Assessment of cashew varieties against apple and nut borer, *Thylocoptila paurosema* (Phycitidae: Lepidoptera)

Abstract

Cashew is influenced by many of the pest out of which cashew apple and nut borer is one of the most important pest which causes economic losses, by considering the importance of this pest a field experiment was conducted at college of Horticulture, Mudigere during the year 2022. Field screening was assessed with cashew varieties to find out the less preferred variety with possible biochemical constituent against incidence of apple and nut borer in a complete randomised block design. Results revealed that, the mean incidence of apple and nut borer showed the least per cent damage in cultivar Priyanka (20.00 %), followed by VRI 3 (20.75 %) and Dhanashree (21.52 %) and highest infestation was recorded in cultivar Sulabha with 43.05 per cent damage during fruiting stage of cashew which was found highly susceptible. Relationship between cashew apple and nut borer with biochemical constituents showed negatively correlated with vitamin C (0.39) and tannin (0.23) with significant impact on pest damage. The Cashew apple and nut borer pest confined to the fruit and nut bearing stage of the crop with a peak incidence during summer season. None of the varieties screened were found resistant to apple and nut borer damage to some extent variety Priyanka is less preferred, while vitamin c and tannin content in fruits showed tolerance to some extent of damage.

Keywords: Apple and nut borer, cashew, varietal screening, tannin, vitamin C

1. Introduction

Cashew (*Anacardium occidentale* L) belongs to the family Anacardiaceae, considered to be a native of Eastern Brazil and it was introduced into India by the Portuguese during the 16th Century. The cashew is a poor man's crop but a rich man's food. It is a source of income and livelihood for poor farmers. However, India produces only about 7 lakh tonnes of raw nuts required by processing industries which comes to 50 per cent of the requirement, with very low return mainly due to damage caused by insect pest. Successful cashew cultivation depends on the selection of the best varieties suited for

the agro-climatic condition and adoption of an improved package of practices recommended for the region. The cashew research stations in India have developed various cashew varieties suitable for growing in different agro-climatic areas of our country. So far, 40 cashew varieties released in India, of which 13 are hybrids and 27 are selections (Bhat *et al.,* 2010). Cashew is damaged by more than 60 insect pests as recorded by Pillai *et al* (1976). While Rai (1984) reported that cashew is infested by more than fifty-eight species of insect pests. However, when extent of damage and intensity of pest infestation taken in to consideration, cashew tea mosquito bug, cashew stem and root borer, flower thrips are the major pest of cashew (Raviraja Shetty, 2023). Basu choudari (1962) reported that *A. syngramma* alone was capable of damaging 75 to 85 per cent leaf damage. While *N. eugraphella* reported to cause 25 to 60 per cent damage (Dharmaraju,1975; Chavan 2024; Nagaraj 2023). The cashew apple and nut borer were considered being a pest of minor significance in the past and hence the earlier research workers have paid not much attention. But now a days it causes more damage to cashew. In view of seriousness of infestation of cashew apple and nut borer in all cashew growing areas of the India. Looking at the emerging insect pest problems in cashew the present study was conducted with below objectives

- Screening of cashew varieties against apple and nut borer
- Correlation of biochemical constituents against apple and nut borer

2. Materials and Methods

2.1 Study area

Cashew varieties used for field screening against cashew apple and nut borer was located at cashew plantation of College of Horticulture, Mudigere. Mudigere lies in zone-9 at an altitude of 982 MSL.

2.2 Experiment details

A total of twelve cashew varieties *viz*., Kanaka, Priyanka, Sulabha, Vengurla 4, dhanashree, Amrutha, Orchard, Itchapur, Ullal 2, VRI 3, Vengurla 7 and Ulla 4 were screened against the pests. A total of 13 trees were present in each variety, 5 trees were tagged randomly in each variety and observations were recorded in all the four directions

of the tree at fort night interval. Observations were recorded on Number of flowering laterals per meter square, Total number of nuts per meter square and Per cent apple and nut damaged by placing a frame of 1.0 square meter area on tree canopy in four sides *viz.* East, West, North, South.

Biochemical basis of resistance against cashew apple and nut borer studied on different biochemical parameters like tannin, acidity and vitamin C were analysed and correlated with respect to pest infestation.

$$\text{Per cent apple damaged} = \frac{\text{Number of infested apples and nuts}}{\text{Total number of apples and nuts}} \times 100$$

2.3 Statistical analysis

The data recorded from each variety in the present investigation for various parameters such as number of cashew apple and nut borers per tree, per cent apple and nut damage were subjected to analysis of variance (ANOVA) with appropriate statistical methods like critical difference, coefficient of variance.

3 RESULTS AND DISCUSSION

3.1 Damage of Apple and nut borer

It is pertinent to mention that the cultivars had different degree of resistance to cashew apple and nut borer attack and the results shown during summer 2021 were significant.

Overall damage of cashew apple and nut borer during summer 2021 at College of Horticulture, Mudigere showed all the varieties were susceptible, and found per cent damage of nuts ranging from 20.00 to maximum of 43.05 per cent. The total number of nuts per tree in entries ranged from 7.78 to 12.98 nuts/m^2 of which the damaged nuts ranged from 1.96 to 3.35 nuts per square meter. There was a significant difference among treatment in infestation of pest cashew apple and nut borer (Table 1).

The maximum infestation was observed in entry Sulabha with 43.05 percent damage and was found more susceptible to the pest. The entry Priyanka found to be least damage with 20.00 percent followed by VRI 3 with 20.75 percent nut damage. The varieties Amrutha, Dhanashree,

itchapur ullal 2, were on par with each other *i.e.* 21.38, 21.52, 21.72 and 21.72 percent damage, respectively. While the entries vengurla 7, kanaka, ullal 4, vengurla 4 showed infestation ranging with 23.42, 24.08, 24.91 and 25.80 percent, respectively.

The results revealed that, overall damage of cashew apple and nut borer during summer 2021 were significantly differed among varieties. The varieties recorded the per cent damage of nuts ranging from 20.00 to maximum of 43.05 per cent. The total number of nuts per tree in varieties ranged from 7.78 to 12.98 nuts per m^2 of which the damaged nuts ranged from 1.96 to 3.35 nuts per square meter. There was a significant difference among varieties on infestation of pest cashew apple and nut borer (Table 1).

None of the varieties found promising against apple and nut borer damage, the least per cent damage was found in Priyanka (20.00 %), followed by VRI 3 (20.75 %) and Dhanashree (21.52 %) and highest infestation was recorded in Sulabha with 43.05 per cent damage. The lowest infestation in the above said cultivars may be due to antibiosis effect induced by biochemical factors. The degree of infestation of cashew apple and nut borer was found to be varying among the varieties. This trend observed in the infestation could be due to the varietal distinctions and natural ability. The results were in findings with Navik *et al.* (2019) who found out the infestation level of apple and nut borer was varied among the 40 different cultivars and seasons. Among the varieties, Bapatla 3/33 had least (4.50 %) infestation and higher infestation was observed in Vengurla 6 (20.50 %) at fruiting stage, the trends in the observed infestation were varied due to natural incidence of pest during the respective years.

3.2 *Biochemical basis of resistance.*

Biochemical analysis of different parameters like Vitamin C, Titratable acidity and Tannin were studied across varieties and presented in table 2.

Vitamin C(mg/100g)

The biochemical constituent vitamin C analyzed in cashew apple varieties ranged from 79.98 mg to 179.23 mg per 100g. The variety sulabha recorded least content of vitamin C in fruits of cashew and highest content was obtained in variety Amrutha which was on par with itchapur and orchard which recorded maximum vitamin C content of 179.23, 172.80 and 166.83 mg, respectively. These

varieties were followed by Kanaka, Dhanashree, Priyanka which recorded next best with vitamin c content 152.31, 150.13, and 141.22 mg respectively. Whereas varieties ullal 2, VRI 3, vengurla 7, Vegurla 4 and ullal 4 had vitamin C of 137, 126.49 , 109.14, 108.64 and 85.77 respectively.

Titratable acidity (percent)

Titratable acidity analyzed in cashew apple across varieties ranged from 0.20 per cent to 0.46 per cent. The variety vengurla 4 recorded least per cent of Titratable acidity 0.20 in fruits of cashew and highest content was obtained in variety orchard recorded maximum titratable content 0.46 per cent. These varieties were followed by ullal 2, VRI 3, priyanka and itchapur recorded next best with titrable acidity content 0.38, 0.35, 0.35 and 0.28 per cent respectively and on par with each other, while varieties ullal 4, itchapur, , kanaka and dhanashree recorded 0.30, 0.28, 0.27and 0.25 per cent respectively and was found significant.

Tannin(mg/100g)

Tannin analyzed in fruits of cashew varieties ranged from 0.34 mg to 0.59 mg. The variety sulabha recorded least mg of tannin in fruits of cashew 0.34 mg and highest content was obtained in variety Priyanka 0.59 mg followed by Amrutha with 0.57 mg. The varieties ullal 4, ullal 2, vengurla 4 and Dhanashree recorded next best with tannin content 0.50, 0.49, 0.47 and 0.46 mg respectively varieties Itchapur, VRI 3 and kanaka recorded 0.41, 0.41and 0.40 mg tannin respectively.

3.3 Relationship between cashew apple and nut borer infestation with Bio chemical parameters

12 varieties of cashew were screened for biochemical parameters, *viz* Vitamin C, Titratable acidity and Tannin were correlated with infestation recorded across months during 2021. The result showed that, infestation of cashew apple and nut borer was found to be negatively correlated with vitamin C (0.39) and tannin (0.23) with significant impact on pest damage. It was observed that co-efficent of determination (R^2= 0.35, 0.36 and 0.095 respectively**).**

The biochemical constituent also varied significantly in varieties with parameters like vitamin C analysed in cashew apple varieties ranged from 79.98 mg to 179.23 mg

per 100g. While, titratable acidity in cashew apple across varieties ranged from 0.20 to 0.46 per cent and the tannin content ranged from 0.34 mg to 0.59 mg/100 g (Table 2). Relationship between cashew apple and nut borer with biochemical parameters showed that, infestation of cashew apple and nut borer was found to be negatively correlated with vitamin C (0.39) and tannin (0.23) with significant impact on pest damage. It was observed that co-efficient of determination (R^2= 0.35, 0.36 and 0.095, respectively) (Table 3). The findings with respect to relationship of vitamin C and cashew apple and nut borer are in line with Wang *et al*. (2014). Were high concentrations of ascorbic acid had negative effects on neonate survival and pupation rate of *Cnaphalocrocis medinalis* (Lepidoptera: Crambidae). Similarly, Goggin *et al.* (2010) confirmed that Ascorbate will act as a synergist for defensive secondary metabolites. Further, they emphasized that, Ascorbate can also influence the efficacy of plant defenses such as myrosinases and tannins, and alter insects' susceptibility to natural enemies. The findings with respect to relationship of tannin and cashew apple and nut borer are in agreement Barbehenn and Constable (2011) reported that, with condensed tannin had a substantial negative effect on normal growth and development and survival of herbivores.

4. CONCLUSION

In the present study, the infestation level of apple and nut borer was varied among the cultivars. The trends in the infestation was varied due to natural incidence of pest during the respective years. Under west coast condition, the variation in apple and nut borer infestation was reported for the forty accession line of cashew in field screening for the tolerant or resistant types of lines (Anonymous, 2016). The cultivars used in the field screening against apple and nut borer showed a varied degree of damage during respective season. However, based on the result, none of cultivars were free pests infestation under different conditions.

Cashew apple and nut borer pest confined to the fruit and nut bearing stage of the crop with a peak incidence during summer season. None of the varieties found resistant to apple and nut borer damage, while vitamin c and tannin content in fruits showed tolerance to some extent of damage.

Table 1. I**ncidence of cashew apple and nut borer in some promising cashew varieties screened during 2021**

Sl. No	Varieties	Average number of nut damage/M² (March-May)		
		Total nuts	Damaged nuts	Per cent damage
1	Kanaka	9.34[b]	2.25 [ab]	24.08
2	Priyanka	9.80[bc]	1.96 [a]	20.00
3	Sulabha	7.78 [a]	3.35 [de]	43.05
4	Vengurla 4	9.57 [b]	2.47 [abcd]	25.80
5	Dhanashree	12.17 [d]	2.62 [abcd]	21.52
6	Amrutha	12.53 [d]	2.68 [cd]	21.38
7	Orchard	12.08 [d]	3.06 [d]	25.33
8	Ichapur	11.14 [cd]	2.42 [abcd]	21.72
9	Ullal 2	12.98 [e]	2.82 [cd]	21.72
10	VRI 3	11.42 [d]	2.37 [abc]	20.75
11	Vengurla 7	11.40 [d]	2.67 [abcd]	23.42
12	Ullal 4	11.40 [d]	2.84 [cd]	24.91
S.Em±		**0.49**	**0.23**	-
CD @ 5%		**1.49**	**0.71**	-
CV%		**5.92**	**16.08**	-

Table 2. Biochemical parameters in different varieties of cashew.

Sl. No	Varieties	Biochemical parameters		
		Vitamin C (mg/100g)	Titrable acidty (%)	Tannin (mg/100g)
1	Kanaka	152.31 [ef]	0.27 [bc]	0.40 [bc]
2	Priyanka	141.22 [de]	0.35 [e]	0.59 [e]
3	Sulabha	79.98 [a]	0.25 [b]	0.34 [a]
4	Vengurla 4	108.64 [b]	0.20 [a]	0.47 [d]
5	Dhanashree	150.13 [de]	0.25 [b]	0.46[d]
6	Amrutha	179.23 [fg]	0.35 [e]	0.57 [e]
7	Orchard	166.83 f	0.46 [g]	0.38 [b]
8	Ichapur	172.80 [fg]	0.28 [bcd]	0.41 [bc]
9	Ullal 2	137.00 [cd]	0.38 [ef]	0.49 [d]
10	VRI 3	126.49[c]	0.35[e]	0.41 [bc]
11	Vengurla 7	109.14 [b]	0.28 [bcd]	0.46 [d]
12	Ullal 4	85.77[a]	0.30[d]	0.50[d]
S.Em±		**5.21**	**0.01**	**0.01**
CD @ 5%		**14.86**	**0.03**	**0.04**
CV%		**6.73**	**6.68**	**6.53**

Table 3. Relationship between biochemical parameters with cashew apple and nut borer

Sl. No	Biochemical parameters	Correlation (r value)	R^2 value
1.	Vitamin C	-0.39*	0.35
2.	Tannin	-0.23*	0.36
3.	Titratable acidity	0.11*	0.09

Note : R - 12

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