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OPTIMIZATION OF IAA PRODUCTION FROM NEEM TREE ENDOPHYTES

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ABSTRACT

Endophytic actinobacteria are prompt to function as a good plant growth promoter in leguminous and cereals crops. They are capacable to encourage plant growth and can enhance the nutrition absorption ability to plants. All reported species are prone to produce IAA and optimize their production on 35°C temperature, 7.5pH and 20th day of harvesting. These strains can be used for production of commercialized IAA.

Keywords: Neem, IAA, Endophytes, Optimisation, Production.

I. INTRODUCTION

In 19th century researchers shown that actinomycetes were closely associated with living plants and giving beneficial and/or adverse effects to host plants. Endophytes are habitat inside plants and gets nutrition as well as protection from the host plants. Endophytic actinobacteria are prompt to function as a good plant growth promoter in leguminous and cereals crops. They are capacable to encourage plant growth and can enhance the nutrition absorption ability to plants (Nimaichand et al., 2016). Khamna and associates (2010); Palaniyandi and associates (2013) reported most promising compound as indole acetic acid (IAA) in majority of endophytic actinobacteria. IAA is a naturally-occurring auxin that produced through different tryptophan-dependent IAA production pathways in plants, bacteria and fungi (Duca et al., 2014).

II. MATERIALS AND METHODS

Four healthy plants of Azadirachta indica A. Juss (Neem) were identified in different locations of Bhopal. Leaves of each plant were collected in a sealed sterile bag and brought to laboratory for this study. Different physical parameters i.e. temperature, pH and day of harvesting were imposed in PDA broth media culture. Supernatant of isolates were mixed with Salkowsky reagent and incubated at 30°C for 20 minutes. Absorbance was measured at 535 nm using a spectrophotometer. Quantification was performed as per standard curve with control. Quantity of IAA production was observed and optimum production was noted.

III. RESULTS AND DISCUSSION

Endophytic actinobacteria are prompt to function as a good plant growth promoter (Nimaichand et al., 2016). Khamna and associates (2010); Palaniyandi and associates (2013) reported most promising compound as IAA in majority of endophytic actinobacteria. IAA is a naturally-occurring auxin that produced through different tryptophan-dependent IAA production pathways in plants, bacteria and fungi (Duca et al., 2014). Plant-microbe interactions is a pathway that bacterium uses to produce IAA within plants naturally (Hardoim et al., 2008). IAA is a primary form of auxin that plays a good role in control the different cellular process of plants. This is helps in elongation as well as in cell division, to form root hair and to make short root length. This is also helps to increase the nutrient absorption capability of plant. IAA producing actonobacteria are also reported in cucumber plants which act as a plant growth promoter (El-Tarabily et al., 2009a; 2009b). Passari and associates, 2017 reported a number of actinobacteria strains including Micromonospora, Streptomyces, Microbacterium, Pseudonocardia that have capacity to produce plant growth phytohormone IAA. Madhurama and associates, 2014 reported one species of actinobacteria Streptomyces sp. that produce high amount of IAA. Khamna and associates, 2010 reported good amount of IAA production in medicinal plants by species of Streptomyces. There were a number of IAA producing actinomycetes reported in tomato Rhizosphere specially species of genus Streptomyces viz. Streptomyces olivaceoviridis, Streptomyces rimosus, Streptomyces rochei (Aldesuquy et al., 1998; Tokala et al., 2002). Verma and associates, 2011 reported a species of Streptomyces endophytic actinobacteria in Azadirachta indica and tomato plants. They also reported the increase of plants'growth. Lin and Xu, 2013 reported Streptomyces strain En-1 in Arabidopsis plantlets that produce IAA and helps to stimulate the growth of that plant (Lin and Xu, 2013). Vijaybharthi and associates told that the endophytic and rhizospheric actinobacteria, own the ability to produce IAA, cytokinins and GA3. Nimnoi and

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associates, 2010 discovered endophytic actinobacteria from Aquilaria crassna (Eaglewood) and reported their potency of IAA and ammonia production. Actinobacteria that produces IAA and siderophore are majorly colonizing in the root and promote root elongation as well as plant growth (Sreevidya et al., 2016). A number of endophytic actinobacteria like Streptomyces viridis, Streptomyces rimosus, Streptomyces olivaceoviridis, Streptomyces atrovirens and Streptomyces rochei have been showed to improve germination and root, shoot elongation (Abdallah et al., 2013). This study was done for optimisation of IAA production by isolates was performed with different physical stress conditions viz. temperature, pH and days of harvesting. Temperature dependent study reported lowest production of IAA in isolate of Curvularia with 0.654mg/l at 35°C whereas highest production reported in isolates of Acremonium. Gradually decreased production reported in species of Streptomyces, Cladosporium, Nigrospora oryzae and Fusarium. Highest production IAA by isolate of Cladosporium species was given in broth incubated at 35°C with 1.476mg/l. Production of IAA was reported 1.123mg/l in broth incubated at 40°C and slight less production reported at 30°C with 1.012. Decreased or very less IAA produced at 45°C with 0.654mg/l. Highest production IAA by isolate of Nigrospora oryzae species was given in broth incubated at 35°C with 0.905mg/l. Production of IAA was reported 0.792mg/l in broth incubated at 40°C and slight less production reported at 30°C with 0.635 mg/l. Decreased or very less IAA produced at 45°C with 0.251mg/l. Highest production IAA by isolate of Streptomyces species was given in broth incubated at 35°C with 2.111mg/l. Production of IAA was reported 1.632mg/l in broth incubated at 40°C and slight less production reported at 30°C with 1.562mg/l. Decreased or very less IAA produced at 45°C with 0.901mg/l. Highest production IAA by isolate of Acremonium species was given in broth incubated at 35°C with 2.571mg/l. Production of IAA was reported 1.741mg/l in broth incubated at 40°C and slight less production reported at 30°C with 1.654mg/l. Decreased or very less IAA produced at 45°C with 0.913mg/l. Highest production IAA by isolate of Fusarium species was given in broth incubated at 35°C with 0.873mg/l. Production of IAA was reported 0.568mg/l in broth incubated at 40°C and slight less production reported at 30°C with 0.517mg/l. Decreased or very less IAA produced at 45°C with 0.163mg/l. Highest production IAA by isolate of Curvularia species was given in broth incubated at 35°C with 0.651mg/l. Production of IAA was reported 0.493mg/l in broth incubated at 40°C and slight less production reported at 30°C with 0.465mg/l. Decreased or very less IAA produced at 45°C with 0.114mg/l. pH dependent study reported lowest production of IAA was reported in isolate of Curvularia broth of pH 7.5units with 0.406mg/l whereas highest production reported in isolates of Acremonium. Gradually decreased production reported in species of Streptomyces, Cladosporium, Nigrospora oryzae and Fusarium. Highest production IAA by isolate of Cladosporium species was given in broth of pH 7.5units incubated for 8 days with 1.452mg/l. Production of IAA was reported 1.021mg/l in broth of pH 6.5units and slight less production reported in broth of pH 8.5units with 0.965mg/l. Decreased or very less IAA produced in broth of pH 5.5 units with 0.236mg/l. Highest production IAA by isolate of Nigrospora oryzae species was given in broth of pH 7.5units incubated for 8 days with 0.914mg/l. Production of IAA was reported 0.785mg/l in broth of pH 6.5units and slight less production reported in broth of pH 8.5units with 0.423mg/l. Decreased or very less IAA produced in broth of pH 5.5 units with 0.124mg/l. Highest production IAA by isolate of Streptomyces species was given in broth of pH 7.5units incubated for 8 days with 2.121mg/l. Production of IAA was reported 1.223mg/l in broth of pH 6.5units and slight less production reported in broth of pH 8.5units with 1.002mg/l. Decreased or very less IAA produced in broth of pH 5.5 units with 0.521mg/l. Highest production IAA by isolate of Acremonium species was given in broth of pH 7.5units incubated for 8 days with 2.543mg/l. Production of IAA was reported 1.314mg/l in broth of pH 6.5units and slight less production reported in broth of pH 8.5units with 1.018mg/l. Decreased or very less IAA produced in broth of pH 5.5 units with 0.593mg/l. Highest production IAA by isolate of Fusarium species was given in broth of pH 7.5units incubated for 8 days with 0.880mg/l. Production of IAA was reported 0.498mg/l in broth of pH 8.5units and slight less production reported in broth of pH 6.5units with 0.421mg/l. Decreased or very less IAA produced in broth of pH 5.5 units with 0.206mg/l. Highest production IAA by isolate of Curvularia species was given in broth of pH 7.5units incubated for 8 days with 0.674mg/l. Production of IAA was reported 0.412mg/l in broth of pH 8.5units and slight less production reported in broth of pH 6.5units with 0.406mg/l. Decreased or very less IAA produced in broth of pH 5.5 units with 0.195mg/l.

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Harvesting day dependent study reported lowest production of IAA was reported in isolate of Curvularia broth on 20th day of harvesting with 0.710mg/l whereas highest production reported in isolates of Acremonium with 2.498mg/l gradually decreased production reported in species of Streptomyces, Cladosporium, Nigrospora oryzae and Fusarium. Highest production IAA by isolate of Cladosporium species was given at 20th day of harvesting with 1.426mg/l. Lowest production of IAA was reported 0.121mg/l on 5th day of harvesting. 1.410, 1.253, 1.109 and 0.229mg/l IAA production was reported in broth harvested on 25th, 30th, 15th and 10th day respectively. Highest production IAA by isolate of Nigrospora oryzae species was given at 20th day of harvesting with 0.964mg/l. Lowest production of IAA was reported 0.082mg/l on 5th day of harvesting. 0.950, 0.912, 0.814 and 0.102mg/l IAA production was reported in broth harvested on 25th, 30th, 15th and 10th day respectively. Highest production IAA by isolate of Streptomyces species was given at 20th day of harvesting with 2.224mg/l. Lowest production of IAA was reported 0.223mg/l on 5th day of harvesting. 2.156, 1.964, 1.946 and 0.787mg/l IAA production was reported in broth harvested on 25th, 30th, 15th and 10th day respectively. Highest production IAA by isolate of Acremonium species was given at 20th day of harvesting with 2.498mg/l. Lowest production of IAA was reported 0.229mg/l on 5th day of harvesting. 2.254, 2.012, 1.984 and 0.864mg/l IAA production was reported in broth harvested on 25th, 30th, 15th and 10th day respectively. Highest production IAA by isolate of Fusarium species was given at 20th day of harvesting with 0.912mg/l. Lowest production of IAA was reported 0.078 on 5th day of harvesting. 0.897, 0.843, 0.756 and 0.219mg/l IAA production was reported in broth harvested on 25th, 30th, 15th and 10th day respectively. Highest production IAA by isolate of Curvlaria species was given at 20th day of harvesting with 0.710mg/l. Lowest production of IAA was reported 0.041mg/l on 5th day of harvesting. 0.685, 0.632, 0.597 and 0.246mg/l IAA production was reported in broth harvested on 25th, 30th, 15th and 10th day respectively.

In respect to all above study reported that 35°C temperature, 7.5pH and 20th day of harvesting are ambient for production of IAA in all six species isolated form neem leaf.

IV. CONCLUSION

All reported species are prone to produce IAA and optimize their production on 35°C temperature, 7.5pH and 20th day of harvesting. These strains can be used for production of commercialized IAA. This can helps in elongation as well as in cell division, to form root hair and to make short root length. This is helpful to increase the nutrient absorption capability of plant. IAA producing actinobacteria is empowered to act as a plant growth promoter.

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