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Determination of Installation Heights For Codling Moth's Synthetic Pheromone Traps in Apple Canopy

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Abstract: Pheromone traps of codling moth (*Cydia pomonella* L., Lepidoptera: Tortricidae) were installed at different heights (2, 4, 6 and 8 m from the ground) in apple (*Pyrus malus* Linn., Rosaceae: Pomoidea) canopy in a private farmer orchard, Quetta, Balochistan, Pakistan. Maximum capture was through the traps, hanged at 4 m from the ground. The study reveals that pheromone traps could use for the control of codling moth if installed at suggested height.

Key words: *Cydia pomonella*, pheromone, Balochistan, Pakistan

Introduction

Apples are grown over >129,400 ha in Balochistan. Quetta division produces >163,400 tons annum^{-1} (Anonymous, 1998-99). Codling moth is the major pest of the crop. Pesticides are the main weapon used for it's control (Malik and Ali, 2002). Malezieux *et al.* (1995), Speich (1996) and Bylemans (1997), reported resistance of codling moth against pesticides. Sauphanor and Delorme (1996), suggested limited use and replacement of pesticides with other control measures. Sazonov *et al.* (1994) and Charmillot *et al.* (1996), found codling moth pheromone traps, quite affected to control the population of the pest in the said crop. In such a way a significant decline in the infestation of codling moth could possible with out using pesticides. Knight (1995), found that the use of pheromones in apple orchards against codling moth, not only reduce the pest but also the labor cost compare to the other controlling techniques. Weissling and Knight (1995), reported that the installation height of the pheromone traps does count in the capture of the moth. Barrett (1995), studied codling moth pheromone tapes at different heights and suggested that traps should be in the upper canopy of the orchard. Chouinard *et al.* (1996), installed the traps in the lower canopy of the trees in a treated orchard and found 100% moth control.

Since different suggestions regarding the installation height of codling moth pheromone traps were reported thus the study was designed to introduce the technique to the farmers in the specific agro-eco system of the province of Balochistan by determination of the most affected height for the installation of the traps in apple canopy.

Materials and Methods

The study was conducted during 2000-2001 in a private farmer's apple orchard (Mastung road, Quetta, Balochistan). The orchard had irregular shape and was of 4.16 ha. The orchard had 05-06 treatments of pesticides each year. Golden and Red delicious, apple varieties, were planted at 03 m apart in 04 m apart rows with a row of peach (*Pyrus persica*) in between. Mostly mild wind (with an average of 7.8 Km hr^{-1}, from southwest to east, was observed during march to July 2000-2001. The precipitation was negligible during the two experimental seasons. Meteorological data was obtained from the Meteorological Station, Agriculture Research Institute, Quetta.

First codling moth appears at 10 °C (Ravn and Madsen, 1995). First moth of first and second generation appears in march and June respectively, in the valley of Quetta (Malik and Ali, 2002), thus 40 green colored plastic pheromone traps with a pheromone capsule (Pherocon®) each, of unknown formulation, were hanged randomly at four different heights (2, 4, 6, 8 m from the ground) in the apple canopies during march when average day/night temperature reached 10 °C for the first while at the end of may for the 2nd generation, each year. The data for the number of captured moths, was collected weekly till population of the pest became nil. Number of moths captured through each generation for each height was analyzed by ANOVA, means were separated by LSD (Least Significant Difference) test and is represented in Table 1 and 2 for the two consecutive years.

Results and Discussion

Heights of the pheromone traps had significant effect on the moths capture. A significant difference was observed among all the tested heights. Maximum number of moths were captured through the trap hanged at 4 m from the ground (Table 1 and 2). Mild wind could take the pheromone upto 6 m high (Milli *et al.*, 1997). Weissling and Knight (1995), got greatest capture of moths at mid and upper canopy. Deschanel and Florac (1996), observed shifting of male moths to the middle canopy and suggested pheromone dispensers should be placed in the middle canopy of apple and pear orchards. A total average of 102 and 110 moths were captured during the 2000-2001, respectively. 40 traps were hanged during each generation thus >400 moths were captured through the traps. Cross (1996), got >500 moths in those orchards where least pesticides were used. Pheromone are affected by the pesticides (Trematerra *et al.*, 1996). The orchard was treated with 5-6 sprays each year. Pheromone are adversely affected by the sunlight (Millar, 1995) and strong winds (Milli *et al.*, 1997).

Table 1: Mean number of codling moths captured by pheromone traps at different heights, through lst and 2nd generations, 2000, from the private farmer's orchard, Mastung road, Quetta, Balochistan

Height (m)	1st generation (captured moth)	2nd generation (captured moth)
2	[1]06Bc	[2]09Ac
4	21Ba	24Aa
6	16Bb	19Ab
8	02Bd	05Ad
Total	45	57

[1]Mean number of moths are from all the pheromone traps (n=40) for each height (n=10). [2] Upper case letters indicate significant differences across the row using LSD test. LSD value for the two generations was 0.744 at significance level of 0.05. [3] Lower case letters indicate, significant differences down the column using LSD test. LSD value for the different traps heights was 0.798 at significance level of 0.05.

Table 2: Mean number of codling moths captured by pheromone traps at different heights, through lst and 2nd generations, 2001, from the private farmer's orchard, Mastung road, Quetta, Balochistan.

Height (m)	1st generation (captured moth No.)	2nd generation (captured moth No.)
2	[1]02Bc	[2]04Ad
4	26Ba	29Aa
6	20Bb	22Ab
8	00Bd	07Ac
Total	48	62

[1]Mean number of moths are from all the pheromone traps (n=40) for each height (n=10). [2] Upper case letters indicate significant differences across the row using LSD test. LSD value for the two generations was 0.758 at significance level of 0.05. [3] Lower case letters indicate, significant differences down the column using LSD test. LSD value for the different traps heights was 0.876 at significance level of 0.05.

During this study, mild wind was observed, while the pheromone capsules were well protected from the sunlight by the lids of the traps. It was observed that during each tested year population of codling moth increased during the second generation (Table 1 and 2). Temperature has direct relations with the development and growth of codling moth (Solomon *et al.*, 1996). Installation of the traps is easier and cheeper. Knight (1995), found that the use of pheromones in apple orchards against codling moth not only

reduce the pest but also the labor cost to control the pest compared to the other controlling techniques. The pheromones are not available in the province of Balochistan and the farmers are poor having small holdings which may cause difficulty in adaptation of the said technique. Williamson *et al.* (1996), reported that the said technique is best for small orchards. The results revealed that the technique could provided better control of the said pest through proper height installation (4 m from the ground).

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