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Resistance of Sweet Potato Lines to the Sweetpotato Weevil[1]

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Abstract. **Out of 38 lines of sweet potato [*Ipomoea batatas* (L.) Lam.] which had demonstrated some resistance in laboratory tests to the sweetpotato weevil, *Cylas formicarius elegantulus* (Summers), 13 lines had significant levels of resistance, based on weevil free yield in artificially infested fields in Yoakum, Texas. Two lines, W 125 and W 119, previously released as having weevil resistance, maintained a high level of resistance.**

The sweetpotato weevil is the most destructive pest of commercially grown sweet potatos in Georgia, Texas, Florida, Louisiana, Mississippi, and Alabama. In recent years, the development of host plant resistance has received increased attention. Waddill and Conover (9) found some resistance in the white-fleshed lines. Rolston et al. (8) reported that resistance to the weevil existed in a continuous gradient and was polygenetic. Mullen et al. (5, 6) found several lines to be resistant in field tests. Jones et al. (3) released 6 lines with multiple insect and disease resistance, all of which possessed moderate levels of weevil resistance. This study was conducted to determine the resistance levels of sweet potato lines to weevil infestation in artificially infested fields.

We tested 107 sweet potato lines in the laboratory using the method described by Mullen et al. (4). In each test, 23 lines were exposed to 30 sweetpotato weevils for 48 hr, and the number of weevil punctures in the periderm were counted and compared to the controls, 'Centennial' and 'Jewel'. Each line was replicated 5 times and ranked according to the number of weevil punctures. Thirty-eight experimental lines and 2 controls, 'Centennial' and 'Jewel', were selected from the laboratory tests for field testing. Field plots were planted on May 20, 1981, in a randomized complete block design. Each cultivar was replicated 8 times in 10-plant plots. Sweet potato slips from greenhouse beds were planted 30 cm apart with 90 cm between plots and 1.0 m between rows. The field was bordered by 2 guard rows of 'Jewel'. Standard commercial practices were followed in growing the crop. Twelve thousand weevils were released from 4 shelters 66 days after planting as previously described by Mullen et al. (5). Plots were harvested 141 days after plantings, on Oct. 8, 1981.

The criteria used for judging resistance levels were crown infestation, hill infestation, yield, and a subjective severity rating. Each crown was examined for weevil damage and rated on a scale of 1 (no visible infestation on crowns) to 5 (severely infested). The crown index was determined by dividing the total rating points scored for all crowns by the number of crowns examined. Each hill was examined in the field for infestation. One infested root was sufficient to consider a hill infested. Two roots from each plot were selected at random, returned to the laboratory, and held at 23 to 26°C for 30 days and the numbers of weevils emerging from each root determined. Roots were not graded, but total yield was determined for each plot. Weevil free yield was calculated by multiplying the percentage of weevil free hills by the total yield. The severity index (SI) was based on a scale of 1 (no visible damage) to 5 (very heavy damage), and was determined before any of the resistance criteria were measured. Data from only 30 lines are reported, since 5 lines failed to produce sufficient roots in the field.

Five lines were found to be highly resistant to weevil infestation and 8 lines were resistant (Table 1). Two lines, W 119 and W 125, released as having weevil resistance (3) also had a very high weevil free yield. 'Jewel', considered in previous studies as intermediate to susceptible (5.6), had high weevil free yield. 'Centennial' was one of the most susceptible lines studied.

Data on crown damage were not considered in determining resistance levels because few differences were found to exist between the lines tested. The mean crown index was 2.03 ± 0.12 (se). This, however, does not mean that crown damage does not affect yield. Mullen et al. (6) found that crown damage so reduced the vigor of 'Centennial' and other lines that root production was greatly reduced.

Numbers of weevils emerging from roots held in the laboratory were also not considered in determining resistance as variability within the same lines was so great that no significant differences existed. Many lines

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Table 1. Field evaluation of sweet potato lines for resistance to the sweetpotato weevil at Yoakum, TX, 1981.[z]

Accession	Weevil free yield (kg/plot)	Hill infestation (%)	Severity index[y]	Resistance rating[x]
W-119	5.7 a	36 bcd	1.75 ab	HR
W-191	5.2 ab	48 ef	1.88 bcd	HR
W-125	5.1 ab	59 fgh	2.00 bcd	HR
W-182	4.7 abc	47 ef	2.25 de	HR
W-193	4.3 abc	30 ab	2.03 bc	HR
W-151	3.6 abcd	45 def	3.25 hij	R
80-41	3.6 abcd	60 fgh	2.25 de	R
W-152	3.5 abcd	24 a	1.43 a	R
80-55	3.3 abcd	45 def	2.00 bd	R
80 BM 9	3.3 abcd	39 cd	2.50 efg	R
80-65	3.2 abcd	39 cd	2.63 fg	R
80-69	3.2 abcd	36 bcd	2.13 cde	R
Jewel	3.2 abcd	62 gh	3.25 hij	R
W-183	3.1 bcd	53 fg	4.13 jk	R
80 BM 4	2.8 bcde	54 fg	2.88 gh	I
80 BM 10	2.7 bcde	46 def	2.63 fg	I
80-84	2.6 bcde	31 abc	2.25 de	I
80-13	2.6 bcde	47 ef	2.13 cde	I
80-29	2.6 bcde	48 ef	2.00 bc	I
80-76	2.5 cde	34 abc	2.00 bc	I
80-89	2.5 cde	34 abc	2.75 gh	I
80-82	2.3 cde	28 ab	2.67 fg	I
80-4	1.9 de	52 fg	2.00 bc	S
80-DW 11	1.9 de	67 h	3.86 j	S
80 BM 5	1.5 de	24 a	2.75 gh	S
80-14	1.4 de	50 ef	3.25 hij	S
80 BM 15	1.4 de	40 cde	3.25 hij	S
80-72	1.1 e	28 ab	2.50 eg	S
Centennial	1.1 e	52 fg	3.25 hij	S
W-188	0.9 e	68 h	3.19 hij	S

[z]Mean separation by Duncan's multiple range test, 5% level.
[y]Severity index: 1 = (no visible damage) to 5 = (high damage).
[x]HR = Highly resistant; R = Resistant; I = Intermediate resistance; S = Susceptible.

with poor yield were probably not infested because their roots were so small that cracks in the soil were not produced to allow weevils to gain access to the roots.

Five lines, not shown in Table 1, (80-11, 80-37, W 181, 80-31, and W 13) showed high resistance with respect to both percent of hill infestation and severity index. However, the yield on these lines was so low that resistance may have been due to escape. W 181 and 80-31 will be released as breeding lines because of their insect and disease resistance, and in addition, 80-31 has good shape and stores well. W 13 will be retained as a breeding line. Two lines, 80-11 and 80-37, have been dropped and are no longer available.

The mechanism of weevil resistance is unknown. Antizenosis (= nonpreference) is probably the most important factor; however, antibiosis, escape, and tolerance to infestation influence resistance. Barlow and Rolston (1) found that nonpreference accounted for most resistance, but not all, and speculated that some resistance in field tests was probably due to escape. Cockerham and Dean (2) and Pillai and Kamalam (7) found that long-necked roots escaped infestation more often than short-necked cultivars. Water and carotene content were hypothesized (2) to influence resistance, and high sugar and low latex favored weevil development (7). Tolerance to crown infestation was reported to influence yield in some cultivars (6).

In the present study, antizenosis probably accounted for many of the differences. Other factors, although not directly measured, might be important. Even small differences in weevil survival and development times due to antibiotic factors in individual sweet potato lines can influence the size of subsequent weevil populations available for reinfestation. Some lines produced so few roots that escape may have been the most important factor. The release method employed in this test provided large numbers of weevils for reinfestation and was designed to minimize any antibiotic effects and to help prevent escape.

This study as well as others (2, 4, 5, 6, 7, 8) have shown that resistance to the sweetpotato weevil is real and can be demonstrated by field testing.

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