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Variability and Heritability of Spike Length in F₁ Hybrids of Durum Wheat (*Triticum Durum*)

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Annotation: The study was conducted during 2021–2023 in the rainfed fields of the Central Experimental Farm of the Scientific Research Institute of Rainfed Agriculture. The experiment involved 20 F₁ hybrid combinations of durum wheat along with their parental forms. The type of inheritance for spike length was evaluated using the formula of P. Petr and K. Frey (1966). According to the results, the inheritance coefficient in F₁ hybrids ranged from –12.4 to +5.2. In some combinations (Leukurum-3 × Tilling), depression was observed; in several combinations (Leukurum-3 × Plc/ruff, Leukurum-3 × Sebatel, Leukurum-3 × Icajoudy1, Marvarid × Ousloukos), positive deviation was recorded; while in other combinations (Leukurum-3 × Korifla/Aeg, Leukurum-3 × Younes, Yoqut-2014 × Joric 69, Yoqut-2014 × Atlas 1, Mrb3/Mna1 × Leukurum-3), heterosis effects were noted.

Keywords:

Durum wheat, F₁ hybrid generation, heritability, hybrid combination, hybridological analysis.

Durum wheat (*Triticum durum*) is one of the most important cereal crops worldwide, distinguished by its high protein content and grain quality. In Uzbekistan, durum wheat is widely used for pasta production. The yield and quality traits of durum wheat are closely associated with

various morphological and physiological characteristics, among which spike length is particularly significant.

Spike length is considered one of the main morpho-biological traits determining the overall yield potential of the crop. A longer spike increases the number of grains and improves the efficiency of yield component distribution. Therefore, studying the genetic factors controlling spike length holds great scientific and practical importance in the breeding process. The heritability coefficient (h^2) of traits such as spike length plays a crucial role in determining breeding efficiency.

Togay et al. (2018) conducted studies on durum wheat (*Triticum durum*) genotypes and reported a high heritability coefficient for spike length, indicating that this trait can be effectively improved through selection. They also examined the relationship between phenotypic and genotypic variability.

Akram et al. (2018) investigated the genetic characteristics of yield components, including spike length, in F_1 and F_2 wheat hybrids. They demonstrated that additive genetic effects predominantly control spike length, suggesting that this trait can be effectively improved through selection, while also highlighting the importance of dominant genetic effects.

The superior performance of F_1 hybrids compared to their parents, known as heterosis, has been documented in numerous studies. Lal et al. (2017) studied the effect of heterosis on yield components, including spike length, in F_1 hybrids. They found a positive heterosis effect for spike length in hybrids derived from diverse parental crosses, indicating the role of dominant genetic effects in this trait.

Materials and Methods. Field experiments were carried out during 2021–2023 in the rainfed experimental plots of the Central Experimental Farm of the Scientific Research Institute of Rainfed Agriculture. Twenty F_1 hybrid combinations of durum wheat, along with their parental forms, were sown in 1.5 m² small plots (mother–hybrid–father scheme), and the inheritance of plant height was analyzed using hybridological methods.

The F_1 hybrids were evaluated together with their parental lines, and the inheritance pattern of traits, i.e., deviation toward either parent, was assessed according to the formula of P. Petr and K. Frey (1966). In this approach:

- if the inheritance coefficient (h_p) = 0, no dominance is observed;
- if h_p ranges from 0 to +1, a positive deviation toward one parent occurs;
- if h_p ranges from 0 to -1, a negative deviation toward one parent occurs;
- if $h_p = +1$, complete dominance of the positive trait is expressed;
- if $h_p > +1$, heterosis (overdominance) is observed;
- if $h_p = -1$, complete dominance of the negative trait is expressed;
- if $h_p < -1$, depression is observed.

Results and Discussion. The choice of parental forms plays a crucial role in achieving success in breeding programs. For hybridization, it is essential to select accessions that not only possess valuable traits but also have the ability to transmit them to the next generations [4]. One of the main approaches to selecting parents for crossing is based on productivity indicators [5].

When analyzing the inheritance of spike length in F_1 hybrids, the inheritance coefficient was found to range from -12.4 to $+5.2$. In relation to the parents, depression ($hp < -1$) was observed in the hybrid Leukurum-3 \times Tilling; positive deviation ($hp = 0$ to $+1$) was recorded in Leukurum-3 \times Plc/ruff, Leukurum-3 \times Sebatel, Leukurum-3 \times Icajoudy1, Leukurum-3 \times Icajoudy1/3, and Marvarid \times Ousloukos; while heterosis ($hp > +1$) was identified in Leukurum-3 \times Korifla/Aeg, Leukurum-3 \times Younes, Yoqut-2014 \times Joric 69, Yoqut-2014 \times Atlast 1, and Mrb3/Mna1 \times Leukurum-3 (Table 1).

№	Hybrid combinations	Spike length, (sm)			Heritability coefficient (hp)
		Female parent, ♀	F1	Male parent, ♂	
1	Leukurum-3 x Omrabi5	7,94	6,10	6,06	-0,96
2	Leukurum-3 x Korifla/Aeg	5,86	6,02	5,64	2,45
3	Leukurum-3 x Younes	6,10	6,84	5,52	3,55
4	Leukurum-3 x Plc/ruff	6,72	6,54	5,66	0,66
5	Leukurum-3 x Sebatel	6,76	6,56	6,02	0,46
6	Leukurum-3 x Icajoudy1	6,90	6,50	5,88	0,22
7	Leukurum-3 x Icajoudy1/3	7,02	6,62	5,94	0,26
8	Leukurum-3 x Tilling	7,40	6,46	7,26	-12,4
9	Marvarid x Omrabi5	6,88	6,12	5,36	0,00
10	Marvarid x Icasyr1/3Bcr	7,04	6,08	5,38	-0,16
11	Marvarid x Sebatel	6,14	5,92	5,52	0,29
12	Marvarid x Icajoudy	7,40	6,90	6,78	-0,61
13	Yoqut-2014 x Omrabi5	6,58	6,08	5,98	-0,67
14	Yoqut-2014 x Sebatel	6,72	6,10	5,64	-0,15
15	Yoqut-2014 x Icajoudy1	6,88	6,96	6,08	1,20
16	Yoqut-2014 x Tilling1/3	6,78	6,46	5,8	0,35
17	Yoqut-2014 x Plc/ruff	5,28	6,44	6,22	1,47
18	Mrb3/Mna1 x Leukurum-3	5,34	5,62	7,36	-0,72
19	Mrb3/Mna1 x Marvarid	5,24	6,10	7,1	-0,08
20	Mrb3/Mna1 x Yoqut-2014	4,54	5,08	4,28	5,2

Conclusion. Among the 20 F_1 hybrid combinations of durum wheat studied, high heritability for spike length was observed in the hybrids Leukurum-3 \times Younes, Yoqut-2014 \times Plc/ruff, and Mrb3/Mna1 \times Yoqut-2014, where heterosis effects were identified, and selection work was carried out.

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