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Seasonal incidence of major insect pests of brinjal (*Solanum melongena*) and their correlation with weather parameters

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ABSTRACT

The present investigation was undertaken to find the seasonal incidence of major insect pests of brinjal during kharif 2019 at the Research farm, College of Agriculture, Tikamgarh (M.P.). The results revealed that the incidence of sucking insect pests viz., whitefly (Bemisia tabaci) started from last week of September (39th standard week) with a population of 4.89/ 3 leaves and reached to a peak level during the second week of October (41st standard week) with a population of 8.96/ 3 leaves whereas jassid (Amrasca biguttula biguttula) started from last week of September (39th standard week) with a population of 0.80/ 3 leaves and reached to a peak level during the second week of October (41st standard week) with a population of 1.29/ 3 leaves. The incidence of shoot and fruit borer started from second week of October (41st standard week) with 4.0% shoot infestation and reached its peak during the second week of November (46th standard week) with 20.0% shoot infestation. Highest fruit infestation of 50% was recorded during the first week of December (49th standard week). Correlation studies showed that among the various abiotic factors, maximum (r= 0.73) and minimum temperature (r= 0.79) exhibited highly significant positive correlation and morning relative humidity exhibited significant negative correlation (r= -0.56) with whitefly population. In case of jassid population, maximum temperature exhibited significant positive correlation (r= 0.59) and minimum temperature exhibited highly significant positive correlation (r= 0.79) with jassid population. The incidence of shoot and fruit borer showed significant negative correlation with minimum temperature and rainfall (r = -0.77, -0.56, respectively).

Keywords: Seasonal incidence, brinjal shoot and fruit borer, whitefly, jassid

INTRODUCTION

Brinjal, (*Solanum melongena* (L.)) is also known as eggplant, belongs to family Solanaceae. The eggplant is a delicate, tropical perennial plant often cultivated as a tender or half hardy annual in temperate climates. In India, during 2019, brinjal is cultivated in about 741 thousand hectares with production and productivity of 13000 thousand MT and 18.3 MT ha^{-1}, respectively. In Madhya Pradesh brinjal is cultivated in about 54.37 thousand hectares with production and productivity of 1135.04 thousand MT and 20.88 MT ha^{-1}, respectively (Anonymous, 2019). The major constraint of low productivity of brinjal is due to damage of number of insect pests. Among the insect pests shoot and fruit borer Leucinodes orbonalis (Guenee), epilachna beetle Epilachna vigintioctopunctata (Fabricius), jassids Amrasca biguttula biguttula (Ishida) and whitefly Bemisia tabaci (Gennadius) are considered to have economic importance. However, brinjal shoot and fruit borer is considered as the major insect pest of brinjal in Asia as it causes serious damage especial.ly during the fruiting stage. The shoot and fruit borer has a specific nature of feeding. After hatching, the tiny larvae bore in the growing tips of young shoots during vegetative stage of the crop. Yellowing and wilting of the affected shoots are the common symptom of attack. During flowering and fruiting stage, the larva prefers flower buds and young fruits. It bores into the young fruits by making a very small hole around the calyx. Thereafter, it completes its larval stage within the developing fruits and the mature larvae come out from the fruit for pupation. It inflicts yield loss as high as 85–90% (Chakraborti and Sarkar 2011). Among sucking insect pests, jassids and whitefly cause damage from the initial stage of the crop growth. Both nymph and adult of the sucking insects suck the cell sap by congregating on the lower surface of the leaves and lower down the vigorous growth of the plants. The loss caused by sucking pests varies from 10-15 percent depending on the intensity of infestation (Chatterjee *et al* 2018). These pests are highly governed by various abiotic factors and meteorological parameters play a pivotal role in the biology of these pests. Temperature, relative humidity, rainfall and sunshine hours are the

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weather parameters that directly influence the activity of a given species of insect. Hence it is necessary to have a thorough knowledge on seasonal incidence of different insect pests with respect to abiotic factors, which helps in developing pest prediction models for forecasting pest incidence.

MATERAILS AND METHODS

The field experiment was conducted at Research Farm, College of Agriculture, Tikamgarh (M.P.) on brinjal variety, Kashi Sandesh during *kharif* 2019. Seeds of brinjal variety Kashi Sandesh were sown on raised nursery with row to row distance of 10 cm on July 15, 2019. Twenty five days old seedlings of brinjal were planted on August 09, 2019 in a plot size of 10 X 10 m^2. The spacing between row to row and plant to plant was kept 80 cm. Light irrigation was provided after transplanting for better establishment of seedlings. All the agronomical practices, except the package recommended for insect pests management were adopted to raise a good crop. The recommended dose of fertilizers such as N, P_2O_5 and K_2O (180:80:80) were applied for crop production. The half dose of nitrogen and full dose of phosphorus and potash were applied as basal at the time of last ploughing while remaining dose of nitrogen was top dressed 30 days after transplanting. The data were recorded from the first appearance of the sucking pests and shoot and fruit borer and continued till maturity of the crop at weekly intervals. The population of jassid and whitefly were recorded (adult) on 3 leaves each from upper, middle and lower plant canopy of randomly selected 25 plants at weekly intervals. The population of shoot and fruit borer was recorded on randomly selected 25 plants for shoot infestation. The withered or drooped stem depicted the initiation of shoot infestation. After that its incidence was noticed on each fruit picking. The numbers of healthy and damaged fruits of twenty five randomly selected plants were counted at each picking. The seasonal fluctuation in the activity of shoot and fruit borer was observed by recording percentage of infested fruits at each picking. Weekly data of various abiotic factors such as maximum and minimum temperature, morning and evening relative humidity, rainfall and sunshine hours was also recorded. The data so obtained was then subjected to statistical analysis for correlation and test of significance.

RESULTS AND DISCUSSION

Whitefly

The incidence of whitefly began at the last week of September (39th standard week) with a population of 4.89/ 3 leaves. The highest whitefly population (8.96/ 3 leaves) was noted at the second week of October (41st standard week) which was almost identical to the study observed by Kumari *et al.* (2016). Kharade *et al.* (2018) observed a maximum incidence of whitefly (14.70 whitefly/3 leaves) during the first week of October which was similar to the present study while the infection rate was higher than this study. During the peak incidence of this study, the maximum and minimum temperature were observed as 32.1°C and 19.6°C, respectively with the highest relative humidity at mornings (89.9%) and the lowest relative humidity at evenings (49.1%). Bright Sunshine during this observed peak period was 8.80 hrs/day with no rainfall (0.00 ml). The population gradually declined after the observed peak reaching 1.2 whitefly / 3 leaves during third week of November (47th standard week). The peak incidence of whitefly was observed at October as reported by Singh *et al.* (2010) indicating a close conformity to present findings. These findings leads to a conclusion that peak incidence of whitefly may be observed at October due to the environmental conditions prevailed at that month.

Correlation studies revealed that maximum and minimum temperature exhibited significantly positive correlation (r= 0.73, 0.79, respectively) with whitefly population while morning relative humidity exhibited significantly negative correlation (r= -0.56). Whereas evening relative humidity, rainfall and sunshine hours were positively correlated (r= 0.05, 0.15, 0.15, respectively) with whitefly population but were non – significant. The significantly positive correlation of weather parameters (maximum temperature) was reported by Patel *et al.* (2015) and Indirakumar *et al.* (2016) which are in agreement with the present results indicating that temperature acts as a factor affecting whitefly population at any place.

Table 1: Seasonal incidence of sucking pests on brinjal at weekly interval, during crop growth period

Standard Week	Period		Whitefly population /3 leaves	Jassid population /3 leaves	Shoot / fruit infestation (%)
	From	To			
39	23 September 2019	29 September 2019	4.89	0.80	0.00
40	30 September 2019	06 October 2019	3.96	0.61	0.00
41	07 October 2019	13 October 2019	8.96	1.29	4.00 (s)
42	14 October 2019	20 October 2019	7.08	0.41	12.00 (s)
43	21 October 2019	27 October 2019	4.82	0.44	16.00 (s)
44	28 October 2019	03 November 2019	4.54	0.33	16.00 (s)
45	04 November 2019	10 November 2019	4.76	0.23	18.00 (s)
46	11 November 2019	17 November 2019	1.26	0.08	20.00 (s)
47	18 November 2019	24 November 2019	1.20	0.13	23.00 (f)
48	25 November 2019	01 December 2019	0.00	0.00	40.00 (f)
49	02 December 2019	08 December 2019	0.00	0.00	50.00 (f)
50	09 December 2019	15 December 2019	0.00	0.00	23.50 (f)
51	16 December 2019	22 December 2019	0.00	0.00	20.00 (f)

(s) : Shoot infestation; (f) : Fruit infestation

Jassid

The first appearance of jassid was recorded at the last week of September (39th standard week) with a population of 0.8/3 leaves, which reached its peak during the second week of October (41th standard week) with a population of 1.29/3 leaves. Kharade *et al.* (2018) observed a peak incidence (12.46 jassids/3 leaves) during the second week of September which was fluctuating from the present study while Verma *et al.* (2020) observed a peak incidence (2.33 jassid/cage) at third week of October and Kumar *et al.* (2014) observed a peak incidence (1.26 to 1.42 jassid/leaf intensity during both the years) which were in close conformity with the present study. This variation from different studies may be due to influence of fluctuating abiotic factors in different years. During the peak period of jassid population, the maximum and minimum temperature were observed as 32.1°C and 19.6°C, respectively with the highest relative humidity at mornings (89.9%) and the lowest relative humidity at evenings (49.1%). Bright Sunshine duration in this observed peak period was 8.80hrs./ day with no rainfall (0.00ml).The population gradually declined reaching 0.13 jassid / 3 leaves at third week of November (47th standard week). Patial and Mehta (2008) and Singh *et al.* (2010) recorded maximum incidence of jassid during October. These findings leads to a conclusion that peak incidence of jassids may be observed at October due to the environmental conditions prevailed during this month.

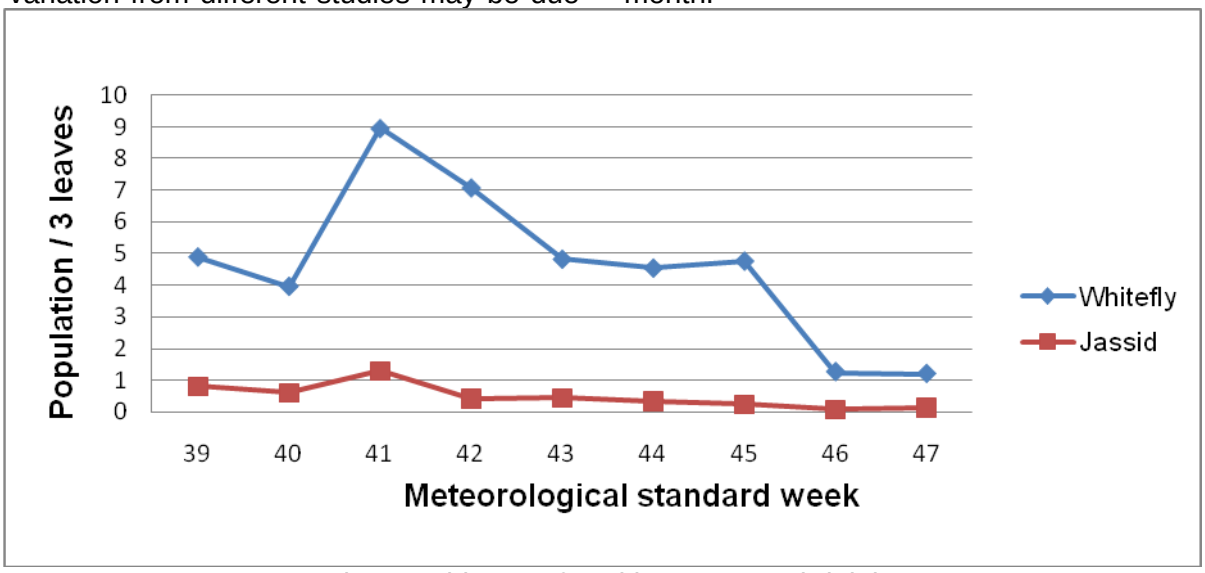

Fig 1: Incidence of sucking pests on brinjal

Correlation studies revealed that maximum temperature and minimum temperature were significantly positive correlated (r=0.59, 0.79, respectively) with jassid population. Whereas morning relative humidity was negatively correlated (r=-0.15) while evening relative humidity, rainfall and sunshine hours were positively correlated (r= 0.31, 0.41, 0.18, respectively) with jassid population but to the non- significant level. The significantly positive correlation of jassid with maximum temperature was reported by Patel *et al.* (2015) as well as Shalini *et al.* (2017).

Shoot and fruit borer

The infestation of shoot and fruit borer was observed at the second week of October (41st standard week) with 4.0% shoot infestation. Then the infestation gradually increased and reached its peak during the second week of November (46th standard week) with 20.0% shoot infestation. Latha *et al.* (2018) observed a peak incidence (30%) during October month and Sahu *et al.* (2018) observed the maximum population at second week of December which were fluctuating from this study while Shukla and Khatri (2010) observed a peak incidence at last two weeks of October month and Maru and Kumar (2018) observed a peak incidence (59.09% damaged fruits) at last week of October. During the peak incidence of this study, maximum and minimum temperature were 30.1^{0}C and 13.4^{0}C, respectively and morning and evening relative humidity were 90.7% and 32% respectively with 7.60 hrs of sunshine.

Table 2: Correlation were observed between insect pets of brinjal and weather factors

Insect pests	Temperature (°C)		Relative humidity (%)		Rainfall (mm)	Sunshine hours (hrs)
	Maximum	Minimum	Morning	Evening		
Whitefly	0.73*	0.79*	-0.56*	0.05	0.15	0.15
Jassid	0.59*	0.79*	-0.15	0.31	0.41	0.18
Shoot and fruit borer	-0.47	-0.77*	0.24	-0.44	-0.56*	-0.08

**Significant at 5% level*

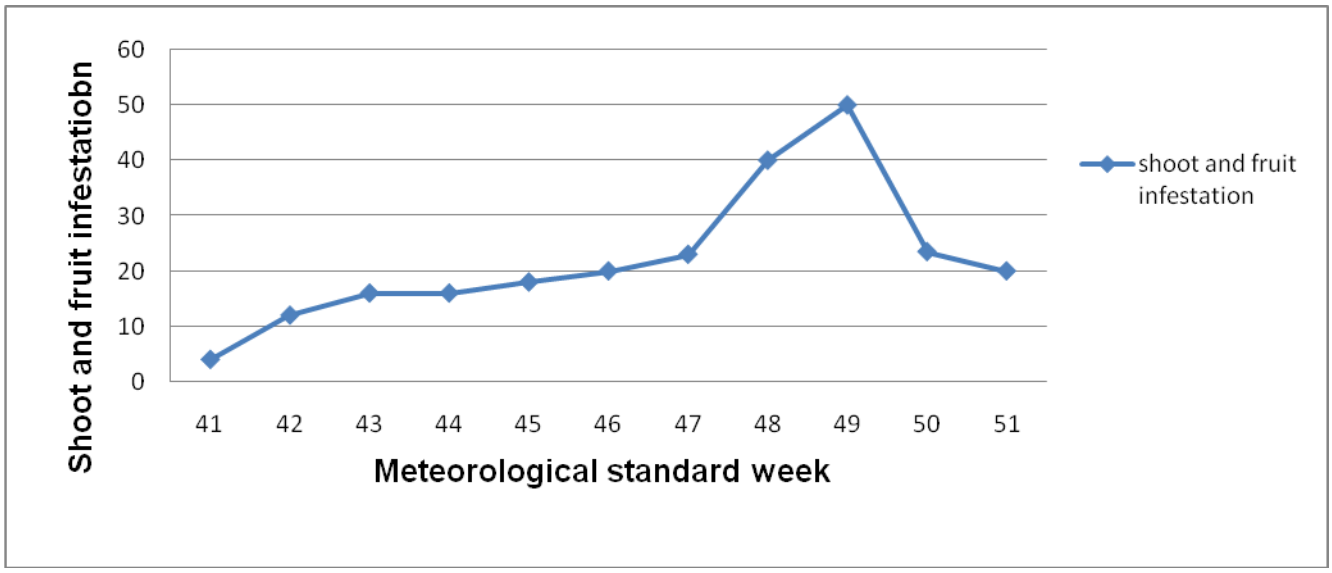

Fig 2: Incidence of shoot and fruit borer on brinjal

The fruit infestation was high during the first week of December (49th standard week) with 50% fruit infestation. During this period, maximum and minimum temperature were 24.4^{0}C and 10.3^{0}C, respectively, and morning and evening relative humidity were 93.7% and 41.1%, respectively with 6.30 hrs of sunshine. Thereafter the fruit infestation gradually declined to 20% during the third week of December (51th standard week). The present results are in agreement with the results of Shukla and Khatri (2010) and Kumar and Singh (2012) who reported the incidence of shoot and fruit borer from October to December.Correlation studies revealed that minimum temperature and rainfall exhibited significant negative correlation (r= -

0.77, -0.56, respectively) with shoot and fruit borer population. Whereas morning relative humidity observed positive correlation (r= 0.24) with shoot and fruit borer population while maximum temperature, evening relative humidity and sunshine hours were observed negative correlation (r= -0.47, -0.44, -0.08, respectively) with shoot and fruit borer population but to non – significant level. In earlier findings negative correlation of minimum temperature was reported by Mondal *et al.* (2014) as well as Deole (2015) and negative correlation of relative humidity (evening) was reported by Sahu *et al.* (2018) which were similar with the present investigation results.

It can be concluded that seasonal population fluctuation of sucking insect pests on brinjal crop is greatly influenced by abiotic factors and peak population levels were observed during October. Whitefly population (4.89/ 3 leaves) was noticed during 39th standard week and reached peak by 41st standard week (8.96/ 3 leaves) (October) whereas the jassid population (0.8/ 3 leaves) was noticed during 39th standard week and reached peak by 41st standard week (1.29/ 3 leaves) (October). The statistically significant values indicated that occurance of insect pests populations were due to the prevailing ecological conditions.

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