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INTRASPECIES DIVERSITY AND ECOLOGICAL-GENETIC POTENTIAL (*T. BOEOTICUM* BOISS.) ON SALT STRESS RESISTANCE

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Abstract

The genetic potential of economically valuable features at intraspecific (different variety) crossings has a certain limit. We need to search for new methods to enrich the genotype of wheat with new useful features. One of such methods is remote and interspecific hybridization.

According to many researchers, the samples of *T. boeoticum* have a high resistance to brown and yellow rust, partially to stem rust, dust brand and powdery mildew, although individual ecogeographical groups of wild eincorn are susceptible to fungal diseases. Because of this, it is very important to consider the possibility of hereditary diversity increase by salt tolerance in wheat due to the introgression of the genetic systems controlling this feature from closely related species.

The purpose of this work is to study the hereditary diversity in salt tolerance among specimens (*T. boeoticum*).

The material for research was represented by 80 samples (*T. boeoticum*) from the world collection of the All-Russian Institute of Plant Genetic Resources named after N.I. Vavilov, Russia.

Intermediate forms between cultivated and wild-growing types of wheat make it possible to use the useful features of wild-growing species in practice effectively.

Saline stable and saline-resistant forms are present in all eco-geographical groups, but the frequency of their occurrence is not the same.

Of 80 samples analyzed, a high degree of salt tolerance (from 92.9 to 95.1%) was noted only in two samples from Azerbaijan - k-28273 and k-30213. The number of medium-stable (intermediate) forms made 42 samples (48.4%), and the number of sensitive forms among this species was approximately the same as among the intermediate forms - 36 samples (45.2%).

Thus, the laboratory analysis of 80 samples of *T. boeoticum* of various ecological and geographical groups showed that *T. boeoticum* is characterized by a considerable variety of hereditary variants in terms of resistance to salt stress. The presence of such a huge intraspecific diversity allows us to select contrasting salt resistant forms that are of interest for genetic and selection studies.

Key words: Intraspecies diversity, genetic potential, wheat, salt tolerance.

Introduction

Currently, the selection of soft wheat has reached such a level, when its potential yield depends on the resistance of cultivated varieties to unfavorable abiotic and biotic factors of the environment in many respects. You can solve this problem by creating the varieties that combine high-productivity genetic structures with the systems that ensure minimum crop losses from the impact of negative factors. "The provision with complex resistance of varieties and hybrids to the action of biotic and abiotic stresses should be the main goal of integrated selection and agrotechnical programs" (Zhuchenko).

The genetic potential of economically valuable signs at intraspecific (inter-variety) crossings has a certain limit. We need to search for new methods enriching the genotype of wheat with new useful features. One such method is remote and interspecific hybridization.

It is known that many types of wheat have no production value, but they have a significant reserve of useful genes.

The knowledge of the botanical composition of wheat shows that most wild species (*T. boeoticum*, *T. urartu*,

T. araraticum, *T. dicoccoides*) and cultivated membranous (*T. Monoco* ccum, *T. macha*, *T. zhukovskyi*, etc.) is not involved in selection. Ancient film species, which possess valuable features for modern selection (high protein content in grain, early maturity, complex resistance to fungal diseases, drought resistance, cold resistance, etc.) are involved in crossing weakly. The species *T. timopheevii*, which are remarkable for their immunity, and its eincorn analogue - a new species of *T. militinae*; the cold-resistant species *T. persicum* immune to powdery mildew; artificially created octaploid species *T. fungicidum* resistant to diseases and others are involved in crossing weakly.

According to many researchers, the samples of *T. boeoticum* have a high resistance to brown and yellow rust, partially to stem rust, dust brand and powdery mildew, although individual ecogeographical groups of wild eincorn are susceptible to fungal diseases [Vavilov, (1940), Zhukovsky (1971)]. Because of this, it is very important to consider the possibility of hereditary diversity expansion by salt tolerance in wheat due to the introgression of genetic systems controlling this feature from closely related species [Shikhmuradov (2014), Shikhmuradov (2011)]. At the first stage of the work, it is necessary to estimate the range of variability in salt tolerance among the samples (*T. boeoticum*) and to isolate the forms that are promising for introgressive hybridization.

The purpose of this work is to study the hereditary diversity in salt tolerance among the specimens (*T. boeoticum*).

Study Materials and mrethods

The work was carried out at the Dagestan experimental station VIR. The material for research was 80 samples (*T. boeoticum*) from the world collection of the All-Russian Institute of Plant Genetic Resources named after N.I. Vavilov VIR.

Salt-resistance was studied by the laboratory method of VIR (1988) using the roll method [Udovenko *et al.*, (1988)]. For this purpose, the seeds of the specimens (40-50 pieces) were soaked in the water of Petri dishes at 22°C. After 72 hours, the germinated seeds were transferred to rolls of filter paper and placed in salt solutions (NaCl) (the concentration made 9.8 g/l, 0,7 MPa) and water (control). After 7 days, the length of the seedlings was measured. The ratio of the lengths of the experimental and control variants, expressed in percent, was considered as the indicator of sample salt tolerance (stability coefficient). The samples with the stability coefficient above 90% were considered as highly tolerant to NaCl, with the stability coefficient less than 60% - as sensitive; intermediate forms were referred to as medium-reactive.

The statistical processing of data was carried out according to Rokitsky (1978), Udovenko *et al.*, (1988) and Dospekhov (1985).

Reults and diiscussion

Wild Boeotian eincorn (*T. boeoticum* Boiss.) is timed to dry foothills and low mountains environmentally. It grows in the vast area of Western Asia (Transcaucasia, Iran, Turkey, Syria, Iraq, Israel, Jordan), as well as in the Crimea, on the Balkan Peninsula, mainly rising to 1,700 m above sea level. It has narrow, dense ears and spikelets with one or two awns. The way of life is winter, rarely spring one. In the Transcaucasus, it occurs in the Abovyan, Ararat, Yeghegnadzor districts of Armenia and in the Nakhichevan, Zangelan, Hadrout, Shemakha, and Divichin regions of Azerbaijan, and in the surroundings of Sevastopol and Feodosia in the Crimea [Mustafayev (1964)]. It has narrow, dense ears and spikelets with one or two awns. The way of life is winter, rarely spring one.

The useful features for selection include a high protein content in grain, which reaches 37%. The content of raw gluten reaches 57.5%, tryptophan - up to 207 mg per 100 g of grain; gluten is extensible. The quality of gluten in a wild eincorn is higher than that of *T. monococcum*. The survey of the VIR collection showed that the protein content in the grain of wild eincorn reaches 23-30.6% [Tyuterev, (1973)].

The use of wild eincorn features in cultivation is usually constrained by a strong spontaneous fragility of a spike rod and very difficult threshing.

In the studies they accumulated a large amount of factual material on interspecific crossings with *T. boeoticum*. The possibility of crossing with *T. monococcum* signifies genetic compatibility and their phylogenetic relationship. However, the genomes A and B in tetraploid species are genetically incompatible with wild eincorn.

The genetic incompatibility of the wild eincorn can not be an insurmountable obstacle in cultivation crossing. Thus, when triploid hard wheat hybrids and wild eincorn were used, the recrossing was carried out with solid wheat, the triploid bridge [Dorofeev, (1987)]. Thus, they performed the transfer of resistance to stem rust from wild eincorn to solid wheat.

Intermediate forms between cultivated and wild-growing types of wheat, make it possible to use the useful features of wild-growing species in practice effectively.

Saline-stable and saline-resistant forms are present in all ecogeographical groups (table 1), but the frequency of their occurrence is not the same.

Thus, stable and medium-stable samples are more often found in the areas with arid conditions and a

significant spread of saline soils (fig. 1).

Among 80 analyzed samples, a high degree of salt tolerance (from 92.9 to 95.1%) was noted only in two samples from Azerbaijan - k-28273 and k-30213 (table 2). The number of medium-stable (intermediate) forms was 42 samples (48.4%), and the number of sensitive forms in this species was approximately the same as in the intermediate forms - 36 samples (45.2%).

Table 1: The characteristic of the species *T. boeoticum* by salt tolerance (NaCl, 0.7 MPa) .

Resistance degree	% of resistance		Average % of resistance	No. of samples	% from total amount of samples
	min	max			
Highly tolerant	92,9	95,1	94,0	2	2,5
Intermediate	60,6	83,8	72,8	42	48,4
Sensitive	37,3	58,0	49,0	36	45,2
In total	37,3	95,1	63,4	80	100,0

Conclussions

The studies of the intraspecific hereditary diversity of *T. boeoticum* plant resistance from the world collection to NaCl have shown the presence of a large amplitude of variability in this feature, *i.e.* the system of *T. boeoticum* variability is very rich in this attribute and includes the genetic potential from unstable (10% - 40% as compared to the control at the salinity by NaCl 0.7 MPa) to highly stable samples (90% or more).

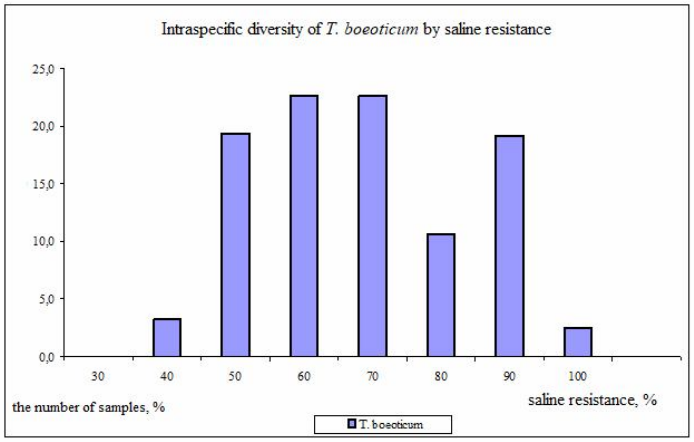

Fig. 1: Intraspecific diversity of *Ò. boeoticum* by saline resistance

Table 2: Distribution of *T. boeoticum* samples by salt tolerance depending on the origin

Origin	Number of samples	Resistance group		
		I	II	III
Azerbaijan	20	2	10	8
Armenia	14	-	8	6
England	1	-	-	1
Bulgaria	5	-	2	3
Germany	2	-	-	2
Greece	6	-	1	5
Iraq	3	-	2	1
Iran	6	-	4	2
Turkey	16	-	10	6
Ukraine	4	-	1	3
Russia (Crimea)	2	-	-	2
Japan	1	-	-	1
Total	**80**	**2**	**38**	**40**

Summary

Thus, the laboratory analysis of 80 samples of *T. boeoticum* of various ecological and geographical groups showed that *T. boeoticum* is characterized by a considerable variety of hereditary variants in terms of resistance to salt stress. The presence of such a huge intraspecific diversity allows us to select contrasting forms by salt tolerance that are of interest for genetic and selection studies.

Conflict of interests

The author confirms that the presented data do not contain a conflict of interest.

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