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How Does Biodiversity Work in Tropical Agroecosystems? - Physiological Responses of Cacao Plants to Neighbouring Plants

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Abstract

While reactions of plants to their abiotic environmental conditions as well as to herbivore attacks are well understood, research on plant-plant interactions such as allelopathy and facilitation is still at the very beginning. The latter may be the clue for understanding the impacts of biodiversity in agroecosystems. It is common knowledge that plants communicate unspecifically via volatile compounds, e.g. jasmonic acid, emitted after a herbivore attack and react by the upregulation of the synthesis of secondary compounds, e.g. polyphenols. Additionally, more specific reactions to such stressful events can take place on the enzymatic level. Stress-related enzymes, such as chitinases or polyphenoloxidases (PPOs), or rather their activity patterns can be considered as a possible physiological marker for such reactions. However, the question whether plants respond to the presence of other plants in their vicinity remains unanswered. A further point to be clarified is whether plants react differently to plants of their own species surrounding them than to plants of other species. Do they recognise their neighbour? The physiological response to allelochemicals emitted by neighbouring plants in particular has scarcely been assessed. To answer these questions, we cultivated cacao seedlings with leaf extracts of banana and/or papaya and analysed the isoenzyme patterns of PPOs using native PAGE. The results indicate that cacao seedlings show changes in the PPO activity pattern when being treated with different leaf extracts. These results are in accordance with greenhouse and field trials. Our data highlight the relevance of plant-plant interactions in diverse cropping systems such as agroecosystems and may contribute to better exploiting the potentials of plant facilitation in agricultural production.

Keywords: Allelopathy, facilitation, isoenzyme patterns, polyphenoloxidases