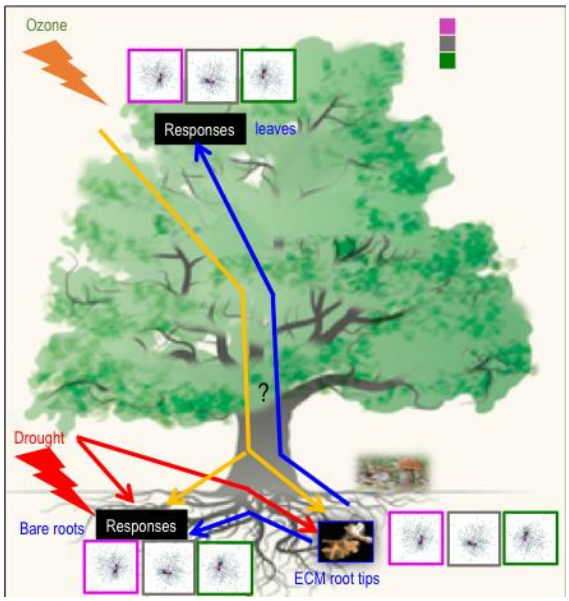
OZMYC (Intermediate report)



Impact of abiotic stresss (Ozone, drought) on ectomycorrhizal symbiosis and role of the ectomycorrhization on tree responses

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Context —In temperate and boreal forest ecosystems, ectomycorrhiza are the most predominant plant-fungal mutualistic interactions established between roots and soil-born fungi. Nowadays, climate change (recurrent droughts, atmospheric pollutant such as tropospheric ozone) is on-going and both trees and soil microorganisms are highly sensitive to the consequences of global change. Tree-associated microorganisms also directly affect plant performance through regulating biomass production, carbon gain and allocation as well as nutrient acquisition. Abiotic stresses negatively impact trees productivity, e.g. by decreasing carbon assimilation and allocation to stems and roots. Still poor data exist on how these abiotic stresses can impact the functioning (bi-directional exchanges of nutrients) of ectomycorrhizal associations and the long-lasting positive effect of this symbiosis on tree productivity. It is thus crucial to address the challenging question of how trees interact with and respond to their biotic and abiotic environment at the same time.

Objectives — We propose to better link the influence of above-ground stress (drought or ozone) responses of plants on below ground processes, and doing so, performing an integrative study on plant-soil-stress interactions.

Approach — We plan to compare three levels of cell organization (metabolites, hormonal and genes profiles) in below- and above-ground organs (roots and leaves) in stress conditions, in order to highlight the impacts of mycorhization on stress response and vice-versa.

Key results —

- Ecophysiology measurements carried out on poplars under stress or not, have demonstrated the presence of abiotic constraints without impact on tree physiology. This allows us to address the question of tree responses to abiotic constraints at the level of cell signaling.

- Weighted correlation network analysis (WGCNA) was performed on transcriptomic data, separately for leaf and root organs. We identified clusters of co-regulated genes, providing a global view of the system and enabling new working hypotheses to be formulated after a detailed analysis of each cluster.

- Ozone stress also led to limited changes in diverse metabolites that were also greatly enhanced with the presence of ectomycorrhizal symbiosis. Aromatic metabolites, particularly salicylates and an array of hydroxycinnamate conjugates, were greatly elevated.

- The presence of the fungal symbiont, *Laccaria bicolor*, negated even short-term effects of drought or ozone on root metabolites

Main conclusions including key points of discussion — The follow-up challenge for this study is to integrate transcriptomics and metabolomics data set. However, we can already point out and discuss that the presence of a fungal symbiont or other key members of a plant's microbiome may have a profound effect on its ability to respond to environmental stressors.Remaining time of the project will be dedicated to the integration of those data and manuscript writing.

Future perspectives — The advances anticipated here will set the stage for detailed understanding of trees adaptation to abiotic stresses without disturbing mutualistic biotic interactions such as ectomycorrhiza. The knowledge acquired on the molecular plasticity of poplar trees under different environmental cues will likely help to reveal genes that cross regulated resistance to multiple stresses and consequently contribute to the development of trees tolerant to a wide range of abiotic stresses without impacting beneficial ectomycorrhizal interaction.

Valorization —

Poster

De Freitas Pereira M, Pavlovic I, Hummel I, Bogeat-Triboulot MB, Priault P, Cohen D, Kohler A, Novak O, Jolivet Y, Veneault-Fourrey C, Vaultier MN (2019) Impact of abiotic stresses on ectomycorrhizal symbiosis and role of ectomycorrhization on tree responses. 23th International Conference on Plant Growth Substances (IPGSA), Paris, 25-29 June 2019