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Variability of the characteristic of length of stem in hybrid-mutant populations of soft winter Wheat

Objective. To investigate the influence of mutagenic factors on the length of the stem in the varieties and hybrids M1, F2M1 and hybrid populations of F3M2 -F5M4wheat of soft winter. Methods. Laboratory for structural analysis of plants, statistical - to determine the variability and reliability of the results. Results A greater number of short-stemmed plants was detected compared to control in variants treated with mutagenic NMCs 0.05%, NES 0.05; 0.1% in M1, F2M1. By mutagenic treatment in the hybrid combinations of F3M2-F5M4 the distribution pattern, mean values and coefficients of variation over the stem length change. Intermediate succession produced less fertile plants. Conclusions The extension of the range of variability based on the length of the stem in the varieties and hybrids M1, F2M1 and the hybrid-mutant populations of F3M2-F5M4 soft winter wheat. Highlighted hybrid mutant populations.

Key words: winter wheat, hybrid combination, length of stem, generation, mutagen, concentration.

Formulation of the problem. To date, over 3000 varieties of different cultures have been created with the use of physical and chemical mutagens [13]. For genetic improvement of wheat varieties, mutational selection in combination with recombinant genesis is of great importance [4]. The length of the stem (plant height) has a significant impact on the resistance to sinking, so the strength of the breeders focuses on the creation of short-stemmed varieties. In varieties and hybrid populations after processing with chemical mutagens, due to the increase in the variability of quantitative characteristics, it becomes possible to select recombinant with the best combination of economically useful signs [12]. Independent combination of chromosomes in meiosis, and, at the same time, a complex of genes for different cross-linking components, gives an opportunity to obtain an unlimited spectrum of signs of combinations [8]. A number of authors [5, 6, 10, 11] pointed to the development of heterosis and the domination of a tall father, while others [7] pointed out that short-stemming dominates in certain wheat hybrids. Alter combinations of the genes of short-stem elongation also differed in the complex of agronomic features [1]. In particular, mutagenesis using y-rays yields wheat mutants with reduced stem length, altered structure of the ear, lack of rugs and other altered features [14]. However, the complex nature of the inheritance of this feature requires detailed study in a number of hybrid generations. The purpose of the research is to investigate the influence of mutagenic factors on the length of the stem in the soft and winter wheat varieties and hybrids M1, F2M1 and to establish the variability and inheritance of this feature in hybrid populations F3M2 - F5M4. Materials and methods of research. The source material for the research was varieties and hybrid combinations: Podolanka, Zolotokolos, Bogdan, Voloshkova, Yasnogirka, Svitanok Myronivsky, Yuvylir Myronivsky, Kryzhinka, Demetra, Kalinova (UKR), Ermak, Father (RUS), TAM 107 (USA), Romance (UKR) / TAM 107 (USA), Juvilir Mironivsky ^ ^ ^ Yasnogoryka (UKR), Demetra (U ^ / Yermak (RUS), Kalinova ^ ShuBatko (RUS), Kalinova ^^ / Podolyanka (UKR), Rostok (UKR), Naousel) / (Ermak (RUS) / Myronivska early Ukraine (UKR)), Remeslovna (UKR) / (Lankao (CHN) / Myronivska Yuvileyna (UKR)), Natalka (UKR) / (Mirleben Shuekspromt (UKR)) - 2013, 2014, Bogdana (UKR) / Stanichna (RUS), Colombia ^^ uRoz ^ (UKR), Yubileinaya 100 (RUS) / Zolotokolos (UKR), Gracia (SER) / Litanivka (UKR), Tilek ^ Vupanna (UKR) - 2012-2014. Studies were conducted at the Myronivsky Wheat Institute named after VM NANES Handicrafts (MIP) in 2010-2014 according to the method of N.N. Zoz [1]. The mutagens were nitroso-ethyl urea (NES 0.01, 0.05 and 0.1%), N-nitroso-methyl-urea (NMC

0.0125, 0.05%), dimethyl sulfate (DMS 0.0125; 0.05%), 1.4-bis-diazoacetylbutane (DAB 0.05%). Dry seeds of varieties and F1 hybrids were soaked in water-based mutagen formulations with an exposure of 18 hours. The control was seed soaked in water (18 hours). The height of plants in the varieties and hybrids M1, F2M1 (2013, 2014) and the hybrid-mutant populations F3M2-F5M4 (2012-2014), obtained after processing of seed of varieties and hybrids F1, were determined. Statistical data processing was performed using the "Statistica 6.0" and "MS-Excel" programs using the algorithms described by B.O. Dospekhov [3]. Research results. The initial stage in the study of experimental mutagenesis is the analysis of breeding material from the first generation. Probable changes in morphological characteristics in M1 and F2M1 indicate the mutability of varieties and hybrids under the influence of a certain mutagen and its concentration [2]. The reaction of varieties and hybrids to treat seeds with mutagens has been shown to increase the variability of the height of winter wheat plants. In 2013, the decrease in plant height compared with the control variant in M1 was detected by the influence of 0.05% (Figure 1) NMS mutagen in varieties: Bogdan - 50.7 cm (19.4 cm less than control); Ermak - 55 cm (- 3.4); Father - 55.2 cm (-2.8) and Kalinova - 78 cm (-2); Under the influence of mutagen NES 0,05% in varieties: Gold-colored - 60,6 cm (-4,6); Bogdan - 67.1 cm (-3); For the influence of AMS 0,05%: Kalinova - 78,5 cm (-1,5); For the actions of DAB 0,05%: Kalinova - 73,1 cm (-6,9); Partition - 66.5 cm (-0.8). Analyzing the hybrid combinations of F2M1 (Fig. 2), the plant height decreased compared to the control in the following combinations: Kalinova / Father for treatment with mutagen NES, plant height of which was on average 60.5 cm (14 cm less than control); Respectively, for processing DMCs - 62.1 cm (-12.4); Romance / TAM 107 under the influence of the mutagen NES - 70.1 cm (-5.1); NMS - 73.1 cm (-2,1); Yuvilir Mironovsky / Yushnohirka for a variant of processing DAB - 73.6 cm (-3.8) and Demeter / Yermak - 80 cm (-0.5). The variants of the treatments distinguished genotypes, which revealed the greatest variability on this basis - they showed a probable decrease in the height of plants compared to control: Bogdan (an average of 19.4 cm); Kalinova (- 6.9 cm); Kalinova / Father (- 14 cm); Romance / TAM 107 (- 5.1 cm).

Fig. 1. Influence of mutagens on height of plants M1 of winter wheat varieties: 1 - Partition; 2 - Goldstone; 3 - Bogdan; 4 - Voloshkova; 5 - Yogurt; 6 - THAT 107; 7 - Mirovinsky Jubilee; 8 - Mud; 9 - Demetra; 10 - Calypole; 11 - Ermak; 12 - Father; □- control (water); I am a NMS of 0.05%; P - NES 0,05%; □- DMC0,05%; □- DAB 0,05%

Fig. 2. Influence of mutagens on height of plants F2M1 of winter wheat hybrids: 1 - Romance / TAM 107; 2 - Anniversaries Mironovsky / Yasnogorka; 3 - Demetra / Ermak; 4 - Kalinova / Father; 5 - Kalinova / Podolanka; 6 - Rostok / Ermak; AND - control (water); □- NMS 0.05%; □NES 0.05%; Sh-DMS 0,05%; S-DAV 0,05%

Using a variety of source material in genetic and environmental terms provides a wider form-forming and the emergence of mutant genes [13]. Mutagens at different concentrations had a multi-directional effect on the variability of plant height in the genotypes we studied. The effect of mutagen NES has reduced the height of the plant depending on the concentration. At higher concentrations, a higher percentage of plants with a lower plant height than the control variant was detected. Fig. 3. Influence of different concentrations of NES mutagen on plant height in M1, Ã2M1 varieties and hybrids of winter wheat: 1 - Myronivsky jubilee; 2 - Dawn of Mironovsky; 3 - Kalinova; 4 - Mironovskaya 808 / Aktior; 5 - Snowy / tm 04; 6 - Mironovskaya 61 / The truth of Odessa; 7-Nausel / Natalka; 8 - Demetra / (Yermak / Myronivska Early Years); 9 - Handwritten / (Iapako / Myronivka Jubilee); 10 - Natalka / (Mirleben / Ex-promt), 2014; SH control; ^ - NPEC 0.01%; N - NES 0.05%; NNES 0.01% The greatest influence on this feature (Figure 3) - in complex crossings, in particular in the hybrid combination Natalka / (Myrleben / Impromptu), plant height under the action of the mutagen NES 0.1% on average was 97.9 cm (4.8 cm less than control); Respectively NES 0,05% - 100,2 cm (- 2,5); NES 0.01% - 101.6 cm (-1.1). In the combination Handicraft / (I_apkao / Myronivska Jubilee) for the processing of NES 0.1% - 95.3 cm (-2). In simple crosses of Snizhan / TM 04 under the action of the mutagen NES 0.1% - 104.4 cm (-3,1); NES 0.05% - 106.4 cm (-1.1); NES 0.01% - 105.6 cm (-1.9). In the Jivilir variety, Myronivsky plant height for treatment with mutagen NES was 0.1% at 101.8 cm (-2.8); NES 0.01% - 102.2 cm (- 2.4).

1. Average meanings of stem length of hybrids of winter wheat, treated with mutagens (2012 -2014 biennium), cm

The mutagen NES at a concentration of 0.01% reduced the height of plants in most of the studied genotypes. To the above mentioned, you can add the varieties Svitanok Myronivsky, whose height was on average 75.1 cm (1.8 cm less than control); Kalinova - 100.3 cm (-7.1) and from simple crossings - a combination of Mironovskaya 61 / Trinity Odessa, plant height of which was 97.6 cm (-0.7). As a result of the mutagenic treatment in the hybrid combinations F3M2 - F5M4, the length of the stalk changes the character of distribution, mean values and coefficients of variation. The length of the stems of the hybrids varied from 53.9 to 118.8 cm in the valiates with the treatment of mutagens at an average of 84.9 cm in control variants (Table 1). The average value for parental forms was 87.4 cm in the years. The smallest indicator in the hybrids was found in the combination of Columbia / Luxurious for processing NMS 0.0125% - 76.8 cm in F3M2 and F4M3 - 53.9 cm and combinations of Bogdan / Stanichnaya for processing DMS 0,0125% in F5M4 - 89.6 cm. The largest length of the stem was observed in the combination of Ogashua / Litanivka for the processing of DMS 0,0125% - 91,6 cm in F3M2 and in the combination Columbia / Luxurious for processing DMS 0.0125% - 72.4 cm in F4M3 and 118.8 cm in F5M4. Mutagens had a multidirectional effect on the value of the coefficient of variation in the studied genotypes. The coefficients of variation (Su) for stem length in combinations for mutagen treatment varied from 4.6 to 19.6%, with an average of 7.8% on control (Table 2). The largest coefficient of variation in F3M2 was reported for processing by mutagenic NPEC 0.01% (10.6%); 0.0125% NMS (10.1%) and F4M3 for processing by mutagenic NPEC 0.01% (19.6%); DMS 0,0125% (17.6%) in the hybrid combination Jubilejnaja 100 / Zolotokolosa, which may indicate the genotype specificity of this combination. The largest variability in F5M4 is observed on the basis of mutagens: 0.0125% NMS in combination with Tliq / Pann (C = 19.6%) and 0.01% NES; 0.0125% NMS in Colombia / Luxurious (15.3% and 14.9% respectively). The coefficient of variation in parental forms was on average 10.1%. Since the height of the plant is a sign that is associated with resistance to sinking, then the negative dominance (reduction of the length of stubble compared with the parent components) is a desirable and selective valuable characteristic. Negative dominance was observed in combinations: Bohdan / Stanichnaja for treatment with all used mutagens and on the control and Jubilejnaja 100 / Zolotokolosa for the action of 0.015% NMS mutagene (see Table 2). Positive dopamine was observed in the combination of Columbia / Rosacea in F5M4 for the action of all used mutagens and in control, other combinations had an intermediate type of inheritance. Consequently, on this basis, in some variants dominated by the proportion of middle-aged morphobio-types, and in others - low-growing. Due to the poly genetic genetic control of this trait, it is not possible to carry out rigorous selection in the early generations, since intermediate succeeding in subsequent generations can produce less mature plants that are of interest for selection for short-stemming.

2. Coefficients of variation and inheritance of the stem length of winter wheat hybrids after processing with mutagens (2012-2014).

Conclusions

The expansion of the range of variation based on the length of the stem in varieties and hybrids and the appearance of a greater number of short-stemmed plants than the control in variants treated with mutagens NMC 0,05%; NES 0.05; 0.1% in M1 and F2M1. By the actions of mutagens, genotypes were identified that revealed the greatest variability in plant height compared to control: Bogdan (on average lower than 19.4 cm), Kalinova (-6.9 cm), Kalinova / Father (-14 cm), Romance / TAM 107 (-5.1 cm). In the hybrid-mutant populations of F3M2-F5M4 wheat, the soft winter also has an expanded range of variation based on the length of the stem. The action of mutagens has shown an increase in the variability of this feature. In hybrid-mutant populations Bohdan / Stanichnaja for processing mutagens NES 0.01%; NMC 0.0125%; DMC 0,0125% and Jubilejnaja 100 / Zolotokolasa under the action of the mutagen NMS 0,0125% revealed a probable increase in the number of co-rhinoscope plants compared with the control. The selection of these combinations is valuable in the selection for short-stemming.

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