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Arbuscular Mycorrhizal Fungi and their Symbiosis with Plants

The great majority of terrestrial plants live in close collaboration with a diversity of soil organisms among which mycorrhizal fungi play an essential role. Mycorrhizal symbioses profit to plant growth and plant protection especially against environmental stresses as well the propagation and the survival of mycorrhizal fungi. The examination of late Devonian fossils revealed that arbuscular mycorrhizal (AM) fungi existed on earth for more than 460 million years before plants first appeared. As such, AM (arbuscular mycorrhizal) fungi contributed directly to the evolution of life, to the development of the earth's biodiversity, to the survival of plant species and consequently to the equilibrium of ecosystems.

AM (arbuscular mycorrhizal) fungi establish symbiotic associations with almost 80% of plants, mainly herbaceous ones, among which are found the cultivated crops that feed the world (cereal and pulse crops, market garden products, fruits and vegetables).

Figure 2: Field culture of mycorrhizal leek plants

The mycorrhizal symbiosis maintains and, in many cases, stimulates plant growth while substantially reducing fertilizer requirements. The fungal mycelium acts for plants as an extension of their root systems, allowing them to optimize the use of soil water and soil minerals from a much larger volume of soil. Healthier plants better resist environmental stresses such as drought, chilling and pollution, and have an improved capacity to survive certain bacterial and fungal pathogen attacks. AM (arbuscular mycorrhizal) fungi improve soil quality by increasing soil micro flora diversity and abundance and by reducing soil erosion through by a better plant rooting capacity.

AM (arbuscular mycorrhizal) fungi are the cornerstone of the development of sustainable agriculture. As such, there is a necessity to accelerate their integration in agriculture production systems. The constant increase in food demand throughout the world, the rise of biofuels production and the imminent depletion of phosphate stock provisioning strengthen the necessity to seriously support research on mycorrhizal symbioses both in Canada as well as internationally.

Microscopic soil fungi, the mycelium and the spores occupy the rhizosphere, the zone surrounding plant root systems.

Figure 3: Start of root colonization

The AM (arbuscular mycorrhizal) fungi hypha first establish contact and penetrate young root epidermis and then spread into root tissues where they differentiate, according to species, vesicles and arbuscules.

As a result, AM (arbuscular mycorrhizal) fungi differentiate a huge intraradical and extraradical mycorrhizal network active in the bidirectional exchange of nutrients between plant and fungi partners.

Figure 4: AM (arbuscular mycorrhizal) fungal hyphae penetrating root

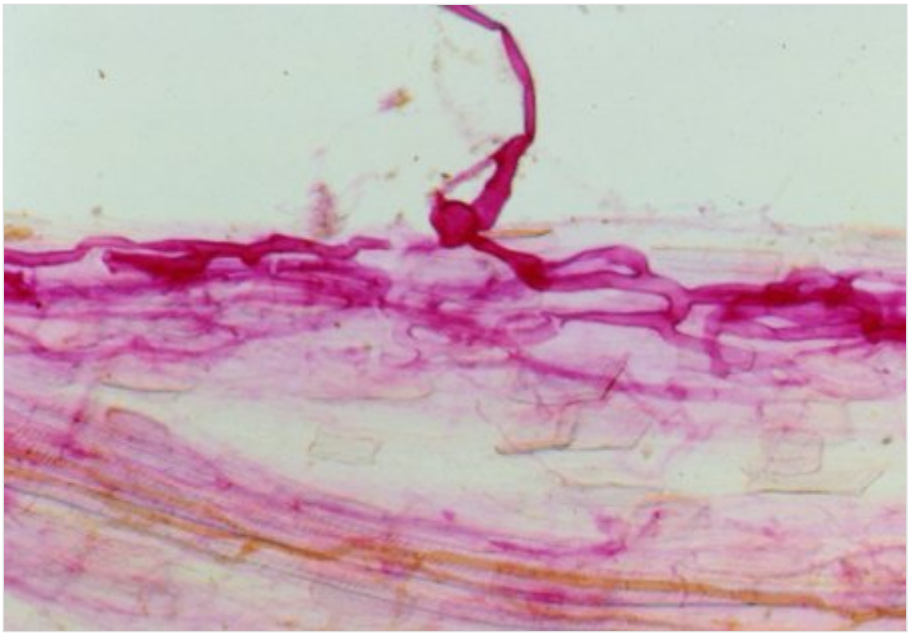


Figure 5: Intraradical vesicles

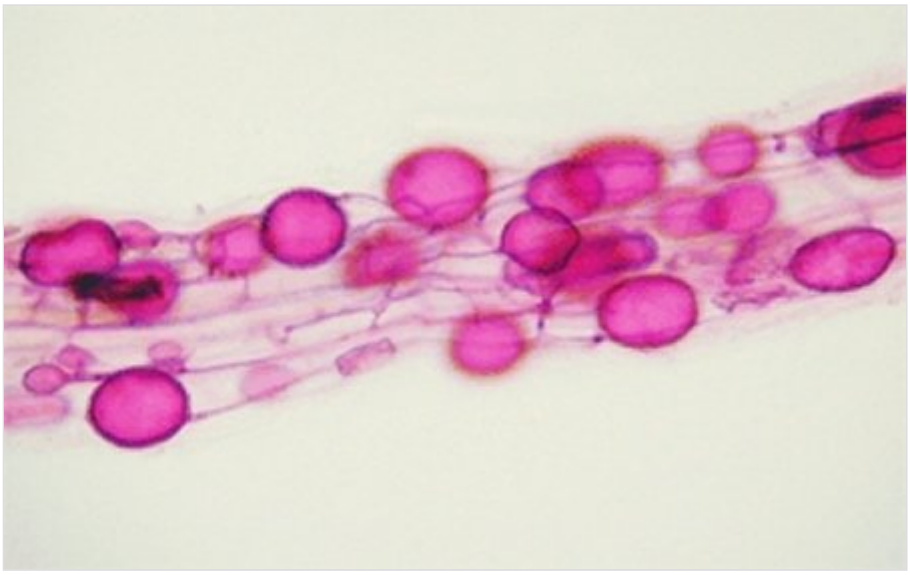


Figure 6: Intraradical arbuscules

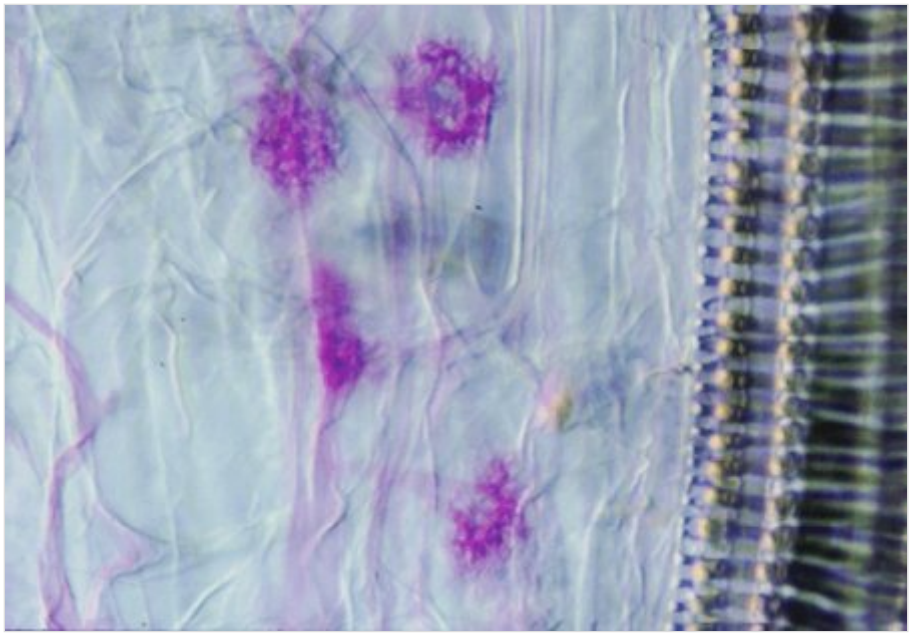
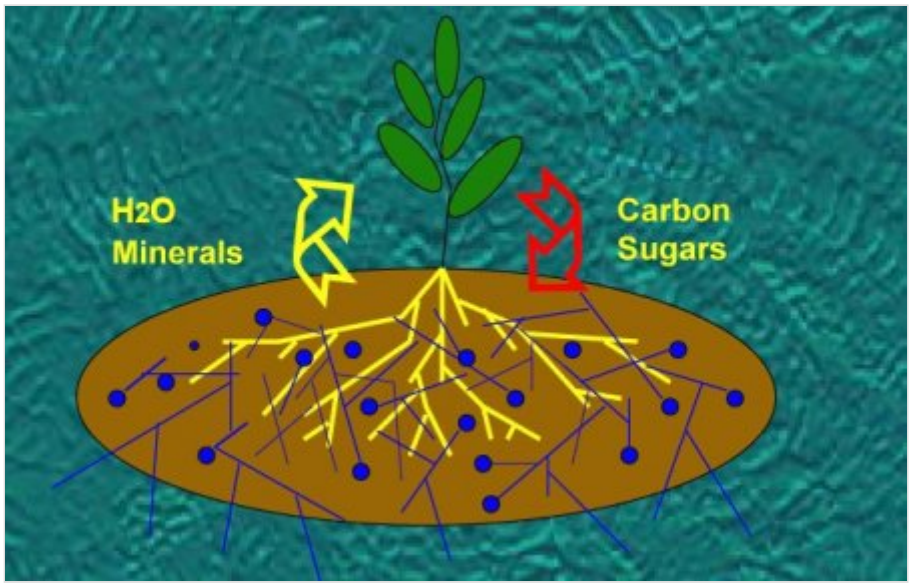


Figure 7: Nutrients bi-directionnal exchange between plant and fungi



▶ Description - Figure 7

All AM (arbuscular mycorrhizal) fungi are grouped in the phylum Glomeromycota, with almost 220 species actually described with the majority of representatives belong to the order Glomerales.

Previous | Table of Contents | Next

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