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# Stomatal response characteristics of *Tradescantia virginiana* grown at high relative air humidity

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Plants produced at high relative air humidity (RH) show poor control of water loss after transferring to low RH, a phenomenon which is thought to be due to their stomatal behaviour. The stomatal anatomy and responses of moderate (55%) and high (90%) RH grown *Tradescantia virginiana* plants to treatments that normally induce stomatal closure, i.e. desiccation, abscisic acid (ABA) application and exposure to darkness were studied using attached or detached young, fully expanded leaves. Compared with plants grown at moderate RH the transpiration rate, stomatal conductance and aperture of high RH grown plants measured at the same condition (40% RH) were, respectively, 112, 139 and 132% in light and 141, 188 and 370% in darkness. Besides the differences in stomatal size (guard cell length was 56.7 and 73.3 μm for moderate and high RH grown plants, respectively), there was a clear difference in stomatal behaviour. The stomata responded to desiccation, ABA and darkness in both moderate and high RH grown plants, but the high variability of stomatal closure in high RH grown plants was striking. Some stomata developed at high RH closed in response to darkness or to a decrease in relative water content to the same extent as did stomata from moderate RH grown plants, whereas others closed only partly or did not close at all. Evidently, some as yet unidentified physiological or anatomical changes during development disrupt the normal functioning of some stomata in leaves grown at high RH. The failure of some stomata to close fully in response to ABA suggests that ABA deficiency was not responsible for the lack of stomatal closure in response to desiccation.

## Introduction

Stomata control leaf gas exchange, especially $CO_2$-uptake for photosynthesis and water vapour loss via transpiration in aerial plant organs. Stomatal movement (producing changes in stomatal aperture) depends on the swelling and shrinking of the guard cells caused by changes in cell turgor (Assmann 1993, Wang et al. 1998). This behaviour is the result of interactions between physiological factors and environmental conditions (Assmann and Wang 2001, Hetherington and Woodward 2003, Kearns and Assmann 1993). Moreover, stomatal responses to leaf water potential are altered by preceding environmental conditions. In general, the threshold leaf water potential required initiating stomatal closure shifts to a lower value by subjecting plants to repeated cycles of water stress by soil drying (Ackerson 1980, Brown et al. 1976, McCree 1974). It has also been shown that stomata of plants grown under water stress are smaller than in well-watered plants (Cutler et al. 1977, Spence et al. 1986, Xia 1994). When low water potentials during drought stress can change the stomatal anatomy and response characteristics, some opposite changes might be

*Abbreviations* – ABA, abscisic acid; RH, relative air humidity; RWC, relative water content; VPD, vapour pressure deficit.