Bacterial endosymbionts compromise the efficiency of biological control of aphids in strawberry crops

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Abstract

Insect parasitoids are widely used as biological control agents against insect pests in numerous crops, especially in greenhouses where inondative releases can be implemented. Despite the high density of biocontrol agents, some ecological and biological factors may limit their efficiency. In some insect pests, resistance against parasitoids may exist and lead to the reduction of the biocontrol program effectiveness. In aphids, such a resistance mainly relies on the association with facultative bacterial endosymbionts: some symbionts like *Hamiltonella defensa* can indeed confer a strong protection against parasitoids, limiting their parasitism and by extent, compromising aphid pests control in greenhouses. In France, aphid biological control by using insect parasitoids is often inefficient in strawberry crops. First, we investigated prevalence of bacterial endosymbionts in aphids collected in various strawberry crops. During two successive years, we sampled individuals from seven aphid species in French strawberry greenhouses at the national scale and detected presence of bacterial symbionts using molecular tools. In the three dominant strawberry aphid pests (*Acyrthosiphon malvae, Macrosiphum euphorbiae* and *Rhodobium porosum*), we found high prevalence of *H. defensa*, sometimes co-occurring with *Regiella insecticola,* another potentially protective endosymbiont in aphids. In order to correlate symbiont prevalences with parasitism efficiency, the level of protection conferred by these symbionts against parasitoids were secondly measured on aphids sampled in various strawberry crops by considering the two major parasitoid species released in strawberry crops: *Aphidius ervi* and *Praon volucre*. Both field and empirical approaches show that bacterial symbionts may partly explain the inefficiency of the aphid biocontrol program in French strawberry crops.

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