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## Turfgrass, Crop, and Weed Hosts of *Blissus occiduus* (Hemiptera: Lygaeidae)

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**ABSTRACT** *Blissus occiduus* Barber is an important pest of buffalograss, *Buchloë dactyloides* (Nuttall) Engelmann, turf. No-choice studies documented the susceptibility of selected turfgrasses, crops, and weeds to *B. occiduus* feeding. Highly to moderately susceptible grasses included buffalograss; yellow *Setaria glauca* (L.) and green foxtail *Setaria viridis* (L.); Kentucky bluegrass, *Poa pratensis* L.; perennial ryegrass, *Lolium perenne* L.; brome, *Bromus* spp. Leyss.; zoysiagrass, *Zoysia japonica* Steudel; Bermuda grass, *Cynodon dactylon* (L.) Pers.; sorghum, *Sorghum bicolor* (L.) Moench; tall fescue, *Festuca arundinacea* Schreb.; and barley *Hordeum vulgare* (L.). Slightly to nonsusceptible grasses included fine fescue, *Festuca ovina hirtula* L.; rye, *Secale cereale* L.; crabgrass *Digitaria sanguinalis* (L.); bentgrass, *Agrostis palustris* Huds.; wheat, *Triticum aestivum* L.; corn, *Zea mays* L.; fall panicum *Panicum dichotomiflorum* Michx.; and St. Augustinegrass, *Stenotaphrum secundatum* (Walt.) Kuntze. The reproductive potential of *B. occiduus* was also investigated on these same grasses. *B. occiduus* produced offspring on 15 of the 18 turfgrass, crop, and weed species evaluated. No reproduction occurred on either Bermuda grass or St. Augustinegrass, and buffalograss plants were killed by *B. occiduus* feeding before offspring could be produced.

**KEY WORDS** Western chinch bug, buffalograss, zoysiagrass, *Buchloë dactyloides*, sorghum

BUFFALOGRASS, *Buchloë dactyloides* (Nuttall) Engelmann, is a perennial, low-growing, warm-season grass that provides an alternative for the turfgrass industry because of its low maintenance and drought-tolerant characteristics (Riordan et al. 1998). In the early 1990s, the western chinch bug, *Blissus occiduus* Barber, emerged as a serious pest of buffalograss.

First described in 1918 (Barber 1918), the reported distribution of *B. occiduus* currently includes California, Colorado, Kansas, Montana, Nebraska, and New Mexico in the United States, and Alberta, British Columbia, Manitoba, and Saskatchewan in Canada (Bird and Mitchener 1950, Slater 1964, Baxendale et al. 1999). Reported hosts of *B. occiduus* include corn, *Zea mays* L. (Ferris 1920); sugarcane, *Saccharum officinarum* L. (Ferris 1920, Box 1953, Slater 1976); wheat, *Triticum aestivum* L. (Bird and Mitchener 1950); barley, *Hordeum* spp. L.; brome, *Bromus* spp. Leyss. (Farstad and Staff 1951); and buffalograss (Baxendale et al. 1999). Possible additional hosts of *B. occiduus* include Kentucky bluegrass, *Poa pratensis* L.; perennial ryegrass, *Lolium perenne* L. (Baxendale et al. 1999); yellow bristlegrass, *Setaria glauca* (L.) Beauv.; and prairie sand reed grass, *Calamovilfa longifolia*

(Hook.) Scribner (T.J. Henry and F.P.B., unpublished data).

Like many chinch bug species, *B. occiduus* exhibits conspicuous wing dimorphism with both brachypterous and macropterous forms present during its life cycle (Baxendale et al. 1999). Since the 1920s, there have been numerous reports of “short-winged” chinch bugs causing damage to crops and turfgrasses along the northeastern Atlantic coastal region, and extending inland to the Great Lakes (Swenk 1925). Additional reports have also placed short-winged chinch bugs in Arizona, Kansas, and Michigan (Kelley and Parks 1911). Unfortunately, these chinch bugs were rarely identified to species. Furthermore, these chinch bugs were frequently collected from their plant host without any indication of whether they were feeding, reproducing, or overwintering on that host (Slater 1976). This information is critical for understanding the biology and ecology of chinch bugs, which typically increase in numbers and then disperse to alternate plant species without necessarily using the original plants as reproductive hosts (Slater 1976). In fact, certain *Blissus* species are known to move from reproductive hosts to a secondary food supply when the original host becomes unsuitable or is no longer available. These chinch bugs may be capable of reproducing on the “secondary hosts,” but only do so in the absence of their preferred host (Slater 1976). Fur-

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thermore, it has been reported that most chinch bug species rarely use only the most abundant hosts in their habitat. Often chinch bugs will be present on a sparsely occurring or inconspicuous grass host, while being absent from related grass hosts found in the same area (Slater 1976).

Chinch bugs injure buffalograss by withdrawing sap from plant tissues in the crown area and stolons. Feeding initially results in reddish discoloration of plant tissues, followed by irregular patches of browning turf. At higher infestation levels, chinch bug feeding has the potential to cause severe thinning or even death of the buffalograss stand. Populations of *B. occiduus* regularly exceed 5,000 m<sup>-2</sup> in buffalograss, and densities of 14,000 chinch bugs per square meter have been documented (Baxendale et al. 1999).

Currently, few effective management options other than insecticides are available for controlling *B. occiduus*. The development of turfgrasses with resistance to insects offers an attractive alternative approach for managing chinch bugs associated with buffalograss because it is sustainable and environmentally compatible. Heng-Moss et al. (2002) evaluated buffalograss germplasm for resistance to *B. occiduus* and found NE91-118 to be highly resistant, NE 86-120 moderately resistant, and 378 highly susceptible to *B. occiduus* feeding.

During summer 2000, *B. occiduus* was, for the first time, discovered causing severe damage to zoysiagrass, *Zoysia japonica* Steudel, stands in southeastern Nebraska. The emergence of *B. occiduus* as a serious pest of buffalograss and now zoysiagrass (F.P.B., unpublished data) underscored the need to document the extended host range of *B. occiduus*, and determine which grasses could potentially be damaged by this emerging pest. A better understanding of the chinch bug–host interactions would provide us with additional options for managing *B. occiduus* by facilitating more efficient monitoring and permitting earlier detection of chinch bug infestations before they build to damaging levels. Furthermore, increased knowledge of *B. occiduus* biology and chinch bug–host interactions will aid in the development and more efficient use of management approaches, including biological control, plant resistance, habitat modification, proper maintenance practices, and chemical controls. Accordingly, the objectives of this research were to document the feeding and reproductive hosts of *B. occiduus* and to ascertain the role these plants play in the biology and ecology of the pest.

### Materials and Methods

**Feeding Studies.** Nineteen grasses were screened in the greenhouse to evaluate their potential as hosts of *B. occiduus*. These grasses were selected for their importance as turfgrasses, crops, and weed species in horticultural and cropping systems. Evaluated grasses included the warm-season turfgrasses: Bermuda grass, *Cynodon dactylon* (L.) Pers., cultivar unknown; buffalograss, NE 86-120; St. Augustinegrass, *Stenotaphrum secundatum* (Walt.) Kuntze, 'Raleigh'; and zoysia-

grass, 'El Toro'. Cool-season turfgrasses included the following: bentgrass, *Agrostis palustris* Huds., 'Penn-eagle'; fine (sheeps) fescue, *Festuca ovina hirtula* L., 'Azay'; Kentucky bluegrass, 'Eclipse'; perennial ryegrass, (nonendophyte-enhanced), 'Saturn II'; and tall fescue, *Festuca arundinacea* Schreb., 'Falcon II'. Agronomic crops screened included: barley, cultivar unknown; corn, 'Pioneer 33G26'; rye, *Secale cereale* L., cultivar unknown; sorghum, *Sorghum bicolor* (L.) Moench, 'Garst 5715'; and wheat, 'Hondo'. The agronomic weed species included smooth brome, *B. inermis* Leyss., fall panicum, *Panicum dichotomiflorum* Michx.; green foxtail, *Setaria viridis* (L.) Beauv.; large crabgrass, *Digitaria sanguinalis* (L.) Scop.; and yellow foxtail, *Setaria glauca* (L.).

The experimental buffalograss selection NE 86-120 was used in all experiments as the susceptible check because it is highly preferred by *B. occiduus* (Heng-Moss et al. 2002). Sod plugs, 10.6 cm in diameter by 8 cm in depth, of NE 86-120 were extracted from research plots at the John Seaton Anderson Turfgrass and Ornamental Research Facility (JSA Research Facility), University of Nebraska Agricultural Research and Development Center, near Mead, NE, in April 2000. These plugs served as the source for vegetative buffalograss. The remaining warm-season grasses (St. Augustinegrass, Bermuda grass, and zoysiagrass) were acquired from Turfgrass America near Cleveland, TX, in May 2000. These grasses were established in the greenhouse in 35 by 50-cm flats and provided the vegetative plant material for these species. All warm season grasses were vegetatively propagated by planting individual stolons or rhizomes of each grass in 'SC-10 Super Cell' single cell cone-tainers (3.8 cm in diameter by 21 cm in depth) (Stuewe & Sons, Inc., Corvallis, OR) containing a potting mixture of sand-soil-peat-perlite in a 2:1:3:3 ratio 3 wk before initiation of experiments. The remaining grasses were grown from seed in cone-tainers as described previously. Fast-germinating grasses (barley, corn, green foxtail, rye, and wheat) and slow-germinating grasses (bentgrass, fall panicum, fine fescue, Kentucky bluegrass, large crabgrass, perennial ryegrass, smooth brome, sorghum, tall fescue, and yellow foxtail) were planted 3 and 6 d before initiation of experiments, respectively. Cone-tainers were placed in seven by 14 cone-tainer trays. Plants were maintained under 400-W high-intensity discharge lamps with a photoperiod of 16:8 (L:D) h and fertilized weekly with a soluble 20:0:4:4:16:6 (20N-10P-20K) fertilizer. Vegetatively propagated grasses were trimmed to the soil surface 1 wk before initiation of experiments to ensure that all grass vegetation was approximately the same age at the onset of the experiment.

Three feeding studies were conducted using first and second generation *B. occiduus*. Chinch bugs were field collected by vacuuming the soil surface with a modified ECHO Shred 'N' Vac (model 2400, ECHO Incorporated, Lake Zurich, IL). First generation chinch bugs were collected from a 'Tatanka' buffalograss lawn in Lincoln, NE, and second generation chinch bugs were collected from buffalograss research

plots at the JSA Research Facility. Chinch bugs were held under laboratory conditions for 24 h to identify and eliminate any individuals killed or injured during the collection process. Chinch bugs were sifted through a 2-mm mesh screen and collected with an aspirator. A total of 30 fourth and fifth (determined according to Baxendale et al. 1999) instars (sex undetermined) were placed on plants in cone-tainers fitted with tubular Plexiglas cages (4 cm in diameter by 30 cm in height), and the tops were covered with organdy fabric. The infestation level of 30 chinch bugs per cone-tainer used in this experiment translates into  $\approx 24,000$  chinch bugs per square meter. Although this infestation level may seem excessive, it was essential the chinch bugs were present in sufficient numbers for feeding symptoms to occur before the grasses outgrew their cone-tainers and/or began to show the effects of being caged for an extended period. The experimental design for all experiments was a completely randomized design with six replications infested with chinch bugs. Additionally, two plants per grass species were caged and served as untreated controls. First generation chinch bugs were evaluated from 4 to 25 July 2001 (study 2), and second generation chinch bugs were evaluated from 22 September to 17 October 2000 (study 1) and from 12 September to 7 October 2001 (study 3).

The susceptibility of the grasses to chinch bug feeding was measured by visually rating plants for chinch bug damage every other day, for 21 d after chinch bug introduction. Damage ratings were based on a 1–5 scale, where 1 is 10% or less of leaf area with reddish discoloration, 2 is 11 to 30% of leaf area with reddish discoloration, 3 is 31 to 50% of leaf area with reddish discoloration, 4 is 51 to 70% of leaf area with reddish or yellowing discoloration, and 5 is 71% or more of leaf area with severe discoloration or dead tissue (Heng-Moss et al. 2002).

Grass species were grouped into one of four levels of susceptibility based on overall mean chinch bug damage ratings. The levels were highly susceptible (HS) (chinch bug damage rating  $\geq 4$ ), moderately susceptible (MS) (chinch bug damage rating  $\geq 3$  but  $< 4$ ), slightly susceptible (SS) (chinch bug damage rating  $> 1$  but  $< 3$ ), and not susceptible (NS) (chinch bug damage rating of 1).

**Reproductive Studies.** Eighteen of the previously described grasses (corn excluded because of restrictive cage size) were also evaluated for their potential as reproductive hosts for *B. occidius*. Vegetatively propagated and seeded plants were established under greenhouse conditions in cone-tainers as described previously. Fast- and slow-germinating grasses were planted 5 and 8 d, respectively, before initiation of experiments to allow additional time for plants to further mature and better withstand chinch bug feeding. All grasses were approximately the same size when experiments were initiated.

Reproductive studies were conducted using first and second generation *B. occidius*. Chinch bugs were field vacuumed in the same manner and from the same sources as described previously. Ten third instars (sex

undetermined) were randomly selected and placed on caged plants. The chinch bugs were allowed to mature, mate, and oviposit on the experimental grasses. The infestation level of 10 chinch bugs per cone-tainer used in this experiment translates into  $\approx 8,000$  chinch bugs per square meter. The experimental design was a completely randomized design with six replications, and two control plants per grass species. First generation chinch bug reproduction was evaluated from 21 June to 13 September 2001 (study 2), whereas second generation reproduction was evaluated from 16 August to 19 October 2000 (study 1) and from 23 September to 22 October 2002 (study 3).

The potential of each grass species to serve as a reproductive host of *B. occidius* was verified by the presence of chinch bug offspring. Plants were visually inspected once per week, and the study was terminated 7 d after first instars were first observed on any experimental grass (typically wheat). The contents (soil and grass) of each cone-tainer were placed in a Berlese funnel (Southwood 1978) for 48 h. Extracted chinch bugs were collected in 70% ethyl alcohol and counted.

**Statistical Analyses.** Grasses were grouped into categories (cool- and warm-season turfgrasses, field crops, and weeds), and the data were analyzed using Mixed model analyses (PROC MIXED, SAS Institute 1999) to detect differences in *B. occidius* feeding among the selected grasses. The residuals from the Mixed model analyses were inspected to check the model assumptions of normality and constant variance. No significant violations of these assumptions were discovered and, when appropriate, means were separated using the least significant difference (LSD) test.

## Results

**Feeding Studies.** *Turfgrasses.* Statistically significant differences (study 1:  $F = 6.34$ ;  $df = 8, 45$ ;  $P = 0.0001$ ; study 2:  $F = 19.98$ ;  $df = 8, 45$ ;  $P = 0.0001$ ; study 3:  $F = 7.67$ ;  $df = 8, 45$ ;  $P = 0.0001$ ) in chinch bug damage ratings were detected among the nine turfgrass species evaluated in studies 1, 2, and 3 (Table 1). The buffalograss selection NE 86-120 was the most severely damaged of all the turfgrasses tested, with an overall mean damage rating of  $> 4$  ( $> 60\%$  damage) at 11 d after introduction (DAI) (Fig. 1A), and all buffalograss plants reaching a damage rating of 5 ( $> 70\%$  damage) by 13 DAI. Zoysiagrass and Bermuda grass plants exceeded an overall mean damage rating of 3 ( $> 50\%$  damage) by 19 DAI, whereas the St. Augustinegrass 'Raleigh' maintained an overall mean damage rating of 1 ( $> 10\%$  damage) over the course of the experiments. Less variability was detected among the cool-season turfgrass species. At 21 DAI, the cool-season turfgrasses fine fescue, Kentucky bluegrass, perennial rye, and tall fescue had only reached overall mean damage ratings between 2.5 and 3.1 (40 and 55% damage), whereas bentgrass never exceeded an overall mean damage rating of 2.0 ( $< 30\%$  damage) (Fig. 1B).

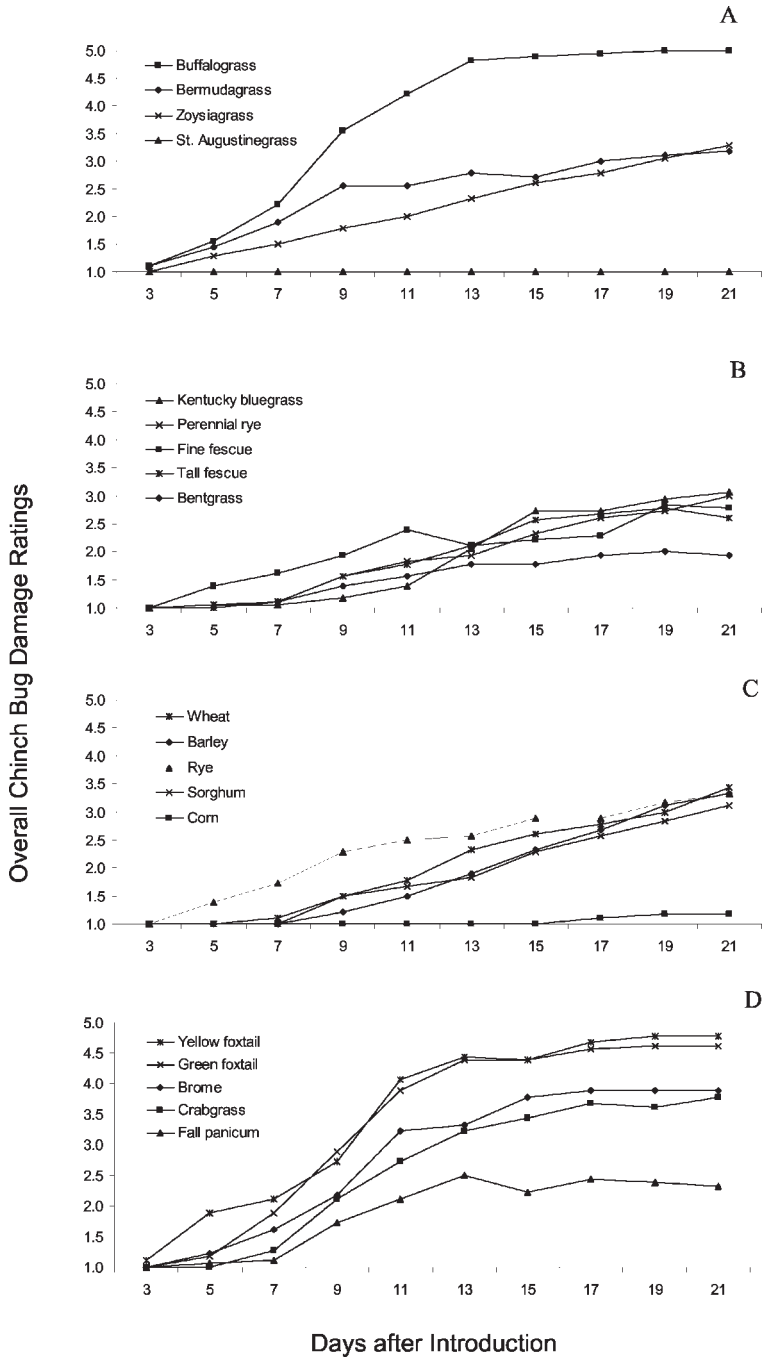


Fig. 1. Overall chinch bug damage ratings (1–5 scale; 1, no damage) for the 19 grasses evaluated. (A) Warm-season turfgrasses. (B) Cool-season turfgrasses. (C) Crops. (D) Weeds.

*Crops.* Statistically significant differences (study 1:  $F = 22.08$ ;  $df = 5, 30$ ;  $P = 0.0001$ ; study 2:  $F = 12.89$ ;  $df = 5, 30$ ;  $P = 0.0001$ ; study 3:  $F = 11.26$ ;  $df = 5, 30$ ;  $P = 0.0001$ ) in chinch bug damage were detected among

the crops (Table 2). The crops wheat, barley, rye, and sorghum all reached an overall mean damage rating  $>3$  (50–60% damage) (Fig. 1C) during the experiments, but corn never exceeded an overall mean dam-

**Table 1. Suitability of turfgrasses as hosts for *B. occidius* in the greenhouse**

Turfgrass	Damage rating <sup>a</sup>			Overall Mean <sup>b</sup>	Feeding Susceptibility <sup>c</sup>
	Study 1	Study 2	Study 3		
Buffalograss	5.0a	5.0a	5.0a	5.0	HS
Zoysiagrass	3.5b	2.8b	3.5b	3.3	MS
Bermudagrass	2.7bc	2.8b	4.0ab	3.2	MS
Kentucky bluegrass	3.3b	1.7cde	4.2ab	3.1	MS
Perennial rye	1.8cd	3.0b	4.2ab	3.0	MS
Fine fescue	3.0bc	2.3bc	3.0bc	2.8	SS
Tall fescue	3.0bc	1.8cd	3.0bc	2.6	SS
Bentgrass	2.7bc	1.7cde	2.0cd	1.9	SS
St. Augustinegrass	1.0d	1.0e	1.0d	1.0	NS

Means followed by the same letter are not significantly different (Fisher's protected LSD,  $P > 0.05$ ).

<sup>a</sup> Chinch bug damage rating 21 d DAI = Rating scale 1-5 with 1, no damage.

<sup>b</sup> Mean damage ratings for studies 1, 2, and 3 at 21 DAI.

<sup>c</sup> Susceptibility category (see text).

age rating of 1.2 (15% damage). There were also statistically significant differences in chinch bug damage ratings between buffalograss (the known susceptible host) and all of the crop species tested except for wheat, barley, and rye in study 2.

**Weeds.** Statistically significant differences (study 1:  $F = 11.42$ ;  $df = 5, 30$ ;  $P = 0.0001$ ; study 3:  $F = 9.93$ ;  $df = 5, 30$ ;  $P = 0.0001$ ) in chinch bug damage were detected among the weeds species in studies 1 and 3. However, no statistical differences were detected among the weed species in study 2 ( $F = 0.56$ ;  $df = 5, 30$ ;  $P = 0.73$ ) (Table 3). Green and yellow foxtail were highly susceptible to *B. occidius* feeding and experienced an overall mean damage rating  $>4$  ( $>60\%$  damage) at 11 DAI (Fig. 1D). Large crabgrass and brome also experienced significant chinch bug damage. Both species had overall mean damage ratings of  $>3$  ( $>60\%$  damage) by 13 DAI, but never reached a mean rating of 5 (70% damage or greater). Fall panicum never exceeded an overall mean damage rating of 2.3 (40% damage). There were no statistically significant differences between damage ratings of buffalograss (the known susceptible host), and yellow or green foxtail, suggesting these weed species are suitable feeding hosts of *B. occidius*.

The overall mean damage ratings taken 21 DAI were used to group the evaluated grasses into categories of chinch bug susceptibility. Buffalograss, yellow foxtail,

and green foxtail were characterized as highly susceptible (overall mean chinch bug damage rating  $\geq 4$ ); brome, large crabgrass, wheat, barley, rye, zoysiagrass, Bermuda grass, sorghum, Kentucky bluegrass, and perennial rye as moderately susceptible (overall mean chinch bug damage rating  $\geq 3$  but  $<4$ ); fine fescue, tall fescue, fall panicum, bentgrass, and corn as slightly susceptible (overall mean chinch bug damage rating  $>1$  but  $<3$ ); and St. Augustinegrass as not susceptible (overall mean chinch bug damage rating of 1) (Tables 1-3).

**Reproductive Studies.** *B. occidius* produced offspring on 15 of the 18 turfgrass, crop, and weed species evaluated (Table 4). All crop and weed species served as reproductive hosts for *B. occidius*. Among the turfgrasses, offspring were produced on fine fescue, perennial rye, bentgrass, zoysiagrass, Kentucky bluegrass, and tall fescue. These results clearly demonstrate that *B. occidius* can reproduce on a variety of hosts.

No reproduction occurred on Bermuda grass or St. Augustinegrass, suggesting the possibility of chinch bug resistance. However, additional research is needed to confirm this hypothesis. No offspring were produced on buffalograss NE 86-120, a known reproductive host of *B. occidius* (Heng-Moss et al. 2002). This occurred because plants were killed by chinch bug feeding before the production of offspring could take

**Table 2. Suitability of crops as hosts for *B. occidius* in the greenhouse**

Crop	Damage rating <sup>a</sup>			Overall Mean <sup>b</sup>	Feeding Susceptibility <sup>c</sup>
	Study 1	Study 2	Study 3		
Buffalograss	5.0a	5.0a	5.0a	5.0	HS
Wheat	3.3bc	4.7a	2.3cd	3.4	MS
Barley	2.7cd	4.2a	3.2bc	3.3	MS
Rye	2.5d	4.2a	3.5b	3.3	MS
Sorghum	3.8b	3.0b	2.7cb	3.1	MS
Corn	1.2e	1.2c	1.3d	1.2	SS

Means followed by the same letter are not significantly different (Fisher's protected LSD,  $P > 0.05$ ).

<sup>a</sup> Chinch bug damage rating 21 DAI. Rating scale 1-5 with 1, no damage.

<sup>b</sup> Mean damage ratings for studies 1, 2, and 3 at 21 DAI.

<sup>c</sup> Susceptibility category (see text).

**Table 3. Suitability of weeds as hosts for *B. occidius* in the greenhouse**

Weed	Damage rating <sup>a</sup>			Overall Mean <sup>b</sup>	Feeding Susceptibility <sup>c</sup>
	Study 1	Study 2	Study 3		
Buffalograss	5.0a	5.0a	5.0a	5.0	HS
Yellow foxtail	5.0a	4.3a	5.0a	4.8	HS
Green foxtail	4.3a	4.3a	5.0a	4.6	HS
Brome	4.3a	3.7a	3.8ab	3.9	MS
Large crabgrass	3.8a	4.3a	3.2b	3.8	MS
Fall panicum	1.2b	4.0a	1.8c	2.3	SS

Means followed by the same letter are not significantly different (Fisher's protected LSD,  $P > 0.05$ ).

<sup>a</sup> Chinch bug damage rating 21 DAI. Rating scale 1-5 with 1, no damage.

<sup>b</sup> Mean damage ratings for studies 1, 2, and 3 at 21 DAI.

<sup>c</sup> Susceptibility category (see text).

Table 4. Suitability of turfgrasses crops and weeds as reproductive hosts for *B. occidius*

Turfgrasses	Mean no. offspring $\pm$ SEM	Crops	Mean no. offspring $\pm$ SEM	Weeds	Mean no. offspring $\pm$ SEM
Fine fescue	6.1 $\pm$ 3.5	Wheat	23.2 $\pm$ 8.5	Green foxtail	13.6 $\pm$ 5.3
Perennial rye	4.8 $\pm$ 3.2	Barley	11.9 $\pm$ 4.2	Yellow foxtail	9.8 $\pm$ 1.2
Bentgrass	2.4 $\pm$ 1.2	Sorghum	9.0 $\pm$ 3.4	Brome	1.8 $\pm$ 1.2
Zoysiagrass	1.7 $\pm$ 1.0	Rye	5.3 $\pm$ 2.9	Fall panicum	0.3 $\pm$ .18
Kentucky bluegrass	1.1 $\pm$ 0.7			Large crabgrass	0.2 $\pm$ .12
Tall fescue	0.9 $\pm$ 0.6				
Bermudagrass	0.0 $\pm$ 0.0				
St. Augustinegrass	0.0 $\pm$ 0.0				
Buffalograss <sup>a</sup>	0.0 $\pm$ 0.0				

<sup>a</sup> Buffalograss is a documented reproductive host (Heng-Moss 2002), but was killed by chinch bug feeding before offspring could be produced.

place. Even though NE 86-120 has documented tolerance to *B. occidius*, it is clear that under heavy enough chinch bug pressure, even this resistant buffalograss can be severely injured by *B. occidius*.

### Discussion

Most grasses investigated in this study served as feeding or reproductive hosts for *B. occidius*. The turfgrasses buffalograss and perennial rye, the crops barley, rye, sorghum, and wheat, and the weeds green and yellow foxtail were all highly to moderately susceptible to *B. occidius* feeding, and all of these grasses exhibited the potential for chinch bug reproduction. This has profound economic implications because several of these grasses (barley, rye, sorghum, and wheat) are important agricultural crops. Of special concern are situations where fields of susceptible crops are grown in proximity to a *B. occidius* infestation, and the primary host is destroyed or becomes unsuitable for chinch bug feeding and/or survival. Lynch et al. (1987) showed that *Blissus leucopterus leucopterus* Say will move from goosegrass, *Elusine indica* (L.) Gaertn., its preferred host, to Bermuda grass if the goosegrass is no longer able to support the chinch bug population. Likewise, a heavily infested buffalograss stand weakened by chinch bugs then invaded with foxtail would continue to provide excellent habitat for *B. occidius*.

The other grasses evaluated, including brome, large crabgrass, wheat, barley, rye, zoysiagrass, Bermuda grass, fine fescue, sorghum, Kentucky bluegrass, and perennial rye, although less susceptible to *B. occidius*, could still serve as important alternative hosts or reservoirs that could maintain chinch bug populations when the preferred host (e.g., buffalograss) becomes unavailable or unsuitable. These observations suggest it is not only important to control chinch bug infestations in adjacent susceptible crop fields but also to monitor and/or control susceptible weeds that could serve as *B. occidius* reservoirs in situations where buffalograss, crops, and other grass hosts interface.

Several of the evaluated grasses showed little or no damage from *B. occidius* feeding (bentgrass, corn, fall panicum, fine fescue, tall fescue, and St. Augustinegrass) or ability to support chinch bug reproduction (bentgrass, Bermuda grass, brome, fall panicum, Kentucky bluegrass, large crabgrass, St. Augustinegrass,

tall fescue, and zoysiagrass). However, it should be noted that only a single cultivar of each species was evaluated, so the results of this study may not accurately reflect the susceptibility/reproductive potential of other varieties/cultivars for these species. For example, the zoysiagrass 'El Torro' used in this study showed only moderate susceptibility to *B. occidius*. However, field observations have documented that 'Meyer' zoysiagrass is highly susceptible to chinch bug feeding and it is an excellent reproductive host.

Numerous researchers have identified chinch bug-resistant turfgrasses. Kentucky bluegrass, fine fescue, and perennial ryegrass cultivars are known to have resistance to *Blissus leucopterus hirtus* Montandon (Baker et al. 1981, Mathias et al. 1990); St. Augustinegrass to *Blissus insularis* Barber (Reinert et al. 1980, Reinert and Dudeck 1974); and buffalograss to *B. occidius* (Heng-Moss et al. 2002). Our research has identified several grasses that warrant further investigation, including Bermuda grass, which was moderately susceptible to *B. occidius* feeding but produced few offspring, suggesting antibiosis. Also of interest is the St. Augustinegrass 'Raleigh'. This warm-season turfgrass is known to be highly susceptible to the southern chinch bug *B. insularis* (Reinert et al. 1980, Crocker et al. 1989) but was not damaged by *B. occidius*. 'Raleigh' may be exhibiting resistance to *B. occidius*, but further research is needed to verify and explain this observation.

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