

SEASONAL FLIGHT PATTERNS OF BOLLWORM, TOBACCO BUDWORM AND BEET ARMYWORM MOTHS IN THE TEXAS HIGH PLAINS

Stanley C. Carroll
Megha N. Parajulee
Texas AgriLife Research
Lubbock, Texas

Abstract

From 2002-2008, adult (moth) flight patterns of the cotton bollworm, *Helicoverpa zea* (Boddie), tobacco budworm, *Heliothis virescens* (F.), and beet armyworm (*Spodoptera exigua* (Hübner)) were monitored by using pheromone traps in three Texas High Plains (THP) counties. During the first four years, moth captures were monitored approximately weekly during all months in three counties which represent the northern (Hale), central (Lubbock), and southern (Gaines/Dawson) regions of the THP. Weekly monitoring has continued in Lubbock County since 2006. Yearly and historical flight profiles are provided and discussed for each of the three counties.

Introduction

In 2002, an ongoing trapping study was initiated to investigate the weekly and seasonal flight activity patterns of the cotton bollworm, *Helicoverpa zea* (Boddie), tobacco budworm, *Heliothis virescens* (F.), and beet armyworm, *Spodoptera exigua* (Hübner) moths in the southern Texas High Plains (THP). Insect pheromone traps were used to measure the seasonal abundance of these pests. Previous research on two of these species includes Parajulee et al. (2004) report on a 14-year (1982-1995) study of monitoring THP bollworm and tobacco budworm populations. In the neighboring Texas Rolling Plains, Parajulee et al. (1998) report on a similar 15-year trapping study which included both weekly and daily trap service intervals.

These three species are significant cotton pests in the THP, which is widely recognized as the most intensive cotton growing area in the world. In the THP, the cotton bollworm is classified as an important economic pest of cotton and other regional crops, while the tobacco budworm and beet armyworm are classified as occasional pests. Seed from genetically modified cotton is available with Bollgard (*Bt*) technology which provides excellent crop protection from these pests. It is important to continue monitoring these pest populations due to the significant amount of cotton acreage that is not planted with this technology, particularly lower input dryland acres which account for approximately 40-50% of the THP cotton acreage. There is also an interest in determining whether the widespread adoption of Bt technology in crops such as cotton and corn will bring about an overall decrease in lepidopteron pest populations across local and neighboring regions. Continued long term monitoring of these pest populations will hopefully help address questions of this type.

Materials and Methods

During the first four years (2002-2005), nine (3 monitored species x 3 replications) pheromone traps were placed in each of three selected counties representing northern (Hale), central (Lubbock) and southern (Gaines/Dawson) regions of the southern Texas High Plains. Monitored species included the cotton bollworm, tobacco budworm and beet armyworm. In each county, three sites (replications) were selected and one trap for each pest species was placed at each site, then baited and monitored approximately weekly throughout the year (2002-2005). Traps originally located in Gaines County (southern county) were moved to neighboring Dawson County after the second year of the study to facilitate more frequent monitoring. Beginning in 2006, traps with the same protocols and sites were serviced only in Lubbock County during the early spring to late fall period.

Trap types used to capture the adult moths included the Texas pheromone trap (Fig. 1A, Hartstack et al. 1979) for bollworm and budworm moths and green bucket traps (Fig. 1B) for beet armyworm moths. Pheromone for all three species was secured from a single source (Trece™, Inc., Adair, OK). The cotton bollworm and tobacco budworm traps were re-baited approximately twice monthly and the beet armyworm pheromone was changed monthly. The bucket (capture container) on beet armyworm traps also contained a 1-inch x 1-inch toxicant strip to kill the moths soon after capture. Exact locations of all trapping sites were determined using a hand-held Garmin® GPS device.

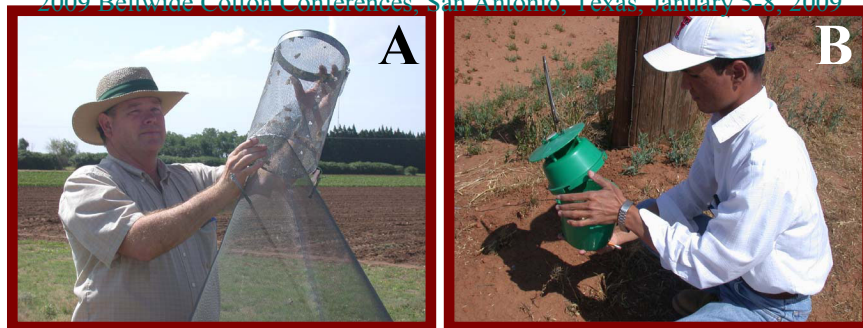


Figure 1. Texas pheromone traps (A) are commonly used to monitor moth populations such as the cotton bollworm and tobacco budworm, while the green bucket trap (B) is commonly recommended for beet armyworms.

Results and Discussion

Cotton Bollworm

Figure 2A illustrates the calculated historical bollworm flight profiles (based upon pheromone trap captures) across year for the three counties. Bollworm flight activity was low or non-existent during the period of mid-November to mid-March. An extended period of high bollworm moth activity occurred during the mid-June to mid-October time period which overlays the entire period that cotton fruit is vulnerable to damage. Within this extended period of activity, the highest numbers of moths responded to traps from early August to mid-September.

Seven (2002-2008) individual yearly bollworm moth flight patterns for each county are shown in Fig. 3. For study years 2002-2005 (Fig. 3A; trapping all year within all counties), the within year county trap response patterns for the three counties were relatively similar to each other, and between years the patterns were also similar except for differences in cotton bollworm abundance. Overall population levels detected in Lubbock County were highest in 2002 (Fig. 3A) and 2008 (Fig. 3B) with peaks of approximately 2000 moths/trap/10-day period and lowest in 2004. Yearly flight profiles and moth abundance were relatively similar to each other in the other four years of the study.

Tobacco Budworm

Figure 2B shows the historical flight activity for tobacco budworms by county across year. Small numbers of budworms started responding to traps in late April while peak numbers were observed from early June to early October. Hale County (northern area) peaked one month later than the more southern areas and also had an abbreviated period of flight activity. After each county's peak activity period, numbers fell quickly with essentially no moth activity detected by late October. Lubbock County had the highest number of tobacco budworms responding to pheromone traps (Fig 2B) but this was likely skewed by the much higher Lubbock County counts in 2002 and 2003 (Fig. 4A).

Within the years 2002-2005, tobacco budworm trap responses had similar patterns in all counties although moth numbers were notably higher in Lubbock County during the active periods of 2002 and 2003 (Fig. 4A). With the exception of 2004, the period of highest flight activity for Hale County typically reached its peak approximately one month later than the more southern counties (Fig. 4A).

Beet Armyworm

The averaged historical trap response profile (Fig. 2C) indicates that beet armyworm populations on the Texas Southern High Plains displayed two peak periods of flight activity during the study. The first peak typically occurred in mid-April followed by an extended peak of moth activity during the period of late August to late November.

Based upon the 2002-2005 yearly data (Fig. 5A), the two peak periods of annual beet armyworm flight activity (Fig. 5A) reflected in the historical profile can be easily seen in most of the individual annual flight profiles. Although beet armyworms can be captured during all months of the year, they are primarily active during the period of early March to early December. Figure 5A illustrates the similarities of the county moth activity patterns within years and at the same time shows how vastly different overall moth abundance can be between individual years.

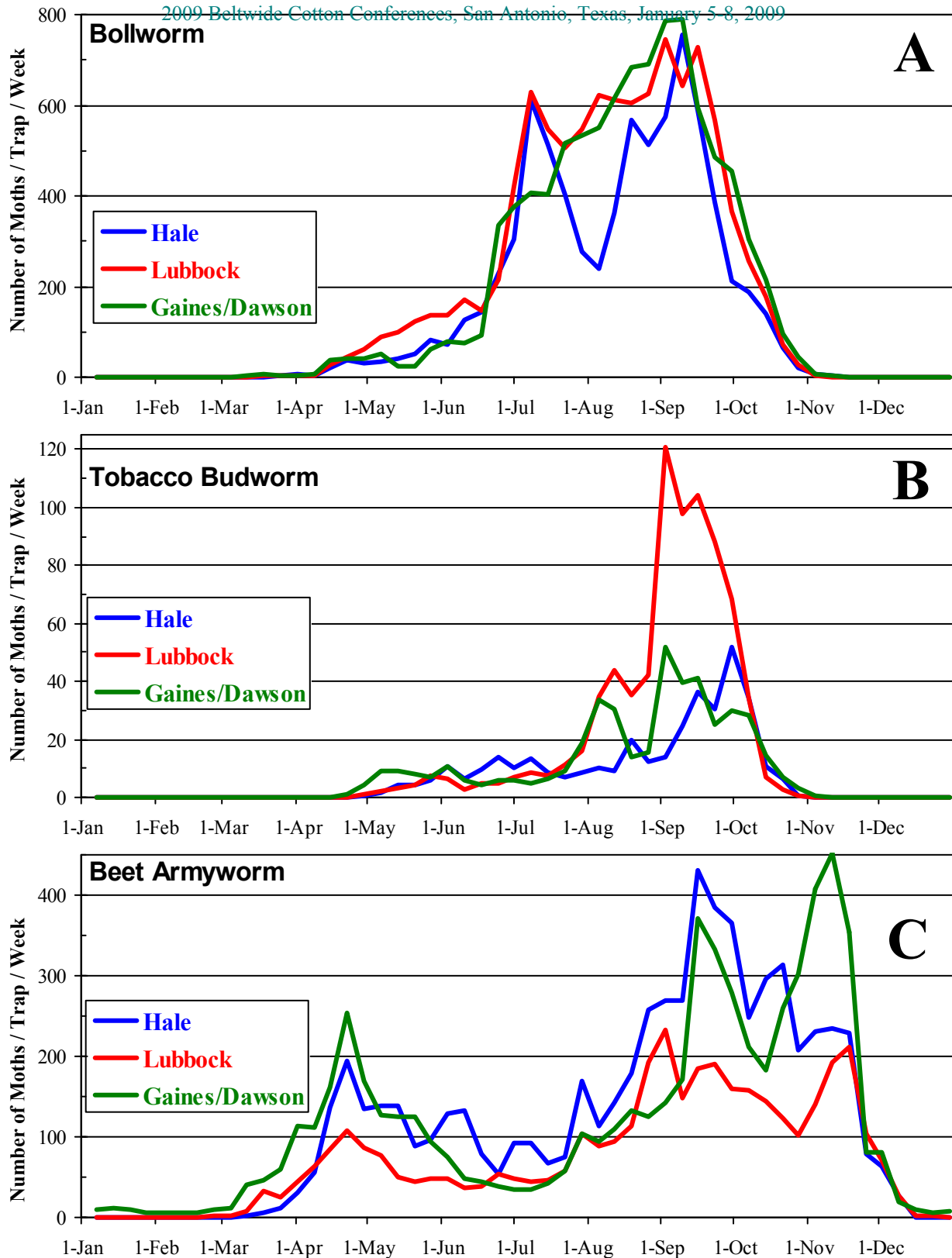


Figure 2. Historical flight profiles (weekly trap captures averaged across all available years) for the cotton bollworm (A), tobacco budworm (B), and beet armyworm (C). For each of the three cotton pest species, county flight profiles are given so that comparisons can be made for areas roughly representing the northern (Hale), central (Lubbock) and southern (Gaines/Dawson) regions of the southern Texas High Plains region, 2002-2008.

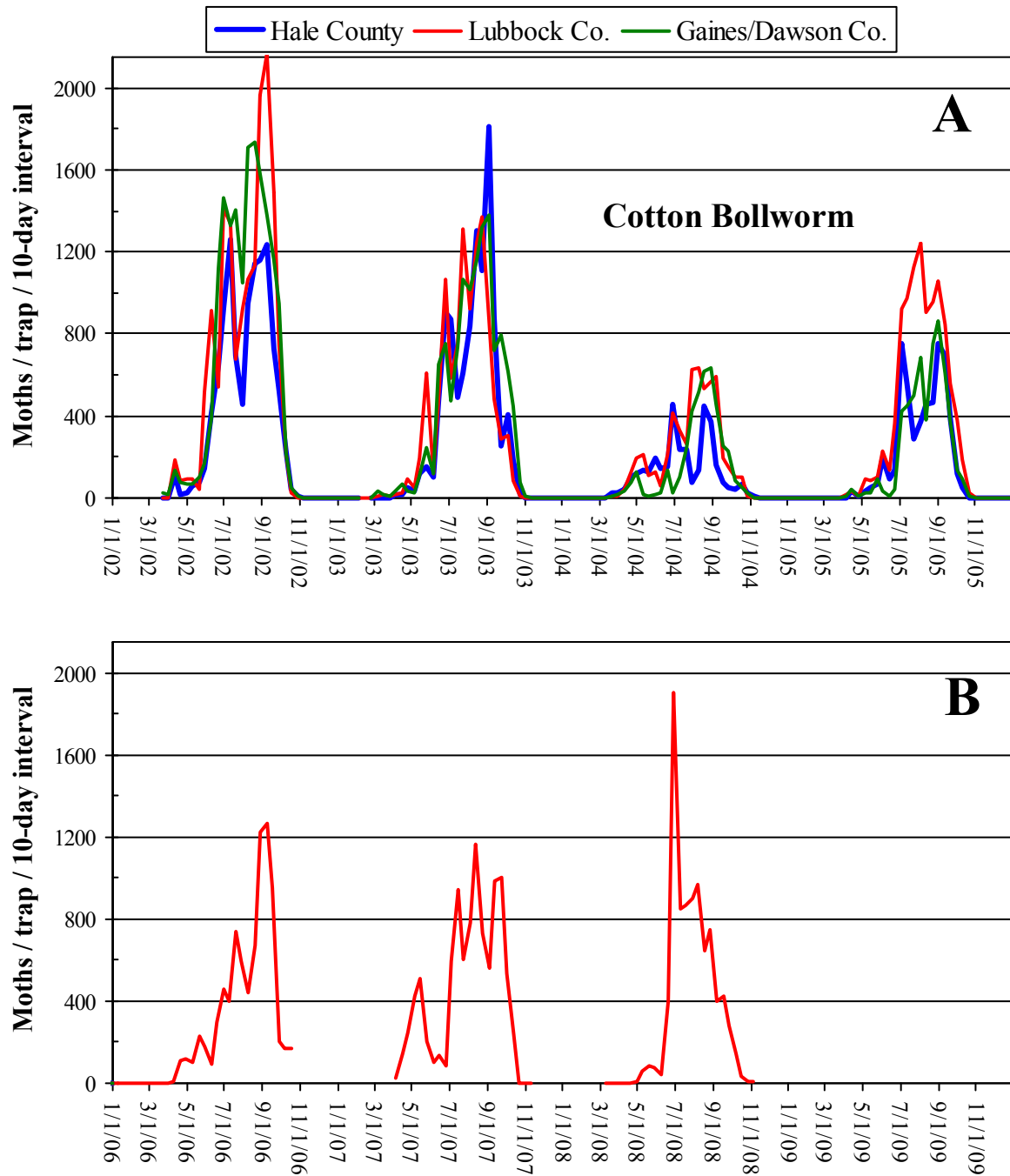


Figure 3. Average number of cotton bollworm moths/trap/10-day period in selected southern Texas High Plains counties, including Hale (2002-2005), Gaines/Dawson (2002-2005) and Lubbock County (2002-2008). Please note that trapping was conducted all year in all three county areas during the first four years (2002-2005) of the study (A). Thereafter only Lubbock county traps were serviced during the early spring to late fall period (2006-2008) (B).

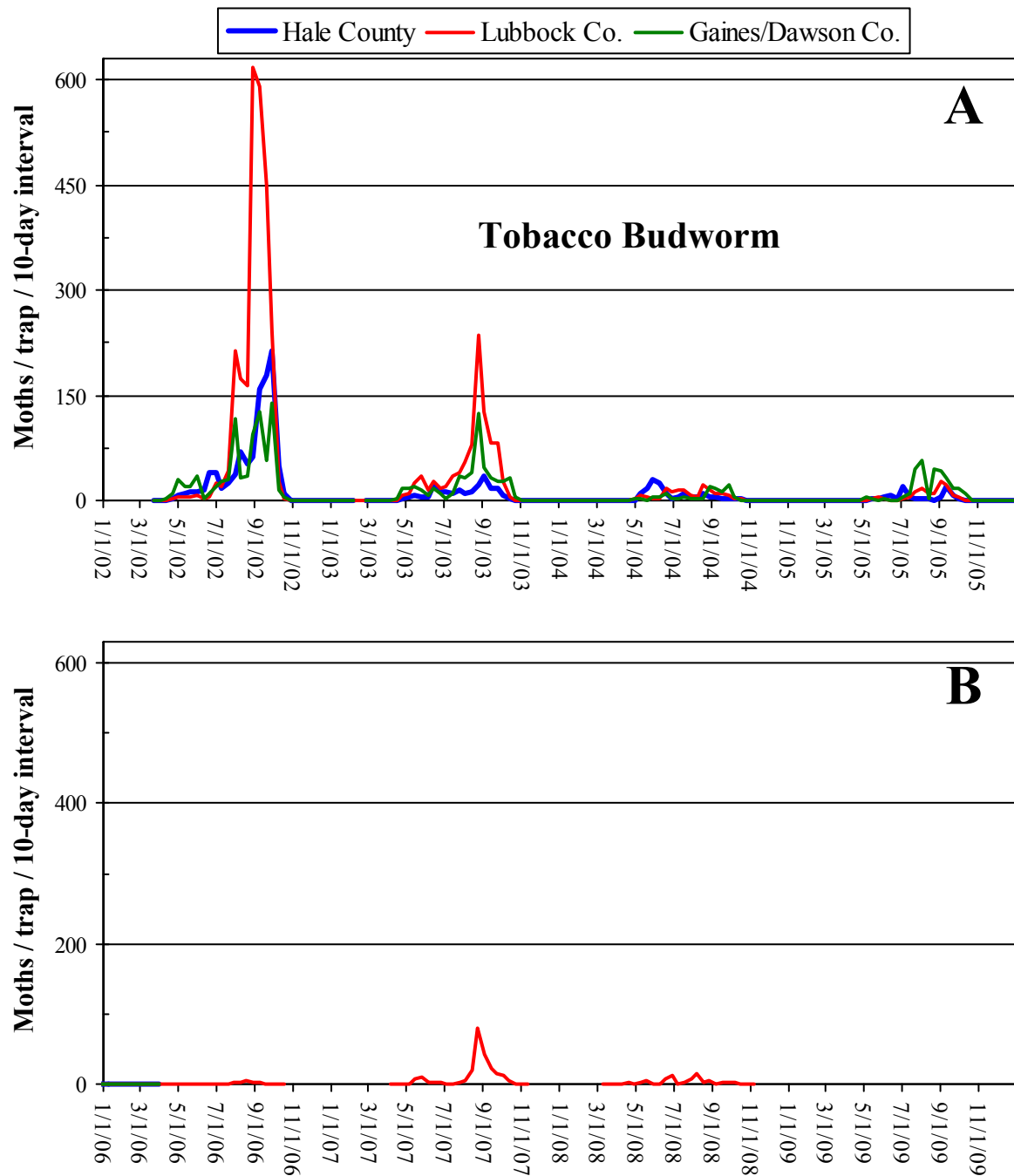


Figure 4. Average number of tobacco budworm moths/trap/10-day period in selected southern Texas High Plains counties, including Hale (2002-2005), Gaines/Dawson (2002-2005) and Lubbock County (2002-2008). Please note that trapping was conducted all year in all three county areas during the first four years (2002-2005) of the study (A). Thereafter only Lubbock county traps were serviced during the early spring to late fall period (2006-2008) (B).

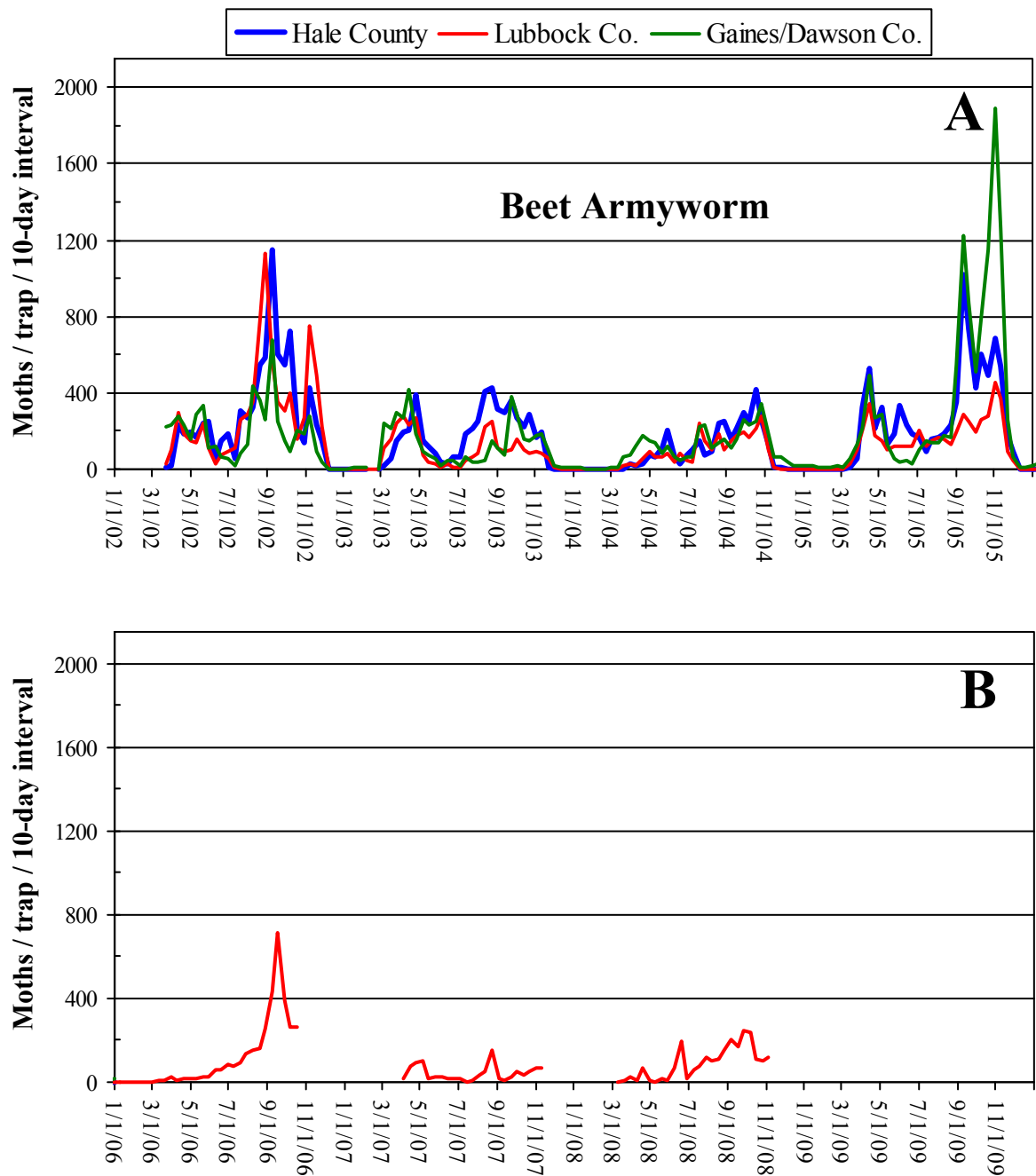


Figure 5. Average number of beet armyworm moths/trap/10-day period in selected southern Texas High Plains counties, including Hale (2002-2005), Gaines/Dawson (2002-2005) and Lubbock County (2002-2008). Please note that trapping was conducted all year in all three county areas during the first four years (2002-2005) of the study (A). Thereafter only Lubbock county traps were serviced during the early spring to late fall period (2006-2008) (B).

Acknowledgements

Funding for this study was provided by Texas AgriLife Research Hatch Project 8810 and Plains Cotton Growers, Inc. We thank Mr. Bill Lingren (Trece™, Inc.) for his contributions to this study, Damara Lucia and Owen McSpadden for their careful species identifications while processing the numerous moth samples, and Mark Arnold for his critical review of the poster associated with this manuscript.

References

- Hartstack, A.W., Jr., J.A. Witz, and D.R. Buck. 1979. Moth traps for the tobacco budworm. J. Econ. Entomol. 72:519-522.
- Parajulee, M.N., J.E. Slosser, and E.P. Boring. 1998. Seasonal activity of *Helicoverpa zea* and *Heliothis virescens* (Lepidoptera: Noctuidae) detected by pheromone traps in the Rolling Plains of Texas. Environ. Entomol. 27:1203-1219.
- Parajulee, M.N., D.R. Rummel, M.D. Arnold, and S.C. Carroll. 2004. Long-term seasonal abundance of *Helicoverpa zea* and *Heliothis virescens* (Lepidoptera: Noctuidae) moths in the Texas High Plains. Journ. Econ. Entomol. 97:668-677.