

Bioinspired Pest Control: Sustainable Formulations for Bioactive Molecule Delivery in Plants

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To limit the use of pesticides and to develop bioinspired control strategies of plant pests and pathogens that are environmentally and economically sustainable as well as socially acceptable, some bioactive molecules have been already identified by exploiting insect-natural antagonist interactions. These include dsRNA and peptides that target chewing insects.

Due to their extreme sensitivity to environmental deterioration, these molecules must be protected by sustainable formulations when sprayed in the field. In addition, these formulations should ensure efficient accumulation of the bioactive molecules into the plant tissues and guarantee their delivery into the bodies of target phytophagous insect without degradation, thereby maintaining their bioinsecticide activity. Several biocompatible formulations with different chemical composition and physical characteristics are presently under development and analysis including (1) zein-based nanoparticles, (2) chitosan/humic substance nanoconjugates, and (3) Ca²⁺-alginate hydrogels.

Using tomato as a crop model plant and combining imaging and molecular approaches, we investigated the absorption and fate of different fluorescein-labeled bioformulations within the plant body after foliage spray as well as their compatibility with plant physiology.