



Checklist of aphyllorphoroid fungi (Agaricomycetes, Basidiomycota) in boreal forests of the Solovetsky Archipelago (Arkhangelsk Region, European Russia)

Oleg Ezhov,¹ Ivan Zmitrovich,² Anna Ruokolainen³

1 N. Laverov Federal Center for Integrated Arctic Research, 23 North Dvina quay, Arkhangelsk, Russia 163000. **2** Komarov Botanical Institute of the North of the Russian Academy of Sciences, 2 Prof. Popov str., Saint Petersburg, Russia 197376. **3** Forest Research Institute, Karelian Research Centre of the Russian Academy of Sciences, 11 Pushkinskaya str., Petrozavodsk, Russia 185910.

Corresponding author: Oleg Ezhov, olegezhik@gmail.com

Abstract

Herein we present a checklist of aphyllorphoroid fungi of the Solovetsky Archipelago, located in the White Sea (Arkhangelsk Region, European Russia). The annotated list contains 275 species belonging to 139 genera of aphyllorphoroid basidiomycetes (Agaricomycetes, Basidiomycota). Eight species (*Athelia bombacina*, *Ceraceomyces tessulatus*, *Clavariadelphus truncatus*, *Clavaria zollingeri*, *Clavulinopsis luteoalba*, *Hyphoderma obtusifforme*, *Phanerochaete jose-ferreirae*, and *Ramaria obtusissima*) are recorded from the Arkhangelsk Region for the first time, and 23 species were recorded for the first time from the Solovetsky Archipelago. Most records are documented by herbarium specimens.

Key words

Aphyllorphorales, corticioids, polyporales, polypores, northern taiga, rare species.

Academic editor: Panu Kunttu | Received 24 March 2016 | Accepted 12 September 2017 | Published 17 November 2017

Citation: Ezhov O, Zmitrovich I, Ruokolainen A (2017) Checklist of aphyllorphoroid fungi (Agaricomycetes, Basidiomycota) in boreal forests of the Solovetsky Archipelago (Arkhangelsk Region, European Russia). Check List 13 (6): 789–803. <https://doi.org/10.15560/13.6.789>

Introduction

The aphyllorphoroid fungi (Agaricomycetes, Basidiomycota) represent a key element of boreal ecosystems due to their wood-decaying and litter-decomposing abilities. Some species also are capable of ectomycorrhiza formation (Köljalg et al. 2000, Rinaldi et al. 2008). However, their diversity in boreal forests is little known over large areas. The present checklist intends to cover the biodiversity of this ecomorphic group of basidiomycetes on the territory of the Solovetsky Archipelago, where old-growth boreal forests have a local mosaic distribution. Such forests are enriched by fallen coarse dead wood

on various stages of decomposition and by fine woody debris, and therefore, a lot of niches for wood-inhabiting fungi are available.

The Solovetsky Archipelago is situated in the North-East of European Russia (64°95'65.8" N to 65°19'30.4" N, 035°50'01.8" E to 036°26'92.3" E), in the western part of the White Sea (Fig. 1). It consists of 6 large islands (Bolshoy Solovetsky Island, Anzersky Island (Anzer), Bolshaya Muksalma, Malaya Muksalma, Bolshoy Zayatsky, Maly Zayatsky), and more than 100 small islands, with a total area of 347 km². Their climate is characteristic for Atlantic–Arctic area, that is, moderately moist with annual precipitation of approximately 480 mm. The



Figure 1. Location of the Solovetsky Archipelago in north-eastern Europe.

average July temperature is 12.9 °C, whereas in February it is –10.1 °C. The sum of active temperatures varies around 889° (Ipatov et al. 2005).

The vegetation of Archipelago combines north taiga and forest tundra features. The forests occupy ca 67% of the area (Gryaznov and Sokolov 2008), and most of them were not cut within the last 90 years. Forest cutting in the 1920s to '30s, as well as forest fires, had an impact on the age structure and species composition of the forest stands (Ipatov et al. 2005). Norway spruce (*Picea abies/obovata*) dominates on silty soils (occupying ca 42.1% of the forested area), and Scots pine (*Pinus sylvestris*) is prevalent on sandy soil (occupying ca 34.5% of the forested area). The fragments of secondary forest are dominated by birch (*Betula pubescens*, 18.4%) and aspen (*Populus tremula*, 5.0%). In mature forest stands, birch and aspen combined comprise 5.0–18.4% of the stand, whereas in old-growth forests they represent 3.4–6.9%.

The median age of the coniferous stands is 150 years, whereas the deciduous stands have in median 65 years (Gryaznov and Sokolov 2008). The most common forests types are *Myrtillus* mesic type (56.4%), *Vaccinium* mesic type (7.1%), *Myrtillus* wet type (5.7%), and *Empetrum–Vaccinium* type (5.6%). There are 77 combinations of former types (Ipatov et al. 2005).

Methods

Study area. The field material was collected during the vegetative growth period of forest plants in 2006–2012, 2014 and 2015 using radial routes (Tolmachev 1974, Shmidt 1984). The radial routes arranged with wind rose have been initiated in 16 directions from each locality within the study area (Fig. 2). All these routes ended on reaching a shoreline. The living and dead standing trees, fallen logs, stumps, wood debris, and forest litter were observed. In total, 3500 trees were included in this study. Individual collection sites are shown in Table 1 (Fig. 2).

Data collection. The material was collected during 9 field expeditions, that visited 17 collection sites, with a set of radial routes made at each site. In total, more than 2500 specimens were collected and identified. Most of the species are documented with herbarium materials deposited at the herbaria of the N. Laverov Federal Center for Integrated Arctic Research (AR) and the Karelian Research Center of the Russian Academy of Sciences (PTZ).

Data analysis. Relevant handbooks concentrated to boreal fungal diversity (Bondartseva and Parmasto 1986, Ryvarden and Gilbertson 1993, 1994, Kõljalg 1996, Hansen and Knudsen 1997, Bondartseva 1998; Zmitrovich 2008, Ryvarden and Melo 2014, Niemelä, 2016) were used for the material identification.

A laboratory study of basidiomata was carried out as described by Gilbertson and Ryvarden (1986). Freehand sections and squash mounts were examined in 5% KOH,

Table 1. Numbers, names, and geographic coordinates of the localities in this study.

Site no.	Site name	Geographic coordinates
1	Botanical garden	65°05'29.8"N, 035°66'26.3"E
2	Dolgaya lip	65°03'82.6"N to 65°04'18.2"N, 035°73'81.4"E to 035°74'01.9"E
3	Kirpichny Zavod	65°02'12.9"N, 035°75'04.9"E
4	Varvarinskoye Lake	65°05'29.7"N, 035°73'61.3"E
5	Bolshoye Torfyanovo Lake	65°01'96.2"N, 035°77'07.6"E
6	Bolshoye Kamennoye Lake	65°02'16.6"N, 035°77'82.5"E
7	Narrow-gage railroad	65°04'26.7"N, 035°71'67.8"E
8	Solovetskiy village	65°05'29.8"N, 035°66'26.3"E
9	Savateevo village	65°11'85.9"N, 035°60'52.9"E
10	Isaakovo village	65°09'18.8"N, 035°61'95.6"E
11	Dam road	65°01'61.3"N to 65°02'45.7"N, 035°76'02.9"E to 035°83'67.6"E
12	Rebolda road	65°05'97.2"N to 65°13'88.4"N, 035°72'59.9"E to 035°81'22.9"E
13	Boat station road	65°03'57.6"N to 65°04'47.8"N, 035°69'36.9"E to 035°71'08.5"E
14	Pechak cape	64°96'15.6"N to 65°00'41.9"N, 035°75'11.9"E to 035°71'67.8"E
15	Sekirnaya Mountain road	65°07'83.6"N to 65°10'37.7"N, 035°52'65.6"E to 035°58'67.9"E
16	Beluzhiy cape road	65°07'83.3"N to 65°07'95.5"N, 035°52'65.3"E to 035°58'72.3"E
17	Bolshoy Zayatskiy Island south-east coast	64°97'06.3"N, 035°67'02.6"E

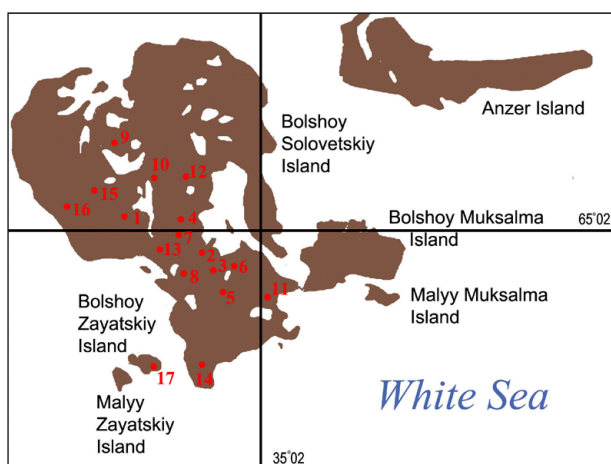


Figure 2. Key points of material collection in the Solovetsky Archipelago. Bolshoy Solovetskiy Island: 1 = Botanical garden; 2 = Dolgaya lip; 3 = Kirpichnyy Zavod; 4 = Varvarinskoye Lake; 5 = Bolshoye Torfyano Lake; 6 = Bolshoye Kamennoye Lake; 7 = narrow-gage railroad; 8 = Solovetskiy village; 9 = Savatyevoye village; 10 = Isaakovo village; 11 = Dam road; 12 = Rebolda road; 13 = Boat station road; 14 = Pechak cape; 15 = Sekiraya Mountain road; 16 = Beluzhiy cape road; Bolshoy Zayatskiy Island: 17 = South East coast.

2% Cotton Blue, and Melzer's reagent. For problematic specimens, at least 30 microstructures dimensions were carried out. Light microscopes MBS-10, Biolam RFN-11, Biomed-1 and LOMO Mikmed-2 were used in this study.

Results

An annotated checklist of aphyllorphoid fungi contains the data on the location of the finding and substrate of the species, the herbarium documentation, and a forest type where the fungus was recorded. Widely distributed species are listed basing on the field reports. The Roman numbers indicate key localities of the area as described above (Fig. 2). The frequency of occurrence is given as follows: very scarce (1 or 2 occurrences), scarce (3–5 occurrences), rather common (≥ 6 occurrences).

The generic concepts are accepted according to CABI Bioscience Databases (Index Fungorum 2016). The species new for Arkhangelsk Region of Russia are marked with 2 asterisks, whereas the species new for Solovetsky Archipelago are labeled with only 1 asterisk. Species found only in anthropogenic sites of the archipelago are marked by a dagger (†).

The present checklist is an addition to previous reports (Ezhov and Ruokolainen 2011, Ezhov 2014) and it includes 275 species belonging to 139 genera of aphyllorphoid basidiomycetes. Within them, 8 species (*Athelia bombacina*, *Ceraceomyces tessulatus*, *Clavaria zollingeri*, *Clavariadelphus truncatus*, *Clavulinopsis luteoalba*, *Hyphoderma obtusifforme*, *Phanerochaete jose-ferreirae*, and *Ramaria obtusissima*) were recorded for the first time from the Arkhangelsk Region and 23 species were recorded for the first time from the Solovetsky Archipelago.

1. **Acanthophysellum lividocoeruleum* (P. Karst.) Parmasto [= *Aleurodiscus lividocaeruleus* (P. Karst.) P.A.

Lemke] (Fig. 3a)—14: on fallen log of *Picea obovata* (AR 1964) in spruce forest. Very scarce.

2. *Albatrellus confluens* (Alb. & Schwein.) Kotl. & Pouzar—1, 16: on soil (AR 1559) in coniferous–deciduous mesic *Vaccinium myrtillus* forests. Very scarce.

3. *A. ovinus* (Schaeff.) Kotl. & Pouzar—1, 11: on soil (AR 1660) in coniferous–deciduous forests. Very scarce.

4. *Alutaceodontia alutacea* (Fr.) Hjortstam & Ryvarden [= *Hyphodontia alutacea* (Fr.) J. Erikss.]—14: on fallen log of *Picea obovata* (AR 1037) in coniferous forest. Very scarce.

5. *Amphinema byssoides* (Pers.) J. Erikss.—4, 8, 10, 14: on fallen logs of *Pinus sylvestris* (AR 2337), *Betula* sp. (AR 1453), *Populus tremula* (AR 2347, PTZ 2043) and *Sorbus aucuparia* (AR 1521) in coniferous–deciduous forests. Scarce.

6. **Amylocorticium subincarnatum* (Peck) Pouzar—1: on fallen logs of *Picea obovata* (AR 2394, PTZ 2046) and *Populus tremula* (AR 2389) in coniferous–deciduous forests.

7. *Amylocorticium subsulphureum* (P. Karst.) Pouzar (Fig. 3b)—4: on fallen log of *Picea obovata* (AR 1862) in spruce forest. Very scarce.

8. *Amylocystis lapponica* (Romell) Bondartsev & Singer (Fig. 3c)—1, 16: on fallen logs of *Picea obovata* in coniferous forests. Scarce.

9. *Amylostereum chailletii* (Pers.) Boidin—4: on the stump of *Picea obovata* (PTZ 1887) in spruce forest. Very scarce.

10. *Amyloporia sinuosa* (Fr.) Rajchenb., Gorjón & Pildain [= *Antrodia sinuosa* (Fr.) P. Karst.]—1, 4, 11, 14–16: on fallen logs of *Pinus sylvestris* in coniferous forests. Rather common.

11. **Anomoloma albolutescens* (Romell) Niemelä & K.H. Larss. [= *Anomoporia albolutescens* (Romell) Pouzar] (Fig. 3d)—8: on fallen log of *Populus tremula* (AR 2368, PTZ 2030) in coniferous–deciduous forest. Very scarce.

12. *A. myceliosum* (Peck) Niemelä & K.H. Larss. [= *Anomoporia myceliosa* (Peck) Pouzar] (Fig. 3e)—3: on fallen log of *Betula* sp. (AR 468, PTZ 1439) in coniferous–deciduous forest. Very scarce.

13. *Antrodia albobrunnea* (Romell) Ryvarden—4: on fallen log of *Picea obovata* (AR 1454, PTZ 1601) in spruce forest. Very scarce.

14. *A. piceata* K. Runnel, V. Spirin & J. Vlasák—4: on fallen log of *Picea obovata* (AR 53) in coniferous forest. Very scarce. Recently described species belonging to the *A. crassa*-complex (Spirin et al. 2015).

15. *A. serialis* (Fr.) Donk—1, 4, 11, 14–16: on fallen logs of *Picea obovata* (AR 1492) in various forest types. Rather common.



Figure 3. Rare and noteworthy species of apylophoroid fungi distributed in boreal forests of Solovetsky Archipelago: (a) *Acanthophysellum lividoceruleum*, (b) *Amylocorticium subsulphureum*, (c) *Amylocystis lapponica*, (d) *Anomoloma albolutescens*, (e) *A. myceliosa*, (f) *Elmerina caryae* (= *Aporpium caryae*), (g) *Boletopsis grisea*, (h) *Clavaria zollingeri*, (i) *Crustoderma dryinum*, (j) *Fomitopsis rosea*, (k) *Gloeophyllum odoratum*, (l) *Hyphoderma medioburiense*. Photographs: O.N. Ezhov. Scale bars = 5 mm.

16. *A. xantha* (Fr.) Ryvarden—1, 11, 14–16: on fallen logs of *Picea obovata* and *Pinus sylvestris* in various forest types. Rather common.

17. *Antrodiella faginea* Vampola & Pouzar—1, 4, 11, 15: on fallen logs of *Betula* sp. (AR 1017), *Populus tremula* (AR 1016, PTZ 1488) and *Sorbus aucuparia* (AR 1018) in spruce and coniferous–deciduous forests. Scarce.

18. *A. pallescens* (Pilát) Niemelä & Miettinen—1, 3, 4: on fallen logs of *Betula* sp. (AR 1019, PTZ 1491) and basidiomes of *Fomes fomentarius* in coniferous–deciduous forests. Scarce.

19. *A. romellii* (Donk) Niemelä—1, 4: on fallen logs of *Betula* sp. (AR 2329, PTZ 2040), *Populus tremula* (AR 74, AR 75, AR 1109, PTZ 1582) and *Salix* sp. (AR 2376, PTZ 2027) in coniferous–deciduous forests. Scarce.

20. *Artomyces pyxidatus* (Pers.) Jülich [= *Clavicornia pyxidata* (Pers.) Doty]—on dry trunk and fallen logs of *Populus tremula* (Cherenkova, 2009).
21. *Asterodon ferruginosus* Pat.—1, 4, 14: on fallen logs of *Picea obovata* (PTZ 1602), *Populus tremula* (AR 1934) and *Sorbus aucuparia* (AR 1020) in coniferous–deciduous forests. Scarce.
22. *Asterostroma laxum* Bres.—1: on fallen log of *Betula* sp. (AR 1974) in coniferous–deciduous forest. Very scarce.
23. *Athelia bombacina* (Link) Pers.—10: on dead branches of *Populus tremula* (AR 2420, PTZ 2042) in coniferous–deciduous forest. Very scarce.
24. *A. decipiens* (Höhn. & Litsch.) J. Erikss.—13: on fallen log of *Picea obovata* (AR 1480) in spruce forest. Very scarce.
25. *A. epiphylla* Pers.—14, 15: on fallen logs of *Picea obovata* (AR 2349, PTZ 2044) and *Pinus sylvestris* (AR 1441, PTZ 1642) in coniferous forests. Very scarce.
26. *Atheliachaete calotricha* (P. Karst.) Tura, Zmitr., Wasser & Spirin [= *Phanerochaete calotricha* (P. Karst.) J. Erikss. et Ryvarden]—1: on fallen log of *Picea obovata* (AR 1459) in spruce forest. Very scarce.
27. *A. sanguinea* (Fr.) Spirin & Zmitr. [= *Phanerochaete sanguinea* (Fr.) Pouzar]—1, 4, 14, 15: on fallen logs of *Pinus sylvestris* (PTZ 1630), *Betula* sp. (AR 2333) in pine forests. Very scarce.
25. *Bjerkandera adusta* (Willd.) P. Karst.—1, 4, 11: on stumps, dry trunks, fallen logs and dead branches of *Betula* sp. in various forest types. Scarce.
26. *B. fumosa* (Pers.) P. Karst.—on fallen logs of deciduous trees (Cherenkova 2009).
27. *Boletopsis grisea* (Peck) Bondartsev & Singer (Fig. 3g)—1, 7, 14, 15: on soil (AR 1662) on among mosses and lichens in pine forests. Scarce.
28. *Botryobasidium laeve* (J. Erikss.) Parmasto—4: on fallen log of *Picea obovata* (AR 1455) in spruce forest. Very scarce.
29. *B. medium* J. Erikss.—3, 11: on fallen logs of *Picea abies* (AR 1981) and *Betula* sp. (AR 1218, PTZ 1475) in coniferous–deciduous forests. Very scarce.
30. *B. subcoronatum* (Höhn. & Litsch.) Donk—1, 4, 15: on fallen logs of *Picea obovata* (AR 117, AR 2332), *Betula* sp. (AR 1456, PTZ 1603) and *Sorbus aucuparia* (AR 1784) in coniferous–deciduous forests. Scarce.
31. *B. vagum* (Berk. & M.A. Curtis) D.P. Rogers [= *Botryobasidium botryosum* (Bres.) J. Erikss.]—11: on fallen log of *Betula* sp. (AR 1971) in coniferous–deciduous forests. Very scarce.
32. *Botryohypochnus isabellinus* (Fr.) J. Erikss.—4, 11, 14, 15: on fallen logs of *Picea obovata* (PTZ 1911), *Pinus sibirica* (AR 2325), *Betula* sp. (AR 1983), *Populus tremula* (AR 1022, AR 1173), *Salix* sp. (AR 1536) and *Sorbus aucuparia* (AR 1676) in various forest types. Rather common.
33. *Cabalodontia cretacea* (Romell ex Bourdot & Galzin) Piątek [= *Phlebia cretacea* (Romell ex Bourdot et Galzin) J. Erikss. et Hjortstam]—14: on fallen log of *Pinus sylvestris* (AR 1955, PTZ 1880) in pine forest. Very scarce.
34. *Cantharellus cibarius* Fr.—11: on soil in coniferous–deciduous forests. Scarce.
35. *Ceraceomyces borealis* (Romell) J. Erikss. & Ryvarden—6: on fallen log of *Salix* sp. (AR 1507) in coniferous–deciduous forest. Very scarce.
36. *C. microsporus* K. H. Larss.—6, 14: on fallen logs of *Picea obovata* (AR 1023) in spruce forests. Very scarce.
37. *C. serpens* (Tode) Ginns—1, 4, 16: on fallen logs of *Juniperus communis* (AR 1448), *Picea obovata* (AR 1449) and *Populus tremula* (AR 1024, PTZ 1585) in various forest types. Scarce.
38. *C. tessulatus* (Cooke) Jülich—6: on basidiome of *Inonotus obliquus* (AR 2392) in coniferous–deciduous forest. Very scarce.
39. *Ceriporia reticulata* (Hoffm.) Domański—1: on fallen log of *Populus tremula* (AR 1617) in coniferous–deciduous forest. Very scarce.
40. *Ceriporiopsis mucida* (Pers.) Gilb. & Ryvarden—1, 15: on fallen logs of *Picea obovata* (AR 2215, PTZ 1878) and *Populus tremula* (AR 2336) in coniferous–deciduous forests. Very scarce.
41. *C. resinascens* (Romell) Domański—4: on fallen log of *Populus tremula* (AR 2213) in coniferous–deciduous forests. Very scarce.
42. *Cerrena unicolor* (Bull.) Murrill—1, 4, 11, 14—16: on fallen logs of *Betula* sp. and *Populus tremula* in various forest types. Rather common.
43. *Chaetodermella luna* (Romell ex D.P. Rogers & H.S. Jacks.) Rauschert—14, 16: on fallen logs and branches of *Pinus sylvestris* (AR 1244, PTZ 1648) in pine forests. Scarce.
44. *Chondrostereum purpureum* (Pers.) Pouzar—1, 2, 4, 11: on dry trunks and fallen logs of *Pinus sibirica* (AR 1817) and *Betula* sp. in various forest types. Scarce.
45. *Clavaria zollingeri* Lév. (Fig. 3h)—1: on soil (AR 2521, PTZ 2008) on meadow. Very scarce.
46. *Clavariadelphus ligula* (Schaeff.) Donk—4, 15: on soil (AR 1757, AR 1758) in spruce and in coniferous–deciduous forests. Scarce.
47. *C. pistillaris* (L.) Donk—1: on soil of track road-side (AR 2407, PTZ 1991) on meadow. Very scarce.

48. *C. sachalinensis* (S. Imai) Corner—1: on soil (AR 2268, PTZ 1893) in coniferous–deciduous forest. Very scarce.
49. **†*C. truncatus* Donk—1: on soil of track roadside (AR 2408) on meadow. Very scarce.
50. *Clavulina cinerea* (Bull.) J. Schröt.—13: on soil (AR 1249, PTZ 1548) in coniferous–deciduous forest. Very scarce.
51. *C. coralloides* (L.) J. Schröt.—4: on soil (AR 2267, PTZ 1879) in coniferous–deciduous forest. Very scarce.
52. ***Clavulinopsis luteoalba* (Rea) Corner—1: on soil (AR 2406, PTZ 2009) on meadows. Very scarce.
53. *Climacocystis borealis* (Fr.) Kotl. & Pouzar—1, 4: on stumps and dry trunks of *Picea obovata* (AR 1665) in coniferous forests. Scarce.
54. *Coltricia perennis* (L.) Murrill—4, 7, 14, 15: on sandy soil in pine forests or near the roads. Rather common.
55. *Conferticium karstenii* (Donk) Hallenb.—4: on fallen log of *Populus tremula* (AR 190) in aspen forest. Very scarce.
56. *Coniophora arida* (Fr.) P. Karst.—1, 5, 6, 10, 11, 14, 16: on fallen logs of *Populus tremula* in various forest types. Rather common.
57. *C. fusispora* (Cooke & Ellis) Cooke—4, 14: on fallen logs of *Picea obovata* (AR 1901), *Pinus sylvestris* (PTZ 1437) in coniferous forests. Very scarce.
58. *C. olivacea* (Fr.) P. Karst.—4, 11, 14: on fallen logs of *Picea obovata* (AR 2366), *Pinus sylvestris* (AR 1594), *Betula* sp., *Populus tremula* and basidiome of *Phellinus chrysoloma* (AR 2367) in various forest types. Rather common.
59. *Corticium boreoroseum* Boidin & Lanq.—14: on fallen log of *Pinus sylvestris* (AR 1126) in coniferous forest. Very scarce.
60. *C. roseum* Pers.—1, 4, 11, 15: on fallen logs and branches of *Salix* sp. in coniferous–deciduous forests. Rather common.
61. *Crustoderma dryinum* (Berk. & M.A. Curtis) Parmasto (Fig. 3i)—1, 14: on fallen logs of *Picea obovata*, *Pinus sylvestris* and *Betula* sp. (AR 1528) in coniferous forests. Scarce.
62. *C. longicystidium* (Litsch.) Nakasone [= *Phlebia longicystidia* (Litsch.) Hjortstam et Ryvarden]—15: on fallen log of *Betula* sp. (AR 1686) in coniferous–deciduous forest. Very scarce.
63. *Crustomyces subabruptus* (Bourdot & Galsin) Jülich—4: on fallen log of *Sorbus aucuparia* (AR 1348) in aspen forest. Very scarce.
64. *Cylindrobasidium laeve* (Pers.) Chamuris—1, 3, 8: on fallen logs of *Populus tremula* in coniferous–deciduous forests. Scarce.
65. *Cytidia salicina* (Fr.) Burt—4, 11: on dry and fallen logs, branches of *Salix* sp. in coniferous–deciduous forests. Scarce.
66. *Daedaleopsis confragosa* (Bolton) J. Schröt.—13: on dry and fallen log of *Salix* sp. in coniferous–deciduous forest. Very scarce.
67. *D. septentrionalis* (P. Karst.) Niemelä—on dry and fallen logs of *Betula* sp. (Cherenkova 2009).
68. *Dendrocorticium polygonioides* (P. Karst.) M.J. Larsen & Gilb. [= *Corticium polygonioides* P. Karst.]—11: on fallen log of *Salix* sp. (AR 1975) in coniferous–deciduous forest. Very scarce.
69. *Dichomitus squalens* (P. Karst.) D.A. Reid—11, 16: on fallen logs of *Picea obovata* (AR 1489, PTZ 1599) in spruce forests. Very scarce.
70. *Dichostereum boreale* (Pouzar) Ginns & M.N.L. Lefebvre—1, 11: on fallen logs of *Picea obovata* (AR 1980, PTZ 1910) and *Salix* sp. (AR 2377) in coniferous–deciduous and spruce forests. Very scarce.
71. *Diplomitoporus crustulinus* (Bres.) Domański—12, 16: on fallen logs of *Picea obovata* (AR 1506, PTZ 1598) in spruce forests. Very scarce.
72. *Elmerina caryae* (Schwein.) D.A. Reid [= *Aporpium caryae* (Schwein.) Teixeira & D. P. Rogers] (Fig. 3f)—4: on fallen logs of *Picea obovata* (AR 1898, PTZ 1862) and *Populus tremula* (AR 1852, PTZ 1892) in various forest types. Very scarce.
73. *Flaviporus citrinellus* (Niemelä & Ryvarden) Ginns [= *Antrodiella citrinella* Niemelä & Ryvarden]—14: on fallen log of *Picea obovata* (AR 65) in coniferous–deciduous forest. Very scarce.
74. *Fomes fomentarius* (L.) Fr.—1–6, 8, 11, 12, 14–16: on dry standing and fallen trees of *Betula* sp. in various forest types. Rather common.
75. *Fomitiporia punctata* (P. Karst.) Murrill [= *Phellinus punctatus* (P. Karst.) Pilát]—1–6, 8, 11, 12, 14–16: on dry and fallen logs, branches of *Betula* sp., *Salix* sp. and *Sorbus aucuparia* in various forest types. Rather common.
76. *Fomitopsis pinicola* (Sw.) P. Karst.—1–17: on living, dry and fallen trees of *Picea obovata*, *Pinus sylvestris*, *Betula* sp., *Populus tremula* and *Salix* sp. in various forest types. Rather common.
77. *F. rosea* (Alb. & Schwein.) P. Karst. (Fig. 3j)—1, 11, 14: on fallen logs of *Picea obovata* in spruce forests. Rather common.
78. *Fuscoporia ferruginosa* (Schröd.) Murrill [= *Phellinus ferruginosus* (Schröd.) Pat.]—on logs of deciduous trees (Cherenkova 2009).
79. *Ganoderma applanatum* (Pers.) Pat.—3, 15: on fallen logs of *Betula* sp., *Populus tremula*, *Salix* sp. in floodlands. Scarce.

80. *Gelatoporia dichroa* (Fr.) Ginns [= *Gloeoporus dichrous* (Fr.) Bres.]—11: on dry log of *Betula* sp. (AR 1031) in various forest type. Very scarce.
81. *Gloeocystidiellum convolvens* (P. Karst.) Donk—1, 14: on dead branches and fallen logs of *Betula* sp. (AR 2228), *Populus tremula* (AR 1278) and *Salix* sp. (AR 1930) in coniferous–deciduous forests. Scarce.
82. *G. leucoxanthum* (Bres.) Boidin—3, 11, 15: on dry and fallen logs of *Populus tremula* (AR 1032, PTZ 1583) and *Salix* sp. (AR 329, AR 1975, PTZ 1901) in aspen forest and floodlands. Scarce.
83. *G. porosum* (Berk. & M. A. Curtis) Donk—1: on fallen log of *Populus tremula* (AR 332) in aspen forest. Very scarce.
84. *Gloeophyllum odoratum* (Wulfen) Imazeki (Fig. 3k)—1: on stump of *Picea obovata* (AR 1405) in spruce forest. Very scarce.
85. *G. protractum* (Fr.) Imazeki—1: on fallen log of *Pinus sylvestris* (AR 342) in pine forest. Very scarce.
86. *G. sepiarium* (Wulfen) P. Karst.—1, 2, 11, 14–16: on fallen logs and timber wood of *Picea obovata*, *Pinus sylvestris*, *Betula* sp. and *Salix* sp. (AR 2415) in various forest types. Rather common.
87. *G. trabeum* (Pers.) Murrill—on fallen logs of forest trees (Cherenkova 2009).
88. *Gloeoporus pannocinctus* (Romell) J. Erikss. [= *Ceriporiopsis pannocincta* (Romell) Gilb. & Ryvarden]—1, 4, 9, 10, 15: on fallen logs of *Populus tremula* (AR 1026, AR 1076, PTZ 1492) and basidiomes of *Phellinus tremulae* (AR 2334) in aspen forests. Scarce.
89. *G. taxicola* (Pers.) Gilb. & Ryvarden—1, 11, 14: on fallen logs of *Picea obovata* and *Pinus sylvestris* (PTZ 1651) in coniferous forests. Scarce.
90. *Gloiodon strigosus* (Schwein.) P. Karst.—on fallen log of *Populus tremula* (Cherenkova 2009).
91. *Gloiothete citrina* (Pers.) Ginns & G.W. Freeman [= *Vesiculomyces citrinus* (Pers.) E. Hagström] (Fig. 5j)—1, 4, 8: on fallen logs of *Picea obovata* (AR 1902), *Betula* sp. (AR 1669), *Populus tremula*, *Salix* sp. and *Sorbus aucuparia* (AR 1952) in coniferous–deciduous forests. Rather common.
92. *Hapalopilus nidulans* (Fr.) P. Karst. [= *Hapalopilus rutilans* (Pers.) Murrill]—1, 4: on dry standing and fallen trees of *Betula* sp. in various forest types. Very scarce.
93. *Hericium cirrhatum* (Pers.) Nikol. [= *Creolophus cirrhatus* (Pers.) P. Karst.]—15: on fallen logs of *Betula* sp. (AR 1567), *Populus tremula* (AR 1027) in coniferous–deciduous forest. Very scarce.
94. *H. coralloides* (Scop.) Pers.—1, 4, 14: on dry standing and fallen trees of *Betula* sp., *Populus tremula* and *Sorbus aucuparia* in coniferous–deciduous forests. Scarce.
95. *Heterobasidion annosum* (Fr.) Bref.—1: on living, dry and fallen trees of *Pinus sylvestris* in coniferous forests. Very scarce.
96. *H. parviporum* Niemelä & Korhonen—1, 11: on fallen logs of *Picea obovata* (PTZ 1434) in spruce forests. Very scarce.
97. *Hydnellum aurantiacum* (Batsch) P. Karst.—4, 14, 16: on soil (AR 1663) in pine forests. Scarce.
98. *H. ferrugineum* (Fr.) P. Karst.—4, 13, 15: on soil in pine forests. Scarce.
99. **H. suaveolens* (Scop.) P. Karst.—4, 15: on soil in pine and coniferous–deciduous forests. Very scarce.
100. *Hydnum repandum* L.—1: on soil in coniferous–deciduous forest. Very scarce.
101. *H. rufescens* Pers.—4: on soil (AR 470) in coniferous–deciduous forest. Very scarce.
102. **Hymenochaete cinnamomea* (Pers.) Bres.—1: on fallen log of *Salix* sp. (AR 2375, PTZ 2028) in coniferous–deciduous forest. Very scarce.
103. **H. fuliginosa* (Pers.) Lév.—6: on fallen log of *Picea obovata* (AR 2348, PTZ 2045) in coniferous forest. Very scarce.
104. *Hymenochaetopsis tabacina* (Sowerby) S.H. He & Jiao Yang—4: on fallen log of *Salix* sp. (AR 1568) in coniferous–deciduous forest. Very scarce.
105. *Hyphoderma medioburiense* (Burt) Donk (Fig. 3l)—11: on fallen log of *Sorbus aucuparia* (AR 1357) in coniferous–deciduous forest. Very scarce.
106. ***H. obtusifforme* J. Erikss. & Å. Strid—15: on fallen log of *Picea obovata* (AR 2395, PTZ 2047) in coniferous–deciduous forest. Very scarce.
107. *H. setigerum* (Fr.) Donk—4, 6, 11, 14, 15: on fallen logs of *Alnus incana* (AR 1036, PTZ 1596), *Betula* sp. (AR 1973), *Populus tremula* (AR 399) and *Sorbus aucuparia* in various forest types. Rather common.
108. *Hyphodontia alutaria* (Burt) J. Erikss.—1, 14: on fallen logs of *Picea obovata* (AR 1893) and basidiome of *Phellinus chrysoloma* (AR 1894) in spruce forests. Very scarce.
109. **H. crustosa* (Pers.) J. Erikss.—14: on fallen log of *Sorbus aucuparia* (AR 1864, PTZ 1889) in coniferous–deciduous forest. Very scarce.
110. *H. pallidula* (Bres.) J. Erikss.—1, 4, 14: on fallen logs of *Picea obovata* (AR 1897), *Pinus sibirica* (AR 2372, PTZ 2029) and *Pinus sylvestris* (AR 1953) in coniferous forests. Scarce.
111. *H. subalutacea* (P. Karst.) J. Erikss.—1: on fallen log of *Picea obovata* (AR 1937) in spruce forest. Very scarce.
112. **Hypochnicium lundellii* (Bourdot) J. Erikss.—15: on fallen log of *Pinus sylvestris* (AR 2331, PTZ 2052) in pine forest. Very scarce.

113. *Inocutis rheades* (Pers.) Fiasson & Niemelä—1, 2: on dry standing trees of *Populus tremula* in aspen and coniferous–deciduous forests. Scarce.
114. *Inonotus leporinus* (Fr.) Gilb. & Ryvarden [= *Onnia leporina* (Fr.) H. Jahn]—1, 4, 14: on dying trees and stumps of *Picea obovata* (PTZ 1433) in spruce forests. Scarce.
115. *I. obliquus* (Ach. ex Pers.) Pilát—1–6, 8, 11, 14–16: on living and dry trees of *Alnus incana* and *Betula* sp. in coniferous–deciduous forests. Rather common.
116. *Irpex lacteus* (Fr.) Fr.—on deciduous trees (Cherenkova 2009).
117. *Ischnoderma benzoinum* (Wahlenb.) P. Karst. (Fig. 4a)—2, 14, 16: on fallen logs and stumps of *Picea obovata* and *Pinus sylvestris* in coniferous forests. Scarce.
118. **I. resinosum* (Schr.) P. Karst.—10: on stump of *Betula* sp. (AR 2414, PTZ 1996) in coniferous–deciduous forest. Very scarce.
119. *Junghuhnia collabens* (Fr.) Ryvarden [= *Steccherinum collabens* (Fr.) Vesterholt]—1: on fallen log of *Picea obovata* (AR 1816) in coniferous–deciduous forest. Very scarce.
120. *J. luteoalba* (P. Karst.) Ryvarden [= *Steccherinum luteoalbum* (P. Karst.) Vesterholt] (Fig. 5f)—4, 15: on fallen logs of *Picea obovata* (AR 1270, PTZ 1605) in coniferous forests. Very scarce.
121. *Kneiffiella flavipora* (Berk. & M.A. Curtis ex Cooke) Zmitr. & Malysheva [= *Hyphodontia flavipora* (Berk. & M.A. Curtis ex Cooke) Sheng H. Wu]—4: on fallen log of *Populus tremula* (AR 432) in coniferous–deciduous forest. Very scarce.
122. *Kurtia argillacea* (Bres.) Karasiński [= *Hyphoderma argillaceum* (Bres.) Donk]—11: on fallen logs of *Picea obovata* (AR 1966), *Betula* sp. (AR 1556, PTZ 1595) in coniferous–deciduous forest. Very scarce.
123. *Laxitextum bicolor* (Pers.) Lentz—3, 4, 11, 14: on fallen logs of *Picea obovata* (AR 2265), *Betula* sp. (AR 1972) and *Sorbus aucuparia* (AR 503) in coniferous–deciduous forests. Scarce.
124. *Lenzites betulina* (L.) Fr.—1, 3, 4, 11, 15: on fallen logs of *Betula* sp. (AR 1819, PTZ 1909) in various forest types. Scarce.
125. *Leptoporus mollis* (Pers.) Quél. (Fig. 4b)—3, 4, 6, 14, 15: on dry trunks and fallen logs of *Picea obovata* (AR 1040, PTZ 2035) in coniferous forests. Scarce.
126. *Leptosporomyces fuscostratus* (Burt) Hjortstam—15: on fallen log of *Picea obovata* (AR 1147, PTZ 1474) in coniferous forest. Very scarce.
127. *L. galzinii* (Bourdot) Jülich—14: on fallen log of *Picea obovata* (AR 1354) in spruce forest. Very scarce.
128. *L. septentrionalis* (J. Erikss.) Krieglst. [= *Fibulomyces septentrionalis* (J. Erikss.) Jülich]—1: on fallen log of *Pinus sylvestris* (AR 1515) in pine forest. Very scarce.
129. *Leucogyrophana romellii* Ginns—4, 14: on fallen logs of *Picea obovata* (AR 1356, PTZ 1593) and *Pinus sylvestris* (AR 1041) in coniferous forests. Very scarce.
130. *L. sororia* (Burt) Ginns—1: on fallen logs of *Picea obovata* (AR 2214, PTZ 1877) in spruce forest. Very scarce.
131. *Macrotiophula fistulosa* (Holmsk.) R. H. Petersen—on soil (Cherenkova 2009).
132. *M. fistulosa* var. *contorta* (Holmsk.) Nannf. et L. Holm—on soil (Cherenkova 2009).
133. *Merulius tremellosus* Schrad. [= *Phlebia tremellosa* (Schr.) Nakasone & Burds.]—1, 4: on fallen logs of *Betula* sp. and *Populus tremula* in coniferous–deciduous forests. Scarce.
134. **Mutatoderma mutatum* (Peck) C.E. Gómez [= *Hyphoderma mutatum* (Peck) Donk]—6, 8: on fallen logs of *Picea obovata* (AR 2390, PTZ 2034) and *Populus tremula* (AR 2371) in coniferous–deciduous forests. Very scarce.
135. *Mycoacia aurea* (Fr.) J. Erikss. & Ryvarden—14: on basidiome of *Fomes fomentarius* (AR 2229) in coniferous–deciduous forest. Very scarce.
136. *M. fuscoatra* (Fr.) Donk—4, 17: on fallen logs of *Pinus sylvestris* (AR 536) and *Sorbus aucuparia* (PTZ 1604) in spruce and coniferous–deciduous forests. Very scarce.
137. **M. uda* (Fr.) Donk—15: on fallen log of *Picea obovata* (AR 2351, PTZ 2048) in coniferous–deciduous forest. Very scarce.
138. *Mycoaciella bispora* (Stalpers) J. Erikss. & Ryvarden—4: on fallen log of *Betula* sp. (AR 1577, PTZ 1704) in coniferous–deciduous forest. Very scarce. Figure 4 c.
139. *Oligoporus alni* (Niemelä & Vampola) Piątek [= *Postia alni* Niemelä & Vampola]—1, 4, 15: on fallen logs of *Populus tremula*, *Alnus incana* in coniferous–deciduous forests. Rather common.
140. *O. persicinus* (Niemelä & Y.C. Dai) Niemelä [= *Postia persicina* Niemelä & Y. C. Dai]—4, 14: on dry trunks of *Picea obovata* (AR 1131, PTZ 1460) in coniferous forests. Very scarce.
141. *Oxyporus corticola* (Fr.) Ryvarden—1, 4, 15, 16: on fallen logs of *Betula* sp. (AR 1044, PTZ 1502), *Populus tremula* (AR 548), *Sorbus aucuparia* (AR 549) and basidiome of *Phellinus tremulae* (AR 1942) in spruce and coniferous–deciduous forests. Rather common.
142. *O. obducens* (Pers.) Donk—2, 15: on fallen logs of *Populus tremula* (AR 1135, PTZ 1485) and *Betula* sp. (AR 1443) in aspen and spruce forests. Very scarce.



Figure 4. Rare and noteworthy species of aphyllporoid fungi distributed in boreal forests of Solovetsky Archipelago: (a) *Ischnoderma benzoinum*, (b) *Leptoporus mollis*, (c) *Mycoaciella bispora*, (d) *Phellodon niger*, (e) *Polyporus badius* (= *Royoporus badius*), (f) *Scytinostroma portentosum*, (g) *Skeletocutis subincarnata*. Photographs: O.N. Ezhov. Scale bars = 5 mm.

143. *O. populinus* (Schumach.) Donk—4, 11: on live trunks of *Betula* sp. (AR 1048) and *Salix* sp. (AR 2410) in coniferous–deciduous forests. Very scarce.

144. *Paullicorticium ansatum* Liberta—1: on fallen log of *Picea obovata* (AR 1962) in spruce forest. Very scarce.

145. *Peniophora incarnata* (Pers.) P. Karst.—1, 4, 14: on dry trunks and fallen logs of *Populus tremula* (AR 1049, PTZ 1584) and *Salix* sp. (AR 1536) in aspen and spruce forests. Scarce.

146. *P. nuda* (Fr.) Bres.—4, 15: on fallen logs of *Popu-*

lus tremula (AR 1935, PTZ 2050) in aspen forests. Very scarce.

147. *P. pithya* (Pers.) J. Erikss.—14: on fallen logs of *Picea obovata* (AR 1927) and *Sorbus aucuparia* (AR 1865, PTZ 1890) in coniferous–deciduous forests. Very scarce.

148. *P. polygonia* (Pers.) Bourdot & Galzin—4: on fallen log of *Populus tremula* (AR 1936) in aspen forest. Very scarce.

149. *P. septentrionalis* Laurila—5, 11, 15, 17: on fallen logs of *Picea obovata* (AR 582, AR 1143, PTZ 1473, PTZ 1597) in spruce forests. Scarce.

150. *Peniophorella praetermissa* (P. Karst.) K.H. Larss. [= *Hyphoderma praetermissum* (P. Karst.) J. Erikss. & Å. Strid.]—4: on dry trunk of *Sorbus aucuparia* (AR 469, PTZ 1438) in coniferous–deciduous forest. Very scarce.

151. *Perenniporia subacida* (Peck) Donk—1, 4, 15: on fallen logs of *Picea obovata* (AR 589, PTZ 1490), *Betula* sp. (AR 1685) and *Populus tremula* (AR 289) in spruce and coniferous–deciduous forests. Scarce.

152. *Phaeolus schweinitzii* (Fr.) Pat.—1, 9, 15: on roots of old of *Larix sibirica*, *Pinus sibirica* (AR 1558) and *Pinus sylvestris* in coniferous forests. Scarce.

153. ***Phanerochaete jose-ferreirae* (D.A. Reid) D.A. Reid—6: on fallen log and branch of *Populus tremula* (AR 2393) in coniferous–deciduous forest. Very scarce.

154. *P. laevis* (Fr.) J. Erikss. & Ryvarden—4, 11, 14: on fallen logs and branches of *Picea obovata*, *Betula* sp., *Populus tremula* (AR 1488) and *Sorbus aucuparia* in various forest types. Scarce.

155. *P. sordida* (P. Karst.) J. Erikss. & Ryvarden—1, 4, 11: on fallen logs and branches of *Picea obovata*, *Pinus sylvestris*, *Pinus sibirica* (AR 2326), *Betula* sp. (AR 1979, PTZ 1899), *Populus tremula* (AR 611) and *Salix* sp. in coniferous–deciduous forests. Rather common.

156. *P. velutina* (DC.) P. Karst.—4, 15: on fallen logs of *Pinus sylvestris* (AR 615) and *Populus tremula* (AR 1352) in aspen and coniferous–deciduous forests. Very scarce.

157. *Phaeoclavulina abietina* (Pers.) Giachini [= *Ramaria abietina* (Pers.) Quél.]—on soil (Cherenkova 2009).

158. *Phellinidium ferrugineofuscum* (P. Karst.) Fiasson & Niemelä [= *Phellinus ferrugineofuscus* (P. Karst.) Bourdot & Galzin]—4, 6, 8–10, 15: on fallen logs of *Picea obovata*, *Pinus sylvestris* in coniferous forests. Rather common.

159. *Phellinopsis conchata* (Pers.) Y.C. Dai [= *Phellinus conchatus* (Pers.) Quél.]—1, 3, 4, 11: on living and dry trees of *Populus tremula*, *Salix* sp. and *Sorbus aucuparia* in various forest types. Rather common.

160. *Phellinus chrysoloma* (Fr.) Donk—1, 4, 5, 6, 11,

12, 14, 16: on living and dry trees of *Picea obovata* in various forest types. Rather common.

161. *P. igniarius* (L.) Quél. [= *Ph. alni* (Bondartsev) Parmasto, *Ph. nigricans* (Fr.) P. Karst.]—1, 3, 4, 8, 11: on living and dry trees of *Alnus incana*, *Betula* sp., *Sorbus aucuparia* and *Salix* sp. in various forest types. Rather common.

162. *P. laevigatus* (P. Karst.) Bourdot & Galzin—4: on fallen logs of *Betula* sp. and *Sorbus aucuparia* in coniferous–deciduous forests. Rather common.

163. *P. lundellii* Niemelä—1, 4, 11: on living and dry trees of *Betula* sp. in coniferous–deciduous forests. Scarce.

164. *P. nigrolimitatus* (Romell) Niemelä, T. Wagner & M. Fisch.—11, 14, 15: on fallen logs of *Picea obovata* (AR 1051, PTZ 1435) in spruce forests. Scarce.

165. *P. populicola* Niemelä—1–6, 8, 11–16: on living and dry trees and dry trunks of *Populus tremula* in coniferous–deciduous forests. Rather common.

166. *P. tremulae* (Bondartsev) Bondartsev & P. N. Borisov—1–6, 8, 11–16: on living trees *Populus tremula* in coniferous–deciduous forests. Rather common.

167. *P. viticola* (Schwein.) Donk—1, 4, 14, 16: on fallen logs of *Picea obovata* and *Pinus sylvestris* in coniferous forests. Rather common.

168. **Phellodon fuligineoalbus* (J.C. Schmidt) Baird [= *Bankera fuligineoalba* (J.C. Schmidt) Coker & Beers ex Pouzar.]—4, 15: on soil among mosses and lichens (PTZ 2001) in pine forests. Very scarce.

169. **P. niger* (Fr.) P. Karst. (Fig. 4d)—4, 10, 15: on soil (AR 2570, PTZ 1992) in pine forests. Scarce.

170. *P. tomentosus* (L.) Banker—10, 13, 14, 15, 16: on soil in coniferous forests. Scarce.

171. *Phlebia centrifuga* P. Karst.—1, 4, 14, 15: on fallen logs of *Picea obovata* (AR 664) and *Pinus sylvestris* (PTZ 1650) in coniferous forests. Scarce.

172. *P. lilascens* (Bourdot) J. Erikss. & Hjortstam—1: on fallen log of *Picea obovata* (AR 1938) in coniferous forest. Very scarce.

173. *P. livida* (Pers.) Bres.—14: on fallen log of *Pinus sylvestris* (AR 1052, PTZ 1487) in pine forest. Very scarce.

174. *P. radiata* Fr.—1, 3, 11: on fallen logs of *Salix* sp. and *Sorbus aucuparia* in various forest types. Scarce.

175. *P. segregata* (Bourdot & Galzin) Parmasto—11, 14: on fallen logs of *Picea obovata* (AR 1053, PTZ 1587) and *Betula* sp. (PTZ 1904) in pine forests. Very scarce.

176. *P. subulata* Erikss. & Hjortstam—4: on fallen log of *Picea obovata* (AR 1054, PTZ 1592) in spruce forest. Very scarce.

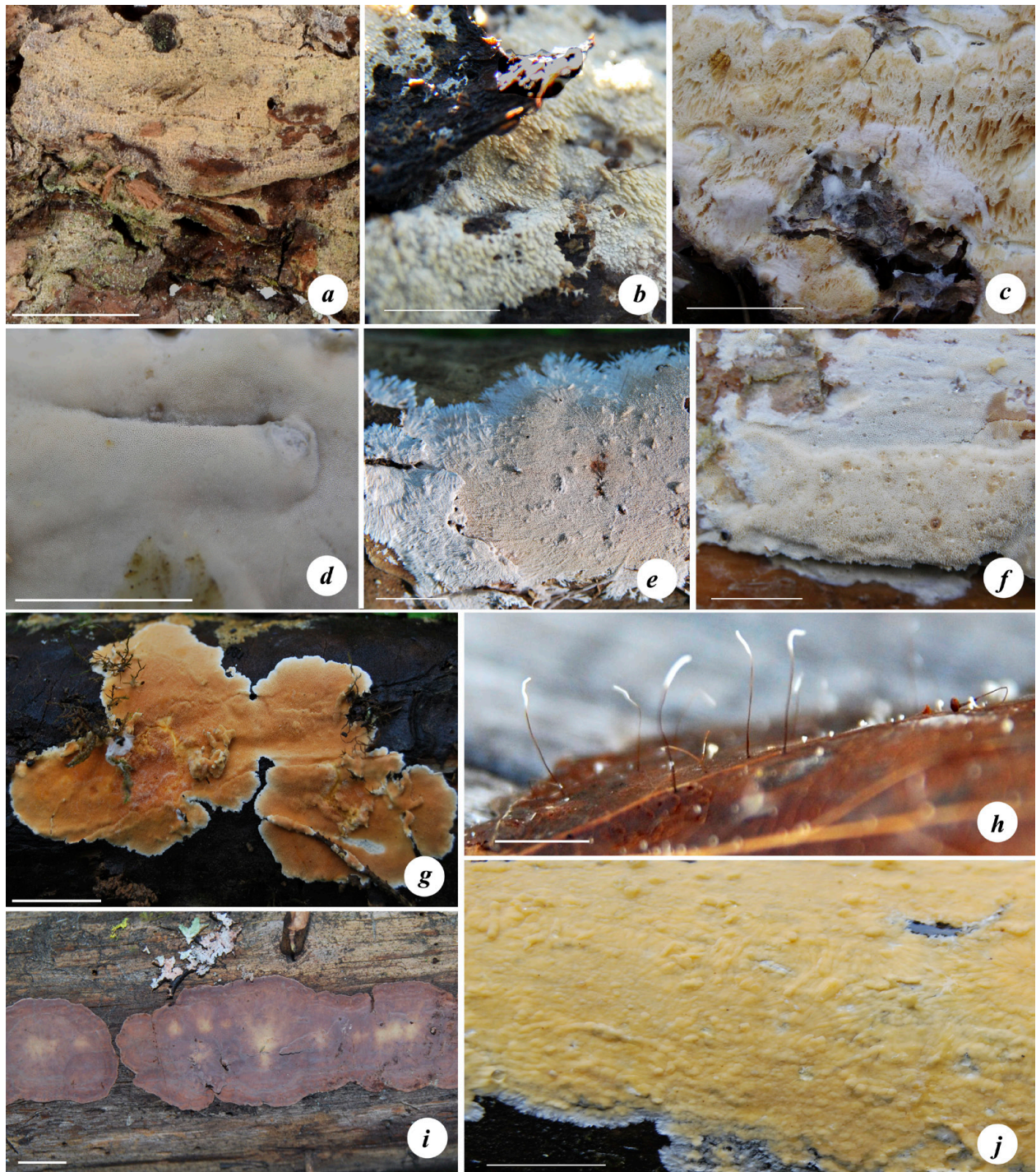


Figure 5. Selected widespread species of aphyllorphoroid fungi distributed in boreal forests of Solovetsky Archipelago: (a) *Scytinostromella heterogenea*, (b) *Sistotrema raduloides*, (c) *Skeletocutis odora*, (d) *S. stellae*, (e) *Steccherinum fimbriatum*, (f) *S. luteoalbum* (= *Junghuhnia luteoalba*), (g) *S. ochraceum*, (h) *Typhula erythropus*, (i) *Veluticeps abietina*, (j) *Vesiculomyces citrinus* (= *Gloiothele citrina*). Photographs: O.N. Ezhov. Scale bars = 5 mm.

177. *Phlebiopsis gigantea* (Fr.) Jülich—1, 4, 15: on dry trunks and fallen logs of *Picea obovata*, *Pinus sibirica* (AR 1582) and *Pinus sylvestris* in coniferous forests. Scarce.

178. *Piloderma bicolor* (Peck) Jülich [= *Piloderma fallax* (Lib.) Stalpers]—1, 4, 11, 14, 15: on fallen logs of *Picea abies* (AR 1963), *Pinus sylvestris* (AR 1056) and *Populus tremula* (AR 1977) in coniferous–deciduous forests. Scarce.

179. *Piptoporus betulinus* (Bull.) P. Karst.—1–4, 7, 11, 12–17: on dry trunks, fallen logs and branches of *Betula* sp. in coniferous–deciduous forests. Rather common.

180. *Polyporus varius* (Pers.) Fr.—1, 4, 15: dry trunks and fallen logs of *Betula* sp., *Populus tremula* and *Salix* sp. (AR 726) in coniferous–deciduous forests and floodlands. Scarce.

181. *Porodaedalea pini* (Brot.) Murrill [= *Phellinus pini* (Brot.) Bondartsev et Singer]—1, 4, 11, 14–16: on living

and fallen trees of *Pinus sylvestris* in coniferous forests. Rather common.

182. *Postia caesia* (Schr.) P. Karst.—1, 4, 10, 15: on fallen logs of *Picea obovata* in coniferous–deciduous forests. Rather common.

183. *P. fragilis* (Fr.) Jülich—1, 14: on fallen logs of *Picea obovata* (AR 1818, PTZ 1489) in spruce forests. Very scarce.

184. *P. guttulata* (Sacc.) Jülich—15: on fallen log of *Picea obovata* in spruce forest. Very scarce.

185. *P. lateritia* Renvall—1: on fallen log of *Pinus sylvestris* (AR 743) in pine forest. Very scarce.

186. **P. rennyi* (Berk. & Broome) Rajhenberg—15: on fallen log of *Populus tremula* (AR 2350) in pine forest. Very scarce.

187. *P. sericeomollis* (Romell) Jülich—1: on fallen log of *Picea obovata* (AR 1468, PTZ 1694) in spruce forest. Very scarce.

188. *P. stiptica* (Pers.) Jülich—1, 4, 15: on dry trunk and fallen logs of *Picea obovata* and *Pinus sibirica* (AR 2327) in pine forests. Scarce.

189. *P. tephroleuca* (Fr.) Jülich—1: on fallen log of *Pinus sylvestris* (AR 1967, PTZ 1898) in coniferous–deciduous forest. Very scarce.

190. *Pseudotomentella nigra* (Höhn. & Litsch.) Svrček—14: on fallen log of *Pinus sylvestris* (AR 1642, PTZ 1705) in birch forest. Very scarce.

191. *P. tristis* (P. Karst.) M.J. Larsen—1, 14: on fallen logs of *Picea obovata* (AR 1959) and *Betula* sp. (AR 1984, PTZ 1866) in coniferous–deciduous forests. Very scarce.

192. *Pycnoporus cinnabarinus* (Jacq.) P. Karst.—1, 4, 11, 15: on fallen logs of *Betula* sp. and *Salix* sp. (AR 1820) in various forest types. Scarce.

193. *Radulodon aneirinus* (Sommerf.) Spirin [= *Ceriopopsis aneirina* (Sommerf.) Domański]—14, 15, 16: on fallen logs of *Populus tremula* (AR 1487, PTZ 1600) in aspen forests. Scarce.

194. **Radulomyces confluens* (Fr.) M.P. Christ.—1: on fallen log of *Betula* sp. (AR 2373, PTZ 2031) in coniferous–deciduous forest. Very scarce.

195. *R. rickii* (Bres.) M.P. Christ.—4: on dry trunk of *Salix* sp. (AR 1613) in floodland. Very scarce.

196. *Ramaria corrugata* (P. Karst.) Schild—4: on soil (AR 1756) in coniferous–deciduous forest. Very scarce.

197. *R. formosa* (Pers.) Quél.—15: on soil (AR 1779) in coniferous–deciduous forest. Very scarce.

198. ***R. obtusissima* (Peck) Corner—1: on soil (AR 2514) in pine forest. Very scarce.

199. *R. stricta* (Pers.) Quél.—on soil (Cherenkova 2009).

200. *Resinicium bicolor* (Alb. & Schwein.) Parmasto—1, 3, 11, 14, 15: on fallen logs of *Picea obovata* (AR 1065) and basidiomes of *Phellinus chrysoloma* (AR 1274) in spruce forests. Scarce.

201. *R. furfuraceum* (Bres.) Parmasto—1: on fallen logs of *Picea obovata* (AR 1960) and *Pinus sylvestris* (AR 2360) in spruce forest. Very scarce.

202. *Rhodonía placenta* (Fr.) Niemelä, K.H. Larss. & Schigel [= *Postia placenta* (Fr.) M. J. Larsen et Lombard]—1: on fallen log of *Pinus sylvestris* (AR 1516, PTZ 1764) in pine–spruce forest. Very scarce.

203. *Royoporus badius* (Pers.) A.B. De [= *Polyporus badius* (Pers.) Schwein.] (Fig. 4e)—3: on fallen log of *Populus tremula* (AR 2266, PTZ 1897) in aspen forest. Very scarce.

204. *Sarcodon fennicus* (P. Karst.) P. Karst.—4: on soil (PTZ 2002) in pine forest. Very scarce.

205. *S. imbricatus* (L.) P. Karst.—1, 14, 15: on soil (AR 1664) in coniferous forests. Scarce.

206. **Schizopora paradoxa* (Schr.) Donk [= *Hyphodontia paradoxa* (Schr.) Langer et Vesterholt]—8: on fallen log of *Betula* sp. (AR 2498) in coniferous–deciduous forest. Very scarce.

207. *Scopuloides hydroides* (Cooke & Masee) Hjortstam & Ryvarden—8, 14: on fallen logs of *Populus tremula* (AR 1624, AR 2369) and *Sorbus aucuparia* (AR 1939) in aspen and coniferous–deciduous forests. Very scarce.

208. *Scytinostroma galactinum* (Fr.) Donk—1: on fallen logs of *Picea obovata* (AR 1954) and *Salix* sp. (AR 1508, PTZ 1637) in coniferous–deciduous forest. Very scarce.

209. *S. hemidichophyticum* Pouzar—12, 15: on fallen logs of *Salix* sp. (AR 839, AR 840, PTZ 1029) in floodlands. Very scarce.

210. *S. portentosum* (Berk. & M. A. Curtis) Donk (Fig. 4f)—14: on fallen log and branch of *Picea obovata* (AR 1207, PTZ 1477) in spruce forest. Very scarce.

211. *Scytinostromella heterogenea* (Bourdot & Galzin) Parmasto (Fig. 5a)—1: on fallen log of *Picea obovata* (AR 1957) in coniferous–deciduous forest. Very scarce.

212. *Sistotrema brinkmannii* (Bres.) J. Erikss.—3, 6, 11: on fallen logs of *Picea obovata* (AR 2335) and *Populus tremula* (AR 1209, PTZ 1476) in coniferous–deciduous forests. Rather common.

213. *S. confluens* Pers.—1: on soil (AR 1677) in aspen forest. Very scarce.

214. *S. raduloides* (P. Karst.) Donk (Fig. 5b)—4: on fallen log of *Populus tremula* (AR 1900) in aspen forest. Very scarce.

215. *S. sernanderi* (Litsch.) Donk—4: on fallen log of

Betula sp. (AR 1684) in coniferous–deciduous forest. Very scarce.

216. *Sistotremastrum suecicum* Litsch. ex J. Erikss.—1, 14, 16: on dead branches of *Picea obovata* (AR 1903) and *Pinus sylvestris* (AR 1479) in coniferous forests. Scarce.

217. *Sistotremella perpusilla* Hjortstam—14, 16: on fallen logs of *Picea obovata* (AR 1535, PTZ 1478) and basidiomes of *Phellinus chrysoloma* (AR 1211) in spruce and coniferous–deciduous forests. Very scarce.

218. *Skeletocutis amorpha* (Fr.) Kotl. & Pouzar—1, 4, 11, 14, 15: on fallen logs and stumps of *Pinus sylvestris* in coniferous forests. Rather common.

219. *S. biguttulata* (Romell) Niemelä—1, 13: on fallen logs of *Picea obovata* (AR 859, AR 1475) in spruce forests. Very scarce.

220. *S. brevispora* Niemelä—1: on fallen logs of *Picea obovata* (AR 1066, PTZ 1440) and basidiomes of *Phellinus ferrugineofuscus* (AR 864) in spruce forests. Very scarce.

221. *S. chrysella* Niemelä—1: on fallen log of *Picea obovata* (AR 872) and basidiom of *Phellinus chrysoloma* in coniferous–deciduous forest. Very scarce.

222. *S. kuehneri* A. David—14: on fallen log of *Pinus sylvestris* (AR 1067, PTZ 1589) in pine forest. Very scarce.

223. *S. odora* (Sacc.) Ginns (Fig. 5c)—14: on fallen log of *Picea obovata* (AR 1858, PTZ 1896) in coniferous–deciduous forest. Very scarce.

224. *S. papyracea* A. David—1, 11, 14: on fallen logs of *Picea obovata* (AR 1965, PTZ 1895) and *Pinus sylvestris* (AR 895) in coniferous forests. Scarce.

225. *S. stellae* (Pilát) Jean Keller (Fig. 5d)—1, 3, 4, 14: on fallen logs of *Picea obovata* (AR 1068, AR 1976, PTZ 1900) and *Pinus sylvestris* (PTZ 1590, PTZ 1894) in coniferous forests. Scarce.

226. *S. subincarnata* (Peck) Jean Keller (Fig. 4g)—16: on fallen log of *Pinus sylvestris* (AR 1478) in pine forest. Very scarce.

227. *Sphaerobasidium minutum* (J. Erikss.) Oberw. ex Jülich—14: on fallen logs of *Betula* sp. (AR 1358) and *Salix* sp. (AR 1615) in coniferous–deciduous forest. Very scarce.

228. *Steccherinum fimbriatum* (Pers.) J. Erikss. (Fig. 5e)—1, 4, 7, 10, 15: on fallen logs of *Juniperus communis* (AR 2365, PTZ 2032), *Populus tremula* (AR 882), *Salix* sp. (AR 1679) and *Sorbus aucuparia* in coniferous–deciduous forests. Scarce.

229. **S. ochraceum* (Pers.) Gray (Fig. 5g)—11: on fallen log of *Picea obovata* (AR 2409, PTZ 2036) in coniferous–deciduous forest. Very scarce.

230. *Stereum hirsutum* (Willd.) Pers.—1, 4, 14, 15:

on dry trunks, fallen logs and branches of *Betula* sp. in coniferous–deciduous forests. Rather common.

231. *S. rugosum* (Pers.)—4, 14, 15: on dry trunks and fallen logs of *Populus tremula* and *Sorbus aucuparia* in coniferous–deciduous forests. Rather common.

232. *S. sanguinolentum* (Alb. et Schwein.) Fr.—1, 14–16: on dry trunks and fallen logs of *Picea obovata* in coniferous forests. Rather common.

233. *S. subtomentosum* Pouzar—4, 14, 15: on fallen logs of *Betula* sp. and *Salix* sp. in coniferous–deciduous forests. Scarce.

234. *Subulicystidium longisporum* (Pat.) Parmasto—4, 11, 16: on fallen logs of *Populus tremula* (AR 1476, PTZ 1656) in aspen forests. Very scarce.

235. *Thelephora terrestris* Ehrh.—11, 13, 16: on soil in coniferous–deciduous forests. Scarce.

236. *Tomentella asperula* (P. Karst.) Höhn. et Litsch.—4, 7, 15: on fallen log of *Populus tremula* (AR 1630) in aspen forests. Scarce.

237. *T. badia* (Link) Stalpers—11: on fallen log of *Salix* sp. (AR 1175, PTZ 1458) in coniferous–deciduous forest. Very scarce.

238. *T. bryophila* (Pers.) M.J. Larsen—4, 6, 10, 11, 14: on fallen logs of *Picea obovata* (AR 1464), *Pinus sylvestris* (AR 1259), *Betula* sp. (AR 1071), *Populus tremula* (AR 1465), *Salix* sp. (AR 1177), *Sorbus aucuparia* (AR 1219, PTZ 1509) and basidiomes of *Inonotus rheades* (AR 1985) and *Phellinus nigrolimitatus* (AR 2363) in various forest types. Rather common.

239. *T. cinerascens* (P. Karst.) Höhn. & Litsch.—4, 11, 14: on fallen logs of *Picea obovata* (AR 1075, PTZ 1507), *Pinus sylvestris* (AR 1387), *Betula* sp. (AR 1187), *Populus tremula* (AR 1073), *Salix* sp. (PTZ 1507) and *Sorbus aucuparia* (AR 1987, PTZ 1906) in various forest types. Rather common.

240. **T. cinereoumbrina* (Bres.) Stalpers—7: on fallen log of *Juniperus communis* (AR 2364, PTZ 2033) in pine forest. Very scarce.

241. *T. coerulea* (Bres.) Höhn. & Litsch.—8: on fallen log of *Sorbus aucuparia* (AR 2495) in coniferous–deciduous forests and on fallen logs (Köljalg 1996).

242. *T. ellisii* (Sacc.) Jülich & Stalpers—1, 14: on fallen logs of *Betula* sp. (AR 1986, PTZ 1907) and *Salix* sp. (AR 2374, PTZ 2041) in coniferous–deciduous forests. Very scarce.

243. *T. fuscocinerea* (Pers.) Donk—1: on fallen log of *Populus tremula* (AR 1626) in aspen forest. Very scarce.

244. *T. lateritia* Pat.—3, 11, 15: on fallen logs and branch of *Sorbus aucuparia* (AR 1074, PTZ 1588) in coniferous–deciduous forests. Scarce.

245. **T. lilacinogrisea* Wakef.—15: on fallen log of

Picea obovata (AR 2405, PTZ 2049) in coniferous forest. Very scarce.

246. *T. radiosa* (P. Karst.) Rick—8, 11, 14: on fallen logs of *Pinus sylvestris* (AR 1075), *Betula* sp. (AR 1182) and *Sorbus aucuparia* (AR 1183, PTZ 1506) in coniferous–deciduous forests. Rather common.

247. *T. stuposa* (Link) Stalpers—4: on fallen log of *Sorbus aucuparia* (AR 1988) in floodland and on fallen log (Köljalg 1996).

248. *T. sublilacina* (Ellis & Holw.) Wakef.—on fallen logs (Köljalg 1996).

249. *T. umbrinospora* M.J. Larsen—1, 4: on fallen logs of *Populus tremula* (AR 1616) and *Sorbus aucuparia* (AR 1347) in various forest types. Very scarce.

250. *Trametes hirsuta* (Wulfen) Lloyd—1, 2, 4–6, 11, 12, 14–16: on dry standing and fallen trees and branches of *Betula* sp., *Populus tremula* and *Salix* sp. in various forest types. Rather common.

251. *T. ochracea* (Pers.) Gilb. & Ryvarden—1, 2, 4–6, 11, 12, 14–16: on dry standing and fallen trees and branches of *Betula* sp. and *Populus tremula* in various forest types. Rather common.

252. *T. pubescens* (Schumach.) Pilát—1, 4, 11, 14, 15: on dry standing and fallen trees of *Betula* sp. in various forest types. Rather common.

253. *T. versicolor* (L.) Lloyd—1, 2, 4, 11, 12, 14: on stumps and fallen logs of *Betula* sp. and *Populus tremula* in coniferous–deciduous forests. Rather common.

254. **Trechispora candidissima* (Schwein.) Bondartsev & Singer—8: on fallen log of *Populus tremula* (AR 2370) in coniferous–deciduous forest. Very scarce.

255. *T. farinacea* (Pers.) Liberta—1, 4: on fallen log of *Populus tremula* (AR 1446) and basidiome of *Fomes fomentarius* (AR 1445) in various forest types. Very scarce.

256. *T. microspora* (P. Karst.) Liberta—1, 14: on fallen logs of *Picea obovata* (AR 1961) and *Pinus sylvestris* (AR 1165, PTZ 1479) in coniferous forests. Very scarce.

257. *T. mollusca* (Pers.) Liberta—4, 11: on fallen logs of *Betula* sp. (AR 1077, PTZ 1586) and basidiome of *Fomes fomentarius* (AR 1896, PTZ 1905) in coniferous–deciduous forests. Very scarce.

258. **T. nivea* (Pers.) K.H. Larss.—9: on basidiome of *Phellinus tremulae* (AR 2330) in coniferous–deciduous forest. Very scarce.

259. *T. praefocata* (Bourdot & Galzin) Liberta—14: on fallen log of *Pinus sylvestris* (AR 1296) in pine forest. Very scarce.

260. *Trichaptum abietinum* (Dicks.) Ryvarden—1, 4, 11, 14: on fallen logs and branches of *Picea obovata* and

Pinus sylvestris in coniferous and coniferous–deciduous forests. Rather common.

261. *T. biforme* (Fr.) Ryvarden [= *Trichaptum pargamentum* (Fr.) G. Cunn.]—1, 2, 4, 11, 15: on dry trunks and fallen logs and branches of *Betula* sp. and *Populus tremula* in various forest types. Scarce.

262. *T. fuscoviolaceum* (Ehrenb.) Ryvarden—1, 4, 11, 14: on fallen logs and stumps of *Picea obovata* in various forest types. Rather common.

263. *T. laricinum* (P. Karst.) Ryvarden—16: on fallen log of *Picea obovata* in coniferous forest. Very scarce.

264. *Tubulicrinis glebulosus* (Fr.) Donk [= *Tubulicrinis gracillimus* (Ellis & Everh. ex D.P. Rogers & H.S. Jacks.) G. Cunn.]—6: on fallen logs of *Pinus sylvestris* (AR 1956) and *Populus tremula* (AR 1457, PTZ 1641) in coniferous–deciduous forests. Very scarce.

265. *T. subulatus* (Bourdot & Galzin) Donk—4, 14: on fallen logs of *Pinus sylvestris* (AR 992, PTZ 1591) in coniferous forests. Very scarce.

266. *Tulasnella violea* (Qué.) Bourdot & Galzin—1: on fallen log of *Betula pubescens* (AR 1668) in coniferous–deciduous forest. Very scarce.

267. **Typhula erythropus* (Pers.) Fr. (Fig. 5h)—3: on leaves of *Populus tremula* (PTZ 2000) in coniferous–deciduous forest. Scarce.

268. *Xanthoporia radiata* (Sowerby) Tura, Zmitr., Wasser, Raats & Nevo [= *Inonotus radiatus* (Sowerby) P. Karst.]—4, 11, 16: on dry trunks and fallen logs of *Alnus incana* in floodlands. Scarce.

269. *Xenasmateella vaga* (Fr.) Stalpers [= *Phlebiella sulphurea* (Pers.) Ginns & M.N.L. Lefebvre]—1, 14: on fallen logs and branches of *Picea obovata* (AR 1055, AR 1470) in spruce forest. Scarce.

270. *Xylodon asperus* (Fr.) Hjortstam & Ryvarden [= *Hyphodontia aspera* (Fr.) J. Erikss.]—4: on fallen log and stump of *Picea obovata* (AR 419, PTZ 1888) in spruce forest. Rather common.

271. *X. brevisetus* (P. Karst.) Hjortstam & Ryvarden [= *Hyphodontia breviseta* (P. Karst.) J. Erikss.]—1, 3, 4, 14: on fallen logs of *Picea obovata* (AR 427), *Pinus sibirica* (AR 1899, PTZ 1902) and basidiome of *Phellinus chrysoloma* (AR 1894, PTZ 1903) in spruce forests. Rather common.

272. **X. nespori* (Bres.) Hjortstam & Ryvarden [= *Hyphodontia nespori* (Bres.) J. Erikss. & Hjortstam]—15: on fallen log of *Populus tremula* (AR 2469, PTZ 2051) in coniferous–deciduous forest. Very scarce.

273. *X. radula* (Fr.) Tura, Zmitr., Wasser & Spirin [= *Basidiiradulum radula* (Fr.) Nobles]—1, 4, 14: on fallen logs of *Picea obovata* (AR 1466, PTZ 1581), on dry trunk of *Sorbus aucuparia* and branches of *Betula* sp. in

coniferous–deciduous forest. Scarce.

274. *Veluticeps abietina* (Pers.) Hjortstam & Telleria (Fig. 5i)—1, 4, 14: on fallen logs of *Picea obovata* in coniferous forests. Rather common.

275. **Vuilleminia comedens* (Nees) Maire—14: on fallen branch of *Betula* sp. (AR 1940, PTZ 1891) in birch forest. Very scarce.

Discussion

The majority of species (82.5%) are saprotrophs inhabiting dead and fallen logs of trees and shrubs. The forest litter and soil were inhabited by 33 species and 16 species of saprotrophic species were found on dead basidiocarps. One species (*Typhula erythropus*) was recorded growing on fallen leaves.

Species having mesophilous requirements (see Ezhov et al. 2011) composed 55.3% of the total; 28.0% of the species were hygrophilous, whereas 16.7% were xerophilous fungi.

The greatest number of species was associated with basic stand-formers: spruce, 106 species; aspen, 73 species; birch, 69 species; and pine, 52 species. The species numbers within understory trees and shrubs were: willow, 36 species; rowan, 34 species; Siberian stone pine, 8 species; alder, 4 species; juniper, 3 species; and larch, 1 species.

Concerning geographic characteristics (see Ezhov et al. 2011), Holarctic species were predominant (40.7%), while more local distributional patterns (Amphi-Atlantic, European, and Palearctic) were fewer (10.5%). The remaining percentage corresponds to cosmopolitan species.

Acknowledgements

The authors are very grateful to Dr R.V. Ershov (N. Laverov Federal Center for Integrated Arctic Research, Arkhangelsk) and Dr L.I. Proyrzin (Solovetsky forestry, Solovky) for research organization on the reserve territory. The research was supported by Program of the Ural Branch of RAS (project N 15-12-5-24 “Species and populations diversity of sub-tundra communities of taiga zone of the north of European Russia”). The work by I.V. Zmitrovich was carried out in frameworks of the State Task N 01201255602 of the Laboratory of Systematics and Geography of Fungi of the Komarov Botanical Institute of the Russian Academy of Sciences.

Authors' Contributions

OE and AR collected the data, filled the database and wrote the text. IZ has identified the material and wrote the text.

References

- Bondartseva MA (1998) Definitorium fungorum Rossiae. Ordo Aphyllophorales. Fasc. 2. Nauka, St Petersburg, 391 pp. [in Russian].
- Bondartseva MA, Parmasto E (1986) Clavis diagnostica fungorum URSS. Ordo Aphyllophorales. Fasc. 1. Nauka, Leningrad, 192 pp. [in Russian].
- Cherenkova NN (2009) [Towards inventory of the Solovetsky Archipelago mycobiota. Problems of Environments Monitoring in Solovetsky Archipelago]. Proceedings of 4th All-Russian Scientific Conference. Institute of Ecological Problems of the North of the RAS, Arkhangelsk, 74–75. [in Russian].
- Ezhov ON (2014) [The differences between island and continental biotas of aphyllophoroid fungi in the Arkhangelsk Region (on example of Solovetsky Archipelago). In: Fungal communities of forest ecosystems]. Vol. 4. Karelian Research Centre of RAS, Moscow/Petrozavodsk; 76–88. [in Russian].
- Ezhov ON, Ruokolainen AV (2011) [Aphyllophoroid fungi of Solovetsky Archipelago]. Mikologiya i fitopatologiya 45 (5): 376–386. [in Russian].
- Ezhov ON, Ershov RV, Ruokolainen AV, Zmitrovich IV (2011) [Aphyllophoraceous fungi of Pinega Reserve]. Ural Branch of RAS, Ekaterinburg, 148 pp. [in Russian].
- Gryaznov SE, Sokolov DL (2008) [Forest Plan of the Arkhangelsk Region.] 3 vols. Department of forest management of the Arkhangelsk Region, Arkhangelsk, 850 pp. [in Russian].
- Index Fungorum (2016) CABI Bioscience Databases. <http://www.indexfungorum.org>. Accessed on: 2016-7-22.
- Ipatov LF, Kosarev VP, Prourzin LI, Torkhov SV (2005) [Solovetsky Forest. Muzey Lesa], Solti, Arkhangelsk, 224 pp. [in Russian].
- Köljalg U (1996) *Tomentella* (Basidiomycota) and related genera in Temperate Eurasia. Fungiflora, Oslo, 213 pp.
- Köljalg U, Dahlberg A, Taylor AF, Larsson E, Hallenberg N, Stenlid J, Larsson K-H, Fransson PM, Kårén O, Jonsson L (2000) Diversity and abundance of resupinate thelephoroid fungi as ectomycorrhizal symbionts in Swedish boreal forests. Molecular Ecology 9: 1985–1996. <https://doi.org/10.1046/j.1365-294X.2000.01105.x>
- Hansen L, Knudsen H (Eds) (1997) Nordic Macromycetes. Vol. 3: Heterobasidioid, Aphyllophoroid and Gastromycetoid Basidiomycetes. Nordsvamp, Copenhagen, 445 pp.
- Niemelä T (2016) Suomen käävät. Norrlinia 31: 1–430.
- Rinaldi AC, Comandini O, Kuyper TW (2008) Ectomycorrhizal fungal diversity: separating the wheat from the chaff. Fungal Diversity 33: 1–45.
- Ryvarden L, Gilbertson RL (1993) European Polypores. Part 1. *Abortiporus–Lindtneria*. Fungiflora, Oslo, 1–387.
- Ryvarden L, Gilbertson RL (1994) European Polypores. Part 2. *Meripilus–Tyromyces*. Fungiflora, Oslo, 388–743.
- Ryvarden L, Melo I (2014) Poroid Fungi of Europe. Fungiflora, Oslo, 1–455.
- Shmidt VB (1984) [Mathematical Methods at Botany.] University Press, St Petersburg, 288 pp. [in Russian].
- Spirin V, Runnel K, Vlasák J, Miettinen O, Pöldmaa K (2015) Species diversity in the *Antrodia crassa* group (*Polyporales*, *Basidiomycota*). Fungal Biology 119: 1291–1310. <https://doi.org/10.1016/j.funbio.2015.09.008>
- Tolmachev AI (1974) [Introduction to Plant Geography]. University Press, St Petersburg, 244 pp. [in Russian].
- Zmitrovich IV (2008) Definitorium fungorum Rossiae. Ordo Aphyllophorales. Fasc. 3. Familia *Atheliaceae* et *Amylocrticiaceae*. Tovarishestvo nauchnykh izdaniy KMK, Moscow/St Petersburg, 278 pp. [in Russian].