SEASONAL WING POLYMORPHISM IN SOUTHERN CHINCH BUGS (HEMIPTERA: LYGAEIDAE)

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St. Augustinegrass, *Stenotaphrum secundatum* (Walt.) Kuntze lawns are used 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). The adaptability of this insect is shown by its developing resistance to insecticides (Reinert & Portier 1983) and overcoming host plant resistance (Busey & Center 1987; Cherry & Nagata 1997).

Southern chinch bugs (SCB) can occur as either macropterous or brachypterous adults. However, other than anecdotal reports, there are little field data on the occurrence of these wing forms in SCB. Also, reasons for the occurrence of brachypterous versus macropterous adults in SCB are poorly understood. Wilson (1929) reported that both macropterous and brachypterous SCB adults occur in Florida and these vary in relative numbers during the year, but no data were given. Komblas (1962) reported that population density was a factor in SCB wing form, noting that a larger percentage of nymphs raised under crowded conditions developed into macropterous adults than did uncrowded nymphs. Leonard (1966) discussed migration as an important factor in SCB wing formation. Lastly, Reinert and Kerr (1973) noted that although macropterous and brachypterous adults may be found in SCB, the latter predominates. However, reasons for the occurrence of the two wing forms were not discussed. The objectives of this study were to determine the seasonal occurrence of wing polymorphism in SCB in southern Florida and to determine if wing polymorphism is correlated with field population density.

Chinch bugs were collected from infested St. Augustinegrass lawns in Palm Beach County, Florida from December 1999, to December 2000. Five new SCB infestations were located each month by looking for damaged yellow grass and then visually confirming the presence of SCB. Insects were collected by suctioning for 5 minutes a 1 × 1 m area at each infestation. Nymphs and 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 SCB 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. Microscopic examination was used to determine the sex and wing form of each adult and count nymphs.

In order to determine possible seasonal differences in wing polymorphism, samples from 3 month periods were pooled. For the purposes of this paper, winter is defined as December, January, and February, spring is March, April, and May, summer is June, July, and August, and fall is September, October, and November. These definitions correspond to seasonal definitions for the North Temperate Zone (Guralnik 1982). Mean differences in population density (nymphs + adults per sample) between seasons were determined using Tukey's test. Mean differences in percentage macropterous adults (macropterous adults/total adults per sample) between seasons were also determined using Tukey's test (SAS 1996). Pearson's correlation (SAS 1996) of percentage macropterous adults versus SCB density (adults, nymphs, or total = adults + nymphs) in all samples (N = 60) was conducted to examine possible relationships between wing form and field population density. Pearson's correlation for percentage macropterous males (macropterous males/total adults) versus percentage macropterous females in all samples (N = 60) was also conducted to determine if both sexes were responding similarly to the factor or factors causing macroptery in the field.

There was no significant difference in population density between the four seasons (Table 1). However, means during the winter-spring were lower than the summer-fall. Hence, data from winter and spring were pooled and compared against pooled data from summer and fall. The summer-fall population density (mean = 1746, SD = 3447) was significantly greater (alpha = 0.05) than winter-spring population density (mean = 431, SD = 682) by t-test analysis (t = 2.1, 58 DF). These data are in general agreement with Komblas (1962) and Reinert and Kerr (1973). Komblas (1962) reported that SCB populations decreased during winter in Louisiana. Reinert and Kerr (1973) also reported that field populations of SCB decrease drastically in cooler weather.

There was no significant difference in percentage of macropterous adults between the four seasons (Table 1). However, as with population density, means during the winter-spring were again lower than the summer-fall. Hence, data from the winter and spring were again pooled and compared against pooled data from the summer-fall. The summer-fall macroptery (mean = 22.3, SD = 18.1) was significantly greater (alpha = 0.05)

TABLE 1. SEASONAL POPULATION DENSITY AND PERCENTAGE OF MACROPTEROUS ADULTS OF SOUTHERN CHINCH BUGS.

	Population density		
Season	Mean[1]	SD	Range
Winter	457.8	982.4	11-3953
Spring	404.8	549.9	2-1737
Summer	1207.1	1038.8	24-3501
Fall	2285.1	5085.5	61-20019
	Macropterous adults		
Season	Mean[2]	SD	Range
Winter	13.5	12.7	0-33.3
Spring	11.2	15.3	0-46.4
Summer	21.0	16.9	0-48.9
Fall	23.6	19.7	0-69.2

[1]Mean bugs (nymphs + adults) per one m^2 sample. There was no significant difference (alpha = 0.05) in means between the four seasons using Tukey's test (SAS 1996). However, there was a significant difference (alpha = 0.05) in mean chinch bugs in pooled data of the winter-spring versus summer-fall periods using t-test analysis (t = 2.1, 58 DF).

[2]Mean percentage macropterous adults (macropterous adults/total adults) per one m^2 sample. There was no significant difference (alpha = 0.05) in means between the four seasons using Tukey's test (SAS 1996). However, there was a significant difference (alpha = 0.05) in mean percentage of macropterous adults in pooled data of the winter-spring versus summer-fall periods using t-test analysis (t = 2.4, 58 DF).

than winter-spring macroptery (mean = 12.3, SD = 13.9) by t-test analysis (t = 2.4, 58 DF). These latter data are consistent with Komblas (1962) report that macropterous adults predominated during the fall in Louisiana. The association of increased macroptery at higher field densities is corroborated by correlation analysis. Pearson's correlation analysis for percent macroptery versus population density in samples throughout the year (N = 60) gave significant (alpha = 0.05) positive correlation coefficients of 0.32, 0.53, and 0.33 for nymphs, adults, and total SCB. Pearson's correlation for percentage macropterous males (macropterous males/total adults) versus percentage macropterous females in samples throughout the year also gave a significant (alpha = 0.05) positive correlation coefficient of 0.63. These latter data indicate that both sexes were responding similarly to the factor or factors causing macroptery in the field.

In summary, the percentage of macropterous adults was higher during the summer-fall when population densities were also higher. Similarly, percentage macropterous adults was positively correlated with population densities in samples taken throughout the year. However, these data report field occurrence and correlation, but do not explain direct causation for macroptery in SCB which is probably more complex. For example, various factors such as heritability, population density, and host plant condition may affect wing dimorphism in insects (Denno & Peterson 2000). Moreover, factors may interact in causing macroptery. For example, the incidence of macroptery in the oriental chinch bug, *Cavelerius saccharivorus* Okajima is density dependent, but also strongly increased by seasonal factors such as long daylength and high temperature (Fujisaki 2000). My data fit the general model of increased macroptery at higher densities for population dispersal (see Denno & Peterson 1995 for discussion). However, controlled laboratory studies are needed to determine more precisely what factor or factors are causing changes in macroptery in SCB.

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SUMMARY

The population density of southern chinch bugs was greater during the summer-fall than the winter-spring. Analogously, macroptery was also greater during the summer-fall than the winter-spring. Macroptery was positively correlated with population densities from samples taken throughout the year.

REFERENCES CITED

BUSEY, P., AND B. CENTER. 1987. Southern chinch bug (*Hemiptera: Heteroptera: Lygaeidae*) overcomes resistance in St. Augustinegrass. J. Econ. Entomol. 80: 608-611.

CHERRY, R., AND R. NAGATA. 1997. Ovipositional preference and survival of southern chinch bugs (*Blissus insularis* Barber) on different grasses. International Turfgrass Soc. J. 8: 981-986.

CROCKER, R. L. 1993. Chemical control of southern chinch bug in St. Augustinegrass. International Turfgrass Res. J. 7: 358-365.

DENNO, R. F., AND M. A. PETERSON. 1995. Density dependant dispersal and its consequences for population dynamics, pp. 113-130. *In* N. Cappuccino and

P. W. Price (eds.), Population dynamics—new approaches and synthesis. Academic Press, New York.
DENNO, R. F., AND M. A. PETERSON. 2000. Caught between the devil and the deep blue sea, mobile planthoppers elude natural enemies and deteriorating host plants. American Entomol. 46(2): 95-109.
FUJISAKI, K. 2000. Seasonal adaptations in subtropical insects: wing polymorphism and egg diapause in the oriental chinch bug, *Cavelerius saccharivorus* Okajima (Heteroptera: Lygaeidae). Entomol. Science 3(1): 177-186.
GURALNIK, D. 1982. Webster's New World Dictionary. Simon and Schuster. New York.
KOMBLAS, K, 1962. Biology and control of the lawn chinch bug, *Blissus leucopterous insularis* Barber. M.S. Thesis. Louisiana State Univ. Baton Rouge, LA.
LEONARD, D. 1966. Biosystematics of the *"Leucopterus* complex" of the genus *Blissus* (Heteroptera: Lygaeidae). Conn. Agric. Expt. Sta. Bull. 677.
REINERT, J. A., AND S. H. KERR. 1973. Bionomics and control of lawn chinch bugs. Bull. Entomol. Soc. Am. 19: 91-92.
REINERT, J. A., AND K. M. PORTIER. 1983. Distribution and characterization of organophosphate-resistant southern chinch bugs (Heteroptera: Lygaeidae) in Florida. J. Econ. Entomol. 76: 1187-1190.
SAS INSTITUTE. 1996. SAS Systems for Windows. Version 6.12 SAS Institute. Cary, NC.
WILSON, R. N. 1929. The chinch bug in relation to St. Augustinegrass. USDA Circ. No. 51.