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Coconut Rhinoceros Beetle Biological Control

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1 Staffing

Staff for this project currently comprises of the PI, a post-doc and a masters student.

- Funding from the Department of Interior, Office of Island Affairs was used to hire an insect pathologist for a 2 year term. Dr. James Grasela was recruited and started work at UOG on June 24, 2018.
- Ian Iriarte, my graduate student and technician returned to the University of Guam to work on this project on April 11, 2018. Ian is developing a coconut rhinoceros beetle damage assessment survey, which is one of the objectives of this project, as his Master's thesis topic.

2 Laboratory Bioassays of OrNV

The major goal of this project is to find an effective biological control agent for coconut rhinoceros beetle biotype G (CRB-G).

Prior to arrival of CRB on Guam during 2007, coconut rhinoceros beetle infestations of Pacific islands were readily controled by classical biological control using Oryctes nudivirus (OrNV). Following a lack of response to release of OrNV on Guam, research showed that the Guam CRB population is a genetically distinct virus-resistant biotype which has become known as CRB-G. This biotype is highly invasive and is causing massive damage to coconut and oil palms in Papua New Guinea and the Solomon Islands. CRB-G has also invaded Oahu and Rota. Eradication attempts have been launched on these two islands.

The current project is part of an informal international collaboration among Pacific island entomologist working to find solutions for CRB-G management. The current focus is on testing new OrNV isolates in the hope of finding on or more that can be used as an effective biological control agent for CRB-G.

2.1 Haemocoel Injection Bioassays

In this series of assays, we tested 4 islates of OrNV which had produced by an insect cell culture at the AgResearch Laboratory in New Zealand. Adult beetles were dosed by direct injection into the haemocoel. This series is a preliminary test for pathogenicity. Insignificant differences in mortality curves between virus treatment and the other two treatments (control treatment and heat-inactivated virus) is an indicator of pathogenicity. Gut tissue samples have been preserved for histology and molecular analysis.

The following is a brief summary of results. Details are provided in the appended technical reports. Results indicate that isolates DUG42 and MALB are not pathogenic for CRB-G, but isolates PNG and V23B are pathogenic. Bioassays in which adult beetles are dosed *per os* are underway and results will be available in a future report.

2.1.1 OrNV Isolate DUG42

Origin: Philippines; 2 replicates; 30 beetles in total

No significant differences among mortality cuves. [control, heat-inactivated virus, virus]

2.1.2 OrNV Isolate MALB

Origin: Malaysia; 2 replicates; 30 beetles in total

No significant differences among mortality curves. [control, heat-inactivated virus, virus]

2.1.3 OrNV Isolate PNG

Origin: Papua New Guinea; 4 replicates; 71 beetles in total

Mortality curves in 2 significantly different groups: [control, heat-inactivated virus], [virus]

2.1.4 OrNV Isolate V23B

Origin: Solomon Islands; 4 repicates; 66 beetles in total

Mortality curves in 2 significantly different groups: [control, heat-inactivated virus], [virus]

3 Environmental Cabinets and CRB Rearing

Three environmental cabinets which allow control of temperature, relative humidity, and lighting for insect rearing were procured and installed. These chambers are set to maintain 30°C, 80% RH and 12h photoperiod.

After a power outage caused by a typhoon, one of the cabinets malfunctioned. It heated beyond the setpoint and killed all beetles. To prevent this problem from recurring, controllers for all three units have been programmed to send email to project staff whenever a fault is detected.

The project does not currently rear beetles form egg to adult. Because CRB are so numerous on Guam, it is far more efficient to field collect prepupae, pupae and adults and rear these to the age required for bioassays. Adults are fed banana slices.

4 CRB Damage Survey

- A 360 degree digital camera and accessories were purchased.
- A protocol for roadside CRB damage surveys using digital imagery was developed and trial runs were made.
- A workflow for scoring CRB damage from digital imagery is under development.

5 Regional Collaboration

Dr. Madoka Nakai, an insect pathologist from Tokyo University and Dr. Shin Asano, an insect pathologist from Hokkaido University visited Guam in November 2018 to collect CRB-G specimens.

Dr. Nakai returned to Guam in February 2019 with two students to collect additional CRB-G specimens.

6 Appendix A: Technical Report: Injection Bioassay of OrNV Isolate DUG42

See following page.

7 Appendix B: Technical Report: Injection Bioassay of OrNV Isolate MALB

See following page.

8 Appendix C: Technical Report: Injection Bioassay of OrNV Isolate PNG

See following page.

9 Appendix D: Technical Report: Injection Bioassay of OrNV Isolate V23B

See following page.