Abundance of Two Whitefly Species (Homoptera: Aleyrodidae) on Georgia Soybean[1]

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ABSTRACT 'Braxton' and 'Cobb' soybeans were surveyed every 7 to 10 days from mid-July through September, 1993 and 1994, to determine the seasonal abundance of the silverleaf whitefly, *Bemisia argentifolii* Bellows and Perring, and the bandedwinged whitefly, *Trialeurodes abutilonea* (Haldeman). Population densities peaked in early September 1993, at over 31 eggs and nymphs per 2.54 cm^2 of leaf area on Cobb soybeans (a Maturity Group VIII variety), and 15 eggs and nymphs on Braxton soybeans (a Maturity Group VII variety). Silverleaf whitefly was the predominant species on all sampling dates throughout the season. At the population peak, there were 14.4 silverleaf whitefly and 3.3 bandedwinged whitefly nymphs per 2.54 cm^2 on Cobb and 8.8 silverleaf whitefly and 2.0 bandedwinged whitefly nymphs on Braxton. Whitefly population densities peaked in late September 1994, at over 6 eggs and 59 nymphs on Cobb and 1 egg and 18 nymphs on Braxton. The whitefly population in 1994 was comprised almost exclusively of silverleaf whitefly, with 58 and 17 nymphs per 2.54 cm^2 on Cobb and Braxton, respectively, on 23 September compared to less than 1.0 bandedwinged whitefly on each of these varieties. At the population peak each year, there were significantly more eggs and silverleaf whitefly nymphs on the upper trifoliolate leaves than on the lower trifoliolate leaves.

KEY WORDS *Bemisia argentifolii, Bemisia tabaci, Trialeurodes abutilonea,* population dynamics

The silverleaf whitefly, *Bemisia argentifolii* Bellows and Perring, previously reported as the sweetpotato whitefly, *B. tabaci* (Gennadius) (Perring et al. 1993) has become a major economic threat to many row crops and ornamentals in the United States, causing annual economic losses in excess of $200 million (Faust 1992). These pests damage plant foliage with their piercing-sucking feeding and cause plant stunting, wilting and loss of vigor (Smith et al. 1970). They also secrete honeydew on which sooty mold develops (Vaishampayan and Kogan 1980) and are known vectors of plant viruses (Duffus and Flock 1982).

The silverleaf whitefly and the bandedwinged whitefly, *Trialeurodes abutilonea* (Haldeman), were reported to infest soybeans; however, they were considered to be only minor pests (Vaishampayan and Kogan 1980). They were

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reported to be increasing in recent years, especially in the southeastern U. S. (Johnson and Nuessly 1995). In Georgia, whitefly control costs and crop damage in 1991 in horticultural and row crops were estimated at $34 million (McPherson and Douce 1992) and are reported to be increasing as a potential threat to Georgia's soybean crop (Hudson et al. 1993). Lambert (1995) reported that some soybean resistant germplasm is available to aid in managing these pests should they continue to increase in economic importance.

Studies in cotton (Flint and Parks 1990) and peanuts (Lynch and Simmons 1993) have documented when peak populations of silverleaf whitefly and bandedwinged whitefly occur; however, information is lacking on the seasonal abundance of whiteflies on soybean. Therefore, this study was initiated to determine the incidence of silverleaf whitefly and bandedwinged whitefly on soybeans throughout the season and to examine the distribution of eggs and nymphs within the plant structure.

Materials and Methods

'Braxton' and 'Cobb' soybeans, two commonly grown varieties in Maturity Groups VII and VIII, respectively, were planted in field plots at the Gibbs Research Farm in Tift Co., GA, on 9 June 1993 and 31 May 1994. Plots were 4 rows wide (0.9 m row spacing) by 6.1 m long and planted in a randomized block design with 4 replications with 1.8 m alleys between replications. The fields were conventionally moldboard plowed and a pre-plant tank mix of Prowl (2.4 L/ha) and Vernam (2.7 L/ha) was incorporated with a tillivator into the soil for grass and broadleaf weed control. Tralomethrin (AgrEvo, Wilmington, DE) was applied in mid-August 1993 to control beet armyworms, *Spodoptera exigua* (Hubner). No insecticides were applied during 1994. Silverleaf whitefly and bandedwinged whitefly population densities were monitored every 7 to 10 days, beginning mid-July and continuing until early October. One plant each from rows 1 and 3 was randomly collected from each replicate and labeled, bagged, and returned to the laboratory. From these plant samples, the under surface of the mid-vein region of a lower (the lowest trifoliolate that was still present and green), middle and upper (the highest uncurled trifoliate of mature size) trifoliolate was observed under a dissecting microscope (Wild-Heerbrugg) set at 12X. The total number of eggs (both species pooled) plus nymphs (including 'crawler' and 'pupal' stages) was recorded for the 2.54-cm^2 viewing area (the size of a dime) under the scope. When the plants reached V10 stage of development (unifoliolate node plus 9 trifoliolate nodes, Fehr et al. 1971), then a lower, two middle and an upper trifoliolate were observed for whitefly eggs and nymphs. The weekly mean number of whitefly eggs and nymphs was plotted on a seasonal distribution curve. These data were analyzed by variety and each date using ANOVA ($P = 0.05$) and sampling dates were identified when significant differences were detected between varieties (SAS Institute 1985). At the population peak each year, the number of eggs and nymphs on each trifoliolate was analyzed within each variety using ANOVA ($P = 0.05$). Means were separated using a Duncan's multiple range test. These data also were analyzed by variety to compare varietal differences (SAS Institute 1985).

Results and Discussion

Whitefly population densities tended to be higher in the earlier-maturing Braxton soybeans than in Cobb soybeans during the early sampling dates in 1993 (Fig. 1), and were significantly higher on 4 August. However, from 25 August until 15 September populations were significantly higher in the later-maturing Cobb, and at the population peak on 8 September populations were twice as high in the Cobb variety than in the Braxton. Populations rapidly declined in both varieties during late September, probably because the soybean seeds were fully developed and the plants were beginning to senesce. Similar population trends were observed in Braxton and Cobb soybeans in 1994. However, populations peaked 2 wks later in 1994 and at population densities that were twice as high in the Cobb soybeans as in 1993 (Fig 2). Whitefly populations were significantly higher in Cobb soybeans than in Braxton soybeans from 1 September to 30 September 1994.

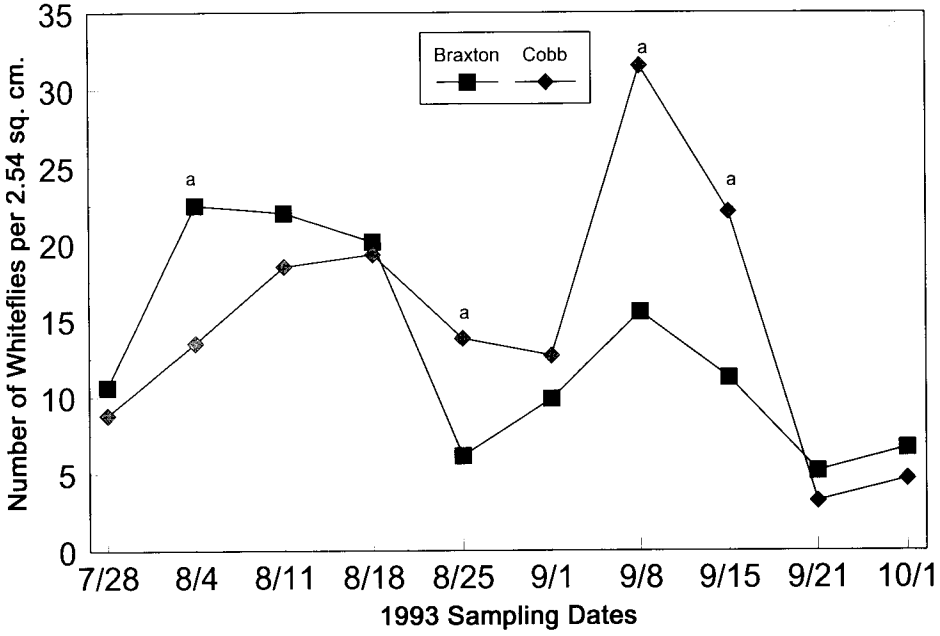

Fig. 1. Abundance of silverleaf and bandedwinged whiteflies on Braxton and Cobb soybeans in Tift Co., GA, 1993. An 'a' indicates a significant (P = 0.05) difference between varieties on that specific sampling date.

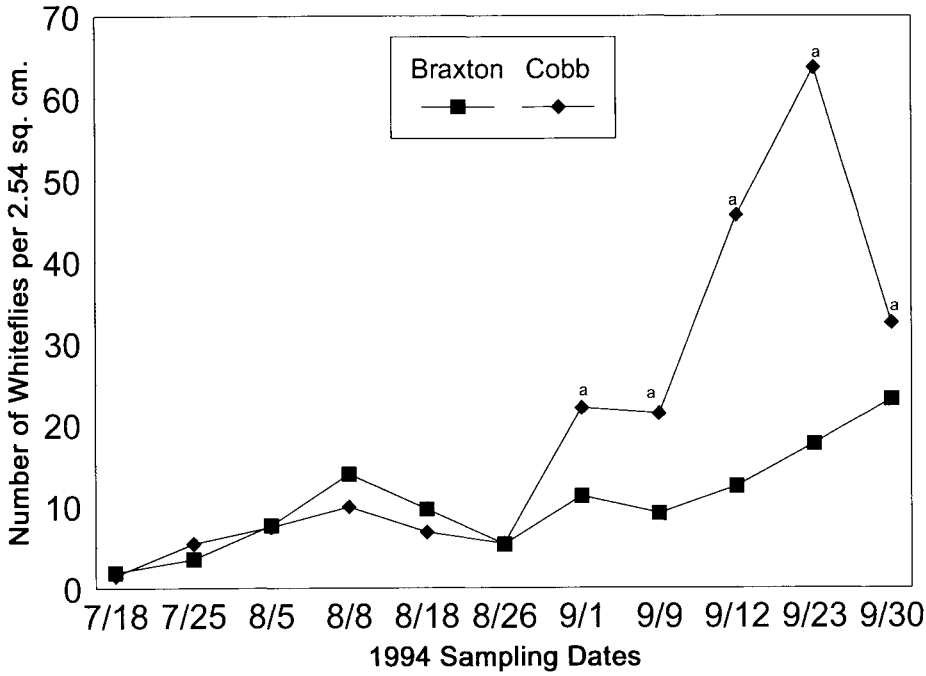

Fig. 2. Abundance of silverleaf and bandedwinged whiteflies on Braxton and Cobb soybeans in Tift Co. GA, 1994. An 'a' indicates a significant (P = 0.05) difference between varieties on that specific sampling date.

Temperature and rainfall most likely influenced the buildup of whiteflies in these field plots. In 1993, July could be characterized as moist and hot. Over 24 cm of rain fell during the month and maximum daily temperatures exceeded 31°C every day (mean daily high temperature was 33.6°C) with the highest temperature reaching 36.1°C on 19 July. Only 4.7 cm of rain fell during August and the mean daily high temperature was 32.4°C. Rainfall totaled 9.9 cm in September with a mean daily high temperature of 30.5°C. July 1994 rainfall (19.5 cm) was similar to 1993, but the mean daily high temperature (30.2°C) was much lower. Much more rainfall (13.1 cm) and cooler temperatures (30.3°C) also were observed in August, and equal rainfall (9.9 cm) and cooler temperatures (28.5°C) were recorded in September 1994.

At the population peak on 8 September 1993, there were significantly more whitefly eggs on the highest trifoliolate leaf than on other leaves of both varieties, although some eggs were found on all leaves examined (Table 1). Significantly more eggs were observed on Cobb than on Braxton. Silverleaf whitefly nymphs also were more abundant on the upper leaves than on the lower leaves, and occurred at significantly higher densities on Cobb than on Braxton. Bandedwinged whitefly populations were low but present on both soybean varieties on all sampling dates. Densities tended to be higher on the lower and middle

Table 1. Distribution of silverleaf (SLWF) and bandedwinged (BWWF) whiteflies on different trifoliolates of Braxton and Cobb soybeans during peak population densities in Georgia, 1993-1994.*

Variety	Trifoliolate Number	Whiteflies per 2.54 cm^2		
		Eggs	Nymphs	
			SLWF	BWWF
		8 Sept 1993		
Braxton	3 (lowest)	0.8 b	6.5 b	2.1 a
	6	3.1 b	9.3 ab	2.1 a
	9	2.9 b	6.5 b	1.9 a
	12 (highest)	12.4 a	12.7 a	1.9 a
Cobb	3	1.6 b	10.3 b	2.9 a
	6	3.9 b	8.4 b	2.8 a
	9	8.5 b	18.0 ab	6.1 a
	14	42.0 a	20.8 a	1.3 a
		23 Sept 1994		
Braxton	3	0.0 a	4.5 c	0.0 a
	6	0.5 a	13.8 b	2.5 a
	9	1.0 b	16.8 b	0.8 a
	12	1.3 a	33.0 a	1.0 a
Cobb	3	0.5 b	9.5 d	0.3 a
	6	0.3 b	28.5 c	0.8 a
	9	1.0 b	60.5 b	1.3 a
	12	23.8 a	131.8 a	0.3 a

* Column means for each variety on each date followed by the same letter are not significantly different according to Duncan's multiple range test ($P = 0.05$).

leaves, but no significant differences were detected. Similar observations were noted for the 1994 whitefly population peak that occurred on 23 September, although egg numbers were lower and silverleaf whitefly nymphal densities were higher than the previous season. The bandedwinged whitefly nymphal populations again were low in 1994. These two whitefly species are also commonly observed infesting cotton (Flint and Parks 1990). However, highest populations occur on the sixth node which is generally the area of the first fruiting branch and is in the lower portion of the cotton plant (Ohnesorge and Rapp 1986).

In conclusion, whitefly population densities on Georgia soybeans are comprised mostly of silverleaf whitefly with low populations of bandedwinged whitefly present throughout the season. Population levels were relatively low during July and August, then steadily rose in September. After peaking around mid-September, the population rapidly declined. The later-maturing Cobb variety had higher population densities than Braxton during September when the populations were highest. During the peak population, more eggs and silverleaf nymphs were present on the upper leaves than on the lower or middle leaves. This information on whitefly seasonal abundance, distribution within the soybean plant structure, and the impact of soybean maturity group on whitefly densities will be implemented into the existing field scouting and integrated pest management programs.

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