Original Research Article

Seasonal incidence of insect pests of tomato (Lycopersicum esculentum Miller)

ABSTRACT

A field experiment was conducted at Entomology research field, IANS, Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur during *Rabi*, 2022 , for studying the seasonal incidence of insect pests infesting tomato. Serpentine leaf miner, aphid appeared during 46th SMW and whitefly, jassid during 48th SMW, while fruit borer was observed during 2nd SMW. Correlation study revealed that Serpentine leaf miner, whitefly, aphid, jassid, fruit borer showed significantly positive correlation with the maximum temperature and minimum temperature while serpentine leaf miner and fruit borer showed negatively non-significant correlation with the relative humidity morning and relative humidity evening, however whitefly jassid and aphid showed negatively significant correlation with the relative humidity morning and whitefly jassid shown negatively significant correlation with relative humidity evening while aphid showed negatively non-significant correlation with the relative humidity evening. However, all the insect pests showed non-significant correlation with the rainfall.

Keywords*: Population, SLM, Whitefly, Aphid, Jassid, Fruit borer, weather parameter, correlation.*

1. INTRODUCTION

Tomato (*Solanum lycopersicum* L.), belonging to the family Solanaceae is the most important vegetable are commonly cultivated both for fresh market and processing. It was originated in tropical America. It is a significant crop cultivated in tropical and subtropical climate. Tomato fruit comprise water 93.1%, fat 0.3gm, calorie 23, vitamin 'A' (320 I.U), vitamin 'B1' (0.07 milligram), vitamin 'B2' (0.01milligram), carbohydrates 3.6%, nicotinic acid (0.4 milligram), vitamin 'C'(31milligram), fibre 0.7%, calcium (20 milligram), phosphorus (36milligram), protein 1.9%, and iron (0.8 milligram). (Mandloi R., 2013).

Tomato is the third most important crop in India after potato and onion. After China, India is the country with the highest tomato cultivation and production. In native habitat, tomato is perennial, although often grown outdoors in temperate climate as an annual herb**.**

Tomato also tops the vegetable in canned products (Chowdhury,1979) it is also used in salad, ketchup, puree, sauces, and other processed foods. In salad fresh and ripe tomatoes fruits are used. For making pickles green tomatoes are used. Tomatoes are cooked alone or used with other vegetables also.

Tomato yield in India is affected by variety of factors, The plant of tomato typically grows to 1-3 metre in height and have a week stem that frequently sprawls over the ground and veins over other plants. The fruit quality of tomato is severely affected by a range of insect pests infesting at various stages of crop growth i.e., from the time of planting until the fruit is harvested. Different parts of the tomato plant offer food, shelter and reproduction site for insects. Insect can may cause death of the tomato plant and also damage fruits in the form of scarring, tissue destruction and aberration in shape or colour. Fruit is contaminated by insects, insect excreta and insect parts. Insects may introduce decay fruit deteriorating organism in to fruit or can act as vector for many viruses, bacteria and several mycoplasmas that cause disorders in growth or death of plant. A total of 41 insect species belonging to 21 families attack the tomato crop (Reddy and Kumar, 2004). There are many insect pests attacking tomatoes have been reported which create havoc by causing both quantitative and qualitative loss to the crop. The tomato agroecosystem is characterized by having few major pests

and some minor or secondary pests. The major insect pests that have the most important role in the economic losses of tomato crop are Leaf miner (*Liriomyza trifolii*), Whitefly (*Bemisia tabaci*), Aphid *(Aphis gossypi*), Fruit borer (*Helicoverpa armigera*), and Jassid (*Amrasca bigutulla*). The estimated losses to the tomato due to attack of different insect pests have been reported in the range of 30-35% (Anonymous, 2007).

2. MATERIAL AND METHOD

The field experiment was conducted during *rabi* season of 2022 for studying the seasonal incidence of insects pests of tomato. The site of the experiment was an Entomology research field, IANS, Deen Dayal Upadhyaya Gorakhpur university Gorakhpur (Uttar Pradesh) (latitude 26.7479º N and longitude 83.3812º E) with an altitude of 75 meters above the mean sea level. During the study tomato variety Lakshmi was grown on a plot size of 3.75 x 4.20 m with 75 cm row spacing and 60 cm plant to plant distance which was replicated thrice. All the recommended horticultural practices were fulfilled as per the scientific suggestions. The crop under investigation was exposed to natural pests' infestation and kept pesticide- free throughout the trial. Observations started with the second metrological week of transplanting and continued till the final crop harvest or final disappearance. The population of the pest was recorded from the tagged five plants at weekly interval. Observation of the population of whitefly (*Bemisia Tabaci*), aphid (*Aphis gossypii*) jassid (*Amrasca bigutulla bigutulla*) was done by counting the number of pests and for serpentine leaf miner number of mines were counted on two upper, two middle and two lower leaves of the plant canopy. For fruit borer larval population was counted on five tagged plants. The data of mean population of pests was correlated with max. temp., min. temp., rh morning and rh evening and rainfall.

3. RESULT AND DISCUSSION

The incidence of insect pests of tomato was studied during Rabi,2022. The study revealed that the five insect pests infesting the crop which are Serpentine Leaf miner (*Liriomyza trifolii*), Whitefly (Bemisia tabaci), Aphid *(Aphis gossypi*), Fruit borer (*Helicoverpa armigera)* and Jassid (*Amrasca bigutulla*). The incidence of this pests started from vegetative stage, after two weeks of transplanting and continued till the harvest whereas the incidence of fruit borer was started at fruiting stage and was observed till the final harvest. The observation of this insects was recorded as mean population and represented in (Table1) with meteorological data and correlation coefficient of pests population with abiotic factors are represented in (Table.2)

3.1 Serpentine Leaf miner (*Liriomyza trifolii* Burgess)

Serpentine leaf miner was first observed during third week of November 2022 during vegetative stage of the crop. The insect was identified as major deteriorator of plant leaves. It is apparent from the data that the serpentine leaf miner was present for the whole cropping period from transplanting to the final harvest. The least population of leaf miner (3.27 live mines plant-1) was observed during the third week of November and the highest population (26.87 live mines plant-1) of serpentine leaf miner was observed in third week of March. Present findings are in accordance with Marcano and Issa (2000), Chaudhary *et al.,* (2001), Asalatha (2002), Reddy and Kumar (2004) they all reported *Liriomyza* spp. as a major pest in tomato. Shinde S. (2007) also reported the presence of this pest on tomato crop throughout the cropping season.

Correlation coefficient among serpentine leaf miner infestation and metrological parameter exhibited significantly positive correlation with the max. temp. (0.504) and min. temp. (0.647) whereas it exhibited negatively non-significant correlation with the rh morning (-0.255) and rh evening (-0.410) and shown positively non-significant correlation with the rainfall (0.0.344). These findings are partially in agreement with Kachave *et al.,* (2020) revealed that the max. temp. had significant role on number of mines and rainfall is positively correlated with the number of mines, Ravipati *et al.,* (2020) reported that min. temp. has significant role on mines and rh morning and rh evening had non-significantly negative impact on *Liriomyza trifolii* population. Choudhary and Rosaiah (2000) reported that evening rh was negatively correlated with incidence of *L. trifolii*.

3.2 Whitefly, (*Bemisia tabaci* Genn.)

Whitefly was first noticed during first week of December 2022. The peak population (10.93 whitefly plant-1) in second week of march and least population (0.53 whitefly plant-1) was recorded during the third week of December. After the first appearance the pests was active till the final harvest. The present data was in accordance with the Kumar *et al.,* (2019), revealed that the population reached peak in second week of March. However, Dhatonde *et al.,* (2014) and Indirakumar *et al.,* (2016) reported the peak population of whitefly during the month of January this finding contradicts with the present results. The difference in the incidence of whitefly might be because of the difference in climate conditions, field conditions and date of transplanting.

Correlation coefficient of whitefly exhibited negatively significant correlation with the rh morning (-0.516) and rh evening (-0.503) while with other metrological parameters such as max. temp. (0.548) and min. temp. (0.703) it showed significantly positive correlation and positive non-significant relation with rainfall (0.231) has been observed. The present results are in agreement with Kumar *et al.,* (2019), observed a significant positive correlation with max. and min. temperature and a significant negative correlation with rh morning and rh evening. Indrakumar *et al.,* (2016), Dhaka and Pareek (2008), Shahnaz *et al.,* (2006) who reported a significant positive correlation with max. and min. temp. and a significant negative correlation with rh morning and rh evening rainfall contradicts the present results.

3.3 Aphid, (*Aphis gossypii* Glover)

The aphid population commenced first during the vegetative stage of the crop in third week of November 2022. The aphid was active till the final harvesting of the tomato fruits. The lowest population (0.53 aphids' plant-1) was observed in the third week in November whereas the highest population (8.13 aphids' plant-1) was recorded during second week in March. Hath and Das (2004) recorded maximum A. gossypii population on during the first week of March

Association of aphids was recorded positive with the rainfall (0.197), significantly positive with maximum temperature (0.501) and minimum temperature (0.670) whereas it showed negatively significant correlation with the relative humidity morning (-0.543) and negatively non-significant correlation with the relative humidity evening (-0.467). Present findings are partially in accordance with the Chakraborty. K. (2011) reported that aphid population is significantly positive correlated with maximum temperature and minimum temperature whereas relative humidity morning is significantly negative correlated and rainfall is positively non-significant correlated, Wade *et al.,* (2020) reported relative humidity negatively non significantly correlated with pest population, Kachave *et al.,* (2020) reported maximum temperature was positively significantly correlated and relative humidity morning showed significantly negative correlation with the pest population whereas non-significant role of rainfall on pest population.

3.4 Jassid, (*Amrasca devastans* Ishida)

Jassid was first observed during the First week of December. After its initial infestation it is seen until final fruit picking. The maximum population (9.27 jassid plant-1) was observed during third week of March along with minimum population of (0.27 jassid plant-1) in first week of December.

Jassid population had significantly positive correlation with the maximum temperature (0.575) and minimum temperature (0.705) and positive correlation with the rainfall (0.320).However it showed negatively significant correlation with the relative humidity morning (-0.575) and relative humidity evening (-0.539).The above data of positively significant maximum temperature and negatively significant relative humidity morning and relative humidity evening match with Sarukh *et al.,* (2017) hence the results strongly supports the present findings . While other parameters differ, it may be due to different climatic conditions, field conditions and sowing date.

3.5 Fruit borer, *Helicoverpa armigera* Hub. (Lepidoptera: Noctuidae)

The larva was first observed during second week of January 2023 at the fruiting stage of the crop and remain active till the final picking of tomato fruits. The maximum fruit borer population (2.07 larvae plant-1) was observed during fruiting stage in second week of March. Rudenko *et al.,*

(2001), Chaudhari *et al.,* (2001), Reddy and Kumar (2004) and Mandal (2012). They all reported that H. armigera had been a major insect pest of tomato.

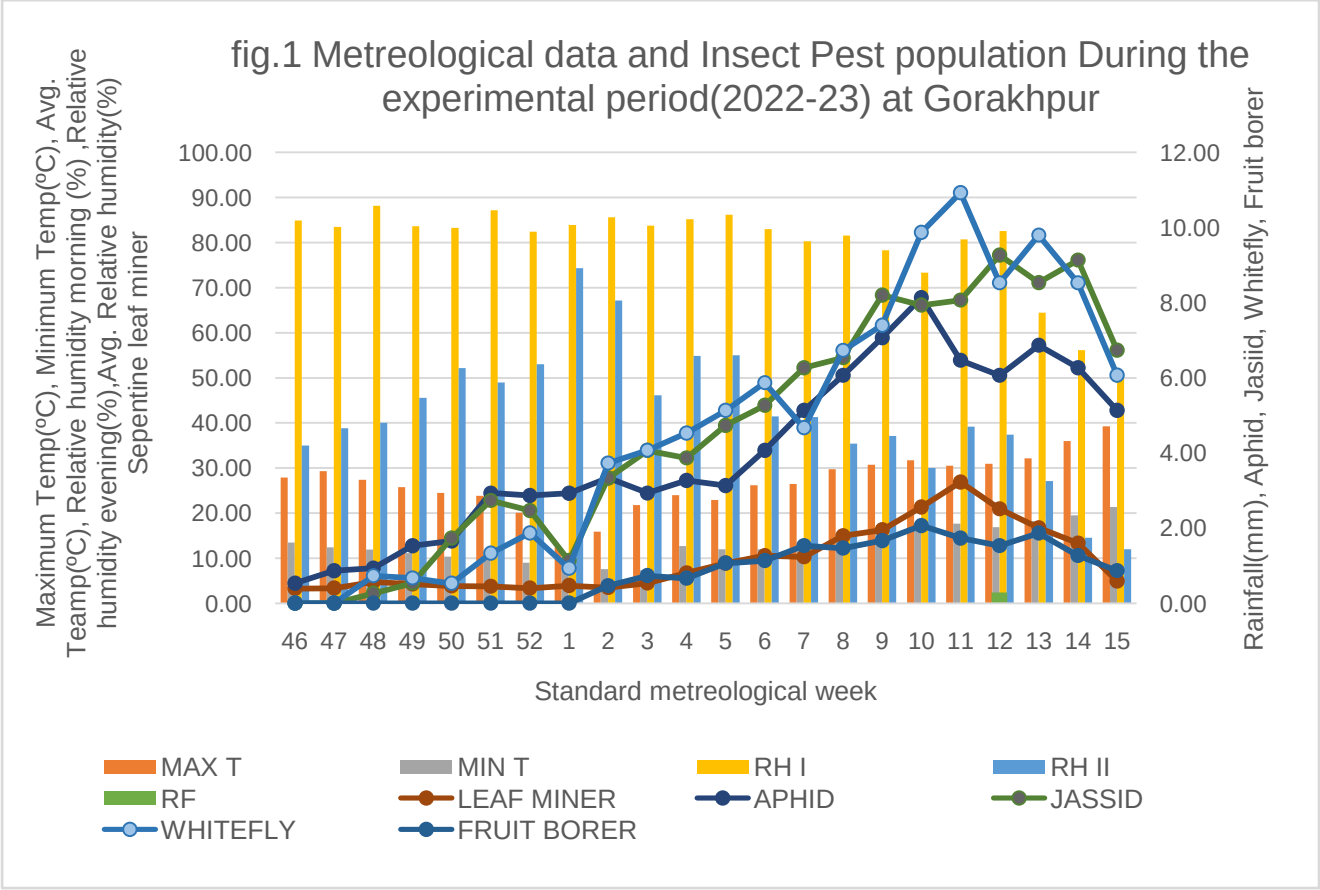
Fruit borer population expressed positive correlation with rainfall (0.196) and positively significant with maximum temperature (0.529) and minimum temperature (0.631). However, it has negatively non-significant correlation with relative humidity morning (-0.422) and relative humidity evening (-0.482). Partially Similar result was reported by Wade *et al.,* (2020) reported the correlation between larval population and relative humidity morning and relative humidity evening were negatively non significantly correlated. Singh, K. (2013) studied that maximum temperature and minimum temperature exhibited positive and significant impact on enhancing the larval population build up. Kachave *et al.,* (2020) recorded the relationship between fruit borer incidence and maximum temperature and recorded significantly positive correlation. Whereas the negatively non-significant with relative humidity morning. Whereas Nadaf and Kulkarni (2006) revealed that Maximum temperature showed significantly positive relation with incidence of *H. armigera* larvae.

Table1. Seasonal incidence of insect pests of tomato (*Solanum lycopersicum*) and metrological data

S.N.	SMW	Temperature(˚C)		Relative humidity %		RF (mm)	APHID	LEAF MINER	JASSID	WHITEFLY	FRUIT BORER
		Max Temp	Min Temp	RH I	RH II						
1	46	27.86	13.47	84.86	35.00	0.00	0.53	3.27	0.00	0.00	0.00
2	47	29.33	12.39	83.43	38.86	0.00	0.87	3.33	0.00	0.00	0.00
3	48	27.39	11.91	88.14	40.00	0.00	0.93	4.73	0.27	0.73	0.00
4	49	25.73	11.17	83.57	45.57	0.00	1.53	4.27	0.53	0.67	0.00
5	50	24.50	10.34	83.29	52.14	0.00	1.66	3.87	1.73	0.53	0.00
6	51	23.84	11.43	87.14	49.00	0.02	2.93	3.73	2.73	1.33	0.00
7	52	20.11	9.04	82.43	53.00	0.00	2.87	3.33	2.47	1.87	0.00
8	1	12.44	9.14	83.86	74.29	0.00	2.93	3.93	1.13	0.93	0.00
9	2	15.89	7.57	85.57	67.14	0.00	3.33	3.47	3.33	3.73	0.47
10	3	21.80	7.36	83.71	46.14	0.00	2.93	4.47	4.07	4.07	0.73
11	4	23.96	12.70	85.14	54.86	0.00	3.27	6.73	3.87	4.53	0.67
12	5	22.91	11.97	86.14	55.00	0.00	3.13	8.87	4.73	5.13	1.07
13	6	26.17	12.01	83.00	41.43	0.00	4.07	10.53	5.27	5.87	1.13
14	7	26.50	11.57	80.29	41.29	0.00	5.13	10.27	6.27	4.67	1.53
15	8	29.73	14.90	81.57	35.43	0.00	6.07	14.93	6.53	6.73	1.47
16	9	30.70	16.06	78.29	37.14	0.00	7.07	16.27	8.20	7.40	1.67
17	10	31.76	17.03	73.29	30.00	0.00	8.13	21.33	7.93	9.87	2.07
18	11	30.54	17.69	80.71	39.14	0.00	6.47	26.87	8.07	10.93	1.73
19	12	30.94	16.86	82.57	37.43	0.00	6.07	20.93	9.27	8.53	1.53
20	13	32.16	18.24	64.43	27.14	0.29	6.87	16.73	8.53	9.80	1.87
21	14	35.99	19.54	56.14	14.57	0.00	6.27	13.33	9.13	8.53	1.27
22	15	39.26	21.37	50.00	12.00	0.00	5.13	4.93	6.73	6.07	0.87

Table 2. Correlation coefficient (r) of insect pests of tomato with meteorological parameters.

Meteorological parameter	Leaf miner	Whitefly	Aphid	Jassid	Fruit borer
Max. Temp(˚C)	0.504	0.548	0.501	0.575	0.529
Min. Temp(˚C)	0.647	0.703	0.670	0.705	0.631
RH (Morning)	-0.255^{NS}	-0.516	-0.543	-0.575	-0.422^{NS}
RH (Evening)	-0.410^{NS}	-0.503	-0.467^{NS}	-0.539	-0.482^{NS}
Rainfall(mm)	0.344^{NS}	0.231^{NS}	0.197^{NS}	0.320^{NS}	0.196^{NS}



4. CONCLUSION

Serpentine Leaf miner (*Liriomyza trifolii*), Whitefly (*Bemisia tabaci*) Aphid (*Aphis gossypi*), Fruit borer (*Helicoverpa armigera*) and Jassid (*Amrasca biguttula biguttula*) were found to be major pests on Lakshmi variety of tomato. The peak activity of SLM (26.87 mines per six leaves) was recorded during 11th SMW. Whitefly (10.93 per plant) reached its peak activity during 11th SMW. Aphid (8.13 per plant) population reach its highest population in 10th SMW. The jassid population (9.27 per plant) was found maximum in 12th SMW. Maximum number of fruit borer larva (2.07 per plant) were found in 10th SMW.

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