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Studies on correlation of gram pod borer, *Helicoverpa armigera* (Hubner) with abiotic factors by pheromone traps

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Abstract
Seasonal incidence of gram pod borer, *Helicoverpa armigera* (Hubner) on chickpea through pheromone traps was carried out at Sehore, during 2015-16. Maximum number of male moths trapped were 29.92 /trap/week, recorded during 2nd standard week (8th Jan. -14th Jan.), while maximum number of larvae was 2.45/ mrl recorded during 4th standard week (22nd Jan. -28th Jan.). A negative and non-significant weak correlation was observed between adult male moths of *H. armigera* with maximum temperature; minimum temperature, and relative humidity; however, negative and significant weak correlation was found between larval population with maximum temperature; minimum temperature, and relative humidity. A positive and non- significant weak correlation between adult male moths population and larval population was observed.

Keywords: Pheromone trap, chickpea, *Helicoverpa armigera*

Introduction
Chickpea is an important pulse crop of India, known as king of pulses. Among the reported insect pests, the gram pod borer, *Helicoverpa armigera* (Hubner) is the key pest at pod formation stage of chickpea crop, which may account for about 20-80 per cent yield loss. The yield losses are mainly due to pod damage, which ranges from 14 to 38 per cent in different years. In case of heavy infestation, the damage has been recorded even upto 80 per cent (Nema and Verma, 2000) [6]. The noctuid genera of *Helicoverpa* contains pest of worldwide importance. More than 75 species and subspecies are found on very wide range of wild and cultivated host plants (Kumar and Shivakumara, 2003) [3]. Early detection of the pest is more important for its effective management. The study of monitoring population dynamics of the pest is important for effective management. Many workers have reported practical applications of pheromones for monitoring, detecting population suppression and population survey for need based use of insecticides (Silverstein, 1981; Schouest and Miller, 1994; Harris *et al.*, 1997) [11, 9, 2]. In addition, pheromone traps are also used to determine a threshold level of trap catch population, indicating the need for insecticide application, and peak period of adult population. *H. armigera* lure, a synthetic sex pheromone comprising (z)-11-hexadecenal and (z)-9-hexadecenal in 97 : 3 ratio impregnated rubber septa (make NCIPM, New Delhi) is using widely for monitoring *H. armigera* male moth population. No work has been done so for on the monitoring of Gram caterpillar by pheromone in in western part of Vindhya plateau of Madhya Pradesh. Therefore the Present investigation was carried out to studies on seasonal incidence of *H. armigera* on chickpea through pheromone traps and its relationship with abiotic factors such as minimum, maximum temperatures and relative humidity.

Method and Materials
For studies on seasonal incidence of *H. armigera* on chickpea through pheromone traps, investigation was conducted at field of R.A.K. College of Agriculture, Sehore, Madhya Pradesh during 2015-16. For this purpose chickpea variety namely JG-130 was planted in 39 m x 15 m block for study the crop was raised under rainfed un-protected conditions as per the recommended agronomical practices. Monitoring studies using sex pheromone on the activity of the male test insect were conducted on the chickpea field. Sleeve traps baited with *H. armigera* lure, a synthetic sex pheromone comprising (z)-11-hexadecenal and (z)-9-hexadecenal in 97: 3 ratio impregnated rubber septa (NCIPM, New Delhi) was used for

monitoring *H. armigera* male moth population. Ready to use two traps were set in the field at a distance of 100 m. The trap was fixed on iron pole at a height of nearly 2 m above ground level. The septum (dispenser) was changed once in 28 days throughout the study period. Observations on male moth traped were recorded daily (from 20th Nov., 2015 to 10th Mar., 2016) and the traps were emptied. Daily trapped populations were pooled and weekly averages were computed. Observations on larval population of *H. armigera* were recorded at weekly interval from twenty randomly selected spots on fixed one meter row length (mrl), (i.e. from emergence 20th Nov., 2015 to till the maturity 10th Mar., 2016). The correlation between the male moth catches, larval population and meteorological data was calculated by using simple correlation co-efficient formula.

Formula of Correlation

$$r = \frac{Cov.\ (X, Y)}{\sigma_X \cdot \sigma_Y}$$

Where,

r	=	Correlation coefficient
Cov. (X, Y)	=	Covariance between X and Y
σ_X	=	Standard deviation of X
σ_Y	=	Standard deviation of Y

Result and Discussion

In the present investigation, the data presented in Table: 1 showed that adult male moths of *H. armigera* first appeared in the traps during 48th standard week (Nov. 27th-Dec. 03rd) with 3.57 moths/trap/week which increased gradually and reached its first peak (26.64 moths/trap/week) during 51st standard week (Dec. 18th–Dec. 24th). Rapid decreased in subsequent weeks was noted during 52nd standard week (Dec. 25th – Dec. 31st). Thereafter, adult male moths population suddenly increased and reached its second peak (29.92 moths/trap/week) during 2nd standard week (Jan. 8th–Jan. 14th) and reached its third peak (26.07 moths/ trap/week) during 3rd standard week (Jan. 15th– Jan. 21st) and soon after slightly decreased. Thereafter, adult male moths population appeared in the traps followed a decreasing trend in subsequent weeks upto 9.71 moths/trap/week in 10th standard week (Mar. 4th–Mar. 10th). Almost similar kind of observations were observed by Suganthy *et al.* (2003) [13] who reported that the maximum moth emergence was observed during the second, third, and fourth week of January and in the first week of February. Present finding are conformed by Kumar and Durairaj (2012) [5], who reported that the peak emergence of *H. armigera* adults during 51st (8.25 moths/trap/week) and 52nd (8.00 moths) standard weeks followed by 1st standard week (7.25 moths).

Incidence of larval population (0.10 larvae/ mrl) was noted later in 49th standard week (Dec. 4th – Dec. 10th) after the adult male moths first appeared in the traps during 48th standard week (Nov. 27th – Dec. 03rd). During the period of investigation, two peaks of *H. armigera* were observed; first peak (2.45 larvae/ mrl) on 4th standard week and second peak (2.10 larvae/ mrl) on 5th standard week. Present finding is in close conformity with the finding of Suganthy *et al.* (2003) [13], who reported the pest incidence at the seedling stage (15 DAS). The larval population was lowest at 15 DAS (7.3 per 20 plants) then gradually increased until its first peak at 29 DAS (60.3), second peak at 57 DAS (85.5), and third peak at 85 DAS (74.3).

Correlation between meteorological parameters and male moth trap catches of *H. armigera*. Present finding revealed that adult male moths of *H. armigera* catches in pheromone traps had a negative and non-significant correlation with maximum temperature (r= -0.428); minimum temperature (r= -0.343), and relative humidity (r= -0.429) noted (Table: 2). Similar kinds of results were also reported by Pathania *et al.* (2009) [7] and Ugale *et al.* (2011) [14].

A negative and significant weak correlated between larval population of *H. armigera* with maximum temperature (r= -0.503); minimum temperature (r= -0.520), and relative humidity (r= -0.589) was observed (Table: 3). Similar findings were also observed by Kumar *et al.* (2012) [5] and Sonkar *et al.* (2012) [12].

A positive and non-significant correlation between adult male moths of *H. armigera* catches in the pheromone traps and larval population was (r= 0.497) recorded (Table: 4). These findings are in favour of Prabhakar *et al.* (1998) [8], who reported that correlation between moth catches and subsequent larval counts after two weeks were positively correlated. Similarly, Gupta and Desh (2003) [1] also reported that the coefficient of correlation (r) between the mean larval count on chickpea crop and weekly catch data in light/pheromone traps were non-significant (r= 0.05) reflecting the polyphagous nature of the pest. Similar kind of correlation was also observed by Sharma *et al.* (2012) [10] who reported that the correlation between male moth catches and larval population was positively non significant (r= 0.8329).

Table 1: Seasonal incidence of gram pod borer, *H. armigera* on chickpea through pheromone traps during *Rabi* 2015-2016

Months	Std. week No.	Date	Temperature (°C)		R.H. (%)	Moths / trap / week	Larvae /mrl
			Max.	Min.			
Nov., 2015	47	20-26	28.54	14.87	61.28	0	0
	48	27-3	28.25	15.88	61.71	3.57	0
Dec., 2015	49	4-10	27.51	10.84	58.78	10.57	0.10
	50	11-17	23.80	8.47	55.64	17.28	0.35
	51	18-24	22.71	7.17	54.42	26.64	0.85
	52	25-31	24.84	7.7	55.78	8.35	1.35
Jan., 2016	1	1-7	27.40	9.7	58.28	15.64	1.55
	2	8-14	26.52	10.61	58.07	29.92	1.80
	3	15-21	22.81	11.65	56.57	26.07	1.90
	4	22-28	24.11	6.84	55.13	15.85	2.45
	5	29-4	27.40	11.18	58.78	14.5	2.10
Feb., 2016	6	5-11	27.08	11.78	57.49	14.85	1.95
	7	12-18	27.42	14.35	59.42	22.35	1.70
	8	19-25	30.42	13.62	61.64	10.35	0.60
	9	26-3	31.45	15.92	63.28	20.71	0.15
Mar., 2016	10	4-10	32.61	16.98	64.28	9.71	0

Table 2: Correlation coefficient of adult male moths population of *H. armigera* with meteorological parameters.

Sr. No.	Correlation of moths population with	'r' value	't' cal.	't' tab.
1	Maximum temperature	-0.428	-1.775	2.145
2	Minimum temperature	-0.343	-1.368	2.145
3	Relative humidity	-0.429	-1.777	2.145

Non significant at 5 % level

Table 3: Correlation coefficient of larval population of *H. armigera* with meteorological parameters.

Sr. No.	Correlation of larval population with	'r' value	't' cal.	't' tab.
1	Maximum temperature	-0.503	-2.182 **	2.145
2	Minimum temperature	-0.520	-2.282 **	2.145
3	Relative humidity	-0.589	-2.727 **	2.145

** Significant at 5 % level

Table 4: Correlation coefficient of adult male moths with larval population of *H. armigera*.

Sr. No.	Correlation of moths population with	'r' value	't' cal.	't' tab.
1	Larval population	0.497	2.142	2.145

Non significant at 5 % level

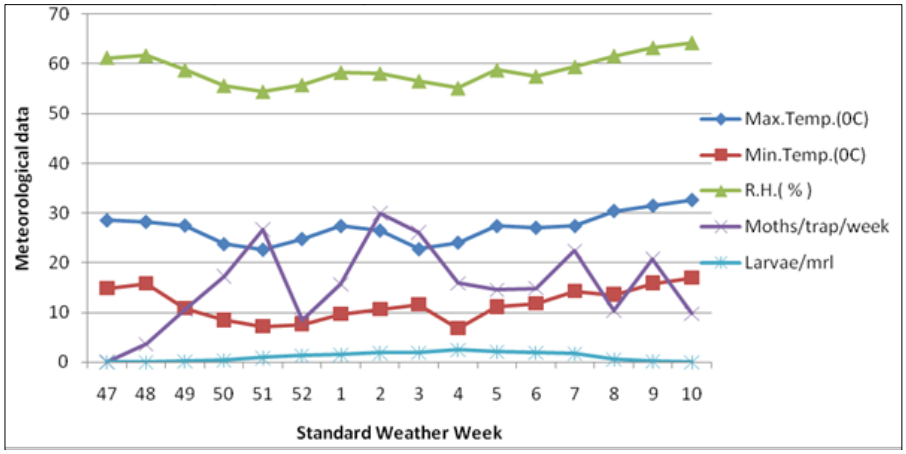

Fig 1: Seaconal incidence of H. armigera on chickpea through pheromone traps

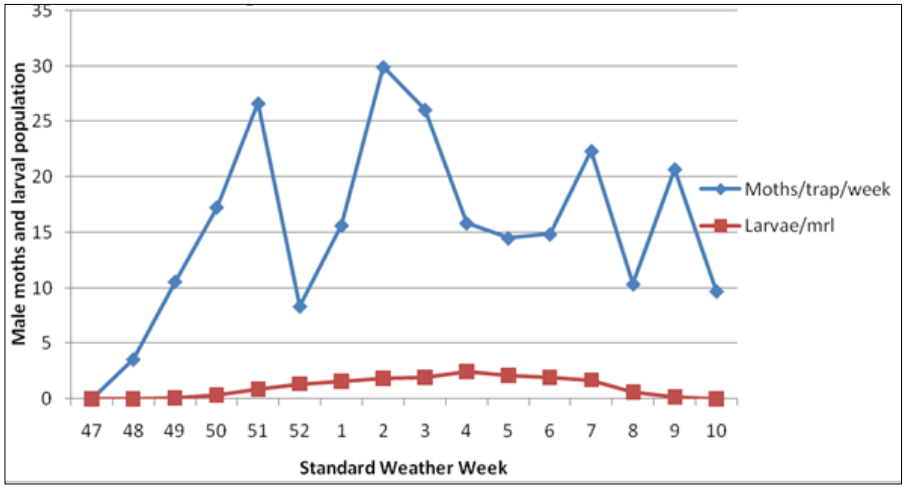

Fig 2: Pheromaone trap catches of male moths and larval population of H. armigera

Conclusion

Based on the results of investigation, it can be concluded that pheromone traps were important tool for monitoring and forecasting of *H. armigera* population, after peak period of adult male moths catches, just after 7 to 10 days, the larval population of *H. armigera* increased gradually and remained throughout the entire season of crop. Therefore, control measures through integrated pest management techniques without indiscriminate use of insecticide may be implemented immediately.

References

1. Gupta RK, Desh R. Monitoring of *Helicoverpa armigera* (Hubner) through light and pheromone traps and relationship of catch data with abiotic factors and larval infestation on chickpea in Himachal Pradesh. Pest Manag. Econ. Zool. 2002-2003; (102):103-110.
2. Harris MK, Millar JG, Knutson AE. Pecan nut case borer (Lepidoptera: Pyralidae) sex pheromone used to monitor phenology and effective range of traps. J Econ. Entomol. 1997; 90:983-987.

3. Kumar ARV, Shivakumara B. Variable response of male *Helicoverpa armigera* moth to sex pheromone blends: A case of behavioral polymorphism? Curr. Sci. 2003; 84(5):705-709.
4. Kumar J, Singh DC, Singh AP. Incidence of pod borer, *Helicoverpa armigera* Hub. And their management through newer insecticides in chickpea. Trends Biosci. 2012; 5(3):240-243.
5. Kumar JR, Durairaj C. Population dynamics of gram pod borer (*Helicoverpa armigera*) in relation to weather factors under Tamil Nadu condition. J Food Legumes. 2012; 25(1):83-85.
6. Nema KK, Verma SN. Integrated management of gram pod borer, (*Helicoverpa armigera*, Hub.) in chickpea. Souvenir Published in Annual Workshop of AICRP on chickpea and MULLaRP organized by JNKVV campus, R.A.K., College of Agriculture, Sehore (M.P.), 2000 at CIAE, Bhopal, 2000, 65-67.
7. Pathania SS, Verma AK, Gupta PR. Pheromone monitoring of *Helicoverpa armigera* (Hubner) and relationship with abiotic factors and infestation on tomato. Indian J Ent. 2009; 71(4):312-316.
8. Prabhakar M, Singh Y, Singh SP, Singh VS. Predicting *Helicoverpa armigera* in chickpea by using sex pheromone traps. Indian J Ent. 1998; 60(4):339-344.
9. Schouest LP Jr, Miller T. Automated pheromone traps show male pink bollworm (Lepidoptera: Gelechiidae) mating response is dependent on weather conditions. J Econ. Entomol. 1994; 87:965-974.
10. Sharma PK, Kumar U, Vyas S, Sharma S, Shrivastava S. Monitoring of *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) through pheromone traps in chickpea (*Cicer arietinum*) crop and influence of some abiotic factors on insect population. IOSR J Envitl. Sci. Toxi. Food Tech. 2012; 1(5):44-46.
11. Silverstein RM. Pheromones: Background and potential for use in insect pest control. Science. 1981; 213:1326-1332.
12. Sonkar J, Ganguli J, Ganguli RN. Studies on correlation of pheromone trap catch of *H. armigera* (Hubner) with larval population in field and weather parameters. Agric. Sci. Digest - Res. J. 2012; 32(3):204-208.
13. Suganthy M, Ranga Rao GV, Kumar ST. Seasonal incidence of gram pod borer in rainfed chickpea in Andhra Pradesh. Indian J Pl. Prot. 2003; 31(1):160-161.
14. Ugale TB, Toke NR, Shirsath MS. Population dynamics of gram pod borer, *Helicoverpa armigera* (Hubner). Intl. J Pl. Prot. 2011; 4(1):204-206.