

ORIGINAL ARTICLE

Strains of *Mesorhizobium amorphae* and *Mesorhizobium tianshanense*, carrying symbiotic genes of common chickpea endosymbiotic species, constitute a novel biovar (*ciceri*) capable of nodulating *Cicer arietinum*

R. Rivas¹, M. Laranjo², P.F. Mateos¹, S. Oliveira², E. Martínez-Molina¹ and E. Velázquez¹

¹ Departamento de Microbiología y Genética, Universidad de Salamanca, Spain

² Departamento de Biologia-Instituto de Ciências Agrárias Mediterrânicas, Universidade de Évora, Portugal

Correspondence to Encarna Velázquez, Departamento de Microbiología y Genética, Lab. 209, Edificio

Departamental de Biología, Campus M. Unamuno, 37007 Salamanca, Spain. E-mail: evp@usal.es

Present address:

Raul Rivas, Laboratorium voor Microbiologie, Vakgroep Biochemie, Fysiologie en Microbiologie, Universiteit Gent K.L., Ledeganckstraat 35, B-9000 Gent, Belgium.

KEYWORDS

chickpea • *Cicer arietinum* • *Mesorhizobium* • nitrogen fixation • symbiosis

Abstract



Aims: To identify several strains of *Mesorhizobium amorphae* and *Mesorhizobium tianshanense* nodulating *Cicer arietinum* in Spain and Portugal, and to study the symbiotic genes carried by these strains.

Methods and Results: The sequences of 16S-23S intergenic spacer (ITS), 16S rRNA gene and symbiotic genes *nodC* and *nifH* were analysed. According to their 16S rRNA gene and ITS sequences, the strains from this study were identified as *M. amorphae* and *M. tianshanense*. The type strains of these species were isolated in China from *Glycyrrhiza pallidiflora* and *Amorpha fruticosa* nodules, respectively, and are not capable of nodulating chickpea. These strains carry symbiotic genes, phylogenetically divergent from those of the chickpea isolates, whose *nodC* and *nifH* genes showed more than 99% similarity with respect to those from *Mesorhizobium ciceri* and *Mesorhizobium mediterraneum*, the two common chickpea nodulating species in Spain and Portugal.

Conclusions: The results from this study showed that different symbiotic genes have been acquired by strains from the same species during their coevolution with different legumes in distinct geographical locations.

Significance and Impact of the Study: A new infrasubspecific division named biovar *ciceri* is proposed within *M. amorphae* and *M. tianshanense* to include the strains able to effectively nodulate *Cicer arietinum*.