Effect of (Changes in) Air Humidity on Transpiration and (Adaptation of) Stomatal Closure of *Tradescantia* Leaves during Water Stress

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Abstract

This paper summarises our recent research on the physiological effects of prolonged high RH during growth on stomatal function and we discuss possibilities that arise from this work for reducing postharvest quality problems in cut flowers. Chlorophyll fluorescence imaging was used to measure stomatal closure in response to desiccation of *Tradescantia virginiana* leaves grown under high (90%) and moderate (55%) relative humidities, or transferred between these humidities. Stomata of plants transferred from moderate RH conditions to high RH showed the same diminished closure in response to desiccation, as did stomata that developed at high RH. This response was found both when the leaves were either fully expanded or still actively expanding during the moderate RH pre-treatment. However, when leaves were grown in high RH prior to a moderate RH treatment, the reduced stomatal closure response to desiccation was only reversed in leaves (regions) which were still actively expanding during moderate RH treatment. This indicates that with respect to stomatal responses to desiccation, high RH leaf regions have only a limited capacity to adapt after transfer to moderate RH conditions. It is suggested that the diminished stomatal closure in high RH-grown plants is the result of changes in the signalling pathway for ABA-related closure induced by a prolonged period (several days) at a low ABA level. A short increase of VPD (by decreasing RH or increasing temperature) once every 2 or 3 days is probably sufficient to overcome vase life problems of cut flowers grown at high RH. Testing the acclimation ability of stomata to desiccation by transferring high RH grown plants to low VPD for just a few days would be a simply and effective screening procedure for genotypes with more adaptable stomata.

INTRODUCTION

Among the environmental conditions during the cultivation period that influence the vase life of cut flowers air humidity is one of the most important, as shown for roses (Mortensen and Fjeld, 1995, 1998; Mortensen and Gislerød, 1997, 1999, 2000; Torre et al., 2001; In et al., 2007). This effect of air humidity during the pre-harvest phase is mainly due to its effect on stomatal behaviour of the cut flowers. The closure of stomata of roses grown at high RH is less sensitive to water stress and darkness (Torre and Fjeld, 2001; Torre et al., 2001) and the cut stems show excessive water loss in indoor conditions (Mortensen and Gislerød, 1999). To obtain the optimal response to multi-factorial environmental changes, stomata sense many environmental factors and have the ability to integrate environmental and endogenous signals (Kearns and Assmann, 1993; Hetherington and Woodward, 2003). Besides the short-term effects of these factors, the history of growth conditions can affect the fine-tuning of the stomatal response. The reason why stomata of high RH-grown leaves are less hydrosensitive is not clear. Desiccation is one of the principal causes of plant death in rooted leafy cuttings and micropropagated plants transferred suddenly from a high to moderate or low RH.

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