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Studies on impact of seasonal and environmental factors on incidence of shoot and capsule borer in cardamom varieties M-1 and M-2

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Abstract

Cardamom shoot and capsule borer, *Conogethes punctiferalis* Guenee (Lepidoptera: Crambidae) is considered to be an important pest causing damage to the cardamom suckers as well as capsules. During the present investigation, peak incidence of *C. punctiferalis*, on the cardamom crop during April- May and October- November in both M1 & M2 varieties. The per cent infestation of shoot was more than 10% from Feb- June with a peak of 30.25% and 31.50% during II fortnight of May on both the varieties. Whereas on capsules, the incidence was observed during August- November with a peak of 20.00% and 21.70% during II fortnight of November on M1 & M2 varieties. Studies on the influence of weather factors on the infestation on shoot borer revealed that, shoot borer population had a positive and significant correlation between maximum temperature on the shoot damage, while had significant correlation with relative humidity and rainfall for capsule damage on M1 & M2 varieties respectively.

Keywords: incidence, shoot and capsule borer, cardamom

Introduction

Small cardamom (*Elettaria cardamomum* Maton) is popularly called as "Queen of spices". The crop belongs to the Zingiberaceae family. It is native to India and Srilanka. It occupies a unique position in the International Spice Market since ancient times. The crop is cultivated in South Indian states viz., Kerala, Karnataka and Tamilnadu, which represents the true Western Ghats situation. South India and parts of Islands of Srilanka are believed to be the place of origin of cardamom (Anonymous, 1952; Abraham, 1965) ^[1, 2]. In India the total area of cardamom in Western Ghats is estimated to be around 86000 ha. The major cardamom producing states in India are Kerala, Karnataka and Tamil Nadu. Kerala ranks first with a production of 7935mt followed by Karnataka and Tamilnadu with production of 1710mt and 735mt, respectively (Anonymous, 2010) ^[3].

Among the various factors affecting the yield and quality of cardamom capsules, damage caused by insect pests is considered as a major constraint for its successful cultivation and pose greater threat to cardamom production in Karnataka. Out of insect pests recorded on cardamom, shoot and capsule borer, *Conogethes punctiferalis* Guenee (Lepidoptera: Crambidae) is considered to be an important pest causing damage to the cardamom suckers as well as capsules. The estimated loss may up to 35-40% (Anonymous, 2010) ^[3]. The changing environmental conditions increase the activity of borers soon after the emergence and reaches peak during flower set and tender capsule formation and cause heavy crop loss (Anonymous, 2010) ^[3] and (Thyagaraj, 2003) ^[12]. Therefore, the present investigation on seasonal incidence and weather impact on incidence of cardamom shoot and capsule borer was carried out at hill zone of Karnataka.

Materials and Methods

The study site is located in the Agro-climatic region-VI of Zone -9. This region is popularly known as Malnad or hilly region of Karnataka state with rolling mountains and deep valleys. It is located at an altitude of 915 m (3001 feet), latitude of 13.08o N latitude and 75.63 oE longitude. The place receives normal annual rainfall ranging from 900 mm to 3700 mm (avg. 2400 mm) mostly of it is received from June to August (104 rainy days). The average maximum temperature is 30 °C (April) and minimum temperature is 14 °C (January), the relative humidity ranges between 50 and 80 per cent.

Seasonal incidence of cardamom shoot and capsule borer (*C. punctiferalis*)

In order to study the seasonal incidence of *C. punctiferalis*, observations were recorded in cardamom plantation except plant protection measures all agronomic practices were followed as per the package of practices (Plate 1). Twenty five cardamom plants were selected randomly in the variety, (M-1) & (M-2) to record the incidence *C. punctiferalis*. Observations were recorded at fortnightly interval. The incidence of cardamom shoot and capsule borer population was estimated by counting the number of shoots with dead hearts and capsules damaged by larva on tagged plants. The extent of infestation is expressed in terms of per cent shoot/capsules infested.

$$\text{Per cent shots/capsules infested} = \frac{\text{Total no. of infected shoots or capsules}}{\text{Total no. of shoots or capsules}} \times 100$$

Relationship between cardamom shoot and capsule borer and weather parameters

The meteorological data was collected from observatory in ZAHRS, Mudigere. The correlation was worked out to understand the relationship between various weather parameters with the incidence of cardamom shoot and capsule borer.

Statistical analysis

The experimental data recorded on various parameters during the investigation were analyzed statistically by adopting Fischer's method of analysis of variance as outlined by Gomez and Gomez (1976) [13]. The interpretation of data was done by using the critical difference value calculated at 0.05 probability level. The level of significance was expressed at 0.05 probability. The transformation of data was done as given by Gomez and Gomez (1976) [13]. Simple correlation of the data was obtained using Microsoft Office Excel.

Results and Discussion

The larva of all stages of *C. punctiferalis* were found boring into tender shoots and tender capsules fed on the contents of the shoots and capsules and remained inside. Neonites bored unopened leaf buds and fed on leaf tissues, they also bored the panicles leading to drying up of the portion from the affected spot. Because of feeding on the young seeds of immature capsules, the capsules became empty. Late stage larvae bored into pseudostem was observed. It fed on central core of the stem, resulting in drying of terminal leaf and produced characteristic 'dead heart' symptom. The caterpillar was light brown to pale white with brown head. Presence of larva inside the plant parts could be easily identified by frass material at the point of tunnelling.

Observation revealed that shoot and capsule borer occurred throughout the year, but their peak populations varied from season to season. The pest incidence *C. punctiferalis* on cardamom was observed throughout the year on variety M1 and M2. The pest incidence ranged from 2 to 30.25% on shoots 1.60 to 20% on capsules. Two peak population was observed in a year i.e., April-June ranging from 25.25 to 30.25 & Sep- Nov infesting population ranging from 14.50 to

20% was boring into the stem (Table 1). Similarly on variety M2 the pest incidence ranging from 3 to 31.50% on shoots, 2.25 to 21.70% on capsules. The peak population was observed on two peaks ranging from 26.50 to 31.50% on shoots & Sep - Nov ranging from 17.50 to 21.70% on capsules (Table 2). There was no significant difference between per cent infestation of *C. punctiferalis* on both the varieties. Infestation of capsules was observed from May till November in both the varieties, and the peak per cent infestation was in second fortnight of November (Table 1 & 2). Similarly, Ballard (1927) [4] reported that a seasonal change affects the insect population and appearance on crops in Papua New.

There was a positive and significant correlation found between maximum temperature with shoot infestation ($r = 0.421$ and $r = 0.482$ on M1 & M2 varieties, respectively), minimum temperatures with capsules ($r = 0.448$ and $r = 0.457$ on M1 & M2 varieties, respectively), maximum relative humidity on capsules ($r = 0.438$ and $r = 0.459$ on M1 & M2 varieties, respectively) and also with minimum relative humidity on capsules ($r = 0.438$ and $r = 0.479$ on M1 & M2 varieties, respectively). There was no influence of rain fall on the incidence of cardamom shoot and capsule borer (Table 3). The incidence of borer showed significant positive correlation with maximum temperature, while the relative humidity & rainfall had a negative correlation both in cardamom varieties M1 & M2. Whereas, the capsule damage had a significant correlation with the both maximum and minimum relative humidity, rainfall and had a negative correlation with the maximum temperature (Table 3). However, Virender Kaul Kesar (2003) [5] reported that, the abiotic factors such as maximum temperature, minimum temperature, Relative humidity and rainfall were correlated with borer infestation. Ganesh (2011) [6] reported that castor shoot and capsule borer population had significant negative relationship with maximum temperature of the same fortnight, and significant positive correlation with morning and evening relative humidity prior to one fortnight. But no significant relationship was found with any weather parameters prior to two fortnights before.

In the present study the larval density was maximum during November first week and minimum during January 2nd week. The results are in the agreement with Patel and Gangrade (1971) [7], who reported the presence of larvae of *C. punctiferalis* in the cardamom field until May. Similar observations were recorded by Bilapate and Talati (1977) [8]. While, Ram *et al.* (1997) [9] observed *C. punctiferalis* infesting grapes during December to January. Patel *et al.* (1988) [10] reported that, *C. punctiferalis* to be potential pest of turmeric at second fortnight of September. Kang *et al.* (2004) [11] reported overwintered generations of *Conogethes* emerged from May 20 to June 28. All these variation from the present study may be due to change in host and weather parameters.

The shift of borer from shoot to capsule was observed during later stages of the crop. This may be due to ageing of shoots which becomes more harder & not congenial for shoot borer, but the capsules will be in small fruit stage which is more preferential hence damage is observed on capsules at later age of crop, Capsule is a preferred host for *Conogethes punctiferalis*.

Table 1: Per cent infestation by *Conogethes punctiferalis* L. Guenee on M1 variety of cardamom

Month	Fortnight	Per cent infestation (%)	
		Shoot	Capsule
January	I	03.00	00.00
	II	04.25	00.00
February	I	12.00	00.00
	II	13.50	00.00
March	I	14.70	00.00
	II	20.50	00.00
April	I	25.25	00.00
	II	26.50	00.00
May	I	28.00	01.60
	II	30.25	02.50
June	I	13.00	04.00
	II	12.50	05.25
July	I	06.70	06.50
	II	06.25	07.50
August	I	07.00	12.75
	II	08.50	13.00
September	I	09.00	14.50
	II	08.25	15.30
October	I	04.00	16.00
	II	03.00	17.00
November	I	03.50	19.50
	II	03.00	20.00
December	I	02.60	00.00
	II	02.00	00.00

Table 2: Per cent infestation by *Conogethes punctiferalis* L. Guenee on M-2 variety of cardamom

Month	Fortnight	Per cent infestation (%)	
		Shoot	Capsule
January	I	04.00	00.00
	II	04.50	00.00
February	I	13.50	00.00
	II	14.50	00.00
March	I	15.90	00.00
	II	21.00	00.00
April	I	26.50	00.00
	II	28.00	00.00
May	I	29.00	02.25
	II	31.50	04.50
June	I	15.50	04.50
	II	14.75	06.60
July	I	12.50	07.50
	II	12.00	07.90
August	I	09.50	15.25
	II	10.00	15.75
September	I	09.00	17.50
	II	08.25	17.90
October	I	05.25	18.50
	II	05.00	19.00
November	I	04.90	21.00
	II	04.50	21.70
December	I	03.75	00.00
	II	03.00	00.00

Table 3: Relation between *Conogethes punctiferalis* L. Guenee incidence and weather parameters

Weather data / Varieties	Temperature (°C)		Relative humidity (%)		Rain fall (mm)	
	Maximum	Minimum	Maximum	Minimum		
M1	Shoot	0.421*	0.237	0.054	-0.176	-0.165
	Capsule	-0.328	0.448*	0.438*	0.438*	0.336
M2	Shoot	0.482*	0.252	0.115	-0.117	-0.057
	Capsule	-0.340	0.457*	0.459*	0.479*	0.342

N = 24

*Significant at 5 % level $r = 0.404$ **References**

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