WSU Plant Pathology Seminar Series

Role of Endophytic Bacteria in Plant Health

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Abstract:

Microbes make up the majority of life on Earth, with a biodiversity that surpasses the combined diversity of plants, animals, and insects (Rana et al., 2020). The term "endophytic bacteria" refers to those that inhabit tissues of healthy plant hosts. More than 200 bacterial genera from 16 phyla have been identified as endophytes. Unlike root-nodule symbionts, these bacteria typically do not significantly alter the morphology of plants. As opposed to phytopathogens, they do not produce symptoms of disease (Malfanova et al., 2013).

Endophytes enter plants through various pathways. They can enter plant roots both through the root tip and root hairs (Compant et al., 2021). Wounds caused by herbivores or other types of mechanical injury, such as leaf scars or root ruptures, can also be a route for endophytic entry into the plant (Liu et al., 2017).

Once established inside the plant, bacterial endophytes can enhance plant growth through both direct and indirect processes. Bacteria can directly promote plant growth by facilitating nutrient uptake and mobilization, as well as producing and/or regulating phytohormones within the plant. Many plants obtain their nitrogen through biological nitrogen fixation process. Bacterial species such as *Azospirillum* spp., *Pantoea* a*gglomerans*, and *Azoarcus* spp. contribute significantly to nitrogen fixation in plant roots (Mushtaq et al., 2023). Endophytes can synthesize growth-promoting phytohormones such as auxin, cytokinin, or gibberellin, directly improving plant growth. Additionally, certain bacterial endophytes produce 1-aminocyclopropane-1-carboxylate (ACC) deaminase, an enzyme that degrades ACC, a precursor of ethylene in plants. Ethylene can build up in high amounts during stress (such as drought, flooding, or pathogen attack) in plants and limit plant growth by increasing leaf senescence, premature fruit ripening, and root growth suppression. These endophytes help plants grow by reducing ethylene levels, promoting healthy development under stress conditions (Santoyo et al., 2016). Indirect stimulation of plant development happens when a plant growth promoting bacteria protect plants from phytopathogens through nutrient and space competition as well as antibiosis (Mishra et al., 2018). Finally, some endophyte species are being used to mitigate the negative effects of abiotic stress via the production of a variety of bioactive

secondary metabolites and phytohormones, which increase tolerance to drought, high salinity and other environmental stresses (Morelli et al., 2020; Khan et al., 2020).

To conclude, bacterial endophytes play a pivotal role in sustainable agriculture by offering natural means to improve crop growth, yields and resilience. By serving as eco-friendly alternatives to chemical pesticides and fertilizers, these microorganisms support a shift towards more sustainable and environmentally conscious agricultural practices.

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