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IMPACT OF WEATHER FACTORS ON THE INCIDENCE OF MAJOR INSECT PESTS OF TOMATO (*SOLANUM LYCOPERSICON* L.) CV. H-86 (KASHI VISHESH)

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ABSTRACT

Major activity period of *Aphis gossypii* Glover was observed from October 2012 to March 2013 with two distinct peaks during 7th and 11th SW (standard week) (11.22 and 11.66 aphid/ 6 leaves) and *Liriomyza trifolii* Burgess was observed from October 2012 to March 2013 with three distinct peaks during 10th, 11th and 12th SW (44.56%, 45.95% and 44.02%) respectively. While, *Bemisia tabaci* Genn was appeared November 2012 to March 2013 with two distinct peaks during 7th and 9th SW (9.84 and 11.85 flies/10cm twig). *Amrasca devastans* Ishida, and *Scirtothrips dorsalis* Hood were observed during November 2012 to March 2013 with two distinct peaks 9th and 11th SW (9.26 and 9.15 jassid/ 6 leaves) and 7th and 9th SW (2.08 and 1.85 thrips/ 6 leaves) respectively. *Helicoverpa armigera* Hub. of observed from November 2012 to March 2013 with two distinct peaks 11th and 12th SW (6.02 and 6.11 larvae/ plant). Analysis of correlation coefficient between abiotic factors (weather parameters) and the major insect pests of tomato showed that population of thrips had a significant positive correlation with evening relative humidity (R.H.) (0.456*), while fruit borer had a significant positive correlation with rainy days (0.428*).

INTRODUCTION

Tomato is the most important vegetable grown widely both for fresh marketing and processing. India is next only to the China in area and production of vegetables. In Madhya Pradesh, it is grown in 60.84 thousand hectare with the annual production of 1484.5 thousand metric tons and productivity of 24.40 metric tons hec⁻¹ (Anonymous). The production and quality of tomato fruits are considerably affected by array of insect pests infesting at different stages of crop growth. The key insect-pests of tomato includes Aphid (*Aphis gossypii* Glover), Jassid (*Amrasca devastans* Ishida), White fly (*Bemisia tabaci* Genn.), Leaf miner (*Liriomyza trifolii* Burgess), Thrips (*Scirtothrips dorsalis* Hood) and Fruit borer (*Helicoverpa armigera* Hub.) .Choudhri *et al.* (2001), Reddy and Kumar (2004). Kharpuse *et al.* (2005) revealed that the fruit borer population peaked (26 larvae\ 10 plants) uniformly distributed. According to Mathuret *al* (2012) Pest abundance and distribution changes with abiotic factors and therefore meteorological parameters play a pivotal role in the biology of any pest. Subba *et al.* (2014) revealed that the lower population level was recorded during 38th standard week to 9th SW and 19thSW to 20thSW. Higher population level was maintained during 10thSW to 20th SW and peak population (1.11/plant) was recorded on 23rdSW. Abiotic conditions such as relative humidity (maximum, minimum and average) had significant negative influence on *Phyllotreta spp.* while non-significant negative correlation with weekly total rainfall. In case of temperature (maximum, minimum, and average), non-significant positive correlation was observed. Temperature influencing the rate of growth and development of insect. However, relative humidity, rainfall, wind speed and temperature are the chief weather parameters that largely direct the activity of a given species of insect. The interaction between pest activity and abiotic factors helps in deriving at predictive models that aids in forecast of pest incidence. The present study was aimed to know the seasonal occurrence of different insect pest and the effect of abiotic factors on their population in Jabalpur region of M.P.

MATERIALS AND METHODS

Present experiment was conducted at Vegetable Research Farm, Department of Horticulture, College of Agriculture, JNKVV, Jabalpur (M.P.) during Rabi 2012-13. Seasonal incidence of major insect pests viz., Aphid (*Aphis gossypii* Glover), Jassid (*Amrasca devastans* Ishida), White fly (*Bemisia tabaci* Genn.), Leaf miner (*Liriomyza trifolii* Burgess), Thrips (*Scirtothrips dorsalis* Hood) and Fruit borer (*Helicoverpa armigera* Hub.) were studied during the season. The Observations on major insect pests were recorded on 25 randomly selected plants of the crop in a standard week (7 day interval) from transplanting to till the availability of insects or maturity of the crop. Kumar (2008) as per the method proposed by. Observations on sucking and miner insect pests population (nymphs and adults) of Aphid, Jassid, Thrips, Leaf miner and whitefly were taken on 6 leaves plant⁻¹ viz. (two upper, middle and lower plant canopies) and in case of fruit borer larval population was recorded on plant⁻¹basis. Observations were statistically analysed in correlation analysis described by Panse and Sukhatme (1963). The impact of abiotic factors on population dynamics

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of major insect pest species of tomato. Infested fruit was recorded and percentage fruit damaged were worked out.

RESULTS AND DISCUSSION

Incidence of major insect pests of tomato during *Rabi* 2012-13 and Correlation coefficient of insect population with abiotic factors (weather parameters) as follows.

Aphid (*A. gossypii* Glover)

Aphid was first recorded during 43th SW on tomato. The activity period of aphid was observed from 43th to 12th SW (22 Oct 2012 to 25 March 2013). With two distinct peaks during 7th

and 11th SW (11.22 and 11.66 aphid/6 leaves). The highest peak was observed in 11th SW (11.66 aphid/6 leaves) during this period was maximum temperature (31.6°C) and minimum/temperature (14.7°C), whereas morning and evening relative humidity and rainy days (no.) were 84% and 39% and 02 days respectively. Thus, the pest was present throughout the growing stage of the crop. It caused leaf curl, defoliation, stunted growth of plants and development of sooty mould on the leaves. Present findings are in accordance with those of Chaudhuri *et al.* (2001), Reddy and Kumar (2004), Umesh and Onukwu (2005) and Mandal (2012). These authors also reported that the, *A. gossypii* to be an important sucking pest

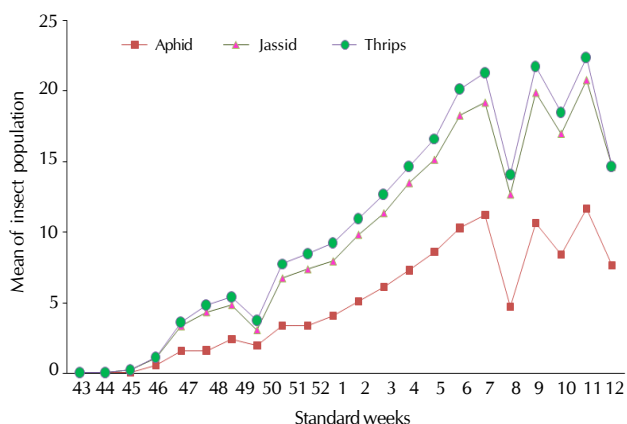
Table 1: Weekly meteorological data and incidence of major insect pests on tomato during *Rabi* 2012-13

Standard week nos.	Temperature (°C)		Relative humidity (%)		Rainy days (no.)
	Max	Min	Morning	Evening	
43	21.6	15.2	82	35	0
44	27.9	15.6	91	51	0
45	28.2	14.6	88	30	0
46	28.6	10.0	85	28	0
47	27.9	10.6	88	29	0
48	28.4	11.5	83	33	0
49	28.7	10.6	85	26	0
50	29.0	14.0	92	41	0
51	25.3	7.1	88	29	0
52	23.8	5.0	90	30	0
1	23.3	7.2	87	42	0
2	23.0	5.2	87	32	0
3	26.7	10.1	84	36	0
4	21.4	5.0	86	36	0
5	24.6	7.4	91	36	0
6	25.9	11.3	88	49	0
7	25.2	13.0	91	60	0
8	25.0	11.0	93	49	3
9	28.0	9.2	87	37	1
10	30.7	9.9	83	28	0
11	31.6	14.7	84	39	2
12	33.4	16.2	77	28	0

Aphid/ 6 leaves	Jassid	Thrips	Whitefly population /10 cm twig	Leaf miner infestation (%)	Fruit borer larval population/plant
0.07	0.00	0.00	0.00	0.14	0.00
0.06	0.00	0.00	0.00	1.22	0.00
0.07	0.20	0.00	0.76	4.70	0.00
0.55	0.56	0.05	0.65	8.33	0.00
1.58	1.77	0.30	0.54	12.59	0.00
1.61	2.73	0.51	1.32	13.55	0.51
2.42	2.42	0.59	1.76	13.46	0.70
1.96	1.11	0.68	0.91	14.70	0.89
3.35	3.39	1.01	3.66	16.29	1.04
3.37	4.01	1.12	4.00	18.62	1.54
4.08	3.87	1.32	4.44	21.82	1.77
5.09	4.74	1.15	5.11	26.28	1.91
6.12	5.24	1.31	5.85	28.40	2.09
7.30	6.21	1.15	4.66	32.43	2.67
8.62	6.54	1.46	6.33	34.29	3.12
10.30	8.00	1.83	7.41	33.18	3.84
11.22	7.99	2.08	9.84	32.74	4.66
4.69	8.00	1.42	4.51	39.04	4.90
10.65	9.26	1.85	11.85	41.80	5.29
8.42	8.59	1.50	9.10	44.56	5.50
11.66	9.15	1.58	8.44	45.95	6.02
7.66	7.00	0.00	6.09	44.02	6.11

Table 2: Correlation coefficient of insect population with Meteorological parameter

Weather Parameter	Aphid r	Jassid r	Whitefly r	Leaf miner r	Thrips r	Fruit borer r
Maximum Temp. (°C)	0.116	0.115	0.106	0.231	-0.226	0.224
Minimum Temp(°C)	0.121	0.189	-0.193	-0.155	-0.421	0.289
Morning RH (%)	0.066	0.060	-0.060	-0.148	0.317	-0.086
Evening RH (%)	0.336	0.280	0.275	0.161	0.456*	0.414
Rainy days	0.379	0.389	0.416	0.386	0.333	0.428*

**Figure 1: Incidence of major insect pests Aphid, Jassid and Thrips on tomato during Rabi 2012-13**

of tomato and was present throughout the growing period of the crop. Hath and Das (2004) recorded maximum *A. gossypii* population on tomato during the first week of March.

Correlation coefficient between various weather parameters and *A. gossypii* population were found no significant.

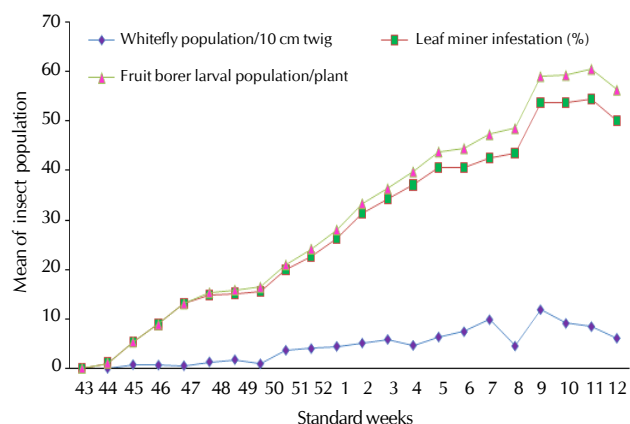
Jassid (*A. devastans* Shida)

A. devastans population was first recorded during 45th SW on tomato. The activity period of *A. devastans* was observed from 45th to 12th SW (05 November 2012 to 25 March 2013). With two distinct peaks during 9th and 11th SW (9.26 and 9.15 jassid/6 leaves). The highest peak was observed 9th SW (9.26 jassid/6 leaves). During this period maximum and minimum temperature were 28.0°C and 9.2°C respectively, whereas morning and evening relative humidity and rainy days (no.) were 87% and 37% and 01 days respectively. The pest was present throughout the growing stage of the crop, and caused leaf curl leading to stunted growth of plants. It was one of the major sucking pests of tomato. Present observations were more or less similar with the results of earlier workers Kumar (2008) reported that the *A. devastans* appeared in the 1st week of January.

Correlation coefficient of *A. devastans* population exhibited non significant relationship with all the weather parameter.

White fly (*B. tabaci* Genn.)

B. tabaci was first appeared during 45th SW on tomato plants foliage canopy. The activity period of *B. tabaci* was observed from 45th to 12th SW (05 November 2012 to 25 March 2013) with two distinct peak during 7th and 9th SW (9.84 and 11.85 flies/10 cm twig). The highest peak was observed 9th SW (11.85 flies/10 cm twig). During this period maximum and minimum

**Figure 2: Incidence of major insect pest White Fly, Leaf miner and Fruit borer on Tomato during Rabi 2012 -13**

temperatures were 28.0°C and 9.2°C respectively, whereas morning and evening relative humidity and rainy days (no.) were 87% and 37% and 01 days respectively. *B. tabaci* population ranged from (0.0 to 11.85 flies/10 cm twig) with an overall mean performance of (4.42 flies/10 cm twig). Similar findings have been reported by Chaudhuri *et al.* (2001), Reddy and Kumar (2004), and Mandal (2012). They also reported, *B. tabaci* to be an important sucking pest of tomato and were present throughout the growing period of the crop. Kharpuse (2005) and Chaudhuri *et al.* (2001) found that the *B. tabaci* population peaked (13 flies/10 cm twig) during first week of March.

Correlation coefficient between various weather parameters and *B. tabaci* population expressed no significant relationship.

Leaf miner (*L. trifolii* Burgess)

L. trifolii was first appeared 43th SW on tomato plants and continued till the harvesting. Increasing trend was observed in this case with crop growth stages. The activity was observed 43rd to 12th SW (22 Oct 2012 to 25 March 2013) with three distinct peaks during 10th, 11th and 12th SW (44.56%, 45.95% and 44.02%) and maximum leaf infestation was recorded on 11th SW (45.95%). During this period was maximum temperature (31.6°C) and minimum temperature (14.7°C), whereas morning and evening relative humidity and rainy days (no.) were 84% and 39% and 02 days respectively. The pest was present throughout the growing stage of the crop and mined the leaves. Present findings are in accordance with those of Marcano and Issa (2000), Chaudhuri *et al.* (2001), Asalatha (2002) and Reddy and Kumar (2004). They recorded *Liriomyza spp.* as major pest in tomato. Kharpuse (2005) revealed that the maximum (76.67%) leaf infestation by *L.*



H. armigera on tomato fruit *A. devastans* on tomato leaf *B. tabacum* on tomato leaf



A. gossypii on tomato leaves



L. trifolii on tomato leaves

Plate 1: Visual symptoms of incidence of major insects on tomato at Jabalpur

trifolii was recorded at middle of the March.

Correlation coefficient between various weather parameters and *L. trifolii* tunnel was found no significant relationship.

Thrips (*Scirtothrips dorsalis* Hood)

S. dorsalis appeared on 46th SW on tomato plants. The activity period of *S. dorsalis* was observed from 46th to 11th SW (12 November 2012 to 18 November 2013) and maximum peak population was appeared in 7th SW (2.08 %). During this period was maximum temperature (25.2°C) and minimum temperature (13.2°C), whereas morning and evening relative humidity and rainy days (no.) were 91% and 60% and 00 days respectively. Present findings are in accordance with those of Rajkumar *et al.* (2003) and Goncalves *et al.* (2004).

Correlation coefficient various weather parameters and *S. dorsalis* population were found non significant, except evening relative humidity which exhibited a significant and positive

correlation (0.456*).

Fruit borer (*Helicoverpa armigera* Hub.)

The larvae of *H. armigera* were first observed on tomato crop during 48th SW. The activity period of *H. armigera* was observed from 48th to 12th SW (26 November 2012 to 25 March 2013) and gradually increased till the crop was harvested. Maximum peak of larval fruit infestation was appeared in 12th SW (6.11 larvae/plant⁻¹), during this period was maximum temperature (33.4°C) and minimum temperature (16.2°C), whereas morning and evening relative humidity and rainy days (no.) were 77% and 28% and 00 days respectively. The pest was present during the entire reproductive stage of the crop and caused circular or irregular holes on the surface of the fruit and bore inside it. Present findings are in accordance with those of Rudednko *et al.* (2001), Chaudhuri *et al.* (2001), Reddy and Kumar (2004) and Mandal (2012). They all reported that *H. armigera* had

been major insect pests of tomato. Meena L. K. *et al.* (2014) revealed that the incidence of *H. armigera* on tomato was recorded at regular weekly interval and correlated with the corresponding meteorological data the incidence of *H. armigera* was also observed throughout the cropping season from 18.10.2011 to 25.02.2012. Kharpuse (2005) revealed that the fruit borer population peaked (26 larvae/10 plant) in the third week of March.

Correlation coefficient various weather parameters and *S. dorsalis* population were found non significant, except rainy day which exhibited a significant and positive correlation (0.428*).

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