PROTECTING COCONUT FROM ENEMIES

CHANDRIKA MOHAN,
JOSEPHRAJKUMAR, A.,

Principal Scientists

K.M. Anes,

Scientist
ICAR-CPCRI, Regional Station, Kayamkulam, Kerala – 690 533
Email: cmcpcri@gmail.com

Coconut palm, the 'Kalpavriksha' is associated with more than 800 species of different invertebrates during its majestic perennial life. The service provided by coconut palm to many vertebrates including human beings, rodents and birds as source of food and shelter is also quite remarkable.

Among the invertebrates, few insects and nematodes pose threat to the host.

KNOW INSECTS:

Insects are different from most other invertebrates. They are the largest Class of organisms and almost account for more than 50%

of all animal species! The word "insect" comes from the Latin word 'insectum', meaning "with a notched or divided body", or literally "cut into" because insects appear "cut into" three sections head, thorax and abdomen. They have three pair of jointed legs and one pair of antennae and the Sanskrit term 'shatpada' refers to the hexapodous condition of insects. They belong to Phylum Arthropoda and live in diverse habitats and are the most diverse group of organisms on earth. Science dealing with study of insects is known as Entomology. Particular insect orders may have some structures absent, reduced or greatly modified and some young stages can appear very different from their mature adult form.

The diversity of both form and behavior of insects is amazing!!!

Man has been attracted by insects from time immemorial. The flight of bees for honey gathering, mud wasp and their nest construction, the trail laying of ants, their cooperative efforts for bridging gulfs to reach sites of food and nests have fascinated mankind. Study of insects has fascinated Scientists because Insects (i) Are Dominant (ii) Have Long evolutionary background (iii) Highly beneficial and (iv) Crop pests and vectors

The life cycles of insects vary but most hatches from eggs. Insect growth is controlled by the inelastic exoskeleton made of chitin and development involves a series of skeleton shedding known as moults or ecdysis. Head is most special in insects as they bear large compound eyes, antennae and other sensory organs

KNOW OUR FRIENDS .....

A great many insects are extremely valuable to humans as they do priceless service of pollination and pest management and serve as sources of chemicals, medicine and other products of commercial value.

Honey bees - the close friends of coconut

The services of pollinators are very essential in enhancing both quantitative and qualitative crop productivity. They are the big ecosystem service providers!! There is a long history of research on honey bees in India. India is endowed with the greatest biodiversity as far as honey bee species are concerned. Three Apis species of true honey bees viz. A. cerana indica, A. dorsata and A. florea are indigenous to India. A. mellifera, the exotic species, is also now established in the country and serving the commercial beekeeping in many states. Honey bees aid in pollination of coconut and helps in better nut setting. Bees depend on coconut for their pollen requirement as well as nectar source. In India, observation of West Coast Tall palms recorded those bees (Apis cerena indica, Apis dorsata, Apis mellifera and Trigona iridipennis were the most predominant floral visitors. There was a significant difference in pollen load on the bodies of the insect visitors. Apis mellifera carried the highest quantity of pollen when they visited staminate flowers.

Other insects seen in close association with coconut inflorescence are wasps, ants, flies, beetles, earwigs, butterflies. To attract and tap maximum potential from pollinators in coconut based cropping system, nectar- bountiful plants viz., banana, vegetables and flowering plants including coral wines should be planted in the interspaces of coconut garden to induce heterogeneity and increase population of defenders and pollinators.

A few species of insects including butterflies (Lepidoptera), Beetles (Coleoptera) and bugs (Hemiptera) cause economic damage to the host plant and are designated as pests

CORRECTLY DIAGNOSE ENEMIES OF COCONUT PALM TO COMBAT THEM

Many insects ravage coconut palm as pests and cause economic loss to farmers. The major pests of coconut in India are rhinoceros beetle (Oryctes rhinoceros Linn.), red palm weevil (Rhynchophorus ferrugineus Oliv.), leaf eating caterpillar (Opisina arenosella Walk.), eriophyid mite (Aceria guerreronis Keifer) and the white grub (Leucopholis coneophora Burm.). Pests like coreid bug, scale insects, mealy bugs, slug caterpillars and rodents cause considerable damage to coconut in certain locations. Recently the invasive pest, rugose spiralling whitefly (Aleurodicus rugioperculatus Martin) has emerged as a serious concern to coconut farmers.

Biological control - A pest management method utilizing the natural enemies of the pests is a well accepted component in agricultural pest management. Conservation, augmentation and introduction of indigenous/exotic natural enemies, has been accepted as an effective, environmentally non-degrading, technically appropriate, economically viable and socially acceptable method of pest management. Birds,

lady beetles, spiders, parasitic hymenoptera and lacewings form major natural enemies in agricultural systems and contribute major role in natural pest suppression. Many species of wasps and flies contribute the service of pest managers.

The robust rhinoceros beetle causes damage to palms at all age groups by boring into the unopened spear leaf and spathes and chew off the soft internal tissues. They also infest juvenile coconut palms and retard growth. Of late it attacks nuts also. Immature life stages of this pest is completed in decaying organic matter viz., cow dung, compost, decaying coconut logs etc.

HOW TO MANAGE THE BEETLE ATTACK?

- Regular monitoring for damage symptoms on the spindle region of the juvenile palm or seedlings at collar region and hooking out of the beetle, if any chewed up fibre is noticed on the collar region or any leaf axils.
- Filling up top most three leaf axils of palms with 250 g of neem cake/ maroti cake / pongamia cake along with equal volume of sand during May, September and December as a prophylactic method.
- For young and juvenile palms, placement of two naphthalene balls covered with sand or perforated sachets containing chlorantraniliprole (3 g) or fipronil (3 g).During dry period, 100 ml of water may be poured over the sachet for effective release of the molecule.

- Incorporation of weed plant, Clerodendron infortunatum into the manure pits/composting materials to induce larval-pupal abnormalities in feeding grubs.
- Application entomopathogenic green muscardine fungus, Metarhizium anisopliae on the breeding pits @ 5 x 1011 spores / m3. Area-wide farmer participatory approach in field delivery of M. anisopliae is more appropriate.

Red palm weevil, the fatal enemy of coconut: Grubs of red palm weevil feeds on growing cabbage tissues of the palm and all stages of this pest are completed inside the palm itself!!

Properly diagnose and manage this dreaded pest of palms

LOOK OUT FOR SYMPTOMS:

- Drying/wilting of spindle leaves
- Yellowing of middle whorls (1-2 fronds) at the site of pest attack
- Leaf splitting at base due to improper growth of trunk.
- Presence of holes in fronds, trunk with exudation of viscous brown fluid.
- Gnawing sound of grubs when closely heard through the trunk.

MANAGE WITH INTEGRATED APPROACH:

- Maintaining optimum palm density (@ 70 palms/acre) for reducing pest attack.
- Vigilant and periodic scouting for early diagnosis.
- Destroy crown toppled palms in a garden.
- Avoiding physical injury to palms to reduce pest incidence. Cutting fronds leaving at least 1 m from trunk, evading knife injury on crown region, careful tractor ploughing shunning away from bole and frond region to avoid injuries need to be overemphasized.
- Prophylactic leaf axil filling to avoid attack by rhinoceros beetle.
- Application of imidacloprid 18.5 SL 0.02% (1 ml per litre of water) or spinosad 2.5 SC 0.013% (5 ml per litre of water) or indoxacarb 14.5 EC 0.04% (2.5 ml per litre of water) with no residue of imidacloprid in nut meat and water.
- Coconut plantations with intercrops such as fruit trees and spices were found to have lesser incidence of RPW attack than mono-cropped gardens as the intercropped system releases a bouquet of volatiles diverting the orientation of weevils away from coconut for egg laying.

How to manage the highly microscopic tiny Coconut eriophyid mite which measures one third of a millimetre only!!

This minute creatures infest developing buttons and suck sap from the tender region below the tepals. Pest damage is clearly visible in older nuts as warts and fissures on nut surface

An integrated strategy blending plant protection and nutrient management has to be implemented to ward off this tiny creatures form coconut

- Removal of dried spathes, inflorescence parts, fallen nuts etc and burying them in the soil or burning them reduces the pest inoculum and consequent infestation. Crown cleaning should be taken up as and when necessary.
- We can Spray any of the eco-friendly materials three times during March-April, October-November and December-January to suppress the pest population
- 2% neem oil - garlic - soap mixture (20ml: 20g: 5g /L of water)
- Neem formulation containing azadirachtin 10000 ppm (0.004%) 4ml/lit
- Palm oil - sulphur - soap (200ml: 5 g: 12g/L of water)
- Under nutritional management, balanced application of NPK fertilizers (500:320:1200), 5 kg neem cake, recycling of organic biomass, raising of green manure crops like cowpea or sunhemp in coconut basin and its incorporation and soil moisture conservation measures are recommended.

Manage the Coconut black headed caterpillars with its own natural enemies !

Opisina arenosella, the leaf feeder multiplies and spread very fast during hot summer in pest prone coastal areas. Pest stages along with its life pupae and adults are seen on under surface of infested dried leaves. The caterpillars feed on chlorophyll containing green tissues leaving a burnt appearance to the palm.

- Early to mild stages of infestation can be reduced by cutting and burning the badly affected leaves / leaflets. In case of very severe infestation, removal and burning of fully dried 2-3 outer whorl of leaves is recommended.
- Augmentative release of stage-

specific parasitoids viz., the larval parasitoids Goniozus nephantidis (Bethylidae)/ Bracon brevicornis (Braconidae) @ 20 parasitoids/palm when larval stages are seen in the galleris on the underside side of leaflets is effective in the sustainable management of the pest.

White grubs or root grubs are not visible outside

Root grubs are subterranean and feed on coconut roots resulting in poor uptake of nutrients and reduction in growth and productivity of the palm.

- Hand picking and destruction of adult beetles during emergence period is an effective strategy to reduce pest multiplication in the field.
- Soil application of bifenthrin @ 2 kg ai/ha (Talstar 10 EC @ 20 litres ha-1 in 500 l of water) when first instar stage of grubs dominate in the field (July-August) and root zone application of entomopathogenic nematode, Steinernema carpocapsae @ 1.5billion IJs / ha and imidacloprid 17.8 SL @ 0.25ml / litre during September-October take care of grub population in soil
- Ploughing white grub endemic areas attract a lot of birds especially cranes along the track of plough/tractor to feed on the exposed grubs.

Coconut Rugose spiralling whitefly, recent invasive pest in our country

The whitefly infesting underside of coconut leaf is effectively suppressed in the field by tiny parasitoid, Encarsia guadeloupae. Extensive de-sapping by rugose spiraling whitefly (RSW) produces honey dew that are deposited on the upper surface of coconut leaflets including intercrops encouraging sooty mould fungus to grow. These black fungal deposits reduced photosynthetic efficiency. Very recently, a sooty mould feeding tenebrionid beetle, Leiochrodes sp. and its immature stages effectively devoured the sooty mould and cleansed the infected sooty- mould laden palm leaves giving a freshening look on palms. Such scavenging action by insects on crop of economic significance is highlighted for the first time which subsequently enhanced photosynthetic efficiency.

Predatory invertebrates in pest suppression: They work in field work 365 days in the back yard to suppress many of the agricultural pests:

Predatory bugs, green lace wings and predatory mites, many species of spiders and few predatory beetles suppress population of coconut black headed caterpillar in the field. Many small predatory beetles species viz., Santallus, Scaritus , Agrypnus etc coexisted in the rhinoceros beetle breeding grounds and predate on eggs and neonate grubs.

PATHOGENS -ANOTHER STRONG GROUP OF BIOCONTROL AGENTS TO FIGHT AGAINST PESTS !

Another group of biocontrol agents include viruses, protozoans and entomopathogenic nematodes and are also extensively used in pest management. Various fungi (Metarhizium anisopliae, Beauveria bassiana, Hirsutella thompsonii), Viruses (Nuclear Polyhedrosis Virus, Granulosis Virus, Oryctes rhinoceros nudivirus) and Bacteria (Bacillus thuringiensis (Bt), B. papillae) are

well documented entomopathogens being used effectively in pest management programmes.

Nematodes:

The word 'nematode' means "thread-like" and they are also known as thread worms or round worms. Nematodes are numerically the most abundant metazoans on earth and second only to insects, in terms of diversity of forms (species) is concerned. Nematodes dwell in all types of habitats on the earth. Most of the nematodes are free living which feeds on microorganisms. Nematodes also parasitize plants, animals and human beings. There is hardly any animal on earth, which is free from one or the other kind of nematode infection.

The science of Nematology is relatively young compared to its contemporary disciplines of Entomology and Plant Pathology. Phyto-nematodes parasitize all types of plants from lower algae to highly developed angiosperms including all plants and trees and cause billions of dollars worth of damage. A handful of soil from around the roots of any plant would yield hundreds of plant parasitic nematodes belonging to at least 4-5 genera. Root knot nematodes, cyst nematodes, burrowing nematodes and lesions nematodes are most important plant parasitic nematodes which cause huge economic loss.

The major nematodes affecting the coconut crop are Bursaphelenchus cocophilus, which cause red ring disease and burrowing nematode, Radopholus similis.

Red ring nematode (Bursaphelenchus cocophilus)

The chief vector of the red ring nematode is an insect, the palm weevil (Rhynchophorus palmarum L.). At present, red ring disease has a restricted distribution in tropical America and has only been reported from the West Indies and from Latin America.

Burrowing nematode (Radopholus similis)

The burrowing nematode occurs in most tropical and subtropical areas of the world and has been reported from coconut palms in Florida, Jamaica, Sri Lanka and India. The burrowing nematode causes non-specific general decline symptoms such as stunting, yellowing, reduction in number and size of leaves and leaflets, delay in flowering, button shedding and reduced yield. R. similis infestation produces small, elongate, orange-colored lesions on tender creamy-white roots. Consequent to nematode parasitization and multiplication, these lesions enlarge and coalesce to cause extensive rotting of the roots.

NEMATODES FOR THE CONTROL OF OTHER COCONUT PESTS

Entomopathogenic nematodes (EPN) of the families Steinernematidae and Heterorhabditidae are soil inhabiting insect pathogens that possess potential as biological control agents. These nematodes, working with their symbiotic bacteria (Xenorhabdus for steinernematids and Photorhabdus for heterorhabditids), kill insects within 24 to 48 hour. They are safe for the plant health, human health, soil and the environment. There is a huge potential for the utilization of these nematodes for the management of many coconut pests like white grub, rhinoceros beetle, red palm weevil etc. Efforts have been made to fine-tune this technology for field realization by ICAR-CPCRI.