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## SUPPRESSION OF WHEAT PHYTOPATHOGENS WITH BIOLOGICAL PREPARATIONS

*Phytopathogenic strains of bacteria and fungi have been isolated from wheat samples cultivated in the Baltic countries. The ability of biological products Bactogen, Zhytsen, Stimul, Gulliver, Nemacid and Aurin to provide antibacterial and antifungal activity against phytopathogens - causative agents of wheat diseases has been shown.*

*Из образцов пшеницы, культивируемой на территории стран Прибалтики, выделены фитопатогенные штаммы бактерий и грибов. Показана способность биопрепаратов Бактоген, Жыцень, Стимул, Гулливер, Немацид и Аурин оказывать антибактериальную и антифунгальную активность в отношении фитопатогенов – возбудителей заболеваний пшеницы.*

**Keywords:** Bactogen; Zhytsen; Stimul; Gulliver; Nemacid; Aurin; phytopathogens - causative agents of wheat diseases; biological preparation

**Ключевые слова:** Бактоген; Жыцень; Стимул; Гулливер; Немацид; Аурин; патогенны пшеницы; биопрепарат.

### Introduction

In Lithuania, grain cultivation is one of the most profitable branches of agriculture and the economy in general. The price of grain is formed by the international market and supported by the financial sector, which actively invests in food raw materials. The cost of grain dictates the price of many food products; Lithuanian grain is exported to more than 25 countries of the world. According to the Ministry of Agriculture, in 2019 Lithuanian wheat exports amounted to almost 1.6 million tons.

Over the past five years, Lithuania has increased the area for grain crops: their area currently covers more than a million hectares. Grain producers annually harvest 3-3.8 million tons of grain, with wheat accounting for 2 million tons.

The development of phytopathogenic microorganisms in the fields where wheat is grown poses a threat to both the quantity and quality of the crop. According to the Food and Agriculture Organization of the United Nations and the International Maize and Wheat Improvement Center, this plant species is affected by four types of smut, three types of rust, powdery mildew, septoria and helminthosporium spots, and root rot. This culture, along with fungal diseases, is affected by bacterial and viral diseases, the causative agents of which also develop on many wild-growing cereals, which complicates the effective protection of crops from pathogens [1].

At present, much attention is paid to the development of integrated wheat protection systems, which should include the use of agrotechnical methods for preventing the development or suppression of certain species, methods for preserving and enhancing the activity of beneficial microorganisms; cultivation of resistant varieties, the use of biological and chemical plant protection products, taking into account an objective assessment of the phytosanitary state of crops and economic damage.

The market for chemicals for wheat protection is extremely diverse and saturated, while information about registered biological products for this purpose is rather poor. In modern agricultural practice, preference is given to biopreparations for multifunctional purposes, which, along with a protective

effect, have the ability to stimulate plant growth, increase their immunity and productivity. All the above requirements are met by microbiological preparations developed at the Research Laboratory of Molecular Genetics and Biotechnology, Faculty of Biology, Belarusian State University. The list of environmentally friendly drugs includes: Aurin, Nemacid, Zhytsen, Stimul, Bactogen, Gulliver and MaxImmun. The manufacturer of the first three of these drugs is LLC "Center for Innovative Technologies", the rest - JSC "Bobruisk Biotechnology Plant". All of these biological products have certificates of state registration and are included in the State Register of Plant Protection Products and Fertilizers Permitted for Use in the Republic of Belarus.

This study has shown the ability of biological products Bactogen, Zhytsen, Stimul, Gulliver, Nemacid and Aurin to provide antibacterial and antifungal activity against phytopathogens - causative agents of diseases of winter wheat grown in Lithuania.

## Methods

To isolate microorganisms from one test batch of wheat grains, about 100 grains were selected and placed on filter paper every 0.5-1 cm and placed in a humid chamber. After cultivation for 7-10 days, the culture was cleared by dilution in sterile water [2]. Further cultivation of bacterial and fungal strains was carried out on complete media. Isolation of phytopathogenic microorganisms was carried out according to [3]. Antagonistic activity was assessed by the plate method.

## Results

To analyze the diversity of microorganisms, a batch of winter wheat grain was provided by UAB "AGROCONSULT LT". UAB "AGROCONSULT LT" has developed into a dynamic company whose main line of business is wholesale of wide range of liquid fertilizers, bulk fertilizers, grains and animal feed. It is one of the leading companies in the Baltic States selling specifically formulated organic fertilizers and plant growth biostimulants. Most of the formulations are based on biologically active plant extracts obtained by using a proprietary technology developed by the company.

Wheat grains were collected on the area of the farms Romo Gylio, Ežerskio and Gataučiu (Lithuania). Employees of the Research Laboratory of Molecular Genetics and Biotechnology of the Biological Faculty of the Belarusian State University isolated 9 strains of fungi and 17 strains of bacteria from lots of wheat grain. Determination of the presence of pathogenic factors made it possible to select 4 strains of phytopathogenic fungi, as well as 1 strain of phytopathogenic bacteria. Fungal strains were identified as *Alternaria alternata*, *Fusarium culmorum*, *Fusarium avenaceum*, and *Fusarium sp.*, and the bacterial phytopathogen was identified as *Pseudomonas syringae*.

It was found that all investigated preparations (Bactogen, Zhytsen, Stimul, Gulliver, Nemacid and Aurin) have antagonistic activity against isolated phytopathogens. Moreover, the degree of suppression of phytopathogens by the biological preparation Aurin varies from 23 to 64 % (Fig. 1); the antifungal activity of the Bactogen preparation is most fully manifested against *F. culmorum* and *P. syringae*, reaching 65 and 71 %, respectively (Fig. 2); similar data were obtained for the nematicide Nemacid (Fig. 3). The maximum degree of inhibition of phytopathogenic fungi *F. culmorum* and *A. alternata* by the biological product Gulliver reaches 74 %, and by the growth regulator Stimul – 65 % (Figs. 4 and 6), while the antibacterial activity of these preparations reached 77 %.

## Conclusions

Phytopathogenic strains of bacteria and fungi have been isolated from wheat samples cultivated in the Baltic countries. The ability of biological preparations Bactogen, Zhytsen, Stimul, Gulliver, Nemacid and Aurin to provide antibacterial and antifungal activity against phytopathogens - causative agents of wheat diseases has been shown.

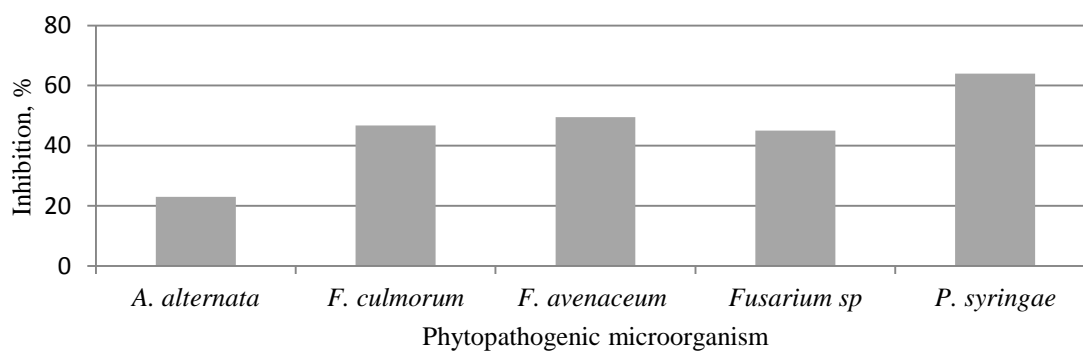


Figure 1. Suppression of wheat phytopathogens by Aurin

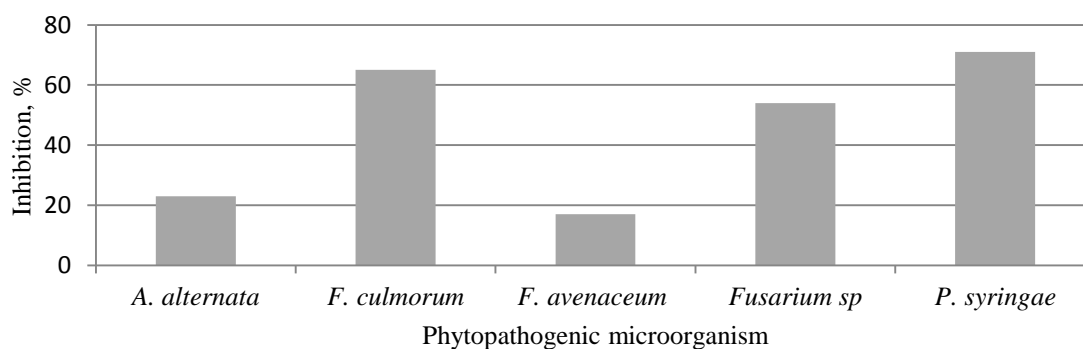


Figure 2. Suppression of wheat phytopathogens by Bactogen

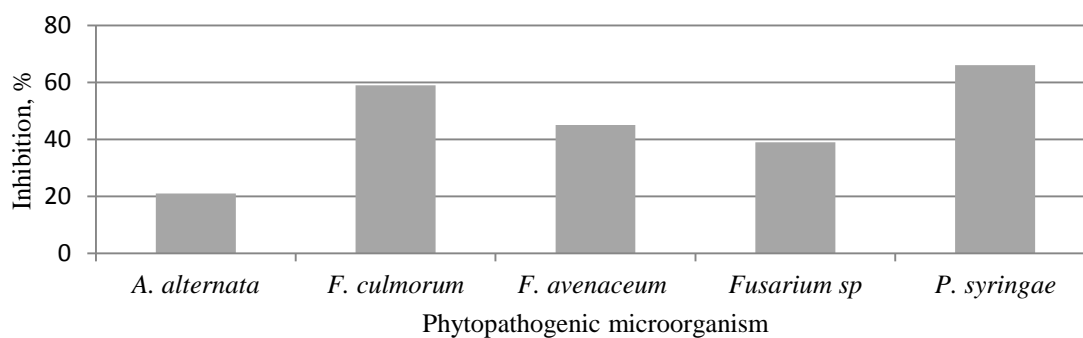


Figure 3. Suppression of wheat phytopathogens by Nemacid

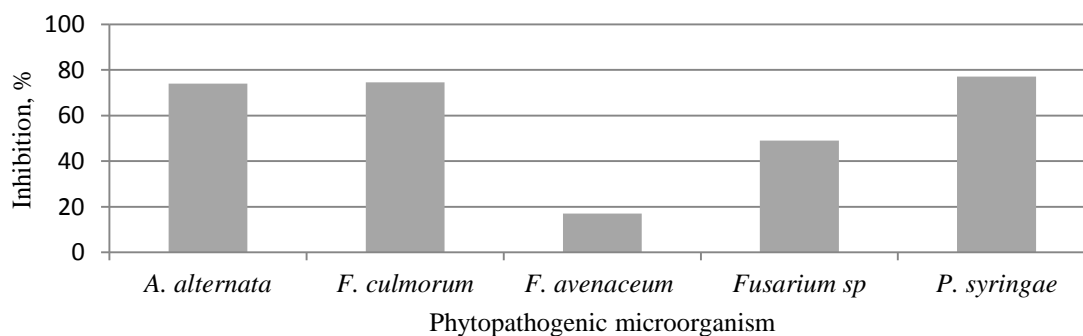


Figure 4. Suppression of wheat phytopathogens by Gulliver

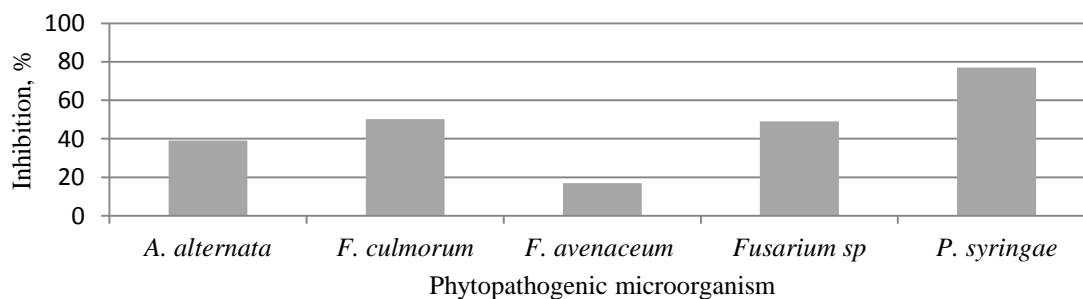


Figure 5. Suppression of wheat phytopathogens by Zhitsen

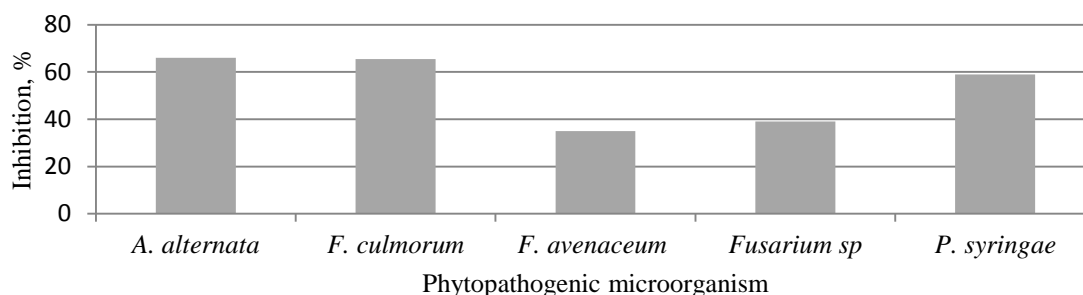


Figure 6. Suppression of wheat phytopathogens by Stimul

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