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Yield loss of large cardamom due to *Colletotrichum* blight in Sikkim

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Large cardamom (*Amomum subulatum* Roxb.) is affected by various viral and fungal diseases of which blight caused by *Colletotrichum gloeosporioides* Penz, (perfect state, *Glomerella cingulata* (Stonem.) Spauld. & Schrenk.) is one of the major production constraints. In order to assess the loss due to *Colletotrichum* blight, yield was studied among existing bearing plants of two cultivars, Varlangey and Sawney which were found infected during July, 2007. Data were also recorded from healthy plants of the same cultivar groups for comparison. There was 46.8% reduction in the dry yield of infected plants of Varlangey and 34.5% reduction in the dry yield of Sawney as compared to healthy. The plants of infected Varlangey under study were found dead in the first year itself, thus the loss amounts to 100%. In addition, among the infected plants, the available produce showed 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. The above data on loss of yield indicated the extent of damage due to *Colletotrichum* blight and consequent monetary loss due to it.

Key words : *Amomum subulatum,* blight, *Colletotrichum gloeosporioides,* large cardamom, yield loos

INTRODUCTION

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 and Biswas, 2000). It is also cultivated in parts of Arunachal Pradesh and other North Eastern states. The dried fruit called as capsule is used as spice for flavouring vegetables, meat preparations, confectionery, hot or sweet pickles and beverages. A devastating epiphytotic of blight caused by *Colletotrichum gloeosporioides* Penz. (perfect state *Glomerella cingulata* (Stonem) Spould & Schrank. (ICRI, 2007; 2008) has been first reported in 1999 (Pun *et al.*, 2006) causing concern to the large cardamom industry. The disease along with various socio-economic reasons results in severe crop loss leading to sharp decline in production and render the cultivation uneconomical. However, no authentic records are available to assess the yield loss due to the disease. Yield loss data indicate the extent of damage to the crop and consequent monetary loss due to it. This paper reports the estimates on the yield loss of the large cardamom capsules due to *Colletotrichum* blight.

MATERIALS AND METHODS

Being a perennial spice crop, vegetative propagation using suckers requires three years to start yielding and seedling progenies required four years. Considering the time lag, yield was studied from existing bearing plants in the research farm of the Indian Cardamom Research Institute at Pangthang, East Sikkim. Two cultivars viz., Varlangey and Sawney planted in 2000 were taken for the yield loss assessment. The plants were found infected during July 2007 and were marked for yield estimation at the time of harvesting in

November-December. Representative diseased sample from experimental area was plated on potato dextrose agar (PDA) and the mycelial growth of *Colletotrichum gloeosporioides* was obtained which ensured 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 cultivar groups for comparison. There were three replications with a plot size of 6 plants / replication for cvs. Varlangey and 5 plants / replication for Sawney. For studying the seed maturity, fifty fresh capsules randomly collected from healthy and infected cvs. Varlangey and Sawney plants were assessed for its seed maturity. The apparently matured capsules were split open and the colour and texture of the seeds present were noted. The black seeds embedded in slimy and sweet mucilage were regarded as matured. The seeds which were patchy, brownish or whitish were regarded as immature. The number of capsules with mature or immature seeds was noted and per cent maturity of capsules was calculated. There were three replications for each set of plants. In another study to record the fresh capsule characteristics, twenty fresh capsules from each set of plants were examined for number of seeds, fresh seed weight and fresh husk weight. The capsules were dried in ICRI improved bhatti (Deka *et al.*, 2003). For assessing the dry capsule characteristics, the weight and number of capsules per 100 g were determined. The data of each cultivar were analysed separately by *t*-test.

RESULTS AND DISCUSSION

In the cultivar Varlangey, there was 46.8% reduction in the dry yield of infected plants as compared to healthy ones and the difference was

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

Parameters	cv Varlangey			cv Sawney		
	Healthy	Infected	*t*-test	Healthy	Infected	*t*-test
Yield						
Number of spikes	20 (12-35)	12 (10-13)	S	23 (21-24)	16 (14-18)	NS
Number of capsules	139 (90-229)	97 (74-137)	NS	206 (187-224)	159 (102-107)	NS
Fresh weight of capsules (g)	613 (380-1025)	391 (345-428)	S	983 (916-1070)	640 (410-822)	NS
Dry weight of capsules (g)	122 (73-210)	65 (52-75)	S	168 (148-188)	109 (72-130)	NS
% reduction in dry yield		46.8			34.5	
Maturity of seeds						
Number of capsules with mature seeds	35 (33-37)	27 (22-30)	NS	45 (43-48)	22 (3-45)	S
Number of capsules with immature seeds	15 (13-17)	23 (20-28)	NS	5 (2-7)	28 (5-47)	S
% of capsules with mature seeds	70 (66-74)	53 (44-60)	NS	90 (86-96)	43 (6-90)	S
% of capsules with immature seeds	30 (26-34)	46 (40-56)	NS	10 (4-14)	56 (10-94)	S
% 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. Figures in parenthesis indicate range. Values representing per cent reduction were not analysed and was determined by the formula ((C-T)/C) x 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.

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

Parameters	cv Varlangey			cv Sawney		
	Healthy	Infected	*t*-test	Healthy	Infected	*t*-test
Fresh capsule characteristics						
No. of seeds / capsule	44 (37-48)	38 (34-40)	NS	44 (42-47)	41 (35-47)	NS
% reduction in No. of seeds / capsule		13.9			7.2	
Fresh weight (g) of seeds from 20 capsules	30 (25-35)	26 (22-30)	NS	56 (54-58)	36 (28-47)	NS
Fresh weight (g) of husk From 20 capsules	60 (55-65)	77 (70-80)	NS	96 (86-104)	84 (61-98)	NS
Seed husk ratio	1:2 (1:1.8-1:2.4)	1:3 (1:2.7-1:3.2)	NS	1:1.7 (1:1.6-1:1.8)	1:2.4 (1:2.1-1:2.8)	NS
Dry capsule characteristics						
Litre weight (g)	314 (310-320)	288 (260-310)	NS	231 (220-249)	211 (209-214)	NS
% reduction in litre weight (g)		8			8.2	
No. of capsules / 100 g	118 (111-124)	135 (117-165)	NS	108 (105-112)	130 (125-136)	NS

Estimates on fresh capsule characteristics are made out of 20 capsules. Figures in parenthesis indicate range. Values representing per cent reduction were not analysed and was determined by the formula ((C-T)/C) x 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.

significant. In cv. Sawney, per cent reduction in dry yield of infected plants was 34.5 over the healthy even though the difference was not significant (Table 1). The infected cv. Varlangey plants under study were found dead at the time of harvest. In healthy cv. Varlangey plants, 70% of the capsules showed matured seeds. But only 53% of capsules of infected cv. Varlangey possessed matured seeds. However, the difference was not significant. In the case of cv. Sawney, 90% of the capsules collected from healthy plants were with matured seeds as against only 43% maturity of capsules from infected plants and the difference was significant (Table 1). There was 13.9% reduction in the number of seeds present in the capsules of the infected cv. Varlangey and there was 7.2% reduction in the case of infected cv. Sawney. The seed husk ratio of capsules from healthy cv. Varlangey is 1:2 and that of infected cv. Varlangey is 1:3. The seed husk ratio of healthy capsules of cv. Sawney is 1: 1.7 and that of infected cv. Sawney is 1: 2.4 even though the differences were not significant (Table 2). The litre weight of capsules from healthy cv. Varlangey was higher than that of infected cv. Varlangey. The same was the case with cv. Sawney and this indicated the weight loss in equal volume as compared with capsules of healthy plants. In healthy cv. Varlangey, 118 capsules weighed 100 g as against 135 capsules from infected cv. Varlangey. In Sawney the same trend was recorded where 108 capsules of healthy cv. Sawney weighed 100 g as against 130 capsules of infected cv. Sawney. However, the differences were not significant (Table 2).

The results indicate the extent of damage and yield loss due to *Colletotrichum* blight affecting large cardamom. In the case of cv, Varlangey, the yield loss was almost 100% since it had resulted in death of infected plants in the first year itself. When the plants are infected, the available yield also affected by lack of maturity of seeds, increased husk weight of fresh capsules and decreased weight of dried capsules etc. This further reduces 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 tune of more or less mentioned above had a significant impact in the rural agricultural economy and livelihood of the farming community in the recent past. Considering the organic status of Sikkim state and existing minimum cultivation practices the above yield loss appraisal points to eco-friendly disease management strategies that could be strengthened and hastened up.

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