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 and fruit borer witnessed significant positive correlation with the maximum temperature and minimum temperature.Serpentine leaf miner and fruit borer recorded negative non-significant correlation with the morning relative humidity and evening relative humidity.Whitefly, jassid and aphid population had significant negative correlation with the morning relative humidity. Whitefly and jassid population registered a significant negative correlation with evening relative humidity.Aphid incidence had a non-significant negative correlation with the evening relative humidity. However, all the insect pests showed non-significant correlation with the rainfall.

Keywords*:Population, Serpentine Leaf Miner, Whitefly, Aphid, Jassid, Fruit borer, weather parameters, correlation.*

1. INTRODUCTION

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

Tomato is the third most important vegetable 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 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. A total of 41 insect species belonging to 21 families attack the tomato crop (Reddy and Kumar, 2004).The major insect pests that have the most important role in the economic losses of tomato crop are Leaf miner (*Liriomyza trifolii*Blanchard), Whitefly (*Bemisia tabaci*Genn.), Aphid *(Aphis gossypii Glov*), Fruit borer (*Helicoverpa armigera Hub.*), and Jassid (*Amrasca bigutullabigutulla* Ish.). The estimated losses to the tomato due to attack of different insect pests have been reported in the range of 30-35% (Anonymous, (2007). As of the devastating effect of the insect pest on the crop it becomes more important to know the time of their infestation to use the pest management practices on time.

2. MATERIAL AND METHOD

The field experiment was conducted during *rabi* season of 2022 for studying the seasonal incidence of insect pests of tomato. The site of the experiment was Entomology research field, Institute of agriculture and natural science Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur, Uttar Pradesh, India. (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 Genn.*), aphid (*Aphis gossypii* Glov.) jassid (*Amrasca bigutulla bigutulla*Ish.) 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 Maximum temperature, minimum temperature, morning relative humidity, evening relative humidity and rainfall.

3. RESULT AND DISCUSSION

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

3.1 Serpentine Leaf miner (*Liriomyza trifolii* Burgess)

Serpentine leaf miner damage was first observed during third week of November 2022 during vegetative stage of the crop. 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), who reported *Liriomyza* spp. as a major pest in tomato. Shinde (2007) also reported the presence of this pest on tomato crop throughout the cropping season.

Correlation coefficient between serpentine leaf miner infestation and metrological parameters 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 influence on leaf miner and morning and evening relative humidity had non-significantly negative impact on *L. 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 (10.93whitefly 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 Kumar *et al.* (2019), who 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 agree with Kumar *et al.,* (2019), who observed a significant positive correlation with max. and min. temperature and a significant negative correlation with morning and evening relative humidity. 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 contradict 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 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. (2011) who reported that aphid population was significantly positive correlated with maximum temperature and minimum temperature whereas morning relative humidity was significantly negative correlated and rainfall was positively non-significant correlated. Wade *et al.* (2020) reported nonsignificant negative correlation between relative humidity and pest population, Kachave *et al.,* (2020) reported that maximum temperature was positively correlated and morning relative humidity was negatively correlated 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) and their results strongly support 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.

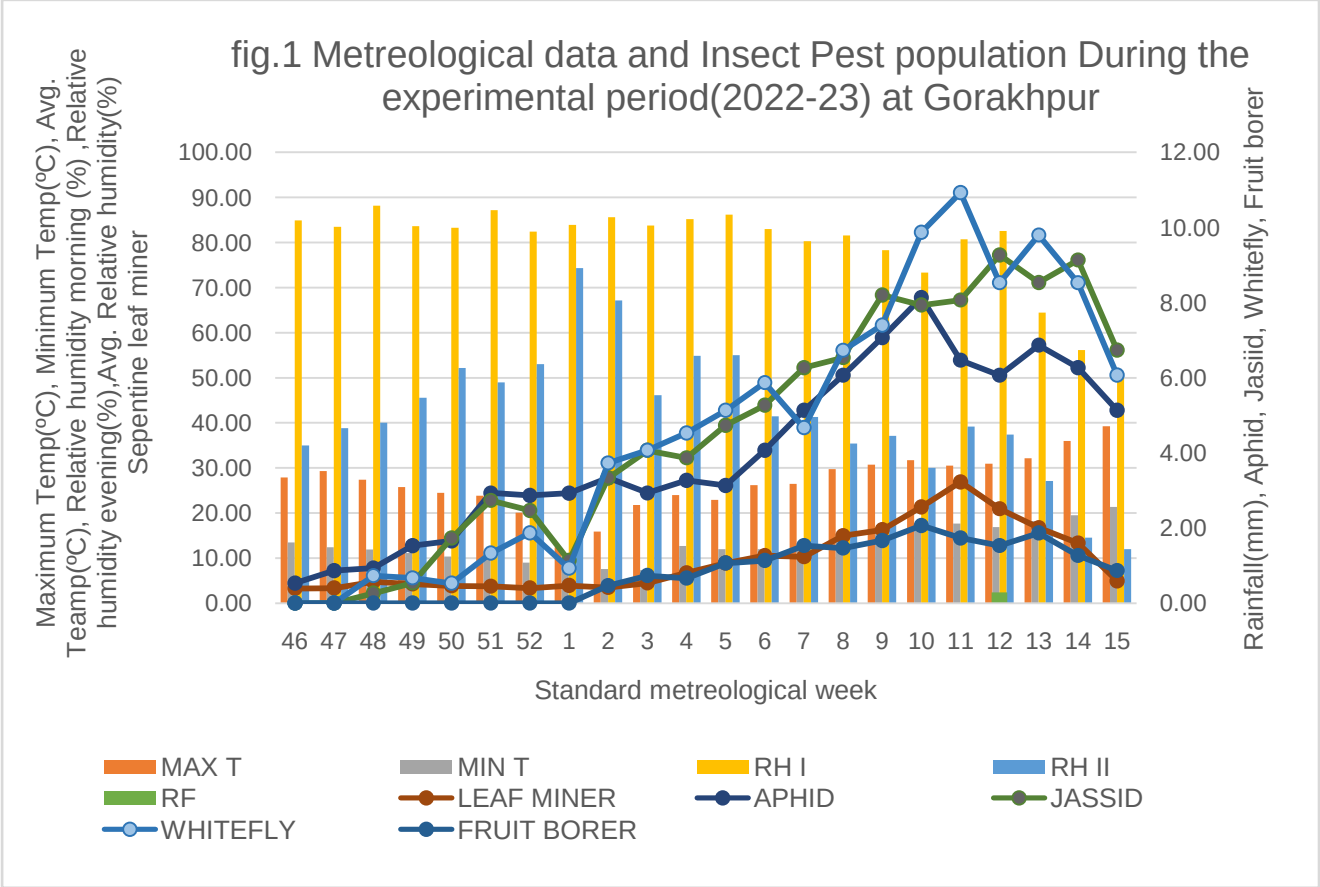
Fruit borer population expressed positive correlation with rainfall (0.196) and positively significant with maximum temperature (0.529) and minimum temperature (0.631). However, it has negatively non-significant correlation with relative humidity morning (-0.422) and relative humidity evening (-0.482). Partially similar result was reported by Wade *et al.,* (2020) who reported non-significant negative correlation between larval population and relative humidity morning and relative humidity evening. Singh (2013) showed 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 and meteorological data

S.N.	SMW	Temperature(˚C)		Relative humidity %		RF (mm)	APHID	LEAF MINER	JASSID	WHITEFLY	FRUIT BORER
		Max Temp	Min Temp	RH Morning	RH evening						
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

The present experimental study concluded that the insect pests such asserpentine leaf miner (*Liriomyza trifolii*), Whitefly (*Bemisia tabaci*) Aphid (*Aphis gossypi*), Fruit borer (*Helicoverpa armigera*) and Jassid (*Amrasca biguttulabiguttula*) 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. So according to the study the suitable time for the use of management practices should be applicable. Furthermore this study will be helpful in reducing the cost of pest management practices and increasing farmers income.

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