TOXICITY OF SEVERAL INSECTICIDES APPLIED TOPICALLY TO TARNISHED PLANT BUGS[1, 2, 3]

Tom C. Cleveland[4]
Southern Field Crop Insect Management Laboratory
Agricultural Research Service, USDA
Stoneville, MS 38776
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ABSTRACT

Serial dilutions of technical material of eleven different insecticides dissolved in acetone were applied topically to tarnished plant bugs, *Lygus lineolaris* (Palisot de Beauvoir), collected from three mid-Delta counties in Mississippi, which represented an area commonly experiencing high levels of insecticide use, and from a county in north Arkansas, representing an area with low levels of insecticide use. Tolerance of tarnished plant bugs to six of the eleven materials was significantly greater in most cases in those collected from the mid-Delta counties of Mississippi than those collected in north Arkansas.

Key Words: *Lygus lineolaris* (Palisot de Beauvoir), tarnished plant bug, resistance, tolerance, insecticide.

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INTRODUCTION

The tarnished plant bug (TPB), *Lygus lineolaris* (Palisot de Beauvois), collected from three mid-Delta counties in Mississippi in 1978 showed resistance to methyl parathion applied topically in laboratory tests (Cleveland and Furr 1979). TPB resistance to insecticides in the Mississippi Delta had not been documented before 1978. Other researchers reported that *Lygus hesperus* (Knight) was resistant to several insecticides. Menke (1954) found that *L. hesperus* on alfalfa in Washington was resistant to DDT and this was later confirmed by Andres et al. (1955). Leigh and Jackson (1968) reported resistance to several chlorinated hydrocarbon-, organophosphate-, and carbamate-insecticides applied topically to *L. hesperus*. Cross-resistance to newly-introduced pesticides was indicated in tests by Leigh et al. (1977). Since the Mississippi Delta is an important and productive agricultural area and has a long history of heavy insecticide use, reference point data will be helpful in determining if resistance is occurring. To establish these data, several commonly used insecticides were bioassayed against TPB.

MATERIALS AND METHODS

The eleven insecticidal compounds evaluated in this study are of 3 chemical groups: one chlorinated hydrocarbon; 9 organophosphates; and 1 carbamate. The chlorinated hydrocarbon was toxaphene and the carbamate was carbaryl. The

[1] Heteroptera: Miridae
[2] In cooperation with the Delta Branch of the Mississippi Agr. and Forestry Exp. Sta. Stoneville, Mississippi 38776.
[3] Mention of a pesticide or a preprietary product in this paper does not constitute recommendation or an endorsement of this product by the U. S. Dept. of Agr.
[4] Research Entomologist

organophosphate group included trichlorfon, azinphosmethyl, dimethoate, chlorpyrifos, malathion, methyl parathion, dicrotophos, monocrotophos, and acephate. These materials were selected because they represent some of the more commonly used insecticides in the mid-Delta area.

The TPB were collected with a 38-cm diam insect net from weeds near cotton fields in Washington, Sunflower, and Bolivar Counties, Mississippi and from weeds in and near pastures in Stone County, Arkansas where cotton is not grown. The former are high insecticide use areas, the latter is a low insecticide use area. TPB were held overnight on green beans to allow for mortality of those injured by sweeping. Only those that appeared healthy were selected in groups of 10 for treatment. Both sexes were used in these tests. They were treated topically with insecticides in acetone solution. Dilutions were made to achieve desired dosage with droplets of approximately 0.5 μl. For treatment, the TPB were briefly anesthetized with CO_2 gas, placed on their backs in a split soda straw and the dosage was applied to the coxal area with a standard model microapplicator. TPB were then held with fresh green beans as food in a holding chamber at 23°C night temperature, 25 - 26°C day temperaure, and 50% humidity. Mortality was determined at 24 and 48 hr.

The square root transformation was applied and the values were analysed as a randomized complete block design with a factoral arrangement of location and treatments on an IBM 4331 computer with SAS-79. Means were separated by Duncan's Multiple Range Test.

The differences in mortality between chemical treatments of TPB collected from each county were not considered in this test, only the differences in mortality between locations. Several preliminary tests were conducted with some of the compounds before a satisfactory dosage was established. It was necessary to reduce the dosage volume for each TPB to 0.5 to avoid a 100% mortality.

RESULTS AND DISCUSSION

There were no significant differences in the 4 locations of TPB mortality when treated with azinphosmethyl, dicrotophos, methyl parathion, trichlorfon, and toxaphene. These data were not too surprising in the cases of trichlorfon and toxaphene since both were used in Stone County, Arkansas in cattle farming. However, the other three compounds were not commonly used in Stone County since cotton is not grown there, and the lack of significant differences in mortality between populations from Stone County and the Mississippi locations is surprising. There was a significant difference in mortality between locations, to some degree, with the following materials: monocrotophos, dimethoate, chlorpyrifos, malathion, acephate, and carbaryl (Table 1).

In an overall comparison of the three Delta counties it appears, according to these data, that TPB in Sunflower County exhibit higher tolerance to the insecticides tested than either Washington or Bolivar Counties. This was probably due to more insecticides being used in Sunflower County because of the greater number of cotton acreage. TPB collected from Washington County exhibited a slightly higher tolerance than those collected from Bolivar County.

With one exception, TPB collected from the three mid-Delta Counties in Mississippi showed more tolerance to the insecticides tested than those collected from Stone County, Arkansas. More tolerance to carbaryl was exhibited in TPB

Table 1. Survival of tarnished plant bugs collected from 4 geographical locations when treated topically with several insecticides.

Chemical	Dosage*	Survival Means†	Location		Survival Means†	
	0.5	24 hr	Co.	St.	48 hr	
	Gr/ha					
monocrotophos	1.68	2.25 a‡	1 – Washington,	MS		
		0.50 ab	3 – Sunflower,	MS	NSD§	
		0.00 b	2 – Bolivar,	MS		
		0.00 b	4 – Stone,	AR		
dimethoate	8.96	8.00 a	3		6.50 a	3
		5.50 ab	2		3.75 ab	2
		3.75 b	1		2.75 b	1
		3.00 b	4		2.00 b	4
chlorpyrifos	2.69	7.00 a	1		6.50 a	1
		5.75 a	3		4.25 ab	3
		4.25 a	2		3.25 b	2
		1.75 b	4		0.75 c	4
malathion	3.36	6.00 a	2		5.25 a	2
		5.25 ab	3		4.25 ab	3
		4.25 ab	1		4.25 ab	1
		3.25 b	4		2.25 b	4
acephate	2.25	5.75 a	1		5.00 a	3
		5.50 a	3		3.75 a	2
		4.25 ab	2		3.50 a	1
		3.00 b	4		1.25 b	4
carbaryl	4.50	6.75 a	3		6.50 a	3
		5.75 a	2		5.00 ab	2
		5.00 ab	4		4.25 ab	4
		2.75 b	1		2.75 b	1

* The indicated AI is equivalent to that applied in 46.7 litres of emulsion spray/ha.
† Within each chemical, the means for each location not followed by a common letter differ significantly ($P = 0.05$) by Duncan's Multiple Range Test.
‡ Average number tarnished plant bugs surviving per replicate (10 bugs per replication, with 4 replications per treatment).
§ NSD = No significant difference.

collected in Stone County, Arkansas than those collected in Washington County, Mississippi.

These data suggest that the increase in tolerance of insects to insecticides is related to the increased usage of those chemicals.

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