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THE CONTROL OF SOYBEAN PHYTOPATHOGENIC PATHOGENS

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Abstract: Soybean cultivation faces significant challenges due to various phytopathogenic pathogens that adversely affect plant health, yield, and economic returns for farmers. This abstract provides an overview of the management strategies employed to mitigate the impact of these pathogens on soybean crops. The review covers the major types of phytopathogens affecting soybeans, including fungi, bacteria, viruses, and nematodes, highlighting common diseases caused by each group. Management practices such as crop rotation, planting resistant varieties, sanitation, chemical control, biological control, and cultural practices are discussed in detail, emphasizing their effectiveness in reducing disease incidence and severity. Integrated Disease Management (IDM) approaches, which combine multiple control strategies, are highlighted as optimal solutions for sustainable disease management in soybean cultivation. The abstract underscores the importance of ongoing research and development efforts aimed at improving disease control measures and ensuring the long-term productivity and profitability of soybean production systems.

Keywords: Soybean, lysimeter, peroxidase, polyphenoloxidase, phenylalanine ammonia-lyase, chlorophyll, carotenoid, transpiration, phytopathogen, disease, control, monitoring, experiment, physiological, biochemical.

КОНТРОЛЬ ФИТОПАТОГЕННЫХ ПАТОГЕНОВ СОИ

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Аннотация: Выращивание сои сталкивается с серьезными проблемами из-за различных фитопатогенных патогенов, которые отрицательно влияют на здоровье растений, урожайность и экономическую выгоду фермеров. В этом реферате представлен обзор стратегий управления, используемых для смягчения воздействия этих патогенов на посевы сои. В обзоре рассмотрены основные типы фитопатогенов, поражающих сою, включая грибы, бактерии, вирусы и нематоды, выделены общие заболевания, вызываемые каждой группой. Подробно обсуждаются методы управления, такие как севооборот, посадка устойчивых сортов, санитария, химический контроль, биологический контроль и агротехнические методы, подчеркивая их эффективность в снижении заболеваемости и тяжести заболеваний. Подходы комплексного управления болезнями (IDM), сочетающие в себе несколько стратегий борьбы, считаются оптимальными решениями для устойчивого управления болезнями при выращивании сои. В реферате подчеркивается важность постоянных исследований и разработок, направленных на улучшение мер борьбы с болезнями и обеспечение долгосрочной продуктивности и прибыльности систем производства сои.

Ключевые слова: Соя, лизиметр, пероксидаза, полифенолоксидаза, фенилаланинаммиаклиаза, хлорофилл, каротиноид, транспирация, фитопатоген, болезнь, контроль, мониторинг, эксперимент, физиологический, биохимический.

Introduction

The control of soybean phytopathogenic pathogens refers to the management strategies employed to mitigate the damage caused by various disease-causing agents that affect soybean plants. Soybean plants are susceptible to a range of pathogens, including fungi, bacteria, viruses, nematodes, and other microorganisms, which can lead to reduced yields and economic losses for farmers [1]. Some common soybean phytopathogenic pathogens include:

Fungal Pathogens: Fungi such as Fusarium, Phytophthora, Rhizoctonia, and Sclerotinia can cause diseases like root rot, damping-off, stem rot, and foliar diseases in soybean plants.

Bacterial Pathogens: Bacterial diseases such as bacterial blight (caused by Pseudomonas syringae pv. glycinea) and bacterial pustule (caused by Xanthomonas axonopodis pv. glycines) can affect soybean leaves, pods, and stems.

Viral Pathogens: Soybean viruses such as Soybean mosaic virus (SMV), Bean pod mottle virus (BPMV), and Soybean dwarf virus (SbDV) can cause stunting, mosaic patterns on leaves, and reduced seed quality [2].

Nematodes: Soybean cyst nematode (Heterodera glycines) is a significant pest affecting soybean crops, leading to stunted growth, yellowing of leaves, and reduced yields [3].

To control these pathogens, farmers utilize various management practices, including:

Crop Rotation: Rotating soybean crops with non-host crops can help reduce the buildup of soil-borne pathogens.

Resistant Varieties: Planting soybean cultivars with genetic resistance to specific diseases can help minimize the impact of pathogens [3].

Sanitation: Removing and destroying infected plant debris and implementing strict hygiene measures can reduce the spread of pathogens [4].

Chemical Control: Fungicides, bactericides, and nematicides may be applied to control fungal, bacterial, and nematode diseases, respectively.

Biological Control: Beneficial microorganisms or natural enemies of pathogens can be introduced to the soil to suppress disease development [5].

Cultural Practices: Practices such as proper irrigation, spacing, and weed control can help promote plant health and reduce disease incidence [6].

Materials and methods

Currently, the total area under crop cultivation worldwide reaches approximately 135 million hectares. Among the cultivated crops, soybeans rank second globally, with nearly 74 million hectares dedicated to soybean cultivation, closely followed by maize (approximately 25 million hectares) in second place, and wheat (nearly 10 million hectares globally) being cultivated in third place. In the regions where irrigation is available in the districts of Tashkent, Syrdarya, Navoiy, and Samarkand provinces of our Republic, representatives of the Leguminosae family, including soybean crops, underwent phytosanitary monitoring in 2021. Symptoms of diseases such as wilting, leaf wilting, leaf curling, pod rot, and infestation with various pests were observed in plant organs. As a result of these observations, samples of various affected plant organs were collected and sent to the laboratory for herbarium preparation and subsequent mycological examination to identify phytopathogenic micromycetes.

Fig. 1. Soybean plants affected by Fusarium wilt disease.

Separating the identified phytopathogenic fungi into distinct species both in terms of their types and to determine the structure of their macro and microconidia, they were individually transferred to separate media and incubated for 5 days to ascertain their development (see Fig. 2).

a b c**Fig. 2. a) Samples of fungal colonies incubated for 1 day. b) Samples of fungal colonies incubated for 5 days. c) Samples of colonies separated into different species.**

In order to isolate fungal colonies for mycological analysis, a total of 32 Petri dishes with Potato Dextrose Agar (PDA) and Czapek-Dox Agar (CDA) media were prepared, with 160 segments inoculated onto them. Among these, a total of 95 colonies consisting of saprophytic and phytopathogenic fungal strains were isolated: Fusarium culmorum - 11%, Fusarium oxysporum - 13%, Alternaria alternata - 9%, Fusarium solani - 14%, Aspergillus niger - 10%, Alternaria sp - 3%, Fusarium spp - 8%, Mucor sp - 3%, Penicillium sp - 7%, Cercospora kikuchii - 3%, Colletotrichum truncatum - 3%, Botrytis cinerea - 3%, Trichoderma sp - 9%, F. heterosporum. Upon mathematical analysis of these isolated saprophytic and phytopathogenic fungal strains, it was found that in soybean fields of Sirdaryo, Navoiy, and Samarkand provinces of our Republic, a total of 10 species were assigned to 7 genera and 17 species were assigned to 14 genera of micromycetes. Among these, 7 genera and 14 species of phytopathogenic micromycetes were identified as causing damage to soybean crops.

In order to study the morphology of these species and identify the disease symptoms they induce; several methods were utilized under laboratory conditions. Specifically, a binocular microscope was used to examine the structure of macroconidia and microconidia of the strains (cultures) of phytopathogenic fungi isolated in mycological examinations. Among the identified phytopathogenic fungi, strains of *F. solani* accounted for 13%, A. alternata for 9%, *F. culmorum* for 11%, and other types of phytopathogenic fungi were also observed to affect soybean crops.

As a result of experiments, representatives of the Leguminosae family were found to have high percentages of Fusarium solani, *Fusarium oxysporum*, and Alternaria alternata strains causing average or strong hypocotyl elongation and average or strong epicotyl elongation in soybean seedlings.

Results

Thirty spores collected for examination were suspended in a culture solution and incubated for one day to adjust to the fungal culture conditions. For monitoring purposes, the spores were suspended in distilled water and inoculated. In the experimental setup, the spores were inoculated into Petri dishes containing Czapek-Dox agar medium and incubated for 7 days at a temperature of 18-20°C in an artificial chamber.

On the ninth day of the experiment, the spore germination rate, primary hyphae, and germ tube length were measured [7]. The virulence of fungal strains, affecting the germination rate and seedling growth, was calculated using the following formula: T = 100% - (Lon / Lk * 100).

Based on the pathogenicity characteristics of the strains examined, they were divided into the following groups: Non-pathogenic strains - spores do not germinate on 0-30% of seeds. Low-pathogenic strains - spores do not germinate on 31-50% of seeds. Strains of phytopathogenic microorganisms were cataloged into 1-gram Eppendorf tubes and registered in the gene pool of the "Phytopathogenic and Other Microorganism Collection" at the Institute of Genetics and Experimental Biology of Plants of the Uzbekistan Academy of Sciences for further laboratory experiments. Moderate-pathogenic strains - spores do not germinate on 51-70% of seeds. Highly-pathogenic strains - spores do not germinate on ≥71% of seeds.

According to the analysis of our research results, under laboratory conditions, monitoring, and spore inoculation in distilled water, the germination rate of soybean varieties ranged from 70.00% to 97.50%. Our research indicated that the germination rates of all soybean varieties did not significantly decrease due to the influence of phytopathogenic micromycetes. The germination rate of soybean Tomaris variety under the influence of F. oxysporum was relatively lower, constituting 22.92% compared to the control. The decrease in germination rate was 43.22% in the Sochilmas variety, while in the Nafis, Baraka, and Genetik-1 varieties, it constituted 54.73%, 65.21%, and 68.54%, respectively. The obtained results indicate the classification of these strains into non-pathogenic, low-pathogenic, and moderate-pathogenic groups.

Table 1.

The effect of phytopathogenic micromycetes on the germination of various soybean varieties

№	Soybean varieties	Seed germination, %	
		Control	*F.oxysporum*
1	Genetik-1	70,00±0,88	22,02±0,33
2	Tomaris	97,50±0,58	75,15±0,58
3	Nafis	83,33±0,88	37,72±0,88
4	Baraka	76,67±0,88	26,67±0,88
5	Sochilmas	75,00±1,53	43,22±0,67

Under the influence of *F. oxysporum*, the hypocotyl lengths of Tomaris, Nafis, and Baraka soybean varieties after 7-day exposure were determined to be significantly reduced compared to the control, measuring 5.85±0.45 cm, 2.58±0.97 cm, and 1.30±0.54 cm, respectively.

On the other hand, the hypocotyl lengths of Sochilmas and Genetik-1 varieties after 7 days of exposure were significantly reduced compared to the control, measuring 0.91±0.24 cm and 0.68±0.19 cm, respectively. Similarly, the epicotyl length of Tomaris variety after 7 days of exposure was significantly reduced

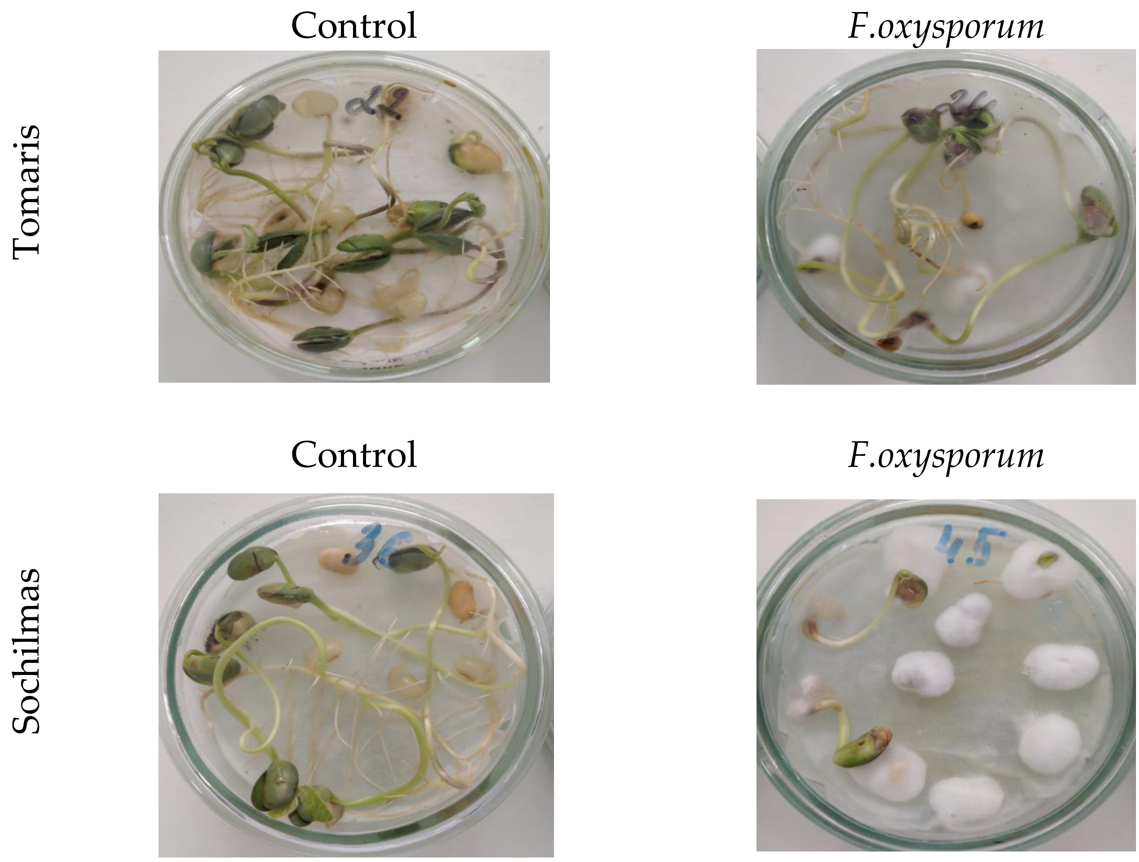

Fig. 3. The effect of phytopathogenic micromycetes on the germination of various soybean varieties.

compared to the control, measuring 3.26±0.35 cm, while in Sochilmas, Genetik-1, Baraka, and Nafis varieties, it decreased to 1.71±0.57 cm, 1.50±0.19 cm, 2.08±0.37 cm, and 3.21±0.56 cm, respectively.

that the germination rates of soybean seeds ranged from 70.00% to 97.50%, indicating a significant influence of phytopathogenic micromycetes on seed germination.

Analysis of the data revealed that all soybean varieties showed varying degrees of susceptibility to the influence of phytopathogenic micromycetes. Specifically, the Tomaris and Baraka varieties exhibited relatively strong resistance, while the Nafis, Genetik-1,

Conclusion

In this study, we investigated the impact of phytopathogenic micromycetes on various soybean varieties. Through laboratory experiments and monitoring, we found and Sochilmas varieties showed moderate resistance.

Further investigation into the effects of specific micromycete strains revealed significant reductions in hypocotyl and epicotyl lengths of soybean seedlings after exposure. Notably, the Tomaris variety demonstrated reduced hypocotyl and epicotyl lengths compared to the control, indicating its vulnerability to certain micromycete strains.

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WATER EXCHANGE PROPERTIES IN THE LEAVES OF FOREIGN COLLECTION SAMPLES BELONGING TO *VICIA FABA* L. SPECIES.

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Abstract. The article presents the study results on the total water content in the leaves of *Vicia faba* L. species of foreign collection samples, the indicator on this trait was 74.9-88.9%. A high value for total water content was found in the ENTRY-22 sample (88.9%) and a slightly lower index for this trait was found in the ENTRY-50 sample (74.9%). It has been shown that the total water content in the plant leaf also depends on the genotypic composition. According to the water retention property of the leaves, the highest parameters were recorded in the ENTRY-19 sample (34.7%), and the lowest result was recorded in the ENTRY-1 sample (12.3%). High parameters of transpiration rate was found in the Bakla UNV-851 sample (214.2 mg/g.h), a low rate was found in the ENTRY-26 sample (63.1 mg/g.h).

Key words: Variety, sample, stomata, total water content, water retention capacity, transpiration intention, variation coefficient.

ВОДООБМЕННЫЕ СВОЙСТВА ЛИСТЬЕВ ОБРАЗЦОВ ЗАРУБЕЖНОЙ КОЛЛЕКЦИИ, ПРИНАДЛЕЖАЩИХ *VICIA FABA* L. SPECIES.

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Аннотация. В статье приведены результаты исследования общего содержания воды в листьях вида *Vicia faba* L. зарубежных коллекционных образцов, показатель по этому признаку составил 74,9-88,9%. Высокое значение общего содержания воды обнаружено в образце ENTRY-22 (88,9%), а несколько меньший показатель по этому признаку обнаружен в образце ENTRY-50 (74,9%). Показано, что общее содержание воды в листе растения зависит также от генотипического состава. По водоудерживающей способности листьев наиболее высокие показатели зафиксированы у образца ЭНТРИ-19 (34,7%), а наименьший результат - у образца ENTRY-1 (12,3%). Высокие показатели скорости транспирации обнаружены в образце Bakla UNV-851 (214,2 мг/г.ч), низкие – в образце ENTRY-26 (63,1 мг/г.ч).