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Knowing and Recognizing Major Destroyers of Black Gold Black Pepper (*Piper nigrum* L.) in India

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Introduction

Many major spices including black pepper originated in the Western Ghats of South India. All these important spices play a significant role in the national economy. India's dominance of spices in the world market is worth mentioning. Black pepper is the main spice in it. Indian pepper is popular all around the world for its flavour and colour. But in terms of production and productivity, Indian pepper is far behind. Although there are many reasons for this, insect pest damage is considered to be the main cause. In this chapter, we look at the major insect pests that significantly affect black pepper production in South India.

Insect Pests

Though the crop is infested by about 20 insect pests, in India only five are serious, such as pollu beetle, top shoot borer, leaf gall thrips, scale insect and mealy bug. See **Table 1.** for details.

IPM For The Pests Of Black Pepper

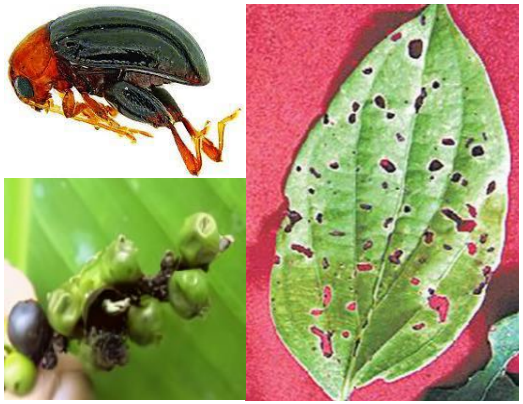
A. Cultural control

1. Regulation of shade in the plantation and eradication of affected vines from vineyard reduces the population of the **Pollu beetle and Top shoot borer**.
2. Clipping off and destruction of severely infested branches reduces the **Scales.**
3. Select healthy and insect-free planting material for propagation in nurseries to control the **Leaf gall thrips.**
4. Use of clean and pest-free planting material for transplanting in the main field reduces the **Mealybugs.**
5. Dipping infested plant materials in hot water at 49°C for 10 seconds helps to eliminate the mealybugs from the roots.

B. Biological control

1. Spraying of a neem-based insecticide, Neemgold (0.6 per cent) during August, September and October is effective for the management of the **Pollu beetle**.
2. In nurseries spraying neem oil at 0.3% or Neemgold at 0.3% or fish oil rosin at 3% is also effective in controlling the **Scales** infestation.

Table 1. Recognition of important pests and their damage symptoms in black pepper

Insect Pest	Biology	Damage Symptoms
1. Pollu beetle: *Lanka ramakrishnae* (*Longitarsus nigripennis*) Family: Chrysomelidae; Order: Coleoptera  (Source: www.telegraphindia.com)	**Eggs:** laid on the berries, mainly 1-2 eggs are laid per hole and egg period 5-8 days. **Grub:** Fully grown grubs are creamy white and measure about 5 mm in length. Grub period is 30-32 days. **Pupa:** Pupation takes place in soil at a depth of 5.0-7.5 cm. Pupal period is 6-7 days. **Adult**: a small shiny black beetle, measuring about 2.5 mm × 1.5 mm, the head and thorax being yellowish brown and the fore wings (elytra) black. **Life cycle**: completes in 40 - 50 days. Four overlapping generations in a year is seen.	• Adult moths feed on tender shoots, spikes, and berries. • Infested shoots and spikes turn black and drop. • Grub on emergence bore into the berries, feed on the internal contents, and make them hollow. • Infested berries turn yellow initially and then black and crumble when pressed
2. Top shoot borer: *Cydia hemidoxa* (*Laspeyresia hemidoxa*) Family: Eucosmidae; Order: Lepidoptera  (Source:http://www.kissankerala.net:8080/KISSAN-CHDSS/English/pepper/pests/images/50.jpg)	**Eggs:** small colourless. **Larva:** greyish green and measure 12-14 mm in length. Larval period is of 10-15 days. **Pupa:** Pupation takes place inside shoots. Pupal period is of 8–10 days. **Adult**: pretty tiny, with a wing span of 10-15 mm. Basal half of forewing is black with distal half orange red. The hind wings greyish. Life cycle completed in a month	• Caterpillars bore into tender shoots that turn black and dry up. • When successive new shoots are attacked, the growth of the vine is affected. • Pest infestation is higher during July-November when numerous new shoots are available on the vines. 

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3. Leaf gall thrips: *Liothrips karnyi* Family: Thysanoptera; Order: Thripidae  (Source: http://krishimala.com/catalogue/leaf-gall-thrips)	**Eggs:** laid in single within the marginal leaf folds or on the leaf surface, egg period6-8 days. **Nymph:** whitish and sluggish, nymphal period 9-13 days **Pupa:** Pupal period, 2 to 3 days **Adult:** Adults with heavily fringed wings. Adult longevity is 7-9 days.	• Thrips feed on tender leaves causing the leaf margins to curl down and inwards, forming marginal leaf galls. • Infested leaves become thick, malformed and crinkled • Life stages of the insect can be seen within the gall. • In severe cases of infestation, the growth of young vines is affected.
4. Pepper mussel scale: **Coconut scale:**   ***Lepidosaphes piperis*** Scale is small, dark, boat shaped ***Aspidiotus destructor*** Circular (1 mm in dia.) & yellowish brown Family: Diaspididae; Order: Hemiptera (Source: NIPHM & DPPQ&S)	**Eggs:** laid underneath the waxy covering and hatch over one to three weeks. **Larvae:** The newly hatched scales (called crawlers) move about over the plant until they locate succulent new growth. • Female scales lose their legs and antennae during the first moult. They moult a second time before reaching maturity and do not pupate. • Male scales go through two additional moults and pupate underneath the wax. **Adult**: males are tiny two-winged, gnat-like insects without mouthparts.	• Scale insects appear as encrustations on stems, leaves and berries. They feed on plant sap resulting in the yellowing and drying of infested portions of the vines.  (Source: http://kirehalli.com/scale-insect-attack-in-pepper/)
5. Mealy bug: *Formicoccus polysperes* *Planococcus lilacinus* *Dysmicoccus subterreus* Family: Pseudococcidae; Order: Hemiptera	**Egg:** yellowish to orange in colour. **Nymph:** The first instar nymphs are also called as crawlers, which are mobile. The total nymphal period is 19 days for male and 21 days for female. The male nymph forms a	• A Large number of mealy bugs colonize the roots of the vine • As a result of sap-sucking, the plant turns yellow, leaves and branches dry and drop.

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 (Source:http://www.kissankerala.net:8080/KISSAN-CHDSS/English/pepper/pests/2.htm)	cottony cocoon in which the pupal stage is found mainly in the winter season . **Adult:** The adult female mealybugs are pinkish white and sparsely covered with white wax. The male (four nymphal instars.) and female (three nymphal) mealybugs are similar in early stages. • The adult male has a pair of wings and a pair of halters. Males are very rare and female mealybugs are commonly found causing the damage in the field. • Mealybug completes the life cycle in about 30 days.	• Many of the vines infested by root mealy bugs are also likely to be infected with Phytophthora and nematodes.  (Source:https://plantvillage.psu.edu/topics/black-pepper/infos)

Table 2. Natural enemies of black pepper pests

Insect pests	Natural enemies
Pollu beetle	**Predators:** Spider (Araneae), *Oecophylla smaragdina* (weaver ant)
Top shoot borer	**Parasitoids:** *Apanteles cypris*, *Eudederus* sp. (Hymenoptera), *Goniozus* sp. **Parasitic mite:** *Clinotrombium* sp. (on larvae). **Entomopathogenic nematode:** *Hexamermis* sp.
Leaf gall thrips	**Parsitoids:** *Aphytis* sp., *Pseudoscymcus* sp., *Chilocorus circumdatus* **Predators***: Montandoniola moraguesi, Androthrips flavipes, Geogarypus* sp., *Lestodiplosis* sp., *Rhodesiella* sp, Predatory mites, Hoverflies, Thrips, Mirids
Scale insect	**Parasitoids:** *Encarsia lounsburyi*, *Aphytis* sp. etc. **Predators: Mite**: *Bdella* sp., **Thrips**: *Karnyothrips melaleucus, Aleurodothrips fasciatus*, **Beetle**: Ladybird beetle, *Chilocorus circumdatus, C. nigrita,* Lacewings, *Pseudoscymnus dwikalpa, Pharoscymna shorni, Sticholotisex anguis, Cybocephalus* sp. etc.
Mealybugs	**Parasitoid:** Parasitic wasps **Predators:** Hover flies, coccinellid (*Cryptolaemus montrouzieri*), praying mantis.

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3. Spraying 3% of NSKE or 3% tobacco extract and 2% custard apple seed extract at monthly intervals reduces the **root mealy bug** population effectively.
4. Spray of Garlic-chilli kerosene extract @ 5ml/lit was found effective against the **Leaf gall thrips**.
5. Spraying of *Lecanicillium lecanii* (or) *Beauveria bassiana* @ 10g/l is found to be effective in managing sucking pests like **mealy bugs, scale insects and marginal gall thrips**.
6. See **Table 2.** for natural enemies of various pests

C. Chemical control

1. Spraying Quinalphos 25 EC (0.05 per cent) in June-July and September - October thoroughly at the undersides of leaves (where adults are generally seen) and spikes controls the **Pollu beetle**.
2. Quinalphos 25 EC (0.05 per cent) sprayed on tender terminal shoots and that should be repeated at monthly intervals (during July-October) to protect emerging shoots from the **top shoot borer**.
3. Spraying of imidacloprid 70% WG @ 2.5gm/10 lit. or Thiamethoxam 25% WG @ 3gm/ 10 lit. or Spinosad 45 SC @ 0.15 ml/ lit. or Flonicamid 50 WG @ 0.30 gm/ lit. of water during the vegetative stage at 12-14 days interval was found effective to control the **Leaf gall thrips**.
4. Spraying of dimethoate (0.1%) on affected vines after harvest of produce controls the **Scales**; repeat spraying after 21 days to control the infestation completely.
5. Soil drenching with imidacloprid 17.8% SL @ 0.3 ml/lit. or chlorpyriphos 20% EC @2m/lit., were effective against the **root mealybugs** in black pepper.

Conclusion

As pepper is considered one of the important commercial crops in India. To preserve quality and quantity, pepper crops must limit insect pest damage. To achieve that, we must employ timely and proper management practices. The initial pest load of main pests in the field would be reduced by using suitable cultural practises during the growing season and soon following harvest. As a result, the infestation's intensity also lessens. Similarly, need-based biological and chemical control methods can also be incurred in an integrated manner for the control of pests and to increase the yields of pepper.

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