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Research Article

POPULATION DYNAMICS OF MAJOR INSECT- PESTS ON KALYANPURTYPE-3 VARIETY OF BRINJAL

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Abstract The population dynamics of major insect pests viz, jassid, hadda beetle and shoot and fruit borer on brinjal was studied. Jassid population was observed from the third week of august till the end of the experiment. The peak period reached on 20th September when the maximum temperature was 32.51^{0}C and minimum 24.48^{0}C with relative humidity of 78.93%. Total rainfall during this period was 3.8 mm in 2000. Similar observation also recorded during 2001 which showed that on September 27th jassid population was seen at peak with maximum temperature of 30 ^{o}C the relative humidity was 82.00% with no rainfall. Whereas hadda beetle population was recorded from third week of August to last week of October. The maximum population 2.5 beetle/ plant were observed in middle of September when maximum and minimum temperature and relative humidity were about 33.17^{0}C & 25.40^{0}C and 75.93%, respectively. Total weekly rainfall on 13th September was 78.8 mm (kharif 2000) . Similar observations were also recorded during kharif 2001 on 20th September when peak beetle population was seen to the extent of 2.39 beetle/ plant with maximum, minimum temperature and R.H. were about 35.23^{0}C ,20.57^{0}C and 63.21%, respectively and no rainfall was observed. The brinjal shoot and fruit borer recorded as the serious pest during September on shoot and thereafter, it shifted to fruit grown thereby during October .The larval population during this time were to the range of 4.16-4.68 in September and October respectively. Thereafter continuous decline persisted in its infestation and there was no shoot infestation after third week of October. The pest was found to switch over to the fruit during initiation of fruiting stage. In the first fortnight of October there was a continuous reduction in fruit infestation till the middle of November. There was positive role of temperature in reducing the intensity and infestation on shoot as well as on fruits, on the other hand the R. H. responded negatively.
Keywords: Brinjal,major insect pests, population, dynamics

Introduction

The vegetables are an important dietary component, because of this reason its extensively cultivated in the world, including India. Amongst the various vegetables, Brinjal (Solanum melongena L.), commonly known as egg plant, is cultivated throughout the year in the country (Shukla and Khatri, 2010). Brinjal cultivation in the nation is done in about 669 thousand hectare area with an annual production of 12,400 thousand tones and productivity of 17 tones per hectare. In Uttar Pradesh, it is cultivated in 7.83 thousand hectare area with a production of 268.82thousand tones and productivity of 25.02 tones per hectare (Anonymous, 2017) .Among the brinjal cultivating state in India; Orissa, Bihar, Karnataka, West Bengal, Andhra Pradesh, Maharashtra and Uttar Pradesh are the major brinjal growing states. West Bengal is the leading states contributing about 23% of the national production while, Madhya Pradesh is contributing about 8% (NHB, 2014) So far, the nutritional value of brinjal is concerned, it supplies per 100 g.; 25 calories, 0.2 g total fat, 2 mg sodium, 229 mg potassium, 6 g total carbohydrate, 3 g dietary fiber, 3.5 g sugar, 1g protein, vitamins (B-6, B-12 and C), iron, magnesium, phosphorus, etc (USDA, 2013). It is as an excellent remedy for those suffering from liver complaints. It has been reported as Ayurvedic medicine for curing the diabetes. In addition, it is also used as a good appetizer, good aphrodisiac, cardiotonic, laxative and reliever of inflammation. Although, productivity of the brinjal in the state is higher than national productivity but quality production of the crop is a matter of concern as it is severaly affected by various insect pest and diseases throughout the year. Among the insect pest jassid (Amrasca biguttula biguttula (Ishida), aphid (Aphis gossypii (Glover), whitefly (Bemisia tabaci (Gennadius), hadda beetle (Epilachna vigintioctopunctata), mealybug (Coccidohystrix insolita (Green), lace bug (Urentius sentis Distant) and shoot and fruit borer (Leucinodes orbonalis (Guenee) have been reported to cause considerable yield loss to the crop (Deole, 2015). No doubt among the insect pests brinjal shoot and fruit borer alone causes more than 90% loss to the crop either quantitative or qualitative (Kalloo, 1988).

The pest when infested the young plant, the damage is seen in the growing shoots of the plants as drooping down of the shoots (**Butani and Jotwani**, 1984) and the infested plant at this stage shows retarded development. But, at flowering and fruiting stage of the crop, damage is done by the larvae of the pest by boring and feeding inside the fruit and detiorating them to the extent of unfit for human consumption and marketing. The damage may reach to the extent of 100 percent (**Islam and Karim**, 1991). S In order of pest severity whitefly, is the next most destructive pest of brinjal and causes direct and indirect damages to the crop. The nymph and adult of whitefly feed on the underside of the leaves by sucking cell sap from them. High infestation of this pest can cause death of seedling and wilting of older plant. It is also known to transmit plant viruses which worsen the crop condition. In addition, it also secret honeydew on the plant and turn them blackish in appearance due to sooty mould development. It cause 25 to 40 percent yield loss(**Anonymous**, 1999). Use of insecticide is one of the most common means for the control of BSFB and other brinjal pests. Which often result in human health hazards and alternation in the agriecosystem and development of resistance to insecticides among the infesting insect (**Harish et al** 2011). Indiscriminate use of pesticides particularly at fruiting stage and non adoption of waiting period practice leads to accumulation of pesticide residues in vegetables (**Kumari at el** 2003) which may be credited to above mentioned problems.S Indiscriminate use of pesticides in the brinjal is also a common practice which is contributing to several problems related to human health and crop ecosystem.

Material and Methods

The experiments on the population dynamics of major insect pests of brinjal ie Jassid *Amrasca biguttula biguttula* Ishida,epilachna beetle *Henosepilechana vigintioctopunctata* Fabr and shoot and fruit borer *Leucinodes orbonalis* Guen were conducted at the vegetable Research centre, kalyanpur,of C S Azad University Of Agriculture and Technology, Kanpur, during kharif 2000-2001.for observing population dynamics, the brinjal variety kalyanpur type-3 was transplanted in seperate field plot measuring 15x10 M size on 1st and 2nd August 2000-2001, respectively.Five plants were selected randomly in the each plot for recording the infestation of the pest. Observation were recorded regularly on these plants weekly interval, starting from 15 days after transplanting in respective years till harvest of the crop.Observation on population dynamics of leaf sucking and feeding pests viz. *Amrasca viguttula viguttula* Ishida ,*Henosepilechna vigintioctopunctata* Fabr were recorded on randomly selected five plants in each replication taking three leaves ie. One each from upper, middle and lover part of each selected plants. Nymph and adults both were counted randomly as mention above and their average population was recrded similarly the population of Hadda beetle was also counted randomly and their average were recrded in tables. The infestation of *Leucinodes orbonalis* Guen. On plants were recorded by counting infested central shoots on randomly selected ten plants from each replication. The fruits of each picking were examined for the larvae count of borer per fruit.The data on population dynamics including infestation of various insect pests on different dates were correlated with prevailing temperature , relative humidity, rain fall on the basis of correlation coefficients betveen the variables.

Result and Discussion

Population dynamics of major insect pests of brinjal crop for kharif describe as below

1. Jassid (*Amrasca biguttula biguttula***)**

The peak period reached on September 20 when the maximum temperature was 32.50$^{\circ C}$ and minimum 24.48$^{\circ C}$ with relative humidity of 78.93 percent. Total rainfall on 24 September was 3.8 mm. (kharif 2000). Similar observations were also recorded on kharif 2001 which shows that on September, peak jassid population was seen with maximum temperature of 30$^{\circ C}$ and followed by minimum R. H. of 82.86 percent was recorded without rainfall. These observations suggested that temperature plays an important role in the population buildup of jassid of brinjal crop due to high temperature of 30.50$^{\circ C}$ and 30.00$^{\circ C}$ with R. H. of 82.86 percent . These finding suggested that as the temperature falls down jassid population also drops down considerably and rainfall & high humidity have no effect on the jassid population buildup. Thus the khaki crop grown in August onward favored more population multiplication of jassid. The present finding is conformity with the finding of Sekhon and Singh, 1985 who stated on the basis of their work that mean range of 27–30$^{\circ C}$ temperature was congenial for the population buildup of jassid *(Amrasca biguttula biguttula)*

2. Hadda beetle (*Henosepilachana vigintioctopunctata***)**

Maximum population of 2.5 beetles per plant on three leaves was observed in middle of September when the maximum , minimum temperature and relative humidity were about 33.17$^{\circ C}$ 25.40$^{\circ C}$ and 75.93 percent R. H. respectively . Total rainfall on 13, September was 78.8 mm (kharif 2000) .Similar observations were also recorded during kharif 2001 which showed that on September, 20

Table:1 Population Dynamics of Major Insect Pests of Brinjal during (Kharif 2000)

Date of observation	Mean Population		Population of insect pests		Environmental Factors			
	Jassid/ Plant three leaves	Hadda beetle/ Plant three leaves	Shoot and fruit borer		Max. Temp. (°C)	Min. Temp. (°C)	Relative Humidity Percent.	Total rain fall (mm)
			On shoots	On fruits				
			No. of larvae /shoot	No. larvae /fruit				
August 16	1.19	1.00	0.00	0.00	32.37	24.00	82.93	44.44
August 23	2.50	1.50	0.00	0.00	34.43	26.17	73.28	0.0
August 30	3.50	2.00	0.89	0.00	31.57	25.11	82.50	72.2
September 06	4.10	2.20	1.08	0.00	31.28	24.26	85.50	72.2
September 13	5.18	**2.50***	1.36	0.00	33.17	25.40	75.93	78.8
September 20	**5.56***	2.00	2.48	0.00	32.50	24.48	78.93	3.8
September 27	4.50	1.00	**3.03***	0.00	34.80	23.77	68.43	2.8
October 04	4.21	2.00	2.01	0.00	34.46	23.17	68.50	0.0
October 11	4.00	0.96	0.78	2.03	35.17	22.00	64.86	0.2
October 18	3.80	0.51	0.30	**4.16***	34.50	17.17	58.00	0.0
October 25	3.50	0.20	0.00	2.73	34.00	17.20	63.50	0.0
November 01	1.70	0.00	0.00	1.49	31.66	17.14	65.57	0.0
November 08	1.60	0.00	0.00	1.28	32.23	13.77	59.14	0.0
November 15	1.60	0.00	0.00	1.77	30.00	10.8	61.36	0.0
November 22	1.50	0.00	0.00	1.31	28.28	11.83	63.93	0.0
November 29	1.00	0.00	0.00	0.84	25.23	8.8	59.36	0.0
December 0 6	0.00	0.00	0.00	0.00	26.11	6.17	52.35	0.0
December 13	0.00	0.00	0.00	0.00	25.23	5.5	57.50	0.0

Note: Peak level of insect population

Table: 2 Population Dynamics of Major Insect Pests of Brinjal During (Kharif 2001)

Date of Observation	Mean population of insect pests		Shoot and fruit borer		Environmental Factors			
	Jassid/ Plant three leaves	Hadda beetle/ Plant three leaves	On shoots	On fruits	Max. Temp. (°C)	Min. Temp (°C)	Relative Humidity Percent.	Total rain Fall (mm)
August 16	2.20	1.09	0.00	0.0	33.17	24.86	81.50	55.8
August 23	2.80	1.89	0.99	0.0	33.23	24.57	78.14	75.04
August 30	3.25	2.13	1.10	0.0	34.38	24.80	73.28	14.05
September 06	3.98	2.00	1.15	0.0	34.34	22.71	67.00	15.08
September 13	4.02	2.07	2.7	0.0	35.56	21.43	56.78	0.0
September 20	4.15	**2.36***	**3.20***	0.0	35.23	20.57	63.21	0.0
September 27	**5.33***	1.25	2.80	0.0	30.00	20.42	82.86	0.0
October 04	4.80	1.95	2.04	1.83	3400	20.28	64.86	50.08
October 11	3.87	1.00	0.53	2.50	33.26	17.00	57.14	5.0
October 18	3.42	0.87	0.18	2.91	32.11	14.14	59.28	0.00
October 25	2.63	0.44	0.00	4.68	33.63	15.57	56.00	0.0
November 08	1.08	0.00	0.00	1.21	29.17	9.14	53.86	0.00
November 15	1.03	0.00	0.00	0.65	26.97	8.14	61.93	0.00
November 22	1.00	0.00	0.00	0.00	25.71	7.28	65.00	0.00
November 29	0.86	0.00	0.00	0.00	26.34	7.00	59.00	0.00
December 06	0.00	0.00	0.00	0.00	20.93	8.00	82.43	0.00
December 13	0.00	0.00	0.00	0.00	21.97	5.43	77.36	0.00

Note : Peak level of insect population.

Table 3: Correlation and regression coefficient between insect population and environmental factor

Name of Insect	Year/ Season	Variates	r	Regression Equation
Amarasca biguttula biguttula Ishida	2000/ Kharif	Maximum Temprature	0.7687**	Y= 939997+.4052 (X)
		Minimum Temprature	0.7885**	Y= -0.7348+0.1915 (X)
		Relative Humidity%	0.5321**	Y= -3.5741+0.0930 (X)
		Rainfall	0.1376	Y= 2.6371+0.0093 (X)
	2001/ Kharif	Maximum Temprature	0.6753**	Y= -2.1206+0.1579(X)
		Minimum Temprature	0.1922	Y= 2.0378+0.0266 (X)
		Relative Humidity%	0.1731	Y= 1.5649 +0.0154 (X)
		Rainfall	0.2051	Y= 2.3416+0.0148 (X)
Henosepilechna vigintioctopunctata fabr	2000/ Kharif	Maximum Temprature	0.5010**	Y= 3.5798+0.1419 (X)
		Minimum Temprature	0.8478**	Y= -1.1267+0.1106 (X)
		Relative Humidity%	0.8108**	Y= -4.2888+0.0761 (X)
		Rainfall	0.4943*	Y= 0.6809+0.00179 (X)
	2001/ Kharif	Maximum Temprature	0.6811**	Y= -1.6223+0.0875(X)
		Minimum Temprature	0.2474	Y= 0.6063+0.0188 (X)
		Relative Humidity%	0.2755	Y= 0.1098 +0.0134 (X)
		Rainfall	0.3764*	Y= 0.7627+0.0149 (X)
Leucinodes orbonalis Guen (on shoot)	2000/ Kharif	Maximum Temprature	0.4637*	Y= -3.6608+0.1375 (X)
		Minimum Temprature	0.5830**	Y= -0.7832+0.0797 (X)
		Relative Humidity%	0.4159*	Y= -2.1144+0.0409 (X)
		Rainfall	0.0655	Y= 0.6359+0.0025 (X)
	2001/ Kharif	Maximum Temprature	0.4566*	Y= -1.2461+0.0688(X)
		Minimum Temprature	0.1599	Y= 0.5158+0.0142 (X)
		Relative Humidity%	0.2153	Y= 0.0050 +0.0123 (X)
		Rainfall	0.0150	Y=0.7913+6.9436 E-04(X)
Leucinodes orbonalis guen (on fruit)	2000/ Kharif	Maximum Temprature	0.2484	Y= 2.016+0.0917 (X)
		Minimum Temprature	-2415	Y= 1.6129+-0.0411 (X)
		Relative Humidity%	-0.4792	Y= 4.8508+0.0587 (X)
		Rainfall	-0.3331	Y= 1.0436+0.0157 (X)
	2001/ Kharif	Maximum Temprature	-0.7422**	Y= 21.3123+-06424(X)
		Minimum Temprature	0.7980**	Y= -5.2693+0.4082 (X)
		Relative Humidity%	-0.8976**	Y=20.9751 +-0.2950 (X)
		Rainfall	-0.1736	Y=2.9767+-00463(X)

Note: * Significant at 5% level.
** Significant at 1% level.

peak beetle population was observed to the extent of 2.39 beetles per plant on the three leaves and maximum, minimum temperature and R. H. of 35.23$^{\circ C}$, 20.57$^{\circ C}$ and 63.21 percent, respectively without rainfall.

Population fluctuation of epilachna beetle in the present experimentation appears to be depend upon the high temperature and moderate relative humidity lower temperature and high relative humidity lowers the beetle population in the crop plant, more rainfall is detrimental to its population buildup. It is apparent that high temperature in the range of 34.00$^{\circ C}$, 35.23$^{\circ C}$, 35.57$^{\circ C}$ and 40.57$^{\circ C}$ along with R. H. of 63.50 , 63.21, 49.93, and 50.43 percent resulted peak population of beetles. Gosh and Senapati 2001 have also studied the season incidence population fluctuation and biology of beetle.

3. Shoot and fruit *borer- (Leucinodes orbonalis)*

It appears as soon as seedlings are transplanted and its activity continues till the harvest of fruits for consumption. Brinjal shoot and fruit borer was recorded as the most serious pest during September on shoot and thereafter , it shifted to fruits during October. The larval populations present during the time were to the range of 4.16 to 4.68 in September and October, respectively .There was continuous decline in its fruit infestation and in intensity and there was no shoot infestation after third week of October. The pest was found to switch over to the fruit during initiation of fruiting stage in the first fortnight of October; there was a continuous reduction in the fruit infestation till the middle of November. There was positive role of temperature in reducing the intensity and infestation on shoot well as on fruits. On the other hand the R. H. responded negetively , these finding are in conformity with those of **Singh et. al. 2000** who have also reported that temperature played important role in the population buildup of *Leucinodes orbonalis*. The larval count on the central shoot of brinjal did not found to be influence by any of the ecological parameters. Temperature more than 30.00$^{\circ C}$ with 60.00 and 65.00 percent R. H. was found to be most favorable for multiplication of the pest.

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