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THE CHARACTERISTICS OF FIRST GENERATION HYBRIDS OF WHEAT IN THE CONDITIONS OF DROUGHT

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ABSTRACT

In this work, we evaluated the genotypes, which allowed us to obtain flexible forms of the first generation and to study their physiological and biochemical characteristics, compared with the original parental forms. Wheat varieties were grown in two options of water availability: with optimal irrigation (control) and in limited irrigation (experience). To maintain moisture in the soil at a level of 70-75% during the growing season, irrigation was performed in control option. In the experimental version, the soil moisture was 45-50%. According to physiological, biochemical characteristics and yield, relatively drought-resistant varieties were isolated and carried out crossing between them. The content of chlorophylls and carotenoids was determined on spectrophotometer (SP-2000), the fluorescence on photosynthesis analyzer (PAM-Germany), and the photochemical activity of chloroplasts on polarograph (OH-103 Hungary). More drought-resistant plants among 20 wheat genotypes were identified. There had been given characteristics of the wheat varieties Barakatly, Qobustan, Garabach, Mirbashir and Shark, which have a higher combining ability, exhibit heterosis in F1 and allow to get the most valuable genotypes. Crossing between drought-resistant genotypes was carried out and hybrids of the first generation were obtained. According to physiological and biochemical characteristics, heterotic forms were revealed, their drought tolerance was studied. Wheat hybrids having the best physiological and biochemical parameters are recommended for further selection.

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INTRODUCTION

One of the abiotic factors that inhibit the growth, development and productivity of plants is drought. According to literary data, about 45% of the agricultural lands of the World were exposed to drought in some extent (Ashraf, Fooled, 2007). Under natural conditions, drought acts in conjunction with other biotic and abiotic factors, which enhances its effect on plant life processes. In the process of evolution, plants developed defense mechanisms against adverse environmental factors, including drought. There is a wide range of adaptation reactions to drought, which includes the synthesis of low molecular weight compounds, protective proteins and antioxidant enzymes. Low-molecular compounds such as proline and glycine betaine contribute to water retention in plant cells and ensure the normal course of life processes in the whole plant under conditions of water deficiency (Jones *et al*. 1980; Farooq *et al*. 2014).

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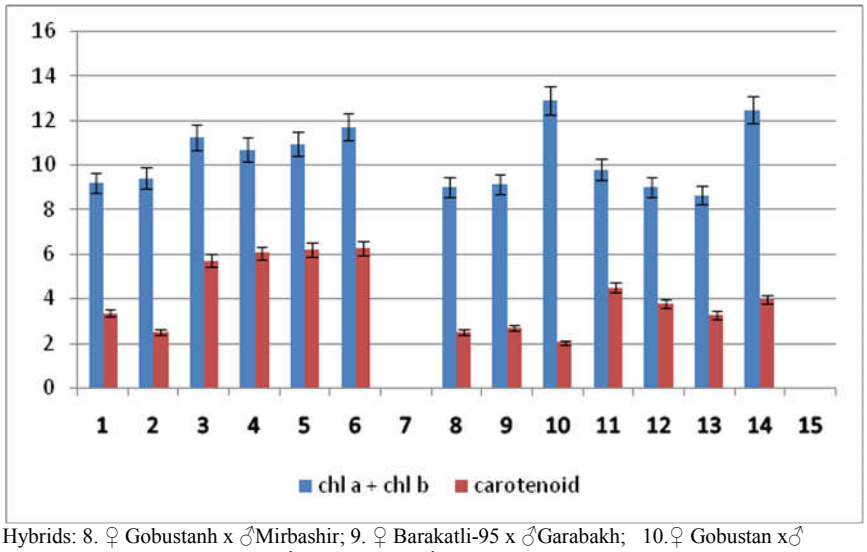
Plants are also capable to change of phenotype in drought conditions, limiting growth, leaf area, increasing root biomass and, ultimately, reducing the degree of injury in drought conditions (Richards at al.2010; Passioura 2012). Studies by Chinese scientists have shown that the selection of plants by morphological features, by architectonics, and their crossing has the potential to increase grain yield under drought conditions (Zhang *et al*., 1999; Li, Zhang, 2013; Li *et al*. 2014). With a favorable combination of components, high values of indicators are observed in F1 compared with parental forms. Assessment of combining ability has become an indispensable element of heterosis selection at the initial stages of the selection process (Drobysh, Taranukho, 2016, Kilchevsky, 1997). This is based on recently works that allow producing and introducing into production new highly productive varieties of wheat, tolerant to drought, to pathogenic and harmful substances, high qualities of grain, that were directed to increase quality and quantity of yield. In this work, we evaluated the genotypes, which allowed us to obtain flexible forms of the first generation and to study their



Hybrids: 8. ♀ Gobustanh x ♂Mirbashir; 9. ♀ Barakatli-95 x ♂Garabakh; 10.♀ Gobustan x♂ Gyrmyzygül; 11. ♀ Gobustan x ♂Garabakh; 12. ♂ Gobustan x ♀Garabakh; 13.♀ Garabah x Mirbashir;14. ♀ Garabakh x ♂ Shark.

Fig. The content of chlorophyll and carotenoids in the leaves of the parent and hybrid forms of wheat. Parents: 1. Gobustan; 2. Mirbashir; 3. Barakatli-95; 4. Karabakh; 5. Gyrmyzigül; 6. Shark

Table 1. Characteristics of F1 hybrids by the number of grains and the weight of seeds per spike

No	Gross breeding	Number of grains in the spike			Weight of grains in the spike, g		
		♀	♂	F_1	♀	♂	F_1
1.	Garabakh X Gobustan	30	64	26	0,9	2,5	1,3
2.	GobustanxBarakatly-95	64	65	71	2,5	2,6	2,7
3.	Gobustan x Girmizigul	64	42	36	2,5	1,8	1,6
4.	Barakatly 95X Gobustan	65	64	53	2,6	2,5	2,0
5.	Gobustan XGarabakh	64	65	42	2,5	2,5	1,9
6.	Garabakh XMirbashir	65	27	71	2,5	1,0	4,2
7.	Garabakh x Shark	65	37	53	2,5	1,8	2,9

Table 2. Effect of drought on the physiological and biochemical parameters of wheat plant hybrids

№	Hybrids	Chla+б mg/g	Carotenoid mg/g	Chloroplast activity mkmol O_2 / mg chl.min	Fv/Fm	Chla+б mg/g	Carotenoid mg/g	Chloroplast activity mkmol O_2 / mg chl.min	Fv/Fm
		CONTROL				DROUGHT			
1	♀Gobustan x♂Mirbashir	9,1	2,3	35,5	0,7	7,2	3,5	30,2	0,6
2	♀Baracatli-95x♂Garabakh	9,2	2,5	37,8	0,8	8,1	4,6	35,8	0,7
3	♀Gobustan x♂Girmizigul	12,9	2,0	43,2	0,7	7,6	3,4	30,6	0,6
4	♀ Gobustan x♂Barakatly 95	9,8	4,5	36,5	0,8	8,5	5,2	34,8	0,7
5	♂ Gobustan x♀Garabakh	9,0	3,7	36,2	0,7	6,7	3,9	32,1	0,6
6	♀Garabachx♂Mirbashir	8,6	3,3	30,9	0,8	8,7	4,8	28,9	0,7
7	♀Garabakh x ♂ Shark	12,5	3.9	42,9	0,8	8,3	5,1	37,8	0,7

morphological and physiological characteristics, compared with the original parental forms.

MATERIALS AND METHODS

The object of the research was 20 varieties and genotypes of winter soft and durum wheat of domestic and foreign breeding, grown under field conditions at the experimental site of the Institute of Molecular Biology and Biotechnology of the National Academy of Sciences of Azerbaijan.

The average humus content in the arable layer of the test plot was 1.6%, total nitrogen — 0.1%, mobile nitrogen — 25 mg / kg, exchanged potassium — 290 mg / kg, calcium — mg eq. / 100 g. The average annual air temperature during the years of research varied within 13-15 degrees Celsius, the amount of precipitation is 170-290 mm. Wheat varieties and genotypes were grown in two variants of water availability: with optimal irrigation (control) and in limited irrigation (experience).

To maintain moisture in the soil at a level of 70-75% during the growing season, control irrigation was performed in control variant. In the experimental version, the soil moisture was 45-50% of the lowest capacity. According to morphological, physiological characteristics and yield, relatively drought-resistant varieties were isolated and crossed between them. The content of chlorophylls and carotenoids was determined on a spectrophotometer (SP-2000), the fluorescence on a photosynthesis analyzer (PAM-Germany), and the photochemical activity of chloroplasts on a polarograph (OH-103 Hungary).

RESULTS AND DISCUSSION

As a result of crosses, 6 F1 hybrids were obtained, they were grown in an experimental plot with parental forms, and the physiological characteristics were studied compared to parental plants. Leaf samples were taken at different stages of plant development to determine the number of photosynthetic pigments, fluorescence parameters and photochemical activity

of chloroplasts. As can be seen from Fig., the hybrids ♀ Gobustan x ♂ Gyrmyzygul and ♀ Garabakh x ♂ Shark are superior to other hybrids and parental forms in chlorophyll content. The remaining hybrids occupy an intermediate position. The content of carotenoids is higher in parental forms compared to hybrid plants. When measuring the fluorescence parameters, it was found that the minimum fluorescence (Fo) in all varieties was almost the same, but high efficiency of the second photosystem (F_v / F_m) was in the hybrids ♀ Barakatli-95 x ♂ Garabakh; ♀ Gobustan x ♂ Garabakh and ♀ Garabakh x ♂ Shark. A comparative study of hybrids of the first and second generation revealed that the heterosis effect manifested in the first generation hybrids of the second generation hybrids is more pronounced (Drobysh, 2016). An analysis of the spike elements showed that the hybrids Gobustan x Barakatly and Garabakh X Mibashir are highly productive in comparison with other hybrids (Table 1). In our studies, the effect of drought on the physiological and biochemical parameters of the first generation hybrids was also studied (Table2).

Concluison

Based on the data obtained, it can be concluded that the hybrids ♀ Gobustan x ♂ Barakatly 95 and ♀ Garabakh x ♂ Mirbashir have heterosis effect, in terms of physiological and biochemical indicators and drought tolerance are superior to other hybrids and they can be used in further breeding work.

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