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Monitoring of ear head worm *Helicoverpa armigera* (Hubner) through sex pheromone in pearl millet crop

■ R.P. JUNEJA, G.M. PARMAR*, Y.H. GHELANI[1], K.D. MUNGRA[2], P.R. PATEL[3] **AND** N.N. CHAUDHARI[3]

Department of Entomology, Junagadh Agricultural University, JAMNAGAR (GUJARAT) INDIA
[1]Director of Research, Junagadh Agricultural University, JUNAGADH (GUJARAT) INDIA
[2]Department of Plant Breeding, Junagadh Agricultural University, JAMNAGAR (GUJARAT) INDIA
[3]Department of Plant Physiology, Junagadh Agricultural University, JAMNAGAR (GUJARAT) INDIA

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***Corresponding author:**
Email: dr_gmparmar@rediffmail.com

ABSTRACT

Monitoring of adults of ear head worm *Helicoverpa armigera* (Hubner) through male sex pheromones was studied during *Kharif* 2002 to 2011 in pearl millet crop at Jamnagar, Junagadh Agriculture University, Junagadh. Highest number of moth catches was recorded during 35th MSW *i.e.* 27th August to 2nd September. Adult moth catches were found negatively correlated with maximum temperature (r = -0.1698). Farmers are advised to install sex pheromone trap for monitoring and mass collection of adult male moth of *H. armigera* @ 5 traps/ha at a height of 2.0 m from 1st week of August to 2nd week of September.

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INTRODUCTION

In India, pearl millet *Pennisetum typhoides* or bajra is grown in about 11.0 million hectares in arid and semi arid regions. Among 116 pests infesting pearl millet, a dozen pose serious problems in the field (Prem Kishore and Solomon, 1989). Among them, ear head worm *Helicoverpa armigera* Hubner appears since 1980 in Gujarat state. Recently during last few years it has been noticed in some parts of Rajasthan also. Larval damage is observed at ear head stage and the cater pillar starts damaging floral parts, milky grains, mature grains which ultimately reduces the grain yield and quality also. Juneja and Raghvani (2000) recorded 10-15 per cent reduction in yield by this pest in pearl millet. Hence there was a high need to develop the strategy which can be helpful to the farmers for taking plant protection measures at a right time and thus experiments were conducted.

MATERIAL AND METHODS

The field experiments were conducted on monitoring of adults of ear head worm *Helicoverpa armigera* (Hubner) through male sex pheromones and to know the larval fluctuations in pearl millet crop during *Kharif* seasons, 2002 to 2011 at Main Pearl Millet Research

Station, Junagadh Agricultural University, Jamnagar. Total five pheromone traps of *Helicoverpa armigera* (Helilures) were installed at a distance of 100 meters in bajra crop. Every alternate day moths were collected and counted. Total catches per week were worked out during sowing to harvest of the crop. Lures were changed every 20 days interval. Simultaneously, larval population was also counted on randomly selected 25 ear heads nearby each trap thus total larval counts per 125 ear heads were worked out on week basis. Weather data were recorded as per Meteorological Standard Week (MSW) and thus correlation was worked out.

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under the following heads:

Helicoverpa moth catches :

Year wise *Helicoverpa* moth catches recorded from *Kharif*- 2002 to 2011 during the bajra crop period (Table 1) revealed that minimum moth catches were recorded during *Kharif*-2011 (36 adults/5 traps) and highest catches were recorded during *Kharif*-2003 (795 adults/5traps). Meteorological Standard Week wise moth catches reveals that moths were trapped during 26th to 44th MSW (majority of the crop period) and highest numbers (405 adults / 5 traps) of moths were recorded during 35th MSW (27th August to 2nd September).

Helicoverpa larval catches:

Year wise *Helicoverpa* larval counts recorded from *Kharif*- 2002 to 2011 during the bajra crop period (Table 2) revealed that maximum larval counts were recorded during *Kharif*-2009 (531 larvae/125 ear heads) and minimum larval counts were recorded during *Kharif*-2011 (36 larvae/ 125 ear heads). Meteorological Standard Week wise *Helicoverpa* larval counts recorded revealed that the incidence commenced in 31st MSW (30th July to 5th August) with maximum during 37th MSW *i.e.* 10-16th September (439 larvae/125 ear heads).

Correlation co-efficient of *Helicoverpa* moth catches:

Year wise data presented in Table 3 on correlation

Table 1: Statement showing MSW and year wise *Helicoverpa* moth cathes/ 5 traps (Kh-2002 to 2011)

Sr. No.	Year / Sowing date MSW	Period	2002	2003 (20/6)	2004 (21/6)	2005 (27/6)	2006 (8/7)	2007 (7/7)	2008 (1/7)	2009 (12/7)	2010 (5/7)	2011 (11/7)	Total
1.	25	18-24 "	*	0	*	*	*	*	*	*	*	*	0
2.	26	25Ju-1 July	*	18	2	*	*	*	*	*	*	*	20
3.	27	2-8 July	23	21	0	11	*	*	0	*	*	*	55
4.	28	9-15 "	33	24	0	4	4	1	0	3	6	0	75
5.	29	16-22 "	44	22	0	2	2	0	12	3	9	0	94
6.	30	23-29 "	54	35	4	18	0	2	3	1	5	0	122
7.	31	30 Ju.-5 Aug.	30	124	69	76	8	5	0	0	3	0	315
8.	32	6-12 Aug.	16	100	88	88	6	10	1	0	3	0	312
9.	33	13-19 "	8	33	86	47	31	10	33	0	3	0	251
10.	34	20-26 "	2	14	70	21	73	21	79	27	2	0	309
11.	35	27 Aug.-2 sep.	34	77	41	9	81	30	60	73	0	0	405
12.	36	3-9 Sept.	53	56	22	7	58	25	13	66	20	6	326
13.	37	10-16 Sept.	21	39	16	4	34	46	1	59	21	8	249
14.	38	17-23 "	18	52	11	2	16	48	0	30	20	10	207
15.	39	24-30 "	20	60	3	0	22	14	3	10	13	10	155
16.	40	1-7 Oct.	29	57	14	0	16	5	7	8	7	2	145
17.	41	8-14 "	31	30	7	0	3	3	6	2	1	0	83
18.	42	15-21 "	38	15	7	2	13	0	0	1	0	0	76
19.	43	22-28 "	29	10	4	0	80	2	1	0	0	0	126
20.	44	29 Oct.-4 Nov.	11	8	2	3	147	1	1	0	0	0	173
		Total counts	494	795	446	294	594	223	220	283	113	36	3498

co-efficient of *Helicoverpa* moth catches with different weather parameters revealed that results were found significant during *Kharif*-2004 to 2011. Whereas, during the rest of years *i.e. Kharif*- 2002 and *Kharif*-2003 the results were found non-significant. As far as pooled over 10 years is concerned the correlation of *Helicoverpa* moth catches with maximum temperature was found negatively significant (-0.1698*) amongst various weather parameters.

Table 2 : Statement showing MSW and year wise *Helicoverpa* larval counts/ 125 ear heads (Kh-2002 to 2011)

Sr. No.	MSW	Year / Sowing gate / Period	2002 (29/6)	2003 (20/6)	2004 (21/6)	2005 (27/6)	2006 (8/7)	2007 (7/7)	2008 (1/7)	2009 (12/7)	2010 (5/7)	2011 (11/7)	Total
1.	25	18-24 "	*	0	*	*	*	*	*	*	*	*	0
2.	26	25Ju-1 July	*	0	0	*	*	*	*	*	*	*	0
3.	27	2-8 July	0	0	0	0	*	*	0	*	*	*	0
4.	28	9-15 "	0	0	0	0	0	0	0	0	0	0	0
5.	29	16-22 "	0	0	0	0	0	0	0	0	0	0	0
6.	30	23-29 "	0	0	0	0	0	0	0	0	0	0	0
7.	31	30 July-5 Aug.	0	0	36	0	0	0	0	0	0	0	36
8.	32	6-12 Aug.	0	31	51	0	0	0	0	0	0	0	82
9.	33	13-19 "	0	65	58	49	0	0	8	0	0	0	180
10.	34	20-26 "	0	103	43	61	16	4	62	0	15	0	304
11.	35	27 Aug.-2 Sept.	15	76	53	39	27	17	100	9	11	0	347
12.	36	3-9 Sept.	15	38	73	18	30	7	96	52	16	0	345
13.	37	10-16 Sept.	14	47	42	8	49	23	24	204	21	7	439
14.	38	17-23 "	35	20	19	0	21	51	1	213	18	11	389
15.	39	24-30 "	61	8	11	0	12	61	11	39	16	13	232
16.	40	1-7 Oct.	55	5	15	0	4	2	18	13	5	5	122
17.	41	8-14 "	29	0	0	0	0	0	0	0	0	0	29
18.	42	15-21 "	23	0	0	0	0	0	0	1	1	0	25
19.	43	22-28 "	20	0	0	0	0	0	0	0	0	0	20
20.	44	29 Oct.-4 Nov.	20	0	0	0	0	0	0	0	0	0	20
		Total counts	287	393	401	175	159	165	320	531	103	36	2570

Table 3 : Correlation co-efficients of *Helicoverpa armigera* moth catches with weather parameters (Kh-2002 to 2011)

Sr. No.	Year	Kh-02	Kh-03	Kh-04	Kh-05	Kh-06	Kh-07	Kh-08	Kh-09	Kh-10	Kh-11	Pooled
1.	No. of cases	18	20	19	18	17	17	18	17	17	17	178
2.	Corr. with larval counts	-0.0559	0.1431	0.7514**	0.1417	0.1991	0.6340**	0.6867**	0.5110*	0.7461**	0.8975**	0.3507**
3.	Temp. maxi. ^{o}C	0.1590	-0.3561	-0.8114**	-0.5903**	0.2123	-0.2551	-0.2890	-0.2367	-0.2099	-0.2868	-0.1698*
4.	Temp. mini. ^{o}C	-0.4083	0.2686	0.3955	0.1337	-0.5958*	0.3762	0.0167	0.2251	0.2682	-0.4006	-0.0520
5.	Diff of temp. ^{o}c	0.0280	-0.3395	-0.7140**	-0.4268	0.4660	-0.3806	-0.1701	-0.2564	-0.3114	0.0750	-0.0824
6.	RH morn. (%)	0.1900	0.1353	0.4847*	0.2754	-0.7080**	0.4678	0.2272	0.1614	0.2126	0.3882	-0.0132
7.	RH even. (%)	0.0978	0.3793	0.5007*	0.4499	-0.4924*	0.3001	0.0658	0.2558	0.1268	0.2066	0.1009
8.	Rainfall (mm)	-0.4398	0.4078	0.7455**	0.4084	-0.2941	0.0994	-0.1826	0.0036	0.0254	0.2353	0.0817
9.	Rainy days	-0.3135	0.1799	0.6480**	0.2243	-0.4084	0.1499	-0.1845	-0.0461	-0.1124	0.1056	0.0152
10.	Critical value (2 tail 0.05%)	0.4670	0.4426	0.4543	0.4670	-0.4807	0.4807	0.4670	0.4807	0.4807	0.4807	0.1471
11.	Critical value (2 tail 0.01%)	0.5900	0.5610	0.5750	0.5900	0.6060	0.6060	0.5900	0.0606	0.6060	0.6060	0.1950

N.B. * and ** indicates significance of values at P=0.05 and 0.01, respectively

Table 4 : Correlation co-efficients of *Helicoverpa* larval counts with weather parameters (Kh-2002 to 2011)

Sr. No.	Year	Kh-02	Kh-03	Kh-04	Kh-05	Kh-06	Kh-07	Kh-08	Kh-09	Kh-10	Kh-11	Pooled
1.	No. of cases	18	20	19	18	17	17	18	17	17	17	178
2.	Temp. maxi. ^{o}C	0.4388	-0.4688*	-0.6810**	-0.1756	-0.0699	-0.0056	-0.0397	0.0303	-0.2157	-0.1577	-0.0609
3.	Temp. mini ^{o}C	-0.3093	0.2353	0.2958	0.0361	0.2441	0.2048	0.0817	-0.0075	0.1492	0.6015*	-0.0259
4.	Diff of temp. ^{o}C	0.5741*	-0.3760	-0.5759**	-0.1247	-0.1725	-0.1280	-0.0730	0.0170	-0.2296	0.2740	-0.0421
5.	RH morn (%)	-0.4484	0.2839	0.3961	0.1171	0.1807	0.2795	0.0955	0.0401	0.1078	0.2148	0.0236
6.	RH even (%)	-0.4532	0.3829	0.3697	0.1662	0.0677	0.1052	-0.0389	0.0184	0.0221	0.0059	0.0432
7.	Rainfall (mm)	-0.2200	-0.0717	0.3996	-0.2045	-0.2610	-0.0680	-0.11733	-0.2280	-0.1244	-0.0534	-0.1143
8.	Rainy days	-0.2738	-0.0886	0.2824	-0.1968	0.2624	0.0128	-0.2052	-0.2605	-0.1852	-0.1231	-0.1294
9.	Critical value (2 tail 0.05%)	0.4670	0.4426	0.4543	0.4670	0.4807	0.4807	0.4670	0.4807	0.4807	0.4807	0.1471
10.	Critical value (2 tail 0.01%)	0.5900	0.5610	0.5750	0.5900	0.6060	0.6060	0.5900	0.6060	0.6060	0.6060	0.1950

N.B. * and ** indicate significance of value at P=0.05 and 0.01, respectively

Correlation co-efficient of *Helicoverpa* moth catches with larval counts:

Year wise data presented in Table 3 on correlation co-efficient of *Helicoverpa* moth catches with *Helicoverpa* larval counts revealed that the results were found significant positively correlated during majority of the years. Moreover, during *Kharif*-2004, 2007, 2008, 2010 and 2011 the results were highly significant. In case of pooled over 10 years the results were found positive and highly significant (0.3507**).

Correlation co-efficient of *Helicoverpa* larval counts:

Year wise data presented in Table 4 on correlation co-efficient of *Helicoverpa* larval counts with different weather parameters revealed that results were found significant during *Kharif*-2002, 2003, 2004 and 2011 only. Whereas, during the rest of years and overall pooled over 10 years the results were found non- significant. Similar work related to the present topic was also done by Khorasiya *et al*. (2014); Jagadeesh and Mallikarjun (2012); Rathod *et al*. (2014) and Barad *et al*. (2014) on pigeonpea, Choudhary *et al*. (2014) and Chatar *et al*. (2010) on chickpea, Gandhi *et al*. (2013) on Sorghum and Ghanta *et al*. (2011).

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