Aphid parasitism alters induced plant responses allowing a hyperparasitoid to locate its hidden parasitoid host

Mitchel E. Bourne[1,2], Alessia Vitiello[1], Gabriel A. Charvalakis[1,3], Leandra Meerkerk[1], Berhane T. Weldegergis[1], Karen J. Kloth[1], Erik H. Poelman[1]

[1] Lab of Entomology, Wageningen University and Research, Droevendaalsesteeg 1, Wageningen, the Netherlands
[2] Institute for Parasitology and OneHealth institute, Universität Zürich, Winterthurerstrasse 266a, Zürich, Switzerland
[3] Department of Animal Ecology, NIOO-KNAW, Droevendaalsesteeg 10, Wageningen, the Netherlands

mitchel.bourne@uzh.ch

Plants typically host insect communities composed of multiple trophic levels that are intricately linked through interactions mediated by the shared food plant. Hyperparasitoids are top-level carnivores in such systems, preying on parasitoid larvae developing inside herbivores. These hyperparasitoids can dramatically reduce the effectiveness of aphid biological control, but how they locate parasitised aphids remained unknown.

In this study [1], we compared two aphid–parasitoid systems occurring on the same host plant to test whether a common aphid hyperparasitoid uses plant volatiles induced by parasitised aphids to locate its host. In addition, we combined behavioural assays with transcriptomic analyses, volatile profiling and aphid feeding behaviour measurements to investigate the underlying mechanisms.

The aphid hyperparasitoid responded to volatile cues induced specifically by its primary host–parasitoid association to locate its concealed host. Transcriptomic analysis indicated that parasitism attenuated plant defence responses to aphid feeding, with changes in homoterpene biosynthesis observed only in the primary host–parasitoid association. In both systems, parasitised aphids increased their xylem feeding activity.

These findings show that parasitism reshapes plant signalling in ways that enable hyperparasitoids to detect hidden hosts via herbivore-induced cues. This interaction web mirrors caterpillar-based systems, despite fundamental differences in herbivore feeding strategies and their induced plant responses.

[1] Mitchel E. Bourne, Alessia Vitiello, Gabriel A. Charvalakis, Leandra Meerkerk, Berhane T. Weldegergis, Karen J. Kloth, Erik H. Poelman, *New Phytologist,* **2025,** *Early View.*