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Coconut Rhinoceros Beetle Biological Control

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Repository: https://github.com/aubreymoore/FB18-Report-2
Document: https://github.com/aubreymoore/FB18-Report-2/raw/master/report.pdf

Contents

1. Summary

Coming soon!

2. Background

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-G on Guam during 2007, coconut rhinoceros beetle infestations of Pacific islands were readily controlled 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[1]. 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.

Additional goals for this project are to establish a CRB damage survey to evaluate efficacy of biocontrol and other tactics, and to maintain and facilitate collaboration with other Pacific island entomologists working to find solutions for CRB-G management.

3. Staffing

Staff for this project currently comprises of only 2 people: the PI, Dr. Aubrey Moore, and a post-doc, Dr. James Grasela.

- Dr. James Grasela, an insect pathologist, has been hired for a term of 2 years with a grant from Department of Interior, Office of Island Affairs.
- Ian Iriarte, a graduate student and technician working on this project, resigned to accept a permanent job. Search for a replacement is under way.

4. Bioassays of Candidate Biocontrol Agents for CRB-G

4.1. 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.

4.1.1. OrNV Isolate DUG42

Origin: Philippines; 2 replicates; 30 beetles in total
No significant differences among mortality cuves. [control, heat-inactivated virus, virus]

4.1.2. OrNV Isolate MALB

Origin: Malaysia; 2 replicates; 30 beetles in total
No significant differences among mortality curves. [control, heat-inactivated virus, virus]

4.1.3. 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]

4.1.4. OrNV Isolate V23B

Origin: Solomon Islands; 4 repicates; 66 beetles in total
Mortality curves in 2 significantly different groups: [control, heat-inactivated virus], [virus]

5. 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.

6. CRB Damage Survey

Proof of concept [2].

7. Regional Collaboration

[3]

References

[1] Sean D. G. Marshall et al. "A New Haplotype of the Coconut Rhinoceros Beetle, *Oryctes Rhinoceros*, Has Escaped Biological Control by *Oryctes Rhinoceros* Nudivirus and Is Invading Pacific Islands". In: *Journal of Invertebrate Pathology* 149 (Oct. 1, 2017), pp. 127–134. ISSN: 0022-2011. DOI: 10.1016/j.jip.2017.07.006. URL: http://www.sciencedirect.com/science/article/pii/S0022201117300289 (visited on 08/26/2017).

[2] Aubrey Moore. *Training an Object Detector to Locate Coconut Palms Damaged or Killed by Coconut Rhinoceros Beetle*. July 2019. URL: https://www.youtube.com/watch?v=zzSorqcmt9U (visited on 10/09/2019).

[3] Aubrey Moore and James Grasela. *Coconut Rhinoceros Beetle Bibliography*. 2019. URL: https://www.overleaf.com/project/5d92e50a61cab30001783d1a.

A. Coconut Rhinoceros Beetle Bibliography