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Biosafety of growing cultivars of Crops

Goal. To study the factors that determine the peculiarities of formation of populations of phytopathogenic micromycetes under the influence of varietal differences of cultivated plants. Methods. Microbiological, phytopathological, visual and statistical. Results According to the developed method, an ecological evaluation of 44 varieties of cultivated plants of different breeding origin has been conducted for the effect on spore formation of phytopathogenic micromycetes. According to the established indicator, tested varieties of plants are divided into groups: environmental risk and environmental safety. Such a distribution is due to the influence of plants of different breeding origin during vegetation on the reproductive capacity of phytopathogenic micromycetes. It was found that such an effect may be caused by physiological and biochemical substances, biogenic elements, endophytic microbiota. Conclusions The results of research confirm the expediency of evaluating varieties and hybrids of cultivated plants as an ecological factor for the formation of the phytopathogenic background, which will enable to solve the problem of controlling the population of phytopathogenic micromycetes in agrocenoses.

Key words: phytopathogenic background, varieties of cultivated plants, agrocenosis, biosecurity, physiological and biochemical substances, endophytic bacteria.

The use of intensive agrotechnologies led to deterioration of the environmental conditions for the cultivation of crops and significantly changed the phytosanitary situation in agrophytocenoses [2]. Anthropogenic disturbances of natural ecosystems (the destruction of natural vegetation, soil cultivation, the use of pesticides and mineral fertilizers) reduce the role of fungi in the cycle of major biofil elements on a global scale [20]. The microscopic mushrooms that are part of the soil biocenose are continuously spread by air and water flows in ecosystems. Therefore, soil contains a large number of pathogenic microbiota, which is the result of saturation of crop rotation with the affected crops, as well as the influence of natural and climatic factors that contribute to the formation and conservation of "stocks" of soil infection [22]. Of great practical importance is the study of mechanisms and factors that determine the rate of formation of natural ecotypes of fungal parasites. Simplification of many ecosystems impedes their optimal functioning and stability, which leads to a deterioration of the ecology of agrocenoses. It should also take into account the possibility of stimulating the phenotypic variability of pathogens due to contact with resistant varieties [29].

Consequently, it is necessary to study the mechanism of interaction of "plant - micromycetes" in order to create a knowledge base on the dynamics of the accumulation of infectious material.

Particular attention should be paid to the toxic properties of pathogens and their ability to accumulate in the soil, on seeds and plant residues. This can be the cause of human and animal poisoning, and also poses a danger of epiphytotism. The greatest danger to human and animal health is their toxic metabolites, which come from food products in the human body.

The purpose of the research is the scientific and methodological substantiation of the plant variety as a biotic ecological factor influencing the formation phytopathogenic background, and the study of indicators of the decline in the quality of plant material for the interaction between varieties of cultivated plants and phytopathogenic micromycetes.

Research methodology. The research was carried out at the laboratory of biocontrol of agroecosomes of the Institute of Agroecology and Nature Conservation of the National Academy of Sciences (IAP) and on

experimental sites of the Skvirsky research station of the IAP, Mironovsky wheat institute NAAS and Nosov VAT.

Infection of plants with phytopathogenic micro-micelles was detected in accordance with DSTU No. 4138: 2003 [11]. The influence of varieties on the change in the aggressiveness of mycrymicetes was studied using the methods given in the methodical recommendations of M.O. Lemesi [9]. National and foreign determinants were used to identify phytopathogenic fungi. The Latin names of fungi were matched by Fungal Databases Nomenclature and Species Banks. The influence of exometabolites of plants on the formation of populations of phytopathogenic fungi was studied by the method of assessing the stimulation of culture growth of diazotrophic bacteria by exudates of barley seedlings under in vitro conditions [13]. Influence of juice of sweet pepper plants on development and intensity of spore formation of phytopathogenic fungi were analyzed according to the method of VO Shkalikova [7]. The content of ascorbic acid and glutathione in plants was determined according to well-known VI method. Magpie [10]. Interaction of endophytic bacteria and cucumber plants was studied using recognized methods [27]. The statistical processing of the research results was carried out using Microsoft Office Excel 2003-2008 computer programs.

Research results. The method of ecological evaluation of winter wheat varieties, sweet pepper, cucumber, carrots, chicken and onions, influenced by the number of populations of phytopathogenic fungi [6, 12], was developed. The use of these methods makes it possible to identify varieties of cultivated plants that, due to their physiological and biochemical properties, can suppress the spore formation of phytopathogenic fungi, reduce the infectious potential remaining in the crops after the cultivation of a particular variety in agrophytocenoses.

According to the developed methodology, an ecological evaluation of 44 varieties and hybrids of winter wheat, sweet pepper, cucumber, carrots, onions, garlic of different breeding origin for the influence on spore formation of phytopathogenic fungi: Alternaria solani (Ellis & G. Martin) LR Jones, Al. cucumerina (Ellis & Everh.) J.A. Elliott, Al. Radicina Meier, Orechsher & E.D. Eddy, Al. tenuissima (Nees) Wiltshire, Fusarium oxysporum Schltdl, Penicillium verrucosum Samcon, P. canescens Sopp. It is known that the damage of 100% of plants with phytopathogenic fungi of non-corrosive food type occurs at the concentration of inoculum of 1 million units / ml [3]. It is precisely this concentration that is the limit of environmental risk. According to the results of the research, it has been established that tested varieties and hybrids of these crops are divided into two ecological groups. Varieties that can inhibit spore formation below the established limit are enrolled in an environmentally safe group. Varieties that can stimulate spore formation in comparison with the established method and lead to biological contamination of biocenoses - to the group of ecological risk. Such varieties can greatly increase the formation of the fungal phytopathogenic background not only during the period of parasitism, but also during the period of the sucrophic phase of the development of micromycetes.

The obtained data allowed to study phytotoxic activity and aggressiveness of micromycetes and ecological indices of cultivated plants: ascorbic acid, glutathione, exomatabolites, plant sap and endophytic bacteria associated with plants.

Scientists note that mycotoxins are characterized by high toxicity [1]. They are capable of breaking the protein, lipid and mineral metabolism, destroying vitamins, and reducing the nutritional value of plant products [4]. The most dangerous toxins of the optional parasites [19]. Therefore, the intensity of the influence of various varieties of carrots, sweet pepper, cucumber and onions on the phytotoxicity of metabolites of phytopathogenic microabs Al was determined. radicina and F. oxysporum.

It has been established that the metabolites of the studied fungi significantly inhibit the similarity of the seeds, growth of germs and roots. Fungi F. oxysporum and Al. radicina have high phytotoxic activity in carrot species that belong to the ecological risk group. During their growing, the quality of products may deteriorate significantly. At the same time, the phytotoxic activity of fungi on rocks of carrot varieties belonging to an environmentally safe group was significantly lower, indicating the safety of their cultivation.

A similar phytotoxic activity was observed in pathosystems: plants of sweet pepper, cucumber and onions with phytopathogenic microspheres F. oxysporum, Al. solani, P. verrucosum.

In Ukraine, the issue is widely studied the emergence of new aggressive pathogens that quickly overcome the genes of the stability of new promising varieties [17]. It is known that on susceptible varieties

in the straw there is a selection for increased aggressiveness [15]. Therefore, a change in the aggressiveness of the fungus isolates F. oxysporum was studied for the effects of different varieties of winter wheat.

Isolates, obtained from different varieties of winter wheat, are divided into 3 groups: weak, medium and highly aggressive with respect to the Kryzhinka variety. Compared to the original culture of fungus F. oxysporum (under the influence of different varieties of winter wheat), the aggressiveness of the fungus increased, the number of intensively affected germs increased from 10 to 40%, and the viability of the spore of the fungus increased depending on the variety (Table 1).

The results of the studies indicate a high dependence of the aggressiveness of phytopathogenic micro-resistors of the non-corrophy type of nutrition on the properties of wheat plants of different breeding origin. According to this indicator, wheat plant species belonging to the ecological risk group may increase the level of biological contamination of agrophytocenoses.

Ascorbic acid is known to promote the adaptation of plants to stress and negative factors of the natural environment and is closely linked to the enzymatic transformation of glutathione, which is able to neutralize the influence of toxins of different pathogens [18]. Therefore, in recent years much attention has been paid to determining the function of ascorbic acid and glutathione in protecting plants from various types of stress, in particular phytopathogens.

According to the results of the research, in the fungus F. oxysporum affected by the cucumber varieties belonging to an environmentally safe group, the content of ascorbic acid and glutathione increases significantly more than in the affected owl hybrids belonging to the ecological risk group (Table 2).

A similar dependence was found during the investigation of quantitative indices of ascorbic acid and glutathione of plants of different varieties of sweet pepper, winter wheat, onions, in interaction with phytopathogenic micromycetes.

Scientists have established the difference in the chemical composition of root extracts of different varieties of the same species [14]. Due to the presence in their composition of physiologically active substances as stimulants [8, 16, 21] or inhibitors of action [24, 28], the plants vary in intensity the intensity of spore formation of phytopathogenic fungi [5]. Therefore, the effects of exometabolites were studied varieties of cultivated plants of different breeding origin to the intensity of sporo-forming of phytopathogenic fungi.

It was established that exombetabolites of sweet pepper plants belonging to an environmentally safe group significantly inhibit sporo-phytopathogenic fungi. Exemetabolites of sweet pepper plants belonging to the ecological risk group stimulate the growth and development of mycelium and the intensity of spore formation. A similar dependence was observed on the influence of exometabolites of plants of cucumber, winter wheat, carrots, onions, garlic and phytopathogenic micromycetes F. oxysporum, A. solani, C. cucumerinum, P. canescens.

It is proved that juice of plants of sweet pepper varieties belonging to the ecological risk group stimulates the growth and development of mycelium of phytopathogenic micromycetes and the intensity of spore formation in comparison with those belonging to the group of ecological safety. A similar pattern was observed in the interaction of phytoncides of juice of ripe poppy seeds and P. canescens micromycete.

Different types of endophytic bacteria contaminate plant tissues and can participate in protecting plants against diseases caused by pathogenic fungi and bacteria, as well as insects and nematodes [23, 25, 26]. Therefore, varieties of cultivated plants susceptible to colonization with associative endophytic bacteria can exhibit increased resistance to phytopathogens and suppress or stimulate the intensity of spore formation of fungi. In view of this, our studies have been directed on the determination of the influence of endophytic associative bacteria on the intensity of spore formation of F. oxysporum mycorrhiza.

In determining the endophytic microbiota, sweet pepper and cucumber seeds, along with fytopathogenic fungi, isolated the bacterium identified by Micrococcus luteus as the micrococcus luteus biochemical analyzer database and the collectively called Micrococcus luteus BCC1. According to the results of the research, it was found that on contaminated plants of the tested sweet peppers, the intensity of the sporulation of F. oxysporum significantly decreased compared with the control (Table 3).

Similar results were obtained for the defeat of plants of various varieties and hybrids of cucumbers by F. oxysporum micromycet. This suggests that the bacterial strain M. luteus LBK1 may be one of the factors influencing the formation of the populations of phytopathogenic micromycetes in agrocenoses.

Consequently, we consider that the intensity of stimulation or suppression of aggressiveness of phytopathogenic micromycetes, the reproducibility of micromycetes under the influence of exometabolites of plants of different selective origin, the intensity of spore formation of phytopathogenic micromycetes due to the influence of juice of cultivated plants, the degree of contamination of plants of different breeding populations, The occurrence of M. luteus BCK1 bacteria, the increase in the content of ascorbic acid and glutathione in response to the damage by phytopathogenic fungi may be indicators of ecological evaluation I plant variety as a factor of influence on pathogenic formulate tion agrocenoses background.

Conclusions

The scientific and methodological substantiation of a plant variety as a biotic ecological factor that affects the formation of the phytopathogenic background makes it possible to assess the level and increase the safety of the cultivation of plant products in agrophytocenoses. The resulting ecological indicators are the basis for increasing the efficiency of the environmental expertise of varieties of cultivated plants and creating a bank of varieties of agricultural crops suitable for cultivation in conditions of organic production.

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