HAUDOR

Project title: Deciphering of Haustorium Development in Orobanche sp

Acronym: HauDOr

Project duration: 36 months – Start date: 01/10/2016 End date: 30/09/2019

Key-words: : Haustorium formation, Cytokinins, Orobanche, Evolution

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Total cost of the project: 128 k€ (Do not include salaries others than those of the people hired for the project : PhD or post- doc)
Financial support required from « Objectif Végétal »: 113 k€

Summary:

Understanding the biological functional networks in the rhizosphere is an important issue for the development of innovative strategies of plant production. Plants as sessile organisms offer a large contact surface between the soil and their roots and the release of organic materials from roots such as organic, amino and fatty acids, carbohydrates or flavonoids is getting more and more interest. It is now known to play a major role in the control of plant communications with others organisms in soils, notably with rhizosphere microorganisms. In return, the benefit of rhizosphere microorganisms producing plant regulators such as auxin and cytokinins for plant growth is also well documented. Such regulatory compounds correspond also to phytohormones that are synthesized and transported through the plants to allow a fine tailoring of its shape and functions. Interestingly, phytohormones can also be exuded from roots but evidences remain rare and the roles of such a process in the control of plant communication with rhizosphere microorganisms and other plants is poorly documented and understood. To date the only clues showing phytohormones act as plant-plant signaling cues within the rhizosphere are the involvement of strigolactones exuded from plant roots in the promotion of hyphal branching of the symbiotic arbuscular mycorrhizal fungi and the symbiotic interaction with Rhizobium, and in the germination of root-parasitic plants.

The plant - parasitic plant communication represents an outstanding opportunity in the present project for pioneer investigations on signaling of plant-exuded cytokinins within the rhizosphere. Indeed, recent data from our laboratory show that host-derived cytokinins promote the formation of the intrusive organ (*haustorium*) of the parasitic plant *Phelipanche ramosa* and are thus required for the establishment of the physical interaction. This will be achieved through the deciphering of the cytokinin signalization pathway in the parasitic plant following germination, and the crosstalk with other plant regulators present in the rhizosphere and known to affect the plant – parasitic plant communication, such as auxin, abscissic acid and strigolactones. This project should therefore shed a new light on the rhizosphere interaction subject which is actually of main interest by establishing hormonal plant-plant interaction as an ecologically important dialogue. In the context of this project, we therefore propose to use root parasitic plants as a tool to explore hormonal plant-plant signaling in the rhizosphere by focusing on cytokinin signaling and its effects on haustorium formation.

Signaling of host-plant derived cytokinins in the parasitic plant will be studied both by a transcriptomic approach using NGS sequencing (RNA-seq) and by bioinformatic analysis of gene networks. In addition,

as a breakthrough approach, functional validation of candidate genes coding for major putative key actors in the parasitic plant will be performed using the targeted CRISPR (clustered regularly interspaced short palindromic repeat) - Cas9 genome editing strategy. Indeed, this strategy has been successfully used for efficient genome editing in human cell lines and animals (zebrafish, mouse) but applications in plants are still rare and need more evidences of successful. Involvement of the newly discovered regulators of such a plant-plant hormonal interaction will also be assessed in other plant – root parasitic plant interactions in order to conclude on the expected significance of this hormonal signaling in plant – parasitic plant communication.