

Integrated Management of Coconut Pests

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Introduction

Coconut palm *Cocos nucifera* is being a perennial crop is subjected to attack by an array of insect pests round the year. There are over 750 insect species including the ones that directly feed and those which are only associated with coconut palm. Among them only a few are considered to be of economic importance. All parts of the palm viz., leaves, stem, root, inflorescence and the nuts are subjected to attack by insect pests. Damage when caused to the leaves lead to reduction in photosynthetic efficiency and decrease in value for thatching purpose but when done to inflorescence and nuts leads to direct economic loss. Hence, to tide over it has become imperative to blend cultural, mechanical, physical, chemical and biological method in a harmonious manner which is depicted as integrated pest management in coconut.

Rhinoceros beetle (*Oryctes rhinoceros* L.) (Scarabaeidae : Coleoptera)

Unlike other insect pests, adult are causing damage. Apart from coconut they also infest Palmyra, date palm, wild date, areca, sago palm, pandanus, pine apple, cocasia, banana, oil palm and sugar cane etc. The pest occurs round the year with a peak spike during June to September during which the adults visit the crowns. This ubiquitous and cosmopolitan pest has currently become the greatest impediment in the early establishment of juvenile palms causing more than 20 % damage through collar entry (Ramachandran *et al.*, 1963). The rhinoceros beetle infestation was reported on banana also (Sivakumar and Mohan, 2013).

Diagnosis

- Bore holes on furred spindle, petiole and spathe. On unfurling it exhibits a diamond shaped (V shaped)

cuts on leaflets.

- Presences of chewed up fresh frass can be seen plugged the hole on the petiole.
- It bores through central shoot of the young seedling and feed on the internal content which eventually cause of bud rot, leaf rot infections RPW infestation.
- Beetles bore into the collar region of the young palms resulting in dead heart, twisted spindle with elephant tusk like symptoms and perverted leaflets



Biology

Eggs are laid in decaying organic matters, cattle dung and compost pits. They are white / whitish brown with a size ranging from 3 - 4 mm length and 2 - 3 mm width. The fecundity is about 108 eggs / female. The peak oviposition occurs in February - April and September - October. On hatching the yellowish white grub with brown head and grayish blue abdomen remains and feed on decaying organic matter for about six months. It grows up and become stout "C" shaped grub with well developed mandible. It pupate there itself inside the agglomerated matrix of organic matter. Pupal stage lasts for 14 to 29 days. The adult beetle emerging from the breeding grounds rests for 5 - 25 days then fly to crown top for feeding. Longevity for 142 days. Males live for about 140 days. Males live up to 120 days.

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Integrated Management

It can be effectively managed by following integrated pest management strategies following Josephraj Kumar et al., 2015.

- Field sanitation: Remove dead and decaying organic debris from coconut plantations as they serve as breeding sites for the beetles. Dead planting material which will rot when accumulated must be removed.
- Hooking out of the beetle using GI hooks. After extracting the beetles from infested palms, the wounds may be treated with Bordeaux mixture (1 %) and plug the holes with mixture neem cake powder or naphthalene balls and mud/cement. It is to prevent further entry of pathogens or insect pests

Prophylactic leaf axil filling with either of the following material

- Naphthalene balls and sand 10.5 g (approx. 3 No.s) to be done at 45 days interval (Sadakathulla and Ramachandran, 1990).
 - Neem cake / marotti cake (*Hydnocarpus sp.*) fine sand (1:1 ratio) @ 500g/palm in leaf axils around spindle during May, September and December. Or
 - Mixture of chlorantraniliprole 0.4 % WG (50 g) + 2kg Sand or mixture of chloridust 1.5 % DP (50 g) and sand (2 kg) @ 250 g / palm
 - Placement of two perforated sachets (3g) containing chlorantraniliprole (0.4 % WG) or fipronil (0.3 % ai) per palm. 100 ml of water may pour to the sachets for subsequent release of molecule.
 - Botanical repellent cake developed by ICAR-CPCRI was found effective during monsoon phase.
 - Covering the cabbage portion of young palms or nursery seedling is very effective mechanical barrier
- Microbial control of biostages of rhinoceros beetle:

Microbial control is an aspect of biological control in which the rational use of pathogen of the pest is included to maintain pest below ETL in agricultural environments. (Nair et al 2002).

Oryctes rhinoceros nudivirus (OrNV)

Larval and adult stages are susceptible to OrNV infection (Purrini, 1989). The pathogen has per - os mode of infection through contaminated food. Release of viroseed beetles in the field @ 12-15 beetles / ha during dusk, to contaminate the breeding sites and spread the disease to life stages present in the breeding sites. Over a period of 5-6 months considerable reduction in rhinoceros beetle population may be achieved. This technology is highly successful in island where infiltration of natural population is less.

Green muscardine fungus, *Metarhizium anisopliae*: It is a deuteromycetes fungus which cause green muscardine disease to grubs and grub die within 10 – 15 days. Infected grub turn into green colour due to production of powdery spores. Treat the breeding sites with green muscardine fungus spores suspension @ 5×10^{11} spores / m³. It is a successful tactics where high humidity and ambient temperature prevail.

Insect growth regulator: A weed plant, *Clerodendron infortunatum* L. harbor insect juvenile hormone analogue which possess growth regulating effect on rhinoceros larvae. It prevents / retards the development of eggs / larvae to a normal adult. Treating the breeding sites with *Clerodendron infortunatum* @ 1: 10 w/w/ basis results in good control of rhinoceros beetle.

Mass capturing and destruction by use of aggregation pheromone: Pheromones are volatile substance released by insect which induce behavioural changes in receiving conspecific individual. Oryctalure [ethyl 4-methyloctanoate]' is the aggregation pheromone of rhinoceros beetle which is capable of attracting male and female beetles to the trap. Use of PVC trap lured with pheromone impregnated in nanomatrix @ 1 trap / ha is an innovative method in pest suppression. Avoid installation of traps in gardens with juvenile palms.

Red Palm Weevil - Rhynchophorus ferrugineus *Oliver (Curculionidae : Scarabaeidae)*

Red palm weevil a fatal enemy and a key pest of coconut palm. Young palms < 20 years succumb to severe damage when infested by this pest. Infection by bud rot, leaf rot disease and

infestation of rhinoceros beetle are predisposing RPW incidence. It is distributed in India, Sri Lanka, Middle East countries, Thailand, New Guinea, Spain and Philippines. Red palm weevil occurs round the year but become serious after monsoon. Alternate hosts are areca, Caryota, Coelococcus, Nypa palms, Palmyrah and oil palm. The adult weevil is ferrugineously brown with long curved and pointed snout. The males are differentiated from females by a tuft of hairs on dorsal side of the snout. The life cycle is completed in four months and the females are short lived than males.

Diagnosis

Being an internal feeder it is very difficult to



detect the damage caused by red palm weevil at an early stage.

- Wilting of the central spindle,
- Presence of holes in the trunk with reddish brown fluid oozing out
- presence of chewed fibres, larvae and cocoons, pupal case inside the trunk if it split open.
- Above mentioned symptoms become prominent in advanced stages which the affected
- On severely infested palms, gnawing sound of the grub inside is audible

Biology

Female beetle commence oviposition 1- 7 days after mating. Eggs are laid in the wound present in the crown, cracks and crevices in the trunk or in the collar region. Creamy white elongated, oval shaped eggs hatch in 2- 3 days. Fecundity of the female is 276 eggs. Incubation period ranges from 2- 3 days. Larval period ranges from 36 - 78 days, after that it forms a cocoon with the debris and pupal stage last for about 12 to 33 days. The adult weevil is ferrugineously brown with long curved and pointed snout.

The pest incidence can be management by adopting intergrated management programme (Abraham *et al.*, 1998)

Management

- Maintaining optimum palm density is crucial for harnessing highest benefits of light energy and reducing pest attack
- Crop habitat diversification: Red palm weevil is highly sensitive to kairomonal volatiles emanating from coconut palms. As the intercropped system releases a bouquet of volatiles which makes the beetles difficult to locate the hosts for egg laying
- Clean cultivation: Crown toppled palms which are serving as breeding site for the RPW in a garden should be immediately destroyed so as to avoid lateral spread
- Avoid causing injury to the palms. Mechanical injury if caused may be covered with mud or coal tar. While cutting fronds, a petiole length of 1.2 m may be left behind so that proximity of cut end and crown can be reduced.
- Prophylactic leaf axil filling suggested for the management of rhinoceros beetles and bud rot disease are to be attempted.
- Crown cleaning, regular surveillance and timely diagnosis of the incidence of through close monitoring and vigilant scouting.
- Placement of three filter paper sachets containing 12 - 15 *Heterorhabditis indica* - infected *Galleria mellonella* cadavers on the leaf axils after application of 0.002 % imidacloprid.
- Palms showing early stage of infestation may be subjected to curative treatment of stem injection with spinosad 2.5 % SL @ 4 ml / litre or imidacloprid 17.8 % SL @ 0.6 – 1 ml/ litre and plug the hole with cement or mud. If the damage occurs in the crown, damage portion may be removed and insecticide suspension may be poured in. Harvest the nuts after a safe period of 45 days. If infestation is through trunk, a slanting hole is made above the point of infestation and the insecticide solution may be poured with a funnel/ a wash bottle.
- Use of pheromone trap: Aggregation pheromone which attract both the sexes along with host plant volatile is exploited here for entrapping. To a plastic buckets of 5 litre capacity four windows (5 x 1.5 cm) below the rim of the bucket is made and to it the coconut fibre / jute sack is wound over it. The commercially available pheromone lure (Ferrolure) is hung inside on the lid of the bucket. The efficiency of pheromone trap can be enhanced by placing 100 g pine apple / sugarcane / banana, 2 g yeast in one litre of water which works as the kairomone. Do

not keep the trap in young garden. This technology would be successful if taken up in a community basis and prophylactic leaf axil placement of repellent on palms surrounding to pheromone trap.

Leaf eating caterpillar/Black headed caterpillar
***Opisina arenosella* Walker (*Oecophoridae: Lepidoptera*)**

The leaf eating caterpillar / black headed caterpillar causes severe damage to palms in coastal and back water areas in certain pockets of peninsular India. It is a sporadic pest and outbreak occurs during summer months (Feb - May) which lead to severe damage to coconut plantation. In India it occurs in Tamil Nadu, Kerala, Karnataka, Andhra Pradesh, Orissa, West Bengal and Gujarat. Apart from coconut they are known to feed on palmyrah, tailpot palm, wild date, ornamental palm and banana are some of the recorded host. (Pushpalatha and Veeresh, 1995)



Biology

Eggs are laid distally on the lower surface of the leaflet near the old gallery. Incubation period prolongs for 5 days. The larval period lasts for 42 days with eight instars including the pre pupal stage. Pupation occurs in the gallery and it is brown in colour. Adult emergence occurs after 12 days of pupal period which coincides with 3 – 5 pre monsoon showers in May - June.

Damage symptoms

- The older leaves of the palms are reduced to dead brown tissues and only three or four youngest leaves at the centre of the crown remain green.
- The larvae are harbored in the lower leaflets in galleries made of excreta and silken web which appear as saw dust.
- It gregariously feeds on chlorophyll containing parenchymatous cells by reducing the photosynthetic area, leaving upper epidermis intact which appears as papery white patch on leaf blade.
- In case of severe infestation, the whole plantations exhibit a scorched appearance.

Leaf eating caterpillar incidence can be successfully managed by biological approach. Classical biological control programmes have been developed and demonstrated. An array of egg/larval / pupal parasitoids are present in nature (Pillai

and Nair, 1993)

Management

- Cut and burn severely infested lower whorl of leaves and four leaves in the next whorl where live biostages can be seen.
- During sporadic outbreaks the pest can be kept under check by spraying dichlorvos 0.2 % or with chloranthraniliprole 18.5 SC @ 1 ml / litre or with malathion 50 EC @ 4 ml / litre on the ventral side of the fronds
- Biological control using egg / larval / prepupal / pupal parasitoids
- Field release of parasitoids may be done as follows: *Goniozus nephantidis* @ 20 parasitoids / palm, *Bracon brevicornis* @ 30 parasitoids / palm, the pre-pupal parasitoid, *Elasmus nephantidis* @ 49/100 prepupae, and the pupal parasitoid *Brachymeria nosatoi* @ 32 / 100 pupae at the appropriate time was found effective in the sustainable management of the pest. (Pillai and Nair 1993).

White grubs / Root grubs *Leucopholis coneophora* Burm., *L. burmeisteri* Brenk., *L. lepidophora* Blanch. (*Scarabaeidae: Coleoptera*)

It is a polyphagous subterranean pest of national importance which prevalent in costal belts of peninsular India. *L. coneophora* burm. is distributed in plains and areas where coastal sandy or sandy loam soils prevails. Coconut grown in parts of Dakshina Kannada districts, *L. burmeisteri* is present and in hilly tracts where clayey loam soil is prevalent, *L. lepidophora* is found associated with coconut based cropping systems. Apart from coconut it feeds on arecanut, rhizomatous and tuberous and other intercrops raised in palm garden viz., tapioca, colocasia, dioscoria, sweet potato, elephant foot yam, fodder grass, rubber, cocoa, banana etc.

Biology

Adult emergence commence with the onset of summer showers in April after a pause in May it resumes with the setting of south west monsoon in May – June in case of *L. coneophora* and *L. burmeisteri*. *L. lepidophora* adult emergence occurs in the month of August. Eggs are oval in shape and creamy white in colour. Freshly laid eggs measures 5 mm long and 4 mm width. Prior to hatching they turn to dirty white. The larvae are “C” shaped, I has annual life cycle. Whereas, other two species has biennial life cycle. (Abraham, 1983 and Prathibha, 2015).

Management

- Collection and destruction on beetles during emergence season. Hand picking and destruction of adult beetles for three weeks starting first day of south west monsoon daily in the evening 6.30 to 7.00 pm (Abraham, 1993; Prathibha et al., 2013).
- Blanket application of bifenthrin @ 2 kg ai / ha (Talstar 10 EC @ 20 litre / ha in 500 L of water) when first instar stage of grubs dominate in the field
- Root zone application of chlorpyrifos 20 EC @ 2kg ai / ha (i.e @ 7 ml / palm after 45 days of first round insecticide application
- Drenching aqua suspension of EPNs *Steinernema carpocapsae* in the interspaces 5-10 cm depth with 40 - 50 Lakh ijs / 5 litre of water. Repeat application of EPN as and when needed based on the grub population.
- Repeated ploughing to expose the grubs to predators / digging and removal of grubs during October to December

Eriophyid mite *Aceria guerreronis* Keifer (*Eriophyidae: Prostigmata*)

Coconut eriophyid mite first reported from Guerrero state of Mexico in 1965, later it spread to Caribbean islands and Latin American countries and Africa. In India the first report on eriophyid mite infesting coconut was made during later part of 1997 from Ernakulam District of Kerala. Since their dispersal is by wind, their distribution to neighboring states Tamil Nadu, Karnataka, Andhra Pradesh and Pondicherry occurred in relative short span of time. Mite incidence can be seen round the year with a peak in summer months and during prolonged dry spells in the monsoon, with a slight reduction during the rainy season. The continued presence of these mites in the nuts causes a yield loss to the tune of 20 – 30 % in terms of copra yield. Severe infestation leads to button shedding (Rajan *et al.*, 2009).



Damage symptoms

- Mite feeding cause physical damage to the cell as a result yellowish discolouration which grow downward as elongated triangular patch.
- It turns brown and later appears as longitudinal fissures and warts on the nut as it develops
- Button shedding

Biology

Adult mite is wormiform, having 200 - 250 micron length with yellowish white colour. Adults have two pairs of legs at the anterior end of the body. The life cycle completes in 7 days.

Management

- By adopting proper agronomic practices viz. integrated nutrient and water management. Under nutritional management, balanced application of NPK fertilizers (500:320:1200), 5 kg neem cake, recycling of organic biomass, raising of suitable green manure crops like cowpea or sunnhemp in coconut. Enhancing nutrient strength of the palm by incorporation of *Azospirillum*.
 - Kalpaharitha (a selection of *Kulasekaram Tall*) recorded lowest mite incidence in the field and could be a preferred choice in endemic zones.
 - Regular crown cleaning and removal of dried spathes, inflorescence parts, fallen nuts and destroying so as to reduce the pest inoculum and consequent infestation.
 - Spraying with either of the following eco-friendly materials thrice a year (during March-April, October - November and December - January) can suppress pest attack
 - 2 % neem oil - garlic emulsion ie., Neem oil : garlic : soap (20 ml: 20g: 5g in L of water)
 - Spraying of 0.004% aqua suspension of commercially available neem formulation (azadirachtin 1 % ai) @ 4ml / L of water
 - 20 % Palm oil - 0.5 % Sulphur emulsion:- Palm oil : sulphur : soap (200 ml: 5 g: 12g/L of water)
 - Root feeding with commercially available neem formulation (azadirachtin 5 % ai) @ 7.5 ml + 7.5 ml water in sandy/ sandy loam soil
 - Spraying of acaropathogenic fungus *Hirsutella thompsonii* @ 20 g talc formulation / L of water containing 1.6×10^8 cfu is also found promising.
- Care to be taken to direct the spray fluid on the petiolar end of butter as the mites colonise under the perianth

Coreid bug *Paradasynus rostratus* Dist. (*Coreidae : Hemiptera*)

It occurs in coastal areas and high ranges in Kerala. Incidence is on higher side on Trivandrum, Wynad and Kasaragod district of Kerala. Apart from coconut it feeds on tamarind, cocoa and guava. The peak population occurs during post monsoon period. The

adults and nymphs feed by desapping the contents on button and developing button below perianth region (Rajan and Nair 2005).

Damage symptoms

- Shedding of nuts/ button
- Presence of gummy exudates and cracks on nuts
- Malformation of nuts

Management

- Crown cleaning to destroy eggs and immature stages
- Spraying of azadirachtin 300 ppm (Nimbecidene) @ 0.0004% (13 ml / L). Two rounds of azadirachtin spray young coconut bunches of 1-5 months ago, during May-June and September-October
- Spraying lambda cyhalothrin 5 EC @ 1ml/L on the pollinated bunches

Scale insects (*Aspidiotus destructor* Sign., *Aonidiella orientalis* Mask., *Lepidosaphes migregori* Banks) (*Diaspididae* : *Hemiptera*)

Occurrence is sporadic nature and mostly occurs during summer. Apart from coconut they also infest banana, guava, citrus, ginger etc.

Diagnosis

- It forms ecrustations over the entire lower lamina resulting in severe yellowing and drying of leaves.
- In addition to leaves they also infest flower, spike and nuts.

Management

- Spraying of fish oil rosin soap (2.5 %)
- Two round spraying of malathion at 20 days interval
- Release of predatory coccinellid beetle *Chilocorus nigritus*

Mealy bugs (*Palmiculator palmarum* Ehrhon, *Pseudococcus cocotis* Maskal, *P. longispinosus* Targ.) (*Pseudococcidae* : *Hemiptera*)

Mealy bug colonise on all tender plant parts like bases of spear leaf, spadix and inflorescence and beneath the perianth of the coconut. Colonization by the mealy bug on the spindle leaves results in failure of heart leaf development and eventually results in death of the seeding. In case of severe infestation the spadix remains stunted coupled with immature nut fall. Phoretic association of ants is seen with the mealy bugs.



Management

- Spraying of 0.05 % dimethoate

Slug caterpillar (*Macroplectra nararia* Moore, *Conthyla rotunda* Habu, *Latoia lepida* Cramer) (*Limacodidae* : *Lepidoptera*)

It is a sporadic pest on coconut with a peak infestation occurs in post monsoon and summer months. The caterpillar feeds gregariously on entire lamina leaving the mid rib alone. The caterpillar resembles slug with spines all over the body.

Diagnosis

- Scorched / burnt appearance of leaves on severe infestation
- Early - instar caterpillars consume the epidermis of leaf leaving the upper surface intact and the grown - up caterpillars feed voraciously on leaf lamina leaving the midrib
- Leaf spot - like black halo marking develops on the feeding areas which later coalesce and form bigger lesions
- Feeding damage promotes the infection of grey leaf blight fungus, *Pestalotiopsis palmarum*
- On severe infestation, all functional leaves are dried up leaving only the inner leaves thus affecting the photosynthetic efficiency of the palm
- Premature drooping of leaves and shedding of nuts and reduction in nut yield

Nut borer (*Cyclodes omma* *Pyralidae*: *Lepidoptera*)

The caterpillar bore into developing button at perianth portion and cause nut drop.

Hand picking and destroying is the effective management tactic.

Inflorescence caterpillar / coconut moth : *Batrachedra arenosella* (*Batrachedridae* : *Lepidoptera*)

Larvae bore on the female flowers and Rachelle of inflorescence.

Diagnosis

- Presence of gummy exudates on inflorescence and male flowers glued together
- Presence of bore holes on female flower and caterpillar inside

Reproduced from *Enhancing productivity in coconut- Quality planting material and agro-techniques*