



## STUDY ON INTEGRATED PEST AND DISEASE MANAGEMENT IN SMALL CARDAMOM PLANTATION

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**Abstract:** Cardamom plantation activities in southern India are considered one of the most expensive farming practices globally, involving enormous inputs and external energy throughout the season (Murugan et al., 2017). Majority of the most successful cardamom plantations are available in Indian cardamom hills (ICH) in the elevation ranging from 700' to 7,000' above sea level. Nearly half a century ago, the ICH was a typical tropical evergreen forest with enormous biodiversity, including epiphytes. Ruthless regular shade lopping is the foremost essential operation that all planters would like to do in the ICH (Murugan et al., 2012a). This causes changes in micro and topoclimatic condition along with fast degradation of the forest structure and function. Published information, on the influence of altitudinal variability on evaporation and precipitation pattern and the hours of bright sun, is scarce for the cardamom hills agroforestry system (Pascal et al., 2004).

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### Introduction

Integrated Pest Management (IPM) is a system where all suitable methods and techniques are utilized in a compatible manner to maintain pest incidence at levels below those causing economic loss of crop. Formulating an effective IPM strategy one needs to have knowledge of bio-ecology of pests and pathogens, economics of control measures and the possible adverse effects of pesticides on non target living organisms and environment & human health.

There are various non-chemical strategies established against pests of small cardamom including cultural, biological, physical and mechanical and have been recommended for incorporation with chemical control measures. These approaches not only control pests effectively but also provide a way for judicious use of chemical pesticides, thereby reducing the harmful effects of chemicals on the environment. To impart a successful IPM programme, it needs the knowledge on:

1. Identification of pests and diseases, time of occurrence and extent of loss
2. Life cycle and biology of the causal organism
3. Site of attack
4. Damage symptoms and sign of pest attack
5. Mode of migration/dispersal

### 6. Alternate hosts

The concept of integrated pest management (IPM) in small cardamom plantations is in existence since 1985, in India and this has resulted in minimizing the use of toxic agrochemicals.

### Elements of IPM

#### 1. Cultural practices

The incidence of pests and diseases can be reduced to some extent by collecting and destroying the different pests and affected plant parts, maintenance of shade and weed control.

#### 1.1 Shade management

Shade regulation is one of the important practices that should be attended during summer (March - April) in the new planting areas and during May - June after the receipt of summer showers in the existing plantation. If there is thick shade, chopping of branches should be done to provide filtered sun light of 40-60 percent of the open area. Below 50% shade, accelerates vegetative growth and adversely affects the flowering and yield. The shade management possesses a vital role for lowering the incidence of pests like thrips, shoot fly etc.

## 1.2 Field sanitation

Viral diseases are responsible for rapid degeneration of production potential in early stages of plantation establishment and cause constant threat to sustainable production. Some weeds including *Alpinia*, *Amomum*, *Curcuma*, *Colocasia* etc. found in the small cardamom plantation are alternate hosts for the aphids which transmit the viruses. An effective weed management system can reduce the spread of these diseases and attack of insect-pest to a considerable extent. Weeds are also potential competitors to small cardamom for water and nutrients. Two or three rounds of hand weeding around the plant base during May, September and December/January and slash weeding in the inter-space are advisable. Pruning operation may be carried out during January and September, which avoid increasing thrips population. Pruning is the operation undertaken with sharp sickles for removing the dead and hanging leaves from the pseudostem and care should be taken not to peel off the leaf sheath from the pseudostem. Trashing may be carried out once a year after the receipt of the pre monsoon showers. It consists of removing of old tillers, dead rhizome, dry leaves and leaf sheaths. The resultant plant material obtained through pruning and trashing can be used for mulching.

### Application of fertilizers & organic manures

Small cardamom responds well to both organic manuring and chemical fertilizer applications. A soil test based judicious manuring schedule is to be arrived at to achieve optimum production on sustainable basis. Application of 5-10 kg of decomposed farmyard manure/compost per plant may be done during May/June. Chemical fertilizers may be applied based on soil test results. The manure should be gently mixed with surface soil after application. Manuring can be done in two splits, one in May and the subsequent application during September. Organic manures such as neem cake (1 kg per plant), bone meal (1 kg per plant) or vermicompost (1 kg per plant) have beneficial effect on root proliferation and plant growth and also helps to reduce nematode infestation. The period of application and quality of organic inputs are very important. Sufficient moisture should be maintained and the organic inputs must be composted well before application.

### Host plant resistance

Use of pest and disease tolerant varieties has been one of the most important ways to reduce the incidence of pests and diseases. Small cardamom being a perennial crop, research on clonal selection and breeding should be primarily aimed at the production of high yielding and superior quality plants with high emphasis on resistance to pests and diseases (Table 1). This approach

would be highly effective in bringing down the use of chemical pesticides.

## 3. Physical control

Manual removal and soil solarization in the nursery are some of the most common approach to control certain types of insect-pest populations in spices. For example, in case of large caterpillars, their pupae can be collected manually and destroyed. Soil solarization can be effectively employed to eliminate root knot nematodes in the nursery.

## 4. Biological control of small cardamom pest

ICRI has carried out studies on biological control of small cardamom root grub with Entomopathogenic Nematodes (EPN) and Entomopathogenic Fungi (EPF) like *Metarhizium anisopliae* and *Beauveria bassiana*. These fungi can be used along with compost at the plant base for management of root grub. Application of EPN infected *Galleria* larva (cadaver) at the plant base has been found to reduce root grub infestation up to 95 percent. EPN survives in moist soil resulting in sustainable management of root grub.

## 5. Biopesticides and other methods of control

Plant products such as neem oil, Pongamia oil and extracts of several herbs having pesticidal properties are also found to be effective against several pests and pathogens. Sex pheromones form an important component of IPM which has been used successfully for controlling populations of moths and flush worms.

## 6. Traps

Different traps are followed for collection of insects

### 6.1 Yellow sticky traps

Set up yellow pan water / sticky traps 15 cm above the canopy for monitoring aphids and yellow sticky traps for whitefly @ 4-5 traps/acre. Locally available empty tins painted yellow / blue and coated with grease / Vaseline / castor oil on outer surface, also can be used.

### 6.2 Light traps

Set up light traps @ 1 trap/acre 15 cm above the crop canopy for monitoring and mass trapping of insects. Light traps with exit option for natural enemies of smaller size should be installed and operated around the dusk time (6 pm to 10 pm).

### 6.3 Fish meal traps

Fish meal traps helps to collect adults of shoot fly infesting small cardamom. It must be installed during Oct-Nov or towards the end of the monsoon. Six to seven traps are required per acre. Traps are to be cleaned and re-installed once in 45-60 days till May.

## 7. Ecological engineering for pest management

Ecological engineering for pest management has recently emerged as a paradigm shift by considering pest management approaches that rely on the use of cultural techniques to effect habitat manipulation and to enhance biological control. Ecological engineering for pest management is based on informed ecological knowledge rather than high technology approaches such as synthetic pesticides and genetically engineered crops.

### 7.1 Ecological Engineering for Pest Management –

**Below Ground** There is a growing realization that the soil borne, seed and seedling borne diseases can be managed with microbial interventions, besides choosing appropriate plant varieties. The following activities increase the beneficial microbial population and enhance soil fertility

- o Add organic matter in the form of Farm Yard Manure (FYM), vermicompost, crop residue which enhance below ground biodiversity of beneficial microbes and insects.

- o Application of balanced dose of nutrients based on soil test report and INM.

- o Application of biofertilizers with special focus on mycorrhiza and Plant Growth Promoting Rhizobacteria (PGPR).
- o Application of *Trichoderma harzianum* / *T. viride* and *Pseudomonas fluorescens* for treatment of seed / seedling / planting materials in the nurseries and field (if commercial products are used, check for label claim. However, biopesticides produced by farmers for own use in their fields, need not be registered).

### 7.2 Ecological Engineering for Pest Management – Above Ground:

Natural enemies play a very significant role in control of foliar insect pests. Natural enemy diversity contributes significantly to the management of insect pests both below and above ground. Natural enemies may require:

1. Food in the form of pollen and nectar.
2. Shelter, overwintering sites and moderate microclimate, etc.
3. Alternate hosts when primary hosts are not present.

Due to enhancement of biodiversity by the flowering plants, parasitoids and predators (natural enemies) population also will increase due to availability of nectar, pollen and insects etc. The major predators are a wide variety of spiders, ladybird beetles, long horned grasshoppers, Chrysoperla, earwigs etc.

### PEST MANAGEMENT IN SMALL CARDAMOM

Small cardamom is infested by many pests, right from the seedling stage to the cured small cardamom in storage. Nearly 60 species of insect pests infest on small cardamom. Based on severity of infestation, these pests are categorized as major and minor, the former include thrips, panicle/capsule/shoot borer, root grub and root knot nematode and the latter include mid-rib caterpillar,

whitefly, scales, red spider mites, lace wing bugs and aphid.

**Integrated Pest Management (IPM)** is an important method for small cardamom pest management. IPM includes careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment. IPM emphasizes on the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms (FAO). Considering the vulnerable stages

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