LETHAL AND SUB-LETHAL EFFECTS OF SELECTED INSECTICIDES ON ORIUS INSIDIOSUS

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Abstract

Spinosad treated cotton leaves caused no significant mortality (18.8%) in Orius insidiosus. Imidacloprid and indoxacarb caused 62.5% and 62.8% mortality respectively. Fipronil and cyhalothrin caused 100% mortality. After exposure to imidacloprid treated leaves, O. insidiosus adults ceased and never resumed feeding.

Introduction

With the success of boll weevil eradication coupled with genetically engineered plants as well as the movement towards insecticides that are more specific to certain pests, there is emerging an increasing reliance on beneficial arthropods for control of cotton pests. Many of the newer insecticides coming onto the market are touted as causing little or no mortality to some beneficial arthropods. However, a simple lack of mortality may not be an adequate measure of an insecticides effect on beneficial arthropods. Sub-lethal effects such as reduced oviposition, longevity, feeding and other behavior changes may occur. Some pesticides have been known to cause natural enemies to stop feeding or reduce their reproductive capacity (Hamilton and Lashomb 1997). Few studies have looked at these sub-lethal effects. These factors must be taken into account when evaluating the effects of pesticides on beneficial arthropod species.

Orius insidiosus, the insidious flower bug, is an important predator of thrips, mites and bollworm/budworm (eggs and small larvae) in cotton (Nuessly and Sterling 1994). Researchers have made observations of reduced numbers of this insect in plots treated with insecticides (Greene et al. 1995, Young et al. 1997). However, imidacloprid has been reported to have little or no effect on minute pirate bugs, a close relative of O. insidiosus, up to 14 days after exposure (McNally and Mullins 1996). Still, data is lacking on sub-lethal effects of newer insectides on this insect.

The objective of this study was to measure the lethal as well as the sub-lethal effects of spinosad, imidacloprid, indoxacarb, fipronil and cyhalothrin on O. insidiosus under field conditions.

Materials and Methods

O. insidiosus adults were collected from crimson clover, corn and grain sorghum early in the season. These individuals were maintained in the lab on green beans and Helicoverpa zea eggs. Plots of SureGrow 125 cotton were planted at the University of Arkansas Northeast Research and Extension Center located in Keiser, AR on May 13, 1998. Plots were sprayed with a hand-held CO_2 powered boom equipped with TX-6, hollowcone nozzles. Insecticides were applied at 10 gallons per acre volume.

Adults were caged on upper leaves of cotton plants as soon as sprays dried. To insure that all insects were approximately the same age, adults used were those that had eclosed 7 to 10 days before from the culture in the lab. Insects were left on treated plants for 24 hours and then removed. Mortality was recorded and surviving individuals were brought back to the lab to evaluate effects on longevity, oviposition and feeding. To measure these effects, survivors were placed individually in 30cc plastic cups with a small piece of green bean and 10 H. zea eggs. Used green beans and eggs were removed and replaced daily with a fresh batch. The number of eggs deposited by O. insidiosus females was counted and feeding was determined by counting the number of remaining H. zea eggs each day.

Results and Discussion

Spinosad was the only treatment that did not have significantly higher mortality than that of the untreated check, while the fipronil and cyhalothrin treatments resulted in 100% mortality (Table 1). Because there were no surviving individuals in the fipronil and cyhalothrin treatments, no data is available on sub-lethal effects of these insecticides. Mortality in the untreated individuals was high (31%). This was most likely due to the hot conditions in the field (near 36 degrees C) compared to lab temperatures at which they were reared (24 degrees C). There were few surviving individuals left for examination of sub-lethal effects with the exception of the spinosad treatment. Therefore, statistical analysis of the effects on oviposition, longevity and feeding was unrealistic. Results reported may indicate possible trends and areas for further research.

Untreated and spinosad treated insects lived for an average of 7 days after exposure. Imidacloprid averaged 5 days, while indoxacarb averaged just over 3 days (Table 1).

Approximately 70% of the O. insidiosus individuals in the untreated check resumed feeding after being brought back in from the field cages. None of the imidacloprid treated individuals resumed feeding (Table 1).

One hundred percent of the females in the untreated check oviposited the first day after being brought in from the field cages. However, this number dropped to 60% the second

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day and remained at this level for the remainder of the study. About 60% of the spinosad treated females oviposited after exposure, while oviposition was approximately 50% in the imidacloprid and 20-40% in the indoxacarb treatments.

Summary

It is apparent that there are some sub-lethal effects caused by some of the insecticides tested. Spinosad appears to have the least effect on O. insidiosus, with few differences between this treatment and the untreated check. Although numbers of individuals for testing in the other treatments were low and variable, making statistical analysis unrealistic, there were some indications of possible sub-lethal effects. The most notable effect was in feeding activity after treatment in which imidacloprid treated individuals never resumed feeding. Areas of further research would include investigating the effects of lower rates of these insecticides using higher numbers of individuals to insure more accurate measurement of sub-lethal effects.

References

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Table 1. Mortality, feeding and longevity effects on O. insidiosus adults.

Insecticide	Rate lb ai/A	Percent Mortality	Percent Adults Resuming Feeding	Average Longevity After Exposure (days)
Untreated		31.0 b	70.0	7.0
Spinosad	0.089	18.8 b	52.5	6.8
Imidacloprid	0.047	62.5 ab	0.0	5.0
Indoxacarb	0.11	68.8 ab	33.8	3.3
Fipronil	005	100.0 a	--	--
Cyhalothrin	0.025	100.0 a	--	--

Means within a column followed by same letter not significantly different (LSD, P=0.05).