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THE EFFECT OF CULTURE BROTH OF FUSARIUM FUNGI ON GERMINABILITY OF THE SEEDS OF SOME VARIETIES OF G.HIRSUTUM L. COTTON PLANT TYPES

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ABSTRACT

The article reveals the results of initial surveys on the determination of resistance potentials of several varieties and lines of medium-fiber cotton plant selected as primary material in the research work conducted on the development of new varieties resistant to Fusarium oxysporum f.sp.vasinfectum and Fusarium solani pathogenic fungi which in recent years have caused significant damage to the yield of cotton varieties grown in large areas of the republic. According to the analysis, UzFA-707 and UzFA-710 varieties showed the highest resistance to Fusarium oxysporum f.sp. vasinfectum mycotoxins, and UzFA-713 and Yulduz varieties showed the highest resistance to Fusarium solani fungi. In the future, it is recommended to conduct scientific research to study the resistance of these varieties to fusarium wilt in field experiments.

Keywords: Fungi, Fusarium oxysporum f.sp.vasinfectum, Fusarium solani, mycotoxins, cotton plant varieties, resistance, germinability.

1. INTRODUCTION

For providing food security the soil conditions under which agricultural crops are grown play a major role. An emergent state of phytosanitary condition in the soil has been observed in the cotton fields of Bukhara region in the recent years. The reasons of the wide spread of fusarium wilt in this region are the lack of varieties resistant to fusarium wilt, not using crop rotation completely, a sharp decrease of organic compounds and humus in the soil, and in result, a rapid decrease of the number of antagonistic saprotrophs against pathogens.

The physiological races and aggressive forms of wilt causing species of the Fusarium family were noted, and it is assumed to indicate the emergence of new physiological races in their cotton-contaminating populations in Bukhara, Namangan and Surkhandarya regions. In result of this, severe cotton contamination cases are being observed in the soils where new physiological breeds are prevalent in small range [5].

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In order to prevent fusarium contamination of crops in the republic and to reduce its damaging level, the study of some biological features of species belonging to the Fusarium family which are isolated from different regions is one of the most urgent problems of biology science.

Any agricultural crop releases organic matters into the soil during its growth and development, and they are assimilated by microorganisms [6, 7]. In its turn, the matters produced by microorganisms living in the soil during their life processes affect the growth, development and productivity of plants.

Aggressive forms of the fusarium wilt causing fungi which belong to Fusarium family, have been observed in cotton plant in Bukhara and Surkhandarya regions, and wheat in Kashkadarya region, and accordingly it proves that new forms are emerging among the representatives of this group. In soils where populations of these new forms occur, damage to cotton and wheat has been observed in small, medium, or large ranges of area [12].

As V.I. Bilay stated in his monograph named "Fuzarii",: "Fungi belonging to the Fusarium family have been attracting the attention of scientists around the world for more than half a century. Firstly, they were mycologists and phytopathologists who studied pathogenic species in agricultural crops, later the researchers of the taxonomic status of the species, and then the number of people interested in the biological properties of these fungi has increased" [2]. Although this idea was set forward less than 50 years ago, this issue has not lost its relevance and is attracting the attention of scientists of our republic too.

For the determination of *Fusarium* spp. cultures, collection of general information about them, i.e. on the symptoms of the disease, isolation of the culture in its pure form, purification, identification of pathogenicity of isolates on the original or other potential host plant, determination of their morphological, and molecular properties also if it is necessary, and about cross-breeding of strains is of great importance.

Fusarium family belonging fungi are widely found in soils, they can cause wilt diseases to many plants such as *Brassica*, *Raphanus*, *Matthiola* [1, 8, 12] and other high plants, except *Gossypium* and *Triticum* family species.

However, some species of these fungi do not show pathogenicity or they have specialized forms that can infect only certain plant species, which can cause disease in certain crops or their certain varieties. For example, *Fusarium oxysporum* f.sp. *vasinfectum* is a cotton-contaminating type native to the American and Asian regions that infects certain varieties of cotton. This specialized form of the fungi has genetic diversity and there is a number of physiological races in it [9, 11].

The symptoms of diseases caused by *Fusarium* and *Verticillium* fungi are quite variable [9]. These two types of fungi can inoculate not only plants (crop) of a certain species, but also a single plant at the same time. Furthermore, a non-pathogenic form of *Fusarium oxysporum* can penetrate into the plant's conduction system. For this reason, when comparing *Verticillium* to *Fusarium*, its viability is shorter within the period from field conditions to laboratory conditions than that of *Fusarium* fungus species [3].

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Due to the fact that the soil and climatic conditions of our country are favorable for the survival and development of fungi belong to *Fusarium* family, they have been found to cause diseases in cotton plant, wheat, vegetables and other crops of economic importance in some regions of the country. In particular, fusarium wilt disease, which lasts from the first sowing period of cotton plant to the end of its growing season in the country, and fusarium root rot, root collar and lower stem rot and grain damage observed in wheat crops at the present, tomato, melon, pumpkin and cucumber fusarium wilt and root rot and other such kind of diseases are obvious examples for this.

Fumonizine mycotoxin is formed in cereals infected by *Fusarium* species [2]. Fumonizine mycotoxins are well soluble in water and can maintain their activity for a long time. The most dangerous fumonizine occur in corn grains inoculated with fusarium wilt; this toxin is extremely dangerous not only to plants but also to animals and humans [12].

In our country, the fungi belonging to *Fusarium* family cause two types of root rot and wilt diseases in cotton plant. According to the results of mycological examination of cotton plant fields, *F. oxysporum* f.sp. *vasinfectum* and Fusarium solani pathogen species have been identified. Their chlamydospores were in a state of dormancy (fungistasis) in a depth of 60 cm to 2 m in the soil, which ensured the viability of the fungus by maintaining for several years. For example, in California state of the USA, the fungus F. oxysporum did not lose its viability for up to 10 years [10].

Several species of *Fusarium* family can cause together wilt and root rot diseases in more than 120 plants. It was found out that *Fusarium solani* causes root rot in cotton plant, Fusarium verticillioides causes rotting disease in fiber, seed and other parts of cotton plant. *Fusarium oxysporum* f.sp. *vasinfectum* was recorded to be a pathogen of fusarium wilt and root rot diseases in cotton plant.

2. MATERIALS AND METHODS

As a primary material for research, the new introgressive hybrid forms with enriched genotype and strains of *Fusarium oxysporum* f. sp. *vasinfectum* and *Fusarium solani* species (obtained from “Collection of phytopathogenic microorganisms - a unique scientific object” of the Institute of Genetics and Plant experimental biology at Science Academy of the RUz) have been used through implementation of interspecific hybridization methods for geographically distant forms involving species of *hirsutum* L. type of *Gossypium* L. family.

Samples of fungi were grown in Czapek Dox nutrient medium of 100 ml in a 250 ml flask at 25–27 ºC for 15 days (Fig. 1). At the end of the cultivation process, mycelium was filtered to separate in the nutrient medium (Fig. 2).

The effect of toxins in the culture broth of fungi was tested on 100 seeds of plants.

The 100 seeds obtained for the purpose of the study were soaked in the culture broth of the fungi for one day. The seeds in the control variant were soaked in Czapek Dox nutrient medium and distilled water (Fig. 3). The soaked seeds with the help of pincers were placed on a Petri dish in

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wet conditions in an artificial chamber at a temperature of 18–20 ºC for 7–10 days to observe the germination (Figures 4–11).

3. RESULTS AND DISCUSSION

The rate of influence of mycotoxins isolated from micromicets of resistance potentials of cotton plant varieties to pathogen fungi *Fusarium oxysporum* f.sp.*vasinfectum* and *Fusarium solani* on the germinability of plant seeds was analyzed (Fig.4-11).

Fig. 1

Fig. 2

Fig. 3

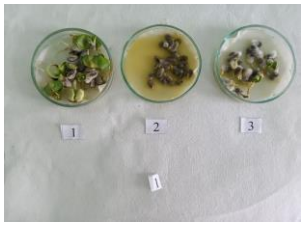

Fig. 4

Fig. 5

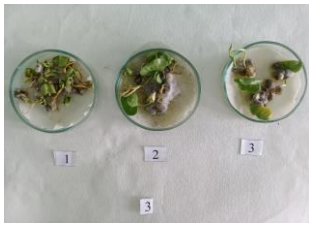

Fig. 6

Fig. 7

Fig. 8

Fig. 9

Fig. 10

Fig. 11

It was detected that in primary materials control variant, germinability indexes of plant seeds performed the following results; for Kelajak and AN-Bayovud-2 variety 90 %, for UzFA-707, Mekhnat varieties and L-983 line 95 %, for UzFA-713 variety 97 %, for UzFA-710 and Yulduz varieties the cotton seeds showed 100 % germinability.

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Table 1 .The rate of the influence of mycotoxins isolated from micromicets of *Fusarium oxysporum* f. sp. *vasinfectum* and *Fusarium solani* on germinability of the seeds of primary material forms

№	Materials	The amount of germinated and non-germinated seeds, %					
		Control		*Fusarium oxysporum* f.sp.*vasinfectum*		*Fusarium solani*	
		Germinated seeds, %	Non-germinated seeds, %	Germinated seeds, %	Non-germinated seeds, %	Germinated seeds, %	Non-germinated seeds, %
1	Kelajak	90	10	0	100	20	80
2	UzFA-707	95	5	50	50	70	30
3	UzFA -710	100	0	45	55	60	40
4	UzFA -713	97	3	15	85	80	20
5	Yulduz	100	0	20	80	75	25
6	Mekhnat	95	5	0	100	5	95
7	AN-Bayavud-2	90	10	5	95	20	80
8	L-983	95	5	30	70	65	35

In accordance with the results of observations conducted on the resistance potentials of the research materials to pathogenic fungi *Fusarium oxysporum* f. sp. *vasinfectum* and *Fusarium solani*, the seeds of the Kelajak variety of cotton plant were infected completely by *Fusarium oxysporum* f. sp. *vasinfectum* and did not germinate at all. Seeds of UzFA-707 variety retained 50% germination, while in UzFA-710 variety this indication made 45%. Seeds germinability percentage was 15% for UzFA-713 variety and 20% for Yulduz variety, while for AN-Bayovud-2 variety 5% and for L-983 line 30%. Germinability index was not noted in Mekhnat variety at all. Taking into account the collected data, it can be said that *Fusarium oxysporum* f. sp. *vasinfectum* pathogens inoculated Kelajak, Mekhnat, AN-Bayovud-2 and UzFA-713 varieties much. The highest resistance rate to these pathogen microorganisms was recorded in the seeds of UzFA-707 and UzFA-710 varieties, a bit less rate after them was noted in L-983 line and Yulduz varieties seeds.

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At the present time, one of pathogenic fungi having greatest impact on agricultural crops yield, mostly the yield of cotton plant varieties, is Fusarium solani. It was determined in the experiments that under the condition contaminated with Fusarium solani, the medium fiber cotton varieties UzFA-713 retained 80 % seed germinability, Yulduz variety 75 %, UzFA-707 variety 70 %, L-983 line 65 %, and UzFA-710 variety kept 60% germinability. The most susceptible variety to mycotoxins of this fungus was observed in comparison with the seeds of Mekhnat variety (5%), followed by Kelajak and AN-Bayovud-2 varieties with 20% germination rate.

4. CONCLUSIONS

According to the aforementioned results of the research, it can be concluded that it is expedient to select UzFA-707 and UzFA-710 cotton plant varieties as a primary material for research on the development of cotton varieties resistant to mycotoxins of *Fusarium oxysporum* f. sp.*vasinfectum* from the analyzed cotton varieties, and UzFA-713, Yulduz, UzFA-707 and UzFA-710 varieties for creating resistant varieties to *Fusarium solani* pathogenic fungi.

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