INSECT PEST AND DISEASES OF ARECANUT IN ASSAM AND THEIR MANAGEMENT

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The arecanut palm *Areca catechu* L. is one of the important plantation crops of India and is widely cultivated in Tropical Asia. In India, arecanut is mainly cultivated in states of Karnataka, Kerala, Tamil Nadu and Assam. Arecanut plays a vital role in the economy of the state of Assam and practically it is the main cash crop for average Assamese farmers. It occupies 13.45% of total area under horticultural crops in the state. The crop is predominantly grown in homestead gardens locally termed as '*Bari*'. It is grown in 69.97 thousand hectares with a production of 62.7 thousand metric tons. Since time immemorial, it is being used as masticatory (chewing), in religious and social ceremonies. Lack of awareness on scientific cultivation practices, management of diseases/pests leads to considerable crop loss in the growers' fields. An array of insect and non-insect pests infest all parts of the palm, such as stem, leaf, inflorescence, root and nut in one or other stage of crop growth. As many as 102 insect and non-insect pests have been reported to be associated with arecanut palm. However, no systematic IPM and IDM practices are followed by this region to manage these diseases and pests.

Insect pests:

In Assam, many insects and non-insect pests infest arecanut palm, among them some insect pests cause huge economic loss (major insect) while others cause less economic loss (minor pest). But we have to be aware about the minor insect pest or diseases, because they may become major if they get favourable environmental conditions coupled with non adoption of management practices. Minor insect pests like scale insect, whitefly, mealy bug, stem weevil, thrips and non-insect pests like mite, squirrel, snail, wood pecker, etc. are important.

1. Inflorescence caterpillar (*Tirathaba mundella*): This lepidopteran caterpillar causes damage to areca inflorescence.

Symptom: The female moth deposits eggs in the spadix through punctures made on the spathe by slugs or snails. The caterpillars on emergence bore into the spathe. They move towards the tip of the inflorescence and commence feeding on the tender rachillae and male flowers. They web the terminal portions of the inflorescences together with silken threads and throw out large masses of frass (Fig 1).

Control: Affected spadices may be forced open and if all the female flowers have been damaged, the inflorescence should be removed and burnt. If damage is partial, remove affected portion and spray Malathion (0.125%).

2.Stem weevil (*Diocalandra stigmaticollis* Gyll): The adult weevil is dark in colour with long and pointed snout having gentle inward curve (Fig 2).

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The grub is dull white in colour and apodous. The incidence was more during July to October and is severe in young palms of below 5 years of age.

Symptom: It infests tender portions of the stem covered by the leaf sheaths.

Control: Spraying of tree trunks and leaf bases with Quinalphos 25 EC at 2 ml/l is effective.

3. **Root grub** (*Leucopholis burmeisteri* Brenske): The adult is a medium sized beetle having a chestnut brown colour (Fig 3). The incidence of the pest is more in ill-drained and low-lying clayey soils.

Symptom: Grubs feed on growing roots and infested palms show a sickly appearance with yellowing of leaves, tapering of stem and reduction in yield.

Control: Phorate (Thimet 10G) applied @ 15g per palm gives effective control of the pest. Apply Phorate to the soil around the plant twice a year, once in May before the onset of south-west monsoon and again in September-October after the monsoon. Repeat the treatment for 2-3 years continuously. Collect the adult beetles from 18.30 to 19.30 hours, after 8-10 days of premonsoon showers and kill them.

4. Mites: In Assam, *Raoiella indica* and *Oligonychus indicus* are recorded to attack on arecanut (Fig 4 a).

Symptom: They suck sap from the green portion of the plant. Feeding by mites lead to formation of yellowish speckles on the lamina. These speckles later coalesce, become bronze coloured and the leaves wither away. In older palms, infestation starts in the lower whorl of leaves and as the population increases, it spreads to the inner whorl (Fig 4 b).

Management: Spray Dicofol (Kelthane) @ 2 ml/ lit of water or Formothion (Anthio 25 EC) @ 1.5ml/ lit of water. Repeat spraying at an interval of 15-20 days if there is recurrence of pest.

5. Scale insect: The scale insects are small insects of the order Hemiptera, generally classified as the superfamily Coccoidea. There are about 8000 species of scale insects. Scales derive their name from the shell like, protective covering they form over themselves when mature. Scale insects show great sexual dimorphism. Female scale insects, unusually for Hemiptera, retain the immature external morphology at sexual maturity. Eggs are laid under the scale of the female insect. The crawlers emerge within a few hours; they are easily dispersed by vectors like wind, insects and cultivation practices. After settling the nymphs starts secreting the characteristic waxy scale

(a) **Wax scale** (*Ceroplastes floridensis* Comstock): This soft scale deeply encased in pinkish-grey wax, which is divided into three wax plates on each side with additional plates at the anterior and posterior ends. The single large dorsal plate has a central nucleus. The mature scales have greyish to pinkish-white waxy covering (Fig 5).

Symptom: Wax scales injure plants by removing large quantities of plant sap. Sticky honey dew, secreted by these scale insects are colonized by a fungus called sooty mold, causing infested plant parts to turn black and unsightly.

(b) Circular black scale (*Chrysomphalus* aonidum): The female scale is round and usually dark purple; the exuviae paler and subcentral. The male scale is similar to that of the female, but smaller and oval. The adult female is

recognisable from other species by rather wide pygidium with the posterior end gently rounded, not ointed; by the fairly numerous ducts in the second and third furroues; and by the cluster of small sub-marginal ducts on segment 2 of the abdomen (Fig 6a). The winged adult males are very short lived and do not feed.

Symptom: Black scales suck sap from palms particularly from new fronds which results in distortion and weakening of plant parts. They produce a sugary substance known as honeydew as they feed. Sooty mould fungi grow on the honeydew, coating the leaves and fruits into a black powder. Sooty mould interferes with photosynthesis, reduce tree vigour and yield (Fig 6b).

(c) **Coconut scale** (*Aspidiotus destructor*): These scales are protected by a distinct, hard, separable shell or scale over their delicate bodies. These are small, flat, yellowish scale with a semitransparent or whitish, waxy cover.

Symptom: The coconut scale feeding on the leaves results in yellowing that lead to drying and wilting in young and old palms. Seedlings and young palms are more likely to die from scale insect outbreaks than mature palm (Fig 7).

(d) **False Oleander Scale** (*Pseudaulacaspis cockerelli* Cooley): The female is pear-shaped, shiny white and 2-3 mm long. Exuviae are terminal and yellowish brown. The male is elongate, snow-white, feebly tricarinate and about 1 mm long. The male exuviae are terminal with a faint yellowish tinge. Males usually occur in clusters on the leaf (Fig 8a).

Symptom: The scale tends to confine itself for feeding on foliage. Its feeding causes chlorotic spots that are visible on the upper leaf surface. These spots are usually several times larger than the scale. Heavy infestations cause the entire leaf to turn yellow and drop prematurely (Fig 8b).

(e) **Mussel Scale** (*Ischnaspis longinostris*): The adult male and female scales look distinctly different. The adult female are greyish to chocolate brown, measuring 2.0-3.5 mm long, 1.0 mm wide, and are straight, or more commonly, curved (Fig 9). The fragile looking male (1 mm long) is aphid like, being winged as an adult after emergence from the scale covering.

Symptom: The scale insects are seen feeding on nuts, rachillae, and leaves. The damage is done by sucking sap from the plant tissues. As a result of continuous sucking, the tissues become yellow in colour and severe feeding leads to withering and shedding of buttons/fruits. The damage is heavy during drought situation.

Management of scale insects

The best prevention for scale is maintenance of healthy plant and early detection. Unstressed plants have better defence against infestations. Chemical fertilizers high in nitrogen, produce large number of population of aphids and scales. Organic fertilizers are better for prevention of infestations.

Physical control: In case of only a few scales, just remove them with a brush. Strong jet of water can be used to wash off the insects. Continue to check back every few days or so. Heavily infested twigs and branches are to be pruned off to eliminate scales when infestations are on limited parts of the plant.

Biological control: Scale insects are attacked by a few specific and a large number of non-specific parasitoids and predators. Coccids are essential food for a large proportion of coccinellid species globally, especially in the tropics and sub-

tropics. The most common coccinellid beetles are *Chilocorus nigritus, Cryptognatha nodiceps, Pseudoscymnus anomalus, P.dwipakalpa, Scymnus luteus, Rhyzobius* spp. and *Telsimia nitida*. Scales are preyed upon by parasitic wasp like *Aphytis* spp., Coccobius reticulatus, Encarsia spp., etc.

Chemical control: The shell or scale protects the older insects from insecticides, so spraying is more effective against newly hatched nymphs. Application of contact insecticides like malathion or parathion is effective. Ants play a major role in transportation of scales from one plant to another. Identify the ant nests and drench chlorpyriphos (5ml/litre) around the ant nests. Spray spinosad (0.5ml/litre) or neem oil (4ml/ 1 litre) or chlorpyrifos (2.5ml/litre) on leaves, inflorescence and tender nuts for effective management.

6. **Whiteflies:** Two species of whiteflies, viz. areca whitefly, *Aleurocanthus arecae* and spiralling whitefly, *Aleurodicus disperses* (Fig 10) are found infesting leaves of middle and lower whorls of young palms.

Symptom: They inhabit on lower surface of leaflets and the presence can be visualized by development of sooty mould on upper surface of leaflets.

Management: These insects are naturally controlled by parasitoids and predators present in ecosystem. Neem formulations were evaluated @ 0.2, 0.4 and 0.6% on areca palms of four years of age.

7. Mealy bug: These are the group of sucking pests which infest almost all parts of areca palm *viz.*, leaves, inflorescence, spadices, sheaths and developing nuts. Peak incidence is noticed after August till the next monsoon starts. The two main species are *Icerya seychellarum* and *Pseudococcus cryptus*.

Symptom: Both nymphs (Fig 11) and adults desap the plants which results in twisting of leaves, shortened leaves and small internodes, nut dropping accompanied with loss in nut weight and quality. Ants serve as transporting vehicles for the mealybugs.

Control: Plant protection for this pest remains same as that of arecanut scales.

8. **Snails or giant African snail** (*Achatina fulica*): It is one of the most problematic pests in arecanut garden in rainy season. They are nocturnal and polyphagous in nature with hard protective shell on their body (Fig 12).

Symptom: They scrap the chlorophyll content on soft portion of the stem near crown, leaf and inflorescence.

Control: Keep rotting papaya fruits or banana leaves in heaps or metaldehyde (20g/spot) at several places in the garden. Snails get attracted and are to be collected and killed.

9. **Squirrels:** Destruction of forest lands and its conversion into agricultural lands, and also cultivation of sole crops are the main reasons for non availability of food and shelter to squirrels (Fig 13) which forced them to feed on arecanut.

Symptom: They scrape near perianth of tender nuts and suck the juice content resulting in nut dropping. Leaf drooping, shredding and excreta on leaves are the common symptoms.

Control: Bait traps are helpful in trapping squirrels. Trap squirrels with nets and release them to distant forest areas.

10. **Wood Pecker:** Woodpeckers have short

legs with two sharp-clawed, backward-pointed toes and stiff tail feathers, which serve as a supportive prop. These physical traits enable them to cling easily to the trunks and branches of trees, wood siding, or utility poles while pecking.

Symptom: They have stout, sharply pointed beaks for pecking into wood and a specially developed long tongue that can be extended a considerable distance. The tongue is used to dislodge larvae or ants from their burrows in wood or bark. Most woodpeckers feed on tree-living or wood-boring insects; however, some feed on a variety of other insects. On arecanut palms, the wounds may attract insects as well as porcupines or squirrels. Feeding wounds also serve as entrances for diseases and wood-decaying organisms.

Control: Drum beating, use of crackers, shouting or tieing the palms with coloured ribbons helps to scare away wood peckers.

Diseases of arecanut and their management

1. Basal stem rot (Anaberoga)

Causal Organism: *Ganoderma lucidum*

Symptom: The affected palm shows yellowing of outer whorl of leaves, which gradually extends to the inner whorl. The leaves become gradually dry and droop around the crown (Fig 14a). Brownish patches develop at the base of the infected palm and sometimes sticky ooze comes out from such areas. Infected roots become brittle, turn into blackish colour and dry and can be easily broken to pieces. At later stages, fruiting bodies (Fig 14b) may develop at the base of the infected palm.

Management: Infected palm should be isolated by digging a trench around the palm at a distance of 90 cm from the base. The depth and width of the trench should be 60 cm and 15-20 cm respectively. Drench the root zone of the affected palm with 0.3% Tridemorph (calixin) (30ml/ 10 lit of water) @ 10-15 lit. per palm and also root feed Tridemorph (calixin) 1.5% (125 ml/ palm). Apply 2-4 kg neem cake per palm at quarterly interval. Phytosanitary measures like cutting and burning of dead palms along with stem and roots should be strictly followed. Improve the drainage in the arecanut garden.

2. Bud rot

Causal Organism: *Phytophthora arecae*

Symptom: The basal portion of the spindle leaf become yellowish and then turns into brownish colour. At a later stage, the spindle leaf droops and rotting occurs at the base (Fig 15). Infected parts of the palms emitted disagreeable odour and the crown leaves turn yellowish and fall off.

Management: Remove and clean the infected rotting tissues completely and treat the wound with 10% Bordeaux paste. Spray Bordeaux mixture (1%) to the crown of healthy palms, which are in the vicinity of the affected palm.

3. Leaf spot

Causal Organism: *Colletotrichum* sp., *Helminthosporium* sp.

Symptom: Observed in seedlings and young palms on lower leaves. The typical symptoms are small dark brown round spots with varied sizes, surrounded by yellow halo. In advanced stages, the whole leaf becomes blighted. The blighted leaves dries up, droop and shed off. The disease is severe during summer and south west monsoon period (Fig 16).

Management: The inoculum load can be reduced by collection and destruction of infected leaves by burning. Spraying the leaves with Dithane M-45 @ 0.3% or Contaf @ 0.2% effectively manages the disease.

4. Stem bleeding

Causal Organism: *Thielaviopsis paradoxa* von.Hon (*Ceratostomella paradoxa*)

Symptom: Incidence of the disease is not severe in arecanut and occurs mostly on young palms. Small discoloured depression appears on the basal portion of the trunk. As the infection advances, the spots coalesce to form larger patches followed by formation of cracks. Subsequently, rotting leads to disintegration of fibrous layers of the stem which hollows up to varying depth along the infected area. Gummy exudates oozes out from these patches in acute stage. In severely affected palms, the stem tapers near the crown and there is reduction in leaf size (Fig 17).

Management: The infected portion should be scraped off and smeared with hot coal tar or Bordeaux paste (10%). Improve drainage as the disease is severe in gardens with high water table and poor drainage.

5. Crown choke/band

Cause: Disorder due to boron deficiency

Symptom: The characteristic of the disorder is that the leaves become shorter, distinctly dark green and the leaflets become brittle and crinkled with wavy margin. As the disorder progresses, there is reduction in the intermodal length and tapering of the stem. In acute stage, due to failure of natural opening of leaves, the top portion of the stem and the crown exhibit rosette shape. Sometimes, multiple shoots are developed or the newly formed shoots may emerge through the sides of tightly folded lower leaves (Fig 18).

Management: Soil application of borax @ 25g/ palm improves the condition of the palm. Better soil management and improvement of drainage helps to reduce the disorder.

6. Leaf blight

Causal Organism: *Phomopsis palmicola* (Wint.) Sacc., *Pestalotia palmarum* Cooke and *Phyllosticta arecae*

Symptom: The symptom is seen on the lower leaves as severe blight from the tip downward (Fig 19).

Management: Spraying with copper fungicides can manage the disease and application of nitrogenous and potassic fertilizer followed by spraying with Dithane Z -78 also reduce blight.

7. Nut splitting: The disease is more prevalent in gardens with high water table and during rainy season.

Cause: Sudden flush of water after a period of drought and potash deficiency are attributed to this disorder.

Symptom: The symptom is premature yellowing of the nuts when they are half to three forth mature. Splitting occurs from the perianth or distal end or from both ends of the fruit or may be restricted to only one side of the nut (Fig 20).

Management: Application of potash fertilizer and spraying of Borax @ 2.0 g/lit of water and improvement of drainage in gardens with high water table helps to minimize the disorder. Soil application of Borax @ 25g/ palm can be applied instead of spraying.

8. **Premature nut drop/Button shedding**

Cause: Several factors like deficiency of nutrients in the soil, excess or deficit of water and temperature variation and pathogen infestation (*Colletotrichum gloeospoiodes*) is also associated with the disorder.

Symptom: Yellowing and drying of rachis from the tip towards the base followed by shedding of female flowers or button is the main symptom.

Management: Remove the fully affected inflorescence and destroy them by burning. Spray Mancozeb @ 3g/l of water at the time of opening of female flowers. Repeat spraying at 25 days interval. Apply recommended dose of manure and fertilizers and follow proper water management practices.

9. Sun Scorching

Cause: Due to constant exposure of the palm to sunrays in south-west direction

Symptom: Initially golden yellow patches developed on tender stem which later turn brown and loose turgidity. The dead tissues decay due to saprophytic organism and insect, leading to stem breakage during heavy rain. (Fig 21)

Management: Grow fast growing trees on southern and western side of the garden for protecting the stem from scorching effect of sunrays. Protect the trunk by covering with dry areca leaves or trail pepper vines on the stem or apply lime on the whole stem.

Diseases in nursery:

1. Collar rot

Causal Organism: *Fusarium* sp., *Rhizoctonia* sp. and *Phytophthora* sp.

Symptom: Causes infection in both root and collar region leading to rotting of root and young bud. Infection in root leads to wilting while infection at collar region lead to rotting of collar region and seedlings can be easily pulled out (Fig 22).

Management: Provide proper drainage. Spray with 1 per cent Bordeaux mixture

2. Leaf blight

Causal Organism: *Phomopsis palmicola* (Wint.) Sacc., *Pestalotia palmarum* Cooke and *Phyllosticta arecae*

Symptom: The symptom is seen on the lower leaves as severe blighting from the tip downward (Fig 23).

Management: Spraying of copper fungicides can manage the disease and application of nitrogenous and potassic fertilizer followed by spraying with Dithane Z -78 also reduce blight.

3.Leaf spot

Causal Organism: *Colletotrichum* sp., *Helminthosporium* sp.

Symptom: Observed in seedlings and young palms on lower leaves. The typical symptoms are small dark brown round spots with varied sizes, surrounded by yellow halo. In advanced stages, the whole leaf becomes blighted. The blighted leaves dries up, droop and shed off. The disease is severe in summer and south west monsoon period (Fig 24).

Management: The inoculum load can be reduced by collection and destruction of infected leaves by burning. Spraying the leaves with Dithane M-45 @ 0.3% (3ml in 1 lit)or Contaf @ 0.2% (2ml/ lit) effectively manages the disease.

Fig 1- Symptoms of Inflorescence caterpillar attack

Fig 2- Stem weevil

Fig 3- Root grub

Fig 4 (a) & (b) - White mite and symptoms

Fig 5 -Wax scale

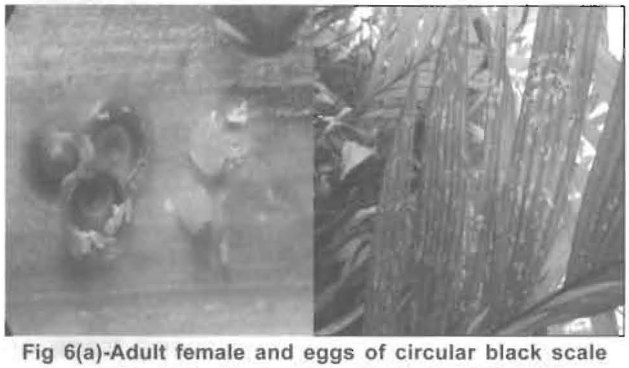

Fig 6(a)-Adult female and eggs of circular black scale and Fig 6(b) - black scale attack on areca leaf

Fig 7:-Coconut scale

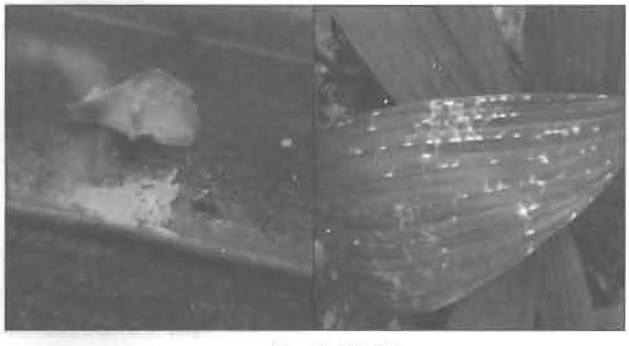

Fig 8(a) & (b)-

False oleander scale with eggs and symptom

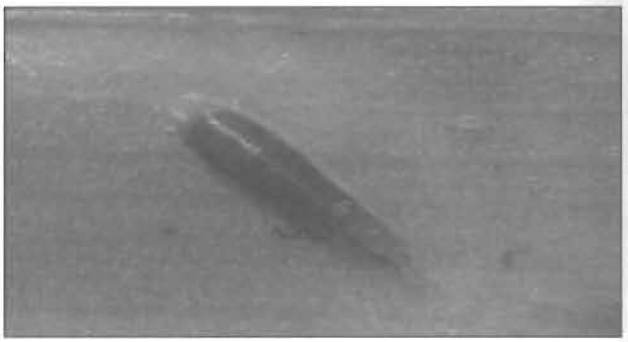

Fig 9:-Mussel scale

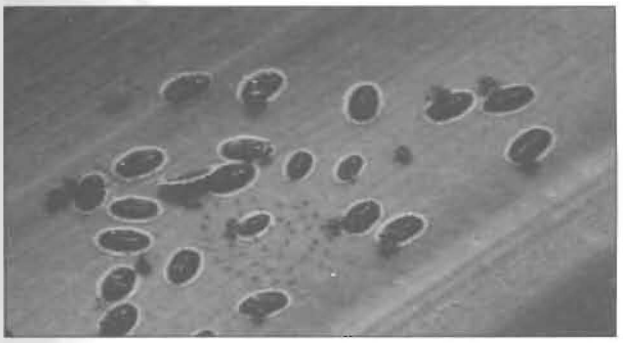

Fig 10- Whitefly

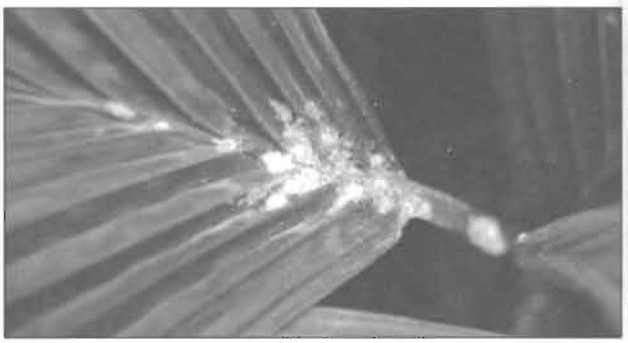

Fig 11- Mealy bug

Fig 12-Giant African Snail

Fig 13-Squirrel

Fig 14 (a) & (b) Basal stem rot

Fig 15-Bud rot

Fig 16- Leaf spot

Fig 17- Stem bleeding

Figs 18- Crown choke

Fig 19- Leaf blight

Fig 20- Nut splitting

Fig 21- Sun scorching

Fig 22- Collar rot

Fig 23- Leaf blight in nursery

Fig 24- Leaf spot in nursery

Conclusion:

Arecanut plantations should be managed with the objective of keeping them in a healthy, productive condition, one in which insect-pests and diseases are kept at low levels. IPM and IDM are the frameworks of decision making action tools directed to maintain plantation health. These approaches bring together the best mix of chemical and biological control and cultural approaches, to manage insect pest and diseases.

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