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# Most Acid-Tolerant Chickpea Mesorhizobia Show Induction of Major Chaperone Genes upon Acid Shock

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**Abstract:** Our goals were to evaluate the tolerance of mesorhizobia to acid and alkaline conditions as well as to investigate whether acid tolerance is related to the species or the origin site of the isolates. In addition, to investigate the molecular basis of acid tolerance, the expression of chaperone genes groEL and dnaKJ was analyzed using acid-tolerant and sensitive mesorhizobia. Tolerance to pH 5 and 9 was evaluated in liquid medium for 98 Portuguese chickpea mesorhizobia belonging to four species clusters. All isolates showed high sensitivity to pH 9. In contrast, mesorhizobia revealed high diversity in terms of tolerance to acid stress: 35 % of the isolates were acid sensitive and 45 % were highly tolerant to pH 5 or moderately acidophilic. An association between mesorhizobia tolerance to acid conditions and the origin soil pH was found. Furthermore, significant differences between species clusters regarding tolerance to acidity were obtained. Ten isolates were used to investigate the expression levels of the chaperone genes by northern hybridization. Interestingly, most acid-tolerant isolates displayed induction of the dnaK and groESL genes upon acid shock while the sensitive ones showed repression. This study suggests that acid tolerance in mesorhizobia is related to the pH of the origin soil and to the species cluster of the isolates. Additionally, the transcriptional analysis suggests a relationship between induction of major chaperone genes and higher tolerance to acid pH in mesorhizobia. This is the first report on transcriptional analysis of the major chaperones genes in mesorhizobia under acidity, contributing to a better understanding of the molecular mechanisms of rhizobia acidity tolerance.

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