

Abstract

Olive tree (*Olea europaea* L.) is one of the world's oldest domesticated crops, a long-living tree capable to withstand periods of high temperatures with limited water supply, deteriorated soil conditions, but also exposure to freezing temperatures during winters. The work is focused on the characterization of stress responses of olives to selected stress factors (drought, salinity, cold) at the level of antioxidant systems and aims to answer the question whether the nature of these responses changes due to repeated exposure to the stress factor. In many plants, an important component of the stress response is the adaptation of carbohydrate balance, including changes in the total carbohydrate content as well as in their spectrum. Due to the potential of soluble carbohydrates to quench free radicals and due to the diversity of the olive carbohydrate spectrum, special attention has been paid to the study of accumulation of individual groups of carbohydrates with protective potential.

We have optimized experimental *in vitro* cultivation conditions for two subspecies of olive tree - domesticated (Picual cultivar) and wild one (ssp. *laperrinei*). It was impossible to find conditions ensuring satisfactory growth of the photoautotrophic culture. In experiments simulating the water shortage by adding PEG to the culture medium, we repeatedly verified that the use of PEG 4000 and 6000 has a strong negative effect on olive growth at our experimental design. Therefore, it was not possible to perform the experiments employing PEG to the planned extent. In the arrangement simulating repeated exposure to salt, the accumulation of mannitol was observed, which showed a memory character.

For monitoring the effect of repeated stress, an experimental model involving the action of suboptimal temperatures seemed to be the most suitable. Using this arrangement, we also obtained data on the response of the wild olive, for which the information on reactions to stress factors are not yet available. The common reaction of both subspecies was an increase in sucrose proportion, which in the case of domesticated olive showed a memory character in one repetition of the experiment. In addition, the reaction comprising of accumulation of total soluble carbohydrates was frequent in domesticated olive. Contrary to our primary assumption, it appears that the wild subspecies (*Olea europaea* ssp. *laperrinei*) is not as resilient against cold as its domesticated relative.

Key words: antioxidants, carbohydrates, *in vitro* cultivation, mannitol, *Olea europaea*, raffinose family oligosaccharides, stress memory, wild olive tree