The Pharma Innovation Journal 2022; SP-11(5): 1689-1693

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(5): 1689-1693

www.thepharmajournal.com
Received: 03-03-2022
Accepted: 09-04-2022

Kamlesh Kumar
Department of Entomology, S.K.N. College of Agriculture, SKNAU, Jobner, Rajasthan, India

Ashok Sharma
Department of Entomology, S.K.N. College of Agriculture, SKNAU, Jobner, Rajasthan, India

Corresponding Author
Kamlesh Kumar
Department of Entomology, S.K.N. College of Agriculture, SKNAU, Jobner, Rajasthan, India

Population dynamics and their correlation coefficient between sucking pests and their natural enemies on brinjal crop in semi-arid conditions of Rajasthan

Kamlesh Kumar and Ashok Sharma

Abstract
Brinjal was a stable vegetable in our diet since ancient time and being grown in all cropping seasons round the year and is also known as poor man's crop. Aphids, jassids, whiteflies, lace wing bugs and mites were cosmopolitan in distribution and were found wherever brinjal is grown. Population of these pests are often seen on tender parts of the plant, particularly on leaves. The nymphs and adults of these pests suck the cell sap from leaves and tender parts of plants which leads to yellowing, deformation, wilting and ultimately drying of the affected parts. Sucking pests also act as a vector of different diseases in brinjal crop such as little leaf by jassids and shooty mould by aphids and whiteflies. Pests were recorded from transplanting to harvest of the crop. Observations on 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. During the population dynamics studies of jassid, *A. biguttula biguttula* whitefly, *B. tabaci* and mite, *T. cinnabarinus* were observed as major sucking pests. The peak incidence of jassid, whitefly on brinjal were observed in (41th SMW) 4th week of September and mite and predators population peaked in the (44th SMW) 3rd week of October.

Keywords: Brinjal, sucking pests, natural enemies, correlation coefficient

Introduction
Brinjal was a stable vegetable in our diet since ancient time and being grown in all cropping seasons round the year and is also known as poor man's crop. It had several vernacular names *viz*., eggplant, aubergine, baingan, badone, kausi, vangi and, vazhuthana (Yawalkar, 1985) [3]. It was a delicate perennial, often cultivated as annual and closely related to tomato and potato. Beside a vegetable, brinjal is used in a variety of culinary preparations. Due to its nutritive value unripe fruits were primarily used as cooked vegetable for the preparation of various dishes in all regions of the world. It had got much potential as raw material in pickle making and dehydration industries. It was supposed to contain certain medicinal properties however, white brinjal is said to be good for diabetic patients (Choudhary, 1967) [7]. The fruit contains moisture 92.7 g, protein 1.4 g, fat 0.3 g, minerals 0.3 g (calcium 18 mg, magnesium 16 mg, phosphorus 47 mg, sulphur 44 mg, sodium 3 mg, potassium 2 mg, chlorine 52 mg, iron 0.9 mg, copper 0.17 mg etc.), fiber 1.3 g, carbohydrate 4.0 g and vitamins (vitamin A 124 IU, thiamine 0.04 mg, vitamin C 12 mg, riboflavin 0.11 mg, nicotinic acid 0.09 mg) per 100 g edible portion (Aykroid, 1963) [6]. The total area under cultivation of this crop in our country was 6. 80 lac hectares with an annual production of 118.96 lac tonnes with productivity of 17.5 MT ha^{-1}. In Rajasthan, it is grown in an area of 1.9 million hectare with an annual production of 2.4 million tonnes and with 12464 kg ha^{-1} productivity (Anonymous, 2012) [5]. Aphids, jassids, whiteflies, lace wing bugs and mites were cosmopolitan in distribution and were found wherever brinjal is grown. population of these pests are often seen on tender parts of the plant, particularly on leaves. The nymphs and adults of these pests suck the cell sap from leaves and tender parts of plants which leads to yellowing, deformation, wilting and ultimately drying of the affected parts. Sucking pests also act as a vector of different diseases in brinjal crop such as little leaf by jassids and shooty mould by aphids and whiteflies. The losses caused by brinjal pests vary from season to season, depending upon environmental factors (Gangawar and Schan, 1981) [8] and Patel *et al*. (1988) [12]. The interaction between pest activity and abiotic factors help in deriving predicative models that in turn forecast the pest incidence. So, the present investigations were undertaken to study the seasonal incidence of different insect pests that occurred in brinjal ecosystem and the most influential abiotic factors that conditioned the pests.

Material and Methods

The materials used and methodology adopted during the course of investigations on the population dynamics of pest their natural enemies, estimation of losses caused by sucking pests on brinjal. Site and location of the experiment: - The present investigations were conducted at Horticulture Farm, S.K.N. College of Agriculture, Jobner (Rajasthan) on brinjal crop during rainy season, 2012. Geographically, Jobner is located at longitude of 78º 28' East; latitude 26º 26' North and at an elevation of 427 metre from Mean Sea Level (MSL) in Jaipur district of Rajasthan. Climate and weather conditions of the location: - The climate of the region was typically semi-arid which is characterized by extremes of the temperature both during the summer and winter. During summer, temperature may rise as high as 47 ºC and in winter, it may fall as low as 2-3 ºC. The average total rainfall is 490 mm and mostly received from July to September Observation:- The incidence of sucking pests *viz*; aphid, *Aphis gossypii*, jassid, *Amrasca biguttula biguttula*, white fly *Bemisia tabaci*, lace wing bug, *Urentius echinus* pests were recorded from transplanting to harvest of the crop. Observations on 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 observations on the incidence of mite, *Tetranychus cinnabarinus*, Boisduval was recorded after one month of transplanting of the crop and later observations were recorded at weekly interval on five randomly selected plants. For counting of mite population, nine leaves were observed from each plant, *i.e.*, three leaves each from top, middle and bottom portions of the plant with the help of hand lens (Anonymous, 2000) [3]. The population of natural enemies was recorded on five plants selected randomly in each replication and population per plant was calculated. These observations were statistically analyzed using $\sqrt{x}$ +0.5 transformations.

Layout and design To study the population dynamics of sucking pests and their natural enemies on brinjal, variety 'Pusa Purple Round' was transplanted on 18th July, 2012 in three plots of 3 x 3 m^2 size keeping row to row and plant to plant distance of 60 and 50 cm, respectively.

For recording the observations, the crop was allowed to have natural infestation. The observations on pest's population and natural enemies were recorded from five tagged plants at weekly interval from the appearance to harvesting of the crop. The data recorded on sucking pests, natural enemies and meteorological parameters were used for statistical analysis (Panse and Sukhatme, 1967) [11]. To interpret the results of seasonal incidence of insect pests on brinjal, simple correlation was computed between pest population and weather parameters, *viz*.; maximum and minimum temperatures, relative humidity and rainfall. The following formula was used for calculating correlation coefficient (Gupta, 1996) [9].

$$r = \frac{N \sum xy - (\sum x)(\sum y)}{\sqrt{N \sum x^2 - (\sum x)^2 . N \sum y^2 - (\sum y)^2}}$$

Where

N= Number of observations

r = Simple correlation coefficient

x = Independent variable i.e. abiotic component

y = Dependent variable i.e. pest

Economics: To evaluate the relative economics of each treatment, the benefit cost ratio was computed taking the yield and cost of all treatments into account.

Result and Discussion

The population of jassid, *Amrasca biguttula biguttula* Ishida. whitefly, *Bemisia tabaci* Genn. and mite, *Tetranychus cinnabarinus* Boisduval. were reported to be high, as such these sucking pests have been categorized as major ones, however, the incidence of aphid, *Aphis gossypii* Glover; and hadda beetle, *Henosepilachna vigintioctopunctata*, Fab. was very low, therefore, their population could not be recorded on the crop in the present study.

The data presented in table 1, 2 and fig. 1 revealed that the incidence of jassid, *A. biguttula biguttula* was recorded at weekly interval on three leaves, one each from top, middle and bottom canopy of each randomly selected and tagged five plants per plot. The incidence commenced in the 1st week of August (33rd SMW) and remained throughout the cropping season. Initially the population of jassid was 1.8 / 3 leaves which gradually increased and reached to its peak (37.8 / 3 leaves) in 4th week of September (41thSMW). Thereafter, jassid population start declining from 1st week of October (42thSMW) to third week of November (48thSMW) and ranged from 29.6 to 2.4 jassids / 3 leaves.

The incidence of whitefly, *B. tabac*i commenced in the 1st week of August (33rd SMW) and remained throughout the cropping season. The population of white fly was 3.4 / 3 leaves which gradually increased and touched peak (60.8 / 3 leaves) in 4th week of September (41thSMW). Thereafter, it gradually decreased from 1st week of October (42thSMW) to 3rd week of November (48thSMW). The population of white fly declined in 3rd week of November to negligible level i.e.4.0 / 3 leaves.

Similarly the incidence of mite, *T. cinnabarinus* was recorded at weekly interval on five randomly selected plants. The counts were done on nine leaves plucked i.e. 3 leaves each from top, middle and bottom portions of the tagged plant. The absolute counts of mite population were made with the help of hand lens. The incidence of mite commenced in the 3rd week of September (39thSMW) and remained throughout the cropping season.

In the begining the population of mite was 1.66 / 9 leaves, which gradually increased and reached to its peak (478.40 / 9 leaves) in 3rd week of October (44thSMW), thereafter the mite population gradually declined from 4th week of October (45thSMW) to 3rd week of December (51thSMW) and ranged from 348 to 10.2 / 9 leaves.

Beside the pests species, two predatory species were also recorded during the croping season, *viz*., green lace wing bug, *Chrysoperla carnea* Stephense and lady bird beetle, *Coccinella septempunctata* Linn. The incidence of green lace wing bug commenced in the 3rd week of September (39thSMW), 2012 with a population of 1.2 / 3 leaves. The population of the predator gradually increased and reached to its peak (6.8 / 3 leaves) in 3rd week of October (44thSMW), thereafter, their population was declined from 4th week of October (45thSMW) to 3rd week of November (48thSMW) and ranged from 6.2 to 1.0 / 3 leaves.

The incidence of lady bird beetle commenced in 4th week of September (40thSMW), 2012 with a population of 2.0 / 3 leaves. The population of the predator gradually increased and peaked (6.6 / 3 leaves) in 3rd week of October (44thSMW), thereafter, their population declined from 4th week of October (45thSMW) to 2nd week of November (47thSMW) and ranged

from 4.4 to 0.6 / 3 leaves.

With the view to provide a sound base for the management of sucking pests of brinjal, a quantitative estimation of population build up of jassid and whitefly was carried out in relation to abitoic factors, *viz.*, minimum and maximum temperature and average relative humidity and rainfall under the prevailing agro-climatic conditions. The table 1 and fig. 1 revealed that incidence of jassid and whitefly on brinjal during kharif, 2012 started in the 32nd SMW when maximum and minimum temperature was 35.3 ^{0}C and 26.2 ^{0}C, respectively, with 58% average relative humidity. The population increased gradually reaching to maximum with 37.8 jassids and 60.8 whiteflies / 3 leaves in the 41th SMW at 36.1 ^{0}C maximum temperature and 17.9 ^{0}C minimum temperature and 43% average relative humidity. Thereafter, the population of these pests start declining and reached to a negligible level in the (48th SMW).

The incidence of mite on brinjal during kharif, 2012 started in the 39rd SMW when maximum and minimum temperature was 33.0 ^{0}C and 23.1 ^{0}C, respectively, with 65% average relative humidity. The population of mite increased gradually reaching to maximum with 478.4 / 9 leaves in the 44th SMW at 30.7 ^{0}C maximum temperature and 13.0 ^{0}C minimum temperature and 52% average relative humidity. Thereafter, the population start declining and reached to a negligible level in the 2nd week of December (51th SMW) as 10.2 mites / 9 leaves.

The correlation matrix table 2 indicated a significant positive correlation of jassid and whitefly with maximum temperature (0.749 and 0.759 respectively) and non-significant correlation with minimum temperature (0.199 and 0.227 respectively), relative humidity (-0.312 and -0.284 respectively) and rainfall (-0.273 and -0.240 respectively). Mite population showed a significant negative correlation with minimum temperature and relative humidity (-0.445 and -0.472 respectively) and a non significant correlation with rainfall and maximum temperature (-0.368 and -0.069 respectively). Table 2 also showed significant negative correlation between green lace wing bug population and relative humidity (-0.555) and non-significant correlation with maximum temperature, minimum temperature and rainfall (0.301,-0.377 and -0.426 respectively. Whereas in case of lady bird beetle, abiotic factors under study had shown showed significant correlation representing figures as 0.479 and -0.539 for maximum temperature and average relative humidity respectively, however, minimum temperature and rainfall had depicted a non-significant correlation (-0.22 and -0.356 respectively).

Table 1: Population dynamics of sucking pests and their natural enemies on brinjal crop

S.N.	SMW*	Date of observation	No. of jassid / 3 leaves	No. of white fly / 3 leaves	No. of mite /9 leaves	No. of green lace wing bug/ 3 leaves	No. of lady bird beetle/3 leaves	Temperature (^{0}c)		Average relative humidity (%)	Total rainfall (mm)
								Maximum	Minimum		
1	32	25/07/2012	0	0	0	0	0	35.3	26.2	58	0.8
2	33	05/08/2012	1.8	3.4	0	0	0	31.3	24.5	85	119.8
3	34	12/08/2012	4.8	7.0	0	0	0	29.4	24.4	85	44.6
4	35	19/08/2012	6.0	9.2	0	0	0	28.4	23.9	89	135.2
5	36	26/08/2012	8.0	14.6	0	0	0	30.8	24.7	82	151.4
6	37	02/09/2012	11.4	21.6	0	0	0	31.1	24.1	87	52.6
7	38	09/09/2012	19.2	30.8	0	0	0	31.9	25.5	79	16.0
8	39	16/09/2012	26.8	41.0	1.6	1.2	0	33.0	23.1	65	0.0
9	40	23/09/2012	32.4	55.0	5.6	2.0	2.0	33.8	19.0	53	0.0
10	41	30/09/2012	37.8	60.8	38.8	2.4	4.2	36.1	17.9	43	0.0
11	42	07/10/2012	29.6	52.4	170.4	4.8	5.6	35.0	15.3	49	0.0
12	43	14/10/2012	24.8	39.2	300.0	5.8	5.8	33.9	16.6	53	1.4
13	44	21/10/2012	18.8	25.8	478.4	6.8	6.6	30.7	13.0	52	0
14	45	28/10/2012	13.6	15.6	348.0	6.2	4.4	30.7	11.3	55	0
15	46	04/11/2012	7.4	10.8	196.8	5.0	1.4	29.7	10.6	55	0
16	47	11/11/2012	5.4	7.2	152.0	3.0	0.6	29.3	09.2	53	0
17	48	18/11/2012	2.4	4.0	96.0	1.0	0	28.2	08.7	55	0
18	49	25/11/2012	0	0	51.7	0	0	27.3	8.0	52	0
19	50	02/12/2012	0	0	24.3	0	0	26.4	7.6	54	0
20	51	09/12/2012	0	0	10.2	0	0	26.1	7.2	55	0

* Standard meteorological week

Table 2: Correlation coefficient between the populations of sucking pests, predators and weather parameters in brinjal crop

Particulars	Correlation coefficient (r)				
	Number of jassid / 3 leaves	Number of whitefly / 3 leaves	No of mite /9 leaves	No. of green lace wing bug/ 3 leaves	Number of lady bird beetle/ 3leaves
Maximum temperature	0.749**	0.759**	0.069	0.301	0.479*
Minimum temperature	0.199	0.227	-0.445*	-0.377	-0.222
relative humidity	-0.312	-0.284	-0.472*	-0.555*	-0.539*
Rainfall	-0.273	-0.240	-0.368	-0.426	-0.356

* Significant at the 5% level

** Significant at the 1% level

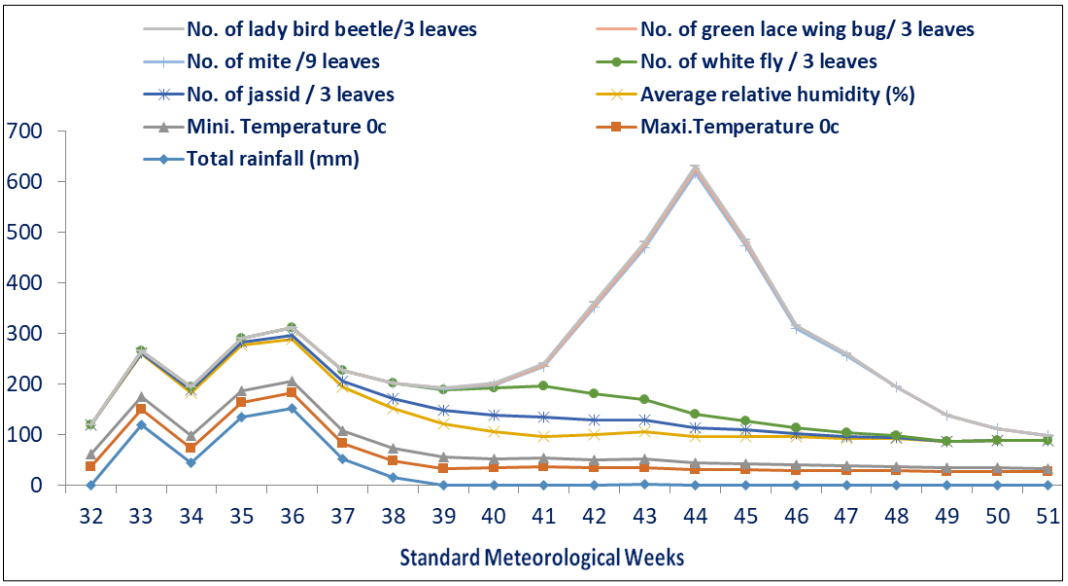

Fig 1: Population dynamics of sucking pests and their natural enemies on brinjal crop

Conclusion

The present investigations entitled "Population dynamics and management of sucking pests of brinjal" estimate the losses caused by sucking pests of brinjal. Was carried on *kharif* season brinjal in 2012 at Horticulture Farm, S.K.N. College of Agriculture, Jobner (Rajasthan) with the objectives: To study the population dynamics of sucking pests of brinjal and its natural enemies in semi-arid conditions of Rajasthan incidence based spray schedule for the management of sucking pests. The population dynamics of major sucking pests and their natural enemies on brinjal crop revealed that three sucking pest species, *viz*. jassid, *Amrasca biguttula biguttula* Ishida, whitefly, *Bemisia tabaci* Genn. and mite *Tetranychus cinnabarinus* Boisduval. appeared as major sucking pests due to their high population. During monitoring some other insect pests *viz.*, aphid, *Aphis gossypii*, Glover and hadda beetle, *Henosepilachna vigintioctopunctata*, Linn. were also found in traces. The incidence of jassid and whitefly were commenced in the 1st week of August and then gradually increased and reached to its peak in 4th week of September (41th SMW) (jassid and whitefly with 37.8 and 60.8 / 3 leaves, respectively), at 36.1 ^{0}C maximum temperature and 17.9 ^{0}C minimum temperature and 43 per cent average relative humidity, thereafter, started declining. Mite first appeared in 3rd week of September (39th SMW) with population of 1.6 / 3 leaves and then gradually increased and reached to its peak in 3rd week of October (44th SMW) at 30.7 ^{0}C maximum temperature and 13.0 ^{0}C minimum temperature and 52 per cent average relative humidity, thereafter, started declining. Two predatory species *viz.*, green lace wing bug, *Chrysoperla carnea* Stephense and lady bird beetle, *Coccinella septempunctata* Linn was recorded during the crop season. The first observation of the green lace wing bug was recorded on 3rd week of September (39th SMW) with population of 1.2 / 3 leaves and lady bird beetle first recorded in 4th week of September (40thSMW) with population of 2 / 3 leaves, which gradually increased and reached to its peak in (44th SMW) 3rd week of October (6.8 and 5.8 / 3 leaves), thereafter, their population was declined. Incidence of jassid and whitefly on brinjal had significant positive correlation with maximum temperature and non-significant correlation with minimum temperature, relative humidity and rainfall. Mite showed a significant negative correlation with minimum temperature and relative humidity and a non-significant correlation with rainfall and maximum temperature. Significant negative correlation of green lace wing bug (predatory population) with relative humidity and non-significant correlation with maximum temperature, minimum temperature and rainfall. Significant positive correlation of lady bird beetle (predatory population) with maximum temperature and significant negative correlation with relative humidity and non-significant correlation with minimum temperature and rainfall.

During the population dynamics studies of jassid, *A. biguttula* whitefly, *B. tabaci* and mite, *T. cinnabarinus* were observed as major sucking pests.

The peak incidence of jassid, whitefly on brinjal were observed in (41th SMW) 4th week of September and mite and predators population peaked in the (44th SMW) 3rd week of October.

Reference

1. Anonymous. Research report. Department of Entomology. B.A. College of Agriculture. G.A.U. Anand, 1986, 13-18.
2. Anonymous. Progr. Rep. (1994-96). AICRP on Agricultural Acarology, University Agricultural Science, Bangalore, 1996, 78p.
3. Anonymous. A progress Report, 2001-01. All India Network Project on agricultural, Acarology, Network Unit AINP on agricultural Acarology, Bangalore, 2000, 1-198p.
4. Anonymous. Progress report (1998-2000). All India Coordinated Research Project on Agricultural Acarology, Project Coordinated Unit, College of BS & H building University of Agricultural Sciences, G.K.V.K., Bangalore, 2000, 14-15, 122p.
5. Anonymous. Indian Horticulture Database. National Horticulture Board, Ministry of Agriculture, Krishi Bhawan, Government of India, New Delhi, India, 2012, 140-142.
6. Arkroyd WR. Nutritive value of vegetables. ICMR Special Report, 1963, 42.
7. Choudhary B. Vegetables (4th edn.) National Book Trust, New Delhi, 1967, 48-54.
8. Gangawar RT, Sachan JN. Seasonal incidence and

control of insect pests of brinjal with special reference to shoot and fruit borer, *Leucinodes orbonalis* Guen. in meghalaya. Journal of Research, Assam Agricultural University. 1981;2(2):87-92.
9. Gupta SC. Correlation, Fundamentals of Statistics. Himalaya Publishing House, Mumbai, 1996, 510-587pp.
10. Gupta VN, Gupta SK. Mites associated with vegetable crops in West Bengal. Indian Journal of Acarology. 1985;10:61-64.
11. Panse VG, Sukhatme PV. Statistical Method of Agricultural Workers, ICAR, New Delhi, 1967, 152-160p.
12. Patel JR, Korat DM, Patel VD. Incidence of shoot and fruit borer (Leucinodes orbonalis Guen.) and its effect on yield of brinjal. Indian Journal of Plant Protection. 1988;16(2):143-145.
13. Yawalkar KS. Vegetable crops in India. Agro Horticulture Publishing House Nagpur, 1985, 85p.