A New Coconut Rhinoceros Beetle Biotype Threatens Coconut and Oil Palms in Southeast Asia and the Pacific

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The purpose of this white paper is to alert stakeholders to an emergent pest problem threatening coconut and oil palms in the Asia/Pacific regions and to recommend action to minimize economic and ecological damage.

Background

The coconut rhinoceros,Oryctes rhinoceros, (CRB) is a major pest of coconut palm, oil palm and other palm species. Palms are damaged when adult beetles bore into the crowns of palms to feed on sap. Tree mortality occurs when beetles destroy the growing tip (meristem). Immature beetles (grubs) do no damage. They feed on dead, decaying vegetation in breeding sites. Preferred breeding sites are dead, standing coconut stems, and piles of decaying vegetation such those left behind by typhoons or replanting of oil palm plantations. If a CRB population is not suppressed, it is possible for a positive feed-back cycle to initiate whereby adult beetles kill massive numbers of palms, thereby generating more food for even more grubs which turn into adults which kill even more palms. An outbreak following this scenario occurred in the Palau Islands during the late 1940s resulting in 50% coconut palms being killed by CRB (Gressitt 1953).

Following 30 years of no geographical range expansion, CRB is "on the move" in the Pacific. CRB was recently detected for the first time at several Pacific Island locations including Saipan (2006), Guam (2007), Port Moresby, Papua New Guinea (2010), Oahu, Hawaii (2013), and Honiara, Solomon Islands (2015). Eradication of CRB is extremely difficult. To date, CRB has been successfully eradicated only once: on Keppel Isand, a very small island belonging to the Tonga (Catley 1969). Failing eradication, the usual response to CRB infestations during the second half of the 20th century was introduction of Oryctes nudivirus, the biological control agent of choice for this pest. OrNV attacks only rhinoceros beetles, typically reduces CRB damage by up to 90% and population suppression lasts indefinitely (Bedford 2013). OrNV is autodisseminated, meaning that the pathogen is carried between breeding sites by CRB adults. Like many biocontrol agents, OrNV is density-dependent, working best at high population densities. Highly pathogenic OrNV isolates suppress population growth to levels which result in only minor damage.

Current invasions of Pacific Islands by CRB involve a new invasive biotype which has escaped from biological control by OrNV.Marshall, Vaqalo, Moore, Quitugua, and Jackson 2015 The coconut rhinoceros beetle (Oryctes rhinoceros; CRB) is a major pest of coconut and oil palm, but the discovery of Oryctes rhinoceros nudivirus (OrNV) in the 1960s enabled the successful management of populations in Pacific Island Countries (PICs). Augmentative release of OrNV continues to be an important mechanism for CRB management in both coconut and oil palm growing regions. For 40 years after adoption of this biocontrol strategy, no new outbreaks of CRB were reported from uninfested palm growing islands in the Pacific ensuring continuity of palm based village economies. However, the situation has recently changed. For first time in 40 years, CRB invasion into completely new areas has been reported in the Pacific, being detected first in Tumon Bay

in Guam 2007, followed by Port Moresby in Papua New Guinea 2010, Honolulu in Hawaii 2013, and Honiara in Solomon Islands 2015. Additionally, Pacific areas with established CRB populations (e.g. Palau) have reported increased severity and frequency of CRB damage. Common to all these areas is the high incidence of severe palm damage not seen since the introduction of OrNV. Initial attempts to introduce OrNV into the Guam CRB population were unexpectedly unsuccessful, raising the possibility that the CRB-G population that invaded Guam could be tolerant or resistant to the commonly applied OrNV isolates. Analysis of several CRB populations has demonstrated that the CRB-G biotype is also found in Hawaii, Palau, and recently (February 2015) in Port Moresby (PNG), with Honiara (Solomon Islands) still to be confirmed. We will discuss current results in relation to what is known about these new invasions and potential implications for the future.

Worst Case Scenario

Uncontrolled infestations of CRB may kill most palms within a few years. In the Palau Islands, QUOTE HERE (Gressitt 1953).

A worse case scenario may be triggered by a massive outbreak of adult CRBs emerging from abundant breeding sites made by large amounts of decaying vegetation left in the wake of a typhoon (such as Typhoon Dolphin which visited Guam in May, 2015). Very high feeding activity will kill mature coconut palms leaving standing dead coconut trunks which are ideal breeding sites for subsequent generations of beetles. During a CRB outbreak, there will be an increased risk of further spread to uninfested islands throughout the Pacific.

Palms are important on Pacific Islanders for various reasons: as an cash crop for nuts, oil and lumber, as an ornamental tree appreciated by residents and tourists. On some of the smaller, more traditional islands the coconut palm is referred to as *the tree of life*. Here, this species is an essential natural resource providing income, housing, food, oil, soap, clothing, mats, baskets, and other containers. The smaller, poorer Pacific islands will suffer the most if the spread of CRB-Guam cannot be controlled.

Recommendations

A coordinated regional collaboration should be organized and adequately staffed and funded to accomplish 3 objectives:

1. Survey CRB populations throughout the Asian/Pacific region to delimit the geographical distribution of CRB-Guam.
2. Survey CRB-Guam populations to find isolate(s) of OrNV which are highly pathogenic for this biotype.
3. *In vivo* or *in vitro* propagation of selected OrNV isolates for auto-dissemination on islands infested with CRB-Guam.

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References

Bedford, Geoffrey O. (2013). "Long-term reduction in damage by rhinoceros beetle Oryctes rhinoceros (L .) (Coleoptera : Scarabaeidae : Dynastinae) to coconut palms at Oryctes Nudivirus release sites on Viti Levu , Fiji". In: 8, 6422–6425. DOI: 10.5897/AJAR2013.7013. URL: http://guaminsects.myspecies.info/sites/guaminsects.myspecies.info/files/Bedford2013_0.pdf.

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. URL: http://guaminsects.myspecies.info/sites/guaminsects.myspecies.info/files/Catley%201969.pdf.

Gressitt, J L (1953). *The coconut rhinoceros beetle (Oryctes rhinoceros) with particular reference to the Palau Islands*. Honolulu, 1–83. URL: http://guaminsects.myspecies.info/sites/guaminsects.myspecies.info/files/Gressitt%20-%201953.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: