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ISOLATION AND CHARACTERIZATION OF PHOSPHATE SOLUBILIZING *PSEUDOMONAS* SPECIES AND ASSESS ITS EFFICACY AS PLANT GROWTH PROMOTER

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ABSTRACT : Sixteen rhizosperic soilsamples, barley, wheat and corn were collected from Jadriya, Abu-Ghraib, College of Agriculture in Baghdad University,Tarmiah and Aqraqof/ Baghdad city,in order to isolate phosphate solubilizing *Pseudomonas* spp. Phosphate solubilization activity was determined qualitatively, for the isolates, in NBRIP broth media. Isolates ability to produce indole acetic acid (IAA), hydrogen cyanide (HCN) and hydrolytic enzymes (protease, cellulase and pectinase) were detected *in vitro* conditions. Selected isolate, which has highest P solubilization and ability to produce previously detected plant growth promoters was characterized and identified using biochemical tests and Vitek2 compact system. The ability of selected bacterial isolate (*Pseudomonas putida*) to produceorganic acids was detected in National Botanical Research Institute's (NBRIP) broth using High performance liquid chromatography (HPLC). Pots experiment was conducted, using mung bean seeds (*Vigna radiate*) and *Pseudomonas putida* isolate, with three replicates andtwo treatments: non-inoculated seeds (C) and inoculated seeds (T). After 2 months from germination, some plant growth parameters were measured. Then *Pseudomonas putida* was tested for its antagonistic effect against *Rhizoctonia solani*, *Macrophomina phaseolina*, *Fusarium oxysporum* and *Aspergillus niger* and the percentage of mycelial growth inhibition is estimated. The results found only six phosphate solubilizing *Pseudomonas* spp. isolates (P1, P2, P3, P4, P5 and P6). Phosphate solubilization capacity of them was varying from 20.10-37.00 ìg.ml^{-1}, the highest value was expressed by P3isolate(37.00 ìg.ml^{-1}).P3 isolate showed highest production of IAA and HCN and was able to produce protease, cellulase and pectinase enzymes. According to this results, P3 isolate was chosen and identified as *Pseudomonas* spp. through different biochemical tests and confirmed as *Pseudomonas putida* by Vitek2 compact system. This strain was able to produce malic acid and oxalic acid with retention times 3.758 and 2.972, respectively. Mung bean plants inoculated with *P. putida* (T) showed significant increases in branches number (25.20), plant length (62.67cm), fresh weight (9.67 mg.plant^{-1}), dry weight (0.867 mg. plant^{-1}), nitrogen concentration (1.733 %), phosphor concentration (0.2034%) and potassium concentration (1.167%). Antagonistic effect test showed that *P.putida* suppressed the growth of plant pathogenic fungi, *Rhizoctonia solani* (79.85%), *Macrophomina phaseolina* (54.45%), *Fusarium oxysporum* (68.75%) and *Aspergillus niger* (83.95%).

Key words : *Pseudomonas putida*, plant growth promoter, phosphate solubilizing bacteria, plant pathogenic fungi, organic acids production.

INTRODUCTION

Phosphorus (P) is an important element for plant nutrition, it considered akey element for photosynthesis, metabolic and biochemical pathways. Despite the higher content of P in soil, its availability to plant is limited due to high reactivity with other components (De Souza *et al*, 2015). Supplied chemical phosphate fertilizers are rapidly converted to insoluble phosphate, which leads to frequently applying P fertilizers, which are undesirable environmentally and economically (Guan-Xi *et al*, 2018). Phosphate solubilizing bacteria (PSB) can solubilize inorganic P by secretion some kinds of organic acids, siderophores as well as hydroxyl ions (De Souza *et al*, 2015). It has been reported that *Pseudomonas, Rhizobium, Bacillus, Beijerinckia*, *Burkholderia*, *Enterobacter*, *Flavobacterium, Azotobacter, Erwinia* and *Serratia* are the most extensive PSB in soil (Ahemad and Kibret, 2014; Rafi *et al*, 2019). Organic acids (i.e. citric, succinic, oxalic, fumaric and malic etc.) amount and types secreted by different PSB are variable. They have many vital functions in the root nutrient acquisition, metal detoxification and microbial chemo taxis, so, they are involved in solubilization of insoluble Pmechanism and also in enhancing P bioavailability (Rafi *et al*, 2019).

Indole acetic acid (IAA) is a signaling molecule which could affects different plant processes, such as cell division and promoting the differentiation of plant vascular (Li *et al*, 2016). The low concentration of IAA could induce