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VARIABILITY OF BIOMETRIC TRAITS AND RELATIONSHIPS BETWEEN EAR COMPONENTS IN WINTER WHEAT – CASE STUDY OF THE ‘BIHARIA’ VARIETY

REBECA TOMUȚA[1], SEBASTIAN PANĂ[1], GABRIELA GORINOIU[1], MIHAI VALENTIN HERBEI[2], FLORIN SALA[1,2*]

[1]Agricultural Research and Development Station Lovrin, Lovrin, 307250, Romania
[2]University of Life Sciences "King Mihai I" from Timisoara, Timișoara, 300645, Romania

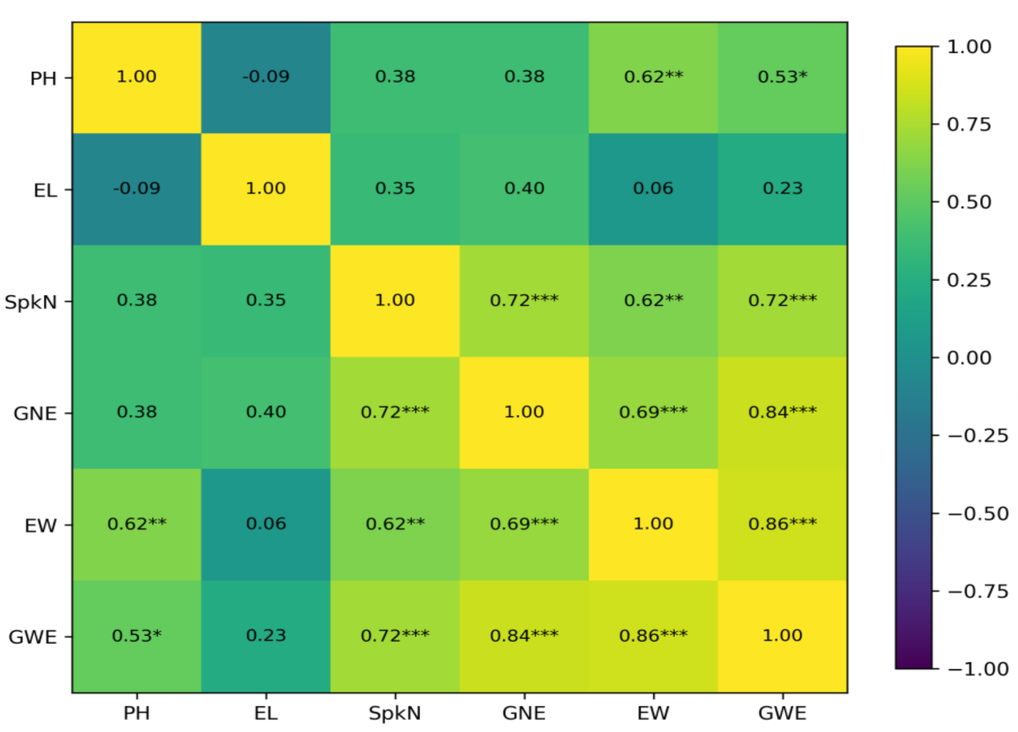
Abstract: The study aimed to characterize the biometric variability and analyze the relationships between the main morphological traits and ear components of the winter wheat variety 'Biharia' under the climatic conditions specific to the 2025–2026 agricultural year. The study was conducted at ARDS Lovrin, Romania. Climatic conditions during the period from September 2025 to July 2026 were characterized by a mean monthly temperature of 11.91 °C, with cumulative precipitation totaling 355.9 mm. Biometric assessments were performed on 20 individual plants randomly sampled from the experimental variant. Plant height (PH, cm), ear length (EL, cm), number of spikelets (SpkN), number of grains per ear (GNE), ear weight (EW, g), and grain weight per ear (GWE, g) were determined. The results highlighted clear interdependencies between the structural and productive components of the ear and indicated the utility of multivariate approaches for characterizing the biometric response of wheat plants.

• Introduction

Wheat (*Triticum aestivum* L.) is one of the world's major cereal crops, playing a key role in ensuring food security and providing energy and protein for the human population (SHEWRY AND HEY, 2015). Grain yield is a complex trait resulting from the contribution and interaction of several morphological and productive components. In particular, wheat ear characteristics are essential for determining the final grain number and, consequently, the wheat's yield potential. Numerous studies have highlighted the existence of genetic and phenotypic relationships between ear length, number of spikelets, number of grains, and grain weight (ZHOU ET AL., 2017; KHAN ET AL., 2022; KUMAR ET AL., 2022). In experiments conducted on wheat, traits such as ear length, number of spikelets, number of grains, and grain weight per ear have been repeatedly identified as relevant variables for explaining differences in productivity (KHAN ET AL., 2022; KUMAR ET AL., 2022). The objective of this study was to characterize the variability of key biometric and productive traits of wheat plants (Biharia variety) evaluated during the 2025–2026 agricultural year and to analyze the relationships between them.

• Material and method

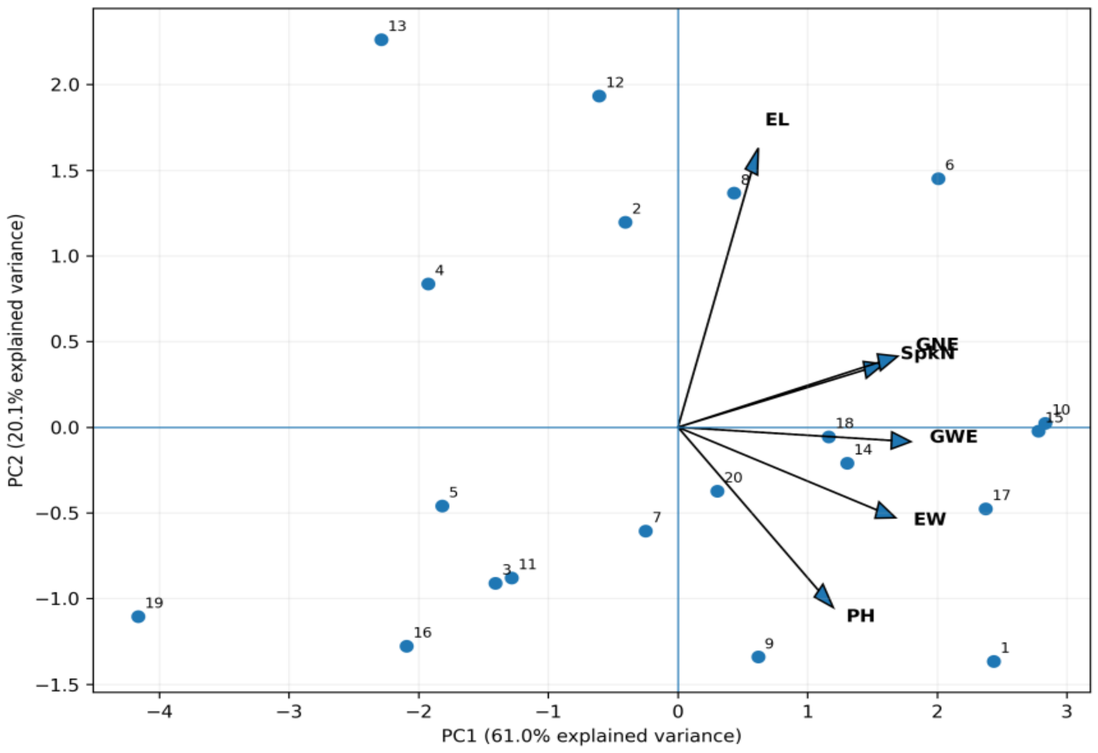
The study was conducted during the 2025–2026 agricultural year on winter wheat plants (*Triticum aestivum* L.), variety Biharia. The experiment was carried out at ARDS Lovrin, Timiș County, Romania. The biometric assessment included 20 individual plants, randomly selected from the experimental plot. For each plant, six biometric and productive traits were determined: plant height (PH, cm), ear length (EL, cm), number of spikelets (SpkN), number of grains per ear (GNE), ear weight (EW, g), and grain weight per ear (GWE, g).



Correlation matrix

• Results and discussions

The average plant height was 86.33 ± 0.78 cm, with values ranging from 81.20 ± 0.78 cm to 91.80 ± 0.78 cm. The coefficient of variation (CV = 4.04%) indicated high plant uniformity for this trait. Low variability was also observed for ear length (EL), with a mean value of 7.81 ± 0.11 cm and a CV of 6.55%, as well as for the number of spikelets per ear (SpkN), characterized by a mean of 16.45 ± 0.28 spikelets and a CV of 7.50%. The number of grains per ear (GNE) showed greater variability, with values ranging from 33±1.23 to 53±1.23 grains, an average of 41.20±1.23 grains ear^{-1}, and a CV of 13.38%. Ear weight (EW) showed the highest relative variability among the analyzed parameters, with values ranging from 1.30±0.09 g to 2.90±0.09 g, a mean value of 2.07±0.09 g, and a CV of 19.83%. Grain weight per ear (GWE) ranged from 1.10±0.06 g to 2.10±0.06 g, with a mean of 1.62±0.06 g and a CV of 16.72%. The Pearson correlation matrix highlighted the existence of significant positive relationships between the structural and productive components of the ear (Figure 4). A strong correlation was identified between ear weight and grain weight per ear ($r = 0.857$; $p < 0.001$). This result is logical, as the grains constitute a major component of the total ear weight. The relationship indicated that plants with heavier ears generally also exhibited higher grain weight. A strong correlation was also observed between the number of grains per ear and grain weight ($r = 0.839$; $p < 0.001$). This result highlighted the role of grain number in determining individual ear productivity. Multivariate analysis (PCA) was performed on the six traits using standardized values. The first two components had eigenvalues greater than 1, and collectively explained 81.09% of the total variability. PC1 explained 61.03% of the total variance and was positively associated with all analyzed traits, with the highest loadings recorded for GWE, GNE, EW, and SpkN (Figure 5).



PCA biplot of biometric and ear productivity traits

• Conclusions

The study revealed varying degrees of variability in the biometric and productive traits of the 'Biharia' wheat variety under the studied conditions. General morphological traits, such as plant height, ear length, and number of spikelets, exhibited relatively low variability, whereas parameters directly associated with ear productivity showed a more pronounced dispersion. Among the traits analyzed, ear weight exhibited the highest relative variability, with a coefficient of variation of 19.83%, followed by grain weight per ear and the number of grains per ear. In contrast, plant height was the most uniform trait, with a coefficient of variation of only 4.04%.

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