INTERGENERATIONAL ANALYSIS OF VIRUS AND GAMMA RAYS EFFECT ON AGRONOMIC TRAITS IN BARLEY REGENERANTS

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Our previous research established that viral infection alone or in combination with gamma radiation generate useful phenotypic variation of some quantitative traits and can be used to enhance genetic variability in barley regenerants ($R_0$) [2]. According to data from the literature phenotypic variation of plant traits can be result of genetic and epigenetic changes under different biotic and abiotic stress factors including gamma rays and viruses [1, 3, 5]. One of major epigenetic modification is DNA methylation that modifies gene expression and is easier passed through generations. In the same time, it is important to highlight that epigenetic modifications show instability and are influenced by the environment, and some epigenetic changes may result in heritable phenotypic variation whereas others are not [1, 5]. In the context of the above, it is purpose to evaluate effect of barley stripe mosaic virus (BSMV) and gamma rays on agronomic trait in barley offspring ($R_1$) compared to the regenerants $R_0$.

Keywords: intergenerational effect, regenerants, barley stripe mosaic virus, gamma rays, quantitative traits

Materials and Method. The two-rowed spring barley cultivars (*Hordeum vulgare* L., $2n = 14$): Sonor, Galactic, Unirea were used in the experiments. The donor plants were obtained from irradiated seeds with gamma rays (at doses of 100, 150 and 250 Gy), from $^{60}$Co source. The dose delivery rate was 0.16 Gy/sec. Barley plants from both irradiated and untreated seeds were mechanically inoculated with a BSMV extract. All plants were tested for the presence of virus infection by negative contrast electron microscopy.

The studied barley regenerants ($R_0$) were obtained from immature embryos-derived calluses via somatic embryogenesis and organogenesis on optimized MS medium (Murashige-Skoog, 1962). The $R_0$ were transferred into soil in pots covered with glass cups and acclimatized under the controlled conditions of light and temperature. Then, somaclones were grown under solarium conditions to obtain seeds. The seeds of $R_0$ were planted in the field conditions to obtain $R_1$ progeny. The plants from each variant
were randomly selected for the measurements of four traits: plant height (PH), apical internode length (AIL), kernel per spike (NKS) and productive tillers per plant (NPT). The differences among the means value were compared using Student’s t test. The dispersion analysis was performed based on the Anova test. The statistical analysis of data was carried out using the software package Statgraphics Plus (version 5.0).

Results. Comparative analysis of the same genotype shows similar quotas of traits with significant deviations of average value from the control in R₀ regenerants compared to descendents R₁, except for Sonor and Unirea genotypes. These genotypes exhibit the lower number of traits with significant deviations of mean value from the control in R₁ generation, for BSMV and BSMV + gamma ray variants (0-25 %) or higher rate of quantitative characters for BSMV + gamma ray, cv. Unirea (100 %). BSMV and gamma radiation influenced the average values of quantitative traits for evaluated cultivars according to the genotype, studied traits, applied factors and generation. In case of Sonor genotype, gamma radiation (250 Gy) increased the average value of PH and AIL traits by 10.97 - 14.78 % over the control in R₁ generation (P≤ 0.001), although it did not significantly influence these parameters in R₀ generation. At the same time, for R₁ descendents of Galactic and Unirea varieties were established lower values of these characters by 13.10 - 46.29 % (P≤ 0.05 - 0.001) for gamma irradiated variants (100 - 250 Gy), comparing with control, except cv. Unirea (PH trait, no significant differences).

BSMV alone or in association with gamma rays (150 - 250 Gy) reduced average value of PH (by 6.83 %) and AIL (by 11.32 - 12.28 %) traits in R₁ generation, only for Unirea genotype (signification P≤ 0.05; 0.01). While, descendants (R₁) of Sonor and Galactic genotypes exhibited the higher value of PH (by 2.3 – 7.15 %) and AIL (by 9.90 – 11.32%) with significant deviations (P≤ 0.05) from the control for BSMV variant, contrarily to R₀ generation. It is important to note that R₁ offspring of Unirea and Galactic varieties from gamma irradiated (100 - 250 Gy), BSMV and BSMV + gamma ray (250 Gy) variants showed the same tendency for lower mean value than the control of PH and AIL traits compared to the R₀ regenerants. The short plant height and apical internodes length are accompanied by the lodging resistance in barley, and play a very important role in grain yield formation. Regarding to the traits direct associated with the yield (NPT and NKS), gamma radiation (250 Gy) and BSMV (only for cv. Unirea, NPT) caused a significantly (P≤ 0.01; 0.001) reduction of average value (by 22.00 - 35.23 %) compared with control variant of NPT (cv. Galactic, Unirea) and NKS (Unirea) characters in R₁ descendents contrarily with R₀ regenerants, except cv. Sonor (no significant differences). Also, these genotypes, only for NPT trait, indicated the same tendency of mean value in R₀ - R₁ regenerants, irradiated (lower mean value than the control) and BSMV (higher over the control) variants.

The analysis of variance established significant variation of quantitative parameters, according to the genotype, trait, generation as well as the interaction of genotype
and studied factors. The *genotype* was mainly responsible for variation of studied characters (14.99 to 38.84%), followed by the interaction of *genotype x dose of radiation* (5.20 to 10.40%), *virus x radiation* (2.54%) and *genotype x virus* (2.35%). It is necessary to note that the contribution of the studied factors on variation of characters related to the plant architecture in the offspring (R₁) had the unequivocally impact (*dose of radiation* and *virus x radiation*) or a greater impact (*genotype x dose of radiation*) compared to the R₀ regenerants.

**Conclusions:** The obtained results confirm the significant (95 - 99.9%) influence of gamma radiation (100-250 %) and viral infection on variation of architectural and productivity traits of descendants R₁ and suggest about intergenerational effect of these factors, according to the genotype. In the context of these, it is need to evaluate the next generation (R₂) of barley regenerants.

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**References:**