California Melon Research Board
2016 Annual Report

I. Project title

Evaluation and breeding of new sources of host plant resistance to sweet potato whitefly biotype B.

II. Principal investigators

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IV. Location(s) where work was performed

1. USDA-ARS, U.S. Agricultural Research Station, Salinas, California
2. University of California, Desert Research and Extension Center (DREC), Holtville

V. Objectives

Evaluate germplasm identified as potential sources of resistance to SPWF-B.
Compare SPWF resistance in PI 122847 with that in potential sources of SPWF resistance reported in the literature.

VI. Results and Analysis

A spring-summer field test was planted at DREC on April 27. The test was a repeat of the 2015 test that compared putative whitefly-resistant melon accessions PI 122847 and PI 123496 with previously reported sources of resistance to SPWF: PI 313970, TGR 1551 (PI

482420), TGR 1937 (PI 482431), PI 161375, PI 414723, and PI 523841. ‘Top Mark’ was included as susceptible control. The experimental design was a randomized complete-block with insecticide in a split-plot design with four blocks (replications) and insecticide treatment as the split (no insecticide and insecticide). Seeds were planted at 1-ft spacing on standard 84-inch beds; experimental units (plots) were 40-ft long. Venom® insecticide for whitefly control was injected at a rate of 6 oz/ac on April 26, 2016 just prior to planting; every plot received this treatment. The herbicide Poast® was applied at a rate of 1.5 pt/ac on May 26, 2016 for weed control.

The adult SPWF-B population levels were low compared with 2015 when weekly whitefly sampling was initiated in mid-May and continued through July 11. The 2016 plan called for weekly sampling during vine development to harvest, but the low adult numbers resulted in only two samples, one on June 21, the other on July 1. Ten-second vacuum samples were collected from the central part of each entry (ca.10 plants) in every replicate. SPWF were collected in tubes and frozen for counting in the lab. Population levels for immature stages of SPWF-B were evaluated at weekly intervals on the same days that adult whiteflies were sampled. A basal leaf was taken from 10 random plants of each accession in every replicate. SPWF-B eggs and nymphs were counted, using a dissecting binocular microscope, on the abaxial surface of a 1.65-cm^2-diameter leaf disk from the lower left-hand quadrat of each leaf. Densities (number per cm^2 leaf area) of whitefly immature stages were averaged across all leaves on each sample date and reported as numbers of eggs and nymphs per 1-cm^2 of melon leaf.

Plant size and condition were evaluated using a 1 to 9 scale as follows. Plant size estimates the area of the bed covered by the plants where 1 = very small plants (comparable to a 1 to 2 leaf plant) and 9 = large plants growing into the next bed and completely covering the bed. Plant condition is an assessment of the general appearance and reflects effects of diseases and stress, where 1 = dead and 9 = actively growing plant with healthy terminal buds, many flowers open, no sign of disease symptoms. CYSDV symptoms were evaluated on a 1 (0 to 10% yellowed canopy) to 10 (100% yellowed canopy) visual scale.

Numbers of adults per 10-second vacuum sample differed significantly among the lines in the non-insecticide treated plots (Table 1) at the June 21 and July 1 sampling dates. PI 313970 had the lowest number of adults, but was not significantly lower than PI 145594 on June 21. There were fewer adults on many of the whitefly-resistant accessions at this time (June 21) of the season than in 2015, though comparable numbers were collected from susceptible ‘Top Mark’ (see 2015 Melon Board Annual Report). Numbers of adults sampled from ‘Top Mark’ were about the same at both dates, while numbers on the resistant accessions changed, increases on some (e.g., PI 313970), decreases on others (e.g., PI 122847) (Figure 1). Most lines had fewer adults than ‘Top Mark’ on June 21, but by July 1 only three lines had significantly fewer adults: PI 313970, PI 414723, and PI 122847.

Table 1. Least square means and their logs of numbers of adult whiteflies in 10-second vacuum samples collected on June 21 and July 1, 2016; untreated plots; Log means separation by *t*-test (P= 0.05)

	June 21		July 1	
Accession	Mean	Log Mean	Mean	Log Mean
PI 313970	16.8	2.6 e	48.2	3.7 cd
PI 145594	20.2	3.0 de	117.5	4. 7 a
PI 532841	38.8	3.6 cd	148.5	4.9 a
PI 414723	45.8	3.6 cd	46.5	3.7 bcd
TGR 1937	51.5	3.8 c	124.8	4.3 abcd
PI 124107	59.8	4.0 c	115.0	4.7 a
PI 116482	70.8	4.0 c	85.0	4.4 abc
PI 122847	78.8	4.3 bc	40.2	3.5 d
TGR 1551	129.5	4.8 ab	102.8	4.5 abc
Top Mark	168.5	5.1 a	177.0	5.1 a
PI 123689	165.8	5.1 a	104.2	4.6 ab
PI 161375	220.5	5.4 a	75.5	4.2 abcd

Means followed by different letters are significantly different, Student's *t*-test ($P_{0.05}$)

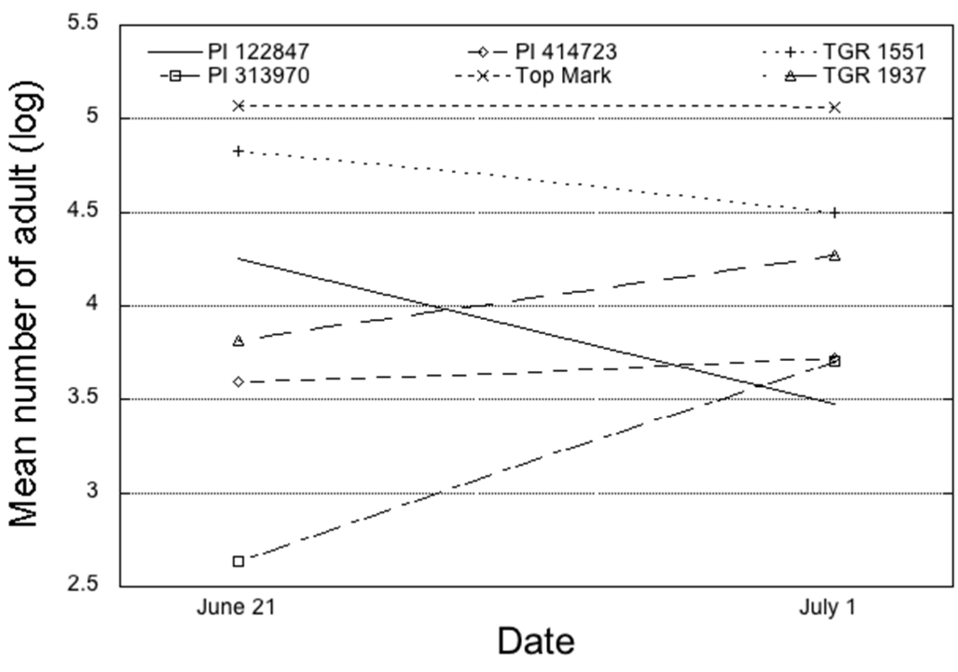

Figure 1. Lease squares mean numbers of adult whiteflies on five putative whitefly-resistant accessions and susceptible 'Top Mark' at two dates, untreated plots.

Number of immatures (eggs + nymphs (instars 1-3) + red-eyed nymphs + empty nymph cases) differed significantly among the accessions and ‘Top Mark’ (Table 2). ‘Top Mark’ had the most immatures but was not significantly different from six accessions on June 21. PI 122847 and PI 313970 had the fewest immatures but were not different from PI 145594 on June 21. TGR 1551 had the most immatures on July 1 but was not significantly different from ‘Top Mark’ and eight other accessions. PI 122847 had the fewest number of immatures in July 1, but was not significantly different from PI 313970, PI 145594, PI 414723, and TGR 1937. PI 122847 was the only line significantly different from ‘Top Mark’ on July 1.

Table 2. Least square means (square root) number of immatures per 2-cm^2 area of single leaf samples taken from five plants in the center of each experimental plot (40 ft in length); means separation by *t*-test (*P*= 0.05); untreated plots.

Accession	June 21	July 1
Top Mark	14.6 a	18.4 abcd
TGR 1937	13.6 ab	17.1 bcde
PI 161375	12.4 ab	26.5 a
PI 116482	11.8 ab	22. 3 ab
PI 124107	11.5 abc	24.4 ab
PI 123689	11.2 abc	20.3 ab
TGR 1551	11.1 abc	22.8 ab
PI 532841	11.0 bc	19.3 abc
PI 414723	10.7 bc	17.1 bcde
PI 145594	8.2 cd	11.9 cde
PI 313970	6.9 d	10.6 de
PI 122847	6.1 d	9.5 e

As in 2015, numbers of adults collected in the 10-second vacuum samples changed through the season. PI 313970 was the best on June 21 but not different from PI 145594. At the second sampling the order was PI 122847 < PI 313970 = PI 414723 < TGR 1937 for numbers of adults. These changes were similar to that observed in 2015 (see 2015 Melon Board Annual Report). PI 122847 had the fewest number of immatures at both sampling dates, followed closely by PI 313970 and PI 145594. PI 414723 was not significantly different from these three lines, but appeared to be extremely susceptible to CYSDV based on a nearly complete yellow canopy (data not shown) on June 21, whereas the other lines were either asymptomatic (PI 122847 and PI 313970) of exhibited very mild symptoms (PI 145594) (Table 3).

Table 3. Mean CYSDV symptom rating on June 21; two reps evaluated on a plot basis.

Accession	Mean
PI 414723	8.0 a
PI 124107	2.5 b
TGR 1937	2.5 b
PI 145594	2.0 bc
PI 123689	1.5 cd
PI 313970	1.5 cd
TGR 1551	1.5 cd
Top Mark	1.0 d
PI 116482	1.0 d
PI 122847	1.0 d
PI 532841	1.0 d
PI 161375	1.0 d

These results corroborate field opportunistic observations of fewer adults and immatures on PI 313970 and PI 122847 in our fall-planted CYSDV breeding trials over the past five years. Resistance to whitefly in Spain has been reported in TGR 1551 (Soria et al., 1999), which is being used as a source of resistance for greenhouse melon production (M.L. Gómez-Guillamón, personal communication). In our tests (2015 and 2016) TGR 1551 did not appear to provide the same level of resistance as PI 313970 or PI 122847 and was not significantly different from 'Top Mark' for numbers of adults or immatures using these sampling methods in Imperial Valley field plots. The mechanisms of resistance and their genetic control of resistance in PI 313970 and PI 122847 should be investigated to facilitate transfer of resistance to western shipping type melons.

Literature Cited

Soria, C., A.I. López-Sesé, and M.L. Gómez-Guillamón. 1999. Resistance of *Cucumis melo* against *Bemisia tabaci* (Homoptera: Aleyrodidae). Environmental Entomology 28:831–835.