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PHYTOSTIMULATORY POTENTIAL OF SOME BACTERIA FOR WHEAT AND MAIZE

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Abstract: *Increasing plant productivity and improving crop quality in agriculture is one of the main tasks of the biological and agronomic sciences. Since wheat and maize are important for the Moldovan agriculture, our goal was to identify strains of microorganisms that could be beneficiary for these crops. Pseudomonas fluorescens CNMN-PsB-01 and P. fluorescens CNMN-PsB-02 were selected for their ability to stimulate wheat and maize by causing 10.8-22.6% and 9.2-26.2% increases in plant root length and seedling dry mass respectively.*

***Keywords: bacterial strains, phytostimulator, wheat, maize*.**

INTRODUCTION

Increasing plant productivity and improving crop quality in agriculture is one of the main tasks of the biological and agronomic sciences. An important role in these matters can be played by the plant growth promoting micro-organisms [1-6]. The latter are known for their ability to stimulate plants and to suppress the phytopathogen activity in soil without substantial risk for the environment and/or human health [3, 7-11]. For example, the representatives of *Bacillus*, *Pseudomonas*, *Azotobacter*, *Paenibacillus*, *Streptomyces*, and other genera can produce such secondary metabolites as phytohormones, siderophores, antibiotics, etc. Their application increased seed germination, accelerated the growth, development, and productivity of plants [3, 8, 10, 11].

Our goal was to identify the microbial strains that could be used for plant growth promoting in the Republic of Moldova. Our focus was on those which could be beneficial for wheat and maize, since these crops are of particular importance for the Moldovan agriculture.

MATERIALS AND METHODS

The study included the following bacterial strains: *Bacillus cereus* var. *fluorescens* CNMN-BB-07, *Bacillus velezensis* CNMN-BB-31, *Pseudomonas fluorescens* CNMN-PsB-01, *Pseudomonas fluorescens* CNMN-PsB-02 and *Pseudomonas fluorescens* CNMN-PsB-12 stored and deposited in the National Collection of Non-Pathogenic Microorganisms (NCNM) at the Institute of Microbiology and Biotechnology of the Technical University of Moldova.

The media for *Bacillus sp.* Was Nutrient Broth (NB) with the following composition (g/L): Peptic digest of animal tissue – 5.0; Sodium chloride – 5.0; Beef extract – 1.5; Yeast extract – 1.5. For *Pseudomonas* spp. – liquid media King B with Peptone – 20.0; Glycerine – 10.0; K_2HPO_4 – 1.5; $MgSO_4 \cdot 7H_2O$ – 1.5. The microorganisms were cultivated in 250 mL Erlenmeyer flasks with a working volume of 50 mL. The inoculum concentration was adjusted to the 0.5 McFarland standard. Optimal cultivation conditions included a temperature of 30±1°C and continuous illumination. Cultures were agitated continuously at 200 rpm for 48 hours.

Winter wheat MOLDOVA 16 and maize hybrid MOLDAVSCHII 450 were used as crop plants. The vegetation experiments were done under laboratory conditions in Petri dishes and in pots with non-sterile soil and included three replicas for each test case and the controls. The stimulatory activity of the bacteria was assessed via measuring the changes in germination capacity of seeds and in plant growth parameters [12]. The tests were done in Petri dishes and in pots with soil. Immediately before the tests the plant seeds were treated for 18-20 hours by microbial suspensions in the concentration of 0.2, 0.3, and 1.0%.

Statistical analysis of data was performed using Microsoft Excel. The statistical significance threshold was $p \leq 0.05$ [10].

RESULTS AND DISCUSSIONS

Under the condition of Petri dishes, the best impacts on wheat were observed from *Bacillus cereus* var. *fluorescens* CNMN-BB-07 and *Pseudomonas fluorescens* CNMN-PsB-12, which when used at concentration 0.3% caused 11.8% and 20.6% increases in dry mass of the seedlings respectively. *Pseudomonas fluorescens* CNMN-PsB-01 and *Pseudomonas fluorescens* CNMN-PsB-02 when used in concentrations 0.3 and 0.2% respectively increased the maize germination up to 100% and the maize seedling dry mass by 1.41 – 1.44 times (tab. 1).

Table 1. The best impacts on germination and growth of wheat and maize in Petri dishes

Variant	Germination, %	Seedling gross mass, g± c.i.*	Seedling dry mass, g ± c.i.
Moldova 16 winter wheat			
Control (distilled water)	98.3	8.8 ±0.02	1.02±0.03
B. cereus var. *fluorescens* CNMN-BB-07	98.3	10.2±0.17	1.14±0.01
P. fluorescens CNMN-PsB-12	93.3	10.4±0.65	1.23±0.05
Moldavschii 450 maize hybrid			
Control (distilled water)	96.7	14.8±2.5	2.04±0.1
B. cereus var. *fluorescens* CNMN-BB-07	96.6	17.4±1.1	2.18±0.2
P. fluorescens CNMN-PsB-01	100.0	29.5±4.6	2.94±0.3
P. fluorescens CNMN-PsB-02	100.0	26.6±3.0	2.88±0.2
P. fluorescens CNMN-PsB-12	93.3	18.3±0.6	2.08±0.1

** Average data for 100 seedlings ± confidence interval at p≤0.05.*

In the experiments with wheat grown in pots with non-sterile soil *Bacillus velezensis* CNMN-BB-31 increased the seedling height and root length by 10.9% and 14.9% respectively. *Bacillus cereus* var. *fluorescens* CNMN-BB-07 caused a 23.3% increase of the maize root length. The greatest stimulation of maize growth was observed from *Pseudomonas fluorescens* CNMN-PsB-01 and *Pseudomonas fluorescens* CNMN-PsB-02 and constituted 10.8–22.6% increases in root length and by 9.2–26.2% increases of the seedling dry mass (tab. 2).

Table 2. The best impacts on growth of wheat and maize in pots with non-sterile soil

Variant	Seedling height, cm ± c.i.*	Root length, cm ± c.i.	Seedling dry mass, g ± c.i.
Moldova 16 winter wheat			
Control (distilled water)	26.5±0.3	15.4±0.2	0.79±0.05
B. velezensis CNMN-BB-31	29.4±1.1	17.7 ±0.3	0.82±0.02
P. fluorescens CNMN-PsB-12	27.5±0.5	16.2 ±1.1	0.75±0.01
Moldavschii 450 maize hybrid			
Control (distilled water)	45.0±1.6	28.8±3.5	0.65±0.08
B. cereus var. *fluorescens* CNMN-BB-07	44.5±2.4	35.5±2.5	0.63±0.07
P. fluorescens CNMN-PsB-01	47.4±0.9	31.9±3.7	0.82±0.05
P. fluorescens CNMN-PsB-02	45.8±1.2	35.3±3.4	0.71±0.09
P. fluorescens CNMN-PsB-12	45.5±1.9	30.5±2.4	0.63±0.03

** Average ± confidence interval at p≤0.05.*

CONCLUSION

Based on the testing under conditions of Petri dishes and pots with non-sterile soil the bacterial strains *Pseudomonas fluorescens* CNMN-PsB-01 and *Pseudomonas fluorescens* CNMN-PsB-02 were selected for their potential to stimulate the growth of maize. Further research is necessary to confirm this potential under field conditions. Further screening of efficient stimulators of wheat growth is needed.

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