2004 BELTWIDE COTTON CONFERENCES, SAN ANTONIO, TX – JANUARY 5-9

ABUNDANCE OF HELIOTHINE MOTHS IN TRAPS AT THE INTERFACE OF Bt COTTON WITH VARIOUS CROPS: 2003

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Abstract

Heliothine moths were trapped in south Georgia from June to November 2003 using pheromone baited wire-traps. Corn earworm traps were located in Berrien, Colquitt, Irwin, and Turner Counties from early June to late October/early November. Tobacco budworm traps were placed in Berrien, Colquitt, and Irwin Counties and monitored from early- to mid-July until 24 October. Traps for both moths were placed at five different crop interfaces: 1) Bt cotton/Bt cotton, 2) Bt cotton/non-Bt cotton, 3) Bt cotton/Corn, 4) Bt cotton/Peanuts, and 5) Bt cotton/Soybeans. Moths in traps were counted and pheromone lure replaced weekly. The pheromone trap data failed to demonstrate any consistent relationship between the abundance of either species of heliothine moth (corn earworm and tobacco budworm) and makeup of the Bt cotton/crop interface. Location (county) did appear to affect the number of moths trapped – more corn earworm moths were captured in Irwin County than in the other counties. Irwin County yielded 29,537 corn earworm moths and 15,679 tobacco budworm moths. Berrien County numbers were 12,778 and 9,028 while Colquitt County had 10,411 and 15,535. Turner County had 12,800 corn earworm moths.

Introduction

The corn earworm, *Helicoverpa zea*, and the tobacco budworm, *Heliothis virescens*, are important pests of cotton, *Gossypium hirsutum*, in the southern United States. Both species are polyphagous and have been reported to feed on over 130 hosts between them (Tietz 1972, cited in Leigh et al. 1996). Both species attack several important row crops and use wild hosts when cultivated crops are not available (Harding 1976). Williams (1997) reported the complex to be the most damaging and costly insect pests of cotton in 13 out of 18 years from 1979 through 1996. The trend has appeared to continue subsequently -- as recently as this past year, they were listed as the most damaging insects (Williams 2003). In Georgia, damage losses and control costs in cotton alone have been estimated to be $40,000,000 per year for these pests (Guillebeau et al. 2003).

The capability of moths of both species to disperse over long distances (Westbrook 2003) plays a major role in their management. Moths traveling several kilometers may play a role in the initial infestation of fields during the early spring. Adults emerge from overwintered pupae from March through May in south Georgia and the adults move into various wild hosts and field corn as the initial hosts. Later generations expand into other row crops such as cotton, peanuts, and soybeans.

Understanding the relative timing and spatial abundance of heliothine moths is critical for managing the susceptibility of these pests to Bt-transgenic cottons and insecticides. This information also is invaluable for developing large-scale community-wide pest management strategies. This study is part of a multi-state project examining the spatial dynamics of heliothine moths in relation to Bt-transgenic cotton fields.

Methods

Corn earworm pheromone-baited wire traps similar to those described by Hartstack et al. (1979) were placed at the interface of 5 crop pairs in 4 counties in south Georgia (Table 1 for locations and dates) during the summer of 2003. The five interfaces included: 1) Bt cotton/Bt cotton, 2) Bt cotton/non-Bt cotton, 3) Bt cotton/Corn, 4) Bt cotton/Peanuts, and 5) Bt cotton/Soybeans. Traps were sampled weekly in all locations. On each sampling date, moths were retrieved from the traps, returned to the lab for counting, and frozen for future analyses. The pheromone was replaced at each sampling. Moth monitoring was initiated the first week of June and continued through the first week of November.

The same trap designs and procedures were used in Berrien, Colquitt, and Irwin Counties for tobacco budworm trapping, except only one trap was placed at each interface of the 5 crop pairs (Table 1). Again, moths were retrieved from the traps weekly, returned to the lab for counting, and frozen for future analyses. Fresh pheromone lure was added at each sampling. Monitoring began the first week of July and ceased the third week of October.

Results and Discussion

Corn earworm trap numbers were comparable for Berrien, Colquitt, and Turner Counties throughout the season, with two nominal peaks in late July and late August (Fig. 1). Moth numbers were substantially higher in Irwin County, with a very pronounced peak in the 4th week in August (5941 moths collected in the 10 traps). In Berrien County, 10 traps yielded 1890 moths during the fourth week of July, the highest peak for this county. The fourth week of August was the peak capture week in both Colquitt and Turner Counties with a total of 1930 and 2753 moths, respectively, collected during this period (Fig. 1).

Corn earworm abundance did not appear to correlate distinctly with the crop interface where the traps were located (Fig. 2). In the Bt Cotton/Bt Cotton interface in Berrien County, 4131 moths were captured throughout the summer. In Colquitt County, the largest number of moths (2616) was collected in the Bt Cotton/Non Bt Cotton interface. In Irwin County, the largest number of moths (9576) was collected in the Bt Cotton/Peanut interface, whereas in Turner County, 3306 moths were captured in the Bt Cotton/Soybean interface. (Fig. 2).

Tobacco budworm numbers peaked the second week of August with 7475 moths captured in 15 traps (498.3 moths/trap). More moths were collected the third week of August than any other week in Irwin County with 3192 captured in 5 traps. The second week of August was the peak week in both Berrien and Colquitt Counties with 2294 and 2638 moths captured, respectively. (Fig. 3).

Bt Cotton/Bt Cotton was the highest yielding interface throughout the season in Colquitt County with 4133 moths collected, although the Bt cotton is a wholly unsuitable host. In Berrien and Irwin Counties, the highest yielding interface was Bt Cotton/Peanuts. This interface provided 2777 moths in Berrien County and 6358 moths in Irwin County. (Fig. 4).

The number of moths captured throughout the season appeared to be determined more by location (county) than by the crop interface. Irwin County traps typically contained more moths than the other counties. Two factors that may have played a role in influencing this trend were crop maturity and corn acreage. Crop maturity in fields adjacent to the traps in Irwin County was 1-2 weeks behind that in the other counties and may have affected moth phenology and abundance. Also, the acreage of corn grown in Irwin County (11,500) almost equaled the amount in the other three counties combined (12,900), which could have affected corn earworm populations. There was a significant positive correlation between the total number of corn earworm moths captured and the total corn acreage in the counties (Fig. 5). It should be pointed out that the period of trap exposure differed somewhat among counties, so that the total moth counts are not quite as accurate an indicator of overall activity as weekly catches. However, the total counts would vary little if adjusted for duration of trap exposure, as the period of time during which traps in the various counties did not overlap yielded few moths.

For tobacco budworms, the Bt Cotton/Peanuts interface yielded the largest number moths in two of the three counties sampled; however, in this same interface corn earworm moths were the most abundant in only one of four counties. Four different crop interfaces ranked as the largest producer of corn earworm moths in the four counties, indicating no preference for particular Bt cotton/crop combinations.

Pheromone trapping provides a valuable tool for assessing activity of moths, but it does not necessarily reflect activity within crop fields (e.g., impending caterpillar populations), nor does it provide insights into the activity of the moths trapped (e.g., are they coming to the location of the traps, or are they emerging locally and being trapped while attempting to emigrate?). Supplementing trap capture with other techniques (e.g., isotope analysis) can provide additional insights into the sources of trapped moths and broaden our base of understanding relative to the mobility of these two important pests in the landscape.

Acknowledgements

We appreciate the funding provided for this project by USDA-ARS and the Georgia Cotton Commission. We also appreciate the growers who cooperated with us: Andy and Randall Carroll, Ken Coleman, John Dixon, Jason Griffin, Marvin Knox, John Morgan, Darrell Ross, Jody Speight, and Jeff Wilson. We appreciate the assistance of Brian Rutland and Logan Edwards in collecting and processing samples and data.

References

Guillebeau, P, N. Hinkle and P. Roberts. 2003. Summary of losses from insect damage and costs of control in Georgia, 2000. Univ. Ga. Coll. Agric. Environ. Sci. Misc. Pub. No. 106, 56 p.

Harding, J. A. 1976. *Heliothis* spp.: seasonal occurrence, hosts, and host importance in the Lower Rio Grande Valley. Environ. Entomol. 5: 666-68.

Hartstack, A.W., D.E. Hendricks, J.D. Lopez, E.A. Stadelbacher, J.R. Phillips, and J.A. Witz. 1979. Adult sampling, PP. 105-131. *In* Economic Thresholds and Sampling of Heliothis Species on Cotton, Corn, Soybeans and Other Host Plants. South. Coop. Series Bull. 231.

Leigh, T.F., S.H. Roach and T.F. Watson. 1996. Biology and ecology of important insect and mite pests of cotton, pp. 17-85. *In* J.R. Phillips and R.J. Coleman (eds.), Cotton Insects and Mites: Characterization and Management. The Cotton Foundation, Memphis, TN.

Tietz, H. M. 1972. An index to the described life histories, early stages, and hosts of the *Macrolepidoptera* of the continental United States and Canada. Vol. I and II. A.C. Allyn, Allyn Museum of Entomology, Sarasota.

Westbrook, J.K. 2003. Dispersal, migration, and population dynamics of *Heliothis / Helicoverpa*. *In* USDA-ARS *Heliothis / Helicoverpa* Workshop. March 25-27. Dallas, TX.

Williams, M.R. 1997. Cotton insect losses-2001. Proceedings Beltwide Cotton conf. National Cotton Council, New Orleans, LA.

Williams, M.R. 2003. Cotton insect losses-2001. Proceedings Beltwide Cotton conf. National Cotton Council, Nashville, TN.

Table 1. Pheromone trap sampling period and placement for heliothine moths in south Georgia, 2003.

	COUNTY	CROP INTERFACE	SAMPLING PERIOD
Corn Earworm	Berrien	Bt Cotton, Non Bt Cotton, Corn, Peanuts	6/06 – 11/07
	Colquitt	Bt Cotton, Non Bt Cotton, Corn, Peanuts, Soybeans	6/09 – 11/07
	Irwin	Bt Cotton, Non Bt Cotton, Corn, Peanuts, Soybeans	6/16 – 11/07
	Turner	Bt Cotton, Non Bt Cotton, Corn, Peanuts, Soybeans	6/16 – 10/30
Tobacco Budworm	Berrien	Bt Cotton, Non Bt Cotton, Corn, Peanuts	7/07 – 10/24
	Colquitt	Bt Cotton, Non Bt Cotton, Corn, Peanuts, Soybeans	7/07 – 10/24
	Irwin	Bt Cotton, Non Bt Cotton, Corn, Peanuts, Soybeans	7/14 – 10/24

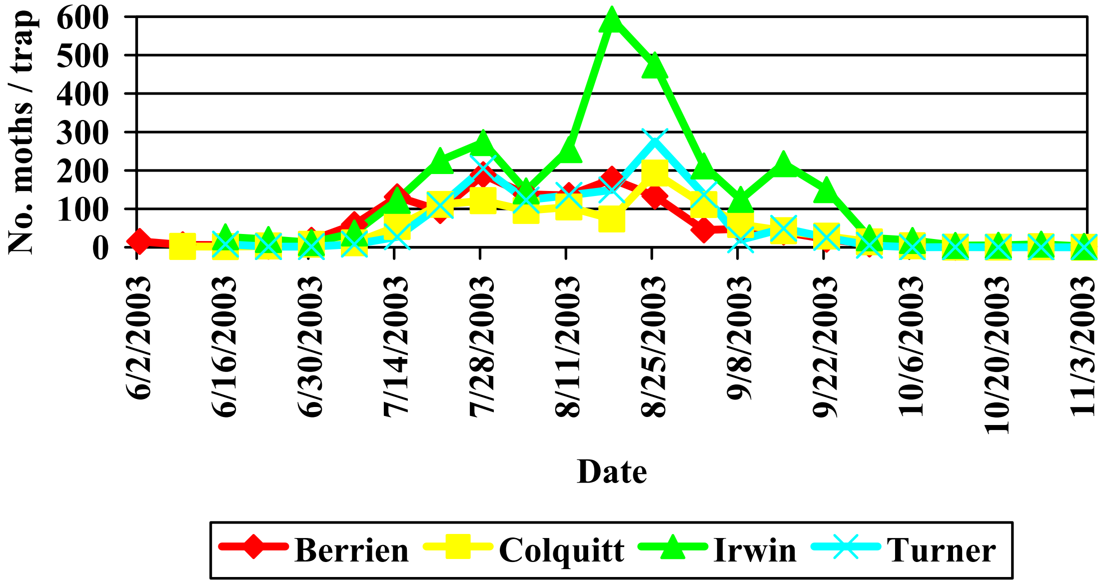

Figure 1. Corn earworm trap captures in three south Georgia counties, 2003.

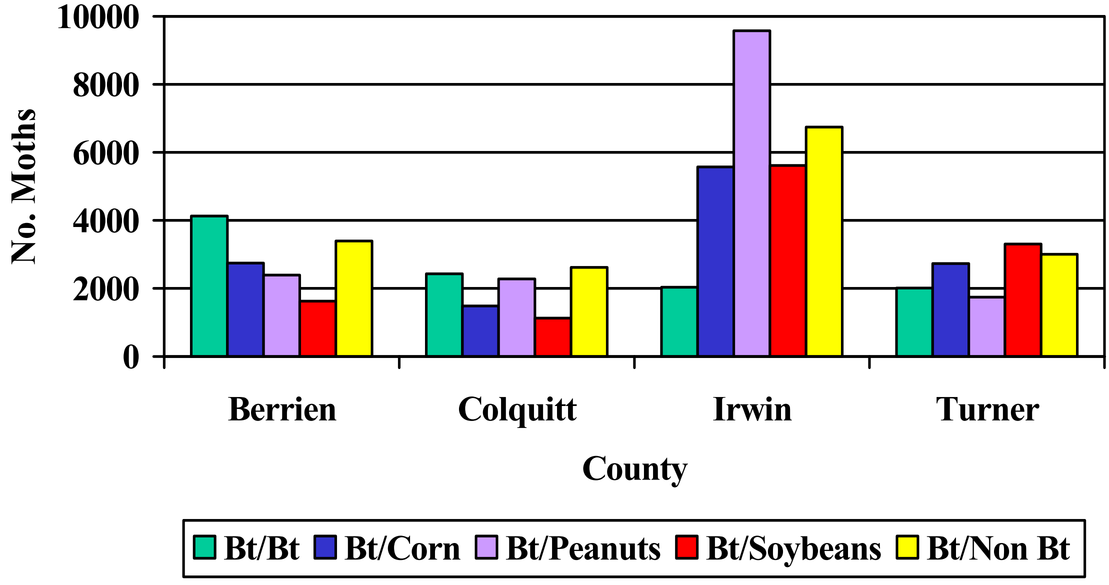

Figure 2. Number of corn earworm moths captured at different crop interfaces in south Georgia, 2003.

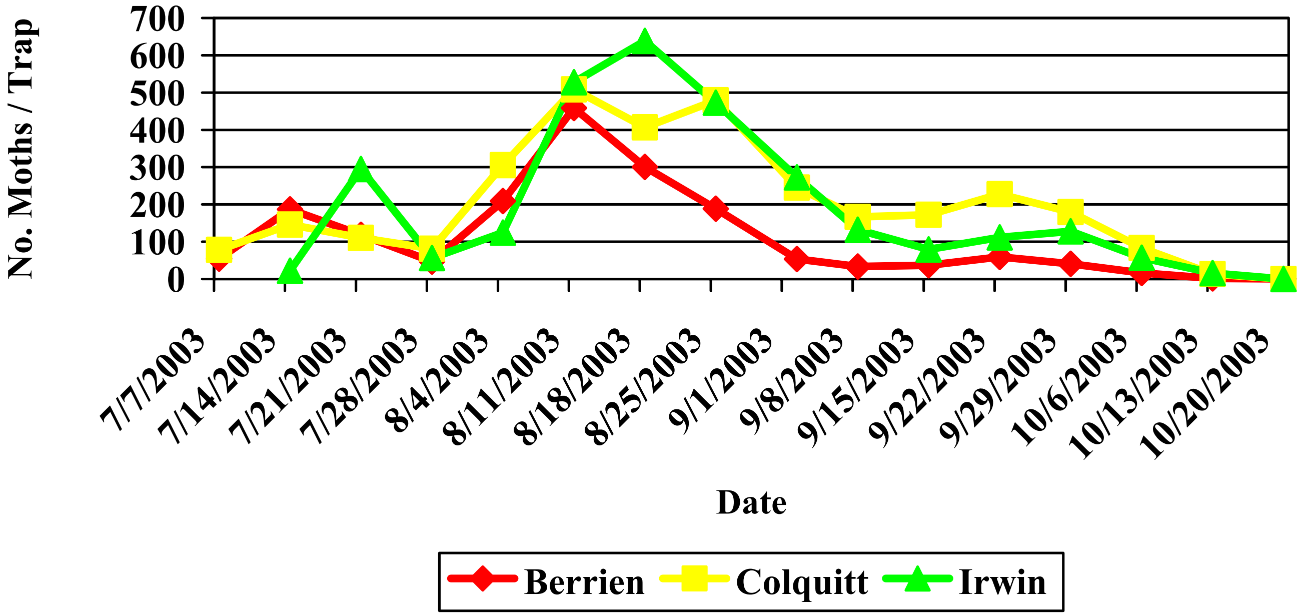

Figure 3. Tobacco budworm trap captures in three south Georgia counties, 2003.

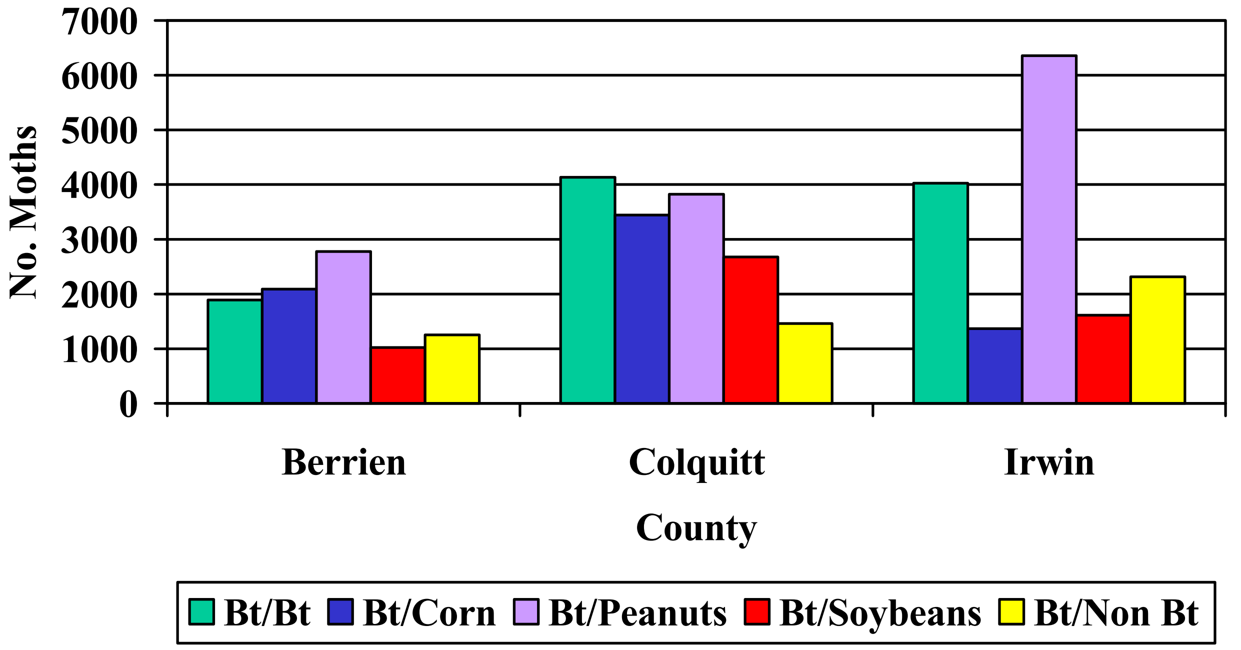

Figure 4. Number of tobacco budworm moths captured at different crop interfaces in south Georgia, 2003.

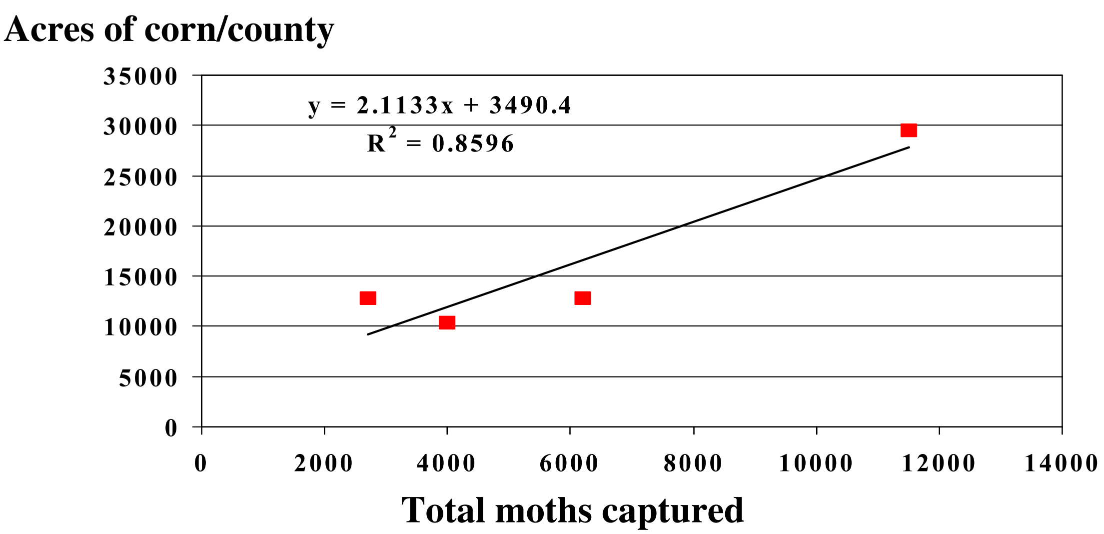

Figure 5. Relationship between corn acreage in the respective counties and the total trap capture of corn earworm moths in four counties in south Georgia (2003).