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# Species diversity of macrofungi on fallows in the buffer zones of the landscape parks in Łódzkie province

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**ABSTRACT**

This study presents the species structure of macrofungi in different plant communities formed on fallows as a result of secondary succession. The mycological observations were carried out in 2012 and 2013 in the buffer zones of all landscape parks in the Łódzkie province, i.e. Bolimów LP, Spała LP, Sulejów LP, Warta-Widawka LP, Łódź Hills LP, Przedbórz LP and Załęcze LP. The botanical research identified fallows representing 7 types of plant communities. In total 46 macromycetes species were found on the fallows. The diversity of macrofungi depended on the type of plant community. The highest number of fungi species was found in the communities with an admixture of trees (*Pinus sylvestris, Betula pendula*), while the lowest was collected on fallows almost completely covered by *Cirsium arvense* and *Solidago canadensis*. Considering the trophic classification of macrofungi found on fallows, most species were saprotrophic and mycorrhizal. Wood inhabiting saprotrophs were represented by only two species.

**KEY WORDS:** fallows, secondary succession, macromycetes, landscape parks, Łódzkie province

## Introduction

The acreage of fallows in Poland continues to increase (Harkot *et al.* 2011) due to the low profitability of farming on low fertility soils and changes in the demographic structure of rural populations. No uniform definition of a fallow exists. In general, a fallow is defined as former agricultural land where human interference has been abandoned for many years (Flis 1985). Traditionally, 'fallow' refers only to an arable land that is no longer used. However, in case of abandoned meadows and pastures the relevant definitions do not exist. The prolonged cessation of farming on all above listed land leads to the similar consequences, i.e. the secondary succession progression. Therefore, it seems reasonable to extend the definition of fallows to overgrown meadows and pastures as well (Krysiak 2011). In this paper the term fallow was adopted to all

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agricultural land (arable fields, meadows, pastures) where farming has been abandoned.

The information about macrofungi on former agricultural land can be found in a limited number of mycological reports (e.g. Kujawa & Kujawa 2008, Kałucka 2009). The purpose of this study was to define the species structure of macrofungi in various plant communities formed on fallows as a result of secondary succession.

**Material and methods**

The mycological observations were carried out in 2012 and 2013. Fallows selected for the study are located in the buffer zones of all landscape parks in the Łódzkie province, i.e. Bolimów LP, Spała LP, Sulejów LP, Warta-Widawka LP, Łódź Hills LP, Przedbórz LP and Załęcze LP. Seven belt transects were established on the fallows. Each transect was divided into 5-6 study plots (100 m x 100 m). In total, 39 study plots were established. Fallows were initially identified based on orthophotomaps scaled 1: 10 000 (the flight was done in 2009), then verified and finally plotted on the land. Each plot was surveyed in the current growing vegetation. The search for macrofungi on the study plots was made three times each year.

The applied nomenclature of macrofungi follows Index Fungorum (2014).

**Results**

The botanical survey revealed fallows representing 7 types of plant communities:

1) the community without vegetation or with very limited vegetation, with growing lichens and bryophytes,

2) the community dominated by grasses, with one grass species being dominant, e.g. *Agrostis capillaris* L. or *Elymus repens* (L.) Goul., and the low number of other plants,

3) the community dominated by *Hieracium pilosella* L. and with the low share of other plant species,

4) the community dominated by 2-3 grass species and with the high number of other plants,

5) the community dominated by *Cirsium arvense* (L.) Scop. and *Solidago canadensis* L., with the low share of other species,

6) the community dominated by *Calamagrostis epigeios* (L.) Roth, with the low share of other plants,

7) the community with highly diversified species composition and a significant share of bryophytes.

Trees and shrubs constituted another element of fallows vegetation that is important for the development of macrofungi. In the studied communities they were represented by *Pinus sylvestris* L., *Quercus robur* L., *Betula pendula* Roth, *Padus serotina* (Ehrh.) Borkh. and *Pyrus communis* L. em. Gaertner.

So far, in a two-year observation, 46 macromycetes species were found on the seven types of fallows. The diversity of fungi depended on the type of plant community developing on a particular fallow type. In the communities formed only by lichens, a limited number of fruit bodies of gasteroid basidiomycetes from *Bovista, Lycoperdon* and *Calvatia* genera were recorded. Fungi in the communities dominated by one grass species or *Hieracium pilosella* were presented by gasteroid species as well as *Crinipellis scabella* (Alb.& Schwein) Murrill, *Marasmius oreades* (Pers.) Gillet,

*Conocybe tenera* (Schaeff.) Fayod, *Panaeolus fimicola* (Pers.) Gillet and *Psilocybe coronilla* (Bull. Ex DC.) Noordel.

The lowest number of fungi species was found on the fallows almost completely covered by *Cirsium arvense* and *Solidago canadensis* (tab. 1). In these communities only single fruit bodies of *Conocybe tenera* and, scarcely, *Macrolepiota procera* (Scop.) Singer were found. The highest number of macrofungi species was found in the communities with an admixture of trees, regardless of the type of vegetation that was dominating there. On study plots with young pines, large numbers of mycorrhizal macrofungi from the genera *Amanita, Boletus, Chalciporus, Inocybe, Laccaria, Paxillus, Suillus,* and *Xerocomus* were found. Some of these species, e.g. *Laccaria laccata* (Scop.) Cooke and *Suillus luteus* (L.) Roussel produced fruit bodies in abundance. The fruit bodies of the mycorrhizal macrofungi (mainly *Amanita muscaria* (L.) Lam. and *Suillus luteus*) were also found on fallows without trees; all were located near tree stands among fields. In the communities where the cover rate of bryophytes was high, species growing on bryophytes, e.g. *Rickenella fibula* (Bull.) Rathelh. and *Arrhenia lobata* (Pers.) Kühner & Lamoure ex Redhead were found.

**Table 1.** Quantitative participation of macrofungal species in plant communities on surveyed fallow types.

| Type of plant community | Number of species |
|---|---|
| Community with lichens and bryophytes | 12 |
| Community dominated by grasseswith a single grass species dominant | 16 |
| Community dominated by *Hieracium pilosella* with trees | 31 |
| Community dominated by 2-3 grass species | 18 |
| Community dominated by *Cirsium arvense* and *Solidago canadensis* | 7 |
| Community dominated by *Calamagrostis epigeios* | 10 |
| Community with a significant share of bryophytes | 29 |

Considering the trophic classification of macrofungi found on fallows, most species were saprotrophic and grew on the soil, plant parts or fruits. Mycorrhizal macrofungi were also numerous and were found on more than ten study plots in the second year of observation. Of these, the highest number of fruit bodies was formed by *Amanita muscaria, Boletus edulis* Bull., *Laccaria laccata*, *Suillus bovinus* (L.) Roussel and *S. luteus*. Saprotrophic fungi growing on wood were represented by only two species *Trichaptum abietinum* (Dicks.) Ryvarden and *Schizophyllum commune* Fr., both forming fruit bodies on fallen pine branches.

## Discussion

Fallows are specific habitats with special soil structure formed under the strong influence of long-term cultivation. Plant communities of fallows are unstable, and their species diversity may increase over time (Kurus & Podstawka-

Chmielewska 2006). It seems that the pattern of succession for the vegetation emerging spontaneously on fallows may be associated with the soil properties and the vegetation on the adjacent areas as well. A two-year mycological study offered a chance to observe only some selected trends in the macrofungal colonization of abandoned land with different types of vegetation developed. The previous studies demonstrated that the succession of plant cover is always linked with the succession of fungi (Arnolds 1992, Keizer and Arnolds 1994, Kałucka 2009). Therefore, the diversity of fungi species on the studied fallows will change in time. Afforestation of former agricultural lands plays an important role in establishing conditions favourable to various macrofungi species (Kujawa & Kujawa 2008). Very few of the fallows studied are spontaneously colonised by trees (mainly pines). On some fallows the young individuals of invasive species *Padus serotina,* can be found and they can have negative effects on the potential growth of native trees. We can deduct that changes in the fungi populations on the studied fallows will be driven by many factors. The mycological observations of the same study plots should to continue in order to identify these factors.

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**Streszczenie**

Przemiany użytkowania ziemi w ostatnich 20 latach przyczyniły się do powstania w naszym kraju znacznych powierzchni odłogów, które stwarzają nowe siedliska dla rozwoju spontanicznej roślinności i grzybów. Dotychczasowe dane o grzybach wielkoowocnikowych gruntów porolnych są znikome. W prezentowanej pracy przedstawiono wyniki dwuletnich obserwacji macromycetes na powierzchniach odłogów, usytułowanych w strefach otaczających wszystkie parki krajobrazowe w woj. łódzkim. Obserwacje te pozwoliły na wyodrębnienie 7 typów zbiorowisk roślinnych

powstałych na odłogach oraz zanotowanie na nich 46 gatunków macromycetes. Roślinność obserwowanych odłogów wykazywała znaczne różnice strukturalne. Były tu pionierskie powierzchnie porośnięte jedynie porostami z rodzaju *Cladonia*, inicjalne stadia muraw, z dominacją traw (np. *Agrostis capilllaris, Festuca ovina*) oraz powierzchnie o znacznej liczbie gatunków roślin zielnych, zarówno łąkowych, jak i leśnych. Odrębną grupę stanowiły powierzchnie porośnięte w przeważającej części gatunkami inwazyjnymi obcego pochodzenia, głównie *Solidago canadensis* i *Padus serotina*. Funga obserwowanych powierzchni wykazywała zróżnicowanie związane z typem roślinności. Najuboższe w grzyby okazały się powierzchnie inicjalnych muraw z chrobotkami lub roślinnością trawiastą oraz powierzchnie z dominacją *Solidago canadensis.* Występowały tu nieliczne owocniki gatunków z rodzaju *Bovista*, *Lycoperdon, Calvatia*. Natomiast najbogatsze w gatunki grzybów były powierzchnie porośnięte drzewami, głównie sosnami, gdzie zanotowano gatunki grzybów mykoryzowych z rodzajów: *Amanita, Boletus, Inocybe, Laccaria, Suillus, Xerocomus*. Na odłogach z dużym pokryciem mszakami, obserwowano grzyby wykorzystujące mchy, np. *Rickenella fibula* i *Arrhenia lobata*. Dotychczasowe badania macromycetes na odłogach woj. łódzkiego dostarczają jedynie wstępnej wiedzy o różnorodności gatunkowej grzybów na tego typu siedliskach. Wydaje się celowe prowadzenia dalszych badań na tych samych powierzchniach i obserwowanie zmian, jakie będą zachodzić w strukturze macromycetes wraz z postępującą na odłogach sukcesją.