britain, Czech Republic, Deutschland, Sweden, Leningrad Region of Russia), North America (USA) (Jülich, 1972; Legon & Henrici, 2005; Zmitrovich, 2008).

The substrate and the distributional ranges testify a nemoral optimum-zone of the species. In the boreal forests of the Arkhangelsk Region, this species behaves as a nemoral irradiating species, namely it grows in alder strip environments.

BYSSOCORTICIUM ATROVIRENS (Fr.) Bondartsev & Singer – Fig. 1b, 2b.

This corticioid fungus develops greenish-smoky-grayish mat, expanded to 2.3 cm in diameter, and 0.3 mm thick. Hymenium smooth, woolly, marginal zone nearly 1 mm wide, fibrillose. Hyphae monomitic, 2–3.5 μm in diameter, with occasional clamps and rectangular branching, smoky-gray. Basidia 19–25 × 5–5.5 μm, head-like, (2) 4-spored, with a basal clamp. Basidiospores 3.4–4.5 × 3–4 μm, subglobose, with a prominent base, nearly thick-walled, smooth, smoky-gray with a central globule, inamyloid, acyanophilous.

Material studied: Russia, Arkhangelsk Region, Pinega reserve, aspen forest, on fallen log of *Populus tremula*. Coll. O.N. Ezhov 26 IX 2009, det. I.V. Zmitrovich 21 XI 2009 (AR 1215, LE 269728).

General substrate range: *Carpinus betulus*, *C. caucasicus*, *C. orientalis*, *Castanea dentata*, *C. sativa*, *Fagus sylvaticus*, *F. grandifolia*, *F. orientalis*, *Quercus iberica*, *Tilia cordata*, *Pyrus malus*, *Alnus* sp., *Betula platyphylla*, *Abies nordmanniana*, *Picea abies*, *Picea* sp., *Pinus rigida*, *P. strobus*, *Pinus* sp.

General distribution: Africa (Morocco), Europe (Portugal, France, Macedonia, Austria, Georgia, Armenia, Deutschland, Czech Republic, Poland, Belarus, Denmark, Norway, Sweden, Finland, Latvia, Russia (Karelia, Krasnodar Region), Urals (Russia – Sverdlovsk Region), Asia (Russia – Buryatia, Khabarovsk Region), North America (USA, Canada) (Jülich, 1972; Hansen, Knudsen, 1997; Zmitrovich, 2008; Kotiranta et al., 2009; Shiryaev et al., 2010).

This evritrophic fungus of the Holarctic distribution appears to be rare and random. The moist habitat conditions are seemingly favourable for this species. In the Arkhangelsk Region, the species demonstrates rather boreotemporal links.

CERIPORIOPSIS JELICII (Tortič & A. David) Ryvarden & Gilb. – Fig. 1c, 2c.

This resupinate polypore forms adnate orbicular patches *ca*. 1.5 cm in diameter, with an inrolled upper margin. Pore surface initially white, then with a citric and finally ochraceous tint, fibrous at the margin and glancing near the centre; pores 7–8 per mm, thin-walled and slightly angular. Margin non-cordonic, narrow, white. Hyphae monomitic, 2–3.5 μm in diameter, clamped, with prominent walls, in the hymenium with numerous crystals. Leptocystidia 8–11 × 4–5 μm, fusoid. Basidia 10–15 × 4–5 μm, clavate, 4-spored, with a basal clamp. Basidiospores 3.0–3.8 × 1.8–2.2 μm, ellipsoid to short-cylindrical, thin-walled, smooth, inamyloid, acyanophilous.

Material studied: Russia, Arkhangelsk Region, Pinega reserve, on fallen log of *Larix sibirica*. Coll. O.N. Ezhov, R.V. Ershov 21 IX 2008, det. W.A. Spirin, I.V. Zmitrovich 25 XI 2008 (AR 873, LE 269733).

General substrate range: *Abies alba*, *Picea abies*, *Pinus sylvestris*.

General distribution: Croatia, Finland (Tortič & David, 1981; Kotiranta et al., 2009).

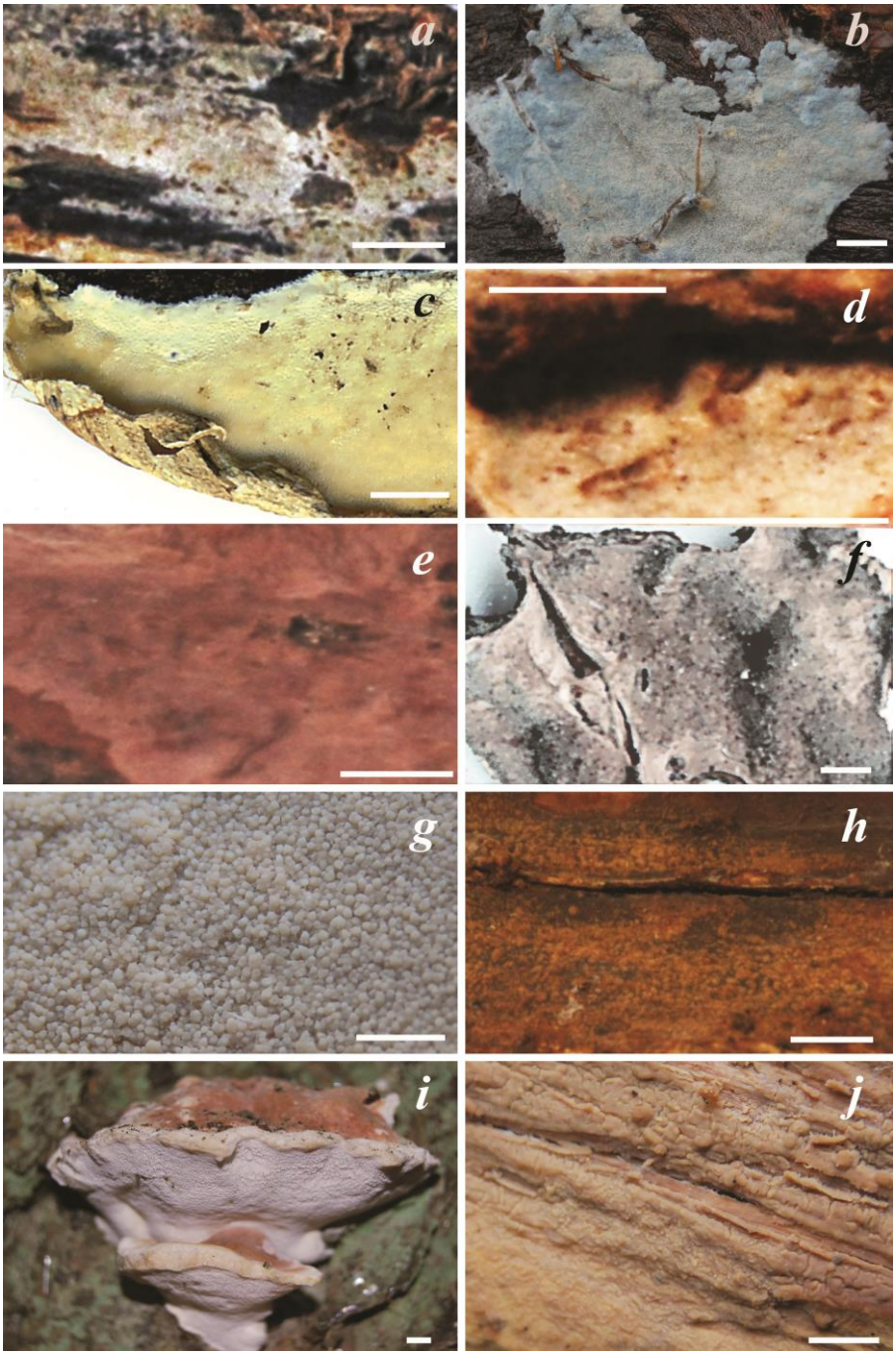

Figure 1. *Athelia alnicola* (*a*), *Byssocorticium atrovirens* (*b*), *Ceriporiopsis jelicii* (*c*), *Ginnsia viticola* (*d*), *Hypochnella violacea* (*e*), *Lopharia cinerascens* (*f*), *Phlebia deflectens* (*g*), *Ph. ochraceofulva* (*h*), *Postia persicina* (*i*), *Scytinostroma portentosum* (*j*). Scale bar – 1 mm.

This is a typical boreal species, distributed in the boreal zone as well as the mountain forests of Europe. In the Arkhangelsk Region (and Russia as a whole) this is a first record.

GINNSIA VITICOLA (Schwein.) Sheng H. Wu & Hallenb. – Fig. 1d, 2d.

This orbicular corticioid fungus, forms confluent films, which expand to 4 cm in diameter and is nearly 0.5 mm thick. The hymenium of this fungus is smooth, ceraceous-pellicular, grayish-tan, whereas the subiculum and margin are orange. Hyphae monomitic, 2.5–5 μm in diameter, simple- to nodose-septate, with granular incrustation, loose in subiculum, densely packed in subhymenium. Leptocystidia 50–112 × 6–12 μm, cylindrical, hyaline. Basidia 25–75 × 5–11 μm, utriculate, 4-spored, without a basal clamp. Basidiospores 8–11.5 × 4.5–5 μm, adaxially flattened, hyaline, thin-walled, smooth, inamyloid, acyanophilous.

Material studied: Russia, Arkhangelsk Region, Pinega reserve, on the fallen log of *Populus tremula*. Coll. O.N. Ezhov, R.V. Ershov 21 IX 2008, det. I.V. Zmitrovich 25 XI 2008 (AR 1139, LE).

General substrate range: *Acer spicatum*, *Fagus grandifolia*, *Vitis* sp., *Abies fraseri*, *Picea* sp., *Thuja occidentalis*.

General distribution: Europe (Russia – Tatarstan Republic), Asia (Russia – Primorje & Khabarovsk Regions; Japan; Taiwan; India; Nepal), North America (USA) (Hayashi, 1974; Rattan, 1977; Hjortstam, 1984; Burdsall, 1985; Wu, 1990; Herb. LE).

The distribution of this species can be characterised as boreotropical with Pacific gravitation; randomly found everywhere. In the Arkhangelsk Region the second European record was made, after the Tatarstan Republic.

HYPOCHNELLA VIOLACEA Auersw. ex J. Schröt. – Fig. 1e, 2e.

This corticioid fungus develops a grayish-violaceous hypochnoid mat, expanded to 3 cm in diameter and 0.2 mm thickness. Hymenium smooth, discontinuous, margin adherent, but easily separable, byssoid. Hyphae monomitic, 4–9 μm in diameter, without clamps, rectangularly branched, in basal subiculum thick-walled. Basidia in loose clusters, 18–30 × 5–7 μm, subcylindrical, 4-spored, without a basal clamp. Basidiospores 6–8 × 3–4.8 μm, ellipsoid to short-cylindrical, thick-walled, smooth, violaceous, then yellow-brown, inamyloid, cyanophilous.

Material studied: Russia, Arkhangelsk Region, Pinega reserve, flood land, debris of *Alnus incana*, *Betula* sp. Coll. O.N. Ezhov, D.A. Kosolapov 24 IX 2009, det. I.V. Zmitrovich 21 XI 2009 (AR 1202, AR 1201, LE 269734).

General substrate range: *Athyrium filix-femina*, decayed deciduous wood.

General distribution: Europe (Switzerland, Sweden), North America (Eriksson, Ryvarden, 1976; Jülich, Stalpers, 1980).

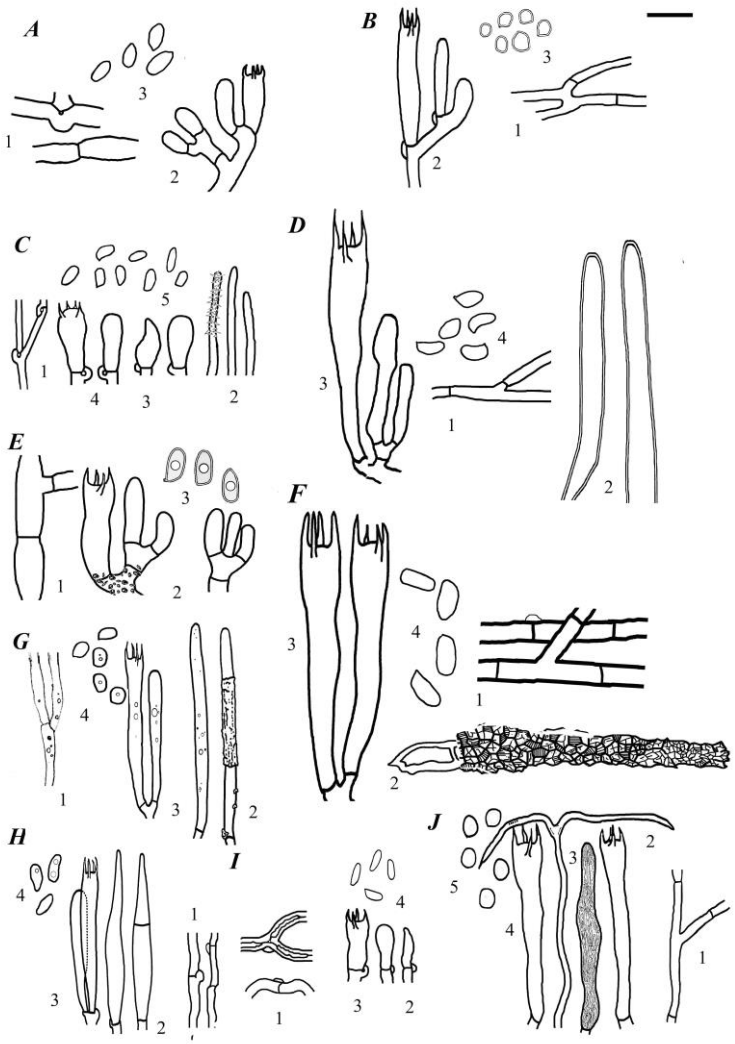

Figure 2. *A* – *Athelia alnicola* (1 – basal hyphae, 2 – basidial cluster, 3 – basidiospores); *B* – *Byssocorticium atrovirens* (1 – basal hyphae, 2 – basidial cluster, 3 – basidiospores); *C* – *Ceriporiopsis jelicii* (1 – basal hyphae, 2 – hyphal ends in tube dissepiments, 3 – leptocystidium, 4 – basidia, 5 – basidiospores); *D* – *Ginnsia viticola* (1 – basal hyphae, 2 – cystidia, 3 – basidial cluster, 4 – basidiospores); *E* – *Hypochnella violacea* (1 – basal hyphae, 2 – basidial clusters, 3 – basidiospores); *F* – *Lopharia cinerascens* (1 – basal hyphae, 2 – lamprocystidium, 3 – basidia, 4 – basidiospores); *G* – *Phlebia deflectens* (1 – basal hyphae, 2 – cystidia, 3 – basidia, 4 – basidiospores), *H* – *Ph. ochraceofulva* (1 – basal hyphae, 2 – cystidia, 3 – basidia, 4 – basidiospores), *I* – *Postia persicina* (1 – hyphae of tube trama and context above, 2 – leptocystidium, 3 – basidium, 4 – basidiospores); *J* – *Scytinostroma portentosum* (1 – basal hyphae, 2 – dichohyphidium, 3 – gloeocystidium, 4 – basidium, 5 – basidiospores). Scale bar – 10 μm.

This is rare Holarctic species is associated, preferably, with moist habitat conditions; random everywhere. In the Arkhangelsk Region the species demonstrates rather boreotemporal links.

LOPHARIA CINERASCENS (Schwein.) G. Cunn. – Fig. 1f, 2f.

This resupinate stereoid fungus develops prostrate pilei with an inrolled, tomentose upperside margin. Hymenium uneven – with warts and ridges, ceraceous, grayish-brown. Hyphae pseudodimitic; generative ones 2–4 μm in diameter, clamped, densely packed; pseudoskeletal ones 3–6 μm in diam., predominating in basal parts, connected to pseudocystidia. Pseudocystidia 60–150 × 10–27 μm, gradually conical, with thickened cinnamomeous walls. Basidia 35–75 × 6–11 μm, 4-spored, with a basal clamp. Basidiospores 8.5–14.5 × 4–8.5 μm, ovoid to short-cylindrical, smooth, thin-walled, inamyloid, acyanophilous.

Material studied: Russia, Arkhangelsk Region, Pinega reserve, aspen forest, the fallen log of *Populus tremula*. Coll. O.N. Ezhov, D. A. Kosolapov 24 IX 2009, det. I.V. Zmitrovich 21 XI 2009 (AR 527, LE 269781).

General substrate range: *Ulmus* spp., *Malus* sp., decayed deciduous wood.

General distribution: Europe (France), Urals (Russia – Sverdlovsk Region), North and Central America (Pilát, 1930; Stepanova-Kartavenko, 1967; Davydkina, 1980).

Davydkina (1980) characterised by the distribution of the species as "tropical", and the part of its area that reaches the Urals, it is characterised as "a relic". In our opinion, the optimal zone of distribution of *L. cinerascens* is temporal-subtropical **(**like *Byssomerulius corium* (Pers.) Parmasto**)**, but its chorionomical characteristics are comparable to *Ginnsia viticola*, i.e., a boreotropical species with a Pacific gravitation. In the Arkhangelsk Region, the second find in Russia (after Urals) was made.

PHLEBIA DEFLECTENS (P. Karst.) Ryvarden (= *Ph. lilacea* M.P. Christ). – Fig. 1g, 2g.

This peculiar waxy corticioid fungus with finely grandiniod hymenophore develops totally prostrate films, which expand to 5 cm in diameter and 0.7 mm thickness. Papillae are very dense, cornescent, watery cream; margin very narrow, adherent, without fibrils, concolorous with the hymenophore. Hyphae monomitic, 3–4 μm in diameter, without clamps, densely packed both in subicular and subhymenium. Basidia 27–40 × 4–4.5 μm, clavate-cylindrical, 4-spored, without a basal clamp, strongly agglued. Basidiospores 3.8–4.5 × 2.8–3.5 μm, ellipsoid, smooth, thin-walled, inamyloid, acyanophilous.

Material studied: Russia, Arkhangelsk Region, Pinega reserve, aspen forest, on fallen log of *Populus tremula*. Coll. O.N. Ezhov 31 VIII 2010, det. I.V. Zmitrovich 25 XI 2010 (AR 600, LE 269731).

General substrate range: *Corylus avellana*, *Quercus robur*, *Ulmus glabra*, coniferous wood.

General distribution: Europe (France, Ukraine, Armenia, Denmark, Norway, Sweden, Finland), Urals (Sverdlovsk Region), Asia (Azerbaijan) (Parmasto, 1968; Hansen & Knudsen, 1997; Shiryaev et al., 2010).

The species can be characterised as having a boreonemoral Palearctic distribution; rather rare. In the Arkhangelsk Region, this fungus is a member of boreonemoral species complex.

PH. OCHRACEOFULVA (Bourdot et Galzin) Donk – Fig. 1h, 2h.

This orbicular corticioid fungus develops purple-brownish waxy patches, reaching 4 cm in diameter and a thickness of 0.7 mm. Hymenophore tuberculate, smooth at periphery, cornescent; margin to 2 mm wide, adherent, strikingly yellow. Hyphae monomitic, 3–4.5 μm in diameter, clamped, densely packed both in subhymenium and subiculum. Cystidia 38–57 × 5–6.5 μm, subulate, apically thin-walled. Basidia 20–30 × 3.5–6 μm, clavate-cylindrical, 4-spored, obscurely clamped at the base, strongly agglued. Basidiospores 5.3–7.8 × 3.0–4.2 μm, ellipsoid, smooth, thin-walled, inamyloid, acyanophilous.

Material studied: Russia, Arkhangelsk Region, Pinega reserve, aspen forest, on fallen log of *Populus tremula*. Coll. O.N. Ezhov 28 IX 2007, det. I.V. Zmitrovich 21 XI 2008 (AR 677, LE 269729).

General substrate range: *Betula* sp., *Salix* sp., deciduous wood.

General distribution: Europe (Denmark, Norway, Sweden, Russia – Rostov Region), Urals (Russia – Sverdlovsk Region), North America (Eriksson et al., 1981; Jülich & Stalpers, 1980; Zmitrovich et al., 2008; Shiryaev et al., 2010).

The species can be characterised as having a boreonemoral circumpolar distribution; rather rare. In the Arkhangelsk Region, the fungus is a member of boreonemoral species complex.

POSTIA PERSICINA Niemelä & Y.C. Dai – Fig. 1i, 2i.

This peculiar tyromycetoid polypore forms small sessile and decurrent clustered pilei that are up to 2.5 cm wide, more or less triquetrous in section, spongy and soaked. Upper surface is finely tomentose to fibrillose, scrupose, orange with pinkish pruina, creamish to white at the margin. Context spongy, white, up to 5 mm thick. Margin thin, sterile below. Hymenophore as a single tube layer up to 3 mm thick; pore surface creamish-white; pores 4–8 per mm, slightly angular. Hyphae monomitic, 2–5 μm in diameter, richly branched; in tube tissues presumably thin-walled, whereas in context with irregularly thickened walls. Leptocystidia 12–17 × 3–5 μm, fusoid. Basidia 15–20 × 4–5.5 μm, clavate, 4-spored, with a basal clamp. Basidiospores 4.3–5 × 1.8–2.2 μm, short-cylindrical, smooth, thin-walled, inamyloid, acyanophilous.

Material studied: Russia, Arkhangelsk Region, Solovetski Islands, on dry trunk of *Picea fennica*. Coll. O.N. Ezhov 21 VIII 2009, det. I.V. Zmitrovich 21 XI 2009 (AR 1131, LE 269760).

Substrate range: *Padus avium*, *Sorbus* sp., *Betula* spp., *Salix* spp., *Abies*, *Picea abies*, *P. sibirica*, *Pinus sibirica*, *P. sylvestris*.

General distribution: Europe (Finland, Russia – Karelia), Urals (Russia – Sverdlovsk Region) (Niemelä et al., 2004; Shiryaev et al., 2010).

The recent extensive findings of this newly described species (Shiryaev et al., 2010) shows a clear boreal preference in this Palearctic fungus. In the Arkhangelsk Region, this is a little-known member of the core boreal species complex.

SCYTINOSTROMA PORTENTOSUM (Berk. & M.A. Curtis) Donk – Fig. 1j, 2j.

This resupinate and totally prostrate corticioid fungus forms tough orbicular films, confluent and then expanded at 10 cm; up to 0.8 mm thick. Hymenophore basically smooth, but with irregular fine wrinkled sculpture, tough-ceraceous, pale-cream. Hyphae dimitic: generative hyphae 1.3–3 μm in diametre, without clamps, predominating and densely packed in all parts of basidiome; skeletal hyphae 1.3–2 μm in diameter, fibrous to dichotomous, weakly dextrinoid. Skeletohyphidia of the same diameter, simple or once branched; branches not dendroid, protruded the hymenium and unwrapped above. Gloeocystidia scarce, 25–50 × 3–6.5 μm, suburniform. Basidia 28–58 × 4–6.5 μm, utriculate, 4-spored, without a basal clamp. Basidiospores 4.5–6.5 × 3.8–5.5 μm, subglobose, smooth, with rather prominent walls, obscurely amyloid, cyanophilous.

We follow the authors, who distinguish *S. portentosum* from *S. hemidichophyticum* Pouzar, the species is characterised by the 2–3 times branched dichohyphidia and slightly larger basidiospores.

Material studied: Russia, Arkhangelsk Region, Pinega reserve, on fallen log of *Populus tremula*. Coll. O.N. Ezhov 01 IX 2010, det. I.V. Zmitrovich 25 XI 2010 (AR 1422, LE 269735).

General substrate range: *Ulmus* sp., *Fagus* sp., *Salix caprea*, *Juniperus virginiana*.

General distribution: Europe (Denmark, Norway, Sweden, Finland), Urals (Russia – Sverdlovsk Region), Asia (Indies), North America, Australia, New Zealand (Rehill & Bakshi, 1965; Gilbertson & Blackwell, 1985; Hansen & Knudsen, 1997).

An unstable concept of *S. portentosum* is the reason for the certain misinterpretation of its distributional pattern. In all cases, it should be characterised as cosmopolitan. In the Arkhangelsk Region, the species can be attributed to the random fraction of multiregional species complex.

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Oleg N. EZHOV, Ivan V. ZMITROVICH and Roman V. ERSHOV

NOVI REGISTAR BAZIDIOMICETA KOJE UZROKUJU TRULJENJE DRVETA U SJEVERNIM BOREALNIM ŠUMAMA ISTOČNE EVROPE, REGIJA ARKHANGELSK, RUSIJA

SAŽETAK

Posmatranjem bazidiomiceta koje uzrokuju truljenje drveta u sjevernim borealnim šumama istočne Evrope (Rusija, Regija Arhangelsk) otkrivene su neke rijetke, malo poznate vrste u tajgama, a to su *Athelia alnicola, Byssocorticium atrovirens, Ceriporiopsis jelicii, Ginnsia viticola, Hypochnella violacea, Lopharia cinerascens, Phlebia deflectens, Ph. ochraceofulva, Postia persicina, Scytinostroma portentosum.* U ovom radu se razmatraju morfologija, zahtjevi prema tlu i distribucija otkrivenih vrsta.

Ključne riječi: bazidiomicete, borealne šume, Rusija