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ECOGENETIC VARIABILITY WINTER WHEAT ON THE CELLS LEVEL

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Chemical supermutagens of the alkyl group are highly genotoxic, i.e. those that cause a significant number of genetic changes in cells. Usually, they can induce mutations in various plant genes with high efficiency, but their use has its drawbacks [1, 3]. These substances are able to significantly increase the frequency of mutations compared to physical factors, sometimes the frequency increases by 1.5-2 times [2]. Chemical supermutagens can exhibit high site specificity, i.e. they are able to induce mutations in specific genes or regions of the genome [1, 3].

We used the chemical supermutagen 1,4-bisdiazoacetylbutane, here and hereinafter referred to as DAB, which belongs to the type of chemicals that can lead to a significant level of mutation occurrence with relatively low harmfulness. Seeds of soft winter wheat varieties Farrel, NE 12443, Ronin, Sailor were treated with an aqueous solution of DAB in concentrations of 0.1%, 0.2%, 0.3%, water was the control. For each treatment, 1000 grains of winter wheat were taken. Exposure to the mutagen was 24 hours.

Statistical analysis of dates was performed using the Statistica 10.0 program. Differences between selections were determined using one-way analysis of variance (ANOVA) and were considered reliable at $P < 0.05$. Differences between samples were assessed using the Tukey HSD test.

The analyzed total frequency of chromosomal changes was slightly mediated by the influence of the initial form factor, but the gradual increase in the concentration of the factor had a significant effect. Individual initial forms differed significantly in pairwise analysis. This applies to the variety Farrel, which turned out to be generally less tolerant than others (a significantly higher frequency of aberrations, except for the second concentration, where it was at the level of the others). The number of rearrangements varied from 3.50% (variety Sailor) to 4.28% (variety Farrell) under the action of DAB, 0.1%, under the action of DAB 0.2% from 5.48% (variety Sailor) to 6.39% (variety Farrell), under the action of DAB 0.3% from 8.12% (variety Sailor) to 9.17% (variety Farrell). Thus, the cytogenetic variability caused by this factor was higher than for epimutagens.

For the total frequency of fragments, no significant difference was found for the genotype factor, and the difference was significant for the concentration factor. Pairwise comparisons showed that when switching between individual concentrations, the difference was always significant. The number varied from 18 (variety Sailor) to 22 (varieties Farrell and NE 12443) under the action of DAB, 0.1%, under the action of DAB 0.2% from 28 (variety Sailor) to 35 (variety Farrell), under the action of DAB 0.3% from 36 (variety Sailor) to 47 (variety Farrell).

For the case with bridges, no significant difference was found for the genotype factor again, and the difference was significant for the concentration factor. Pairwise comparisons showed that the difference between the first and second concentrations was insignificant for the Farrell variety. In general, the number of bridges varied from 13 (varieties NE 12443 and Sailor) to 16 (variety Farrell) under the action of DAB, 0.1%, under the action of DAB 0.2% from 18 (variety NE 12443) to 20 (varieties Farrell and Ronin), under the action of DAB 0.3% from 27 (variety Farrell) to 28 (varieties Ronin and Sailor). As for other types of chromosomal rearrangements (lagging chromosomes and micronuclei), for them the variety factor also turned

out to be insignificant, but the response to increasing concentration was statistically significant. When comparing the variants in pairs, we find that there is no difference between the control and DAB 0.1% in the Farrel, Ronin and Sailor varieties, between DAB 0.1 and DAB 0.2% in the Ronin variety, between DAB 0.2 and DAB 0.3% there is always a difference in action, the difference is at any concentration in NE 12443. The number of other aberrations varied from 4 (varieties Ronin and Sailor) to 5 (varieties NE 12443 and Farrel) under the action of DAB, 0.1%, under the action of DAB 0.2% from 8 (varieties Ronin and Sailor) to 13 (variety NE 12443), under the action of DAB 0.3% from 17 (variety Sailor) to 19 (variety NE 12443). The influence of the variety on the induction of complex aberrations is significant, an increase in concentration leads to a significant increase in the frequency of complex changes. The number under the action of DAB 0.1% was 4-5 in all varieties, under the action of DAB 0.2% from 8 (varieties Ronin and Sailor) to 13 (variety Farrell), under the action of DAB 0.3% from 17 (variety Sailor) to 19 (variety NE 12443). For all variants there are statistically significant differences, except for the transition between concentrations of DAB 0.1% and 0.2% in the varieties Ronin and Sailor.

In the case of genotype, discriminant analysis showed the significance for the genotype of only one model parameter - complex aberrations, for changes in the concentration of the total frequency, the number of fragments and complex changes. Thus, the results of the analysis in the factor space are predicted for factors of this nature (among the model features, only frequency, the number of fragments and complex changes for changes in the concentration, complex changes for the initial form are present as indicators of the strength of action). The differentiating ability is sufficient for model parameters to identify less tolerant forms (partially Farrell). According to discriminant analysis, there is no point in using DAB variants of 0.1 and 0.2% at the same time.

Analysis of the action of DAB as a mutagen showed that for this factor, when studied at the cellular level, the parameter such as the increase in the number of cells with two or more rearrangements is more significant. This is a reliable indicator of concentration changes. With increasing concentration, there is a gradual constant increase with significant transitions between individual variants for all model indicators of the total frequency and spectrum of chromosomal rearrangements, except for concentrations of 0.1 and 0.2%, where the difference is not always significant. The Farrel variety showed a significantly higher genetic affinity for the action of DAB due to lower tolerance to adverse effects, especially for model indicators. The difference between other varieties was not significant, although some fluctuations may occur in individual pairwise comparisons. The applied concentrations should be attributed to the range of conditionally moderate cytogenetic activity.

List of sources:

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