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Actinomycetes from the Kekanadura forest soil: Candidates for biofertilizer formulations

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Abstract

Actinomycetes synthesize a wide range of secondary metabolites with agronomical, industrial, and pharmaceutical importance. Actinomycetes were isolated from a tropical forest soil in order to identify strains with plant growth promotion traits for the selection of candidates for biofertilizer formulations. Actinomycetes were isolated from 10-20 cm depth soil in starch casein agar (SCA) and glycerol asparagine agar (GAA) with 7.8×10^4 CFU/g. Twenty-seven morphologically distinct strains were identified by evaluating their aerial and substrate mycelial characteristics in SCA. Twenty-one of those were provisionally identified to the genus level by their spore chain morphology of the aerial mycelia, which is a widely used criterion in actinomycetes identification. Among the identified strains, there were eleven *Streptomyces*, five *Nocardiopsis,* two *Nocardia* and one each of *Actinomadura*, *Rhodococcus*, and *Kineococcus.* However, their identity needs to be confirmed by DNA sequencing. All 27 strains were found N-fixing at aerobic or microaerophilic conditions in the N-free-malate medium (semi-solid). Ammonia productions by those strains were confirmed using the peptone water *in vitro* assay. Fifteen strains were also found capable of solubilizing phosphate in the Pikovskaya's agar medium which contained calcium phosphate as the insoluble phosphate source. Except one strain, all other strains were able to produce indole acetic acid (IAA) at varying concentrations in broth cultures when tryptophan was provided as the precursor molecule. Their IAA production ranged 4.61-429.03 mg/L. Sixteen strains exceeded 100 mg/L IAA production. Therefore, plant growth promotion potential of such strains should be investigated further before incorporating into formulations as high IAA tend to inhibit plant growth in some instances. We tested antagonistic property of actinomycetes strains against *Sclerotium rolfsii,* which has a broad host range among the horticultural crops in Solanaceae and Cucurbitaceae families. They showed varying degrees of antagonistic potential. Twelve strains showed moderate to strong antagonistic activity against *S. rolfsii*. Overall results highlighted strain ACM 31, ACM 35, and ACM 45 were the best performing in terms of tested agronomic traits. We recommend testing isolated actinomycetes strains in different combinations with different host plants and soil types to evaluate their plant growth promotion potential.

Keywords: Antagonism, IAA, Nitrogen fixation, Plant growth promotion, Phosphate solubilization

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