INFLUENCE OF SUPRAOPTIMAL TEMPERATURES ON MAIZE AT THE INITIAL STAGES OF GROWTH

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**Purpose** of this work was to study the resistance to supraoptimal temperatures of various maize hybrids by evaluating some changes in seed germination and mobilization of reserve substances.

Introduction. The initial stages of plant growth is the more influenced by abiotic factors, in special by high temperatures. Supraoptimal temperatures delay seed germination and reduce the growth rate of embryonic roots and shoots. [5]. Taking into account that the number of studies on germination characteristics and mobilization of reserve substances of maize seeds in correlation with their tolerance to non-optimal temperature is very limited, research on the primary resistance to supraoptimal temperatures of maize lines used in the Republic was initiated [3].

**Keywords:** heat shock, maize seed, germination, vigor, metabolic efficiency

**Materials and Method.** The experiments were carried out in 2022 year in laboratory conditions. Maize seeds of hybrids Porumbeni 383 (P383) and BEMO 203 (B203), which differ by maturation period and size of seeds, were contributed by the „Porumbeni” Institute of Crop Science (Republic of Moldova). Previously soaked with water for 24 hours, the maize seeds were exposed to heat shock at temperatures of 48°C 50°C and 52°C for 30 min. Germination of treated and intact seeds (control) was performed according to the standard method described by the international rules [2]. After 7 days of germination, the modification of followed bio-morphological traits were determined: germination capacity; lengths of roots and shoots; vigour index [4]; dry biomass of separated components (seeds, roots, shoots) and metabolic efficiency [1].

**Results.** The germination capacities of maize seeds exposed to heat shock reduced with increasing temperature. However, the tested hybrids reacted differently to elevated temperatures. At 50°C the germination capacity of B203 seeds decreased by 16%, and that of P383 by 21%. Heat shock at 52°C led to a diminution of seed germination by 21% and 32%, respectively in hybrid B203 and P383.

The physiological response, evaluated through the growth of embryonic roots and shoots of the two hybrids also differed at different temperatures. The roots length of ger-
minated seeds after heat shock at 48°C did not change significantly in comparison with intact seeds of both hybrids. An increase in temperature to 50-52°C led to inhibition of roots growth. The roots length of both hybrids decreased by 25-35% compared to intact seeds. It is necessary to mention that the roots length of intact seeds of tested hybrids differed significantly (p≤0.001). The root length of hybrid B203 was 14.00±0.31 cm and that of P383 – 6.81±0.25 cm. After heat shock at 50°C and 52°C, the lengths of roots were shorter by 3.85-5.2 cm in B203 hybrid and 1.75-1.93 cm in P383 hybrid; and had the statistically significant differences at p≤0.001 for hybrid B203 and p≤0.05 for hybrid P383 between intact and treated seeds.

Concerning the shoots of tested hybrids, their lengths of germinated intact seeds did not differ; the shoot length was 6.28±0.13 cm and 6.03±0.12 cm, respectively for hybrids B203 and P383. It was shown that the shoots were less affected by high temperature than the roots of treated seeds. However, after heat shock at 52°C the germinated seeds had the shoots, the length of which were statistically significant shorter from intact seeds by 2.38 cm (p≤0.001) for hybrid B203 and 0.89 cm (p≤0.05) for hybrid P383.

The initial vigor of intact seeds in hybrid B203 was equal to 542.37, and in P383 – 431.81. Seeds of B203 hybrid treated at 48°C lost 5% in vigor and P383 hybrid about 30%. A subsequent increase in temperatures to 52°C led to a decrease in the vigor index of both hybrids, approximately two times. Therefore, the vigor of B203 seeds remained 1.5 times higher than that of P383 seeds.

During the germination, the seeds of both hybrids consumed for growth of roots and shoots only 46-54% of reserve substances mobilized from the endosperm. The remaining mobilized reserve substances were used to provide energy for physiological processes. The ratio between the weights of reserve substances utilized for the growth of roots/shoots and spent for energy supply changed depending on the degree of heat treatment of seeds and characterized the metabolic efficiency of hybrids. In limits of experimental temperatures (48-52°C) the metabolic efficiency of treated seeds in relation to the intact ones decreased in direct proportion. The equations for reducing metabolic efficiency from 48 to 52°C were determined. The degradation coefficient of metabolic efficiency for hybrid B203 was 0.0137 and for hybrid P383 - 0.3826. These data showed that the rate of degradation of the P383 hybrid was significantly higher than that of B203 under the influence of supraoptimal temperatures.

**Conclusions.** The effect of supraoptimal temperatures on such bio-morphological traits as germination, length of roots and shoots, dry weight of biomass, vigor and metabolic efficiency of maize seeds of two different hybrids was studied. The significant changes in physiological processes of seeds germination were established within the temperature range of 48-52°C. Taking into account the obtained data about modification of total germination, vigor and metabolic efficiency with an increase in temperature
by two degree (from 48 to 50°C; from 50 to 52°C) it can be concluded that the maize seeds of P383 hybrid are more vulnerable to the influence of supraoptimal temperatures than the seeds of the P203 hybrid.

**Acknowledgment.** The authors gratefully acknowledge colleagues from the „Pörumbeni” Institute of Crop Science, who kindly provided us with the maize seeds.

Research was carried out within the State Program no. 20.80009.7007.07 “Determining the parameters that characterize the resistance of plants with the different level of organization to the action of extreme temperatures in order to reduce the effects of climate change”, financed by the National Agency for Research and Development.

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