

## MULTIPLE FUNCTIONS OF ALLELOCHEMICALS IN ECOSYSTEMS

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### ABSTRACT

Plants synthesize a broad range of secondary metabolites (allelochemicals) to defend themselves against herbivores, pathogens and their competing neighbors (allelopathy). Insect damage and pathogen infection in many plants initiates a series of signal transduction processes, which in turn induce an array of defence genes to produce more compounds which can mount resistance against subsequent infection. In our laboratory 32 plant species in South China have been investigated for allelopathy. The allelochemicals have been identified from 11 plant species. RNA interference (RNAi) was used to identify functions of specific allelochemicals in rice allelopathy and defence against pathogens. Signaling pathways regulating rice allelochemical production and role of allelopathy in biological invasion of exotic plants were determined. We also demonstrated that the root exudates of eight species of Brassicaceae strongly stimulate the hyphal growth of several ectomycorrhizal (ECM) fungi. Isothiocyanates and other related compounds degraded from indole GLSs are responsible for growth stimulation of ECM fungi. Polyphagous herbivores encounter numerous allelochemicals in their many host plants. Certain plant allelochemicals (e.g. coumarin and flavone) reduced toxicity of co-occurring compounds and insecticides to insects by inducing detoxification systems, including cytochrome P450 mono-oxygenases (P450s), which can metabolize a broad range of substances. Ecological significances of xenobiotic resistance induced by plant allelochemicals will be discussed. These results suggest that allelochemicals in plants have multiple ecological functions and mediate plant interactions with various organisms in ecosystems. Appropriate manipulation of plant allelochemicals is a promising approach to reduce human dependency on synthetic chemicals.

**Keywords** Allelochemicals, ecological function, species interaction, allelopathy, cytochrome P450 mono-oxygenases, xenobiotic resistance