ABSTRACT

"Insertion mutants in Medicago truncatula as tools to study symbiotic nodule identity and bacterial recognition."

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The legume species *Medicago truncatula* establishes a symbiotic interaction with the nitrogen-fixing bacterium *Sinorhizobium meliloti*. A complex molecular dialogue between the two partners is necessary for microbial colonization and plant organogenesis leading to a functional nitrogen-fixing nodule. During formation of this organ, specific cellular differentiation is seen both for host cells and for the endosymbiotic bacteria, called bacteroids. This process is accompanied by novel gene expression patterns for both plant and bacteria. Our laboratory has demonstrated that insertion mutant collections can be developed in this model legume plant using the tobacco retrotransposons *Tnt1* or the endogenous retroptransposon *MERE1*. In collaboration with the Noble Foundation (OK-USA), we characterized tagged symbiotic plant mutants that form no nodules, nonfunctional nodules or nodules with altered development during the interaction with *S. meliloti*. Among these mutants, we identified three alleles of a new Fix^- symbiotic mutant locus. The Fix^- nodules produce fluorescent compounds reminiscent of phenolic molecules normally produced during defense reactions. This observation suggests a shift from symbiosis to pathogenesis during the interaction between the two symbiotic partners. A detailed analysis indicates that bacteroid differentiation is altered in this plant mutant and that the mutated gene may be important for the plant to recognize bacteria. The tagged locus was cloned and we are studying the biological function of this gene in order to understand its role in the recognition between the two partners.

We also characterized 4 alleles of an original mutant that we called *noot* (*no*dule ro*ot*). This *noot* mutant develops nodules that appear functional for nitrogen fixation in the presence of bacteria but are altered in the pattern of development and organization. During development, a root appears in apical position of the nodules. The *noot* mutation is sufficient to convert a nodule into a root suggesting that root and nodule morphogenetic pathways share more common elements that previously admitted. We have cloned the gene responsible for this phenotype. This mutant unravels one element of the molecular determinants controlling the symbiotic nodule organ identity but also how during evolution nodules evolved from legume roots.