

Monitoring and Control of *Helicoverpa armigera* by Synthetic Pheromone Traps in Peas, *Pisum sativum*

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Abstract: Pheromone traps against American Bollworm (*Helicoverpa armigera* Hub., Lepidoptera: Noctuidae) were installed at 1.5 m from the ground in peas (*Pisum sativum* var. Green Feast). First month was appeared on 25th and 23th April 1994-95 and 1995-96 seasons respectively. Four peaks of the pest infestation were observed each years. 1st peak (13 and 16 months) was recorded on 09-05-95 and 12-05-96 respectively. The average temperatures were 25.50 and 20.45°C, each day respectively. Last peak (16 and 11 months) was recorded on 26-06-95 and 21-06-96 respectively. The average temperature were 25.40 and 24.30°C, each day respectively. A total mean of 424 and 416 months were captured during the two seasons of the study respectively. The adult pest remained in the field till the end of the crop. The study strongly recommends the use of the pheromones than pesticides against the said pest in peas not only to control but also for the monitoring of *H. armigera*.

Key words: *Helicoverpa armigera*, pheromone trap, Quetta, Balochistan, Pakistan

Introduction

The province of Balochistan is well known for the production of fruits and vegetables in Pakistan. For the last few years the vegetable industry is prospering in the province. Peas are an important vegetable industry is prospering in the Province. Peas are important vegetable of Balochistan, cultivated over an area of 545 ha and produce 6046 tones per year in the Province. Kalat and Makran divisions are the main districts for the productions of these legumes. The two divisions contribute 2519 and 2229 tons per year (Anon., 1999-2000) Peas (*Pisum sativum*) belong to the family Leguminosae (Malik, 1994). Peas are full of protein, vitamin A, B and C and minerals like iron and phosphorus (Bajwa, and Anon, 2002).

Agrotis flammata Lepidoptera: Noctuidae (cutworm) was supported to be the only insect pest attack to this crop (Bajwa, 2002) but know the farmers are reporting *Helicoverpa armigera* Lepidoptera: Noctuidae (American Bollworm, ABW) as the main problem in the region. ABW is a cosmopolitan insect pest (Baloch, 1989, Baloch *et al.*, 2002 a; Hazara *et al.*, 2000; Malik *et al.*, 2000 b, c) and Aheer *et al.* (2000) reported more than 1000 host plants including tomato, maize, gram, tobacco, cotton and okra for the said pests. It is a major pest of cotton in Pakistan (Baloch,

1989) and has already attained the status of as a major pest in apple (Malik *et al.*, 2002 b), tomato (Malik *et al.*, 2002 c) and okra (Malik *et al.*, 2003) in Balochistan. Balochistan in that province of Pakistan where literacy rate is very low (Shah *et al.*, 2002; Malik *et al.*, 2002 c and 2002 d). Farmers of the province mainly use pesticides against insect pests (Malik and Ali, 2002; Malik *et al.*, 2002 b and 2002 c). The moth has already got some resistance against pesticides (Alaux, 1995). Sulphanor and Delorme (1996) suggested that the insect resistance could be avoided by limited use and replacement of pesticides with other control measures. Malik *et al.* (2002 b, c and 2003) reported Pheromone traps as a good tool of monitor and control *H. armigera*.

Keeping in view this study was designed to evaluate the efficacy of the synthetic pheromone traps to determine the production dynamics the population dynamics and control of this new emerging insect pest, *H. armigera*, on peas in the region.

The study was conducted during 1994-95 and 1995-96 in a private vegetable and fruit farm, beside Karh Road, Quetta, Balochistan, Pakistan. Peas were cultivated over an area of 0.4 ha and was surrounded by apple (*Pyrus malus*), apricot (*Prunus armeniaca*) and peach (*Pyrus persica*) trees. The orchards were regularly sprayed by pesticides. The peas area was kept spray free. No or negligible rainfall was recorded during 1994-95 while an average of 9.28 mm rainfall was observed during 1996. The Meteorological data was obtained by the Meteorological Station, Agriculture Research Institute, Quetta. Vitavax treated (@ 2 g⁻¹ kg seed) seeds of peas var. Green Feast were obtained from the local market and sown in 2-5 cm deep and 15 cm apart holes in 90 cm wide lines on plane surface on 08th and 1st October 1994 and 95 respectively. The crop was regularly irrigated after 7 to 10 days of intervals by tube-well. On 25th February each year, 1995 and 1996, three green colored plastic traps (one in the center and two on the edges of the field) each with a synthetic pheromone capsule (of unknown formulation) were installed at 1.5 m from the ground. The capsules were replaced after every 30 days (Malik and Ali, 2002). Data for the captured was collected weekly before the emergence of the moth and daily after ward. Mathematical means for the number of moths captured/day/3 traps were calculated for further discussion.

Results and Discussion

Table 1 depicts the mean number of ABW captured by pheromone traps in peas, during 1994-95 season, Quetta, Balochistan. First moth appeared on 25th April 1995 at 19.05°C. Four peaks of the pest infestation were observed in that season. 1st peak (13 moths) was recorded on 09-05-95. The average temperature was 20.50°C at the day. Last peak (16 moths) was recorded on 26-06-95 at an average temperatures of 25.40°C.

Table 2 reveals the mean number of ABW captured by pheromone traps in peas, during 1995-96 season, Quetta, Balochistan. First moth appeared on 23rd April 1996 at 17.55°C. Four peaks of the pest infestation were observed in that season again 1st peak (16 moths) was recorded on 12-05-96. The average temperature 20.45°C at the day. Last peak (11 moths) was recorded on 24.30°C.

Table1: Mean number of ABW captured by pheromone traps, during 1994-95 season, at Quetta, Balochistan, Pakistan in peas

1994-1995			1994-1995		
Date	¹ Temperature	² Moth captured	Date	Temperature	Mothcaptured
25-04-95	19.05	01	01-06-95	21.20	07
26-04-95	16.80	00	02-06-95	21.00	04
27-04-95	17.45	03	03-06-95	20.75	08
28-04-95	17.40	00	04-06-95	21.25	05
29-04-95	15.50	00	05-06-95	22.25	04
30-04-95	15.75	00	06-06-95	24.20	07
01-05-95	16.80	07	07-06-95	24.60	09
02-05-95	16.95	05	08-06-95	25.20	23
03-05-95	19.10	05	09-06-95	25.05	05
04-05-95	19.55	06	10-06-95	24.55	07
05-05-95	20.80	02	11-06-95	25.15	08
06-05-95	21.70	06	12-06-95	24.55	04
07-05-95	23.50	05	13-06-95	24.10	05
08-05-95	24.95	07	14-06-95	28.35	07
09-05-95	25.50	13	15-06-95	28.75	04
10-05-95	25.00	09	16-06-95	29.20	09
11-05-95	13.15	07	17-06-95	28.70	09
12-05-95	23.90	04	18-06-95	29.00	05
13-05-95	22.30	04	19-06-95	29.90	08
14-05-95	21.70	05	20-06-95	27.80	01
15-05-95	22.80	04	21-06-95	25.10	07
16-05-95	22.55	00	22-06-95	25.10	08
17-05-95	22.75	07	23-06-95	25.85	08
18-05-95	19.65	04	24-06-95	27.30	04
19-05-95	19.75	08	25-06-95	26.00	05
20-05-95	20.10	05	26-06-95	25.40	16
21-05-95	18.20	17	27-06-95	25.90	04
22-05-95	17.35	08	28-06-95	25.60	04
23-05-95	18.15	02	29-06-95	26.80	04
24-05-95	19.30	07	30-06-95	26.75	02
25-05-95	20.10	04	01-07-95	26.30	06
26-05-95	18.45	05	02-07-95	26.90	09
27-05-95	19.35	07	03-07-95	28.35	02
28-05-95	19.50	08	04-07-95	28.70	02
29-05-95	21.00	04	05-07-95	28.90	04
30-05-95	22.30	02	06-07-95	28.80	08
31-05-95	21.60	07	07-07-95	29.55	04
Grand total					424

A total mean number of 424 and 416 moths were captured during the two years of the study respectively (Table 1 and 2). Apple (Malik *et al.*, 2002 b) is a good host of the said pest. Apple orchard might effect on the infestation in peas field that surrounded the experimental field.

Table 2: Mean number of ABW captured by pheromone traps, during 1995-96 season, at Quetta, Balochistan, Pakistan in peas

1995-1996			1995-1996		
Date	¹ Temperature	² Moth captured	Date	Temperature	Moth captured
23-04-96	17.55	02	30-05-96	21.40	04
24-04-96	19.70	00	31-05-96	23.70	05
25-04-96	20.30	01	01-06-96	24.25	07
26-04-96	22.05	01	02-06-96	24.35	04
27-04-96	21.85	02	03-06-96	25.45	08
28-04-96	21.90	02	04-06-96	26.85	09
29-04-96	20.05	02	05-06-96	25.80	04
30-04-96	16.40	04	06-06-96	27.45	08
01-05-96	16.40	01	07-06-96	26.30	04
02-05-96	16.10	01	08-06-96	26.50	05
03-05-96	17.25	02	09-06-96	26.00	07
04-05-96	16.30	01	10-06-96	24.50	27
05-05-96	17.10	01	11-06-96	25.50	01
06-05-96	17.60	01	12-06-96	27.50	05
07-05-96	19.70	02	13-06-96	25.80	08
08-05-96	19.85	02	14-06-96	26.60	07
09-05-96	19.85	08	15-06-96	26.25	08
10-05-96	20.00	04	16-06-96	24.40	04
11-05-96	20.00	05	17-06-96	24.00	08
12-05-96	20.45	16	18-06-96	21.10	08
13-05-96	22.70	09	19-06-96	23.15	07
14-05-96	19.30	04	20-06-96	23.45	09
15-05-96	19.00	04	21-06-96	24.30	11
16-05-96	18.90	05	22-06-96	24.05	04
17-05-96	19.70	07	23-06-96	25.05	08
18-05-96	20.25	07	24-06-96	25.30	07
19-05-96	21.30	06	25-06-96	25.95	07
20-05-96	23.40	09	26-06-96	26.75	18
21-05-96	22.15	04	27-06-96	26.90	04
22-05-96	22.40	04	28-06-96	25.65	05
23-05-96	18.50	04	29-06-96	26.05	07
24-05-96	16.90	04	30-06-96	25.90	04
25-05-96	20.20	05	01-07-96	24.75	02
26-05-96	21.25	09	02-07-96	25.60	04
27-05-96	23.50	08	03-07-96	25.95	01
28-05-96	22.30	05	04-07-96	25.55	05
29-05-96	23.80	19	05-07-96	26.35	01
		Grand total			416

¹Temperature is the average of maximum during 24 hours. ²Moths captured, are the mean of captured moths during the day from all the pheromone traps (n=03) installed in the field and were rounded to the nearest whole number

Low infestation was observed during 1996 than 1995. Temperature has direct relations with insect development and distribution (Sharma and Chaudhry, 1988; Marco *et al.*, 1997 and Malik, 2001). An average of 23.01 and 22.57°C temperatures were observed during the study

seasons respectively. The presence of adult moths in the field was observed during the study seasons respectively. The presence of adult moths, in the field, was observed till the end (7th and 5th July 1995 and 96, respectively) of the crop, which means that the moth could have more generations, depending on the availability of the host. Baloch (1989) reported 4-7 generations of the pest in a year. ABW is a polyphagous insect pest (Baloch, 1989; Baloch *et al.*, 2000 a). *H. armigera* prefers cotton than other hosts (Baloch *et al.*, 2000 b). No cotton is grown in the up lands of Balochistan but the hosts shifts to tomatoes and okra after peas and apples. Further studies to discover other hosts in the valley are suggested. The population of the moth was greater at the corners than in the central areas of the field, that confirms the lazy movement of the pest (Malik *et al.*, 2002 b). Humidity is usually higher in the center on the cultivated field which effects to the availability of oxygen adverse effects on the bioactivities of *H. armigera* (Sharma and Chaudhary, 1998).

The results of this study not only strongly suggest the use of pheromones than pesticides as an economical and efficient method to control *H. armigera* in peas but also could use a tool to monitor the said pest in the crop. Pesticides affect the efficiency of the pheromones (Malik and Ali, 2002 and Malik *et al.*, 2002a) and also cause insects resistance (Alaux, 1995 and Sauphanor and Delorme, 1996) thus might not be used together.

References

- Alaux, T., 1995. Pyrethroid resistance management in *H. armigera* (Hub.) (Lepidoptera: Noctuidae) in cote d' Ivoire, *Resis. Pest Manag.*, 7: 11.
- Anon., 1999-2000. Agriculture Statistics Balochistan. Statistics Wing, Directorate General of Agriculture Extension, Balochistan, Quetta, Pakistan.
- Aheer, G.M. A. Ghani, R. Ahmed and M. Ramzan, 2000. Development of American Bollworm, *Helicoverpa armigera* (Hbn.) In different host plants. *J. Agric. Res.*, 38: 229-232.
- Anon., 2002. The quarterly Ziraat-e-Balochistan. Information and Publicity, Department of Agriculture (Extension), Balochistan, Pakistan, pp: 9-12.
- Baloch, A.A., 1989. Insect pests of cotton, their identification, mode of damage and control strategy. Proceedings of workshop organized by CWM project of Sind in collaboration with USAID, Sakrand, Pakistan, pp: 20.
- Baloch A.A., A.M. Kalroo and M.W. Sanjrani, 2000 a. A perspective review on ecobiological aspect of *Helicoverpa (Heliothis armigera)* Hubn (Lepidoptera: Noctuidae) as a pest of cotton in Pakistan. I. Taxonomy, Biology, Ecology and population dynamics. *Balochistan J. Agric. Sci.*, 1: 36-43.
- Baloch A.A., A.M. Karloo and A. Pathan, 2000 b. A retrospective review on eco-biological aspects of *Helicoverpa (Heliothis armigera)* Hubner (Lepidoptera: Noctuidae) as a cotton pest in Pakistan. II. incidence, extent of damage, scouting and economic thresholds. *Balochistan J. Agric. Sci.*, 1: 44-51.
- Bajwa, M.A., 2002. Peas. The quartely Ziraat-e-Balochistan. Information and publicity, Department of Agriculture (Extension), Balochistan, Pakistan, pp: 79-81.

- Hazara, A.H., J. Khan, M. Shakeel, M. Iqbal and A.H. Bajoi, 2000. Population dynamics and control of *Helicoverpa*, (*Heliothis*) *Armigera*, Hubner (Lepidoptera: Noctuidae) on different crops in Balochistan. Balochistan J. Agric. Sci., 1: 52-62.
- Marco, V., A. Teberner and Castanera, 1997. Development and survival of immature *Aubeonymus mariaefrancisae* (Coleoptera: Curculionidae) at constant temperatures, Ann. Entomol. Soc. Am., 90: 169-176.
- Malik M.N., 1994. Horticulture National Book Foundation. Islamabad, Pakistan, pp: 633.
- Malik, M.F., 2001. Some biological attribute of *Trichogrammatoidea bactrea*, Hymenoptera: Trihogrammatoidae, at high temperatures in Pink Bollworm (*Pectinophora gossypiella*, Lepidoptera: Gelechiidae) eggs. OnLine J. Biol. Sci., 1: 485-487.
- Malik, M.F. L. Ali and S. Anwar, 2002 a. Determination of installation heights for codling moth's synthetic pheromone traps in apple canopy. Asian J. Pl. Sci., 1: 226-227.
- Malik, M.F. A.G. Khan, S.W. Hussainy, D.U. Rahman and M. Amin, 2002 b. Scouting and control of *Hellicoverpa armigera* by a synthetic pheromone technology in apple. Asian J. Plant Sci., 1: 652-654.
- Malik, M.F. S.W. Hussainy, D.U. Rahman. A. Munir and L. Ali, 2002 c. Efficacy of synthetic pheromone for the control of *Helicoverpa armigera* in tomato. Asian J. Plant. Sci., (In press).
- Malik, M.F., M. Nawaz and Z. Hafeez, 2002 d. Evaluation of crop management techniques and economic status of onion in Balochistan, Pakistan. Pak. J. Agron., (In press).
- Malik, M.F., D.U. Rahman and L. Ali., 2003. Pheromone technology for the control of *Helicoverpa armigera* in okra. Asian J. Plant Sci., 2: 409-411.
- Sharma, S.K. and J.P. Chaudhary, 1988. Effect of different levels of constant temperature and humidity on the development and survival of *Heliothis Armigera* (Hunber). Ind. J. Entomol., 50: 76-81.
- Sauphanor, B. and R. Delorme, 1996. Development of insecticide resistance, which strategy? Phytoma, 482: 30-31.
- Shah, S.Y., M.F. Malik and L. Ali, 2002. Determination of effectiveness of localized irrigation system in Balochistan. Asian J. Plant Sci., 1: 188-189.