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SEASONALITY AND SAMPLING OF THE MANGO SHOOT BORER, *Chlumetia transversa* Walker (LEPIDOPTERA : NOCTUIDAE)

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ABSTRACT : Field observation on *C. transversa* showed that the peak percent infestation was in September, 1996 (22.26%) and in November, 1997 (47.17%). Correlation analysis showed that there was a very significant correlation between percentage infestation of lower and upper canopies. Both lower and upper canopies were again significantly correlated to total infestation. A linear and a polynomial models were worked to estimate total infestation based on lower canopy sampling. A third order polynomial model was worked out to predict infestation, using mean RH as a variable, with a reliability of 53%.

Key Words : *Chlumetia transversa,* mango, sampling, seasonality.

INTRODUCTION

The mango shoot borer, *Chlumetia transversa* Walker (Lepidoptera : Noctuidae) attacks new mango *(Mangifera indica* L.) shoots. The infestation is mainly after the post-harvest phase from June to February. In Maharashtra and Uttar Pradesh, it has been reported that the incidence of the pest is high between July to October (Bhole *et al* 1987; Pandey *et al* 1981). Eggs are laid on the tender leaves and freshly hatched caterpillars bore into tender midribs and come out after a few days and bore tender apical shoots tunnelling downwards. Larval excreta is ejected out of the entrance hole (Singh, 1957). Affected shoots wilt and are prone to secondary infection by plant pathogens.

Shahjahan and Ahmad (1990) have recorded 10-20% yield loss due to *C. transversa.* Nearly 43 to 57% of young grafted Dushehari plants in nursery and field were infested (Singh *et al* 1996). Chahal and Singh (1977), reported that the maximum damage to the mango nurseries due to this pest was observed from August to October. In the South, there is inadequate documentation of crop loss, seasonality, and population fluctuation. The effect of weather parameters on the insects is not clear. Considering the export potential of mango, its geographical and genetic diversity in India, it is all the more important that detailed documented data on minor pests are relevant, in distinct geographical zone. Hence, the present study was taken up to study the seasonality and to arrive at a prediction model, if abiotic factors were influencing the population. An attempt was also made to standardise a sampling plan for *C. transversa.*

MATERIALS AND METHODS

The study was conducted in a 9 - year old mango orchard (cv. Banganapalli) at the Indian Institute of Horticultural Research, Bangalore. Of the 50 trees, 20 trees were randomly selected for regular sampling. The height of the tree was of 2 - 3 m and the canopy diameter was 3 - 4 m. Each tree was delineated into approximately two halves - upper and lower canopies. Observations were taken once in three weeks on the number of new shoots and number of shoots freshly infested in upper and lower canopies separately from September 1996 to February 1998. From these, the mean percent infestation and mean number of shoots damaged (for lower and upper canopies and full tree) and mean total new shoots were calculated. Old infestation (manifested by secondary infection) and completely dry shoots were not recorded. The data on mean number of damaged shoots and infestation were subjected to simple correlation analysis with weather parameters such as maximum and minimum temperatures, RH, rainfall and wind speed. The lower and upper canopy levels of infestation and damage were correlated with total infestation and damage. These were further subjected to ANOVA, taking each observational date as a replicate.

RESULTS AND DISCUSSION

Population studies

Field observation on *C. transversa* showed that the peak percent infestation was in September, 1996 (22.26%) and in November, 1997 (47.17%), Fig. 1. A maximum of 4.85 shoots per tree was recorded in November, 1996, which approximated to 18% of the new shoots put forth. It is not clear whether this would affect the overall growth or yield loss. This would require detailed observation over years especially, as mango has several pests, diseases and physiological complexes that influence the yield. In 1997, the maximum number of shoots affected was 17.95, which constituted nearly 47% of the shoots. At this level it would be prudent to initiate control for *C. transversa*. In Solomon Islands, mango failed to produce flowers due to the attack of *C. euthysticha*, a related species (Walton, 1987). In Southern China, *C. transversa* was the most injurious of three noctuid pests (Wu and Zhu, 1981).

In general, the infestation of *C. transversa* was observed between September and February. By February, when mango inflorescence are in full bloom in cv. Banganapalli, insecticidal sprays for controlling mango hopper (*Idioscopus niveosparsus* Leth.) is advocated. *Chulmetia transversa* could not be observed on tender foliage between February and June, as insecticides sprayed to control major pests sufficiently suppressed *C. transversa*. Fresh infestation was again observed by the end of July.

There was no significant difference between the canopy levels (Table 1) indicating canopy levels do not significantly influence *C. transversa* infestation. The variance/mean ratio (V/M) being more than unity indicated a clumped distribution (Southwood, 1978). The trend was similar when mean number of damaged shoots were considered (Table 2).

Table 1. Percent infestation of *Chlumetia transversa* and V/M ratio in lower and upper canopies

	Mean (%)	Variance	V/M Ratio
Lower	11.31	17.3	15.33
Upper	8.61	13	16.20
F-test (P = 0.05)	NS		

The mean number of damaged shoots was around one shoot/tree (Table 2) and had a clumped distribution. The mean damage on an overall long term dimension may be misleading, as between October and November, the number of new shoots per tree is fairly high (Fig. 1). In 1996, the mean number of shoots damaged per tree was as high as 2.95 shoots per tree, which peaked to 4.85 by the end of November. In 1997 the maximum damage was observed in later part of October when a mean of 17.95 shoots was observed, that can potentially affect the subsequent reproductive shoots.

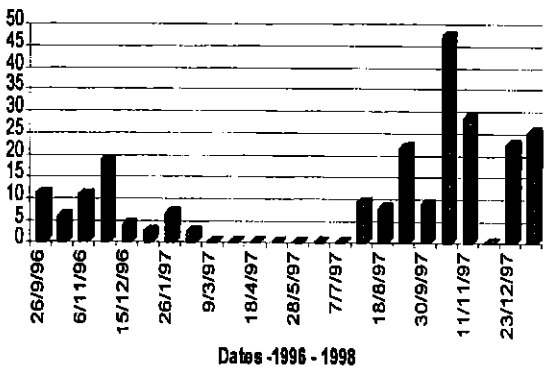

Fig. 1 Percent infestation of Mango shoot borer

Table 2. Mean number of damaged shoots/tree and V/M ratio in lower and upper canopies

	Mean no. of damaged shoots/tree	V/M Ratio
Lower	1.06	4.93
Upper	0.94	5.02
F test (P=0.05)	NS	

Sampling

There was a very significant, positive correlation between percentage infestation of lower and upper canopies ($r = 0.8976$; $P = 0.01$). Both lower and upper canopies were again significantly correlated to total infestation (Table 3). Further, between lower and upper canopies there was no significant difference for percentage infestation and number of damaged leaves (Tables 1 & 2). This indicated that precise estimation of infestation level is possible by sampling the lower canopy. The number of shoots damaged in the lower (x) was fitted to a linear model as follows:

Table 3. Correlation Coefficients ('r') of infestation in canopy height

	Percentage infestion	No. of damaged shoots
Lower vs total tree	0.9741**	0.9610**
Upper vs total tree	0.9666**	0.9567**

**Significant at P = 0.01

$y = 0.089 + 1.8x$, with a $R^2 = 0.9235$, where y is equal to total number of shoots damaged per tree.

However, the fit was better with the polynomial model.

$y = -866x^2 + 2.608x - 0.2903$, with $R^2 = 0.9458$.

So sampling for *C. transversa* could be restricted to lower canopy, and total infestation be estimated from the above second order polynomial model.

The number of shoots damaged in both lower and upper canopies were very significantly correlated to the total number of new shoots (Table 4). So studies on the control of *C. transversa* should coincide with new leaves.

Effect of abiotic factors

It was observed that maximum temperature (x_1) had significant negative correlation, while rainfall (x_3) had positive correlation with mean infestation (y). Further, RH (x_2) showed highly significant positive correlation with mean infestation (Table 5). The regression model using all these factors was as follows :

Table 4. Correlation coefficient ('r') of mean number of damaged shoots with total number of new shoots

Lower	0.7889**
Upper	0.7168**

**Significant at P = 0.01

Table. 5. Correlation coefficient between mean infestation and other parameters

	'r'
No. of damaged shoots and mean infestation	0.6589**
Mean infestation and maximum temperature	-0.4113*
Mean infestation and minimum temperature	0.1280
Mean infestation and RH	0.5605**
Mean infestation and wind speed	0.0658
Mean infestation and rainfall	0.3876*

*, ** Significant at P = 0.05 and P = 0.01, respectively

$y = -17.31 - 0.53x_1 + 0.58x_2 + 0.60x_3$ with $R^2 = 0.3441$.

This however, explained the variability in the mean infestation only to an extent of 34%.

As RH was found to have the best correlation with mean percentage infestation, further models like linear, logarithmic, exponential and polynomial were attempted using only RH as a variable to explain variation in the mean infestation. It was found that a third order polynomial model fitted best with $R^2 = 0.53$, and was as follows :

$$y = 0.0006x^3 - 0.056x^2 + 1.6088x + 63.078.$$

Thus, shoot borer infestation, can be predicted with RH using the above model, as variability in infestation is explained by RH to the extent of 53%. This will be useful to forecast infestation. However, difference in geography, climate and genotypes necessitate zone specific studies in the Indian subcontinent.

CONCLUSION

The present study conducted during 1996 and 1997 showed that the shoot borer infestation in mango is mainly between October and November. This coincided with new shoots and the study showed a significant positive correlation of infestation with new flush. The yield or crop loss due to *Chlumetia transversa* has to be worked out. There was no significant difference between the upper and lower canopies, and both these levels were significantly correlated to total infestation or mean number of damaged shoots facilitating sampling from lower canopy. A polynomial model to predict total infestation from mean RH has been developed.

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REFERENCES

Bhole, S.D., Jadhav, V.S., Dumbre, R.B. and Dalvi, C.S. 1987. Seasonal incidence and chemical control of mango nursery pests in the Konkan region. *Journal of Maharashtra Agricultural Universities* **12** : 3, 387 - 388.

Chahal, B.S. and Singh, D. 1977. Bionomics and control of mango shoot borer, *Chlumetia* *transversa* Walker (Lepidoptera : Noctuidae). *Indian Journal of Horticulture* **34** : 2, 188- 192.

Pandey, N.D., Pandey, V and Awasthi, B.K. 1981. Insecticidal control of mango shoot borer. *Pesticides* **15** : 5, 28 - 29.

Shahjahan, M. and Ahmad, M. 1990. Occurrence of the mango shoot borer, *Chlumetia transversa* Walker (Lepidoptera : Noctuidae) in the Agricultural University area, Mymensingh, Bangladesh, *Bangladesh Journal of Zoology* **6** : 1, 103 - 105.

Singh, S.M. 1957. A serious damage to mango shoots by the borer Chulmetia transversa Walker in Uttar Pradesh. *Indian Journal of Horticulture* **14**(4) 236-238.

Singh, R., Thakur, A.K. and Singh, R. 1996. Studies on incidence and control of Chlumetia transversa Walker (Lepidoptera : Noctuidae) on mango. *Pest Management in Horticultural Ecosystems* **2**:2, 55-59.

Southwood, T.R.E. 1978. Ecological methods. Metheun and Co., London.

Walton, P.D. 1987. Fruit and nut trees. Eds. Oliouou, M.M. and Abington, J.B. Annual Report of Ministry of Agriculture and lands Research department. Agriculture Division. Solomon Islands. pp. 44-46.

Wu, J. T. and Zhu, B. 1981. A new species of mango noctuid. *Entomotaxonomia* **3**:1, 29-33.

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