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1) Techniques developed for screening soybeans for Mexican bean beetle resistance.

The lack of uniform infestations of Mexican bean beetle (Epilachna varivestis Mulsant) in field plantings can make selection for resistance in segregating soybean populations very difficult. For this reason, the results from screening F_2 plants in the field have been inconsistent. An alternative is to advance F_2 plants to the F_3 to provide replication at more than one location. However, this procedure is costly in both time and land requirements. The development of supplemental greenhouse screening techniques which provide precise, repeatable results is essential to the progress of the breeding program. We report here a comparison of two such techniques, adult beetle feeding on mature soybean trifoliates and on unifoliate soybean seedlings, to foliar feeding in field nurseries.

Field Evaluations: In 1976, F_3 progenies from a backcross to a susceptible adapted parent were planted in randomized complete block designs with two replications/entry. Rows were 4.8 m long, spaced 1.1 m apart; and each row contained 25 seed. Every third row in each nursery consisted of Henderson bush lima beans, and 'Davis', 'Clark', and 'Forrest' soybeans in a 1:1:1:1 mixture, planted 14-21 days before test lines, to increase and hold incoming beetle populations in the nurseries. Populations were monitored weekly, and when extensive defoliation was evident, a visual estimate of defoliation from 0 to 60% in 5% increments was recorded.

Greenhouse Evaluations:

Excised trifoliate tests: The 9th and 10th trifoliates from field grown F_3 progenies were placed in water-filled 250 ml Erlenmeyer flasks and placed in a randomized complete block design (10 replications/treatment) on the floor of a 120 x 120 x 90 cm wooden frame cage covered with Saran screen. The cage was then infested with beetles (1/trifoliate), placed on a bench in a shaded, open-air insectary, and covered with a double layer of black floral cloth to lessen the interference of sunlight. After 48 hr, feeding damage was visually estimated on a scale of 1-12: 1 = extensive feeding in 1 of 12 trifoliate quadrants; 12 = extensive feeding in all of the 12 trifoliate quadrants, and converted to percent defoliation.

Seedling tests: Seed from each of the test progenies and the resistant and susceptible checks were planted in randomly arranged rows in wooden flats containing a sand, soil, and peat potting mix. When unifoliate leaves were present on all seedlings, cotyledons were clipped off, and the plants were infested with beetles (1/seedling). Small wooden frame cages with Saran screen tops and foam rubber strips along the bottom edge were then placed over the flats. After 72 hr, seedlings were rated for damage on a scale of 1-8: 1 = extensive feeding in 1 quadrant of the 8 quadrants in the two unifoliates; 8 = extensive feeding in all 8 quadrants of the two unifoliates. In both seedling and excised trifoliate tests, 2-wk-old female beetles were used for testing after the following pretest conditioning: 24 hr feeding on Forrest leaves; 24 hr with access to distilled H_2O.

Of the lines evaluated in the field, 13 were found to have moderate to high levels of resistance. For purposes of illustration, the responses of 4 of these are shown in Table 1.

Table 1

Adult Mexican bean beetle feeding on selected progeny in three types of evaluations

	Field	Greenhouse	
	$\bar{x}$ %	Excised trifoliates	Seedling
Line	Defoliation[1]	$\bar{x}$ % defoliation	$\bar{x}$ damage[2]
Resistant check	5 a[3]	8 ab	0.8 a
1	7 a	14 abc	0.4 a
2	7 a	15 abc	0.9 a
3	10 ab	26 c	2.0 a
4	14 ab	24 bc	2.8 a
Susceptible check	30 c	44 d	5.5 b

[1]Mean damage computed for data at three locations.

[2]1 = no damage; 8 = heavy feeding on both unifoliate leaves.

[3]Means in each column not followed by the same letter differ significantly at the .05 probability level as determined by Duncan's Multiple Range Test.

Drought conditions may have affected the uniformity of beetle infestation in the field, thus tests with excised trifoliates were conducted to more critically evaluate the resistant lines. Results of these tests were similar to those of field evaluations, but lines 3 and 4 proved to be more susceptible (Table 1).

Similar results were also obtained in feeding tests with seedlings of the same 13 lines and these results and those of field evaluations were closely correlated (r = .63**, 12 df). Seedling tests did not detect susceptible lines as accurately as did the excised trifoliate test, but ratings of the more resistant lines were similar in both tests. Additionally, results of both tests were also highly correlated (r = .71**, 11 df). The results of these tests indicate the usefulness of each to a breeding program. The utility of excised trifoliate and/or seedling screening tests of F_2 plants in the greenhouse is yet to be determined. These tests would greatly increase the efficiency of the breeding program. Both techniques are now being used to increase the efficiency and precision of insect resistance evaluations.

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1) Characterization of cytoplasmic diversity in soybeans.

Soybean cultivars which occupy a majority of the U.S. acreage trace to only a few maternal parents. According to a recent report (1972) by the National Academy of Sciences, the maternal ancestors and their combined frequency of occurrence in the parentage among Northern and Southern varieties are: 'Mandarin' 51%, 'Illini' 23%, 'Tokyo' 11%, 'Dunfield' 8%, 'Mukden' 4%, and 'Roanoke' 4%. Four of these parents are introductions from Manchuria, one from Japan, and one is of unknown origin. The limited geographical origin and the paucity of maternal parents is a reasonable basis for concluding that a high degree of cytoplasmic uniformity exists in currently grown soybean