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Bemisia tabaci : Population increases on cotton cultivars in Turkey

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Summary

The rate of buildup of whitefly, *Bemisia tabaci*, populations on the different cotton cultivars was compared with that of "Carolina Queen", a standard local variety cultivated extensively, for three years. The cultivars that showed smaller populations had glabrous, either small or okra-leaf shapes, and an open canopy. The variety "LA 510 ONS" stood out as the most important selection because of the low *B. tabaci* population developing on it.

Introduction

The sweetpotato whitefly, *Bemisia tabaci* (Gennadius) is a serious pest of cotton causing the fiber to be sticky and transmitting crumple leaf virus. It is also a very serious virus vector to other crops in many parts of the world. Both leaf pubescence and the okra-leaf trait appear to influence whitefly abundance in cotton. Early studies in Sudan Gezira showed that hairy-leaved leafhopper-resistant cottons had larger *B. tabaci* populations than glabrous-leaved varieties (Mound, 1965). The relationship between high abundance of the bandedwinged whitefly, *Trialeurodes abutilonea* (Haldeman), and leaf pubescence was noted for the "Dwarf A x Lankart" genetic combination in Arizona (Butler and Muramoto, 1967). In Mississippi greenhouse studies, cultivars having the highest mean colonization rating of *T. abutilonea* were classified as hairy or densly hairy (Lambert et al., 1982). "Stoneville 825" and "Deltapine 41" cottons with pubescent leaves had the highest populations of *B. tabaci* in Arizona and California in 1982. Eight smooth-leaf cottons had significantly fewer adults in 2-min vacuum samples than their semismooth and pubescent counterparts (Butler and Hennebrry, 1984). Also in Arizona, smoothleaf in "AET-5" had significantly fewer adults of both *B. tabaci* and *T. abutilonea* than did pubescent-leaf plants (Butler and Wilson, 1986). Okra and

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superokra-leaf traits were associated with a high degree of resistance to T. abutilonea in field studies in Louisiana (Jones et al., 1975). Observations of adult populations made in Arizona in 1985 by a beating technique indicated that okra-leaf selections of "ST-8710N" and "ST-8737N" had fewer adult whiteflies. "La Okra 5-5" had fewer whiteflies than the normal-leaf "Stoneville 213" (Butler and Wilson, 1986). In Arizona during 1986, seven of the 19 cotton cultivars had significantly fewer whiteflies than the check, "Stoneville 825". Five of the seven were okra-leaf and two were normal-leaf cottons. At several locations in Israel during 1986, the okra-leaf cotton, "Bet Dagan 12", had significantly fewer whiteflies than a number of normal-leaf cottons (Wilson and Butler, 1987).

The very rapid rate of increase of B. tabaci populations, the protected location this species inhabits on the undersides of cotton leaves, and the development of resistance to insecticides makes chemical control ineffective (Prabhaker et al., 1985). The complex of other harmful insects currently being controlled in cotton by sequential insecticidal treatments makes the use of natural or biological measures for whitefly control impossible. The following report is based on studies of the population development of B. tabaci in various cotton cultivars in Çukurova, Turkey by Özgür and Şekeroğlu (1986). The rate of buildup of the populations in the different cultivars is compared with that of "Carolina Queen", a local standard variety that was grown extensively having a moderate whitefly population.

Materials and Methods

These experiments were conducted at Çukurova, Turkey, which is located in the center of the south of Turkey ca. 20 miles inland from the Mediterranean. The cotton cultures were planted in randomized blocks with 3 replicates in 1982 and 1983 and 4 replicates in 1984. The plot size was increased from 16 m2 in 1982 to 32 m2 in 1983, and 250 m2 in 1984. Irrigation, fertilization, and other cultural practices were done according to standard local practices. When needed, the plots were sprayed with amitraz at 600 g AI/ha.

B. tabaci were sampled by collecting 3 leaves (top, middle, bottom) per plant from 10 plants per plot. Counts were made of the number of eggs, larvae and pupae with a steriomicroscope on each of three 2.85 cm^2 samples from each leaf. In 1982, sampling began on 14 June and 8 samples were taken by 11 August. An insecticide treatment was applied on 13 August but whitefly counts generally continued to rise to 18 August in 12 of the varieties and to 1 September in 6 of the varieties so were included in the regression equations. Sampling began on 2 May 1983. Populations were absent or extremely low on 2 May and 9 June. Results for analyses were used from all of the 6 samples collected between 23 June and 8 August. An insecticide treatment was applied on 21 July but did not appear to affect the increase of whiteflies in most of the varieties. In 1984, sampling began on 6 June and extended for a 89-day period until 3 September. All observations were used except for those made on 6 and 18 June for "LA 510 ONS" and 6 and 1 June for "Coker 413".

Comparisons of the rates of increase in whitefly population density were made by comparing the slopes (b) of the linear regression equation, $y = a+bx$ where y is the $\log_{10}$ of the number of whiteflies

and x is the date. The rates of increase among the different varieties were compared by testing for homogeneity of regression equations and different slopes against "Carolina Queen", a variety grown each year, and generally intermediate in its B. tabaci populations. Differences were considered significant if the F value exceeded the 5 % level and highly significant if they exceeded the 1% level. The estimated population on 1 September was calculated from each regression equation.

Results and Discussion

The mean number of B. tabaci immature stages (egg+larval+pupal) per 2.85 cm^2 area of leaf area on various cotton cultivars for various dates during 1982 and 1983 are presented in Tables 1 and 2 in Özgür and Şekeroğlu (1986). The regression equations for the buildup of B. tabaci on the 22 varieties observed in 1982 indicate that the rise in the population (b value of the regression equation) averaged 0.0643 and varied from a high of 0.0763 for "DPL 15.21" to a low of 0.0478 for "LA 510 ONS" (Table 1). This rate of increase of the population is similar to the rate of increase of 0.064 and 0.065 for sticky trap collections observed at Brawley, California and Yuma, Arizona in 1982 (Butler et al., 1985). With the relative uniformity of the rate of increase of the whiteflies in all of these cultivars, there was no rate of increase that was significantly different from that of "Carolina Queen". In the increase of the total number of whiteflies, "A2" and "Coker 413" had significantly more individuals, while "Gumbo" and "LA 520 ONS" had significantly fewer. The estimate of the 1 September populations was largest for "Adana 967/10" and smallest for "LA 510 ONS" (Table 1).

During 1983, the average rate of increase of 0.0519 was slightly less than that observed during the previous year (Table 2). Three varieties, "LA 510 ONS", "LA 740142", and "Yerli 193" had b values less than the smallest of the previous year but only "Yerli 193" had significantly smaller rate of increase than that of "Carolina Queen". Seven varieties had significantly larger populations than "Carolina Queen" and one of these, "Aleppo Glandless", was highly significant. Only two selections had fewer whiteflies than "Carolina Queen". These were "LA 510 ONS" and "Yerli 193", this latter difference was highly significant.

The average rate of increase during 1984 was 0.0535 for all the cultivars (Table 3). The increase for "DPL 15 A292" was significantly greater than that of "Carolina Queen". Both this variety and "Tashkent" had significantly more whiteflies. "LA 510 ONS" once again had fewer whiteflies than "Carolina Queen".

Ranking the cultivars according to the estimated number of whiteflies on September 1 showed that there were none that were consistantly high each year. On the other hand, the cultivar "LA 510 ONS" was consistently lower in numbers than "Carolina Queen". Those cultivars with smaller populations had glabrous, either small or okra-leaf shapes, an open canopy and were taller. The cultivars with large pubescent leaves and a closed canopy showed much higher numbers of whiteflies. "LA 510 ONS" stands out as the most important selection because of the relatively low B. tabaci population developing on it.

Table 1. Regression equations (a) for the increase in the number of B. tabaci on different cotton varieties, a comparison of the population with than on Caroline Queen, and an estimate of the populations on 1 September, Çukurova, Turkey, 1982

Cotton Variety	No. Obs.	Regression Equation	r^2	Compar. w/Carol. Queen Slope F	Intcpt. F	Estim. 1 Sept.
DPL 15.21	8	-12.586+0.0763	0.97	2.80	2.87	416
COKER 413	8	-12.583+0.0755	0.97	2.72	4.99*	343
AZ-64	8	-12.275+0.0753	0.95	2.12	1.36	445
GUMBO	8	-12.612+0.0741	0.83	0.81	4.05*	237
TASHKENT 1	9	-11.951+0.0717	0.97	1.69	6.31*	256
GIZA 45	7	-12.070+0.0710	0.98	1.55	1.78**	191
LA 566 FN	8	-11.253+0.0709	0.94	1.05	0.57	423
PIMA S-4	7	-11.371+0.0705	0.98	1.24	1.33	341
HAR 1233	8	-11.266+0.0703	0.98	1.32	1.05	360
ADANA 967/10	8	-10.445+0.0687	0.85	0.37	0.97	554
DPL SMOOTH	8	-10.405+0.0657	0.89	0.20	0.66	277
STN 731-N	8	-10.190+0.0623	0.90	0.03	4.84*	150
ALEPPO GLANDLESS	8	-8.975+0.0614	0.90	0.01	1.27	406
A-2	8	-8.632+0.0612	0.91	0.01	4.58*	545
CAROLINE QUEEN	8	-9.086+0.0603	0.92	----	----	278
MNS 79 PAK	9	-8.748+0.0590	0.91	0.02	0.07	284
LA 740142	9	-8.951+0.0572	0.89	0.08	2.57	149
DPL 15 X A292	9	-8.654+0.0563	0.88	0.14	1.77	161
YERLİ 193	7	-8.245+0.0553	0.70	0.09	0.29	190
TAMCOT SP 37	9	-8.005+0.0550	0.96	0.41	0.21	225
GLANDLESS	8	-6.827+0.0495	0.96	1.59	0.85	191
LA 510 ONS	9	-8.883+0.0478	0.73	0.84	0.17**	16

(a) Regression equation: y= a+bx, where y is the log10 of the number of whiteflies and x is the date. The "*" denotes significance at P= 0.05, and "**" at P= 0.01 (Neter and Wasserman, 1976).

Table 2. Regression equations (a) for the increase in the number of B. tabaci on different cotton varieties, a comparison of the population with that on Caroline Queen, and an estimate of the populations on 1 September. Çukurova, Turkey, 1983

Cotton Variety	No. Obs.	Regression Equation	r^2	Compar. w/ Carol. Queen Slope F	Intcpt. F	Estim. 1 Sept.
HAR 1233	6	-13.102+0.0750	0.76	0.89	0.51	181
DPL 15 X A292	6	-12.781+0.0744	0.98	2.98	1.49	215
GIZA 45	6	-11.830+0.0701	0.94	1.46	0.77	195
TASHKENT 1	6	-11.290+0.0677	0.85	0.71	0.42	187
GUMBO	6	-11.479+0.0668	0.94	1.02	0.75	124
TAMCOT SP 37	6	-8.710+0.0594	0.89	0.22	4.56*	325
MNS 79 PAK	6	-8.459+0.0573	0.98	0.18	4.91*	250
COKER 413	6	-9.513+0.0563	0.92	0.09	0.74	68
PIMA S-4	6	-8.440+0.0562	0.82	0.06	1.51	195
AZ-64	6	-8.079+0.0550	0.93	0.05	3.05	209
DPL SMOOTH	6	-7.961+0.0524	0.85	0.01	0.57	124
A-2	6	-7.313+0.0523	0.92	0.01	5.09*	232
CAROLINE QUEEN	6	-8.228+0.0518	0.82	----	----	82
NONGOSSYPOL-50	6	-6.832+0.0503	0.92	0.01	6.19*	231
DPL 15.21	6	-6.965+0.0492	0.89	0.03	2.53	154
LA 566 FN	6	-6.651+0.0491	0.96	0.04	6.35*	206
STN 731-N	6	-6.487+0.0477	0.91	0.08	4.10	172
NONGOSSYPOL-47	6	-6.335+0.0476	0.94	0.10	5.96*	196
GLANDLESS	6	-6.270+0.0467	0.84	0.10	3.57	168
NONGOSSYPOL-52	6	-6.194+0.0463	0.90	0.15	4.29	164
ALEPPO GLANDLESS	6	-5.653+0.0456	0.93	0.21	9.57**	238
ADANA 967/10	6	-6.200+0.0447	0.84	0.21	1.55	110
LA 510 ONS	6	-5.717+0.0312	0.43	0.92	6.50*	7
LA 740142	6	-3.337+0.0282	0.66	2.27	1.18	35
YERLİ 193	6	+0.315+0.0154	0.60	7.15*	11.19**	59

(a) Regression equation: y= a+bx, where y is the log10 of the number of whiteflies and x is the date. The "*" denotes significance at P= 0.05, and "**" at P= 0.01 (Neter and Wasserman, 1976).

Table 3. Regression equations (a) for the increase in the number of B. tabaci on different cotton varieties, a comparison of the population with that on Caroline Queen, and an estimate of the populations on 1 September. Çukurova, Turkey, 1984

Cotton Variety	No. Obs.	Regression Equation	r^2	Compar. w/Carol. Queen Slope F	Intcpt. F	Estim. 1 Sept.
DPL 15 X A292	11	-14.500+0.0728	0.88	5.09*	3.47*	26.1
COKER 413	11	-12.720+0.0643	0.89	2.63	2.24	19.5
TASHKENT	13	-11.867+0.0631	0.78	2.06	4.42*	34.1
GUMBO	13	-10.732+0.0543	0.83	0.67	0.62	12.4
CAROLINE QUEEN	14	-9.209+0.0457	0.77	----	----	7.0
LA 510 ONS	11	-5.342+0.0211	0.37	4.24	10.43*	0.8

(a) Regression equation: y= a+bx, where y is the log10 of the number of whiteflies and x is the date. The "*" denotes significance at P= 0.05, and "**" at P= 0.01 (Neter and Wasserman, 1976).

Özet

Bemisia tabaci: Değişik pamuk çeşitleri üzerinde populasyon gelişmesi

Bemisia tabaci'nin değişik pamuk çeşitleri üzerindeki populasyon gelişmesi, bölgede yaygın olarak kullanılan "Caroline Queen" pamuk çeşidi üzerindeki populasyon gelişmesi ile karşılaştırılmıştır. Beyaz sinek populasyonunun gelişmesinin düşük olduğu pamuk çeşitleri tüysüz, bamya yapraklı ve açık habituslu özellikler göstermişlerdir. "LA 510 ONS" çeşidi, üzerinde Beyaz sinek populasyonunun gelişmesinin çok düşük düzeyde olması nedeniyle en önemli çeşit olarak dikkati çekmiştir.

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