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Seasonal incidence and effect of abiotic factors on population dynamics of major insect pests on brinjal crop

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ABSTRACT

Effect of abiotic factors on the seasonal incidence of major insect pests was observed on brinjal crop during *Rabi* 2009. The incidence of leaf hopper (*Amrasca biguttula biguttula*) was maximum during December, 52 nd Standard Week (SW) and minimum during March (12th SW). The incidence of white fly (*Bemisia tabaci*) was maximum during January (2nd SW) and lowest in March (12th SW). Both these insects showed significant negative correlation with both maximum and minimum temperature and wind speed while a positive correlation was revealed with mean relative humidity and total rainfall. The incidence of shoot and fruit borer, *Leucinodes orbonalis* Guenee was observed during Nov. – Dec. with peak infestation during Feb. (6th and 7th SW). The per cent shoot damage was positively correlated with both maximum and minimum temperature, rainfall and wind speed while negatively correlated with mean relative humidity. While per cent fruit infestation revealed a non significant positive correlation with maximum and minimum temperature, rainfall and wind speed exhibited negative correlation with mean relative humidity. The statistically significant values indicated that occurrence of insect pests population was due to the prevailing ecological conditions. Thus the management of brinjal pest complex during *Rabi* sown brinjal should therefore be promoted and tailored from November onwards using an integrated approach.

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INTRODUCTION

Brinjal, *Solanum melongena* L. is one of the most important vegetables in South Asia which accounts for almost fifty per cent of the world's area under cultivation (Alam *et al*., 2003). In India, brinjal is an important and indigenous vegetable crop often known as the cash crop for the farmers. The area under brinjal cultivation is estimated at 0.51 million ha with productivity of 16.08 t/ha Patel *et al.* (1988). In the brinjal field, various pests prevail during seedling to harvesting stage and the loss

caused by brinjal pests vary from season to season depending upon environmental factors (Gangwar and Sachin, 1981). The crop is attacked by number of insect pests but the major ones include jassid (*Amrasca biguttula biguttula*), aphid (*Aphis gossypii*), white fly (*Bemisia tabaci*) and shoot and fruit borer (*Leucinodes orbonalis* Guenee). Pest abundance and distribution changes with abiotic factors and therefore meteorological parameters play a pivotal role in the biology of any pest. Temperature is the most crucial abiotic factor influencing the rate of growth and development of insect and is especially important for insect as pests control measures must be timed carefully to be effective. However, relative humidity, rainfall, wind speed and temperature are the chief weather parameters that largely direct the activity of a given species of insect. The interaction between pest activity and abiotic factors helps in deriving at predictive models that aids in forecast of pest incidence.

MATERIAL AND METHODS

Field experiment was conducted at Alandhurai, Coimbatore, India on brinjal local cultivar, oval violet in Randomized Block Design (RBD) during *Rabi* season 2009 with three replications. The plot size was 2m × 2m. with 50 cm and 50 cm spacing. The incidence of selected pests was recorded from sowing to harvesting of the crop. Observations on the population of sucking pests were recorded on three leaves one each from top, middle and bottom canopy of the five plants selected randomly in each replication. The incidence of brinjal shoot and fruit borer was recorded by counting total number of shoots and fruits with the damaged onces. Weekly data on different abiotic parameters were also recorded. Data so obtained were then subjected to statistical analysis for correlation and test of significance.

RESULTS AND DISCUSSION

The data (Table 1 and 2) revealed the abundance of different insect pests in brinjal agro ecosystem. The incidence of leaf hopper (*Amrasca biguttula biguttula*) varied from 15-110 per five plants and was maximum during 52 nd Standard week (SW) and minimum during March (12th SW). The incidence of white fly (*Bemisia tabaci*) was maximum (nine /five plants) during January (2nd SW) and lowest was recorded in March (12th SW). Overall incidence was more during January. Both these insects showed significant negative correlation with both maximum and minimum temperature and wind speed while a positive correlation was observed with mean

Table 1 : Seasonal incidence of major insect pests of brinjal during *Rabi* – 2009

Standard meterological week	Max. temp. (°C)	Min. temp. (°C)	Mean temp (°C)	Mean RH (%)	Total rainfall (mm)	Wind speed (km/hr)	Mean population per five plants			
							Leaf hopper	White fly	BSFB Shoot infestation	BSFB fruit infestation
47	26.65	10.3	18.45	73	0	2.55	50	5.2	0	0
48	31.07	12	21.5	68.2	0	2.97	60	6	0	0
49	26.65	14.08	20.3	45.7	0	4.8	90	6.8	2.25	0
50	24.5	15.02	19.75	47.5	0	5.3	95	7.1	3.78	6.21
51	24.01	10.04	17	50.5	0	3.6	98	7.8	4.2	7.54
52	23.1	10.21	16.6	45.5	0	5	110	8	4.68	8.93
1	20.8	8.22	14.5	61.7	2	5.1	82	8.6	5.15	12.46
2	18.1	4.6	11.3	75.3	2.6	4.4	88	9	5.92	16.75
3	22.6	6.91	14.7	60.2	0	2.8	70	8	6.92	20.54
4	26.04	11.04	18.5	52.9	0	5.4	60	7.8	7.61	25.23
5	33.72	12.48	23	43.6	0	5.1	54	7.1	8.54	29.13
6	29.75	12.97	21.3	41.5	1.6	5.7	58	6.6	9.42	29.88
7	24.8	13.2	19	68.7	0	7.2	40	6.2	9.13	31.34
8	27.5	11.94	19.7	48	2.4	4.8	32	5.1	8.86	35
9	32.02	16.71	24.3	34.2	0	5	21	4	7.54	28.02
10	30	15.95	22.9	38.2	0	6.5	18	33	6.32	24.5
11	34.72	19.71	27.2	26.6	0	7.3	19	3	5.87	15.5
12	37.88	20.84	29.3	21.8	0	5.7	15	21	4.28	12.33

Table 2 : Correlation between abiotic factors and major insect pests of brinjal during *Rabi* – 2009

Major insect pests of brinjal	Temperature (°C)		Mean RH (%)	Wind speed (km/hr)	Total rainfall (mm)
	Maximum	Minimum			
Leafhopper (*Amrasca biguttula biguttula*)	-0.738	-0.653	0.441	-0.416	0.115
White fly (*Bemisia tabaci*)	-0.824	-0.862	0.635*	-0.386	0.310
BSFB shoot infestation	0.035*	0.019	-0.250*	0.544	0.368*
BSFB fruit infestation	0.145	0.063	-0.204*	0.479	0.359*

* indicates significance of value at P = 0.05

relative humidity and total rainfall. A non-significant correlation of leaf hopper population with rainfall was observed in present studies. The preferred habitat for jassid nymphs were the underside of leaves, it is unlikely that the direct action of raindrop afford any significant control. Significant negative correlation of leafhopper and white fly with temperature in brinjal agroecosystem was also reported earlier Chandrakumar *et al*. (2008). On the contrary to present observations, studies from Bangladesh have reported a positive correlation of leaf hopper and white fly population with temperature (Mahmood *et al*., 2002 and Mustafa and Kaur, 2008). The incidence of jassid was also recorded from third week of August to last week of December Singh *et al.* (2010). High incidence of leaf hopper and white fly on brinjal crop was earlier reported but no significant effect of abiotic factors on the population dynamics of these pests was observed Singh *et al.* (2005). High incidence of white fly during the month of January was reported on tomato crop Ashwathnarayana (2004). The incidence of Brinjal Shoot and Fruit Borer (BSFB), *Leucinodes orbonalis* Guenee commenced during Nov – Dec with peak shoot infestation during Feb. (6 th SW). The incidence of fruit borer was noticed during Dec. with peak infestation during Feb. (7th SW). The per cent shoot damage was positively correlated with both maximum and minimum temperatures, total rainfall and wind speed while negatively correlated with mean relative humidity.

The effect of abiotic factors *viz.*, maximum temperature, mean relative humidity and rainfall was significantly correlated with population fluctuation (r = 0.035, -0.250 and 0.368, respectively). While per cent fruit infestation revealed a non-significant positive correlation with maximum and minimum temperature, rainfall and wind speed and negative significant correlation with mean relative humidity. Earlier reports also suggest that maximum and minimum temperature and abundance of brinjal shoot and fruit borer showed a positive correlation (Shukla and Khatri, 2010). A positive correlation of brinjal shoot and fruit borer infestation with maximum temperature and also with relative humidity was observed but was found to be non significant (Shyamprasad and Logiswaran, 1997). Many of the earlier workers have also reported the incidence of shoot and fruit borer throughout the year in different regions of South East Asia. (Atwal and Verma, 1972; Khan and Al-salem, 2007, Mall *et al.*, 1992 and Mehto *et al*., 1980). Peak population of shoot and fruit borer was reported in second week of Feburary (Pawar *et al*., 1986). Arthropod biodiversity in the brinjal field showed that brinjal shoot and fruit borer, jassid and white fly were found as most common and major insect pests of brinjal crop (Latif *et al*., 2009).

Conclusion :

The present experiment provides a basic study for population dynamics. It can be concluded that seasonal population fluctuation of major insect pests on brinjal crop is greatly influenced by abiotic factors and peak population levels are observed during December – February. The statistically significant values indicated that occurrence of insect pests population was due to the prevailing ecological conditions. The management of brinjal pest complex during rabi sown brinjal under semiarid agroclimatic zone should therefore be promoted and tailored from November onwards using an integrated approach.

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