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Using gene fund of wild relatives for common wheat improvement

Abstract. The article describes the research results, the method of distant hybridization can provide to get new genotypes with new parameters, high-yielding, immune, with a high content of protein in the grain and adapted to environmental conditions.

Key words: distant hybridization, drought resistance, forming, quality, density, cross-breeding, hybrids.

Introduction

A large variety of agroecological zones of wheat cultivation and breeding intensification puts before scientists of Kazakhstan a number of challenges: the varieties creation that combine high yield with complex resistance to diseases, to withstand adverse conditions (drought, the harsh winters) and high quality grain.

It is no coincidence that the most perspective breeding programs of the world along with the use of classical breeding methods, selection and hybridization, intraspecific wheat crosses are also used genetic methods with representatives of related genera of wheat – *Aegilops*, *Agropyron*, *Secale*, *Elymus* genotype carriers and other signs and properties.

It is the only method of creating fundamentally new plants that combine their hereditary basis of the most valuable features and characteristics of cultivated and wild plants.

Powerful formative process created by distant hybridization, is the source of unique forms and replenishing gene fund of cultivated plants [1, 2, 3]. In this paper, we analyzed the older generation hybrids (F_8 - F_{10}) constant $2n = 42$ forms, in combination (*T.aestivum* L x *Aegilops triaristata* Wild) according to the method described in UPOV, remembering the diversity of wheat on morphological characters [4, 5].

Materials and methods

Field experiments were conducted in the Kazakh Research Institute of Agriculture and Plant growing in Karasai district of Almaty region, lo-

cated in the foothills of the Zailiyskyi Alatau. The experimental sowing plots were 1 to 6 rows depending on the number of hybrid seeds. The length of the row is 120-130 cm, the distance between the rows is 15 cm, the distance between the grains is 5 cm, and depth of seed placement is 4-5 cm. Used for crossbreeding varieties of winter wheat ($2n = 42$) *T.aestivum* L. (AABBDD) with wild species *Aegilops triaristata* Willd (CUCUMM), $2n = 28$. Spike of *Aegilops triaristata* Willd has 3-4 spikelets. Spikelets are slightly convex, oblong, and most often pubescent. Inhabits on open dry rocky sunny slopes; common in Azerbaijan and Georgia; not observed in Kazakhstan.

Results and their discussion

In our experiments in crossing varieties of common wheat (*Triticum* L.) with *Aegilops triaristata* Willd species, there was a completely different character formation. In the first generation is dominated by signs of wild forms. And only through cytogenetic analysis of ploidy $2n = 42$ (in F_3 - F_4) and back crossing in F_4 - F_5 pollen of common wheat significantly shifts forming toward the formation of wheat and new varieties forms of common wheat.

These lines were chosen on the base of cytogenetic analysis. In hybrid lines for F_1 - F_4 on constancy $2n = 42$, and starting in F_4 for their relatively good agronomic traits, such as tillering, spike density, height, hardness, quality, maturity, disease resistance, and others. Housekeeping valuable traits

for use in breeding programs. Presented new forms have not been previously known in the science.

F₇ (Bezostaya 1 x *Aegilops triaristata* Willd) x Bezostaya1 (1633- 26) variety (*Triticum aestivum* L.) – compactoides. Form of the spike is compact, it means that shortened spike is compact, the transition from soft to dwarf wheat. Spike is white, red grain, glumes are not downy. The bush type is erect, no erected flag leaf is missing, sheet waxy film is weakly expressed. Plant height is 105.2 cm, productive tillering 4.2 pc. Spike length is 8.4 cm, color is white, density of 22.0 units (very tight). In spike -70.0 pieces grains, weight of 1000 grains was 45.8. Spiklet glume: shoulder shape is straight, wave form is short, blunt. Grain yield was 58.4 t/ha, with yields of standart varieties Almali 62.2 t/ha. Protein in the grain is 18.2%, starch – 54.4, grain hardness -73, sedimentation – 74, gluten – 34.5. Winter resisted plant, the percentage of surviving plants after wintering very high 92-98%. In the heading stage and milk stage is resistant to yellow, stem rust. Susceptibility to leaf rust 1-3 score.

Plant is tolerant to powdery mildew and septariose, dust and smut. F₈ (Bezostaya 1 x *Aegilops triaristata* Willd) x Bezostaya 1 (1633- 29) variety (*Triticum aestivum* L.) – maesto-milturum. Glume color is red with a black border; owns cusps is red color; inflyant presence – absence, the presence of Ligula – there is, the name of the variety on KA Flyaksbergu – Kazakstanicum Orl. Plant height is 108.1 cm, the bush type is erect, productive tillering 4.1 pc., Anthocyanin color in the sheet is weak, curved leaf flag is absent; waxy film on the leaf sheaths is weak. Spike length is 14.0 cm; the spike density of 24.2 pc., the spike shape fusiform, spikelet or spikelet types spines are absent, the spike color is colored. Spike glumes – shoulder width is narrow; short wave length; direct wave form; red weevil; grain protein 23.0%; 132 grain hardness; gliadin + 52.3 glutelin. In the spike is 70.4 pc. grain weight of 1000 grains of 49.4 g; grain yield was – 64.3 t/ha. Winter resisted plant, the percentage of surviving plants after overwintering is high (96-98%). In the heading stage and milk stage is resistant to stem rust and yellow. Susceptibility to leaf rust of not more than 2 points. Resistant to mildew and septariose, dusty, smut.

F₉ (Bezostaya 1 x *Aegilops triaristata* Willd) x Bezostaya1 (1633 – 31) Variety (*Triticum aestivum* L.) – velutineum-inflatum- spike is white, red grain, inflyatnt, the presence of Ligula – there is. Name of the variety for V.F. Dorofeev et al. – Heraticum (Vav. et Kob) Manst. The bush type is erect, anthocyanin

color og the leaf is weak, curved leaf flag is missing, the spike wax coating is weak. Average plant height, the spike shape is pyramidal, the spike density -average, the spike length is average. Shoulder width is very narrow, shoulder shape is sloping, tooth shape is straight, weight of 1000 grains -50.2 g, grain protein- 22.7%, gluten content -40.5%, starch- 49.7; grain hardness-75, sedimentation -83, the composition of glutenin bands 7 + 9. Grain yield is 63.0 t/ha, with yields of standard varieties Almali -62.2 t/ha. Winter-resisted plant, the percentage of surviving plants after overwintering is high (97-98%). In the heading stage and milk stage is resistant to stem and yellow rust. Susceptibility to leaf rust is 1-3 score. Resistant to mildew and septariose, dusty, smut.

F₇ (*ErythrospERMUM* 350 x *Aegilops triaristata* Willd) x Almali (2003-2) Variety (*Triticum aestivum* L.) – preude-glauca-ferrugineum. Color of spike scales is smoky gray on a red background, the inflyant presence – absence, the presence of Ligula – absence, name of the variety on V.F. Dorofeev et al. – *PseudocAESIUM* (Greb) Manst. The bush type is erect, non erect flag leaf is missing, waxy film on the leaf sheaths is average. Plant height is 110.3 cm, productive tillering – 3.7 pc., spike is spinous, pyramidal. Spike length – 15.0 cm; density – 20.0 units. 70.0 grains per spike piece., weight of 1000 grains – 46.7. Grain yield – 68.7 t/ha, with yields of standard varieties Almali – 62.2 t/ha. Protein in the grain – 18.3%, starch – 53,8; grain hardness – 73, gluten – 36,4; sedimentation -75. The plant is winter resisted, the percentage of surviving plants after overwintering is high about- 98%. In the heading stage and milk stage is resistant to stem and yellow rust. Susceptibility to leaf rust – 1-3 score. Resistant to mildew and septariose, dust and smut.

F₇ (*ErythrospERMUM* 121 x *Aegilops triaristata* Willd) *ErythrospERMUM* x 121 (2005-3) Variety (*Triticum aestivum* L.) – quasi-erythrospERMUM, spike is white, the spines color - white, the inflyatn presence – absence, Ligula presence - there is, the name of the variety on V.F. Dorofeev et al. – Kabulicum (vav) Manst. Spikelet glumes not pubescent, the type of plants directly stoyashy, italic flag leaf is missing, waxy film is weak. Plant height -108,2cm, productive tillering - 4.1 pc., spike spinous, the spike length -11.4 cm, the shape of the spike is prismatic, the spike density - 22.0; in the spike 60.4 piece, grain weight of 1000 grains - 62.8. Spikelet glume: shoulder oblique, acute tooth - long, until the end of the keel pronounced. Grain yield – 62.8 t/ha, with yields of standard varieties Almali -62.2 t/ha. The protein content -19.1%, starch – 53,3; grain

hardness-85, gluten -35,7; sedimentation – 80. The plant is winter resisted, the percentage of surviving plants after overwintering is high -97%. In the heading stage and milk stage is resistant to stem and yellow rust. Susceptibility to leaf rust is 1-3 score. Resistant to mildew and septariose, dust and smut.

F₇ (*Erythrosperrum* 121 x *Aegilops triaristata* Willd) *Erythrosperrum* x 121 (2005-4) variety (*Triticum aestivum* L.) – maesto-milturum - (spike white, red corn, spike beardless). Color of spike scales is smoky gray on a red background, the inflyant presence – absence, the presence of Ligula – absence. The plant is erect, tall -107.4 cm, sloping flag leaf is missing, productive tillering - 4.1 pc. Spike length - 16.0 cm, number of spikelets per spike developed to 22.2-pcs. Number of grains per spike 88, 1 pcs., weight of grains per plant - 7.2 g, weight of 1000 grains-48.9, grain yield is 52.4 t/ha, at the standard-50.2 kg/ha. The protein content -22.6%, gluten-40.8%, grain hardness – 79, sedimentation – 83. The level of plants stability in this combination was high-97.2%. Plant resistance to lodging, hardy, the percentage of surviving plants after overwintering is high- 98%. In the heading stage and milk stage is resistant to stem and yellow rust. Susceptibility to leaf rust is 2 points. Resistant to mildew and septariose, dust and smut.

F₇ (*Erythrosperrum* 121 x *Aegilops triaristata* Willd) x *Erythrosperrum* 121 (2005 – 13) variety (*Triticum aestivum* L.) – Sub.*Lutescens*. The presence of spines and awn typed cusps the spike of the type inermis, but the upper spikelets are 2-3cm, awn typed cusp longer than 2.0 cm. Plant height 107.4 cm, the bush type is erect, productive tillering -3.8 pc. Anthocyanin coloration in the leaf is weak. Curved leaf flag is missing, the wax coating on the leaf sheaths is weak. Spike length – 16.4 cm, the spike pieces 20.1., grains -76.7, the mass of 1000 grains- 46.0 The spike form – cylindrical, spine or awn typed processes are absent. Color of the spike is colored. Glume: shoulder width wide, the shoulder shape -straight, the shape of the tooth – straight, red weevil. In the grain protein content-22.2%, starch – 50,4; grain hardness-77, gluten – 40,2; sedimentation - 82. Grain yield - 75.0 t/ha, with yields of standard varieties Almali - 62.2 t/ha. The plant does not lodge, winter resisted, the percentage of surviving plants after overwintering is high - 96%. In the

heading stage and milk stage is resistant to stem and yellow rust. Susceptibility to leaf rust is 2 points. Resistant to mildew and septariose, dust and smut.

F₇ (*Lutescens* 200 x *Aegilops triaristata* Willd) Kazakhstanskaya 126 (2006-1) variety (*Triticum aestivum* L.) – quasi-erythrosperrum – glume color – white, the spines color is white, the inflyant presence – absence, presence of ligula – absence, name of the variety on V. F. Dorofeev et al. – *Kabulicum* (vav) Manst. Plant height is 112.4 cm, the bush type is erect, productive tillering – 4.2 pc. Anthocyanin coloration is weak, sloping flag leaf is missing, waxy film on the vagina is weak. Spike length – 13.5 cm, the spike pieces -20.0., in the spike – 64.7 piece, grain weight of 1000 grains is 48,3g. Glume: shoulder width is narrow, shoulder shape is sloping, the shape of the tooth is straight. Protein in the grain is 21.2%, grain hardness – 102, gliadin + glutelin content is 54.7. Grain yield – 64.2 q/ha. With yields of standard varieties Almali – 62.2 t/ha. The plant does not lodge, winter resisted, the percentage of surviving plants after overwintering is high -96%. In the heading stage and milk stage is resistant to stem and yellow rust. Susceptibility to leaf rust is 2 points. Resistant to mildew and septariose, dust and smut.

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