https://doi.org/10.30970/apmicro.2026.26

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PROTECTIVE AND STIMULATING PROPERTIES OF THE ENDOPHYTIC STRAIN *BACILLUS VELEZENSIS* IMV B-8134

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Abstract. The plant microbiome, particularly endophytic microorganisms, is attracting attention due to its targeted probiotic effects on plants. The development of novel bioformulations based on endophytic bacteria is of critical importance for the sustainable development of crop production under extreme climate change. Under field conditions, stimulatory and phytoprotective effects on soybean plants were observed through the synergistic action of the endophytic strain *Bacillus velezensis* IMV B-8134 and the association of soybean rhizobia. These effects persisted in the next generation of plants, ensuring higher disease resistance and soybean productivity.
Keywords: endophytes, rhizobia, biotic and abiotic stresses, soybean fungal diseases, yield.

Soybean (*Glycine max* (L.) Merr.) is one of the most important protein and oil crops in world agriculture (Ramlal et al., 2026). It plays a significant role in ensuring food and energy security. In Ukraine, there has been a tendency to expand the acreage devoted to this crop in recent years, and as of 2025, almost 2,091 thousand hectares were planted with soybeans (State Statistics Service of Ukraine). A major obstacle to obtaining high yields of high-quality soybean seeds is infection by phytopathogenic microorganisms, 50 % of which are fungal pathogens (Pospielova et al., 2020). Pathogenic fungi are capable of synthesizing toxins, the accumulation of which can lead to a reduction in the food and feed properties of the crop and to poisoning in humans and animals (Bandara et al. 2020; Salotti et al., 2024). Alternaria blight is a disease that is becoming increasingly prevalent in soybean crops due to global climate change. The dominant pathogens are *A. alternata* (Fr.) Keissler, *A. solani* (Ell. et Mart.), and *A. tenuissima* (Fr.) Wiltshire (Pospielova et al. 2020; Rani et al., 2020). The damage caused by Alternaria blight is that the disease leads to a reduction in the photosynthetic surface area of the leaves, their wilting and death. Infected plants lag behind in growth, produce small, underdeveloped beans and non-viable seeds, or produce no beans at all.

Experiments on the cultivation of the mid-early soybean variety ‘Sculptor’ were conducted at the experimental field of the D. K. Zabolotny Institute of Microbiology and Virology of the NAS of Ukraine under arid conditions in 2025. The field research design included the following seed inoculation treatments: 1 – control (no inoculation, water treatment); 2 – Ryzobin^{K} (association of *Bradyrhizobium japonicum* UCM B-6018, B-6023 and B-6035); 3 – *B. velezensis* IMV B-8134; 4 – Ryzobin^{K} + *B. velezensis* IMV B-8134; 5 – Ryzobin^{K} + *B. velezensis* IMV B-8134 bioprimed seeds (seeds from the soybean harvest inoculated with the Ryzobin^{K} + *B. velezensis* IMV B-8134 bioformulation in the previous year).

During the active vegetation period, in the flowering- early bean formation stages (BBCH 65–71), symptoms of Alternaria leaf blight were observed on infected plants – dark brown or black circular spots with a yellow margin that contrasted strongly with the green background of healthy leaf tissue. The results of the phytopathological analysis confirmed the absence of *Alternaria* infection in soybean plants in the variants with mono-inoculation

of *B. velezensis* IMV B-8134 and the complex inoculation of Ryzobin^{K} + *B. velezensis* IMV B-8134. In the variant with bioprimed plants, the number of infected plants was three times lower than the control. At the same time, soybean yield in the variants with complex inoculation and with bioprimed plants was 20.9 % and 38.4 % higher than the control, respecttively. This effect was probably achieved due to the synergistic action of the studied rhizobial and non-rhizobial endophytic bacteria, which improved nitrogen nutrition, provided protection against biotic and abiotic stresses, and stimulated soybean growth and productivity.

Thus, the obtained results indicate that the use of a complex inoculant based on the association of complementary rhizobia and the non-rhizobial endophytic strain *B. velezensis* IMV B-8134 contributed to the reduction of soybean damage by Alternaria blight under natural infection background, as well as to the increase in productivity. These effects persisted in the next generation of plants.

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https://doi.org/10.30970/apmicro.2026.27

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PRODUCTION OF BIOETHANOL AND HIGH-VALUE SUBSTANCES BY NON-CONVENTIONAL YEASTS

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Abstract. The non-conventional yeasts *Ogataea polymorpha* and *Candida famata* were studied as hosts for the production of ethanol, L-lactic acid, and riboflavin from xylose, glycerol, and lignocellulosic hydrolysates. Metabolic engineering and selection improved ethanol production by