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An Attempt to Develop Two-Rowed Awnless Barley (vvLkLk) by Using Genetic Awnless Plasma of cv. Tsvetelina (*Hordeum sativum* Jess. ssp. *Vulgare*, var. Dundar Beyi Zhuk)

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Abstract

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The morphological variability of spike in the two-rowed barley varieties is very narrow. Only awned forms are grown in production. There are no awnless barley varieties. An attempt was made to correct this shortcoming. After crossing awned two-rowed forms (vvlklk) to awnless six-rowed varieties (VVLkLk), the spikes in F_1 had an intermediate structure (VvLklk) ending with short awns. A significant variability of new original awnless two-rowed barley varieties (VVLkLk) was developed in F_2 for the purposes of breeding and production. Both awnless forms with cylindrical spikes and forms with pyramidal spikes were observed. The awnless two-rowed barley forms with pyramidal spikes were of highest breeding value. Some of them combined very well high number of grains per spike and a relatively short stem.

Key words: awnless barley, breeding, barley

Introduction

In contrast to wheat, morphological variability of spike in barley is very narrow. Mainly awned varieties are grown for production purposes. There are no awnless forms, which is most evident in two-rowed barley. Nilan, 1964, has established that the development of awnless barley forms depended on the presence of molecular marker Lk (Awnless) in chromosome 2 suppressing development of awns. The few awnless barley varieties existing up to now have been developed due to the fact that genes V (awned) and Lk (awnless) are very closely linked, which makes experimental work very difficult (Schreiber, 1992). A significant progress was achieved at Dobroudja Agricultural Institute with the development of the awnless six-rowed barley variety Tsvetelina (VVLkLk). In 2000 this vari-

ety was approved as an original variety by the State Varietal Commission.

This paper presents attempts to develop genetic variability of new awnless two-rowed barley varieties for the purposes of breeding and production (Figure 1/1-2/).

Material and Methods

The experimental research work on developing two-rowed barley varieties was carried out at Dobroudja Agricultural Institute - General Toshevo, Bulgaria during 1996-2001. Crossing was done of awned two-rowed barley cv. (B)Obzor (vvlklk) ♀ to the awnless six-rowed barley cv. (A) Tsvetelina (VVLkLk) ♂. Schreiber used in his experiments the Ethiopian two-rowed barley varieties F. 79 and HOR 2937 (VVLkLk). The system of the products from the segregation in F_2 was done on the basis of spike morphology (presence/absence of awns). Selection was carried out towards awnless spikes. The spikes were divided into three systematic groups: two-rowed, intermediate and six-rowed. Mathematical processing of data was performed according to Molostov, 1965.

Results and Discussion

After the crossing of awned two-rowed barley (vvlklk) to awnless six-rowed one (VVLkLk), the spikes from the first hybrid generation (F_1) were of intermediate shape (VvLkLk) and ended with short awns. In F_2, wide-ranged and most various combining of spike morphological characters occurred. Both awned and awnless plants were observed. In the selection process special attention was paid to the awnless forms. These forms were divided into three systematic groups: two-rowed, intermediate and six-rowed. Similar grouping of the segregation products has been made also by Schreiber, 1992.

In Table 1 the number of awnless two-rowed barley forms was highest. Out of 188 plants selected, the number of typical awnles forms (VVLkLk) was 58 (30.8 %), followed by awnless two-rowed forms with short awns - 45 items (23. 9 %), and by forms with medium long awns, also 45 items (23.9 %). In the group with intermediate characters, typical awnless plants were not registered. In this group, however, the number of awnless forms with short awns was 16 (8.5 %) (Figure 1). Typical awnless forms (VVLkLk) were observed in the group of the six-rowed barley plants, as well - 14 items (7. 4%).

When developing awnless two-rowed barley forms for breeding and production purposes, it is very important to establish their production potential against the background of plant height. Two man groups of awnless barley forms were observed: with cylindrical and pyramidal spikes. It was established that the mean number of grains per main spike in the two-rowed barley forms with cylindrical spikes was close to that of the check variety Krona with cylindrical spikes. The hybrid variability presented in F_2 did not allow developing individual derivatives with plant height similar to that of cv. Krona through selection (Table 2).

It was established that most promising for the purposes of breeding and production were the hybrid plants of awnless two-rowed barley forms with pyramidal spikes. By their spike morphology they were similar to that of the mother variety Obzor, also having pyramidal spikes. In this systematic group the hybrid variability in F_2 allowed to develop single hybrid plants thr-

Table 1

Selection in F_2 of awnless barley forms by systematic groups after crossing awned two-rowed barley (vvlklk) to awnless six-rowed barley (VVLkLk)

Number of selected plants	Two-rowed			Intermediate			Six-rowed		
	awn-less	with short awns	with medium long awns	awn-less	with short awns	with medium long awns	awn-less	with short awns	with medium long awns
188 (cv. Obzor x cv. Tsve-telina)	58.00 (30.8%)	45.00 (23.9%)	45.00 (23.9%)	-	16.00 (8.5%)	2.00 (1.1%)	14.00 (7.4%)	7.00 (3.7%)	1.00 (0.5%)

Table 2

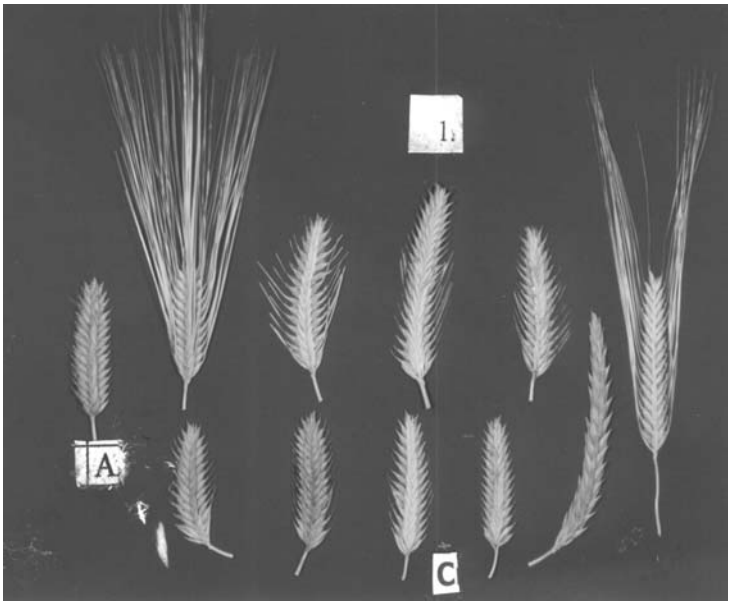
Production potential of awnless two-rowed barley forms (VVLkLk) (*Hordeum sativum* Jess., ssp. *distichum* L.) in F2

Combination and check variety	Selected plants (No)	Plant height, cm	Main spike		
			length, cm	spikelets (No)	grains (No)
		I. Cylindrical spikes			
cv.Obzor x cv.Tsvetelina	12	108.0 ± 2.31(107-110)	9.7± 1.879.8 (9.0-11.5)	30.0± 1.97(27-34)	27.0± 2.09(26-30)
cv. Krona - check		82.9±1.28	9.8±1.86	31.9±2.04	30.2±1.77
		II. Pyramidal spikes			
cv. Obzor - check		104.3±1.99 (92-118)	5.8±2.01 (4.5-6.5)	28.5±2.14 (21-33)	26.1±1.88 (21-33)
		96.7±1.44	6.0±2.16	26.1±1.65	25.3±1.09

ough selection, which possessed increased production potential combined with low stem (less than 100 cm, Table 2). In this respect, the awnless two-rowed plants Nos 34 and 39 with typical pyramidal spike shape were of special breeding value. In these two plants the very good grain content of spike (27 to 30 grains per spike as compared to 27-30 grains per spike of check variety Obzor) was combined with a comparatively short stem (88 to 100 cm).

Conclusion

In hybridization between awned two-rowed barley forms (vvlklk) to awnless six-



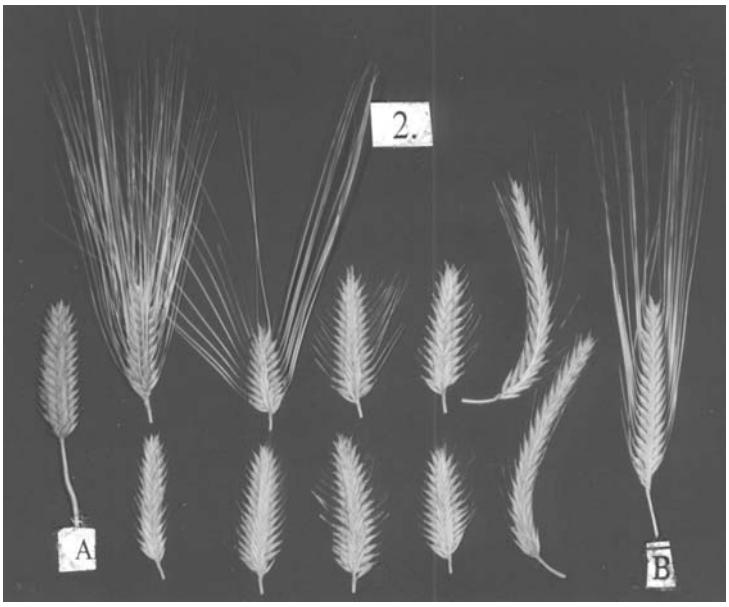


Fig. 1 (1-2) a - cv (A) Tsvetelina (VVLkLk) ♂

b - cv (B) = Obzor (vvlklk) ♀; c - hibrid variability in F_2 of awnless two-rower barley forms (VVLkLk)

rowed forms (VVLkLk), spikes in F_1 were of intermediate shape (VvLklk). In F_2 a significant variability was created of new original awnless two-rowed barley forms (VVLkLk). By their systematic affiliation they were divided into three main groups: two-rowed, intermediate and six-rowed. Most promising for breeding and production were the awnless hybrid plants from the two-rowed systematic group. Plants were observed with both cylindrical and pyramidal shapes of spike. The awnless rwo-rowed barley forms with pyramidal spike were of special breeding value. Some of them possessed very good combination of high grain content of spike and comparatively low stem.

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