Consolidated responses to the

PAFPNet Discussion Query on

Ways to reduce Coconut Rhinoceros Beetle breeding sites in and around coconut plantations

20 May 2018

SUMMARY

This discussion generated a lot of discussion about many aspects of Coconut Rhinoceros Beetle (CRB) management, which went far beyond the initial intention of focusing on reduction in breeding sites (phyto-sanitation of plantations). There were 13 responses, some of which were specific requests for assistance from member countries which are not reported here but will be followed up independently by the SPC Plant Health team.

Participants asked fundamental questions about biological control options, in particular the use of new viruses to continue the control that has been achieved since the 1970s, and the use of various partial controls including *Metarrhizium* fungus.

There was very strong interest in emergency response planning, and ways to increase public awareness of the risks posed by the beetles, and requests for SPC to assist in developing appropriate response plans.

Part of the biosecurity approach is to have trapping stations around ports and airports to enable early detection of entry by the beetles. This overlaps with the issues of how best to reduce breeding sites.

Designated trapping sites, such as compost heaps which are systematically treated with Metarrhizium fungus, and which may be surround by nets to trap the beetles, provide an essential means of monitoring beetle numbers.

This is complementary to the idea of managing coconut plantations to maintain composted materials on-site, and actively managing the fertility of the plantations through maintenance of humus and soil, but requires active management of husks, fallen logs and fronds.

Prevention is better than cure. Always.

Plantations should be clean and compost materials should be managed by burying and/or regularly turning compost and mulch to expose eggs, larvae and pupae to predators. Also, regular turning of compost traps will destroy eggs, larvae and pupae. This will be an important part of ongoing control for CRB.

One solution: Trapping coconut rhinoceros beetle, Oryctes rhinoceros. Breeding sites are heaps of old fronds or other organic matter; they are covered by a gill net, and the beetles get caught in the mesh when entering or leaving the heaps. Photo courtesy of:

http://www.pestnet.org/fact_sheets/coconut_rhinoceros_beetle__oryctes_108.htm

CONSOLIDATED RESPONSES

1 May 2018
Ilagi Puana

As a lay person in this subject and from the comment made that CRB affects native palm species, would this include, the betelnut and the sago palms, the two common palm species that is abundant in PNG and elsewhere and have food security and cultural significance to these societies. In PNG and I imagine elsewhere where these palms are domesticated, sago is extracted from sago palms and the wood is used as building material for houses in villages or parts of fallen palm trees are left to compost and edible grubs are harvested for food in some communities. Not sure whether these are CRB larvae or some other insects larvae. Have not observed in the betelnut palm. The issue is, if, CRB also affect sago palms and betelnut, could these palms provide a reservoir source for CRB and the epidemiology for spread of CRB considering the cultural and traditional practices for food security and movement of these palms and their products in and between communities including between Islands. If so, these palms and CRB as potential food source should be considered in the medium to long term control or eradication strategies. Just an observation.

1st May 2018

Bob Macfarlane, Solomon Islands CRB Coordinator

Thanks for the thoughts Ilagi.

CRB is recorded to attack many palms including betelnut and the sago palms but it prefers coconut and oil palm. If coconut and oil palm are nearby it rarely attacks other palms. It is the adult that attacks the living palm but the larvae live in rotting palms and other rotting vegetation. The larvae ae not a pest, in fact the make quite good compost. Unfortunately they grow into adults and they are a serious pest.

The insect can be transferred from place to place as larvae in compost or chicken manure or rotting palms but usually it is the adult that travels long distances by attaching itself to ships and aircraft.

Betelnut and the sago palms are not usually considered to be reservoirs of the beetle and certainly the movement of betelnuts or sago do not constitute a risk from CRB.

30th April 2018

Maclean Vaqalo, SPC Entomologist

Unlike CRB-P, CRB-G is apparently tolerant to the known effective virus (*Oryctes nudivirus*, OrNV). CRB-G is apparently doing more severe damage, which results in palms dying within 1-2 years of attack. An assessment report on Guadalcanal Island in Solomon Islands suggests that the beetle is spreading on the island at the rate of 1.7 km per month and leaving behind trails of dead palms as it progressively infests the coastal coconut plantations. This rate of spread in the report is very worrying when considering the low-lying atoll islands in Solomon Islands and beyond.

CR-G threatens native palm species, tourism revenues and the protection from erosion of coastlines.

So what should we do to prevent the spread of this pest beetle? First and foremost, greater awareness is paramount. SPC has produced a pest alert, poster and brochure leaflets about CRB-G. We hope this discussion will stir more interest and further awareness about restricting spread and management of the beetle.

Today, CRB-G is known to be present in Guam, PNG, Palau, Hawaii and Solomon islands. Nobody knows the origin of this new strain but it could have come from Southeast Asia. We must all be mindful when traveling from these countries to other Pacific Island nations and we must train the general public too. The beetle breeds in phyto-compost materials where eggs, larvae, pupae and adults are likely to live so quarantine restriction of movement of any items with compost soils is highly recommended.

Boats and planes leaving CRB-G infested ports are at high risk of spreading the adult beetle pest. Boats that are anchoring or cruising within 700m of the coast of infested islands are at high risk of beetles flying to them. The beetles, attracted to the boat lights, can land on the deck of the boats without being noticed and can survive many days thereafter before fly off upon reaching new locations. Planes that fly at night also pose high risk of transferring adult live beetles. The captains and crew of all shipping carriers need to be aware and take extra precautionary measures for CRB-G when moving from the infested countries.

As an example Marshall Islands have island hopping flights which begin from Guam and also direct flights from Hawaii. The beetles can hitch hike along these pathways.

Putting traps at the high quarantine risk areas, such as seaports and airports can be very helpful in providing early warning and detection of the beetle. SPC has pheromones and an Instruction Manual on how to set up these traps. SPC invites key players to request the lures and traps. They can be placed every 50m apart to cover the landing wharves and air terminals.

Detection of CRB presence by a symptom surveillance method can be another early warning detection method. CRB classical damage is the v-notch shape on the leaves. However, this detection method can only be detected four months after the damaged young folded leaf has emerged and opened; by which time, it might be too late for an eradication campaign as the same beetle might have laid more eggs and moved to several breeding sites to breed.

Avoiding breeding sites at high quarantine risk sites for potential invading CRB-G female adults is important. As much as possible, both seaports and airports must be kept clean and compost free. If possible, avoid having palms at these port areas. If palms are in the vicinity, they should be closely monitored for infestations.

Developing an Emergency Response Plan (ERP) for CRB-G is very important for each of the PICTs. This will give clear command to an agency and ensure that inter-agency cooperation is in place to quickly implement control measures in the event that a new pest invades a sovereign nation. SPC has a generic ERP for any pest invasion which all the countries should already have. The ERP may vary in the way it is implemented in the respective PICTs. Plans are underway to hold ERP training with countries who request it.

There is no silver bullet for effective management of CRB. Proper plantation sanitation/destruction of breeding sites, collection of beetle stages in composts and traps, bioagents, insecticides are all part of the integrated control package for CRB. However, learning from past experience, it was the discovery and distribution of a virus in the 1960s that sustainably put CRB-P under control. Damage level was reduced 70-80 per cent within a year of virus release into the plantations. Emerging outbreaks in the CRB-P countries in recent years has called for a review of the known effective virus. It's been about 50 years since the virus was first released and there is the need to establish if the virus is still present and effective. Work is currently underway to look for an effective virus for CRB-G. While the effective bioagents are still being researched, restricting the spread of the beetle and suppression of its population through plantation phytosanitation, collection of beetle stages

from compost and traps, and application of insecticides are advised to be applied are recommended.

The key message and advice to all PICTs including Kiribati and Marshall Islands is this, "Prevention is better than cure. Please make all the necessary awareness and take all the precautionary measures about CRB-G and make sure CRB-G does not spread to your countries and islands. "

For those that have CRB already, "Please make sure your plantations clean and that compost materials are properly disposed of by burning, burying and or regularly turning compost and mulch to expose eggs, larvae and pupae to predators. Also, regular turning of compost traps will destroy eggs, larvae and pupae and this will be an important part of ongoing control for CRB."

1st May 2018
Grahame Jackson, responding to Maclean Vaqalo

A couple of things, or three. First, Maclean: I would like to know how you can tell that this G-strain is more aggressive than the P-strain. After all, there is no virus in Solomon Is to limit numbers; this means there are lots of beetles infesting a few palms, so obviously the damage looks bad. The numbers in the oil palms at Okea, Guadalcanal Plains, has to be seen to be believed, so if similar numbers are breeding in coconut plantations then the population must be enormous.

But where's the proof for aggression?

Second, look at history. Only the virus controlled the P strain. It WAS the "silver bullet" then, and let's hope it's going to be the silver bullet now for the G strain. History tells us that it's unlikely to be controlled by any other way means. Yes, the activities you suggest are good, sensible, necessary, but testing all the strains that have been collected and, if necessary, prospecting for new virus strains has to be the way forward. And needs to be done urgently.

Remember the work of Zelazny, and I quote from his Pest Information Wiki:
http://wiki.pestinfo.org/wiki/ Oryctes_rhinoceros_nudivirus_(entomopathogen)

"While the extremely low incidence of the virus in eastern Java indicated the presence of virus resistance there, releases of virus-infected beetles in Central Java, with a virus strain from Sumatra, still reduced the *O. rhinoceros* populations. Eleven years after these releases, the beneficial effects were still visible in the palm damage of the treated plots. However, strangely, the damage reduction had not spread to the nearby untreated control plots, 10-20 km away (Munaan et al., 1989).

Therefore, the prevalence of the virus in and its effect on *O. rhinoceros* populations appear to be the result of a combination of different factors which include:

- susceptibility of the *O. rhinoceros* population to the virus
- ecological conditions which effect the transmission of the disease
- virulence of the virus strain(s) present in the area
- density of the *O. rhinoceros* population"

These are important considerations.

And third, and just to add to Bob's response to Ilagi's question about hosts, it might be a good idea to have a look around Honiara. There are ornamental palms at the hotels infested, eg a fan palm at the Heritage is badly damaged. The Pacific Pest and Pathogen app records betel nut, sago palm, banana, Pandanus, sugarcane, and tree fern, other than oil palm and coconut. It does not say how severely these are damaged in comparison to coconut, and as Bob says they are probably secondary hosts. But checking on sago should be done urgently as this is such an important palm to many communities in Melanesia.

27 April 2018

Lesio Saurara, SPC

Thanks Bob,

I agree that, given the CRB emergency, burning can be implemented in affected areas if planned well.

1. There can be a centralized or demarcated area within the affected areas for burning debris because of the threat and risk that this pest presents to its hosts (production and yield) plus impacts on an important source of livelihood.

2. Use the debris to power up boilers for energy?

Burning organic debris is something already being practiced by many farmers and ash is then used as a soil amendment. I don't believe that burning of such debris will significantly increase greenhouse gas emissions. In this specific case of suppression/contaminant/control management, when planned well, it may be an important tool in the toolbox for breaking the life cycle of the pest, in conjunction with other measures.

It's a decision to be made by those affected and at this particular point in time, priority is on reducing and removing the pest (primary) rather than on the organic humus (secondary) that can be replenished/regenerated once CRB control is achieved. Burning should only be used in most affected areas (hot spots) with an approved management action plan, not across whole island countries. It is one of the many measures that collectively will reduce the population of this pest.

On Question 4, in Fiji we have the introduced mongoose which may be ideal predators and of course we have birds everywhere. I suspect that there are other predators out there which need to be investigated which can contribute to reducing this pest population.

On Question 5, we are aware that sea and air routes around the Pacific are a means for pests such as CRB to spread across borders internationally with neighboring countries and relevant authorities need to continue to be proactive in having measures increased in their foreshores and coastlines.

Equally important is the restriction of moving plant materials from infested areas to other islands (intra) or within particular islands. These other biosecurity control mechanisms require targeted additional resources for monitoring and control to be successful.

Lesio Saurara

Market Access (Food Safety Consultant) and Biosecurity

LRD, Pacific Community (SPC)

Moderator comment:

Thankyou Lesio for the contribution. I agree that the total amount of greenhouse gas emissions from this sort of phyto-sanitation burning in Pacific Island Countries and Territories, relative to global emissions, is very very small. However, we need to be mindful of maintaining soil fertility. Soil organic matter (leaf litter, humus, compost and mulch) are important in creating living soil, which will increase plant-available nutrients. They protect the structure of the soil from heavy rain and increase the water-holding capacity of the soil.

That was the real intent of Question 3, rather than greenhouse gas emissions themselves.

Instead of burning in centralised areas, could composting be undertaken, with an integrated system of beetle trapping and fungal control? Are members aware of these types of composting pits?

I agree that cocowood which cannot be sawn or used for higher value products could be chipped and used as an energy input. Are members aware of practical systems of collecting and drying old logs for use as an energy source?

29 April 2018

Bob Macfarlane, Solomon Islands responding to Daniel Mataroa, Cook Islands Food Security & Self Reliance Group Inc.

Cook Islands

Thank you Daniel for your interest in our problem, I will try to answer some of your questions below.

- Birds - Minar birds were introduced into the Cook Islands to control the stick insects but they ended up becoming a pest themselves. Not only did they control the stick insects, they also managed to kill a lot of our native birds by eating their eggs. Why are the minar birds not controlling the CRB? (Maybe they moved from the trees to the hotels for easier pickings)

There are reports of birds eating adult beetle here and chickens do a great job on the larvae too when they are exposed by breaking up breeding sites but the numbers they eat are not enough to deal with our current outbreak problem. We have to get the population of beetles down first before birds will have a good controlling effect. That is why we want to destroy the beetle breeding sites which are rotting palm and other rotting vegetation.

- Introducing parasite Beetle? Is there such a bug? How is it that the CRB is not bothering the palms in the deserts like Sahara and places like that? How are they controlling their bugs?

In the 1960s a major project was run in Fiji, Tonga and Samoa and it investigated all the parasites and predators which keep the beetle under control in its home countries of SE Asia but none gave a useful effect until a virus disease was found which was subsequently introduced and reduced damage levels from 80%+ to 10-20% which was manageable. Unfortunately the strain of Oryctes we, PNG, Guam and Hawaii have is tolerant to this virus and we now have a major project to look for a new virus in SE Asia. We are hopeful of success as the beetle is not a serious problem to coconuts anywhere in SE Asia under normal conditions.

- Has any research been done on the CRB itself? What are they allergic to? How long do they live for? Why do they like the coconut and not cabbage? What part of the coconut do they eat? Why? Are there any sounds or level of sound waves that makes them uncomfortable and is OK on us? Can we control their population? Where do they sleep? When do they eat? (Day or Night?) What time? Why that time?

See comment above. It attacks most palm trees mostly but loves coconut and oil palm, it also attacks Pandanus, pineapple, Colocasia, banana and sugarcane. There of no records of it attaching other kinds of trees. They are mostly active at dusk and are attracted to lights!

- Will it help to inter plant between the rows of coconut to create a forest environment. Maybe the Guava is supposed to be the Beetles favorite food but because we planted only coconut, it has choice but to eat only coconut and over generations have now become their favorite food. Will the Beetle eat any other plant?

To my knowledge inter-planting has not been tried but it is hard to know what might be successful quickly as their favourite food seems to be coconut and oil palm.

- Burning the coconut leaves around the plantation - extreme but necessary. We do have a dire situation that requires extreme remedy. Unfortunately burning also drives your unseen "worker" bugs away. When I was growing up, burning was a way of controlling the bugs and mosquitoes.

We are looking at burning dead and rotting palms and other rotting vegetation to destroy the breeding sites. We do not believe this is a real nuisance in plantations as it will be done infrequently after the first initial clean-up. We would like to find an alternative so some ideas would be welcome.

27 April 2018

George Taoaba, Kiribati

As you may have already know, there is no evidence and presence of the Coconut Rhinoceros Beetle here in Kiribati. However, this is a concern given that the majority of our population rely on copra as a form of financial income, especially for the unemployed. Copra in Kiribati is considered a "treasure" and therefore the concern for an outbreak of the Rhinoceros Beetle maybe of priority concern.

I notice that a few of the questions you send are more on the phase of managing, reducing, and eradicating the CRB in the country and we look forward to the consolidated result. however, we would like to know also if there is any early detection and rapid response plan on CRB that is available to assist to like Kiribati, where there is no presence of CRB and would like to keep it that way. Thanks.

27 April 2018

Karness Kusto, Marshall Islands

This is great the Pacific small islands like the Marshall Islands, Kiribati and Tuvalu will benefit from anything like this. These small islands have no other land resources for drinking apart from coconuts (besides water or underground water). If we find ways to control and get CRB minimized or even get rid of them it will be very useful for the small islands in the Pacific that rely on coconut.
Karness

27 April 2018

Grahame Jackson responding to Bob Macfarlane

Agree on the climate change. And I can see what you mean about being an emergency.

My only opposition to it would be on the grounds that i) its bad practice when many people and organisations are suggesting that burning land for eg garden making is not a good thing

as all the organic matter is wasted; and ii) it generates a lot of smoke (saw it last year or was 2016?) and if living nearby it would not be nice for people, and it lasted some days.

27 April 2018

Bob Macfarlane

This is an excellent initiative and we in Solomon Islands will be keen to see all comments as it is an issue which worries us considerably. At this stage I have only one comment/question:

Is the statement "Given the need to reduce greenhouse gas emissions, we need to minimise burning of coconut and timber residues, both in plantations and at sawmills." really valid? The amount of burning that will take place in a normal plantation to get rid of dead palms will be trivial (hard to measure) in its effect on climate change. Even in plantations with recent outbreaks and several dead palms burning of large quantities of dead palms will be done only once every 30 years or so with again an overall trivial impact. I do not think burning is a significant issue. In fact in the short, emergency, term it is the only method of quick disposal available. What do others think?

PAFPNet Discussion Query on

'Ways to reduce Coconut Rhinoceros Beetle breeding sites in and around coconut plantations'

May 2018

INTRODUCTION

TheCoconut Rhinoceros Beetle (CRB) is now the number one pest of palms, especially coconut, in the Pacific region. It is native to tropical Southeast Asia but came into the Pacific since1909. The beetle is now present in Samoa, American Samoa, Tonga, Tokelau, Wallis and Futuna, Fiji, PNG, Palau, Guam, Hawaii, and Solomon Islands. Within the last decade, a new strain of the same beetle known as the CRB-G has emerged with damaging behaviour more severe than the old CRB-P. The CRB-G strain is now present in Guam, Palau, PNG, Hawaii and Solomon Islands.

SPC has been undertaking a number of initiatives to help member countries deal with CRB. A regional workshop was held in Suva, Fiji on 17-18 September 2017 to engage key actors in the work of prevention, containment and suppression, eradication and management of CRB-G, and initiate an increased and more coordinated regional program (and National Response Plans when the need arises). The program will address short-, medium- and long-term goals in the protection of the palm industries in the Pacific. Recommendation 25 from the meeting states *'The workshop recognized that phyto-sanitation and management of*

organic waste was a vital CRB management practice and that further research into disposal techniques and economics are needed.'

Work is continuing on improving awareness and processes for international / inter-island biosecurity and improvement of trapping systems. The focus of this query is about the management of sites where the beetle breeds.

These breeding sites can be in old coconut logs, other timber, compost heaps, sawmill residues and landfills for municipal waste. Therefore management of the cleanliness or 'phyto-sanitation' of coconut plantations and surrounding areas can make an important contribution to the reduction in CRB-G populations.

In this PAFPNet discussion query we seek your views and advice on successful ways to reduce potential beetle breeding sites. *This information will assist in drafting regional phytosanitary guidelines for coconut plantations, sawmills and landfills.*

There is a tension between the need to minimise opportunities for CRB-G breeding, while at the same time maintaining important sustainable farming practices of composting, mulching around trees and other crops to improve soil fertility and soil water-holding capacity.

There are also important economic issues to be solved to make replanting and phyto-sanitation affordable and these may include the use of logs for cocowood timber, chipping of upper logs and creation of composting sites that are carefully managed as trap sites for CRB-G.

QUESTIONS

1. What practical and affordable approaches are being used in your country or elsewhere for preventing/reducing CRB infestation through reduction of breeding sites?Briefly describe what is being done. Is it working? How could it be improved?

2. Current markets for cocowood timber and veneer are limited. What support is needed to increase markets and improve access for sawmill owners and other types of processors who might use coconut by-products and reduce breeding sites?

3. Given the need to reduce greenhouse gas emissions, we need to minimise burning of coconut and timber residues, both in plantations and at sawmills. Describe composting systems that you believe could be used to reduce breeding sites, and how you might manage these to reduce CRB populations.

4. Can you see ways where the use of livestock and/or other crops could contribute to reducing CRB nesting sites or CRB eggs and larvae?

5. Discuss any major concerns / risks that you see with biosecurity control of CRB in your country (at the border, or internally)?