Activity assessment of tomato endophytic bacteria bioactive compounds for the postharvest biocontrol of *Botrytis cinerea*

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Postharvest Biology and Technology, Volume 172, February 2021, 111389

Abstract

Botrytis cinerea is one of the most important postharvest fungal pathogens causing significant losses in fresh fruits, vegetables and ornamentals. Synthetic fungicides are primarily used to control postharvest decay loss, but due to their hazardous use the recent trend is shifting toward safer and more eco-friendly alternatives. The use of antagonistic microorganisms is becoming popular throughout the world. This study investigated the antifungal, the plant growth promoting activities and the identity of volatile organic compounds (VOCs) produced by tomato-derived endophytic bacteria strains. The capacity of selected strains to prevent postharvest *B. cinerea* infection on tomato fruit through VOCs and soluble compounds was also studied. A collection of 50 bacterial strains was established from different organs of tomato plants sampled from six localities in Cape Bon region (Tunisia). Despite the small geographical scale, complexity and abundance of endophytic communities varied greatly according to the site of origin. Healthy tomato plants harbor diverse endophytic bacteria of *Bacillus* and *Enterobacter* genera colonizing mainly leaves with a significant enrichment with *Bacillus* strains. The *in vitro* dual culture assays showed that 36 % of the endophytic bacterial strains produce antifungal VOCs against *B. cinerea*. To our knowledge, this is the first report of VOCs antifungal activity produced by *B. nakamurai, B. pseudomycoides, B. proteolyticus, B. thuringiensis, E. asburiae* and *E. cloacae* against *B. cinerea*. About 14 % of bacterial strains produce VOCs with *in vitro* specific promoting effects on tomato seedling length or biomass production. The five selected antagonistic endophytic bacterial strains produced a core set of seven VOCs along with different strain-specific and known antifungal VOCs such as 3-Methylbutan-1-ol, sulfur-containing compounds, 2-Heptanone and Dodecanal. Tomato fruit bio-protection assay showed that the *Enterobacter* strain TR1 produces

the most protective VOCs against *B. cinerea* infection with 3-Methylbutan-1-ol as a major volatile compound which totally suppressed *B. cinerea* growth and infection on tomato fruit at 0.442 mL L^{-1} headspace, whereas the *Bacillus* strains showed better protection against fungal infection when applied as vegetative cells on tomato fruit. These results support the use of the selected strains as potential biocontrol agents to reduce postharvest decay of *B. cinerea*, as well as 3-Methylbutan-1-ol as promising antifungal volatile to apply during postharvest commercialization of tomato fruit.