

## Movement of Packaged Soil Products as a Dispersal Pathway for Coconut Rhinoceros Beetle, *Oryctes rhinoceros* (Coleoptera: Scarabaeidae) and Other Invasive Species

Aubrey Moore<sup>1\*</sup>, Roland Quitugua<sup>1</sup>, Ian Iriarte<sup>1</sup>, Michael Melzer<sup>2</sup>,  
Shizu Watanabe<sup>2</sup>, Zhiqiang Cheng<sup>2</sup>, and Jathan Muna Barnes<sup>3</sup>

<sup>1</sup>College of Natural and Applied Sciences, University of Guam, Mangilao, Guam 96923, USA <sup>2</sup>Plant and Environmental Protection Sciences, University of Hawaii at Manoa, Honolulu, 96822, USA <sup>3</sup>Biosecurity Division, Guam Department of Agriculture

\*Corresponding author: aubreymoore@guam.net

The coconut rhinoceros beetle (CRB), a major pest of coconut and other palms, was first detected on Guam in 2007. Adults damage and may kill palms when they bore into crowns to feed on sap. Grubs do no damage, but feed on decaying plant material which includes dead trees and piles of compost, sawdust, or manure. Here we report that CRB grubs can feed and develop in a variety of packaged commercial soil products and movement of these products is a high-risk pathway for dispersal of CRB.

On April 19 2016, a retired officer of the Guam Customs and Quarantine Agency reported finding CRB-like grubs in a bag of soil (Miracle-Gro Garden Soil for Flowers and Vegetables; 2 cu. ft. bag; UPC 032247345248) purchased from a local garden center. Upon inspection, 57 third instar grubs were found in this bag. Mass of the grubs was  $11.74 \pm 0.75$  g (mean  $\pm$  SD). DNA analysis confirmed the grubs were CRB.

This incident and multiple previous reports of Guam residents finding large scarab grubs in packages of soil products purchased from local garden centers prompted us to visit one on April 20, 2016. This garden center, part of a large hardware store franchise, imports many types of soil products from the United States mainland, typically packaged in plastic bags. Upon arrival, plastic-wrapped

pallets of these products are stored on industrial shelving in a fenced, outdoor garden shop.

We noticed several unopened bags of potting mix (Miracle-Gro Nature's Care Organic Potting Mix; 32 qt. bag; UPC 071645168318) with multiple holes (about 2 cm dia.) in the outer packaging. Contents of these bags were inspected on the spot. One bag harbored 5 CRB-like grubs (2 second instar and 3 third instar). DNA analysis confirmed the grubs were CRB. The remaining two bags did not contain CRB grubs.

### Discussion

We know that packaged soil products may be a good food source for CRB grubs because we use one of these products (Earthgro Steer Manure Blend; 1 cu. ft.; UPC 036865175119) to rear them from egg to adult in the laboratory. We have had many complaints from clients who claimed that they had purchased soil products prepopulated with CRB grubs but we were not able to discount the possibility of infestation after purchase. We now have proof that unopened bags are infested before sale.

In addition to being a pathway for intra-island movement of pests, importation of soil is clearly a pathway for accidental introduction of invasive species. Live insects, mites, nematodes, and weed seeds

have been found in unopened bags of soil imported to Guam (AM, personal observation). This pathway could be closed by enforcing existing Guam law which prohibits importation of soil. According to the Guam Administrative Rules and Regulations (Government of Guam 1998), Title 9 – Animal Regulations; Division 1 – Care and Conservation of Animals; Chapter 3 – Animal Control:

§ 3304. Soils, Snakes, Injurious Insects, Etc.

Importation Prohibited. All persons are prohibited from receiving for transportation, bringing, or causing to be brought to the Territory, for the purpose of debarkation or entry there into, any of the following named articles:

(1) Soil, provided that limited quantities of soil may be imported into the Territory for experimental or other scientific purposes, under permit with conditions prescribed by the department.

“Soil” and “import” are previously defined in the document as follows:

§ 3301. Definition.

(17) Soil means that part of the upper layer of earth in which plants can grow; this material may or may not contain organic matter and includes such planting media as deteriorated peat, except clean coral, sand, pottery and industrial clay, volcanic cinders and other similar soil-free material.

(18) Import means shipment into the Territory from any point outside of the Territory.

Enforcement of the existing Guam law with respect to importation of soil is a priority action item in the Regional Biosecurity Plan for Micronesia and Hawaii

(United States Department of the Navy 2015):

Enforce the Guam law prohibiting the importation of soils for all soil and similar materials, specifically the bags of soil and soil like products soil[sic] in hardware stores. Either these items should not be imported or should need to be sterilized prior to import.

It is probable that movement of commercial soil products contributed to the rapid spread of CRB throughout Guam. Unfortunately, closing this pathway will do nothing to mitigate damage from the current CRB outbreak on this island. However, we suggest that regulatory actions to reduce the risk of accidental transport of CRB in packaged soil products should be considered on islands recently invaded by this pest. For example, banning outdoor storage of packaged soil products in CRB infested areas would almost eliminate the risk of bags of soil products becoming miniature, mobile CRB breeding sites.

### Literature Cited

**Government of Guam.** 1998. Guam Administrative Rules and Regulations, Title 9: Animal Regulations; Division 1: Care and Conservation of Animals; Chapter 3: Animal Control. url: <http://www.guamcourts.org/CompilerofLaws/GAR/09GAR/09GAR001-3.pdf>.

**United States Department of the Navy.** 2015. Regional Biosecurity Plan for Micronesia and Hawaii, Volume 1. Ed. by University of Guam and Secretariat of the Pacific Community. url: [http://www.navfac.navy.mil/content/dam/navfac/NAVFAC%20Pacific/PDFs/Regional%20Biosecurity%20Plan%20for%20Micronesia%20and%20Hawaii/PAC\\_Regional%20Biosecurity%20Plan%20for%20Micronesia%20and%20Hawaii%20Volume%20I.pdf](http://www.navfac.navy.mil/content/dam/navfac/NAVFAC%20Pacific/PDFs/Regional%20Biosecurity%20Plan%20for%20Micronesia%20and%20Hawaii/PAC_Regional%20Biosecurity%20Plan%20for%20Micronesia%20and%20Hawaii%20Volume%20I.pdf).