Available online @ www.iaraindia.com
Research Explorer
ISSN: 2250-1940 (P) 2349-1647 (O)
Impact Factor: 3.655(CIF), 2.78(IRJIF), 2.77(NAAS)
Volume VI, Issue 17 - April 2018

STUDIES ON INFLUENCE OF WEATHER PARAMETERS ON TRAP CATCHES OF Helicoverpa armigera (HUBNER) IN REDGRAM [Cajanus cajan (L.)] ECOSYSTEM

S LEKHA PRIYANKA
Research Scholar, Department of Agricultural Entomology, ADAC&RI, TNAU, Tiruchirappalli

V R SAMINATHAN
Assistant Professor, Department of Agricultural Entomology, NPRC, TNAU, Vamban

S SITHANANTHAM
Director of Sun Agro Bio-Tech Research Center, Chennai

V AMBETHGAR
Dean, Department of Agricultural Entomology, JSACAT, TNAU, Cuddalore

N MANIVANNAN
Professor, Department of Plant Breeding and Genetics, NPRC, TNAU, Vamban

Abstract

*An experiment was conducted to study the influence of weather parameters on trap catches and seasonal incidence of Helicoverpa armigera (Hubner) in redgram Cajanus cajan (L.) ecosystem during kharif 2017 at experimental farm of NPRC, Vamban and farmer's field at Vadakaddu with green colour funnel pheromone traps erected with Heli lure. The highest catch (98 moths/ 5 traps) was recorded on 2nd SMW at Vamban and on 52nd SMW at Vadakaddu. In both the locations lowest catch (20 moths/5 traps) and (30 moths/5 traps) was recorded on 35th SMW. The moth catches had highly significant negative correlation with maximum temperature (r = -0.73**), (r = -0.74**) and minimum temperature (r = -0.58**), (r = -0.60**), wind speed (r = -0.65**) and (r = -0.69**) at Vamban and Vadakaddu respectively. The trap catches showed significant negative correlation with rainfall (r = -0.37*) at Vadakaddu and there was no significant correlation with rainy days at NPRC, Vamban. But there was highly significant positive correlation with relative humidity (r = 0.75**) and (r = 0.76**) at Vamban and Vadakaddu respectively.*

Keywords: Helicoverpa armigera, Redgram, Trap catches, Weather parameters, Seasonal incidence.

Introduction

Pulses are very important in balanced diet because of their high nutritional value. The year 2016 was declared as "The International year of pulses" by FAO on (Anonymous, (2016)) which mentions about the importance of pulses. India is a major pulse growing country in the world. The insect pest spectra that infest pulse crops include more than 40 species (Sharma *et al.*, (2005)) out of which, gram pod borer, *Helicoverpa armigera* (Hubner) is a serious pest of pulses.

High polyphagy, mobility, reproduction rate, and diapause are major factors contributing to its serious pest status (Fitt, (1989)). The gram pod borer begins infestation at the seedling stage and later feed on the flower and developing seeds in pods until crop maturity (Mandal and Roy, (2012)). Farmers rely heavily on the use of chemical pesticides to control these pests on pulses (Phokela *et al.*, (1990)).

Intensive and indiscriminate use of pesticides leads to complications like development of resistance to insecticides, environmental degradation, harmful effect on beneficial flora and fauna and secondary pest resurgence. Chemical management of pod borers is also challenging because of the cryptic behaviour of larvae. Hence, it creates an urging need to manage the pest by non-pesticidal eco-friendly methods. Behavioural control using pheromone traps is a recent advancement in pest management. This is a best tool for monitoring and forecasting in addition to management.

Methodology

The field experiments were conducted at the farmland of NPRC, Vamban and farmer's field at Vadakaddu, Pudukottai (10^{o}36'N and 78^{o}93'E), Tamilnadu. In Pudukottai, a semi-arid climate with high temperature throughout the year and relatively low rainfall prevails. In both locations, average maximum temperature is 35.4^{o}C and minimum temperature is 23.2^{o}C with mean annual rainfall of 881mm in 45 rainy days during last 10 years (NPRC weather station). The soil type is red laterite with acidic pH (3.9-6.5). Since Pudukottai is a pulse belt, this centre was selected for research.

Ten green coloured funnel traps were installed for monitoring in barren land where redgram was going to be raised. The traps were fitted with hexadecanol lures made up of rubber septum. (Ugale *et al.*, (2011)). The similar procedure was adopted in Vadakaddu. Data on weekly trap catches of adults were recorded from Vamban and Vadakaddu. The adults of *Helicoverpa armigera* were collected and counted. Weather parameters of 52 standard weeks were collected from NPRC weather station. Simple correlation was worked out between the weekly average values of weather parameters and pheromone trap catches of *Helicoverpa armigera*.

Results and Discussion

The results indicated that the seasonal incidence of this pest was much dependent on the weather parameters prevailing in these locations. The trap catches of adults of *Helicoverpa armigera* was first observed during 32nd SMW.

At Vadakaddu, the moth catches were ranging from 32 to 98 moths/ 5 traps during the entire cropping period. The highest catch of (98 moths/5 traps) was recorded on 52nd SMW in December, when the mean atmospheric temperature was 29.7^{o}C and 21.7^{o}C, relative humidity was 92.5 per cent followed by (97.4 moths/5 traps) on 49th SMW in December. The lowest catch (30 moths/5 traps) was recorded on 35th SMW in August, when the mean atmospheric temperature was 34.6^{o}C and 20.2^{o}C, relative humidity was 83.4 per cent. The moth catches were higher from 49th SMW (97.4 moths/5 traps) in December to 2nd SMW (96 moths/5 traps) in January. It was lower from 32nd SMW (32 moths/5 traps) to 35th SMW (30 moths/5 traps) in August since the traps were placed in barren lands.

At Vamban, the moth catches were ranging from 29 to 98 moths/ 5 traps during the entire period. The highest catch of (98 moths/5 traps) was recorded on 2nd SMW in January when the mean atmospheric temperature was 30.6^{o}C and 20.4^{o}C, relative humidity was 91 per cent followed by (97.6 moths/5 traps) on 51st SMW in December. The catches declined thereafter towards the maturity of the crop. This confirms that the adult emergence reaches its peak during December to January. It is in accordance with Chatar *et al.*, (2010) who indicated that the pest appeared from 2nd week of December and attained a peak during 2nd week of January. Then the pest population gradually declined towards the maturity of the crop. Suganthy *et al.*, (2003) indicated that the peak population of *Helicoverpa armigera* was observed during the first two weeks of December, January and February. Harish *et al.*, (2015) found that *Helicoverpa armigera* (Hubner) peaked at 46th standard week (5.5 moths/ trap). Here the crop is groundnut but our crop is pulses. In pulses the peak population was observed during 49th SMW. Shinde *et al.*, (2013) indicated that the peak population was observed during November to December which is in line with our findigs. Pawan Ojha *et al.*, (2017) concluded that during February month, the population had the highest peaks. In contrast to this, we had a considerably higher population during this period since this is a pulse belt, apart from our crop, pulses like blackgram, greengram, and cowpea were cultivated. *Helicoverpa armigera* from these crops might have been attracted. The lowest trap catch of 20 moths/5 traps was recorded on 35th SMW in August, when the mean atmospheric temperature was 34.6^{o}C and 20.2^{o}C, relative humidity was 83.4 per cent. The lowest population might be due to increased parasitism and favourable weather parameters prevailed in our study area which is similar to the findings of Dharmendra Singh *et al*., (2015) who concluded that weather parameters are associated with early stage larval parasitization of *H. armigera* by *Campoletis chlorideae* and leads to eventual mortality up to 90 per cent. Our findings are in contrast to Bajya *et al*., (2010))who studied that the highest population was recorded during the third week of September, gradually declined during the last week of September and remained static thereafter. As the traps were placed in barren lands during this period for monitoring, catch may be low in our findings. Ram Keval (2017) concluded the *H.armigera* population reached its peak in the 9th standard week. In contrast, our findings indicate that the population was lower during this period. Rahul Kumar Rawat *et al*., (2017) indicated that in long duration pigeonpea , the adult male moth activities were first noticed in the 4th standard week and the population attained its peak level in the 12th standard week (7.5 moths/ trap). His findings are in contrast with our findings because redgram variety used was medium duration. The moth catches were higher from 49th SMW (95.8 moths/5 traps) in December to ^{2nd} SMW (98 moths/5 traps).

There was highly significant negative correlation with maximum temperature temperature (r = -0.73**) and minimum temperature (r = -0.58**), wind speed (r = -0.65**) significant negative correlation with rainfall (r = -0.37*), highly significant positive correlation with relative humidity (r = 0.75**) and there was no correlation with rainy days at Vamban. It is in accordance with Chatar *et al*., (2010) who indicated that the larval population of *H. armigera* exhibited highly significant negative correlation with maximum temperature and significant negative correlation with minimum temperature while the pest population showed highly significant positive correlation with relative humidity. Ugale *et al*., (2011) indicated that population of *Helicoverpa armigera* was found to be negatively and significantly correlated with mean atmospheric temperature which is in accordance to our findigs. Bajya *et al*., (2010) indicated that Minimum temperature, rainfall and relative humidity were positively correlated with *H. armigera* population. Our findings are in contrast with Rahul Kumar Rawat *et al*., (2017) who reported that the population of *Helicoverpa armigera* had positive correlation with maximum temperature, minimum temperature and significant negative correlation with relative humidity. Ram Keval (2017) indicated that the population of *Helicoverpa armigera* exhibited a significant positive correlation with maximum temperature whereas a significant negative correlation was established with relative humidity. Pawan Ojha *et al*., (2017) reported that Mean atmospheric temperature and wind speed had positive correlation while relative humidity and rainfall had negative correlation on pest population. This may be due to the weather parameters prevailing in our place. There was highly significant negative correlation with mean atmospheric temperature (r = -0.74**) and (r = -0.60**), wind speed (r = -0.69**), significant negative correlation with rainfall (r = -0.43*) and rainy days (r = -0.37*), highly significant positive correlation with relative humidity (r = 0.76**) at Vadakaddu.

Conclusion

These observations will be helpful for timely prediction and control measure and the present findings are in conformity with those results reported by earlier workers.

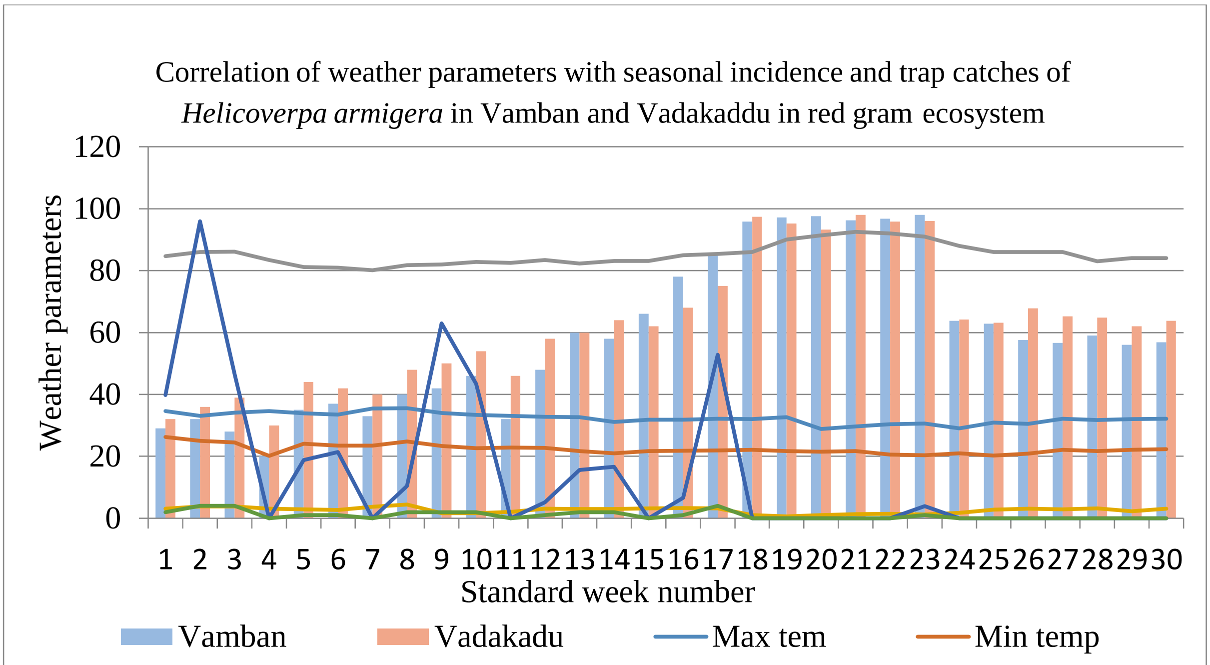
Table 1. Seasonal incidence of *Helicoverpa armigera* in correlation with weather parameters at Vamban in redgram ecosystem

SW.NO	Max tem	Min temp	RH	Wind sp	Rainfall	Rainy day	5 traps
Aug 32	34.6	26.2	84.7	3.09	39.8	2	29
33	33.1	25	86	3.8	95.9	4	32
34	34.1	24.5	86.1	3.8	46.6	4	28
35	34.6	20.2	83.4	3.04	0	0	20
Sep 36	33.9	24.1	81.1	2.87	18.8	1	35
37	33.5	23.5	80.9	2.67	21.4	1	37
38	35.4	23.5	80.1	3.74	0	0	33
39	35.6	24.8	81.8	4.46	10.4	2	40
Oct 40	34	23.4	82	1.6	63	2	42
41	33.4	22.6	82.8	1.69	43.4	2	46
42	33.1	22.8	82.5	2.02	0	0	32
43	32.8	22.7	83.4	3.09	5.2	1	48
44	32.7	21.7	82.3	3.03	15.6	2	60
Nov 45	31.1	21	83.1	2.97	16.6	2	58
46	31.8	21.7	83.1	3.18	0	0	66
47	31.8	21.8	85	3.27	6.6	1	78
48	32.1	21.9	85.4	3.16	52.8	4	85
Dec 49	32	22.1	86	1.02	0	0	95.8
50	32.7	21.7	90	0.61	0	0	97.2
51	28.8	21.5	91.4	1.01	0	0	97.6
52	29.7	21.7	92.5	1.33	0	0	96.2
Jan 1	30.4	20.6	92	1.43	0	0	96.8
2	30.6	20.4	91	1.26	3.9	1	98
3	29	21	88	1.77	0	0	63.8
4	30.9	20.3	86	2.76	0	0	62.8
5	30.5	20.9	86	3.08	0	0	57.6
Feb 6	32.1	22.1	86	2.84	0	0	56.6
7	31.7	21.7	83	3.22	0	0	59
8	32	22.1	84	2.28	0	0	56
9	32.1	22.3	84	3.13	0	0	56.8

Table 2. Seasonal incidence of *Helicoverpa armigera* in correlation with weather parameters at Vadakaddu in redgram ecosystem

SW.NO	Month	Max tem	Min temp	RH	Wind sp	Rainfall	Rainy day	5 traps
Aug 32	August	34.6	26.2	84.7	3.09	39.8	2	32
33		33.1	25	86	3.8	95.9	4	36
34		34.1	24.5	86.1	3.8	46.6	4	39
35		34.6	20.2	83.4	3.04	0	0	30

Sep 36	Sep	33.9	24.1	81.1	2.87	18.8	1	44
37		33.5	23.5	80.9	2.67	21.4	1	42
38		35.4	23.5	80.1	3.74	0	0	40
39		35.6	24.8	81.8	4.46	10.4	2	48
Oct 40	Oct	34	23.4	82	1.6	63	2	50
41		33.4	22.6	82.8	1.69	43.4	2	54
42		33.1	22.8	82.5	2.02	0	0	46
43		32.8	22.7	83.4	3.09	5.2	1	58
44		32.7	21.7	82.3	3.03	15.6	2	60
Nov 45	Nov	31.1	21	83.1	2.97	16.6	2	64
46		31.8	21.7	83.1	3.18	0	0	62
47		31.8	21.8	85	3.27	6.6	1	68
48		32.1	21.9	85.4	3.16	52.8	4	75
Dec 49	Dec	32	22.1	86	1.02	0	0	97.4
50		32.7	21.7	90	0.61	0	0	95.2
51		28.8	21.5	91.4	1.01	0	0	93.2
52		29.7	21.7	92.5	1.33	0	0	98
Jan 1	Jan	30.4	20.6	92	1.43	0	0	95.8
2		30.6	20.4	91	1.26	3.9	1	96
3		29	21	88	1.77	0	0	64.2
4		30.9	20.3	86	2.76	0	0	63.2
5		30.5	20.9	86	3.08	0	0	67.8
Feb 6	Feb	32.1	22.1	86	2.84	0	0	65.2
7		31.7	21.7	83	3.22	0	0	64.8
8		32	22.1	84	2.28	0	0	62
9		32.1	22.3	84	3.13	0	0	63.8



References

1. Anonymous. The Hindu - Business line. (2016)
2. Bajya, D. R., Monga, D., Tyagi, M. P. and Meena, B.L. (2010). Population dynamics of Helicoverpa armigera on chickpea, pigeonpea and cotton in correlation with weather parameters. Annals of Plant Protection Sciences, 18(1): 227-229.
3. Chatar, V. P., Raghvani, K. L., Joshi, M. D., Ghadge, S. M., Deshmukh, S. G. and Dalave, S. K. (2010). Population dynamics of pod borer, Helicoverpa armigera (Hubner) infesting chickpea. International Journal of Plant Protection, 3(1): 65-67.
4. Dharmendra Singh, Singh, S. K. and Vennila, S. (2015). Weather parameters influence population and larval parasitization of Helicoverpa armigera (Hübner) in chickpea ecosystem. Legume Research, 38 (3): 402-406
5. Dinesh Kachhawa, Rana, B.S. and Saminathan, R. (2016). Seasonal incidence of Helicoverpa armigera (Hubner) in chickpea ecosystem in correlation with weather parameters. The Bioscan, 11(4): 2227-2230.
6. Fitt, G. P. (1989). The ecology of Heliothis in relation to agroecosystems. Annual Review of Entomology. 34: 17-52.
7. Gautam, M. P., Umesh Chandra, Yadav, S.K., Ramesh Jaiswal, Giri, S.K. and Shesh Narain Singh. (2018). Studies on population dynamics of garm pod borer Helicoverpa armigera (Hubner) on chickpea (Cicer arietinum L.). Journal of Entomology and Zoology Studies, 6(1): 904-906
8. Harish, G., Nataraja, M.V., Poonam Jasrotia, Prasanna Holajjer, Savaliya, S.D. and Meera Gajera. (2015). Impact of weather on the occurrence pattern of insect pests on groundnut. Legume Research, 38 (4): 524-535.
9. Mandal, S. K. and Roy, S. P. (2012). Impact of environmental factor (s) on certain pulse crops of north-eastern Bihar (India) with reference to resource management. The Ecoscan, 1(Special Issue): 35-40.
10. Patel, S. R., Patel, K. G and Ghetiya, L. V. (2015). Population dynamics of pod borer (Helicoverpa armigera Hubner) infesting chickpea in relation to abiotic factors. AGRES, 4(2): 163-170.
11. Pawan Ojha, K., Renuka Kumari and Ram Chaudhary, S. (2017). Impact of abiotic and biotic factors on population dynamics of Helicoverpa armigera Hubner (Noctuidae: Lepidoptera) in chickpea. Journal of Entomology and Zoology Studies, 5(1): 636-642.
12. Phokela, A., Dhingra, S., Sinha, S. N., Mehrotra, K. N. (1990). Pyrethroid resistance in Heliothis armigera Hübner III. Development of resistance in field. Pesticide Research Journal. 2(1): 28-30
13. Rahul Kumar Rawat , Ram Keval , Snehel Chakravarty and Sabuj Ganguly. (2017). Monitoring of gram pod borer, Helicoverpa armigera (Hübner) through pheromone traps on long duration pigeonpea [Cajanus cajan (L.) Millsp.]. Journal of Entomology and Zoology Studies, 5(5): 665-669.
14. Ram Keval, Jitendra Khamoriya, Snehel Chakravarty and Sabuj Ganguly. (2017). Seasonal Incidence of Gram Pod Borer, Helicoverpa armigera (Hübner) and Tur Pod Fly, Melanagromyza obtusa (Malloch) on Late Maturing Pigeonpea in Varanasi Region of Indo-Gangetic Plain. Journal of Experimental Agriculture International, 19(1): 1-8.
15. Sardar, S. R., Bantewad, S. D. and Jayewar, N.E. (2018). Seasonal Incidence of Helicoverpa armigera Influenced by Desi and Kabuli Genotype of Chickpea. International Journal of Current Microbiology and Applied Sciences, 6 (Special Issue): 536-541.
16. Sharma, H. C., Ahmad, R., Ujagir, R., Yadav, K. P., Singh, R. and Ridsdill-Smith, T. J. (2005). Host plant resistance to cotton bollworm/ legume pod borer, Helicoverpa armigera, In Heliothis/ Helicoverpa Management. Emerging trends and strategies for future research (Sharma, H.C. Eds) New Delhi, India: Oxford and IBH Publishing Inc. 167–208.
17. Shinde, Y.A., Patel, B.R. and Mulekar,V.G. (2013). Seasonal incidence of gram caterpillar, Helicoverpa armigera (Hub.) in chickpea. Current Biotica, 7(1&2): 79-82.
18. Suganthy, M., Ranga Rao, G.V. and Tej kumar, S. (2003). Seasonal incidence of gram pod borer in rainfed chickpea in Andhra Pradesh. Indian Journal of plant protection , 31(1): 160-161.
19. Ugale, T.B., Toke, N.R. and Shrisath M.S. (2011). Population dynamics of gram pod borer, Helicoverpa armigera (Hubner). International Journal of plant protection, 4(1): 204-208
20. Vikram, Ashwani Kumar, Keshav Mehra and Renu Choudhary. (2018). Effect of weather parameters on incidence of key pest, Helicoverpa armigera (Hubner) on tomato. Journal of Entomology and Zoology Studies, 6(1): 97-99