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Comparative Efficacy of Some Insecticides Against *Helicoverpa armigera* Hub. and *Spodoptera* spp. on Tobacco

SOHAIL AHMED[1], MOHAMMAD RASHAD RASOOL, IRFANULLAH AND IMRAN RAUF
Department of Agricultural Entomology, University of Agriculture, Faisalabad–38040, Pakistan
[1]Corresponding author's e-mail: saha786@fsd.paknet.com.pk

ABSTRACT

A field study for comparative efficacy of three insecticides, viz. indoxacarb 150SC, methomyl 40SP and chlorpyriphos 40EC @ 100, 400 and 500 mL per 100 L of water against *Helicoverpa armigera* and *Spodoptera* spp. was carried out. The experiment was laid out in Randomized Complete Block Design with four treatments including a control and three replications**.** All three insecticides**,** indoxacarb, methomyl and chlorpyriphos, had non-significant difference among themselves in reducing the larval population of *H. armigera* and *Spodoptera* spp. at 3, 5, 7 and 15 days following the application of the insecticides. Indoxacarb proved to be the best over chlorpyriphos and methomyl in reducing number of larvae on the basis of pre-spray data. Toxicity of indoxacarb compared with methomyl and chlorpyriphos is discussed.

Key Words: Indoxacarb; Methomyl; Chlorpyriphos; *Helicoverpa armigera; Spodoptera* spp.; Tobacco

INTRODUCTION

In Pakistan, though tobacco cultivation occupies relatively a small area of 0.27% of the total irrigated land in the country but it is of great economic significance as a source of revenue, employment and foreign exchange earnings to the country (Shah & Hussain, 1991; Anonymous, 2002.). Tobacco is major cash crop of the North-West Frontier Province of Pakistan. In spite of the presence of nicotine, which is used as the insecticide, the tobacco and its products are attacked at all stages starting from the time of nursery sowing right up to the stage of final consumption by numerous insects. There is no denying the fact that cotton bollworm (*Helicoverpa armigera* Hub.) and armyworm (*Spodoptera* spp.) have attained the status of the primary pest insects on cotton in the recent years in the Pakistan (Ahmad *et al*., 1997, 1999). Besides cotton, these pest insects are dangerous on tobacco and crucifers (Hussain & Shah, 1998). Tobacco is also attacked by Greasy Cutwrom, *Agrotis* spp. (Khan, 1982). The extent of damage by these pest insects to leaf quality of tobacco crop varies from place to place and also dependent upon the environmental conditions (Iqbal *et al*., 1997; Hussain & Shah, 1998).

The control of insect pests on tobacco mainly relies on the use of pyrethroids (permethrin, cypermethrin, deltamethrin, cyhalothrin etc.), which comprise the group of insecticides mainly used against tobacco budwrom (*Heliothis virescens*) as is reported elsewhere (Johnson *et al*., 1997; Wolfenbarger & Vargas-Camplis, 1997; Allen *et al*., 2000). The resistance to insecticides in the tobacco budwrom (*H. virescens*) has been reported (Bagwell *et al*., 1998). One way of delaying resistance is to discourage the continuous use of one insecticide for a long period of time. However, *H. armigera* and *Spodoptera* are the insect species known for damage to tobacco crop in the Pakistan (Iqbal *et al*., 1997). *H. armigera* has been recorded for resistance to a number of insecticides on cotton (Ahmad *et al*., 1997, 1999). Previously tried insecticides against insect pests of tobacco crop included endosulfan 35EC, deltamethrin 2.3EC, ethophin prox 30EC, monocrotophos 40WSC, demeton S-methyl 45EC, dimethoate 40EC, methamidophos 60Sl (Hussain & Shah, 1998). Insecticides from different sources ought to be tested against *H. armigera* and *Spodoptera* spp., because both pests insects are polyphagous and they shift to cotton following tobacco in certain places where tobacco is extensively grown such as Sahiwal Distt. (Punjab: Pakistan). The present studies report the comparative efficacy of indoxacarb 150SC (Steward), methomyl 40SP (Lannate) and chlorpyriphos 40EC on tobacco against *H. armigera* and *Spodoptera* spp.

MATERIALS AND METHODS

The experiment was carried out at a farmer's field at Village 235 GB in Distt. Toba Tek Singh–Pakistan. The trial was laid out in Randomized Complete Block Design (RCBD) with four treatments including a control and replicated thrice. Plot size was 0.38 m^2 with row to row and plant to plant distance were 60 and 30 cm, respectively. Three insecticides viz., indoxacarb 150SC, methomyl 40SP and chlorpyriphos 40EC @ 100, 400 and 500 mL per 100 L of water. The control plots were sprayed with water only. Data on number of larvae of *H. armigera* and *Spodoptera* spp. were taken from five randomly selected plants from each treatment plot just before and then after 3, 5, 7 and 15 days of application of the insecticides. The mean larval number from each treatment were compared by Duncan's

Multiple Range Test after One Way ANOVA at α= 5%.

RESULTS

Three insecticides, indoxacarb, methomyl and chlorpyriphos had non-significant difference among themselves in reducing the larval population of *H. armigera* (Table I). Indoxacarb registered above 90% (average 92) reduction in number of larvae on the basis of pre-spray data, followed by 87% each by chlorpyriphos and methomyl.

Three insecticides, indoxacarb, methomyl and chlorpyriphos had non-significant difference among themselves in reducing the larval population of *H. armigera* (Table II). Indoxacarb registered average 89% reduction in number of larvae on the basis of pre-spray data, followed by 85 and 82% by chlorpyriphos and methomyl, respectively.

DISCUSSION

Indoxacarb is a broadspectrum insecticide in a new class of chemical compound with a new mode of action and is registered for use against a wide variety of Lepidopteran pest insects including *H. armigera* and *Spodoptera* spp. Indoxacarb is not systemic, but does have translaminar movement into the mesophyll. Indoxacarb affects insects from direct exposure to spray droplets and through ingestion of treated foliage/fruit. Once absorbed, it kills by binding to a site on the sodium channel and blocking the flow of sodium ions. The result is impaired nerve function, feeding cessation, paralysis, and death. Beneficial insects such as assassin bug, bigeyed bug, minute pirate bug, Damsel bug, lacewing larvae, spiders, predacious mites and parasitic wasps are not significantly affected by dried residues of indoxacarb. This is primarily because of very limited ingestion due to the feeding habits of these insects and lack of uptake via tarsal exposure (McKinley *et al*., 2002).

The present study was intended to compare the indoxacarb with methomyl and chlorpyriphos for the control of *H. armigera* and *Spodoptera* spp. on tobacco. The three insecticides, indoxacarb, methomyl and chlorpyriphos had non-significant difference among themselves in reducing the larval population of *H. armigera* and *Spodoptera* spp. at all post spray intervals. These results are in agreement with those of Johnson *et al.* (1997), Wolfenbarger and Vargas-Camplis (1997), and Allen *et al.* (2000), who found significant reduction in the larval population of these insects on tobacco.

The efficacy of methomyl and chlorpyriphos against these insects has been reported elsewhere on tobacco (Khan, 1982; Iqbal *et al*., 1997; Hussain & Shah, 1998). The development of resistance to these insecticides in *H. armigera* has been reported on cotton (Ahmad *et al*., 1997, 1999). Tobacco being an important cash crop cannot withstand the damage of these leaf feeding caterpillars as these impair the quality and quantity as well (Khan, 1982). Hence, the preservation of efficacy of insecticides is necessary for effective pest control. Indoxacarb has given good control of *H. armigera* on tobacco *(*Allen *et al*., 2000), which is also evidenced by the results of present studies. There is no report of control failure of *H. armigera* and *Spodoptera* spp. on tobacco with a number of insecticides from pyrethroids, organophosphates and carbamate groups. There is possibility that the presence of nicotine might be playing an additional natural control agent, as nicotine sulphate has been found effective against the pest insects in many crops. Thus, indoxacarb can play a useful role in

Table I. Mean larval number plant^{-1} of *H. armiegra* at pre- and post-spray intervals of application of insecticides

Treatments	Mean number of *Helicoverpa armigera* larvae plant^{-1}				
	Pre-spray	Post-spray			
		3rd day	5th day	7th day	15th day
Indoxacarb 150SC	1.73±0.13ns	0.13±0.13b (92)	0.13±0.06b (92)	0.00±0.00b (100)	0.03±0.03b (98)
Methomyl 40SP	1.66±0.17	0.26±0.17b (84)	0.13±0.06b (92)	0.20±0.00b (87)	0.20±0.00b (87)
Chlorpyriphos 40EC	1.93±0.06	0.40±0.11b (79)	0.13±0.06b (93)	0.13±0.06b (93)	0.26±0.01b (86)
Control	2.00±0.30	2.80±0.20a	2.80±0.20a	2.80±0.20a	2.97±1.07a

Values are means±SE. Means (compared by DMR Test) sharing same letter in a column are not significantly different at α= 5%. Parenthesis contains % reduction in larval population.

Table II. Mean larval number plant^{-1} of *Spodoptera* spp. at pre- and post-spray intervals of application of insecticides

Treatments	Mean number of Spodoptera spp. larvae plant^{-1}				
	pre-spray	post-spray			
		3rd day	5th day	7th day	15th day
Indoxacarb 150SC	2.06±0.33ns	0.27±0.17b (86)	0.20±0.00b (90)	0.20±0.00b (90)	0.20±0.00b (90)
Methomyl 40SP	2.20±0.40	0.86±0.37b (61)	0.20±0.11b (91)	0.26±0.13b (88)	0.26±0.13b (88)
Chlorpyriphos 40EC	2.73±0.17	0.67±0.27b (75)	0.26±0.06b (90)	0.26±0.06b (90)	0.33±0.06b (87)
Control	2.46±0.17	2.60±0.23a	3.46±0.24a	3.93±0.37a	4.13±0.37a

Values are means±SE. Means (compared by DMR Test) sharing same letter in a column are not significantly different at α= 5%. Parenthesis contains % reduction in larval population.

resistance management programs because it has a mode of action not shared by other insecticides. Research done to-date indicates no cross-resistance of indoxcarb with methomyl and chlorpyriphos (McKinley *et al*., 2002). insecticides.

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