

MACROFUNGI FROM “GRĂDINIȚA” PEAT BOG (EASTERN CARPATHIANS, ROMANIA)

V. CHINAN*

Abstract: The observations on macrofungi were carried out in the period 2004–2010, in the *91D0 Bog woodland* habitat from “Grădinița” peat bog, habitat included in the Natura 2000 site “Larion” (Eastern Carpathians, Romania). In total 69 macrofungi species were recorded, most of them basidiomycetes, on different substrates, such as peat, wood, litter and mosses. The analysis of the trophic groups point out that most species are ectomycorrhizal and saprotrophic lignicolous, which are associated with woody flora of this habitat: *Picea abies*, *Pinus sylvestris*, *Betula pendula*, *Betula alba* subsp. *glutinosa* and *Salix caprea*. In addition to some frequent species, in the “Grădinița” peat bog were inventoried some hydrophilous species (rare in Romania), such as: *Gymnopus aquosus*, *Entoloma cetratum*, *Leccinum oxydabile* and *Suillus flavidus*. Their presence underlines the importance of this habitat for macrofungi conservation.

Keywords: macrofungi, diversity, *bog woodland* habitat.

Introduction

The “Grădinița” peat bog is situated in Dornelor Depression (Eastern Carpathians), on the territory of two counties, Suceava and Bistrița–Năsăud (47° 20' 15" N, 25° 03' 25" E), at an altitude of 890 m, nearby the Grădinița train station. This peat bog was mentioned by Pop in 1960 under the name “Tinovul Câmpelilor” [10]. It is a well preserved peat bog where the woody flora is composed mainly of *Pinus sylvestris*, *Picea abies*, *Betula pendula* and *Betula alba* subsp. *glutinosa*. Since 2007, according to Ministerial Order no. 1964 [18], the “Grădinița” peat bog is included in the Natura 2000 site Larion, the protected habitat being the *91D0 Bog woodland*, which occupies 1% of the entire site area (approximately 30 ha).

The aim of this study was to inventory the macrofungi species of the *91D0 Bog woodland* habitat from the “Grădinița” peat bog (photo 1, Pl. I) and to highlight the importance of this habitat for macrofungi conservation. Particular attention was paid to the presence of threatened and characteristic species to peat bogs. This is necessary because the macrofungi were not specified when this peat bog was included in the European Ecological Network Natura 2000. Regarding this issue, Dahlberg et al. (2010) mentions the necessity to include fungi in the selection and evaluation of protected areas.

Previous information about the mycobiota of this peat bog, published so far, refers to the presence of 27 species of macrofungi [6, 13, 14].

Materials and methods

The observations on macrofungi were carried out from 2004 to 2010, during seven field surveys, in the phytocoenosis of the *91D0 Bog woodland* habitat. Each specimen was collected and identified on the basis of macro and micromorphological characteristics, taking into account the following literature: Bon (1988, 1999), Borgarino

* Alexandru Ioan Cuza University, Faculty of Biology, Bd. Carol I, no. 11, Iasi - 700506 Romania, vasilechinan@yahoo.com

& Hurtado (2004), Breitenbach & Kränzlin (2000), Hansen & Knudsen (1992), Jülich (1989), Roux (2006), Stephenson & Stempen (1994), Tănase et al. (2009). In addition photographs of the sporocarps were made in the habitat. Names of fungi and author's abbreviations follow the Index Fungorum database [17].

Results and discussions

In the period from 2004 to 2010 were recorded 69 macrofungi species (tab. 1). Among these, most species are basidiomycetes, the main genera being *Cortinarius* (4 species), *Lactarius* (5 species), *Russula* (5 species) and *Mycena* (4 species). Besides these, two ascomycetes and three myxomycetes species were identified. The macrofungi species are mentioned on the basis of their nutrition mode as follows: ectomycorrhizal (27), saprotrophic on soil (10), saprotrophic on sphagnum moss (3), saprotrophic on litter (2), saprotrophic on wood (21), saproparasitic on wood (5) and parasitic on sphagnum moss (1).

The ectomycorrhizal macrofungi are represented by 27 species. As regards the substrate preference, most ectomycorrhizal species are acidophilous and hygrophilous. Some of them, even in their characteristic habitat, are very rare in the "Grădinița" peat bog, being recorded only once during the period of the observations. These are: *Lactarius theiogalus* (photo 2, Pl. I), *Lactarius vietus*, *Leccinum oxydabile* and *Suillus flavidus* (photo 3, Pl. I). By contrast, a number of species with a wider ecological spectrum, such as *Laccaria laccata*, *Lactarius rufus* (photo 4, Pl. I), *Lactarius turpis*, *Paxillus involutus* and *Suillus variegatus*, showed a higher frequency, being observed in majority of field surveys.

Wood decomposers macrofungi were identified mainly on rotten wood, only *Fomitopsis pinicola* and *Piptoporus betulinus* have been found on living trees. Given the fact that naturally fallen trees are not extracted, they represent an important substrate for saprotrophic wood-inhabiting macrofungi; so the majority of the lignicolous species have been recorded on logs or branches and less on tree stumps. Most of these species have been observed on *Picea abies* wood, and only a few have been collected from other trees such as *Pinus sylvestris*, *Betula pendula*, *Betula alba* subsp. *glutinosa* and *Salix caprea*. Besides common lignicolous macrofungi, in this peat bog exist some rare species, such as: *Exidia saccharina* (photo 5, Pl. I), *Skeletocutis amorpha* (photo 6, Pl. I) and *Pleurocybella porrigens*.

In moss synusia were found four species of sphagnicolous macrofungi, of which three are saprotrophic (*Arrhenia sphagnicola*, *Hypholoma elongatum*, *Galerina paludosa*) and one is parasitic (*Tephrocybe palustris*). On the peat substrate were identified 10 saprotrophic species, of which only *Gymnopus aquosus* and *Entoloma cetratum* are mentioned in the literature as hygrophilous. Besides these were registered some saprotrophic species, which have a wider ecological spectrum, such as: *Phaeocollybia festiva*, *Rhodocollybia butyracea* and *Cystoderma amianthinum*. These species migrate from the surrounding spruce forest and their development is facilitated by a decrease of soil moisture caused by drainage channels that cross the peat bog, so that water from precipitation does not stagnate.

A number of rare species were identified; some of them are included on the Red List of Romanian Macrofungi Species [16] and are therefore considered to be vulnerable

or near threatened with extinction: *Amanita regalis* (NT), *Helvella acetabulum* (NT), *Hypholoma elongatum* (VU), *Leccinum oxydabile* (VU), *Suillus flavidus* (VU) and *Tephrocye palustris* (NT). Of these, the last four are characteristic for the peat bogs, their presence indicating a good preservation state of this Natura 2000 habitat.

Conclusions

The habitat *91D0 Bog woodland* from “Grădinița” peat bog provides favorable conditions for a significant number of species, of which the hydrophilous ones stands out.

The analysis of the macrofungi diversity indicates a high number of ectomycorrhizal species, some of them (*Lactarius helvus*, *Lactarius theiogalus*, *Lactarius vietus*, *Leccinum oxydabile*, *Russula claroflava*, *Russula decolorans*, *Russula emetica*, *Russula paludosa*, *Suillus flavidus*) being particularly linked to this habitat.

The fact that coniferous trees are dominant in the *91D0 Bog woodland* habitat is evident through the mycobiota composition, most macrofungi species being associated to *Picea abies* and *Pinus sylvestris*.

The presence in this habitat of some rare species, with a limited ecological spectrum highlights the role that “Grădinița” peat bog has for the conservation and protection of macrofungi.

REFERENCES

1. BON M., 1988 – *Champignons de France et d'Europe occidentale*. Arthaud.
2. BON M., 1988 – Clé monographique des Russules d'Europe. Documents mycologiques, **28**: 70–71.
3. BON M., 1999 – *Flore mycologique d' Europe, Collybio–Marasmioides et ressemblants*. Documents Mycologiques Mémoire Hors Série, **5**: 28–32.
4. BORGARINO D., HURTADO C., 2001 – *Champignons de Provence, Haute-Provence et Midi Méditerranéen*. Édisud, Aix-en-Provence.
5. BREITENBACH J., KRÄNZLIN F., 2000 – *Champignons de Suisse, 5. Champignons à lames, 3^e partie*. Ed. Mykologia, Lucerne.
6. CHINAN V., TĂNASE C., 2009 – The importance of wooded peat bogs from Suceava County (Eastern Carpathians) in conservation of lignicolous macromycetes. *Planth's health*, special edition.: 7–11.
7. DAHLBERG A., GENNEY D. R., HEILMANN-CLAUSEN J., 2010 – Developing a comprehensive strategy for fungal conservation in Europe: current status and future needs. *Fungal Ecology*, **3**, 2: 50–64.
8. HANSEN L., KNUDSEN H., 1992 – *Nordic Macromycetes. Vol. 2. Polyporales, Agaricales, Russulales*. Nordsvamp Copenhagen Denmark.
9. JÜLICH W., 1989 – *Guida alla determinazione dei funghi. Aphyllophorales, Heterobasidiomycetes, Gastromycetes*. Saturnia.
10. POP E., 1960 – *Mlaștinile de turbă din R. P. R*. Edit. Academiei R. P. R, București: 292–296.
11. ROUX P., 2006 – *Mille et un champignons*. Edition Roux - Sainte Sigolène France.
12. STEPHENSON L. S., STEMPEN H., 1994 – *Myxomycetes. A Handbook of Slime Molds*. Timber Press, Inc. Portland, Oregon.
13. TĂNASE C., 2000. – Macromycetes found in oligotrophe swamps located in the Dornelor Depression (Eastern Carpathians). *St. și Cerc. Biol., Bacău*, **5**: 17–22.
14. TĂNASE C., 2001 – Aspecte privind conservarea macrobiontei în mlaștini oligotrofe din Depresiunea Dornelor (Carpații Orientali). *Bul. Grăd. Bot. Iași*, **10**: 63–68.
15. TĂNASE C., BÎRSAN C., CHINAN V., COJOCARIU ANA, 2009 – *Macromicete din România*. Edit. Univ. „Al. I. Cuza” Iași.
16. TĂNASE C., POP ADRIANA, 2005 – Red List of Romanian Macrofungi Species. *Bioplatform–Romanian National Platform for Biodiversity*. Edit. Academiei Române, București: 101–107.

17. www.indexfungorum.org;

18. ****, 2008 – Anexa nr. 6 la Ordinul ministrului mediului și dezvoltării durabile nr. 1.964/2007 privind instituirea regimului de arie naturală protejată a siturilor de importanță comunitară, ca parte integrantă a rețelei ecologice europene Natura 2000 în România. Monitorul Oficial al României nr. 98 bis/februarie 2008: 737–739.

Table I

Macrofungi species identified in the “Grădinița” peat bog

Species	Trophic Groups and Substrate
1. <i>Amanita fulva</i> Fr.	ectomycorrhizal, among sphagnum mosses, under <i>Pinus sylvestris</i>
2. <i>Amanita regalis</i> (Fr.) Michael	ectomycorrhizal, on bare peat, under <i>Picea abies</i>
3. <i>Armillaria ostoyae</i> (Romagn.) Herink	saproparasitic, on decayed <i>Picea abies</i> logs
4. <i>Arrhenia sphagnicola</i> (Berk.) Redhead, Lutzoni, Moncalvo & Vilgalys	saprotrophic, on sphagnum mosses
5. <i>Boletus badius</i> (Fr.) Fr.	ectomycorrhizal, on peat, under <i>Picea abies</i>
6. <i>Boletus chrysenteron</i> Bull.	ectomycorrhizal, on peat, under <i>Picea abies</i>
7. <i>Calocera viscosa</i> (Pers.) Fr.	saprotrophic, on rotten stump of <i>Picea abies</i>
8. <i>Clitocybula lacerata</i> (Scop.) Singer	saprotrophic, on fallen braches of <i>Picea abies</i>
9. <i>Cortinarius collinitus</i> (Pers.) Fr.	ectomycorrhizal, on peat, among sphagnum mosses, under <i>Picea abies</i>
10. <i>Cortinarius flexipes</i> (Pers.) Fr.	ectomycorrhizal, on peat, under <i>Pinus sylvestris</i>
11. <i>Cortinarius sanguineus</i> (Wulfen) Fr.	ectomycorrhizal, on peat, under <i>Picea abies</i>
12. <i>Cortinarius semisanguineus</i> (Fr.) Gillet	ectomycorrhizal, among sphagnum mosses, under <i>Pinus sylvestris</i>
13. <i>Cystoderma amianthinum</i> (Scop.) Fayod	saprotrophic, on peat, under <i>Picea abies</i>
14. <i>Daldinia concentrica</i> (Bolton) Ces. & De Not.	saprotrophic, on rotten logs of <i>Betula pendula</i>
15. <i>Entoloma cetratum</i> (Fr.) M.M. Moser	saprotrophic, on peat, among sphagnum mosses, under <i>Pinus sylvestris</i>
16. <i>Entoloma conferendum</i> (Britzelm.) Noordel.	saprotrophic on peat, under <i>Picea abies</i>
17. <i>Exidia saccharina</i> Fr.	saprotrophic, on rotten logs of <i>Picea abies</i>
18. <i>Flammulina velutipes</i> (Curtis) Singer	saproparasitic, on decayed logs of <i>Salix caprea</i>
19. <i>Fomitopsis pinicola</i> (Sw.) P. Karst.	saproparasitic, on trunks of <i>Pinus sylvestris</i> and <i>Picea abies</i>
20. <i>Fuligo septica</i> (L.) F.H. Wigg.	saprotrophic, on rotten stumps of <i>Picea abies</i>
21. <i>Galerina paludosa</i> (Fr.) Kühner	saprotrophic, on sphagnum mosses
22. <i>Gloeophyllum odoratum</i> (Wulfen) Imazeki	saprotrophic, on rotten stumps of <i>Picea abies</i>
23. <i>Gymnopilus penetrans</i> (Fr.) Murrill	saprotrophic, on rotten logs of <i>Picea abies</i>
24. <i>Gymnopus aquosus</i> (Bull.) Antonin & Noordel.	saprotrophic, on peat, under <i>Pinus sylvestris</i>
25. <i>Gymnopus perforans</i> (Hoffm.) Antonin & Noordel.	saprotrophic, on fallen <i>Pinus sylvestris</i> needles
26. <i>Hebeloma longicaudum</i> (Pers.) P. Kumm.	ectomycorrhizal, on peat, among sphagnum mosses, under <i>Betula pendula</i>
27. <i>Helvella acetabulum</i> (L.) Quéf.	saprotrophic, on soil, under <i>Picea abies</i>
28. <i>Hypholoma capnoides</i> (Fr.) P. Kumm.	saprotrophic, on rotten stumps of <i>Picea abies</i>
29. <i>Hypholoma elongatum</i> (Pers.) Ricken	saprotrophic, on sphagnum mosses
30. <i>Hypholoma fasciculare</i> (Huds.) P. Kumm.	saprotrophic, on rotten stumps of <i>Picea abies</i>
31. <i>Laccaria laccata</i> (Scop.) Cooke	ectomycorrhizal, on peat, among sphagnum mosses, under <i>Picea abies</i>
32. <i>Lactarius helvus</i> (Fr.) Fr.	ectomycorrhizal, on peat, among sphagnum mosses, under <i>Pinus sylvestris</i>
33. <i>Lactarius rufus</i> (Scop.) Fr.	ectomycorrhizal, on peat, among sphagnum mosses, under <i>Pinus sylvestris</i> and <i>Picea abies</i>
34. <i>Lactarius theiogalus</i> (Bull.) Gray	ectomycorrhizal, on peat, among sphagnum mosses, under <i>Betula alba</i> subsp. <i>glutinosa</i>
35. <i>Lactarius turpis</i> (Weinm.) Fr.	ectomycorrhizal, on peat, among sphagnum mosses, under <i>Betula pendula</i>
36. <i>Lactarius vietus</i> (Fr.) Fr.	ectomycorrhizal, on peat, among sphagnum mosses, under <i>Betula pendula</i>
37. <i>Leccinum oxydabile</i> (Singer) Singer	ectomycorrhizal, on peat, among sphagnum mosses, under <i>Betula pendula</i>
38. <i>Lentinellus vulpinus</i> (Sowerby) Kühner & Maire	saprotrophic, on rotten logs of <i>Picea abies</i>

Species	Trophic Groups and Substrate
39. <i>Lycogala epidendrum</i> (J.C. Buxb. ex L.) Fr.	saprotrophic, on rotten logs of <i>Picea abies</i>
40. <i>Mycena epipterygia</i> (Scop.) Gray	saprotrophic, on peat, among sphagnum mosses
41. <i>Mycena galopus</i> (Pers.) P. Kumm.	saprotrophic, on peat, among sphagnum mosses,
42. <i>Mycena haematopus</i> (Pers.) P. Kumm.	saprotrophic, on fallen branches of <i>Betula pendula</i>
43. <i>Mycena rosella</i> (Fr.) P. Kumm.	saprotrophic, on fallen <i>Picea abies</i> needles
44. <i>Mycena rubromarginata</i> (Fr.) P. Kumm.	saprotrophic, on stumps of <i>Picea abies</i>
45. <i>Paxillus involutus</i> (Batsch) Fr.	ectomycorrhizal, on peat, among sphagnum mosses, under <i>Picea abies</i>
46. <i>Phaeocollybia festiva</i> (Fr.) R. Heim	saprotrophic, on peat, under <i>Picea abies</i>
47. <i>Pholiota flammans</i> (Batsch) P. Kumm.	saprotrophic, on rotten stumps of <i>Picea abies</i>
48. <i>Piptoporus betulinus</i> (Bull.) P. Karst.	saproparasitic, on <i>Betula pendula</i> trunks
49. <i>Pleurocybella porrigens</i> (Pers.) Singer	saprotrophic, on rotten logs of <i>Pinus sylvestris</i>
50. <i>Ramaria abietina</i> (Pers.) Quéf.	saprotrophic, on peat, among <i>Picea abies</i> needles
51. <i>Rhodocollybia butyracea</i> (Bull.) Lennox	saprotrophic, on peat, under <i>Picea abies</i>
52. <i>Rozites caperatus</i> (Pers.) P. Karst.	ectomycorrhizal, among sphagnum mosses, under <i>Picea abies</i>
53. <i>Russula claroflava</i> Grove	ectomycorrhizal, among sphagnum mosses, under <i>Betula pendula</i>
54. <i>Russula decolorans</i> (Fr.) Fr.	ectomycorrhizal, on peat, among sphagnum mosses, under <i>Pinus sylvestris</i> and <i>Picea abies</i>
55. <i>Russula emetica</i> (Schaeff.) Pers.	ectomycorrhizal, among sphagnum mosses, under <i>Pinus sylvestris</i>
56. <i>Russula paludosa</i> Britzelm.	ectomycorrhizal, on soil among sphagnum mosses, under <i>Pinus sylvestris</i> and <i>Picea abies</i>
57. <i>Russula sardonia</i> Fr.	ectomycorrhizal, on peat, among sphagnum mosses, under <i>Pinus sylvestris</i>
58. <i>Schizophyllum commune</i> Fr.	saproparasitic, on fallen branches of <i>Betula pendula</i>
59. <i>Skeletocutis amorpha</i> (Fr.) Kotl. & Pouzar	saprotrophic, on rotten logs of <i>Pinus sylvestris</i>
60. <i>Stemonitis fusca</i> Roth	saprotrophic, on rotten stumps of <i>Picea abies</i>
61. <i>Stereum subtomentosum</i> Pouzar	saprotrophic, on rotten log of <i>Picea abies</i>
62. <i>Suillus flavidus</i> (Fr.) J. Presl	ectomycorrhizal, on peat, among sphagnum mosses, under <i>Pinus sylvestris</i>
63. <i>Suillus variegatus</i> (Sw.) Kuntze	ectomycorrhizal, on peat, among sphagnum mosses, under <i>Pinus sylvestris</i>
64. <i>Tephrocye palustris</i> (Peck) Donk	parasitic, on sphagnum mosses
65. <i>Thelephora terrestris</i> Ehrh.	ectomycorrhizal, on peat, under <i>Picea abies</i>
66. <i>Trichaptum abietinum</i> (Dicks.) Ryvarden	saprotrophic, on rotten logs of <i>Picea abies</i>
67. <i>Tricholomopsis decora</i> (Fr.) Singer	saprotrophic, on rotten stumps of <i>Picea abies</i>
68. <i>Tubifera ferruginosa</i> (Batsch) J.F. Gmel.	saprotrophic, on logs of <i>Picea abies</i>
69. <i>Tylopilus felleus</i> (Bull.) P. Karst.	ectomycorrhizal, on peat, among peat moss, under <i>Picea abies</i>

Explanation of the Plate I

Photo 1. Phytocoenosis with *Pinus sylvestris* in the 91D0 Bog woodland habitat

Photo 2. *Lactarius theiogalus*

Photo 3. *Suillus flavidus*

Photo 4. *Lactarius rufus*

Photo 5. *Exidia saccharina*

Photo 6. *Skeletocutis amorpha*

