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Curtobacterium sp. MA01 generates oxidative stress to inhibit the plant growth

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ABSTRACT

Soil habitat bacteria associate with plants to offer growth benefits or to cause detrimental effects on host-plants. The present study was aimed to know the basis for inhibition of petunia plant growth by *Curtobacterium sp*. MA01. The bacterial isolate MA01 infected petunia plants reduced the growth of roots and shoots without causing any disease. The genomic DNA of MA01 was isolated and the bacterium was identified as *Curtobacterium sp*. MA01 by molecular and phylogenetic studies. The bacterial interaction caused the degradation of protein synthesis in infected plants. However, the high rate of lipid peroxidation was observed in plants associated with bacteria than their control. The significant reduction of antioxidants such as carotenoids, catalase and polyphenol oxidase activities were found in bacterium treated plants. The results of this study revealed that *Curtobacterium sp*. MA01 caused the oxidative stress and declined the antioxidants to suppress the growth of petunia plants.

1. Introduction

Microorganisms are major living organisms in soil, which play vital role to decompose several biological and organic materials. The numbers of bacterial and fungal genera were reported as phosphate solubilizers, nitrogen fixers, plant growth hormone producers to enhance the growth of plants (Kang et al., 2015b; Radhakrishnan et al., 2015). On the other hand, those microorganisms secrete some of the toxic metabolites to prevent the growth of plant pathogens (Kang et al., 2015a; Radhakrishnan et al., 2018) and weeds or plants (Radhakrishnan et al., 2017). The plant growth suppressing microbes can be used as bioherbicides to control the weed populations (Boyette and Hoagland, 2015). The growth and yield of crop plants are affected by diversified weed growth in agricultural fields. The application of chemicals to prevent the weed growth has a possibility to develop multiple herbicide resistant weed populations (Culliney, 2005) and affects the food quality due to the deposition of pesticides and herbicides (Kim et al., 2013). The harmless and environmental friendly microorganisms or their products might be useful to prevent the weed growth. Several groups of bacteria and fungi were reported as weed controlling agents, but the mechanism of weed growth suppression is not studied well (Radhakrishnan et al., 2018).

Recently, we reported that the bur cucumber seed extracts and *Enterobacter spp*. I-3 inhibited the weed growth by altering hormones and nutrients uptake (Lee et al., 2015; Radhakrishnan et al., 2017). The understanding of bioherbicidal microbial interaction with plants would be helpful to find out the economic importance of those microorganisms. The previous studies highlighted the bioherbicidal effects of bacteria and fungi on weed seed germination and biomass variations, while few studies were conducted in biochemical changes in weeds (Radhakrishnan et al., 2018). An analysis of stress related parameters including reactive oxygen species (ROS) and antioxidants in plants reveals the detrimental biomolecular changes of infected plants (Sewelam et al., 2016).

Petunia is an ornamental plant which contains economically important secondary metabolites. The growth of plants is affected by several biotic and abiotic environmental factors. Previously, we showed the stunted growth of petunia due to the effect of a bacterial species (Radhakrishnan and Sandhya, 2019) and identified as *Curtobacterium spp*. which are Gram-positive bacilli present in soil and plants (Mariita et al., 2015; Bulgari et al., 2014) and not harmful to human (Agarkova et al., 2012). Some of the *Curtobacterium spp*. promote the plant growth and act as a biocontrol agents against pathogens (Feng et al., 2017). There is no report on bioherbicidal activity of *Curtobacterium spp*. This

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