LYGUS HESPERUS FEEDING INJURY TO BT COTTON IN NEW MEXICO Stacey R. Bealmear and C. Scott Bundy New Mexico State University Las Cruces, NM

<u>Abstract</u>

A study done during the summer of 2005 examined the injury to two age classes of squares and bolls by *Lygus hesperus* in New Mexico. Feeding of 4th instar, 5th instar, and adult Lygus was evaluated for Bt cotton (DP 499 BR). No external feeding lesions were observed for any cotton squares exposed to lygus this season. Internal injury was significantly greater for 5th instars than adults. External feeding lesions were observed on bolls exposed to all three bug stadia. The greatest number of lesions was produced by 4th instars in young bolls and 5th instars in older bolls. Inner carpel wall injury or "warts" and lint injury were produced by all three age classes of lygus, with 5th instars producing the greatest amount of damage.

Introduction

In recent years, plant bugs have become among the most damaging insect complex in U.S. cotton production. This change in pest status is primarily the result of widespread use of Bt cotton and reduced use of broad spectrum insecticides (Hardee and Bryan 1997, Ellsworth 1998). Plant bug-related injury to cotton in the West is primarily due to the western tarnished plant bug, *Lygus hesperus* Knight. Lygus feeding to fruiting structures causes dropping of squares and young bolls, staining of lint, alteration of plant canopy, and introduction of boll rot –all of which reduce quality and yield. Lygus feeding on terminal growth produces plants that are tall and spindly with excessive branching (Ohlendorf 1996, O'Leary 1998, Wheeler 2000).

Squares between 4-8mm and bolls under 10 days old are most vulnerable to lygus. Squares are pierced during feeding so that anthers and other plant parts can be consumed. This can cause the squares to shrivel and fall off (1-4 days) or develop into lopsided bolls. On bolls, plant bugs penetrate the carpel wall to feed on inner tissue. Internal injury can be seen to the inner carpel wall in the form of warts and lint may also be stained around the feeding sites. External injury can be seen as black sunken areas on the outer carpel wall. Injury due to feeding can also cause bolls to fall off (Mauney and Henneberry 1979, Ohlendorf 1996, Wheeler 2000).

Although the general signs of lygus feeding are well-established, less information is available on the relationship between injury and the timing of injury by *L. hesperus*, particularly for bolls. This study was initiated to examine the external and internal signs of feeding by *L. hesperus* on known fruiting ages of cotton to better aid detection of injury in the field.

Methods and Materials

DP 449 BR (Bt and roundup ready) was planted at the Leyendecker Plant Science Research Center near Las Cruces, New Mexico in 2005. Two planting dates were utilized, May 3rd (early planting) and May 16th (late planting), to provide more opportunity to study lygus feeding on early fruiting structures.

Two age categories for cotton squares (pinhead and matchhead) and bolls (1-3 day and 7-8 day) were evaluated for lygus injury. Three age classes of lygus (4th instar, 5th instar, and adult) were evaluated. The experiment was arranged in a randomized complete block design with 4 blocks and five replications.

Within eight walk-in field cages (183 cm x 183 cm), individual bolls and squares of known ages were isolated in small cages constructed of styrofoam cups (280 ml) covered with nylon stockings (Greene et al. 1998, Bundy et al. 2000). Cotton was sprayed with malathion prior to cage placement to prevent interference from other insects. Bugs were field-collected from alfalfa and starved for 24 hrs prior to being introduced into cages; nymphs were supplemented with laboratory-reared individuals as needed. Into each small cage an individual bug was introduced and allowed to feed for 48 hrs and then removed. Controls consisted of caged bolls or squares without an insect. One-half of the cages were removed a week after

feeding to evaluate lygus injury. The remaining cages stayed on the plants until the cotton was mature to determine yield and quality.

Both external and internal signs of lygus feeding injury were evaluated for both squares and bolls. The number of external feeding lesions and internal carpel wall calloused areas or "warts" were recorded. The percentage of internal injury was also recorded. Lint quality will be assessed this winter. Data were analyzed with a mixed model analysis of variance.

Results

Square Injury (Table 1). No external feeding lesions were observed for any cotton squares exposed to lygus this season and no significant square size by lygus instar interactions were observed either, therefore, injury was averaged across square sizes.

Internally, squares exposed to all three stadia of lygus had significantly greater internal injury than the control (4th instar, p=0.001; 5th instar, p<.0001; adult, p=.0013). Internal injury was significantly greater for 5th instars than adults (p=.0043); however, injury observed for 4th instars was not significantly different from 5th instars or adults (p=0.0637 and p=0.2284, respectively).

Boll Injury (Table 2). External feeding lesions were observed on bolls exposed to all three bug stadia. In young bolls, the number of lesions was significantly greater for 4th instars (p=.0241) and adults (p=.0484) than the controls. In older bolls, the number of lesions were significantly greater for all instars as compared to the controls (4th instar, p<.0001; 5th instar, p<.0001; adult, p=.0074). The greatest number of lesions was produced by 4th instars in young bolls and 5th instars in older bolls.

Inner carpel wall injury or "warts" were produced by all three age classes of lygus. In young bolls, only adults produced injury that was significantly greater from the control (p=.0006). Production of warts in older bolls was significantly greater among all age classes (4th instar, p=.0003; 5th instar, p<.0001; adult, p=.0057), with 5th instars causing the highest number of warts.

Significant lint injury was observed among all age classes of lygus as compared to the controls (4th instar, p<.0001; 5th instar, p<.0001; adult, p<.0001). However, no differences in lint injury were observed between boll sizes. Numerically, 5th instars produced the greatest amount of lint injury.

Conclusions

Based on a year's data it appears that external feeding lesions produced by *L. hesperus* are not reliable indicators of lint injury to Bt cotton in New Mexico; this is similar to that observed for stink bugs in cotton (Bundy and McPherson 1999). Our observations that production of internal injury to squares and boll lint appeared to be greatest for 5th instars are supported by prior research (Zink and Rosenheim 2004).

The occurrence of external lesions and corresponding internal lint injury will soon be analyzed statistically to determine any potential correlation between the two. Our data support the importance of internal examinations of squares and bolls to estimate lygus injury as part of the scouting process. This research will be repeated again in 2006.

Acknowledgments

We would like to thank the following people Jason French, Sean O'Donnel, Derek Romig and Paul Smith for help in the laboratory and field. This research was supported by a grant from Cotton Incorporated (# 05-664NM) and by the New Mexico Agricultural Experiment Station, Las Cruces, New Mexico.

References

- Bundy, C. S., R. M. McPherson, and G. A. Herzog. 2000. An Examination of the External and Internal Signs of Cotton Boll Damage by Stink Bugs (Heteroptera: Pentatomidae). J. of Entomol. Sci. 35: 402-410.
- Ellsworth, P. C. 1998. Susceptibility Management of *Lygus* in the West, pp. 955-957. *In* Proc. 1998 Beltwide Cotton Conferences. National Cotton Council, Memphis, TN.
- Greene, J. K., S. G. Turnipseed, and M. J. Sullivan. 1998. Managing stink bugs in Bt cotton, pp. 1174-1177. In Proc. 1998 Beltwide Cotton Conferences. National Cotton Council of America, Memphis, TN
- Hardee, D. D. and W. W. Bryan. 1997. Influence of *Bacillus thuringiensis*-transgenic and nectariless cotton on insect populations with emphasis on the tarnished plant bug (Heteroptera: Miridae). J. Econ. Entomol. 90: 663-668.
- Mauney, J. R. and T. J. Henneberry. 1979. Identification of damage symptoms and patterns of feeding of plant bugs in cotton. J. Econ. Entomol. 72: 496-501
- O'Leary, P. F. 1998. Economic importance of *Lygus* spp. in cotton. *In* Proc. 1998 Beltwide Cotton Conferences. National Cotton Council, Memphis, TN.
- Ohlendorf, B. L. P.1996. Integrated Pest Management for Cotton in the Western Region of the United States. 2nd ed. Univ. Ca, Division of Agric. and Nat. Res. Publ. 3305. 164 pp.
- Wheeler, A. G., Jr. 2000. Plant bugs (Miridae) as Plant Pests, pp. 37-83. *In* C. W. Schaefer and A. R. Panizzi (eds.), Heteroptera of Economic Importance. CRC Press, New York. 828 pp.
- Zink, A.G. and J.A. Rosenheim, 2004. Square abscission in California cotton and the stage structure of western tarnished plant bug populations, pp. 1514-1517. *In* Proceedings Beltwide Cotton Conferences, 2004. National Cotton Council, San Antonio, TX.

Table 1. Internal injury to cotton squares by Lygus hesperus.

Instar	Mean % internal damage (+SE) ¹		
Control	0.12 (±.1363) a		
4th Instar	1.26 (±.2074) bc		
5th Instar	1.86 (±.2552) c		
Adult	0.09 (±.2100) b		

Means followed by the same letter do not differ significantly α =0.05

Boll Age	Treatment	Mean # external lesions (±SE)	Mean # internal lesions (<u>+</u> SE)	% Lint injury (<u>+</u> SE)
1-3 days	Control	0 a	0 a	
	4th instar	3.95 (±1.28) b	0.40 (±.4576) a	
	5th instar	2.70 (±1.27) ab	0.48 (±.4463) ab	
	Adult	3.25 (±1.28) b	1.79 (±.4529) b	
7-8 days	Control	0 a	0 a	
	4th instar	10.69 (±2.25) bc	5.62 (±1.405) bc	
	5th instar	14.20 (±2.25) c	9.02 (±1.45) c	
	Adult	5.95 (±2.07) b	3.73 (±1.30) b	
Combined	Control			13.94 (±9.35) a
	4th instar			69.17 (±6.50) b
	5th instar			76.43 (±6.42) ab
	Adult			72.24 (±6.10) b

Table 2. Injury to Cotton Bolls by Lygus hesperus.

Means followed by the same letter do not differ significantly $\alpha{=}0.05$