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‘Erica’s Appalachian Sunrise’: An Apomitically Derived Cultivar from *Cornus florida* ‘Comco No. 1’ Cherokee Brave™

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Cornus florida L. or flowering dogwood is native throughout most of the eastern the southeastern United States and has become a mainstay ornamental tree species grown and sold by numerous small- or large-volume woody plant nurseries. Many of the popular cultivars are clonally propagated selections identified from natural variations present in seedlings growing in the field for disease resistance (e.g., powdery mildew; Windham et al. 2003) or in natural settings (e.g., ‘Appalachian Spring’, which is resistant to dogwood anthracnose; Windham et al. 1998), “sports” for floral bract/leaf color variations discovered on existing cultivars (Cherokee Sunrise), or cultivars with unique growth and floral bract traits from trees growing in natural environments (Rebecca’s Appalachian Angel; Trigiano et al. 2023). Seldom are cultivars of flowering dogwood developed via breeding programs. However, ‘Erica’s Appalachian Sunrise’ [EAS: US Plant Patent (PP) 32,468] was obtained from a breeding attempt between ‘Karen’s Appalachian Blush’ [KAB (PP 13,165 P2; Windham et al. 2003)], which is resistant to powdery mildew, and ‘Comco No. 1’ Cherokee Brave™ [CB (PP 10,166)], which displays showy pink-red floral bracts in the spring.

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Origin

In Spring 2011, two individual trees of both CB and KAB with numerous unopened flower buds were obtained and their identities confirmed using single sequence repeat (SSRs) loci (Table 1; Wadl et al. 2008; Wang et al. 2008). The four trees were placed in a cage covered with a plastic netting impervious to outside insect intrusions and pollination effected by honeybees according to the methods outlined in Wadl et al. (2009). Five red fruits were harvested from one CB tree; no seeds were formed on the other three trees. Fruits were depulped by hand and stratified in moist peat and bark mulch at 4 °C for 4 months. Only one seed germinated and grew into a seedling that was maintained for 3 years in a greenhouse/bowhouse until flower buds were formed. This tree was planted in a residential area in Maryville, TN, USA in 2015. Data on bloom dates, floral bract pigmentation and shapes, and leaf color were recorded for 3 years (Table 2).

Description

The tree architecture of EAS is columnar and open with regular branching in contrast to CB, which is bushy with many small branches. EAS and CB specimen trees bloomed during the first 3 weeks of Apr 2016 and at a similar timeframe through 2023 (Fig. 1A–C). The floral bracts of EAS had the following two morphologies: spade-like and linear with red-colored veins and “diffuse” color into the adjacent parenchyma tissue (Fig. 1B and C). In contrast, the bracts of CB were primarily linear, but a few were spade-like and had similar vein color but less “diffused” color in interveinal tissue than EAS (Table 2). EAS leaves emerged in mid-April and were green (143C) (all colors from Royal Horticultural Society Colour Chart 2001) with weak purple-red (61B) color in some of the leaves. In contrast, nearby CB leaves exhibited green (136C) colored leaves. The primary and essential differences between EAS and CB were tree architecture and, to a lesser extent, the shapes and color of the bracts. Both EAS and CB have good resistance to powdery mildew (Table 2).

In 2020, PP 32,468 was granted and reported EAS to be a “self,” the result of self-pollination event of CB. However, Gunatilleke and Gunatilleke (1984) and Reed (2004) reported that *Cornus* species, including *Cornus florida*, were essentially self-incompatible and thus, self-pollination or selfing of CB was improbable. A reexamination of the SSR loci data (Table 1) supports this report. The SSR loci were identical for CB and EAS. If EAS was the result of selfing, then there would have been at least a 50% chance that any one of the heterozygous loci in CB (CF 213, 273, 562, and 597; Table 1) would have been homozygous for either allele in EAS. The probability of the four heterozygous loci in CB being expressed in EAS as homozygous is 6.25%. The genomic DNA of EAS and CB was compared using reduced representation sequencing (RRS) and revealed 99.8% similarity for more than 7000 markers between the two cultivars (Pfarr Moreau 2022). This indicated that the EAS

Table 1. Allelic comparisons at nine simple sequence repeat (SSR) loci for flowering dogwood (*Cornus florida*) cultivars Karen’s Appalachian Blush (KAB), Cherokee Brave™ (CB), and Erica’s Appalachian Sunrise (EAS).

GenBank accession no.	SSR loci[i]	KAB (Male) (bp)	CB (Female) (bp)	EAS (bp)
ED651874	CF213	270:270	267:278	267:278
ED651856	CF191	132:169	144:144	144:144
ED651920	CF273	140:144	133:142	133:142
ED651957	CF322	137:173	154:154	154:154
ER870607	CF585	167:187	174:174	174:174
ER870619	CF597	114:126	105:120	105:120
ER870656	CF634	120:126	113:113	113:113
ER870735	CF713	154:154	144:144	144:144
ER870584	CF562	208:208	212:225	212:225

[i] Published in Wadl et al. (2008).
bp = base pairs.

Table 2. Physical characteristics of *Cornus florida* 'Erica's Appalachian Sunrise' and Cherokee Brave™.

Characteristic	'Erica's Appalachian Sunrise'	Cherokee Brave™
Tree architecture	Columnar and open	Squat and very bushy
Bracts		
Vein color[i]	Red purple N57B; extensive "diffusion" into interveinal tissue (Fig. 1C)	Red purple N74B; restricted to veins: no or little "diffusion of color" into interveinal tissue
Color of cleft	White 155A to yellow green 145C	White 155A to yellow green 145C
Color of the base of the bracts	White 155A	White 155A
Dimensions[ii]		
Inner	47 mm × 61mm	38 mm × 54 mm
Outer	50 mm × 69 mm Spade-like (Fig. 1C)	48 mm × 62 mm Spade-like
Dimensions[ii]		
Inner	42 × 47 mm	44 × 47 mm
Outer	46 × 51 mm linear	44 × 50 mm linear
No. of flowers/ inflorescences	22	25
Fully expanded leaves	Green group 143C	Green group 137C
Disease incidence[iii]		
Powdery mildew	Sparse	Sparse
Spot anthracnose	Sparse	Sparse

[i] All colors are from the Royal Horticultural Society Colour Chart (2001).
[ii] Mean of 30 measurements rounded to a whole number.
[iii] Powdery mildew caused by *Erisiphe pulchra* and spot anthracnose caused by *Elsinoe corni*.

Fig. 1. *Cornus florida* 'Erica's Appalachian Sunrise'. (**A**) A 4-year-old specimen tree in full bloom in a residential area (mid-April in Maryville, TN, USA). (**B**) A cluster of inflorescences (several branches) showing uniform coloration among individual inflorescences. (**C**) An individual inflorescence showing uniform red coloration of the distil portions of the spade-like bracts, especially along veins, whereas the basal portions are pure white.

seed was formed via apomixis [asexual reproduction via seeds without traditional fusion of gametes (Hand and Koltunow 2014; Ozias-Akins 2007)] and was genetically identical to CB or a "maternal clone" as defined by Hand and Koltunow (2014) and the similarity of the RRS data. The less than 100% similarity of the two sequenced genomes could be the result of a small amount of error inherent in RRS. Apomixis has been reported in many plants (Carman 1997), although it does not occur frequently in most species (Ozias-Akins 2007). However, it is common in species of Poaceae, Asteraceae, and Rosaceae (Richards 1986) but has not been reported to occur in species from Cornaceae (Gunatilleke and Gunatilleke 1984).

Although the DNA sequences (SSR loci and RRS data) between the maternal plant (CB) and the plant (EAS) derived from apomixis are identical (Felsenfeld 2014), there are several significant phenotypic differences noted between the two cultivars, including tree architecture and frequency of bract types, dimensions, and color expression (Table 2). These morphological differences are stable following multiple rounds of clonal propagation over 5 years at two commercial nurseries and thus may be attributed to epigenetics, which are associated with either physical or chemical modifications of DNA (Felsenfeld 2014) or regulation of gene expression (Villota-Salazar et al. 2016) perhaps via growth regulators that can affect "gene expression and phenotypic plasticity" without affecting the DNA sequences (Rudolf et al. 2024).

In conclusion, the genomic evidence suggests that EAS is not a result of self-pollination of CB but of apomixis or an asexually formed seed (a maternal clone) that occurred on CB. The genotype by sequencing (GBS) data of CB and EAS are virtually identical, and the disparity of its defining phenotypic characteristics can be attributable to epigenetic factors. This is the first report of apomixis in *C. florida*.

Availability

For additional information and availability of the cultivars, contact R.N. Trigiano (rtrigian@utk.edu).

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