Screening of Strawberry Germplasm for Resistance to the Two-spotted Spider Mite
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Two-spotted spider mite (TSM; *Tetranychus urticae* Kock.) is a common strawberry pest that causes severe damage to strawberries. Mite populations in commercial fields reach a peak in late spring and decline rapidly in early summer after harvest (MacFarlane and Hepworth, 1994; Shanks and Doss, 1989). Mite damage occurs mainly in late spring and includes stomatal closure and reduced chlorophyll content on the lower surface of leaflets (Sances et al., 1979), lowered photosynthesis, transpiration, and fruit size (Sances et al., 1981). Walsh et al. (1998) found an average of 25% yield reduction in TSM-treated plots.

A number of studies have described genetic variation in TSM susceptibility (Hancock, 1999; Hancock et al., 1991). Most recently, Shanks and Moore (1995) studied mite resistance in genotypes of *F. chiloensis* (L.) Duch. and *F. virginiana* Duch., and *F. xananassa* L. cultivars and reported that while resistant *F. xananassa* exist, most are moderately to highly susceptible to TSM damage. *Fragaria chiloensis* genotypes had in general fewer mites than the *F. xananassa* cultivars, with CL-5 from California and a number of Chilean genotypes being most resistant. Some of the *F. virginiana* showed modest resistance, but none were superior to *F. chiloensis* genotypes.

During growth chamber screens of the photoperiod requirements of five native *F. virginiana* genotypes and five *F. xananassa* genotypes, we were presented with an evenly spaced, natural infestation of TSM. As many of the genotypes had not been screened previously for TSM resistance, we decided this was an opportunity to search for new sources of TSM resistance, we reported on the an opportunity to search for new sources of resistance to TSM. Herein, we report on the most resistant to mite infestation (Table 2). Montreal River-10 was consistently in the lowest significance group for MDS and MNO, regardless of day length. Frederick-9 was in the lowest significance group for all the treatments except MDS under 8-h day lengths.

The least resistance was generally found in the *F. xananassa* cultivars Ft. Laramie and Honeoye.

The TSM resistance that we have identified in *F. virginiana* may prove useful in strawberry breeding, as Montreal River-10 and Frederick-9 are considered among the most elite native genotypes and have already been incorporated into breeding populations (Hancock et al., 2001a, 2001b). Chaplin et al. (1968, 1970) and Barritt and Shanks (1981) have reported high heritability for TSM resistance, and a relatively high ratio of general to specific combining ability. We still need to test the durability of our resistance in the field; however, genotype resistance has often been shown to be stable across environments (Cary et al., 1995; Medina et al., 1999), and the laboratory rankings of resistance have in general agreed with field scores (Gimenez-Ferrer et al., 1993).

| Genotype | Source | Mite damage score | Mite no./leaflet | Mite no./cm² leaf area |
|----------|--------|-------------------|------------------|-----------------------|
| 18.2     | 63.3   | Block (day length)|                   |                       |
|          | 2      | 37.5              | 51.3             | 42.1                  |
|          | 27     | 18.2              | 63.3             | 42.1                  |
|          | 120    | 1.5               | 11.8             | 7.3                   |

Table 1. Analysis of variance for two-spotted spider mite damage and population size on strawberries grown in growth chambers at 18 °C and 6-, 8-, and 10-h day lengths.

The means of MDS and MNO were progressively reduced at 6-, 8-, and 10-h photoperiod treatments (Table 2). Mean MNO did not follow this trend exactly as mite numbers under 8 and 10 h were about the same, but numbers at 6 h were still highest. When Patterson et al. (1994) compared resistance of ‘Redchief’ and ‘Tribute’ to TSM under, 8- and 24-h day conditions, they also found the highest mite numbers under the shorter day treatment (8 h) on both cultivars.

Overall, the *F. virginiana* genotypes, Frederick-9 and Montreal River-10, proved to be most resistant to mite infestation (Table 2). Montreal River-10 was consistently in the lowest significance group for MDS, MNA and MNO, regardless of day length. Frederick-9 was in the lowest significance group for all the treatments except MDS under 8-h day lengths.

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Table 2. Mean two-spotted spider mite damage and population size on strawberry genotypes grown in growth chambers at 18°C and 6-, 8-, and 10-h day lengths.

| Genotype       | 6 h | 8 h | 10 h | Mean | 6 h | 8 h | 10 h | Mean | 6 h | 8 h | 10 h | Mean |
|----------------|-----|-----|------|------|-----|-----|------|------|-----|-----|------|------|
| BT3            | 3.4 | 5.2 | 2.2  | 3.6  | 8.0 | 1.1 | 2.1  | 3.7  | 7.9 | 1.2 | 1.8  | 3.6  |
| Frederick 9    | 4.8 | 5.8 | 3.4  | 4.7  | 1.6 | 0.9 | 1.3  | 1.2  | 2.3 | 1.5 | 2.3  | 2.1  |
| LH 50-4        | 6.0 | 3.2 | 3.8  | 4.3  | 6.0 | 2.3 | 3.9  | 4.0  | 6.6 | 1.3 | 1.6  | 3.1  |
| Montreal River-10 | 4.4 | 2.0 | 2.4  | 2.9  | 5.4 | 2.1 | 3.4  | 3.6  | 3.1 | 0.8 | 1.8  | 1.9  |
| RH 30          | 6.4 | 4.2 | 2.8  | 4.5  | 7.3 | 6.0 | 3.2  | 5.5  | 8.2 | 6.6 | 1.9  | 5.6  |
| DHL 1336       | 6.4 | 6.4 | 4.4  | 5.7  | 8.5 | 5.3 | 5.7  | 6.5  | 4.3 | 2.4 | 3.5  | 3.4  |
| ‘Ft. Laramie’  | 5.6 | 7.6 | 3.2  | 4.3  | 6.0 | 2.3 | 3.9  | 4.0  | 6.6 | 1.3 | 1.6  | 3.1  |
| ‘Honeoye’      | 8.0 | 7.8 | 8.4  | 8.7  | 13.3| 4.6 | 11.7 | 9.9  | 5.9 | 3.3 | 8.9  | 6.0  |
| ‘Oglalla’      | 7.2 | 8.6 | 6.6  | 7.5  | 3.5 | 9.7 | 4.8  | 6.0  | 1.7 | 13.8| 2.7  | 6.1  |
| ‘Tribute’      | 7.0 | 8.4 | 5.0  | 6.8  | 5.0 | 8.7 | 8.1  | 7.2  | 3.9 | 2.6 | 2.6  | 3.0  |
| Mean           | 5.9 | 5.9 | 4.4  | 5.4  | 7.0 | 5.0 | 5.6  | 5.9  | 4.9 | 3.9 | 3.0  | 3.9  |
| LSD            | 1.9 | 0.8 | 1.6  | 0.9  | 4.4 | 4.5 | 4.6  | 2.5  | 3.9 | 3.8 | 2.2  | 1.9  |

*0 = no visual symptoms; 10 = complete coverage of leaves with webbing.*

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