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Қазақ ұлттық аграрлық университеті

# Х А Б А Р Л А Р Ы

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## RESULTS OF PHYTO EXPERTISE OF AGRICULTURAL CULTURES SEEDS

**Abstract.** In laboratory condition of Kazakh Research Institute of Plant Protection and Quarantine was conducted an evaluation evaluate seed germination and infestation of barley, wheat, zea mays and soybeans with soil born fungus spp. It was found that the greatest prevalence on the seeds of all the studied crops belongs to the fungi of the genera *Alternaria* and *Fusarium*, as well as mold (*Aspergillus*, *Penicillium*, *Mycorales*), with a lower frequency found *Bipolaris sorokiniana*. The laboratory germination of crops grain seeds (wheat, barley, zea mays and soybeans) amounted to 23.8-71.4%, the prevalence of *Alternaria* spp. – 28.5-76.6%, *Fuzarium* spp. – 14.3-33.3%, *Aspergillus* spp. and *Penicillium* spp. – 11.9-27.3%, respectively. It was found that the greatest prevalence in the seeds of all the studied crops belongs to the fungi of the genera *Alternaria* and *Fusarium*, as well as mold (*Aspergillus*, *Penicillium*, *Mycorales*).

**Keywords:** seeds, fungal microflora, microorganisms, crops, germination, phyto examination.

**Introduction.** Plant diseases produce the cereal crops loss on average by 20%. Seed infection takes a special place among the pathogenic flora of cereal crops. It is well known that more than 60% of all pathogens of cereal crops are distributed by seeds. 2 types of microbial population occurs on seeds. They are: saprotrophic microbial population (*Penicilla*, *Aspergilla*, *Mucor*, *Alternaria*, etc.) and pathogenic microbial population (smut, helminthosporia, fusarium, septoriosis, etc.) [1]. The composition of the pathogenic seed complex includes by the dozens of fungi and bacteria species. This whole complex of pathogenic and saprophytic microbial population causes enzyme-mycotic depletion of seed which negatively affects on germinating ability of seeds, germination readiness and plant development during the growing season. They accumulate in the rhizosphere of the root system in case of the seed sprouting therefore they cause of root disease and radical root disease [2].

Massive infection of seeds with pathogenic fungi often reduces germination energy and their growing. Harmfulness hardly depends on the depth of mycelium and the number of affected seeds localization. In addition, when seed lots are used for food and feed purposes, it is necessary to know not only the degree of infection but also the species composition of pathogens.

Sowing infected seeds lead to the transmission of diseases to vegetative plants and thereby creates and maintains foci of infection in the field. Infection of seed microflora occurs at different times – during the growing season, when harvesting, especially in conditions of high humidity, during threshing or the post-harvest processing of grain, during storage due to a violation of its regime, as well as during storage of seeds with high humidity [2, 3].

Phytoevaluation of seeds is an integral part of modern agricultural production technologies, it allows one to foresee the possible susceptibility of plants to diseases and as result thus makes it possible to preserve the crop and the quality of grain. Only the correct diagnosis of diseases, knowledge of the occurrence causes and the characteristics of development are the basis for the successful implementation of

preventive and protective measures [1, 4]. High-quality seed treatment with fungicides should begin with a mandatory phytoexpert. Based on the results of phyto examination, a conclusion is made on the possibility of using a grain batch for seed purposes and on the need for grain processing [1].

The aim of our research was to evaluate seed germination and infestation of barley, wheat, zea mays and soybeans with soil born fungus spp. and bacterias in laboratory condition.

The work was carried out in the framework of the project BR06349590 "Creation of an innovative agrotechnological park for the implementation of precision farming".

**Material and methods.** We evaluated seed germination and infestation of barley, wheat, zea mays and soybeans with soil born fungus spp. in laboratory condition. Phytoevaluation of crop seeds to isolate fungal and bacterial mycophlora was carried out on nutrient media: potato glucose agar, Chapek's medium, and also in wet chambers. The studies were carried out according to the method generally accepted in phytopathology [4]. Identification of fungi was carried out on the basis of the colonies type on the Chapek nutrient medium and by microscopic examination on the morphological signs of sporulation [5]. Was done statistical analysis.

**Results and discussion.** We conducted a photo examination of seeds of agricultural crops to determine their infection with pathogenic microorganisms (figures 1–5). According to the phytoexpert data, it was found that the greatest prevalence on the seeds of all the studied crops belongs to the fungi of the genera *Alternaria* and *Fusarium*, as well as mold (*Aspergillus*, *Penicillium*, *Mycorales*), with a lower frequency found *Bipolaris sorokiniana*. High infection rates of bacteriosis were found, which may adversely affect seed germination, cause damage to crops by root rot, fusarium wilt and bacterial diseases.



Figure 1 – Affected barley seeds in a humid chamber

The results of the examination showed that the laboratory germination of crops seeds amounted to 23.8-71.4%, the prevalence of *Alternaria spp.* – 28.5-76.6%, *Fusarium spp.* - 14.3-33.3%, *Aspergillus spp.* and *Penicillium spp.* - 11.9-27.3%, respectively (table). Some saprotrophs in certain conditions are able to move to parasitism and partially or completely destroy the grain, changing the physical properties and chemical composition. At the same time, they cause significant damage during the storage of seeds, reducing their quality and even causing death. Seeds affected by saprotrophic fungi can be repackaged during storage. This is reflected in sowing qualities because germination decreases.



The frequency of isolation of microorganisms from seed crops on nutrient media

Crop	Germination, %	Selected microorganisms, %			
		<i>Fusarium</i>	<i>Alternaria</i>	<i>Aspergillus, Penicillium</i>	bacterialexudate
Barley	57,2	14,3*	76,6	25,9	85,7
Wheat	71,4	14,3	31,4	27,3	85,7
Zea mays	48,6	16,7	28,5	11,9	12,4
Soybeans	23,8	33,3	52,3	21,3	37,1

\**Bipolarissorokiniana*.

Fungus of the genus *Alternaria spp.* were isolated from the seeds of all crops and ranged from 28.5% to 76.6%, respectively. *Alternaria* grain caused by fungi of the genus *Alternaria*, which usually do not lead to a significant decrease in the quantitative indicators of grain yield, but can pollute agricultural products with their metabolites, is a widespread disease of cereals. The species of the genus often found in grain (*A. tenuis*, *A. alternata*, etc.) synthesize a number of substances that are toxic to various organisms, including plants, birds, and mammals. Toxins produced by *alternaria* fungi have high activity, which helps the pathogen colonization of the tissues of living plants. Toxication is manifested in the delay in the germination of grain and the development of the root system. *Alternaric acid*, which retains toxicity throughout the growing season, inhibits the growth of other pathogens. According to S.F. Bug [2], with early lesion



Figure 2 – Affected barley seeds on nutrient media and isolated conidia of the fungus *Bipolarissorokiniana*



Figure 3 – Affected barley seeds in a humid chamber



Figure 4 – Affected wheat seeds on nutrient media and isolated conidia of a fungus of the genus *Alternaria* spp.





Figure 5 – Affected soybean seeds on nutrient media

of the ear of barley, alternaria fungi can cause grain and a decrease in its mass by 38%. The harmfulness of *Alternaria* is also a decrease in the photosynthetic surface of the leaves, molding of seeds and a decrease in yield [6–9].

**Conclusion.** On the basis of laboratory studies, it was found that the greatest prevalence in the seeds of all the studied crops belongs to the fungi of the genera *Alternaria* and *Fusarium*, as well as mold (*Aspergillus*, *Penicillium*, *Mycorales*), with a lower frequency found *Bipolaris sorokiniana* which is a dangerous pathogen causing root rot of grain crops. Also, high infection of seeds by bacteriosis pathogens, which can adversely affect the field germination of seeds, cause damage to crops by root rot, tracheomycosis and bacterial diseases. Such a phytopathological state of seeds of spring grain crops necessitates their obligatory disinfection.

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#### АУЫЛШАРУАШЫЛЫҚ ДАҚЫЛДАР ТҰҚЫМЫНЫҢ ФИТОТАЛДАУ НӘТИЖЕЛЕРІ

**Аннотация.** Зертханалық жағдайда арпа, бидай, жүгері және майбұршақ тұқымдарының өнгіштігі мен топырақ саңырауқұлағымен зақымдалуы бағаланды. Барлық зерттелген ауылшаруашылық дақылдарының тұқымдарында *Alternaria* және *Fusarium* саңырауқұлақтары, сонымен қатар *Aspergillus*, *Penicillium*, *Mycorales* коздырғыштары кең таралған, ал *Bipolaris sorokiniana* аз мөлшерде кездесті. Ауылшаруашылық дақылдарының (арпа, бидай, жүгері, майбұршақ) зертханалық өнгіштігі 23,8-71,4 пайыз құрады, *Alternaria spp.* таралуы – 28,5-76,6 пайыз, *Fusarium spp.* – 14,3-33,3 пайыз, *Aspergillus spp.* және *Penicillium spp.* сәйкесінше 11,9-27,3 пайыз болды.

**Түйін сөздер:** тұқымдар, саңырауқұлақ микрофлорасы, микроорганизмдер, ауылшаруашылық дақылдары, өнгіштік, фитоталдау.

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## РЕЗУЛЬТАТЫ ФИТОЭКСПЕРТИЗЫ СЕМЯН СЕЛЬСКОХОЗЯЙСТВЕННЫХ КУЛЬТУР

**Аннотация.** В лабораторных условиях Казахского научно-исследовательского института защиты растений и карантин была проведена оценка семян ячменя, пшеницы, кукурузы и сои на всхожесть и заражение почвенным грибом spp. Выяснилось, что наибольшая распространенность на семенах всех изученных сельскохозяйственных культур принадлежит грибам родов *Alternaria* и *Fusarium*, а также плесени (*Aspergillus*, *Penicillium*, *Mucorales*), с более низкой частотой встречается *Bipolaris sorokiniana*. Лабораторная всхожесть сельскохозяйственных культур (пшеница, ячмень, кукуруза и соя) составила 23,8-71,4%, распространенность *Alternaria* spp. – 28,5-76,6%, *Fusarium* spp. – 14,3-33,3%, *Aspergillus* spp. и *Penicillium* spp. – 11,9-27,3% соответственно.

**Ключевые слова:** семена, грибная микрофлора, микроорганизмы, сельскохозяйственные культуры, всхожесть, фитодиагностика.

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