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“Bridging the gap between increasing knowledge and decreasing resources”

Endophyte Microbiome of Banana Roots Reveals High Diversity and Potential for Agricultural Uses

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Abstract

Similar to humans, plants are populated with different sets of microorganisms with potential roles on host and ecosystem functions. Endophytic microorganisms colonize root tissues inter- and/or intracellularly producing a wide range of compounds useful for plants growth as well as for protection against biotic and abiotic stresses. Clonally propagated crops such as banana are frequently multiplied by using tissue culture techniques in order to get uniform, pathogen-free plants. This process, however, also eliminates the endophyte beneficial microbiota and might have their fitness altered. To understand the microbial functional diversity of *Musa* spp., and its potential application in banana production systems, root-associated endophytic microorganisms (360 bacteria and 143 fungal) were isolated from 20 *Musa* spp. genotypes of the *ex situ* collection in CORBANA, Guapiles, Costa Rica. Analyses of specific genome regions (16S rDNA for bacteria and *tefa-1α* or ITS for fungi) revealed 21 different bacterial genera, with *Klebsiella*, *Enterobacter*, *Bacillus*, *Acinetobacter* and *Burkholderia* as the most frequent. *Trichoderma* spp. and *Fusarium oxysporum* prevailed among the 12 genera of fungi identified. Most isolates are known to be associated with banana, but genera such as *Sphingobacterium*, *Grimontella*, *Providencia*, *Pleosporaceae* have not been reported previously. Microorganisms with no significant similarities to the analysed database (04 bacteria and 03 fungi) were found and will probably constitute new descriptions. Some endophytes were more frequent or uniquely found on certain banana genotypes, but endophyte-host specificity needs to be further verified. Partial characterisation of the collection showed that *T. asperellum* isolates from cv. Yangambi Km5 (AAA) can significantly inhibit (up to 80.5%) the mycelial growth of the banana pathogen *Fusarium oxysporum* f. sp. *cubense*. When a set of selected bacteria was inoculated in the tissue culture plants of the commercial cultivar Cavendish, three bacterial isolates (*Bacillus aryabhatai*, *Burkholderia* spp. and unknown) significantly increased the dry root weight. These results revealed a high and multifunctional diversity of culturable endophytes from *Musa* spp. roots, with a strong potential for new product developments and methods to enhance productivity in banana. Opportunities also exist to explore *Musa* genotypes in their native habitat and to characterise non-culturable microorganisms.

Keywords: Biological control, endophytic microorganisms, *Fusarium*, *Musa* spp