Volatile compounds other than CO2 emitted by different microorganisms promote distinct post-transcriptionally regulated responses in plants

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Using a “box-in-box” co-cultivation system we have investigated plant responses to microbial volatile compounds (VCs), and evaluated the contributions of organic and inorganic VCs (VOCs and VICs, respectively) to these responses. Arabidopsis plants were exposed to VCs emitted by adjacent Alternaria alternata and Penicillium aurantiogriseum cultures, with and without charcoal filtration. No VOCs were detected in the headspace of growth chambers containing fungal cultures with charcoal filters. However, these growth chambers exhibited elevated CO2 and bioactive CO and NO headspace concentrations. Independently of charcoal filtration, VCs from both fungal phytopathogens promoted growth and distinct developmental changes. Plants cultured at CO2 levels observed in growth boxes containing fungal cultures were identical to those cultured at ambient CO2. Plants exposed to charcoal-filtered fungal VCs, non-filtered VCs, or super-elevated CO2 levels exhibited transcriptional changes resembling those induced by increased irradiance. Thus, in the “box-in-box” system, (a) fungal VICs other than CO2 and/or VOCs not detected by our analytical systems strongly influence the plants´ responses to fungal VCs, (b) different microorganisms release VCs with distinct action potentials, (c) transcriptional changes in VC-exposed plants are mainly due to enhanced photosynthesis signaling, and (d) regulation of some plant responses to fungal VCs is primarily posttranscriptional.