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ABSTRACT *Blissus occiduus* Barber, a relatively small chinch bug characterized by conspicuous wing dimorphism, has emerged as an important insect pest of buffalograss, *Buchloe dactyloides* (Nuttall) Engelmann. It completes 2 generations a year on buffalograss in Nebraska. Overwintered adults become active as early as mid-March. Depending on the season, 1st-generation nymphs can be present from early May through early August, with 1st-generation adults (up to 60% macropterous forms) appearing in mid to late June. Second generation nymphs can be present from early July through fall, with 2nd-generation adults appearing in late August to early September. These predominately brachypterous (>95%) adults overwinter in and around the turf area. *Blissus occiduus* was confirmed to be associated with natural buffalograss pastures, seeded and vegetatively propagated buffalograss lawns, right-of-ways, cemeteries, and golf courses in 21 Nebraska counties. Chinch bugs were generally found feeding on the stolons and in the crown area of the buffalograss plant. Initial *B. occiduus* injury resulted in reddish discoloration of infested plant tissues. As feeding progressed, damage appeared as patchy areas in the turf that turned from yellow to straw-brown. At higher infestation levels, chinch bug feeding resulted in severe thinning or death of the buffalograss stand. Field studies documented buffalograss as a reproductive host of *B. occiduus*, with Kentucky bluegrass and perennial ryegrass identified as potential hosts. Creeping bentgrass, tall fescue, and zoysiagrass did not appear to be suitable turfgrass hosts for *B. occiduus*.

KEY WORDS *Blissus occiduus*, *Buchloë dactyloides*, turf

BUFFALOGRASS, *Buchloë dactyloides* (Nuttall) Engelmann, is a perennial, warm-season grass native to the semiarid regions of the North American Great Plains (Wenger 1943). In recent years, it has gained popularity as an alternative turfgrass species because of its lower maintenance requirements and relative freedom from diseases and arthropod pests. As a turfgrass, established buffalograss requires less mowing, irrigation, fertilizer, and fewer pesticide applications than traditional turfgrass species (Pozarnsky 1983, Riordan et al. 1993).

Few arthropods are considered serious pests of buffalograss. Baxendale et al. (1994) reviewed the arthropods reported to be injurious to buffalograss, and discussed the biology, distribution and significance of *Tridiscus sporoboli* (Cockerell) and *Trionymus* sp. (Homoptera: Pseudococcidae), 2 mealybug pests previously unreported from buffalograss. Reference also was made to an unknown species of chinch bug that was severely damaging buffalograss turf in Lincoln, NE. This chinch bug was subsequently identified as *Blissus occiduus* Barber by Thomas J. Henry, Systematic Entomology Laboratory, ARS–USDA, National Museum of Natural History, Washington, DC.

Chinch bugs, *Blissus* spp. (Hemiptera: Lygaeidae) are common pests of grain crops, forage grasses and turfgrasses throughout much of the United States (Horton and Satterthwait 1922, Leonard 1966, Webster 1909). The important turfgrass-inhabiting species include the common chinch bug, *Blissus leucopterus leucopterus* (Say); the hairy chinch bug, *Blissus leucopterus hirtus* Montandon; and the southern chinch bug, *Blissus insularis* Barber (Reinert et al. 1995). These chinch bugs have been reported as pests of numerous turfgrass species, including Bermuda grass, *Cynodon dactylon* (L.) Persoon; creeping bentgrass, *Agrostis palustris* Hudson; Kentucky bluegrass, *Poa pratensis* L.; perennial ryegrass, *Lolium perenne* L.; St. Augustinegrass, *Stenotaphrum secundatum* (Walter) Kuntze; zoysiagrass, *Zoysia japonica* Steudel.; and the tall and fine fescues, *Festuca* spp. (Tashiro 1987).

Blissus occiduus was described by Barber in 1918 from specimens collected in Ft. Collins, CO, and Geronimo, NM (Barber 1918). Although *B. occiduus* was described >80 yr ago, little is known about its biology and ecology. The reported distribution of *B. occiduus* includes California, Colorado, Montana, and New Mexico in the United States, and Alberta, British Columbia, Manitoba, and Saskatchewan in Canada (Bird and Mitchener 1950, Slater 1964). Among its reported hosts are barley, *Hórdeum* L.; sugarcane, *Saccharum officinárum* L.; wheat, *Triticum aestívum* L.; bromegrass, *Bromus* spp., and "native grasses" (Ferris 1920, Parker 1920, Bird and Mitchener 1950, Farstad and Staff 1951). Until recently, no turfgrass species

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were known to be hosts to *B. occiduus*. The purpose of this research was to investigate the biology, distribution, and injury potential of *B. occiduus* on buffalograss in Nebraska.

Materials and Methods

Description, Biology, and Seasonal Occurrence. Information on the biology and seasonal occurrence of *B. occiduus* was obtained by collecting sod plug samples from chinch bug-infested buffalograss on the University of Nebraska East Campus, Lincoln, NE. A minimum of 12 samples was taken every week (May–September) or 2 wk (March–April and October–November) during 1991 and 1992 using a golf cup cutter (10.6 cm diameter). Sod plugs were taken to the laboratory and placed in Berlese funnels (Southwood 1978) fitted with 40-watt incandescent lights and maintained at ≈38°C for 72 h to extract *B. occiduus*. Chinch bugs extracted from plugs were collected in 70% ethyl alcohol for later identification, characterization (e.g., age class, sex, wing dimorphism), and counting. *B. occiduus* nymphs were divided into 5 instars based on body dimensions and color (Slater 1979). The body length of 100 individuals in all *B. occiduus* age classes were measured at 20× using a stereo microscope fitted with a calibrated optical grid. Mean lengths and their standard errors were calculated for all age classes. Color and distinguishing markings also were recorded.

Distribution and Damage. A survey of *B. occiduus* distribution in Nebraska was conducted by collecting and examining sod plug samples from buffalograss stands in the southern, central, and southeastern portions of the state during 1990–1992. Samples were taken from natural buffalograss stands in pastures, and from seeded and vegetatively propagated buffalograss in lawns, right-of-ways, cemeteries, and golf courses. Field observations on *B. occiduus* feeding location and injury to buffalograss also were recorded. Chinch bugs were extracted from sod plug samples using Berlese funnels as described above. Records of *B. occiduus* in buffalograss samples submitted to the University of Nebraska Plant and Pest Diagnostic Clinic served to identify additional locations.

Turfgrass Hosts. To identify potential turfgrass hosts, *B. occiduus* were caged on field plots of Kentucky bluegrass, bentgrass, tall fescue, zoysiagrass, perennial ryegrass, and '609' buffalograss. Four open-ended (15.5 cm diameter, 17 cm high) metal cylinders were implanted 2.5 cm into the soil of each turfgrass species. Chinch bugs were collected from a 'Texoka' buffalograss lawn at the University of Nebraska East Campus, Lincoln. Ten adult chinch bugs (5 males and 5 females) were introduced into each cage and the tops were covered with organdy fabric to prevent chinch bug escape. After 60 d (17 July–15 September), the sod core enclosed by each cage was excised to a depth of 5 cm and placed in a Berlese funnel to extract established chinch bugs. Turfgrass quality (1–9 scale, where 9 is best density, color, and overall appearance [Skogley and Sawyer 1992]) within enclosures was evaluated at harvest.

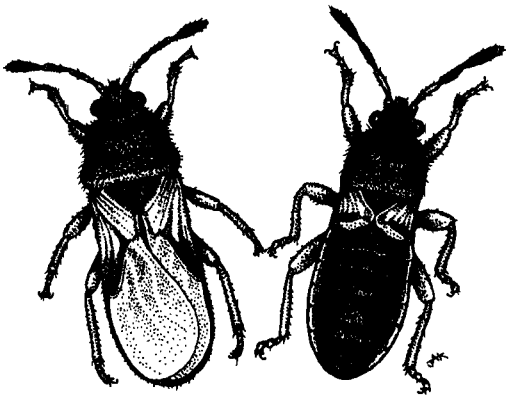

Fig. 1. Comparison of macropterous (left) and brachypterous (right) adults of *B. occiduus*.

Results and Discussion

Description, Biology, and Seasonal Occurrence. *Blissus occiduus* exhibits conspicuous wing dimorphism (Fig. 1). Brachypterous females (3.10 ± 0.02 mm) (mean ± SE) and males (2.72 ± 0.02 mm) are significantly larger than macropterous females (2.78 ± 0.06 mm) and males (2.53 ± 0.01 mm) (female: $F = 28.33$; df = 1, 199; $P < 0.0001$; male: $F = 14.00$; df = 1, 199; $P < 0.0002$). *B. occiduus* eggs are oval, pale yellow, and 0.86 ± 0.006 mm in length. They are deposited in buffalograss crowns, within the leaf sheaths, or in the organic debris and soil. Bright red with a white band across the abdomen, 1st and 2nd instars average 1.03 ± 0.01 and 1.33 ± 0.01 mm in length, respectively; 3rd, 4th, and 5th instars progressively darken from orange-brown to black and average 1.89 ± 0.02, 1.97 ± 0.02, and 2.41 ± 0.06 mm in length, respectively.

Blissus occiduus completes 2 generations a year on buffalograss in Nebraska (Table 1). In 1991, overwintered *B. occiduus* adults (46.2% males, 53.8% females) were present in samples from 11 March until 20 May. First instars appeared 6 May with the remaining instars

Table 1. Seasonal occurrence of *B. occiduus* as indicated by number and age class of individuals collected from buffalograss turf at the University of Nebraska East Campus, Lincoln, NE, 1991 and 1992

Age class	1991 dates (no.)[a]	1992 dates (no.)[a]
Adults	11 March–20 May (221)	17 March–11 June (325)
1st generation		
1st instar	6 May–17 June (481)	21 May–9 July (1,943)
2nd instar	20 May–1 July (117)	28 May–16 July (621)
3rd instar	28 May–8 July (88)	4 June–23 July (429)
4th instar	10 June–15 July (53)	11 June–30 July (375)
5th instar	17 June–15 July (97)	18 June–6 Aug (494)
Adults	17 June–5 Aug (879)	25 June–21 Aug (848)
2nd generation		
1st instar	1 July–9 Sept (1,310)	23 July–17 Sept (644)
2nd instar	15 July–9 Sept (434)	30 July–15 Oct (370)
3rd instar	24 July–23 Sept (150)	6 Aug–15 Oct (238)
4th instar	12 Aug–20 Nov (109)	21 Aug–15 Nov (133)
5th instar	26 Aug–20 Nov (116)	3 Sept–15 Nov (62)
Adults	26 Aug–20 Nov (741)	10 Sept–15 Nov (271)

[a] Number of individuals collected during indicated time period.

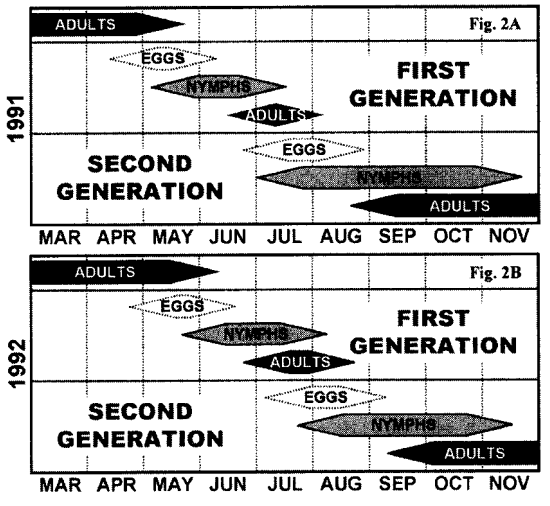

Fig. 2. Diagrammatic representation of seasonal occurrence of *B. occiduus* in Nebraska.

present until 15 July. First-generation adults (45.1% males, 54.9% females) were present from 17 June until 5 August. First instars of the 2nd generation began to appear in early July (1 July). Second-generation adults (50.1% males, 49.9% females) appeared in late August (26 August) and remained active until 20 November when sampling was terminated with the onset of freezing temperatures (Fig. 2A). A similar pattern of seasonal activity was noted by Parker (1920) for this chinch bug on prairie grass in Montana.

The seasonal occurrence pattern of *B. occiduus* was similar in 1992. However, temperatures cooler than normal from May through early July seemed to delay *B. occiduus* development. Overwintered adults (49.2% males, 50.8% females) were again present in samples taken in mid-March (17 March). However, 1st instars did not appear until 21 May. First-generation adults (54.7% males, 45.3% females) were collected on 25 June, but 2nd-generation nymphs did not appear until 23 July, which was 3 wk later than in 1991. First-generation adults were present until 21 August. Second-generation adults (54.7% males, 45.3% females) were collected in early September (10 September) and remained active in the buffalograss until sampling was stopped in November (15 November) (Fig. 2B).

Blissus occiduus overwinters primarily as brachypterous adults. Second-generation (overwintering) chinch bugs collected in mid-November in 1991 and 1992 were 100 and 99.6% brachypterous, respectively. Macropterous adults, however, can be quite common in the 1st generation. In 1992, 63.9% of 1st-generation adults were macropterous, whereas only 6.6% were macropterous in 1991. The reason for this dramatic year-to-year variability is unclear, but considerable variation often can be observed with respect to wing dimorphism among insect species, including chinch bugs (Dingle 1979). Reasons for this variation have been attributed primarily to environmental suitability, host plant quality, and colonization of new habitats. Macropterous individuals are generally selected when conditions are unfavorable for continued development, whereas brachypterous individuals are produced when conditions are favorable for development. *B. occiduus* may overwinter as brachypterous adults to ensure they remain near a suitable perennial host plant for growth next spring. Further, macropterous adults may be produced during the summer months to allow for colonization of new turfgrass areas. Mailloux and Streu (1981) reported similar seasonal changes in the relative proportions of macropterous and brachypterous forms of *B. leucopterus hirtus*. Additional research is needed to understand fully the factors affecting wing dimorphism in *B. occiduus*.

Distribution and Damage. Fig. 3 shows the known distribution of *B. occiduus* in Nebraska. Survey results revealed the presence of *B. occiduus* in 15 of the 19 counties sampled, and records from the University of Nebraska Plant and Pest Diagnostic Clinic detected *B. occiduus* in 6 additional Nebraska counties (Cass, Dawes, Morrill, Keith, Scotts Bluff, and Thayer). *B. occiduus* had not previously been recorded from Nebraska. *B. occiduus* was collected from all types of buffalograss stands sampled. Although most samples contained relatively few chinch bugs (<25/1.0 m^2), *B. occiduus* numbers exceeded 5,000 per 1.0 m^2 at several sites. These results and the previously reported distribution of *B. occiduus* indicate a wide geographic range for this chinch bug and suggest the need for further sampling at other locations in the United States where buffalograss is grown as a turfgrass. Because buffalograss stands are primarily established vegetatively with plugs or sod, it is possible that chinch bugs present in the vegetative material may have been inadvertently distributed to other areas where buffalograss is becoming popular as a turfgrass.

Serious chinch bug injury was present in several of the buffalograss stands sampled. *B. occiduus* was observed feeding on the stolons and in the crown area of the plant. Initially, this resulted in reddish discoloration of affected plant tissues. As feeding progressed, patchy areas, which turned from yellow to straw-brown, appeared in the turf. At higher infestation levels, chinch bug feeding resulted in severe thinning or even death of the buffalograss stand. Chinch bug injury to buffalograss was most prevalent during late July to early September. Interestingly, in some cases there appeared to be little correlation between the number of chinch bugs present and the severity of associated plant damage. One explanation for this observation could be that certain buffalograss genotypes exhibit chinch bug resistance. Preliminary studies (T.M.H., unpublished data) have shown statistically significant differences among buffalograss selections in their ability to tolerate *B. occiduus* feeding.

Turfgrass Hosts. At harvest, all caged turfgrass species showed acceptable (5 or 6 on 1–9 scale) turf quality with little or no visible stress (i.e., high temperature, reduced moisture, low light) symptoms associated with caging or from chinch bug feeding on infested plants. In total, 53 (19 brachypterous males; 14 brachypterous females; and one 3rd, six 4th, and 13

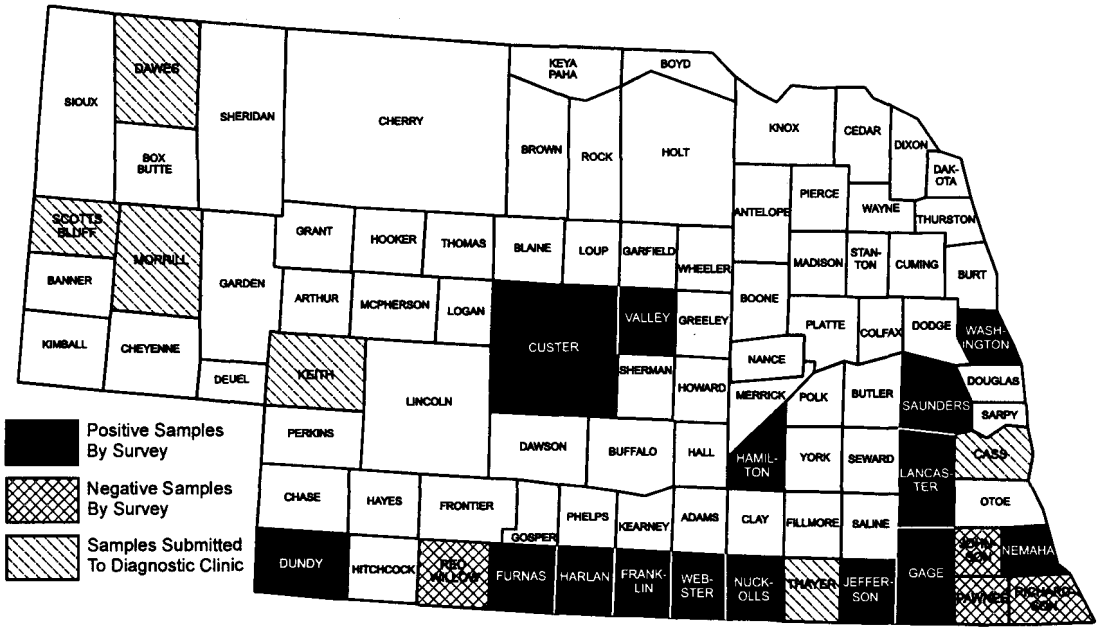

Fig. 3. Known distribution of *B. occiduus* in Nebraska.

fifth instars) *B. occiduus* were extracted from the 4 '609' buffalograss sod cores. This confirms the status of buffalograss as a reproductive host of this chinch bug. Twenty-one (1 brachypterous female, 20 first instars) and 2 (4th instars) chinch bugs were extracted from the Kentucky bluegrass and perennial ryegrass sod cores, respectively, indicating these turfgrasses may also serve as *B. occiduus* hosts. However, no chinch bugs survived on the bentgrass, tall fescue, or zoysiagrass sod cores. This suggests these turfgrass species may not be suitable hosts for *B. occiduus*. Other grass hosts from which *B. occiduus* has been collected include yellow bristlegrass, *Seteria glanca* (Weigel) Hubbard, and prairie sand reed grass, *Calamovilfa longifolia* (Hooker) Scribner (T. J. Henry and F.P.B., unpublished data).

Considerable progress has been made in identifying the arthropod complex associated with buffalograss. However, implementation of a comprehensive buffalograss-integrated pest management program has been hampered by limited knowledge of potential insect and mite pests. Information on the biology, distribution, and injury potential of *B. occiduus* obtained from this research will be used to develop effective, sustainable, and environmentally responsible management strategies for this potentially serious pest of buffalograss.

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