

RESEARCH PAPER

The role of abscisic acid in disturbed stomatal response characteristics of *Tradescantia virginiana* during growth at high relative air humidity

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Abstract

In this study, the role of abscisic acid (ABA) in altered stomatal responses of *Tradescantia virginiana* leaves grown at high relative air humidity (RH) was investigated. A lower ABA concentration was found in leaves grown at high RH compared with leaves grown at moderate RH. As a result of a daily application of 20 μ M ABA to leaves for 3 weeks during growth at high RH, the stomata of ABA-treated leaves grown at high RH showed the same behaviour as did the stomata of leaves grown at moderate RH. For example, they closed rapidly when exposed to desiccation. Providing a high RH around a single leaf of a plant during growth at moderate RH changed the stomatal responses of this leaf. The stomata in this leaf grown at high RH did not close completely in response to desiccation in contrast to the stomata of the other leaves from the same plant. The ABA concentration on a fresh weight basis, though not on a dry weight basis, of this leaf was significantly lower than that of the others. Moreover, less closure of stomata was found in the older leaves of plants grown at high RH in response to desiccation compared with younger leaves. This was correlated with a lower ABA concentration in these leaves on a fresh weight basis, though not on a dry weight basis. Stomata of leaves grown at moderate RH closed in response to short-term application of ABA or sodium nitroprusside (SNP), while for leaves grown at high RH there was a clear difference in stomatal responses between the leaf margins and main-vein areas. The stomatal aperture in response to short-term

application of ABA or SNP at the leaf margins of leaves grown at high RH remained significantly wider than in the main-vein areas. It was concluded that: (i) a long-term low ABA concentration in well-watered plants during growth at high RH could be a reason for less or no stomatal closure under conditions of drought stress; and (ii) the long-term ABA concentration on a fresh weight basis rather than on a dry weight basis is likely to be responsible for structural or physiological changes in stomata during leaf growth.

Key words: Chlorophyll fluorescence, nitric oxide, PSII efficiency, stomata, vapour pressure deficit.

Introduction

Stomatal movement (producing changes in stomatal aperture) is a complex result of interactions of physiological factors and environmental conditions (Kearns and Assmann, 1993; Assmann and Wang, 2001; Hetherington and Woodward, 2003). Besides short-term conditions, stomatal movement also depends on the growth conditions in which the stomata developed, of which one of the most important is relative air humidity (RH). For example, a lack of stomatal closure under conditions of water stress has been reported in roses grown at RHs >85% (Torre and Fjeld, 2001; Torre *et al.*, 2003). Similarly, a failure of stomata to close in response to desiccation or abscisic acid (ABA) has been shown in leafy cuttings rooted at high RH (Fordham *et al.*, 2001) and in plants propagated *in vitro* (Ziv *et al.*, 1987; Santamaria *et al.*, 1993). Recently,

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Abbreviations: ABA, abscisic acid; Φ_{PSII} , relative quantum yield or efficiency for electron transport by photosystem II; PSII, photosystem II; RH, relative air humidity; SNP, sodium nitroprusside; VPD, vapour pressure deficit.