INFLUENCE OF ENVIRONMENTAL FACTORS ON BINDING OF HYBRID GRAINS OF INTERSPECIFIC WHEAT HYBRODS

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Annotation. According to the results of the study, it was found that the percentage of hybrid grain setting in inter specific wheat hybrids depends both on the genotypic characteristics of the crossing forms and on environmental factors. Therefore, the study of the influence of environmental factors on the setting of hybrid grains should be carried out in various climatic conditions that provide the maximum possible modification variability.

Key words: wheat, distant hybridization, selection, ecological factors, modification variability, genotype-condition interactions.

1. Introduction

One of the urgent problems of modern wheat breeding is the creation of varieties that can maximize the genetic potential of productivity in specific agro ecological zones. The solution to this problem is possible by inter specific hybridization of local ancient varieties of spring soft wheat with foreign varieties of winter durum wheat. This approach makes it possible to isolate hybrid combinations in which the desired genotypes can be selected with great efficiency. Therefore, the study of the issue of setting hybrid grains when crossing different chromosomal wheat species and the selection of promising genotypes for creating new varieties combining a complex of economically valuable traits and biological properties is very relevant.

In the scientific literature, there is a report that in inter specific wheat hybrids, seed setting depends on the direction of crossing and environmental factors. These results necessitate the search for a favorable ecological niche, in which it would be possible to assess the nature of the modification variability of grain setting in inter specific wheat hybrids. All this opened up the possibility of elucidating the nature of the variability of the setting of hybrid grains depending on the direction of crossing, the ecological-geographical origin of the species of the lifestyle of forms, as well as environmental factors, and the development on this basis of a special system of hybridization and plant cultivation in specific agro-ecological zones.

From all the above, it should be noted that in this direction, in Uzbekistan, the issues of the influence of environmental factors on the setting of grains of inter specific wheat hybrids are practically not studied. Therefore, the task of our research was to elucidate the influence of environmental factors on the setting of hybrid grains when crossing spring-winter different-chromosomal wheat species.

Field experiments were carried out in the steppe and foothill agro ecological zones. For crossing, seven local ancient varieties of spring soft wheat and three varieties of winter durum wheat were used as parental components, significantly differing in the complex of economically valuable traits.

At present, there has been a noticeable increase in interest in the distant hybridization of wheat as an effective factor in the natural and artificial form of plant formation [8, 9, 10]. This is explained primarily by the fact that the gene pool of cultivated wheat as a result of intensive selection has been significantly depleted and can no longer serve as a sufficient source of valuable genes when creating new varieties [5, 7]. This is especially true of genes for drought resistance and immunity to rust of highly productive varieties when cultivated in different soil and climatic zones. Therefore, the global trend in the field of genetics and wheat breeding is the expansion of the genetic variability of the Tritium aestivum L. species through the use of new highly efficient genes of local ancient varietal populations and similar aboriginal forms, which have preserved biologically valuable traits and properties [1-12].

The scientific literature available to us contains a lot of information about inter specific.

2. Materials and research methods

Field experiments on interspecific hybridization were carried out in 1910 - 1912. in two ecological points: steppe (710 m above sea level) and foothill (1320 m above sea level) zones located within the Samarkand region. The following four local ancient varietal populations of soft spring wheat were involved in inter specific hybridization: Watan (var. Graecum), Safedrozg (var. Graecum), K - 55579 (var. Tadjicorum), K - 56572 (var. Murgabicum) from the VIR collection and three varieties of durum winter wheat: Parus, Coral, Black Sea (var. Coerullescens) from Odessa.

Field experiments were carried out in two agro ecological (steppe - 450 m above sea level and foothill - 1320 m above sea level) zones differing in temperature, light and soil cover.

Hybridization was performed reciprocally. Castration of flowers within each zone was carried out from 8 am to

12 noon, at an average air temperature of 180C and a relative humidity of 70%. In 3 - 4 days after stigma maturation, pollination was carried out according to the method of P.P. Lukyanenko, i.e., male plants were placed in vessels with water and their ears were introduced under the isolator.

Within each genotype, 20-25 plants were castrated to obtain a sufficient number of hybrid seeds.

The experimental data were statistically processed by the analysis of variance [3].

3. Results and their discussion

In the studies of a number of authors it is noted that environmental conditions play an important role in the germination of pollen grains on the stigmas of pistils, fertilization and seed formation [2, 4, 6]. These results prompted us to search for a favorable ecological niche in which we could use it as a kind of natural climate chamber for assessing the modification variability of the setting of hybrid wheat grains and their reproduction.

Studies have shown that in the case of using hexaploid spring wheat as a parent form, the percentage of hybrid grain setting averaged 53 ± 2.9%, varying from 43 ± 4.0 (K - 55576 X Parus) to 61 ± 3.6% (Vatan X Coral). At the same time, in reciprocal crosses, the limits of variability in setting hybrid grains expanded much and averaged 73 ± 3.6%, varying from 66 ± 3.3 (Parus X Safedrozg) to 86 ± 2.7% (Black Sea X Safedrozg) (Table. 1). Based on these results, the question arises whether the setting of hybrid grains depends on the direction of crossing, the ecological and geographical origin of the variety samples, and environmental factors.

For a comparative assessment of the level of grain set in interspecific hybrids, vertical zoning created favorable conditions.

As a result of a comparative assessment of the grain setting in inter specific hybrids, a significant difference was found between the combinations of crossing and growing conditions.

However, it should be noted that, as we move from the conditions of high temperatures (steppe zone) to the conditions of relatively low temperatures (foothills), a decrease in the setting of hybrid grains was noted in all combinations of crossing. It should be noted that the reaction of hybrid combinations for the setting of grains to environmental conditions is possible with the temperature regime of the growing zones, which stimulates the flowering rhythm of plants.

In general, for all combinations of crossing, the average percentage of fertile flowers in the steppe zone was higher than in the foothill zone. At the same time, the decrease in the setting of hybrid grains from the steppe zone to the foothill zone was sharper. The response of five hybrid combinations to the growing conditions turned out to be of the same type, with the exception of the K - 56572 X Coral combination, in which the tying rate remained at the average level in the foothills, but the difference between the K - 55572 X Coral combination and the closest to it in terms of the degree of grain tying Vatan X Coral was insignificant (F = 0.89). Judging by the reaction of the four hybrid combinations to environmental conditions, there was a genotype - environment interaction.

Table 1

Setting of hybrid wheat grains depending on the crossing condition (on average over 2 years)

Crossing combination	Crossing combination					
	Stepnaya			Foothill		
	Pollinated flowers, pcs	Tying shredding grains, pcs	Fertil ness, %	Pollinated flowers, pcs	Tying shy grains, pcs	Fertil ness, %
Vatan X Коралл	140	85	61±3,6	162	75	46±3,1
K – 55579 X Chernomorskaya	180	95	53±2,8	176	80	46±4,1
Safedrozg X Chernomorskaya	230	118	51±3,2	240	105	44±4,2
K – 55576 X Parus	160	70	43±4,0	150	51	34±4,5
K – 56572 X Korali	175	101	58±4,6	165	90	55±4,6
The average			53±2,9			45±4,1
Reciprocal crosses						
Korall X Vatan	142	110	76±3,3	160	93	58±4,4
Chernomorskaya X K – 55579	181	130	72±3,5	178	105	59±4,3
Chernomorskaya X Safedrozg	235	201	86±2,7	136	93	68±3,4
Parus X K – 55576	160	105	66±3,3	148	62	50±3,8

Korall X K – 56572	178	120	67±3,1	150	101	67±3,3
The average			73±3,6			60±3,7

From the data in Table 1, it can be seen that in each of the growing zones, all the crossing combinations had a rather close number of hybrid grains set in an ear and a unidirectional change in the mean from zone to zone. Consequently, in this case, both indicators were ambiguous, and the results of the static analysis of one of them could be adequate to the results for the other.

From the data in Table 2 it can be seen that the presence of a variety of wheat cultivars involved in hybridization has a significant effect on the variability of the results of crossing. At the same time, the interaction of the genotypes of the parental forms turned out to be statically significant.

Table 2

Analysis of variance for the setting of hybrid wheat grains in two ecological zones

Reciprocal crosses	Number of degrees of freedom	Middle squares	Confidence criterion (F)	The power of influence%
Common wheat genotype	4	745,66	5,66	0,46
Durum wheat genotype	1	6,34	0,16	0,24
Interaction of genotypes X genotypes	4	230,41	6,42	
Random reasons	30	60,3	-	0,33

Note: ** reliability at P = 0.01

The obtained experimental data served as the initial one for revealing the significance of the influence of environmental factors on the variability of the setting of hybrid grains in each zone and establishing the role of genotypic diversity of wheat cultivars in the manifestation of this trait. From the data in Table 3, it can be seen that the setting of hybrid grains is most influenced by both the genotype of the hybrid and the conditions of hybridization, which is statistically significant the role of both factors. At the same time, the quantitative assessment of genotypes and the interaction of genotype X environment are comparable in magnitude. At the same time, modification variability accounts for almost half of the total observed variability of this trait. Hence, it should be noted that the setting of hybrid grains during inter specific hybridization of wheat is most influenced by environmental factors, in particular, the temperature and humidity of the air during the period of pollination and fertilization of plants.

A common feature for all hybrid combinations was the response to temperature growth zones. So, for example, under the conditions of the steppe zone, the temperature is 24-250C and humidity 70-75%, and in the foothills of 20-220C with a humidity of 60-70%, were optimal for obtaining a sufficient amount of hybrid grains (Table 4). However, pollination of castrated flowers under conditions of elevated (+ 29-300C) or low (16-170C) air temperature leads to a sharp decrease in the setting of hybrid seeds.

Table 3

Influence of genotypic diversity of F1 hybrids and environmental conditions on the setting of seeds

Source of variation	Number of degrees of freedom	Medium square	Confidence criterion (F)	Contribution share
Genotypes of F1 hybrids	8	798,12	13,28**	0,23
Conditions of the place of crossing	2	4693,16	79,87**	0,41
Interaction of genotypes X environment	18	239,09	4,05**	0,18
Random	82	58,48		0,3

Comparison within the dispersion complex showed that the average setting of hybrid grains in the steppe zone significantly differs from that in the foothills.

Table 4 shows the results of the setting of hybrid grains of inter specific wheat hybrids depending on temperature and humidity. It follows from the data in the table that during the wheat flowering period, the temperature regime in both zones turned out to be almost identical, and the setting of hybrid grains was different. Perhaps, in addition to the temperature and humidity of the air during the flowering and pollination period, the degree of grain binding is influenced by other environmental factors that we did not take into account in the experiment. On the other hand, analysis of the

morphological characteristics of plants showed that in the foothills the growth of plants was lower than in the steppe zone, the plant had a shorter ear, fewer flowers per ear, but bushiness was about the same as in the steppe zone and more abundant than in the middle mountains.

A visual comparison of the average hybrid grains for tying showed that within both zones, Vatan X Coral and K - 56572 X Coral could be attributed to the number of combinations with a relatively stable hybrid grain tying.

Judging by the results of crossing, the question arises whether the difference between the Vatan X Coral combination and other combinations is significant? To answer this question, within the framework of the dispersion complex, we compared the average values of the setting of hybrid grains of the combination of Vatan X Coral and K - 56572 X Coral (F = 34.46). On the other hand, Safedrozg X Chernomorskaya was compared with the closest to it in terms of tying with combinations K - 55576 X Parus. The difference turned out to be significant (F = 68.74).

Under the conditions of the steppe zone, an equally high setting of hybrid grains was noted in the combinations Vatan X Coral and K - 56572 X Coral. The smallest set of grains was found in the combination K - 5576 X Parus.

Table 4

Characteristics of meteorological indicators provided that the plant grows during wheat hybridization.

Zones	Average and range of air temperature variability, C^0			
	Maximum	Midnight	Average daily	Humidity, %
Stepnaya	30,1	22,1	24,6	71,6
	20,4:36,2	19,2:25,1	20,6:27,2	65-80
Mid-mountain	33,2	19,9	22,6	60,4
	29,1:36,0	19,8:22,7	22,1:24,3	44-63

It should be noted that the decrease in the setting of hybrid grains from the steppe zone to the foothills was very sharp. In this case, the response to hybridization conditions in five combinations was the same. The exception was the combination K - 56572 X Coral, in which the tying rate remained at the average level in the foothills, but the difference between the combination K - 55572 X Coral and the closest to it in terms of the degree of tying of grains Watan X Coral was insignificant (F = 0.89). In the foothills, relatively higher average setting of hybrid grains was revealed in the combination K - 56572 X Coral, and the lowest in K - 55576 X Parus.

Thus, the results of the conducted studies indicate that the involvement of various local varieties of common wheat in interspecific hybridization, it is possible to single out valuable combinations of hybrid grains differing in the setting of hybrid grains, regardless of the conditions of plant growing, which can be of practical importance for creating new varieties.

4. Conclusion

• Involvement of local ancient varieties of soft spring wheat with foreign varieties of durum winter wheat in inter specific hybridization allows obtaining a sufficient amount of hybrid grains in different ecological zones;

• The success of crossbreeding of different chromosomal wheat samples depends on the genotypic characteristics of the crossed varieties and environmental factors;

• To obtain a sufficient number of hybrid grains, it is advisable to castrate flowers at the optimum temperature (24-250C) and humidity (70-75%) air. Pollination of castrated flowers under conditions of high (+ 29-300C) or low (+ 170C) air temperature leads to a sharp decrease in the setting of hybrid seeds.

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