Eco. Env. & Cons. 23 (2) : 2017; pp. (1211-1218)
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ISSN 0971–765X

Identification of germplasm of Wheat on leaf rust *(Puccinia recondita* Rob. ex Desm. f.sp. *tritici)*

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(Received 17 January, 2017; accepted 23 March, 2017)

ABSTRACT

Leaf rust is the most common and dangerous disease of wheat. Despite comprehensive studies of leaf rust *(Puccinia recondita* Rob. ex Desm. f.sp. *tritici)*, protection of wheat from this disease is still relevant. In order to determine resistance to leaf rust under field and laboratory conditions, phenologic, phytopathological and genetic studies were conducted on 55 varieties of wheat and 40 isogenic lines of the variety Thatcher. Out of above-mentioned varieties of wheat, 4 (Alikhan, Akdan, Koksuand Krasnovodopadskaya-25) were selected that showed results by all features. During the screening of the population on isogenic lines for leaf rust the best results were demonstrated by lines RL6010 (*Lr9*), RL6079 (*Lr28*), RL6040 *(Lr19*), RL6084 (*Lr19*), RL6008 (*Lr17*), RL6009 (*Lr18*), RL6012 *(Lr23)*, RL6064 (*Lr24*) and RL6144 (*Lr45*). These valuable genotypes will be recommended for use in selection as a valuable source material in releasing leaf rust resistant varieties in the future.

Key words : *Wheat, Isogenic line, Resistant genes, Genotype, Leaf rust, Pathogen.*

Introduction

Kazakhstan is one of the great wheat producers in Central Asia. Currently Kazakhstan steadily produces 16-18 million tons of wheat yield, half of which are used for domestic needs. The bread consumption in the region is very high (45%-60% of daily calories come from wheat), making wheat a very important crop. Resistance to leaf and stripe rusts is the most important objectives in our region and the major factor that adversely affects wheat yield, quality and finally causes considerable economic damage. Yield losses reach 30%-50% in epidemic years. The FAO data indicate that annual yield losses from diseases may reach up to 10% of the world wheat production (Zjivotkov *et al.*, 1989).

Leaf rust occurs to some extent wherever wheat is grown. Losses in grain yield are primarily attributed to reduced floret set. In severe epidemics with moisture stress, shriveling of the grain occurs. In rare genotypes, florets, tillers, and plants can be killed by early (pre-heading) epidemics. Losses due to leaf rust are usually small (10%), but can be severe (30% or more) (Roelfs *et al.*, 1992). Yield losses in wheat from *P. recondita* infections are usually the result of decreased numbers of kernels per head and lower kernel weight. *P. recondita* is now recognized as an important pathogen in wheat production worldwide, causing significant yield losses over large geographical areas (Kolmer, 2005; Roelfs *et al.*, 1992; Saari and Prescott, 1985). Despite the unfavorable spring and summer, leaf rust has survived and

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spread in winter wheat growing areas of southern Kazakhstan, Uzbekistan and Kyrgyzstan in 2004-2010. During 2007-2010, the most widely grown high yielding, not only spring but also winter wheat cultivars had severe leaf rust. In the period between 2001 and 2007 in north Kazakhstan, epidemic development of *Puccinia recondita* Rob. exDesm. f.sp. *tritici*. occurred four times (2002, 2003, 2005, and 2007). In 2006, leaf rust appeared under severe development of *Septoria nodorum* (Koyshibayev and Ponomaryeva, 2008).

On a world-wide basis, the primary host of *P. recondita* is hexaploid common wheat (Roelfs *et al.*, 1992). *P. recondita* also occurs on tetraploid durum (*T. turgidums* sp. Durum), wildemmer (*T. dicoccoides*), domesticated emmer wheat (*T. dicoccon*) and triticale (*X. triticosecale*). In Israel a form of *P. recondita* that is not found on wheat has been found in limited areas on the diploid species, Aegilopsspeltoide (Yehuda *et al.*, 2004). Cytological work by Allen (1926) first described the process of *P. recondita* infection and development in wheat. Urediniospores are deposited by wind or rain on either side of the wheat leaf. Urediniospores imbibe water, swell and develop a germ tube after coming into contact with a film of moisture such as dew or light rain on the leaf surface. Germination occurs after 4–8 h at 20 ºC under 100% humidity (Hu and Rijkenberg, 1998; Zhang and Dickinson, 2001; Zhang *et al.*, 2003)

P. recondita can survive the same environmental conditions that the wheat leaf survives, provided infection but no sporulation has occurred. The fungus can infect with dew periods of 3 hours at temperatures of about 20°C, however, more infections occur with longer dew periods. At cooler temperatures, longer dew periods are required, for example at 10°C a 12-hour dew period is necessary. Few if any infections occur where dew period temperatures are above 32°C (376) or below 2°C (Roelfs *et al.*, 1992). At 7–10 days after inoculation, the mycelium growing in susceptible wheat leaf tissue gives rise to uredinia that produce dikaryoticurediniospores. Orange–red urediniospores are released when uredinia rupture the epidermis. The released urediniospores impart the characteristic 'rusty' appearance to leaves. In highly susceptible hosts, secondary uredinia form in a small oval around the primary pustule (Schafer 1987). Even at 16 days postinoculation, less than 1% of host cells have died as a result of infection 7(Allen 1926).

According to the catalogue of gene symbols, about 80 leaf rust resistant genes are known by now (McIntosh *et al*. 2011). Unfortunately, the effect of genes on resistance to the disease is different in different geographical regions across the globe. Therefore, identification of effective genotypes and donors specific for different sowing regions and implementation them onto selection process is the key issue at the moment.

Materials and Methods

Research work was conducted in the field of Kazakh Research Institute of Agriculture and Plant growing in Almalybak village of Almaty area and in the laboratory of genetics and breeding of Institute of Plant Biology and Biotechnology. As a research object were taken 55 varieties of winter wheat (*Triticum aestivum* L.) permitted to sow within Kazakhstan territory and 40 isogenic lines of the variety Thatcher taken from Turkey Seed Gene Bank of Turkey Field Crops Central Research Institute in Ankara, Morocco-55 was chosen as a control variety. As an epidemic material was used the local population of the causative agent (*Puccinia recondita*) of leaf rust collected from the field of Kazakh Research Institute of Agriculture and Plant growing. At the screening for resistance to leaf rust, 2 indicators were evaluated: the type of reaction and the degree of leaf damage. In the experiments to assess the resistance to leaf rust in the early phase of vegetation under climatic chamber conditions, the Stakman *et al.* scale was used (1962) (Stakman *et al.*, 1962). Following this method, 7 varieties of reaction type of infection were examined:"0" – Immune, No visible uredia; ";"- Very resistant, Hypersensitive flecks; 1 – Resistant, Small uredia with necrosis; 2 – Resistant to moderately resistant, Small to medium sized uredia with green islands and surrounded by necrosis or chlorosis; 3 – Moderately resistant, Medium sized uredia with or without chlorosis; 4 – Susceptible, Large uredia without chlorosis; X– Resistant, Heterogeneous, similarly distributed over the leaves (McIntosh *et al.*, 1995).

During the studying, the resistance of plants to individual types of rust, fraction of the leaves was used, placed into a benzimidazole solution that supports their metabolism (Mikhailova and Kvitko, 1979). For this purpose, 7 to 10-day-old leaves with the length of 3-5 cm were spread in cuvettes in rows or onto a layer of cotton wool soaked with 0.004%

benzimidazole solution. The leaves of different varieties were laid in close proximity to each other. The ends of the segments were covered with cotton rolls, also moistened with benzimidazole solution. The infection was carried out by spraying with an aqueous suspension of Urediniospore by means of a spray gun. After the inoculation, the cuvette was tightly closed with glass, kept for 10-15 hours in scattered light, which promotes better germination of the spores, and then placed under fluorescent lamps. Under the laboratory conditions, studies on the resistance to leaf rust were carried out using a benzimidazole reagent and light installations according to the method of Mikhailov and Kvitko, (1979).

Phytopathological evaluation of resistance to leaf rust of experimental wheat material was carried out by the method of McIntosh *et al.* (1995). The percentage of infection spread and the infectious type of disease were determined according to this method (0 - immune, R - resistant, MR - moderately stable, MS - moderately susceptible, S - susceptible). The variety of wheat Morocco-55 will be exploited as a universally receptive standard and variety Steklovidnaya-24 as a receptive local standard.

By using the Green Seeker instrument (Trimble Navigation Limited, USA), by means of the light emission at two wavelengths and by measuring the reflected light from the leaf surface of plants the biomass index of plants (NDVI – Normalized Difference Vegetative Index) was identified. Green Seeker emits red and near infrared rays, which, reflected from plants, gets on the photodiode located at the head of the sensor. The NDVI indicator can be used to monitor crop conditions, identify potential yields, and establish stress factors, the impact of pests and diseases. Obtained data are NDVI index for a given plant, which ranges from 0.00 to 1.0, and the higher the index, the higher the resistance to disease and the less the need for nitrogen feeding (depending on variety, culture, etc.) (Chu *et al.*, 2007).

Results

The aim of the research is to define leaf rust resistant varieties and genotypes of wheat in the east-south Kazakhstan and offer them as parental forms during the selection process. Therefore, screening was done in natural and artificial environments for leaf rust on isogånic lines of the variety Thatcher (Table 1). According to the results of the experiment, disease resistance and susceptible genes were identified.

When first signs of the disease of susceptible control varieties in the natural field conditions manifested, phytopathological evaluation was given on leaf rust for samples by the method of McIntosh *et al*. (1995). Based on the results of the study, having immune to leaf rust 20 isogenic lines of wheat that showed 0-type of infection were identified. RL6007 *(Lr3ka)*, RL6010 *(Lr9)*, RL6011 *(Lr12)*, RL4031 *(Lr13)*, RL6052 *(Lr15)*, RL6005 *(Lr16)*, RL6008 *(Lr17)*, RL6008 *(Lr17a)*, RL6009 *(Lr18)*, RL6040 *(Lr19)*, RL6092 *(Lr20)*, RL6043*(Lr21)*, RL6012 *(Lr23)*, RL6084 *(Lr25)*, RL6078 *(Lr26)*, RL6079 *(Lr28)*, RL6080 *(Lr29)*, RL6058 *(Lr34)*,

RL6147 *(Lr44)* and RL6144 *(Lr45)*. The rest of the isogenic lines demonstrated susceptibility to leaf rust or medium resistance to the disease due to infection rate, which was between MS – S.

At the early stage of ontogenesis, which is the seedling phase, isogenic lines of the variety Thatcher were tested in the laboratory conditions to leaf rust resistance. Firstly, uredospores of leaf rust collected from the local arable lands were propagated by the benzimidazole method (Mikhailova and Kvitko, 1979). The length of leaves of 8-9 days old wheat samples were cut by 4 cm and put into cuvettes in order, then, in accordance with the method, they were infected with uredospore of leaf rust by sprinkling. (Figure 1-2) (Mikhailova and Kvitko, 1979). After infecting, to create comfortable conditions for the development of phytopathogens, the leaves were left in dark climate camera with 19^{o}C temperature for 15 hours, and then left for 8 days under the 2,500-3,000 lux light. After 7 days of inoculation, tiny spores surrounded by necrosis appeared on leaves, whereas rounded uredospores clearly could be observed on the leaves. Samples were twice evaluated by Stakman *et al*., (1962) (McIntosh *et al.,* 1995) scale,

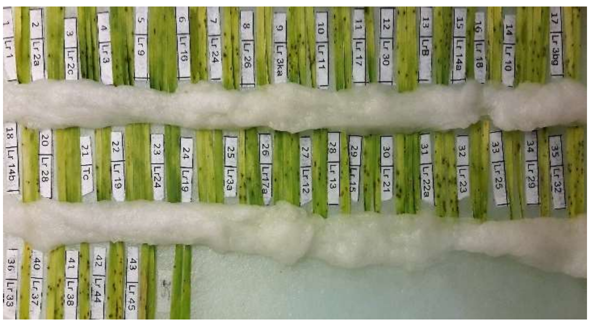

Fig. 1. Isogenic lines of the variety Thatcher infected by leaf rust in the laboratory conditions

in order to identify contamination types and grades by the leaf rust fungus. As the experiment results showed, isogenic lines could be divided into 6 groups by the contamination types (Table 1). As demonstrated in Table 1, with the 0 score reaction to the disease, high resistant RL6010 (Lr9) and RL6079 *(Lr28)* isogenic lines could be confidently considered as the immune (Table 1, Figure 1). Due to the presence of only vulnerable spots on leaves of the lines RL6040*(Lr19)* and RL6084*(Lr19)*, it was identified that they were leaf rust resistant. During the experiment, on leaves of the lines RL6008*(Lr17)*, RL6009

Table 1. Screening of isogenic lines of the variety Thatcher on leaf rust.

Differential	Source	References	Genes	Leaf rust resistance in field conditions		Seedling resistance to wheat leaf rust	
				I	II	I	II
RL6003	Malakof	Ausemusetal. (12)	*Lr 1*	20MS	30S	3	3
RL6016	Webster	DyckandSamborski (94)	*Lr 2a*	20MS	50S	3	3
RL6047	Brevit	DyckandSamborski (94)	*Lr 2c*	10MS	20S	3	3
RL6002	Democrat	HaggagandDyck (128)	*Lr 3*	10MS	40S	4	4
RL6002			*Lr3a*	10MS	40S	3	4
RL6007	KleinAniversario	HaggagandDyck (128)	*Lr 3ka*	0	0	3-4	4
RL6042	Bage	HaggagandDyck (128)	*Lr 3bg*	0	20S	3	4
RL6010	*Triticumumbellulatum*	*Solimanetal. (360)*	*Lr 9*	0	0	0	0
RL6004	*Lee*	*Choudhuri (68)*	*Lr 10*	30MS	70S	4	4
RL6053	Hussar	Solimanetal. (361)	*Lr 11*	40S	100S	1	3
RL6011	Exchange	Dycketal. (96)	*Lr 12*	0	0	3	4
RL4031	Frontana	Dycketal. (96)	*Lr 13*	0	0	3	4
RL6013	Hope	DyckandSamborski (93)	*Lr 14a*	10MS	20S	3	4
RL6006	Bowie	DyckandSamborski (93)	*Lr 14b*	0	10MS	3	3
RL6052	Kenya 1-12 E-19-J	LuigandMcintosh (212)	*Lr 15*	0	0	4	4
RL6005	Exchange	DyckandSamborski (92)	*Lr 16*	0	0	3	4
RL6008	KleinLucero	DyckandSamborski (92)	*Lr 17*	0	0	x	x
RL6008			*Lr17a*	0	0	3	4
RL6009	Africa 43	DyckandSamborski (92)	*Lr 18*	0	0	x	x
RL6040	*Agropyronelongatum*	*SharmaandKnott (341)*	*Lr 19*	0	0	;	;
RL6092	Thew	Browder (50)	*Lr 20*	0	0	3	4
RL6043	*T. tauschii*	*RowlandandKerber (324)*	*Lr 21*	0	0	3	4
RL6044	*T. tauschii*	*Rowland and Kerber (324)*	*Lr 22a*	10MS	30S	3-4	4
RL6012	Gabo	Mcintosh and Dyck (237)	*Lr 23*	0	0	õ	õ
RL6064	A. *elongatum*	Browder (51)	*Lr 24*	10MR	30S	1	1
RL6084	Rosenrye	Driscoll and Anderson (83)	*Lr 25*	0	0	;-1	;
RL6078	Imperialrye	Singhetal. (348)	*Lr 26*	0	0	3	4
RL6079	*T. speltoides*	*Mcintoshetal. (246)*	*Lr 28*	0	0	0	0
RL6080	A. *elongatum*	Sears (337)	*Lr 29*	0	0	2	3
RL6049	Terenzio	DyckandKerber (89)	*Lr 30*	0	20MS	3	4
RL6086	*T. tauschii*	Kerber (171)	*Lr 32*	0	20MS	3	3
RL6057	PI58458	Dycketal. (91)	*Lr 33*	0	10MS	3	3
RL6058	Terenizo	Dyck (87)	*Lr 34*	0	0	3	4
RL6082	*T. speltoides*	Unpublished	*Lr 35*	20MS	70S	3	4
ER84018	*T. speltoidesý*	Unpublished	*Lr 36*	10MS	40S	3	3
RL6081	*T. ventricosa*	*Unpublished*	*Lr 37*	0	30S	3	4
RL6097	A. *intermedium*	Unpublished	*Lr 38*	5MR	40S	3	4
RL6147			*Lr 44*	0	0	3	4
RL6144			*Lr 45*	0	0	2	2
RL6051	Brevit	Unpublished	*LrB*	0	40S	3	4
Thatcher			*Tc*	20MS	40S	2-3	3
Morocco-55				40S	80S	3	4

(Lr18) and RL6012 *(Lr23)*, tiny and large (Heterogeneous) pustules were noticed, which indicated X reaction type resistance of the lines to diseases. The line RL6064 *(Lr24)* distinguished with 1 reaction type to leaf rust, fully being considered as a leaf rust resistant, and isogenic line RL6144 *(Lr45)* with 2 type of infection showed moderate resistance to the disease. On the rest of the moderate susceptible and susceptible isogenic lines of the wheat, infection developed intensively (infection score was between 3 and 4).

Discussion

One of the effective ways to fight dangerous pathogens of wheat is to produce the varieties of wheat, with the resistant genes in genotype that are immune to diseases and have high productivity, which will prevent the reduction of the productivity, and improve grain quality.

Phenological and phytopathological controls were conducted on variety samples of the grain grown in field conditions. As a result of phonological observation, among samples tested in the field conditions, the varieties such as Bulava,

Dinara, Intensivnaya, Karaspanand Koksu were more short-season, their heading stage took place in the period since May 18 to June 1, which is 2-3 days earlier than standard Almaty. In southeast regions of Kazakhstan, estimation for diseases for winter wheat starts during the milky ripeness phase of the wheat. According to Terrapin's data, during the milky phase of wheat, 10-25% of the wheat was infected by leaf rust, consequently, the productivity of crops was reduced by 0.8-4,5%. If leaf rust infects wheat during branching then productivity will be 36-47,2%, during branching and heading stage infection rate will be 50-75%, then the productivity consequently will be reduced by 18.5-27.9% (Turapin and Mostovoi, 1995). As immune, 29 varieties were identified by the results of phytopathological examination conducted in the field conditions: Alikhan, Akdan, Aniya, Batyr, Botagoz, Bezostaya-1, Dinara, Farabi, Kazakhstanskaya-10, Karaspan, Karlygash, Koksu, Konditerskaya, Krasnovodopadskaya-25, Maira,

Naz, Nureke, Odesskaya-120, Prezident, Ramin, Rasad, Sultan-2, Steklovidnaya-24, Yubileinaya-60, Yuzhnaya-12, Zhalyn, Zhadyra and Zhetisu. The varieties Daulet, Intensivnaya and Raminal that had infection index of between 5-10 MR demonstrated moderate resistance to leaf rust. The rest of the varieties, which showed infection index between MS-S, were susceptible or moderate resistant (Table 1).

In the selection of wheat, the NDVI indicator is used to monitor the state of sowing, to determine the potential yield, to establish stress factors, the impact of pests and diseases. Index indicator of plant biomass is estimated during the heading stage. Showing 0.75-0.83, this indicator was high in varieties Almaly, Alikhan, Akdan, Arap, Egemen, Matay, Naz, Raminal, Sapaly, Sultan-2, Yubileinaya-60 and Yuzhnaya-12. In the next step of the research, the seedling resistance of the varieties to leaf rust in the artificial infectious environment was tested by the benzimidazole method. Among 55 varieties of wheat that were researched in accordance with the results demonstrated in Table 2, the variety named Alikhan was found immune to the disease, because on the leaves of that variety some signs of diseases were noticed. Due to the spots (necrosis) on the leaves, the variety Akdanwas was found to be the most resistant to the disease, and there was a strong evidence of identifying the variety Koksu as resistant to the leaf rust as the variety showed 1 score reaction to the disease. The varieties Alatau, Almalyand Krasnovoopadskaya-25 were found to be moderate resistant to the disease with 2 point indicator of infection.

In the adaxial part of leaves of the varieties of wheat large spores were clearly seen and identified as disease susceptible (3-4 type of infection), these variety samples are considered to be susceptible to the disease in the area where they were researched (Table 2, Fig. 2).

Conclusion

In the field conditions leaf rust for winter wheat

Fig. 2. Winter wheat varieties infected by leaf rust in the laboratory conditions

Table 2. Phenological and phytopathological screening on leaf rust of wheat varieties in the field and artificial infectious conditions

Varieties	Origin	Date of earing	Leaf rust resistance in field conditions		NDVI*	Seedling resistance to leaf rust	
			I	II		I	II
Almaly	KAZ	25.05.2015	10MS	30MS	0.76	1	2
Alatau	KAZ	24.05.2015	15MS	20MS	0.71	2	2
Alikhan	KAZ	22.05.2015	0	0	0.76	0	0
Akterekskaya	KAZ	23.05.2015	5MR	20MS	0.69	2	2-3
Akdan	KAZ	25.05.2015	0	0	0.77	;	;
Aniya	KAZ	26.05.2015	0	0	0.73	2	2-3
Arap	KAZ	26.05.2015	40MS	40S	0.77	2	3
Batyr	KAZ	24.05.2015	0	0	0.71	2	3
Bayandy	KAZ	25.05.2015	20MS	0	0.68	2-3	3
Botagoz	KAZ	25.05.2015	0	0	0.72	2-3	3
Bogarnaya-56	KAZ	28.05.2015	5MR	20S	0.68	2-3	3
Bulava	RUS	20.05.2015	10MS	10MS	0.62	2-3	3
Bezostaya-1	RUS	24.05.2015	0	0	0.69	2-3	3
Dastan	KAZ	25.05.2015	10MS	20MS	0.70	2	3
Derbes	KAZ	23.05.2015	15MS	20MS	0.55	2-3	3
Daulet	KAZ	21.05.2015	5MR	5MR	0.69	2-3	3
Diana,	KAZ	22.05.2015	15MS	20S	0.66	2-3	3
Dinara	KAZ	20.05.2015	0	0	0.66	;-1	2-3
Egemen	KAZ	28.05.2015	0	20MS	0.77	;-1	2-3
Egemen-20	KAZ	25.05.2015	10MS	10MS	0.73	;-1	2-3
Intensivnaya	KGZ	19.05.2015	5R	5R	0.67	;-1	2-3
Farabi	KAZ	29.05.2015	0	0	0.70	2	3
Kazakhstanskaya-10	KAZ	27.05.2015	0	0	0.74	;-1	2-3
Karabalykskaya-101	KAZ	26.05.2015	5R	20MS	0.67	2	3
KarabalykskayaOst	KAZ	30.05.2015	10MR	20MS	0.73	2-3	3-4
KarabalykskayaOzimaya	KAZ	31.05.2015	0	20MS	0.72	2-3	4
Karasai	KAZ	26.05.2015	0	20MS	0.73	1	3
Karaspan	KAZ	18.05.2015	0	0	0.65	2	3
Karlygash	KAZ	24.05.2015	0	0	0.74	2	3
Koksu	KAZ	20.05.2015	0	0	0.71	;-1	;-1
Konditerskaya	KAZ	01.06.2015	0	0	0.75	1-2	3
Krasnovodopadskaya-25	KAZ	25.05.2015	0	0	0.71	;-1	1-2
Krasnovodopadskaya-210	KAZ	25.05.2015	0	20MS	0.74	;-1	3
Maira	KAZ	27.05.2015	0	0	0.70	1	2-3
Matay	KAZ	26.05.2015	40S	70S	0.77	2	3
Mereke-70	KAZ	27.05.2015	10MS	20MS	0.74	1-2	3
Mereke-75	KAZ	24.05.2015	10MR	40S	0.64	1-2	3
Mironoskaya-808	UKR	01.06.2015	0	15MS	0.75	2	3
Naz	KAZ	21.05.2015	0	0	0.76	2	3
Nureke	KAZ	25.05.2015	0	0	0.72	2	3
Odesskaya-120	UKR	24.05.2015	0	0	0.71	2	3
Prezident	KAZ	26.05.2015	0	0	0.75	2	3
Ramin	KAZ	25.05.2015	0	0	0.71	1-2	2-3
Raminal	KAZ	26.05.2015	0	10MR	0.76	1-2	3
Rasad	KAZ	26.05.2015	0	0	0.75	;	3
Rausin	KAZ	25.05.2015	30MS	60S	0.73	2	3
Reke	KAZ	24.05.2015	30MS	40S	0.68	;-1	2-3
Sapaly	KAZ	24.05.2015	40S	60S	0.77	;-1	2-3
Sultan-2	KAZ	01.06.2015	0	0	0.83	;-1	3
Steklovidnaya 24	KAZ	25.05.2015	0	0	0.74	;-1	3

Table 2. *Continued ...*

Varieties	Origin	Date of earing	Leaf rust resistance in field conditions		NDVI*	Seedling resistance to leaf rust	
			I	II		I	II
Yubileinaya 60	KAZ	30.05.2015	0	0	0.77	2	3
Yuzhnaya-12	KAZ	01.06.2015	0	0	0.78	2	3-4
Zhalyn	KAZ	23.05.2015	0	0	0.71	1-2	3
Zhadyra	KAZ	31.05.2015	0	0	0.74	;-1	3
Zhetisu	KAZ	26.05.2015	0	0	0.74	2	3
Morocco-55		25.05.2015	40S	80S	0.66	3	3-4

* Index biomass indicator of plant

starts during the heading stage of wheat. Based on phenological observation, among the samples, the most short-season were varieties Bulava, Dinara, Intensivnaya, Karaspanand Koksu. As a result of phytopathological analysis of leaf rust, 29 varieties were found to be immune to leaf rust and did not show any signs of the disease on the leaves, also 20 lines of isogenic lines of the variety Thatcher were identified as immune to leaf rust in the fields. The varieties Almaly, Alikhan, Akdan, Arap, Egemen, Matay, Naz, Raminal, Sapaly, Sultan-2, Yubileinaya-60 and Youzhnaya-12 demonstrated high results with biomass index of a plant between 0.75-0.83.

Screening of isogenic lines of the varieties for leaf rust resistance was done in the artificial infectious environment, screening of the variety Thatcher - in the laboratory conditions. Thus, resistant genes were identified in the genotype of wheat.

As a result of the research, the lines RL6010 *(Lr9)*, RL6079 *(Lr28)* and variety Alikhan were immune to the disease, because of the presence of the *Lr9* or *Lr28* genes that were responsible for immunity this variety might be resistant to the leaf rust, also the lines RL6040 *(Lr19)* and RL6084 *(Lr25)*and variety AKDAN showed high resistance, therefore Akdan might have the genes responsible for resistance to leaf rust such as *Lr19* and *Lr25*. The line RL6064 *(Lr24)* and the variety Koksu with 1 reaction type showed resistance to the disease, it could be assumed that the variety Koksu could be resistant to the disease due to its gene *Lr24* which was responsible for resistance. It was observed that the varieties Almaly, Alatau, Krasnovodopadskaya-25 and the isogenic line RL6144 *(Lr45)* were moderate resistant to the disease, therefore they might have *Lr45* gene that was responsible for moderate resistance to the disease. As a result of the research dedicated to the resistance of the wheat germplasm to leaf rust, beneficial donors and advanced lines of wheat were identified. Valuable genotypes were included in the hybridization program.

Acknowledgments

The authors would like to thank the members of the laboratory of the Institute of Genetics and Selection of Plant Biology and Biotechnology, Department of the Gene Pool of the Kazakh Research Institute of Agriculture and Plant growing for promoting research.

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