NOTE

Effect of Southern Chinch Bug (Hemiptera: Lygaeidae) on Weed Establishment in St. Augustinegrass[1]

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St. Augustinegrass, *Stenotaphrum secundatum* (Walt.) Kuntze, lawns are used throughout the southern United States for their climatic and environmental (soil types) adaptation and ability to tolerate full sun to moderate shade. The southern chinch bug, *Blissus insularis* Barber, is the most damaging insect pest of St. Augustinegrass (Crocker 1993, Intern. Turfgrass Soc. J. 7: 358-365). This insect pest has the ability to develop resistance to insecticides (Reinert and Portier 1983, J. Econ. Entomol. 76: 1187-1190; Cherry and Nagata 2005, Florida Entomol. 88: 119-121) and overcome host plant resistance (Busey and Center 1987, J. Econ. Entomol. 80: 608-611; Cherry and Nagata 1997, Intern. Turfgrass Soc. J. 8: 981-986). In southern Florida, heavy southern chinch bug infestations have been shown to cause substantial damage to St. Augustinegrass that leads to dead brown patches of turf (Cherry 2001, Florida Entomol. 84: 151-153).

In monoculture stands of turfgrass, weeds create disruptions of visual uniformity that reduce aesthetic appeal (McCarty et al. 2001, Color Atlas of Turfgrass Weeds. 269 pp.). High plant densities can prevent weeds from becoming established by occupying space, utilizing water and nutrients, and intercepting light (Akey et al. 1991, Weed Res. 31:63-72; Roush and Radosevich 1985, J. Appl. Ecol. 22: 895-905). Vigorous and actively-growing crops are more able to compete with weeds than weakened or slow-growing crops (Norris and Kogan 2000, Weed Sci. 48: 94-158). Thus, biotic or abiotic conditions that weaken grass stands can result in increased weed populations (Genung and Orsenigo 1965, Florida Entomol. 48: 221-226).

Interactions between weeds and arthropods in managed ecosystems can result in habitat modification that favors the development of one or both species. Although relationships between arthropod-damaged crops and weeds have long been recognized (Norris and Kogan 2000), there are few documented examples. Simulations of insect defoliation on soybeans altered the competitive relationship between the crop

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and several weed species (Grymes et al. 1999, Weed Sci. 47: 90-94; Higgins et al. 1984, Weed Sci. 32: 511-519). Herbivore-induced stress has been shown to influence weed populations in alfalfa (Summers and Newton 1989, Environ. Entomol. 18: 958-963). However, we are unaware of any research documenting insect pests and weed relationships in turfgrass.

In southern Florida, weed infestations commonly occur in areas with southern chinch bug infestations. However, the relationship between southern chinch bugs and weeds in St. Augustinegrass is not known. The objective of our study was to determine if southern chinch bugs caused higher weed populations in St. Augustinegrass.

Eight sites were sampled from March to August, 2005, in urban lawns in Palm Beach Co., FL. Each site contained three distinct habitats: an active infestation of southern chinch bugs in St. Augustinegrass, weedy St. Augustinegrass, and green healthy-appearing St. Augustinegrass. Chinch bug infestations were located by looking for areas of yellowed St. Augustinegrass indicating possible damage (Cherry 2001), and presence of live chinch bugs was confirmed visually. Healthy habitats were defined as dense, primarily weed-free St. Augustinegrass without symptoms of chinch bug damage. Areas of St. Augustinegrass with >30% weed cover were classified as weedy. At each site, a 5 × 5 m area of each of the three habitats was delineated and marked with spray paint. Chinch bug populations were sampled in each habitat by vacuuming 5 randomly selected 30 × 30 cm areas for 2 min using a modified Weed Eater® Barracuda blower/vacuum (Poulan/Weedeater, Shreveport, LA). The use of a vacuuming technique for southern chinch bug has been described by Crocker (1993). After collection, samples were frozen for later counting in a laboratory. Samples were passed through a U.S.A. Standard Testing Sieve #10 (2 mm opening) to remove debris. Chinch bugs were counted by microscopic examination. Following chinch bug sampling, weed populations were documented within 5 randomly located 0.4-m^2 subplots in each habitat. Weeds were counted and recorded by genus and species. St. Augustinegrass groundcover was estimated visually on a scale of 0-100%, with 0% being bare ground or weeds and 100% being a monoculture of St. Augustinegrass. Data from the 8 sites were pooled. Mean differences in chinch bug populations, weed populations, and percentage ground cover among habitats were determined using a Least Significant Difference (LSD) test (SAS 1996, SAS Institute, Cary, NC).

Southern chinch bug populations averaged 1957, 13, and 1.4 individuals per m^2 in the infested, weedy, and healthy St. Augustinegrass habitats, respectively (Table 1). These data are consistent with Cherry (2001) who showed similar southern chinch

Table 1. Southern chinch bugs (SCB), weeds, and St. Augustinegrass ground cover by habitat in St. Augustinegrass lawns*

Habitat	SCB per m^2	Weeds per m^2	Groundcover %
SCB infested	1956.9 ± 3139.1 B	62.3 ± 41.1 B	39 ± 28 B
Weedy	13.3 ± 21.1 A	164.9 ± 130.2 A	13 ± 16 A
Healthy	1.4 ± 4.4 A	9.1 ± 11.8 C	96 ± 8 C

* Means ± 1 SD. Means followed by the same letter within a column are not statistically different (alpha = 0.05) using the LSD test (SAS 1996).

bug densities and that southern chinch bugs are highly aggregated at infestations with few in surrounding healthy St. Augustinegrass. Weed populations were greatest in the weedy habitat followed by the infestation and healthy habitats (Table 1). It is important to note that weed populations were significantly greater in the chinch bug-infested St.

Table 2. Weed species occurring in St. Augustinegrass lawns (pooled over sampling sites and habitat)

Scientific name	Common Name	Class
Alternanthera philoxeroides Mart.	Alligatorweed	dicot
Alternanthera pungens HBK.	Khakiweed	dicot
Amaranthus lividus L.	Livid amaranth	dicot
Amaranthus viridus L.	Slender amaranth	dicot
Bidens alba (L.) DC.	Hairy beggarticks	dicot
Chamaesyce cordifolia (Ell.) Small	Roundleaf spurge	dicot
Chamaesyce hyssopifolia L. Small	Hyssop spurge	dicot
Commelina diffusa Burm. f.	Common dayflower	monocot
Cynodon dactylon (L.) Pers.	Common bermudagrass	monocot
Cyperus compressus L.	Annual sedge	monocot
Cyperus esculentus L.	Yellow nutsedge	monocot
Desmodium canum J.F. Gemel.	Creeping beggarweed	dicot
Dichondra carolinensis Michx.	Dichondra	dicot
Digitaria ciliaris (Retz.) Koel.	Southern crabgrass	monocot
Diodia teres Walt.	Poorjoe	dicot
Drymaria cordata L.	Heartleaf drymary	dicot
Emilia fosbergii Nicols.	Cupid's-shaving-brush	dicot
Hedyotis corymbosa (L.) Lam.	Old world diamond-flower	dicot
Hydrocotyle umbellata L.	Many-flower pennywort	dicot
Kyllinga brevifolia Rottb.	Green killinga	monocot
Oxalis florida Salisb.	Florida yellow woodsorrel	dicot
Phyla nodiflora (L.) Green	Mat lippia	dicot
Phyllanthus tenellus Roxb.	Longstalked phyllanthus	dicot
Richardia scabra L.	Florida pusley	dicot
Spermacoce verticillata L.	Whitehead broom	dicot
Stellaria media (L.) Vill.	Common chickweed	dicot
Trifolium dubium Sibth.	Small hop clover	dicot
Urochloa subquadripara Trin.	Smallflowered alexandergrass	monocot

Augustinegrass than in the healthy St. Augustinegrass. Superimposing chinch bug and weed data shows that weeds were infesting areas of chinch bug damage because chinch bugs had little attraction to weedy habitats. Chinch bugs have been shown to breed exclusively on monocotyledonous plants (Slater 1976, Biotropica 8: 143-165). Of the 28 weed species found at the sample sites, only 7 were monocots (Table 2). Healthy sites contained a mean (±SE) of 3.8 ± 2.6 different weed species compared with 6.8 ± 4.3 in both weedy and southern chinch bug infested habitats. However, there where no trends that indicated certain weed species were more able than others to capitalize on southern chinch bug damage and to become established. At most sites, the prevailing weed species in the healthy St. Augustinegrass habitat tended to be the dominant species in the neighboring infested and weedy habitats. The most commonly found weed species in all three habitats were southern crabgrass, *Digitaria ciliaris* (Retz.) Koel., common bermudagrass, *Cynodon dactylon* (L.) Pers., small hop clover, *Trifolium dubium* Sibth., Hyssop spurge, *Chamaesyce hyssopifolia* L. Small, and green killinga, *Kyllinga brevifolia* Rottb. (data not shown).

Overall weed populations were 6.8× higher in the southern chinch bug-infested St. Augustinegrass compared with the healthy St. Augustinegrass (Table 1). Additionally, St. Augustinegrass groundcover was much lower in weedy and infested habitats than in the healthy St. Augustinegrass. It is generally accepted that weeds can become a greater problem in crops that are damaged or weakened (ZimDahl 2004, Weed Crop Competition-a Review, Blackwell Publishing, Ames, IA). In the resource-based interaction between crops and weeds, factors that reduce the competitiveness of the crop subsequently favor weed growth (Norris and Kogan 2000). When damage to a stand of turfgrass reduces groundcover, resources such as space and light become available to other plants in the ecosystem that are not being damaged.

In summary, the data from this study illustrate that southern chinch bug damage to St. Augustinegrass provides an opportunity for weeds to use available resources and to become established. Also, even after southern chinch bug infestations are reduced through insecticidal and/or natural controls, the weed problem at infestation sites remains. Consequently, weed suppression as a result of southern chinch bug control should be considered when determining the economic threshold for their control in St. Augustinegrass.