A genomic approach to understand insecticide toxicokinetics in a global crop pest

Supervisory team:
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Host institution: University of Exeter (Penryn)
CASE partner: Syngenta

Project description:
Background and project aim: Aphids are among the world's most damaging group of insect pests causing tens of millions to billions US$ of yield loss per annum across a wide range of crops. The evolution of aphid resistance to the insecticides used for control currently represents a serious threat to their sustainable control. There is thus an urgent need to understand the key processes that influence how insecticides enter, move about, are modified, and leave the aphid body - and understand how these are modified in resistant clones. The aim of this studentship is to address this knowledge gap by leveraging new tools and resources to characterise the key genes of aphids and their internal microbes that affect the uptake and translocation of insecticides in insecticide susceptible and resistant aphids.

Experimental approaches: The project will leverage extensive biological and genomic resources we have developed for the peach potato aphid, Myzus persicae, an economically important pest aphid species worldwide. These include a living library of over 100 clones collected from almost every continent in the world. The student will use a variety of approaches to explore the uptake and translocation of specific insecticides in a selection of the M. persicae clones held in the host lab, including insect bioassays, high performance mass-spec analysis, and bioinformatics analysis of genomic and transcriptomic data already available to us. Candidate genes associated with altered insecticide uptake will be functionally characterised using cutting-edge transgenic approaches. Finally the influence of the microbiota on insecticide uptake will be explored using a combination of metagenomic analysis, antibiotic treatments and culture-based approaches.

Impact: The project will provide fundamental insights into the key genes involved in insecticide uptake, and the quantitative or qualitative alterations in these genes that lead to resistance. Furthermore the knowledge and tools developed during the project will facilitate the future development of novel methods of controlling a global crop pest.

Benefits to the student: The student will be trained in a variety of state-of-the-art approaches that are highly sought-after by employers in academia and industry including molecular approaches and bioinformatics. The student will be based in a thriving group comprising multiple PhD students and post-doctoral researchers and will also benefit from exposure to industry through the Syngenta link/placement. Finally, the student will benefit from an annual enhancement of £2,500 per annum to their stipend.