

## The Biodiversity of Wood Destroying Fungi in the Central Europe and Their Possible Application in Biotechnology

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Wood rotting fungi represent significant component of forest. They play a crucial active role in processes of wood degradation, especially in the degradation of the most important constituents of wood - cellulose and lignin. These fungi are the only eukaryotic organisms producing lignolytic enzymes able to destroy lignin. Besides the above mentioned enzymes, another compounds potentially utilizable in medicine have been found in various wood rotting fungi. So that why nowadays many researchers are interested in exploring of the useful compounds produced by wood destroying fungi, mainly polysaccharides (glucans), polypeptides and also terpens, alkaloids and other. Wood rotting fungi are very important organisms also from the point of view of biodiversity. Although some of wood destroying fungi are considered as important pathogens of woody plants, many of wood destroying fungi are the most endangered organisms at all. The reason of it is decreasing quantity both of retained dead wood as a substrate and niche of these organisms in managed forests, in spite of conservation of some types of forest ecosystems in protected areas within programs of dead wood and trees conservation. Some of wood rotting fungi are on the Red list in some of the European countries.

For the conservation of biodiversity, a fundamental condition is to retain a sufficient volume of wood which is maintained in forests for natural processes, including a wood decay by wood destroying fungi. Important condition in relation to conservation in forests is dependent even on quantity and quality of rotten wood such as a kind of timber, diameter and length of logs, and position of fallen down stems, etc. The diversity of dead wood is required for conservation of biodiversity of many organisms, including fungi. Above all the stems of big diameter are most important.

The ratio of dead wood is estimated as 7% from the total stand volume in the contemporary managed forests in the Czech Republic. In Europe ranged quantity of dead wood in forests are from 1~12% in managed forests. The volume of dead wood is significantly important in the natural type forests, where the ratio between dead wood and total stand volume is 9~50%, depending on stand development. The volume of dead wood under conditions of natural reserves is 50~220 m<sup>3</sup> per ha. At this moment is conservation of some wood destroying fungi depending on the strategy of nature protection in the Czech Republic and also in other central European countries.

Besides wood rotting fungi are involved species from Agaricales like *Armillaria* spp., *Kuehneromyces* spp., *Hypholoma* spp., *Pholiota* spp., *Lentinus* spp. etc. Most of wood rotting fungi belonging to Aphyllphorales, especially bracket fungi from genera *Phellinus* spp., *Inonotus* spp., *Trametes* spp., *Daedalea* spp. etc. There are only

few wood rotting species from sac fungi Ascomycetes, like *Ustulina* spp., *Hypoxylon* spp., *Camarops* spp. etc. From the point of view of wood decay and also its further application in biotechnologies have the crucial importance a type of decay, respectively if this fungus belong to white or brown rot fungus. In the nature predominate white rot fungi both the same from the point of view of quantity of species and the volume of decayed wood. Only in some special cases predominate in wood decay the brown rot fungi, optionally predominate one or two species like in the case of mountains spruce stands, disrupted by bark beetles or other mortality stress factors. Brown rot fungi prevail also in wood decay in buildings like *Merulius lacrymans*, *Coniophora puteana* or in decay of trimmed wood, including impregnated wood, like *Lentinus lepideus*, *Gloeophyllum sepiarium*, *Deadalea quercina* etc.

The mycofloristic research in different nature reserves areas in the Czech Republic shows, that wood rotting fungi share 60~80% of species which were noted in the plots within several year of research. The rotten wood is besides the soil one of the richest niche in forests at all.

Some of wood destroying fungi were successfully tested in biotechnologies for decomposition of waste material, like organic pollutants, oils, petroleum derivates, plastic materials, phenolic compounds etc. The high price and technological difficulties make recently wide applications in industry and environmentology impossible. Mushrooms have been long considered having a medicinal value, especially in Asia. Myco-pharmacological investigations of bioactive metabolites and medicinal properties of mushrooms play an important role in development of new biotech products and biopharmaceuticals. Especially wood rotting fungi are studied for purpose of production pharmaceutically active compounds, and so new species and strains of wood rotting fungi are explored.

The wood rooting fungi are in Central Europe intensively studied group from the point of view of taxonomy, ecology, bionomy and pathology. Especially groups of polypores and some agaricales are quite known well. In these groups there are some of fungi which are interesting for their potential use in biotechnologies and biopharmacy. From Agaricales there is a very interesting group honey fungus *Armillaria*, which 5 annulate species (*A. ostoyae*, *A. gallica*, *A. cepistipes*, *A. borealis*, *A. mellea*) are very common in Central Europe. Exannulate *A. tabescens* thermophilic species, growing only in some areas, *A. ectypa* is very rare species, in the Czech Republic known only from a few findings in peat bogs. In some secondary spruce stands there are *Armillaria* spp. Which are the important pathogens of root system. Honey mushrooms are the favourite edible fungi collected in Czech forests.

Another interesting group from polypores (bracket fungi) is *Ganoderma* species. In Europe there are three species producing perennial fruit bodies: *G. applanatum*, *G. adspersum* and *G. pfeiferii*, other species produce annual basidiocarps. *G. lucidum*, *G. resinatum* are connected with broadleaved species, *G. carnosum* and *G. valesiacum* prefer coniferous hosts. *G. lucidum* and related species are used for the production of pharmaceutical active compounds. Central European species and also strains produce the same compounds as cultivated strains of *G. lucidum*, there re variation of concentration searched compounds only. Especially cultivated *G. resinatum* produce mushrooms of excellent quality. The fructifications of cultivated *G. resinatum* are high similarity to *G. lucidum* with its enormous production of spores.

For biotechnologies there are also very interesting two genera of white rotting fungi, *Phellinus* s. l. and *Inonotus* s. l., playing the crucial role in forest ecosystems of northern hemisphere. Some of them, e.g. *Inonotus obliquus* and *Phellinus linteus*, are used for anti-carcinogenic purpose in Eastern Asia and northern part of Russia. In case of the two genera the knowledge of biochemical features of various species is unequal and some European species (e.g. *Inonotus radiatus*, *Phellinus conchatus*, *P. hartigii*, *P. lundellii*) have not been sufficiently studied yet. There are 40 species altogether of *Inonotus* s.l. and *Phellinus* s.l. species are currently recognized in Central Europe: *Inonotus*

*andersonii, I. cuticularis, I. dryadeus, I. dryophilus, I. hastifer, I. hispidus, I. leporinus, I. nidus-pici, I. nodulosus, I. obliquus, I. radiatus, I. rheades, I. ulmicola, I. tomentosus, I. triqueter; Phellinus alni, P. cinereus, P. cavicola, P. chrysoloma, P. conchatus, P. contiguus, P. ferrugineofuscus, P. ferruginosus, P. hartigii, P. ignarius, P. laevigatus, P. lundellii, P. mediterraneus (known as of Fomitiporia mediterranea), P. nigrolimitatus, P. pilatii, P. pini, P. populicola, P. pouzarii, P. pseudopunctatus, P. punctatus, P. rhamni, P. robustus, P. torulosus, P. tremulae, P. tuberculosus, P. viticola.*

Also some other wood rotting fungi like *Meripilus giganteus, Grifola frondosa, Perenniporia fraxinea*, were already tested in biotechnologies, are in Central Europe mentioned like pathogens of root system of woody plants. Also products from *Sparassis crispa, S. brevipes, S. nemecii* could be interesting for production of some useful compounds, eg. antibiotics and preserved basidiocarps in nature. Also monkey head species growing in Europe like *Hericium alpestre* and *H. coralloides* could be very interesting for further application studies.

Compendium of Central European species with possible application in mycotechnologies and mycopharmacy could be much longer. Most of mentioned species are well available for isolation and introduction; some of them are endangered species as *Aurantioporus croceus* due to the absence of suitable substrates.

Curriculum Vitae			
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