HOST RESPONSE

Deadly perfume

Insects can succumb to infection after ingestion of pathogens or when the insect cuticle is breached by pathogenic fungi. Antimicrobial defences which can combat pathogens that have gained access to the haemocoel have been characterized in *Drosophila melanogaster*, and include the production of reactive oxygen species and antimicrobial peptides. Juergen Gross and colleagues now report that beetle larvae secrete perfumes that can kill pathogens before they have had a chance to infect, and have published their findings in the *Journal of Chemical Ecology*.

Leaf-beetle larvae produce glandular secretions that contain salicylaldehyde, a metabolic by-product that is derived from the catabolism of salicin and saligenin. Previous studies revealed that salicylaldehyde was a potent antifungal and antibacterial agent *in vitro*, but little was known about when it was released or which microorganisms it could kill. Larvae of *Phratora vitellinae* were placed in glass vials and their headspace was analysed by gas chromatography, which confirmed that the main volatile component of the secretions was salicylaldehyde. Glands can be everted to dispense secretions during predator attack, but close inspection of the cuticle above the glandular reservoir using scanning electron microscopy revealed furrow-shaped openings through which the larvae could continuously secrete volatile compounds. The larvae are therefore permanently surrounded by a cloud of salicylaldehyde.

Draining of glandular contents prior to exposure to fungal spores significantly reduced the survival of larvae, and the authors propose that fumigation of fungal spores by the perfume cloud might prevent spore germination and reduce the chances of infection. Moreover, treating cultured *Bacillus thuringiensis* serovar tenebrionis and *B. thuringiensis* serovar kurstaki with concentrations of salicylaldehyde either directly or as a volatile inhibited bacterial growth, and therefore the deadly perfume could kill bacterial and fungal pathogens.

Insects, which are the most numerous animal group on the Earth, have evolved a swathe of effective defences against pathogens. This new study reveals that insect perfumes might have been conserved during evolution to not only benefit the producer, by killing competitor insects or altering the behaviour of predators, but also to disinfect the external insect microenvironment and reduce the chances of disease.

Susan Jones

ORIGINAL RESEARCH PAPER Gross, J., Schumacher, K., Schmidtberg, H. & Vilcinskas, A. Protected by fumigants: beetle perfumes in antimicrobial defense. *J. Chem. Ecol.* **34**, 179–188 (2008)