Sulphuric Acid Scarification of Seedballs of Beta Trigyna and Other Beta Spp.

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Seeds of *Beta trigyna* Waldst. & Kit. and related species of the section *Corollinae,* as well as seeds of the three species in the section *Procumbentes* of the genus *Beta,* usually fail to germinate under conditions favorable for the germination of sugar beets. In greenhouse plantings of these hard-seeded species a few seedlings may emerge over a period of several weeks but the total germination of a seed lot is seldom as high as 20 percent. If the relatively thick, hard layer of tissue surrounding the seed is cut away, germination will occur immediately even in freshly harvested seed. It has been found that the hard tissue can be removed sufficiently to permit prompt germination by the corrosive action of sulphuric acid without serious injury to the embryos.

Figure 1. Seedballs of *Beta trigyna:* On left, untreated; Center, 3 hours in H_2S0_4; Right, from sample shown in Center given 2 additional hours in H_2S0_4, or a total of 5 hours.

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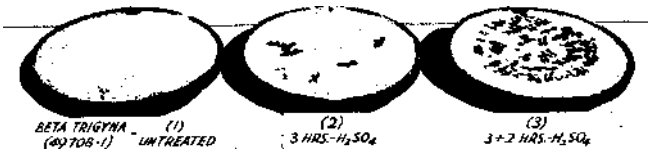

Figure 2. *Beta trigyna,* seed lot 49708-1. Left, untreated, germination zero; Center, 3 hours in H_2SO_4, germination 15 percent; Right, from same sample as shown in Center but given 2 additional hours in H_2SO_4, germination 92 percent. Fifty seedballs planted in each dish.

Methods

Concentrated sulphuric acid (sp. gr. 1.84) is added to the seeds slightly in excess of the amount they will take up with stirring. The length of time the hard seeds must be exposed to the action of the acid for effective scarification is not the same for all species and, furthermore, the small seeds of a sample require a shorter period than the larger ones. Seeds of the monogenn species *B. procumbens* Chr. Srn., *B. patellar is* Moq., *B. webbiana* Moq., and *B. lomatogona* Fisch. &: Mey., as well as the small seedballs of *B. trigyna,* show a marked increase in germination after a treatment of two hours. The larger seedballs of *B. trigyna* require an additional treatment of two or possibly three hours, making a total of 4 or 5 hours in the acid, as shown in Figure 1. Although the above schedule of treatments has been used, it must be recognized that a satisfactory scarification depends upon the extent to which the hard tissue has been decomposed by the acid and this can be determined only by examination. A treatment which produces the type of sculpturing shown in Figure 1, right, in 20-30 percent of the seedballs has given the highest germination with the least injury to the seedlings. Drastic treatments to expose all the seeds or to free them completely from the mother tissue will result in severe injury or possibly the decomposition of the seed itself. The development of temperatures above 60° C. in the seeds during treatment should be avoided and as an aid in this respect a container, relatively large in comparison to the quantity of seed being treated, has been used.

After the seeds have been scarified, they are transferred to a large volume of water, washed through a screen and finally rubbed in a fold of

cheesecloth to remove the charred material. It has been a practice to transfer the seeds to dilute lime water for a few minutes before drying.

Results

The hard-seeded species of *Beta* frequently produce seeds of poor quality. Often the seed coats are empty or contain a seed not fully formed and non-viable. A germination of 50 percent following scarification has been considered good since this is thought to approach the true viability percentage of the seeds. When one considers the fact that within a period of two weeks after planting the untreated seeds usually germinate less than 1 percent, the value given for scarified seeds represents a marked improvement. Occasionally plants have been found which produce seed of high quality as shown for a plant of *B. trigyna* in Figure 2. This seed lot, 49708-1, also gave a striking demonstration of the improvement in germination which may be obtained from sulphuric acid scarification. A planting of 100 seedballs, 50 per dish, did not give a single seedling during a period of three weeks, as shown for the dish on the left in Figure 2. Sulphuric acid treatment for 3 hours gave one or more seedlings from 15 percent of the seedballs planted; an additional treatment of 2 hours, making a total of 5, gave the remarkable germination of 92 percent.

Although ample plants have been obtained from plantings of the hard-seeds to maintain the species in culture, it can be said that the low germination of the seedballs of *B. trigyna* and *B. lomatogona* has discouraged or made impractical extensive tests to evaluate them under field conditions. Scarification has given seed lots satisfactory for this purpose.

Sulphuric acid scarification is a practice of long standing for hard seeds, especially species of legumes and grasses, but this is thought to be the first report of its application to obtain germination of hard-walled fruits of *Beta*. Seedballs of the sugar beet and those of its cultivated relatives germinate promptly when planted under favorable conditions, therefore sulphuric acid scarification has no place in the processing of commercial beet seed.