
- *Chilocoris circumdatus* and *Sasajiscymnus dwipakalpa* are some of the natural enemies feeding on scale insects and maintain the pest population below ETL
- Application of neem formulations (0.5%) four times at fortnight intervals is effective
- Application of dimethoate 30 EC @ 1.5 ml/l twice at fortnight intervals is also effective against the pest

**Lace wing bug (*Stephanitis typicus* Dist.)**

Adults and nymphs feed on the under surface of the leaf by sucking in groups lead to the appearance of greyish yellow spots. Plants show dried appearance during severe infestation in summer season.


***Control measures***

- Destruct and remove alternate hosts such as banana, *colocasia etc*.
- Provide adequate shade in the plantations
- Spraying systemic insecticides like acephate 75 SP @ 1.5 g/l & dimethoate 30 EC @ 1.5 ml/l would effectively manage the pest

**Shoot fly (*Formosina flavipes* Mall)**

The pest is severe when excess nitrogenous fertilizers are applied. It is a prominent pest during warm summer months (April-May) in plantations with inadequate shade. The adult flies lay cigar shaped white eggs singly between the terminal leaf sheaths. The maggots hatch out of the eggs bore in to the inner whorl and cause dead hearts in young leaves. Maggots feed on tip of the younger shoots and leads to the rotting of that portion.


***Control measures***

- Judicious application of nitrogenous fertilizers
- Provide adequate shade in cardamom plantations
- Application of quinalphos 25 EC @ 2 ml/l or dimethoate 30 EC @ 1.5 ml is recommended to manage the pest

**Red Spider Mite (*Tetranychus urticae*)**

Mites are found in large numbers on the undersurface of the leaves with webbings cause yellow speckles on leaves. Drying of leaves occurs in severe infestations. Mite infestation is higher in summer season with low rainfall. Predatory mites belonging to *Amblyseius* sp. is found feeding on mites of cardamom.


***Control measures***

- Application of sulphur containing insecticides (wettable sulphur 0.2%) found effective against mites
- Application of dimethoate 30 EC @ 2ml/l on the under surface of the leaves suppresses the mite population

**Root knot nematode (*Meloidogyne* sp.)**

The nematode pest infests roots of cardamom leading to development of knots in the roots causing reduction in uptake of nutrients. Infested plants show yellowing of leaves and excessive tillering near the root tips. Crop loss occurs under severe infestation.


***Control measures***

- Soil drenching of *Paecilomyces lilacinus* @ 10-20 g/l is strongly recommended under mild infestation
- Selective drenching of chlorpyriphos 50 EC @ 1.5 ml/l is advocated under severe infestation
- Avoid banana in cardamom plantation as it spreads /hosts plant parasitic nematodes

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# CARDAMOM
## Integrated Pest Management

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## CARDAMOM PEST MANAGEMENT STRATEGIES

Cardamom is proudly known as 'Queen of spices'. The yield of cardamom is adversely affected by host of pests like thrips, shoot, panicle and capsule borer, root grub, scale insects, mealy bugs, root knot nematodes *etc*. The yield loss can be avoided through the effective management of these pests at appropriate time.

### Cardamom itch (*Sciothrips cardamomi* Ramk.)

Cardamom itch on the capsules is developed by the infestation of a sucking pest called thrips. They also suck the sap from unopened leaves, leaf sheaths and flower bracts and as a result shedding of flowers occur. Stunted panicles and scab on the capsules were well pronounced. Itched capsules fetch lower price in the market and not preferred by the consumers.


***Control measures***

- Remove dry drooping leaves as well as dry leaf sheaths (trashing) during January- February and apply recommended insecticides
- Avoid pesticide application during continuous and heavy rain
- Spray insecticides once in 30 days during February to May, preferably immediately after harvest
- Apply insecticides in rotation, same chemical must be avoided
- Insecticides such as dimethoate 30 EC @ 1.5 ml/l, quinalphos 25 EC @ 2 ml/l, phosalone 35 EC @ 2 ml/l, spinosad 45 SC @ 0.2 ml/l, imidacloprid 200 SL @ 0.5 ml/l, acetamiprid 20 SP @ 0.2 g/l and thiamethoxam 25 WG @ 0.2 g/l can be used in rotation. Insecticide application should be done with correct dosage.
- *Malabar* types are tolerant to thrips infestation, therefore cost of pesticides can be minimized if *Malabar* types are chosen for cultivation besides increasing natural enemy population in cardamom ecosystem
- Augmentative release of green lace flies, *Chrysoperla* can check the thrips population.

### Shoot, panicle and capsule borer (*Dichocrocis punctiferalis* Guen.)

The larvae bore into the stem of young tillers, panicles and capsules in the plantations. Presence of moth can be monitored by installing a light trap that attracts adult insects. Caterpillars emerge within 10-15 days after the moth appearance. Application of insecticides is very effective at this time.


***Control measures***

- Apply fertilizer nutrients strictly at recommended doses only
- Higher doses of fertilizer will result in succulent stem and increases the chance for damaging the shoots
- Avoiding alternate hosts like castor, ginger and turmeric in the plantations decrease the pest incidence level
- Conserve larval-pupal parasitoids such as *Agropyron* sp., *Telenomus* sp. at field level
- Apply insecticides in correct dosage at right time
- Rotation of chemicals is advocated rather than application of same insecticide throughout the year
- Quinalphos 25 EC @ 2 ml/l, dimethoate 30 EC @ 1.5 ml/l, spinosad 45 SC @ 0.2 ml/l, actin plus (Pongamia oil 0.1% + neem oil 0.1%) @ 2 ml/l, chlorantraniliprole 18.5 SC @ 0.3 ml/l and flubendiamide 39.35 SC @ 0.1 ml/l are some of the insecticides recommended for managing shoot and capsule borer

### Root grub (*Basilepta fulvicorne* Jacoby)

The damage is very severe in those gardens with inadequate shade and irrigation. The grubs congregate on the root zone of cardamom clumps. Grubs feed and cause irregular patch on the roots resulting in reduction of nutrient uptake followed by yellowing of leaves finally leads to considerable crop loss. The damage is very severe in April-May and September-October months.


***Control measures***

- Ensure adequate shade and soil moisture level in cardamom plantations
- Drench with *Metarihizium anisopliae*, an entomo-pathogenic fungi @ 10 g/l
- Introduce entomopathogenic nematode *Heterorhabditis indica* infected *Galleria mellonella* @ 4 cadavers/plant
- Adult beetles feed on the leaves of mango, fig *etc*. and hence these trees shall be avoided as shade trees for cardamom plantations
- Drench chlorpyriphos 50 EC @ 1.5 ml/l

### Root mealy bug (*Xenococcus annandalei*)

Mealy bugs are soft bodied sucking insects appear as white powder near the rhizome region of cardamom. Crawlers aggregate on the root zone and pierce into the feeding roots of cardamom. Plants show yellowing, wilting and defoliation of leaves due to feeding injury.

***Control measures***

- Soil drenching of affected plants with chlorpyriphos 50 EC @ 5 litres / plant, for younger plants 2-3 litres per plant.


- Entomopathogenic fungi *Lecanicillium lecanii* is very effective against root mealy bugs
- Drenching with *L. lecanii* @ 10 g/l. Repeat the drenching 2-3 times in severely infested fields
- *L. lecanii* can be applied in endemic areas as prophylactic measure

### Whitefly (*Kanakarajiella cardamomi* David Subr.)

This pest of minor importance has assumed major status owing to injudicious use of insecticides like spraying insecticides at shorter intervals, mixing two or more insecticides, spraying the same insecticides throughout the year, spraying synthetic pyrethroids at higher concentrations than the recommended dose as well as climate change. Such practices of pesticide application had eliminated the natural enemies of the pest and resulted in resurgence. Intermittent rain coupled with increased temperature predisposes the outbreak of whitefly.

Colonies of nymphs and adults desap from the lower surface of the leaves. Chlorotic patches appear initially on leaves, which in turn become yellow and necrotic in the advanced stages.


***Control measures***

- Avoid indiscriminate application of insecticides and nitrogenous fertilizers
- Avoid repeated application of same insecticide
- Reduce the use of synthetic pyrethroids
- Monitoring and trapping of adults using yellow sticky traps coated with viscous castor oil. The traps can be placed between rows of cardamom plants or on the shade trees
- Application of dimethoate 30 EC @ 1.5 ml/l on the under surface of the leaves will effectively manage the pest during severe infestation
- Application of acephate 75 SP @ 1.5g/l is also effective against whiteflies

### Scales (*Aspidiotus destructor*, *Mytilaspis sp.*, *Saissetia coffeae)*

Scale insects are small sophisticated sucking pests seen in groups on the under surface of the leaves. In severe infestation, yellowing and drying of leaves occur.

***Control measures***

- Remove severely affected leaves and destroy/burn them