Development of natural semiochemical slow-release formulations as biological control devices

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Semiochemicals – informative molecules used in insect-insect or plant-insect interactions – have been widely considered within various integrated pest management (IPM) strategies. In the present work, two sesquiterpenoids, *E*-*β*-farnesene and *E*-*β*-caryophyllene, were formulated for their properties as aphid enemy attractants. *E*-*β*-farnesene, the alarm pheromone of many aphid species, was also identified as a kairomone by attracting aphid predators and parasitoids. *E*-*β*-caryophyllene was identified as a potential component of the aggregation pheromone of the Asian ladybird, *Harmonia axyridis* Pallas, another aphid predator. The two products were purified from essential oils of *Matricaria chamomilla* L. (Asteraceae) and *Nepeta cataria* L. (Lamiaceae), respectively. Natural and biodegradable formulations were then investigated in order to deliver these molecules on crop fields for a long period of time as biological control devices. Due to their sensitivity to oxidation, both sesquiterpenes needed to be protected from oxygen degradation. For this purpose, alginate – hydrophilic matrix with low oxygen permeability – was used as polymer for the formulations: the main objective was to deliver semiochemicals in the air in a controlled way. Consequently, a careful selection of alginates was realised. Formulated beads showed different structural and encapsulation properties depending on various formulation factors. Alginate formulations were characterised by texturometry and by confocal microscopy in order to observe the distribution of semiochemicals in alginate network. The last step of alginate bead characterisation consisted in studying release rate of semiochemicals in laboratory-controlled conditions by optimised volatile collection system and validated fast GC analytical procedures Finally, the efficiency of formulations as aphid predator (Syrphidae species) and parasitoid (Aphidius ervi) attractants was demonstrated by field trapping and olfactometry experiments.