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SCREENING OF NEW SOYBEAN CULTIVARS AND CULTIVAR SAMPLES TOWARDS COMMON DISEASES IN KAZAKHSTAN

A.D. Maulenbay *, N.D. Kurymbaeva, G.Sh.Yskakova , M.Zh. Baygutov, A.M. Asraubaeva, A.S. Rsaliyev

"Research Institute of Biological Safety Problems", Ministry of Health of the Republic of Kazakhstan, Guardeysky, Kazakhstan
*maulenbay.id@gmail.com

Abstract. As part of the strategy to diversify cultivated areas and increase the profitability of agricultural enterprises, oilseeds, including soybeans, represent a promising direction for the development of the agricultural sector in the country. Kazakhstan is among the top 20 soybean-producing countries globally. However, significant damage to soybean crops in the region was affected primarily by fungal diseases, leading to 20-50 % yield losses. This article presents field experiments conducted in the arid submontane agro-climatic Zhambyl region, focusing on the resistance of the global soybean collection. The study used 276 soybean varieties from Eastern Europe, Western Europe, North America, East Asia, and Kazakhstan. Screening of world soybean collection from 25 countries for field resistance towards various pathogens demonstrated a total of 197 soybean sources resistant to Cercospora sojina, 260 resistant to Septoria glycines, 76 resistant to Pseudomonas solanacearum, and 174 resistant to Peronospora manchurica. Among the tested samples, 24 soybean varieties of different origins exhibited high resistance to all pathogens, accounting for only 8.79% of those evaluated in the field during this experiment. These findings highlight the importance of identifying and utilizing disease-resistant soybean varieties to mitigate the impact of fungal diseases and improve soybean production in the region.
Keywords: resistance; soybean; cultivar samples; septoria; cercospora.

Introduction

As part of the strategy to diversify the cultivated areas and increase the profitability of agricultural enterprises, oilseeds, including soybeans, represent a promising direction for the development of the agrarian sector in the country. Soybean (Glycine max (L.) Merrill) plays an important role in the grain legume family and shows significant interest to agricultural producers. Soybean cultivation and processing is becoming more and more appealing every year. The soybean cultivation area in Kazakhstan occupies an area of 140 thousand hectares The soybean yield in the country fluctuates on average from 18 to 21 centners per hectare [1].

Kazakhstan is one of the top 20 soybean-producing countries. The Almaty region is considered as the primary region of its cultivation. Currently, soybean is also grown in southern, northern and eastern Kazakhstan [2, 3]. However, an increase in cultivated areas and non-compliance with agricultural practices can contribute to the accumulation and further spread of pathogens of soybean diseases. Significant damage to soybean crops is caused by fungal pathogens [4-6]. The damage caused by pathogens is determined by different factors including environmental conditions, the pathogen biology, the degree of its prevalence and the characteristics of the variety. By various estimates, soybean yield losses affected by the diseases can reach 20-50% [4, 7, 8]. According to the literature, the most common fungal pathogens in Kazakhstan that affect various parts of the plant in the form of spottings are septoria, cercospa, ascochyta, as well as diseases affecting the root system [1, 9, 10].

All of the above diseases of grain and legume crops are considered dangerous pathogens in Kazakhstan. The most effective method against phytopathogens is the cultivation of resistant varieties. However, almost none of the domestic soybean varieties approved in Kazakhstan are resistant. There are no samples that are resistant to biotrophic and hemibiotrophic pathogens among commercial cultivars of crops, only some weakly deteriorating cultivars.

Solving current problems of phytosanitary security is the key to determining the real threats and the current situation of dangerous diseases to develop measures towards preventing the spread of pathogens in legume crops. One of the modern approaches to solving the problems of phytosanitary and food security in the country is the creation of highly productive, disease-resistant and high-quality varieties of legume crops, including the use of modern methodologies of breeding, phytopathology, molecular genetics and genomics [11-14]. Genome-wide studies on resistance to dangerous diseases of grain legume crops are successfully and effectively carried out in various regions. These results are beneficial for breeders, phytopathologists, and geneticists in providing them with new tools to strengthen breeding projects.

Materials and methods

The world soybean collection of 288 cultivars and lines from Eastern Europe (121 cultivars) and Western Europe (22 samples), North America (44), East Asia (55) and Kazakhstan (34) was used for this trial (Table 1). The materials were derived from the Institute of Plant Biology and Biotechnology, Almaty. Field experiments were conducted in the "Research Institute of Biological Safety Problems" area in Gvardeysky village, Korday district, Zhambyl oblast.

Table 1 –Tested soybean varieties of the World Soybean Collection and their country of origin

№	Name of the sample	Country of origin	№	Name of the sample	Country of origin
1	Светлая [Svetlaya]	Russia	139	Черемош [Cheremosh]	Ukraine
2	Соер-5 [Soyer-5]	Russia	140	OO533	China
3	Kollekcyina	Poland	141	Darika	Moldova
4	Касатка [Kasatka]	Russia	142	K2132	China
5	Свапа [Svapa]	Russia	143	Кубань [Kuban]	Ukraine
6	СибНИИСХОЗ 6 [SibNIISHOS-6]	Russia	144	Colby	Canada
7	Nawiko	Poland	145	Agasis	USA
8	ПЭП 27 [PEP 27]	Russia	146	SL 01 26	Canada
9	Золотистая [Zolotistaya]	Russia	147	Славия [Slaviya]	Russia
10	Магева [Mageva]	Russia	148	Десна [Desna]	Ukraine
11	Малета [Maleta]	Russia	149	Донька [Donka]	Ukraine
12	Зерница [Zernica]	Russia	150	Supra	Canada
13	Хейхек 14 [Haihek 14]	China	151	Maplearrow	Canada
14	LMF	Poland	152	Mapleglen	Canada
15	Северная 5 [Severnaya 5]	Russia	153	840-2-7	Sweden
16	Окская [Okskaya]	Russia	154	Buster	Canada
17	Maplepresto	Канада	155	Хей Лун 48 [Hei Lun 48]	China
18	Arctic	Poland	156	Одесская 150 [Odesskaya 150]	Ukraine
19	Смена [Smena]	Russia	157	KZ 597	Hungary
20	Соната [Sonata]	Russia	158	O412	Canada
21	Закат [Zakat]	Russia	159	Полтава [Poltava]	Ukraine

22	Сибирячка [Sibiryachka]	Russia	160	Терек [Terek]	Ukraine
23	Эльдорадо [Eldorado]	Russia	161	Amphor	France
24	ПЭП26 [PEP 26]	Russia	162	362/2(В.Красавица) [362/2 V. Krasavica]	Kazakhstan
25	Аннушка [Annushka]	Украина	163	404/2 (Бірлік КВ) [404/2 Birlik KV]	Kazakhstan
26	Rana	Czech Republic	164	Evans	USA
27	Fiskeby v	Sweden	165	Enterprise	Canada
28	308/1	Kazakhstan	166	Быстрица 2 [Bystica 2]]	Russia
29	Warsawska	Poland	167	Вилана [Vilana]	Russia
30	Луч надежды [Luch nadezhdy]	Russia	168	Дельта [Delta]	Russia
31	Ланцетная [Lancetnaya]	Russia	169	Dawson	USA
32	Омская 4 [Omskaya]	Russia	170	Lambert	USA
33	Брянская [Bryanskaya]	Russia	171	Лира [Lira]	Russia
34	Красивая мечта [Krasivaya mechta]	Russia	172	Искра [Iskra]	Kazakhstan
35	350/1	Kazakhstan	173	Память ЮГК [Pamyat UGK]	Kazakhstan
36	Соер -3 [Soyer-3]	Russia	174	Сюй Нун 26 [Cui Nun 26]	China
37	Соер 4 [Soyaer 4]	Russia	175	Особлива [Osobliva]	Ukraine
38	Злата [Zlata]	Russia	176	Склея [Skleya]	Ukraine
39	Соер 345 [Soyer 345]	Russia	177	Maurau	Czech Republic
40	173/1	Kazakhstan	178	Bellemondeau	Canada
41	Chabem Wekoju	Poland	179	Мисула [Misula]	Kazakhstan
42	Рассвет [Rassvet]	Russia	180	Никко [Nikko]	Serbia
43	Амурская 401 [Amurskaya 401]	Russia	181	Джинь Нун 62 [Djin Nun 62]	China
44	Л315/07 [L 315/07]	Russia	182	Хей Фен 50 [Hei Fen 50]	China
45	Черновицкая 7 [Chernovitskaya 7]	Ukraine	183	Октябрь 70 [Oktyabr 70]	Russia
46	Соер 3491 [Soyer 3491]	Russia	184	RCAT Bobcat	Canada
47	Tachisuzuhari	Japan	185	Алматы [Almaty]	Kazakhstan
48	126/1	Kazakhstan	186	6877	Philippines
49	261/1	Kazakhstan	187	371/2	Kazakhstan
50	Picket	USA	188	Лань [Lan]	Russia
51	OAC Vision	Canada	189	Сюй Сюн 1 [Sui Sn 1]	China
52	Maple Ridge	Canada	190	Зара [Zara]	Kazakhstan
53	Лидия [Lidiya]	Russia	191	OAO Wallace	Canada
54	Бара [Bara]	Russia	192	Sl 02 25	Canada
55	Алтом [Altom]	Russia	193	Xinjiang D10-51	China
56	301	Denmark	194	Приморская 495	Russia

				[Primorskaya 495]	
57	Sito	Germany	195	Amour	France
58	Mapleamber	Canada	196	Isidor	France
59	ВНИИС2 [VNIIS2]	Russia	197	Safrfna	France
60	Нива 70 [Niva 70]	Russia	198	Xinjiang D11-252	China
61	УСХИ 6 [USHI 6]	Ukraine	199	Корсак [Korsak]	Ukraine
62	Semu 315	Germany	200	Crystal	Canada
63	186/1	Kazakhstan	201	CH 147020-1	Belorussia
64	209/1	Kazakhstan	202	Zen	Switzerland
65	ВНИИС -1 [VNIIS-1]	Russia	203	Жалпаксай [Zhalpaksay]	Kazakhstan
66	Гармония [Garnoiya]	Russia	204	Elgin 141	USA
67	Вейделевская 17 [Veidelevskaya 17]	Russia	205	Астра [Astra]	Russia
68	Янтарная [Yantarnaya]	Russia	206	Амантай [Amantay]	Kyrgyzstan
69	Белор [Belor]	Russia	207	Болашак [Bolashak]	Kazakhstan
70	Прикорпатьска 81 [Prikorpatska 81]	Ukraine	208	Xinjiang D10-135	China
71	422/1 (Ивушка) [Ivanushka]	Kazakhstan	209	Dekabig	USA
72	398	Kazakhstan	210	Сава [Sava]	Serbia
73	Танаис [Tanais]	Ukraine	211	Shama	France
74	Accord	Canada	212	Бисер 291 [Biser 291]	Bulgaria
75	Надежда [Nadezhda]	Russia	213	Даная [Danaya]	Kazakhstan
76	Лучезарная [Luchezarnaya]	Russia	214	Xinjiang D10-130	China
77	Устя [Ustya]	Ukraine	215	Jachynes 74 Brond	USA
78	Kalmit	France	216	Wilstar 194	USA
79	Fiskeby III	Sweden	217	Перизат [Perizat]	Kazakhstan
80	KG 20	Canada	218	RCAT Persian	Canada
81	Oyachi №2	Japan	219	Венера [Venera]	Serbia
82	Припять [Pripyat]	Belorussia	220	Вита [Vita]	Kazakhstan
83	Романтика [Romantika]	Russia	221	Xinjiang D09-676	China
84	Грибская Кормовая [Gribskaya Jormovaya]	Russia	222	Херсонская 840 [Hersonskaya 840]	Ukraine
85	Викторина [Viktorina]	Ukraine	223	Роза [Roza]	Kazakhstan
86	Turijskaja masnaja	Czech Republic	224	Воеводжанка [Voevodzhanka]	Serbia
87	Mc call	USA	225	Веста [Vesta]	Russia
88	Major	France	226	Руно [Runo]	Russia
89	R121427	Moldova	227	Parker	USA
90	Версия [Versiya]	Ukraine	228	Sponsor	France
91	Л 129-08 (Кобза) [L 129-08 (Kobza)]	Ukraine	229	Zispida 641	Belgium
92	Мрия [Mriya]	Ukraine	230	Жансая [Zhansaya]	Kazakhstan
93	Рось [Ros]	Belorussia	231	Уссурийская 267 [Ussuriiskaya 267]	Russia
94	Carola	USA	232	Лара [Lara]	Serbia

95	OAC Erin	Canada	233	Ана [ana]	Serbia
96	Ясельда [Yaselda]	Belorussia	234	Santana	France
97	Росинка [Rosinka]	Russia	235	Букурия [Bukuriya]	Moldavia
98	Спритна [Spritna]	Ukraine	236	Сабира [Sabira]	Kazakhstan
99	Xinjiang a don 1	China	237	Linkoln	USA
100	Дина [Dina]	Russia	238	Радость [Radost]	Kazakhstan
101	Мажеста [Majesta]	Canada	239	Суламит [Sulamit]	Kazakhstan
102	1674	China	240	1028	Korea
103	Morsoy	USA	241	1055	Korea
104	Toury	Czech Republic	242	Shelby	USA
105	Хуа я Доу 1 [Hua ya Dou 1]]	China	243	Виктория [Viktoriya]	Ukraine
106	Бей Джян 91 [Bey Djyan 91]	China	244	1017	Korea
107	Дун Доу 641 [Dun Dou 641]	China	245	1069	Korea
108	Мальвина [Malvina]	Ukraine	246	1003	Korea
109	Cobb 266	USA	247	Казахстанская 2309 [Kazakhstanskaya 2309]	Kazakhstan
110	Xinjiang heihe 38	China	248	Ласточка [Lastochka]	Kazakhstan
111	Хэй Хе 47 [Hei he 47]	China	249	Акку [Akku]	Kazakhstan
112	Спритна [Spritna]	Ukraine	250	Эврика [Evrika]	Kazakhstan
113	Райнер 58 [Rainer 58]	Moldova	251	1065	Korea
114	Естофита [Estofita]	Ukraine	252	Селекта 301 [Selekta 301]	Russia
115	Джинь Юан 55 [Jin uan 55]	China	253	1076	Korea
116	Фемида [Femida]	Ukraine	254	1026	Korea
117	Korada	Canada	255	1070	Korea
118	370/2	Kazakhstan	256	Хабаровская 4429 [Khabarovskaya 4429]]	Russia
119	Кен Фен 16 [Ken Fen 16]	China	257	K1889	China
120	Цзин Синь 2 (661) [Tzin Sin 2 ()1]	China	258	Harrow Manuchu	China
121	Ватра [Vatra]	Ukraine	259	Nhat 11	Вьетнам
122	ВНИИС 1 [VNIIS 1]	Russia	260	Перемога [Peremoga]	Ukraine
123	ISZ 13	Hungary	261	1031	Korea
124	Emerson	Canada	262	1034	Korea
125	Харбин [Harbin]	China	263	1044	Korea
126	Подяка [Podyaka]	Ukraine	264	1082	Korea
127	Сюй Нун 35 [Sui Nun 35]	China	265	1095	Korea
128	Кэн Фэн 20 [Ken fen 20]	China	266	1071	Korea
129	Фора [Fora]	Russia	267	1022	Korea
130	Фея [Feya]	Ukraine	268	Надежда [Nadezhda]	Kazakhstan

131	Вега [Vega]	Russia	269	1054	Korea
132	Хорол [Horol]	Ukraine	270	1033	Korea
133	Sepia	France	271	1049	Korea
134	407/2	Kazakhstan	272	Дун Доу 1 [Dun Dou 1]	China
135	Лыбидь [Lybid]	Ukraine	273	Дун Доу 29 [Dun Dou 29]	China
136	Кэн Нун 8 [Ken Nun 8]	China	274	Дун Доу 339 [Dun Dou 339]	China
137	GEO	Canada	275	Дун Доу 027 [Dun Dou 027]	China
138	Рента [Renta]	Russia	276	Мей Фен 18 [Mei Fen 18]	China

According to the natural-climatic conditions, the place of field research is the arid submontane agro-climatic region. As stated in the long term data, around 80-190 mm of precipitation falls during the vegetation period of grain crops. The hydrothermal coefficient is 0,41-0,50. The sum of effective temperatures varies between 3000-3500°C, and annual rainfall is 250-400 mm. According to Kordai meteorological station, the average air temperature (°C) and amount of precipitation (mm) in April 2021 were 9.7 and 37, in May - 17.2 and 15, in June - 21.2 and 5, in July - 25.8 and 5, in August - 22.8 and 10, respectively.

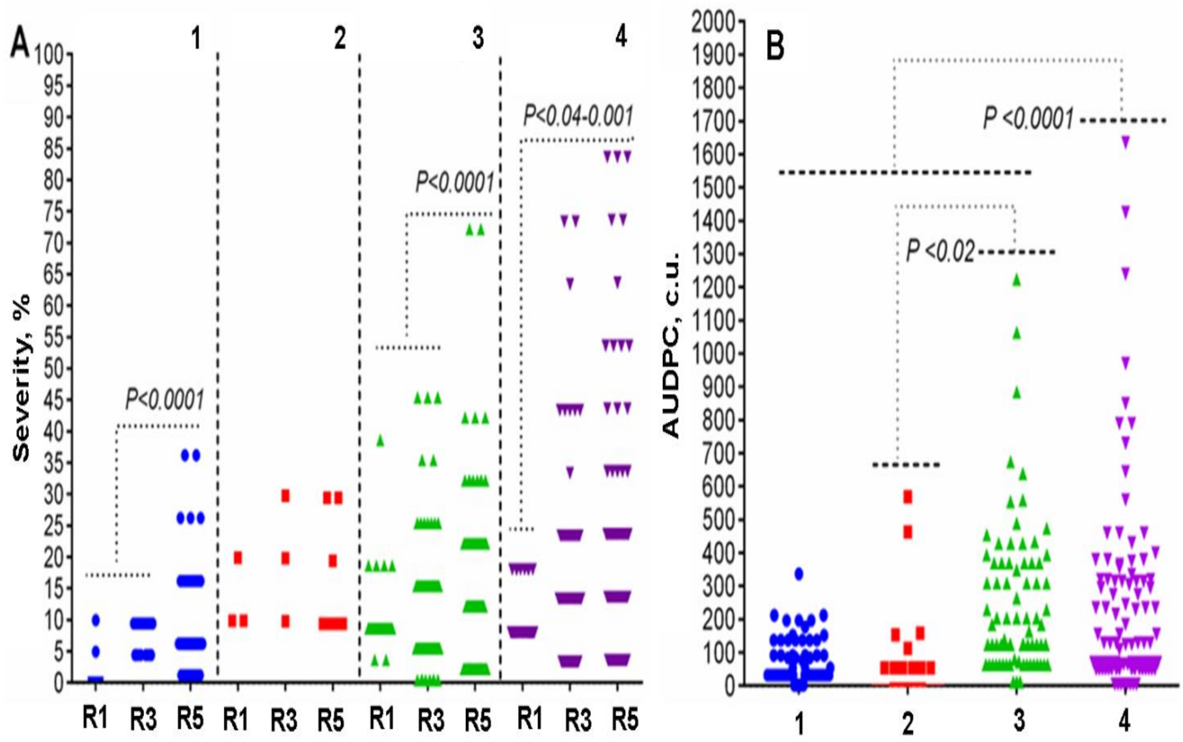
The species identification of soybean diseases and their development under field conditions were recorded and determined during flowering, seed formation and grain ripening on various vegetative plant organs. Pathogen species were identified under laboratory conditions using identifiers [15, 16]. The degree of soybean infection with septoria was based on visual assessment on a scale from 0 to 4, where 0 = no symptoms (highly resistant), 1 = <3% (resistant), 2 = 3 to 15% (moderately resistant), 3 = 15 to 35% (susceptible), 4 = >35% (highly susceptible) of affected leaf area [17]. The extent of bacterial wilt and Peronospora of soybean was measured as a percentage of the total leaf area affected using the Horsfall and Barratt scoring system [18]. The level of resistance and susceptibility of soybean samples to cercospa was determined using a 10-point Sinclair scale [19]. In all cases, the disease progression rate criterion expressed as the AUDCP was used [20].

Data on the field resistance of plants to diseases were plotted and statistically analyzed using GraphPadPrism 9.2.0 software (GraphPad Software, Inc., LaJolla, CA, USA). The significance level was set as $P < 0.05$.

Results

During the reporting period, 276 soybean varieties from 25 countries were screened for field resistance to various diseases, from the flowering phase to ripening. The vegetation period of 2021 was characterized by the absence of precipitation in mid-June and high air temperatures in the initial period, which, in turn, led to the compressed passage of soybean plant development phases from sprouting to flowering. Nevertheless, against the natural infection background during the growing season, soybean was affected by *Cercospora sojina, Septoria glycines, Pseudomonas solanacearum* and *Peronospora manchurica.*

Under field conditions, soybean cultivars showed differentiation to diseases in all studied phases, respectively, which revealed significant differences between plant growth phases in the degree of damage by diseases (Figure 1A). The average degree of soybean varieties affected by pathogens at the end of vegetation (grain ripening phase) varied from 3.62% to 16.37%. The correlation of resistance assessment results between the three counts (R1, R3, R5) to bacterial wilt was highly reliable (P <0.04-0.001). Also, the development level of cercospora and perenospora on soybean samples during R5 showed statistical significance (P<0.0001). Infection with these fungi occurred better in later stages because of greater plant susceptibility and dependence of pathogen development on the duration of daylight hours and higher solar activity in summer at the time of plant ripening. The analysis revealed no significant differences between the phases of soybean development in the degree of septoria (Fig. 1A).



R1 - Beginning Bloom; R3 - Beginning Pod; R5 - Beginning Seed;
1 – Cercospora; 2 – Septoria; 3 – Perenospora; 4 – bacterial wilt.
Figure 1 – Dynamics of disease development (A) and AUDPC on soybean cultivars during the vegetation period (B)

AUDPC was calculated to determine the level of partial resistance of soybean accessions (Figure 1B). As a result, the soybean accessions were 2-25 times more resistant to bacterial wilt (mean level 175.45 conventional units) than to other pathogens (mean level 6.86 to 100.68 c.u.), which confirms their data on the degree of damage ($P < 0.0001$). In addition, there was an AUDPC correlation between septoria and perenospora ($P <0.02$).

According to the degree of disease damage, soybean cultivars were grouped. As can be seen from the data presented in Figure 1, the studied soybean materials differed in field resistance and susceptibility to pathogens. In 2021, 72% (197 varieties) of the studied soybean accessions were highly resistant to cercospora (lesions up to 5%), whereas 23% (62) were moderately resistant (lesions up to 10%), 4% (12) were moderately susceptible (lesions up to 30%) and 1% (2) were susceptible (lesions up to 40%). Sonata and KG 20 cultivars were most affected by cercospora.

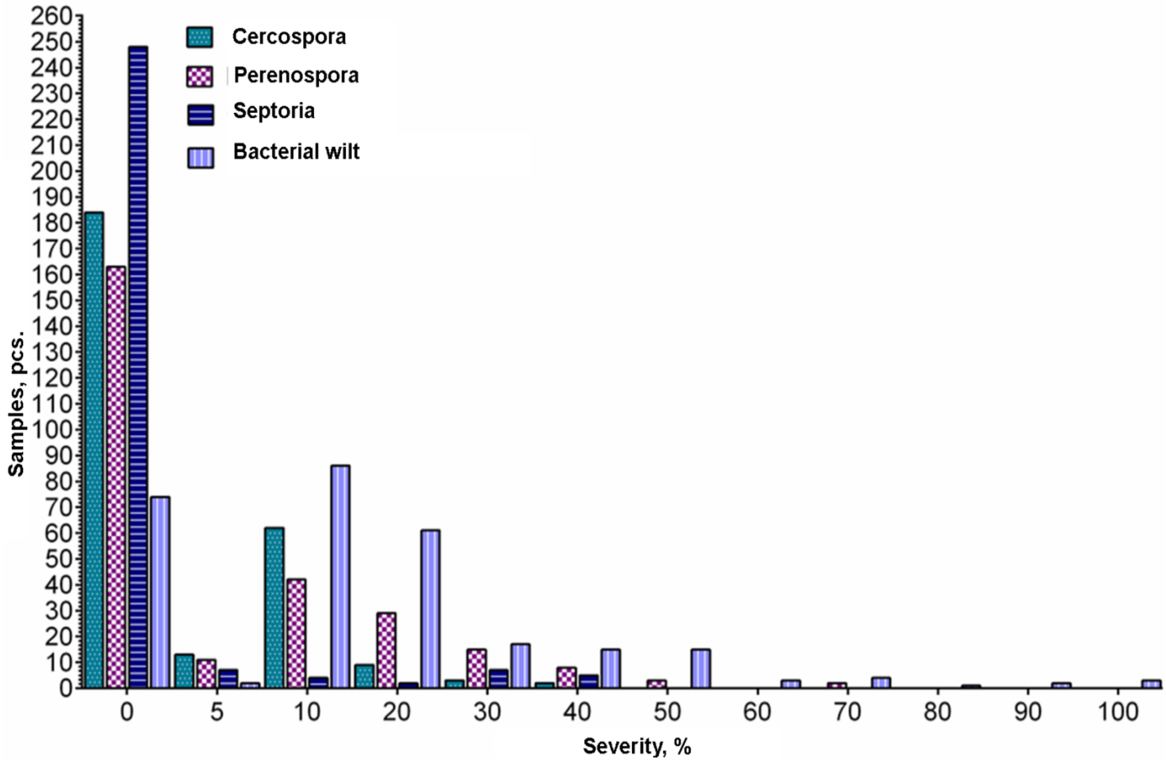


Figure 2 – Distribution of soybean varieties by degree of pathogen damage

The number of soybean samples resistant to septoria was significantly higher than cercospora. Resistance to septoria showed 260 soybean accessions with no symptoms of the disease. In 9 studied samples, the lesion was 10%, and in four - 20-30%. Severe damage was noted in Soer-5, Kollekcyina, Nikko and Warsawska varieties.

The severity of soybean samples to perenopora ranged from 0% to 70%; Fourty four accessions showed medium susceptibility, and 13 were susceptible to perenophora at the adult plant development stage. The maximum damage was noted in line 371/2 (70%).

The studied soybean cultivars were more susceptible to bacterial wilt. 31.5% of the soybean varieties and samples were MS to bacterial wilt, 28.6% were S, and 9.9% - VS; Obtained show data that more than 2.2% of the studied samples are severely affected by bacterial wilt, and only 27.8% (76 samples) were resistant to wilt.

Among the studied samples, 24 soybean accessions of different origins showing a high degree of resistance to all pathogens were identified, which is only 8.79 % in the field in this experiment. Sources of group resistance to various pathogens (cercospora, septoria, bacterial wilt) among soybean cultivars: Hungary (KZ 597), Kazakhstan (Sulamit), Canada (OAC Erin, Majesta, Korada, OAO Wallace, Maple Ridge, Maplearrow), China (Xua ya doe 1, Xei Lun 48, Xinjiang D10-51), Russia (North 5, Rosinka, VNIIS 1, Renta), USA (Morsoy), Ukraine (Spritna, Vatra, Korsak, Victorina), France (Amphor, Amour), Czech Republic (Toury), Japan (Oyachi #2).

Thus, based on the analysis of field data in 2021, a total of 197 sources of soybean, 260, 76 and 174 were identified as resistant to the cercospora, septoria, bacterial wilt and perenospora respecitviely.

Discussion

The problem of soybean production, which is the source of food and feed protein, is of global importance. Scientists face the challenge of combining different genetic traits in one plant to achieve optimal productivity and resistance to various stress conditions. The development of such genotypes is a priority to ensure sustainable and efficient soybean production and meet food and feed protein needs.

In Kazakhstan, the main focus of breeding research on soybeans was to increase yield [2, 10, 21]; identify drought-resistant forms [21], and create early maturing varieties for the eastern regions and ultra-early maturing cultivars for northern Kazakhstan [21]. At the same time, research related to the creation of resistant forms of soybeans to diseases has been carried out insufficiently, and this direction is new in soybean breeding in Kazakhstan.

The main work in this area has been related to the identification of fungal pathogens of soybean diseases. Studies have determined that soybean is affected by 15 pathogens that can attack different parts of the plant, including stems, roots, leaves, beans, and whole plants.

Given the significant impact of diseases on the yield and quality of soybeans, more research on resistant forms to pathogens is necessary. It will make it possible to develop soybean varieties that will have improved resistance to fungal infections and resist various pathogens, which will significantly increase the productivity and sustainability of this crop in Kazakhstan.

Conclusion

Overall, 276 soybean cultivars from 25 countries were screened for field resistance to various pathogens. A total of 197 soybean sources with resistance to cercospora, 260 to septoria, 76 to bacterial wilt and 174 to perenospora were identified based on field data analysis. Among the studied samples, 24 soybean varieties of different origins showing a high degree of resistance to all pathogens were identified, which is only 8.79 % of those that were evaluated in the field in this experiment.

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ҚАЗАҚСТАНДА КЕҢ ТАРАЛҒАН АУРУЛАРҒА АС БҰРШАҚТЫҢ ЖАҢА СОРТТАР МЕН СОРТҮЛГІЛЕРДІҢ ФИТОПАТОЛОГИЯЛЫҚ СКРИНИНГІ

А.Д. Мәуленбай *, Н.Д. Курымбаева, Г.Ш.Ысқақова , М.Ж. Байгутов, А.М. Асраубаева, А.С. Рсалиев

ҚР ДСМ "Биологиялық қауіпсіздік проблемаларының ғылыми-зерттеу институты",
Гвардейский ктк, Қазақстан
*maulenbay.id@gmail.com

Аннотация. Мәдени өсімдіктерді өсіру алаңдарды кеңейту және ауыл шаруашылығы кәсіпорындарының табыстылығын арттыру стратегиясы шеңберінде майлы дақылдар, мәдени сояны қоса алғанда, елдегі аграрлық секторды дамыту үшін перспективалы бағыттардың бірі. Қазақстан мәдени сояны өндіретін үздік 20 елдің қатарына кіреді. Алайда, соя дақылдарына айтарлықтай зиян бірінші кезекте – саңырауқұлақ ауруларының қоздырғыштары. Әр түрлі бағалаулар бойынша, аурулардан соя өнімінің зардабы – 20-50% жетуі мүмкін. Бұл мақалада Жамбыл облысының құрғақ тау бөктеріндегі агроклиматтық аймақта сояның әлемдік коллекциясының тұрақтылығын зерттеудің далалық эксперименттері көрсетілген. Зерттеу үшін Шығыс Европадан, Батыс Европадан, Солтүстік Америкадан, Шығыс Азиядан және Қазақстаннан 276 сортүлгі қолданылды. Әлемнің 25 елінен келген сояның әртүрлі патогендерге далалық төзімділігі бойынша әлемдік коллекциясының скринингі негізінде 197 – Cercospora sojina, 260 – Septoria glycines, 76 – Pseudomonas solanacearum, және 174 – Peronospora manchurica қоздырғышына төзімділігі бар сояның көзі анықталды. Зерттелген үлгілердің ішінде барлық патогендерге жоғары төзімділік дәрежесін көрсететін әртүрлі шығу тегі бар сояның 24 сорт үлгілері анықталды, бұл осы экспериментте далалық скринингтен өткендер санының тек 8,79% құрайды.

Түйін сөздер: төзімділік; ас бұршақ; сортүлгі; септориоз; церкоспороз.

ФИТОПАТОЛОГИЧЕСКИЙ СКРИНИНГ НОВЫХ СОРТОВ И СОРТООБРАЗЦОВ СОИ К РАСПРОСТРАНЕННЫМ БОЛЕЗНЯМ В КАЗАХСТАНЕ

А.Д. Мауленбай *, Н.Д. Курымбаева, Г.Ш.Ысқақова , М.Ж. Байгутов, А.М. Асраубаева, А.С. Рсалиев

«Научно-исследовательский институт проблем биологической безопасности» МЗ РК, пгт Гвардейский, Казахстан
*maulenbay.id@gmail.com

Аннотация. В рамках стратегии диверсификации культурных площадей и увеличения прибыльности сельскохозяйственных предприятий, масличные культуры, включая сою, представляют собой перспективное направление для развития аграрного сектора в стране. Казахстан входит в топ 20 стран производителей сои. Однако, значительный ущерб посевам сои наносят в первую очередь – возбудители грибных болезней. По разным оценкам, потери урожая сои от болезней могут достигать 20–50%. В данной статье представлены полевые эксперименты исследования устойчивости мировой коллекции сои, в засушливом предгорном агроклиматическом регионе Жамбылской области. Для исследования использовались 276 сортообразцов из Восточной Европы, Западной Европы, Северной Америки, Восточной Азии и Казахстана. На основе скрининга мировой коллекции сои из 25 стран мира по полевой устойчивости к различным патогенам, выявлено всего 197 источников сои с устойчивостью к возбудителю церкоспороза, 260 – септориоза, 76 – бактериального увядания и 174 – ложной мучнистой росы. Среди изученных образцов выделено 24 сортообразца сои различного происхождения, проявляющих высокую степень устойчивости ко всем изученным патогенам, что составляет всего лишь 8,79 % от числа тех, что прошли полевую оценку в данном эксперименте.

Ключевые слова: устойчивость; соя; сортообразцы; септориоз; церкоспороз.