

Doctoral dissertation summary

Fungi associated with hardwood-inhabiting bark beetles with particular emphasis on the genus *Geosmithia*

Bark beetles (*Coleoptera: Curculionidae: Scolytinae*) are diverse group of insects including several species that are regarded as forest pests. These insects are known to live in close association with fungi, especially with the Ascomycete species distributed in the two unrelated orders *Microascales* and *Ophiostomatales*, commonly referred to as ophiostomatoid fungi. Majority of them are agents of wood discoloration. However, some species such as *Ophiostoma novo-ulmi* cause serious tree diseases. In addition, bark beetles are also often associated with the genus *Geosmithia* (*Ascomycota, Hypocreales*). However, only little is known regarding the fungal ectosymbionts of bark beetles on hardwood trees in Europe. Nothing is also known about diversity of *Geosmithia* spp. living on hardwood trees in Poland.

The aim of this study was to increase the knowledge regarding diversity, taxonomy, ecology and pathogenicity of beetle-associated fungi on hardwood trees, with special emphasis on the genus *Geosmithia*. Fungi associated with 18 species of bark beetles, infesting hardwood trees at 11 deciduous stands of Poland, were isolated and identified in the years 2013-2016. The fungal identifications were based on morphological characteristics and DNA sequence analysis. In total, from 2915 beetles and 1887 galleries, 4461 isolates were obtained. Among them, 3401 (76,2%) isolates represented species in the *Ophiostomatales* and *Microascales*, while 1060 (23,8%) isolates belonged to the genus *Geosmithia*. The survey revealed the occurrence of 47 taxa (11 species of *Geosmithia*; 4 species of *Microascales* and 32 species of *Ophiostomatales*). Among them, species of *Ophiostoma sensu lato* (14 species) and *Geosmithia* (11 species) dominated.

Most of identified species in this study were recorded for the first in Poland, and several species were first detected in Europe. A surprisingly high number of previously unknown fungal species were discovered in hardwood forests. During the survey, eight of these species were described as new taxa. They included *Leptographium alneum*, *L. betulae*, *L. trypodendri*, *Ophiostoma solheimii*, *O. taphrorychi*, *Ceratocystiopsis synnemata*, *Geosmithia fagi* and *G. pazoutovae*. In addition, the study revealed many new insect-fungus relationships.

The species composition of fungal communities associated with bark beetles was diverse, and frequency of occurrence of particular fungal species depended mainly on beetle

species and host plant species. *Scolytus intricatus* on oak was characterized by the highest species richness (17 taxa). In communities of bark beetles occurred generalists (*Ophiostoma quercus*, *Geosmithia flava*) that were associated with many species of bark beetles and different species of hardwood trees, as well as specialists having restricted host range (e.g. *Ophiostoma karelicum*).

The inoculation experiment conducted on 2-year-old seedlings of beech, oak, maple, linden and elm has demonstrated that *Geosmithia* spp. are non-pathogenic.

The high number of taxa encountered, including the discovery of 12 unknown taxa, covering a relatively small geographical area, indicates that there are many more bark beetles-associated fungi occurring in the hardwood forests than has previously been recognized.

Original research results have been published in five articles.

Keywords: bark beetles, hardwood trees, insect-fungus interactions, *Microascales*, *Ophiostomatales*, ophiostomatoid fungi, pathogenicity, taxonomy