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The role of the 4-*HTHDPS* gene family in symbiotic and abiotic stress responses in plants of the *Fabaceae* family

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As the world faces more challenges linked to food security and environmental preservation, the specific characteristics of legumes (*Fabaceae*) make them important candidates to reach sustainable agriculture. Apart from their high protein content, legumes are relatively rich in the amino acid lysine. Lysine is referred to as an 'essential' amino acid, because it cannot be synthesized by humans or monogastric animals and is considered to be the most limiting dietary component in food and feed. The biosynthesis of lysine is tightly regulated by 4-hydroxy-tetrahydrodipicolinate synthase (4-*HTHDPS*), our candidate gene (family) of interest. Recently the 4-*HTHDPS* gene family of the model legume plant *Medicago truncatula* was analyzed, which led to the discovery of novel, legume specific, 4-*HTHDPS* genes with multiple amino acid substitutions on positions previously shown to be involved in feedback inhibition and of residues important for catalytic activity, possibly affecting the enzymatic properties of these isoforms. Furthermore, these newly discovered isoforms seem to be specifically upregulated in roots colonized with mycorrhizal fungi or infected with pathogens, thus suggesting a role for these 4-*HTHDPS* genes in pathogenesis in legumes. By use of natural variation, publically available - and induced CRISPR/Cas9 mutants, we want to elucidate the functions and interplay of all 4-*HTHDPS* isoforms within the aspartate metabolic pathway together with its role in symbiosis with Rhizobia and (a)biotic stress responses in *Fabaceae*.

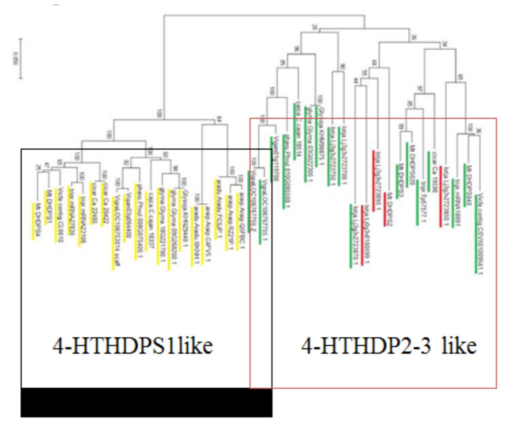

Figure 1: The evolutionary history of 4-HTHDPS in Fabaceae (NJ tree, tree is drawn to scale, with branch lengths in the same units as those of the evolutionary distances used to infer the phylogenetic tree). The 4-HTHDPS isoforms in general regulate lysine formation in plants. The Fabaceae specific 4-HTHDPS isoforms seem to have distinct functions, fine-tuning the regulation the lysine pathway and connecting it to the interaction with Rhizobia, which fixate N2, but also to (a)biotic stress responses in general. Yellow=Mt-HTHDPS1-4-like - Green=Mt-HTHDPS 3-like - Red=Mt-HTHDPS 2-like sequences.

Biography

Raphaël Kiekens is a Researcher at the Plant Genetics Lab of the VUB (Vrije Universiteit Brussels). He was a Former Researcher at the Plant Systems Biology Lab of UGent-VIB working on natural variation of the cell cycle in *Arabidopsis thaliana* and taught Bioinformatics for several years at the University College in Bruges (Howest).

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