

NOTES ON SEVERAL ASIAN SPECIES  
OF STYRAX SERIES CYRTA (STYRACACEAE)

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ABSTRACT

Geographic range extensions are documented for the Asian species *Styrax japonicus* and *S. odoratissimus* of *S. series Cyrta*. Implications of the range extension in *S. japonicus* for the taxonomic distinctness and phylogenetic relationships of *S. formosanus* are discussed.

KEY WORDS: Asia, Styracaceae, *Styrax*, taxonomy

RESUMEN

Se documentan las extensiones del rango geográfico para las especies asiáticas *Styrax japonicus* y *S. odoratissimus* de la *S. serie Cyrta*. Se discuten las implicaciones de la extensión del rango en *S. japonicus* para la distinción taxonómica y las relaciones filogenéticas de *S. formosanus*.

*Styrax* L. is the largest of the 12 genera in the Styracaceae and comprises about 140 species of trees and shrubs in the Mediterranean region, eastern and southeastern Asia, Malesia, and the New World (Fritsch 2015). The most recent worldwide monograph of *Styrax* was conducted by Perkins (1907). Since then, several groups within *Styrax* have been revised taxonomically, including *S. series Cyrta* (Lour.) P.W. Fritsch, a clade distributed in South, East, and Southeast Asia through Micronesia and Melanesia, as well as North America. Part of *S. series Cyrta*, encompassing 17 eastern Asian species, all with imbricate corolla aestivation, was revised by Huang et al. (2003). Huang's (2003) treatment provides a key for 21 of the 22 species of the series with imbricate corolla aestivation. It includes the four species of the series in North America, treated in more depth elsewhere (Fritsch 1997, 2009), but does not include the Asian *S. rhytidocarpus* W. Yang & X.L. Yu, discovered after the treatment was published (Zhou et al. 2015). The rest of *S. series Cyrta*, comprising the species with valvate aestivation, has been recently revised in the work of Li and Fritsch (2018). During the course of that revision, we found specimens of *S. odoratissimus* Champ. ex Benth and *S. japonicus* Siebold & Zucc. representing records that were not included in the revision of Huang et al. (2003). Those specimens represent notable range extensions for these species, including into other countries.

*Styrax odoratissimus* is widespread throughout eastern and southeastern China, becoming less common northward and westward (Huang et al. 2003). This species was thought to be a Chinese endemic, but we observed two flowering specimens of *S. odoratissimus* from Vietnam, *P.K. Loc et al. 1745* and *P.K. Loc et al. 1842* (MO, P). Those specimens were collected in Ha Giang Province, just south of the border with Yunnan, China. Although they have shorter inflorescences than usual, the imbricate aestivation, densely pubescent stamens and style, long petioles, rounded leaf bases, dull leaf surfaces, and lack of large calyx trichomes firmly place them in *S. odoratissimus*.

Moreover, we observed fruiting specimens of *Styrax odoratissimus* from Maoming in western Guangdong and Hainan provinces (*L. Deng 2148*, *F.C. How 73423*, *S.K. Lau 27934*, *F.A. McClure 9566*, and *C. Wang 30956*). The distribution map of *S. odoratissimus* in Huang et al. (2003) shows an absence of this species in these areas; as such, these specimens represent a further southerly range extension of *S. odoratissimus*. Because of the wide range of morphological variation in the species, sterile and fruiting specimens of *S. odoratissimus* can be confused with *S. finlaysonianus* Wall. ex G. Don and *S. faberi* Perkins, both of which also occur on the island of

Hainan. Like *S. finlaysonianus*, *S. odoratissimus* usually has seeds with appressed stellate trichomes on the surface. However, the fruits of *S. odoratissimus* are usually smaller than those of *S. finlaysonianus* (0.8–1.0 × 0.6–0.8 cm versus 1.4–4 × 0.6–2.5, respectively). The fruit of *S. odoratissimus* is also usually subglobose with a thin, narrow rostrum, versus oblique-ovoid to oblique-ellipsoid with a thicker, robust rostrum in *S. finlaysonianus*. *Styrax odoratissimus* can also be confused with *S. faberi*, because *S. odoratissimus* occasionally has seeds without appressed stellate trichomes or inflorescences that are shorter than average. However, the petioles of *S. odoratissimus* are much longer (5–12 mm) than those of *S. faberi* (1–4 mm). Furthermore, the two most proximal leaves of each shoot are alternate in *S. odoratissimus*, versus opposite in *S. faberi* (Li & Fritsch 2018).

Specimens examined: *Styrax odoratissimus*. **CHINA. Guangdong:** Maoming Xian [=Maonan Qu], Dapo District [=Dapo Cun], Gexiang Xiang, Shang Dong, [21.591°N, 110.881°E], 12 Aug 1956 (fr), *L. Deng 2148* (MO!); Sunyi [=Xinyi Shil], Tai Ping, [22.35°N, 110.95°E], 17 Jul 1931 (fr), *C. Wang 30956* (A!). **Hainan:** Po-ting [=Baoting Lizu Miaozu Zizhixian], [18.641°N, 109.775°E], Jul–Aug 1935 (fr), *F.C. How 73423* (A!); Bo-ting [=Baoting Lizu Miaozu Zizhixian], [18.641°N, 109.775°E], 9 Oct 1936 (fr), *S.K. Lau 27934* (A!); [Qiongzhou Lizu Miaozu Zizhixian], Five Finger Mt. [=Wuzhi Shan], [18.921°N, 109.733°E], 13 May 1922 (fr), *F.A. McClure 9566* (A, BM, C, CAS!, E, K). **VIETNAM. Ha Giang:** Huyen Dong Van, municipality Ho Quang Phin, vicinity of Ta Xa village, 14–16 km to SSW of Dong Van town, 23°16'N, 105°22'E, 1550–1600 m, 28 Apr 1999 (fl), *P.K. Loc et al. CBL 1745* (P!); Huyen Meo Vac, municipality Sung Chang, vicinity of Lu Lu Phin village, 23°11'M, 105°18'E, 1350–1450 m, 29 Apr 1999 (fl), *P.K. Loc et al. CBL 1842* (MO not seen—digital image[barcode 5154599]!, P!).

*Styrax japonicus* is widespread throughout eastern Asia, ranging in the east from Japan west to Myanmar, and from central China south to Laos, with some outliers in the far northern Philippines, Hainan, and Lanyu, near Taiwan. *Styrax japonicus* has been thought to be absent from the island of Taiwan (Huang et al. 2003). However, we found herbarium specimens of *S. japonicus* collected from Hualien County in eastern Taiwan. Although previously identified as *S. formosanus* Matsum., *T.S. Hsieh et al. 538* and *C.I. Peng 7338* both possess characteristics of *S. japonicus*, i.e., calyces that are nearly glabrous abaxially (versus completely covered with trichomes, the trichomes usually becoming less dense within 1 mm of the margin in *S. formosanus*) and longer pedicels (20 mm versus 7–18 mm in *S. formosanus*) that are sparsely stellate-pubescent (versus completely covered with stellate pubescence in *S. formosanus*). Furthermore, the flowering specimen *T.S. Hsieh et al. 538* has flowers that possess imbricate corolla aestivation, as in *S. japonicus* (versus subvalvate in *S. formosanus*). Based on these features, we identify the specimens in question as *S. japonicus*.

Because of the apparent absence of *Styrax japonicus* from Taiwan, Huang et al. (2003) considered it possible that *S. formosanus* is an isolated regional variant or derivative of *S. japonicus* [albeit there were reports of *S. formosanus* on the mainland that are now confirmed (see Li & Fritsch 2018)]. The discovery of specimens of *S. japonicus* on Taiwan fill what was a notable gap in the geographic distribution of *S. japonicus* between populations in the northern Philippines, Lanyu Island off the eastern coast of Taiwan, and islands at the southern tip of the Japanese archipelago. This corroborates the recognition of *S. formosanus* as distinct from *S. japonicus*.

Nonetheless, in the course of work toward our taxonomic revision of the species of *Styrax* series *Cyrta* with valvate aestivation, we observed flowers on several specimens of *S. formosanus* with some of the lobes strongly overlapping in bud, versus the normal condition of valvate (*B.J. Conn & W.H. Hu 4066*, *S.F. Huang 4781*, *Y.C. Kao & S.H. Lai 337*, *C.I. Peng 15312*, and *T. Tanaka & Y. Shimada 11001*). These specimens were from Nantou, Yilan, and Taibei counties, located in northeastern Taiwan, near the area where the specimens of *S. japonicus* were collected. In light of the newly documented range extension of *S. japonicus* to Taiwan, those specimens of *S. formosanus* could be evidence of introgression between the two species. The molecular phylogeny from Fritsch (2001) places *S. japonicus* and *S. formosanus* as sister taxa and thus even though they are clearly distinct species, reproductive isolation between the two species may not be complete in this area of sympatry. Further study of this aspect of *S. series Cyrta* is warranted, including a new molecular phylogeny based on the updated taxonomy and high-throughput DNA sequencing methods.

Specimens examined: *Styrax japonicus*. **CHINA. Taiwan:** Hualien [=Hualien Xian], Hoping [=Heping Cun], [24.306°N, 121.651°E], 50 m, 14 Feb 1989 (fl), *T.S. Hsieh et al. 538* (TAI!); Hualien Hsien [=Hualien Xian], Shoufeng Hsiang, Mt. Mukwashan Forest, Halun Station [=Halun Shan], [23.934°N, 121.353°E], 2000–2100 m, 23 Sep 1984 (fr), *C.I. Peng 7338* (CAS!).

Specimens examined: Possible introgressants of *Styrax japonicus* into *Styrax formosanus*. **CHINA. Taiwan:** Nantou Xian, about 100 m E of Chingching Villa, Provincial Highway 14A, between Meifeng and Wushe, Jenai [=Ren'ai Xiang], 24°2'9"N, 121°9'27"E, 1670 m, 22 Apr 1994 (fl), B.J. Conn & W.H. Hu 4066 (MO!); Ilan County [=Yilan Xian], Taipingshan, [24.494°N, 121.535°E], 1870 m, 14 May 1992 (fl), S.F. Huang 4781 (TAI!); Taipei Hsien [=Xinbei Shi], Kungliao Hsiang [=Gongliao Xiang], Laolanshan, hiking trail near Kungnankung [=Gongnan Gong], 25°0'54"N, 121°57'57"E, 300 m, 19 Mar 1998 (fl), Y.C. Kao & S.H. Lai 337 (CAS!); Nantou Xian, Jenai Hsiang [=Ren'ai Xiang], Shouting, on Provincial Highway 14 Jia, at road mileage sign 6 km, 24°5'40"N, 121°9'2"E, 1650 m, (fl), C.I. Peng 15312 (CAS!, KUN!); Taihoku-shu [=Xinbei Shi], Sozan [=Yangming Shan], [25.167°N, 121.564°E], 4 May 1932 (fl), T. Tanaka & Y. Shimada 11001 (C!, E!, L!, P[2]!).

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