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Monitoring and Control of Codling Moth (*Cydia pomonella*, Lepidoptera: Tortricidae) by Pheromone Traps in Quetta, Pakistan

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Abstract: Codling moth (*Cydia pomonella*, Lepidoptera: Tortricidae) was monitored and controlled in the valley of Quetta, Balochistan, Pakistan, in an apple orchard by pheromone traps. The moth got climax at 19.50 and 18.85 during Ist and 29.30 and 27.90°C during 2nd generation, 1998, 99 respectively. A total average of 267 and 273 moths were captured during the entire seasons in the said years respectively. Comparing to the chemical control, the results are not attractive, but the study reveals that the technique could be used, for monitoring/forecasting, in addition to the control of the said pest in the field.

Key words: Pheromone trap, codling moth, Pakistan

Introduction

Balochistan is the largest province of Pakistan by area. The province has all kinds of climatic zones (tropical, sub tropical and temperate). The sub tropical and temperate regions are very famous for apple production in the country. Apple are grown over >36, 500 ha and produce around 487,279 tons annum^{-1} in the said province. Codling moth and mites are the two main pests, attack to the crop in Balochistan. During 1998-99, about 5150 M ton pesticides were used on orchards and 28% of the amount is consumed on apples alone in the region (Anonymous, 1998-99). Farmers of the province are mostly illiterate and have no idea about biological or pheromone techniques for the control of codling moth. Unawareness of pest monitoring, spray orientation, use of specific insecticides and the time of population climax in the region results 6 applications of pesticides for the pests of apple as a common practice among the local farmers of the area. Keeping in view the study was designed to evaluate monitoring of population climax and control of codling moth by introducing pheromone trap technique, so that an appropriate time for spray could be determined. The tortricids could be control with upper hands by forecasting the time of their peek population (Balazs *et al.*, 1996).

Pheromone trap is a good tool to determine the population of the lapidopterous pests in the field. Mani *et al.* (1995), installed pheromone traps in apple's canopy at a distance of 10-40 m. Weissling and Knight (1995), studied the distribution of codling moth in the treated and untreated apple and pear orchards by hanging the dispensers at 2 to 4 m above the ground and found good capture of male and female codling moths. The studies suggests that the pheromone dispensers should be placed in the upper canopy of apples and pear orchards. Barrett (1995), also found that the traps in the upper canopy area of the orchards caught maximum number of moths. Millar (1995), reported that the major component of the pheromone of *Cydia pomonella* is adversely affected by sunlight. Knight (1995), found that the use of pheromone in apple orchards, against codling moth, not only reduces the pest but also the labor cost as compared to other control techniques.

Materials and Methods

The study was conducted in a private farmer's apple (*Pyrus malus*) orchard (Mastung Road, Quetta, Balochistan) during 1998, 99. The orchard was of 4.16 ha and was in irregular shape. Apple varieties, Golden Delicious and Red Delicious, were grown. The apple trees were planted at 03 m apart in 04 m apart rows. A row of peach (*Pyrus persica*) was planted in between each two apple rows. Mostly mild wind (with an average of 8.5 Km ha^{-1}, from southwest to east) was observed during march to July 1998, 99. The precipitation was negligible during the two experimental seasons. Meteorological data was obtained from The Meteorological Station, Agriculture Research Institute, Quetta. The orchard was treated with 05-06 sprays every year. First codling moth of first generation appears at 10 °C (Ravn and Madsen, 1995), thus 10 Green colored plastic pheromone traps (2 for a ha, as recommended by the manufacturers) with a pheromone capsule (Pherocon®) each, of unknown formulation, were hanged randomly in the middle canopy (5m high from the ground) of the trees during February each year when average day/night temperature reaches 8 °C. The data for the number of captured moths, was collected daily till population of the pest became nil. Means for number of moths captured/day, in each generation were calculated and is represented in Tables 1 and 2 during the said period.

Results and Discussion

Table 1 and 2 depict that the population of codling moth increased with the increase in average day temperature. Temperature has direct relations with the development and growth of codling moth (Solomon *et al.*, 1996). 1st generation moth was caught, when average day temperature was 12.20 and 12.00 °C during march 1998, 1999 respectively. Gottwald (1996), reported 10°C as an appropriate temperature for the development of the moth. Maximum of 18 (at 19.50 °C) and 23 (at 18.85 °C) moths were captured during first generation 1998, 1999 respectively (Table 1 and 2). Ravn and Madsen (1995), reported that codling moth required 300 day-degrees to reach 50% population while at 100 day-degrees (10 °C) first moth of first generation appears. The generation was repeated, after about three months, when the temperature was 24.30 and 24.85 °C during June 1998, 1999 respectively. Peek (20 and 29 moths) of the second generation was observed at 29.30 and 27.90 °C during the years, respectively.

Table 1: Mean number of codling moth captured, through Ist and 2nd generations, from private farmer's orchard during 1998, Mastung road, Quetta, Balochistan

Ist Generation			2nd Generation		
Date	[1]Temperature (°C)	[2]Population (Mean No.)	Date	[1]Temperature (°C)	[2]Population (Mean No.)
25/3	12.20	04	18/6	24.30	01
26/3	15.80	02	19/6	23.35	00
27/3	16.85	02	20/6	23.75	05
28/3	16.70	00	21/6	26.15	09
29/3	16.50	05	22/6	26.85	11
30/3	16.85	01	23/6	24.70	02
31/3	19.50	06	24/6	24.60	01
01/4	19.95	08	25/6	26.35	12
02/4	19.45	12	26/6	25.85	16
03/4	17.55	15	27/6	27.30	15
04/4	17.55	04	28/6	29.30	20
05/4	17.60	11	29/6	29.60	18
06/4	19.50	18	30/6	29.90	19
07/4	16.50	09	01/7	28.10	14
08/4	09.55	03	02/7	27.10	11
09/4	11.55	00	03/7	26.60	04
10/4	12.95	01	04/7	27.30	02
11/4	13.05	00	05/7	28.80	00
12/4	13.10	04	06/7	29.30	00
13/4	14.20	00	07/7	29.60	05
14/4	16.20	01	08/7	30.60	00
15/4	16.80	00	09/7	29.85	00
16/4	17.75	00	10/7	28.80	00
17/4	19.40	00	11/7	28.80	00

Temperature is the average of 24 hours. [2]Mean number of moths are calculated from all the pheromone traps (n = 10) installed in the orchard and are rounded to the nearest whole number.

Table 2: Mean number of codling moths captured, through Ist and 2nd generations, from the private farmer's orchard during 1999, Mastung road, Quetta, Balochistan

Ist Generation			2nd Generation		
Date	[1]Temperature (°C)	[2]Population (Mean No.)	Date	[1]Temperature (°C)	[2]Population (Mean No.)
22/3	12.00	06	04/6	24.85	03
23/3	15.00	00	05/6	26.55	00
24/3	15.30	04	06/6	26.90	01
25/3	14.45	02	07/6	28.20	03
26/3	14.60	00	08/6	27.60	09
27/3	15.70	01	09/6	27.00	12
28/3	17.75	05	10/6	25.60	09
29/3	18.85	02	11/6	23.60	07
30/3	17.20	05	12/6	23.70	04
31/3	17.60	06	13/6	24.50	07
01/3	14.90	04	14/6	26.40	15
02/4	15.35	06	15/6	26.90	18
03/4	15.80	08	16/6	27.90	29
04/4	19.05	11	17/6	27.60	10
05/4	18.65	09	18/6	27.00	17
06/4	18.75	01	19/6	25.30	05
07/4	19.75	07	20/6	26.10	07
08/4	18.85	23	21/6	25.80	02
09/4	21.50	08	22/6	25.00	00
10/4	21.25	00	23/6	26.50	00
11/4	17.10	01	24/6	27.70	00
12/4	11.90	00	25/6	27.50	00
13/4	12.15	06	26/6	29.70	00
14/4	14.10	00	27/6	29.30	00

[1]Temperature is the average of 24 hours. [2]Mean number of moths are calculated from all the pheromone traps (n = 10) installed in the orchard and are rounded to the nearest whole number.

Temperature declines after the month of September in the valley, due to the reason third generation of the moth may not appear. Morgan (1996), found that 1 to 2 °C increase in daily average temperature may cause third generation of the moth. 5-6 pesticides for the moth and other pests were sprayed in the tested orchard. A total average of 267 and 273 moths were captured during the entire season of 1998, 99 respectively. Cross (1996), got >500 moths in those orchards where least pesticides were used. Pheromone are affected by the pesticides (Trematerra *et al.*, 1996). Deschanel and Florac (1996), suggested that pheromone could not control the moth alone thus other control measures may also be utilized with them. Pheromone are adversely affected by the sunlight (Millar, 1995) and strong winds (Milli *et al.*, 1997). During this study, mild wind was observed while the pheromone capsule was well protected from the sunlight by the lid of the trap. Tortricids could be control batter through smart forecasting (Balazs *et al.*, 1996; Buban *et al.*, 1996: Laurent, 1997). Maximum oviposition occurs after three days of mating (Karalius and Buda, 1995), thus spray may be applied at population climax. Comparing to the chemical control the results are not attractive but the study reveals that the technique could be used for monitoring/forecasting of codling moth in addition to the partial control measures.

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