THE FEATURES OF INTERACTION *RHIZOBIUM GALEGAE* WITH *GALEGA ORIENTALIS*

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The strain of Rhizobium galegae K- 3 - active symbiote of Galega orientalis has been received by means of selection. Positive influence of this strain on formation and functioning of symbiosis during the first and second years of cultivation of Galega orientalis plants is shown. R. galegae K- 3 promotes to formation of generous amount of indeterminate nodules on the roots, increase of activity of symbiotic nitrogen fixation and increase in the yield of Galega orientalis.

Key words: *Rhizobium galegae*, *Galega orientalis*, legume-rhizobial symbiosis

Today, significant attention is paid to the introduction of different legumes with economically valuable signs into the culture. According to the literature, new macro-cultural species, which are similar to their wild relatives by physiological properties, have a high symbiotic potential [1]. Use of *Galega orientalis* in agriculture is due to its high winter resistance and productivity, intensive growth and longevity, early spring regrowth of tops, the ability for utilization at the same place for 10-12 years, as well as high quality of feed obtained without the use of nitrogen fertilizers – due to the symbiotic nitrogen fixation [2; 3]. Increased ability of *Galega orientalis* to fix atmospheric nitrogen, prevalence of symbiotrophic nutrition over autotrophic, high sensitivity to inoculation with specific strains of rhizobia have a positive impact of bacterization on productivity of culture and quality of raw materials.

Cultivation of *Galega orientalis* on soils where no active strains of specific rhizobia are present requires the use of biopreparation for pre-seeding bacterization, which in turn stipulates extensive research of features of legume-rhizobial symbiosis formation.

The aim of this paper was to study features of relationships of *Rhizobium galegae* with *Galega orientalis* plants.

Materials and methods. Study of the inoculation efficiency of *Galega orientalis* (variety Kavkazskiy branets) by the strains

of *R. galegae* was conducted under the conditions of field experiment on sod-podzolic sandy loam soil (pH – 6.47; humus content – 0.8-1.1 %; easily-hydrolysed nitrogen (by Tiurnyn and Kononova) – 56.0-57.0 mg; P₂O₅ – 160.0-170.0 mg and K₂O (by Kirsanov) – 100-110 mg per 1 kg of soil). Planting was carried out by the wide-row method, row spacing – 40 cm. Seeding norm – 10 kg/ha. Before seeding, seeds were scarified and inoculated with the strains of rhizobia at a rate of 200-300 thous. cells/seed. Standard strain of *R. galegae* 0703 obtained from the collection of beneficial soil microorganisms [4] and strain *R. galegae* K-3, isolated from nodules of *Galega orientalis* were used for bacterization.

Nodules were sampled from the roots of *Galega orientalis* for cytological tests, wash them out from the soil residues and fixed by FAA (16 % formalin – 1 portion, acetic acid (concentrated) – 1 portion; 96 % alcohol – 5 portions). Glutaric aldehyde was also used for fixing nodules. Fixative was washed out in 80 % alcohol solution. Fixed material was dehydrated by four-fold washing in alcohol (from 96 % to 100 %), keep in the solution containing of alcohol and toluene with gradual alcohol replacement by toluene. Then toluene was replaced by paraffin. Longitudinal microtome slices were obtained from the fixed material by paraffin blocks method [5]. A part of obtained slices were left

unstained, the rest of the slices were stained by haematoxylin.

For electron-microscopic examination, nodules of plants inoculated by *R. galegae* K-3 were separated, cut into the layers of 1 mm thickness, fixed with 6 % glutaric aldehyde solution and 1 % OsO₄ [6]. Dehydration of fixed material as performed by 50, 70, 76 and 100 % alcohols and poured in Epone-812. Ultrathin slices were obtained on ultramicrotome BS 490A, stained with uranyl acetate, examined under electronic microscope BS-540 "Tesla".

In the main phase of plant development of the first and second years of cultivation, number of nodules on the roots of plants and activity of symbiotic nitrogen fixation measured by acetylene method, were determined [7]. Roots were sampled from soil-plant monoliths of 22x22x27 cm, carefully separating from the soil, washed and placed them in bottles where acetylene was injected. Incubation time was 1 hour. Amount of reduced ethylene was measured on a gas chromatograph Chrom-4. Then the roots were removed from the bottles, and number of nodules was counted.

Mowing of plants was on the first and second year of vegetation of *Galega orientalis* in the flowering stage, with further measurement of their air dry tops.

Statistical processing of experimental data was carried out by B. O. Dospiekhov [8] using computer program Statistica 6.0.

Therefore, selected active strain *Rhizobium galegae* K-3 forms an effective nitrogen-fixing symbiosis with plants of *Galega orientalis* and promotes formation of the significant number of nodules with distinct histological zoning on the roots that is typical for non-determined type of nodules. It has been established that symbiotic apparatus of *Galega orientalis*, formed during the first year, after wintering retains its structure and functional activity. During the second year of plants cultivation, increase in the number of nodules on the roots of plants and a significant increase in the level of symbiotic nitrogen fixation is observed since the beginning of regrowth of the tops. Mowing of *Galega orientalis* does

not affect intensity of nodule formation, but significantly reduces the activity of symbiotic nitrogen fixation. Strain *Rhizobium galegae* K-3 improves productivity of *Galega orientalis* by 20 %, in total of two years of cultivation compared with control.