Non-poroid aphyllophoraceous fungi proposed to the third edition of the Red Data Book of Belarus

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Twelve endangered, declining or rare species: morphological, ecological, and geographical characterization

The history of state protection of organic world in Belarus includes two editions of the National Red Data Book. The first edition (Red Data Book..., 1981) lacked fungal organisms, the second, last edition includes 17 species of fungi, among they three non-poroid aphyllophoraceous ones (Golovko, Serzhanina, 1993). They were arranged in accordance with former IUCN conservation categories used in Soviet literature (Red Data Book…, 1984: 7–8; Dorofeev et al., 1993): *Clavariadelphus pistillaris* in III category (rare), and two species in II category (declining) — *Hericium coralloides* under the name *H. clathroides* and *Sparassis crispa*.

For selection of candidates for protection we used the criteria of geographical restriction of populations, narrow ecological amplitude of the species, declining of the species in adjacent countries, endangered situation with habitats typical for the species. Many mycologists for selection of macrofungi as objects of conservation are guided by the principle of remarkability and esthetic view of fruitbodies (Kreisel, 1991). We add the last criterion to the set of biological and geographical ones. In simple words, the ideal protected species must to be more or less easily found and identified in field by naturalists, not closely familiar with fungal taxonomy.

For species status evaluation we used the modern IUCN red list categories.[1] To the species described in this article the next categories were attributed:

Endangered (EN) — the taxa facing a very high risk of extinction in the near future, especially when causal factors leading to their reduction continue operating; there is reducing of the taxon number to a critical level or drastic reducing of the taxon habitats that can lead to immediate danger of extinction;

Vulnerable (VU) — the taxa facing a high risk of extinction in the medium-term future; these taxa can move into the EN category in the near future if the causal factors continue operating; main criteria are decreasing or depletion of most or all the populations of the taxon because of over-exploitation, extensive destruction of habitats or other environmental disturbances;

Species of lower risk (LR) — the taxa which are the focus of a continuing nature conservation program, the cessation of which can result in the taxon qualifying for

[1] Regardless wide using, these categories have certain demerits: rather indistinct limits between the grades and the quantitative criteria with difficulty applied to fungal species.

one of the threatened categories described above (presumably VU) within a period of five years; either other taxa, which are close to qualifying for Vulnerable.

Human economic activity, including intensive forests exploitation (selective and total cuttings), and recreation effect on forest ecosystems are commonly considered as almost "universal" limiting factors for the fungi, which are target of conservation.[2] The picking of basidiomata having esthetic appeal or some food value is commonly considered as additional limiting factor. We regard this factor insufficiently affecting a species declining in nature when to compare with anthropogenic destroying of the species environment.

Descriptions of basidiomata macromorphology were based on dry herbarium material, except of the cases specially indicated in the text. Basidiomata sections for the study were prepared in 5% KOH water solution.

The reference specimens are kept in V.F. Kuprevich Institute of Experimental Botany Fungal Herbarium (MSK–F).

For mapping of the species we use the next signs:

● 1 ○ 2 ◒ 3 □ 4

1 — localities based on data of collections examined by us, or in some cases, by other researchers [and then the sing is accompanied by the letter(s), indicating the name of collector]; 2 — literature data; 3 — localities mapped in the 2nd edition of the Red Data Book as "sites of inhabiting in the present" without special indication of reference specimens (Golovko, Serzhanina, 1993), 4 — other data (verbal communications).

The next acronyms are used for the largest depositaries of cultures containing the genetic fund of aphyllophoroid fungi: CBS — Centraalbureau voor Schimmelcultures, Baarn, Netherlands; FCUG — culture collection of the Botanical Institute, Göteborg University, Sweden.

Species descriptions

1. Bankera fuligineoalba (Schmidt : Fr.) Pouzar, Česká Mykol. **9**: 96, 1955.

Fig. 1, 2.[3]

Proposed category: Endangered.

Conservation in other countries: The species is included in Red Data Lists of Poland (Wojewoda, Ławrynowicz, 1992), Germany, Netherlands (Arnolds, 1989), Denmark, Norway, Great Britain.

Economic importance: Unknown.

Morphology: Basidiomata with strong fenugreek odor, separate or confluent in couples. Based on study of MSK specimens, pileus *ca*. 3.5–8 cm diam, flatly-bulging, sometimes with a central knob, upper surface ochraceous, at the margin paler, more

[2] Nevertheless, this statement is the subject of discussion, taking into consideration examples of high adaptation ability of some wood-inhabiting fungi, occurring in anthropogenically modified ecosystems.

[3] All drawings and digital photos by the author.

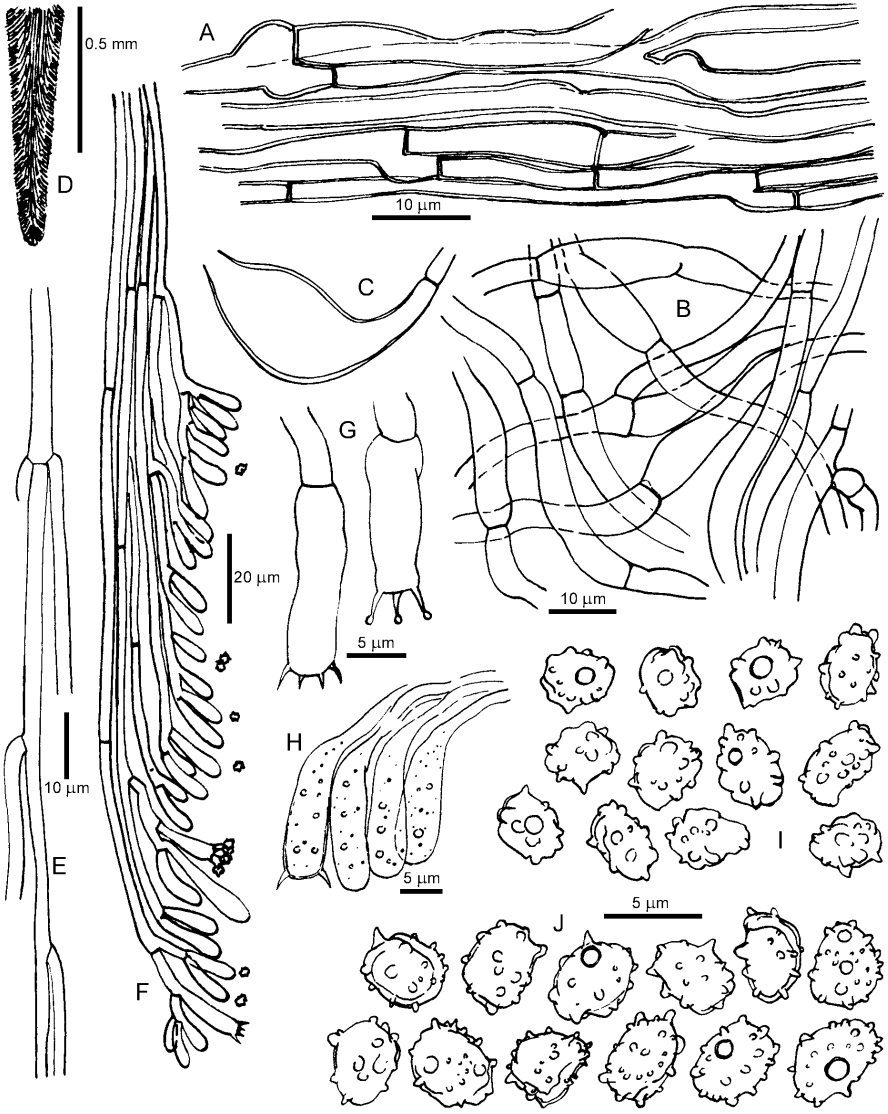

Fig. 1. *Bankera fuligineoalba*: A, B, C — hyphae of pileus trama, D — vertical section through hymenophore spine, E — hyphal branching in the central part of spine, F — hymenium and subhymenial hyphae, G — basidia, H — fragment of hymenium, I, J — spores.

A–G, I — MSK 23, H — MSK 3927, J — MSK 3793.

or less velvety, commonly with adhering plant particles. Stipe central, slightly swollen-cylindrical, *ca.* 1.8–3 × 1.5–2.5 cm, ochraceous, with lacunae. Hymenophore hydnoid. Spines very fragile when dry, subulate, ochraceous, 1–3 × 0.13–0.6 mm, decurrent on stipe. Hyphae clampless, thin-walled, in pileus trama more or less parallel arranged, (2) 2.5–7.5 µm wide, with scattered swellings up to 14.5 µm, in spine trama *ca.* 3 µm wide. Cystidial elements absent. Basidia clavate, 15–30 × 4–5 µm, with simple, sometimes indistinct septa (fig. 2 H) at base. Spores irregularly ellipsoid to angular and lobed, warted, (3) 4.3–4.5 (5) × 2.5–3.3 µm, yellowish in mass, with oily inclusions, with hyaline apiculus.

In MSK 3793 the pilei during growth involved fallen needles and twigs of *Pinus sylvestris* L., living shoots of *Pleurozium schreberi* (Brid.) Mitt. and died shoots of *Polytrichum* sp.

General distribution: Europe, Siberia, East Asia, N. America (Nikolajeva, 1961; Maas Geesteranus, 1971, 1975). Based on data available, this is apparently rare species in Belarus in contrast with more dense distribution in West and north-central Europe (Nikolajeva, 1961; Jülich, 1984).

Distribution in Belarus:. There are two sites based on herbarium data. The species was also reported from Klichau (supposedly near Ubalatstse village) and Myadzel' districts by Komarova and Golovko (1965, 1966).

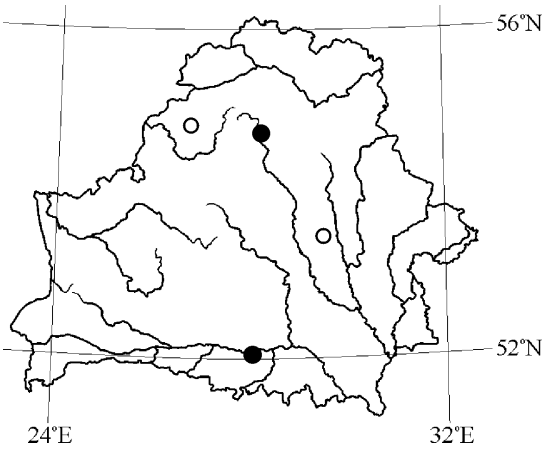

Fig. 2. Distribution of *Bankera fuligineoalba* in Belarus.

Ecology: The species is mycorrhiza-forming with *Pinus sylvestris* (Arnolds, 1989), producing basidiomata on soil, among mosses, in pine forests with *Cladonia, Pleurozium, Vaccinium* (Maas Geesteranus, 1975). Basidiomata were found single or in small groups in August–September.

Main limiting factors: Drastic reduction of *Cladonia–Pinus* forests in Belarus, destroying of forest litter as a result of human activity, limited number of populations.

Specimens examined: Byarezinski Biosphere Reserve (typological sample plot No. 3), coll. Z.V. Zakharova 23 VIII 1973 (MSK 3793). — Zhytkavichy district, Prypyatski Reserve, near Perarouski Mlynok, *Cladonia* spp.–*Pinus sylvestris* forest, coll. G.I. Serzhanina 13 VIII 1974 (MSK 23).

2. Cantharellus cinereus Pers. : Fr., Syst. mycol. **1**: 320-321, 1821.

Fig. 3–6.

Proposed category: Species of lower risk (LR), care demanding.

Conservation in other countries: It is included in Red Data List of Germany (Niedersachsen and Bremen), Netherlands (Arnolds, 1989), Denmark, Sweden, Norway, Finland.

Economic importance: The species is not widely known edible fungus. Though, there is information that *C. cinereus* has good food qualities (Anonymous, 1999).

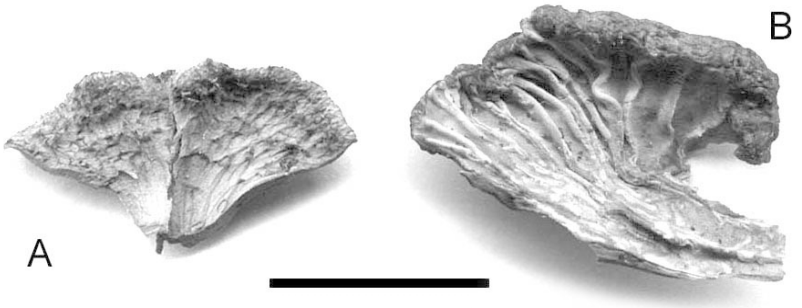

Fig. 3. Pileus and hymenophore of *Cantharellus cinereus*: A — pileus upper surface (MSK 3690), B — hymenophore (MSK 3733). Bar = 1 cm.

Morphology: Basidiomata near infundibuliform, of fibrous-fleshy consistency, as a rule growing in clusters with a common base. Pileus *ca.* 1–3 cm diam, depressed to funnel-shaped, gray brown, commonly with fibrous surface, covered by minute more or less uplifted scattered scales. Margin of pileus waved. Hymenophore venose or rugulose, decurrent on stipe, with folds 0.3–1.2 mm wide, smoky gray when fresh, frequently yellowish or pale brown in dry state. Stipe central, irregularly-cylindrical, solid, gray brown, when dry 0.7–3 × 0.1–0.65 cm, consisting of pigmented parallel hyphae 2.5–5 μm wide in outer layer, gradually turning into loosely arranged, interwoven hyaline hyphae 5.5–16 μm wide of central spongy part, both with clamped and simple septa. Upper side of pileus covered by the layer of hyphae with brownish yellow heterogeneous content, *ca.* 10 μm wide. Hyphae of trama with simple and clamped septa, hyaline, 3.3–12 μm wide, inflated up to 20 μm (in MSK 3690 with moderate inflations near some septa), mostly parallel arranged. Subhymenial hyphae 4.5–5.5 μm wide. Cystidial elements absent. Basidioles yellowish, with oily, strongly refractive content. Basidia subhyaline or hyaline, with or without guttules, narrowly clavate, more or less sinuous, 70–85 × 7.5–10 μm, with clamped base and big sterigmata 6.3–10.5 μm long. Spores broadly ellipsoid, narrow-

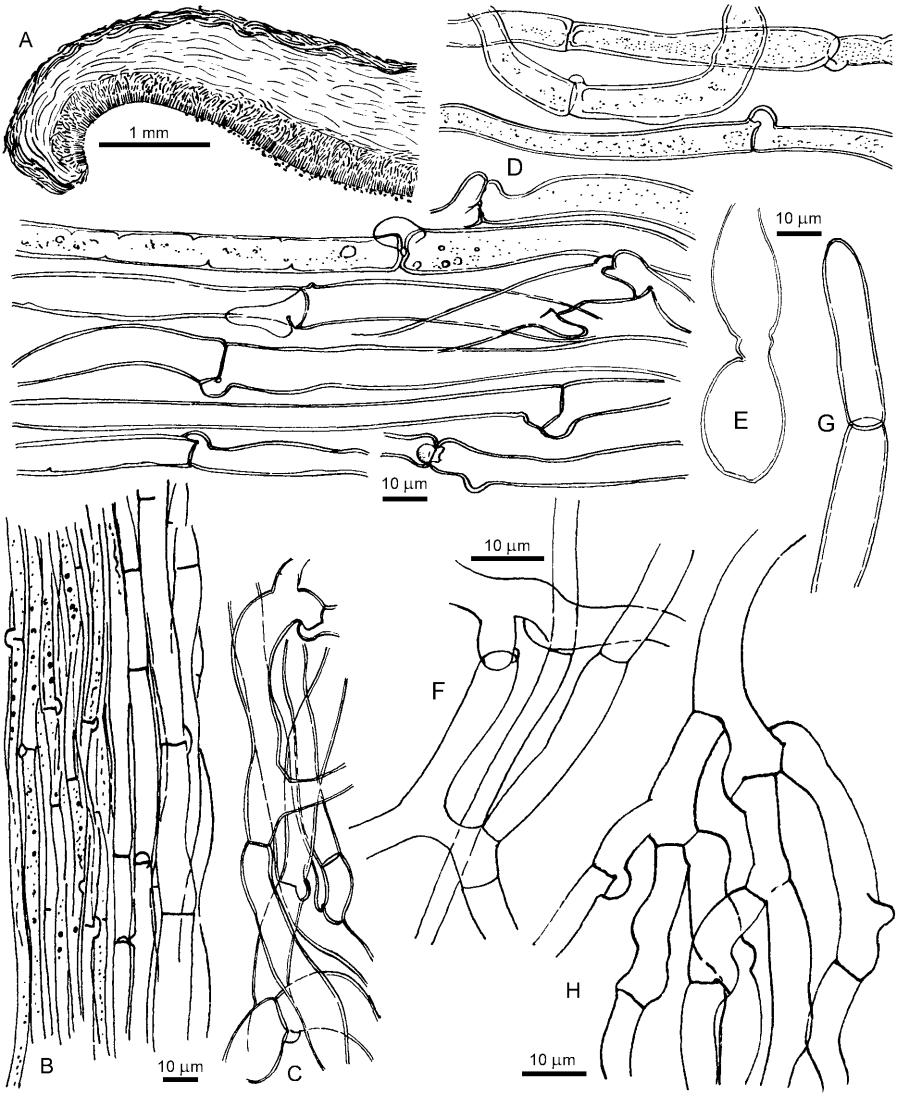

Fig. 4. Pileus section and hyphae of *Cantharellus cinereus*: A — vertical section of pileus, B — hyphae of stipe outer layer, C — hyphae of stipe central part, D — clamped hyphae of pileus trama, E —tramal hypha with inflations, F — clampless hyphae of pileus trama, G — hyphal end in pileus trama, H — subhymenial hyphae.

A–E, H — MSK 3733, F, G — MSK 3690.

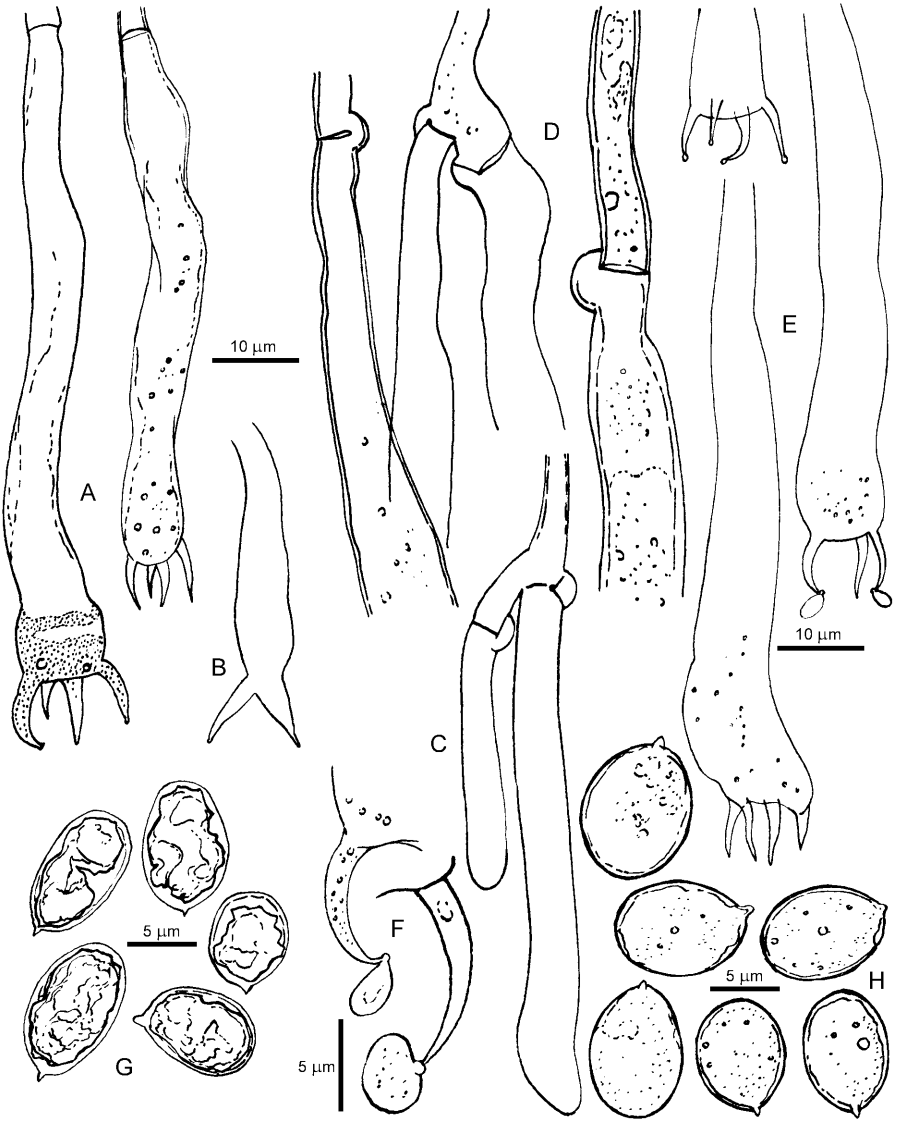

Fig. 5. Basidia and spores of *Cantharellus cinereus*: A — normal basidia, B — abnormal bi-sterigmate basidium, C — basidioles, D — basidial bases, E — upper portions of basidia, F — sterigmata with developing spores, G, H — spores.

A, B, G — MSK 3690, C–F, H — MSK 3733.

ly ellipsoid, ovoid, yellowish or pale olivaceous, (6) 8–11 (12) × 4.3–7.5 (9.3) μm, with slightly thickened wall and heterogeneous refractive oily content, with prominent thin-walled apiculus.

As a rule basidia of the species have 5 sterigmata (Hansen, Knudsen, 1997) or number of those is varying between 4–6. The small droplet forming during spore ontogenesis at spore base is well visible on *C. cinereus* basidia (fig. 5 F).

General distribution: Europe, N. America (Jülich, 1984; Anonymous, 1999).

Distribution in Belarus: The species is known from three sites based on herbarium data.

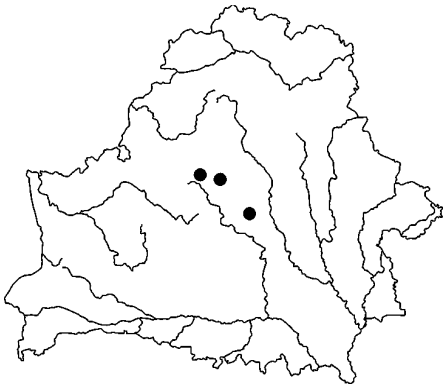

Fig. 6. Distribution of *Cantharellus cinereus* in Belarus.

Ecology: Mycorrhiza-forming species, associated with different trees and shrubs (Arnolds, 1989), confined presumably to leaf forests of *Oxalis* type, on rich soils. In MSK 3686 the basidiomata bases have apparent connection with living roots. Fructifications were registered in September.

Main limiting factors: Limited number of populations, narrow ecological amplitude of the species.

Specimens examined: Asipovichy district, near Dubrova (sample plot No. 2-3), *Oxalis acetosella–Quercus robur* forest, coll. O.S. Gapienko 30 IX 1978 (MSK 3733). — Minsk district, near Hlebkavichy, *Fragaria vesca–Oxalis acetosella–Frangula alnus–Corylus avellana–Populus tremula–Pinus sylvestris* forest (*Pinetum oxalidosum*), coll. D.I. Tret'yakov 23 IX 2000 (MSK 3690). — Minsk district, near Kryzhouka, *Aegopodium podagraria–Oxalis acetosella–Tilia cordata–Betula pendula* forest (*Betuletum oxalidosum*), in group scattered over the area 3 × 3 m, coll. D.I. Tret'yakov 27 IX 2000 (MSK 3686).

3. Ceraceomyces sulphurinus (P. Karst.) J. Erikss. et Ryvarden in J. Erikss. et al., Cort. N. Eur. **5**: 895, 1978.

Fig. 7–9.

Proposed category: Vulnerable. The species with resupinate, but conspicuous brightly colored fruitbodies.

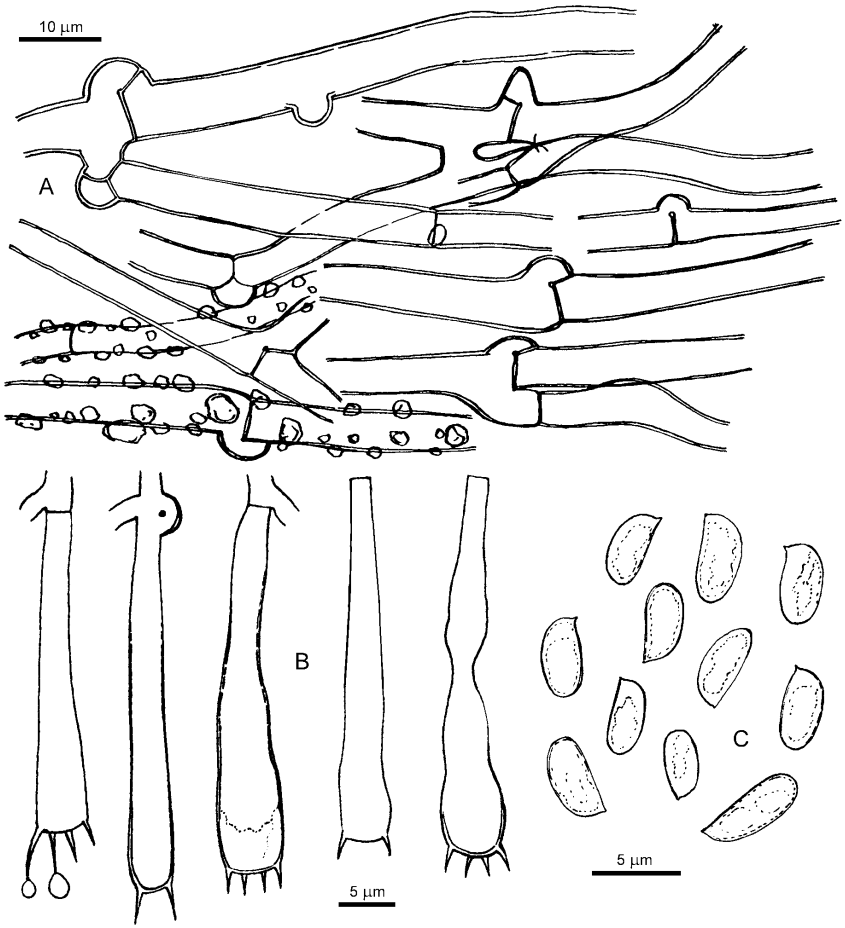

Fig. 7. *Ceraceomyces sulphurinus* (MSK 3952): A — subicular hyphae, B —basidia, D — spores.

Conservation in other countries: This is rare species in Europe, included in Red Data Lists of Sweden and Finland. The species is still little studied in ecological and geographical aspects.

Economic importance: Unknown.

Morphology: Basidioma effuse, pellicular (athelioid), cracking, up to 12 × 4 and more cm in extent, 0.1–0.5 mm thick, dirty-colored with sulphury yellow and pale brown areas. Margin bright yellow, more or less thinned or abrupt, with or without hyphal cords. Hymenophore even. Subicular hyphae loosely arranged, with big

Fig. 8. Basidioma of *Ceraceomyces sulphurinus* (MSK 3952).

clamps, thin-walled, 3.2–7 µm wide, smooth or loosely encrusted by big crystals. Subbasidial hyphae ca. 2.5 µm wide. Cystidia scarce, immersed, cylindrical, thin-walled, heavily and coarsely encrusted, in KOH solution smooth, *ca.* 50–60 µm long, 6.5–10 µm wide. Hymenium pellicular, rather dense. Basidia narrowly clavate, sometimes with constrictions, 30–33 × (3.3) 4–6 (7) µm, clampless or clamped at base, with 2 or 4 sterigmata. Spores narrowly ellipsoid to cylindrical, hyaline or subhyaline, moderately thin-walled, 3.3–6 (6.7) × 2–3 µm, inamyloid, indextrinoid.

General distribution: Europe, Asia, N. America (Jülich, Stalpers, 1980).

Distribution in Belarus: There is single site based on herbarium data.

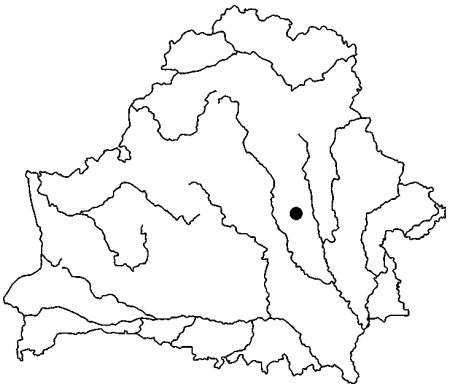

Fig. 9. Distribution of *Ceraceomyces sulphurinus* in Belarus.

Ecology: White-rot fungus on fallen wood of deciduous and coniferous trees (*Carpinus betulus* L., *Picea abies* (L.) Karst.). In Belarus it was collected on naked, moderately decayed wood. Fructifications were registered in September.

Main limiting factors: Very limited population, discontinuous distribution.

Specimen examined: Klichau district, near Ubalatstse, *Quercus robur* forest, on fallen wood of *Carpinus betulus*, coll. E.P. Komarova 21 IX 1963 (MSK 3952).

4. Clavariadelphus pistillaris (L. : Fr.) Donk, Rev. Niederl. Homob. Aphyll. **2**: 73, 1933.

Fig. 10.

Proposed category: Vulnerable.

Conservation in other countries: The species is included in Red Data Book of Lithuania (Gricius et al., 1992), Russia (Bondartseva et al., 1988), Leningrad region (Kovalenko et al., 2000), Karelia (Shubin, 1985), former USSR (Gorlenko et al., 1984), in Red Data List of Poland (Wojewoda, Ławrynowicz, 1992), Germany (Niedersachsen and Bremen, Saarland), and Netherlands (Arnolds, 1989).

Economic importance: Not edible on one source, like Serzhanina (1990), edible on another sources (Phillips, 1981; Shubin, 1985).

Morphology: Short morphological descriptions of the species are given in some Belarusan sources — Serzhanina (1990), Golovko and Serzhanina (1993).

General distribution: Europe, East Asia, N. America (Gorlenko et al., 1984). The species has clearly discontinuous distribution and is rare in East Europe in comparison with sporadic distribution in West Europe.

Distribution in Belarus: The species is known from five sites — Smalyavichy district (Kuprevich, 1931), Asipovichy, Ushachy, Zhytkavichy districts (Golovko, Serzhanina, 1993), Belavezhskaya Pushcha National Park (Mikhalevich, 1997), and mapped in Pruzhany district also by Golovko and Serzhanina (1993). Though, none specimens confirming these finds were deposited in MSK–F herbarium.

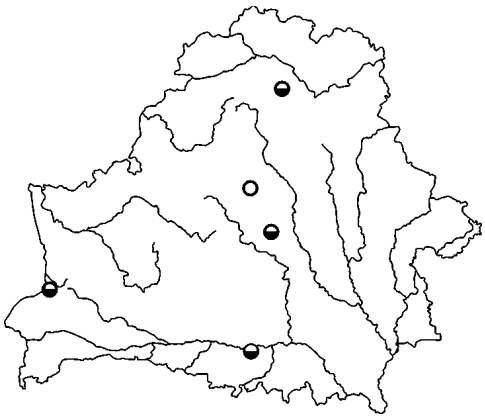

Fig. 10. Distribution of *Clavariadelphus pistillaris* in Belarus.

Ecology: The species is litter saprobic (Shubin, 1985) or supposedly mycorrhiza-forming (Arnolds, 1989), growing in broadleaf (*Carpinus*, *Tilia*), mixed, sometimes coniferous forests. It has attraction to rich, carbonate loam or clay soils (Phillips, 1981; Gorlenko et al., 1984; Arnolds, 1989). Fruitbodies occur in small groups, not rarely among mosses, in autumn.

Main limiting factors: Limited number of populations, rather narrow ecological amplitude.

5. *Clavicorona pyxidata* (Pers. : Fr.) Doty, Lloydia **10**: 43, 1947.

Fig. 11, 12.

Proposed category: Species of lower risk (LR).

Conservation in other countries: It is comparatively rare species in Europe (Jülich, 1984), included in Red Data Lists of Poland (Wojewoda, Ławrynowicz, 1992), Sweden, Norway.

Economic importance: The fungus is capable to grow[4] and to pruduce basidiomata in culture (Koske, Leathers, 1969; Dodd, 1972). This property together with good food qualities give it a potential of commercial species (James, McLaughlin, 1988). The species is deposited in CBS and FCUG.

Morphology: Basidioma clavarioid, up to five times verticillately (whorl-like) branched, pliable when fresh, brittle when dry, commonly pale yellow when fresh, in herbarium dark ochraceous or flesh-colored. In the studied specimen basidioma *ca.* 7 cm high and 5 cm wide. Basal part 2–2.5 mm wide, nearly cylindrical or flattened. Branches rounded or ribbed in transverse section, near 2 mm in diam, jug-like widened at the tip, with 6 marginal outgrowths, proliferating in new branches (like the thallus in some *Cladonia* species); apices ca. 0.1–0.3 mm wide. Contextual hyphae clamped, uneven, with smoothed swellings, (3) 4–11.5 µm wide. Gloeoplerous hyphae well developed, with simple septa, yellowish, 2–7.5 µm wide, united in fascicles, parallel arranged in context. Scattered gloeocystidia as tips of gloeoplerous hyphae coming into the hymenium present, 3–4 µm wide. Basidia clavate, 18–20 × 3.7–5.5 µm. Spores minute, short cylindrical or slightly curved, in part narrowed towards the apiculus, hyaline, thin-walled, (3.2) 3.5–5 × 1.7–2 µm, with or without guttules, weakly amyloid (in Melzer's solution grayish with rough surface).

We can describe subhymenial hyphae of *C. pyxidata* as more or less cylindrical, clamped, 1.5–1.7 µm wide. Following McAfee and Grung (1982) subhymenial hyphae consist of small rounded cells. Spores of the species have rather variable morphology, e.g. they are ovoid to pip-shaped, 2–4.5 × 2.5–3 µm according to McAfee and Grung (1982), or ellipsoid, 3.5–5.5 × 2–3 µm, minutely asperulous or warted following Dodd (1972) and Jülich (1984).

General distribution: Widely over Northern Temperate Zone — in Europe, Cauca-

[4] The data on growth of a species in culture in this section over the article are based on published information only, taking into account that theoretically all saprobic fungi are capable to grow *in vitro*.

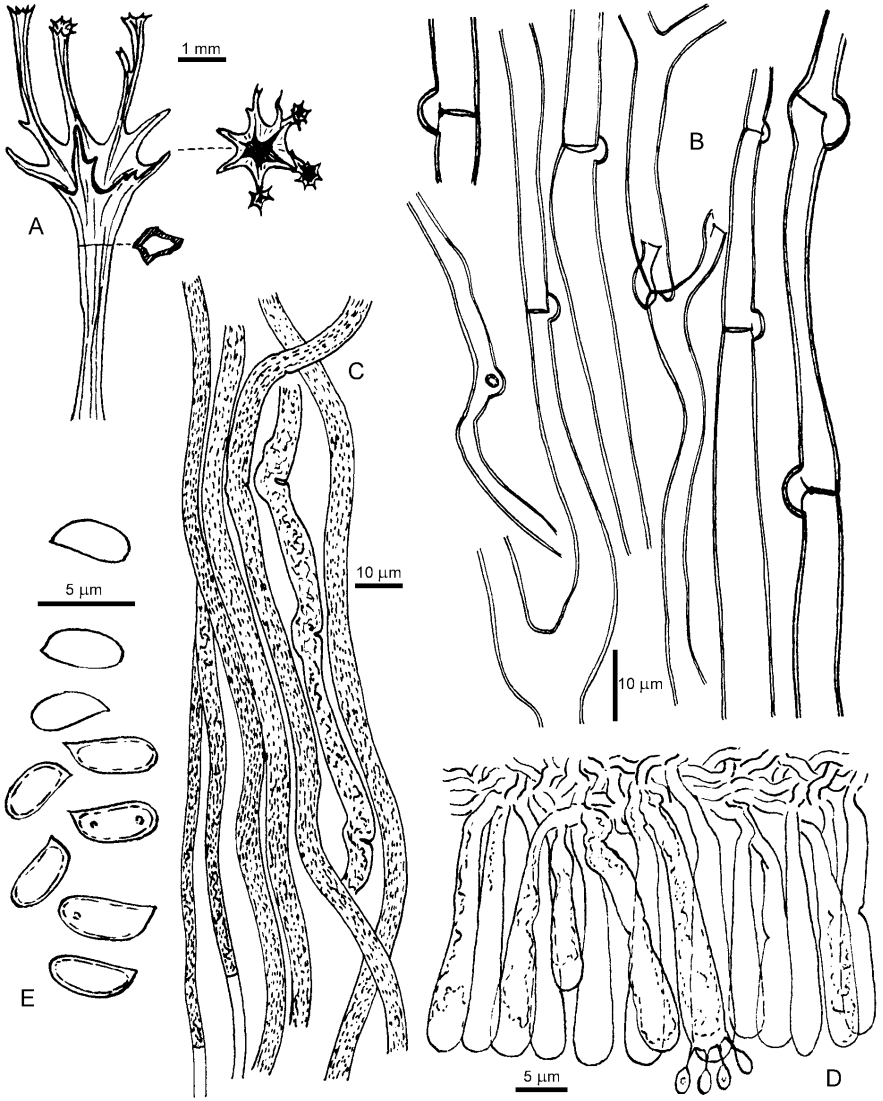

Fig. 11. *Clavicorona pyxidata* (MSK 3805): A — fragment of basidioma, B — medullar hyphae, C — gloeoplerous hyphae, D — hymenium, E — spores in KOH.

sia, West Siberia, Kazakhstan, Altai, Russian Far East, China, N. America, Central America (Parmasto, 1965; Dodd, 1972; Lickey et al., 2002). Parmasto (1965) characterized the distribution of the species in East Europe as "frequently".

Distribution in Belarus: Following the literature sources the species was found in Asipovichy and Smalyavichy districts and near town Valkavysk (Lebedewa, 1925; Kuprevich, 1931; Tumiłowiczówna, 1935). One of the specimens analyzed by Dodd (1972: 766) has the next information: "Minsk district, coll. Savicz s.n. 26 VIII 1924" (fig. 11, "S"). Thus, most of the finds in the republic were made in the first half of XX century, since 1978 the species was not registered. This fact permits to attribute "LR" category to it, taking into consideration more dense distribution of the species in adjacent countries (e.g. northwest Russia — Bondartseva et al., 1999).

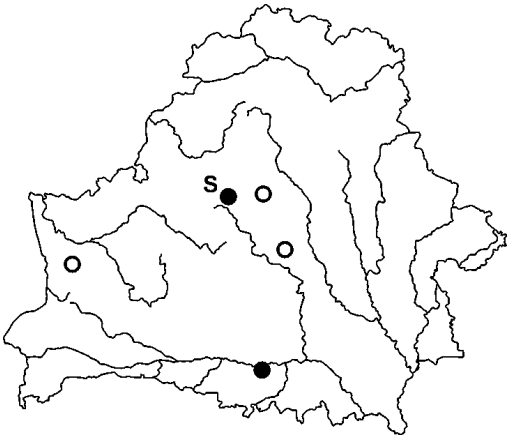

Fig. 12. Distribution of *Clavicorona pyxidata* in Belarus.

Ecology: White-rot fungus, colonizing well-decayed wood of deciduous (presumably *Populus*), rarely coniferous arboreous plants (Parmasto, 1965; Jülich, 1984). In Belarus the species was found on fallen wood and stumps of *Betula* sp. (Kuprevich, 1931) and *Populus tremula*. Fructifications were observed from July to September.

Main limiting factor: Limited number of populations.

Specimen examined: Near Turau (Turau forest economy), supposedly Zhytkavichy district, *Majanthemum bifolium–Oxalis acetosella–Quercus robur* forest (*Quercetum oxalidosum*), on fallen well-decayed wood of *Populus tremula*, coll. A.I. Golovko 27 VIII 1978 (MSK 3805).

6. Dentipellis fragilis (Pers. : Fr.) Donk, Persoonia **2 (2)**: 233, 1962.

Fig. 13–15.

Proposed category: Endangered. The species with resupinate, but conspicuous light colored hydnoid fruitbodies.

Conservation in other countries: The species is included in Red Data Book of Leningrad region (Kovalenko et al., 2000), in Red Data Lists of Poland (Wojewoda, Ławrynowicz, 1992), Finland (Kotiranta, Niemelä, 1996), Denmark, Sweden, Norway.

Economic importance: Unknown. The species is able to grow in culture and deposited in CBS and FCUG.

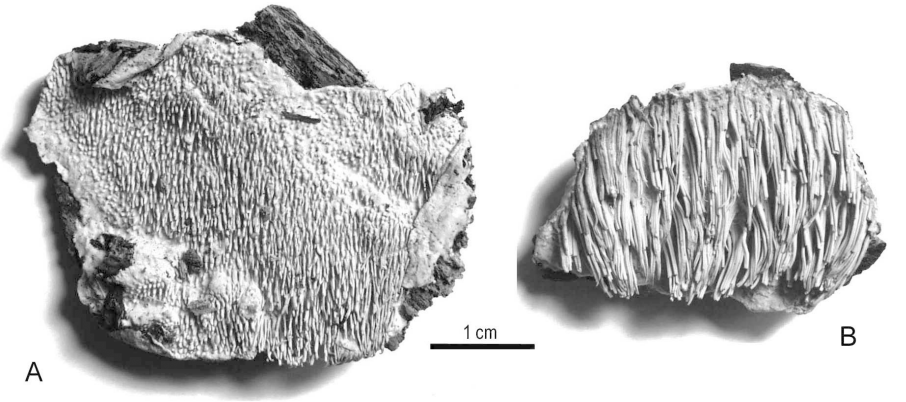

Fig. 13. Basidiomata of *Dentipellis fragilis*: A — MSK 3936, B — MSK 3598.

Morphology: Basidioma resupinate, membranaceous, fragile when dry, *ca.* 5–10 x 1.5–3.5 or more cm in extent. Margin abrupt or (in young basidiomata) mould-like, appressed, but very easily detachable, frequently in-rolled in dry state. Subiculum 0.1–2.6 mm thick, loose. Abhymenial surface even or rugose, cream or yellow. Hymenophore hydnoid, cream to dark cream. Surface between spines of the same color or pale. Spines subulate or conical, 0.5–9 × 0.1–0.4 mm, loosely arranged (up to 1.5 mm apart) or crowded, sometimes glued in dry material, as a rule strongly declined or appressed to the subiculum, commonly confluent at bases in aggregates *ca.* 3.5 mm wide. Margin zone without theeth 2–5 mm wide, whitish. Hyphae clamped, 2.5–3.3 µm wide, with refractive or non-refractive content. Cystidia numerous, with refractive content, fusiform in outline, 65–110 µm long and 4.5–7.5 µm wide, with 4–10 and more constrictions in upper portion (moniliform), sometimes without constrictions, or fusoid with a minute segment at the tip. Cystidial segments 3.3–10.5 × 4.3–6.3 µm. Basidia clavate or utriform, 27–37 × 4.5–7 µm. Spores globose to widely ellipsoid, smooth or rough with very minute echinuli, (3.7) 4–6.3 × (3.3) 4.5–5.5 (6) µm, strongly amyloid — bluish gray to blackish in Melzer's solution or IKI.

In basidiomata developing on lateral side of trunks toothless areas up to 5 mm wide are present. Sometimes in such fruitbodies downwards oriented spines set the tips against the underlying subiculum. Cystidia with constrictions are more appropriate to long-spine forms or developmental stages.

General distribution: Europe, Caucasia, Siberia, Middle Asia, Russian Far East, South Asia (Nikolajeva, 1961; Jülich, Stalpers, 1980; Niemelä, Saarenoksa, 1985).

Distribution in Belarus: There are four sites in Ivanava, Pruzhany, Zhytkavichy districts.

Ecology: White-rot fungus, colonizing well-decayed naked fallen wood of leaf trees

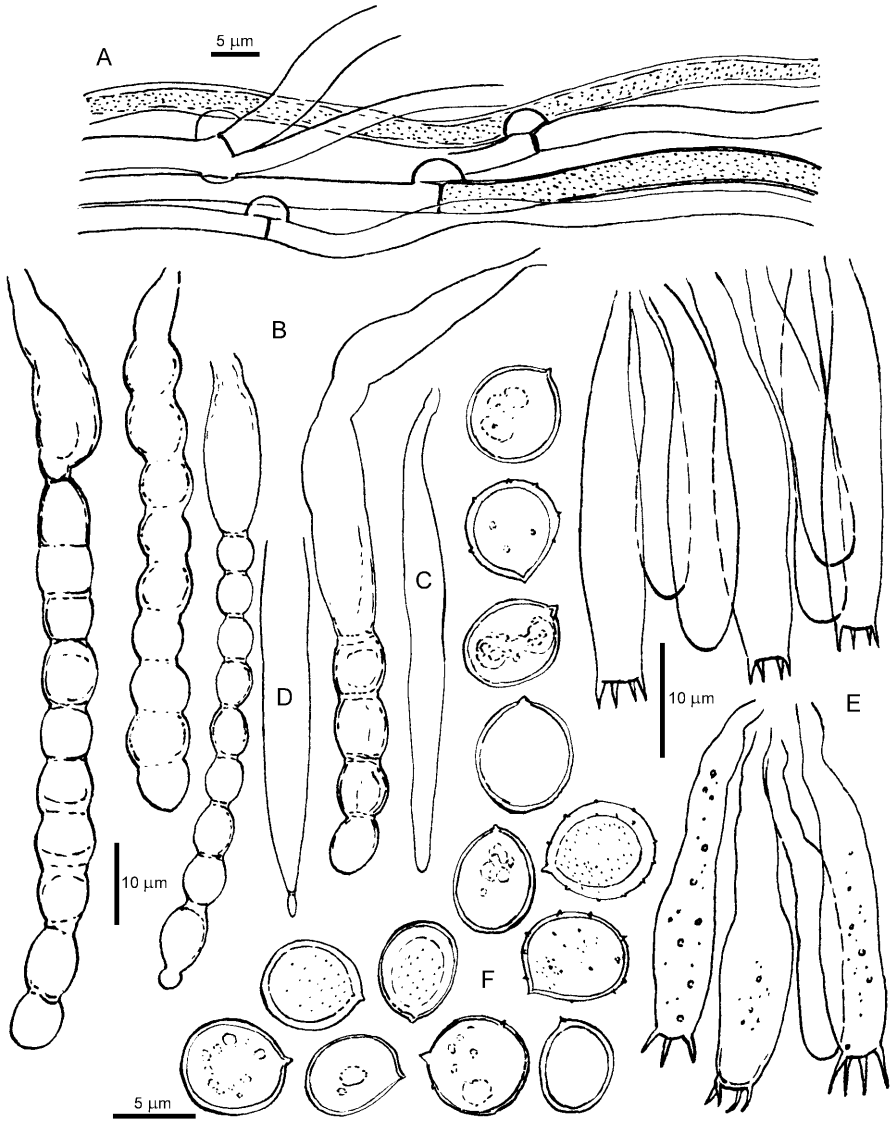

Fig. 14. *Dentipellis fragilis*: A — hyphae, B — moniliform gloeocystidia, C — even fusoid cystidium, D — cystidium with a minute apical segment, E — basidia and basidioles, F — spores.

A–C, E, F — MSK 3598, D — MSK 3599

(*Acer platanoides* L., *Alnus glutinosa* (L.) Gaertn., *Carpinus betulus*; outside of Belarus was reported from *Betula*, *Padus*, *Populus*, *Quercus*, *Sorbus*, *Tilia*, *Salix*), mostly in moist or dampish, shady forests (Niemelä, Saarenoksa, 1985; Koski-Kotiranta, Niemelä, 1987). The species is regarded as indicator of forest communities minimally affected by human activities (Parmasto E., Parmaso I., 1997). Though, it regard by Koski-Kotiranta and Niemelä (1987) as slightly hemerophilous. Fructifications were registered in July–September.

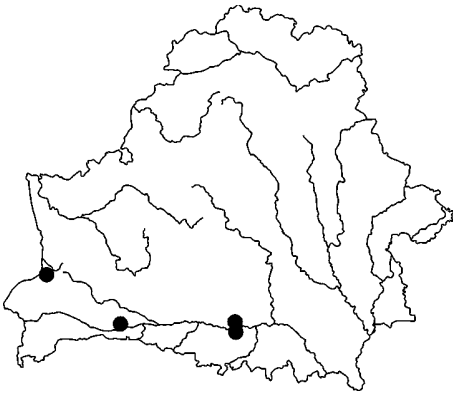

Fig. 15. Distribution of *Dentipellis fragilis* in Belarus.

Main limiting factors: Limited number of populations, lowering of groundwater level and drying of swamp forest ecosystems.

Specimens examined: Pruzhany district, Belavezhskaya Pushcha, near Khvoiniki, broadleaf forest, on fallen wood of *Carpinus betulus*, coll. E.P. Komarova 13 IX 1957 (MSK 3598).— ibid., moss–*Picea abies* forest, on fallen wood of *Alnus glutinosa*, coll. E.P. Komarova 14 IX 1957 (MSK 3597). — Zhytkavichy district, Prypyatski Reserve, near Perarouski Mlynok, damp mixed broadleaf forest, on fallen wood of leaf tree, coll. E.P. Komarova 31 VII 1958 (MSK 3600). — Ivanava district, near Zavishcha, mixed broadleaf forest, on fallen wood of *Acer platanoides*, coll. E.P. Komarova 29 VIII 1958 (MSK 3599). — Zhytkavichy district, near Naida (Naida forestry), *Urtica dioica–Alnus glutinosa* forest, on fallen wood[5] of *Corylus avellana* or *Fraxinus excelsior*, coll. A.I. Golovko 21 VIII 1967 (MSK 3596).

7. Hericium coralloides (Scop. : Fr.) Pers., Neues Mag. Bot. **1**: 109, 1794. — *H. clathroides* (Pall. : Fr.) Pers.

Fig. 16, 17.

Proposed category: Endangered.

Conservation in other countries: This is rare or sporadically distributed species in Europe and popular object of conservation in a number of countries. The species produces striking esthetically attractive fruitbodies. It is included (also under the

[5] Subiculum of this specimen is associated with shoots of living mosses, like *Brachythecium* sp.

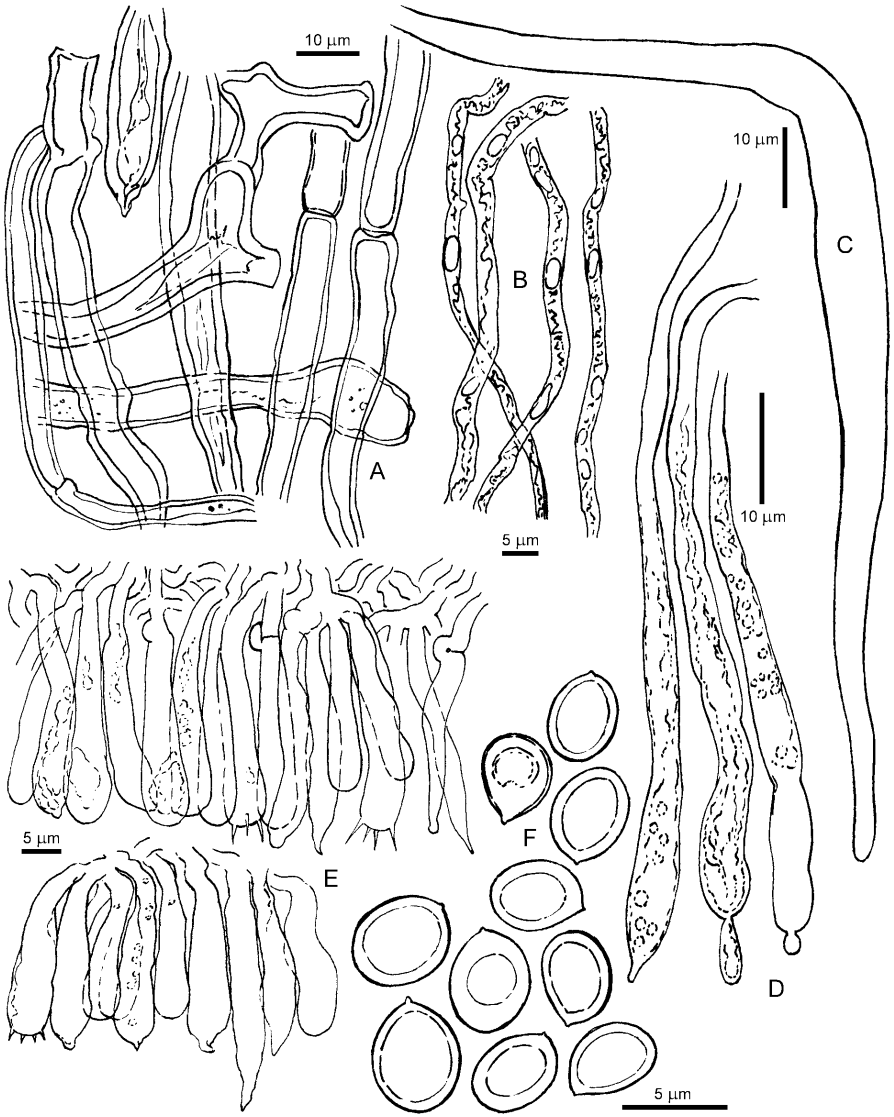

Fig. 16. *Hericium coralloides* (MSK 3581a): A — tramal hyphae, B — gloeoplerous hyphae, C — typical gloeocystidium, D — upper portions of gloeocystidia, E — two fragments of hymenium, F — spores.

epithet *H. clathroides*) in Red Data Book of Lithuania (Gricius et al., 1992), Russia (Bondartseva at al., 1988), Karelia (Shubin, 1985), Tatarstan Republic, in Red Data Lists of Poland (Wojewoda, Ławrynowicz, 1992), Germany, Netherlands (Arnolds, 1989), Denmark, Sweden, Norway.

Economic importance: The species is edible when young (Serzhanina, 1990). It is capable to grow in culture (Stalpers, 1978; Hallenberg, 1983) and deposited in CBS and FCUG.

Morphology: Basidioma up to eight times branched, of coralloid appearance, almost spherical or hemispherical in outline, 10–15 and more cm in diam, on short stipe-like base, soft-pliable or with fibrous tissue when fresh, more or less brittle when dry, whitish when fresh, pale brown or yellow brown when dry. Branches anastomosing in the basal part, thinning up to 0.7 mm towards the tip, covered presumably in terminal part by mostly downwards oriented and arranged in rows subulate hymenophore spines 1–9 × 0.2–0.5 mm. Hymenium on spines. Hyphae in trama of branches and spines thick-walled, 5–12 µm wide, clampless, with swellings. Subhymenial hyphae 2–4 µm wide. Gloeoplerous hyphae 1.7–3.7 µm wide. Gloeocystidia common or scattered, fusiform, rarely narrowly clavate, originating from contextual gloeoplerous hyphae and coming into the hymenium by narrowed tips, *ca.* 65–100 µm long and 4.5–7 µm wide, with or without shallow constrictions, tip blunt, rounded, mucronate or with a small clavate outgrowth. Basidioles with blunt or some acute and wrinkled tips present in hymenium, 16–30 × 4.2–5.5 µm. Basidia clavate, in part with a constriction near the tip, 16–25 × 3.3–5 µm, with four sterigmata up to 3–3.3 × 0.7 µm. Spores broadly ellipsoid or almost ovoid, almost colorless, smooth, with thickened wall, (2.3) 4.2–4.5 (5.5) × (2) 3–4.5 µm, greenish-yellow, bluish-gray or blackish when treated by iodine reagents.

Serzhanina (1990) described the hymenophore spines up to 15 mm long. According to Stalpers (1996) all spores are roughened or verrucose.

General distribution: Europe, Caucasia, Siberia, Russian Far East, N. America, South and Southeast Asia, Australia (Nikolajeva, 1961; Maas Geesteranus, 1971).

Distribution in Belarus: There are seven sites based on herbarium data, and additionally several localities of the fungus in Brest, Dokshytsy, Hrodna, Minsk, Mahilyou, Petrykau, and Rechytsa districts were reported and mapped in Red Data Book (Golovko, Serzhanina, 1993).

Ecology: White-rot fungus, inhabiting big-size fallen wood, dead unfallen trunks and large branches, stumps; sometimes basidiomata occur in trunk holes (Serzhanina, 1990). The species is confined presumably to wood of *Alnus glutinosa* and *Betula* spp., also occurs on *Abies alba* Mill., *Acer platanoides*, *Carpinus betulus*, *Fraxinus excelsior* L., *Quercus petraea* (Mattuschka) Liebl., *Q. robur* L. (Komarova et al., 1968; Mikhalevich, 1997), and inhabits presumably oak forests. Outside of Belarus it was reported also from *Populus*, *Salix*, *Sorbus*, *Tilia*, and *Ulmus* wood. The species is slightly hemerophobic and has indicator value for minimally affected forest ecosystems (Koski-Kotiranta, Niemelä, 1987; Parmasto E., Parmasto I., 1997). Nevertheless, there are data on its occurring in parks (Serzhanina, Yashkin, 1986; Serzhani-

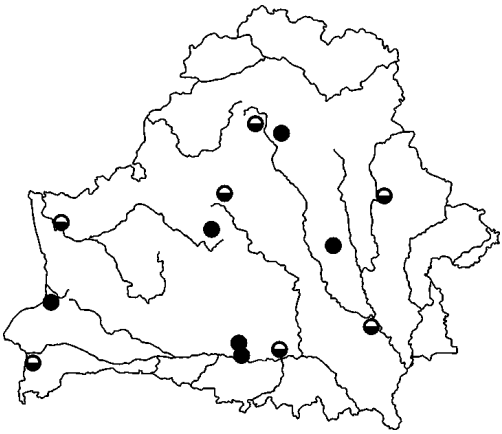

Fig. 17. Distribution of *Hericium coralloides* in Belarus.

na, 1990). The species is known as saprobic, but we suppose the capability of it to develop on dying wood. Fructifications were observed from June to September.

Main limiting factor: Limited number of populations.

Specimens examined: Zhytkavichy district, near Yurkevichy (forest sq. No. 93), *Sphagnum* spp.–*Pinus sylvestris* boggy forest, on dead unfallen tree of *Betula* sp., coll. E.P. Komarova 19 VIII 1956 (MSK 3582). — Belavezhskaya Pushcha, supposedly Pruzhany district, moss-*Picea abies* forest, coll. E.P. Komarova 13 IX 1957 (MSK 3585). — Klichau district, near Ubalatstse, coll. E.P. Komarova VIII 1963 (MSK 3584). — ibid., *Oxalis acetosella–Quercus robur* forest, coll. E.P. Komarova (without date; MSK 3583). — ibid., coll. E.P. Komarova 21 IX 1963 (MSK 3581a, b, c). — Belavezhskaya Pushcha (forest sq. No. 325), mixed forest, fallen wood of *Alnus glutinosa*, coll. A.I. Golovko 28 IX 1964 (MSK 3580). — Zhytkavichy district, near Borki, *Aegopodium podagraria–Quercus robur forest*, coll. O.S. Gapienko 24 VIII 1978 (MSK 3794). — Zhytkavichy forest economy, supposedly Zhytkavichy district, *Quercus robur* forest, on fallen wood of *Betula* sp., coll. A.I. Golovko and N.A. Novikov 25 VIII 1978 (MSK 3866a, b, c). — Neharelae forest economy, supposedly Dzyarzhynsk district, on stump of *Betula* sp., coll. A.I. Golovko VIII 1983 (MSK 3856). — Lepel' district, on the NE border of Byarezinski Biosphere Reserve, near Tsyareshki, on trunk of supposedly living *Pinus sylvestris*, coll. D.B. Belomesyatseva and T.G. Shabashova 28 IX 1999 (MSK 3577).

8. Phlebia albomellea (Bondartsev) Nakasone, Mycologia **88 (5)**: 766, 1996.

Fig. 18, 19, 22.

Proposed category: Endangered. The species with resupinate, but conspicuous orbicular or cup-like fruitbodies.

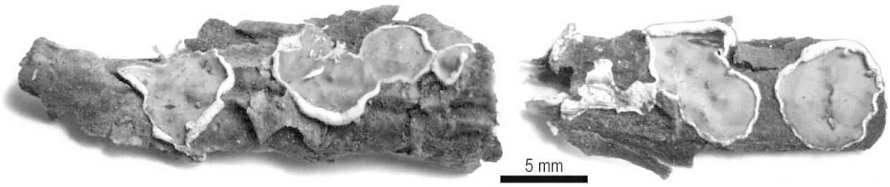

Fig. 18. Basidiomata of *Phlebia albomellea* (MSK 5574).

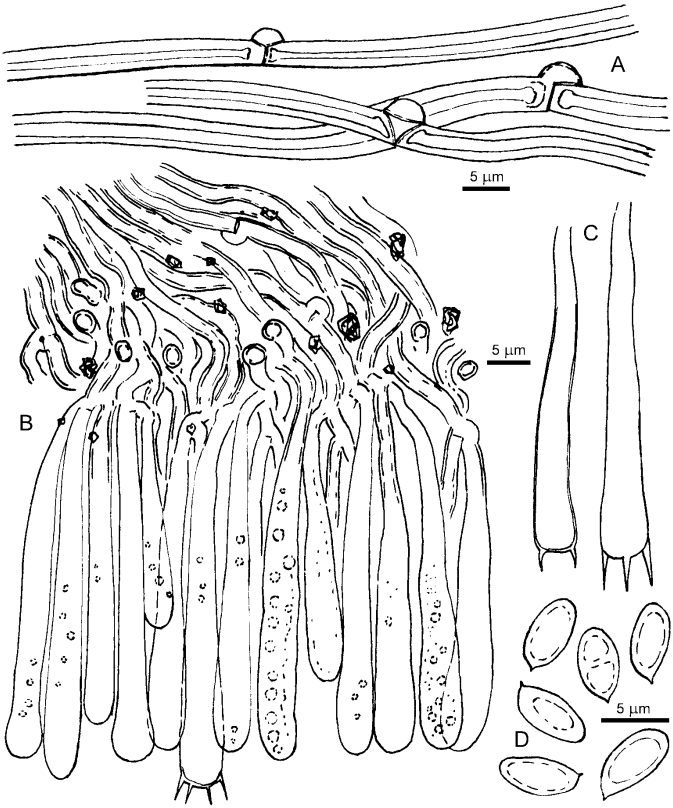

Fig. 19. *Phlebia albomellea* (MSK 5574): A — subicular hyphae, B — hymenium and subhymenium, C — basidia, D — spores.

Conservation in other countries: Rare species in Europe, included in Swedish Red Data List.

Economic importance: Unknown. The species is capable for growth is culture (Nakasone, 1996) and deposited in CBS.

Morphology: Basidiomata rounded, then confluent, about 2.5–17 × 1.5–13 mm, almost cup-like, 0.07–0.3 mm thick. Hymenophore even, dark ochraceous to yellowish brown with tobacco tint. Abhymenial surface white, velvety. Margin commonly with white velvety border *ca.* 0.2 mm wide. Reflexed part of basidioma up to 4 mm wide. Subicular hyphae clamped, hyaline, thick-walled, *ca.* 3.3 µm wide. Subhymenial hyphae *ca.* 2.5 µm wide, with thickened walls. Cystidial elements absent. Basidioles with refractive or hyaline content, 4–4.5 µm wide. Basidia clavate, 30–40 × 4.5–5.5 µm, at base with clamp-connection coincident with branching. Spores elongate ellipsoid or short cylindrical, 6 × 3–3.3 µm, amyloid.

Thickened walls of subhymenial and subicular hyphae are well visible on vertical section of basidioma, where some horizontally arranged hyphae are transversely cutted (fig. 19 B).

General distribution: Europe, Southwest Asia (Iran), N. America (Hallenberg, 1981; Nakasone, 1996).

Distribution in Belarus: Single known site in West part of Belarus, near the borders with Poland and Lithuania (fig. 22).

Ecology: White-rot fungus on fallen and still-attached dead branches of coniferous and deciduous species (*Corylus*, *Pinus*, *Quercus*).

Main limiting factors: Obviously very limited populations and discontinuous distribution, regardless the ability to colonize occurring everywhere *Pinus sylvestris* wood.

Specimen examined: Hrodna district, near Kalety, *Pleurozium schreberi–Juniperus communis–Pinus sylvestris* forest, underside on fallen branch of *Pinus sylvestris*, coll. E.O. Yurchenko 17 VII 1998 (MSK 5574).

9. Punctularia strigosozonata (Schwein.) P.H.B. Talbot, Bothalia **7 (1)**: 143, 1958.

Fig. 20–22.

Proposed category: Species of lower risk (LR).

Conservation in other countries: The species is included in Red Data List of Finland.

Economic importance: Unknown. The species is able to grow in culture and deposited in CBS and FCUG.

Morphology: Basidiomata about 0.6–4.5 × 0.6–2.5 cm, ceraceous-membranaceous, 0.1–0.25 (0.6) mm thick, totally resupinate and orbicular when young (with adherent or free margin), then confluent and with reflexed pileus-like parts up to 24 × 9 mm and more, sometimes of imbricate arrangement. Pileus surface coarsely rough or wrinkled, violaceous brown, dark, tomentose when young, margin area distinctly in-rolled, zonate, yellowish brown at the edge. Hymenial surface dark vinaceous red (Latin name of color: *umbrosus*), towards the margin zonate, turning into castaneous and then yellowish brown zone, moderately wrinkled, mostly with radiating folds, sometimes big-tuberculate in the center of basidioma. Basidiomata 3-layered. Abhymenial layer (pileus tomentum) composed of brown thick-walled hyphae

united in fascicles, gradually turning into subicular hyaline or yellowish hyphae with gelatinized walls, *ca.* 3–4.3 µm wide. Crystalline conscretions up to 50 µm in diam present in subiculum. Subhymenium with grainy incrustation between hyphae; subhymenial hyphae tightly packed, moderately thin-walled, 1.7–2.5 µm wide. Some parts of subhymenium loose, demonstrating hyphae with simple and clamped septa (fig. 20 G). Basidioles narrowly clavate, 2.5–3.3 µm wide. Dendrohyphidia abundant, up to 2.5 µm wide, forming catahymenium *ca.* 8 µm thick, with abundant brown-pigmented crystalline masses. Spores hyaline or pale yellow, slightly thick-walled, (5.5) 6–8 (9) × (2.7) 3–4 µm.

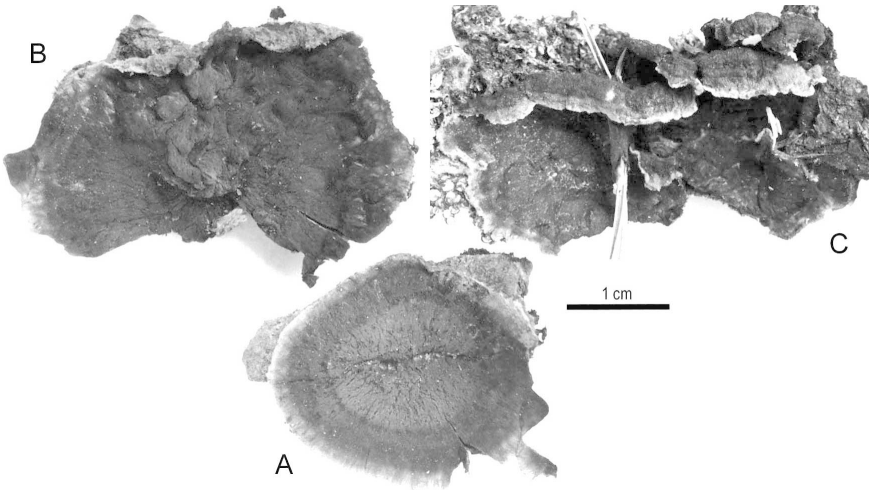

Fig. 20. Basidiomata of *Punctularia strigosozonata* (MSK 5472): A — discoid with free margin and zonate hymenial surface, B — resupinate with slightly reflexed margin, C — with effused part and typical reflexed pilei with zonate margin.

Growing basidiomata of the fungus commonly include fallen plant particles. Subicular gloeocystidia were described for *P. strigosozonata* by Parmasto (1960) and others (e.g. Domański, 1991), but these structures were not observed in examined material. Nevertheless, the length of most basidiospores more than 6.5 µm fits in the species concept of *P. strigosozonata* in comparison with *P. subhepatica* (Berk) Hjortstam. Mature basidia are very scattered elements in *P. strigosozonata*, and were never observed by us. In MSK 5472 rounded thin-walled guttulate bodies of unknown nature were found between subicular hyphae (fig. 20 E). In general appearance of content they were similar with subicular hyphae of *P. strigosozonata*.

General distribution: East and North Europe, Siberia, South Asia, N., Central, and S. America, South Africa, Madagascar, Australia, Oceania (Parmasto, 1960). The

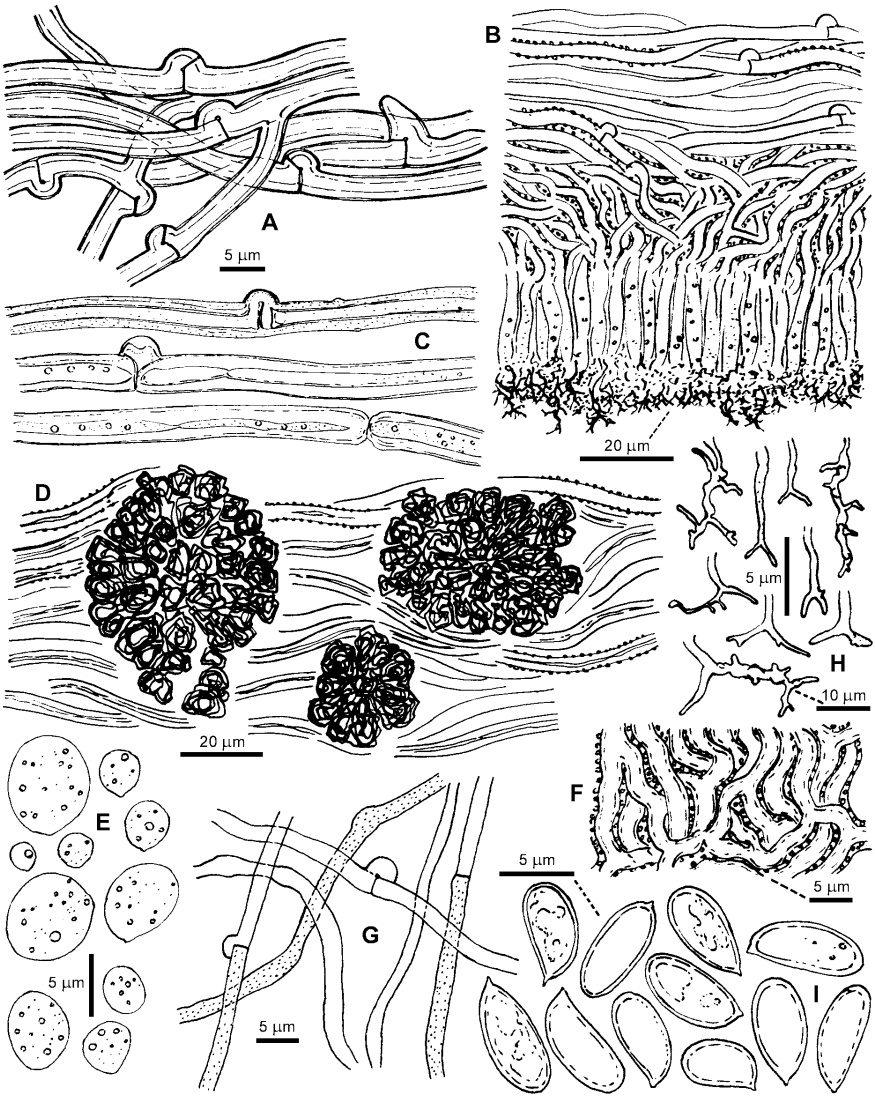

Fig. 21. *Punctularia strigosozonata*: A — hyphae of abhymenial layer, B — vertical section of basidioma, C — subicular hyphae, D — crystalline concretions in subiculum, E — rounded bodies from subiculum, F — closely packed subhymenial hyphae, G — occasional loosely arranged subhymenial hyphae, H — dendrohyphidia, I — spores.

A–C, E–H, — MSK 5472, D, I — MSK 6032.

species is exclusively rare in West Europe (only a site in Finland is known for this region) and rare in East Europe (Parmasto, 1960; Bondartseva et al., 2000), but common in more east regions (e.g. West Siberia). Perhaps, the limiting factor in West Europe is scanty distribution of aspen forests, taking into consideration that the main host is *Populus tremula*. The conspecifity of quite isolated populations from different continents, inhabiting hosts of distant phylogenetic position is need to be proved in further investigations.

Distribution in Belarus: There are five sites confirmed by herbarium material (fig. 22). Four of they follow from MSK collections and one (in Dzmitravichy forest, Kamyanets district) is based on LE specimen, collected by M.A. Bondartseva and E. Parmasto (fig. 22, "BP"; Bondartseva et al., 2000). The species was reported also from Ivanava, Valozhyn, and Zhytkavichy districts (Komarova, 1966).

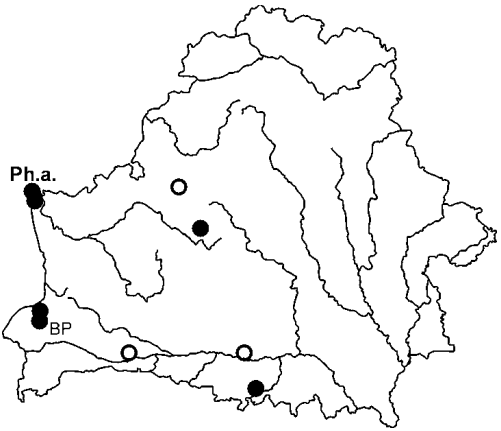

Fig. 22. Distribution of *Punctularia strigosozonata* and *Phlebia albomellea* (marked "Ph.a.") in Belarus.

Ecology: Saprobic species, causing white rot and colonizing wood of deciduous trees (*Acer*, *Alnus*, *Betula*, *Populus*, *Quercus*, *Salix*, *Sorbus* — Bondartseva et al., 2000). All finds in Belarus were made on *Populus tremula*.

Main limiting factor: Limited number of populations.

Specimens examined: Lel'chytsy district, near Baravoe, *Oxalis acetosella–Quercus robur* forest, on fallen wood of *Populus tremula*, coll. E.P. Komarova 22 VII 1963 (MSK 3941). — Hrodna district, near Kalety, *Pleurozium schreberi–Juniperus communis–Pinus sylvestris* forest, on thick fallen branch of *Populus tremula*, also on living thalli of a crustose and a foliose lichen, coll. E.O. Yurchenko 17 VII 1998 (MSK 5472). — Stoubtsy district, near Kolasava, *Pleurozium schreberi–Pinus sylvestris* forest, on fallen trunk of *Populus tremula*, coll. N.G. Kordiyako 14 IX 2000 (MSK 3644). — Kamyanets district, Belavezhskaya Pushcha National Park, near Vyalikiya Selishcha, *Oxalis acetosella–Populus tremula–Picea abies* forest (*Piceetum oxalidosum*), on upper side of big fallen trunk of *Populus tremula*, coll. E.O. Yurchenko 25 VI 2001 (MSK 6032).

10. Scytinostroma odoratum (Fr. : Fr.) Donk, Fungus **26**: 20, 1956.

Fig. 23–26.

Proposed category: Vulnerable. The species with resupinate, but conspicuous (when well developed) light colored fruitbodies.

Conservation in other countries: This is rare species in Europe, included in Red Data List of Poland (Wojewoda, Ławrynowicz, 1992), Norway, and Finland.

Economic importance: Unknown.

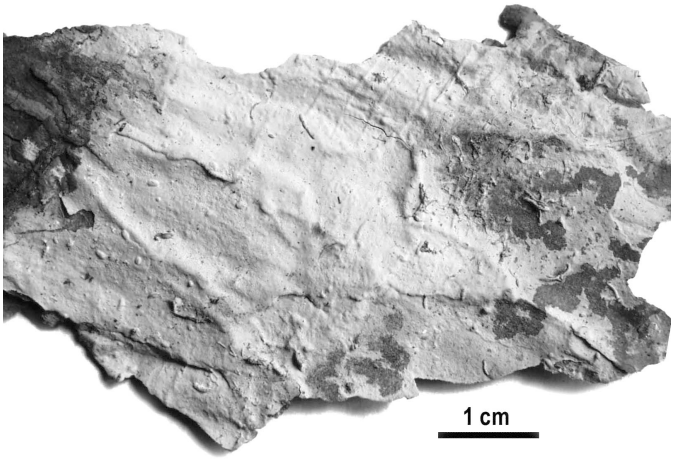

Fig. 23. Basidioma of *Scytinostroma odoratum* (MSK 4931).

Morphology: Basidioma totally effuse, coriaceous or subceraceous, cream, dark cream, grayish ochraceous or pale brown, up to 10–15 × 5 and more cm in extent, 0.1–0.25 mm thick (in some places 0.03 mm thick), *ca.* 1 mm thick in layered form (described below). Margin adnate, abrupt or thinning. Hymenophore even or tuberculate, cream-colored. Skeletal hyphae numerous, especially in young fruitbodies, with "scytinostromoid" ramification (fig. 23 G), about 0.5–2 µm wide, thinned out (thread-like) towards the apices, sometimes rightly or almost so dichotomously branched (fig. 23 H). Generative hyphae clampless, 1.5–3.3 µm wide. Gloeocystidia cylindrical or fusiform, with granulose, strongly refractive content, 18–50 µm long and 3–6 µm wide. Immature non-refractive gloeocystidia present in hymenium, fusiform or irregularly cylindrical, with or without constrictions, apex blunt or tapering, 20–32 × 2.5–6.3 µm. Basidioles *ca.* 11 µm long, mostly urniform. Spores ellipsoid, short cylindrical to navicular, with blunt to acute well-pronounced apiculus, hyaline to pale yellowish brown, commonly with heterogeneous content, with thickened wall that well visible on empty coats, 5.5–8.5 × 3–5 µm.

We cannot judge with precision about the morphology of mature basidia because of they are very scarce in examined material. This fact can witness about

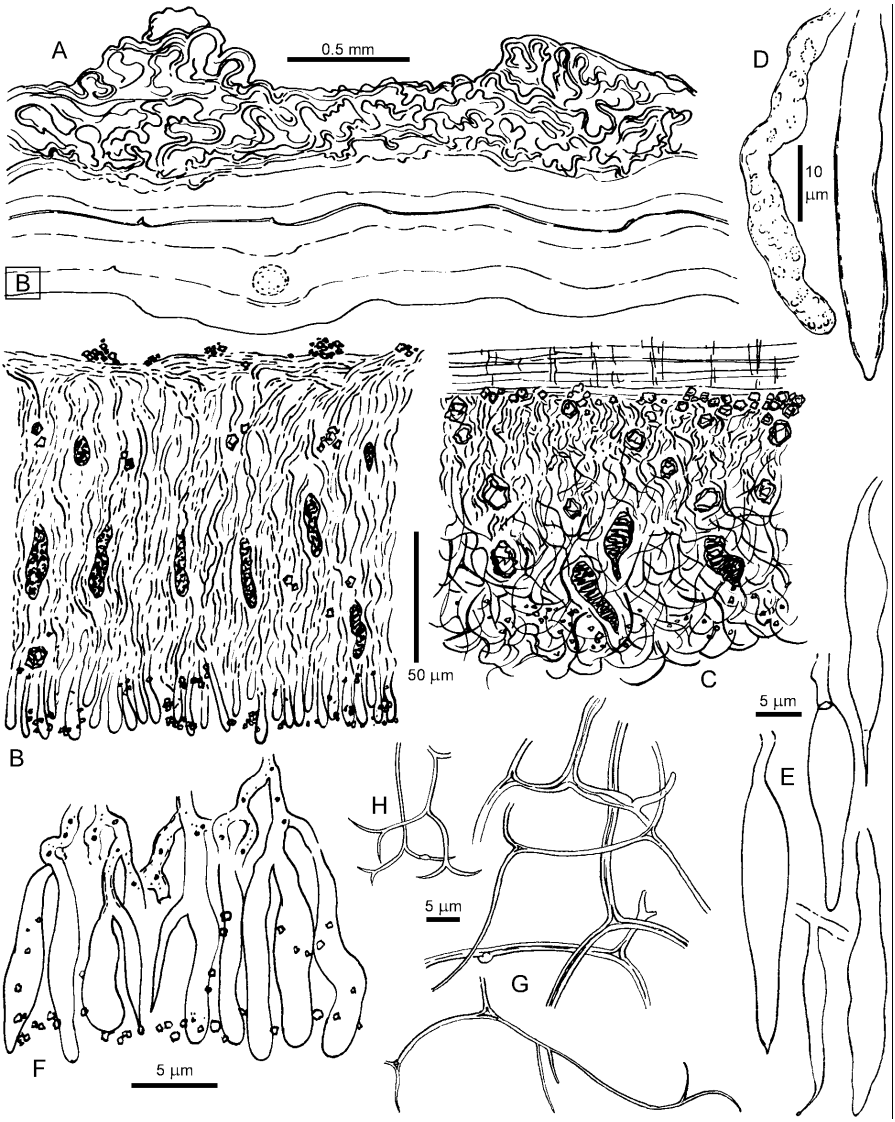

Fig. 24. *Scytinostroma odoratum*: A — vertical section through multi-layered basidioma, B — the latest layer of basidioma, C — vertical section through young basidioma, D, E — cystidia, F — a portion of hymenium, G, H — skeletal hyphae.

A, B, F — MSK 3916, C, H — MSK 3712, D, E, G — MSK 4931.

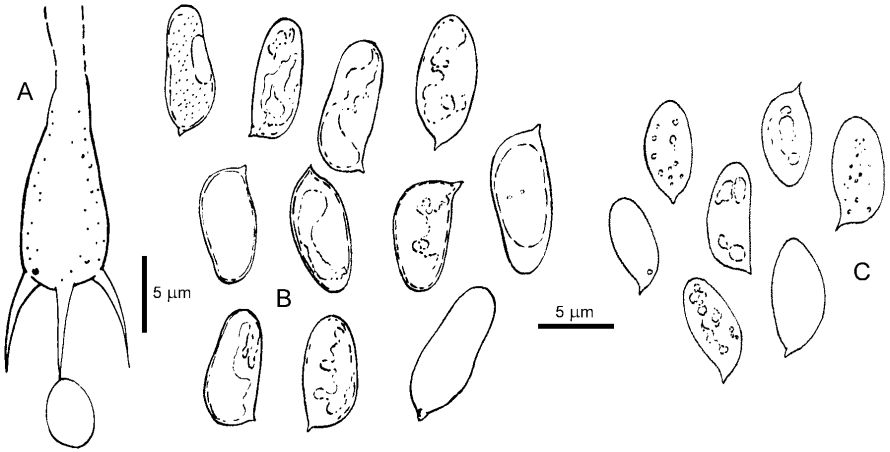

Fig. 25. Basidium and spores of *Scytinostroma odoratum*: A — upper portion of a basidium, B, C — spores.

A, B — MSK 4931, C — MSK 3712.

certain "economical" organization of hymenium in the species. Basidia are about 6 µm wide, with sterigmata up to 15 × 6.5 µm. According to Parmasto's description (1970) basidia are utriform, almost cylindrical, 20–50 × 4–6 µm, and basidiomata unclearly layered. Atypical specimen MSK 3916 has stratified basidioma *ca.* 1 mm thick, with strata separated by distinct narrow dark zones, composed of horizontal agglutinated hyphae and crystalline concretions. Basal part of basidiomata consists of black with ochraceous inclusions, strongly plicate matter composed of dematiaceous conidial fungi propagules intermingled with *S. odoratum* hyphae and crystals (fig. 23 A). The uncommon feature is also the latest stratum with hymenium — in this layer skeletal hyphae were not observed (fig. 23 B).

General distribution: Europe, Asia, N. America (Jülich, Stalpers, 1980).

Distribution in Belarus: There are three sites based on herbarium data and one locality reported by Komarova (1966) in Klichau district.

Ecology: *S. odoratum* is saprobic (according to our data) fungus causing white rot, colonizing wood of deciduous and coniferous trees (*Alnus glutinosa*, *Betula* sp., *Carpinus betulus*, *Pinus sylvestris*, *Populus tremula*) in broadleaf and pine forests. In West Europe the species was registered presumably on coniferous wood (Jülich, 1984). Fructifications were observed in June–August.

Main limiting factors: The species was collected in sites with small anthropogenic pressure and in south part of Belarus probably is associated with declining broadleaf forests.

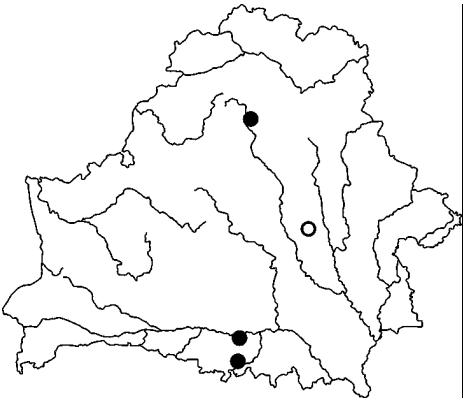

Fig. 26. Distribution of *Scytinostroma odoratum* in Belarus.

Specimens examined: Zhytkavichy district, Prypyatski Reserve, near Perarouski Mlynok, *Urtica dioica–Quercus robur* forest, on decayed fallen wood of *Betula* sp., coll. E.P. Komarova 31 VII 1958 (MSK 3711). — Lel'chytsy district, near Baravoe, moss–*Carpinus betulus* forest, on fallen wood of *Populus tremula*, coll. E.P. Komarova 20 VIII 1963 (MSK 3916). — ibid., *Oxalis acetosella–Quercus robur* forest, on fallen wood of *Alnus glutinosa*, coll. E.P. Komarova 22 VIII 1963 (MSK 3712). — Lepel' district, near Rozhna, Byarezinski Biosphere Reserve, *Pleurozium schreberi–Vaccinium myrtillus–Pinus sylvestris* forest, on bark on lower side of fallen *Pinus sylvestris* trunk, immersed in moss cover and litter, coll. E.O. Yurchenko 3 VI 1999 (MSK 4931).

11. Sistotrema raduloides (P. Karst.) Donk, Fungus **26**: 4, 1956.

Fig. 27–29.

Proposed category: Vulnerable. The species with resupinate, but conspicuous whitish hydnoid fruitbodies.

Conservation in other countries: Rare species, included in Red Data List of Finland (Kotiranta, Niemelä, 1996).

Economic importance: Unknown. The species is capable to grow in culture (Stalpers, 1978) and deposited in CBS and FCUG.

Morphology: Basidioma effused, *ca.* 5–10 × 1.5–4 and more cm in extent, loose, soft, white or yellowish. Margin closely adnate, diffuse (thinning out), up to 6 mm wide, rarely abrupt. Hymenophore composed of distinctly conical teeth 0.3–2.5 × 0.1–0.6 mm. Teeth cream-colored, erect, declined or appressed to the subiculum, crowded or scattered, sometimes glued in clusters, when appressed then arranged in rows. Subiculum of the same color as teeth, 0.1–0.4 (1.1) mm thick. Hyphae sybhyaline, slightly refractive, thin-walled, with big clamps, branching frequently coinciding with clamps, 3–6 μm wide, not swollen, commonly with oily inclusions, some of segments refractive. Cystidial elements absent. Basidia typically urniform, with oily

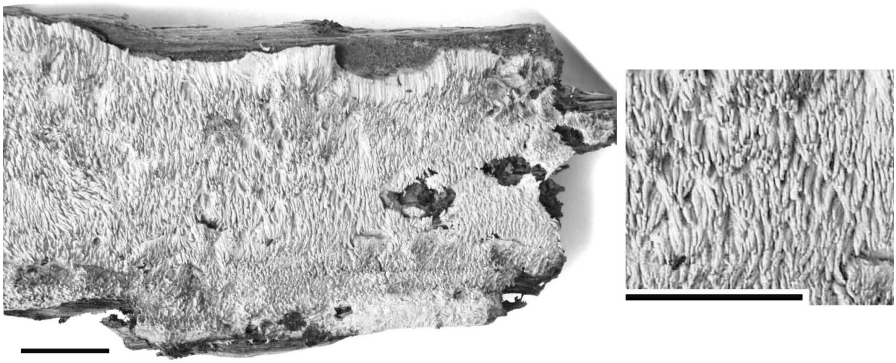

Fig. 27. Basidioma of *Sistotrema raduloides* (MSK 3918, general view and hymenophore teeth). Bar = 1 cm.

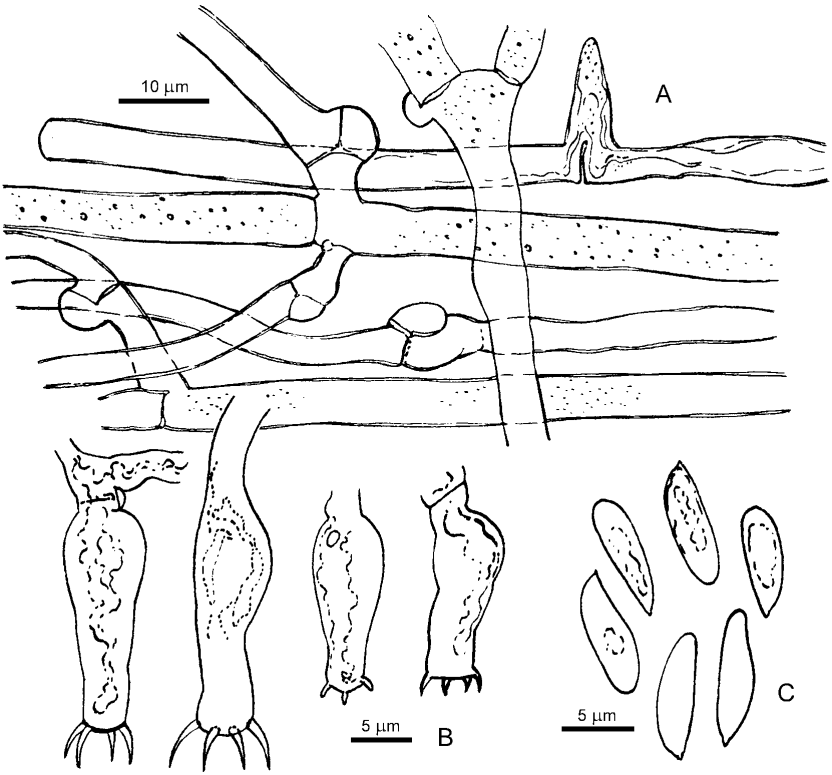

Fig. 28. *Sistotrema raduloides*: A — subicular hyphae, B — basidia, C — spores. A — MSK 3588, B, C — MSK 3918.

inclusions, (11) 13.5–24 (30) × (5.5) 6–7.5 μm, with 4 (6) sterigmata. Spores cylindrically fusiform, narrowed towards the apiculus, (6) 6.5–9.5 × 2–3 μm.

In comparison with morphological descriptions of *S. raduloides* basidia with 6–8 sterigmata (Jülich, 1984; Hansen, Knudsen, 1997) we observed only 4–6-sterigmate ones.

General distribution: Rare north-temperate species, known in Europe, Asia, N. America (Nikolajeva, 1961; Jülich, Stalpers, 1980).

Distribution in Belarus: There are three localities based on herbarium data and one report from Ivanava district (Komarova, Golovko, 1966).

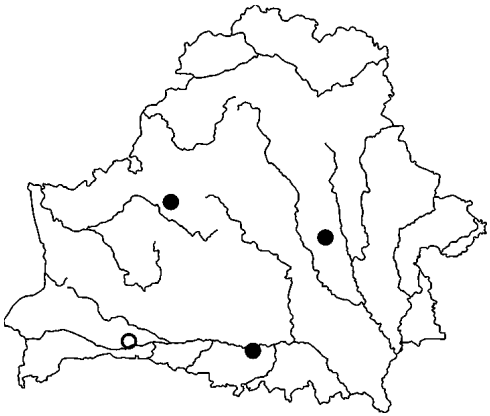

Fig. 29. Distribution of *Sistotrema raduloides* in Belarus.

Ecology: White-rot fungus inhabiting naked, moderately and well decayed fallen wood (trunks) of leaf trees (*Betula* sp., *Carpinus betulus*, *Populus tremula*) in *Quercus robur*, *Alnus glutinosa*, and *Picea abies* forests. The species is regarded as indicator of forest communities, minimally affected by human activity (Parmasto E., Parmasto I., 1997). Fructifications were registered in July–September.

Main limiting factors: Limited number of populations, reduction of old forests.

Specimens examined: Stoubtsy district, Nalibotskaya Pushcha, near Klyatsishcha (forest sq. No. 30), dampish moss-*Picea abies* forest, on decayed fallen wood of *Betula* sp., coll. E.P. Komarova 28 VIII 1957 (MSK 3591). — ibid., on decayed fallen wood of *Populus tremula*, coll. E.P. Komarova 28 VIII 1957 (MSK 3590a, b, c). — Zhytkavichy district, Prypyatski Reserve, near Perarouski Mlynok, *Corylus avellana–Alnus glutinosa* forest, on decayed fallen wood of *Betula* sp., coll. E.P. Komarova 27 VII 1958 (MSK 3592). — ibid., on fallen wood of *Betula* sp., coll. A.I. Klimovich 27 VII 1958 (MSK 3588). — ibid., on fallen wood of *Carpinus betulus*, coll. A.I. Klimovich 1 VIII 1958 (MSK 3589). — Klichau district, near Ubalatstse, *Oxalis acetosella–Quercus robur* forest, on fallen wood of *Populus tremula*, coll. E.P. Komarova 22 IX 1963 (MSK 3918).

12. Sparassis crispa Wulfen : Fr., Syst. mycol. **1**: 465, 1821.

Fig. 30, 31.

Proposed category: Vulnerable.

Conservation in other countries: The species is included in Red Data Book of Lithuania (Gricius et al., 1992), Russia (Bondartseva et al., 1988), former USSR (Gorlenko et al., 1984), in Red Data List of Poland (Wojewoda, Ławrynowicz, 1992) and Norway.

Economic importance: Good edible fungus, known among mushroomers under the Russian name translated as "mushroom luck" (Serzhanina, 1990). The fungus is able to grow in culture (Stalpers, 1978; Gorlenko et al., 1984; Bukhalo, 1988) and deposited in CBS and FCUG. It is weak pathogen of *Pinus* trees, causing very little damage of forest stand.

Morphology: Basidioma of almost globose form, many times branched, with coralloid branching pattern, in dry state horny or ceraceous, dark cream, pale brown or dark ochraceous towards the lobes tips. Branches flattened, thin, with waved margins, covered by even hymenium. Hyphae in central part of context more or less parallel arranged; hyphae at the periphery of context, under the subhymenium, with short and strongly swollen segments, forming spongy layer, 4–9 µm wide, inflated up to 18.5 µm, subhyaline to yellowish, with simple and clamped septa, sometimes clamp-connections with a hole, hyphal walls thickened up to 0.8 µm. Gloeoplerous hyphae scattered to abundant in context, yellowish, 5–11 µm wide, clamped. Subhymenial hyphae closely packed, with short segments, 2.5–3.5 µm wide. Hymenium slightly thickened, dense, yellowish in vertical section. Cystidial elements absent. Hyphal ends ca. 2.5 µm wide sometimes present in hymenium. Basidia narrowly clavate, (30) 42–48 × 5.5–6 (7) µm. Spores ellipsoid to pip-shaped, subhyaline or yellowish, (4) 5–6 × (2.5) 3–4.7 µm, with distinct wall, content granular or commonly with a big oil drop.

The basidioma found in town park (MSK 3601) was quite reduced, about 5 cm in diam.

General distribution: Europe, Caucasia, West Siberia, Altai, Asian Far East, N. America (Gorlenko et al., 1984).

Distribution in Belarus: Three sites are known from herbarium data. The species was reported from Valkavysk region (Tumiłowiczówna, 1935), Berazino, Drahichyn, Zhytkavichy, Minsk, Petrykau, Pinsk, Smalyavichy, Stoubtsy, and Uzda districts (Serzhanina, 1967; Kapich, Golovko, 1992; Serzhanina, Golovko, 1993). In the Red Data Book the species is also mapped in Asipovichy, Brest, Dzyarzhynsk, Kalinkavichy, Kamyanets, Lahoisk, and Pruzhany districts (Serzhanina, Golovko, 1993). We have a personal observation of the species in Dzyarzhynsk district, near Mastsishcha.

Ecology: The species is treated as biotrophic (Jülich, 1984), either weak parasite or saprotroph (Gorlenko et al., 1984), developing on roots and bases of old trunks, sometimes on fresh stumps of *Pinus sylvestris*. Most of finds were made in pine fo-

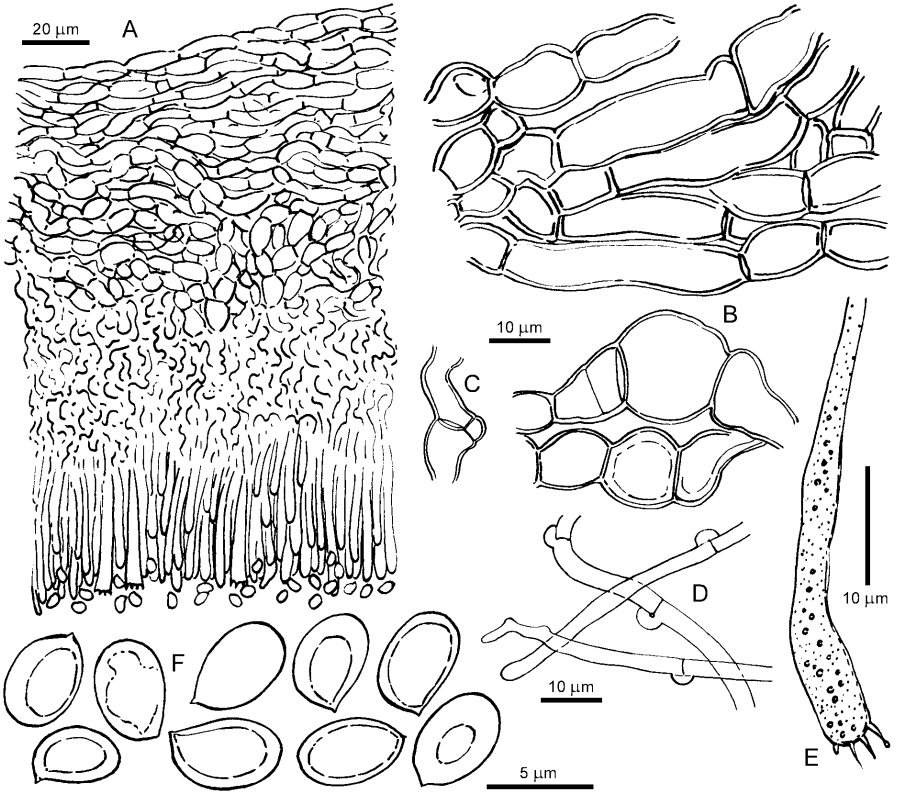

Fig. 30. *Sparasis crispa* (MSK 3634): A —vertical section through fruitbody lobe, B —tramal hyphae, C — clamp on separate tramal hypha, D — hyphae from hymenium, E — basidium, F — spores.

rests. It causes yellow-brown or brown cubical rot of roots and basal part of trunk (Jülich, 1984; Lindsey, 1988).

The finds of the species two times in Chalyuskintsy Park in Minsk (in 2001, first by D.I. Tret'yakov, then by Ye.N. Rotkina) indicate the ability of the fungus to colonize ecosystems deeply transformed by human activity, where obviously the competition effect of other lignicoluos fungi is weakened. Fructifications as sole basidiomata were observed in August–September.

Main limiting factors: Limited number of individuals and discontinuous distribution.

Specimens examined: Belavezhskaya Pushcha, supposedly Kamyanets district, at *Pinus sylvestris* stump base, coll. [initials unknown] Ivanov 27 VIII 1967 (MSK 3849). — Minsk City,

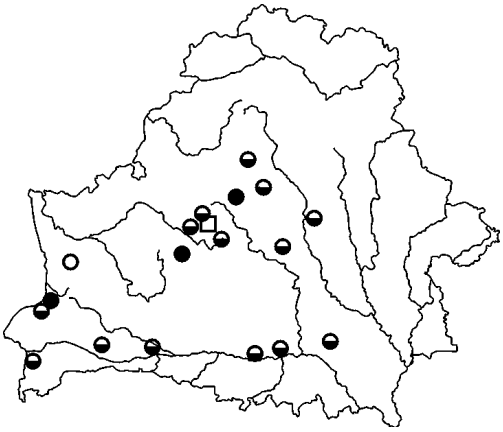

Fig. 31. Distribution of *Sparassis crispa* in Belarus.

Chalyuskintsy park, near the base of living *Pinus sylvestris* trunk, coll. Ye.N. Rotkina 3 IX 2001 (MSK 3601). — Nyasvizh district, near Prastsi, *Pinus sylvestris* forest, coll. V.A. Metelitsa 15 IX 2001 (MSK 3634).

Conclusion

Of course, the series of species described above are far from sufficient representativeness of genetic fund of the order *Aphyllophorales*, obviously requiring protection in Belarus. Many of aphyllophoroid species are rare and possibly endangered, plus some of they have indicator significance for appraisal of old and minimally affected forest ecosystems, but we have not sufficient information for proof of their declining. On the other hand, many of corticioid fungi have non-remarkable or small-size fruitbodies either differ with difficulty from related species with wide distribution. It can suggest for further investigation and inclusion in Red Data Book of Belarus in future the next species of non-poroid aphyllophoraceous fungi:[6] *Amaurodon viridis* (Alb. et Schwein.) J. Schröt., *Amylocorticium subincarnatum* (Peck) Pouzar, *Asterodon ferruginosus* Pat., *Byssomerulius albostramineus* (Torrend) Hjortstam, *Cantharellus tubaeformis* Bull., *Climacodon pulcherrimus* (Berk. et M.A. Curtis) Nikol., *Crustoderma dryinum* (Berk. et M.A. Curtis) Parmasto, *Cytidia salicina* (Fr.) Burt, *Dendrophora versiformis* (Berk. et M.A. Curtis) Chamuris, *Dichostereum granulosum* (Pers.) Boidin et Lanquetin, *Hymenochaete fuliginosa* (Pers.) Lév., *Hyphoderma definitum* (H.S. Jacks.) Donk, *H. litschaueri* (Burt) J. Erikss. et Å. Strid, *Hyphodontia floccosa* (Bourdot et Galzin) J. Erikss., *H. pilaecystidiata* (S. Lundell) J. Erikss., *Hypochnicium lundellii* (Bourdot) J. Erikss., *Kavinia himantia* (Schwein.) J. Erikss., *Phanerochaete avellanea* (Bres.) J. Erikss. et Hjortstam, *Phlebia centrifuga* P. Karst., *Ramaricium albo-ochraceum* (Bres.)

[6] All of the listed species are rare or sporadically distributed in Europe.

Jülich, *Serpula sororia* (Burt) Zmitrovich, *Serpulomyces borealis* (Romell) Zmitrovich, *Sistotrema octosporum* (J. Schröt.) Hallenb., *Steccherinum ciliolatum* (Berk. et M.A. Curtis) Gilb. et Budington, *Tomentella galzinii* Bourdot, *Trechispora byssinella* (Bourdot) Liberta.

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SUMMARY: Twelve species of aphyllophoroid fungi are regarded as candidates to the nearest new edition of the Red Data Book of Belarus Republic. The criteria for their selection were very limited populations in the republic, confining of the species to reducing types of communities, sensitivity to anthropogenic effect, and rare distribution in other European countries. Eleven species are provided by original morphological diagnoses based on specimens collected in Belarus and illustrations of micromorphological structures. Besides, black-white photos of fruitbodies of seven species are adduced. Twenty-six other aphyllophoroid species are listed as perspective objects of conservation in future.

Key words: *Aphyllophorales*, *Bankera*, *Cantharellus cinereus*, *Ceraceomyces sulphurinus*, *Clavariadelphus*, *Clavicorona*, *Dentipellis*, *Hericium*, *Phlebia albomellea*, *Punctularia*, *Scytinostroma odoratum*, *Sistotrema raduloides*, *Sparassis*, conservation, geography, morphology.

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