Pink Bollworm Trapping in the Southern Plains of Texas and New Mexico

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Summary

This study identified several cotton fields in southern Midland County, TX on which large numbers of pink bollworm (PBW) moths were caught. No other large concentrations of PBW were found in the region. Winds with the capability of moving moths long distances occurred during the 2010 study. Wind trajectories were appropriate to have moved moths from areas where PBW moth captures were high, to areas in which only few PBW moths were caught. These findings help to support the theory that the wild pink bollworm moths trapped in 2009 on the east side the El Paso/Trans Pecos (EP/TP) eradication zone may have originated in southern Midland County. No PBW moths were captured in trap lines between cotton growing areas in the southern plains and those in the EP/TP zone in 2010. Capture of moths in traps on the trap lines would have provided further evidence either supporting or contradicting the theory.

Objective

Pink bollworm (PBW) is one of the world's most important cotton pests. Losses to PBW prior to the availability of Bt cotton and the initiation of the eradication program were estimated at $32 million per year (NCC 2001).

PBW eradication began in the El Paso/Trans Pecos (EP/TP) zone in Texas in 2001 and is nearing completion. It is threatened by PBW migration from the southern plains of Texas and New Mexico, areas not in eradication programs.

The Pecos Work Unit (east side of the EP/TP zone), caught no wild PBW moths in 2007 or 2008. In 2009, 669 wild moths were caught on Bt cotton fields between late September and the end of November. The question was, "Where did these moths come from?"

When PBW reproduction occurs and background populations are low, fall trap captures normally occur in "hot spots" indicating the locations of infested fields. The 2009 wild PBW moth captures were distributed over a large land area and were not indicative of one or more infested fields within the work unit. Data

from a few traps in the southern plains outside the EP/TP zone in 2009 suggested PBW infestations may have been present in Midland County - 75 to 80 miles from cotton fields in the Pecos Work Unit.

The primary objective of this project was to investigate correlation of cultural practices on PBW presence in southern plains cotton fields. A second objective was to investigate patterns of PBW movement from infested fields. Data from this and subsequent studies will be used to develop a model of pink bollworm populations in the southern plains region. The model will provide opportunities for the cotton industry to develop and implement areawide control programs which can intelligently target available resources to the fields which are likely sources of PBW reproduction and spread.

Materials and Methods

From mid-September to early November, 2010, a trapping study was conducted in four areas of the southern plains. Trapping was conducted in the Pecos Valley NM, Gaines County TX, Dawson/Martin Counties TX and Midland/ Glasscock/Upton Counties TX; cotton production areas which border the EP/TP zone on the north and east sides. Delta Sticky Traps baited with gossyplure impregnated rubber septa were deployed, geo-referenced and serviced weekly. The protocol was to trap 10 Bt fields and 10 non-Bt fields – one trap per field - in each area. Data collected on each field included: producer name, trap number, latitude, longitude, elevation, planting date, variety, acres, irrigation status/type and intensity, Bt transgenic, fall/winter tillage, whether the field was planted in killed wheat, winter irrigation, lbs. nitrogen (N) fertilizer/ac, and proximity to 2009 non-Bt cotton. Dr. David Kerns, Texas AgriLife Extension Entomologist, provided trapper training and confirmed the identification of moths.

Three highway trap line loops - with traps placed at five mile intervals - were established. Each trap line extended into the EP/TP zone. As traps were inspected; date of capture, number of PBW moths caught and trap number were recorded.

In the Pecos Valley NM production area, 21cotton fields were trapped, including ten Bt and eleven non-Bt fields. All fields were irrigated and 19 fields were tilled in the fall/winter of 2009-10. None of the fields were grown in killed wheat cover or received winter irrigation. The Carlsbad trap line had 29 traps. The trap line ran south from Carlsbad NM to Orla TX, west to the Guadalupe Mountains and White City NM and northeast to Carlsbad.

In Gaines County TX, 22 fields were trapped of which eleven were Bt and eleven were non-Bt. Twenty-one fields were irrigated and one was dryland. Five received fall/winter tillage, 18 were grown in killed wheat cover and 15 received winter irrigation. The Kermit trap line had 31 traps. It began in Seminole, TX and ran south to Gardendale TX (8 miles north of Odessa), west to Kermit TX, and north to Hobbs NM.

In western Martin and southwestern Dawson Counties 19 fields were trapped. Ten were Bt and nine were non-Bt fields. Nineteen fields were dryland and two were irrigated. Seven fields received fall/winter tillage.

In Midland, Glasscock and Upton Counties 20 fields were trapped. Nine were Bt and eleven were non-Bt fields. Nine were irrigated and eleven were dryland. All fields received fall winter tillage and all nine irrigated fields received winter irrigation. The Crane trap line had 17 traps. It started north of Rankin TX and ran south to Rankin, northwest to Crane TX, north to Odessa TX and northeast to Midland TX.

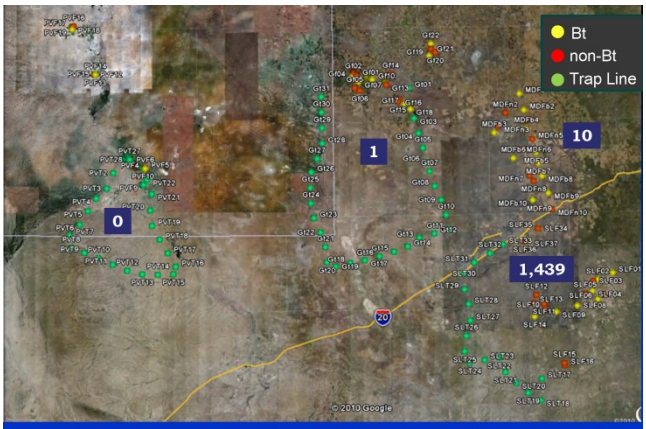

Figure 1. 2010 season long PBW total trap catches in four regions of the southern plains.

The HySPLIT Transport and Dispersion model (Draxler and Rolph 2010) was run on the Real-time Environmental Applications and Display sYstem (READY) website (Rolph 2010) of the National Oceanic and Atmospheric Administration / Air Resources Laboratory (NOAA/ARL) to determine if daily wind patterns were conducive to transport pink bollworm (PBW) moths in western Texas in the fall of 2010. Weather information for the model was obtained from the EDAS (40-km resolution) reanalysis initialization files archived at the NOAA/ARL site.

Results and Discussion

Total trap captures are shown in Figures 1, 2 and 3. Figure 1 shows the total number of moths captured in each of the four areas of the southern plains. Figures 2 and 3 show the total moths captured by trap in the Martin/Dawson area and the Midland/Glasscock/Upton area, respectively.

Pecos Valley NM

No PBW moths were caught in Pecos Valley NM cotton fields and no PBW moths were caught in the traps on the Carlsbad trap line (Fig. 1).

Gaines County

One PBW moth was caught in Gaines County (Figure 1). It was caught on October 28 on a 60 acre center pivot field which was planted on May 4 with a Bt cotton variety. The field had been tilled during the previous fall/winter, was grown in killed wheat cover, had received winter irrigation and was fertilized with 120 lbs/ac N. The Gaines County capture on Bt cotton suggests the moth moved to the field from a "source" field. No PBW moths were caught on the Kermit trap line.

Martin/Dawson Counties

Ten PBW moths were caught from a total of six fields in the Martin/Dawson Counties from October 22 through November 5 (Fig. 2). Moths were caught on 32% of the fields trapped in the area and no field caught moths on more than one inspection date. A single moth was caught on each of four fields - one Bt and three non-Bt. Three moths were caught on each of two fields – one Bt and one non-Bt. Captures of moths on Bt cotton fields and fields capturing moths on only one inspection date suggest PBW moths moved from source fields to the fields where they were trapped.

Figure 2. Martin & Dawson season long PBW total trap catches

All catches in the Martin/Dawson area were in dryland fields planted May 11 to June 1 in which N fertilization ranged from 0 to 100 lbs/ac. Two of the fields were tilled the previous winter and two had non-Bt cotton planted in adjacent fields in 2009. One field that caught moths had non-Bt cotton planted one mile away and another had non-Bt planted four miles away in 2009.

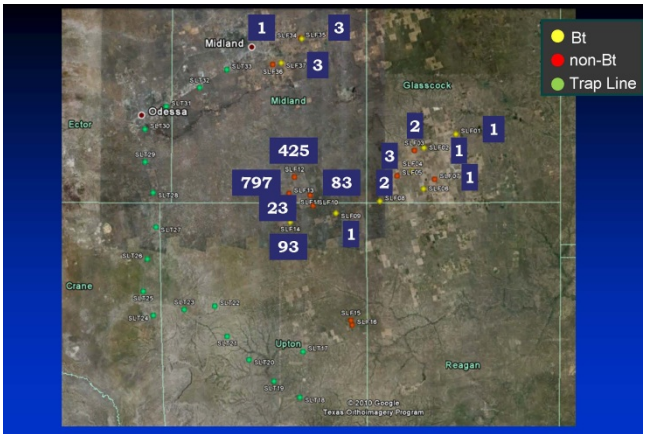

Figure 3. St. Lawrence season long PBW total trap catches

Midland/Glasscock/Upton Counties

PBW moths were caught on 15 of 20 (75%) fields trapped in Midland/Glasscock/Upton Counties (Fig. 3). A total of 1,438 moths were captured. Eighty-five percent of the moths were caught on two organic fields, SLF#12 and SLF#13 located in south central Midland County. Two other organic fields, SLF#15 and SLF#16 were located in Upton County 25 miles south of SLF#12 and 13. No PBW moths were caught in the Upton County organic fields.

Five fields located within a five mile radius of SLF#13 - SLF #10 through 14 - caught the highest numbers of moths. Catches on these fields ranged from 23 to 797. Except for SLF#14, all of these fields were non-Bt cotton. None of the five fields received inorganic nitrogen fertilizer but all were tilled during the fall or winter of 2009-2010. The two organic fields, SLF#12 and SLF#13, were drip irrigated and received winter irrigations. SLF#10, 11 and 14 were dryland fields. Three fields - SLF#12, SLF#13 and SLF#14 - caught moths on seven consecutive inspection dates. PBW reproduction almost certainly occurred in SLF#12 and SLF#13. Despite repeated captures and relatively higher numbers of moths caught in SLF#14, the field was in Bt cotton. It is doubtful reproduction occurred there.

Of the fields that caught PBW moths, seven Bt fields caught 102 moths (7%) and eight non-Bt fields caught 1,336 moths (93%). Capture of PBW moths on Bt cotton, the spatial pattern of the captures and capture of moths on only one inspection date (eight fields) suggests moths were moving from source fields to uninfested fields.

Weather Data

From a south-central Midland County source population, dispersal of PBW to southern Glasscock County would have been supported by westerly winds on Sep. 28 and Oct. 11 (Fig. 4). Dispersal from the south central Midland County source to northern Midland County would have been supported by southerly winds on Sep. 16-17, 21-24, and Oct. 2, 4-19.

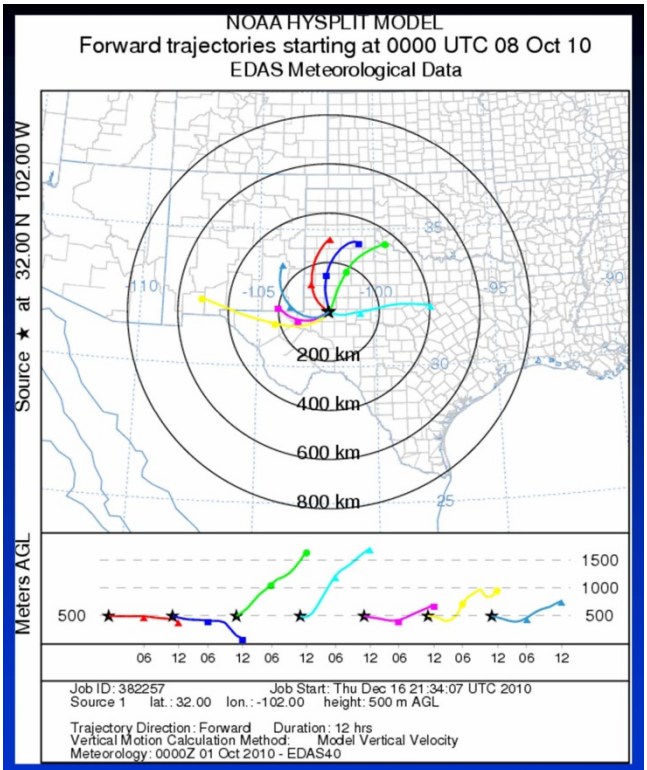

Figure 4. Simulated nocturnal atmospheric trajectories originating at Midland County, TX, on Oct. 8-14, 2010. The assignment of dates reads sequentially from left to right (i.e., red=Oct. 8, dark blue=Oct. 9, green=Oct. 10, etc.).

Conclusions

A total of 1,449 PBW moths were caught during the 2010 PBW trapping study in the southern plains region. Ninety-eight percent of the total moths captured, came from five fields within a five mile radius of SLF#13, an organic cotton field in southern Midland County. Two organic cotton fields within this small area, SLF#12 and 13, appeared to be the epicenter of the population in the area. Eighty-four percent of the total moths caught came from these two fields.

Moths caught on Bt cotton fields, fields that caught moths on only one inspection date and spatial patterns of moth capture strongly suggest PBW moth movement occurred during the study. During the course of the study, winds were observed which were capable of supporting PBW moth movement from fields thought to be the source of the population to fields in which only a few moths were caught.

References

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