N O T E

Morphology and Fertility of Wing Polymorphic Adults of Southern Chinch Bugs (Hemiptera: Lygaeidae)[1]

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St. Augustinegrass, *Stenotaphrum secundatum* (Walt.) Kuntze, lawns are utilized throughout the southern United States for their climatic adaptation and their ability to tolerate full sun to moderate shade. The southern chinch bug, *Blissus insularis* Barber, is the plant's most damaging pest (Crocker 1993, International Turfgrass Soc. J. 7: 358-365). The adaptability of this insect pest is shown by its ability to develop resistance to insecticides (Reinert and Portier 1983, J. Econ. Entomol. 76: 1187-1190) and to overcome host plant resistance (Busey and Center 1987, J. Econ. Entomol. 80: 608-611; Cherry and Nagata 1997, International Turfgrass Soc. J. 8: 981-986).

Wing polymorphism is an interesting phenomenon that has been observed in various insects. The function of the wing polymorphism is usually related to the reproductive and dispersal abilities of the two morphs. For example, to a large extent, the costs associated with flight capability in planthoppers, and in many other phytophagous insects as well, are imposed on reproduction (Denno and Peterson 2000, Amer. Entomol. 46(2): 95-109). Wing polymorphism is found in southern chinch bug adults with macropters (long-winged adults) and brachypters (short-winged adults). Seasonal wing polymorphism in southern chinch bugs and reasons for its occurrence have most recently been discussed by Cherry (2001, Florida Entomol. 84: 737-739). However, data on body size, wing length, and fertility of macropters versus brachypters of southern chinch bugs are not known, and these data have been shown to be important in the population dynamics of other species of chinch bugs (Fujisaki 1985, Res. Popul. Ecol. 27: 125-136; Fujisaki 2000, Entomol. Science 3: 177-186). The objectives of this study were to determine body sizes, wing lengths, and fertility of macropters and brachypters of southern chinch bugs.

Chinch bugs were collected from infested St. Augustinegrass lawns in Palm Beach Co., FL, from January 2000 to December 2000. Five new chinch bug infestations

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were located each month by looking for damaged yellow grass and then visually confirming the presence of chinch bugs. The use of several locations over time guaranteed a large pool of specimens from which chinch bugs could be withdrawn for measurements. Insects were collected by suctioning for 5 min at each infestation. Adults were collected by suction into a gasoline powered modified WeedEater® Barracuda blower/vacuum (Poulan/WeedEater, Shreveport, LA). The use of a suction technique for sampling southern chinch bugs was described by Crocker (1993). After collection, samples were frozen for later counting in a laboratory. Samples were passed through as U.S.A. Standard Testing Sieve #10 (2 mm opening) to remove large debris, and adults were removed and stored in alcohol for later examination.

One hundred adults of each of the four adult types (2 sexes × 2 wing forms) were randomly drawn from samples in different months and locations to measure body length and wing length. Body length and wing length of each adult were measured with a microscope fitted with an eyepiece micrometer. Macropterous wings overlap to a common tip and brachypterous wings do not overlap but extend straight back from the thorax with two wing tips present. Hence, macropterous wing length was measured from the midpoint of the posterior edge of the pronotum straight back to the tip of the overlapping forewings. Brachypterous wing length was measured from the midpoint of the posterior edge of the pronotum straight back to the tip of one randomly chosen forewing of the two forewings. Two hundred female adults of each of the two wing types were also randomly drawn from different months and different locations. These females were dissected under a microscope and the fertility (eggs/female) recorded in order to compare fertility between the two wing types.

The fertility of live females of the two wing types was also determined. In May 2002, chinch bugs were collected by vacuuming as previously described from five locations. Thereafter, one randomly chosen brachypterous female was put into a plastic tube (3.5 cm diam × 10 cm) containing moist filter paper and an excised sprig of St. Augustinegrass and two males of either wing type. This tube was paired with a similar tube except containing a macropterous female. Twenty pairs of these tubes were held for 10 days at 31°C with new sprigs added and filter paper moistened after 5 days. At the end of 10 days, tubes were placed in a freezer for several days. Thereafter, tubes were taken to a laboratory where a microscopic examination was conducted to count eggs and newly-hatched first instars in each tube.

Mean differences in body length and wing length between the four adult types were compared using a Least Significant Difference (LSD) test (SAS 1996, SAS Institute, Cary, NC). The mean difference in fertility (eggs/female) between the two wing types in dissected females was analyzed by a t-test (SAS 1996). The mean difference in fertility (eggs + first instar/female) between the two wing types in live females was also analyzed by a t-test (SAS 1996).

Females were significantly larger (= longer body lengths) than males within each wing type (Table 1). These data are consistent with studies reported on the chinch bugs, *Blissus occiduus* Barber (Baxendale et al. 1999, J. Econ. Entomol. 92: 1172-1176) and *Cavelerius saccharivorous* Okajima (Fujisaki 1985). Within each sex, macropters were larger than brachypters. Fujisaki (1985) also reported that macropters were usually larger in body size than brachypters within each sex in *C. saccharivorous.* In contrast, Baxendale et al. (1999) reported that brachypters were larger than macropters within each sex in *B. occiduus.* In spite of significant differences in size among the four adult types, the ranges of body lengths of all four types overlapped. These latter data show that size alone cannot be relied on solely to visually separate

Table 1. Body length and wing length of polymorphic winged adults of southern chinch bugs

	Body length (mm)		
	Mean*	SD	Range
Female - macropterous	3.64A	0.17	3.20-4.04
Female - brachypterous	3.62A	0.19	3.24-4.00
Male - macropterous	3.23B	0.17	2.20-3.80
Male - brachypterous	3.12C	0.13	2.72-3.40
	Wing length (mm)		
	Mean*	SD	Range
Female - macropterous	2.22A	0.18	1.80-3.20
Male - macropterous	2.08B	0.16	1.68-3.28
Female - brachypterous	1.14C	0.12	0.84-1.48
Male - brachypterous	1.03D	0.12	0.60-1.40

* Means followed by the same letter are not significantly different (alpha = 0.05) using the LSD test (SAS 1996).

adults for experimental purposes. As a last note, Reinert et al. (1995 Chinch bugs, pp. 38-42, *In* Handbook of turfgrass insect pests, (Eds) R. L. Brandenburg and M. G. Villani, Entomol. Soc. Amer., Lanham, MD) noted that southern chinch bug adults were 3.0 to 3.6 mm long and that females were slightly more robust than males, but more specific data were not given. Our data essentially corroborate these earlier observations.

Macropters of both sexes had significantly longer wings than brachypters of both sexes (Table 1). Unlike size, there was no overlap in ranges of wing length between macropters and brachypters. These latter data show the clearly dimorphic nature of wing length in southern chinch bugs. Females had significantly longer wings than males within each of the two wing types. Because southern chinch bug females are larger than males, these data are similar to Fujisaki's (2000) observation that wing length was positively correlated with body size in polymorphic winged adults of the oriental chinch bug, *C. saccharivorus.*

Of the 400 females dissected, 63% of brachypterous females and only 21% of macropterous females contained eggs. Similar to our study, Fujisaki (1985) dissected field collected females of *C. saccharivorus* and found that a higher percentage of brachypterous females contained mature eggs than macropterous females. The t-test showed that brachypterous females had significantly ($t = 6.9$; df = 398; $P < 0.001$) more eggs/dissected female than macropterous females. The mean ± SE eggs/female was 2.9 ± 0.2 for brachypterous females and 1.06 ± 0.2 for macropterous females.

Of the 40 live females tested for oviposition, 75% of brachypterous females and 40% of macropterous females laid eggs during the 10-day period. The t-test showed that brachypterous females laid significantly (t = -3.3; df = 38; $P < 0.005$) more eggs/female than macropterous females. The mean ± SE eggs/live females was 3.9 ± 1.0 for brachypterous females and 0.7 ± 0.2 for macropterous females.

In summary, wing polymorphism in insects has been related to various factors such as dispersal, population density, and reproduction (Denno and Peterson 2000). In southern chinch bugs, macropters can fly (Kerr 1966, Florida Entomol. 49: 9-18; Reinert and Kerr 1973, Bull. Entomol. Soc. Amer. 19: 91-92), but brachypters have not been observed to fly. In addition, Cherry (2001) has shown that macroptery was positively correlated with population density in southern chinch bugs. In this study, we have shown that macropterous females contain fewer eggs as determined by dissection and also lay eggs at a slower rate than brachypterous females. Data in this study and the previously noted southern chinch bug studies show that macroptery in southern chinch bugs is a flight dispersal mechanism which is positively correlated with population density and achieved by reduced fertility of macropterous females.