California Melon Research Board

2015 Annual Report

I. Project title

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

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IV. Locations where work was performed

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

V. Objectives

A. Characterize host plant resistance to CYSDV and introgress to western U.S. shipping type background adapted to the desert southwest U.S.

1. Continue advancement of selections from crosses of PI 313970, TGR-1551 and TGR-1937 for CYSDV resistance and western U.S. shipping type fruit quality.
2. Develop populations from crosses of five putative resistant sources identified in previous years (PI 614486, PI 124550, PI 145594, PI 123496, PI 122847) for selection of CYSDV resistance. PI 145594 and PI 123496 are of particular interest for dessert fruit qualities (Fig. 7). PI 122847 is of particular interest for resistance to SPWF (see Objective B).

B. Evaluate germplasm identified as potential sources of resistance to SPWF-B. Compare SPWF resistance in PI 122847 with resistance in previously identified potential sources of resistance to SPWF in a field test at DREC in spring using a split-plot design with four replications and insecticide treatment as the split (no insecticide and insecticide)

VI. Results and Analysis

Objective A. Characterize host plant resistance to CYSDV and introgress to western U.S. shipping type background adapted to the desert southwest U.S.

Selections from fall 2014 were cross- and self-pollinated during the winter, spring and summer 2015. Progenies from backcrosses will be self-pollinated for subsequent planting in fall 2016.

A field test for CYSDV resistance was sown and watered at DREC the week of August 18, 2015. Whitefly numbers were abundant at time of planting, as in past years. The initial evaluation of plant stand and symptom onset was done September 22 to 25, 5-weeks post-planting (WPP), and leaf samples were collected to confirm presence of evaluation. Nearly 100% of the plants exhibited symptoms 5 WPP and all leaves assayed were positive for CYSDV. The final evaluation was done the week of October 25, 10 WPP. All plants were symptomatic.

Cucurbit leaf crumple virus (CuLCrV) was present throughout the field, but infection level, as evidenced by symptom expression, was low-to-moderate and it did not appear to have a major effect on the plants. *Squash vein yellowing virus* (SqVYV) was detected but appeared to be at a lower level than in 2014, when it first appeared in California.

The fall test included the following.

- CYSDV-resistant selections. This includes material from crosses of PI 313970 and TGR 1551 with western shipping type cantaloupe and green flesh honeydew:
  F2 (PI 313970 x TGR 1551) Top Mark,
  F2 Green Flesh HD x F_5(PI 313970 x TGR 1551)
  F2 Green Flesh HD x (PI 313970 x TGR 1551)

$S1BC_1$((PI 313970 x TGR 1551) Top Mark) Top Mark
$S1BC_1$ Green Flesh HD((PI 313970 x TGR 1551) Top Mark)
$S1BC_1$ Top Mark(Top Mark x PI 313970)

Some improvement in fruit type was noted in the S_1BC_1, but the plants exhibited a high frequency crown blight-like (McCreight, 1996) senescence of the crown leaves. Vegetative cuttings were taken from 104 selections at 10 WPP; 66 of them survived and were transplanted for backcrossing to either 'Top Mark' or 'Green Flesh Honeydew'.

- Genetic study of the inheritance of resistance to CYSDV of in three new sources of CYSDV resistance: PI 122847, PI 123469 and PI 145594. These three populations were not planted in a replicated design and the parents were planted on the opposite side of the field, so statistical comparisons cannot be made. Mean symptom severity ratings of PI 122847, PI 123469 and PI 145594 were comparable to TGR 1551, PI 313970 and TGR 1937 (Table 1). PI 123469 was notable, as it had the lowest mean symptom severity rating among the six accessions. The F_2 means were higher than those of the resistant parents, which suggested recessive resistance as indicated by their frequency distributions (Figure 1).

Objective B. Evaluate germplasm identified as potential sources of resistance to SPWF-B.

We compared 11 melon accessions and 'Top Mark' for resistance to SPWF in a field test at DREC in a spring planting. The experimental design was a split-plot with four replications and insecticide treatment as the split (no insecticide and insecticide). This allowed side-by-side comparisons of host plant resistance to SPWF with or without insecticide. The test was sown and watered at the University of California, Desert Research and Education Center, Holtville (DREC) the week of April 27. Whiteflies were present at time of planting and increased in numbers through the final evaluation on July 9.

Some of the accessions were previously identified as potential sources of resistance to SPWF in 2012 or 2014, or in previously published reports. Numbers of SPWF adults were estimated by 10-second vacuum samplings of each plot. Immatures (eggs, crawlers, nymphs and red eyes stages of development) were estimated from a 2-cm^2 areas of single leaf samples taken from five plants in the center of each experimental plot (40 ft in length). Samples were taken at approximately weekly intervals from 27 May through July 7, with a final sample collected on July 9.

Adults per 10-second vacuum sample. Insecticide treatments significantly reduced numbers of adults collected. There were significant differences among the lines in the non-insecticide treated plots (Figure 2). PI 122847 had the lowest number of adults, but was not significantly lower than four other accessions (PI 532841, PI 313970, PI 145594,

PI 414723). The lower number of adults on PI 122847 may have been an artifact of its lower mean plant stand per plot than the other lines (4 *vs*. 23) that may have affected the number of adults collected as there were fewer plants to sample. PI 122847 was also notable in that more adults were collected from the insecticide treated plants than from the non-insecticide treated plants (Figure 3), but this, too, could be an artifact of the low plant stands (mean of 6 plants in the insecticide plots *vs*. 2 plants in the non-insecticide plots).

Immatures per cm² of sampled leaf area. Insecticide treatments neutralized, or masked, resistance to whitefly expressed by the 11 melon accessions. PI 122847, PI 313970, and PI 145594 did not significantly differ from one another for numbers of immatures. Mean numbers of immatures on these three accessions were significantly lower than on 'Top Mark' and PI 125107 accessions through the 7-week sampling period (Figure 4, No insecticide). Data analysis suggested the possibility of a genotype–insecticide interaction, whereby the accession (PI 122847) with the lowest number of SPWF in the non- insecticide treatment had the highest number of SPWF under the insecticide treatment (Figure 4, Insecticide). As noted for the adults, the lower numbers on PI 122847 may have resulted from lower plant stands.

CYSDV incidence was affected by insecticide treatment and genotype. The mean insecticide treatment effect was not significant in mid-June, but was significant on July 1; however, by July 14 the effect was again not significant (Table 2). Mean symptom severity ratings of the 12 melon lines ranged from 1 to 4 in mid-June, from 3 to 10 on July 1, and from 4 to 10 on July 14 (Table 3).

Literature Cited

McCreight, J.D. 1996. Crown blight of melons, p. 73. In: T.A. Zitter, D.L. Hopkins, and C.E. Thomas (eds.). Compendium of cucurbit diseases. APS Press, St. Paul, Minn.

Table 1. Mean CYSDV symptom severity ratings, 10-weeks post-planting, DREC, fall 2015.

Entry	n	Mean[z]
Susceptible culitvars		
Top Mark	4	10.0
GF Honeydew	10	9.3
Previously reported CYSDV resistance sources		
TGR 1551	13	6.1
TGR 1937	8	7.2
PI 313970	15	5.8
New resistance sources and their F_2 families		
PI 122847	9	5.2
PI 123496	7	3.7
PI 145594	10	6.9
F_2 Impac x PI 122847	176	9.5
F_2 PI 123496 x Impac	91	6.1
F_2 PI 123496 x Impac	89	6.7
F_2 PI 145594 x GFHD	184	7.3
Whitefly resistance sources		
PI 116482	10	6.1
PI 123689	10	7.4
PI 125107	6	8.4
PI 161375	5	6.3
PI 414723	4	10.0

[z]Rated using a visual scale from 1 (≤10%) to 10 (100%) scale that estimated the percentage leaf area exhibiting CYSDV symptoms.

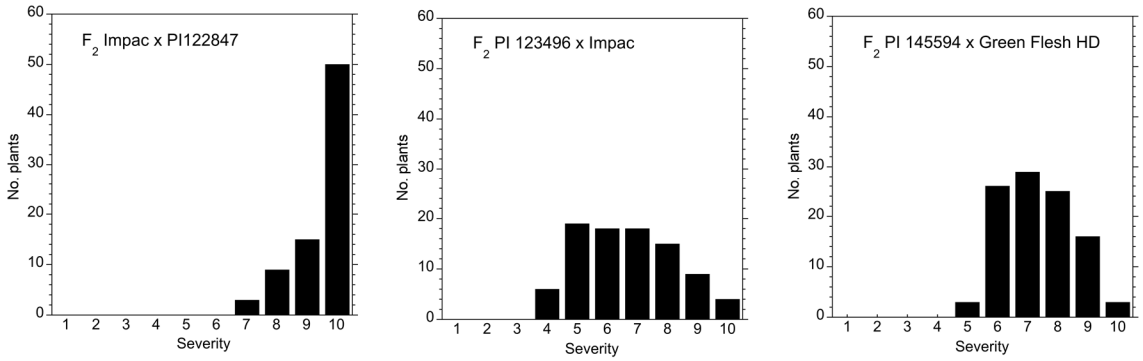

Figure 1. Frequency distributions of CYSDV symptom severity ratings in three F_2 families, fall 2015, DREC.

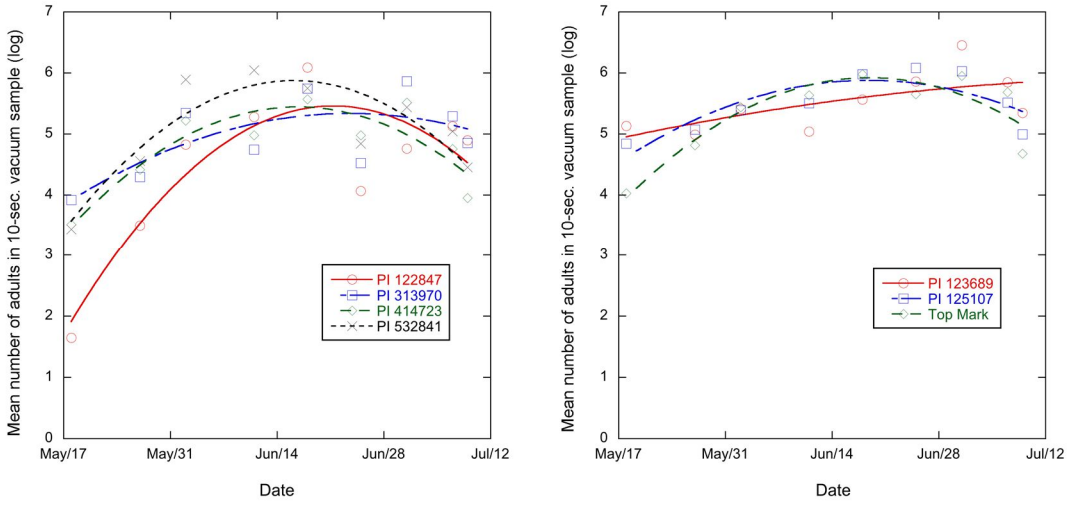

Figure 2. Mean numbers (log) of adults in 10-second vacuum samples of six melon accessions and 'Top Mark' at eight sampling dates from May 27 through July 9, 2015, highest (left) and lowest (right); DREC; no insecticide treatment.

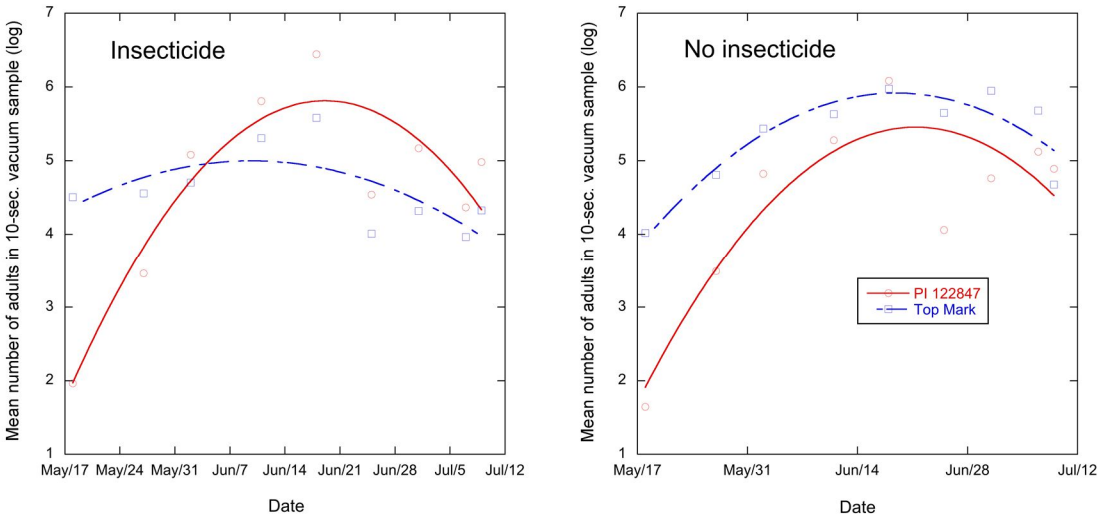

Figure 3. Mean numbers (log) of adults in 10-second vacuum samples of PI 122847 and 'Top Mark' at eight sampling dates from May 27 through July 9, 2015.

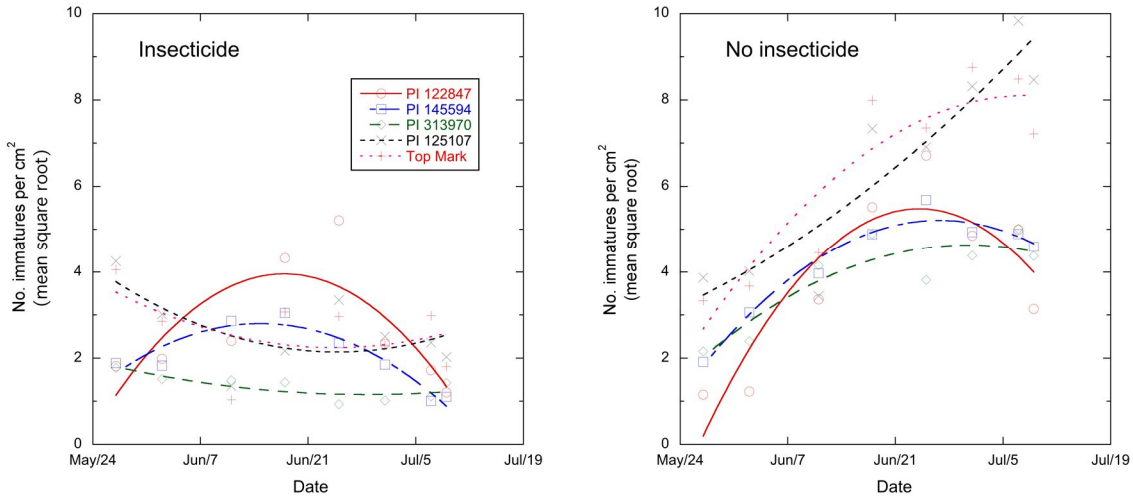

Figure 4. Mean numbers (square root) of immature (eggs + crawlers + nymphs + red eyes) SPWF per cm² on five melon lines at eight sampling dates from May 27 through July 9, 2015.

Table 2. Mean CYSDV symptom severity ratings of 12 melon lines treated with insecticide or not treated with insecticide at three dates, 2015, DREC.

		Date		
Treatment	n	6/12	7/1	7/14
Insecticide	12	1.2	6.0	7.3
No insecticide	12	1.4	6.8	8.0
ANOVA P > F		ns	0.0002	ns

[z]Symptom severity was evaluated on a visual scale from 1 (≤10% foliage symptomatic) to 10 (100%).

Table 3. Mean CYSDV symptom severity ratings of 12 melon lines, averaged across insecticide treatment at three dates, 2015, DREC.

		Date		
Line	n	6/12	7/1	7/14
PI 116482	8	1.5	7.6	9.2
PI 122847	8	1.0	4.7	5.8
PI 123689	8	2.0	7.4	7.6
PI 124107	8	1.8	8.6	9.1
PI 145594	8	1.0	5.5	7.2
PI 161375	8	1.2	5.9	8.8
PI 313970	8	1.1	3.4	5.2
PI 414723	8	3.1	8.9	9.4
PI 532841	9	1.0	6.3	7.3
TGR 1551	8	1.0	5.0	6.0
TGR 1937	8	1.0	4.9	6.5
Top Mark	8	1.0	8.8	9.4
ANOVA P > F		ns	0.0001	ns

[z]Symptom severity was evaluated on a visual scale from 1 (≤10% foliage symptomatic) to 10 (100%).