Potential of Organic Waste Substrates as Attractants in Log Traps for Coconut Rhinoceros Beetle (*Oryctes rhinoceros* L.)

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Abstract

Coconut rhinoceros beetle is an important agricultural pest that is prevalent to cause serious damage on coconuts. One of the control methods for this pest is by using different potential breeding sites/substrates. The objective of this study is to assess the efficacy of organic waste substrates as trapping media for Coconut Rhinoceros Beetle (CRB). The organic waste substrates tested were the saw dust (control), corn cobs, rice straw, decaying vegetables, decomposing banana stumps and leaves and animal manure as CRB attractant in log traps. Among the six organic waste substrates tested, animal manure and rice straw were the most promising substrates that can be used as CRB trapping media in terms of the number of eggs collected, with 56 and 19, respectively. Also, high mortality of developing larvae was observed in these substrates compared to saw dust.

Keywords: Trapping medium; Abundance; Develop; Green muscardine fungus; Mortality

Introduction

Coconut rhinoceros beetle is a large beetle (1.5 to 2.0 inches in length), with shiny dark brown to blackish in color. It is known to be native in Southern Asia and is established throughout the Pacific Islands (Kumashiro et al., 2014). The male beetle is recognized from a female by a larger horn on its head while the female has an orange fuzzy posterior. The larva or grub is light colored (off-white with brown heads) and can grow to a length of 4 inches. From the various studies conducted, it was indicated that female beetles are known to lay their eggs in decaying logs or decomposing organic matter such as mulch piles and etc. (Kumashiro et al., 2014; Manjeri, Muhamad & Tan, 2014). Eggs of Coconut rhinoceros beetles are whitish in color hatching in 8-12 days after being laid. Larvae develop in decaying logs or stumps, piles of decomposing vegetation or sawdust, or other organic matter for another 2.5 to 6.5 months. It becomes a pupa after 10-20 days spent in a cell made in the wood or in the soil beneath where the larvae feed, after which the adults would emerged and fly to palm crowns to feed. The beetles are active at night and hide in feeding or breeding sites during the day. Most mating takes place at the breeding sites. The life cycle (egg to adult) may vary greatly depending on the food source and environmental conditions. It may range from 4 -9 months, however, adults can live as long as 20 months.
as 9 months and gravid females lay 50-150 eggs throughout their lifetime (Hara, 2014; Kumashiro et al., 2014). They are capable of flying long distances and can infest isolated coconut trees over a mile from the breeding site.

Coconut rhinoceros beetle especially adults, damage palms by boring into the center of the crown (Kumashiro et al., 2005). It attacks not only the adult coconuts, but also younger ones and seedlings (Dallaire & Rueffler, n.d.), habitually injure the growing tissues and feed on the exuded sap. As they bore into the crown, they cut through the developing leaves. When the leaves grow out and unfold, the damage appears as V-shaped cuts in the fronds or holes through the midrib (Schmaedick, 2005). Damage to the inflorescence especially in canopy size due to the beetle attack often leads to a reduction in the photosynthesizing area resulting in decreased or delayed fruit production (Manjeri, Muhamad & Tan, 2014).

As cited by USDA (2015) from Gressitt (1953), though coconut rhinoceros beetles generally attack adult palms, young palms are rarely attacked, thus significant decreases in yield are observed. Moreover, coconut rhinoceros beetle are strong fliers - they can fly 2 miles at a time (Iriarte et al., 2015), hence, serious attacks may be observed in areas adjacent to a breeding site with a high beetle population. Due to the expansive nature of this beetle, usually more than one beetle attacks a single palm and this often results in serious damage and plant death. Such incidences have a negative impact on the palm industry (Manjeri, Muhamad & Tan, 2014). At the farmer’s level, coconut rhinoceros beetle can be controlled using integrated pest management strategies. One of the control methods used is the installation of sawdust log traps (PCARRD, 2006).

CRB is attracted to substrates that contain soil with high organic matter content. Materials like compost, sawdust heaps, rotting logs, decaying vegetation, bridges made of coconut trunk, dead pandanus, old latrines, sugar cane bagasse, rice straws, cattle dung and humus rich soil could serve as suitable habitats for immature beetles (Catley, 2009; Jackson et al., 2010; Manjeri, Muhamad & Tan, 2014). Aside from high organic matter content, CRB are also attracted to ammonia and acetone scents but are being repelled by acetic acid scent (Bedford 1980; PCARRD, 2006). Many of literatures reveal different possible breeding sites of coconut rhinoceros beetle and why they are attracted to it. However, only limited study are conducted on the efficacy of the possible breeding sites or organic waste substrates in trapping CRB. Thus, there is a necessity in comparing the efficiency of selected decaying waste substrates as trapping media in log traps for rhinoceros beetles and to monitor the abundance of CRB caught or trapped in log traps with varied trapping media/substrates.
Figure 1. Establishment of log traps with different organic waste substrates: A) cutting of coconut logs; B) Laying out of logs; C) assembled log trap; D) filling up of organic waste substrate in log trap

Materials and Methods

Establishment of Coconut Log Traps with Different Decaying Substrates

Eighteen traps using coconut logs were constructed measuring 0.5 m x 0.5 m x 1.0 ft. These were filled up with different decaying substrates being used as trapping media for the adult beetles (Fig. 1). Six trapping media were used as treatments in this experiment, namely, saw dust (control), corn cobs, rice straw, decaying vegetables (mixed waste vegetables of carrot, cabbage, beans, etc.), decomposing banana stumps and leaves, and animal manure (2 days air dried of mix animal manures of carabao, cow and horse). The trapping media were air dried for two days before the application. Each trapping medium was replicated three times. Approximately three hectares of coconut area were used for this experiment. For each hectare, six traps containing the different media were arranged randomly representing one replication.

Monitoring on the Abundance of CRB Eggs in Log Traps with Decaying Substrates

The presence of CRB eggs indicated the attractiveness of the decaying substrates. Monitoring of the CRB eggs was conducted two weeks after the establishment of the different log traps. Consequently, observation and recording of results were conducted every week, by recording the number of eggs and larvae that may have developed from the eggs. Figure 3 depicts the collected eggs and corresponding CRB larvae. The eggs in the log traps were collected and brought to the Department of Pest Management in the Visayas State University for analysis. The eggs were placed and the larvae were reared.
Figure 2. A) Collecting of CRB eggs from organic waste log traps and B) placing the collected CRB eggs in plastic containers

Figure 3. Collected CRB A. Egg and B. Larvae from saw dust

Data Gathered

The Abundance of CRB eggs was measured by counting the number of eggs per substrate per replication. The incidence of GMF infection on CRB larvae was measured through the appearance of the white fungus that will eventually turn green after 3 to 5 days on the mummified body of the CRB larvae. Moreover, the most effective substrate in trapping CRB was determined based on the number of eggs trapped in it.
The log traps were laid in Randomized Complete Block Design with three replications per treatment. The number of eggs laid were subjected to analysis of variance (ANOVA).

**Results and Discussion**

**Efficacy of Organic Wastes as Breeding Substrates of CRB in Log Traps**

Table 1 shows that among the organic wastes used as substrates for log traps, animal manure and rice straw stood out to be the most promising substrates comparable or even more efficient than coconut saw dust log traps. Their effectiveness can be due to their high moisture content, suitable soil pH, softness of the substrates resulting from the constant rainfall which influence the breeding activity of the CRB and affect either directly or indirectly to the CRB population (Kamarudin, Wahid, & Moslim, 2005; Manjeri, Muhamad & Tan, 2014). This is very evident in the total number of eggs that were laid by the adult beetles in these log traps. For a period of two months, animal manure obtained a total of 56 eggs, twice more than that of the saw dust log traps. The rice straw substrate was also comparable to the saw dust log traps, with 19 eggs and 21 eggs, respectively.

These eggs also successfully developed into larvae with 100% hatchability. However, some of the larvae failed to develop or reached the second larval instar stage in this substrate. In animal manure, high mortality of larvae, (57% mortality) was recorded while in rice straw 26% larvae mortality was obtained. This mortality however, was comparable to that of sawdust which was 28%. The results indicate that even with the high efficacy of the animal manure as attractants to the beetles to induce laying of eggs, this substrate could not sustain the development of the immature to succeeding instars. High mortality rate of the CRB larvae in animal manure can be due to the presence of pathogens. A wide variety of pathogenic viruses, bacteria and parasites may be found in the feces/manures of wild and domestic animals including cow, carabao and horse which could have led to the death of the larvae (Olson, n.d.; Kirk, n.d.). Other factors of this incidence are the excessive temperatures since animal manure is one of the important sources of anthropogenic greenhouse gases: methane, nitrous oxide and carbon dioxide (Vac et al., 2013). The chemicals present in the animal manure and its pH are also possible factors on the high mortality rate of the CRB larvae. On the other hand, rice straw is an organic material that abounds all the year in the Philippines round because of rice production. The results of this study indicate the effectiveness of rice straw as breeding site for CRB with low mortality of larvae. Thus, as mentioned earlier, studies could also be done to validate long term effect of the substrate on the development of the larvae compared to saw dust or other substrates. In this way,
appropriate management of rice straw heaps could be imposed in order not to influence or trigger problems of CRB population outbreak and infestation. Analysis of variance indicates that there is a significant difference among treatments in terms of the number of eggs collected in animal manure compared to corn cobs, decaying vegetables and decomposing banana stumps and leaves, but not to rice straw and sawdust (control).

Conclusion

Animal manure is more efficient in trapping the coconut rhinoceros beetle but cannot sustain larval population as shown by high mortality of larvae. The result of the study can be integrated as one of the options in CRB management as a natural way of controlling the population of coconut rhinoceros beetle without the threat of completely eliminating them. Although, the present study is an initial research along this line of subject matter, it may be worthwhile to conduct further studies to validate and confirm the effect of this organic substrate on the development of the beetle. In this way the presence of so much animal manures in coconut areas would be proven as a threat or not to coconut production. Nevertheless, animal manure is suggested to be tested in other coconut farms/plantations to confirm its efficacy. The development of CRB on these organic substrates can be also studied in order to provide information on CRB breeding sites. Moreover, animal manure as organic substrate can be subjected to further study to determine what specific chemicals it contain that allows attraction to CRB together with its high mortality rate. Another aspect to be studied is the possible mutation of the CRB if the use of animal manure becomes widespread.

References Cited


