
Breeding Value of Southern Highbush Blueberries

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Abstract. Native highbush blueberries (Vaccinium corymbosum L.) from the flatwoods of Alachua County (North-central, Florida) and from Highlands County (Central peninsula) were surveyed for chromosome number and crossability with breeding lines derived from northern highbush cultivars. The Alachua County population was predominately tetraploid; a diploid component differed in leaf serration and glandulation. Tetraploid plants were fully cross-fertile with highbush cultivars. The Alachua County population was predominately tetraploid; a diploid component was not begun until 30 years later. Thus, highbush cultivars have undergone more selection for fruit size and quality than rabbiteye cultivars. The short period between flowering and fruit ripening in highbush blueberries also makes them desirable in southern regions where earliness is important.

Northern highbush cultivars grow poorly in Florida, in part because plants receive insufficient winter chilling. An early attempt to adapt northern cultivars to the southeastern U.S. involved crosses with V. myrsinites Lam., a tetraploid, evergreen, lowbush blueberry native as far south as Miami (5). The crosses succeeded, but F1 seedlings were not vigorous and were not used in further breeding. Another evergreen blueberry native in Florida, the diploid, V. darrowi Camp, has been crossed with northern highbush cultivars and with V. ashei, and the tetraploid lines obtained were used in back-crossing low chilling genes into northern highbush cultivars (5). Lines obtained from these backcrosses have produced fruit of high quality and large size. Unfortunately, most lines lack adequate resistance to cane canker incited by Botryosphaeria corticis (Demaree & Wilcox) Arx & Muller. Cane canker is widespread on V. myrsinites in Florida, and genetic tolerance in cultivars appears necessary. V. darrowi, the main source of low chilling genes used in adapting northern blueberries to the southeastern United States, has only moderate tolerance to canker (3).

Tetraploid plants of the southern highbush complex (7) appear to be a promising source of canker tolerance and low-chilling genes. A principle source of canker resistance used in the North Carolina breeding program (4) was Crabbé-4, a tall, decidual, tetraploid plant of a type common to much of the eastern U.S. coastal plain (G.J. Galletta, personal communication). Crabble-4 had broadly elliptic, eglandular, entire leaves and sub-glaucous fruit. The purpose of this study was to determine chromosome numbers of highbush blueberries native to the Florida flatwoods and to see how readily plants could be hybridized with our highbush breeding lines.

Leaves, flowers, and fruit were examined of several hundred V. corymbosum plants growing in wet flatwoods and around cypress ponds in Alachua County in North-central Florida. Chromosome counts were made from flower buds and apical meristems for various plants of this group as well as for several highbush plants from a similar habitat in Highlands County in South-central Florida.

About 700 flowers on 5 tetraploid highbush breeding lines which trace back to northern highbush cultivars were emasculated and pollinated in a greenhouse with pollen composites from 10 tetraploid V. corymbosum plants from Alachua County. A total of 575 flowers on the same highbush breeding lines were emasculated and pollinated with pollen from other highbush lines.

A single wild Alachua County diploid highbush that closely resembled the tetraploids was transplanted to the greenhouse, and hybridized on separate branches with V. darrowi and V. elliottii Chapman. Seeds from all crosses were extracted, dried, stored at 5°C for 5 months, and germinated on peat moss in the greenhouse.

The Alachua County flatwood highbush blueberry population was variable in leaf size, leaf pubescence, flower size and shape, fruit size, time of fruit ripening, and date of autumn leaf drop. Chromosome counts indicated the presence of both tetraploid and diploid plants. Plants could be visually separated in almost every case into diploid and tetraploid because diploid plants tended to be somewhat less robust, had minutely serrate leaves, bore a few stalked glands on leaf subsurfaces, and were concentrated in areas of drier soil. The tetraploids had entire leaves and no subsurface leaf glands except on rapidly growing water sprouts. Chromosomes counts confirmed 10 diploids and 10 tetraploids. Tetraploid plants far outnumbered diploids in North...
Florida, which substantiates Camp's (1) opinion that *V. fuscatum* Ait. (Camp's name for this group) in North Florida is tetraploid because it forms so many natural hybrids with the tetraploid, *V. myrсинites* Lam. The evolutionary position of the diploid population within the genus Vaccinium and its relationship with the other diploid *Vacciniums* is not clear. Camp's taxonomic keys (1) do not include a Florida diploid highbush *Vaccinium* with leaves similar in size to those of *V. fuscatum* and having serrate margins and glands on the undersurface.

The 3 highbush plants from Highlands County for which chromosome counts were made were diploid. These fit the description of *V. fuscatum* given by Camp (1) and resembled the *V. fuscatum* in Highlands County studied and found diploid by Vander Kloot (6).

Crossoes between native tetraploid *V. corymbosum* from Alachua County and Florida highbush breeding lines were nearly as fertile as crosses between 2 highbush breeding lines (Table 1). Two-year old seedlings from crosses where 1 parent was a native highbush were consistently more vigorous than seedlings from crosses where both parents were breeding lines. Fruit was smaller and darker on seedlings from crosses with native highbush; either F1 sib crosses or backcrosses to highbush breeding lines probably will be necessary to obtain acceptable fruit quality.

Crossoes of the diploid highbush from Alachua County with both *V. darrowi* and *V. elliottii* gave many seedlings. Crossoes of the diploid from Highlands County with *V. darrowi* and *V. elliottii* were not made, but similar diploids were previously reported to be fertile with *V. darrowi* (6).

No crossing barriers were found in this study that would impede transfer of canker resistance and low chilling requirement from tetraploid Florida *V. corymbosum* into northern highbush. The Florida tetraploid highbush seems to share with the northern highbush a need for moist soils. Thus, it seems desirable also to incorporate genes from more drought tolerant species such as *V. ashei*, *V. darrowi*, and *V. elliottii* into highbush cultivars to extend blueberry adaptability for the southern United States.

<table>
<thead>
<tr>
<th>Highbush breeding lines</th>
<th>Pollen source</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. flowers pollinated</td>
<td>No. of seedlings</td>
</tr>
<tr>
<td>Fl. 5-2</td>
<td>250</td>
</tr>
<tr>
<td>Fl. 5-12</td>
<td>100</td>
</tr>
<tr>
<td>Avonblue</td>
<td>50</td>
</tr>
<tr>
<td>Harrison x</td>
<td>100</td>
</tr>
<tr>
<td>Sharpblue</td>
<td>200</td>
</tr>
<tr>
<td>Total</td>
<td>700</td>
</tr>
</tbody>
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Table 1. Flowers pollinated and seedlings obtained from highbush x Florida *V. corymbosum* and highbush x highbush crosses.

**Literature Cited**


**A New Device for Hot-callusing Graft Unions**

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Additional index words. plant propagation

There are various problems associated with hot-callusing graft unions of dormant fruit and nut trees. Since the whole plant is exposed to elevated temperatures, growth is promoted not only at the graft union, but also from the scion buds and the roots. Translocation demands are placed on the graft union once growth of scion buds starts and leafing out occurs. Scion buds and leaves will desiccate if a callus bridge between rootstocks and scion is inadequately formed (1).

There has never been a simple and successful method for applying heat to the graft union alone. A device that limits the heat to the area of the graft union has now been developed. It is proving successful in rapidly callusing the unions of fruit and nut trees. The device localizes convected, thermostatically regulated air only to the graft union. Scion buds are exposed to ambient air temperature while the root system of the rootstock is heeled into moist sawdust.

The device is constructed of 5 cm (2 inch) PVC pipe into which 12 mm (½ inch) slots have been routed, perpendicular to the length of the pipe (Fig. 1). A strip of foam rubber is placed on the graft union once growth of scion buds starts and leafing out occurs. Scion buds and leaves will desiccate if a callus bridge between rootstocks and scion is inadequately formed (1).

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Fig. 1. This sample section of the hot-callusing device shows the larger, notched PVC pipe with a single graft in place. A smaller diameter pipe is used primarily to separate the heating cables, but it has also been filled with water and capped to provide greater thermal stability. A strip of foam rubber loosely covers the notches and grafts to aid heat distribution and retard heat loss.