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CORRELATION BETWEEN FIELD EFFICACY TESTS AND LABORATORY DIAGNOSTIC DOSAGES, ON BOLL WEEVIL POPULATIONS FROM THE YAQUI VALLEY, SONORA. MÉXICO

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Abstract

Laboratory and field bioassays were performed with the pyrethroid insecticide cyfluthrin on boll weevil populations from the Yaqui Valley, Sonora, Mexico. Results indicated high correlation between both type of bioassays and showed a reduction in susceptibility to this insecticide. Pyrethroids should not be used against this pest and they have to be restrict for other insect pests to one month in middle of the cotton season as it was suggested in the resistance management strategy established for this region.

Introduction

Cotton area in Mexico has decreased drastically in the last few years. In 2002 there were planted 40, 248 ha from which Sonora established 3,674 ha, corresponding 1,713 ha to the south part of Sonora. Boll weevil *Anthonomus grandis* is the main insect pest of cotton in the Yaqui Valley, located is in south Sonora, other insect pest are a complex of cotton bollworm *Helicoverpa zea* and tobacco budworm *Heliothis virescens* and different plant sap sucking insects. In order to control these pests several insecticides of different chemical groups such as pyrethroids, organophosphates, carbamates and others are used. The application of these insecticides generates a selection pressure on the insect pests and through time resistant individuals increase. Reports on differential response on efficacy of insecticides through time, supports the above explanation on selection pressure. In 1978, only the pyrethroid insecticides fenvalerate (90g ai/ha) and permethrina (100 g ai/ha) gave satisfactory control of boll weevil (León 1980). However, in 1980, the pyrethroids fenvalerate, permethrina, cypermethrina and deltamethrina at 150, 150, 80 and 12.5 g ai/ha did not controlled boll weevil populations in the Yaqui, Valley (Guerra 1981). Pacheco (1985), reports that pyrethroids such as cyfluthrin, fluvalinate, and permethrin at 25, 200 and 170 g ai/ha respectively showed the same efficiency and were statistically similar to azinphos methyl 500 g ai/ha, against boll weevil. In 1996, cyfluthrin 37.5 g ai/ha showed 74.46% mortality of boll weevil after 48 h of insecticide application (Pacheco 1996).

Monitoring of resistance is an indicator of the selection pressure generated on an insect population. These data together with those obtained in efficacy tests can be used to detect any shift in response and reinforce resistance management actions at the regional level. These data have been generated in the Yaqui, Valley for several years and had been the support to evaluate the impact of an insecticide management strategy established in cotton (Martinez-Carrillo and Pacheco 1990).

In this paper data on the response of boll weevil populations to cyfluthrin in field and laboratory evaluations are presented and discussed with respect to resistance and resistance management strategy.

Materials and Methods

Boll weevil populations were obtained from infected bolls collected in commercial cotton fields during July, August and September in 2002 up to 2003. This material was maintained in emergency cages until adults were present. Boll weevils of different origins and edges were also obtained from boll weevil pheromone traps.

Laboratory bioassays were performed through the glass vial technique as indicated by Kanga et al. 1995. Five insects were introduced in 20 ml scintillation vials coated with diagnostic dosages of 2.5 (Kanga et al 1995) and 5 µg/ml of cyfluthrin. Mortality was determined 48 h after exposure. Weevils were considered dead if no movement was observed when the insect mouth parts were pinched with forceps.

Field bioassays were done by spraying 50 g ai/ha of cyfluthrin on cotton plants. The application was realized with a 20 l motorized backpack sprayer, calibrated to release 450 l/ha. Once sprayed 80 adult boll weevils (3-5 days old) in four replicates of 20 adults each, were introduces in 25 cm diameter by 35 cm height organdy cages placed in the terminal of the cotton plants. Mortality was determined 48 h after application.

Analysis of variance was performed on mortality data, corrected for control mortality (Abbott, 1925).

Results and Discussion

Data of laboratory bioassays with cyfluthrin on boll weevil populations from the Yaqui, Valley, Sonora, are presented in Table 1. Higher survivorship of boll weevil adults collected from infested cotton bolls than those collected from pheromone traps was observed. This situation may be due in part to differential age structure in those insects collected from pheromone traps.

Table 1 also shows that survivors increase in bioassays realized after July in both pheromone trap and cotton boll reared weevils. This may be explained because the selection pressure is higher as the cotton season progresses, and susceptibility to pyrethroid and other insecticides decreases. This trend has been detected through the years of evaluation.

In order to correlate data obtained in laboratory bioassays with field performance, cyfluthrin 50 g ai/ha was evaluated under field conditions. Results indicated 6.0 and 7.5 percent mortality for 2002 and 2003 boll weevil populations. Data obtained in 1996 showed 74.46% mortality with 37.5 g ai/ha of cyfluthrin (Pacheco 1997). Thus it is an indication of decreased susceptibility. The low mortality observed in 2002 and 2003 corresponds well with high survivorship observed in laboratory bioassays and confirms that boll weevil populations from the Yaqui Valley have been selected for resistance to pyrethroids.

Pyrethroids have been used extensively in the Yaqui Valley for different insect pest in various crops. They should not be used in cotton for boll weevil control and have to be restricted to one month in middle of the cotton season for other insect pests as it has been suggested in the strategy proposed to manage insecticide resistance in this region (Martinez-Carrillo and Pacheco 1990).

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Table 1. Percent boll weevil adults surviving two diagnostic dosages of cyfluthrin in the Yaqui, Valley. Sonora. Mexico.

Weevils obtained from	Month	Dosage µg/ml	Year 2000	2001	2002	2003
Pheromone traps	July	2.5	25.83	24.9		
Pheromone traps	July	5	20.67	15.5		
Cotton bolls	July	2.5	44	64.1		94.2
Cotton bolls	July	5	14.48	30.2		87.2
Pheromone traps	August	2.5	41.26	40.9		80.5
Pheromone traps	August	5	39.31	26.3		67.2
Cotton bolls	August	2.5	50.61	83.1	69.9	96.1
Cotton bolls	August	5	41.32	64.7	32.5	89.8
Pheromone traps	September	2.5	30.63	81.3		
Pheromone traps	September	5	10.99	34		
Cotton bolls	September	2.5		70		
Cotton bolls	September	5		68		