ENTOMOLOGY

INFLUENCING OF WEATHER PARAMETERS ON PHEROMONE TRAP CATCHES OF COTTON BOLLWORMS

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Abstract

The present study revealed that the peak catches of American bollworm were observed during 37th (34.77 moth trap/week), 43rd (11.25 /trap/week) and 48th meteorological weeks (MW) (11.75/trap/week). The peak activity of spotted bollworm was observed from 39th to 45 MW where the population was in the range of 8.15 to 11.15 moth/ trap/week. Six peak catches of pink bollworm were observed during 45th MW (156.9/trap/week), 46th MW (186.1 trap/week), 47th MW (390/trap/week), 48th MW (432.5/trap/week), 49th MW (306.2/trap /week) and 50th MW (148.5/trap/week). The rainfall had no significant correlation with trap catches of all three bollworms, while the trap catches of *Helicoverpa armigera* were positively and significantly correlated with minimum temperature, evening relative humidity and wind speed of either current week or previous weeks. Whereas sunshine hours of current and previous weeks had a negative relation with trap catches of *H. armigera.* The current and previous week of maximum and minimum temperature were found to be positive and significant correlation with trap catches of *Earias vitella* while *Pectinophora gossypiella* had negative correlation with either current and previous weeks of morning and evening relative humidity.

Keywords: Bollworms, Pheromone trap, Peak periods, Weather parameters, Correlation, Meteorological weeks

Introduction

Cotton (*Gosseppium* spp.) a "Friendly fibre" is one of the most important commercial crops being grown in 111 countries. In India cotton is cultivated in 8.97 million ha with a production of 21.3 million bales of seed (Annon, 2006). Among the various pests of cotton, the bollworms, viz., spotted bollworm *Earias vitella*, *E. insulana*, American bollworm *Helicoverpa armigera* and pink bollworm *Pectinophora gossypiella* are of regular occurance and inflict heavy losses every year. Traps baited with behaviour – modifying chemicals, particularly sex pheromone are being used on large scale for monitoring insect pests (Minks, 1977). The use of pheromones in the management of *H. armigers* and *P. gossypiella* is studied and discussed by earlier workers (Mclaughlin and Mitchel, 1982 and Methwally *et al.* 1982), Kumar and Devraj Urs, (1991) reported that the evaluation of pheromone and virgin female traps in monitoring of *Earias vitella* on bhendi. The seasonal variation of the insect is important information necessary for careful timing of applications of control measure. Hence the present study was undertaken under India condition to develop a pheromone based monitoring system for fluctuations of bollworms population build-up. This will facilitate proper timing of insecticidal spray and other control strategies for the management of bollworms. In view of the above facts the present studies have been initiated to work out peak periods of bollworms and their correlation with weather parameters.

Materials and Methods

The present investigation on "Influencing of weather parameters on pheromone trap catches of cotton bollworms" was carried out at cotton research unit, Dr. Panjabroa Deshmukh Krish Vidyapeeth, Akola during kharif 2004-2005. Sowing was done on 10th July 2004 in plot area of 7.5 ha with a spacing of 60 cm x and sixty sleeve traps were installed at square initation stage of the crop and kept continuously till the end of crop season. Traps were hanged by using 150 cm tall bamboo stick and each trap was fixed above 30 cm crop canopy. Out of these, 20 traps were baited with helilures, 20 with vitlures and 20 with gossyplures. The distance between two traps of same species were kept at 50 meters. The lures were changed at 3 weeks interval and male moths trapped were counted, removed and destroyed daily early in morning from installation of traps until the end of crop season. The data on daily catches were pooled and total number of male moth trapped per week/trap was work out. The data on number of moths trapped weekly were correlated with weather parameters of current week and that prevailed during 1, 2, 3 and 4 weeks before the trap periods. The statistical analysis of data on

pheromone trap catches of bollworms and weather parameters were averaged out and were subjected to correlation studies following the methods of Gomez and Gomez (1984).

Results and discussion
American bollworm

The weekly data on male moth trap catches of *H. armigera* and meteorological data are presented in Table 1. The data indicated that the trap catches of *H. armigera* were observed from 35th meteorological (MW) and continued upto end of the crop season. There were three peak trap catches observed the first during 36th to 38th MW, the second during 43rd MW and third during 47th to 49th MW. The mean density of trap catches for the corresponding period ranged from 10.55 to 34.77, 11.25 and 6.7 to 11.75 male moths / trap /week, respectively. The highest peak catches of *H. armigera* was observed in 37th MW (34.7 moths/trap/week). As such Patel and Koshiy (1999) reported that there were three peak generation of *H. armigera* during first week of September, the first week and third week of October.

Correlation coefficient between trap catches of *H. armigera* and weather parameters as presented in Table 2. Indicated that minimum temperature of current week, one week, three weeks and four weeks before trap recorded were positively correlated. Similarly the wind speed of current week and all the previous four weeks were also found positively and significantly correlated with trap catches.

Relative humidity (evening) that prevailed during one, two week and three weeks before the record of trap data showed positive and significant correlation with the trap data. Whereas sunshine hours of current week and all the four previous weeks were found negatively and significantly correlated with trap catches. However, there were no correlation existed between trap catches and maximum temperature, relative humidity and rainfall.

Mehto *et al.* (1985) revealed that incidence of *H. armigera* was positively and significantly related with minimum temperature which was found in support of the present findings. The correlation studies between moth catches of *H. armigera* and rainfall could not be established. In contrast, Balasubramanian *et al.*, (1981) reported the negative correlation between moth activity and intensity of rainfall and number of rainy days. The variation may be attributed to scanty rainfall with improper distribution received during study period.

Spotted bollworm

Pheromone trap catches of male moth moths of *E. vitella* and meterological data are tabulated in Table 1. The data on catches of *E. vitella* in pheromone traps showed that the pest was active throughout the crop season. Peak activity period of male moths (above 8 to 10 moths/trap week) was observed from 39th MW to 45 MW where the population was in the range of 8.15 to 11.15 male moths / trap / week.

Naik *et al.* (1997) reported that four peak catches of *E. vitella* the first peak in the last week of September, the 2nd in the third week of November, 3rd in the last week of November and fourth peak in the third week of December which are in agreement with the present investigation.

The result on correlation coefficient between trap catches of *E. vitella* and weather parameters has been described in Table 2. There was no significant relationship existed with moth catches and rainfall, wind speed, sunshine, morning and evening relative humidity of current week which agreed with finding of Naik *et al.* (1997) who reported that no significant correlation existed between moth catches and rainfall relative humidity, wind speed, sunshine hours. The present findings of significantly positive correlation of moth catches with maximum and minimum temperature of current week contrasted with Patil *et al.* (1992) who observed that relationship between the trap catches and maximum and minimum temperature were negatively and significantly correlated. These variation might be due to the different location and ecological factors.

Pink bollworm

Pheromone trap catches of male moths of pectinophora gossypiella and meterological parameters are given in Table 1. These revealed that six peak catches of *P. gossypiella* were observed during 45MW, 46MW, 47MW, 48MW, 49MW and 50 MW which was 156.9, 186.1, 390.8, 432.5, 306.2, 148.5 moths / trap/week respectively.

These result are in coincide with six peak catches of *P. gossypiella* observed between third week of August and last week of November by Sangappa *et al.* (1985) during 1981-82. Correlation coefficient between trap catches of *P. gossypiella* and weather parameter are presented in Table 2.

The experimental finding indicated that morning and evening relative humidity of current week, previous first and second weeks showed negative and significant correlation with trap catches. Whereas sunshine hours of current week and all the previous four weeks and maximum temperature of previous second week, third and fourth week were positively and significantly related with trap catches.

The present finding find support of Tadas *et al.* (1994) who reported that evening relative humidity was negative and significant correlated while sunshine hours showed positive and significant correlation with

trap catches. The present findings revealed that non-significant correlation of current week rainfall, maximum and minimum temperature with trap catches agree to Naik *et al.* (1996) who reported that no significant relationship of *P. gossypiella* male moth trap catches with rainfall, maximum and minimum temperature-existed.

Fig. 1. Average male moth trap catches of bollworms / trap / week with current week weather parameters
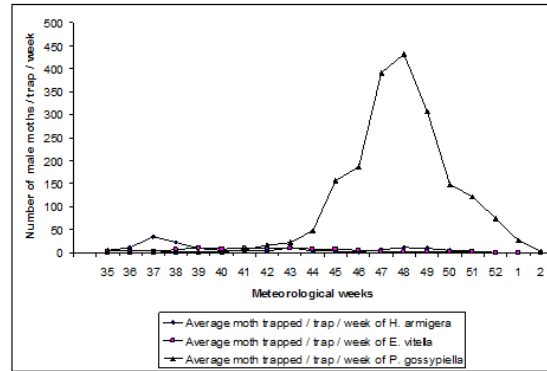

Table 1. Average male moth trap catches of bollworms / trap / week with current week weather parameters

Period of observations	Meteorologic al week	Average moth trapped / trap / week of *H. armigera*	Average moth trapped / trap / week of *E. vitella*	Average moth trapped / trap / week of P. *gossypiella*	Meteorological parameters						
					Temperature (°C)		Relative humidity (%)		Rainfall (mm)	Win d speed (kmph)	Sunshi ne hrs.
					Max.	Min.	Mor ning	Evenin g			
Aug27-2 Sept	35	4.15	2.45	0	28.7	22.5	92	75	28.1	10.3	2.7
Sept 3-9	36	10.55	2.9	0	28.7	22.7	90	70	6.5	12.0	2.2
10-16	37	34.7	3.3	0	30.2	22.6	90	63	9.8	12.1	4.3
17-23	38	21.7	6.0	1.3	30.1	23.9	83	67	0.5	10.0	3.3
24-30	39	9.3	11.15	1.75	30.1	22.7	95	70	83.7	4.8	4.8
1-7 Oct	40	4.6	8.5	1.85	32.8	20.7	84	45	1.0	4.0	7.8
8-14	41	3.2	8.85	7.1	33.3	19.6	76	38	0.0.	4.1	8.2
15-21	42	2.85	10.1	16.5	33.6	18.3	87	42	0.0	3.5	8.5
22-28	43	11.25	9.5	22.65	31.9	15.8	73	30	0.0	4.2	7.1
29-4 Nov	44	2.9	8.7	48.05	32.9	20.2	85	57	0.5	4.8	6.1
5-11	45	3.2	8.15	156.9	33.0	16.0	65	32	0.0	3.9	8.8
12-18	46	2.35	4.15	186.1	31.6	14.6	70	34	0.0	4.3	8.9
19-25	47	6.7	3.1	390.8	32.3	15.7	71	29	0.0	6.2	8.8
26-2 Dec	48	11.75	2.0	432.5	32.2	16.5	77	33	0.0	3.4	8.1
3-9	49	9.35	1.75	306.25	31.2	11.9	64	21	0.0	3.0	8.4
10-16	50	4.5	1.7	148.2	31.4	12.6	63	26	0.0	4.7	8.7
17-23	51	3.4	2.8	122.2	28.6	10.8	72	30	0.0	4.0	8.1
24-31	52	0.7	0.75	75.1	26.8	10.3	72	36	4.9	4.9	7.2
1-7 Jan	1	0.05	0.1	27.15	28.1	12.6	75	39	3.8	7.4	6.9
8-14	2	0	0	3.2	28.4	10.4	70	28	0.0	3.5	8.5

Table 2. Correlation male moth trap catches of cotton bollworms with weather parameters

| Bollworms | Weeks | Weather parameters | | | | | | |
		Maximum Temp. (C)	Mini. Temp. (C)	R.H morn. (%)	R.H. even. (%)	Rainfall (mm)	Wind speed (kmph)	Sunshine hours
Helicoverpa armigera	Current week	0.007	0.528*	0.354	0.424	0.100	0.598**	-0.500*
	Previous one week	-0.099	0.494*	0.440	0.453*	-0.221	0.609**	-0.509*
	Previous second week	-0.251	0.423	0.402	0.495*	0.190	0.489*	-0.506*
	Previous third week	-0.325	0.453*	0.418	0.502*	0.354	0.479*	-0.474*
	Previous fourth week	-0.309	0.498*	0.364	0.437	0.229	0.511*	-0.465*
E. vitella	Current week	0.656**	0.537*	0.400	0.254	0.301	-0.230	-0.029
	Previous one week	0.545*	0.601**	0.422	0.309	0.076	-0.065	-0.133
	Previous second week	0.317	0.589**	0.540*	0.381	0.157	0.113	-0.255
	Previous third week	-0.055	0.657**	0.685**	0.533*	0.190	0.238	-0.443
	Previous fourth week	-0.457*	0.682**	0.696**	0.652**	0.261	0.371	-0.573**
Pectinophora gossypiella	Current week	0.227	-0.400	-0.604**	-0.564**	-0.259	-0.365	0.508*
	Previous one week	0.407	-0.383	-0.568**	-0.548*	-0.326	-0.394	0.573**
	Previous second week	0.488*	-0.403	-0.578**	-0.544*	-0.317	-0.435	0.587**
	Previous third week	0.622**	-0.356	-0.415	-0.420	-0.352	-0.505*	0.535*
	Previous fourth week	0.648**	-0.370	-0.316	-0.417	-0.399	-0.553*	0.503*

References

Balasubramaniam. G., Balasubramanian, M. and Kulandaivelu, R. 1981. Prediction of bollworms damage in cotton in relation to weather factors. Madras Agriculture Journal, 68: 657-659.

Gomez, K.A. and Gomez, A.A. 1984. Statistical procedure for agricultural research, a willey inter science publication, New York, pp.660.

Mcaughlin, J.R. and Mitchel, E.R. 1982. Practical development in Heliothis management. Proceeding of the International Workshop on *Heliothis armigera* ICRISAT, pp.309-318.

Mehto, D.N. Singh, K.M. and Singh, R.N. 1985. Incidence of insect pest in chickpea. *Cicer aritinum* Linn, Indian Journal of Entomology, 47(2): 117-136.

Minks A.K. 1977. Trapping with behaviour modifying chemical. John Wiley and Sons, New York. pp.385-394.

Naik, M.I. S.Lingappa and Mallapur C.P. 1996. Monitoring pink bollworm. *Pectinophora gossypiella* (Saunders) using pheromone trap. Mysore J. Agric. Sci. 30: 43-47.

Naik, M.I. S.Lingappa and Hiremath, I.G. 1997. Pheromone trap to monitor adult spotted bollworm *Earias vitella* on cotton. Mysore J. Agric. Sci. 30(1): 33-35.

Patel, C.C. and Koshiya, D.J. 1999. Seasonal abundance of American bollworm, *Helicoverpa armigera* on different crop host at Junagarth (Gugrath). Ind. J. Entomol. 59(4): 396-401.

Patil, B.V., Nandihalli, B.S., Parameshwar Hugar and Somasekhar. 1992. Influence of weather parameters on pheromone trap catches of cotton bollworms. Ind. J. Plan Prot. 25(1): 29-33.

Sangappa, H.K. Patil, B.V. and Basavangoud, K., 1985. Monitoring the activity of pink bollworm *Pectinophora gossypiella* with pheromme traps. In behaviour and physiological approaches in pest management, Coimbatore, pp.56-61.

Tadar, P.L. Sarnaik, D.N. Kene, H.K. and Satpute U.S. (1994). Effect of weather parameters on monitoring of cotton bollworms with pheromone trap. PKV Res. J. 18(1): 87-90.

Kumar, K.K. and Devaraj Urs, K.C. 1991. Evaluation of pheromone virgin female traps monitoring *Earias vitella* on bhendi. Indian J. Entomol., 53(2): 232-239.