INTRA AND INTER- CROP MOVEMENT OF TARNISHED PLANT BUGS

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Abstract

A key economic and primary pest of cotton in the mid south is the tarnished plant bug (TPB), *Lygus lineolaris (Hemiptera: Miridae)*. It is believed that early season crops like corn play a major role in building up TPB populations which then move to nearby cotton fields. TPB densities within cotton fields are often much higher near corn fields, but the degree of movement between corn and cotton, or the range at which corn influences movement is not known. A better understanding of this movement could play a key role in managing TPB. The objective of this research was to determine the movement dynamics of TPB within and at the interface of these crops using 2 marking techniques. First we used the mark- release-recapture technique to record movement of TPB over time within and at the interface of corn and cotton fields. For the 2nd marking technique we sprayed corn and cotton habitats with marker proteins so that tarnished plant bugs were marked in their habitat. Our 2008 data indicate that there was high influx of TPBs into cotton from corn at the interface when corn was maturing from green to brown silk. Growers need to scout frequently at the interface when corn is turning into brown silk to minimize TPB damage to cotton.

Introduction

Tarnished plant bug (TPB), *Lygus lineolaris* (Palisot de Beauvois) is a serious pest of cotton, *Gossypium hirsutum* L., in the mid south (Scott et al. 1985) . Tarnished plant bugs can be collected from as many as 169 host plant species representing 36 plant families, in the Mississippi River Delta of Arkansas, Louisiana, and Mississippi (Snodgrass et al. 1984). TPB adults overwinter in leaf litter or plant debris. They become active in early spring and start reproducing on a variety of spring weeds. Wild hosts play an important role in TPB population increases in the fall and in early spring when cultivated crops are not flowering. Corn, being an early season crop, provides a habitat for TPB when spring weed hosts start drying out. Tarnished plant bugs find corn attractive for oviposition during VT (tasseling) and R1 (silking) stages (Abel and Snodgrass 2003). Cotton generally reaches the squaring stage, when it is attractive to TPB, as the corn is advancing to the later reproductive stages. Because higher TPB damage is observed in cotton near corn, it is believed that TPB are migrating from corn to cotton, but this movement has not been documented. The current experiment was conducted to understand the movement of tarnished plant bugs at the interface of corn and cotton and within cotton fields.

Materials and Methods

We conducted two similar experiments using two different marking techniques. First we used the mark-release- recapture (MRR) technique. We choose two locations in commercial fields for this experiment where natural TPB densities were low. We selected each field where corn was at green silk stage and cotton was squaring at the same time. Corn and cotton were planted side by side with their rows running parallel to each other in these fields. TPB maintained on an oligidic diet (Cohen 2000) were marked a day before releasing them using 10% egg white solution using a fine sprayer. Extreme care was taken to avoid spraying too much which could hinder their ability to fly normally. Thirty marked TPBs were kept in a 250 ml plastic cup with green bean pieces. On the next day between 9 am and 11 am we released 300 marked TPB from 25 m lines in the corn monoculture, cotton monoculture and at the interface of the corn and cotton. In each line release we 10 cups were placed gently and evenly spaced on the ground in between two rows of the cotton, corn or corn-cotton interface. We returned back 1, 3 and 6 days after the release and collected TPBs at 2.5, 5.5, 10 and 16 m on both sides away from the line of release. We used a separate 25 m line release for each collection day in each habitat. In cotton, TPBs were collected using a sweep net as it is the most efficient method to collect adult TPB in cotton (Musser et al. 2007). We thoroughly swept each distance away from the release line, dumping the contents into kill jars to minimize the risk of unmarked insects becoming marked during collection. For corn, an aspirator was used to collect TPBs at each

distance. Collection of TPBs began at the furthest distance from the release line and moved toward the TPB release line. Captured TPBs were brought to the lab and individually transferred to microcentrifuge tubes. They were washed in a buffer solution and then removed from the buffer. The buffer was then stored at -70°C in microcentrifuge tubes labeled with the day, habitat and distance. Later they were analyzed for the egg white mark using Indirect ELISA (Jones et al. 2006).

For the 2nd marking method, instead of releasing marked TPBs, we sprayed TPB infested habitat and marked the existing TPBs in the field habitat. Field selection was similar to the one described above with the exception that this time we choose two locations which had high natural TPB densities. A 25 m line spray of 10% egg white solution was done using a CO_2 sprayer in corn and cotton monoculture. Foliage was saturated completely with the spray solution. At the interface we sprayed the cotton side with 10% egg white solution and the corn side with 20% soy milk solution. The rest of the protocol was same as the one described above for MRR technique.

Results and Discussions

Results from the mark-release-recapture experiment showed that 2/3rd of the marked insects caught were found in cotton and 1/3rd in corn when corn was at green silk stage and cotton at squaring (Fig. 1). There was no movement of tarnished plant bugs into corn once it reached brown silk stage, suggesting that corn is not attractive to tarnished plant bugs after the green silk stage. In the interior of the cotton field during the first week of blooming, 4% of the captured marked tarnished plant bugs were found 16m away from the line of release 1 day after the release. Similarly 7% and 10.5% of caught marked tarnished plant bugs were found at 16m away after 3 and 6 days, respectively (Fig. 2). This indicates that tarnished plant bugs can move up to 16m per day in suitable crop host.

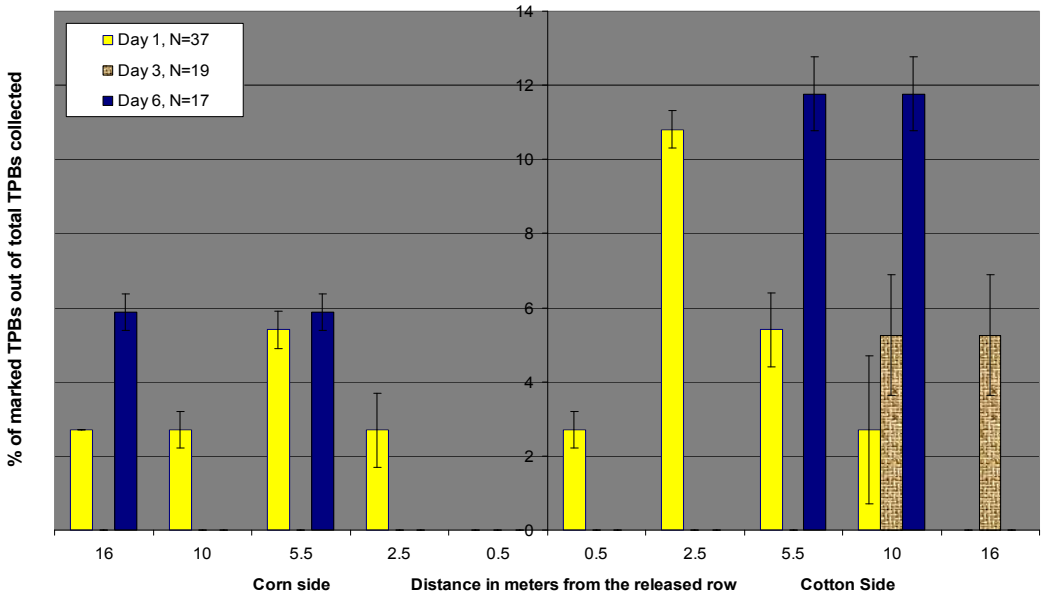

Figure 1. Movement pattern of TPB for MRR Technique at the corn-cotton interface. Corn was at green silk stage and cotton was squaring, 2008.

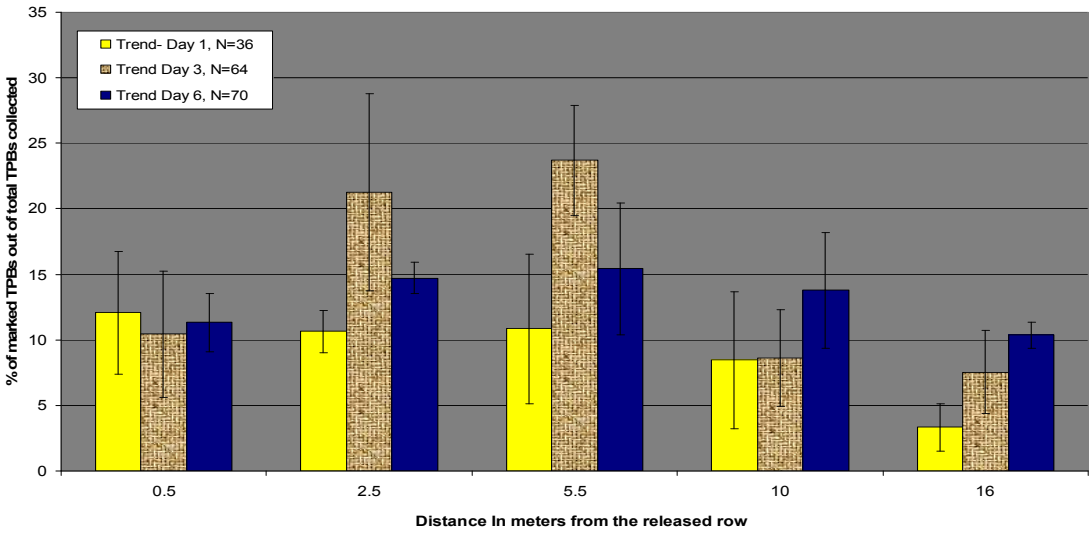

Figure 2. Movement pattern of TPBs for MRR technique in cotton monoculture, 2008.

In the habitat marking experiment, when corn was at green silk stage and cotton at squaring, many tarnished plant bugs were moving out of corn into cotton, but a very few were moving into corn from cotton therefore it appears that squaring cotton is more attractive to TPBs than corn at its green silk stage, even though corn is a suitable host for tarnished plant bug development at this time (Abel and Snodgrass 2003).

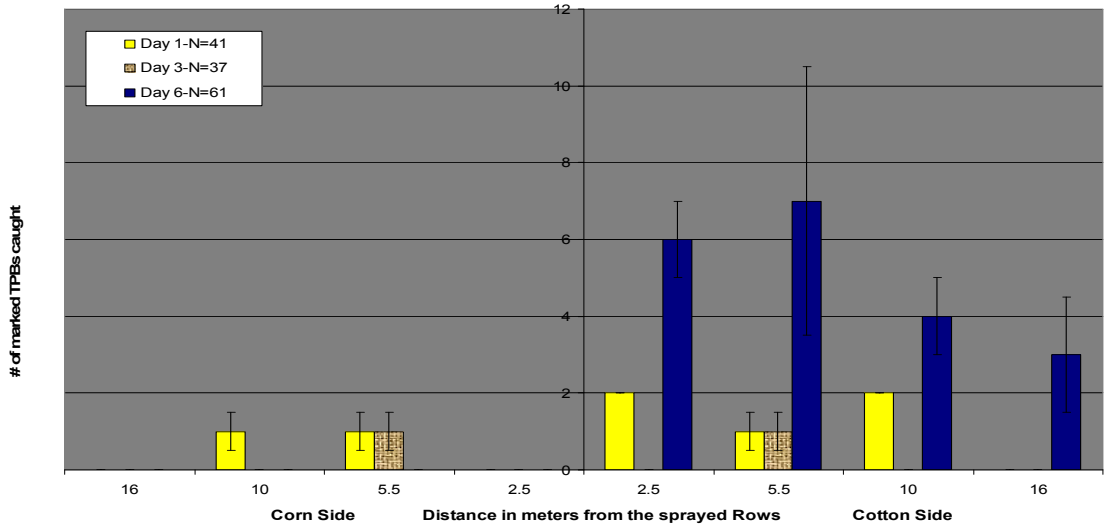

Figure. 3 Movement patterns of TPBs in habitat marking technique at the corn-cotton interface. Corn was at green silk stage and cotton was squaring, 2008.

When corn was at brown silk stage and cotton in the first week of blooming, we found no movement of tarnished plant bugs from cotton to corn. However we found 15 tarnished plant bugs that had been in corn moved into cotton 1 day after spraying. Similarly we found 3 and 2 tarnished plant bugs that had been in corn into cotton, 3 and 6 days after the spray, respectively. There was no movement of tarnished plant bugs across the interface of the two crops once corn passed brown silk stage. In the interior of the cotton field during the first week of blooming, we observed a similar amount of movement as in MRR fields. We found 7 TPBs which have moved 16 m away from the spray line in 1 day. Similarly there was a high number captured at 16 m from the sprayed line on day 3 and day 6 (Fig.4). From all trials we observed that tarnished plant bugs can move up to 16m per day, even when the crop host is suitable for development.

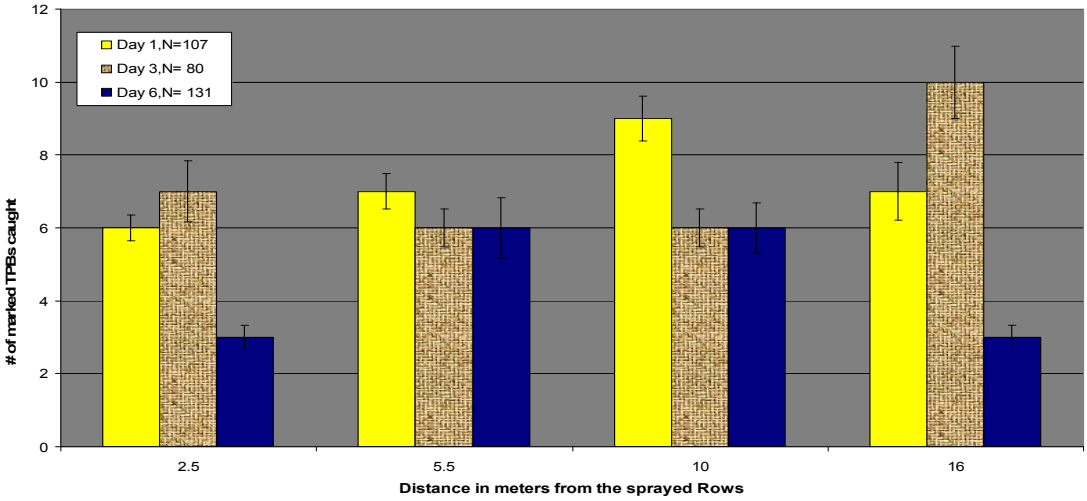

Figure 4. Movement pattern of TPBs for habitat marking technique in cotton monoculture, 2008.

Tarnished plant bugs are capable of moving at least 16 m in a day and did not seem to remain on cotton field edges once they move out of corn. However, a high number of nymphs near the edges during sampling later in the season were observed. Since TPB damage is known to be more severe on field edges, it is possible that the tarnished plant bugs which move out of corn lay their eggs on the first few rows at the edge of the cotton field before dispersing further into field. Later in the season, nymphs emerging from those eggs are largely responsible for the damage. Future research will continue to examine the role of corn-cotton interfaces in the movement of TPB.

Summary

As indicated by this research, there is high amount of movement of tarnished plant bugs into cotton from corn when corn is maturing to brown silk stage. Intense scouting of the edges of cotton fields is recommended when corn is in between green silk and brown silk stages. Intense scouting should be continued until corn has attained brown silk. We plan to conduct similar research in 2009 to clarify the role of corn in the population dynamics of TPB and injury to cotton

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