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CORTICIOID FUNGI (*BASIDIOMYCOTA*) ON LIVING WOODEN PLANTS IN BELARUS: SPECIES INVENTORY AND HOST COLONIZATION STRATEGIES

Eugene Yurchenko

V. F. Kuprevich Institute of Experimental Botany, Laboratory of Mycology, Akademichnaya Str. 27, BY-220072, Minsk, Belarus; e-mail eugene_yu@tut.by

Abstract

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Forty-three species of non-poroid resupinate homobasidiomycetes were found on living above-ground wooden structures of trees and shrubs in Belarus. The specific sites for basidiomata attachment on host were classified, taking into account the preferences of different species. Thirty kinds of sites, or microhabitats, were distinguished. The most species-rich microhabitat, where 21 species were recorded, was non-injured bark of living trunks from ground level up to 2.5 m. Five species, typically inhabiting fallen wood and litter, occurred only at trunk bases. The second most preferable site was living bark, surrounding open wounds, colonized by 18 species, most frequent being *Hyphodontia sambuci*. Two species, *Chondrostereum purpureum* and *Stereum hirsutum*, manifested clear pathogenic abilities, causing the total death of tree or shrub.

Keywords: *Chondrostereum*, *Corticiaceae* s. l., *Dendrothele*, parasite, *Peniophora*, rhytidome, *Stereum*, wound.

INTRODUCTION

A great bulk of corticioid fungi (resupinate non-poroid homobasidiomycetes, or *Corticiaceae* s. l., former order *Aphyllophorales pro parte*) are obligate saprobes on fallen dead wood, bark, herbaceous remains, mosses, litter and soil. The assessment of the number of species which belong to biotrophs and necrotrophs in mycobiotas is uncertain or hesitating because of difficulties in classification of the interaction between fungi and living host tissues in each particular case. Considering wooden plants, this issue is more complex, because a large part of the tree may consist of dead tissues, giving the living space for fungi, but these dead parts are indeed necessary for normal functioning of living tissues – phoem, cambium and sapwood. Insufficient documentation may generate many doubtful or confusing records, when, e.g. a fungus is collected without adequate portion of substratum and documented as growing on living structures, but actually it is saprobic on recently dead tissues.

There were few detailed researches into corticioid fungi ecology in respect of colonization of host on the border of dead and living tissues. The review by Shigo (1967) on the fungi colonizing wounds and heartwood in growing trees included some data on corticioid taxa. Boddy & Rayner (1983) investigated the distribution of fungal individuals and decay communities in attached oak branches, with a focus on necrosis zone. Vasiliauskas & Stenlid (2000) summarized the data on

biology of several corticioid fungi, colonizing spruce trunk wounds.

In a wide sense we could consider all fungi on living (growing) wooden plants, including species inhabiting both living and dead still-attached structures, both above-ground and underground ones, since these structures to be parts of the entire plant individual. In the present study, however, species on dead still-attached branches were excluded, if not located in immediate vicinity of living tissue. This way the controversial question about the mode of a fungus nutrition can be avoided. Besides, only the fungi on above-ground structures were surveyed.

Under ''living bark'' we imply the complex of phloem plus rhytidome (or phloem plus periderm) which has remained unaltered in colour and consistency, when compared with bark covering clearly dead structures. Such living bark includes living parenchymatic cells, and it has often a green tint due to the presence of chloroplasts, and especially when living cambium is present beneath.

The aim of this research was to make inventory of the *Corticiaceae* s. l. growing on living above-ground structures and in necrosis zones of wooden plants in Belarus and to classify the preferences of these fungi to specific sites or microhabitats on host.

MATERIALS AND METHODS

Herbarium collections. Most collections were of the author (*Ceratobasidium cornigerum* and *Leptosporomyces galzinii* were collected by E. Yurchenko and D. Belomesyatseva); the conventional route method with special attention to the communities where wound-inhabiting fungi occurred more frequently, like park and roadside plantations, was used. Samples were collected in all seasons, and the plants were examined from the ground surface to the height of 2.5 m. Altogether the material from 38 collection sites in Belarus was analyzed: from Brest province (7 localities), Homel' province (4 localities), Hrodna province (1 locality), Mahilyou province (2 localities), Minsk City (6 localities), Minsk province (13 localities), Vitsebsk province (5 localities). The reference samples are deposited in Fungal Herbarium of V. F. Kuprevich Institute of Experimental Botany (MSK-F).

Fungi isolation from living tissue. The spreading of hyphae in bark and wood was tested experimentally. For this purpose one representative fresh sample of each species, with the fruitbodies situated on living bark, was collected. Unsterilized chips of bark and wood 3–4 mm long and less than 0.5 mm thick were cut by sterilized razor blade from the depth of 1–4 mm under the fruitbodies. Ten chips from each sample were put on Petri dish with malt agar (2 % of malt extract; 1.5 % agar; ampicillin 0.1 mg/ml) and incubated for 7 days at 26 °C. In addition, pieces of the same size were cut from the fruitbodies and put on other Petri dishes with the same medium and incubated under similar conditions. After the mycelial mats reached 2.5–4 cm in diam, macroscopic and microscopic morphology was compared to identify bark or wood and fruitbody isolates.

Classification of the basidiomata attachment sites on wooden plants. The attachment of fungal fruitbodies and superficial vegetative mycelia on living and dead portions of host structures was analysed based on all field observations and collections available. The frequency of the occurrences in different sites of the host was also considered for the classification. Thus, species on non-injured rhytidome were subdivided into occurring near ground and higher than 15 cm. The positions (Fig. 1) are encoded and grouped as follows:

1 – non-injured parts of living trunks
1a – bark at base (0–15 cm above the ground) of mature trunks or wooden stems
1a* – bark at base (0–15 cm above the ground) of young sprouts
1b – bark higher that 15 cm above the ground, not in fork areas
1b* – bark in trunk forks
1c – bark in necrosis zones, the areas were associated with a living trunk portion
1d – bark in necrosis zones, the areas were associated with a recently dead trunk portion
2 – lateral trunk wounds (excluding branch stubs)

Wounds not associated with branch sites
2a – dead open wood, differently decayed
2a* – dead bark pieces bordering open wood
2b – adjacent living bark (mostly the callus of healing wound)
2b* – living bark in old closed wounds

Wounds in attachment site of windbroken limbs
2c – open wood
2c* – surrounding dead bark
2d – adjacent living bark
3 – the bases of dead still-attached branches
3a – dead bark
3b – living (but can be decaying) bark or the border between dead and living bark
3c – decorticated areas (dead wood)
4, 5 – dead branch stubs and adjacent areas; apical wounds (broken or cut stem tip)

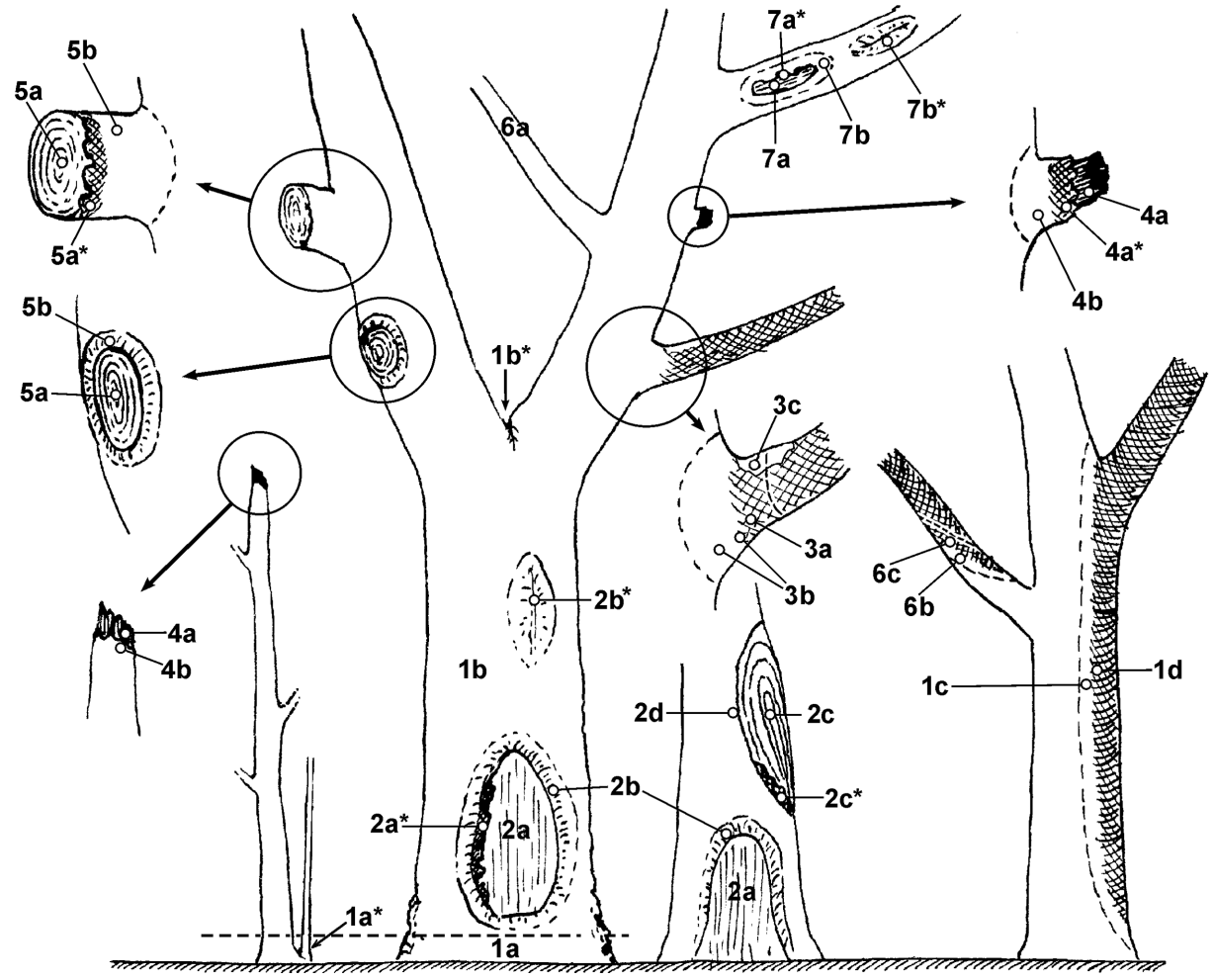

Fig. 1. Scheme of the positions for fungal fruitbodies or superficial vegetative mycelia on living trees and bushes (designations are explained in Materials and Methods). White areas symbolize living bark, hatched areas – dead bark

Natural stubs
4a – dead open wood
4a* – dead bark
4b – adjacent living bark (in most cases the callus)

Pruning stubs
5a – dead open wood (mostly pruning face)
5a* – dead bark
5b – surrounding living bark (in most cases the callus)
6 – non-injured areas of branches
6a – intact living bark of branches and twigs
6b – bark in necrosis zones, the areas were associated with a living portion of branch
6c – bark in necrosis zones, the areas were associated with a recently dead portion of branch
7 – injured branch areas
7a – dead wood in open wounds
7a* – dead bark bordering dead open wood
7b – adjacent living bark (in most cases the callus)
7b* – living bark in old closed wounds
8 – living acicular leaves

In most cases the main areas on which fungal fructifications occur are dead open wood and dead bark, but some fruitbody patches can occupy the adjacent living bark. To formulate such situations exactly we use the sign "+". For instance, 2a+2b means that fruitbodies occupy mostly dead open wood (2a), but some their patches occur on the adjacent living callus (2b); 1d+1c means that most fruitbodies occur on recently dead trunk portion (1d), but some of them occur also on bordering living areas (1c).

RESULTS

Most species were associated with non-injured trunk and branch rhytidome and periderm, from which 6 species were collected only at trunk base of growing trees (Table 1). The fungi occurring on living bark, surrounding open wounds (except branch stubs), were second according to species number and frequency. In total 21 species (49 %) were observed in wound areas (Table 2), colonizing living wound margins mostly as secondary substratum, i.e. the main basidioma patches were attached to the dead wound tissues. In comparison with the growth of the *Corticiaceae* on dead still-attached branches, their occurrence on living bark and wood is a far more rare event.

Spreading of the fungal hyphae in living tissues. For three *Peniophora* species growing on living bark of *Syringa vulgaris*: *Peniophora cinerea*, *P. incarnata* and *P. nuda*, the presence of hyphae in bark and sapwood at the depth of 1–1.5 mm under the attachment site of the fruitbody was confirmed by isolations in culture. For *P. incarnata* the frequency of isolations was low – 1 inoculum of 10, and evidently its hyphae are uncommon in living tissue. The quite scattered hyphae having *Peniophora incarnata* morphology were recorded also visually under a microscope in living wood of *Syringa vulgaris*, under *Peniophora incarnata* fruitbodies.

By isolation in culture, the presence of *Stereum hirsutum* hyphae in living wood of *Corylus avellana*, 3–4 mm deep under fruitbody attachment site, was proved.

DISCUSSION

The preceding collections of corticioid fungi in Belarus were focused mostly on dead wood lying on ground and still-attached dead branches, thus only 6 species were known from living above-ground structures of trees and bushes: *Athelia arachnoidea*, *Chondrostereum purpureum*, *Hypochnicium bombycinum*, *Peniophora incarnata*, *Stereum hirsutum*, *Thelephora terrestris* f. *resupinata* (Yurchenko, 2001). The present research has demonstrated that the species occurring on this kind of substrata constitute about 19 % of the total number of the *Corticiaceae* s. l. known in Belarus today.

The frequency of the fungi occurrence on living wooden parts of trees and bushes was quite different: the most regular were *Athelia arachnoidea*, *Chondrostereum purpureum*, *Dendrothele* species, *Hyphodontia sambuci*, *Stereum hirsutum*. While *Ceratobasidium cornigerum*, *Lagarobasidium detriticum*, *Phlebia aurea* were evidently occasional on such kinds of substrata. *Ceratobasidium cornigerum* commonly inhabits fallen (sometimes recently fallen) twigs and branches, especially of *Pinus sylvestris* and *Populus tremula*. *Lagarobasidium detriticum* occurs on fallen angiosperm wood; its occurrence on a living vertical trunk is quite uncommon, though only 0.17 m above the ground. *Phlebia aurea* predominantly inhabits fallen branches of angiosperms (*Alnus*, *Corylus*, *Populus*).

The numbers of fungal species associated with living wooden parts of a tree or bush species were also notably different. Some plants seem to be preferable for such fungi – the highest numbers of species were recorded on *Salix caprea* (11), *Corylus avellana* (10) and *Quercus robur* (9). No fungi were observed on living structures of conifers, except of juniper. However, Kovbasa (1996) reported *Amylostereum areolatum* (Chaillet) Boidin from wounded spruce in Belarus, which was isolated in samplings from up to 83 % of wounds.

The fungi considered here can be distributed among the following main eco-biological groups: (a) parasites, continuing their life cycle in dead wood, or which can live saprobically, (b) colonizers of recently dead wood, partly expanding on living bark, (c) the species developing in pockets of dead wood, but on the border to living tissue, (d) specialized saprotrophs on living bark, (e) inhabitants of fallen wood and litter, occasionally appearing on living bark near the ground.

Parasites, **continuing their life cycle in dead wood**. Only two of the considered fungi are well-known tree pathogens: *Chondrostereum purpureum* and *Stereum hirsutum*. Besides, *Sarcodontia crocea* is also a pathogen, but rare and little documented. It produces abundant fructifications mostly after death of a limb, a sector of trunk, or the complete host individual. In case of partial host necrosis a part of individual mycelium evidently feeds in living tissue. At the same time the fungi can develop basidiomata on still living bark or in gradual necrosis zones, either directly on a rather distinct boundary between dead and decayed and living but infected tissues.

Chondrostereum purpureum fructifications commonly occur on recently dead tissues of angiosperm trees (*Acer*, *Betula*, *Malus*, *Populus*, *Salix*, *Sorbus*, *Tilia*): on limb pruning faces, cut surface of rather fresh stumps, stumps of windfall, dead wood and bark in trunk wounds, dead standing trunks, large still-attached branches. Its basidiomata often develop near the ground. Sometimes the fungus occurs on recently dead stumps with young sprouts (e.g. *Quercus robur*), evidently killing such stumps. The main host for *Chondrostereum purpureum* in ornamental plantations is *Sorbus aucuparia*, and evidently the fungus is able to kill its weakened individuals.

Table 1.

Corticioid fungi found on living tree and shrub structures and in necrosis zones. Numbering of microhabitats the same as in Materials and Methods

No.	Species	Microhabitats	Hosts
1	2	3	4
1	*Amphinema byssoides*	1a	*Betula pubescens*,[1] *Salix caprea*
2	*Athelia arachnoidea*	1a, 1b, 2a*, 6a	See Yurchenko & Golubkov (2003)
3	*Athelia fibulata*	1a, 1a*, 1d+1c	*Betula pendula*, *Corylus avellana*, *Populus tremula*, *Quercus robur*
4	*Athelicium hallenbergii*	1a	See Yurchenko & Kotiranta (2007)
5	*Botryobasidium candicans* (only anamorph *Haplotrichum capitatum*)[2]	2a+2b	*Fraxinus excelsior*
6	*Botryobasidium laeve*	1a	*Sorbus aucuparia*
7	*Byssomerulius corium*	2a+2b, 4a+4b	*Acer japonicum*, unidentified tree
8	*Ceratobasidium cornigerum*	6a+8	*Juniperus communis*
9	*Chondrostereum purpureum*	1d+1c, 2a+2b	*Acer negundo*, *A. saccharinum*, *Malus domestica*, *Salix fragilis*, *Sorbus aucuparia*
10	*Coniophora puteana*	2a+2b, 4a+4b, 7b*+6a	*Prunus domestica*, *Tilia cordata*
11	*Corticium roseum*	1d+1c	*Salix caprea*
12	*Cylindrobasidium evolvens*	2a+2b, 2b, 7a+7b	*Acer saccharinum*, *Frangula alnus*, *Quercus robur*, *Salix caprea*
13	*Dendrothele acerina*	1a, 1b	For *Dendrothele* species see Yurchenko (2008)
14	*Dendrothele alliacea*	1a, 1b	
15	*Dendrothele amygdalispora*	1b	
16	*Dendrothele commixta*	1b, 1b*, 3a+3b, 3b, 4b	
17	*Dendrothele griseocana*	1b	
18	*Hyphoderma setigerum*	3a+3b	*Tilia cordata*
19	*Hyphoderma transiens*	3a+3b (in deep bark fissure)	*Tilia cordata*
20	*Hyphodontia arguta*	2c+2c*+2d	*Salix caprea*

[1] Appeared only as sparse hyphae, mixed with *Tulasnella violea* (Quél.) Bourdot et Galzin fructifications

[2] *H. capitatum* was found also in western parts of Minsk, in small hole on *Padus serotina* (Ehrh.) Borkh. trunk, on bark over discoulored (evidently recently dead) wood (MSK 6571)

Table 1 (continued).

1	2	3	4
21	*Hyphodontia crustosa*	2a+2b	*Salix caprea*
22	*Hyphodontia paradoxa*	3a+3b	*Corylus avellana*
23	*Hyphodontia sambuci*	2a+2b, 2a+2a*+2b, 4a+4b	*Acer negundo*, *A. platanoides*, *Corylus colurna*, *Fraxinus excelsior*, *Juglans cinerea*, *Syringa vulgaris*, *Tilia cordata*
24	*Hypochnicium bombycinum*	1b, (?)2b*, 3a+3b, 5a*+5b	*Acer saccharinum*, *Corylus avellana*, *Malus sylvestris*, *Salix caprea*, *Sorbus aucuparia*, *Tilia cordata*
25	*Lagarobasidium detriticum*	2a+2b	*Salix caprea*
26	*Leptosporomyces galzinii*	1a	*Juniperus communis*
27	*Peniophora cinerea*	1b, 1c+1d, 1d+1c, 2a+2b+1b, 3a+3b, 5a+5a*+5b	*Corylus avellana*, *Malus domestica*, *Syringa vulgaris*
28	*Peniophora incarnata*	1b, 2a+2a*+2b, 2b*+1b, 5a+5a*+5b, 5a+5b	*Acer platanoides*, *Corylus avellana*, *Quercus robur*, *Syringa vulgaris*
29	*Peniophora nuda*	1b	*Syringa vulgaris*
30	*Phlebia aurea*	2a+2b	*Corylus avellana*
31	*Phlebia radiata*	2b*, 3a+3b, 3a+3b+2b*	*Cerasus avium*, *Malus domestica*
32	*Phlebia tremellosa*	2a+2a*+2b, 2a+2b, 5a+5b	*Cerasus avium*, *Malus domestica*, *Fraxinus excelsior*
33	*Phlebiella pseudotsugae*	1a	*Betula pendula*
34	*Pseudochaete tabacina*	2a+2b, 4a+4b, 5a+5a*+5b	*Corylus avellana*, *Crataegus submollis*, *Micromeles alnifolia*, *Sorbus aucuparia*
35	*Radulomyces confluens*	1b, 1b*, 2a+2b, 4a+4a*+4b, 7a+7b	*Alnus glutinosa*, *Caragana arborescens*, *Crataegus ×kyrtostila*, *Prunus divaricata*, *Pyrus communis*, *Salix caprea*
36	*Radulomyces molaris*	7a*+7b	*Quercus robur*
37	*Sacodontia crocea*	3a+3b (in basal part of living trunk and abundantly on adjacent still-attached large partly decorticating dead limb)	*Malus domestica*
38	*Steccherinum fimbriatum*	1a, 2a+2b	*Salix caprea*, *Syringa vulgaris*
39	*Stereum hirsutum*	1d+1c, 2a+2b, 2a+2a*+2b, 2b, 2b*, 3a+3b, 3b+3a, 4a+4b, 5a+5a*+5b, 5a+5b, 6c+6b, 7a+7b	*Corylus avellana*, *Fraxinus excelsior*, *Malus domestica*, *Prunus divaricata*, *P. domestica*, *Pyrus communis*, *Quercus borealis*, *Q. robur*

Table 1 (continued).

1	2	3	4
40	*Stereum rugosum*	1d+1c, 2a+2b	*Corylus avellana*, *Malus sylvestris*
41	*Thelephora terrestris*	1a	*Juniperus communis*
42	*Uthatobasidium fusisporum*	1a	*Populus tremula*, *Quercus robur*
43	*Vuilleminia comedens*	6c+6b	*Quercus robur*

Sacodontia crocea was reported as parasite of the *Rosaceae* in Europe, mostly on old *Malus* trees (Kotiranta & Saarenoksa, 2000). The earlier record was on a fallen apple-tree (Yurchenko, 1998).

Stereum hirsutum is a very common ubiquitous inhabitant of deciduous wood (especially *Alnus*, *Betula*, *Corylus*, *Prunus*, *Quercus*), both exposed (dead still-attached branches, corticated dead segments of living trunk) and fallen parts closer to the ground. Most records of this species in Belarus and adjacent countries were on dead wood. Abundant fructifications occur on weakened or strongly damaged (e.g. broken, pruned) trees, on living or comparatively fresh stumps. The fruitbodies develop predominantly on recently dead structures, on various injury areas, especially branch stubs, pruning faces, naked wood in wounds. In anthropogenic habitats the main hosts are *Cerasus vulgaris* and *Prunus divaricata*. Stressed by pruning

Table 2.

The number of corticioid fungi species occurring in different attachment sites (microhabitats) on living trees and bushes in Belarus

Site (microhabitat) type and its conventional code (in brackets)	Number of species	Percentage of species, recorded on living structures (rounded)
non-injured rhytidome of living trunks (1)	21	49
– 0–15 cm above the ground (1a, 1a*)	12	28
– more than15 cm above the ground (1b)	12	28
– living bark in trunk forks (1b*)	2	5
living bark, surrounding open wounds (except branch stubs)	18	42
– on trunks, not associated with windbroken limbs (2b)	17	40
– on branches (7b)	4	9
– living bark adjacent to the open wood in attachment site of windbroken limbs (2d)	1	2
living bark at base of dead still-attached branches (3b)	9	21
living bark adjacent to the natural branch stubs (4b)	7	16
living bark in necrosis zones (not directly associated with wounds)	7	16
– on trunks (1c)	6	14
– on branches (6b)	2	5
living bark or callus associated with branch pruning stubs (5b)	6	14
living bark in old closed wounds	5	12
– on trunks (2b*)	4	9
– on branches (7b*)	1	2
living bark of branches and twigs (rather far from wounds; 6a)	3	7
living acicular leaves (8)	2	5

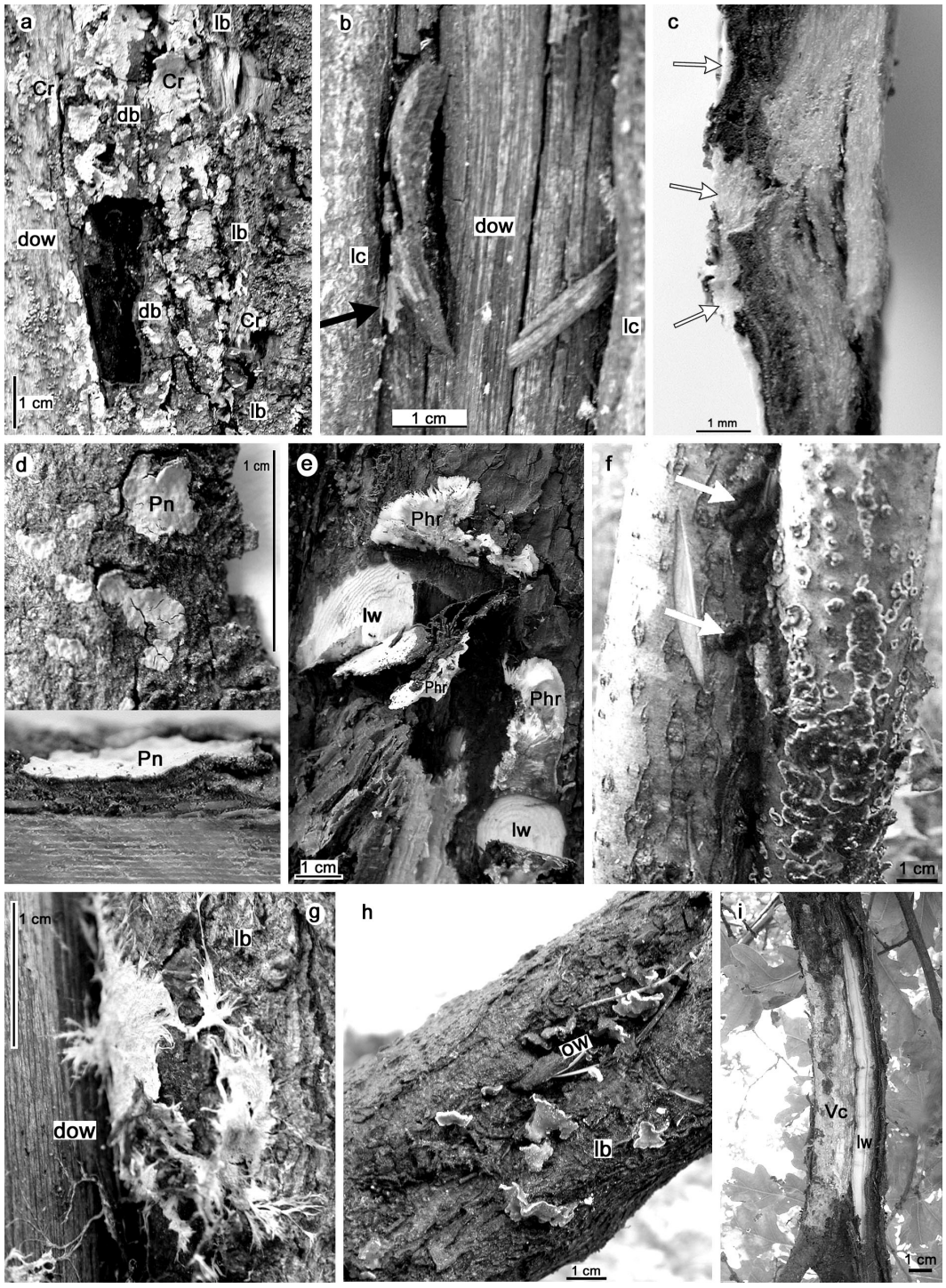

Fig. 2. Corticioid fungi in some characteristic positions on living trees and bushes: a – *Corticium roseum* (Cr; MSK 6887) on dead open wood (dow), dead bark (db) and living bark (lb) of *Salix caprea* trunk; b – *Cylindrobasidium evolvens* (arrow; MSK 6579) on the margins of *Salix caprea* trunk wound (dow – dead open wood, lc – living callus); c – *Hypochnicium bombycinum* (arrows, MSK 6542) on living bark of *Tilia cordata*, in vertical section; d – *Peniophora nuda* (Pn; MSK 6848) on living bark of *Syringa vulgaris*, view from the hymenophore (above) and in vertical section (below); e – *Phlebia radiata* (Phr; MSK 6499)

or unfavourable environment, small-sized trees of *Cerasus*, *Malus*, *Prunus*, infected by *Stereum hirsutum* in their trunk, often die approximately a year after the fruitbodies occurrence. In natural communities *S. hirsutum* causes trunk decay in living oaks, but without serious damage for the forest stand. For instance, in natural spruce-birch-aspen forests it occurs on living trunks of approximately one *Quercus robur* tree per 4–5 ha. Contrary, in orchards its occurrence is higher. There were observations of parasitic *Stereum hirsutum* on at least eight plum individuals in a *Prunus domestica* plantation (Minsk, Loshytsa) occupying 0.74 ha.

Pioneer dead wood colonizers, **sometimes expanding on living bark**. They have mostly saprobic mode of nutrition; necrotrophic activity of some species is presumed but demands experimental proofs. At least 13 species from the list (30 %) commonly act as early decayers of recently dead wood and bark: *Byssomerulius corium*, *Corticium roseum*, *Cylindrobasidium evolvens*, *Hyphodontia paradoxa*, *H. sambuci*, *Peniophora cinerea*, *P. incarnata*, *P. nuda*, *Phlebia radiata*, *Pseudochaete tabacina*, *Radulomyces confluens*, *Stereum rugosum*, *Vuilleminia comedens*. However, the ecological role of these species is host- and environment-dependent. For instance, *Phlebia radiata* was recorded on recently died structures of *Cerasus*, *Frangula*, *Salix*, but Boddy & Rayner (1983) described it on attached oak branches as a secondary invader only, replacing other fungi.

The distribution of the species from this group in Belarus is different, from very common, ubiquitous (*Cylindrobasidium evolvens*, *Hyphodontia sambuci*, *Peniophora cinerea*, *P. incarnata*, *Pseudochaete tabacina*) to sporadical (*Byssomerulius corium*, *Peniophora nuda*) and rare (*Botryobasidium candicans*).

Within this group several ecological subgroups can be distinguished, regarding the growth on dead wood in contact with ground or situated above the ground, which were discussed by us (Yurchenko, 2002). Several species occur equally often on fallen wood at various decay stages and on dead still-attached branches (*Hyphoderma setigerum*, *Hyphodontia crustosa*, *H. sambuci*). *Hyphodontia paradoxa* and *Phlebia radiata* grow mostly on attached branches and dead standing trunks, but sometimes on fallen wood. *Byssomerulius corium* inhabits both dead still-attached and fallen branches, but in the last case those which are not in close contact with ground. *Coniophora puteana* has a wide ecological amplitude: it was observed on dead still-attached branches and pockets of dead wood on deciduous tree trunks in orchards and parks, but it is better known as house fungus (Golovko, 1981). Chapela & Boddy (1988 a, b) noted this species as an earlier colonizer of living or partly living *Fagus* branches, Vasilyauskas & Stenlid (2000) – as minor decayer in spruce trunk wounds.

Pioneer wood decay fungi display different microhabitat preferences. A remarkable example is *Hypochnicium bombycinum*. It is a rare species in Belarus, most records were from Minsk City and its outskirts. Besides growing trees, it was found also on dead standing trunks of *Corylus* and *Sorbus*. But mostly this fungus occurs on basal areas of dead still-attached branches (collected 4 times) and on pruning stubs (collected 3 times). Concerning dead branch stubs, they seem to accumulate a great proportion of the fungi recorded in this research, appearing as a gate for colonization by airborne basidiospores.

The fungi growing on living rhytidome often display the association of basidiomata with bark irregularities – splits, 'folds', depressions, areas with big rhytidome scales (*Dendrothele* spp., *Hypochnicium bombycinum*, *Phlebia radiata*).

The species observed on recently dead trunk sectors (necrotic columns) were *Cylindrobasidium evolvens*, *Peniophora cinerea*, *Radulomyces confluens*.

Pseudochaete tabacina is a remarkable example of a fungus which, inhabiting dead substratum, colonizes the closely adjacent living trunks by expanding basidiomata. In MSK 6612 the fruitbody portion colonizing living trunk has atypical vigorous growth of red-brown mycelium at its margin, and very thick (1.5–3 mm) subiculum of brownish-yellow hyphae, pierced by the holes indicating invertebrate activity.

Recently dead wood colonizers display some degree of host preferences. For instance, *Byssomerulius corium* occurs mostly on *Populus* and *Salix*; *Corticium roseum* grows predominantly on *Salix*; most records of *Hyphodontia crustosa* were from *Corylus*, *Quercus* and *Salix*; *Hyphoderma setigerum* is most frequent on *Alnus glutinosa* and *Betula pendula*; *Stereum rugosum* occurs

on bark of living *Malus domestica* trunk base (lw – cuts showing living wood under the fruitbodies); f – *Pseudochaete tabacina* (MSK 6612) on dead (right) and the adjacent living trunk (left, arrows) of *Corylus avellana*; g – *Steccherinum fimbriatum* (MSK 6586) on dead open wood (dow) and adjacent living bark (lb) of *Salix caprea* trunk; h – *Steccherinum hirsutum* (MSK 6711) in old wound (ow) and on living bark (lb) of *Corylus avellana* trunk; i – *Vuilleminia comedens* (Vc; MSK 6466) on *Quercus robur* branch; lw – the cut showing living wood and bark along the fruitbody

mostly on *Alnus*, *Corylus* and *Sorbus*; *Pseudochaete tabacina* is especially frequent on *Corylus*, *Salix*, *Sorbus*, but very occasional on *Picea*. *Peniophora cinerea* has no specialization, but most records were from *Corylus*, *Betula* and *Sorbus*. *Radulomyces confluens* was recorded mostly on the *Rosaceae* (*Cerasus*, *Malus*, *Prunus*, *Pyrus*) and was very occasional on fallen *Picea* twigs.

Several species are clearly multi-host xylotrophs, like *Cylindrobasidium evolvens*, *Hyphodontia sambuci* and *Peniophora incarnata*. *Cylindrobasidium evolvens* inhabits dead still-attached branches, dead standing trunks (especially recently dead sectors – necrotic columns), sometimes fallen branches of many angiosperm trees and bushes (especially *Alnus*, *Frangula*, *Populus*, *Sorbus*). On living trees it occurs also on dead branch stubs and on dead wood in trunk wounds (in the last case e.g. on *Malus domestica* and *Picea abies* (L.) Karst.). It was reported as less significant or minor wood decayer in spruce wounds (Vasiliauskas & Stenlid, 2000). On wounded *Cerasus vulgaris* Mill. and *Picea abies* trunks we observed its fructifications is association with resin areas.

Hyphodontia sambuci is an inhabitant of dead still-attached and fallen branches of many angiosperms, occurs also on bark of dead areas on living trunks. It demonstrates a remarkable preference of trunk wounds colonization, both their dead open wood and living calluses, on which it was collected 7 times.

Peniophora incarnata is an inhabitant of dead still-attached branches and branch stubs of deciduous trees and shrubs, especially *Betula*, *Corylus*, *Populus*, *Salix*, *Sorbus*. A common habitat is also naked wood in trunk wounds of leaf species, where it is a pioneer basidiomycete. Vasiliauskas & Stenlid (2000) noted it as not dangerous, occasional colonizer of spruce trunk wounds. Concerning the growth on living bark, the fungus shows a clear preference for *Syringa vulgaris*. Besides, in trunk wounds of *Syringa* it was observed 4 times in association with *Peniophora cinerea*.

Vuilleminia comedens occurs commonly on dead still-attached, partly corticated lower branched of *Quercus robur*, which are in different state of decay, from recently dead (saving still-attached brown leaves) to moderately decayed, lost thinner twigs. It was recorded twice on recently dead sectors from below the living branches, with the fruitbodies in close proximity to living tissues. The ability of *Vuilleminia comedens* to colonize living branches was reported by Boddy & Rayner (1983). Moreover, in forest pathology this fungus is considered as the agent of oak branch necrosis (e.g. Fedorov, 2004), especially of the lower situated branches which are weakened by light deficiency.

Species growing in pockets of dead wood, **at the border with living tissue**. The most typical example from this group is *Phlebia tremellosa*. This species is mostly found on dead stumps, root necks, dead standing trees, fallen trunks of angiosperms (e.g. *Betula*, *Corylus*, *Malus*) and sometimes gymnosperms (*Pinus*), with quite clear preference for fructification in near-ground areas. Sometimes it occurs in holes of partly decayed but growing trees.

Specialized bark saprotrophs. This group includes *Dendrothele* species, which occur exclusively on living bark of angiosperms, except for *D. alliacea* and *D. commixta*, recorded also on dead bark (Yurchenko, 2008).

The term ***epiphytes*** is sometimes applied to the fungi inhabiting outermost bark layer and provoking minor decay, or feeding by metabolic products of other bark-inhabiting fungi or non-fungal organisms. The most known epiphytic fungi are *Alternaria alternata*, *Epicoccum nigrum*, *Trichoderma harzianum* (Hudson, 1971; Wang & Guo, 2007; Biggs & Alm, 1992). In these terms *Dendrothele* species on living bark can be classified as epiphytes, or displaying epiphytic life style. Several fungi recorded on living bark have occasional epiphyte-like behavour, e.g. *Hypochnicium bombycinum*, *Radulomyces confluen* and the species discussed below.

Fallen wood-inhabiting and litter-inhabiting fungi occasionally occurring on living trunk bases. These fungi prefer fallen wood and bark (*Athelia fibulata*, *Phlebiella pseudotsugae*), fallen wood and litter (*Botryobasidium leave*, *Leptosporomyces galzinii*) or are unspecialized saprobes in litter stratum, spreading by hyphal cords (*Amphinema byssoides*, *Steccherinum fimbriatum*). All these species are saprobic, except for *Amphinema byssoides*, which is facultatively mycorrhizal. Their occurrence at trunk bases is explained by specific characteristics of this microhabitat: the rhytidome areas here are situated in wetter microclimate, frequently covered by snow in cold season, comparatively shaded, and more subjected to decay than higher situated bark.

This group includes the species of common (*Amphinema byssoides*, *Steccherinum fimbriatum*), sporadic (*Botryobasidium laeve*, *Leptosporomyces galzinii*, *Phlebiella pseudotsugae*) or rare distribution (*Athelia fibulata*, *Uthatobasidium fusisporum*) in Belarus.

Thelephora terrestris also belongs to this group. It is a common species, with the ability for saprobic and mycorrhizal nutrition mode, growing on soil, litter, dead wood. Its resupinate form occurs mostly on fallen wood of *Pinus sylvestris*. Differently shaped vertical types of the fructifications are known in Belarus as the agents of

mechanical oppression ('suffocation') of growing tree seedlings in nurseries (Fedorov, 2004). Sometimes in forests, effused-reflexed form of *Thelephora terrestris* fructifications encrust rather large portions of living shoots of *Juniperus communis* situated near the ground, including their needles (MSK 8042, 8045, 8046, coll. D. B. Belomesyatseva) and provoke shoots oppression.

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APPENDIX

Names and herbarium reference numbers (MSK) of the investigated fungi. The names of fungi and authors of their names follow *Cortbase* (Parmasto et al., 2006), except of sanctioning author formulation, which was omitted. The current name according to *Index Fungorum* (Kirk & Cooper, 2004) is in brackets after *Cortbase* name, if taxonomic point of view in *Index Fungorum* is different.

Amphinema byssoides (Pers.) J. Erikss. – 4982, 6102
Athelia fibulata M. P. Christ. – 6801, 6849, 6852, 6856
Botryobasidium candicans J. Erikss. (only in anamorph state *Haplotrichum capitatum* (Link) Willd.) – 6557
Botryobasidium laeve (J. Erikss.) Parmasto – 6850
Byssomerulius corium (Pers.) Parmasto (*Meruliopsis corium* (Pers.) Ginns) – 6536, 6874
Ceratobasidium cornigerum (Bourdot) D. P. Rogers – 8059
Chondrostereum purpureum (Pers.) Pouzar – 5173–5175, 5180, 5756, 5765, 6432, 6479, 6560, 6740
Coniophora puteana (Schumach.) P. Karst. – 6439, 6450, 6544
Corticium roseum Pers. (*Laeticorticium roseum* (Pers.) Donk) – 6887
Cylindrobasidium evolvens (Fr.) Jülich – 6449, 6461, 6579, 6908
Hyphoderma setigerum (Fr.) Donk – 6611
Hyphoderma transiens (Bres.) Parmasto – 6609
Hyphodontia arguta (Fr.) J. Erikss. – 4943
Hyphodontia crustosa (Pers.) J. Erikss. – 6583
Hyphodontia paradoxa (Schrad.) E. Langer et Vesterh. – 6713
Hyphodontia sambuci (Pers.) J. Erikss. – 6482, 6541, 6587, 6594, 6855, 6861, 6862, 6906
Hypochnicium bombycinum (Sommerf.) J. Erikss. – 5132–5136, 5138, 5144, 6480, 6542, 6584, 6590–6592
Lagarobasidium detriticum (Bourdot) Jülich (*Hyphodontia detritica* (Bourdot et Galzin) J. Erikss.) – 6585
Leptosporomyces galzinii (Bourdot) Jülich – 8004
Peniophora cinerea (Pers.) Cooke – 6498, 6503, 6505, 6577, 6582, 6847, 6853, 6940
Peniophora incarnata (Pers.) P. Karst. – 4401, 6400, 6459, 6485, 6504, 6507, 6554
Peniophora nuda (Fr.) Bres. – 6572, 6848, 6939
Phlebia aurea (Fr.) Nakasone (*Mycoacia aurea* (Fr.) J. Erikss. et Ryvarden) – 6546
Phlebia radiata Fr. – 6437, 6499, 6558
Phlebia tremellosa (Schrad.) Nakasone et Burds. (*Merulius tremellosus* Schrad.) – 6556, 6559, 6567
Phlebiella pseudotsugae (Burt) K.H. Larss. et Hjortstam – 4917
Pseudochaete tabacina (Sowerby) T. Wagner et M. Fisch. – 6483, 6484, 6534, 6612
Radulomyces confluens (Fr.) M. P. Christ. – 6573, 6580, 6626, 6724, 6860
Radulomyces molaris (Chaillet ex Fr.) M. P. Christ. – 6473
Sacodontia crocea (Schwein.) Kotl. – 6501
Steccherinum fimbriatum (Pers.) J. Erikss. – 6586, 6851
Stereum hirsutum (Willd.) Gray (*Stereum hirsutum* (Willd.) Pers.) (Fig. 2 h) – 5080, 5084, 5760, 6438, 6440–6442, 6444, 6471, 6472, 6475, 6477, 6508, 6510, 6548, 6550–6552, 6568, 6574, 6578, 6588, 6663, 6711, 6714, 6716, 6719, 6721
Stereum rugosum (Pers.) Fr. (*Stereum rugosum* Pers.) – 5337, 6712, 6717, 6718
Thelephora terrestris Fr. (*Thelephora terrestris* Ehrh. f. *resupinata* (Bourdot et Galzin) Donk) – 4094
Uthatobasidium fusisporum (J. Schröt.) Donk (*Thanatephorus fusisporus* (J. Schröt.) Hauerslev et P. Roberts) – 6836, 6854, 6857
Vuilleminia comedens (Nees) Maire – 6466, 6468

ŽIEVIAGRYBIAI (*BASIDIOMYCOTA*) ANT GYVŲ SUMEDĖJUSIŲ AUGALŲ BALTARUSIJOJE: RŪŠIŲ INVENTORIZACIJA IR AUGALO ŠEIMININKO KOLONIZACIJOS STRATEGIJA

Eugene Yurchenko

Santrauka

Baltarusijoje ant gyvų sumedėjusių antžeminių krūmų ir medžių dalių rasti 43 rūšių išsiplėtusius vaisiakūnius turintys homobasidiomicetai. Specifinės vaisiakūnio prisitvirtinimo prie augalo šeimininko vietos suskirstytos atsižvelgiant į įvairius grybų poreikius. Iš viso išskirta 30 mikrobuveinių. Rūšių gausiausia grybų mikrobuveinė buvo nepažeista gyvo kamieno žievė nuo žemės iki 2,5 m aukščio. Šio tipo mikrobuveinėse aptikti 21 rūšies grybai. Iš jų 5 rūšių grybai, paprastai randami ant nukritusios medienos ar paklotės, buvo rasti tik kamieno pamatinėje dalyje. Kitoje grybų labiausiai mėgstamoje mikrobuvienėje – ant gyvos žievės, esančios aplink medžio ar krūmo atviras žaizdas – rasti 18 rūšių grybai. Iš jų dažniausia rūšis buvo *Hyphodontia sambuci*. Dviejų rūšių – *Chondrostereum purpureum* ir *Stereum hirsutum* – grybai turi patogeninių savybių ir dėl jų medis ar krūmas gali nudžiūti.