

Раздел VI ЗАЩИТА РАСТЕНИЙ

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CHALKY SOIL BACTERIAL CONSORTIUM FOR PROMOTING WHEAT (*TRITICUM AESTIVUM* L.) GROWTH AND BIOCONTROL ACTIVITY AGAINST *BIPOLARIS SOROKINIANA* A CAUSATIVE AGENT OF WHEAT FUNGAL DISEASE

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Abstract. *Wheat (*Triticum aestivum* L.) is the second largest staple food crop grown worldwide. However, its production is jeopardized by fungal diseases caused by *Bipolaris sorokiniana*. In the current study, seed inoculation with chalky soil bacterial consortium significantly increased the shoot length, root length and fresh weight of wheat and exhibited antimicrobial activity against *B. sorokiniana*. Therefore, inoculation with chalky soil bacterial consortium might be a promising strategy for promoting wheat growth and biocontrol of *B. sorokiniana*.*

Key words: *microbial consortium, *Bipolaris sorokiniana*, biopesticide, plant growth promotion, sustainable agriculture, food security*

INTRODUCTION

Over 20% of the world's food requirements are met by wheat (*Triticum aestivum* L.), the second-largest staple food crop grown globally [Raj et al., 2024]. It is well known that wheat is a vital crop for the Russian economy, contributing significantly to both export and home consumption. However, several diseases jeopardize its production, resulting in an annual output loss of 20–80% [Mourad et al., 2024]. Among the many risks to wheat is *Bipolaris sorokiniana* (Sacc.), a serious fungal infection that primarily affects wheat in warmer climates. These fungal pathogens produce a variety of wheat diseases, such as spot blotch, common root rot, and seedling blight, which cause large yield losses worldwide [Farzana et al., 2025]. This phytopathogen can systematically infect the overground and underground portion of the plant. Some of the major consequences of this disease includes reduced germination, slowed plant growth and development throughout the growing season, and lower grain product yield and quality [Toropova et al., 2022].

Current management strategies to combat these diseases include crop rotation and extensive use of pesticides, which not only raise production

costs but also cause environmental issues. Therefore, utilizing cutting-edge technologies and other sustainable management strategies are crucial to reducing the impact of *B. sorokiniana* on wheat production globally [Farzana et al., 2025]. Plant inoculation with plant growth promoting rhizobacteria (PGPR) is one of the most effective strategy for plant growth and protection [Cardoso et al., 2018]. In recent years, a lot of research has been done to check how well biocontrol agents work against many different types of plant pathogens [Bakr et al., 2025]. For example, the bacterial isolate *Bacillus velezensis* JK-1 showed notable antagonistic activity against *B. sorokiniana* [Kang et al., 2024]. In another study, *Bacillus subtilis* strain BS87 was found to control spot blotch disease in wheat, which is caused by *B. sorokiniana* [Chandra et al., 2024]. Luna et al. [2023] found that *B. amyloliquefaciens* DB2 can be used as a possible biocontrol agent to stop *B. sorokiniana* from affecting wheat and to promote wheat growth. There is no much information available on microbial consortia for controlling *B. sorokiniana* and promoting wheat growth. Therefore, in this study, a microbial consortium of chalky soil rhizobacteria isolated from wild legumes was examined for their ability to promote wheat growth and inhibit the growth of *B. sorokiniana*.

MATERIALS AND METHODS

Two chalky soil rhizospheric bacteria were chosen for this study to evaluate the effect of microbial consortia on promoting wheat growth and biocontrol activity against *B. sorokiniana*. A two days bacterial culture (200 μ L each) were inoculated into a 250 mL volume flasks containing modified LB growth medium which composed of yeast extract 1g/L, tryptone 2g/L, NaCl 5g/L. The total of three bacterial cultures were prepared. The culture includes Z11, Z82, Z11+Z82. The cultures were incubated in a shaker incubator at 30°C and 120 rpm for five days.

Antimicrobial activity was examined as the method described by [Asfha et al., 2023]. One day culture of *B. sorokiniana* (200 μ L) was inoculated on to plates containing sabouraud dextrose agar which is composed of sugar 40 g/L, peptone 10 g/L, and Agar 20 g/L. The fungal solution was uniformly distributed throughout the plates. Then, 5 μ L from each bacterial culture was dropped over the plates. The clear zone formed around the bacterial colonies is an indication of antimicrobial activity against *B. sorokiniana*.

The plant growth promoting activity of the bacterial consortium on wheat growth was conducted using the method described by [Asfha et al., 2023]. Seed germination was done to check how well the selected bacteria as a single or in consortia can promote wheat growth. The bacterial isolates were grown for five days at 30°C and a shaking speed of 120 rpm. In each treatment, a total of 20 surface-sterilized wheat seeds were placed on

plates. Then, the seeds were treated with 25 mL of bacterial solution that had been diluted to an OD600 of 0.1. The seeds untreated with bacterial solution were used as the control group. During the 15 days experiment, 10 mL of sterilized water was added daily throughout the entire period. The experiment was performed in triplicates. Finally, the impact of bacteria as a single or in consortia on wheat growth was assessed by comparing growth parameters such germination rate, shoot length, root length, and plant fresh weight with the control treatment. The data were statistically evaluated using a *t*-test at $p < 0.05$.

RESULTS

The effect of chalky soil bacteria on promoting wheat growth is demonstrated in Fig 1. *Janthinobacterium ruvuli* Z82, *Streptomyces lasiocapitis* Z11, and their consortium (Z82 Z11) did not significantly improve seed germination. Conversely, they significantly promoted shoot length and plant fresh weight. On the other hand, the bacterial consortium (Z82 Z11) had shown a pronounced effect on shoot growth and plant fresh weight. Furthermore, the bacterial strain *J. ruvuli* Z82 greatly extended root length both on its own and in consortium with *S. lasiocapitis* Z11.

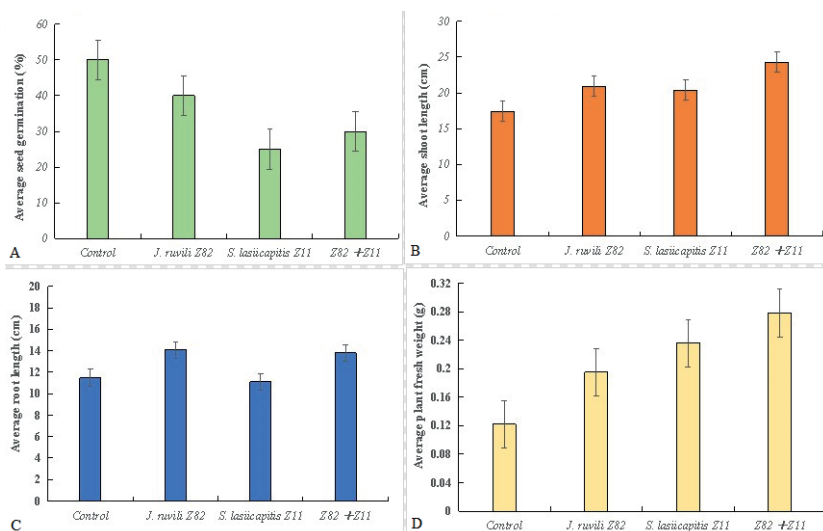


Fig. 1. The effect of bacterial strain *J. ruvuli* Z82, *S. lasiocapitis* Z11 and their consortium (Z82+Z11) on seed germination (A), shoot length (B), root length (C) and plant fresh weight (D). The error bars represent the least significant difference among treatments at $p < 0.05$.

The antimicrobial activity against *Bipolaris sorokiniana* F-4006 is depicted

in Fig 2. The bacterial isolate *J. ruvili* Z82 did not hinder the growth of *B. sorokiniana* F-4006. However, a bacterial isolate *S. lasiicapitis* Z11 shown antimicrobial activity against *B. sorokiniana* F-4006. The antimicrobial activity was pronounced when *S. lasiicapitis* Z11 and *J. ruvili* Z82 were co-cultivated.

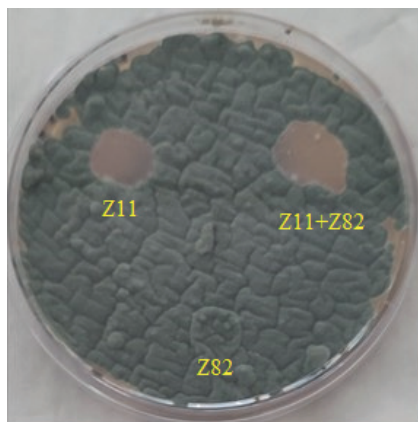


Fig. 2. The antimicrobial activity of Chalk soil rhizobacteria and their consortium against the fungal pathogen *B. sorokiniana*

CONCLUSION

In conclusion, chalky soil bacterial consortium is a promising agent can be employed for promoting wheat growth and protecting it from fungal pathogen especially *B. sorokiniana*.

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**ОЦЕНКА ИСПОЛЬЗОВАНИЯ ПРОТИВОГРИБКОВЫХ
ПРЕПАРАТОВ В ПРОЦЕССЕ КОНТРОЛЯ ФИТОФТОРОЗА
ПРИ ВОЗДЕЛЫВАНИИ КАРТОФЕЛЯ
ПРИ КАПЕЛЬНОМ ОРОШЕНИИ
EVALUATION OF THE USE OF ANTIFUNGAL AGENTS
IN THE PROCESS OF CONTROLLING PHYTOFLUOROSIS
IN POTATO CULTIVATION UNDER DRIP IRRIGATION**

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Аннотация. Исследование направлено на изучение результативности применения различных фунгицидов в борьбе с заболеванием картофеля, вызываемым фитофторозом. Данная работа ставит целью оценить, насколько эффективно применяемые фунгицидные средства способны подавлять раз-