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研究报告

慢生根瘤菌属结瘤基因的进化及遗传分析

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摘要

根瘤菌中存在一系列控制固氮结瘤因子(lipo-chito-oligosaccharides)合成的结瘤基因(nodulation genes)。其中, *nodA*基因是合成结瘤因子所必需的, 该基因负责酰基转移酶的合成, 能将不饱和脂肪酸转移到结瘤因子寡聚糖骨架上; 基因*nodZ*, *nolL*和*noeI*为宿主专一性结瘤基因, 分别转录合成岩藻糖基转移酶, 岩藻糖乙酰化酶和岩藻糖甲基化酶。通过GenBank调取慢生根瘤菌属及其他根瘤菌属的结瘤基因*nodA*, *nodZ*, *nolL*和*noeI*, 构建系统发育树, 进行进化和遗传分析。结果表明, 慢生根瘤菌属各个菌株的*nodA*, *nodZ*, *nolL*和*noeI*具有很高的相关性, 但是与根据保守基因16S rDNA和dnaK分类情况不完全相符。这表明慢生根瘤菌属的结瘤基因主要是通过直系遗传的, 同时可能为适应宿主及环境条件, 结瘤基因有少量的平行转移。结果表明, 慢生根瘤菌属各个菌株的*nodA*, *nodZ*, *nolL*和*noeI*具有很高的同源性, 同时发现基于保守基因16S rDNA和dnaK对慢生根瘤菌的分类情况与慢生根瘤菌属各菌株在*nodA*, *nodZ*, *nolL*和*noeI*具有较高同源性的事实不完全相符。这表明慢生根瘤菌属的结瘤基因主要是通过直系遗传的, 同时可能为适应宿主及环境条件, 结瘤基因有少量的平行转移。

关键词 慢生根瘤菌属 进化 遗传分析 结瘤基因 16S rDNA dnaK

分类号

Phylogenetic and genetic analysis of symbiotic nodulation genes within the *Bradyrhizobium*

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Abstract

<P>Symbiotic nitrogen fixing bacteria-known as rhizobia-harbour a set of nodulation (<EM>nod</EM>) genes that control the synthesis of modified lipo-chitooligosaccharides, called Nod factors that are required for legume nodulation. The nodA gene, which is essential for symbiosis, is responsible for the attachment of the fatty acid group to the oligosaccharide backbone. The <EM>nodZ</EM>, <EM>nolL</EM>, and <EM>noeI </EM>genes are involved in specific modifications of Nod factors common to bradyrhizobia, i.e., the transfer of a fucosyl group on the Nod factor core, fucose acetylation and fucose methylation, respectively. The distribution of the <EM>nodZ</EM>, <EM>nolL</EM>, and <EM>noeI </EM>genes in the studied strains was found to correlate with the <EM>nodA </EM>tree topology. Moreover, the <EM>nodA</EM>, <EM>nodZ</EM>, and <EM>noeI </EM>phylogenies were largely congruent, but did not closely follow the taxonomy of the strains shown by the housekeeping 16S rRNA and <EM>dnaK </EM>genes. Additionally, the distribution of <EM>nodZ</EM>, <EM>noeI</EM>, and <EM>nolL </EM>genes suggested that their presence may be related to the requirements of their legume hosts. These data indicated that the spread and maintenance of nodulation genes within the <EM>Bradyrhizobium </EM>genus occurred through vertical transmission, although lateral gene

transfer also played a significant role.
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Key words Bradyrhizobium evolution genetic analysis Nod genes 16S rDNA dnaK

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