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Abstract

Axillary bud outgrowth is a major process allowing the plant to adapt its architecture to environmental constraints. Indeed, the dormant buds formed at each leaf axil contain meristems, which depending on the environment, remain quiescent or resume activity leading to bud outgrowth and the development of a new axis [1]. Studies on apical dominance, *i.e.* the inhibition of buds by the growing apical zone, have highlighted the opposite roles of auxin and sugar, which is involved in a signaling and trophic regulation of bud activity [2-4]. However, understanding the interaction between the environment and the mechanisms of apical dominance is a major issue [3]. Our study tests the long-standing hypothesis that sugar availability is involved in the mediation of light effect on bud outgrowth at plant-level. We combined experimental studies and computer simulations, using rose as a plant model.

First, using buds grown *in vitro*, high sugar availability was demonstrated to reduce auxin repressing effect on bud outgrowth, indicating that it could reduce the auxin-related apical dominance *in planta*. Sugar effect was highlighted to be due to a repression of a pathway downstream of auxin by testing different possible scenarios in a model [5].
Then, we demonstrated the ability of sugar availability to modulate bud outgrowth rate and to explain, at least partly, light effect *in planta*. Plants were grown under comfort light conditions, or under permanent or temporary light limitation. Physiological and morphological analyses showed a positive relationship between bud outgrowth rate and sugar contents in stems. Moreover, the exogenous supply of sugar stimulated bud outgrowth under unfavorable light conditions. Calculating photosynthesis and carbohydrate (C) demand highlighted that, compared to high light, continuous and temporary low light altered sugar contents through a predominant effect on photosynthesis and on C demand, respectively.

These results highlight that light, by controlling C sources and sinks, modulates the availability of sugar for buds and thus the repressive effect of auxin on axillary bud activity. They pave the way for a better consideration of the mechanisms controlling the control of lateral meristems in plant models.

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