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AGRONOMIC CHARACTERISTICS OF THE NEWLY SYNTHESIZED PRIMARY ALLOPLASMIC OCTOPLOID FORMS OF TRITICALE

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Abstract

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The influence of alien cytoplasm, nucleo-cutoplasmic interaction and parental genotypes concerning 9 agronomical characters: heading date, common tillering, culm length, last internode length, ear length, spikelet number per ear, kernel number per ear, kernel weight per main ear, kernel weight per plant and 1000-kernel weight was studied. Agronomical investigation was carried out on 12 new triticale lines, isolated in the process of the cytological stabilization of line 1732-2 and 3 new triticale lines, isolated in the process of the cytological stabilization of line 1737-1. It was established that the agronomical characteristics in the newly synthesized lines depends on the nucleus, cytoplasm, their interaction and nucleus-cytoplasm co adaptation. The cytoplasms of D^2 –type render the strongest positive effect on the ear lenght, spikelet number per ear, kernel number per ear, kernel weight per main ear, kernel weight per plant and 1000- kernel weight in newly syntesized alloplasmic octoploid lines triticale 1732-65 and 1732-66.

Key words: alloplasmic forms triticale, agronomical characteristics, cytoplasmic effect

Introduction

Triticale (× Triticosecale Wittmack) is the intergeneric hybrid between the female parent wheat (*Triticum* ssp.) and the male parent rye (*Secale* ssp.). Triticales are agronomically desirable due to their ideal combinations of yield and quality advantages of common wheat. Working with primary triticales, the breeder is necessary to have knowledge on character correlation in the crop and to be able to assess the potential of a newly synthesized genotype as early as possible.

Estimates of wheat, rye and wheat x rye interaction variance components disclosed parental main effects to be the most important source of genetic variation in primary triticales. The rye parent was dominant for all characters affecting fertility, and the wheat parent was more important for vegetative development. Character correlations were very similar for triticale of both ploidy levels. The lack of association between grain yield and tillering and the positive correlation between kernels per spike and thousand kernel weight indicated physiological disorders specific for primary triticales (Oettler et al., 1991).

Additive effects of the rye component on the

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quantitative characters investigated, except for plant height and for spikelet number are very low. Besides exerting a major effect on plant height, the wheat component also affects days to heading, spike length and number spikelet per spike. While floret fertility is influenced by both additive a non-additive gene actions, thousand kernel weight is mainly controlled by non-additive gene actions (Lelley and Gimbel, 1989).

The success of breeding programs is highly dependent on the magnitude of genetic variation and its effective use. Although most studies on the inheritance of some plant traits in different species indicated the predominating significance of nuclear genes, cytoplasmic factors and cytoplasmic x nuclear interactions were also found to be significant in some studies (Ekiz and Konzak, 1994; Tsunewaki, 1988). However, when a cytoplasm, nucleus and plant traits are investigated, significant cytoplasm, cytoplasm x nucleus interaction effects may play an important role in the expression of a trait (Dhitaphichit et al., 1989; Keane and Jones, 1990; Konzak et al., 1991; Panayotov et al., 1982; Yasumura et al, 1988).

The main aim of the present investigation is to study the influence of the parental genotypes and the alien cytoplasm on agronomical characteristics in the newly synthesized primary alloplasmic octoploid triticale forms.

Materials and Methods

Agronomical investigation was carried out on 12 new triticale lines, isolated in the process of the cytological stabilization of line 1732-2 and 3 new triticale lines, isolated in the process of the cytological stabilization of line 1737-1. The line 1732-2 (2n=56), genome formula ABDR was obtained from the hybridization between the alloplasmic line of the hexaploid common wheat Roussalka with a cytoplasm of *Ae. vavilovii* (D^2-type) and the diploid inbred rye Lozen 14 (L14), and was treated with 0.25% colchicines solution for obtaining of fertile amphidiploids (Kussovska and Bochev, 2000). The line 1737-1 (2n=56), genome formula ABDR was obtained from the hybridization between the alloplasmic line of the hexaploid common wheat Roussalka with a cytoplasm of *T. dicoccoides* (B-type) and the diploid inbred rye line Bulgarian Low Stem Rye (BLSR), and was treated with 0.25% colchicines solution for obtaining of fertile amphidiploids (Kussovska and Bochev, 2000).

The newly synthesized primary alloplasmic octoploid triticale forms are grown in field conditions, at the same time with the standard 7291. For agronomical characteristics twenty plants from each line were analyzed. Characters investigated were heading date (days counted from May 1), common tillering, culm length, ear length, spikelet number per ear, kernels number per ear, kernel weight per main ear, kernel weight per plant and 1000-kernel weight.

The significance of the differences between the newly synthesized primary alloplasmic octoploid triticale forms and the standard was made according to Student's **t**-criterion.

Results and Discussion

The average values of 9 studied characteristics of the newly synthesized primary alloplasmic octoploid lines of triticale are presented on Table 1 (Table 1; Figures 1 and 2).

The alien cytoplasms affect differently the heading date of the alloplasmic octoploid lines of triticale. The *Ae. vavilovii* cytoplasm in lines, obtained from 1732-2 causes 8-9 days delay in the heading date by, compared with the standard 72-91, and *T. dicoccoides* cytoplasm in lines obtained from line 1737-1 causes 3-7 days delay in the heading date by compared with the standard 72-91.

Common tillering is higher in lines 1732-67, 1732-66 and 1732-65 and it is commensurable with the common tillering of the standard . These lines were obtained with the participation of L14 as a male parent, which is characterized by higher

Table 1

Mean values of 9 agronomical characteristics in 15 new triticale lines

Amphi diploid	Heading date, day1	Common tillering	Culm length, cm	Ear length, cm	Spikelet number per ear	Kernel weight per plant	Kernel weigh per main ear	Kernel number per ear	1000-kernel weight
72-91	5.12± 0.92	20.80±5.83	105.83±6.70	9.95±1.83	22.40±2.39	27.32±6.49	2.21±0.71	44.00±13.65	54.36
1732-64	13.24±1.24***	19.00±5.08	103.00±6.43	9.75±0.88	22.50±1.67	29.36±6.57	2.80±0.39**	56.85±11.07***	44.32
1732-65	15.31±2.16***	20.30±5.21	119.45±6.35***	13.62±0.98***	31.60±2.39***	33.29±6.08**	3.72±0.72***	60.70± 9.62***	55.17
1732-66	14.27±1.98***	23.40±5.60*	125.72±4.04***	13.98±1.25***	31.10±2.29.***	35.00±5.56***	3.56±1.07***	59.15±15.51***	55.85
1732-67	13.15±2.05***	20.60±4.90	124.20±5.42***	14.20±1.51***	32.70±2.08***	32.70±2.08**	3.59±0.63***	63.85±16.20***	49.94
1732-77	14.21±2.21***	17.30±4.28*	132.15±10.60***	12.32±1.46***	31.15±2.78***	29.07±8.02	2.41±0.62	47.65±12.41	50.19
1732-81	13.15±2.31***	14.90±5.33**	115.62±10.83***	12.02±1.45***	30.00±3.89***	23.42±8.06	2.60±0.66*	43.55±12.07	44.87
1732-82	13.17±2.35***	15.45±3.50**	119.90±11.69***	12.40±1.45***	30.55±2.66***	27.05±5.62	2.41±0.61	43.15±8.83	51.19
1732-83	14.28±1.89***	15.85±4.50**	118.70±8.22***	13.32±1.16***	30.70±2.45***	29.66±6.76	2.61±0.46*	42.20±5.88	52.66
1732-84	14.26±2.04***	17.20±5.26*	116.88±7.61***	12.00±1.42***	30.00±3.29***	26.94±9.62	2.28±0.49	42.85±13.44	51.11
1732-85	14.18±2.17***	15.75±5.48**	125.62±8.00***	13.00±1.38***	29.50 ±2.55***	29.91±7.63	2.42±0.44	42.10±6.15	45.52
1732-88	14.12±1.97***	15.65±5.01**	123.30±10.36***	11.58±1.04**	28.40±2.30***	27.78±5.35	2.48±0.41	44.75±6.08	48.63
1732-90	14.21±1.89***	15.45±3.46***	110.52±6.04	11.22±0.97**	27.70±2.27***	27.08±5.96	2.02±0.67	38.50±8.83	51.60
1737-92	8.27±1.12*	15.85±3.22**	101.92±3.60*	11.75±0.98***	24.90±1.48***	26.69±5.71	2.64±0.67*	50.60±13.00*	43.28
1737-94	9.14±1.65**	15.40±2.84***	99.02±6.32***	11.72±1.06***	24.90±1.33***	25.82±2.89	2.54±0.60	47.90±14.76	45.01
1737-95	8.56±1.32*	15.55±3.14***	101.57±5.51*	11.37±1.31**	24.65±2.25***	27.62±5.60	2.21±0.84	46.95±15.34	46.25

1/ As May 1= 1

*, **, *** - Significant at P=0.05, P= 0.01, P=0.001, respectively

Fig. 1. 1- triticale standard 72-91, 2- line 1732-64, 3- line 1732-65, 4-line 1732-66

Fig. 2. 1-line 1732-84, 2- line 1732-90, 3-line -1737-92, 4-line 1737-94

tillering compare with BLSR (Kussovska et al., 1999).

Culm length in triticale lines obtained from 1737-1 are less, compared to the standard, as they are obtained with the participation of BLSR as a male parent and 1737-94 shows the lowest values (99.02 cm.). Culm length in triticale lines obtained from line 1732-2 varies from 103.00 cm in line 1732-64 to 132.15 cm in line 1732-77. These triticale lines are medium height because they are obtained with the participation of the L14 male parent.

Selected ears of the new triticale lines and the ear of the standard are shown on Figure 1. Selected ears of the new triticale lines are shown on Figure 2.

Ear length for all newly synthesized triticale lines, except line 1732-64 is longer compare with the standard, as it is longer for lines 1732-67, 1732-66 and 1732-65. The isolated lines from line 1737-1 possess shorter ear length than those isolated from line 1732-2. Differences are not observed for the ear length of both inbred rye lines (Kussovska et al., 1999). The female parents are alloplasmic lines of Roussalka cultivars with different cytoplasms and bigger ear length in the alloplasmic line with D^2 cytoplasm type was observe.

Spikelet number per ear for all newly synthesized, except line 1732-64, is bigger compared to the standard as the bigger is the spikelet number per ear for lines 1732-67, 1732-66 and 1732-65. The cytoplasm of D^2 type also shows positive influence on this agronomical character.

The kernel number and weight per main ear, as well as the kernel weight in the whole plant are bigger again for the alloplasmic triticale lines 1732-67, 1732-66 and 1732-65. Therefore, the influence of D^2 type of cytoplasm is greater for

three characters too.

1000-kernel weight character has the biggest values exceeding the standard for lines 1732-66 and 1732-65. For this character the influence of D^2 type of cytoplasm is again positive.

Conclusion

Our studies suggest that use of alien cytoplasm is a suitable way of obtaining of new triticale lines, possessing better agronomical characteristics. In newly synthesized primary alloplasmic octoploid forms of triticale D^2–type cytoplasm render the strongest positive effect on the ear length, spikelet number per ear, kernels number per ear, kernel weight per main ear, kernel weight per plant and 1000- kernel weight in newly synthesized primary alloplasmic octoploid lines triticale 1732-65 and 1732-66.

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