



## Yield loss of large cardamom (*Amomum subulatum* Roxb.) due to *Colletotrichum* blight in Sikkim

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### Abstract

Large cardamom (*Amomum subulatum* Roxb.) is affected by various fungal diseases. Of these, blight caused by *Colletotrichum gloeosporioides* (Penz.) Sacc. (perfect state *Glomerella cingulata* (Stoneman) spaulding & Schrenk) is one of the major production constraints. In order to assess the loss due to *Colletotrichum* blight, yield of affected plants of two cultivars, Varlangey and Sawney was recorded. Yields were also recorded from healthy plants of the same cultivars for comparison. There was 46.8% reduction in the dry yield of infected plants of Varlangey and 34.5% reduction in dry yield of Sawney as compared to healthy plants. The infected plants of Varlangey were found dead in the first year itself causing 100% loss. Lack of maturity of seeds, increased husk weight of fresh capsules and decreased weight of dried capsules were observed in the infected plants.

**Keywords:** *Amomum subulatum*, blight, *Colletotrichum gloeosporioides*, yield loss

Large cardamom (*Amomum subulatum* Roxb.) belonging to the family *Zingiberaceae* is the principal cash crop cultivated in the sub-Himalayan state of Sikkim and in Darjeeling district of West Bengal (Subba 1984; Varadarasan & Biswas 2000). It is also cultivated in parts of Arunachal Pradesh and other North Eastern states. An epiphytotic of blight caused by *Colletotrichum gloeosporioides* (Penz.) Sacc. [perfect state *Glomerella cingulata* (Stoneman) Spauld. & Schrenk] reported to have first appeared in 1999 devastated the crop in Sikkim and Darjeeling (Pun *et al.* 2006; Saju *et al.* 2012

& 2010). However, no authentic records are available to assess the yield loss due to the disease. This paper reports the estimates on the yield loss of the large cardamom due to *Colletotrichum* blight.

Being a perennial spice crop, vegetative propagation using suckers requires three years to start yielding and seedling progenies takes four to five years. Considering the time lag, yield was studied from bearing plants in the research farm of ICRI at Pangthang (2160 m MSL), East Sikkim. Two cultivars *viz.*,

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Varlangey and Sawney planted in the year 2000 were taken for yield loss assessment. The plants were found infected during July 2007 and were marked for yield estimation at the time of harvest in November–December. Representative diseased samples were plated on potato dextrose agar (PDA) to ensure the association of the pathogen in causing blight. Number of spikes, number of capsules, fresh weight (g) of capsules and dry weight (g) of capsules per plant were recorded. Data were also recorded from healthy plants of the same cultivars for comparison. There were three replications with a plot size of six plants / replication for Varlangey and five plants/ replication for Sawney. For studying the seed maturity, 50 fresh capsules randomly collected from healthy and infected Varlangey and Sawney plants were assessed. The apparently matured capsules were split open and the colour and texture of the seeds were noted. The black seeds embedded in slimy and sweet mucilage were regarded as mature. The seeds which are patchy, brownish or whitish were regarded as immature. The number of capsules with mature or immature seeds was noted and percent maturity of capsules calculated. There were three replications for

each set of plants. In another study, to record the fresh capsule characteristics, 20 fresh capsules from each set of plants were examined for number of seeds, fresh seed weight and fresh husk weight. For assessing the dry capsule characteristics, the litre weight and number of capsules 100 g<sup>-1</sup> were determined. The data of each cultivar were analysed separately by *t*-test.

In the cultivar Varlangey, there was 46.8% reduction in the dry yield of infected plants as compared to healthy and the difference was significant. Likewise, in Sawney, reduction in dry yield of infected plants was 34.5% over the healthy plants and the difference was significant (Table 1). The infected Varlangey plants under study were found dead at the time of harvest. This means that no new tillers were formed and the plant did not regenerate in the subsequent season. However, the capsules formed during the study period were harvested and the yield was estimated. In healthy Varlangey plants, 70% of the capsules showed mature seeds. But only 53% of capsules of infected Varlangey possessed mature seeds and the difference was significant. In the case of Sawney, 90% of the capsules collected from healthy plants were with mature seeds as

**Table 1.** Yield and maturity of seeds of healthy and *Colletotrichum* blight infected plants of large cardamom in Sikkim

Parameters	cv Varlangey			cv Sawney		
	Healthy	Infected	<i>t</i> -test	Healthy	Infected	<i>t</i> -test
<b>Yield</b>						
Number of spikes	20	12	S	23	16	S
Number of capsules	139	97	NS	206	159	NS
Fresh weight of capsules (g)	613	391	S	983	640	S
Dry weight of capsules (g)	122	65	S	168	109	S
Reduction in dry yield (%)		46.8			34.5	
<b>Maturity of seeds</b>						
Number of capsules with mature seeds	35	27	S	45	22	NS
Number of capsules with immature seeds	15	23	S	5	28	NS
Capsules with mature seeds (%)	70	53	S	90	43	NS
Capsules with immature seeds (%)	30	46	S	10	56	NS
Reduction in maturity of capsules (%)		23.4			53.5	

Yield loss shown is per plant basis. Estimates on maturity of seeds are made out of 50 capsules. Values representing percent reduction were not analysed and was determined by the formula  $((C-T)/C) \times 100$  where C is the value for control (healthy) and T is the value for treated (infected); S, significant at *t* 5%; NS, non-significant; cv, cultivar.

against 43% from infected plants, however, the difference was not significant (Table 1). There was 13.9% reduction in the number of seeds present in the capsules of the infected Varlangey and 7.2% reduction in the case of infected Sawney. The seed : husk ratio of capsules from healthy Varlangey was 1:2 and that of infected Varlangey was 1:3. The seed: husk ratio of healthy capsules of Sawney was 1: 1.7 and that of infected Sawney was 1: 2.4 and the differences were significant (Table 2). The litre weight of capsules from healthy Varlangey was higher than that of infected Varlangey. The same was the case with Sawney and this indicated weight loss in equal volume as compared with capsules of healthy plants. In healthy Varlangey, 118 capsules weighed 100 g as against 135 capsules from infected Varlangey, however, the difference was not significant. Sawney also recorded the same trend where 108 healthy capsules weighed 100 g as against 130 infected capsules and the difference was significant. This further indicated weight loss in capsules of infected plants (Table 2).

The results indicated the extent of damage and yield loss due to *Colletotrichum* blight affecting large cardamom. In the case of Varlangey, the loss was up to 100% since it had resulted in

death of infected plants in the first year itself. When the plants are infected, the available yield was also affected by lack of maturity of seeds, increased husk weight of fresh capsules and decreased weight of dried capsules. This further reduced the economic gains due to poor acceptance and quality of the produce. Large cardamom being the main cash crop of Sikkim, yield loss to the extent mentioned above has had a significant impact in the rural agricultural economy and livelihood of the farming community.

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### References

- Pun K B, Deka T N & Biswas A K 2006 Leaf and sheath blight – an epidemic devastating the large cardamom plantations in Sikkim and Darjeeling hills of India. In: Souvenir & Abstracts, 58<sup>th</sup> Annual Meeting of Indian Phytopathological Society and National Symposium on Emerging Plant Diseases, their Diagnosis and Management, January 31–February 2, 2006, Siliguri (p.30). Department of Botany, North Bengal University, Siliguri.

**Table 2.** Fresh and dry capsule characteristics of healthy and *Colletotrichum* blight infected plants of large cardamom in Sikkim

Parameters	cv Varlangey			cv Sawney		
	Healthy	Infected	<i>t</i> -test	Healthy	Infected	<i>t</i> -test
Fresh capsule characteristics						
No. of seeds/ capsule	44	38	NS	44	41	NS
Reduction in no. of seeds/ capsule (%)		13.9			7.2	
F W of seeds from 20 capsules (g)	30	26	NS	56	36	S
F W of husk from 20 capsules (g)	60	77	S	96	84	NS
Seed husk ratio	1:2	1:3	S	1:1.7	1:2.4	S
Dry capsule characteristics						
Litre weight (g)	314	288	NS	231	211	NS
Reduction in litre weight (%)		8			8.2	
No. of capsules 100 g <sup>-1</sup>	118	135	NS	108	130	S

Estimates on fresh capsule characteristics are made out of 20 capsules. Values representing percent reduction were not analysed and was determined by the formula  $((C-T)/C) \times 100$  where C is the value for control (healthy) and T is the value for treated (infected); NS, non-significant at *t* 5%; cv, cultivar; FW Fresh Weight.

- Saju K A, Deka T N, Gupta U, Biswas A K, Sudharshan M R, Vijayan A K & Thomas J 2013 Identity of *Colletotrichum* infections in large cardamom (*Amomum subulatum* Roxb.). *J. Spices Arom. Crops* 22: 101–103.
- Saju K A, Deka T N, Gupta U, Biswas A K, Vijayan A K, Thomas J & Sudharshan M R 2010 An epiphytotic of *Colletotrichum* blight affecting large cardamom in Sikkim and Darjeeling. *J. Hill Res.* 23: 14–21.
- Subba J R 1984 Agriculture in the hills of Sikkim. Sikkim Science Society, Gangtok.
- Varadarasan S and Biswas A K 2000 Large cardamom (*Amomum subulatum* Roxb.). In: Ravindran P N & Madhusoodanan K J (Eds.), *Cardamom: The genus Elettaria* (pp.291–329), Taylor and Francis, London.