

Oryctes Nudivirus for Biocontrol of the Guam Biotype of the Coconut Rhinoceros Beetle

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1 Brief Description of Project

Funding in the amount of \$20K is requested to be used as seed money to establish a project with the objective of finding a strain of *Oryctes nuditarsis* (OrNV) which is highly pathogenic for the newly discovered Guam biotype of CRB (Marshall et al. 2015, Moore and Marshall 2015). The Guam CRB biotype, currently found in Guam, Oahu, Palau, Papua New Guinea, and Solomon Islands (Marshall et al. 2015, SPC 2015), is resistant to OrNV and is likely to spread to other islands. Prior to emergence of the Guam CRB biotype, OrNV was used as a very effective classical biocontrol agent to mitigate damage whenever Pacific islands were invaded by CRB (Bedford 2013). Introduction of the virus into a CRB population typically reduced damage by up to 90% and control lasts indefinitely.

Given that CRB eradication for this species is very difficult, achieved on only one island (Catley 1969) out of many where it has been attempted, it is very important to have a density-dependent biocontrol agent available for cases in which eradication fails (Guam) or an eradication attempt is not feasible. Despite significant progress in development of effective IPM tactics for CRB, these are not sufficient to limit CRB damage to acceptable levels without an effective density-dependent biocontrol component.

In collaboration with Sean Marshall, AgResearch New Zealand, we have determined that the rhino beetle attacking Guam's palms is genetically distinct from those elsewhere in the Pacific, except for those invading Hawaii and part of the CRB population in Palau, and that this new biotype is apparently resistant to OrNV, which has been used as a very effective density-dependent biocontrol agent for CRB wherever it has invaded Pacific Islands.

Bioassays of several isolates of *Oryctes nuditarsis* provided by AgResearch New Zealand failed to result in significant pathogenicity for the Guam CRB genotype. In a 'last ditch' attempt we made a 'witches brew' slurry containing all frozen dead beetles from previous bioassays plus frozen virus samples in vials. Forty adult beetles were forced to swim in the slurry for 30 minutes on January 22, 2015. A control group of 41 beetles were forced to swim in water. Beetles were checked weekly.

By May 10, 2015, mortality of the virus treated beetles (78%) was significantly greater than that of the control group (54%).

This experiment is incomplete: a postmortem needs to be done on the dead beetles and the 'witches brew' process needs to be repeated to see if this also results in significant mortality.

If additional funds become available, these will be used to hire Ian Iriarte, who did the original work, as a graduate assistant to repeat the 'witches' brew bioassay. He will also help establish a biocontrol lab to facilitate discovery of an OrNV strain which is highly pathogenic for the CRB-Guam biotype.

Although invasion by CRB-Guam is a regional problem, it is anticipated that Guam will be the location at which OrNV candidates from foreign exploration will be tested. The project PI already has USDA-APHIS permits to import OrNV and CRB into Guam. The graduate assistant will assist in establishing an insect pathology lab at the University of Guam to be used for applied research in CRB biocontrol.

2 Project Objectives

- to find of an OrNV strain which is highly pathogenic for the CRB-Guam biotype

- establishment of an insect pathology lab at the University of Guam to be used for applied research in CRB biocontrol

3 Justification and Urgency

The need to find a strain of OrNV or other density-dependent biocontrol agent for the CRB-Guam biotype is urgent. In a worst-case scenario a population explosion of CRB on Guam could result in high palm mortality. The resulting dead palms would provide abundant CRB breeding sites, creating a positive feedback loop where even more CRB adults are generated, killing even more palms. An effective density-dependent biocontrol agent for CRB-Guam, such as a highly pathogenic OrNV strain, is needed to counteract this feedback process.

A possible trigger for a CRB population outbreak on Guam is abundant green waste left in the wake of typhoons. Typhoon Dolphin past over Guam in May 2015, leaving much decaying vegetation behind. The Guam CRB population is expected to increase during 2015 and 2016, increasing the risk of accidental export of this pest to other islands.

4 Appendix 1- Budget

4.1 Budget Request

Salary 9000 9000 Benefits 688.5 689 Indirect charges 968.85 968 Laboratory supplies 9342.65 9343

Item	Requested Funding
Salary	\$9,000
Benefits	\$689
Indirect costs	\$968
Laboratory supplies	\$9,343
Total	\$20,000

4.2 Budget Request Explanation

Salary Graduate student assistant (Ian Iriarte) at \$15.00 per hour for 600 hours

Benefits Social security and Medicare at 7.65% of salary.

Overhead Indirect costs to UOG at 10% of salary plus benefits.

References

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- Catley, A. (1969). “The coconut rhinoceros beetle, *Oryctes rhinoceros*(L) [Coleoptera: Scarabaeidae: Dynastinae]”. In: *International Journal of Pest Management: Part A* 15, 18–30. ISSN: 0434-5541. DOI: [10.1080/04345546909415075](https://doi.org/10.1080/04345546909415075). URL: <http://guaminsects.myspecies.info/sites/guaminsects.myspecies.info/files/Catley%201969.pdf>.
- Marshall, Sean, Maclean Vaqalo, Aubrey Moore, Roland Quitugua, and Trevor Jackson (2015). “A new invasive biotype of the coconut rhinoceros beetle (*Oryctes rhinoceros*) has escaped from biological control by *Oryctes rhinoceros nudivirus*”. In: *Society of Invertebrate Pathology Annual Meeting, Vancouver, BC, August, 2015*.
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- SPC (2015). “Managing the incursion of coconut rhinoceros beetle into Solomon Islands”. In: 2. URL: http://www.spc.int/lrd/publications/doc_download/2350-lrd-newsvol11-nolapril15.