

A Grafting Technique Enabling an Unthrifty Interspecific Hybrid of Beta to Survive

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F1 seedlings arising from crosses of sugar beets, *Beta vulgaris* L., with each of the three species, *Beta procumbens* Chr. Sm., *B. patellaris* Mocj., and *B. webbiana* Moq., do not survive beyond the seedling stage. Stewart (2)² obtained several hundred of the hybrid seedlings but was able to grow only a single plant, *B. vulgaris* X *B. procumbens*, to maturity.

There is interest among sugar beet breeders in making inter-specific hybrids with these wild species, since these species appear to be immune



Figure 1.—Comparisons of leaves of sugar beet, *Beta procumbens*, and their hybrid. The two leaves at the upper left are sugar beet and *B. procumbens*, respectively. The others are from the interspecies hybrid.

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² Numbers in parentheses refer to literature cited.



Figure 2.—Hybrids of sugar beet X *Beta procumbens*. The graft union of the plant on right— can be seen just above the soil level.

to leaf spot and show high resistance to curly top, two of the major diseases of sugar beets in the United States. It has been reported that the sugar beet nematode, *Heterodera schachtii* Schmidt, cannot complete all stages of development in the roots of these wild species (1). If these factors for disease resistance and nematode reaction can be transferred to the sugar beet, they may contribute to sugar beet improvement. An effective means of growing the unthrifty F_1 plants to sexual maturity would be helpful.

It was observed that the F_1 seedlings do not form a secondary root system. Under conditions of good culture the hypocotyl, cotyledons and young leaves may remain alive for several weeks, but the primary root system fails to expand, turns dark and finally becomes necrotic. Sugar beet seedlings growing in the same progeny with the interspecific hybrids and in the same environment make excellent growth. The obvious deduction is that if the unthrifty F_1 seedlings were given more effective root systems to support growth, they might have a chance of surviving. A grafting technique to accomplish this with a *Beta vulgaris* X *B. procumbens* hybrid has been developed.

Sugar beet seedlings 2 or 3 days old are used as the stock of the graft. The hybrid seedling is used as the cion when initials of its first leaves are visible. A hole in which to make the insertion of the cion is made in the apex of the stock seedling with a small dissecting needle and then enlarged with a larger one. A sloping cut is made through the hypocotyl of the hybrid no more than $\frac{1}{4}$ inch below the point of attachment of the cotyledons. The cut end of the cion is inserted into the opening in the stock, and the grafted plant is placed in a high humidity chamber until the cion has grown about 2 inches. It can then be taken from the high humidity



Figure 3.—Hybrids of sugar beet X *Beta procumbens*. The plant on the left has numerous branches started.

chamber. The most important factor influencing the success of the union appears to be the use of seedlings of the proper age, i.e., a very young sugar beet seedling for the stock and an older hybrid seedling for the cion. It also appears important to use, as stocks, seedlings which are closely related to the sugar beet parent of the F_1 hybrids. The greatest difficulty encountered is the mechanical dislodging of the cion by growth of leaves from the apex of the stock.

Only 25 of the grafts with F_1 plants of sugar beet X *B. procumbens*, or 7 percent of those attempted, have given successful union. Of the 25 hybrid cions, 15 have grown to be vigorous individuals. No two of the 25 plants have been alike in appearance. They have shown great morphological variations, particularly in leaf size and leaf shape (Figure 1). The amount of branching and the extent of stem development have also shown

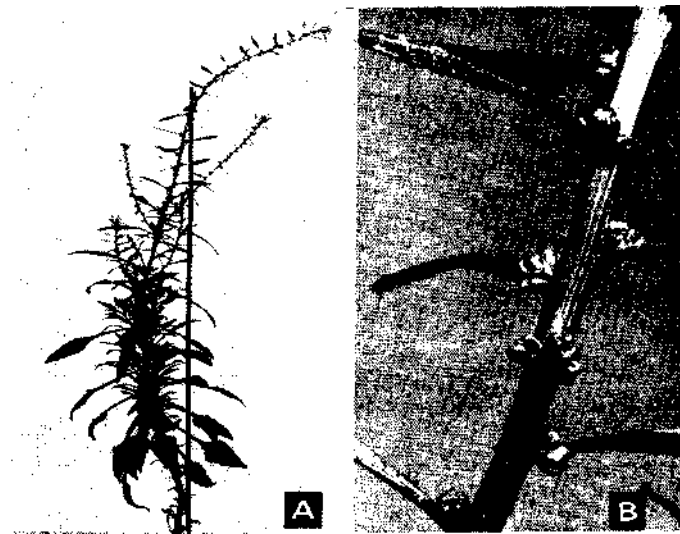


Figure 4.—Left (A), inflorescence of species hybrid, sugar beet X *B. procumbens*. Right (B), flowers of species hybrid, sugar beet X *B. procumbens*. These flowers closely resemble those of sugar beets.

considerable variation (Figures 2 and 3). The inflorescences and flowers have resembled more nearly those of the sugar beet than those of *B. procumbens* (Figure 4). The morphological variations are encouraging since they are indicative of genetic differences within the wild species which should broaden the combining possibilities in future breeding work. Some successful combinations may eventually be found.

Literature Cited

- (1) HIJNER, J. A.
1952. The susceptibility of wild beets for *Heterodera schachtii*. Meded. Inst. v. Rationele Suikerproductie, 21: 18 pp. Apr.
- (2) STEWART, DEWEY.
1950. Sugar beet X *Beta procumbens*, the F_1 and backcross generations. Proc. Amer. Soc. Sugar Beet Tech. 6:176-179.