Growing *Salvia divinorum* From Seed

by Jon Hanna

When mature, *Salvia divinorum* seeds (technically mericarps or nutlets) are 1.8–2 mm long, 1(1.2) mm wide, somewhat pyriform, minutely tuberculate, and dark brown (Reisfield 1993).

At one time it was believed that *Salvia divinorum* did not produce viable seed, and the only manner in which it could be reproduced was by cuttings (Emboden 1972; Schultes 1972; Heffern 1974; Mayer 1977; Foster 1984). While this belief is now known to be in error, it is true that *S. divinorum* only rarely sets seed. Those wishing to grow *S. divinorum* from seed face three obstacles: a low seed set, a low germination rate, and a low survival rate.

The first inkling that *Salvia divinorum* did indeed produce viable seed came from the 1973 book *Growing the Hallucinogens*, wherein the author stated that, "This salvia is generally grown from cuttings, but I know of one instance in which it was grown from seed" (Grubber 1973).

Then in 1980 while working on his Ph.D. dissertation, Leander J. Valdés III performed breeding experiments in which he cross-pollinated 14 *Salvia divinorum* flowers (using the "Cerro Quemado" clone and a "Wasson/Hofmann" clone). 4 flowers were pollinated successfully, and 8 seeds were produced (not 4 as has mistakenly been stated; Ott 1996). A photo of these 8 seeds was published in 1987, the first time that *S. divinorum* seeds had appeared in print (Valdés *et al.* 1987). These 8 seeds represent a 14.3% seed set, since each flower has the potential to produce 4 seeds. Unfortunately, these seeds were killed by overheating in a growth chamber, and their viability couldn't be ascertained (Valdés 1983).

Aaron Reisfield was the next person reported to attempt pollination experiments. Self-pollinated plants with 108 flowers produced 11 seeds—a 2.5% seed set, and his cross-pollination of 190 flowers produced 24 seeds—a 3.2% seed set (Reisfield 1993). Clearly it is difficult to get *Salvia divinorum* to produce seed. It has been noted that since the anthers and the pistils of a single flower appear to mature at different times (a way for a flower to prevent self-pollination), that this must be accounted for when hand-pollinating flowers; both the anther and the pistil must be ripe (Valdés 1999). This may be partially responsible for the substantially lower

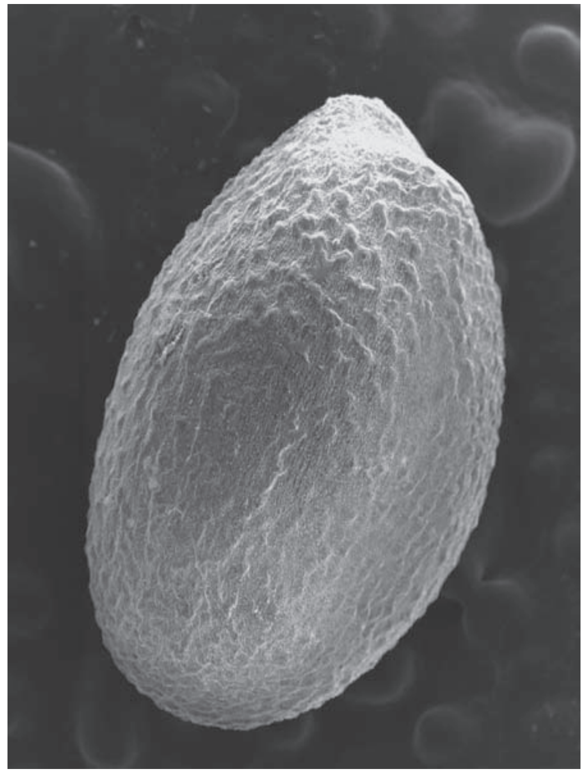

Figure 4: A 200 micrometer shot showing an entire *Salvia divinorum* seed.
Photo by Michael Dunlap, University of California Chemical Engineering and Material Science.

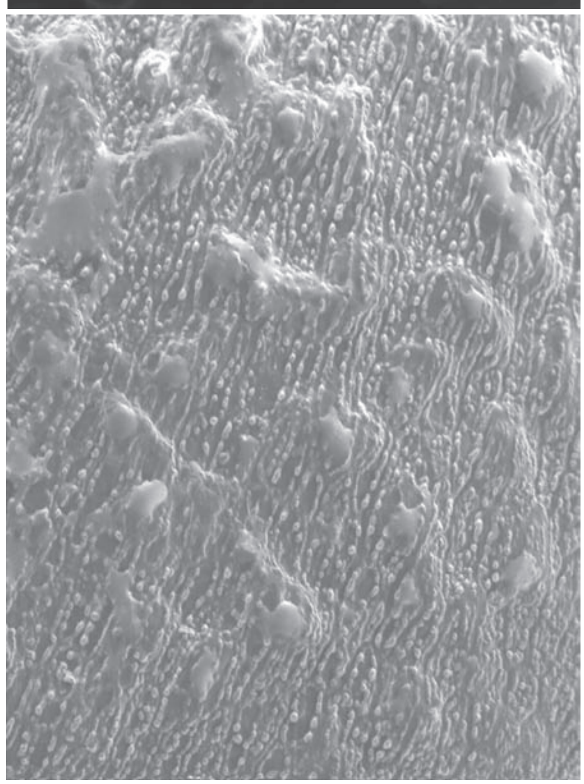

Figure 5: A 50 micrometer section of the surface of a *Salvia divinorum* seed.
Photo by Michael Dunlap, University of California Chemical Engineering and Material Science.

seed set that REISFIELD obtained when compared to VALDÉS (but it could also be argued that VALDÉS' sample was statistically small). REISFIELD was able to get a few of these seeds to germinate, and he described these seedlings growth as "vigorous" (REISFIELD 1993).

In January 1994 DANIEL SIEBERT collected 70 seeds from "WASSON/HOFMANN" clones residing at the BOTANICAL DIMENSIONS' garden in Hawaii. Hand-pollination had not been attempted on these plants, which means that the seeds were generated in conditions that might be considered as being similar to "the wild." Of 70 seeds, SIEBERT was able to get 12 or 13 to germinate (a 17.1% to 18.6% germination rate), and only 6 to survived to maturity. (Clones of these seed-grown plants are available for sale from SIEBERT's web-based *Salvia divinorum* business.) Unlike REISFIELD's seedlings growth, SIEBERT described his own seedlings as growing "very weakly," and he has commented that "[t]he seed raised clones seem a bit less vigorous than some of the Oaxacan material" (SIEBERT 1999A; Siebert 1999B).

More recently in 1999, BRENT LINDBERG—a commercial *Salvia divinorum* farmer in Hawaii (growing about 800 of the so-called "palatable" clone) collected 305 seeds from his plants. The plants that produced these seeds were growing in pots under 70% shade, with approximately 60 inches of rain per year. They first started to flower in November, and they were cut back at this time to promote better leaf growth, but by December there were so many in flower that LINDBERG decided to stop cutting them back. The seeds were first spotted in January, when LINDBERG was hand-pollinating flowers; LINDBERG does not think that his hand-pollination was responsible for any of these seeds (presumably since he saw them early-on in his attempts at hand-pollination). Nevertheless, he did not notice any insects near the flowers, other than a few ants. The seeds were collected over a 2 month period; by February 13 LINDBERG had 162 seeds, and he harvested the rest after this. Only about 80% of the seed had reached maturity. Germination of 100 of these seeds was attempted, with 31 germinating (a 31% germination rate), and 10 surviving to maturity. The seeds were germinated in potting soil mixed with peat moss, and LINDBERG believes that those seedlings that died (when they just had their first small leaves) did so due to overly moist conditions (they dissolved from being too wet). The first seed germinated after 10 days, and the last seed took over 30 days to germinate. The surviving seedlings are growing with equal vigor, comparable to that of a cutting of the same size. As of August, these seedlings were 1–2 feet tall. They are kept outdoors in pots under 70% shade cloth (BEIFUSS 1999).

Several others were also sent seeds from LINDBERG's harvest. In early April, SIEBERT attempted to germinate 20 of these seeds, of which 3 sprouted (a 15% germination rate), but only 2 survived. The first seed germinated at about 10 days, and the last at about 18 days. The 2 surviving seedlings are growing vigorously. The seeds were planted directly into commercial potting soil, about ⅛th inch deep. The 2 seedlings are kept in a semi-tropical greenhouse with moderate humidity and partial shade; by early August one plant was 12" tall and the other was 21" tall.

WILL BEIFUSS attempted to germinate 27 seeds, of which 9 sprouted (a 33.3% germination rate), and 3 survived. Germination was done between wet paper towels kept in a plastic tupperware-style container with the lid half off. Seeds took 6–10 days to germinate. At 3 months old, one of these seedlings was 9 inches tall and 13 inches wide at the base (leaf-tip to leaf-tip), and its growth has slowed considerably (see FIGURE 7). BEIFUSS believes that this is due to this seed-grown plant having a more limited root system than a cutting of similar size would have. The remaining two seedlings (germinated at a later date) are a sickly yellow-green and much less vigorous, having only grown to about 1 inch tall after one-and-a-half months (see FIGURE 6). BEIFUSS does not think that these will pull through.

After sacrificing one of the seeds sent to me to be photographed with a scanning electron microscope (see FIGURES 4 and 5), I was left with 6 seeds to attempt gemination on. I decide to see if gibberellic acid-3 (GA-3) would help my success rate with germination. (See *Seed Germination: Theory and Practice*, second edition by NORMAN C. DENO[1] for more on the use of GA-3; this is an excellent book that I recommend to anyone who is trying to germinate difficult seeds.) On

Figure 6: A *Salvia divinorum* seedling exhibiting stunted growth.

August 16, 1999 I attempted germination in paper towels using GA-3 and following the advice in the aforementioned book. In 8 days, 1 of these seeds germinated, and by 20 days a second seed germinated. The first germinated sprout seems to be growing well, albeit slowly; the second sprout hasn't yet pushed through the soil. Although additional seeds may still germinate, as it stands this is 33.3% germination rate. With such a small number of seeds, it is tough to say for certain whether or not the GA-3 treatment had any positive or negative effect on germination.

It has been proposed that the various collected plants brought into cultivation in the USA might all be genetically identical, and the similarly low seed set with self-pollinated plants and cross-pollinated plants might indicate that this is the case (Reisfield 1993). It is certainly a *possibility* that all of these plants are monoclonal, and this question could easily be put to rest by performing genetic testing on the various plants now available.

All of the seed-grown plants currently in cultivation look identical to their parent plants except for one grown by Siebert, "Paradox" (aka DS03), which has leaves that are "ever so slightly mottled" (Siebert 1999). It has been suggested that *Salvia divinorum* may be a hybrid (Reisfield 1993), but no reasonable candidates for parent plants have been proposed. Due to the consistent similarity of all known seed-grown plants (excepting the very minor difference in the "Paradox" clone), it seems unlikely that *S. divinorum* is a hybrid. If the plant were a hybrid, the seed would be expected to produce extremely variable plants (Valdés 1999).

There are also the questions of whether or not the plant is a cultigen, whether or not it has been found in the wild, and whether or not it has set seed in its native habitat in México. Cultigens, by definition, require the intervention of human beings to thrive and reproduce. (For example, corn—a true cultigen—cannot survive without human intervention.) In the Sierra Mazateca, *Salvia divinorum* can clearly do quite well by itself (Valdés 1999). The Mazatec curandero Don Alejandro Vicente has stated that the plant does indeed grow wild in the fairly inaccessible highlands of the Sierra Mazateca, and he has also stated that these plants produce seed that can be planted to grow *S. divinorum* (Valdés 1987; Valdés 1994; Valdés 1999).

It seems unlikely that Don Alejandro Vicente would lie about where *Salvia divinorum* grows wild, and whether-or-not it produces seed. Nevertheless, no definitively "wild" stands of *S. divinorum* have been found to date, and no Mexican-grown plants have been observed by ethnobotanists to produce seed.

Salvia divinorum depends on a shorter photoperiod to produce flowers. In warmer climates, where the plants can be left outside during the late fall and early winter, plants will go to flower naturally. My own plants, grown in California, have flowered every year. Those who live in colder climates that necessitate indoor growing will have to shorten the amount of daily light that the plants receive, in order to induce flowering, should they wish to attempt hand-pollination. ✧

NOTES

1. *Seed Germination: Theory and Practice*, second edition by Norman C. Deno is privately published and distributed by the author. It is available for $20.00 postpaid (to anywhere in the world) from: Norman C. Deno, 139 Lenor Drive, State College, PA 16801, USA.

Figure 7: A healthy *Salvia divinorum* seedling.

Received & Noted

The following texts were received by *The Entheogen Review*. A listing here does not preclude review in a future issue of *ER*. Publisher addresses are provided at the end of this listing; contact them for direct order procedures and shipping & handling costs.

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