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IDENTIFYING THE PREDATORS THAT INTERFERE WITH BOLL WEEVIL TRAPPING AND EVALUATING A LURE/INSECTCIDE COMBINATION

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Abstract

A modified boll weevil trap was evaluated to determine if it would reduce the number of unwanted predators that interfere with trapping efficiency. Arthropods responsible for interfering with boll weevil trap captures were surveyed from both trap types. A separate study was conducted to evaluate boll weevil trap efficiency when grandlure was combined with an insecticide (Combo Lure®) dispenser versus the insecticide DDVP and grandlure in separate dispensers. The modified trap did not reduce the unwanted arthropods. Ninety-eight percent of the arthropods came from 13 different spider families representing 14 known species, and 15 were identified to genus. The spider families most commonly collected from weevil traps were Anyphaenidae, Araneidae, Lycosidae, and Tetragnathidae. The combination lure-insecticide (Combo Lure®) attracted boll weevils as well as the lure and insecticide presented in separate dispensers. These two treatments were not significantly different from one another in killing captured weevils, and other arthropods caught in the trap, and both treatments killed significantly more weevils than a grandlure dispenser in the absence of the insecticide dichlorovos.

Introduction

The successes of boll weevil eradication throughout the United States has largely been due to the ability to monitor boll weevil (*Anthonomus grandis grandis* Boheman) with grandlure-baited traps. The threshold for treatment during active eradication is one weevil captured per trap over a weekly trapping interval. An impediment to trapping efficiency is predation of boll weevils in or on the trap by insects and spiders once they enter the capture area of the trap (Armstrong et al. 2005). In 2004 and 2005, Armstrong et al. (2005) reported that of 768 boll weevil trap inspections made in the Rio Grande Valley, 185 (24%) were affected by webbing or predation from spiders (Arachnidae) or other arthropods. The Texas Boll Weevil Eradication Foundation uses kill strips impregnated with 10% wt:wt dichlorovos DDVP [2,2,-dichlorovinyl dimethyl phosphate]), (Hercon Environmental, Emigsville, PA) placed in traps along with the standard 10 mg grandlure dispenser (Scentry Biologicals, Billings, MT) to kill boll weevils in the trap and prevent escape (Suh et al. 2003). A new three-component lure (Combo Lure® that contains 25 mg grandlure, 30 mg eugenol, and 90 mg dichlorovos has been formulated by Plato Industries (Houston, TX) to save time, labor and costs of maintaining boll weevil traps by extending the length of operation and by only changing one combined lure/kill strip. An extended operation of traps could reduce material costs, especially as most eradication zones enter a maintenance phase where traps are operated for boll weevil detection and not for decision making on when to treat individual fields. The objectives of this study were to 1) identify the arthropod species that interfere with boll weevil trapping, 2) determine if a trap modification would reduce the number of arthropods interfering with boll weevil trapping, and 3) compare the efficacy of a new three-component lure (ComboLure®) to grandlure and dichlorovos used in separate septa for boll weevil attractiveness and reduction of arthropods that interfere with trap efficiency.

Materials and Methods

Arthropod Identification and Trap Modification

Twenty Texas Boll Weevil Eradication Foundation (TBEF) traps were supported by a 1 m conduit pole and baited with a standard 10 mg grandlure. Traps were inspected weekly and the grandlure septa changed every two weeks, just as Boll Weevil Eradication personnel would service them. Because we wanted to identify the spiders that inhabit the traps, we did not use dichlorovos (DDVP) kill strips. Ten of the traps were modified by inverting a 2-L funnel 0.3 m from the ground surface to prevent arthropods from climbing the support pole and interfering with trap captures (Fig. 1).

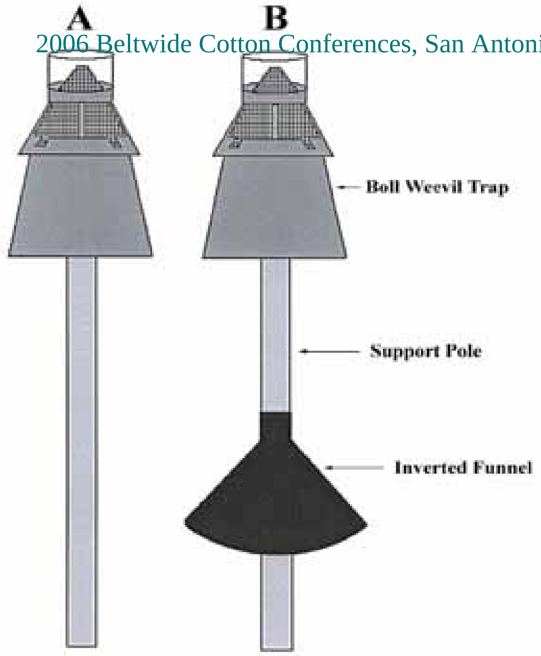

Fig 1. Texas Boll Weevil Eradication Trap (A) and a modified Texas Boll Weevil Eradication Trap (B) with a 2 L funnel attached to the support pole approximately 0.3 m from the ground level.

Ten paired replicates of the two trap types were compared by placing a pair 50 m apart, with the next pair being deployed 100 m away on the Russell Plantation, near San Benito, TX, 23 February to 22 March 2004. Traps were established along brush-lined drainage canals oriented to the east and west, typical Rio Grande Valley cotton production, with brush and cover along the channel canals enhancing boll weevil trap captures (Spurgeon et al. 1998, Sappington and Spurgeon 2000). Traps were inspected weekly and the contents emptied into a 20 ml vials. Boll weevils were determined to be dead or alive in the laboratory. Captured spiders were noted as being on the interior or exterior of the trap, and if dead or alive. Each trap was examined for spider webbing that blocked the entrance of the cone. All arthropods (insects and spiders) were stored in 90% ethyl alcohol. The arachnids were sent to New Mexico State University, Department of Entomology, Plant Pathology and Weed Science (DBR) for identification.

Lure/Insecticide on Combined or Separate Septa Three lure/insecticide treatment combinations were compared for boll weevil attractiveness, boll weevil trap mortality, and arthropod interference of trap efficiency. The treatments included 1) Combo Lure® (Plato Industries, Houston, TX) which contains 25 mg grandlure + 30 mg eugenol + 90 mg dichlorovos (DDVP), 2) an extended lure (Hercon Environmental, Emigsville, PA) containing 25 mg grandlure + 30 mg eugenol with a 10% (60 mg) DDVP strip, and 3) an extended lure consisting of 25 mg grandlure + 30 mg eugenol only. Newly designed boll weevil traps (Technical Precision Plastics, Mebane, NC) that have a plastic catch cone were used for each of the three treatments and replicated 16 times. A lure treatment was randomly assigned to a trap within a replicate. Treatment traps within a replicate were spaced at 50-m intervals, while replicates were deployed 100 m apart. Traps were inspected weekly from 15 February to 22 March 2005 where all boll weevils and other arthropods were removed and determined to be alive or dead.

Statistical Analysis

Analysis of variance for trap modification was performed on the number of arthropods (weevils, spiders and other insects) by trap type and week. These variables were arcsine square root transformed, and the weekly means compared using paired t-test at P=0.05 (SAS 2001). The proportions of obstructed (spider webbed) trap entrances were compared for the two trap types using a Chi-square test (SAS 2001). Observations for the evaluation of extended lures such as the number of live/dead boll weevils captured per week, the number of live/dead spiders caught per week, and the proportion of traps that exhibited obstructed entrances were statistically analyzed by PROC GLM (SAS, 2001). Percentage mortality for dead arthropods was calculated on a weekly basis by taking the number of dead over the total number of captured arthropods and multiplying by 100. This value was then arcsine square root transformed. Means were separated by the Ryan-Einot-Gabriel-Welsch multiple range test (*P*=0.05), (SAS, 2001).

Results and Discussion

Arthropod Identification and Trap Modification

Ninety-eight percent of the arthropods caught in the modified and TBEF traps other than boll weevils were Arachnids. There were 13 identified and one unknown families of spiders representing 35 different genera captured from both the TBEF and modified traps (Table 1).

Table 1. Spider taxa collected from the inside or outside boll weevil traps over a four week period, I = found inside trap, O = found outside the trap, R = rare (<1%);O = occasional (1 – 5%); C = common (> 5%), Cameron County TX.

Taxa	Location	Frequency
Anyphaenidae		
Hibana futilis (Banks)	I / O	C
Hibana sp.	I	R
Araneidae		
Araneid	I / O	C
Araneid undetermined	I / O	C
Araneus sp.	I / O	R
Eustala bifida f. O. P.-Cambridge	I / O	R
Eustala sp.	I / O	R
Metazygia sp.	I	R
Metazygia wittfeldae McCook	I	O
Metazygia zilloides (Banks)	I / O	R
Metepeira minima Gertsch	I	C
Neoscona arabesca (Walckenaer)	I / O	C
Larinia sp.	I	R
Undetermined		
Clubionoid	I	R
Gnaphosidae		
Micaria sp.	I	R
Lycosidae		
Allocosa cf. floridana (Chamberlin)	I	R
Pardosa sp.	I / O	C
Pirata sp.	I	R
Linyphiidae		

Table 1 continued

Ceraticellus sp.	O	R
Eperigone sp.	O	R
Miturgidae		
Cheiracanthium inclusum (Hentz)	I / O	O
Philodromidae		
Tibellus sp.	O	O
Pholcidae		
Pholcid	I	R
Pisauridae		
Dolomedes sp.	O	R
Salticidae		
Messua limbata (Banks)	I	R
Pelegrina galathea (Walckenaer)	O	R
Pelegrina sp.	O	R
Phidippus audax (Hentz)	I	O
Thiodina sp.	O	R
Salticid undetermined	I / O	O
Tetragnathidae		
Tetragnatha pallescens F. O. P.-Cambridge	I	R
Tetragnatha sp.	I / O	C
Theridiidae		
Undetermined	O	R
Thomisidae		
Misumenops californicus (Banks)	I	R
Synema viridians (Banks)	I	R

Seven of the spiders were classified as being common in the traps; four are from the family Araneidae. Other families found with common frequency were Anyphaenidae, represented by *Hibana futilis* (Banks), Lycosidae, represented by a *Paradosa* sp., and Tetragnathidae represented by a *Tertragnathid* sp. Other arthopods collected from the traps included 2 earwigs (Dermaptera), 4 ants (Formicidae), 3 cockroaches (Blattellidae), and 5 longhorned beetles (Cerambycidae). There was no significant difference in the number of spiders found on modified traps versus TBEF traps (t=0.89, df = 78, P>t=0.37), and the average number of spiders found per trap/week was ≈2.0. The number of boll weevils captured weekly in the modified trap versus the TBEF trap was not significant (t=0.78, df = 78, P>t=0.44). Weekly boll weevil trap captures from both trap types ranged from 25 to 35 over the four weeks in March. The proportions of traps with the cone entrance obstructed for modified versus TBEF traps was not significant (χ^2 = 052, df = 1, P = 0.82), and ranged from 20 to 60 % obstruction.

Lure/Insecticide on Combined or Separate Septa

The overall model for differences in capture of weevils for the Combo Lure® extended Lure + DDVP on separate septa, and the extended lure with no DDVP was not significant (F=1.03, df=2, 239, P=0.36). Weekly mortality of captured weevils (F=19.2, df=2, 34, P>0.0001) was significantly higher for the first four consecutive weeks of trapping for the Combo Lure® and extended lure + DDVP in separate septa as compared to the extended lure with no DDVP. The proportion of traps with obstructions in the cone entrance was not significant (χ^2=0.16, df=2, P=0.92) for any treatment and averaged ≈ 20% over the five consecutive weeks of trapping. The number of spiders captured on the traps was not significant for any of the lure treatments (F=0.71, df=2, 39, P>0.49). The insecticide DDVP causes mortality to boll weevils, but does not appear to be active against spiders based on the fact that obstruction and total spider numbers per trap were not significantly different for any of the three treatments.

The results presented herein should be viewed as preliminary, but we have observed high arthropod activity, especially spiders, during February and March when trapping for boll weevils in the Rio Grande Valley. It has been our observation that temperatures reach 50˚ C during the summer and into the fall resulting in a shorter survival time for arthropods captured in the clear plastic top of the boll weevil trap. However, it is apparent that spiders play a significant role in the efficiency of south Texas boll weevil trapping in early spring by directly preying on captured boll weevils and by webbing the entrance of the trap. The Combo Lure® was as attractive to boll weevils as the extended lure + DDVP, or the extended Lure alone, and also provided the same mortality to boll weevils when compared to the extended lure + DDVP. Spiders were not deterred from traps regardless of the use of DDVP, and the presence of obstructed cones entrances was not different for the Combo Lure®, extended lure + DDVP or the extended lure used alone.

Acknowledgments

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