

THE MICROBIAL COMMUNITY OF VETIVER ROOT IS NECESSARY FOR ESSENTIAL OIL BIOSYNTHESIS

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Vetiveria zizanioides (L.) Nash, *root-associated bacteria, vetiver oil biogenesis, sesquiterpene metabolism, plant-bacteria interaction*

Vetiveria zizanioides (L.) Nash (vetiver) is a perennial graminaceous plant growing wild, half wild or cultivated in many tropical and subtropical areas (Maffei 2002). Vetiver is cultivated for its unique ability among grasses to produce in the root an essential oil, a complex mixture of sesquiterpene alcohols and hydrocarbons, used extensively in perfumery and cosmetics. Because of this complexity, the oil is difficult to reproduce with synthetic aromatic chemical formulations.

Essential oil production is localized in the first cortical layer outside the endoderms of mature vetiver roots while the bacteria are observed into lysigen lacunae in association with essential oil (Massardo et al. 2004). The close relationship between bacteria and essential oil production stimulated the hypothesis of a direct involvement of endophytic bacteria in the essential oil metabolism.

In the present study we have characterized the microbial community of the vetiver root by culture-based and culture-independent approaches, and have investigated the possibility that the root-associated bacteria may be involved in vetiver oil metabolism.

By electron analysis we confirmed the presence of bacteria in the cortical parenchymatous essential oil-producing cells and in lysigen lacunae. No bacteria were found in the same kind of cells in axenic vetiver plants cultivated in vitro. We then isolated the root-associated bacteria, which were identified by nucleotide sequence analysis of 16S rRNA gene. A total of 10 taxa were represented including 4 strains belonging to Pseudomonadoceae, 4 to Enterobacteriaceae, one to Aeromonadaceae and one to Micrococcaceae. Owing to the close association of bacteria with vetiver root cells producing essential oil, we tested the ability of isolated endophytic bacteria to grow using vetiver essential oil as the sole carbon source. Both Enterobacteriaceae strains and Micrococcaceae strains demonstrated ability to grow in these media. We then tested the ability of isolated endophytic bacteria to metabolize terpenoids from the raw vetiver oil as the sole source of carbon. Results demonstrated that each given microorganism was able to release into the medium a large number of compounds, some of which were absent in the raw oil. These results were indicative of a potential ability of endophytic bacteria to contribute to the vetiver oil composition.

The results of this study open the intriguing and immediate possibility to manoeuvre the molecular structure of the vetiver oil either in vivo, by acting on the bacterial colonization of the plant root, or in vitro, by means of strain-dependent bioconversion processes. The ability of the

isolated bacterial strain to produce arrays of new interesting compounds is of relevance for biological struggle strategies and will find many industrial applications.

- M. Maffei (2002). "Vetiveria. The genus *Vetiveria* (ed. M. Maffei), 1-18. Taylor & Francis, London and New York.

- D.R. Massardo et al. (2004). SIGA-XLVIII Annual Congress.

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