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RHIZOSPHERE-COMPETENT ACTINOBACTERIAL ISOLATES WITH ACC DEAMINASE ACTIVITY ALLEVIATE SALT STRESS IN TOMATO PLANTS IN THE UAE

by

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Date & Venue

11:00 AM

Wednesday, 08 June 2022

https://eu.bbcollab.com/guest/b92f14ad53c34eb9b70ccb504affa1db

Abstract

Tomato (*Solanum lycopersicum*) is one of the most popular vegetables in the world, including the United Arab Emirates (UAE). Salinity is a global menace to plant growth and development, causing significant economic losses to tomato and other crop plants. It is well-known that 1-aminocyclopropane-1-carboxylic acid (ACC) deaminase (ACCD) can increase plant tolerance to environmental stresses. This can be attributed to the increased activity of the enzyme ACCD, which breaks down ACC [the immediate precursor of ethylene (ET)] to ammonia and α-ketobutyrate, to lower the overproduction of ET levels *in planta* and to reduce the damages caused by salt stress. Consequently, the application of beneficial actinobacteria was assessed to alleviate the destructive effects of salt stress on tomato plants. The main objective of this project was to isolate and apply ACCD-producing actinobacteria with increased salt tolerance to relieve any stress on tomato plants cultivated under high salt conditions. The specific aims were to: (1) isolate rhizosphere actinobacteria capable of producing ACCD from UAE soils; (2) *in vitro* evaluate the most promising ACCD-producing isolates to high salt levels; and (3) determine the response of tomato seedlings grown under saline conditions to the soil-inoculation of the halotolerant rhizosphere ACCD-producing actinobacterial isolate(s) under greenhouse conditions. Four hundred ninety-one actinobacteria were isolated from the rhizosphere soils of Sweihan area in Abu Dhabi-UAE. *In vitro* screening demonstrated that three actinobacterial isolates produced ACCD, while tolerating up to 8% NaCl. In the greenhouse, the most promising ACCD-producing isolate (referred to as +ACCD isolate) significantly ($P<0.05$) enhanced the growth of tomato seedlings in response to salt stress. This was evident in the increase in the length, fresh and dry weight of the shoots and roots as well as the total chlorophyll content in leaves of tomato plants treated with the +ACCD isolate. The results also showed that the +ACCD isolate reduced the endogenous ACC levels by three- and four-fold in both root and shoot tissues, respectively, compared to those of control (no isolate) and non-ACCD-producing isolate treatments; thus, confirming the hypothesis. This study has shed light on the identification of a potential ACCD-producing isolate that can reduce the negative effects of salt stress and enhance salinity tolerance of crop plants, such as tomato, in the UAE and elsewhere.

Keywords: ACC deaminase, actinobacteria, ethylene, plant growth promoting rhizobacteria, soil salinity, *Streptomyces*, tomato.