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"Resilience of agricultural systems against crises"

Legume Small GTPase MtROP9 and its Role in Establishment of Plant Defense During Pathogenic and Symbiotic Interactions with *Medicago truncatula*

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Abstract

Legumes are among the most economically important crop families providing excellent sources of protein, vitamins, minerals and other nutrients to human and animal diets. Production of legume crops such as peas, soybean, dry beans, etc, which form an essential protein source for majority of population in semi-arid and tropical regions is hampered by soil borne pathogens. Ability of these crops to defend temselves against infections by oomycete root rot pathogens like *Aphanomyces euteiches* and interactions with symbionts (nitrogen fixing bacteria and abascular mycorrizal) involves small GTP-binding proteins that function as molecular switches controlling the signal transduction pathway resulting to host defense response.

We investigated the role of *Medicago truncatula* small GTPase MtROP9 (*M. truncatula* Rho of plants) orthologous to *M. sativa* Rac1 via an RNA interference silencing approach. MtROP9 deficient plants whose roots were transformed by *A. rhizogenes* carrying RNAi vector were produced and infected with pathogenic oomycete *A. euteiches* symbiotic arbuscular mycorrhiza fungus *Glomus intraradices* as well as rhizobial bacteria *Sinorhizobium meliloti*. Phenotypic observations clearly showed a retarded growth in MtROP9i transgenic lines. Neither ROS generation nor MtROP9 and MtRBOH gene expression resulted after microbial infections. The knockdown of MtROP9 clearly promoted mycorrhizal and *A. euteiches* early hyphal root colonisation, while rhizobial infection was clearly impaired. The results of our study suggest a key role of small GTPase MtROP9 in development of host plant defense involving ROS-mediated early infection signalling.

These results contributes to the investigation on the development of new techniques for the control of soil borne pathogens and provides an outlook to the investigations on opportunities for disease resistance development in legumes and in plant breeding to capture possibilities of raising crop yield, nutritional quality, limited pesticide use and over all poverty alleviation.

Keywords: *Aphanomyces euteiches*, arbuscular mycorrhizal symbiosis, *Medicago truncatula*, MtROP9, plant defense proteins, rhizobia bacteria symbiosis, small GTPase

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