

**Indian Farmer**

Volume 10, Issue 05, 2023, Pp. 233-235
 Available online at: www.indianfarmer.net
 ISSN: 2394-1227 (Online)

Original paper

Leaf Blight: A major threat to of large cardamom (*Amomum subulatum* Roxb.) in Sikkim Himalayas

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Received: 10/05/2023

Published: 18/05/2023

Abstract

Large cardamom (*Amomum subulatum* Roxb.), is one of the most important cash crop of Sikkim. The state is the largest producer in the country and accounts for almost the 90 percent of total national production. Almost half of the population in the state is dependent on the cultivation of large cardamom. But now the future of this crop is at stake as it is being damaged severely for more than three decades. Several factors are responsible for the decline of this crop but the infestation of major diseases especially caused by fungus has been considered as one of the most important cause of the problem. Since the disease is widespread in these areas, availability of healthy mother plants for production of healthy planting material is also very difficult.

Introduction

Large cardamom (*Amomum subulatum*) a member of Zingiberaceae family under the order Scitaminae is the most important cash crop in the eastern Himalayan region including Sikkim and the Darjeeling hills in India, the eastern part of Nepal, and southern Bhutan (Sharma et al. 2000). Sikkim is the largest producer of large cardamom in India and second largest in the world, after Nepal. Large cardamom is a perennial, shade-loving crop found at between 600–2,400 MSL. It requires a high level of humidity (>90%) and soil moisture (>70%) and, therefore, grows best in areas with annual rainfall of 2,000–4,000 mm and ambient air temperature of 10–22°C (Sharma 2012; Sharma et al. 2000). The crop does not perform well under direct exposure to sun and is, therefore, cultivated as an understory crop in association with nitrogen fixing Himalayan alder (*Alnus nepalensis*) and other forest tree species that provide shade.

Area and distribution

Large cardamom is one of the most important cash crops grown in sub Himalayan state of Sikkim. Sikkim is the largest producer of large cardamom (3681t) and constitutes the major share of Indian and world market. Among the four districts of Sikkim, East district (1110 t) ranks first in production followed by south district (742 t), west district (736 t) and north district (1093 t) (Anonymous, 2010). In Sikkim during 2011-12 the total area under large cardamom was 15600 hectare with production of 3681 tones and productivity of 235 kg per hectare. Sikkim contributes 88 per cent of the annual production in India. Large cardamom is also found in Darjeeling Hills, Nepal and Bhutan.

Problems in large cardamom cultivation

For the past few years, large cardamom production has gone down due to various factors like lack of quality planting materials, climate change, lack of irrigation facilities, open cultivation, inadequate nutrient management, non adoption of scientific methods of cultivation, diseases and pests etc. the fungal diseases especially blight is considered to be the most destructive one.

Major Fungal Diseases in large cardamom

Blight (*Colletotrichum gloeosporioides*)

Colletotrichum blight has devastated the large cardamom plantation and is the cause of concern for severe crop loss and decline in plant population in the recent past.

Causal organism : Blight is caused by *Colletotrichum gloeosporioides* and its perfect state *Glomerella cingulata*.

Epidemiology: The disease appears generally with the advent of the pre-monsoon showers in April-May and progresses rapidly during the rainy season. However, in some areas the incidence starts during winter months (January-March).

Symptoms: Water-soaked lesions appear either at margins or tips or any other point on the leaves which rapidly enlarge, coalesce and cover major portion or the entire leaf lamina giving a blighted appearance. The advancing lesions are blackish brown in color and margins give a yellow halo. In some cases, the entire lamina becomes yellowish and blighted. The affected area becomes necrotic and dry up. Leaf sheath covering the pseudostem show blackish brown discoloration which extends up to rhizomes and subsequently turn into greyish or blackish patches with brown margins. Gradually the pseudostem becomes brittle and breaks in the middle or at the collar regions. In most cases, the lesions on the pseudostem become necrotic as a result the entire leaves dry out giving a burnt appearance. Later, the pseudostem lodges at the point of necrotic lesion. As a whole, the affected clumps and hence, the entire plantation look dried up. The disease mostly affects the bearing tillers of the clump while the new tillers remain apparently healthy. However, later in the season, in some cases the young emerging leaves of the new tillers in the diseased clump show pale yellow discoloration in the inter-veinal areas. Sometimes the emerging leaves are whitish in colour and droop without opening properly. Slight yellowing and narrowing of emerging leaves are also noticed and in some cases the pseudostem break open longitudinally in the middle and the young leaves emerge through the opening. Examination of the rhizomes of such tillers showed brown lesion with air space in the middle. The spike from the diseased clump exhibit elongated appearance in comparison to the spike from the healthy clump and this is mainly due to lack of fruit setting. However, in other cases, flowering and seed-setting takes place but the seeds do not mature and remains whitish or light brown instead of natural black. Generally the roots are not infected. In the cultivar Varlangey the newly formed tillers in the diseased clump show pale yellowing and rosetting of leaves giving a stunted appearance as compared to the healthy plants.

Collateral hosts: 14 species of plants belonging to various families showed symptoms similar to *Colletotrichum* blight. Some of them are marigold, *Amomum dealbatum* (*Churumpa*), canna, wild colocasia, ornamental basil, *Alnus nepalensis* etc.

Organic management: As far as the state is concerned, the use of any kind of chemicals, pesticides and inorganic fertilizers for the field activities or disease management is strictly prohibited. Therefore the management has to be fully organic. The mature and bearing tillers cut during harvesting must be composted. Even the leaves and residue of spikes must also be composted. During the composting process, temperature increase and most pathogens are killed. Compost pits for the purpose may be made at convenient places in each plantation prior to harvest. Use of EM (Effective Microorganisms) solution or cow dung slurry may be encouraged for easy composting. For the land to be fertile and fruitful the adoption of these composting has to be followed at least for 2-3 years. The tillers which are cut during harvest and other plant debris can also be burnt for safe disposal. However, burning is not permitted under organic norms. As a third alternative, the plant debris generated during harvest can be chopped into small pieces and buried in pits for quick decomposition. Most of the cultivars were found susceptible to the disease under natural conditions. Proper phyto-sanitation by removal and destruction of disease affected plants/plant parts in the plantation and nursery. Pre treatment of suckers with bio- agent *Pseudomonas fluorescens* @ 5 lit in 100 lit water or Copper oxychloride @ 0.3% (*i.e.* 300gm in 100 lit water) at the time of planting in nursery/ field can be done. the collateral host plants such as Marigold, *Amomum dealbatum* (*Churumpa*), Canna, wild Colocasia, ornamental Basil etc has to be destroyed. Regulate shade in thickly shaded areas and also ensure proper shade in open conditions. Application of bio- control agent *Trichoderma* mixed with FYM (1:100) @ 2kg /clump at plant soil basin can also be effective.

Conclusion

It must be kept in mind that high disease pressure exists in the large cardamom ecosystems which has developed over the last few years in the absolute absence of management practices either developed or followed. It is observed that, generally, the bearing and old tillers are cut and spread around the plant base during the harvesting time. Since bearing tillers (old tillers) are the infected ones with plenty of lesions and sporulation all over, they serve as the inoculums in the next season. Hence, the management practices of large cardamom have to be followed in a systematic way. The organic management has to be followed strictly owing to the fact that the state is an organic one.

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