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Review article

Improving stomatal functioning at elevated growth air humidity: A review

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ABSTRACT

Plants grown at high relative air humidity (RH ≥ 85%) are prone to lethal wilting upon transfer to conditions of high evaporative demand. The reduced survival of these plants is related to (i) increased cuticular permeability, (ii) changed anatomical features (i.e., longer pore length and higher stomatal density), (iii) reduced rehydration ability, (iv) impaired water potential sensitivity to leaf dehydration and, most importantly, (v) compromised stomatal closing ability. This review presents a critical analysis of the strategies which stimulate stomatal functioning during plant development at high RH. These include (a) breeding for tolerant cultivars, (b) interventions with respect to the belowground environment (i.e., water deficit, increased salinity, nutrient culture and grafting) as well as (c) manipulation of the aerial environment [i.e., increased proportion of blue light, increased air movement, temporal temperature rise, and spraying with abscisic acid (ABA)]. Root hypoxia, mechanical disturbance, as well as spraying with compounds mimicking ABA, lessening its inactivation or stimulating its within-leaf redistribution are also expected to improve stomatal functioning of leaves expanded in humid air. Available evidence leaves little doubt that genotypic and phenotypic differences in stomatal functioning following cultivation at high RH are realized through the intermediacy of ABA.

Contents

1. Introduction

The ability of stomata to tune their aperture considerably affects plant survival, especially under conditions of water deprivation (Sellin et al., 2014; Papanatsiou et al., 2016). Since stomatal responsiveness to closing stimuli is set by the growth environment (Fanourakis et al., 2015b; van Meeteren and Aliniaeifard, 2016),

Abbreviations: ABA, abscisic acid; RH, relative air humidity; VPD, vapour pressure deficit.

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