

## REVIEW

# Harnessing beneficial microbial resources, analysis of their diversity and development of bioformulations for crop improvement

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Microorganisms isolated from soil samples of forest, river basins and agricultural field of terai, dooars and hills of North Bengal were screened *in vitro* for their beneficial traits. Potential biocontrol agents (BCA), phosphate solubilising fungi (PSF) as well as phosphate solubilizing bacteria (PSB) were selected for molecular identification by amplification of their partial 18s rRNA and 16s rRNA gene sequence analysis respectively. All these sequences obtained for BCA, PSF and PSB isolates were further aligned separately with ex-type sequences obtained from NCBI genbank database. Phylogenetic inference was performed by the unweighted pair group method with arithmetic mean (UPGMA). The evolutionary distances were computed using maximum composite likelihood method. Phylogenetic analysis of BCA, PSF and PSB isolates were conducted in MEGA package version 4.1. The diversity of selective potential bioinoculants were analysed using RAPD-PCR methods. Dominant arbuscular mycorrhizal fungi (AMF) in the rhizosphere of cereal, pulses, horticultural and plantation crops were documented, identified using scanning electron microscopy as well as their root colonization were determined following indirect immunofluorescence test using polyclonal antibody raised against AMF. Talc based formulation of selective PSB strains showing plant growth promoting activities using mass mixture, whereas FYM based formulation of PSF and Tricho-compost for BCA were developed for value addition in vermicomposting. Suppression of fungal diseases of cereals, pulses, horticultural and plantation crops were evident either by single or joint inoculation by BCA, PGPR and AMF. In all cases, disease suppression was associated with enhanced activity of defence enzymes like chitinase,  $\beta$ -1,3 glucanase, phenylalanine ammonia lyase and peroxidase. Induction of PR-2 and PR-3 and their cellular localization in leaf and root tissues were determined by indirect immunofluorescence and their immunogold localizations were further confirmed by transmission electron microscopy using PABs of chitinase. Bioformulations with these bioinoculants can encourage entrepreneurship development in order to take future line of action in crop protection.

**Key words:** Agriculturally important microorganisms, biocontrol agent, plant growth promoting rhizobacteria, arbuscular mycorrhizal fungi, phosphate solubilizing fungi, bioformulation

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