UNIVERSIDAD DE LA FRONTERA

Facultad de Ingeniería y Ciencias

Doctorado en Ciencias de Recursos Naturales

ANTARCTIC SOIL MICROBIOMES AS A PROMISING STRATEGY TO COUNTERACT THE EFFECTS OF CLIMATE CHANGE BY NATURAL MICROBIOME ENGINEERING IN TOMATO PLANTS GROWING UNDER WATER DEFICIT STRESS

DOCTORAL THESIS IN FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE DOCTOR OF SCIENCES IN NATURAL RESOURCES

RODRIGO NICOLÁS RODRÍGUEZ QUIROZ

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“Antarctic soil microbiomes as a promising strategy to counteract the effects of climate change by natural microbiome engineering in tomato plants growing under water deficit stress”

Esta tesis fue realizada bajo la supervisión del director de tesis, Dra. Paola Durán del Departamento de Agroindustria de la Universidad de la Frontera y ha sido aprobada por los miembros de la comisión examinadora.

…….
Dr. Francisco Matus Baeza
DIRECTOR DEL PROGRAMA DE DOCTORADO EN CIENCIAS DE RECURSOS NATURALES

……
Dra. Paola Durán

.....
Dr. Víctor Beltrán Varas
DIRECTOR ACADEMICO DE POSTGRADO
UNIVERSIDAD DE LA FRONTERA

…….
Dr. Gonzalo Tortella

…….
Dr. Francisco Chávez

……
Dr. Victor Carrión

……
Dr. Paula Cartés

……
Dr. Patricio Barra

Thesis summary

Modern agriculture faces the challenge of climate change and seeks ecological solutions to mitigate (a)biotic stress. A promising avenue is the use of soil microbiomes from extreme environments to discover microorganisms that protect plants. We demonstrate the effectiveness of a 'Resilient Microbiome' created through Host-Mediated Microbiome Engineering and soil transfer to promote plant growth under water- deficient stress. Antarctic soils were collected as microbiome donors, mixed with an Andisol soil to cultivate tomatoes under water stress. Several Antarctic microorganisms remained in the recipient soil after 2 years. After 7 generations, all soil blends exhibited significant improvements in water stress tolerance and changes in the bacterial microbiome structure of the rhizosphere soil. The improved tolerance is attributed to the selection of a resilient microbiome through the recruitment of microorganisms with 'protective action'. Candidatus nitrocosmicus and Bacillus spp. are proposed as key microorganisms for enhancing water stress tolerance in tomato seedlings. In situ microbiome engineering through three-dimensional factors could lead to new microbial inoculants