
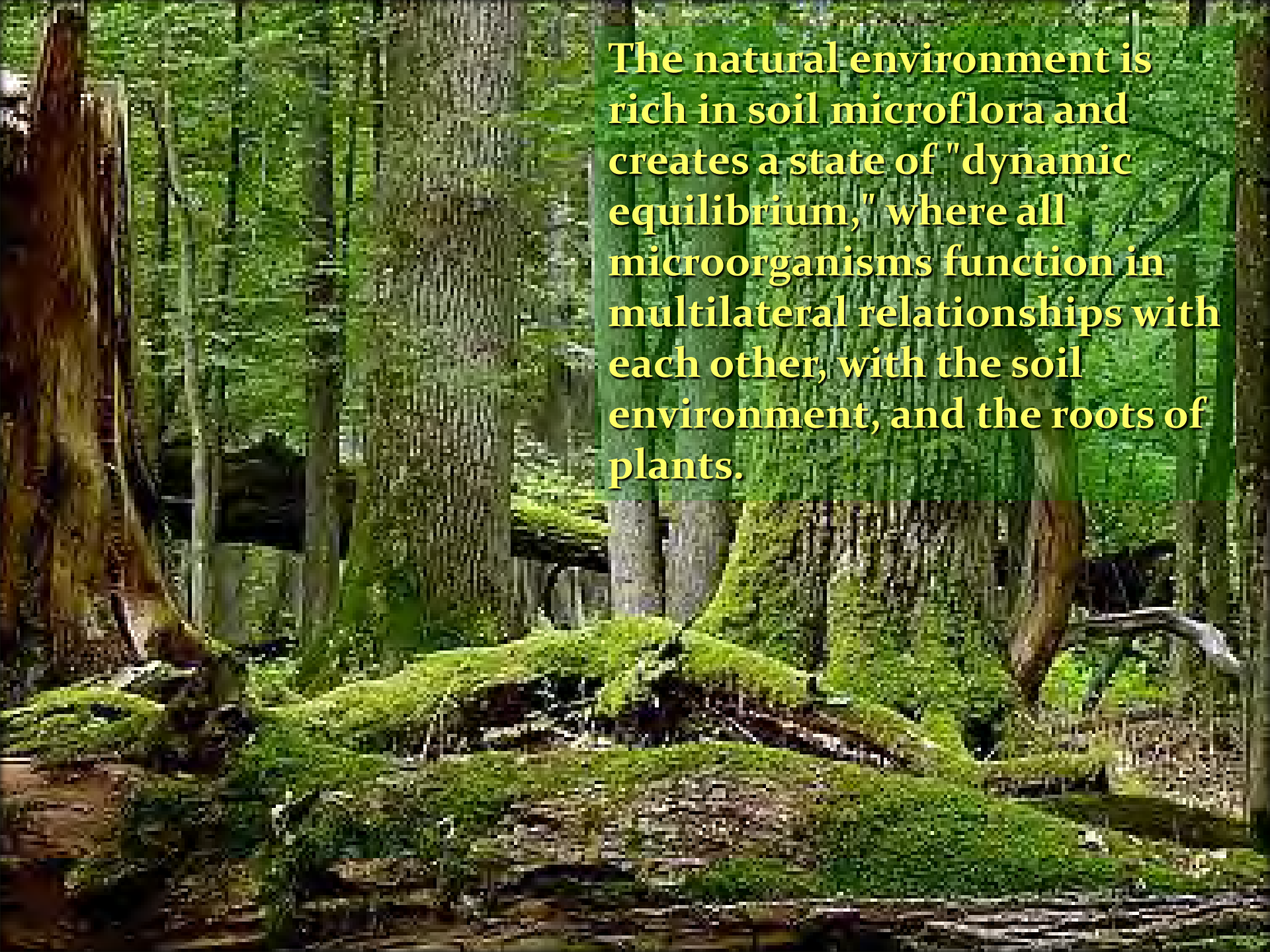


The role of mycorrhiza in modern plant cultivation

What can mycorrhizal fungi do for you?

- 
- Mycorrhiza is a symbiotic relationship, i.e. mutually beneficial co-existence of fungi and plants. This means that in this relationship both partners benefit: the fungi are nourished by assimilation products, and the plant receives a great deal of help from the fungus in surviving in the environment, often very unfavourable. As a result, the plants better and healthier and grow mycelium can produce fruiting bodies we know as **edible and poisonous mushrooms** such as boletus, toadstools, saffron milk caps and many others.
 - Most plants, especially in unfavourable environmental conditions, do not grow at all, or grow very poorly without mycorrhizal fungi.

A photograph of a forest floor. The ground is covered in a thick layer of green moss. Several large, fallen tree trunks are scattered across the moss. In the background, there are many standing trees with green foliage. The lighting is soft, suggesting a shaded forest environment.

The natural environment is rich in soil microflora and creates a state of "dynamic equilibrium," where all microorganisms function in multilateral relationships with each other, with the soil environment, and the roots of plants.

Co-existence of plants with fungi has a long (about 400 million years) evolutionary history: it is believed that the greater resistance of fungi to environmental stress was "exploited" by plants to conquer land.



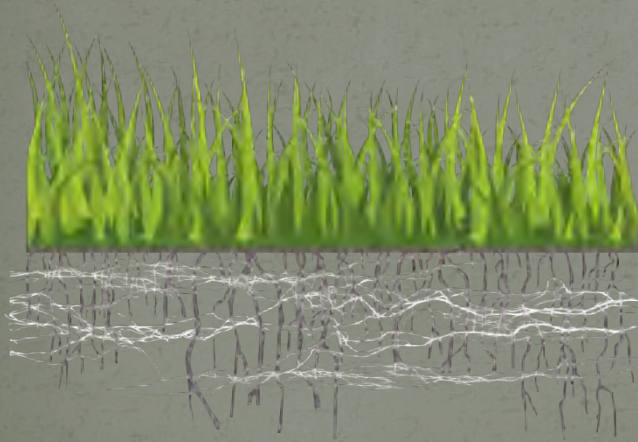
The affinity between the kingdom of plants and the kingdom of fungi has proved to be so favorable to the symbionts that at present mycorrhiza occurs in most vascular plants, with various fungi, and in various forms

Mycorrhizal fungi begin in the root





ENDOMYCORRHIZA



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Ectomycorrhiza - highly "specialized"



Boletus edulis.

Mycorrhiza with spruce, pine, beech



Saffron milk cap - *Lactarius deliciosus.*

Mycorrhiza with pine, dwarf spruce, spruce
(in young trees)



Leccinum scabrum.

Mycorrhiza with birch

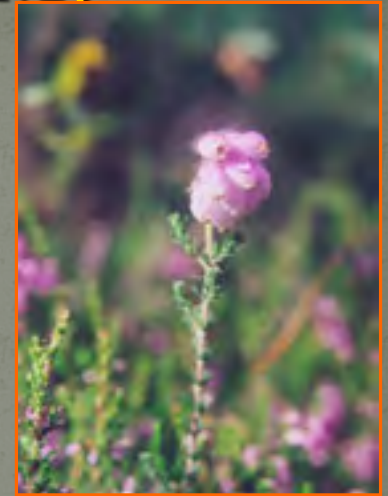
Leccinum aurantiacum.

Mycorrhiza with aspen

Ericoid Mycorrhiza (ERM)

Calluna - heather

Erica - heath



Rhododendron

Rhododendron



Azalea





Mycorrhiza mycelium penetrates the soil space and increases the root system surface by a multiple of up to 10,000

**Mycorrhiza
facilitates plant
vegetation with
dramatically
increased surface
area of the root
system
(approximately
10,000 x)**

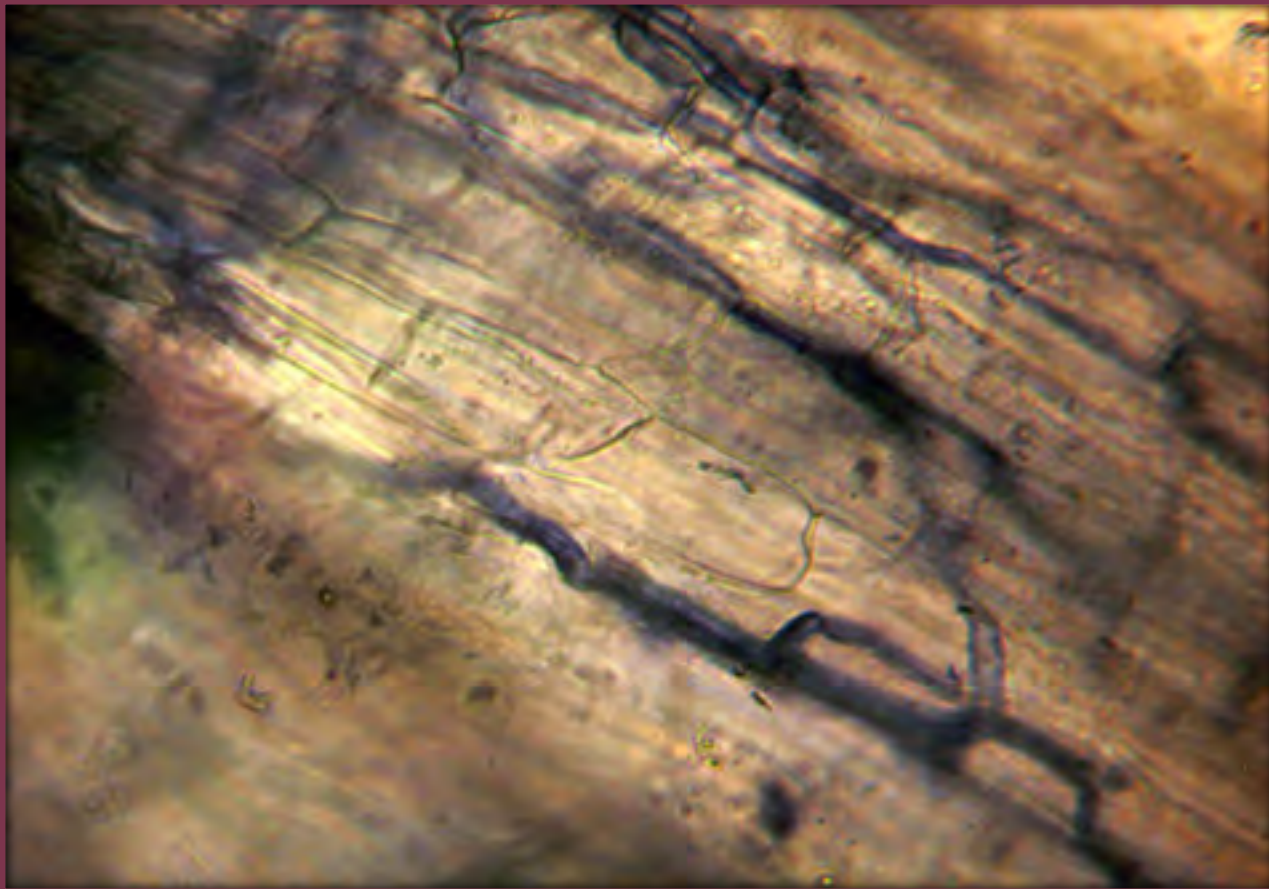


Hyphal sheath (mantle) of mycelium on a shortened root

Mycelium mantle is a barrier against invasion of pathogenic fungi and replaces root hair cells multiplying their absorbent surface.



Evidence of mycorrhiza, Hartig net in root tissue





When we pick blueberries or mushrooms,
we "walk on mycorrhiza".



Visible evidence of the presence of mycorrhizal fungi is provided by their fruiting bodies (*Amanita muscaria*)

The best edible mushrooms, such as many species of *Boletus*, are also excellent mycorrhizal fungi. They co-exist with most trees and shrubs, though they also include poisonous species like Devil's boletus (*Rubroboletus satanas*).



Mycorrhizal fungi are "involved" in many of life processes of plants

Mycorrhizal symbiosis affects:

- **nutrition:** making available and uptake of phosphorus (P), nitrogen (N), microelements, and transport of products of photosynthesis
- **protection against stressors:** abiotycznymi – drought, soil salinity, pH, temperature and biotic – soil pathogens, leaf infections (newest suggestion), nematodes
- **physiological processes** – photosynthesis, water cycle and gas exchange
- **biochemical processes** - enzymatic activity
- **improvement of soil structure**

Preparation of mycorrhizal vaccines

- 1 - Finding the right location with plants (trees, shrubs) to collect the roots from; evaluation of the condition of plants and their habitat, collecting the roots.
- 2- Placing the roots in Petri dishes with the culture medium.
- 3 - Collecting mycelium with desirable morphological characteristics and inoculating the dishes.
- 4 - Propagating the best strains to produce commercial quantities.



Fungi on a plate with the culture medium



Filling the applicator
with the vaccine



... then applying



Mycorrhizal treatment at the Omajola olive grove



Mycorrhizal fungi are also needed in the nursery



Results of mycorrhizal symbiosis: growth



After a year of growth - visible differences

Without mycorrhiza



With ectomycorrhiza



Ectomycorrhiza



Control



100 days after planting in 2015 ...

Effects of mycorrhiza on tangerines



Comparison of the size of olives



Control



Ectomycorrhiza



It improves living conditions in extremely unfavourable environments



The roots confirm mycorrhiza



Richer root system

WITHOUT MYCORRHIZA



WITH MYCORRHIZA



Truffle plantations established in Europe



Tuber magnatum from our vaccination



In all ecosystems, mycorrhizal fungi play an important role and allow plants to survive in the most difficult conditions.



Mycorrhiza plays a very important role in the reclamation of degraded areas such as: open-cast mines, mining and industrial slag heaps





Significant effects of mycorrhizal symbiosis

- ⊙ - much larger absorbent surface of the root system - up to 10,000 times
- ⊙ - active and effective intake of water and minerals
- ⊙ - assimilation efficiency and yield increases related to the above
- ⊙ - active and passive protection against pathogens and root parasites
- ⊙ - more resistant to environmental stresses

Physiological correlations

- The activity symbiotic mycorrhizal fungi translates into visible growth effect. It is impossible to achieve this by other methods, as in comparative studies plants with mycorrhiza always achieve better growth parameters (minimum 20%).
- Improved intake of water and minerals (especially phosphorus) result in a much higher efficiency of assimilation, which linearly affects mass gain
- Reducing many other restrictions additionally increases chlorophyll content
- Blocking of heavy metals intake allows for efficient cultivation of plants for consumption where such metals occur

Find out more on the
company's website



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