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Field Studies on the Efficacy of Various Insecticides and Insect Growth Regulators Against Codling Moth, *Cydia pomonella* L., at Two Different Altitudes in Swat Valley

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Abstract: The present studies were conducted to investigate the efficacy of insecticides; Talstar 10 EC, Decis 2.5 EC, Lorsban 40 EC and Advantage 20 EC, and insect growth regulators (IGR); Cascade 10 DC and Match 50 EC, against codling moth, *Cydia pomonella* L. in apple orchards at Mingora (850 m altitude) and Khwazakhela (1170 m altitude), in Swat valley, Pakistan, during April-August, 2001. At both altitudes, the IGR, Cascade 10 DC, afforded the best protection to apple by resulting in the lowest average infestation (2.60%) and the highest average yield (59.71 kg tree⁻¹). Talstar 10 EC ranked first among the insecticides for the effective management of codling moth. All other treatments were found superior than control.

Key words: Codling moth, insecticides, insect growth regulators (IGR), altitudes

Introduction

The perception of good health without fruits is impossible. Among fruits, the most dominant and important one is the apple, *Pyrus malus* L. (Rosaceae; Pomoideae). Apple is the leading fruit of the temperate regions of the world (Potter, 1983). Today, apple plays an important role in the economy of many countries (Buttitude, 1984).

The production of good quality of apple for human consumption is the need of the hour. Pests and diseases constitute the major hurdles in the way of quality apple production. Some of the most serious insect pests and diseases of apple are: codling moth, wooly apple aphid, san jose seal, apple lace bug, European red mite, two spotted spider mite, apple scab, apple powdery mildew and root rot (Tori, 1992). Among all these pests, codling moth, *Cydia pomonella* L. (Lepidoptera; Tortricidae) is one of the major and most serious pests of apple throughout the world. In Pakistan it occurs in almost all the provinces and is considered as the key/serious pest of apple because of deep feeding and the resulting rots from bacteria and fungi. Often a significant amount of apple drops before maturity, which may be 20-25% of the total fruits of a tree. Damage to apple fruit by codling moth varies from 1-35 and 3-95% under favorable conditions (Tuhan *et al.*, 1979).

To control codling moth, arsenicals and DDT were used in 1880 and 1974, respectively. They were then replaced by other synthetic products because of the development of resistance in codling moth and their residual effects. Different workers have used different chemicals for the control of codling moth. Bajoi *et al.* (1982) used

azinophos-methyl and methamedophos against codling moth with significant control. Brown and Brown (1982) analyzed that the female of codling moth was affected in the adulthood, when they received a single topical application of the juvenile hormone, the methoprene. The adult survival was decreased by 25% and so was their fecundity. Campbell *et al.* (1988) reduced the per unit infestation of codling moth to 0.9% by applying azinophos-methyl as compared to untreated where the infestation was 20.3%. Medvedeva (1989) used Dimilan (Diflubenzuron), Bulut *et al.* (1992) Karate 5EC, Menthrin 20EC, Alsystin 25WP and Sumicidin 20EC and Chernii *et al.* (1993) used diflubenzuron and triflumuron against codling moth. Berrie *et al.* (2000) concluded that the organophosphorus (mainly chlorpyrifos) and the carbamate (Pirmicarb) insecticides afforded best protection to apple against codling moth.

The information regarding the effect of different pesticides in comparison with insect growth regulators (IGRs) at different altitudes is very rare. Also different types of pesticides including IGRs and other chemicals are available in the market, therefore, it was considered essential to study different pesticides for their efficacy against codling moth at different altitudes.

Materials and Methods

To study the efficacy of different insecticides and insect growth regulators against codling moth in apple orchards, an experiment laid out in randomized complete block design (RCBD) with three replications, was conducted at Mingora (850 m) and Khwazakhela (1170 m) in Swat valley during April-August, 2001. An apple orchard of Red

Delicious variety was selected at each altitude. The age of the experimental trees was about 10 years. The trees were healthy in appearance and bearing fruit under normal conditions.

Sprays were applied by using power sprayer machine and standard doses of treatments were applied. The first spray was applied after the completion of 70-80% petal fall. The second and third sprays were applied at an interval of 21 days each (Jones, 1987).

After the application of each spray, the percent infestation of codling moth larvae was recorded on weekly basis. For this the total fallen fruits were collected. After counting total dropped fruits, infested fruits were separated by cutting with a knife for confirmation of infestation. The percent infestation was calculated by the following formula:

$$\text{Percent infestation} = \frac{\text{No. of infested fruits}}{\text{No. of total dropped fruits}} \times 100$$

The data were analyzed by analysis of variance of factorial RCBD, using MSTATC computer programme and the treatment means were compared by Fisher's Protected LSD Test (Steel and Torrie, 1980).

Results and Discussion

The post-spray percent infestation of codling moth in apple orchards at Mingora and Khwazakhela has been given in Table 1 and 2, respectively.

The average percent infestation at Mingora was 20.96% as compared to 16.45% recorded at Khwazakhela i.e. 4.51% higher than the later, which is being attributed to the hot and dry weather prevailing at Mingora. Cranham (1981) reported that the codling moth development is favored by hot and dry weather.

At both altitudes, Mingora and Khwazakhela, the IGR, Cascade 10 DC (Flufenoxuron) was found to be the most effective treatment for the management of codling moth, which resulted in the lowest average infestation (2.60%) and the highest average yield (59.71 kg tree⁻¹). Roselli and Vergnani (2001) also reported flufenoxuron as the most effective IGR for the management of codling moth. Among the insecticides tested, almost in all cases, Talstar 10 EC (Bifenthrin) afforded best protection to apple trees against codling moth by resulting in the lowest average infestation and the highest average yield. This finding is compatible with the results of Bulut *et al.* (1992) and Kilic and Aykac (1992) who also found Talstar (Bifenthrin) as the most effective insecticide against codling moth. All other products were found superior than control in

Table 1: Average percent infestation of codling moth, *Cydia pomonella* L. in apple orchard after application of three sprays at Mingora

Treatments		Dose per 100 L. water	Average percent infestation			Yield (kg tree ⁻¹)
Common name	Trade name		1st spray	2nd spray	3rd spray	
Lufenuron	Match 50 EC	100 ml	4.09b	4.22c	5.04bc	51.25b
Flufenoxuron	Cascade 10 DC	50 ml	2.56c	3.36c	3.40c	58.29a
Bifenthrin	Talstar 10 EC	200 ml	4.53b	4.65bc	5.53bc	46.60bc
Deltamethrin	Decis 2.5 EC	50 ml	5.39b	4.86bc	5.84bc	45.00c
Chlorpyrifos	Lorsban 40EC	200 ml	4.05b	5.41bc	6.40bc	41.51c
Carbosulfan	Advantage 20 EC	300 ml	4.36b	6.77b	6.75b	41.29c
Untreated (Control)	-	-	13.68a	21.87a	27.34a	15.42d

Table 2: Average percent infestation of codling moth, *Cydia pomonella* L. in apple orchard after application of three sprays at Khwazakhela

Treatments		Dose per 100 L. water	Average percent infestation			Yield (kg tree ⁻¹)
Common name	Trade name		1st spray	2nd spray	3rd spray	
Lufenuron	Match 50 EC	100 ml	2.81c	3.20c	2.73cd	56.84ab
Flufenoxuron	Cascade 10 DC	50 ml	2.04c	2.32c	1.93d	61.13a
Bifenthrin	Talstar 10 EC	200 ml	3.12bc	3.60c	3.87bcd	52.96abc
Deltamethrin	Decis 2.5 EC	50 ml	4.25b	4.22c	3.60bcd	49.50bc
Chlorpyrifos	Lorsban 40EC	200 ml	2.90c	4.32c	5.67bc	43.88cd
Carbosulfan	Advantage 20 EC	300 ml	2.75c	8.15b	6.06b	43.67cd
Untreated (Control)	-	-	9.55a	17.72a	22.08a	19.04e

Means followed by a different letter (column wise) are significantly different from one other (P < 0.05), using LSD test

reducing the percent infestation of codling moth in apple orchards.

From this study, it may be concluded that the IGR, Cascade 10 DC and the insecticide, Talstar 10 EC, can be used for the effective management of codling moth in apple orchards.

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