Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2020; 8(3): 1546-1548

Received: 22-03-2020
Accepted: 24-04-2020

PS Wade
Department of Agril. Entomology, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. Dist. Ratnagiri, Maharashtra, India

Dr. SM Wankhede
Jr. Entomologist, Regional Coconut Research Station, Bhatye, Maharashtra, India

NK Hatwar
Department of Agril. Entomology, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. Dist. Ratnagiri, Maharashtra, India

Dr. BD Shinde
Assistant Professor, Department of Agril. Entomology, College of Agriculture, Dapoli. Dist. Ratnagiri, Maharashtra, India

Dr. PB Sanap
Vegetable Specialist, Vegetable Improvement Scheme, Central Experiment Station, Wakawali, Ratnagiri, Maharashtra, India

Corresponding Author:
PS Wade
Department of Agril. Entomology, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. Dist. Ratnagiri, Maharashtra, India

Seasonal incidence of major pests infesting tomato (*Solanum lycopersicum* L.)

PS Wade, Dr. SM Wankhede, NK Hatwar, Dr. BD Shinde and Dr. PB Sanap

Abstract
A field experiment was conducted at Central Experimental Station, Wakawali, during *rabi*, 2018-2019 to study the effect of weather parameters on incidence of major pests infesting tomato. Whitefly, aphid and leaf miner appeared during 2nd Standard Meteorological Week (SMW), while first incidence of fruit borer was seen on 5th SMW. The peak population of whitefly were observed in 16th SMW with a mean population of 7.83 per three leaves. Aphids (4.53 per three leaves) and leaf miner (40.02% infestation) were observed in 7th and 12th SMW, respectively. Whitefly, leaf miner and fruit borer demonstrated non-significant positive association with maximum temperature (r =0.319, 0.468 and 0.314, respectively), but non-significant negative correlation (r= -0.472) in aphids. Positive significant correlation was recorded (r= 0.521 and 0.571) of minimum temperature with whitefly and leaf miner, respectively. Whereas, non-significant negative correlation found (r= -455) between minimum temperature and aphid population. Fruit borer infestation had positive non-significant correlation (r= 0.450) with minimum temperature. The maximum relative humidity was non-significantly negative correlated (r= -0.429, -0.209, -0.498 and -0.484) with whitefly, aphid, leaf miner and fruit borer, respectively. Evening relative humidity showed positive non-significant correlation (r= 0.397, 0.384 and 0.407) with whitefly, leaf miner and fruit borer population, respectively. Aphid population was non-significantly negative correlated (r= -0.308) with evening relative humidity.

Keywords: Tomato, incidence, weather, whitefly, aphid, leaf miner, fruit borer

Introduction
Tomato (*Solanum lycopersicum* L.) is an important vegetable crop grown worldwide after potato. It is affected by several biotic, physiochemical and mesobiotic factors. Among the biotic factors insect pests are predominant and occur regularly at different stages of crop growth. A number of insect pests *i.e.* about 100 insect pests and 25 non insect pests species are reported to ravage the tomato fields (Lange and Bronson, 1981) [10]. Tomatoes provide an very good amount of vitamin C, a good amount of the minerals, manganese and vitamin E. With regard to phytonutrients, it includes flavanones, flavonols and carotenoids like lycopene, zeaxanthin and beta-carotene. Reduced risk of heart disease is an area of health benefits in which tomatoes truly excel. There are two basic lines of research that have repeatedly linked tomatoes to heart health. The first line of research involves antioxidant support and the second line involves regulation of fats in the blood stream (Mateljan, 2006) [12]. Tomato is cultivated in 789.15 thousand hectares area in India with 19759.32 metric tons production and 25.03 tons per hectare productivity. In Maharashtra, tomato is grown over an area of 45,500 hectares with a production of 1086.56 metric tons and productivity is 23.88 tons per hectare during 2017-18 (Anonymous, 2018) [1]. The sucking pests *viz.* whiteflies and aphids cause severe damage to crop by transmitting virus disease rather than direct feeding (Kumar *et al*., 2010) [9]. Among the pests, the loss incurred by *Liriomyza trifolii* (Burgess) has become most important in recent years (Medeiros *et al*., 2005) [13]. The tomato fruit borer, *Helicoverpera armigera* (Hubner) is a key pest and cause upto 40-50 per cent damage to the tomato crop (Pareek and Bhargava 2003) [15]. This pest is a nocturnal and polyphagous in nature, distributed throughout the Indian subcontinent. The larval stage of this pest infest fruits and makes it unfit for human consumption. The young larval stage feed on the foliage and later instars bore inside the fruits (Singh and Narang, 1990) [20]. Incidence of above pests is dependent on weather parameters, therefore the present study was carried out to see the effect of weather parameters on incidence of major pests infesting tomato.

Materials and Methods

The investigation was carried out at Vegetable Improvement Scheme, Central Experimental Station, Wakawali, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli during the *rabi* season of 2018-19. The tomato genotype, Sonali was sown in plot size 21.6 m^2 with spacing of 60 x 60 cm. Seasonal incidence of major insect pests *viz*., Aphid (*Aphis gossypii* Glover), white fly (*Bemisia tabaci* Genn.), leaf miner (*Liriomyza trifolii* Burgess) and fruit borer (*Helicoverpa armigera* Hub.) were studied during the season. The observations on major insect pests were recorded on 10 randomly selected plants of the crop in a standard week (7 days interval) from transplanting to till the availability of insects. Observations on sucking and miner insect pests population (nymphs and adults) of aphid, whitefly and leaf miner were taken on nine leaves plant-1 *viz.* (three upper, middle and lower plant canopies) and in case of fruit borer, per cent fruit infestation was recorded on plant. The influences of different meteorological parameters on major insect pest population were studied by graphical super imposition technique.

Results and Discussion

Incidence of major pests of tomato during *rabi* 2018-2019 and correlation coefficient of pest population with weather parameters as follows.

Whitefly (*Bemisia tabaci* Genn.)

Whitefly was first recorded during 2nd SMW on tomato. The activity period of aphid was observed from 2nd to 16th SMW (8th January to 23rd March, 2019). The highest population was observed in 16th SMW (7.83 whitefly per three leaves). Thus, the pest was observed throughout the growing stage of the crop. Present findings are in accordance with those of Kumar *et al.* (2019) [8] and Chavan *et al*. (2013) [5] who reported that whitefly population commenced three week after transplanting and reached to peak 2nd week of March. Chaudhuri *et al*. (2001) [4] and Lin *et al.* (2007) [11] reported the peak level of whitefly population from mid-February to mid-March also partially confirm the present results. Correlation coefficient of various weather parameters and *B. tabaci* population were found non-significant, except minimum temperature which exhibited a significant and positive correlation (0.521*).

Table 1: Weekly meteorological data and incidence of major pests infesting tomato during *rabi* 2018-2019.

SMW	Temperature (◦C)		Relative humidity (%)		Overall mean (whitefly per 3 leaves)	Overall mean (aphid per 3 leaves)	Overall mean leaf miner infestation (%)	Overall mean fruit infestation (%)
	T max	T min	Morning	Evening				
2	32.77	11.77	87.92	26.00	0.07	0.53	14.04	0.00
3	34.34	15.86	89.66	32.54	0.30	1.03	19.22	0.00
4	32.91	12.97	81.42	32.56	5.83	3.40	24.25	0.00
5	32.11	14.13	87.19	29.54	5.27	3.83	27.14	7.70
6	28.92	11.10	84.66	12.48	5.63	4.13	31.36	26.72
7	33.01	14.91	82.38	19.03	5.67	4.53	34.22	31.25
8	35.71	17.14	82.32	31.40	6.27	3.83	37.18	33.36
9	33.29	13.84	77.34	64.61	5.80	3.43	35.13	36.20
10	33.89	15.74	80.81	71.45	6.10	2.97	33.23	39.26
11	34.29	16.47	71.03	50.15	6.33	2.33	36.19	39.61
12	36.57	16.46	72.35	35.61	6.43	2.27	40.02	40.25
13	37.24	21.24	89.37	48.12	6.67	2.20	39.09	43.13
14	36.56	20.64	84.81	46.97	6.90	1.77	36.39	41.14
15	33.87	22.03	83.62	44.45	7.07	1.30	35.08	30.58
16	37.14	21.19	83.37	62.59	7.83	0.90	35.42	17.99

Aphid (*Aphis gossypii* Glover)

Aphis gossypii was first appeared during 2nd SMW on tomato plants foliage canopy. The activity period of *Aphis gossypii* was observed from 2nd to 16th SMW (8th January to 23rd March, 2019). The highest peak was noticed on 7th SMW (4.53 aphid per three leaves). Similar findings have been reported by Hath and Das (2004) [6] who observed maximum aphid population on tomato during the first week of March. Barde (2006) [2] reported that the peak population of aphid was observed during the last week of February. Chakraborty (2011) [3] also reported that population of *A. gossypii* was initiated during second fort night of November and gradually increased the population and reached peak in last fort night of February. Correlation coefficient between various weather parameters and *Aphis gossypii* population expressed negative non-significant relationship.

Leaf miner (*Liriomyza trifolii* Burgess)

Liriomyza trifolii was first appeared during 2nd SMW on tomato plants and continued till the harvesting. Increasing trend was observed in this case with crop growth stages. The maximum leaf miner infestation was recorded on 12th SMW (40.02%). The pest was present throughout the growing stage of the crop and mined the leaves. Present observations were more or less similar with the results of earlier workers Reddy and Kumar (2005) [18] who reported that the peak incidence of *Liriomyza trifolii* on tomato was noticed during March – April, which coincided with vegetative and reproductive stages of the crop. Shinde (2007) [19] also observed the presence of this pest on tomato crop from vegetative stage throughout the cropping season. Correlation coefficient of various weather parameters and *Liriomyza trifolii* infestation were found non-significant, except minimum temperature which exhibited a significant and positive correlation (0.571*).

Fruit borer (*Helicoverpa armigera* Hubner)

The larvae of *Helicoverpa armigera* were first observed on tomato crop during 5th SMW. The activity period of *Helicoverpa armigera* was observed from 5th to 16th SMW (30th January to 23rd March, 2019) and gradually increased till the crop was harvested. Maximum peak of larval fruit infestation was appeared in 13th SMW (43.13% fruit infestation). The pest was present during the entire

reproductive stage of the crop and caused circular or irregular holes on the surface of fruit and bored inside it. Similar results were reported by Reddy and Kumar (2004) [17] who noticed that the maximum incidence of fruit borer, *H. armigera* was during March to April. Kharpuse and Bajpai (2006) [7] also reported fruit borer population in third week of February during *Rabi*, 2004-05. Reddy *et al.* (2009) [16] and Pandey *et al.* (2012) [14] also observed peak population of fruit borer in the month of March. Correlation coefficient between various weather parameters and *Helicoverpa armigera* population expressed no significant relationship.

Table 2: Correlation coefficient of pests population with meteorological paramters

Weather parameters	Whitefly (*r*)	Aphid (r)	Leaf miner (r)	Fruit borer (r)
Maximum temperature (^{0}C)	0.319	-0.472	0.468	0.374
Minimum temperature (^{0}C)	0.521*	-0.455	0.571*	0.450
Morning relative humidity (%)	-0.429	-0.209	-0.498	-0.484
Evening relative humidity (%)	0.394	-0.308	0.384	0.407

Conclusion

Whiteflies (*B. tabaci*), aphids (*A. gossypii*), leaf miner, (*L. trifolii*) and fruit borer (*H. armigera*) were observed as the major pests on tomato variety Sonali. The peak activity of whitefly (7.83 ± 2.25) per three leaves was recorded during 16th SMW (17th to 23th April, 2019). Aphids reached its peak activity during 7th SMW (13th -19th February) which was recorded (4.53 ± 1.28) mean aphids population per three leaves. The leaf miner per cent infestation reached its peak infestation (40.02% ± 7.49) during 12nd SMW (20th to 26th March, 2019). While maximum (43.13%) fruit borer infestation was recorded during 13th SMW (27th March- 2th April, 2019).

Acknowledgements

The researchers would like to express their gratitude to the Department of Agricultural Entomology, Dr. Balasaheb Sawnat Konkan Krishi Vidyapeeth, Dapoli for the support of labour cost, experimental land and research facility support. I would like to sincerely thank all staffs and the students of Department of Entomology, Department of Plant Pathology, Department of Agricultural Statistics and Department of Meteorology, Dr. Balasaheb Sawnat Konkan Krishi Vidyapeeth, Dapoli– 415712 (India) for the support of research work.

References

1. Anonymous. Horticulture Statistics Division, Department of Agriculture, Cooperation and Farmer's Welfare, Ministry of Agriculture and farmer's Welfare, Govt. of India, 2018, 203.
2. Barde SK. Studies on seasonal incidence of pest complex of tomato and management of fruit borer (*Helicoverpa armigera* Hubner) by use of biopesticides. M.Sc. (Ag.) (Ent) Thesis submitted to J.N.K.V.V., Jabalpur (M.P.), 2006, 1-45.
3. Chakraborty K. Incidence and abundance of aphid, *Aphis gossypii* Glover in relation to the time of cultivation in the northern parts of West Bengal, India. World J. Zool., 2011; 6(2):187-191.
4. Chaudhuri N, Deb DC, Senapati SK. Biology and fluctuation of whitefly population on tomato as influenced by abiotic factors under Terai region of West Bengal. Indian J. Agril. Res., 2001; 35(3):155-160.
5. Chavan SM, Kumar S, Arve SS. Population dynamics and development of suitable pest management module against major insect pests of tomato (*Solanum lycopersicum*). Journal of Applied Horticulture, 2013; 15(2):150-155.
6. Hath TK, Das BR. Incidence of insect pests in late planted tomato under Terai agroecology of West Bengal. Environ. Ecol., 2004; 22(1):136-140.
7. Kharpuse YK, Bajpai R. Seasonal incidence of major insect pests of *tomato (Lycopersicon esculentum* Mill). lndian J. Tropical Biodiversity, 2006; 14(2):178-181.
8. Kumar A, Tripathi MK, Chandra U, Veer R. Efficacy of botanicals and bio-pesticide against *Helicoverpa armigera* in chickpea. Journal of Entomology and Zoology Studies, 2019; 7(1):54-57.
9. Kumar B, Mistry NC, Singh B, Gandhi CP. National Horticulture Board, Ministry of Agriculture, Government of India, Institutional Area Sector 18, Gurgaon, 2010.
10. Lange WH, Bronson L. Insect pests of tomatoes. Ann. Rev. Entomol., 1981; 26:345-371.
11. Lin K, Wu K, Zhang Y, Guo Y. Over wintering and population dynamics of *Bemisia tabaci* biotype B in greenhouse during the spring in northern China. Crop Protection, 2007; 26(12):1831-1838.
12. Mateljan G. The book named 'The world's Healthiest foods' published by GMF publishing, 2006.
13. Medeiros MA, Villas Boas GL, Carrijo OA, Makishima N, Vilela NJ. Embrapa Vegetables Circular Technician, 2005; 36:10.
14. Pandey BM, Tripathi MK, Lakshmi V. Seasonal incidence of gram pod borer, *Helicoverpa armigera* (Hub.) on chickpea in Varanasi area. Journal of Experimental Zoology India, 2012; 15(2):667-669.
15. Pareek PL, Bhargava MC. Estimation of avoidable losses in vegetables caused by borers under semi-arid condition of Rajasthan. Insect Environment, 2003; 9:59-60.
16. Reddy V, Ananadhi P, Elamanthi S, Varma S. Seasonal occurrence of pulse pod borer *Helicoverpa armigera* on chickpea at Eastern U.P. Region. Agriculture Science Digest, 2009; 29(2):60-62.
17. Reddy NA, Kumar CTA. A study on correlation between abiotic factors and incidence of tomato fruit borer, *Helicoverpa armigera* (Hubner). Mysore J. Agric. Sci., 2004; 38(3):417-421.
18. Reddy NA, Kumar CTA. Influence of weather factors on abundance and management of serpentine leaf miner, *Liriomyza trifolii* (Burgess) on tomato. Annals of plant protection sciences, 2005; 13(2):315-318.
19. Shinde S. Bioefficacy and dissipation of residue of some popular insecticides on tomato (*Lycopersicon esculantum* Mill.). M.Sc. (Ag.) Thesis, Indira Gandhi Krishi Vishwavidyalaya, Raipur, 2007, 18.
20. Singh D, Narang DD. Control of tomato fruit borer *Heliothis armigera* Hubner with synthetic pyrethroids. Indian Journal of Entomology. 1990; 52(4):534-540.