

## **Mycorrhiza ‘helper’ bacteria: A biostimulant of *Arbuscular mycorrhiza* fungi**

**Seema Sangwan**

Division of Microbiology, ICAR Indian Agricultural Research Institute, New Delhi-110012, India

**A**rbuscular mycorrhiza fungi (AMF) colonization ability and efficiency are now also attributed to a third component of the symbiosis which are less investigated- mycorrhizae helper bacteria (MHB). They constitute a dense, active bacterial community, tightly associated with AMF, and involved in the development and functioning of AMF. Although AMF spores are known to host several bacteria in their spore walls and cytoplasm, their role in promoting the ecological fitness and establishment of AMF symbiosis by influencing spore germination, mycelial growth, root colonization, metabolic diversity and biocontrol of soil borne diseases is now being deciphered. MHB also promote the functioning of arbuscular mycorrhizal symbiosis by triggering various plant growth factors, leading to better availability of nutrients in the soil and uptake by plants. In order to develop strategies to promote mycorrhization by AMF, and particularly to stimulate the ability to utilize phosphorus from the soil, there is a need to decipher crucial metabolic signalling pathways of MHB and elucidate their functional significance as mycorrhiza helper bacteria. MHB, also referred to as AMF bioenhancers, also improve agronomic efficiency and formulations using AMF along with enriched population of MHB are a promising option. This review covers the aspects related to the specificity and mechanisms of action of MHB, which positively impact the formation and functioning of AMF in mycorrhizal symbiosis, and the need to advocate MHB as AMF bioenhancers towards their inclusion in integrated nutrient management practices in sustainable agriculture.

**Keywords:** bacteria; fungi; growth stimulation; rhizosphere; symbiosis