

## Subtle chemical variations with strong ecological significance: Stereoselective responses of male orchid bees to isomers of carvone epoxide

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Several constituents within floral scents are chiral and are known to trigger distinct biological responses in insects. Androeuglossinophilous plants produce floral perfumes to attract male euglossine bees as pollinators. Within the floral perfumes of *Eulaema*-pollinated *Catasetum* orchids, carvone epoxide was found to be the main attractant for several species of the genus *Eulaema*. In this study, we synthesized four carvone epoxide stereoisomers and tested them in electrophysiological and field assays with *Eulaema* species occurring in the Atlantic Rainforest in the state of Pernambuco, NE-Brazil. We determined the stereochemistry of carvone epoxide in the floral scent of several *Catasetum* species pollinated by *Eulaema* and tested in electroantennographic measurements whether the antennae of male bees of four different *Eulaema* species react differentially to these stereoisomers. Further we explored in field assays whether this species exhibit a preference for any of the stereoisomers. Our results suggest that 1) all tested *Catasetum* species emit only the (-)-*trans*- stereoisomer of carvone epoxide, 2) there was a species-specific antennal reaction which differed among the four *Eulaema* species but was similar to the four tested stereoisomers and 3) bees of three *Eulaema* species preferred (-)-*trans*-carvone epoxide over the other tested stereoisomers in the field assays. We assume (-)-*trans*-carvone epoxide to be the dominant stereoisomer in all *Eulaema*-pollinated plant species and speculate that biosynthetic constraint could hamper the production of the other stereoisomers in perfume-producing plants. Three of the four tested bee species (i.e. *Eulaema atleticana*, *E. nigrita* and *E. niveofasciata*) are able to perceive all four carvone epoxides, suggesting they possess different olfactory receptors for each of the tested stereoisomers, whereas *E. marcii* was neither able to perceive any of the carvone epoxides, nor did it respond during the field assays. The ability to perceive carvone epoxide in general underlines the significance of this compound as main attractant for the genus *Eulaema*. Further, the preference of three *Eulaema* species for a specific stereoisomer (i.e. (-)-*trans*-carvone epoxide) in the field assays could be a result of conditional learning by foraging-experienced bees and the possibility to behaviorally distinguish the stereoisomers represents an important example for stereoselective preferences within euglossine bees.

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