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A Novel Intersectional *Buddleja* Hybrid

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Abstract. *Buddleja indica* Lam. is encountered frequently as a houseplant or a conservatory specimen and is attractive ornamentally for its oak-shaped foliage. *Buddleja indica*, a tetraploid African species, $2n = 76$, was crossed to the Asiatic tetraploid species *B. davidii* Franch. The F_1 generation was intermediate in foliage character between the two parents. Flowers of the F_1 were either white or light lavender in color and the number of flowers per inflorescence was intermediate between the parents. The F_1 plants were fertile. These hybrids might be suitable for greenhouse or container culture due to their attractive foliage and floral display.

The genus *Buddleja* L. [syn. *Buddleia* L. of the Loganiaceae C. Mart. (syn. Buddlejaceae Wilhelm)] consists of ≈ 100 species found in Asia, Africa, and North and South America (Leeuwenberg, 1979; Norman, 2000). Historically, taxonomists have disagreed about the use of an *-i* versus a *-j* when spelling the generic name. The American Society of Horticultural Science recently adopted Griffiths (1994) as the modern source for scientific names. Griffiths (1994) and two recent taxonomic treatments of the genus (Leeuwenberg, 1979; Norman, 2000) all cite the genus as *Buddleja*, the name used herein. Leeuwenberg (1979) separated the genus into four sections: *Buddleja*, *Chilianthus* (Burch.) Leeuw., *Neemda* Benth., and *Nicodemia* (Tenore) Leeuw. Norman (2000) recognized two sections in *Buddleja*: *Nicodemia* and *Buddleja*. She considered *Chilianthus* Burch. to be a separate genus and combined sect. *Neemda* and *Buddleja* of Leeuwenberg (1979) into sect. *Buddleja*.

Most cultivated species of *Buddleja* are Asiatic in origin and in sect. *Buddleja*. *Buddleja davidii* Franch., the butterfly bush, native to China and Japan, is the most commonly grown species with many cultivars and is assigned to *Buddleja* sect. *Buddleja*. Section *Nicodemia* encompass species that have a berry as a fruit, rather than a capsule. Two members of this section are cultivated. *Buddleja indica* Lam. is known as the parlor oak and is native to the Comoro and Mascarene Islands and Madagascar (Leeuwenberg, 1979). It is cultivated as a houseplant for its attractive, glossy, dark green, oak-shaped foliage. The other member of the section found in cultivation is *B. madagascarensis* Lam. It is a large-growing plant with panicles of orange, noisome (in some clones) flowers that open in winter and continue through spring. The hybrid *B. \times lewisiana* Everett (Maunder, 1987) had been described between the latter species and *B. asi-*

atica Lour. (sect. *Buddleja*). Also, Leeuwenberg (1979) reported on a natural hybrid between *B. madagascarensis* and *B. indica*.

Interspecific hybridization in *Buddleja* was reported first by Van De Weyer in the 1910s when he crossed *B. globosa* Hope. with *B. davidii* to create *B. \times weyeriana* Weyer (Van De Weyer, 1920). Cultivars of this hybrid ('Golden Glow', 'Moonlight', 'Sun Gold', and 'Honeycomb') are grown today (Dirr, 1998). Moore (1949) reported on a series of interspecific *Buddleja* hybrids he produced in the 1940s. Species used in his breeding work included *B. alternifolia* Maxim., *B. asiatica*, *B. stenostachya* Reh. et Wils., *B. salviifolia* Lam., and *B. lindleyana* Fort. (Moore, 1949). Leeuwenberg (1979) and Maunder (1987) published extensive lists of known interspecific *Buddleja* hybrids; however, recent hybridization in *Buddleja* has been restricted to either *B. davidii* or *B. fallowiana* Balf. f. (Tobutt, 1993). Many *Buddleja* species possess ornamental cultural attributes lacking in selections of *B. davidii*. These characters include orange or yellow flower color, pronounced foliage and stem pubescence, interesting foliage shape, heat tolerance, and disease resistance. Our objective is to report on an artificial interspecific *Buddleja* hybrid between two different sections, *Buddleja* and *Nicodemia*. Such crosses may be useful to introduce the unique foliage and fruiting characteristics of *B. indica* into *B. davidii* cultivars.

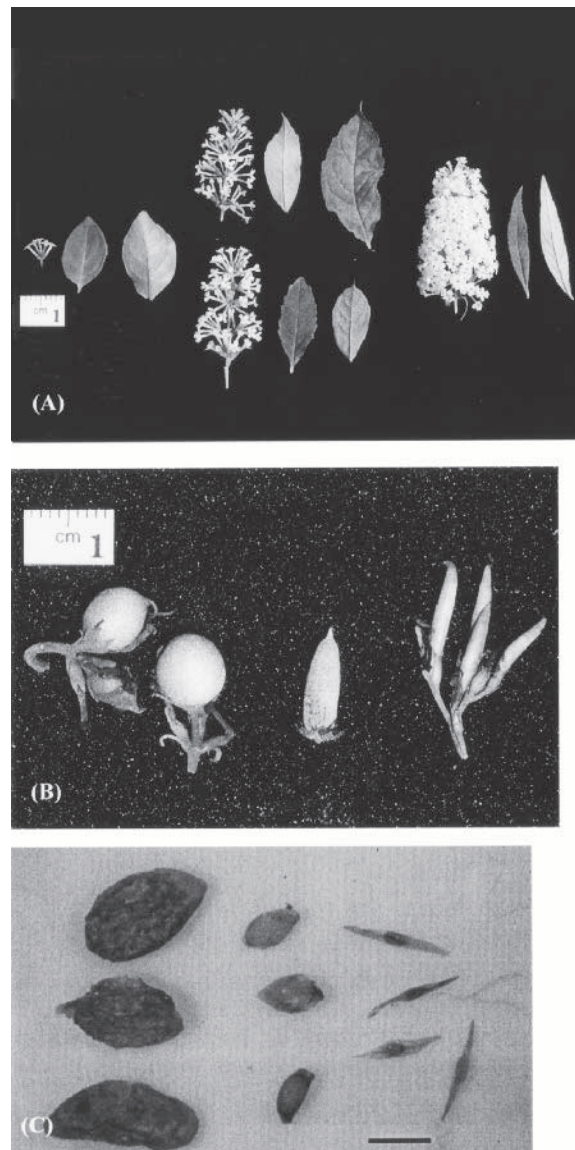
Both *B. davidii* and *B. indica* are tetraploids ($2n = 76$) (Gadella, 1962; Moore, 1947, 1960). *Buddleja indica* is the only known

tetraploid *Buddleja* species native to Africa (Keenan, 1969). The other cultivated member of the section *Nicodemia*, *B. madagascarensis*, is a diploid ($2n = 38$) (Moore, 1947).

Materials and Methods

Plant material. Plants of *B. indica* were obtained in October 2000 from Black Pines Bonsai Nursery, Baltimore, Md. This particular genotype produces a four to seven-flowered cyme of greenish-yellow flowers from the axil of the leaf. *Buddleja davidii* 'White Bouquet' was obtained in October 1999 from Forestfarm, Williams, Ore. Both parents were maintained under greenhouse conditions. Controlled crosses between the two species were made in early fall (October 2000) with *B. indica* as the male parent. One day before anthesis, the corolla and stamens were removed from *B.*

Fig. 1. Flowers, foliage, fruit, and seed from the progeny and parents of the *Buddleja davidii* \times *B. indica* cross. In each, *B. indica* is on the left, the F_1 progeny in the center, and *B. davidii* on the right. (top) Flowers and foliage, (middle) fruit, (bottom) seeds, bar = 1 mm.



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Table 1. Morphological measurements (mean \pm 1 sd, n = 10) of progeny and parents of the interspecific *Buddleja davidii* 'White Bouquet' \times *B. indica* cross.

Taxa	Inflorescence length (mm)	No. of flowers/inflorescence	Corolla width (mm)	Flower color	Leaf length (mm)	Leaf width (mm)
<i>B. indica</i>	15.4 \pm 0.9	6 \pm 1	5.5 \pm 1.2	Green	58.3 \pm 11.2	36.8 \pm 5.5
<i>B. davidii</i> 'White Bouquet'	81.8 \pm 12.6	380 \pm 71	7.0 \pm 0.6	White	74.4 \pm 15.7	15.0 \pm 2.8
F ₁ hybrids						
01-20-498	64.4 \pm 9.8	41 \pm 9	5.0 \pm 0.6	White	52.7 \pm 3.6	23.0 \pm 5.4
01-20-499	50.3 \pm 12.5	59 \pm 9	5.9 \pm 1.5	White	45.0 \pm 5.8	23.7 \pm 3.6
01-20-501	53.3 \pm 13.0	36 \pm 10	5.0 \pm 1.2	White	63.3 \pm 8.7	27.3 \pm 4.6
01-20-502	66.7 \pm 12.0	37 \pm 11	5.3 \pm 0.8	Lavender	---	---
01-20-503	68.4 \pm 11.2	39 \pm 10	3.7 \pm 0.5	White	71.5 \pm 5.3	46.7 \pm 14.3
01-20-504	53.3 \pm 14.3	48 \pm 11	3.9 \pm 0.6	White	69.3 \pm 7.9	32.8 \pm 9.8
01-20-505	82.0 \pm 11.3	61 \pm 13	5.3 \pm 0.9	White	66.7 \pm 3.5	33.0 \pm 3.3
01-20-506	65.0 \pm 9.0	61 \pm 14	5.3 \pm 0.8	White	57.0 \pm 4.8	40.0 \pm 5.1
01-20-508	73.6 \pm 9.5	69 \pm 15	5.1 \pm 0.6	White	45.0 \pm 4.7	21.5 \pm 4.1
01-20-509	85.0 \pm 17.3	66 \pm 6	5.5 \pm 0.7	Lavender	60.7 \pm 2.4	20.7 \pm 1.7
01-20-510	77.5 \pm 10.6	41 \pm 19	5.2 \pm 0.4	Lavender	70.5 \pm 8.3	28.3 \pm 5.8
01-20-511	56.6 \pm 8.5	31 \pm 10	3.9 \pm 0.6	White	46.3 \pm 4.5	22.0 \pm 4.4
01-20-513	54.5 \pm 9.7	27 \pm 9	4.0 \pm 0.5	White	55.3 \pm 4.5	---
01-20-514	60.7 \pm 6.6	21 \pm 8	3.7 \pm 0.5	White	53.5 \pm 3.6	16.7 \pm 2.9
01-20-515	55.4 \pm 9.8	-	4.0 \pm 1.0	White	34.5 \pm 5.0	17.3 \pm 1.8

davidii. Two days after emasculation, pollen from *B. indica* was applied to the stigmatic surface of *B. davidii* 'White Bouquet'. Seeds from capsules of *B. davidii* 'White Bouquet' were harvested and sown in mid winter (Feb. 2001, \approx 4 months after the cross was made).

Characterization of F₁ hybrids. Morphological measurements (inflorescence length, number of flowers per inflorescence, corolla width, flower color, leaf length, and leaf width) of the F₁ progeny and parents were taken during the following fall and winter from plants growing in the greenhouse. The flower color and measurements for each of the characters listed were taken and the mean and standard deviation were calculated.

Results and Discussion

Eighteen putative F₁ seedlings were obtained from the cross of *B. davidii* 'White Bouquet' \times *B. indica*. Although the reciprocal cross was made, no fruit were produced on *B. indica*. Progeny began to flower 7 months after sowing (September 2001) and the last F₁ plant flowered for the first time 16 months after sowing. Plants were maintained in the greenhouse, and flowering times coincided with those of *B. davidii* and *B. indica*. Appearance of flowers, foliage, and fruit for both parents and two examples of F₁ progeny are shown in Fig. 1. Morphological measurements for 15 F₁ plants are shown in Table 1. Three plants died before flowering due to cultural mishaps. In general, F₁ plants were intermediate in appearance between the two parents. Flower color was either white or light lavender. The intensity of the lavender color varied due to ambient temperature and color was more intense in the fall with cooler night temperatures. Fragrance was noted in the flowers of F₁ plants. The scent was peppery, unlike the honey-like floral fragrance of *B. davidii* 'White Bouquet'. Flowers on our clones of *B. indica* are unscented.

Number of flowers per inflorescence of the

F₁ was intermediate between the two parents (Table 1). The clone of *B. indica* used in this cross averaged six flowers per cyme. Floral display in the F₁ hybrid was sparse as compared to *B. davidii* cultivars. This problem needs to be addressed in future breeding. Other clones of *B. indica* have a terminal inflorescence like that found in *B. davidii*; however, these genotypes may not be in cultivation (Leeuwenberg, 1979). F₁ progeny of the *B. davidii* 'White Bouquet' \times *B. indica* cross were fertile. These progeny have been backcrossed successfully to both parents and have been sib-crossed (data not presented). Then, progeny could be selected for both high flower numbers and attractive oak-shaped leaves.

The fruit that developed on the F₁ hybrid are unique for a *Buddleja* spp. (Fig. 1B). It was intermediate between the two parents, but unlike *B. davidii*, the fruit did not dehisce upon maturity. Fruit on plants grown in the field do not develop the fleshy or juicy character observed in *B. indica*. However, in greenhouse-grown material, the fruit developed a juicy character \approx 5 months after pollination.

Also, seed from F₁ plants are intermediate between the parents both in size and in the presence of the wing observed on *B. davidii* (Fig. 1C). It is unlikely, given the size of the wing compared to the size of the seed, that seeds of the F₁ would be disseminated far by wind, as occurs in most *Buddleja* spp., including *B. davidii* (Norman, 2000). Presumably, because of its long-winged seeds, this species has become weedy in many places (Anisko and Im, 2001). Incorporating seed characteristics of *B. indica* into hybrids with *B. davidii* may reduce the invasive ability found currently with this species.

Plants of the F₁ hybrid were planted outdoors in full sun in Fayetteville, Ark. As with greenhouse plants, they flowered heavily in late summer and early fall. Due to the tropical nature of *B. indica*, it is unlikely that this hybrid will survive winters in USDA Cold Hardiness

Zone 6b. However, they may be suitable for warmer regions. Also, it would be worthwhile to investigate the suitability of this hybrid for container or greenhouse culture since some genotypes exhibit a restrained growth habit and attractive foliage. These hybrids were easy to propagate from cuttings taken in summer, following procedures cited for *B. davidii*. (Dirr and Heuser, 1987).

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