STINK BUG DISTRIBUTION AND REPRODUCTIVE CAPACITY IN GEORGIA COTTON FARMSCAPES

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Abstract

Stink bugs and their associated damage are a serious economic issue for cotton production for the southeastern United States. In Georgia, stink bugs are the primary reason for the application of insecticides in the mid to late summer. The most commonly encountered stink bugs in Georgia cotton are the southern green stink bug, *Nezara viridula* L., the brown stink bug, *Euschistus servus* (Say), and the green stink bug, *Acrosternum hilare* (Say). Stink bugs are a cosmopolitan pest and are generalists capable of feeding on a wide variety of plants. Stink bugs move among noncultivated and agricultural hosts in correspondence with plant phenology, and understanding this movement and reproductive capacity will be important for formulating novel pest management strategies. In this study, stink bug density was sampled in a pilot scale Georgia farmscape planted with cotton, corn, soybean, and peanut. Samples were taken weekly and adult stink bugs were brought to the laboratory, dissected, and classified as non-reproductive, intermediate, or reproductive. Stink bug populations were the greatest in soybean followed by cotton and peanut respectively. Reproductive data from *N. viridula* indicated that females from all three reproductive classifications were present in cotton and soybean, but intermediate females were largely absent from peanut. These data suggest that peanut may not be a suitable host for egg development in adult female *N. viridula.* Understanding the role of each crop in the life history of the insect is essential to ecologically based pest management programs.

Introduction

Stink bugs are a growing concern to cotton producers throughout the southeastern states including Georgia. Increased stink bug populations have been hypothesized to occur as a result of a reduction in broad spectrum pesticide applications formerly used to control the boll weevil (*Anthonomus grandis* Boheman) and the boll worm complex (Bundy and McPherson 2000, Green et al. 1999). Stink bug damage in cotton is caused by direct feeding on bolls that decreases quality and yield of cotton though lint staining, seed death, and boll abscission (Barbour et al. 1990, Toscano and Stern 1976). Stink bugs are also a vector of boll rot pathogens (Medrano et al. 2007). The southern green stink bug, *Nezara* viridula L., the brown stink bug, *Euschistus servus* (Say), and the green stink bug, *Acrosternum* hilare (Say) are the most frequently encountered stink bugs in Georgia farmscapes. Stink bugs are cosmopolitan pests that are capable of feeding on numerous hosts, and their presence and abundance in a particular crop is related to crop phenology (Velasco and Walter 1992). Understanding the role of different crops and how crop phenology affects the reproduction and development of stink bugs is important to the development of management strategies for stink bug populations. This study was designed to elucidate the role of cotton, soybean, corn, and peanut in the reproduction and development of stink bug populations in Georgia farmscapes.

Materials and Methods

Experiments were conducted at UGA research stations located in Plains and Midville. Plots ranged in size from 1.62 to 2.83 hectares and each main plot was subdivided into four subplots that were equal in area for that particular location. Two subplots were rectangular in shape and located along the outside long edge of the plot; the remaining two subplots were square in shape and located in the middle of the strip plots. Each subplot contained one crop, and peanut and corn were always planted in the outside subplots (strips) with cotton and soybean planted within the inside subplots (Figure 1). Corn in Plains and Midville was planted on April-09, and 22-April-09 respectively. Cotton, soybean, and peanut were planted on the same day at a single location and were planted on 2-June-09 and 3-June-09 for Plains and Midville respectively. Corn, soybean, peanut, and cotton varieties were DKC67-87RR2 (corn), AG7501 (soybean), Georgia Green (peanut), and avicta treated DP 161 B2RF (cotton).

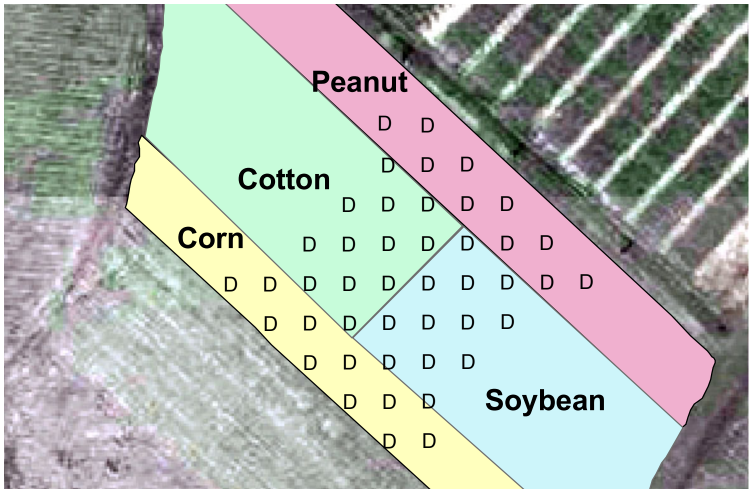


Figure 1. Main plot and subplot layout with sampling locations.

After planting, sampling locations were marked within rows with a flag mounted on a 2.44 m long fiberglass shaft. Sampling locations were arranged on a 20 x 20 m grid that was then rotated at a 45° angle with respect to the direction of the crop rows creating a diamond shaped sampling grid with respect to the plot layout (Figure 1). Sampling points within a row were separated by 20.12 m and rows containing marked sampling locations were separated by 11 rows. Insect sampling occurred once per week from 13-July-09 thru 16-September-09 and biweekly thereafter until the 19-October-09. Cotton, soybean, and peanut were sampled using a sweep net with a diameter of 46 cm. Twenty sweeps were taken from two rows located 3 rows apart such that ten sweeps were taken before the flag and ten sweeps were taken after the flag (Figure 2). Corn was sampled using whole plant sampling

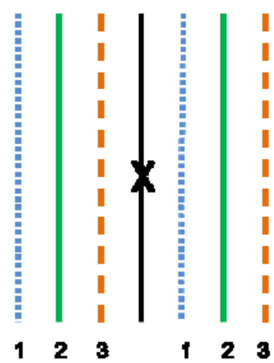


Figure 2. Rows sampled for each sampling location. X marks the location of the flag and 20 sweep samples were taken from each of the rows 1, 2, or 3, with 10 sweeps before and 10 sweeps after the X.

for ten consecutive plants in each row with the same row arrangement as cotton, soybean and peanut. There were only two stink bugs recorded from corn after 13-July-09 when cotton, soybean, and peanut were being sampled. Therefore, we do not include corn in our analyses.

Each sweep net sample was transferred into a sealed 3.79 liter produce bag, stored in a cooler while in transport to the laboratory, and placed in the freezer. Stink bug adults and nymphs were identified to species, and adult stink bugs were identified as male or female. Beginning on the 11-August-09, adult stink bugs were dissected to assess the presence of parasitoid larvae and gonad development. Figures and photographs from Esquivel (2009) were used to assess ovary and male genital development and used form a scale to rank genital development. Ovary and male genital development were ranked as non-developed, intermediately developed, and reproductive. Females that had black necrotic eggs inside their ovaries were considered post reproductive (Esquivel 2009). Data presented in this paper are focused on abundance of stink bugs in each crop, and female reproductive status. Due to small numbers of all reproductive classes among species and location, reproductive data presented in this paper are limited to those collected for *N. viridula*. To determine the main effects of location and crop on total stink bug abundance, stink bug counts were averaged for each flag across the entire season, square root transformed and analyzed using a one way analysis of variance in Proc Glimmix (SAS institute 2008). An analysis was performed to test if non-reproductive, intermediate, or reproductive females were more abundant in cotton, soybean, or peanut. Female reproductive data were averaged by flag and analyzed Proc Glimmix (SAS Institute 2008) using the lognormal distribution function in the model statement.

Results

Stink bug abundance varied by crop and was most abundant in soybean followed by cotton. Peanut had the fewest number of stink bugs per sample. These results were consistent for Midville and Plains (Figure 3).

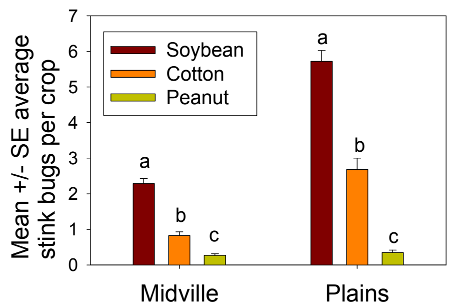
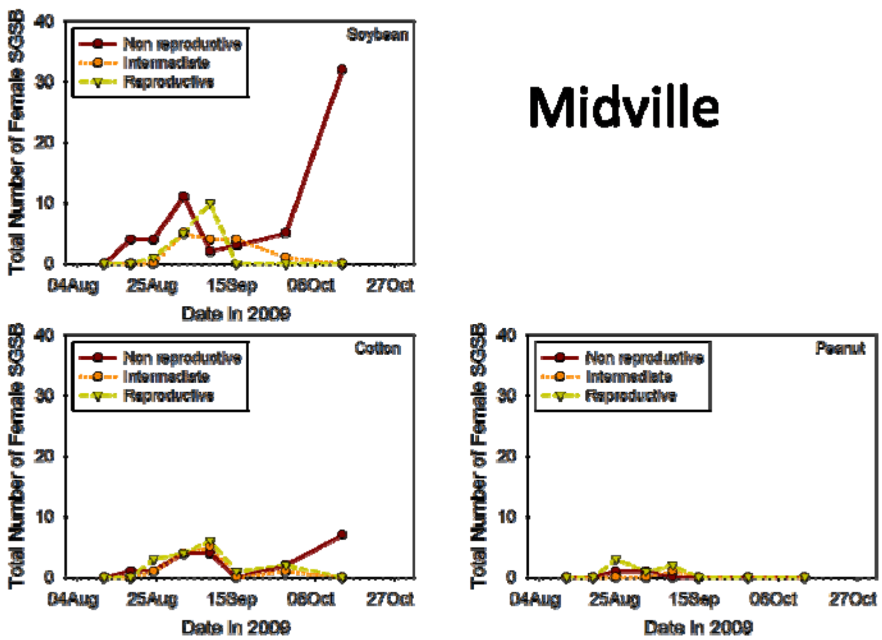


Figure 3. Abundance data for Midville and Plains for the average number of stink bugs per crop. Means with different letters are different at P<0.05 Tukeys HSD.

Non-reproductive, intermediate, and reproductive female *N. viridula* were present in soybean and cotton at both Midville and Plains. Peanut contained both non-reproductive and reproductive female *N. viridula* at each location, but did not contain intermediate females in Plains. One intermediate female was recorded from Midville for all peanut samples on all collection dates (Figure 4).



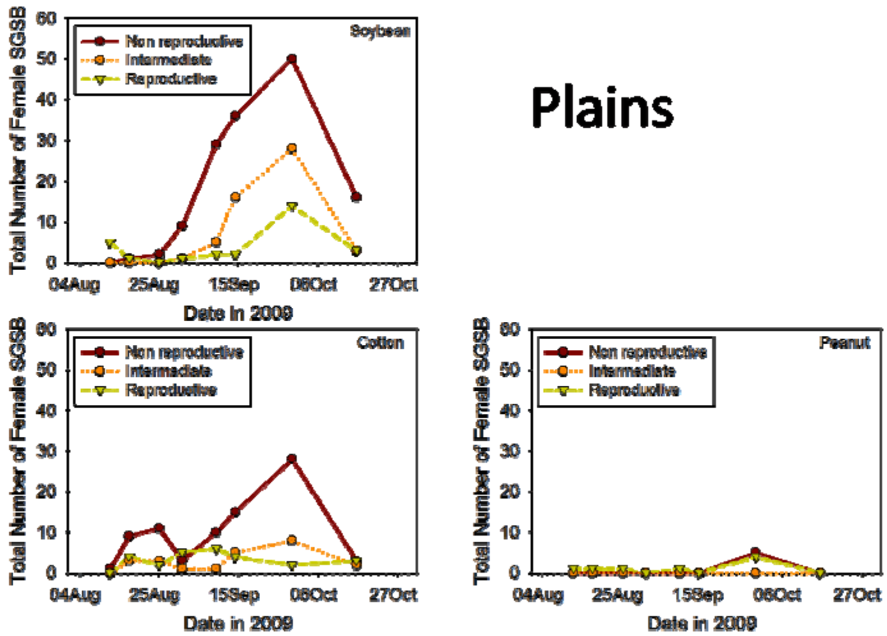


Figure 4. Total number of female *N. viridula* in each reproductive classification over time for soybean, cotton, and peanut for the locations Midville and Plains.

In Midville, non-reproductive females were more abundant in soybean than cotton or peanut, and data from Plains showed differences among all three crops for non-reproductive females (Figure 5). Intermediate and reproductive females did not show statistically different populations among the three crops at either sampling location.

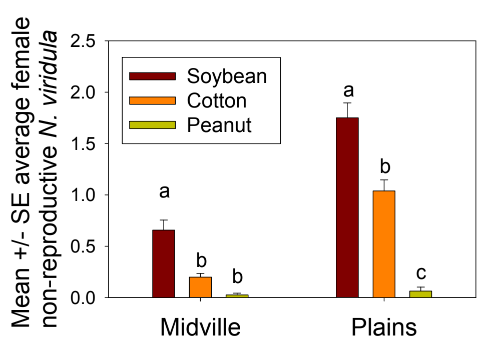


Figure 5. Abundance data for Midville and Plains for the average number of non-reproductive female *N. viridula* per crop. Means with different letters are different at P<0.05 Tukeys HSD

Summary

Data on the abundance of stink bugs in cotton, soybean, and peanut are consistent with the findings of Bundy and McPherson (2000) in that we found significantly more stink bugs in soybean than in cotton. In addition to cotton and soybean, we found stink bugs in peanut. Stink bug populations in peanut are important to pest management because all stadiums of *N. viridula and E. servus* have been found in peanut and stink bug populations tend to aggregate on the borders of cotton and peanut fields (Tillman et al. 2009, Tillman 2008a,b). Data from this study indicate that *N. viridula* females differ in their abundance and reproductive status among cotton, peanut, and soybean. For all sampling locations in peanut at Midville and Plains, only one intermediate female *N. viridula* was observed for the entire year. The remaining *N. viridula* females in peanut were either non-reproductive or reproductive. In contrast, cotton and soybean had numerous females from all three reproductive classifications. These results suggest that peanut may have a different role in the reproduction and development of *N. viridula* than cotton and soybean. The absence of *N. viridula* intermediate females may indicate that peanut is not a suitable host for egg development, which is important when considering pest management strategies. Integrated pest management and ecologically friendly pest management strategies should consider the role of different plant species as they relate to the abundance and distribution of stink bugs through the landscape. Applying knowledge of how crops affect stink bug abundance and distributions will allow growers to exploit life history traits of stink bugs leading to better management of stink bug populations.

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