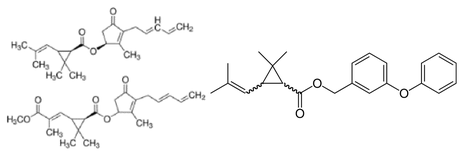
Development of analytical tools for the study of Aedes aegypti exposure to common pesticides

Anthony Castellanos, Florida International University
Collaborators: Dr. Cesar E. Ramirez (FIU-AMSF) and Dr. Keira Lucas (CMCD)
Research Mentor: Dr. Francisco Fernandez-Lima

Goals

- Develop a quantitative mass spectrometry-based method to detect common insecticides directly from mosquitoes
- Study levels of insecticides in treated lab and wild-caught Collier strain *Aedes aegypti*

Figure 1. *Aedes aegypti* mosquito.



Pyrethrin I and II Phenothrin

Insecticide	Active Ingredient	Diagnostic Dose	Diagnostic time
Merus	Pyrethrins	15 µg	15 min
Anvil	Sumithrin	22 µg	10 min

Figure 2. Commonly used insecticides for vector control and their active ingredients.

Research Methodology

- CDC Bottle Bioassay of Orlando (ORL 1952) and resistant Puerto Rico (NR-48830) lab reference strains to confirm resistance
- Treatment of susceptible lab strain with doses of pyrethrin and phenothrin
- Liquid extraction of insecticide-treated insects
- Development of quantitative LC-MS/MS method
- Application of method to wild-caught *Ae. aegypti*

Figure 3. Application of insecticide to *Ae. aegypti.*

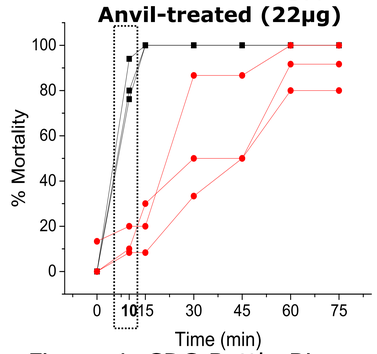
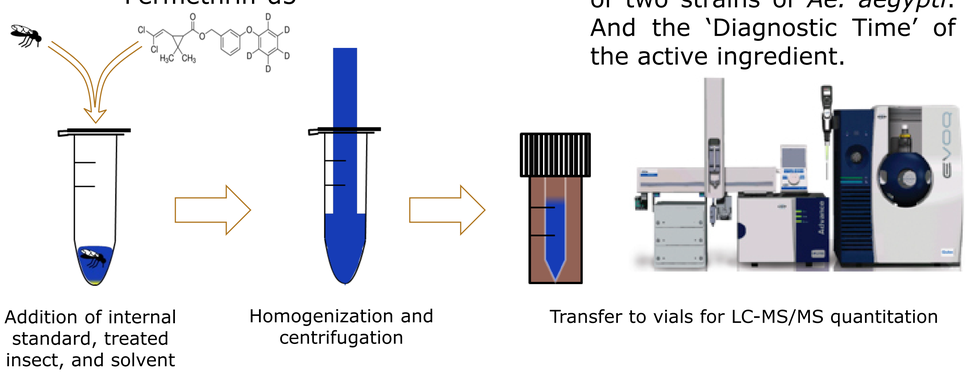


Figure 4. CDC Bottle Bioassay of two strains of *Ae. aegypti*. And the 'Diagnostic Time' of the active ingredient.

Method development



Addition of internal standard, treated insect, and solvent Homogenization and centrifugation Transfer to vials for LC-MS/MS quantitation

Figure 5. Extraction methodology for LC-MS/MS.

Results

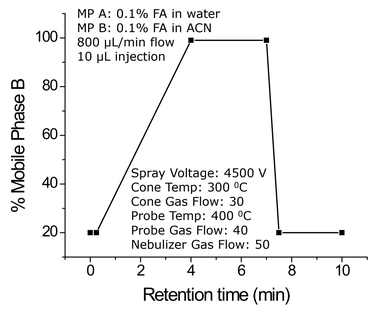


Figure 6. LC gradient separation (Dionex Acclaim 120 C18, 250x2.1 mm, 5 µm).

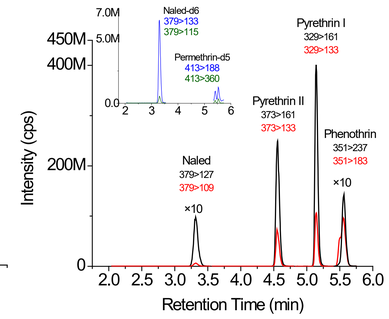


Figure 7. Preliminary LC separation of standards and internal standards.

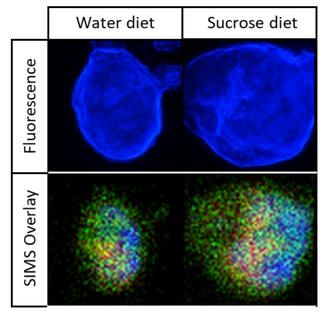


Figure 8. Mass Spectrometry Imaging (TOF-SIMS) showing high triacylglyceride content in ovarian follicles of *Ae. aegypti.*

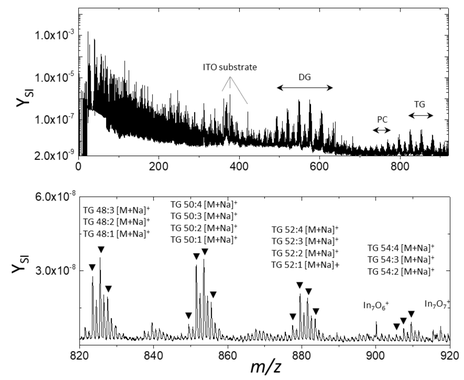


Figure 9. Untargeted TOF-SIMS analysis of ovarian follicles detects several lipid classes simultaneously.

Future Directions

- Continue developing quantitative LC-MS/MS method
- Apply quantitation to lab-treated insects

acast124@fiu.edu http://crestcache.fiu.edu

FIU Center for Aquatic Chemistry and Environment
NSF Center of Research Excellence in Science and Technology

This material is based upon work supported by the National Science Foundation under Grant No. HRD-1547798. This NSF Grant was awarded to Florida International University as part of the Centers of Research Excellence in Science and Technology (CREST) Program. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.