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# Comparison of Seed Number and Mass of Southern Highbush Blueberries vs. Those of Their $F_1$ Hybrids with *V. simulatum* after Open Pollination

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***Abstract.*** **Open-pollinated southern highbush (*V. corymbosum* L. hybrids) and $F_1$ (southern highbush x *V. simulatum* Small) hybrid blueberry seedlings were compared for fertility in a high-density nursery in Gainesville, Fla. Most of the pollen sources in the field were tetraploid southern highbush seedlings. Berries were collected from 100 southern highbush seedlings and from 100 seedlings from southern highbush x *V. simulatum* crosses. The seeds were extracted and dried on a laboratory bench for several days before weighing. No significant differences were found in seed mass/berry between the two types of seedlings. Although the $F_1$ interspecific hybrids averaged slightly lower in seed mass per berry, this was due to the smaller size of their well-developed seeds, not to poor seed development. The estimated number of well-developed seeds per berry was 35.4 and 39.1 for southern highbush blueberries and their $F_1$ hybrids with *V. simulatum*, respectively. These results indicate that reduced fertility should not be a problem in using *V. simulatum* to breed southern highbush blueberries.**

Camp (1945) described *V. simulatum* as a crown-forming species native to open mountain slopes and meadows from northern Alabama northward to Virginia. He described the plants as being 1.5 to 3.0 m tall, with occasional plants reaching 4 m. Camp postulated that *V. simulatum* was an autotetraploid derivative of *V. pallidum* Ait., a diploid species of shorter stature that occurs in the same area.

Camp (1945) found tetraploid *V. simulatum* and a hexaploid species, which he called *V. constablaei* Gray, growing together on open areas of the high mountain peaks of the southern Appalachian mountains. His studies were not extensive enough to define morphological characters that reliably separated the tetraploid from the hexaploid plants. Thus, his description of *V. constablaei* included plants that were crown-forming and 5.0 to 8.0 m tall, as well as lower-growing plants that produced colonies suckering over an area several meters in diameter while attaining a height of only 0.5 to 2.0 m. More recent surveys (P. Lyrene, unpublished) have indicated that only the lower-growing, highly rhizomatous clones are likely to be hexaploid, at least on Roan Mountain, Tenn., Grandfather Mountain, N.C., and in the Shining Rock Wilderness Area southwest of Asheville, N.C. The taller, crown-forming plants we have studied from the high mountains are tetraploid and should be included in *V. simulatum*. Luby et al. (1991) and Galletta and Ballington (1996) discuss the taxonomy of *V. simulatum*.

Because of its ability to fruit reliably at elevations of nearly 2000 m on exposed mountain slopes, *V. simulatum* could be useful in breeding cold-tolerant southern highbush blueberry cultivars. Because it grows at such high altitudes, *V. simulatum* apparently ripens its fruit with relatively few heat units and might therefore be useful in breeding early-ripening tetraploid cultivars.

Little published information is available on the ease with which *V. simulatum* can be crossed with cultivated forms of the highbush blueberry or on the fertility of the $F_1$ hybrids. Ballington (cited by Luby et al., 1991) noted that preliminary information on crossability supported the maintenance of *V. simulatum* and *V. corymbosum* as separate species. Vander Kloet (1988) had earlier treated *V. simulatum* as a race of *V. corymbosum*. In this report, we compare $F_1$ hybrid seedlings from five crosses of each of two types: cultivated southern highbush x *V. simulatum* and cultivated southern highbush x cultivated southern highbush. The goal was to see whether reduced fertility would cause problems in breeding with *V. simulatum*.

## Materials and Methods

Seed number and mass were compared following open-pollination of 1.5-year-old seedlings from five *V. corymbosum* x *V. corymbosum* and five *V. corymbosum* x *V. simulatum* crosses (Table 1) in a high-density field nursery at the Horticultural Unit of the Univ. of Florida, Gainesville, in 1994. Most of the other seedlings in the nursery, and the most abundant source of pollen, were hybrids between advanced selections of southern highbush (tetraploid, largely *V. corymbosum* but with introgression from *V. darrowi* Camp five to six generations back). Twenty $F_1$ seedlings per cross were randomly selected at ripening time from the seedlings that fruited, and four berries were randomly picked per plant to produce one 80-berry sample per cross. The seeds were extracted separately from the berries of each cross using a food blender (Galleta, 1975), and were separated from non-seed debris by washing in water. The seeds were then dried for several days at room temperature (≈22 °C) on a benchtop in an air-conditioned laboratory. After they were dried, the seeds obtained from each 80-berry sample

Table 1. Comparison of masses of air-dried seeds from five *V. corymbosum* x *V. corymbosum* and five *V. corymbosum* x *V. simulatum* $F_1$ populations after open-pollination in the field.

| Cross | | | Mean seed mass/berry (mg)[z] | | Mean mass/seed (mg)[y] |
|---|---|---|---|---|---|
| | | | (*V. corymbosum*)[x] | x | (*V. corymbosum*)[x] |
| 91-16 | x | 87-217 | 17.3 | | 0.58 |
| 82-217 | x | 81-83 | 17.5 | | 0.50 |
| 92-79 | x | 91-156 | 27.0 | | 0.56 |
| 92-97 | x | 6-19 | 16.8 | | 0.52 |
| 92-81 | x | 90-171 | 18.0 | | 0.55 |
| Mean | | | 19.3 | | 0.54 |
| | | | (*V. corymbosum*)[x] | x | (*V. simulatum*)[w] |
| HB cvs[v] | x | 92-286 | 14.5 | | 0.45 |
| Marimba | x | (92-156 + 92-152B)[u] | 12.8 | | 0.47 |
| 90-174 | x | 92-152C | 19.5 | | 0.41 |
| 90-173 | x | 92-156 | 21.8 | | 0.46 |
| 90-150 | x | 92-157 | 19.3 | | 0.45 |
| Mean | | | 17.5 | | 0.45 |
| Significance | | | NS | | * |

[z]Based on 80 berries (four berries from each of 20 seedlings) per cross.
[y]Based on 200 seeds (randomly selected from total seeds from 80 berries) per cross.
[x]Southern highbush cultivars and advanced selections from the Florida blueberry breeding program.
[w]All originated from Grandfather Mt., N.C.
[v]Bulk of seed from six crosses.
[u]Bulk of pollen from two clones.
[NS, *]Overall means for the two types of populations differ at $P \leq 0.05$ (*) or do not differ (NS) by analysis of variance.

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were weighed. Two-hundred well-developed seeds were then selected randomly from each sample and weighed to estimate mean seed mass for the well-developed seeds of each cross.

Mean seed mass per berry and mean mass per well-developed seed were calculated for each cross. The means for the two types of crosses (*V. corymbosum* x *V. corymbosum* and *V. corymbosum* x *V. simulatum*) were compared by analysis of variance, using a completely random design in which the five *V. corymbosum* x *V. corymbosum* crosses were considered a random sample representing all crosses of this type that could have been made and the five *V. corymbosum* x *V. simulatum* crosses were considered a random sample from possible crosses of that type. Variation among crosses within type of cross was used as the error variance in the F-tests.

## Results and Discussion

Each blueberry ovary normally contains 100 or more ovules, each of which can become a seed (Darnell et al., 1992; Vorsa and Ballington, 1991). If bees and compatible pollen are abundant, seed number per berry can be a good measure of female fertility. Highly fertile plants of *V. ashei* Reade (rabbiteye) and *V. corymbosum* (highbush) clones usually produce 15 to 30 well-developed seeds per berry when open-pollinated in mixed-cultivar field plantings (Kushima and Austin, 1979; Moore et al., 1972), although they can produce more seed when cross-pollinated by hand with pollen from compatible cultivars. On the other hand, plants of low fertility, such as *V. darrowi* x *V. arboreum* Marsh $F_1$ hybrids (Lyrene, 1991), triploids (Dweikat and Lyrene, 1988), and pentaploids (Meader and Darrow, 1944; Vorsa et al., 1987), produce fewer seeds. The number of well-developed seeds in the triploid and intersectional hybrid plants mentioned above ranges from zero to two seeds per berry following hand pollination with their most compatible pollinizers.

$F_1$ hybrids between *V. corymbosum* x *V. corymbosum* and *V. corymbosum* x *V. simulatum* appeared to have high fertility after open-pollination in the field in Gainesville, Fla. (Table 1). The high seed mass/berry and the lack of significant differences between the two types of hybrids indicate that *V. corymbosum* x *V. simulatum* $F_1$ clones are fully female-fertile. Well-developed seeds from the *V. corymbosum* x *V. simulatum* hybrids were significantly lighter than *V. corymbosum* x *V. corymbosum* seeds (Table 1). The average number of well-developed seeds per berry for each type of cross, estimated from the data in Table 1, was 35.4 and 39.1 for *V. corymbosum* x *V. corymbosum* and *V. corymbosum* x *V. simulatum* $F_1$ hybrids, respectively. These values are quite high, demonstrating that both types of hybrids have high fertility. The high fertility of the *V. corymbosum* x *V. simulatum* $F_1$ hybrid seedlings is an indication that the *V. simulatum* clones from Grandfather Mountain are probably tetraploid.

The seed content of the fruit indicated that *V. corymbosum* x *V. simulatum* $F_1$ hybrids were as fertile as *V. corymbosum* x *V. corymbosum* $F_1$ hybrids when open-pollinated. The high fertility of the interspecific hybrids suggests that *V. simulatum* could be used to breed *V. corymbosum* cultivars, since fertility of the hybrids would not be a limitation.

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