Abstract

Response of selected physiological and morphological parameters of maize to hypoxia/posthypoxia growing conditions and their genetic determination

Hypoxia and posthypoxia are two important abiotic stresses that limit the crop yield all over the world. Understanding the exact location and mechanisms of the waterlogging effects is very important for the future improvement of the crop productivity.

My diploma thesis is focused on characterization of various physiological (Hill reaction activity (HRA), photosystem 1 activity (PS1), photosynthetic pigments content and ratio (chlorophyll (chl) *a*, chl *b*, chl (*a*+*b*), chl *a*/*b*, carotenoids (car), chl/car), relative water content (RWC) and specific leaf mass) and morphological (metrical and weight parameters of plants) changes occuring in different maize genotypes under hypoxia (7 days) and posthypoxia. Two inbred lines (2023, CE704), their reciprocal F_1 hybrids and F_2 generation were used. Genetic analysis was performed to determine individual genetic effects.

I found that posthypoxia has more negative impact on maize plants than hypoxia. Significant decrease of photosynthetic pigments content (chl *a* and *b*) was also observed. It could be explained as an adaptative feature leading to the minimization of the photooxidative damage in the plant tissues. Photosystem 2 activity (expressed as HRA) was less affected with watterlogging than PS1. This could mean, that the capacity of HRA is higher than it is for PS1, which seems to limit an electron flow through photosystems under short-term hypoxia. It could also mean that photooxidation during 7 days of hypoxia is not so destructive for HRA. Differences in physiological traits among genotypes were rarely significant (usually under stress conditions). The parental line CE704 performed low values in majority of parameters with exception of RWC. Differences among genotypes were significant for many of the morphological parameters. Line CE704 attained less values in most of the traits again both under stress and nonstress conditions, but in contrast to other genotypes, the changes caused by hypoxia/posthypoxia were less pronounced. It coul be concluded that the line CE704 is potentially the most tolerant to waterlogging. Genetic analysis of individual traits showed both aditive and dominance genetic effects. Dominat maternal effects was also significant for most of parameters. The significant changes in genetic determination of traits were observed not only under hypoxia and posthypoxia but also during growth and developement of plants.

Key words: waterlogging, hypoxia/posthypoxia, maize, Hill reaction activity, photosystem 1 activity, photosynthetic pigments, genetic analysis

Klíčová slova: zaplavení, hypoxie/posthypoxie, kukuřice, aktivita Hillovy reakce, aktivita fotosystému 1, fotosyntetické pigmenty, genetická analýza