OVIPOSITION SITE PREFERENCE OF CREONTIADES SIGNATUS (DISTANT) ON OKRA-LEAF AND CONVENTIONAL COTTON

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Abstract

We examined the oviposition preference of *Creontiades signatus* (Distant) on okra-leaf 'FiberMax 832' (FM 832) and normal-leaf 'Stoneville 452" (SV 452) cotton varieties through choice and no-choice experiments. In a no-choice study, *C. signatus* oviposited an average of 10.7 eggs/female/plant over a 48 h period regardless of the host cultivar. Eighty-three percent of the total eggs were oviposited on the leaf petiole of FM 832, as opposed to 90% of all eggs being deposited on the leaf petiole for SV 452. The remainder of eggs for both varieties were laid on the mainstem, fruiting structures (squares and small bolls), and the peduncles, respectively. In the free-choice experiment, *C. signatus* oviposited three times more eggs on SV 452 than FM 832, and the site preference and distribution of eggs was similar for the two cotton types. This is the first report of the oviposition behavior of *Creontiades signatus* on cotton. These results indicate that this relatively new plant bug pest of South Texas cotton has a preference for normal-leaf STV452 over okra-leaf FM382, but it is not known if such a preference exists under field conditions. This information may prove useful in understanding the basic biology of C. *signatus*, and the development of infestations in commercial cotton fields.

Introduction

Creontiades signatus (Distant) is a light-green colored plant bug, about 0.25" in length (adults) that has only recently been identified to species. In south Texas, it was reported as an economic pest of cotton from feeding injury to reproductive structures as early as 1998 (Norman and Sparks 1998). This plant bug injects salivary enzymes that break down the tissue of developing squares and bolls, forming a liquid substrate that is sucked into the gut. This feeding process dissolves the pollen sacks of developing squares, damages the developing embryos (seeds), and discolors the lint (Armstrong et al. 2007). The feeding sites also allow for the invasion of secondary pathogens to further deteriorate the lint and boll quality (Medrano et al 2007). Very little is known about this plant bug pest of cotton, including the oviposition behavior or the development of nymphs. The cotton acreage of the Rio Grande Valley of Texas is dominated by okra-leaf genotypes where an estimated 83% of 100,000 acres planted in 2007 were okra-leaf types (Texas Agricultural Ext. Service 2007). The Coastal Bend Region of Texas grows between 400,000 to 500,000 acres of cotton annually, and the ratio of normal-leaf to okra-leaf is considered to be about equal (R. Parker, personal com.). Okra-leaf genotypes have been increasing in popularity in the United States over the last 10 yr and have displayed some advantages in pest management by allowing increased pesticide penetration (James and Jones 1985), some resistance to pink bollworm (Wilson 1990), and reduced whitefly development as compared to normal-leaf genotypes (Chu et al. 1999). Our study investigated the oviposition behavior of *C. signatus* on okra-leaf and normal-leaf cotton with the objective of 1) determining if there is an oviposition preference relative to leaf-type and 2) determining within-plant distribution of eggs on the two morphologically different cottons.

Materials and Methods

Insect Rearing. The insects used in these studies were reared from a colony of *C. signatus* that were originally collected from rocket mustard, *Sisymbrium irio* L., and pigweed, *Amaranthus* spp. in January 2005 from several locations in Hidalgo, county TX. The bugs were maintained on bean *Vigna unguiculata* L. (C. V. Texas Pinkeye) pods for feeding and oviposition, and this was supplemented with field corn *Zea mays* L. The laboratory colony was occasionally augmented with field collected adults to ensure sufficient numbers for this and other ongoing studies. Two gallon Tupperware® containers were used to maintain the insects in environmental chambers at 27º C and a 14:10 h L:D photophase (Coleman 2007).

No-choice Oviposition Study. FiberMax 832 ('FM 832') and Stoneville 452 ('SV 452') varieties were planted individually in 6.6 L pots containing potting soil (Sunshine mix, Bellevue, WA) and maintained in the greenhouse under standard conditions until there were 12 nodes above the cotyledon leaves (65 DAP). The plants were beginning to flower and averaged 18 inches in height at the initiation of oviposition studies. Individual plants (five replicates per cultivar) were covered with pre-fabricated enclosure made of Lumite® screen (Bio-Quip® Products, Gardena, CA) held over the plant by wire hoops. Ten *C. signatus* females from the laboratory colony, and at least 5 d of age, were enclosed with each plant and left in the greenhouse for 48 h. Whole plant inspections for eggs were made by clipping the plant at the soil surface and visually inspecting the entire surface area under stereo microscope. The number and location of eggs were recorded on a data-sheet template of a cotton plant showing the main and axillary stems, leaf blades, basal and distal halves of leaf petioles, peduncles, floral buds, and small bolls. The distribution of eggs along the plant axis was determined by summing the number of eggs associated with the cotyledon leaves (node 0) through subsequent branch nodes (1-12). The number of eggs on each plant, and individual plant parts, was analyzed by PROC GLM (SAS 2001), and tested among the two genotypes and different plant structures by Student-Neuman-Kuel's multiple comparison test ($\alpha < 0.05$).

Free-choice Oviposition Study. The free-choice experiment was conducted using the same methodology as the no-choice study with the exception that 10 replications of paired 'SV 452' and 'FM 832' plants were planted and maintained in the same pot, and 20 female *C. signatus* were enclosed for 48 h. The data-sheet template and data analysis used for the free-choice experiment was identical to that of the no-choice experiment.

Results and Discussion

No-choice Oviposition. There were no differences (F = 0.01; df = 1, 40; P < 0.908) in the total number of eggs oviposited by *C. signatus* on okra-leaf (n = 530) or normal-leaf (n = 542) cotton in the no-choice experiment (Fig. 1). There was a significant pattern within genotype (F = 21.9; df = 4, 20; P <0.001 for 'SV 452', F = 8.45; df = 4, 20; P < 0.001 for 'FM 832') for eggs oviposited on the basal and distal portions of the leaf petioles when compared to the other plant parts. We made a distinction for eggs oviposited on the basal and distal half of the petiole because other plant bugs, such as *Lygus hesperus* (Knight) and *Lygus lineolaris* (Palisot de Beauvois), demonstrate a preference for oviposition on the distal half of the petiole (Benedict et al. 1981 and Bariola 1969 respectively). Ninety percent of the total number of eggs on 'SV 452' were oviposited on the leaf petioles compared to 83% for the 'FM 832' (Fig. 1). The main stem was the next most frequented site for oviposition, followed by the fruiting structures and peduncle. The 'FM 832' had almost double the percentage of eggs laid on the main stem than 'SV 452', but the remaining percentages on the peduncle and fruiting structures were almost identical.

Free-choice Oviposition. The results of offering *C. signatus* a choice between an okra-leaf and a normal-leaf cotton variety showed a strong preference for the normal-leaf cotton over the okra-leaf. The total number of eggs oviposited on 'SV 452' (n = 1,850) was three times higher (F = 49.39; df = 1, 90; P < 0.001,) than 'FM 832' (n = 608), and the number of eggs oviposited on the basal and distal halves of the leaf petiole and main stem was significantly higher (F = 32.99; df = 4, 90; P < 0.001) on 'SV 452' when compared to 'FM 832' (Fig. 2). More eggs were oviposited on the main stem of 'SV 452' as compared to 'FM 832', but the overall distribution in the percentages of eggs oviposited on the main stem was similar (Fig. 2). We found a noticeably higher percentage of total eggs oviposited in the main stem for both genotypes when compared to the no-choice experiment.

This is the first report of ovipostion behavior of *C. signatus* on cotton. Although we did not examine egg eclosion and subsequent nymphal survival in this experiment, we have confirmed that *C. signatus* eggs hatch and nymphs survive when maintained on cotton in the laboratory, and are currently conducting developmental biology studies on cotton identical to those conducted on green bean (Coleman 2007). The total number of eggs per female oviposited by *C. signatus* when enclosed on cotton plants appears is similar to *Lygus hesperus* when treated in the same manner (Benedict 1981, Benedict 1983). However, *C. signatus* prefers to oviposit on any portion of the petiole, while *Lygus hesperus* Knight, and *Lygus lineolaris* prefer to oviposit on the pulvinus, or the thickened portion of the petiole where it attaches to the leaf blade (Tingey et al. 1975, Benedict et al. 1981, Benedict et al. 1983, Bariola 1969). In Australia, *Creontiades dilutus* (Stål) and *Creontiades pacificus* (Stål) prefer to oviposit on the leaf petioles, but no there is no mention for a preference for the distal or basal portion of the leaf petiole (Khan et al. 2004).

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References Cited

Armstrong, J. S., R. J. Coleman, and B. L. Duggan. 2007. Characterizing the damage and oviposition of a *Creontiades* plant bug to South Texas cotton, pp. 34-37. *In* Proc. Beltwide Cotton Conf.

Bariola, L. A. 1969. The biology of the tarnished plant bug, *Lygus lineolaris* (Beauvois), and its nature of damage and control on cotton. Ph.D. Dissertation, Texas A&M University.

Benedict, J. H., T. F. Leigh, J. L. Frazier, and A. H. Hyer. 1981. Oviposition behavior of *Lygus hesperus* on two cotton genotypes. Ann. Entomol. Soc. Am. 74: 392-394.

Benedict, J. H., T. F. Leigh, and A. H. Hyer. 1983. *Lygus hesperus* (Heteroptera: Miridae) oviposition behavior, growth, and survival in relation to cotton trichome density. Environ. Entomol. 12: 331-335.

Chu, C. C., A. C. Cohen, E. T. Natwick, G. S. Simmons, and T. J. Henneberry. 1999. *Bemisia argentifolii* (Hemiptera: Aleyrodidae) biotype b colonization and leaf morphology relationships in upland cotton cultivars. Aust. J. Entomol. 38: 127-131.

Coleman, R. J. 2007. Life history of *Creontiades signatus* (Heteroptera: Miridae) on green bean and an evaluation of boll damage by adults caged on bolls in field cotton. (Southwest. Entomol. In press).

James, D. and J. E. Jones. 1985. Effects of leaf and bract isolines on spray penetration and insecticidal efficacy, pp. 399. *In* Proc. Beltwide Cotton Conf., National Cotton Council of America, Memphis, TN.

Khan, M., D. Kelly, M. Hickman, R. Mensah, H. Brier, and L. Wilson. 2004. Mirid ecology in Australian cotton. Australian Cotton CRC Research Review. No. 14.

Medrano, E. G., Esquivel, J. F., Bell, A. A. 2007. Transmission of cotton seed and boll rotting bacteria by the southern green stink bug (*Nezara viridula.* L.). J. Appl. Microbio. 103: 436-444.

Norman, J. W. Jr. and A. N. Sparks Jr. 1998. Creontiades species. Pest Cast (Tex. Agric. Ext. Serv.) 24(8):2.

SAS Institute, 2001. SAS/STAT user's guide, release 8.02 ed. SAS Institute, Cary, NC.

Tingey, W. M., T. F. Leigh, and A. B. Hyer. 1975. *Lygus hesperus* growth, survival and egg laying resistance on cotton genotypes. J. Econ. Entomol. 68: 28-30.

Wilson, F. D. 1990. Relative resistance of cotton lines to pink bollworm. Crop Sci. 30: 500-504.

Texas Cooperative Extension, 2007. Texas A&M University, Lower Rio Grande Cotton, Grain Sorghum, and Corn Blue Book Regional Report 500-2007. http://lrgvipm.tamuedu/blue book.htm.

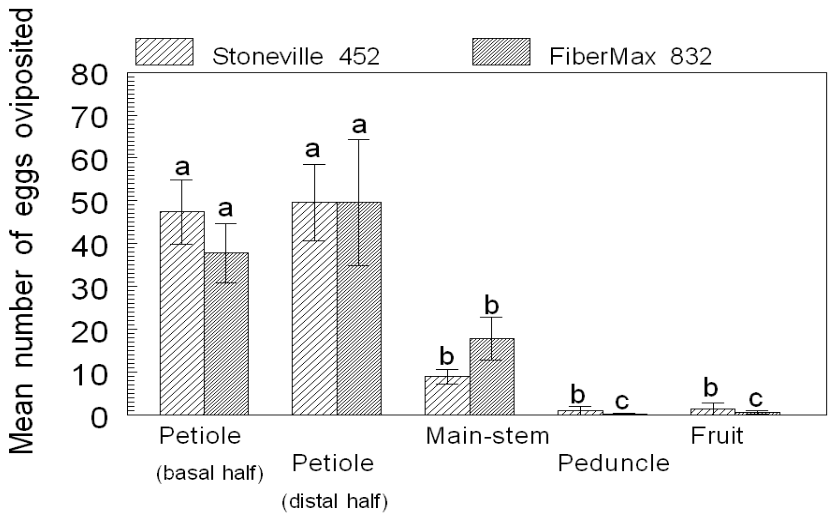

Fig. 1. No-choice oviposition experiment; egg counts are the mean of 5 replicates (cotton plants) enclosed with 10 female *Creontiades signatus* (Distant) for 48 h. Bars followed by a different lowercase letter, within a genotype, are significantly (α < 0.05) different after Student-Neuman-Kuel's multiple comparison test.

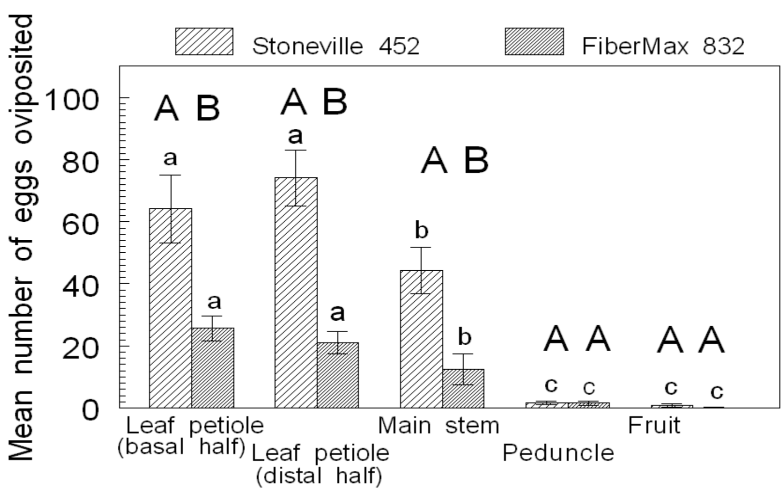

Fig. 2. Free-choice oviposition experiment; egg counts are the mean of 10 replicates (cotton plants) enclosed with 20 female *Creontiades signatus* (Distant) for 48 h. Bars followed by a different lowercase letter, within genotype, are significantly (α < 0.05) different after Student-Neuman-Kuel's multiple comparison, while uppercase letters signify differences between cultivars for specific plant structures.