AGRI MAGAZINE
(International E-Magazine for Agricultural Articles)
Volume: 02, Issue: 07 (July, 2025)
Available online at http://www.agrimagazine.in
©Agri Magazine, ISSN: 3048-8656

Biology, Ecology and Integrated Pest Management of Rhinoceros beetle of Oil Palm

*Rudraboyina Sai Kiran, Dr. A. R. N. S. Subbanna, Dr. M. V. Prasad and K. Vamsi Krishna
ICAR-Indian Institute of Oil Palm Research, Pedavegi, Andhra Pradesh, India
*Corresponding Author's email: ratnasai990@gmail.com

The rhinoceros beetle, *Oryctes rhinoceros* (L.), belongs to the Scarabaeidae family and the Dynastinae subfamily. The rhinoceros beetle has four life phases: egg, larva, pupa, and adult. The larva has three stages known as instars. The lifespan ranges from 9 to 18 months, depending on environmental conditions. Generation time varies from 5 to 9 months. Rhinoceros beetles typically have a sex ratio of 50:50, In ideal conditions with abundant food supplies, rhinoceros beetle populations can rapidly expand. The rhinoceros beetle is a major pest of oil palm, coconut and other palm species, causing damage by burrowing into the palm's crown. Effective control of this pest requires Integrated Pest Management strategies for reducing beetle populations and minimize damage, ultimately promoting healthy oil palm growth and productivity.

Keywords: Rhinoceros beetle, biology, ecology, life cycle, integrated pest management, oil palm

Introduction

Oryctes rhinoceros, commonly known as the coconut rhinoceros beetle, Asiatic rhinoceros beetle, and coconut palm rhinoceros beetle. The *Oryctes rhinoceros* majorly affects commercially significant oil palm. It can cause major damage to the palm's growing fronds (leaves), leading to its demise. The beetle breeds in decaying palm trunks and other organic debris, such as sawdust or compost heaps. This beetle's native range extends throughout tropical Asia, from India and the Maldives in the west to Myanmar, Thailand, Malaysia, Vietnam, most of Indonesia, the Philippines, Taiwan, and southern China in the east. It was mistakenly introduced into a wider number of tropical islands in the Pacific as a result of human activities, beginning with Samoa in 1909, when larvae came with the soil of rubber seedlings from Ceylon. The coconut rhinoceros beetle spread throughout the Pacific after first appearing in Samoa. Its range has also expanded to other Indian Ocean islands, as well as the Western Pacific, including Palau and New Britain.

Biology and Ecology

Oryctes rhinoceros is a huge dynastid beetle measuring 35-50 mm in length and ranging in color from dark brown to black. The head bears a horn, which is more apparent in males. The pronotum has a huge central depression with two humps along the rear edge, and the foreleg's tibia contains three massive teeth. Male beetles are easily identified from females by the tip of their abdomen, which is rounded, shiny, and hairless. Females' abdominal tips are more pointed and densely covered with hair. The eggs are whitish and roughly 3 mm in diameter. Scarab beetle larvae are typically C-shaped white grubs. The three larval stages can be differentiated by the size of their head capsule (Gressitt, 1953) which is around 2.5-3 mm (first instar), 5-6 mm (second instar), and 10-11 mm (third instar).

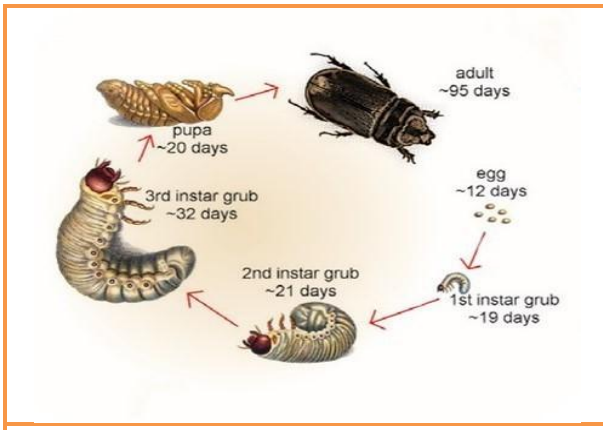

Fig.1: Life cycle of rhinoceros beetle

Fig. 2: Eggs of Rhinoceros beetle

Fig. 3: Larvae

Fig. 4: Adult

Fig.5: Rhinoceros beetle Female (left) have short horn and Male (right) long horn (photo source: Mark Schmaedick, 2005).

Fig. 6: Breeding site of rhinoceros beetle, larvae on manure pits

Fig. 7: Breeding site of rhinoceros beetle on decaying trunks of oil palm

Eggs are laid and larvae grow in decaying logs or stumps, heaps of decomposing vegetation or sawdust, and other organic debris. Eggs hatch in 8-12 days, then larvae feed and grow for an additional 82-207 days before transitioning to an 8-13 day nonfeeding pre-pupal stage. Pupae develop in a cell created in the wood or soil beneath where the larvae feed. The pupal stage lasts 17 to 28 days. Adults spend 17-22 days in the pupal cell before emerging and flying to palm crowns seeking food. Rhinoceros beetles are active at night and hide in feeding or breeding areas during the day. Most mating occurs at breeding locations. Adults can survive for four to nine months, and each female lays 50 to 100 eggs during her lifetime.

Nature of Damage

Adult rhinoceros beetles feed in the oil palm crown region. On oil palms, they bore through the petiole bases to the core unopened central leaves. This results in tissue maceration, and the presence of fibrous frass inside and at the entrance to the feeding hole indicates that it is active (Catley, 1969). A single attack may be followed by another on the same palm (Barlow and Chew, 1970; Young, 1975). These attacks result in fronds with wedge-shaped gaps or the typical V-shaped cuts (Wood, 1968; Sadakathulla and Ramachandran, 1990). Spear snapping and oval shaped holes on petiole.

Fig.8: Spear snapping

Fig.9: Wedge shaped gaps or V-shaped cuts on the leaf silhouette

Fig.10: Holes on petiole

Impact of rhinoceros beetle damage on oil palm

On oil palms, *Oryctes rhinoceros* bores into the base of the cluster of unopened leaves (spears), creating V or wedge-shaped cuts in the unfolded fronds. Spears may collapse, and newly developed fronds may break off along the petiole or midrib (Wood, 1968). Damage can be substantially more severe in immature palms because the spears are smaller and penetration may occur lower down (Wood, 1968). Young palms with beetle damage are thought to have a delayed immaturity stage (Liau and Ahmad, 1991). As a result, a lengthy and severe rhinoceros beetle infestation might significantly limit early oil palm yields. Although (Wood *et al.,* 1973) claimed that damage to juvenile palms results in very minor crop losses, field trials done by (Liau and Ahmad, 1991) demonstrated an average yield loss of 25% over the first two years of production. This could be due to a more than 15% reduction in canopy size for moderately significant to severe damage levels (Samsudin *et al.,* 1993). The pest inflicts major damage to palms 1–3 years old (sometimes leading to demise), while in healthy older palms the damage caused can be minor (Giblin-Davis *et al.,* 2001).

Integrated Pest Management

- Only well-rotted cattle manure should be applied to the oil palm plantations. Before application, add 1 kg. *Metarhizium anisopliae* powder per 1 tonne of cattle manure should be mixed and applied.

- Rhinoceros beetles and its other life stages can be destroyed by spraying *Metarhizium anisopliae* on piles or heaps of manure, standing or fallen dead oil palm trunks, coconut and palmyrah palm stumps and other waste or decomposing wood materials.
- Rhinoceros beetles typically avoid breeding in vegetation-covered areas (Mark Schmaedick, 2005). Vines or ground covers can be planted or allowed to grow over logs or stumps that can't be destroyed. Dried leaves or fronds can be composted, mulched, burned, or spread thinly on the ground.
- Ensure proper maintenance of compost piles. When rotating compost piles or applying compost to palms, eliminate any rhinoceros beetles and their life stages that are present. Rhinoceros beetle larvae take longer to mature than it does to generate compost, so properly maintained compost should not be a source of rhinoceros beetles.
- The entomopathogenic fungus *Metarhizium anisopliae* and viruses such as *Oryctes rhinoceros Nudivirus* (OrNV) or *Baculovirus* are employed to control the rhinoceros beetle. These bio-agents are highly contributing to the reduction of rhinoceros beetle populations.
- Adult beetles can be captured and eliminated using fermented castor seed flour or oiled cake or sex attractant baits (Pheromone traps).
- Installation of pheromone traps in the oil palm plantations using rhino lures or chemical attractant called ethyl-4-methyloctanoate has been utilized in traps to attract and kill beetles and also used for pest monitoring purpose.
- A tiny polythene bag with holes packed with 20 grams of naphthalene balls can be placed in the oil palm shoot to protect it from adult rhinoceros beetles. This bag should be refilled with new naphthalene balls every month and placed in the central shoot. otherwise, the new leaves may remain below the bag and the upper leaves may be infested with rhinoceros beetles.
- Young oil palms are more likely to be infested, damaged and killed by Rhinoceros beetles. Therefore, rhinoceros beetles can be controlled at this stage by using discarded fishnets. The unused or discarded fishnets should be tied in small bundles around the central shoot of the oil palm. This will trap the adult rhinoceros beetles that come to feed on the palm and eventually die.
- Use a hooked wire to retrieve and kill adult rhinoceros beetles which are feeding in palm crowns.
- In case of severe rhinoceros beetle infestation in the oil palm plantations, spraying of Lambda cyhalothrin 2 ml per litre of water (on and around central shoot region of oil palm) in the juvenile plantations of oil palm is more effective to control the adult beetle populations.

Fig.11: Spraying of *Metarhizium anisopliae* on manure/compost pits

Fig.12: Rhinoceros larvae infested with *Metarhizium anisopliae*

Fig. 13: Pheromone trap installed at juvenile oil palm for catching adult rhinoceros beetles

Fig. 14. Trapped adult rhinoceros beetles in the pheromone trap

Fig. 15: Insertion of fishnet trap surrounding central shoot

Fig. 16: Adult Rhinoceros beetle trapped in fishnet trap

Conclusion

The rhinoceros beetle (*Oryctes rhinoceros*) is a major pest of oil palm and it poses a serious threat to oil palm plantations, inflicting extensive damage and reducing crop productivity. Effective management necessitates a multifaceted strategy that incorporates biological, cultural, mechanical, and along with the judicious use of chemical control when necessary, is crucial for achieving sustainable and effective pest management. IPM relies heavily on the use of entomopathogenic fungi such as *Metarhizium anisopliae* and viruses such as *Oryctes rhinoceros Nudivirus* (OrNV) or *Baculovirus*. Proper sanitation, which includes removing and burning nesting or breeding areas such as decaying palm trunks, proper maintenance of compost or manure pits etc., is critical for lowering rhinoceros beetle populations. Regular monitoring and capturing of adult beetles can also assist control their populations.

References

1. Barlow HS, Chew PS, 1970. The rhinoceros beetle *Oryctes rhinoceros* in young oil palms replanted after rubber on some estates in Western Malaysia. In: Wastie RL, Wood BJ, eds. Proceedings of the Malaysian Crop Protection Conference 1970. Kuala Lumpur, Malaysia: *Incorporated Society of Planters*, 133-144.
2. Catley A, 1969. The coconut rhinoceros beetle *Oryctes rhinoceros* (L.). PANS, 15:18-30.
3. Giblin-Davis RM. Borers of palms. In *Insects on Palms*; Howard FW, Moore D, Giblin-Davis RM, Abad R, Eds.; CABI Publishing: *Oxon*, UK, pp 267-304, https://doi.org/10.1079/9780851993263.0267
4. Gressitt JL. 1953. The coconut rhinoceros beetle (*Oryctes rhinoceros*) with particular reference to the Palau Islands. *Bulletin of the Bernice P. Bishop Museum* 212: 157.
5. Liau SS, Ahmad A, 1991. The control of *Oryctes rhinoceros* by clean clearing and its effect on early yield in palm to palm replants. *Proceedings of the 1991 PORIM International Palm Oil Development Conference Module II - Agriculture.* PORIM (Palm Oil Research Institute of Malaysia), Kuala Lumpur, Malaysia.
6. Schmaedick, M, 2005, Coconut Rhinoceros Beetle Pests and Diseases of American Samoa, Brochure no.8, *ASCC CNR*, 684-699-1575.
7. Sadakathulla S, Ramachandran TKA, 1990. A novel method to control rhinoceros beetle, Oryctes rhinoceros L. in coconut. *Indian Coconut Journal Cochin*, 21:7-8, 10-12
8. Samsudin A, Chew PS, Mohamad MM, 1993. Oryctes rhinoceros: Breeding and damage on oil palms in an oil palm to oil palm replanting situation. *The Planter*, 69(813):583-591.
9. Subbanna ARNS, Prasad MV, 2025. Oil Palm lo Nalla Kommu Purugu yokka Samagra Sasyarakshana, ICAR-IIOPR, *Extension folder* 2025-1.
10. Wood BJ, 1968. Pest of Oil Palms in Malaysia and their Control. Kuala Lumpur, Malaysia: *Incorporated Society of Planters*.
11. Young EC, 1975. A study of rhinoceros beetle damage in coconut palms. Technical Paper, *South Pacific Commission*, No. 170:vi + 63 pp.