2002 BELTWIDE COTTON CONFERENCES, ATLANTA, GA – JANUARY 8-12

MALATHION ADHERENCE TO BOLL WEEVILS EXPOSED TO BWACT AND SUBSEQUENT MORTALITY

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Abstract

Hexane washes of boll weevils (*Anthonomus grandis* Boheman) exposed to Boll Weevil Attract and Control Tubes (BWACT) showed that the amount of malathion adhering to individual weevils increased as time on BWACT increased. Similarly, mortality increased as malathion accumulation on individual weevils increased, and as time spent on fresh BWACT increased. Malathion accumulation and mortality was not correlated as time spent on BWACT aged in the field for five months increased.

Introduction

An original attract-and-kill device for boll weevils, *Anthonomus grandis* Boheman, was developed some years ago (McKibben et al. 1990). This device, the boll weevil bait stick, consisted of a vertically-oriented wooden broomstick coated with a concoction, the active ingredients of which were grandlure (a synthetic form of the boll weevil's aggregation and sex pheromone), cottonseed oil, and an insecticide. Plato Industries, Houston, TX, is the sole commercial provider of bait sticks now marketed as Boll Weevil Attract and Control Tubes (BWACT). BWACT are similar to the original bait sticks except that instead of being solid wooden sticks, they are hollow, cardboard-like tubes. According to the BWACT label, malathion comprises 37.27% of the BWACT coating.

The objectives of this paper were determine the amount of malathion adhering to individual boll weevils as time spent on a BWACT increased, the relationship between malathion adherence and subsequent mortality, and the relationship between time spent on a BWACT and mortality.

Materials and Methods

BWACT were supplied by the Southeastern Boll Weevil Eradication Foundation, Montgomery, AL after that organization had received BWACT from Plato Industries Inc, Houston, TX for use in boll weevil eradication. Boll weevils were from a long-established laboratory colony at Mississippi State, MS.

BWACT from a box in storage for about five months ("fresh")and BWACT from the same box, but held in the field during that time period ("old;" 2 September 99 to 20 January 2000) were used in the test. Groups of 20 boll weevils, one at a time, were placed on either the fresh or old tubes for 0, 5, and 10 sec intervals and at sequential 10 sec intervals up to 100 sec. To determine mortality, 10 weevils from each group were put into 15- by 60-mm plastic petri dishes, one per dish, and mortality was recorded 24 h later. To determine malathion adherence to individual boll weevils, each of the other 10 weevils was dropped into 2-ml autosampler vials to which 1 ml hexane was added.

A Hewlett-Packard 5890 gas chromatograph equipped with a flame photometric detector, an auto-sampler, and ChemStation (Hewlett-Packard) software was used to quantitate malathion residues. The parameters of our residue analyses method were as follows: Injector temperature, 200° C; oven program, 120° C initial temperature with a 25° C per min increase to 250° C for 1 min, then a 25° C per min increase to 280° C for 4 min. A Hewlett-Packard Ultra-1 cross-linked methyl silicone gum phase column (25 m by 0.32 by 0.52 µm) with a 2.65 ml per min flow of helium was used. Retention time of malathion was 5.597 min. Malathion content was calculated as ng malathion per µl hexane. All plots, regression equations, and r^2 values were produced with Sigma Plot® 5.0 (SPSS Inc., Chicago, IL).

Results and Discussion

The curves depicted in Figs. 1 and 2 are almost identical and show mortality increasing sharply to 100% as malathion adherence to an individual weevil increased and as time spent on a fresh BWACT increased. In contrast, neither malathion adherence nor mortality increased as time spent on an old BWACT increased; nevertheless, mortality on the old tubes was greater than the 0% observed in the controls suggesting the presence of some amount of malathion on old BWACT.

Mortality on fresh BWACT was generally 100% for weevils exposed to fresh tubes for more than 20-sec. Mortality rose sharply as malathion adherence increased beyond 1-µg/weevil and, except for one case, resulted in 100% mortality for all eight points beyond 1.5-µg.

The amount of malathion adhering to individual weevils increased as time spent on fresh BWACT increased (Fig. 3). Unlike the strong sigmoidal relationships depicted in Figs. 1 & 2, a significant linear relationship was seen in Fig. 3. Weevils on old BWACT did not accumulate more malathion as time of exposure increased.

Generally, high mortality of weevils exposed to BWACT did not occur until time spent on fresh BWACT exceeded 5 sec or malathion adherence exceeded 1-µg/weevil. After 5 sec or 1-µg/weevil, mortality rose sharply to 100%. Malathion adherence to individual weevils also increased with time, but the increase was linear and not so steep as the increase in mortality associated with both time and malathion adherence. Mortality at or near 100% can be expected when 1.5-µg of malathion or more adheres to individual weevils. The exposure time required for a weevil to accumulate this amount of malathion is relatively short for fresh BWACT and lengthens as time in the field or in storage increases. Malathion accumulation will depend largely on the original quality and age of BWACT and the environmental conditions to which they are subjected. These factors will affect the rate at which malathion will be available to be picked up from the tube surface.

Acknowledgments

We thank Joe Stewart, Bill Kellum, and Debra Gary for technical assistance.

References

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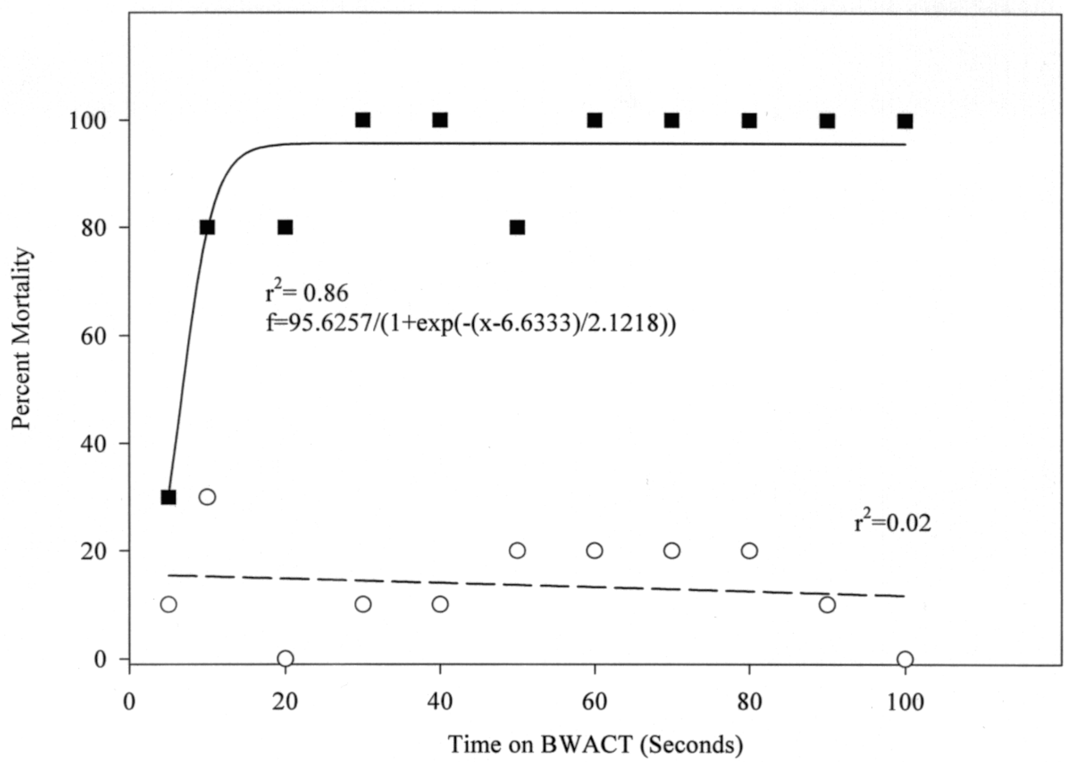

Figure 1. Percent mortality of boll weevils as time spent on BWACT increased. Squares = fresh tubes; circles = tubes in field 5 months.

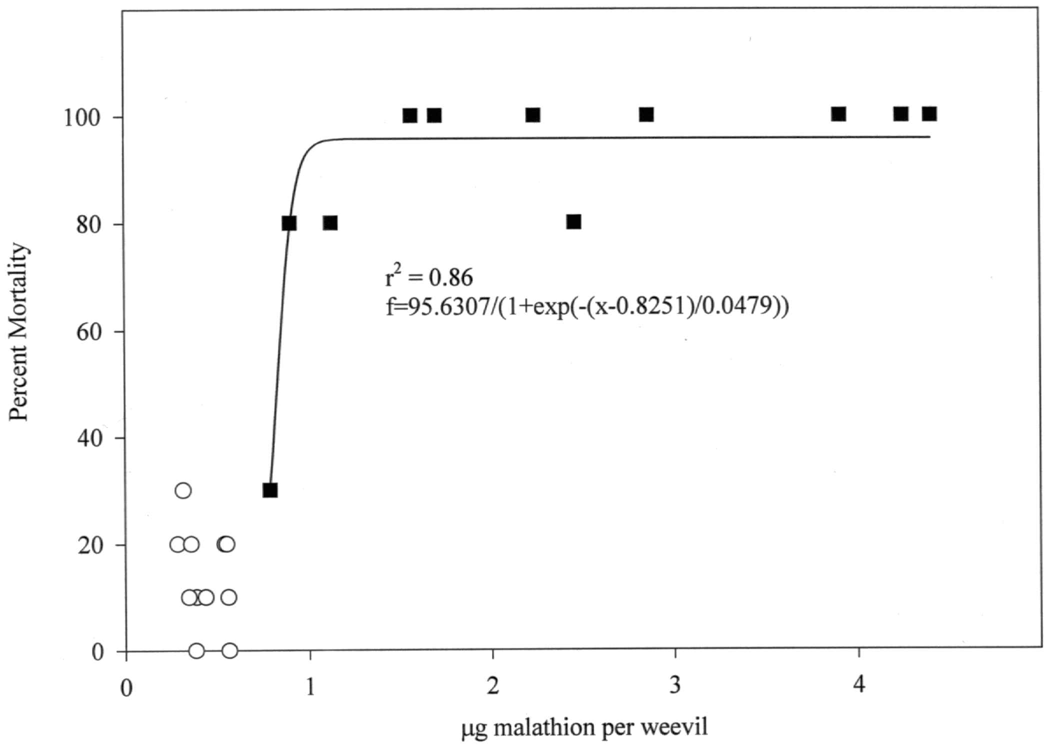

Figure 2. Percent mortality of boll weevils as malathion accumulation increased. Squares - fresh tubes; circles = tubes in field for 5 months.

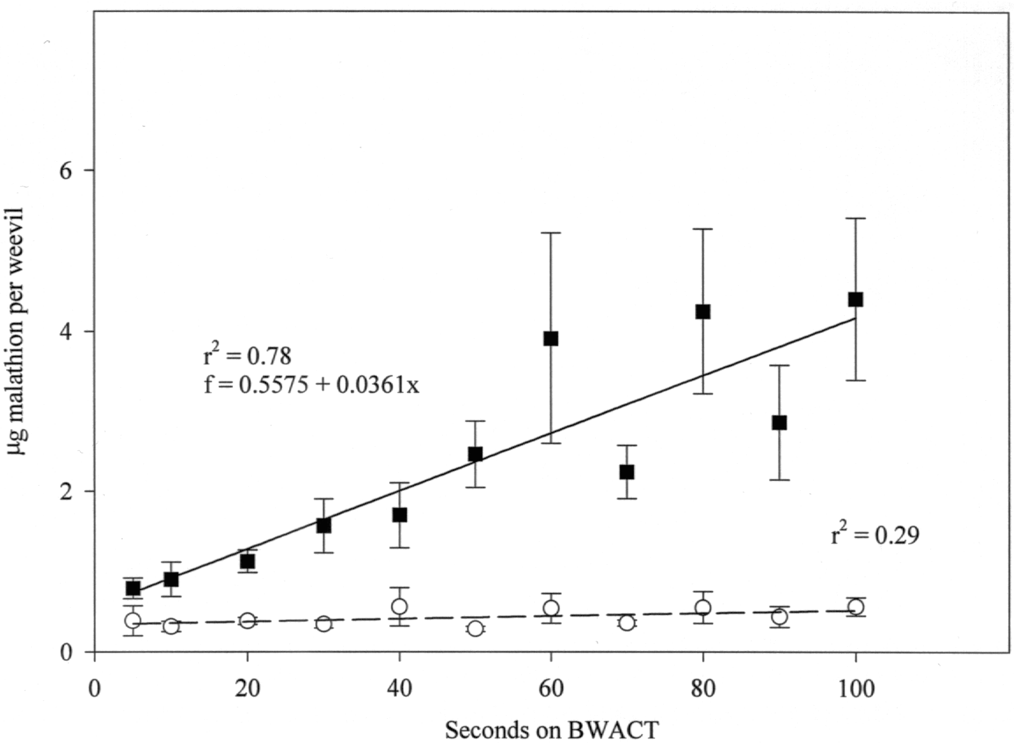

Figure 3. Malathion accumulation on individual weebvils as time on tubes increased. Squares = fresh tubes; circles = tubes in field 5 months.