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Germination and Growth of Sparkleberry Seedlings (*Vaccinium arboreum* Marsh)

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Abstract

The sparkleberry, a small, ornamental native tree which reaches the height of 10 m in the forests of the southeastern United States, is of interest as a rootstock onto which highbush blueberry cultivars could be grafted, as an ornamental landscaping plant, and as a source of upland-soil adaptation and drought tolerance in breeding cultivated highbush blueberries. The sparkleberry has proved difficult to propagate either by seeds or by cuttings. Experiments were conducted to find better methods of growing sparkleberry plants from seed. Cold stratification for 2 to 6 weeks in moist sand at 5-7 °C increased seed germination markedly in some experiments. A high percentage of the sparkleberry seeds that were stratified in the dark in moist sand at 7 °C for 156 days germinated during stratification and produced etiolated seedlings, most of which died after transplantation. Stratified sparkleberry seeds germinated better if planted in summer than if planted in winter in north Florida. Seeds not kept continuously moist during germination germinated poorly. However, after germination, excessive moisture resulted in high seedling mortality. Seedlings that were transplanted soon after germination to a freshly prepared peat-perlite mix and moved to a warm environment (daily maximums 28 °C; daily minimums 13 °C) survived well and grew rapidly if not overwatered. Sparkleberry seedlings can be grown in quantities sufficient for commercial utilization if large numbers of seeds are planted and if germination and early growth conditions are carefully managed. However, consistent, high percentage (above 50%) germination of sparkleberry seeds remains an elusive goal.

Introduction

The sparkleberry, a small tree native in the southeastern United States, has considerable potential as a landscape plant due to its long life, wide adaptability to soil types, graceful form, and attractive leaves, bark, flowers, and fruit (4). Sparkleberry is also a compatible rootstock onto which highbush (*Vaccinium corymbosum* L) and rabbiteye (*V. ashei* Reade) blueberry cultivars can be grafted (1, 2). Sparkleberry can grow well on mineral soils with less than 2% organic matter, on which highbush blueberry grows poorly. It tolerates higher soil pH than either highbush or rabbiteye blueberry and is more drought tolerant than either (4). Thus, grafting on sparkleberry rootstock could allow highbush blueberries to be grown over a wider range of soils, particularly as a backyard fruit plant. Because sparkleberry is upright in growth habit and has less basal sprouting than highbush and rabbiteye blueberry plants, sparkleberry rootstock could be used to produce plants that would yield highbush or rabbiteye fruit on a bush that was monopodial to a height of 45 cm, an architecture well suited to mechanical harvesting (1).

Propagation difficulties have limited the use of sparkleberry, both as a landscape plant and as a rootstock for cultivated blueberry. Cuttings from mature plants root slowly and at low percentages. Reese (3) tested various methods of wounding and auxin application to promote rooting of sparkleberry softwood cuttings, but none gave survival rates high enough to be commercially feasible. Stockton (4) found softwood cuttings of sparkleberry very difficult to root, and noted that certain manipulations that promoted adventitious root formation on *V. ashei* softwood cuttings had no effect on cuttings of *V. arboreum*. Ballington et al. (1) showed that *V. arboreum* can be propagated from root cuttings taken from old trees, but they indicated that this was not a convenient way of obtaining large numbers of plants for commercial use.

In the experiments that have been reported, sparkleberry seeds have germinated poorly and erratically. Stockton (4) got

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the best results by planting seeds under white light at the lowest of several temperature treatments tested (7 °C night, 21 °C day). The highest germination achieved over a 7-week period was 20%. This was obtained with only one of three seed lots tested, the other two giving lower germination. At higher temperatures (21 °C night, 32 °C day), almost no seeds germinated.

Over the past decade, we have attempted to germinate sparkleberry seeds on many occasions, with results that varied from almost complete failure to modest success. This paper describes experiments designed to improve sparkleberry seed germination and seedling growth.

Materials and Methods

Except as noted for Experiment 2, the seeds used in these experiments were gathered from large populations of native sparkleberries growing within 100 km of Gainesville, FL, in the north-central Florida peninsula, an area where the mean temperature of the coldest month is about 13 °C. Most of the seeds used in these experiments were composite collections from 20 to 50 plants. The composites were used to provide large amounts of seed and to test populations that were not heavily biased by the performance of particular trees. Fruit were gathered during or after the ripening season, which extends from late September through late November in north Florida. Seeds were removed from the fruit using a food blender, and the skins and pulp were washed away with water (2). The seeds were dried on a desk top at 22 °C and stored at 5 °C until needed. The seeds for various experiments ranged from freshly harvested to seeds that had been stored up to 3 years.

Experiment 1. Berry and seed characteristics. On 5 Jan. 1997, 1636 g of sparkleberry fruit were gathered from 50 sparkleberry plants growing near Oleno, Fla., 35 km northwest of Gainesville, Fla. The berries were composited and divided into 4 equal lots, 409 g per lot. The seeds were then extracted separately for each lot using a food blender and water. The blended fruit were poured into a gallon bucket, and water was used to separate the seeds from other fruit residues. Skins, pulp, and other nonseed material were decanted, and the seeds that remained in the bottom of the bucket were dried on a desk top. The decanted material was saved and rewashed with water to salvage seeds that separated with the pulp on the first washing. More seeds were rescued by two further repetitions of this process. This gave four chances for a seed to be rescued, and fewer than 20% of the viable seeds were lost during extraction. Much of the weight of the cleaned, dried "seed material" consisted of sclereids, rather than seeds. It was not possible to separate these from the seeds using water. Sieves were used to remove sclereids that were substantially larger than or smaller than the seeds. The remaining "seed material" consisted of seeds plus sclereids that were the same size as seeds. The "seed material" was weighed for each of the 4 samples. A random 1-gram sample was taken from each seed lot, and the well-developed, apparently germinable seeds were separated by hand, counted, and weighed. These data made it possible to estimate the number of potentially-viable seeds present in weighed samples of "seed material."

Experiment 2. Cold stratification. Berries were gathered from Keystone Heights, Fla., 35 km northeast of Gainesville, and from Chattahoochee, Fla., 275 km northwest of Gainesville, in November 1993. The seeds were extracted, dried on a desktop, and stored at 5 °C. Two seed lots (120 seeds per lot) from Keystone Heights and two (100 seeds per lot) from Chattahoochee were used. On 1 July 1994, one seed lot from each location was soaked for 16 hr in 2000 ppm GA_3 (Sigma Chemical Company) dissolved in 20% ethanol. After the GA treatment, the seeds were planted on the surface of peat in pots placed in an air-conditioned laboratory near a south-facing window. The temperature was maintained near 22 °C, and the maximum light intensity during the day was 50 micromoles/m^2/sec. The seeds were sprinkled daily with water to keep

the surface of the peat moist. On 1 July 1994, the second seed lot from each location was treated with GA as described above and then placed in stratification in moist sand at 7 °C for 35 days. On 4 Aug., the stratified seeds were planted in the same location as the unstratified seeds. The seedlings that appeared were counted through 1 Sept.

Experiment 3. Cold stratification. Seeds were composites collected Sept. 1994 from two locations: Oleno and Gainesville. Eight seed lots, 100 seeds each, were counted from each location. Four lots from each location were soaked in water for 16 h and then stratified in moist sand at 7 °C for 33 days. The other 4 lots from each location were not stratified. On 26 Oct. 1994, the 16 seed lots were planted on the surface of a sand-peat mix and placed near a large north window in a laboratory in Chillán, Chile, where they received bright, indirect light during the day. Within the laboratory, night minimum temperatures averaged about 16 °C and daily maximums averaged about 24 °C. The pots were watered daily to keep the surface moist, and the number of seedlings that appeared were counted weekly through 19 Dec.

Experiment 4. Cold stratification. Fruit were harvested from 50 sparkleberry trees at Keystone Heights, Fla. in Nov. 1996. The berries were randomly assigned to 10 lots. Four lots contained 80 g of berries per lot and the other six, 160 g of berries per lot. The seeds were separately extracted from each lot. The four 80-g lots were planted on the surface of peat in an unheated greenhouse in Gainesville, Fla. on 20 Nov. 1996, one day after extraction. Seeds from the 6 other lots were soaked in water for 24 hours outside in full sun, and then stratified in the dark in moist sand at 7 °C for 14 days (3 lots) or 28 days (3 lots). Immediately after stratification, seeds of the stratified lots were planted in the same greenhouse as the unstratified seeds. Planting dates were 2 Dec. for the 14-day stratification and 16 Dec. for the 28-day stratification. The number of seeds that germinated per pot was recorded through 29 Jan. Mean daily maximum and minimum temperatures in the greenhouse during this period were about 23 °C and 9 °C. The maximum light intensity during the day in the greenhouse was about 400 micromoles/m^2/sec. Although the seeds planted in each treatment were not counted, the approximate number planted was calculated using the data in Table 1 to give an indication of the percentage germination in this experiment for each treatment.

Experiment 5. Effect of germination environment. Berries were gathered 1 Sept. 1994 from 20 plants growing in the forest near Oleno, Fla. Seeds were extracted, dried, and stored at 5 °C until 28 June, 1995. Sixteen seed lots, 60 large seeds per lot, were counted and soaked for 1 h in water, after which they were stratified in moist sand at 5 °C for 40 days. On 7 Aug. 1995 the seeds were planted in pots on the surface of a mix of peat, sand, and pine bark. Six pots were placed outside, where mean daily maximum and minimum temperatures were 32 °C and 23 °C, respectively, during the germination period. Five pots were placed near a south window of an air-conditioned laboratory, where the temperature was maintained near 22 °C. Five pots were placed in a closed greenhouse cooled by an evaporative cooler, where daily maximum and minimum temperatures during the germination period were 29 °C and 23 °C. The pots were watered to keep the surface of the germination medium moist. Seedlings were counted 16 days after sowing (23 Aug.). Thereafter, the number of seedlings per pot declined due to seedling mortality.

Experiment 6. Germination without light. A large composite of seeds was harvested from the forest at Oleno in Nov. 1995. After extraction, the seeds were dried on a desktop at 22 °C for 48 h and then stored at 7 °C. On 11 July 1996, eight seed lots, 1.00 g of seed material per lot (approximately 300 seeds), were weighed and soaked for 48 h in water, after which they were placed in moist sand at 7 °C in packages that excluded light. On 14 Dec., after 156 days, the packets were opened and the seedlings were counted.

Experiment 7. Effect of covering seed. Twelve lots of seed material, 2.5 g per lot, estimated seed number 750 per lot, were obtained from a composite of trees at Oleno, Fla. on 5 Jan. 1997. Starting 10 Jan. 1997, shortly after extraction and drying, the seeds were soaked in water for 44 h outdoors in a sunny location. They were then stratified in moist sand at 7 °C for 19 days. On 1 Feb. the seeds were planted in a mix of 90% by volume coarse river sand plus 10% Canadian peat. Half the pots were placed in an unheated greenhouse with an evaporative cooler (average daily maximum 24 °C, average daily minimum 10 °C), where they received intermittent mist for 3 h per day. The other half were placed under an open veranda where õthey were protected from rain, received bright but indirect sunlight, were exposed to outside air temperatures (ave. daily maximum 22 °C, minimum 10 °C) and were watered every 5 days to keep the surface of the sand moist. At each location the seeds in half of the pots were covered with 5 mm of coarse sand after they were planted and in the other half, the seeds were left uncovered. The seedlings were counted weekly until 13 March (41 days after planting), after which seedling mortality reduced the number of seedlings present.

Survival and growth of transplanted seedlings. On 14 Jan. 1997 sparkleberry seedlings about 1.5 cm tall were transplanted to 3-liter pots, 20 seedlings per pot. Half the pots were filled with a 1:1 mix (by volume) of Canadian peat and perlite. The other half were filled with 33% peat-67% perlite. The pots were then distributed to 3 environments: a warm greenhouse (mean daily maximum 28 °C, minimum, 13 °C; maximum daily light intensity 620 micromoles/m^2/sec.), a cooler greenhouse (means 24 °C, 10 °C, maximum light 500 micromoles/m^2/sec.) and by a south window in an air-conditioned laboratory, with constant temperature about 22 °C and maximum light about 50 micromoles/m^2/sec. The plants were watered when the surface of the medium became dry and were fertilized every 10 days with water-soluble 20-20-20 plus minor elements.. Survival and growth of the seedlings in the various environments were recorded.

On 1 Feb. 1997, 21 trays of sparkleberry seedlings, about 2 cm tall, were transplanted from the germination pots. Twelve trays contained a 1:1 mix of Canadian peat and perlite. Nine trays were filled with Metromix 200. Either 40 or 96 seedlings were transplanted to each tray, depending on tray size. After they were transplanted, the seedlings were kept in the cooler greenhouse described in the previous paragraph. On 13 March, survival and growth of the seedlings were observed.

In several experiments, the Chi Square test of independence was used to compare germination percentages for two or more treatments. The null hypothesis in this test is that the ratio formed by the number of seeds that germinated and the number that did not germinate is independent of the treatment, that is, the ratios did not differ significantly among the treatments.

Results

The average weight of well-developed seeds collected from Oleno on 5 Jan. 1997 was 1.02 mg per seed (Table 1). There were an estimated 18.4 well-developed seeds per g of fresh berry weight, or an average of 5.1 well-developed seeds per berry.

In Experiment 2, stratification at 7 °C in moist sand for 35 days greatly increased germination of GA_3-treated seed planted near a laboratory window and maintained at 22 °C (Table 2). Germination rates of 20 to 50% were obtained for the stratified seeds compared to 4 to 5% for unstratified seeds.

Stratification in moist sand at 7 °C for 33 days greatly hastened the germination of seeds that had not been treated with GA when they were planted near a laboratory window in Chillán, Chile (Experiment 3, Table 3). However, unstratified seeds from the Gainesville source had equaled the germination percentage of stratified seeds by 54 days after sowing. Some of the stratified seeds in this experiment ger-

Table 1. Sparkleberry seed parameters based on a large berry composite collected 5 Jan. 1997, 30 km northwest of Gainesville, Fla.

Characteristic	Mean	Standard deviation
1. Weight of dried "seed material" per g berry fresh weight (g)	0.0616	.0018
2. Weight of clean seed per g berry fresh weight (g)	0.0188	.0019
3. Number of well-developed seeds per g berry fresh weight	18.4	2.45
4. Number of well-developed seeds per g "seed material"	298.7	40.6
5. Average weight per seed (mg)	1.02	0.035

minated fewer than 5 days after being planted, indicating that germination may have already started in the stratification environment. This experiment gave the best germination percentage of all the experiments conducted. Of the four treatments (2 seed sources, stratified and not stratified), the best three together yielded 759 seedlings from 1200 seeds (63% germination) and the fourth gave 87 seedlings from 400 seeds.

Stratification also improved the germination of seeds planted in an unheated greenhouse in Gainesville, Fla. between 20 Nov. and 16 Dec. 1996 (Experiment 4, Table 4). However, even the best treatment (2-weeks stratification) gave only an estimated 5.9% germination. In this experiment, 4 weeks of stratification was not better than 2 weeks.

Germination of seeds stratified 40 days and planted 7 Aug. 1995 was about the same in each of the three environments tested in Experiment 5 (Table 5). The time between the planting of the seeds and the counting of the seedlings (7 Aug. and 23 Aug.) was warm, with daily outdoor maximums around 32 °C and daily minimums around 23 °C. Despite these high temperatures, germination ranged from 23% to 29%. The cooler laboratory environment (temperature about 22 °C) did not give better germination than the warmer environments. The results in the laboratory environment were similar to those obtained for stratified seed planted in the same location in August a year earlier (Table 2).

Many of the seeds stratified at 7 °C in sand for 156 days without light germinated during stratification. In the 8 packets stratified, each containing about 300 seeds, the number of seedlings present at the end of the stratification period ranged from 6 to 158. Overall, the mean number of seedlings per packet was 90 with a standard deviation of 59. The 4 packets that had over 100 seedlings per packet were the ones in which the sand was driest. In the two packets that had only 6 and 25 seedlings per packet, the sand was excessively wet. The germination in the drier packets was among the highest achieved in any of the experi-

Table 2. Germination of stratified[z] and unstratified sparkleberry seeds from two sources planted in 1994 near the window of an air-conditioned laboratory (Experiment 2).

Source	Stratification treatment	Number of seeds planted	Germination[w] (%)
Keystone Hts.	No[y]	120	4.9*
Keystone Hts.	Yes[x]	120	20.0*
Chattahoochee	No[y]	100	4.0**
Chattahoochee	Yes[x]	100	50.0**

*These two means differ from each other at P = 0.05 by Chi Square test.
**These two means differ from each other at P = 0.01 by Chi Square test.
[z]35 days at 7 °C in moist sand. The unstratified seeds were soaked in 2000 ppm gibbrellic acid solution for 16 h before planting and the stratified seeds received the same treatment before stratification.
[y]Planted 1 July.
[x]Planted 4 Aug.
[w]Counted 1 Sept. No more seedlings appeared after that date.

Table 3. Germination after 19 and 54 days for stratified and unstratified sparkleberry seeds receiving indirect sunlight from a large window in a laboratory in Chillán, Chile[z] (Experiment 3).

		Seeds germinated			
		(Nov. 14) 19 days[y]		(Dec. 19) 54 days[y]	
Source	Stratified	number	%	number	%
Oleno	No	33	8.3	87	21.8
Oleno	Yes	212	53.0	271	67.8
Difference[y]		**		**	
Gainesville	No	4	1.0	245	61.3
Gainesville	Yes	199	49.8	243	60.8
Difference		**		ns	

[z]400 seeds were planted for each treatment. Stratification was at 5 °C in moist sand for 33 days.
[y]Days after planting.
**, ns: Totals for stratified vs nonstratified differed at the 1% level (**) or did not differ at the 5% level (ns) according to the Chi Square test.

ments. Previous experience has indicated that unstratified seeds of cultivated blueberries (*Vaccinium* section Cyanococcus) require light for high germination. Whether sparkleberries differ in this respect or whether stratification can overcome the light requirement is unknown. Before the seeds were placed in the stratification environment, they had been soaked for 48 hours in water. During this period, they were exposed to light during the day, and this light received before stratification could have been a factor in their germination. Most of the seedlings that germinated during stratification were 4 to 6 mm long when the packets were examined, indicating that they had germinated considerably earlier. The seedlings were completely etiolated, and efforts to rescue them by transplantation were largely unsuccessful. The rapid germination of some seeds after removal from stratification in other experiments (for example, after only 5 days in Experiment 3), indicates that germination may have already begun during dark stratification.

Because it appeared that light was not necessary to germinate stratified sparkleberry seeds, Experiment 7 was done to compare the effects of not covering or covering with 5 mm of coarse sand seeds that had been stratified for 19 days. The seeds were planted on 1 Feb. 1997. No advantage or disadvantage to covering was found (Table 6). In this experiment, the seeds germinated better on the veranda than in the greenhouse. It was not clear what environmental factors caused the difference, although moisture may have been excessive in the greenhouse. Even the best treatment in this experiment gave less than 6% germination.

Table 4. Germination of sparkleberry seeds from Keystone Hts., Fla. after 0, 14, and 28-day stratification at 7 °C[z] (Experiment 4).

Number of days stratified	Planting date	Amount of seed planted: Weight of source berries[y]	Amount of seed planted: Estimated seed number[x]	Date of maximum seedling number	Total number of seedlings	Mean number of seedlings per g of fruit*	Approximate germination (%)[x]
0	20 Nov.	320 g	5900	11 Jan.	146	0.45	2
14	2 Dec.	480 g	8800	11 Jan.	521	1.08	6
28	16 Dec.	480 g	8800	29 Jan.	445	0.93	5

*1.08 and 0.93 do not differ at P = 0.05 by t-test. 0.93 and 0.45 differ at P = 0.01.
[z]Seeds were planted in a greenhouse in Gainesville under mist 20 Nov. to 16 Dec. 1996.
[y]The 320 g consisted of 4 replications, 80 g per replication. The 480 g consisted of 3 replications, 160 g per replication.
[x]Based on the estimate of 18.4 well-developed seeds per g berry fresh weight.

Table 5. Number of seeds planted and percent germination for sparkleberry seeds stratified for 40 days at 5 °C and planted 7 Aug. 1995 in three environments (Experiment 5).

Environment	Number planted	Percent germination[z]
Greenhouse	360	28.6
Laboratory[y]	300	23.0
Outside	300	23.3

[z]Percentages did not differ at P = .05 according to adjusted Chi Square.
[y]Received indirect sunlight, 20 to 50 micromoles per m^2 per sec.

Survival and growth of transplanted seedlings. The seedlings transplanted to 3-liter pots 14 Jan. 1997 and placed in three different environments survived and grew well. There was no difference in survival and growth between the 1:1 mix (peat to perlite) vs the 33% peat-67% perlite mix. Survival was essentially 100% through the time of evaluation on 12 March 1997. The seedlings grew somewhat faster in the warmer greenhouse than in either the cooler greenhouse or in the laboratory by the window. The mean heights and standard deviations (in parenthesis) of 30 random plants measured in each environment on 12 March were 4.0 cm (0.8) in the cool greenhouse, 4.5 cm (1.3) in the laboratory, and 6.1 cm (1.6) in the warmer greenhouse. The mean height for the plants in the warmer greenhouse was significantly higher than the other two means at P = 0.01 according to Student's t test.

The sparkleberry plants transplanted to trays of peat-perlite mix in the greenhouse on 1 Feb. 1997 grew rapidly, had a healthy green leaf color, and survived well, with fewer than 5% of the plants dying by the evaluation date of 13 March. The plants transplanted to Metromix 200 averaged 20% mortality, grew very slowly, and had poor leaf color (red, yellow, white, pale green) by 12 March. Many plants on this medium were barely alive on 12 March.

Over the past 10 years, we have transplanted many sparkleberry seedlings from seedling flats in the greenhouse to high-density field plantings with overhead irrigation on sandy soil, with less than 5% organic matter, fumigated with methyl bromide. Seedlings have survived well and grown rapidly. If transplanted in early June, they typically are 30 to 60 cm tall by December.

Discussion

Sparkleberry seed germination in these experiments ranged from 68% to almost nothing. The results of various experiments were consistent enough to provide useful information but not consistent enough to guarantee high percentage germination in commercial practice. The following observations and conclusions are based on all the experiments described here, as well as on others not described, although not every experiment supported every conclusion. (a). Sparkleberry seeds store well at 5 °C for at least 3 years if extracted and dried on a desktop. (b). If soaked for 48 h in water, sparkleberry seeds will germinate in total darkness at high percentage within 6 months during stratification in moist sand at 7 °C. It is not known whether expose to light is necessary during the 48 hours in water. If

Table 6. Germination of covered and uncovered seeds planted in two environments on 1 Feb. 1997 after 19 days of stratification at 7 °C.

Environment[z]	Covered vs. No[y]	Mean number of seedlings per 2.5 g of seed material[x]	Approximate germination (%)
Greenhouse	No	12.3 a	2
Greenhouse	Yes	11.3 a	2
Veranda	No	42.0 b	6
Veranda	Yes	36.3 b	5

[z]Unheated greenhouse under mist or covered veranda shaded from direct sunlight and rain and exposed to ambient outdoor temperatures.
[y]Covered with 5 mm coarse sand.
[x]Approximately 750 seeds pr 2.5 g seed material. Each mean based on 3 replications. Mean followed by a different letter differ at P = 0.01 according to the t-test.

kept too long in stratification, the seedlings that germinated will be etiolated and will be hard to keep alive when transplanted. (c). Most experiments suggested that stratification at 5 to 7 °C for 2 to 6 weeks is highly beneficial to germination. Stratification is especially important if the subsequent germination environment is warm, with daily minimum temperatures above 20 °C. (d). Stratified sparkleberry seeds germinated better if planted in summer than if planted in winter in north Florida. This may have been due to the fact that the warmer temperature and higher light intensity and duration in summer reduced problems with fungal pathogens. (e). Seeds that were allowed to dry during the germination period germinated poorly. For seeds planted on the surface, daily watering is necessary during sunny weather in Florida. (f). Once germinated, the seedlings grow poorly, and many will die, if the medium is excessively wet and packed. Thus, a well-drained germination medium should be used, and the seedlings should be transplanted soon after germination to fresh medium where watering can be minimized. Because the seeds need constant moisture to germinate, whereas the seedlings are very susceptible to excess moisture, careful management is required to obtain good results in growing sparkleberry from seed. Why the seedlings died when they were kept too wet was not determined, but the initial problem was with the roots. (g.) Two other problems that must be controlled to obtain good results with sparkleberry seeds are mice, which eat the seeds lying on the surface, and the larvae of an unidentified fly, which frequently become abundant in unfumigated Canadian peat 4 to 6 weeks after it is watered. These larvae eat both the roots and the tops of the seedlings. (h). After they are 5 mm tall, sparkleberry seedlings survive and grow well if transplanted to a 50-50 mix of Canadian peat and perlite. The seedlings should be given plenty of light and watered only when the medium becomes dry. Germinating the seeds and growing the young seedlings outside in Florida gives poor results because rainfall keeps the medium too wet. After the seedlings are transplanted, they should be placed in a warm environment (daily maximum temperatures averaging above 25 °C and daily minimums averaging above 15 °C). (i). Once they are 10 cm tall, sparkleberry seedlings survive and grow well in sandy, well-drained soil in the field in Florida if provided with overhead irrigation. They can also be grown to a large size in large pots of peat-perlite mix. (j). Sparkleberry seedlings are nearly as precocious as seedlings of cultivated blueberry species (e.g., *V. corymbosum*). Some sparkleberry seedlings will flower 1 year after germination if grown in pots of peat-perlite mix in Florida.

Using best practices, sparkleberry seedlings can be grown from seed in quantities large enough to permit commercial exploitation of the species in landscaping or as a blueberry rootstock. Although consistent germination of 30 to 50% remains an elusive goal, large numbers of sparkleberry seeds can be obtained at relatively low cost, and even the production of one surviving seedling per 10 viable seeds is enough to make sparkleberry production from seed commercially interesting.

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