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Florida 4B: Native Blueberry with Exceptional Breeding Value

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Genes from virtually all the native species of blueberry have been incorporated into the northern highbush background, but the most useful native clone of all has been Florida 4B, a selection of diploid *Vaccinium darrowi*. Florida 4B was particularly instrumental in reducing the chilling requirement of the northern highbush, but it has also proven to transmit exceptionally high fruit quality, vigor, heat tolerance and adaptation to mineral soils (1, 3, 6). To date, its genes are in the background of 11 southern cultivars, and it shows high promise as a northern breeding parent.

The name of the species was given by the blueberry taxonomist, W.H. Camp to honor George M. Darrow who first recognized it as a specific entity (2). Dr. Darrow, USDA-ARS small fruit breeder, and Ralph Sharpe, University of Florida blueberry breeder, selected Florida 4B from the wild in Central Florida. Dr. Darrow related (personal communication) that they were driving near Tampa, Florida and saw from the highway a vigorous and outstanding *V. darrowi* plant growing in a pasture adjacent to the road. They stopped, took cuttings and gave it the designation Florida 4B.

In 1966, a series of blueberry crosses were initiated at Beltsville, Maryland to produce seedling populations adapted to low-chilling areas (500-900 winter hours below -7° C) in the Gulf Coast region of southeast U.S. The tetraploid highbush blueberry (*V. corymbosum*) with a rather lengthy history of genetic improvement has large, flavorful fruit, but a high chilling requirement (greater than 1,000 hours below -7° C) and does not succeed in low-chill areas. The breeding objectives were to originate tetraploid blueberry seedling populations that had highbush blueberry fruit quality, but were adapted to the soils and climate of southeast U.S. This type of blueberry later became known as southern highbush.

Plants of several southern diploid *Vaccinium* species, *V. elliottii, V. tenellum, V. atrococcum, V. darrowi,* tetraploid *V. myrsinites* and hexaploid *V. ashei* were used in our crosses at Beltsville to obtain southern adaptation (4, 5, 6). At the time, blueberry breeders generally did not intercross *Vaccinium* species due to the small fruit of diploids. The trend was to attempt crosses of diploid species with hexaploid species (chiefly the rabbiteye blueberry, *V ashei*) with an objective of obtaining tetraploid hybrids that could be crossed with highbush blueberry. This breeding approach had only limited success, and it was later discovered that many of the putative tetraploid hybrids were pentaploid, arising from unreduced gametes in the diploid parents.

A plant of Florida 4B, left in the greenhouse by the retired Dr. Darrow, was used as female parent in crosses with the highbush cultivars 'Bluecrop' and 'Berkeley', and the rabbiteye blueberry, 'Tifblue'. Florida 4B was used as female to preclude accidental self-pollination during crossing, since *Vaccinium* diploid plants generally set no seed when self-pollinated. Two seedlings came from the cross with 'Bluecrop' (US74 and US75), three from the 'Berkeley' cross (US120, US121 and

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US122) and two from the 'Tifblue' cross (US118 and US119). The seedlings from the crosses of Florida 4B with 'Bluecrop' and 'Berkeley' were unexpected, because triploid seedlings were considered to be rare to non-existent in blueberry. When the hybrids US74, US75, US120, US121, and US122 were crossed with tetraploid highbush cultivars, the progeny proved fully fertile and tetraploid. Later studies showed that US75 had regular tetrasomic inheritance (10). Obviously, Florida 4B was successful in crosses with tetraploid highbush because it had a propensity to produce a rather high frequency of unreduced gametes (7). A later cross of Florida 4B x 'Bluecrop' yielded another 13 seedlings.

Two of the interspecific hybrids from Florida 4B proved to be puzzling. US136 (Florida 4B x 'Bluecrop') and US118 (Florida 4B x 'Tifblue') were infertile when used in crosses with highbush blueberry. Subsequent counts of chromosomes proved them to be diploid, even though they were clearly hybrids based on their morphology. The meiotic mechanism by which tetraploid and hexaploid parents produce pollen with the same chromosome number as the diploid female parent remains unknown.

The hybrids US74 and US75 were surprisingly close to having all the characteristics recognized in improved cultivars. They were low-chilling, healthy, vigorous and productive plants with fruit a little smaller than that of 'Bluecrop' When backcrossed to highbush blueberry cultivars, the seedlings had improved fruit size and color with complex flavors unknown in highbush blueberries, surpassing that of the parents and grandparent Florida 4B. Blueberry breeders welcome such serendipity and often exhibit it as skill.

US75 proved to be a superior breeding clone producing a number of named cultivars among its progenies (Table 1). US74 has produced to date one named cultivar 'Blue Ridge' ('Patriot' x US74). Selections US120, US121, and US122 (Florida 4B x 'Berkeley') have not yet produced named cultivars, but may do so in the future, as they have been used by several southern highbush blueberry breeders.

The contributions of Florida 4B to the breeding of southern highbush blueberry are numerous. They include: healthy, vigorous and fertile plants with low chilling requirement, good yields and bearing fruit with exceptional powder blue color, firmness, small scars, integrity of berry and with excellent flavors (7,8). Another contribution of Florida 4B to breeding of southern highbush blueberries has been its use as a bridge to bring germplasm from other diploid species, that do not have unreduced gametes, into the highbush background. These interspecific diploid hybrids can then be crossed with tetraploid plants and yield some hybrids. The tendency of Florida 4B to produce unreduced gametes appears to be transmitted to some of the interspecific diploid hybrids. This

Table 1. Tetraploid blueberry cultivars descending from Florida 4B, a native selection of *Vaccinium darrowi*.

Georgiagem	G-132 x US75
Cape Fear	Patriot x US75
Blue Ridge	Patriot x US74
Cooper	G-180 x US75
Gulfcoast	G-180 x US75
Legacy	Elizabeth x US75
Jubilee	Sharpeblue x MS60 (G-132 x US75)
Sierra	US 169 [US79 (Fla4B x US56) x self] x G156 [US56 (*V. constablaei*) x T-65 (*V. Ashei*)]
Cara's Choice	G-144 x US 165 (same parentage as US 169 above)
Sampson	Bluechip x NC 1524 (Patriot x US 75)
Biloxi	See Figure 1

approach permitted the incorporation of genes from several diploid species such as *V. elliottii* and *V. atrococcum* into the genome of tetraploid cultivars. The cultivar 'Biloxi' was developed through this pathway (Figure 1).

Generally, when plants of native species are crossed with improved cultivars in blueberry breeding, the hybrid seedlings are more like the wild parent in fruit characters (small, dark and soft). However, hybrid seedlings coming from Florida 4B have been exceptional in fruit characters. It is fortunate that this plant attracted the attention of Darrow and Sharpe, and made its way into the hands of blueberry breeders. Its descendants are performing well in breeding programs and more named cultivars are sure to be released. The influence of Florida 4B in breeding highbush blueberry has been strong and will remain for many generations.

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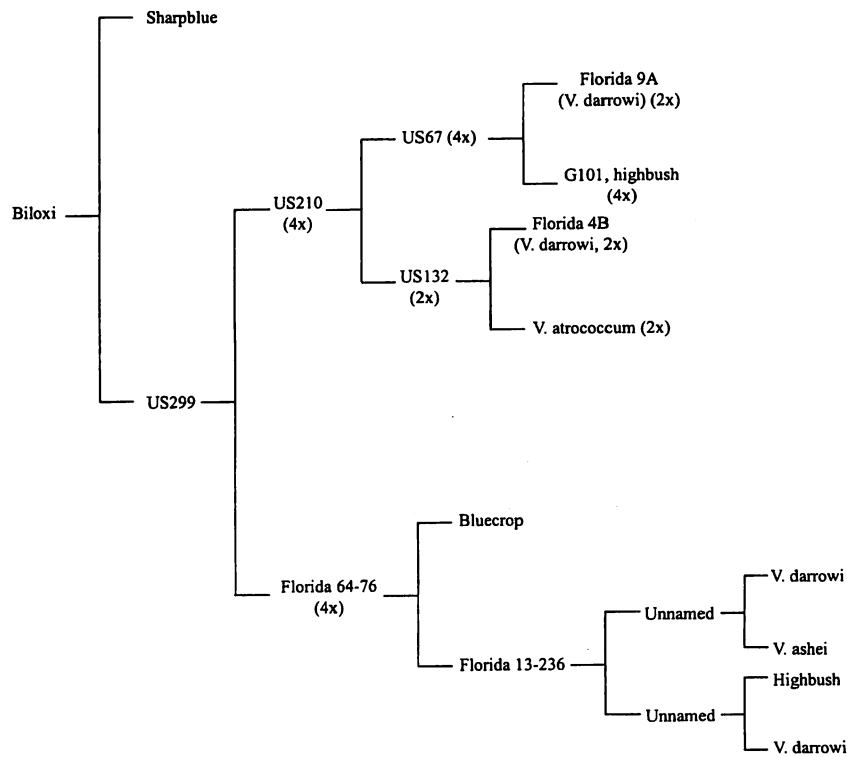

Figure 1. Ancestry of the Florida 4B Derivative, "Biloxi'

germplasm: The legacy of Arlen Draper. J. Small. Fruit. Vit. 3:1-16.

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