LETHAL AND SUBLETHAL EFFECTS OF EARLY-SEASON INSECTICIDES ON INSIDIOUS FLOWER BUG (*Orius insidiosus*): AN IMPORTANT PREDATOR IN COTTON

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RESEARCH PROBLEM

Many new insecticides today are marketed as having a reduced impact on beneficial insect species. Many of these claims are based upon survival following application to a field or research plot. However, surviving exposure to a pesticide does not necessarily mean that the insect has not been impacted in some way. This research was designed to measure not only the mortality caused by some newer insecticides used in early season cotton, but also to determine the sublethal effects on oviposition, feeding activity, and longevity in an important early season predator, the insidious flower bug.

BACKGROUND INFORMATION

Many of the newer insecticides becoming available to the cotton grower are target-specific and, as a result, have a lower toxicity to certain insects or insect groups. Some newer insecticides are also less toxic to beneficial arthropods. However, some do have an effect on beneficials, reducing their efficacy even though they do not cause significant mortality (Elzen *et al.*, 1999). Although the diversity of beneficial insects in a cotton field is high (Whitcomb and Bell, 1964), several groups are credited with giving significant pest control. Of these, the insidious flower bug, *Orius insidiosus*, is both abundant and important in the suppression of thrips and bollworms/budworms during the early growing season (Lincoln and Williams, 1952; Elkassabany, 1994). Because of its abundance and importance in pest suppression, this insect was chosen for this study.

MATERIALS AND METHODS

Cotton cultivar 'SureGrow 125' was planted on 11 May 1999. Treatments were arranged in a randomized complete-block design with four replications. Insecticide treatments were applied using a hand-held CO_2 backpack sprayer calibrated to deliver 10 gal/acre through two TX4 hollow cone nozzles per row. As soon as sprays had dried, insidious flower bugs were caged on leaves using clip cages. Insects were left on plants for 24 h and then removed. Mortality was recorded, and all surviving insects were

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placed in individual cups in an environmental chamber. Each insect was provided a fresh green bean and bollworm eggs each day. Green beans were checked for flower bug eggs, and bollworm eggs were counted to determine feeding activity. Insects were maintained in this way for 2 wk or until all insects had died.

To measure repellancy or movement caused by the insecticide treatments, large plots of cotton cultivar 'DP 20' were planted 12 May 1999. Plots were 28 rows wide and 200 ft long. Treatments were arranged in a randomized complete-block design, with untreated areas 28 rows wide bordering each treatment on both sides. Counts of all beneficial arthropods (insects ands spiders) were made using a white dishpan covered with 1/4 inch hardware cloth. Plants were bent over and beat against the hardware cloth, dislodging them into the pan. Counts were made in four transects across each treated and untreated area on rows 5, 10, 15, 20, and 25. Counts were made at 1, 2, 3, 6, 9, and 12 d after treatment.

RESULTS

Survival ranged from 0 to 95% after insidious flower bugs were exposed to treated cotton for 24 h (Table 1). Longevity ranged from 0.8 to 7.1 d (Table 2). Oviposition ranged from 0 to 18 eggs produced per female (Table 3). All females resumed feeding activity, while males exposed to the high rates of indoxacarb and imidicloprid did not resume feeding (Table 4). There were no significant increases in predatory arthropod numbers in untreated plots adjacent to treated areas. All reductions in predatory arthropod numbers appeared to be the result of mortality and not repellancy caused by the insecticides tested. Spinosad and methoxyfenozide had no lethal or sublethal effects on insidious flower bug. Cyhalothrin also had no sublethal effects but did cause significant mortality in this insect.

PRACTICAL APPLICATIONS

Good integrated pest management practices encompass the use of chemical, cultural, and natural controls in managing pests in cotton. Often the use of a chemical insecticide negates the benefits from any natural enemy in the field. The impact of a pesticide on a natural enemy must be known in order to properly utilize both the pesticide and the natural controls afforded by a predator. This research shows that even though an insecticide does not kill some predators, it can have a negative effect in reducing the effectiveness of that predator. Of the insecticides tested in this study, only spinosad and methoxyfenozide caused no significant mortality or sublethal effects in the insidious flower bug.

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Table 1. Percentage of survival of both sexes of *Orius insidiosus* after 24-h exposure to treated cotton.

Insecticide	Rate	Females	Males
	lb ai/acre		
Untreated control		90.00 a[z]	87.50 ab
Spinosad 4SC	0.089	80.00 ab	75.00 abc
Spinosad 4SC	0.178	85.00 ab	60.00 bc
Indoxacarb	0.07	90.00 a	81.25 ab
Indoxacarb	0.11	90.00 a	92.50 a
Imidacloprid 1.6F	0.024	60.00 bc	75.00 abc
Imidacloprid 1.6F	0.047	50.00 c	50.00 c
Fipronil 2.5EC	0.038	10.00 d	0.00 d
Fipronil 2.5EC	0.05	0.00 d	0.00 d
Methoxyfenozide	0.25	87.50 ab	95.00 a
Methoxyfenozide	0.75	95.00 a	81.75 ab
Cyhalothrin	0.012	20.00 d	0.00 d
Cyhalothrin	0.025	0.00 d	0.00 d
LSD (0.05)		25.63	24.88

[z] Means within a column followed by the same letter do not significantly differ (DMRT, P = 0.05).

Table 2. Longevity of both sexes of *Orius insidiosus* after 24-h exposure to treated cotton plants in the field.

Insecticide	Rate	Females	Males
	lb ai/acre		
Untreated control		6.8 a	3.9 bc
Spinosad 4SC	0.089	5.8 ab	6.7 a
Spinosad 4SC	0.178	7.1 a	6.4 ab
Indoxacarb	0.07	4.1 bcd	1.9 c
Indoxacarb	0.11	2.3 def	1.9 c
Imidacloprid 1.6F	0.024	3.5 cde	1.5 c
Imidacloprid 1.6F	0.047	1.7 ef	1.8 c
Fipronil 2.5EC	0.038	0.8 f	
Methoxyfenozide	0.25	6.0 ab	5.3 ab
Methoxyfenozide	0.75	5.5 abc	6.3 ab
cChalothrin	0.012	6.5 a	
LSD (0.05)		2.04	2.54

[z] Means within a column followed by the same letter do not significantly differ (DMRT, P = 0.05).

Table 3. Eggs produced by *Orius insidiosus* females after 24-h exposure to treated cotton plants in the field.

Insecticide	Rate	Total Eggs/Female	Eggs/Day/Female
	lb ai/acre		
Untreated control		17.8 a	2.6 ab
Spinosad 4SC	0.089	17.6 a	3.1 a
Spinosad 4SC	0.178	16.9 a	2.4 ab
Indoxacarb	0.07	9.8 abc	2.4 ab
Indoxacarb	0.11	0.0 c	0.0 d
Imidacloprid 1.6F	0.024	8.0 abc	1.5 bc
Imidacloprid 1.6F	0.047	0.0 c	0.0 d
Fipronil 2.5EC	0.038	0.0 c	0.0 d
Methoxyfenozide	0.25	13.5 a	2.2 ab
Methoxyfenozide	0.75	11.6 a	2.1 ab
Cyhalothrin	0.012	18.0 a	2.8 ab
LSD (0.05)		10.17	1.29

[z] Means within a column followed by the same letter do not significantly differ (DMRT, P = 0.05).

Table 4. Feeding activity of both sexes of *Orius insidiosus* after 24-h exposure to treated cotton plants in the field.

Insecticide	Rate	Females	Males
	lb ai/acre		
Untreated control		+[z]	+
Spinosad 4SC	0.089	+	+
Spinosad 4SC	0.178	+	+
Indoxacarb	0.07	+	+
Indoxacarb	0.11	+	–
Imidacloprid 1.6F	0.024	+	+
Imidacloprid 1.6F	0.047	+	–
Fipronil 2.5EC	0.038	+	NA
Methoxyfenozide	0.25	+	+
Methoxyfenozide	0.75	+	+
Cyhalothrin	0.012	+	NA

[z] A + denotes feeding activity; – denotes no feeding activity.