Abstract

Plants are sessile organisms and so they cannot escape changes in environmental conditions. In order to optimize seed production and to ensure that flowering occurs during the appropriate season, plants have evolved a complex of regulatory pathways to control when the floral transition takes place. One group of regulatory pathways involves enviromental factors like certain photoperiod or vernalization. The second group of regulatory pathways involves the state of development and is not sensitive to environmental cues, this pathway is called autonomous pathway and plants in this group do not require a particular photoperiod or vernalization, they are called day-neutral plants. The transition of these plants from vegetative to reproductive phase depends on combination of reaching certain minimal number of nodes, inhibition effect of roots, floral signals generated by leaves and activity of the shoot apical meristem (SAM). Among early events of the transition of SAM to reproductive phase belongs an increase in the mitotic activities of the cells in SAM. Precise mechanisms of the action of the signals connected with transition of SAM to flowering have not been elucidated yet.

The plants of day-neutral tobacco (*Nicotiana tabacum* L.) cv. Samsun were transformed with fission yeast mitotic activator coded by *cdc*25 (*Spcdc25*) and besides others precocious flowering was observed (Bell et al. 1993). The aim of the presented study was to determine the component of the multifactorial system controlling flowering onset which was most affected by the *Spcdc25* transformation and based on the results to contribute to elucidation of flowering regulation in day-neutral plants.

The transformation led to dramatic change in flowering of tobacco plants cultivated under *in vivo* conditions. Transformed plants of two lines flowered earlier after reaching lower number of leaves / nodes compared to the control plants. The grafting experiments enabling combination of parts of transformed and control plants indicated, that the speeding up of flowering was caused by the effect of the transformation on the SAM. This finding was supported by anatomical analysis of SAM which revealed substantial differences between the SAM structure of transformed and control plants already at early stages of the plant development.

Sugars, especially sucrose, are proposed to be a part of the control system of flowering. *In vitro* experiments confirmed the previously found effect of enhanced sucrose supply on earlier onset of flowering and beside this also the disturbed acropetal gradient of floral capacity in transformants. The study of sugar content and transport within plant body

(performed with the help of leaf and decapited plants exudates analysis) revealed no significant and systematic changes in these characteristics between transformed and control plant material.

Based on the presented results we propose that the main change caused by the transformation of the day-neutral tobacco with *Spcdc25* gene is connected with altered characteristics of SAM, presumably as a consequence of changed mitotic activity of the SAM cells, which results in higher capacity to flower in transformed material.