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Incidence pattern of guava shoot borer, *Microcolona technographa* Meyrick (Lepidoptera: Agonoxidae) in relation to weather conditions in West Bengal, India

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ABSTRACT: Incidence pattern of shoot borer (*Microcolona technographa* Meyrick) on guava and the effect of weather parameters on its occurrence were studied during 2014 and 2015 at Horticulture Research Station (HRS), Mondouri,West Bengal, India.The infestation of the shoot borer, *Microcolona technographa* Meyrick (Lepidoptera: Agonoxidae) started by end of January to mid February coinciding with the increase of temperature and emergence of new flush and with its peak activity was recorded from middle of July to 2nd week of August. Correlation studies revealed that both maximum and minimum temperature, RH minimum, vapour pressure and rainfall showed significant positive effect, while sunshine hours had negative impact. The density of the larval population in the shoots of guava significantly varied in different direction and followed the trend like East > South > North > West.

Keywords: Guava, *Microcolona technographa,* shoot borer, weather parameters

INTRODUCTION

Guava crop is threatened by a number of biotic stresses including insect pests. About 80 insect species are reported to affect the yield and quality of guava fruits (Butani, 1979), but only a few of them are of regular occurrence and cause serious damage. They include fruit flies, *Bactrocera* spp., bark eating-caterpillar, *Indarbela* spp., tea mosquito bug, *Helopeltis antonii* (Signoret), fruit borers, *Deudorix isocrates* (Fab.) and *Dichocrocis punctiferalis* (Guenee). However of late shoot borer, *Microcolona technographa* is emerging as an important pest (Haseeb, 2007). Earlier record of its occurrence on guava was by Pruthi and Batra, (1960) Punjab and North India. There has been no systematic work on its seasonal incidence on guava and their relation to weather conditions prevailing in West Bengal. The present study was, therefore, undertaken to generate relevant information on these aspects, which will help in formulating integrated pest management strategies against this pest.

MATERIALS AND METHODS

Incidence of shoot borer, *M. technographa* on guava crop was studied during 2014 and 2015 at Horticulture Research Station (HRS), Mondouri, West Bengal, India on variety Sardar (L-49). For the purpose, four branches from different directions of each plant were selected randomly as criterion for determining the per cent shoot infestation by counting the infested shoots in a branch at weekly interval starting from the month of January to December. Four replications with each tree constituting one had been taken for the study. Another observation was also taken to estimate the effect of direction on the larval population. For this purpose hundred shoots had been chosen randomly from different plants with respect to each direction (*viz.*, North, East, West, and South) and living larvae present in the shoots from each direction were taken round the year at fortnightly interval during 2014 and 2015.

Data of different meteorological parameters constituting maximum and minimum temperature (°C), rainfall (mm), maximum and minimum relative humidity (%), bright sunshine hours (hr) and wind speed were collected from the meteorological observatory of the farm with a view to determine the relationship between shoot borer incidence and abiotic factors by correlation and regression analysis and calculation was done in SPSS statistical package (20.0 version).

RESULTS AND DISCUSSION

Temporal distribution of *M. technographa* on guava

It was observed that the newly hatched larvae were found feeding mostly at the base of the leaf of the newly emerged twigs, flower buds (both axillary and apical buds), leaf petioles etc. It was further observed that, in general the tendency of the early instar larvae were to bore into the tender twigs and shoots particularly at the nodal regions and to feed on the pith by making tunnels downwards. The presence of the larva within the tunnel could be detected with the presence of the products of the larvae *i.e.*, the faecal matter coming out from the entry holes all the times which was more clear during peak periods, it was peculiar enough to note that unlike other borers the larvae of *M. technographa* never allowed any excretory products remaining indirection the tunnel, reason might be for preventing secondary infection caused by external agents like bacteria, fungus leading to further disintegration of the feeding site and also for avoiding plugging of the tunnels so that the adults after emergence could easily come out.

The infested twigs just above the bored hole dried up, affecting further growth of the plant and as the pest also attacked flower buds and larvae fed indirection which resulted in decrease of fruit production. Hence, it can be stated that the attack of the pest adversely affected both the vegetative and reproductive growth significantly.

In the first year of study (2014), the pest could be recorded on the plant for fifty weeks, where it grew on for thirty weeks to reach its peak and then declined in next twenty weeks. From the figure 1, it can clearly be narrated that, initiation of infestation of shoot borer on guava crop started during third week of January (1.25% infestation), at the preceding week of which, average T max, T min, RH max, RH min, rainfall, vapour pressure, bright sunshine hours and wind speed of 22.60°C, 9.79°C, 95.86%, 58.71%, 0.00 mm, 10.46 kpa, 8.01 hrs and 0.49 km/hr were observed.

There after the activity of pest increased more rapidly to reach its peak during third week of August with 75.75% infestation. During preceding one week period of the peak stage, average T max (31.73°C), T min (24.94°C), RH max (96.43%), RH min (83.14%) and vapour pressure (25.92 kpa) with 4.77 bright sunshine hours, 7.81 mm average rainfall and average wind speed of 1.73 km/hr. Then, it started to decline and disappeared from the field during early January.

During 2015 (Fig. 2), it was found that the infestation remained in the field for forty four weeks and it took twenty five weeks to grow to reach its peak from

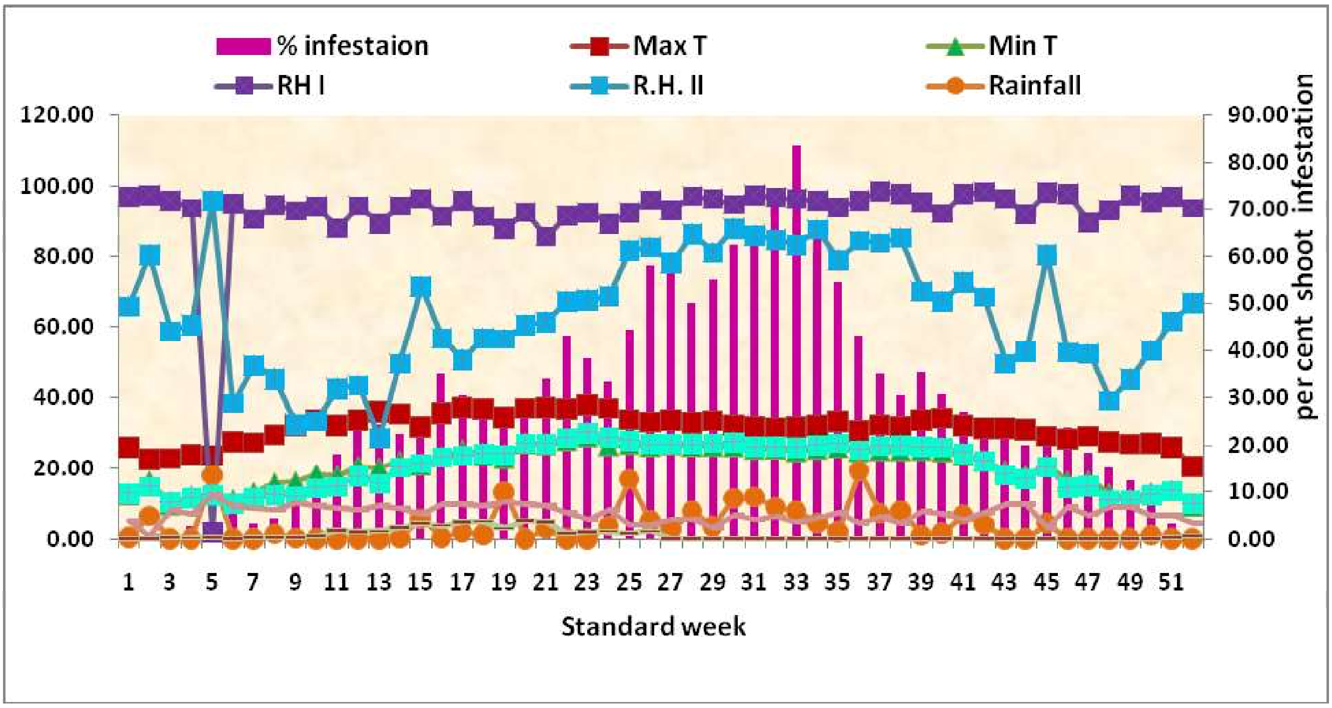

Fig. 1. Influence of weather factors on the incidence pattern of *M. technographa* on guava crop during 2014

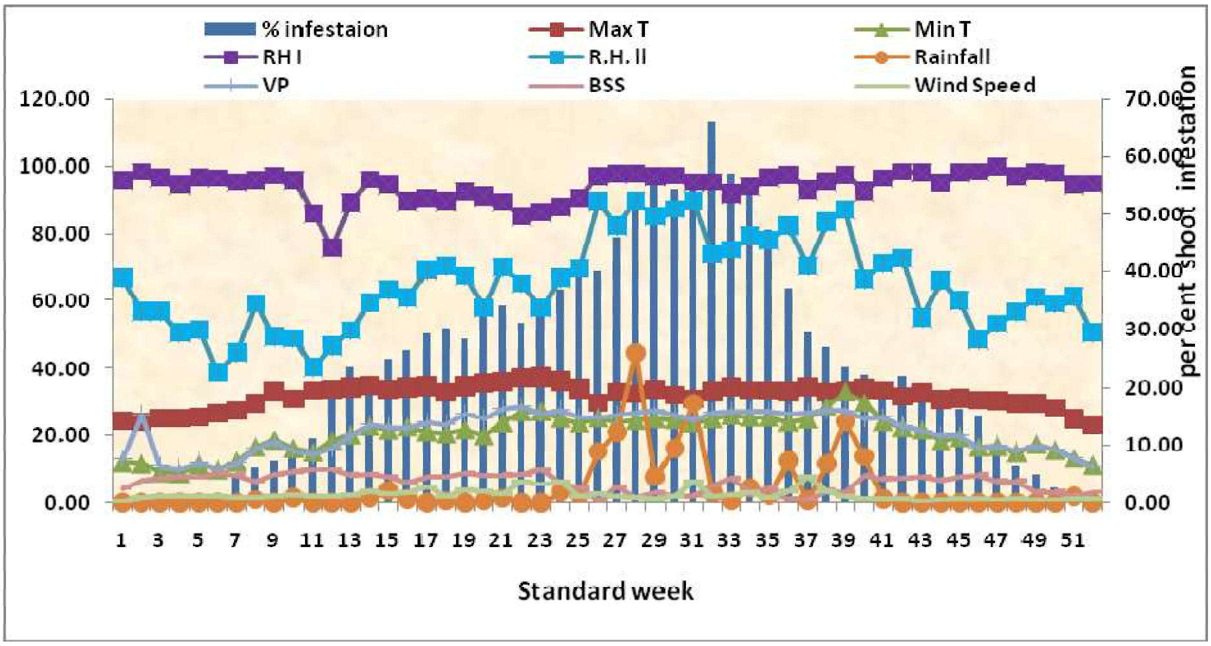

Fig. 2. Influence of weather factors on the incidence pattern of *M. technographa* on guava crop during 2015

initial infestation and the declining phase was for eighteen weeks. As compared to first year, during second year the initiation of shoot borer infestation started later during second week of February with 5.05% infestation, then the pest infestation increased to reach its peak during the second week of August (66.34% shoot infestation), when average T max and T min (25.03°C and 32.93°C), average RH max and RH min 95.43% and 73.57%), vapour pressure (26.85 kpa), BSS (5.43hr), wind speed (1.87 km/hr) with 3.07 mm average rainfall were there at preceding one week period. Thereafter, it showed decreasing trend with no infestation from third week of December to first week of February.

Thus, from both the years of investigation it can be revealed that, with the increase of temperature and emergence of new flush of guava crop during February the biological activity of the pest was observed under field condition. The feeding and breeding activities of the pest were found to continue up to early part of December with variable growth of pest population. From the earlier discussion, it can be interpreted that different abiotic factors along direction with fresh shoot availability, the change in population structure took place.

During severe winter condition *i.e.* middle of December to mid part of February the activity of the pest was noted to be quite negligible or absent due to both prevailing adverse climatic condition and non-availability of suitable food material particularly under field condition. After passing the winter they again started their activities from end of February. However, role of different weather parameters could be adjudged through correlation and regression studies, which had been done here.

Spatial distribution of *M. technographa* in different directions of canopy

There was significant variation of larval population present in the tender shoots of the guava variety L-49 with respect to four different directions of the plant. From the Table 1, during 2014 revealed that, east direction showed significantly maximum mean number of larvae of shoot borer *i.e.*19.63 followed by south with 15.25 per hundred shoots. North and west directions of the plant had significantly lowest population *i.e.*, 9.21 and 7.46 larvae/100 shoots of guava, respectively.

During 2015 also, the east direction of the plant had maximum 15.88 mean number of larvae/100 shoots and differed from other directions, this was followed by south direction with 12.70 mean number of larvae/ 100 shoots, whereas north direction with 8.22 larvae and minimum 6.96 number of larvae per hundred shoots observed on west direction of the plant. West and north directions showed less number of larvae of shoot borer than other directions.

Table 1. Larval count of *M. technographa* on various plant directions of guava during 2014

Month	Fort night	No. of larvae/100 shoots in different directions East	South	West	North	Mean
JAN	1st F.N.	0(0.71)	0(0.71)	0(0.71)	0(0.71)	0.00
	2nd F.N.	2(1.58)	0(0.71)	0(0.71)	2(1.22)	1.00
FEB	1st F.N.	3(1.87)	0(0.71)	0(0.71)	1(1.58)	1.00
	2nd F.N.	5(2.35)	3(1.87)	2(1.58)	3(1.87)	3.25
MAR	1st F.N.	14(3.81)	12(3.54)	7(2.74)	3(2.35)	9.00
	2nd F.N.	21(4.64)	14(3.81)	8(2.92)	6(2.55)	12.25
APR	1st F.N.	23(4.85)	14(3.81)	6(2.38)	9(2.92)	13.00
	2nd F.N.	25 (5.05)	16(4.06)	10(3.24)	13(3.67)	16.00
MAY	1st F.N.	24 (4.95)	14(3.81)	8(3.09)	15(3.94)	16.00
	2nd F.N.	30 (5.52)	19(4.42)	13(3.67)	12(3.54)	18.50
JUN	1st F.N.	28 (5.34)	22(4.74)	10(3.24)	18(4.30)	19.50
	2nd F.N.	32 (5.70)	26(5.15)	14(3.81)	16(4.06)	22.00
JUL	1st F.N.	35 (5.96)	35(5.96)	12(3.54)	21(4.64)	25.75
	2nd F.N.	38 (6.20)	31(5.61)	16(4.06)	19(4.42)	26.00
AUG	1st F.N.	46 (6.82)	46(6.82)	18(4.30)	21(4.64)	32.75
	2nd F.N.	40 (6.36)	30(5.52)	17(4.18)	17(4.18)	26.00
SEP	1st F.N.	35 (5.96)	28(5.34)	12(3.45)	15(3.94)	22.50
	2nd F.N.	27 (5.24)	18(4.30)	103.24)	12(3.54)	16.75
OCT	1st F.N.	15 (3.94)	13(3.67)	8(2.92)	52.35)	10.25
	2nd F.N.	12 (3.54)	11(3.39)	3(1.87)	7(2.74)	8.25
NOV	1st F.N.	8(2.92)	7(2.74)	2(1.58)	4(2.12)	5.25
	2nd F.N.	5(2.35)	5(2.35)	0(0.71)	2(1.58)	3.00
DEC	1st F.N.	3(1.87)	2(1.58)	0(0.71)	00.71)	1.25
	2nd F.N.	0(0.71)	0(0.71)	0(0.71)	0(0.71)	0.00
	Mean	19.63	15.25	7.46	9.21	

Figures in parentheses are square root transformed values

	S. Em. (±)	CD (P=0.05)
Month	- 0.262	0.573
Direction	- 0.181	0.413
Month: Direction	- 0.458	1.210

Table 2. Larval count of *M. technographa* on various plant directions of guava during 2015

Month	Fort night	No. of larvae/100 shoots in different directions East	South	West	North	Mean
JAN	1st F.N.	0(0.71)	0(0.71)	0(0.71)	0(0.71)	0.00
	2nd F.N.	0(0.71)	0(0.71)	0(0.71)	0(0.71)	0.00
FEB	1st F.N.	3(1.87)	2(1.58)	0(0.71)	2(1.58)	1.75
	2nd F.N.	8(2.35)	6(2.57)	3(1.87)	4(2.12)	3.75
MAR	1st F.N.	14(3.81)	12(3.54)	4(2.12)	5(2.35)	8.75
	2nd F.N.	17(4.30)	14(3.81)	6(2.55)	8(2.92)	11.25
APR	1st F.N.	15(4.19)	14(3.81)	9(3.08)	8(2.92)	12.25
	2nd F.N.	20(4.53)	16(4.06)	8(2.92)	9(3.08)	13.25
MAY	1st F.N.	19(4.42)	14(3.81)	10(3.24)	10(3.24)	13.25
	2nd F.N.	25(5.05)	19(4.42)	8(2.92)	12(3.54)	16.00
JUN	1st F.N.	23(4.85)	20(4.53)	11(3.39)	15(3.94)	17.25
	2nd F.N.	21(4.95)	21(4.64)	9(3.08)	15(3.94)	17.25
JUL	1st F.N.	28(5.35)	21(4.64)	12(3.54)	16(4.06)	18.50
	2nd F.N.	33(5.79)	26(5.15)	14(3.81)	17(4.18)	22.50
AUG	1st F.N.	38(6.20)	29(5.43)	16(4.06)	19(4.42)	25.50
	2nd F.N.	30(5.52)	25(5.05)	13(3.67)	18(3.80)	21.50
SEP	1st F.N.	22(4.74)	17(3.94)	10(3.24)	8(2.92)	13.75
	2nd F.N.	17(4.18)	12(3.54)	6(2.55)	6(2.55)	10.25
OCT	1st F.N.	17(4.18)	9(3.08)	7(2.74)	5(2.35)	9.50
	2nd F.N.	14(3.81)	10(3.24)	6(2.55)	4(2.12)	8.50
NOV	1st F.N.	8(2.92)	5(2.35)	3(1.87)	5(2.35)	5.25
	2nd F.N.	5(2.35)	3(1.87)	3(1.87)	3(1.87)	3.50
DEC	1st F.N.	3(1.87)	2(1.58)	2(1.58)	0(0.71)	1.75
	2nd F.N.	1(1.22)	0(0.71)	0(0.71)	0(0.71)	0.25
	Mean	15.88	12.70	6.96	8.22	

Figures in parentheses are square root transformed values

	S. Em. (±)	CD (P=0.05)
Month	- 0.224	0.432
Direction	- 0.146	0.322
Month: Direction	- 0.392	1.053

Thus, during both the years of study east direction of the plant had significantly the highest abundance of larvae of shoot borer followed by south and north directions. The west direction of the guava plant showed significantly the lowest population of shoot borer larvae during both the years of study. It was also observed from the same investigation that the larval population of shoot borer initially established during February, March and then increased slowly to reach its peak during July-August and then decreased quite sharply during September following a slow decline there onwards. Thus, it is evident that the abundance of the larval population followed the trend, East > South > North > West.

The present findings are in agreement with Sharma *et al.,* (2004) who observed that guava shoot borer remained active from mid-April to November with its peak period of infestation from mid-July to mid-August. Pruthi and Batra (1960) reported on the incidence of *Microcolona technographa*, on the twigs of guava plant in Punjab and North India.

Observation on the abundance of larval activity of *M. technographa* which was not reported elsewhere revealed that, the eastern and southern direction of the plant itself harboured more numbers of individuals than other direction *i.e.*, west and north. The above mentioned phenomenon might be due to, that plant canopy of eastern and southern directions got more sunshine exposure in comparison with other two directions. This generally results in development of more number of flushes in these directions. Hence, more of attack of the pest could be recorded from these directions.

Incidence of shoot borer in relation to weather conditions

The infestation of *M. technographa* showed a great sensibility to weather fluctuations prevailing over the period under study. Analysis of correlation between incidence of shoot borer and different abiotic factors on cumulative basis revealed that a highly significant positive correlation existed with T max (r = 0.613), T min (r = 0.806), RH min (r = 0.679), rain fall (r = 0.471) and vapour pressure (r = 0.819). However, negative correlation with BSS (r = -0.225) was noted.

Therefore, from results of present investigation regarding correlation of shoot borer incidence with different weather parameters from both years of study, it is revealed that both maximum and minimum temperature, minimum relative humidity, vapour pressure and rainfall showed significant positive effect on the population build up of pest, while sunshine hours had negative impact on shoot borer incidence.

The results of present investigation are in close conformity with the observation of Sharma *et al.,* (2004) who showed that mean temperature, relative humidity and vapour pressure had significant impact on the build up of shoot borer population in guava. Sun shine hours has negative impact, wind velocity and evaporation (mm) had no association with build up of shoot borer population.

Where, Y= % shoot infested on cumulative basis (2014+2015), X1= Temperature maximum (°C), X2= Temperature minimum (°C), X3= Relative humidity maximum (%) X4= Relative humidity minimum (%),

Table 3. Correlation Coefficient (r) and Coefficient of Determination (R^2) between shoot borer incidence and weather parameters

Year	Temp. (°C)		RH (%)		RF (mm)	VP (Kpa)	BSS (h)	WS(km/hr)	N
	Max.	Min.	Max.	Min.					
2014	0.599**	0.841**	0.044	0.636**	0.533*	0.855**	-0.141	0.218	52.00
2015	0.653**	0.772**	0.134	0.758**	0.498*	0.811**	-0.325	0.30	52.00
Cumulative	0.613**	0.806**	0.099	0.679**	0.471*	0.819**	-0.225	0.224	104

*Significant at 5% **Significant at 1%, RH = Relative Humidity, BSS = Bright Sunshine, VP = vapour pressure, RF = Rain fall, WS = Wind speed

$Y = -90.256 + 2.040 (X_1)^* + 0.052 (X_2)^{**} - 0.079 (X_3) + 0.690 (X_4)^{**} + 0.251 (X_5)^* + 0.902 (X_6) - 1.110 (X_7) + 0.451 (X_8)^*$ (R^2 = 0.723)

X5= Rainfall (mm), X6= Bright sunshine (hr), X7= wind speed (km/hr), X8=Vapour pressure (Kpa), R^2 = Coefficient of Determination, *Significant at 5%, **Significant at 1%

Combined quantitative effect of the observed abiotic factors on the cumulative basis on the infestation fluctuation of *M. technographa* was also worked out through regression analysis, the co-efficient of determination factors (R^2) was 0.723 when all these factors computed together resulted in 72.3% variation in the shoot borer incidence. In the obtained regression equation, T max, T min, RH min, rain fall and vapour pressure showed significant impact with positive response.

On the basis of field investigation it was observed that, incidence of shoot borer was quite significant, as based on percent shoot infested and also the larvae present within the shoot as the index of damage, it can be concluded that the incidence of guava shoot borer, *M. technographa* peaked during middle of July to second week of August. Therefore, management strategy should be followed well before the month of July. The information generated about the importance of the different weather parameters can be used in developing weather based forecasting models for successful implementation of the pest management strategies against the pest. Because of the increasing incidence of *M. technographa*, it was considered to be one of the important shoot feeders of the guava crop particularly under West Bengal condition and the relevant information on the incidence of the pest as recorded in the present study may be considered as new addition to the information pool from this area.

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