×*Sinocalycanthus raulstonii* (Calycanthaceae): A New Intergeneric Hybrid between *Sinocalycanthus* *chinensis* and *Calycanthus floridus*

F.T. Lasseigne¹, P.R. Fantz², and J.C. Raulston³
Department of Horticultural Science, North Carolina State University,
Raleigh, NC 27695-7609

G.B. Straley⁴
Botanical Garden, University of British Columbia, Vancouver, British
Columbia, V6T 1Z4, Canada

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Abstract. A morphological comparison of *Calycanthus* L., *Chimonanthus* Lindl., and
Sinocalycanthus W.C. Cheng and S.Y. Chang is presented. Intergeneric crosses between
Sinocalycanthus chinensis (W.C. Cheng and S.Y. Chang) W.C. Cheng and S.Y. Chang and
Calycanthus floridus L. produced hybrid progeny. Data are presented comparing the
parents and the progeny. ×*Sinocalycanthus raulstonii* Lasseigne and Fantz is proposed
as the name for these hybrids and is validated with a Latin diagnosis. The original cultivar
is named ‘Hartlage Wine’.

Cultivated members of the Calycanthaceae Lindl. (sweetshrub family) found in the eastern United States and Europe historically included two species of deciduous shrubs valued for their fragrant flowers (Bean, 1970; Dirr, 1998; Flint, 1997; Griffiths, 1994; Krüssmann, 1984). The sweetshrub (Carolina allspice or strawberry shrub), *Calycanthus floridus* [synonyms: *C. fertilis* Walt. and *C. mohrii* (Small) Poll.], is native from Virginia south to Florida and Alabama and was introduced into cultivation in 1726 (Dirr, 1998). Fragrant wintersweet, *Chimonanthus praecox* (L.) Link [synonym *Calycanthus praecox* L.], was introduced from China into cultivation in 1766.

Recently, a third species in this family was introduced into cultivation. Cheng et al. (1963) described a species from Zhejiang Province in

eastern China as *Calycanthus chinensis* W.C. Cheng and S.Y. Chang. Cheng and Chang (1964) transferred the species to a new monotypic genus, *Sinocalycanthus*, as *Sinocalycanthus chinensis*. This species (Chinese wax shrub) is valued for its large, showy, individual flowers (Bygrave, 1996; Dirr, 1998).

Seeds of *S. chinensis* collected from the wild were distributed by the Shanghai Botanical Garden in 1980 (Raulston, 1993, 1996; Straley, 1991, 1994). The resulting plants flowered in 1984 at the Univ. of British Columbia Botanical Garden (Straley, 1991). Raulston (1993) provided a description of the flowers

after growing a cutting received from Straley in 1985 (Straley, 1991). Lancaster (1990) published the first color photograph along with a description of the plant flowering in his garden in Hampshire, England, in 1989.

Straley was unsuccessful in crossing western sweetshrub (*Calycanthus occidentalis* Hook. & Arn.) (female parent) with *S. chinensis* (male parent). Raulston (1996) and Dirr (1998) reported successful intergeneric hybridization between *S. chinensis* (female parent) and *C. floridus* (male parent). The objective of this paper is to validate a name for this hybrid.

Materials and Methods

Richard Hartlage, then an undergraduate student in Horticultural Science at North Carolina State Univ., performed a series of reciprocal crosses between *Sinocalycanthus chinensis* and *Calycanthus floridus* in 1991. A single pseudocarp (seed pod) was produced. Raulston collected and stratified seeds for 3 months; four seedlings were transferred to field plots, one of which exhibited intermediate foliage, suggesting a hybrid. Flowers appeared 5 years later, confirming the hybrid origin.

Results and Discussion

The three genera in the Calycanthaceae are compared in Table 1. *Chimonanthus* is distinguished quickly from *Calycanthus* and *Sinocalycanthus* by its small, axillary flowers with few fertile stamens, staminodes lacking, and yellow outer perianth. In addition, plants are evergreen to semi-evergreen (only *Chimonanthus praecox* is deciduous).

The American Society for Horticultural Science (ASHS) replaced *Hortus Third* (Liberty Hyde Bailey Hortorium, 1976) with Griffiths (1994) as the official source for scientific names of plants. Griffiths (1994) does not recognize the genus *Sinocalycanthus*, regarding it as synonymous with *Calycanthus*. Currently, two views exist regarding generic classification: *Calycanthus* only (Flint, 1997;

Table 1. A comparison of genera in the Calycanthaceae.

Character	Genus		
	<i>Chimonanthus</i>	<i>Calycanthus</i>	<i>Sinocalycanthus</i>
<i>Leaves</i>			
	Evergreen (1 deciduous)	Deciduous	Deciduous
<i>Inflorescences</i>			
	Axillary	Terminal	Terminal
<i>Flowers</i>			
Color	Yellow	Brown to maroon	White to pale pink
Diameter	2 to 3 cm wide	3 to 7 cm wide	4.5 to 7 cm wide
Odor	Fragrant	Fragrant	Nonfragrant
<i>Perianth</i>			
Arrangement	In two series	One series	In two series
Inner row	Small	Lacking	Small
<i>Stamens</i>			
Fertile	5 to 6	5 to 30	18 to 20
Staminodes	Lacking	10 to 30	11 to 12
Filaments	Short	Short or lacking	Short
<i>Species</i>			
Number	4 to 6	2	1
Origin	China	North America	China

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¹Assistant Director, JC Raulston Arboretum.

²Professor. To whom requests for reprints should be addressed.

³Director, NCSU Arboretum (now renamed the JC Raulston Arboretum), deceased.

⁴Curator of the Asian Collection, deceased.

Fu, 1992; Griffiths, 1994; Wen et al., 1995; Xiang et al., 1998) vs. *Calycanthus* and *Sinocalycanthus* (Bygrave, 1996; Cheng and Chang, 1964; Dirr, 1998; Lancaster, 1990; Mabberley, 1997; Raulston, 1993 and 1996; Straley, 1991; Watson and Dallwitz, 1992). Clarification is needed to determine if the hybrid is intrageneric or intergeneric.

Morphological characters were compiled from recent generic and species descriptions in order to determine which classification should be used. Distinguishing characters are presented in Table 2. Zhang and Shen (1999) recognized two genera segregated in a key by petiole length, presence or absence of reduced stamen sap (crystals), nativity, and tepal type, shape and color. Ihsan Al-Shehbaz (personal communication), chief editor of the *Flora of China* (in progress), will treat *Sinocalycanthus* as distinct from *Calycanthus*, segregated in the proposed key by leaf margin, flower color, and pollen data (Table 2). Wen et al. (1995) reported the Asian species as *Calycanthus chinensis* in their study of 48 chloroplast DNA restriction sites. They reported that the North American species formed a group (as illustrated by a phylogenetic tree in their figure 1) with the Asian species segregated and cladistically basal, clustered near *Chimonanthus*. In our opinion, reinterpretation of these data supports segregation of the Asian species as *Sinocalycanthus*, a genus distinct from *Calycanthus*.

The hybrid is compared with its parents in Table 3. Leaves exhibit intermediate traits in the hybrid, with the longer petioles, asymmetrical bases, larger blades and acumens (leaf apex projections), and occasional, irregularly spaced, marginal teeth on the largest leaves similar to *S. chinensis*. The glaucescent lower surface and leaf pubescence on mature leaves in the hybrid were derived from the *C. floridus* parent. The buds and flowers in the hybrid appear similar to *S. chinensis* at first observation. The hybrid's flowers bear two distinct rows of tepals, a larger outer series with a distinctively reduced inner row, and broad tepals with rounded apices, and are borne on long floral stalks. Similarities between the hybrid's flowers and those of *C. floridus* include color, fragrance, bracts borne on the flower stalk, and short filaments. However, using a standardized color chart (Royal Horticulture Society, 1986), the hybrid's flowers are maroon (59A–B to 60A) with the inner tepals occasionally exhibiting a pale yellowish apical edge (RHS 12D to 13D) fading to white with age, whereas the flowers of *C. floridus* are reddish-brown (53A to 183A or B), lacking a whitened tip.

Conclusion

Intergeneric hybridization between *S. chinensis* and *C. floridus* was obtained and constitutes the first intergeneric cross involving *Sinocalycanthus* and *Calycanthus*. The nothogenus $\times$ *Sinocalycanthus* Lasseigne and Fantz is proposed for the generic name in accordance with Article H.6.2 (Greuter, 1994) that required the nothogeneric name of a big-

Table 2. Comparison of the genera *Calycanthus* (two species, North America) and *Sinocalycanthus* (one species, China).

Character	<i>Calycanthus</i>	<i>Sinocalycanthus</i>
<i>Leaves</i>		
Petioles	Short	Long
Margin	Entire	Entire (or serrate)
Length	5 to 15 cm	16 to 25 cm
Width	4 to 7 cm	10 to 12 cm
<i>Flowers</i>		
Color	Brownish-red ²	White, margins pink to purplish
Diameter	3 to 7 cm wide	4.5 to 7 cm wide
Odor	Fragrant	Nonfragrant
<i>Perianth</i>		
Types	One	Two
Arrangement	Imbricate	Two distinct series
Shape	Narrow lanceolate to elliptic	Obovatospatulate to obovate
<i>Stamens</i>		
Sap (crystals)	White	Lacking
<i>Pollen</i> ³		
Series	Dusulcate	Distlosulcate
Shape	Oblate-elliptic or prolate-elliptic	Elliptic or prolate-elliptic
Polarity	Isopolar	Heteropolar
Symmetry	Radial	Bilateral
Exine	Psillate	Verrucate-rugose
<i>Fruit</i>		
Pseudocarp	Obovate	Campanulate

²*Calycanthus floridus* 'Athens' is one of a few yellow-flowered variants (Dirr, 1998).

³Pollen data provided by Dr. Ihsan Al-Shehbaz, Missouri Botanical Garden and Chief Editor of the *Flora of China*.

Table 3. A comparison of the hybrid with the parents *Sinocalycanthus chinensis* (female) and *Calycanthus floridus* (male).

Character	<i>Sinocalycanthus chinensis</i> (female)	Hybrid	<i>Calycanthus floridus</i> (male)
<i>Leaf sizes</i>			
Petiole	7 to 11 mm	7 to 12 mm	4 to 7 mm
Blade length	7 to 14 cm	6 to 12.5 cm	5 to 7.5 cm
Blade width	3.5 to 9 cm	3 to 7.5 cm	2 to 3.5 cm
Apex acumen	9 to 13 mm	5 to 15 mm	4 to 7 mm
<i>Leaf blade</i>			
Teeth on margin	Occasional, irregular	Occasional, irregular	Lacking
Base	Asymmetrical	Asymmetrical	Symmetrical
Lateral veins	6 to 8 pairs	5 to 7 pairs	4 to 6 pairs
Lower surface	Green	Glaucescent	Glaucescent
<i>Leaf pubescence</i>			
Upper surface	Glabrous	Scattered trichomes	Scattered trichomes
Lower surface	Glabrate	Pubescent veins	Pubescent veins
<i>Inflorescence</i>			
Flower buds	Globular	Obovoid to subglobular	Ellipsoid
Flower stalk	15 to 25 mm	10 to 15 mm	8 to 10 mm
Bracts	Lacking	2 - deciduous	2 - one deciduous
Bract length	Lacking	11 to 14 mm long	17 to 20 mm long
Flower odor	Nonfragrant	Weakly fragrant	Fragrant
Receptacle width	8 to 9 mm	5 to 6 mm	5 to 6 mm
<i>Perianth</i>			
Color outer tepals	White tinged pink	Maroon wine red	Wine reddish-brown
Color inner tepals	Yellow	Maroon wine red	Wine reddish-brown
Apical edge color	± darker yellow	± yellow to white	Wine reddish-brown
Arrangement	Two series	Two series	One imbricate series
Tepal apex	Obtuse	Broadly acute	Acute
Width outer tepal	18 to 20 mm	9 to 11 mm	3 to 5 mm
Width inner tepal	4 to 8 mm	3 to 4 mm	1.5 to 3 mm
<i>Stamens</i>			
Filament length	1 mm	0.5 mm	0.5 mm
Anther length	5 mm	3.5 to 4 mm	3 mm
Connective exerted	ca 1 mm	ca 0.7 mm	ca 0.5 mm

Fig. 1. Flowers of the parents and the intergeneric hybrid. *Sinocalycanthus chinensis* (left), (*Sinocalycanthus raulstonii* (center), and *Calycanthus floridus* (right).

eneric hybrid to be a combination of the parents' generic names in whole or in part. The new hybrid species is described as follows: *Nothospecies nova* $\times$ *Sinocalycanthus raulstonii* Lasseigne & Fantz [male *Sinocalycanthus chinensis* (W.C. Cheng and S.Y. Chang) W.C. Cheng and S.Y. Chang $\times$ female *Calycanthus floridus* L.] *distinguibili folia asymmetricus et infra glaucescentibus, petiolis elongatis, gemmis ovatis, pedicellus elongatis, et flores aromaticus cum tepalis biseriibus, amplitudine deminutis introrsum*.

Shrub, currently to 1.7 m tall $\times$ 1.3 m wide. Leaves are opposite, broad elliptic, acuminate (acumen 5 to 15 mm), asymmetrical basally, rotund, entire to occasionally irregularly serrate toward apex on largest leaves, green above and glaucescent below, 6 to 12.5 cm long, 3 to 7.5 cm wide; pubescence strigose on major veins below and scattered puberulent above with trichomes exhibiting a swollen bulbous base; petiole 7 to 12 mm. Flower buds obovoid to subglobose. Flowers (Fig. 1) solitary, terminal, weakly fragrant, maroon (RHS 59A-B to 60A) fading to wine-red (RHS 70A to 71A); pedicel 10- to 15-mm; bracts 2, one caducous, one deciduous, 11 to 14 mm long $\times$ 2 to 3 mm wide, borne 4 to 7 mm below the perianth; perianth of broadly obtuse tepals in two series, outer members spreading to weakly ascending, 18 to 25 mm long $\times$ 6 to 11-mm wide, inner members strongly ascending, 7 to 9 mm long $\times$ 3 to 4 mm wide, occasionally bearing pale yellow apices fading to white. Stamens numerous; fertile stamens on brownish fila-

ments 0.5 mm long with anther sacs 3.5 to 4 mm long and an extended connective $\approx$ 0.7 mm; sterile stamens brownish with anther sacs lacking or greatly reduced in size. Pseudocarps lacking. Holotype: field plot, JC Raulston Arboretum, North Carolina State Univ., 27 Apr. 1998, *Fantz and Lasseigne 6210* (NCSC).

The hybrid species is named in honor of Dr. J.C. Raulston, Director of the North Carolina State Univ. Arboretum (subsequently renamed the JC Raulston Arboretum), who directed the successful intergeneric hybridization before his death. Cuttings of one hybrid progeny were distributed. We designate this original clone as the cultivar 'Hartlage Wine' for the unique maroon wine-red flower color and in honor of Mr. Hartlage's contribution. He currently is Director of the Elizabeth Miller Botanical Garden, Seattle, Wash.

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