Rhizobial microsymbionts of the narrowly endemic *Oxytropis* species growing in Kamchatka possess a set of genes that are associated with T3SS and T6SS secretion systems and can affect the development of symbiosis

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A collection of rhizobial strains isolated from root nodules of the narrowly endemic legume species *Oxytropis erecta*, *O. anadyrensis*, *O. kamtschatica* and *O. pumilio* growing on the Kamchatka Peninsula (Russian Federation) was obtained. Analysis of the 16S rRNA gene sequence showed a significant diversity of isolates belonging to the families *Rhizobiaceae* (*Rhizobium*), *Phyllobacteriaceae* (*Mesorhizobium*, *Phyllobacterium*) and *Bradyrhizobiaceae* (*Bosea*, *Tardiphaga*). Pairs of taxonomically different strains in various combinations were isolated from some nodules of *Oxytropis* plants. Plant nodulation assays showed that only strains belonging to the genus *Mesorhizobium* (*M. jarvisii*, *M. loti* and *M. huakuii*) could form nitrogen-fixing nodules. The nitrogen-fixing activity of the strains was more associated with the host plant than with the species of strains. The whole genome sequences analysis showed that the strains *M. loti* 582 and *M. huakuii* 583 possessed symbiotic genes necessary for the formation of effective symbiosis and grouped into *Sym*-clusters. In contrast, the strain *T. robiniae* 581 had only a reduced number of fix genes, while the strains *Phyllobacterium* sp. 628 and *R. lusitanum* 629 possessed only individual symbiotic genes, which obviously did not participate in the formation of nodules. It was also stated that the strains *M. loti* 582 and *M. huakuii* 583 had a significantly larger set of genes related to the secretion systems T3SS and T6SS that can affect the host specificity of strains, compared with 6 commercial strains used as reference. These two strains formed nodules of two types (typical elongated and atypical rounded) on *Oxytropis* plants. We suggest that a possible cause of the observed phenomenon is the availability of different nodulation strategies in these strains (dependent and independent of Nod-factors).

Thus, as a result of studying the collection of strains isolated from the narrow endemic species of Kamchatka *Oxytropis*, interesting objects were selected to study the functions of the T3SS and T6SS genes, and their role in the development of rhizobia-legume symbiosis. The prospects of using strains with gene systems for both symbiotic and non-symbiotic nodulation to enhance the efficiency of plant-microbe interactions by expanding the host specificity and increasing the efficiency of nodulation are discussed.

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