Investigation of the photomorphogenic and nodulation phenotypes of the *Medicago truncatula* heme oxygenase mutant

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The purpose of this research was to investigate the genetic association between two phenotypes found in a heme oxygenase mutant (*giraffe)* in the model legume species *Medicago truncatula*. By performing a cosegregation analysis, it could be determined: (1) whether the photomorphogenic and nodulation phenotypes of the *giraffe* mutant are caused by a mutation in one or two genes and (2) whether the deletion of the GIRAFFE gene indeed causes the two mutant phenotypes. By examining the F3 generation of a *giraffe* backcross to wild-type, we could examine a population of plants in order to determine whether the nodulation and photomorphogenic phenotypes occurred together or segregated independently. Plants were grown and inoculated with *Rhizobium* bacteria and assessed for the two different phenotypes. In addition, leaf material was collected from F2 offspring and pooled to determine the presence or absence of the GIRAFFE gene using PCR. Out of the 41 F2 families tested thus far, all 41 exhibit cosegregation of the photomorphogenic and nodulation phenotypes. Twenty-five of these F2 families were tested for the presence or absence of the GIRAFFE gene. Our results indicate that the presence of the photomorphogenic and nodulation phenotypes occurs only when the GIRAFFE gene is absent. Therefore, the phenotypes we see in *giraffe* mutant plants are a result of a deletion in the GIRAFFE gene or the GIRAFFE gene and a very closely linked adjacent gene.