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Variability in Resistance of Peach Plant Introductions to *Tetranychus urticae* (Acari: Tetranychidae) Infestation[1]

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Abstract

Populations of twospotted spider mites infested peach plant introduction lines at different levels under field conditions in late season sampling in North Carolina. Leaf injury ratings based on a 1-5 scale showed wide differences in plant response to mite feeding among the lines. However, mite fecundity in laboratory tests was highly variable, and no significant differences among lines were found. These results suggest variability in the phenotypic response of peach germplasm to mite population development and effects of feeding.

Introduction

Twospotted spider mites, *Tetranychus urticae* Koch, are a potential pest of peach trees [*Prunus persica* (L.) Batsch] causing damage to leaves and affecting fruit yield. Mizell et al. (9) found no significant water loss or increase in leaf water stress at high mite population densities, but Kovach and Gorsuch (7) showed that high mite population levels accelerated leaf-drop and increased peach bloom density with no reduction in fruit weight or size. However, Bailey (3) found that high mite populations reduced peach yield during the final fruit-growth phase and also promoted early leaf drop.

During recent seasons, only a few acaricides were available for use on peaches in North Carolina, and the future for current or new acaricides is not promising. Therefore, other management strategies, such as cultural control, biological control, or host plant resistance are needed if mite populations become economically important. Meagher and Meyer (8) documented mite abundance in trees over different types of ground cover and found populations developed more quickly and with higher densities in trees over ground cover (especially *Vicia angustifolia* Reichard) compared to bare ground. Their research describes cultural methods for mite management.

Few studies have documented phenotypic variation in mite infestation across tree fruit species or cultivars. Host plant resistance to spider mites in horticultural crops appears to be related either to pubescence, trichomes, and other physical leaf characteristics (5, 6, 10, 13), or biochemically-based host-arthropod interactions that affect mite feeding and fecundity (12). Studies with *Impatiens* have shown variation in the degree of leaf injury among species and hybrids (1), and also suggested the use of several tests to determine these differences (2). During 1988 an opportunity was taken to monitor both natural artificially-infested field populations of *T. urticae* on several peach plant introductions (PI). Laboratory studies were also conducted using these introductions in oviposition tests. The objective of this research was to document variation of mite infestation across these peach introductions.

Materials and Methods

Two studies were conducted during 1988 to screen peach plant introductions against *T. urticae*. The first involved field sampling of artificially- and naturally-infested trees. Fourteen 8-year old PI trees arranged in 2-tree plots, located at the University Re-

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search Unit 2, Raleigh, were infested by attaching 2 bean leaves containing mites on 11 May 1988. Mites were sampled by selecting 20 leaves at random around the periphery of the tree and placing them in "Berlese" (modified Tullgren) funnels until the leaves were dry (8). Mites fell into vials of alcohol and the peach leaves were weighed to calculate the number of mites per g of leaf. Sample dates were 9 June and 6 July (early season samples), and 6 September and 29 September (late season samples). Mite injury to leaves (bronzing, leaf drop) was assessed on 19, 20 September by rating each tree on a scale of 1-5, from no injury to high injury, respectively.

Mite fecundity on another group of PIs was measured under laboratory conditions. Leaves were obtained from 18 nursery trees located at the Sandhills Research Station, Jackson Springs, and used the next day. Individual female mites from stock colonies reared on beans (*Phaseolus lunatus*) were placed on leaf disks (1.6 cm) (4 replications). Dispersal from the disks was prevented by placing them on a filter paper and cheesecloth layer standing in a water and benzimidazole mixture (2, 4). Trays with mites were placed in growth chambers at 27°C. After 5 days eggs were deposited by mites on each disk were counted.

Analysis of variance (PROC ANOVA, 11) was used to test the hypothesis that the PI lines were similar, and the Ryan-Elinot-Gabriel-Welsch (REGWQ) multiple range test was used to separate means for all studies. Field count data were subjected to log (y+1) transformation; mite fecundity data were subjected to log y transformation. Untransformed means are presented.

Results and Discussion

Field Sampling and Damage Assessment. Early season samples showed no significant differences among the PIs (Table 1), with relatively low densities of mites collected. Both late

Table 1. Mites per g of leaf collected (n = 2) and mite injury assessment (n = 3) in selected peach plant introductions, Raleigh, NC, 1988.

PI#	9 June Mean ± SD[a]	6 July Mean ± SD	6 September Mean ± SD	29 September Mean ± SD	Rating ± SD[b]
133982	0.00 ± 0.00 a	0.30 ± 0.14 ab	25.10 ± 9.76 a	0.45 ± 0.21 bc	3.7 ± 0.3 abc
134401	0.10 ± 0.14 a	0.60 ± 0.42 ab	18.70 ± 0.57 ab	0.40 ± 0.57 bc	2.3 ± 0.7 cde
117679	0.80 ± 0.71 a	4.85 ± 2.33 a	16.85 ± 1.20 ab	3.05 ± 1.77 bc	5.0 ± 0.0 a
113455	0.10 ± 0.14 a	0.65 ± 0.35 ab	12.30 ± 0.14 ab	0.45 ± 0.64 bc	3.3 ± 0.3 abcd
113452	0.00 ± 0.00 a	1.85 ± 0.49 ab	12.30 ± 0.14 ab	19.85 ± 1.48 a	3.0 ± 0.0 bcde
93826	0.20 ± 0.00 a	0.25 ± 0.07 ab	10.80 ± 0.42 ab	0.30 ± 0.14 bc	5.0 ± 0.0 a
119840	0.00 ± 0.00 a	0.15 ± 0.21 b	9.30 ± 7.07 ab	0.15 ± 0.07 c	4.3 ± 0.3 ab
146137	0.65 ± 0.92 a	0.90 ± 0.42 ab	7.45 ± 8.56 ab	1.00 ± 0.57 bc	1.3 ± 0.3 e
55776	0.30 ± 0.42 a	0.55 ± 0.21 ab	6.40 ± 0.57 ab	4.25 ± 4.03 b	2.3 ± 0.7 cde
104488	0.40 ± 0.14 a	1.45 ± 1.20 ab	5.30 ± 2.40 abc	0.65 ± 0.07 bc	2.0 ± 0.6 cde
106062	0.25 ± 0.35 a	2.90 ± 2.83 ab	4.30 ± 0.00 ab	1.30 ± 0.42 bc	1.7 ± 0.3 de
133984	0.35 ± 0.21 a	1.85 ± 1.91 ab	3.40 ± 2.12 ab	0.95 ± 0.07 bc	1.7 ± 0.3 de
101686	0.45 ± 0.35 a	3.20 ± 1.41 ab	3.15 ± 1.91 ab	1.10 ± 0.28 bc	1.3 ± 0.3 e
36126	0.00 ± 0.00 a	0.70 ± 0.42 ab	2.85 ± 2.62 b	1.25 ± 0.21 bc	2.3 ± 0.3 cde
	P = 0.4644	*P* = 0.0229	*P* = 0.0171	*P* = 0.0001	*P* = 0.0001

[a]Mites/g means were transformed using log (y+1) before analysis. Means within columns followed by the same letter are not significantly different, REGWQ test.

[b]Leaf injury rating scale, 1 = no leaf injury, 5 = high leaf injury; sampled mid-September. Means within columns followed by the same letter are not significantly different, REGWQ test.

season sampling dates produced significant differences among PIs (Table 1). The 6 September sample had 6 PIs with over 10 mites/g (ca. 3 mites/leaf); in the 29 September sample only PI 113452 contained high mite densities. Mite injury ratings suggested differences among PIs with the 93826, 117679, and 119840 lines having the most leaf injury symptoms (Table 1). PI's 101686 and 146137 produced the least leaf injury symptoms.

Oviposition Test. High variability among replications caused differences in the number of mite eggs among PIs to be nonsignificant ($P = 0.6642$) (Fig. 1). Mites on the 101686 line produced an average of 35.75 eggs/disk, whereas mites on the 119840 line produced only 17.5 eggs/disk. Mites on several PI's (101686 and 36126) produced many eggs (35.75 and 33.75 eggs/disk, respectively), but those PI's contained low mite population densities (3.15 and 2.85 early September mites/g, respectively) and low levels of leaf injury (1.3 and 2.3 rating, respectively) in the field.

Results from these studies suggest that there is variation in the response of herbivore to host in peach germplasm. This study offers both field and laboratory bioassay techniques to record host plant resistance in tree fruits, although because of large within-test variation, it appears that improvement is needed with the laboratory technique.

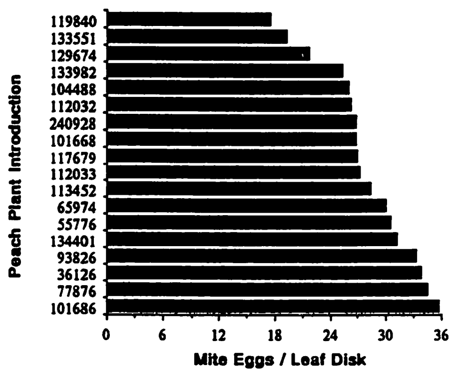

Figure 1. Mite eggs per disk from individual females on selected peach plant introductions. Means were transformed using log y before analysis and were not significantly different among PI's, $P = 0.6642$.

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