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Scouting and Control of *Helicoverpa armigera* by Synthetic Pheromone Technology in Apple

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Abstract: Pheromone traps of American/cotton bollworm (ACBW) (*Helicoverpa armigera*, Lepidoptera: Noctuidae) were installed at 4 m from the ground in apple (*Pyrus malus* Linn., Rosaceae: Pomoidea) canopy in the two adjacent apple orchards in Quetta, Balochistan, Pakistan. Maximum capture was through the traps, hanged at the edges of the orchards. First moth, in the orchard, was appeared on 22nd (at 16.65 °C) and 8th March (at 12.00 °C) during 1995 and 96 respectively. Population climax of the moth was observed at 19.00 (32 moths on 7th April) and 18.75 °C (36 moths on 27th March) during 1995 and 96 respectively. During 1995 the pest remained in the orchard for 29 while in 1996 for 24 days. The study reveals that pheromone traps could affectively be used for the scouting/control of the said pest in apple canopy.

Key words: *Helicoverpa armigera*, pheromone traps, Quetta, apple

Introduction

Apple is a major horticultural produce of the province of Balochistan, Pakistan. It is grown over 36,532 ha and produces 487, 279 tons/annum (Anonymous, 1998-99). American/cotton bollworm (ACBW) is a polyphagous insect pest which has more then 100 plant hosts (Baloch, 1989; Baloch *et al*., 2000a; Hazara *et al*., 2000). The worm is becoming a major pest of apple crop in the province. Mainly pesticides are used for the control of insect pests in Balochistan (Malik and Ali, 2002).

A number of apple pests, specifically codling moth (*Cydia pomonella*) has already got resistance against pesticides (Malezieux *et al*., 1995; Speich, 1996; Bylemans, 1997). To avoid resistance, limited use and replacement of pesticides, is suggested with other control measures by Sauphanor and Delorme (1996). Sazonov *et al*. (1994), Charmillot *et al*. (1996) and Malik and Ali (2002) found pheromone traps, quite affected to control the population of codling moth in the said crop. In such a way a significant decline in the infestation of the moth could possible with out using pesticides. Knight (1995), found that the use of pheromones has low labour cost than other controlling techniques. Installation height of the pheromone traps affects on the capture of the moth (Weissling and Knight, 1995). Barrett (1995) and Malik *et al*. (2002) tested different heights of pheromone tapes against codling moth in apple. They suggested that traps should be in the upper (4 m above the ground) canopy of the orchard. Farmers of the province are mostly illiterate (Shah *et al*., 2002) thus have no idea of pest scouting, spray orientation, use of specific insecticides and the time of population climax of *H. armigera* in the region. Pheromone trap is a good tool to determine/control the population of the lepidopterous pests in the field but the farmers are unaware with the technique (Malik and Ali, 2002). The moths could be controlled with upper hands by forecasting the time of their peek population (Balazs *et al*., 1996).

Keeping in view, the study was designed to evaluate the time of appearance, population climax and efficacy to control ACBW by pheromone technique, so that an appropriate time for chemical control (if needed) could be determined.

Materials and Methods

The study was conducted during 1995-96 in apple orchard of the Balochistan Agriculture College (BAC), Beleli, Quetta. The orchard is divided by the path way into two parts of 0.62 and 1.34 ha. Both the parts are rectangular in shape. The smaller portion has mostly red and golden delicious apple varieties, planted at 4.27 m apart in 3.96 m apart rows. The large portion has a few trees of apricot (*Prunus armeniaca*), plum (*Prunus domestica*), pomegranate (*Punica granatum*), almond (*Prunus amygdalus*) and peach (*Pyrus persica*) along with said apple varieties, planted at 4.87 m apart in 3.66 m apart rows. The orchard was occasionally sprayed. No or negligible rainfall was recorded during 1995 while an average of 9.28 mm rainfall was observed during 1996. Meteorological data was obtained by the Meteorological Station, Agriculture Research Institute, Quetta. When the average day temperature has reached above 10 °C (at petal fall), ten green coloured plastic traps (on each corner and one in the center of each portion) each with a pheromone capsule (of unknown formulation) were installed at 4 m from the ground as suggested by Malik *et al*. (2002). The capsule was replaced after every 30 days till the end of the experiment. Data for the moth capture was collected daily. Statistical Means for the number of moths captured/day/10 traps were calculated.

Results and Discussion

First moth appeared at 16.65 °C on 22nd March, 1995. Maximum mean number of moths (32) were captured on 7th April, when the average temperature was 19.00 °C. The adult moths remained in the field for 29 days (Table 1).

First moth appeared at 12.00 °C on 08th March, 1996). Maximum mean number of moths (36) were captured on 27th March, when the average temperature was 18.75 °C. The adult moths remained in the field for 24 days (Table 2).

During 1996 the presence of the moth in the field was shorter. Temperature has indirect relations with the insect development period (Sharma and Chaudhary, 1988; Marco *et al*., 1997; Malik, 2001). High temperature was observed in early spring during 1996. The population of the moth were greater at the corners than in the central areas of the orchards, which confirms the lazy movement of the pest. Malik and Ali (2002) reported first generation of codling moth during the months of March and April in the same valley of Balochistan. Thus the two moths could be controlled together if chemicals are applied. No 2nd generation of the ACBW was observed in apple. Hazara *et al*. (2000) also reported the same results. Baloch (1989) reported 4-7 generations of the pest in a year. ACBW is a polyphagous insect pest (Baloch, 1989; Baloch *et al*., 2000a; Hazara *et al*., 2000) and prefers cotton than other hosts (Baloch *et al*., 2000b). No cotton is grown in the up lands of Balochistan. The moth may have other hosts to survive thus further studies are suggested to discover the host rang for the said pest in the valley. The results of this study positively suggest the use of pheromones to control the said pest in apple but the life cycle duration of ACBW seems to be synchronized with codling moth in Quetta valley. Codling moth has already been consider a serious major pest of apple and farmers of the region prefer chemical control than any other control measures for this pest. Pesticides affect the efficiency of the pheromones (Malik and Ali, 2002).

Table 1: Mean number of American/cotton bollworm during 1995

[1]Temperature (°C)	Date	[2]Population (Mean No.)	[1]Temperature (°C)	Date	[2]Population (Mean No.)
10.50	12/3	00	16.60	05/4	09
11.30	13/3	00	18.80	06/4	09
06.20	14/3	00	19.00	07/4	32
10.75	15/3	00	17.50	08/4	28
11.45	16/3	00	12.65	09/4	05
11.80	17/3	00	12.00	10/4	08
12.40	18/3	00	12.10	11/4	01
13.25	19/3	00	16.10	12/4	01
12.90	20/3	00	16.65	13/4	14
16.00	21/3	00	16.70	14/4	05
16.65	22/3	08	15.90	15/4	04
13.85	23/3	01	16.80	16/4	01
15.80	24/3	05	14.40	17/4	01
12.10	25/3	09	13.00	18/4	00
11.15	26/3	05	14.80	19/4	02
13.15	27/3	02	15.70	20/4	00
14.20	28/3	04	17.75	21/4	00
10.10	29/3	08	19.20	22/4	00
10.10	30/3	02	19.50	23/4	00
10.80	31/3	04	19.85	24/4	00
10.20	01/4	00	19.05	25/4	00
11.20	02/4	00	16.80	26/4	00
11.40	03/4	01	17.45	27/4	00
15.85	04/4	03	17.40	28/4	00

Table 2: Mean number of American/cotton bollworm during 1996

[1]Temperature (°C)	Date	[2]Population (Mean No.)	[1]Temperature (°C)	Date	[2]Population (Mean No.)
10.75	21/2	00	02.05	17/3	00
07.40	22/2	00	09.05	18/3	00
05.90	23/2	00	09.30	19/3	02
00.25	24/2	00	11.15	20/3	11
03.60	25/2	00	10.00	21/3	05
05.20	26/2	00	10.80	22/3	04
08.60	27/2	00	09.55	23/3	01
09.60	28/2	00	13.65	24/3	06
08.50	29/2	00	14.95	25/3	02
08.20	01/3	00	16.25	26/3	01
06.90	02/3	00	18.75	27/3	36
09.95	03/3	00	15.95	28/3	12
10.65	04/3	00	11.70	29/3	00
12.95	05/3	00	11.80	30/3	08
13.85	06/3	00	11.80	31/3	04
12.20	07/3	00	11.75	01/4	00
12.00	08/3	07	13.05	02/4	00
13.05	09/3	05	14.55	03/4	00
12.50	10/3	11	17.05	04/4	00
13.25	11/3	05	13.20	05/4	00
13.40	12/3	01	11.30	06/4	00
13.40	13/3	15	10.40	07/4	00
12.30	14/3	10	10.75	08/4	00
10.25	15/3	02	10.95	09/4	00
08.50	16/3	01	13.90	10/4	00

1: Temperature is the average of minimum and maximum (during 24 hours) daily readings 2: Mean number of moths were calculated from all the pheromone traps (n = 10) installed in the two parts of the orchard and were rounded to the nearest whole number

Keeping in view the above discussion same kind of control measures must be applied for both pests (ACBW and codling moth) at a time.

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