Isolation and characterization of edaphic herbicide-degrading fungal strains after exposure to a mixture of herbicides

Stauffer, M.1,2, Boisnoir, M.1,2, Bardot, C.1,2, Besse-Hoggan, P.3,4, Perrière, F.1,2, Joly, P.1,2, Mallet, C.1,2, Batisson, I.1,2

1 Clermont Université, Université Blaise Pascal, LMSE, F-63100 Clermont-Ferrand, France; 2 CNRS, UMR 6023, Laboratoire Microorganismes: Génome et Environnement, BP 80026, F-63171 Aubière Cedex, France; 3 CNRS, UMR 6024, Institut de Chimie du Clermont-Ferrand, BP 80026, F-63171 Aubière Cedex, France

Current agricultural techniques tend to use lower doses of pesticides but also an increasing number of more specific molecules which may be applied over a short time or in mixture. In the environment, this panel of compounds may lead to cumulative, synergic or antagonist/competitive effects, influencing the abiotic and biotic processes governing their fate. Soil microorganisms are widely studied for their pesticide biodegradation capacities. However (i) the “pesticides cocktail” aspect is rarely considered in biodegradation studies and (ii) reports on fungal pesticide degradation are relatively scarce compared to those on bacterial degradation. Thus, in this study, we have isolated and characterized fungal strains able to resist to a mixture of herbicides and to degrade some of these molecules.

Enrichment culture procedure used in this study, with herbicides mixture as sole carbon source allowed to isolate 2 fungal strains showing dissipation capacities for mesotrione, nicosulfuron and S-metolachlor molecules. These isolates are currently used to identify, firstly, the chemical structures of degradation products formed during biotransformation and secondly, proteins involved in degradation processes and in global metabolism adaptation of fungal strains toward herbicides mixture. These data will allow us to obtain a complete overview of the fungal metabolic pathways involved in the study of herbicides biodegradation and will be useful for the management of microbial metabolisms involved in bioremediation processes of soils.