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Rhizobial genes involved in the symbiosis with host legumes

○Hien P. Nguyen[1], Omar M. Faruque[1], Hiroki Miwa[1], Takakazu Kaneko[2], Shusei Sato[3], Shin Okazaki[1]

[1]Graduate School of Agriculture, Tokyo University of Agriculture and Technology,
[2]Faculty of Life Sciences, Kyoto Sangyo University, [3]Graduate School of Life Sciences, Tohoku University

E-mail: nguyenphuochien92@gmail.com

Symbiosis specificity has been demonstrated in the interactions between rhizobia and leguminous plants. While the compatible symbiosis leads to formation of the nitrogen-fixing nodules, some cultivars exhibit incompatibility with the specific strains, resulting in ineffective nodulation. *Vigna radiata* cv. KPS1 and soybeans carrying *Rj4* gene are incapable of nodulation with *Bradyrhizobium elkanii* USDA61 due to presence of pathogen-like proteins. This work was performed to understand the molecular mechanisms underlying nodulation incompatibility of KPS1 and *Rj4* plants. By mutagenesis, we isolated six Tn*5* mutants of USDA61, designated BE5, BE21, BE53, BE85, BE103 and BE168, which could nodulate KPS1 efficiently. The T3SS mutant BErhcJ could form nodules on both KPS1 and *Rj4* soybean. Similarly, inoculation test on *Rj4* soybean revealed that four mutants BE5, BE85, BE103 and BE168 were able to nodulate, suggesting the commonality of incompatible mechanism of KPS1 and *Rj4* plants. Sequencing analysis of the Tn*5*-flanking sequence indicated that five genes encoding the cytosine deaminase, hypothetical proteins, manitol-binding protein and GTP pyrophosphokinase respectively were disrupted. The deduced gene products of these Tn*5* mutants shared high similarity with the hypothetical proteins of pathogens. One *tts* box was found at 96-bp in upstream of *bel53* gene found in BE53, indicating that the gene product was involved in T3SS. To determine the infectious properties of USDA61 and its mutant, the infection process of BE21 was analysed using *DsRed* and *gusA* genes. Both USDA61 and BE21 infected KPS1 through infection threads (ITs) and formed bumps. Our results indicated that KPS1 halted both infection and nodule organogenesis of *B. elkanii* USDA61.