Geophysical Research Abstracts
Vol. 15, EGU2013-6569, 2013
EGU General Assembly 2013

Biogeochemical markers for insect provenance assignment in biosecurity

Peter Holder (1), Karen Armstrong (1), Russell Frew (2,4), Robert VanHale (2), Joel Baker (3), Marc-Alban Millet (3,5)

(1) Bio-Protection Research Centre, Lincoln University, New Zealand (peter.holder@lincolnuni.ac.nz), (2) Department of Chemistry, Otago University, New Zealand, (3) School of Geography Environment and Earth Sciences, Victoria University, New Zealand, (4) Currently: IAEA/FAO, Vienna, Austria, (5) Currently: Origins Laboratory, University of Chicago, USA

Protecting a nation's primary production sector and natural estate is heavily dependent on rapidly determining the risk presented by incursions of exotic insect species. Accurate point of origin discrimination in such biosecurity incursions can direct appropriate operational responses in exotic pest investigation and eradication campaigns, as well as identify risk pathways.

Reading natural abundance biogeochemical markers via mass spectrometric methods is a powerful tool for tracing pathways and provenance determination of commercial products as well as items of ecological and forensic interest. However, the application of these methods to trace insects – amongst which are man's most damaging competitors – has been underutilised to date. Although significant potential exists, biogeochemical science in entomology remains largely untapped and the field is still in a phase of basic development.

An internationally distributed moth, *Helicoverpa armigera* [Lepidoptera: Noctuidae], has been used to evaluate the potential for entomological provenance resolution through multiple biogeochemical markers. This study initially required the development of an integrated method for the collection of natural abundance δ^2H, ^{87}Sr/^{86}Sr, ^{207}Pb/^{206}Pb and ^{208}Pb/^{206}Pb isotope ratios and trace element concentration profiles from single insect specimens.

In a comparison of moths from Australia and New Zealand, none of these biogeochemical markers were individually able to separate moths from the different experimental regions (that are 150 – 3000km apart). However, multivariate analysis provided successful provenance discrimination between the study regions. This was repeated in two separate field seasons, and used the combination of the global scale distribution patterns of δ^2H and the finer spatial scale of heavy element isotope ratios and minor element concentration profiles.

Further, the integrity of biogeochemical marker expression from location (both precipitation and soil) - to host plant - to insect was also studied; and valuable information regarding within population variability of marker expression and the concomitant sample sizes required has also been revealed.

Given the geographic resolution demonstrated, with further adaptation of the method to accommodate additional global regions and insect-host relationships, this approach to geo-location has considerable potential for biosecurity as well as other disciplines including forensics, ecological studies and pest management.