Enhancing biological pest control:
Learning mechanisms and olfactory conditioning in parasitoid wasps

Nikoletta Foskolou[1], Matthew Back[1], Joe Roberts[1], Helmut van Emden[2], Liam Harvey[3], Neil Ward[3], Tom Pope[1]

1. Harper Adams University, Newport, Shropshire,TF10 8NB, UK
2. University of Reading, Whiteknights Road, Reading, Berkshire, RG6 6AU, UK
3. Biobest Group UK, Henwood Industrial Estate, Ashford, Kent, TN24 8DW, UK

Background

Parasitoid wasps are mass reared and commonly used in augmentative biocontrol programmes to regulate aphid populations. However, parasitoids can be slow to establish following release. It is suggested that this may be because current mass-rearing systems do not account for the cognitive processes underlying how they locate, recognise and memorise their hosts[1].

Crop pests have predominantly been managed using synthetic chemical pesticides, but their negative impacts on the environment and human health have put greater focus on the development of more environmentally sustainable strategies, such as the use of augmentative biological control.

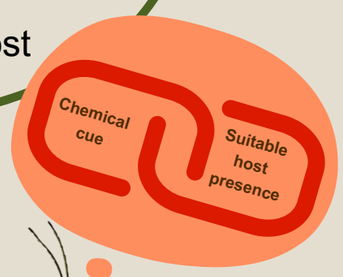
Host-searching behaviour

Parasitoid host-searching behaviour relies on chemical cues from their enlivenment following a three-level process:

Host habitat location
Using herbivore-induced plant volatiles (HIPVs)

Host location
Using HIPVs and host-originating chemical cues

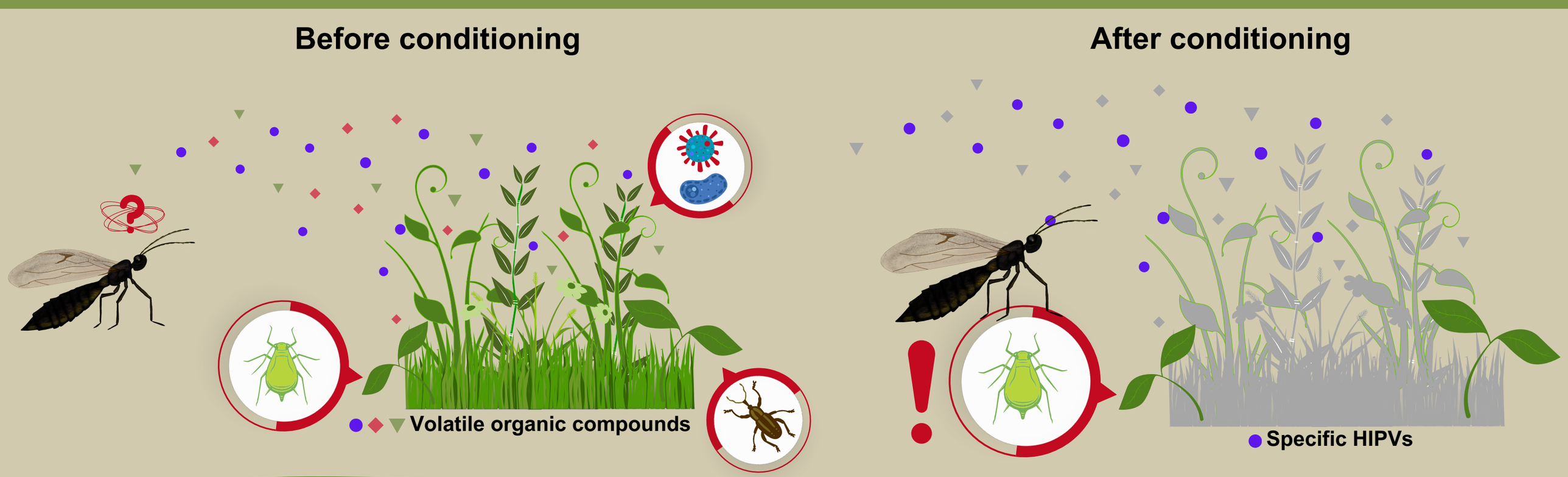
Host acceptance
Using chemical cues directly derived from the host



Associative learning

The association between a chemical cue (stimuli) and the presence of a suitable aphid host and thus, an oviposition event (response) from the wasp.

Olfactory conditioning: The training of parasitoids to respond specifically and/or more strongly to cues involved in the target pest system



Project aim and objectives

Explore how insect learning can be used to improve the efficiency of parasitoids as biological controls in sustainable crop protection, specifically:

- Characterise chemical cues associated with host-searching behaviour
- Determine the learning abilities of commercially available parasitoids
- Develop mass-rearing techniques that incorporate parasitoid learning
- Evaluate the impact of improved parasitoid learning on biological control efficacy under semi-field conditions

1. Kruidhof, H.M. et al. (2019) 'Integrating parasitoid olfactory conditioning in augmentative biological control: Potential impact, possibilities, and challenges', Frontiers in Ecology and Evolution, 7. doi:10.3389/fevo.2019.00084

nfoskolou@harper-adams.ac.uk

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