International Journal of Engineering Research & Management Technology
ISSN: 2348-4039
January-February-2023 Volume 10, Issue-1
Email: editor@ijermt.org www.ijermt.org

REGULAR INCIDENCE OF DIFFERENT INSECT PESTS OF BRINJAL IN ADDITION, THEIR CORRELATION WITH ABIOTIC FACTORS

Anuj Kumar Tiwari,
Research Scholar,
Dept. of Botany,
Sikkim Professional University, Sikkim

Dr. Ashok Kumar,
Professor, Dept. of Botany,
Sikkim Professional University, Sikkim

Abstract
The present paper was carried out during the period of November 2014 to April 2015 at Agriculture farm, Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati, at Sriniketan. Influence of weather parameters on the seasonal incidence of insect pests of okra was observed during rabi season. In brinjal the incidence of A. gossypii, was maximum during February (8th MSW) and minimum during April (14th MSW). The incidence of B. tabaci was maximum during March (10th MSW) and minimum during April (14th MSW). The incidence of A. biguttula biguttula, was maximum during March (12th MSW) and minimum during April (14th MSW). The population of Epilachna spp., was maximum during February (8th MSW) and minimum during April (14th MSW). The incidence of Leucinodes arbonalis on shoots and fruits was maximum during March (11th MSW) and minimum during April (14th MSW). The coefficient of determination (R2) for aphid, whitefly, leafhopper, Epilachna, shoot and fruit infestation was 0.342, 0.783, 0.743, 0.319, 0.851, 0.685, respectively. The statistically significant values indicated that occurrence of insect pests population was due to the prevailing ecological conditions.
Keywords: Brinjal, A. , biguttula biguttula, Epilachna, shoot

Introduction

Vegetables are important source of vitamins, minerals, and proteins in human diet throughout the world. Vegetable cultivation, one of the most dynamic branches of agriculture, is rapidly becoming an important source of income for the rural population. However, the cultivation of vegetables is also becoming more costly due to increasing use of purchased inputs such as pesticides and fertilizers to sustain production levels. Injudicious use of such inputs in long runs resulted in negative effects on human health, wildlife, environments and agriculture. Brinjal (Solanum melongena L.) belonging to family Solanaceae is a popular and economically important vegetable crop among small-scale farmers and low-income consumers India ranks second in area (39.3%) and production (27.55%) of brinjal in the world In India, it occupies an area of 669.0 thousand ha with an annual production of 12400.0 thousand tons. West Bengal is the leading brinjal producing state which has production of around 3019.0 thousand tons followed by Odisha 2010.90 thousand tons (Indian Horticulture Database – 2014-15). However, the production of brinjal has been reported to hamper severely due to the attack by a large number of pests right from nursery stage to harvesting. Reports revealed that the solanaceous vegetable is very much susceptible to various insect-pests viz aphid, Aphis gossypii (Glover); whitefly, Bemisia tabaci (Gennadius); leaf hopper, Amarasca biguttula biguttula (Ishida); Hadda beetle, Henosepilachna vigintioctopunctata (Fabricius); fruit and shoot borer, Leucinodes orbonalis (Guenee) and non-insect pest like red spider mites, Tetranychus macfarlanei (Baker and Pritchard) and T. urticae (Koch) while okra is suffered regularly from aphid, A. gossypii; leaf hopper, A. biguttula biguttula, whitefly, B. tabaci, shoot and fruit borer, Earias vittella Fabricius and two spotted spider mite, Tetranychus urticae (Koch) . The population dynamics is the aspect of population ecology dealing with factors affecting changes in population densities. The seasonal effects of weather and ongoing changes in climatic conditions will directly lead to modification in dispersal and development of insect species. The changes in surrounding temperature regimes certainly involve alterations in development rates, voltinism, and survival of insects and subsequently act upon size, density and genetic composition of population as well as to some extent of host plant exploitation. Insect, the ectodermal creature, has very short life cycles and possesses population size variation under the influenced of weather factors. The abiotic factors play an important role in population fluctuation of insect-pests. The interaction between pest activity and abiotic factors will help in deriving at predictive models that aids in forecast of pest incidence. Further, it provides plan for appropriate management strategies of different insect pests. However, the knowledge on seasonal incidence of different pests in relation to weather parameters in brinjal and okra particularly in Red lateritic region is meager.

Materials and Methods

The present experiment entitled "Seasonal incidence of different insect pests of Brinjal (Solanum melongena L.) and their correlation with abiotic factors in Red lateritic zone of west Bengal" was conducted at Agriculture Farm, Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati, Sriniketan, Birbhum, West Bengal Sriniketan during the period of November 2014 to April 2015.

Sriniketan is situated at 24.030N latitude, 87.050F longitude and at an average altitude of 58.90 m above mean sea level in western part of South Bengal. The soil of experimental site was loamy sand in texture with medium to low fertility status and acidic in nature with a pH of 4.40. The other physiochemical properties of soil like Organic carbon (%), available N (Kg/ha), available P (Kg/ha) and available K (Kg/ha) are 0.45, 198.45, 129.84 and 42.42 respectively.

Sriniketan comes under the north of the Tropic of cancer and experiences sub-tropical, sub humid, semi-arid climate. During the experimental period, (November 2014 to April 2015) range of weekly maximum and minimum temperature was 26.36 to 37.52 and 9.02 to 25.62, respectively.

The test variety selected for the study was "Mukta keshi" was shown in 15m x 10m observational strip with the spacing of 1m x 1m (RR X PP). Recommended Agronomic practices were adopted to raising of crop except the crop protection measures

Observations on sucking pests' viz., aphid, leafhopper and whitefly from three leaves (top, middle and bottom) of tagged 10plants at each quadrate were observed carefully and minutely with the help of magnifying glass (10x) for the presence of insect during early morning hours when the pests were less active. Mean population of the insects were expressed as number of insect/leaf/plant. Observations on Epilachna beetle from three leaves (top, middle and bottom) of tagged 10 plants at each quadrate were carefully examined for the presence of grubs and adults during early morning hours when the pests were less active. In case of fruit and shoot borer Number of healthy and damaged shoots was recorded from whole experimental plot. The infestation of fruits was observed at every picking with respect to meteorological standard week. Number of healthy and damage fruits were recorded separately at each picking. The data thus obtained were converted to percent shoot and fruit damage.

The cumulative percent shoot and fruit damage was worked out using following formulae.

$$\text{Per cent shoot damage} = \frac{\text{Number of infested shoots}}{\text{Total number of shoots}} \times 100$$

$$\text{Per cent Fruit damage} = \frac{\text{Number of infested fruits}}{\text{Total number of fruits}} \times 100$$

For finding out the effect of abiotic factors on insect pests population correlation and regression analysis were carried out. The graphical superimposition technique for trend analysis based on these data was done in "MS-Excel".To compare the population means of insects of different sample sizes two samples t-test was carried out. (Gomez and Gomez, 1984).

Results and Discussion

Seasonal incidence of insect pests of brinjal

The population dynamics of important insect pests of brinjal viz. A. gossypii, B. tabaci, A. biguttula biguttula, Epilachna spp., L. arbonalis during different periods of the crop growing season was examined critically in relation to some important climatic factors viz. temperature (maximum and minimum), relative humidity, rainfall, sunshine hours during the whole experimental period as they have significant role on the biology of the insect pests of brinjal plants. Perusal of Table1 showed that population of aphid during field trial initiated on or before 2nd week of November (46thMeteorological Standard Week) at very early stage of the crop (4-6 leaves). Population build up gradually increased and attained peak (28.10aphid/leaf/plant) on 4th week of February (8thMSW) during peak fruiting period of the crop. In this period, population was recorded significantly higher than rest of the period. Thereafter, the population gradually decreased and disappeared after 2nd week of April (14thMSW) reported that the peak population of aphid (91.8 aphid/5 leaves) population reached peak in the last week of February.

The incidence of whitefly population initiated on or before 4th week of January (4thMSW) at peak flowering stage. Population build up gradually increased and attained at peak (2.2whitefly/leaf/plant) on 2nd week of March (10thMSW) during peak fruiting period of the crop. Thereafter, the population gradually decreased and disappeared after 2nd week of April (14thMSW) (Table 1). On the contrary to present observation, white fly (B. tabaci) recorded maximum (nine/five plants) during January (2ndstandard week) reported by Perusal of Table 1 shows that the incidence of leafhopper population during field trial initiated on or before 1st week of February (5thMSW) at fruiting initiation stage. Population build up gradually increased and attained at peak (3.9leafhopper/leaf/plant) on 4th week of March (12thMSW) during fruiting and initiation of senescence period of the crop. Thereafter, the population gradually decreased and remained up to 2nd week of April (14thMSW). This might be due to ageing of the leaves reported that the jassid population was started from third week of February and reached to its peak level (9.53jassids/leaf) at first week of May. The population of Epilachna beetle during field trial initiated on or before 4th week of November (48thMSW) at branching initiation stage. Population build up gradually increased and attained at peak (3.3beetle/leaf/plant) on 4th week of February (8thMSW) during peak fruiting period of the crop. Thereafter, the population gradually decreased and remained up to 2nd week of April (14thMSW). (Table 1).The result is a similar findings of reported the incidence of H. vigintioctopunctata on brinjal in Aligarh in rabi season and noticed that beetle population reached the peak in the third week of February thereafter decreasing trend in population was observed during February to April 2009.

The perusal of Table 1 revealed that the infestation of shoot borer on shoots of brinjal crop, commenced in the first week of February (5thMSW) (0.4%) i.e. three months after transplanting, which gradually increased and reached its peak (3.3%) in the third week of March (11thMSW). Thereafter, the infestation gradually decreased and disappeared during the 2st week of April (14thMSW). The infestation of shoot borer on fruits of brinjal crop started in the 2nd week of February (6thMSW) (7.3%) during fruiting stage of the crop and infestation gradually increased and attained its peak at 3rd week of March (11thMSW) (85%) during fruiting period of the crop. Thereafter, the infestation gradually decreased and remained in low level during the 2nd week of April (14thMSW), (Table 1 reported that brinjal shoot and fruit borer, L. orbonalis and the infestation of shoot borer was observed from last week of February to third week of April with maximum (8.42%) in fourth week of March. Incidence on fruit was noticed at first picking of the crop to the last week of March with maximum (32.36%) in the first week of June.

Pests Calendar of Brinjal

Pest calendar of a crop represents the chronological appearance of different insect pests of a particular crop during the total crop growth period. It is a comprehensive chart where comparative abundance is depicted over the backgrounds of the crop phrenology. In practice, it clearly indicates the degree of periodic vulnerability towards different groups of insect spp. or intensity of damage actually received during that period. The entire spectra of activity are represented against six-month divisions. Major insect pests, the period of activity in a fortnight interval during the crop growing season (1stNovember, 2014 to April, 2015) were considered while preparing the calendar. The details are being illustrated.

Table 1: Incidence of major insect-pests of brinjal at different growth stages of the crop during 2016-2017

Meteorological Standard Week (Month)	Crop Growt stages	Population of Insect-Pests						Meteorological information during crop season				
		h Aphids (No./leaf/ plant)	Whitefly (No./leaf/ plant)	Leafhopper (No./leaf/ plant)	*Epilachna* Beetle (No./leaf/ plant)	Fruit & shoot borer % Shoot infestation	Fruit & shoot borer % Fruit infestation	Min. Temperate (oC)	Max. Temperature	Relative Humidity	Rainfal (mm)	Sunshin Hours
45(1st week of November)	2-3 Leaf	0.0	0.0	0.0	0.0	0.0	0.0	31.38	17.25	74.00	0	7.6
46(2nd week of November)	4-6 Leaf	0.40	0.0	0.0	0.0	0.0	0.0	30.95	14.68	71.28	0	8.6
47(3rd week of November)	6-8 Leaf	1.87	0.0	0.0	0.0	0.0	0.0	29.42	14.26	76.00	0	6.0
48(4th week of November)	Branching Initiat	1.97	0.0	0.0	0.2	0.0	0.0	26.83	12.01	79.86	0	6.67
49(1st week of December)	Branching	2.70	0.0	0.0	0.3	0.0	0.0	28.72	13.14	82.29	0	7.69
50(2nd week of December)	Branching	3.50	0.0	0.0	0.4	0.0	0.0	26.36	10.07	82.57	0	7.34
51(3rd week of December)	Vegetative	4.10	0.0	0.0	0.5	0.0	0.0	26.90	12.11	81.29	0	4.15
52(4th week of December)	Peak Vegetative	4.90	0.0	0.0	0.7	0.0	0.0	26.20	12.86	88.29	0	4.41
1(1st week of January)	Peak Vegetative	5.70	0.0	0.0	1.2	0.0	0.0	26.47	12.11	84.85	0	5.66
2(2nd week of January)	Flowering initiat	6.30	0.0	0.0	1.5	0.0	0.0	23.77	10.44	77.14	0.3	5.90
3(3rd week of January)	Flowering	7.20	0.0	0.0	1.8	0.0	0.0	26.74	9.02	70.71	0	8.47
4(4th week of January)	Peak flowering	8.40	0.2	0.0	2.1	0.0	0.0	28.48	12.15	73.57	0	7.65
5(1st week of February)	Fruiting initiatio	9.30	0.3	0.1	2.1	0.4	0.0	26.98	11.41	79.71	0	6.79
6(2nd week of February)	Fruiting	13.50	0.5	0.4	2.4	1.2	7.3	29.84	12.87	66.14	0	8.66
7(3rd week of February)	Fruiting	27.70	0.6	1.2	2.9	1.4	16.7	29.63	15.15	68.57	0	4.54
8(4th week of February)	Peak Fruiting	28.10	0.8	1.4	3.3	1.5	25.0	32.30	16.62	66.14	0	6.78
9(1st week of March)	Peak Fruiting	24.20	1.3	1.8	1.7	2.4	42.9	33.29	15.19	54.29	0	8.84
10(2nd week of March)	Peak Fruiting	5.67	2.2	2.9	1.1	2.7	43.8	30.40	18.34	68.71	0.57	4.68
11(3rd week of March)	Fruiting	1.60	1.7	3.4	0.8	3.3	85.0	31.99	14.84	55.14	0	8.90
12(4th week of March)	Fruiting + Initiation Senescence	1.10	1.4	3.9	0.5	1.9	55.6	34.14	19.12	69.28	0.10	4.50
13(1st week of April)	Fruiting + Senescence	0.27	0.2	2.7	0.4	0.6	22.2	37.32	24.97	72.85	0.80	7.42
14(2nd week of April)	Harvesting	0.00	0.0	1.3	0.2	0.0	10.0	37.52	25.62	73.57	0	8.65

The role of weather parameters on the population fluctuation of insect pests of brinjal

It is well understood that in the nature ecological parameters play significant role on the biology of any insect pest. The population of pest may build up at any time as a result of interaction between pest and weather parameters. In the present investigation, it was found that the population fluctuation of insect pests of brinjal was greatly influenced by weather prevailed surrounding the experimental area during the previous weeks rather than in real time when observation on pest population was recorded.

During field experiment, among various weather parameters viz. maximum temperature (r=0.130), minimum temperature (r= 0.003) and sunshine hours (r=0.024) showed positive but non-significant correlation with aphid population, whereas other weather parameters viz. rain fall (r= -0.235) and relative humidity (r= -0.436) had non-significant negative effect on aphid population when correlation studies were carried out with weather parameters. Surprisingly, While, reported that average temperature had significant positive correlation with the population of aphid and average relative humidity had significant negative correlation with aphid.

In case of whitefly, when the pest population correlated with weathers prevailed during observation, positive but non-significant effects were recorded for maximum temperature (r=0.154), minimum temperature (r=0.158) and rainfall (r=0.111) while relative humidity (r= -0.566) and sunshine hours (r= -0.228) showed non-significant negative correlation (Table 2). The result was in agreement with who reported that whitefly population showed non- significant relationship with abiotic factors.

Consideration of time of observation and weather data resulted in significant negative correlation with relative humidity (r= -0.646*) and non-significant negative correlation with sunshine hours (r= -0.242) with leafhopper population, whereas, other parameters viz maximum temperature (r=0.041), minimum temperature (r=0.011) and rainfall (r=0.157) had non-significant positive correlation (Table 2). On the contrary, of present observations, reported that leafhopper in brinjal showed significant negative correlation with both maximum and minimum temperatures and wind speed while a positive correlation was revealed with mean relative humidity and total rainfall.

Observation time weather data revealed that *Epilachna* beetle population had non- significant negative correlation with maximum temperature (r= -0.115), minimum temperature (r= -0.242), relative humidity (r= -0.377) and rainfall (r= -0.207) whereas, sunshine hours (r=0.054) had non-significant positive correlation. The result was an agreement with the findings of Percent shoot infestation by fruit and shoot borer of brinjal had significant negative correlation with relative humidity (r= -0.792*). The result was corroborated with who reported relative humidity had significant negative correlation with shoot and fruit borer. Whereas minimum temperature (r= -0.056), rainfall (r= -0.132) had non-significant negative correlation. However, maximum temperature (r=0.093), and sunshine hours (r=0.091) had a positive non-significant correlation with shoot and fruit borer.

Conclusion

Based on the present findings, it can be concluded that correlation of insect pest populations with advanced week's weather data is very much helpful in predicting the pest population in advance. The outcome of the study will be helpful to adopt control measure in time, so that pest population can be managed before it reaches to economic threshold level.

From the overall observations, it was concluded that the above-mentioned 'Pest Calendar' would provide a distinct picture of key pests of brinjal and its seasonal incidence in this Lateritic zone of West Bengal. This will be served as a ready recovers for future survey and surveillance and helps in forecasting and determination of population build-up of insect pests during the crop-growing season.

References

- Indirakumar K, Devi M, Loganthan R. Seasonal incidence and effect of abiotic factors on population dynamics of major insect pests on brinjal crop. Int. J pl. prot. 2014; 9:142-145.

- Naik VCB, Rao PA, Krishnayya PV, Chalam MSV. Seasonal incidence and management of *Bemisia tabaci* Gennadius and *Amrasca biguttula biguttula* Ishida of brinjal. Ann. Pl. Protec. Sci. 2009; 17:971-3573.
- Patel HV, Radadia GG, Chavda SK. Seasonal incidence of major insect pests of brinjal crop during summer season Insect Env. 2015; 20:149-151.
- Qamar M, Haseeb M, Sharma DK. Biology and Morphometrics of *Henosepilachna vigintioctopunctata* (Fab.) on Brinjal. Ann. Pl. Protec. Sci. 2009; 17:303- 306.
- Rashid MH, Khatun MJ, Mahfuz MS, Dash CK, Hussain MA. Seasonal fluctuation of insect pests of brinjal at agricultural research station, Burirhat, Rangpur. Int. J Expt. Agric. 2013; 3:4-8.
- Regupathy A, Palanisamy S, Chandramohan N, Gunathilagaraj K. A Guide on Crop Pests. Sooriya Desk Top Publishers, Coimbatore, 1997, 264.
- Sarvendra S, Akhilesh K, Awasthi BK. Study of Sucking and leaf feeding insect in relation to weather parameters on the brinjal crops. Veg. Sci. 2005; 32:210-212.
- Singhal V. Indian Agric., Indian Economic Data Research Centre, New Delhi, 2003.
- Uthamasamy S, Balasubramanian M. Efficacy of some insecticides in controlling the pests of bhendi (*Abelmoschus esculentus*). Pesticides. 1978; 12:39-41.
- Vanitha SM, Chaurasia SN, Singh PM, Naik PS. Vegetable Statistics. Technical Bulletin No. 51, IIVR, Varanasi, 2013, 250.