

NEWS

OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN

SERIES OF AGRICULTURAL SCIENCES

ISSN 2224-526X

Volume 3, Number 51 (2019), 80 – 88

<https://doi.org/10.32014/2019.2224-526X.40>

UDC 638.132.2: 631.531.011.2/5

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**THE ANALYSIS OF QUALITY OF SEEDS OF PLANT-SIDERATE
LACY PHACELIA (*PHACELIA TANACETIFOLIA* BENTH., 1834)
«BAYSERKE-AGRO» LLP WITH THE HELP OF PHYTOEXPERTISE**

Abstract. With the results of phytoexamination of seeds of the plant-siderite lacy phacelia *Phacelia tanacetifolia* Benth., 1834, their sowing qualities have been established. Germination energy during the experiments in a humid chamber averaged 68.0 %, laboratory viability comprised on average 72.2 %, the percentage of diseased seeds was 27.0 %. When conducting the experiments on moistened sand, these indicators were slightly lower: germination energy was 39.0 %, laboratory viability decreased to the level of 50.75 %, the number of diseased seeds amounted to 14.5 %. The identified fungal microflora was represented by species from the genera *Mucor*, *Penicillium*, *Alternaria* and *Fusarium*, bacterial microflora was represented by representatives of the genera *Pseudomonas* and *Erwinia*. The revealed microflora creates an infectious background for molding seeds, damaging plants with root rot, *Fusarium*, *Alternaria* and bacteriosis during the growing season, and also worsens the sowing quality of seeds, reduces the germination of plants and, thereby, significantly reduces the productivity of plants. Based on the results of the phytoexamination carried out against the complex of fungal and bacterial infections, a protective-stimulating composition was selected and the recommendation was given to the workers of the production sector of «Bayserke-Agro» LLP (Almaty region) on the improvement of the lacy phacelia seeds with the PMTD time in conjunction with a stimulant, the biological stimulant Extrasol, based on the bacterium *Bacillus subtilis*.

Key words: Phytoexpertise, seeds, siderat, lacy phacelia, *Phacelia tanacetifolia*, «Bayserke-Agro» LLP, Almaty region, Kazakhstan.

Introduction. The currently existing technological maps for the cultivation of fodder crops do not take into account biological and ecological plant protection products from pests and diseases. Such studies are now actively conducted and implemented in all advanced and developed countries of the world, and their implementation is fully consistent with the tasks of transfer and adaptation of technologies and improving the environmental friendliness of agricultural products set by the President of the Republic of Kazakhstan N.A. Nazarbayev in his annual message to the people in 2018.

According to these tasks, on the acreage of «Bayserke Agro» LLP in Almaty oblast, scientific research is being actively carried out as a part of the project of the Ministry of Agriculture of the Republic of Kazakhstan BR 06249249. «Development of an integrated system to increase productivity and improve the breeding qualities of farm animals, on the example of «Bayserke Agro» LLP» under the subproject 2. «Improving the technology of cultivation and harvesting of forage crops». In order to improve the agro-technology of the cultivation of fodder crops, it is proposed to use the subseed plant - siderat lacy phacelia to them (*Phacelia tanacetifolia* Benth., 1834), belonging to the borage- or forget-me-not family (Boraginaceae) (according to another botanical system, to the Hydrophyllaceae family of the order Boraginales). It is an insect plant. Inflorescence is spike-shaped curl. Flowers are small, pinkish-blue. Perianth are rigidly pubescent. The fruit is a multi-seeded box. Seeds are oval. The mass of 1000 seeds is 1,7-1,8 g.

This green manure is of great interest for several advantages. It unpretentious, it is grown in a variety of conditions, on poor sandy and stony soils. Lacy phacelia enriches the soil with nitrogen and potassium, besides being a good soil disintegrant, improves its aeration, retains moisture and prevents wind erosion. It is rich in phytoncides. When released into the soil, these components have a disinfecting effect and provide prevention of fungal diseases. If this plant is used as a siderate, it will retain moisture inside the soil, while at the same time protecting the roots from rotting and inhibiting the reproduction of pathogenic nematodes and weeds. Lacy phacelia has a deterring effect on some pests (aphids, leafworm, locusts). As a good honey plant, it serves as a powerful attracting factor for entomophages and pollinators, and makes it possible to more effectively use their useful properties in the fields of forage crops [1, 2]. Another advantage of lacy phacelia is that it is not related to any of the studied feed crops (soybean, alfalfa, barley, wheat), and has no pests and diseases in common with them. The green mass of this siderat is used fresh and for ensiling, but it is better mixed with other plants, mainly legumes. The fodder mixture with *Phacelia tanacetifolia* can be used to feed cows, sheep, goats, rabbits, pigs, poultry. Green mass of 8-15 t/ha yield. Mowing the feed must be completed before flowering begins. With the beginning of flowering plants, the feed value of the green mass is greatly reduced. By this time, the dry matter content in the green mass reaches 20 %, its accumulation stops. Because of the beneficial properties of lacy phacelia, intensive research is being conducted worldwide [3-8].

Lacy phacelia, like other cultures are affected by various diseases, many of which are transmitted through seeds. At the same time, pathogenic microflora in the seeds causes their molding, decay, reduces germination energy and germination, and also serves as a source of diseases during the growing season. Sick plants, in turn, are more damaged by pests, for example, true bags, which are abundant on the crops of fodder crops of «Bayserke Agro» LLP [9-11]. Considering that the use of *Phacelia tanacetifolia* seeds is of great importance for their quality, prior phytoexamination is necessary. It will allow the correct selection of a disinfectant against the complex of pathogenic and saprophytic microflora [12].

For phytoexamination and health improvement of seeds, certain studies were conducted by employees of the Kazakh Research Institute of Plant Protection and Quarantine [13-20]. However, for some cultures against the complex of fungal and bacterial infections, protective-stimulating compositions have not been developed.

A phytoexamination of seeds of forage crops (wheat, barley, alfalfa and soybeans), which we carried out earlier in the framework of the same project, showed a high population of pathogenic microflora, which creates a dangerous infectious background for the manifestation of diseases - root rot, *Fusarium*, *Alternaria* and bacterioses, as well as mold and seed rotting. According to the degree of seed contamination, selection of highly effective fungicides with a wide range of fungicidal and bactericidal properties is required. As a result of the studies, a wide range of treaters, biological products, growth regulators, insecticides, and insecticides have been tested, a number of compositional compositions have been developed for wheat and barley. Research continues to develop compositional compositions for alfalfa and soybean [13-20]. Since the seeding of siderate of *Phacelia tanacetifolia* was planned as a part of the research and production research carried out during the project, it was necessary to carry out a phytoexamination of its seeds before sowing and recommend measures for their recovery. This is due to the relevance of the research.

Material and methods. Seeds of *Phacelia tanacetifolia* were purchased by «Bayserke Agro» LLP as a part of the project of the Ministry of Agriculture of the Republic of Kazakhstan BR 06249249 «Development of an integrated system for increasing productivity and improving the pedigree qualities of farm animals, using the example of «Bayserke Agro» LLP in Almaty through «Green Garden» LLP. Producer is Green Carpet LLC, Moscow, Russian Federation.

During phytoexamination of lacy phacelia seeds, submitted from «Bayserke-Agro» LLP to the grain crops protection department of the LLP "Zh. Zhiembayev Kazakh SRI of Plant Protection and Quarantine named", their sowing qualities were evaluated (germination energy for 3 days, laboratory germination - for 7 days) according to GOST 10250-80. The sowing qualities of seeds were determined in wet chambers in plastic containers and on a humid sand dish in Petri dishes. From each sample, 100 seeds were taken in the 4th multiple. The number of diseased seeds and seedlings was taken into account. When phytopathological analyzes of seeds, the species composition of fungal and bacterial microflora established. Analyzes carried out on a nutrient medium - potato (CA), in accordance with the methodological guidelines of N.A.

Naumovoy "Analysis of seeds for fungal and bacterial infection" [14]. The determination of fungal and bacterial microflora was carried out according to the morphological features of the colonies of fungi and bacteria, and their pure cultures. The morphological features of the fungi were investigated by microscopic examination through sporulation.

Research results. The results of laboratory analyzes of phytoexpertise on assessing the sowing qualities of seeds of *Phacelia tanacetifolia* (germination and laboratory germination), as well as the identification of diseased seeds and seedlings in humid chambers and on humid sand are presented in table 1 and figures 1–8.

Table 1 – Sowing qualities of *Phacelia tanacetifolia* seeds, seedling growth rate and their population by mushroom microflora (humid chamber, humid sand)

Repetition	Germination, %	Laboratory germination, %	Growth intensity of sprouts on the 7th day, %			The number of diseased seeds and seedlings, %
			+	++	+++	
Humid chamber (plastic containers)						
I	64,0	64,0	14,0	71,0	15,0	12,0
II	70,0	74,0	17,0	69,0	14,0	13,0
III	66,0	74,0	21,0	70,0	9,0	18,0
IV	72,0	77,0	14,0	73,0	13,0	27,0
The average	68,0	72,2	16,5	70,7	12,8	17,5
Humid sand (in Petri dishes)						
I	40,0	50,0	–	–	–	15,0
II	39,0	50,0	–	–	–	18,0
III	38,0	57,0	–	–	–	14,0
IV	39,0	46,0	–	–	–	11,0
The average	39,0	50,75	–	–	–	14,5
+ - weak growth; ++ - medium height; +++ - intensive growth.						

The results of phytoexamination of the sowing qualities of seeds of *Phacelia tanacetifolia* showed low germination energy, which averaged 68.0 % and low laboratory germination on average 72.2 %. With another experience of moistened sand, these indicators were slightly lower, germination energy was 39.0 %; laboratory germination comprised 50.75 %.

The results of phytopathological analyzes of seeds of *Phacelia tanacetifolia* on a nutrient medium potato-glucose agar (CAA) revealed the dominant fungal and bacterial microflora. The total seed contamination is 100 %. Fungi from the genera *Alternaria* and *Fusarium* predominate from the fungal microflora, causing *Alternaria*, *Fusarium* and root rot. Saprophytic fungi of the genera *Mucor* and *Penicillium* were found, causing mold growth of seeds (figures 3-5). The results of phytoexamination showed that bacterial microflora prevails in the seeds of the phycameral lacy phacelia (figures 6, 8). Based on the morphological features of the bacterial colonies on the nutrient medium and pathogenic properties, they are assigned to the genera *Pseudomonas* and *Erwinia*.

Discussion of research results. The results of phytoexamination showed that the seeds of *Phacelia tanacetifolia* showed low germination energy, low laboratory germination in a humid chamber and humid sand. These rates may lower in the field as well.

The pathogenic seed microflora creates an infectious background for the molding of seeds, it will reduce the germination energy and seed germination, damage of plants with root rot, *Fusarium*, *Alternaria* and bacteriosis.

In order to heal the seeds of *Phacelia tanacetifolia*, it is necessary to treat the seeds with drugs that have fungicidal and bactericidal properties, in combination with a stimulant that activates physiological processes in plants.



Figure 1 – Laboratory germination of seeds *Phacelia tanacetifolia* in a humid chamber



Figure 2 – Affection of seeds of *Phacelia tanacetifolia* by the complex of phytopathogenic fungi

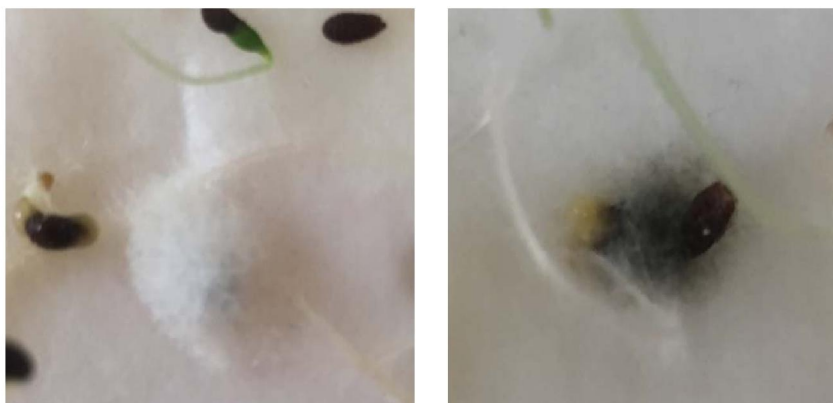


Figure 3 – Damage of seeds of *Phacelia tanacetifolia* by fungi of the genus *Fusarium* spp. and *Alternaria* spp.



Figure 4 – Damage seeds of *Phacelia tanacetifolia* by the fungi of the genus *Mucor* spp.

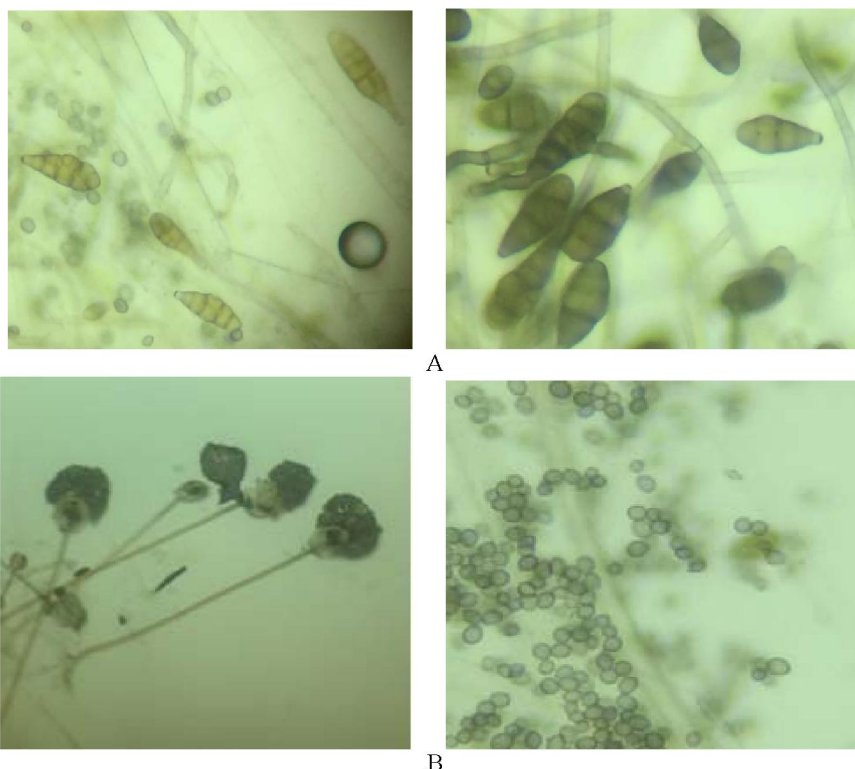


Figure 5 – The dominant fungal microflora isolated from seeds of *Phacelia tanacetifolia*:
A – *Alternaria* spp. (conidia); B – *Mucor* spp. (sporangium with discharges)



Figure 6 – Damage of seeds of *Phacelia tanacetifolia* by bacteria



Figure 7 – Affection of seeds of *Phacelia tanacetifolia* by the complex of phytopathogenic fungi (on humid sand)

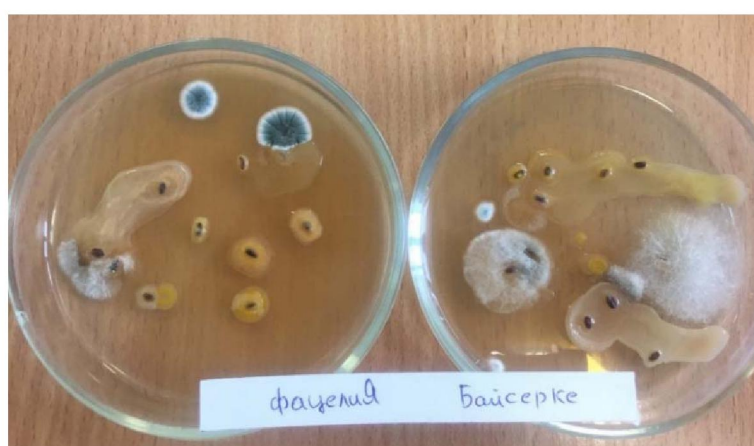


Figure 8 – Damage to the seeds of *Phacelia tanacetifolia* with fungal microflora and bacterial complex

Findings. As a result of phytoexamination of the seeds of *Phacelia tanacetifolia*, their low germination energy and low laboratory germination both on the humid chamber and on the humid sand have been established.

In the phytopathological analysis a complex of fungal and bacterial microflora was revealed. The dominant fungal microflora is represented by representatives of the genera *Alternaria*, *Fusarium*, *Mucor* and *Penicillium*; bacteria from the genera *Pseudomonas* and *Erwinia*.

Based on the results of phytoexamination against the complex of the fungal and bacterial infection, a protective-stimulating composition has been selected and the recommendation has been given to the workers of the manufacturing sector of «Bayserke-Agro» LLP (Almaty region) for the improvement of *Phacelia tanacetifolia* seeds by the PMTD scrubber with bactericidal and fungicidal properties - 8.0 l/t, in combination with a biological stimulator Extrasol on the basis of the bacterium *Bacillus subtilis* – 2.0 l/t.

Source of research funding. The work was prepared as part of the project implementation of the Ministry of Agriculture of the Republic of Kazakhstan BR 06249249 «Development of a comprehensive system to increase productivity and improve the breeding qualities of farm animals, using the example of «Bayserke Agro» LLP» under the subproject 2. «Improving the technology of cultivation and harvesting of forage crops».

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**АНАЛИЗ КАЧЕСТВА СЕМЯН РАСТЕНИЯ-СИДЕРАТА ФАЦЕЛИИ ПИЖМОЛИСТНОЙ
(*PHACELIA TANACETIFOLIA* BENTH., 1834) ТОО «БАЙСЕРКЕ-АГРО»
С ПОМОЩЬЮ ФИТОЭКСПЕРТИЗЫ**

Аннотация. Пижмажапырақты фацелия *Phacelia tanacetifolia* өсімдік-сидератының тұқымына жүргізілген фитосараптаманың нәтижесінде оның себінділік қасиеттері анықталды. Ылғалды орта тәжірибесінде өсу энергиясы орташа есеппен алғанда 68,0 %, зертханалық өнгіштігі 72,2 %, ауруға шалдыққан тұқымның саны 27,0 %-ға жетті. Ылғалды құм тәжірибесінде бұл көрсеткіштер айтарлықтай төмен болды: тұқымның өсу энергиясы 39,0 %, зертханалық өнгіштігі 50,75 %, ал ауруға шалдыққан тұқымның саны 14,5 %-ды құрады. Бөлінген микрофлорадан саңырауқұлақтардан *Mucor*, *Penicillium*, *Alternaria* және *Fusarium* туыстары, ал бактериялардан *Pseudomonas* және *Erwinia* туыстарына жататын бактериялар бөлінді. Бөлінген микрофлора тұқымның зеңденуіне, өсімдіктердің тамыр шіріктеріне, вегетация кезеңінде фузариоз, альтернариоз және бактериоз ауруларының қозуына инфекциялық фон тудырады, сонымен қатар, тұқымның себінділік қасиеттерін нашарлатады, өсімдіктің өнімділігін айтарлықтай төмендетеді. Жүргізілген фитосараптаманың негізінде ауру қоздыратын саңырауқұлақ және бактериялар кешеніне қарсы қорғаныш-ынталандыру құрамы таңдалып алынды және «Байсерке-Агро» ЖШС-нің (Алматы облысы) өндірістік секторының жұмысшыларына пижмажапырақты фацелия тұқымын сауықтыру мақсатында тұқымды ТМТД с.с.к. препаратымен қоса *Bacillus subtilis* бактериясы негізінде жасалған Экстрасол өсу үдеткішін қосып дәрілеу ұсыныстары берілді.

Түйін сөздер: Фитосараптама, тұқым, сидерат, пижмажапырақты фацелия, *Phacelia tanacetifolia*, «Байсерке-Агро» ЖШС, Алматы облысы, Қазақстан.

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**АНАЛИЗ КАЧЕСТВА СЕМЯН РАСТЕНИЯ-СИДЕРАТА ФАЦЕЛИИ ПИЖМОЛИСТНОЙ
(*PHACELIA TANACETIFOLIA* BENTH., 1834) ТОО «БАЙСЕРКЕ-АГРО»
С ПОМОЩЬЮ ФИТОЭКСПЕРТИЗЫ**

Аннотация. По результатам проведенной фитоэкспертизы семян растения-сидерата фацелии пижмолистной *Phacelia tanacetifolia* Benth., 1834 были установлены их посевные качества. Энергия прорастания при экспериментах во влажной камере составила в среднем 68,0 %, лабораторная всхожесть в среднем 72,2 %, процент больных семян - 27,0 %. При экспериментах на увлажнённом песке эти показатели были

несколько ниже: энергия прорастания - 39,0 %, лабораторная всхожесть - 50,75 %, количество больных семян - 14,5 %. Выявленная грибная микрофлора была представлена видами из родов *Mucor*, *Penicillium*, *Alternaria* и *Fusarium*, бактериальная - представителями родов *Pseudomonas* и *Erwinia*. Выявленная микрофлора создает инфекционный фон для плесневения семян, поражения растений корневыми гнилями, фузариозами, альтернариозами и бактериозами в период вегетации, а также ухудшает посевные качества семян, снижает энергию прорастания растений и, тем самым, существенно снизит продуктивность растений. На основании результатов проведенной фитоэкспертизы против комплекса грибной и бактериальной инфекции подобран защитно-стимулирующий состав и дана рекомендация работникам производственного сектора ТОО «Байсерке-Агро» (Алматинская область) по оздоровлению семян фацелии пижмолистной протравителем ТМТД в.с.к., совместно со стимулятором – биологическим препаратом Экстрасол на основе бактерии *Bacillus subtilis*.

Ключевые слова: фитоэкспертиза, семена, сидерат, фацелия пижмолистная, *Phacelia tanacetifolia*, ТОО «Байсерке-Агро», Алматинская область, Казахстан.

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REFERENCES

- [1] Bokina I.G. (2017). Agroecological regulation of the number of useful and harmful fauna // XV Congress of the Russian Entomological Society, July 31-August 17, 2017. Novosibirsk. P. 80-81 (in Rus.).
- [2] Vition P.G. (2016). The experience of attracting entomophages and pollinating insects with aromatic and honey plants // Eurasian Entomological Journal. 15. 1. P. 89-94 (in Rus.).
- [3] Popović V., Sikora V., Vučković S., Mihailović V., Živanović Lj., Ikanović J.A., Merkulov- Popadić L. (2016). Visoko nektarnabiljka – *Phacelia tanacetifolia* Benth. Biltenradova. 5. Naučno-stručniskup. Tehnološkeinovacije – Generator privrednograzvoja. 11/11/2016. Banja Luka, BiH. Izdavač. Savez Inovatora Republike Srpskei Privredna Komora R. Srpske. P. 12-14 (in Eng.).
- [4] Handlirova M., Lukas V., Smutny V. (2017). Yield and soil coverage of catch crops and their impact on the yield of spring barley // Yield and Plant Soil Environ. 63: 5. P. 195-200. doi: 10.17221 / 801/2016-PSE (in Eng.).
- [5] Hickman J.M., Wratten S.D. (1996). The use of phacelia tanacetifolia to improve the biological activity of aphids and the larvae in cereal feeds // Journal of Economic Entomology. 89: 832-840 (in Eng.).
- [6] Layberit E., Wratten S., Hemptinne J. (2012). It is beneficial to have a healthy insectary plant species to adult hoverfly (Diptera: Syrphidae) fitness // Journal Biological Control. 61: 1-6. <https://doi.org/10.1016/j.biocontrol.2011/12.010> (in Eng.).

- [7] Williams I.H., Christian D.G. (1991). Observations on *Phacelia tanacetifolia* Benth (Hydrophyllaceae) as a food plant for honeybees and bumble bees // Journal Apiculture Research. 30: 3-12 (in Eng.).
- [8] Wroblewska A. (2010). Flowering dynamics of *Phacelia tanacetifolia* nectar secretion. A. Gray // ActaAgrobotanica. 63 (1): 29-35. <https://doi.org/10.5586/aa.2010.004> (in Eng.).
- [9] Esenbekova P.A., Temreshev I.I., Kenzhegaliev A.M., Tursynkulov A.M., Dosmukhambetov T.M. Hemiptera (Hemiptera: Heteroptera) - pest and grain (barley, triticale, wheat) Bayserke-Agro LLP // News of the National academy of sciences of the Republic of Kazakhstan. Series of agricultural sciences. 2019. Vol. 2, N 50. P. 21-30. ISSN 2224-526X (in Rus.). <https://doi.org/10.32014/2019.2224-526X.12>
- [10] Esenbekova P.A., Temreshev I.I., Kenzhegaliev A.M., Tursynkulov A.M., Dosmukhambetov T.M. Bugs (Hemiptera: Heteroptera) - pests of alfalfa "Bayserke-Agro" LLP // News of the National academy of sciences of the Republic of Kazakhstan. Series of agricultural sciences. 2019. 2(50). P. 55-65. ISSN 2224-526X (in Rus.). <https://doi.org/10.32014/2019.2224-526X.17>
- [11] Kenzhegaliev A.M., Esenbekova P.A., Temreshev I.I., Sagitov A.O., Dosmukhambetov T.M. (2019). Hemiptera (Insecta, Heteroptera) on barley crops (*Hordeum spontaneum*) Bayserke Agro LLP (pests and entomophages). Science, production, business: current state and ways of innovative development of the agricultural sector on the example of the Baiserke Agro Agroholding // Collection of works of the international scientific and practical conference dedicated to the 70th anniversary of Honored Worker of the Republic of Kazakhstan Dosmukhambetov Temirkhan Mynaidarovich (4-5 April 2019, Almaty Kazakhstan) / Ed. ed. acad. B.T. Zhumagulov, A.O. Sagitov, N.M. Temirbekov. Vol. 1. Almaty, 2019. P. 307-311 (in Rus.).
- [12] Govorov D.N., Zhiviykh A.V., Schetinin P.B. (2018). Phytoexamination and pre-sowing seed treatment are the most important methods of grain cultivation technology // Protection and quarantine of plants. 8: 12-13 (in Rus.).
- [13] Sagitov A.O., Dzhaymurzina A.A., Umyralieva Zh.Z., Kopzhasarov B.K. (2014). Protective and stimulating compositions for the treatment of vegetable seeds from fungal and bacterial infections // Mat. Reports of the 8th conference "Prospects for the use of new forms of fertilizers, means of protection and plant growth regulators in agricultural technologies" VGNU All-Russian Institute of Agricultural Chemistry. D.N. Pryanishnikov. Anapa, 2014. P. 251-254 (in Rus.).
- [14] Kozhabaeva G.E., Sultanova N.Zh., Dzhaymurzina A.A., Temreshev I.I. (2018). Phytoexpertise and health improvement of seeds of forage crops // Materials of the International Scientific Conference "Formation and Development of Plant Protection and Quarantine Science in the Republic Kazakhstan" December 6, 2018. Almaty, 2018. P. 366-371 (in Rus.).
- [15] Bekezhanova MM, Dzhaymurzina A.A., Sultanova N.Zh., Temreshev I.I., Kozhabaeva G.E. (2019). Zhоңышқа түкүмүнүн микрофлорасы және оған қарсы қорғаныс-ынталандыру құрамдмның тиімділігі. Science, production, business: current state and ways of innovative development of the agricultural sector on the example of the Baiserke Agro Agroholding // Collection of works of the international scientific and practical conference dedicated to the 70th anniversary of Honored Worker of the Republic of Kazakhstan Dosmukhambetov Temirkhan Mynaidarovich (4-5 April 2019, Almaty Kazakhstan) // Ed. ed. acad. B.T. Zhumagulov, A.O. Sagitov, N.M. Temirbekov. Vol. 1. Almaty, 2019. P. 194-198 (in Kaz.).
- [16] Ageenko A.V., Dzhaymurzina A.A. The dominant microflora of soybean seeds and the effectiveness of the protective-stimulating composition against it // News of the National academy of sciences of the Republic of Kazakhstan. Series of agricultural sciences. 2017. 6 (42): 198-207 (in Rus.).
- [17] Dzhaymurzina A.A., Sagitov A.O., Eszhanov T.K., Umyralieva Z.Z. (2014). The method of determining the effectiveness of drugs against fungal and bacterial infections in the seeds. Innovative patent RK № 28979 (in Rus.).
- [18] Dzhaymurzina A.A., Sagitov A.O., Eszhanov T.K., Umyralieva Zh.Z., Kopzhasarov B.K. (2015). The method of disinfecting seeds with protective-stimulating compounds. Innovative patent RK № 28978 (in Rus.).
- [19] Dzhaymurzina A.A., Umyralieva Z.Z., Badaev E.A., Sagitov A.O. (2015). The effectiveness of the treatment of soybean seeds with a protective-stimulating compound materialdary. Almaty, 2015. P. 24-25 (in Rus.).
- [20] Naumova N.A. (1970). Seed analysis for fungal and bacterial infection. L.: Kolos (in Rus.).