



ISSN (E): 2277-7695
 ISSN (P): 2349-8242
 NAAS Rating: 5.23
 TPI 2023; 12(8): 201-211
 © 2023 TPI
www.thepharmajournal.com
 Received: 01-05-2023
 Accepted: 05-06-2023

PL Ambulkar
 Scientist (Plant Protection)
 JNKVV, Krishi Vigyan Kendra,
 Dindori, Madhya Pradesh, India

AK Sharma
 Associate Professor
 (Entomology), Department of
 Entomology, JNKVV, Jabalpur,
 Madhya Pradesh, India

RK Jhade
 Scientist (Horticulture) JNKVV,
 Krishi Vigyan Kendra,
 Chhindwara, Madhya Pradesh,
 India

AK Patel
 Programme Assistant JNKVV,
 Krishi Vigyan Kendra, Dindori,
 Madhya Pradesh, India

Shivam Mishra
 Young Professional, ATARI
 Zone -IX, JNKVV campus,
 Jabalpur, Madhya Pradesh,
 India

Corresponding Author:
PL Ambulkar
 Scientist (Plant Protection)
 JNKVV, Krishi Vigyan Kendra,
 Dindori, Madhya Pradesh, India

Seasonal incidence of major insect pest species of vegetable ecosystem during rabi season at district Chhindwara under the Satpura Plateau region of Madhya Pradesh

PL Ambulkar, AK Sharma, RK Jhade, AK Patel and Shivam Mishra

Abstract

Major activity period of *H. armigera* (Hubner) was observed from 45th SMW to 17th SMW. *P. orichalsia* (Fabricius) was observed from 47th SMW to 17th SMW. *S. litura* (Fabricius) was appeared during 47th SMW and was continuously observed till crop harvesting. *L. orbonalis* (Guenée) was recorded during 47th SMW. After the appearance of moth in trap catches, a gradual increase and decrease trend was observed from 48th SMW to 10th SMW. Activity of *P. xylostella* (Linnaeus) was observed from 47th SMW to 17th SMW. Among all the abiotic factors, maximum temperature, minimum temperature, were showed significantly positive correlation with *H. armigera* ($r = 0.78^*$ and $0.59 = \text{byx}$), ($r = 0.79^*$ and $0.66 = \text{byx}$). *P. orichalsia* ($r = 0.67^*$ and $0.12 = \text{byx}$), ($r = 0.68^*$ and $1.35 = \text{byx}$). *S. litura* ($r = 0.84^*$ and $0.56 = \text{byx}$). ($r = 0.85^*$ and $0.62 = \text{byx}$). *L. arbonalis* ($r = 0.84^*$ and $1.20 = \text{byx}$). ($r = 0.85^*$ and $1.34 = \text{byx}$) and *P. xylostella* ($r = 0.66^*$ and $1.20 = \text{byx}$), ($r = 0.68^*$ and $1.35 = \text{byx}$) while morning and evening relative humidity were showed significantly negative correlation with *H. armigera* ($r = -0.64^*$ and $-0.15 = \text{byx}$), ($r = -0.63^*$ and $-0.12 = \text{byx}$). *P. orichalsia* ($r = -0.73^*$ and $-0.42 = \text{byx}$), ($r = -0.72^*$ and $-0.36 = \text{byx}$). *S. litura* ($r = -0.77^*$ and $-0.17 = \text{byx}$). ($r = -0.79^*$ and $-0.15 = \text{byx}$), *L. arbonalis* ($r = -0.73^*$ and $-0.34 = \text{byx}$), ($r = -0.73^*$ and $-0.29 = \text{byx}$) and *P. xylostella* ($r = -0.71^*$ and $-0.42 = \text{byx}$) ($r = -0.71^*$ and $-0.35 = \text{byx}$).

Keywords: Seasonal incidence, insect pest, correlation

Introduction

In India there exists a diverse climate which ensures availability of all types of vegetables. In the world India ranks second in vegetable production, after China. In India the total area of vegetables is 10353 thousand ha with production 191769 thousand MT and productivity of vegetables 17.97 MT /ha. In Madhya Pradesh it was cultivated in 967.23 thousand ha with production 19144.37 thousand MT during 2019-20 second estimate (Anonymous, 2020) [1]. In district Chhindwara of Madhya Pradesh total cultivated area of vegetable was 65.04 thousand ha with production 1513.11 thousand MT during 2019-20 (Anonymous, 2020) [2].

Light trap is an important tool for minimizing the insect pests damage without any toxic hazard (Sharma *et al.*, 2004) [6], apart from this light trap has been used to supplement the knowledge of pest fauna of given locality, geographical distribution and their seasonal activity, etc (Verma and Vaishampayan, 1983) [12]. Nocturnal insects are often attracted to light sources that emit a large amount of UV radiation, and devices that exploit this behavior, such as light traps for forecasting pest outbreaks, and electric insect killers, have been developed (Shimoda and Honda, 2013) [9]. Sinu *et al.*, (2013) [10] suggested that that light trap is an effective, bias-free monitoring tool of moth pests, it has often been used in the ecological studies of lepidopteron insect pests in agroecosystems. Sharma *et al.*, (2004) [6] suggested that light trap is an important tool for minimizing the insect pests damage without any toxic hazards. Vaishampayan (2002) [11] proposed a new concept of adult-oriented pest management strategy, which is based on the suppression of pest population through mass trapping and killing of adults using their behavioral responses (visual, olfactory, gustatory, sexual reproductive, biological, etc.) and describe the salient points of using light traps as a component of such strategy.

Materials and Methods

The experiment was conducted at farmers' field of Chhindwara (MP) during rabi 2019-20.

The experiment was conducted by using Jawahar light trap with a 125-watt mercury vapor lamp in a vegetable ecosystem at a farmer's field in Chhindwara (M.P.) during, rabi 2019-20, the seasonal occurrence of major insect pests of vegetable crops (Table 1) was evaluated (October to April).

Seasonal incidence study of major insect pests of vegetables and their natural enemies were carried out through operating the light trap in Rabi season, 2019-20. Activities of major insect pests and their natural enemies of vegetables were observed on daily basis. In order to study the seasonal incidence, trap catches were converted into weekly total and mean per week. The week division during the year was based on standard meteorological week. Observations of weather data (Maximum temperature, Minimum temperature, relative humidity morning & evening, rainfall, no. of rainy days, etc.) were recorded on daily basis from JNKVV, Chhindwara meteorological observatory. The correlation coefficient between various insect pests of vegetables and weather parameters were calculated by using the correlation regression analysis.

Results and Discussion

Five major insect pests species namely Tomato fruit borer *Helicoverpa armigera*, Cabbage semilooper *Plusia orichalsia* (Fabricius), Tobacco caterpillar *Spodoptera litura*, Brinjal shoot and fruit borer *Leucinodes orbonalis* and Diamond back moth *Plutella xylostella* were identified as important phototactic insect pests in this region because they occurred in significantly high numbers in trap catches and in field. Species wise as description is as follows.

Helicoverpa armigera (Hubner)

Helicoverpa armigera is a major polyphagous pest of pulses, tomato and okra in Chhindwara. During the year 2019-20 *H. armigera* it was absent from 40th SMW to 44th SMW but observed from 45th SMW to 17th SMW. First appearance was recorded during 45th SMW (1.11 moths). After the appearance of moth in trap catches during 45th SMW, a slight increase and decrease trend was observed from 46th SMW to 12th SMW. The trap catches then gradually started increasing and reached to its first peak in 13th SMW (12.05 moths). During this period maximum temperature and minimum temperature were 33.67 °C and 25.0 °C respectively, whereas morning and evening relative humidity were 36.4 and 29.0 percent and wind velocity 11.4 km/hr. There was no rainfall during this week. From 15th SMW it further increased and reached to its second and highest peak during 16th SMW (12.94 moths). During this period maximum temperature and minimum temperature were 37.7 °C and 27.6 °C respectively, whereas morning and evening relative humidity were 23.3 and 15.0 percent and wind velocity 13.1 km/hr. There was no rainfall during this week. Sharma *et al.* (2019)^[7] reported that highest peaks of *Helicoverpa armigera* were observed during first and fourth week of April. Similarly, Sumit *et al.* (2019)^[8] reported that the highest peak was observed in 14th SMW. Vaishampayan and Vaishampayan (1983)^[12] reported the activity of the noctuids *Helicoverpa armigera* (Hubner), population remained low during December, January and February. March and April were a period of very high activity for the species.

In contrast with the present findings, Megha (2019)^[5] observed that first appearance of *H. armigera* was recorded during 39th SW and its highest peak was observed during 40th

SW (13.43 moths). Correlation data revealed that maximum temperature, minimum temperature, sunshine hours and wind velocity had a significant positive correlation while relative humidity (morning and evening) had a significant negative correlation with the catches of *H. armigera*. Rainfall and number of rainy days showed non-significant negative correlation with the catches of *H. armigera*.

Plusia orichalsia (Fabricius)

Plusia orichalsia is a major Pest of cabbage in Chhindwara. During the year 2019-20 *Plusia orichalsia* was absent from 40th SMW to 46th SMW. The pest was observed from 47th SMW to 17th SMW. First appearance was recorded during 47th SMW (2.07 moths). After the appearance of moth in trap catches during 47th SMW (20.70 moths), a slight increase and decrease trend was observed from 48th SMW to 8th SMW. The trap catches then gradually started increasing and reached to its first and highest peak in 10th SMW (28.51 moths). During (10th SMW) this period maximum temperature and minimum temperature were 29.1 °C and 29.7 °C respectively, whereas morning and evening relative humidity were 40.3 and 29.1 percent, wind velocity 12.0 km/hr. and 12.8 mm rainfall observed during this week. Population then gradually declined with an increasing and decreasing trend upto 15th SMW and reached to its second peak in 16th SMW (20.48 moths). During (16th SMW) this period maximum temperature and minimum temperature were 37.7 °C and 27.6 °C respectively, whereas morning and evening relative humidity were 23.3 and 15.0 percent and wind velocity 13.1 km/hr. There was no rainfall during this week. Similarly, Sumit *et al.* (2019)^[8] also reported that the *Plusia orichalsia* is a major polyphagous pest of vegetable crops, like cabbage, cauliflower in Jabalpur. The activity of pest started from 45th SW. The highest peak was observed in the 12th SMW. Correlation studies revealed that Maximum temperature, minimum temperature, sunshine hours and wind velocity had a significant positive correlation while relative humidity (morning and evening) had a significant negative correlation with the trap catches of *Plusia orichalsia*.

Spodoptera litura (Fabricius)

Spodoptera litura is a major pest of major pest of tobacco but also feed on tomato in Chhindwara. During the year 2019-20, It was absent from 40th SMW to 46th SMW but appeared during 47th SMW and was continuously observed till crop harvesting. First appearance was recorded during 47th SMW (0.93 moth). After the appearance of moth in trap catches, a slight increase and decrease trend was observed from 48th SMW to 10th SMW. The trap catches then gradually started increasing and reached to its highest peak in 11th SMW (9.89 moths). During the 11th SMW maximum temperature and minimum temperature were 31.0 °C and 21.0 °C respectively, whereas morning and evening relative humidity were 34.4 and 29.9 percent, wind velocity 11.7 km/hr. and 1.8 mm. rainfall recorded during this week.

Gradual decreasing and increasing trend of populations was observed up to 15th SMW and then reached to its second peak in 16th SMW (9.70 moths). During the 16th SMW maximum temperature and minimum temperature were 37.7 °C and 27.6 °C respectively, whereas morning and evening relative humidity were 23.3 and 15.0 percent and wind velocity 13.1 km/hr. There was no rainfall during this week. Sharma *et al.* (2019)^[7] observed that major activity period of *S. litura* was

February and reported that the peak activity was recorded during April. Sumit *et al.* (2019) [8] also reported that it is a major pest of vegetable crops like cabbage, cucurbits, potato, chilli and pea etc. in Jabalpur. Correlation studies revealed that maximum temperature, minimum temperature, sunshine hours and wind velocity had a significant positive correlation while relative humidity (morning and evening) had a significant negative correlation with the trap catches of *Spodoptera litura*

***Leucinods orbonalis* (Guenée)**

Leucinods orbonalis (brinjal shoot and fruit borer) is the major pest of brinjal in the district Chhindwara (M.P.). During the rabi season 2019-20 from 40th SMW to 46th SMW *Leucinods orbonalis* was absent. First appearance was recorded during 47th SMW (2.40 moths). After the appearance of moth in trap catches, a gradual increase and decrease trend was observed from 48th SMW to 10th SMW. The trap catches then sharply started increasing and reached to its first and highest peak in 11th SMW (22.95 moths). During the 11th SMW maximum temperature and minimum temperature were 31.0 °C and 21.0 °C respectively, whereas morning and evening relative humidity were 34.4 and 29.9 percent, wind velocity 11.7 km/hr. and 1.8 mm. rainfall recorded during this week.

Population of *Leucinods orbonalis* with a slight decrease in 12th SMW and further slightly increased and reached to its second peak during 15th SMW (21.39 moths). During (15th SMW) this period maximum temperature and minimum temperature were 38.3 °C and 27.7 °C respectively, whereas morning and evening relative humidity were 16.6 and 11.4

percent and wind velocity 9.9 km/hr. There was no rainfall during this week. Maximum temperature, minimum temperature, sunshine hours and wind velocity had a significant positive correlation while relative humidity (morning and evening) showed significant negative correlation.

***Plutella xylostella* (Linnaeus)**

Plutella xylostella is the major pest of cabbage and cauliflower in Chhindwara (M.P.). During the rabi season 2019-20, activity of *Plutella xylostella* was observed from 47th SMW to 17th SMW. First appearance was recorded during 47th SMW (3.07 moths). A slight increase and decrease trend were observed from 47th SMW to 8th SMW. The trap catches with a gradual increasing trend, reached to its highest peak in 9th SMW (27.94 moths). During this period maximum temperature and minimum temperature were 31.0 °C and 20.6 °C respectively, whereas morning and evening relative humidity were 31.1 and 20.9 percent and wind velocity 10.0 km/hr. There was no rainfall during this week. Indirakumar *et al.* (2016) [4] reported that *Leucinodes orbonalis* (Guenée) was observed during November to Decemer with peak infestation during Feb. (6th and 7th SW). Chandra kumar *et al.* (2018) [3] also reported that Brinjal shoot and fruit borer (BSFB) infestation was maximum during 1st and 4th weeks of December. Correlation studies revealed that maximum temperature, minimum temperature, sunshine hours and wind velocity had a significant positive correlation while relative humidity (morning and evening) had a significant negative correlation with the trap catches of *Plutella xylostella*.

Table 1: Major insect species of vegetables trapped in Jawahar Light trap during Rabi 2019-20

Sr. No.	Common Name	Scientific Name	Family	Status
Order Lepidoptera				
1.	Tomato fruit borer	<i>Helicoverpa armigera</i> (Hubner)	Noctuidae	Major Pest of Tomato
2	Cabbage semilooper	<i>Plucia orichalsia</i> (Fabricius)	Noctuidae	Major Pest of cabbage
3.	Tobaco caterpillar	<i>Spodoptera litura</i> (Fabricius)	Noctuidae	Feed on tomato
4.	Brinjal shoot and fruit borer	<i>Leucinods orbonalis</i>	Pyraustidae	Major Pest of brinjal
5.	Diamond back moth	<i>Plutella xylostella</i>	Plutellidae	Major Pest of cabbage and cauliflower

Table 2: Seasonal Incidence of insect pest species of vegetable crops during Rabi 2019-20

SMW	<i>Helicoverpa armigera</i>	<i>Plusia orichalsia</i>	<i>Spodoptera litura</i>	<i>Leucinods orbonalis</i>	<i>Plutella xylostella</i>
40	0	0	0	0	0
41	0	0	0	0	0
42	0	0	0	0	0
43	0	0	0	0	0
44	0	0	0	0	0
45	1.11	0	0	0	0
46	0.96	0	0	0	0
47	1.36	2.70	0.93	2.40	3.07
48	1.25	3.31	0.79	2.02	3.10
49	3.02	2.59	0.43	2.35	2.46
50	1.84	2.88	1.79	2.88	2.36
51	2.18	2.36	2.07	3.83	2.59
52	2.25	2.32	2.36	4.00	2.25
1	3.17	1.82	2.32	3.65	1.82
2	1.84	1.68	1.35	3.51	1.93
3	1.98	2.36	2.39	4.60	2.81
4	3.82	1.80	1.71	4.48	2.00
5	2.35	4.93	2.08	3.83	4.49
6	2.02	5.95	1.46	5.40	6.21
7	2.25	5.08	2.00	5.49	5.35
8	2.14	5.92	3.57	4.87	5.92

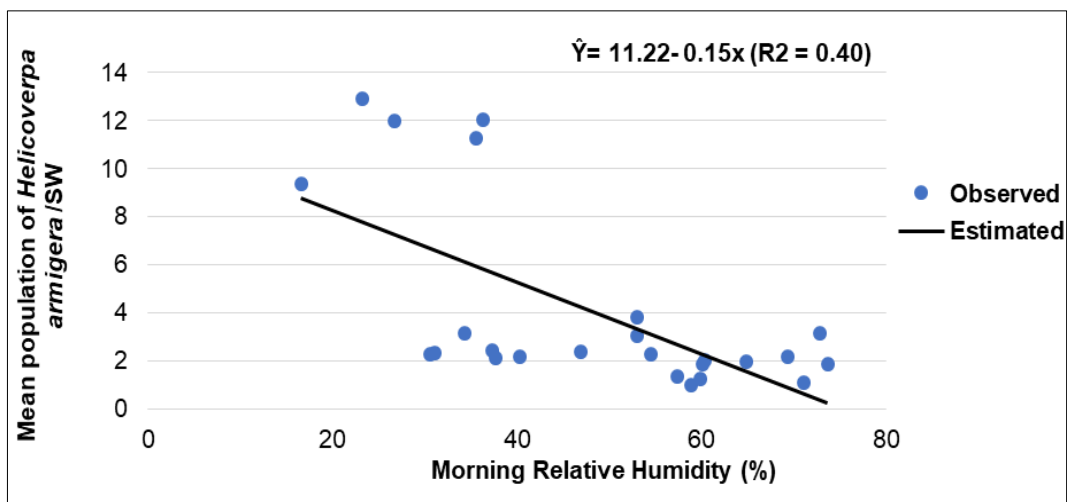


Fig 3: Regression of morning relative humidity (%) on *Helicoverpa armigera* trapped in light trap during rabi, 2019-20

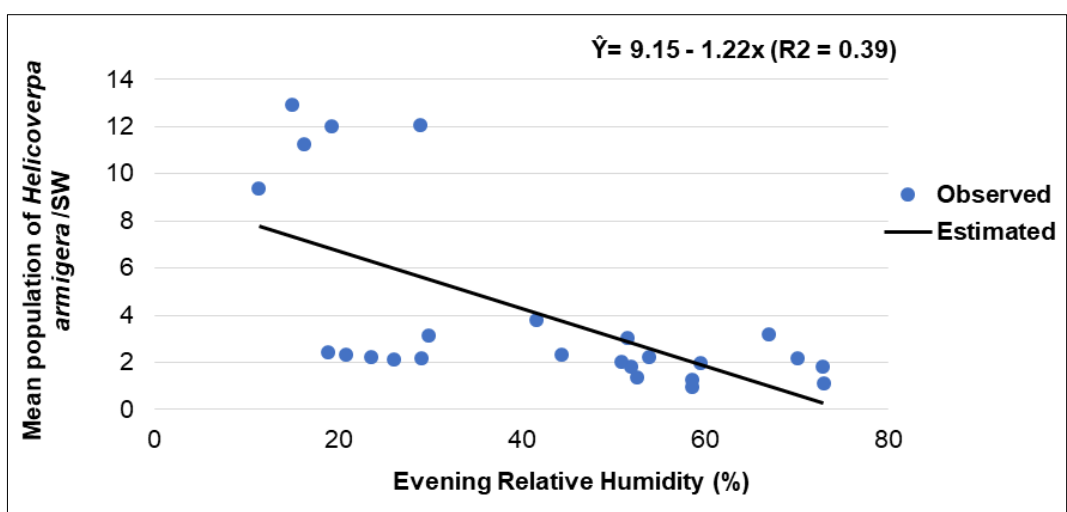


Fig 4: Regression of evening relative humidity (%) on *Helicoverpa armigera* trapped in light trap during rabi, 2019-20

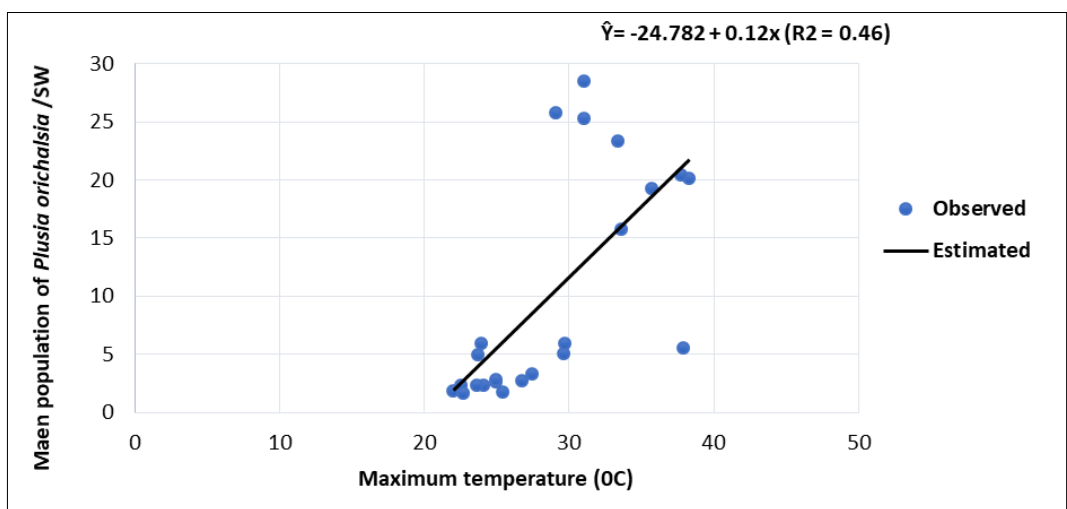


Fig 5: Regression of maximum temperature (°C) on *Plusia orichalsia* trapped in light trap during rabi, 2019-20

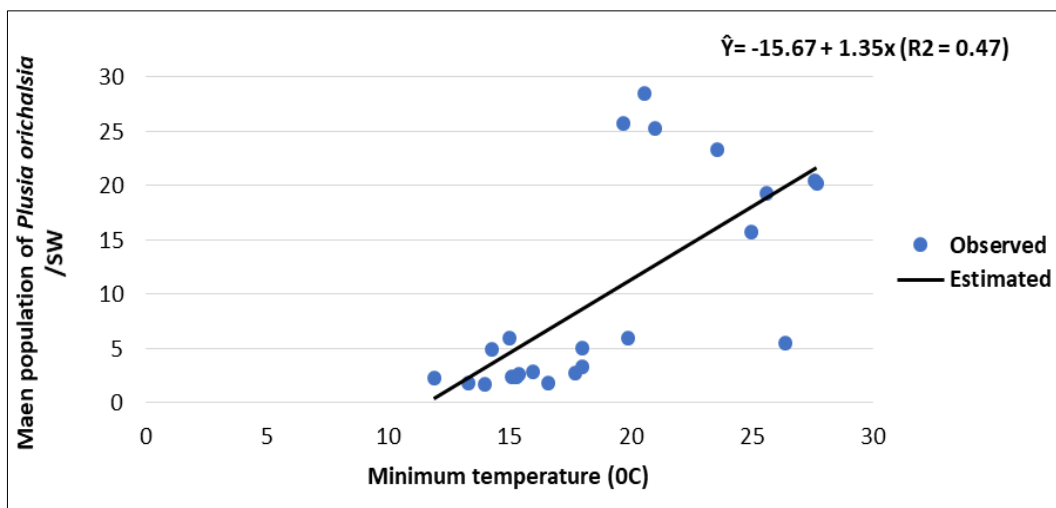


Fig 6: Regression of minimum temperature (°C) on *Plusia orichalsia* trapped in light trap during rabi, 2019-20

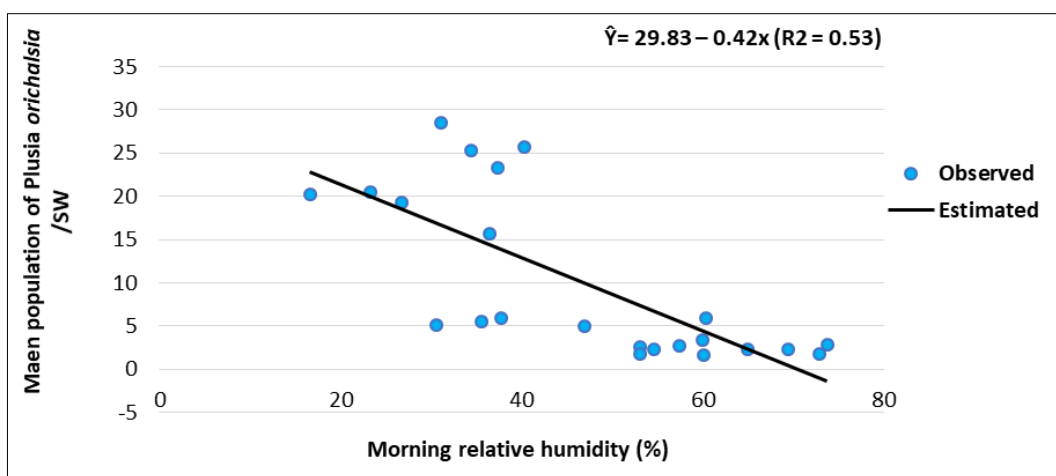


Fig 7: Regression of morning relative humidity (%) on *Plusia orichalsia* trapped in light trap during rabi 2019-20

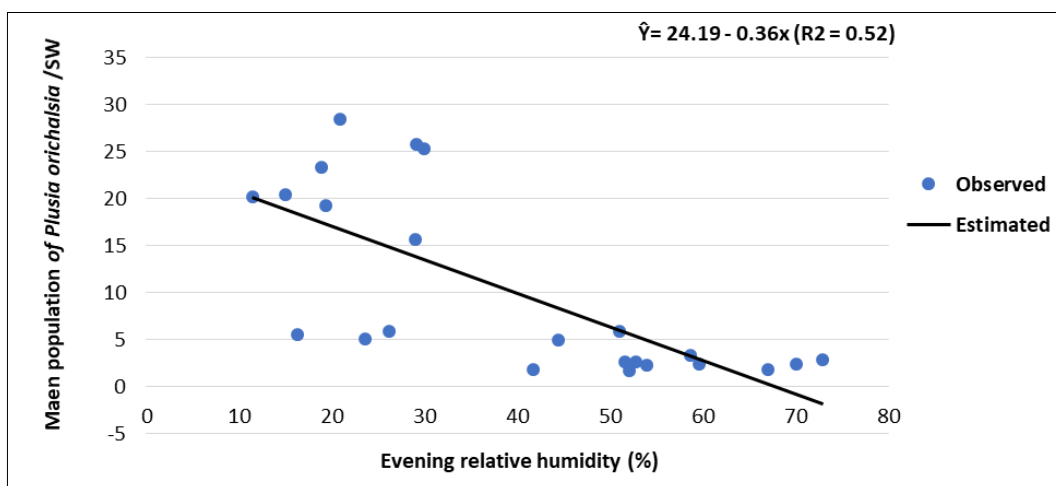


Fig 8: Regression of morning relative humidity (%) on *Plusia orichalsia* trapped in light trap during rabi 2019-20

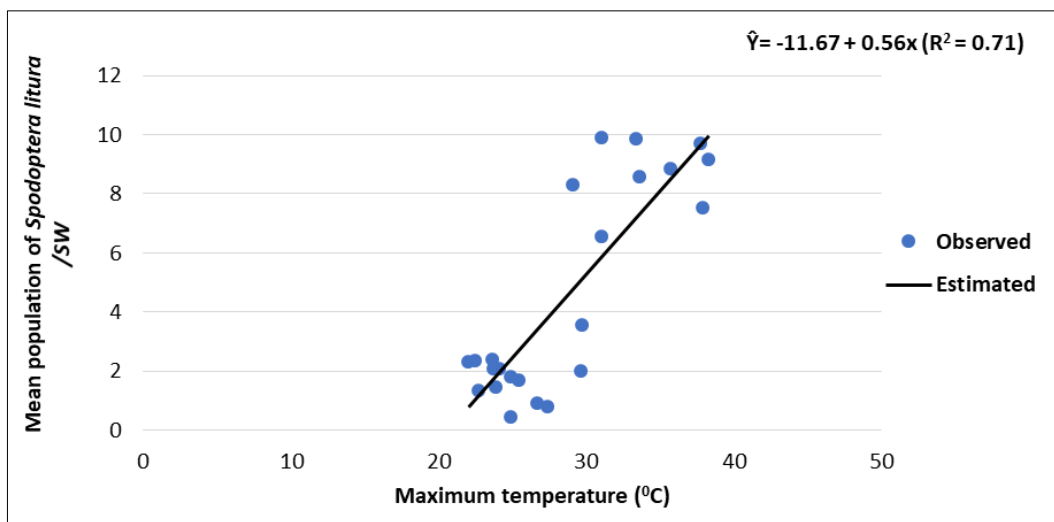


Fig 9: Regression of maximum temperature on *Spodoptera litura* trapped in light trap during Rabi 2019-20

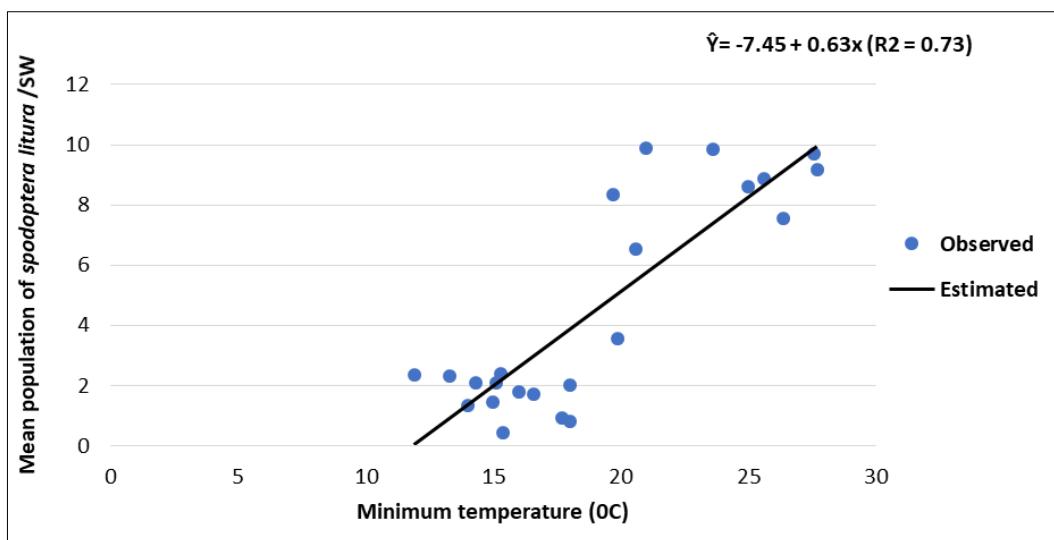


Fig 10: Regression of minimum temperature on *Spodoptera litura* trapped in light trap during rabi 2019-20

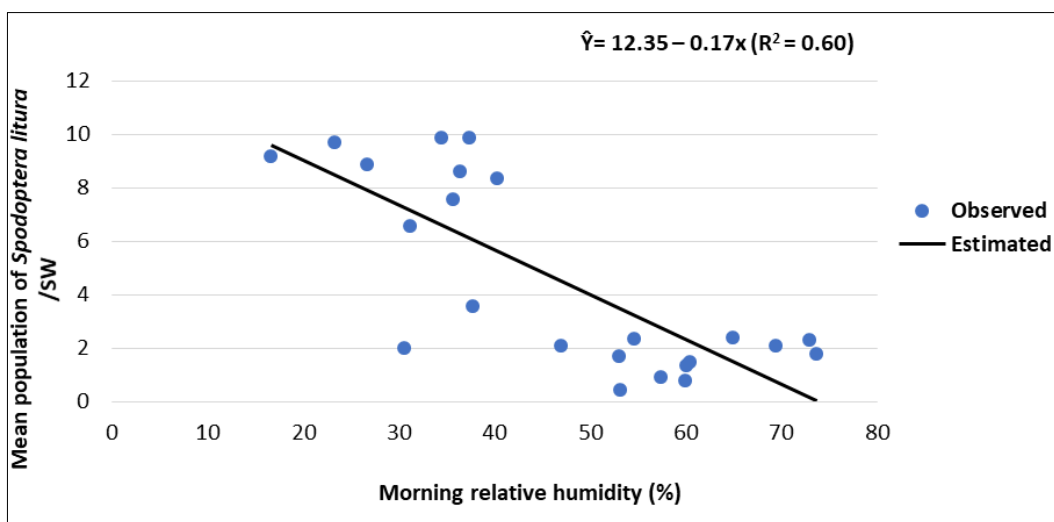


Fig 11: Regression of morning humidity (%) on *Spodoptera litura* trapped in light trap during rabi 2019-20

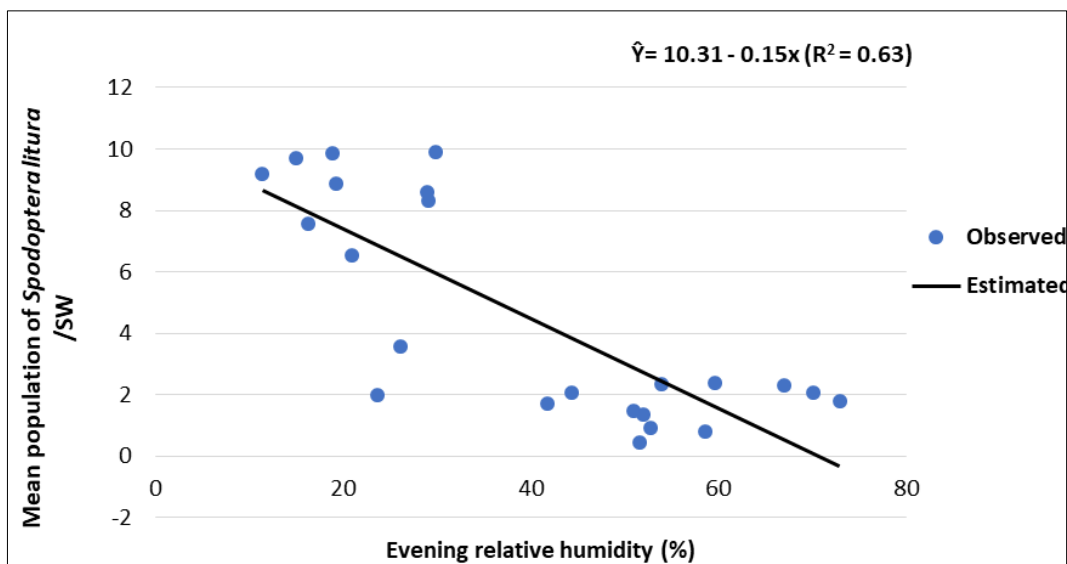


Fig 12: Regression of evening humidity (%) on *Spodoptera litura* trapped in light trap during *rabi* 2019-20 and 2020-21 (pooled data)

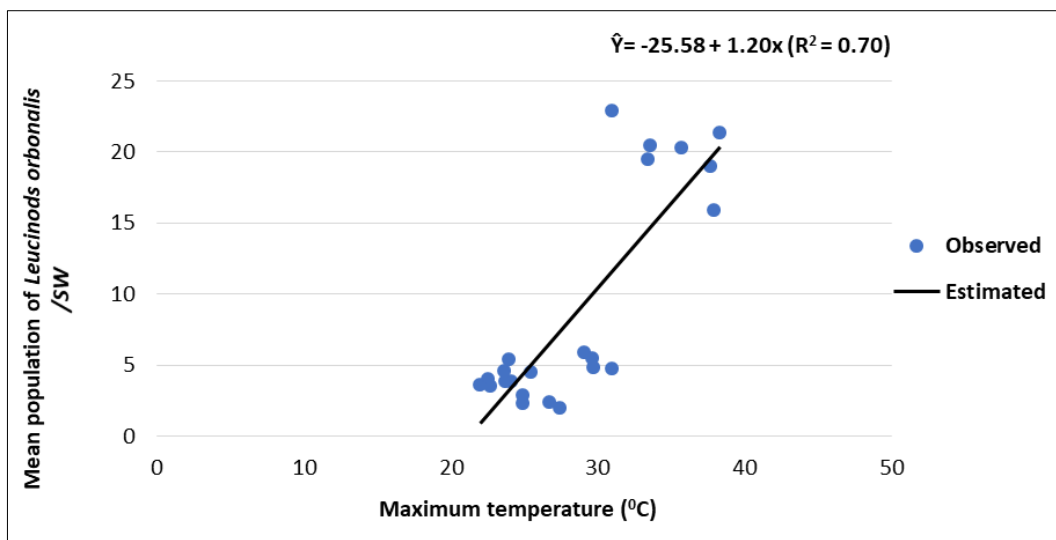


Fig 13: Regression of maximum temperature (°C) on *Leucinods orbonalis* trapped in light trap during *rabi* 2019-20

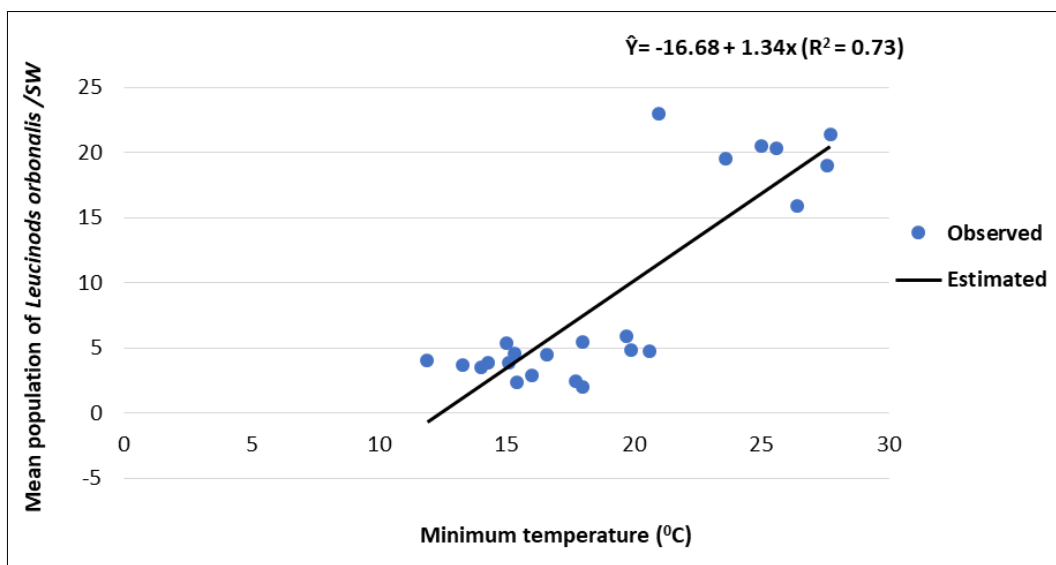


Fig 14: Regression of minimum temperature (°C) on *Leucinods orbonalis* trapped in light trap during *rabi* 2019-20

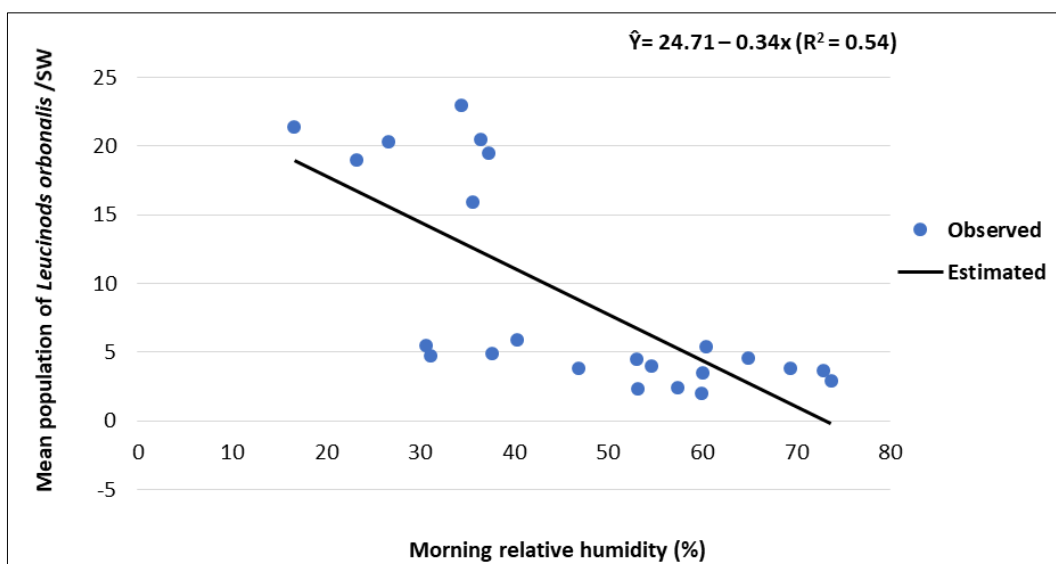


Fig 15: Regression of morning relative humidity (%) on *Leucinods orbonalis* trapped in light trap during rabi 2019-20

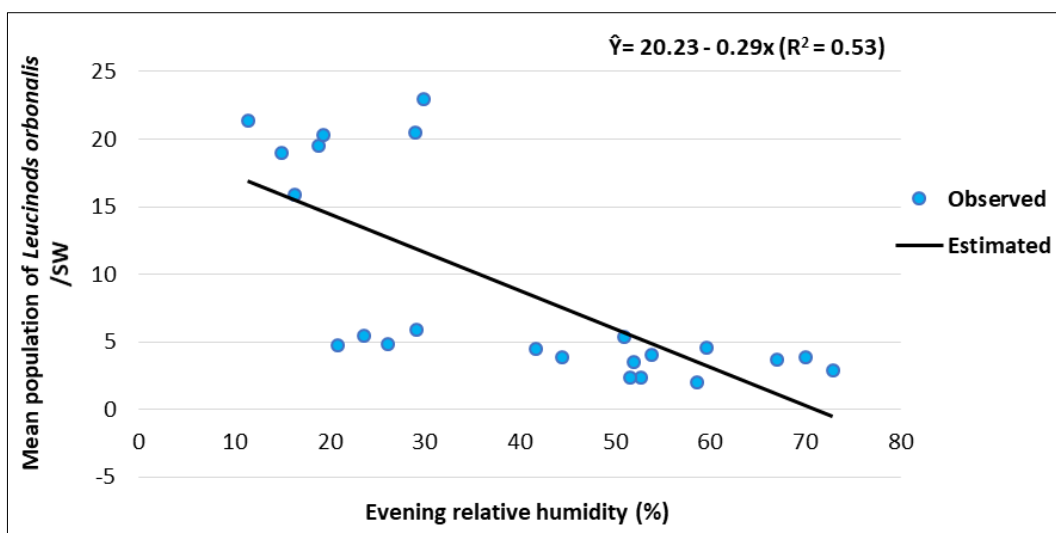


Fig 16: Regression of evening relative humidity (%) on *Leucinods orbonalis* trapped in light trap during rabi 2019-20

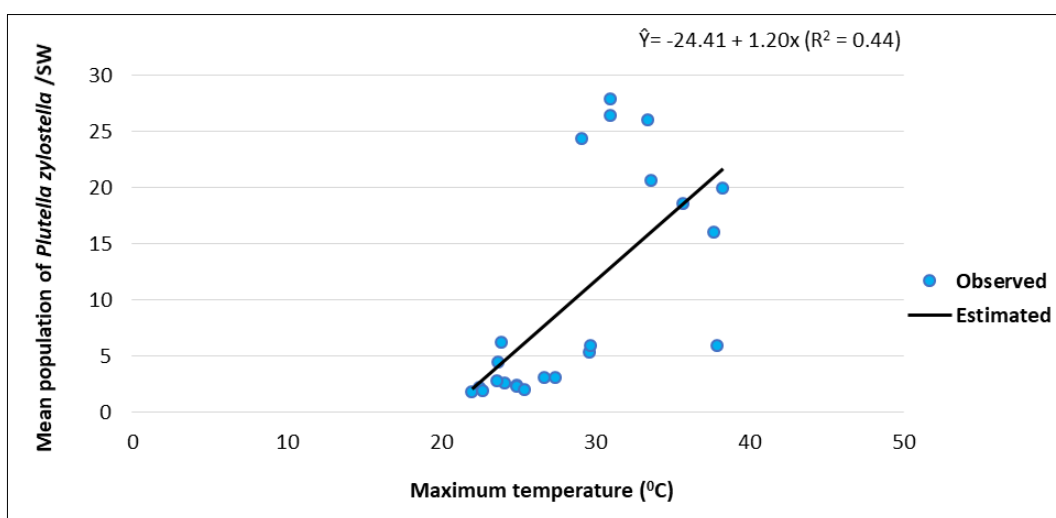


Fig 17: Regression of maximum temperature (°C) on *Plutella xylostella* trapped in light trap during rabi 2019-20

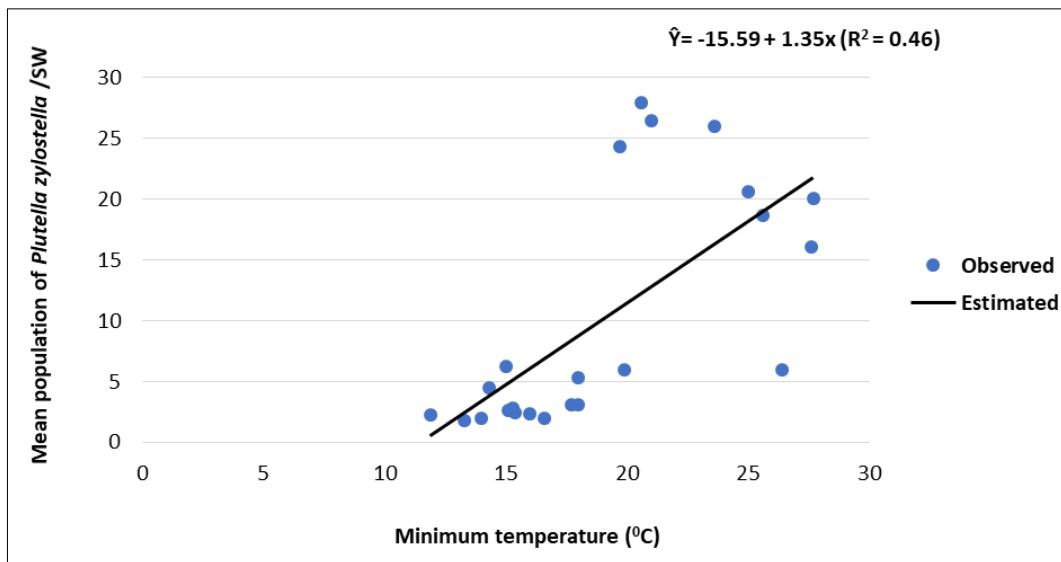


Fig 18: Regression of minimum temperature (°C) on *Plutella xylostella* trapped in light trap during rabi 2019-20

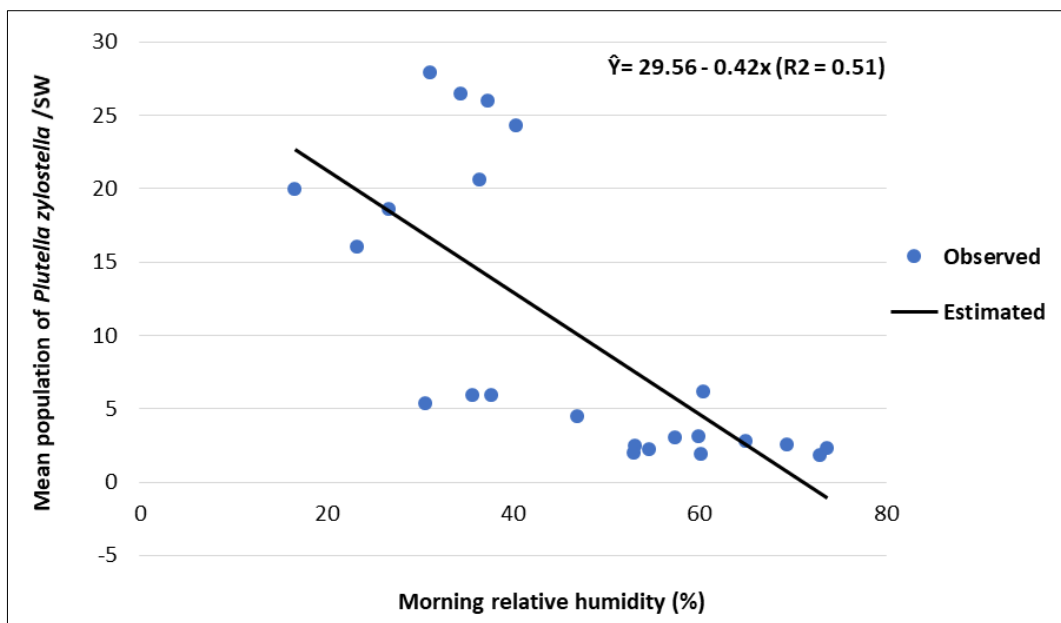


Fig 19: Regression of morning relative humidity (%) on *Plutella xylostella* trapped in light trap during rabi 2019-20

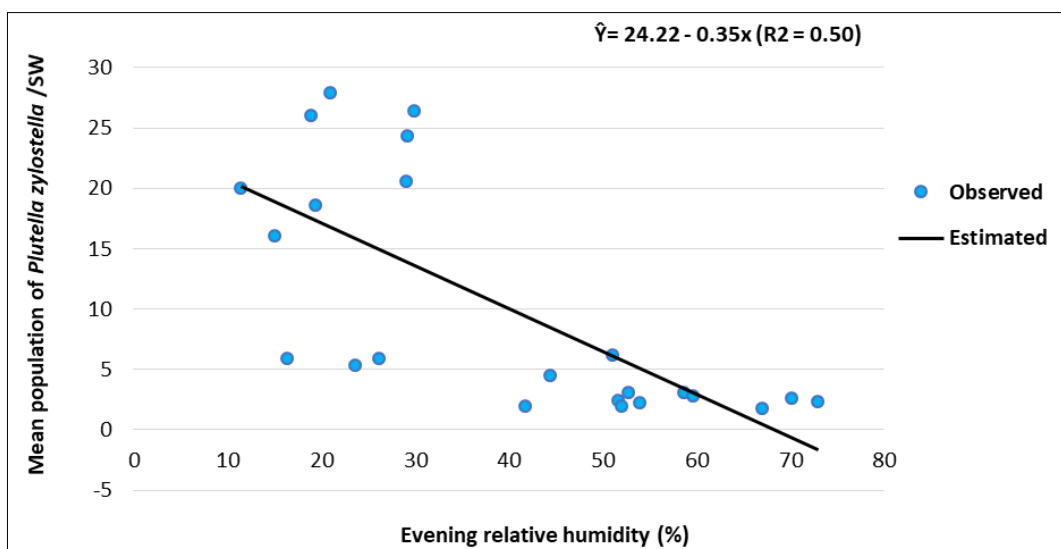


Fig 20: Regression of evening relative humidity (%) on *Plutella xylostella* trapped in light trap during rabi 2019-20

Conclusion

Five different species of insect pests were recorded namely Tomato fruit borer *Helicoverpa armigera*, Cabbage semilooper *Plucia orichalsia*, Tobacco caterpillar *Spodoptera litura*, Brinjal shoot and fruit borer *Leucinods orbonalis* and Diamond back moth *Plutella xylostella* at farmers field of district Chhindwara (M.P.) during Rabi 2019-20 which represented order Lepidoptera and 03 families (Noctuidae, Pyraustidae and Plutellidae). *H. armigera* is a major polyphagous pest. Its first peak observed in 13th SMW (12.05 moths) and reached to its second and highest peak during 16th SMW (12.94 moths). *P. orichalsia* is a major Pest of cabbage. Its first and highest peak observed in 10th SMW (28.51 moths). *S. litura* is a major pest of major pest of tobacco but also feed on tomato. Its highest peak observed in 11th SMW (9.89 moths). *L. orbonalis* (brinjal shoot and fruit borer) is the major pest of brinjal. its first and highest peak observed in 11th SMW (22.95 moths). *P. xylostella* is the major pest of cabbage and cauliflower. Its highest peak observed in 9th SMW (27.94 moths). Correlation data revealed that, maximum temperature, minimum temperature were showed significantly positive correlation while morning and evening relative humidity were showed significantly negative correlation with *H. armigera*, *P. orichalsia*, *S. litura*, *L. arbonalis* and *P. xylostella*.

References

1. Anonymous. National Horticulture database; c2020. <http://www.nhb.gov.in>
2. Anonymous. Department of Horticulture and Food Processing, Chhindwara, Madhya Pradesh; c2020.
3. Chandrakumar HL, Ashok Kumar CT, Kumar NG, Chakravarthy AK, Putta Raju TB. Seasonal occurrence of major insect pests and their natural enemies on brinjal. *Current Biotica*, 2018;2(1):63-73
4. Indirakumar K, Devi M, Loganathan R. Seasonal incidence and effect of abiotic factors on population dynamics of major insect pests on brinjal crop. *International Journal of Plant Protection*. 2016;9(1):142-145.
5. Megha. Taxonomic documentation of insect fauna collected in light trap during Rabi season in Medicinal Garden at Jabalpur. M.Sc. Thesis, JNKVV, Jabalpur; c2019. p. 1-89.
6. Sharma AK, Barche S, Mishra PK. Scope of light trap as IPM tool for sustainable cultivation of rice. *Modern Biotechnology and its Applications*, New India publishing agency; c2004. p. 303-312.
7. Sharma AK, Pachori R, Bhowmick AK, Thakur AS. Records the seasonal activity and population fluctuation of *Helicoverpa armigera* (Hub.) and *Spodoptera litura* (Fabricius) through light trap catches in Jabalpur region of M.P. *Journal of Entomology and Zoology Studies*. 2019;7(2):665-667
8. Sumit HK, Sundar B, Sandhya S, Sharma AK. Study on seasonal incidence of insect pests of vegetable crops collected through light trap. *International Journal of Chemical Studies*. 2019;7(4):687-689.
9. Shimoda M and Honda K. Insect reactions to light and its applications to pest management. *Journal of Applied Entomology and Zoology*. 2013;48(4):413-421.
10. Sinu PA, Mandal P, Banerjee D, Tapan SM, Talukdar, Pathak SK. Moth pests collected in light traps of tea plantations in North East India: species composition, seasonality and effect of habitat type. *Current Science*. 2013;104(5):646-651.
11. Vaishampayan SM. Use of light trap as a component of adult oriented strategy of pest management. *Resources Management in Plant Protection*. 2002;2:139-144.
12. Verma R, Vaishampayan SM. Seasonal activity of major insect pests on light trap equipped with mercury vapour lamp at Jabalpur. *Insect Ecology and Resource Management*; c1983. p. 173-180.