

## THE ROLE OF FUNGI IN THE CARBON- AND NITROGEN CYCLES

J. VETTER

*Department of Botany, University of Veterinary Science, Budapest, Hungary*

The green plants fix a great amount of carbon (CO<sub>2</sub>) and accumulate as different organic molecules mainly as lignocelluloses. Fungi belong not only to an independent group of Eukaryotes but they have – in most of the cases – a specific biochemical, physiological ability to decompose organic molecules, to produce substrates of respiration and to mineralize these for the biological cycles of ecosystem.

Different groups of lower and higher fungi are able to degrade cellulose. Such genera of lower fungi are: *Trichoderma*, *Penicillium*, *Fusarium*, *Aspergillus*, etc.; the most powerful fungi are the so-called xylophagous or wood decaying fungi [1–3]. The classical mycological and biochemical investigations demonstrated the production of a synergistic, cellulase decomposing enzyme system. The lignin degrading ability is the property of different fungus taxa. Lignin degradation studies of white-rot fungi were performed extensively but basic questions remained problematic. The observations have led to the conclusion that the lignin degrading system is associated with the secondary metabolism of the fungi [4, 5]. This system consists of ligninase (lignin peroxidases), manganese peroxidase, phenoloxidase and peroxide producing enzymes. The lignin decomposition is regulated by various nutritional (N supply, Mn level) and ecological (pH, temperature) factors.

A lot of fungi have the required genetic information of the degrading enzyme system. After an adaptation time the following processes are going on: (1) uptake and utilization of soluble, free sugars, (2) increase of biomass, formation of new hypha- and mycelial system, starting of cellulose- and hemicellulose decay, (3) increase of secretion of organic acids, (4) increase of quantity and activities of intra- and mainly of extracellular oxidases, (5) cellulose and lignin decay are leading later to the complete decomposition (to mineralization) of lignocellulose substrates.

The ecological N-cycle is composed of different processes (nitrogen fixation, nitrification, nitrate-reduction, etc.). The fungi belong to the organisms of relative high N content (15–40% dry weight crude protein) but their common substrates contain low N level. There are three possibilities (6): a specific biological adaptation, a dynamic

JÁNOS VETTER  
Department of Botany, University of Veterinary Science  
P.O. Box 2, H-1400 Budapest, Hungary

reutilization of nitrogen of older cells into the young mycelium or the utilization of N from different sources including the possibility of N fixation. The role of fungi in the N cycle is undoubtful, they can be important components of the soil-plant-animal chain

## REFERENCES

1. Rypacek,V.: Biologie holzerstörender Pilze. Gustav Fischer Verlag, Jena. 1966.
2. Ganbarov,H.G., Muradov,M.Z.: Celljuloliticseszkaja aktivnoszty derevorazrusajusesih bazidiomicetov iz roda Bjerkandera adusta P. Karst. V. uszlovijah glubinnoj i tvjorodfaznoj fermentacii. (in Russian) Mikol. i fitopat. **25**, 48–52 (1991).
3. Jakucs,E.: The role of fungi in the degradation of cellulose and lignin. (in Hungarian) Mikológiai Közlemények, **29**, 13–37 (1990).
4. Haider,K., Trojanowski,J.: Decomposition of specifically <sup>14</sup>C-labelled phenols and dehydropolymers of conyferyl alcohol as models for lignin degradation by soft and white rot fungi. Arch Microbiol **105**, 33–41 (1975).
5. Kirk,T.K., Chang,H.M.: Potential applications of bio-ligninolytic systems. Enzyme Microbiol Technol **3**, 189–196 (1981).
6. Kurtzman,R.H.: Nitrogen fixation by Pleurotus. Mushroom Science **10**, 427–435 (1978).