AN INTENSIVE BOLL WEEVIL TRAPPING EFFORT IN SOUTHERN MISSOURI

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Abstract

The impacts of the heavy boll weevil (*Anthonomus grandis grandis* Boheman) pressure of the 1995 growing season and the severe winter of 1995-96 on boll weevil populations during the 1996 growing season are discussed. Winter mortality was extensive enough to virtually eliminate the weevil as an economic consideration in the 1996 Missouri cotton crop. However, boll weevils were not effectively extirpated from Missouri by the cold weather, and populations resurged at the end of the season.

Introduction

The boll weevil (*Anthonomus grandis grandis* Boheman) is historically a relatively minor pest in Missouri cotton. However, a succession of mild winters from 1991 through 1995 allowed boll weevil populations to increase tremendously, and economically damaging infestations became widespread by the 1995 growing season (Table 1)(Williams et al. 1996).

Winter kill is the most significant factor affecting population dynamics of the boll weevil in Missouri, and we have engaged in an active research program to improve our understanding of this factor (Sorenson and House 1995, Sorenson and George 1996, Sorenson et al. 1996); this effort continued through the winter of 1995-96. We monitored the temperatures under leaf litter in boll weevil habitat at locations across the Bootheel and we examined leaf litter samples for the presence of boll weevils.

Interest among Missouri cotton growers in comprehensively measuring the impact of winter kill on the following year's populations increased tremendously when it became apparent that this winter was the most severe in several years. The Missouri Department of Agriculture (MDA), in cooperation with the University of Missouri, initiated several trapping programs to determine the impact of the winter on subsequent populations, to determine the need for pin-head insecticide applications, and to assess the distribution and intensity of populations at the end of the growing season.

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The paper describes the efforts made to monitor boll weevil populations in Missouri and examine the impact of the winter of 1995-96 on boll weevil populations and future management.

Methods and Materials

Leaf Litter Analysis

Twenty-seven 1m^2 samples of leaf litter were collected from woodlot boll weevil wintering habitat throughout the Missouri cotton production region during January and February of 1996. In each sample, all un-consolidated organic matter down to the soil surface was removed and placed into plastic bags for transport to the lab. Each sample was carefully searched for live boll weevils and the remains of dead boll weevils. The presence of other living or dead arthropods was also noted.

Monitoring Temperatures in Overwintering Habitat

Individual electronic temperature loggers with external sensors (Onset Corp.) were deployed in boll weevil wintering habitat at seven locations in southeastern Missouri. Locations were chosen to represent the range of possible habitats (bottomlands versus upland sites) and latitudinal gradients in the region. The sensor was placed under the leaf litter on the soil surface; this placement should represent a conservative estimate of the minimum temperatures experienced by boll weevils in the vicinity. Temperature data were collected on a laptop computer at two week intervals. On occasions following severe cold periods, the sites were examined early in the morning for the presence and depth of frost in the leaf litter.

Spring Emergence Trapping

Three spring emergence trapping operations were conducted.

"Hotspot" Trapping. In the first trapping project, three traps were deployed in the vicinity of cotton at each of twelve sites historically identified as boll weevil hotspots. These same sites have been monitored season long for six years. The traps were deployed in early March and checked weekly through November.

Region-wide Spring Distribution. The second program consisted of a four mile by four mile grid across the entire southeastern Missouri cotton production region. Three traps were placed in the cotton field nearest each grid intersection and were monitored weekly for four weeks in June and July. Trap data were entered into a mapping program (Atlas Pro) to generate weekly and comprehensive distribution maps.

Intensive Spring Trapping in High-Risk Areas. The third operation consisted of the deployment of one trap per 10 acres in all cotton fields in Dunklin and Stoddard Counties. These counties have historically had the greatest boll weevil pressure due to the presence of a relative abundance of well-drained, high quality overwintering habitat (Sorenson and George 1996). This program was managed by the MDA with the cooperation of the University of Missouri and was staffed with contract trappers. Traps were checked every week or two weeks for eight weeks in June and July. Data are being used to develop distribution maps for the two counties.

Late Summer Trapping Program
The MDA re-deployed traps across the entire production region for eight weeks August-October. Traps went out at the rate of one trap per 20 acres. Traps were checked every two weeks. Data were used to develop a map of late summer boll weevil densities.

Results and Discussion

Leaf Litter Analysis
No live boll weevils were found in any of the 27 samples. Approximately 97 dead weevils were recovered; the exact figure cannot be given because many of the specimens were fragmentary. Approximately 20 of the recovered weevils came from one sample from near Senath, MO. Numerous live arthropods were recovered, including spiders, Lygus plant bugs, bean leaf beetles, and centipedes.

While the number of samples and recovered boll weevils were clearly inadequate to accurately define over-wintering survival of the insects, these data do suggest very high winter mortality. The presence of numerous live arthropods of other species in the samples suggests our sampling technique was effective for detecting live arthropods.

Monitoring Temperatures in Overwintering Habitat
Season-long minimum temperatures in overwintering habitat ranged from 20°F at two sites to 10°F at one site. Maximum duration at or below 15°F at any site was approximately 4 hours; maximum duration at or below 20°F was approximately 10 hours. Frozen water from the leaf litter surface to the ground was found at all sites the morning following the two most severe bouts of cold. One of these episodes was immediately preceded by heavy rain.

The presence of frozen water in the leaf litter may result in higher boll weevil mortality than might be indicated by temperature alone. Sorenson and George (1996) found evidence that the presence of free water greatly increased the mortality of boll weevils exposed to sub-freezing temperatures.

Spring Emergence Trapping
The results of the first two trapping programs may be compared to those from previous years.

"Hotspot" Trapping. The hotspot program found numbers of weevils much lower in 1996 than those of 1995 and comparable to those of 1993 and 1994 (Figure 1). While it appears that emergence began later in 1996 than in 1995, which would be consistent with the findings of Jones and Sterling (1979), observation of the entire emergence curve suggests that the apparent delay may be due to an inability to detect the less abundant early emergers. Peak emergence occurred at approximately the same time each year but intial emergence could not be detected in 1992 and 1996 because numbers were low.

Region-wide Spring Distribution. The results of the area wide trapping program again suggest substantially reduced populations in the spring of 1996 as compared to 1995 (Figures 2 and 3). Populations were lower throughout the region with the possible exception of some areas along the northern reaches of Crowley's Ridge in Stoddard County.

Intensive Spring Trapping in High-Risk Areas. While no baseline exists for this data set, and analysis of these data continues, preliminary examination of this information collaborates the findings of the region-wide program. Higher numbers of weevils and more traps with at least one weevil were found in portions of Stoddard County than in other regions of these two counties.

Late Summer Trapping Program
Boll weevils were found throughout the southeastern Missouri cotton growing region by the end of summer. High concentrations of weevils occurred in the same areas of Stoddard County that had relatively high numbers in the spring, and in the southwestern corner of the Bootheel. Weevil numbers at the end of the season were approximately 45% lower than those found in traps in some of the same localities the previous year.

Insecticide use in Missouri cotton during the 1996 growing season was very low (see the Insect Loss Report elsewhere in these Proceedings). In addition, the crop cut-out early. These factors probably contributed to substantial population recovery during the growing season and subsequent dispersal across the region.

All indications point to very heavy winter mortality during 1995-96. Mortality was sufficient to reduce the economic significance of the boll weevil to more traditional levels. However, mortality was not sufficient, following the high numbers of 1995, to effectively accomplish eradication, as many growers and others had hoped. Those conducting eradication programs in Missouri in the future will need to carefully evaluate both Fall populations and winter weather. Substantial reductions in the costs of an eradication program will probably not be realized after one severe winter if initial Fall populations are very high.

(Note: winter climatic data and MDA boll weevil distribution maps can be obtained by contacting the authors.)

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Table 1. Economic infestations of boll weevils in Missouri, 1988-96 (From Beltwide Insect Loss Reports).

Year	% Acres above Threshold	% Yield Reduction
1988	1.0	.03
1989	45.5	4.55
1990	0	0
1991	0	0
1992	50.0	5.00
1993	85.5	3.42
1994	68.0	2.40
1995	85.2	2.56
1996	4.7	<1.0

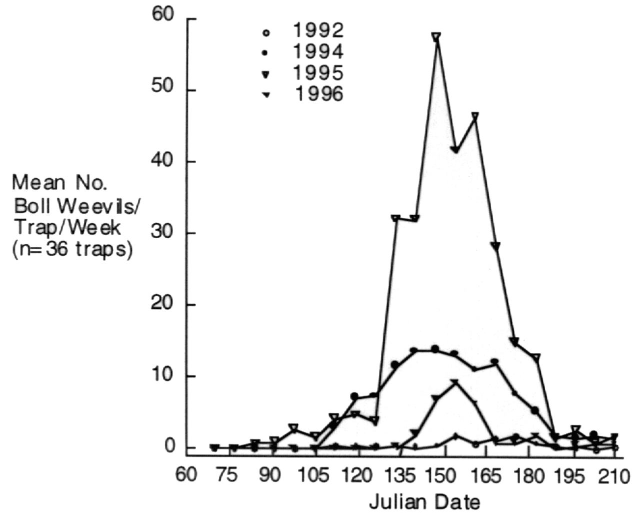

Figure 1. Mean boll weevil trap captures at twelve locations in southeastern Missouri, 1992-96. Open inverted triangles are 1995; closed inverted triangles are 1996.

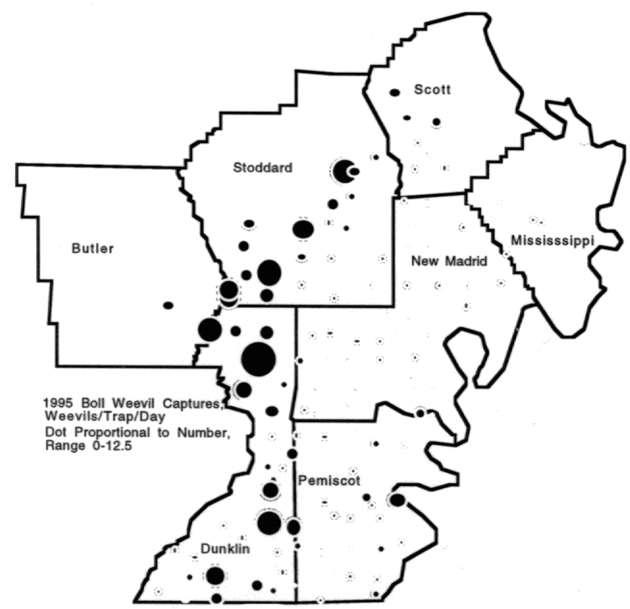

Figure 2. Distribution and density of emerging boll weevils, 1995.

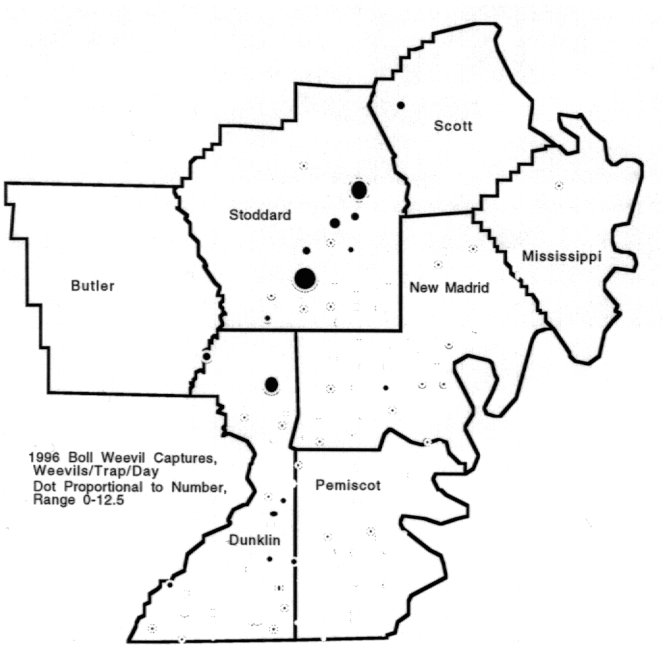

Figure 3. Distribution and density of emerging boll weevils, 1996.