POTENTIAL IMPACT OF FECAL DEPOSITION BY LYGUS HESPERUS ON COTTON BOLLS

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Abstract

A study was conducted during 2007 to evaluate the potential for feces deposited by *Lygus hesperus* on cotton bolls to cause the formation of external lesions. Four treatments were evaluated: normal activity, feeding only, feces only, and a control. Bolls 7-9 days old were exposed to the four treatments for one week, then removed and taken to the laboratory for evaluation. Each boll was evaluated externally for numbers of feeding lesions and fecal deposits and internally for numbers of warts and percentage of lint staining. Preliminary analyses showed significant differences among treatments for each injury category. Lesions were present only in the normal feeding and feeding only treatments, and numbers of lesions for the normal feeding treatment were significantly greater than the feces only and control treatments. Internally, warts and lint staining were present only in the normal feeding and feeding only treatments. Significantly greater lint injury was observed for both normal feeding and feeding only than the other treatments, while numbers of warts was greatest for normal feeding. Based on our preliminary analyses, we conclude that *Lygus* feeding and not feces results in external injury to bolls.

Introduction

The plant bug complex is one of the most damaging insect groups in U.S. cotton production. In western U.S. cotton, bug-related injury primarily is due to the western tarnished plant bug, *Lygus hesperus* Knight. This insect and related true bugs feed by inserting their mouthparts into plant tissue and extracting liquefied food (Schaefer and Panizzi 2000). *Lygus* feeding on fruiting structures causes abscission of squares and young bolls, staining of lint, alteration of plant canopy, and introduction of boll rot –all of which reduce quality and yield (Ohlendorf 1996, O'Leary 1998, Wheeler 2000).

Plant bugs are often elusive and may quickly move in and out of cotton. Therefore, a proper direct evaluation of injured bolls and squares is a critical component of effective sampling for *Lygus*, and it is important that injury descriptions be as accurate as possible to reduce confusion. Internally, feeding results in calloused growths of the inner carpel wall often known as "warts," and staining of the lint around feeding sites. External injury can be seen as dark, sunken areas on the outer carpel wall (Mauney and Henneberry 1979). A common statement in the literature is that the sunken lesions evident externally on bolls are caused by a toxin in the feces of *Lygus* (Ohlendorf 1996). Since plant lesions are often associated directly with feeding in certain bugs (e.g. Wheeler 2001, McPherson and McPherson 2000, Bundy et al. 2000), we felt that the relationship between feeding and potentially-toxic feces should be evaluated. Presented here are the preliminary results of this research.

Materials and Materials

Cotton (DP 449 BR) for this research was planted in early May of 2007 at the Leyendecker Plant Science Research Center near Las Cruces, New Mexico, and the experiment was performed from late July through early September. White blooms were flagged and caged in a 13 x 25 mm mesh bag to prevent feeding by other insects. The four treatments were 1) normal: a single adult insect that was allowed to feed and defecate without restriction; 2) Feeding only: a single adult insect whose anus was covered to prevent defecation; 3) Feces only: 1-2 fresh fecal deposits of *L. hesperus* deposited directly on a boll in the field; and 4) Control: caged bolls with no insect or feces. Adult *L. hesperus* were collected from alfalfa and starved for 24 hrs before exposure to bolls. Insects in treatment 2 were cooled down in the laboratory to slow their movement, white Elmer's glue was then placed over the anus with the head of an insect pin and held in place for a few seconds to allow the glue to dry before being taken to the field. For treatment 3,

Lygus feces was collected from waxed paper lining a laboratory colony of *L. hesperus* newly established from alfalfa and fed green beans. Since the feces dried quickly and was difficult to transfer, each fecal deposit was put in solution with distilled water (0.1 µl) and then 0.3 µl was collected in a pipette tip and deposited on a boll in the field to more accurately represent normal defecation. Bolls 7-9 days old were exposed to the four treatments for one week, then removed and taken to the laboratory for evaluation. Each boll was evaluated externally for numbers of feeding lesions and fecal deposits and internally for numbers of warts and percentage of lint staining. Data were analyzed with a PROC GLM in SAS and means were separated using Duncan's multiple range test with $P = 0.05$ (SAS).

Results

In this study 436 bolls were examined. Abscission rates for bolls were 36.4%, 27.5%, 19.4%, and 31.2% for normal, feeding only, feces only, and control treatments, respectively. These bolls were removed from the current analysis because they masked true lint injury, but will be examined closely in a future analysis to determine potential impacts from feeding.

Our preliminary results are shown in Fig. 1. There were significant differences among treatments for each injury category. Externally, lesions were present only in the normal feeding and feeding only treatments. Numbers of lesions for the normal feeding treatment were significantly greater than the feces only and control treatments. Numbers of fecal deposits were significantly greater for normal feeding than the other treatments. Internally, warts and lint staining were present only in the normal feeding and feeding only treatments. Significantly greater lint injury was observed for both normal feeding and feeding only than the other treatments, while numbers of warts was greatest for normal feeding.

Conclusions

Based on our preliminary analyses we conclude that *Lygus* feeding and not fecal material results in external injury to bolls. Specifically, no external injury (in the form of lesions) was present on bolls exposed to feces only, and both treatments with a feeding component did cause external injury. It is still possible that there is some slight toxic reaction of the boll to fecal material. However, the sunken, irregular lesions often evident externally on bolls injured by Lygus appear to be the direct result of feeding, i.e., insertion of the proboscis and release of digestive enzymes). As the bugs defecate while feeding, it is easy to understand how the lesions mistakenly could be considered directly caused by feces.

While the literature does not suggest that feces has any impact to bolls internally, our data show that presence of carpel warts and lint staining is caused directly by feeding and not by any toxic reaction of the plant to feces. Internal evidence of feeding by *Lygus* and other plant bugs remains the most reliable evidence in injury. However, external lesions are an often-present obvious clue to consultants and growers that *Lygus* injury has taken place. It is our hope that this data will help to better describe the external injury symptoms.

Acknowledgments

We would like to thank Derek Romig, Joni Blount, and Ashley Scitern for help in the field. This research was supported by a grant from USDA CSREES RAMP (#GR0002085) and by the New Mexico Agricultural Experiment Station, Las Cruces, New Mexico.

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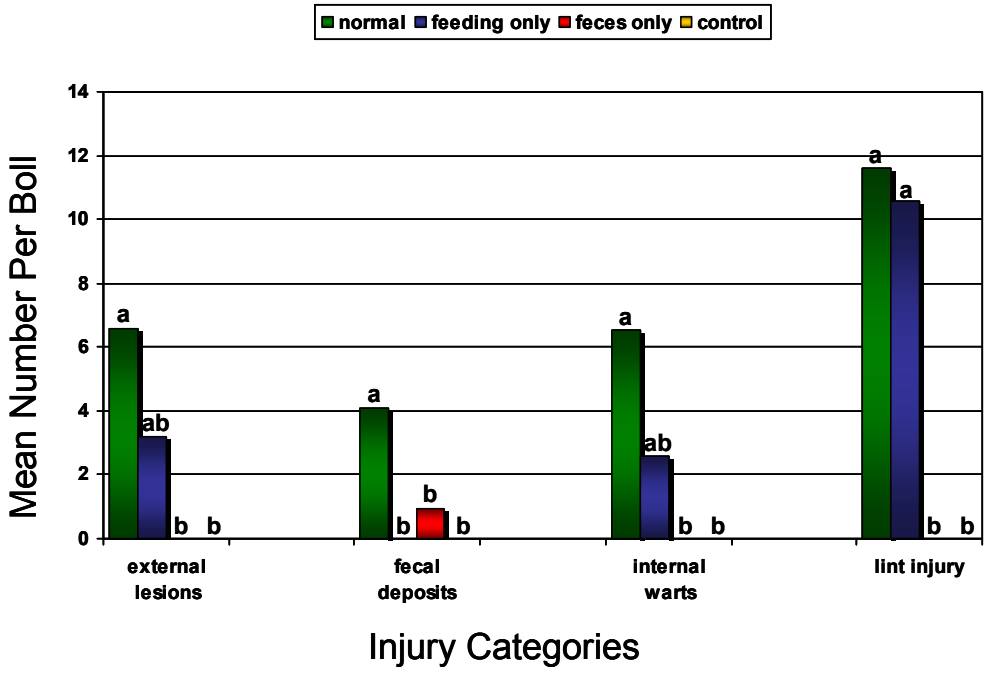

Figure 1. Summary of external and internal injury by *Lygus hesperus* to 7-9 day old bolls associated with the four treatments. Within categories, means with the same letter do not differ significantly (α=0.05).