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Coconut Risk Management and Mitigation Manual for the Pacific Region

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7. ORYCTES RHINOCEROS BEETLE

By M. A. M. Gruber, R. Bourdeix, T. McKenzie, R. Tautua and N. S. Aratchige

Description

The main risks are that the new and very aggressive biotype of *Oryctes rhinoceros* beetle (CRB-G), already present in Papua New Guinea, Guam, Solomon Islands, Palau, New Caledonia, Northern Marianas and Hawai'i continues to kill many coconut palms; and that it invades more islands in the Pacific region. The most common CRB-S/CRB-P biotype also cause damage in many coconut producing countries.

Oryctes rhinoceros (commonly called Coconut Rhinoceros Beetle or CRB) is an important pest of coconut palms, and currently causes more concern than other pests and diseases in the Pacific. The adults bore into the heart of the palm to feed on sap, damaging immature fronds which emerge subsequently showing typical V-shaped cuts with reduced photosynthetic area. When the flag leaf is damaged, it will be hanging from the top of the palm. Crooked leaf bud with retarded growth of the seedling occurs when the young seedling of less than a year is damaged and repeated attacks destroy the growing point and kill the palm. Beetle exit holes can often be seen at the crown base. Young oil palms are also attacked and more easily killed. While it is endemic in Asia, the pest was accidentally introduced into the South Pacific in the early 20th century, and then spread and become established in several South Pacific countries.

Oryctes rhinoceros has two different 'biotypes' in the Pacific, known as CRB-S (biotype susceptible to known virus isolates) and CRB-G ('Guam' biotype, tolerant to the virus infection). Sometimes people use the term CRB-P instead of CRB-S. CRB-G is not affected by the viral biocontrol isolates that have been used to control CRB-S. This means CRB-G can reach very high numbers, as adults live up to nine months, that cause severe damage in palm plantations and become very difficult to control.

Occurrence and severity

Where pest populations are generally under control, the damage CRB causes to palms results in reduced leaf area, early death of flowers and early nut fall, consequently reducing coconut yields. However, CRB-G resistance to the biocontrol virus has allowed this biotype to grow in numbers and move to new areas where there are fewer natural predators. It has been nicknamed the 'Palm Killer' as it can cause devastating damage and within one year destroy entire palm populations. It has been estimated the CRB-G has killed 50% or more of palms on some islands. Damage from CRB increases the risk of secondary infections and infestations e.g., by bacteria, fungi, viroids, viruses and weevils, in the crown.

In many Pacific countries, people living in the outer islands are still reliant on coconut/copra for income. Therefore, the introduction of CRB into countries such as Republic of the Marshall Islands or Kiribati will significantly harm the country's economy, culture, livelihoods and well-being of the people. As stated in the CIDP meeting held in Nadi 17- 20th April 2018, destruction of coconuts by beetles may also have significant impact on tourism and handicraft, with significant economic flow-on effects.

Mitigation and adaptation

Integrated pest management (IPM) based strategies including removal of breeding sites, extracting beetles using metal hooks, application of coal tar or burnt engine oil on innermost leaf bases to repel the adult beetles, placing naphthalene balls at the leaf bases, insecticides and biological control, are practised worldwide to control CRB.

Coconut rhinoceros beetles have general natural enemies such as birds, pigs, rats, insects including ants and scoliid wasp parasites. Although rats are invasive in the Pacific, especially on islands, they can be important predators of both CRB larvae and adults. However, the most useful biological control has been isolates of the *Oryctes rhinoceros* NudiVirus. Adults are infected with the virus and then released to spread infection to larvae in breeding sites, and to other adults within palms. Unfortunately, the CRB G-biotype is apparently resistant to the strains of *Oryctes rhinoceros* NudiVirus used for control.

Metarhizium majus (formerly *Metarhizium anisopliae*, green muscardine fungus) has also been an effective biocontrol. Spores can be applied to known breeding sites, or adult beetles dusted with the fungus spores and released to infect larvae and adults in natural breeding sites or artificial impregnation boxes of 1 m x 1 m x 0.5 m which is filled with breeding medium (typically a mixture of coir/saw dust and cow dung). *Metarhizium* is easily mass-produced on-farm using maize grits. It is important that the impregnation boxes are kept moist for survival and longevity of the fungus. The fungus can also be purchased from the supplier FGV AGRI SERVICES SDN BHD in Malaysia, and in bulk online at websites such as alibaba.com (subject to local biosecurity requirements). Samoan farmers cut trunks into logs and bulk it up, then add the virus and fungus portion, then cover the mass with coconut leaves. When the beetle encounters this bulk to lay eggs, they can be infected with virus and fungus.

Removal or reduction of plant waste (fallen palms, organic manure) is needed to reduce the breeding sites for CRB. Sanitation of plant materials is currently the main tool for control and is therefore very important. It is much easier to control the beetle life-stages that take place in the ground (eggs and larvae), rather than in the trees (adults) - i.e., control of breeding sites. The removal of fallen palm trunks and dead standing palms is essential to reduce breeding substrates. If possible, cut or break up the trunks into smaller pieces, dry them and then burn. Fine chipping will help rot down the wood faster. Breaking up the palms into smaller chunks (30 to 40 cm) that rot down quickly will also reduce breeding habitat. Note that it is not always feasible to burn, especially in wet tropical climates. Burning can also be an environmentally unfriendly action in and adjacent to urban areas. If the logs cannot be burned that should be used for something, rather than left to rot in the plantation. It is also possible to allow cover crops to grow over the felled trunks to provide less access for adult beetles to reach the decaying trunks for egg laying. Organic materials should be composted and turned regularly, so the larvae can be completely removed. Organic manure and coir dust heaps should be properly disposed of or should be well earthed up with the soil or maintained as a thin layer of less than 1 inch, if using as manure.

In the Andaman Islands of India traditionally people made a fig fire by night at the centre of their villages. Many beetles were attracted by the fire light and burned.

Biosecurity awareness material should include advice to all Pacific countries about activities being undertaken in countries where the new CRB-G strain is already present. Inter-island shipping biosecurity is critical e.g., farmers transporting compost or plant materials between islands. In high risk countries, biosecurity/quarantine services issue trap surveillance kits, and

have prepared emergency response plan and control intervention measures such as: short/long term responses, eradication and containment plans.

Mass trapping using the aggregation pheromone, ethyl-4-methyl octanoate which attracts both male and female beetles is an effective way to reduce the rhinoceros beetle population. However, care should be taken in using pheromone traps. Firstly, pheromone traps are only a component in the IPM of CRB. From the experiences of other countries such as Sri Lanka, it is evident that the pheromone traps alone will not be enough to manage the pest, but can reduce the damage by more than 50%. Secondly, the traps should be continuously maintained with timely replacement of the pheromone. Thirdly, experience in coconut and oil palm plantations in Sri Lanka reveals that the pheromone traps are more effective if used in large plantations (>1ha). If small scale growers opt for the use of the pheromone traps, they should be installed community-wide i.e., to install the traps in a village or by a few growers installing traps simultaneously. It is also advised to preferably install the traps along the periphery of the plantation or in non-coconut areas. However, placing pheromone traps at the border of the plantation has found to be effective only in blocks without infested breeding sites.

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Plate 9. Dr Visoni Timote of SPC demonstrates how to use a CRB trap with PVC pipe.

One pheromone trap per hectare is recommended, but it can be reduced to one per two hectares in moderately damaged areas. Two types of traps can be used. The first one, 'PVC tube or Pitfall trap' is made of 1.5 m long and 10-15 cm diameter PVC pipe (see Plate 9). Two windows, 10 x 10 cm^2 each are made on either side at 0.5 m and 0.75 m from one end. Close to the other end, a few holes are made to drain excess rainwater. This end is closed with an end-cap or any other closely fitting lid and fixed to the ground vertically with the aid of a pole or may be attached to a trunk of an adult palm. The pheromone sachet is fixed on one window using a wire. The beetles attracted to the pheromone fall into the pipe and are killed manually or using an insecticide/soap solution. The beetles cannot escape the trap so will eventually die anyway.

The second type of trap (cross vane trap) is made of a plastic bucket of 10 litters and two metal sheets of the diameter of the bucket and a height of 0.5 m, arranged at an angle of 90^0 by making a slit on each sheet halfway. Cross vanes are pushed into the opening of the bucket and made to stand erect by removing a triangular portion of the metal. A few holes on the bottom of the bucket are made to drain excess water. A soap-water solution is filled up to the level of the holes. The pheromone sachet/vial is hung on the middle of the vanes. The beetles attracted to the pheromone hit the metal vanes and drop into the soap-water solution and die.

Oryctes pheromones are available at ChemTica Internacional, S.A. Apodo. 640-3100, Heredia, Costa Rica (www.chemtica.com., info@pheroshop.com., sales@pheroshop.com) and Pest Control (India) Pvt. Ltd. Mumbai, India (www.pestcontrolindia.com. solutions@pcil.in). Other sources may be available but have not been tested.

Actions to undertake

- Biosecurity rules and International Guidelines for transfer of coconut germplasm should be strictly followed to prevent pests and diseases being moved to new locations.
- Scientists should strengthen the search and evaluation of virus strains effective against the CRB-G biotype.
- More investigation into the tolerance of diverse coconut varieties, the role of adequate plant nutrition, and other factors such as general phyto-sanitation must be part of the solution. As it is easier to manage short palms than tall ones against *Oryctes*, the many Compact Dwarf varieties and their hybrids with local varieties should be tested and distributed, together with local Tall varieties. A consistent program of collecting Compact Dwarf varieties and testing them for *Oryctes* resistance should be developed in several Pacific countries. Farmers can start to plant and test some Compact Dwarfs by themselves.
- In the Solomon Islands, seek the coconut palms remaining in the old Yandina Research Centre and try to recover the existing varieties. Old documents and offices were burned, but the coconut palms remain. When visited in 2018, evidence was found that some red or yellow Compacts Dwarfs are still alive and could be cultivated.
- Investigate ways to obtain value from the huge quantity of *Oryctes* larva and adults presently harvested (up to 15 tons per month in some oil palm plantations).
- Scientists in the Pacific region to test the method recently developed in Pakistan with other bio-control agents.

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