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Editorial

Plant Endophytes: True Symbiont or Opportunistic Pathogens?

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Abstract

Routine use of plant associated endophytic microorganism for sustainable agriculture has been getting prevalent worldwide as they can successfully colonize plants to enhance productivity. Genetically diverse indigenous micro-flora would exhibit as "plant probiotic" for enhancing immunity and influencing cellular metabolism and preventing pathogens. But under stress condition, how endophytes can modulate their behavior and dynamic interaction with plants may become more of predation than mutualism for their survival.

Keywords: A*Plant Endophytes; Symbiont; Opportunistic Pathogens*

Introduction

Exploration of plant associated beneficial microorganism are getting prevalent worldwide as they can contribute for the holistic development of plant health and enhance crop productivity [1]. These microorganisms can colonize to create their own micro-environment in rhizosphere and rhizoplane as they possess diverse metabolism to utilize different plants exudates (organic acids, sugars, ions, flavinols, phenols etc.) [2]. The rhizospheric niche selection and association with plants, perhaps due selective pressure as nutritionally poor non-rhizospheric soils cannot support their growth, proliferation and forward movement in evaluation. On the other hand, it is quite evident that the competition for food and shelter in rhizosphere is extensive due to allelopathy and autotoxicity interaction among all the species present in the rhizosphere. Among all rhizospheric organism, a few privileged one can enter inside the plants and colonies in different phytonic locations such as root, stem, leaf, phylosphere and phylloplane forming the family of endophytes [3,4].

Chemoattractant and the signal transduction

Beginning of tissue specific colonization triggers when microbes detects chemical signals from plants, resulting activation of transcription factors for chemotaxis. The chemotaxis also relays specificity as amino acids from tomato roots entice *Pseudomonas fluorescens* strain WCS365 while sugars cannot evoke chemotaxis [5]. The motility driven response is a classic example of two component signal transduction where histidine kinase *CheA* recognize the chemo attractants while *CheY*, the response regulator synchronizes flagella-driven bacterial motility [6].

Patterns of endophytic colonization

Most of the endophytes infiltrate through elongating zone of lateral roots, root hairs, cracks created by arthropod or nematode activities etc [7]. Several microbial components such as Type IV pili, exo and lipo-polysaccharides aids the association and colonization within the plant tissues. The association with plants tissues protect endophytic communities from physical factors like rainfall, temperature and UV radiation than those on the rhizospheric microbes [8].

Beneficial effects on plants

Generally, endophytes have been reported to be mutualistic protect plants against abiotic and biotic stresses too. Additionally, in the last two decades plant associated microbes have been consider as source of new bioactive compounds as they encode enzymes and antioxidants involved in scavenging reactive oxygen species [9,10]. They can fix N_2, produce different plant regulators (e.g. phenols, auxins, ACC deaminase, gibberellins, cytokinins, ABA etc.), antibiotics etc. which support growth and the alkaloids, steroids, terpenoids, diterpenes, enzymes (e.g. cellulases, lipases, proteinase, esterases etc.) and compete with pathogens for nutrition and space inside the plant tissue etc. which support plant growth [8,11].

Induction of plat defence and priming

Plants possess a set of non-specific defence mechanism such as salicylic acid (SA), pathogenesis-related (PR) proteins, jasmonic acid/ethylene (JA/ET) mediated systemic acquired resistance to discriminate between symbiont and pathogens [12]. *Arabidopsis thaliana* inoculated of with endophytic *Actinobacteria* evoked SA and JA/ET-signaling defense which prevented infection of necrotrophic *Erwinia carotovora* [13].

Climate change and disease expression

Due to rapid urbanization, industrialization and climate change (increase in temperature, salinity, water stress etc.) are becoming major concern as it interacts with expression of housekeeping cellular macromolecules of plants [10]. Cumulative stress induces generation of reactive oxygen species (ROS), alters activity of plant growth regulating MAP kinases leads to destabilization of ionic homeostasis, damages tissues resulting an "immune compromised" plant [14]. Few opportunistic endophytic members of *Botryosphaeriaceae* can remain hidden many years without manifesting any disease symptoms to host pants. While taking the advantage of an immune compromised plants, these saprophytes become aggressive causing several diseases [15].

Conclusion

Research on endophytes are relatively new and a tittle known about their life style and interaction with host plants. As microbes thrive at the bottom of trophic level, they are very sensitive to any minute change in surrounding atmosphere. The conversion of symbiotic nature to opportunist may be triggered by environmental stress where endophytes are challenged with their own survival. However, further research on their behavior, predation, mutualistic interaction under normal and stress (biotic as well as abiotic) condition will provide a new horizon predicting microbe-plant interaction and reduction of plant disease under climate change in global perspective.

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