Resistance in the Eggplant to Two-Spotted Spider Mites

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Abstract: Seven varieties of the eggplant *Solanum melongena* L. were selected for an evaluation of resistance to the two-spotted spider mite *Tetranychus urticae* Koch. The Sinompiro variety which was observed in the field to be highly resistant to mites did not exhibit a high level of resistance when tested in the laboratory. The Black Beauty and Sinompiro varieties exhibited some resistance to the mites. The Dingras #1 and #3 varieties showed a lower level of resistance than the Black Beauty and Sinompiro varieties.

INTRODUCTION

Two-spotted spider mites (*Tetranychus urticae* Koch.) are serious pests of several food crops including eggplant (*Solanum melongena* L.) (Metcalf et al. 1962). Some eggplant varieties exhibit natural resistance to certain insect pests. Poos and Haenseler (1931) reported that in New Jersey, Long Purple was seriously injured by the potato leafhopper (*Empoasca fabae* Harris), whereas other common varieties (Black Beauty, New York Improved, and Florida High Bush) were only slightly affected.

Dharmaraju and Chowdary (1960) in Ceylon tested 38 varieties of eggplant for resistance to the stem borer (*Euzophera perticella* Ragonet) and found that the incidence of infestation ranged from 91% for Chodavaram to 67% for Sattenapalli variety. Srinivasan and Basheer (1961) reported that the percentage of infested fruits was only 10.8% for the variety Coimbatore, but 48.0% for the variety Surtigote.

Nowhere in the literature did we find a report of an investigation of potential resistance to mites in eggplant. However, Professor H. M. Munger (1970, personal communication), of Cornell University, while in the Philippines, observed that certain eggplant varieties (Sinompiro, Karume Long, Dingras #1 and #3) had few mites, whereas others (Millionaire) had many mites. The aim of this investigation was to evaluate these five varieties of eggplant, plus two others, for resistance to the two-spotted mite.

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MATERIALS AND METHODS

In this study, the following seven varieties of the eggplant were tested in the laboratory for their relative degree of resistance to spider mites:

1. Black Beauty
2. Karume Long
3. Sinompiro
4. Dumaguete Long Purple
5. Millionaire
6. Dingras #3
7. Dingras #1

Earlier we mentioned that Professor Munger indicated that varieties Sinompiro, Karume Long, Dingras #1 and #3 showed some resistance, whereas variety Millionaire was susceptible to mites. No information was available on Dumaguete Long Purple and Black Beauty.

The eggplants were grown in an environmental chamber under controlled conditions. Illumination with a daily photoperiod of 16 hr and at about 500 ft-candle at the plant level was provided by fluorescent lights (VHO Powertube, Cool White™ F72T12CW, 72 in., Sylvania Electric Products, Inc., Danvers, Mass. 01923, USA). The temperature was maintained at 80 ± 2° F and relative humidity at 70 ± 5%. Each plant was grown in a 15 cm. diameter plastic pot in a mixture of loam, sand, peat, and fertilizer. The pots were watered on alternate days and the soil was fertilized once in two weeks with a standard dilution of fertilizer (Stern's Miracle-Gro,™ 15-30-15). The test plants were randomly arranged in the environmental chamber.

The eggplants were tested eight weeks after germination. When leaves or leaf discs were used for the tests, the third leaf from the base was selected for uniformity. In tests requiring confinement of mites to a part of the leaf during the test period, the following leaf-disc technique [a slight modification of the method devised by Rodriguez (1953)] was used.

For this test, leaf discs 2.5 cm. in diameter were cut with a sharp cork borer (#15). A streak of pure lanolin (Botany™) was applied to the cut edge of the leaf disc to prevent the escape of mites. A circular piece of cellucotton, about 5 cm. in diameter and moistened with tap water, was placed in a plastic petri dish about 6 cm. in diameter. One leaf disc was placed, ventral side facing upward, on the moist cellucotton in a petri dish. The cover of the petri dish was kept slightly open to prevent the condensation of water on its inner side and subsequent drip onto the leaf disc. The cellucotton was moistened every 48 hr. During the tests, petri dishes containing the leaf discs were marked and randomly placed in the growth chamber.

Spider mites for all tests were reared under similar conditions on Fordhook lima bean plants (selecton 242). The bean plants were replaced every two weeks.

TABLE 1. A comparison of spider mite responses on seven varieties of the eggplant, by Duncan's multiple-range test. Means underscored by the same line differ significantly; * p = 0.05 and ** p = 0.01.

Varieties: 1 = Black Beauty; 2 = Karume Long; 3 = Sinompiro; 4 = Dumaguete Long Purple; 5 = Millionaire; 6 = Dingras #3; 7 = Dingras #1							
Test Explanation[a]							
Mean preference of 20 mites for varieties	1	6	3	7	4	5	2
	1.7	2.3	2.15	2.6	3.7	3.9	4.8 **
Mean number of mites leaving the leaf disc during four days	5	1	4	2	6	3	7
	0.2	0.5	0.7	0.9	0.9	1.3	1.3 *
Mean number of progeny produced/pair after 12 days	6	5	1	3	7	4	2
	77.6	86.6	90.4	103.0	117.8	120.4	123.6 **
Index of mite damage for varieties	1	3	6	7	4	2	5
	3.2	3.2	3.2	3.4	3.6	4.2	4.2 **

[a] See text for methods.

The data on susceptibility or resistance were tested by the analysis of variance. When the treatment differences were found to be significant, the means were compared by Duncan's new multiple-range test (Duncan, 1955). The specific methods for each of seven different experiments are described in the results section.

RESULTS

Feeding Preference. The feeding preference of the mites was tested using the following multiple-choice design. Seven leaf discs, one from each variety, were placed in a circle close to the margin of an open plastic petri dish, 10 cm. in diameter. The leaf discs were not lined with lanolin. A thin film of tanglefoot was applied to the vertical wall of the dish to prevent the escape of mites. The petri dishes were placed in a dark humid chamber with a relative humidity of about 100%. Twenty mites which had been starved for 12 hours were released at the center of the petri dish. After 12 hours, the number of mites on and under each leaf disc was noted. Ten replications were run.

The Black Beauty variety was least preferred (p = 0.01) and Karume Long was the most preferred variety (Table 1).

Repellency Test. One leaf disc from each variety was placed on moist cellucotton in a plastic petri dish. The disc was not ringed with lanolin. Ten mites were released on the disc. After four days, the number of mites that had wandered off the leaf disc and drowned in moist cellucotton was recorded. There were ten replicates.

The mites were repelled most ($p = 0.05$) by Sinompiro and Dingras #1 varieties and least by the Millionaire variety (Table 1).

Oviposition Response. One leaf disc of each variety was placed on moist cellucotton in a plastic petri dish and one young female mite was placed on the disc. The petri dishes were placed inside the environmental chamber and the number of eggs laid on each disc was counted after 72 hr. Ten replicates were run.

The smallest number of eggs (2.9/female) was laid by the mites on the Sinompiro variety and the largest (5.0/female) number on Karume long variety, but the differences were *not* significant.

Longevity and Fecundity. Leaf discs of the various varieties, ringed with lanolin, were placed individually on moist cellucotton in petri dishes. One young female mite was placed on each disc. There were ten replicates. The mites were observed daily and their longevity was recorded. The leaf discs were replaced every 72 hours. The number of eggs laid by each mite was recorded daily. The eggs were then removed with a moist camel-hair brush. There were no differences in longevity, but the number of eggs laid by a female was lowest (4.3) on Black Beauty and highest (12.8) on the Millionaire variety.

Mite Reproduction. To determine whether there were any differences in the rate of multiplication of the mites on the various varieties, a test was run with mites caged directly on the plants. The mites were confined to a leaf by drawing a narrow ring of lanolin around the petiole. Three young female mites and three males were released on each test leaf. Ten replicates were made. After 12 days, the number of adult mites on each test leaf was counted.

The mean number of adult progeny per pair of mites was lowest (77.6) on the Dingras #3 variety and highest (123.6) on the Karume Long variety ($p = 0.01$) (Table 1).

Index of Damage. Five plants of each variety were randomly placed inside the growth chamber and were uniformly infested with mites by placing on each plant a heavily infested bean leaf. After three weeks, the extent of damage suffered by each plant was given a visual rating according to the following scale.

Rating	*Observed Damage*
0	No apparent damage
1	Less than 10% damage
2	About 25% damage
3	About 50% damage

4	About 75% damage
5	100% damage

The varieties Black Beauty, Sinompiro, and Dingras #3 showed the least damage ($p = 0.01$), while the Karume Long and Millionaire varieties showed the greatest damage (Table 1).

DISCUSSION

The responses of the seven eggplant varieties to mites based on seven different tests are not consistent. In general, however, varieties Black Beauty and Sinompiro exhibit some degree of resistance to mites. These results were not totally in agreement with Professor Munger's observations in the Philippines, which indicated that the Sinompiro variety was highly resistant to mites.

That resistance responses of plants to insects vary from field conditions to laboratory conditions is not surprising and has been observed by other workers (Kindler and Kher, 1970; Curry and Pimentel, 1971). Conditions in the laboratory are never exactly the same as in the field relative to light, soil nutrients, water, temperature, and wind; hence, it is not surprising that plants respond differently. Any one or a combination of these factors may alter the physiology of the plant, and in turn, its resistance factors.

Furthermore, much depends upon what test(s) is being used to measure resistance. Mite resistance in eggplant varieties is quite complex and is illustrated by the results with the Sinompiro variety. On this variety, mites had an intermediate level of preference but once present, they were seldom repelled by the variety compared to the other varieties. Mite reproduction was also intermediate; however, heavy mite infestations did little damage to this variety. Certainly an examination of the results in Table 1 indicates other differences in response, suggesting that several factors are involved in eggplant resistance to mites. Again, these results support the principle that most resistance in plants to insects is due to polygenic characteristics (Painter, 1951).

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