

Comparative performance of *Aspergillus niger* isolates of different habitats on solubilisation of tricalcium phosphate in broth and their impact on yield attributes of wheat (*Triticum aestivum* L.)

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ABSTRACT

Eleven strains of *Aspergillus niger* isolated from rhizospheric soils of cereals, oil seeds, pulses and vegetables crops were tested for their ability to form halozone on Pikovskaya's agar media, lowering of pH, and solubilization of tricalcium phosphate in broth at one, two and three week of incubation. Their inoculation effect on growth, yield attributes, P contents in produce and acquisition of P by straw, grain, and by whole wheat crop were also studied in sterilized pot soil experiment. *Aspergillus niger* isolated from sugarcane rhizosphere gave maximum and significant greater size of halozone and acidity of broth compared to same isolates of other rhizospheric soils. All isolates increased acidity of broth with increase in incubation period but magnitude of increase was greater up to second week of incubation. Solubilisation of tricalcium phosphate had direct correlation with acidity of the broth. *Aspergillus niger* of sugarcane rhizosphere solubilized maximum quantity of tricalcium phosphate. All strain of *Aspergillus niger* showed their significant superiority over uninoculated control in increasing growth, yield attributes, P contents in produce and acquisition of P by straw, grain, and by whole wheat crop. Response of *Aspergillus niger* strain, varied with their source of isolation. *Aspergillus niger* isolated from the sugarcane rhizospheric soil appeared to be an efficient phosphate solubilizers.

Key words: *Aspergillus niger*, Tricalcium phosphate, Yield, Uptake, pH

INTRODUCTION

The phosphate solubilising ability of various soil microorganisms is well documented in literature. Soil fungi play a vital role in solubilisation of tricalcium phosphate (Singh et al. 1994). This character in respect of eleven *Aspergillus niger* strains isolated from the rhizospheric soils of cereals, oil seeds, pulses and vegetables crops of Varanasi region, was studied using Pikovskaya's medium with tricalcium phosphate (TCP) as the substrate. The phosphate solubilising action of *Aspergillus niger* was observed both in solid (agar media) as well as liquid culture (broth). Very scarce informations available on the efficacy potential of *Aspergillus niger* isolated from different habitats. In the present experiment various phosphate solubilising fungal strain were isolated like *Aspergillus niger*, *Aspergillus flavus*, *Aspergillus sulphuriosus*, *Rhizopus stolonifer*, *Penicillium* but *Aspergillus niger* dominated in alluvium of all rhizospheric soils of Varanasi. Therefore present experiment was designed to study the efficacy of *Aspergillus niger* strain isolated from different habitats for their potential in solubilisation of tricalcium phosphate, change in acidity and their impact on growth, yield, P content and P uptake by wheat under sterilized soil pot experiment.

MATERIALS AND METHODS

Isolation and identification of phosphate solubilizing fungi:

Eleven soil samples collected from different crop rhizosphere were kept in sterile container separately and maintained at 4 °C until analysis. Phosphate solubilising fungi present in rhizospheric soils of different crops of different localities were cultured on Pikovskaya's modified medium (Sundra Rao and Sinha, 1963). Fungal colonies showing clear zone of phosphate solubilisation were selected and transferred to agar slants and maintained at 4 °C.

Halozone diameter of TCP solubilisation:

Sterilized Pikovskaya's agar medium was poured into sterilized petriplates. After solidification of the medium, a pinpoint inoculation of *A. niger* strain was made on the plates aseptically and incubated for seven days at 28 ± 2 °C. The intensity of TCP solubilisation was measured as the diameter of the halozone formed around the colonies.

Measurement of pH and solubilisation of TCP in liquid medium:

Pikovskaya's liquid medium (100 mL; pH 7 ± 0.2) was dispensed

in 250 mL Erlenmeyer conical flask and 300 mg P₂O₅ of TCP was added to the flask. The sterilized media were inoculated in triplicate with 0.5mL suspension of *Aspergillus niger* strain separately, keeping uninoculated control. The entire inoculated flask were incubated in BOD for 7, 14 and 21 days at 30 ± 2°C. Sterilized distilled water was added to make the volume 100 mL and the contents were filtered through Whatman No. 42 filter paper to remove the fungal mats. The pH and water soluble phosphorus content of the filtrate were recorded for 21 days of incubation at 7 days interval by pocket pH meter and molybdophosphoric acid blue colour method described by Jackson (1973).

Pot Experiment:

A sterilized pot experiment was carried out to judge the efficacy of *Aspergillus niger* strains of different habitats. Soil used in this experiment was collected from the research farm of Institute of Agricultural Sciences, BHU, Varanasi, having pH 7.5; EC 0.25 dSm⁻¹, Organic carbon 0.65 %, Available N and P₂O₅ (Olsen) were 110.5 and 18.32 mg/kg, respectively. Soil was autoclaved three times for two hours at 121 °C (15 lb/inch²) and placed in 5 kg lots in ethanol disinfected plastic pots. There were twelve treatments, replicated three times in completely randomized designed (CRD). Ten uniform size seeds of wheat (*Triticum aestivum*) were surface disinfected with 0.5 % sodium hypochlorite solution and rinsed in sterilized water. Seeds were uniformly coated on surface by spores of *Aspergillus niger* separately and sown in sterilized pot soil. After germination, seedlings were thinned to 5 plants per pot. Plants were subsequently fed with 50 ml of nutrient solution lacking phosphate (Hogland and Arnon 1938) after 15, 35 and 50 days and watered with distilled water as required.

RESULTS AND DISCUSSION

Aspergillus niger isolated from the rhizosphere of sugarcane showed maximum and significantly greater diameter of halozone (5.9 cm) than other except strains isolated from rhizosphere of tomato and potato. Strains from mustard rhizosphere exhibits lowest diameter of halozone (3.7 cm). Strain of maize rhizosphere caused greater zone of clarity than isolates of wheat rhizosphere. All *Aspergillus niger* isolated from different habitats (different rhizospheric soils) causes the significant decrement in original value of pH (Table 1) which was according to findings of Liu et al, (2004). Decrease in pH may be due to the production of various types of organic acids by

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