

Sugar Beet X Beta Procumbens, the F₁ and Backcross Generations

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The sugar beet (*Beta vulgaris* L.) and the three species of the section *Procumbentes*² hybridize readily, but the F₁ seedlings usually do not live beyond the second or third leaf stage. Hundreds of F₁ seedlings have been obtained from the hybridizations in which sugar beets of various varieties have been used as maternal parents and either *B. procumbens* Chr. Sm., *B. patellaris* Moq., or *B. webbiana* Moq., occurred as the pollen parent.

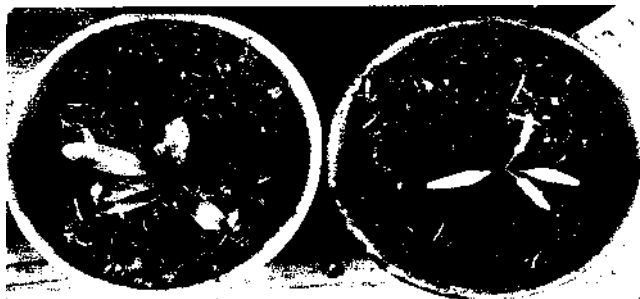


Figure 1. Two seedlings of the same age. Left, healthy sugar beet; Right, unthrifty F₁ sugar beet x *B. procumbens*. The F₁ seedlings seldom survive beyond the stage shown here.

Each of these wild species when mated with the sugar beet has given the same type of unthrifty F₁ plants, which seldom survived beyond the seedling stage. A typical F₁ seedling is shown on the right in Figure 1. However, in one of the hybrid progenies of sugar beet x *B. procumbens*, a seedling became fairly vigorous after three or four weeks of laggard growth and eventually produced several flowering branches. This plant is shown in Figure 2.

The F₁ plant was pollen sterile but approximately 45 seeds were produced following heavy applications of sugar beet pollen. The seeds as shown in Figure 3 were monogerm and in this respect the hybrid resembled somewhat the *B. procumbens* parent. There was a tendency for two or three seeds to adhere in clusters but these could be broken apart easily.

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² Coons, G. H. "Wild species of genus *Beta*"—1938 Proc. Amer. Soc. Sugar Beet Tech., pp. 74-76.



Figure 2. Left, F_1 plant, sugar beet x *B. procumbens* at flowering stage. Right, *B. procumbens*.

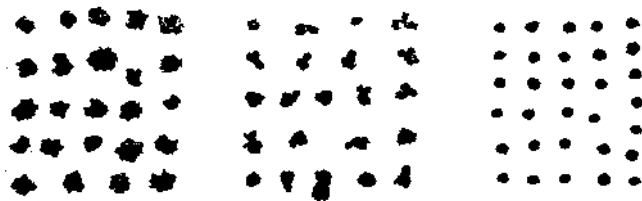


Figure 3. Left, sugar beet seed; Center, seeds produced on F_1 plant, sugar beet x *B. procumbens*; Right, monogerm seeds of *B. procumbens*.



Figure 4. Left, plant of the first backcross generation (sugar beet x *B. procumbens*) x sugar beet. This plant produced a few seed. Right, plant of second backcross generation. Seed parent shown on left.

A progeny of 26 seedlings was obtained from the seeds produced on the F_1 plant. Unfortunately, the seedlings arising from the backcross showed the same unhealthy condition as that observed in the F_1 and except for two plants the entire progeny was lost. The two survivors grew to sexual maturity. They were pollen sterile, as was true of their F_1 mother. One of these plants, shown in Figure 4, set a few seeds when pollinated with sugar beet pollen.

Only two seedlings, representing the second backcross generation, were obtained from the seeds produced on the plant shown in Figure 4 (left). One died in the seedling stage and the other one, though not a vigorous plant, produced a seed stalk about one foot in length. This plant, shown in Figure 4 (right), grew to the flowering stage but died without forming a seed, thereby bringing to a disappointing end the series of hybridizations.

Schneider³ has reported sugar beet x *B. procumbens* hybrids which behave quite differently from the ones described here. He stated that there

³ Schneider, F. Zuechtung der Betarueben in Roemer, T. Handbuch der Pflanzenzuechtung 4(4):1-92, 1939.

was an F_3 with certain segregations of which it is impossible to get a clear idea. All generations are completely fertile. Coons has questioned whether the material studied by Schneider was hybrid, since the criterion used in picking out the F_1 was a slight delay in germination of a portion of the seed¹. The cultures he saw were entirely like *Beta vulgaris* in growth habit.

Beta procumbens and its allies may contribute some important genetic characters. Two German investigators, according to Schneider, have reported that the species is either not attacked by the sugar beet nematode or that the larvae which penetrate the roots do not form cysts. The species shows immunity or near immunity to certain sugar beet diseases. Whereas a high degree of leaf-spot-resistance has been established by selection and breeding within the commercial varieties of sugar beet, actual immunity to the pathogen has been found only in *B. procumbens* and other species of the section *Procumbentes*. Similarly, there is evidence of high resistance if not immunity to the curly top virus. In addition to these characters, all three species of this section of the genus *Beta* have truly monogerm seed, a character much desired in the sugar beet as an aid in mechanizing the operations in growing the crop. It is recognized that these species are characterized by a fibrous root system, and a viny, indeterminate growth habit, clearly undesirable characters from the standpoint of sugar beet production.

The difficulties presented by lack of viability and fertility in the hybrids when these wild species are mated with sugar beet are not solved. The limited success obtained in the hybridization here reported is encouraging for additional and more extensive attempts.

¹ Verbal communication from G. H. Coons who saw Schneider's cultures in 1935.