Inhibitory effect and possible mechanism of carvacrol against *Colletotrichum fructicola*

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Abstract

Carvacrol (CVR) is an essential oil and has been reported to exhibit significant inhibitory effects against a wide range of microorganisms. Anthracnose, which is caused by *Colletotrichum fructicola* is one of the most serious postharvest diseases in pitaya fruit. In this study, we investigate the inhibitory effect of CVR against *C. fructicola* and elucidate the possible modes of action. The results from our study showed that treatment with CVR could effectively inhibit mycelial growth, spore germination and germ tube elongation of *C. fructicola in vitro*, significantly reducing the onset and development of anthracnose in red pitaya fruit. Membrane permeability and leakage of cellular components in the hyphae of *C. fructicola* increased as the concentrations of CVR increased. The results from microscopy indicated that CVR treatment caused abnormalities of hyphal morphology, disruption of cytoplasmic membranes, and disorganization of intracellular organelles. Moreover, CVR treatments induced the generation of reactive oxygen species (ROS), which caused oxidative injury to the cell membrane *via* lipid peroxidation. The antifungal mechanism of CVR against *C. fructicola* may be attributed to induced ROS production, increased membrane permeability, abnormalities of ultrastructure, and loss of intracellular contents.