International Journal of Statistics and Applied Mathematics

ISSN: 2456-1452
Maths 2024; SP-9(6): 109-111

www.mathsjournal.com
Received: 18-10-2024
Accepted: 22-11-2024

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Population dynamics of invasive tomato leaf miner *tuta absoluta* (Meyrick) under open field condition

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Abstract
The present experiment was conducted during the summer season of 2024, in the open field of a farmer in the Kolhapur District (Maharashtra) with the objective to study the population dynamics of invasive tomato leaf miner *Tuta absoluta* (Meyrick**)** under open field conditions. The study indicated that the infestation of *T. absoluta* was recorded throughout the cropping season. *T. absoluta* incidence first appeared in the 9th MW and the population steadily increased and reached its peak in the 18th MW (4.4 larvae per plant). A positive significance with maximum temperature (0.977) and minimum temperature (0.644) and a negative non-significance with morning relative humidity (-0.450) and with an evening relative humidity (- 0.202) was noticed.

Keywords: *Tuta absoluta,* tomato leaf miner, population dynamics, invasive pest, weather correlation

Introduction

Maharashtra emerges as a key player in India's tomato production with its favourable climate, fertile soils and adoption of advanced farming method. Districts like Pune, Satara, Nasik, Dhule and Ahmednagar are renowned for producing high quality tomatoes. Around 56,000 hectares of land cultivated in Maharashtra are dedicated to tomato farming, with a yield of 33.20 tonnes per hectare and a total production of 1 million metric tonnes. Integrating modern agricultural practices and technologies enhances the productivity and quality of tomatoes, thereby strengthening their position in India [1]. The impact factors *viz*, seasonal weather, temperature, humidity, illnesses and insect pests can affect tomato yield. In India a significant hurdle for the low productivity of tomato is the pest complex that affects the crop growth starting from planting to harvesting [2]. Several pests are known to harm tomato crops, like fruit borers, *Spodoptera litura* (Fabricius), *Helicoverpa armigera* (Hubner), sucking pests, *Bemicia tabaci* (Gennadius), *Ferrisia vitrgata* (Cockerella), and serpentine leaf miner, *Liryomyza trifolii* (Burgess). Recently the invasive pest named, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae), a South American tomato leaf miner also known as tomato pinworm. This pest has been reported to cause serious damage to fruits and leaves and reduced commercial production of tomato by leaving pin-sized holes. It has been discovered to harm tomato and other crops in the Solanaceae family [3].

Tuta absoluta (Meyrick) is the name given to the tomato leaf miner that was first discovered in 1917 in Peru and identified the species as *Tuta absoluta* in 1994 [4]. In 2006, it was detected in Spain, Europe. Thereafter, it has swiftly entered into other European Nations and proliferated throughout the Mediterranean area, encompassing Middle East, North Africa and parts of Asia [5-7]. In India the pest was discovered for the first in October 2014 on tomato plants grown in polyhouses and fields in Pune and currently expanding throughout the Indian subcontinent [7-9].

This experimental study was conducted during the summer season of the year 2024, in open field of farmer in the Kolhapur District (Maharashtra) with the objective to study the population dynamics of invasive tomato leaf miner *Tuta absoluta* (Meyrick) under field conditions in the sub-montane zone of Kolhapur.

Materials and Methods

Experimental Site

The experiment was carried during summer season of 2024 on the farmer's field in Sarawade in Kolhapur District (Maharashtra) in the NARP sub-montane zone.

Soil Type

The selected field for the experiment was uniform, with sandy loam soil having medium fertility and fairly good drainage.

Climate and Location

Sarawade has subtropical climate and average rainfall 721 mm. It is situated on 616.27 meter (2021.89 ft.) above mean sea level. It lies between 16°46' N to 74°23' E latitude with the average annual temperature of 25°C

Population dynamics of *Tuta absoluta* (Meyrick)

For conducting studies on population dynamics of tomato leaf miner, *Tuta absoluta* the Sai-25 variety of tomato was transplanted and labelled. Recommended agronomic practices were followed and scrupulously corresponding weekly record of meteorological data *viz.,* minimum and maximum temperature, morning and evening relative humidity and rainfall were maintained. The influence of different meteorological parameters on pest's population was studied. To record weekly observations on total number of larvae of leaf miner, randomly five plants were selected and labelled on 100 m^2 area.

Meteorological parameters

In order to study the effect of climatic condition on the incidence of pest, meteorological parameters *viz*., maximum (T max °C) and minimum temperature (T min °C), relative humidity (RH_1 & RH_2) in different meteorological weeks during the crop season were taken into account. The meteorological data were obtained from Skymet Weather Services Pvt. Ltd., Kolhapur.

Analysis

In order to find out the specific impact of different weather parameters on tomato leaf miner, *Tuta absoluta* observations were correlated with the meteorological data in different standard meteorological weeks during the crop season using OPSTAT.

Results and Discussion

Investigation on the present experiment was carried out during summer, 2024 in 100 m^2 plot of tomato to know the influence of weather parameters like temperature, relative humidity and rainfall on the incidence of *T. absoluta* (Meyrick**)**. Data regarding larval stage on five randomly selected plants was analysed through correlation analysis.

Experimental data depicted in Table 1, clearly indicated that the infestation of *T. absoluta* was recorded throughout the cropping season. *T. absoluta* incidence first appeared in the 9^{th} MW corresponding to the 4^{th} week of February with a mean population of 0.4 larvae per plant. Population steadily increased and reached its peak in the 18^{th} MW equivalent to the last week of April (4.4 larvae per plant) when the maximum and minimum temperatures were 40.04 and 22.82°C, respectively and the average relative humidity was found 59.21 per cent.

The correlation coefficient between the *T. absoluta* population and weather parameters were examined. The analysis in Table 2, indicated a highly positive significance with maximum temperature (0.977) and minimum temperature (0.644) as well as a negative non-significance with morning relative humidity (-0.450) and evening relative humidity (- 0.202).

Similarly, Devaraj *et al.* [3] reported that temperature had positive correlation on *T. absoluta* population that recorded the highest incidence level in summer season. Kumari *et al.* [10] noted that relative humidity had negative influence on the infestation levels and larval population was at maximum level from 13^{th} MW (last week of March) to 18^{th} MW (end of April). Dibbad *et al.* [11] also confirmed that peak incidence of *T. absoluta* was noticed during 18^{th} MW.

Similarly, Sapkal *et al*. [12] observed maximum incidence (3.6 larvae/plant, 28.2 mines/plant and 10.93 per cent fruit damage) during 41^{st} MW. The present investigation was also in line with Dhanda *et al.* [13] who observed a positive correlation between the *T. absoluta* population and temperature, while revealed a negative correlation with morning and evening relative humidity.

The present investigation indicated that a considerable variation in the relationship between weather parameters and larval population of *T. absoluta* (Meyrick).

Table 1: Population dynamics of tomato leaf miner *T. absoluta* (Meyrick) larvae during summer, 2024

Week after transplanting (WAT)	Meteorological Week (MW)	No of *T. absoluta* larvae/plant	Temperature (° C)		Relative humidity (%)	
			maximum	minimum	RH_1	RH_2
1	7	0.0	35.21	17.84	83.47	39.33
2	8	0.0	34.64	17.04	84.06	40.73
3	9	0.4	35.67	20.15	80.54	50.68
4	10	1.6	36.49	19.24	71.77	39.79
5	11	1.8	37.33	20.34	67.84	44.20
6	12	2.8	37.56	21.32	69.84	36.69
7	13	3.2	39.39	23.55	76.96	52.31
8	14	4.2	40.18	22.74	67.60	42.01
9	15	3.8	39.22	23.30	60.96	35.71
10	16	2.6	38.85	24.73	85.80	68.14
11	17	3.6	39.51	24.24	79.16	50.84
12	18	4.4	40.04	22.82	78.39	40.04
13	19	2.8	38.58	22.78	91.69	57.56
14	20	1.8	37.18	23.70	90.31	59.17
15	21	0.8	35.95	24.58	96.00	88.46

Weather Data Source-Skymet Weather Services Pvt. Ltd., Kolhapur

Table 2: Correlation between abiotic factors and tomato leaf miner *T. absoluta* (Meyrick)

Sr. No.	Pest	Temperature (^{0}C)		Relative Humidity (per cent)	
		Maximum	Minimum	Morning	Evening
1.	Leaf miner larvae	0.977**	0.644**	-0.450^{NS}	-0.202^{NS}

**significant at 1 per cent level NS-Non significant

Conclusion

The experimental studies concluded that the larval count of tomato leaf miner per leaf increased with an increase in the maximum and minimum temperature with a strong significance in the summer season in open field conditions. The correlation however was non-significant in the present study duration with respect to the relative humidity.

Acknowledgement

The author would like to express his gratitude towards the facilities provided by the RCSM College of Agriculture, Kolhapur and Mahatma Phule Krishi Vidyapeeth, Rahuri for the conduct of this post-graduate research.

References

1. Anonymous. Spiralling Tomato Prices: Issues and Concerns. NABARD. Issue No 03, 2023.
2. Kusanal SD. Bioecology and Management of Tomato Leaf Miner *Tuta absoluta* (Meyrick) (Gelechiidae: Lepidoptera) [dissertation]. Dharwad: University of Agricultural Science, 2016.
3. Devaraj AN, Kumar PPK, Jayappa J. Seasonal phenology of South American tomato leaf miner *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) in parts of Southern Karnataka. 2017;179-183.
4. Oztemiz S. *Tuta absoluta* Povolny (Lepidoptera: Gelechiidae), the exotic pest in Turkey, 2014.
5. Lietti MM, Botto E, Alzogaray AR. Insecticide resistance in Argentine populations of *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae). Neotrop Entomol. 2005;34:113-119.
6. Urbaneja A, Vercher R, Navarro V, Garcia MF, Porcuna JL. La polilla del tomato, *Tuta absoluta*. *Phytoma España*. 2007;194:16-23.
7. Shridhar V, Nitin KS, Naik OS, Nagaraja T. Comparative biology of South American tomato moth, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) on three solanaceous host plants. *Pest Manag Hortic Ecosyst*. 2015;21:159-161.
8. Nitin KS, Shridhar V, Kumar KP, Chakravarthy AK. Seasonal incidence of South American tomato moth, *Tuta absoluta* (Meyrick) (Gelechiidae: Lepidoptera) on tomato ecosystem. Int J Pure Appl Biosci. 2017;5:521-525.
9. Sharma PL, Omkar G. New distributional record of invasive pest *Tuta absoluta* (Meyrick) in western Himalayan region of India. Nat Acad Sci Lett, 2017, p. 1-4.
10. Kumari DA, Anitha G, Vennila S, Nayak MH. Incidence of tomato pinworm, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) in Telangana (India). J Entomol Zool Stud. 2018;6(5):1085-1091.
11. Dibbad SH, Hanumantharaya L, Hanumanthappa M, Srinivasa V, Kumari S. Studies on population dynamics of major insect pests of tomato. J Entomol Zool Stud. 2020;8:1245-1248.
12. Sapkal SD, Sonkamble MM, Savde VG. Seasonal incidence of tomato leaf miner, *Tuta absoluta* (Meyrick) on tomato, *Lycopersicon esculentum* (Mill) under protected cultivation. J Entomol Zool Stud. 2018;6(4):1904-1907.
13. Dhanda S, Yadav S, Yadav S, Kumari S. The population dynamics of insect pests infesting tomato and their relation with different abiotic factors. J Entomol Zool Stud. 2020;8(6):1158-1161.