Abstract

Potato (*Solanum tuberosum*) tuberization is a complex, strictly regulated morphogenic process. Since potato is one of the most important crops in the world, understanding the regulation of this process is gaining in importance not only from a theoretical but also from a practical point of view. This work focuses on the role of sugars, which can serve not only as an energy and building material sources, but also as an important signal regulating many developmental processes including the tuberization. As a primary experimental material potato cv. Lada (WT) and its spontaneously tuberizing (ST) mutant was used. Since the previous results with ST plants suggested altered carbohydrate partitioning between plant organs and significant difference in total carbohydrate contents between ST plants and the WT (Fischer et al. 2008), in the first manuscript presented, the aim was to examine in detail the sugar metabolism of ST plants grown *in vitro* mixotrophically (MT) and photoautotrophically (PA). We observed changes in soluble carbohydrate allocation and starch deposition, favouring basal stem part in ST. Even thought, gibberellins (GAs) are considered to be the main tuberization inhibitors, ST potato plants had surprisingly high GAs levels. The determination of tuber-inducing marker gene expressions revealed increased levels of *StSP6A* (potato *FT* homologue) in ST leaves. The second manuscript presented is focusing on a comparison of physiological reactions of four plant species (potato, tobacco, rapeseed and strawberry) under MT and PA cultivation *in vitro*. We found significant differences in plant carbohydrate metabolism between MT and PA cultivation systems. Moreover, each plant species under study had its own specific reaction to MT cultivation, completely altering the way of using its resources, probably due to the different strategies each plant uses to deal with the high amount of assimilates. In the third manuscript presented we investigated ST potato root cultures, which eventhough separated from the rest of the plant body showed similar changes in the phenotype and sugar metabolism as the whole ST plant. The main aim of the thesis is to contribute to the understanding of the role of the carbohydrate metabolism in the network of regulatory relationships governing the plant morphogenic processes.

Key words: carbohydrate metabolism, cultivation *in vitro*, photoautotrophic cultivation, potato, tuberization