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M. M. Bekezhanova, N. Zh. Sultanova, O. Zhumakhanuly,
A. A. Jaimurzina, I. I. Temreshev, A. M. Makezhanov, A. M. Tursynkulov

«Kazakh Research Institute of Plant Protection and Quarantine named after
Zh. Zhiyembaev» LLP, Ministry of Agriculture of the Republic of Kazakhstan, Almaty, Kazakhstan.
E-mail: madina.bekezhanova.80@mail.ru, nadira.sultanova@mail.ru,
alia-45@mail.ru, temreshev76@mail.ru, Makezhanov.arman@bk.ru, askhat_t-26@mail.ru

EFFICIENCY OF APPLICATION OF PROTECTIVE-STIMULATING COMPOSITIONS AND BIOLOGICAL PREPARATION EXTRASOL ON ALFERIA SEEDS

Abstract. During phyto-examination of alfalfa seeds, it was found that pre-sowing seed treatment had a positive effect on the sowing quality of seeds. The growth rate of alfalfa seedlings was 6.4-20.8 % higher compared to the control variant. Biological effectiveness against fungal and bacterial infections was 75.0-85.0 %. The fungal microflora of the genera *Penicillium*, *Alternaria*, and *Fusarium* was revealed, with bacterial species from the genera *Pseudomonas* and *Erwinia*. Based on the results of phyto-examination against a complex of fungal and bacterial infections, a protective-stimulating composition for the recovery of alfalfa seeds together with the biological preparation Extrasol was selected. As a result of processing the crops with Extrasol during the vegetation of plants, a positive effect of the drug on the growth and development of alfalfa was established. The stalk height of alfalfa on the 10th day after treatment with extrasol increased by 22.2 cm (99.7 cm), in the control variant this indicator was 77.5 cm, respectively. The plant bushiness during the treatment with the drug increased by 27.9 % compared with the control. As a result, the yield increase in the variant with extrasol was higher by 29.1 % compared with the control.

Key words: phyto-examination, seeds, alfalfa, biological product, extrasol, mushrooms, microflora, effectiveness.

Introduction. One of the integral part of the development of animal husbandry in the Republic is an increase in the production of valuable fodder crops - alfalfa, soy, wheat, and barley. The cultivated area under these crops is increasing annually in the Republic. One of the reasons for reducing their gross collection is due to the widespread occurrence of pests - insects and ticks, as well as other harmful invertebrates. There is a wide spread of infectious diseases of fungal, bacterial and viral etiology in the crops of fodder crops, which also significantly damage the crop and the quality of the resulting feed. This entire complex of pests damages plants, from seedlings to the end of the growing season. Therefore, the protection of plants from these pests is crucial in the agricultural technology of cultivating feed crops.

At present, the introduction of technologies is highly relevant, in which the reduction of the effects of adverse environmental factors, the enhancement of the adaptive ability of plants and the maximum use of potential crops is achieved by the use of effective and environmentally friendly biological preparations, which, along with preserving the crop of processed crops, helps to reduce environmental pollution and agricultural products.

According to these tasks, scientific research is actively carried out in the sown areas of «Bayserke-Agro» LLP in the Almaty region as part of the implementation of the Ministry of Agriculture project BR06249249. “Development of an integrated system to increase productivity and improve breeding qualities of farm animals, for example, «Bayserke-Agro» LLP for subproject 2. “Improving the technology of cultivation and harvesting of forage crops”.

Among pathogenic microflora of crops, seed infection occupies a special place. It is well known that more than 60% of all pathogens of agricultural crops are distributed with seeds. The microflora found on the seeds can be saprotrophic (*Penicillas, Aspergillus, Mucor, Alternaria*, etc.) and pathogenic (smut, helminthosporiasis, fusarium, septoria, etc.) [1]. The composition of the pathogenic complex of seeds includes dozens of species of fungi and bacteria. Practice shows that currently the quality of sown seeds of agricultural crops is declining, their infection with a complex of pathogenic and saprophytic microflora is increasing. This entire complex of pathogenic and saprophytic microflora negatively affects the germination, germination energy and development of plants during the growing season. When seeds germinate, they accumulate in the rhizosphere of the root system and cause root and root rot [2]. Mass infection of seeds with pathogenic species of fungi often reduces germination energy and their germination. The harmfulness largely depends on the depth of localization of the mycelium and the number of affected seeds. In addition, when batches of seeds 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 with infected seeds leads to the transmission of diseases to vegetative plants and thereby creates and maintains foci of infection in the field. Infection of seed material with microflora occurs at different times - during the growing season, during harvesting, in conditions of high humidity, during threshing or post-harvest part-time grain storage during storage due to violation of its regime, as well as when laying seeds for storage with high humidity [2-5].

With poor-quality pre-sowing treatment, improper selection of seed dressing, seed infection during seed germination will begin to multiply intensively and poses a serious danger to plants that cannot provide a full crop. In addition, many pathogens produce mycotoxins that adversely affect the physiological processes in plants, inhibit the growth of seedlings and roots, and can be stored in the final product. At the same time, not only the yield is reduced, but also the quality of the agricultural products received. In this regard, the choice of protectant must necessarily be based on the results of preliminary phyto-examination to identify the species composition of microflora of seeds. This will allow you to choose the right drug based on its action and ensure the effectiveness of this event

A phyto-examination of fodder seeds (wheat, barley, alfalfa and soybeans) that we carried out earlier in the framework of the same project showed a strong population of their pathogenic microflora, which creates a dangerous infectious background for the manifestation of diseases - root rot, fusariosis, alternariosis and bacteriosis, as well as mold and rotting of seeds. According to the degree of seed infection, the selection of highly effective fungicides with a wide range of fungicidal and bactericidal properties is required. As a result of research, a wide range of protectants, biological products, growth regulators, insectofungicides and insecticides were tested, a number of compositional compositions for wheat, barley and alfalfa were developed. Research continues on the development of composite compositions for alfalfa and soy [5]. A composition has been developed for the recovery of seeds of the siderata plant of phacelia tansy [6].

At present, the introduction of technologies in which the reduction of the effects of adverse environmental factors, the enhancement of the adaptive ability of plants and the maximum use of potential crops is achieved by the use of effective and environmentally friendly biological preparations, which, along with preserving the crop of processed crops, helps to reduce environmental pollution and agriculture. At the moment, in the world practice, along with organic, mineral and micronutrient fertilizers, bacterial fertilizers are increasingly used in agricultural production [7-17]. One of these preparations is Extrasol, which is based on the rhizospheric bacteria strain *Bacillus subtilis* Ch-13 isolated from chernozem soil. This bacterium has a set of useful properties: the ability to synthesize during its growth substances that inhibit the development of phytopathogenic fungi and bacteria that are causative agents of plant diseases; improves the development of root hairs and their absorption capacity, settling on the roots of plants. It also enhances plant immunity, and resistance to stress, such as frost and drought; improves the supply of nutrients to plants; increases seed germination; accelerates the development of plants; reduces the susceptibility to phytopathogenic microorganisms, which significantly increases the productivity of plants [18, 19].

Material and methods. During phyto-examination of alfalfa seeds, their sowing qualities (germination energy on 3 days, laboratory germination on 7 days) were evaluated according to GOST 10250-80. Sowing qualities of seeds were determined in wet chambers in plastic containers and on wet sands in Petri dishes. From each sample, 100 seeds were taken in 4-fold repetition. The number of

diseased seeds and seedlings was taken into account. During phytopathological analyzes of seeds, the species composition of the fungal and bacterial microflora was established. The analyzes were carried out on a nutrient medium of potato agar (KA), according to the guidelines of N.A. Naumova [20]. The determination of fungal and bacterial microflora was carried out according to the morphological characteristics of the colonies of fungi and bacteria and their pure cultures. The morphological characters of the fungi were examined by sporulation microscopy.

During the growing season, after the second mowing, a microbiological preparation was carried out to stimulate plant growth and increase the immunity of plants to fungal and bacterial diseases. The processing method is spraying plants with a powerful «Farmate» knapsack sprayer-blower. The concentration of the working solution is 1 % (10 ml per 1 liter of water). Biometric indicators of alfalfa plants in a production experiment were measured using a tape measure.

Research results. The results of phyto-examination showed that the analyzed alfalfa seeds were infected with fungal and bacterial microflora, in particular, fungi from the genera *Penicillium spp.*, *Alternaria spp.*, *Fusarium spp.*, and bacteria *Pseudomonas spp.*, *Erwinia spp.*

As it is known, the degree of infection of seeds with fungal and bacterial microflora can create a high infectious background for seed molds, plant damage by root rot, fusarium, alternariosis and bacteriosis during the growing season, as well as worsen sowing quality of seeds, reduce the energy of plant germination. The level of infection of the analyzed seeds with a fungal and bacterial infection requires effective presowing treatment with drugs that have high fungicidal and bactericidal properties and a combination of their stimulants that activate physiological processes in the plant.

In laboratory conditions, on the alfalfa seeds, the effectiveness of 21 different variants of the developed protective-stimulating compositions, including several preparations, was evaluated. At the same time, their effect on the sowing quality of seeds, germination energy and laboratory germination, on the growth rate and on their suppression of fungal and bacterial infections were evaluated.

Based on the studies, of the 21 options, 3 most effective protective-stimulating compositions were selected that positively affect the sowing quality of seeds (germination energy and laboratory germination) and the growth rate of seedlings and root system, effectively suppressing the fungal and bacterial microflora of seeds and the number of diseased seeds and alfalfa seedlings. The results of evaluating their effectiveness are presented in tables 1, 2.

Table 1 – Efficiency of processing alfalfa seeds with protective-stimulating compounds (dampening chamber)

Variant	Sowing quality of seeds, %		The seedling growth rate on the 7th day, %	The number of diseased seeds and seedlings, %	Biological efficiency, %
	germination energy	laboratory germination	+++		
Control	57,5	74,5	62,5	2,0	–
No. 4 TMTD + Extrasol	64,5	75,5	67,0	0,5	75,0
No. 5 TMTD + Sodium Humate	65,0	78,5	66,5	0,5	75,0
No. 6 TMTD + Aminopul	73,5	80,5	75,5	0,3	85,0

Table 2 – Effectiveness of processing alfalfa seeds with protective-stimulating compounds for sowing quality of seeds and their population with fungal microflora (nutriculture medium)

Variant	5th day of accounting, %			7th day of accounting, %		
	number of seeds sprouted	microflora of seeds		number of seeds prouted	microflora of seeds	
		fungal	bacterial		fungal	bacterial
Control - no processing	40,0	25,0	65,0	50,0	25,0	80,0
No. 4 TMTD + Extrasol	65,0	–	10,0	65,0	–	10,0
No. 5 TMTD + Sodium Humate	70,0	–	15,0	70,0	5,0	15,0
No. 6 TMTD + Aminopul	55,0	–	10,0	60,0	–	10,0

The results of phyto-examination of the sowing qualities of seeds showed that pre-sowing seed treatment with protective-stimulating compounds had a positive effect on the sowing quality of seeds. Thus, the growth rate of alfalfa seedlings was higher by 6.4-20.8% compared with the control variant. Biological efficiency against fungal and bacterial infections was 75-85.0%.

As can be seen from the results shown in table 2, protective-stimulating compounds not only positively affect the sowing quality of alfalfa seeds, but also significantly reduce the number of diseased seeds by inhibiting the development of molds. The biological effectiveness in the 4th and 6th variants against fungal infection reached 100 %, and in the 5th variant it amounted to 80 %, respectively. Against a bacterial infection, the biological effectiveness in the experimental variants varied within 81.2-87.5 %, respectively.

As a result of phytopathological analyzes of alfalfa seeds on a nutrient medium, Potato dextrose agar (PDA) revealed the dominant fungal and bacterial microflora. Mushroom microflora is dominated by fungi from the genera *Alternaria spp.* and *Fusarium spp.* causing alternariosis, fusariosis and root rot. A saprophytic fungus of the genus *Penicillium spp.*, which causes seed moldiness, was also identified. The results of phyto-examination showed that bacterial microflora predominates in alfalfa seeds. Based on the morphological characteristics of bacterial colonies on a nutrient medium and pathogenic properties, they are assigned to the genera *Pseudomonas* and *Erwinia*.

As a production experience, we carried out the processing of crops with the biological preparation Extrasol during the vegetation of plants, as a result, a positive effect of the preparation on the biometric indicators of alfalfa was established. On the 5th day after treatment with Extrasol, the stalk height of alfalfa was 6.4 cm higher than that of untreated ones. Also, the bushiness of plants and the number of flowers per 1 m2 when treated with the drug increased compared with the control by 15.4 % and 22.7 %, respectively (table 3). Also, the stalk height of alfalfa on the 10th day after treatment with Extrasol increased by 22.2 cm (99.7 cm), in the control variant this indicator was 77.5 cm, respectively. The plant bushiness during the treatment with the drug increased by 27.9 % compared with the control. As a result, the yield increase in the version with Extrasol was higher by 29.1 % compared with the control.

Table 3 – Economic efficiency of the drug extrasol and its effect on the structure of alfalfa harvest, Almaty region, Talgar district, «Bayserke-Agro» LLP (2019)

Options	On the 5th day of treatment			On the 10th day of treatment	
	plant length, cm	stooling, pcs/m^2	number of flowers, pcs/m^2	green mass productivity, g/m^2	yield increase, %
Extrasol	73,7	12,0	2,7	1,42	29,1
Control	67,3	10,4	2,2	1,1	–

Discussion of research result. The results of phyto-examination of the sowing qualities of seeds showed that, the pre-sowing treatment of seeds had a positive effect on the sowing qualities of seeds. The growth rate of alfalfa seedlings was 6.4-20.8 % higher compared to the control variant. Biological effectiveness against fungal and bacterial infections was 75.0-85.0 %.

Pathogenic microflora of seeds creates an infectious background for moldy seeds, reduces germination energy and germination of seeds, damage to plants by root rot, fusarium, alternariosis and bacteriosis.

For the recovery of alfalfa seeds, it is necessary to treat the seeds with preparations having fungicidal and bactericidal properties and in combination with a stimulator that activates physiological processes in plants.

Findings. Thus, the results of phyto-examination showed that the analyzed alfalfa seeds are infected with fungal and bacterial microflora, in particular, fungi from the genera *Penicillium spp.*, *Alternaria spp.*, *Fusarium spp.*, and bacteria *Pseudomonas spp.*, *Erwinia spp.* The results of phyto-examination of the sowing qualities of seeds showed that, pre-sowing seed treatment had a positive effect on their sowing qualities. The growth rate of alfalfa seedlings was 6.4-20.8 % higher compared to the control variant. Biological effectiveness against fungal and bacterial infections was 75.0-85.0 %.

During the phytopathological analysis of alfalfa seeds on a nutriculture medium, potato dextrose agar (PDA) revealed the dominant fungal and bacterial microflora. Mushroom microflora is dominated by

fungi from the genera *Alternaria spp.* and *Fusarium spp.* causing alternariosis, fusariosis and root rot. A saprophytic fungus of the genus *Penicillium spp.*, which causes moldy seeds, was also identified. Bacterial microflora, based on the morphological characteristics of bacterial colonies on the nutrient medium and pathogenic properties, revealed bacteria from the genera *Pseudomonas* and *Erwinia*.

As a result of processing the crops with Extrasol during the vegetation of plants, a positive effect of the drug on the growth and development of alfalfa was established. The stalk height of alfalfa on the 10th day after treatment with Extrasol increased by 22.2 cm (99.7 cm), in the control variant this indicator was 77.5 cm, respectively. The plant bushiness during the treatment with the drug increased by 27.9% compared with the control. As a result, the yield increase in the version with Extrasol was higher by 29.1% compared with the control.

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М. М. Бекежанова, Н. Ж. Султанова, О. Жұмаханұлы,
А. А. Джаймурзина, І. И. Темрешев, А. М. Макежанов, А. М. Турсынкулов

ҚР АШМ ТОО Ж. Жиембаев атындағы Қазақ өсімдік қорғау
және карантин ғылыми зерттеу институты, Алматы, Қазақстан

ЛЮЦЕРНА ЕГІСІНДЕ ЭКСТРАСОЛ БИОЛОГИЯЛЫҚ ПРЕПАРАТЫН ЖӘНЕ ҚОРГАНЫШ-ЫНТАЛАНДЫРУШЫ ҚҰРАМДАРДЫ ҚОЛДАНУ ТИІМДІЛІГІ

Аннотация. Ауыл шаруашылығы дақылдарының патогенді микрофлорасының ішінде тұқымдық инфекция ерекше орын алады. Тұқымдармен ауыл шаруашылығы дақылдары ауруларының барлық қоздырғыштарының 60%-дан астамы таралатыны жалпыға мәлім. Тұқымдарда кездесетін микрофлоралар сапротрофты (пениңилл, аспергилл, мукор, альтернария және т.б.) және патогенді (қаракүйе, ғельминтоспориоз, фузариоз, септориоз және т. б.) болуы мүмкін. Саңырауқұлақтардың патогенді түрлерімен тұқымдар жаппай залалданғанда олардың өсу энергиясы мен өнгіштігін төмендетеді. Аурулардың зияндылығы елеулі дәрежеде жіншумақтың еиі тереңдігіне және шалдыққан тұқымдардың санына байланысты келеді. Сонымен қатар, тұқым партиялары азық-түліктік және жемдік мақсаттарға пайдаланылса, залалдану дәрежесін ғана емес, патогендердің түрлік құрамын да білу қажет.

Себер алдында тұқымды сапасыз өңдеу, тұқым дәрілейтін препаратты дұрыс таңдамау, тұқымдық инфекция тұқым өңе бастағанда қарқынды көбейе бастайды және өсімдіктер үшін елеулі қауін төндіреді. Сонымен қатар, көптеген патогендер өсімдіктердегі физиологиялық үрдістерге теріс әсер ететін микотоксиндер бөледі, өскіндер мен тамырлардың өсуін тежейді, соңғы өнімде де сақталуы мүмкін. Бұл ретте тек өнім ғана емес, алынатын ауыл шаруашылығы өнімдерінің сапасы да төмендейді. Осыған байланысты, тұқым өңдейтін препаратты таңдау тұқым микрофлорасының түрлік құрамын анықтау бойынша алдынала фитосараптама нәтижелеріне міндетті түрде негізделуі тиіс. Бұл оның әсерін ескере отырып, препаратты дұрыс таңдауға мүмкіндік береді және осы іс-шараның тиімділігін қамтамасыз етеді.

Жоңышқа тұқымына жүргізілген фитосараптаманың нәтижесінде тұқымды препараттармен алдын-ала өңдеудің оның себінділік қасиеттеріне оңтайлы әсер ететіні анықталды. Жоңышқа өскіндерінің өсу қарқындылығы тәжірибе нұсқаларында бақылаумен салыстырғанда 6,4-20,8 %-ға жоғары болды. Саңырауқұлақ және бактериялық инфекцияларға қарсы биологиялық тиімділік 75,0-85,0%-ды құрады. Бөлінген микрофлорадан саңырауқұлақтардан *Penicillium*, *Alternaria* және *Fusarium* туыстары, ал бактериялардан *Pseudomonas* және *Erwinia* туыстарына жататын бактериялар бөлінді. Жүргізілген фитосараптаманың негізінде ауру қоздыратын саңырауқұлақ және бактериялар кешеніне қарсы қорғаныш-ынталандыру құрамы мен Экстрасол өсу үдеткіші таңдалып алынды. Өңдеу нәтижесінде, егістікті Экстрасол веғетаңия кезінде өсімдіктердің орнатылды оң әсері препараттың өсуі мен дамуы жоңышқа. Биіктігі стеблестой жоңышқа 10-шы күні өңдеуден кейін экстрасолом шамасы 22,2 см (99,7 см), бақылау нұсқасында бұл көрсеткіш 77,5 см сәйкесінше. Кустистость өсімдіктерді өңдеу кезінде препаратпен көтерілді бақылаумен салыстырғанда 27,9 %-ға артты. Нәтижесінде салмақ егін нұсқада экстрасол жоғары болды 29,1 % бақылаумен салыстырғанда.

Түйін сөздер: фитосараптама, тұқым, жоңышқа, биопрепарат, Экстрасол, саңырауқұлақ, микрофлора, тиімділік.

**М. М. Бекежанова, Н. Ж. Султанова, О. Жұмаханұлы,
А. А. Джаймурзина, И. И. Темрешев, А. М. Макежанов, А. М. Турсынкулов**

ТОО Казахский научно-исследовательский институт защиты и карантина растений
им. Ж. Жиембаева МСХ РК, Алматы, Казахстан

ЭФФЕКТИВНОСТЬ ПРИМЕНЕНИЯ ЗАЩИТНО-СТИМУЛИРУЮЩИХ СОСТАВОВ И БИОЛОГИЧЕСКОГО ПРЕПАРАТА ЭКСТРАСОЛ НА ПОСЕВАХ ЛЮЦЕРНЫ

Аннотация. Среди патогенной микрофлоры сельскохозяйственных культур семенная инфекция занимает особое место. Общеизвестно, что с семенами распространяется более 60 % всех возбудителей болезней сельскохозяйственных культур. Микрофлора, встречающаяся на семенах, может быть сапротрофной (пенициллы, аспергиллы, мукор, альтернария и др.) и патогенной (головня, гельминтоспориоз, фузариоз, септориоз и др.). Массовое заражение семян патогенными видами грибов зачастую снижает энергию прорастания и их всхожесть. Вредоносность в значительной степени зависит от глубины локализации мицелия и количества пораженных семян. К тому же, когда партии семян используются на продовольственные и кормовые цели, необходимо знать не только степень инфицированности, но и видовой состав патогенов.

При некачественной предпосевной обработке, неправильном подборе протравителя, семенная инфекция при прорастании семян начнет интенсивно размножаться и представляет серьезную опасность для растений, которые не смогут обеспечить полноценный урожай. Кроме этого, многие патогены вырабатывают микотоксины, которые отрицательно влияют на физиологические процессы в растениях, сдерживают рост проростков и корней, могут сохраняться в конечной продукции. В связи с этим, выбор протравителя должен обязательно основываться на результатах предварительной фитоэкспертизы по выявлению видового состава микрофлоры семян.

При фитоэкспертизе семян люцерны установлено, что, предпосевная обработка семян, оказала положительное влияние на посевные качества семян. Интенсивность роста проростков семян люцерны была выше на 6,4-20,8 % по сравнению с контрольным вариантом. Биологическая эффективность против грибных и бактериальных инфекции составила 75,0-85,0 %. Выявлена грибная микрофлора родов *Penicillium*, *Alternaria* и *Fusarium*, бактериальными видами из родов *Pseudomona*s и *Erwinia*. На основании результатов фитоэкспертизы против комплекса грибной и бактериальной инфекции подобран защитно-стимулирующий состав по оздоровлению семян люцерны совместно с биологическим препаратом Экстрасол. В результате обработки посевов Экстрасолом во время вегетации растений, было установлено положительное влияние препарата на рост и развитие люцерны. Высота стеблестоя люцерны на 10-й день после обработки экстрасолом повысилась на 22,2 см (99,7 см), в контрольном варианте этот показатель составил 77,5 см соответственно. Кустистость растений при обработке препаратом повысилась по сравнению с контролем на 27,9 %. В результате прибавка урожая в варианте с экстрасолом была выше на 29,1 % по сравнению с контролем.

Ключевые слова: фитоэкспертиза, семена, люцерна, биопрепарат, Экстрасол, грибы, микрофлора, эффективность.

Information about authors:

Bekezhanova M.M., «Kazakh Research Institute of Plant Protection and Quarantine named after Zh. Zhiyembaev» LLP, Leading researcher, candidate of agricultural sciences; madina.bekezhanova.80@mail.ru; https://orcid.org/0000-0001-6480-4030

Sultanova N.Zh., Kazakh Research Institute of Plant Protection and Quarantine named after Zh. Zhiyembaev» LLP, Head of the department of grain and oilseeds, candidate of agricultural sciences; nadira.sultanova@mail.ru; https://orcid.org/0000-0002-9538-3512

Zhumakhanuly O., Kazakh Research Institute of Plant Protection and Quarantine named after Zh. Zhiyembaev» LLP, Senior assistant; https://orcid.org/0000-0002-8788-9580

Jaimurzina A.A., Kazakh Research Institute of Plant Protection and Quarantine named after Zh. Zhiyembaev» LLP, Leading researcher, candidate of biological sciences; alia-45@mail.ru, https://orcid.org/0000-0001-6402-7403

Temreshev I.I., Kazakh Research Institute of Plant Protection and Quarantine named after Zh. Zhiyembaev» LLP, Head of laboratory of the Biotechnology, candidate of biological sciences; temreshev76@mail.ru; https://orcid.org/0000-0003-0004-4399

Makezhanov A.M., Kazakh Research Institute of Plant Protection and Quarantine named after Zh. Zhiyembaev» LLP, Senior assistant; Makezhanov.arman@bk.ru; https://orcid.org/0000-0003-1587-1979

Tursynkulov A.M., Ж Kazakh Research Institute of Plant Protection and Quarantine named after Zh. Zhiyembaev» LLP, Junior researcher, PhD-докторант; askhat_t-26@mail.ru; https://orcid.org/0000-0003-1108-8506

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